Arkansas Water Resources Center

WATER QUALITY SAMPLING, ANALYSIS AND ANNUAL LOAD DETERMINATIONS FOR TSS, NITROGEN AND PHOSPHORUS AT THE L'ANGUILLE RIVER NEAR PALESTINE 2005 ANNUAL REPORT

Submitted to the
Arkansas Natural Resources Commission

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MSC-334

June 2006

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SUMMARY

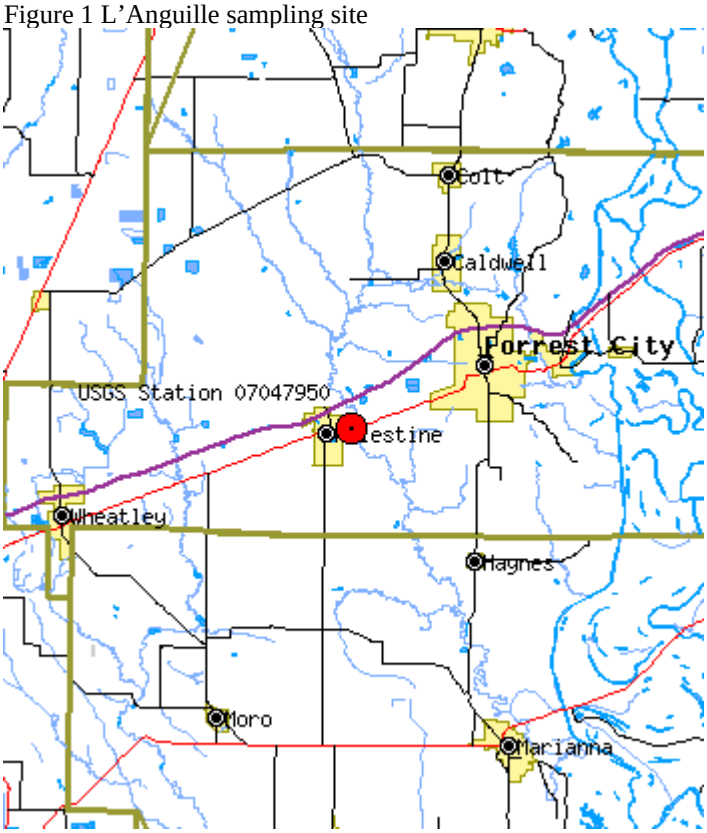
2005 results L'Anguille near Palestine.

Pollutant	Total Discharge (m^3/yr) 566,566,559	Total Load (kg/yr)	Average Discharge (m^3/s) 17.9	Mean Concentrations (mg/l)
N03-N		83,224		0.15
TP		146,787		0.26
NH4		67,576		0.12
TKN		389,540		0.69
PO4		39,470		0.07
TSS		13,218,157		23.33

INTRODUCTION

A water quality sampling station was installed at the L'Anguille River near Palestine in 2003. This station is coordinated with a USGS gauging station at the same location. This station is instrumented to collect samples at sufficient intervals across the hydrograph to accurately estimate the flux of total suspended solids, nitrogen and phosphorus in the River. The L'Anguille River was listed on Arkansas' 1998 (listed in later reports?) 303d list as impaired from sediment (turbidity). The L'Anguille River was the second stream to have total maximum daily loads (TMDL) determined in Arkansas. Accurate determination of stream nutrients and sediment is critical for future determinations of TMDLs, effectiveness of best management practices and trends in water quality.

Figure 1 L'Anguille sampling site



SCOPE

This report is for water quality sampling, water sample analysis and annual pollutant load calculations at the L'Anguille River near Palestine for the period of January 1, 2005 to December 31, 2005. This project is a cooperative effort between the Arkansas Water Resources Center (AWRC) at the University of Arkansas and the Arkansas State University (ASU) Department of Biological Science. The parameters measured on collected samples were nitrate-nitrogen, ammonia-nitrogen, total nitrogen, total phosphorus, dissolved reactive phosphorus and total suspended solids. In addition turbidity, conductivity and pH were measured in-situ and recorded in thirty-minute intervals. The AWRC collected samples and analyzed the data from the water quality sampling station, computed the annual load for all parameters and report annually to the Arkansas Natural Resources Commission (ANRC).

METHODS

Initially the sampler was operated in a discrete mode taking samples at thirty-minute intervals for the first twenty-four samples and sixty-minute intervals for the next twenty-four samples of each storm event. The sampler was set to begin taking samples when the stage rose to ten percent over the prior base flow. Discrete samples were collected when all twenty-four bottles were filled or within forty-eight hours after the first sample. Grab samples were taken often enough to have a minimum of one sample between each storm event. The sampler was operated using this protocol until three storms were adequately sampled. The results from this initial sampling phase were used to determine the sampling start (trigger) and frequency for flow-weighted composite sampling. In addition, the results were used to develop rating curves to predict pollutant concentrations as a function of discharge in order to calculate loads for inadequately sampled storm events.

The trigger level for the storm sampling was not set to a fixed value. It was determined that there was no consistent base-flow, just rising and falling stages. Therefore, a variable storm trigger was used and the value was set at each grab sample to just above the stage.

After the initial phase, the sampler was reconfigured to take flow-weighted composite samples. The sampler began sampling after the stage exceeded the set trigger level. It took discrete samples after a fixed volume of water had passed. The volume used in the flow-weighted composite sampling was set to 4 million gallons. The discrete samples were composited by combining equal volumes of each into a single sample for analysis. Discrete samples were collected for compositing when all twenty-four bottles were filled or within forty-eight hours after the first sample. Storms were sampled in this manner for the period when the river stage was rising or falling quickly. Grab samples were taken approximately every two weeks, but a minimum of once between each storm event after the initial sampling phase. All samples were collected by ASU Personnel and transported to the AWRC Water quality Laboratory for analysis. All samples were analyzed for nitrate-nitrogen, ammonia-nitrogen, total nitrogen, total phosphorus, dissolved reactive phosphorus and total suspended solids.

RESULTS

This report details the sampling results for the period from January 1, 2005 to December 31, 2005. From that time until the end of December, 61 individual samples were collected and analyzed. There were 26 grab samples, 24 storm samples, 3 blank samples, 4 duplicate samples and 4 blank replicate samples. These results are illustrated in figure 3 and summarized in table 2.

Figure 2. Sampling results for 2005.

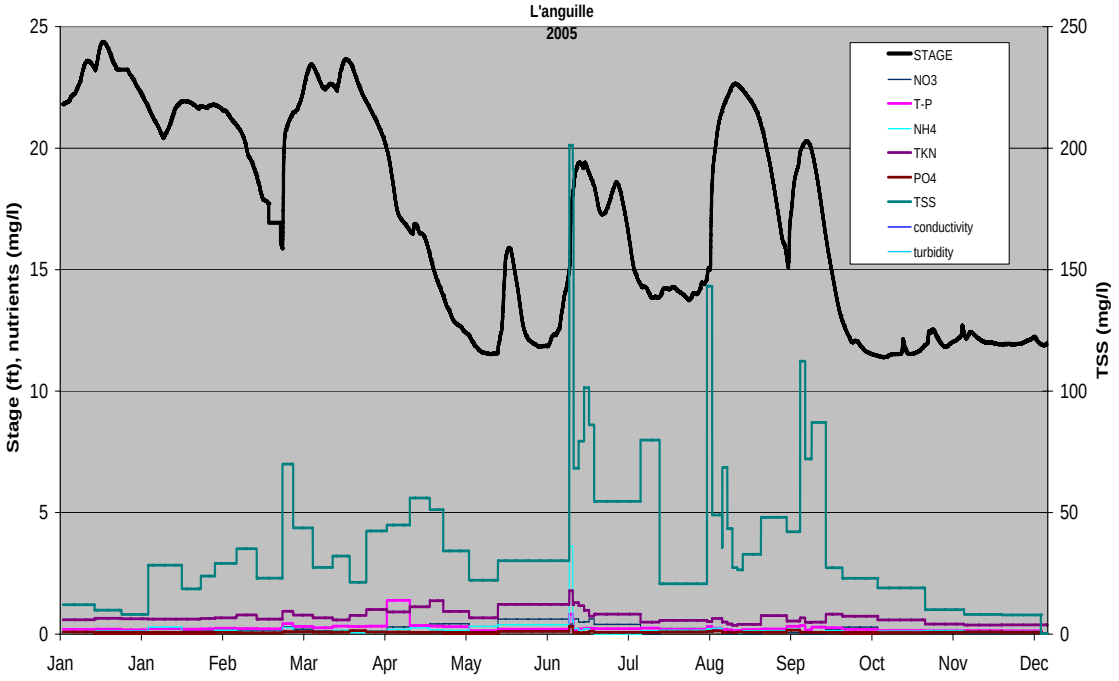


Table 1 **2004** results L'Anguille near Palestine.

Pollutant	Total Discharge (m^3/yr) 508,360,564	Total Load (kg/yr)	Average Discharge (m^3/s) 16.1	Mean Concentrations (mg/l)
N03-N		77,845		0.153
TP		232,872		0.46
NH4		45,764		0.09
TKN		576,511		1.134
PO4		39,284		0.077
TSS		90,599,070		178

Table 2 **2005** results L'Anguille near Palestine.

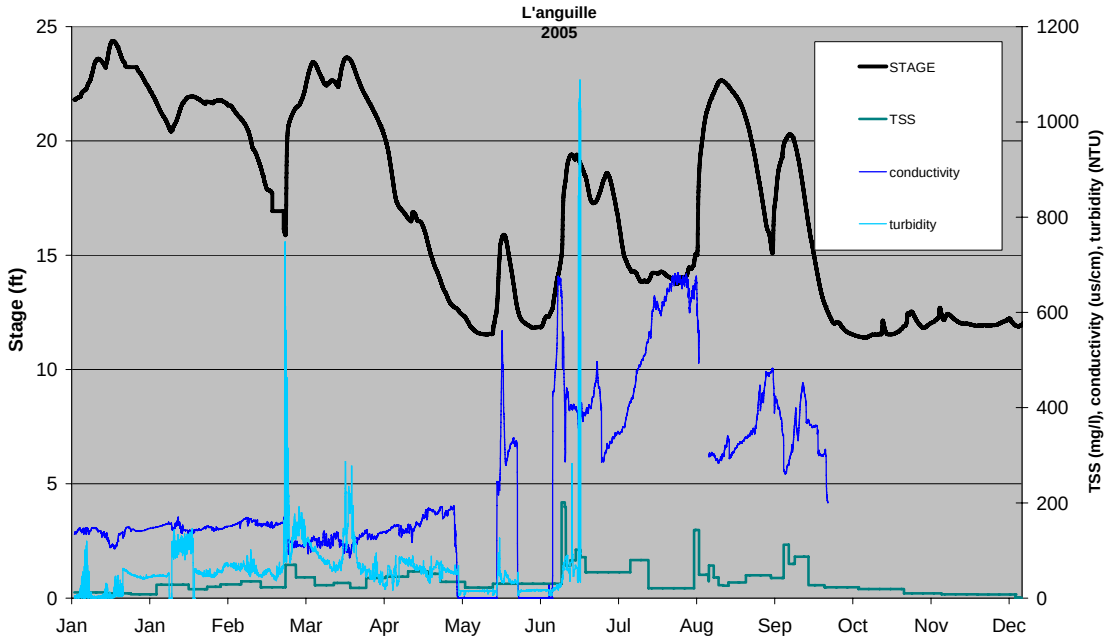
Pollutant	Total Discharge (m^3/yr) 566,566,559	Total Load (kg/yr)	Average Discharge (m^3/s) 17.9	Mean Concentrations (mg/l)
N03-N		83,224		0.15
TP		146,787		0.26
NH4		67,576		0.12

TKN		389,540		0.69
PO4		39,470		0.07
TSS		13,218,157		23.33

DISCUSSION

The 2005 monitoring results from the L'Anguille River should be considered an accurate estimate of sediment and nutrient loads and concentrations. Problems with intake line contamination in 2004 were corrected and QC samples show that the autosampler was collecting representative samples. The autosampler did not sample parts of three storm events adequately. However, grab samples were collected manually during those events and the concentrations estimated for those time periods should be fairly accurate and slightly conservative.

Figure 3 TSS conductivity and turbidity 2005



Results for specific conductance (conductivity) shown in figure 2 are somewhat unusual. Conductivity is a measure of the dissolved ions in the water. These ions may be nutrients such as nitrate or non-nutrient salts such as chloride. The results show the conductivity values peaking in the summer at near 700 us. This represents a significant concentration of ions that does not seem to correlate to nutrients. Often conductivity has an inverse relationship with discharge in that constant sources are diluted with runoff. However, the summertime peaks seem directly related to discharge indicating NPS runoff impacts or direct discharges that are seasonal in nature.

The L'Anguille river results can be compared to monitoring results from 7 Northwest Arkansas (NWA) watersheds. The watersheds in NWA are not directly comparable to those in the Delta because of numerous differences such as ecoregion, land use, morphology and watershed size. However, if all results are normalized by dividing by watershed area, the results can be compared with caution. The comparison values are listed in table 3.

Table 3 Comparison between average values for L'Anguille and seven Northwest Arkansas watersheds. All data are normalized by dividing the results by watershed area. .

	Average of 7 NWA watersheds	L'Anguille
Hectares	67,925	203,580
years of data	4	2
tss load (kg/ha)	587	255
p load (kg/ha)	1.62	0.9
total nitrogen load (kg/ha)	9.48	1.9
discharge/area (m^3/ha)	4,092	2,497

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