Monitoring Plan Development for Phased TMDLs in Bull Creek, Levisa Fork, Pound River and Powell River

Background:

The Bull Creek, Levisa Fork, Pound River, and Powell River TMDLs were submitted in 2011 as phased TMDLs, due to uncertainties and differences of interpretation regarding data, and predictive tools. A number of questions have been identified regarding data needs for these TMDLs. These questions are the basis for the monitoring plan design.

<u>All TMDLs</u>

- What sediment loads, in terms of total suspended solids (TSS), are discharged from active mining sediment control ponds during storm events?

<u>Bull & Pound TMDLs</u>

- What is the annual contribution of total dissolved solids (TDS) from the abandoned underground mine workings?
- What percentages of the total TDS waste load assigned to active mining are attributable to 1) background, 2) current mine activity, and 3) groundwater?

<u>Bull TMDL</u>

- How much do the existing straight pipes and failing septic systems contribute to the stream's poor benthic macroinvertebrate health?

<u>Pound TMDL</u>

- How much of the TDS waste load assigned to the active mines is a result of pre-law "Rahall" eligible discharges?

<u>Levisa TMDL</u>

- What are the specific sources of the PCBs observed/measured in the watershed?

<u>Powell TMDL</u>

- Should PAH be considered as a probable stressor?
- What are the sources of the PAHs observed/measured in the watershed?

Preliminary Monitoring Discussions:

Representatives from the Southwest Regional DEQ Office (DEQ-SWRO), Department of Mines, Minerals, and Energy (DMME), and MapTech met at the DEQ offices in Abingdon, VA to discuss plans for monitoring on May 11, 2011. The results of the discussion are presented here. General monitoring plans to address each question

were discussed. The full monitoring plan will be developed, within the constraints of budgets and resources, after input from concerned parties is gathered and assessed, and potential for collaborative efforts is explored.

Each of the questions can be categorized as follows:

General Modeling Support: Questions that relate to the over all modeling approach, may be applicable to multiple TMDL areas, and could have an impact on the TMDL itself.

Stressor Identification Support: Questions that relate to the stressors identified during TMDL development. These questions may impact the TMDL, or might only affect Implementation strategies.

Implementation Support: Questions that relate to the distribution of sources and may affect implementation approaches, but probably won't affect the TMDL itself.

What sediment loads, in terms of total suspended solids (TSS), are discharged from active mining sediment control ponds during storm events? **(General Modeling Support)**

Two methods have been used in these TMDLs to estimate the existing load of TSS contributed from active mining sediment control ponds. One uses bimonthly monitored flow and concentration of TSS, the other uses a modeling approach. There are concerns that the monitored bi-monthly data underestimates the load due to missing the impact of larger rainfall events, while the modeling approach appears to over-estimate the load as compared to the monitored data. The goal of this portion of the monitoring effort is to assess the existing monitoring approach, and the model estimates, using a more comprehensive dataset.

This will be accomplished through the use of automated samplers, rain gages, and stream gages. The automated samplers will be configured to collect composite flow-weighted samples from storm events. Sampling could be triggered by rainfall amounts and/or flow volumes. Monitoring stations will be installed at a representative number of ponds. The number will be determined after more information is gathered with respect to costs and funding.

What is the annual contribution of total dissolved solids (TDS) from the abandoned underground mine workings? **(General Modeling Support)**

Within the Bull Creek watershed, there are a number of well-defined discharges from abandoned underground mine workings. The flow from these discharges is considered to be relatively stable. In order to assess the contribution from these discharges flow and TDS will be measured on a fixed frequency (*e.g.*, monthly or quarterly), while conductivity and depth of flow are monitored continuously to assess variability over time. The anticipation is that the loads of TDS can be related to the expanse (*e.g.*, area

or volume) of the mine workings that contribute to each discharge. If so, the data could be extrapolated for use in other watersheds.

An alternative plan was explored that would be more appropriate for an area where discharges from abandoned underground mine workings are not well defined. The approach was to record the average TDS level in the mine workings (TDS_M) and in unaffected groundwater (TDS_{GW}), and use these values in conjunction with TDS (TDS_S) and flow (Q_S) monitoring in the stream to calculate the TDS loads for mine workings and groundwater. First, a flow separation process would be used to analyze the hydrograph and determine periods of baseflow conditions. At baseflow conditions, a mass-balance approach would be used for the calculation as follows:

$$Q_S \times TDS_S = Q_M \times TDS_M + Q_{GW} \times TDS_{GW}$$

and

$$Q_S = Q_M + Q_{GW}$$

Solving these two equations for the flow volumes from mine workings (Q_M) and groundwater (Q_{GW}), and multiplying each by their respective TDS concentrations will yield the load from each source.

***What percentages of the total TDS waste load assigned to active mining are attributable to 1) background, 2) current mine activity, and 3) groundwater?* (Implementation Support)**

While this question is interesting, the results will not likely impact the TMDL, and it should be given a lower priority than monitoring efforts that will affect the TMDL, unless alternative/additional funding sources can be identified.

Depending on the specifics of a given situation, “background” loads could be monitored at an upstream location that is not impacted by the current mine operations. Groundwater contributions will be harder to separate out, but an approach similar to the one outlined above could be adapted to the situation.

***How much do the existing straight pipes and failing septic systems contribute to the stream’s poor benthic macroinvertebrate health?* (Stressor Identification Support)**

Since straight pipes contribute TSS and TDS to the stream, this may be merely an implementation question, however, if specific pollutants associated with straight pipes are identified, the TMDL could change. There may be some data available from a nearby study, conducted by the Virginia Department of Health (VDH) at Stonega, that would give us some insight. Additionally, benthic assessments can be combined with fluorometric analysis and estimates of straight pipe numbers to determine if there is a relationship between straight pipes and poor benthic health.

***How much of the TDS waste load assigned to the active mines is a result of pre-law "Rahall" eligible discharges?* (Implementation Support)**

"Rahall" eligible discharges are discharges from abandoned mine sites, where remining is being conducted and alternative effluent limits are in place, which will allow the practice and eventually improve water quality through reclamation of the abandoned site. The alternative effluent limits do not currently apply to TDS, since there are not currently effluent limits on TDS. While this question is interesting, the results will not likely impact the TMDL, and it should be given a lower priority than monitoring efforts that will affect the TMDL, unless alternative/additional funding sources can be identified.

This monitoring effort would have to be very site specific. If the "Rahall" eligible discharges are related to underground mines, then it may be possible to use the techniques suggested for quantifying the TDS load from abandoned underground mine workings. If the discharges are related to surface disturbances, then the monitoring approach would have to isolate the impact from these disturbances either through monitoring upstream and downstream of the inputs, or, where possible, by monitoring discharges from the disturbed area itself.

***What are the specific sources of the PCBs observed/measured in the watershed?* (Implementation Support)**

While this question is interesting, the results will not likely impact the TMDL, and it should be given a lower priority than monitoring efforts that will affect the TMDL, unless alternative/additional funding sources can be identified.

Based on monitoring conducted during the TMDL development, specific areas can be identified where additional monitoring of PCBs in sediments could help to prioritize the search for PCB sources.

***Should PAH be considered as a probable stressor?* (Stressor Identification Support)**

During TMDL development, high PAH levels in sediment samples were identified as a possible stressor. The predominant form of PAH was naphthalene, a highly volatile substance. Most of the naphthalene that enters the environment is from the burning of wood and fossil fuels. Naphthalene is typically a white solid substance that evaporates easily. It is used in mothballs, moth flakes and tar camphor. Both coal and petroleum naturally contain naphthalene. Because naphthalene is so volatile it is usually gone from rivers or lakes within two weeks. In addition, it binds very weakly to soil and sediments. Because of this, it was speculated during TMDL development that either there is an active, widely distributed source of naphthalene in the watershed, or that the naphthalene being detected is bound-up in coal sediments that are not bio-available.

To test for bioavailability, benthic surveys can be performed in areas where high levels of PAHs (*e.g.*, naphthalene) have been recorded and in areas where low levels of PAHs

have been monitored. Tissue from the collected fauna can be analyzed for the levels of PAHs in both cases. Significantly higher values in the fauna collected from sites with high PAH values would indicate bioavailability.

***What are the sources of the PAHs observed/measured in the watershed?* (Implementation Support)**

While this question is interesting, the results will not likely impact the TMDL, and it should be given a lower priority than monitoring efforts that will affect the TMDL, unless alternative/additional funding sources can be identified.

Spatially distributed sampling could be used to supplement data that have already been collected, which could help in prioritizing the search for PAH sources.