Big Creek Research and Extension Team

University of Arkansas System Division of Agriculture

Quarterly Report – April 1 to June 30, 2015

MONITORING THE SUSTAINABLE MANAGEMENT OF NUTRIENTS ON C&H FARM IN BIG CREEK WATERSHED

Mission of the University of Arkansas System Division of Agriculture

The mission of the **Division of Agriculture** is to advance the stewardship of natural resources and the environment, cultivate the improvement of agriculture and agribusiness, develop leadership skills and productive citizenship among youth and adults, enhance economic security and financial responsibility among the citizens of the state, ensure a safe, nutritious food supply, improve the quality of life in communities across Arkansas, and strengthen Arkansas families.

Dr. Mark J. Cochran
Vice President for Agriculture

Executive Summary

This is the second Quarterly Report of 2015 for the Big Creek Research and Extension Team that details the following progress made from April 1 through June 30, 2015.

1. Continued collection weekly baseflow and periodic storm flow water samples from Big Creek above and below the C&H Farm, along with water from the spring, ephemeral stream, surface runoff sites on Fields 1, 5a, and 12, interceptor trench below the slurry holding ponds, and house well for chemical analysis.

2. We started monitoring the nutrient and bacterial concentrations in Left Fork as it enters Big Creek in early June. At the same time USGS installed a station that currently measures stage height, the same as at our downstream site on Big Creek. This will allow the comparison of nutrient and bacteria flows from a watershed similar to Big Creek, but without a hog operation. The Left Fork watershed (16 % pasture and 79% forest) has similar land use classification to Big Creek watershed (18 % pasture and 80% forest), except for the presence of the hog operation.

3. At the beginning of 2015, we initiated the measurement of pH, alkalinity, chloride, electrical conductivity, and total dissolved solids in water samples collected at the upstream, downstream, spring, house well, and trench sites. This information will in the long term, allow us to better define the sources of water at these sampling sites. The data collected to date are presented in this report, with median values from January 8, 2015 to May 25, 2015 given below.

Median pH, alkalinity, chloride, conductivity, and total dissolved solids at several Big Creek monitoring sites.

Location	pH	Alkalinity	Chloride	Conductivity	Total dissolved solids
		mg/L	mg/L	µS/cm	mg/L
Upstream	7.740	40.0	1.732	109.7	67.6
Downstream	7.75	64.0	2.023	150.4	89.1
Spring			1.853	513.5	283.7
House well			5.018	453.0	237.3
Trench 1			1.945	248.9	129.6
Trench 2			0.934	164.9	140.8

4. A final report detailing findings of the Electrical Resistivity Imaging (ERI) analysis conducted on application fields was not available at the time this Quarterly Report was due. The ERI report will be released as soon as it is available to us.

Big Creek Research Team

Andrew Sharpley, Ph.D., TEAM LEADER – Distinguished Professor - Soil science, water quality, soil phosphorus chemistry, agricultural management

Brian Breaker, M.Sc., Hydrologic Technician, stream flow and constituent collection, analysis, and statistical evaluation of trends.

Kris Brye, Ph.D., Professor - Effects of land application of poultry litter on in-situ nutrient leaching, effects of land use and management practices on soil physical, chemical, and biological properties related to soil quality and sustainability

Rick Cartwright, Ph.D., Professor – Associate Director of Extension for Agriculture and Natural Resources

Mark Cochran, Ph.D., – Vice President, University of Arkansas System Division of Agriculture.

Mike Daniels, Ph.D., Professor – Extension water quality and nutrient management specialist

Ed Gbur, Ph.D., Professor and Director, Agricultural Statistics Laboratory - Experimental design, linear and generalized linear mixed models, regression, agricultural applications of statistics.

Brian Haggard, Ph.D., Professor - Ecological engineering, environmental soil and water sciences, water quality chemistry, water quality monitoring and modeling, algal nutrient limitation, pollutant transport in aquatic systems

Phil Hays, Ph.D. Ground Water Specialist, U.S. Geological Survey and Research Professor with Geosciences Dept., University of Arkansas, application of stable isotopes and other geochemical indicators in delineating movement and behavior of contaminants in ground-water systems

Tim Kresse, M.Sc., Water Quality Specialist, U.S. Geological Survey, natural geochemical evolution of groundwater and separating these processes from anthropogenic sources of contamination

Nathan McKinney, Ph.D., – Assistant Director, Agriculture Experiment Station

Morteza Mozaffari, Ph.D. – Director, Univ. of Arkansas Soil Testing and Research Laboratory, Marianna.

Mary Savin, Ph.D. - Structure and function of microbial communities in natural and managed ecosystems, microorganisms in nutrient cycling, contaminant degradation

Thad Scott, Ph.D., Associate Professor - Water quality, transport of contaminants to and within water bodies

Karl VanDevender, Ph.D. and P.E., Professor - Extension Engineer, Livestock and poultry manure and mortality management, nutrient management planning

Jun Zhu, PhD., Professor - Biological and agricultural engineering, agricultural sustainability, manure treatment technologies

Adam Willis, M.Sc., Newton County Extension Agent - Agriculture

Field Technicians - The Big Creek Research and Extension Team are ably supported by several excellent Program Technicians based in Little Rock and Fayetteville.

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Watershed Land Use Analysis

Land use of the watershed drainage area was determined for several segments of the Big Creek Watershed (Tables 1 and 2). This was determined using data from the USDA-NRCS Geospatial Data Gateway for Newton Co., AR http://datagateway.nrcs.usda.gov/; national land cover dataset by State for 2006; cropland data layer by State for 2006; and hydrography data layer for streams and HUC 12 watershed boundaries for 2007 to present. The following drainage areas were delineated; Big Creek (Figure 1), Big Creek upstream of the C&H (Figure 2), downstream of the C&H Farm to the Buffalo River (Figure 3), the monitored land area encompassing fields permitted to receive manure slurry (Figure 4), Dry Creek Watershed (Figure 5), and the newly monitored Left Fork Watershed (Figure 6).

Monitoring flow and water quality of Left Fork, as it enters Big Creek, was initiated in May 2015 by both USGS and the BCRET Project. The quality of water in Left Fork will be used as a baseline to compare with water quality at the site downstream of the C&H Farm, as the Left Fork Watershed does not contain any concentrated animal feeding operations. Left Fork enters Big Greek just below the BCRET downstream monitoring station.

Overall, land use of the area of the monitored watershed encompassing the C&H Farm (18% pasture and 78% forest) was similar to the land area downstream of the C&H Farm to the Buffalo River (17% pasture and 80% forest) (Table 2). Upstream of the C&H Farm there was less pasture (5%) and more forest (92%) (Table 2). Land use in the monitored portion of the Big Creek watershed (17% pasture and 80% forest) was also similar to the land use in the newly instrumented Left Fork watershed (16% pasture and 79% forest) (Table 2), which is planned to serve as a baseline of chemical and biological composition representative of waters draining a watershed without an animal feeding operation.

Table 1. Land use classification of the monitored watershed, upstream of C&H, downstream of C&H and Dry Creek Watersheds. 1

	Big Creek watershed (Figure 1)		Upstream of C&H (Figure 2)		Downstream of C&H (Figure 3)		Monitored watershed (Figure 4)		Dry Creek watershed (Figure 5)		Left Fork watershed (Figure 6)	
Land use/Land cover			**Area (acres)**	**% of total area**	**Area (acres)**	**% of total area**	**Area (acres)**	**% of total area**	**Area (acres)**	**% of total area**	**Area (acres)**	**% of total area**
Forest												
Deciduous forest	45,977	79.0	15,110	86.5	24,297	75.9	6,570	75.1	4,036	89.0	17,324	73.1
Evergreen forest	1,858	3.2	514	2.9	1,094	3.4	250	2.9	145	3.2	1,406	5.9
Mixed forest	69	0.1	4	0.0	54	0.2	11	0.1	2	0.03	440	1.9
Shrub land	9	0	5	0.0	2	0.0	- - [2]	- -	- -	- -	2.73	0.0
Woody wetlands	2	0	0.4	0.0	0.7	0.00	0.7	0.0	- -	- -	3	0.0
Pasture												
Grassland/ Pasture	8,381	14.4	1,389	8.0	5,431	17.0	1,561	17.9	231	5.1	3,833	16.2
Urban												
Developed/ Open space	1,800	3.1	435	2.5	1,038	3.2	327	3.7	119	2.6	675	2.8
Developed/Low intensity	113	0.2	13.	0.1	77	0.3	23	0.3	0.7	0.01	30	0.1
TOTAL	**58,209**		**17,470**		**31,994**		**8,745**		**4,534**		**23,714**	

[1] Obtained the following data from the USDA:NRCS Geospatial Data Gateway for Newton Co., AR http://datagateway.nrcs.usda.gov/; National land cover dataset by State, 2006; Cropland data layer by State, 2006; and Hydrography (streams and HUC 12 watershed boundaries), 2007-present.

[2] None measured.

Table 2. Area as pasture forest and urban for upstream of C&H, downstream of C&H, the monitored watershed, Left Fork watershed, and Dry Creek watershed.

Land use/Land cover	Upstream of C&H		Monitored watershed		Downstream of C&H		Left Fork watershed		Big Creek watershed	
	Area (acres)	% of total area	Area (acres)	% of total area	Area (acres)	% of total area	Area (acres)	% of total area	Area (acres)	% of total area
Forest	15,633	89.4	6,834	78.1	25,448	79.5	19,176	80.9	47,915	82.3
Pasture	1,389	8.0	1,561	17.9	5,431	17.0	3,833	16.2	8,381	14.4
Urban	448	2.6	350	4.0	1,115	3.5	705	2.9	1,913	3.3

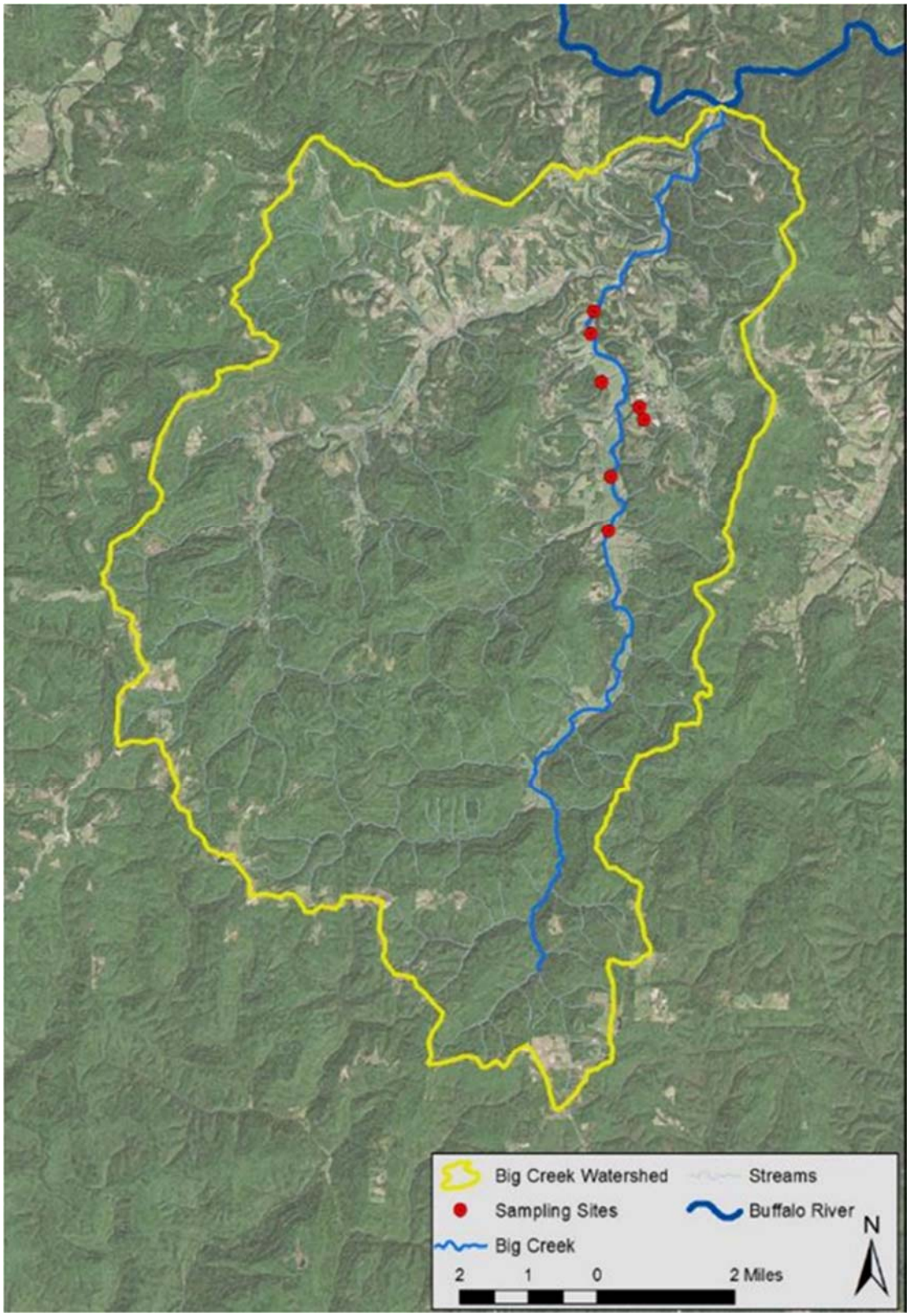

Figure 1. Big Creek Watershed.

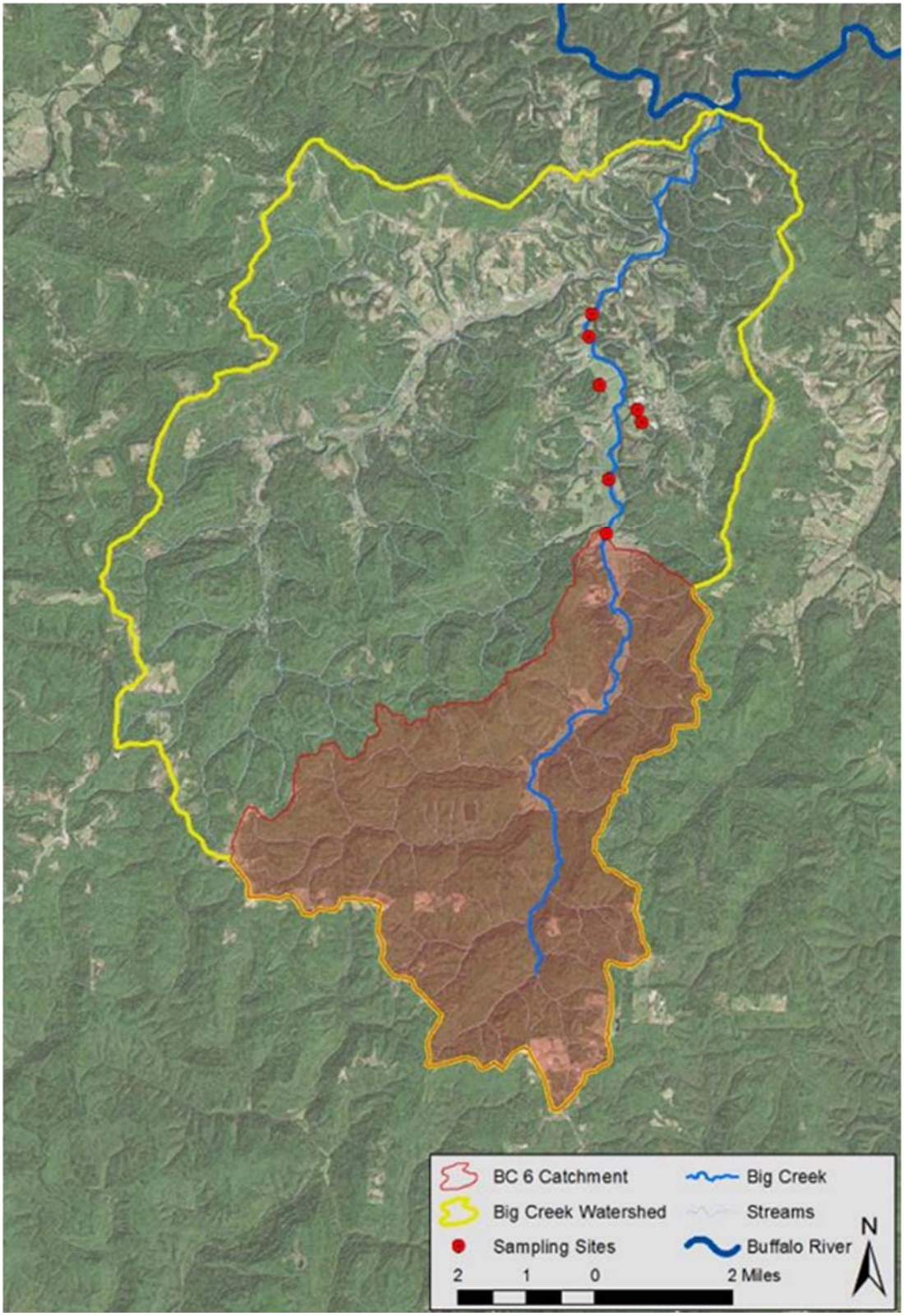

Figure 2. Big Creek Watershed up stream of the C&H Farm.

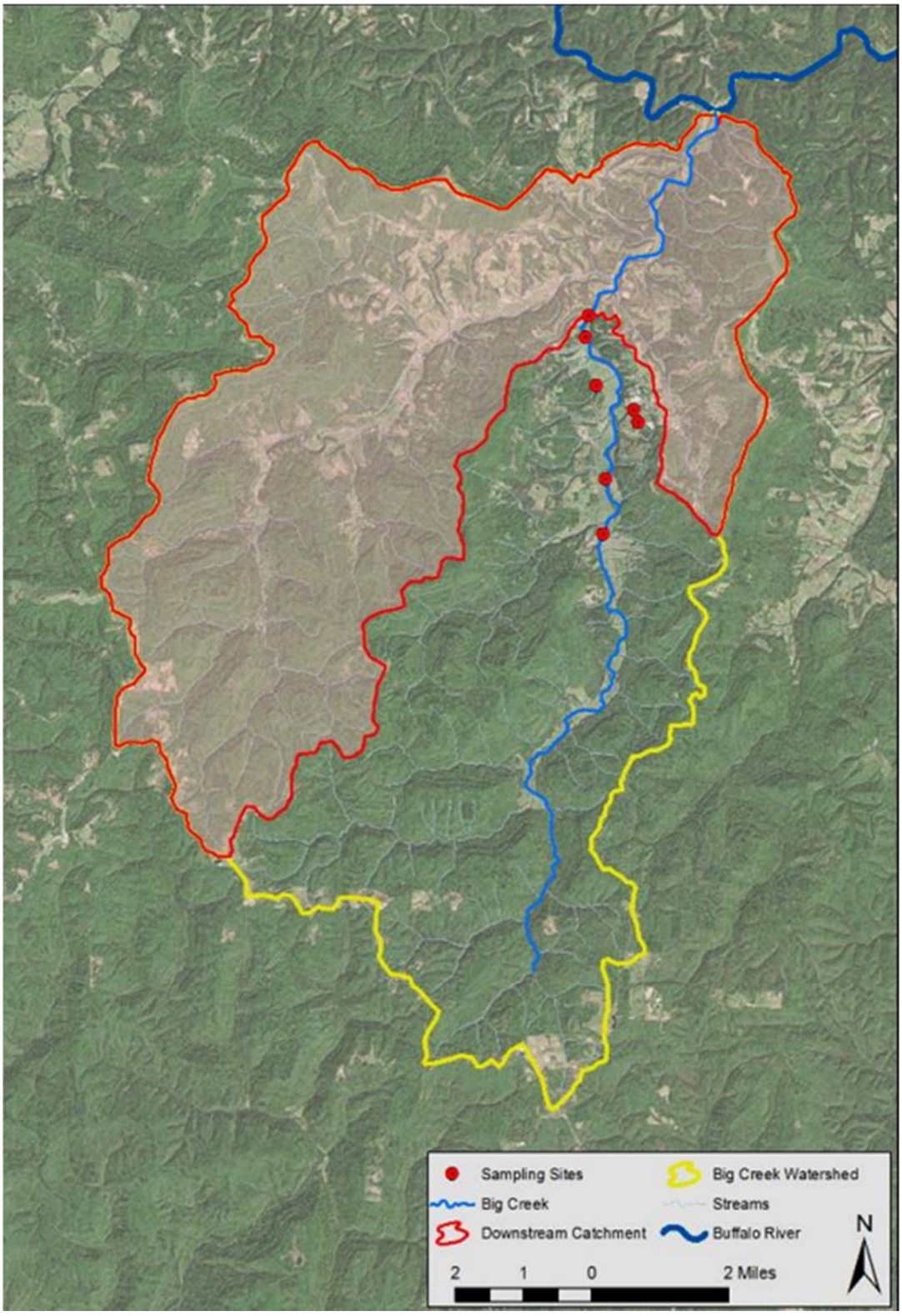

Figure 3. Big Creek Watershed below the downstream monitoring site on C&H Farm.

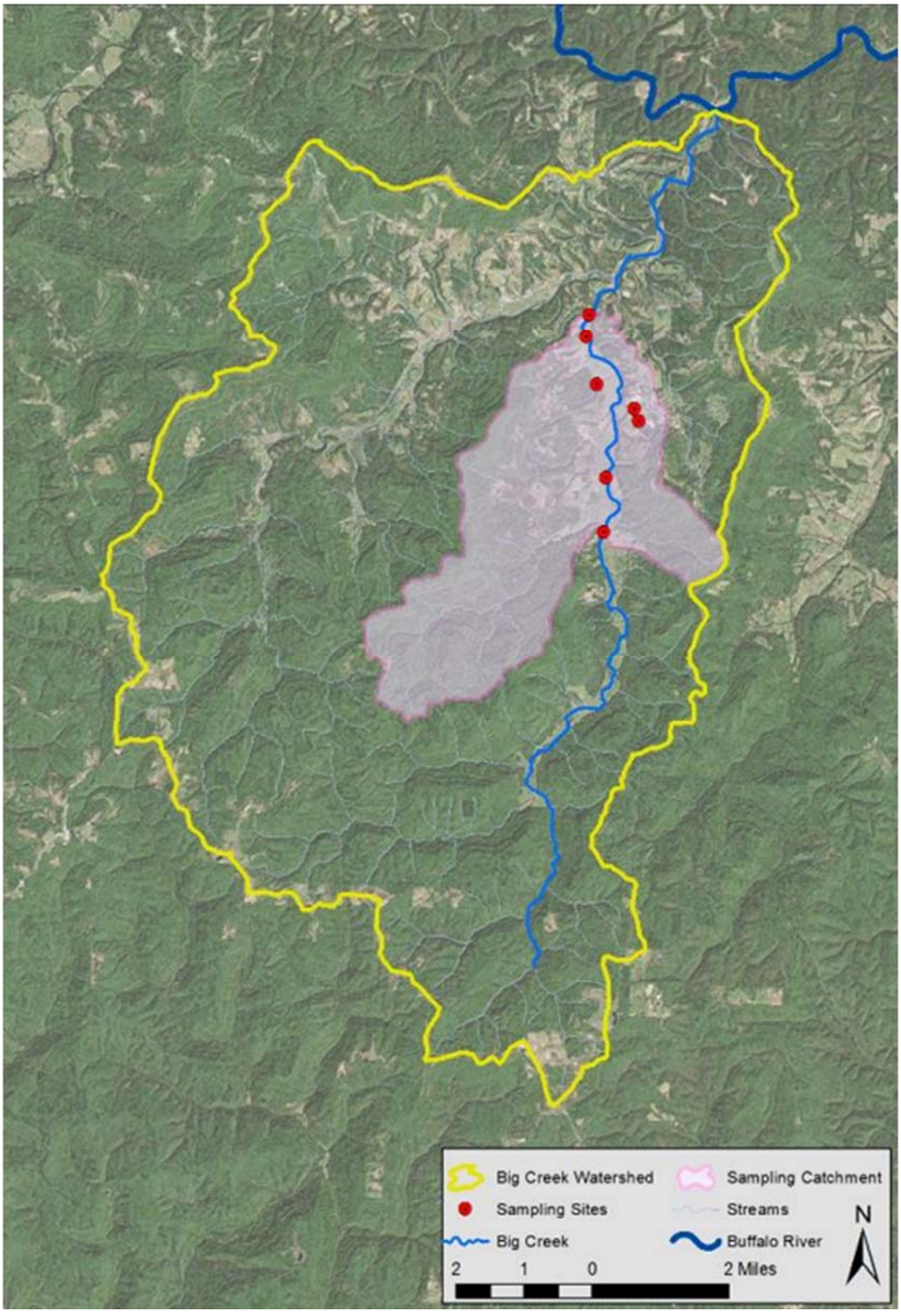

Figure 4. The watershed created by BRCET up and downstream sampling sites at C&H Farm. The C&H permitted fields' watershed.

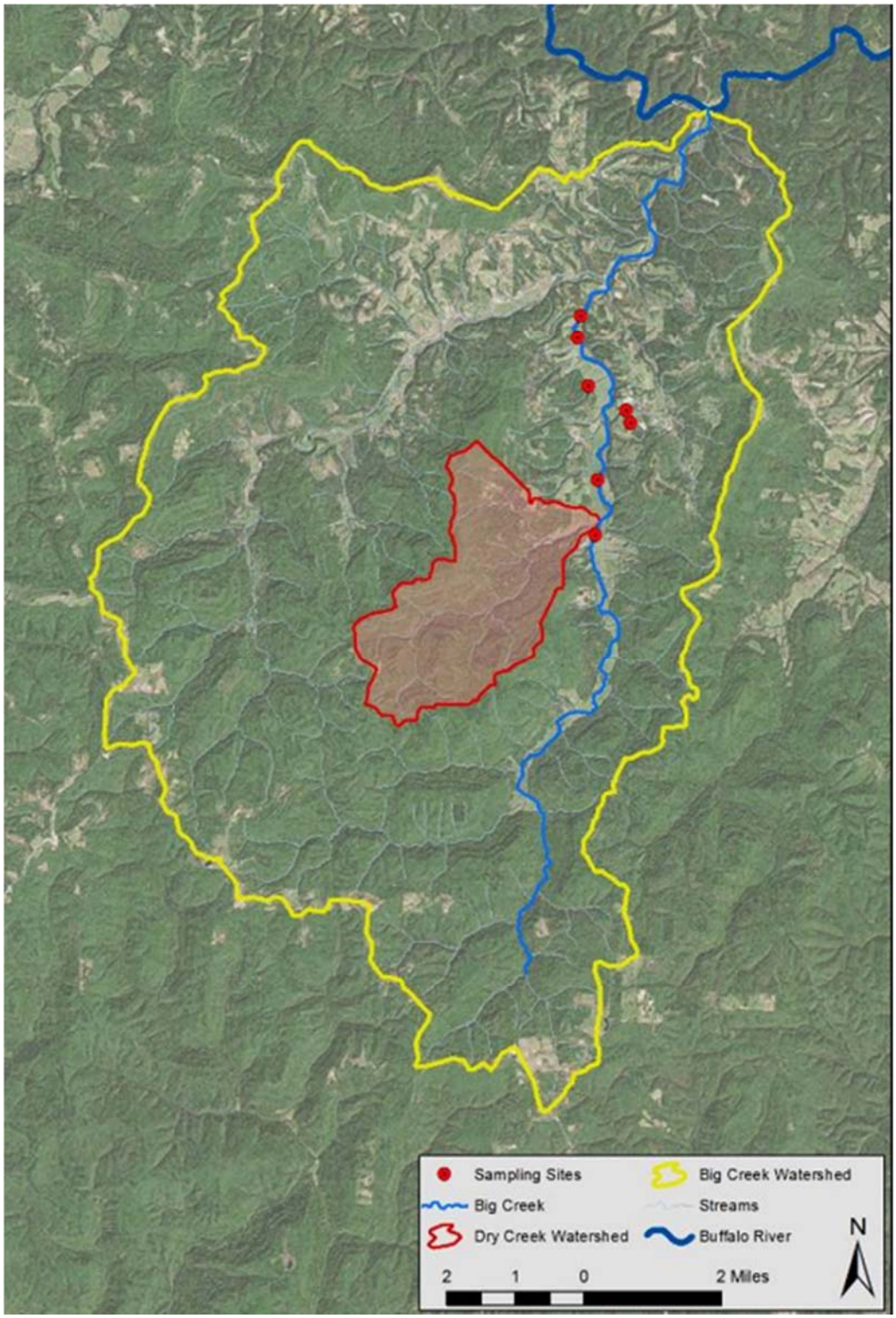

Figure 5. Dry Creek Watershed.

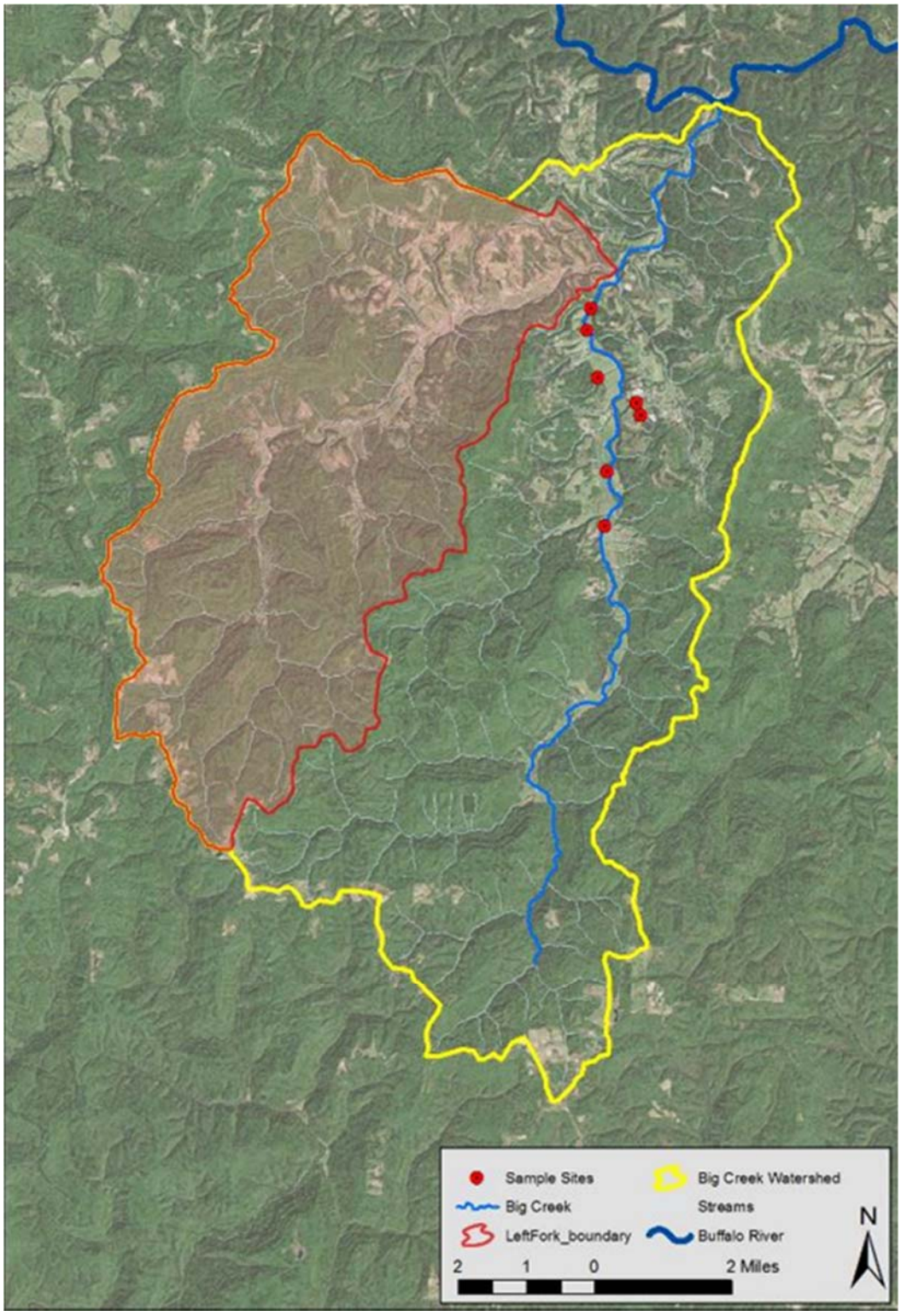

Figure 6. Left Fork Watershed.

Grid-Soil Sampling

Grid-soil sampling was completed on Field 5a in January, 2015. Samples were collected to a depth of 24 inches and sent to the University of Arkansas Soil Testing and Research Laboratory, Marianna, AR.

Table 3. Mehlich-3 extractable soil phosphorus, potassium, and calcium and pH of soils collected from Field 5a, January, 2015.

Soil depth, inches	pH	Phosphorus	Potassium	Calcium
Mean, mg/kg				
0 – 4	5.59	45	60	1289
4 – 8	5.7	30	54	1230
8 – 12	5.8	31	68	1383
12 – 18	5.9	42	81	1605
18 – 24	5.9	43	86	1638
Median, mg/kg				
0 – 4	5.45	42	53	955
4 – 8	5.6	24.0	54.5	962.5
8 – 12	5.9	24.5	67.0	1217.0
12 – 18	6.0	29.5	79.0	1384.0
18 – 24	6.1	25.5	87.0	1700.0
Minimum, mg/kg				
0 – 4	4.50	17	25	167
4 – 8	4.7	9.0	21.0	206.0
8 – 12	4.7	7.0	37.0	411.0
12 – 18	4.7	7.0	46.0	491.0
18 – 24	4.6	5.0	40.0	400.0
Maximum, mg/kg				
0 – 4	7.00	91	176	3404
4 – 8	6.8	72.0	89.0	3397.0
8 – 12	7.0	97.0	105.0	3976.0
12 – 18	6.8	300.0	124.0	2752.0
18 – 24	7.3	262.0	135.0	3228.0

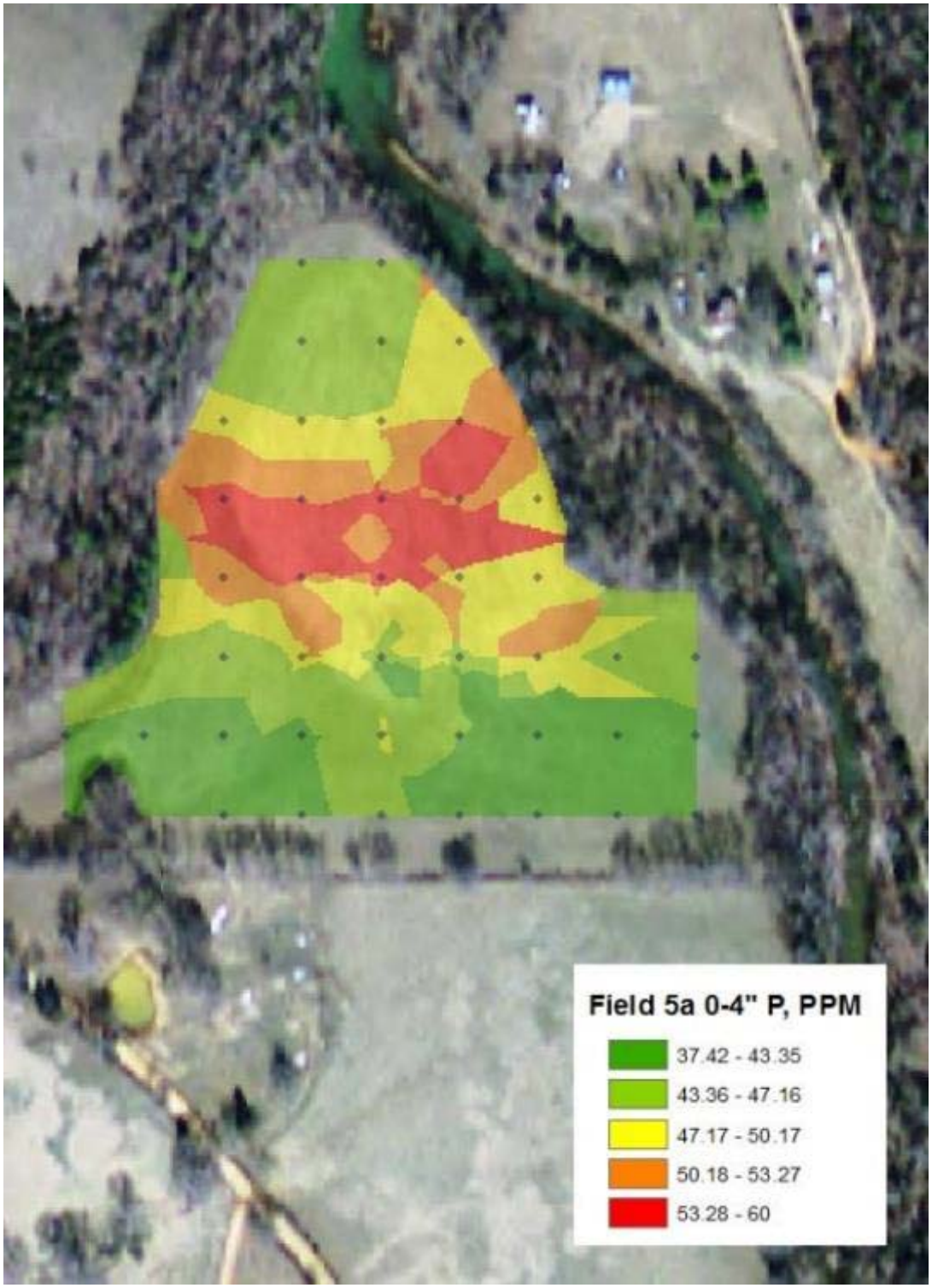

Figure 7. Spatial distribution of soil test P with depth for Field 5a.

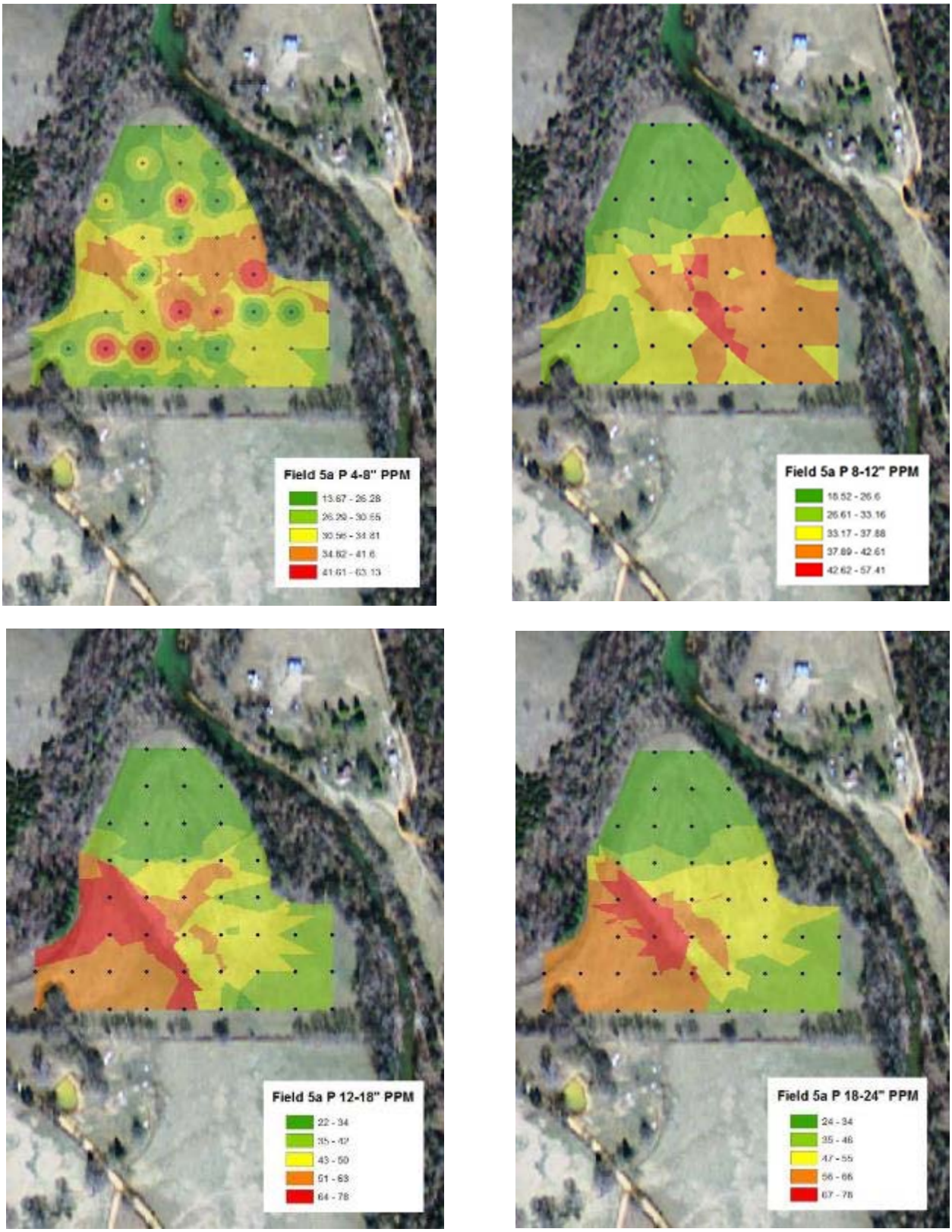

Figure 8. Spatial distribution of soil test P with depth for Field 5a.

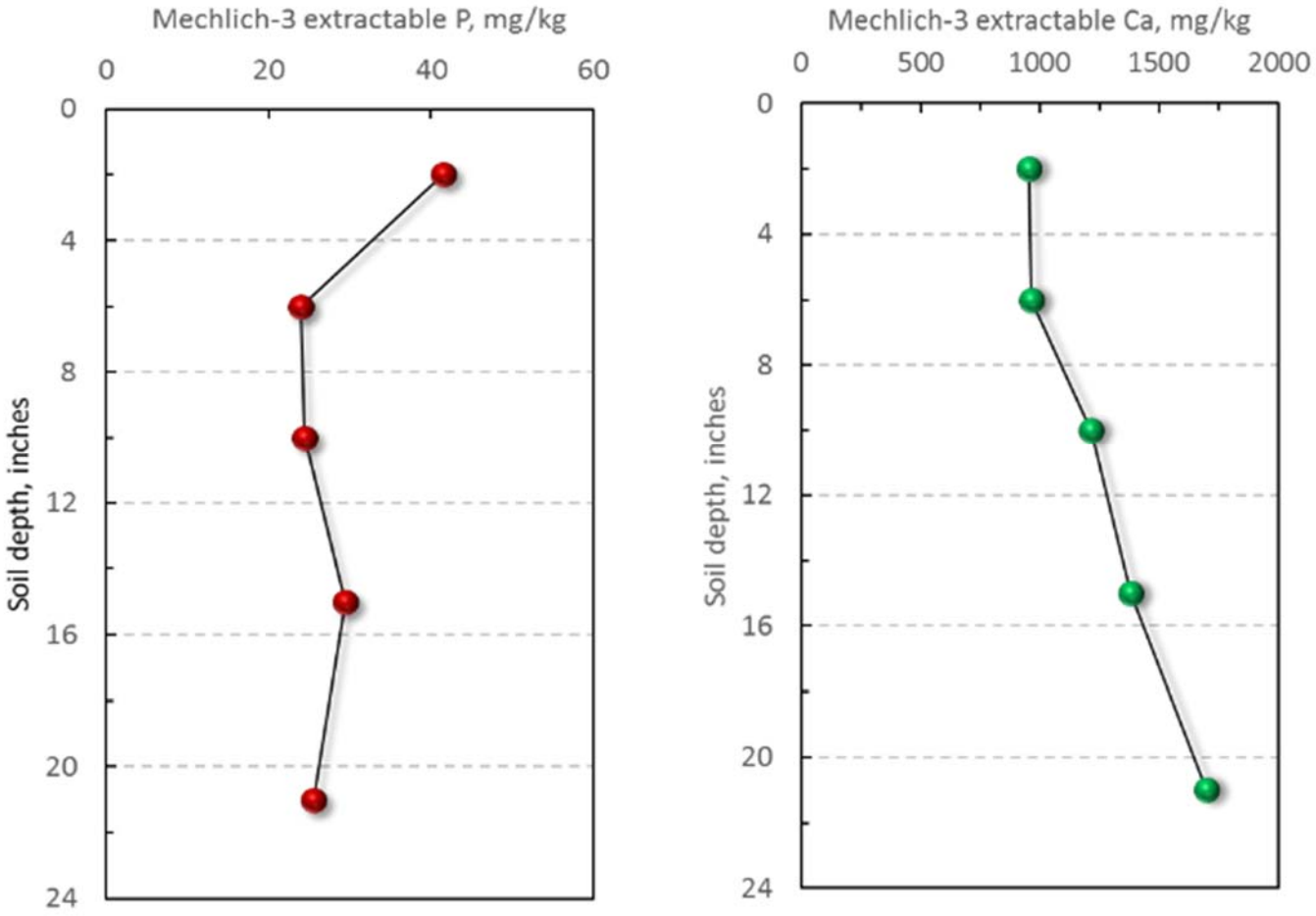

Figure 9. Relationship between median soil test P and Ca for Field 5a with depth.

The concentration of Soil test P at the surface of the soil is slightly greater than at depth. This is consistent with soils under pasture that have received fertilizer and in this case poultry litter in the past. However, the median soil test P concentration is just below the optimum (50 mg/kg) recommended by the State for warm season grass forage production. The increase in Ca concentration with depth, represent weathering processes occurring in a limestone setting, where lower concentrations in the upper soil profile representing uptake by plants, in addition to weathering and downward leaching of Ca.

Similar trends were observed for Field 12, for samples collected in 2014. For Field 1, which was at a higher elevation compared to the stream channel, samples could not be collected beyond 12 inches.

The grid-soil sampling of Fields 1, 5a, and 12 will be repeated in the fall of 2015. Nutrient concentrations will be compared with data from prior grid samplings to determine if any soil fertility changes are occurring these fields with time of farm operation.

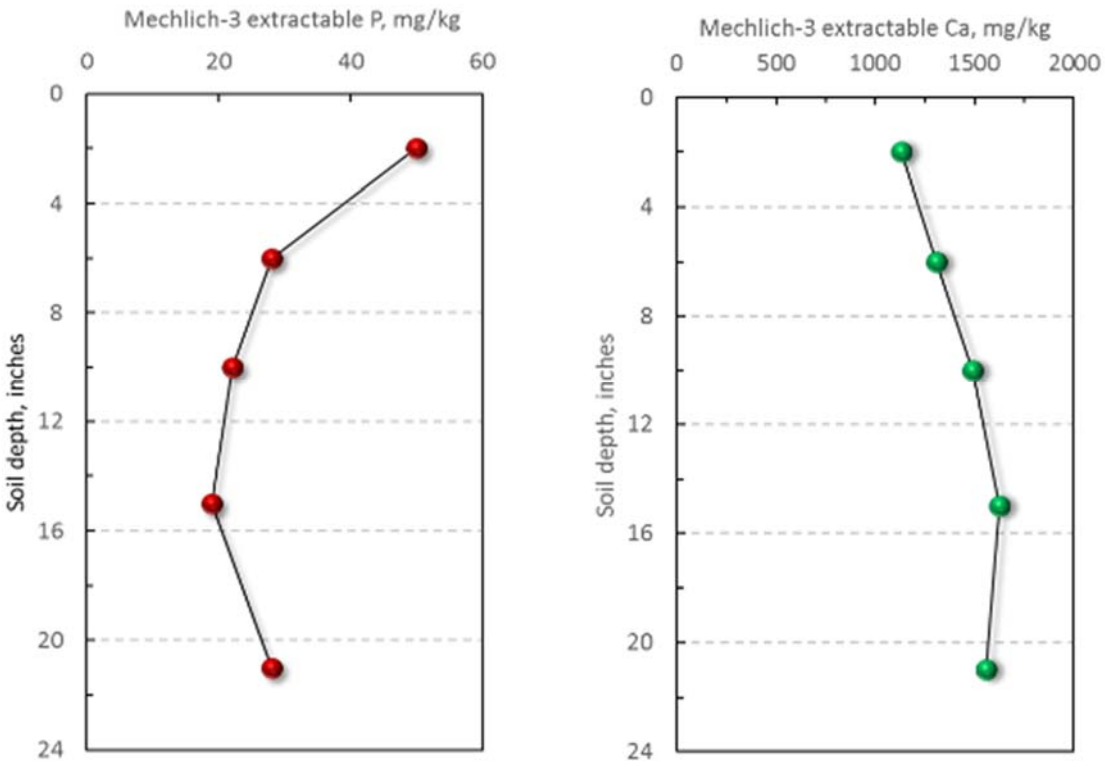

Figure 10. Relationship between median soil test P and Ca for Field 12 with depth.

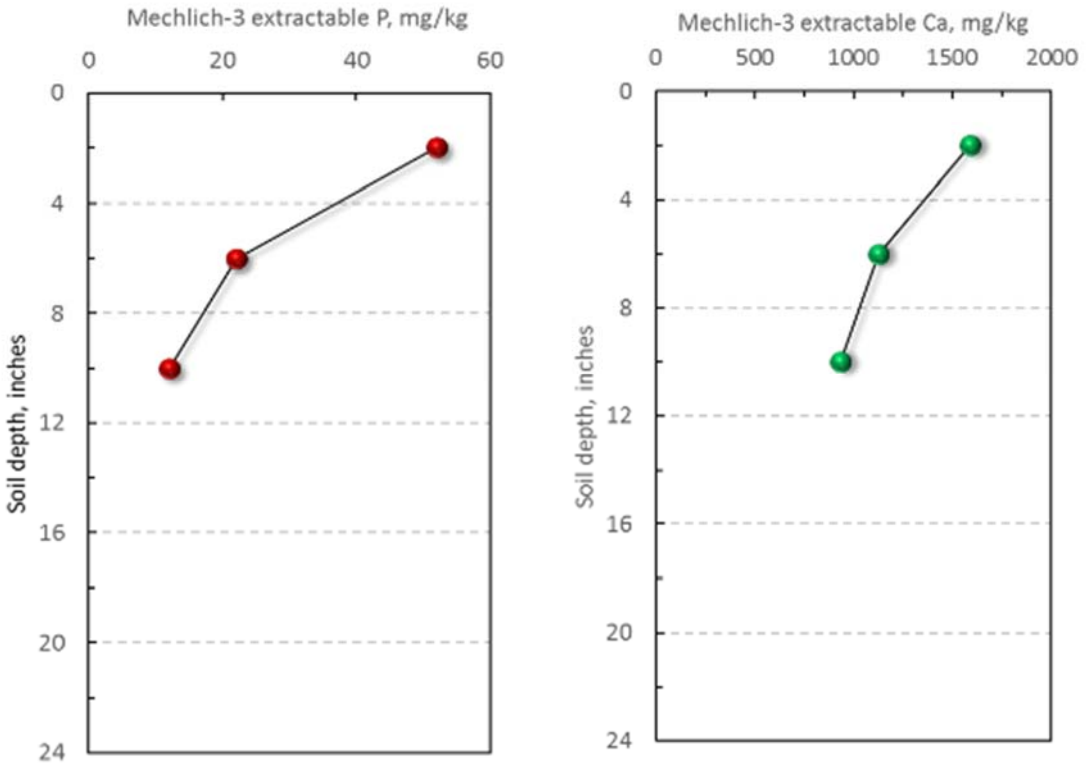

Figure 11. Relationship between median soil test P and Ca for Field 1 with depth.

Water Sampling and Analytical Methods

Sampling Locations

Water quality monitoring sites are shown in Figure 12 and are;

Site 1. Edge-of-field monitoring on Field 1 permitted to receive slurry.

Site 2. Edge-of-field monitoring on Field 5a.

Site 3. Edge-of-field monitoring on Field 12 permitted to receive slurry.

Site 4. Ephemeral stream flow draining a subwatershed containing the production facilities.

Site 5. Spring below Field 1.

Site 6. Big Creek upstream of the C&H Farm operation.

Site 7. Big Creak downstream of the C&H Farm operation.

Site 8. Manure holding pond trench. The site was visited weekly and trench water sampled when flowing.

Sampling Protocols and Analyses

The following protocols were used to collect, prepare, and analyze all water samples:

1. One-liter acid-washed bottles were used to collect the stream samples for nutrient analyses.
2. Water was collected from just beneath the surface, where the stream was actively moving and well-mixed.
3. The bottle was rinsed with stream water before collecting the sample.
4. Sterilized specimen cups were used to collect samples for bacterial evaluation.
5. Time of collection was noted, and samples placed in a cooler on ice to preserve them until processed and were submitted to the Arkansas Water Resources Center Water Quality Lab on the day of collection for analyses.
6. Analyses included Alkalinity (APHA 2320-B), Ammonia (EPA 351.2), Chloride (EPA 300.0), Dissolved Phosphorus (EPA 365.2), E. coli (APHA 9223-B), Electrical Conductivity (EPA 120.1), Nitrate (EPA 300.0), pH (EPA 150.1), Total Coliforms (APHA 9223-B), Total Dissolved Solids (EPA 160.1), Total Nitrogen (APHA 4500-P J), Total Phosphorus (APHA 4500-P J), and Total Suspended Solids (EPA 160.2). APHA is American Public Health Association from the Wadeable Streams Assessment, Water Chemistry Laboratory Manual http://www.epa.gov/owow/monitoring/wsa/WRS_lab_manual.pdf
7. The minimum detection limits (MDLs) for each chemical and biological constituent measured are listed in Table 4.
8. Chemical and biological analyses of samples collected from the beginning of 2015 to the end of May, 2015 are presented in Tables 5, 6, and 7.

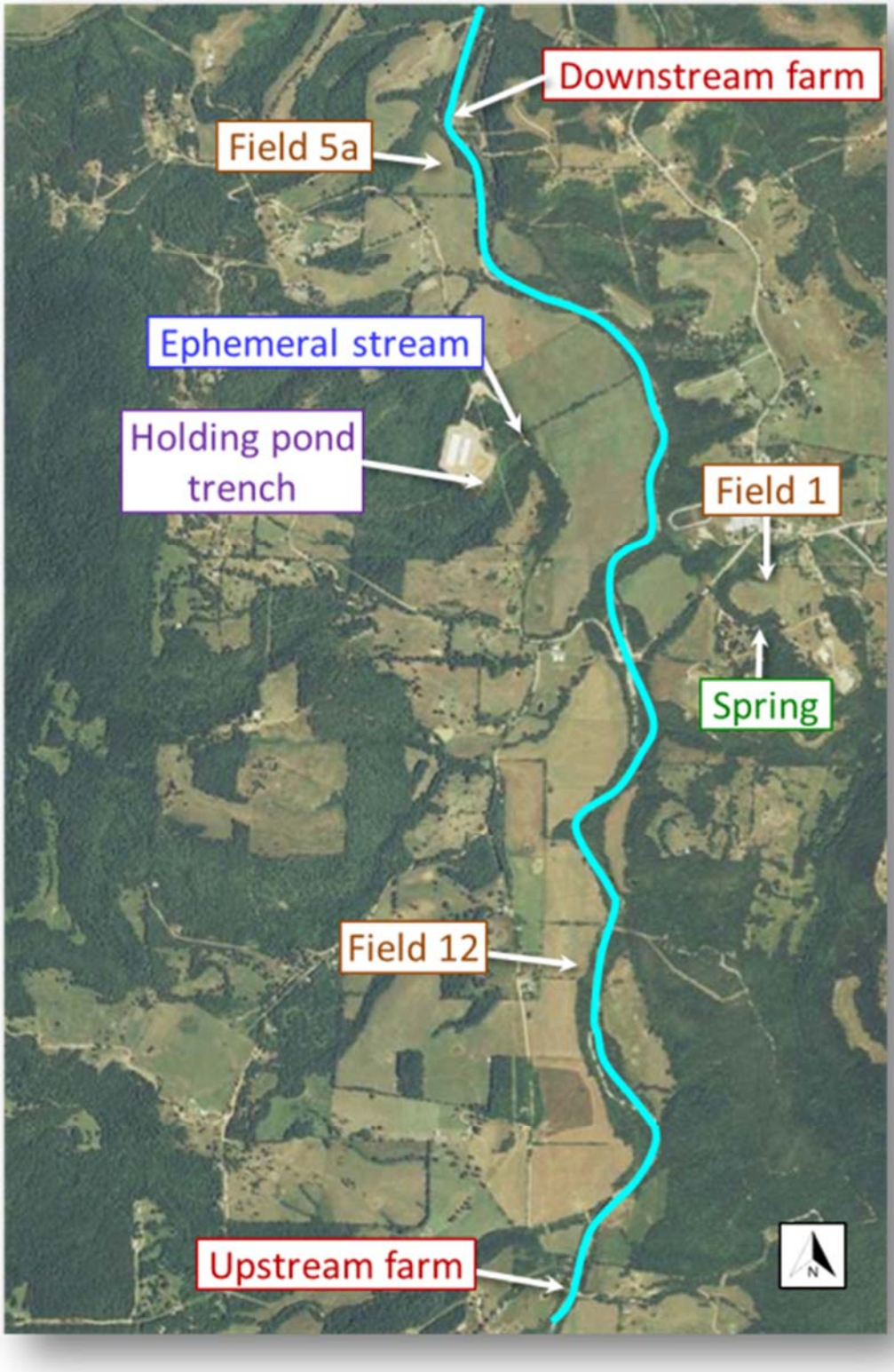

Figure 12. Location of water quality sampling sites on Big Creek and the C&H Farm.

Table 4. Minimum detection limits (MDLs) for each chemical and biological constituent measured.

Constituent	Minimum detection limit
Alkalinity, mg/L as $CaCO_3$	2
Chloride, mg/L	0.093
Dissolved P, mg/L	0.002
Conductivity, uS/cm	1
Ammonium-N, mg/L	0.03
Dissolved organic carbon, mg/L	0.18
E. coli, MPN 100/L	1
Nitrate-N, mg/L	0.004
pH	0.1
Total coliform, MPN 100/L	1
Total dissolved solids, mg/L	15.22
Total N, mg/L	0.006
Total P, mg/L	0.012
Total suspended solids, mg/L	6.58

USGS Stations

Big Creek Continuous Flow

We are collaborating with USGS at Big Creek near Mt. Judea (USGS 705579; downstream of the C&H Farm operation) and at Left Fork Big Creek near Vendor (USGS 07055792), to collect base and storm water flows for N, P, and bacteria analysis. The USGS Big Creek site is instrumented with continuous flow gaging equipment and a nitrate sensor, which provides real-time flow, water temperature, nitrate and precipitation data. These data are available on line at the USGS website below. Gage height, water temperature, precipitation, and continuous nitrate concentrations for the USGS downstream site for the last quarter are shown in Figures 13, 14, 15, and 16.

USGS 07055790 Big Creek near Mt. Judea, AR

http://nwis.waterdata.usgs.gov/ar/nwis/uv/?site_no=07055790&agency_cd=USGS

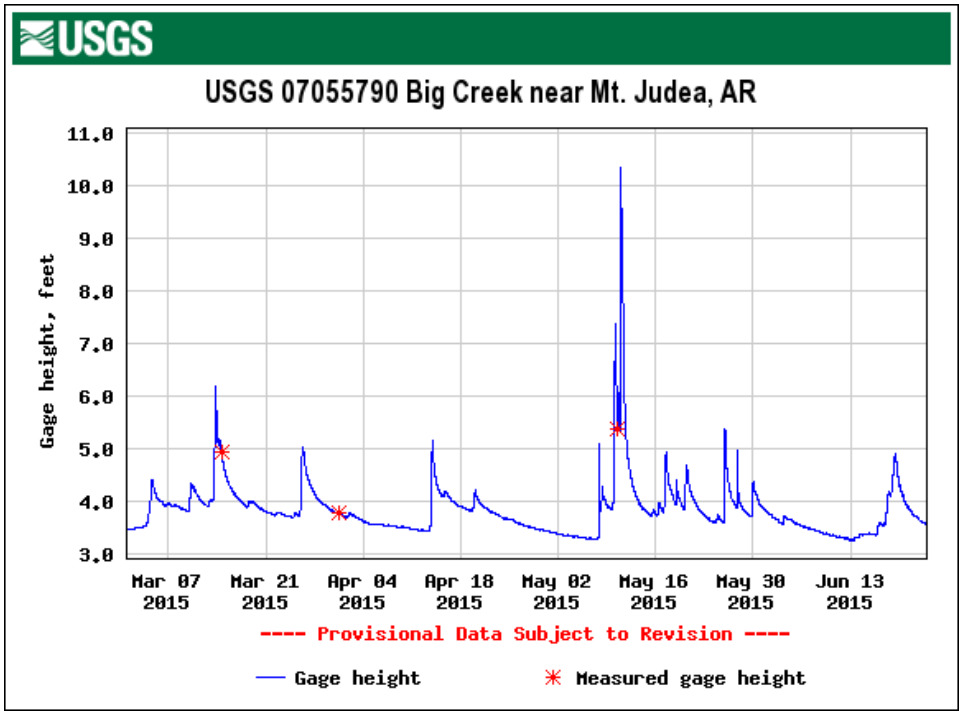

Figure 13. Flow at the Big Creek monitoring site downstream of the C&H Farm during the 2nd quarter of 2015.

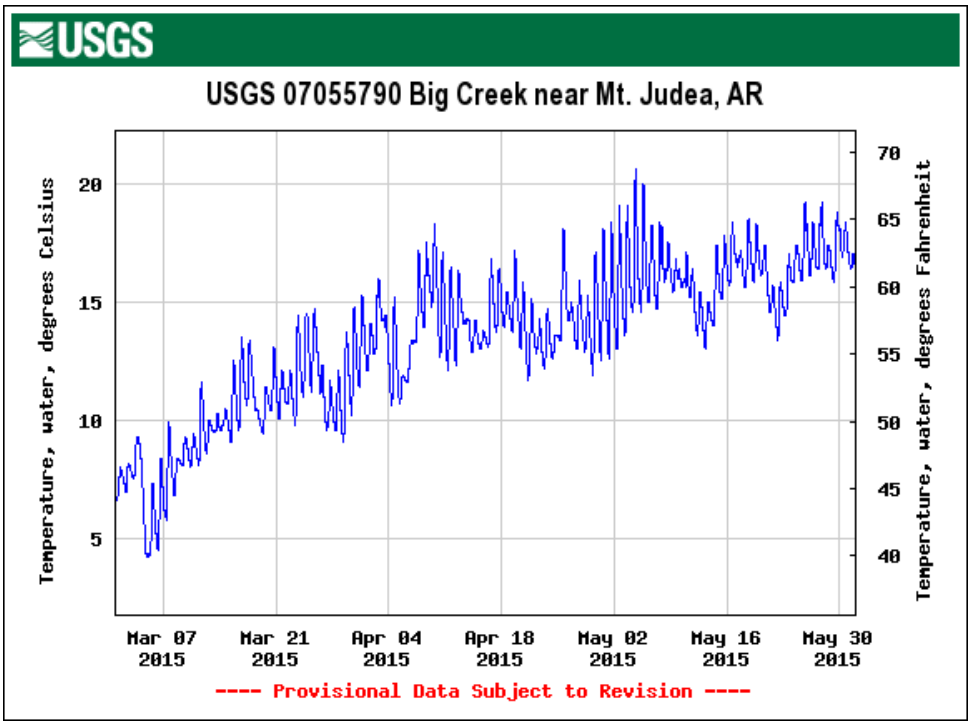

Figure 14. Water temperature at the Big Creek monitoring site downstream of the C&H Farm during the 2nd quarter of 2015.

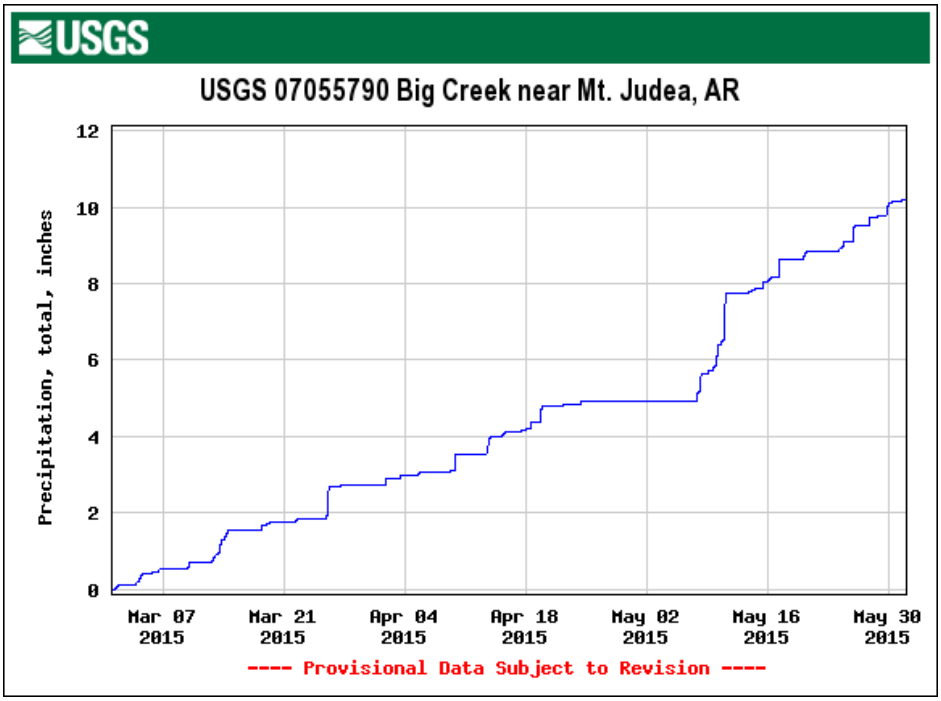

Figure 15. Precipitation at the Big Creek monitoring site downstream of the C&H Farm during the 2nd quarter of 2015.

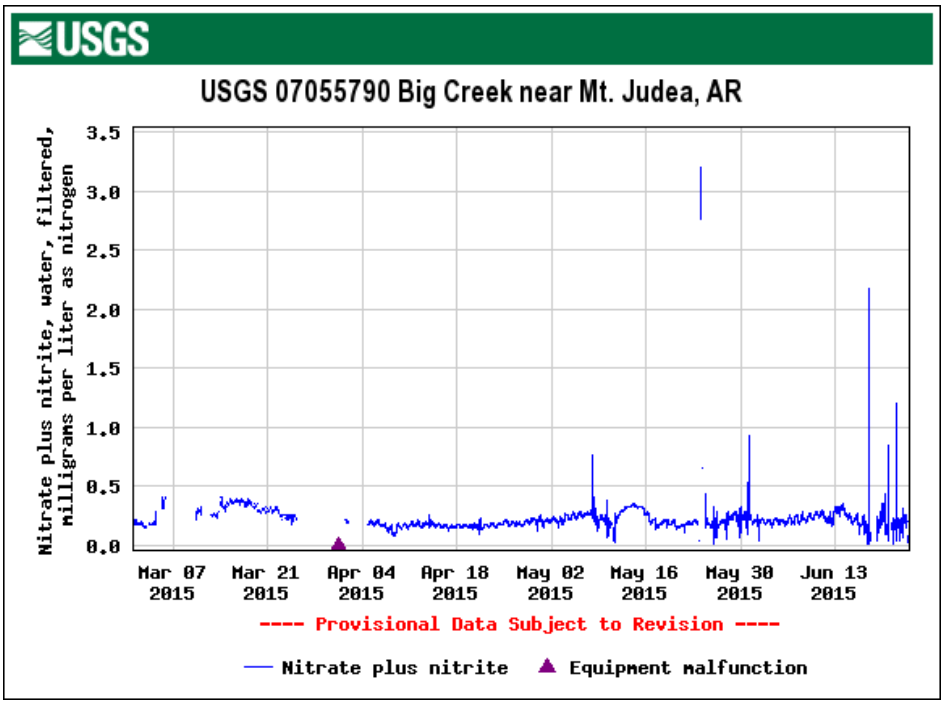

Figure 16. Nitrate concentration at the Big Creek monitoring site downstream of the C&H Farm during the 2nd quarter of 2015.

USGS 07055792 Left Fork Big Creek near Vendor, AR

http://waterdata.usgs.gov/ar/nwis/uv?cb_00065=on&format=gif_default&site_no=07055792&period=&begin_date=2015-05-01&end_date=2015-06-27

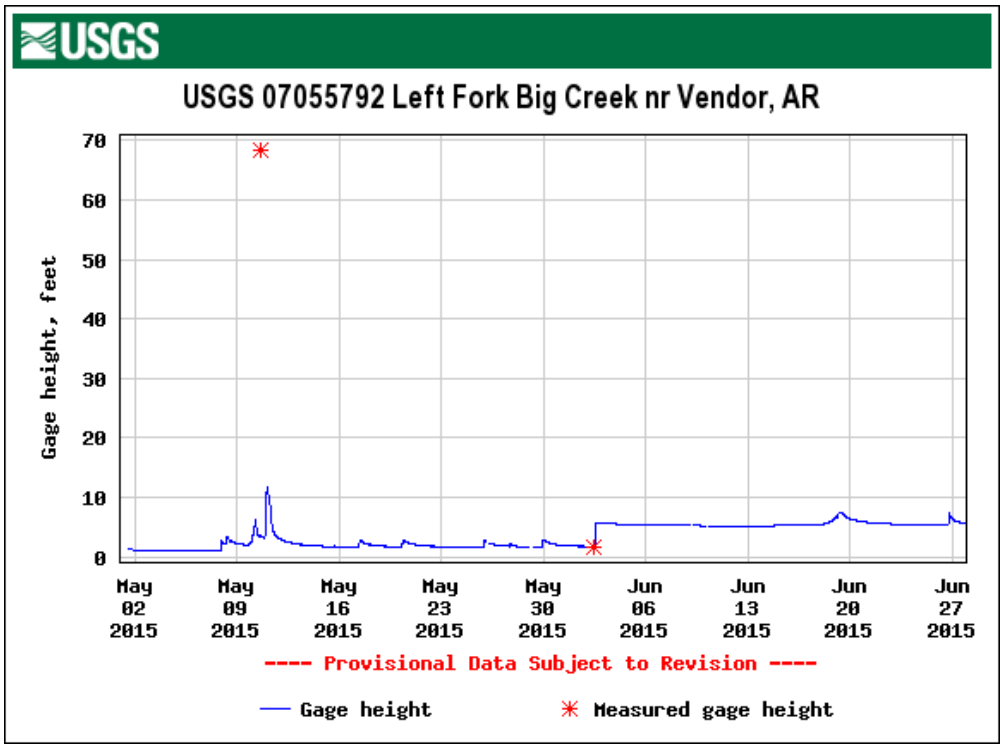

Figure 17. Gage height at the Left Fork monitoring site downstream of the C&H Farm during the 2nd quarter of 2015.

Big Creek Research and Extension Team Monitoring Data

Nutrients, Sediment, and Bacteria by Date of Sampling

Table 5. Water quality analyses at each sample site. Coliform units are Most Probable Number (MPN) per 100 mL of water for the 2nd Quarter of 2015.

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
			mg/L							MPN/100 mL	
1/8/2015	**1/8/2015**	**Base flow**									
11:05	15:05	Spring	0.010	0.014	<0.03	0.376	0.56	2.0	3.80	14.8	686.7
11:25	15:05	Upstream farm	0.009	0.022	<0.03	0.187	0.21	2.3	1.41	30.9	547.5
10:53	15:05	Downstream farm	0.011	0.024	<0.03	0.376	0.39	2.5	1.22	42.6	980.4
11:40	15:05	Ephemeral stream	0.008	0.022	<0.03	0.448	0.59	2.4	1.73	25.6	1203.3
12:00	15:05	Trench 1	0.005	0.022	<0.03	0.769	0.75	4.7	0.88	1.0	13130.0
1/14/2015	**1/14/2015**	**Base flow**									
11:30	15:20	Spring	0.010	0.028	<0.03	0.473	0.66	1.1	10.20	21.6	613.1
11:45	15:20	Upstream farm	0.012	0.032	<0.03	0.135	0.19	1.1	3.02	88.2	727.0
11:15	15:20	Downstream farm	0.011	0.020	<0.03	0.388	0.34	1.0	2.03	25.6	613.1
12:00	15:20	Ephemeral stream	0.007	0.028	<0.03	0.469	0.55	1.9	0.55	7.4	1413.6

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
1/21/2015	**1/21/2015**	**Base flow**									
11:15	15:28	Spring	0.009	0.020	<0.03	0.552	0.69	1.5	2.29	9.8	461.1
11:52	15:28	Upstream farm	0.008	0.018	<0.03	0.089	0.12	1.1	0.95	70.3	579.4
11:05	15:28	Downstream farm	0.010	0.026	0.06	0.197	0.30	1.1	1.60	37.4	613.1
11:25	15:28	Ephemeral stream	0.005	0.016	<0.03	0.370	0.46	1.0	2.34	155.3	2419.2
1/29/2015	**1/29/2015**	**Base flow**									
10:40	15:28	Spring	0.010	0.018	0.03	0.886	0.74	2.3	4.27	1.0	2850.0
11:45	15:28	Upstream farm	0.006	0.060	<0.03	0.065	0.21	47.8	1.71	727.0	1413.6
1:20	15:28	Downstream farm	0.009	0.020	0.04	0.168	0.27	1.3	1.50	19.9	1046.2
2/3/2015	**2/3/2015**	**Base flow**									
11:05	15:40	Spring	0.008	0.018	<0.03	0.691	0.77	3.8	7.64	1.0	461.1
11:40	15:40	Upstream farm	0.006	0.022	<0.03	0.051	0.28	1.1	2.69	4.1	1203.3
10:50	15:40	Downstream farm	0.009	0.018	<0.03	0.140	0.29	4.1	2.66	1.0	547.5
2/10/2015	**2/10/2015**	**Base flow**									
10:38	15:08	Spring	0.010	0.010	<0.03	0.544	0.64	1.9	0.76	2.0	686.7
11:05	15:08	Upstream farm	0.009	0.012	<0.03	0.056	0.09	0.7	1.04	1119.1	2419.2

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
10:25	15:08	Downstream farm	0.011	0.012	<0.03	0.143	0.23	1.0	1.15	7.4	1553.1
2/26/2015	**2/26/2015**	**Base flow**									
10:45	15:30	Spring	0.009	0.042	0.02	0.237	0.38	5.0	3.97	37.3	2419.2
11:36	15:30	Upstream farm	0.006	0.024	<0.03	0.100	0.13	0.6	1.20	47.9	686.7
10:34	15:30	Downstream farm	0.008	0.026	0.02	0.200	0.25	0.8	1.17	48.7	866.4
10:55	15:30	Ephemeral stream	0.006	0.022	<0.03	0.530	0.57	1.3	1.38	16.1	4790.0
11:15	15:30	Trench 1	0.004	0.028	0.01	0.712	0.76	46.0	0.60	1.0	41063.0
3/3/2015	**3/3/2015**	**Base flow**									
11:07	15:33	Spring	0.008	0.052	<0.03	0.124	0.35	13.5	4.90	N.S.	N.S.
11:50	15:33	Upstream farm	0.006	0.026	0.02	0.048	0.11	2.3	1.50	N.S.	N.S.
10:55	15:33	Downstream farm	0.007	0.028	<0.03	0.138	0.23	1.3	1.50	N.S.	N.S.
11:18	15:33	Ephemeral stream	0.006	0.020	<0.03	0.477	0.52	2.0	1.84	N.S.	N.S.
11:30	15:33	Trench 1	0.003	0.024	<0.03	0.867	0.89	14.9	0.95	N.S.	N.S.
3/11/2015	**3/11/2015**	**Storm Flow**									
11:30	14:58	Spring	0.009	0.030	<0.03	0.242	2.37	5.5	14.79	19.5	111.9

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
12:30	14:58	Upstream farm	0.005	0.026	0.02	0.118	0.16	2.1	3.38	34.5	579.4
11:20	14:58	Downstream farm	0.007	0.030	0.02	0.209	0.27	1.8	1.44	66.3	770.1
11:45	14:58	Ephemeral stream	0.006	0.022	0.04	0.567	0.60	0.5	2.20	6.3	410.0
12:10	14:58	Trench 1	0.003	0.014	0.07	0.989	0.97	0.3	2.00	<1.0	2419.2
12:15	14:58	Trench 2	0.003	0.056	0.04	1.443	1.59	1.2	3.51	<1.0	2419.2
3/19/2015	**3/19/2015**	**Base flow**									
10:59	15:10	Spring	0.010	0.028	0.03	0.184	0.29	10.6	7.37	38.9	79.4
12:00	15:10	Upstream farm	0.007	0.024	0.04	0.111	0.20	1.7	2.53	42.6	866.4
11:13	15:10	Downstream farm	0.009	0.028	0.04	0.234	0.35	2.8	2.87	71.7	1119.9
11:08	15:10	Ephemeral stream	0.007	0.018	0.01	0.529	0.63	1.0	4.31	14.6	866.4
11:13	15:10	House well	0.009	0.020	0.02	0.467	0.55	1.2	4.93	1.0	31.3
11:30	15:10	Trench 1	0.003	0.012	0.01	0.849	0.93	<6.58	3.11	1.0	275.5
11:35	15:10	Trench 2	0.004	0.062	0.09	1.036	1.42	1.9	5.12	5.2	2419.2
3/25/2015	**3/25/2015**	**Base flow**									

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
11:45	15:20	Spring	0.006	0.014	0.02	0.197	0.39	1.6	1.45	23.1	275.5
13:30	15:20	Upstream farm	0.006	0.028	0.02	0.056	0.16	2.9	1.36	125.9	2419.2
11:30	15:20	Downstream farm	0.008	0.036	0.04	0.162	0.29	5.0	1.41	547.5	3410.0
12:00	15:20	Ephemeral stream	0.007	0.014	0.02	0.462	0.53	1.1	0.64	8.6	344.8
12:20	15:20	House well	0.007	0.016	<0.03	0.450	0.52	1.9	0.03	18.5	30.1
12:30	15:20	Trench 1	0.003	0.008	<0.03	0.838	0.88	0.2	0.59	<1.0	410.6
3/26/2015	**3/26/2015**	**Storm flow**									
13:10	15:25	Upstream farm	0.013	0.064	0.06	0.090	0.30	11.4	3.71	547.5	5200.0
13:35	15:25	Downstream farm	0.013	0.076	0.06	0.144	0.41	14.1	3.94	816.4	4960.0
12:55	15:25	Trench 1	0.004	0.026	0.02	0.904	1.00	15.4	0.69	<1.0	1553.1
12:50	15:25	Trench 2	0.004	0.126	0.13	0.873	1.44	22.2	4.63	105.4	6950.0
13:20	15:25	Field 1	0.143	0.346	0.41	0.216	2.68	65.5	15.65	N.S.	N.S.
12:30	15:25	Field 5a	0.813	1.330	0.39	0.225	2.59	72.3	15.95	N.S.	N.S.
4/2/2015	**4/2/2015**	**Base flow**									

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
11:50	15:25	Spring	0.008	0.042	0.04	0.173	0.35	3.5	10.47	248.1	1299.7
12:15	15:25	Upstream farm	0.007	0.040	0.02	0.045	0.14	3.1	3.61	166.9	2419.2
1:30	15:25	Downstream farm	0.007	0.042	0.02	0.139	0.22	2.5	2.71	121.1	1986.3
12:30	15:25	Ephemeral stream	0.006	0.032	0.02	0.467	0.46	1.8	4.41	5.2	547.5
12:48	15:25	House well	0.008	0.030	<0.03	0.477	0.50	0.7	6.05	39.3	9060.0
12:54	15:25	Trench 1	0.003	0.028	0.02	0.865	0.87	0.3	3.34	1.1	308.6
4/9/2015	**4/9/2015**	**Base flow**									
11:45	15:30	Spring	0.011	0.034	0.01	0.257	0.42	4.9	9.11	7380.0	9040.0
12:30	15:30	Upstream farm	0.011	0.042	0.04	0.066	0.18	13.1	2.13	86.0	2650.0
12:50	15:30	Downstream farm	0.010	0.048	0.03	0.157	0.25	19.7	1.82	47.2	1986.3
12:00	15:30	House well	0.011	0.026	<0.03	0.499	0.50	1.5	0.74	4.1	325.5
12:10	15:30	Trench 1	0.006	0.018	<0.03	0.790	0.83	0.8	2.99	<1.0	187.2
4/15/2015	**4/15/2015**	**Storm Flow**									
11:38	14:55	Spring	0.007	0.034	<0.03	0.210	0.39	7.7	4.70	275.5	2280.0

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
12:23	14:55	Upstream farm	0.007	0.040	0.03	0.090	0.16	3.5	3.24	648.8	4040.0
12:40	14:55	Downstream farm	0.009	0.048	0.03	0.166	0.26	4.4	2.67	344.8	2920.0
11:48	14:55	Ephemeral stream	0.005	0.026	0.03	0.472	0.56	0.8	1.26	305.0	2430.0
11:58	14:55	House well	0.008	0.022	0.02	0.475	0.60	1.2	3.72	9.6	80.9
12:10	14:55	Trench 1	0.003	0.020	<0.03	0.857	0.93	1.3	4.29	<1.0	3180.0
4/23/2015	**4/23/2015**	**Base Flow**									
12:23	15:30	Spring	0.008	0.034	<0.03	0.264	0.36	7.4	3.64	71.7	648.8
13:00	15:30	Upstream farm	0.007	0.032	0.03	0.083	0.18	4.0	5.11	104.6	2419.2
12:15	15:30	Downstream farm	0.007	0.032	0.03	0.162	0.25	2.6	2.51	65.7	2419.2
11:55	15:30	Ephemeral stream	0.008	0.026	0.03	0.520	0.56	2.0	1.78	12.0	3270.0
11:35	15:30	House well	0.008	0.082	<0.03	0.496	0.53	1.4	1.69	18.5	35.0
11:48	15:30	Trench 1	0.003	0.034	<0.03	0.877	0.97	1.2	1.18	3.1	2690.0
4/29/2015	**4/29/2015**	**Base flow**									
11:25	14:05	Spring	0.010	0.028	<0.03	0.419	0.59	9.0	4.28	25.6	1732.9

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
11:53	14:05	Upstream farm	0.010	0.020	0.03	0.082	0.13	2.7	1.58	58.3	1732.4
12:13	14:05	Downstream farm	0.012	0.018	0.03	0.189	9.82	2.1	1.64	58.6	1986.3
11:30	14:05	Ephemeral stream	0.012	0.018	0.02	0.569	0.61	3.5	1.98	14.3	4080.0
11:35	14:05	House well	0.010	0.006	<0.03	0.517	0.51	0.7	2.26	248.1	5040.0
5/7/2015	**5/7/2015**	**Base flow**									
11:10	14:10	Spring	0.011	0.036	0.02	0.499	0.58	9.9	44.04	135.4	980.4
11:43	14:10	Upstream farm	0.008	0.032	0.01	0.110	0.16	7.5	10.16	77.6	3280.0
12:05	14:10	Downstream farm	0.009	0.034	<0.03	0.267	0.36	4.5	7.70	27.8	2280.0
11:18	14:10	Ephemeral stream	0.013	0.066	0.02	0.628	0.71	3.2	16.41	71.7	7170.0
11:23	14:10	House well	0.008	0.022	0.01	0.512	0.49	<6.58	28.63	3.1	59.4
5/8/2015	**5/8/2015**	**Storm flow**									
13:25	15:32	Upstream farm	0.134	0.354	0.16	0.340	1.12	51.4	9.30	N.S.	N.S.
13:25	15:32	Downstream farm	0.195	0.544	0.27	0.292	1.20	113.2	7.47	N.S.	N.S.

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
11:43	15:32	Ephemeral stream	0.005	0.254	0.41	2.287	3.23	127.1	6.45	N.S.	N.S.
13:00	15:32	Field 1	0.525	0.714	0.16	0.475	2.19	16.9	13.28	N.S.	N.S.
12:38	15:32	Field 12	0.675	0.956	0.14	0.303	1.82	57.0	16.00	N.S.	N.S.
5/11/2015	**5/12/2015**	**Storm Flow**									
11:35	8:30	Spring	0.008	0.058	0.01	0.339	0.49	8.7	3.67	N.S.	N.S.
11:28	8:30	Upstream farm	0.004	0.074	0.04	0.004	0.24	4.5	4.31	N.S.	N.S.
12:47	8:30	Downstream farm	0.031	0.530	0.11	0.071	1.12	277.5	8.48	N.S.	N.S.
12:05	8:30	Ephemeral stream	0.008	0.146	0.15	0.941	1.80	22.0	8.09	N.S.	N.S.
12:15	8:30	House well	0.009	0.038	0.02	0.541	0.55	4.2	0.89	N.S.	N.S.
12:25	8:30	Trench 1	0.003	0.060	0.02	0.916	0.97	27.6	1.78	N.S.	N.S.
12:35	8:30	Trench 2	0.003	0.042	0.05	0.553	0.76	8.8	3.44	N.S.	N.S.
11:25	8:30	Field 1	0.251	0.386	0.09	0.055	0.86	44.4	6.31	N.S.	N.S.

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
11:40	8:30	Field 5a	0.248	0.968	0.26	0.127	1.50	320.1	8.58	N.S.	N.S.
1:05	8:30	Field 12	0.194	0.364	0.09	0.135	0.83	36.7	7.03	N.S.	N.S.
5/14/2015	**5/14/2015**	**Base flow**									
12:35	15:12	Spring	0.009	0.062	0.02	0.222	0.35	41.5	2.84	121.1	2419.2
12:28	15:12	Upstream farm	0.011	0.046	0.02	0.177	0.23	2.8	1.35	145.5	2470.0
12:47	15:12	Downstream farm	0.015	0.050	0.02	0.326	0.39	6.1	1.16	128.1	4370.0
12:57	15:12	Left Fork	0.015	0.038	0.02	0.321	0.38	3.3	1.36	83.3	2690.0
12:15	15:12	Ephemeral stream	0.010	0.022	0.01	0.527	0.50	1.7	0.73	41.3	1986.3
12:05	15:12	Trench 1	0.005	0.042	0.02	0.904	0.94	29.9	1.20	81.6	1732.9
5/18/2015	**5/18/2015**	**Storm Flow**									
10:45	14:43	Spring	0.005	0.084	0.05	0.209	0.56	114.2	2.79	98.7	1413.6
11:57	14:43	Upstream farm	0.007	0.034	0.02	0.110	0.15	5.2	1.29	137.6	2419.2

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
12:17	14:43	Downstream farm	0.009	0.040	0.03	0.201	0.25	6.1	1.47	185.0	6770.0
12:29	14:43	Left Fork	0.011	0.040	0.04	0.209	0.29	4.1	1.90	167.4	8300.0
11:14	14:43	Ephemeral stream	0.007	0.028	0.03	0.525	0.55	0.7	1.18	90.7	7630.0
11:20	14:43	House well	0.008	0.018	<0.03	0.529	0.53	0.9	0.90	5.2	13.4
12:55	14:43	Trench 1	0.002	0.020	<0.03	0.897	0.93	0.3	1.28	32.3	1732.9
10:58	14:43	Field 1	0.208	0.512	0.54	0.410	3.59	53.7	26.12	N.S.	N.S.

N.S. is No Sample.

Values proceeded by '<' were reported by the analytical laboratory as zero and the Minimum detection limit is given.

Nutrients, Sediment, and Bacteria by Date Spring, Upstream, and Downstream Sites

Table 6. Water quality analyses at the spring and in Big Creek upstream and downstream of the C&H Farm boundary of permitted land application for the 2nd Quarter of 2015.

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
	mg/L							MPN/100 mL	
1/8/2015									
Spring	0.010	0.014	<0.03	0.376	0.56	2.0	3.80	14.8	686.7
Upstream	0.009	0.022	<0.03	0.187	0.21	2.3	1.41	30.9	547.5
Downstream	0.011	0.024	<0.03	0.376	0.39	2.5	1.22	42.6	980.4
1/14/2015									
Spring	0.010	0.028	<0.03	0.473	0.66	1.1	10.20	21.6	613.1
Upstream	0.012	0.032	<0.03	0.135	0.19	1.1	3.02	88.2	727.0
Downstream	0.011	0.020	<0.03	0.388	0.34	1.0	2.03	25.6	613.1
1/21/2015									
Spring	0.009	0.020	<0.03	0.552	0.69	1.5	2.29	9.8	461.1
Upstream	0.008	0.018	<0.03	0.089	0.12	1.1	0.95	70.3	579.4
Downstream	0.010	0.026	0.06	0.197	0.30	1.1	1.60	37.4	613.1

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
1/29/2015									
Spring	0.010	0.018	0.03	0.886	0.74	2.3	4.27	1.0	2850.0
Upstream	0.006	0.060	<0.03	0.065	0.21	47.8	1.71	727.0	1413.6
Downstream	0.009	0.020	0.04	0.168	0.27	1.3	1.50	19.9	1046.2
2/3/2015									
Spring	0.008	0.018	<0.03	0.191	0.77	3.8	7.64	1.0	461.1
Upstream	0.006	0.022	<0.03	0.051	0.28	1.1	2.69	4.1	1203.3
Downstream	0.009	0.018	<0.03	0.140	0.29	4.1	2.66	1.0	547.5
2/10/2015									
Spring	0.010	0.010	<0.03	0.544	0.64	1.9	0.76	2.0	686.7
Upstream	0.009	0.012	<0.03	0.056	0.09	0.7	1.04	1119.1	2419.2
Downstream	0.011	0.012	<0.03	0.143	0.23	1.0	1.15	7.4	1553.1
2/26/2015									
Spring	0.009	0.042	0.02	0.237	0.38	5.0	3.97	37.3	2419.2
Upstream	0.006	0.024	<0.03	0.100	0.13	0.6	1.20	47.9	686.7
Downstream	0.008	0.026	0.02	0.200	0.25	0.8	1.17	48.7	866.4

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
3/3/2015									
Spring	0.008	0.052	<0.03	0.124	0.35	N.D.	4.90	N.S.	N.S.
Upstream	0.006	0.026	0.02	0.048	0.11	N.D.	1.50	N.S.	N.S.
Downstream	0.007	0.028	<0.03	0.138	0.23	N.D.	1.50	N.S.	N.S.
3/11/2015									
Spring	0.009	0.030	<0.03	0.242	2.37	5.5	14.79	19.5	111.9
Upstream	0.005	0.026	0.02	0.118	0.16	2.1	3.38	34.5	579.4
Downstream	0.007	0.030	0.02	0.209	0.27	1.8	1.44	66.3	770.1
3/19/2015									
Spring	0.010	0.028	0.03	0.184	0.29	10.6	7.37	38.9	79.4
Upstream	0.007	0.024	0.04	0.111	0.20	1.7	2.53	42.6	866.4
Downstream	0.009	0.028	0.04	0.234	0.35	2.8	2.87	71.7	1119.9
3/25/2015									
Spring	0.006	0.014	0.02	0.197	0.39	1.6	1.45	23.1	275.5
Upstream	0.006	0.028	0.02	0.056	0.16	2.9	1.36	125.9	2419.2
Downstream	0.008	0.036	0.04	0.162	0.29	5.0	1.41	547.5	3410.0

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
3/26/2015									
Spring	0.013	0.064	0.06	0.090	0.30	11.4	3.71	547.5	5200.0
Upstream	0.013	0.076	0.06	0.144	0.41	14.1	3.94	816.4	4960.0
Downstream	0.004	0.026	0.02	0.904	1.00	15.4	0.69	<1.0	1553.1
4/2/2015									
Spring	0.008	0.042	0.04	0.173	0.35	3.5	10.47	248.1	1299.7
Upstream	0.007	0.040	0.02	0.045	0.14	3.1	3.61	166.9	2419.2
Downstream	0.007	0.042	0.02	0.139	0.22	2.5	2.71	121.1	1986.3
4/9/2015									
Spring	0.011	0.034	0.01	0.257	0.42	4.9	9.11	7380.0	9040.0
Upstream	0.011	0.042	0.04	0.066	0.18	13.1	2.13	86.0	2650.0
Downstream	0.010	0.048	0.03	0.157	0.25	19.7	1.82	47.2	1986.3
4/15/2015									
Spring	0.007	0.034	<0.03	0.210	0.39	7.7	4.70	275.5	2280.0
Upstream	0.007	0.040	0.03	0.090	0.16	3.5	3.24	648.8	4040.0
Downstream	0.009	0.048	0.03	0.166	0.26	4.4	2.67	344.8	2920.0

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
4/23/2015									
Spring	0.008	0.034	<0.03	0.264	0.36	7.4	3.64	71.7	648.8
Upstream	0.007	0.032	0.03	0.083	0.18	4.0	5.11	104.6	2419.2
Downstream	0.007	0.032	0.03	0.162	0.25	2.6	2.51	65.7	2419.2
4/29/2015									
Spring	0.010	0.028	<0.03	0.419	0.59	9.0	4.28	25.6	1732.9
Upstream	0.010	0.020	0.03	0.082	0.13	2.7	1.58	58.3	1732.4
Downstream	0.012	0.018	0.03	0.189	9.82	2.1	1.64	58.6	1986.3
5/7/2015									
Spring	0.011	0.036	0.02	0.499	0.58	9.9	44.04	135.4	980.4
Upstream	0.008	0.032	0.01	0.110	0.16	7.5	10.16	77.6	3280.0
Downstream	0.009	0.034	<0.03	0.267	0.36	4.5	7.70	27.8	2280.0
5/8/2015									
Spring	0.134	0.354	0.16	0.340	1.12	51.4	9.30	N.S.	N.S.
Upstream	0.195	0.544	0.27	0.292	1.20	113.2	7.47	N.S.	N.S.
Downstream	0.005	0.254	0.41	2.287	3.23	127.1	6.45	N.S.	N.S.

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
5/11/2015									
Spring	0.008	0.058	0.01	0.339	0.49	8.7	3.67	N.S.	N.S.
Upstream	0.004	0.074	0.04	0.004	0.24	4.5	4.31	N.S.	N.S.
Downstream	0.031	0.530	0.11	0.071	1.12	277.5	8.48	N.S.	N.S.
5/14/2015									
Spring	0.009	0.062	0.02	0.222	0.35	41.5	2.84	121.1	2419.2
Upstream	0.011	0.046	0.02	0.177	0.23	2.8	1.35	145.5	2470.0
Downstream	0.015	0.050	0.02	0.326	0.39	6.1	1.16	128.1	4370.0
5/18/2015									
Spring	0.005	0.084	0.05	0.209	0.56	114.2	2.79	98.7	1413.6
Upstream	0.007	0.034	0.02	0.110	0.15	5.2	1.29	137.6	2419.2
Downstream	0.009	0.040	0.03	0.201	0.25	6.1	1.47	185.0	6770.0

N.S. is No Sample.

Values proceeded by '<' were reported by the analytical laboratory as zero and the Minimum detection limit is given.

Nutrients, Sediment, and Bacteria by Site for Ephemeral Stream, House Well, Trenches, Left Fork and Field Runoff

Table 7. Water quality analyses at the ephemeral stream draining the subwatershed containing the production houses and manure holding ponds, the well adjacent to the ponds, and surface runoff from Fields 1, 5a, and 12 for the 2nd Quarter of 2015.

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
	mg/L							MPN/100 mL	
Ephemeral stream									
1/8/2015	0.008	0.022	<0.03	0.448	0.59	2.4	1.73	25.6	1203.3
1/15/2015	0.007	0.028	<0.03	0.469	0.55	1.9	0.55	7.4	1413.6
1/21/2015	0.005	0.016	<0.03	0.370	0.46	1.0	2.34	155.3	2419.2
2/26/2015	0.006	0.022	<0.03	0.530	0.57	1.3	1.38	16.1	4790.0
3/3/2015	0.006	0.020	<0.03	0.477	0.52	ND	1.84	N.S.	N.S.
3/11//2015	0.006	0.022	0.04	0.567	0.60	0.5	2.20	6.3	410.0
3/19/2015	0.007	0.018	0.01	0.529	0.63	1.0	4.31	14.6	866.4
3/25/2015	0.007	0.014	0.02	0.462	0.53	1.1	0.64	8.6	344.8
4/2/2015	0.006	0.032	0.02	0.467	0.46	1.8	4.41	5.2	547.5
4/15/2015	0.005	0.026	0.03	0.472	0.56	0.8	1.26	305.0	2430.0
4/23/2015	0.008	0.026	0.03	0.520	0.56	2.0	1.78	12.0	3270.0
4/29/2015	0.012	0.018	0.02	0.569	0.61	3.5	1.98	14.3	4080.0

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
5/7/2015	0.013	0.066	0.02	0.628	0.71	3.2	16.41	71.7	7170.0
5/8/2015	0.005	0.254	0.41	2.287	3.23	127.1	6.45	5200.0	241920
5/11/2015	0.008	0.146	0.15	0.941	1.80	22.0	8.09	N.S.	N.S.
5/14/2015	0.010	0.022	0.01	0.527	0.50	1.7	0.73	41.3	1986.3
5/18/2015	0.007	0.028	0.03	0.525	0.55	0.7	1.18	90.7	7630.0
House well									
3/19/2015	0.009	0.020	0.02	0.467	0.55	1.2	4.93	1.0	31.3
3/25/2015	0.007	0.016	<0.03	0.450	0.52	1.9	0.03	18.5	30.1
4/2/2015	0.008	0.030	<0.03	0.477	0.50	0.7	6.05	39.3	9060.0
4/9/2015	0.011	0.026	<0.03	0.499	0.50	1.5	0.74	4.1	325.5
4/15/2015	0.008	0.022	0.02	0.475	0.60	1.2	3.72	9.6	80.9
4/23/2015	0.008	0.082	<0.03	0.496	0.53	1.4	1.69	18.5	35.0
4/29/2015	0.010	0.006	<0.03	0.517	0.51	0.7	2.26	248.1	5040.0
5/7/2015	0.008	0.022	0.01	0.512	0.49	<6.58	28.63	3.1	59.4
5/11/2015	0.009	0.038	0.02	0.541	0.55	4.2	0.89	N.S.	N.S.
5/18/2015	0.008	0.018	<0.03	0.529	0.53	0.9	0.90	5.2	13.4

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
Interceptor Trench 1 (South)									
1/8/2015	0.005	0.022	<0.03	0.769	0.75	4.7	0.88	1.0	13130.0
1/14/2015	0.007	0.028	<0.03	0.469	0.55	1.9	0.55	7.4	1413.6
2/26/2015	0.004	0.028	0.01	0.712	0.76	46.0	0.60	1.0	41063.0
3/3/2015	0.003	0.024	<0.03	0.867	0.89	N.D.	0.95	N.S.	N.S.
3/11/2015	0.003	0.014	0.07	0.989	0.97	0.3	2.00	<1.0	2419.2
3/19/2015	0.003	0.012	0.01	0.849	0.93	<6.58	3.11	1.0	275.5
3/25/2015	0.003	0.008	<0.03	0.838	0.88	0.2	0.59	<1.0	410.6
3/26/2015	0.004	0.026	0.02	0.904	1.00	15.4	0.69	<1.0	1553.1
4/2/2015	0.003	0.028	0.02	0.865	0.87	0.3	3.34	1.1	308.6
4/9/2015	0.006	0.018	<0.03	0.790	0.83	0.8	2.99	<1.0	187.2
4/15/2015	0.003	0.020	<0.03	0.857	0.93	1.3	4.29	<1.0	3180.0
4/23/2015	0.003	0.034	<0.03	0.877	0.97	1.2	1.18	3.1	2690.0
5/11/2015	0.003	0.060	0.02	0.916	0.97	27.6	1.78	N.S.	N.S.
Interceptor Trench 2 (North)									

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
3/11//2015	0.003	0.056	0.04	1.443	1.59	1.2	3.51	<1.0	2419.2
3/19/2015	0.004	0.062	0.09	1.036	1.42	1.9	5.12	5.2	2419.2
3/26/2015	0.004	0.126	0.13	0.873	1.44	22.2	4.63	105.4	6950.0
5/11/2015	0.003	0.042	0.05	0.553	0.76	8.8	3.44	N.S.	N.S.
5/14/2015	0.005	0.042	0.02	0.904	0.94	29.9	1.20	81.6	1732.9
5/18/2015	0.002	0.020	<0.03	0.897	0.93	0.3	1.28	32.3	1732.9
Left Fork									
5/14/2015	0.015	0.038	0.02	0.321	0.38	3.3	1.36	83.3	2690.0
5/18/2015	0.011	0.040	0.04	0.209	0.29	4.1	1.90	167.4	8300.0
Field 1									
3/26/2015	0.143	0.346	0.41	0.216	2.68	65.5	15.65	N.S.	N.S.
5/8/2015	0.525	0.714	0.16	0.475	2.19	16.9	13.28	N.S.	N.S.
5/11/2015	0.251	0.386	0.09	0.055	0.86	44.4	6.31	N.S.	N.S.
5/18/2015	0.208	0.512	0.54	0.410	3.59	53.7	26.12	N.S.	N.S.
Field 5a									

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
3/26/2015	0.813	1.330	0.39	0.225	2.59	72.3	15.95	N.S.	N.S.
5/8/2015	0.248	0.968	0.26	0.127	1.50	320.1	8.58	N.S.	N.S.
Field 12									
5/8/2015	0.675	0.956	0.14	0.303	1.82	57.0	16.00	N.S.	N.S.
5/11/2015	0.194	0.364	0.09	0.135	0.83	36.7	7.03	N.S.	N.S.

N.S. is No Sample.

N.D. is No Data

E. coli and total coliform were not measured on surface runoff samples collected by ISCO samplers when sample holding time exceeded the required 8-hour threshold.

Values proceeded by '<' were reported by the analytical laboratory as zero and the Minimum detection limit is given.

Water pH, Alkalinity, Chloride, Electrical Conductivity, and Total Dissolved Solids for Several Big Creek Sites

At the beginning of 2015, the pH, alkalinity, chloride concentration, electrical conductivity and total dissolved solids were determined on water samples collected at the upstream and downstream sites, spring, house well, and trenches, to build a data base that will enable to eventually source track the major water source pathways at these sites. These values are given below in Table 8.

Table 8. The pH, Chloride concentration, electrical conducting, and total solids concentration of water samples collected at upstream, downstream, spring, house well and trench sites, initiated at the beginning of 2015.

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
		mg/L	mg/L	µS/cm	mg/L
Upstream					
1/8/2015	7.3	36.0	1.8	90.4	71.6
1/14/2015			2.1	104.6	49.1
1/21/2015	7.6	48.0	1.9	121.3	71.1
1/29/2015			2.1	139.9	71.3
2/3/2015	7.74	54.0	2.400	128.5	71.1
2/10/2015			2.507	131.5	67.6
2/26/2015	7.59	40.0	1.976	107.0	56.4
3/3/2015			2.080	111.7	58.9
3/11/2015	7.79	30.0	1.878	85.3	269.3
3/19/2015			1.552	98.0	58.0
3/25/2015	8.01	42.0	1.767	110.1	67.6
3/26/2015			1.328	114.8	64.4
4/2/2015	8.0	42.0	1.566	109.7	76.0
4/9/2015			1.732	115.5	74.9
4/15/2015	7.7	36.0	1.376	90.8	63.8

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
4/23/2015			1.651	94.5	60.4
4/29/2015	8.1	50.0	1.556	85.1	54.3
5/7/2015			1.797	157.1	88.4
5/8/2015			1.628	131.2	110.0
5/11/2015	7.5	24.0	1.553	143.1	79.3
5/14/2015			1.197	106.6	56.2
5/18/2015			1.095	89.6	58.4
5/26/2015	7.7	28.0	1.083	77.7	55.3
Median	7.74	40.0	1.732	109.7	67.6
			Downstream		
1/8/2015	7.56	64	2.023	143.8	89.3
1/14/2015			2.755	166.3	79.8
1/21/2015	7.55	84	2.442	190.8	91.1
1/29/2015			2.512	204.5	109.1
2/3/2015	7.71	88.0	2.823	196.4	103.3
2/10/2015			3.012	204.4	105.5
2/26/2015	7.75	66.0	2.270	161.9	88.0
3/3/2015			2.393	170.1	80.0
3/11/2015	7.78	52.0	2.020	127.9	77.3
3/19/2015			1.753	147.7	84.9
3/25/2015	7.83	64.0	2.072	158.0	88.7
3/26/2015			1.457	82.9	78.7
4/2/2015	8.1	68.0	1.946	163.3	103.0
4/9/2015			2.081	167.5	100.4
4/15/2015	7.8	56.0	1.541	129.9	82.0
4/23/2015			1.812	142.4	81.0

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
4/29/2015	8.0	80.0	2.150	150.4	97.3
5/7/2015			2.497	225.0	125.8
5/8/2015			1.731	148.9	130.9
5/11/2015	7.5	36.0	1.059	103.1	80.2
5/14/2015			1.545	150.3	58.7
5/18/2015			1.248	136.6	89.1
5/26/2015	7.7	46.0	1.202	125.1	93.3
Median	7.75	64.0	2.023	150.4	89.1
Spring					
1/8/2015			2.274	534	321.1
1/14/2015			2.79	517	310
1/21/2015			2.272	553	324
2/3/2015			2.199	562.0	321.8
2/10/2015			2.437	581.0	314.2
2/26/2015			1.740	491.0	266.4
3/3/2015			1.569	430.0	234.9
3/11/2015			1.626	495.0	54.7
3/19/2015			1.537	474.0	220.0
3/25/2015			2.076	544.0	277.6
4/2/2015			1.778	515.0	289.8
4/9/2015			2.029	509.0	305.8
4/15/2015			1.761	480.0	276.9
4/23/2015			1.928	512.0	297.3
4/29/2015			2.545	564.0	294.9
5/7/2015			2.293	623.0	318.9
5/8/2015			1.107	408.0	202.0

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
5/14/2015			1.349	507.0	259.6
5/18/2015			1.167	508.0	265.8
5/26/2015			1.084	516.0	250.4
Median			1.853	513.5	283.7
House well					
3/19/2015			4.787	458.0	232.2
3/25/2015			5.270	453.0	221.6
4/2/2015			4.908	453.0	256.0
4/9/2015			5.100	419.0	242.2
4/15/2015			5.023	426.0	240.9
4/23/2015			4.826	414.0	237.3
4/29/2015			4.960	436.0	226.4
5/7/2015			5.104	452.0	238.2
5/14/2015			5.189	484.0	234.7
5/18/2015			4.817	481.0	178.0
5/26/2015			5.018	488.0	249.6
Median			5.018	453.0	237.3
Trench 1					
2/26/2015			2.079	171.4	78.4
3/3/2015			2.106	177.1	86.7
3/11/2015			1.945	193.3	114.0
3/19/2015			1.702	209.4	109.3
3/25/2015			2.132	238.2	105.1
3/26/2015			1.639	209.0	120.2
4/2/2015			1.944	260.6	151.3
4/9/2015			1.985	260.0	154.0

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
4/15/2015			1.801	259.5	146.7
4/23/2015			2.060	230.9	132.7
5/11/2015			2.086	262.0	126.5
5/14/2015			1.857	299.0	156.5
5/18/2015			1.566	346.0	173.1
5/26/2015			1.650	297.0	146.0
Median			1.945	248.9	129.6
Trench 2					
3/11/2015			1.769	158.9	140.8
3/19/2015			1.043	167.5	104.9
3/26/2015			0.778	134.8	160.9
5/11/2015			0.411	164.9	88.5
5/26/2015			0.934	284.0	141.3
Median			0.934	164.9	140.8

Nutrient and Bacteria Concentration in Big Creek over the Monitoring Period

The difference in dissolved P, total P, nitrate-N, total N, E. coli, and total coliform between down- and up-stream monitoring sites are presented in Figures 18, 19, and 20, respectively. No consistent differences in the trends in concentrations at the downstream site on Big Creek compared with the upstream site appear evident over the current monitoring period.

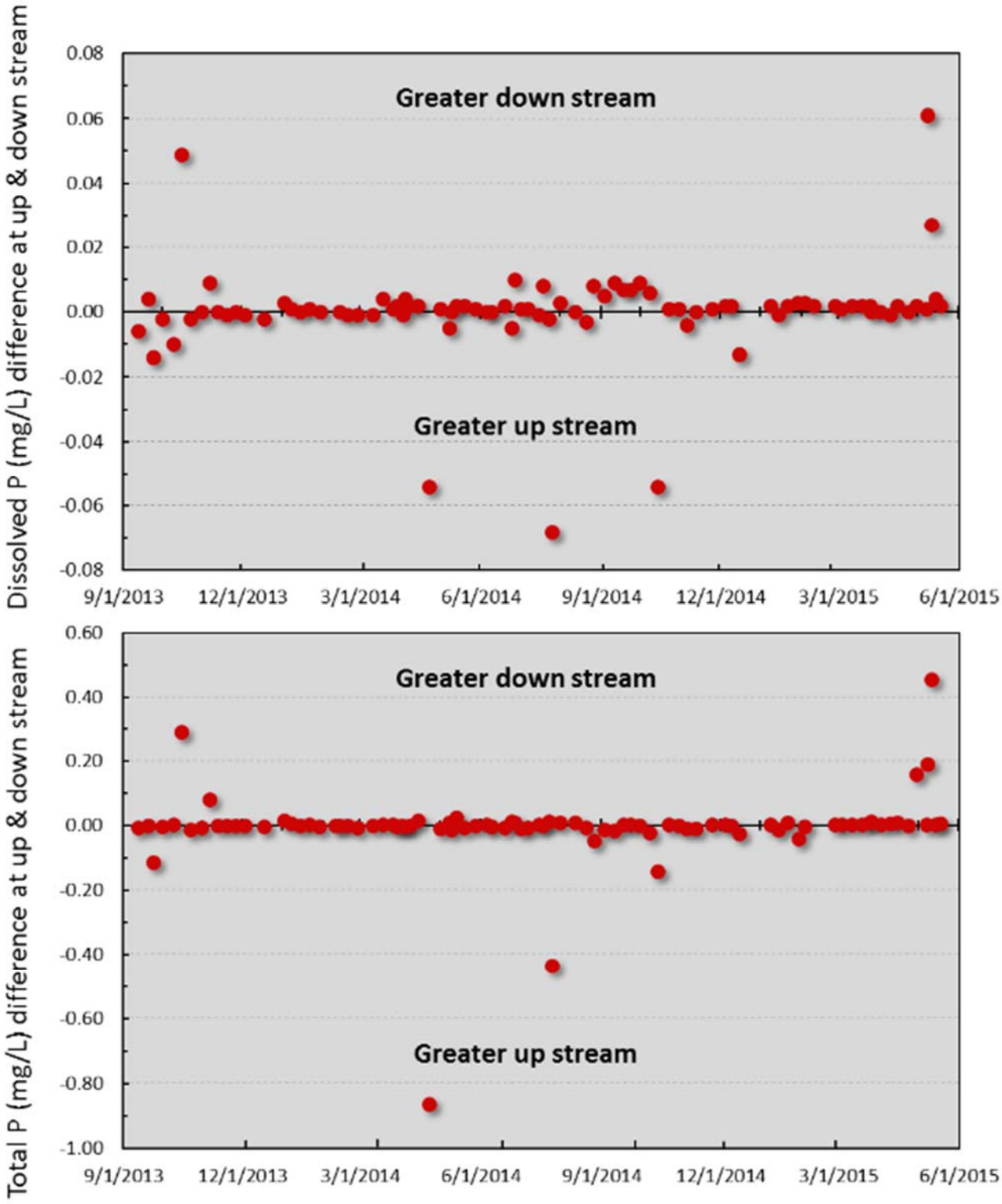

Figure 18. Differences in phosphorus concentrations between up and downstream sites on Big Creek.

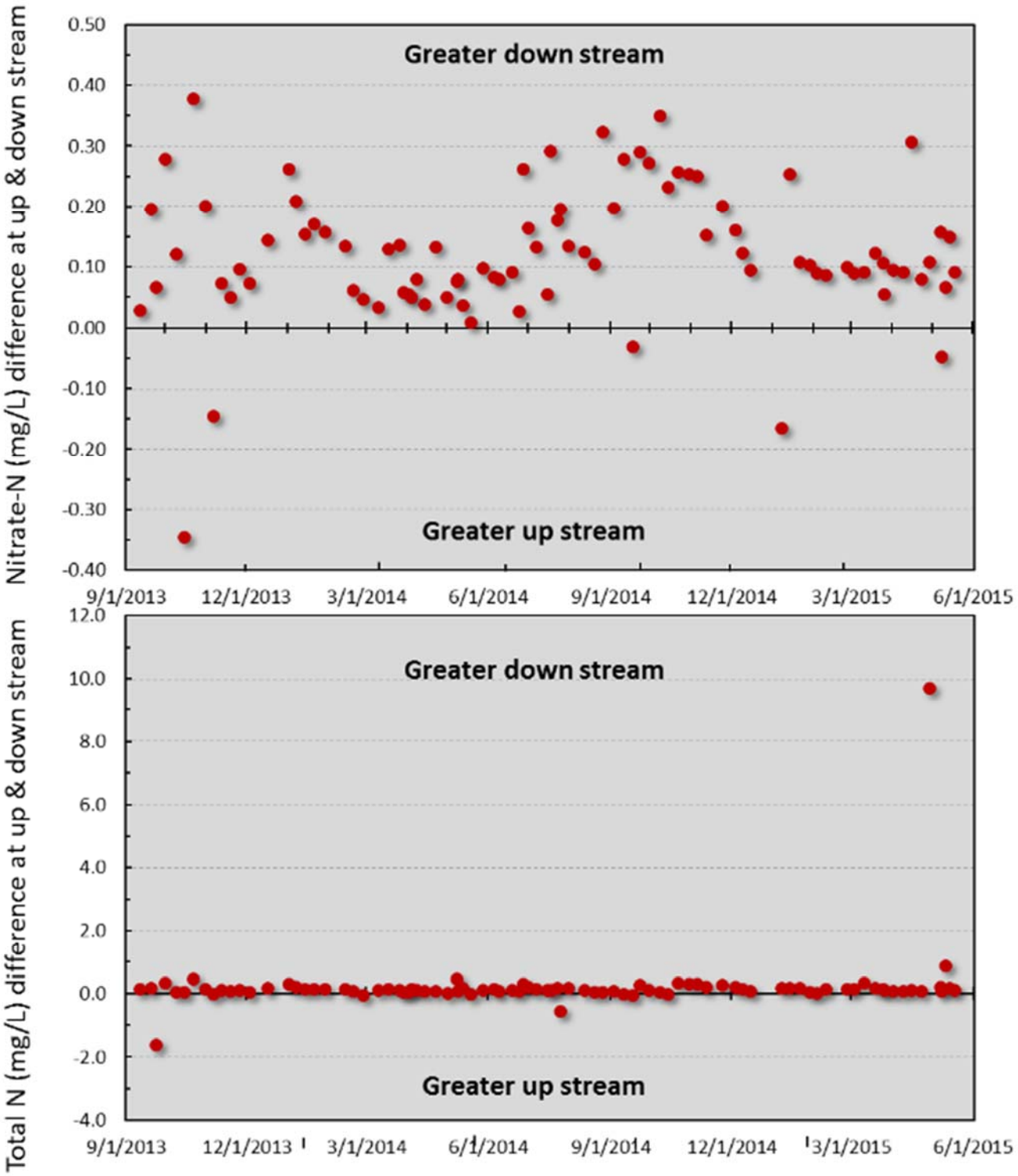

Figure 19. Differences in nitrogen concentrations between up and downstream sites on Big Creek.

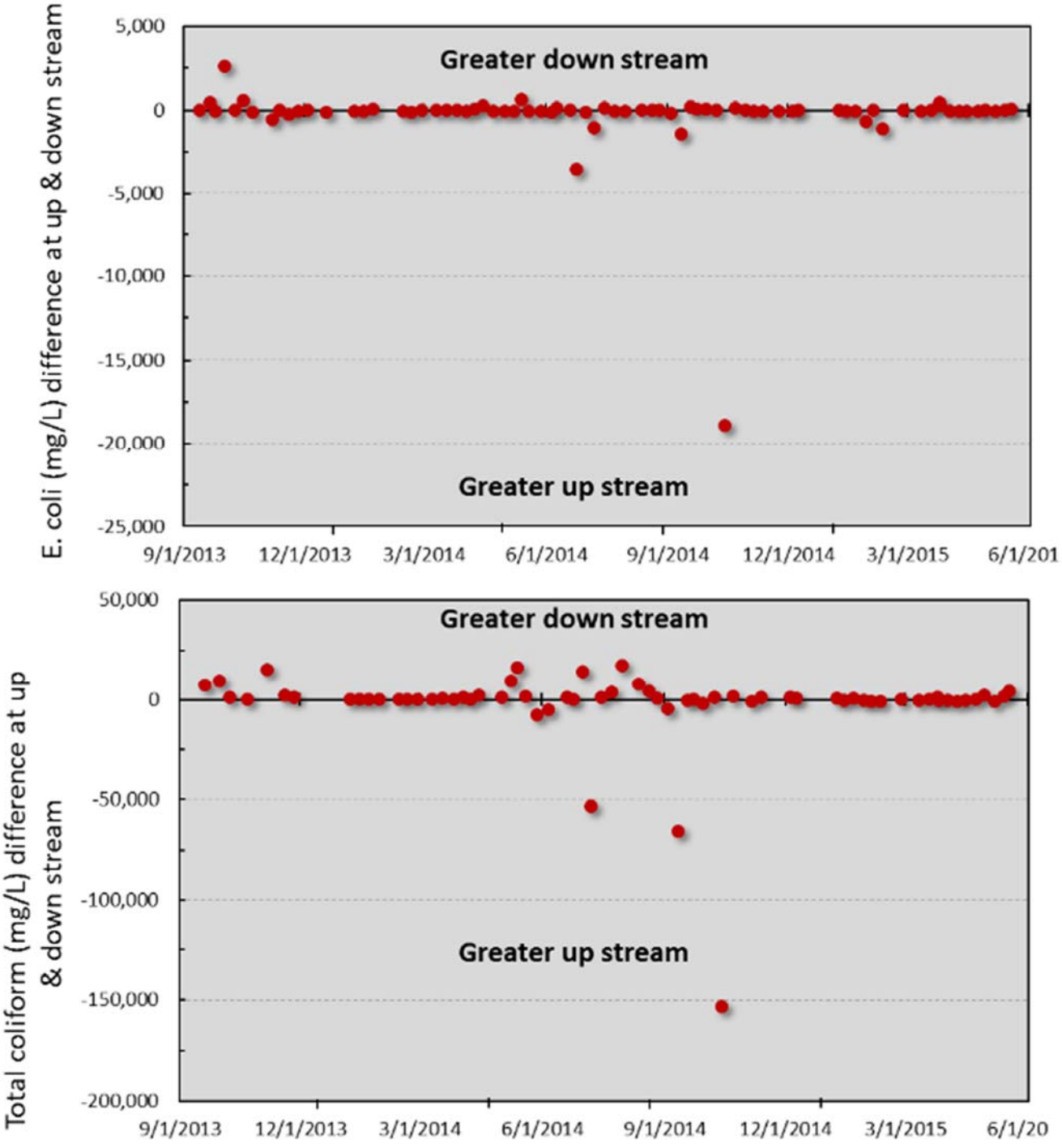

Figure 20. Differences in bacteria concentrations between up and downstream sites on Big Creek.

Table 9. Soil analyses of 0 – 4 inch samples collected from Field 5a in January, 2015.

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58314	19	6.6	34	98	3168	108	16	16	116	138	2	7.3	0.9	20.1
58318	20	7	36	115	3404	96	15	15	154	214	2.5	6.9	1	20.2
58323	21	6.4	17	71	2413	92	28	10	111	197	2.2	3.5	0.6	16.6
58329	22	5.6	35	56	1692	86	13	11	143	230	2.7	4.2	0.4	14.4
58332	23	5.4	55	49	1028	81	9	12	197	212	0.9	2.9	0.4	10.5
58338	24	5.9	40	40	1299	71	9	10	177	169	1.1	3.8	0.4	10.7
58343	25	6	28	45	1578	83	9	10	178	204	1.3	3.3	0.5	12.2
58348	30	6.3	27	49	2031	85	11	11	147	211	1.4	4	0.6	14.5
58354	31	6	26	44	1762	72	13	11	161	188	1.2	3.6	0.3	13.1
58359	32	5.5	74	55	1040	69	14	11	230	210	1.1	2.9	0.1	10.5
58364	33	5.6	61	61	987	57	10	11	180	198	1.4	1.8	0.1	9.6
58369	34	6.4	29	65	1984	57	16	11	143	268	1.9	3.3	0.3	14.1
58375	35	6.1	23	65	2257	66	11	12	123	186	1.9	3.7	0.3	15.5
58380	45	6.6	32	103	2914	95	17	15	123	227	2.1	5.4	0.6	18.7
58383	46	5.4	50	63	840	93	14	14	192	275	1.4	2.6	0.1	9.7
58389	47	5.5	86	70	877	76	10	14	207	341	2	4.4	0.2	9.7
58394	48	5.3	59	50	922	65	11	13	188	215	0.9	2	0.1	9.8
58400	49	6.2	19	42	2055	82	11	12	135	223	1.6	4.7	0.5	14.6
58404	50	6.1	22	46	1776	81	13	12	130	224	1.4	5.1	0.4	13.2
58410	59	5.2	33	44	565	63	13	15	151	247	1.1	1.5	0.1	9.0

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58415	60	5	51	57	584	69	13	17	170	232	0.9	1.2	0.1	9.2
58420	61	5.1	55	176	795	70	11	13	176	285	2	3.3	0.2	10.6
58426	62	5.3	69	78	846	83	11	15	161	163	0.8	1.6	0.2	9.7
58431	72	5.1	43	46	574	54	12	15	142	249	1.2	1.2	0.1	9.0
58436	73	4.8	47	48	484	50	13	20	153	254	1.1	0.9	0.1	9.0
58441	74	5.3	51	39	513	61	13	14	148	246	1.1	1.9	0.1	7.7
58444	75	5.3	85	51	829	61	14	15	167	167	0.8	1.8	0.2	9.3
58450	84	4.9	61	60	628	81	12	16	122	143	1	1.7	0	10.5
58455	85	5	54	38	350	62	11	14	118	200	1	1.5	0	7.9
58461	86	4.5	91	25	167	32	6	11	163	110	0.7	1	0	6.2
58466	87	6.4	18	60	2016	57	11	9	96	150	1.6	2.8	0.3	14.3
58471	98	4.6	51	25	359	42	8	14	155	168	0.8	1.2	0	8.2
58476	99	4.8	64	29	315	49	5	12	138	129	0.6	1.1	0	8.1
58482	100	6.4	20	81	2022	53	7	11	104	157	1.5	3.4	0.4	14.3
58487	111	4.8	38	70	682	52	9	7	115	39	0.4	0.3	0	10.6
58492	112	5	23	46	644	53	7	13	118	128	0.4	0.7	0	9.3
Mean, mg/kg		5.6	45	60	1289	70	12	13	151	200	1.3	2.8	0.3	11.7
Median, mg/kg		5.5	42	53	955	69	11	13	150	207	1.2	2.9	0.2	10.5
Minimum, mg/kg		4.5	17	25	167	32	5	7	96	39	0.4	0.3	0.0	6.2
Maximum, mg/kg		7.0	91	176	3404	108	28	20	230	341	2.7	7.3	1.0	20.2
Standard dev., mg/kg		0.7	20	28	855	17	4	3	31	57	0.6	1.7	0.3	3.5
Coeff. variation, %		11.7	46	47	66	24	33	20	20	28	42.7	59.4	94.9	30.0

Table 10. Soil analyses of 4 – 8 inch samples collected from Field 5a in January, 2015.

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58315	19	6.5	13	78	3125	67	14	10	100	156	2.2	4.7	0.6	19.4
58319	20	6.8	15	89	3397	66	15	12	114	214	2.6	5.2	0.8	20.3
58324	21	6.8	9	70	2443	58	15	7	105	230	2.5	2.7	0.5	15.4
58333	23	5.4	33	47	915	47	9	8	157	150	1	2.3	0.3	9.6
58339	24	5.8	31	40	991	32	9	8	180	145	1	2.4	0.3	9.4
58344	25	6.1	23	50	1490	56	9	7	183	197	1.3	2.8	0.4	11.6
58350	30	6.3	16	43	1632	49	11	8	146	173	1.2	2.6	0.3	12.2
58355	31	6.3	21	29	1139	29	9	6	161	138	0.8	2.3	0.2	9.1
58360	32	5.8	62	54	1016	43	9	7	204	171	1.1	2.3	0.1	9.6
58365	33	6	61	78	1331	46	17	8	196	184	1.9	1.3	0.1	10.8
58370	34	6.1	25	70	1992	43	19	8	156	242	2.3	2.7	0.2	14.1
58376	35	6.4	10	68	2295	35	12	9	126	212	2.2	3	0.3	15.5
58384	46	5.6	31	56	881	55	9	8	177	192	1.4	1.9	0.1	9.0
58390	47	5.4	58	66	929	42	12	10	193	265	2.4	3.2	0.2	9.7
58395	48	5.6	48	55	1038	42	13	8	167	128	0.8	0.9	0.1	9.7
58401	49	6.6	11	52	2211	55	12	8	130	201	1.9	2.9	0.4	14.7
58405	50	6.4	15	36	1172	43	9	7	124	149	1.1	2.9	0.2	9.3
58411	59	5.4	15	44	607	54	11	11	146	242	1.1	1.2	0.1	8.1
58416	60	5.1	34	56	564	46	12	11	158	179	0.9	0.6	0.1	8.9
58422	61	5.3	43	65	934	46	18	10	160	223	2.1	2.6	1.9	9.8

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58427	62	5.2	72	77	923	61	13	9	146	87	0.7	0.5	0.1	10.9
58437	73	5.2	19	44	558	35	16	14	138	222	1.2	0.6	0.1	8.8
58446	75	4.8	44	57	687	41	17	10	109	62	1.5	1.6	1.1	10.5
58451	84	4.8	37	56	543	49	13	11	105	75	1	0.6	0	9.3
58456	85	5.3	19	35	403	44	9	9	96	151	1.1	1	0	7.0
58462	86	4.8	56	23	206	22	5	7	134	115	0.7	1.1	0	7.3
58467	87	6.5	10	51	1685	34	10	6	97	174	1.5	1.8	0.1	11.9
58472	98	4.7	36	21	270	20	6	10	136	117	0.7	1	0	7.6
58477	99	5.2	27	32	492	33	7	6	104	102	0.7	2.4	0	8.3
58483	100	6.5	10	74	2087	29	8	7	95	143	1.6	2.2	0.3	13.9
58488	111	5.3	22	56	722	50	6	8	139	164	0.8	0.8	0	8.7
58494	112	4.8	19	52	669	39	13	14	122	127	0.4	0.8	0	10.4
Mean, mg/kg		5.7	30	54	1230	44	11	9	141	167	1.4	2.0	0.3	11.0
Median, mg/kg		5.6	24	55	963	44	12	8	138.5	167.5	1.2	2.3	0.2	9.7
Minimum, mg/kg		4.7	9	21	206	20	5	6	95	62	0.4	0.5	0.0	7.0
Maximum, mg/kg		6.8	72	89	3397	67	19	14	204	265	2.6	5.2	1.9	20.3
Standard dev., mg/kg		0.7	18	17	805	12	4	2	32	51	0.6	1.1	0.4	3.3
Coeff. variation, %		11.5	60	31	65	26	32	24	23	30	45.5	56.6	138.7	29.7

Table 11. Soil analyses of 8 – 12 inch samples collected from Field 5a in January, 2015.

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58320	20	6.9	10	102	3976	51	22	8	102	197	2.5	4.2	0.6	23.2
58326	21	6.7	7	83	2719	52	14	6	117	235	2.7	1.6	0.6	17.3
58334	23	5.7	37	56	1187	35	9	5	165	162	1.4	2	0.4	10.9
58340	24	5.9	32	60	1419	38	9	7	178	194	1.8	3.1	0.3	11.1
58345	25	6.1	24	76	2165	79	12	7	165	205	2.1	3.2	0.5	15.2
58351	30	6.3	15	37	1261	37	10	6	147	150	1	2	0.2	9.8
58356	31	6.4	21	40	1247	33	10	5	254	164	1.1	2.1	0.2	9.7
58366	33	6.1	88	104	1635	46	17	6	202	145	2	1	0.1	12.4
58371	34	6.3	36	81	1842	36	21	5	158	181	2.2	1.8	0.1	13.3
58377	35	6.6	10	71	2216	28	13	8	137	236	2.4	2.7	0.3	14.6
58381	45	7	9	82	2498	60	14	7	107	228	1.8	2.9	0.3	15.3
58386	46	5.9	45	83	1335	69	14	7	194	174	1.7	3.2	0.2	11.0
58391	47	5.9	70	86	1273	36	13	6	208	202	2.1	1.5	0.2	10.4
58396	48	6	76	105	1852	49	14	5	176	86	0.8	0.6	0.1	13.5
58402	49	6.3	11	79	2524	64	12	7	144	193	1.8	2.4	0.3	16.9
58406	50	6.3	17	37	908	35	10	5	124	122	0.8	2.3	0.1	7.5
58412	59	5.5	11	68	994	56	12	9	159	256	1.4	0.8	0.2	10.2
58417	60	5.3	36	77	725	47	12	10	156	114	1	0.3	0.1	8.8
58423	61	5.4	50	67	1076	36	12	8	178	216	2	2	0.8	10.4
58428	62	5.2	97	86	989	56	13	8	146	41	0.5	0.3	0.1	11.2
58432	72	5.4	27	63	800	33	18	8	150	136	1.4	0.3	0.1	9.0

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58438	73	5.1	25	61	589	30	15	14	133	134	1.1	0.6	0.1	8.9
58447	75	4.7	37	67	636	47	14	11	107	40	1.6	0.9	0.5	10.3
58452	84	5	51	65	624	53	13	10	103	25	0.8	0.7	0.0	9.3
58458	85	5.5	13	45	609	37	10	7	103	135	1	0.5	0.0	8.0
58463	86	5.1	35	37	411	29	7	5	119	118	0.9	0.8	0.0	7.9
58468	87	6.6	11	50	1391	30	14	5	99	184	1.5	1.3	0.0	9.9
58473	98	5.4	18	64	1069	27	9	8	109	92	0.9	0.3	0.0	10.3
58478	99	5.4	14	63	855	37	12	9	105	95	0.8	0.3	0.0	9.3
58484	100	6.7	8	70	2109	27	10	5	104	173	1.6	1.7	0.2	14.0
58489	111	5	29	60	680	45	8	7	140	144	0.8	0.5	0.0	9.5
58495	112	4.9	12	65	642	38	11	22	117	94	0.3	0.5	0.0	10.2
Mean, mg/kg		5.8	31	68	1383	43	13	8	144	152	1.4	1.5	0.2	11.5
Median, mg/kg		5.9	25	67	1217	38	12	7	142	156	1.4	1.4	0.2	10.4
Minimum, mg/kg		4.7	7	37	411	27	7	5	99	25	0.3	0.3	0.0	7.5
Maximum, mg/kg		7.0	97	105	3976	79	22	22	254	256	2.7	4.2	0.8	23.2
Standard dev., mg/kg		0.6	24	18	795	13	3	3	38	59	0.6	1.1	0.2	3.3
Coeff. variation, %		11.0	78	27	57	30	27	43	26	39	43.2	71.1	100.8	28.9

Table 12. Soil analyses of 12 - 18 inch samples collected from Field 5a in January, 2015.

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58316	19	6.5	8	93	3225	54	15	7	110	184	2.2	3.7	0.6	19.9
58321	20	7.3	8	95	3806	44	19	6	99	214	2.4	3.7	0.6	21.7
58327	21	6.6	5	102	3126	51	17	5	122	173	2.2	0.7	0.5	19.4
58330	22	6.3	12	94	2807	70	15	6	122	153	2.3	1.7	0.6	18.4
58335	23	6	65	76	1906	39	12	7	184	190	2.4	3.6	0.5	13.6
58341	24	6	37	87	2276	54	13	7	193	232	2.6	4.6	0.5	15.6
58346	25	6.2	26	92	2330	78	14	8	165	205	2	3.2	0.5	16.1
58352	30	6.3	22	46	1416	35	11	6	164	168	1.2	2.5	0.2	10.5
58357	31	6.4	16	66	2037	49	11	6	174	261	1.7	3.1	0.3	14.3
58362	32	6.3	300	103	2752	49	15	8	168	278	3.7	9.1	0.7	18.0
58367	33	6.3	115	124	1837	49	19	5	191	86	1.9	0.7	0.1	13.5
58372	34	6.4	35	84	1812	41	18	5	160	158	2.1	1.3	0.2	13.2
58378	35	6.4	7	85	2140	36	15	6	144	182	1.7	0.8	0.3	14.8
58382	45	6.8	20	94	2167	53	14	5	120	147	1.1	1.7	0.1	14.1
58387	46	6.2	61	101	1569	86	16	5	197	131	1.5	1.2	0.2	11.9
58392	47	6.4	97	111	1666	33	13	5	218	146	1.3	1	0.2	12.4
58398	48	6.1	77	102	1846	50	15	5	166	58	0.9	0.6	0.1	13.5
58403	49	6.3	15	86	2597	64	14	7	148	175	1.7	2	0.3	17.3
58407	50	6.4	16	46	1152	35	10	4	124	139	0.9	2.1	0.1	9.2
58413	59	6	14	94	1402	61	15	7	167	167	1.2	0.4	0.2	11.3
58418	60	5.1	30	85	676	49	13	13	149	68	0.8	0.3	0.1	9.6
58424	61	5.9	56	79	1203	42	13	5	175	158	1.5	0.8	0.4	10.1

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58429	62	5.2	106	98	1100	63	14	9	159	33	0.7	0.3	0.1	11.8
58434	72	5.6	107	95	1035	59	16	8	160	34	0.6	0.4	0.1	10.0
58439	73	4.7	30	72	491	30	14	17	131	77	0.9	0.3	0.1	9.0
58442	74	5.8	12	58	888	35	14	7	157	248	1.4	0.9	0.2	8.9
58448	75	4.7	35	79	665	63	13	11	113	40	1.8	1.2	0.1	10.6
58453	84	4.8	42	62	523	48	12	12	110	21	0.6	0.7	0.0	9.2
58459	85	5.6	18	65	793	37	11	6	96	65	0.7	0.2	0.0	8.5
58464	86	5.7	40	55	703	39	13	4	104	58	1	0.3	0.0	8.0
58470	87	6.7	14	51	1366	22	8	4	106	195	1.5	1.2	0.0	9.7
58474	98	4.8	17	67	627	41	10	13	114	53	1.1	0.5	0.0	10.2
58479	99	4.9	14	69	653	59	9	13	113	93	0.6	0.2	0.0	10.5
58485	100	6.7	11	67	1914	24	11	4	108	182	1.5	1.4	0.1	13.0
58490	111	5.4	29	51	753	70	4	8	121	104	0.7	1.4	0.0	9.0
58496	112	4.9	7	64	511	40	11	27	110	65	0.3	0.4	0.0	9.1
Mean, mg/kg		5.9	42	81	1605	49	13	8	143	137	1.5	1.6	0.2	12.7
Median, mg/kg		6.0	30	79	1384	49	13	7	153	143	1.3	0.9	0.1	11.0
Minimum, mg/kg		4.7	7	46	491	22	4	4	96	21	0.3	0.2	0.0	8.0
Maximum, mg/kg		6.8	300	124	2752	86	19	27	218	278	3.7	9.1	0.7	18.0
Standard dev., mg/kg		0.7	54	19	873	15	3	4	33	70	0.7	1.7	0.2	3.6
Coeff. variation, %		11.4	127	24	54	30	23	58	23	51	49.5	107.9	95.1	28.8

Table 13. Soil analyses of 18 - 24 inch samples collected from Field 5a in January, 2015.

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58317	19	6.8	6	73	3146	48	14	6	97	353	2.6	3.9	0.7	18.9
58322	20	7.3	8	99	3084	44	20	5	116	187	2.6	1.7	0.5	18.1
58328	21	6.8	5	110	3098	51	24	4	114	114	1.6	0.9	0.4	18.8
58331	22	6.3	8	102	2820	77	16	5	125	117	1.9	1.1	0.5	18.6
58336	23	6.1	52	77	1965	38	13	6	177	175	2.3	3	0.5	13.9
58342	24	6.3	24	108	3228	78	14	8	177	237	2.8	5.1	0.8	20.6
58347	25	6.1	22	105	2759	86	16	8	159	204	2	3	0.5	18.9
58353	30	6.5	15	47	1727	31	11	6	170	202	1.3	3.5	0.3	12.1
58358	31	6.2	9	100	3212	79	15	7	157	250	2.1	2.8	0.4	20.5
58363	32	6.3	262	109	2886	51	12	7	171	282	3.8	8	0.8	18.7
58368	33	6.3	136	135	1970	54	15	4	193	70	2	0.9	0.1	14.2
58374	34	6.4	41	85	1765	41	13	5	157	117	1.5	0.8	0.2	12.9
58379	35	6.5	9	76	2084	28	17	8	144	245	2.1	2.3	0.4	13.9
58388	46	6.3	72	116	1820	111	15	5	182	95	1.5	1.1	0.2	13.9
58393	47	6.5	118	115	1807	35	14	5	207	109	1.3	0.8	0.2	12.7
58399	48	5.8	77	104	1818	56	17	6	183	62	0.8	2	0.1	14.9
58408	50	6.4	19	40	979	32	9	4	133	140	0.8	2.3	0.1	7.8
58414	59	6.1	21	114	1673	73	16	6	162	109	1.2	0.4	0.2	12.8
58419	60	4.8	30	87	633	55	15	14	145	60	0.9	0.4	0.2	10.4
58425	61	6.1	74	91	1340	59	14	5	167	136	1.4	0.7	0.2	11.0
58430	62	5.2	90	100	1079	74	15	10	152	36	0.6	0.4	0.1	11.8
58435	72	5.1	40	93	816	62	18	11	152	74	0.6	0.3	0.1	10.4

Lab Number	Site	pH	P	K	Ca	Mg	Na	S	Fe	Mn	Cu	Zn	B	CEC
58440	73	4.7	32	75	500	46	14	15	128	71	0.7	0.2	0.1	9.1
58443	74	5.8	24	82	1201	78	15	6	163	153	1.4	0.4	0.2	11.4
58449	75	4.6	34	76	619	68	14	10	112	37	1.9	1.4	0.0	10.4
58454	84	4.8	40	62	439	47	12	15	106	31	0.7	0.8	0.0	8.8
58460	85	5.4	19	62	648	48	9	10	92	49	0.5	0.2	0.0	8.3
58465	86	5.7	46	87	1008	51	17	4	139	50	0.8	0.3	0.0	9.8
58475	98	5.1	15	41	704	22	7	7	116	117	0.9	0.7	0.0	9.3
58480	99	4.9	14	67	536	88	11	19	111	67	0.5	0.2	0.0	9.6
58486	100	6.8	15	67	1765	22	10	3	109	190	1.3	1	0.0	11.7
58491	111	4.8	27	65	528	48	7	8	105	45	0.3	0.3	0.0	9.2
58497	112	4.7	8	58	400	40	12	27	108	57	0.4	0.5	0.0	8.5
Mean, mg/kg		5.9	43	86	1638	55	14	8	143	129	1.4	1.6	0.2	13.1
Median, mg/kg		6.1	25.5	87.0	1700.0	51.0	14.0	6.5	148.5	111.5	1.3	0.8	0.2	11.9
Minimum, mg/kg		4.6	5.0	40.0	400.0	22.0	7.0	3.0	92.0	31.0	0.3	0.2	0.0	7.8
Maximum, mg/kg		7.3	262.0	135.0	3228.0	111.0	24.0	27.0	207.0	282.0	3.8	8.0	0.8	20.6
Standard dev., mg/kg		0.8	51	23	952	21	4	5	31	81	0.8	1.7	0.2	3.9
Coeff. variation, %		12.9	119	27	58	38	25	62	22	63	57.3	108.8	101.3	30.0

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April 1 to June 30, 2015