CIVIL DESIGN GROUP, LLC
ENGINEERING. LAND USE. PLANNING. PERMITTING.

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June 23, 2020

Mr. Vincent J. Roy
Executive Director
Sudbury Water District
P.O. Box 111
Sudbury, MA 01776

Re: ***Cold Brook Crossing***
Stormwater Management Peer Review
Response to Comments

Dear Mr. Roy:

Civil Design Group, LLC (CDG) is in receipt of the review letter by Dr. Edward T.T. Chiang, P.E., Ph.D., dated June 10, 2020, for the above-referenced project. Our responses are provided below in **bold** following each of Dr. Chiang's comments:

1. Most storm water management studies are for the determination of possibility of flooding issue, but this project, its purpose should be the ground water pollution protection issue, due to the project site is so closed to the Town of concord and the Sudbury Water District water supply wells.

   The project has been designed to comply with Massachusetts Department of Environmental Protection's ("DEP's") Stormwater Management Handbook ("the Handbook"), Standard 6 of which pertains to discharges that are located within the Zone II of a public water supply. Standard 6 requires the use of specific source control measures, pollution prevention measures, and structural stormwater best management practices that DEP has determined to be most suitable for managing discharges within a Zone II.

2. The report indicates that the water quality control shall depend on the WQU, but no detail design of the WQU. Water quality parameters for stormwater comprise a long list and are classified in many ways, but the important items can impact groundwater are: nutrients, metals, chemical, biological, toxic, nontoxic, and others. The proposed WQU may capable to meet the U.S. Water Pollution Control Acts which specify the restoration and maintenance of the chemical, physical, and biological integrity of the nation's water to meet the act's interim fishable and swimmable numeric goals but not to the drinking water quality. Assume this is the feasible treatment can be accepted, the question is the capacity of WQU that what is the quantity (rate of flow) of water can pass it?

   As noted above, the project has been designed to comply with the Handbook, Standard 4 of which addresses water quality. The water quality treatment Best Management Practices ("BMPs") utilized on this project including the water quality units ("WQU's") have been very carefully and deliberately selected to meet this standard. CDG's *Stormwater Management Report for Cold Brook Crossing*, dated March 11, 2020, quantifies the water quality treatment

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associated with each of the selected BMPs and documents the level of treatment associated with each of the WQUs.

3. The capacity of WQU should be determined for each proposed WQU. Too large of water quantity passing through a WQU, it may not be able to control the water quality for it design for. For example: On system #1, refer to plan, only one WQU was proposed. It shall be located at DMH-55. The peak flow passing through is 23.89 cfs. With 24 inch diameter pipe, the flow velocity, assume pipe flow full, is 7.6 ft per sec. This velocity is much higher than erosion velocity. Flow at this velocity goes into a DMH. It will become turbulence and WQU can not function as it should.

   As provided on this project, one properly-sized WQU at the downstream end of each pipe network, immediately upstream of each infiltration BMP, is consistent with the requirements of the Handbook and is standard industry practice. CDG's *Stormwater Management Report for Cold Brook Crossing*, dated March 11, 2020, provides treatment capacity and flow documentation for each of the proposed WQUs.

4. The results from the Auto CAD computer program analysis have some problem. I can accept that the total flow quantity reduction when two pipe joint together at a DMH, its outflow is less than the sum of two inflows, which may due to the time of concentration varies thus the two peak flow are not occur at the time, but I can not accept the flow rate reduction when flow passing through a DMH with no outlet. It is against the principle of hydraulics. This only can happy if the piping system has leak. For example: System #1, Line 5 has flow rate of 11.71 cfs but the down stream Line 4 only has flow of 11.49 cfs, a 1.88% flow reduction. Same as Line 12 to Line 11, flow reduced from 7.54 cfs to 7.27 cfs, 3.58% flow reduction. There are so many un-reasonable flow reductions. Flow reduction may not impact the water quality issue, but it may cause problem for sizing the leaching facility or detention/retention basin and cause overflow problem.

   The stormwater pipe networks for this project have been sized to handle a "Rational Method" storm event representative of an extremely intense downpour that generates a very large volume of runoff in a relatively short amount of time. Hydraflow Storm Sewers is an industry standard software utilized for this purpose. The software utilizes the system time of concentration ("Tc") for determining flow in each line. For lines with flow added at the upstream end, the system utilizes a Tc of 6 minutes. For lines that do not add flow at the upstream end, such as system 1 lines 4 and 11, the software reevaluates the system Tc by adding the pipe travel time to it. This results in a slightly lower system intensity and hence slightly lower flow rate on the downstream line, the difference of which is considered negligible and not expected to have any impact on the pipe sizes, particularly since the Tc is set back to 6 minutes at any downstream junction where additional flow is added to the system.

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Recommendation:

It is recommended that assume WQU does meet the treatment for water quality purpose, more WQU should be installed in the system. The reason is to avoid turbulence flow passing the WQUs.

1. Each WQU should sized based on inflow and make sure the passing through velocity is in the range of design standard.

   CDG's *Stormwater Management Report for Cold Brook Crossing*, dated March 11, 2020, includes documentation that each WQU has been sized to treat the 1" water quality volume storm as required by DEP for discharges within a Zone II of a public water.

2. On system #1 (Refer the plan) add two WQUs, one at DMH-51 the other at DMH-43.

   An appropriately-sized WQU (DMH-55) has been provided downstream of DMH-43 and DMH-51, and as such we do not see a technical justification or benefit to adding water quality units to these upstream manholes. As proposed for this project, providing one properly sized WQU at the downstream end of each pipe network immediately upstream of the infiltration BMP is consistent with the requirements of the Handbook and is standard industry practice.

3. On System #2 also add two WQUs, one at DMH-7 the other at DMH-13

   Similar to the response above to recommendation #2, an appropriately-sized WQU (DMH-16) has been provided downstream of DMH-7 and DMH-13 and as such, we do not see a technical justification or benefit to adding water quality units to these upstream manholes.

4. System #3 is fine with the proposed one WQU. ·

   No response required.

5. System #4 is confusing. The plan and the computer calculation sheet are not mach. Based on computer sheets, flow from DMH-40 goes to SIS-7and CB-SIS-7A also goes to SIS-7. · That means the outfall is SIS-7.

   This is correct, DMH-40 and CB-SIS7A both discharge to SIS-7. SIS-7 is the outfall.

6. System #5 need to add one WQU at DMH-33.

   Similar to the response above to recommendations #2 and #3, an appropriately-sized WQU (DMH-35) has been provided downstream of DMH-33 and as such, we do not see a technical justification or benefit to adding a water quality unit to this upstream manhole.

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We trust the responses provided above and the enclosed plans and documents sufficiently address the comments expressed by Dr. Chiang. Please feel free to contact our office should you have any questions or required further clarification.

Respectfully Submitted,
CIVIL DESIGN GROUP, LLC

Matthew A. Leidner, P.E.
Principal