The Leon River Watershed
Leon Watershed

- Counties: Coryell, Hamilton, Comanche, and small portions of Mills and Erath
- 190 miles long, covering 1,375 square miles
The Leon River Watershed is a rural watershed. Rural watersheds have different characteristics compared to urban watersheds:
- Feral hogs and wildlife vs pets
- Dairy and beef cattle operations
- Septic systems
Leon Watershed Protection Plan

- 303d list in 1996
- TMDL prepared in 2008
  - 21% reduction in bacteria
  - Final adoption delayed in August
- Town hall meeting (2008)
- WPP submitted 2012
- WC hired June 2013
- EPA comments
- Response to comments
Potential Sources of Impairment

- Direct
  - Wastewater Treatment and Collection
  - Septic Systems
  - Wildlife, Feral Hogs, Livestock, and Carcass Disposal
- Indirect - “runoff”
  - Forestland - wildlife and feral hogs
  - Cropland - application of manure and fertilizers
  - Rangeland - wildlife, hogs, and livestock
  - Urban - bacterial runoff from many sources
### Sources of Impairment

#### Load Contribution of Pollutant Source (10^6 org/day)

<table>
<thead>
<tr>
<th>Pollutant Source</th>
<th>Subwatershed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Direct Discharges of Pollutants to Waterbody</td>
<td></td>
</tr>
<tr>
<td>WWTF</td>
<td>-</td>
</tr>
<tr>
<td>Wastewater Collection System</td>
<td>-</td>
</tr>
<tr>
<td>OSSF</td>
<td>12</td>
</tr>
<tr>
<td>Direct Deposition</td>
<td>21,672</td>
</tr>
<tr>
<td>Polluted Storm Water Wash Off</td>
<td>Forest</td>
</tr>
<tr>
<td></td>
<td>Cropland</td>
</tr>
<tr>
<td></td>
<td>Rangeland</td>
</tr>
<tr>
<td></td>
<td>Waste Application Field</td>
</tr>
<tr>
<td></td>
<td>Residential/Commercial/Industrial</td>
</tr>
<tr>
<td><strong>Total Source Loads</strong></td>
<td>27,157</td>
</tr>
</tbody>
</table>

#### Pie Charts

1. **Unidentified (n=4): 7%**
   - **Human (n=9): 15%**
   - **Cattle (n=11): 18%**
   - **Wildlife (n=31): 52%**
   - **Other Domestic Animals (n=5): 8%**

2. **Unidentified (n=5): 5%**
   - **Human (n=1): 2%**
   - **Cattle (n=0): 0%**
   - **Other Domestic Animals (n=1): 5%**
   - **Wildlife (n=13): 65%**

3. **Unidentified (n=2): 10%**
   - **Human (n=0): 0%**
   - **Cattle (n=2): 10%**
   - **Other Domestic Animals (n=0): 0%**
   - **Wildlife (n=16): 80%**
Bacterial Source Tracking

Leon River WPP

- TWRI
- Agrilife Research
- UT El Paso
Project Goals

• Monitor water quality and streamflow at 15 sites for 1 year

• Evaluate *E. coli* levels in water samples

• Collect known source fecal samples for inclusion in the Texas *E. coli* BST Library

• Conduct BST analysis to assess different sources of bacterial loading to the Leon River
## Monitoring Stations

<table>
<thead>
<tr>
<th>Site</th>
<th>TCEQ ID</th>
<th>Location</th>
<th>County</th>
<th>Latitude</th>
<th>Longitude</th>
<th>USGS Gage</th>
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</thead>
<tbody>
<tr>
<td>LEO 01</td>
<td>11934</td>
<td>Leon River at Hwy 67/377</td>
<td>Comanche</td>
<td>31.95778</td>
<td>-98.4593</td>
<td>Yes</td>
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<tr>
<td>LEO 02</td>
<td>17379</td>
<td>Walnut Creek at FM 1476</td>
<td>Comanche</td>
<td>31.97312</td>
<td>-98.4367</td>
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<tr>
<td>LEO 03</td>
<td>11818</td>
<td>Indian Creek at CR 304</td>
<td>Comanche</td>
<td>31.88658</td>
<td>-98.4381</td>
<td>No</td>
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<tr>
<td>LEO 04</td>
<td>11817</td>
<td>South Leon River at Hwy 36</td>
<td>Comanche</td>
<td>31.84813</td>
<td>-98.3708</td>
<td>No</td>
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<td>LEO 05</td>
<td>11933</td>
<td>Leon River at CR 382</td>
<td>Comanche</td>
<td>31.82971</td>
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<td>Leon River at CR 431</td>
<td>Hamilton</td>
<td>31.60882</td>
<td>-97.8968</td>
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<td>LEO 10</td>
<td>11929</td>
<td>Leon River at CR 190</td>
<td>Coryell</td>
<td>31.52514</td>
<td>-97.8601</td>
<td>No</td>
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<tr>
<td>LEO 11</td>
<td>18405</td>
<td>Plum Creek at CR 106</td>
<td>Coryell</td>
<td>31.5126</td>
<td>-97.9001</td>
<td>No</td>
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<tr>
<td>LEO 12</td>
<td>17501</td>
<td>Leon River at Faunt Leroy Park</td>
<td>Coryell</td>
<td>31.46250</td>
<td>-97.7492</td>
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<td>LEO 13</td>
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<td>Leon River at Hwy 36</td>
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<td>LEO 14</td>
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<td>31.33584</td>
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<tr>
<td>LEO 15</td>
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<td>Coryell Creek at FM 107</td>
<td>Coryell</td>
<td>31.39278</td>
<td>-97.5994</td>
<td>No</td>
</tr>
</tbody>
</table>
Where did the Bacteria (*E. coli*) Come From?

- Potential sources
  - Humans
  - Domesticated animals
  - Wildlife

- Methods for determining sources
  - Source survey
  - Modeling
  - Bacterial source tracking
Development of Texas *E. coli* BST Library

Sources

Isolate *E. coli* → DNA Fingerprint → Add to Library
Use of Texas *E. coli* BST Library for Identifying Water Isolates

- Isolate *E. coli*
- DNA Fingerprint
- Compare to Library
- Source ID
Table 5. Summary of *E. coli* enumerations, expressed as colony forming units (CFU) per 100 mL, sampled from flowing water in the Leon River watershed

<table>
<thead>
<tr>
<th>Station</th>
<th>TCEQ Station ID</th>
<th># of Samples</th>
<th>Geometric Mean (CFU/100 mL)</th>
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</thead>
<tbody>
<tr>
<td>LEO 1</td>
<td>11934</td>
<td>12</td>
<td>40</td>
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<td>LEO 2</td>
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<td>8</td>
<td>163</td>
</tr>
<tr>
<td>LEO 3</td>
<td>11818</td>
<td>4</td>
<td>225</td>
</tr>
<tr>
<td>LEO 4</td>
<td>11817</td>
<td>4</td>
<td>32</td>
</tr>
<tr>
<td>LEO 5</td>
<td>11933</td>
<td>10</td>
<td>118</td>
</tr>
<tr>
<td>LEO 6</td>
<td>11808</td>
<td>5</td>
<td>71</td>
</tr>
<tr>
<td>LEO 7</td>
<td>11932</td>
<td>7</td>
<td>54</td>
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<tr>
<td>LEO 8</td>
<td>17547</td>
<td>6</td>
<td>16</td>
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<td>LEO 9</td>
<td>11930</td>
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<tr>
<td>LEO 10</td>
<td>11929</td>
<td>12</td>
<td>76</td>
</tr>
<tr>
<td>LEO 11</td>
<td>18405</td>
<td>3</td>
<td>20</td>
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<td>LEO 12</td>
<td>17501</td>
<td>12</td>
<td>75</td>
</tr>
<tr>
<td>LEO 13</td>
<td>11926</td>
<td>12</td>
<td>54</td>
</tr>
<tr>
<td>LEO 14</td>
<td>11925</td>
<td>12</td>
<td>66</td>
</tr>
<tr>
<td>LEO 15</td>
<td>11804</td>
<td>4</td>
<td>42</td>
</tr>
</tbody>
</table>

* Geometric means reported in this column were calculated using data collected from flowing water at each respective sampling site.
* **BOLD** geometric means exceed the state’s contact recreation standard of 126 CFU/100 mL
Sources of impairment from three sampling locations

- Human: 65% (n=13)
- Wildlife: 25% (n=5)
- Other Domestic Animals: 5% (n=1)
- Unidentified: 5% (n=1)

For another location:
- Human: 15% (n=9)
- Wildlife: 18% (n=31)
- Other Domestic Animals: 8% (n=5)
- Unidentified: 7% (n=4)

For another location:
- Human: 0% (n=0)
- Cattle: 10% (n=2)
- Other Domestic Animals: 0% (n=0)
- Unidentified: 0% (n=2)

Wildlife: 80% (n=16)
Project Results

- Geometric means of *E. coli* collected at 13 of 15 sites was in compliance with the state’s primary contact recreation standard of 126 cfu/100 mL.

- Primary *E. coli* sources in watershed appear to be wildlife (coyotes, deer, feral hogs, avian wildlife).

- BST results must be assessed keeping drought conditions in mind.

- BST results at individual sites were similar to the results for all sites in the watershed combined.

- Although non-avian wildlife vs avian-wildlife was parsed out, specific wildlife groups could not be based on the analysis.
Evidence for contribution by feral hogs

- In 2011 there were an estimated 1.9-3.4 million hogs across 134 million acres of Texas
- Population growth (18-20% annually)
- Hogs “hang out” in riparian areas
- Wallowing and defecation

[Map of Texas]
Feral Hogs: impact to water quality
Leon Watershed Hog Abatement

- Education and Outreach in all 3 counties
- CHAMP; Hog-Out; Coryell Abatement Program
- Traps, cameras, and spotlights given away
- Over 2,000 tails collected from bounty programs
- Helicopter hunting
- Wounded Warriors project
Feral Hog Workshops
Feral Hog Booth at CCYF
Trap Demos and Prizes
Other Wildlife Concerns
Wildlife Efforts

- Newsletter article highlighting wildlife management
- Out On The Land
- Extension publication
- 319 grant for workshops
- Wildlife Field Day
Livestock Strategy

Which side of the fence would you like to be on?

It takes grass to grow grass

Take half leave half
Workshops

 Lonestar Healthy Streams
    Dairy
    Beef Cattle
    Horses
 Watershed Stewards
 Riparian Workshop
Urban Strategies

- Rainwater Harvesting
- Native Landscaping
- Minimize pollutant run-off
- Wastewater Treatment Facilities
- Septic System Maintenance
Homeowner Water Day in Comanche: Feb 26th
Hamilton County Septic Program
Coryell County Septic Program

- $100,000 funded by TCEQ
- WC and County Attorney’s office
- Identify and prioritize
- Fix a few key systems
- Future 319 funding for implementation
- Expand model to Comanche
Grant Proposals: progress

- TCEQ- OSSF program for Coryell County--accepted
- TSSWCB- extension of Hamilton’s OSSF program--pending
- TSSWCB- district water technician--pending
- TSSWCB- extension of Leon WC project--accepted
- TSSWCB- wildlife/riparian workshop--pending
- TDA CHAMP Grant--accepted
Newsletter

- Wastewater Treatment
- Rainwater Harvesting
- Urban BMPs
- Triennial Revisions
- Workshops highlighted

Leon River Watershed Project

Wastewater Treatment in the Leon River Watershed

Municipalities in the watershed that operate a wastewater treatment facility (WWTF) discharge their treated effluent to streams. When operated and maintained properly, WWTFs discharge effluent with bacteria concentrations much lower than the water quality standards. For example, in 2008 the City of Conroe was in compliance with the effluent 10,000 E. coli limit. However, a number of alternative systems require extensive infiltration, the WWTF may be overwhelmed and not have the capacity to properly treat the wastewater. No matter the reason, the release of improperly treated wastewater from a WWTF is a permit violation. The consequence is that it is

Did you know that

Inside this issue:
- Rainwater Harvesting
- Improving water quality through water conservation at home
- Workshops in the Leon River Watershed
- TCRQ's triennial revisions

Leon River Watershed Project

March 2014
Volume 1, Issue 4

Texas A&M AgriLife & Texas State Soil and Water Conservation Board

Wastewater Treatment in the Leon River Watershed

Municipalities in the watershed that operate a wastewater treatment facility (WWTF) discharge their treated effluent to streams. When operated and maintained properly, WWTFs discharge effluent with bacteria concentrations much lower than the water quality standards. For example, in 2008 the City of Conroe was in compliance with the effluent 10,000 E. coli limit. However, a number of alternative systems require extensive infiltration, the WWTF may be overwhelmed and not have the capacity to properly treat the wastewater. No matter the reason, the release of improperly treated wastewater from a WWTF is a permit violation. The consequence is that it is
Project Website

http://leonriver.tamu.edu/
Implementation Updates
TCEQ Triennial Revisions

- Adopted revisions pertinent to the Leon
  - Primary contact recreation 2
  - Splitting the Leon Watershed into 2 watersheds
  - Revisions to uses and criteria for:
    - Resley Creek- SCR2 (1030 cfu/100 ml)
    - Indian Creek- SCR2 (1030 cfu/100 ml)
    - Walnut Creek- SCR2 (1030 cfu/100 ml)
    - South Leon River- SCR1 (630 cfu/100 ml)
Northern Portion

- Resley Creek- SCR2 (1030 cfu/100 ml)
  - 209.23 and 380.57
- Indian Creek- SCR2 (1030 cfu/100 ml)
  - 719.71 and 268.53
- Walnut Creek- SCR2 (1030 cfu/100 ml)
  - 339.64
- South Leon River- SCR1 (630 cfu/100 ml)
  - 256.75
The rest of the watershed

- 1221_01 (Coryell-Lake Belton) - 174.21
- 1221_02 (Coryell-Stillhouse) - 125.03
- 1221_03 (Stillhouse-Plum Creek) - 166.37
- 1221_04 (Plum Creek-Pecan Creek) - 194.41
- 1221_05 (Pecan Creek-South Leon) - 153.37
- 1221_06 (South Leon-Walnut Creek) - 288.80
- 1221_07 (Walnut Creek-Lake Proctor) - 121.84
Summary of efforts

- Revisions to the WPP
- Septic Incentive Programs
- Over 40 WQMPs in the watershed
- TDA funding—over 2,000 feral hogs eradicated
- Pecan Creek removed from impaired list
- Hamilton WWTF conversion
- Several workshops
  - Riparian, Watershed Stewards, Well Owners, Septic, Dairy BMPs
Spreading the Word

Local stakeholders know best how to take care of their own backyard.......... The only way to avoid regulation is to be involved! Please sign up on our mailing list as a good first step

Website- Leonriver.tamu.edu

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email: Leon.Watershed@gmail.com