

# BMP Trains 2020 Example Problem 12

## Single Catchment (wet detention and side-bank filter)



# BMP Trains 2020 Model

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# Example Problem 12

## Stormwater Wet Detention and Filtration



- Average annual removal of a wet detention pond in series with a Surface Filtration System
- Net improvement analysis
- Located on the East Coast of Florida, in meteorological zone 4
- Mean annual rainfall is 50 inches
- Wet Pond area is 10 acre and permanent pool volume is 5.0 acre-feet


<b>Catchment configuration</b>	<b>Pre-development</b>	<b>Post-development</b>
Area (acres)	10	10
Land-use	Low-Intensity Commercial	High-Intensity Commercial
Non-DCIA CN	60	60
DCIA (%)	0	30.0

# Example Problem

## Input data for watershed and catchment area

General Site Information for Project File: — □ ×

  Enter a Name for Your Project:

Select Meteorological Zone for Project:  

Enter the Mean Annual Rainfall:  inches

Specify Type of Surface Discharge Analysis:

Conduct a Groundwater Discharge Analysis:

**1. Enter Catchment**

2. Enter Treatment

3. Configure Catchments

4. Summary Treatment Report

5. Complete Report

6. Cost Comparisons

# Example Problem

## Input data for watershed and catchment area

Watershed Characteristics Worksheet Version: 3.0.0

Add Catchment **Catchment 1 Wet Detention with Filtration**

Current Catchment Number (use 1 if single catchment): **1 Wet Detention with Filtration**

Land Use Catchment Name: **Wet Detention with Filtration**

Pre: Agricultural - Citrus: TN=2.240 TP=0.183

Post: Single-Family: TN=2.070 TP=0.327

Total Pre-Development Catchment Area (ac): 10.00

Total Post-Development Catchment Area (ac): 10.00

Pre-Development Non DCIA Curve Number: 60

Pre-Development DCIA Percentage (0 - 100%): 0.0

Post-Development Non DCIA Curve Number: 60

Post-Development DCIA Percentage (0 - 100%): 30.0

Wet Pond Area (No loading from this area, ac): 1.00

Pre N: 0.000 P: 0.000

Groundwater Load (kg/yr) Post N: 0.000 P: 0.000

Concentrations used in Analysis

	Pre:	Post:
EMC(N) mg/l	2.240	2.070
EMC(P) mg/l	0.183	0.327
Annual C	0.040	0.275
Runoff (ac-ft/yr)	1.800	11.138
N Loading (kg/yr)	4.971	28.426
P Loading (kg/yr)	0.406	4.491

Report

Calculate



Cancel


Back

# Example Problem

## Input data for watershed and catchment area

General Site Information for Project File: — □ ×

  Enter a Name for Your Project:

Select Meteorological Zone for Project:  

Enter the Mean Annual Rainfall:  inches

Specify Type of Surface Discharge Analysis:

Conduct a Groundwater Discharge Analysis:

1. Enter Catchment

**2. Enter Treatment**

3. Configure Catchments

4. Summary Treatment Report

5. Complete Report

6. Cost Comparisons

# Example Problem

## Input data for Treatment Options (BMPs)

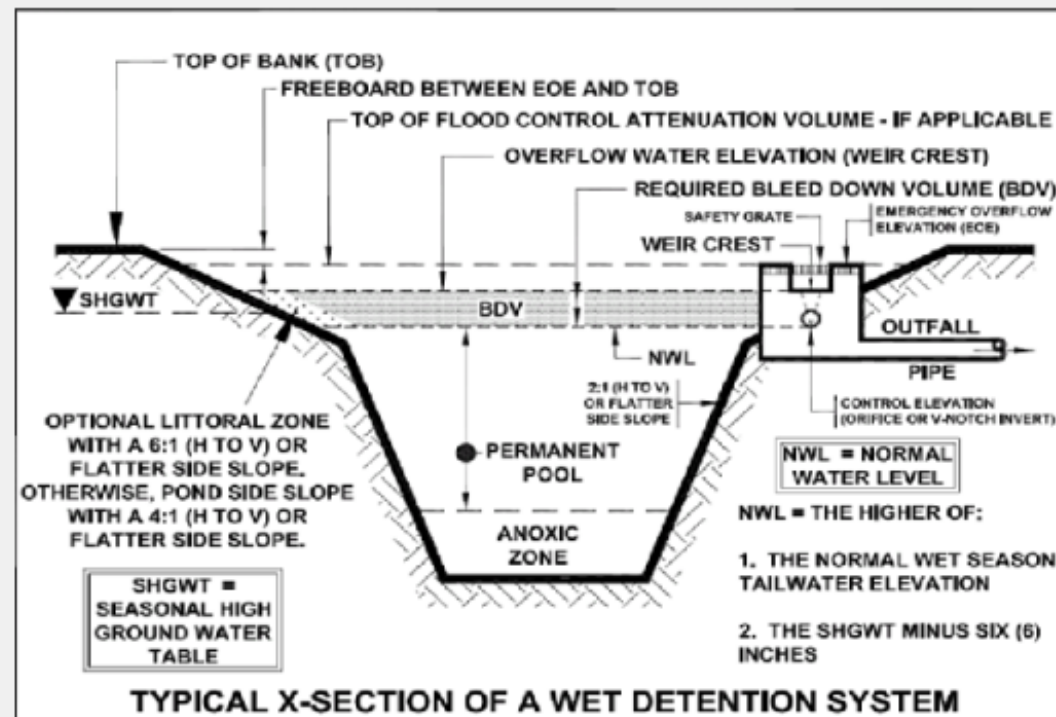
Select Treatment Options for individual performance, not in series or in multiple catchments. Analysis: Net Improvement Required Removal N: 87% P: 85%

Catchment 1 Detention/Filter Media

### Treatment Options

Retention Basin	Greenroof
<b>Wet Detention</b>	Rainwater Harvesting
Exfiltration Trench	Vegetated Buffer
Permeable Pavement	Filter or Vegetated Filter Strip
Stormwater Harvesting	Rain Garden
Surface Discharge Filter	Tree Well
Swale	User Defined
BMPs in Series	

Current: 1 Detention/Filter Media



Tools

Reset All

Catchments


Cost Report

Back

# Example Problem

## Input data for Wet Detention Pond – Permanent Pool Volume

Wet Detention Analysis: Net Improvement Required Removal N: 83% P: 91%

Permanent Pool Volume (acre-feet):  

Littoral Zones Improvement Credit (%):

Floating Wetland or Mats Improvement Credit (%):

Help

**Calculate**

Cost

Print

Plot

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**Back**

### Load Diagram for Wet Detention (stand-alone)



The diagram shows a flow from 'Load' to 'Treatment' and then to 'Surface Discharge' and 'Mass Reduction'. The 'Load' box contains 'N: 28.43 kg/yr' and 'P: 4.49 kg/yr'. The 'Treatment' box contains 'N: 43 %' and 'P: 78 %'. The 'Surface Discharge' box contains 'N: 16.31 kg/yr' and 'P: 0.98 kg/yr'. The 'Mass Reduction' box contains 'N: 12.11 kg/yr' and 'P: 3.51 kg/yr'. Arrows indicate the flow from Load to Treatment, and from Treatment to both Surface Discharge and Mass Reduction. A downward arrow points from the Treatment box to the Mass Reduction box.


```
graph LR; Load["Load  
N: 28.43 kg/yr  
P: 4.49 kg/yr"] --> Treatment["Treatment  
N: 43 %  
P: 78 %"]; Treatment --> SurfaceDischarge["Surface Discharge  
N: 16.31 kg/yr  
P: 0.98 kg/yr"]; Treatment --> MassReduction["Mass Reduction  
N: 12.11 kg/yr  
P: 3.51 kg/yr"];
```

# Example Problem

## Input data – Configure Catchment

General Site Information for Project File: — □ ×

  Enter a Name for Your Project:

Select Meteorological Zone for Project:  

Enter the Mean Annual Rainfall:  inches

Specify Type of Surface Discharge Analysis:

Conduct a Groundwater Discharge Analysis:

1.

2.

3.

4.

5.

6.



# Example Problem

## Input data – Configure Catchment

Select Catchment Configuration

Routing Catchment From: 1

Routing Catchment From: 1

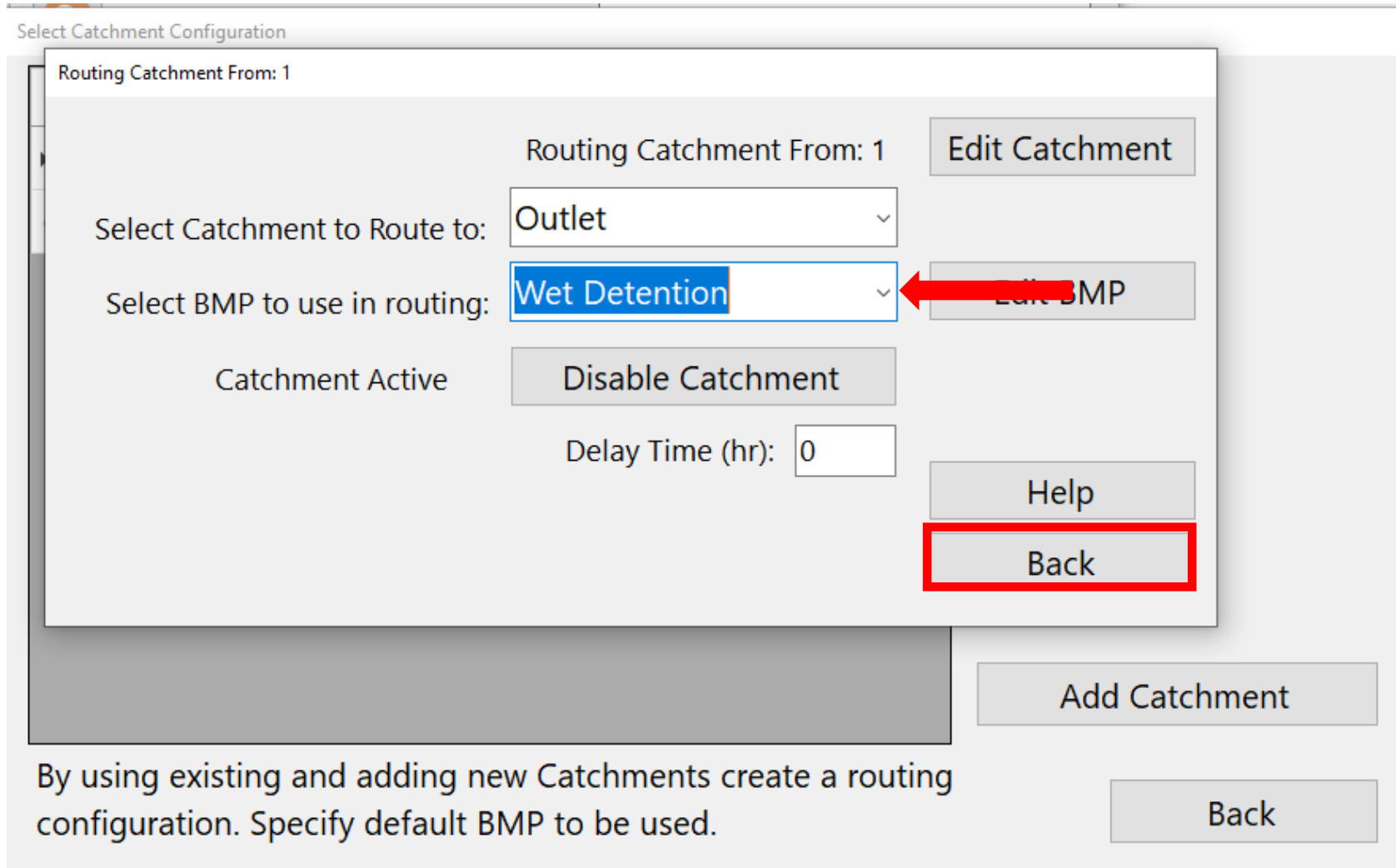
Select Catchment to Route to:

Select BMP to use in routing:

Catchment Active

Delay Time (hr):

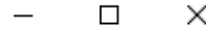
By using existing and adding new Catchments create a routing configuration. Specify default BMP to be used.






# Example Problem

## Output Data – Wet Pond Only

General Site Information for Project File:



  Enter a Name for Your Project:

Select Meteorological Zone for Project:  

Enter the Mean Annual Rainfall:  inches

Specify Type of Surface Discharge Analysis:

Conduct a Groundwater Discharge Analysis:

Open Project

New Project

Save Project

Exit BMPTrains

1. Enter Catchment
2. Enter Treatment
3. Configure Catchments
- 4. Summary Treatment Report**
5. Complete Report
6. Cost Comparisons

# Example Problem

## Output Data – Wet Pond Only

BMP Trains Reports

Copy Back

### Summary Treatment Report Version: 3.0.0

Project: Example Problem #12

Analysis Type: Net Improvement

BMP Types:

Catchment 1 - Wet Detention

Total nitrogen target removal met? **No** ←

Total phosphorus target removal met? **No** ←

### Summary Report

Nitrogen

Surface Water Discharge

### Routing Summary

Catchment 1 Routed to Outlet

### Nitrogen

#### Surface Water Discharge

Total N pre load	4.97 kg/yr	
Total N post load	28.43 kg/yr	
Target N load reduction	83 %	
Target N discharge load	4.97 kg/yr	
Percent N load reduction	43 %	
Provided N discharge load	16.31 kg/yr	35.97 lb/yr
Provided N load removed	12.11 kg/yr	26.71 lb/yr

### Phosphorus



#### Surface Water Discharge


Total P pre load	.406 kg/yr	
Total P post load	4.491 kg/yr	
Target P load reduction	91 %	
Target P discharge load	.406 kg/yr	
Percent P load reduction	78 %	
Provided P discharge load	.981 kg/yr	2.16 lb/yr
Provided P load removed	3.51 kg/yr	7.739 lb/yr

# Example Problem

## Input data for Treatment Options (BMPs)

General Site Information for Project File: — □ ×

  Enter a Name for Your Project:

Select Meteorological Zone for Project:  

Enter the Mean Annual Rainfall:  inches

Specify Type of Surface Discharge Analysis:

Conduct a Groundwater Discharge Analysis:

1. Enter Catchment

**2. Enter Treatment**

3. Configure Catchments

4. Summary Treatment Report

5. Complete Report

6. Cost Comparisons

# Example Problem

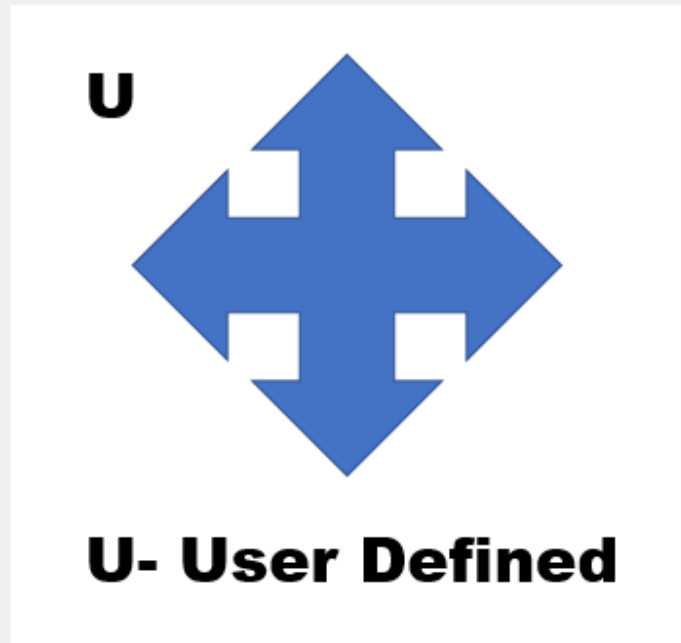
## Input data for Treatment Options (BMPs)

Select Treatment Options for individual performance, not in series or in multiple catchments. Analysis: Net Improvement Required Removal N: 87% P: 85%

Catchment 1 Detention/Filter Media

Treatment Options	
Retention Basin	Greenroof
Wet Detention	Rainwater Harvesting
Exfiltration Trench	Vegetated Buffer
Permeable Pavement	Filter or Vegetated Filter Strip
Stormwater Harvesting	Rain Garden
Surface Discharge Filter	Tree Well
Swale	User Defined
BMPs in Series	

Current: 1 Detention/Filter Media



Catchments	Tools	Reset All
Cost Report	Back	

# Example Problem

## Input data for Treatment Options (BMPs)

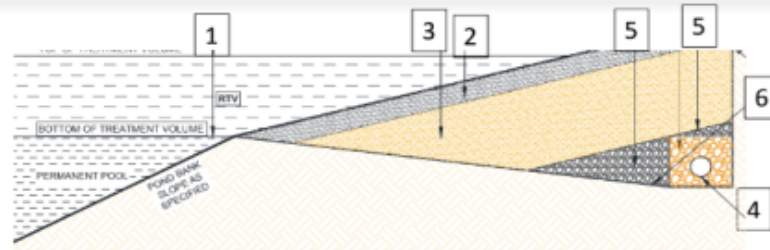
Select Treatment Options for individual performance, not in series or in multiple catchments. Analysis: Net Improvement Required Removal N: 83% P: 91%

Catchment 1 Wet Detention with Filtration

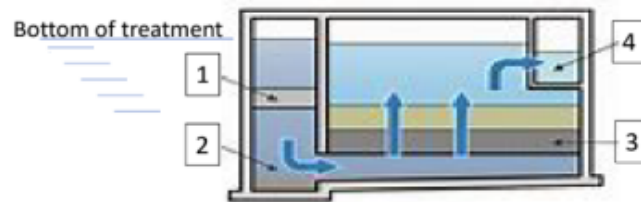
### Treatment Options

Retention Basin	Greenroof
Wet Detention	Rainwater Harvesting
Exfiltration Trench	Vegetated Buffer
Permeable Pavement	Filter or Vegetated Filter Strip
Stormwater Harvesting	Rain Garden
Surface Discharge Filter	Tree Well
Swale	User Defined
BMPs in Series	

### Current: 1 Wet Detention with Filtration



Typical Side-Bank Filter in relation to: 1 control elevation, 2 cover, 3 Media, 4 outlet pipe or collection box, 5 fabric or bridging rock, 6 liner and slope if needed



Typical Up-Flow Filter Showing Flow Lines  
1 Inlet Screen, 2 Sump, 3 Media, 4 Outlet

Tools

Reset All

Catchments

Cost Report

Back

# Example Problem

## Input data for Treatment Options (BMPs)

Filtration System Worksheet Analysis: Net Improvement Required Removal N: 83% P: 91%

Click Button to Select Media: **Media** Not Specified

Treatment Depth (0.0-4.0 inches):

Is there an upstream BMP in this Catchment (ex. wet pond)?

**Project:** Example Problem #12  
**Date:** 1/23/2020

**Surface Discharge Filtration Design**

Treatment Depth (in)	0.000
Wet detention effluent?	
Hydraulic Capture Efficiency (%)	
Media Type	Not Specified

**Watershed Characteristics**

Catchment Area (acres)	10.00
Contributing Area (acres)	9.000
Non-DCIA Curve Number	60.00
DCIA Percent	30.00
Rainfall Zone	Florida Zone 4

Cost

Calculate

Print

Plot


Copy

Back

# Example Problem

## Input data for Treatment Options (BMPs)

Enter Media Mix Information

Select Media Mix:  

If all runoff are treated: { TN Reduction (%):   
TP Reduction (%):

Enter Media Mix Information

Select Media Mix:

If all runoff are treated: { TN Reduction (%):   
TP Reduction (%):



# Example Problem

## Input data for Treatment Options (BMPs)

Filtration System Worksheet Analysis: Net Improvement Required Removal N: 83% P: 91%

Click Button to Select Media:

Treatment Depth (0.0-4.0 inches):  ←

Is there an upstream BMP in this Catchment (ex. wet pond)?  ←

**Project:** Example Problem #12  
**Date:** 1/23/2020

**Surface Discharge Filtration Design**

Treatment Depth (in)	0.000
Wet detention effluent?	
Hydraulic Capture Efficiency (%)	
Media Type	B&G CTS24

**Watershed Characteristics**

Catchment Area (acres)	10.00
Contributing Area (acres)	9.000
Non-DCIA Curve Number	60.00
DCIA Percent	30.00
Rainfall Zone	Florida Zone 4

# Example Problem

## Input data for Treatment Options (BMPs)

Filtration System Worksheet Analysis: Net Improvement Required Removal N: 83% P: 91%

Click Button to Select Media:

Media

B&G CTS24

Treatment Depth (0.0-4.0 inches):

1.75

Is there an upstream BMP in this Catchment (ex. wet pond)?

Yes

**Project:** Example Problem #12

**Date:** 1/24/2020

### Surface Discharge Filtration Design

Treatment Depth (in) 0.000

Wet detention effluent?

Hydraulic Capture Efficiency (%)

Media Type B&G CTS24

### Watershed Characteristics

Catchment Area (acres) 10.00

Contributing Area (acres) 9.000

Non-DCIA Curve Number 60.00

DCIA Percent 30.00

Rainfall Zone Florida Zone 4

Cost

Calculate

Print

Plot

Copy

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# Example Problem

## Input data for Treatment Options (BMPs)

Filtration System Worksheet Analysis: Net Improvement Required Removal N: 83% P: 91%

Click Button to Select Media:

Treatment Depth (0.0-4.0 inches):

Is there an upstream BMP in this Catchment (ex. wet pond)?

TP Concentration (mg/L) 0.037

**Load Diagram for Surface Discharge Filtration (stand-alone)**

The diagram shows a flow from 'Load' to 'Treatment' to 'Surface Discharge'. The 'Load' box contains 'N: 28.43 kg/yr' and 'P: 4.49 kg/yr'. An arrow points to the 'Treatment' box, which contains 'N: 71 %' and 'P: 89 %'. Another arrow points to the 'Surface Discharge' box, which contains 'N: 8.39 kg/yr' and 'P: 0.48 kg/yr'. Below the 'Treatment' box, a downward arrow points to a 'Mass Reduction' box, which contains 'N: 20.04 kg/yr' and 'P: 4.01 kg/yr'.

Cost

Calculate

Print

Plot

Copy

**Back**

# Example Problem

## Input data for Treatment Options (BMPs)

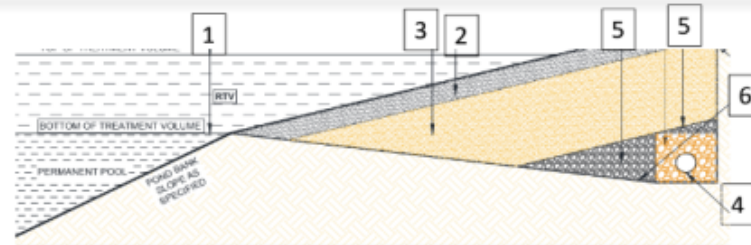
Select Treatment Options for individual performance, not in series or in multiple catchments. Analysis: Net Improvement Required Removal N: 83% P: 91%

Catchment 1 Wet Detention with Filtration

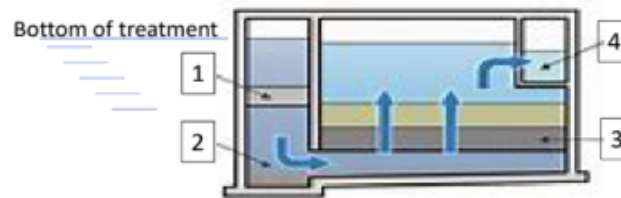
### Treatment Options

Retention Basin	Greenroof
Wet Detention	Rainwater Harvesting
Exfiltration Trench	Vegetated Buffer
Permeable Pavement	Filter or Vegetated Filter Strip
Stormwater Harvesting	Rain Garden
Surface Discharge Filter	Tree Well
Swale	User Defined
BMPs in Series	

Current: 1 Wet Detention with Filtration



Typical Side-Bank Filter in relation to: 1 control elevation, 2 cover, 3 Media, 4 outlet pipe or collection box, 5 fabric or bridging rock, 6 liner and slope if needed



Typical Up-Flow Filter Showing Flow Lines  
1 Inlet Screen, 2 Sump, 3 Media, 4 Outlet

Tools

Reset All

Catchments

Cost Report

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# Example Problem

## BMP in Series Calculator

Multiple BMP Worksheet for Catchment 1

Add up to 4 BMP's to each catchment in order of routing

BMP 1: None

BMP 2: None

BMP 3: None

BMP 4: None

Calculate

Print

Copy

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Multiple BMP Worksheet for Catchment 1

Add up to 4 BMP's to each catchment in order of routing

BMP 1: Wet Detention

Open

BMP 2: Filtration

Open

BMP 3: None

BMP 4: None

Calculate

Print

Copy

Back

Load  
N: 28.43 kg/yr  
P: 4.49 kg/yr

Treatment  
N: 83 %  
P: 98 %

Surface Discharge  
N: 4.81 kg/yr  
P: 0.10 kg/yr

Mass Reduction  
N: 23.61 kg/yr  
P: 4.39 kg/yr

# Example Problem

## BMP in Series Calculator

General Site Information for Project File:

Enter a Name for Your Project:

Select Meteorological Zone for Project:

Enter the Mean Annual Rainfall:  inches

Specify Type of Surface Discharge Analysis:

Conduct a Groundwater Discharge Analysis:

1. Enter Catchment
2. Enter Treatment
3. **Configure Catchments**
4. Summary Treatment Report
5. Complete Report
6. Cost Comparisons

Open Project    New Project

Save Project    Exit BMPTrains

Select Catchment Configuration

	From	To	Area	BMP Used	Edit
▶	1	0	10.00	Wet Detention	Edit
*					

0 is Outlet

Routing Catchment From: 1

Routing Catchment From: 1

Select Catchment to Route to:

Select BMP to use in routing:

Catchment Active

Delay Time (hr):

# Example Problem

## BMP Configuration Analysis

Routing Catchment From: 1

Select Catchment Configuration

Select Catchment to Route to:

Select BMP to use in routing:

Catchment Active  Disable Catchment

Delay Time (hr):

	From	To	Area	BMP Used	Edit
▶	1	0	10.00	Multiple BMP	Edit
*					

0 is Outlet

Add Catchment

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By using existing and adding new Catchments create a routing configuration. Specify default BMP to be used.

# Example Problem

## Nutrient Reduction Results

Analysis Type: Net Improvement

BMP Types:

Catchment 1 - Multiple BMP

Total nitrogen target removal met? **Yes**

Total phosphorus target removal met? **Yes**

Nitrogen

Surface Water Discharge

Total N pre load	4.97 kg/yr	
Total N post load	28.43 kg/yr	
Target N load reduction	83 %	
Target N discharge load	4.97 kg/yr	
Percent N load reduction	83 %	
Provided N discharge load	4.81 kg/yr	10.61 lb/yr
Provided N load removed	23.61 kg/yr	52.07 lb/yr

Phosphorus

Surface Water Discharge

Total P pre load	.406 kg/yr	
Total P post load	4.491 kg/yr	
Target P load reduction	91 %	
Target P discharge load	.406 kg/yr	
Percent P load reduction	98 %	
Provided P discharge load	.105 kg/yr	.23 lb/yr
Provided P load removed	4.386 kg/yr	9.67 lb/yr

BMP Trains Reports  
Copy Back

**Summary Treatment Report Version: 3.0.0**

Project: Example Problem #12      Date: 1/24/2020

**Analysis Type:** Net Improvement  
**BMP Types:**  
Catchment 1 - Multiple BMP  
Total nitrogen target removal met? **Yes**  
Total phosphorus target removal met? **Yes**

Routing Summary  
Catchment 1 Routed to Outlet

**Summary Report**

**Nitrogen**

Surface Water Discharge

Total N pre load	4.97 kg/yr	
Total N post load	28.43 kg/yr	
Target N load reduction	83 %	
Target N discharge load	4.97 kg/yr	
Percent N load reduction	83 %	
Provided N discharge load	4.81 kg/yr	10.61 lb/yr
Provided N load removed	23.61 kg/yr	52.07 lb/yr

**Phosphorus**

Surface Water Discharge

Total P pre load	.406 kg/yr	
Total P post load	4.491 kg/yr	
Target P load reduction	91 %	
Target P discharge load	.406 kg/yr	
Percent P load reduction	98 %	
Provided P discharge load	.105 kg/yr	.23 lb/yr
Provided P load removed	4.386 kg/yr	9.67 lb/yr

TN Removal = 83% ≥ 83% Met  
TP Removal = 98% ≥ 91% Met



# Calculation for Filter Media Surface Area

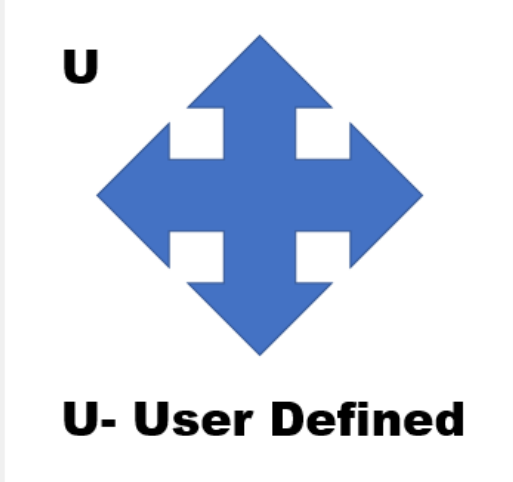
General Site Information for Project File: Circle\_K\_NSB Glencoe Nutrient Reduction

Select Treatment Options for individual performance, not in series or in multiple catchments. Analysis: Net Improvement Required Removal N: 76% P: 73%

Catchment 1 Detention/Filter Media

Current: 1 Detention/Filter Media

**U**



**U- User Defined**

1. Enter Catchment

**2. Enter Treatment**

3. Configure Catchments

4. Summary Treatment Report

5. Complete Report

6. Cost Comparisons

Retention Basin

Greenroof

**Wet Detention**

Rainwater Harvesting

Exfiltration Trench

Vegetated Buffer

Permeable Pavement

Filter or Vegetated Filter Strip

Stormwater Harvesting

Rain Garden

**Surface Discharge Filter**

Tree Well

Swale

User Defined

BMPs in Series

Open Project

New Project

Save Project

Exit BMPTrains

Tools

Reset All

Catchments

Cost Report

Back

# Calculation for Filter Media Surface Area

BMP Trains Calculators

These are tools designed to assist with the complex tables and calculations used in BMP Trains.

Information entered in these forms is not saved and does not have any effect elsewhere in the program.

Pervious Pavement Storage Calculator

Harvesting Efficiency Table

Rational Coefficient Lookup Table

Retention Efficiency Lookup Tables

Media Filter Area in Square Feet

Media Filter Service Life in Years

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# Calculation for Filter Media Surface Area

Calculate Media Filter Area

Select Catchment:  ←

Effective Impervious Area (ac):

Treatment Depth (0.05 in - 4 in):

Rate in GPM/SF (0.02-10.0):   ▾

Half of the runoff volume is treated in day one

Calculate

Copy

Print

Back

Calculate Media Filter Area

Select Catchment:  ←

Effective Impervious Area (ac):

Treatment Depth (0.05 in - 4 in):  ←

Rate in GPM/SF (0.02-10.0):   ▾

Half of the runoff volume is treated in day one

Calculate

Copy

Print

Back

# Calculation for Filter Media Surface Area

Calculate Media Filter Area

Select Catchment:

Effective Impervious Area (ac):

Treatment Depth (0.05 in - 4 in):

Rate in GPM/SF (0.02-10.0):

Half of the runoff volume is treated in day one

## Media Filter Report

Catchment Name: Catchment 1  
Treatment Depth (in): 1.75  
Rate (GPM/SF): 0.05  
Effective Impervious Area (acres): 3.79  
Minimum Filter Area (sf): 1,202.09

Calculate

Copy

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Minimum Filter Area (SF) = 1,202.1  
Minimum Filter Volume (CF) = 2,404.2

# Calculation for Actual Filter Media Surface Area from Drawdown Analysis

## □ Methodology

1. FDOT – FDOT Drainage Design Guide
2. SJRWMD – Permit Information Manual
3. SWFWMD – Drainage Spreadsheet (ERP Applicant's Handbook Vol. II)

## □ Filtration Options:

1. Vertical Filter – Underdrain (Retention Pond)
2. Lateral Filter – Side-bank or Shelf Filter (Retention/Detention Pond)
3. Upflow Filter – Vaults

# Examples of Filter Systems

## Effluent Filtration

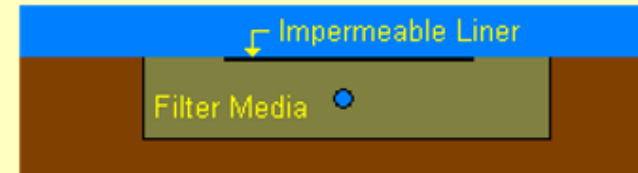
Select Effluent Filtration Type



**Sidebank Filter**



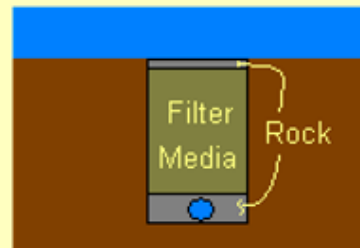
**Constant Filter Area**



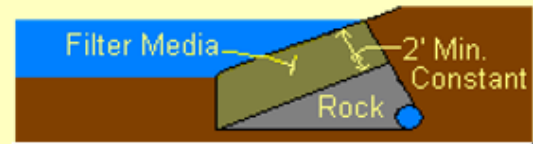
**Pond Bottom Filter**



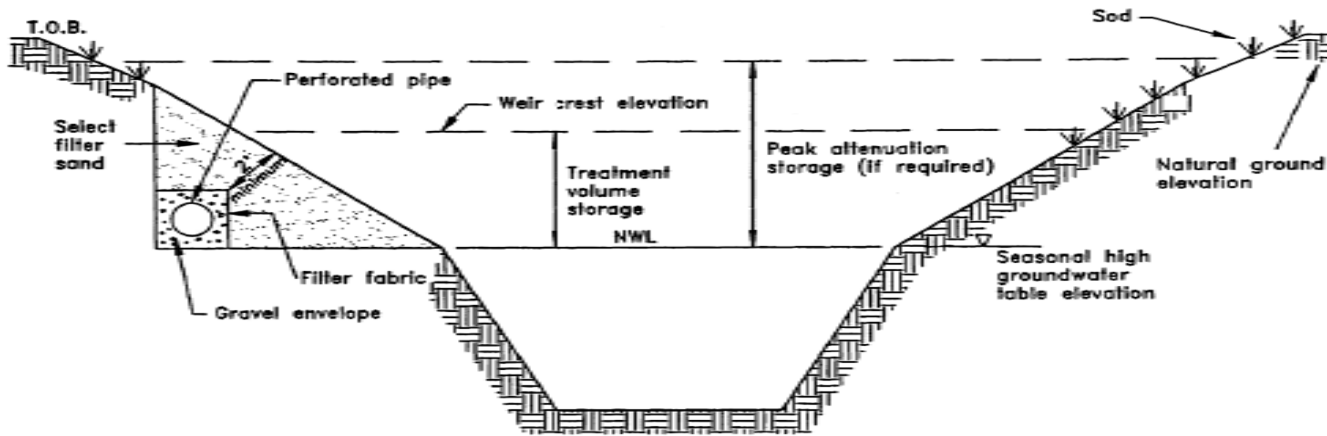
**Constant and Variable Filter Area**



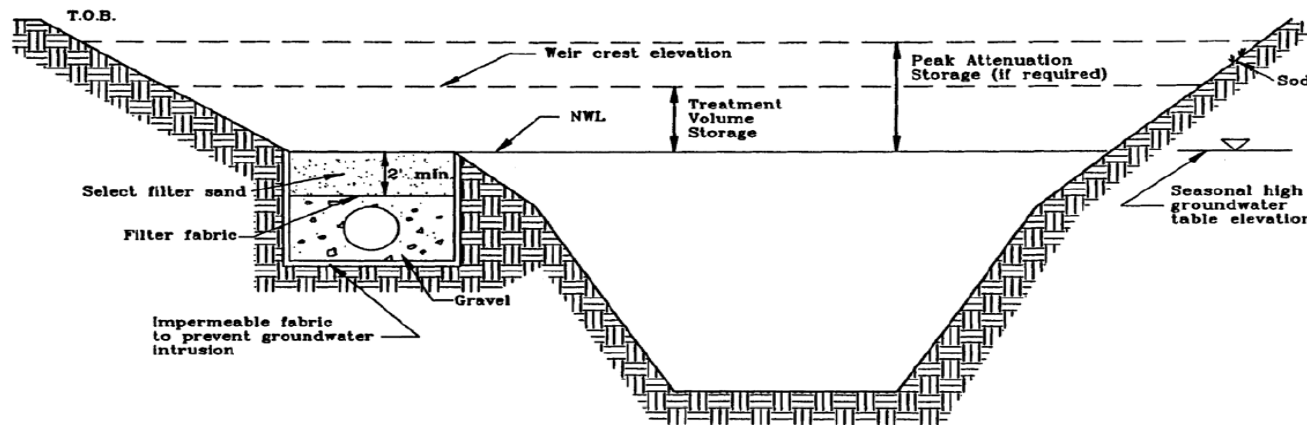
**Trench Underdrain**



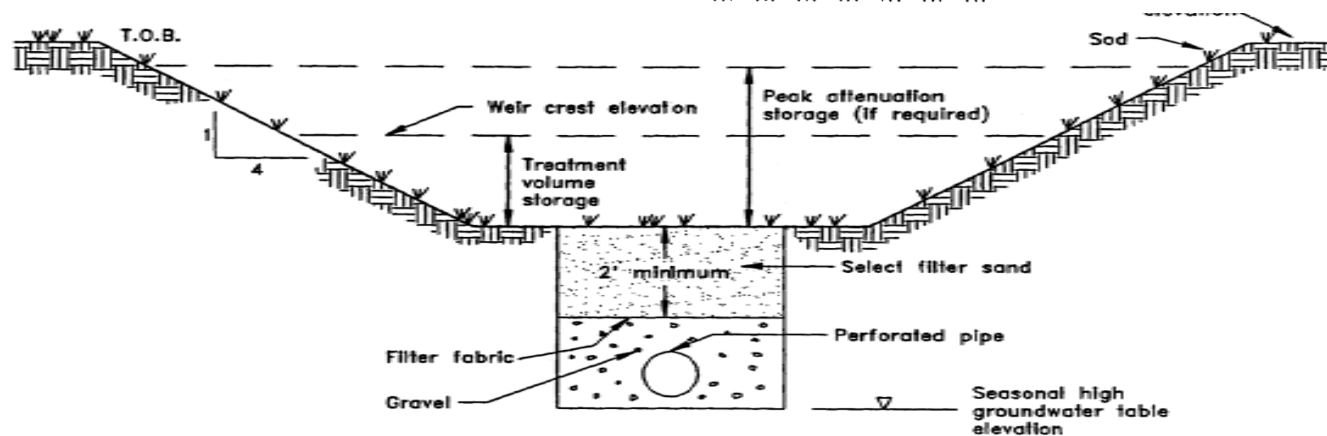
**Variable Filter Area**



Side-bank Filter System



Shelf Filter System



Underdrain Filter System

# Calculation for Filter Media Surface Area

## ☐ **SJRWMD methodology for drawdown analysis**

- Side-bank filter
- Shelf filter

## ☐ **Required Input Data**

- Permeability of Filter media
- Stage-Storage chart
- Pipe invert elevation – Tailwater elevation or SHGWT elevation
- Pond configuration and dimensions
- Treatment volume



## Incremental Method for Calculating Drawdown Time for Side-Bank Filter Systems Using Darcy's Equation

Project Name:	<b>Bold &amp; Gold CTS Filter Media</b>
Project No.:	<b>Side-Bank Filter</b>

### Basic Information

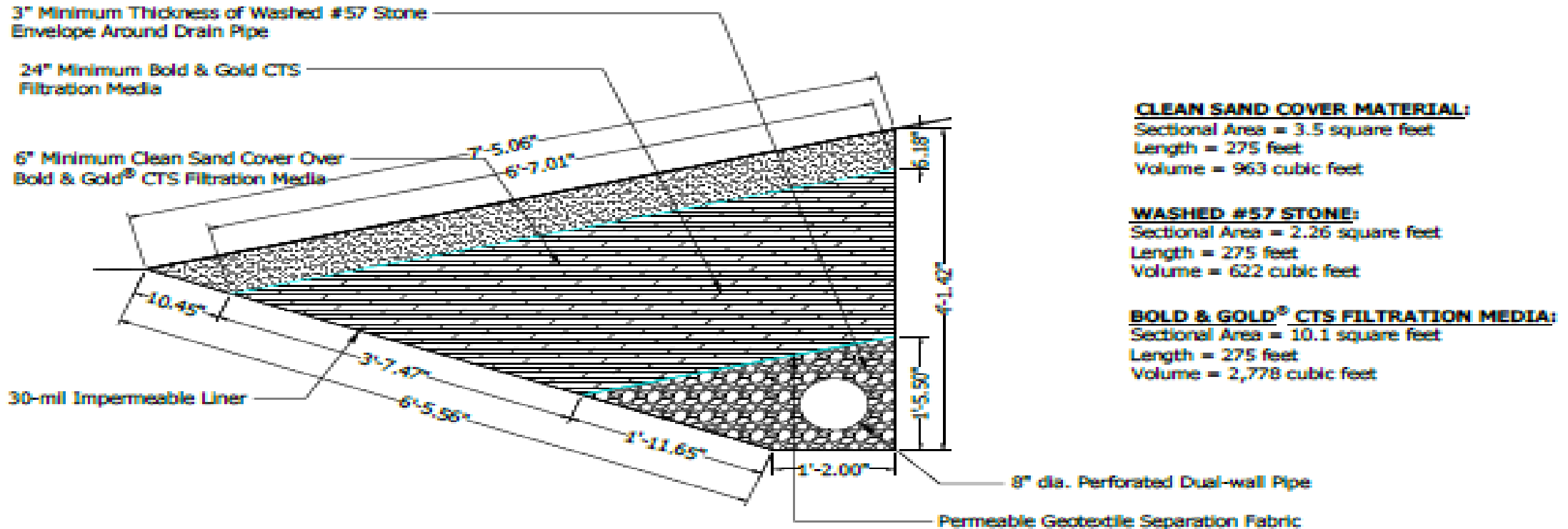
Descriptions	Data	Units
Filter Permeability (k)	<b>1.04</b>	ft/hr
Basin Side Slope (h/v)	4	ft/ft
Top of Treatment Volume Elevation	18.30	ft.
Bottom of Treatment Volume Elevation	16.50	ft.
Number of Increments	5	
Storage Volume	<b>13,027</b>	cf
Pipe Capacity (Inside Diameter)	<b>7.65</b>	in.

### Filter Pipe Information

Description	Data	Units
Length of Pipe (L)	<b>275</b>	ft.
Pipe Diameter (d)	<b>8.0</b>	in.
Pipe Invert Elevation	14.43	ft.
Horizontal Distance (D <sub>h</sub> )		ft.
Envelope Height above Pipe	3.00	in.
Average Envelope Width	3.00	in.
Manning's n	0.016	
Slope (ft per ft)	0.0012	ft/ft

Elevation (ft)	Storage (cf)	Storage Increment, V (cf)	Distance of Flow Path Through Filter Media, D <sub>i</sub> (ft.)	Average Flow Distance, D (ft)	Change in Elevation, H (ft)	Hydraulic Gradient, i	Average Filter Width, W (ft.)	Average Filter Flow Area, A (sf)	Instantaneous Discharge, Q (cfh)	Average Discharge per Increment, Q <sub>ave</sub> (cfh)	Drawdown Time per Increment, t <sub>i</sub> (hrs.)	Total Drawdown Time, T (hrs)
<b>18.30</b>	<b>13,027</b>		2.99	<b>3.92</b>	<b>3.53</b>	<b>0.90</b>	4.21	<b>1157.75</b>	<b>1085.65</b>			<b>0</b>
		<b>2,773.77</b>								<b>913.96</b>	<b>3.03</b>	
<b>17.94</b>	<b>10,253</b>		2.69	<b>4.11</b>	<b>3.17</b>	<b>0.77</b>	3.36	<b>923.08</b>	<b>742.27</b>			<b>3.03</b>
		<b>2,715.91</b>								<b>595.12</b>	<b>4.56</b>	
<b>17.58</b>	<b>7,537</b>		2.88	<b>4.46</b>	<b>2.81</b>	<b>0.63</b>	2.48	<b>682.69</b>	<b>447.96</b>			<b>7.60</b>
		<b>2,598.79</b>								<b>341.44</b>	<b>7.61</b>	
<b>17.22</b>	<b>4,939</b>		3.77	<b>4.99</b>	<b>2.45</b>	<b>0.49</b>	1.67	<b>459.02</b>	<b>234.93</b>			<b>15.21</b>
		<b>2,511.54</b>								<b>167.30</b>	<b>15.01</b>	
<b>16.86</b>	<b>2,427</b>		4.96	<b>5.60</b>	<b>2.09</b>	<b>0.37</b>	0.93	<b>255.98</b>	<b>99.66</b>			<b>30.22</b>
		<b>2,427.00</b>								<b>64.48</b>	<b>37.64</b>	
<b>16.50</b>	<b>0</b>		6.24	<b>6.24</b>	<b>1.73</b>	<b>0.28</b>	0.37	<b>101.29</b>	<b>29.30</b>			<b>67.86</b>

# Calculation for Filter Media Volume – Side-bank



Side-Bank Section with Bold & Gold® CTS Filter Media

Length of Side-bank = 275 ft.

Volume of filter media = 2,778 CF. (*use for service life calculation, if greater than minimum*)

# Service Life Calculations

## □ Questions:

1. How long before it becomes ineffective?
2. How often will the filter media be replaced?
3. How can I determine the replacement cycle?

## □ Responses:

- Nitrate conversion is a **biological** process
- Orthophosphate (OP) is by **adsorption**
- Loading rate of OP – **OP is a fraction of TP** (site-specific parameter)
- **Sorption rate:** 0.2 mg of OP per gram of moist filter media (0.0032 oz. of OP per pound of moist filter media)

# Service Life Calculations

BMP Trains Calculators

These are tools designed to assist with the complex tables and calculations used in BMP Trains.

Information entered in these forms is not saved and does not have any effect elsewhere in the program.

Pervious Pavement Storage Calculator

Harvesting Efficiency Table

Rational Coefficient Lookup Table

Retention Efficiency Lookup Tables

Media Filter Area in Square Feet

Media Filter Service Life in Years

Back

Calculate Media Filter Service Life

Select Catchment:

Select BMP:

Amount Removed (kg TP/yr):

Removal Rate in mg OP/g media (0.01-10.0):

Filter Volume Provide (cf):

Saturated Weight of Media (lbs/cf):

Fraction OP in TP (< 1.0):

Calculate

Copy

Print

Back

# Service Life Calculations

Calculate Media Filter Service Life


— □ ×

Select Catchment:


Select BMP:

Amount Removed (kg TP/yr):

Removal Rate in mg OP/g media (0.01-10.0):

 Filter Volume Provide (cf):

Saturated Weight of Media (lbs/cf):

 Fraction OP in TP (< 1.0):

Calculate

Copy

Print

Back

Calculate Media Filter Service Life

— □ ×

Select Catchment:

Select BMP:

Amount Removed (kg TP/yr):

Removal Rate in mg OP/g media (0.01-10.0):

Filter Volume Provide (cf):

Saturated Weight of Media (lbs/cf):

Fraction OP in TP (< 1.0):

Calculate

Copy

Print

Back

## Inputs

1. Filter media depth = 2',
2. Length = 275' and width = 6.6'
3. Fraction of TP (approx.) = 0.9
4. Volume of Filter Media = 2,778 CF

# Service Life Calculations

Calculate Media Filter Service Life

Select Catchment:

Select BMP:

Amount Removed (kg TP/yr):

Removal Rate in mg OP/g media (0.01-10.0):

Filter Volume Provide (cf):

Saturated Weight of Media (lbs/cf):

Fraction OP in TP (< 1.0):

Phosphorus Into Media Per Year (kg/yr): 0.88  
Phosphorus Removed per Year (kg OP/yr): 0.79  
Filter Capacity (kg OP/g media): 23.96  
Sorption Rate (mg OP/g media): 0.20  
Filter Volume Provided (cf): 2,778.00  
Saturated Weight of Media (lbs/cf): 95.00  
Filter OP in TP (fraction): 0.90  
**Service Life (years): 30.4**

Calculate  
Copy  
Print  
**Back**

**Service Life  $\approx$  30 years**

*Service Life = OP Removal Capacity of Media divided by the OP supplied to the filter per year.*