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95-e07

DEPARTMENT OF ECOLOGY

November 7, 1995

TO: Jim Milton

FROM: Art Johnson

SUBJECT: Progress Report on Survey of Metal Concentrations in the Similkameen River

Summary

The concentrations of metals in water and sediment samples collected from the Similkameen River during August 1995 were generally very low and not a water quality concern. Copper and arsenic concentrations were elevated in the sediments, but the significance of this finding is uncertain at present.

Background

The 1994 Needs Assessment for the Okanogan River basin identified a need for data on metal concentrations in the Similkameen River (Milton, 1995). In response to a request from the Central Regional Office, Environmental Investigations initiated a reconnaissance survey to obtain data on the water column and sediments (Johnson, 1995).

The survey is being done in two parts: a low-flow collection of water and sediment samples, completed during August 29-30, 1995, and a second collection of water samples to be done during spring runoff in 1996. This memorandum summarizes results of the August field work. A final report providing details of sampling methods, chemical analyses, quality assurance, and a more thorough assessment of the results will be prepared after the survey is completed in 1996.

Methods

Sampling locations are shown in Figure 1. Water samples were collected above the Canadian border at Chopaka bridge; at the town of Nighthawk; and at Oroville. Sediment samples were collected at Chopaka bridge, above and below the Kabba Texas mine near Nighthawk, and just above Enloe Dam. A sample was also taken from portions of the Kabba Texas tailings pile that border the river. No sediment sampling was done in the lower river because this reach is rocky.

Water samples were simple grabs Metals samples were collected in 0 5 liter teflon bottles, specially pre-cleaned for low-level metals analysis by Manchester Laboratory. Two separate sets of samples were collected at each of the three sites shown in Figure 1 Samples for determination of dissolved metals were filtered through a 0.45 micron Nalgene filter unit, also pre-cleaned by Manchester Metals samples were preserved in the field with nitric acid to pH < 2.

Each sediment sample consisted of the top 2-cm layer from five grabs taken with a 0.05m^2 stainless steel Ponar sampler and homogenized in stainless steel beakers All water and sediment samples were held on ice for transport to Manchester.

Water samples were analyzed for the ten metals covered by state water quality standards. The same metals were analyzed in sediment, with the addition of aluminum, iron, and manganese for purposes of comparing to sediment guidelines and/or normalizing the data Ancillary variables measured included temperature, pH, conductivity, turbidity, total suspended solids, and hardness in water; and grain size and percent solids in sediment

Manchester Laboratory encountered no problems during analysis of these samples and the accuracy and precision of the data are good Bottle and filter blanks for water samples were prepared in the field and showed no significant metals contamination.

Results

The results on water samples are summarized in Table 1 and compared to state standards for protection of aquatic life Standards for dissolved metals are a function of hardness, with metals toxicity decreasing with increasing hardness. The lowest hardness value observed during the survey was used to calculate the dissolved metals criteria in Table 1.

The river was clear and had very low concentrations of suspended solids at the time of the survey. River flow at the USGS gage near Nighthawk was 558 cfs, compared to the monthly mean for August of 946 cfs.

Metals concentrations were uniformly low at all sampling sites. Of the ten metals analyzed only copper and arsenic were present at detectable levels Copper concentrations ranged from 0.51 - 0 72 ug/L and arsenic concentrations were estimated at 2.0 - 4.0 ug/L. As shown in the table, all metals were well within state standards.

Sediment results are summarized in Table 2. Because state standards have not yet been established for freshwater sediments, Table 2 compares the Similkameen data to Canadian guidelines for adverse effects on benthic invertebrates (Persaud et al., 1993). The lowest-effect level (LEL) can be tolerated by most benthic organisms At the severe-effect level (SEL) a pronounced disturbance of the benthic community is predicted to occur

Concentrations of most metals were beneath their LELs. The higher concentrations of nickel were above the LEL, but only slightly.

Sediment concentrations of copper and arsenic, however, were substantially greater than their respective LELs. Arsenic approached or exceeded the SEL at the two sampling sites near Nighthawk (30.0 and 46.1 mg/Kg vs. 33 mg/Kg). As noted above, these were the same metals detectable in the water column, although concentrations were low. The possible significance of elevated copper and arsenic in the Similkameen's sediments remains to be determined

Relative to concentrations in the sediments, the Kabba Texas tailings sample was high in zinc (1340 mg/Kg), copper (531 mg/Kg), lead (355 mg/Kg), cadmium (10.3 mg/Kg), and silver (3.9 mg/Kg). The river sediments collected above and below the tailings pile showed no increased levels of these metals.

According to Don Abbott of the Central Region, a substantial amount of sediment and water sampling has already been done at the Kabba Texas site. These data have been requested for possible use in the final report.

Acknowledgements

The assistance of Dale Davis and Dave Serdar in collecting these samples is very much appreciated.

References

Johnson, A. 1995. Survey of Metals Concentrations in the Similkameen River, 1995-96: Quality Assurance Plan. Washington Dept. Ecology, Olympia.

Milton, J. 1995. Needs Assessment for the Okanogan Watershed. Washington Dept. Ecology, Yakima.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, Ontario Ministry of Environment and Energy. ISBN 0-7729-9248-7.

AJ:jl
cc: Larry Goldstein, Dale Norton, Don Abbott, Dave Serdar, Dale Davis

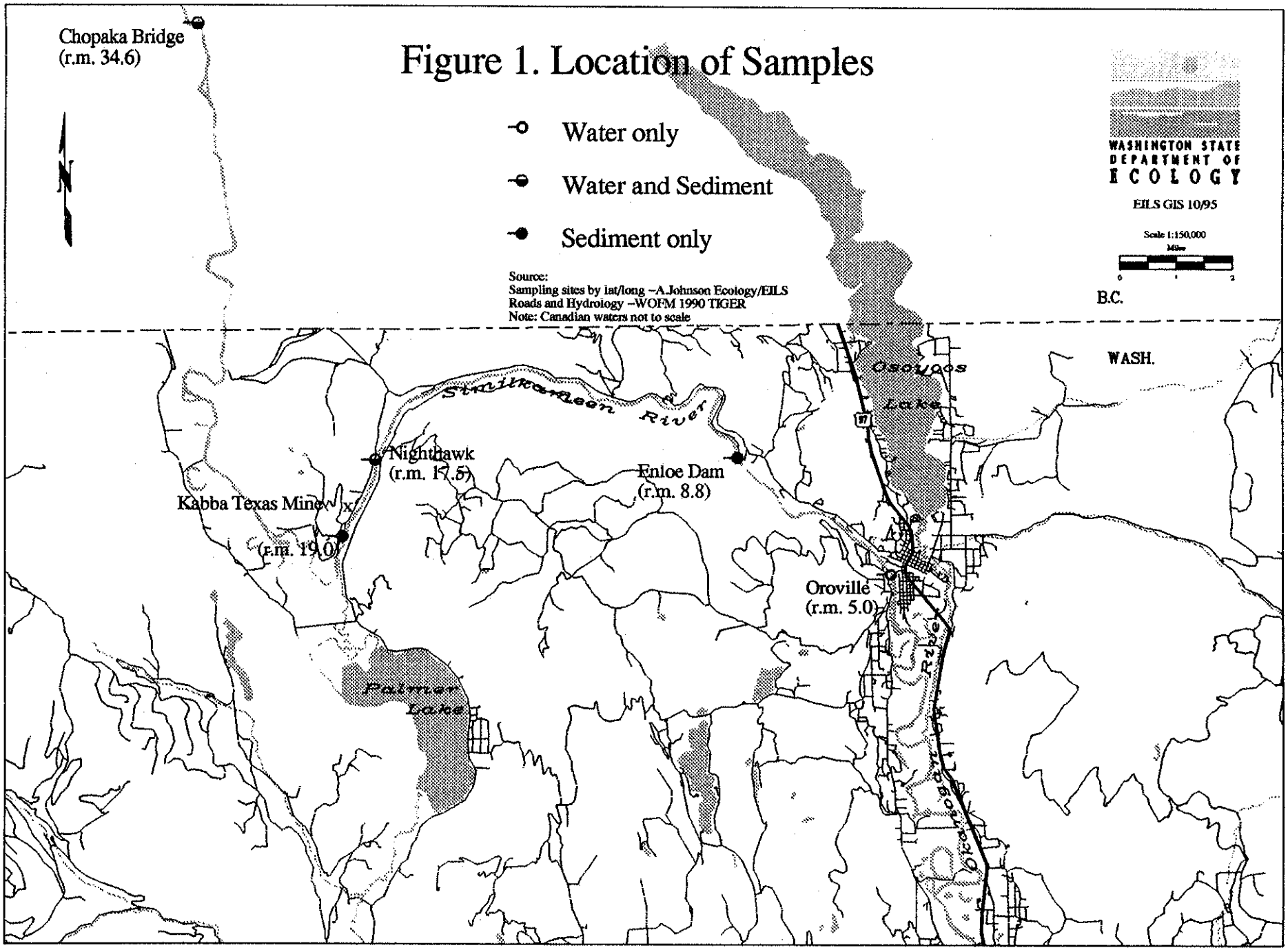
Figure 1. Location of Samples
Chopaka Bridge
(r.m. 34.6)
Water only
Water and Sediment
Sediment only
Source:
Sampling sites by lat/long –A.Johnson Ecology/EILS
Roads and Hydrology –WOFM 1990 TIGER
Note: Canadian waters not to scale
WASHINGTON STATE
DEPARTMENT OF
ECOLOGY
EILS GIS 10/95
Scale 1:150,000
Miles
0 1 2
B.C.
WASH.
Similkameen River
Osoyoos
Lake
97
Nighthawk
(r.m. 17.5)
Enloe Dam
(r.m. 8.8)
Kabba Texas Mine
(r.m. 19.0)
Oroville
(r.m. 5.0)
Palmer
Lake
Okanogan River

Table 1. Summary of Results on August 29, 1995 Water Samples (n = 6)

Variable	Units	Range of Values	State WQ Standard* Chronic	Acute
Dissolved Cu	ug/L	0.51 - 0.72	8.6	12.7
" Ni	"	1 U (all samples)	127	1140
" Zn	"	1 U (all samples)	79.8	88.2
" Cd	"	0.04 U (all samples)	0.84	2.7
" Pb	"	0.03 (all samples)	1.7	43.6
" Ag	"	0.03 U (all samples)	-	1.5
Tot. Recov. As	"	2.0 P - 4.0 P	190	360
" Cr	"	1 U (all samples)	176	1480
" Se	"	1 U (all samples)	5	20
" Hg	"	0.001 U (all samples)	0.012	2.4
Temperature	C	17.5 - 18.3	18.0 (Class A)	
pH	s. u.	7.6 - 8.2	6.5 - 8.5	
Conductivity	umhos/cm	184 - 195	-	
Turbidity	NTU	0.6 - 1.4	< 5 NTU increase	
TSS	mg/L	1 U - 2	-	
Hardness	mg/L	82.0 - 88.5	-	

* at hardness = 82.0 mg/L

U = not detected at or above value shown (i.e., less than)

P = above detection limits but below quantification limit

Table 2. Summary of Results on August 29-30, 1995 Sediment Samples (n=4)

Variable	Units	Range of Values	Sediment Guidelines: Lowest Effect	Sediment Guidelines: Severe Effect
Fe	mg/Kg, dry	12900 - 19500	20000	40000
Al	"	7030 - 10700	-	-
Mn	"	236 - 389	460	1100
Zn	"	34.9 - 56.4	120	820
Cu	"	22.4 - 59.6	16	110
As	"	11.5 - 46.1	6	33
Cr	"	11.5 - 20.9	26	110
Ni	"	11.6 - 19.0	16	75
Pb	"	2.4 - 5.4	31	250
Ag	"	0.3 U - 0.34 J	0.5	-
Hg	"	0.01 U - 0.012	0.2	2
Se	"	0.4 U (all samples)	-	-
Cd	"	0.3 U (all samples)	0.6	10
Gravel	%	0 - 2	-	-
Sand	%	56 - 99	-	-
Silt	%	1 -36	-	-
Clay	%	0 - 6	-	-
Solids	%	54 - 77	-	-

U = not detected at or above reported value (i.e., less than)

J = estimate value