Amtrak Lancaster Tunnel Discharge Tunnel – An Innovative Approach to Prevent Groundwater Infiltration from Entering the Combined Sewer System

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The Lancaster City Sewer Authority (LCSA) is under increasing pressure to identify and eliminate groundwater discharges to the combined sewer to increase treatment efficiencies and prevent system surcharge and bypass during storm events. Discharge from the Amtrak Lancaster Station tunnel foundation drain system was expected to be a significant contributor to the LCSA.

The Lancaster Station Tunnel is constructed to a depth of approximately 20 feet below the active train rails and used to transfer mail between trains on adjacent tracks. Perimeter and sub-slab drains around the tunnel foundation collect a steady flow of groundwater and drain from an 8-inch combined sewer line through a catch basin to the LCSA. The foundation drain system maintains stable soil conditions around the tunnel and protects the tunnel walls from potential flooding and groundwater damage.

Amec Foster Wheeler prepared a Groundwater Intrusion Discharge Alternatives Study for Amtrak to characterize the groundwater quality and identify potential ways to manage the discharge. Samples were collected and analyzed, demonstrating that the foundation drain produced clean groundwater. Considering these results, the most cost-effective solution appeared to be a discharge back to the aquifer through the use of an injection well. The local geology and geomorphology was evaluated and the results supported the proposed groundwater injection into the local karst soil.

In order to evaluate the ability of an injection well to accept the anticipated flows, a test apparatus was assembled in the catch basin. The apparatus was used to capture discharge from the foundation drain system and measure peak, average, and total projected flows. Periods of peak flow in excess of 48 gpm (28 million gallons per year) were measured. The test flow data was used to establish 100 gpm as the design capacity for an injection well and pump system.

A boring was completed in close proximity to the tunnel to a depth of 194 feet below ground surface. The boring was converted to an injection well and cased with steel into bedrock (to the full depth of the boring). The well was developed and a geophysical survey was performed. A series of pump tests were performed to confirm an injection capacity of more than 100 gpm. A dual pump system was designed to transfer discharge from the catch basin to the injection well.

The pump system includes two rugged, submersible pumps controlled with variable speed drives, continuous and point level controls, totalizing flow measurement, and pressure monitoring. The outlet in the catch basin was fitted with a duck-bill check valve to prevent backflow from the combined sewer into the tunnel during sewer surcharge events. The PLC-based controls are enclosed in a NEMA 4X panel with a wireless cellular modem to facilitate password-secured remote monitoring and control of the system from a smart phone or PC. In addition, system status outputs are hard-wired to Amtraks centralized monitoring system at the station. The actual flow rates and totals are measured and recorded by the system to allow Amtrak to routinely report the flow reductions to LCSA.

This action by Amtrak reduces the flow to the LCSA wastewater treatment plant, reduces surcharge during storm events, and helps to improve overall water quality in the Conestoga River and the

Chesapeake watershed. In addition, the system is expected to save Amtrak approximately $50,000 per year in storm water fees.