Larkin Creek Phase II
Project 11-1800

Jennifer L. Bouldin, PhD
Ecotoxicology Research Facility
Arkansas State University
Background

• Larkin Creek
  – tributary of the L’Anguille River
  – dominated by row crop agriculture

• L’Anguille River
  – tributary of the St. Francis River
  – in the Delta ecoregion
  – 303d list for sedimentation and pathogens

• ADEQ authorized the St. Francis County Conservation District to implement BMPs to reduce pollutant loading to L’Anguille
Site description

Lateral 1-A of Larkin Creek
  – Tributary of the L’Anguille River
  – HUC#080202050506

Middle Site ~ 0.48 km downstream of Sedimentation Pond
BMPs

St. Francis County Conservation District
• sediment pond construction
• plant riparian buffers
• plant cover crops
• remove sediment
• restore the channel
  – Lateral 1-A of Larkin Creek

L’Anguille River
• Agricultural activities cited as major cause of the impairment within watershed
  – excessive turbidity from silt, suspended solids loading, sedimentation
Measured Parameters

- pH
- Dissolved Oxygen
- Total Suspended Solids (TSS)
- Turbidity
- Dissolved Nitrate, Nitrite, Orthophosphate

- Weekly sampling concluded Sept 2014
- Samples categorized as rainfall (>2 cm) and baseflow events (Lon Mann Cotton Research Station, Marianna, AR)
### Annual mean TSS and turbidity

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TSS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Site</td>
<td>37.0</td>
<td>33.1</td>
<td>21.1</td>
</tr>
<tr>
<td>Middle Site</td>
<td>57.1</td>
<td>60.0</td>
<td>38.8</td>
</tr>
<tr>
<td>Lower Site</td>
<td>44.1</td>
<td>40.8</td>
<td>32.3</td>
</tr>
<tr>
<td><strong>Turb</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Site</td>
<td>56.9</td>
<td>78.5</td>
<td>58.8</td>
</tr>
<tr>
<td>Middle Site</td>
<td>82.6</td>
<td>124.2</td>
<td>104.0</td>
</tr>
<tr>
<td>Lower Site</td>
<td>86.5</td>
<td>88.7</td>
<td>69.7</td>
</tr>
</tbody>
</table>

### Mean TSS and turbidity 2012-2014

<table>
<thead>
<tr>
<th></th>
<th>TSS (mg/L)</th>
<th>Turb (NTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Site</td>
<td>31.4</td>
<td>70.4</td>
</tr>
<tr>
<td>Middle Site</td>
<td>50.9</td>
<td>93.3</td>
</tr>
<tr>
<td>Lower Site</td>
<td>40.3</td>
<td>84.4</td>
</tr>
</tbody>
</table>
TSS - rainfall and baseflow

2012 rainfall = 90 cm (35.4 inches)
2013 rainfall = 138 cm (54.3 inches)
2014 rainfall = 138 cm (54.3 inches)
## Annual mean dissolved nutrients (ppm)

<table>
<thead>
<tr>
<th></th>
<th>NO₂</th>
<th>NO₃</th>
<th>PO₄</th>
<th>NO₂</th>
<th>NO₃</th>
<th>PO₄</th>
<th>NO₂</th>
<th>NO₃</th>
<th>PO₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Site</td>
<td>0.068</td>
<td>1.065</td>
<td>0.144</td>
<td>0.086</td>
<td>1.540</td>
<td>0.810</td>
<td>0.097</td>
<td>0.187</td>
<td>0.351</td>
</tr>
<tr>
<td>Middle Site</td>
<td>0.154</td>
<td>1.864</td>
<td>0.150</td>
<td>0.049</td>
<td>1.432</td>
<td>0.425</td>
<td>0.130</td>
<td>0.651</td>
<td>1.120</td>
</tr>
<tr>
<td>Lower Site</td>
<td>0.122</td>
<td>1.699</td>
<td>0.205</td>
<td>0.079</td>
<td>2.257</td>
<td>0.422</td>
<td>0.093</td>
<td>1.059</td>
<td>0.214</td>
</tr>
</tbody>
</table>

## Mean dissolved nutrients (ppm) 2012-2014

<table>
<thead>
<tr>
<th></th>
<th>NO₂</th>
<th>NO₃</th>
<th>PO₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Site</td>
<td>0.084</td>
<td>1.104</td>
<td>0.307</td>
</tr>
<tr>
<td>Middle Site</td>
<td>0.086</td>
<td>1.595</td>
<td>0.240</td>
</tr>
<tr>
<td>Lower Site</td>
<td>0.088</td>
<td>1.726</td>
<td>0.262</td>
</tr>
</tbody>
</table>
NO$_3$ - rainfall and baseflow

2012 rainfall = 90 cm (35.4 inches)
2013 rainfall = 138 cm (54.3 inches)
2014 rainfall = 138 cm (54.3 inches)
$PO_4$ - rainfall and baseflow

2012 rainfall = 90 cm (35.4 inches)
2013 rainfall = 138 cm (54.3 inches)
2014 rainfall = 138 cm (54.3 inches)

[Chart showing phosphate concentration over years with error bars]
Pre-conservation practices (2010)

• 16 week sampling period
  – June – Sept 2010
• June – Sept 2012-2014 comparisons

• 2010 extremely dry year
  – (Lon Mann Cotton Research Station, Marianna, AR)

<table>
<thead>
<tr>
<th>June – Sept (16 weeks)</th>
<th>Rainfall (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>3.40</td>
</tr>
<tr>
<td>2012</td>
<td>5.97</td>
</tr>
<tr>
<td>2013</td>
<td>6.22</td>
</tr>
<tr>
<td>2014</td>
<td>10.80</td>
</tr>
</tbody>
</table>
June – Sept TSS means prior to (2010) and post (2012-2014) conservation practices

Mean TSS 2010 = 117.9 mg/L
Mean TSS 2012-2014 = 32.9 mg/L
72% reduction
June – Sept TSS means prior to (2010) and post (2012-2014) conservation practices
Conclusions

• TSS remains greatest at Middle Site
  – Especially following rain events
• Nutrient spikes following applications and rainfall events
  – Greater values at lower site
• Data following conservation practice implementation may show continued improvement over time
  – Pre- and post-implementation shows improvement
  – Drought year (2012) and wet years (2013 & 2014)
  – Separating rain and baseflow events
• Sarah’s MS thesis complete – graduated May 2015
Questions?

Upper Larkin Creek  Middle Larkin Creek  Lower Larkin Creek

Thanks to ANRC, Sarah Frasier, students and technicians at Ecotox