IDENTIFYING ZONES OF GROUNDWATER DISCHARGE IN AN URBAN BEDROCK STREAM

Krygier, Lindsay C., Little, Susan F.B., Lowry, Christopher S.

Department of Geology, University at Buffalo, The State University of New York, 411 Cooke Hall, Buffalo, NY 14260|lindsayk@buffalo.edu

INTRODUCTION

Scajaquada Creek, where this study takes place, is a highly urbanized bedrock stream running through Buffalo, NY. While the alterations and structural changes made to the Creek have been well documented, it is important to note that the natural geomorphology of the waterway remains unclear. The study attempts to close this gap by taking advantage of the temperature differences between groundwater and surface water: using a thermal imaging camera to determining the locations of groundwater input into the Creek. It is the hope of the researchers that such information will assist in future restoration and preservation efforts on Scajaquada Creek.

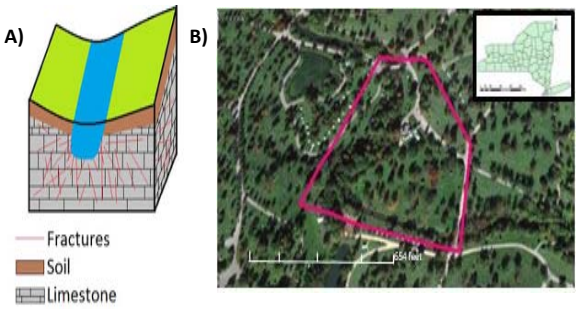


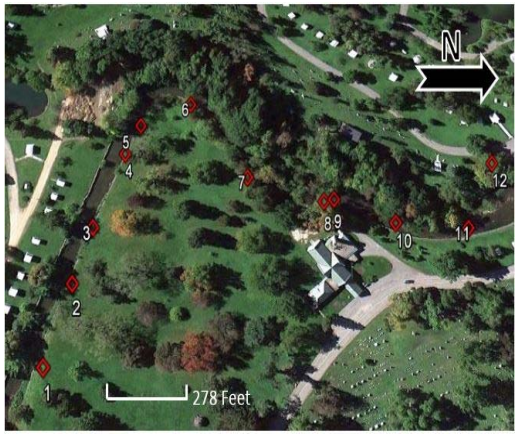
Figure 1: (A) Diagram of a fractured bedrock stream and (B) aerial image of field site, shown in the pink polygon, in Forest Lawn Cemetery, Buffalo, NY

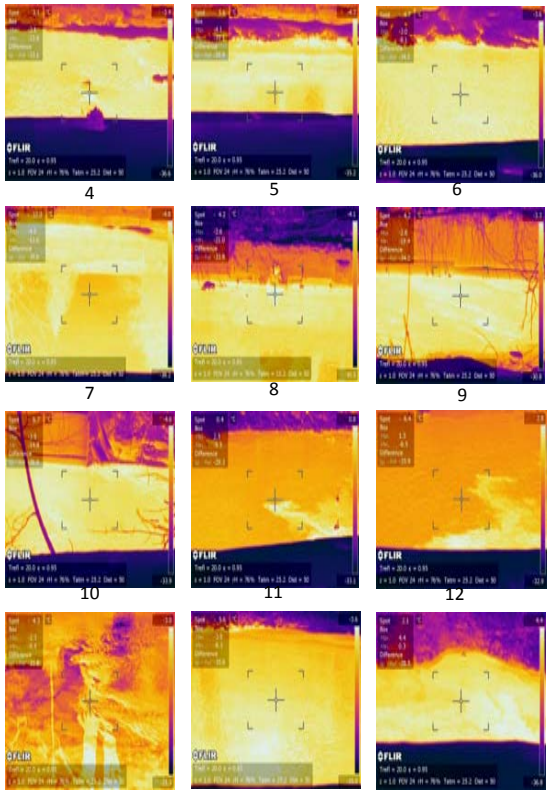
METHODS

Unlike recent studies using thermal imaging, this project was land-based. A FLIR Systems Thermacam SC640 was used to take thermal images , and a digital thermometer was used to take manual temperature measurements wherever possible.

Figure 2: (A) Initial camera test, (B) camera in the field, and (C) image of manual measurements being taken.

FIELD RESULTS





PROBLEMS

The thermal camera is extremely photosensitive, thus shadows and roughness on the surface of objects cause variability in the observed surface temperature. As a result the camera is sensitive to its angle of incidence with the target.

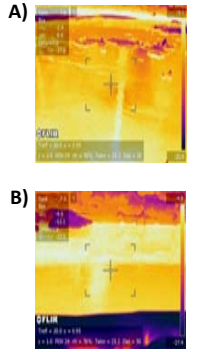
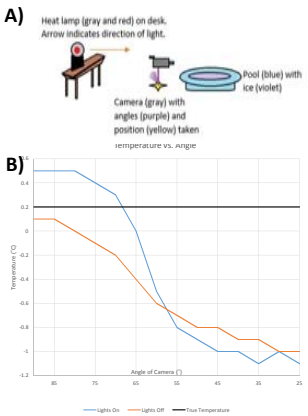


Figure 5: Images taken (A) on January 22, 2014 after sunrise and (B) on February 28, 2014 before sunrise.

LAB TESTING



In order to determine the impact of the angle of incidence, a laboratory experiment was conducted using a constant temperature bath. Images were then taken in 5 degrees increments to determine the deviation in temperature due to the angle of incidence.

Figure 6: (A) Lab testing setup and (B) deviation in temperature due to angle of incidence.

CONCLUSIONS

Preliminary results show the presence of warm temperature anomalies likely caused by groundwater discharge to the Creek. These temperature anomalies represent both diffuse discharge at the stream bank (Images 1-3), and focused discharge (Images 8-9). Lab results illustrate deviations in temperature measured with the thermal camera due to the angle of incidence.

ACKNOWLEDGEMENTS

Support for this work comes from the University at Buffalo Center for Undergraduate Research and Creative Activities.