# **FSAEF Stormwater BMP** Life-Cycle Costing Tool

FSA 2024 Annual Conference JUNE 13, 2024



YEARS 1974-2024

# **Nonpoint Source Funds**



#### Nonpoint Source Funds

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#### Nonpoint Source Funds Quick Links

Contacts

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How to Apply?

Program Resources

Frequently Asked Questions (Grants Q&A)

Nonpoint Source Pollution Education

Green Infrastructure/Low Impact Development

Story Map of Florida's Nonpoint Source Projects

#### About Nonpoint Source Funds

Funding for control of water pollution from nonpoint sources is managed by the Nonpoint Source Management Program. Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources, including stormwater. The program administers both the Federal Clean Water Act Section 319(h) Grants (also known as "319 Grants") and the State Water-quality Assistance Grants (also known as "SWAG"). The goal of these grants is to reduce nonpoint source pollution from land use activities. Total funding amounts available each year in these two grant programs depends on Federal and state appropriations, but is usually around \$8 - \$9 million.

#### How to Apply

Project proposals may be submitted anytime throughout the year. Department review and evaluation periods are expected to occur in September/October and March/April of each year, or as needed. If the project is not funded in the current selection cycle, it will be considered in the following cycle with no need to resubmit (unless there is a need to update the proposal). If your project is not selected within the current state fiscal year, the proposal will need to be resubmitted for evaluation.

#### State Water-quality Assistance Grants

 Cost effectiveness based on the cost per pound of total nitrogen and/or total phosphorus removed per acre treated



#### **Conventional BMPs vs. Low-Impact Design/Green Infrastructure**





#### New Statewide Stormwater Rule (Finally!)





#### New O&M Requirements in ERP (Volume I)

- 12.3.5 All operation and maintenance entities shall provide a cost estimate for the perpetual operation and maintenance of the stormwater management system through the submission of the documents described in this section.
  - (a) Cost estimates:
    - Cost estimates are required for all stormwater management systems, except those using a self-certification in accordance with the 10/2 general permit authorization under section 403.814(12), F.S.



### **What Was Lacking**



- Consistent, unified approach
  - BMP Trains for water quality
- A more detailed accounting of service life
- Guidance on the service life of BMP components



#### **What Was Working**

OPINION OF P	ROBA	BLE COST				
OWNER:		ESTIMATED BY:				
Volusia County		Amy Goodde	en			
CLIENT:		CHECKED BY:			-	
Volusia County		Jamie Bell			-	
PROJECT TITLE:		PROJECT SEGMEN	Ť			
Mosquito Lagoon Reasonable Assurance Plan						
Options Analysis						
PROJECT NUMBER:		DATE:				
22015-012-01	1	10/23/2017				
ESTIMATE TYPE (ROM, BUDGET, DEFINITIVE):		SUBJECT				
ROM	1	Option 1 - Ro	oslyn	Avenue Po	ond	l
DESCRIPTION	UNIT	QUANTITY	U	NIT COST	1	TOTAL COST
LAND ACQUISITION						
Long-term Lease Agreement	LS	1	\$	-	\$	-
CONSTRUCTION						
Dewatering and Flow Diversion	LS	2	\$	15.000	\$	30.000.00
Sheetpile Low Head Dam - 70 LF X 15 ft	SF	1050	\$	40	\$	42,000.00
Temporary Rock Check Dam	LS	2	\$	1.500	\$	3.000.00
Diversion Weir - FDOT Type H DBI, Assumed depth 10 ft	EA	1	\$	11,000	\$	11,000
Diversion Weir - 36" RCP	LF	32	\$	133	\$	4,256
Outlet Structure - FDOT Type H, Modified, Assumed depth						
10 ft	EA	1	\$	11,000	\$	11,000
Outlet Structure - 36" RCP	LF	32	\$	133	\$	4,256
Outlet Structure - Manatee Grate 36" RCP	EA	1	\$	3,600	\$	3,600
Concrete driveway apron- FDOT turnout	SY	49	\$	23	\$	1,124
Gravel access road 1800LF, clearing and grubbing	AC	0.58	\$	12,000	\$	6,942
Gravel access road 1800LF, Stabilized base, Group 6	SY	2400	\$	14	\$	33,600
Gravel access road 1800LF, #57 stone	TN	835	\$	90	\$	75,150
Soil Tracking Prevention Device	EA	1	\$	2,500	\$	2,500
Staked Silt Fence	LF	1800	\$	4	\$	7,200
Staked Turbidity Barrier	LF	80	\$	4	\$	320
Subtotal					\$	236,000
Miscellaneous Items and Fine Grading (15%)	LS	1	\$	35,400	\$	35,400
Mobilization (10%)	LS	1	\$	23,600	\$	23,600
TOTAL CONSTRUCTION COST ESTIMATE					\$	300,000
PLANNING, DESIGN, PERMITTING						
FAA Permitting and Management Plan	LS	1	\$	50,000	\$	50,000
Wetland Mitigation	CR	2	\$	150,000	\$	300,000
Engineering & SJRWMD Permitting (15%)	LS	1	\$	45,000	\$	45,000
Subtotal					\$	395,000
SUBTOTAL PROJECT COST ESTIMATE					\$	700,000
TOTAL PROJECT COST ESTIMATE RANGE		\$ 560,000		to	\$	910,000

- Opinions of probable cost
  - Moves rapidly with the state of the economy
- Regional differences



#### Framework



#### LIFE-CYCLE COSTING TOOL SUMMARY REPORT

Florida Stormwater Association Educational Foundation (FSAEF) October 2021

- Working group of FSAEF Board, DEP, WMDs, and FSA members
- Reviewed existing tools
- Performed a literature review
- Developed BMP components and expected service life
- Built the spreadsheet tool
- Developed documentation



### **Acknowledgements**

#### **FSAEF Board Members**

Brett Cunningham, Chair (Jones Edmunds) Tim Kelly (Wood Environmental & Infrastructure Solutions) Amy Eason (AECOM) Melissa Long (City of Jacksonville) Kimberley Tracy (City of Maitland)

#### **FDEP Member**

Jared Searcy

#### **NWFWMD Member**

Linda Chaisson

#### SJRWMD Member

Cammie Dewey

#### SFWMD Member

Jesse Markle

#### **SRWMD Members**

Pat Webster Leroy Marshall

#### **SWFWMD Member**

Nancy Norton

#### **FSA Members**

Lee Mullon (Drummond Carpenter) Mike Hardin (Geosyntec) Amy Goodden (Jones Edmunds) Jason Icerman (Jones Edmunds)



### **Life-Cycle Costing**



### **Tool Structure - Directions**

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- Why a spreadsheet?
- Directions READ FIRST
- Explains each component



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- Economic Evaluation Duration
- Discount Rate
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### **Tool Structure – Life-Cycle Cost Analysis**

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	onstruc Cost	Capital C	apital Cost, Range								1,320,000	\$	1,500,00
	Capital Cost Annualized over the Project Evaluation Duration						\$	50,802	\$	57,73			
								Expected Service Life (Years)	# Replacements Over Project Life	Rep	1 time blacement Cost	Re Co: Wor	placement st (Present th Assumed
		Replacen	ient Costs										
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		Annual C	osts				Unit	% of Initial	Present Worth	Pres	ent Worth	A	nnual cost
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- Enter data in blue cells
- Duration
- Construction Cost
- Replacement Costs
  - Lookup tables
- O&M Costs



#### **Economic Evaluation Duration**

- Sometimes is prescribed
- Longer is generally better
- Should capture major replacement cycles





### **Tool Structure – System Database**

3	Stormwater Management								
4		Equipment or Element	Expected service life	Typical Annual Maintenance % of System Cost	Estimated Range of Annual Maintenance % of System Cost				
5	0								
6	1	Pump Station, Continuous	10	2.5%	2-4%				
7	2	Pump Station, Intermittent	20	0.5%	0.5-3%				
8	3	Electrical Service	20	1.0%	0.5-2%				
9	4	Piping, Force Main	30	30 1.0%					
10	5	Piping, Gravity Flow <sup>1</sup>	60	1.0%	0.2-1.25%				
11	6	Wet Storage <sup>2</sup>	1000	0.1%	0.005-0.25%				
12	7	Dry Storage	40	1.5%	1-6%				
13	8	Overflow Gate Structure	20 2.0%		0.8-2%				
14	9	Outlet Structure, Fixed	60 0.3%		0.03-0.4%				
15	10	Outlet Structure, Adjustable	20	2.0%	0.5-2%				
16	11	Baffle Box/ Gross Pollutant Separators	50	6.0%	5-10%				
17	12	Underdrain	20	6.0%	4-15%				
18	13	Biosorption Activated Media (BAM) <sup>3</sup>		6.5%	1-7%				
19	14	Wetland, Small	30	4.0%	1-10%				
20	15	Wetland, Large Stormwater Treatment Area (STA)	60	4.0%	0.4-5%				
21	16	Lined (hardened) Canal	1000	3.0%	0.5-3%				
22	17	Unlined Canal	1000	4.0%	2-5%				
23	18	Underground Storage	20	4.0%	2-6%				
	▲ → … Background Information Life Cycle Cost Analysis Water Quality System Database								

- By component not overall BMP
- Expected service life
- Typical O&M
- O&M range
- Considerations
  - Economies of scale
  - Level of service
  - Visibility
  - Consequence of failure



#### **Tool Structure – Other Costs**

	Stormwater Management-Other Mainte	enance Co	osts	
	Feature	Expected service life	Ma	Annual intenance \$/unit
100				
101	Canal Maintenance, \$/mile	10	\$	24,000
110	STA Maintenance, \$/acre	60	\$	550
120	AquaFiber	20	\$	800,000
130	Miscellaneous Slope and Berm Repair		\$	150
140	Mowing/Vegetation Control/Litter Removal		\$	1,850
150	Clean/Repair Drainage Structures		\$	30

- Some costs are more difficult as a percentage
- Adjust to dollars of current year



### **Tool Structure – Unit Cost Summary**

4

(+)

4	В	С	D	E	F						
1	Uni	t Cost Su	mmary								
2		Example	XYZ								
3	Estimated Present Worth Nutrient Removal Unit Costs										
4	For Life Cycle Of: 60 Years										
		TOTAL N	TOTAL P	TSS	PARAMETER-						
5					USER CHOICE						
6		FOR	60	YEAR	DURATION						
7	ESTIMATED POLLUTANT REMOVAL (LBS/YR)	500	100	200000	25						
8	ESTIMATED POLLUTANT REMOVAL (LBS FOR LIFE CYCLE DURATION)	30000	6000	12000000	1500						
11	ESTIMATED COST PER POUND OF POLLUTANT REMOVED (LOW END OF RANGE) (\$/LB)	\$78	\$388	\$0.19	\$1,553						
12	ESTIMATED COST PER POUND OF POLLUTANT REMOVED (HIGH END OF RANGE)(\$/LB)	\$88	\$438	\$0.22	\$1,753						

13 © Florida Stormwater Association Educational Foundation 2021

Enter your project's estimated annual pollutant load removal estimates. The total life cycle removal and associated unit costs will be automatically

[The above table will print on one page for your use]

14

15 16 17

18

- \$/lb-removed
- \$/lb/yr not shown but could be computed





DRAFT	
INDIAN RIVER LAGOON STORMWATER CAPTURE AND TREATMENT PROJECT DEVELOPMENT AND FEASIBILITY STUDY UPDATE	
St. Johns River Water Management District   April 2024	

- Acknowledgements
  - SJRWMD
  - Suzi Kaufman



### Example #1



- Flow rediverted from the IRL to the St. Johns River and treated
- Treat what cannot be rediverted





- Wet detention treatment
- Polishing with BAM
- Flow pumped from the C-1 Canal



- No wet detention treatment
- Large BAM treatment
- Flow pumped from the C-1 Canal



1	1 Water Quality Project Life Cycle Cost Analysis											
2	© Florida	Stormwat	er Association Educational Foundation 2021									
з	ative											
4	Altern	Alternat	ive 1									
5	Duration	Econom	ic Evaluation Duration				60		years			
6	on Cost	Initial C	nitial Capital Cost Estimated Cost Low <sup>1</sup> High <sup>2</sup>									
7 8	structic	Capital	Cost, Range		\$ 13,410,000	\$	16,390,000					
10	3	Capital	Cost Annualized over the Project Evaluat	tion Durati	on		\$ 516,103	\$	630,792			
11 12					Expected Service Life	# Replacements Over Project	1 time Replacement Cost	Re Co	eplacement ost (Present Worth			
13		Replace	ment Costs									
14	2	1	Pump Station, Continuous		10	5.0	\$ 425,000	\$	2,125,000			
15	ð	13	Biosorption Activated Media (BAM)3		20	2.0	\$ 1,600,000	\$	3,200,000			
16	ett	6	Wet Storage2		1000	0.1	\$ -	\$	-			
17	E E	9	Outlet Structure, Fixed		60	0.0	\$ 12,500	\$	-			
18	ġ		#N/A		#N/A	#N/A		\$	-			
19	Re		#N/A		#N/A	#N/A		\$	-			
20			#N/A		#N/A	#N/A		\$	-			
21			#N/A		#N/A	#N/A		\$	-			
22			#N/A		#N/A	#N/A		\$	-			
23			#N/A		#N/A	#N/A		\$	-			
24									F 995 999			
25		TOTAL PRESENT WORTH OF REPLACEMENT COST \$ 5,325,000										
26		керіасе	ment costs Annualized over the Project	LITE		1		8 2	204,940			

- Major components
- Capital vs. replacement



27		Annual (	Costs	Unit	% of Initial	Present Worth Factor	Present Worth	Annual cost
28		Mainten Replace same or	ance Cost of Items Listed in ment Cost Section. NOTE!: Must be in der as Replacement Costs above as inste link to Replacement Cost Entries			25 9832		
29		1	Pump Station Continuous	1	2 50%		\$ 276 071	\$ 10.625
30		13	Biosorption Activated Media (BAM)3	1	6 50%		\$ 2,702,253	\$ 104,000
31		6	Wet Storage2	1	0.10%		\$ -	\$ -
32		9	Outlet Structure. Fixed	1	0.25%		\$ 812	\$ 31
33		-	#N/A	1	0.00%		\$ -	\$ -
34			#N/A	0	0.00%		s -	ş -
35	ы		#N/A	0	0.00%		\$ -	\$ -
36	ŝ		#N/A	0	0.00%		\$ -	\$ -
37	lan -		#N/A	0	0.00%		\$ -	\$ -
38	un l		#N/A		0.00%		\$ -	\$ -
39	1	Other Ma	aintenance Costs, \$/unit	Unit	\$/ unit	Present Worth Factor	Present Worth	Annual cost
40		110	STA Maintenance, \$/acre	10	\$ 550		\$ 142,908	\$ 5,500
41			0	0	\$ -		\$ -	\$ -
42			0	0	\$ -		\$-	\$-
43			0	0	\$ -		\$-	\$-
44			0	0	\$-		\$-	\$-
45			0	0	\$-		\$-	\$-
46			0	0	\$ -		\$-	\$ -
47		Electrica	I Energy		25000	kwh	\$ 74,702	\$ 2,875
48		TOTAL PR	ESENT WORTH OF ANNUAL COST				\$ 3,196,745	
49		TOTAL OF	ANNUAL COSTS					\$ 123,031
50			ESTIMATED REPLACEMENT + O&M	c	327 070	то	د د	372 050
51			ANNUALIZED COST RANGE	2	527,970	10	\$	372,550
52 53	ğ		TOTAL ANNUALIZED COST RANGE	\$	840,000	то	\$	1,000,000
54 55	ğ	тс	TAL PRESENT WORTH COST RANGE <sup>3</sup>	\$	21,930,000	то	\$	26,080,000

- O&M costs
- Capital vs. other



1		Water Quality Project Life Cycle Cost Analysis										
2	© Florida	Stormwat	ter Association Educational Foundation 2021									
з	ative											
4	Alterr	Alternat	tive 2									
5	Duration	Econom	ic Evaluation Duration					60		years		
6	on Cost	Initial C	itial Capital Cost Estimated Cost Low <sup>1</sup> High <sup>2</sup>									
7 8	structi	Capital	Cost, Range				\$	27,810,000	\$	33,990,000		
10	ē	Capital	Cost Annualized over the Project Evaluat	tion Durati	on		\$	1,070,307	\$	1,308,153		
11 12					Expected Service Life	# Replacements Over Project	Rep	1 time placement Cost	Re Co:	placement st (Present Worth		
13		Replace	ment Costs									
14	sts	2	Pump Station, Intermittent		20	2.0	\$	400,000	\$	800,000		
15	ð	4	Piping, Force Main		50	1.0	\$	600,000	\$	600,000		
16	le M	13	Biosorption Activated Media (BAM)3		20	2.0	\$	16,125,000	\$	32,250,000		
17	сел	9	Outlet Structure, Fixed		60	0.0	\$	12,500	\$	-		
18	elq :		#N/A		#N/A	#N/A	\$	1,000	\$	-		
19	ĕ		#N/A		#N/A	#N/A	\$	1,000	\$	-		
20			#N/A		#N/A	#N/A	\$	1,000	\$	-		
21			#N/A		#N/A	#N/A	\$	1,000	\$	-		
22			#N/A		#N/A	#N/A	\$	1,000	\$	-		
23			#N/A		#N/A	#N/A	\$	1,000	\$	-		
25			RESENT WORTH OF REPLACEMENT COST						s	33 650 000		
26		Replace	ment Costs Annualized over the Project	Life					s	1,295,068		
			source source and the moject				11111		¥	2,200,000		

#### Same components, different quantities



27		Annual C	Costs	Unit	% of Initial	Present Worth Factor	Present Worth	Annual cost
28		Mainten Replacer same ord	ance Cost of Items Listed in ment Cost Section. NOTE!: Must be in der as Replacement Costs above as losts link to Replacement Cost Entries			25.9832		
29		2	Pump Station, Intermittent	1	2.50%		\$ 259,832	\$ 10,000
30		4	Piping, Force Main	1	1.00%		\$ 155,899	\$ 6,000
31		13	Biosorption Activated Media (BAM)3	1	6.50%		\$ 27,233,641	\$ 1,048,125
32		9	Outlet Structure, Fixed	1	0.25%		\$ 812	\$ 31
33			#N/A	1	0.00%		\$-	\$ -
34			#N/A	0	0.00%		\$ -	\$ -
35	2		#N/A	0	0.00%		\$-	\$ -
36	క		#N/A	0	0.00%		\$-	\$-
37	8		#N/A	0	0.00%		\$-	\$-
38	And		#N/A		0.00%		\$-	\$-
39		Other Ma	aintenance Costs, \$/unit	Unit	\$/ unit	Present Worth Factor	Present Worth	Annual cost
40			0	0	\$ -		\$-	\$ -
41			0	0	\$ -		\$-	\$ -
42			0	0	\$ -		\$-	\$-
43			0	0	\$-		\$-	\$-
44			0	0	\$-		\$-	\$-
45			0	0	\$ -		\$-	\$-
46			0	0	\$ -		\$-	\$-
47		Electrica	I Energy		25000	kwh	\$ 74,702	\$ 2,875
48		TOTAL PR	ESENT WORTH OF ANNUAL COST				\$ 27,724,886	
49		TOTAL OF	ANNUAL COSTS					\$ 1,067,031
50 51			ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	\$	2,362,100	то	s	3,125,220
52 53	ğ		TOTAL ANNUALIZED COST RANGE	\$	3,430,000	то	\$	4,430,000
54 55	ğ	то	TAL PRESENT WORTH COST RANGE <sup>3</sup>	s	89,180,000	то	\$	115,190,000

#### Higher capital and other costs



### **Example #1 – Alternatives Comparison**

Description	Alternative 1	Alternative 2	
Capital Cost	\$13.4M - \$16.4M	\$27.8M - \$34.0M	
Annualized Cost	\$0.8M - \$1M	\$2.4M - \$3.1M	
Average Annual TN Reduction	13,000 lb	27,000 lb	
Capital/TN Reduction	\$1,150/lb/yr	\$2,380/lb/yr	
Annualized/TN Reduction	\$69/lb	\$211/lb	







Pump and treat





- Wet detention
- BAM polishing





BAM treatment only



1		Water Quality Project Life Cycle Cost Analysis							
2	© Florida	Stormwater Association Educational Foundation 2021							
3	Alternative	Alternative 1							
5	Duration	Economic Evaluation Duration 60 years							
6	on Cost	Initial C	apital Cost				Estimated Co Low <sup>1</sup>	st Est	imated Cost High <sup>2</sup>
7 8	structio	Capital	Cost, Range				\$ 3,240,00	0\$	3,960,000
10	ē	Capital	Cost Annualized over the Project Evaluat	tion Durati	on		\$ 124,69	6 \$	152,406
11 12 13		Replace	ment Costs		Expected Service Life	# Replacements Over Project	1 time Replacemen Cost	t Co	eplacement ist (Present Worth
14	2	1	Pump Station, Continuous		10	5.0	\$ 250,00	0 \$	1,250,000
15	ð	13	Biosorption Activated Media (BAM)3		20	2.0	\$ 800,00	0\$	1,600,000
16	lem	6	Wet Storage2		1000	0.1	\$-	\$	-
17	сеп	9	Outlet Structure, Fixed		60	0.0	\$ 12,50	0\$	-
18	alq :		#N/A		#N/A	#N/A		\$	-
19	¥.		#N/A		#N/A	#N/A		\$	-
20			#N/A		#N/A	#N/A		\$	-
21			#N/A		#N/A	#N/A		\$	-
22			#N/A		#N/A	#N/A		> c	-
23			#N/A		#N/A	#N/A		>	-
25		TOTAL PI	RESENT WORTH OF REPLACEMENT COST					\$	2,850,000
26		Replacement Costs Annualized over the Project Life \$ 109,686							

 Pump station and BAM are the biggest replacement cost items



27		Annual (	Costs	Unit	% of	Present Worth	Present Worth	Annual cost
		Mainten Replace	ance Cost of Items Listed in ment Cost Section. NOTE!: Must be in			1 82101		
28		same or	der as Replacement Costs above as			25 9832		
29		Annuar C	Pump Station Continuous	1	2.50%		\$ 162,395	\$ 6,250
30		13	Biosorption Activated Media (BAM)3	1	6.50%		\$ 1.351.126	\$ 52.000
31		6	Wet Storage2	1	0.10%		s -	\$ -
32		9	Outlet Structure, Fixed	1	0.25%		\$ 812	\$ 31
33			#N/A	1	0.00%		\$ -	\$ -
34			#N/A	0	0.00%		\$-	\$-
35	2		#N/A	0	0.00%		\$-	\$ -
36	ð		#N/A	0	0.00%		\$-	\$-
37	la l		#N/A	0	0.00%		\$-	\$-
38	Ann		#N/A		0.00%		\$-	\$-
39		Other Maintenance Costs, \$/unit		Unit	\$/ unit	Present Worth Factor	Present Worth	Annual cost
40		110	STA Maintenance, \$/acre	5	\$ 550		\$ 71,454	\$ 2,750
41			0	0	s -		\$-	\$-
42			0	0	\$ -		\$-	\$-
43			0	0	\$ -		\$-	\$ -
44			0	0	\$ -		\$-	\$ -
45			0	0	\$ -		\$-	\$ -
46			0	0	\$ -		\$-	\$ -
47		Electrica	I Energy		25000	kwh	\$ 74,702	\$ 2,875
48		TOTAL PR	ESENT WORTH OF ANNUAL COST				\$ 1,660,489	
49		TOTAL OF ANNUAL COSTS						\$ 63,906
50 51		I	ESTIMATED REPLACEMENT + 0&M ANNUALIZED COST RANGE	\$	173,590	то	\$	199,350
52 53	ğ		TOTAL ANNUALIZED COST RANGE	\$	300,000	то	\$	350,000
54 55	g	то	TAL PRESENT WORTH COST RANGE <sup>3</sup>	\$	7,750,000	то	\$	9,140,000

 Pumping and BAM are also higher maintenance costs



1		Water Quality Project Life Cycle Cost Analysis							
2	© Florida	Stormwater Association Educational Foundation 2021							
з	native								
4	Alter	Alternative 2							
5	Duration	Economic Evaluation Duration 60 years							
6	n Cost	Initial C	apital Cost				Estimated Cost Low <sup>1</sup>	Estimated Cost High <sup>2</sup>	
7 8	Istructio	Capital (	Cost, Range				\$ 6,840,000	\$ 8,360,000	
10	ā	Capital	Cost Annualized over the Project Evaluat	ion Durati	on		\$ 263,247	\$ 321,746	
11 12		Boolocomont Costs			Expected Service Life	# Replacements Over Project	1 time Replacement Cost	Replacement Cost (Present Worth	
13									
14	sts	2	Pump Station, Intermittent		20	2.0	\$ 212,500	\$ 425,000	
15	8	6	Wet Storage2		1000	0.1	\$-	\$-	
16	le m	13	Biosorption Activated Media (BAM)3		20	2.0	\$ 3,225,000	\$ 6,450,000	
17	cen	9	Outlet Structure, Fixed		60	0.0	\$ 12,500	\$-	
18	pla		#N/A		#N/A	#N/A		\$-	
19	Re		#N/A		#N/A	#N/A		\$-	
20			#N/A		#N/A	#N/A		\$-	
21			#N/A		#N/A	#N/A		\$ -	
22			#N/A		#N/A	#N/A		\$ -	
23			#N/A		#N/A	#N/A		\$-	
24 25		TOTAL P	RESENT WORTH OF REPLACEMENT COST					\$ 6,875,000	
26		Replace	Replacement Costs Annualized over the Project Life \$ 264,594						

Greater amount of BAM



27		Annual Costs		Unit	% of Initial	Present Worth Factor	Present Worth	Annual cost
		Mainten Replace	ance Cost of Items Listed in ment Cost Section. NOTE!: Must be in					
		same order as Replacement Costs above as						
28		Annual (	Costs link to Replacement Cost Entries			25.9832		
29		2	Pump Station, Intermittent	1	2.50%		\$ 138,036	\$ 5,313
30		6	Wet Storage2	1	0.10%		ş -	ş -
31		13	Biosorption Activated Media (BAM)3	1	6.50%		\$ 5,446,728	\$ 209,625
32		9	Outlet Structure, Fixed	1	0.25%		\$ 812	\$ 31
33			#N/A	1	0.00%		\$-	\$ -
34			#N/A	0	0.00%		\$-	\$-
35	<b>ş</b>		#N/A	0	0.00%		\$ -	\$-
36	ð		#N/A	0	0.00%		\$-	\$-
37	5		#N/A	0	0.00%		\$-	\$ -
38	<b>un</b>		#N/A		0.00%		\$ -	\$ -
39		Other Maintenance Costs, \$/unit		Unit	\$/ unit	Present Worth Factor	Present Worth	Annual cost
40			0	0	\$ -		\$-	\$-
41			0	0	\$ -		\$-	\$ -
42			0	0	\$ -		\$-	\$-
43			0	0	ş -		\$-	\$ -
44			0	0	ş -		s -	s -
45			0	0	ş -		s -	\$ -
46			0	0	<b>\$</b> -		\$ -	\$ -
47		Electrica	I Energy		25000	kwh	\$ 74,702	\$ 2,875
48		TOTAL PR	RESENT WORTH OF ANNUAL COST	1			\$ 5,660,278	
49		TOTAL OF ANNUAL COSTS						\$ 217.844
50			ESTIMATED REPLACEMENT + O&M					•
51			ANNUALIZED COST RANGE	\$	482,440	то	\$	635,070
52								
53	2	TOTAL ANNUALIZED COST RANGE		\$	750,000	то	\$	960,000
54 55	ß	то	DTAL PRESENT WORTH COST RANGE <sup>3</sup>	s	19,380,000	то	\$	24,860,000

#### Increased O&M



### **Example #2 – Alternatives Comparison**

Description	Alternative 1	Alternative 2
Capital Cost	\$3.2M - \$4.0M	\$6.8M - \$8.4M
Annualized Cost	\$0.3M - \$0.35M	\$0.8M - \$1.0M
Average Annual TN Reduction	5,000 lb	8,000 lb
Capital/TN Reduction	\$716/lb/yr	\$950/lb/yr
Annualized/TN Reduction	\$65/lb	\$106/lb



#### Example #3



- Treats 21,000 acres
- Runoff and baseflow
- Alternatives to enhance treatment





- Baffles in pond
- Increased flow path and sedimentation





- Additional gabion baffles
- Increased flow path sedimentation
- Biological uptake





- Pump to BAM treatment
- Interevent removal



### **Example #3 – Alternatives Comparison**

Description	Alternative 1	Alternative 2	Alternative 3
Capital Cost	\$2.3M - \$2.9M	\$7.1M - \$8.7M	\$12.8M - \$15.6M
Annualized Cost	\$0.1M - \$0.12M	\$0.29M - \$0.37M	\$1.4M - \$1.9M
Average Annual TN Reduction	13,000 lb	40,000 lb	20,000 lb
Capital/TN Reduction	\$200/lb/yr	\$198/lb/yr	\$710/lb/yr
Annualized/TN Reduction	\$8/lb	\$8/lb	\$82/lb



#### **Summary**



#### LIFE-CYCLE COSTING TOOL SUMMARY REPORT

Florida Stormwater Association Educational Foundation (FSAEF) October 2021

- Life-cycle costing is the fairest, most thorough means of comparing projects
- FSA's Life-Cycle Costing Tool is a convenient, easy-to-use tool
- It is based on available research and input from the FSA membership
- Input and suggestions are always welcome

