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MINUTES
REGULATORY ADVISORY PANEL MEETING
Turbidity Criteria Development Water Quality Standards (WQS)
August 10, 2021

Welcome and Introductions

Advisory Panel Members and/or Alternates Present:

- Chris French, ***Bio Clean***
- James Beckley, ***Chesterfield County DPU***
- James Filson, ***Dewberry***
- Shannon Curtis, ***Fairfax County***
- Dr. Katherine Filippino, ***Hampton Roads PDC***
- Evan Branosky, ***Home Builders Association of Virginia***
- Jamie Brunkow, ***James River Association***
- Mark Vigil, ***Luck Stone***
- Shelly Surles, ***Metallurgical Coal Producers Association (MCPA)***
- Normand Goulet, ***NoVA Regional Commission***
- Ashley Hall, ***Stantec Consulting Services***
- Kyle Shreve, ***VA Agribusiness Council***
- Chris McDonald, ***VA Association of Counties (VACO)***
- Chris Pomeroy, ***VA Association of Municipal Stormwater Agencies (VAMSA)***
- Jamie S. Heisig-Mitchell/Richard Sedgley, ***VA Association of Municipal Wastewater Agencies (VAMWA)***
- John Brooks, ***VA Transportation Construction Alliance (VTCA)***
- Todd Asselborn, ***VA Manufacturers Association (VMA)***
- Rene Hypes, ***Dept. of Conservation & Recreation (DCR)***
- Ryder Bunce, ***Virginia Dept. of Health (VDH)***
- Michael Smith, ***Dept. Mines Minerals and Energy (DMME)***
- Jacob Bauckman, ***VA Dept. of Transportation (VDOT)***

DEQ Staff Present:
Jutta Schneider (Facilitator), Melanie Davenport, Bryant Thomas, Dr. Tish Robertson, David Whitehurst, Allan Brockenbrough, Andrew Hammond, Conner Brogan, Erin Belt, Matthew Stafford

Others Present: Doug Moyer, **U.S. Geological Survey**
Ed Wallingford, **VDOT**

Background, Overview and Discussion of Turbidity Criteria Development
Ms. Schneider, Water Planning Division Director, welcomed the Panel members and reviewed the agenda and a brief review of comments received during the Notice Of Intended Regulatory Action (NOIRA) comment period. She also explained the goals and guideline expectations for Regulatory Advisory Panel (RAP) discussions and that the RAP meetings and communications are subject to the Freedom of Information of Act. Introductions of RAP members and DEQ staff present were made.

David Whitehurst, Water Quality Standards staff, gave an overview of the rulemaking procedures which included an explanation of the Administrative Process Act timeline and a potential schedule expected for the promulgation of turbidity criteria. Evan Branosky asked if the time frame for going to the State Water Control Board (SWCB) in December was set by DEQ. Mr. Whitehurst explained that the timing of taking a proposal before the Board is a function of the timing of the NOIRA publication. Staff have 180 days after completion of the NOIRA comment period to take a proposal to the next SWCB meeting. The September quarterly meeting was too tight, so staff plan to take it to the SWCB in December.
It was asked how many RAP meetings are planned and Mr. Whitehurst responded staff are tentatively planning four RAP meetings. One on August 24 and two dates planned in October (October 5th and 19th). It is worth noting that the second RAP meeting tentatively planned for August 24, 2021, was subsequently postponed to allow staff time to consider the comments and information received at this first meeting. RAP members were notified of this via email sent August 17, 2021.

Dr. Tish Robertson then presented basic concepts regarding water quality standards which included what they are, what they are used for, and the core components of water quality standards. She reviewed designated uses and the types of water quality criteria (numeric and narrative) used to protect those uses. Mr. Branosky asked if a numeric threshold can be established for achieving a narrative criteria and are there any existing numeric thresholds that implement turbidity. Dr. Robertson mentioned that while not a criteria, secchi depth for lakes, which is a component of determining a lake's trophic index, is a turbidity-related parameter. Shannon Curtis asked for clarification on the water clarity example in Dr. Robertson's presentation. Dr. Robertson explained that the criteria are expressed as percent-light-through-water, which is calculated using the light attenuation coefficent (k_d)—a parameter that is estimated from turbidity and other water quality measurements taken in a waterbody using a boat equipped with underway monitoring technology. These estimates are then spatially interpolated to provide an acreage estimate.

Review of Turbidity Data, Information and Literature
Mr. Whitehurst then gave a brief presentation regarding turbidity and total suspended solids (TSS) and how they are related, as well as differentiated. He explained that, although TSS can be a component of turbidity, they are not the same.

Mr. Curtis asked if the units of turbidity measurement are interchangeable between NTU and FNU. Doug Moyer of the USGS responded they are functionally and numerically equivalent. Although how they are measured is different as well as the equipment calibration. He stated that part of any criteria needs to consider the measurement, methods and units. Mr. Branosky asked about the status in Virginia for turbidity in ambient waters. Ms. Schneider replied that Dr. Robertson would be discussing this in detail later in the day.

Overview of Turbidity Literature

Dr. Robertson then presented the results of a DEQ staff review of scientific literature related to the effects of turbidity on aquatic life. She stated that 52 controlled field and laboratory studies were reviewed and presented the following findings:

- Most of the scientific literature is focused on how turbidity affects fish feeding and predator avoidance behavior, particularly of salmonids.
- Very few studies have been conducted on the effects of turbidity on invertebrates.
- Studies focused on lethal levels of turbidity are rare. The ones that have been performed have found lethal effects only at very high turbidity levels (greater than 3,000 NTU)
- Non-lethal effects of turbidity have been detected at a broad range of turbidity levels, from 1.5 NTU (reduced reactive distance to prey in salmonids) to 898 NTU (increased breathing rate in a species of sunfish).

She then mentioned the following challenges to interpreting the results of the studies reviewed:

- In the vast majority of studies, control subjects are those exposed to 0 NTU. "Significant effects" are based on responses in test subjects that are statistically different from controls. But the majority of Virginia's surface waters always have some detectable turbidity.
- Most studies documenting behavioral responses do so without paired growth, reproduction, or survival data.
- Turbidity studies are highly variable in their design, complicating generalization.

Dr. Robertson then presented the results of staff review of studies related to the effects of turbidity on recreational uses:

- Studies on turbidity in the context of recreation often use water clarity (secchi depth) as an indicator.
- Aesthetics and swimming/bathing safety are usually examined separately.
- Thresholds may be based on user perception or expert consensus; sometimes both experts and non-experts are targeted.

She then reviewed the range of turbidity thresholds from those studies and explained the challenges to interpreting the studies reviewed by DEQ staff. Recommended thresholds ranged from 1.5 to 8 NTU for streams and rivers, and 0.7 to 2.5 m for lakes and reservoirs. The challenges to interpreting studies include:

- User perception of recreational benefits can be influenced by the user's socioeconomic status, knowledge, experience, and location.
- The thresholds are often provided without a recommended duration or frequency.
- There is sometimes considerable overlap in turbidity levels rated as "high recreation quality" and "low recreation quality" by survey respondents.

Dr. Robertson also presented information regarding past EPA efforts to develop nationally recommended turbidity criteria in 1986 and the early 2000s, none of which had been widely adopted by States.

The following questions were asked as part of the discussion among the RAP.

Did any of the research look at any solids that were not settleable or consider algae suspended in the water. Dr. Robertson responded none that she was aware of.

James Beckley asked did any studies look at desirable recreational water quality. Dr. Robertson responded that the user perception surveys did and derived specific thresholds.

Chris French suggested distinguishing between field and laboratory studies in the reference materials and, secondly, has DEQ looked at data it has collected? Dr. Robertson responded that the RAP will be presented with Virginia-specific data.

Evan Branosky asked is there a reason why NTUs are not applied in lakes/reservoirs, as Secchi depth is not used in streams/rivers? Dr. Robertson responded, and others echoed, that one can use NTUs in lakes/reservoirs but measurement using a Secchi disc is simple, less costly, and the dynamics of lakes/reservoirs (3 dimensions) may complicate measurement of turbidity as NTUs.

A RAP member asked if there is any correlation between Secchi depth and turbidity and would this be water body specific. Dr. Robertson replied that a relationship can be built, and one could develop a waterbody-specific relationship, but the Virginia-specific information and analyses which would be presented to the RAP was done it at a state-wide basis.

Jamie Brunkow asked if we considered mussels in our research. Dr. Robertson noted that we did not see many studies on invertebrates in the literature, and if there was not a turbidity component to a study (e.g. only total suspended solids), then the study was not reviewed. Mr. Brunkow suggested that DEQ also include the TSS aspect as this is very important for protecting sensitive species.

Ashley Hall asked if DEQ would be considering anything specific for the special/sensitive waters in Virginia. Dr. Robertson responded that, yes, DEQ would consider any special waters, such as natural trout designated waters.

Shannon Curtis asked if there was any distinction between types of turbidity as some can have toxic components and was there any distinction in the literature. Dr. Robertson responded that, in general, the source(s) of turbidity in the studies was not toxic. As an example, no journal articles reviewed considered turbidity as a result mine tailings.

Rene Hypes then asked and Ms. Schneider affirmed and encouraged that if RAP members identify any additional studies or literature references to be considered in this rulemaking, they should be sent to David Whitehurst for distribution to the RAP.

At the conclusion of this presentation and discussion, the RAP meeting paused for a lunch break.

Overview of Turbidity Monitoring in VA

After lunch, Dr. Robertson presented information regarding turbidity monitoring for Virginia's inland surface waters and an overview of the analyses of turbidity as it relates to geographic patterns, aquatic life integrity and habitat, watershed land cover and pipeline continuous monitoring stations. She first summarized the available datasets for the analyses, noting there is a great deal of turbidity data collected from the various DEQ monitoring programs, as well as the trend monitoring and continuous monitoring conducted by the USGS. She also provided background information on each of the datasets used in the analyses throughout her presentation to provide context and foster understanding and discussion among the RAP.

The following geographic patterns were seen with respect to turbidity:

- Turbidity tends to be lower in the mountainous streams than in the piedmont and coastal plain streams. This is probably because mountain streams tend to have lower suspended sediment concentrations with a lower proportion of fine particles than other streams.
- The relationship between turbidity and TSS is strong, though the reliability of TSS as a predictor of turbidity does appear to differ between the coastal plain and the rest of the state.
- River characteristics likely determine how turbidity changes from its headwaters to the mouth.

The following correlations were noted between turbidity and aquatic life integrity and habitat:

- Both instantaneous turbidity and long-term median turbidity were correlated with Virginia Stream Condition Index (VSCI) scores, indicating there is a weak negative correlation between turbidity and stream biotic integrity.
- Both long-term trend and probabilistic datasets indicate that turbidity tends to be elevated in streams with the poorest habitat quality compared to streams with the best habitat quality.
- Turbidity in mountain streams appears to be more strongly associated with habitat degradation than turbidity in piedmont or plains streams.
- Of the three sediment-related habitat variables examined (embeddedness, bank stability, and sediment deposition), embeddedness shows the strongest positive correlation with turbidity.

The following land cover correlations were identified:

- There is a weak positive correlation between turbidity and barren, agriculture, and urban land cover at the watershed scale.
- There is a weak negative correlation between turbidity and forest land cover at the watershed scale.
- There is a weak negative correlation between turbidity and barren, urban, and forest land cover at the scale of the adjacent riparian area.

The following were noted regarding turbidity changes during storm events, as documented with stream flow data and USGS River Input Monitoring sampling:

- Turbidity increases dramatically during storm events.
- Monthly ambient samples miss the highest turbidity values at a stream site, but still adequately capture the ambient condition.

Dr. Robertson then presented USGS continuous monitoring station data from 2017-2021. These continuous monitoring stations are located on streams crossed by the Mountain Valley Pipeline Proposed Track. While no stream crossings have yet occurred with the construction activities, there has been active clearing work in the subject watersheds.

Turbidity Data Analysis Discussion Summary

Questions and discussion items concerning the detailed analyses presented by Dr. Robertson are summarized below.

It was asked if citizen monitoring data would be considered. Dr. Robertson indicated that DEQ does have citizen datasets, but she was not reviewing those data in her analyses or presentation for the RAP.

Shannon Curtis asked if there any qualifiers about field collection of data, i.e. does DEQ have storm and base flow information in the datasets. Dr. Robertson indicated that staff will generally sample as long as it is safe and the weather is not too extreme. Accordingly, data collected under the DEQ trend monitoring program would capture a wide range of flow conditions.

Mr. Beckley asked what the rationale of the categorization of turbidity values was as the top range of scale in the charts. He noted that the highest category of 21-117 NTUs is much larger than the other groupings. Dr. Robertson indicated there was nothing specific other than grouping of the data for visualizing.

Mr. French stated the river continuum concept presented makes sense. The Nottoway River is very tannic in nature, so you might expect the turbidity to be higher in this system. He asked about the multiple impoundments in the Roanoke River Basin and would like to see a similar chart in that system showing the impoundments.

Mr. Beckley noted the river continuum is helpful, however, looking at land use and human impacts can be important to consider as well. He noted the New River shows some consistency in values; the land use in this watershed is very similar. Other watersheds may be more impacted by variety in land uses which the river continuum model may not explain. Dr. Robertson noted that we would be looking at land cover shortly (not land use).

It was asked if DEQ has looked at any taxa beyond macro-invertebrates. Dr. Robertson noted that we have not analyzed any other assemblages. DEQ does have some fish community data that possibly could be evaluated.

There was a question as to whether the analysis might distinguish and remove the element of turbidity that is TSS, to understand the potential impacts of turbidity alone. It was noted that DEQ has not looked at the data in that manner.

A RAP member noted that there has been a lot of effort put into establishing buffers and Best Management Practices (BMPs) on riparian area land cover and barren lands, and asked if DEQ has looked to see if any BMPs are in place? Dr. Robertson noted that it was a good question and responded that we have not considered BMP implementation relative to the data.

Ashley Hall asked if DEQ staff has looked at impervious cover and how that may play into the data analysis. Dr. Robertson noted that we have not, though we have the information and could possibly include it in the analysis.

Chris French asked if the land cover was held constant over time considering the length of time the probabilistic data has been collected. Dr. Robertson responded that we looked at the most recent land cover year against the entire probabilistic dataset. We did not try and change the land cover over time to correlate with the age of the data collected.

There was a question to clarify what constitutes barren lands. Dr. Robertson reviewed a slide with definitions. It was asked if silviculture was considered barren or agriculture. Dr. Robertson replied she believes it is considered forested lands.

It was stated by a RAP member that mined areas are all required to have sediment controls or BMPs, so that may help explain the negative correlations. Mines try to maintain all sediment on-site in settling pits.

It was asked what other factors may contribute to spikes in turbidity with the correlation between increased rainfall and increased turbidity. Dr. Robertson responded that while there is a relationship between rainfall and increased turbidity, the causes and impacts on water quality are not fully understood. It can be stated that turbidity increases with rainfall events and drops quickly afterwards. One of the RAP members noted, and Dr. Robertson agreed that even with very high turbidity spikes, high VSCI scores are often seen. So, the direct impact of turbidity on stream health is not clear. Doug Moyer offered that the USGS finds turbidity is a better predictor of water quality than stream flow. Because of the many variables influencing turbidity (first flush, BMPs), it is a better surrogate of predicting water quality than many other parameters they have considered in the past.

James Beckley noted that Bottom Creek is a smaller stream order while the Blackwater River is a larger stream order. Looking at that larger watershed, it makes sense that turbidity events last longer because many more upstream sources in the watershed contribute to it.

A question was asked whether we considered the variance in VSCI scores at the biological monitoring sites associated with the pipeline monitoring, noting that the average scores had been presented. Dr. Robertson responded that we did not compare the variance, but that we would expect some level of variation over time and considering seasonality of collections.

There was also a question seeking to understand the location of biological monitoring sites in relation to stream crossings, specifically, were they upstream or downstream. Dr. Robertson responded that the VSCI scores were composites of both upstream and downstream sites. There have not been any stream crossings, so combining the results at this stage is acceptable.

Review of Other States' Criteria

Ms. Schneider then presented an overview of other States' turbidity criteria and noted the following:

- Almost all states have narrative criteria that stipulate the control of substances causing turbidity which interfere with designated uses.
- About 60% of jurisdictions have numeric turbidity criteria.
- The majority of numeric turbidity criteria are expressed as a value or percentage above background turbidity.
- A few states use TSS in place of turbidity, specifically Arizona and New Mexico.
- For numeric turbidity criteria expressed as an instantaneous maximum, values range from 10 to 150 NTUs.
- Most jurisdictions have general numeric turbidity criteria. Some have varying criteria for different designated uses, waterbody types, or river basins. Some have seasonal criteria.
- Some jurisdictions have either replaced numeric turbidity criteria with TSS criteria or use TSS as a surrogate for permit limits.

Questions and discussion items concerning the presentation of criteria in other states included:

- Regarding the turbidity criteria for Maryland, it was asked that if the criteria do not apply to stormwater construction permits, what permits it would they apply to? DEQ responded that discussions with MDE staff indicated the criteria do not seem to be specifically applied. This would be a good follow-up with MDE to ask if and where/how the criteria are specifically applied in permitting programs. It was noted that DEQ staff can follow-up regarding how other states are implementing their criteria.

- Conversation among the RAP then focused on considering implementation of any turbidity water quality standard (WQS) that may be developed. Some RAP members noted that while turbidity criteria development is separate from implementation concerns, any WQS will likely have permitting implications and we should be aware of how any criteria might be implemented.
- Andrew Hammond, with DEQ, explained that MDE does not have any individual construction permits, only General Permits (GP). The Maryland Construction GP was last reissued in 2014, and there was some discussion about how to potentially include the numeric criteria into the GP. Like Virginia, Maryland applies the same approach to the Construction GP as a technology based permit focusing on BMPs.
- Mr. Branosky stated that it seems like an important piece of information would be what the turbidity levels are in different effluents. We would need to understand the turbidity values of discharges at the point of discharge. These data are very different than the NTUs of ambient waters (after mixing has occurred). Ms. Schneider commented that we wanted to look and see if there is anything in the ambient data that helps provide insight to impacts to aquatic life from turbidity data.
- A RAP member asked which States went back to TSS from turbidity and why. Ms. Schneidger noted that Minnesota and Arizona went to TSS because of implementation challenges.

Ms. Schneider asked the Panel whether there were any additional states to consider.

- Mr. Branosky requested to look into what North Carolina has done as that may be helpful information. There was a request to look at Georgia as well. Ms. Schneider noted that DEQ staff will do so.
- There was a request to help explain and clarify Delaware's criteria implementation as it was not clear who is responsible and how activities are regulated. Ms. Schneider indicated DEQ staff would research how other states are implementing their numeric turbidity criteria.

Overview of Virginia Programs and Controls for Turbidity/Sediment

Melanie Davenport, DEQ Water Permitting Division Director, then gave a presentation regarding Virginia's programs and their controls for turbidity and sediment. She reviewed the Virginia Water Protection Permit program (VWP) and the activities the program regulates (filling, excavation, impounding surface waters, and surface water withdrawals) and the types of permits the program issues (General Permit vs Independent Permits).

She then reviewed the Virginia Erosion and Sediment (E&S) Control program and the types of activities that program regulates stating that E&S controls apply to land-disturbing activities ≥ 10,000 square feet, or ≥ 2,500 square feet in areas subject to the Chesapeake Bay Preservation Act.

She then reviewed the Virginia Stormwater Management Program (VSMP). The types of activities to which that program applies are land-disturbing activities ≥ 1 acre, or ≥ 2,500 sf in areas subject to Chesapeake Bay Preservation Act.

Ms. Davenport then reviewed the Virginia Stormwater Management Program (VSMP) which is the regulation which also governs municipal separate storm sewer systems (MS4). The land-disturbing activities it regulates are:

- All land-disturbing activities ≥ 1.0 acre

- All land-disturbing activities < 1.0 acre and part of a Common Plan of Development
- All land-disturbing activities ≥ 2,500 s.f. in areas subject to Chesapeake Bay Preservation Act

The general requirements for the VSMP regulation are:

- Prepare Stormwater Pollution Prevention Plan (SWPPP)
- SWPPP components include:
  - Approved Erosion & Sediment Control (ESC) Plan
  - Approved Stormwater Management (SWM) Plan
  - Pollution Prevention Plan
  - Measures to address applicable TMDLs
- Obtain Construction General Permit (VAR10) coverage

She then reviewed the numerous and various mechanisms utilized to control and minimize sediment and erosion.

Ms. Schneider posted questions to assist with guiding the discussion, and offered that we would share the questions with the group, including those not present today. Those questions were:

- *Which designated use(s) should numeric turbidity criteria be targeted to?*
- *What degree of impact(s) should be avoided? What should be the level of protection?*
- *Is there a particular approach or existing criteria that seems most (or least) suitable or desirable?*
- *Should we incorporate different background levels, for example based on flow condition or region? If so, how?*
- *Should other parameters be considered? If so, how?*
- *What implementation questions should be considered when developing numeric turbidity criteria?*

Questions and discussion items are summarized below.

- Shannon Curtis stated that the VSMP authorities have obligations to inspect. Ms. Davenport clarified that for any federal and state construction projects, DEQ has the responsibility to inspect. One of the reasons the State Water Control Board (SWCB) is interested in turbidity is due to the Mountain Valley and Atlantic Coast pipe line projects. Federal projects are exempt from DEQ requirement for a 402 permit. Ms. Davenport further clarified the numbers presented represent only DEQ-conducted inspections.
- Evan Branosky asked how would we start to determine the benefits of BMPs on controlling turbidity. Can DEQ determine this or would it require more study to revise/update BMP data and what else can be pulled out of current BMPs that are employed? It was noted that perhaps that is why other construction stormwater permits in EPA Region 3 states do not have specific numeric requirements. It was also noted that the federal Effluent Limit Guideline (ELG) at one time had attempted to incorporate a numeric turbidity endpoint. Mr. Hammond explained that EPA tried to develop a technology-based ELG for turbidity that was initially 280 NTU. They were sued and indicated they had inappropriately evaluated the data. They then removed the NTU from the permit and put in a placeholder. That may be why other states are not applying numeric values to the CGP.
- It was stated that it is difficult to apply a numeric value to construction BMPs. Construction activities are variable unlike traditional point sources. Most states have implemented BMPs in lieu of numeric limitations.

- It was asked what was the charge or direction of the SWCB. Ms. Davenport made it clear that she does not speak for the Board but her observation was that the construction activities associated with the pipeline were a driver. There was likely some surprise to see turbid water from a construction activity that was in compliance with a permit.
- Chris Pomeroy stated that this is more difficult than any of the other hard problems that we have addressed with criteria development, i.e. how to develop numeric turbidity criteria for the various streams across the state. He asked if this is really getting towards better construction practices and is there a more direct way to get at the main problem/issue. Ms. Schneider commented that DEQ would very much like to hear suggestions from the RAP. Staff are looking for input, and there are many complexities. Perhaps there are ways to get at the issues, including the monitoring and ambient assessment implementation aspect of turbidity criteria. She expressed that she thinks the SWCB would be willing to discuss options.
- Mr. Curtis asked why go down the turbidity rabbit hole and not more directly looking at suspended sediment concentration (SSC) or TSS? Ms. Schneider noted that DEQ staff provided information to the SWCB and they initially did not accept alternative suggestions. We are willing to entertain ideas and input from the RAP on these issues.
- Mr. Branosky stated that homebuilders provided input that turbidity itself is not a pollutant and we should only be addressing/controlling pollutants. Ms. Davenport commented that she does not think courts have weighed in on the issue of whether or not turbidity is a pollutant. She posed the question can or should we regulate a pollutant or metric that is not achievable? These issues need to be considered.
- Michael Smith stated that the coal mining point source regulations recognize that sediment ponds control TSS but allow an alternate limit for settleable solids in the regulations with certain rain events. Ms. Schneider commented on what can be done about turbidity, and also does it have an impact. This gets at the frequency, magnitude and duration issues of criteria development.
- It was noted by one RAP member that with their operations in West Virginia, they have observed that they will write a violation for turbidity if the discharge is significantly different than the receiving stream turbidity. It is based on field observations.
- It was stated there is a clear relationship between TSS and turbidity in most of the state. If we are already looking at TSS, which is the bulk of turbidity, then perhaps we should really focus on the ecoregion where there is not a strong relationship. Virginia is already effectively regulating TSS with stormwater and construction controls, so perhaps we should focus on that limited ecoregion.

The floor was then opened for Public Forum comments. There were no comments from the general public.

Ms. Schneider thanked all for their participation and she offered Items for DEQ and the RAP to research or further consider. She also invited any RAP member the opportunity to provide their own presentation at a subsequent meeting if they would like to do so.

The meeting was adjourned at approximately 4:00 p.m.