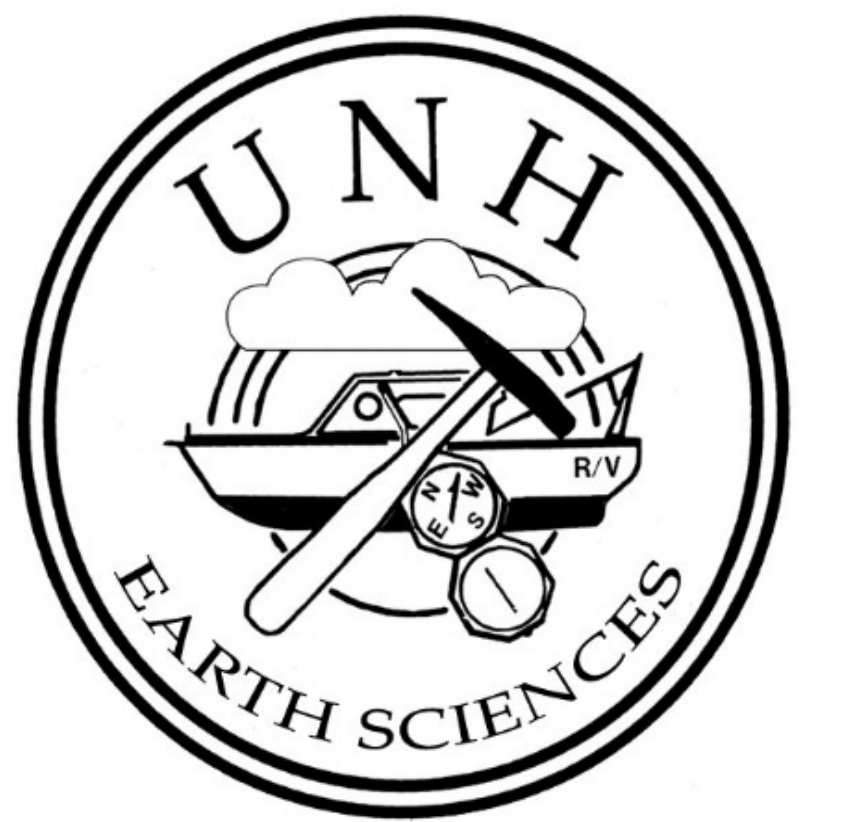




Sediment Erosion in a Tributary to Woodman Brook

Jacob Poirier, B.S in Environmental Science: Hydrology, *jhg35@wildcats.unh.edu*
Advisor: Anne Lightbody, Assistant Professor: Department of Earth Science



Introduction: Sediment erosion is one of the most common problems leading to impaired water quality. High levels of suspended sediment pose water quality problems that range from reduction of aesthetic quality to degradation of aquatic habitats.

Site Description: Woodman Brook is a small tributary that flows into the Lamprey River in Durham, NH. This study focuses on T-Creek, which is a small tributary to Woodman Brook that drains a portion of the Thompson Farm fields. At the project site, T-Creek is in a small ravine with a relief of about 20 ft.

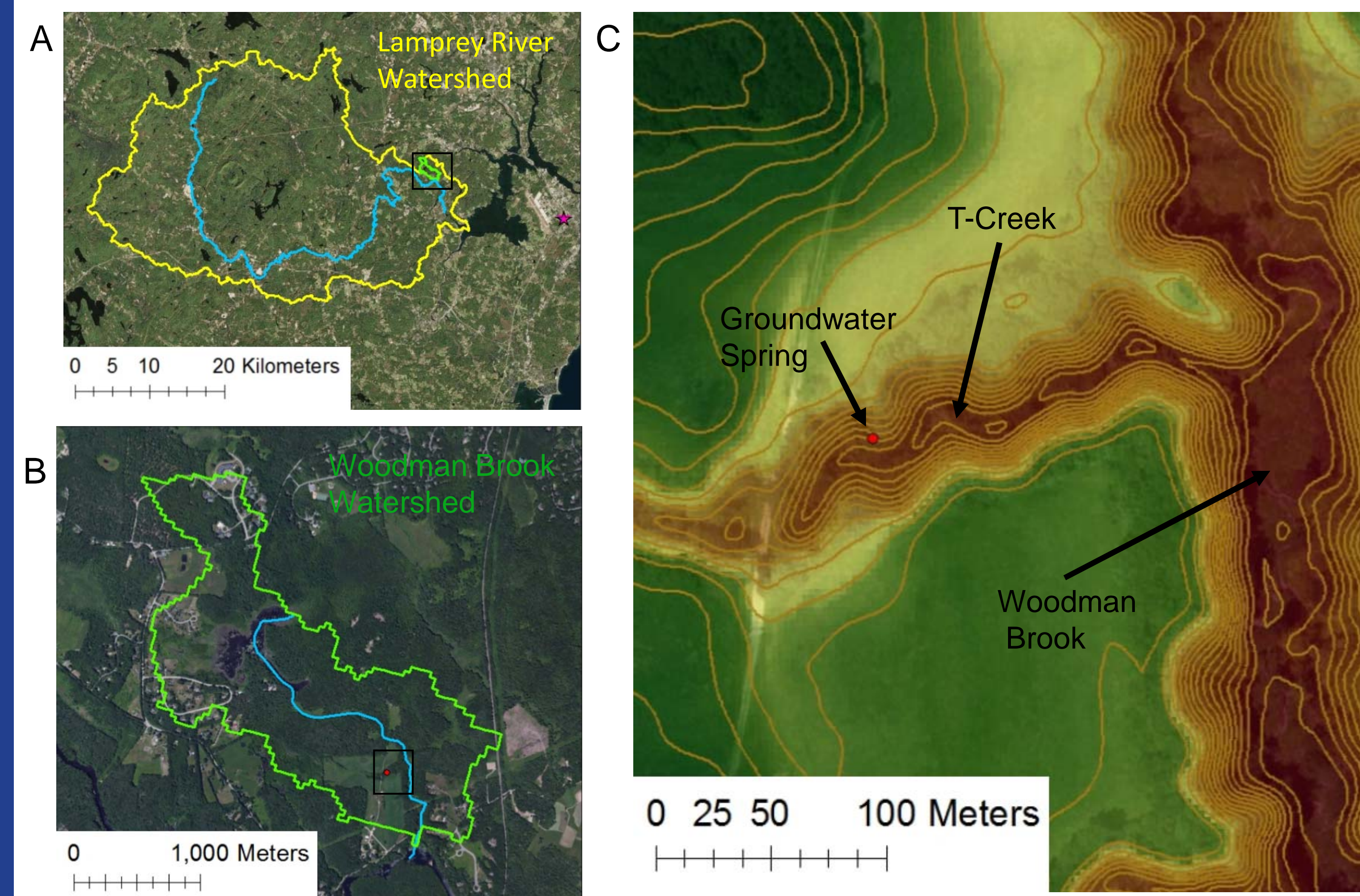


Figure 1: A) Lamprey River watershed. B) Woodman Brook watershed. C) T-Creek. — 2 Foot Contours

The Problem: There is a groundwater spring that flows year round and intermittently delivers sediment into T-Creek. At times, the sediment can be transported all the way to Woodman Brook and even the Lamprey River. During spring 2015, benthic macroinvertebrates were present in T-Creek above the groundwater spring and not below it. Anecdotal observations suggest that sediment flux has been increasing over the last 5 years.



Figure 2:
A) Groundwater spring discharging highly turbid water into T-Creek (2015).
B) Suspended sediment entering Woodman Brook (Dick Lord 2010).
C) Suspended sediment entering the Lamprey River (Dick Lord 2010).

Research Question: This project attempted to determine the hydro-geologic processes that contribute to high levels of suspended sediment in the groundwater spring on T-Creek.

Methods:

Geological Assessment: Suction coring was used to obtain in-situ sediment samples from varying depths on the bank uphill of the spring.

Water Table Elevations: Logging pressure transducers (Solinst Levellogger Junior) were installed in the bank and stream within perforated PVC pipes screened across the water table. Water table elevations were obtained by subtracting atmospheric pressure (measured in Portsmouth and Rochester) from total pressure. An auto level was used to survey the elevations of PVC casing.

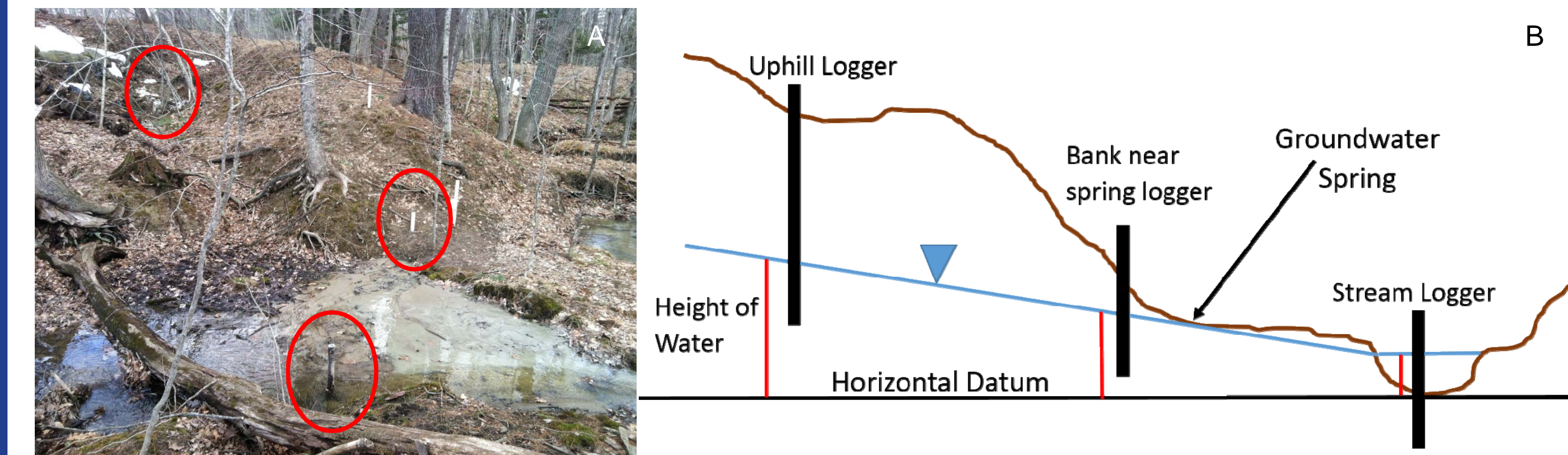


Figure 3: A) Photograph of site showing pressure transducer locations in April 2015. B) Diagram showing cross-section with pressure transducers. Not to scale.

Stream Chemistry: The Solinst Levelloggers also recorded water temperature. A HydroLab DS 5 was deployed in T-Creek downstream of the spring to record temperature, turbidity, and conductivity. Conductivity was also measured using a hand-held Corning CD-55 throughout the stream reach.

Results:

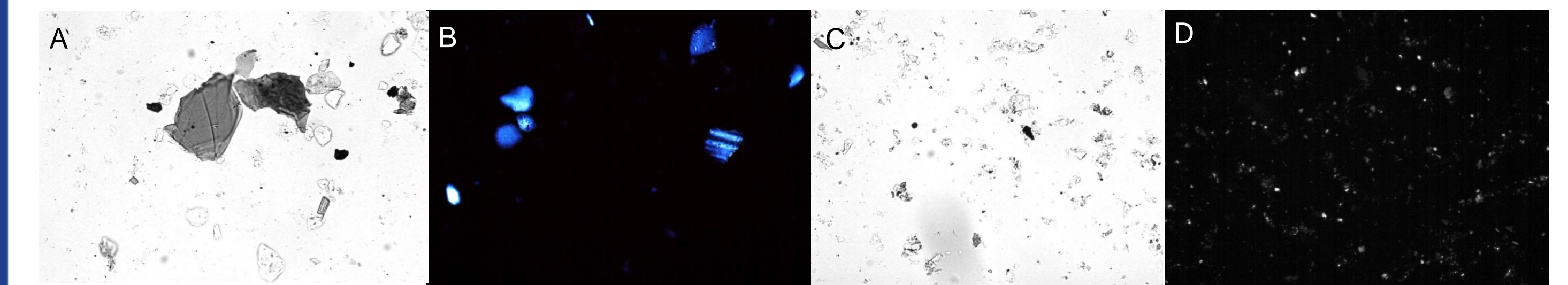


Figure 4: Photomicrograph of smear slides of evaporated sediment from spring in A) plane-polarized light and B) cross-polarized light, and sediment from bank near spring at a depth of 1.5 feet in C) plane-polarized light and D) cross-polarized light. Scale bar for all images is 0.6 mm.

The sediment from the spring is, on average, larger grained than bank sediment, suggesting the sediment exiting the spring does not come from the bank.

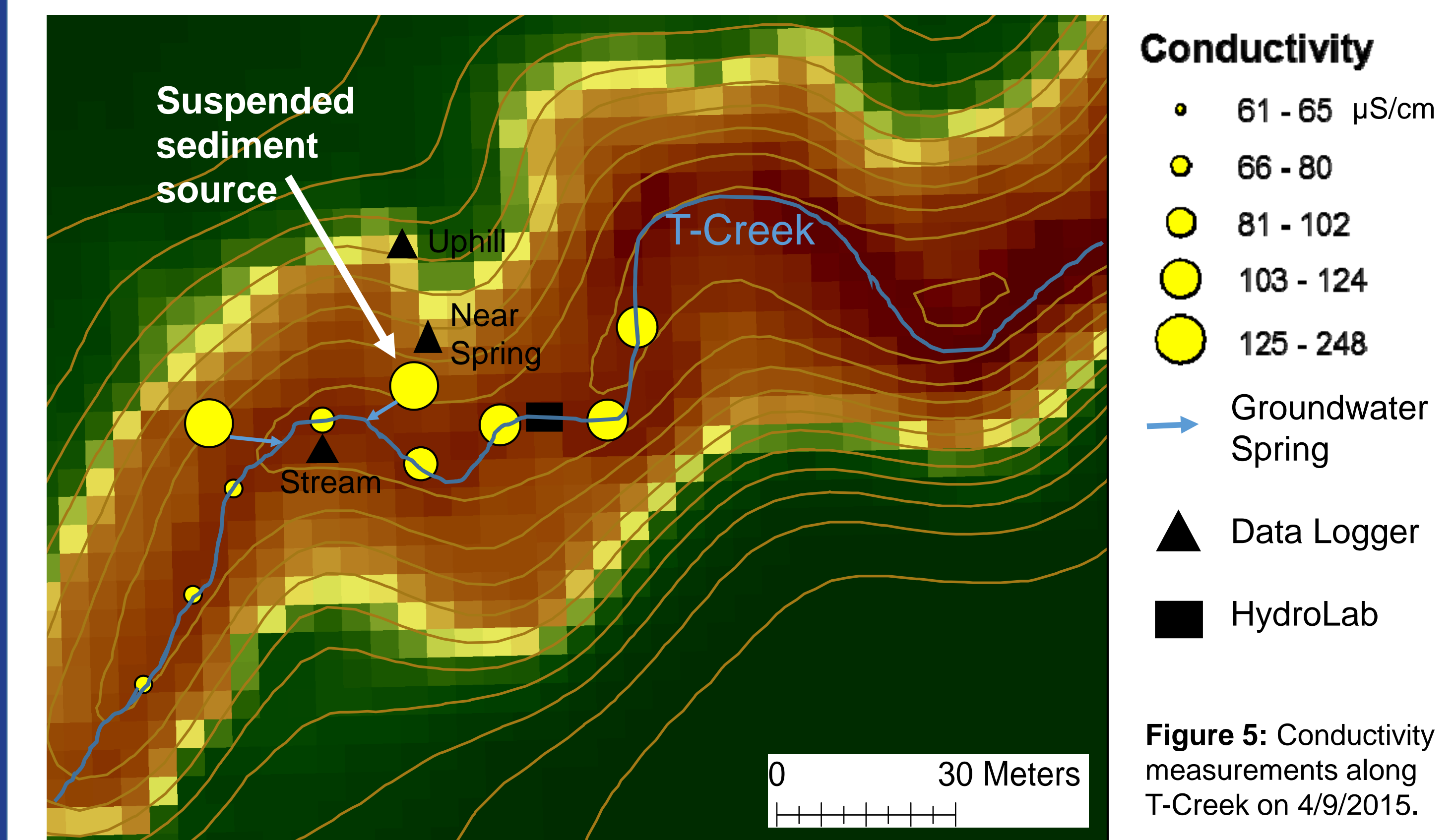


Figure 5: Conductivity measurements along T-Creek on 4/9/2015.

Timing of Turbidity:

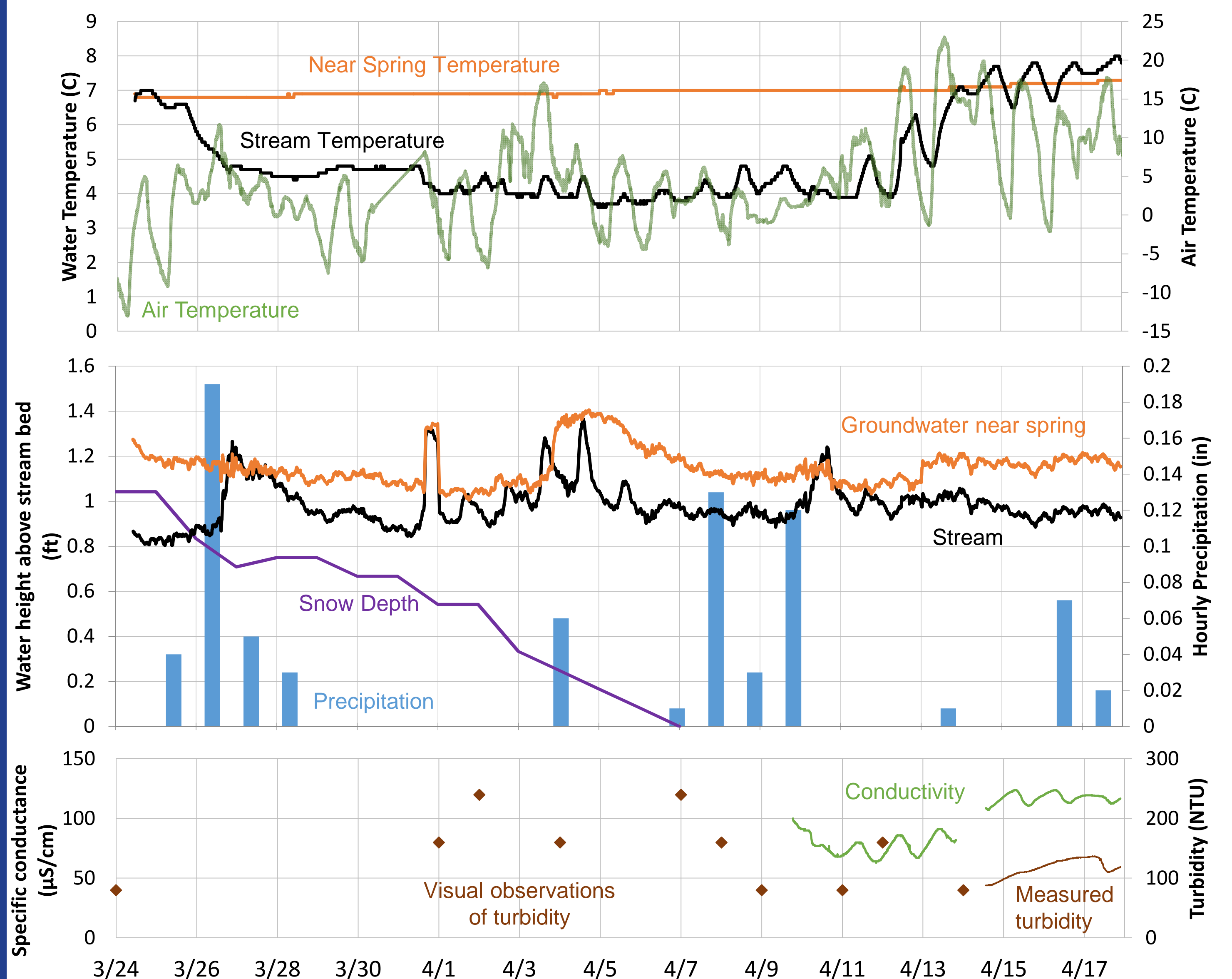


Figure 6: Time series of temperature, water surface elevation, snow depth on Thompson Farm fields, precipitation, conductivity in T-Creek downstream of spring, and turbidity in T-Creek downstream of spring during 2015. Observed turbidity was determined by visual observation and is reported relative to measured turbidity on 4/14.

Temperatures in T-Creek were similar to groundwater temperatures during baseflow but decreased as snow melted in late March. Water table elevation and stream stage both increased during snow melt in early April, but water table elevation responded more slowly to precipitation. The highest levels of turbidity were observed approximately 1 day after snow melt on 3/31 and 4/3–4/5. Conductivity increased during base flow, which was consistent with increased groundwater contribution to stream flow.

Conclusion:

Suspended sediment levels in the groundwater spring on T-Creek appear to increase following snow melt, when the groundwater table rises. The sediment exiting the spring does not appear to be material from the bank in close proximity to the spring. If a confined aquifer is present, possibly due to a lacustrine clay, the source could be lower in the soil profile. Continued evaluation is important to determine the exact source and ensure elevated levels of suspended sediment do not become an increasing threat to the water quality of Woodman Brook and the Lamprey River.

Acknowledgements:

I would like to thank Anne Lightbody for her wisdom, guidance, and assistance. I also would like to thank Joel Johnson for the use of his AMS sludge sampler, Linda Kalnejais for the use of her HydroLab DS-5, Stephen Eisenhaure for permission to conduct research on UNH property, Jo Laird for her assistance with mineral identification and obtaining photomicrographs, and Dick Lord for bringing the problem to our attention. Meteorological data was obtained from the NOAA National Climactic Data Center (NCDC).