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To: The Urban Stormwater Workgroup

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Re: New Technologies for Inclusion into the Chesapeake Bay Program

On July 25, 2012 the Chesapeake Stormwater Network hosted a “New Technologies Technical Workshop” on the potentially effective new technologies of Floating Treatment Wetlands (FTW) and Algal Turf Scrubbers (ATS) as potential methods for improving water quality in the Chesapeake Bay. This was an opportunity for researchers to present their initial monitoring results and findings in order for the Chesapeake Bay Program’s Urban Stormwater Workgroup to make an informed decision regarding if there is enough independent data to allow for an Expert Panel on these new technologies. The findings from this workshop are outlined in this technical memo to the Urban Stormwater Workgroup.

Floating Treatment Wetlands

Research was presented by four different research groups on the technology of Floating Treatment Wetlands and their ability to reduce and/or remove water quality pollutants associated with the Bay TMDL. Much of the research is ongoing but preliminary results showed that FTWs are a potentially effective new technology for water quality treatment.

There are many variables that impact the performance of FTWs and thus would need to be considered and addressed by an expert panel in order to estimate the effectiveness of FTWs as a best management practice (BMP). Some of those variables are as follows:

- Terminology/nomenclature – definition of FTW
- Technological specifications and design choices
- Method of nutrient removal – plant uptake vs. denitrification
- Permanent vs. temporary
- Plant species options and nutrient removal abilities
- Harvesting and disposal (in the case of temporary systems)
- Passive vs. activated systems
- Long-term maintenance and replacement frequency
- Lifecycle costs
- Applicability for use in offset trading and the risk of additionality

Floating Treatment Wetlands can be implemented in open water systems, stormwater ponds or in aquatic nursery operations. With these varied applications the USWG would need to incorporate aquatic nursery researchers on an expert review panel. The workshop presenters could provide this piece. FTWs appear to be a potentially effective new technology that localities can utilize to help meet their TMDL load reductions. However due to the fact that much of the research is ongoing and will be coming out over the next 9 months it is our recommendation to the USWG that an expert panel be convened no sooner than early 2013.

Algal Turf Scrubbers

Algal Turf Scrubbers® have been actively employed in nutrient removal from flowing waters for over two decades, with several acre field deployments in Florida and Texas and smaller scale capacities in marine aquaria at the Smithsonian Institution.

Several presentations were made documenting pilot study results in the Chesapeake watershed, both brackish and freshwaters, and a wastewater treatment plant outside of New York City. The technology functions through natural algal colonization of plastic mesh that overlies a hard substrate with a 0.5%-2% slope. Nutrient-rich and natural algal containing waters are pumped into the upper end of the scrubber system and allowed to flow across the mesh to a down-gradient outlet. Within days, the natural algae colonize the mesh under the sheet flow and assimilate nutrients from the overlying water into algal biomass. Growth of the algae is very rapid, with a strong temperature and light dependence; maximum rates occur in the summer ($>30 \text{ g/m}^2/\text{d}$), lowest rates in the winter. The accumulating algal biomass concentrates N and P from the water, contributing 1%-5% of algal weight. The algae are harvested weekly during the warmest months, removing accumulated algal tissue for use as biofuels, compost, omega-3 oils, or fertilizer. Importantly, the N and P removed from the scrubber as algal biomass is prevented from entering the bay thereby substantially reducing N and P loads (discussions of uses in and out of the basin could be included in any future considerations of the technology). The N and P removed is quantifiable, and therefore a tradable entity that could provide huge benefits to meeting required load reductions and a stimulant to market-driven nutrient trading.

The technology, although simple, requires a continuous water source and therefore the wet-dry cycle in urban stormwater ponds is not a reasonable habitat for routine use of the ATS®. However, as an extremely effective nutrient removal technology for flowing waters, it could prove invaluable to watershed load reductions for systems unable to implement sufficient practice densities to provide detectable declines in N or P in receiving waters. Therefore, the USWG strongly encourages the Water Quality GIT to continue exploration of the technology as a practical and efficient large-scale BMP for nutrient-enriched creeks, streams, or tributaries, whether from point or diffuse sources. Implementing the BMP at acre-to-multi-acre plots would provide sufficient load reduction to meet most TMDL limits. Additionally, the WQ GIT should explore costs per pound of nutrient removed but initial back-of-the-envelope calculations at the USWG meeting (J. McGrath, UMD) indicated use of open land could generate

approximately \$30,000/acre, much more profitable than any crop from regional agricultural croplands.

Variables to be examined prior to selection of the ATS® technology as a CBP BMP include:

- Scale issues: Acres necessary for loads to be reduced
- Siting
- Start-up, Operations and Maintenance, Lifecycle costs
- Temporal shifts in nutrient removal
- Algal harvesting and use (possible toxic species, contaminant accumulation; in/out of watershed) vs. disposal
- Applicability for use in offset trading

Algal turf scrubbers (ATS®) provide large quantifiable removals of N and P from nutrient-rich waters and hence, the Water Quality GIT is encouraged to undertake a multi-workgroup assessment of the technology as a large-scale BMP for future nutrient removal in the watershed.

All of the resources from this workshop as well as these recommendations will be added to the Chesapeake Stormwater Network website here: www.chesapeakestormwater.net.