



# Project Summary

Texas Department of Transportation

## 0-6147: Bacteria Levels in Discharges from Road Right-of-Way

### Background

Excessive bacteria concentrations are the most common cause of water quality impairments in Texas, with almost 300 waterbodies identified by the Texas Commission on Environment Quality (TCEQ) as not meeting state standards. Total Maximum Daily Loads (TMDLs) which are designed to bring the waterbodies into compliance by reducing the bacteria discharge must be adopted for each of these systems. The Texas Department of Transportation (TxDOT) is often identified as being a contributor to these problems even though runoff from roads and bridges is only a very small fraction of the contributing watershed and has little in the way of natural bacteria sources. This research project is designed to provide TxDOT with the information to respond to regulatory requirements by evaluating the contribution of bacteria from TxDOT facilities to two diverse systems in Central Texas: the Guadalupe River in Kerrville, and Bull Creek in Austin.

### What the Researchers Did

The researchers identified two bridges in the Central Texas area where cliff swallows (*Petrochelidon pyrrhonota*) nest during the spring and early summer. Sampling plans were developed for the two waterbodies to allow comparison of the change in water quality from upstream to downstream of the bridges. The sampling occurred both when the swallows were present and absent, and in dry and wet weather. In addition, sampling was conducted throughout the day to identify any diurnal variation, and at the Bull Creek site sampling occurred for 0.75 miles downstream to determine the persistence of any bacteria concentration increase. Samples were analyzed for *E. coli*, fecal coliform, and enterococci, (Fecal Indicator Bacteria; FIB) which are commonly used by regulatory agencies to identify the potential presence of pathogens.

### What They Found

Although FIB loading from the cliff swallows can be significant, the results of this study suggest that the cliff swallows might be a minor contributor and are far from the sole cause of exceedances of bacterial criteria. Nesting swallows may contribute to bacterial loading of waterbodies during the nesting season (generally late April to mid-May in Central Texas), but not to a degree that results in impairment. When exceedances were observed, the nesting swallows were not implicated and upstream non-point sources are the likely cause.

### Research Performed by:

Center for Transportation Research (CTR),  
The University of Texas at Austin

The University of Texas at San Antonio  
(UTSA)

### Research Supervisor:

Michael E. Barrett, CTR

### Researchers:

Randall Charbeneau, CTR

Joseph Malina, CTR

Sazzad Shafique, UTSA

Hatim Sharif, UTSA

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However, anomalous weather conditions and low sample size confound the interpretation of these data and more work is needed to characterize the contribution of nesting swallows to TMDL.

The results of this study provide conflicting evidence on the contribution of nesting colonies of cliff swallows to *E. coli* and FC in the underlying waterbodies. In general, the impact appears to be less at the Guadalupe River site. At Bull Creek there was an apparent significant increase in *E. coli* concentrations downstream of the bridge during dry weather, irrespective of whether the birds were present or not and during wet weather when the birds are present. The significant increase in concentration during wet weather for *E. coli* and FC appears to be an artifact of the extremely small data set.

The sample set for the dry weather/birds absent is also very limited. Because of difficulties identifying appropriate sampling locations, no samples were collected in the fall of 2008, and only monthly samples were collected in the fall of 2009. Additional sampling is recommended in this situation to verify whether *E. coli* concentrations downstream of the bridge on Bull Creek actually are significantly higher than concentrations upstream of the bridge.

A further complication when analyzing the data is the substantial difference in flow rates on the two waterbodies in the successive years of monitoring. The first was extremely dry, with flow ceasing completely in Bull Creek. The second year had substantially more rainfall than average during the period when the swallows were nesting. An additional year of monitoring could provide data that is more representative of typical conditions and resolve some of the contradictions identified above.

## *What This Means*

The research conducted under this project has several direct and immediate implications. TxDOT has been increasingly named as a contributor to bacteriological impairments of surface waters in Texas. This research provides local data that will allow TxDOT to accurately quantify their contribution, so that retrofits in the watershed can be focused on other sources that are the main causes of violations of contact recreation standards.

### *For More Information:*

Research Engineer - Duncan Stewart, TxDOT, 512-416-4730  
Project Director - Stirling Robertson, TxDOT, 512-416-2511  
Research Supervisor - Michael E. Barrett, CTR, 512-471-0935

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