APPENDIX-A TECHNICAL INFORMATION FOR USE AND APPLICATION OF PERFORMANCE CURVES FOR INDICATOR BACTERIA.

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MEMORANDUM

DATE: January 13, 2020

SUBJECT: Technical Information for Use and Application of Performance Curves for Indicator Bacteria developed under Task 4D of the Tisbury Ma Impervious Cover Disconnection Project (9/30/2019)

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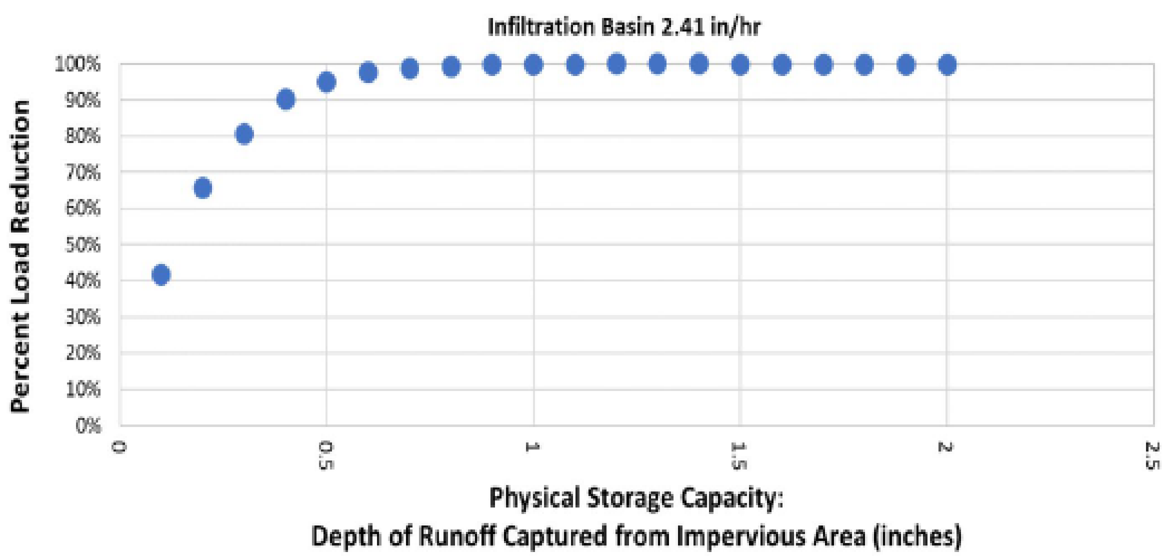
The purpose of this memorandum is to is to provide information and background on performance curves recently developed to estimate indicator bacteria reduction of various Stormwater Control Measures (SCMs) implemented in the New England Region. These indicator bacteria performance curves are described in the Technical Memorandum entitled "Develop Planning Level Green Infrastructure (GI) SCM Performance Curves for Estimating Cumulative Reductions in SW-Related Indicator Bacteria (Task 4D)", dated September 30, 2019 (hereinafter, "Technical Memorandum").

Currently, EPA Region 1 has adopted performance curves for a variety of SCMs estimating the removal of Total Phosphorus, Total Nitrogen, Total Suspended Solids, Zinc and water volume. The performance curves for these pollutants (and volume) are detailed in Stormwater Best Management Practices Performance Analysis (2010) and a 2015 BMP performance calibration approach sensitivity analysis performed by Tetra-Tech for EPA. The performance curves for the parameters mentioned above have been updated and validated through SCM monitoring since 2010 and are currently used for compliance purposes in the 2016 Massachusetts Small Municipal Separate Storm Sewer System (MS4) General Permit and the 2017 New Hampshire Small MS4 General Permit. In general, performance curves provide pollutant load reduction estimates for structural SCMs. A performance curve tells a stormwater practitioner how much of a given pollutant (e.g., nitrogen) may be controlled on an average annual basis *simply based on the size of the SCM.* This is important because the practitioner need not spend time and resources monitoring SCMs to assess pollutant removal (i.e., treatment) efficiency. Rather, practitioners need only (a) construct SCMs to specification and (b) operate and maintain the SCMs to function as designed.

To-date, there has been limited information related to the performance of many SCMs regarding bacteria reduction. While bacteria reduction strategies should focus on the well-documented bacteria reduction benefits of infiltrating stormwater, stormwater practitioners can benefit from a greater level of detail regarding bacteria reduction performance of other SCMs. Therefore, EPA funded development of performance curves for indicator bacteria to further the understanding of bacteria reduction performance of a variety of SCMs as described more fully in the Technical Memorandum. *Currently these indicator bacteria performance curves have* ***no*** *regulatory import.* Rather, they represent an important technical resource for stormwater practitioners, in part because the presence of bacteria and pathogens in stormwater poses unique human health and economic risk. This is particularly so for municipalities with surface waters used for recreation such as those located along coastlines where swimming beaches and shellfishing resources may be adversely impacted by pathogenic organisms potentially associated with indicator bacteria in stormwater discharges.

The figure below, excerpted from the Technical Memorandum, is the indicator bacteria performance curve for an infiltration basin SCM with a design infiltration rate of 2.41 inches per hour (typical Hydrologic Soil Group A). Simply on the basis of the performance curve, a practitioner can expect the SCM to control about 90% of the indicator bacteria load for a Design Storage Volume (DSV) sizing of about 0.4 in. of runoff depth from the contributing impervious cover (IC) area. The DSV represents the maximum design storage volume capacity of a SCM to hold water (i.e., equals volume



of potential ponding and aggregate pore space of the SCM). Moreover, performance curves emphasize the opportunities that relatively small design capacity SCMs offer to make progress towards achieving water resource goals. This information is particularly valuable for installing SCMs in already-built environments (i.e., retrofitting) to manage IC runoff. In other words, the performance curves tell the practitioner to not limit investigations to consider only conventional SCM design capacities (e.g., water quality volume of 1 inch) for retrofitting but to expand the analysis to consider all opportunities where smaller design capacity SCMs can be installed. This flexible, distributed GI approach for retrofitting the built environment can potentially save communities significant amounts of money on implementation while making the stormwater system more resilient.

Unlike performance curves developed for Total Phosphorus, Total Nitrogen, Total Suspended Solids, Zinc, and volume reduction discussed above, the performance curves for indicator bacteria in the Technical Memorandum are based solely upon the available literature and data contained in the International BMP Database (available at BMP Database). As such, the indicator bacteria performance curves have not been developed using models specifically calibrated for individual SCMs with detailed performance data but are based on models calibrated to best align with the body of the information in the literature. Nonetheless, EPA believes the indicator bacteria performance curves represent a more accurate estimation of SCM performance for bacteria removal for varying design capacities in New England than the generalized information contained in the International

BMP Database. In employing these indicator bacteria performance curves, the following should be kept in mind:

- the indicator bacteria performance curves may be used to estimate annual bacteria load reductions from planned or already installed SCMs;
- the indicator bacteria performance curves may be used as an educational and informational tool for SCM performance-related bacteria reduction;
- the indicator bacteria performance curves should not be used for sizing SCMs to meet a bacteria concentration or load-reduction water quality target;
- the indicator bacteria performance curves are applicable to E. coli or enterococcus indicator bacteria;
- data contained in the Technical Memorandum should not be used to estimate land use bacteria loadings unless it is supported by local data and information; and
- more site-specific data are needed on SCM performances related to bacteria in order to refine and validate the indicator bacteria performance curves to more accurately reflect the performance of specific SCMs in the New England region and further support their potential use to demonstrate compliance with any applicable bacteria concentration or load-reduction water quality target.

Lastly, the following excerpt from the Executive Summary of the Technical Memorandum is provided to clarify and reinforce the aforementioned:

> Several factors may contribute to bacteria removal efficiency within an SCM with the major mechanisms being physical processes including sedimentation, sorption, and filtration. However, other factors impacting bacteria removal include SCM holding time, temperature, sunlight, salinity, and predation. Careful consideration of SCM types and associated processes is necessary when applying these curves to specific sites and watersheds. For example, it is well documented that infiltration practices are highly effective at achieving bacterial reductions as runoff exfiltrates through subsoils. Consequently, practitioners may confidently select infiltration SCMs to address excessive SW bacteria loading wherever site conditions are favorable for infiltration. However, there is greater uncertainty in bacteria removal performances associated with flow-through SCMs that rely primarily on sedimentation or vegetative filtering because of the potential bacterial regrowth and subsequent entrainment during storm events resulting in the SCM becoming a source of bacteria to surface waters. Generally, users should first consider infiltration SCMs followed by filtering systems and last other SCMs to address excessive SW bacterial loading.
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> While such due diligence can help facilitate the implementation of SCMs that can achieve the estimated bacteria load reductions given local conditions, there is still a large amount of uncertainty involved in estimating both bacterial loading and long-term cumulative performances of SCMs especially for flow-through SCMs. The removal curves provide estimates of bacterial load removal efficiency based on the literature rather than detailed model calibrations of individual SCMs with extensive performance data. Consequently, the curves represent planning level information for developing management plans and quantifying potential benefits. SCMs intended to achieve the reductions presented in Opti-Tool should be installed and maintained in a manner that promotes the identified bacteria removal processes and mechanisms. Regular inspections and ambient water quality monitoring are recommended to help ensure that the SMCs are operating as expected.