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DEPARTMENT OF ECOLOGY
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TO: Ken Merrill

FROM: David Hallock

SUBJECT: Little Spokane River Study -- Final Report

BACKGROUND

In March, 1989, Ecology included the Little Spokane River on Washington's 304(L) mini-list as water quality impaired due to toxics because of mercury and cyanide contamination. This assessment was based in part on Ambient Monitoring Section (AMS) mercury data for WY87 and WY88 which showed occasional mercury levels in excess of EPA's chronic criteria of 0.012 μg/L.

Because Manchester Lab's detection limit for mercury was 0.02 μg/L, above the chronic criteria level, a water quality standards violation was assumed any time mercury was detected in the monthly samples. However, not only is a fairly large amount of uncertainty associated with values below the quantitation limit (approximately 10 times the detection limit), but the standards specify a four-day average value.

The Eastern Regional Office (ERO) requested that AMS determine whether or not a mercury problem actually exists in the Little Spokane River; and if mercury contamination is found, to identify which general area within the basin is the source of the contamination. In addition, ERO requested we sample the usual suite of conventional constituents in order to further characterize general water quality in the basin.

METHODS

AMS and ERO identified four stations within the Little Spokane River drainage, in addition to AMS' routine ambient monitoring station near the mouth (Table 1).

These five stations were sampled monthly from July 1990 through June 1991. Conventional constituents were sampled at all stations and total metals (Hg, Cu, Pb, Cd, Cr, and Zn) were sampled at the Little Spokane near the mouth in accordance with AMS' standard protocols

(Hopkins, *et al.*, in press) and sent to Manchester Lab for analysis. In addition, the six metals listed above were sampled at the mouth, and mercury was sampled at the remaining four stations for analysis at Battelle Marine Research Laboratory in Sequim, Washington. All metals were collected directly into the sample containers by attaching the containers to a stainless steel holder and lowering the apparatus into the water via a rope. Battelle Lab's samples were collected in teflon bottles previously cleaned by heating in concentrated reagent grade HNO_3 for 48 hours at 90°C, then rinsed five times in deionized water and dried in a laminar flow clean-air bench. Acid preservative (8% HCl) was added in the field, and the bottles placed in zip-lock bags and shipped on ice to the Battelle Lab via Manchester.

Battelle Lab extracted metals with ammonium pyrrolidine dithiocarbamate for Cu, Pb, and Cd, followed by analysis by graphite furnace (Bloom and Crecelius, 1984). Cr and Zn were analyzed directly by graphite furnace. Mercury was analyzed by cold vapor AA (Bloom and Crecelius, 1983). Battelle's results were blank-corrected. Data analysis and graphics were done using WQHYDRO (Aroner, 1991).

DATA QUALITY

The quality of Manchester's data is evaluated through Manchester's continuing quality assurance/quality control (QA/QC) program which includes quality control charts, check standards, in-house matrix spikes, laboratory blanks and duplicates, and regular performance evaluation standards. In addition, AMS maintains its own QA/QC programs which includes standard sampling protocols, blind field duplicates, and blind field blanks. These QA/QC procedures and results are discussed in more detail in Hopkins, *et al.* (in press).

The quality of data from Battelle lab was generally good. The results of an analysis of a performance evaluation sample for Hg were good, although a little low. Where QC results were not within acceptable limits data are flagged with the appropriate remark code. Reviews of Battelle's data by Craig Smith are attached.

RESULTS AND DISCUSSION

Mercury Contamination

Manchester Lab reported results above detection limits for five of the 12 monthly mercury samples from the routine monitoring station near the mouth (Table 2). However, all five were flagged 'J' (estimate) or 'P' (below quantitation limits). (During the first part of the study 'P' was not used and Manchester flagged values below quantitation limits with 'J'.) A field duplicate was collected from the Little Spokane River near the mouth on June 4. Manchester reported a mercury concentration of 0.14 μg/L for this sample; the original sample result was 0.04P μg/L. Manchester was unable to explain the differences between the two values, but given that the result from the first sample was flagged and Battelle's result was well below the criteria, I do not feel a violation of standards occurred.

With exception of one sample date, Battelle Lab's mercury results were approximately an order of magnitude below chronic criteria at all stations (Table 3). Three values in March were above chronic criteria for mercury. These results were from the Little Spokane River stations near Griffith Springs, above Dartford Creek, and above Peone Creek. The mercury concentration near Griffith Springs was two to three orders of magnitude greater than all other results and results from the two upper-most stations were one to two orders of magnitude greater. Battelle re-ran the Griffith Springs sample with nearly identical results. I am inclined to believe these results represent true environmental concentrations. Sample contamination would not explain violations at all three upstream stations: it is unlikely that three samples in March would be contaminated with no contamination problems encountered during the rest of the study. Batch contamination would not explain the low values near the mouth and in Peone Creek. The high mercury results were not correlated with suspended sediment or discharge; these were both greatest at all stations in February.

One explanation for these results is that a pulse of mercury originating upstream of our upper-most station was moving through the system. The pulse had not yet reached the mouth when we sampled, and had, for the most part, passed the upper two stations at the time of sampling. Because travel time between the upper and lower stations is only about six hours, water quality standards for the chronic criteria, which specify a four-day average, were not exceeded. EPA (1986) states that "freshwater aquatic organisms and their uses should not be affected unacceptably" if the four-day chronic criteria is not exceeded. All results were well below the acute criteria of 2.4 μg/L.

At the time the 304(L) list was prepared identifying the Little Spokane River as an area of concern, data between detection and quantitation limits were not qualified and residence time was not considered. Had they been, all the data except one result would have been qualified. That one result, 0.45 μg/L collected October 3, 1989, was verified with the lab at the time. It may have been sample contamination or it may have also been the result of a pulse.

Other Metals Results

Manchester Lab's results exceeded both the tenth percentile and the specific chronic criteria for copper and lead at the Little Spokane River near the mouth in February and March. Copper exceeded the tenth percentile for criteria in June, but the actual chronic criteria value for that date were not exceeded. No values exceeded drinking water criteria. The reasons for these exceedances are unknown. However, February and March were the two highest flow months indicating the source was probably not point-related. Because concentrations were high in both February and March, the four-day average probably exceeded the criteria and water quality standards were violated for Cu and Pb.

Battelle Lab's results for both copper and lead exceeded the tenth percentile in February, and lead exceeded the tenth percentile for the criteria in March (Table 2). The actual chronic criteria values for February (but not March) were also exceeded, based on hardness values for those dates.

Battelle Lab's results were almost always lower than Manchester Lab's, particularly where Manchester's was qualified "J" or "P". This is inevitable, given that most concentrations were below Manchester Lab's detection limits but above Battelle's. There were a number of samples which Manchester quantified as above detection limits but below quantitation limits and which were, therefore, qualified. The differences between the results from these two labs highlight both the difficulty in accurate analysis for whole-water metals, and the importance of interpreting results below the quantitation limit with great caution.

Conventional Water Quality

Conventional water quality was generally fair (Table 4). Individual results from all stations are attached. Figures 1 through 5 illustrate the distribution of oxygen, pH, temperature, fecal coliform bacteria, and total ammonia at each main stem Little Spokane station by river mile. Lines representing water quality standards are also plotted. These distribution plots should be considered conditional since they are based at most on only 12 samples at each station.

Several water quality standards were violated during the course of the study (Table 5) with the Little Spokane River above Dartford Creek displaying the most violations.

Upstream summer temperatures were dramatically higher than downstream temperatures between RM 7.5 and RM 10.3 (Figure 1). Temperatures at the two upper stations and Peone Creek may be expected to exceed (violate) state standards nearly 25% of the time. Temperatures at the lower two stations may be kept below standards by dilution with (presumably) cooler groundwater inflow and Waikiki Springs, although without knowing the temperature and flow of these sources, this is only conjecture.

Oxygen concentrations were above criteria at all stations (there were no violations) (Figure 2). The spread between maximum and minimum concentration increased as distance upstream increased. This is not surprising: the greater volume of water downstream than upstream would be more likely to buffer diurnal and seasonal changes in oxygen. Also, the mid-reach springs would likely have a stabilizing influence on water quality in general. Median oxygen concentrations were significantly ($p=0.004$) lower at the Griffith Springs station (RM 7.5) than at the station above Dartford Creek (RM 10.3). Percent saturation also increased with increasing river mile. The lower two stations were generally below saturation while the upper two were above saturation. This may indicate a decrease in the production:respiration ratio downstream relative to upstream, a lower downstream reaeration coefficient, or the influence of the springs.

Distributions of pH were similar at all stations with the exception of the station above Dartford Creek (RM 10.3) and the Peone Creek station which may both be expected to violate state standards more than 25% of the time (Figure 3 and Table 4).

All stations except Peone Creek exceeded (violated) fecal coliform bacteria standards (Table 4). That is, the 10th percentile was greater than 200 organisms/100 mL. In general, fecal coliform counts increased with increasing river mile (Figure 4). The uppermost station (above Peone Creek) had the lowest median value of all stations, but this station also had the highest single

value, 2100 organisms/100 mL on February 5, 1991. This is also the date where streamflow was highest near the mouth, indicating a nonpoint source. Based on one year of monitoring, fecal coliform bacteria are a nonpoint source problem in the Little Spokane drainage.

Although the maximum total ammonia concentrations exceeded the tenth percentile (based on up to 12 data points) for chronic criteria at every station except near the mouth and the Peone Creek station (Table 4 and Figure 5), no concentration exceeded the actual criteria calculated for that particular date. In other words, no ammonia water quality standards violations occurred during the study.

Total ammonia and total phosphorus concentrations were lower in the two downstream stations and higher in the two upstream stations while nitrate+nitrite nitrogen exhibited the opposite pattern. Peone Creek had consistently low nutrients. Median ammonia concentrations were low at all stations compared to ecoregion (Omernik and Gallant, 1986) averages, while nitrate+nitrite nitrogen was high and total phosphorus was similar to other stations in the same ecoregion.

CONCLUSIONS AND RECOMMENDATIONS

1. Water quality standards for mercury were probably not violated during the study. After one year of monthly sampling at five stations in the Little Spokane River basin, three stations had unqualified mercury results exceeding chronic criteria, all in March. However, the four-day average was probably well below the chronic criteria.

2. Water quality standards for copper and lead were probably violated in February and March at the Little Spokane near the mouth.

3. Water quality violations in conventional constituents occurred at all stations but were most likely to occur at the upper stations, especially the station above Dartford Creek. Water quality at the routine ambient monitoring station at the mouth is better than upstream water quality, possibly due to the influence of springs below the station above Dartford Creek and below the station near Griffith Springs.

4. Nonpoint sources of fecal coliform bacteria should be investigated, particularly upstream of the Little Spokane River above Peone Creek station.

cc: Dick Cunningham
Carl Nuechterlein
Steve Saunders
Steve Butkus

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Table 1. Stations in the Little Spokane system monitored during this study and other points of interest.

Station	Name	River Mile
55B070	Little Spokane R nr Mouth	1.1
	WDW Fish Hatchery	~6.5
55B080	Little Spokane R nr Griffith Spring	7.5
	Sewage Disposal Ponds	~9.3
	Waikiki Springs	~9.4
	Dartford Creek	10.2
55B082	Little Spokane R abv Dartford Cr	10.3
	Peone Creek	12.9
55C070	Peone (Deadman) Creek abv Little Deep Cr	0.5
55B100	Little Spokane R abv Peone Cr	13.5

Table 2. Metals results (μg/L) from the Little Spokane River near the mouth. Except for mercury, criteria, which are a function of hardness, are 10 percentiles for all stations and dates.

Date	Laboratory	Little Spokane near Mouth					
		Hg	Cu	Pb	Cd	Cr	Zn
7/10/90	Manchester	0.04K	5.0K	1.2J	0.10K	0.62J	5.0K
	Battelle	0.00036	0.517	0.17	0.013	0.48	0.59
8/07/90	Manchester	0.04K	5.0K	1.0K	0.10K	0.33K	5.0K
	Battelle	<0.001	0.66	0.23	0.004	0.55	0.95
9/04/90	Manchester	0.089J	2.0K	1.0K	0.10K	0.65B	2.0K
	Battelle	<0.00100	0.66	0.26	0.05	0.374	3.74
10/09/90	Manchester	0.085J	3.5B	1.0K	0.10K	0.43J	8.4B
	Battelle	<0.001	0.4	0.097	0.031	0.374	2.0N
11/06/90	Manchester	0.077J	2.3B	1.0K	0.10K	0.89J	2.7B
	Battelle	<0.00023	0.45	0.094	0.023	<0.325	1.54N
		<0.00012					1.46N
12/04/90	Manchester	0.04K	2.0K	1.0K	0.10K	1.0B	2.2J
	Battelle	<0.00013	1.05	0.27	0.013	0.374	3.17N
01/08/91	Manchester	0.04K	2.0K	1.0K	0.10K	0.30J	7.0J
	Battelle	0.00034B	0.487B	0.34	<0.002	0.64B	2.50B
02/05/91	Manchester	0.04K	18.	19.2	0.32J	9.91	57.7
	Battelle	0.00578B	20.6B	9.40	0.153	7.10B	47.6B
03/05/91	Manchester	0.04K	13.	7.2	0.12J	1.92	51.
	Battelle	0.00152B	3.61B	2.34	0.031	1.42B	12.2B
04/02/91	Manchester	0.04K	4.9J	1.4J	0.10K	0.71JV	4.0K
	Battelle	0.00359	0.93J	0.449J	0.004KJ	0.70J	3.14J
05/07/91	Manchester	0.10P	3.0K	1.0K	0.10K	0.44V	4.0K
	Battelle	0.00176	1.49J	0.479J	0.004KJ	0.62J	3.34J
06/04/91	Manchester	0.04P	8.6P	1.0K	0.2K	0.37V	5.5PB
		0.14	3.0K	1.2	0.2K	0.72V	9.8
	Battelle	0.00527	0.79	0.429	0.004K	0.57	2.76
Chronic Criteria		0.012	8.2	1.8	0.8	145	77
Acute Criteria 2.4		11.8	47.2	2.4	1220	81	
Drinking Water Standards*		2	1000+	50	10	?	5000+

K - Less Than
J - Estimated Value
B,V - Detected in the method blank
N - value not within control limits
P - Value is above method detection limit but below quantitation limit.
* - From Department of Health (1989) State Board of Health Drinking Water Regulations
+ - Secondary standard for taste and odor.

Table 3. Mercury results (μg/L) from the Little Spokane River stations.

Station		DATE Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
55B070	L. Sp. nr Mouth	.00036	<.00100	<.00100	<.001	<.00012 <.00023	<.00013	.00034B	.00578B	.00152B	.00359	.00176	.00527
55B080	L. Sp. nr Griffith	<.00010	<.00100	<.00100	<.001	<.00016	.00037	<.000136B	.00362B	.29590B	.00491	.00136	.00219
55B082	L. Sp. abv Dartford	.00083	.00136	.00133	<.001	.00161	.00011	.00016B	.00577B	.02139B	.00306	.00293	.00133
55B100	L. Sp. abv Peone	.00035	.00100	.00109	<.001	.00081	.00018 .00039	.00016B	.00379B	.04974B	.00209	.00133	.00161
55C070	Peone Cr.	.00130	<.00113	.00100	<.001	.00120	.00106	.00225B .00220B	.00437B	.00502B	.00237	.00241	.00167

Table 4. Distribution of selected constituents, Little Spokane River Basin, July 1990-July 1991. Values below detection limits were replaced with 1/2 the detection limit.

Station name	Number of samples	Minimum	PERCENTILES 10	25	50 (median)	75	90	Maximum
			Temperature (°C)					
Little Spokane R nr Mouth	12	3.5	4.2	6.4	10.1	14.1	16.4	16.5
Little Spokane R nr Griffith Spr	12	1.7	2.8	6.0	10.3	14.4	16.8	16.9
Little Spokane abv Dartford Cr	12	0.7	0.9	4.0	9.6	17.2	21.1	21.1
Peone (Deadman)Cr abv Lt Deep Cr	11	3.8	4.2	7.0	12.0	17.9	20.7	20.7
Little Spokane R abv Peone Cr	12	0.1	0.2	3.6	9.2	17.5	21.7	21.8
			Conductivity (μmhos/cm)					
Little Spokane R nr Mouth	12	174	183	231	262	279	289	290
Little Spokane R nr Griffith Spr	12	140	156	219	261	271	278	280
Little Spokane abv Dartford Cr	12	104	125	179	228	243	253	256
Peone (Deadman) Cr abv Lt Deep Cr	11	135	136	168	239	275	298	300
Little Spokane R abv Peone Cr	12	101	123	178	221	232	284	298
			Oxygen concentration (mg/L)					
Little Spokane R nr Mouth	12	9.3	9.3	9.4	10.0	10.5	10.9	10.9
Little Spokane R nr Griffith Spr	12	8.7	8.8	9.2	9.8	10.3	11.1	11.2
Little Spokane abv Dartford Cr	12	9.1	9.2	10.1	11.2	12.3	12.9	13.0
Peone (Deadman) Cr abv Lt Deep Cr	11	8.5	8.5	9.4	10.2	11.3	11.8	11.9
Little Spokane R abv Peone Cr	12	9.4	9.4	10.1	11.3	12.6	13.1	13.1
			Oxygen Percent Saturation (%)					
Little Spokane R nr Mouth	12	85.6	86.5	89.3	91.3	97.2	103.0	104.3
Little Spokane R nr Griffith Spr	12	83.8	84.5	87.7	91.2	93.6	97.8	98.8
Little Spokane abv Dartford Cr	12	87.4	89.7	97.2	102.0	109.3	110.3	110.5
Peone (Deadman) Cr abv Lt Deep Cr	11	95.5	95.9	97.8	99.5	100.2	103.6	103.9
Little Spokane R abv Peone Cr	12	87.6	89.7	97.5	102.9	112.1	113.6	113.7
			pH					
Little Spokane R nr Mouth	12	7.5	7.6	7.9	8.3	8.3	8.4	8.4
Little Spokane R nr Griffith Spr	12	7.6	7.6	8.0	8.3	8.4	8.5	8.5
Little Spokane abv Dartford Cr	12	7.6	7.6	8.1	8.3	8.6	8.7	8.7
Peone (Deadman) Cr abv Lt Deep Cr	11	7.7	7.8	8.2	8.4	8.6	8.7	8.7
Little Spokane R abv Peone Cr	12	7.5	7.6	8.1	8.3	8.5	8.5	8.5
			Total Suspended Sediment (mg/L)					
Little Spokane R nr Mouth	11	2	2	5	12	22	500	600
Little Spokane R nr Griffith Spr	9	3	3	4	9	54	640	640
Little Spokane abv Dartford Cr	9	2	2	6	11	65	510	510
Peone (Deadman) Cr abv Lt Deep Cr	8	4	4	5	15	29	379	373
Little Spokane R abv Peone Cr	9	2	2	5	12	30	250	250

Table 4. Continued.

Station name	Number of samples	Minimum	10	25	50 (median)	75	90	Maximum
				PERCENTILES				
Hardness (mg/L $CaCO_3$)								
Little Spokane R nr Mouth	12	71	77	107	130	136	137	137
Little Spokane R nr Griffith Spr	12	58	67	100	119	129	136	138
Little Spokane abv Dartford Cr	12	39	49	81	100	115	119	121
Peone (Deadman) Cr abv Lt Deep Cr	11	58	58	65	108	125	135	136
Little Spokane R abv Peone Cr	12	32	45	79	97	112	119	120
Turbidity (NTU)								
Little Spokane R nr Mouth	12	0.5	0.5	0.5	1.7	2.9	132.1	178.0
Little Spokane R nr Griffith Spr	12	0.5	0.5	0.5	1.3	2.8	160.7	220.0
Little Spokane abv Dartford Cr	12	0.5	0.7	1.2	1.3	3.3	136.8	185.0
Peone (Deadman) Cr abv Lt Deep Cr	11	0.5	0.6	1.1	2.0	3.6	43.4	53.0
Little Spokane R abv Peone Cr	12	0.5	0.5	0.5	1.5	2.9	75.7	103.0
Fecal Coliform Bacteria (Colonies/100ml)								
Little Spokane R nr Mouth	11	4	6	16	33	75	444	520
Little Spokane R nr Griffith Spr	11	23	25	32	53	240	616	700
Little Spokane abv Dartford Cr	11	10	13	24	63	116	1082	1300
Peone (Deadman) Cr abv Lt Deep Cr	10	3	3	7	21	49	98	100
Little Spokane R abv Peone Cr	11	3	4	11	14	52	1726	2100
Total Ammonia-nitrogen (mg/L)								
Little Spokane R nr Mouth	11	0.005	0.005	0.010	0.013	0.080	0.321	0.374
Little Spokane R nr Griffith Spr	9	0.005	0.005	0.005	0.012	0.045	0.418	0.418
Little Spokane abv Dartford Cr	8	0.010	0.009	0.012	0.017	0.020	0.469	0.482
Peone (Deadman) Cr abv Lt Deep Cr	7	0.005	0.004	0.005	0.010	0.020	0.106	0.030
Little Spokane R abv Peone Cr	9	0.010	0.010	0.011	0.018	0.060	0.581	0.581
Chronic Total Ammonia Criteria (mg/L Total NH3-N)								
Little Spokane R nr Mouth	12	0.414	0.429	0.521	0.653	1.506	1.975	1.995
Little Spokane R nr Griffith Spr	12	0.330	0.343	0.411	0.567	1.058	2.015	2.043
Little Spokane R abv Dartford Cr	12	0.201	0.213	0.263	0.493	0.941	2.045	2.070
Peone (Deadman) Cr abv Lt Deep Cr	11	0.200	0.201	0.297	0.477	0.739	1.768	1.988
Little Spokane R abv Peone Cr	12	0.236	0.251	0.324	0.580	0.900	2.045	2.078
Acute Total Ammonia Criteria (mg/L Total NH3-N)								
Little Spokane R nr Mouth	12	2.355	2.371	2.926	3.396	7.831	12.409	13.283
Little Spokane R nr Griffith Spr	12	1.905	1.913	2.357	2.949	5.500	11.394	11.727
Little Spokane R abv Dartford Cr	12	1.262	1.326	1.664	2.655	4.895	11.820	12.464
Peone (Deadman) Cr abv Lt Deep Cr	11	1.273	1.319	1.545	2.479	3.841	9.188	10.328
Little Spokane R abv Peone Cr	12	1.734	1.786	2.035	3.018	4.678	12.735	13.566

Table 4. Continued.

Station name	Number of samples	Minimum	10	25	50 (median)	75	90	Maximum
				PERCENTILES				
			Nitrate+nitrite-nitrogen (mg/L)					
Little Spokane R nr Mouth	12	0.774	0.800	0.891	0.995	1.183	1.315	1.360
Little Spokane R nr Griffith Spr	12	0.614	0.656	0.774	0.940	1.085	1.250	1.310
Little Spokane abv Dartford Cr	12	0.467	0.468	0.486	0.655	0.895	1.165	1.240
Peone (Deadman) Cr abv Lt Deep Cr	12	0.253	0.255	0.357	0.670	0.780	0.868	0.880
Little Spokane R abv Peone Cr	12	0.447	0.449	0.462	0.600	0.914	1.192	1.270
			Total Phosphorus (mg/L)					
Little Spokane R nr Mouth	12	0.010	0.013	0.020	0.021	0.039	0.782	1.070
Little Spokane R nr Griffith Spr	12	0.010	0.012	0.020	0.022	0.034	0.775	1.060
Little Spokane abv Dartford Cr	12	0.017	0.018	0.022	0.038	0.041	0.818	1.100
Peone (Deadman) Cr abv Lt Deep Cr	11	0.037	0.038	0.040	0.055	0.100	0.184	0.190
Little Spokane R abv Peone Cr	12	0.013	0.015	0.020	0.031	0.047	0.669	0.905
			Ortho-phosphorus (mg/L)					
Little Spokane R nr Mouth	12	0.005	0.005	0.006	0.010	0.013	0.109	0.139
Little Spokane R nr Griffith Spr	12	0.005	0.005	0.010	0.010	0.016	0.122	0.157
Little Spokane abv Dartford Cr	12	0.005	0.006	0.010	0.017	0.020	0.142	0.181
Peone (Deadman) Cr abv Lt Deep Cr	11	0.024	0.024	0.030	0.034	0.050	0.140	0.160
Little Spokane R abv Peone Cr	12	0.005	0.005	0.006	0.010	0.018	0.144	0.184
			Discharge (cfs)					
Little Spokane R nr Mouth	12	359	359	365	406	578	989	1040

Table 5. Water quality standards violations (and total non-qualified results available) at the Little Spokane River stations, July 1990 through June 1991.

Station	Temp.	Oxygen	FC	pH	Ammonia
55B070	0 (11)	0 (12)	1 (11)	0 (12)	0 (11)
55B080	0 (11)	0 (12)	3 (11)	0 (12)	0 (9)
55B082	2 (11)	0 (11)	2 (11)	3 (12)	0 (8)
55C070	2 (10)	0 (11)	0 (10)	3 (11)	0 (7)
55B100	2 (11)	0 (12)	2 (11)	0 (12)	0 (9)

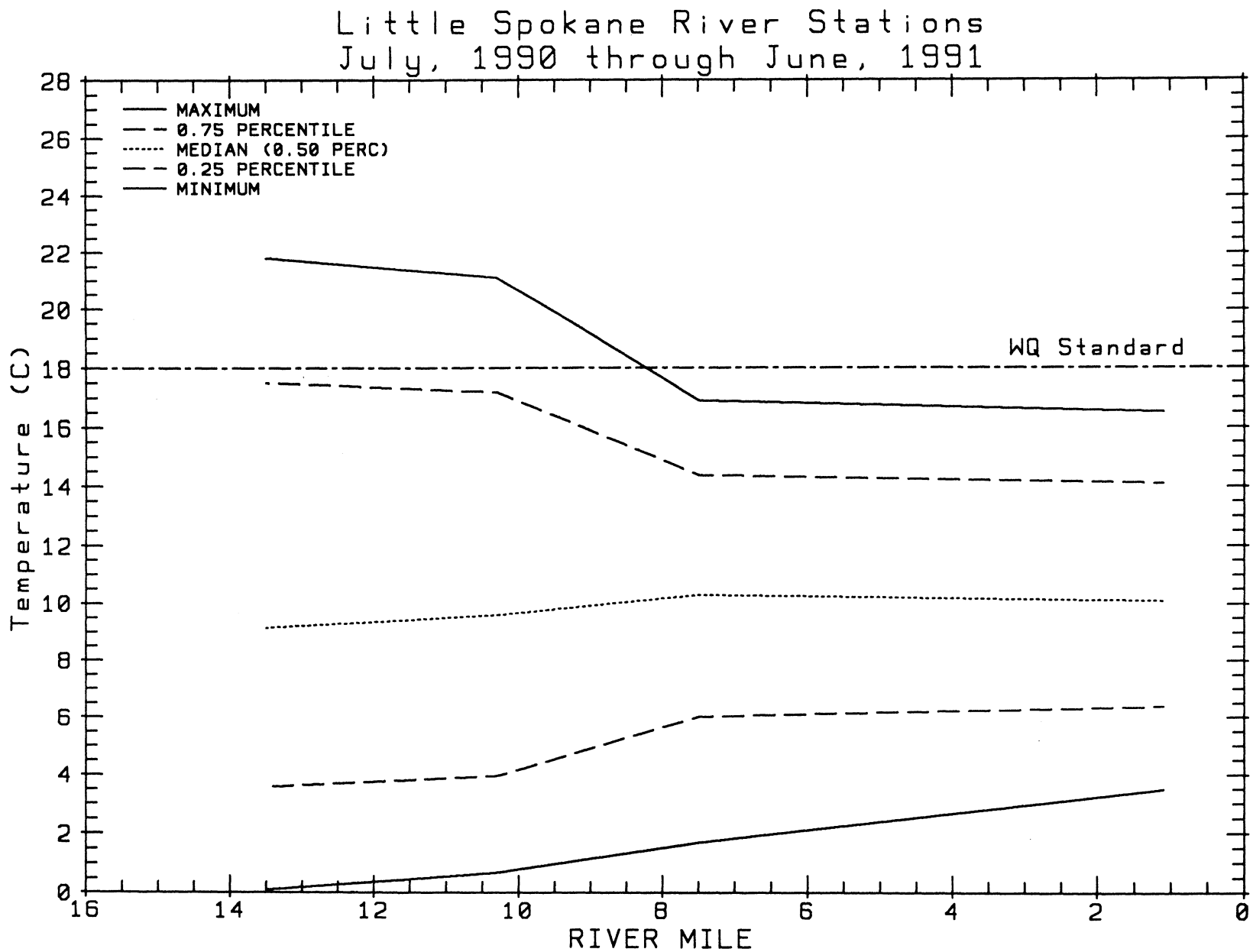

Figure 1. Little Spokane River Stations-Temperature (°C), July 1990 - June 1991.

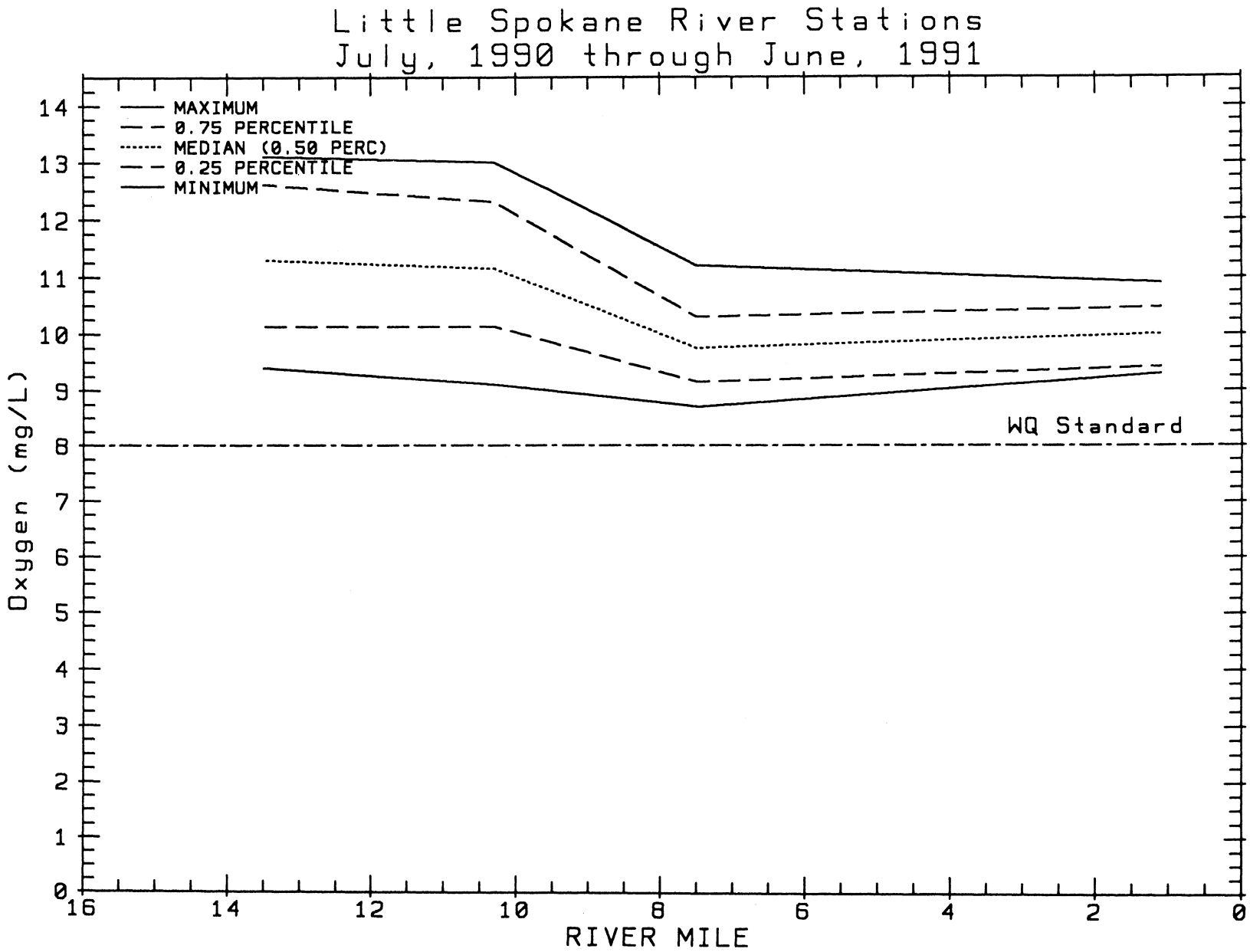

Figure 2. Little Spokane River Stations-Dissolved Oxygen (mg/L), July 1990 - June 1991.

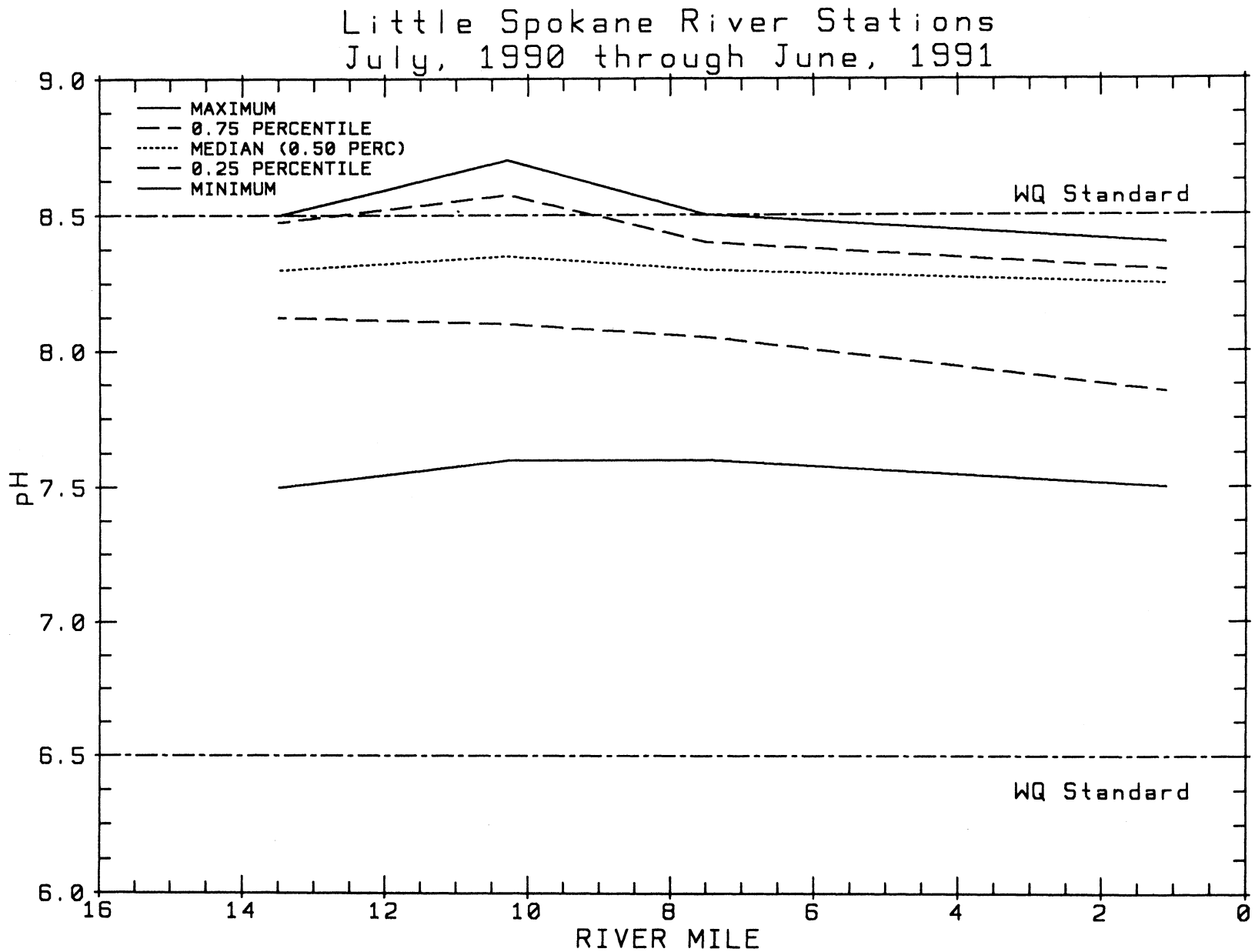

Figure 3. Little Spokane River-pH, July 1990 - June 1991.

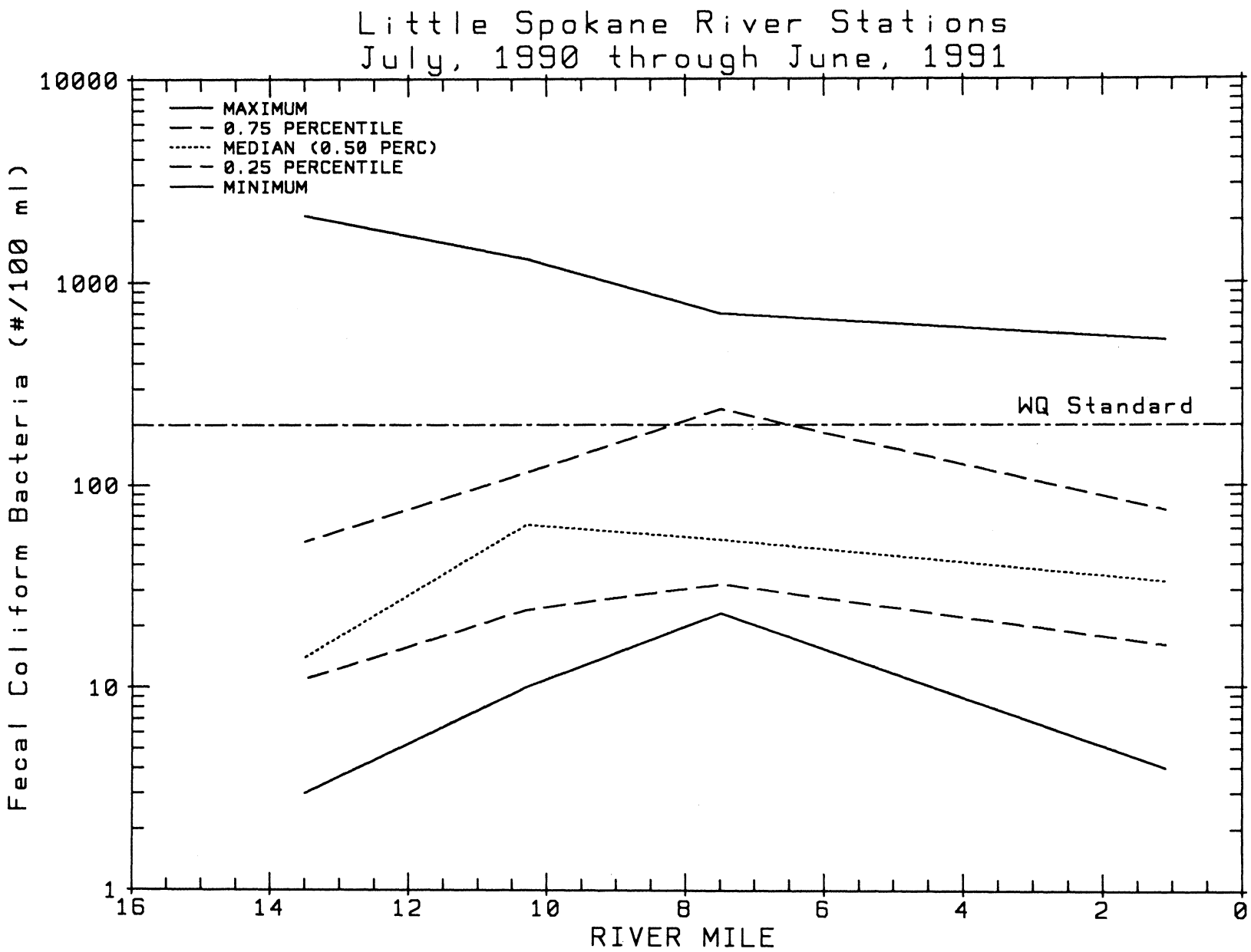

Figure 4. Little Spokane River-fecal coliform bacteria (#/100 mL), July 1990 - June 1991.

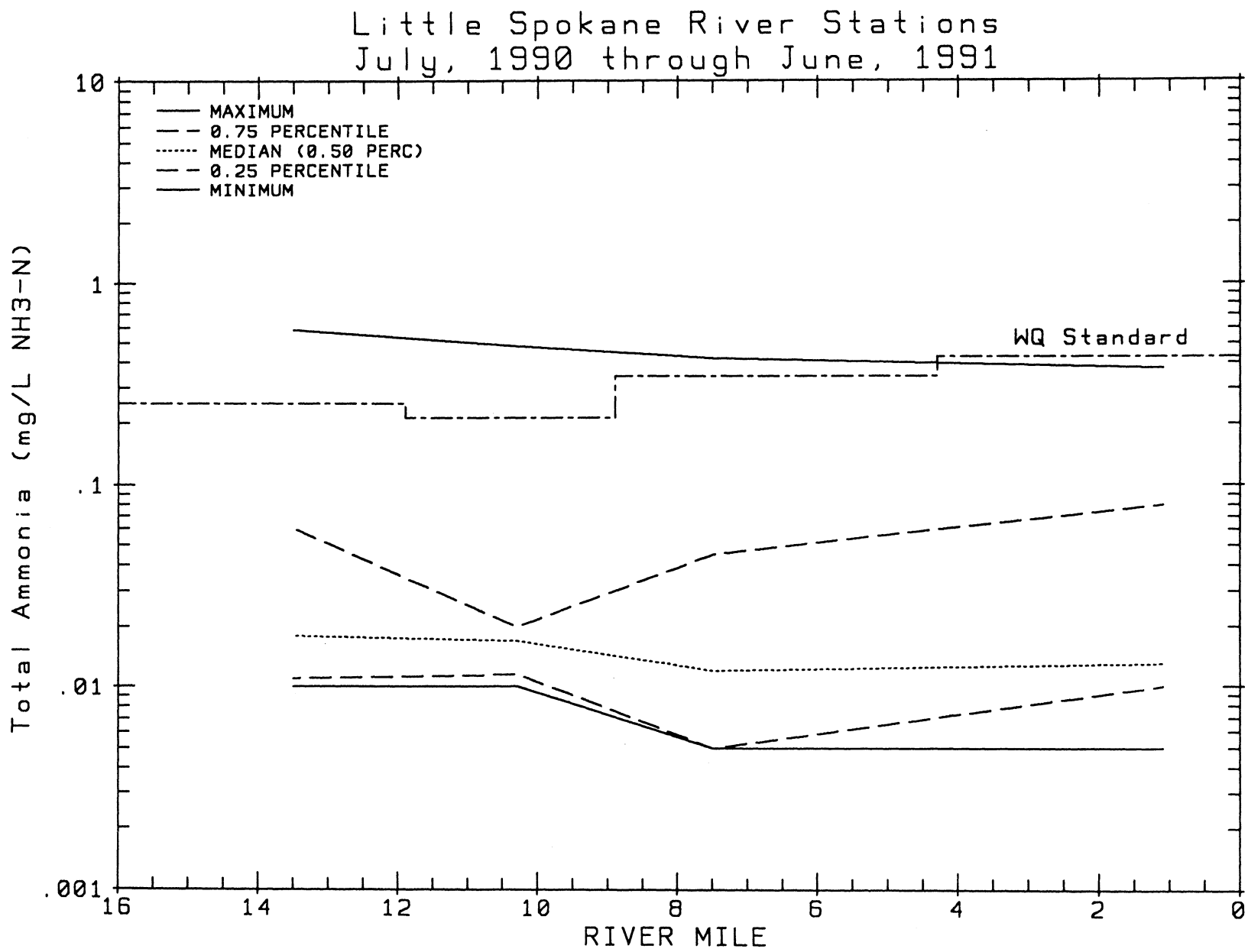

Figure 5. Little Spokane River-total ammonia (mg/L NH_3-N) July 1990 - June 1991.

WASHINGTON STATE DEPARTMENT OF ECOLOGY
MANCHESTER ENVIRONMENTAL LABORATORY
Manchester, Washington 98353

DATA REVIEW

By:	Craig Smith, Chemist		
PROJECT:	Eastern Routine Monitoring		
Lab Sample No:	Week #'s 28, 32, 36, 41, 45, 49 of 1990	**Report Date:**	03-19-91

Metals

Digestion: APDC Technique for extraction: Total Metals
Hg Analysis by Bloom and Crecilius(1983)

Turnaround Time: Six sample sets were received on March 5, 1991. Based upon contracted dates for deliverables, the following is a summary:

Sample Set:	
286161	169 days late
326161	155 days late
366161	123 days late
416161	104 days late
456161	96 days late
496163	48 days late

DELIVERABLES: One of the stipulated deliverables was all raw data. Raw data <u>was not</u> provided for Hg. TheY "discarded" the raw data.

All parameters requested were received except the following:
416161 separate Hg analysis
496167 separate Hg analysis

HOLDING TIME: With regard to holding time, analysis may or may not have been within the accepted criterion. No raw data was available for Hg.

REAGENT BLANK: Sample results were blank corrected by the laboratory.

MATRIX SPIKE: The targeted accuracy of matrix spikes is +/- 25% of the true value. All values were within the targeted limits.

SPIKE DUPLICATE: The target limits are +/- 20%, or +/- 1 detection limit for samples less than 5 times the detection limit. All values were within the targeted limits.

LABORATORY CONTROL SAMPLE The target is a +/- 20% recovery control limit. All values were within the targeted limits except for Zn on weeks 41, 45, and 49. The RPD was 90%. The Zn data for these three sets will receive an "N" qualifier.

SAMPLE DATA: The data may be used with the qualification attached.

N = value not within control limits.

WASHINGTON STATE DEPARTMENT OF ECOLOGY
MANCHESTER ENVIRONMENTAL LABORATORY
Manchester, Washington 98353

DATA REVIEW

By:	Craig Smith, Chemist		
PROJECT:	**ERM Metals**		
Lab Sample No:	026163 - 026167 066163 - 066167 106163 - 106167, 109999(PE Sample)	**Report Date:**	06-19-91

	Collected	To Manchester	Data Received
HOLDING TIME:	01-08	01-09	06-07-91
	02-05	02-06	06-07-91
	03-05	03-06	06-07-91

Metals
Digestion: Hg-Bloom and Crecelius Method. Totals by APDC technique

HOLDING TIME: Analyses for all parameters were performed within the holding time limits.

REAGENT BLANK: The method blank showed no analyte values above the reporting detection limit except for Cr, Cu, Hg, and Zn. See data summary for the actual values. See explanation below.*

MATRIX SPIKE: The targeted accuracy of matrix spikes is +/- 25% of the true value. All values were within the targeted limits.

SPIKE DUPLICATE: The target limits are +/- 20%, or +/- 1 detection limit for samples less than 5 times the detection limit.
All values were within the targeted limits.

LABORATORY CONTROL SAMPLE The target is a +/- 20% recovery control limit. All values were within the targeted limits.

*The blank gave values above the reporting detection limit for all three sets of analyses. As a result, the affected data will receive a "B" qualifier.
For sample sets 02, 06, and 10, the Cu contamination is very low. The net affect will be negligible.

For all other parameters, the net affect is appreciable.
On sample sets 02, 06, and 10, the Hg and Zn data are most affected. For Hg, the blank corrected values are also given. This was not done for Zn.

The data may be used with the attached qualifiers.

B = analyte found in blank as well as sample. Possible/probable blank contamination.

As we discussed earlier, a PE sample was included in one of the sample sets from week 10. I gave this PE Sample the number 109999.

I sent ORMS-1, a riverine water sample. A copy of the certified data is attached.

The results that Battelle obtained for this sample were not too bad. Their blank corrected value was 0.00502 ug/L. The certified value was 0.0068 +/- 0.0013 ug/L. If you apply the -0.0013 value you get 0.0055, close to their 0.00502 value. Battelles results are a little low.

55B070 6355B070 12431900
LITTLE SPOKANE RIVER NEAR MOUTH
47 47 00.0 117 31 43.0 2F 0 Elev= 0 ft
53063 Washington Spokane Co. PACIFIC NORTHWEST
SPOKANE (Little Spokane-55) 130355
21540000 Reach= 0.000 Drg= 0 sqmi
Seg ID= 24-55-02 Class= A Miles= 0.00 to 0.00
AMBNT/STREAM/RMP

INDEX 1310001 006500 00510
MILES 0643.00 0056.30 001.10 . . . . . .

DATE FROM TO	TIME	DEPTH FEET	8 LAB IDENT. NUMBER	10 WATER TEMP CENT	25 BAROMTRC PRESSURE MM OF HG	60 STREAM FLOW CFS	80 COLOR PT-CO UNITS	95 CNDUCTVY LAB @ 25C UMHO	300 DO MG/L	301 DO SATUR PERCENT	310 BOD 5 DAY MG/L	340 COD HI LEVEL MG/L
90/07/10	1350		286161	16.5	720	410		287	9.7	104.3		
90/08/07	1420		326161	16.3	718	361		238	9.3	99.8		
90/09/04	1320		366161	14.1	724	359		281	9.4	95.5		
90/10/09	1335		416161	9.9	723	359		290	10.3	95.5		
90/11/06	1345		456161	7.7	734	389		272	10.5	91.0		
90/12/04	1405		496163	7.0	718	402		268	10.4	90.6		
91/01/08	1440		26163	5.7	724	376		271	10.8	90.3		
91/02/05	1520		66163	3.5	728	1040		174	10.9	85.6		
91/03/05	1415		106163	6.2J	719	871		203	10.4	88.7		
91/04/02	1350		146163	10.3	723	587		230	9.5	88.9		
91/05/07	1405		196163	11.9	720	549		233	9.4	91.5		
91/06/04	1400		236163	14.1	723	497		255	9.6	97.8		

DATE FROM TO	TIME	DEPTH FEET	400 PH SU	405 CO2 MG/L	410 T ALK CACO3 MG/L	440 HCO3 ION HCO3 MG/L	445 CO3 ION CO3 MG/L	530 RESIDUE TOT-NFLT MG/L	610 NH3+NH4- N TOTAL MG/L	613 NO2-N DISS MG/L	615 NO2-N TOTAL MG/L	620 NO3-N TOTAL MG/L
90/07/10	1350		8.30					6.0	0.010K	0.010K		
90/08/07	1420		8.40									
90/09/04	1320		8.30					2.0	0.010	0.010K		
90/10/09	1335		8.40					5.0	0.014	0.009		
90/11/06	1345		8.30					3.0	0.010K	0.010K		
90/12/04	1405		7.80					6.0	0.010	0.010K		
91/01/08	1440		8.10					15.0	0.020	0.010K		
91/02/05	1520		7.70					600.0J	0.374	0.010K		
91/03/05	1415		7.50					100.0	0.080	0.010K		
91/04/02	1350		8.20					22.0	0.013	0.001		
91/05/07	1405		8.00					12.0	0.013	0.010K		
91/06/04	1400		8.30					12.0	0.111	0.010K		

DATE FROM TO	TIME	DEPTH FEET	625 TOT KJEL N MG/L	630 NO2+NO3 N-TOTAL MG/L	660 ORTHOPO4 PO4 MG/L	665 PHOS-TOT MG/L P	671 PHOS-DIS ORTHO MG/L P	680 T ORG C C MG/L	900 TOT HARD CACO3 MG/L	902 NC HARD CACO3 MG/L	915 CALCIUM CA,DISS MG/L	925 MGNSIUM MG,DISS MG/L

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH FEET	625 TOT KJEL N MG/L	630 NO2+NO3 N-TOTAL MG/L	660 ORTHOPO4 PO4 MG/L	665 PHOS-TOT MG/L P	671 PHOS-DIS ORTHO MG/L P	680 T ORG C C MG/L	900 TOT HARD CACO3 MG/L	902 NC HARD CACO3 MG/L	915 CALCIUM CA,DISS MG/L	925 MGNSIUM MG,DISS MG/L
90/07/10	1350			0.940		0.020	0.010K		129			
90/08/07	1420			1.040		0.020	0.010		133			
90/09/04	1320			1.130		0.010	0.010K		137			
90/10/09	1335			1.072		0.020	0.012		137			
90/11/06	1345			1.200		0.020	0.010		136			
90/12/04	1405			1.210		0.020	0.010		131			
91/01/08	1440			1.360		0.040	0.010		134			
91/02/05	1520			0.774		1.070	0.139		71			
91/03/05	1415			0.950		0.110	0.040		92			
91/04/02	1350			0.894		0.035	0.013		106			
91/05/07	1405			0.859		0.023	0.010K		108			
91/06/04	1400			0.890		0.028	0.013		126			

DATE FROM TO	TIME	DEPTH FEET	930 SODIUM NA,DISS MG/L	935 PTSSIUM K,DISS MG/L	940 CHLORIDE CL MG/L	945 SULFATE SO4-TOT MG/L	1000 ARSENIC AS,DISS UG/L	1002 ARSENIC AS,TOT UG/L	1005 BARIUM BA,DISS UG/L	1025 CADMIUM CD,DISS UG/L	1027 CADMIUM CD,TOT UG/L	1030 CHROMIUM CR,DISS UG/L

DATE FROM TO	TIME	DEPTH FEET	1034 CHROMIUM CR,TOT UG/L	1040 COPPER CU,DISS UG/L	1042 COPPER CU,TOT UG/L	1049 LEAD PB,DISS UG/L	1051 LEAD PB,TOT UG/L	1065 NICKEL NI,DISS UG/L	1075 SILVER AG,DISS UG/L	1090 ZINC ZN,DISS UG/L	1092 ZINC ZN,TOT UG/L	1094 ZINC TOT REC UG/L
90/07/10	1350											5.0K
90/08/07	1420											5.0K
90/09/04	1320											2.0K
90/10/09	1335											8.0V
90/11/06	1345											3.0V
90/12/04	1405											2.0V
91/01/08	1440											7.0V
91/02/05	1520											58.0
91/03/05	1415											12.0V
91/04/02	1350											4.0K
91/05/07	1405											3.0J
91/06/04	1400											6.0B

DATE FROM TO	TIME	DEPTH FEET	1113 CADMIUM TOT REC UG/L	1114 LEAD TOT REC UG/L	1118 CHROMIUM TOT REC UG/L	1119 COPPER TOT REC UG/L	1145 SELENIUM SE,DISS UG/L	31504 TOT COLI MFIM LES /100ML	31616 FEC COLI MFM-FCBR /100ML	71900 MERCURY HG,TOTAL UG/L	71901 MERCURY TOT REC UG/L	82079 TURBIDTY LAB NTU
90/07/10	1350		0.10K	1.2J	0.6J	5.0K			32		0.04K	1.2
90/08/07	1420		0.10K	1.0K	0.3J	5.0K			33		0.04K	1.0K
90/09/04	1320		0.10K	1.0K	0.6V	2.0K			45		0.09V	1.0K

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH FEET	1113 CADMIUM TOT REC UG/L	1114 LEAD TOT REC UG/L	1118 CHROMIUM TOT REC UG/L	1119 COPPER TOT REC UG/L	1145 SELENIUM SE,DISS UG/L	31504 TOT COLI MFIM LES /100ML	31616 FEC COLI MFM-FCBR /100ML	71900 MERCURY HG,TOTAL UG/L	71901 MERCURY TOT REC UG/L	82079 TURBIDTY LAB NTU
90/10/09	1335		0.10K	1.0K	0.4V	3.5V			14		0.09V	1.0K
90/11/06	1345		0.10K	1.0K	0.9V	2.3V			4		0.08V	1.0K
90/12/04	1405		0.10K	1.0K	1.0	2.0K			41		0.04K	1.2
91/01/08	1440		0.10K	1.0K	0.3V	2.0K			75		0.04K	2.3
91/02/05	1520		0.32V	19.2	9.9	18.0			520		0.04K	178.0
91/03/05	1415		0.03	2.3	1.4V	3.6V			140		0.00	25.0
91/04/02	1350		0.10K	1.4J	0.7V	4.9J			23		0.04K	3.0
91/05/07	1405		0.10K	1.0K	0.4V	3.0K					0.00	2.4H
91/06/04	1400		0.20K	1.0K	0.4V	8.6V			16		0.00	2.2

55B080 6355B080
LITTLE SPOKANE RIVER NEAR GRIFFITH SPRINGS
47 46 12.0 117 27 09.0 2F000 Elev= 0 ft
53063 Washington Spokane Co. PACIFIC NORTHWEST
SPOKANE (Little Spokane-55) 130355
21540000 Reach=17010308000 0.000 Drg= 0 sqmi
TYPEA/AMBNT/STREAM

INDEX 1310001 006500 00510
MILES 0643.00 0056.30 007.50 . . . . . .

DATE FROM TO	TIME	DEPTH FEET	8 LAB IDENT. NUMBER	10 WATER TEMP CENT	25 BAROMTRC PRESSURE MM OF HG	95 CNDUCTVY LAB @ 25C UMHO	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	530 RESIDUE TOT-NFLT MG/L	610 NH3+NH4- N TOTAL MG/L	613 NO2-N DISS MG/L
90/07/10	1430		286169	16.9	719	262	9.1	98.8	8.40	5.0	0.010K	0.010K
90/08/07	1455		326169	16.5	718	270	8.7	93.8	8.50			
90/09/04	1400		366169	14.3	723	271	9.1	93.0	8.40			
90/10/09	1410		416169	10.2	723	280	9.9	92.4	8.50			
90/11/06	1420		456169	7.7	734	262	10.3	89.3	8.40	3.0	0.010K	0.010K
90/12/04	1430		496164	7.0	718	259	10.0	87.2	8.00	3.0	0.020	0.010K
91/01/08	1510		26164	5.7	724	275	10.3	86.2	8.20	8.0	0.020	0.010K
91/02/05	1600		66164	1.7	728	140	11.2	83.8	7.70	640.0J	0.418	0.010K
91/03/05	1450		106164	5.4J	719	193	10.8	90.3	7.60	89.0	0.070	0.010K
91/04/02	1420		146164	10.4	722	219	9.6	90.1	8.30	19.0	0.012	0.001
91/05/07	1435		196164	12.2	720	220	9.4	92.1	8.30	9.0	0.012	0.010K
91/06/04	1440		236164	14.4	722	230	9.3	95.4	8.30	11.0	0.010K	0.010K

DATE FROM TO	TIME	DEPTH FEET	630 NO2+NO3 N-TOTAL MG/L	665 PHOS-TOT MG/L P	671 PHOS-DIS ORTHO MG/L P	900 TOT HARD CACO3 MG/L	31616 FEC COLI MFM-FCBR /100ML	71900 MERCURY HG,TOTAL UG/L	71901 MERCURY TOT REC UG/L	82079 TURBIDTY LAB NTU
90/07/10	1430		0.900	0.020	0.010	112	32		0.00K	1.0
90/08/07	1455		0.950	0.020	0.010	126	120		0.00K	1.0K
90/09/04	1400		1.040	0.010	0.010K	129	53		0.00K	1.0K
90/10/09								0.00K		
90/10/09	1410		1.028	0.018	0.016	138	33			1.0K
90/11/06	1420		1.100	0.020	0.010	131	31	0.00K		1.0K
90/12/04	1430		1.110	0.020	0.010	125	240	0.00		1.0K
91/01/08	1510		1.310	0.030	0.010	129	280	0.00K		1.6
91/02/05	1600		0.614	1.060	0.157	58	700S	0.00		220.0
91/03/05	1450		0.930	0.110	0.040	87	120	0.00		22.5
91/04/02	1420		0.769	0.035	0.012	99	53		0.00	3.1
91/05/07	1435		0.753	0.024	0.010K	103			0.00	2.1H
91/06/04	1440		0.790	0.029	0.014	109	23		0.00	1.6

55B082 6355B082
LITTLE SPOKANE RIVER ABOVE DARTFORD CREEK
47 00 01.0 117 24 52.0 2F000 Elev= 0 ft
53063 Washington Spokane Co. PACIFIC NORTHWEST
SPOKANE (Little Spokane-55) 130355
21540000 Reach=17010308000 0.000 Drg= 0 sqmi
TYPEA/AMBNT/STREAM

INDEX 1310001 006500 00510
MILES 0643.00 0056.30 010.30 . . . . . .

DATE FROM TO	TIME	DEPTH FEET	8 LAB IDENT. NUMBER	10 WATER TEMP CENT	25 BAROMTRC PRESSURE MM OF HG	95 CNDUCTVY LAB @ 25C UMHO	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	530 RESIDUE TOT-NFLT MG/L	610 NH3+NH4- N TOTAL MG/L	613 NO2-N DISS MG/L
90/07/10	1500		286170	21.1	719	221	9.1	107.3	8.40	7.0	0.010	0.010K
90/08/07	1520		326170	21.0	717	235	9.3J	109.8	8.60			
90/09/04	1420		366170	17.5	722	245	10.1	110.5	8.60			
90/10/09	1435		416170	9.2	722	256	12.0	109.5	8.70			
90/11/06	1445		456170	5.2	733	242	12.6	102.7	8.50	2.0	0.020	0.010K
90/12/04	1455		496165	4.1	717	236	12.4	100.5	8.10	5.0	0.020	0.010K
91/01/08	1535		26165	1.3	723	243	13.0	97.0	8.30	8.0	0.020	0.010K
91/02/05	1625		66165	0.7	728	104	12.0	87.4	7.60	510.0J	0.482	0.010K
91/03/05	1515		106165	3.9J	719	175	11.8	94.9	7.70	103.0		0.010K
91/04/02	1440		146165	10.0	721	183	10.5	97.8	8.10	26.0	0.013	0.002
91/05/07	1455		196165	12.8	720	178	10.2	101.3	8.30	11.0	0.014	0.010K
91/06/04	1500		236165	16.2	721	189	10.2	108.7	8.40	16.0	0.011	0.010K

DATE FROM TO	TIME	DEPTH FEET	630 NO2+NO3 N-TOTAL MG/L	665 PHOS-TOT MG/L P	671 PHOS-DIS ORTHO MG/L P	900 TOT HARD CACO3 MG/L	31616 FEC COLI MFM-FCBR /100ML	71900 MERCURY HG,TOTAL UG/L	71901 MERCURY TOT REC UG/L	82079 TURBIDTY LAB NTU
90/07/10	1500		0.510	0.040	0.020	94	63		0.00K	1.2
90/08/07	1520		0.630	0.040	0.020	105	48		0.00	1.0
90/09/04	1420		0.680	0.020	0.010	115	116		0.00	1.2
90/10/09								0.00K		
90/10/09	1435		0.850	0.017	0.013	121	63			1.2
90/11/06	1445		0.910	0.020	0.010	116	24	0.00		1.0K
90/12/04	1455		0.990	0.030	0.010	111	24	0.00		1.2
91/01/08	1535		1.240	0.040	0.020	115	10	0.00		1.4
91/02/05	1625		0.478	1.100	0.181	39	1300S	0.01		185.0
91/03/05	1515		0.780J	0.160	0.050	72	77S	0.01		24.5
91/04/02	1440		0.550	0.042	0.015	80	210		0.00	3.5
91/05/07	1455		0.467	0.032	0.010K	82			0.00	2.5H
91/06/04	1500		0.471	0.037	0.020	88	49		0.00	2.5

55B100 6355B100
LITTLE SPOKANE RIVER ABOVE PEONE CREEK
47 47 54.0 117 22 54.0 2F000 Elev= 0 ft
53063 Washington Spokane Co. PACIFIC NORTHWEST
SPOKANE (Little Spokane-55) 130355
21540000 Reach=17010308000 0.000 Drg= 0 sqmi
TYPEA/AMBNT/STREAM

INDEX 1310001 006500 00510
MILES 0643.00 0056.30 013.50 . . . . . .

DATE FROM TO	TIME	DEPTH FEET	8 LAB IDENT. NUMBER	10 WATER TEMP CENT	25 BAROMTRC PRESSURE MM OF HG	95 CNDUCTVY LAB @ 25C UMHO	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	530 RESIDUE TOT-NFLT MG/L	610 NH3+NH4- N TOTAL MG/L	613 NO2-N DISS MG/L
90/07/10	1515		286171	21.8	718	212	9.4	112.5	8.40	6.0	0.010	0.010K
90/08/07	1540		326171	21.6	716	298	9.5	113.7	8.50			
90/09/04	1445		366171	17.8	722	232	10.3	113.4	8.50			
90/10/09	1455		416171	8.6	722	251	12.3	110.8	8.30			
90/11/06	1510		456171	4.4	733	232	13.0	103.9	8.50	2.0	0.010	0.010K
90/12/04	1530		496166	3.3	718	229	12.7	100.7	8.10	4.0	0.030	0.010K
91/01/08	1600		26166	0.1	722	230	13.1	94.6	8.30	13.0	0.030	0.010K
91/02/05	1650		66166	0.5	729	101	12.1	87.6	7.70	250.0J	0.581	0.010K
91/03/05	1535		106166	4.4J	718	173	11.9	97.0	7.50	38.0	0.090	0.010
91/04/02	1455		146166	9.7	720	179	10.7	99.1	8.30	22.0	0.014	0.002
91/05/07	1520		196166	13.0	719	178	10.2	101.9	8.20	9.0	0.018	0.010K
91/06/04	1520		236166	16.6	720	187	10.1	108.8	8.40	12.0	0.012	0.010K

DATE FROM TO	TIME	DEPTH FEET	630 NO2+NO3 N-TOTAL MG/L	665 PHOS-TOT MG/L P	671 PHOS-DIS ORTHO MG/L P	900 TOT HARD CACO3 MG/L	31616 FEC COLI MFM-FCBR /100ML	71900 MERCURY HG,TOTAL UG/L	71901 MERCURY TOT REC UG/L	82079 TURBIDTY LAB NTU
90/07/10	1515		0.460	0.030	0.010	90	48		0.00	1.0
90/08/07	1540		0.580	0.030	0.020	104	52		0.00	1.0K
90/09/04	1445		0.620	0.020	0.010K	113	36		0.00	1.0K
90/10/09								0.00K		
90/10/09	1455		0.865	0.013	0.010	120	7			1.0K
90/11/06	1510		0.930	0.020	0.010K	116	13	0.00		1.0K
90/12/04	1530		1.010	0.020	0.010	107	11	0.00		1.0K
91/01/08	1600		1.270	0.050	0.010	108	11	0.00		2.3
91/02/05	1650		0.447	0.905	0.184	32	2100S	0.00		103.0
91/03/05	1535		0.770	0.120	0.050	76	230	0.00		12.0
91/04/02	1455		0.561	0.039	0.012	78	3		0.00	3.1
91/05/07	1520		0.469	0.032	0.010K	80			0.00	2.1H
91/06/04	1520		0.455	0.033	0.014	85	14		0.00	2.3

55C070 7355C070
PEONE (DEADMAN) CREEK ABOVE LITTLE DEEP CREEK
47 47 37.0 117 22 33.0 2F000 Elev= 0 ft
53063 Washington Spokane Co. PACIFIC NORTHWEST
SPOKANE (Little Spokane-55) 130355
21540000 Reach=17010308003 0.000 Drg= 0 sqmi
TYPEA/AMBNT/STREAM

INDEX 1310001 006500 00510 0140
MILES 0643.00 0056.30 013.10 000.50 . . . . . .

DATE FROM TO	TIME	DEPTH FEET	8 LAB IDENT. NUMBER	10 WATER TEMP CENT	25 BAROMTRC PRESSURE MM OF HG	95 CNDUCTVY LAB @ 25C UMHO	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	530 RESIDUE TOT-NFLT MG/L	610 NH3+NH4- N TOTAL MG/L	613 NO2-N DISS MG/L
90/07/10	1530		286172	20.6	718	209	8.5	99.5	8.40	5.0	0.010K	0.010K
90/08/07	1600		326172	20.7	716	275	8.7	102.3	8.60			
90/09/04	1510		366172	17.9	721	288	9.4	103.9	8.70			
90/10/09	1515		416172	13.2	721	300	10.0	100.1	8.60			
90/11/06	1530		456172	8.8	732	262	11.1	99.0	8.40	4.0	0.020	0.010K
90/12/04	1545		496167	7.0	718	239	11.3	98.5	8.20	6.0	0.010K	0.010
91/01/08	1620		26167	5.9	722	268	11.6	97.8	8.40	14.0	0.030	0.020
91/03/05	1550		106167	3.8J	718	135	11.9	95.5	7.70	373.0		0.010K
91/04/02	1510		146167	10.7	721	168	10.3	97.5	8.20	33.0	0.010	0.003
91/05/07	1530		196167	12.0	718	139	10.2	99.8	8.10	15.0	0.013	0.010K
91/06/04	1545		236167	15.6	720	170	9.5	100.2	8.30	15.0	0.010K	0.010K

DATE FROM TO	TIME	DEPTH FEET	630 NO2+NO3 N-TOTAL MG/L	665 PHOS-TOT MG/L P	671 PHOS-DIS ORTHO MG/L P	900 TOT HARD CACO3 MG/L	31616 FEC COLI MFM-FCBR /100ML	71900 MERCURY HG,TOTAL UG/L	71901 MERCURY TOT REC UG/L	82079 TURBIDTY LAB NTU
90/07/10	1530		0.470	0.080	0.050	88	100		0.00	2.0
90/08/07	1600		0.710	0.190	0.160	125	84		0.00K	1.7
90/09/04	1510		0.670	0.040	0.030	133	37	0.00K		1.1
90/10/09	1515		0.819	0.037	0.034	136	10	0.00K		1.0K
90/11/06	1530		0.730	0.040	0.030	124	3	0.00		1.1
90/12/04	1545		0.620	0.050	0.030	108	7	0.00		1.6
91/01/08	1620		0.780	0.100	0.050	125	27	0.00		3.6
91/02/05	1715							0.00		
91/03/05	1550		0.880J	0.160	0.060	58	14S	0.00		53.0
91/04/02	1510		0.263	0.055	0.024	65	5		0.00	5.2
91/05/07	1530		0.253	0.049	0.024	60			0.00	2.2H
91/06/04	1545		0.357	0.066	0.042	77	31		0.00	2.1