Charles Chloride Monitoring FY 2025

Introduction:

Charles County, Maryland, established a chloride monitoring program in compliance with its National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit (No. 22-DP-3322/MD0068365). The program addresses chloride pollution resulting from roadway and parking lot deicing operations, a key contributor to elevated chloride concentrations and conductivity levels in non-tidal streams. The County has long been required under its MS4 permit to track deicing operations and report annually on the extent of application throughout the County. Under the current generation MS4 permit, the County is required to establish a monitoring program to determine the potential impact these operations are having on receiving streams.

In accordance with the Maryland Department of the Environment's (MDE) *2021 MS4 Monitoring Guidelines: BMP Effectiveness and Watershed Assessments,* the County selected a first-order stream segment in the impaired Mattawoman Creek watershed, located near Country Lane in Waldorf, as its primary chloride monitoring site. The Country Lane monitoring site fulfills the criteria for a chloride monitoring site in Charles County, which are as follows: first-order stream segment, significant County-owned roadways subject to deicing, accessible site, and an impaired watershed (Mattawoman).

Methods & Materials:

Charles County installed the Onset HOBO U24-001 conductivity logger on March 18th, 2025. This same logger is used by MDE (MDE, draft) and by Maryland Department of Natural Resources' Maryland Biological Stream Survey (J. Cessna, personal communication, May 2022) for the long-term logging of conductivity measurements. Other Maryland Counties deploy the HOBO U24-001 logger and have had success using the logger to collect continuous/high-frequency conductivity and specific conductance data. The HOBO logger is also one of the least expensive conductivity loggers available.

Logger installation closely followed the methods MDE uses for chloride and conductivity monitoring projects (MDE, draft). The conductivity logger was placed in an area of the stream that is out of the main flow but still moving to avoid stagnant conditions which may not accurately characterize the conductivity and specific conductance of the study stream. A PVC housing was constructed with a removable screw-on cap on both ends and drilled with multiple holes to allow for water to flow through, and sediment to wash through the housing and not

accumulate inside. The conductivity logger was affixed to the screw-off cap with a zip-tie through the hole in the end of the logger body.

The HOBO logger was launched according to manufacturer's instructions and set to record conductivity at a minimum of 30-minute intervals to comply with MDE's requirements (MDE, 2021).

During maintenance, the logger is removed from the housing and data is downloaded using the HOBO shuttle and software. Staff review the logger data in the HOBOware Pro software to identify any anomalous records or identify periods where excessive drift in the data has occurred for correction. A stiff brush is used for the housing and the exterior of the logger to scrub off biofouling and sediment that has accumulated since the previous visit. The logger sensor is cleaned gently with a cotton swab or lint-free cloth like a Kimwipe. The logger is then relaunched following the procedures in the HOBOware Pro software.

The cleaned and downloaded logger is reinstalled in the housing and redeployed in the stream. After the temperature has stabilized in the logger (10 to 15 minutes) a second stream water temperature and conductivity measurement is taken using a water quality meter and recorded.

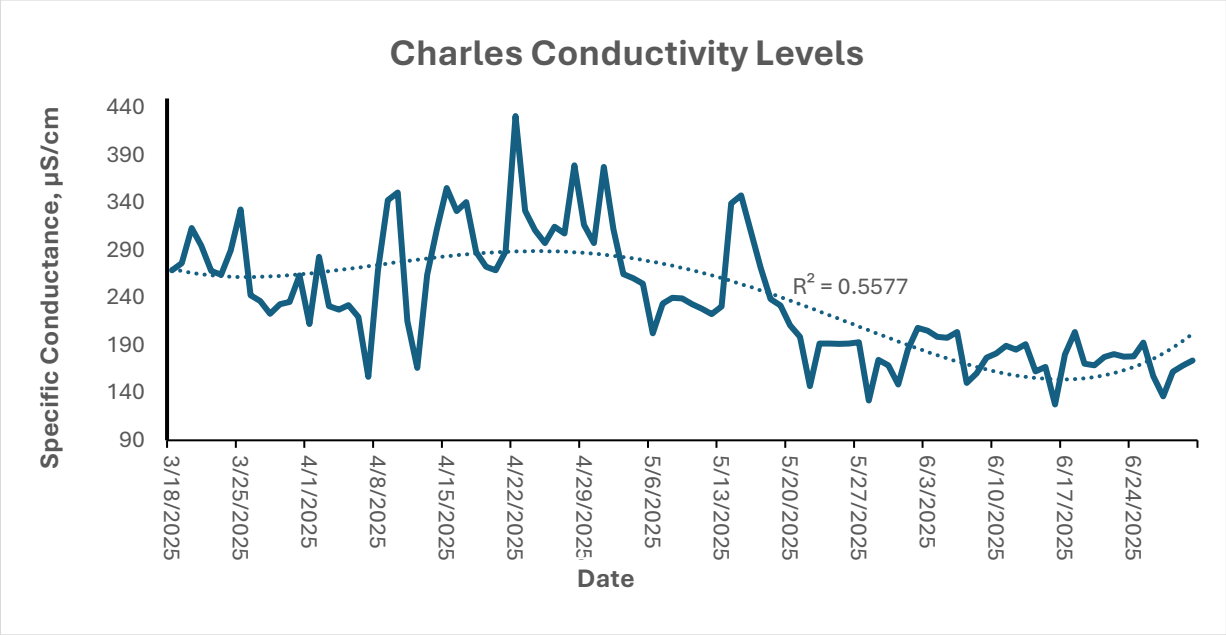
All logger data has been adjusted in the HOBOware Pro software using the conductivity measurements from the water quality sonde at each maintenance visit. Staff has filled out template field visit data sheets to track the maintenance of the logger and downloading of the data. Raw logger files, converted data, field visit data sheets and Excel spreadsheets are kept in the project file.

Conductivity data from the logger is converted to specific conductance using the HOBOware Pro software. Monthly data has been compiled into annual data files for analysis and reporting. Data has been analyzed to produce 30-minute instantaneous, daily mean, and daily maximum conductivity values (MDE, 2021). Summary statistics are calculated for winter (November 1 through March 31) and non-winter periods, as well as 75th and 90th percentiles and maximum observed values for the same periods.

Data Analysis:

Specific conductance levels are shown for the FY 2025 monitoring period from March through June 2025. A quadratic polynomial trendline was used to describe the data. A quadratic polynomial was found to be the best trendline because of the high variability in the data. An R^2 value of 0.5577 captures the trend of the data well, but there is still a significant amount of variability in the data that is not captured by the trendline. The average conductivity level for the examination graphed is 220.37 µS/cm. Conductivity levels show an increasing trend beginning in April where levels peak at 431.51 µS/cm on April 22nd, then proceed to steadily decrease until the end of June reaching its lowest specific conductance at 127.8 µS/cm. Variability in conductivity levels cannot be attributed to deicing events. A last deicing event of the FY 2025

winter weather season occurred February 19th-20th, 2025, which was prior to the FY 2025 monitoring period (March- June 2025).



Conclusions:

This study was conducted to assess seasonal variations in stream conductivity and evaluate the potential influence of roadway deicing operations and other watershed factors on water quality in Charles County, Maryland. Continuous conductivity monitoring at the Country Lane site revealed distinct seasonal patterns, with daily mean conductivity values peaking in April (431.5 µS/cm) and reaching a minimum in June (127.8 µS/cm). The mean conductivity during the study period was 220.37 µS/cm, indicating measurable but variable ionic activity throughout the year.

Sources:

Maryland Department of the Environment (MDE). 2022. Maryland's Final Combined 2020-2022 Integrated Report of Surface Water Quality. Final version dated January 27, 2022. Maryland Department of the Environment. Baltimore, MD.

Maryland Department of the Environment (MDE). 2021. National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permits 2021 MS4 Monitoring Guidelines: BMP Effectiveness and Watershed Assessments. Final version dated October 2021. Maryland Department of the Environment. Baltimore, MD.

Maryland Department of the Environment (MDE). Draft. Hobo U24-001 Conductivity Logger Instructions. Maryland Department of the Environment. Baltimore, MD