Summary of Water Quality Data Collected for Cedar Creek Watershed (Monroe County)

From August 22 through September 23, 2013, staff from the Iowa Department of Natural Resources – Geological and Water Survey conducted preliminary sampling of fourteen stream locations throughout the Cedar Creek Watershed in Monroe County (Figure 1). Five of the sites were on Cedar Creek while the other nine were on tributaries to Cedar Creek. Sites were selected to provide a spatial perspective of water quality throughout the watershed in Monroe County. Table 1 lists the Universal Transverse Mercator coordinates for the sites. Only three sampling events occurred due to when the monitoring was initiated and because of the dry conditions. Sites were monitored for a variety of field parameters (pH, dissolved oxygen, water temperature, turbidity) and IOWATER parameters (nitrate-N, nitrite-N, phosphate, chloride). IOWATER is the Iowa Department of Natural Resources' volunteer water monitoring program which utilizes a variety of field test kits and test strips.

Water sampling occurred under low stream flow conditions. Figure 2 provides the monthly rainfall for the Albia, Iowa, climatic station. Rainfall was below the long-term monthly average for the months of June through September. There was no rainfall recorded for the month of August. The lack of rain resulted in extremely low water levels in Cedar Creek and its tributaries. In some instances, there was no water. Figure 3 illustrates stream flow for the U.S. Geological Survey gaging station on Cedar Creek at Bussey. During the monitoring period (August 22 through September 23), stream flow was <1 to 5% of normal for this time period.

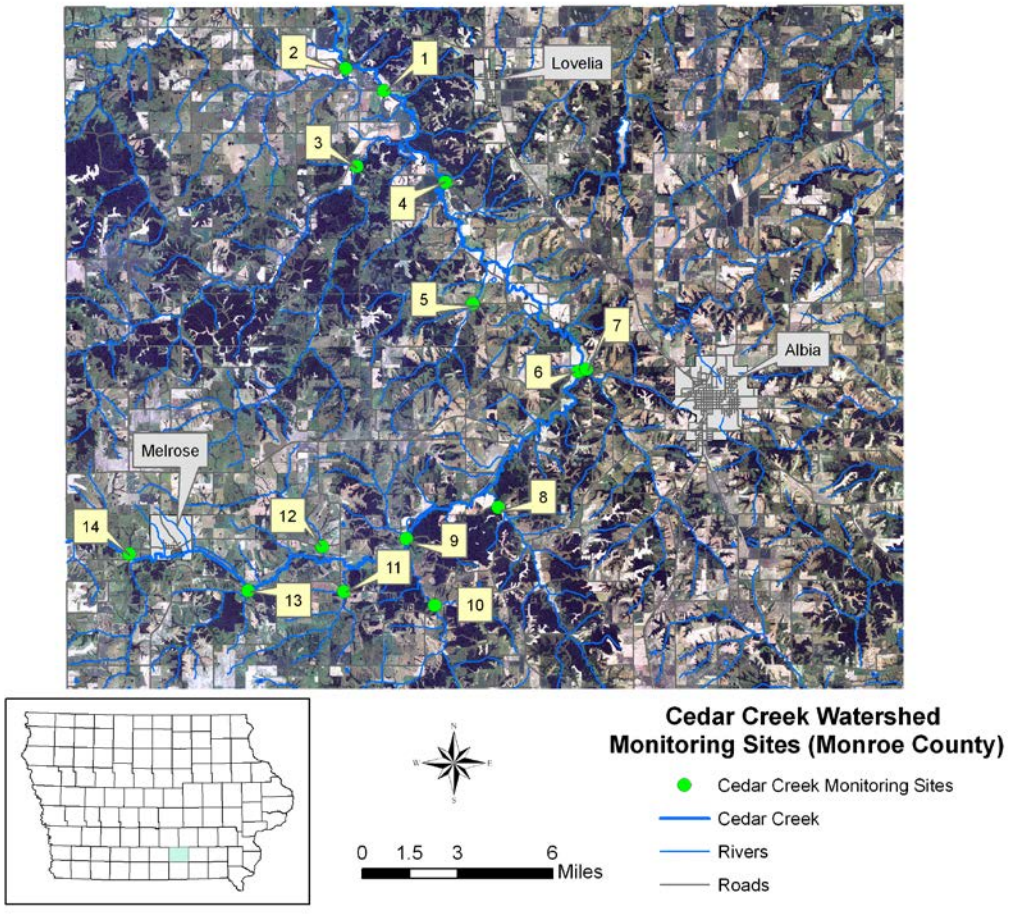


Figure 1. Location of sites monitored within the Cedar Creek Watershed (Monroe County).

Table 1. Location of sites monitored as part of the Cedar Creek Watershed.

Site Number	Site Location	UTMX (meters)	UTMY (meters)	Tributary versus Main Stem
1	Cedar Creek 120th St. (outside Lovilia)	503869	4553424	Main Stem
2	Whipporwill Creek 565 Tr	502400	4554275	Tributary
3	White Creek 139th Tr	502843	4550528	Tributary
4	Cedar Creek 139th Tr	506214	4549938	Main Stem
5	Bee Branch 170th	507266	4545305	Tributary
6	Cedar Ck 188th Tr	511302	4542731	Main Stem
7	Coal Creek 188th Tr	511617	4542822	Tributary
8	Inghram Branch 218th St.	508256	4537544	Tributary
9	Cedar Creek 227th St.	504734	4536351	Main Stem
10	Unnamed Creek at 328th Tr	505825	4533803	Tributary
11	Unnamed Creek at 328th Tr	502357	4534318	Tributary
12	Unnamed Creek at 225th St.	501525	4536050	Tributary
13	Unnamed Creek 235th Tr	498682	4534349	Tributary
14	Cedar Creek 510th Tr	494132	4535765	Main Stem

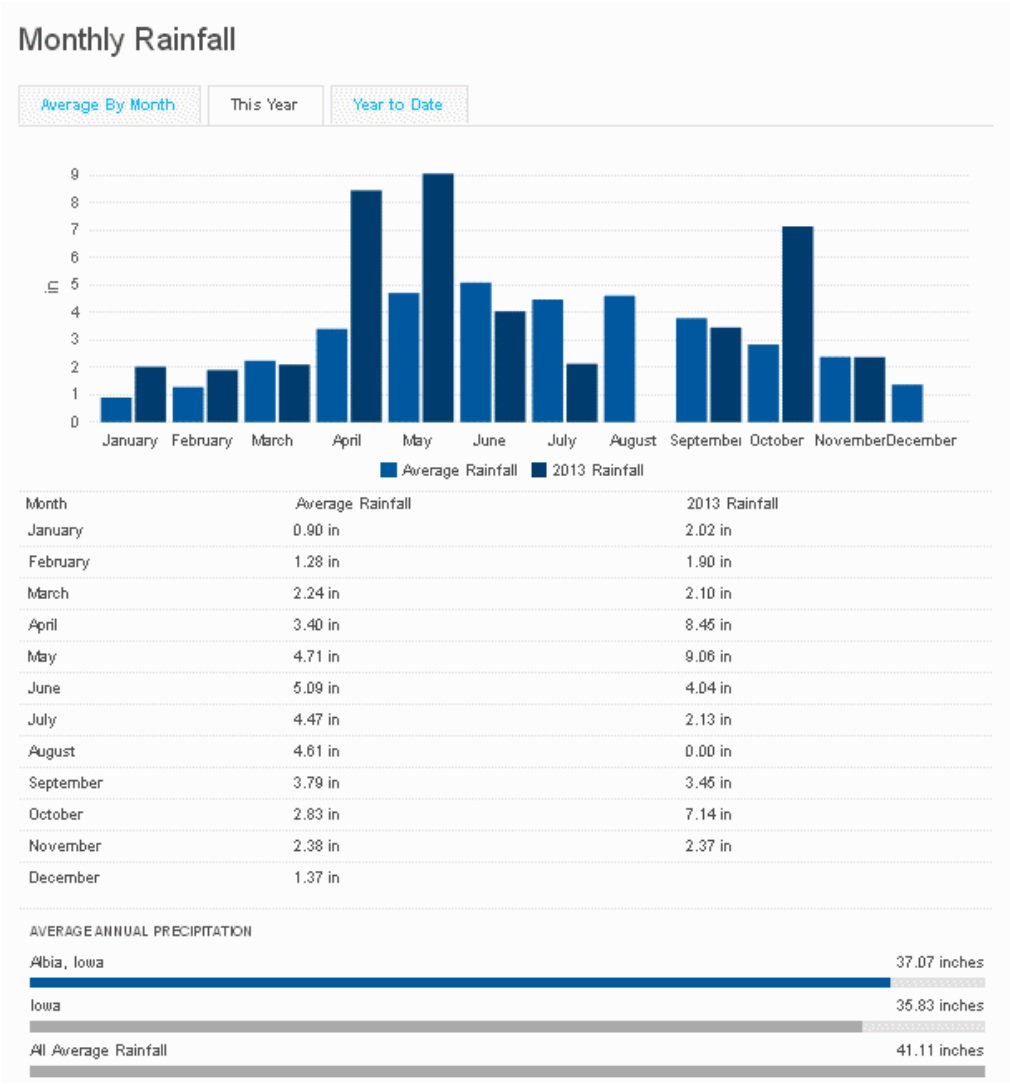


Figure 2. Monthly rainfall for Albia, Iowa. Source: http://average-rainfall.weatherdb.com/l/526/Albia-Iowa; accessed December 20, 2013.

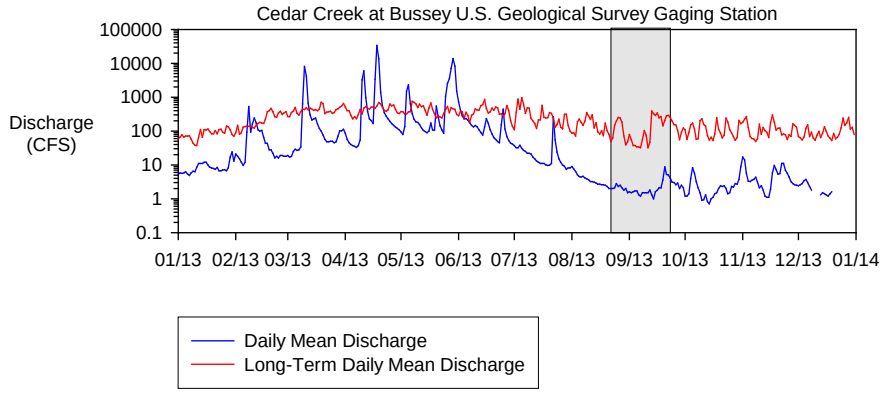


Figure 3. Discharge for Cedar Creek at Bussey. Gray shaded area represents the period of water testing.

WATER QUALITY RESULTS

Table 2 summarizes the water quality data collected from August 22 through September 23, 2013, for the Cedar Creek watershed in Monroe County. Sites 5, 8, 10, 11, 12, 13, and 14 were never sampled, as the sites either had no water or water conditions were stagnant. On August 22, seven sites were sampled, while three were on September 10, and six on September 23.

Table 2. Cedar Creek Sampling Results – 2013.

	Unit	Method	# of samples	Min Value	Percentiles			Max Value
					25th	50th	75th	
Field Parameters - Field Meters								
Dissolved Oxygen	mg/L	Field Meter	16	3	3.7	4.9	5.8	6.4
pH	pH units	Field Meter	16	7.3	7.6	7.8	7.8	8
Turbidity	NTU	Field Meter	16	1.79	7.19	13.8	16.35	29.6
Water Temperature	degrees C	Thermometer - Field	16	14.5	17.9	20.8	22.6	27.5
Field Parameters – IOWATER Methods								
Chloride	mg/L	IOWATER Test strip	16	<29	<29	<29	<29	35
Nitrate-N	mg/L	IOWATER Test strip	16	0	0	0	0	0
Nitrite-N	mg/L	IOWATER Test strip	16	0	0	0	0	0
Phosphate	mg/L	IOWATER Test strip	16	0	0	0	0.1	0.1

mg/L = milligrams per liter (or parts per million - ppm)
NTU = Nephelometric Turbidity Units
Note: Sites were sampled three times (August 22, September 10, and September 23) in 2013, with some sites never being sampled due to no water. Sampling occurred under abnormally dry conditions.

Dissolved Oxygen

Dissolved oxygen is necessary for nearly all aquatic life to survive. Dissolved oxygen in water bodies can be affected by water temperature, season, time of day, stream flow, aquatic plants, dissolved or suspended solids, and human impacts. Iowa has a warm water standard of 5 milligrams per liter (mg/L) which is intended to protect aquatic life. A few of the samples collected from sites in the Cedar Creek watershed fell below the 5 mg/L standard (Table 2 and Figure 4). The time of year, very low stream flow conditions, and warm water temperatures all likely contributed to these low results. Dissolved oxygen levels were lower than those measured in streams statewide during this time (Figure 4).

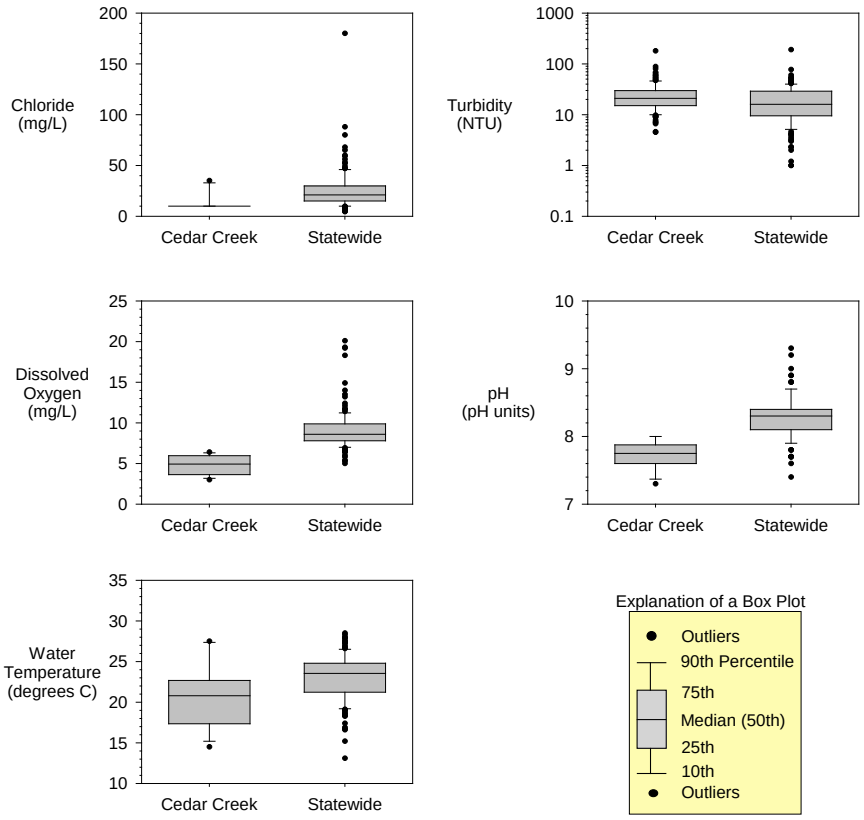


Figure 4. Box plots comparing water quality results for August and September 2013 from the Cedar Creek watershed compared to a network of 76 streams statewide that were monitored during the same months.

pH

pH is a measure of a water's acid/base content and is measured in pH units on a scale of zero to 14. A pH of seven is neutral, while a pH greater than seven is basic/alkaline and a pH less than seven is acidic. The pH level of surface water is influenced by the concentration of acids in rain and the types of soils and bedrock in an area. Typical pH levels for streams in Iowa are 8.0 to 8.4. Iowa has a pH water quality standard for aquatic life of 6.5 to 9.0. pH measured in the Cedar Creek watershed ranged from 7.3 to 8 (Table 2 and Figure 4), all within the acceptable aquatic life water quality standard. Cedar Creek pH levels tended to be lower than those measured in streams statewide (Figure 4).

Turbidity

Turbidity is a measure of the ability of light to penetrate through water. Turbidity is measured in Nephelometric Turbidity Units (NTUs). Higher turbidity values indicate more turbid samples. Turbidity is affected by the amount of suspended material in water. More material means less light can pass through, resulting in a more turbid sample. Suspended materials include soil, algae, plankton, and microbes. Typical turbidity levels for Iowa streams generally vary from 5.7 to 39 NTU with higher values often associated with rainfall/runoff events. Turbidity for Cedar Creek watershed ranged from 1.79 to 29.6 NTU (Table 2 and Figure 4). Turbidity values were similar to those measured in streams statewide during August and September 2013 (Figure 4).

Water Temperature

Many of the chemical, physical, and biological characteristics of a stream are directly affected by water temperature. Water temperature impacts the amount of oxygen dissolved in water, the rate of photosynthesis by algae and aquatic plants, and the metabolic rates of aquatic animals. Water temperatures for Cedar Creek watershed ranged from 14.5 to 27.5 Celsius and were cooler than temperatures measured in streams statewide (Table 2 and Figure 4).

Chloride

Chloride is a chemical found in salts and which is easily dissolved in water. In natural waters, elevated chloride may indicate human or animal waste inputs. During winter months, elevated chloride levels in streams may be from road salt runoff. Chloride is a conservative tracer in that it does not react chemically or biologically. Typical chloride concentrations in Iowa streams vary from 16 to 29 mg/L. Chloride in the Cedar Creek watershed ranged from <29 to 35 mg/L and were lower than levels in streams statewide (Table 2 and Figure 4).

Nitrate-N and Nitrite-N

Nitrate and nitrite are two forms of nitrogen. Nitrate is very easily dissolved in water and is more common in streams. Sources of nitrate include soil organic matter, animal wastes, decomposing plants, sewage, and fertilizers. Because nitrate is very soluble in water, it can move readily into streams. Nitrite is another form of nitrogen that is rare because it is quickly converted to nitrate or returned back to the atmosphere as nitrogen gas. Iowa's drinking water standard for nitrate-N is 10 milligrams per liter (mg/L). Neither nitrate-N nor nitrite-N was detected in any of the samples collected in the Cedar Creek watershed. Nitrate-N concentrations tend to be lower in the late summer and fall do to the lack of sources and lower rainfall during this time of year.

Phosphate

Phosphate is an essential nutrient for plants and animals and is usually present in natural waters attached to sediment, in organic material, and dissolved in water. There are natural sources of phosphorus, such as certain soils and rocks, but most elevated levels of phosphorus are caused by human activities (i.e., human, animal and industrial wastes; fertilizer runoff). Excess phosphorus in water speeds up plant growth, causes algal blooms, and can result in low dissolved oxygen conditions. Typical phosphorus concentrations in Iowa rivers range from 0.11 to 0.34 mg/L. Phosphorus concentrations in the Cedar Creek watershed ranged from 0 to 0.1 mg/L.

Cedar Creek at Bussey Long-Term Monitoring Site

Since January 2000, Cedar Creek at Bussey in Marion County has been monitored monthly as part of the Iowa Department of Natural Resources stream monitoring program. This site is located downstream of the sites monitored in Monroe County. Figure 5 compares the water quality results from Cedar Creek at Bussey for 2013 to the long-term median monthly values based on data collected from this site from 2000 through 2012. In spite of the dry conditions and low water levels in 2013, concentrations or levels for many of the parameters for August and September were similar to historic levels. Exceptions include turbidity and total phosphate for 2013 which were lower than the long-term medians for these particular months.

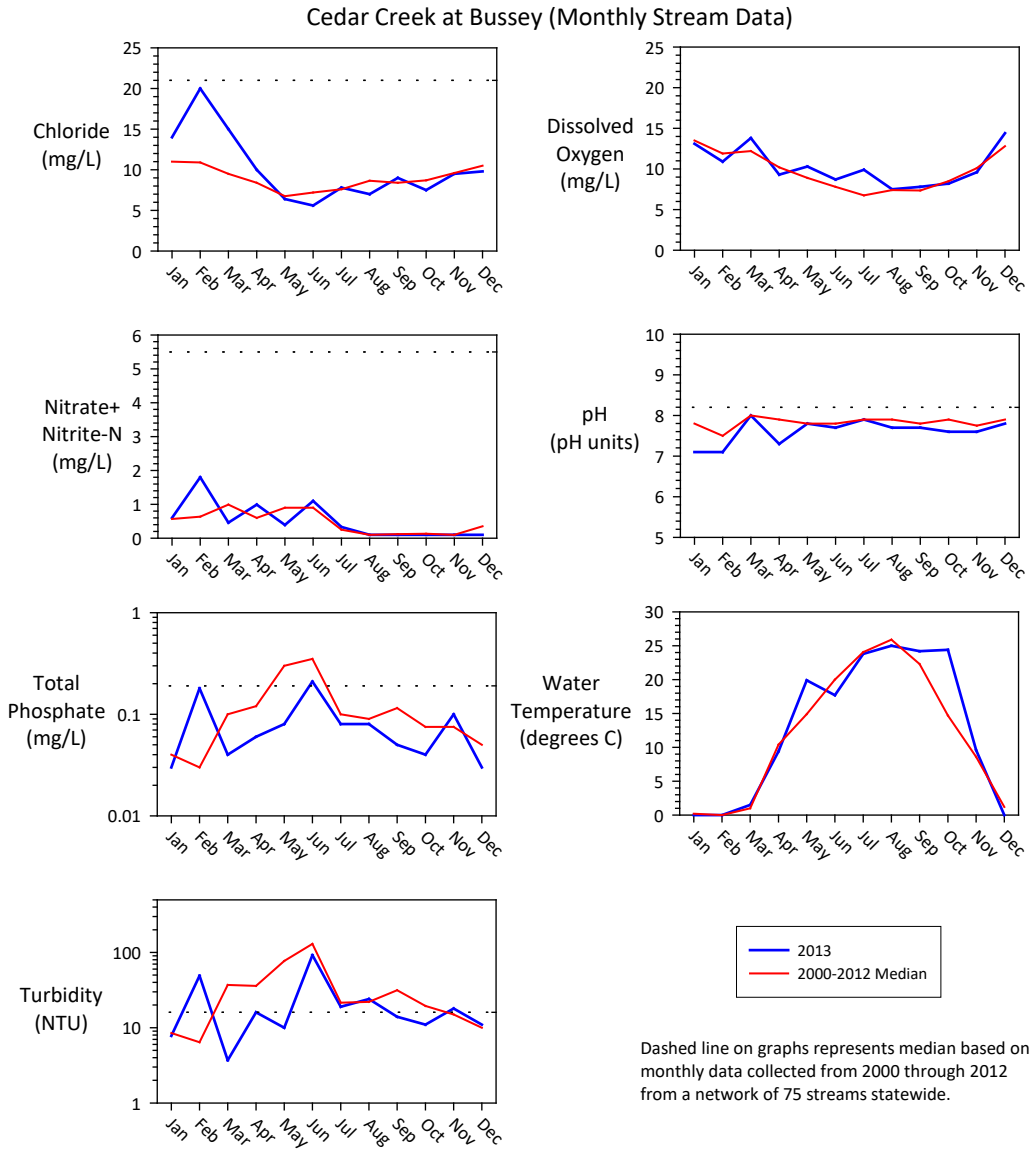
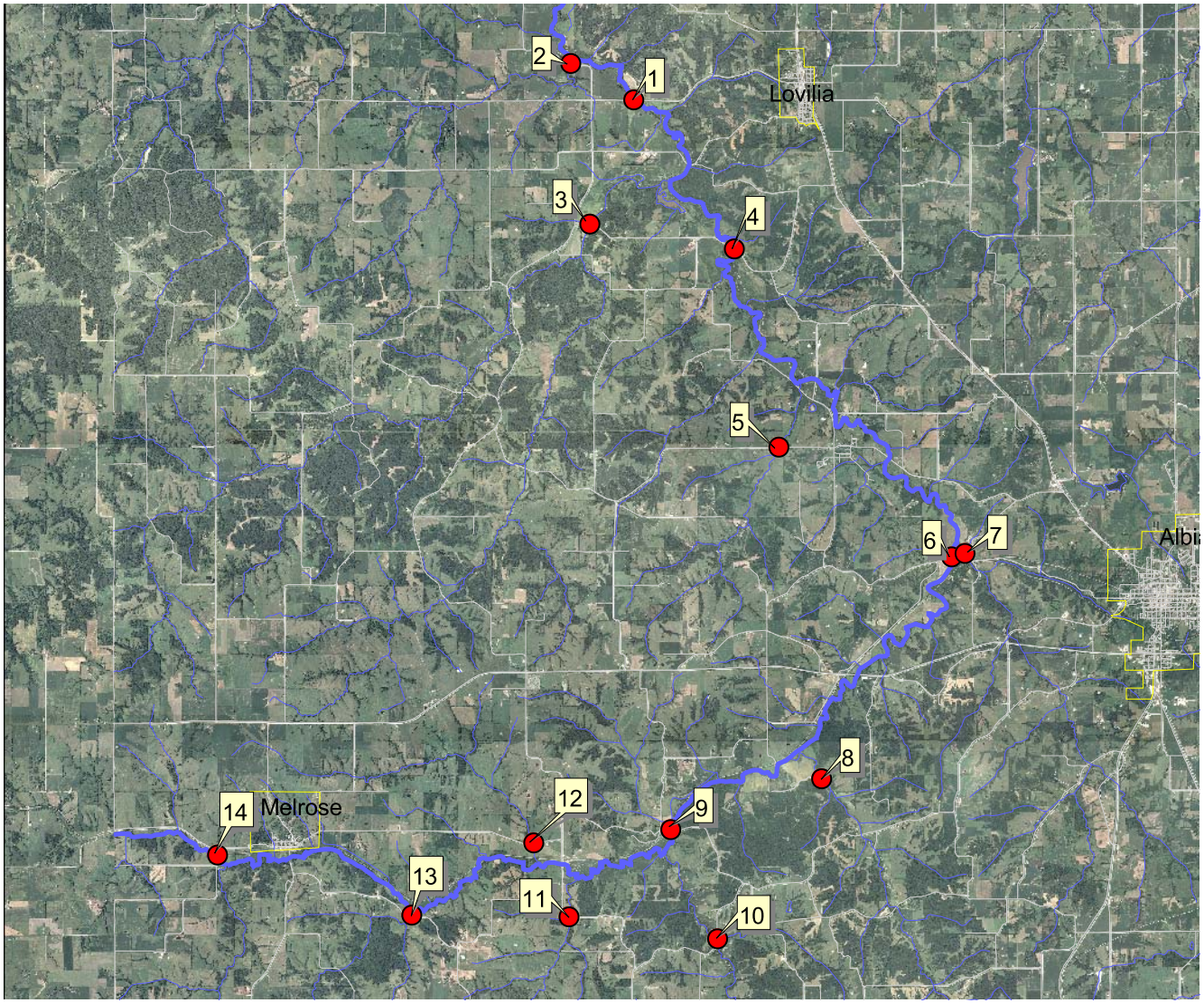


Figure 5. Time series graphs of monthly water quality results for Cedar Creek at Bussey (Marion County). Displayed are the results for 2013 compared to the monthly median levels based on 2000 through 2012 data.

Prepared by Lynette Seigley
Iowa Department of Natural Resources
Date: December 23, 2013

Cedar Creek watershed sampling locations



1 - Cedar Creek 120th St.
2 - Whipporwill Creek 565 Tr
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13 - Unnamed Creek 235th Tr
14 - Cedar Creek 510th Tr

Cities
Cedar Creek monitoring sites
Cedar Creek
Rivers
Roads

N
W
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S

5 0 5 10 Miles