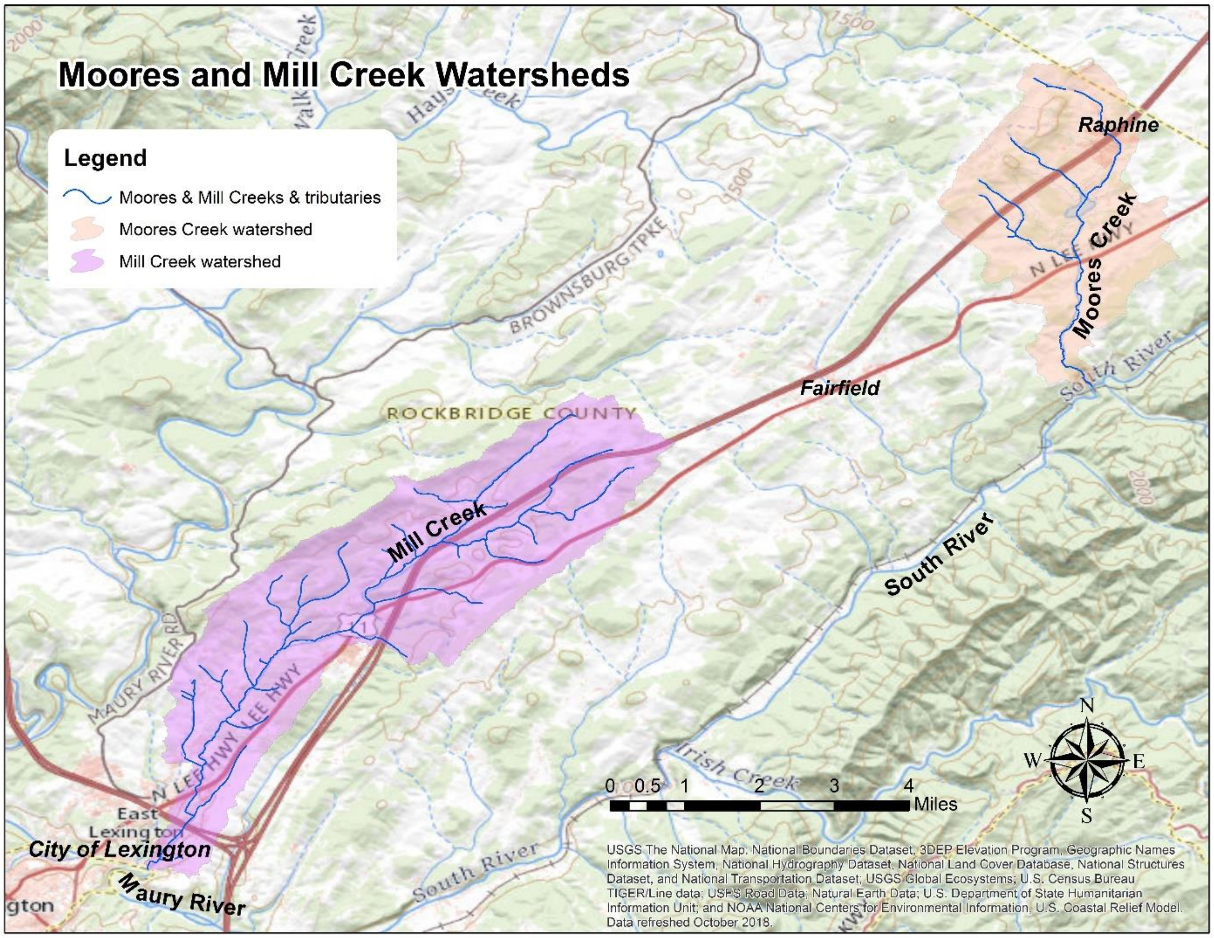
Moores and Mill Creek Technical Advisory Committee Meeting

Jordan’s Point Park, Lexington VA

November 3, 2021



What does the Technical Advisory Committee do?

- Represents the watershed community
- Shares information on:
    - Historic and current land use
    - Future development
    - Previous and planned restoration projects
    - Local monitoring efforts
    - Key stakeholder groups and contacts
- Reviews data related to:
    - Pollutants responsible for biological impairment
    - Pollutant sources
    - Pollutant reduction scenarios

What is a Benthic Stressor Analysis?

- Weight of evidence approach to determine pollutants responsible for the benthic impairments
- Candidate stressors considered in Moores and Mill Creeks
  - Suspended solids
  - Deposited sediment
  - Dissolved oxygen
  - Phosphorus
  - Nitrogen
  - Ammonia
  - Total dissolved ions
  - Dissolved chloride
  - Dissolved sulfate
  - Dissolved sodium
  - Dissolved potassium
  - Dissolved metals
  - Temperature
  - Conductivity
  - pH
  - Organic matter
- Score each stressor (-3 to +3) based on different lines of evidence. Use scores to group stressors into three categories: Non stressor, Possible stressor, Probable stressor
- Data used for analysis
  - Benthic monitoring data
  - Water quality data
  - Habitat data
  - Relative bed stability data
  - Land use data
  - Flow data (USGS)

Preliminary findings of benthic stressor analysis

- **Sediment** is a probable stressor in Moores and Mill Creeks
- **Conductivity** is a possible stressor in Moores and Mill Creeks

Evidence for sediment as a probable stressor

Spring/Fall Stream Condition Index Scores

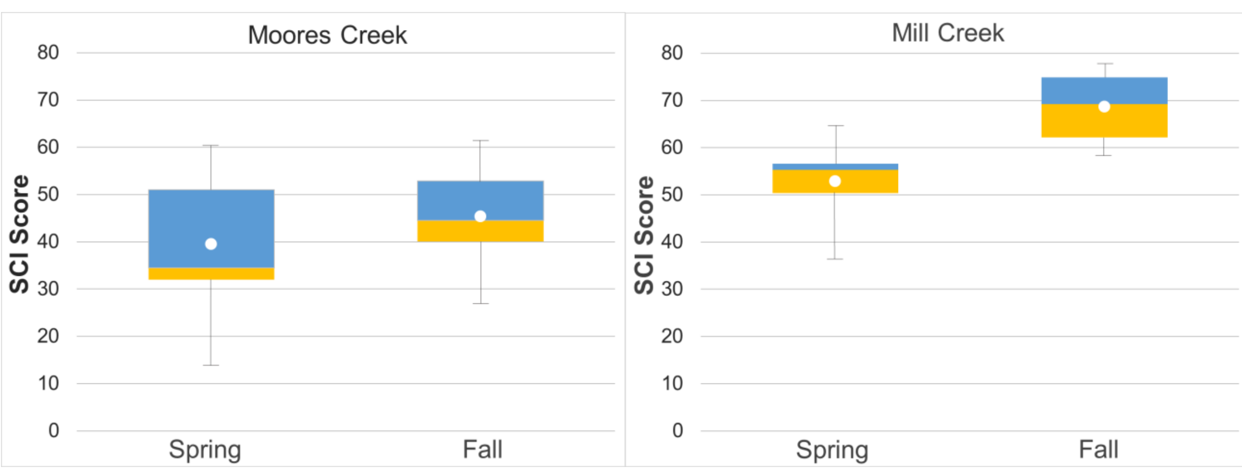


Figure 1 Moores and Mill Creek stream condition index scores (spring and fall). Whiskers indicate the range, boxes indicate the inter-quartile range, lines indicate the median, and white markers indicate the average. Lower spring scores suggest sediment impacts during high flow events.

Shifts in benthic community composition compared to reference condition

A non-impaired reference watershed was selected to compare biological and chemical monitoring data from Moores and Mill Creeks with. Factors considered when selecting the reference watershed include land use, stream gradient, and watershed size. Strait Creek in Highland County was selected as the reference condition with which to compare Moores and Mill Creeks.

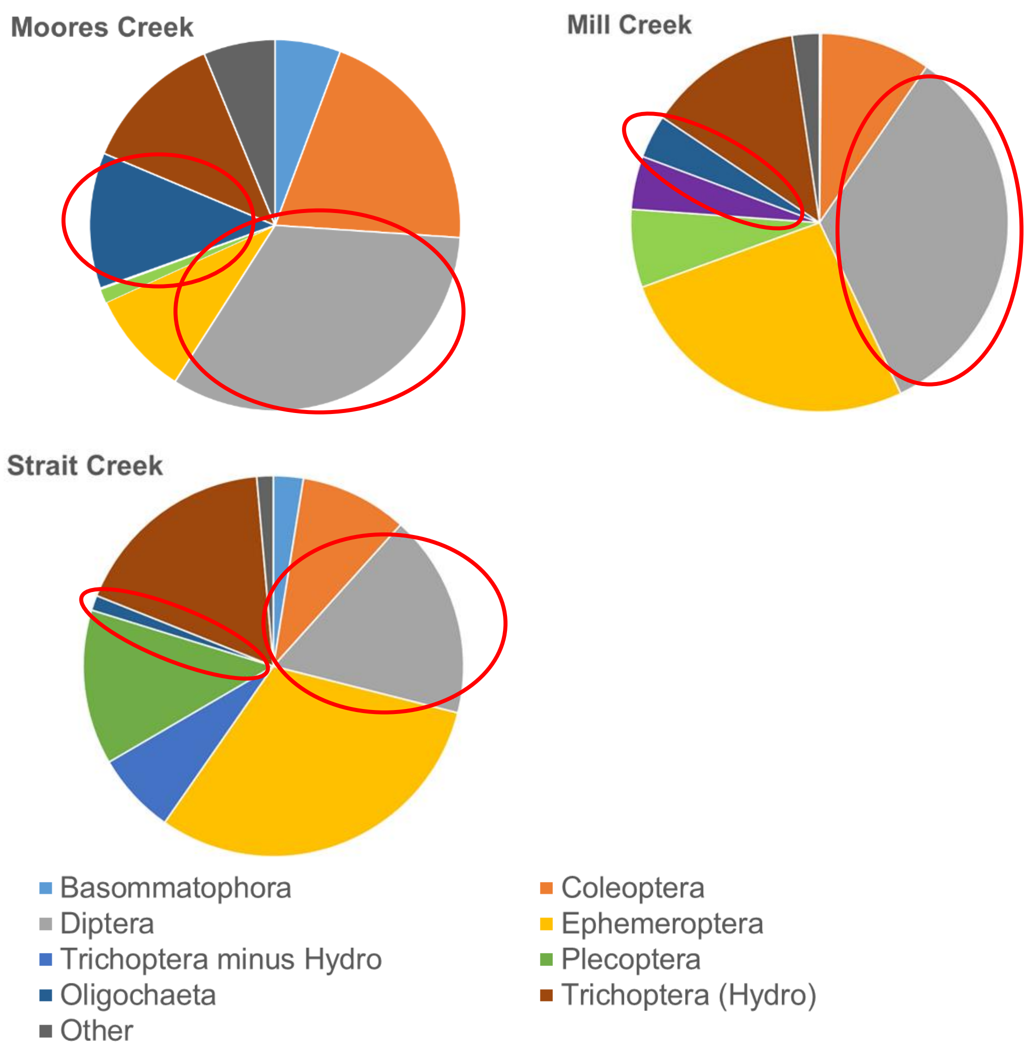
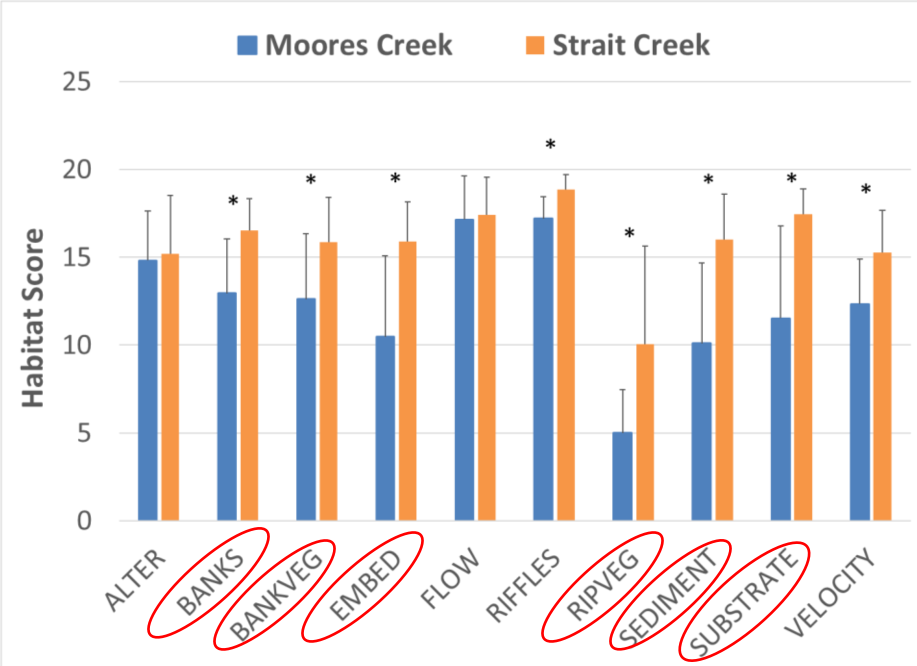


Figure 2 Benthic community structure (by order) in the Moores and Mill Creek watersheds in comparison with a reference watershed, Strait Creek.

Habitat Measurements



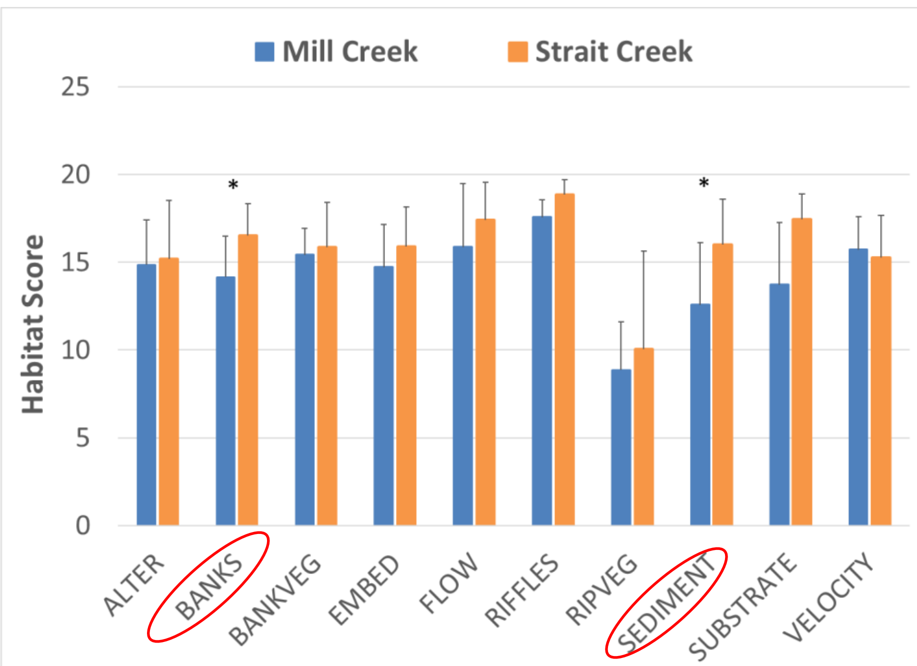
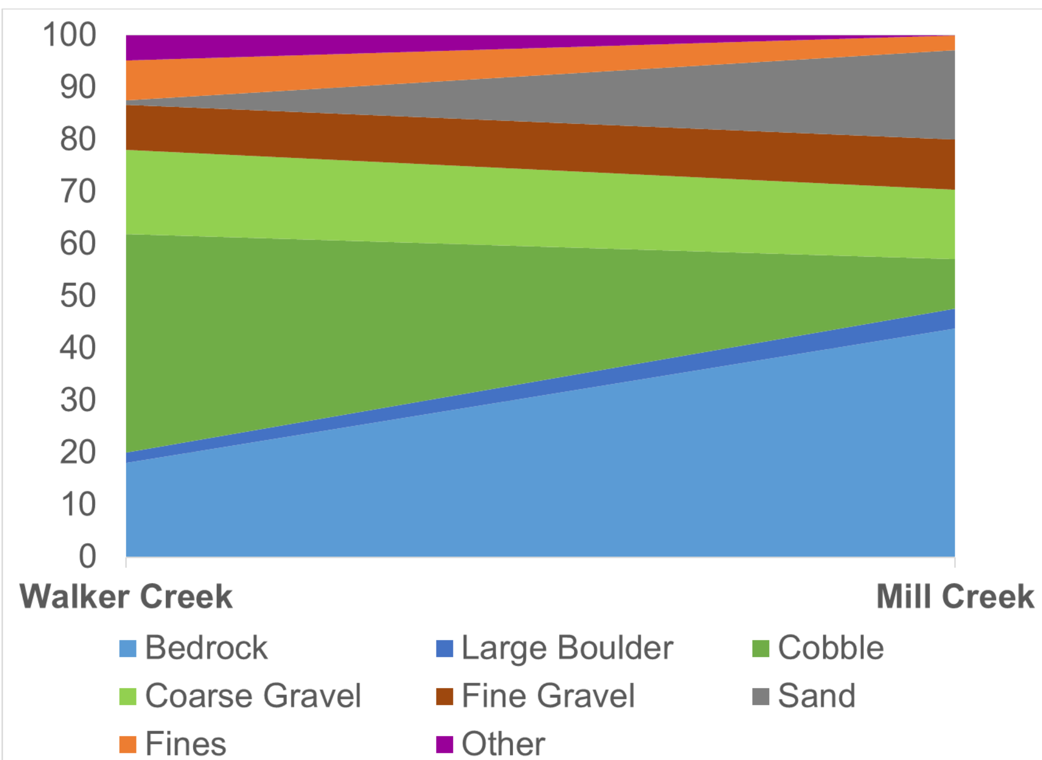


Figure 3 Habitat metric scores for Moores and Mill Creeks. Metrics with a * are statistically different from the reference site (α=0.05).

Bottom Substrate

Figure 4 Mill Creek stream bottom photos



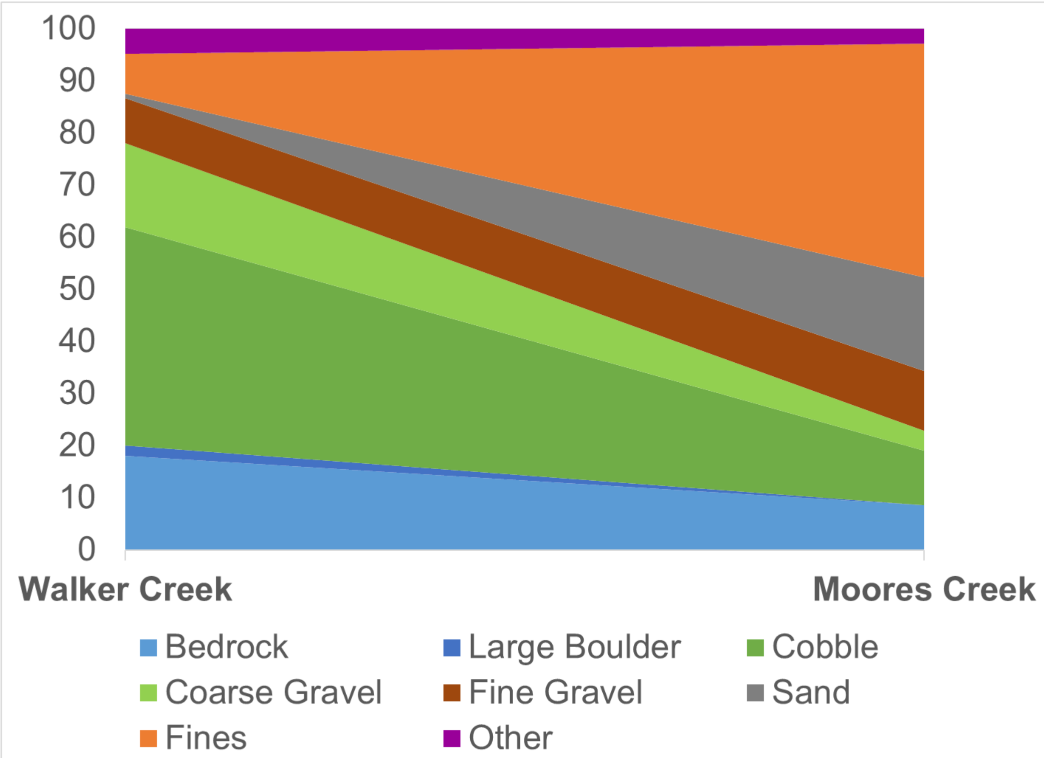


Figure 5 Moores and Mill Creek bottom substrate comparisons with reference (Walker Creek). Note: Walker Creek was selected as a reference for substrate comparisons due to the fact that these data were not available for Strait Creek.

- Shifts to more sediment tolerant Diptera and Oligochaeta taxa in both streams are consistent with environmental stress due to excess sediment.
- Habitat measurements of streambank conditions and bottom substrate suggest that sediment is impacting aquatic life in both streams. Bank conditions in both streams indicate that streambank erosion is contributing sediment to the streams. Measurements in Moores Creek are indicative of considerable impacts.
- Measurements of bottom substrates in Moores Creek show excessive deposition of fines and sand when compared to the reference stream. In Mill Creek, the lack of suitable bottom substrate for colonization (e.g. course gravel and cobble) coupled with more limited impacts from excess sediment appear to be contributing to benthic impairment. Nearly half of the stream bottom in Mill Creek is comprised of bedrock, suggesting that habitat available for benthic macroinvertebrates is limited in the stream.

Evidence for conductivity as a possible stressor

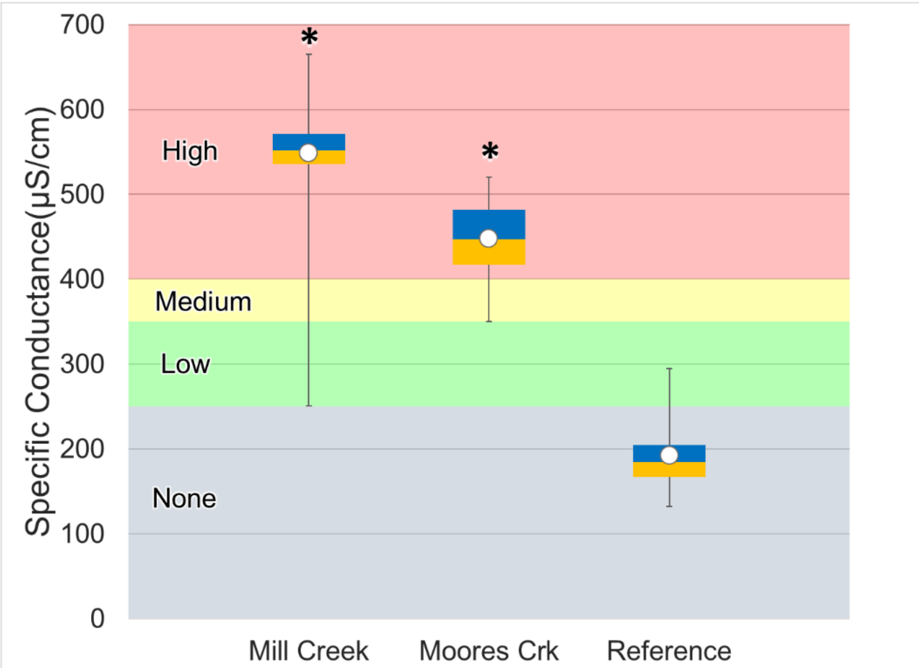


Figure 6 Specific conductance measured in Moores and Mill Creeks. Whiskers indicate the range, boxes indicate the inter-quartile range, lines indicate the median, and white markers indicate the average. Streams with a * are statistically different from the reference site (Strait Creek). Colors represent the probability that data within that range would be responsible for causing stress.

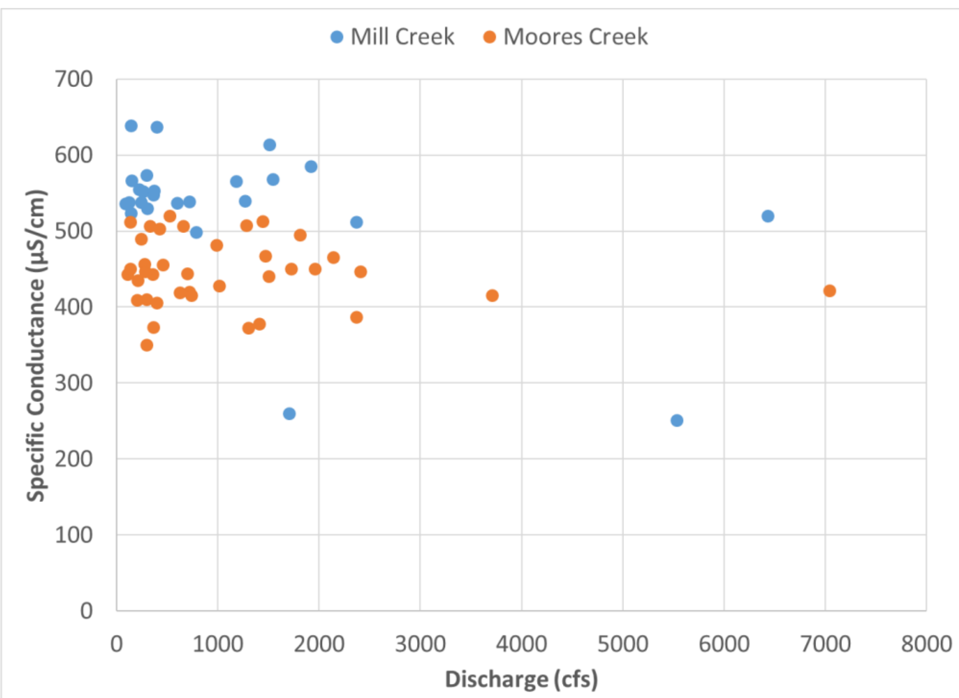


Figure 7 Specific conductance in Moores and Mill Creeks and daily discharge rates at USGS gage 2024000 on the Maury River near Buena Vista.

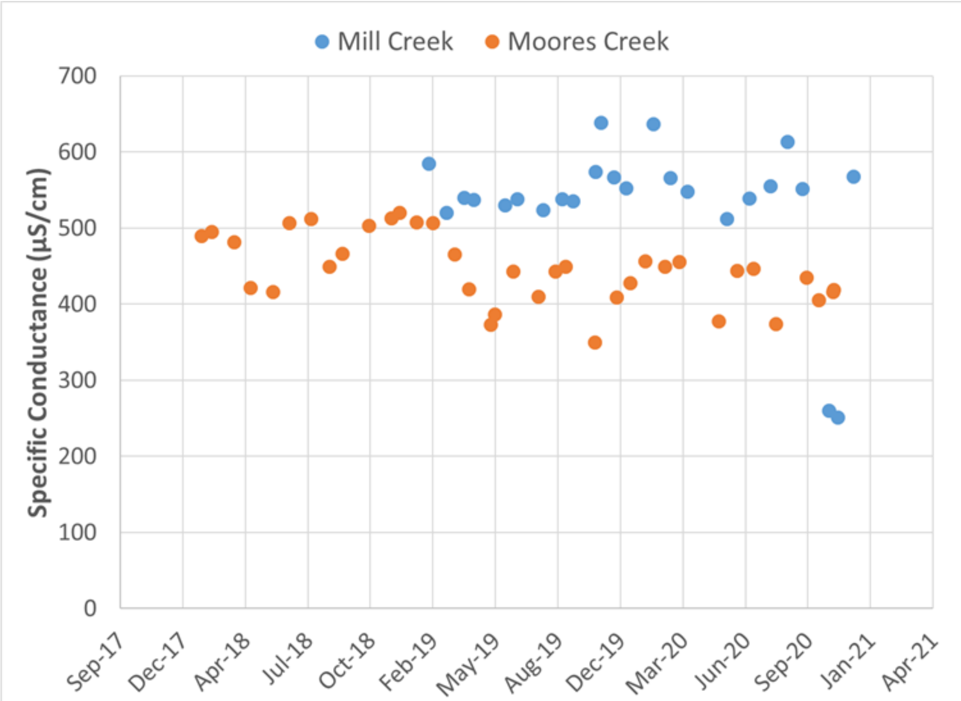


Figure 8 Temporal variability in specific conductance in Moores and Mill Creeks

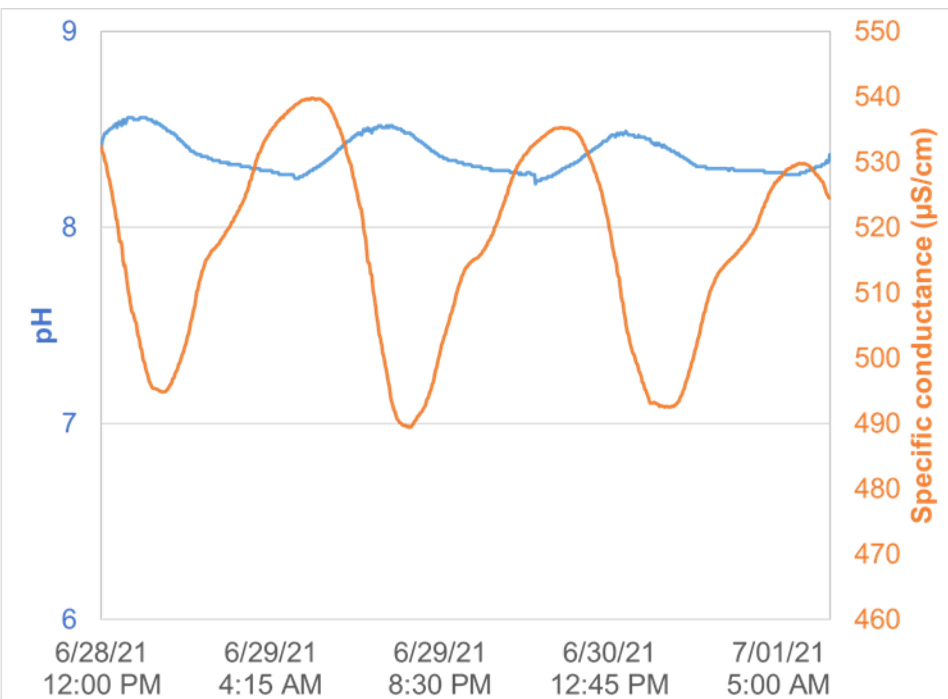


Figure 9 Diurnal shifts in pH and specific conductance in Mill Creek.

- Evidence suggests that groundwater inputs are largely responsible to elevated conductivity levels, which have no seasonal pattern. This suggests that runoff of potentially harmful de-icing agents in the winter is an unlikely source of high conductivity. Based on the predominance of karst topography in the watersheds, it is likely that natural weathering processes are responsible for elevated conductivity.
- The strong diurnal pattern in conductivity observed in Mill Creek further supports this conclusion. As photosynthesis occurs during the day, consuming CO_s and releasing O_2, the pH of the stream goes up, causing calcite from the groundwater to precipitate out of the water column and conductivity to drop. As respiration occurs in the evening, the pH drops, and calcite becomes resuspended causing conductivity to increase.
- Similarly high conductivity has been measured in other karst streams in the Valley, which also support a healthy benthic macroinvertebrate community.

Next Steps

- Development of a watershed model
  - Simulate transport of sediment from the land to the stream
  - Estimate existing pollutant loads
  - Develop target pollutant load
  - Evaluate scenarios to meet target load
- Committee will meet to review land use data and sediment loading estimates
  - Poll on meeting timing and format to come

Contact Information

Nesha McRae, VA DEQ
Nesha.mcrae@deq.virginia.gov
540-574-7850

Katie Shoemaker, Wetland Studies and Solutions
kshoemaker@wetlands.com
540-953-0170 ext. 4318