Chesapeake Bay Program
Science. Restoration. Partnership.

Joint Integrated Trends Analysis Team (ITAT) & Factors Meeting

Wednesday, August 28th, 2024

10:00 AM – 11:30 PM

Theme: tidal/nontidal connections

Meeting Materials: Link

This meeting was recorded for internal use only to assure the accuracy of meeting notes.

Action items:

✓ *Please respond to this mentimeter for your feedback on the work presented on tracking the status and trends of different key indicators.*

Minutes

10:00 – 10:05 Welcome – Breck Sullivan (USGS) and Kaylyn Gootman (EPA)

Announcements:

- Introduction of the new Staffer – *Gabriel Duran*
- Returning intern, Sarah Betts from Franklin and Marshell, September 9th.

Upcoming Conferences, Meetings, Workshops and Webinars

- Restore America's Estuaries (RAE) 2024 Coastal & Estuarine Summit – October 6-10, 2024, Washington, D.C.
    - Representatives from the different groups (including Climate, Healthy Watersheds, Clean Water, Shallow Waters and People) will be present on a panel (October 7th) and provide recommendations on how we proceed with Beyond 2025.
- American Planning Association (APA) Maryland 2024 Conference – October 22-24, 2024, Ellicott City, Maryland.
    - ITAT's Watershed data dashboard, the Tributary Summaries (under "Projects and Resources") and the Land Use/Land Cover (LULC) will be demonstrated.
- American Geophysical Union (AGU) 2024 Fall Meeting – December 9-13, 2024, Washington, D.C.
    - There will be some select Chesapeake Bay sessions.
- 14th National Monitoring Conference – March 10-12, 2025, Green Bay, Wisconsin.
- The 35th Annual Environment Virginia Symposium – April 8-10, 2025, Lexington, VA.

10:05 – 10:35 ***Forecasting Reported Water Withdrawals – A Comparison of the Tidal and Non-Tidal Potomac Basin***

Presenter(s): *Stephanie Nummer, Interstate Commission on the Potomac River Basin (ICPRB)*

Description: Compiling reported water withdrawal values from the five jurisdictions located in the Potomac basin, the Interstate Commission on the Potomac River Basin (ICPRB) has modeled trends in historic water withdrawals using a hierarchical structure across various sectors and extrapolated these trends to project future water withdrawals from 2025 to 2050. This hierarchical structure allows results to be compared based on various characteristics – including the tidal and non-tidal portions of the basin.

Reported water withdrawals aims to project future water withdrawals in the Potomac River basin and their associated consumptive use with the goal to understand the entire picture of water use in the basin. This work looks at the future trends expected using the reported data from 2017. This was prompted by the recurring 5-year Washington metropolitan area demand study that's performed by the ICPRB Coop Section. This study is extremely useful for forecasting the demands of water in the Washington metropolitan area. The comprehensive plan captures and reports on both the nontidal and tidal regions.

The first steps of the study were to report on the 5 different water withdrawals from the different jurisdictions in the basin (Pennsylvania (PA), Virginia (VA), West Virginia (WV), Maryland (MD), District of Columbia (D.C.)). This was compiled into one database, the withdrawal consumptive use database, with one universal format over the course of many years and iterations of quality control. Accuracy was ensured by comparing raw data to results reported by both Virginia and Pennsylvania.

The reported water use sectors were identified over 11 different sectors used by USGS, like aquaculture, irrigation, livestock, mining, among others. Using the withdrawal consumptive use database, researchers performed a trend analysis with a hierarchical structure that estimated a linear model of each withdrawal site within each sector. The structure was applied for each sector in the database separately, so researchers applied it to all 11 sectors. These estimated models were then used to predict future withdrawals.

The model incorporates site level effects and seasonal effects, so the model was applied to each site and season combination using the hierarchical structure. This allows for each location to lend information to others and acts like a shrinkage estimator. The hierarchical structure reduces the overall uncertainty for each sector and for each location, allowing for more accurate estimation.

Using the hierarchical structure, researchers then applied linear models with the predictor variable being month. Month was used as a monthly timestep with January 1980 being the first month, and every following month being a consecutive monthly timestep. Seasons were aggregated using the designations that are used by ICPRB Coop Section for their five-year metropolitan demand study. With our linear regressions, they were able to predict future total estimated withdrawals (2025-2050). Researchers took the sum of monthly withdrawals for each sector for 5-year increments.

Results:

Overall, researchers expect to see a small increase in the Potomac basin in reported water withdrawals from 2025 to 2050. The public water supply sector is predicted to grow the most within this period with a growth of about 170 million of gallons per day (MGD). Some notable trends include an increase in the mining sector (~22 MGD) and a decrease in the "other" sector (~88 MGD).

Next, they took the percent change anticipated in withdrawals. This was mapped to the Potomac HUC8 (subbasins) basins. The lower Potomac is expected to see approximately 9% decrease in the total water withdrawals and the middle Potomac, Catoctin, will see an increase of about 10-23% between this same period of 2025-2050.

One of the features that the researchers compare is the HUC8 watersheds – the lower two watersheds comprise the tidal Potomac – Middle Potomac-Anacostia-Occoquan and the Lower Potomac. The upper nine HUC8 watersheds comprise the tidal watersheds.

Nontidal vs Tidal withdrawals: there is about ~¾ of the withdrawals coming from the nontidal Potomac with about ~¼ of the predicted withdrawals coming from the tidal Potomac. Some features noted include that the hydroelectric sector has no reported withdrawals in the tidal Potomac and therefore no future predicted withdrawals. This applies to livestock as well. On the other hand, the "other" sector does not have nontidal withdrawals and therefore no future predictions. Overall, there is a predicted increase in withdrawals for the nontidal Potomac and a decrease in the tidal Potomac.

Looking by sectors – some notable trends include the expected increase in the nontidal rise of the Public Water Supply sector. Whereas in the tidal Potomac, the "other" sector is predicted to decrease by ~80 MGD alongside a slight decrease for the thermoelectric sector. On the other hand, the thermoelectric sector's relative proportions increased between 2025 and 2050 for the tidal Potomac.

Take home:

The tidal withdrawals decrease by about 88 MGD from 2025 to 2050, largely from that "other" sector. Thermoelectric and Public Water Supply sectors will account for greater proportions of the total withdrawals for the same period. Nontidal withdrawals increase by about 185 MGD for the same period. Lastly, the Nontidal Potomac Public Water Supply will account for greater proportions.

Next Steps:

Next steps are largely associated with developing and implementing a Scope of Work for continuous improvement of the Withdrawal Consumptive Use (WCU) database and additional analysis. The Scope of work includes: 1) a maintenance plan; 2) Public sharing protocol with the agreement from all of the contributing jurisdictions; and 3) tabular and geospatial online querying tools for aggregate-level data.

Further next steps will include updating the consumptive use rates with special considerations for location specific factors when possible, and for agriculture. Also, creating sectors specific to calculations rather than just a literature search from not necessarily Chesapeake Bay areas. Finally, providing information/education material on how to use the information.

Discussion:

Q: *Lew:* Hydroelectric – how is that counted as a withdrawal and not a pass through? Do you think there is a way to count in the different climate change factors, like water use and higher temperatures and the improved technology, like Thermoelectric, which uses very little water withdrawal in the future? ***A****: Stephanie:* To answer your first question, the results presented are only withdrawals and when considering hydroelectric, they do report how much they pull out, not considering consumptive use and therefore little withdrawal. The consumptive use portion presented here uses values published from the literature but there are efforts to produce more Potomac Basin specific consumptive use factors. For your second question, the thermoelectric, we did not include any locations that did not have a withdrawal in the last 5 years. We tried to capture more recent data to ensure that we were getting more accurate technology and data. In terms of climate change, seasonality was included but the linear model that was incorporated is preliminary, and we aim to include temperature and rainfall in the future. For instance, the public water supply sector did not include the population and that is something we would like to do in the future.

Q from the chat: *Gopal*: What was the period of historical record that was used in the development of the model? Was it the same across the space and sector? ***A***: *Stephanie:* The WCU database includes 1980-2019 and this varied by location. We used the data what was available.

Q: *Gary*: what is the basic unit for the equation? ***A***: *Stephanie:* Our basic unit is one withdrawal location. For instance, one facility will withdraw from one location and that will be its own model but if it was across multiple locations, each location got their own model. This was to account for all confounding factors that could vary from location to location, like soil type, groundwater vs surface water, among others.

10:35 - 11:30 *[Tracking Status and Trends in Seven Key Indicators of River and Stream Condition in the Chesapeake Bay Watershed]*

Presenter(s): *Lindsey Boyle, and John Clune, U.S. Geological Survey (USGS)*

Description: This presentation will summarize initial results from a multi-year effort to quantify status and trends in seven indicators of stream health in the Chesapeake Bay watershed (aquatic communities, streamflow, water quality, hydromorphology, water temperature, salinity, and toxic contaminants). See the video and factsheet for more information.

Lindsey: The nontidal network (NTN) is a collaborative effort between the USGS, Environmental Protection Agency (EPA), the Chesapeake Bay States, District of Columbia (D.C.), and the Susquehanna River Basin Commission (SRBC). Across 123 stations in the watershed, water quality data is assembled to estimate nutrient and sediment loads (mass passing a gaged nontidal location per unit time) and trends in loads over time. This data is collected using standardized methods and analyzed every two years to determine changes in nutrients and sediment over time.

Since there is a multitude of different indicators of stream condition for which no such established watershed wide network currently exists for, the Status and Trends Team was assembled to analyze trends and other indicators using multisource monitoring data from across the watershed. The end goal is to have an integrated network of additional indicators of stream condition organized and analyzed via similar processes and time scaled to the nontidal network.

Seven stream indicators were identified to determine stream health and current conditions - Status. Also, to understand the changing conditions over time – Trends. The seven indicators are: Nutrients and suspended sediment (from the nontidal network); stream temperature; salinity; toxic contaminants; stream flow; habitat and hydromorphology; and biological assemblages. Our goal is to take an inventory of all the available long term monitoring sites for each of these indicators, then determine an appropriate methodology to harmonize and analyze data for trends and, lastly, report our initial findings to partners. Each indicator has different amounts of available sites and data from a variety of different sources, and they're collected at different time steps and required separate analytical methods.

For today's presentation, we will primarily be showing status and trend results from this data compilation and analysis effort for each indicator, and then we will discuss some next steps and future goals.

Results:

Nutrients and Sediment:

John: The purpose of these nutrient and sediment loads is for water quality managers to consider the effects of downstream waterbodies, especially within the Chesapeake Bay Total Maximum Daily Load (TMDL) - starting in 1985 and enhanced in 2004 for nutrients and sediment, and in stream flow. This has allowed the computation of actual, and flow normalized loads of nitrogen, phosphorus, and sediment to the Chesapeake Bay.

Nine of the sites within the network are referred to as RIM sites, River Input Monitoring sites, and they're the downstream end of the nontidal zone and they provide the ability to quantify concentration loads that exported directly into the Bay from major tributaries like the Susquehanna, the Potomac, James and others. The nine RIM sites loads and trends are collected every year in contrast to the two-year NTN sites.

For site selection, they must have a complete annual record of daily values of stream flow from 1984-2020. Also, they had discrete sampling of nutrients and sediments with at least 20 samples collected per year and eight of which must be considered high flow target events. We ended with around 70-89 sites depending on the parameter.

For the most recent contemporary period of data (2011-2020), you will find that the highest yields are in places like the lower Susquehanna or the Eastern Shore. Additionally, higher sediment yields in places like that of the Potomac. For trends, there are two groups: 1) the long-term trends with a 36-year record from monitoring sites and trends in loads where loads have been improving across most sites, like 55% of the sites for nitrogen have been improving over time, 67% for phosphorus, and 39% for sediment; 2) the short-term trends of 10-years, results show less improvements across the network among the parameters of nitrogen, phosphorus and sediment.

Stream temperature:

Many will be aware of the Scientific and Technical Advisory Committee (STAC) workshop on rising temperatures in the Chesapeake Bay and watershed. There was a call for an updated analysis of stream temperature by the USGS, with newer and more expansive data. The purpose being to address these stakeholders' needs and report on the suitability of available multi-agency, continuous and discrete datasets. Second, to explore the methods and determine the status and trends of stream temperature at select sites.

The first step was data compilation of continuous data - high frequency, every 15 minutes - discrete data, and the USGS Aquarius database – a data source where technicians that collect discharge measurements also take ancillary temperature data. The second step was data harmonization.

Site selection criteria: for continuous data we aimed for 2013 to 2022 with at least 300 observations per year (31 sites) and discrete sites was between 1985 to 2022 with no more than 5 years of missing data (320 sites). Lastly, for status and trends, the continuous data was averaged per day to compute a status, and we used a generalized additive model

(GAMs) to various trends over time (decadal). The discrete data was used for a population trend analysis where linear mixed models were used to produce a general trend across the Bay watershed, utilizing the pool of spatially distributed sites.

Results: For status, 2022 was the second warmest year for the stream temperature on average for the continuous sites (9- or 10-year period of record – 2013/2014 to 2022). Looking at decadal trends, the GAM modeling of the continuous daily value data, showed increasing trends in stream temperature from likely to extremely likely for 79% of the 31 sites across the Bay watershed with only two indicating downward trends. Looking at discrete data, and using the Linear Mixed Models, showed an increasing warming trend, approximately about half a degree across the entire watershed – this is daytime data.

Stream salinity:

Lindsey: To start off, many streams in the mid-Atlantic are at risk for freshwater salinization or an increase in ion concentrations. Natural background salinity in our region is typically low and any slight increase can cause osmotic stress to organisms. There are natural sources of salinity in the region, like carbonate lithology and atmospheric deposition. There are also anthropogenic sources of salinity like road salt, deicer applications, point sources, agricultural land use and mining activities that can quickly increase salinity above natural levels.

Specific conductance (SC) is a standardized measurement of conductivity and is used as a proxy for salinity and ion concentration. An inventory of discrete SC data was created using data acquired from the national water quality portal and the final inventory consisted of over 1 million observations and almost 17,000 sites. This data underwent several processing steps, including the removal of Quality Assurance (QA)/Quality Control (QC) samples and screening of duplicates and samples that were not surface water were omitted. Lastly, units were reviewed and harmonized. To be included in the trend analysis, sites had to have at least one sample per season.

Results:

For the Status analysis, a 3-year median annual SC values were calculated for the last three years of the trend analysis, which was 2015-2017, and then compared to a published background SC dataset. This resulted in 278 sites qualifying for analysis. Median annual SC for this period were lowest in central Virginia and northern Pennsylvania and highest in areas with urban land use like Baltimore and Washington D.C.

For trend analysis, two analytical techniques were utilized for a 10-year period between 2008-2017. Approach one utilized a weighted regression on time, discharge and season (WRTDS) approach on sites with higher data density and existing stream flow records (35 sites). Approach 2 utilized a seasonal Mann-Kendall test for sites with at least one sample per season for the 10-year trend period. This latter method was less robust as it does not incorporate flow, but those looser data requirements allow it to be applied to far more sites – 278 sites. WRTDS indicated that of the 35 sites, 60% had significant increasing trends and only 18% had decreasing trends – the remaining have no trends. The Seasonal Mann-Kendall indicated that 33% of sites had increasing trends and 12% had decreasing trends, with over half of the sites having no significant trend.

Toxic contaminants:

Compiling and harmonizing toxic contaminant data was very challenging due to the wide array of sample collection, site location, analysis, etc. After considering many contaminants, polychlorinated biphenyls (PCB), mercury and organochlorine pesticides were selected as focus constituents for compilation of a toxic contaminant's dataset. This is because multiple TMDL's across the watershed provides enough constituent data for an inventory of these contaminants. However, this inventory did not provide enough data for a robust trend analysis.

The inventory included over 241,000 individual toxic contaminants compiled over a period record from 1938 to 2019 across a wide variety of mediums, including water, fish tissue and sediments. Across these different toxic contaminants, only PCBs demonstrated the potential for trend analysis across 89 sites. These sites may have enough data for trend analysis in the coming years if monitoring continues.

Streamflow:

Streamflow is an incredibly important aspect of stream condition because it influences all our other indicators. Stream flow is the indicator with the largest number of continuous sites with data from 417 gage locations. Flow trends were analyzed using 4 different methods to maximize flexibility and applicability to various policy needs. However, for each analysis, trends were analyzed at 10- and 37-year time intervals ending in water year 2022 (1984-2022). Status was determined by the average annual flow of all sites relative to all water years in the period. Trends were determined using Theil-Sen regression at 10- and 36-year intervals.

Results:

Status: 2022 ranked 12th lowest mean annual flow out of the past 37 years and 2002 was the lowest water year while 1996 was the highest. Linear trends in streamflow were analyzed for all qualifying sites over 10- and 37-year periods of record. For both timescales, mean stream flow was increasing at the majority of sites. However, the majority of the increases were small, with slopes less than .1 cubic feet per second per year.

Hydromorphology:

Hydromorphology is the interplay of geomorphology, hydraulics and physical habitat conditions and it describes the form and flow of a river and its capability to support aquatic life. Sediment and physical habitat degradation have been identified as a leading cause of local ecological impairment across the Chesapeake Bay watershed. Degraded bed conditions are often regulatorily linked to sediment, but sediment is only one of several possible factors of degraded bed conditions.

To analyze hydromorphology, two different datasets and analytical methods were used in order to maximize site coverage and higher hydromorphological metrics measured. First, instream rapid habitat data was used to assess changes in stream habitat condition over time. This dataset has metrics that directly relate to biological health, and it provides powerful targeted information about condition. However, only a small subset of sites had enough data for trend analysis. Second, specific gage analysis, regularly collected channel dimension and flow measurements from gage locations, were used to analyze long-term change in hydromorphic elements such as channel width. This dataset has metrics describing broad hydromorphic elements of stream and was able to have a lot of larger number of sites suitable for trend analysis.

Results:

First looking at rapid habitat analysis, nine metrics from the assessment were selected for analysis between the years of 2007-2017, and they included metrics such as channel alteration, embeddedness, and bank stability, among others. This is intended to be a quick, visually qualitative ranking (0=poor, 20=optimal) of conditions at a meso- and microhabitat spatial scale. Sites were selected for trend analysis if they had at least seven years of habitat data within the period.

Status was defined by the average of the most recent three years of score for each metric. Channel embeddedness had the lowest average score, indicating that many sites had high levels of fine sediment surrounding bed substrate. Channel alteration had the highest average score, indicating that there was little physical alteration such as channelization or artificial banks. Trends were analyzed using GAMs with a smooth year covariate. Most sites had no trends in any habitat metric and of the sites that did have significant trends, the majority showed decreases in condition score over time.

Specific gage analysis: This uses routine streamflow measurements collected at USGS stream gages to document changes to channel dimensions and hydraulics, i.e., channel evolution. Three metrics indicative of change in channel dimensions were selected for trend analysis – bed elevation, channel area, and channel velocity. To qualify for trend analysis, the gage site had to have at least 10 years of continuous stream flow and stage data. This resulted in 342 sites for at least a 10-year trend analysis. Between 36%-51% of trends analyzed for each time interval (10-, 25-, 50-, and 75-years) were significant where 75-year interval had the most significant trend. Channel Velocity and Channel Area had fewer significant trends (41%), and Bed Elevation had the most (47%). Results indicated that Bed Elevation and Channel Velocity are more likely to decrease through time and Channel Area is more likely to increase. This indicates that gaged locations are generally moving towards wider, shallower, slower streams over the short term after having some stronger channelization in the long term.

Biological Assemblages:

Specific changes in assemblage compositions, such as decreases and sensitive taxa or functional traits, like fish that eat benthic invertebrates, can really help us determine what stressors are affecting the biological communities and degrading stream condition. Multi-Metric Index (MMI) is reported here, which aggregates multiple biological assemblage's metrics into a single value indicating overall biological condition. For macroinvertebrates, this is the Chessi BIBI (compiled by ICPRB) and for fish it is the MMI compiled by the EPA. For each of these, they also analyzed an assemblage sensitivity metric.

Similar to the rapid habitat analysis, datasets were truncated to a set window of interest that allowed for uniform Start/Stop dates while incorporating the most sites possible. Between the window of 2008-2017, sites had to have at least seven years of data collected in the same season to quality for trend analysis, resulting in 99 macroinvertebrate sites and 44 fish sites.

Status was defined as the average of the most recent three-year values for each metric at each site. Thus, status varied greatly among sites. But both macroinvertebrates and fish sites had MMI scores indicating poor condition in the highly developed areas around DC and Baltimore, and some on the Eastern Shore. Additionally, a higher percentage of sensitive taxa in less developed areas of the watershed.

GAMs with a smooth year covariate were used to determine Trends. Very few sites in either assemblage had strong trends in either metric. The sensitivity metric had the most trends for both macro invertebrates and fish. There were some significant increases in fish MMI scores when there were strong trends in the mix of increasing and decreasing macroinvertebrate BIBI scores in trend sites.

Take Home:

It is important to note that the trends sites presented here are not representative of the watershed. Our trend sites for many of these indicators are highly clustered in urban areas or not fully representative of all stream sizes and elevations and landscape types in the watershed. Moving forward, more work needs to be done in contextualizing what is being represented.

For nutrients and sediment, short-term (2011-2020) trend results showed increasing trends at 42% of total nitrogen, 23% of total phosphorus and 46% of suspended sediment sites. For stream temperatures, the 2022 water year was the second warmest year and warming trends were apparent across the watershed. For salinity, 85% of sites had 3-year median SC values above predicted background SC. For toxic contaminants, there was not enough data for analysis of trends, however there are some potential sites that with continued monitoring, may be suitable for future analyses. For streamflow, annual streamflow for the Bay watershed during the 2022 water-year was below average and trends show little change over the full period of record (37 years). For hydromorphology, the majority of habitat metrics with significant trends indicate degrading condition. Also, specific gage analysis captured patterns of deepening, eroding channels over long-term trend windows (75 years) and then more recently (10 years) stream beds beginning to fill, widen, and have lower channel velocity. Lastly, for Biological Assemblages, trends show more declines than increases in macroinvertebrate sensitive taxa and MMI scores, increases in fish MMI scores, and equal increases and decreases in fish sensitive taxa.

Next Steps:

Some challenges the team is currently facing is the lack of co-occurrences of key indicator sampling. For instance, there are no sites that capture all 7 key indicators and only one site that captures 6 (Susquehanna River, Danville, PA). Therefore, there is a big disconnect between flow and water quality data with physical habitat and biology data. There is a need for more co-occurrence to develop an integrated network of multiple indicators in the future.

Next steps include a network gap analysis where they aim to quantify gaps in the spatial and temporal coverage of the trend sites to improve representation of network conditions. Additionally, they want to incorporate additional data and fall into a routine Status and Trends analysis similar to the Nontidal network. Lastly, they want to gather stakeholder feedback to capture some ideas and opinions about this work.

Please respond to this mentimeter for your feedback on the work presented and different indicators.

Contact lists for the different leads:

Nutrients and Sediment – Christopher Mason (Camason@usgs.gov)

Temperature – John Clune (jclune@usgs.gov)

Salinity – Rosemary Fanelli (rfanelli@usgs.gov)

Toxic Contaminants – Trevor Needham (tneedham@usgs.gov)

Streamflow – Samuel Austin (saustin@usgs.gov)

Hydromorphology – Zachary Clifton (zclifton@usgs.gov) & Marina Metes (mmetes@usgs.gov)

Biological Assemblages – Lindsey Boyle (lboyle@usgs.gov)

Discussion:

Q from the chat: *Anthony Timpano:* SC 3-yr medians, is there any indication if or how winter deicing influenced the medians, especially in the northern jurisdictions? ***A***: *Rosemary:* Great question – we haven't yet looked into the drivers of the status and trend patterns. Preliminary analyses, however, showed higher levels of urbanization in sites with higher 3-year median SC values, which does suggest deicer applications in winter seasons could be a driver of elevated salinity.

Q from the chat: *Ari Engelberg:* For the various datasets and sites presented today, were watersheds being sampled typically non-nested vs nested? Wondering if you teased out that potential source of autocorrelation in the trend analyses? ***A:*** *Lindsey:* We were analyzing an individual trend at each site. ***A:*** *John:* For example, for temperature we did GAMs analysis at each individual site. And with this analysis, we can deconstruct the seasonal components and assess the warming and cooling years. For the discrete data, it was more challenging, but we can tease out some of the seasonal components as well from the Linear Mixed Effect models but with potential autocorrelation effects.

Q from the chat: *Carl Friedrichs*: Is there a reason that GAMs was chosen for some trends and Seasonal Mann-Kendall for other trends? Have you checked to see if they give the same uncertainty bounds on the resulting trend estimates? ***A:*** *Lindsey:* Each parameter was different and was tasked to the different leads to choose what was best for their analysis. ***A:*** *John:* for stream temperature, being able to use multiple covariance gave a more robust way to get a non-monotonic trend versus using a seasonal Mann-Kendall. ***A:*** *Rosemary:* For SC, we followed methods that have been previously used for salinity/SC so that we could compare our results to other efforts outside the basin.

C: *Breck:* It is kind of shocking to see how little overlap there is. Maybe using some of this information to help guide some of the monitoring planning in the future to help locate some more reoccurring sites. Also, the Climate Resilience Workgroup (CRWG) at the Chesapeake Bay Program (CBP) is really interested in the temperature work. There is some need/interest to dive into this more. *C: Lindsey:* We're very excited about the gap analysis because we believe that it will really help us in identifying not just where we're lacking but also to gather pinpoint locations of preexisting gage sites and how to add capacity to capture more indicators there. Or even something like sending out a temperature sensor to a small watershed to capture more representative landscapes, etc. We think we will strengthen our network quite a bit in the future after that analysis.

11:30 Adjourn

Next Meeting: Wednesday September 25th, 2024, from 10 AM – 12 PM

Attendees:

Gabriel Duran (CRC), John Clune (USGS), Gary Shenk (USGS), Qian Zhang (UMCES), Stephanie Nummer (ICPRB), Renee Karrh (MD DNR), Jeffrey Chanat (USGS), Michael Lane (ODU), Kyle Hurley (USGS), Olivia Devereux (CBPO), Lindsey Boyle (USGS), Carol Cain (MD DNR), Carl Friedrichs (VIMS), Andrew Keppel (MD DNR), Joseph Delesantro (EPA - ORISE), Mukhtar Ibrahim (MWCOG), Isabela Bertani (UMCES), Rebecca Murphy (UMCES), Helen Golimowski (CBPO), Christopher Mason (USGS), Rosemary Fanelli (USGS), August Goldfischer (CRC), Breck Sullivan (USGS), Kaylyn Gootman (EPA), Ari Engelberg (MD DNR), Gopal Bhatt (Penn State), Anthony Timpano (VADEQ), Joseph Morina (VADEQ), Lewis Linker (EPA), Peter Tango (USGS), Douglas Moyer (USGS), Samuel Austin (USGS), Alexander Soroka (USGS), Claire Buchanan (ICPRB), Cynthia Johnson (VADEQ), Caroline Kleis (CRC), James Webber (USGS), Tammy Zimmerman (USGS), Samuel Miller (USGS), Elgin Perry (CBPO), Cassandra Davis (NY DEC), Cory Russell (MD DNR), Kenneth Hyer (USGS), Tom Parham (MD DNR).