2021 COLD BROOK CONDUCTIVITY STUDY | MEMORANDUM

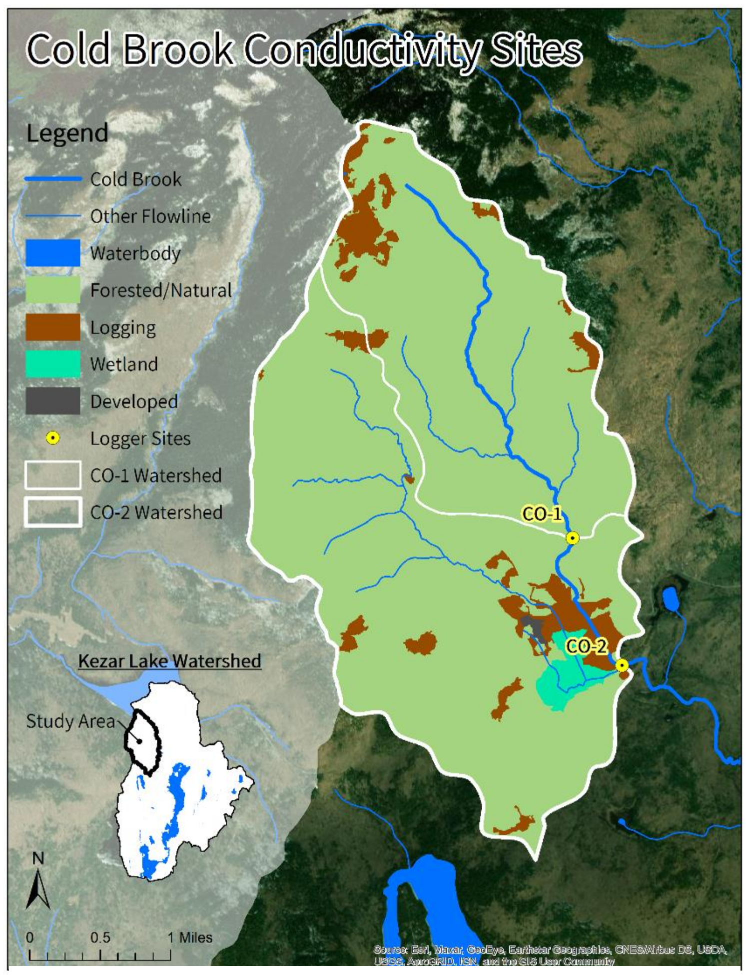
TO: Steve Lewis & Heinrich Wurm, Kezar Lake Watershed Association
FROM: Laura Diemer, FB Environmental Associates
SUBJECT: **2021 Cold Brook Conductivity Study**
DATE: December 22, 2021
CC: Forrest Bell, FB Environmental Associates

BACKGROUND

There is a known malfunctioning septic system associated with a private inn and villas in the Cold Brook watershed. The issue has been brought to the attention of the Maine DEP who are coordinating with the owners for upgrade of the septic system. In the meantime, KLWA hired FB Environmental Associates (FBE) to track and quantify the potential impact of the malfunctioning septic system (and other development activities or general usage of the property) on Cold Brook.

METHODS

On April 20, 2021, two Onset HOBO® conductivity-temperature data loggers were deployed at an upstream control site (CO-1) and a downstream impacted site (CO-2) in Cold Brook to bracket the malfunctioning septic system (Map 1). These loggers collected continuous measurements of temperature and conductivity at 30-minute intervals until they were retrieved on November 2, 2021. At each site, the loggers were deployed within PVC pipes attached to cement blocks that were secured to trees on the bank using metal cables. Maintenance was performed on the loggers during monthly site visits from June to September, during which the loggers were cleaned, the data were downloaded, and measurements of water temperature and specific conductivity were taken using a YSI ProSolo field meter.



MAP 1. Cold Brook conductivity sites shown along with the land use associated with their watersheds.

Quality assurance and quality control of the data followed the USGS Guidelines and Standard Procedures for Continuous Water-Quality Monitors (Wagner et al., 2006), as well as the HOBO® logger user manuals and best professional judgement. Conductivity data were converted to specific conductivity and calibrated using YSI ProSolo field measurements, if necessary, through the HOBOware® Pro Conductivity Assistant. At site CO-2, temperature and conductivity values were removed from October 31 to November 2 due to anomalously low values indicative of logger error. Air temperature and daily precipitation values are taken from the NOAA's Local Climatological Data station in Fryeburg, ME (National Centers for Environmental Information, 2021).

RESULTS

In general, temperature and conductivity values were higher at CO-2 compared to CO-1 in 2021 (Figure 1). Water temperatures were strongly influenced by atmospheric weather conditions, as demonstrated by the similar temporal pattern observed between the two sites and air temperature (Figure 1a). Specific conductivity had a weaker response to weather conditions at both sites, with values remaining relatively constant before and after precipitation events (Figure 1b). During extended periods without rainfall, however, specific conductivity tended to increase at CO-2 while remaining constant at CO-1. This most notably occurred in June, where the specific conductivity at CO-2 rose above 60 µS/cm in the beginning of the month and above 100 µS/cm at the end of the month, while the values at CO-1 generally remained below 20 µS/cm. Similar increases at CO-2 were observed in August and October, however the magnitude was much smaller than in June. Since CO-1 is located upstream of the property and CO-2 is located downstream of the property, it is possible that the elevated conductivity at CO-2 during dry conditions is the result of the concentration of an illicit discharge from the malfunctioning septic system.

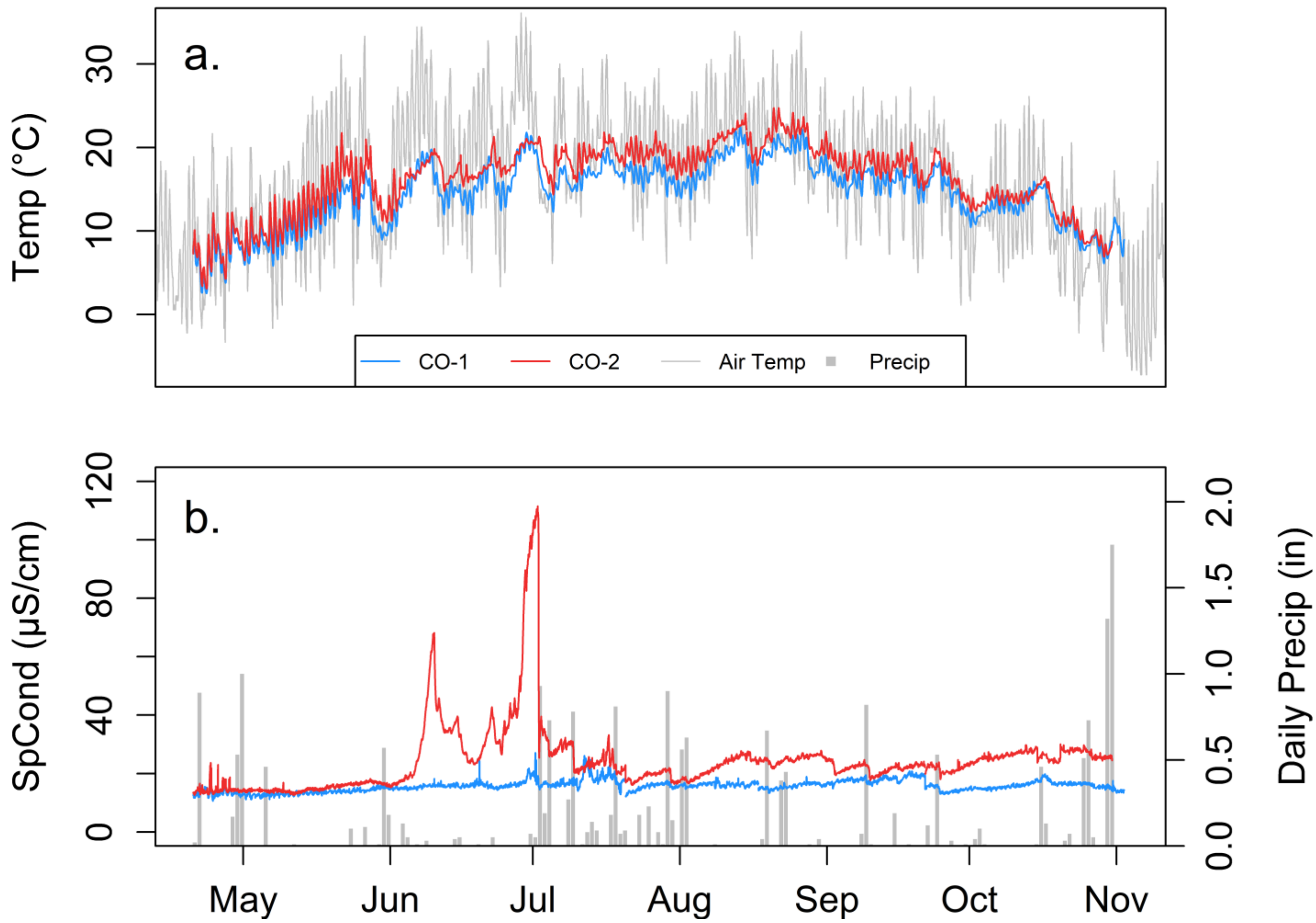


FIGURE 1. 2021 continuous monitoring data for Cold Brook at sites CO-1 and CO-2 for water temperature (a) and specific conductivity (b). Time series of weather conditions (air temperature and daily precipitation) are shown in gray.

Although these results suggest that the septic system may be impacting water quality in Cold Brook during baseflow, other factors could also be contributing to the observed differences in conductivity between the two sites. Both CO-1 and CO-2 have similar land use coverages in their watersheds, with 7% of land area covered by logging activity and the remainder covered by forest/natural or wetland areas (Figure 2). For CO-2, however, this logging activity is located directly adjacent to the stream, while for CO-1 it is located near the edges of the watershed far from the stream (Map 1). This difference could also be contributing to the elevated conductivity at CO-2, as surface runoff from logging areas likely has more dissolved constituents than runoff from forested areas due to erosion. Additionally, the geomorphology of Cold Brook at the two sites differs substantially, with CO-1 located in a confined channel with rocks stabilizing the banks while CO-2 is located in a floodplain channel where the banks are more erodible. This difference in erodibility related to geomorphology could also be a factor in causing the higher baseline conductivity at site CO-2.

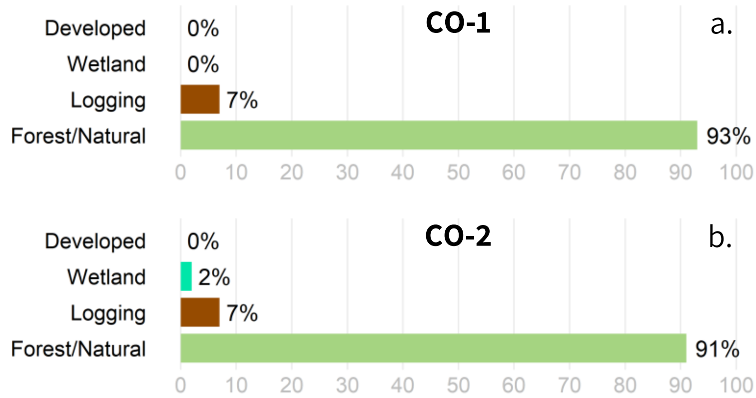
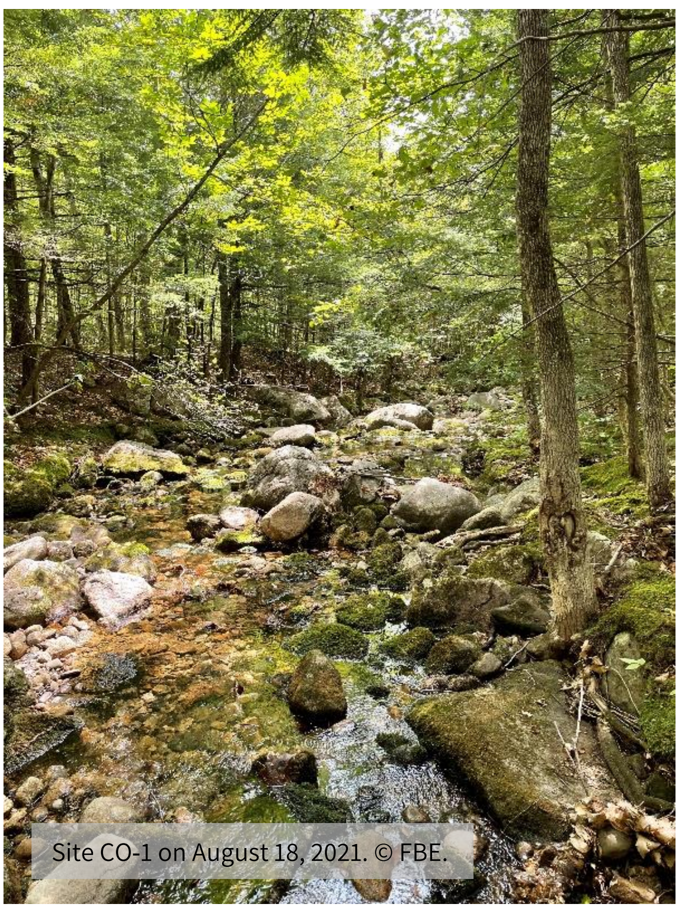


FIGURE 2. Land use coverage in the watersheds for sites CO-1 (a) and CO-1 (b) as shown in Map 1.


Site CO-1 on August 18, 2021. © FBE.


Site CO-2 on August 18, 2021. © FBE.

CONCLUSIONS

- The downstream site CO-2 saw elevated conductivity during dry periods compared to the upstream site CO-1, suggesting that the malfunctioning septic system may be impacting water quality in Cold Brook during baseflow.
- Differences in erodibility at the two sites related to land use and geomorphology could also be contributing to the elevated conductivity at CO-2, and therefore also need to be taken into consideration.
- To further evaluate the impact of the septic system and investigate the natural water quality conditions at these sites, a similar study should be performed after the septic system has been repaired.

REFERENCES

National Centers for Environmental Information. (2021). Local Climatological Data. NOAA National Centers for Environmental Information. https://www.ncdc.noaa.gov/cdo-web/datatools/lcd

Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A. (2006). Guidelines and standard procedures for continuous water-quality monitors-Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3, 51 p. + 8 attachments. http://pubs.water.usgs.gov/tm1d3