STATEWIDE BEST MANAGEMENT PRACTICE (BMP) EFFICIENCIES FOR NONPOINT SOURCE MANAGEMENT OF SURFACE WATERS

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The Florida Department of Environmental Protection (DEP) has developed specific approaches in support of watershed restoration activities. The pages that follow describe the DEP methods to calculate total nitrogen (TN) and total phosphorus (TP) reductions for urban stormwater loads related to surface watershed restoration. These calculation methods may be used to assist stakeholders with the selection of BMPs to achieve surface water nutrient load reductions related to basin management action plans (BMAPs), 4e Plans, and 4b/Reasonable Assurance Plans (RAPs).

These calculation methods are not designed for Environmental Resource Permits (ERP) use; the appropriate permitting agency should be consulted for their approved calculation methods.

Removal efficiencies for various standard BMP types as shown in **Table 1**. **Table 2** contains TN and TP reductions for provisional nonpoint source management BMPs. **Table 3** contains a list of BMPs for which data are lacking and water quality benefits are unknown. As additional data become available, these BMPs may be assigned provisional load reduction credits.

At this time, specific activities ineligible for nutrient credits include macroalgal harvesting and natural wetlands as filters, as shown in **Table 4**. Macroalgal harvesting from the impaired waterbody is not eligible for credits because it is a biological result of nutrient loading that should be abated before it reaches the waterbody of concern. See **Table 2** for information about aquatic vegetation harvesting that is eligible for credit, based on specific conditions. Filtration from natural wetlands is ineligible for credit because natural wetlands should not be used as BMPs to attenuate stormwater loads. Various types of artificial wetlands and modular wetland treatment systems are eligible for nutrient credits.

Equations for online and offline retention BMPs are shown in **Table 5** and are based on inches of retention. In addition, the wet detention removal efficiency curves for TP (**Figure 1**) and TN (**Figure 2**) are included in this document.

This is a working document which will be updated periodically as new information becomes available.

TABLE 1: EFFICIENCIES FOR NONPOINT SOURCE MANAGEMENT BMPS

N/A = Not applicable

[1] This is a change from a previous method. The benefits of a baffle box—including BMP maintenance—are included in the baffle box credits when they are installed.

STANDARD BMPS	TP % REDUCTION	TN % REDUCTION	DATA SOURCE
Off-line retention BMPs	40 % - 84 % (see Table 5 for formulas)	40 % - 84 % (see Table 5 for formulas)	Harper, H. & D. Baker. 2007. *Evaluation of Current Stormwater Design Criteria within the State of Florida.*
On-line retention BMPs	30 % - 74 % (see Table 5 for formulas)	30 % - 74 % (see Table 5 for formulas)	DEP Evaluation/Regression of Harper, H., and D. Baker 2007
Grass swales with swale blocks or raised culverts	Use on-line retention BMPs above	Use on-line retention BMPs above	DEP Evaluation/Regression of Harper, H., and D. 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, H., and D. Baker 2007
Wet detention ponds	Formula shown on Figure 13.2 of the Draft Stormwater Treatment Applicant's Handbook- (see Figure 1 below for formula)	Formula shown on Figure 13.3 of the Draft Stormwater Treatment Applicant's Handbook (see Figure 2 below for formula)	Draft Stormwater Treatment Applicant's Handbook, March 2010
Dry detention ponds	10 %	10 %	DEP Evaluation/Regression of Harper, H., and D. Baker 2007
BMP treatment trains using a combination of BMPs	BMP Treatment Train equation: Efficiency = Eff1 +((1-Eff1) *Eff2) or BMPTRAINS model	BMP Treatment Train equation: Efficiency = Eff1 +((1-Eff1) *Eff2) or BMPTRAINS model	Draft Stormwater Treatment Applicant's Handbook, March 2010 and UCF Stormwater Management Academy BMPTRAINS model
Baffle boxes—First generation (hydrodynamic separator)[1]	2.30 %	0.50 %	First and second generation: Final Report Contract S0236 Effectiveness of Baffle Boxes Plus Media Filter: UCF and City of Casselberry studies
Baffle boxes—Second generation[1]	15.5 %	19.05 %	
Baffle boxes—Second generation plus Bold & Gold® media filter[1]	70 %	75 %	
Baffle boxes—Second generation plus Vault-Ox® media filter[1]	8 %	50 %	
Alum injection systems	90 %	50 %	DEP Evaluation/Regression of Harper, H., and D. Baker 2007

STANDARD BMPS	TP % REDUCTION	TN % REDUCTION	DATA SOURCE
Stormwater reuse	Estimate annual load of stormwater (and percentage of total if not 100 %) not discharged because used for irrigation	Estimate annual load of stormwater (and percentage of total if not 100 %) not discharged because used for irrigation	Evaluated on case-by-case basis
Stormceptor units	13 %	2 %	Final Report Contract S0095 Sanford Stormceptor project
Continuous Deflective Separation (CDS) units	10 %	N/A	Final Report Contract WM793 Broadway Outfall Project
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 dry weight/volume of material collected annually and multiply by values provided by FSA UF MS4 BMP project (FINAL MS4 Load Reduction Tool Version 1.2)	Determine dry weight/volume of material collected annually and multiply by values to be provided by the FSA UF MS4 BMP project (FINAL MS4 Load Reduction Tool Version 1.2)	Final Report of 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 dry weight/volume of material collected annually and multiply by values provided by FSA UF MS4 BMP project (known as the "FSA Street Sweeping Tool")	Determine dry weight/volume of material collected annually and multiply by values provided by the FSA UF MS4 BMP project (known as the "FSA Street Sweeping Tool")	Final Report of FSA UF MS4 BMP Project

STANDARD BMPS	TP % REDUCTION	TN % REDUCTION	DATA SOURCE
BMP cleanout (volumetric stormwater features that were designed to catch solids and particles) including the following: • **Basins** • **Tanks** • **Vaults** • **Wet Ponds** • **Dry Ponds** • **Swales (calculating under catch basin cleanout category also acceptable)** • **Ditches (calculating under catch basin cleanout category also acceptable)** **Do not include baffle box material collected[1]—see baffle box category above that includes maintenance benefits**	Determine dry weight/volume of material collected annually and multiply by values provided by FSA UF MS4 BMP project (known as the "FSA Street Sweeping Tool")	Determine dry weight/volume of material collected annually and multiply by values provided by the FSA UF MS4 BMP project (known as the "FSA Street Sweeping Tool")	Final Report of FSA UF MS4 BMP Project
Hybrid Wetland Treatment Technology (HWTT) (patented)	Reduction is specific to the site design and confirmed by monitoring.	Reduction is specific to the site design and confirmed by monitoring.	Based on data and past performance of similar projects.
Green Infrastructure Efforts			
Green roofs (with or without cistern)	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
Rain gardens and bioswales	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
Tree boxes/tree wells	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
Vegetated natural buffers/vegetated filter strip	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model

STANDARD BMPS	TP % REDUCTION	TN % REDUCTION	DATA SOURCE
Green Infrastructure Efforts--continued			
Pervious pavers	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model

TABLE 2: EFFICIENCIES FOR PROVISIONAL NONPOINT SOURCE MANAGEMENT BMPS

N/A = Not applicable

PROVISIONAL BMPS	TP % REDUCTION	TN % REDUCTION	DATA SOURCE
Public education	0.25 % to 6 %, depending on extent of program	0.25 % to 6 %, depending on extent of program	Evaluation of Center for Watershed Protection. 2002. Watershed Treatment Model Version 3.1. Separate calculation spreadsheet available
Muck removal/restoration dredging	Case-by-case depending on nutrient flux of muck	Case-by-case depending on nutrient flux of muck	DEP Muck Removal Credit Guidance (developed for IRL BMAPs)
Floating islands/ Managed aquatic plant systems (MAPS)	Credit based on monitoring results	Credit based on monitoring results	Site-specific monitoring
Aquatic vegetation harvesting	Based on total mass of material collected, type of plant(s), and associated nutrient content in dry material	Based on total mass of material collected, type of plant(s), and associated nutrient content in dry material	DEP Removal of Aquatic Vegetation for Nutrient Credits (developed for IRL BMAPs)
Septic system phase out (proper condemnation and hook-up to sewer service)	N/A	Based on values from ArcNLET model	ArcNLET model
Dispersed water management (DWM)	Based on measured data or ac-ft of storage and land use concentration	Based on measured data or ac-ft of storage and land use concentration	Determined through discussions between the Department and SFWMD
Stormwater treatment areas (STAs)	Based on engineering design calculations	Based on engineering design calculations	SFWMD
Denitrification walls	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
Biosorption activated media (BAM)	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model

TABLE 3: BMPS FOR WHICH DATA ARE LACKING TO ASSIGN CREDIT/UNKNOWN BENEFITS/NO CREDIT

BMPS LACKING DATA FOR CREDIT
Creating/enhancing living shoreline
Creating/enhancing oyster reefs
Seagrass planting
Local code changes/economic incentives
Reduction of nutrients in reclaimed water
Enhanced public education
Plugging artesian wells
Retention of storm events larger than 4.0 inches
Turbidity reducing polymers (e.g., Floc logs ®)

TABLE 4: SPECIFIC ACTIVITIES INELIGIBLE FOR NUTRIENT CREDIT

INELIGIBLE BMPS/ACTIVITIES
Macroalgal harvesting
Natural wetlands as filters

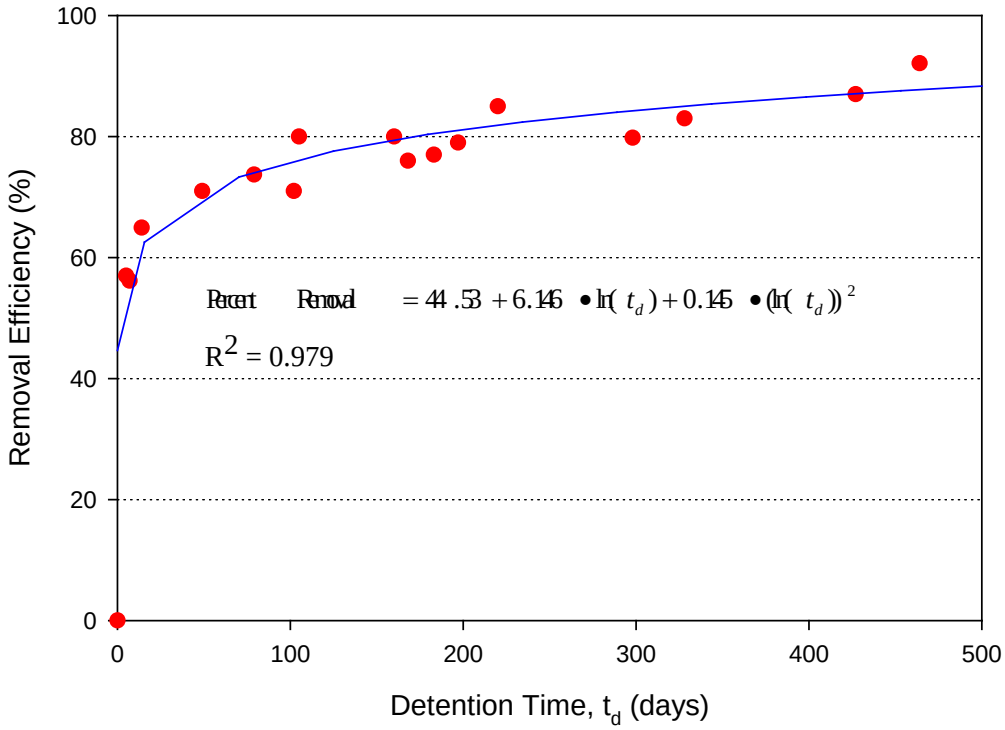

FIGURE 1: WET DETENTION REMOVAL EFFICIENCY CURVE FOR TOTAL PHOSPHORUS

T_d= (PPV/RO)*CF

where:

T_d = Detention time (days)

PPV = Permanent pool volume (acre-ft)

RO = Annual runoff inputs (acre-ft/year)

CF= Conversion factor (365 days/year)

And

RO =DA*C*R*CF

where:

RO= Annual runoff inputs (acre-ft/year)

DA = Drainage area to pond (acre)

C = Runoff coefficient

R = Mean annual rainfall (inches/year)

CF= Conversion factor (ft/12 inches)

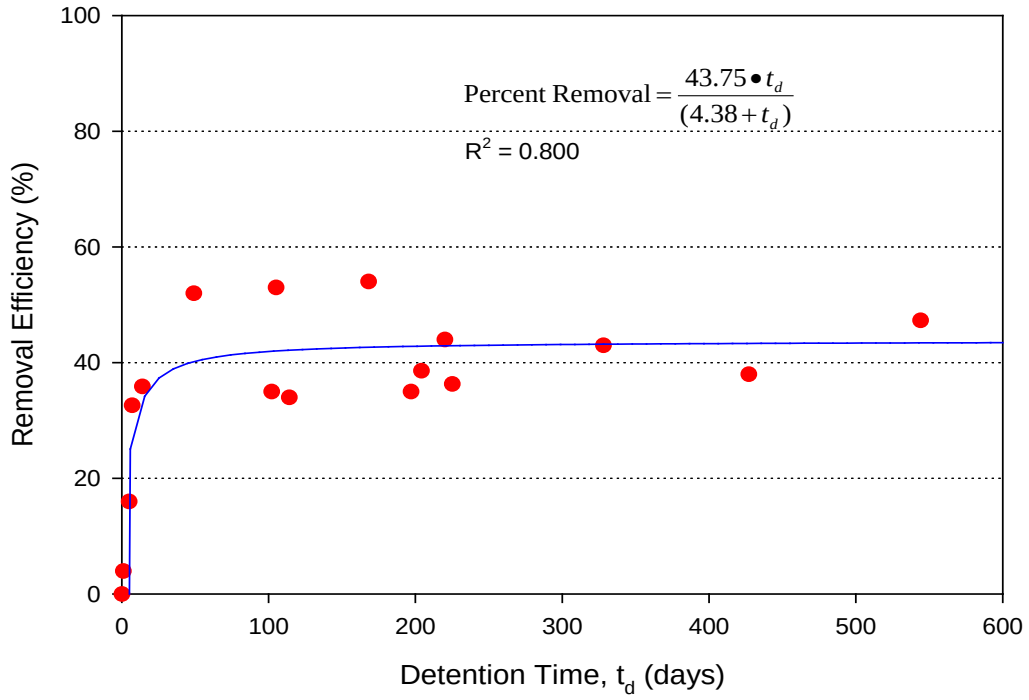

FIGURE 2: WET DETENTION REMOVAL EFFICIENCY CURVE FOR TOTAL NITROGEN

T_d= (PPV/RO)*CF

where:

T_d = Detention time (days)

PPV = Permanent pool volume (acre-ft)

RO = Annual runoff inputs (acre-ft/year)

CF= Conversion factor (365 days/year)

And

RO =DA*C*R*CF

where:

RO= Annual runoff inputs (acre-ft/year)

DA = Drainage area to pond (acre)

C = Runoff coefficient

R = Mean annual rainfall (inches/year)

CF= Conversion factor (ft/12 inches)

TABLE 5: EQUATIONS FOR ONLINE AND OFFLINE RETENTION BMPS

STANDARD BMPS	INCHES OF RETENTION	TP AND TN % REDUCTION	DATA SOURCE
Retention BMPs (includes basins, exfiltration trenches, swales with swale blocks, etc.)	0.25 to 4.0 inches	Based on percent reduction from appropriate table in Appendix F of the Draft Stormwater Treatment Applicant's Handbook using project's percent DCIA, non-DCIA CN, and rainfall zone.	Draft Stormwater Treatment Applicant's Handbook, March 2010
Off-line retention BMPs (Power Formula)	< 0.15 inch	0.8656 * (x)^0.5403	DEP Evaluation/Regression of Harper, H., and D. Baker 2007
Off-line retention BMPs (Natural Log Formula)	≥ 0.15 inch	0.3178 * ln(x) + 0.8405	DEP Evaluation/Regression of Harper, H., and D. Baker 2007
On-line retention BMPs (Natural Log Formula)	≥ 0.1 inch	0.3178 * ln(x) + 0.7405	DEP Evaluation/Regression of Harper, H., and D. Baker 2007