2007
The Buck Creek Watershed
Bacterial Monitoring and Sourcing Projects
Texas Agricultural Experiment Station - Vernon

Participating/Cooperating agencies:
- USEPA - United States Environmental Protection Agency
- TSSWCB - Texas State Soil and Water Conservation Board
- TWRI - Texas Water Resources Institute
- SWCDs - Soil and Water Conservation Districts:
  - Salt Fork SWCD (Collingsworth County)
  - Donley County SWCD
  - Hall-Childress SWCD
- TAES - Texas Agricultural Experiment Station
- TCE - Texas Cooperative Extension
- TCEQ - Texas Commission on Environmental Quality
- RRA - Red River Authority
- USDA - Farm Service Agency

Bacterial Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Sample Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. COLI</td>
<td>14000</td>
<td>08/07/2001</td>
</tr>
<tr>
<td>MTEC</td>
<td>12000</td>
<td>06/11/2001</td>
</tr>
<tr>
<td>MF</td>
<td>5200</td>
<td>05/08/2001</td>
</tr>
<tr>
<td>#/100 ml water sample</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Yellow indicates exceedance of the 394 colonies/100 ml single sampling limit. If more than 25% of the samples collected are above 394, then the water body is considered impaired.

Data provided by Red River Authority; testing by Clean Rivers Program criteria.
Defining the Problem

- Nonpoint source rural watershed of crops and grazing lands
- USEPA requires water quality to be suitable for fishing, swimming, wading, & a healthy aquatic ecosystem.
  No more than 25% of the individual water samples should contain more than 394 E. coli colonies/100 ml or a geometric mean from at least 10 samples of no more than 126 colonies/100 ml.
- Testing of Buck Creek at US HWY 83 from 1997 to 2001 showed bacterial levels (E. coli) were elevated and had a geometric mean of more than the 126 colonies/100 ml and more than 25% of samples exceeded 394 colonies/100 ml.

Role of TAES-Vernon

- Collect samples
- Collect and document data
- Compile and analyze data
- Attend SWCD meetings as time permits
- Prepare electronic quarterly reports
- Develop final report
- Provide leadership for a stakeholder-developed Watershed Protection Plan

Geometric Mean 2004-2007

- If an impairment persists, Federal/State agencies could impose regulations that may impact the use of watershed
- Concerned land owners & local SWCD’s: contacted the Texas State Soil Water Conservation Board & the Texas Water Resources Institute
- Vernon Center contacted by TWRI to conduct additional studies: (1) degree of impairment, (2) sources of contaminants, (3) develop a watershed protection plan

Site 01 Site 02 Site 03 Site 04 Site 05 Site 06 Site 07 Sites: 8,9 Sites: 10A,B,C Sites: 11A,B Site 12 Site 13

Fecal coliforms - colonies turn blue
E. coli - colonies turn magenta

Counting colonies
Filtering 100ml of Sample

Geometric Mean exceeding 126 colonies per 100 ml of sample are noted in red

Geoemtric Mean 2004-2007

- Need 10 to count
- Total number of samples
- (Total number of samples)
- (Total number of samples)
- (Total number of samples)
- (Total number of samples)
- (Total number of samples)
- (Total number of samples)
- (Total number of samples)
- (Total number of samples)
- (Total number of samples)
- (Total number of samples)
### E. coli and Fecal Data Summary

<table>
<thead>
<tr>
<th>Site</th>
<th>Number</th>
<th>Geometric Mean</th>
<th>Single sample exceedances</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>02</td>
<td>7</td>
<td>162.45</td>
<td>&lt; 10 samples</td>
</tr>
<tr>
<td>03</td>
<td>66</td>
<td>11.78</td>
<td>v 10.6%</td>
</tr>
<tr>
<td>04</td>
<td>66</td>
<td>18.92</td>
<td>v 18.2%</td>
</tr>
<tr>
<td>05</td>
<td>55</td>
<td>20.10</td>
<td>v 20%</td>
</tr>
<tr>
<td>06</td>
<td>29</td>
<td>6.86</td>
<td>v 6.9%</td>
</tr>
<tr>
<td>07</td>
<td>14</td>
<td>42.83</td>
<td>v 42.8%</td>
</tr>
<tr>
<td>08</td>
<td>5</td>
<td>&lt; 10 samples</td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>10A</td>
<td>71</td>
<td>36.57</td>
<td>v 36.6%</td>
</tr>
<tr>
<td>10B</td>
<td>35</td>
<td>8.57</td>
<td>v 8.6%</td>
</tr>
<tr>
<td>10C</td>
<td>38</td>
<td>15.83</td>
<td>v 15.8%</td>
</tr>
</tbody>
</table>

**Potential Contributors to Bacterial Impairment**

- Antibiotic Resistance Analysis
- Ribotyping
- ERIC-PCR
- PFGE Gel Electrophoresis

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- **Antibiotic Resistance Analysis**
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- **ERIC-PCR**
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**Bacterial Source Tracking**

- Using bacteria DNA to match E. coli colonies found in the water to a library of DNA ‘fingerprints’ gathered from human and animal species found in the watershed.
  - Contribution results

**Texas Agricultural Experiment Station - El Paso**

**Lake Waco - North Bosque River**

- 17% Human origin
- 23% Animal origin
- 10% Avian
- 9% Exotics/Other
- 10% Unknown

**Four Methods used:**

1. Antibiotic Resistance Analysis
2. Ribotyping
3. ERIC-PCR
4. PFGE Gel Electrophoresis

**Buck Creek Water Quality Project - Phase I**

- Identified As Impaired
- Initiate routine Sampling 13 sites
- Impairment Not confirmed
- Report Findings To TSSWCB
- Impairment Confirmed
- Final Report ...Then begin Phase II

**Buck Creek Water Quality Project - Phase II**

- Continue Water Monitoring
- Isolate E. coli
- DNA analysis
- Impairment
- Identify Source
- Collect known fecals
- DNA Library
- Compare to El Paso
- DNA Library
- Water Chi-square test
- Cattle/Deer/Elk/Antelope
- Bovine
- Other/Unknown
- Partion E. coli into animal groups, build DNA library
- Source: Watershed Protection Plan/5th Report
- Initiate Phase III
Buck Creek Water Quality Project - Phase III

- Develop Watershed Protection Plan
  - Substitute water sources
  - Leasing & land stream
  - Rotational grazing
  - Animal control
  - Alt. Feed sources
  - Other

- Monitoring
- Review Watershed Plan Effectiveness
- Modify Plan to Remain Compliant

Watershed Protection Plan

- Balanced
- Fair

- Cooperators and stakeholders make suggestions
- Committee to draft ideas into the WPP
- Draft goes out for review by all
- Final document to EPA for approval

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- Phyllis Dyer: Research Tech  (940) 991-5977
- Buck Creek: http://twri.tamu.edu/buckcreek

"Bleat! Bleat!...."

Translation:
"Do you have any questions?"