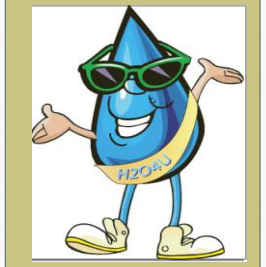
CASE STUDIES: CENTRAL OFFICE COMPLEX

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.

CENTRAL OFFICE COMPLEX BUILDING

PRE AND POST CONDITION

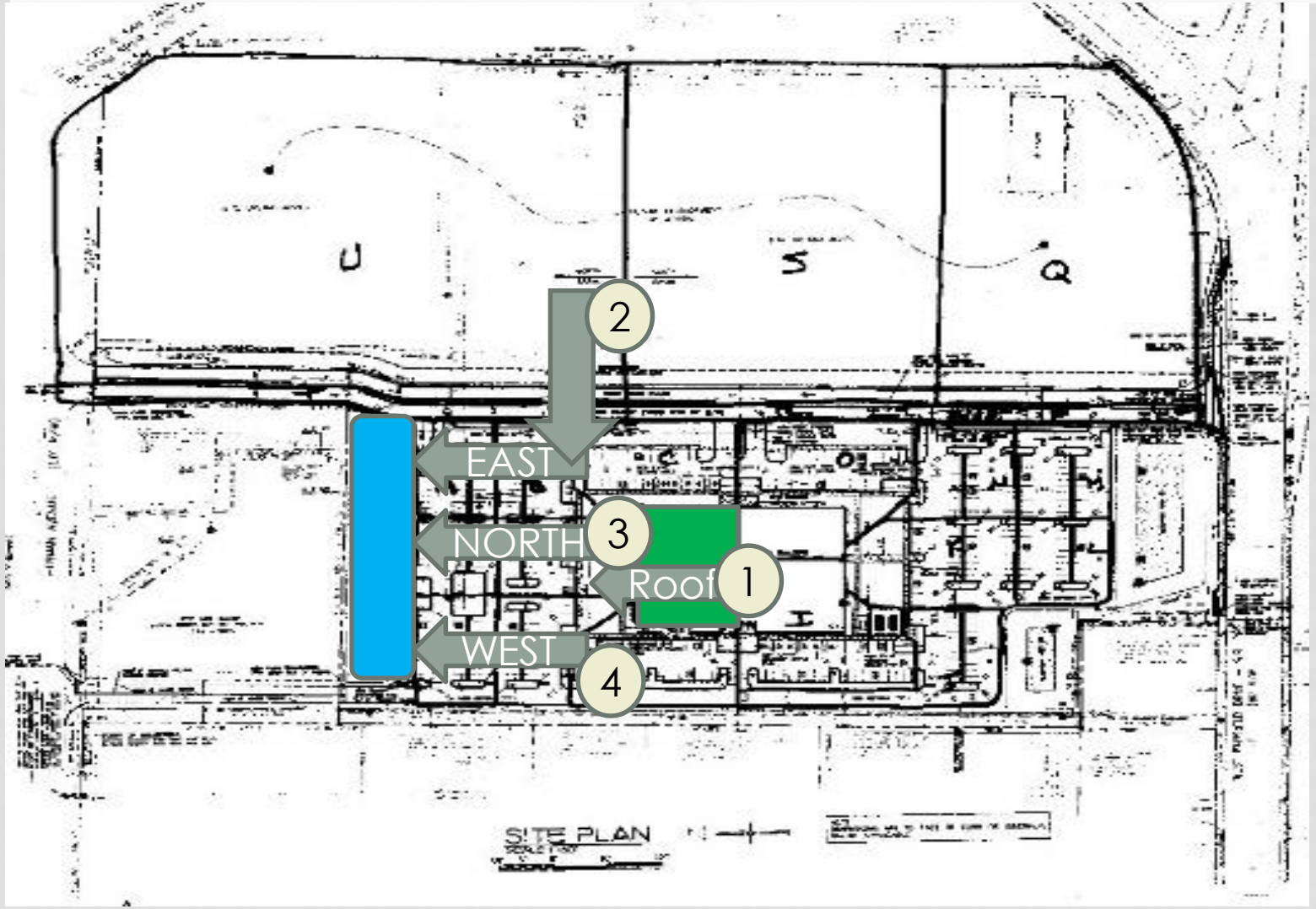
NORTH

PRE (near 100% impervious)

POST (about 80% impervious)

DEMONSTRATION OF STORMWATER MANAGEMENT (greenroof, pervious pavements and storage)

DRAINAGE PLAN
CENTRAL OFFICE ESCAMBIA COUNTY



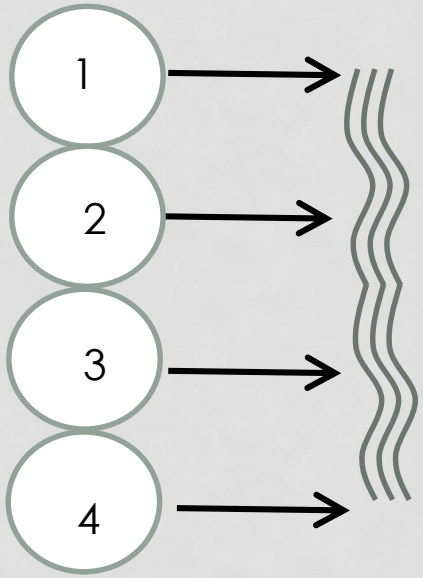
North Basin
Client wishes to use

1. Greenroof (0.4 ac)
2. Pervious Pave(8.3 ac)
3. Rain Gardens (1.9 ac)
4. Retention Basin (0.5 ac)
5. Watershed (11.1 ac)

4 drainage inlets to basin
3 from parking, 1 from roof
Soil survey data available

Plan Detail:
Credit: JEHLE Engineering

LID OPTIONS WITH INPUT TO NORTH BASIN



L - 4 Catchment-Parallel

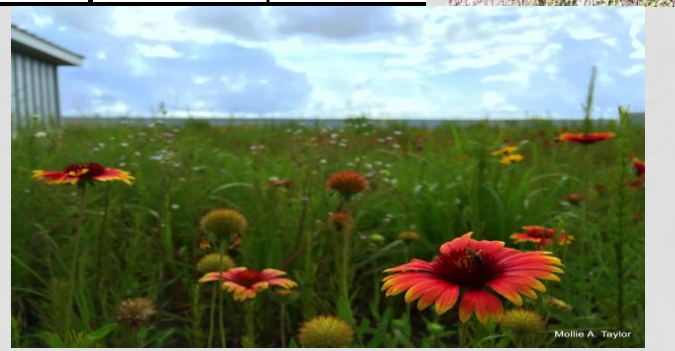
4 catchments defined by an LID possible at each:

1. A 0.4 acre greenroof from the central office roof.
2. East area has off property flow and is 7.1 acres with pervious pavement
3. North area is onsite flow and is 1.5 acres with both depression storage and pervious pave
4. West area is onsite flow and is 2.1 acres with both depression storage and pervious pave

AND about a ½ acre basin will be available for the basin from all the areas.

GREENROOF CATCHMENT

WATERSHED CHARACTERISTICS V 8.0			GO TO STORMWATER TREATMENT ANALYSIS
SELECT CATCHMENT CONFIGURATION 8/1/2016			CLICK ON CELL BELOW TO SELECT CONFIGURATION
			L - 4 Catchment-Parallel
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			VIEW AVERAGE ANNUAL RUNOFF "C" Factor
Delay [hrs]		CATCHMENT NO.1 NAME:	Roof
		CLICK ON CELL BELOW TO SELECT	VIEW EMC & FLUCCS
Pre-development land use: with default EMCs		High-Intensity Commercial: TN=2.40 TP=0.345	
		CLICK ON CELL BELOW TO SELECT	GO TO GIS LANDUSE DATA
Post-development land use: with default EMCs		High-Intensity Commercial: TN=2.40 TP=0.345	
Total pre-development catchment area:	0.40	AC	
Total post-development catchment or BMP analysis area:	0.40	AC	Average annual pre run
Pre-development Non DCIA CN:	98.00		Average annual post ru
Pre-development DCIA percentage:	100.00	%	Pre-development Annua
Post-development Non DCIA CN:	98.00		Pre-development Annua
Post-development DCIA percentage:	100.00	%	Post-development Annu
Estimated BMPArea (No loading from this area)		AC	Post-development Annu



PARKING AND OTHER PLANNED BUILDINGS

CATCHMENT NO.2 NAME:	East Parking	
	CLICK ON CELL BELOW TO SELECT	
Pre-development land use:	High-Intensity Commercial: TN=2.40 TP=0.345	
with default EMCs	CLICK ON CELL BELOW TO SELECT	
Post-development land use:	High-Intensity Commercial: TN=2.40 TP=0.345	
with default EMCs		
Total pre-development catchment area:	7.10	AC
Total post-development catchment or BMP analysis area:	7.10	AC
Pre-development Non DCIA CN:	75.00	
Pre-development DCIA percentage:	95.00	%
Post-development Non DCIA CN:	75.00	
Post-development DCIA percentage:	85.00	%
Estimated BMPArea (No loading from this area)		AC

CATCHMENT NO.3 NAME:	North Parking	
	CLICK ON CELL BELOW TO SELECT	
Pre-development land use:	High-Intensity Commercial: TN=2.40 TP=0.345	
with default EMCs	CLICK ON CELL BELOW TO SELECT	
Post-development land use:	High-Intensity Commercial: TN=2.40 TP=0.345	
with default EMCs		
Total pre-development catchment area:	1.50	AC
Total post-development catchment or BMP analysis area:	1.50	AC
Pre-development Non DCIA CN:	85.00	
Pre-development DCIA percentage:	95.00	%
Post-development Non DCIA CN:	85.00	
Post-development DCIA percentage:	85.00	%
Estimated BMPArea (no loading from this area)		AC

CATCHMENT NO.4 NAME:	West Parking	
	CLICK ON CELL BELOW TO SELECT	
Pre-development land use:	High-Intensity Commercial: TN=2.40 TP=0.345	
with default EMCs	CLICK ON CELL BELOW TO SELECT	
Post-development land use:	High-Intensity Commercial: TN=2.40 TP=0.345	
with default EMCs		
Total pre-development catchment area:	2.10	AC
Total post-development catchment or BMP analysis area:	2.10	AC
Pre-development Non DCIA CN:	60.00	
Pre-development DCIA percentage:	95.00	%
Post-development Non DCIA CN:	60.00	
Post-development DCIA percentage:	85.00	%
Estimated BMPArea (no loading from this area)		AC

GREENROOF INPUT AND EFFECTIVENESS

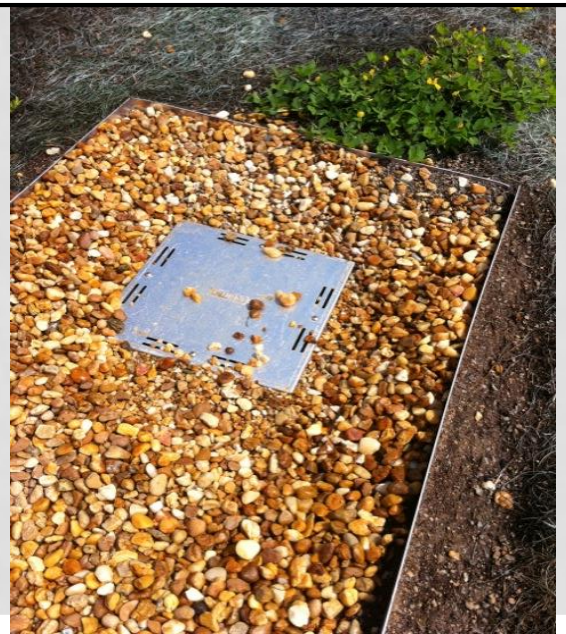
GREENROOF	8/1/2016	V 8.0	Central Office North Basin

Select Greenroof: CLICK ON CELL BELOW TO SELECT

Rainfall Station: Niceville # 6240

	Roof	East Parking	North Parking	West Parking	
Required treatment efficiency (**Nitrogen**):	80.000	80.000	80.000	80.000	%
Required treatment efficiency (**Phosphorus**):	80.000	80.000	80.000	80.000	%
Greenroof Area:	17,500.00				SF
Retention Provided (over the greenroof area):	4.00				IN
Retention Volume Required for Cistern:	5,833.33	NO CISTERN	NO CISTERN	NO CISTERN	CF
Total **Nitrogen** removal efficiency provided:	71.395				%
Total **Phosphorous** removal efficiency provided:	71.395				%
Irrigation demand					IN/YR
Rainfall excess (filtrate under drain flow)					IN/YR
Average yearly demand for harvested water per year:					MGY
Average supply of harvested water per year:					MGY
The average supplemental water needed per year:					MGY

Thanks to: County, Bay Design Arch, AENew Jr., FDEP, and IFAS



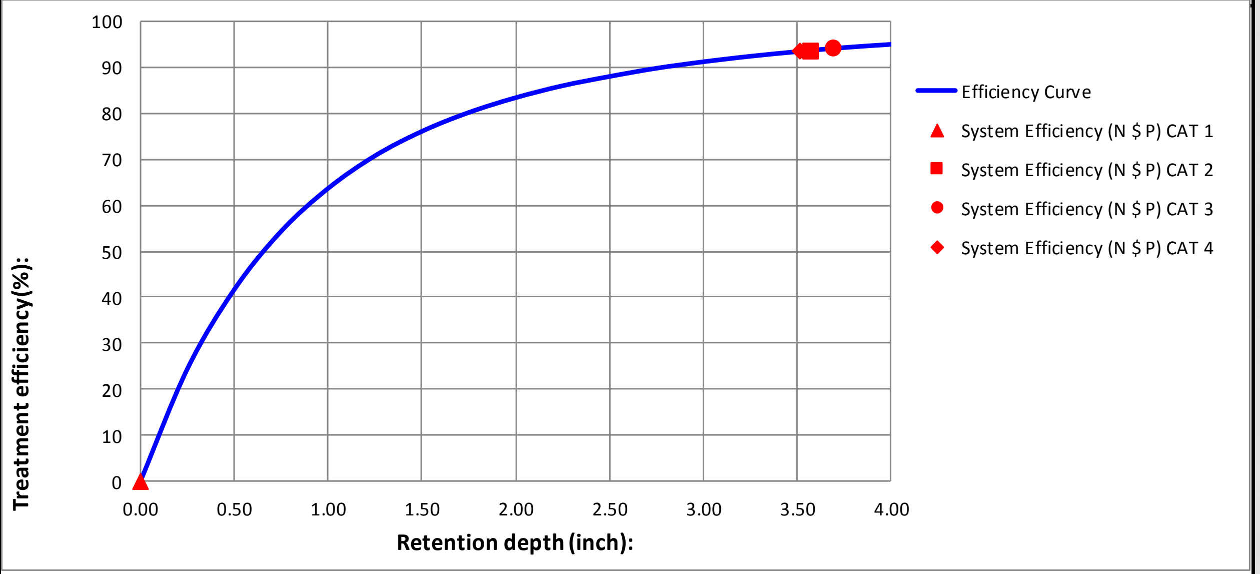
PERVIOUS PAVEMENT INPUT AND EFFECTIVENESS

CONTRIBUTING WATERSHED AND PERVIOUS PAVEMENT CHARACTERISTICS:

Pervious Pavement Section Storage Calculator (S')

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	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		8.00	24.00	1.920
Recycled (crushed) concrete			21.00	
BOLD & GOLD™			9.00	
Other SubBase				
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		8.00	24.00	1.920
Recycled (crushed) concrete			21.00	
BOLD & GOLD™			9.00	
Other SubBase				
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		8.00	24.00	1.920
Recycled (crushed) concrete			21.00	
BOLD & GOLD™			9.00	
Other SubBase				

Note: There are loadings from this BMP area needing treatment.	Roof	East Parking	North Parking	West Parking	
Contributing catchment area:	0.400	7.100	1.500	2.100	ac
Required treatment efficiency (**Nitrogen**):	80.000	80.000	80.000	80.000	%
Required treatment efficiency (**Phosphorus**):	80.000	80.000	80.000	80.000	%
Storage provided in specified pervious pavement system:	0.000	4.612	4.612	4.612	in
Area of the pervious pavement system:		5.500	1.200	1.600	ac
Provided retention over the contributing catchment area:	0.000	3.573	3.690	3.514	in
Provided treatment efficiency (**Nitrogen**):	0.000	93.751	94.166	93.542	%
Provided treatment efficiency (**Phosphorus**):	0.000	93.751	94.166	93.542	%
Remaining treatment efficiency needed (**Nitrogen**):	80.000	0.000	0.000	0.000	%
Remaining treatment efficiency needed (**Phosphorus**):	80.000	0.000	0.000	0.000	%
Remaining retention depth needed if retention:	1.735	0.000	0.000	0.000	in



RAIN GARDEN INPUT AND EFFECTIVENESS

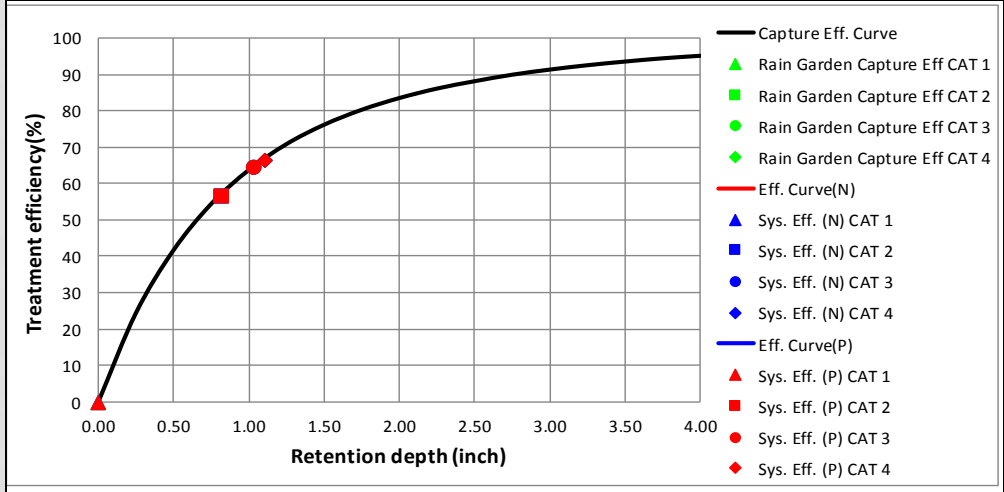
RAIN GARDEN **8/1/2016** **V 8.0**

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.	Roof	East Parking	North Parking	West Parking	
Contributing catchment area:	0.400	7.100	1.500	2.100	ac
Required treatment efficiency (**Nitrogen**):	80.000	80.000	80.000	80.000	%
Required treatment efficiency (**Phosphorus**):	80.000	80.000	80.000	80.000	%
Provided retention depth for hydraulic capture efficiency (see below):	0.000	0.815	1.028	1.102	in
Provided retention volume for hydraulic capture efficiency:	0.000	0.482	0.129	0.193	ac-ft
Is this a retention or detention system?		Retention	Retention	Retention	
Select media mix [View Media Mixes]					
Provided treatment efficiency (**Nitrogen**):	0.000	56.803	64.518	66.604	
Provided treatment efficiency (**Phosphorus**):	0.000	56.803	64.518	66.604	

Volume Storage Input data

Sustainable void space fraction		0.20	0.20	0.20
Media volume CF =		30000	8000	12000
Water above media in CF =		15000	4000	6000
Thus volume storage CF=	0	21000	5600	8400
Used for retention depth above in row 10 & volume storage (inches) =	0.000	0.815	1.028	1.102



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.

HOW MUCH RUNOFF VOLUME IS REDUCED TO THE RETENTION BASIN?

Based on the **capture** design of each LID

1. Greenroof: Residual moisture is 0.6 inch if 6 inches' deep.
   (0.6 inch/12 inches) x 0.4 acre = 0.02 Acre Feet
2. Rain Gardens or depression storage is 1.0 inch
   (1/12) x 1.9 acres = 0.16 Acre Feet
3. Pervious Pavement Reservoir and Pavement is 4.6 inches
   (4.6/12) x 8.3 acres = 3.18 Acre Feet
   Total storage not discharged = 3.36 Acre Feet

On-site Infiltration Retention Basin sized for 0.5 acres and 6 foot deep.

CATCHMENTS AND TREATMENT SUMMARY RESULTS V 8.0

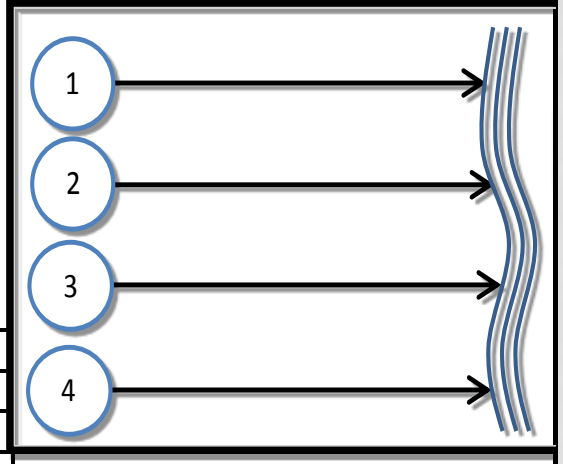
CALCULATION METHODS:

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	Central Office North Basin	Optional Identification		
	Roof	East Parking	North Parking	West Parking
BMP Name	Greenroof	Pervious Pavement	Pervious Pavement	Pervious Pavement
BMP Name		Rain Garden	Rain Garden	Rain Garden
BMP Name				

Summary Performance of Entire Watershed

Catchment Configuration	L - 4 Catchment-Parallel		8/1/2016
Nitrogen Pre Load (kg/yr)	138.69		BMPTRAINS MODEL
Phosphorus Pre Load (kg/yr)	19.94	Treatment Objectives or Target MET	
Nitrogen Post Load (kg/yr)	126.71		
Phosphorus Post Load (kg/yr)	18.21		
Target Load Reduction (N) %	80		
Target Load Reduction (P) %	80		
Target Discharge Load, N (kg/yr)	25.34		
Target Discharge Load, P (kg/yr)	3.64		
Provided Overall Efficiency, N (%):	94		
Provided Overall Efficiency, P (%):	94		
Discharged Load, N (kg/yr & lb/yr):	7.47	16.45	
Discharged Load, P (kg/yr & lb/yr):	1.07	2.36	
Load Removed, N (kg/yr & lb/yr):	119.24	262.64	
Load Removed, P (kg/yr & lb/yr):	17.14	37.75	



SUMMARY RESULTS

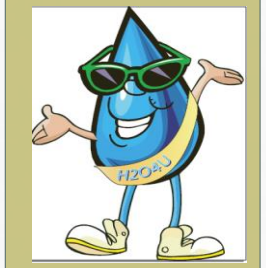
Capture of over 94% of the Average annual Runoff Volume

Can reduce the size of the Infiltration retention basin

Calculations are authenticated Using BMPTRAINS

QUESTIONS, REMARKS AND DISCUSSION

BY: MARTY WANIELISTA AND ERIC LIVINGSTON



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