On-Site Measurements of General Water Quality Parameters in Big and Little Bayou Creeks, July 1997

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When sampling the Bayou Creek drainage for water and sediments in July of 1997, instantaneous measurements of pH, dissolved oxygen, conductivity and temperature also were made jointly by FFOU personnel and our group. Data were recorded by Jon Maybriar and a copy was forwarded to our laboratory. In reviewing this information, a number of important observations were evident, as addressed in this report.

Mean results are presented in Table 1 and illustrated in Figures 1 through 4. Effluents considered to have contributed to these stream conditions are listed in parentheses in Table 1, given in an upstream to downstream sequence.

The values for pH ranged from 7.33 to 8.24 and 6.71 to 7.38 for Big and Little Bayou Creeks, respectively (Table 1, Figure 1). All values were within State of Kentucky guidelines (KDEP, 1990). However, the pH of 8.24 recorded at BB5 approaches the desirable upper limit of 8.5, as well as the maximum allowable State limit of 9.0 (KDEP, 1990). This elevation in pH results from effluent 006, which traditionally has been alkaline. Values near or above 9.0 have been recorded in the past (Birge and Short, 1990; Birge *et al*., 1990) and this site probably should be designated for follow-up monitoring. As shown in Figure 1, pH does not drop back into the normal range except below station BB8, which was situated 3.2 Km below the 006 outfall.

Dissolved oxygen (mg/L) ranged from 2.45 to 7.15 and 0.10 to 5.00 for Big and Little Bayou Creeks, respectively (Table 1, Figure 2). The low value recorded at the upstream reference site (LB1) on Little Bayou Creek was the result of a lack of flow and difficult monitoring conditions. The only problematic result likely traceable to effluent discharges occurred at stations BB5 (3.90 mg/L) and BB6 (2.45 mg/L) where values were below the minimum State standard of 4.0 mg/L (KDEP, 1990).

The results for conductivity were of some concern at and below station BB6 on Big Bayou Creek. Effluent 001 traditionally has been characterized as having high conductivity. Values recorded in 1987 and 1988 ranged from 715 to 1029 (Birge *et al*., 1989). In July 1997 the conductivity increased from 184 at station BB5 to 1048 at BB6 and remained elevated downstream through BB9, a distance of 10.7 Km (Table 1, Figure 3). The 1997 conductivity measurements for this stream sector are the highest on record, as far as we can determine. For example, mean values determined in 1987-1991, based on a minimum of seven measurements each, ranged from 189 to 324 for station BB5 and 356-513 for BB6. Therefore, the measurements given in Table 1 for this segment are two to three times higher than in the past (Birge and Short, 1989; Birge *et al*.; 1990; 1992). These results support the findings given in the December report in which sharp increases in five

different metals were recorded at BB6 (Birge and Price, 1997). Therefore, it is suggested that this sector of Big Bayou Creek be given high priority in the future for frequent measurements of conductivity. Conductivity is a measurement of aqueous ionic constituents (*i.e*. anions, cations) and, therefore, represents an efficient, inexpensive means of prioritizing stream sectors for monitoring metal pollution.

It was also apparent that effluent discharges increased water column temperatures in Big and Little Bayou Creeks (Table 1, Figure 4). Temperatures recorded at stations BB3 and BB4 exceeded the State upper limit of 31.7^{o} C (KDEP, 1990) for warm water aquatic habitat. In addition, values recorded for BB3 through BB6 exceeded the period average for the month of July listed by the State as 84^{o} F (29.9^{o} C). Effluent discharges also elevated temperature in Little Bayou Creek, particularly at stations LB2A and LB2. It is suggested that thermal pollution also be given a high priority for future monitoring activities under FFOU.

References

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Birge, W.J, J.R. Lauth, and T.M. Short. 1990. *Biological Monitoring Plan for the Paducah Gaseous Diffusion Plant. Three-Year Draft Report.* University of Kentucky, Lexington, KY.

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(KDEP) Kentucky Department for Environmental Protection. 1990. *Surface Water Standards*. Division of Water. Frankfort, KY.

Table 1. Water Quality Parameters for PGDP Surface Water, July 15-16, 1997[a]

Stream Station	pH	Dissolved Oxygen (mg/L)	Conductivity (µS)	Temperature (^{o} C)
BB1 (009)	7.50	5.30	206.3	27.7
BB3 (008)	7.61	4.40	210.3	32.1
BB4 (006)	7.38	4.28	208.1	32.1
BB5 (001)	8.24	3.90	183.6	31.4
BB6	8.05	2.45	1048.5	30.4
BB7	7.86	4.30	989.5	29.7
BB8	7.86	6.15	969.0	NR[b]
BB9	7.33	7.15	852.5	NR[b]
LB1 (012) (011)	6.71	0.10	103.7	23.0
LB2A (010)	7.36	4.70	204.0	29.7
LB2	7.25	5.00	234.0	27.1
LB3	7.38	4.90	240.5	24.7
LB4	7.20	3.00	233.0	25.1

[a] Effluents that may affect stream monitoring stations are given in parentheses.
[b] Not recorded.

Figure 1. pH in PGDP Surface Water, July 15-16, 1997.

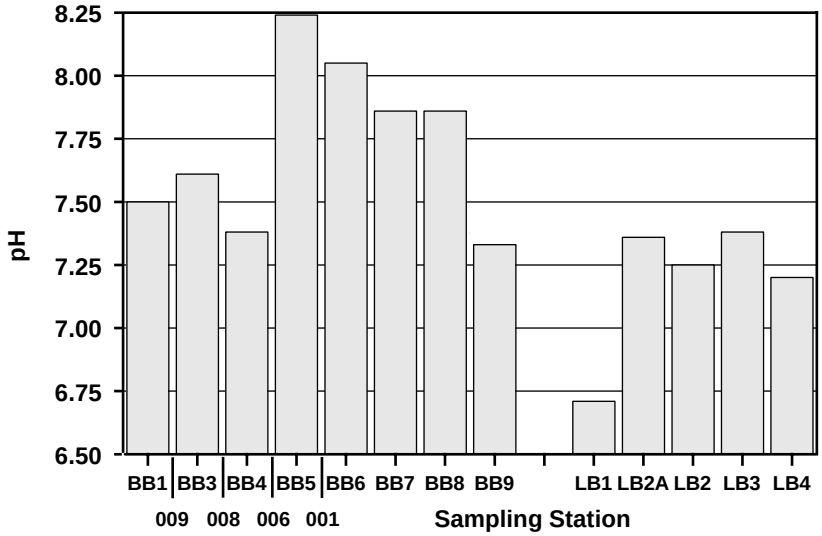

Figure 2. Dissolved Oxygen in PGDP Surface Water, July 15-16, 1997.

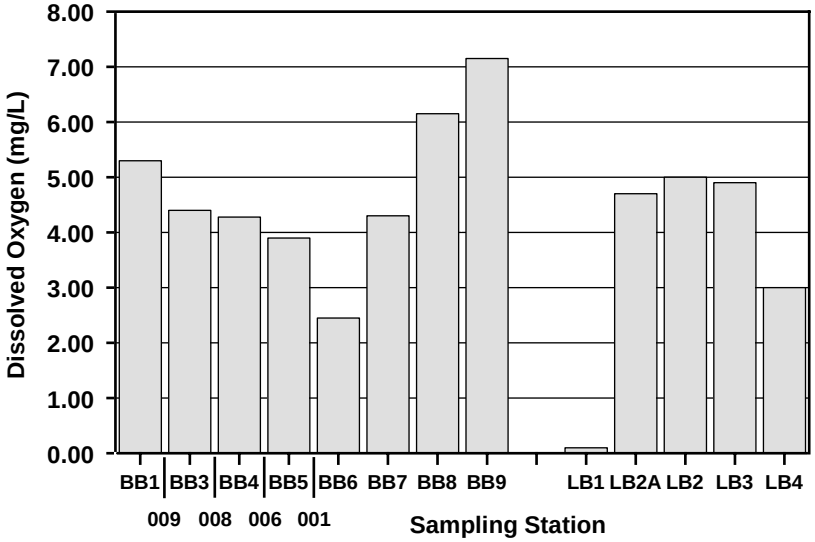

Figure 3. Conductivity in PGDP Surface Water, July 15-16, 1997.

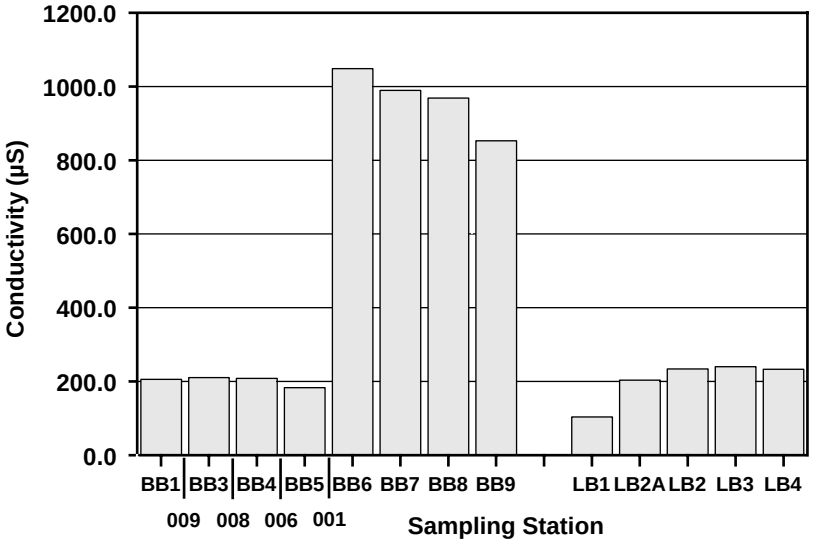

Figure 4. Temperature in PGDP Surface Water, July 15-16, 1997.