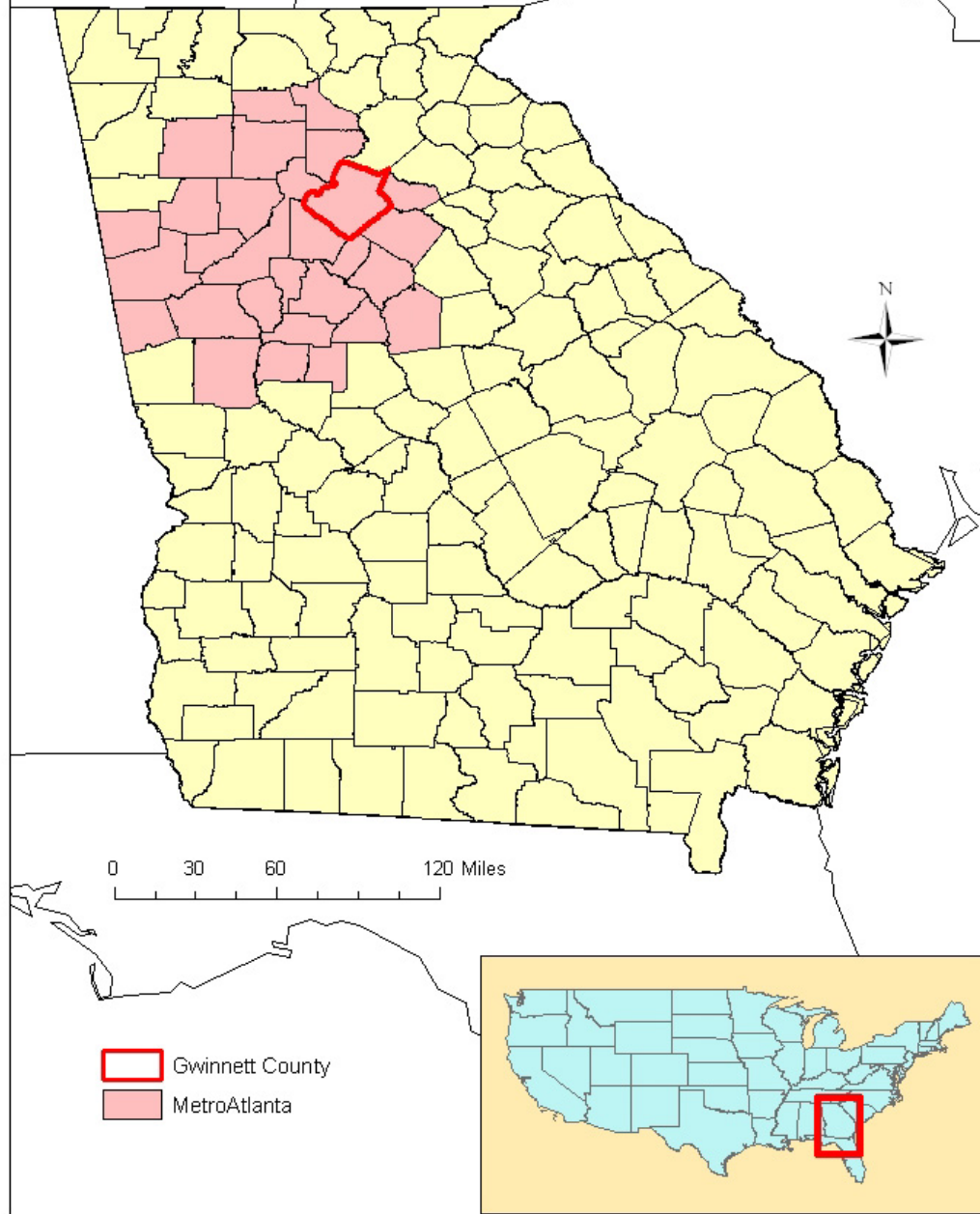


THE EFFECTS OF EXTREMELY HIGH DENSITY SEPTIC SYSTEMS ON SURFACE WATER QUALITY IN GWINNETT COUNTY, GEORGIA

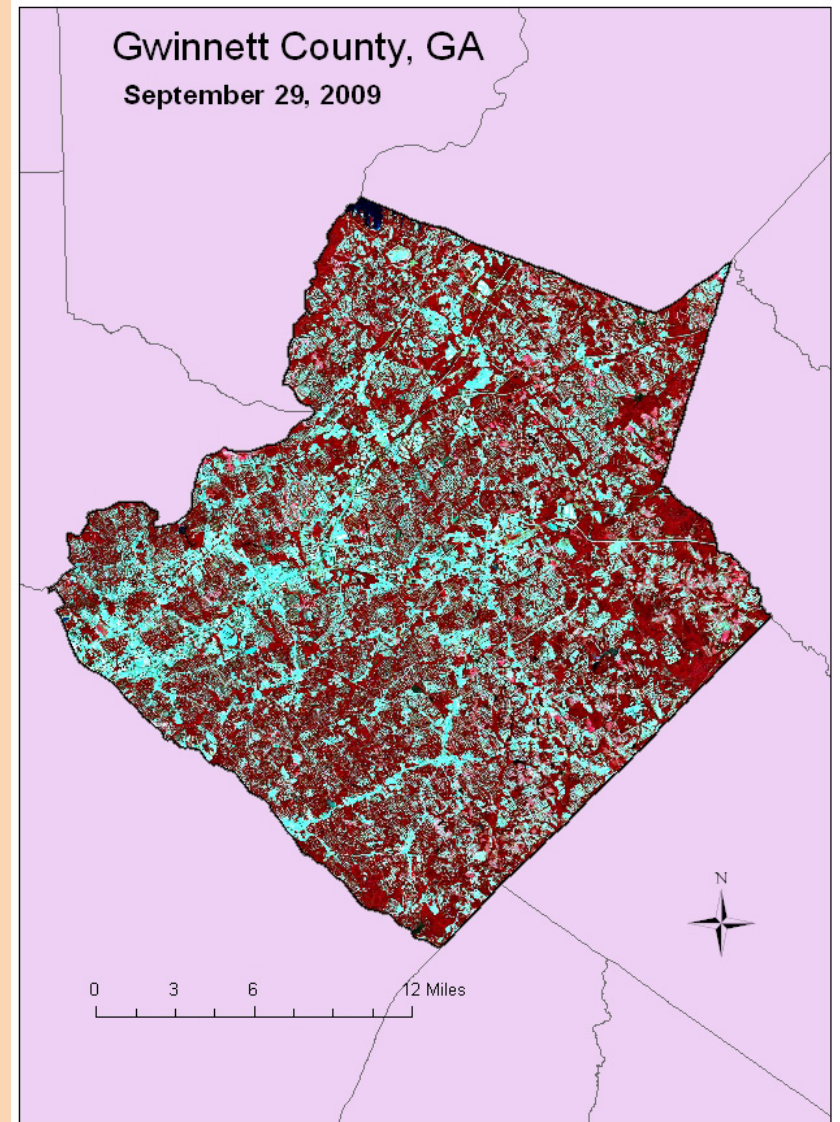
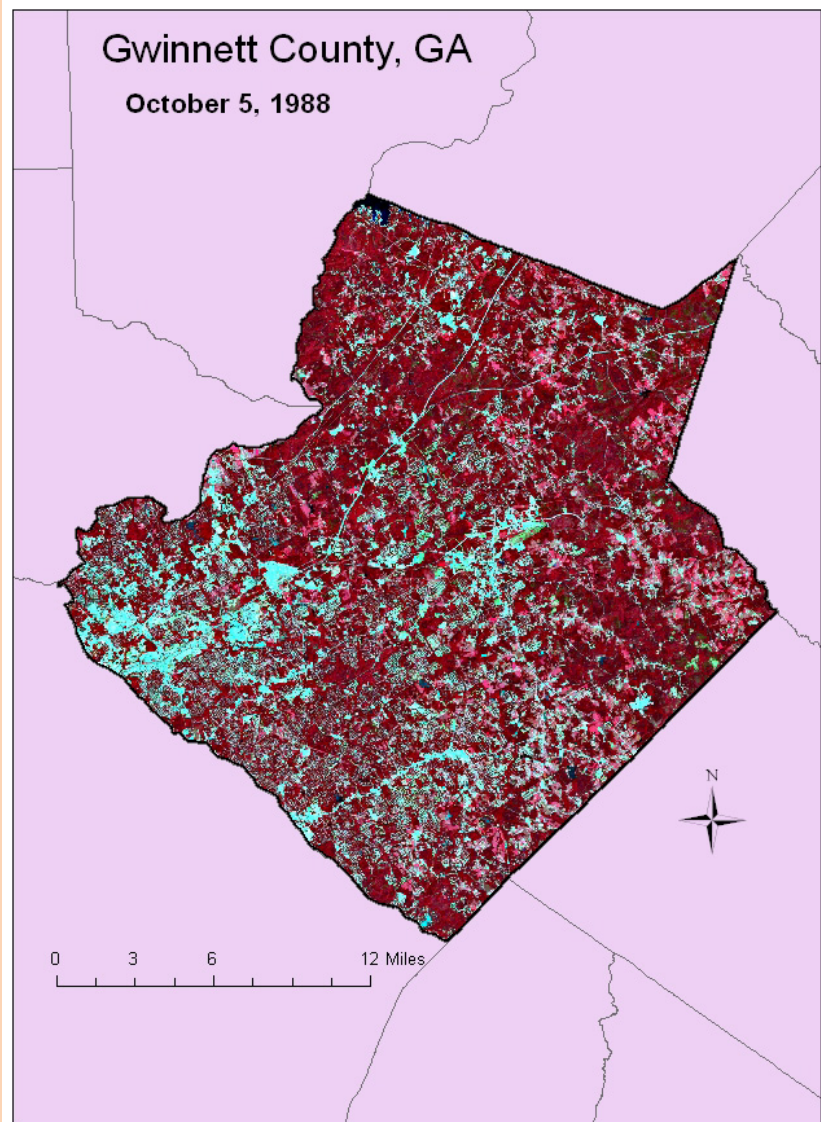
John Anderson
Georgia Perimeter College
Lawrence Kiage
Georgia State University

Geographic Setting

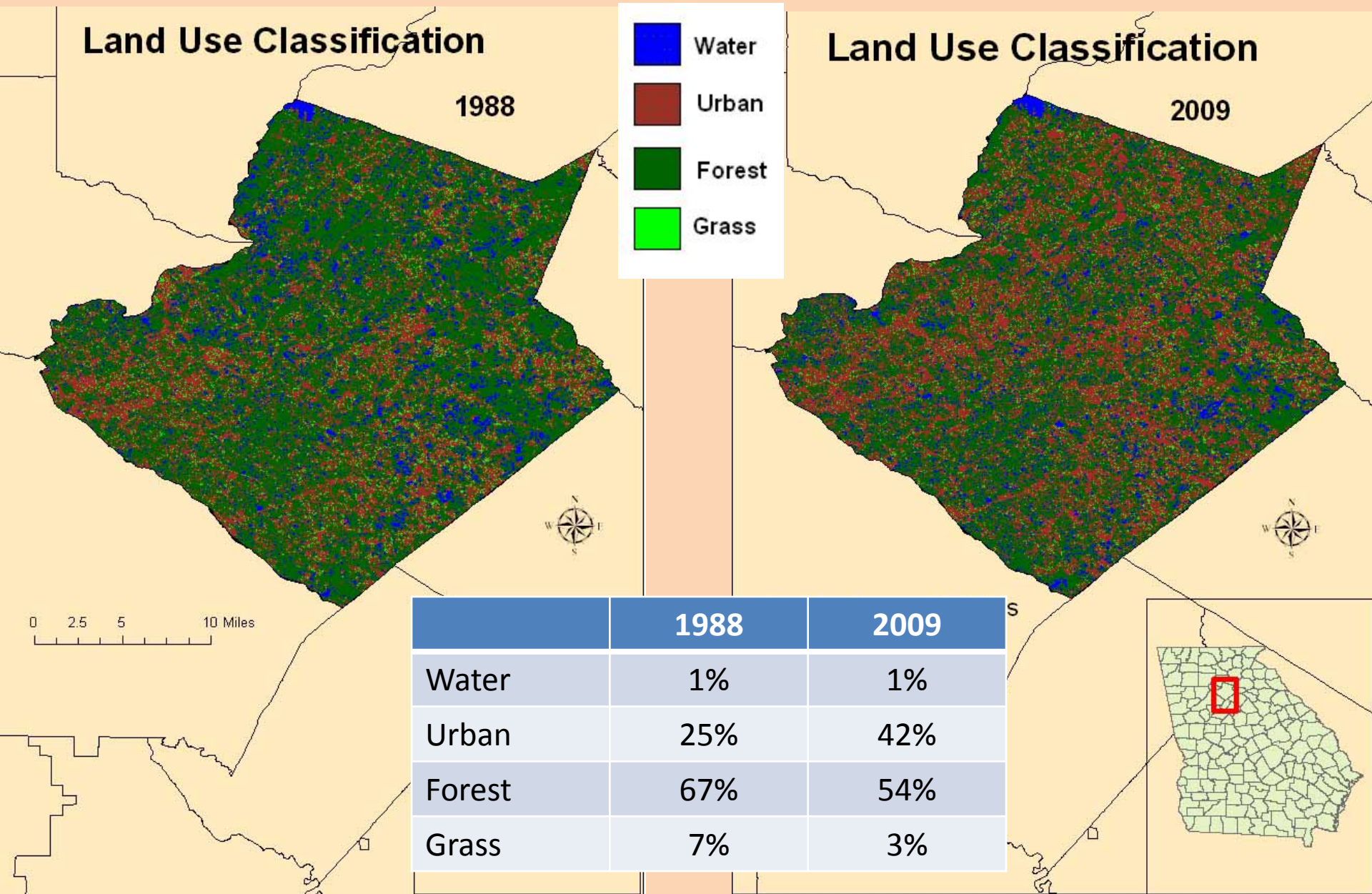
Where in the world is
Gwinnett County, Georgia



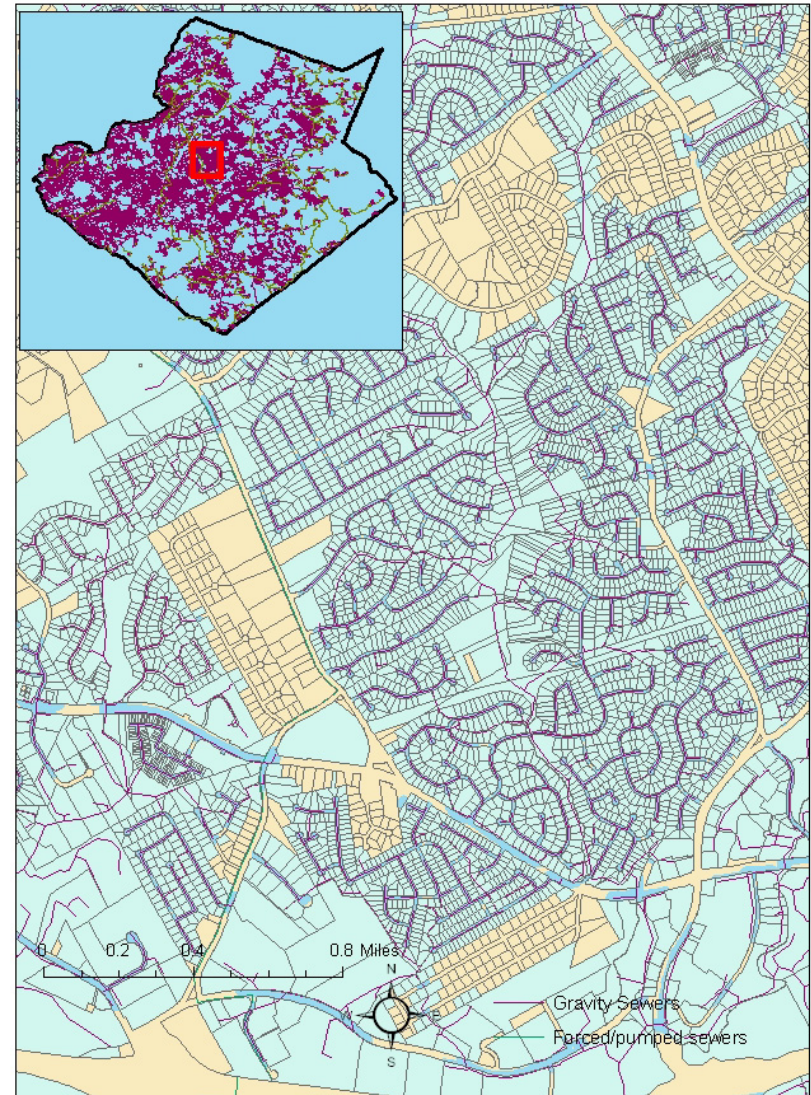
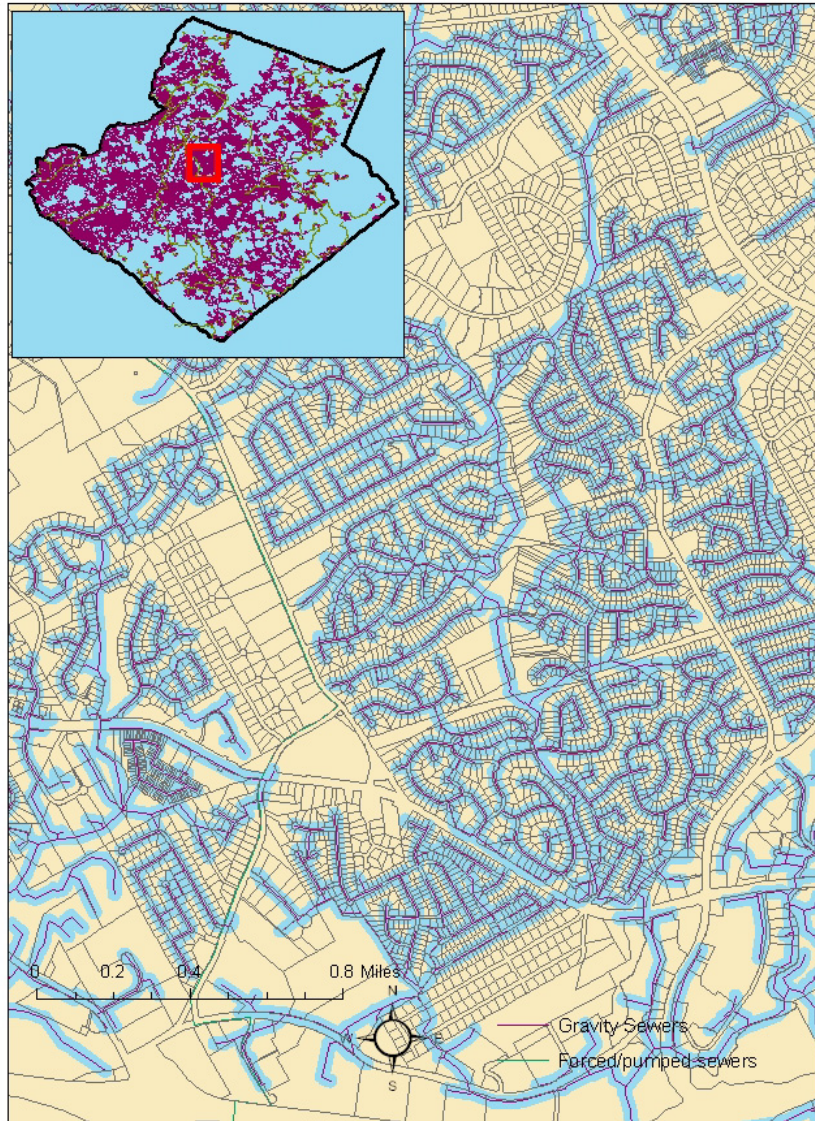
What do we know about the County?



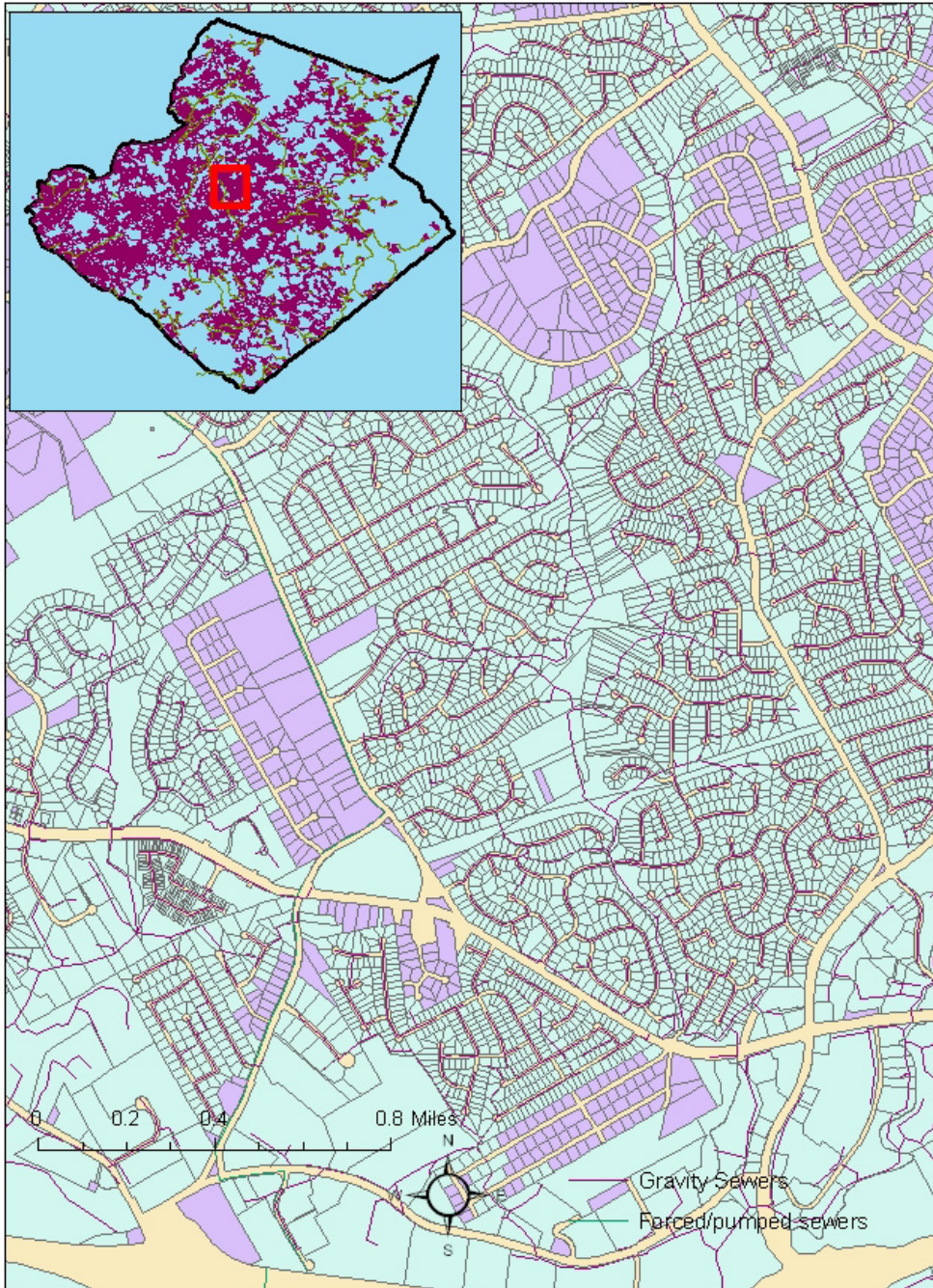
Land Use Classification



Sewers to Septic



Septic



Gwinnett County, Georgia

Properties on Sewers, and
those with Septic Systems,

Sewer 68%

Septic = 32%

By number of properties

Now
487 septic
systems/sq.
mile

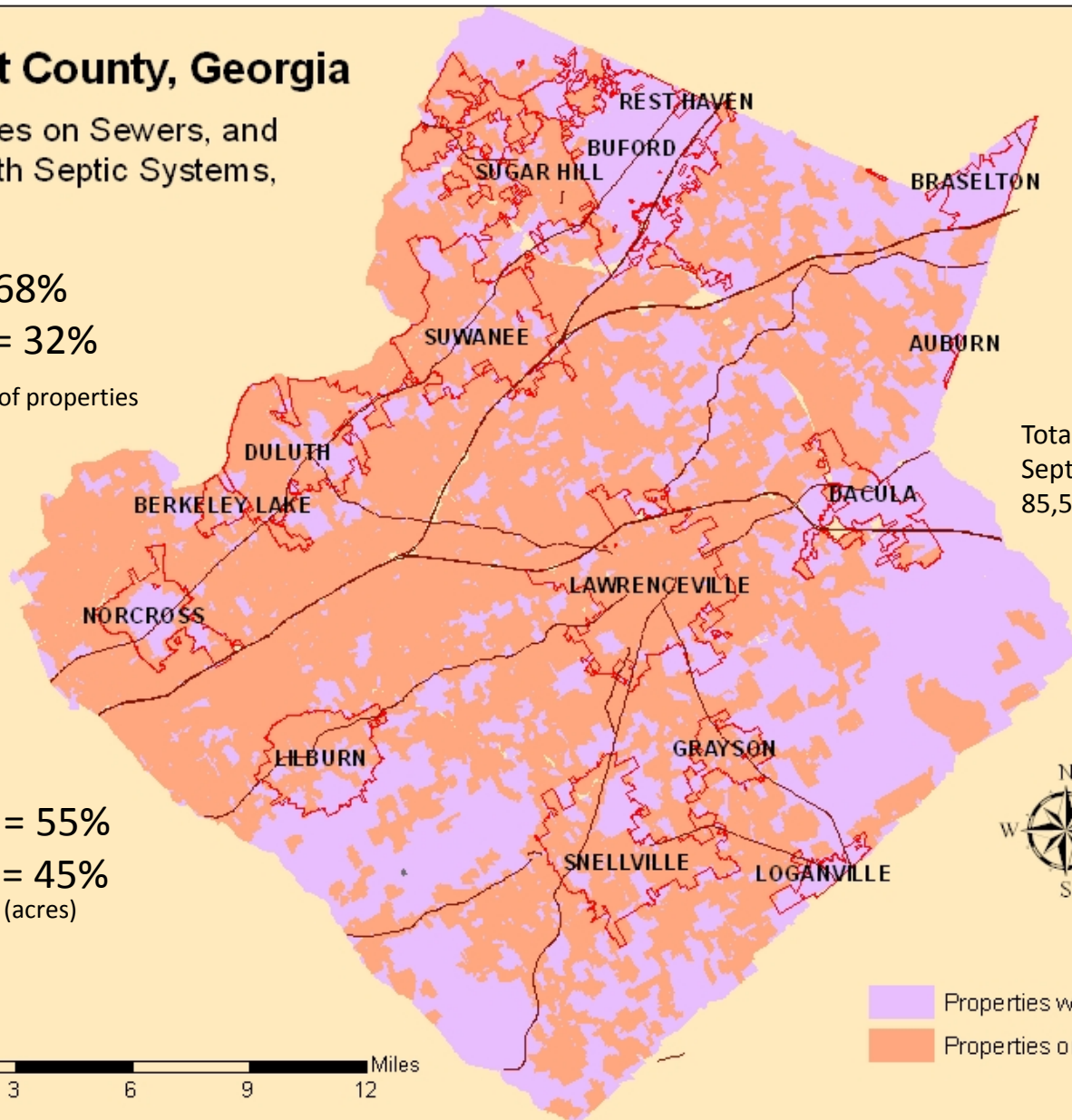
Total number of
Septic systems =
85,574

Sewer = 55%

Septic = 45%

By area (acres)

0 1.5 3 6 9 12 Miles



Properties with Septic
Properties on Sewer

Gwinnett County, Georgia

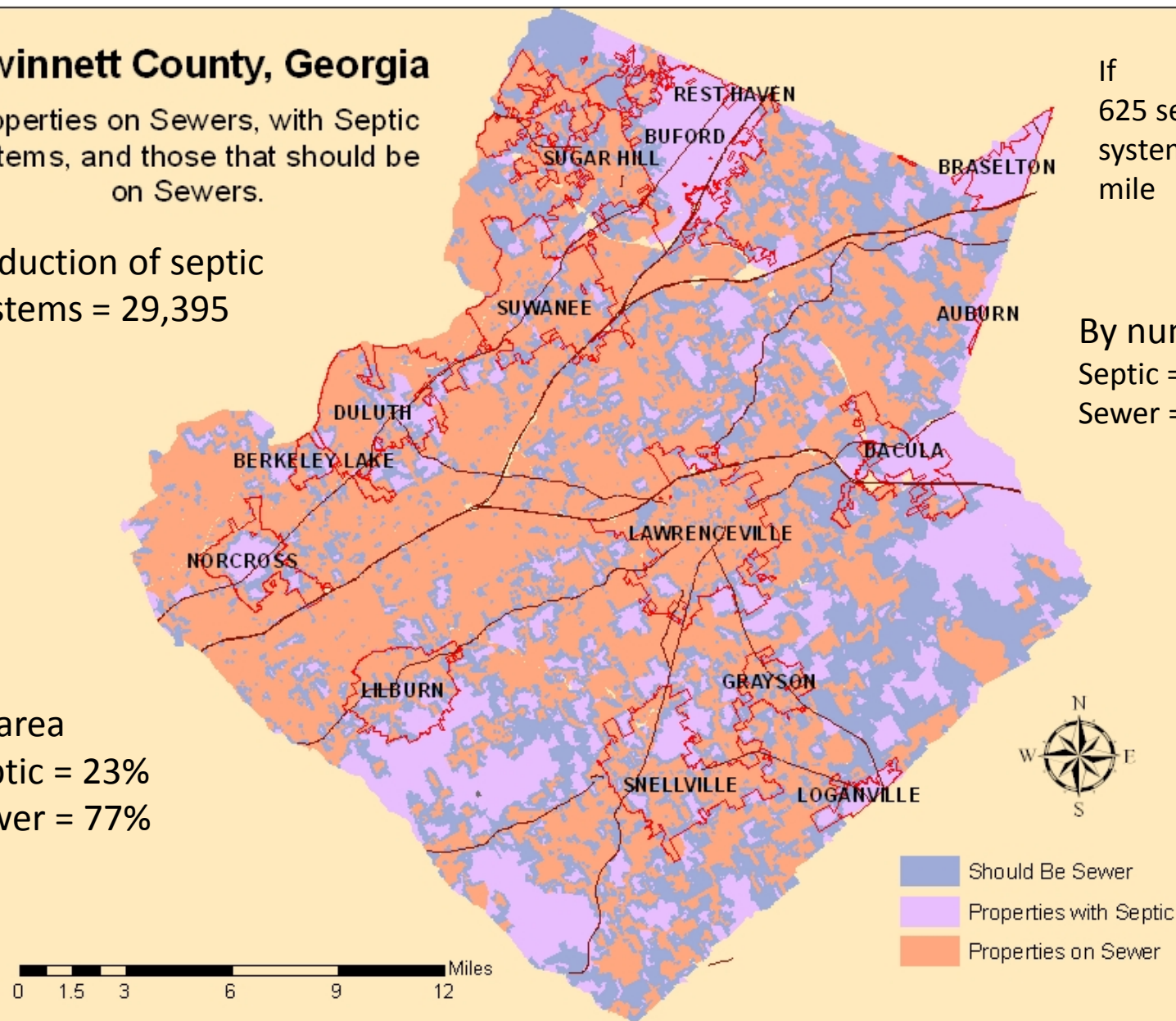
Properties on Sewers, with Septic Systems, and those that should be on Sewers.

Reduction of septic systems = 29,395

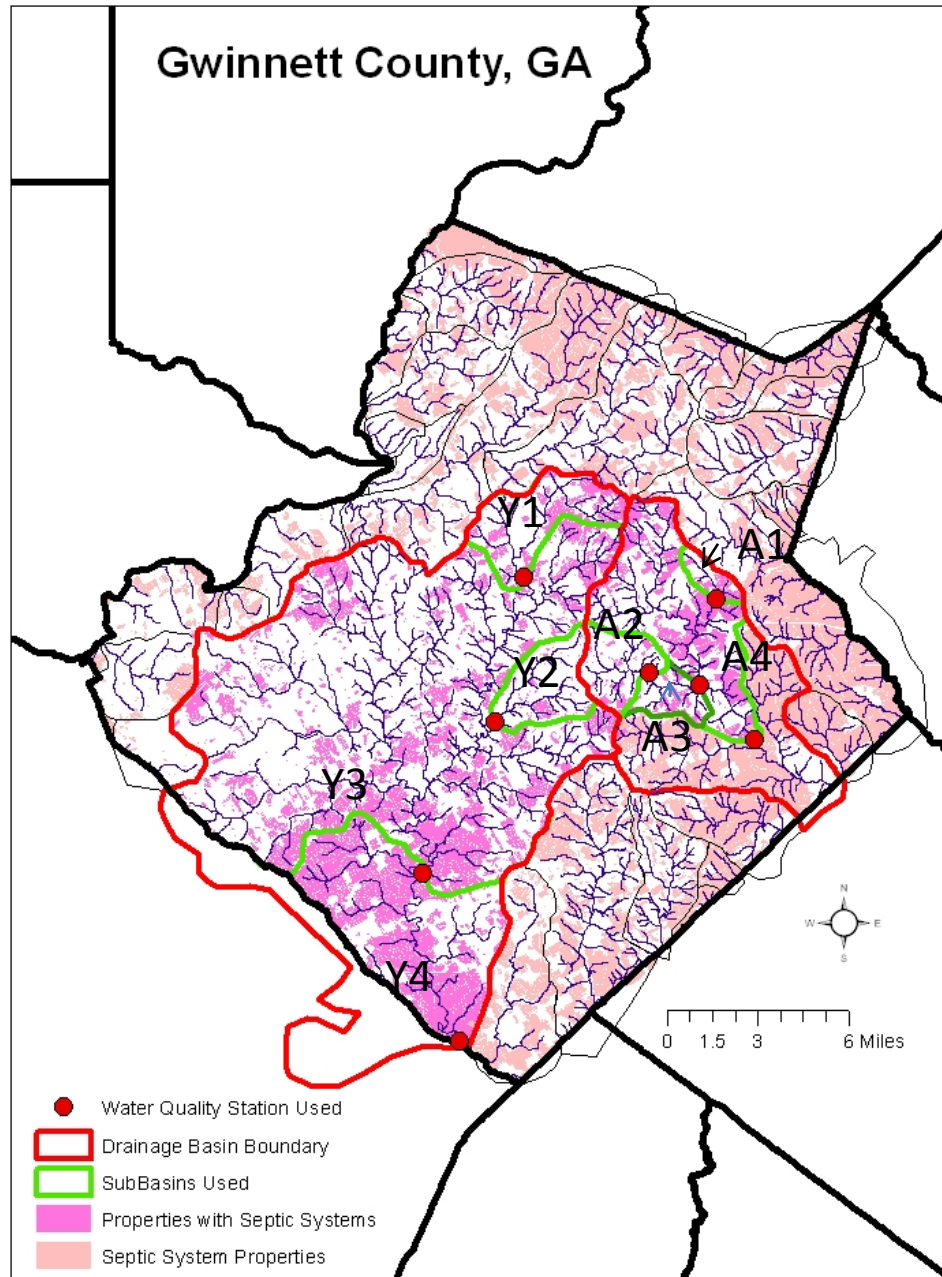
By area
Septic = 23%
Sewer = 77%

If
625 septic systems/sq. mile

By numbers
Septic = 21%
Sewer = 79%



Yellow River and Alcovy River Basins In Gwinnett County, Georgia



Yellow River Basin

Y1 = Little Suwannee Creek

Y2 = Pew Creek

Y3 = Yellow River – Snellville

Y4 = Yellow River – Lithonia

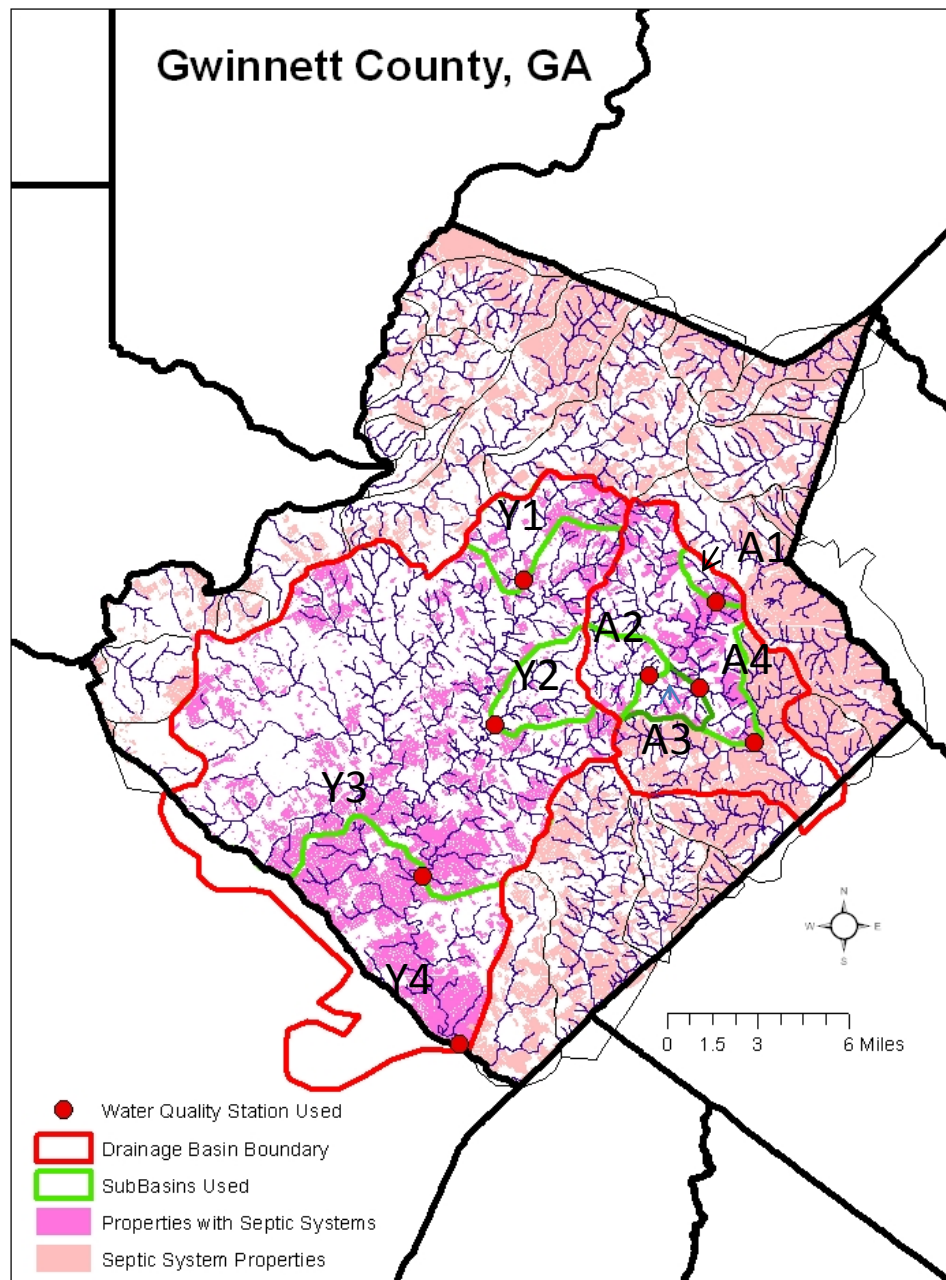
Alcovy River Basin

A1 = Hopkins Creek

A2 = Shoal Creek – Headwater

A3 = Shoal Creek – lower

A4 = upper portion of the
Alcovy River Basin



Yellow River Basin

Y1 = 9.9 mi², 2,459 septic

Y2 = 7.3 mi², 798 septic

Y3 = 132.8 mi², 27,306 septic

Y4 = 162.7 mi², 39,191 septic

Alcovy River Basin

A1 = 1.9 mi², 374 septic

A2 = 5.4 mi², 309 septic

A3 = 8.7 mi², 651 septic

A4 = 30.8 mi², 3,109 septic

Yellow River Basin

Y1 = 670 sep/mi², 37%

Y2 = 738 sep/mi², 15%

Y3 = 784 sep/mi², 26%

Y4 = 786 sep/mi², 31%

Alcovy River Basin

A1 = 656 sep/mi², 30%

A2 = 476 sep/mi², 12%

A3 = 430 sep/mi², 17%

A4 = 332 sep/mi², 30%

Key Water Quality Measures

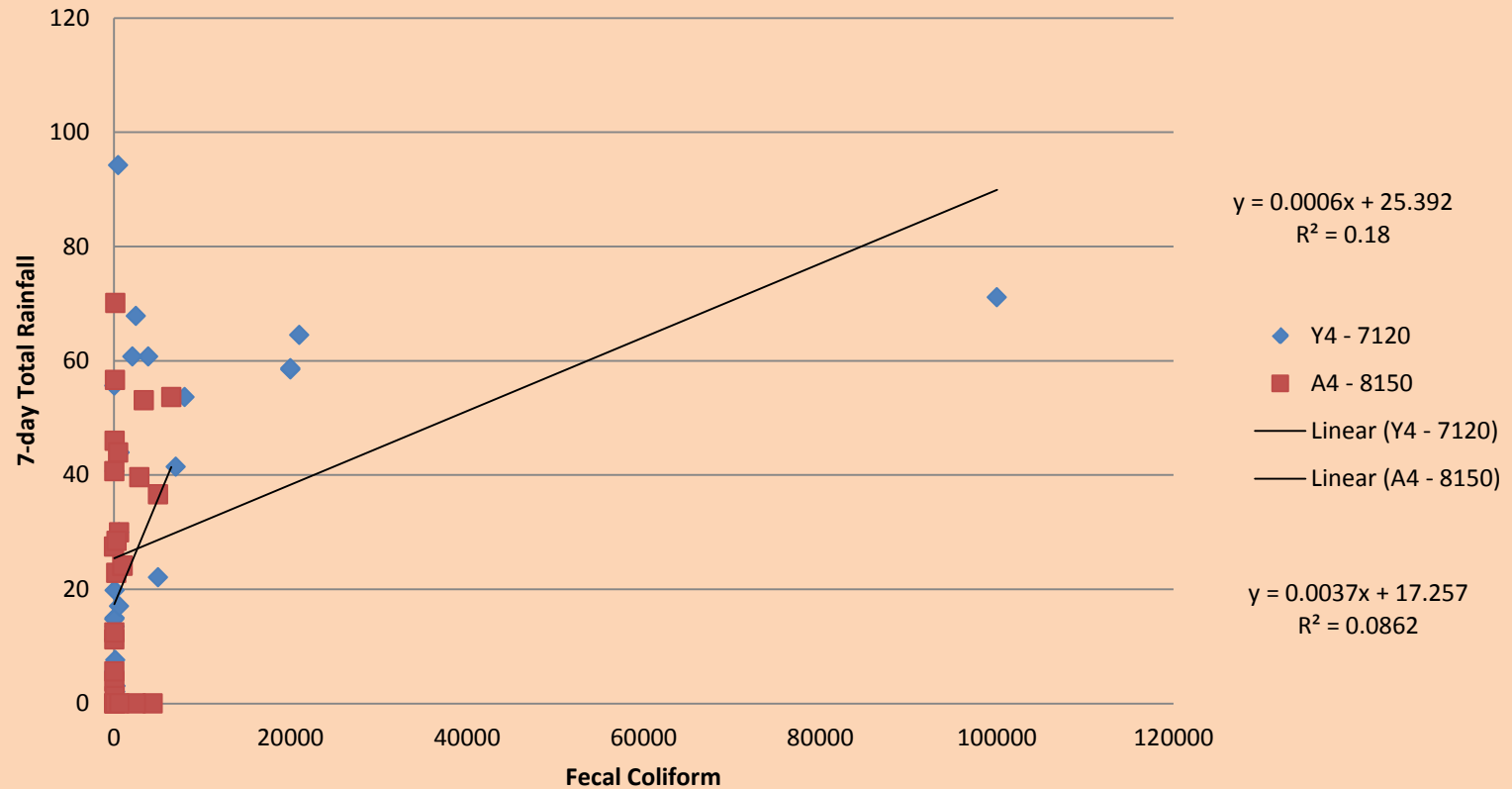
- Water Temperature
- Specific Conductance
- Hydrogen Ion concentration
- pH
- Dissolved Oxygen
- Biochemical Oxygen Demand
- Various Nitrogen measures
- Metals
 - Mg, Mn, Cd, Cr, Cu, Pb, Fe, Zn
- Phosphorus
- Coliform
 - Total, Fecal
 - *E. coli*

Rain Data

- Total Rainfall
 - 7-days prior
 - 14-days prior
 - 21-days prior
 - 28-days prior
- Amount of Rainfall
 - 1 week prior
 - 2 weeks prior
 - 3 weeks prior
 - 4 weeks prior
- Number of days of rain
 - 7, 14,21,28
- Amount of rain fall immediate before water quality reading
- Average rainfall
 - 7,14,21,28
- Amount of rain that fell on the day of the water quality reading

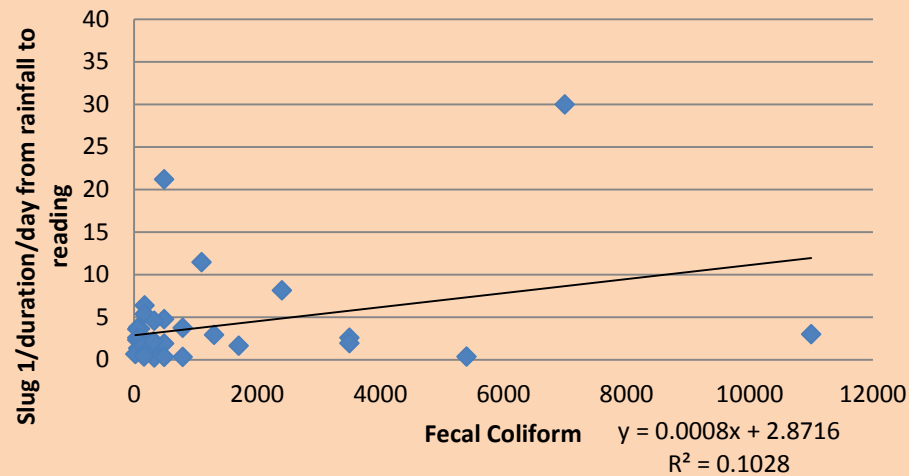
Fecal Coliform

Station Y4 to Station A4

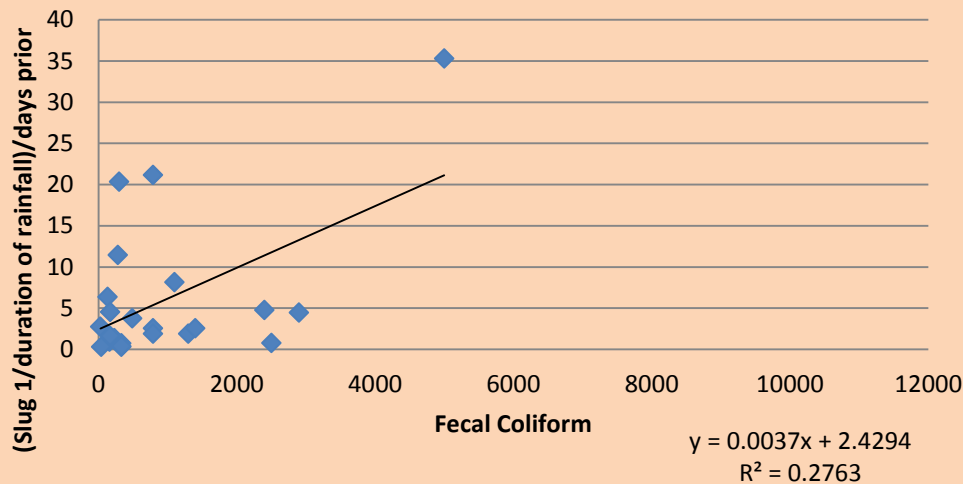


Relationship of fecal coliform to the rainfall prior to the reading/duration/time before reading and rainfall

Yellow River Basin - 1999

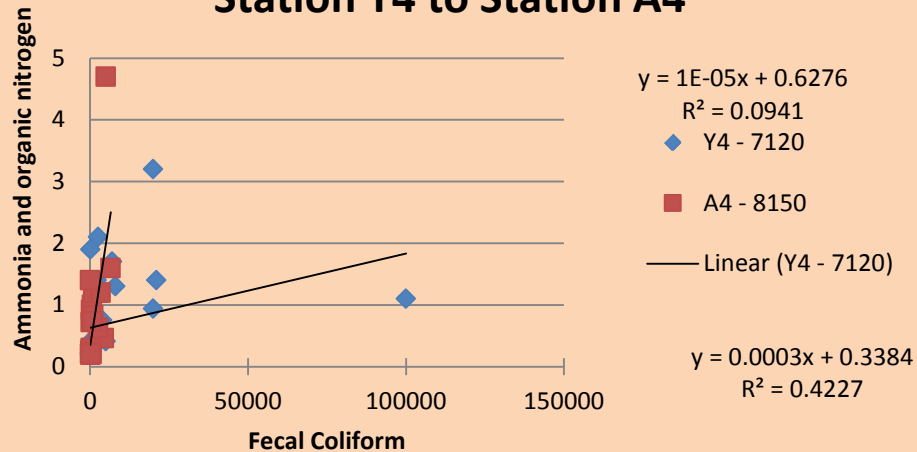


Alcovy River Basin - 1999

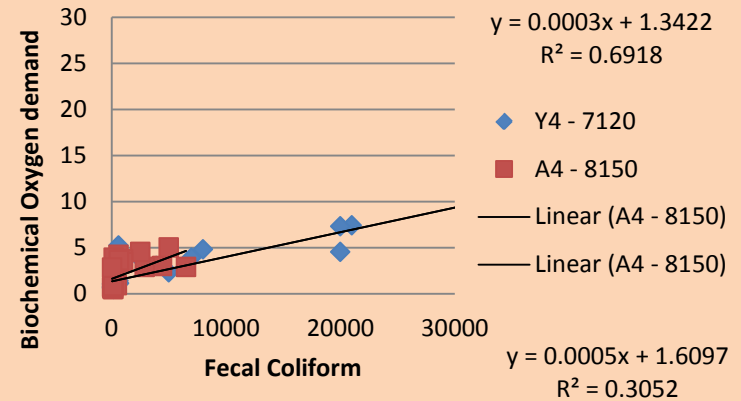


Biologicals and nutrients

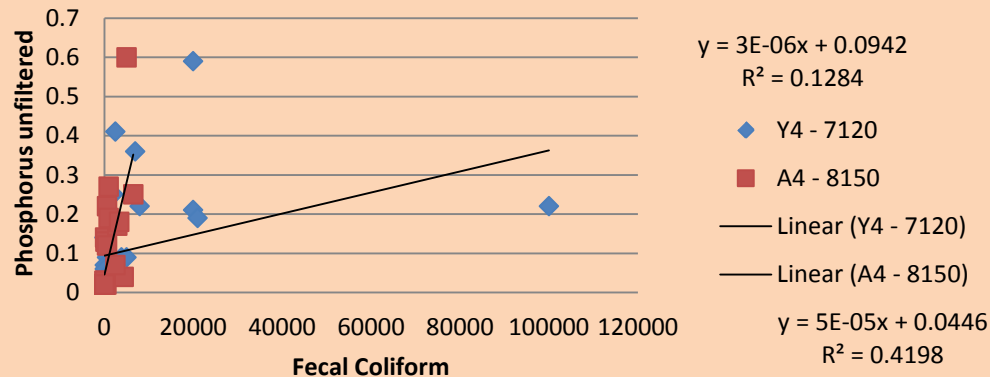
Station Y4 to Station A4



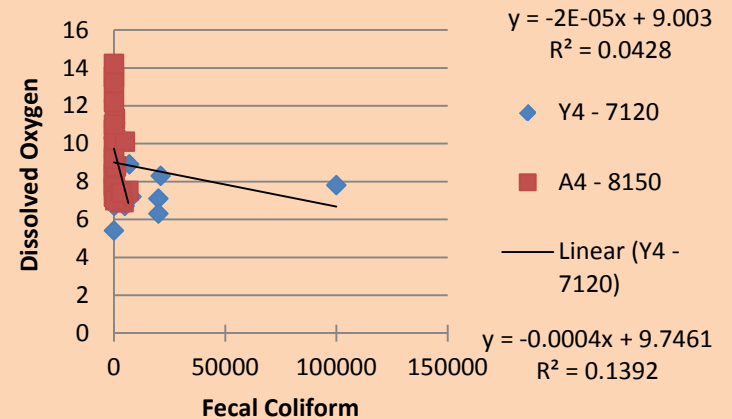
Station Y4 to Station A4



Station Y4 to Station A4

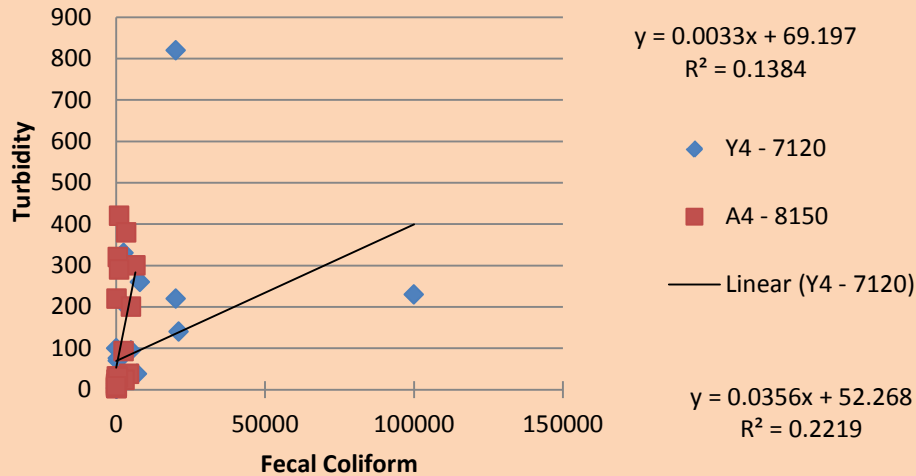


Station Y4 to Station A4

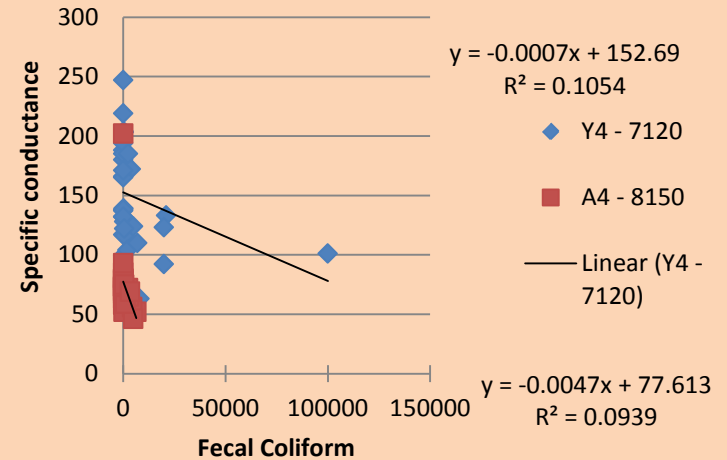


Water Conditions

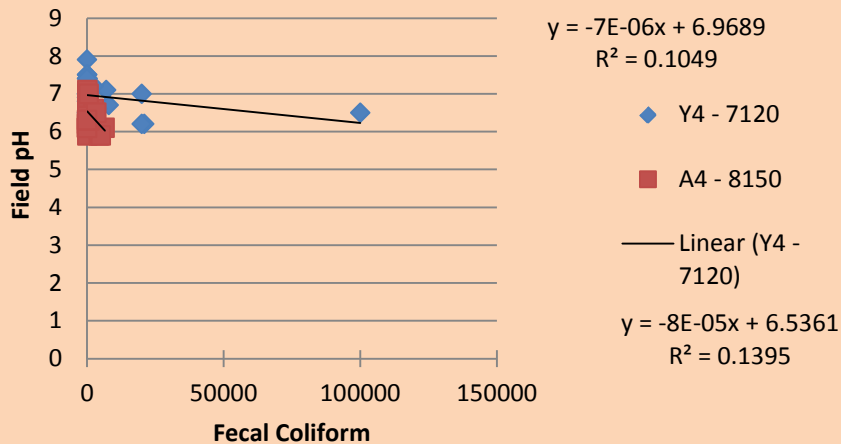
Station Y4 to Station A4



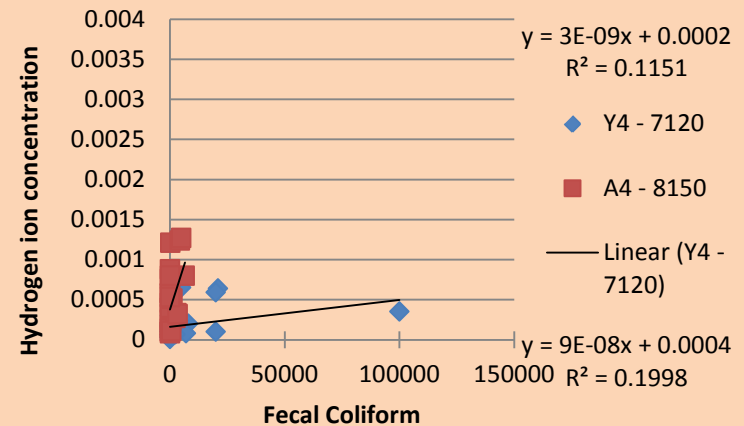
Station Y4 to Station A4



Station Y4 to Station A4



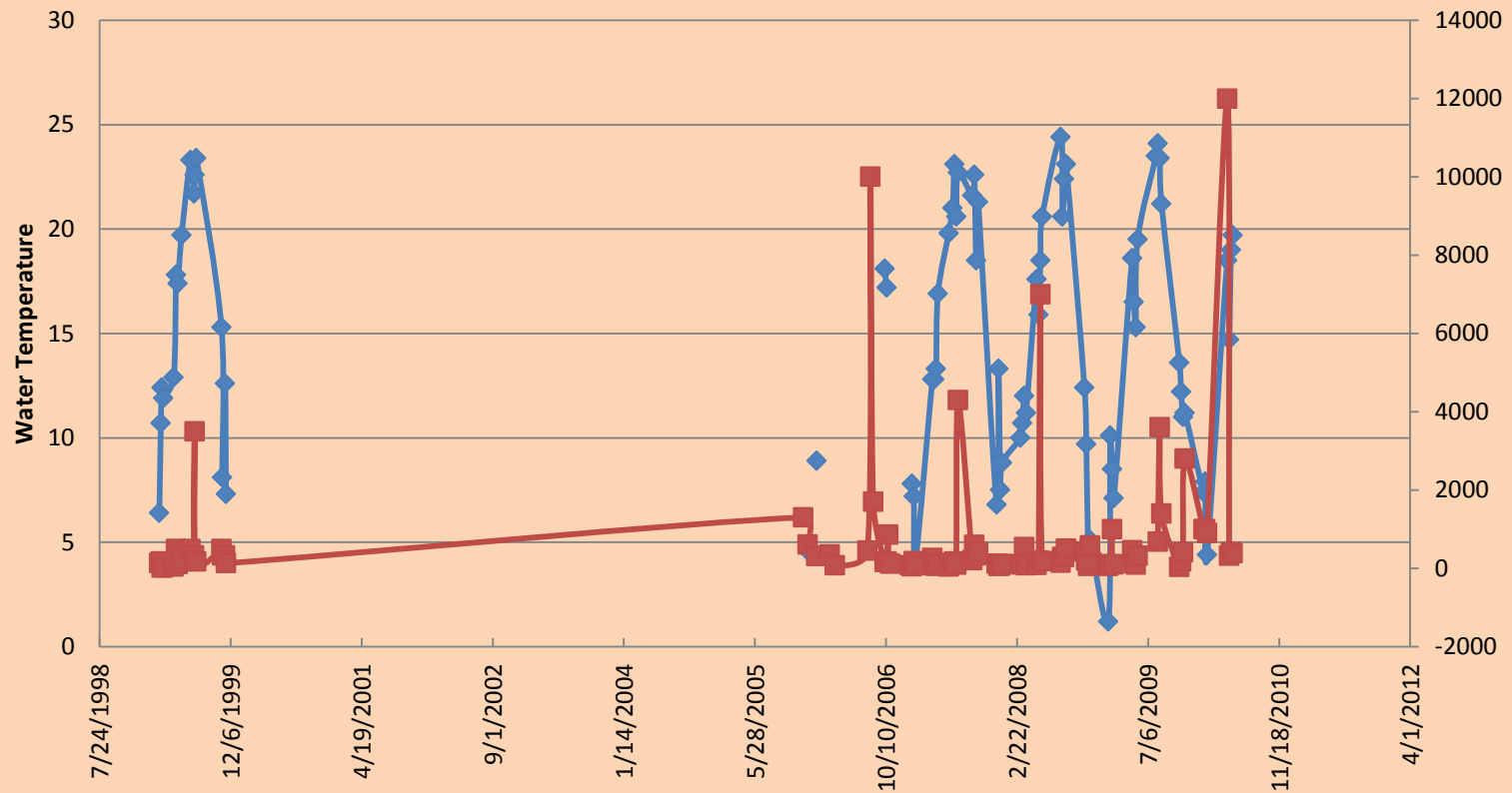
Station Y4 to Station A4



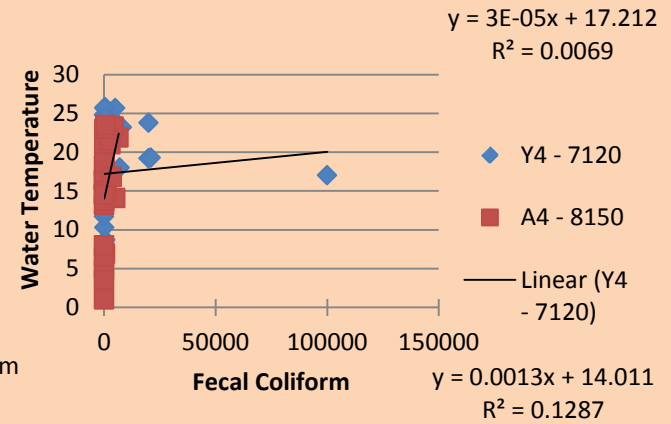
Water temperature and Fecal Coliform

Pew Creek – Y2

Water Temperature Fecal Coliform



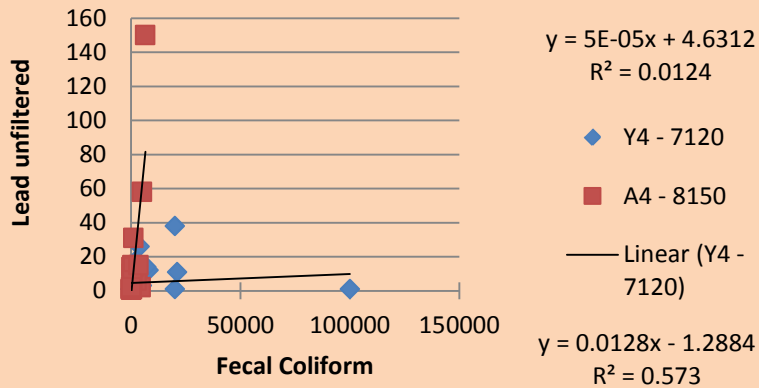
Station Y4 to Station A4



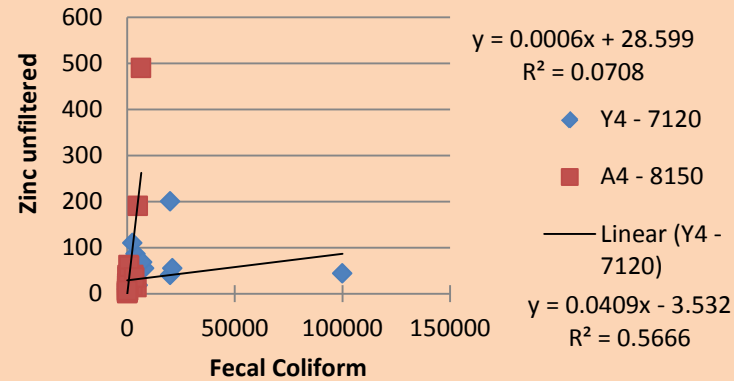
Metals

Runoff – car parts

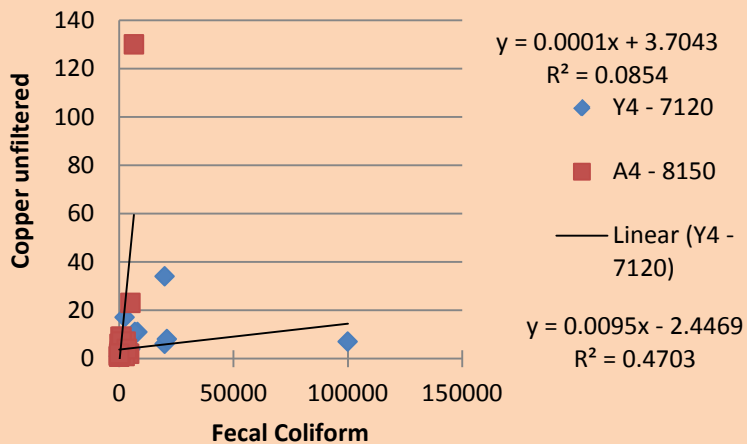
Station Y4 to Station A4



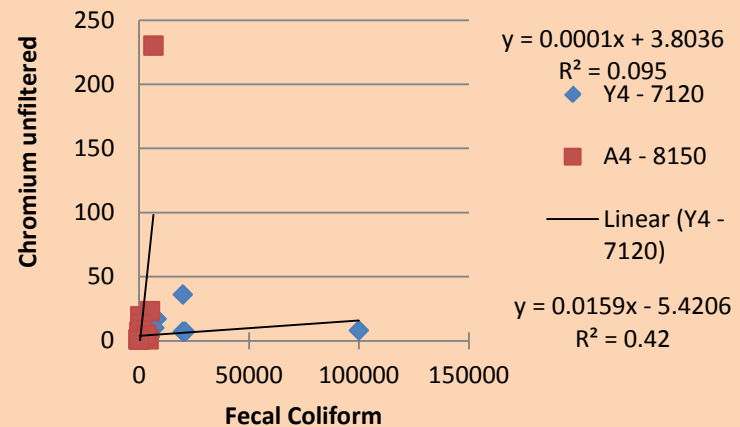
Station Y4 to Station A4



Station Y4 to Station A4

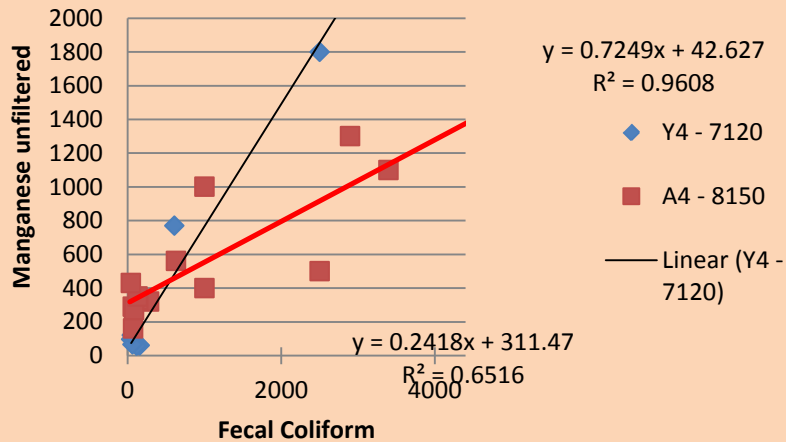


Station Y4 to Station A4

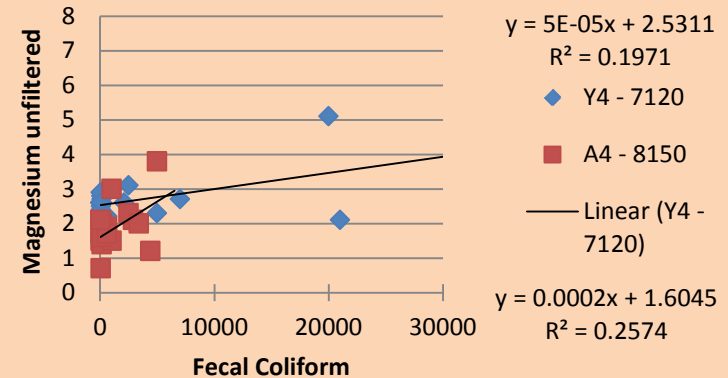


More Metals

Station Y4 to Station A4

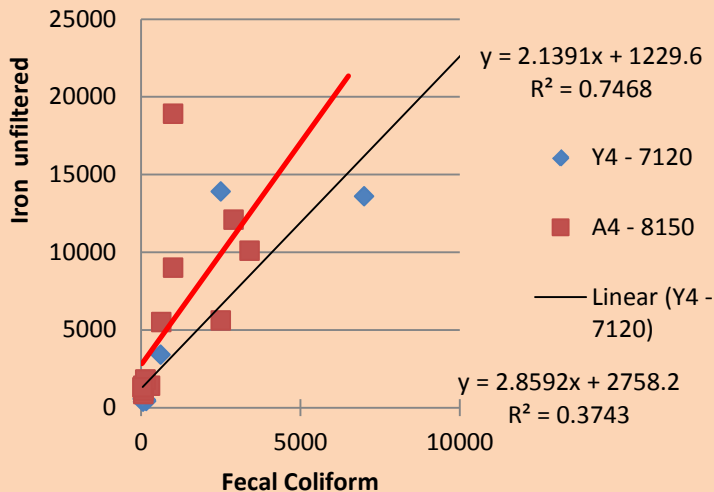


Station Y4 to Station A4

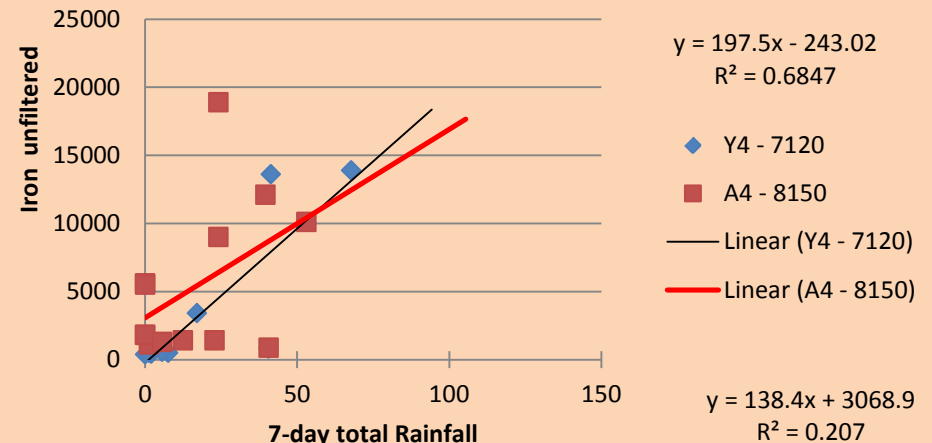


Station Y4 to Station A4

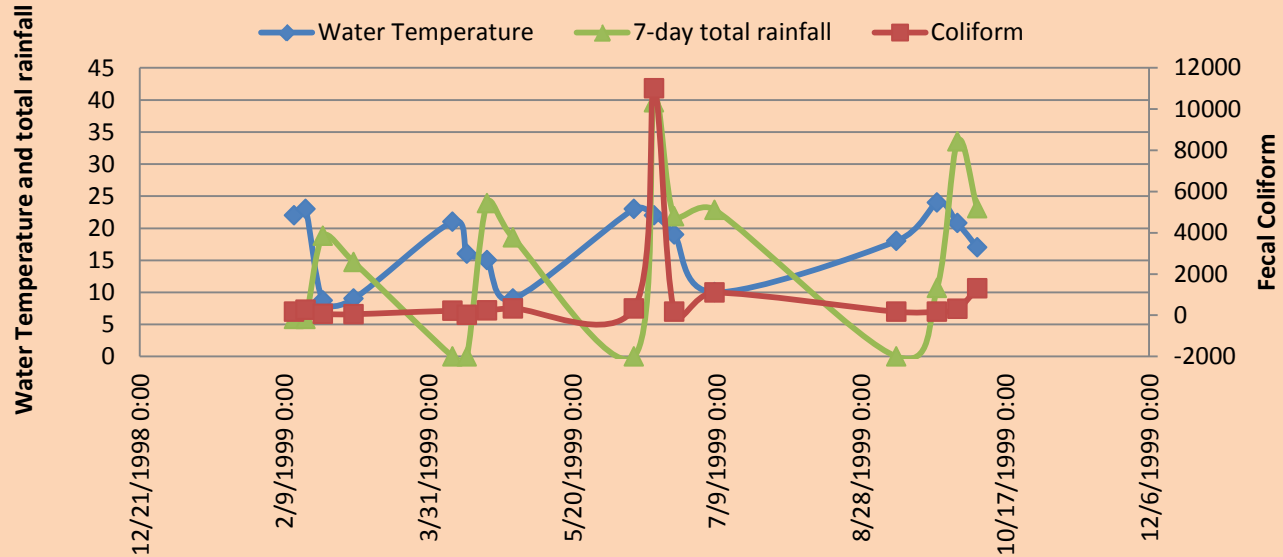
Flushing



Station Y4 to Station A4



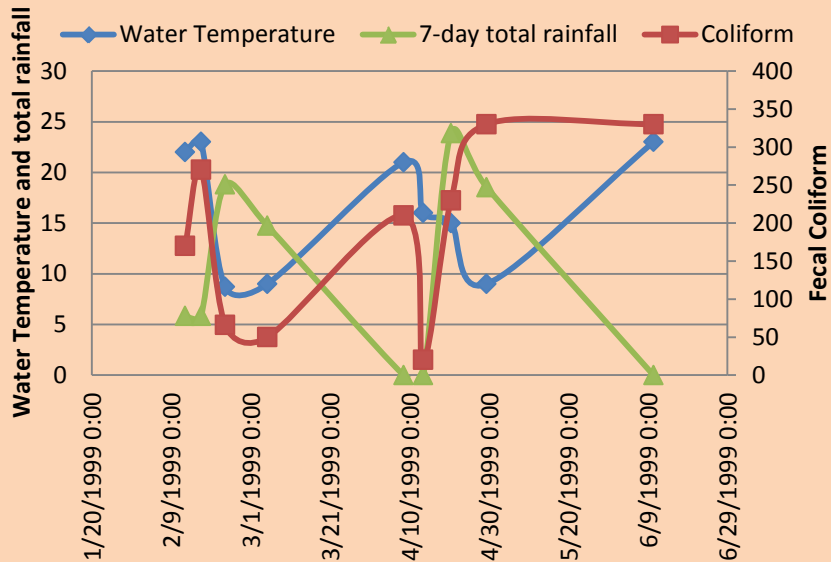
Yellow River near Snellville - Y3



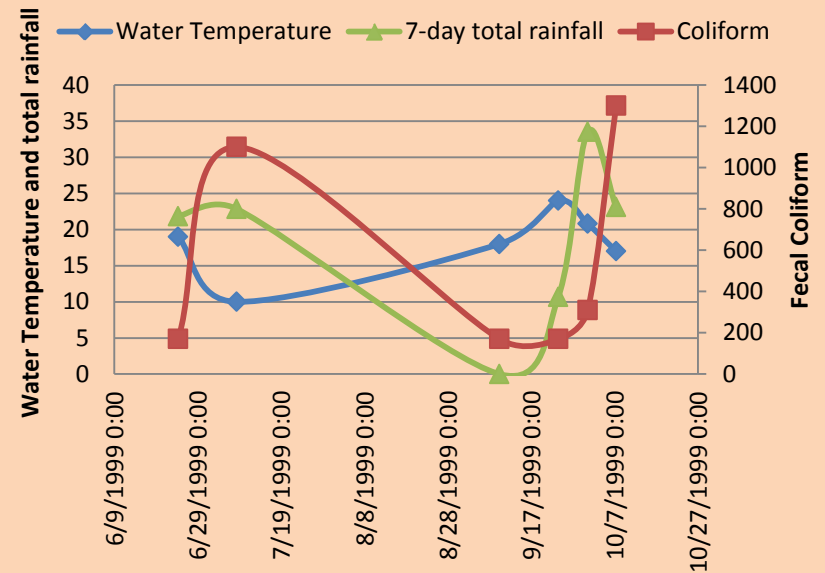
Flushing

Runoff or is it flushed?

Yellow River near Snellville - Y3

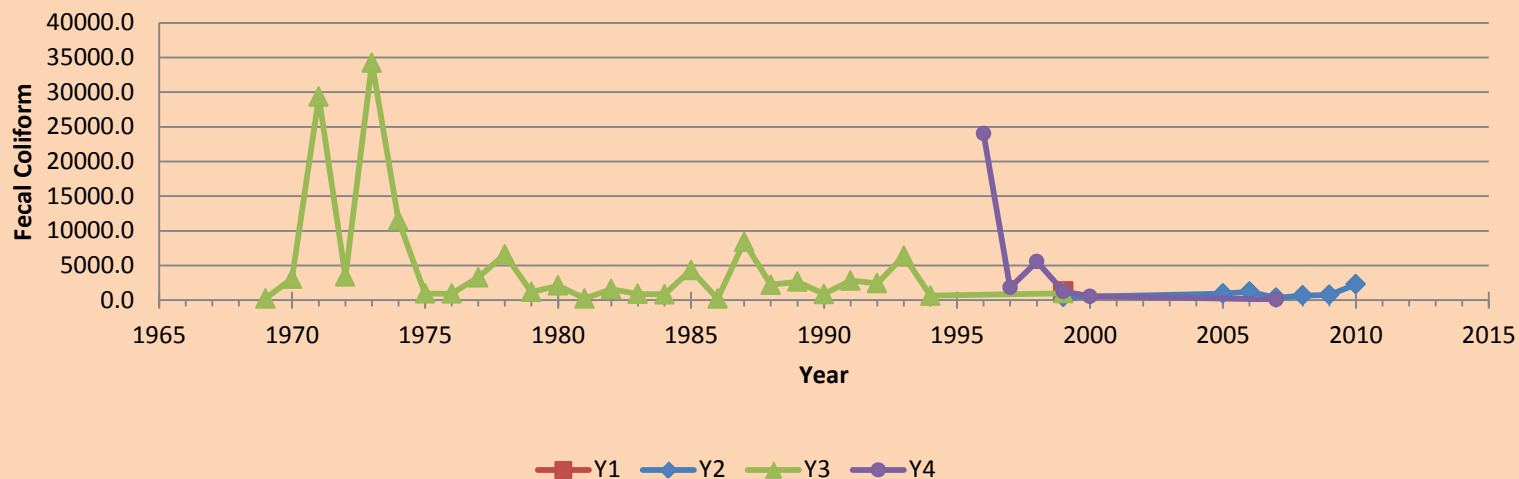


Yellow River near Snellville - Y3

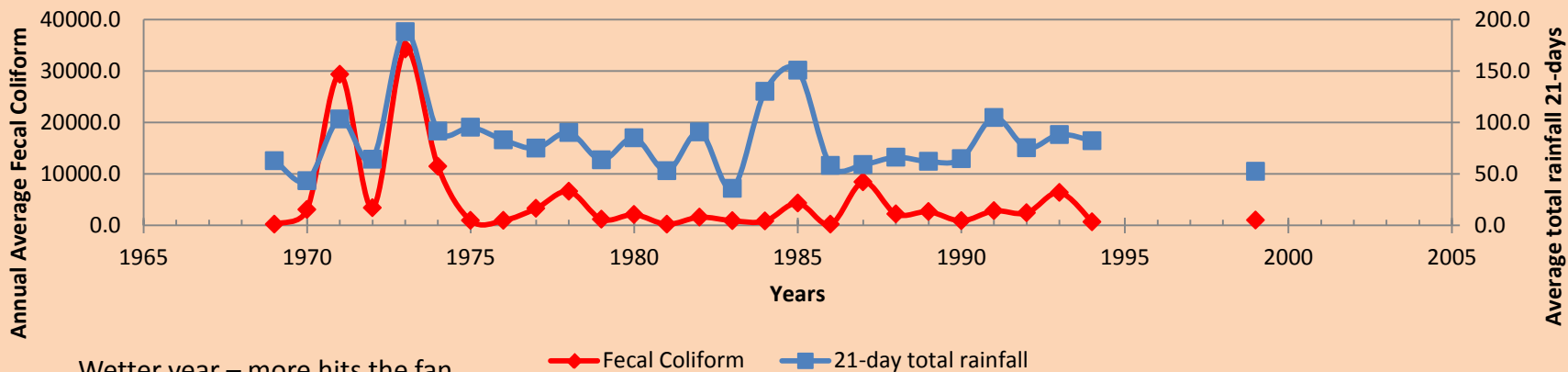


Oh no!

Yellow River Annual Mean Fecal Coliform

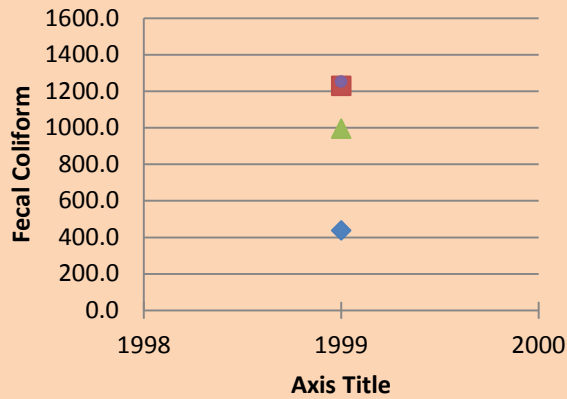


Yellow River - 2206500 - Y3



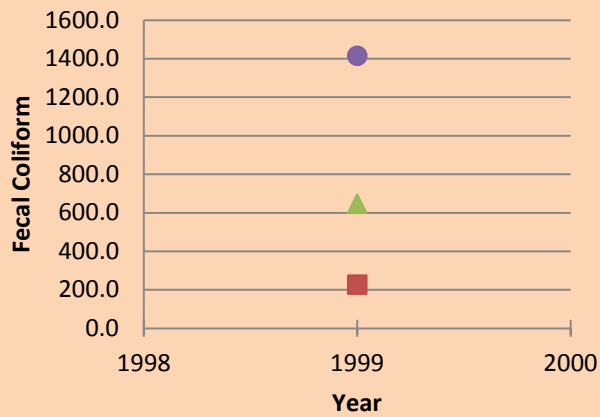
Wetter year – more hits the fan

Yellow River - 1999

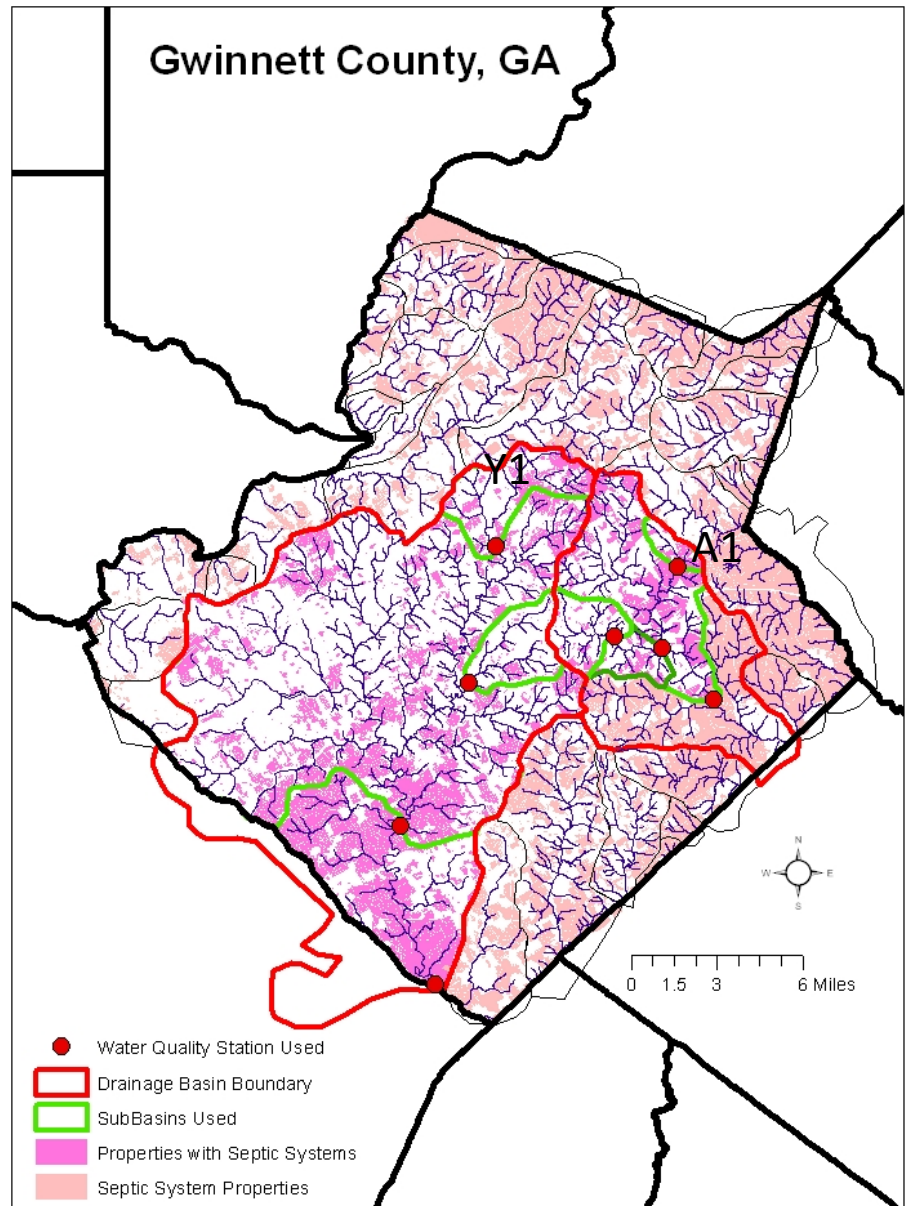


Y1 = 37%, Y4 = 31%

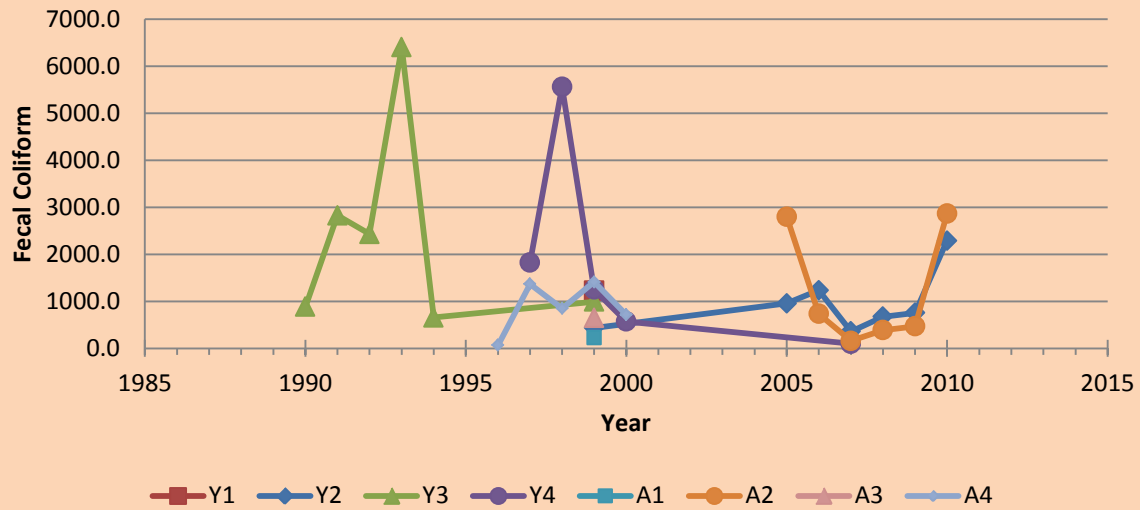
Alcovy River - 1999



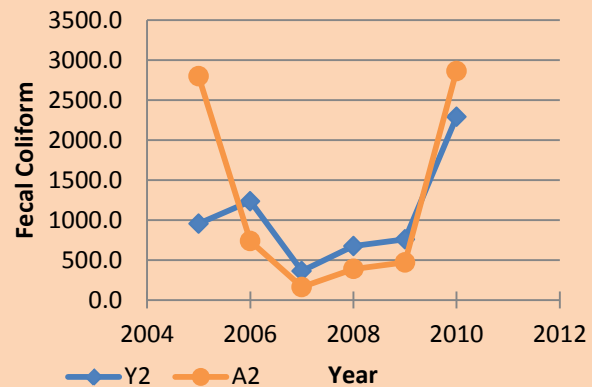
A1 = 37%, A4 = 31%



Annual Mean Fecal Coliform Comparison - 1996 - 2010



Annual Mean Fecal Coliform - 2005 to 2010



The Drought

Conclusions

- There is a positive correlation between the amount of rainfall to the water quality readings.
- There is an increase in the fecal coliform with increased discharge of the stream which is a factor of the amount of rainfall prior to the water quality measurements.
- There is a positive correlation between fecal coliform and water temperature.

Conclusions

- There is evidence for flushing of septic effluent to the surface to be the cause of the high fecal coliform levels in the water. (Water temperature and rainfall, plus the increase in iron , magnesium, and possibly manganese.)
- The classic relationships of higher fecal coliform causes an increase in the BOD and a decrease in DO.

Conclusions

- Higher fecal coliform caused by more rainfall causes a lower specific conductance in the water due to dilution. (the solution to pollution is dilution)
- There are seasonal variations in the amount of fecal coliform in the water.

Further work

- Look at age of septic systems to see if there is any relationship to failing septic systems? (Data needed from County to do this)
- Water temperature and fecal coliform
- Improve the septic system map with better data. (I am working on this.)

Yellow River well named?

