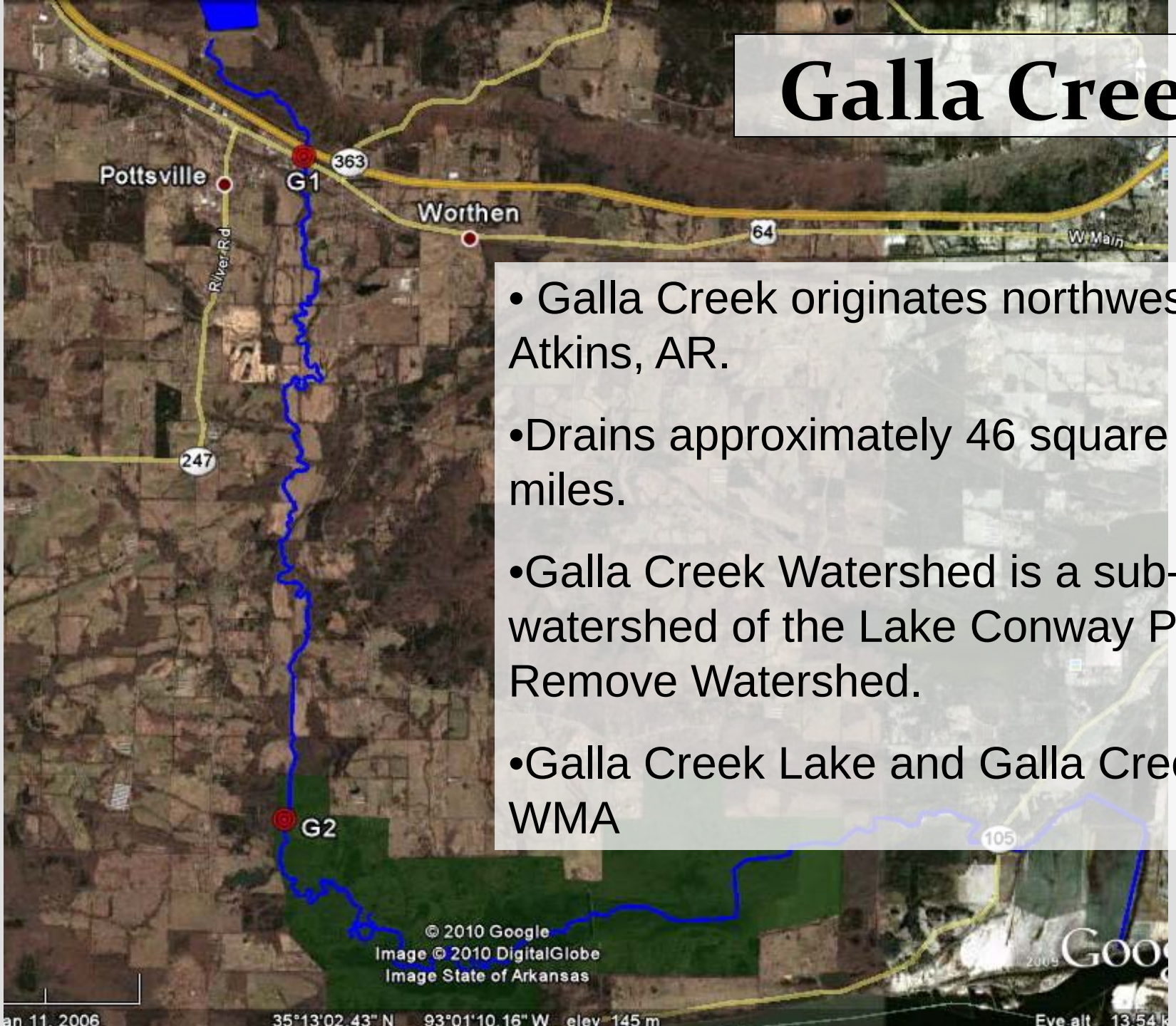
Water Quality Monitoring :

Galla Creek
Bayou Bartholomew
L'Anguille River

Presented By: The Ecological Conservation Organization

eco
Ecological Conservation Organization

Galla Creek



- Galla Creek originates northwest of Atkins, AR.
- Drains approximately 46 square miles.
- Galla Creek Watershed is a sub-watershed of the Lake Conway Point Remove Watershed.
- Galla Creek Lake and Galla Creek WMA

Galla Creek Goals

- To develop an EPA approved functional tool to ensure the successful implementation of effective and efficient monitoring. (i.e. **Quality Assurance Project Plan**)
- To continue water quality monitoring at two water quality monitoring stations in order to determine parameter trends during the project period .
- Prepare report with water quality results.

Galla Creek Objectives

- Use representative monitoring stations with similar physical attributes while maintaining precise and accurate sampling protocols.
- Collect grab samples routinely at weekly intervals.
- Determine concentrations of extracted samples.
- better understand the fluctuating pollutant trends and dynamics within the water system

Methodology

- Grab sample Collection every week
- In situ Sondes to record pH, DO, temperature, and Specific Conductance
- Data analysis and statistical evaluation

Galla Creek Sample Report

Project Summary								
Project Quarter	**Site**	**Total Number of Samples Analyzed**	**Range of sample numbers that were analyzed**	**Range of sample numbers that were collected**	**Number of grab samples collected**	**Number of replicate samples collected**	**Number of Samples Passing QAQC**	**Total Number Samples collected**
July – Sept 2009	G1	**14**	**268g-279g**	**268g-281g**	**14**	**2**	**14**	**16**
	G2	**14**	**371g-382g**	**371g-384g**	**14**	**2**	**14**	**16**
	TOTAL	**28**	**Na**	**Na**	**28**	**4**	**28**	**32**
Oct – Dec 2009	G1	**14**	**280g-292g**	**282g-293g**	**13**	**1**	**14**	**14**
	G2	**15**	**383g-395g**	**385g-396g**	**13**	**1**	**15**	**14**
	TOTAL	**29**	**Na**	**Na**	**26**	**2**	**29**	**28**
Jan – Mar 2010	G1	**14**	**293g-304g**	**294g-306g**	**13**	**2**	**14**	**15**
	G2	**13**	**396g-407g**	**397g-409g**	**13**	**1**	**13**	**14**
	TOTAL	**27**	**Na**	**Na**	**26**	**3**	**27**	**29**
April – June 2010	G1	**11**	**305g-314g**	**307g-314g**	**8**	**0**	**11**	**8**
	G2	**11**	**408g-418g**	**410g-418g**	**8**	**1**	**11**	**9**
	TOTAL	**22**	**Na**	**Na**	**16**	**1**	**22**	**17**
Project Total	G1	**53**	**268g-314g**	**268g-314g**	**48**	**5**	**53**	**53**
	G2	**53**	**371g-418g**	**371g-418g**	**48**	**5**	**53**	**53**
	TOTAL	**106**	**Na**	**Na**	**96**	**10**	**106**	**106**

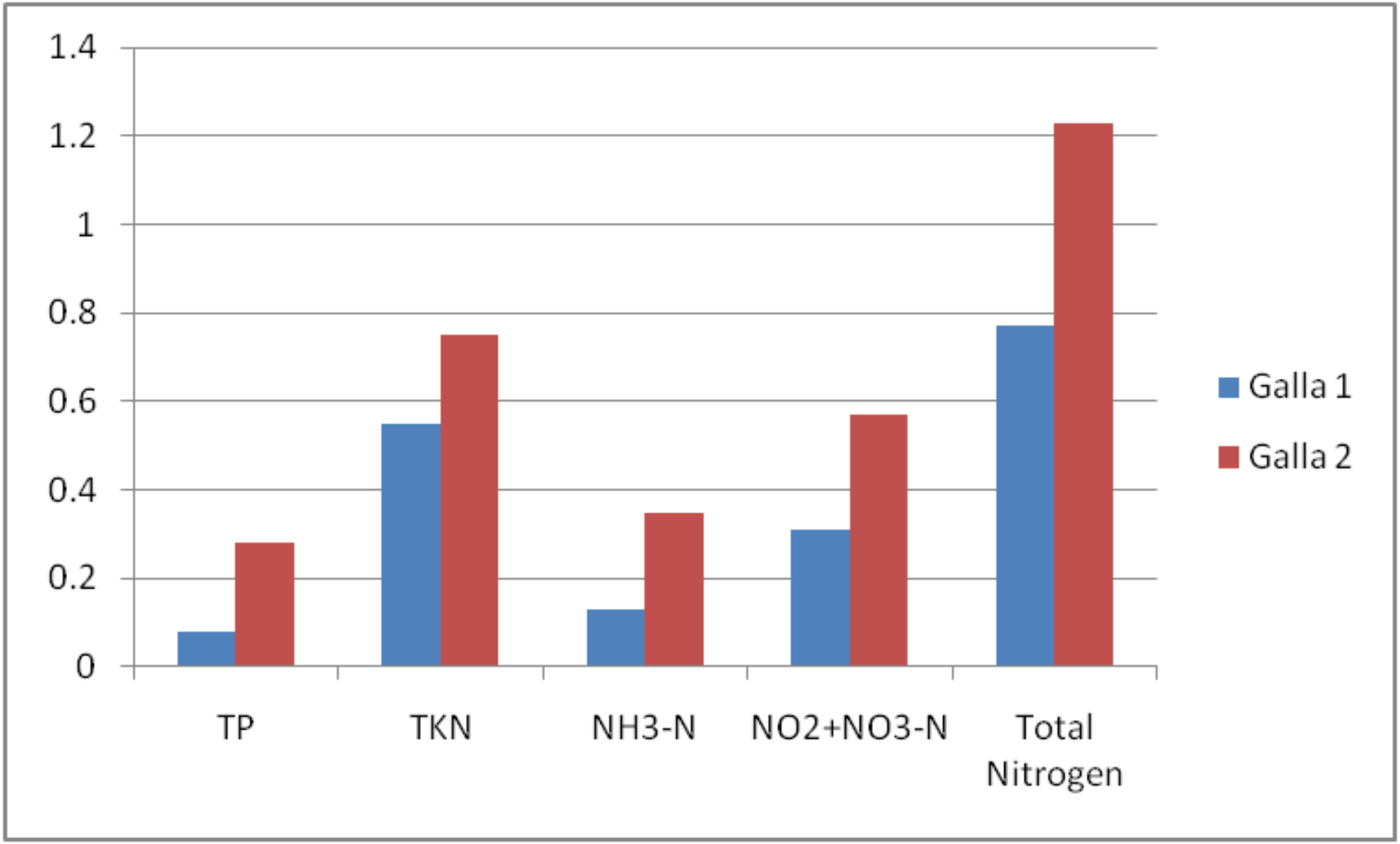
Galla Creek Results
G1

N=48	Time (H:M)	TP (mg/L)	TKN (mg/L)	TSS (mg/L)	NH_3-N (mg/L)	Turbidity (NTU)	NO_2+NO_3-N (mg/L)	Total Nitrogen (mg/L)
Average	11:41	0.08	0.55	6	0.13	10	0.31	0.77
Median	11:45	0.06	0.48	6	0.05	7.4	0.28	0.74
Mode	11:30	0.06	0.48	4	0.03	11.9	0.22	0.63
Min	9:00	0.01	0.28	2	0	2.14	0.09	0.32
Max	15:00	0.56	2.81	24	2.07	100	0.66	1.77
Std Dev	1:14	0.09	0.39	4	0.31	13.94	0.13	0.25

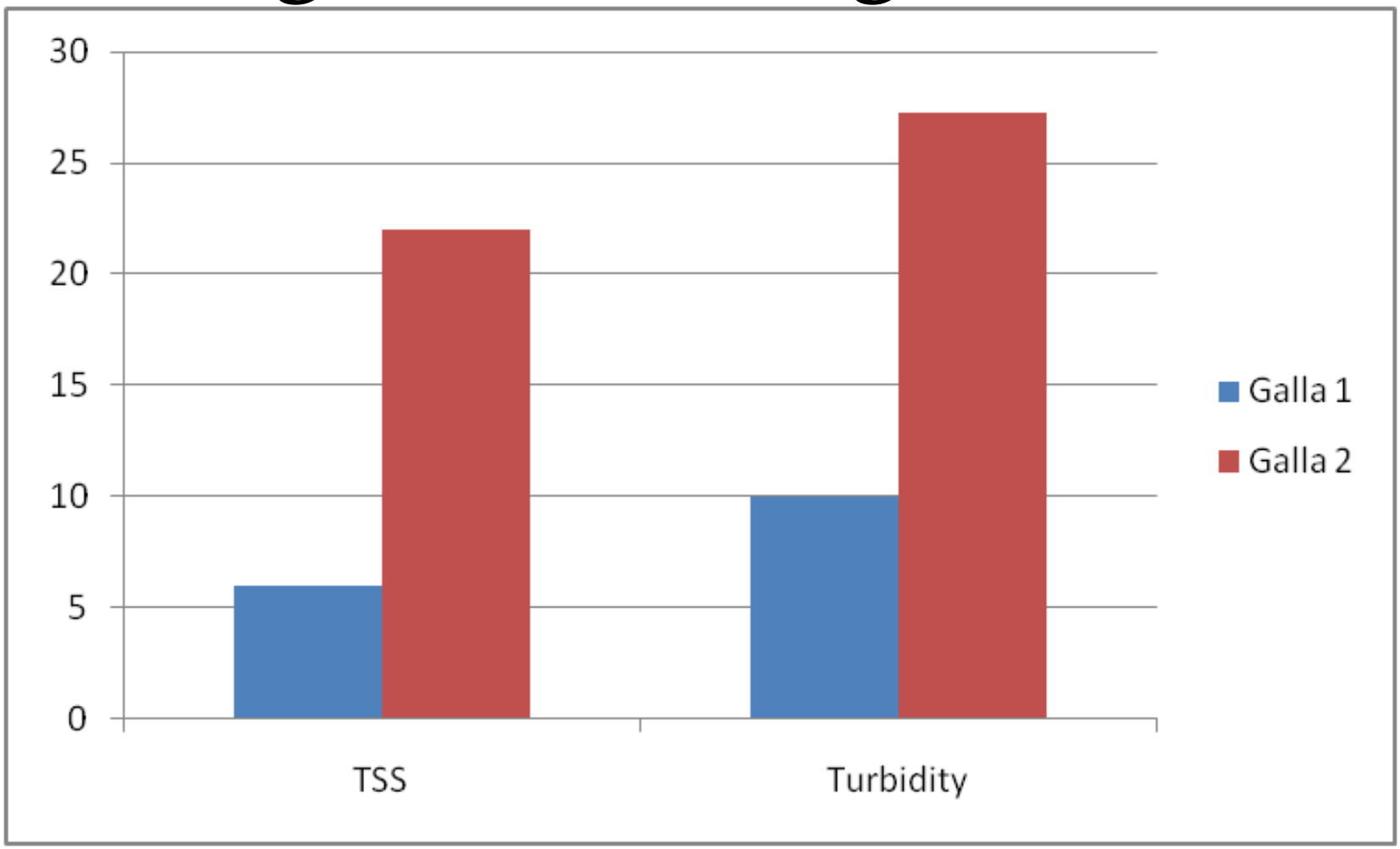
Galla Creek Results
G2

N=48	Time (H:M)	TP (mg/L)	TKN (mg/L)	TSS (mg/L)	NH_3-N (mg/L)	Turbidity (NTU)	NO_2+NO_3 -N (mg/L)	Total Nitrogen (mg/L)
Average	10:53	0.28	0.75	22	0.35	27.3	0.57	1.23
Median	11:02	0.1	0.6	11	0.08	15.8	0.42	0.91
Mode	11:00	0.09	0.67	6	0.04	18.2	1.1	2.69
Min	8:30	0.01	0.28	2	0.02	5.9	0.08	0.39
Max	15:30	4.55	2.99	237	10.2	269	2	3.07
Std Dev	1:23	0.65	0.49	38	1.48	45.1	0.46	0.68

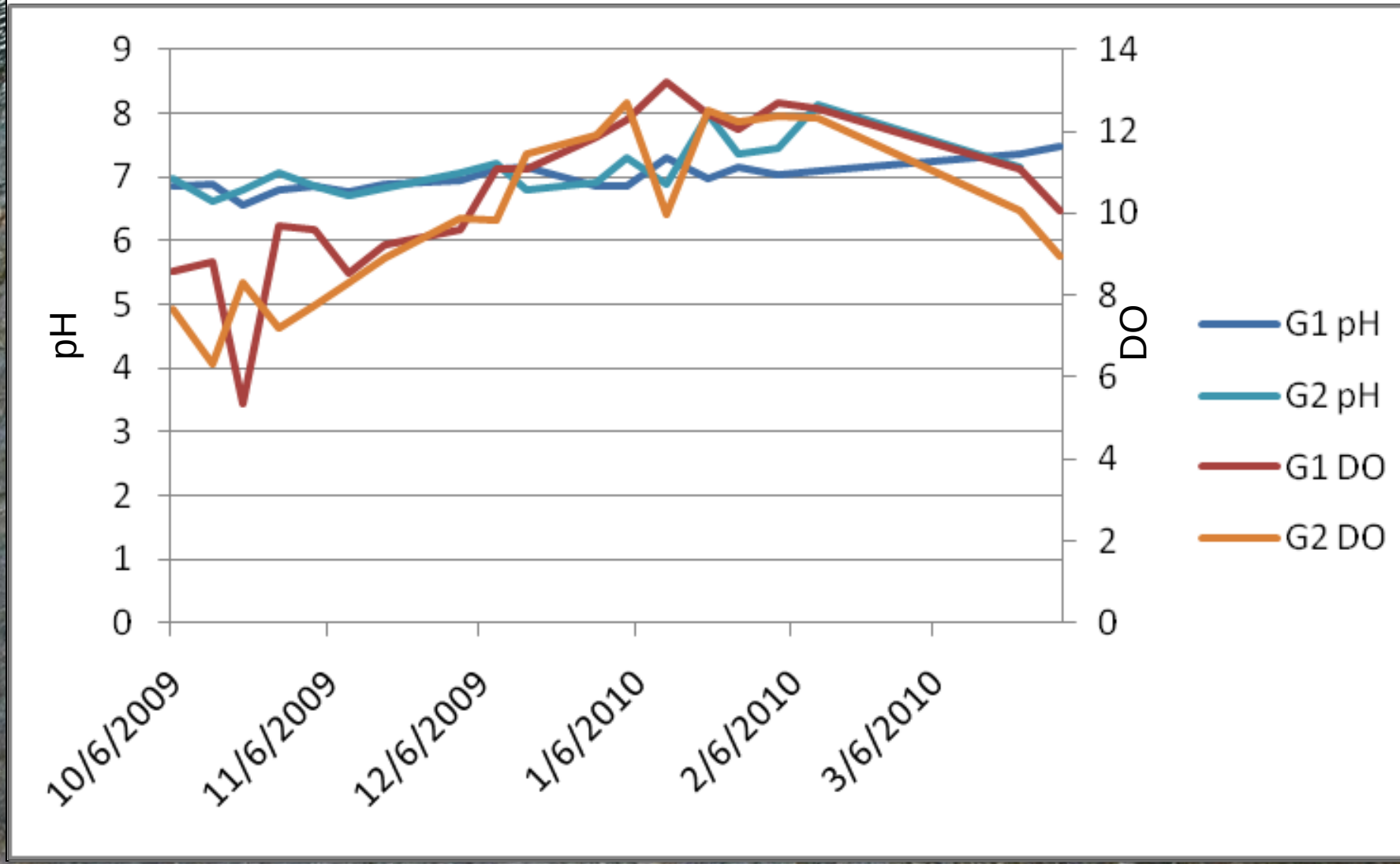
Galla Creek Results
Average Concentration (mg/L)



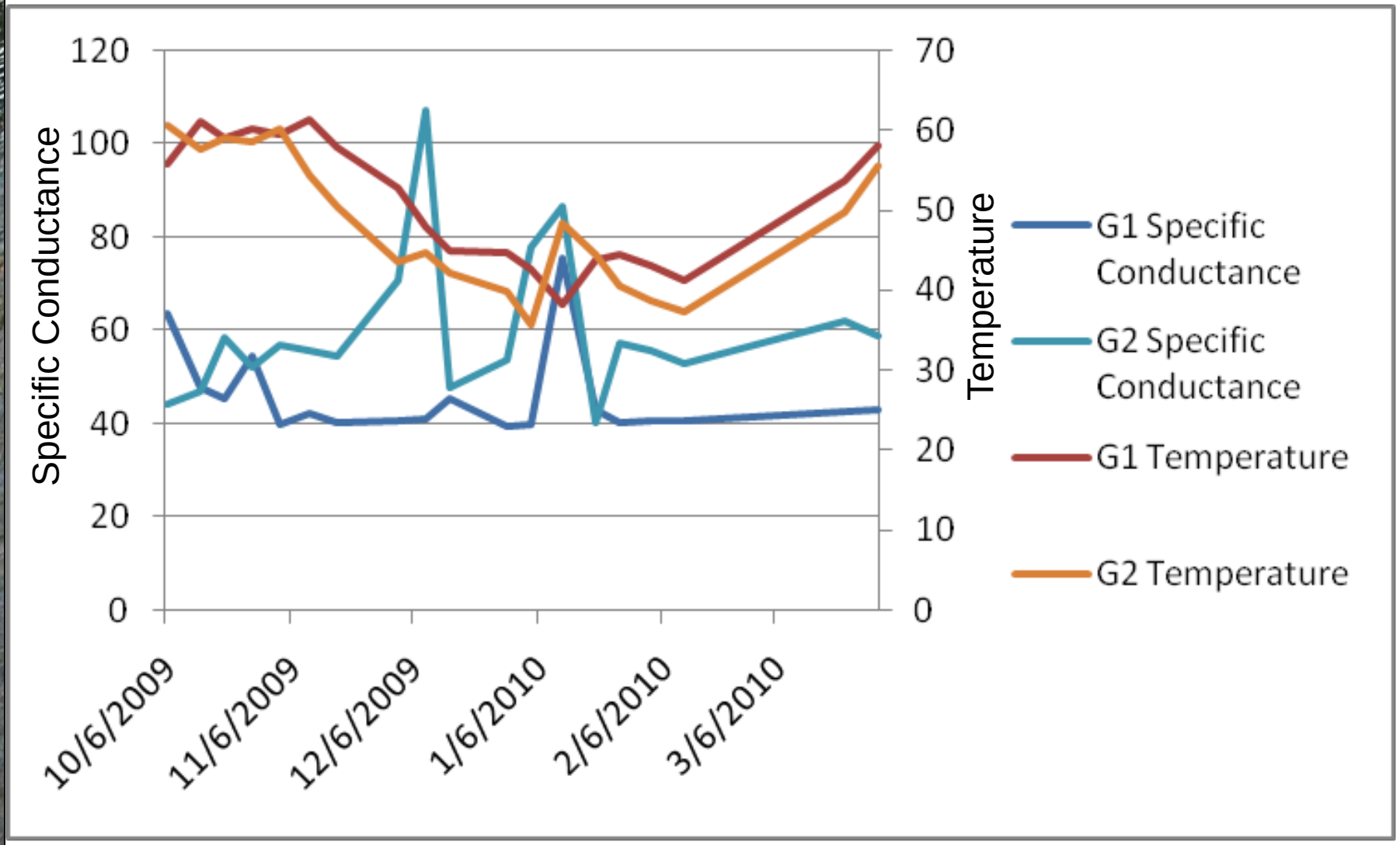
Galla Creek Results
Average Results (mg/L & NTU)



Galla Creek In-situ Results



Galla Creek In-situ Results

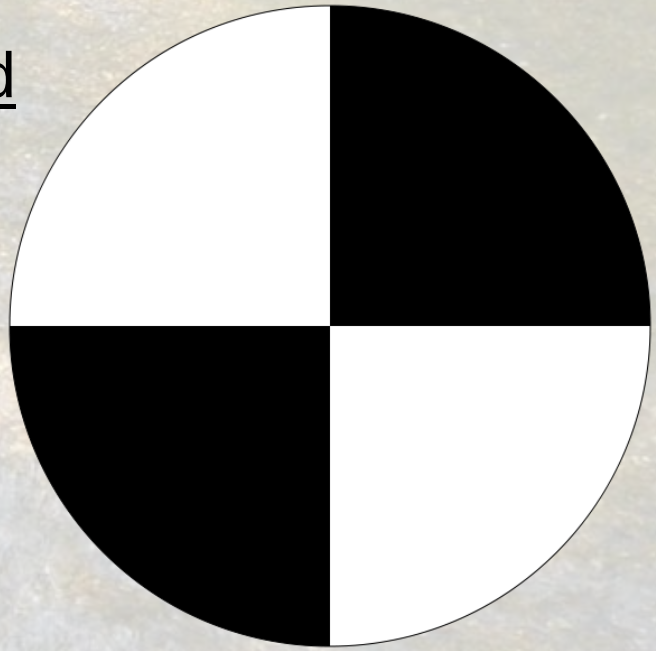


Results

Reg. 2 Turbidity Standard

Base Flow (NTU <21)

- G1 – 96% of samples met standard
- G2 – 75% of samples met standard



Storm Flow (NTU <40)

- G1 – 98% of samples met standard
- G2 – 94% of samples met standard


•L'Anguille River
•Bayou
•Bartholomew

Goals

- To develop an EPA approved **functional tool** to ensure the successful implementation of effective and efficient monitoring. (i.e. Quality Assurance Project Plan)
- To determine **trends** in **parameter concentrations** during the project period at each monitoring station.
- To determine accurate estimations of **parameter loadings**.
- Provide **statistical analysis** to better understand the dynamics of pollutants in the watershed
- **Compare** the estimated parameter **loadings** to the established **TMDL**.
- Prepare **report** with **water quality results**.

Objectives

- To **collect** sufficient amount of water quality **samples** and data to **determine trends** in parameter **concentrations** and to estimate **parameter loadings** at each monitoring station.
- To **validate sampling results** thoroughly against quality assurance and quality control (QAQC) measures

Collected Data

- **Routine samples –** collected every 23 hours, **later composited** into one weekly composite sample
- **Grab samples –** collected once per week
- **Replicate Samples –** 10% of Grab and Composite Samples
- **Blank Samples –** Every site, every sample set

- **YSI 600-OMS Optical Sonde –** turbidity, specific conductance, and water temperature
- **YSI 556 Handheld Sonde –** water temperature, specific conductance, pH, and dissolved oxygen

- **River Stage**
  - USGS, COE and ECO

Laboratory Analyses

Parameter List

- Nitrate + Nitrite-Nitrogen
- Ammonia-Nitrogen
- Total Kjeldahl Nitrogen
- Total Phosphorus
- Total Suspended Solids
- Turbidity

QAQC Samples

Field Blank – Analyte free deionized water transported into the field in a clean container, where it was transferred into a sample container at the site of sampling. From that point, it was treated the same as other samples.

Replicate Sample – During a field operation, two samples were obtained simultaneously from the water body being sampled. One sample was designated by the appropriate sample number while the other used the same number followed by “REP”.

Split Sample – Two aliquots from one sample bottle were analyzed for each set of samples. This sample was designated with “Split” following the sample number.

Spiked Sample – An addition of a standard to one sample per set of samples was made which increases the concentration of the analyte by a set amount.

Split Spike Sample – For some parameters, it is advantageous to use the spike sample for the sample which is to be split. For such parameters, two spiked samples were prepared; one was indicated with an “S” and the other with an “SS” indicating a split spike.

Loading Requirements

Load - the mass of pollutant that passes a sampling station over a specific period of time (Hedlin *et al*, 2006)

Due to the dynamic nature of rivers, accurate estimation of parameter loads should be conducted with high frequency sampling and continual discharge measurements.

Two Essentials – Sample Concentration and Discharge Data

Often the number samples that are collected and analyzed is dictated by budgets.

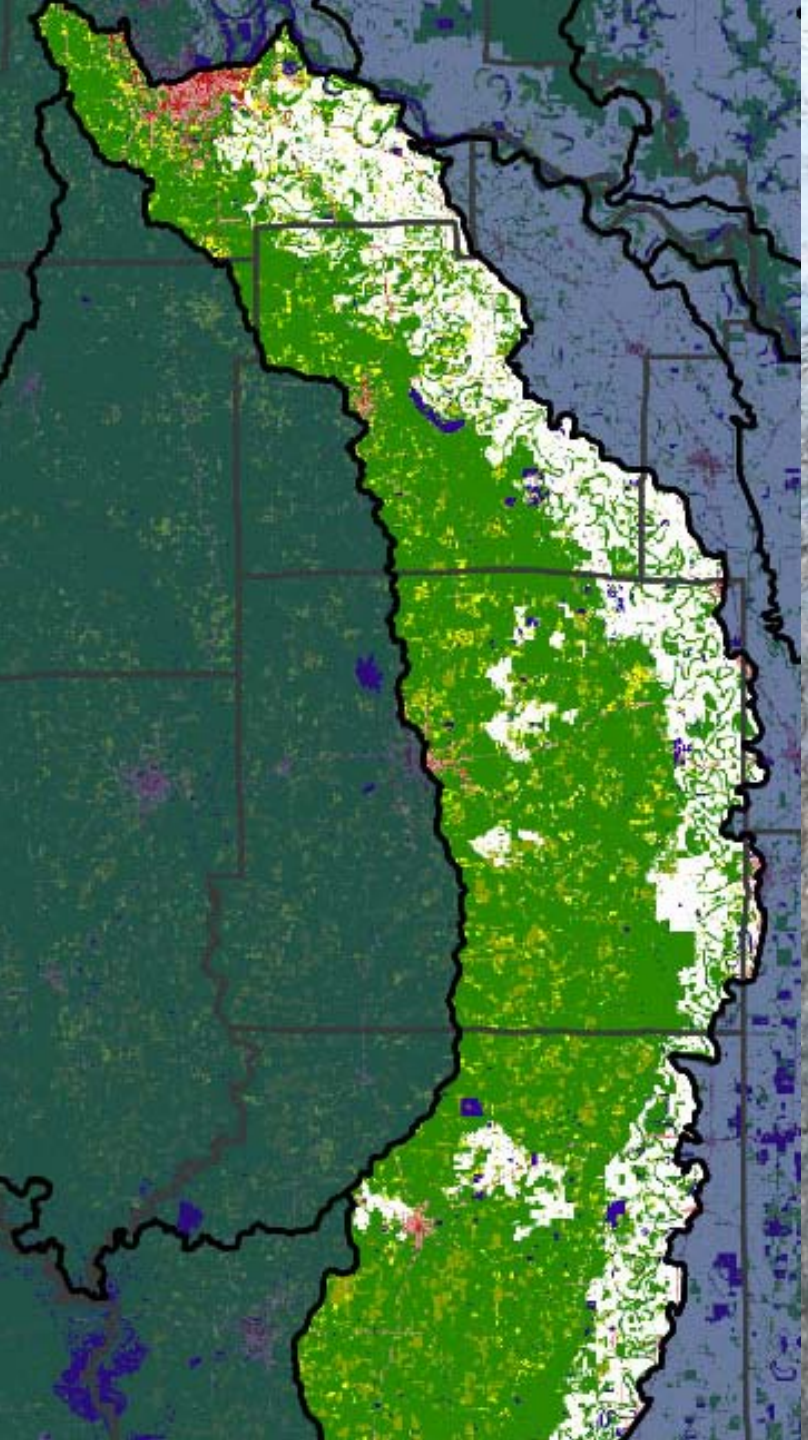
Collecting continuous discharge data is much easier and more affordable then collecting continuous parameter concentration data

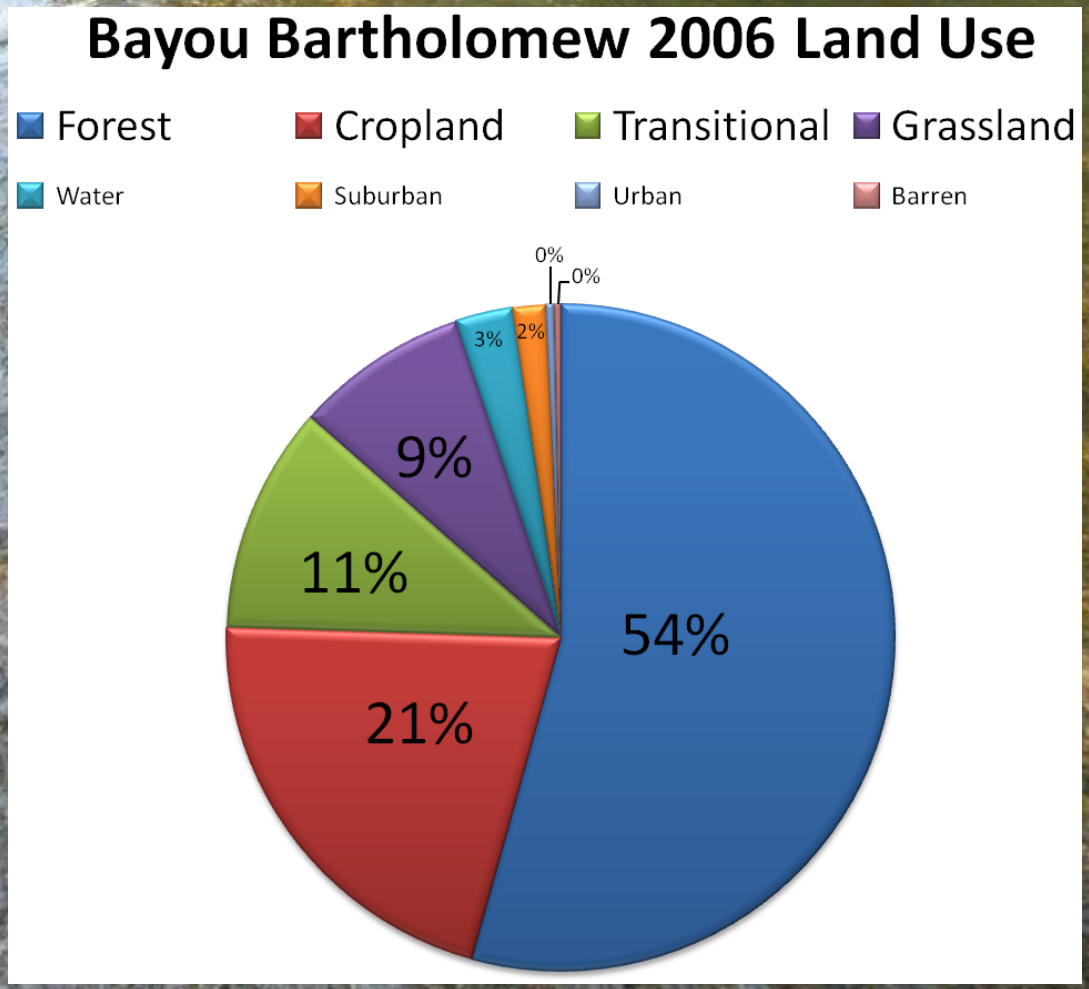
Loading Methodology

Period–weighted method

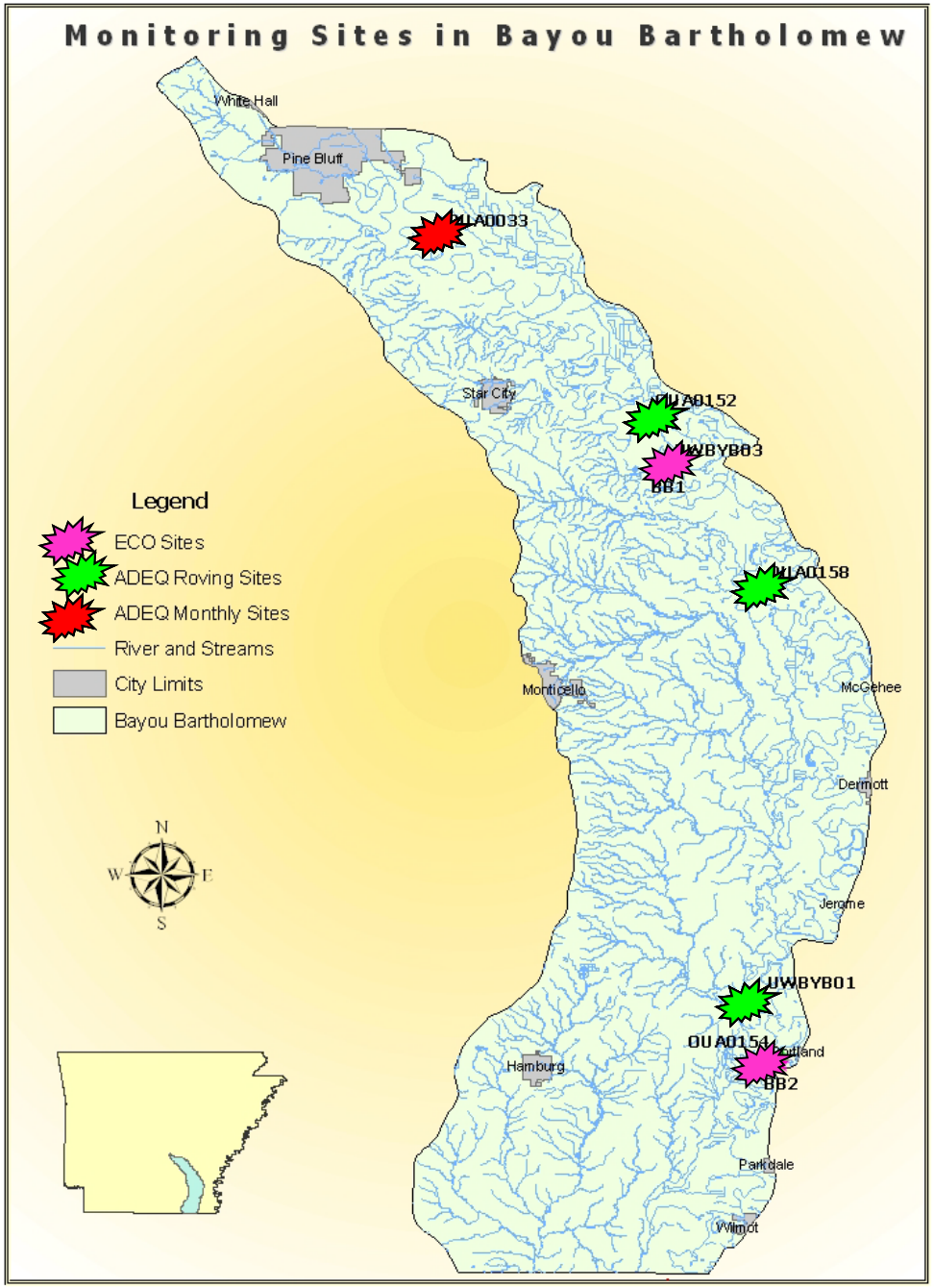
- Apply mass integration to datasets that have continuous discharge but do not have continuous concentration data.
- Assumptions must be made about unknown concentrations in between collected water samples and measured concentrations.
- Measured concentrations are assumed to represent a period around which the sample was collected.
- The product of concentration and discharge is summed through time to determine load.

Introduction





Source: Arkansaswater.org


Monitoring Sites in Bayou Bartholomew
White Hall
Pine Bluff
UUA0033
Star City
UUA0152
UWBYB03
BB1
UUA0158
Monticello
McGehee
Dermott
Jerome
UWBYB01
OUA0154
Hamburg
Eudora
BB2
Parkdale
Wilmot
Legend
ECO Sites
ADEQ Roving Sites
ADEQ Monthly Sites
River and Streams
City Limits
Bayou Bartholomew
N
W
E
S

Bayou Bartholomew Mean Sample Concentrations

Samples Mean Concentrations (Composite and Grab)				
Parameter	**BB-1 (Composite) (Mean)**	**BB-1 (Grab) (Mean)**	**BB-2 (Composite) (Mean)**	**BB-2 (Grab) (Mean)**
TP (mg/l)	0.31	0.27	0.29	0.29
TKN (mg/l)	0.89	0.78	0.80	0.80
TSS (mg/l)	29.00	29.09	24.95	25.51
NH_3-N(mg/l)	0.09	0.07	0.07	0.06
Turbidity (NTU)(Lab)	64.73	57.54	59.91	56.87

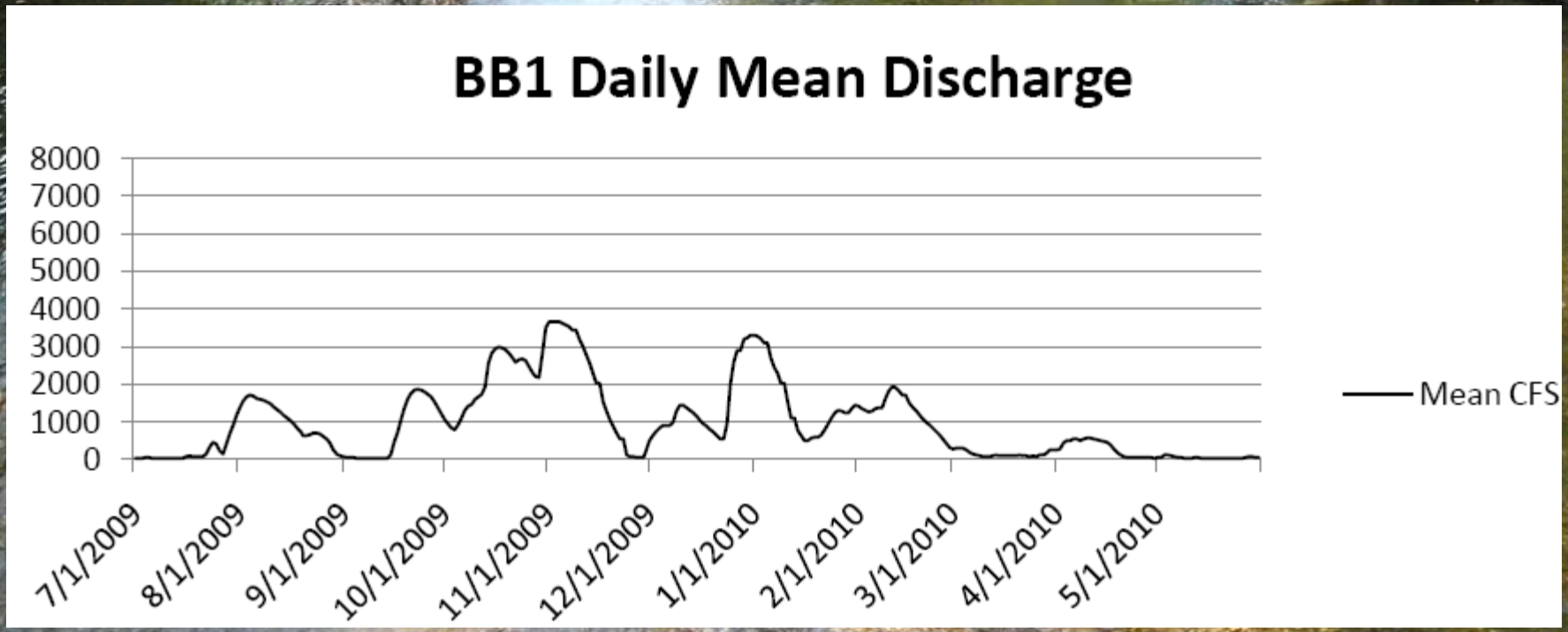
BB 1

Garrett Bridge, Arkansas

Located near Dumas, AR off Hwy 54; Lincoln County, Arkansas

Latitude 33°51'59", Longitude 91°39'22" NAD27

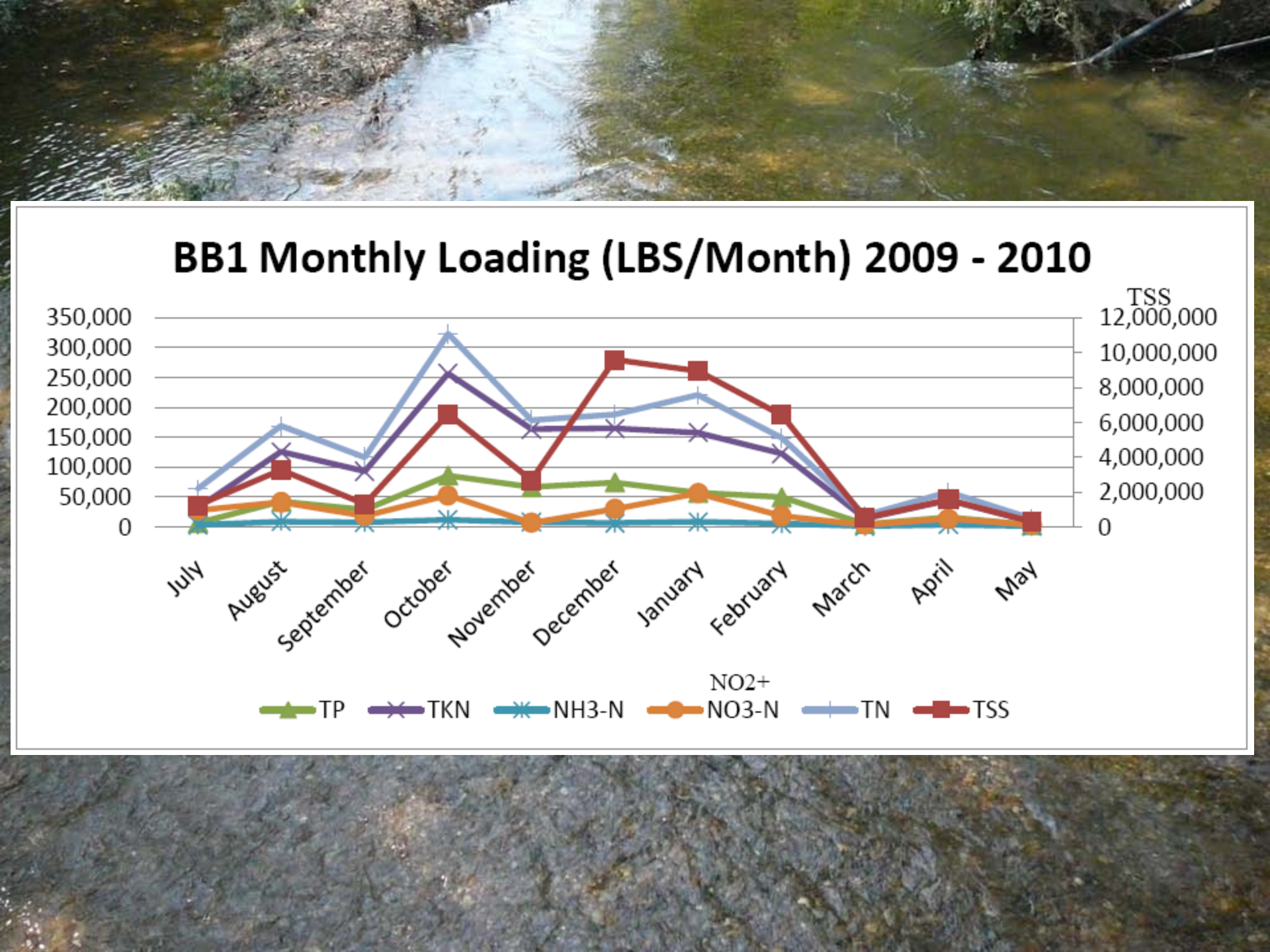
Hydrologic Unit 08040205-013

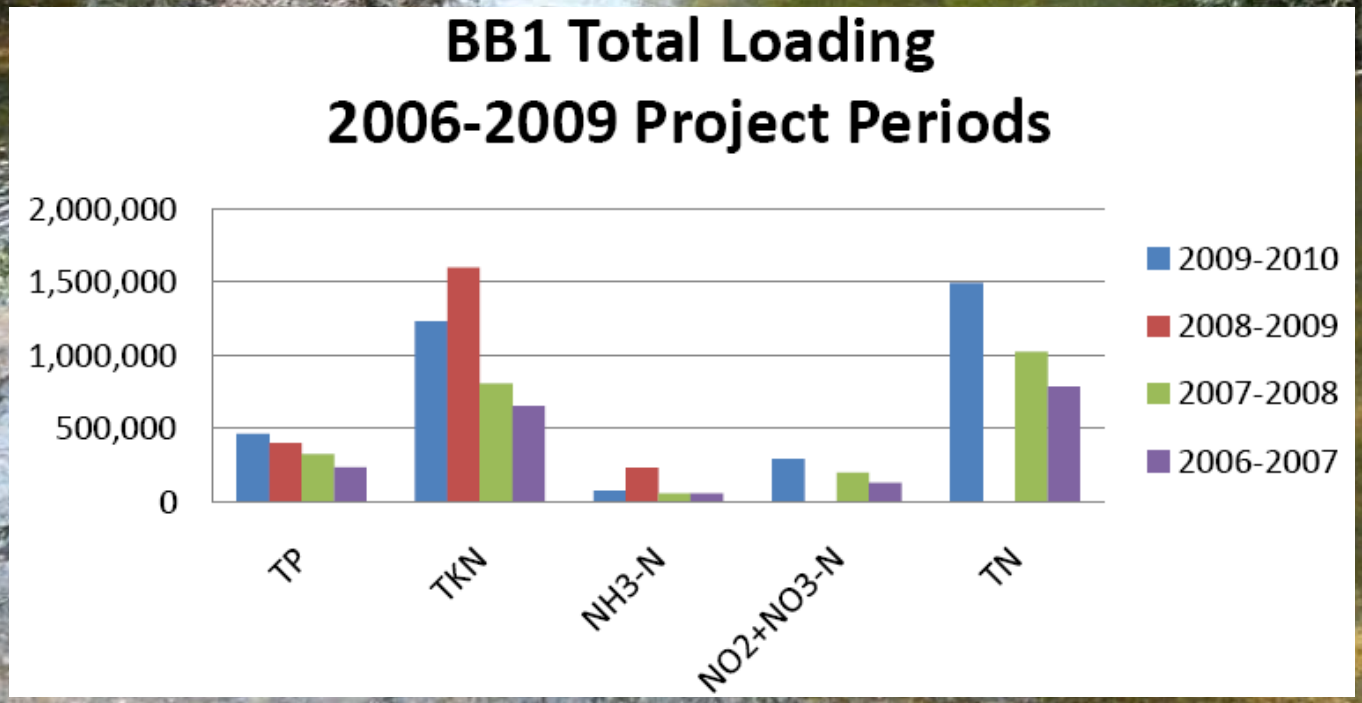


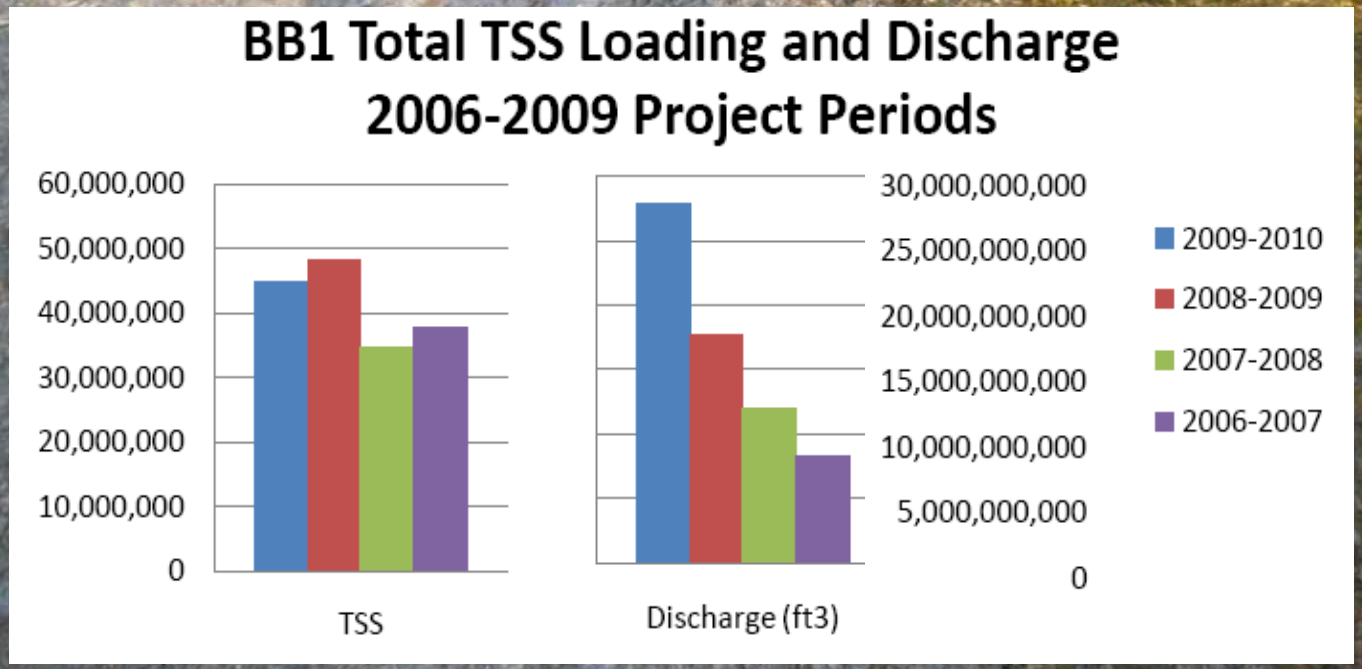
Discharge Statistics BB1		
	Cubic Feet per Day	Date
Max Daily Discharge	317,000,000	11/03/2009
Minimum Daily Discharge	1,640,000	07/01/2009
Average Daily Discharge	83,200,000	07/01/2009-05/31/2010
Total Discharge	27,900,000,600	07/01/2009-05/31/2010

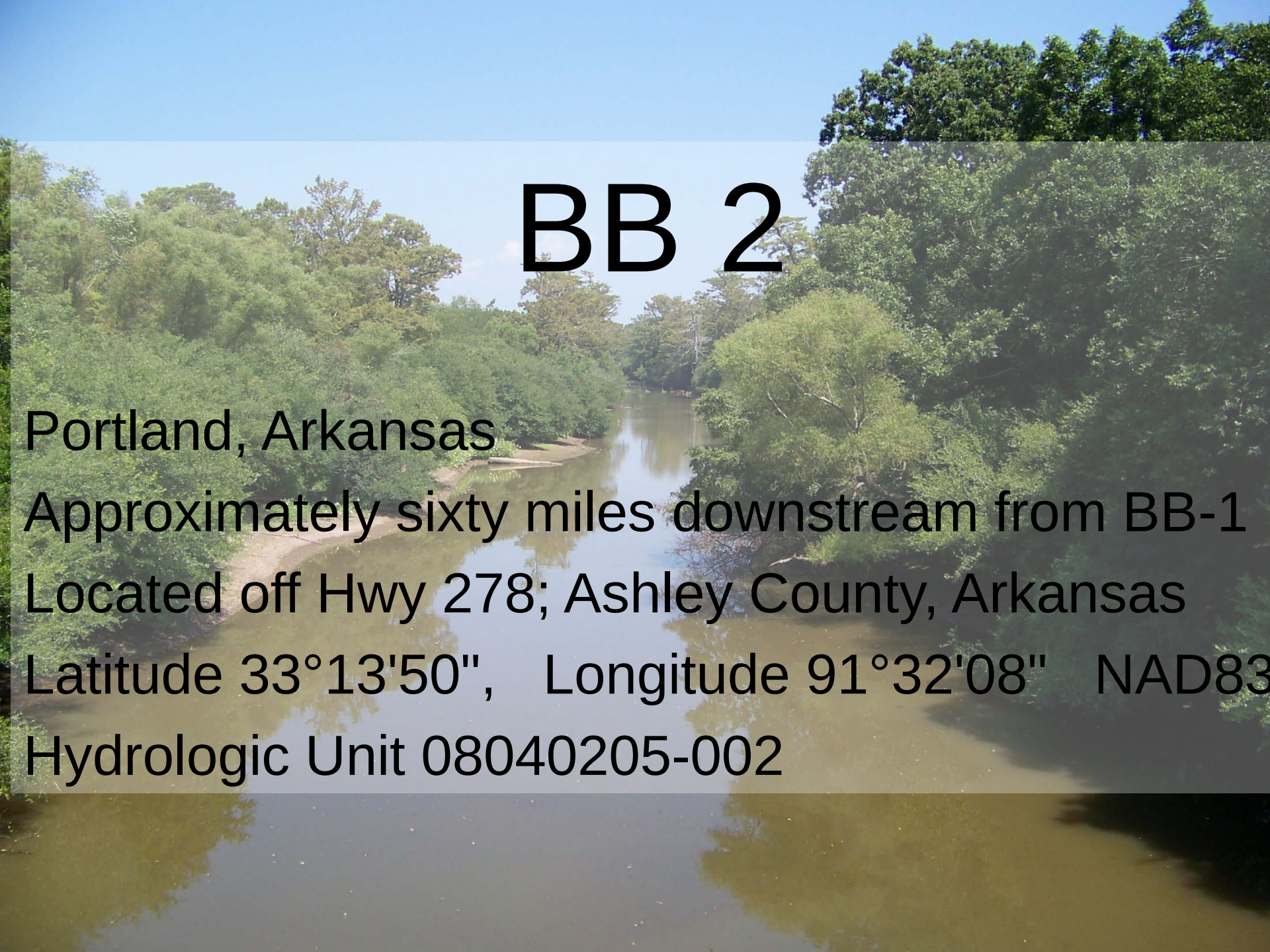
Monthly Loading at BB1

Monthly Loading at BB1 2009 – 2010							
Month	Cubic Feet per Month	TSS LBS/Month	TP LBS/Month	TKN LBS/Month	NH3-N LBS/Month	NO_2+NO_3-N LBS/Month	TN LBS/Month
July	493,000,000	1,250,000	7,260	31,800	3,800	28,200	60,200
August	2,620,000,000	3,260,000	42,300	126,000	9,500	41,800	167,000
September	1,930,000,000	1,310,000	28,700	93,500	7,870	18,700	110,000
October	5,460,000,000	6,490,000	86,200	257,000	12,200	53,100	317,000
November	4,640,000,000	2,690,000	66,800	164,000	8,470	7,400	182,000
December	3,660,000,000	9,590,000	74,800	165,000	6,420	30,400	186,000
January	3,860,000,000	8,940,000	57,300	158,000	8,820	56,800	228,000
February	2,910,000,000	6,430,000	49,900	123,000	5,380	18,600	153,000
March	359,000,000	539,000	5,300	14,700	1,120	3,940	19,200
April	771,000,000	1,580,000	16,300	45,300	3,900	14,000	56,400
May	131,000,000	321,000	3,570	9,320	1,200	3,970	13,800
Total	27,900,000,000	44,900,000	459,000	1,230,000	70,900	288,000	1,490,000


BB1 Monthly Loading (LBS/Month) 2009 - 2010
TSS
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
July
August
September
October
November
December
January
February
March
April
May
TP
TKN
NH3-N
NO2+ NO3-N
TN
TSS


BB1 Total Loading
2006-2009 Project Periods
2,000,000
1,500,000
1,000,000
500,000
0
TP
TKN
NH3-N
NO2+NO3-N
TN
2009-2010
2008-2009
2007-2008
2006-2007


BB1 Total TSS Loading and Discharge
2006-2009 Project Periods
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
TSS
30,000,000,000
25,000,000,000
20,000,000,000
15,000,000,000
10,000,000,000
5,000,000,000
0
Discharge (ft3)
2009-2010
2008-2009
2007-2008
2006-2007



BB 2

Portland, Arkansas

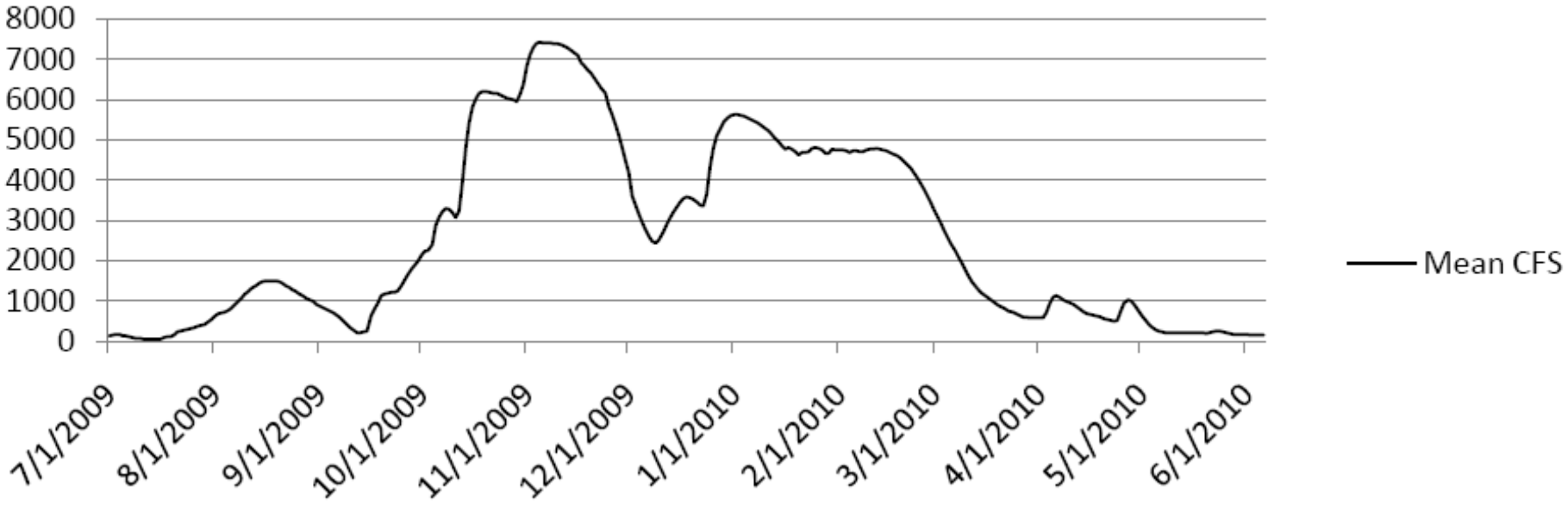
Approximately sixty miles downstream from BB-1

Located off Hwy 278; Ashley County, Arkansas

Latitude 33°13'50", Longitude 91°32'08" NAD83

Hydrologic Unit 08040205-002

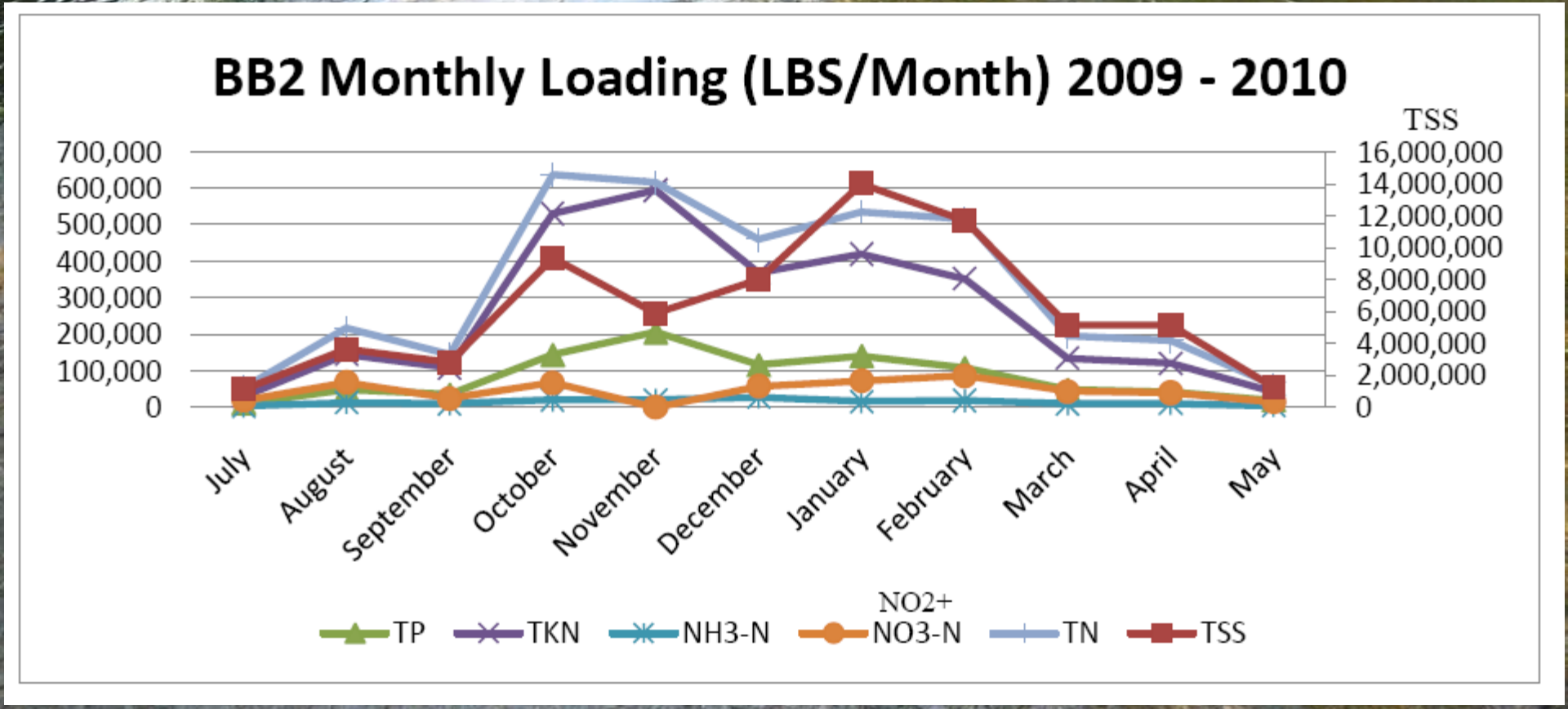
BB 2 Daily Mean Discharge



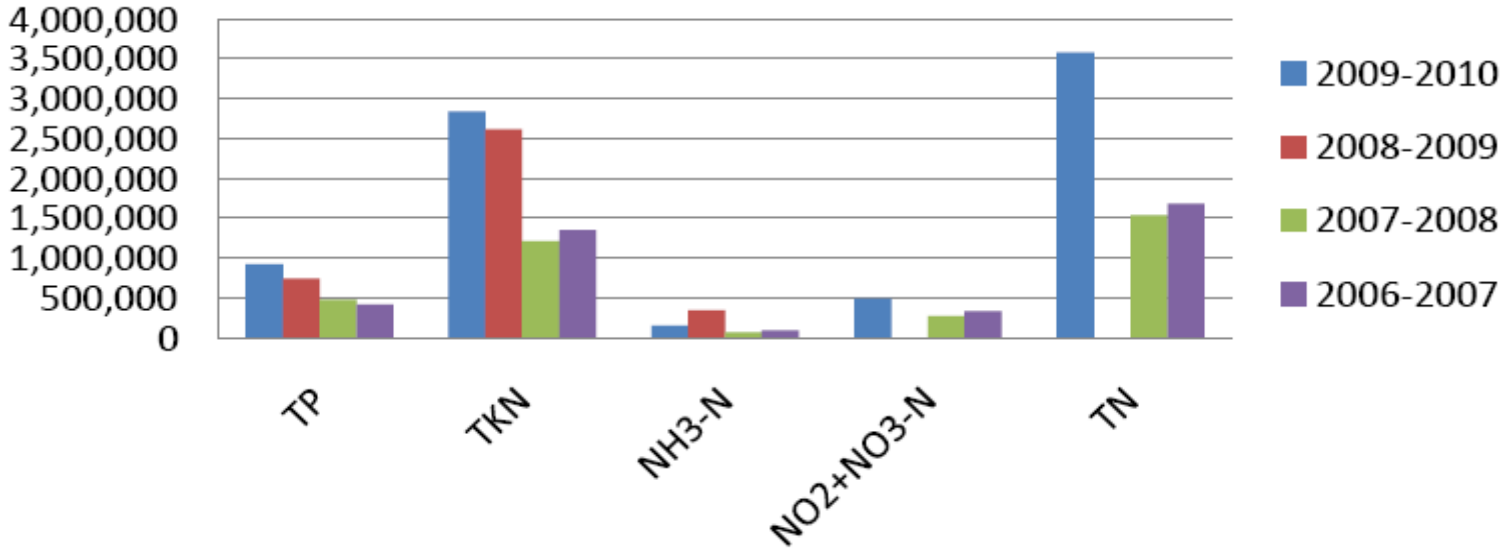
Discharge Statistics BB2		
	Cubic Feet per Day	Date
Max Daily Discharge	640,000,000	11/05/2009
Minimum Daily Discharge	2,760,000	07/14/2009
Average Daily Discharge	228,000,000	07/01/2009-05/31/2010
Total Discharge	76,300,000,000	07/01/2009-05/31/2010

Monthly Loading at BB2

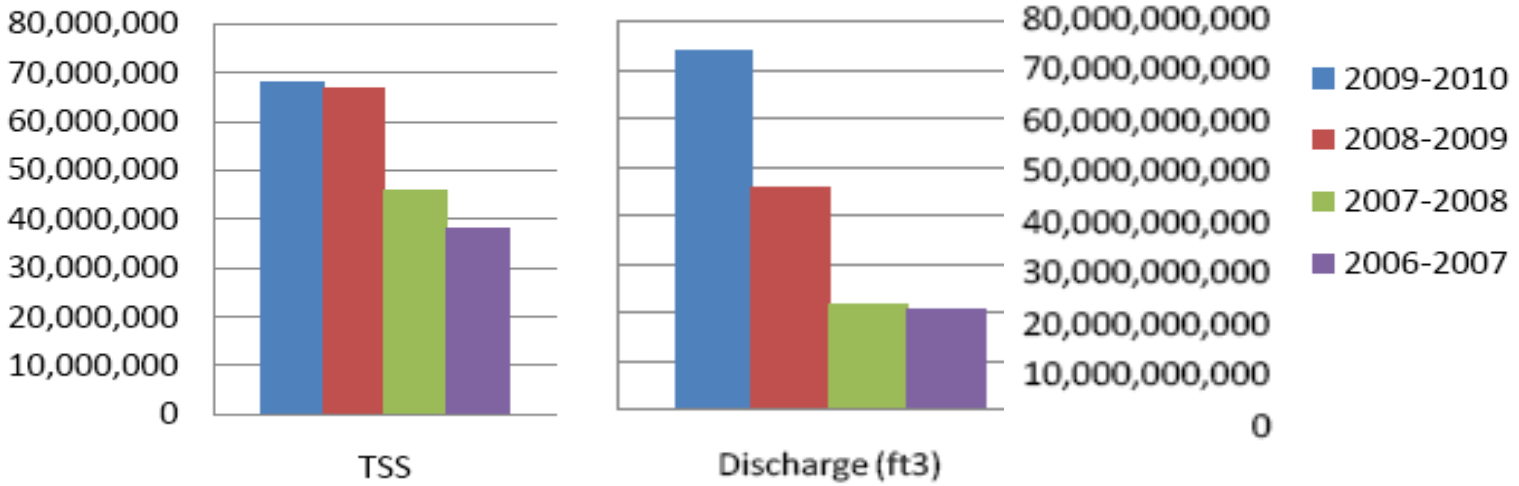
Monthly Loading at BB2 2009 – 2010							
Month	Cubic Feet per Month	TSS LBS/Month	TP LBS/Month	TKN LBS/Month	NH3-N LBS/Month	NO_2+NO_3-N LBS/Month	TN LBS/Month
July	475,000,000	1,110,000	10,800	30,000	3,120	19,300	51,000
August	3,020,000,000	3,640,000	48,000	145,000	12,300	67,800	215,000
September	2,270,000,000	2,800,000	34,600	107,000	9,740	24,200	142,000
October	12,400,000,000	9,360,000	144,000	531,000	20,400	67,000	628,000
November	16,700,000,000	5,870,000	206,000	595,000	20,300	lower than detectable limits	NA
December	9,360,000,000	8,000,000	116,000	368,000	27,900	57,700	450,000
January	13,000,000,000	14,000,000	141,000	420,000	15,900	72,500	536,000
February	10,400,000,000	11,700,000	108,000	352,000	18,500	86,400	512,000
March	3,550,000,000	5,160,000	47,600	134,000	8,920	43,100	197,000
April	1,970,000,000	5,140,000	42,400	120,000	10,000	39,800	175,000
May	595,000,000	1,240,000	19,400	41,100	4,100	14,900	61,400
Total	73,700,000,000	68,000,000	918,000	2,840,000	151,000	493,000	3,580,000

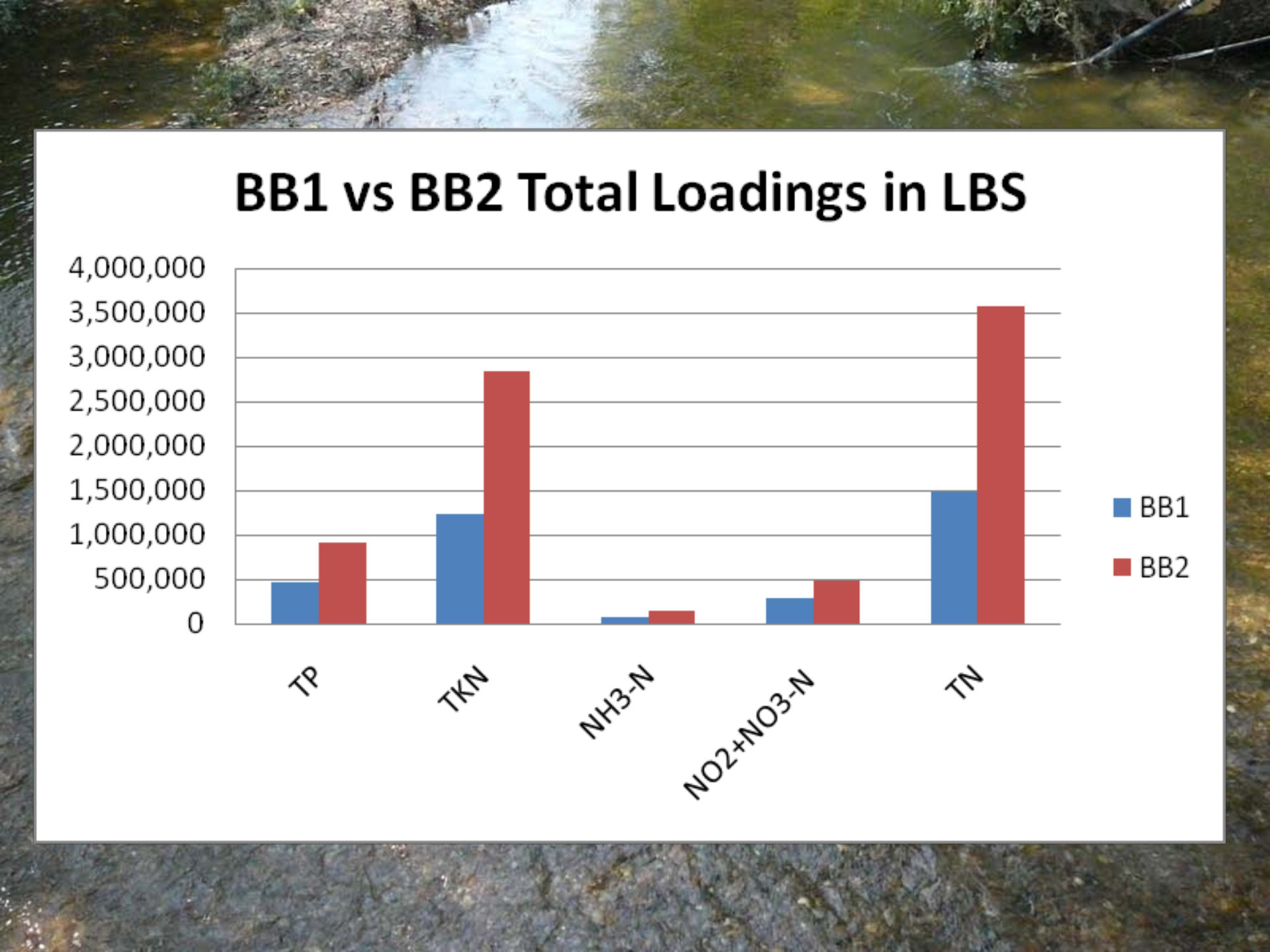

BB2 Monthly Loading (LBS/Month) 2009 - 2010
TSS
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
July
August
September
October
November
December
January
February
March
April
May
TP
TKN
NH3-N
NO2+ NO3-N
TN
TSS

BB2 Total Loading
2006-2009 Project Periods



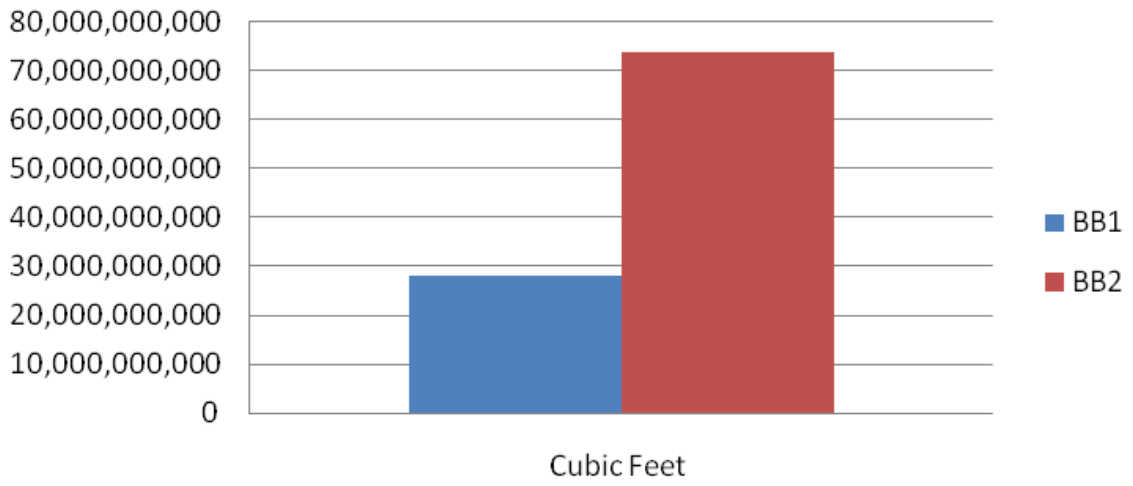
BB2 Total TSS Loading and Discharge
2006-2009 Project Periods




BB1 vs BB2 Total Loadings in LBS
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
TP
TKN
NH3-N
NO2+NO3-N
TN
BB1
BB2

BB1 vs BB2 Annual TSS Loadings in LBS

BB1 vs BB2 Total Discharge



Results
Bayou Bartholomew

Exceeding TMDL for TSS

BB1 – 82% of time

3,496 lbs/day (July-Nov)

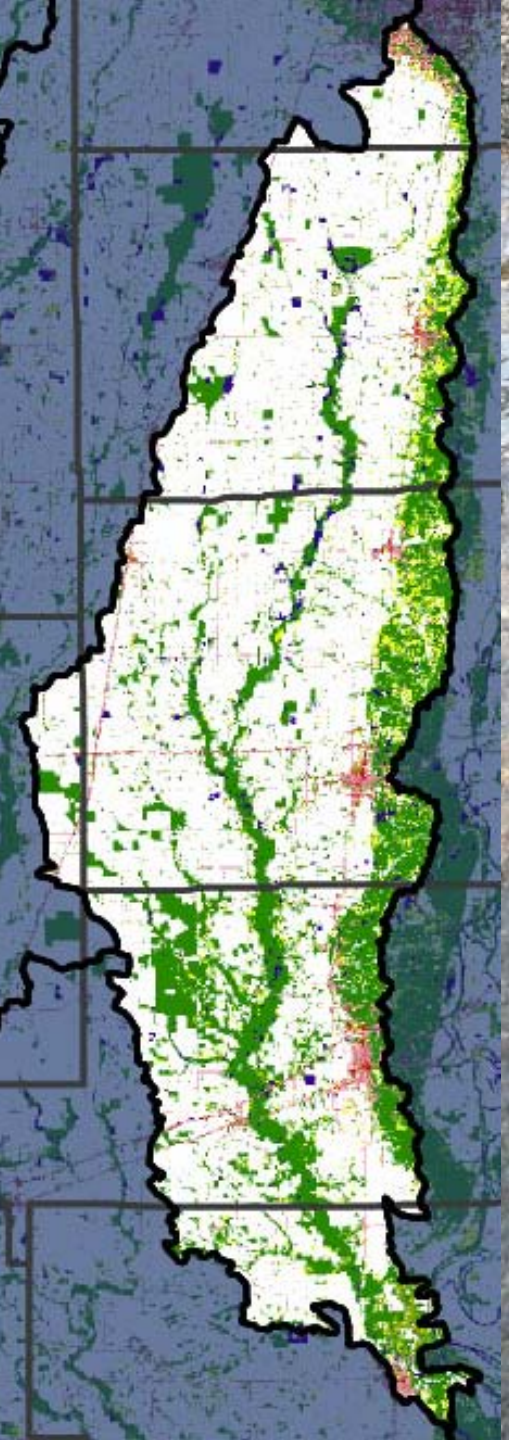
14,478 lbs/day (Dec-June).

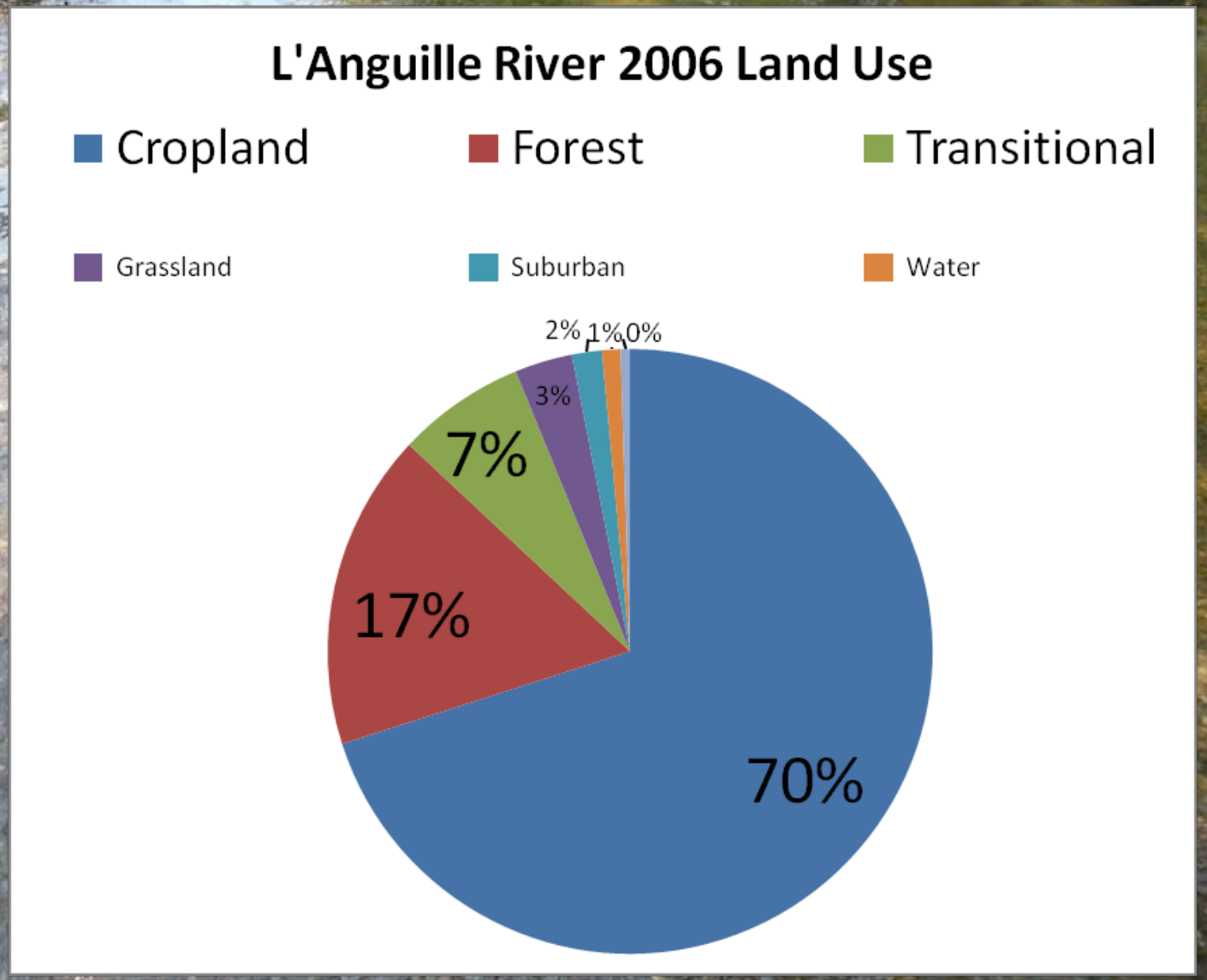
BB2 – 91% of time

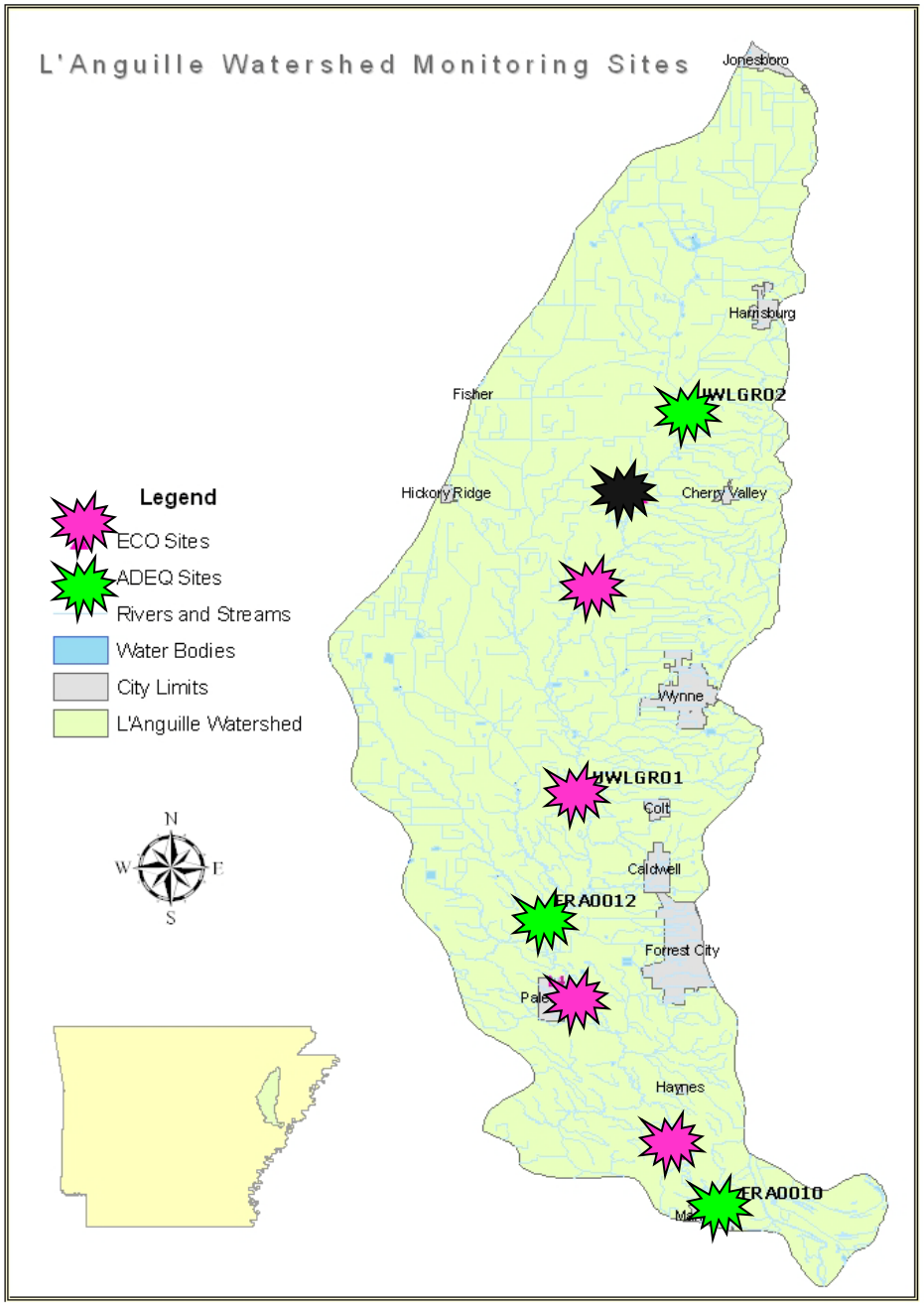
30,629 lbs/day (July-Nov)

66,836 lbs/day (Dec-June).

Introduction



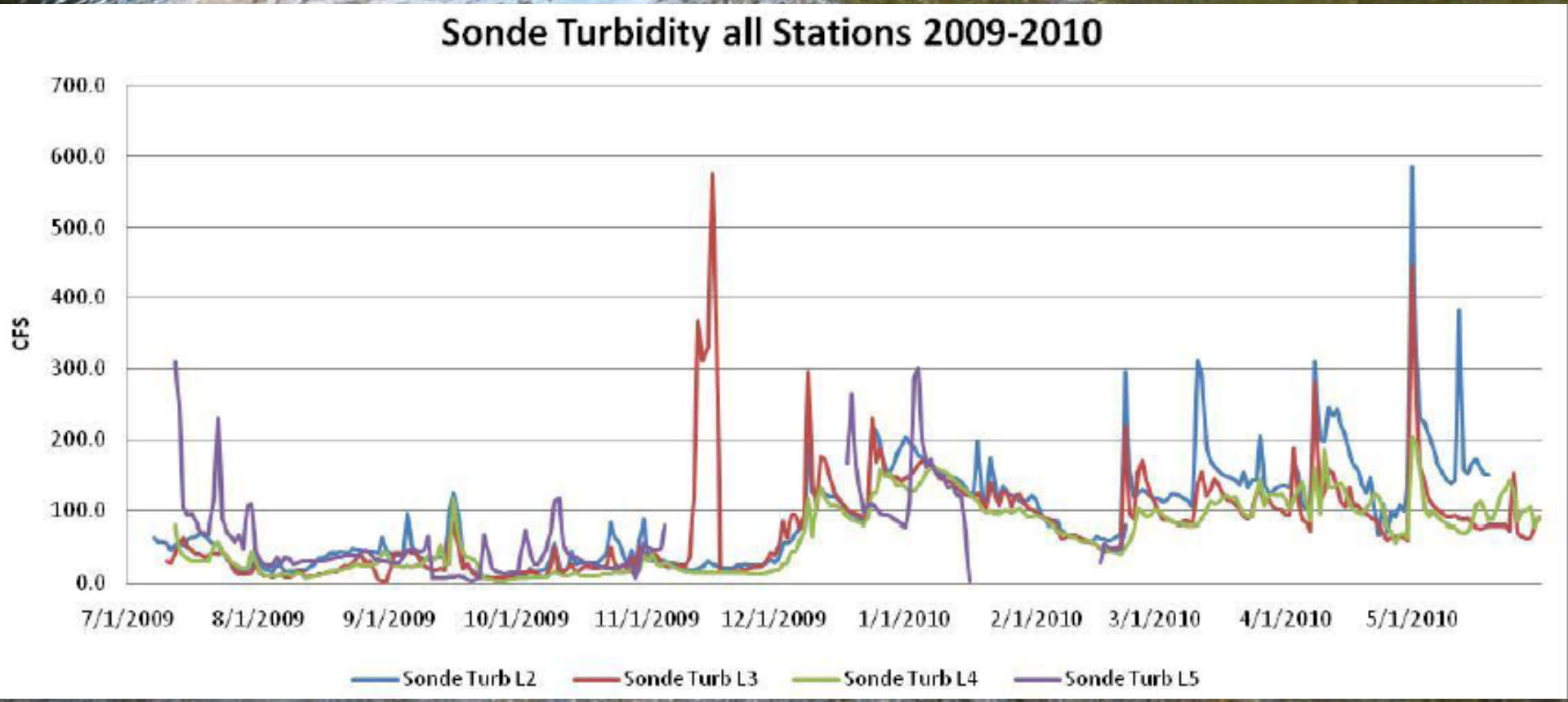

L'Anguille River 2006 Land Use
Cropland
Forest
Transitional
Grassland
Suburban
Water
2%
1%
0%
3%
7%
17%
70%


L'Anguille Watershed Monitoring Sites
Jonesboro
Harrisburg
Fisher
HWLGR02
Hickory Ridge
Cherry Valley
Wynne
HWLGR01
Colt
Caldwell
ERA0012
Forrest City
Palestine
Haynes
ERA0010
Legend
ECO Sites
ADEQ Sites
Rivers and Streams
Water Bodies
City Limits
L'Anguille Watershed
N
W
E
S

L'Anguille Mean Sample Concentrations

Samples Mean Concentrations (Composite and Grab)								
Parameter	**L2 (Composite) (Mean)**	**L2 (Grab) (Mean)**	**L3 (Composite) (Mean)**	**L3 (Grab) (Mean)**	**L4 (Composite) (Mean)**	**L4 (Grab) (Mean)**	**L5 (Composite) (Mean)**	**L5 (Grab) (Mean)**
TP (mg/l)	0.46	0.37	0.33	0.3	0.29	0.27	0.57	0.37
TKN (mg/l)	1.31	1.07	0.99	0.94	0.87	0.86	1.13	0.94
TSS (mg/l)	104	74.6	46	49.8	36.4	35	120	71.8
NH_3-N(mg/l)	0.13	0.11	0.1	0.09	0.07	0.06	0.09	0.07
Turbidity (NTU) (Lab)	118	86.4	73.9	67.8	60.7	56.6	127	90.2
NO_2 + NO_3 -N (mg/l)	NA	1.06	NA	0.23	NA	0.18	NA	0.23

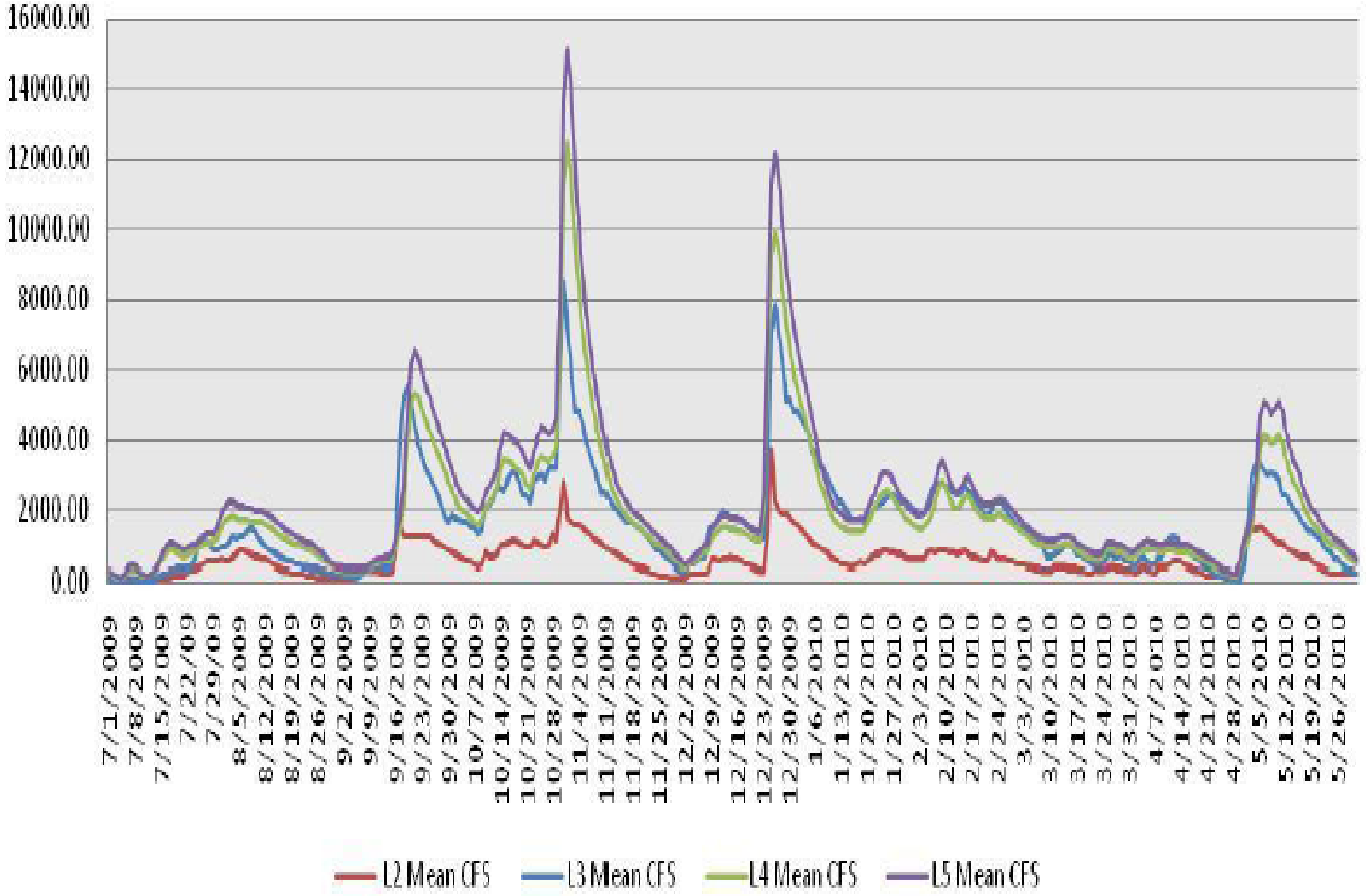
Sonde Turbidity



Stage Rating Curves

Regression Results				
Station	Best Fit Regression Model	Correlation Coefficient	R^2 Value	Equation
L2	Double Reciprocal	0.9947	98.95%	Q = 1/(-0.00274893 + 0.0375646/HOBO)
L3	Exponential	0.9594	93.89%	Q = exp(2.91691 + 0.303464*HOBO)
L5	Exponential	0.9868	92.04%	Estimated Q = exp(4.03551 + 0.33315*Hobo)

Hydrograph at all Stations

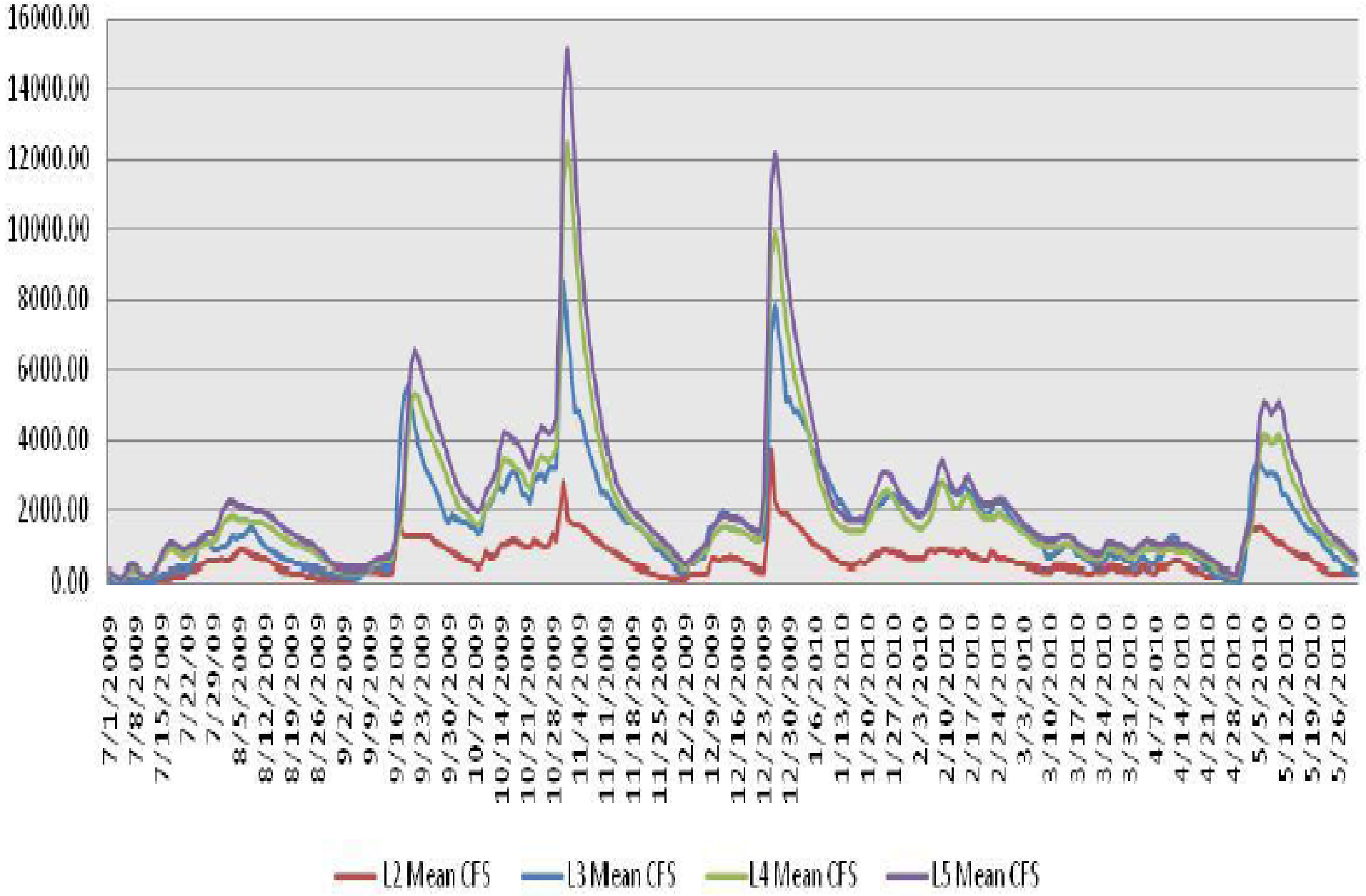



L2
Highway 364 near Vanndale, Arkansas
Reach Five of the L’Anguille River
Latitude 35°19'32.00"N
Longitude 90°51'41.09"W

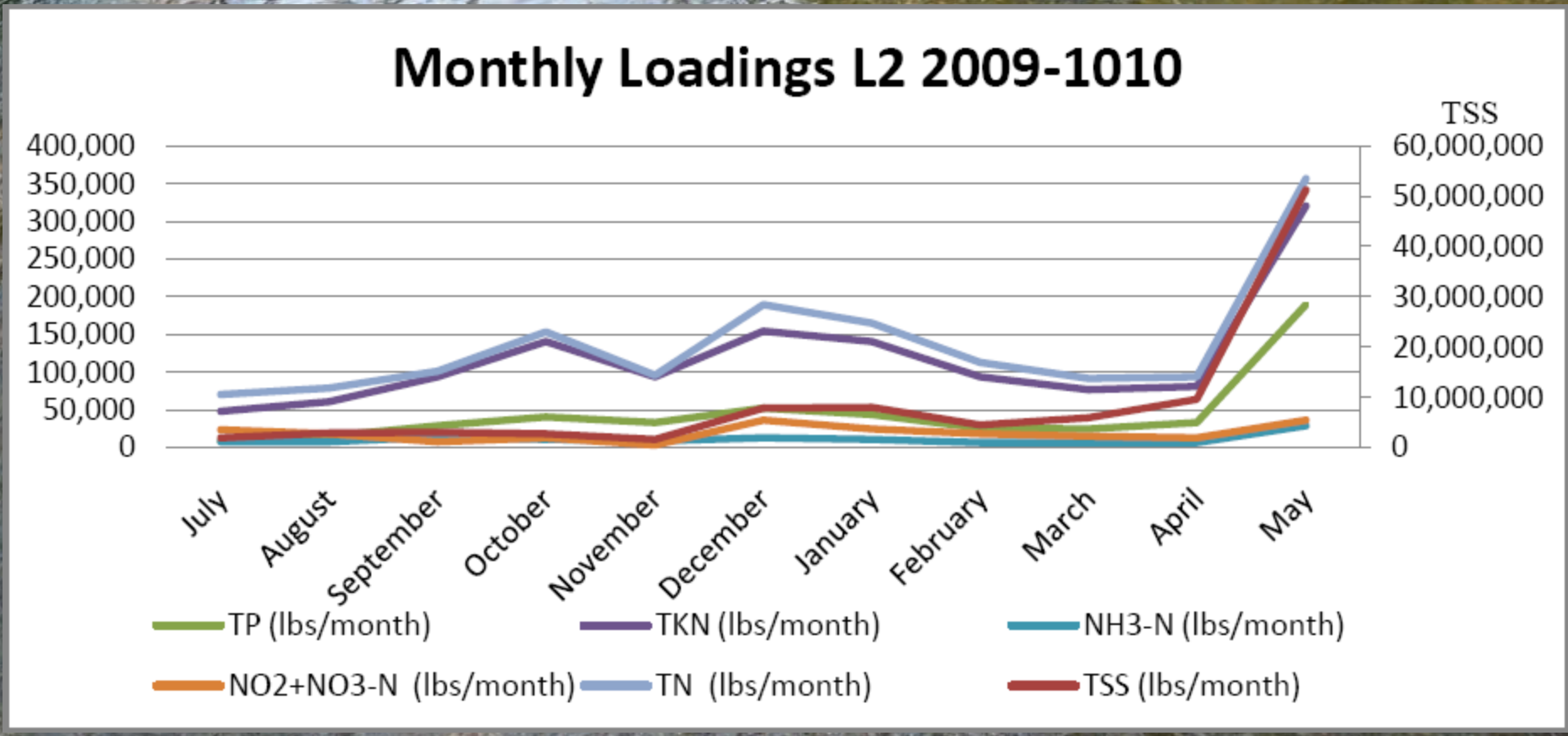
Monthly Loading L2

Monthly Loading at L2 2009 – 2010							
Month	Cubic Feet per Month	TSS	TP	TKN	NH_3-N	NO_2+NO_3-N	TN
		LB/Month	LB/Month	LB/Month	LB/Month	LB/Month	LB/Month
July	574,000,000	1,890,000	9,040	47,700	7,120	23,100	62,300
Aug.	1,120,000,000	2,890,000	15,000	61,000	8,000	17,800	72,000
Sept.	1,820,000,000	3,080,000	29,100	94,000	14,200	7,690	94,500
Oct.	2,600,000,000	2,710,000	40,100	140,000	10,600	13,400	148,000
Nov.	1,960,000,000	1,630,000	33,000	93,200	8,480	2,950	96,300
Dec.	2,250,000,000	7,910,000	51,700	154,000	13,100	35,900	184,000
Jan.	2,100,000,000	8,050,000	44,100	140,000	11,000	25,000	162,000
Feb.	1,730,000,000	4,530,000	26,100	94,200	6,120	18,500	120,000
Mar.	964,000,000	5,960,000	24,900	77,200	6,410	14,700	92,200
Apr.	784,000,000	9,510,000	33,100	80,800	6,600	12,500	84,800
May	2,040,000,000	51,200,000	189,000	320,000	29,300	36,600	208,000

Hydrograph at all Stations



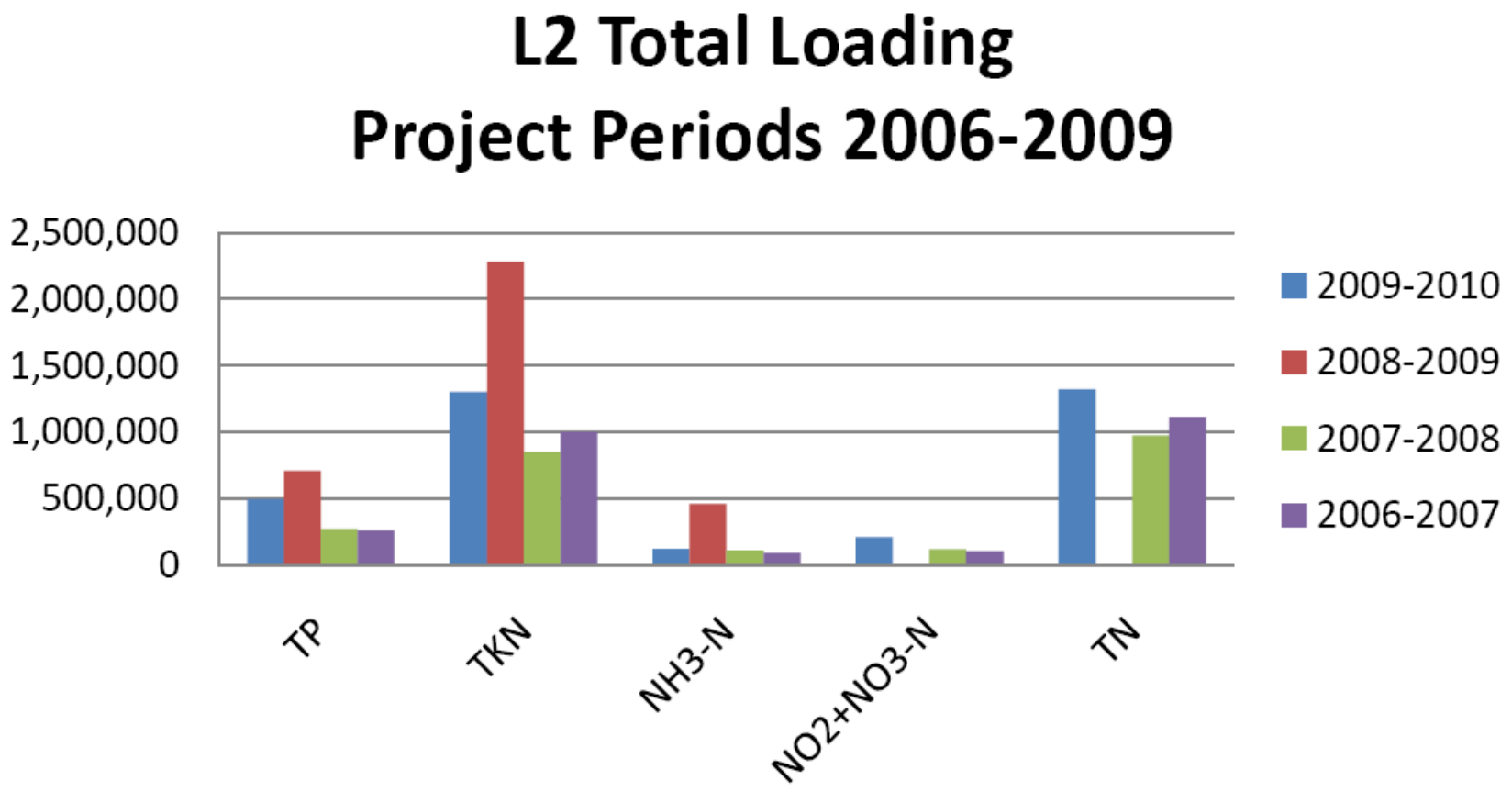
Monthly Loading L2

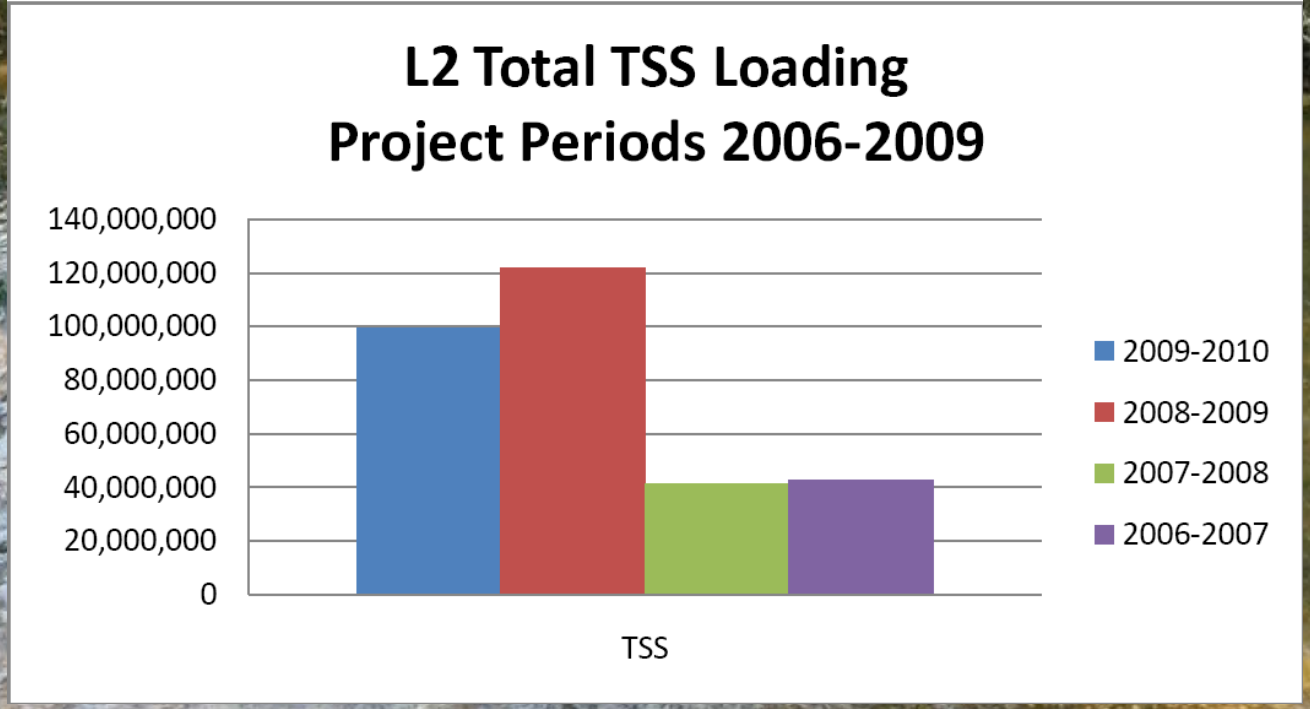


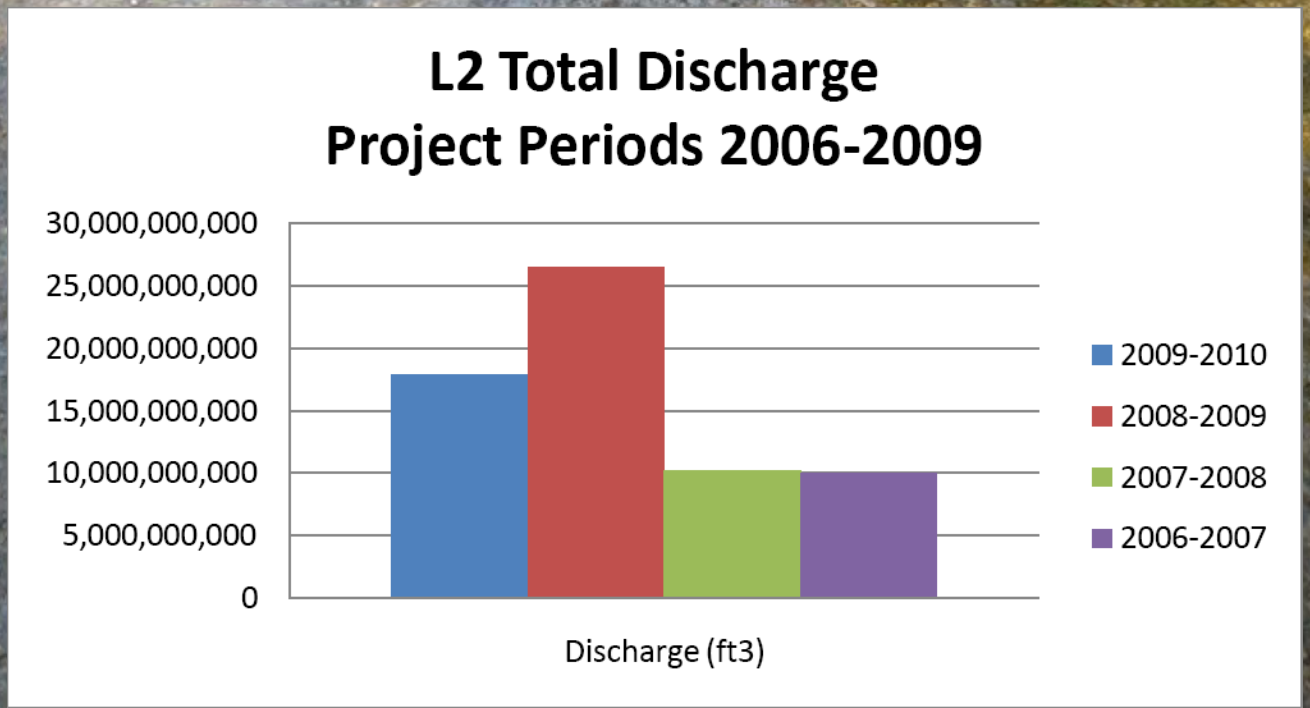
Annual Loading L2

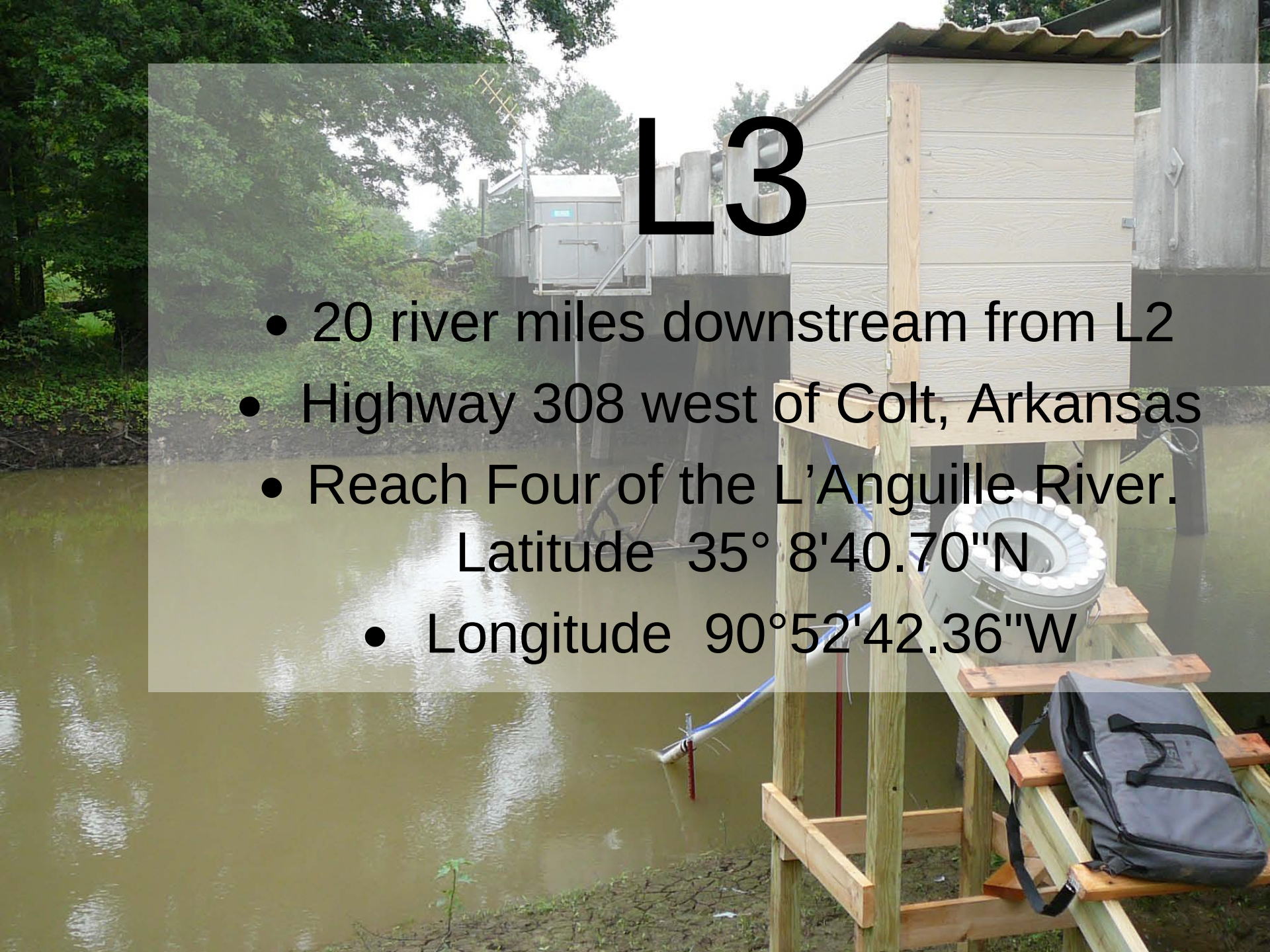
Loading at L2				
Parameter lb/yr*	**2009-2010**	**2008-2009**	**2007-2008**	**2006-2007**
TP	495,000	708,000	271,000	258,000
TKN	1,300,000	2,280,000	852,000	1,000,000
TSS	99,400,000	122,000,000	41,400,000	42,400,000
NH_3-N	121,000	463,000	107,000	94,000
NO_2+NO_3-N	208,000	NA	119,000	105,000
TN	1,320,000	NA	973,000	1,110,000
Discharge (ft^3)	17,900,000,000	26,500,000,000	10,200,000,000	9,990,000,000

Annual Loading L2




L2 Total TSS Loading
Project Periods 2006-2009
140,000,000
120,000,000
100,000,000
80,000,000
60,000,000
40,000,000
20,000,000
0
TSS
2009-2010
2008-2009
2007-2008
2006-2007


L2 Total Discharge
Project Periods 2006-2009
30,000,000,000
25,000,000,000
20,000,000,000
15,000,000,000
10,000,000,000
5,000,000,000
0
Discharge (ft3)
2009-2010
2008-2009
2007-2008
2006-2007



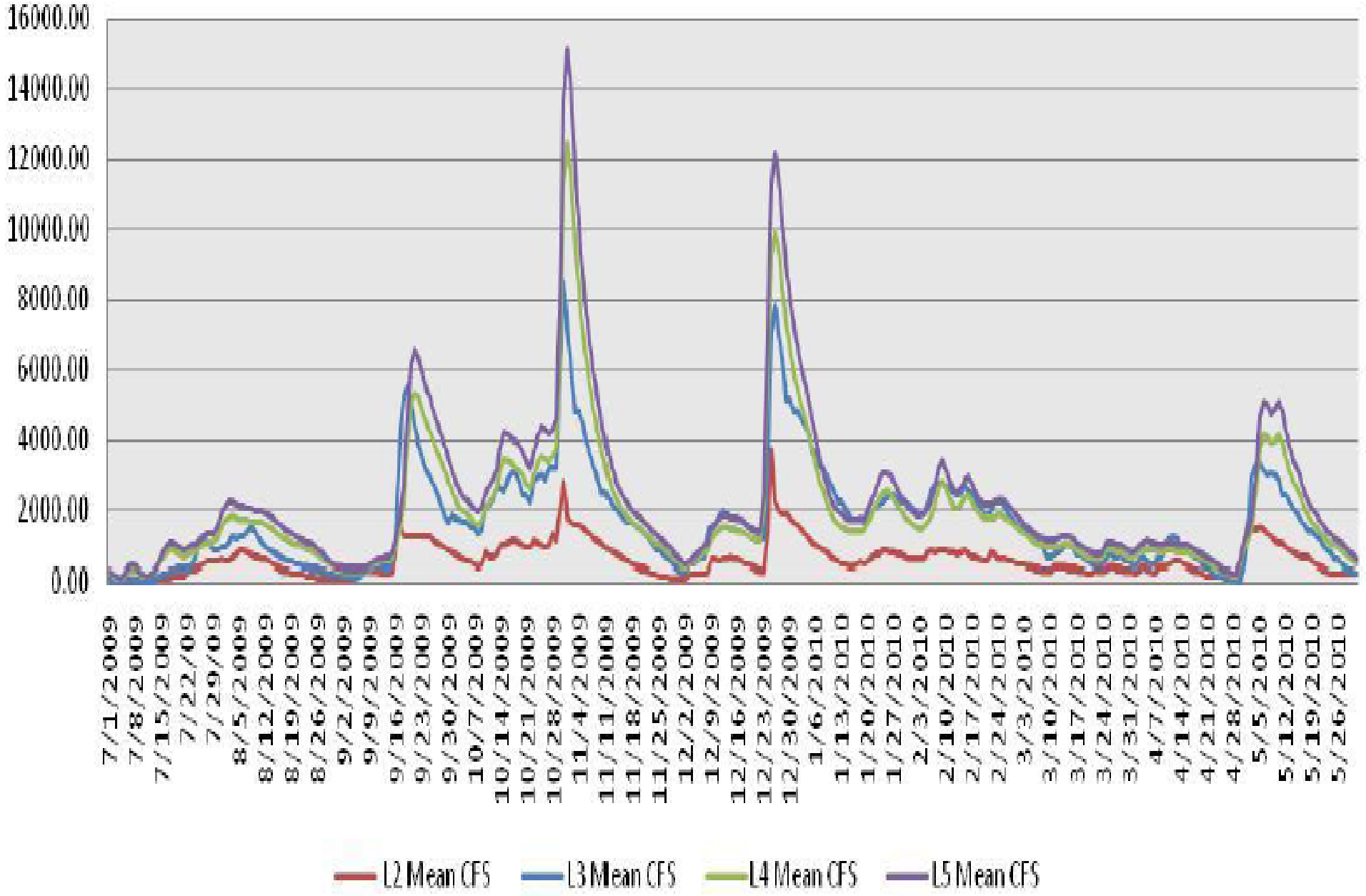
L3

- 20 river miles downstream from L2
- Highway 308 west of Colt, Arkansas
- Reach Four of the L’Anguille River.
  Latitude 35° 8'40.70"N
- Longitude 90°52'42.36"W

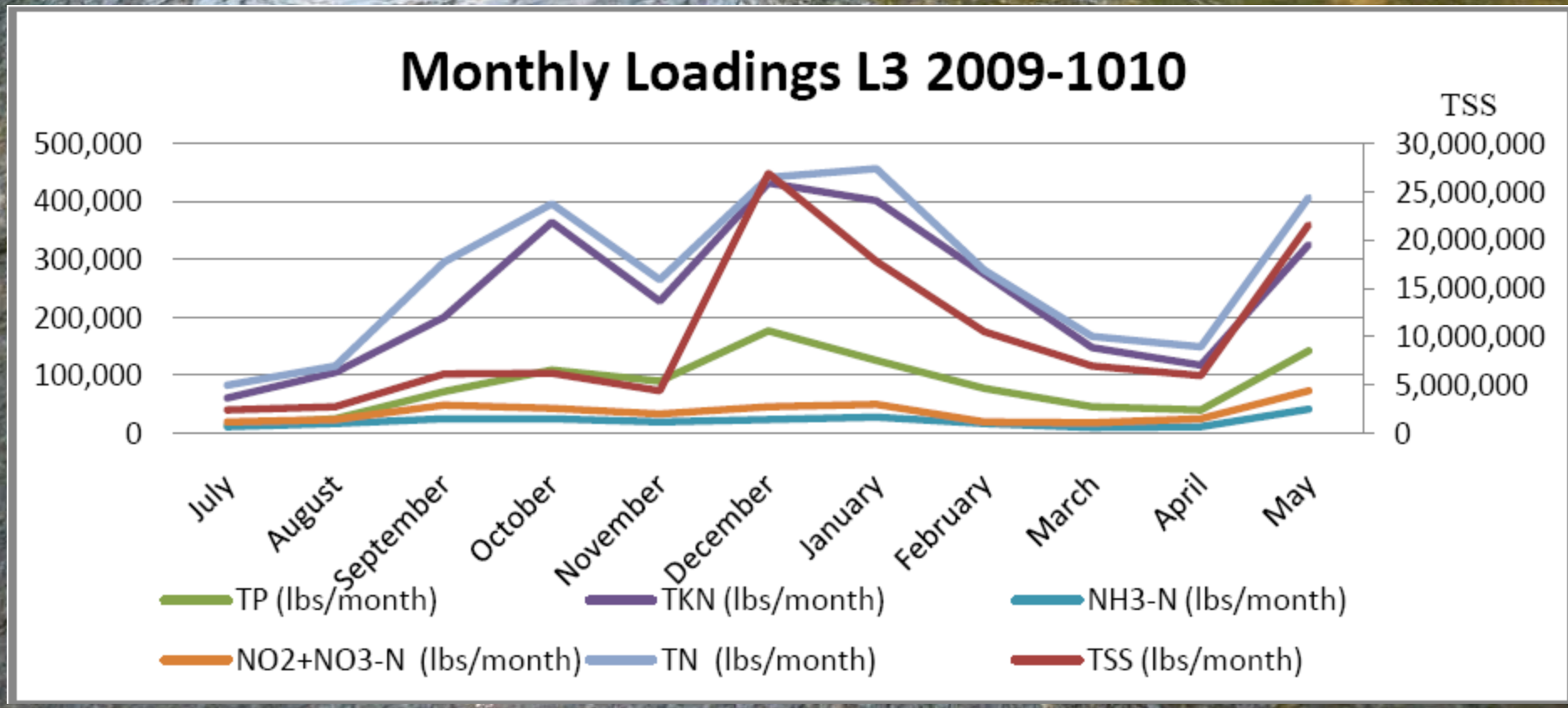
Monthly Loading L3

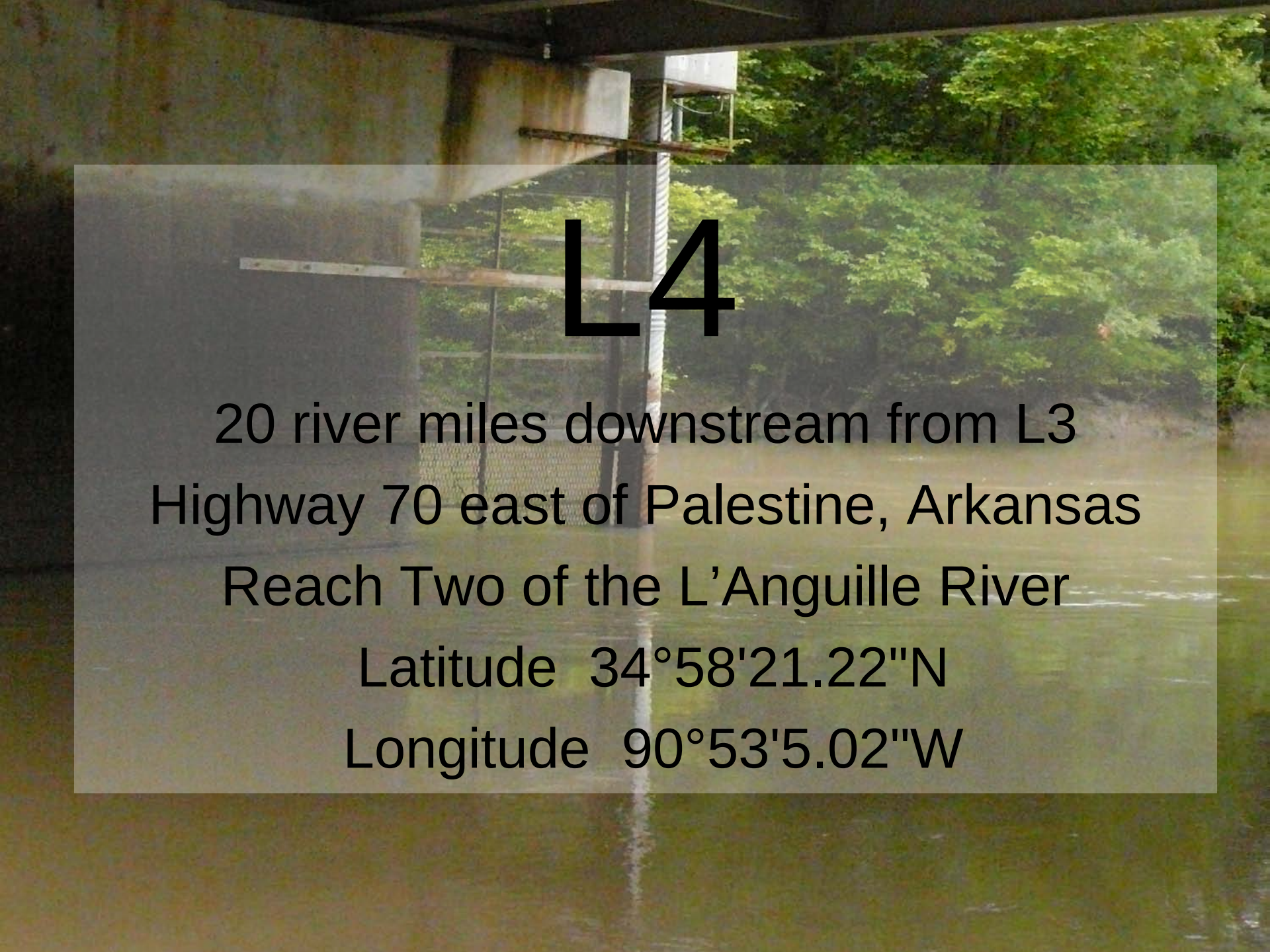
Monthly Loading at L3 2009 - 2010							
Month	Cubic Feet per Month	TSS	TP	TKN	NH_3-N	NO_2+NO_3-N	TN
		LB/Month	LB/Month	LB/Month	LB/Month	LB/Month	LB/Month
July	988,000,000	2,360,000	13,000	60,400	10,300	18,800	73,600
Aug.	2,030,000,000	2,700,000	24,100	105,000	16,000	23,100	105,000
Sept.	4,700,000,000	6,120,000	71,000	200,000	24,300	48,500	273,000
Oct.	7,050,000,000	6,180,000	109,000	364,000	25,300	42,600	377,000
Nov.	5,470,000,000	4,410,000	89,400	228,000	18,700	32,600	250,000
Dec.	6,510,000,000	26,900,000	176,000	432,000	23,300	45,100	421,000
Jan.	6,620,000,000	17,800,000	126,000	402,000	27,900	49,200	434,000
Feb.	5,340,000,000	10,500,000	77,000	274,000	16,800	19,200	273,000
Mar.	2,150,000,000	6,940,000	45,300	147,000	9,090	17,700	159,000
Apr.	1,420,000,000	5,970,000	40,200	117,000	11,000	24,600	138,000
May	4,450,000,000	21,600,000	142,000	325,000	41,500	73,100	374,000

Hydrograph at all Stations



Monthly Loading L3





L4

20 river miles downstream from L3

Highway 70 east of Palestine, Arkansas

Reach Two of the L’Anguille River

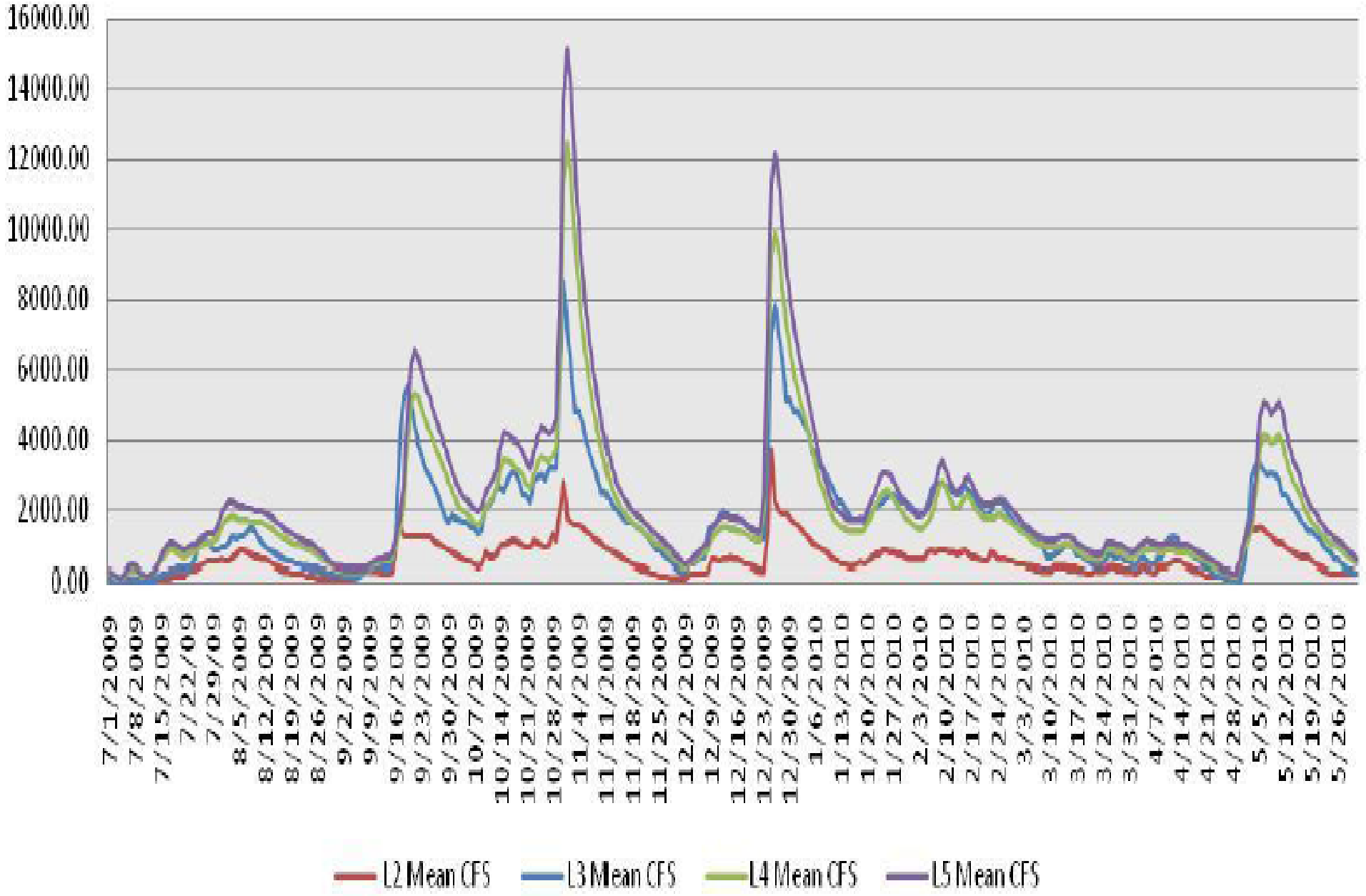
Latitude 34°58'21.22"N

Longitude 90°53'5.02"W

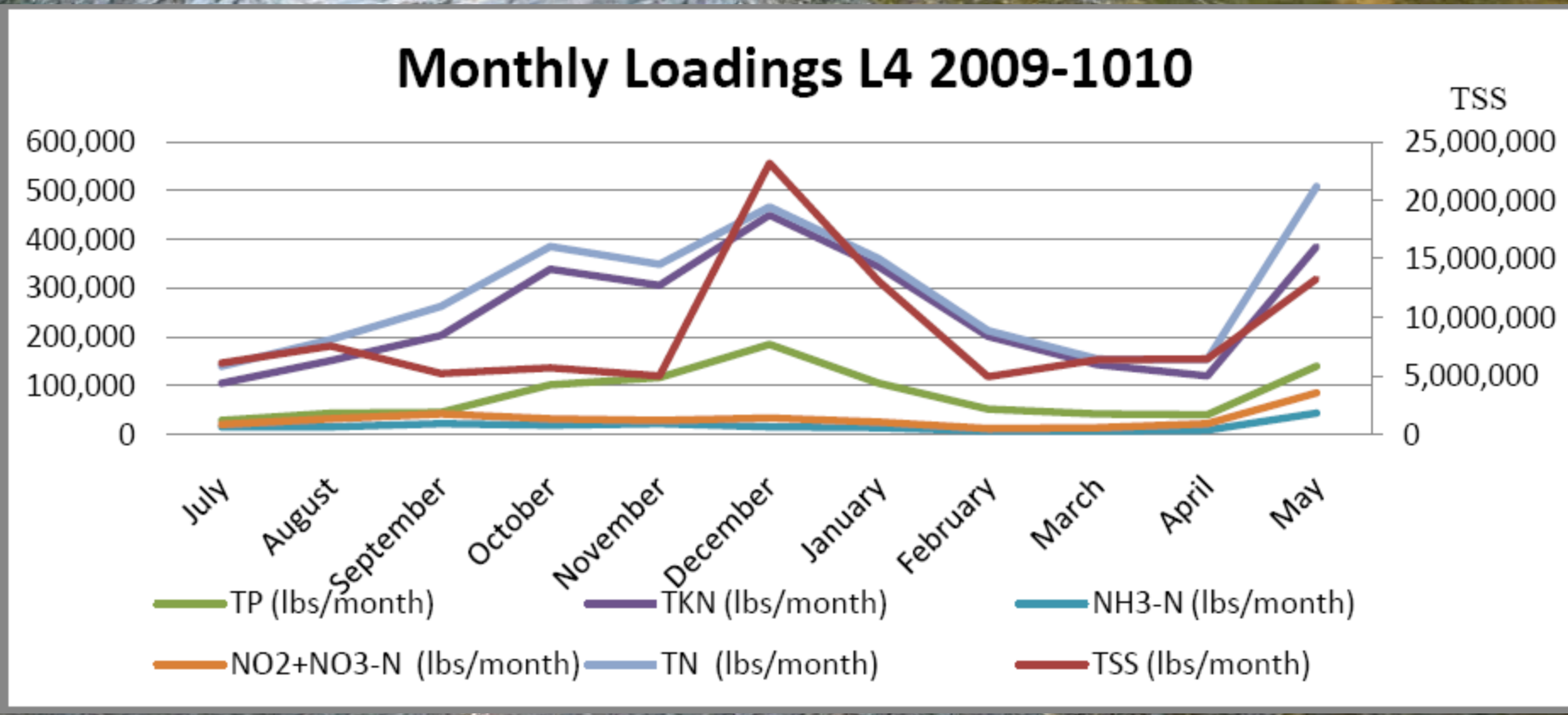
Monthly Loading L4

Monthly Loading at L4 2009 - 2010							
Month	Cubic Feet per Month	TSS	TP	TKN	NH_3-N	NO_2+NO_3-N	TN
		LB/Month	LB/Month	LB/Month	LB/Month	LB/Month	LB/Month
July	1,660,000,000	6,100,000	28,900	106,000	16,100	21,800	130,000
Aug.	3,290,000,000	7,560,000	44,900	152,000	16,500	32,300	181,000
Sept.	5,240,000,000	5,220,000	45,600	204,000	22,900	43,400	244,000
Oct.	8,100,000,000	5,720,000	102,000	339,000	20,400	32,700	370,000
Nov.	7,940,000,000	5,050,000	117,000	306,000	23,200	28,800	336,000
Dec.	7,590,000,000	23,200,000	186,000	450,000	15,700	34,800	451,000
Jan.	5,960,000,000	13,100,000	106,000	345,000	15,100	26,500	349,000
Feb.	4,650,000,000	4,930,000	53,400	201,000	7,300	12,800	208,000
Mar.	2,380,000,000	6,380,000	42,600	143,000	7,870	15,300	149,000
Apr.	1,650,000,000	6,470,000	41,800	120,000	10,200	22,900	144,000
May	5,590,000,000	13,300,000	140,000	386,000	44,800	86,300	470,000

Hydrograph at all Stations



Monthly Loading L4



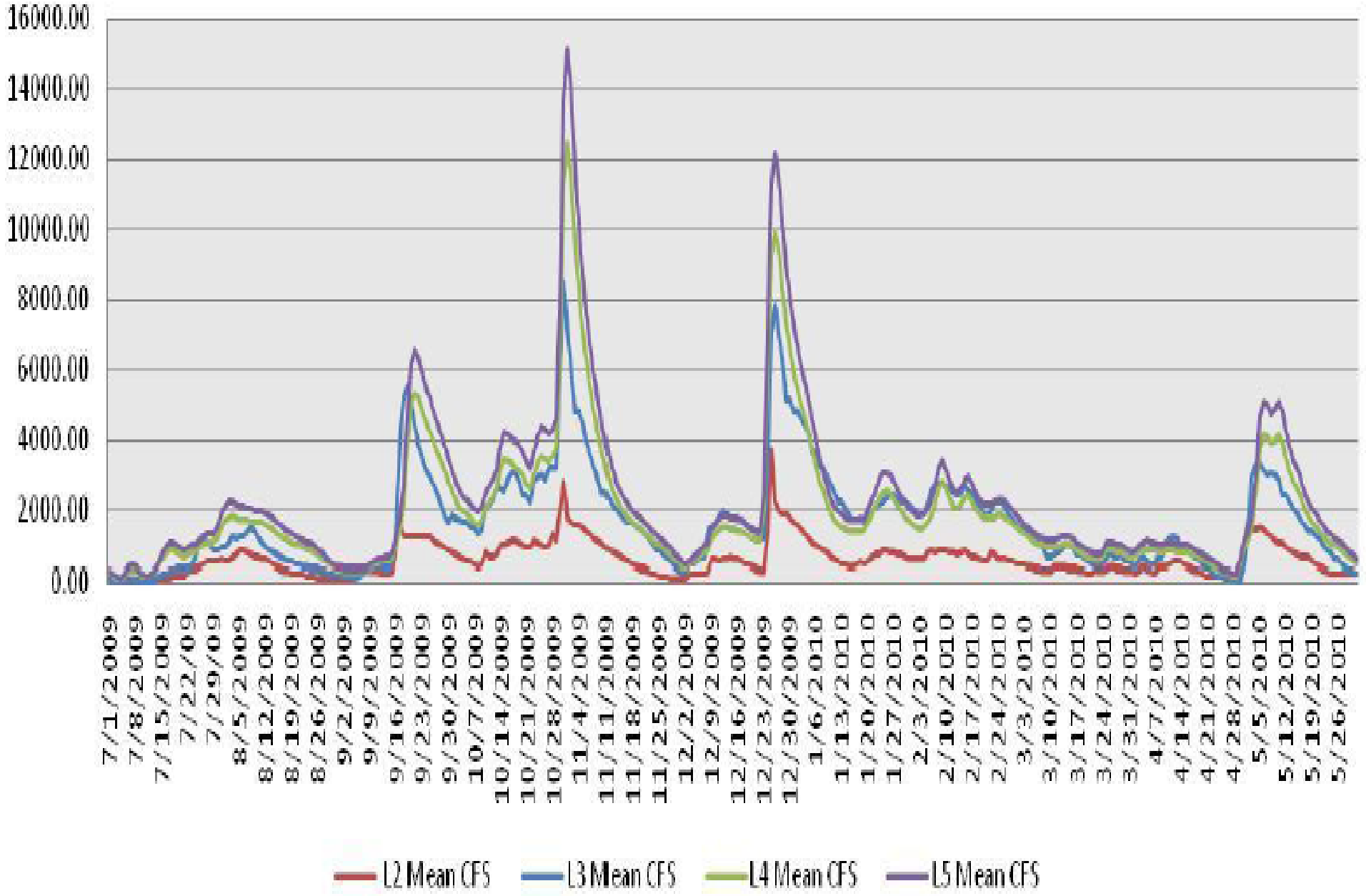
L5

- 19 river miles downstream from L4 Highway 1 north of Marianna, Arkansas
- Reach One of the L’Anguille River
  - Latitude 34°50'16.73"N
  - Longitude 90°47'45.82"W

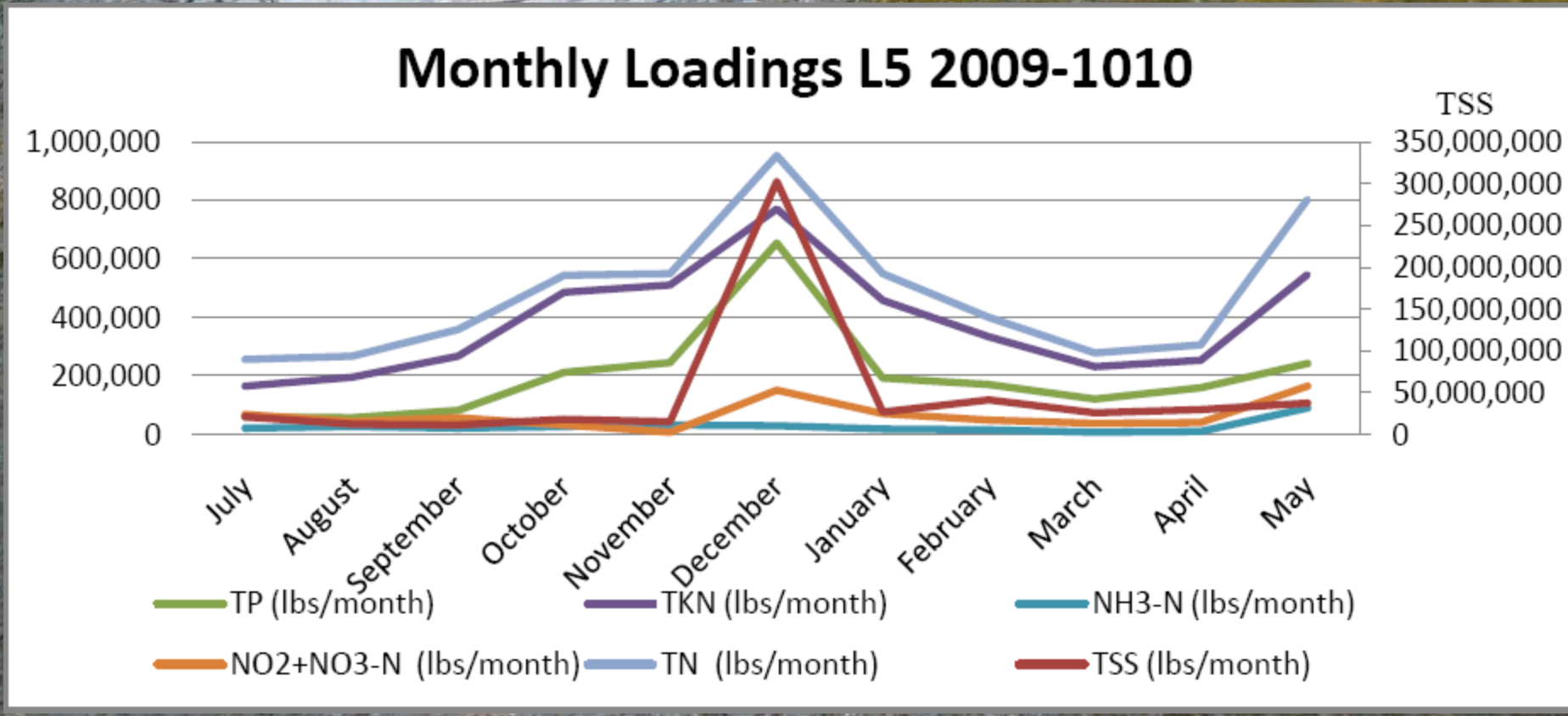
Monthly Loading L5

Monthly Loading at L5 2009 - 2010							
Month	Cubic Feet per Month	TSS	TP	TKN	NH_3-N	$NO_2$2+NO=-N	TN
		LB/Month	LB/Month	LB/Month	LB/Month	LB/Month	LB/Month
July	2,030,000,000	21,400,000	61,200	165,000	22,700	67,200	232,000
Aug.	4,020,000,000	12,800,000	57,000	196,000	28,200	43,600	249,000
Sept.	6,410,000,000	11,300,000	83,200	268,000	21,400	58,700	327,000
Oct.	10,200,000,000	18,600,000	213,000	486,000	26,500	31,900	518,000
Nov.	11,000,000,000	15,000,000	246,000	509,000	32,600	6,450	515,000
Dec.	9,330,000,000	302,000,000	655,000	771,000	28,700	151,000	922,000
Jan.	7,860,000,000	26,500,000	193,000	459,000	18,100	72,600	531,000
Feb.	5,860,000,000	41,500,000	171,000	333,000	15,800	50,600	384,000
Mar.	3,070,000,000	26,200,000	121,000	232,000	8,840	38,300	270,000
Apr.	2,090,000,000	29,700,000	161,000	253,000	11,100	41,500	295,000
May	6,930,000,000	37,300,000	242,000	545,000	91,600	165,000	710,000

Hydrograph at all Stations



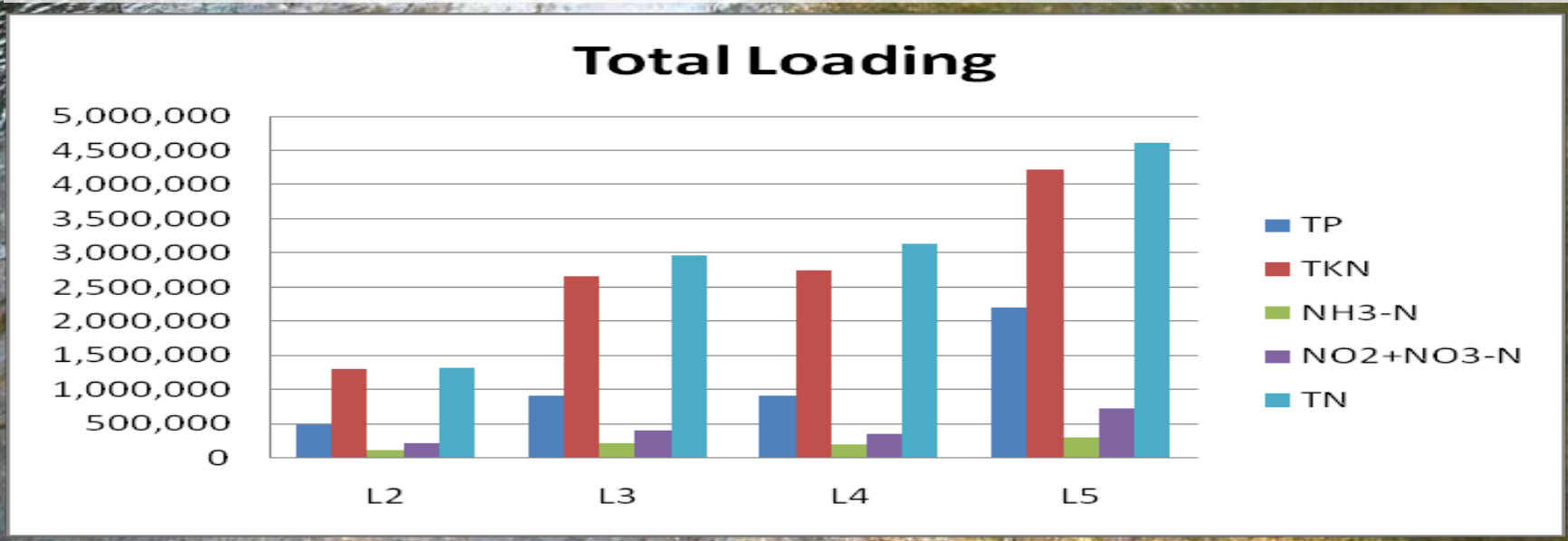
Monthly Loading L5

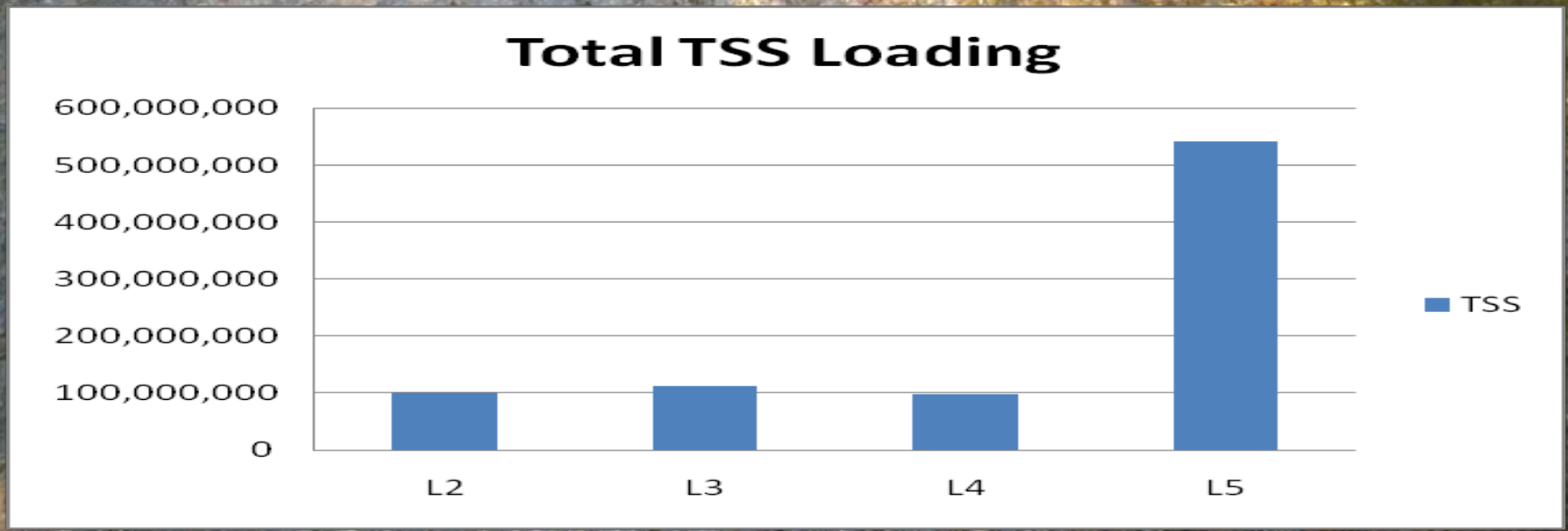


Total Load

Total Loading at all Stations 2009-2010							
Station	Cubic Feet per Monitoring Period	TSS LBS per Project Period	TP LBS per Project Period	TKN LBS per Project Period	NH_3-N LBS per Project Period	NO_2+NO_3-N LBS per Project Period	TN LBS per Project Period
L2	17,900,000,000	99,400,000	495,000	1,300,000	121,000	208,000	1,320,000
L3	46,700,000,000	112,000,000	913,000	2,660,000	224,000	394,000	2,960,000
L4	54,000,000,000	97,000,000	908,000	2,750,000	200,000	358,000	3,140,000
L5	68,800,000,000	542,000,000	2,200,000	4,220,000	306,000	727,000	4,953,000

Total Load


Total Loading
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
L2
L3
L4
L5
TP
TKN
NH3-N
NO2+NO3-N
TN


Total TSS Loading
600,000,000
500,000,000
400,000,000
300,000,000
200,000,000
100,000,000
0
L2
L3
L4
L5
TSS

Comparison of findings to TMDL Allocations

- **L2**
  - **34% of the samples exceeded the target TSS “spring” TMDL**
  - **74% of the samples exceeded the target TSS “summer” TMDL**
- **L3**
  - **92% of the samples exceeded the target TSS “spring” TMDL**
  - **92% of the samples exceeded the target TSS “summer” TMDL**
- **L4**
  - **99% of the samples exceeded the target TSS “spring” TMDL**
  - **100% of the samples exceeded the target TSS “summer” TMDL**
- **L5**
  - **100% of the samples exceeded the target TSS “spring” TMDL**
  - **100% of the samples exceeded the target TSS “summer” TMDL**

Questions?