Project Area 2
River Basin Groups D and E
Bacteria Impairments
TMDL

Texas Commission on Environmental Quality
James Miertschin & Associates, Inc.

Introduction

- Section 303 (d) of the Clean Water Act requires states to identify water bodies that do not meet applicable water quality standards. This is known as the 303 (d) list.
- Pursuant to the Clean Water Act, and development of the 303 (d) list, the TCEQ is responsible for development of TMDL's.
- Due to elevated bacteria indicators, specifically fecal coliform or *E. coli*., Guadalupe River above Canyon Lake was selected for assessment in an area known as Project Area 2 – Basin Groups D and E.

What is a TMDL (Total Maximum Daily Load)?

- Establishes the maximum amount of an impairing substance, or stressor, that a waterbody can assimilate and still meet Water Quality Standards
- allocate that load among pollutant contributors
- are a tool for implementing State water quality standards and are based on the relationship between pollution sources and in-stream water quality conditions

Which Waterbodies Require TMDLs?

- Waterbodies require TMDLs when the pollution control requirements are not stringent enough to meet applicable Water Quality Standards.

What are Water Quality Standards?

- Serve two (2) purposes:
  - they establish water quality goals for a waterbody
  - they provide a regulatory basis for controls beyond technologically based limits

What are Criteria?

- Criteria are water quality conditions which are to be met in order to support and protect designated uses.
- Criteria are expressed as the number of "colony forming units" of bacteria per 100 milliliters (ml) of water.
- Indicator bacteria, although not generally pathogenic, are indicative of potential contamination by feces of warm blooded animals.

Segment 1806 – Guadalupe River

- Placed on the 2000 §303(d) list because bacteria exceeded the segment specific criteria of 126 colonies per 100 ml (geometric mean) and 394 colonies per 100 ml (single grab).

- Designated Uses
  - Aquatic Life
  - Contact Recreation
  - Fish Consumption

TMDL Development

- Segment is listed on the federal Clean Water Act Section 303 (d) list
- Selection of Pollutant (bacteria) for TMDL
- Initiate TMDL Project
- Data Collection – Compile data about current water quality conditions, collect additional data
- Data Assessment – Quantify impacts and sources (point, non-point, natural background, atmospheric deposition)

TMDL Development, continued

- TMDL Allocation – Identify a quantifiable water quality target for each constituent
- Implementation Plan – Comprehensive strategy for restoring the beneficial uses of the water body
- Draft TMDL Report
- TCEQ Review / Public Comment
- TCEQ Approval / EPA Approval
- Implementation

Stakeholder Involvement

- Improves the quality and quantity of contributions to TMDL projects
- Ensures that state government considers the local perspective in its decisions
- Leads to consensus-based solutions
- Encourages open dialogue on water quality issues

What is *E. coli*?

- abbreviated name of the bacterium in the Family Enterobacteriacae named Escherichia (Genus) coli (Species).
- *E. coli* and other kinds of bacteria within our intestines are necessary for us to develop, operate properly, and remain healthy.
- *E. coli* along with other species of bacteria, provide our bodies with many necessary vitamins, for example K and B-complex vitamins. These vitamins are absorbed through our intestines, where the bacteria reside.

E. coli 0157:H7

- Is a member of the EHEC – enterohemorrhagic *E. coli* group and produces a toxin, called Shiga-like toxin (SLT), or Vero toxin.

- This toxin is a protein that causes severe damage, specifically:
  - hemorrhaging
  - hemolytic syndrome (HUS),
  - kidney failure
  - loss of red Blood cells

How does *E. coli* spread?

- *E. coli* bacteria can be spread by many sources, such as:
  - undercooked ground beef,
  - un-pasteurized milk,
  - raw vegetables,
  - and contaminated water.
- *E. coli* can be passed from person-to-person.

How does *E. coli* get in the water?

- *E. coli* comes from human and animal wastes. During precipitation, *E. coli* may be washed into creeks, rivers, streams, lakes, or groundwater and ultimately may end up in drinking water.

Point Source Pollution

- Point Source - "Point Source" means any discernible, confined, and discrete conveyance from which pollutants are or may be discharged.
- Examples include:
  - pipe
  - ditch
  - channel
  - tunnel
  - conduit
  - well
  - landfill
  - concentrated animal feeding operation, etc.

Non-point Source Pollution

- Non-point Source – pollution occurs when rainfall or sprinkler runoff gathers manure, oil, grease, litter, fertilizer and other toxic substances and washes them into storm drains, creeks and rivers.

Suspect Pollutant Sources

- Wastewater Treatment Plants
- Confined Animal Feedlot Operations (CAFO's)
- On-Site Sewage Facilities (OSSF's)
- Domestic Animal Feces
- Wild Animal Feces
- Storm Water Runoff
- Agriculture Practices

Purpose of Today's Meeting

- Review Historical *E. coli*/Fecal Coliform Data for Guadalupe River
- Discuss the sampling plan
- Discuss next phase

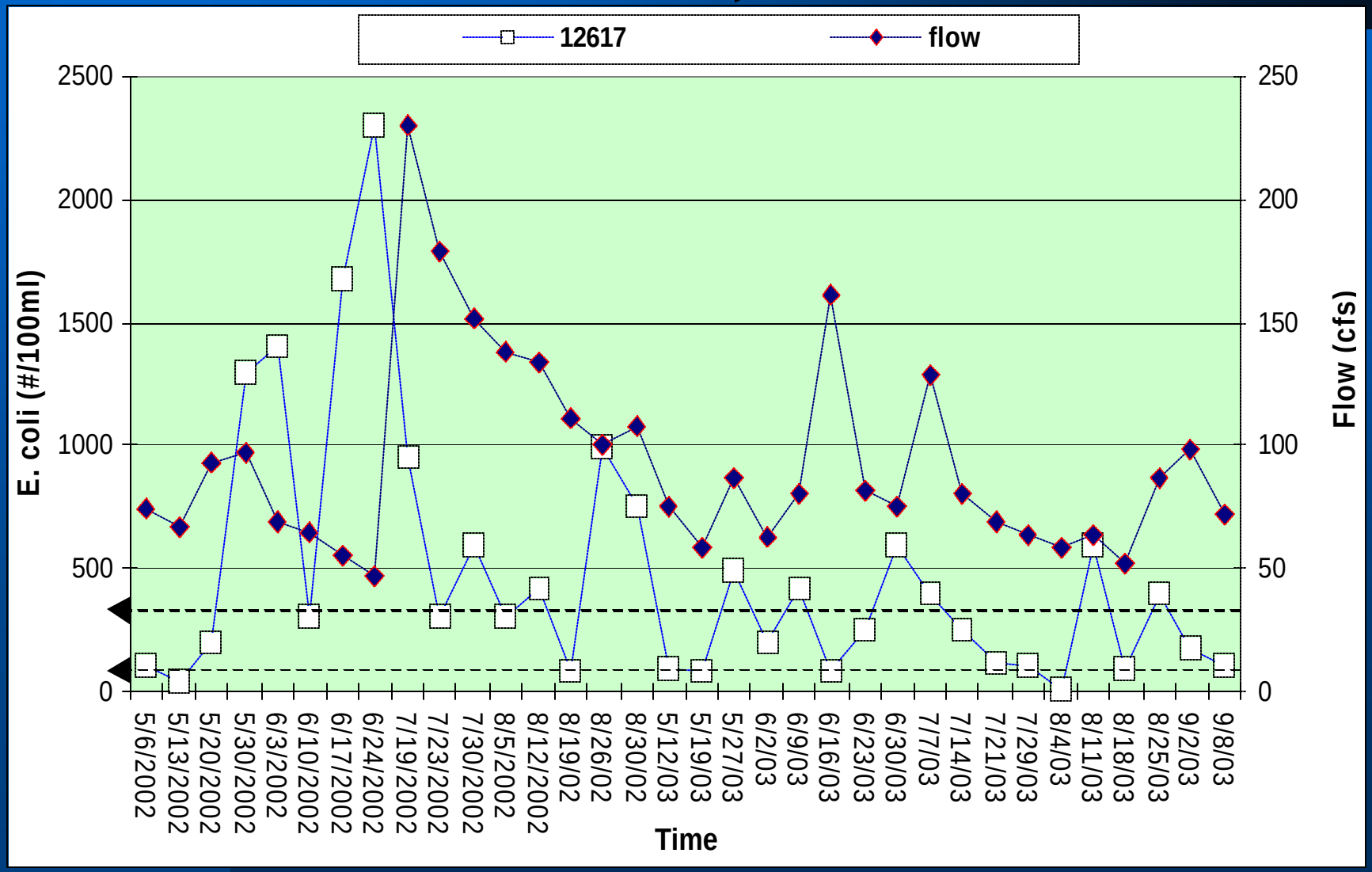
Guadalupe River *E. coli*/Fecal Coliform Geometric Means (2001-2004)

STATION	LOCATION	FECAL COLIFORM GEOMETRIC MEAN (Col/100 ml)	*E. COLI* GEOMETRIC MEAN (Col/100 ml)
12548	Indian Cr in Ingram (12548)	637	520
12549	Town Cr at Hamilton St (12549)	843	427
12550	Town Cr at Town Cr Rd (12550)	842	43
12617	Guadalupe R at SH 16 (12617)	761	355
12616	Guadalupe R at G St (12616)	228	69
16244	Guadalupe R at fotbridge in L. Hays Park (16244)	213	76
16243	Guadalupe R at L. Hays Park Dam (16243)	228	131
12541	Quinlan Cr at Travis St (12541)	579	208

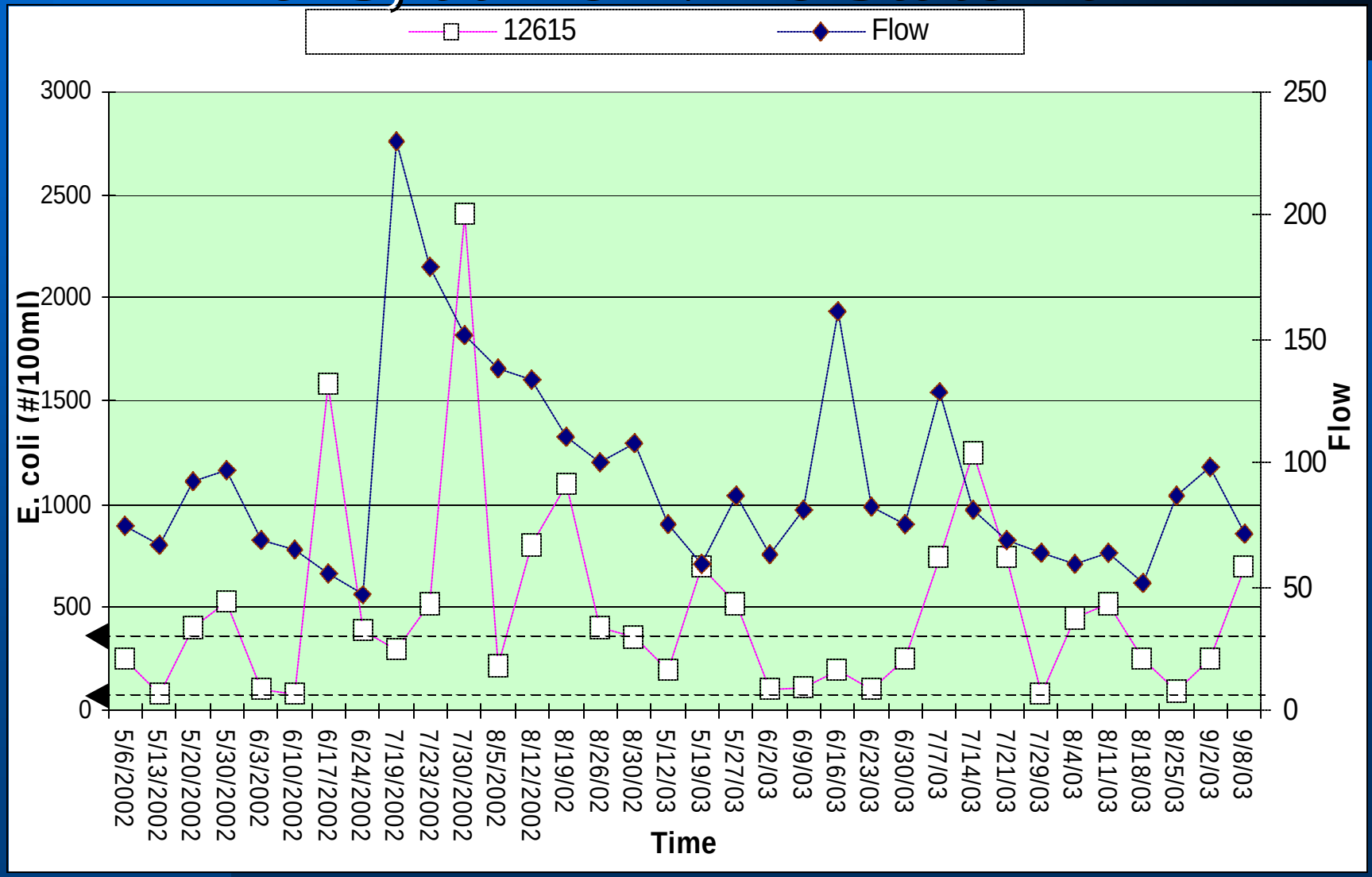
Guadalupe *E. coli*/Fecal Coliform Geometric Means – Cont'd

STATION	LOCATION	FECAL COLIFORM GEOMETRIC MEAN (Col/100 ml)	E. COLI GEOMETRIC MEAN (Col/100 ml)
12542	Quinlan Cr at IH10 (12542)	1671	162
12546	Camp Meeting Cr at Spur 100 (12546)	615	147
12615	Guadalupe R at Kerrville State Park (12615)	297	177
12611	Guadalupe R below Flat Rock Dam (12611)	262	28
12608	Guadalupe R at Center Point Lake (112608)	207	84
12543	Verde Cr near Center Point (12543)	364	126
12552	Cypress Cr at SH 27 (12552)	377	196
12551	Cypress Cr in Comfort (12551)	380	123

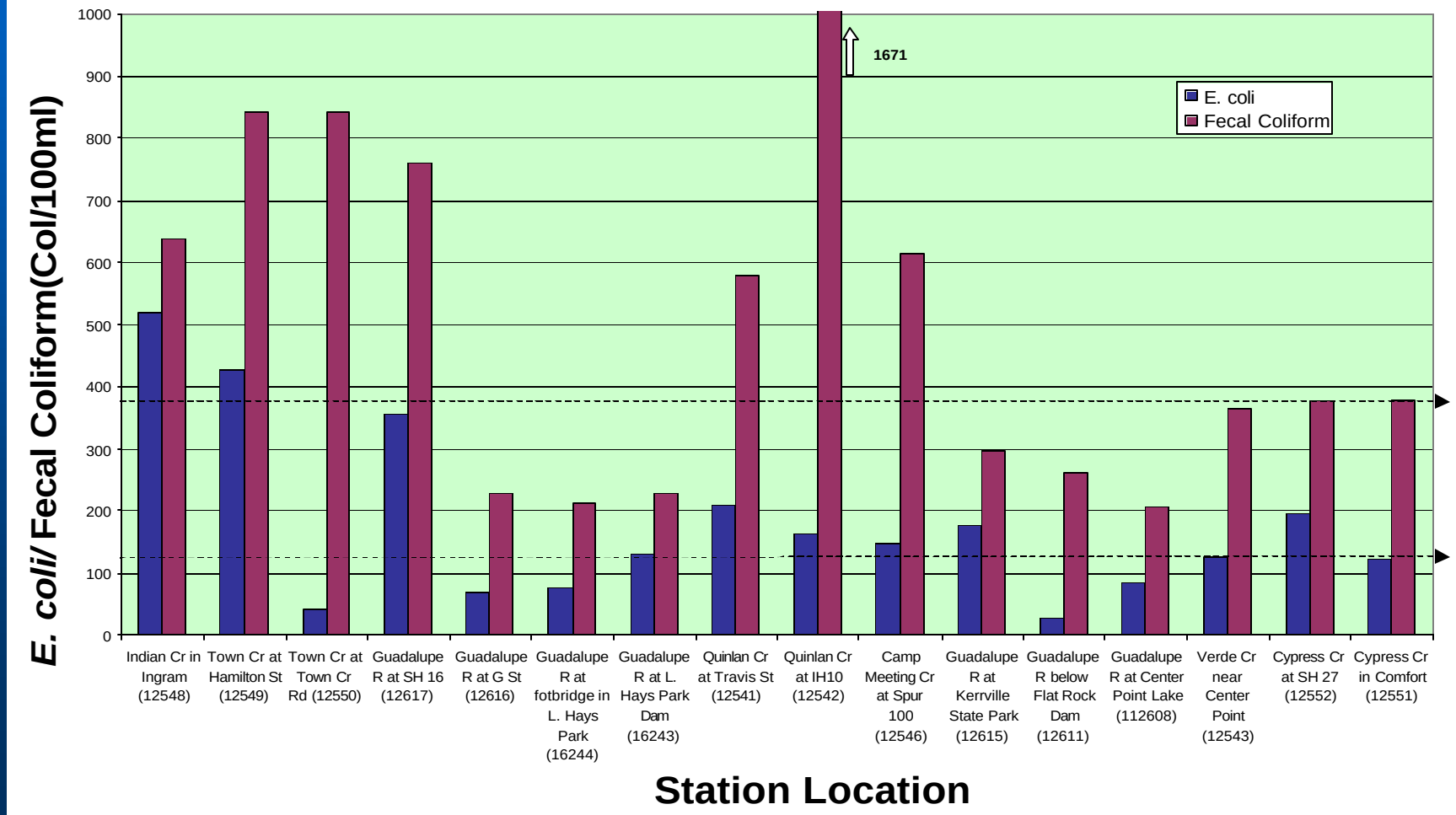
Guadalupe River *E. coli* vs. Time, Station 12617, at SH 16



Guadalupe River *E. coli* vs. Time, Station 12615, at Kerrville State Park

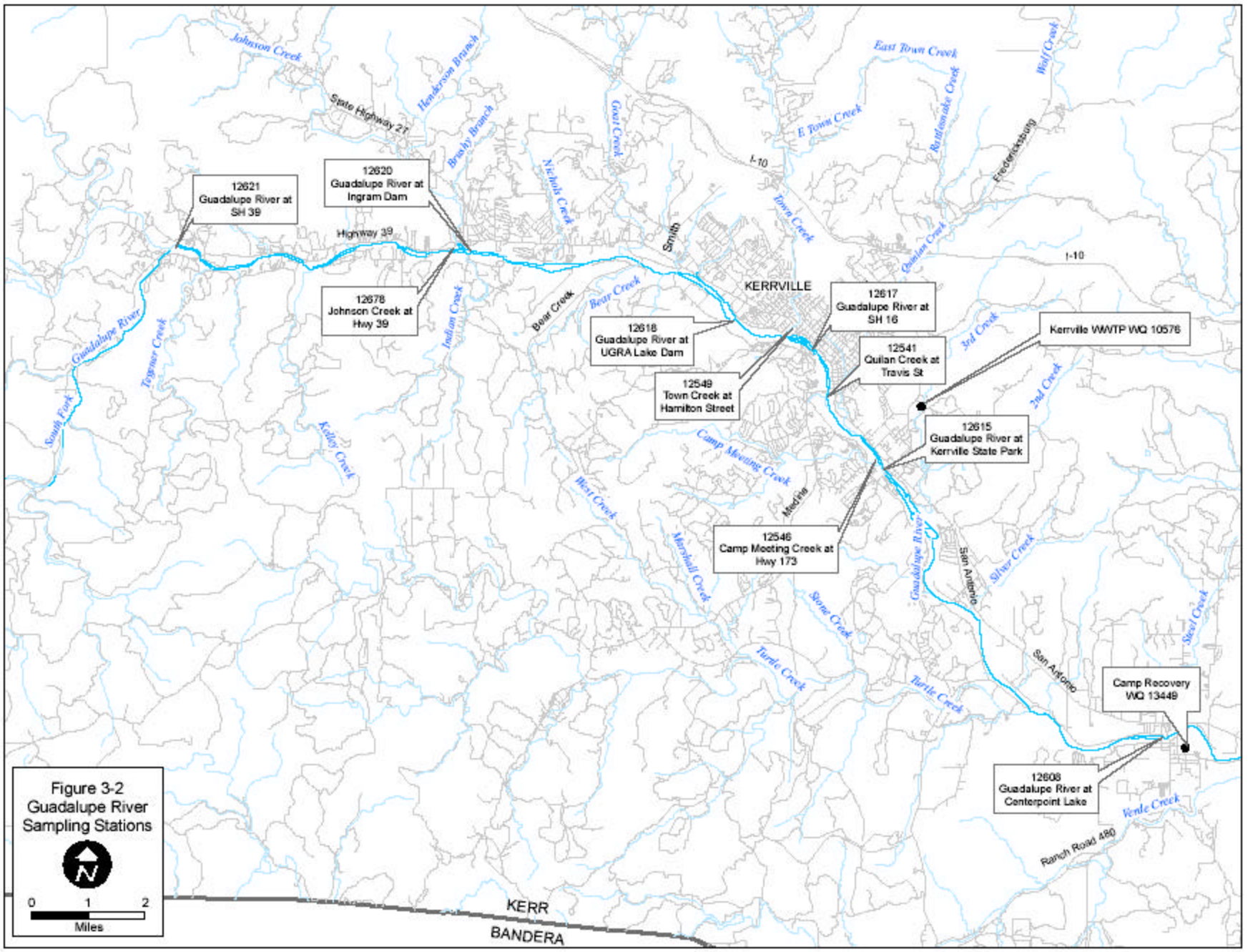


Guadalupe River Fecal Coliform & *E. coli* Geometric Means by Station (2001-2004)



Monitoring Plan Details

		General Assesment Monitoring		Modeling Support					
		Routine Testing (TQ)/Geographic Source (TQ)/Point Source (TN)		Baseflow Sampling (TN) 1 Event		Runoff Sampling (TN)2 Events		BST Sampling	
Description	Station ID	E. coli	Field Parameters (T, DO, pH, Cond., Cl2-Res., Flow Quan., Flow Severity)	E. coli	Field Parameters (T, DO, pH, Cond., Cl2-Res., Flow Quan., Flow Severity)	E. coli	Field Parameters (T, DO, pH, Cond., Cl2-Res., Flow Quan., Flow Severity)	Ambient Water Samples	Isolaes from Ambient Water Samples
Mainstem									
Guadalupe River at SH 39 Near Hunt, 0.1 Km below the North/South Fork Confl.	12621	10	10	2	2	6	6	50	100
Guadalupe River at Ingram Dam in Ingram	12620	10	10	2	2	6	6		
Guadalupue River at UGRA Lake Dam	12618	10	10	2	2	6	6		
Guadalupe River at SH 16 in Kerrville	12617	10	10	2	2	6	6	50	100
Guadalupe River at Kerrville State Park	12615	10	10	2	2	6	6	50	100
Guadalupe River Center Point Lake	12608	10	10	2	2	6	6		
Tributaries									
Johnson Creek, Hwy 39	12678	10	10	2	2	6	6		
Town Creek, at Hamilton St in Kerrville	12549	10	10	2	2	6	6		
Camp Meeting Creek, 0.1 Km above Confl. With Guadalupe in Kerrville	12546	10	10	2	2	6	6	50	100
Quinlan Creek at Travis Street in Kerrville	12541	10	10	2	2	6	6		
Wastewater Discharges									
WQ0010576.001 - City of Kerrville	NA	0	0	2	2	6	6		
WQ0013449.001 - The Camp Recovery Center, L.P.	NA	0	0	2	2	6	6		


12621
Guadalupe River at
SH 39
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12678
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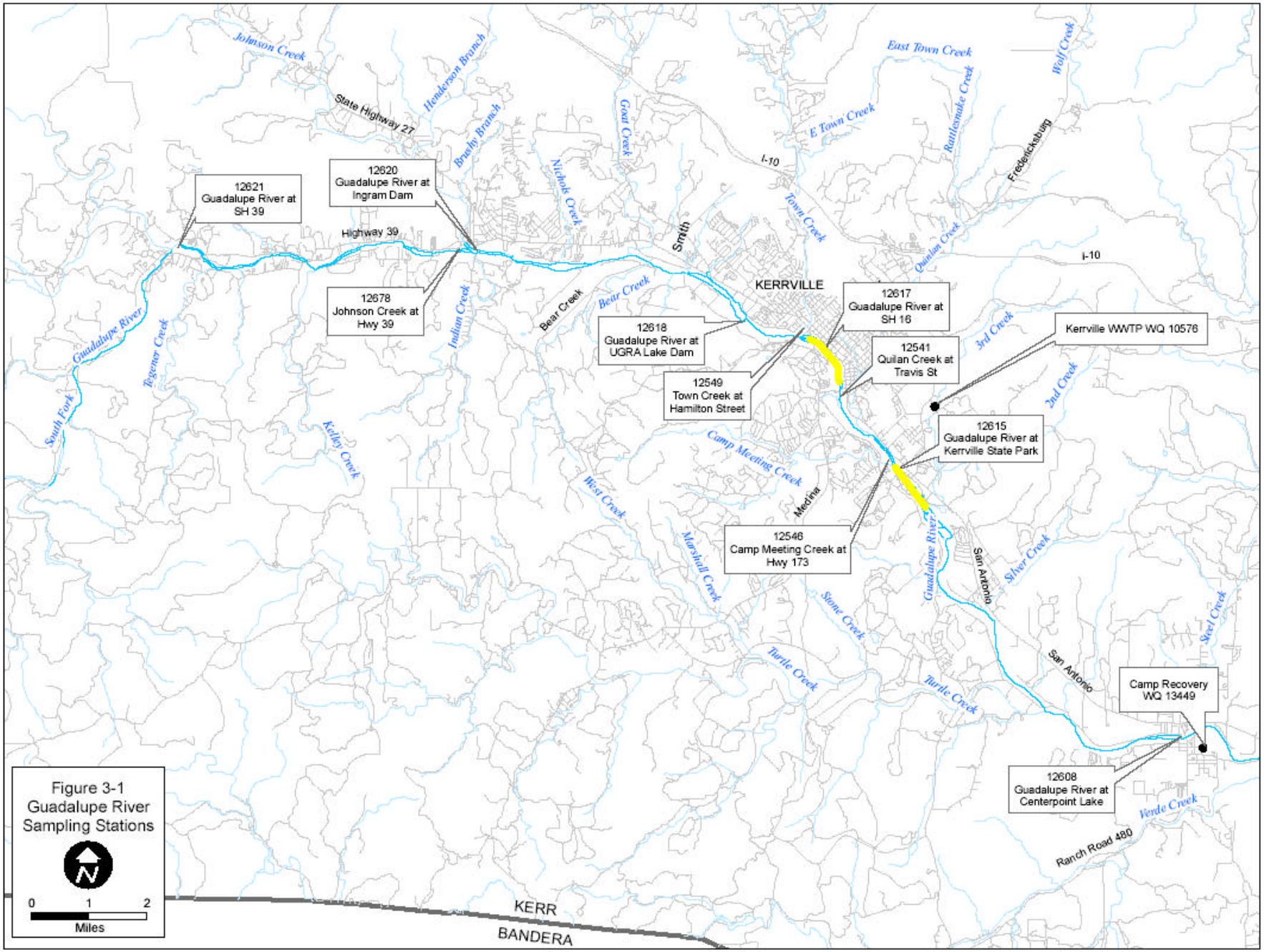
Travis St
Kerrville WWTP WQ 10576
12615
Guadalupe River at
Kerrville State Park
12546
Camp Meeting Creek at
Hwy 173
Camp Recovery
WQ 13449
12608
Guadalupe River at
Centerpoint Lake
KERRVILLE
Johnson Creek
State Highway 27
Henderson Branch
Brushy Branch
Nichols Creek
Goat Creek
Smith
East Town Creek
E Town Creek
Rattlesnake Creek
Wolf Creek
Fredericksburg
I-10
Town Creek
Quinlan Creek
3rd Creek
2nd Creek
Highway 39
Guadalupe River
Turner Creek
South Fork
Indian Creek
Bear Creek
Kelley Creek
Camp Meeting Creek
West Creek
Marshall Creek
Medina
Guadalupe River
San Antonio
Silver Creek
Stone Creek
Turtle Creek
Steel Creek
Venle Creek
Ranch Road 480
KERR
BANDERA
Figure 3-2
Guadalupe River
Sampling Stations
N
0
1
2
Miles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12608
Guadalupe River at
Centerpoint Lake
Verde Creek
Ranch Road 480
KERR
BANDERA
Figure 3-1
Guadalupe River
Sampling Stations
N
0
1
2
Miles

Low Water Crossing Outside of Kerrville State Park

Highway 16 Bridge

Bacterial Source Tracking (BST)

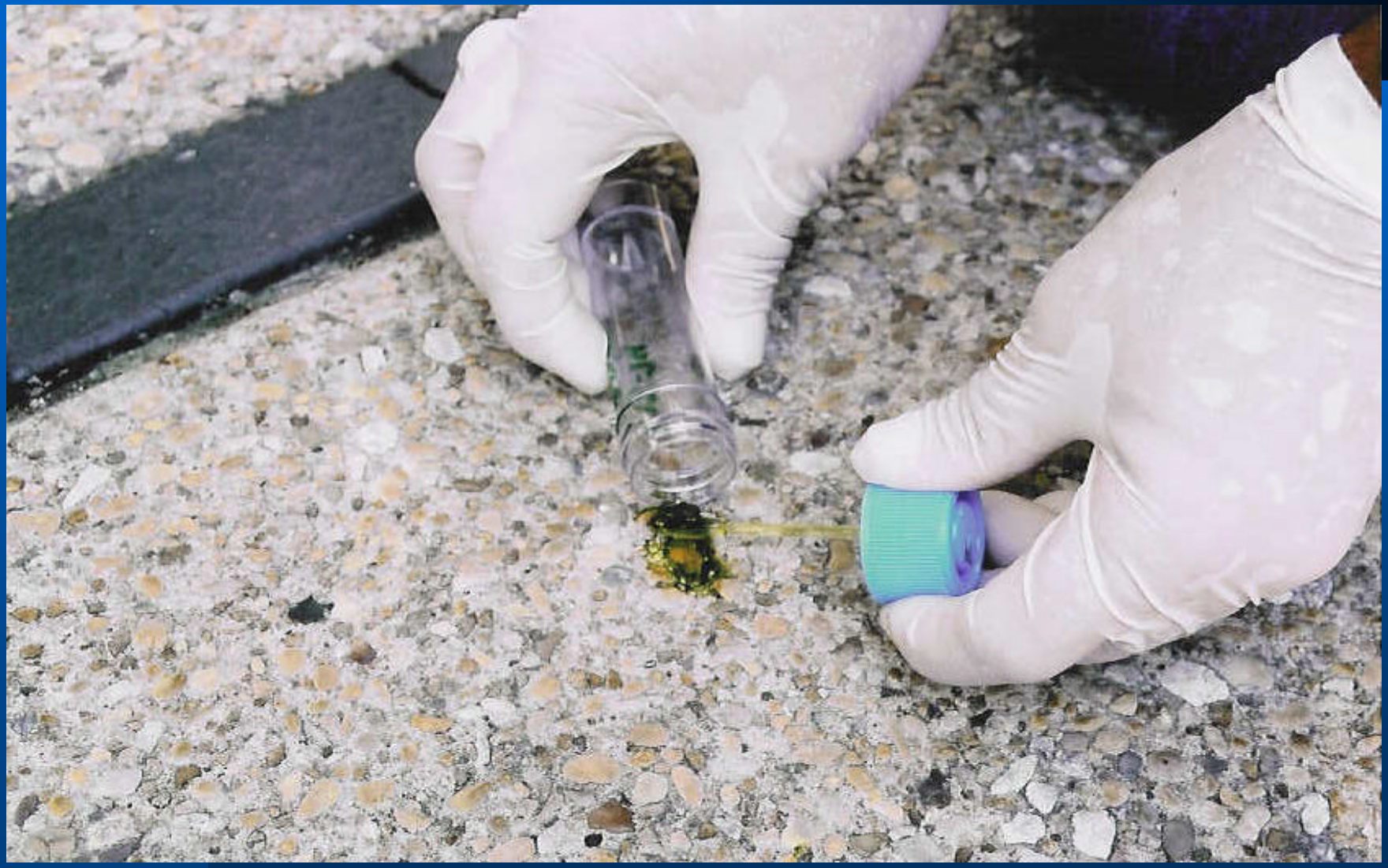
- Method: Ribotyping
  - Genetic fingerprints of *E. coli* strains
  - Genes that code for ribosome RNA
  - Distinguish between different bacterial strains
  - Lab Results from Source Molecular Corporation, Inc. - Miami, Florida

Bacterial Source Tracking (BST)

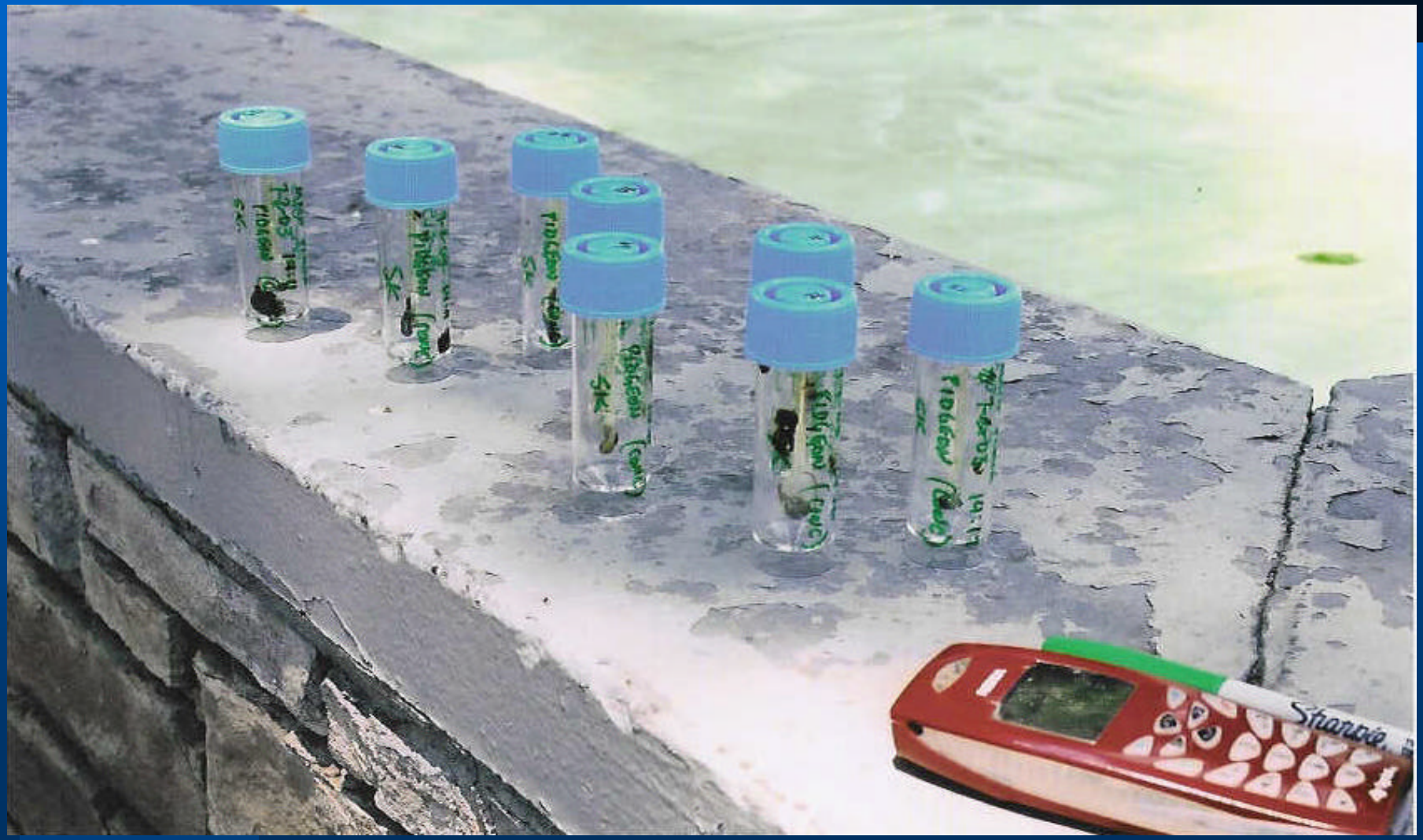
- Library of Known Bacteria Types
- Guadalupe River: 100 samples

BST

BST



BST



BST Water Samples (Unknowns)

- Guadalupe River
  - Station 12621 – SH 39 –50 Samples
  - Station 12617 – SH 16 in Kerrville– 50 samples
  - Station 12615 –Kerrville State Park– 50 samples
  - Station 12546 – Camp Meeting Creek –50 samples

Questions / Comments ?