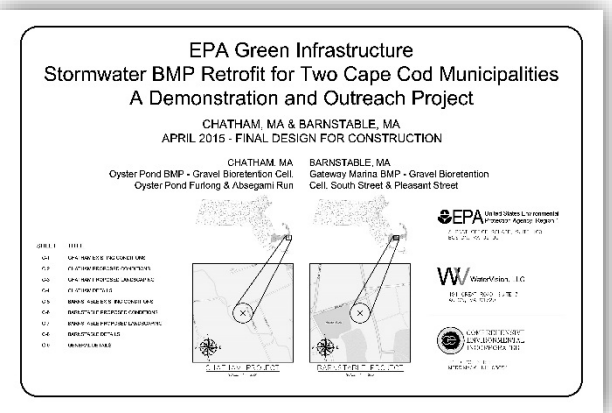
Nitrogen Removal Focus of CEI Design for EPA



Throughout 2014 and 2015 CEI as part of an on-call team worked with the U.S. Environmental Protection Agency (EPA), the Town of Chatham, and the Town of Barnstable (Hyannis) to design and install Green Infrastructure (GI) Stormwater Best Management Practice (BMP) Retrofit Education and Outreach Projects consisting of hybrid bioretention and gravel wetland systems installed in each town. This project helps treat stormwater runoff and reduce nonpoint source pollution from entering the nearby nitrogen-impaired waters of Oyster Pond (Chatham) and the Hyannis Inner Harbor (Barnstable). Anticipated to come online in the summer of 2016, this project will help reduce nitrogen and other water quality parameters while also serving as a demonstration project to help encourage area developers, planners and engineers to use green infrastructure techniques similar to this in future designs.

In Chatham, construction will entail installation of a new deep sump manhole in Oyster Pond Furlong for sediment pretreatment removal. The manhole will be equipped with a diversion wall to direct small storms into a gravel wetland cell where it is exposed to aerobic bacteria for nitrogen conversion. Stormwater then percolates through a soil layer while plant matter provides further nutrient uptake through the root systems where it enters a zone of anaerobic conditions. Here, anaerobic bacteria provide further nitrogen removal via conversion of oxygenated nitrogen to nitrogen gas. Finally, treated stormwater will be released in a controlled manner via a new outlet control structure. Addition design elements include an impermeable membrane and perimeter drain around the basin to prevent mixing of groundwater with stormwater. A maintenance road will also be constructed to provide access to site features.

The Barnstable design will be similar to the Chatham design. A new deep-sump manhole with a diversion wall will be installed to intercept the existing drainage trunk line adjacent to the site. From there, stormwater will flow into a single wetland cell providing surface aerobic and subsurface anaerobic conditions for nitrogen removal and conversion. Treated stormwater will then be released back into the existing drainage line where it will discharge into Hyannis Inner Harbor. The basin will be extensively vegetated through the planting of drought-tolerant, native planting plugs and shrubs.

Both sites have been designed to bypass large storm events via both the existing stormwater infrastructure and integrated bypass systems. Finally, influent, effluent, and

stormwater bypasses at both sites will be monitored to evaluate select water quality parameter removal efficiency of this BMP.

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