

# Module 4: WinSLAMM v 9.1 Control Practice Cost Analysis

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## We will cover . . .

- Cost Analysis Overview
- Sources of Cost Data
- Entering Cost Data
- Running the model with Cost Data and Reviewing Cost Output

## We will cover . . .

- **Cost Analysis Overview**
- Sources of Cost Data
- Entering Cost Data
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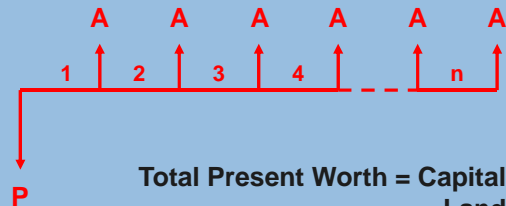
## Cost Analysis Overview

### What Does the Cost Analysis Program Do?

- Calculates the cost of the control practices listed in a model run
- Allows you to compare the cost of different sets of practices
- Provides the option of applying either pre-determined costs or user-defined costs
- **Doesn't** evaluate the cost reductions due to the use of control practices, ie, no asphalt pavement reduction determined if porous pavement is used. The separate cost spreadsheet calculates the basic drainage system costs for comparison though.

## Cost Analysis Overview

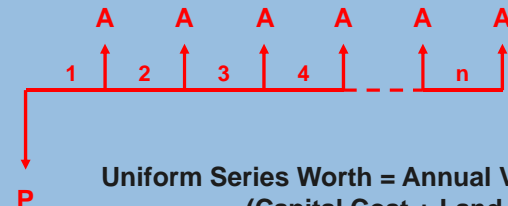
How are the Cost Values Normalized?



Total Present Worth = Capital Cost +  
Land Cost +  
Present Worth of  
Annual Maintenance Cost

## Cost Analysis Overview

How are the Cost Values Normalized?



Uniform Series Worth = Annual Value of  
(Capital Cost + Land Cost) +  
Annual Maintenance Cost

## Cost Analysis Overview

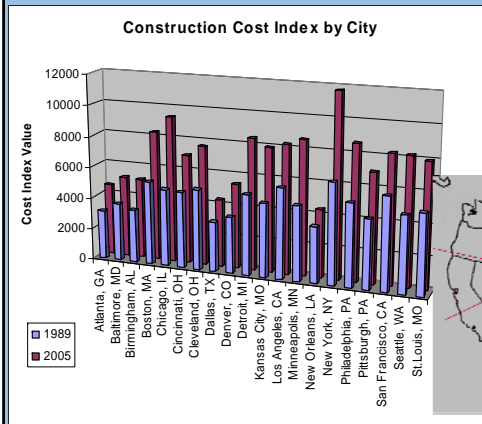
What is the General Cost Evaluation Process?

- Edit and Save the Cost Template.csv File
- Select the Cost Data File for a Model Run
- Run the Program
- Review the Cost Output

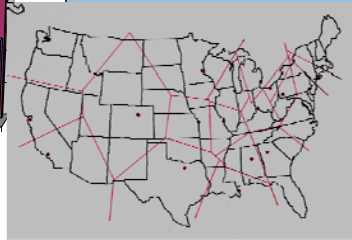
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## Sources of Cost Data

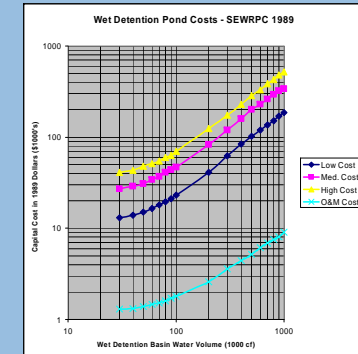


- Pre-Determined Costs
  - SEWRPC 1991 Cost Report
  - Costs Updated Using ENR Cost Indices
  - Cost Indices Available for 20 Cities



## Sources of Cost Data

- Pre-Determined Costs
  - Costs Available for –
    - Wet Detention
    - Porous Pavement
    - Grass Swales
    - Street Cleaning
    - Catchbasins
    - Infiltration Trenches



## Sources of Cost Data

- User-Defined Costs for Each Practice
  - Enter Items that Define the Practice
  - Select Unit
  - Enter Cost per Unit
  - Enter Quantity
  - Program Calculates Cost
- Program Determines Total Unit Cost
- Enter Routine Maintenance Cost

Use User Defined Costs

Capital Costs			
Item Description	Unit	\$/Unit	Quan
Porous Pavement	SF	15.00	2000
underdrain	LF	1.50	800
Rock Fill	CY	6.00	74
Excavation	CY	4.00	111
Design Costs	EA	4000.00	1
		0.00	0
		0.00	0

Total Unit Cost: \$ 18 /sf

LF : Linear Feet  
 SY : Square Yards  
 CY : Cubic Yards  
 EA : Each

Annual Routine Maintenance Cost (\$/ac): 3

## We will cover . . .

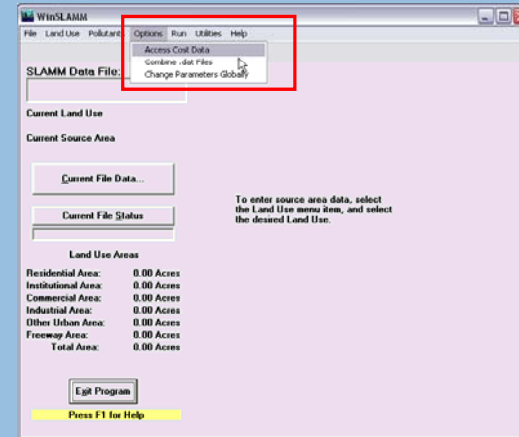
- Cost Analysis Overview
- Sources of Cost Data
- **Entering Cost Data**
- Running the model with Cost Data and Reviewing Cost Output

## Edit and Save the Cost Template.csv File

- On the Summary Data Page
  - Enter project life and interest rate information
  - Enter Land Costs
  - Select Cost Index
- For Each Control Practice
  - Select either Pre-Determined or User-Defined Costs
  - For Pre-Determined Costs, select Cost Range
  - For User-Defined Costs, enter Cost Data
  - Enter Land Use Multiplier
- Re-name and Save Cost Data File

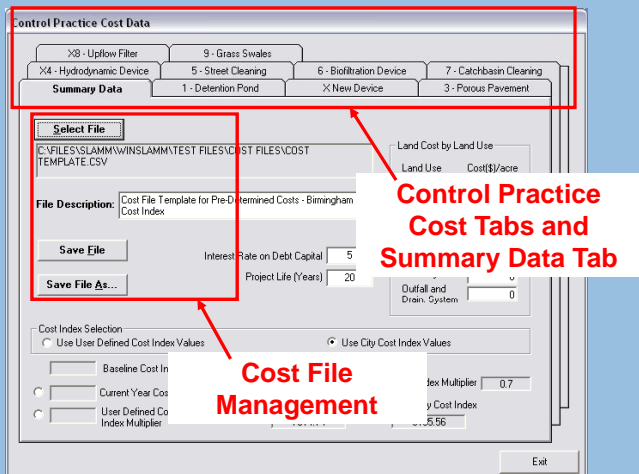
## Edit and Save the Cost Template.csv File

From the Main Menu go to the Options/Access Cost Data Summary Tab . . .



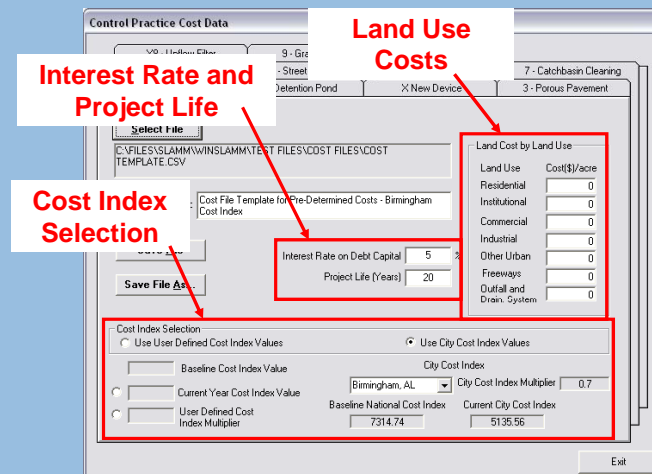
## Edit and Save the Cost Template.csv File

### Summary Data Tab



## Edit and Save the Cost Template.csv File

### Summary Data Tab



## Edit and Save the Cost Template.csv File

### Wet Detention Pond Cost Data

Pre-Determined Cost Table

Use Pre-Determined Costs

Total Pond Volume (1000 cf)	Low Capital Cost	Med. Capital Cost	High Capital Cost	Annual O&M Cost
30.0	19.7	40.9	62.2	1.97
40.0	21.2	44.0	65.2	1.98
50.0	22.7	47.0	72.8	2.09
60.0	25.0	51.6	77.3	2.19
70.0	27.3	56.1	83.4	2.31
80.0	29.6	62.2	91.0	2.43
90.0	31.8	66.7	95.5	2.58
100.0	34.9	71.3	106.2	2.73
200.0	62.2	125.9	189.6	3.95
300.0	94.0	182.0	265.4	5.46
400.0	127.4	242.6	348.8	6.67
500.0	157.3	303.3	432.2	7.69
600.0	190.5	348.8	500.4	8.25
700.0	206.2	394.3	583.8	10.47
800.0	230.5	447.4	652.1	11.37
900.0	257.8	495.3	727.9	12.29
1000.0	280.5	515.6	788.6	13.65

2005 Costs - Cleveland, OH

Capital Costs

Item	Unit	\$/Unit
Cut/Fill	CY	0.00

Total Unit Cost: \$0

Applicable Cost Range

Low Capital Cost  
 Medium Capital Cost  
 High Capital Cost

Land Cost Site Area Multiplier: 1.5

Pre-Determined Capital Cost Range

## Edit and Save the Cost Template.csv File

### Wet Detention Pond Cost Data

User-Defined Cost Table

Use User Defined Costs

Item	Unit	\$/Unit	Quan.	Cost (\$)
Cut/Fill	CY	3.00	15000	45000
Storm Sewer	LF	48.00	200	9600
Inlet MH	EA	3000.00	1	3000
Outlet Structure	EA	7000.00	1	7000
Landscaping	SY	0.75	10000	7500
		0.00	0	0.00
		0.00	0	0.00

Total Unit Cost: \$178/1000 cf

Maintenance Cost Data

- Sediment Removal Costs  
 - Routine Maintenance Cost

Sediment Removal Frequency (yrs): 25  
 Sediment Removal Cost (\$/CY of sediment): 30  
 Annual Routine Maintenance Cost (\$/1000 cf): 2

Applicable Cost Range

Low Capital Cost  
 Medium Capital Cost  
 High Capital Cost

Land Cost Site Area Multiplier: 1.5

Total Unit Cost per 1000 cubic feet

Maintenance Cost Data

Land Area Multiplier

## Edit and Save the Cost Template.csv File

### Porous Pavement Cost Data

Pre-Determined Cost Table

Use Pre-Determined Costs

Stone Reservoir Depth (ft)	Low Capital Cost	Med. Capital Cost	High Capital Cost	Annual O&M Cost
0.5	33.43	62.17	83.40	0.30
1.0	60.96	90.96	121.32	0.30
1.5	90.98	128.90	174.39	0.30
2.0	122.83	166.81	227.47	0.30

2005 Costs - Cleveland, OH

Capital Costs

Item Description	Unit	\$/Unit
Porous Pavement	SF	0.00

Total Unit Cost: \$0

Applicable Cost Range

Low Capital Cost  
 Medium Capital Cost  
 High Capital Cost

Land Cost Site Area Multiplier: 0

Pre-Determined Capital Cost Range

## Edit and Save the Cost Template.csv File

### Porous Pavement Cost Data

User-Defined Cost Table

Use User Defined Costs

Item Description	Unit	\$/Unit	Quan.	Cost (\$)
Porous Pavement	SF	15.00	2000	30000.00
underdrain	LF	1.50	800	1200.00
Rock Fill	CY	6.00	74	444.00
Excavation	CY	4.00	111	444.00
Design Costs	EA	4000.00	1	4000.00
		0.00	0	0.00
		0.00	0	0.00

Total Unit Cost: \$18/sf

Maintenance Cost Data

- Routine Maintenance Cost

Annual Routine Maintenance Cost (\$/ac): 5500

Applicable Cost Range

Low Capital Cost  
 Medium Capital Cost  
 High Capital Cost

Land Cost Site Area Multiplier: 0

Total Unit Cost per square foot

Maintenance Cost Data

Land Area Multiplier

## Edit and Save the Cost Template.csv File

### Street Cleaning Cost Data

Pre-Determined Cost Table

Use Pre-Determined Costs

	Capital Cost (\$) per Cub-Mile	O and M Cost (\$) per Cub-Mile Cleaned
Low	2.43	12.74
Medium	3.43	18.00
High	4.40	23.10

Cost per Street Sweeper (\$/unit): 100000

Miles Cleaned per year per Unit (Fleet Average):

Expected Life of Typical Street Cleaner:

Capital Cost: \$156 per Cub-Mile

Operation and Maintenance Cost (\$ per Cub-Mile Cleaned):

Applicable Cost Range:

- Low Capital Cost
- Medium Capital Cost
- High Capital Cost

2005 Costs - Birmingham, AL

Pre-Determined Capital Cost Range

## Edit and Save the Cost Template.csv File

### Street Cleaning Cost Data

User-Defined Cost Table

Total Unit Cost per curb mile

Maintenance Cost Data - Routine Maintenance Cost

Use User Defined Costs

Capital Cost (\$):

O and M Cost (\$) per Cub-Mile Cleaned:

Cost per Street Sweeper (\$/unit): 100000

Miles Cleaned per year per Unit (Fleet Average): 6400

Expected Life of Typical Street Cleaner: 10

Capital Cost: \$156 per Cub-Mile

Operation and Maintenance Cost (\$ per Cub-Mile Cleaned): 25

Applicable Cost Range:

- Low Capital Cost
- Medium Capital Cost
- High Capital Cost

2005 Costs - Cleveland, OH

## Edit and Save the Cost Template.csv File

### Biofiltration Cost Data

Pre-Determined Cost Table

Use Pre-Determined Costs

Depth (ft)	m	B	m	B
3.0	4.57	30.96	0.32	1.38
4.0	5.70	34.69	0.36	1.42
5.0	6.60	38.49	0.40	1.58
6.0	7.91	41.23	0.45	1.48
8.0	10.05	45.92	0.55	1.55
10.0	12.43	49.53	0.63	1.85
12.0	14.66	58.31	0.73	1.99

Crushed Stone Fill (\$/CY): 6.67

Equation Form:  $y = m^2x + b$   
where:  $y = \text{Cost}$   
 $x = \text{Biofilter Depth (ft)}$

2005 Costs - Birmingham, AL

Crushed Stone Fill Cost

## Edit and Save the Cost Template.csv File

### Biofiltration Cost Data

User-Defined Cost Table

Total Unit Cost per cubic yard

Maintenance Cost Data - Routine Maintenance Cost

Land Area Multiplier

Use User Defined Costs

Depth	m	B	m	B
3.0	4.57	30.96	0.32	1.38
4.0	5.70	34.69	0.36	1.42
5.0	6.60	38.49	0.40	1.58
6.0	7.91	41.23	0.45	1.48
8.0	10.05	45.92	0.55	1.55
10.0	12.43	49.53	0.63	1.85
12.0	14.66	58.31	0.73	1.99

Crushed Stone Fill (\$/CY): 10.00

Annual Routine Maintenance Cost (\$/SY): 22

Land Cost Site Area Multiplier: 1.25

Total Unit Cost: \$46.26 /cy

## Edit and Save the Cost Template.csv File

### Catchbasin Cleaning Cost Data

Pre-Determined Cost Data

Use Pre-Determined Costs

Installation Cost per CB

Low Capital Cost	3032
Medium Capital Cost	4549
High Capital Cost	6065

Cleaning Cost (\$ per CB Cleaned): 53

Applicable Cost Range:

Low Capital Cost

Medium Capital Cost

High Capital Cost

Capital Costs

Item Description	Unit	\$/Unit	Quan.	Cost (\$)
Catchbasin	EA	0.00	1	0.00

Total Unit Cost: \$0.00

2005 Costs - Cleveland, OH

Pre-Determined Capital Cost Range

## Edit and Save the Cost Template.csv File

### Catchbasin Cleaning Cost Data

User-Defined Cost Table

Total Unit Cost per unit

Maintenance Cost Data - Routine Maintenance Cost

Use User Defined Costs

Installation Cost per CB

Low Capital Cost	3032
Medium Capital Cost	4549
High Capital Cost	6065

Cleaning Cost (\$ per CB Cleaned): 7

Total Unit Cost: \$10810/Unit

Capital Costs

Item Description	Unit	\$/Unit	Quan.	Cost (\$)
Catchbasin	EA	4000.00	1	4000.00
Piping	LF	45.00	150	6750.00
Inlet protection	EA	60.00	1	60.00
		0.00	0	0.00
		0.00	0	0.00
		0.00	0	0.00
		0.00	0	0.00

2005 Costs - Cleveland, OH

## Edit and Save the Cost Template.csv File

### Grass Swale Cost Data

Pre-Determined Cost Tables

Use Pre-Determined Costs

Capital Costs in Dollars per LF

Bottom Width (ft)	A	B	C
1.0	0.70	3.54	4.36
3.0	0.71	3.94	5.05
5.0	0.57	4.80	5.76
8.0	0.51	5.31	7.33
10.0	0.52	3.79	10.55

Maintenance Costs in Dollars per LF

Bottom Width (ft)	m	B
1.0	0.10	0.43
3.0	0.10	0.47
5.0	0.10	0.50
8.0	0.09	0.56
10.0	0.10	0.59

Capital Cost Equation Form:  $y = A*x^2 + B*x + C$

where:  $y = \text{Cost } (\$/ft)$   
 $x = \text{Swale Depth (ft)}$

Maintenance Equation Form:  $y = m*x + B$

where:  $y = \text{Cost } (\$/ft)$   
 $x = \text{Swale Depth (ft)}$

Land Cost Site Area Multiplier: 0

2005 Costs - Birmingham, AL

## Edit and Save the Cost Template.csv File

### Grass Swale Cost Data

User-Defined Cost Table

Total Unit Cost per foot

Maintenance Cost Data - Routine Maintenance Cost

Land Area Multiplier

Use User Defined Costs

Capital Costs in Dollars per LF

Bottom Width (ft)	A	B	C
1.0	5.31	6.54	
3.0	5.91	7.50	
5.0	7.20	8.62	
8.0	14.65	10.99	
10.0	5.69	15.00	

Maintenance Costs in Dollars per LF

Bottom Width (ft)	m	B
1.0	0.10	0.43
3.0	0.10	0.47
5.0	0.10	0.50
8.0	0.09	0.56
10.0	0.10	0.59

Capital Cost Equation Form:  $y = A*x^2 + B*x + C$

where:  $y = \text{Cost } (\$/ft)$   
 $x = \text{Swale Depth (ft)}$

Maintenance Equation Form:  $y = m*x + B$

where:  $y = \text{Cost } (\$/ft)$   
 $x = \text{Swale Depth (ft)}$

Land Cost Site Area Multiplier: 1.25

2005 Costs - Birmingham, AL

## We will cover . . .

- Cost Analysis Overview
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- **Running the Model with Cost Data and Reviewing Cost Output**

## Two Types of Cost Output

1. Capital, Land, and Maintenance Costs on the Summary Tab of a WinSLAMM Model Run
2. Capital, Land, and Maintenance Costs included with the output when you run a set of .dat files using the Batch Processor

### 1. Output on a Model Run Summary Tab

Current File Data

SLAMM Data File Name: C:\Files\SLAMM\WinSLAMM\Test Files\Cost Files\Detention Pond in Outfall.dat

Site Descript.: Detention pond 0.55 ac

Seed: 42

Rain File: C:\PROGRAM FILES\WINSLAMM\RAIN FILES\BHAMRICE.RAN

Start Date: 01/01/99 End Date: 12/31/99

Pollutant Probability Distribution File: C:\PROGRAM FILES\WINSLAMM\BHAM.PPD

Runoff Coefficient File: C:\PROGRAM FILES\WINSLAMM\RUNOFF.RSV

Particulate Solids Concentration File: C:\PROGRAM FILES\WINSLAMM\BHAM.PSC

Particulate Residue Delivery File: C:\PROGRAM FILES\WINSLAMM\DELIVERY.PPR

Street Delivery File (Select LU): Residential LU, Industrial LU, Institutional LU, Other Urban LU, Commercial LU, Paveways

Use Cost Estimation Option:  **Select Cost Data File**: C:\Files\SLAMM\WinSLAMM\Test Files\Cost Files\Cost Data 1.csv

Drainage System: Data Entered

Enter the Cost Data File Name in the Current File Data Window

### 1. Output on a Model Run Summary Tab

WinSLAMM Model Output

File Name: C:\Files\SLAMM\WinSLAMM\Test Files\Cost Files\Detention Pond in Outfall.dat

	Runoff Volume (cu. ft.)	Percent Runoff Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total Before Drainage System	1.649E+06	Base	208.1	21413	Base
Total After Drainage System	1.649E+06	0.00 %	196.5	20215	5.59 %
Total After Outfall Controls	1.649E+06	0.24 %	63.53	6517	69.57 %

Total Basin Area (ac) 100.00

**Total Control Practice Costs**

Capital Cost	\$ 93234
Land Cost	\$ 9450
Annual Maintenance Cost	\$ 2503
Present Value of All Costs	\$ 133881
Annualized Value of All Costs	\$ 10743

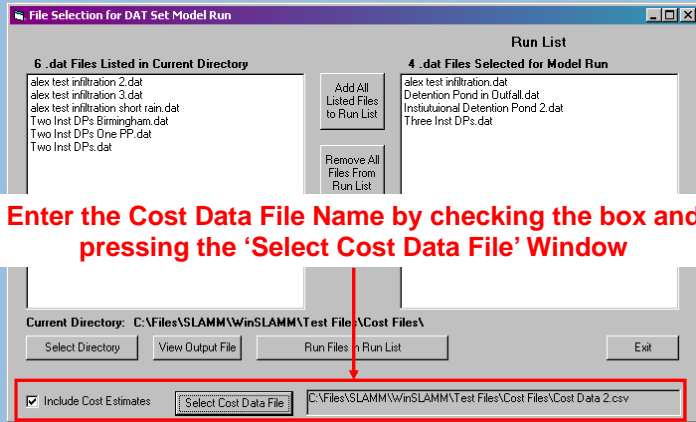
Print Output Summary to Comma Separated Value File

Print Output Summary to Text File

Total Control Practice Costs



## 2. Output from a Set of .dat Files



## 2. Output from a Set of .dat Files

**Import the output file 'DATSetOutput.CSV' into Excel**

**Cost Output for each .dat file**

File Name	Catchment Area (ac)	Runoff Volume (cf)	Particulate Solids Yield (lbs)	Sub Basin Capital Cost	Sub Basin Maintenance Cost	Sub Basin Annualized Cost	Sub Basin Total Present Value Cost
Cost Example - Base Case No Controls	65	5246545	37412.91	0	0	0	0
Cost Example - G	65	3136146	22341.03	119109	0	9100	18658
Cost Example - P 20 percent	65	4425257	30761.3	681686	0	3422	58122
Cost Example - P 50 percent	65	3193328	20783.89	1704215	0	8555	145306
Cost Example - W	65	5204862	7496.197	366536	300000	7125	60809
Cost Example - W/G	65	2840801	6824.506	360849	170000	14109	56706

## 2. Output from a Set of .dat Files

**Import the output file 'DATSetOutputCostDetail.CSV' into Excel**

**Cost Information for each control practice**

File Name	Source Area Number	Control Practice Type	Control Practice Cost Variable	Control Practice Cost	Capital Cost	Land Cost	Maintenance Cost	Total Sediment Removal (Run (Bsf) (Bsf)	Sediment Accumulated During pre Designing (Bsf)	Sediment Removed Above Rock (Bsf)	Total Sediment Removed BF Volume (CY)	Present Value of Future Sediment Removal Costs
Hunts Indus A site bioret	0	0	Restoration BF Length	160	29155	4242	1933	N/A	N/A	N/A	6244	N/A
Hunts Indus B site bioret	1	0	Restoration BF Length	160	56029	9800	4511	N/A	N/A	N/A	6244	N/A
Inst C	2	161	Catchment Number of	40	161728	0	2900	N/A	N/A	N/A	N/A	N/A
Inst O	3	161	Grass Swi Swale Dep	2	470209	0	20228	N/A	N/A	N/A	N/A	N/A
Inst S Ind S	4	48	Street Cms Total Curb	158	887	0	3804	N/A	N/A	N/A	N/A	N/A
Inst S Ind S	4	109	Street Cms Total Curb	85	289	0	1502	N/A	N/A	N/A	N/A	N/A
Institutional Detention Pond 2	5	35	Inst Detent Pond Volu	100900	75710	3000	1952	N/A	N/A	N/A	N/A	N/A

## 2. Output from a Set of .dat Files

**Import the output file 'DATSetOutputCostDetail.CSV' into Excel**

**Additional Detention Pond Sediment and Biofilter Volume Information**

**Additional Detention Pond Sediment and Biofilter Volume Information**

Control Practice Cost Variable	Capital Cost	Land Cost	Maintenance Cost	Total Sediment Removal (Run (Bsf) (Bsf)	Sediment Accumulated During pre Designing (Bsf)	Sediment Removed Above Rock (Bsf)	Present Value of Future Sediment Removal Costs (CY)	Present Value of Future Sediment Removal Costs (CY)	Present Value of Future Sediment Removal Costs (CY)	Annual Value of Future Sediment Removal Costs	Annual Value of Future Sediment Removal Costs
Restoration BF Length	160	29155	4242	1933	N/A	N/A	6244	N/A	N/A	12.48521	6.03E-02
Restoration BF Length	160	56029	9800	4511	N/A	N/A	6244	N/A	N/A	12.48521	1.34447
Catchment Number of	40	161728	0	2900	N/A	N/A	N/A	N/A	N/A	12.48521	1.96652
Grass Swi Swale Dep	2	470209	0	20228	N/A	N/A	N/A	N/A	N/A	12.48521	7.22304
Street Cms Total Curb	158	887	0	3804	N/A	N/A	N/A	N/A	N/A	12.48521	4.5596
Street Cms Total Curb	85	289	0	1502	N/A	N/A	N/A	N/A	N/A	12.48521	1.9996
Inst Detent Pond Volu	100900	75710	3000	1952	N/A	N/A	N/A	N/A	N/A	12.48521	10.2300

## 2. Output from a Set of .dat Files

Import the output file 'DATSetOutputCostDetail.CSV' into Excel

**Present Value and Annual Value Cost Information**

Variable	Value	Cost	Land Cost	Ice Cost	Cost	Run (Res)	(Res)	Present Value of Future Sediment Volume	Present Value of All Costs	Annual Value Multiplier	Annual Value of All Costs			
erBF Length	160	23155	4242	1533	N/A	N/A	N/A	6244	N/A	N/A	12.46221	57409	8.02E-02	4613
erBF Length	160	68020	9890	4511	N/A	N/A	N/A	6244	N/A	N/A	12.46221	134147	8.02E-02	10764
er Number of	40	161728	0	2800	N/A	N/A	N/A	N/A	N/A	N/A	12.46221	196622	8.02E-02	15777
er Sample Dis	2	470208	0	20228	N/A	N/A	N/A	N/A	N/A	N/A	12.46221	722304	8.02E-02	87960
er Total Curt	156	897	0	3604	N/A	N/A	N/A	N/A	N/A	N/A	12.46221	45596	8.02E-02	3659
er Total Curt	65	286	0	1502	N/A	N/A	N/A	N/A	N/A	N/A	12.46221	18998	8.02E-02	1524
er Pond Volu	100900	75710	3000	1092	N/A	N/A	N/A	N/A	N/A	N/A	12.46221	102300	8.02E-02	8209

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