HELP AND BACKGROUND

University of Central Florida

BMPTRAINS MODEL:

A TRAINING WORKSHOP

BY: MARTY WANIELISTA, HARVEY HARPER AND MIKE HARDIN.

PURPOSE OF TRAINING IS TO:

- Understand the theory essential for estimating annual nutrient mass removal.
- Understand the basis of removal for 15 Stormwater Best Management Practices.
- Define input data required for the BMPTRAINS program.
- Use BMPTRAINS for the selection of stormwater best management practices.

Credit and thanks to: Mike Hardin, Dr. Harvey Harper, Dr. Ikiensinma Gogo-Abite and Chris Kuzlo

BMPTRAINS MODEL AND USERS MANUAL

BMPTRAINS: an EXCEL based model for sizing BMPs and estimating annual removal effectiveness.

It's name is derived from the analysis of stormwater BMPs in series.

The model is used to evaluate **B**est **M**anagement **P**ractice **T**reatment options for **R**emoval on an **A**nnual basis by those **I**nterested in **N**utrients in **S**tormwater.

Available from: www.stormwater.ucf.edu

What's New

BMPTRAINS Stormwater Best Management Practices Analysis Model (Version 7.4) Registration, Model, and User's Manual

LITERATURE REVIEW

FROM THE USER'S MANUAL

Literature Review 2

Jordan/Falls Lake Stormwater Nutrient Load Accounting Model 2

BMP SELECT Model 3

EPA Clinton River Site Evaluation Tool (SET) and National Stormwater Calculator 5

Virginia Runoff Reduction Method Worksheet 7

Department of Environmental Services (DES) Pollutant Loading Spreadsheet Model 9

Stormwater Best Management Practice Design Workbook 11

Stormwater Management and Design Aid (SMADA) 12

NAVIGATING the BMP Nutrient Model BMPTRAINS

EXCEL BASED

Stormwater BMP Treatment Trains [BMPTRAINS©]

CLICK HERE TO START

FDOT University of Central Florida

INTRODUCTION PAGE

Model requires the use of Excel 2007 or newer

This program is compiled from stormwater management publications and deliberations during a two year review of the stormwater rule in the State of Florida. Input from the members of the Florida Department of Environmental Protection Stormwater Review Technical Advisory Committee and the staff and consultants from the State Water Management Districts is appreciated.

The State Department of Transportation provided guidance and resources to compile this program. The Stormwater Management Academy is responsible for the content of this program.

HELP - INTRODUCTION

HELP AND BACKGROUND

1) There is a users manual to help navigate this program and it is available at www.stormwater.ucf.edu

2) This spreadsheet is best viewed at 1280 BY 1080 PIXELS screen resolution. If the maximum resolution of your computer screen is lower than 1280 BY 1080 PIXELS you can adjust the view in the Excel VIEW menu by zooming out to value smaller than 100 PERCENT.

3) This spreadsheet has incorporated ERROR MESSAGE WINDOWS. Your analysis is not valid unless ALL ERROR MESSAGE WINDOWS are clear.

4) PRINTING INSTRUCTIONS: Print the page to MICROSOFT OFFICE DOCUMENT IMAGE WRITER (typically the default) or ADOBE PDF, save the page as an image document, then print the document you saved.

5) Click on the button located on the top of this window titled CLICK HERE TO START to begin the analysis.

Disclaimer: These workbooks were created to assist in the analysis of Best Management Practice calculations. All users are responsible for validating the accuracy of the internal calculations. If improvements are noted within this model, please e-mail Marty Wanielista, Ph.D., P.E. at martin.wanielista@ucf.edu with specific information so that revisions can be made.

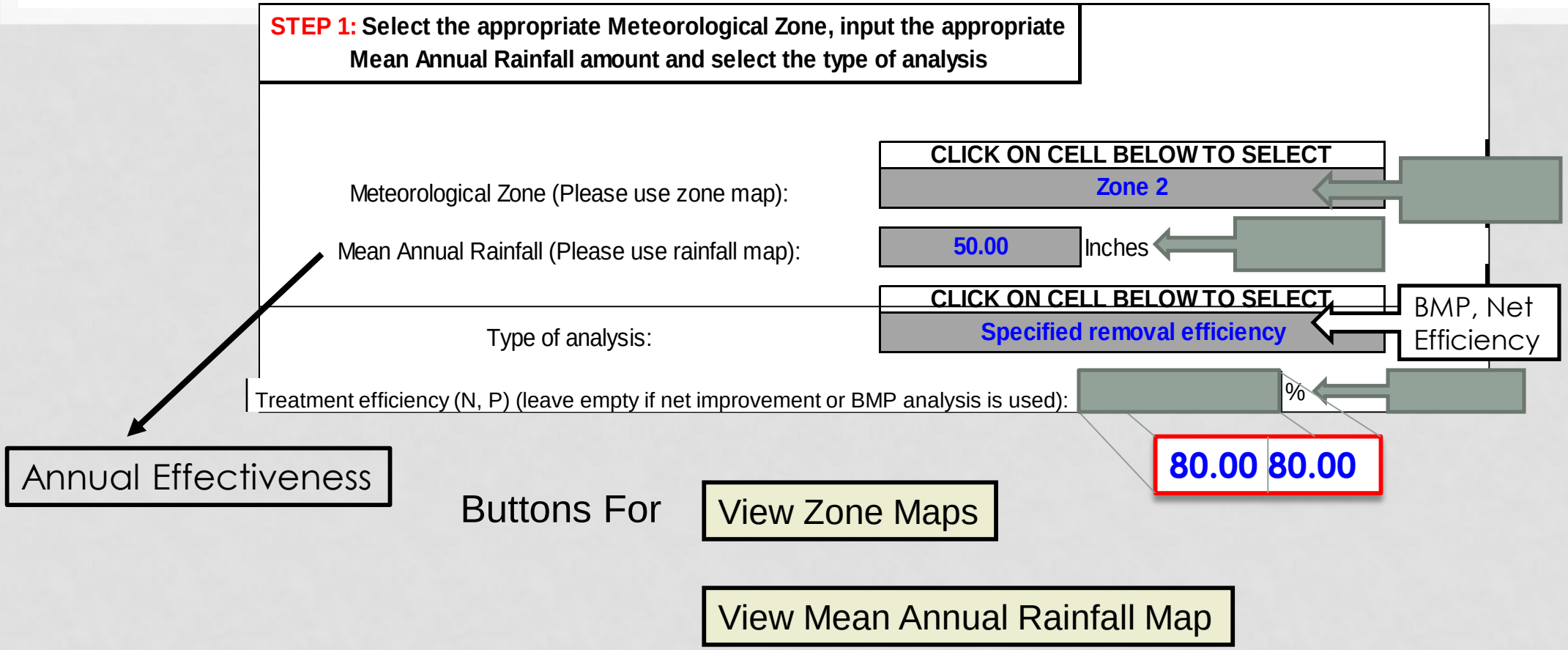
The authors of this program were Christopher Kuzlo, Marty Wanielista, Mike Hardin, and Ikiensinma Gogo-Abite.
This is version 7.4 of the program, updated on September 5, 2014. Comments are appreciated.

HELP - HYDROGRAPH AND LEGACY PROGRAMS

SMADA ONLINE

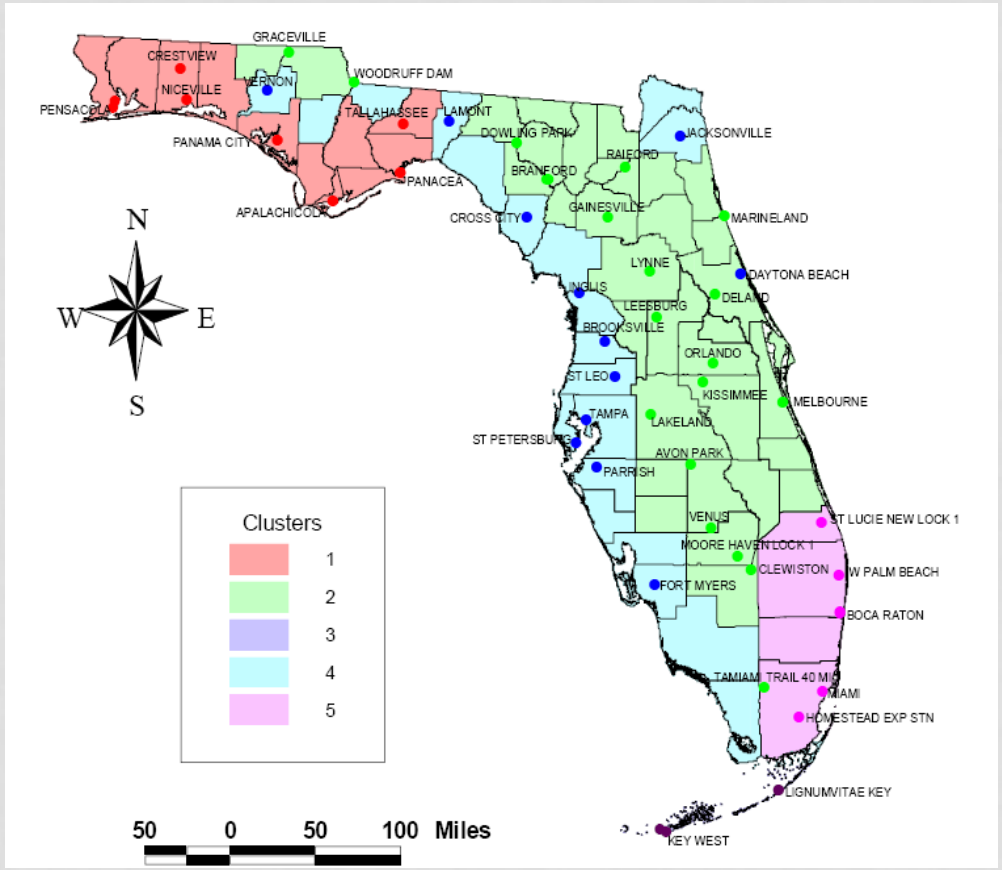
NOTE: the HELP button on a page will take you to information related to that page

RAINFALL AND TYPE OF EFFECTIVENESS ANALYSIS



RAINFALL DISTRIBUTIONS

- Rainfall distributions are regionally different.



WATERSHEDS
CATCHMENT INPUTS

WATERSHED CHARACTERISTICS	GO TO STORMWATER TREATEMENT ANALYSIS
SELECT CATCHMENT CONFIGURATION	CLICK ON CELL BELOW TO SELECT CONFIGURATION

CATCHMENT NO.1 CHARACTERISTICS: \ **If mixed land uses (side calculation)**

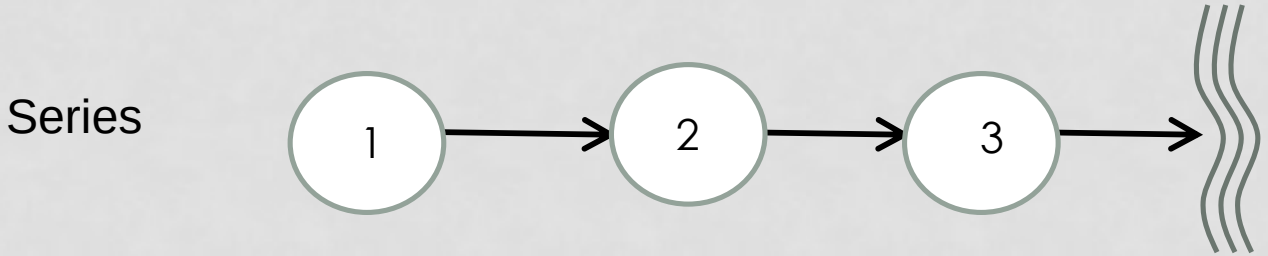
	CLICK ON CELL BELOW TO SELECT	Land use	Area Acres	non DCIA CN	%DCIA
Pre-development land use:	Multi-Family: TN=2.230 TP=0.520				
with default EMCs	CLICK ON CELL BELOW TO SELECT				
Post-development land use:	Highway: TN=1.640 TP=0.220				
with default EMCs		Total			

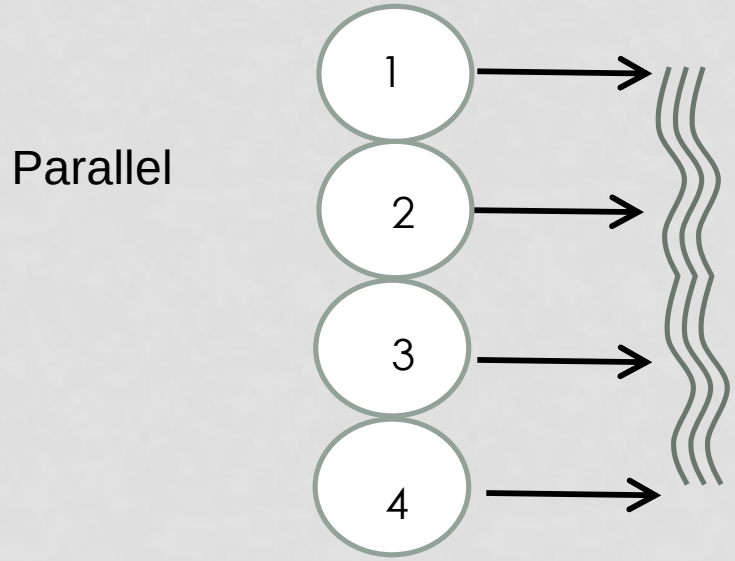
Total pre-development catchment area:	0.55	AC
Total post-development catchment or BMP analysis area:	0.55	AC
Pre-development Non DCIA CN:	80.00	
Pre-development DCIA percentage:	0.00	%
Post-development Non DCIA CN:	80.00	
Post-development DCIA percentage:	100.00	%
Estimated Area of BMP (used for rainfall excess not loadings)	0.03	AC

WATERSHEDS

CATCHMENT CONFIGURATIONS

WATERSHED CHARACTERISTICS	VIEW CATCHMENT CONFIGURATION
SELECT CATCHMENT CONFIGURATION	





Up to 3 BMPs in Each catchment

up to 14 configurations

EMC DEFAULT VALUES

AS OF JUNE 3, 2013

LAND USE CATEGORY	Event Mean Concentration (mg/l)	
	TOTAL Nitrogen	TOTAL Phosphorus
Low-Density Residential[1]	1.51	0.178
Single-Family	1.87	0.301
Multi-Family	2.1	0.497
Low-Intensity Commercial	1.07	0.179
High-Intensity Commercial	2.2	0.248
Light Industrial	1.19	0.213
Highway	1.37	0.167
Agricultural - Pasture	3.3	0.621
Agricultural - Citrus	2.07	0.152
Agricultural - Row Crops	2.46	0.489
Agricultural - General Agriculture[2]	2.79	0.431
Undeveloped	1.15	0.055
Mining / Extractive	1.18	0.15

1. Average of single-family and undeveloped loading rates

2. Mean of pasture, citrus, and row crop land uses

METHODOLOGIES: Effectiveness based on annual removals

GENERAL SITE INFORMATION:	GO TO INTRODUCTION PAGE	Blue Numbers = Input data Red Numbers = Answers

STEP 1: Select the appropriate Meteorological Zone, input the appropriate Mean Annual Rainfall amount and select the type of analysis

Meteorological Zone (Please use zone map):	CLICK ON CELL BELOW TO SELECT Zone 2	VIEW ZONE MAP
Mean Annual Rainfall (Please use rainfall map):	50.50 Inches	
Type of analysis:	CLICK ON CELL BELOW TO SELECT Specified removal efficiency	VIEW MEAN ANNUAL RAINFALL MAP
Treatment efficiency (leave empty if net improvement analysis is used):	80.00 %	

STEP 2: Select the STORMWATER TREATMENT ANALYSIS to begin analyzing Best Management Practices.

STORMWATER TREATMENT ANALYSIS

Systems available for analysis:
Retention Basin
Wet Detention
Exfiltration Trench
Pervious Pavement
Stormwater Harvesting
Underdrain Biofiltration
Greenroof
Rainwater Harvesting
Floating Island with Wet Detention
Vegetated Natural Buffer
Vegetated Filter Strip
Swale
Rain Garden

RESET INPUT FOR SINGLE SYSTEM TABS

METHODOLOGY FOR CALCULATING REQUIRED TREATMENT EFFICIENCY

METHODOLOGY FOR RETENTION SYSTEMS

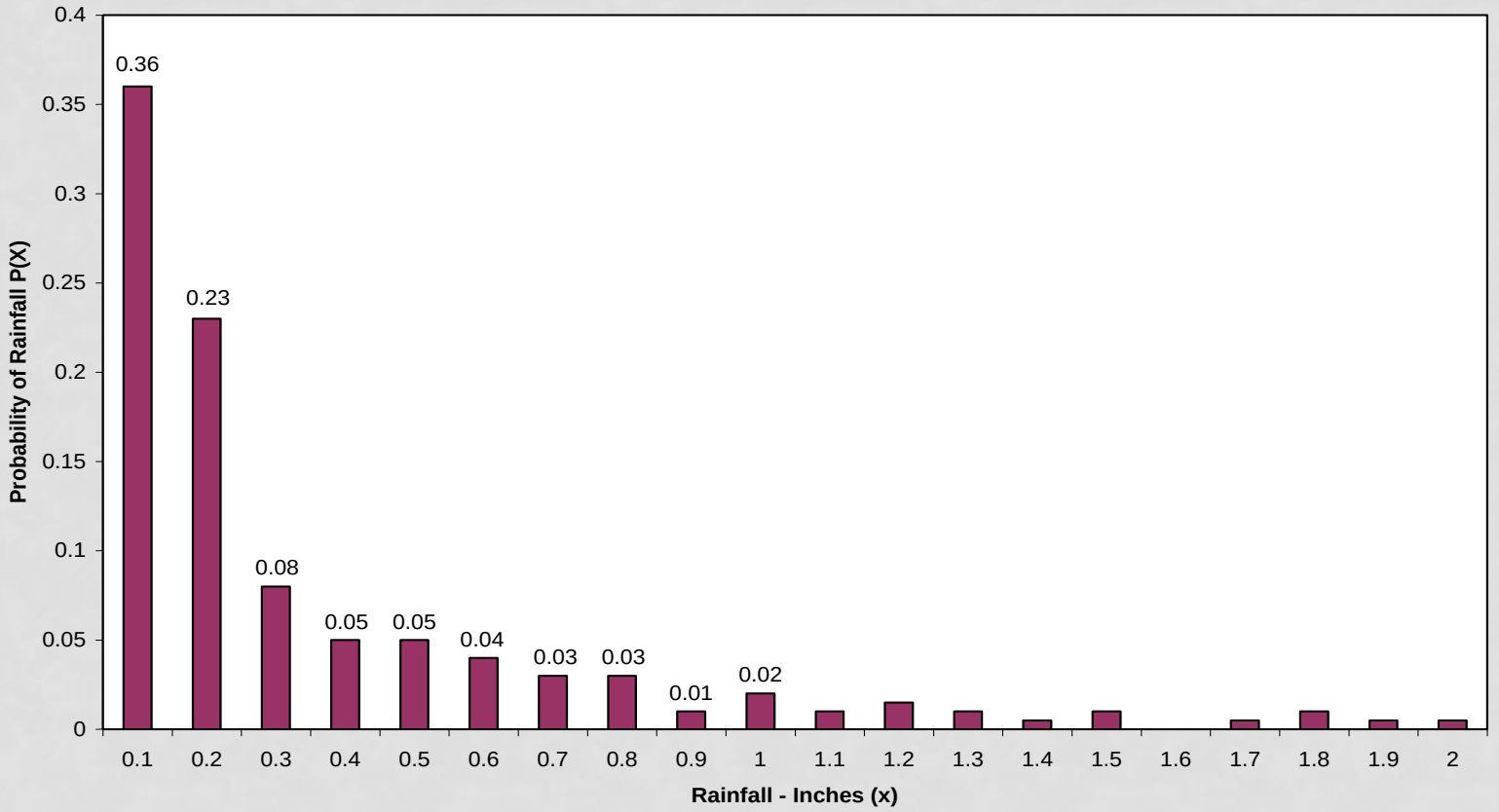
METHODOLOGY FOR WET DETENTION SYSTEMS

METHODOLOGY FOR STORMWATER AND RAINWATER HARVESTING

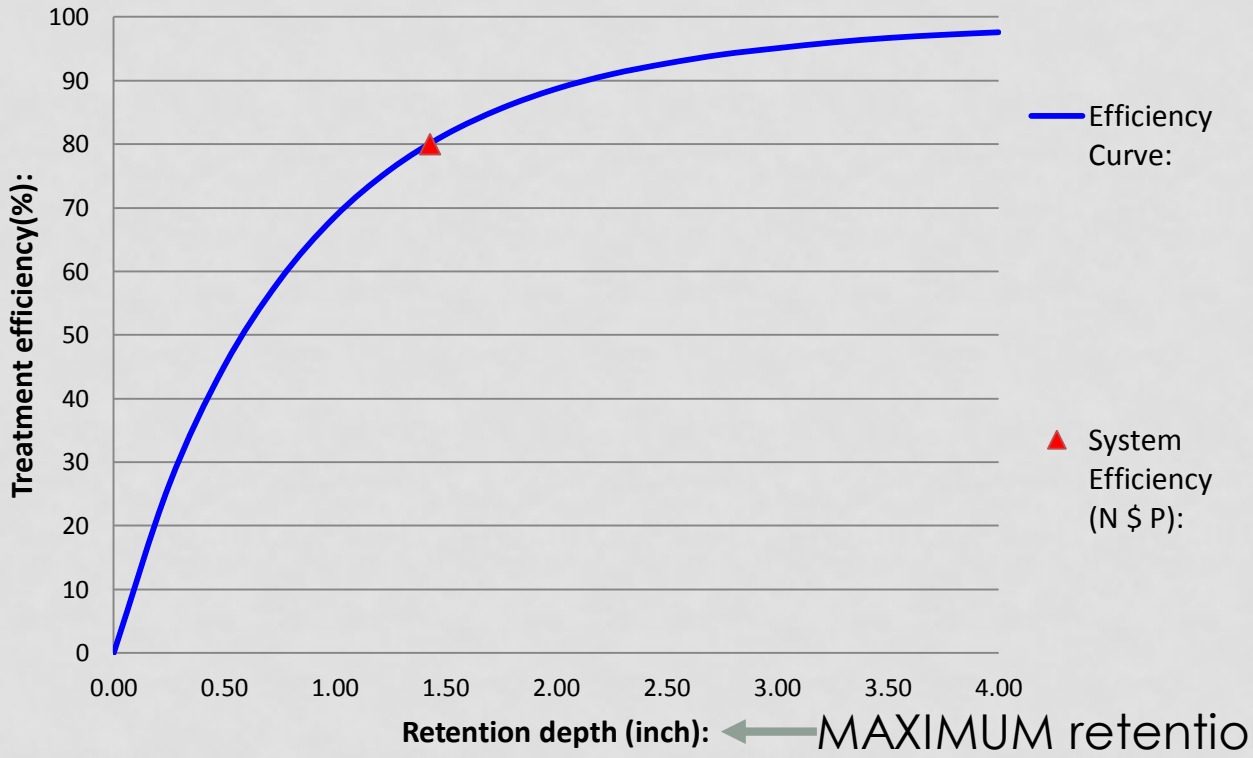
METHODOLOGY FOR GREENROOF SYSTEMS

HISTOGRAM OF RAINFALL VOLUMES

Most Rainfall Data are hourly based and for 30 years, up to 2005
There are regional differences affecting treatment efficiency



Example Demonstration Retention in Series

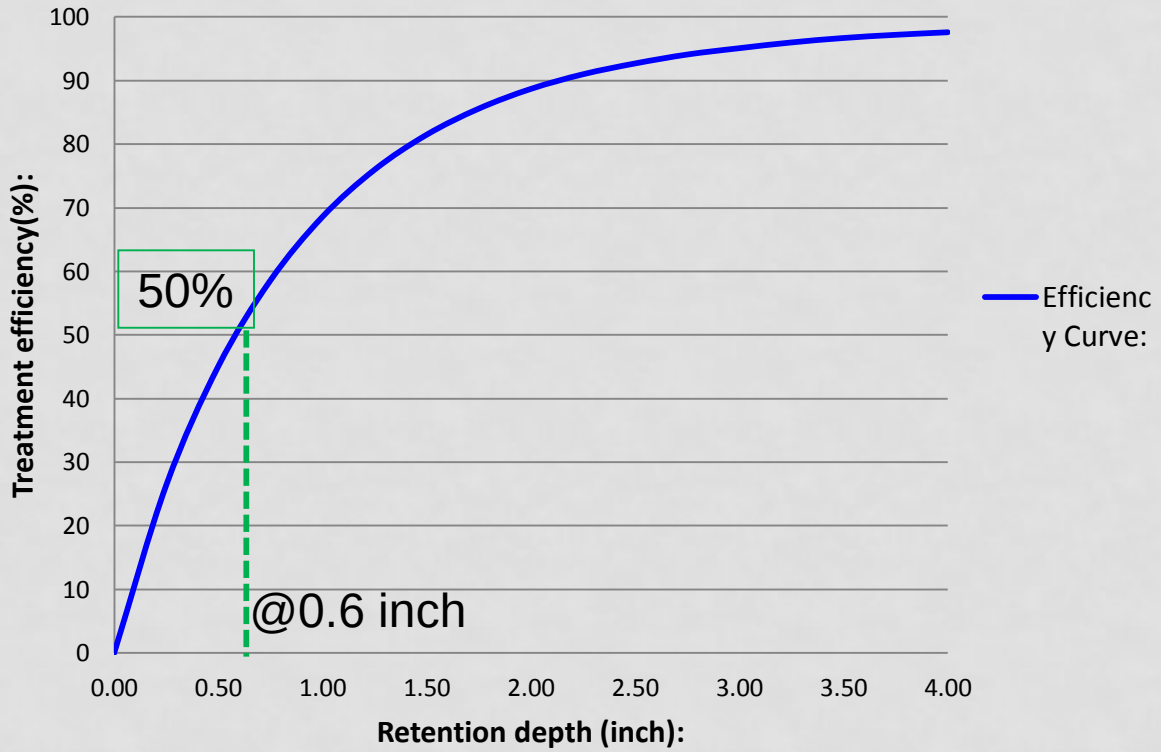


MAXIMUM retention for all events in a year

Retention depth over the watershed area is 1.43 inches for the watershed conditions and rainfall zone.

BUT not sufficient area for one retention basin
But may use 3 BMPs for each catchment in Series in one Watershed

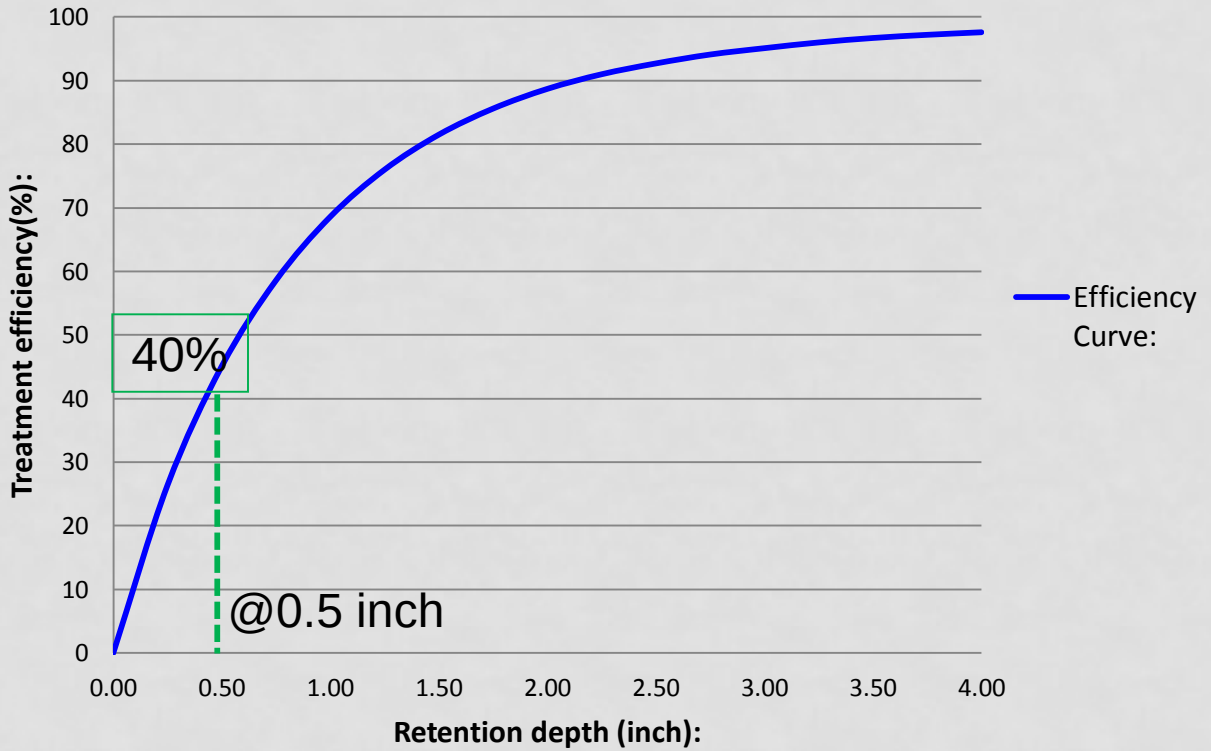
1st BMP is pervious pavement @ 0.6 inch treatment



NOTE: This is the effectiveness curve if pervious pave is only used.
Retention depth over the area is 0.60 inches
For a pervious pavement with reservoir.

Example 3 BMPs in Series in one Watershed

2nd BMP in series is exfiltration @ 0.5 inch treatment

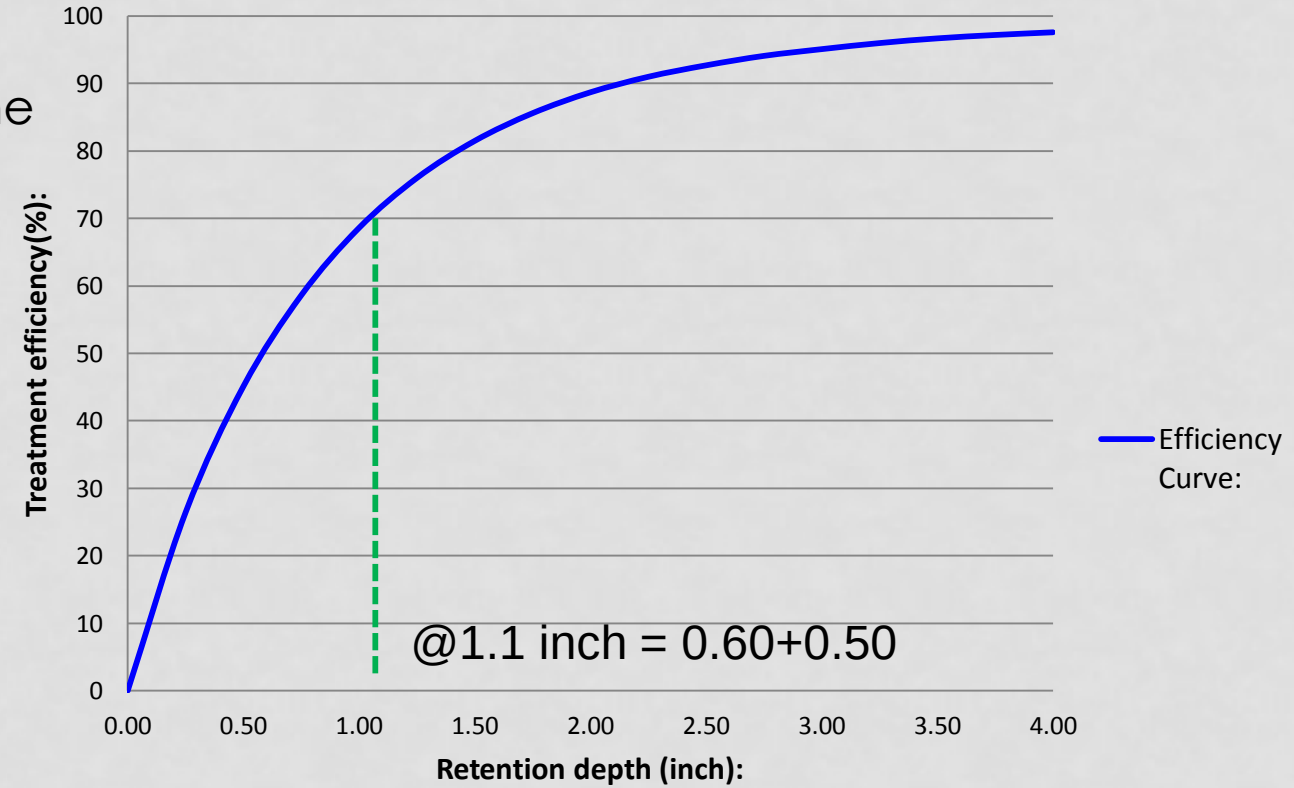


NOTE: This is the effectiveness curve if exfiltration is only used. Retention depth over the equivalent impervious area is 0.50 inches for an exfiltration system.

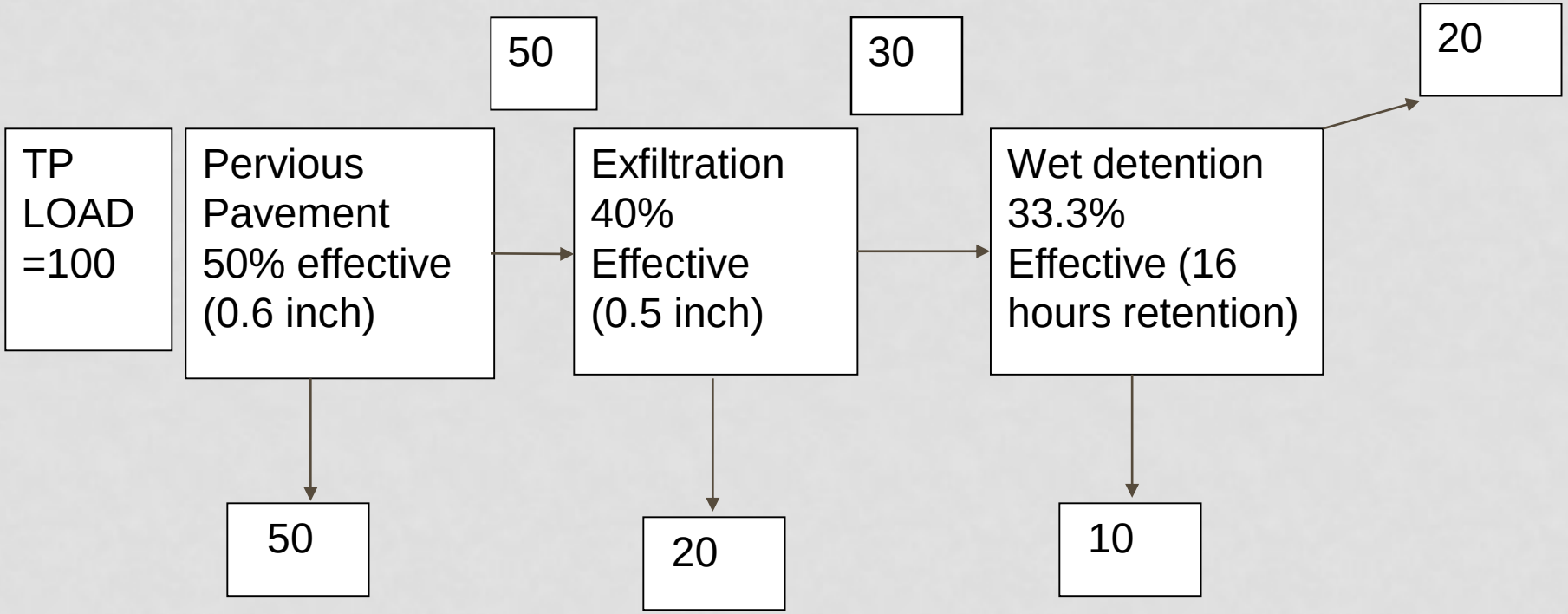
FOR RETENTION
STAY TRUE TO THE UNDERLYING PRINCIPLES

Annual effectiveness is **not** the sum of the two efficiencies (50+40= 90%)
It is however the annual effectiveness at 1.1 inch retention or 70%.

NOTE: order of retention BMPs has no affect on the removal.



BMP TREATMENT TRAIN CREDITS WHEN THREE EFFICIENCIES ARE IN SERIES



M = 100 [1- {(1-0.5)(1-0.4)(1-.33)}] = 100[1-.20] = 80 % removed

NOT 50+40+33.3=123.3%

NOTES 1. Example flow diagram for this problem only.
2. There was no input or additional catchment flow between BMPs

15 BMPS AND ONE USER DEFINED

STEP 2: Select one of the systems below to analyze efficiency.					
RETENTION BASIN	WET DETENTION	EXFILTRATION TRENCH	RAIN (BIO) GARDEN	SWALE	USER DEFINED BMP
PERVIOUS PAVEMENT	STORMWATER HARVESTING	FILTRATION including BIOFILTRATION	LINED REUSE POND & UNDERDRAIN INPUT	NOTE !!!: All individual system must be sized prior to being analyzed in conjunction with other systems. Please read instructions in the MULTIPLE WATERSHEDS AND TREATMENT SYSTEMS ANALYSIS tab for more information.	
GREENROOF	RAINWATER HARVESTING	FLOATING ISLANDS WITH WET DETENTION			
VEGETATED NATURAL BUFFER	VEGETATED FILTER STRIP	VEGETATED AREA Example tree well	CATCHMENT AND TREATMENT SUMMARY RESULTS		

Seal of Approval

Learning Topics

1. BMPTRAINS model is used to size treatment systems based on an average annual effectiveness. It is available at no cost to the users.
2. The average annual effectiveness is site specific incorporating rainfall conditions, impervious cover, soil conditions, type of land use, and type of BMP.
3. BMPs can be analyzed in either series or parallel structure. The estimates stay “true” to the underlying rainfall and catchment conditions.

QUESTIONS, REMARKS AND DISCUSSION

THANK YOU!