Attachment 11:

Sea level rise and groundwater impact on hydraulic design of stormwater management measures for the Mid-Currituck Bridge, February 4, 2020

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MEMORANDUM

To: **Meeting Attendees**

From: **John Dorney**

Date: **February 4, 2020**

Subject: **Sea level rise and groundwater impacts on hydraulic design of stormwater management measures for the Mid-Currituck Bridge**

STIP No. R-2576

A meeting was held on January 21, 2020 at the NCDOT Century Center. The purpose of the meeting was to discuss questions that have been raised by the environmental resource and regulatory agencies (primarily the NC Division of Coastal Management) as to the long- term effect of groundwater rise, driven by sea level rise in the Albemarle Peninsula of North Carolina primarily, as it relates to the proposed Mid-Currituck Bridge. The individuals in attendance at the meeting included:

- Andy McDaniel – NCDOT Hydraulic Unit
- Brian Lipscomb – NCDOT Hydraulics Unit
- Paul Atkinson – NCDOT Hydraulic Unit
- John Conforti – NCDOT Project Management Unit
- Jennifer Harris – NCTA/HNTB
- Tracy Roberts – NCTA/HNTB
- John Dorney – Moffatt & Nichol
- Roy Bruce – Lochner

The basic concern is that the required separation from the top of the seasonal high-water table to the bottom of a particular constructed stormwater management measure may be gradually reduced as sea level rise occurs over the coming decades in this area. The concern is that if that occurs, the effectiveness of the stormwater management devices put into place for this project may be reduced, potentially resulting in increased pollutant loads from the highway and bridge facility into local waters.

While it is true that sea level rise has occurred and will continue to occur in the Albemarle Peninsula, this future impact to the Mid-Currituck Bridge itself has been modeled and accounted for in the bridge design (Moffatt & Nichol, 2019). As local sea level gradually rises over the next several decades, it is generally true that the local seasonal high-water table level will also rise, but probably at a reduced rate since groundwater levels generally reflect the local surface water. The effect diminishes as the distance from the sea and site elevation increases (Fetter, 2001; pages 327-337). Therefore, there is not a one-to-one correlation between sea level rise and the associated groundwater rise (in other words, if sea

level rises one foot, then the groundwater rise will likely be less than one foot). It is certainly possible to model the future interaction of the rising sea level and the associated rise in groundwater levels but to do so accurately would require a great deal of site-specific information to calibrate the model. Without that information, any modeling effort would be largely driven by assumptions instead of calibrated site-specific data. Additionally, uncertainty of the rate of sea level rise over a decadal time period would further reduce the usefulness of such a model. The presently designed stormwater management measures have been designed per the NCDOT Stormwater BMP Toolbox or with guidance provided by the Hydraulics Unit and the NC Department of Environmental Quality (DEQ) – Division of Water Resources (DWR).

Instead of a modeling effort, the NC Turnpike Authority (NCTA) and NC Department of Transportation (NCDOT) will follow the existing Stormwater BMP Inspection and Maintenance Program protocols as required through the Department's National Pollutant Discharge and Elimination System (NPDES) permit (NCS000250). The approved NCDOT Stormwater Control Inspection and Maintenance Manual is available on the internet at: https://connect.ncdot.gov/resources/roadside/EnvironmentalOperationsDocuments/Stormwater%20Control%20Inspection%20and%20Maintenance%20Manual.pdf.

In summary, under the current approved processes, NCDOT tracks all stormwater Best Management Practices installed on NCDOT property across the state using the Stormwater Control Management System (SCMS), described in Section 4.5 of the I&M manual. The manual also includes an inspection process which requires the Division Roadside Environmental Engineer or their delegated staff to conduct the inspections (typically annually), rate the device on a five tier scale and then propose and implement remedial action for those devices in the lowest two tiers that are no longer functioning as designed. The data from these inspections is utilized by NCDOT staff for management and reporting activities. NCDOT produces an annual report and a permitting agency can request an audit if desired. It is recommended that this process be cited in the upcoming Permit applications for the Mid-Currituck Bridge project in order to address the regulatory agency concerns about this issue. Information on the process could then be incorporated by reference into required state and federal approvals for this project.

References:

Fetter, C.W., Jr. 2001. Applied Hydrogeology. Fourth Edition. Prentice Hall Publishing Company.

Moffatt & Nichol. August 19, 2019. Technical Memorandum, Mid-Currituck Bridge—Sea Level Rise.

North Carolina Department of Transportation. Stormwater Control Inspection and Maintenance Manual - NCDOT-HSP-2010-01.