



Stream Contamination in the Cities of Millersville and Goodlettsville, Tennessee

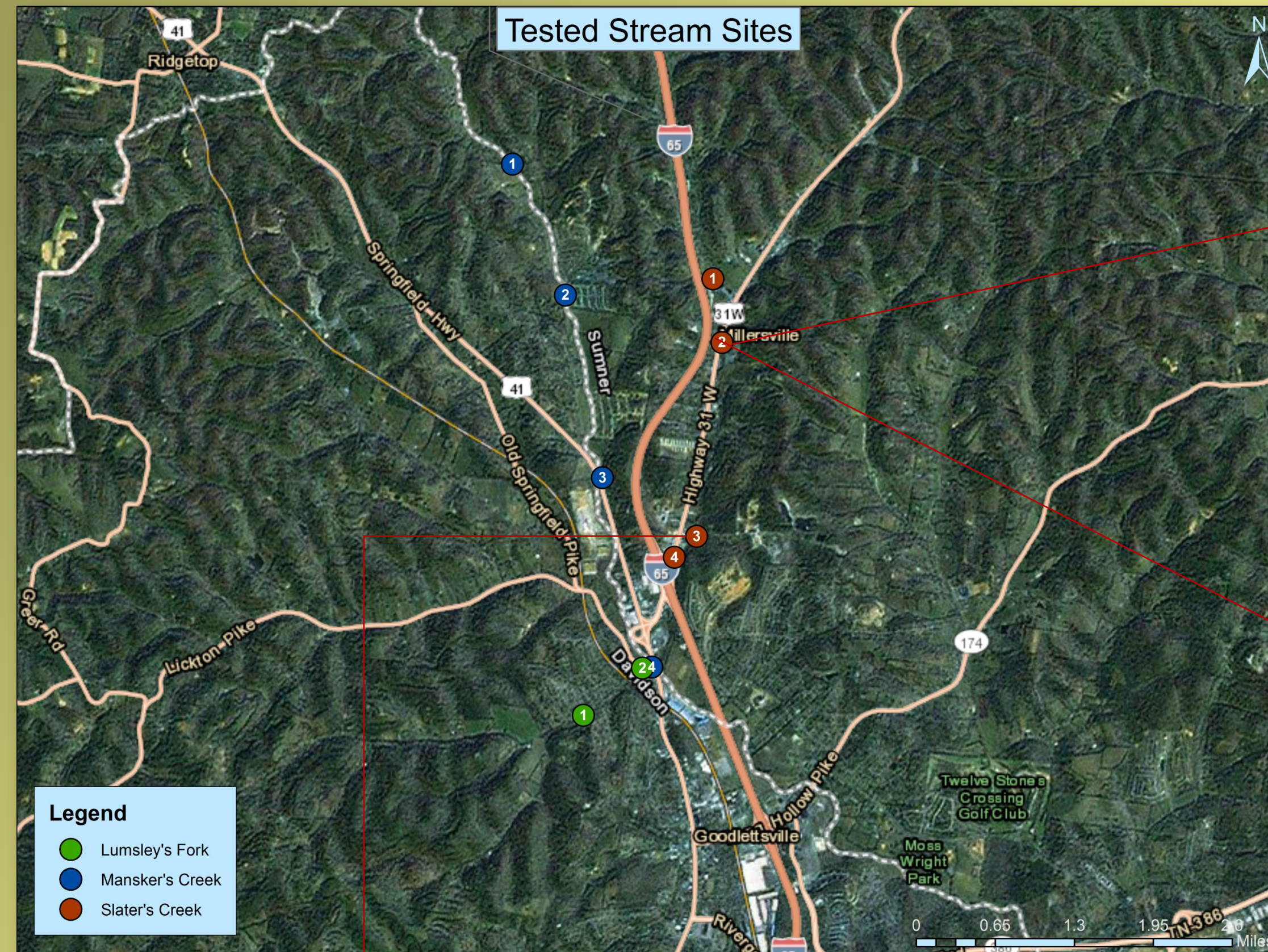
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Abstract

The Environmental Protection Agency (EPA) has placed several of the Cumberland River's tributaries in the cities of Millersville and Goodlettsville, Tennessee on the 303(d) list. The 303(d) list is designed to locate impaired waters and keep them from being used for municipal supply; only by identifying and implementing controls to reduce pollutants to acceptable levels may the water source be removed from the list. Lumsley Fork, Slater's Creek and Mansker's Creek have E.coli levels that exceed the EPA's maximum contaminant level. E. coli contaminates surface and groundwaters from sources including sewage systems, septic systems, and agriculture. Slater's Creek and Lumsley Fork have several locations with exposed pipes and sewage drains, as well as a few locations with an excessive amount of trash or dead animals. Initially, observations of color, odor, and canopy cover, as well as pH, dissolved oxygen, and temperature were recorded at several locations on each of these streams. In our study, streamflow measurements and stream piezometers will determine if the underlying aquifers are at risk of E.coli contamination. Additional water sampling, including nitrates, total dissolved solids, and E.coli will provide further contaminate source information. Our findings will help locate the sources of stream contamination and initiate the clean-up process in order to allow recreational use of the streams.



Discussion

- In September and October, Slater's Creek was almost completely dry at site 2. Even after months of higher than average rainfall or directly after heavy rainfall, it remains dry. This could be due to the local Karst terrain or seasonal fluctuations, but further data will need to be collected to determine the cause of this drying of Slater's Creek.
- Dissolved oxygen declined from March through September, then began to increase in October. Once again, further testing is required to see if this trend continues.
- pH decreased from 8.4-8.9 in the spring to 7.4-8.0 during the summer months. *E. coli* bacteria prefer a pH of 7.5 and even a slight increase or decrease can begin to stunt their growth or induce a viable but non-culturable state (Parhad and Rao,1974).
- A steady increase in total dissolved solids was observed between March and September, which is likely due to decreased water levels during the summer months.

Future Work

The long term goals of this research include the following three objectives:

- Repeat the enumeration testing carried out by the Tennessee Department of Environmental Conservation (TDEC) to confirm the presence of *E. coli* O157:H7 in the water bodies. DNA analysis would be ideal as it would identify the source of the *E. Coli* bacteria, but funding would need to be secured due to the high cost of these analyses.
- Continue investigations of potential sources of the *E. coli* bacteria contamination.
- Create a chemical and physical profile of the water bodies over several years to investigate the cause of the original fluctuations in *E. coli* populations as tested by TDEC.
- Continue chemical measurements to determine if these fluctuations are a direct result of variations in precipitation or other factors.

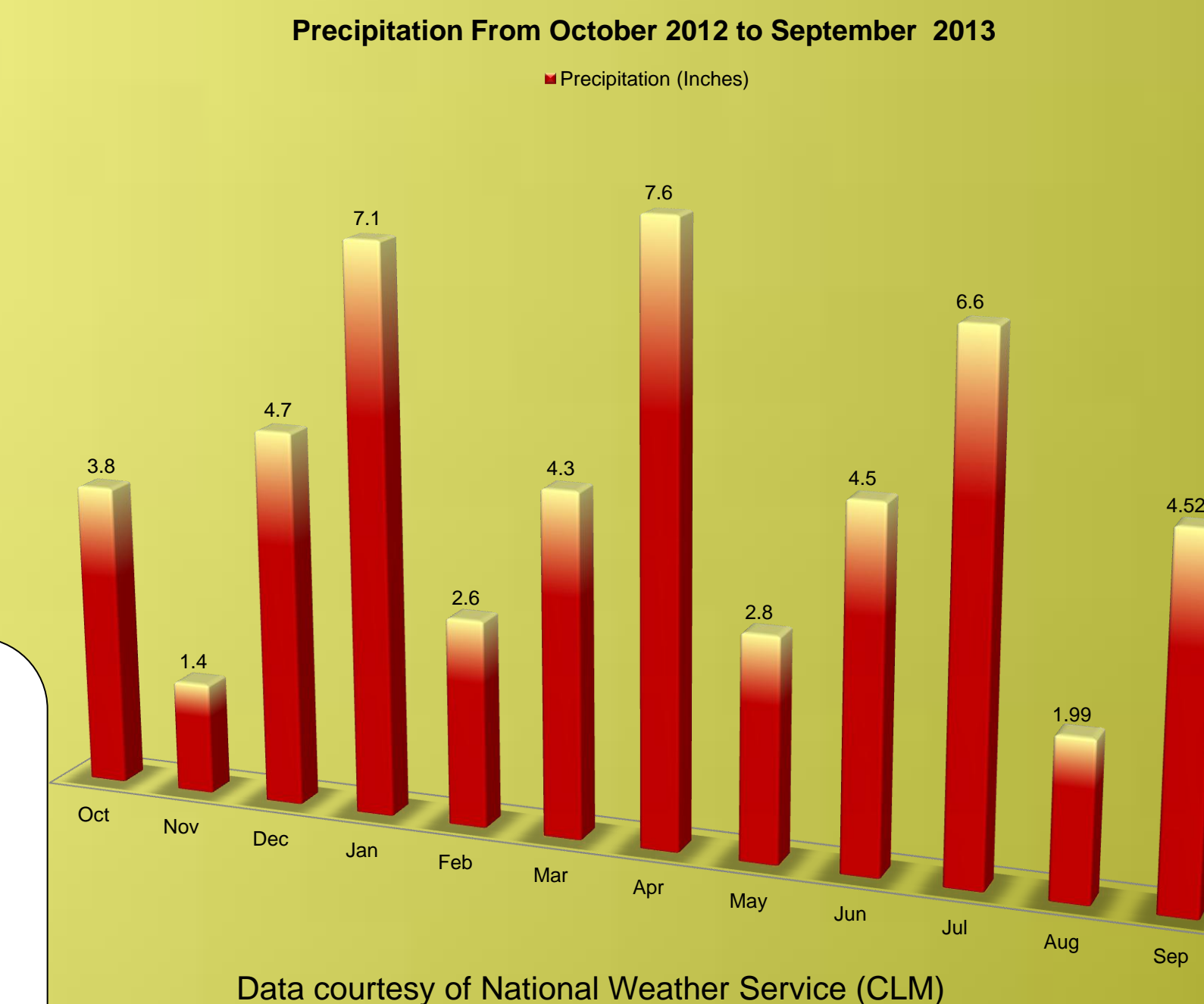
References

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- Liu, Y., Gilchrist, A., Zhang, J. and Li, X. F. 2008. Detection of viable but nonculturable *Escherichia coli* O157:H7 bacteria in drinking water and river water. *Applications in Environmental Microbiology*, vol. 74 no. 5, p. 1502-1507

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Introduction

In February of 2001, the Tennessee Department of Environmental Conservation (TDEC) began testing six locations across Mansker's Creek, Slater's Creek, and Lumpsley's Fork to bring the streams into compliance with the Clean Water Act. In 2003 the streams were found impaired with siltation and *E. coli* bacteria and placed on the EPA's 303(d) list. A stormwater management plan was created, which included continued monitoring and data collection on the impaired water bodies. This research, as an extension of the stormwater management plan, seeks to locate the sources of stream contamination and better understand the characteristics of the water bodies.

E. coli are able to adapt to a variety of conditions, but enter a viable but non-culturable (VBNC) state when stressed (Liu et al., 2008). The ability of the bacteria to enter a VBNC state makes it almost impossible to fully eliminate them, as populations quickly rebound when conditions return to a more favorable state. Combating *E. coli* is a challenge not only because of their hardiness, but some DNA analyses cannot differentiate between living individuals and dead ones.

