

July 12, 2024

Meco Project No. N/A

Thomas (Tom) Bateman
Manager of Public Affairs
CN Rail

(Via Email Thomas.Bateman@cn.ca)

**Re: CN Railbed Drainage - Damage Assessment
Stormwater Management - East Hants**

Mr. Bateman:

In your Letter to Walter Tingley, District 7 Councilor for the Municipality of East Hants (MEH), you expressed an opinion consistent with many of the residents of the municipality, i.e., a need for a fundamental understanding of drainage and flooding in MEH. I am writing to provide some context to recent efforts by residents of Robert Scott Drive to raise awareness of deficiencies in stormwater drainage at the CN railbed, forming the outlet control for the Barney's Brook watershed, Figure 1.

CN RAILBED BELOW ROBERT SCOTT DRIVE

You have has an opportunity to review our opinion on inundation at Robert Scott Drive and surrounding areas on July 22nd 2023. At the time, we measured the CN culvert in Figure 1, located at the outlet for the Barney's Brook Watershed, a tributary of the Shubenacadie River, as a 3.3 m diameter culvert with invert elevation 7.59 m. We measured the top of the railbed at elevation 19.8 m.

Recently, images at low tide taken by Ryan Dunphy provide a clear understanding of the discharge structure. Referring to Figure 2, taken May 2024, we now understand the inlet consists of what appears to be a multiplate arch on concrete foundations. This was likely installed inside the original stone masonry arch and extends upstream where it is covered with loose stones. We expect the upstream inlet addition was likely sealed to the original archway with pillow concrete, similar to what appears to have occurred downstream, but the area is obscured with the stones. The outlet, by contrast, appears to be a circular section with an inclined outlet that matches the railbed slope. What is disconcerting is the barrel between the inlet and outlet appears to be the original archway, with unknown dimensions, but certainly larger than the revised inlet and outlet. Hydraulically, this modification is vulnerable to blockages, and is not designed to withstand pressures that likely occurred June 2023. At the likely flow velocities in July 2023, this culvert was experiencing severe cavitation CN is lucky it was not destroyed.



Figure 1 Inlet to CN Railbed Culvert (Oct 2023)

Figure 2 demonstrates damage and partial reduction of hydraulic discharge capacity through blockage. The damage observed in May 2024 could have occurred during the July event or have been a pre-existing condition. The deformed CSP section is highly likely a result of cavitation during flow July 2023. As observed, the outlet culvert is deformed and is blocking drift debris from exiting the culvert. The drift debris appears firmly lodged and may have been there for some time. The culvert has diminished capacity.

Meco considered barrel blockage in our modelling but did not pursue that scenario to calibrate our hydraulic model because it was considered unlikely a corrugated culvert would block given the flow velocities. However, for the configuration present, with a different inlet and outlet design, plus a larger cavernous barrel, we can now imagine several problematic flow environments, blockage, cavitation, etc. There was almost certainly partial blockage of the outlet capacity of the culvert.



Figure 2 Outlet to CN Railbed Culvert (May 2024)

MAINTENANCE AND SURVEILLANCE

The images in Figure 2 are provided as a courtesy in case CN is interested in forwarding them to their maintenance group for repair works. I believe Jesse Hulsman, P.Eng. of the Municipality of East Hants has already forwarded these to CN. I am also referencing an asset assessments of the CN culverts from prior to the July storm event that may or may not have been addressed. I personally have not inspected the culverts. The full report is available on the HEH website at <https://www.easthants.ca/wp-content/uploads/easthants-occ/agendas/42816/attachments/24981/226421-20240222-East%20Hants%20-%20Revised%20Final%20Report.pdf>.

In your response to the MEH, you indicate the culvert at Barney's Brook is sized appropriately and performing as required. The image in Figure 2 indicates the outlet for the conveyance has functionally failed, is partially blocked, and if a flow event approaching a 100-year annual exceedance probability were to occur, as occurred July 11, 2024 (yesterday) in part of Nova Scotia, the railbed could collapse while the residents in the Barney Brook watershed would be exposed to life safety risk for inundation. Further, now that there is a known occurrence of pressurized flow in the culvert, the design concept of modifying the inlet and outlet for these culverts should be abandoned as inadequate, even dangerous to the public.

In closing, CN are responsible for infrastructure that is not maintained to achieve design performance and is likely contributed to flooding past flood inundation to residents of Lantz. There are further evidence other culverts in the corridor area are somewhat compromised as well. There was a series of thunderstorms yesterday (July 11 2024) that indicate the flooding from July 2023 may not be an anomaly that behooves everyone to take appropriate measures to design for these events. The least cost method to address infrastructure deficiencies is to get in front of them and develop evidence-based opinions and designs that address the underlying problem.

