Appendix P. Lucas Lake, Beneficial Use Assessment and Reconnaissance Metals Monitoring

Water Quality Summary Report 33

Lucas Lake, Beneficial Use Assessment and Reconnaissance Metals Monitoring

August 2, 2002

Water Quality Summary Report 33

Lucas Lake, Beneficial Use Assessment and Reconnaissance Metals Monitoring Idaho County, Idaho

August 2, 2002

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Introduction

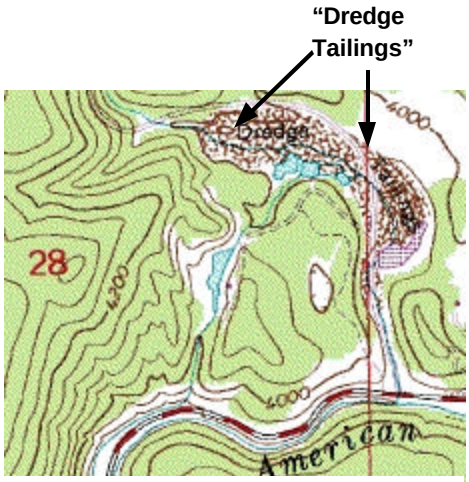

Figure 1. Lucas Lake and surrounding area

Lucas Lake, which is a small (less than one acre) locally-named waterbody, is in Idaho county, Idaho (45º 49' 17"N and 115º 28' 04" W). Lucas Lake outflow discharges into the American River between the town of Elk City and the South Fork Clearwater River. Lucas Lake's location is indicated on Figures 1 and 2.

Although it is not classified in Idaho's Water Quality Standards, Lucas Lake is currently listed on Idaho's 1998 §303(d) list[1] with sediment as its pollutant. Lucas Lake was originally put in Idaho's §303(d) program because of its 1988 305(b)[2] status, which was suggested by the Bureau of Land Management (BLM). The pollutants on the 1988 §305(b) report were identified only as "sediment and toxic substances." These §305(b) listings were the basis for listing Lucas Lake on Idaho's 1994 §303(d) list. Based on recent observations and anecdotal information, Lucas Lake's existing beneficial uses include Cold Water Aquatic Life and Primary Contact Recreation.

Figure 2. Location of Lucas Lake in Idaho

The only available previous assessment of Lucas Lake was performed by the BLM in 1981. This assessment, by Craig Johnson on August 21, 1981, is comprised of half a page of field notes and five captioned photographs. Craig states that the "Lake has suspended/sediment (colloidal?)."

Objectives

The Objectives of this study are to:

- Analyze appropriate metals and sediment samples, and collect water quality information to determine Lucas Lake's support status, and
- Determine if Lucas Lake should remain on Idaho's §303(d) list and have a TMDL developed.

[1] The 303(d) list is a federally required, public reviewed, list of waterbodies whose status is "not fully supporting" one or more beneficial uses.
[2] The 305(b) report is a report to congress listing waterbody beneficial use status and/or monitoring status, and may include causes and sources of pollution for impaired waterbodies.

Methods

Preliminary Site Visit

Daniel Stewart and Robert Steed visited Lucas Lake on November 13, 2001. Lucas Lake is a short walk south from neighboring dredge tailings. There is no surface water connection with these dredge tailings contrary to what is shown on the United States Geological Service (USGS) 1:24K map (see Figure 1). The outlet does function and discharges to the American River.

Lucas Lake is a sink or depression, whose genesis is unknown to the author. Daniel Stewart has hypothesized that it may be an old "glory hole" (a large open pit ore is extracted from). It is also possible that it is a natural erosional feature. Lucas Lake has steep underwater banks (steeper than 45º), and appears to maintain full pool conditions throughout the year. Lucas Lake is surrounded by a very small, steep, contributing watershed, which is conifer covered and made up of small grained (1-10mm) sedimentary outcrops and clay. (In Figure 3, the outcrops are light, almost-white areas, not quite as light and white as the lake surface.) Many raw outcroppings of this erosive sedimentary parent material are visible. Lucas Lake has healthy riparian vegetation that filters sediment around approximately 95% of its perimeter. With no non-natural sediment sources identified, it is anticipated that Lucas Lake sedimentation rates reflect natural conditions. There is a distinct blue-green color to the water, probably colloidal in nature, which may have been mistaken for toxic substances in past assessments. Abundant waterboatman (*Hemiptera Corixidae*) or backswimmer (*Hemiptera Notonectidae*) insects were observed, but past observations of fish were not verified. Lucas Lake has characteristics of both a lake and a wetland.

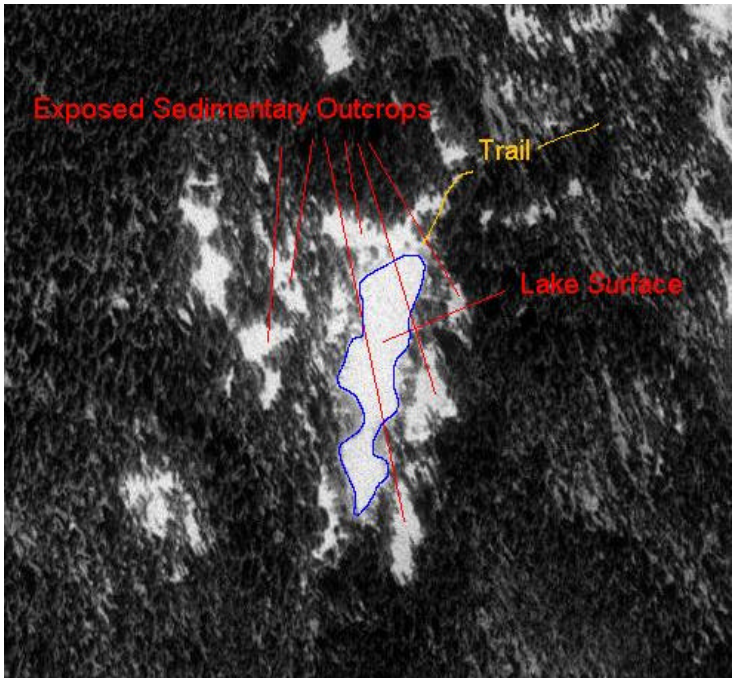

Figure 3. Aerial photo of Lucas Lake and watershed

Metals Monitoring Objectives

This investigation is to evaluate Lucas Lake for two existing uses: Cold Water Aquatic Life and Primary Contact Recreation. The bases for declaring these existing beneficial uses are direct observation (Cold Water Aquatic Life) and Anecdotal reference (Primary Contact Recreation).

To assess Cold Water Aquatic Life as an existing beneficial use, Lucas lake was monitored for toxic substances (metals), and compared to Aquatic Life Criteria for Toxic Substances

(Equivalent to 40 CFR 131.36(b)(1), Columns B1, B2 and D2[3]). Based on the neighboring lode and typical mining practices in the area, the following list of potential toxics was developed: cadmium, zinc, arsenic, mercury, copper, and iron. Iron is not identified in Aquatic Life Criteria for Toxic Substances and should be compared to a value of 5000µg/l as an asphyxiate (Bruce Schuld, personal communication).

For the other beneficial use, Primary Contact Recreation, Lucas Lake is to be monitored for pathogens, and compared to Idaho Water Quality Standards, *E. coli* Criteria.

Figure 4. Using auger to drill through ice

Monitoring

On December 18, 2001, at 11:48 am, Robert Steed and Daniel Stewart collected water quality samples from Lucas Lake. The lake was frozen over with a slight snow cover. A hole was drilled through approximately 6 inches of ice and snow, with a steel auger (see Figure 4.). Three 500-ml samples of Lucas Lake water were taken, using new, 3-foot long disposable bailers, at a depth of 0 to 2.5 feet below lake surface. Samples were collected and transported in decontaminated or new sterilized equipment. Samples were then chilled and transported to State of Idaho Bureau of Laboratories. These samples were submitted at 8:43 am the following day (December 19, 2001) for immediate analysis.

Description of Samples Collected During Initial Visit

Samples were taken and labeled as follows:

Sample container 1 was

- not filtered
- analyzed for hardness
- not preserved.

Sample container 2 was

- not filtered
- analyzed for total iron
- preserved with 3 ml nitric acid.

Sample container 3 was

- filtered with a 0.45 µm filter using syringes and disposable filter cartridges
- analyzed for dissolved: cadmium, zinc, arsenic, mercury, and copper; these analyses supplied at least 50 – 60 ml/analyte
- preserved with 3 ml nitric acid.

[3] Code of Federal Regulations, Title 40, Part 131, Section 6.

Field Parameters

The following field parameters were measured immediately after samples were taken (see Figure 5):

- Water Temperature – 3.6ºC
- pH – 7.46
- Dissolved Oxygen – 8.98 mg/l
- Conductivity – 31.6 µS/cm.

Figure 5. Measuring field parameters with a multi-meter

Sediment Monitoring During Follow-Up Visit

One June 12, 2002, Daniel Stewart performed a follow-up monitoring visit to Lucas Lake. During this visit he measured turbidity at 0.80 NTU,[4] and also collected a sample to be analyzed for Total Suspended Sediment (TSS). This sample was transported to University of Idaho's Analytical Sciences Laboratory (lab) for analysis. Both 0.80 NTU and 1 mg/l TSS (see lab results in Table 1) indicate low sediment.

Analysis Results

Analysis results from the initial visit were received from the lab on January 18, 2002, and are presented in Table 1. A copy of the lab bench sheet is included as Appendix A.

Table 1. Metals Water Quality Report Data

STORET[a]	Test Performed	Results	Completed
01000	Arsenic, Dissolved	6 (µg/l)	01/14/02
01025	Cadmium, Dissolved	< 1 (µg/l)	01/04/02
01040	Copper, Dissolved	< 10 (µg/l)	12/20/01
00900	Hardness (as $CaCO_3$)	6 (mg/l)	01/08/02
01046	Iron, Dissolved	90 (µg/l)	12/20/01
01045	Iron, Total	150 (µg/l)	12/21/01
71890	Mercury, Dissolved	< 0.5 (µg/l)	12/27/01
00530	Total Suspended Solids (TSS) (105 C)	1 (mg/l)	12/20/01
01090	Zinc, Dissolved	20 (µg/l)	12/20/01

a. Reference identification for test performed, from EPA Water Quality database

Analysis results from the follow-up visit were received from the lab on June 28, 2002, and are presented in Table 2. A copy of the Certificate of Analysis is included as Appendix B.

Table 2. Sediment Water Quality Report Data

Test No.	Test Performed	Results	MDL [a]
EPA 160.2	Non-Filterable Residue/TSS [b]	BDL [c]	4 mg/l

a. method detection limit
b. total suspended solids
c. below detection limit

[4] Nephelometric Turbidity Units

Discussion

Metals

Hardness-dependent metals criteria are calculated by formula. Originally, formulas were based on total recoverable metals values, but the Environmental Protection Agency later recommended metals criteria be based on the more bioavailable dissolved form, and developed conversion factors to estimate the dissolved fraction of the metals values. Idaho has subsequently adopted either the conversion factors values or the Code of Federal Regulations (CFR) formula values as acceptable criteria. The criteria in Table 3 were developed using an inhouse metals calculator spreadsheet. This spreadsheet calculates both the conversion factors and resulting criteria values for a given hardness value. The lowest hardness that is to be used in calculating metals criteria, according to CFR, is 25 mg/l. Lucas Lake's hardness was much lower, at 6 mg/l.

Table 3. Metals Calculator Input and Outputs.

Metal	Hardness	CMC[a] (µg/l)	CCC[b] (µg/l)
Arsenic (III)	25	360	190
Cadmium	25	0.8227	0.3369
Copper	25	4.6090	3.4719
Mercury	25	2.0400	0.0120
Zinc	25	35.3574	32.1519

a. Criterion Maximum Concentration, from 40 CFR 131.36(b)(1), Column B1
b. Criterion Continuous Concentration, from 40 CFR 131.36(b)(1), Column B2

Table 4. Lucas Lake Results Compared to Criteria.

Status	Test Performed	Results	CMC[a] (µg/l)	CCC[b] (µg/l)	HH[c](µg/l)
Pass	Arsenic, Dissolved	6 (µg/l)	360	190	50
BDL	Cadmium, Dissolved	<1 (µg/l)	0.82	0.34	-
Pass	Copper, Dissolved	<10 (µg/l)	4.61	3.47	-
Pass	Iron, Total	150 (µg/l)	5000 as asphyxiate		
BDL	Mercury, Dissolved	<0.5 (µg/l)	2.04	0.01	0.15
Pass	Zinc, Dissolved	20 (µg/l)	35.4	32.2	-

a. Criterion Maximum Concentration, from 40 CFR 131.36(b)(1), Column B1
b. Criterion Continuous Concentration, from 40 CFR 131.36(b)(1), Column B2
c. Human Health, from 40 CFR 131.36(b)(1), Column D2

The results indicate good water quality, with all but two of the analytes (cadmium and mercury) at concentrations less than calculated criteria. Concentrations of cadmium and mercury were below detection limits (BDL), which means the concentration is some value less than the detection limit of 1µg/l and 0.5 µg/l, respectively. In order to make more exact determinations of cadmium and mercury concentrations, further investigation (ultra-clean monitoring methods) and additional laboratory analysis (at significant cost) would be needed, which would be beyond the scope of this metals reconnaissance effort.

Sediment

Based on observation of the site, it appears that there are minimal anthropogenic sources of sediment, limited to recreation on the North shore near the trail. The underwater banks of Lucas Lake are steep, nearly matching above water banks, which demonstrates minimal sediment deposition, or recent genesis. Most banks are well vegetated with sedges and bushes, which also demonstrates bank stability and indicates that over-surface flow-filtering mechanisms are functional.

Field and laboratory results show minimal water column sediment. Idaho Water Standards criteria for turbidity for Cold Water Aquatic Life (IDAPA 58.01.02.250.02.d) states: "Turbidity, below any applicable mixing zone set by the Department, shall not exceed background turbidity by more than fifty (50) NTU instantaneously or more than twenty-five (25) NTU for more than ten (10) consecutive days." Turbidity measured on June 12, 2002 was 60 times less than the instantaneous criteria.

Total Suspended Solids (TSS) concentrations are below the 4 mg/l detection limit. It is unlikely that sediment is impairing beneficial uses.

Conclusions

- Water quality metals criteria have been not been exceeded as far as we know.
- From visual observation, sediment does not appear to be impairing existing beneficial uses.
- Lucas Lake should be removed from the §303(d) list, and should not be a candidate for TMDL development.
- The potential exists for cadmium and mercury concentrations in Lucas Lake to be above Water Quality criteria. However, given the low metals values (some BDL), and the morphology of the lake, and the BDL results, DEQ concludes that Lucas Lake does not have problems with toxic substances.

Appendix A. State Of Idaho Laboratory Water Quality Report

State of Idaho, Department of Health and Welfare
Bureau of Laboratories - Boise Laboratory
2220 Old Penitentiary Road, Boise, Idaho 83712
WATER QUALITY REPORT - CHEMICAL REPORT

LAB: BOISE, Phone: (208) 334-2235
Section Manager, Inorganic Chemistry: Barry Pharaoh

RECEIVED
JAN 18 2002
DEPT. OF ENVIRONMENTAL QUALITY
TECHNICAL SERVICES OFFICE

IDEQ-BSO
ROBERT STEED
1410 N. HILTON
BOISE, ID 83706

Tracking Number: 41201-0281/
(Please Refer to this Tracking Number on any communications)

Grant/Project: 8206
Watersheds
Survey Name:
Storet:
NPDES No.:
Sample Location: DEEP PART OF LAKE
Submitted by: ROBERT STEED
Purpose: Other
Taken From: Lake - L
Type of Sample: Grab
Composite: No
Preservation: HNO3, Cooled 4° C

Date Collected: 12/18/01 Date Received in Lab: 12/19/01
Time Collected: 11:00

STORET	TEST PERFORMED	RESULTS	COMPLETED	ANST
01000	Arsenic, Dissolved	6 (ug/l)	01/14/02	JS
01025	Cadmium, Dissolved	<1 (ug/l)	01/04/02	JS
01040	Copper, Dissolved	<10 (ug/l)	12/20/01	HH
00900	Hardness (as CaCO3)	6 (mg/l)	01/08/02	BO
01046	Iron, Dissolved	90 (ug/l)	12/20/01	HH
01045	Iron, Total	150 (ug/l)	12/21/01	HH
71890	Mercury, Dissolved	<0.5 (ug/l)	12/27/01	JS
00530	Total Suspended Solids (105 C)	1 (mg/l)	12/20/01	LB
01090	Zinc, Dissolved	20 (ug/l)	12/20/01	HH

Steve Rodebaugh
LAB # 1-17-02
ID00018

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Appendix B. University of Idaho Analytical Sciences Laboratory Certificate of Analysis.

University of Idaho
Holm Research Center
Moscow, Idaho 83844-2203
Phone: (208) 885-7081 Fax: (208) 885-8937

CERTIFICATE OF ANALYSIS

Submitted by:
Daniel Stewart

Dept. of Environmental Quality
300 W MAin St Rm 203
Grangeville ID 83530

UIASL Case #: WJUN02-14
Submitter Case #: Grangeville
Group: WATER
Date Received: 06/12/2002
Report Status: Final

Laboratory Comments:

1st Level QC: _____ Date: 6-18-02

2nd Level QC: _____ Date: 6-18-02

ANALYTICAL SCIENCES LABORATORY

WJUN02-14
Grangeville

CERTIFICATE OF ANALYSIS

RECEIVED
JUN 28 2002
DEPT. OF ENVIRONMENTAL QUALITY
TECHNICAL SERVICES OFFICE

Owner: Project Name:

Submitter ID: Lucas Lake
UIASL #: W0201459
Samp. Type: Water - Surface

Test: EPA 160.2-Non-Filterable Residue/T.S.S.
Ref: 06/13/2002 03:33:49 PM

EPA 160.2	Results	MDL	Units
Non-Filterable Res.	BDL	4	mg/L

Samples will be discarded one month after date of final report, unless otherwise requested.
All samples classified as hazardous waste will be returned to the submitter after analysis.

Turbidity 0.80 NTU'S

ND - None Detected QNS - Quantity Not Sufficient for Analysis NA - Not Applicable NQA - Non-quantifiable Area
EDL - Estimated Detection Limit MDL - Method Detection Limit BDL - Below Detection Limit

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