Recommendations of the Expert Panel to Define Removal Rates for Urban Nutrient Management

December 17, 2012

Chesapeake Bay Program
A Watershed Partnership

Outline of Presentation

- The Panel Process
- Background on Turf in the Bay
- Review of the Science
- CBWM Modeling Issues
- UNM Definitions
- The Four Recommended Credits
- Verification Procedures
- Implementation Issues

1. The Panel Process

- Outlined in the BMP Review Protocol (WQGIT, 2010)
- BMP Expert Panel → reviews existing research → set of recommendations
- 7 calls, 2 workshops, 5 drafts over 12 months
- Product: Technical Memo and 5 Appendices

The Agriculture Work Group and Watershed Technical Workgroup is also actively involved in the review process

The Expert Panel

Panelist	***Affiliation***
Jonathan Champion	District Department of the Environment
Karl Berger	Metropolitan Washington Council of Governments
Dr. Stu Schwartz	University of Maryland, Baltimore County
William Keeling	Virginia Department of Conservation and Recreation
Dr. Gary Felton	University of Maryland, College Park
Dr. Neely Law	Center for Watershed Protection
Marc Aveni	Prince William County Department of Public Works
Dr. Mike Goatley	Virginia Tech
Tom Schueler	Chesapeake Stormwater Network (panel facilitator)

Technical support by Jeremy Hanson (CRC), Molly Harrington (CRC), Gary Shenk (EPA CBPO), Jeff Sweeney (EPA CBPO) and Mark Sievers (TetraTech) is gratefully appreciated

Panel Charge

- Current CBWM 5.3.2 land use data for urban pervious areas and recommend the most probable splits for turf management status (i.e., fertilized, un-fertilized, and over-fertilized)

- Available literature on the nutrient and sediment loading rates associated with fertilized, un-fertilized and over-fertilized turf, accounting for regional and terrain differences.

- Specific definitions for each class of UNM practices and the qualifying conditions and rationale under which a locality can receive a nutrient reduction credit.

- Whether the 2003 CBP-approved nutrient removal rates for UNM practices developed in 2003 is still reliable.

The Charge

- What, if any, nutrient credits can be provided by outreach campaigns to change homeowner fertilization behavior.
- The proper units to report UNM implementation to receive credit in the Chesapeake Bay Watershed Model
- Critically analyze any unintended consequence associated with the removal rates and any potential for double or over-counting of the load reduction achieved.

Comparison of Acres of Urban Pervious Areas and Anticipated Acres Under Urban Nutrient Management by 2025, For Each Bay State		
State	Urban Pervious Area [1]	Urban Nutrient Management [2]
	Acres	
Delaware	36,481	34,584
District of Columbia	17,206	42,240
Maryland	990,291	555,575
New York	170,716	170,654
Pennsylvania	1,052,558	311,154
Virginia	1,195,567	517,058
West Virginia	88,218	347
TOTAL	3,551,037	1,631,612

[1] Acres of Urban Pervious Area in Version 5.3.2 of Chesapeake Bay Watershed Model

[2] Acres under urban nutrient management in each state by 2025 as reported in the Phase 2 Watershed Implementation Plan submissions to EPA in 2012, as summarized in spreadsheet by Jeff Sweeney, EPA CBPO

[3]

Adaptive Management Approach

- Panel acknowledges that while we have a lot more science than we had ten years ago, there are still gaps in our understanding of nutrient dynamics on turf
- Nutrient reduction credits were developed with the notion that they could be improved/refined over time as better research and fertilizer statistics becomes available
- Many research and management recommendations provided to increase confidence in the methods, implementation and delivery of UNM
- Protocols should be revisited in 2017 when more research, better practitioner experience, and an improved CBWM model all become available to Bay managers.

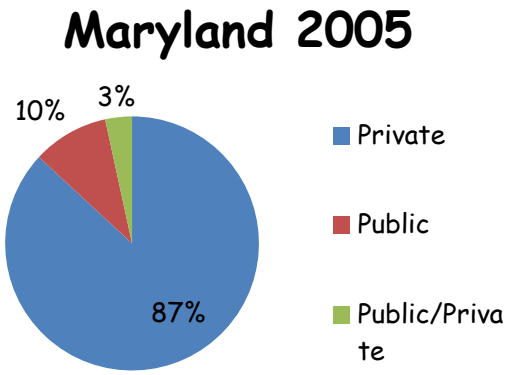
Summary of Urban Nutrient Management Credits for Phosphorus and Nitrogen on Urban Pervious Land				
Nutrient	*Statewide with P fertilizer legislation*	*Statewide without P fertilizer legislation*	*Urban Nutrient Management (UNM)*	*Alternative Outreach Option*
TP	25%	20%	Low risk: 3% High risk: 10% Blended: 4.5%	Alternative: 0% Passive: 0%
TN	3% for every 10% decrease in N urban fertilizer input		Low risk: 6% High risk: 20% Blended: 9%	Alternative: 3% Passive: 0%

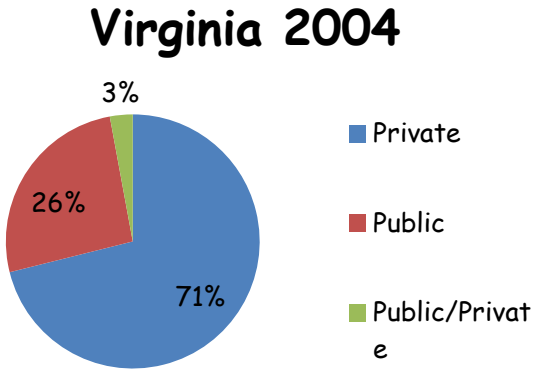
2. Review of Turf and Fertilization in the Chesapeake Bay

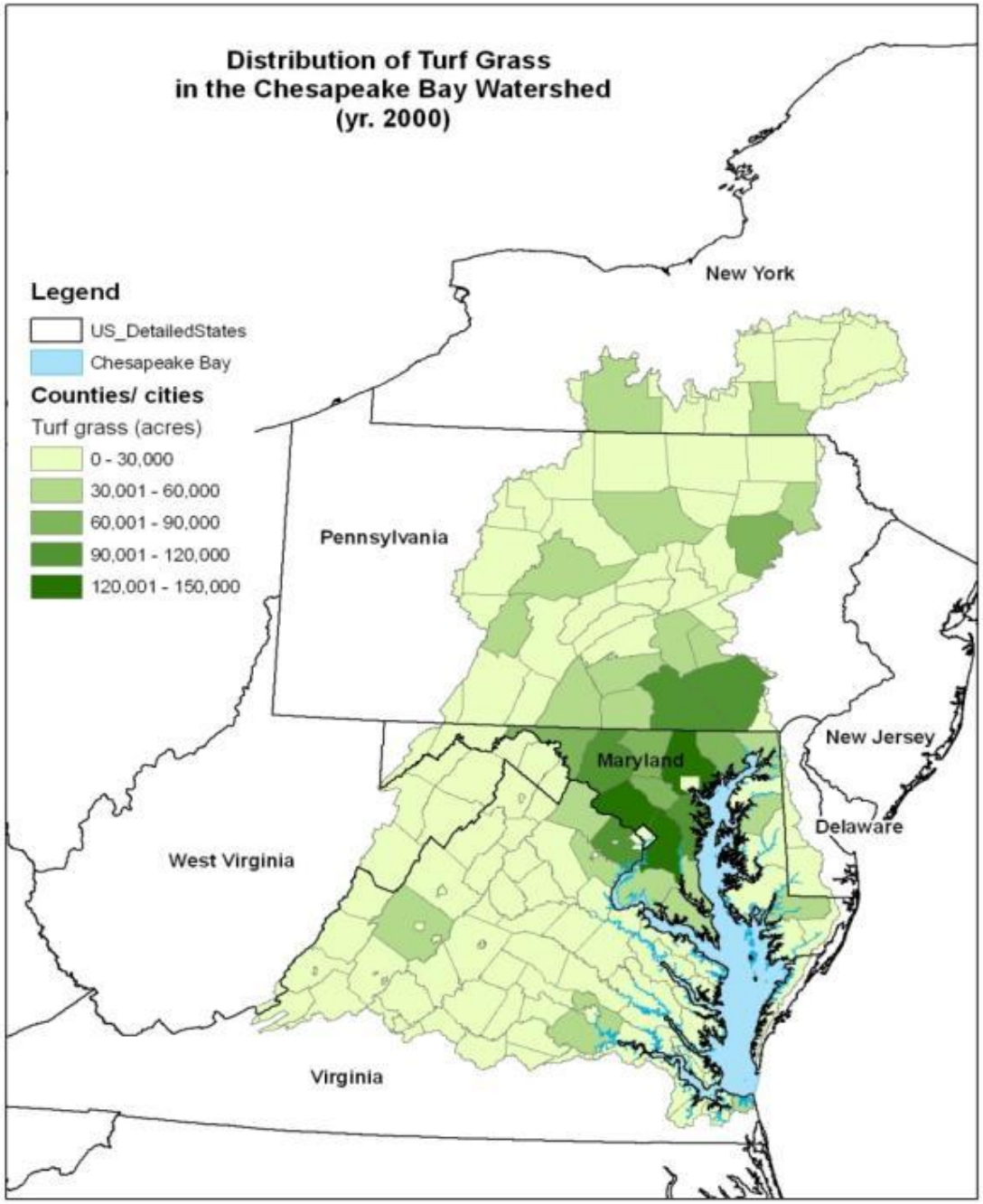
- Estimates of turf/pervious cover in watershed.
- Differences in State P fertilizer legislation
- Trends in non-farm fertilizer sales
- Derivation of existing CBP rate

Pervious land has grown steadily in the last 3 decades

Most recent estimates by P. Claggett indicate pervious land is about 10% of entire Bay watershed





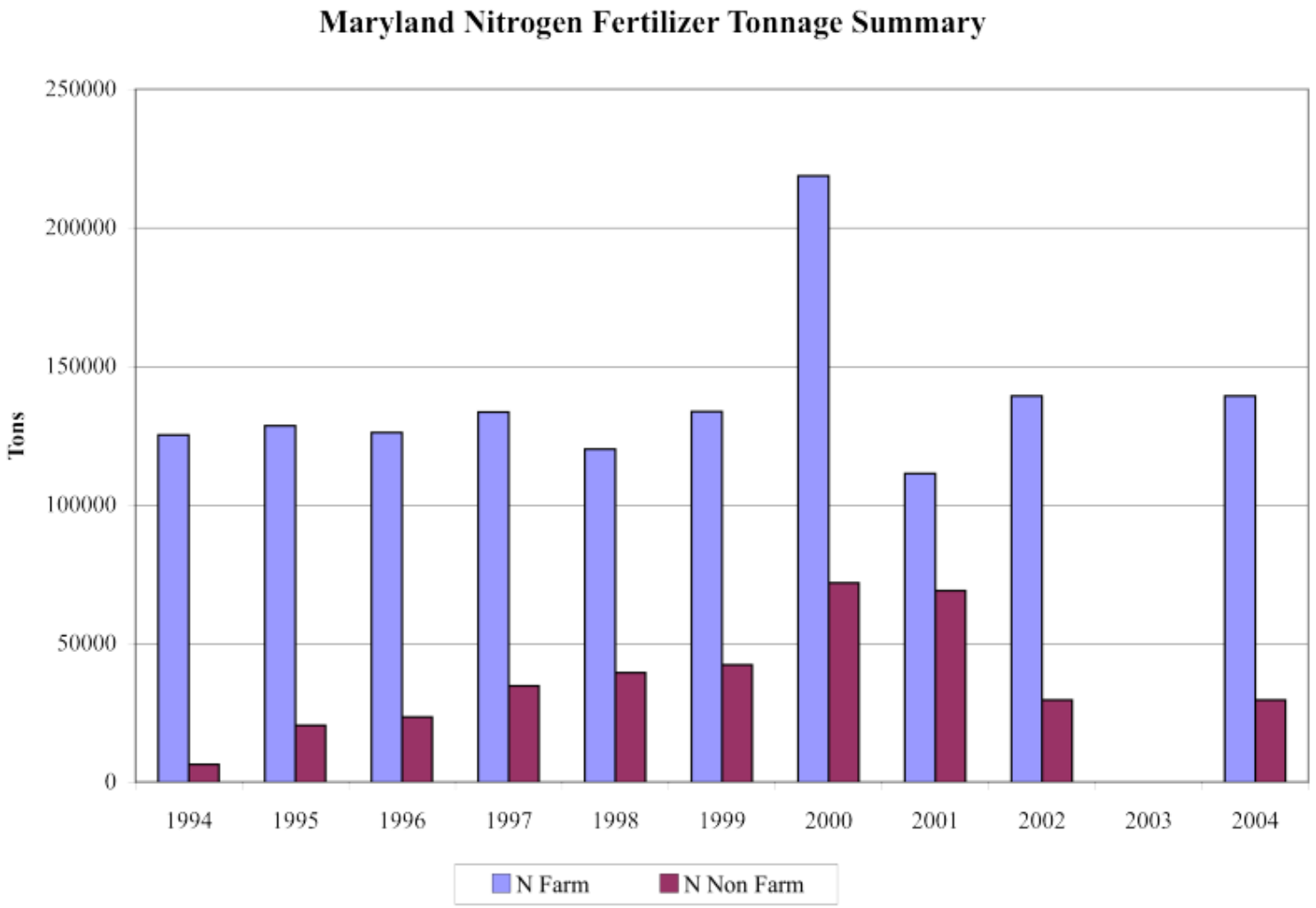

Distribution of Turf Grass
in the Chesapeake Bay Watershed
(yr. 2000)
Legend
US_DetailedStates
Chesapeake Bay
Counties/ cities
Turf grass (acres)
0 - 30,000
30,001 - 60,000
60,001 - 90,000
90,001 - 120,000
120,001 - 150,000
New York
Pennsylvania
New Jersey
Maryland
Delaware
West Virginia
Virginia

State P fertilizer legislation

- 3 States have done so (MD,NY, VA)
- Each legislation is different, and is not equivalent to a P-ban in fertilizer products
- States that not passed laws still benefit from industry phase-out of fertilizer products

Comparison of Bay State P Fertilizer Legislation

Key Elements	**MD**	**NY**	**VA** [2]
Year Enacted/Year Effective	2011/2013	2011/2012	2011/2014
P Ban for Lawn Maintenance Fertilizer	Yes	Yes	Yes
Winter Application Ban	Yes	Yes	**No**
Product Labeling Requirements	Yes	Yes	Yes
Starter Lawn Exemption	Yes	Yes	Yes
Organic/Biosolid Exemption	Yes	**No**	Yes
Retail Display Requirements	**No**	Yes	**No**
Prohibit Application on Paved Surfaces	Yes	Yes	**No**
Prohibit Application Near Water Features	Yes	Yes	**No**
No Fertilizer Use as a Deicer	Yes	**No**	Yes
Maximum N Fertilizer Application	Yes	**No**	**No**
Slow Release N Requirement	Yes	**No**	**No**
Special Requirements for Applicators	Yes	**No**	Yes
Certification of Commercial Applicators	Yes	**No**	Yes
Enforcement and Fines	Yes	Yes	**No**



Non-farm N fertilizer sales statistics show trends but have some real data quality issues

Some strong evidence that P fertilizer sales have declined in last few years

Industry Reported Change in P Fertilizer Sales in the Bay States, 2006 to 2010 [1]			
State [2]	2006 Millions of Pounds	2010 Millions of Pounds	Percent reduction
Pennsylvania	1.41	0.26	82 %
Maryland	0.68	0.10	85 %
Virginia	0.60	0.22	63 %
Delaware	0.09	0.04	55 %
West Virginia	0.07	0.02	71 %
Total	**2.85**	**0.655**	**77%**

[1] annual sales data reported by Scotts (2011) for non-farm fertilizer sales by state. Scott's currently has a 60% market share, and has committed to a full phase out of P in its fertilizer products by January 1, 2013. Analysis performed by Gary Felton, 2012.

2 Note that the statistics on P sales are provided for each state as a whole, and NOT the fraction of the state located within the Bay watershed

Sharp Declines in non-farm P sales in a state w/o P fertilizer legislation

Change in Non-Farm Sales of Phosphate Fertilizer in Delaware 2006 to 2010						
Million lbs of P_2O_5	2006	2007	2008	2009	2010	Change
	0.934	1.114	0.584	0.308	0.132	- 86%
Source: Delaware Department of Agriculture, as Reported in DE Final Phase 2 Watershed Implementation Plan (May, 2012)						

Panel concluded that more accurate non-farm fertilizer statistics that account for actual N and P content of fertilizer were essential to verify any state-wide credits…..and needed for Phase 6 of CBWM

The Panel and the Old CBP-Approved UNM Rate

... urban nutrient management leads to a reduction in urban fertilizer applied. Urban nutrient management involves public education (targeting urban/suburban residents and business) to encourage reduction of excessive fertilizer use. The CBP Nutrient Subcommittee Tributary Strategy Workgroup has estimated that urban nutrient management ***reduces nitrogen loads by 17% and phosphorus loads by 22%***

- **No scientific or modeling analysis could be found to support or document the above cited rates.**
- **UNM definition was extremely ambiguous and could not be accurately measured, tracked or verified.**
- **Panel concluded the existing CBP-approved UNM practice could not be technically justified.**

3. Review of Available Science

1. P Dynamics on Urban Lawns
2. N Dynamics on Urban Lawns
3. High Risk Factors for Nutrient Export
4. Justification for Core UNM Practices
5. Impact of P Fertilizer Restrictions
6. Homeowner Fertilizer Behavior
7. Effect of Outreach on Fertilizer Behavior
8. Pervious Land and the Bay Watershed Model

Panel reviewed more than 150 papers and met 7 times

P Dynamics on Urban Lawns

1. Leaching to groundwater (minimal)
2. Soluble P loss in surface runoff
3. Sediment-bound P in surface runoff
4. Organic P (clippings/leaves) in runoff

P losses range from less than 1% of fertilizer input up to 18%, depending on timing, turf conditions

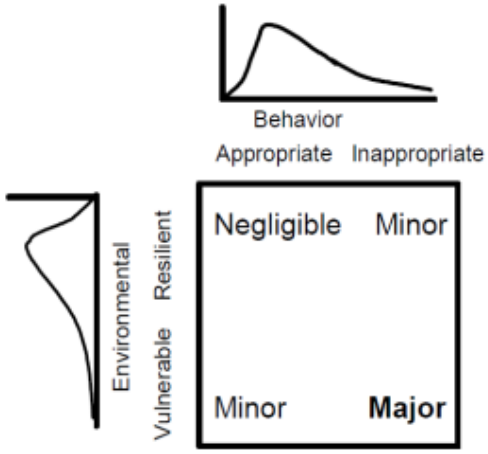
P losses strongly related to lawn runoff volume (e.g., steep slope, compacted soils, frozen ground, low turf density)

Significant P loss occurs independent of fertilization

N Dynamics on Urban Lawns

- Nitrate Leaching
- Nitrate/Ammonia in Overland Flow
- Washoff of Organic Nitrogen (clippings, leaves, eroded soil)
- Atmospheric Volatilization
- Denitrification

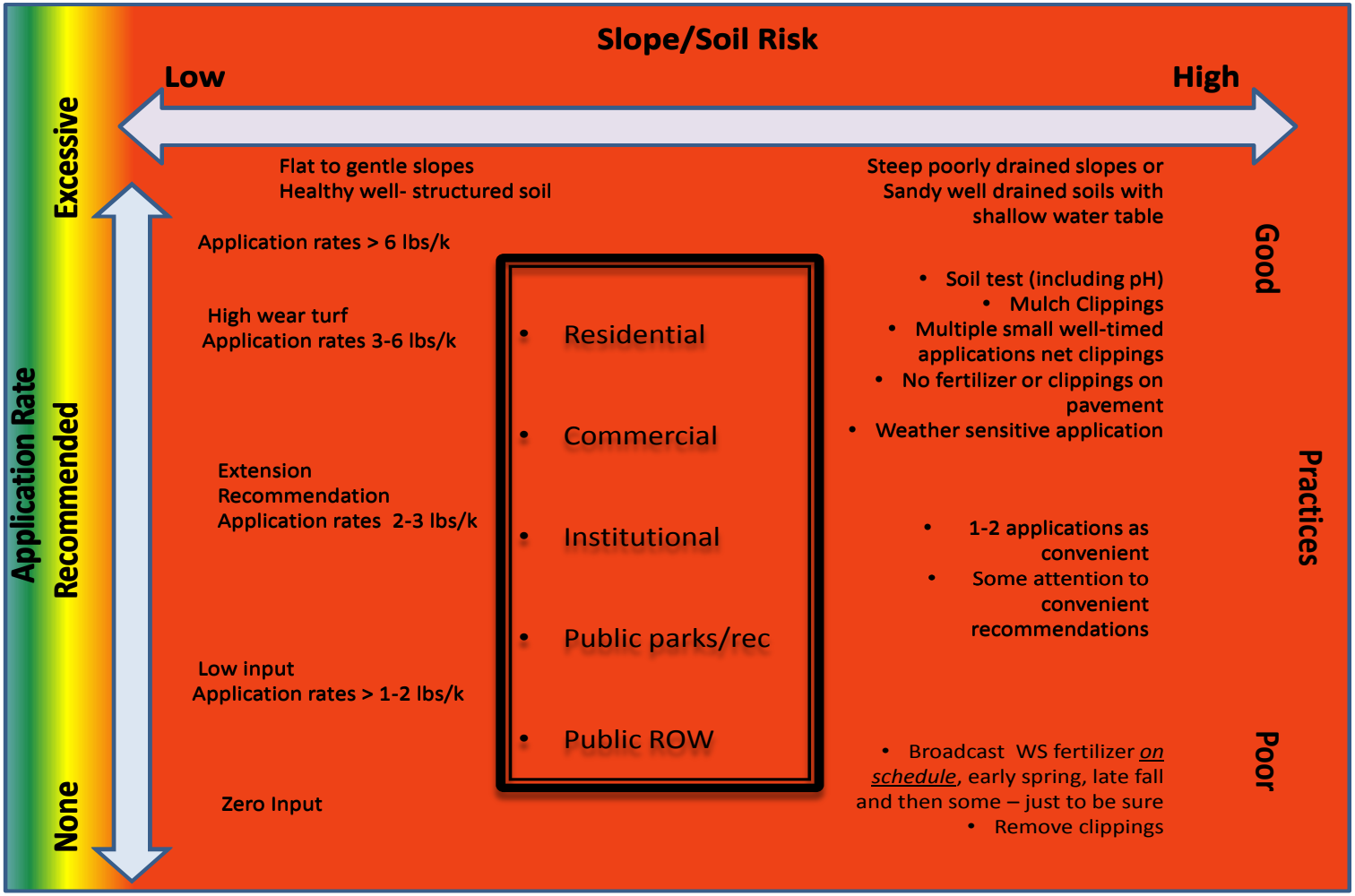
Most lawns are highly retentive of fertilizer inputs



N Losses from Turf Grass as a Function of Fertilizer Application Rate				
N Load Exported (lb/ac)	N Fertilizer Input (lb/ac)	% of Fertilizer Exported	Reference	Notes
0.17	85	**0.20%**	Mancino & Troll, 1990	In 10 weekly apps
0.28	87.5	**0.32%**	Namcino & Troll, 1990	In 5 biweekly apps
0.06	93.7	**0.06%**	Spence et al. 2012	High Maintenance Fescue lawn
0.13	76.75	**0.17%**	Spence et al 2012	Low Maintenance Fescue Lawn
0.87	87.45	**1%**	Frank et al. 2006	Lo input *leaching losses*
1.78	131	**1.36%**	Guillard & Kopp 2004	Organic fertilizer
1.8	43.6	**4.13%**	Mancino & Troll, 1990	Single application
3.3	131	**2.52%**	Guillard & Kopp, 2004	PCSCU slow release
2.68	268	**1%**	Quiroga-Garza et al. 2001	Semi-arid, Warm season Bermuda grass
3.66	268	**1.37%**	Erickson 2001	*Leaching loss*
6.25	79	**7.91%**	King et al. 2001	**Hi Risk**: Watered to maintain 85% FC with tile drains
10.7	1071	**1%**	Quiroga-Garza et al 2001.	**Hi Risk**: Hi Input semi-arid Bermuda grass
23.02	131	**17.55%**	Guillard & Kopp 2004	**Hi Risk**: Highly soluble ammonium nitrate
24.05	219	**11%**	Frank et al. 2006	**Hi Risk**: Hi Input
68.02	412.3	**16.5%**	Roy et al 2000	**Hi Risk:** 3x sod grower practice overwhelms turf, fall *leaching losses*.
87-222	312	**28%-71%**	Pare et al 2006	**Hi Risk**: 80:20 sand peat media, applied 25kg/ha biweekly over 7 month growing season. Multiple cultivars.

Export is calculated as % fertilizer inputs. This overestimates turf *system* exports for field studies with atmospheric inputs in precipitation

High Risk Nutrient Export Factors



High Risk Factors Defined

- Owners are currently over-fertilizing beyond state or extension recommendations
- P-saturated soils as determined by a soil P test
- Newly established turf
- Steep slopes (more than 15%)
- Exposed soil (more than 5 % for managed turf and 15% for unmanaged turf)
- High water table (within three feet of surface)
- Over-irrigated lawns
- Soils that are shallow, compacted or have low water holding capacity)
- High use areas (e.g., athletic fields, golf courses)
- Sandy soils (infiltration rate more than 2 inches per hour)
- Adjacent to stream, river or Bay (within 300 feet)
- Karst terrain

Justification of Core UNM Practices

- More than 40 studies support reduced risk of N export associated w/ individual lawn care practices
- Practices include both fertilization AND management of "lawn biomass"

Core UNM Practices for the Chesapeake Bay

1. Get *technical assistance* to develop an effective UNM plan for the property
2. Maintain a **dense** vegetative cover of turf grass or conservation landscaping
3. Choose not to fertilize, **OR** adopt a reduce rate/monitor approach **OR** the use the small fertilizer dose approach
4. Retain clippings and mulched leaves on the yard and keep them out of streets and storm drains
5. Do not apply fertilizer before spring green up or after Halloween *

Core UNM Practices for the Chesapeake Bay

6. Maximize use of slow release N fertilizer during the active growing season
7. Set mower height at 3 inches or taller
8. Immediately sweep off any fertilizer that lands on a paved surface
9. Do not apply fertilizer within 20 feet of a water feature and manage this zone as a perennial planting, a tall grass buffer or a forested buffer
10. Employ lawn practices to increase soil porosity and infiltration capability and use the lawn to treat stormwater runoff.

The "Choose not to fertilize" option only applies to mature, flat lawns with dense ground cover

Norm goulet's house does not qualify

Impact of P Fertilizer Restrictions

- Limited number of research studies in upper Mid-west have measured reductions in ambient P concentrations in water bodies where P-fertilizer bans had been enacted

- TP concentrations reduced by 12-16% in two studies, especially for storms greater than 0.5 inch
- Might have been a bigger impact, but 28% of residents ignored the P ban
- The reported TP reductions are generally consistent with reductions for a zero P input CBWM run

Homeowner Fertilizer Behavior

Summary of Research on Homeowner Fertilization Behavior				
Study [1]	Location	% Fertilize	% DIY [2]	% Lawn Care [3]
Aveni, 1996	Northern VA	79	--	--
Swann, 1999	Ches Bay	50	91	9
Law et al, 2004	Glyndon MD	68	71	29
	Baisman Run	56	44	56
Osmond and Hardy 2004 North Carolina	Cary	83	48	52
	Goldsboro	66	76	24
	Kingston	54	70	30
	New Bern	72	75	25
	Greenville	73	65	35
Varlamof et al 2001	Georgia	76	--	--
Schueler, 2000	Non-Bay States	54-82	--	--
SMC (2001)	National	56	90	10

[1] Each of the studies utilized different survey methods and sample sizes so the studies are not strictly comparable
[2] Do-it-yourselfers
[3] Employ a lawn care company that applies fertilizer on their behalf.

1 .7 to 2.0 fertilizer applications per year for do it yourselfers
4 - 5 fertilizer applications per year for lawn care companies

Effect of Outreach on Fertilizer Behaviors

- Recent sociological research indicated fertilization and lawn care behaviors are deeply rooted and hard to change
- Strong neighborhood pressures and norms often outweigh environmental or water quality considerations

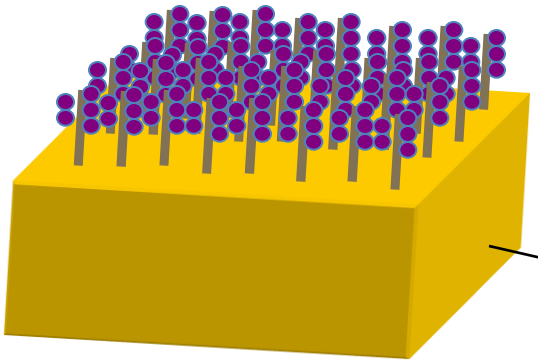
***Retail* methods** rely on direct engagement with individual property owners to develop an UNM plan based on field visits, training and direct technical assistance or train commercial fertilizer applicators on appropriate UNM practices.

***Wholesale* methods** rely on social marketing campaigns that utilize a combination of TV, radio, internet, newspaper, billboard and other media to influence homeowner norms and awareness relative to desired fertilization behaviors.

Summary of Impact

- Limited research available on actual impact of outreach in changing behaviors
- Wholesale outreach: documented changes in awareness, some changes in intentions, but no measurable changes in behaviors or outcomes
- Retail outreach: see above

4. How CBWM Simulates Nutrients



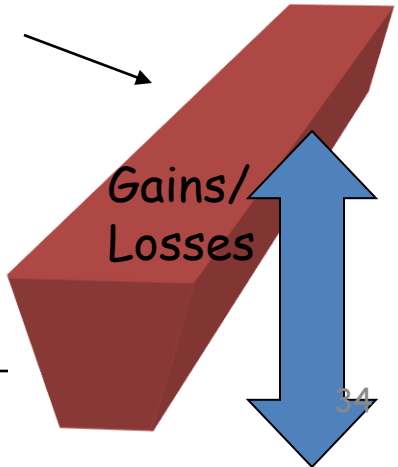
Edge of **Stream**
Expected loads from one acre that reach 100 cfs stream or tidal waters

BMP Factor

Land Acre Factor

Regional Factor

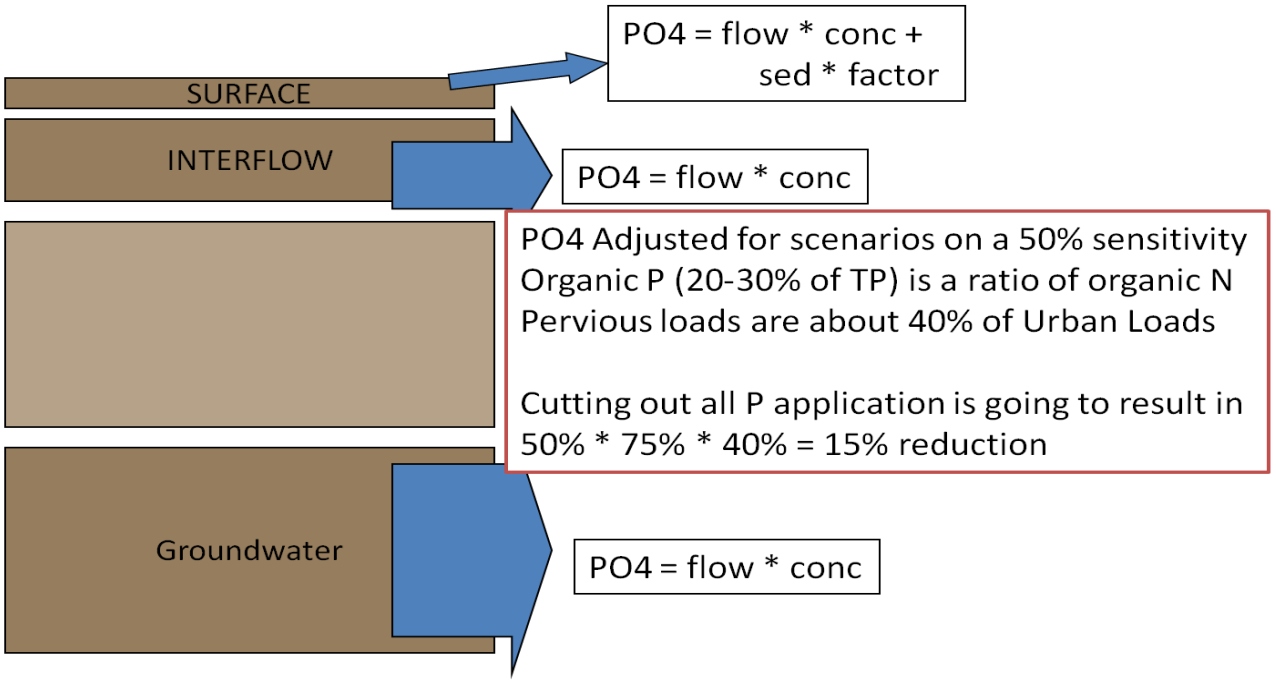
Edge of Stream
60-100 sq miles



In Stream Concentrations

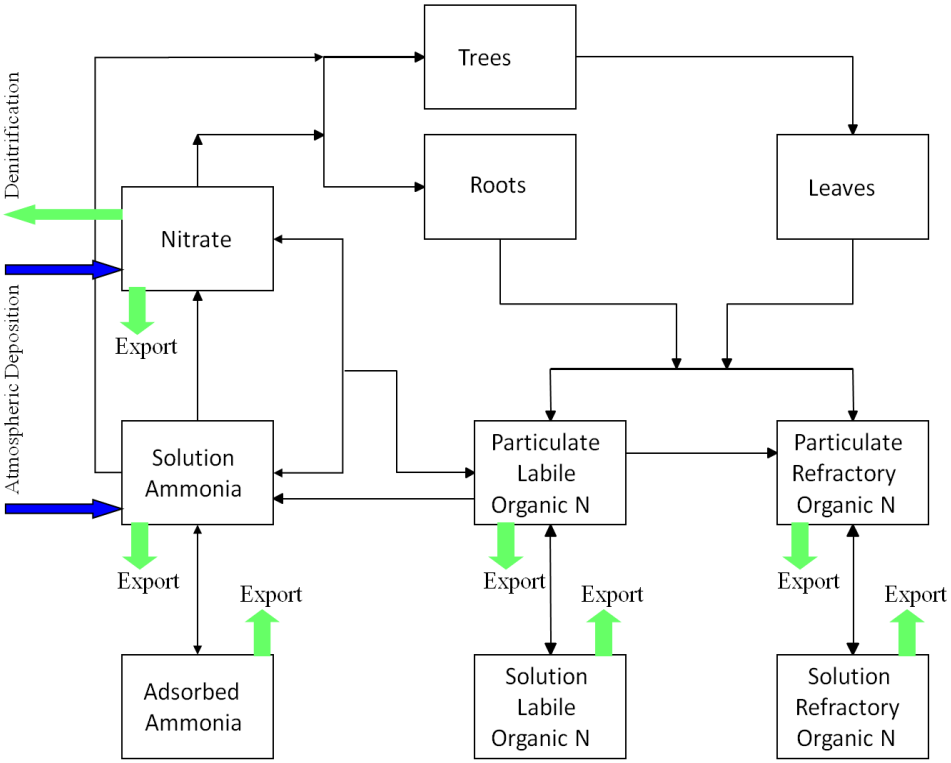
P Dynamics on Pervious Land Simulated in PQUAL

Pervious Urban Phosphate sensitivity



N Dynamics Simulated in AGCHEM

Each submodel has a complex hydrologic or nutrient cycling structure



30% Sensitivity to N Fertilizer Inputs

CBWM Fertilizer Input Assumptions

- Unit acre of Pervious land includes fertilized and unfertilized turf (50% each)
- Weighted N input of 43 lbs/ac/yr or 1 lb per 1000 sf
- Weighted P input of 1.3 lbs/ac/yr

5. Definitions

- Pervious Land vs. Turf
- Urban Nutrient Management
- P Fertilizer Restrictions
- UNM Planning Agency
- Qualifying UNM Plan
- Trained UNM Expert
- Passive, Active, and Alternative Outreach

Pervious Land vs. Turf

- *Pervious Land*: term used to describe urban and suburban land that is not impervious in the Chesapeake Bay Watershed Model (CBWM). This land use category predominately includes residential lawns, but may also include landscaping, gardens, parks, rights of way, vacant lots and open areas….may also include a limited amount of forest canopy.

- *Turf* (aka lawns, turf grass, turf cover): refers to a subset of pervious areas that are managed to attain dense grass cover, which may involve fertilization, irrigation, weed control, and other turf management practices.

UNM Planning Agency

- Refers to the specific agency in a community that has authority and/or qualifications to assess the property and prepare a verifiable UNM plan.
- Depending on the state, the UNM planning agency may be:
  - State Cooperative Extension
  - Service, Soil and Water Conservation District,
  - State Agency
  - Local Agency.
- UNM support may be provided by Master Gardeners, a watershed stewards academy, local watershed groups or landscape contractors associations.

UNM Plans, Pledges and Experts

- *Qualifying Urban Nutrient Management Plan.* The basic reporting unit for the practice is the acreage of written UNM plans or applicator certifications that contain the applicable lawn care UNM practices which are subject to verification.

- *Homeowner UNM Pledge:* This is a shorter version of a UNM plan in which an individual homeowner submits a written pledge to implement the applicable UNM practices on their lawn,
  - May requires on-site visit from a trained professional to assess risk factors and take a soil test.
  - Nutrient reduction credit is less than that granted for a qualified UNM plan = low risk UNM credit for both TN and TP.
  - Each Bay state will choose whether homeowner pledges are or are not an acceptable UNM delivery option.

- *Trained UNM Expert:* An individual with the requisite training and experience to prepare UNM plans in their jurisdiction. States may establish voluntary or mandatory training programs to certify UNM experts.

Meaningless Photo to Break up Monotonous Word Slides

Local Outreach Campaigns

Three kinds of outreach can influence homeowner fertilization behavior to differing degrees

- Passive
- Active
- Alternative

Passive Outreach

- This outreach effort uses non-targeted and wholesale methods to get the UNM message out to the public.
- Wholesale methods have been traditionally used by MS4;s to fulfill their stormwater education requirements in MS4 permits.
- May include providing information about proper fertilization on a local webpage, newsletters, kiosks, fact sheets and handbooks.
- NO NUTRIENT CREDIT FOR THIS OPTION

Active Outreach

- Retail outreach effort is designed to directly interact with individual fertilizer applicators to adopt core UNM practices.
- Targeted to properties with known high risk factors in a community.
- Product is a verifiable UNM plan or pledge whereby an individual homeowner, lawn care company, HOA, business, institutional or public landowner commits to the applicable UNM practices that apply to their turf.
- NUTRIENT CREDIT PER UNM PLAN

Alternative Outreach

Alternative methods to motivate property owners or commercial applicators to implement the core UNM practices, such as:

- Use of local or regional social media/marketing campaigns to deliver the core message to a geographically defined target population, and encourage them to develop a UNM plan/pledge.
- Map high risk export factors within a community to target outreach efforts to develop more UNM plans in these areas
- Target training to commercial applicators, lawn care companies, landscape contractors or property managers to encourage them to adopt UNM practices
- Point of sale outreach at retail sales outlets to encourage UNM practices
- Other innovative outreach efforts, as approved by state and/or extension service.

Alternative Outreach (cont.)

- The acreage of UNM plans and/or pledges is still the metric for nutrient credit
- Sponsoring agencies are eligible for a three year N reduction credit equivalent to 3% of the N load generated for the total pervious area within the geographical area target.
- Credit is contingent upon the implementation of a before and after survey to measure actual changes in fertilization behavior outcomes.
- After 3 years, the credit is adjusted upwards or downwards based on the actual survey results or UNM plans.

6. Recommended Credits

- Automatic State-wide P Reduction Credit for UNM Legislation
- Contingent State-wide N Reduction Credit based on Sales
- N and P Reductions for Qualifying UNM Plans
- Programmatic Credit for Alternative Outreach Option

Automatic TP Load Reduction Credit from Pervious Lands for States that HAVE adopted urban nutrient management legislation

Bay State	TP Reduction (million pounds)	% Change in Pervious Load	% Change in Urban Load
MD	0.060	- 25.1	- 8.6
NY	0.012	- 26.5	- 11.6
PA [2]	0.053	- 23.3	- 10.4
VA	0.125	- 26.7	- 10.2

[1] 2010 Delivered Loads
[2] PA UNM legislation is still under consideration, no credit is allowed until it has passed
Source: Gary Shenk, CBPO, April 10, 2012 spreadsheet of CBWM 5.3.2. model runs assuming 0% P application rates

Assumed 70% Reduction in TP fertilizer Inputs to CBWM

Automatic P Reduction Credit from Pervious Lands in States that influenced by fertilizer industry phase-out

Bay State	TP Reduction (million pounds)	% Change in Pervious Load	% Change in Urban Load
DE	0.0018	- 19.0	- 7.8
DC	0.0006	- 21.2	- 3.6
PA [2]	0.046	-20.0	-8.9
WV	0.0048	-21.1	- 4.4

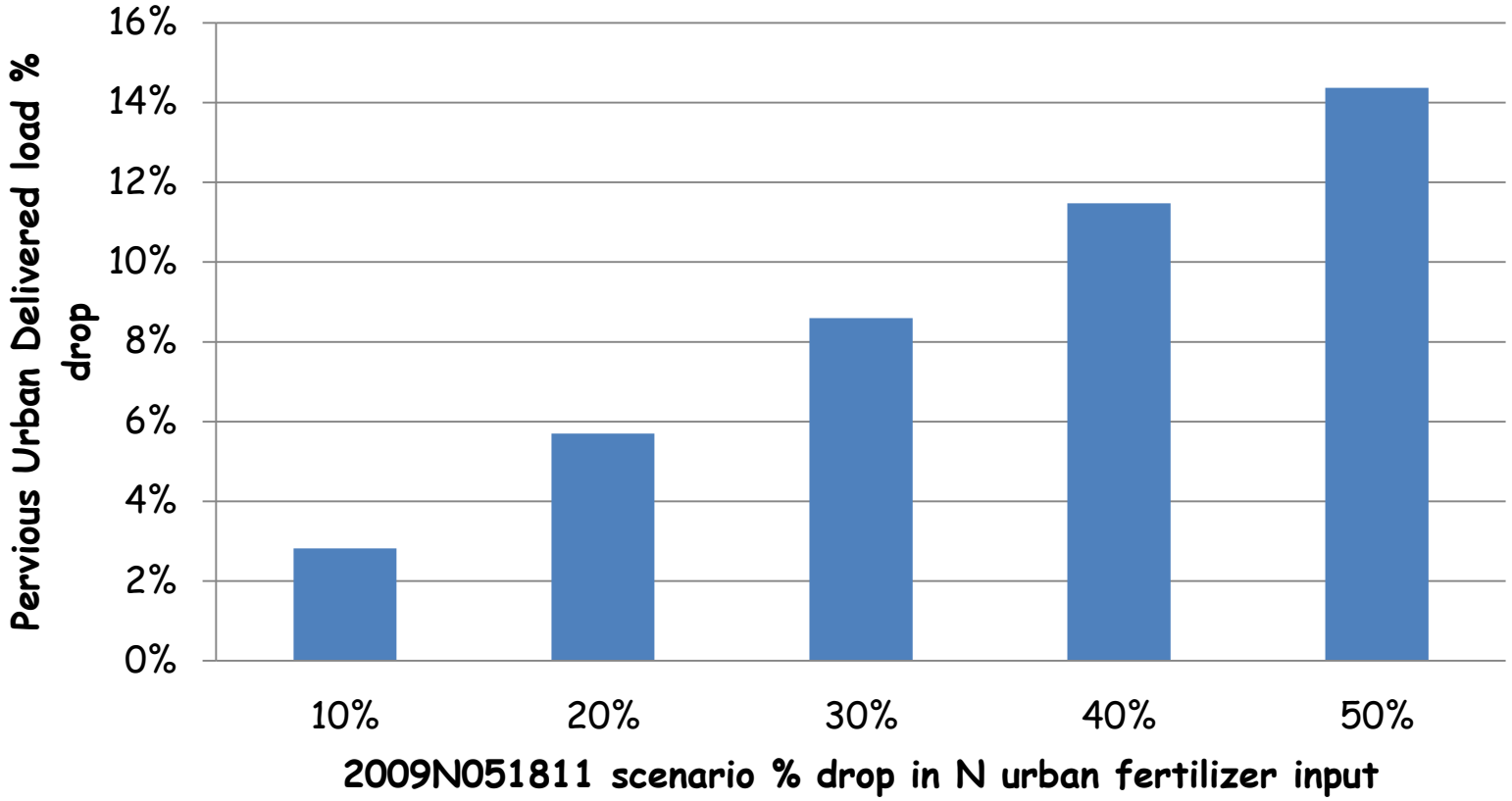
[1] 2010 Delivered Loads
[2] In the event UNM legislation is not passed
Source: Gary Shenk, CBPO, April 10, 2012 spreadsheet of CBWM 5.3.2. model runs assuming 0% P application rates

Assumed 60% Reduction in TP fertilizer Inputs to CBWM

Statewide Nitrogen Reduction Credit for Pervious Land

- Load reduction credit contingent on the expected decline in N fertilizer sales over time.
- Credit is based on each state's 2014 N fertilizer inputs, relative to the current CBWM assumption of 43 lbs/ac/year for pervious land.
- Only granted when states can document a downward trend in the N content of non-farm fertilizer sales data.
- The magnitude of the credit will be determined by changing N fertilization inputs in the CBWM.
- Subject to biannual verification

3% Decline in N Load for each 10% decline in N fertilizer sales



Fundamental Reporting Unit: Acres in UNM Plan

UNM Plan for 9200 Bradford Pear Lane: 0.5 acres		
1	Get Expert Lawn Advice	✓
2	Maintain Dense Cover on Turf	✓
3	Choose NOT to fertilize	✓
4	Recycle Lawn Clippings and Compost Fallen Leaves	✓
5	Correct Fertilizer Timing	N/A
6	Use Slow Release Fertilizer	N/A
7	Set Mower Height at 3 inches	✓
8	No off-target fertilization	N/A
9	Fertilizer free buffer zones around water features	✓
10	Increase soil porosity and infiltration	✓

Nitrogen Reduction Credits for Qualifying UNM Plans Per Acre of Residential, Commercial, Institutional or Public Land

Turf Nitrogen Management Category	Annual Nitrogen Reduction Rate
Low Risk Lawns [1]	**6 % reduction of pervious load**
Hi Risk Lawns [1]	**20% reduction of pervious load**
Blended Rate [2]	**9% reduction of pervious load**

[1] regardless of fertilization regime (including non-fertilized lawns
[2] state-wide credit, assuming 80% of lawn acreage falls into the low category and 20% is high risk

While rates were based on best professional judgment, they are reinforced by a CBWM loading mass balance analysis

Phosphorus Reduction Credits for Qualifying UNM Plans Per Acre of Residential, Commercial, Institutional or Public Land

Turf Management Category [1]	Annual TP Reduction Rate [1]
Low Risk Lawns	**3 % reduction of pervious load**
Hi Risk Lawns	**10 % reduction of pervious load**
Blended Rate	**4.5% reduction of pervious land**

[1] regardless of fertilization regime (including non-fertilized lawns
[2] state-wide credit, assuming 80% of lawn acreage falls into the low category and 20% is high risk

Rationale for Setting the UNM Rates

The Panel made the following assumptions when it defined UNM rates:

• 80% of the pervious land in the Bay watershed in the low risk category, 20% is considered high risk (will vary across the watershed.

• 5% of applied N fertilizer is exported in high risk category: only 1% of applied N fertilizer is exported in low risk category.

• No P fertilizer applied for either hi or low risk (no P fertilizer export)

•Current CBWM pervious fertilizer application rates and export sensitivity used as the baseline for the estimating reductions.

•A portion of the total N/P load from pervious land is not subject to any reduction by UNM practices.— defined as twice the average load from forest land in CBWM.

• Fraction of the remaining load was available for potential reduction by UNM practices --defined as the total load less the fertilizer input load and less the non-removable load.

• Only 10% (N)and 20% (P) of this residual load could be reduced by UNM practices that do not affect the fertilization rate.

•A lower maximum removal rate is assigned for P since reductions in P fertilizer application are already addressed by the state-wide P reduction credit for pervious land.

Two independent mass balance checks were conducted to determine if the rates were reasonable and consistent w/ CBWM – see Appendix A

Qualifying Conditions for UNM

- Each UNM plan must be prepared by a trained expert (e.g., certified plan writer)
- Plan must be consistent with the applicable UNM core lawn care practices or existing state requirements (e.g., Virginia)
- Each UNM plan must clearly document the:
  - Start and end dates for the plan
  - Name, contact information and locator data for the owner, applicator and UNM planner
  - Acreage of turf and landscaping covered by the plan
  - Annual N and P fertilization rate, if any
  - Whether the turf is classified as high or low risk of nutrient export or is an unfertilized lawn (optional)

Alternative Outreach Option

Communities can create programs that motivate property owners to implement the core UNM practices, such as:

- Local or regional social media/marketing campaigns to deliver the core message to a geographically defined target population, and funnel them to a UNM planning agency.

- Mapping of high risk export factors within a community to target outreach efforts to develop more UNM plans.

- Targeted training to commercial applicators, lawn care companies, landscape contractors and property managers.

- Distribution of point of sale outreach materials at retail sales outlets (e.g., information kiosks at home and garden stores)

- Other alternative outreach efforts, as approved by state and/or extension service.

Credit for Alternative Outreach Option

- Communities that utilize them are eligible for a one-time, three year N reduction credit equivalent to **3% of the N load** generated from the total pervious land area in the geographical area that is targeted.

- Credit is contingent upon before and after surveys, monitoring or other research that can scientifically evaluate the quantitative outcome of the outreach program, in terms of actual changes in fertilization behavior or increased delivery of UNM plans.

- After the three years, the alternative outreach program credit will expire, and the acreage of UNM plans/pledges will become the metric by which credit is determined

- Acknowledged that some alternative outreach efforts may fail or may not meet their original expectations, but new data collected will improve future UNM delivery.

7. Verification Procedures

Different for each credit, although all must meet specific reporting, tracking and verification requirements

Verification Procedures for State-wide Credits

After 2015, however, the automatic state credit will lapse and be replaced with state-reported estimates of P fertilizer applications to pervious land using the following verification procedures

Step 1: Multiply the state acreage in pervious land by the 1.3 lbs P/acre/year average application rate assumed in the current version of CBWM to establish the state P application benchmark.

Step 2: Determine the P content of reported non-farm fertilizer sales for two consecutive years, accounting for the differential P content in the various lawn and garden fertilizer products that are represented in the sales statistics.

Convert to total pounds of P, and adjust downward to account for non-Bay watershed area in the state on a pro-rata basis.

The mass of estimated P sold is then divided by the state acres of pervious land determine the new state average P application rate in lbs/ac/year

Step 3: Divide the new state P application rate by the state application benchmark and then multiply by 100 to get the percentage reduction in P application from the CBWM benchmark.

Step 4: The state-specific unit area P application rate is then entered into the CBWM directly to compute the revised P load generated from pervious lands for the state.

The Panel acknowledges that most current state non-farm fertilizer sales statistics are not detailed enough to characterize urban nutrient content, but feel that such data is critical to verify the substantial reductions provided.

UNM Plan Verification

- Maximum duration of a UNM plan is 3 years
- Can be renewed based on affirmation from the owner or applicator that they are either (a) maintaining the plan or (b) or have modified the plan based on further professional feedback/tests
- If a UNM plan cannot be reconfirmed after 3 years, it will be considered lapsed, and the treated acreage should be deducted from the UNM planning agency database.
- Turf areas greater than one acre in size may require an on-site visit to assess turf condition and nutrient export risk.

UNM Record Keeping

- Electronic or hard copy of the individual UNM plan
- Owner contact information and street and watershed address
- A UNM contact database so that they can communicate by mail or e-mail, and send at least one reinforcement message to each UNM owner/applicator each year.
- A UNM tracking database or spreadsheet to track required data elements for NEIN reporting and the status of UNM plans over time

More on UNM Verification

- Verification involves an affirmation by the plan writer, property owner or operator that the UNM plan is still valid, and is still being implemented.
- The UNM planning agency (or delegated third party organization) will also need to randomly sub-sample either plan writers or property owners with high nutrient export risk under a defined schedule.
- The aggregate compliance rates derived from the sub-sample surveys will be used to extrapolate UNM compliance rates for the community as a whole.
- The compliance rates are then used to downgrade UNM nutrient reduction credits

Verification for Alternative Outreach Option

- Nature of the intended target population (including number of applicators, their demographics, and the estimated acreage of pervious land they manage)
- Specific geographic area in which the outreach effort is being applied (e.g., total acres of pervious land)
- Specific UNM hypothesis that will be tested
- UNM metric that will be measured or mapped (e.g., fertilization behavior, risk factors, change in lawn runoff or nutrient concentration).
- Baseline measurement or survey prior to define the metric prior to the implementation of the alternative outreach option
- Post outreach measurement or survey to assess whether the metric changed in response to the outreach effort and test the original hypothesis
- Surveys should be designed to provide a maximum 5% margin of error for the target population
- All surveys should be focused on measuring changes in UNM outcomes; documenting changes in awareness or attitudes are not sufficient.

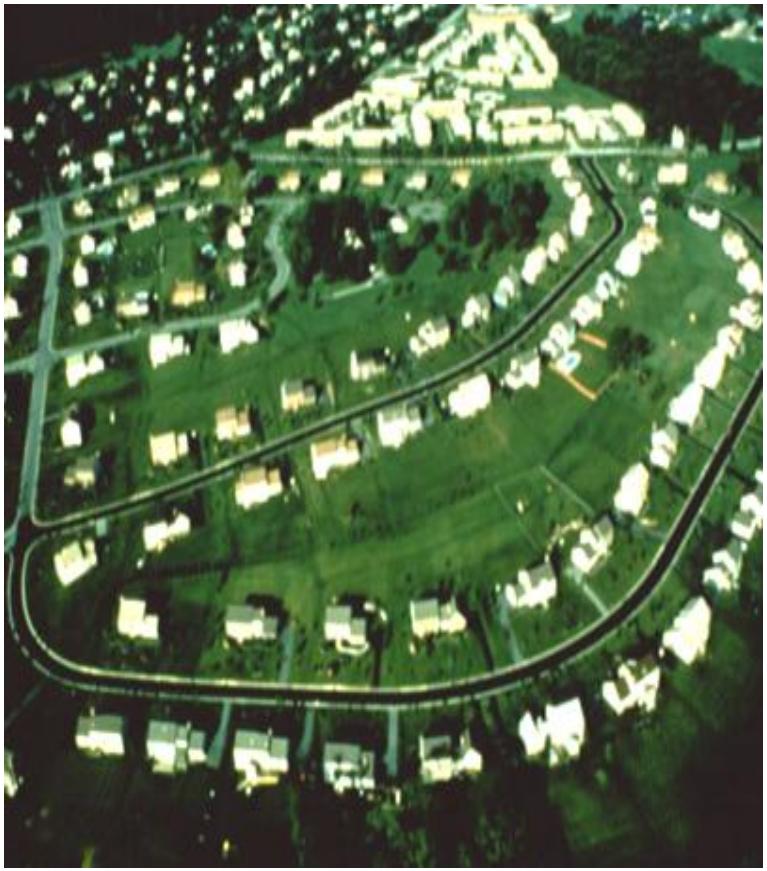
Double Counting ?

- The UNM credits were designed to prevent double counting even if all 4 are used in the same community.
- Acreage treated under the proposed UNM credits will geographically coincide with the treated area of downstream structural urban BMPs
- Mass UNM reductions should be calculated independently of any additional reductions by "downstream" urban BMPs at this time

8. Implementation Issues

UNM Capacity Issues

- Writing UNM plans for 1.6 million acres could outstrip capacity of existing UNM delivery system
- Several panel recommendations to increase cadre of qualified plan writers



UNM Communication Issues

- Need for Bay-wide meeting of urban extension, soil scientists, turf specialists and green industry professionals to craft and deliver a consistent and concise Bay UNM message to homeowners

Research Recommendations

- Monitoring of loads, concentrations and sources of nutrients from lawns w/ and w/o UNM plans
- Surveys of homeowner fertilizer behavior & norms in urban, suburban and exurban locales

CBWM Modeling Refinements

- Ground truth current estimates of extent of pervious land and fertilizer status
- Update unit area fertilization rate in model using improved non-farm sales statistics
- Expand pervious land to include at least two fertilizer management categories (fertilized/non-fertilized)
- Consider additional "Hi Risk" categories if they can be characterized at RB segment scale

9. Next Steps??

- 30 day comment period until Friday Jan 18
- Technical comments to be addressed by CSN, CWP (may need to go back to panel)
- Policy/permitting comments to relevant work group chairs
- CSN to revise report and go thru the WTWG/WQGIT approval process in Feb

All comments are welcome, but panel is especially interested in:

- Better ideas for on-site UNM verification
- Whether the incentive credit for outreach is workable
- Dealing with UNM capacity and delivery issues