SAN ANTONIO RIVER AUTHORITY

Leaders in Watershed Solutions

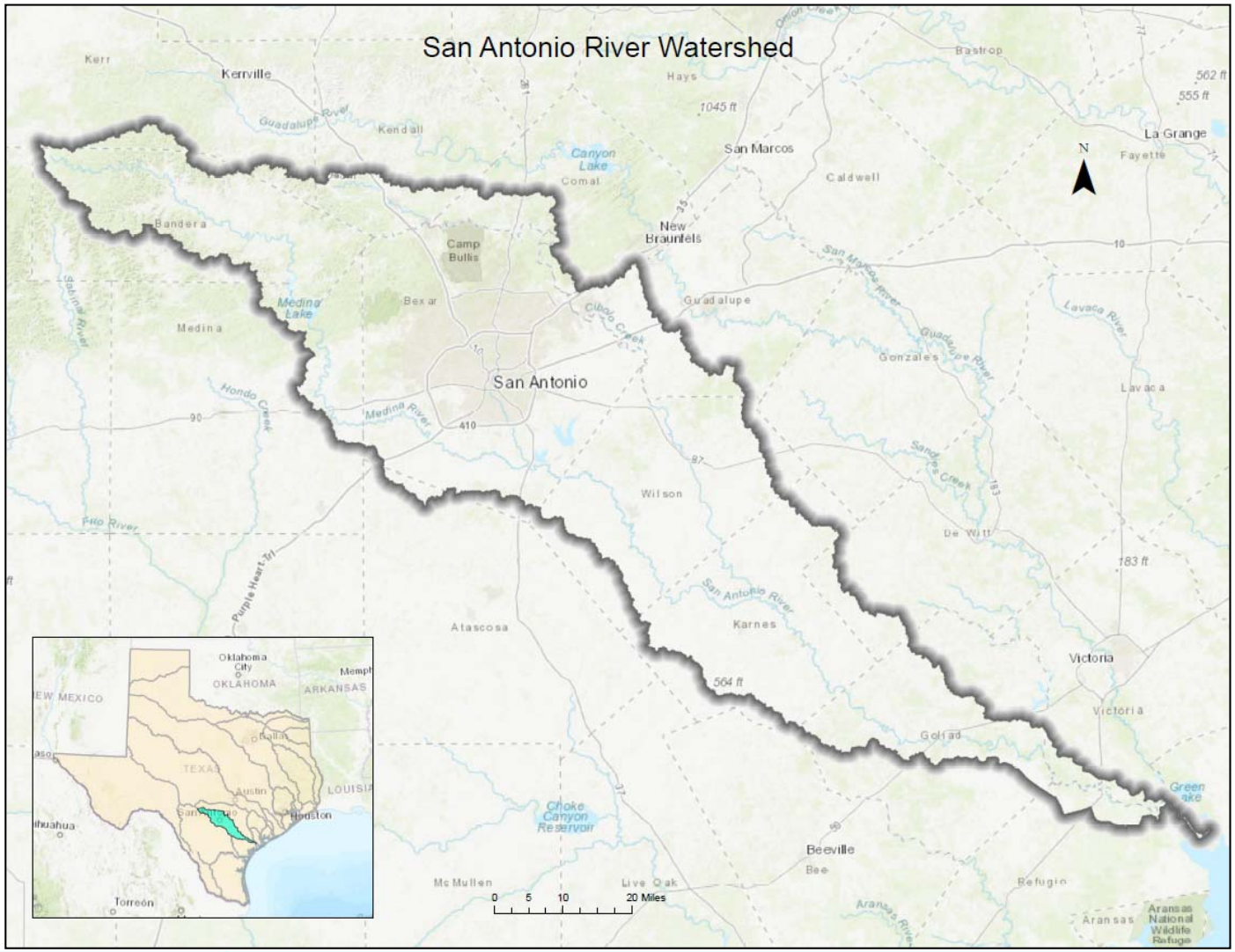
Ambient microbial testing in the San Antonio River watershed, a three-pronged approach

Shaun Donovan – Monday, August 6, 2018

INSPIRING ACTIONS FOR HEALTHY CREEKS & RIVERS

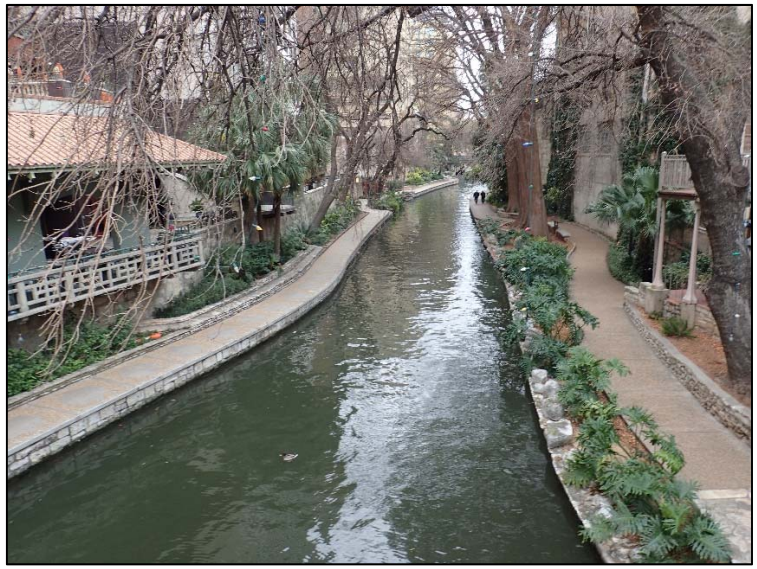
Outline

- Introduction to the San Antonio River (SAR) watershed
- Basic discussion of three-pronged sampling approach
- SARA's routine water quality monitoring
- Lower SAR Implementation Plan/Escondido Creek Case Study


San Antonio River Watershed
Kerr
Kerrville
Kendall
Guadalupe River
Hays
1045 ft
Canyon Lake
Comal
San Marcos
Caldwell
Bastrop
562 ft
555 ft
La Grange
Fayette
N
Bandera
Camp Bullis
New Braunfels
Medina Lake
Bexar
Guadalupe
Cibolo Creek
San Marcos River
Lavaca River
Medina
Sabinal River
Hondo Creek
San Antonio
Medina River
Gonzales
Lavaca
90
410
10
35
87
Wilson
Sandies Creek
183
183 ft
De Witt
Frio River
Purple Heart Trl
San Antonio River
Karnes
Atascosa
564 ft
Victoria
Goliad
Green Lake
Choke Canyon Reservoir
Beeville
Bee
Refugio
McMullen
Live Oak
Aransas
Aransas National Wildlife Refuge
0 5 10 20 Miles
Oklahoma City
OKLAHOMA
ARKANSAS
NEW MEXICO
TEXAS
Austin
Houston
Torreón

San Antonio River Watershed

- Drains ~4,180 mi.^{2}
- Main stem ~240 mi.
- 13 classified segments



San Antonio River Authority

- Established May, 1937 by the 45th Legislature of Texas
- Committed to safe, clean and enjoyable creeks and rivers
- Responsible for coordinating and conducting routine water quality monitoring in the basin

Segment	WQ Stations	Biological Samples
1901 – Lower San Antonio River	11	4
1902 – Lower Cibolo Creek	15	4
1903 – Lower Medina River	6	2
1904 – Medina Lake	5	
1905 – Upper Medina River	8	2
1906 – Lower Leon Creek	4	2
1907 – Upper Leon Creek	4	
1908 – Upper Cibolo Creek	4	2
1909 – Medina Diversion Lake	2	
1910 – Salado Creek	6	4
1911 – Upper San Antonio River	31	6
1912 – Medio Creek	2	1
1913 – Mid Cibolo Creek	3	

Water Quality Monitoring

- Water Quality Analysis:
  - Nitrate, nitrite, total suspended solids, chloride, sulfate, chlorophyll-a, *E. coli*
- Abiotic Parameters:
  - Dissolved oxygen, temperature, pH, conductance
- Field Observations

Water Quality Monitoring

- Chemical Analysis:
  - Nitrate, nitrite, total suspended solids, chloride, sulfate, chlorophyll-a, *E. coli*
- Water Quality Parameters:
  - Dissolved oxygen, temperature, pH, conductance
- Field Observations

Adaptive Three-Pronged Approach

Routine Monitoring

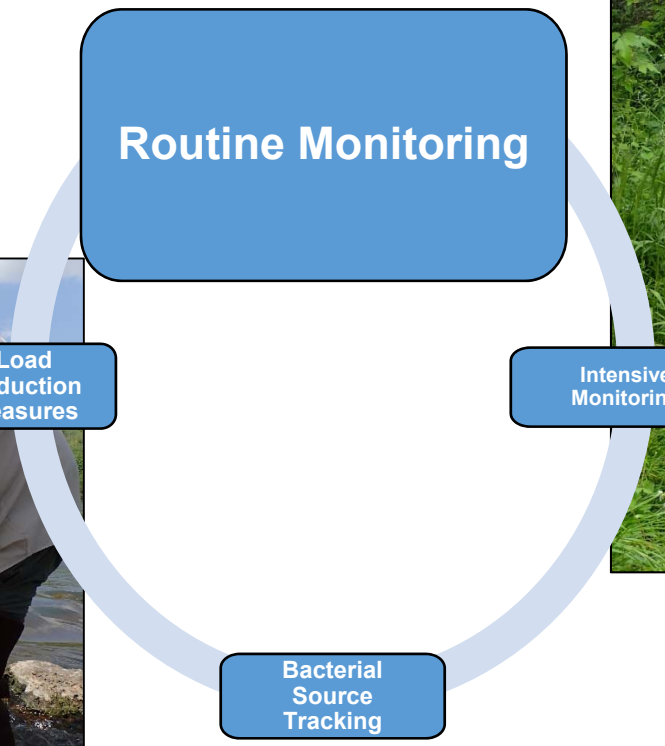
Intensive Monitoring

Bacterial Source Tracking

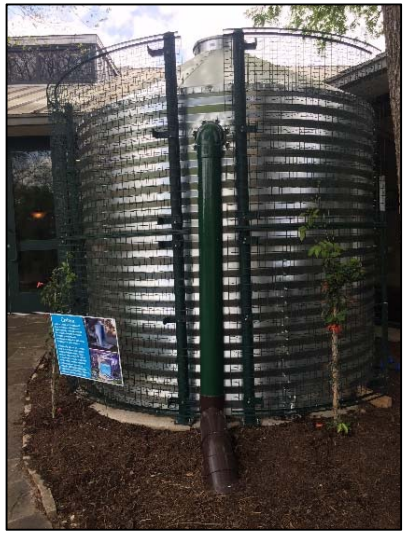
Adaptive Three-Pronged Approach

- Routine Monitoring
- Intensive Monitoring
- Bacterial Source Tracking
- Load Reduction Measures

Adaptive Three-Pronged Approach Time



Adaptive Three-Pronged Approach Money



Routine Monitoring

Load Reduction Measures

Intensive Monitoring

Bacterial Source Tracking

SARA's Case Studies

1) Lower San Antonio River Implementation Plan (LSAR I-Plan)

2) San Antonio Zoo UV Discharge

3) Cibolo Creek Watershed Protection Plan (WPP)

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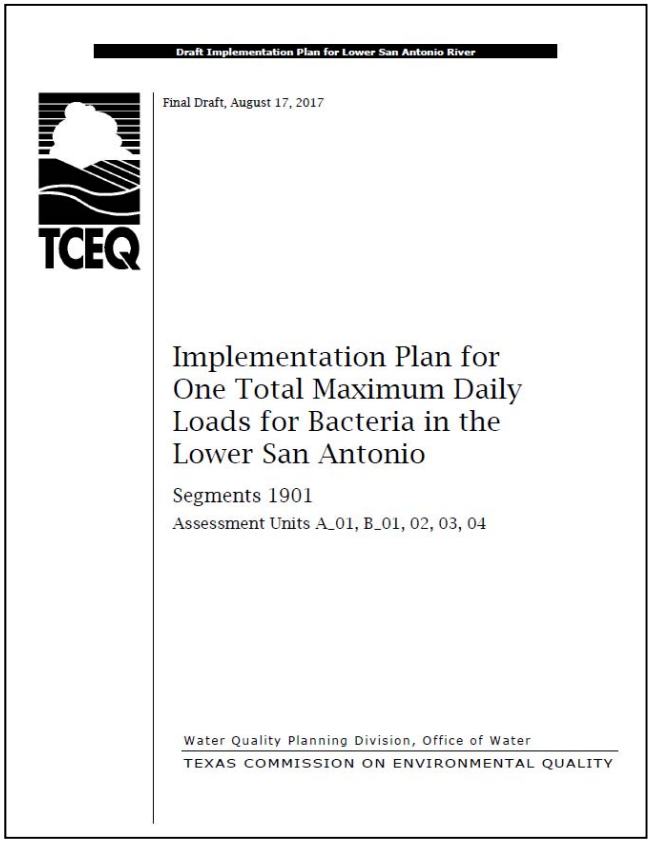
LSAR I-Plan

- Bacterial TMDL adopted on 8 Aug 2008

- I-Plan:
  - Describes steps to be taken towards load reduction
  - Outlines schedule for implementation


Draft Implementation Plan for Lower San Antonio River

TCEQ

Final Draft, August 17, 2017

Implementation Plan for One Total Maximum Daily Loads for Bacteria in the Lower San Antonio

Segments 1901

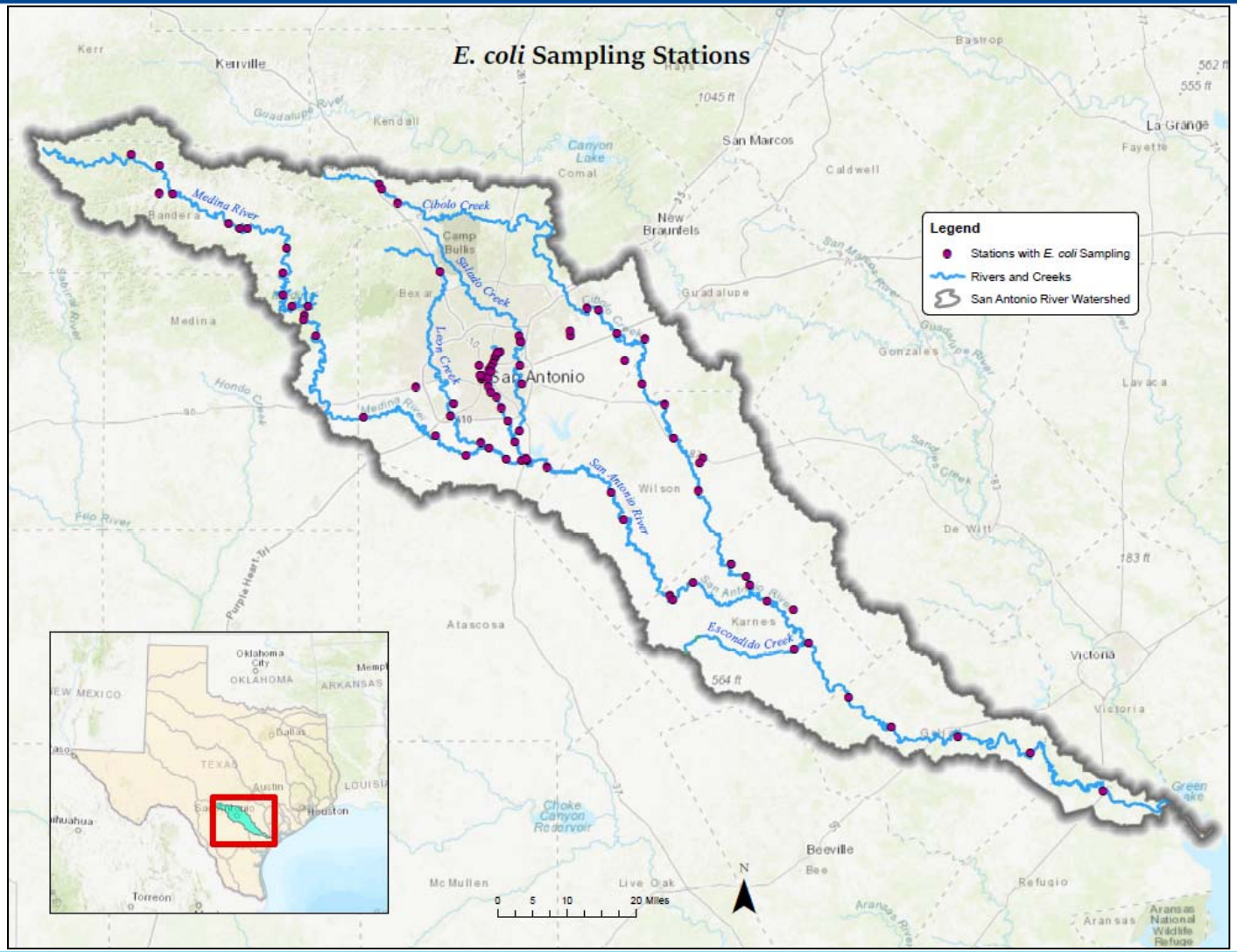
Assessment Units A_01, B_01, 02, 03, 04

Water Quality Planning Division, Office of Water

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

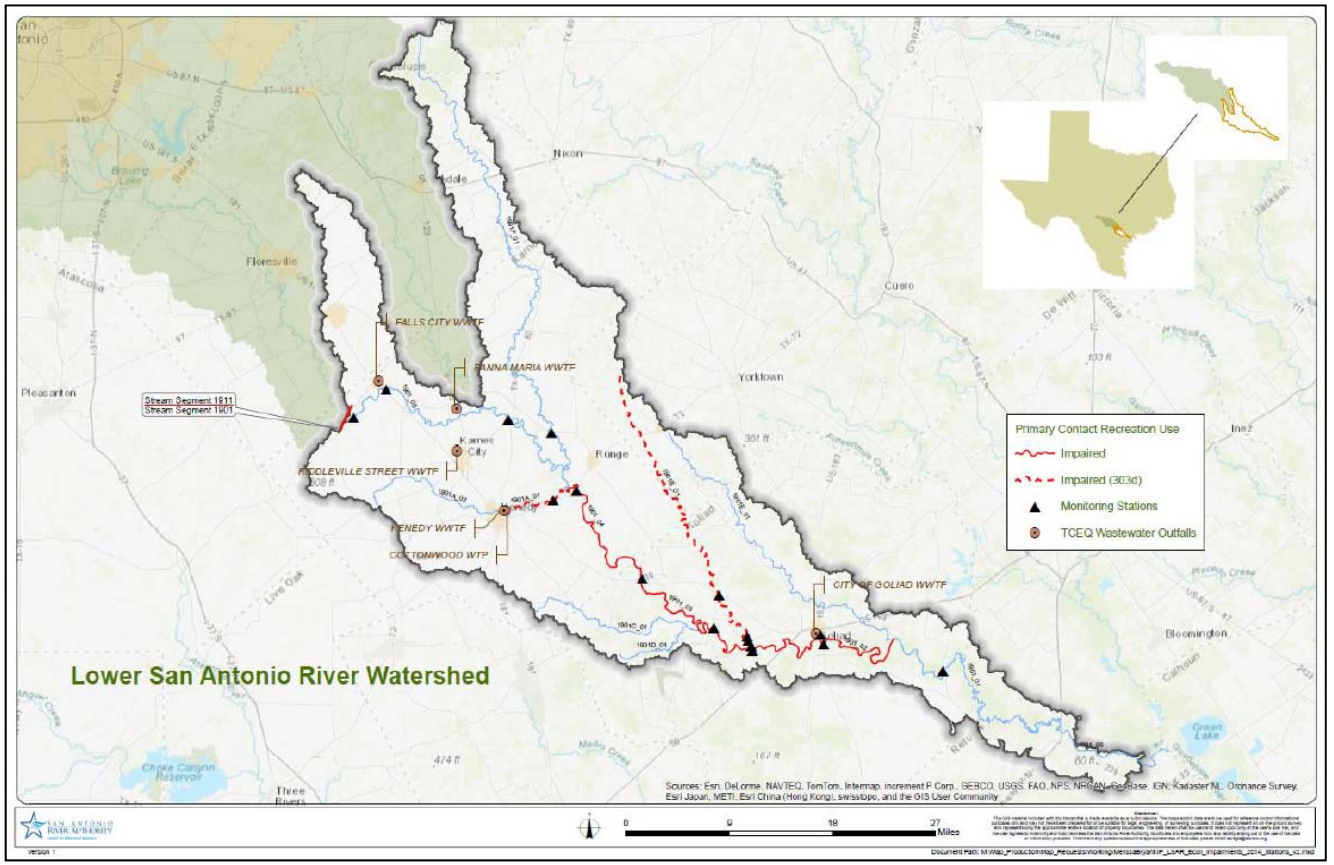
Routine Monitoring

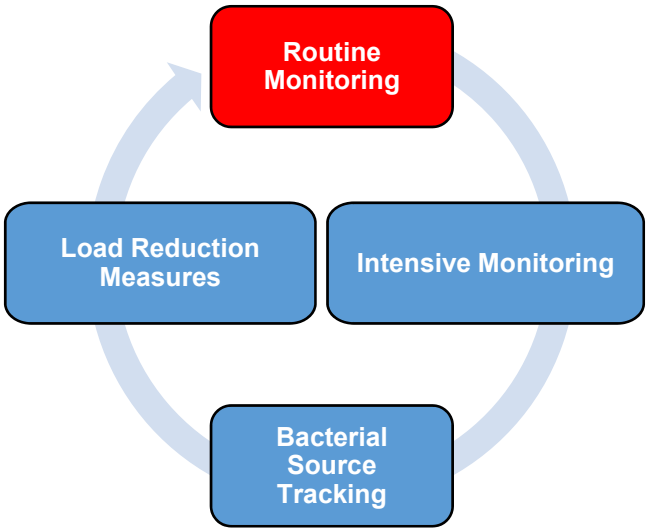
- 86 *E. coli* sampling stations
- Weekly to bi-monthly



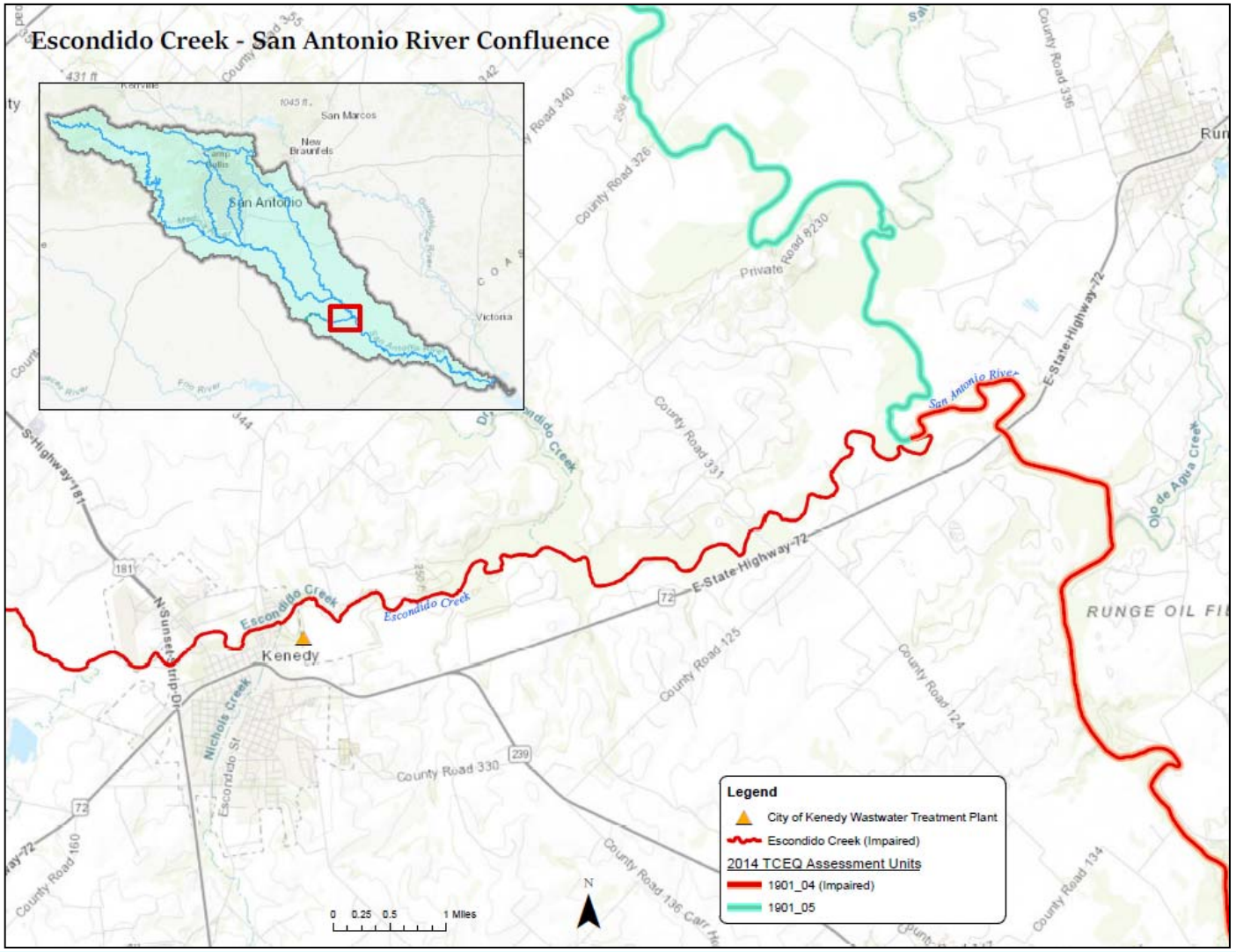
LSAR I-Plan: Escondido Creek

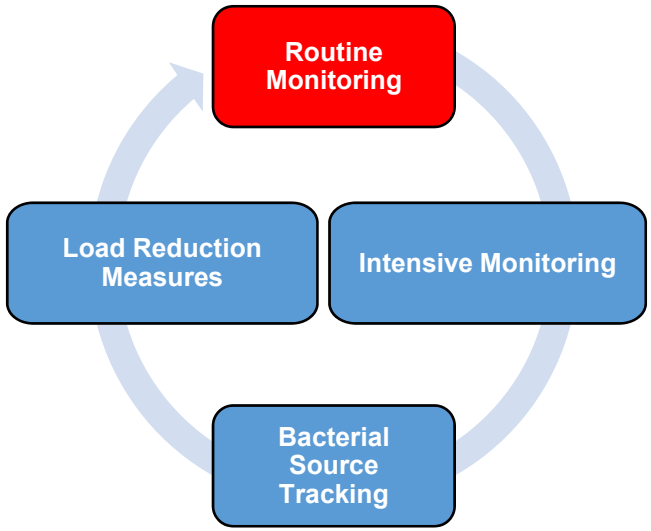
- ~8.6 mi. long
- Bacterial impairment since 2010
- WWTP discharge receiving stream



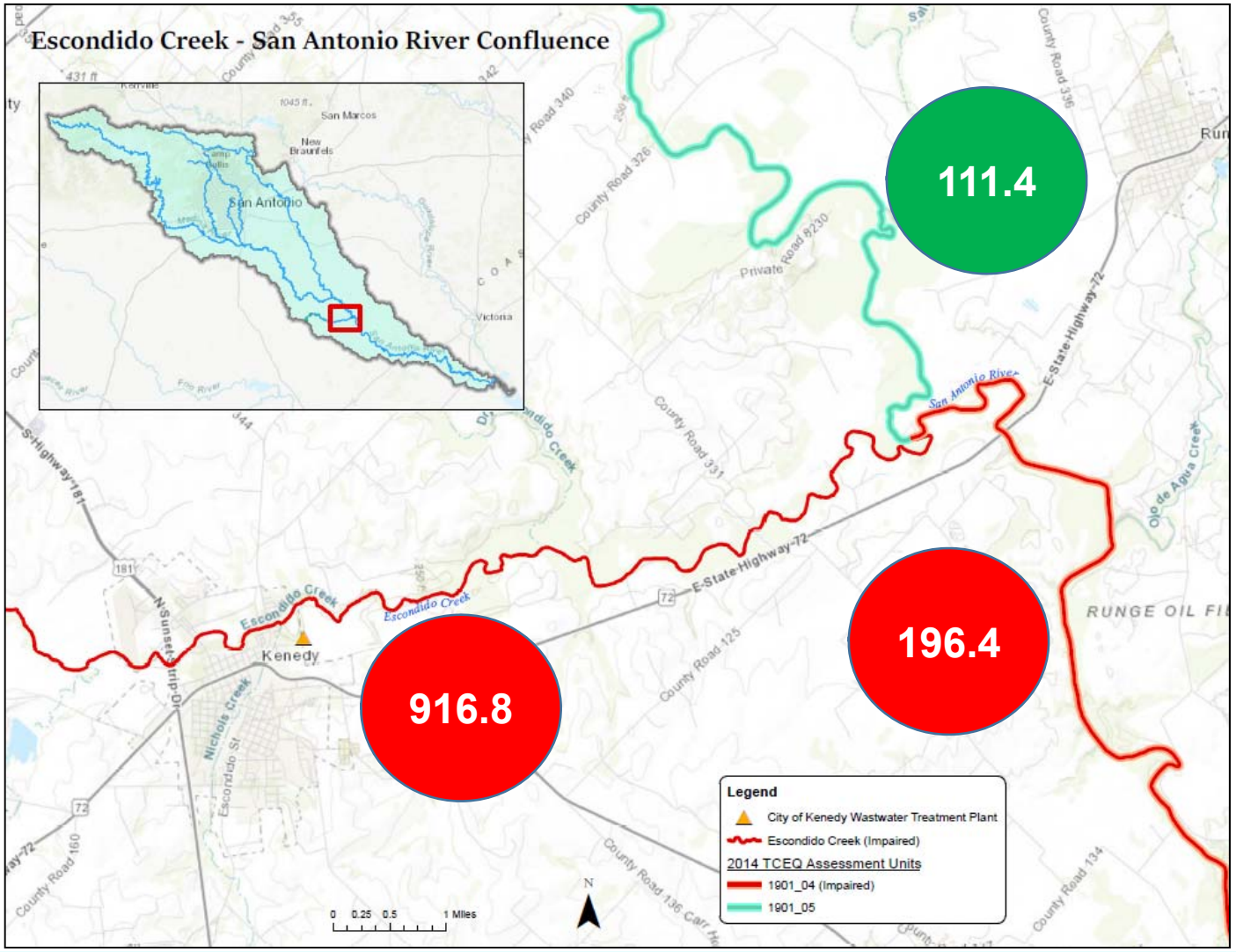


- Seven year period of record



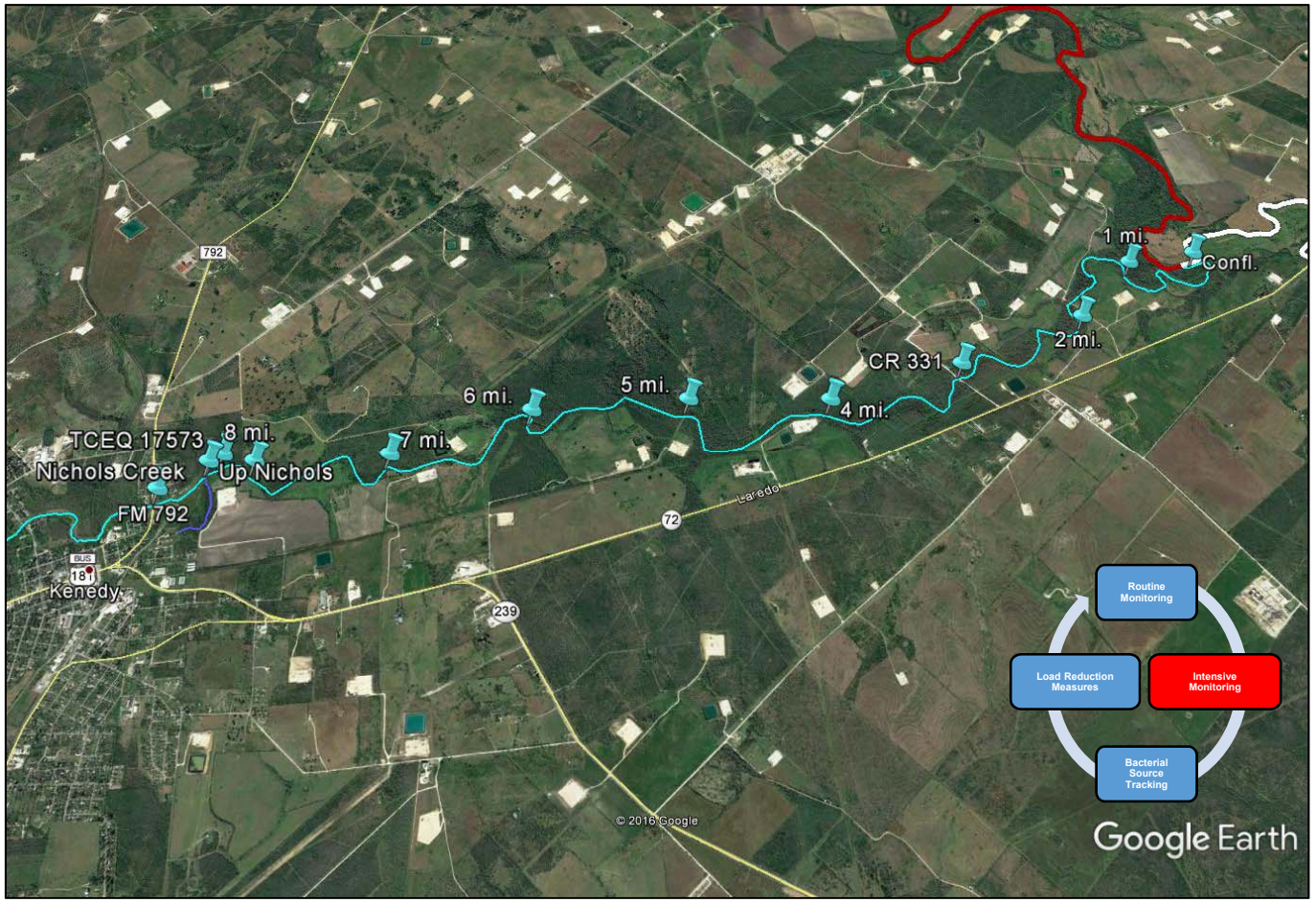


- Bacterial geomean
- Standard of 126 cfu/100 mL



Escondido Creek Intensive Survey

- 13 samples collected
- No unidentified discharges
- 96 – 1600 MPN



Escondido Creek Intensive Survey

FLOW

Station	Flow	*E. coli* (MPN)	Days Since Last Precip.
Escondido at FM 792	0.1	140	5
Escondido Creek immediately upstream of Nichols Creek Confluence	0.0	96	5
Nichols Creek	0.1	220	5
TCEQ_17573 Escondido Creek Downstream of Nichols Creek Confluence	0.1	210	5
Escondido Creek 8 miles upstream SAR Confluence	0.1	240	5
Escondido Creek 7 miles upstream SAR Confluence	0.1	1600	5
Escondido Creek 6 miles upstream of SAR Confluence	0.7	520	5
Escondido Creek 5 miles upstream of SAR Confluence	1.6	460	5
Escondido Creek 4 miles upstream of SAR Confluence	1.3	770	5
TCEQ_18402 Escondido Creek at CR 331	2.0	610	5
Escondido Creek 2 mi. upstream SAR Confluence	1.6	410	5
Escondido Creek 1 mi. upstream SAR Confluence	1.2	520	5
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What is BST?

- Fundamental idea is that some intestinal bacteria differs from one animal group to another, due to:
  - Basic Habitat
    - Body temp., food supply, digestive system, etc.
  - Natural Selection
    - Direct competition, prior exposure to agents like antibiotics

What is BST?

- Library “Independent” vs. “Dependent”:
  - Both depend on sourcing bacteria from known organisms
  - Both use ‘signatures’ to identify sources of bacterial contamination
  - Dependent method requires a ‘library’ to be constantly updated

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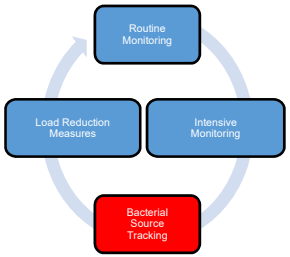
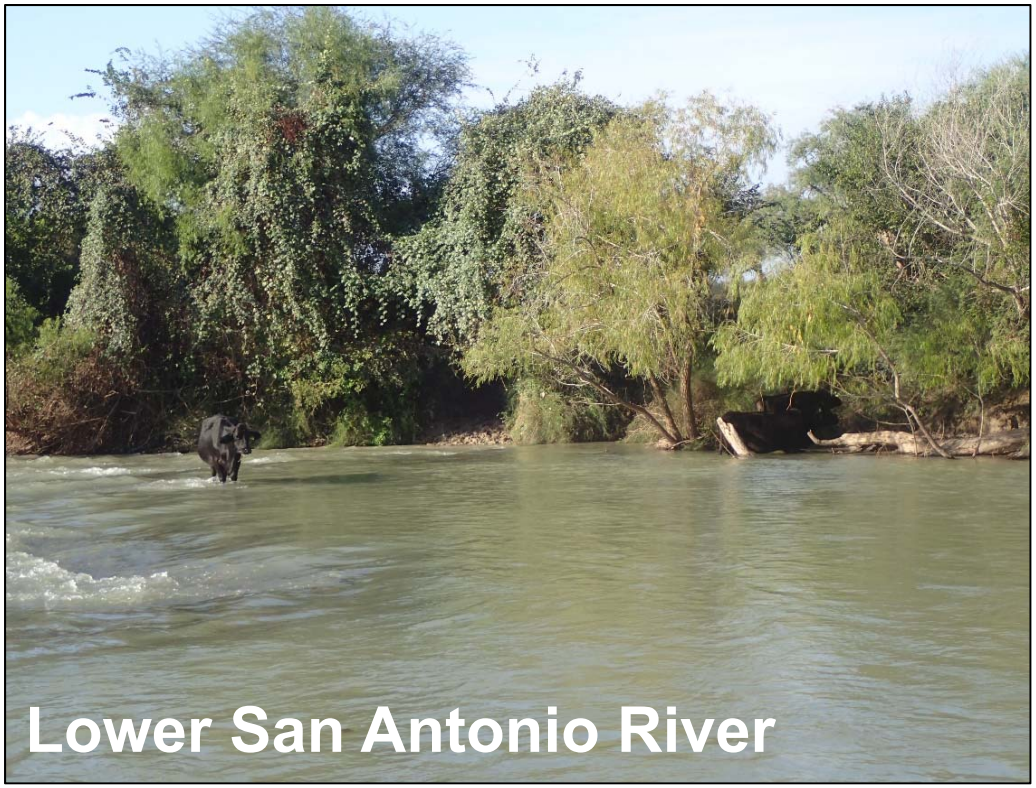
Bacterial Source Tracking (BST)

- Working Hypothesis…
  - Agricultural impact in rural waterways
  - Human impact in urban waterways
- Shift in thought?



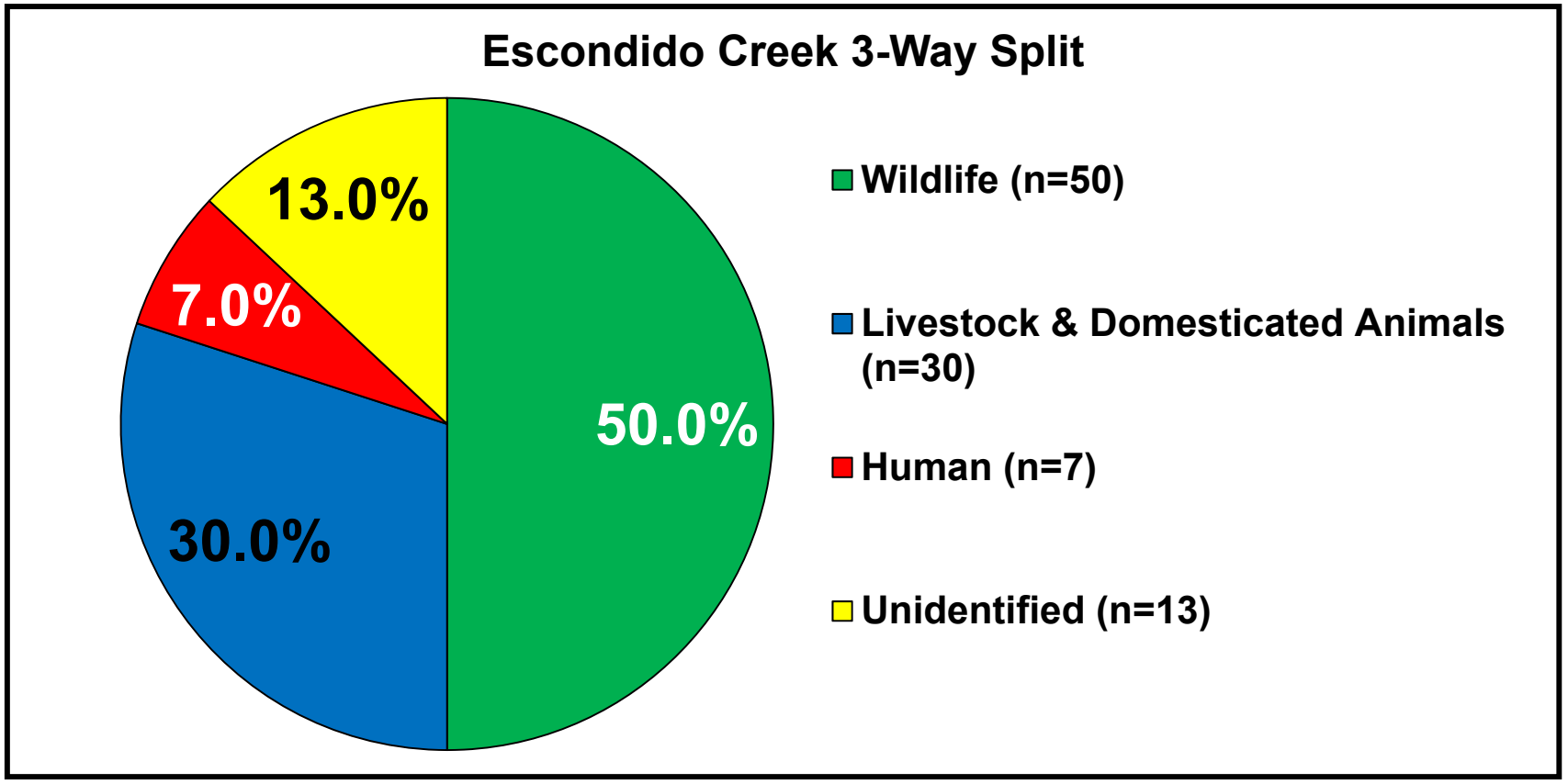

Lower San Antonio River

E. coli mTEC Results

Station	20 June 2017		17 July 2017		Station Summary	
	E. coli[1]	Flow[2*]	*E. coli*[1]	Flow[2*]	Geomean[1]	Avg. Flow[2]
17573 – Escondido Creek 122 m Downstream Nichols Creek Confluence	520	1.3	380	3.4	444	2.4
ESCO7 – Escondido Creek 7 mi. Upstream SAR Confluence	700	1.3	1600	2.5	1058	1.9
ESCO5 – Escondido Creek 5 mi. Upstream SAR Confluence	680	0.05	540	3.4	606	1.7
18402 – Escondido Creek at CR 331	430	1.7	570	2.7	495	2.2
S0037 – Escondido Creek Immediately Upstream SAR Confluence	1500	1.7	600	2.9	948	2.3

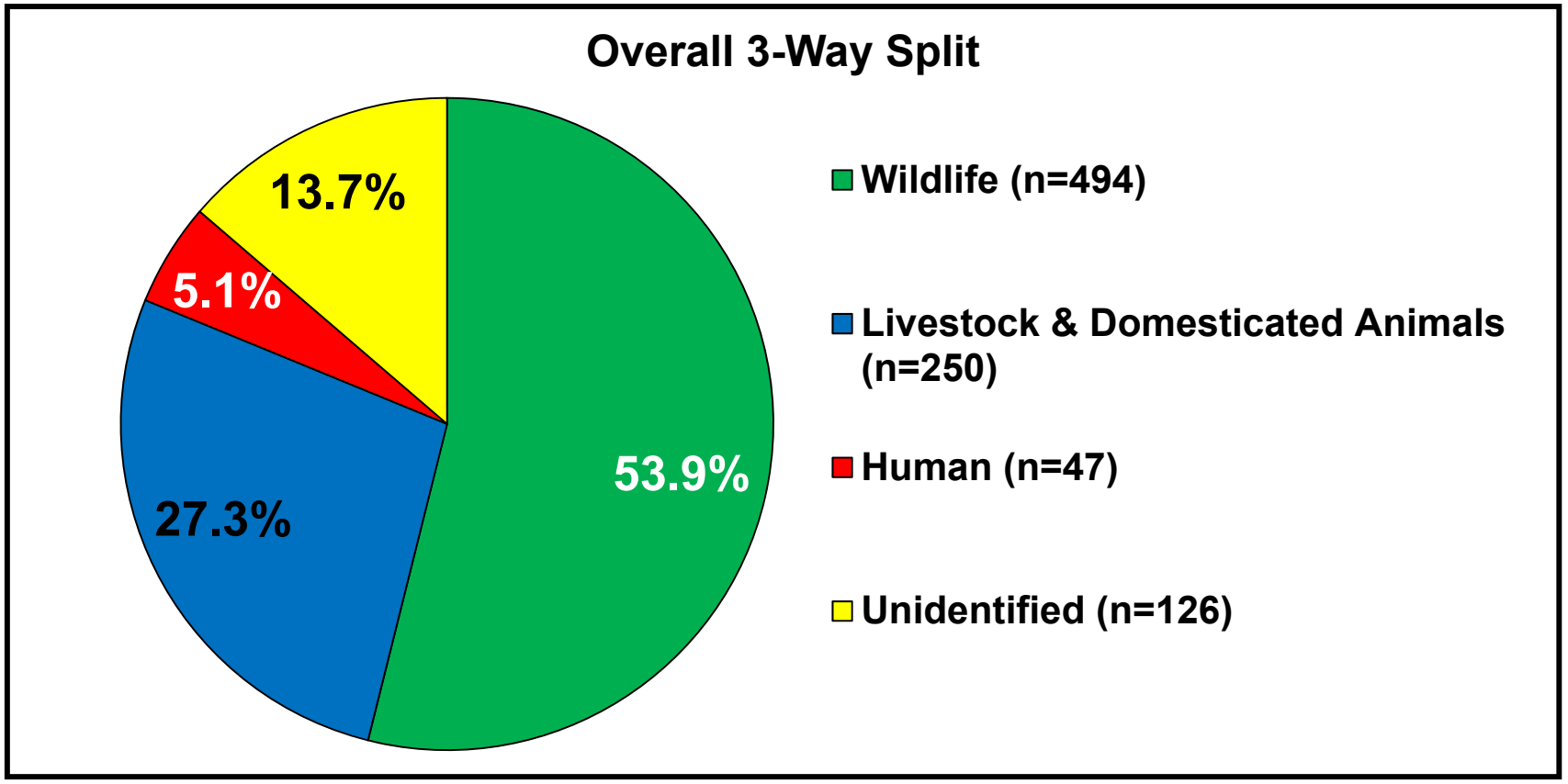
1 – *E.coli* reported in cfu/100mL 2 – Flow reported in cfs *Flow estimated using 'mechanical' methods

Escondido Creek BST Results



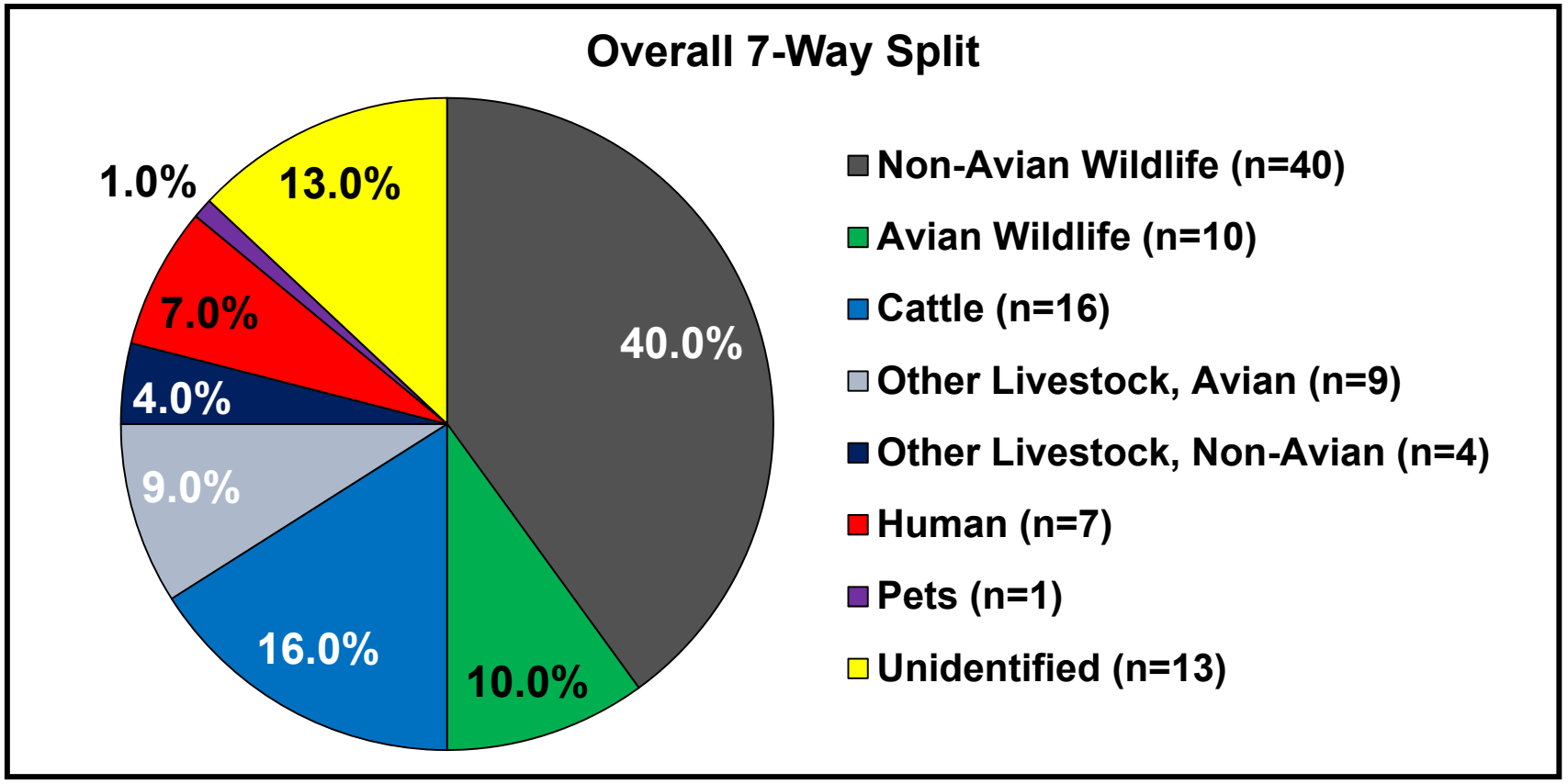
Source classification of *E. coli* isolates (n=100) from 10 samples

Basin Wide BST Results



Source classification of *E. coli* isolates (n=917) from 90 samples

Escondido Creek BST Results



Source classification of *E. coli* isolates (n=100) from 10 samples

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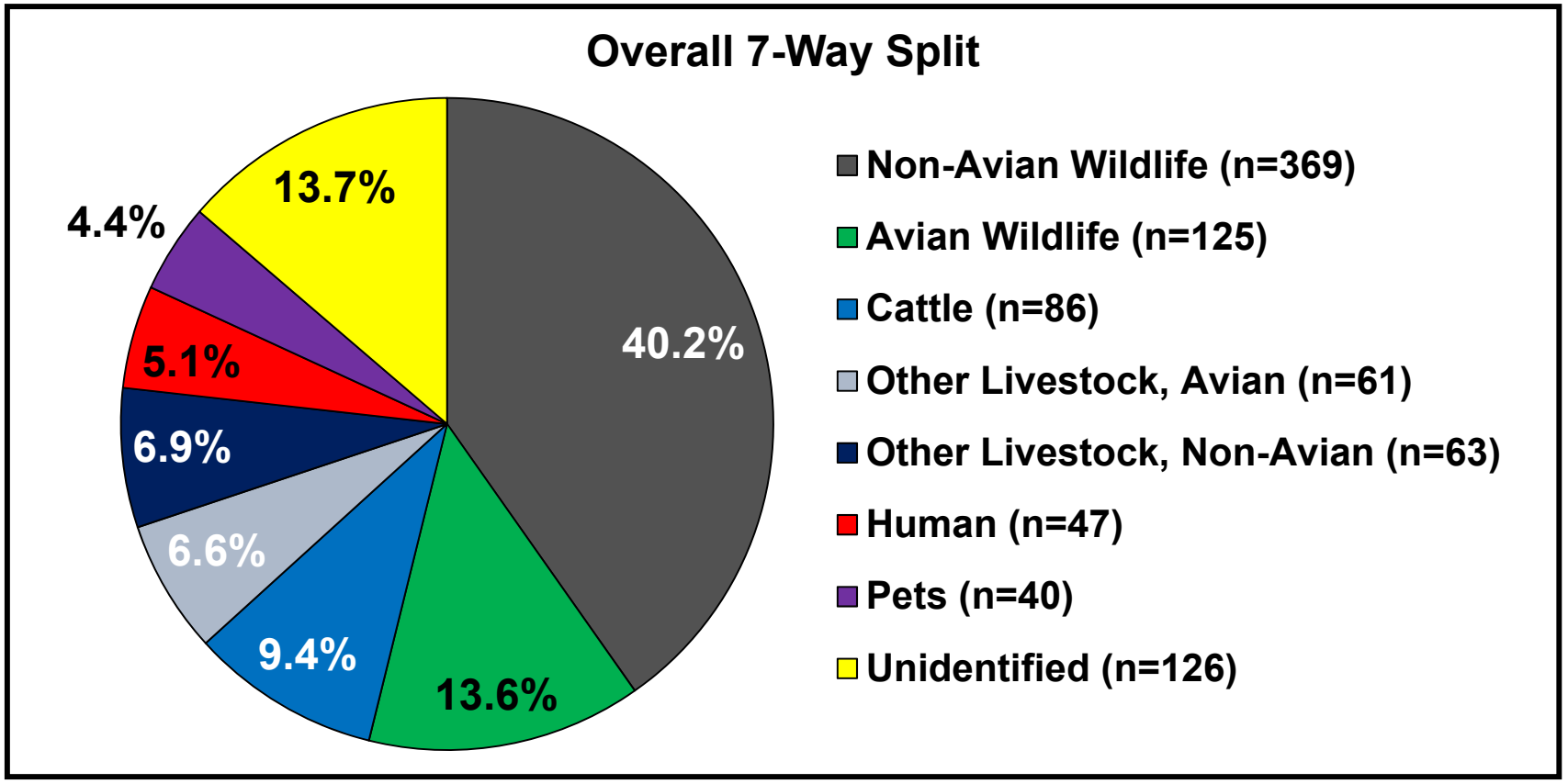
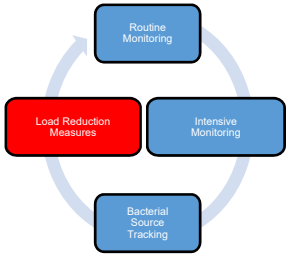


Source classification of *E. coli* isolates (n=917) from 90 samples

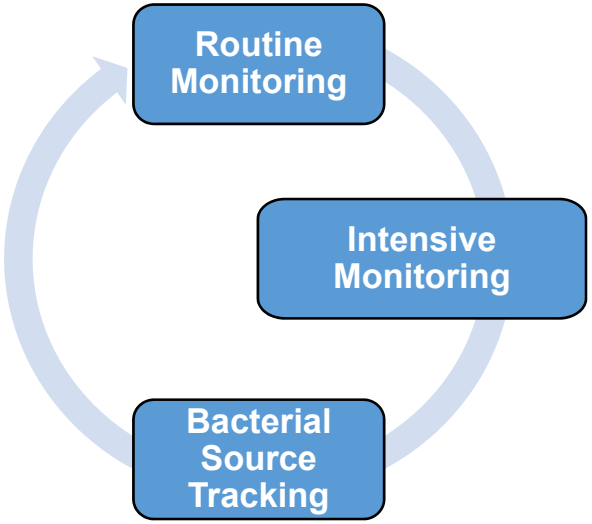
LSAR I-Plan Management Measures

- Adopted Measures Include:
  - Restore and repair riparian zones (all sources)
  - Management of feral hogs and landowner education (wildlife)
  - Identify On Site Sewage Facilities and reduce Sanitary Sewer Overflows (human)
  - Coordinate and expand existing water quality monitoring (routine monitoring)



LSAR I-Plan: Escondido Creek

1. Routine Monitoring
2. Intensive Monitoring
3. Bacterial Source Tracking



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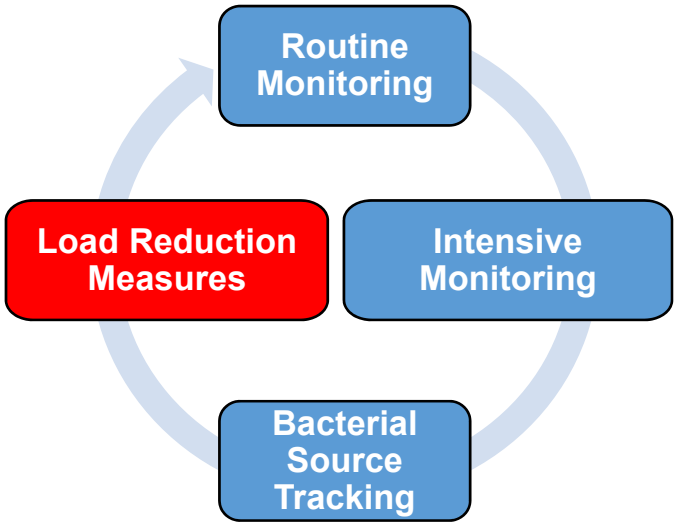

Result: On the ground management measures to reduce bacterial loading

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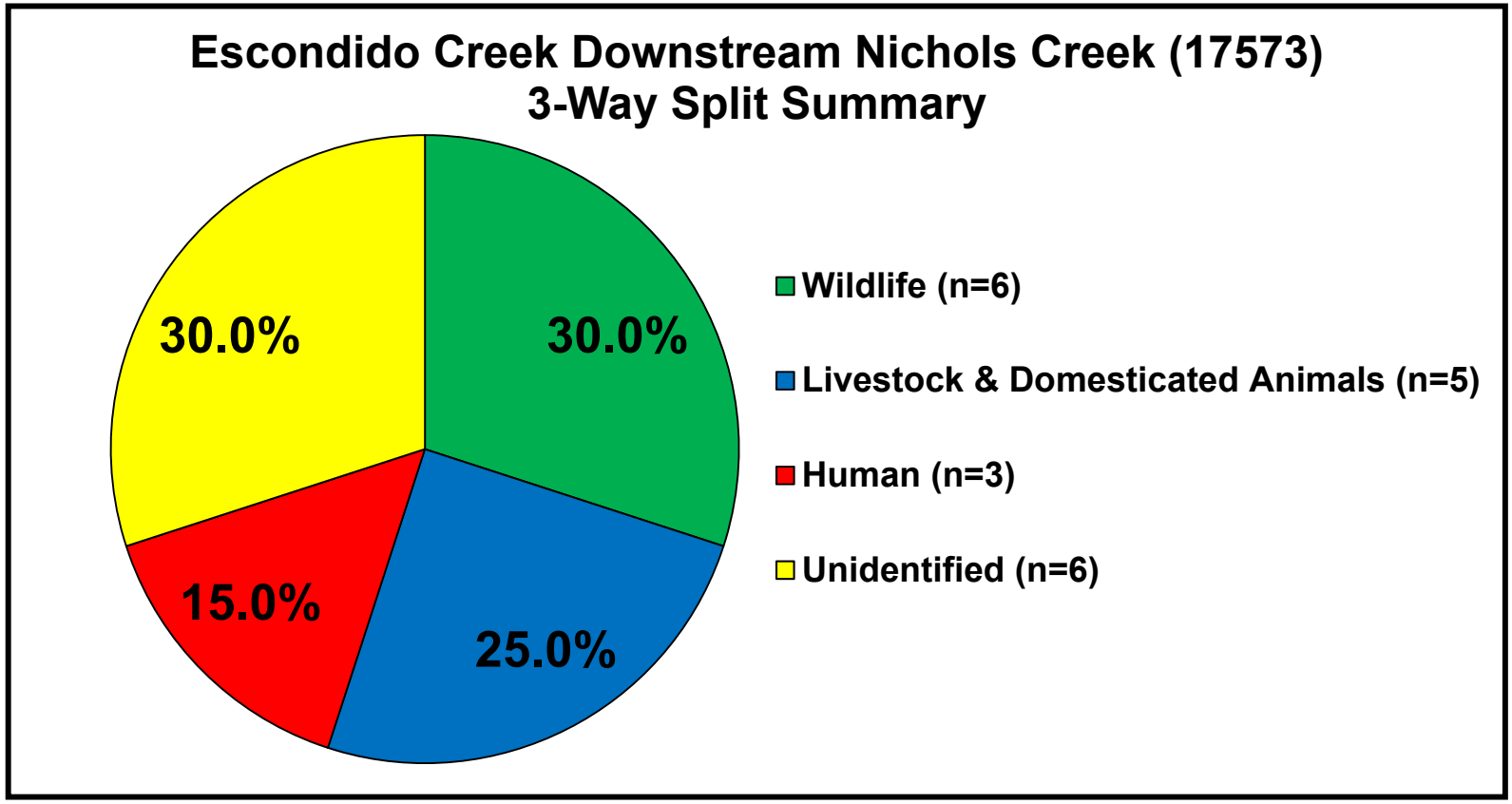
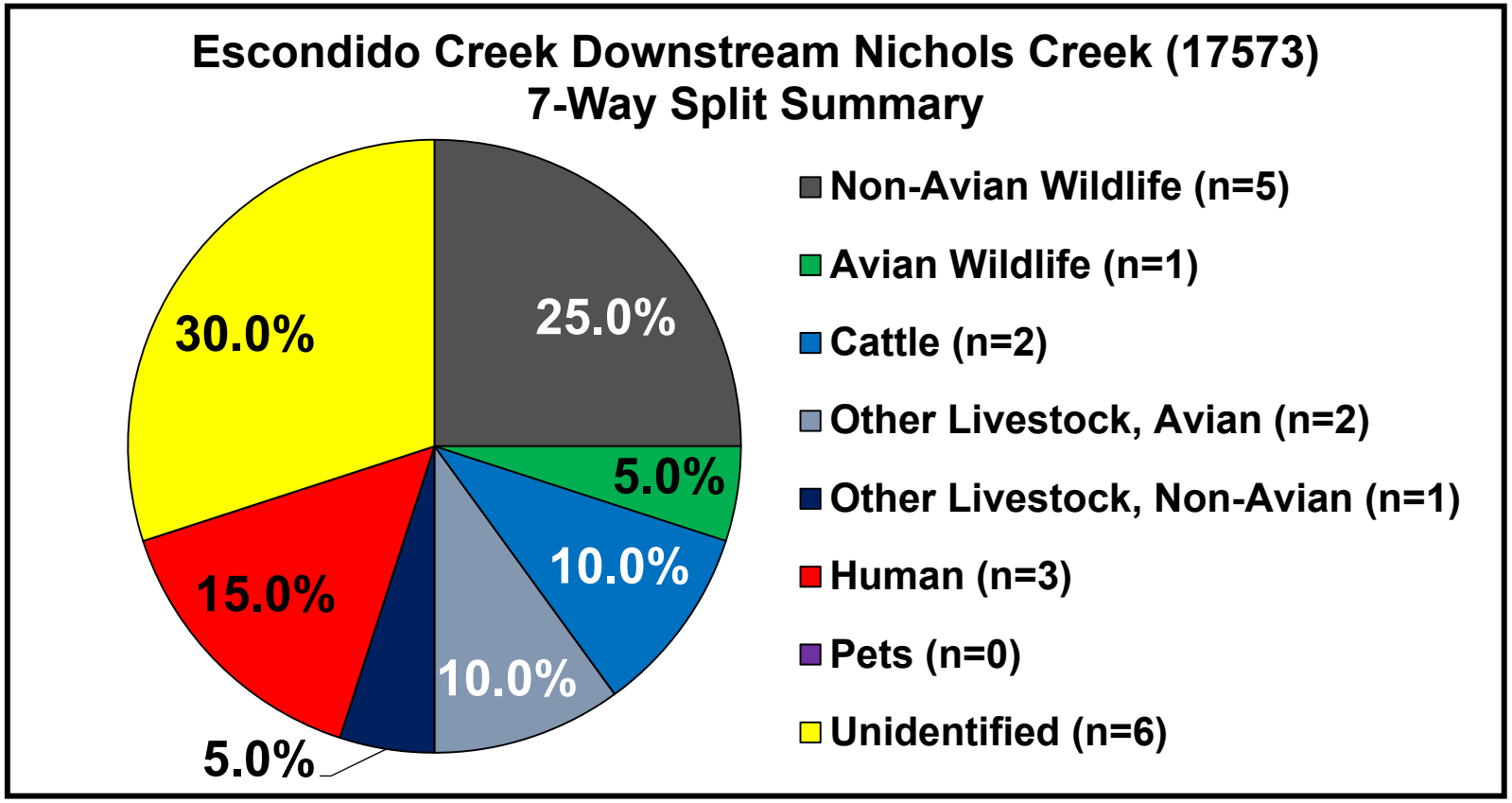
Escondido Creek BST Results



Source classification of *E. coli* isolates (n=20) from 2 samples

Escondido Creek BST Results



Source classification of *E. coli* isolates (n=20) from 2 samples