Date: March 7, 2018

From: Tom Schueler and David Wood, CSN

To: Urban Stormwater Work Group

Re: Request for a Land Use Credit for Conversion of Turf to Mixed-Open Land Use

VA DEQ has inquired whether the USWG could determine whether it was justifiable to grant a land use credit for allowing managed turf grass to convert over to the new "mixed-open natural" land use that was created for the new Phase 6 watershed model.

1. Definition of Mixed Open Natural Land Use:

The following is the definition for this new land use category based on the Phase 6 model documentation.

Definition of Mixed Open Natural:

> All scrub-shrub and herbaceous and barren lands that have been minimally disturbed (e.g., periodically bush hogged, meadows, etc.), reclaimed, or that have internal and/or regulated drainage. These include active, abandoned and reclaimed mines, landfills, beaches, water body margins, natural grasslands, utility right-of-ways and a portion of herbaceous lands within industrial, transitional (early stages of construction), and warehousing land uses. Also included are potential agricultural lands that were not mapped as either cropland or pasture in the NASS Cropland Data Layers (2008 through 2015).

As you can see, the new category acts likes a "dumpster" where "everything else that is mostly green" gets dumped.

It also acts to shift a portion of the acres in the previous "pervious land cover" category into the mixed open natural (MON) category, thereby reducing the number of acres of the new turf grass (TG) category across the Bay watershed. It is also worth noting that the mixed open category is not defined as an urban land use category.

2. Relative Loading Rates for the Two Land Uses

Table 1: Comparative Loading Rates for Turf Grass and Mixed Open Land Uses [1]

Land Use	Sediment [2]	Nitrogen	Phosphorus
	pounds/acre/year		
Turf Grass	760	11.19	0.86
Mixed Open Natural	4,720	2.45	0.43
Difference (%)	-521	78	50

[1] from most recent CAST output 2013 progress runs
[2] Sediment loading rates based on MS4 average loading rates.

The higher sediment load for MON is believed to be due to the fact the category includes active, abandoned and reclaimed mine lands which were previously simulated to have higher erosion rates than turf-grass (in Phase 5.3.2 model). So a land use conversion from TG to MON would earn a negative credit in the current model. Even if mines were not included in the MON category, it is doubtful that there would be much sediment reduction, given that the UNM expert panel noted that TG was very retentive of sediments.

On the other hand, the nutrient removal credit associated with the conversion of TG to MON is fairly high (50 to 80% -- Table 1). The higher TG loading rates are presumably due to the fact that some fraction of TG is fertilized, whereas MON is generally not. In addition, TG also experiences higher runoff rates due to urban soil compaction and the shallower rooting depths of TG compared to MON.

3. Arguments for Offering Credit

The land use conversion credit would fill an key gap by allowing credit for landscaping BMPS for homeowners, institutions and municipal lands. Currently, communities do not get any credit for converting turf grass into conservation landscaping, urban meadows, Bay-scapes or other natural landscaping practices. Several minimum criteria should be met before credits are granted for the conversion.

- The conversion needs to have a design plan (seeding/planting/tilling, etc) that shows how turf cover will be transformed into a meadow

- Need a minimum maintenance regime to arrest succession and ensure the parcel stays in meadow state (e.g., periodic mowing, controlled burns, etc)

- Most conservation landscapes will be small in area (usually less than one acre in size). This makes it hard to report, inspect and verify the conversions, unless communities have access to reporting software such as the SMART tool.

The other issue involves how the credit is defined. The simplest approach is to apply the nutrient reduction rates shown in Table 1. A more technically defensible approach would be to adapt the methods devised by the urban tree canopy expert panel. Appendix A highlights how the method could be specifically adapted to show nutrient reduction associated with meadow creation using a curve number approach.

4. Arguments Against Offering Credits

There are several strong arguments against offering a land use conversion credit. The first one is that it could devolve into a "Zen credit" where a community gets something for doing nothing at all -- ceasing to mow and allow natural succession to proceed on abandoned turf grass. While this conversion may be desirable, there is no assurance that a future owner or land manager would not revert back to turf grass, especially if the meadow "product" looks scruffy, creates nuisances (ragweed, pests, ticks) or prompts public complaints.

The credit would seem to be a nightmare to report and verify, and unlike tree canopy, cannot be easily measured by remote sensing techniques across the jurisdiction (indeed, the diversity of cover types in the MON category reflects the difficulty in distinguishing among them). It is unclear who would report the practice to whom to get credit, as there are no meadow management agencies at either the local or state level

Appendix A

Dealing with Meadows Using the Approach Developed
by the Urban Tree Canopy Expert Panel

An approach that could be used, was developed by the tree canopy expert panel. They used the CN method to show loading rate changes based on different hydrology characteristics. USDA has a CN for meadows (Table 2-2c) that might be appropriate to substitute into this methodology to come up with a similar protocol. See appendix B in their report to see how they computed the land use changes:

http://chesapeakestormwater.net/download/7222/

Communities do not need to calculate the pollution removal credit in order to report urban tree canopy practices to the state. However, if a community would like to estimate their pollution reduction credit for planning purposes, they may use the following design example[1]:

A locality is planning two tree canopy projects and would like to know how much pollution credit they will earn. The first project will create forest-like conditions on a 2-acre grassy lot in the city. The second project will plant 400 new street trees.

Step 1. *Apply a conversion factor to convert the number of street trees to acres of tree canopy.*

300 trees planted are equivalent to 1 acre of tree canopy coverage.
400 trees * 1/300 acre = 1.33 acres

Step 2. *Calculate the pollution loads prior to the tree plantings.*

The canopy from the street trees will cover the existing "Roads" land use, so you will need to determine the pollutant load from 1.33 acres of Roads. Similarly, the forest planting is converting a grassy lot to forest, so you will calculate the existing pollutant load from 2.00 acres of Turf.

[1] Example is based upon average land use loading rates for the draft final Phase 6 Watershed Model. Average loading rates are subject to change.

Roads have a nitrogen loading rate of 22.87 lbs/acre/year, while Turf has a nitrogen loading rate of 11.19 lbs/acre/year (Table 1).

Street Trees: 1.33 acres * 22.87 lb/ac/yr = 30.42 lbs TN
Forest Planting: 2.00 acres * 11.19 lb/ac/yr = 22.38 lbs TN

Table 1. Average Loading Rates in the Phase 6 Watershed Model

Land Use	Total Nitrogen (lbs/acre/year)	Total Phosphorus (lbs/acre/year)	Total Suspended Solids (lbs/acre/year)*
Turf	11.19	0.86	760
Roads	22.87	0.86	1,880
Other Impervious	18.08	0.69	2,080
Forest	1.68	0.08	140

* Sediment loading rates based on MS4 average loading rates. Sediment loading rates for Non-Regulated and CSS acres are slightly different.

Step 3. *Calculate the pollution load reductions for each tree planting project.*

Table 3. Tree canopy relative land use loading rates based on the underlying land use land cover (Source: Hynicka and Divers 2016)

Land Use	TN Reduction (%)	TP Reduction (%)	TSS Reduction (%)
Canopy Over Turf	23.8	23.8	5.8
Canopy Over Roads	8.5	11.0	7.0
Forest	85.0	90.7	81.6*

*Percent reduction is based on average MS4 land use loading rate for sediment.

For each planting, multiply the pollutant load prior to the planting, by the percent reduction associated with the new land use cover (Table 3). For the street trees, you convert “Roads” to “Canopy over Roads”. For the forest planting, you convert “Turf” to “Forest”.

Street Trees: 30.42 lbs TN * 0.085 = 2.59 lbs TN reduced
Forest Planting: 22.38 lbs TN * 0.85 = 19.02 lbs TN reduced

Step 4. *Repeat steps 2-3 for phosphorus and total suspended solids.*

In this example, the community reduced 2.59 lbs TN for their street tree planting, and 19.02 lbs TN for their forest planting on the grassy lot.