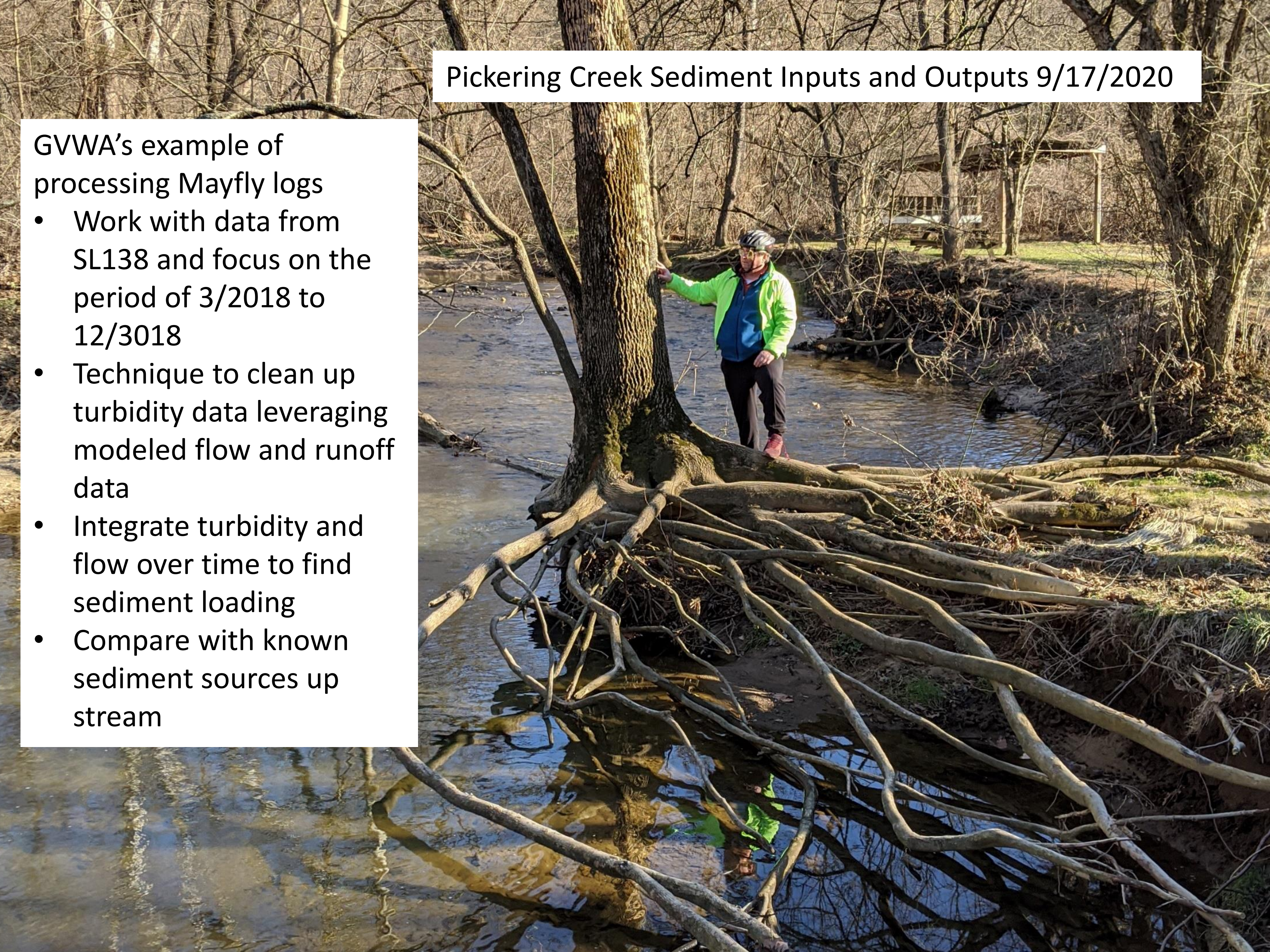
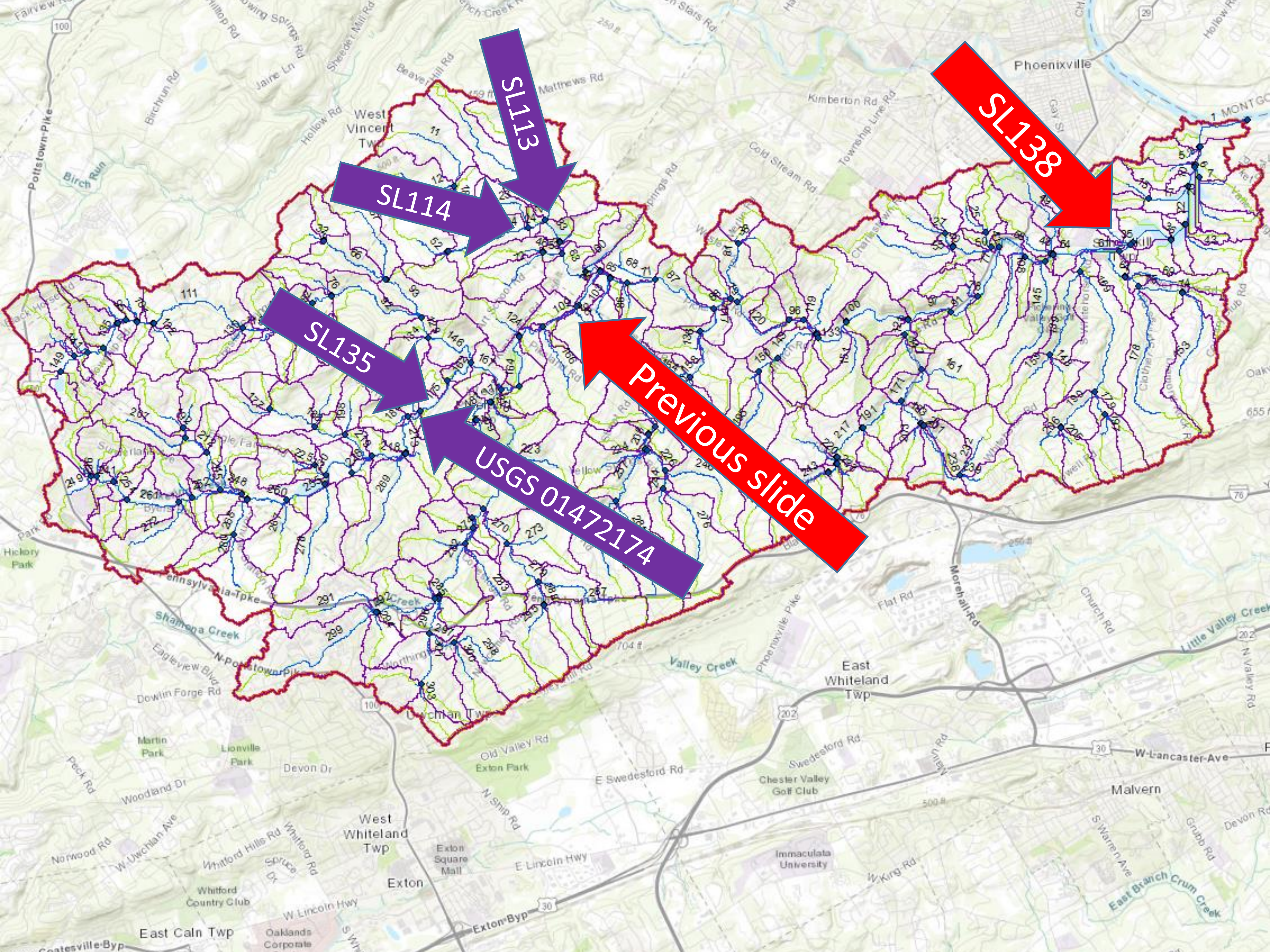
Pickering Creek Sediment Inputs and Outputs 9/17/2020



GVWA's example of processing Mayfly logs

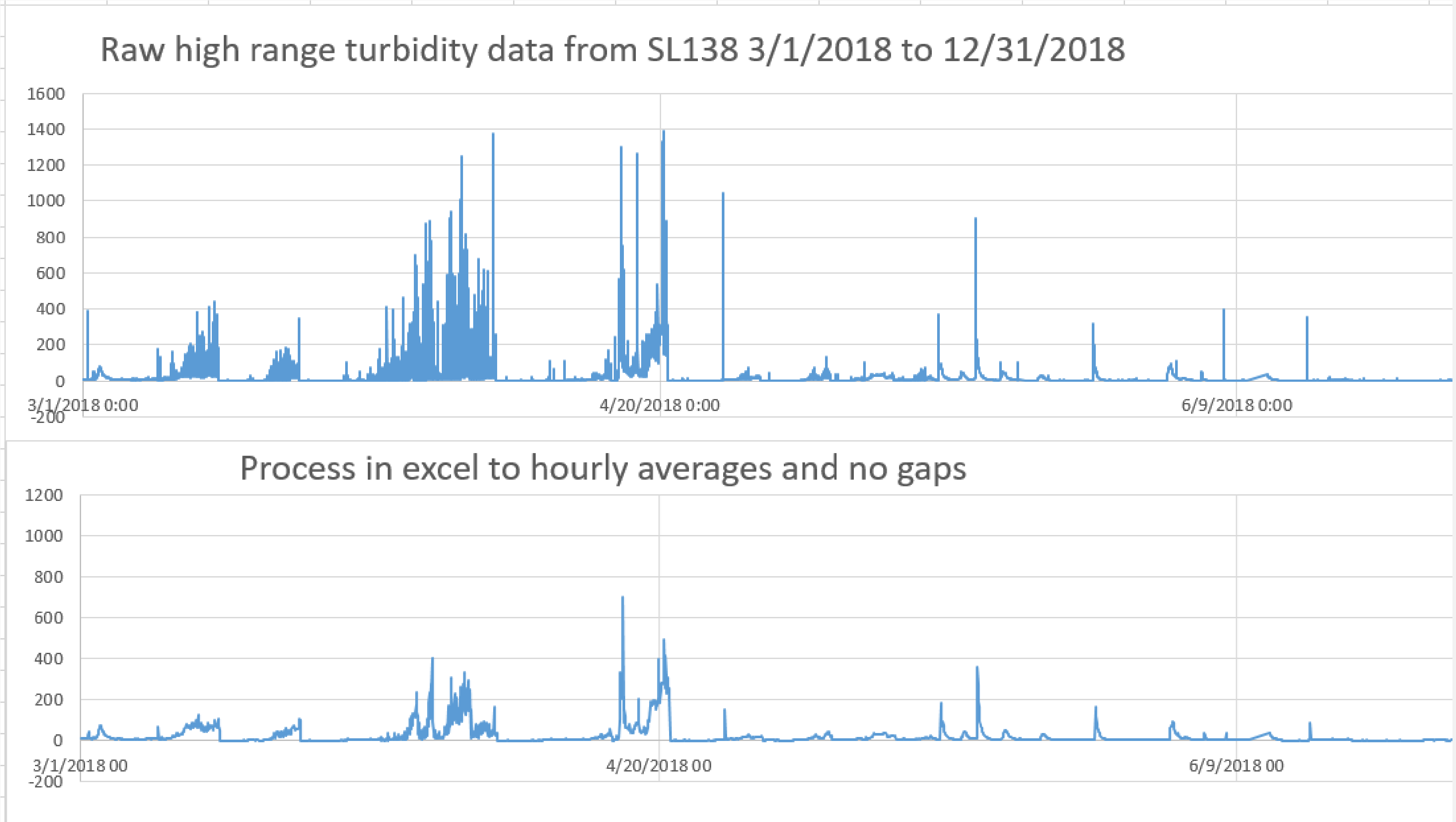
- Work with data from SL138 and focus on the period of 3/2018 to 12/3018
- Technique to clean up turbidity data leveraging modeled flow and runoff data
- Integrate turbidity and flow over time to find sediment loading
- Compare with known sediment sources up stream


SL113
SL114
SL135
USGS 01472174
SL138
Previous slide

Brook trout (stocked) catch and release photo: Josh Carr.

Raw high range turbidity data from SL138 3/1/2018 to 12/31/2018

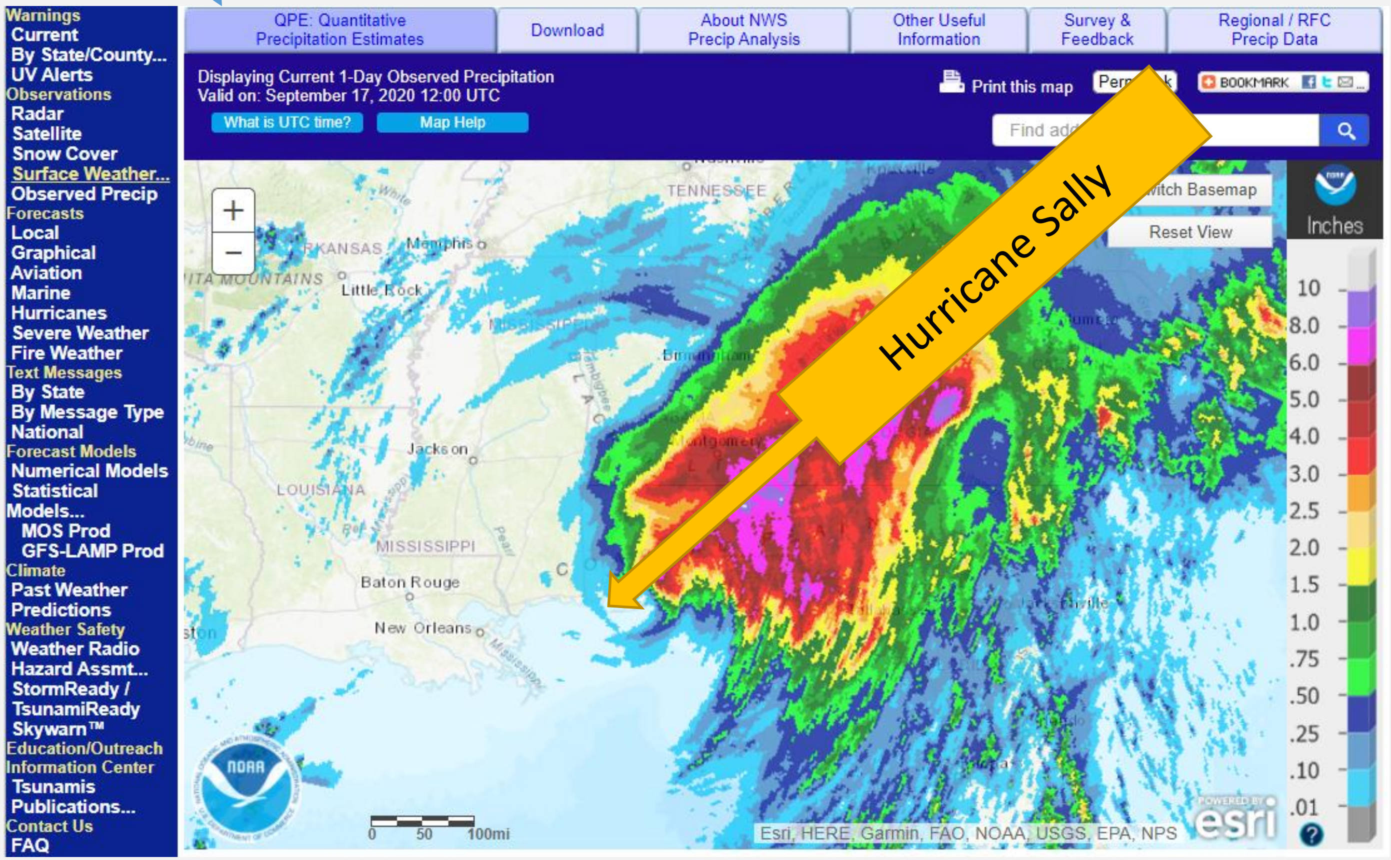
- 5 minute intervals but gaps of any size may be present
- Process in excel to hourly averages and no gaps
- Missing hourly data should be filled as #NA (for graphing in Excel)



We know some of the > 10 turbidity data is from sensor fouling; **we need to filter out turbidity data collected during baseflow conditions.**

- Leverage additional data sources available for the watershed above the SL138
- Data available:
  - Precipitation
  - Solar radiation
  - Wind
  - Humidity
  - Temperature
  - Soils
  - Land Cover
  - Topography

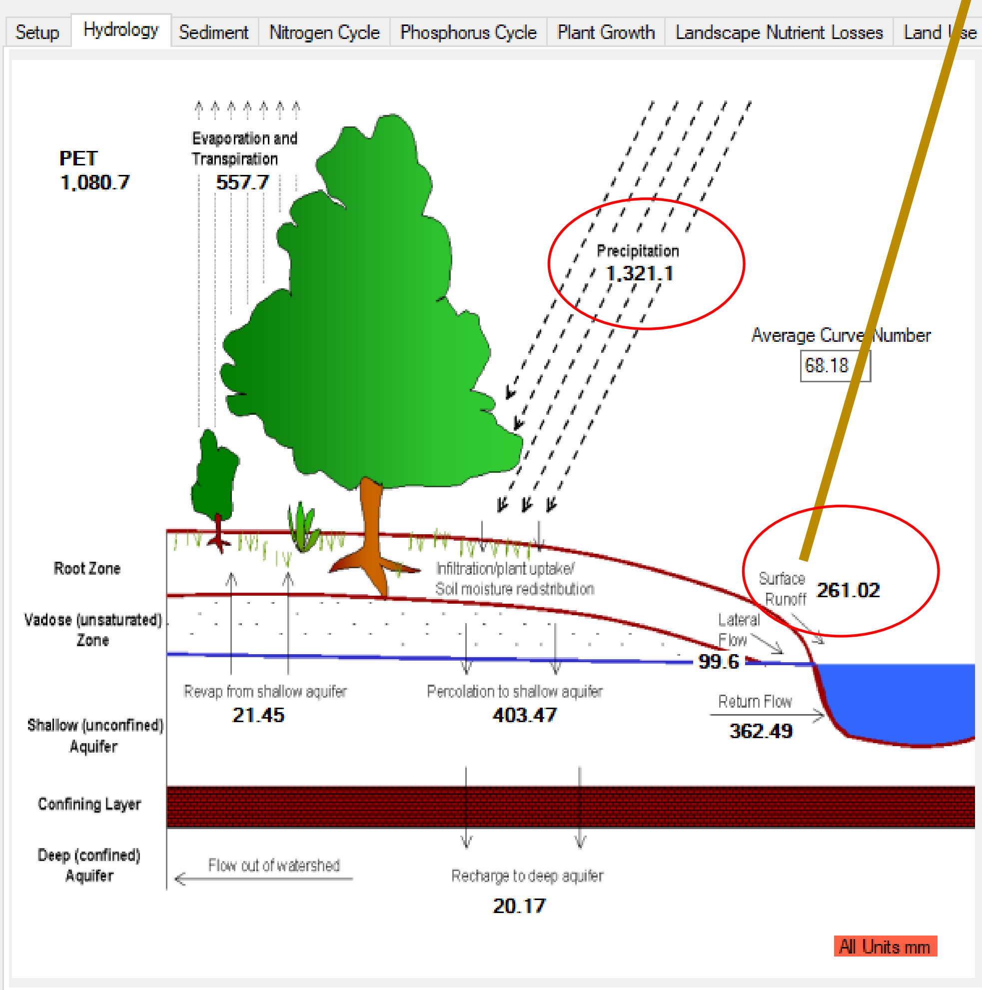
Quantitative Precipitation Estimates combine surface data and Nexrad radar to provide high resolution precipitation data



Use SWAT model to process this "outside the stream" data into daily and hourly outputs for

- Water yield to stream channel--includes stormwater
- Surface runoff to stream channel—stormwater
- Groundwater flow to stream channel
- Shallow aquifer flow to stream channel
- Evapotranspiration

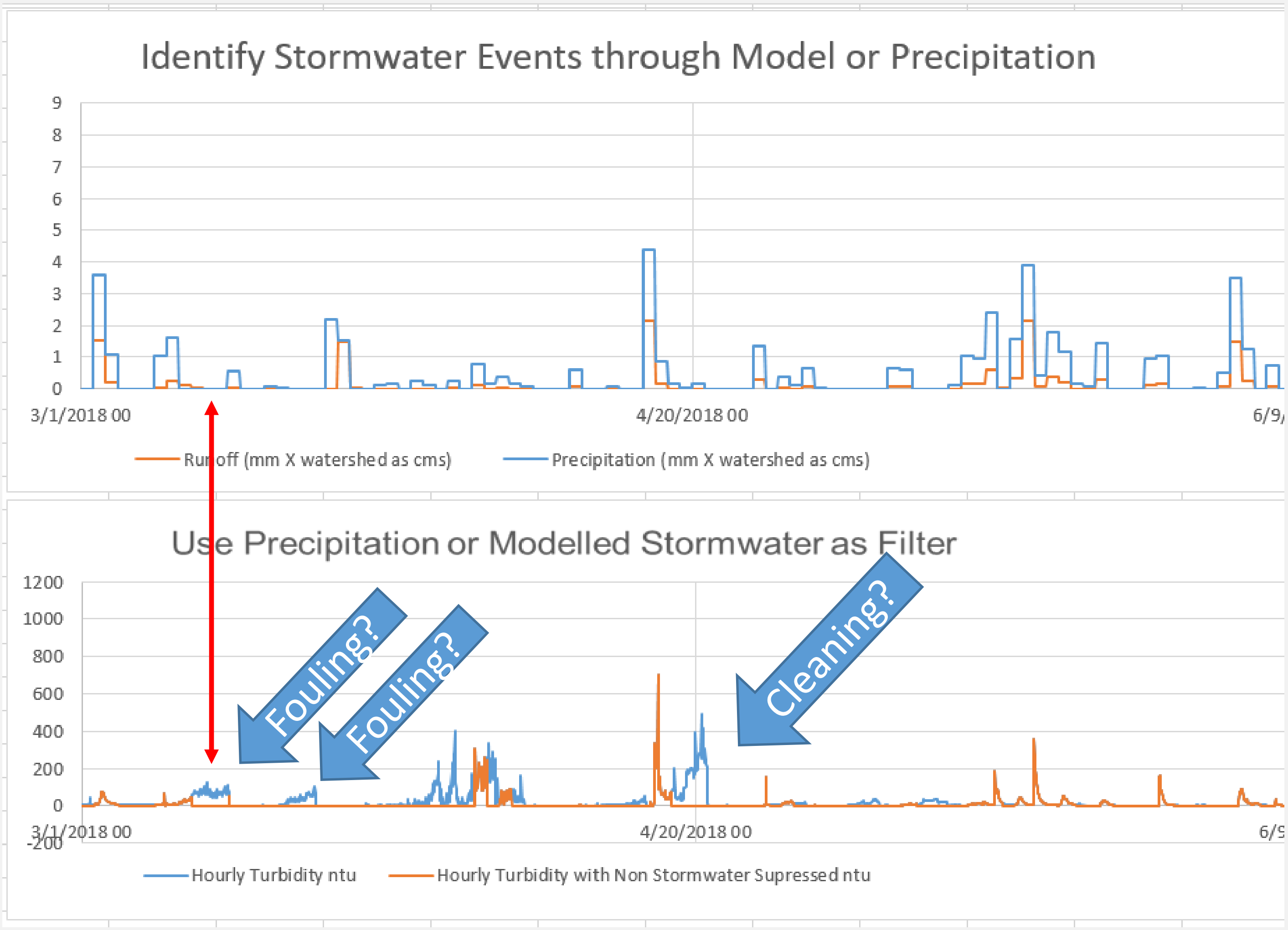
Model provides daily and hourly runoff data--use this as filter. Many other filter approaches available



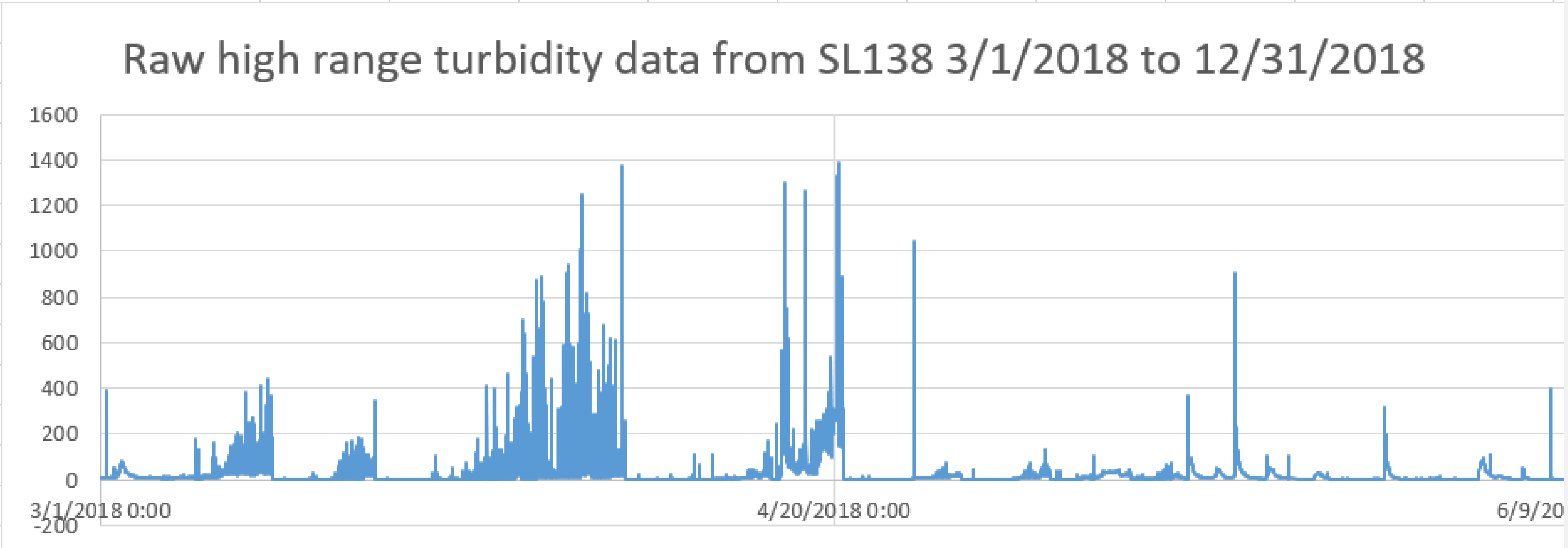
Water Cycle 365 Day Total French Creek Watershed (adjacent to Pickering). Modelled averaged for 2000 to 2015:

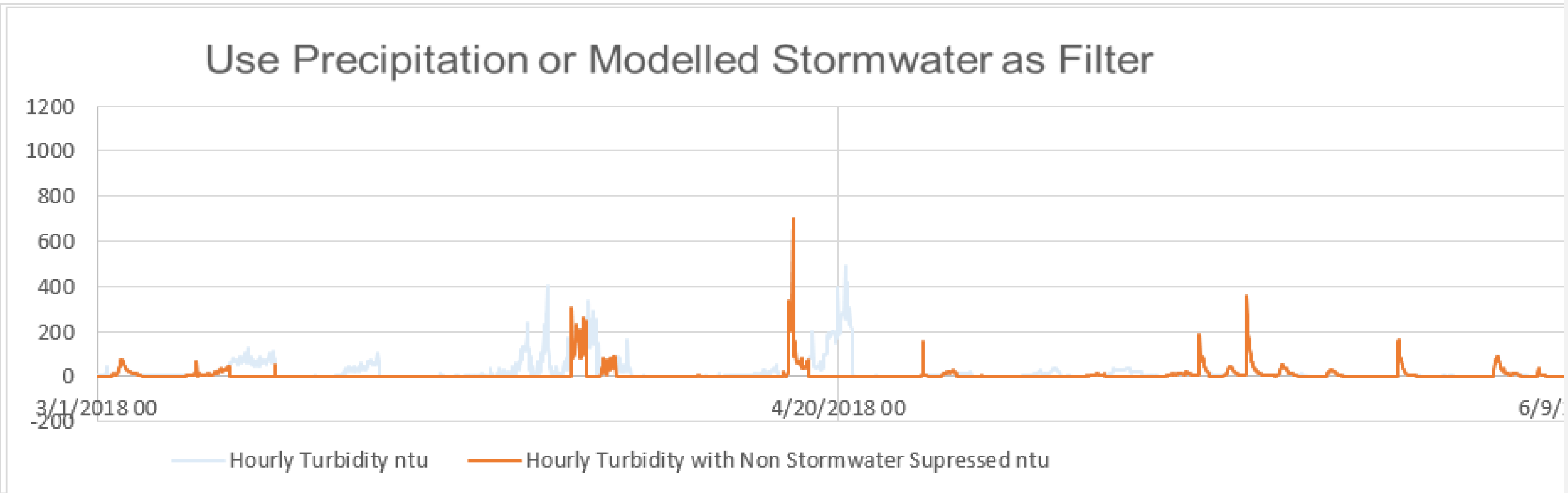
- Precipitation 52 inches 100%
- Evaporation and Transpiration 42%
- Runoff 20%
- Lateral Flow 8%
- Base Flow to Stream 27%
- Recharge Deep Aquifer 1%

Use modelled stormwater flow as a filter—suppress turbidity data from baseflow conditions. Other approaches are to use precipitation in watershed or process the hydrograph for baseflow. Need to develop QA/QC for applying filter.



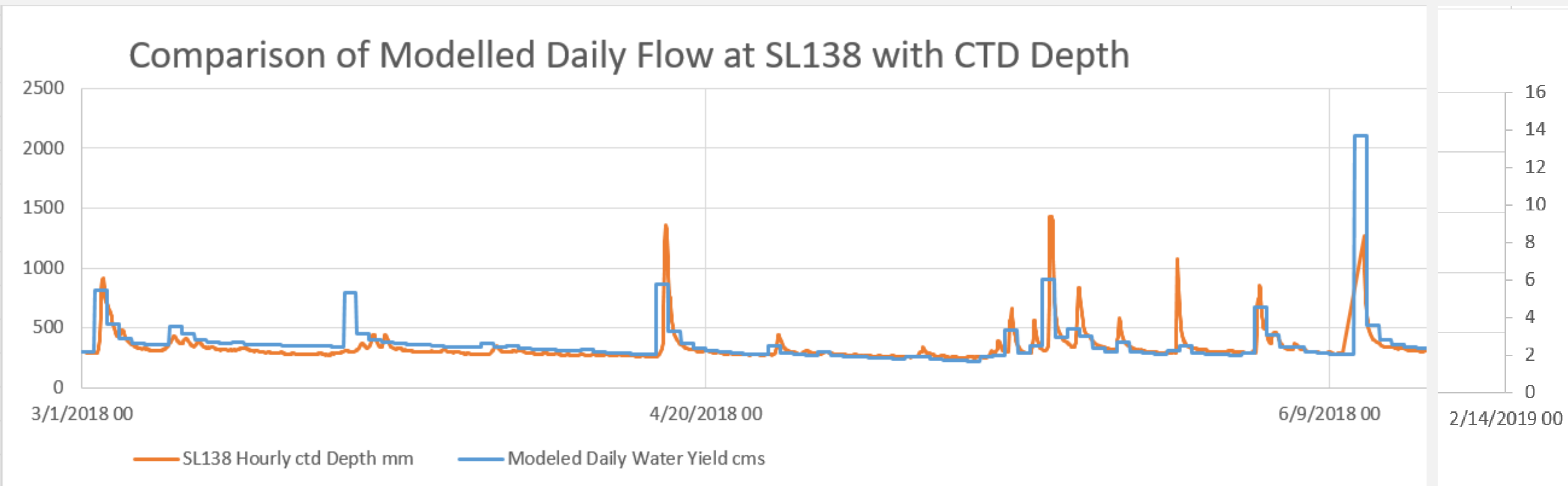
Comparison of raw 5 minute turbidity data to filtered hourly data

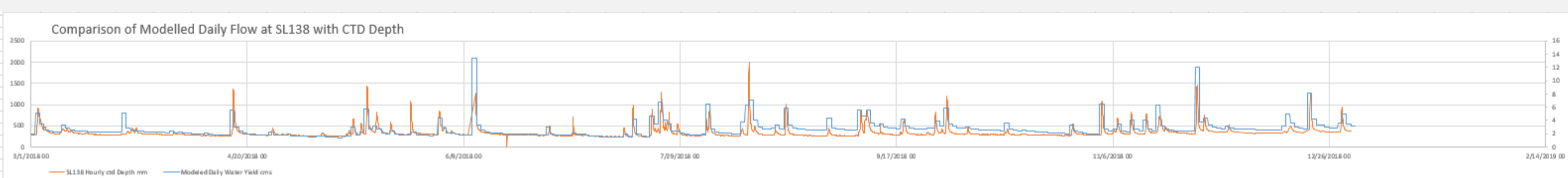




Integrate turbidity and flow over time to find sediment loading

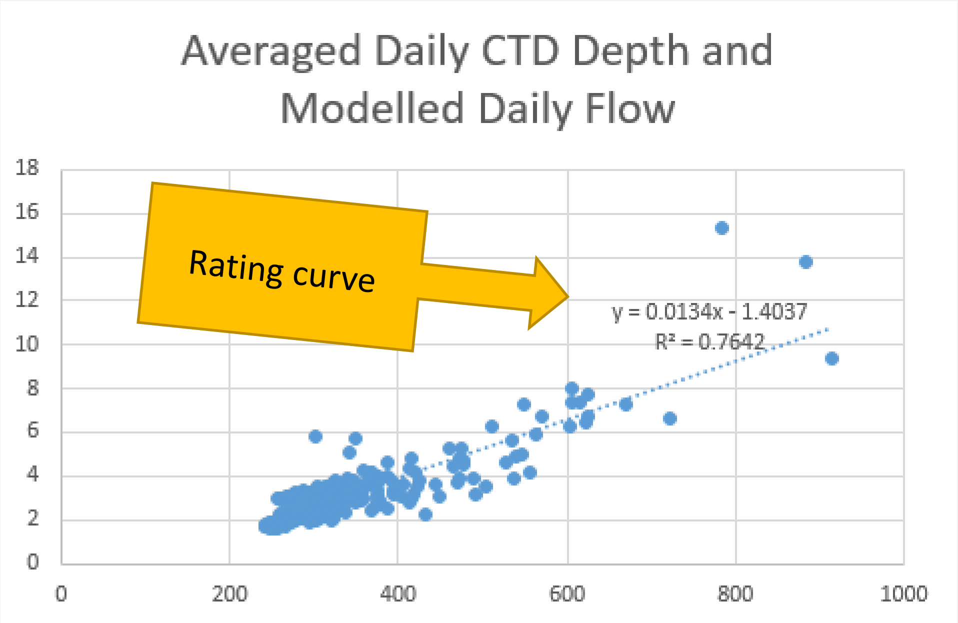
- concentration X volume = mass
- Concentration is proportional to turbidity. Assume for this example that 1 ntu = 2 mg/l total suspended solids (@ 105 C). *Lots of caveats—should be using curve.*
- Need hourly flow, and this will typically come from rating curves developed and updated at the gauge station.
- For this example, using modelled flow and CTD depth to develop rating curve
- Time period of 3/1/2018 to 12/31/2018 was chosen for apparent stability in stream channel depth at SL138.

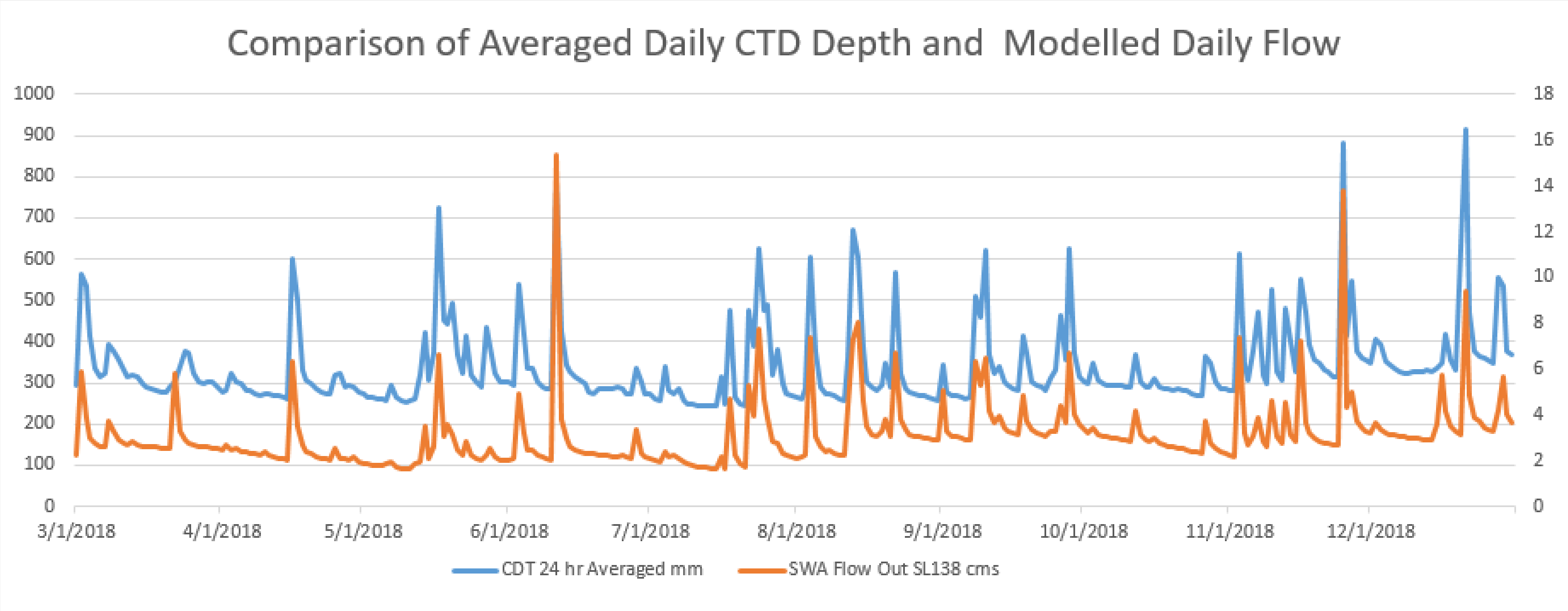




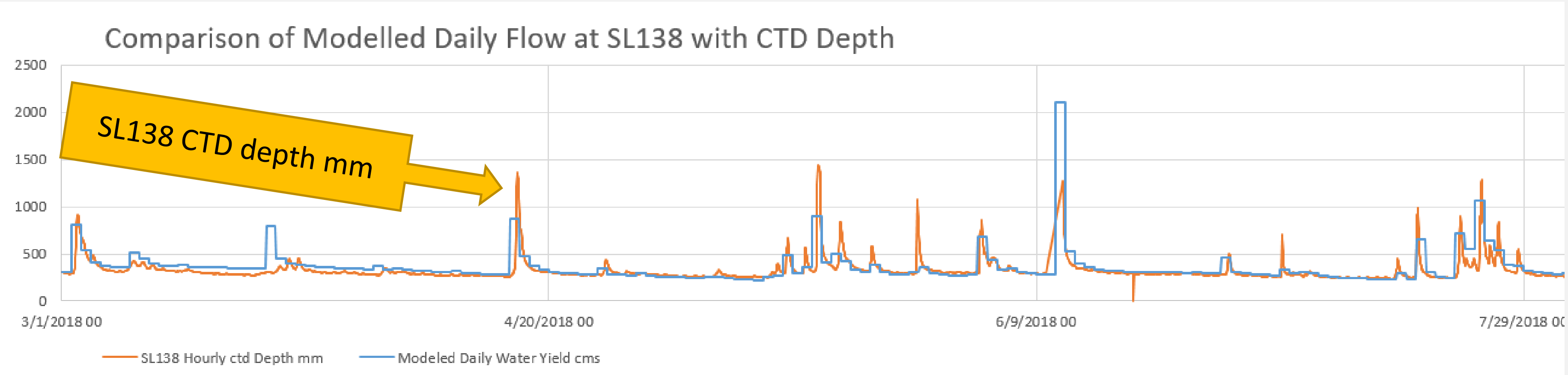
Make a Rating Curve

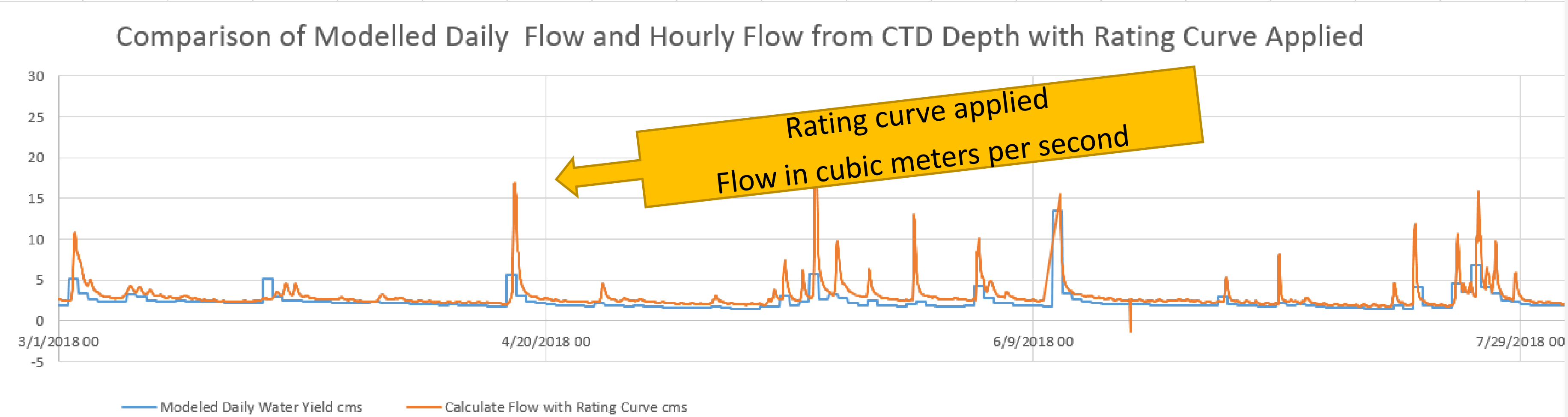
For this example, rating curve was developed from averaged daily CTD depth and modelled daily flow—NOT FIELD MEASUREMENTS. Caution, averaging the CTD depth to 24 hour intervals introduces errors; the rating curve should be developed at hourly or sub hourly frequency. SWAT data is daily.





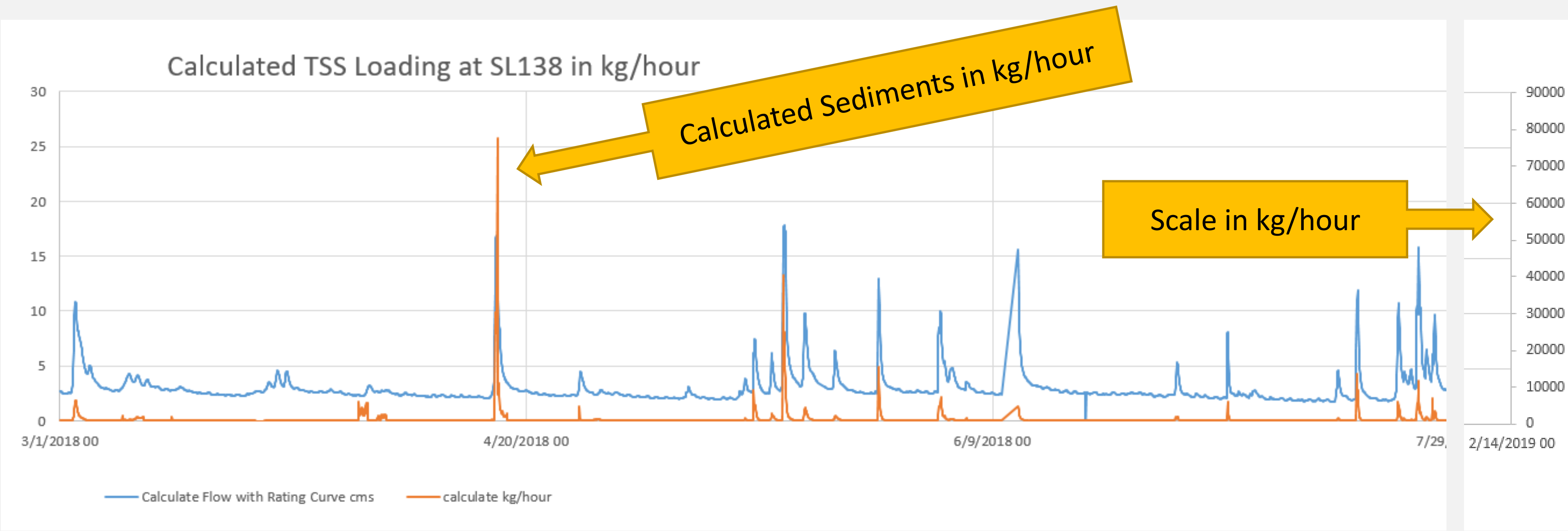
CTD depth in mm upper figure, flow in cubic meters per second lower figure. Hourly time step.





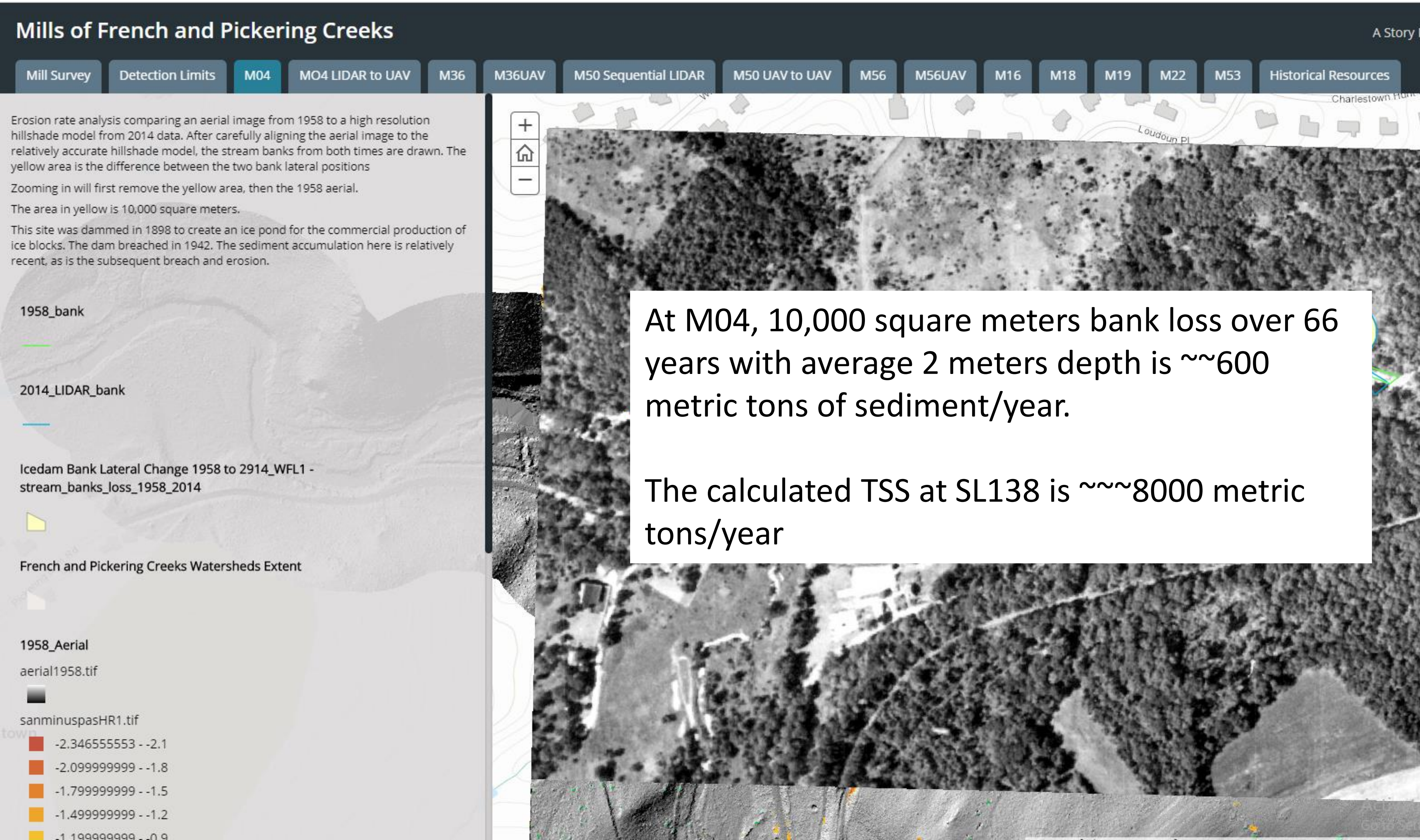
Integrate turbidity and flow over time to find sediment loading

- concentration X volume = mass
- TSS mg/l convert to TSS/cubic meter water (cm)
- TSS/cm X flow cubic meters per second = mg TSS/second
- Convert to kg/hour
- Total calculated TSS 6,900,000 kg or 6,900 metric tons 10 months
- This example indicates ~8000 metric tons/year at SL138.
- Many caveats about this example analysis
- Next step is to try other turbidity filters and develop QA/QC for their application



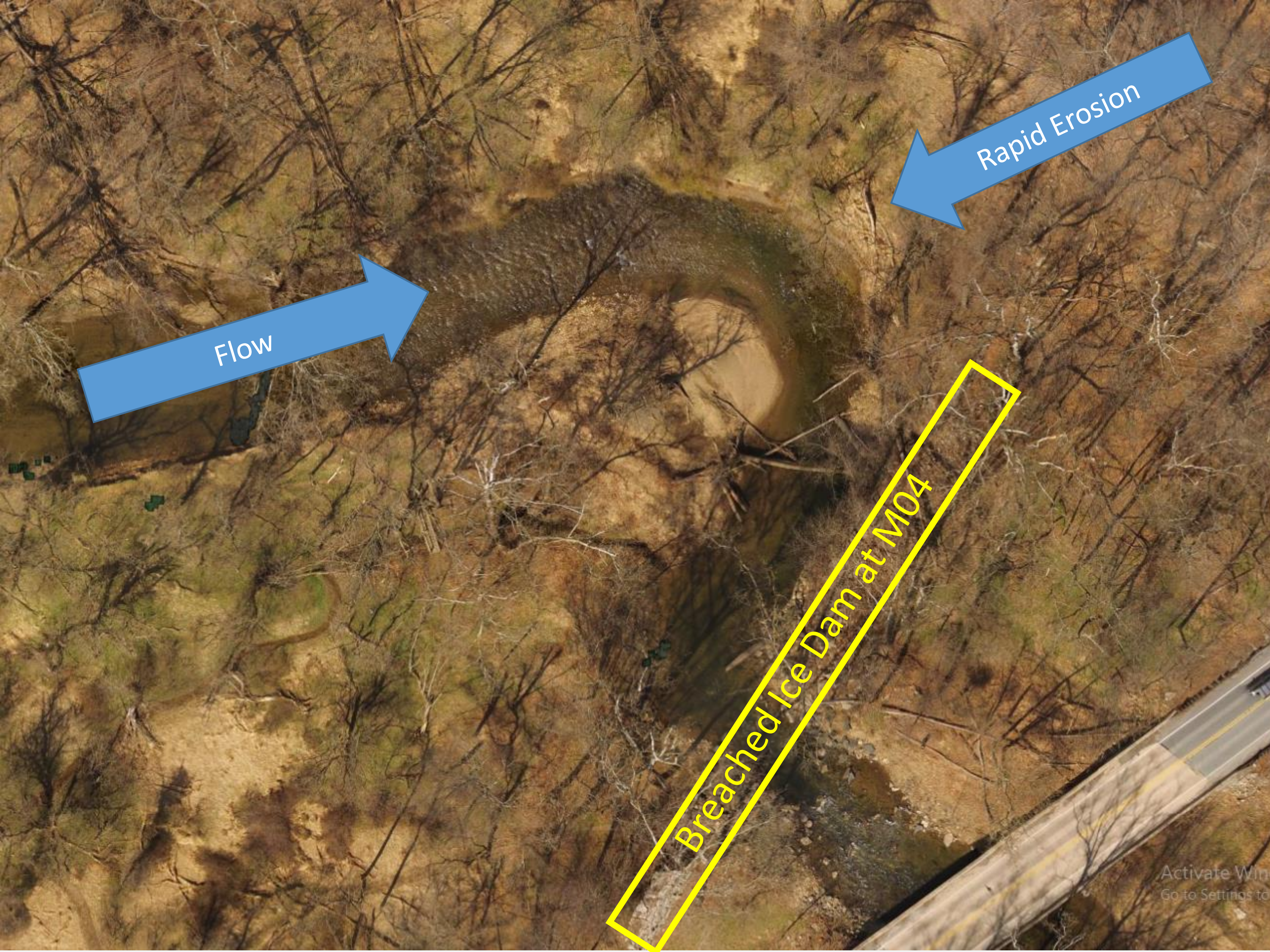
Go to story map https://arcg.is/08r5ba0 see tabs for M04 and M22

Stream Bank Sediment Sources



At M04, 10,000 square meters bank loss over 66 years with average 2 meters depth is ~~600 metric tons of sediment/year.

The calculated TSS at SL138 is ~~~8000 metric tons/year


Rapid Erosion
Flow
Breached Ice Dam at M04

Stream bank erosion

3d model of stream bank at M04

SL113