



ChesBay ALERT

AMEC Load Estimation and Reduction Tracking

Metropolitan Washington Council of Governments October 4, 2012







- 1. Build a GIS-based system to plan and track BMPs for the Chesapeake Bay TMDL.
- 2. Help MS4-permitted communities estimate the total cost of compliance.
- 3. Design for maximum flexibility.

ALERT Summary



GIS Component

- Establish regulated MS4 landuse.
- Calculate baseline loads.
- Capture expected redevelopment and Post-2009 BMPs.
- Identify and draw in "real" retrofit projects though a desktop exercise.
- Assign project timing and efficiencies.
- Calculate reductions.

Spreadsheet Component

- Establishes the "gap" between projects captured in GIS and the target loads to meet permit requirements.
- Allows the user to input BMP mixes to meet the remaining compliance gap.
- Automatically calculates initial capital and life cycle costs for BMPs based on user inputs.

ALERT Process Diagram





ALERT GIS Process





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Landuse Data	Calculate Baseline Load	Define BMPs	Calculate Reduced Load			

Baseline Conditions



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A Company	<u>File Edit Format View H</u> elp AMEC Water Quality Tools Baseline Conditions Report	
A CO	DESCRIPTION City of Alexandria; Nitrogen baseline. INPUTS Landuse Feature C:\temp\Alexandria \AlexMS4_LU_LRsegs_010312.shp Loading Rate Field N	
	Landuse Field IMP Cellsize 100 OUTPUTS Grid C:\temp\Alexandria\Baseline\nbase Report C:\temp\Alexandria\Baseline\nbase.txt	
CAR SHE	RESULTS Baseline Load (lbs) 64096.9469768 Area (ac) 7530.20977527 Execution Time (s) 72.4219999313 DETAILED RESULTS (tab-separated)	
	Landuse Load (lbs) Area (ac) Impervious_DC 2430.68180556 241.139068012 Impervious_VA 31968.1647007 3245.49895438 Pervious_DC 2444.16813022 274.00988007 Pervious_VA 27253.9323404 3769.5618728	
Landuse Data	Define BMPs	

Defining BMPs in ALERT

- After baseline and target loads for N, P, and S are determined, BMPs can be defined.
- Default BMP types are stored in a table populated by the user.
- To define a BMP, simply draw the treatment area and select a type.
- All BMP data is stored in an ESRI file geodatabase (.gdb)

Define BMPs

Calculate

Reduced

Load

Calculate

Baseline

Load

Landuse Data





	Attributes of al	ex_bmps			X
Г	FacilityID	Туре	N	Р	S
	wp1	Wet Ponds and Wetlands	<null></null>	<null></null>	<nul></nul>
	wp2	Wet Ponds and Wetlands	<null></null>	<null></null>	<null></null>
E	wp4	Wet Ponds and Wetlands	<null></null>	<null></null>	<null></null>
	pr1	<null></null>	<null></null>	<null></null>	<null></null>
	phase1	Wet Ponds and Wetlands	<null></null>	<null></null>	<null></null>
	phase2	Dry Extended Detention	<null></null>	<null></null>	<null></null>
	phase3	Infiltration Practices w/o Sand, Vegetation	<null></null>	<null></null>	<null></null>
	cityprop	Filtering Practices	<null></null>	<null></null>	<null></null>
	row3	Bioretention (C/D soils)	<null></null>	<null></null>	<null></null>
	row1	Vegetated Open Channels (C/D soils)	<null></null>	<null></null>	<null></null>
	row2	Vegetated Open Channels (A/B soils)	<null></null>	<null></null>	<null></null>
	row4	Bioswale	<null></null>	<null></null>	<null></null>
	wp5	Dry Detention Ponds and Hydrodynamic Structures	<null></null>	<null></null>	<null></null>
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Landuse Data	Calculate Baseline Load	Define BMPs	Calculate Reduced Load

Calculating BMP Reductions



Treatment area polygons and BMP efficiencies are used to calculate reductions.

Inputs

- Baseline conditions grid
- BMP treatment area polygons
- BMP types/efficiencies table

Outputs

Landuse Data

 Grid with reduced conditions (cell values in lbs/yr)

Report (.txt file)

S Calculate BMP Load Reduction	x
Baseline Conditions Grid	^
- PMD Designed Area Each area	<u> </u>
	2
Calculation Order (optional)	
RMD Subset (options)	<u>•</u>
	50
 FacilityTypes Table 	
	2
Type Field	-
Efficiency Field	_
	-
M Area-Weighted BMP Calculations	
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Output Grid	
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Calculate Reduced Load

Calculating BMP Reductions (continued)



Additional features:

- Set custom efficiencies for specific BMPs.
- Allow treatment trains OR use maximum efficiencies.
- Evaluate subsets of BMPs using a SQL statement.

S Calculate BMP Load Reduction				_ _ _ ×
Baseline Conditions Grid				^
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 BMP Drainage Area Features 				
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BMP Subset (optional)				
J FacilityTypes Table				SQL
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Area-Weighted BMP Calculations				
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Baseline Conditions







Reduced Conditions



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A Contraction	<u>File E</u> dit F <u>o</u> rmat <u>V</u> iew <u>H</u> elp AMEC Water Quality Tools BMP Load Reduction Report Tue Jan 17 14:58:14 2012	
1 A 18	DESCRIPTION City of Alexandria; Nitrogen, with planned BMPs	March 1
	INPUTS Baseline Cond. Grid \Chy-gis2\Chantilly\Staff\williams_T\Alexandria \Calculations\Baseline\nbase BMP Feature Class \Chy-gis2\Chantilly\Staff\williams_T\Alexandria \Calculations\Results_011712\AMECWQToolTemp5\sqlfacilities.shp Calculation Order Phase BMP Feature Class \Chy-gis2\Chantilly\Staff\williams_T\Alexandria \Calculation Order Phase BMP Subset FacilityTypes Table \Chy-gis2\Chantilly\Staff\williams_T\Alexandria \Calculations\BMPS\Alex_BMPs.gdb\CBPtypes Facility Type Field Type Facility Type Field Type Efficiency Field N Area-weighted BMPs true Overlap Calcs COMBINED	
1 Constant	OUTPUTS Grid \\Chy-gis2\Chantilly\Staff\Williams_T\Alexandria\Calculations \Results_011712\calc2_n Report \\Chy-gis2\Chantilly\Staff\Williams_T\Alexandria\Calculations \Results_011712\calc2_n.txt	
	RESULTS Baseline Load (lbs) 64096.9475849 Reduced Load (lbs) 61788.4637244 Reduction (lbs) 2308.4838605 Execution Time (s) = 732.776000023	
	DETAILED RESULTS (tab-separated)	
	FacilityIDReduction (lbs) Efficiency (%) Efficiency ValueArea (ac)TypeOverlapsPhasephase1174.9665968690.15Default 144.388566149Redevelopmentcityprop,phase2,phase3,pr1,row1,row2,row3,wp1,wp21wp1251.1054231420.2Default 155.877770298Wet Ponds andwetlandscityprop,phase1,phase2,phase31phase2416.8815529620.15Default 428.34417355Redevelopmentcityprop,phase1,phase3,pr1,row1,row2,row4,wp1,wp52	
Landuse Data Calculate Baseline Load	Define BMPs Calculate Reduced Load	





- Helps make high-level predictions about the level of effort needed to achieve compliance.
- Used to inform further planning exercises.
- Estimates the total treated acreage and cost to comply.



Inputs

- Baseline loads (lbs/yr)
- Reductions from planned projects (lbs/yr)
- Total regulated land area (acres)
- Impervious fraction (%)
- Total required reductions (lbs/yr)
- Other user-defined information
 - BMP mix
 - BMP unit costs (\$ per impervious acre treated)
- Outputs
 - Total area of treatment required (acres)
 - Cost





Three main tabs represent the three phases of compliance.

- Phase I (5% compliance 2017)
- Phase II (40% compliance 2023)
- Phase III (100% compliance 2028)
- Results from each phase feed into the next.
- "Match Target" button uses the Goal Seek function to "meet" targets.
 - Total acreage of treatment is automatically adjusted until the target is achieved.
- Many factors can be adjusted to fit the needs of a community.
 - BMP mix
 - BMP unit costs

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	Load Data				127,900 -					5 740 000						
2	Load Data	Nitrogen	Phosphorus	Sediment	127 800		8 940			5,740,000			\$4,000,000 -			
3 Base	eline loads (lb/yr)	127,860	8,940	5,740,080	127,800 -		0,510		-	5,730,000 -			\$3,500,000 -			
4 and P	Planned Phase 1 Projects	0	0	0	127,700 -					5.720.000 -						
5 Total	l area (ac)	10,000			127,600 -		8,920	-	-	,			\$3,000,000 -	Budget		
6 Imper	rvious area (% of total area)	40.0%			127,500 -	Phase Base	e 1 line		Phase 1 Baseline	5,710,000 -	Ph Ra	iase 1 Iseline	\$2,500.000 -			
8 Input	its from User	Nitrogen	Phosphorus	Sediment	127.400 -	Targe	at 8,900	-	Target	5,700,000 -	Ta	rget		Initial		
Total	I load reductions required				127.200				-	5 690 000		-	\$2,000,000 -	Cost		
9 (lb/yr Reg'd	r) d Phase 1 (5%) reductions	9,282	1,163	1,082,015	127,300 -	Redu	ced 8 880		Reduced	5,050,000 -	Re	duced	\$1 500 000 -	■ Lifetime		
10 from	Baseline (lb/yr)	464	58	54,101	127,200 -	Load	0,000	1 Ber 1	Load	5,680,000 -	Lo	ad	\$1,500,000	Maint.		
11 Budge	get	\$0			127,100 -		-		-	5,670,000 -			\$1,000,000 -	Cost		_
12					127,000 -		8,860		-				\$500.000			
			Match Terr		125 900					5,660,000 -			\$500,000 -			
Selec	ect Calculation Factor	Sediment	Match Targ	get	120,500	Nitrogen	8,840			5,650,000 +			\$0 —	L,		
16						(Ib/yr)	Pho	osphorus (Ib/y	r)	Sedir	ment(lb/yr)		Co	ost		=
17		C		Dana da da com	A											
19 7 Bioret	etention	_ ⊂us	tom +	13%	Area (ac) 20	BM	P Mix (% of	Target Are	a)	_	BMP M	lix (Initi	ial Costs)			
20 7 Filtrat	tion	- <u>-</u>	•	13%	20											
21 New 22 Pond	Ponds and Wetlands	E		23%	37					_						
23							13%						Biore	tention		
24 Othe	er Treatment Ontions	llnits	Cost Over Phase 1					Bio	pretention		\$008,159					
25 Strea	am Restoration (linear ft)	Units	Thuse T					.3%	tration	\$361	145		Filtra	tion		
26 Collect	et Sweeping (Ibs/yr debris octed)					52%						\$1,975,9	93 New	Ponds and		
27								■ Ne	w Ponds and		50 515		Wetl	ands		
28 Resu	ulite se 1 target loade (lb/ur)	Nitrogen	Phosphorus	Sediment			239	6 PO	nd Retrofits		55,010		Pond	Retrofits		
Load	d reductions from Planned	127,390	0,002	3,003,919						H						
30 BMPs	s (lb/yr)	0	0	0						_						
31 reduc	ctions (lb/yr)	464	58	54,101												
Projec	ected load reductions from	504	05	54 404												
33 Redu	uced loads (lb/yr)	127,276	8,875	5,685,979												
34 Targe	get area (ac)	161	2%	of total land ar	ea.											
35 Initia Aver	al Cost rage Annual Maintenance	\$3,964,912														
36 Cost	t	\$90,085														
37 Lifeti 38 Lifeti	time (yrs) time Maintenance Cost	20 \$1 801 697														
39 Total	al Cost over Phase 1 (5 yrs)	\$4,415,337														
40 Total	al Cost through end of	SE 246 405														
41 Total	al Lifetime Costs	\$5,766,609														
42	12 Requirements Dba	se 1 Dhace	2 / Phase 3	* / ·					1 4							► Π
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Phase I BMPs	%
Bioretention	10%
Filtration	10%
New Ponds	30%
Pond Retrofits	50%

Calculation Factor	Phosphorus
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Phase 1	Results
Target Area	145 ac.
Initial Cost	\$3.5 m
Ann. Maint.	\$81,000



Phosphorus and nitrogen targets are met, but sediment lags behind. Recalculate.



Phase I BMPs	s %			
Bioretention	10%	□ Phase 1	Phase 1	
Filtration	10%	_ Baseline ■Target	Baseline Target	_
New Ponds	30%	- ■Reduced	Reduced	_
Pond Retrofits	s 50%	Load	Load	_
Calculation Factor	Sediment			
Phase 1	Results			
Target Area	161 ac.	Nitrogen (Ib/yr)	Phosphorus (Ib/yr)	Sedim
Initial Cost	\$4.0 m	All Phase I tar	gets achieved.	
Ann. Maint.	\$90,000		0	



1. Use GIS.

Regardless of the tools used to plan and track BMPs, the ability to integrate a spatial aspect is important to verify that your plans are realistic.

2. Plan for Efficiency.

In a resource constrained environment, the ability to run and assess multiple retrofit scenarios to test for cost-efficiency will be important.

3. Build in Flexibility.

State and federal expectations continue to change. The platform should allow for changes in technical assumptions as well as changing community expectations and targets.





Questions?

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