Issues with the Bay Model and Draft WIP and a Cost-Effective Solution for the Bay

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TMDL Model Input Problem

Urban Surfaces will Increase Drastically

Urban impervious and pervious surfaces are currently being revised by EPA. These should be rectified before TMDL completion because loads from the Urban sector are directly related to the surface area.

Comparison of Urban Surfaces and Loads for the Phase 5.3 and Phase 5.3mod Models[1]

Model Version	Analysis Year	Surface Area (ac)	
		Impervious	Pervious
Phase 5.3 (current model input)	2002	675,917	1,885,935
Phase 5.3mod[2] (proposed model input)	2001	1,569,377	3,442,346
Increase		**893,460 (132%)**	**1,556,411 (83%)**

Note 1. EPA provided WSSI (via e-mail) a memo titled, "Phase 5.3 (modified) 'Developed' and 'Extractive' Land Use Datasets," dated 5/25/2010 which included the surface data provided hereon. Surfaces represent the entire Chesapeake Bay watershed.

Note 2. Excludes suburb and rural wooded areas.

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TMDL Model Input Effect on Budgets

Urban Retrofit Costs will Increase Drastically

EPA's backstops are based on retrofitting a percentage of impervious area. Therefore, doubling the impervious area will double the retrofit cost.

Comparison of Capital Cost to Retrofit Virginia's Urban Surfaces

<table>
<tr><td rowspan="2">Model Version</td><td colspan="3">VA Impervious Surface Area (ac)</td><td colspan="2">Retrofit Capital Cost[1]</td></tr>
<tr><td>High-Density</td><td>Low-Density</td><td>Total</td><td>($/ac)</td><td>($)</td></tr>
<tr><td>Phase 5.3</td><td>150,340</td><td>116,098</td><td>266,438</td><td rowspan="2">102,520</td><td>$10.7B</td></tr>
<tr><td>Phase 5.3mod[2]</td><td>335,260</td><td>258,900</td><td>594,160</td><td>$23.8B</td></tr>
<tr><td>Increase</td><td>184,920</td><td>142,802</td><td>327,722</td><td>--</td><td>$13.1B</td></tr>
</table>

Note 1. Total cost = (Unit cost * 50% of high density impervious) + (unit cost x 25% of low density impervious). This is based on the EPA Backstop retrofit requirement, which states, "EPA assumes that the applicable MS4 performance standard applies to 50 percent of urban lands…" and "25 percent of unregulated stormwater… is assumed to meet the performance standard for nutrient and sediment reductions." For this analysis, MS4 areas are assumed to equate to high-density impervious surfaces from the Chesapeake Bay Model, while non-MS4 areas are assumed to equate to low-density impervious areas from the Chesapeake Bay Model.

Note 2. Phase 5.3mod estimate assumes that Virginia's impervious surface increases at the same rate as the Chesapeake Bay watershed as a whole (132%). Therefore, 150,340 ac * 2.23 = 335,260 ac.

TMDL Model Input Effect on Allocations

Urban Nutrient Allocations will Change Drastically

EPA has indicated that pervious loads will not change because they are based on fertilizer sales.

Loads from impervious surfaces, however, will change as the impervious surfaces increase.

If the load from impervious urban surfaces increases but the overall loads in the Chesapeake Bay do not change (since they are based on real-world monitoring data), the loads from other sectors will be reduced.

Numeric perspective: If urban surfaces increase by 327,722 acres:

- The TN load increases by 3,867,120 lb/yr (7.2% of Virginia's total allocation, 53,400,000 lb/yr)
- The TP load increases by 688,216 lb/yr (12.7% of Virginia's total allocation, 5,410,000 lb/yr)

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Determining Equity

Comparison of Costs Across Sectors

Order-of-Magnitude Cost Estimate for Various Nutrient Reduction Options

Sector	Nutrient Reduction Option	Removal Cost ($/lb-yr; 2010 Dollars)	
		TN	TP
Urban	Retrofit - CWP[1]	6,000	33,500
	Retrofit - EPA[2]	3,100	24,000
	New BMPs - CWP[3]	3,700 (1,500-8,700)	14,600 (6,500-32,700)
	Urban Fertilizer Management	19	0
Septic	Septic Field Upgrades[4]	720	N/A
Wastewater	WWTP Upgrades (Tier III to Tier IV)	250	2,700
Agriculture	Agricultural BMP: Enhanced Nutrient Management[5]	125	2,750

Note 1. Calculated from Center for Watershed Protection, Urban Subwatershed Restoration Manual Series, Manual 3, Urban Stormwater Retrofit Practices, Version 1.0, Appendix E, Table E.1, 2007. The average cost is listed as $88,000/impervious acre treated. Scaling up based on the ENR Construction Cost Index (20 city average): January 2006: 7660; October 2010: 8921; Resulting Index = 8921/6130 = 1.165; CC = $102,520. Assuming a 30 year life and a rate of 4%, present worth = $6,000 and $33,500.

Note 2. EPA, "The Next Generation of Tools and Actions to Restore Water Quality in the Chesapeake Bay," September, 2009. The cost/lb for TN and TP is reported as $3,088 and $23,984, respectively. Scaling up based on the Consumer Price Index (US City average): September 2009: 215.969; September 2010: 218.439; Resulting Index = 218.439/215.969 = 1.011; CC = $3,122/lb TN and $24,248/lb TP.

Note 3. Calculated from Center for Watershed Protection, Urban Subwatershed Restoration Manual Series, Manual 3, Urban Stormwater Retrofit Practices, Version 1.0, Appendix E, Table E.2, 2007. The median costs listed in the document (for constructed wetlands, extended detention, wet ponds, water quality swales, bioretention, and infiltration practices) were scaled up based on the ENR Construction Cost Index (20 city average): January 2006: 7660; October 2010: 8921; Resulting Index = 8921/6130 = 1.165; Present worth values were calculated assuming a 30 year life and a rate of 4%.

Note 4. Chesapeake Bay Program. "Nutrient Reduction Technology Cost Estimations for Point Sources in the Chesapeake Bay Watershed," November, 2002.

Note 5. Calculated from Chesapeake Bay Commission. Cost-Effective Strategies For the Bay: 6 Smart Investments for Nutrient and Sediment Reduction, December, 2004. The cost/lb for TN and TP is reported as $4.41 and $95.79, respectively. Scaling up based on the Consumer Price Index (US City average): December 2004: 190.3; September 2010: 218.439; Resulting Index = 218.439/190.3 = 1.148; CC = $5.06/lb of TN and $109.97/lb of TP. Assuming a capitalization rate of 4%, capitalized values are $126.50 and $2,749.25.

Determining Equity

Comparison of Costs for the Urban Population

Urban Sector Cost Comparison of Draft WIP, EPA Backstop, and Proposed WIP Modification

Plan	Cost by Sector (Billion $)				Cost/capita	
	WWTP	Urban	Septic	Total	Total	Yearly
Draft WIP (without trading)	0	45.2	0.5	45.7	$7,614	$507
EPA Backstop	2.9	12.5	0.5	15.9	$2,649	$177
Proposed WIP Modification	5.2	3.0	0.5	8.7	$1,449	$97
EPA Urban Retrofit Estimate	--	41.6	--	--	$6,930	$462

Note 1. Over 15 years

Note 2. Derived from US EPA, 2009. The Next Generation of Tools and Actions to Restore Water Quality in the Chesapeake Bay, A Draft Report Fulfilling Section 202a of Executive Order 13508. U.S. Environmental Protection Agency, Chesapeake Bay Program Office, Annapolis, MD. (Page 23.)

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A Fundamental Problem

The Cost of Focusing on Urban Retrofits

Potential Cost to Retrofit Impervious Areas in Fairfax and Arlington Counties

County	Impervious Area (ac)[1]	Retrofit[2]	Retrofit Area (ac)	Cost ($/ac)[3]	Total Cost	Yearly Cost[4]	2011 County SWM Budget[5]	2011 Overall County Budget[6]
Fairfax	44,474	50%	22,237	102,520	$2.3B	$152M	$28M	$1.2B
		100%	44,474		$4.6B	$304M		
Arlington	6,833	50%	3,417		$350M	$23M	$7M	$3.3B
		100%	6,833		$700M	$47M		

Note 1. 2008 GIS Vector Data was obtained digitally from Fairfax and Arlington Counties.

Note 2. 50% retrofit requirement based on EPA Backstop. 100% retrofit requirement based on VA draft WIP.

Note 3. Center for Watershed Protection, Urban Subwatershed Restoration Manual Series, Manual 3, Urban Stormwater Retrofit Practices, Version 1.0, Appendix E, Table E.1, 2007. The average cost is listed as $88,000/impervious acre treated. Scaling up based on the ENR Construction Cost Index (20 city average): January 2006: 7660; October 2010: 8921; Resulting Index = 8921/6130 = 1.165; CC = $102,520

Note 4. The yearly cost is assumed to be the total cost divided by 15 years (2010-2025).

Note 5. Fairfax County's 2011 stormwater services budget was obtained electronically on 11/17/2010 from http://www.fairfaxcounty.gov/dmb/fy2011/adopted/volume2/sr_125.pdf
Arlington County's 2011 stormwater management budget was obtained electronically on 11/16/2010 from http://www.arlingtonva.us/departments/ManagementAndFinance/budget/page77167.aspx

Note 6. Fairfax County's 2011 stormwater services budget was obtained electronically on 11/17/2010 from http://www.fairfaxcounty.gov/dmb/fy2011/fy2011-adopted-where-it-goes.htm#
Arlington County's 2011 budget was obtained electronically on 11/16/2010 from http://www.arlingtonva.us/departments/ManagementAndFinance/budget/file77000.pdf

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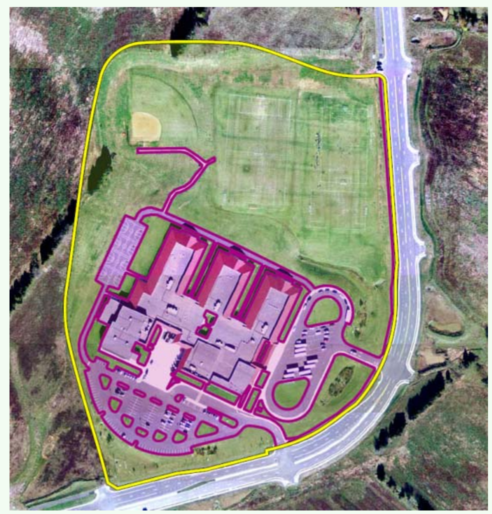
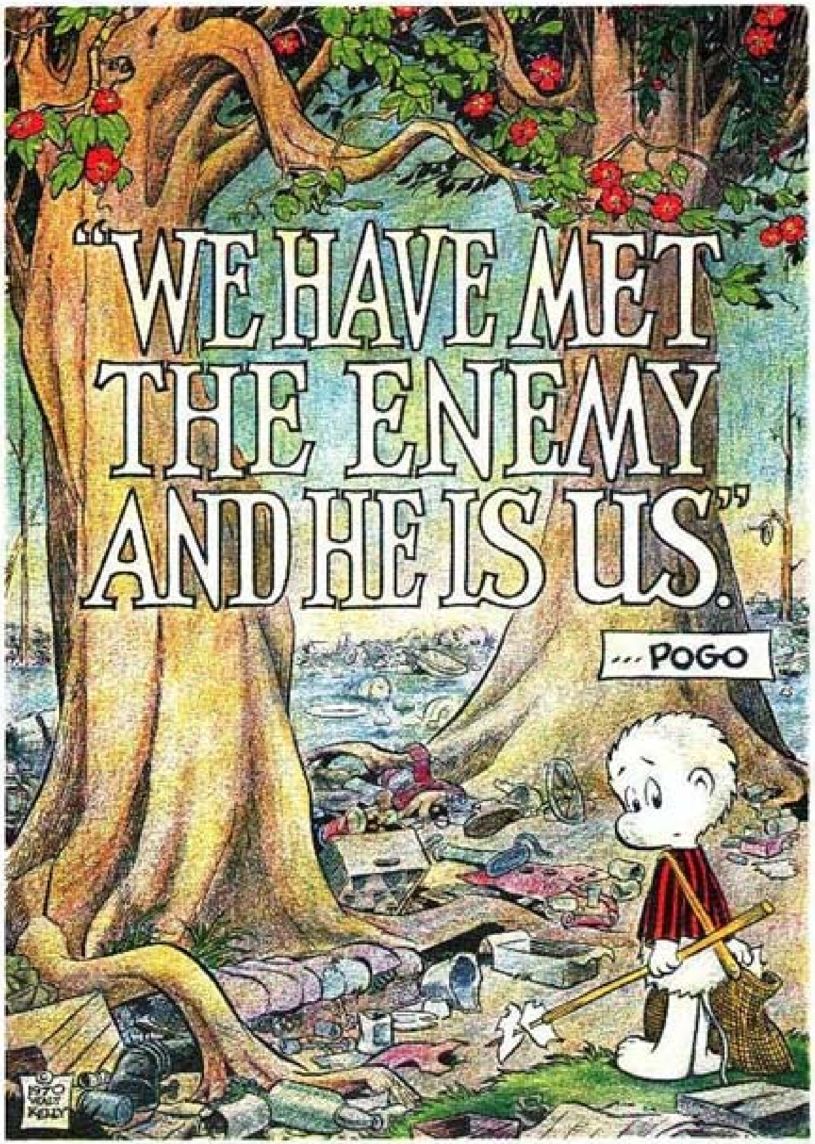
The Cost to Retrofit Our Schools

	Sycolin Creek Elementary School Leesburg, VA	Loudoun Valley Estates Middle School Ashburn, VA	Briar Woods High School Ashburn, VA
Site Impervious Surface Pervious Surface			
Acres of Impervious Area	9.1 acres	9.7 acres	19.8 acres
Cost to retrofit site[1]	$934,000	$994,000	$2,029,900

Note 1. Center for Watershed Protection, Urban Subwatershed Restoration Manual Series, Manual 3, Urban Stormwater Retrofit Practices, Version 1.0, Appendix E, Table E.1, 2007. The average cost is listed as $88,000/impervious acre treated. Scaling up based on the ENR Construction Cost Index (20 city average): January 2006: 7660; October 2010: 8921; Resulting Index = 8921/6130 = 1.165; CC = $102,520

Sector Warfare



Walt Kelly's poster for the first Earth Day

"*They* have already spent billions to upgrade WWTP plants."

"*They* have already done more than their fair share of (WWTP) load reductions since 1985."

However:

They are not the WWTP owners. *They* are *us*: the rate-payers and tax-payers who will bear the financial burden of both urban retrofits and WWTP upgrades. *They* are home owners who pay both sewage fees and property taxes, as well as urban apartment-dwellers who will have property tax and/or stormwater utility increases passed through to their rental fees.

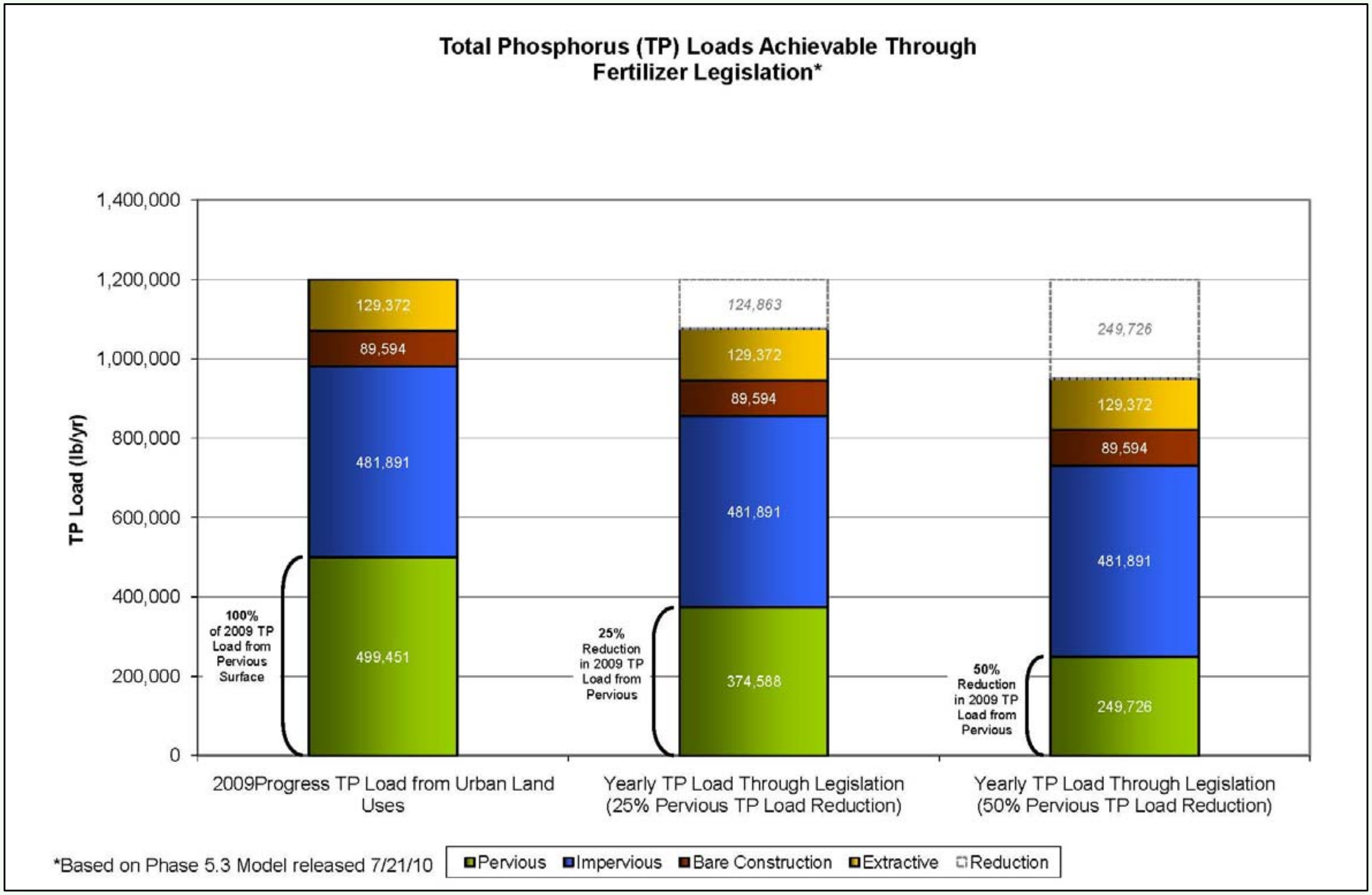
WWTP Average Concentrations

Flow Weighted Average for Concentrations (mg/L) used for Current WLAs for Significant Dischargers by Basin

Basin	**Flow-weighted Average Concentration (mg/l)**	
	TN	TP
Shenandoah-Potomac[1]	4.12	0.20
Rappahannock[1]	4.00	0.30
York[1]	3.08	0.50
James[1]	6.95	0.65
Eastern Shore[1]	4.93	0.30
***Total* Flow Weighted Average**	**5.55**	**0.48**
Potomac Embayment	**3.0**	**0.18**
EPA Backstop - WV, DE, NY, PA	**3.0**	**0.10**
EPA Backstop - VA	**4.0**	**0.30**

Note 1. Current concentrations were calculated from design flows and waste load allocations which were provided by Russ Baxter (DEQ- Chesapeake Bay Program) via e-mail on 9/21/2010.

Potential Effect of Fertilizer Legislation



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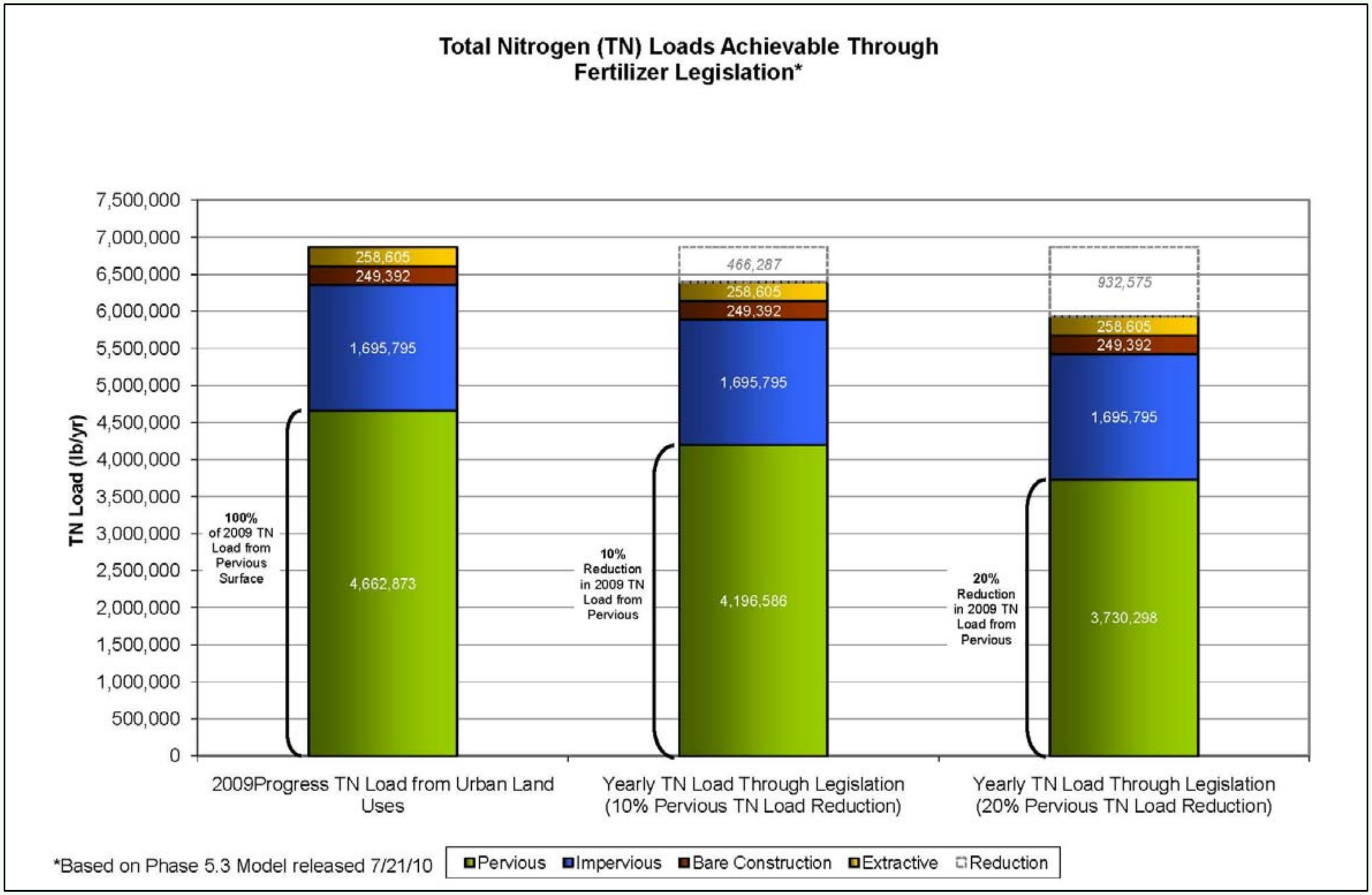
Potential Effect of Fertilizer Legislation



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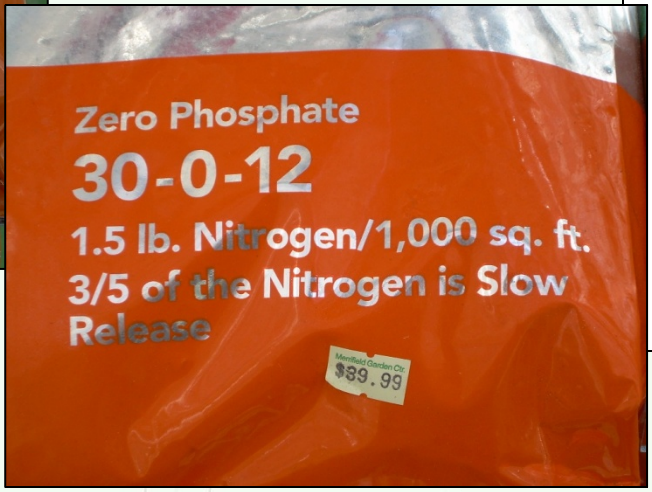
The Cost of Urban Nutrient Management

Recent product and price comparisons at garden centers and home improvement stores show that Phosphorus-Free and Slow-Release Nitrogen (SRN) fertilizer is available at no cost premium, and sometimes at a cost savings, over standard 10-10-10 (or similar) fertilizer.

(N - P - K)



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Proposed WIP Modifications

1. Upgrade all Significant Discharger Wastewater Treatment Plants
2. Establish Urban Fertilizer Regulations
3. Expand 5-year On-Site Septic Pump-Out Requirement
4. Improve Erosion and Sediment Control Training and Specifications
5. Establish a "Nutrient Trading Fund" for Non-BAT Septic Users and Development Offsets
6. Allow New Construction with On-Site Sewage Disposal to Exceed NSF/ANSI Standards or Contribute to the Nutrient Trading Fund
7. Allow Development Exceeding the Allowable WIP Loads to Contribute to the Nutrient Trading Fund

Proposed WIP Modification - TN

Total Nitrogen TMDL Allocation Comparison

Source Data	2009 [1]	WIP Sept. 2010 [2]	SAG [3]	**Proposed WIP**
Agriculture	21,840,226	16,391,000	16,577,610	17,985,000
Urban Runoff	6,868,018	3,915,000	6,107,925	6,108,000
Wastewater	20,028,080	20,394,000	19,471,849	12,082,000 [4]
On-Site	2,631,823	1,922,000	2,673,994	2,674,000
Forest	13,756,189	13,939,000	13,951,338	13,939,000
Non-Tidal Dep.	604,005	612,000	611,967	612,000
Total	65,728,341	57,173,000	**59,394,683**	**53,400,000**

Note 1. SAG Handout, 6/16/2010

Note 2. Public Review Draft of WIP, September 2010

Note 3. AG Handout, 8/24/2010

Note 4. Load Reduction achieved by reducing significant WTP effluent concentrations to: TN = 3 mg/L; TP = 0.10 mg/L (except UOSA due to sediment):
Wastewater (TN lb/yr) = WIP Sept 2010 - [Current WLA – Load Reduction]
= 20,394,000 - 8,312,412 = 12,081,588 TN lb/yr
Wastewater (TP lb/yr) = WIP Sept 2010 - [Current WLA – Load Reduction]
= 1,832,000 - 1,141,825 = 690,175 TP lb/yr

Proposed WIP Modification - TP

Total Phosphorus TMDL Allocations Comparison

Source Data	2009 [1]	WIP Sept. 2010 [2]	SAG [3]	**Proposed WIP**
Agriculture	3,065,034	2,146,000	2,200,340	2,533,000
Urban Runoff	1,200,194	380,000	1,038,535	1,039,000
Wastewater	1,728,923	1,832,000	1,828,174	690,000 [4]
On-Site	-	-	-	-
Forest	1,089,197	1,090,000	1,090,986	1,090,000
Non-Tidal Dep.	56,755	58,000	57,421	58,000
Total	7,140,103	5,506,000	**6,215,456**	**5,410,000**

Note 1. SAG Handout, 6/16/2010

Note 2. Public Review Draft of WIP, September 2010

Note 3. SAG Handout, 8/24/2010

Note 4. Load Reduction achieved by reducing significant WTP effluent concentrations to: TN = 3 mg/L; TP = 0.10 mg/L (except UOSA due to sediment):
Wastewater (TN lb/yr) = WIP Sept 2010 - [Current WLA – Load Reduction]
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=1,832,000 - 1,141,825 = 690,175 TP lb/yr

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Questions?

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