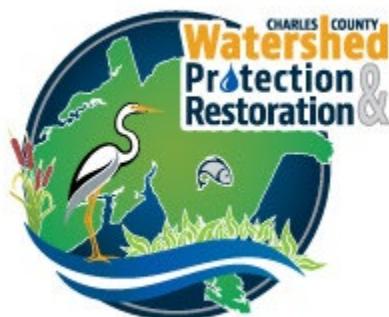


INDIAN CREEK BACTERIA TMDL MONITORING REPORT

MONITORING YEAR 1

December 2025



Charles County, Maryland

Department of Planning and Growth Management

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1 Introduction

Charles County Department of Planning and Growth Management is charged with monitoring fecal indicator bacteria in the County's portion of the Lower Patuxent River (02131101) watershed with a bacteria Total Maximum Daily Load (TMDL), specifically the Indian Creek subwatershed PAX0887. The TMDL (MDE, 2004) is for a fecal coliform indicator bacteria impairment in shellfish harvesting areas within tidal portions of the subwatershed. The PAX0887 subwatershed is located in Charles County on the border of St. Mary's County to the east of Hughesville. Because Indian Creek drains both Charles and St. Mary's Counties, bacteria loads identified for future remediation along the mainstem will need to be parsed across each County in future revisions to the County's TMDL plan.

A major component of implementing the TMDL is monitoring to identify potential sources of bacteria in the watershed. The County's Indian Creek bacteria monitoring program is designed to identify potential upland sources, generate a long-term record of fecal indicator bacteria to support implementation of the TMDL, and to aid in the assessment of the effectiveness of potential future management strategies. The monitoring design for the Indian Creek bacteria monitoring program was described in Charles County's Indian Creek Bacteria TMDL Implementation Plan (Charles County, 2024) submitted to Maryland Department of the Environment (MDE) in April of 2024 and approved by MDE on July 31, 2024. In addition to supporting TMDL goals, the first phase of monitoring supports meeting bacteria monitoring condition of the Assessment of Controls - Watershed Assessment Monitoring (IV.G.2.b.ii) in Charles County's current MS4 permit (permit number 22-DP-3322 MD0068365, dated December 30, 2022).

The monitoring strategy described in the TMDL Implementation Plan was modified following MDE review and recommendation to use *Escherichia coli*, or *E. coli* as the fecal indicator bacteria. The TMDL is for fecal coliform bacteria, which is the appropriate indicator in the tidal shellfish harvesting area, and is monitored routinely by MDE in Indian Creek. The County is monitoring *E. coli*, which is the appropriate indicator for freshwater streams to detect sources from the County's contributing land source portions of the watershed. Therefore, the County's efforts are focused on freshwater streams above the tidal limits using the fecal indicator bacteria *E. coli*.

The first phase of monitoring, beginning with sampling in April 2025, includes the Source Identification Phase, with a goal to identify areas of the subwatershed that are contributing high levels of bacteria for further study, and at the same time establish the MS4 Permit Require Trend Monitoring and TMDL trend monitoring sites that will act as long-term

records of bacteria levels as the TMDL is implemented. Description of the specific sites and how each fits the framework is included below in the Methods section of the report.

2 Methods

The Indian Creek bacteria monitoring program includes monthly grab samples in PAX0887 subwatershed (Charles County, 2024). Bacteria samples were collected at one fixed, long-term monitoring station in Indian Creek and two source identification sites in each main tributary of Indian Creek for a total of three sampling locations. Grab samples were collected on the third Tuesday of each month. Sample collection and analysis methods were consistent with the MDE 2021 MS4 Monitoring Guidelines (MDE, 2021) and those outlined in the Charles County Indian Creek Bacteria Monitoring QAPP (Charles County, 2025). Bacteria sampling began in April 2025.

2.1 Monitoring Stations

Descriptions of the monitoring stations are as follows and can be seen in the figure below.

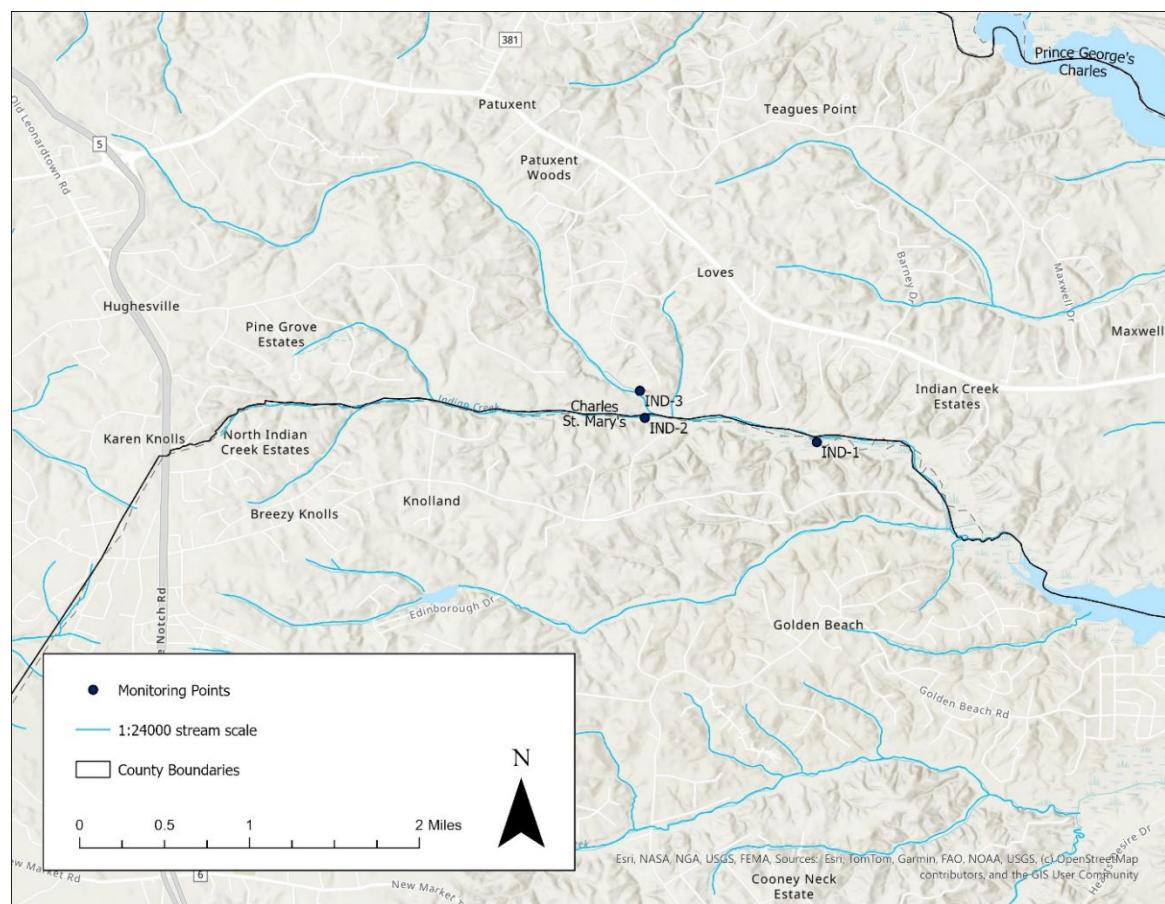


Figure 1. Monitoring site locations.

It is noted that Indian Creek drains both Charles and St. Mary's Counties. Bacteria loads identified for future remediation along the mainstem will need to be parsed across each County in future revisions to the County's TMDL plan.

Photos from each site are included in Appendix A.

IND-1: This site serves as the MS4 Permit Required Trend Monitoring site. IND-1 is the most downstream site on Indian Creek on the border of Charles and St. Mary's counties (Figure 1). This site has a drainage area of 6.64 square miles and encompasses the totality of the drainage areas of the two upstream sites. This site is accessed from Sulky Place in Hughesville, MD. Both stream banks have a forested riparian buffer and the stream bed is sandy.

IND-2: Located on Indian Creek on the border of Charles and St. Mary's counties (Figure 1) and has drainage from both counties. The drainage area to this site is 2.42 square miles. This site is accessed by a powerline right of way off Crockett Court in Hughesville, MD. Both stream banks have a forested riparian buffer at the sampling location though the stream runs through areas with mixed agricultural and residential land use. This site is a Source Identification site and can later serve as a TMDL Trend Monitoring site if necessary.

IND-3: Located on Indian Branch, a tributary of Indian Creek in Charles County (Figure 1). The drainage area to this site is 2.97 square miles and only drains Charles County. Prior to sampling the field crew performed an initial site reconnaissance and noted a beaver dam upstream from the specific sampling site. This site is accessed from the powerline right of way off Crockett Court in Hughesville, MD. Both banks have a riparian buffer comprised of trees and grasses. This site is a Source Identification site and can later serve as a TMDL Trend Monitoring site if necessary.

2.2 Fecal Indicator Bacteria Sampling

Each site was sampled on the third Tuesday of each month regardless of preceding and current weather and precipitation on the sampling date. Sites were sampled in the same order each month beginning with IND-1 followed by IND-3 and IND-2.

Following protocols outlined in Charles County's Indian Creek Bacteria Monitoring QAPP (Charles County, 2025), samples were collected with pre-sterilized bottles containing a preservative (sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3$) by a crew member wearing nitrile gloves. Each sampling point was approached from downstream, taking care to cause as little disturbance as possible to the stream's water and sediment. Sample bottles were submerged below the surface of the water with the opening of the bottle pointing upstream away from the sample collector in the deepest, fastest-flowing portion of the stream. A

label was created for the sample containing the date, sampling location code, time of collection, and the collector and applied to the outside of the sample bottle. Samples were put into a cooler with a sufficient amount of ice to maintain the samples at 4°C for transport to the laboratory within the required hold time. Flow conditions are recorded on the field data sheet following MDE's 2021 MS4 Monitoring Guidance (MDE, 2021). Flow is categorized visually as either high (stormflow) or low (baseflow). Stream velocity and depth data is collected at each sampling event at the established cross section at each sampling location and recorded in a field notebook. This data is used to calculate discharge at each sampling location during each sampling event.

2.3 Sample Processing and Laboratory Analysis

Samples were prepared and analyzed following the methods and protocols for the Quanti-Tray system for analyzing *E. coli* bacteria levels. Field collected 100mL samples are processed with the addition of the Colilert-18 reagent to the sample and mix thoroughly to ensure that the reagent is completely dissolved. The Quanti-Tray/2000 and Quanti-Tray sealer are prepared according to manufacturer instruction and any bubbles present in the sealed sample to settle or dissipate. The samples are incubated at $35.0 \pm 0.5^{\circ}$ for at least 18 hours, but no more than 22 hours. After incubation, samples are exposed to UV light to quantify *E. coli* by counting the number of wells that are yellow and fluoresces to a degree that is equal to or greater than the Colilert Comparator. *E. coli* concentrations are determined by comparison to a manufacturer's MPN (Most Probably Number) conversion table. These results are recorded on the laboratory bench sheet and entered into a reporting spreadsheet. Specific protocols and standard operating procedures (SOPs) covering laboratory sample analysis are presented in Charles County's Indian Creek Bacteria Monitoring QAPP (Charles County, 2025).

2.4 Water Quality Criteria - Bacteria

MDE has established water quality criteria for fecal indicator bacteria in Maryland waters that are listed in the Code of Maryland Regulations (COMAR) 26.08.02.03-3 – *Water Quality Criteria* (Table 1). The Indian Creek bacteria TMDL is based on restricted shellfish harvesting areas in the tidal Indian Creek, a Use Class II Waterbody, using sampling and analysis of fecal coliform as the fecal indicator bacteria. The County's focus in the TMDL Implementation Plan and the monitoring effort is on upland controllable sources of bacteria in Indian Creek's freshwater tributaries, Use Class I Waterbodies, using *E. coli* as the fecal indicator bacteria.

For this first reporting period, the monthly results were compared to water quality criteria for *E. coli*. As more data is generated additional analyses tracking trends in *E. coli* against

MDE's tidal fecal coliform results will be developed. The freshwater *E. coli* criteria states that the geometric mean of samples taken over a 90-day period should not exceed the steady state geometric mean (GM) values for *E. coli* and ten percent of the samples taken over a 90-day period should not exceed the statistical threshold value (STV). The GM and STV were developed with bathing beaches and other high-contact recreational activities in mind. Comparison to monthly bacteria monitoring should be viewed with the intent of the water quality criteria in mind.

Table 1. COMAR water quality criteria

Use Class	Bacteria Indicator	Geometric Mean (MPN/100mL)	Median Concentration (MPN/100mL)	Statistical Threshold Value (MPN/100mL)	90th Percentile Concentration (MPN/100mL)
I	<i>E. coli</i>	126	--	410	--
II	Fecal coliform	--	14	--	49

Water quality criteria thresholds for fecal bacteria in Class II shellfish harvesting waters are based on fecal coliform as the indicator organism. These water quality criteria, as found in COMAR 26.08.02.03-3, were used to develop the TMDL load allocations, and will therefore be used to assess exceedances in the MDE's water quality monitoring data over the course of the County's monitoring.

The current regulatory value is a fecal coliform median concentration upper threshold criterion for at least 30 water samples taken over a 3-year period of 14 MPN/100 mL and a 90th percentile upper threshold criterion of 49 MPN/100 mL. COMAR provides for two 90th percentile values depending on the lab analysis used; 43 MPN/100mL for a 5-tube decimal dilution test or 49 MPN/100mL for a 3-tube decimal dilution test. The TMDL references the 49 MPN/100 mL concentration, therefore that is the value the County will use to assess MDE results. The TMDL states that an implicit margin of safety was used in development of the TMDL load allocation, therefore no adjustment is necessary in the concentrations to meet the TMDL. Thresholds for impairment are shown in Table 2 below.

Table 2. Bacteria Indicator Criteria from COMAR

Bacteria Indicator	Median concentration*	90 th Percentile Concentration*
Fecal coliform	14	49

* Values expressed as counts per 100 milliliters

3 Results- Year 1 /Monitoring Year 2025

3.1 Summary Results and Comparison to Water Quality Criteria

Presented below are the results of all sampling events occurring during Monitoring Year 2025, with sampling beginning in April 2025 and reporting for this year ending in June 2025 (Table 2, Figure 2). The monitoring and data reporting period covers samples collected during Fiscal Year 2025 and coincides with the County's MS4 reporting and monitoring period for year 3 of the MS4 permit which runs from July 1, 2024 to June 30, 2025.

The STV of 410 MPN/100mL is used in the analysis as a single sample threshold. All results that have exceeded the STV have been highlighted in Table 3. Geometric means were calculated for all sites from the results of the April, May, and June sampling events to capture a 90-day period and compared to the COMAR threshold. Geometric means that have exceed the COMAR threshold have been highlighted in Table 4.

A total of nine samples were collected and 22%, or two samples, exceeded the STV (Table 3, Figure 2). The majority of the geometric means exceeded the COMAR threshold (Table 4, Figure 3).

Table 3. E.coli results from all sites from April 2025 to June 2025

Sampling Date	Sites		
	IND-1	IND-2	IND-3
4/15/2025	86.2	133.4	76.8
5/20/2025	325.5	148.3	71.7
6/17/2025	517.2	517.2	344.8

Table 4. Summary statistics of Year 1 sampling

Summary Statistic	Sites		
	IND-1	IND-2	IND-3
Minimum	86.2	133.4	71.7
Maximum	517.2	517.2	344.8
Average	309.6	266.3	164.4
Standard Deviation	215.9	217.4	156.2
Geometric Mean	243.9	217.1	123.8
Geometric Standard Deviation	2.5	2.1	2.4

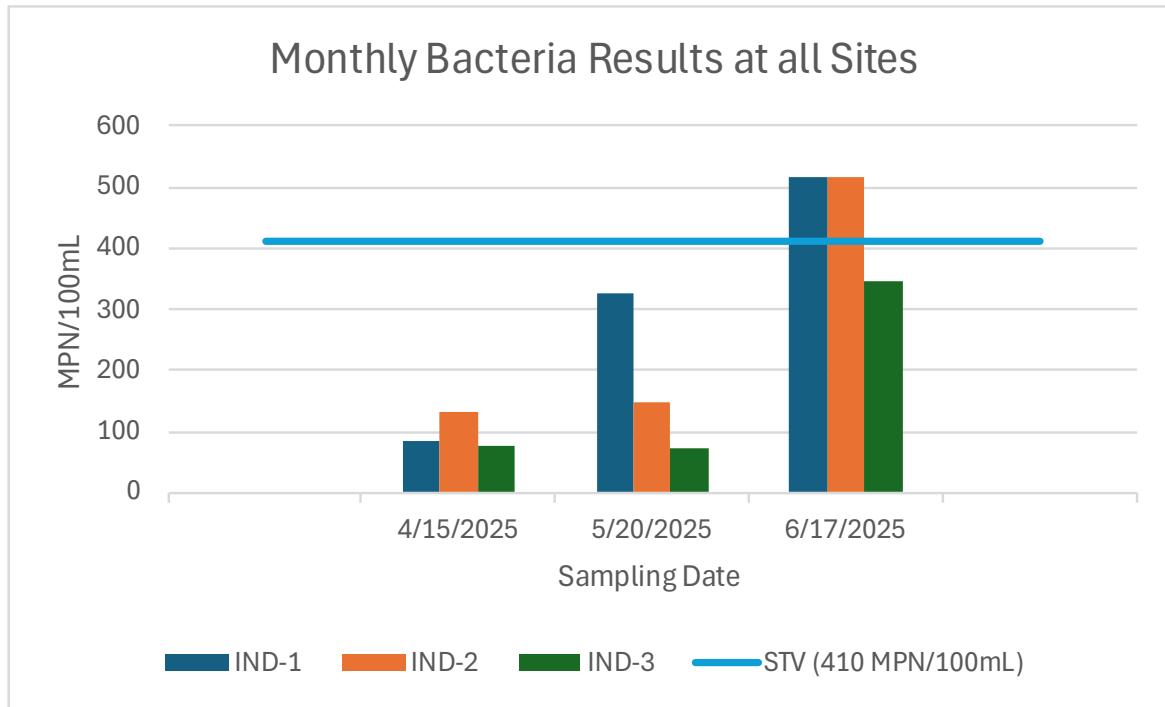


Figure 2. *E.coli* results compared to STV for all sites from April 2025 to June 2025

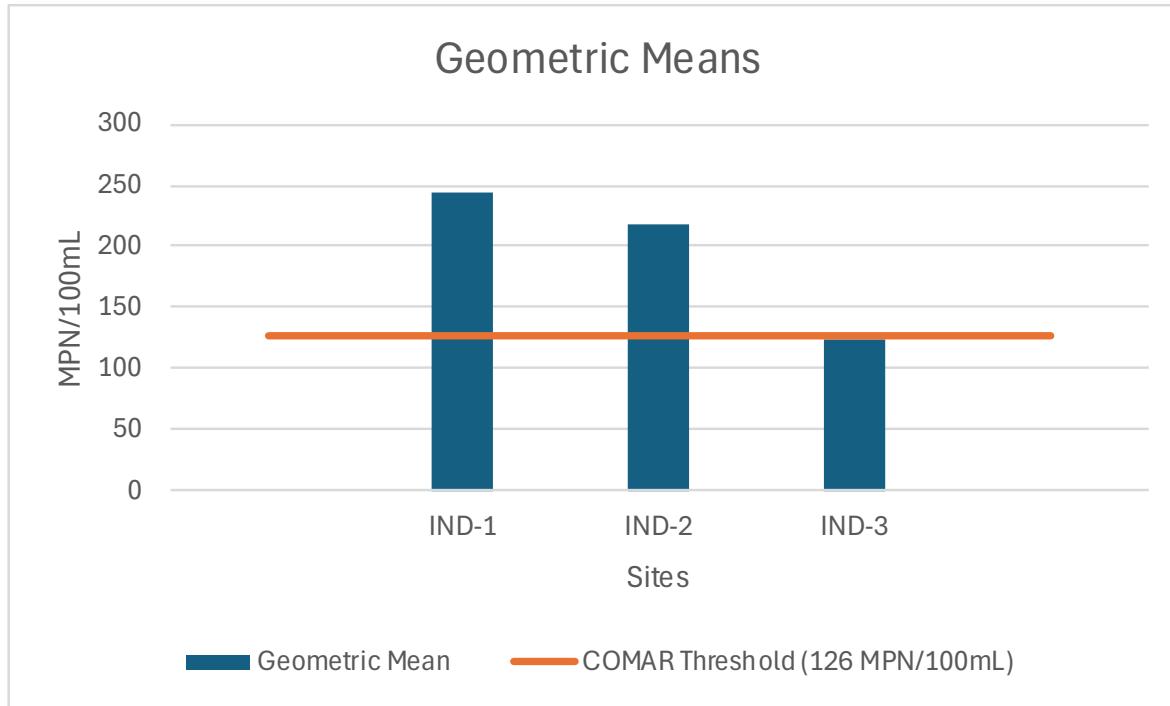


Figure 3. Geometric Means compared to COMAR threshold for all sites from April 2025 to June 2025

3.2 Site Level Results

IND-1: This site shows steadily increasing bacteria results with the last sample collected in fiscal year 2025 exceeding the STV of 410 MPN/100mL (Figure 4). The calculated GM (Table 4) exceeds the COMAR threshold of 126 MPN/100mL (Figure 4).

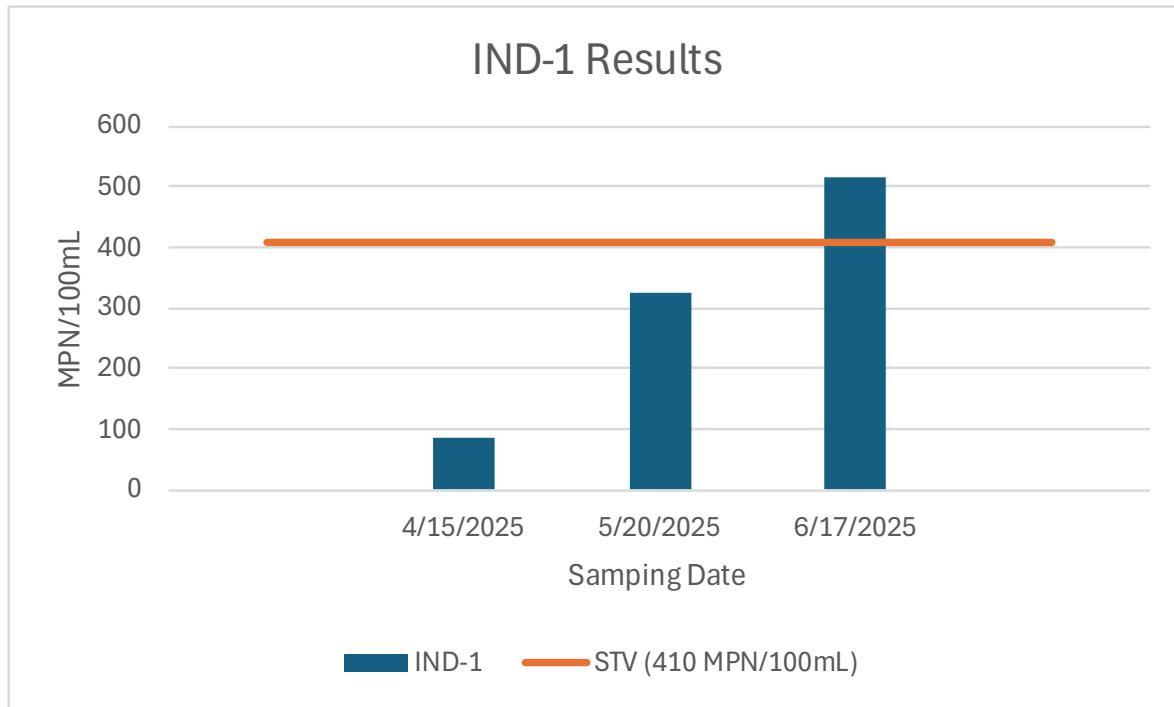


Figure 4. *E. coli* results compared to the STV at IND-1

IND-2: The majority of the samples collected at this site fell below the STV of 410 MPN/100mL except for the sample collected in June (Figure 5). The field crew did not note any unusual conditions at the time of sampling to provide context for the high result in June. The calculated GM (Table 4) exceeds the COMAR threshold (Figure 5).

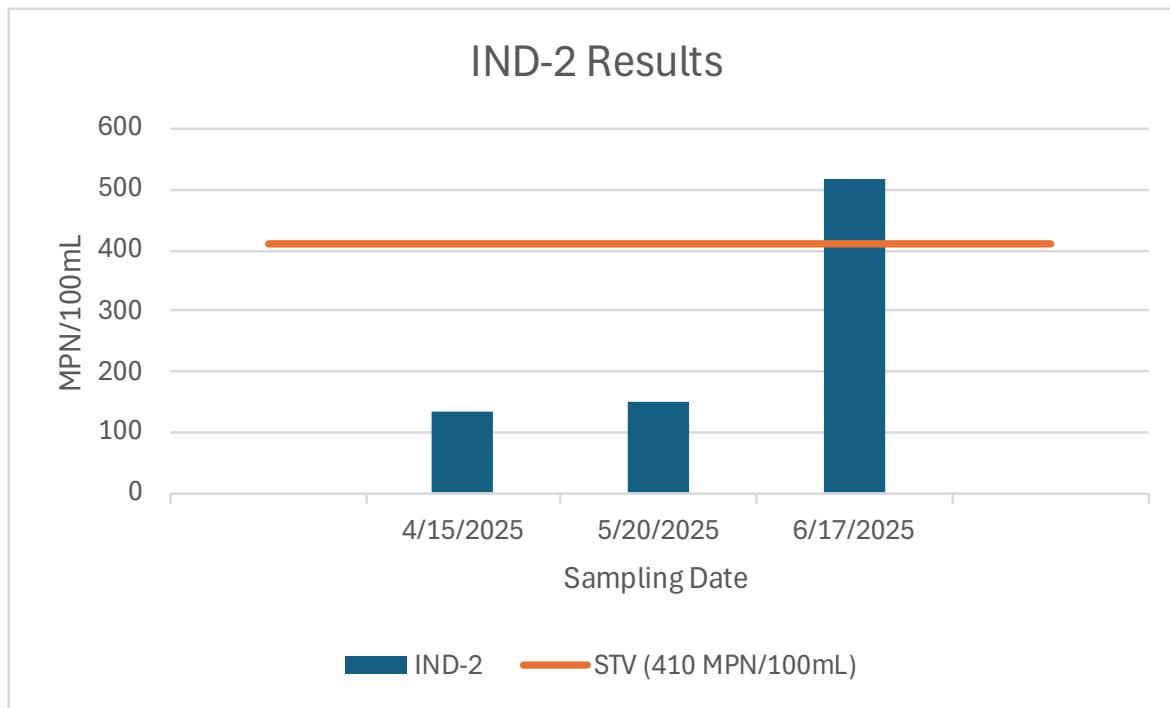


Figure 5. *E. coli* results compared to the STV at IND-2

IND-3: The samples collected at this site show the lowest results collected each month (Table 3). All the samples collected at this site fall under the statistical threshold value (Figure 6) and the geometric mean (Table 4) is the lowest calculated among all the sites (Figure 3) falling below the COMAR threshold (126 MPN/100mL).

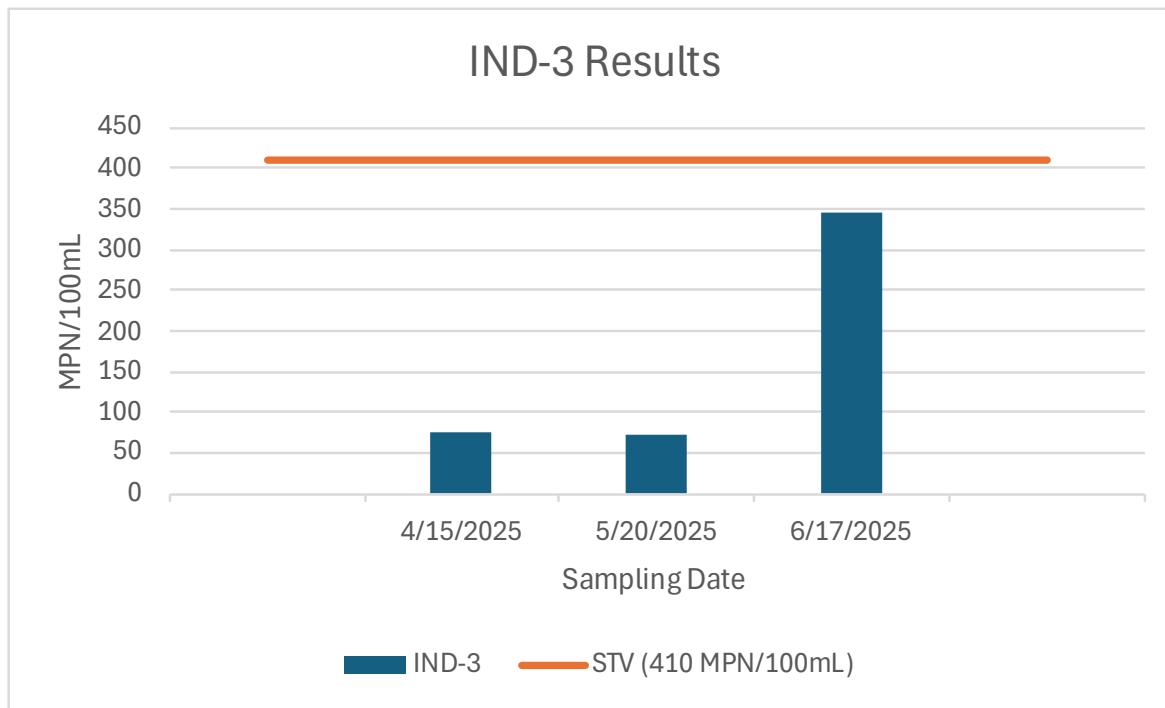


Figure 6. *E. coli* results compared to the STV at IND-3

3.3 Shellfish Harvesting

Fecal coliform data from MDE's shellfish sampling station (0901013) in the tidal Indian Creek was gathered and reviewed against the COMAR shellfish harvesting water quality criteria as described above in Section 2.4. Results for the 30 samples taken between February 2023 and November 2025 indicate a median fecal coliform value of 18 MPN/100ml, just above the 14 MPN/100ml threshold, and a 90th percentile value of 93 MPN/100ml which is also above the 49 MPN/100ml threshold.

3.4 Quality Control Samples

No quality control samples were collected in Monitoring Year 2025. Subsequent reports will include quality control sample data and analysis, i.e. Year 2 will include data and analysis for duplicate and blank samples.

4 Conclusions

Bacteria results from the short three-month reporting time frame indicated *E. coli* values falling generally under the statistical threshold value (410 MPN/100mL). The sites located on the border with St. Mary's County, IND-1 and IND-2, have a geometric mean that exceeded the COMAR threshold (126 MPN/100mL). The third site, IND-3, has a geometric mean below the COMAR threshold. Additional analysis and comparisons to this year's results will be made in Year 2 reporting when more data are available.

Fecal coliform data from MDE's shellfish sampling station (0901013) indicate a median fecal coliform value of 18 MPN/100ml, just above the 14 MPN/100ml threshold, and a 90th percentile value of 93 MPN/100ml which is also above the 49 MPN/100ml threshold.

Data following Year 2 will be used to identify areas for further investigation and potentially additional bacteria source tracking monitoring and will be used to inform updates to Charles County's bacteria TMDL implementation plans.

5 References

Charles County. 2024. Indian Creek TMDL Implementation Plan. Charles County Planning and Growth Management. Charles County, Maryland. April.

Charles County. 2025. Quality Assurance Project Plan for the Charles County Indian Creek Bacteria Monitoring 2025. Charles County Planning and Growth Management. Charles County, Maryland. June.

Code of Maryland Regulations (COMAR), Title 26, Department of the Environment, Part 1, Vol. XXIII.

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). 2004. Total Maximum Daily Loads for Island Creek, Town Creek, Trent Hall Creek, St. Thomas Creek, Harper and Pearson Creeks, Goose Creek and Indian Creek and a Water Quality Analysis for Battle Creek of Fecal Coliform For Restricted Shellfish Harvesting Areas in the Lower Patuxent River Basin in Calvert, Charles, and St. Mary's Counties, Maryland. Final version dated September 2004. Maryland Department of the Environment. Baltimore, MD.



IND-1 – Downstream – Summer 2025



IND-1 - Upstream – Summer 2025



IND-2 - Downstream – Summer 2025



IND-2 – Upstream – Summer 2025



IND-3 – Downstream – Summer 2025



IND-3 – Upstream – Summer 2025