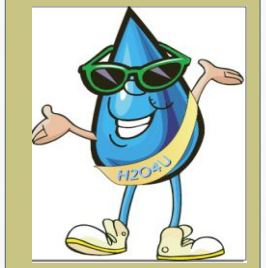
CASE STUDIES: BMPTRAINS MODEL

BY: MARTY WANIELISTA AND ERIC LIVINGSTON



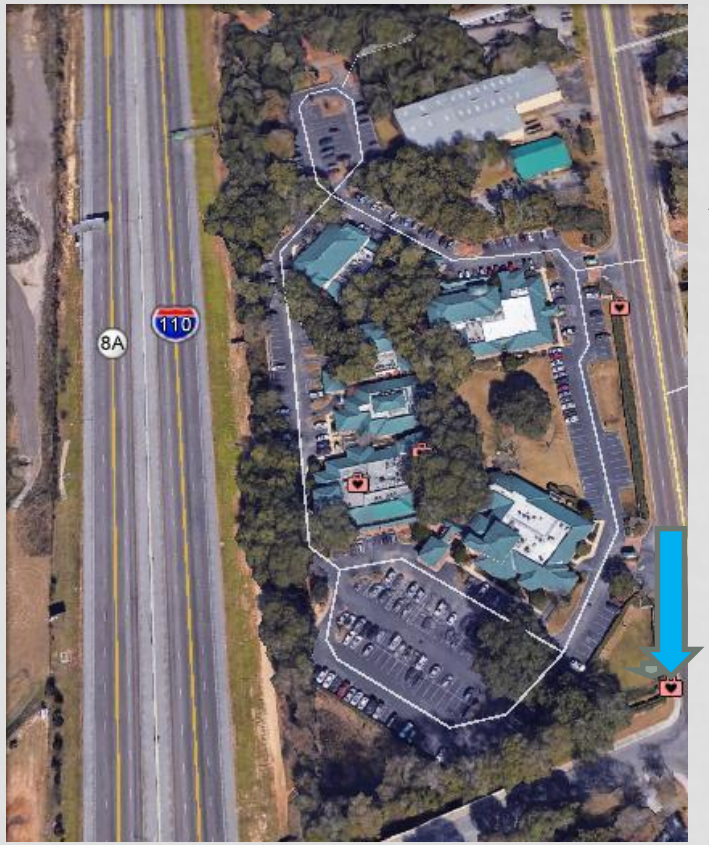
August, 2016
Escambia County

ACKNOWLEDGEMENTS

- The Low Impact Design BMP workshops were presented on August 24 and 25, 2016 at the Escambia County Central Office Complex in Pensacola.
- The Escambia County LID BMP Manual and the LID BMP Workshops were funded in part by a Section 319 Nonpoint Source Management Program Implementation grant from the U.S. Environmental Protection Agency through an agreement/contract with the Nonpoint Source Management Section of the Florida Department of Environmental Protection.

LID IN PENSACOLA: FROM SINGLE FAMILY TO MULTI-FAMILY

- Using as an example, the following
- 10 acre watershed
- Annual rain = 62.2 inches
- Soil Type is sandy with CN=50
- Pre condition is single family
  - with % DCIA = 20
- New development is multi-family
  - with % DCIA = 60 and
  - The developer wants to use depression storage and pervious pavements
- Net improvement is required resulting
  - In 67% TN and 77% TP reduction



Note: not the Actual location

RAINFALL AND TYPE OF EFFECTIVENESS ANALYSIS

GENERAL SITE INFORMATION: V 8.0	GO TO INTRODUCTION PAGE	7/31/2016	Blue Numbers = Input data Red Numbers = Calculated or Carryover
Select the appropriate Meteorological Zone, input the appropriate Mean Annual Rainfall amount and select the type of analysis	NAME OF PROJECT: Escambia County Res to Multi family		HELP VIEW ZONE MAP
Meteorological Zone (Please use zone map):	CLICK ON CELL BELOW TO SELECT: Zone 1		VIEW MEAN ANNUAL RAINFALL MAP
Mean Annual Rainfall (Please use rainfall map):	62.20 Inches		
Type of analysis:	CLICK ON CELL BELOW TO SELECT: Net improvement		GO TO WATERSHED CHARACTERISTICS
Treatment efficiency (N, P) (leave empty if net improvement or BMP analysis is used):	%		
Select the STORMWATER TREATMENT ANALYSIS Button below to begin analyzing the effectiveness of Best Management Practices.		Model documentation and example problems.	

Button For View Zone Maps

Note: Annual rainfall of 62.2 inches approved for use.

WATERSHEDS
CATCHMENT INPUTS

WATERSHED CHARACTERISTICS V 8.0			GO TO STORMWATER TREATMENT ANALYSIS
SELECT CATCHMENT CONFIGURATION	7/31/2016		CLICK ON CELL BELOW TO SELECT CONFIGURATION
			A - Single Catchment

For comingling, the off-site catchment must be upstream. The delay is only for retention BMPs and must be used in hours as measured by the time of concentration at a one inch/hour rain

Delay [hrs]		CATCHMENT NO.1 NAME:	Pensacola Tropics
		CLICK ON CELL BELOW TO SELECT	
Pre-development land use: with default EMCs		Single-Family: TN=2.070 TP=0.327	
		CLICK ON CELL BELOW TO SELECT	
Post-development land use: with default EMCs		Multi-Family: TN=2.320 TP=0.520	

VIEW AVERAGE ANNUAL RUNOFF "C" Factor

VIEW EMC & FLUCCS

GO TO GIS LANDUSE DATA

Total pre-development catchment area:	10.00	AC	
Total post-development catchment or BMP analysis area:	10.00	AC	Average annual pre run
Pre-development Non DCIA CN:	50.00		Average annual post ru
Pre-development DCIA percentage:	20.00	%	Pre-development Annua
Post-development Non DCIA CN:	50.00		Pre-development Annua
Post-development DCIA percentage:	60.00	%	Post-development Annu
Estimated BMPArea (No loading from this area)		AC	Post-development Annu

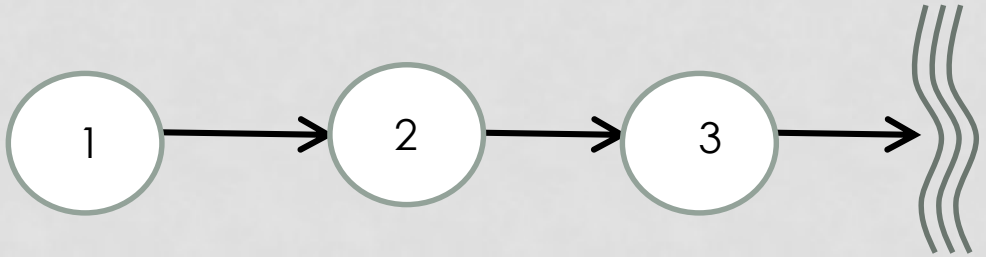
CATCHMENT NO.2 NAME:	

WATERSHEDS

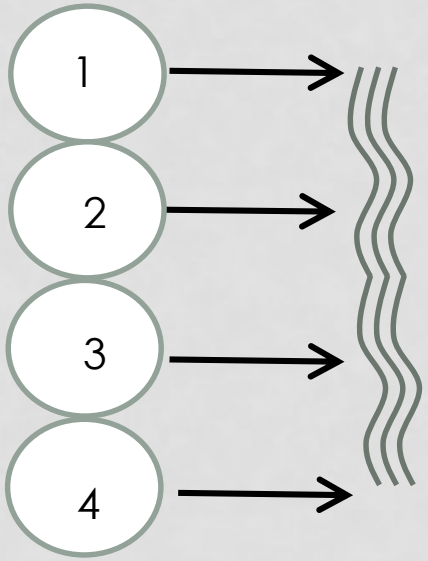
CATCHMENT CONFIGURATIONS

WATERSHED CHARACTERISTICS	VIEW CATCHMENT CONFIGURATION
SELECT CATCHMENT CONFIGURATION	

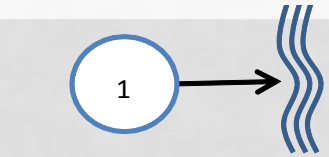
Series



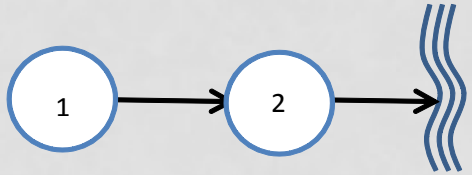
Parallel



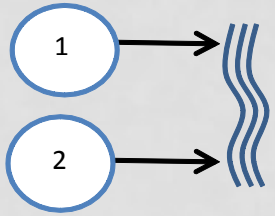
UP TO THREE BMPS IN SERIES IN EACH CATCHMENT



A - Single Catchment



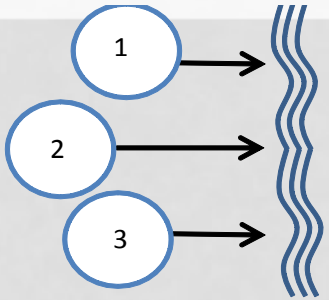
B - 2 Catchment-Series



C - 2 Catchment-Parallel

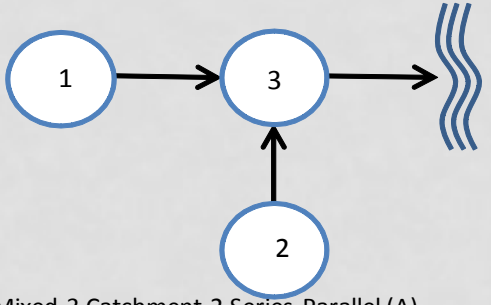
Up to 3 BMPs in Each catchment

E



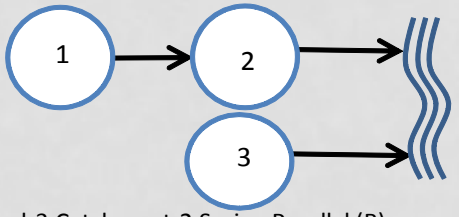
E - 3 Catchment-Parallel

F



F - Mixed-3 Catchment-2 Series-Parallel (A)

G

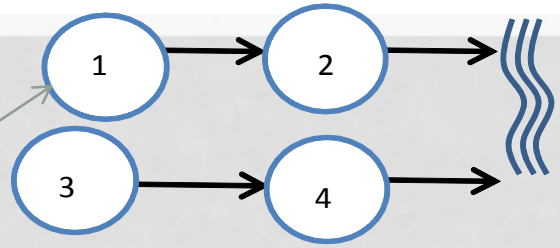


G - Mixed-3 Catchment-2 Series-Parallel (B)

UP TO 14 CONFIGURATIONS

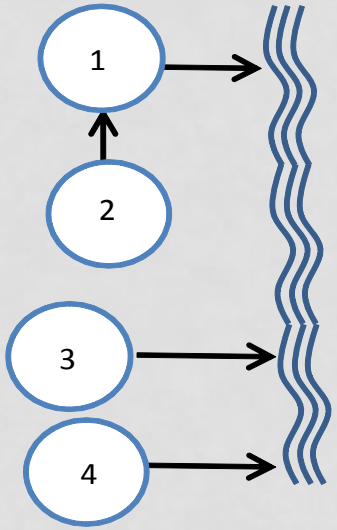
Up to 3 BMPs in Each catchment with no increase in catchment area between the BMPs

M



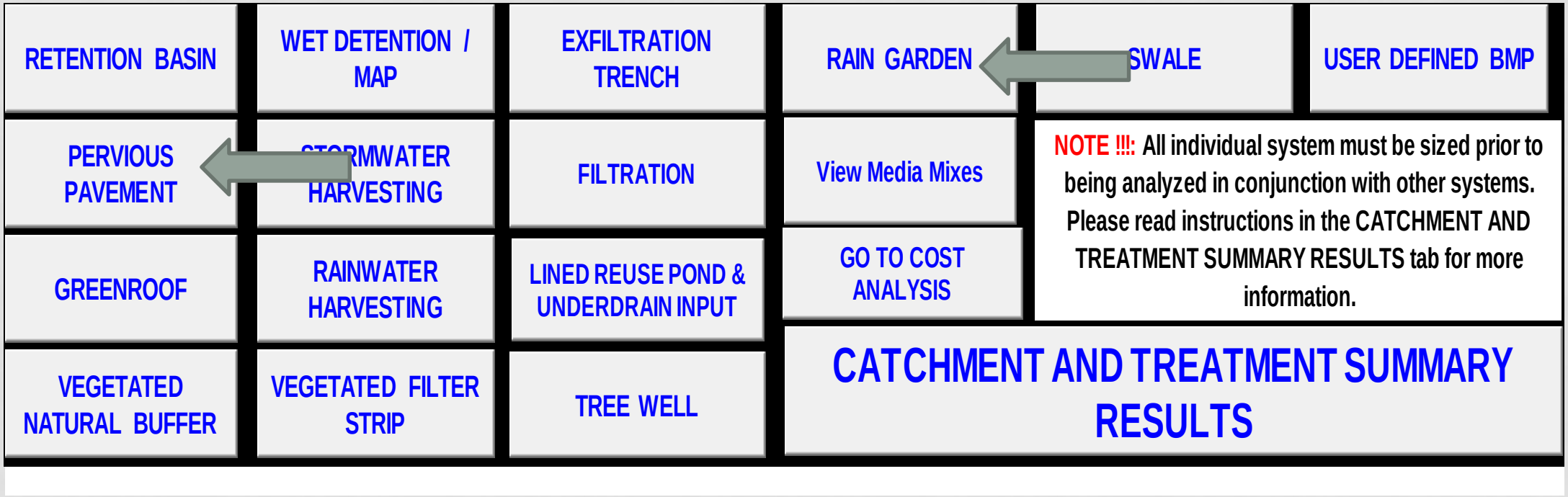
M - Mixed-4 Catchment-2 Series

N



N - Mixed-4 Catchment-2 Series-2 Parallel

15 BMPS AND ONE USER DEFINED



PERVIOUS PAVEMENT INPUT AND RESULTS

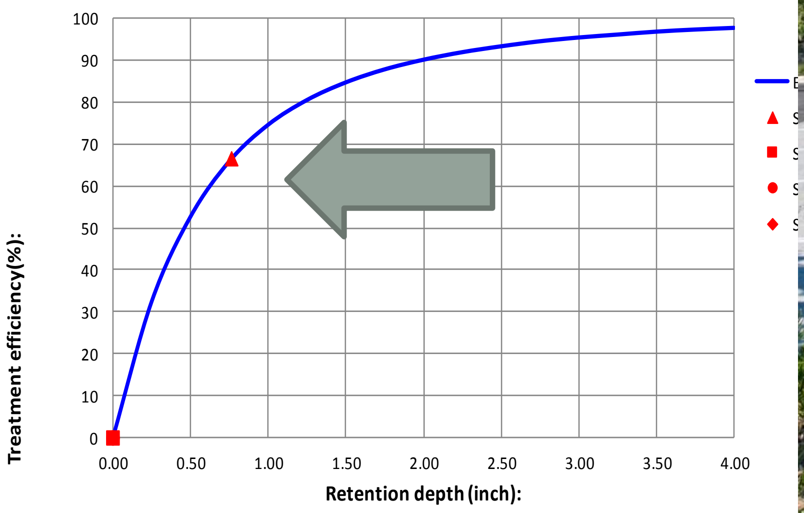
PERVIOUS PAVEMENT:		7/31/2016	V 8.0	
CONTRIBUTING WATERSHED AND PERVIOUS PAVEMENT CHARACTERISTICS:				
Pervious Pavement Section Storage Calculator (S')				
Layer		Thickness (in):	Operational Porosity (%):	Storage (in):
Pvmt Name	concrete	6.00	0.20	0.012
Pvmt/ SubBase				
#57 rock		8.00	21.00	1.680
#89 pea rock		4.00	25.00	1.000
#4 rock			24.00	
Recycled (crushed) concrete			21.00	
BOLD & GOLD™			9.00	
Other SubBase				
Layer		Thickness (in):	Operational Porosity (%):	Storage (in):
Pvmt Name				
Pvmt/ SubBase				
#57 rock			21.00	
#89 pea rock			25.00	
#4 rock			24.00	
Recycled (crushed) concrete			21.00	
BOLD & GOLD™			9.00	
Other SubBase				
Layer		Thickness (in):	Operational Porosity (%):	Storage (in):
Pvmt Name				
Pvmt/ SubBase				
#57 rock			21.00	
#89 pea rock			25.00	
#4 rock			24.00	
Recycled (crushed) concrete			21.00	
BOLD & GOLD™			9.00	
Other SubBase				
Layer		Thickness (in):	Operational Porosity (%):	Storage (in):
Pvmt Name				
Pvmt/ SubBase				
#57 rock			21.00	
#89 pea rock			25.00	

Escambia County Res to Multi family	Blue Numbers =	
	Red Numbers =	Calcul

GO TO STORMWATER TREATMENT ANALYSIS

VIEW TYPICAL PERVIOUS PAVEMENT SYSTEM SCHEM

Note: There are loadings from this BMP area needing treatment.	Pensacola Trop	Catchment 2	Catc
Contributing catchment area:	10.000	0.000	
Required treatment efficiency (**Nitrogen**):	66.948		
Required treatment efficiency (**Phosphorus**):	76.705		
Storage provided in specified pervious pavement system:	2.692	0.000	
Area of the pervious pavement system:	2.850		
Provided retention over the contributing catchment area:	0.767	0.000	
Provided treatment efficiency (**Nitrogen**):	66.499	0.000	
Provided treatment efficiency (**Phosphorus**):	66.499	0.000	
Remaining treatment efficiency needed (**Nitrogen**):	1.339		
Remaining treatment efficiency needed (**Phosphorus**):	30.464		
Remaining retention depth needed if retention:	0.322	0.000	



RAIN GARDEN DEPRESSION AREAS INPUT AND RESULTS

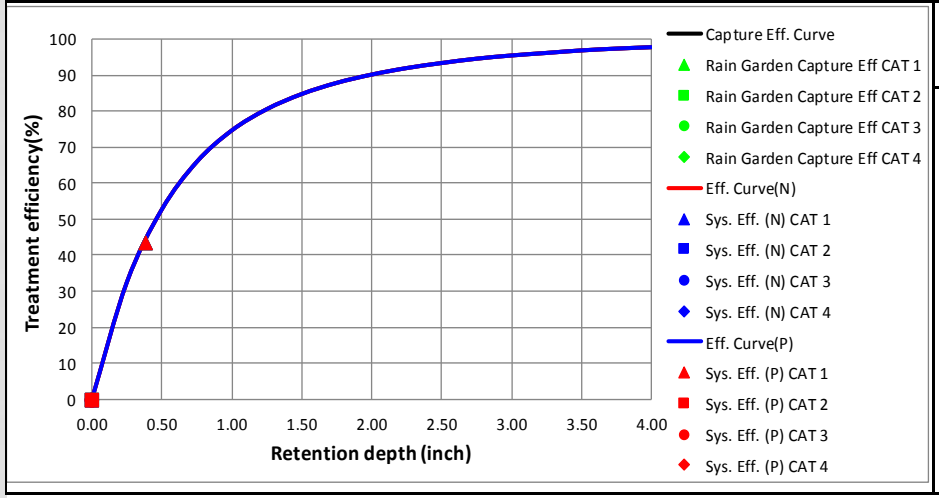
RAIN GARDEN **7/31/2016** **V 8.0**

These are depressed areas in a landscape for the storage of runoff water.

Loadings from BMP area are contained by the BMP, thus no BMP area load.	Pensacola Tropic	Catchment 2	Catchment 3	Catchment 4	
Contributing catchment area:	10.000	0.000	0.000	0.000	ac
Required treatment efficiency (**Nitrogen**):	66.948				%
Required treatment efficiency (**Phosphorus**):	76.705				%
Provided retention depth for hydraulic capture efficiency (see below):	0.386	0.000	0.000	0.000	in
Provided retention volume for hydraulic capture efficiency:	0.321	0.000	0.000	0.000	ac-ft
Is this a retention or detention system?	Retention				
Select media mix — View Media Mixes					
Provided treatment efficiency (**Nitrogen**):	43.463	0.000	0.000	0.000	
Provided treatment efficiency (**Phosphorus**):	43.463	0.000	0.000	0.000	

Volume Storage Input data

Sustainable void space fraction	0.20				
Media volume CF =	20000				
Water above media in CF =	10000				
Thus volume storage CF=	14000	0	0	0	
Used for retention depth above in row 10 & volume storage (inches) =	0.386	0.000	0.000	0.000	



NOTE FOR TREATMENT EFFICIENCY GRAPH:

The purpose of this graph is to help illustrate the treatment efficiency of the retention system as the function of retention depth. The graph illustrates that there is a point of diminished return as the retention depth is substantially increased. Therefore, to provide the most economical BMP treatment system, other alternatives such as "treatment trains" and compensatory treatment should be considered.

SUMMARY RESULTS

SINGLE TO MULTI-FAMILY WITH RAIN GARDENS AND PERVIOUS PAVEMENT

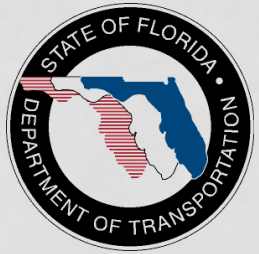
CATCHMENTS AND TREATMENT SUMMARY RESULTS				V 8.0
CALCULATION METHODS:				
1. The effectiveness of each BMP in a single catchment is converted to an equivalent capture volume.				
2. Certain BMP treatment train combinations have not been evaluated and in practice they are at this time not used, an example is a greenroof following a tree well.				
3. Wet detention is last when used in a single catchment with other BMPs, except when followed by filtration				
PROJECT TITLE	Escambia County Res to Multi family	Optional Identification		
	Pensacola Tropics	Catchment 2	Catchment 3	Catchment 4
BMP Name	Pervious Pavement			
BMP Name	Rain Garden			
BMP Name				

Summary Performance of Entire Watershed			
Catchment Configuration	A - Single Catchment		7/31/2016
Nitrogen Pre Load (kg/yr)	25.54	Treatment Objectives or Target MET	BMPTRAINS MODEL
Phosphorus Pre Load (kg/yr)	4.03		
Nitrogen Post Load (kg/yr)	77.27		
Phosphorus Post Load (kg/yr)	17.32		
Target Load Reduction (N) %	67		
Target Load Reduction (P) %	77		
Target Discharge Load, N (kg/yr)	25.50		
Target Discharge Load, P (kg/yr)	3.98		
Provided Overall Efficiency, N (%):	78		
Provided Overall Efficiency, P (%):	78		
Discharged Load, N (kg/yr & lb/yr):	16.84	37.09	
Discharged Load, P (kg/yr & lb/yr):	3.77	8.31	
Load Removed, N (kg/yr & lb/yr):	60.43	133.10	
Load Removed, P (kg/yr & lb/yr):	13.54	29.83	

Seal of Approval

Conclusions

1. BMPTRAINS model is used to evaluate and size treatment systems based on an average annual effectiveness.
2. The average annual effectiveness is site specific incorporating rainfall conditions, impervious cover, soil conditions, type of land use, and type of LID BMP.
3. LIDs can be analyzed in either series or parallel structure. The estimates stay “true” to the underlying rainfall and catchment conditions.



QUESTIONS, REMARKS AND DISCUSSION

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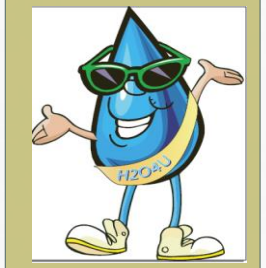

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