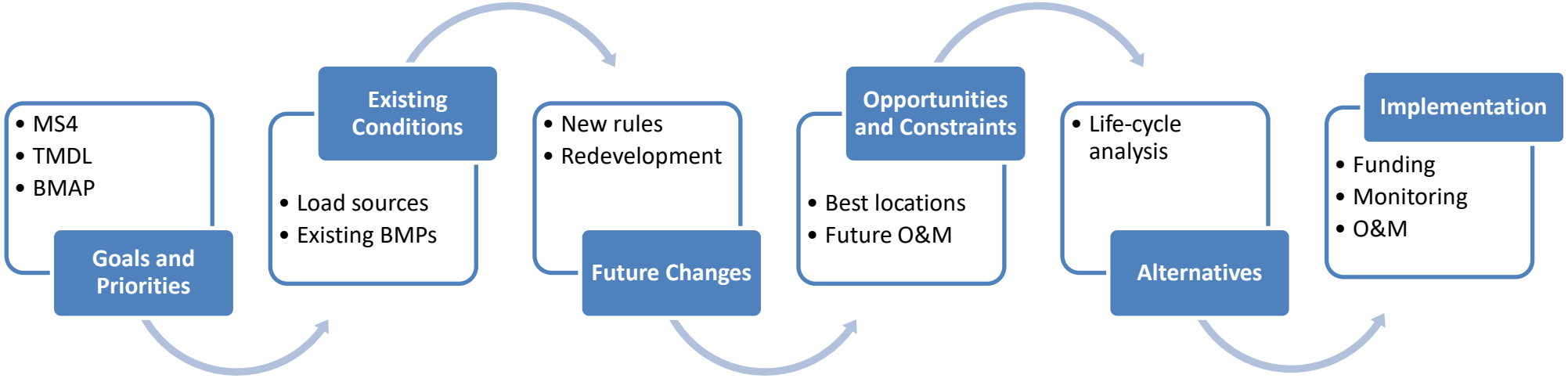
Structural Pollution Control Planning

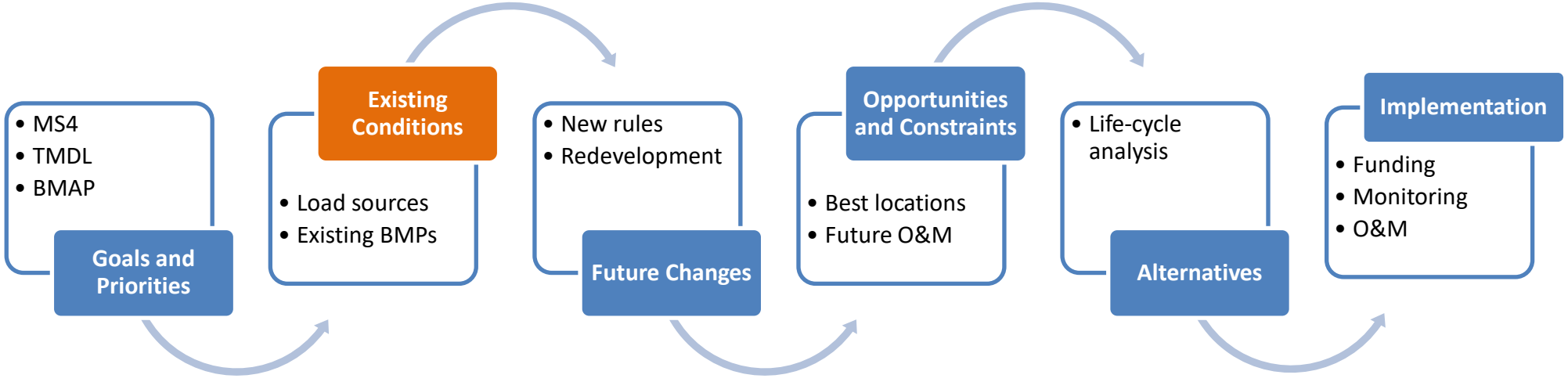
MS4 Permits: Demonstrating Compliance with New Permits

September 16, 2022

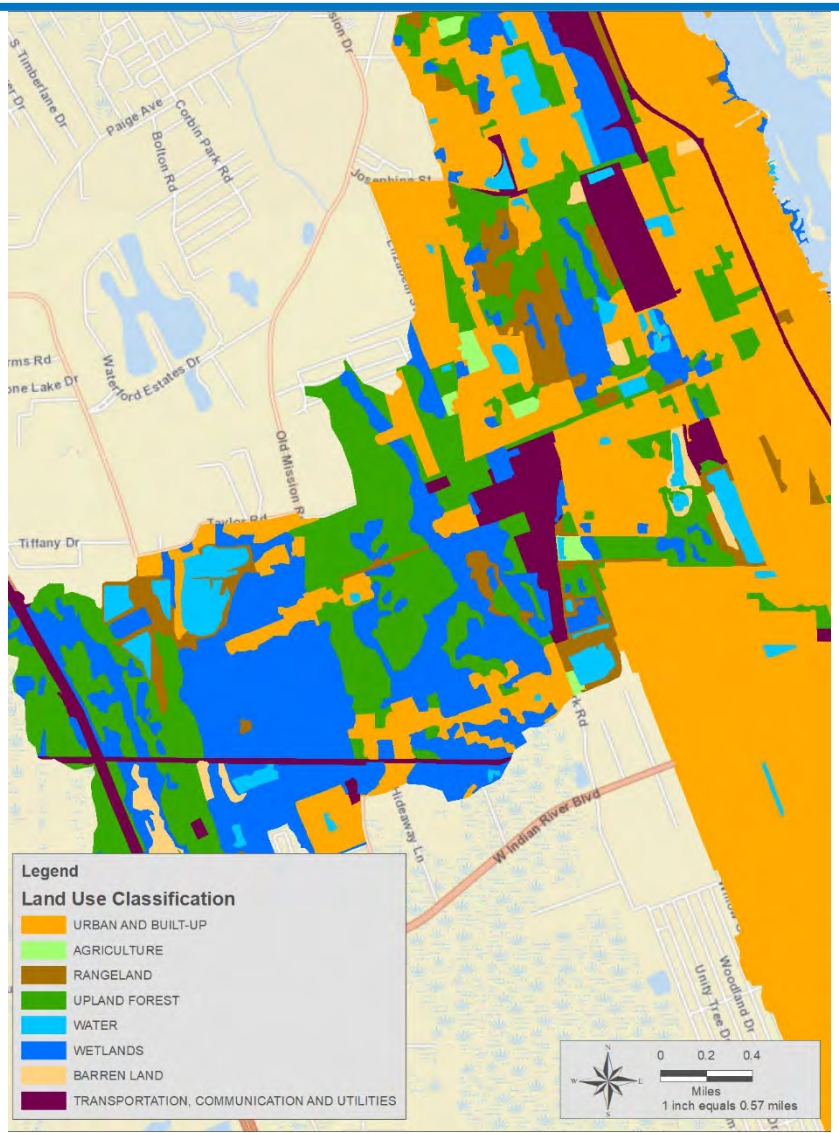
Overall Planning Strategy



Overall Planning Strategy



Existing Conditions - Understanding Pollutant Sources



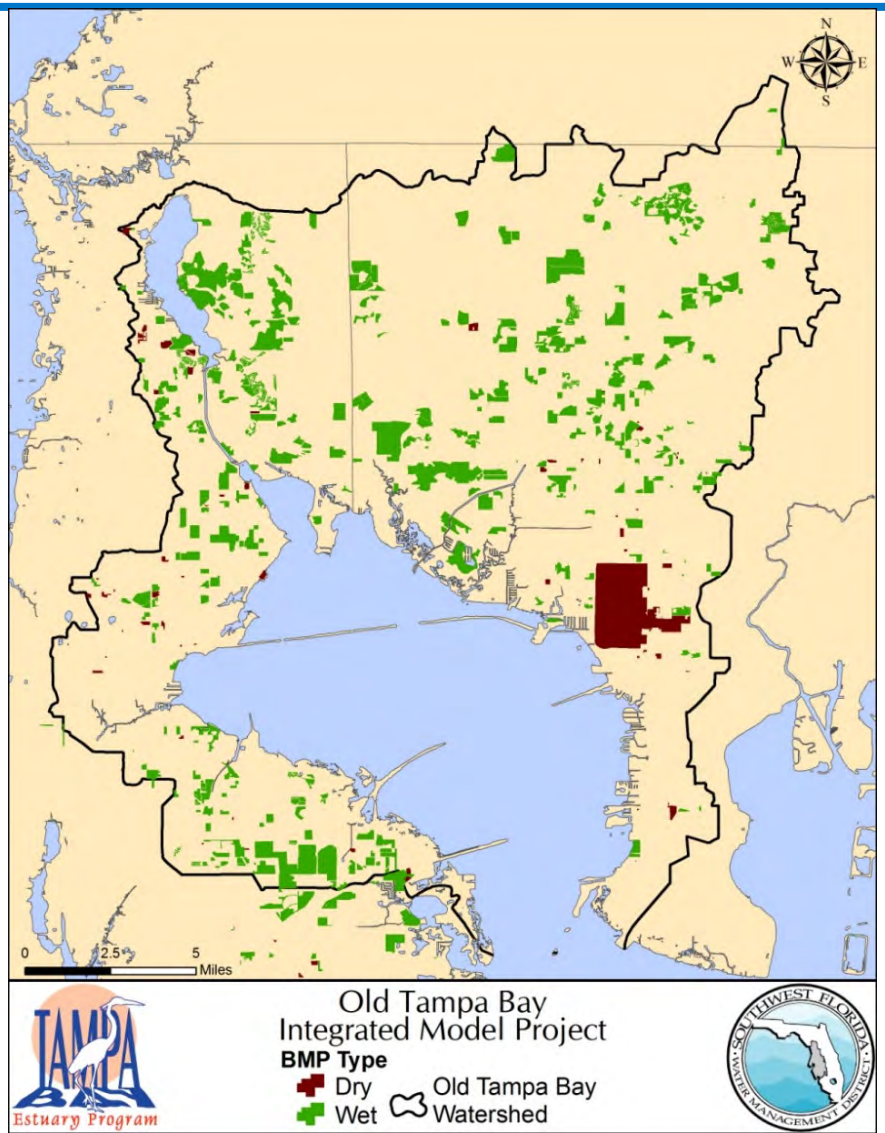
- **Event Mean Concentrations (EMCs)**

  vs.

  Buildup and Washoff

- **Lessons learned from early Phase 1 monitoring**

Existing Conditions - Identifying Existing Treatment



Existing Conditions – Best Management Practice Removal Efficiencies

Existing Conditions – Best Management Practice Removal Efficiencies

BMP Type	Standard BMPs	TP % Reduction	TN % Reduction	Data Source
Retention[1]	**Offline retention BMPs (must limit catchment to <10 acres)**	See **Table 5** for formulas	See **Table 5** for formulas	*Evaluation of current stormwater design criteria within the state of Florida*, Harper, H., and D. Baker 2007; and DEP evaluation/ regression of Harper and Baker 2007
	Online retention BMPs	See **Table 5** for formulas	See **Table 5** for formulas	DEP evaluation/regression of Harper and Baker 2007
	Grass swales with swale blocks or raised culverts	Use on-line retention BMPs	Use online retention BMPs	DEP evaluation/regression of Harper and Baker 2007
	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	DEP evaluation/regression of Harper and Baker 2007
	Retention or Detention BMPs with Nutrient Reducing Media	Use appropriate retention/detention calculation and add media % removal as a treatment train (see **Table 2** for media mix efficiencies from the 2020 or newer BMPTRAINS User's Manual and unlisted media mixes)	Use appropriate retention/detention calculation and add media % removal as a treatment train (see **Table 2** for media mix efficiencies from the 2020 or newer BMPTRAINS User's Manual and unlisted media mixes)	2020 or newer BMPTRAINS User's Manual
Detention[2]	**Wet detention ponds**	Formula shown in Figure 13.2 of *Draft stormwater treatment applicant's handbook* (see **Figure 1** below for formula)	Formula shown in Figure 13.3 of *Draft stormwater treatment applicant's handbook* (see **Figure 2**Figure 2 below for formula)	March 2010 draft DEP and water management districts (WMDs) *ERP Stormwater Quality Applicant's Handbook*
	Dry detention ponds	10 %	10 %	DEP evaluation/regression of Harper and Baker 2007

Existing Conditions – Best Management Practice Removal Efficiencies


FDOT

Stormwater Management Academy

"Managed Stormwater is Good Water"

University of Central Florida

User Manual
for the BMP Trains 2020 Model

Version 4.3.5
December 1, 2021

Marty Wanielista, Ron Eaglin, Harvey Harper, Eric Livingston,
Mike Hardin, Rich Magee, Przemyslaw Kuzlo, and Ikiensinma Gogo-Abite

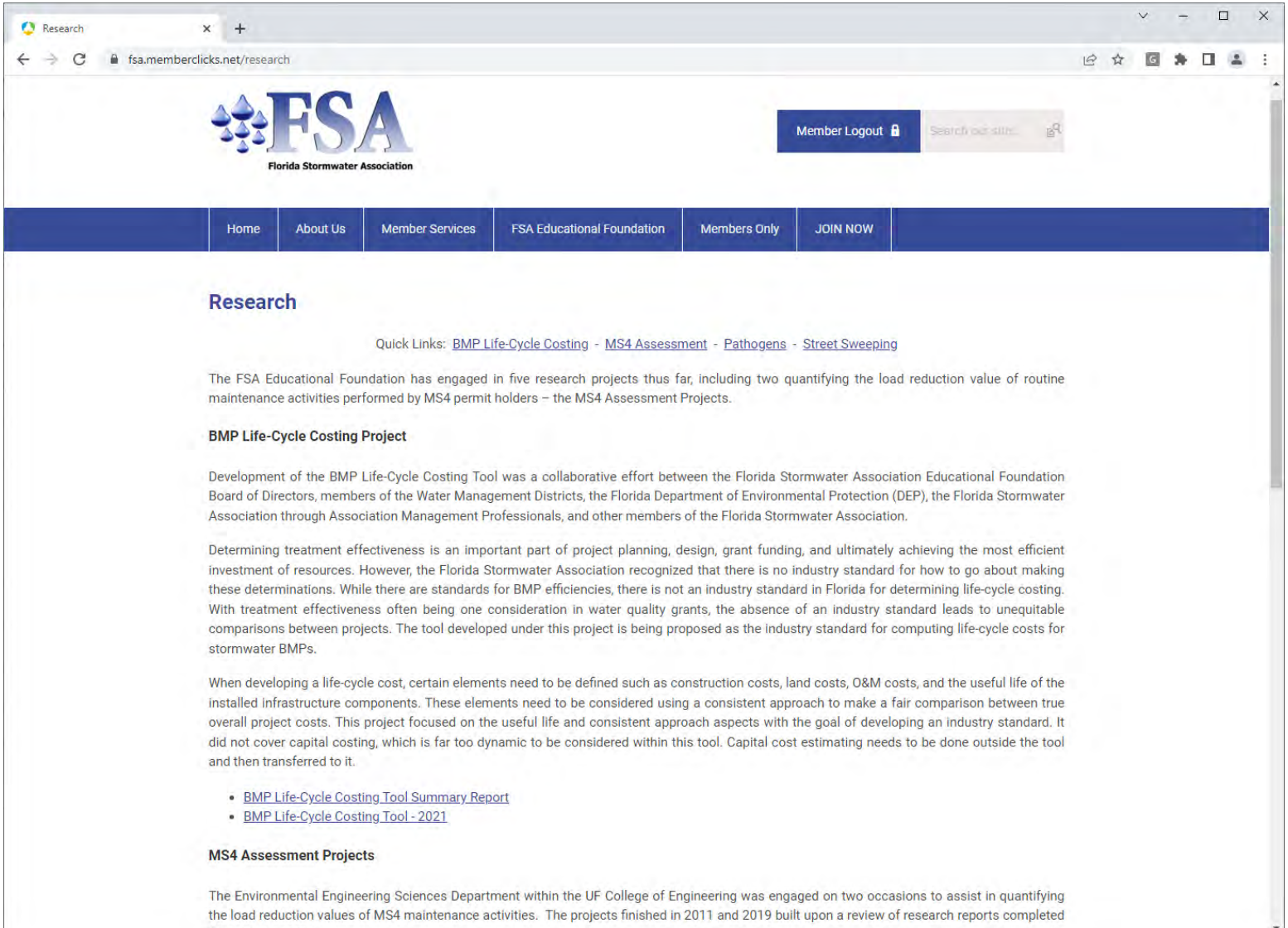
Existing Conditions – Non-Structural Best Management Practices

Image source: Globalsweeper.com

Existing Conditions – Non-Structural Best Management Practices

BMP Type	Standard BMPs	TP % Reduction	TN % Reduction	Data Source
Material Collection	**Street sweeping (materials collected from roadway and gutter sweeping)** **Do not include baffle box material collected[1]—see baffle box category above that includes maintenance benefits**	Determine annual average dry weight/volume of material collected over a period of 3 years (or representative period of current effort) and enter values into the Florida Stormwater Association (FSA) University of Florida (UF) Municipal Separate Storm Sewer (MS4) BMP Toolkit (FINAL MS4 Load Reduction Tool 2019 or newer version) for estimated TP reduction	Determine annual average dry weight/volume of material collected over a period of 3 years (or representative period of current effort) and enter values into the Florida Stormwater Association (FSA) University of Florida (UF) Municipal Separate Storm Sewer (MS4) BMP toolkit (FINAL MS4 Load Reduction Tool 2019 or newer version) for estimated TN reduction	2019 Final Report (or newer version), FSA UF MS4 BMP Project
	Catch basin inserts/inlet filter cleanout (drainage features and units with no specific water quality treatment mechanism), including the following: • Curb inlets. • Area catch basins. • Pavement catch basins. • Projects serving drainage and conveyance functions. • Swales (calculating under BMP cleanout category also acceptable). • Ditches (calculating under BMP cleanout category also acceptable). Do not include baffle box material collected[1]—see baffle box category above that includes maintenance benefits	Determine annual average dry weight/volume of material collected over a period of 3 years (or representative period of current effort) and enter values into the Florida Stormwater Association (FSA) University of Florida (UF) Municipal Separate Storm Sewer (MS4) BMP toolkit (FINAL MS4 Load Reduction Tool 2019 or newer version) for estimated TP reduction	Determine annual average dry weight/volume of material collected over a period of 3 years (or representative period of current effort) and enter values into the Florida Stormwater Association (FSA) University of Florida (UF) Municipal Separate Storm Sewer (MS4) BMP toolkit (FINAL MS4 Load Reduction Tool 2019 or newer version) for estimated TN reduction	2019 Final Report (or newer version), FSA UF MS4 BMP Project

Existing Conditions – Non-Structural Best Management Practices



Existing Conditions – Non-Structural Best Management Practices

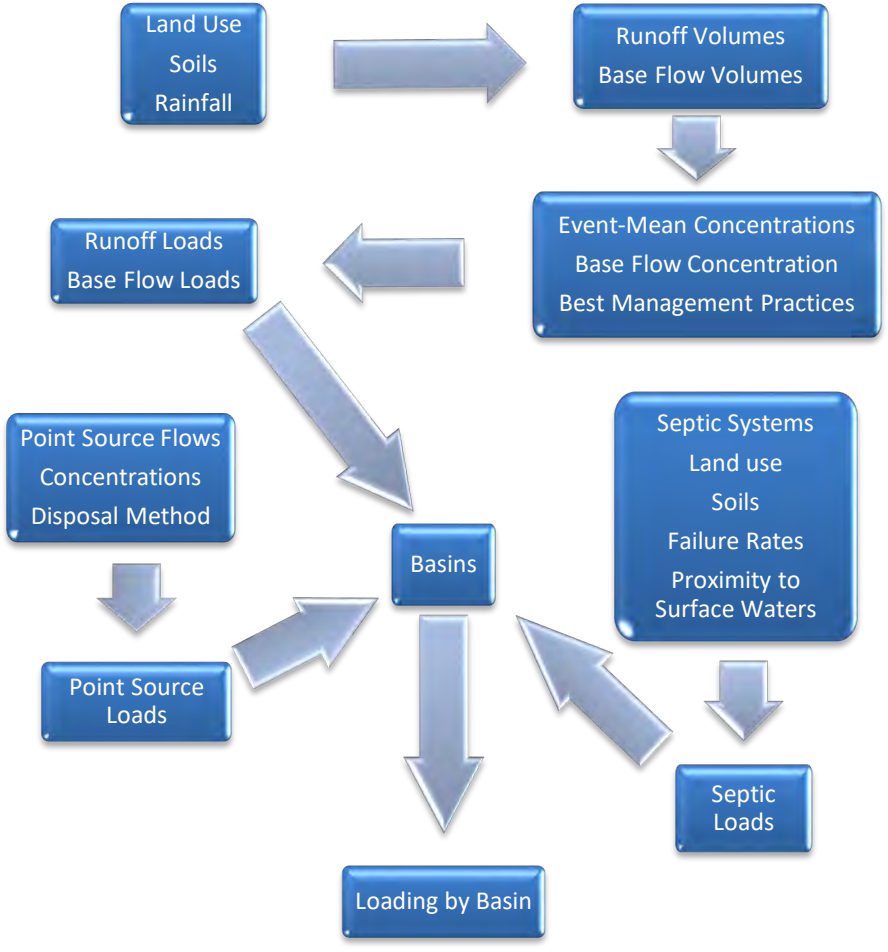
Table 2: Efficiencies for provisional nonpoint source management BMPs

N/A = Not applicable

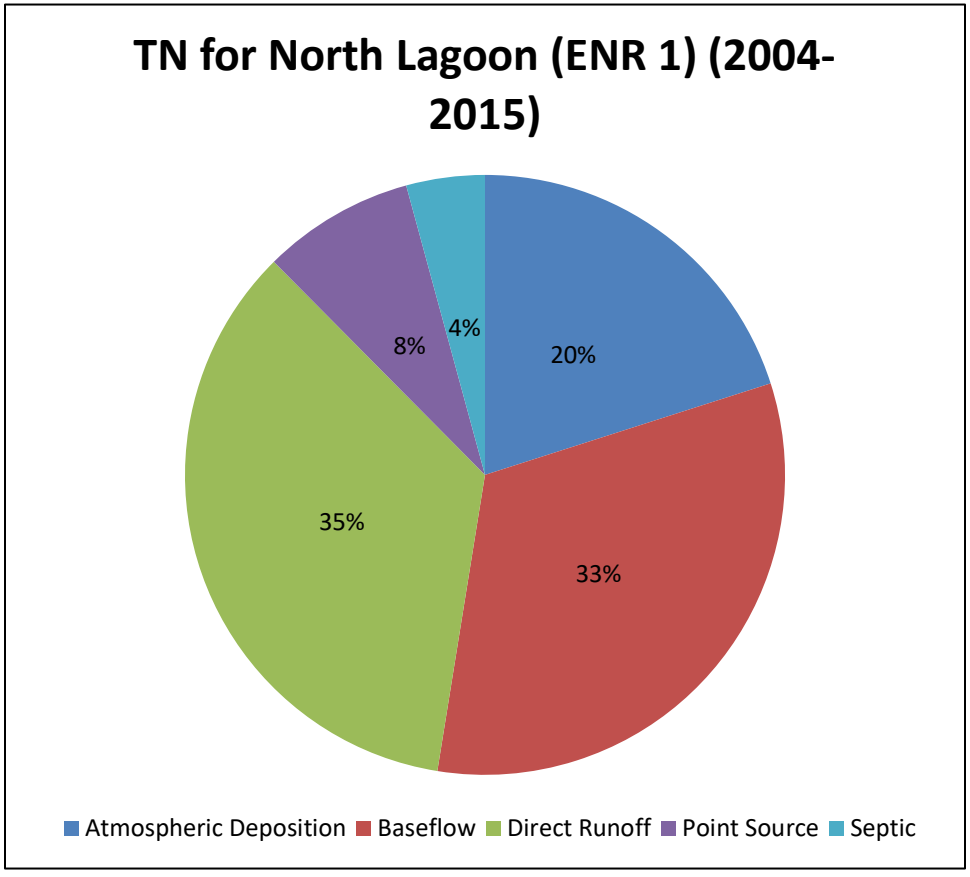
Provisional BMPs	TP % Reduction	TN % Reduction	Data Source
Public education efforts	0.25 % to 6 %, depending on extent of program and 4 specific ordinance types	0.25 % to 6 %, depending on extent of program and 4 specific ordinance types	Evaluation of Center for Watershed Protection. 2002. Watershed Treatment Model Version 3.1. Separate calculation spreadsheet available
Fertilizer cessation or fertilizer reduction	Based on acreage previously fertilized, fertilization rates, and fertilizer composition	Based on acreage previously fertilized, fertilization rates, and fertilizer composition	Determined on case-by-case basis (see Orange Creek Basin BMAP for example)

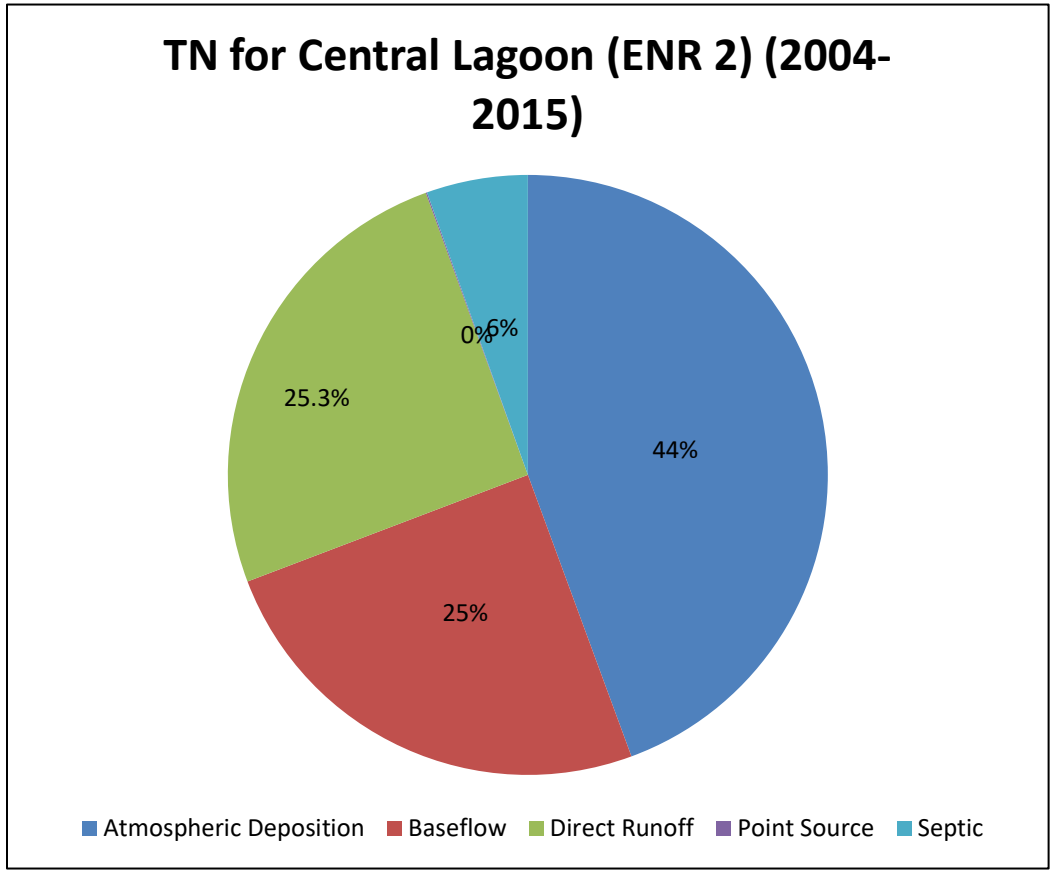
Existing Conditions – Load Accounting

Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE) - Seasonal

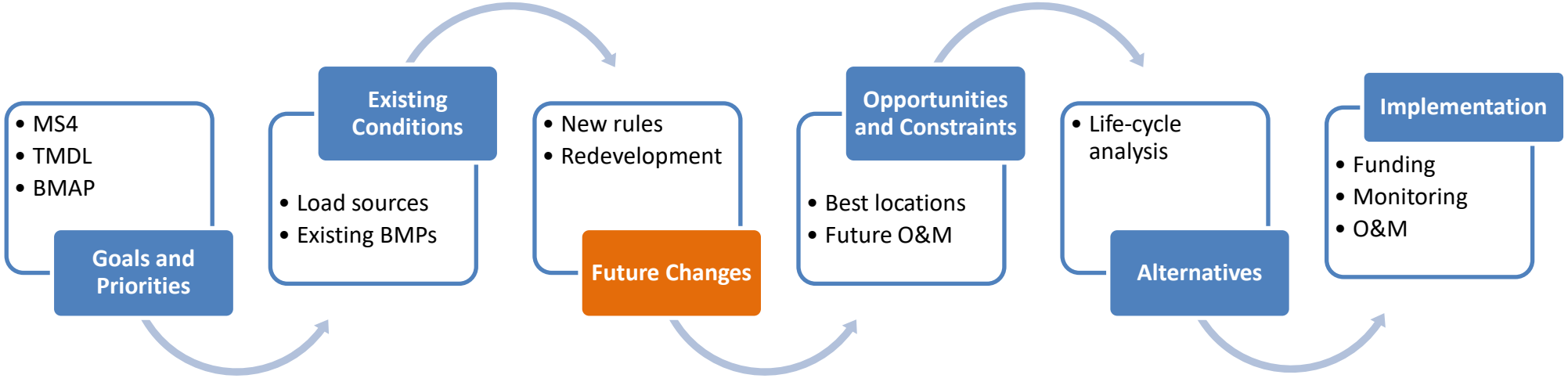


Existing Conditions - Understanding Pollutant Sources





Overall Planning Strategy



Future Changes – Old Rules

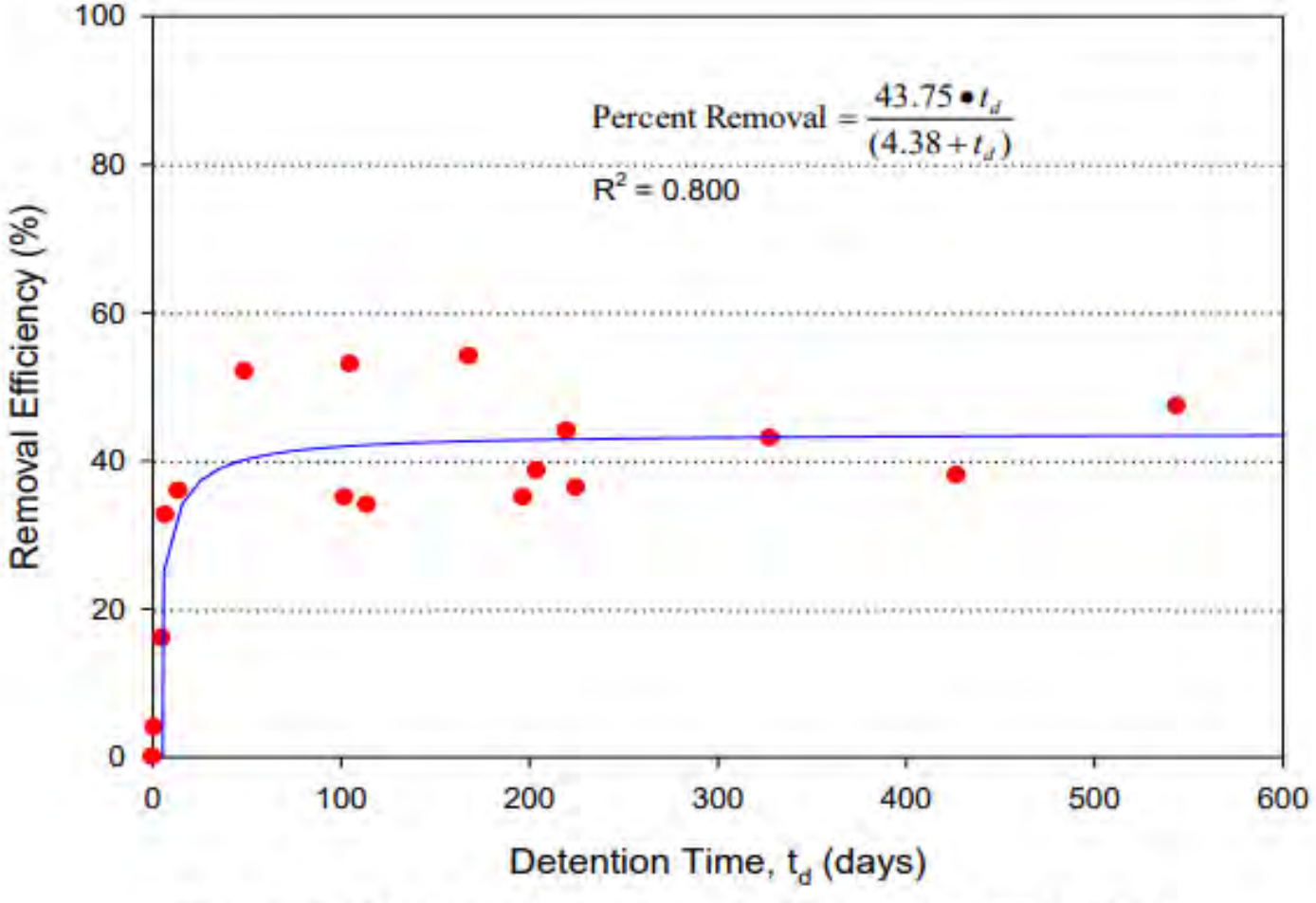


Figure 2: Wet detention removal efficiency curve for TN

Future Changes – Proposed Rules

8.3.2 Minimum Performance Standards for all sites

Except as provided below, all stormwater treatment systems shall provide a level of treatment sufficient to accomplish the **greater** of the following nutrient load reduction criteria:

(a) an 80% reduction of the average annual loading of total phosphorus (TP) and total nitrogen (TN) from the post-development project land use; or

(b) a reduction such that the post-development average annual loading of nutrients does not exceed the predevelopment nutrient loading.

Future Changes – Proposed Rules

2. Stormwater treatment systems that fall within a HUC 12 where a Total Maximum Daily Load (TMDL) has been adopted shall provide the level of treatment sufficient to accomplish the greater of the following nutrient load reduction criteria:

(a) the level of stormwater treatment required in Section 8.3.4.1, as applicable; and

(b) the greater of:

1. **Net improvement** for the pollutant that is not meeting water quality standards; or

2. the **percent reduction**, where specified in the load allocation of an adopted TMDL for the pollutant(s) that is not meeting water quality standards.

(c) **Load reduction for nutrients shall not be lower than that for undeveloped or natural conditions**.

Future Changes – Proposed Rules

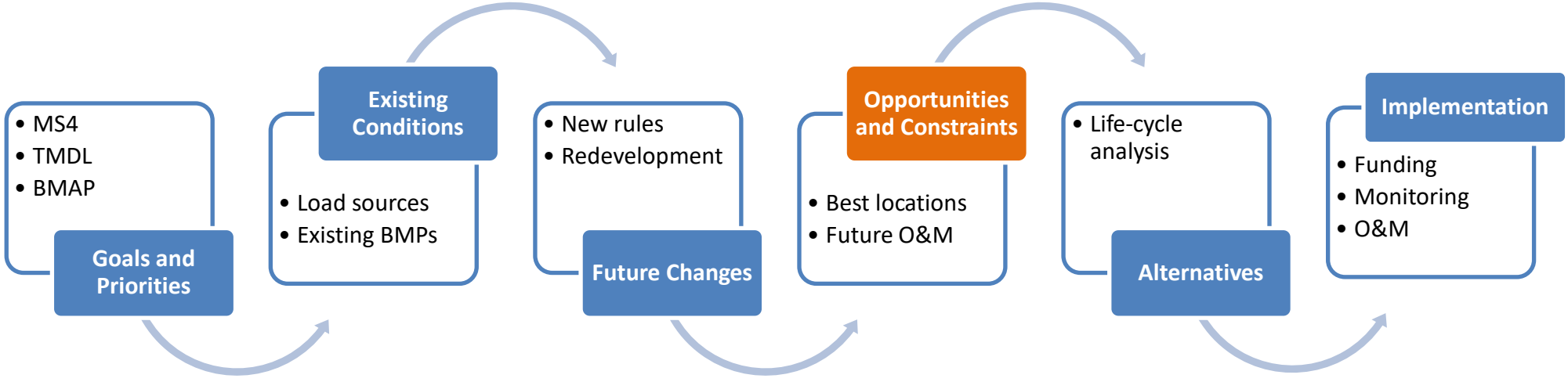
Alternative Performance Standards for Redevelopment

Stormwater treatment systems serving redevelopment activities shall meet the appropriate minimum level of treatment set forth above in 8.3.2 - 8.3.4. However, an applicant may request approval by the Agency of a lower level of treatment if the redevelopment project is under five acres and does not discharge to a nutrient impaired waters. The minimum level of treatment allowable for these sites shall be as follows:

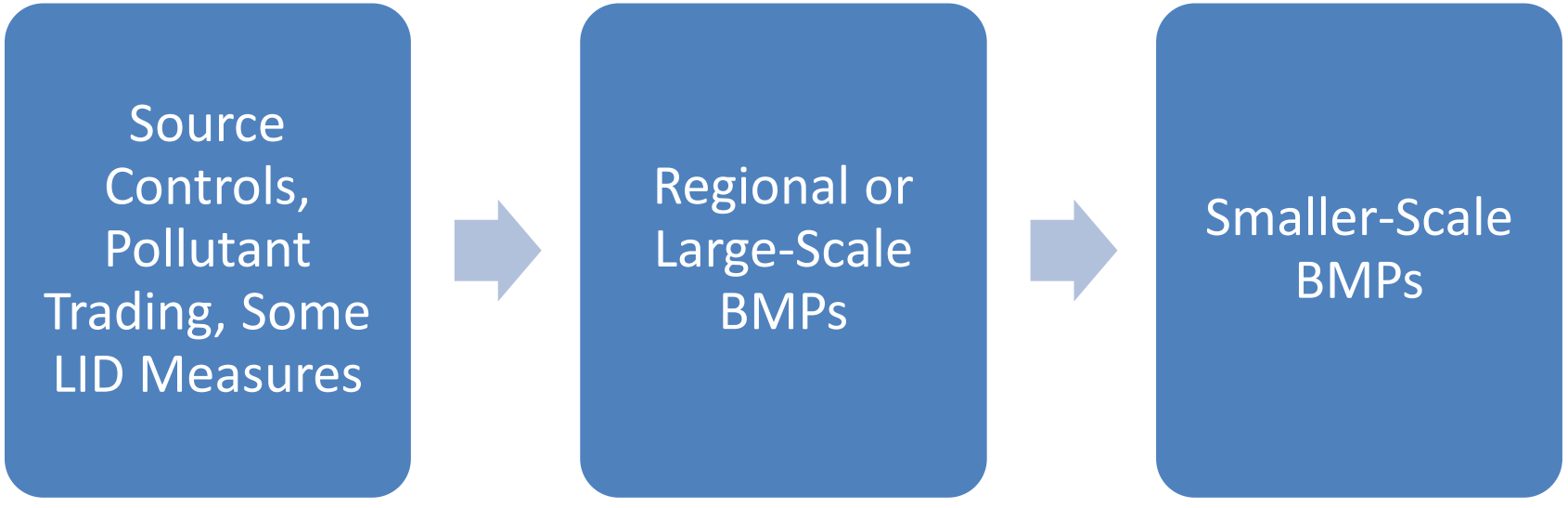
(a) **an 80% reduction of the post-development average annual loading of TP and a 45% reduction of the post-development average annual loading of TN from the project**; or

(b) for stormwater systems that fall within a HUC 12 containing an OFW, a 95% reduction of the post-development average annual loading of total phosphorus (TP) and a 50% reduction of the post-development average annual loading of total nitrogen (TN) from the project.

Overall Planning Strategy



Opportunities and Constraints - Exhaust Least-Cost Options First



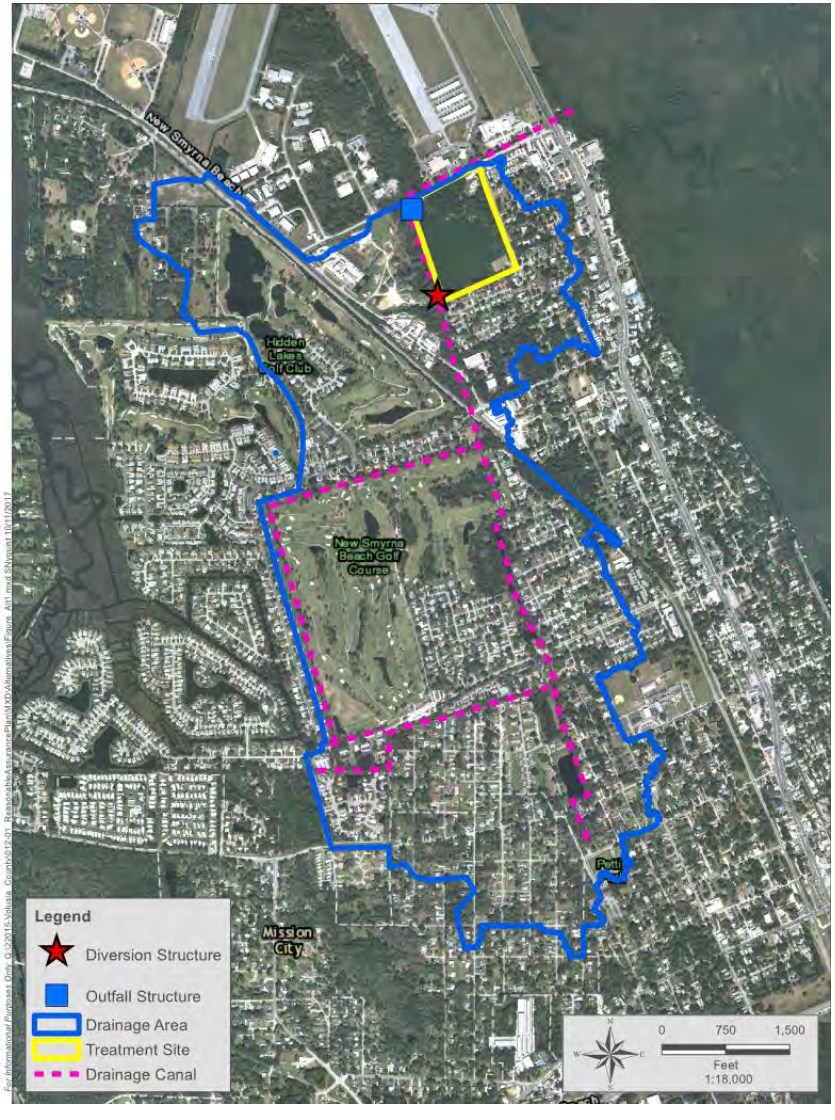
Option 1: Diversion to Borrow Pit South

Base Flow and Runoff

Treats 640 acres

1,300 lb/yr TN

$20/lb TN



Option 2: 10th Street Treatment Facility

Base Flow and Runoff

Treats 4,600 acres

5,600 lb/yr TN

$20/lb TN

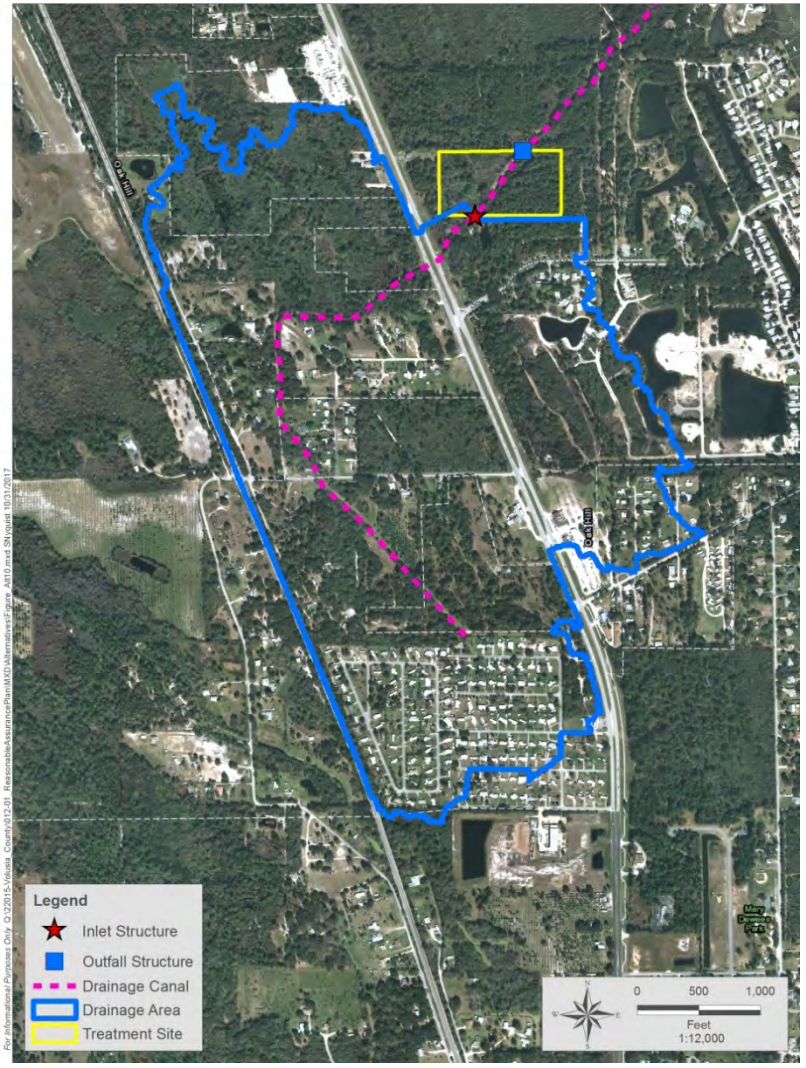
Option 10: Lighthouse Cove Treatment Facility

Base Flow and Runoff

Treats 420 acres

760 lb/yr TN

$80/lb TN



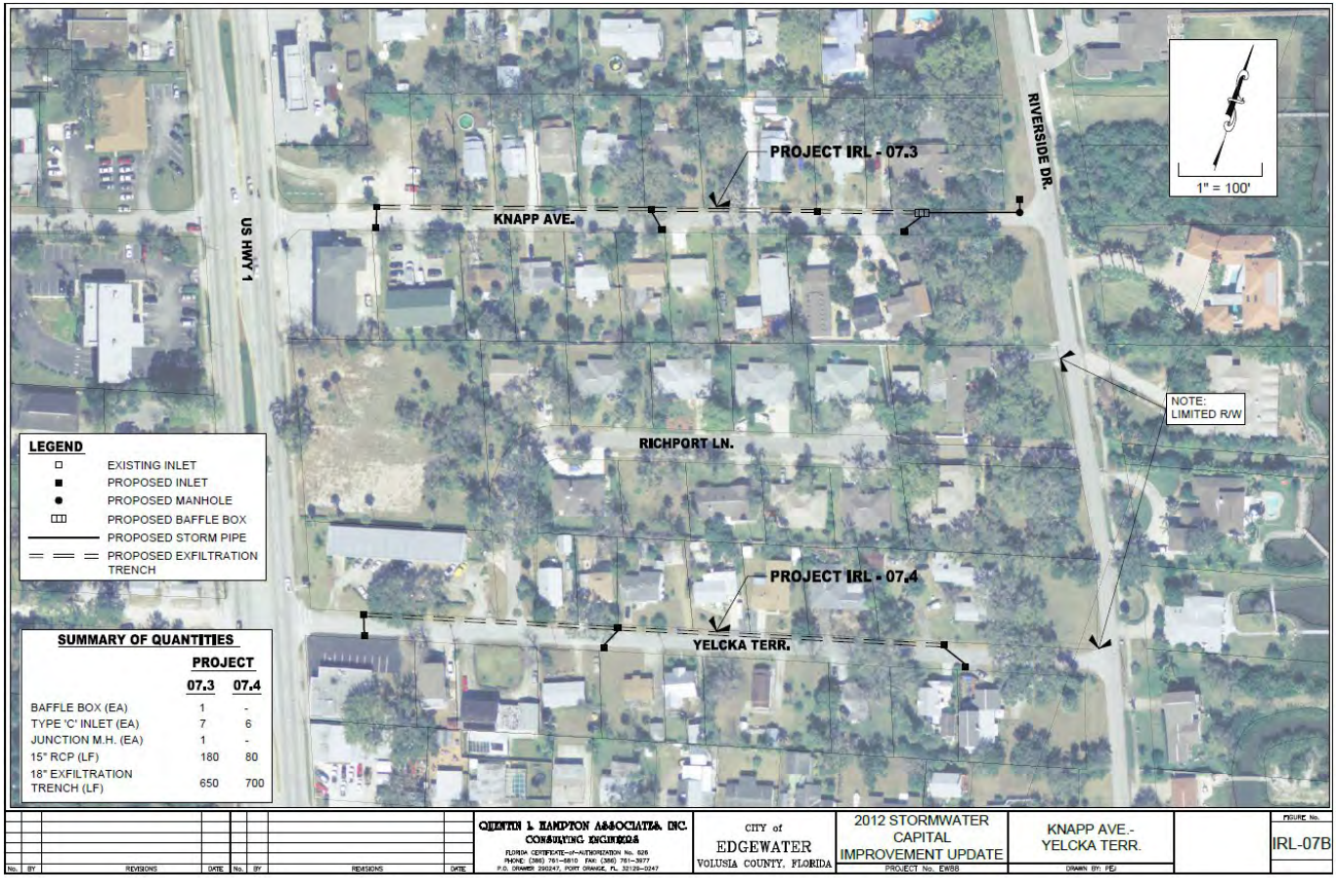
Stormwater Master Plan Projects

$140,000 to $325,000

3 – 12 acres

4 - 95 lb/yr TN

$150 to $1,500/lb TN



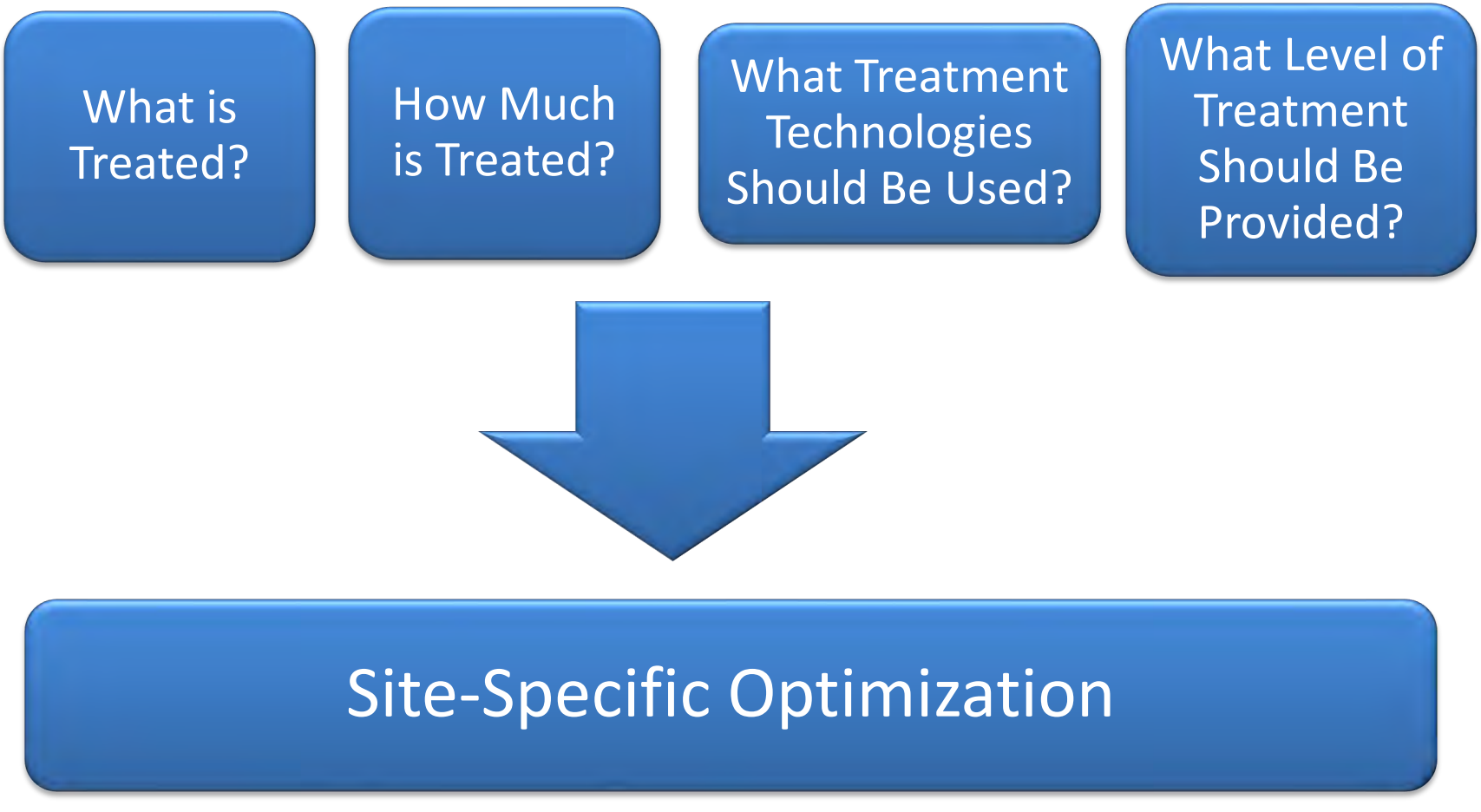
Planning of Individual BMPs

THIS IS NOT FOR NEW DEVELOPMENT!

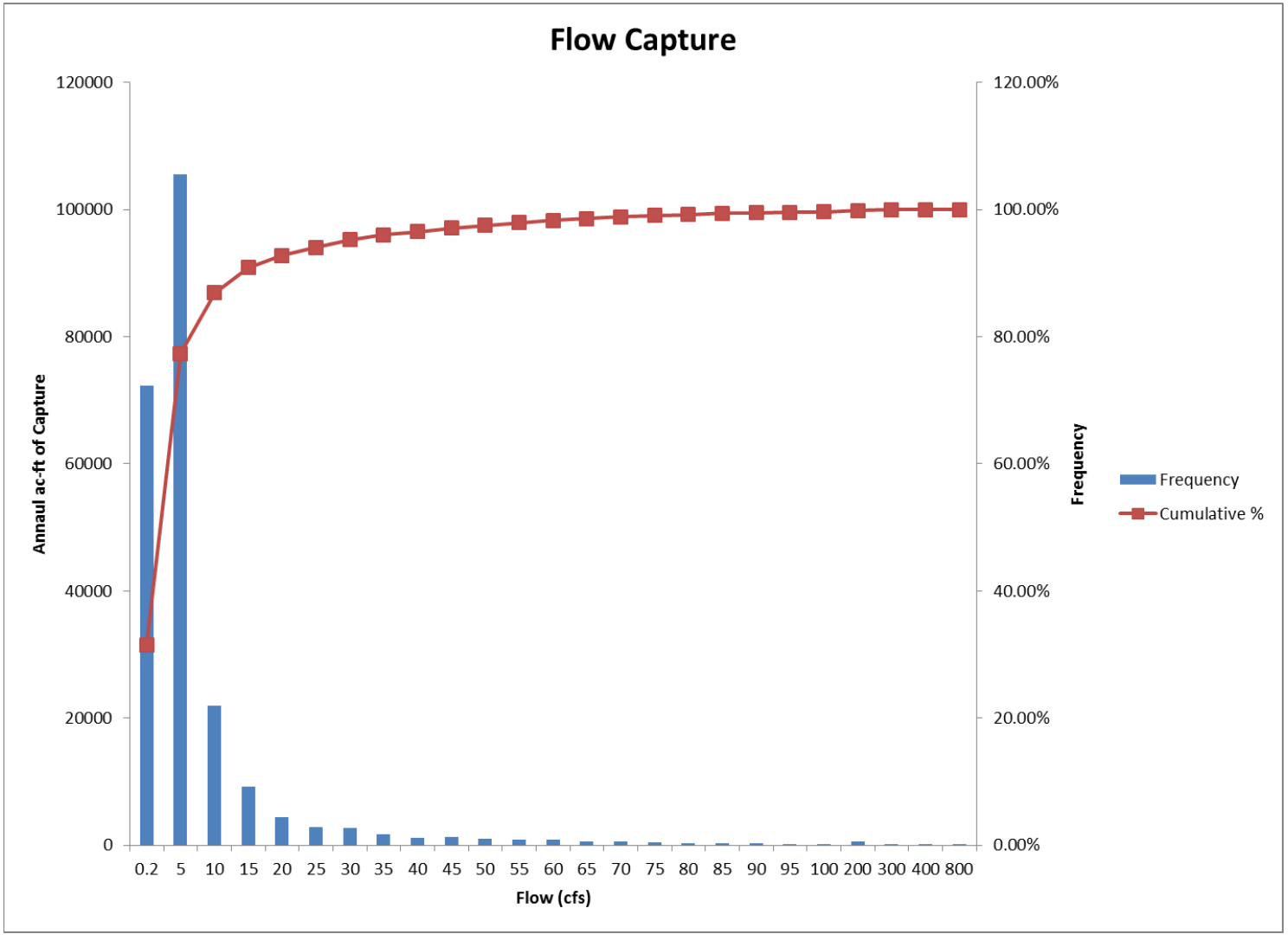
Planning of Individual BMPs

- Lowest $/lb-removed life cycle costs
- Permitting and water quality reasonable assurance
- O&M and sustainability considered
- Consideration of grant funding
- Awareness of multiple purposes

Optimizing BMP Design

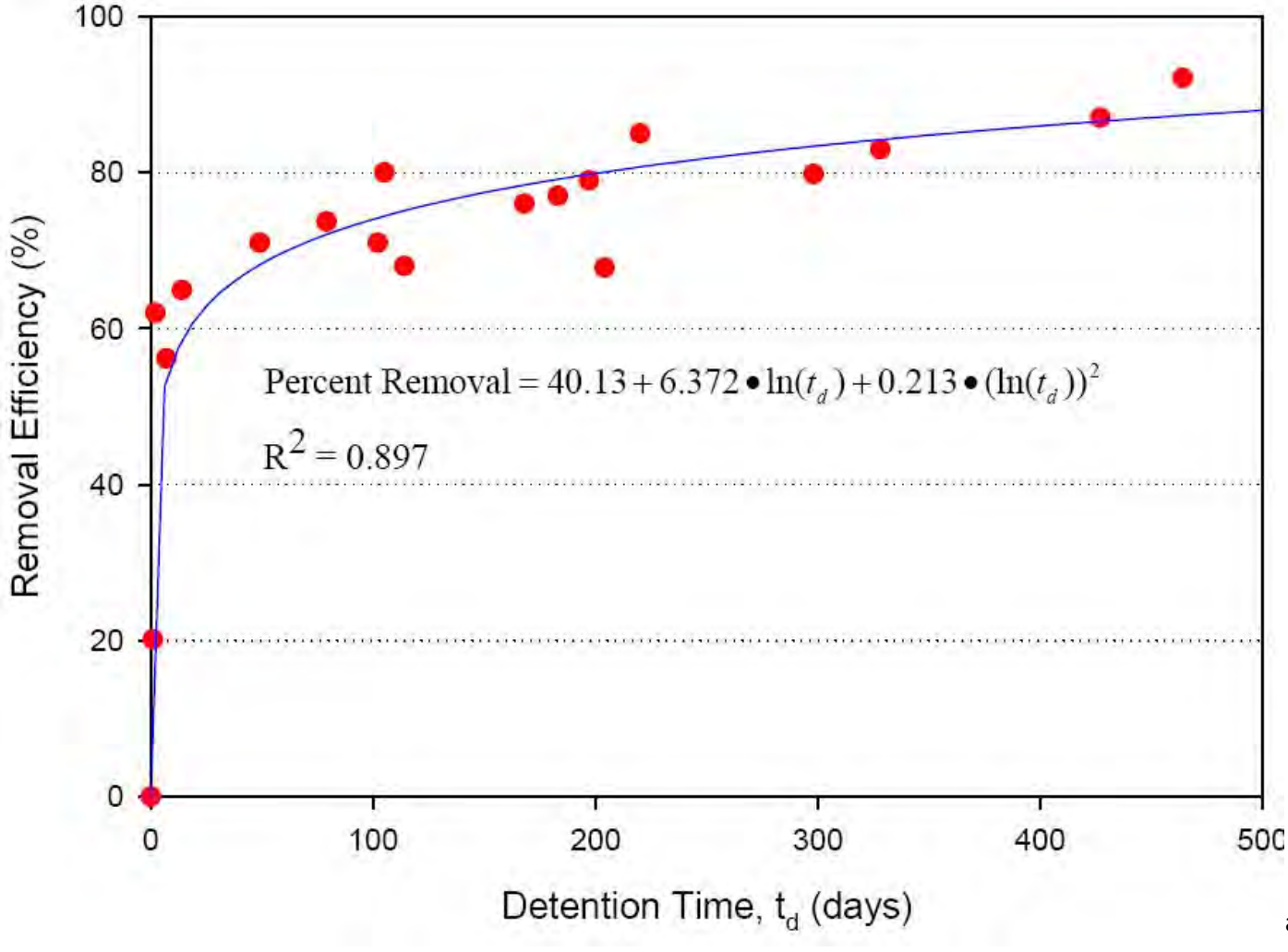


How Much is Treated?



What Treatment Technologies Should Be Used?

What Level of Treatment Should Be Provided?



aker, 2007

Site-Specific Optimization

Site-Specific Optimization

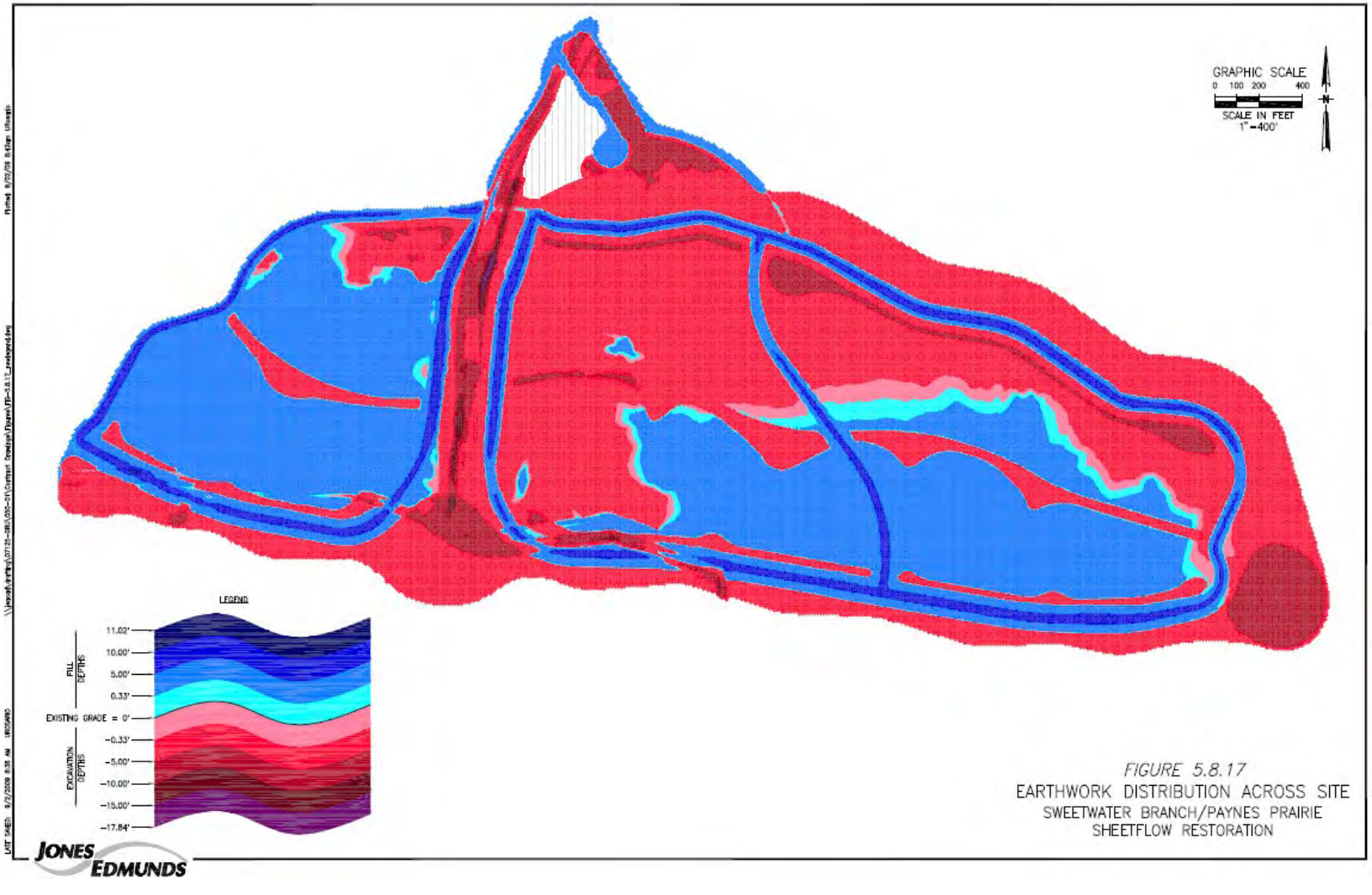
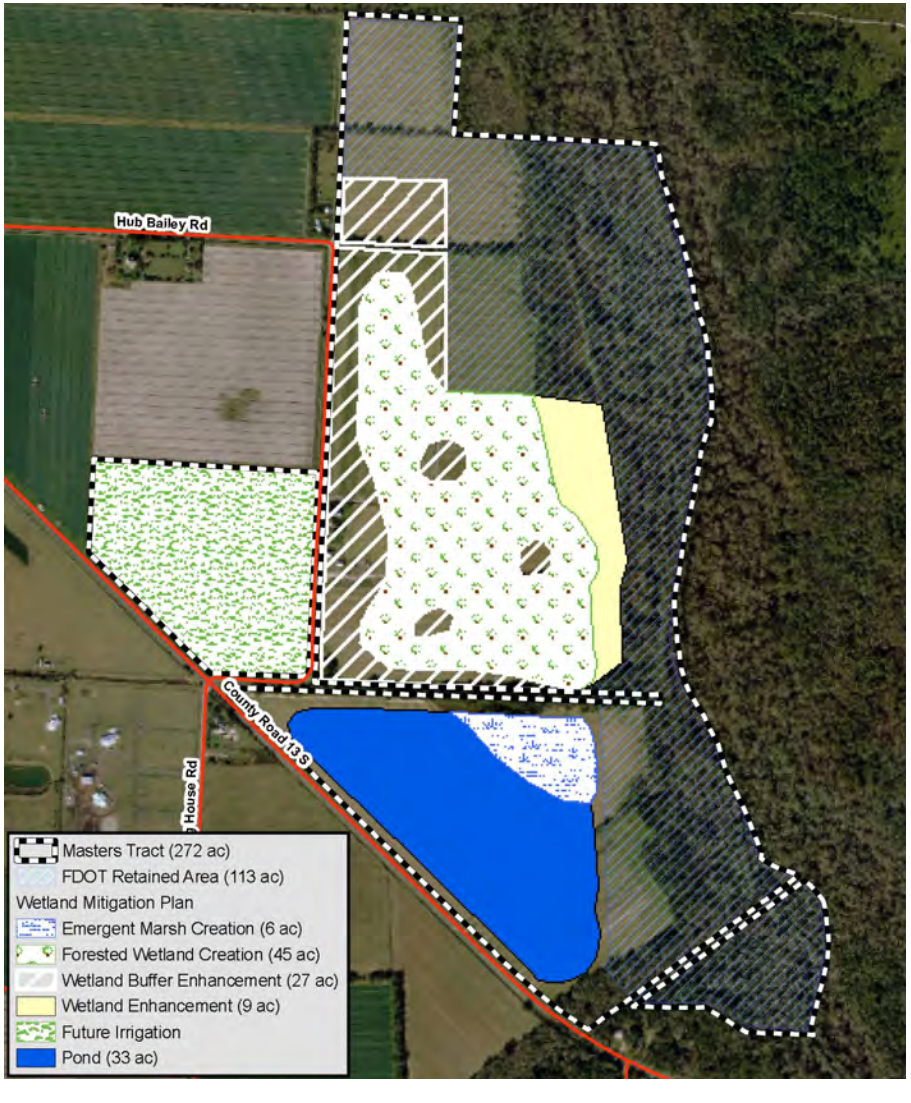
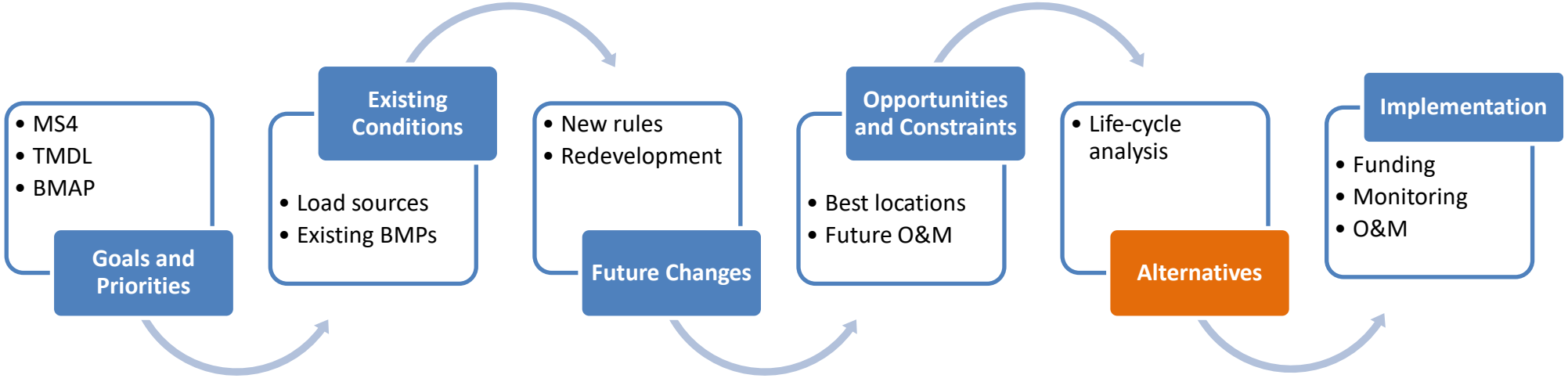


FIGURE 5.8.17
EARTHWORK DISTRIBUTION ACROSS SITE
SWEETWATER BRANCH/PAYNES PRAIRIE
SHEETFLOW RESTORATION

Evaluating Across Multiple Areas of Responsibility



Overall Planning Strategy



Capital costs ÷ Annual load reductions projected over economic life ($/lb)

Annual O&M costs ÷ Annual load reductions ($/lb)

Capital + O&M ($/lb)

Life-Cycle Costing – FSAEF Tool

LIFE-CYCLE COSTING TOOL
SUMMARY REPORT

Florida Stormwater Association Educational Foundation (FSAEF)
October 2021

FSA BMP Life-Cycle Tool

Water Quality Project Life Cycle Cost Analysis

Florida Stormwater Association 2021

EXAMPLE # 1

Project A - Regional Dry Retention Facility with Biosorption Activated Media (BAM)

USER'S CHOICE BUT OFTEN DICTATED BY FUNDING AGENCY

Economic Evaluation Duration: 60 years

BELOW COLUMNS TO BE USED FOR UPPER END ESTIMATE OF FUTURE COSTS

		Estimated Cost Low[2]	Estimated Cost High[2]
Initial Capital Cost			
Capital Cost, Range		$ 3,000,000	$ 3,450,000
Capital Cost Annualized over the Project Evaluation Duration		$ 115,459	$ 132,778

	Replacement Costs	Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional): 1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
7	Dry Storage	1000	0.1	$ -	$ -	$ -	$ -
13	Biosorption Activated Media (BAM)3	25	2.0	$ 200,000	$ 400,000	$ 250,000	$ 500,000
	#N/A	#N/A	#N/A		$ -		$ -
	#N/A	#N/A	#N/A		$ -		$ -
	#N/A	#N/A	#N/A		$ -		$ -
	#N/A	#N/A	#N/A		$ -		$ -
	#N/A	#N/A	#N/A		$ -		$ -
	#N/A	#N/A	#N/A		$ -		$ -
	#N/A	#N/A	#N/A		$ -		$ -
	#N/A	#N/A	#N/A		$ -		$ -
TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 400,000		$ 500,000
Replacement Costs Annualized over the Project Life					$ 15,395		$ 19,243

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional): % of Initial Cost	Present Worth	Annual Cost
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE! Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832					
7	Dry Storage	1	1.50%		$ -	$ -	2.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	0	6.50%		$ -	$ -		$ -	$ -
	#N/A	1	0.00%		$ -	$ -		$ -	$ -
	#N/A	0	0.00%		$ -	$ -		$ -	$ -
	#N/A	0	0.00%		$ -	$ -		$ -	$ -
		0	0.00%		$ -	$ -		$ -	$ -
		0	0.00%		$ -	$ -		$ -	$ -
		0	0.00%		$ -	$ -		$ -	$ -
		0	0.00%		$ -	$ -		$ -	$ -
	#N/A		0.00%		$ -	$ -		$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
130	Miscellaneous Slope & Berm Repair	1	$ 150		$ 3,897	$ 150	$ 250.00	$ 6,495.80	$ 250.00
140	Mowing/Vegetation Control/Litter Removal	1	$ 1,850		$ 48,069	$ 1,850	$ 2,000.00	$ 51,966.40	$ 2,000.00
150	Clean/Repair Drainage Structures	1	$ 30		$ 779	$ 30	$ 35.00	$ 909.41	$ 35.00
160	Sump Cleaning	1	$ 500		$ 12,992	$ 500	$ 600.00	$ 15,589.92	$ 600.00
	0				$ -	$ -		$ -	$ -
	0				$ -	$ -		$ -	$ -
	0				$ -	$ -		$ -	$ -
	Electrical Energy		0 kwh		$ -	$ -		$ -	$ -
TOTAL PRESENT WORTH OF ANNUAL COST					$ 65,737			$ 74,962	
TOTAL OF ANNUAL COSTS						$ 2,538			$ 2,885

FOR UNDERGROUND BAM NO O&M ASSUMED. FOR BAM IN A POLLUTION CONTROL DEVICE, AN ENTRY WOULD BE APPROPRIATE DUE TO MAINTENANCE NEEDS

USE JUDGMENT BASED ON MAINTENANCE FREQUENCY ON CASE-BY-CASE BASIS

Alternative				
Duration				
Construction Cost				
Replacement Costs				
Annual Costs				
LCC	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 17,920	TO	$ 22,130
LCC	TOTAL ANNUALIZED COST RANGE	$ 130,000	TO	$ 150,000
LCC	**TOTAL PRESENT WORTH COST RANGE[4]**	**$ 3,470,000**	**TO**	**$ 4,020,000**

THIS ROW ROUNDED TO NEAREST 10,000 CONSIDER PARTICULARLY FOR VERY SMALL PROJECTS

THESE VALUES ARE USED IN THE UNIT COST SUMMARY SHEET FOR THE ULTIMATE BENEFIT TO COST COMPARISON

1 - Opinion of Probable Construction Cost on Base Bid Item Unit Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing Benefit/Cost information

Treatment Train Removal Efficiencies

BMP Type	Standard BMPs	TP % Reduction	TN % Reduction	Data Source
	BMP treatment trains using a combination of BMPs	BMP Treatment Train equation: Efficiency = Eff1 +((1-Eff1) *Eff2) or BMPTRAINS model 2020 or newer	BMP Treatment Train equation: Efficiency = Eff1 +((1-Eff1) *Eff2) or BMPTRAINS model 2020 or newer	March 2010 draft DEP and WMDs *ERP Stormwater Quality Applicant's Handbook* and 2020 or newer UCF Stormwater Management Academy BMPTRAINS model

Solids settling / removal

Mass removal

Biological uptake

Biological / chemical transformation

Adsorption

Treatment Train Removal Efficiencies

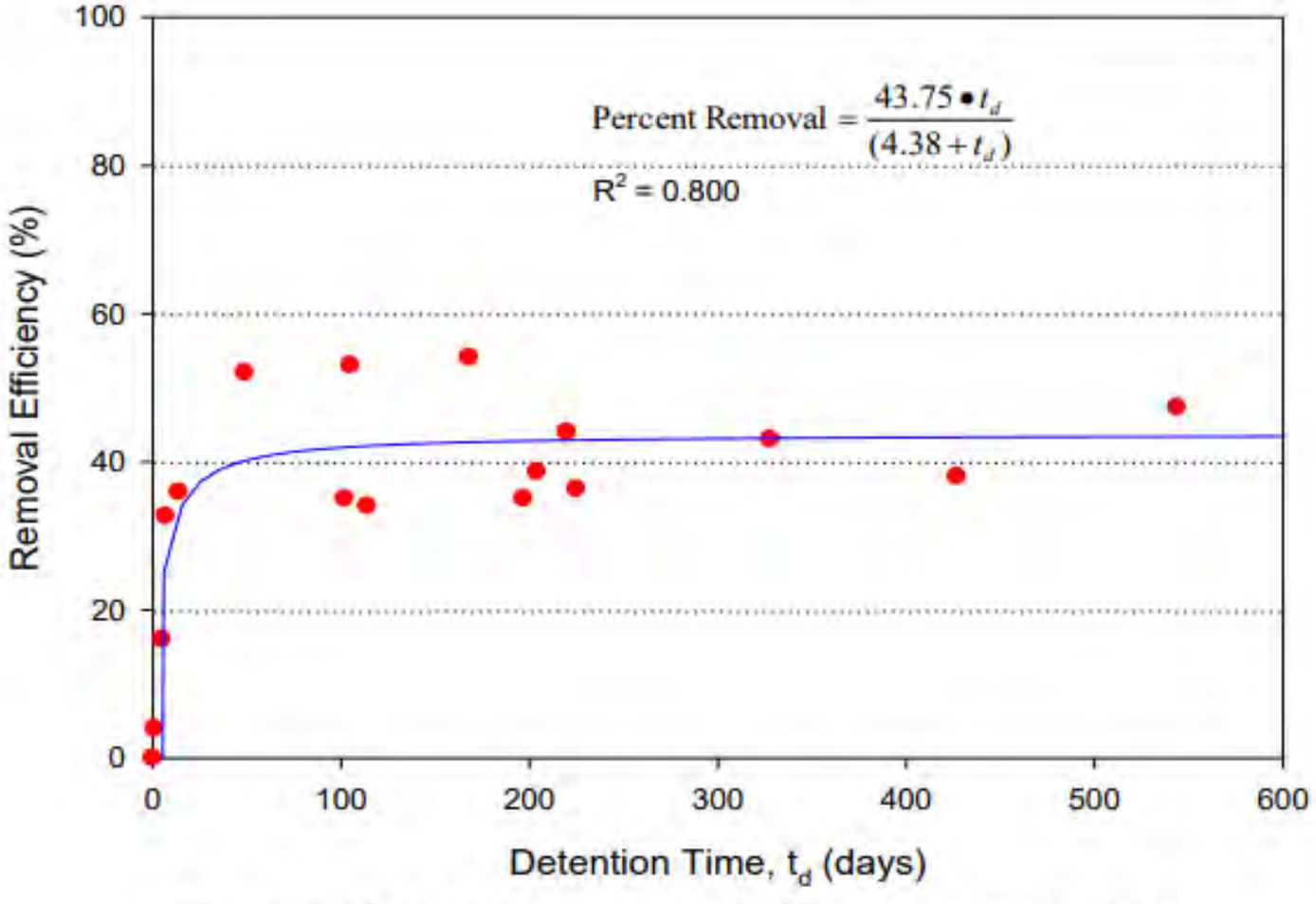


Figure 2: Wet detention removal efficiency curve for TN

Overall Planning Strategy