UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

August 4, 2020

Mr. Carlton M. Ray
Director, DC Water Clean Rivers Project
District of Columbia Water and Sewer Authority
500 Overlook Avenue, SW
Washington, District of Columbia 20032
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Re: **District of Columbia Water and Sewer Authority**
Rock Creek Sewershed Green Infrastructure Practicability Report and Post Construction Monitoring Report No. 1

Dear Mr. Ray:

The District of Columbia Water and Sewer Authority (DC Water) submitted its Practicability Report and Post Construction Monitoring Report No. 1 for the Rock Creek Sewershed Green Infrastructure (Report) on June 12, 2020 in accordance with Appendix F, Section II. D. 7. of its Amended Consent Decree (CD). In the Report, DC Water presents a hybrid approach, combining components of the green and gray infrastructure outlined in the CD. The U.S. Environmental Protection Agency (EPA) has reviewed the Report and enumerates its comments, questions, and recommendations below.

Comments, Questions, and Recommendations

1. Throughout the practicability assessment, DC Water uses the 1.2-inch green infrastructure (GI) capture criterion. What percentage of the average annual rainfall will be captured under DC Water's 1.2-inch capture criterion?

2. Figure ES-2, page ES-4: The Downspout Disconnection bubble states that 1.2 acres of impervious area has been managed and more than 280 homes have participated. Based on EPA's calculation, this equates to approximately 186 square feet of impervious area per home. This seems a small amount of impervious area per home. Please provide explanation on DC Water's calculation for downspout disconnection for imperious area.

3. Section 1.2.3: The "Retention Standard" ignores runoff from pervious surfaces and is also a tributary to the drainage system. Depending upon building density and soil conditions, the runoff from pervious surfaces can be significant, particularly during larger storms. This may explain part of the shortfall in GI performance noted in Table ES-3 for

the Rock Creek Sewershed. Explain why DC Water ignored the runoff from pervious surfaces.

4. Section 2.1.2: The first paragraph reports that several improvements were constructed as part of the Kennedy Revitalization Project, some appear to be compliance-related and other improvements non-compliance-related. DC Water should explain how project costs were allocated between compliance-related construction and non-compliance-related construction, and more importantly, how the inclusion of non-compliance-related construction affects overall project costs and the 30-year Net present value (NPV) comparison of "all green," "all gray" and "hybrid green/gray" alternatives.

5. Section 2.1.3: The first paragraph reports several improvements constructed as part of the GI Challenge Parks Project, some compliance-related and others non-compliance-related. Explain how project costs were allocated between compliance-related construction and non-compliance-related construction.

6. Section 2.1.7, Figures 2-9 and 2-10: The first paragraph reports that there are 4,436 downspouts in the Rock Creek and Potomac pilot areas and 36% (1597) were already disconnected. An additional 47% (2085) could not be disconnected for siting reasons. This leaves only 17% (754) of the downspouts that could be disconnected in the pilot areas. The paragraph further reports that there are approximately 13,200 downspouts in the 2018 and 2019 project areas, also shown in Figures 2-9 and 2-10. Of these, 58% (7660) downspouts were already disconnected and 27% (3560) of the downspouts could not be disconnected for siting reasons. This leaves only 15% (1980) of the downspouts that could be disconnected in the 2018 and 2019 project areas. This data suggests that future downspout disconnections, while still beneficial to overall combined sewer system performance and particularly in localized areas, may not have a major influence in reducing overall CSO volumes or frequencies. Explain how DC Water will be able to meet its CSO volumes or frequencies with the available downspouts that can and will be disconnected.

7. Table 2-3 page 2-15: It appears that the GI design parameters were significantly more flexible for Potomac Basin projects versus Rock Creek Basin projects. Was this due to "lessons learned" and how would Rock Creek Sewershed project costs have been affected if the more flexible design standards had been applied? Also, please explain the values included under the "Contributing Drainage Area (CDA)" line item.

8. Figure 2-11 page 2-17: What are the range of depths, stone gradation and void ratio of the aggregate stone layer? Why is a "waterproofing membrane" placed underneath the aggregate stone layer? This membrane seems to take away potential exfiltration from the storage zone, which could otherwise enhance stormwater capture. Is the groundwater level so high at the pilot project construction sites that it would intrude into the storage zone?

9. Section 2.4: The performance acceptance testing described should be repeated every 3 to 5 years to determine the overall effectiveness of DC Water's maintenance practices and

the ultimate service lives of the GI facilities installed. It is noted that such tests are not specifically mentioned in Table 2-4. What were the range of permeabilities of the native sub-soils and depths to groundwater at the sites of the bioretention facilities?

10. Section 2.7.2: EPA concurs with the overall approach for comparing pre- and post-construction monitoring data presented. However, based upon the information presented in Appendices E and K, EPA has a general concern that DC Water did not deploy enough rain gauges, which may have caused some of the variations observed in measured versus modeled peak flow rates for the flow-metered areas. Provide an explanation why DC Water did not use additional rain gauges.

11. Section 2.8: The construction costs for the various public sector GI projects listed ranged from $538,700 per acre for AlleyPalooza to $896,000 per acre for the RC-A project. These costs are somewhat higher than national averages for similar work as reported by Water Environmental Federation (WEF) in its 2015 article entitled: "The Real Cost of Green infrastructure" "https://stormwater.wef.org/2015/12/real-cost-green-infrastructure/" where construction costs ranged from $150,000 per acre to $500,000 per acre ($180,000 to $560,000 per acre in 2020) depending upon the particular GI measure implemented. DC Water's GI cost compared to other cities in 2020 dollars seem to be higher. Explain why DC Water's GI cost were higher than the WEF's cost.

12. DC Water should submit a list of projects they have planned for the hybrid approach that combines components of the green and gray infrastructure for Rock Creek sewershed. Also, how does DC Water plan future projects beyond the ones they already have planned. DC Water should include its adaptive management process for planning future projects.

13. Section 3.3.8 page 3-15: EPA generally concurs with the inclusion of a "safety factor" in the sizing of "gray" (and "green") infrastructure. Please explain the basis for the 1.4 safety factor included in Table 3-3.

14. The operation and maintenance (O&M costs) presented in Table 3-6 are based upon expenses actually incurred by DC Water for similar construction and as such should be valid to determining O&M for future construction. EPA concurs with the annual rehabilitation cost assumptions presented in Table 3-7 for CSO storage. However, DC Water's assumptions regarding rehabilitation frequencies and anticipated rehabilitation expenditures presented for GI measures appear optimistic. Higher GI infrastructure long-term renewal costs would raise the NPV 30-year cost of Alternative 2 presented in Table 3-8. Explain why the GI renewal costs are higher.

15. Section 4 and Section 5. These Sections present a new alternative not addressed in the amended Consent Decree. DC Water concluded that, "*DC Water's analyses indicate that to manage 365 impervious acres, there is inadequate low-cost GI in the sewershed and that significant amounts of high cost GI would be required.*" This conclusion is supported in Table ES-4, which shows that an "all green" approach would have a NPV cost of $407M over 30 years, versus an "all gray" solution, which would have an NPV

cost of $211M over 30 years. In comparison, Table ES-5 (and Table 4-1) shows that a hybrid plan of both "gray" and "green" infrastructure would have a slightly lower NPV cost than the "all gray" plan of $207M over 30 years and a significantly lower initial capital cost of $133M versus $188M for the "all gray" solution, and as such will provide a significantly lower up-front financial impact on rate payers.

16. The Rock Creek Practicability Assessment does not provide any technical details of the elements of DC Water's hybrid plan other that those presented in Table 5-1. Please provide the following information:

    a. Locations, configurations, and O&M procedures of the "gray" facilities that will provide 4.2 MG of storage, including operational procedures and timing of release of stored combined wastewater.

    b. Types and locations of "green" measures that will provide 3.0MG of storage, including operational procedures and timing of release of stored stormwater runoff.

    c. Inventory of existing facilities receiving DC Department of Energy and the Environment (DOEE) MS-4 credit for 2.3 MG of storage, including operational procedures and timing of the release of stored stormwater.

17. Appendix E - Model Documentation - Green Infrastructure Modeling for RC-A Sewershed: This Documentation presents the hydraulic model calibration results for the RC-A portion of the Rock Creek Sewershed, and the following are EPA's comments regarding this documentation:

    a. Appendix E Section 2.3 states that a single gauge was used for rainfall monitoring in the 136-acre RC-A Sewershed. Appendix E Figure 2-2 shows that this gauge was located at the Washington Latin School, which is on the far southwest edge of the RC-A area. In EPA's professional experience, this rain gauge should have been placed more centrally in the RC-A area and a second gauge provided to validate the results of the first gauge. The lack of sufficient rainfall data may explain DC Water's challenges in attempting to match measured and modeled peak flow rates as discussed under EPA's Section 3 comments. EPA recommends following the Chartered Institution of Water and Environmental Management (CIWEM) Code of Practice for the Hydraulic Modelling of Sewer Systems (2002), which suggests 1 rain gauge plus one additional rain gauge for every 0.4 to 0.8 square miles of tributary area for areas having average to flat ground slopes, respectively. Therefore, under the CIWEM guidance, there should have been 2 rain gauges in the RC-A Sewershed. EPA recommends that DC Water's future post-construction monitoring efforts include at least two rain gauges any area being flow-metered, plus sufficient additional rain gauges to meet CIWEM criteria.

    b. Appendix E Section 3: Appendix E Table 3-1 shows that the input data for the updated Pre-construction model was substantially up graded from the 2016 model, therefore, this updated model should yield significantly more accurate results, which may explain the under-performance of GI facilities from pre-construction predictions as presented in Table ES-3, Table 3.2 (main report) and Appendix E Table 4-1. The relative improvement in model accuracy is also revealed through comparison of pre-construction linear regression R^2 values for event volumes presented in Appendix E Figure 3-1 versus the post-construction R^2 values for event volumes presented in Appendix E Figure 3-5. Appendix E Section 3.3 reports that additional model calibration resulted in even better correlation of measured versus modeled event volumes as demonstrated by the R^2 values shown in Figure 3-9. However, it appears that even the post-construction model has difficulty in predicting peak flow rates as demonstrated by the inconsistent post-construction R^2 values for peak flow rates presented in Figure 3-6. These variations may be due to lack of sufficient rainfall data as noted under EPA's comments regarding Section 2 above. The model variations in peak flow rate are not likely to affect the sizing of "gray" or "green" storage facilities but may affect the sizing of connecting conduits.

c. Appendix E Section 4: Appendix E Table 4-1 presents the post-construction model results. As shown under the Average Year Rainfall Conditions line item, the predicted volume reduction using post-construction monitoring data was 18.7% versus the predicted volume before construction of 31.8%. It is not possible from the information presented to determine the effects of the enhancements in hydraulic modeling regarding prediction of GI facility performance versus actual shortfalls in that performance. However, DC Water should take into consideration the lesser actual performance of GI facilities in the sizing of future improvements.

18. Appendix K - Model Documentation - Overflow & Green Infrastructure Modeling for Piney Branch Sewershed: This documentation presents the hydraulic model calibration results for the Piney Branch portion of the Rock Creek Sewershed, and the following are EPA's comments regarding this documentation:

a. Appendix K Section 2.3 states that a single gauge was used for rainfall monitoring in the 2,330-acre Piney Creek Sewershed or one gauge for nearly 4 square miles. EPA believes there should have been more rain gauges in the Sewershed. EPA recommends following the CIWEM Code of Practice for the Hydraulic Modelling of Sewer Systems (2002), which suggests 1 rain gauge plus one additional rain gauge for every 0.4 to 0.8 square miles of tributary area for areas having average to flat ground slopes, respectively. Therefore, under the CIWEM guidance, there should have been as many as 11 to as few as 6 rain gauges in the Piney Creek Sewershed. The lack of sufficient rainfall data may explain DC Water's challenges in attempting to match measured and modeled peak flow rates as discussed under EPA's Section 3 comments (see Response 18(b)). EPA recommends that DC Water's future post-construction monitoring efforts include at least two rain gauges at any area being flow-metered plus sufficient additional gauges to meet CIWEM criteria.

b. Appendix K Section 3: Regarding hydraulic model calibration, the first paragraph on page 8 of the Model Documentation states: "*The overall modeled overflow* *volume exceeds metered overflow volume by 3.4% for the calibration period. The model tends to over-predict peak flows consistently.*" The statement is confirmed by Appendix K Table 3-1 which shows a high level of correlation between metered and measured flow volumes over the four metered at Outfall 049. This Outfall has three weirs plus a bypass pipe, therefore, EPA requests that measurements from all must be summed to determine actual CSO flow rates and volumes.

c. The over-estimation of peak flow rates is shown in the scatter graph presented as Appendix K Figure 3-4. Since the proposed CSO abatement solution for the Rock Creek Sewershed is a hybrid mix of conventional wastewater storage facilities and GI, storage volume is the primary design consideration. Therefore, model calibration appears satisfactory for evaluating storage facility sizing. As noted above, the Model Documentation reports that peak flowrates are over-estimated. This over-estimation will yield conservative sizing of any conveyance facilities that must be constructed to place storage facilities into service. Should extensive conveyance facilities be required, DC Water may wish to recalibrate its hydraulic model to more accurately predict peak flow rates.

d. Appendix K Section 4: The second bullet point states: "*To meet the regulatory target of one overflow per year, storages were based on the volume of the 4th overflow event highlighted in the table below for each of the baseline and GI scenarios for all of 1988-1990.*" However, if facilities are sized for the fourth largest event, then events 1 through 3 will produce CSOs. Please explain basing the sizing of storage and GI facilities for the fourth largest event rather than the second largest event, when the compliance criterion is one overflow in the average year.

Once DC Water has reviewed this letter, EPA would like to schedule a call to discuss the Agency's comments. If you have any questions, please do not hesitate to contact Mr. Steven Maslowski, of my staff at (215) 814-2371 or via email at: maslowski.steven@epa.gov.

Sincerely,

STACIE PRATT

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