Algal Turf Scrubbers – A Biomimicry

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 $g/m_2/d$), 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.

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.