DEPARTMENT OF
ECOLOGY
State of Washington

Addendum to
Quality Assurance Project Plan

Assessment for Chemical Contaminants in Northeastern Washington Area Lakes:

Sampling Additional Lakes and Wetlands for Metals Contamination

August 2012

Publication No. 12-03-115

Publication Information

Addendum

This addendum is an addition to an original Quality Assurance Project Plan. The addendum is not a correction (errata) to the original plan.

This addendum is available on the Department of Ecology's website at
https://fortress.wa.gov/ecy/publications/summarypages/1203115.html

Ecology's Activity Tracker Code for this study is 13-038.

Original Publication

Quality Assurance Project Plan: Assessment for Chemical Contaminants in Northeastern Washington Area Lakes

Publication No. 10-03-119

The Quality Assurance Project Plan is available on the Department of Ecology's website at
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DEPARTMENT OF ECOLOGY

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SUBJECT: Addendum to Quality Assurance Project Plan for Assessment for Chemical Contaminants in Northeastern Washington Area Lakes:

Activity Tracker Code: 13-038
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The purpose of this addendum is to describe additional sediment sampling to be conducted for waterbodies in the area of Ecology's 2010-11 study *Baseline Characterization for Metals and Organic Compounds in Northeast Washington Lakes, Part 1: Bottom Sediments* (Ecology publication number 11-03-035). ERO-TCP has requested that surface sediment and limited subsurface sediment samples be pursued from additional lakes and wetlands generally located within the historically mapped SO_2 plume impact footprint of the Trail, B.C. smelter. ERO-TCP further requested an exploratory age-dated sediment core be attempted from Cedar Lake near the international border.

The sediment samples will be analyzed for antimony, arsenic, cadmium, lead, mercury, and zinc. These metals were identified in the 2010-11 study as contaminants of concern in northeast Washington lake sediments. TOC and grain-size analyses also will be performed consistent with the original study.

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Background

A 2010-11 study by the Washington State Department of Ecology (Ecology) characterized background concentrations of metal and organic contaminants in sediments and fish collected from 17 northeast Washington lakes and rivers (Johnson et al., 2011a,b). Waterbodies thought to exhibit relatively low impact from local human activities were selected for sampling. These data were needed to support cleanup decisions in Ecology's Eastern Region. The study was conducted by Ecology's Environmental Assessment Program (EAP) with the assistance of the Eastern Regional Office (ERO). A Quality Assurance Project Plan (QAPP) guided the project (Johnson, 2010).

An important finding from the 2010-11 study was the occurrence of elevated levels of antimony, arsenic, cadmium, lead, mercury, and zinc in the sediments of lakes from the western part of the study area along the Upper Columbia River. The probable source of contamination was concluded to be historical transboundary air pollution from the Trail smelter in British Columbia and potentially to a lesser extent limited contribution from an historic smelter in Northport, Washington.

The project report included interpretation of previously unpublished Ecology data on metals concentrations in an age-dated sediment core from Black Lake, centrally located within the study area. The core, collected in 2009, documented changes in lead and mercury inputs over time and showed a steady increase in concentrations until the late 1900s. The deeper layers of the core provided an historical benchmark for background concentrations of lead, mercury, and other metals.

The ERO Toxics Cleanup Program (TCP) has requested that sediment sampling be conducted to assess metals contamination in additional northeast Washington waterbodies near the U.S.-Canadian (British Columbia) border. TCP wants to further evaluate lacustrine sediment metal concentrations within portions of the upper Columbia River watershed where smelter-related impacts may also be more evident. The additional study will also initiate an evaluation of metals contamination associated with selected wetlands within this same geographic region.

TCP has investigated a number of candidate lakes and wetlands as potential new sampling sites for 2012. Ten preferred waterbodies have been recommended to EAP for sediment sampling. TCP also has requested collection of an age-dated sediment core from Cedar Lake to potentially improve current understanding of smelter emissions history and associated impacts. Cedar Lake, located four miles south of the international boundary, was sampled for surface sediment in the 2010-11 study.

The supplemental lake and wetland sediment investigation will follow the sampling design considerations, measurement quality objectives, field procedures, and analytical methods for metals and ancillary parameters described in the previous 2010-11 sediment study QAPP, except as detailed in this addendum. Sediment coring, sectioning, and age-dating will follow the QAPP used to obtain the Black Lake core mentioned above (Coots, 2006). Field work for the proposed study will be conducted by EAP and TCP personnel during September and October of 2012. A draft project report is anticipated in March 2013, prepared by EAP.

Objectives

- Further characterize sediment metal concentrations from selected upland lakes and wetlands in the proximity of the historically mapped SO_2 damage zone associated primarily with the Trail, BC smelter.
- Evaluate historical changes in selected metals concentrations within the sediment profile at one near-border lake.
- Initiate an evaluation of metals in wetland environments.
- Evaluate sedimentation rates of lakes within the SO_2 damage zone, as feasible.
- Obtain sediment samples for archiving.

Sampling Sites and Procedures

TCP has selected a list of preferred waterbodies for sediment sampling, presented in Table 1. Their locations are shown in Figure 1. Ease of access to these waterbodies, and potential human-related impacts (e.g., proximity of roads, historical mining, general land use) were evaluated as part of a field reconnaissance survey conducted during the early summer of 2012.

Surface sediment samples will be collected from 10 waterbodies (lakes or wetlands), as identified in Table 1. Subsurface sediment profile samples will also be collected from the four designated lakes or wetlands, as feasible. In addition, an effort will be made to obtain a sediment box core from Cedar Lake, previously sampled for surface sediment in 2010. Williams and Phalon Lakes, about 20 miles southwest of Cedar, are alternate coring sites if an acceptable box core cannot be obtained from Cedar Lake. The size of the boat needed as a box coring platform for this project precludes similar coring of other lakes that might otherwise be appropriate for this objective, but which lack adequate road access and/or boat ramps.

As feasible, surface sediment samples from open water areas will be collected from the top 10 cm of the sediment column using a stainless steel Ponar grab, following an EAP SOP (Blakley, 2008). One composite sample will be prepared for each waterbody by pooling material obtained along a three-grab transect from shallower water to deeper water. The same procedures were followed for the 2010-11 study. For the wetland-dominated environments, the collection of composite three-grab surface sediment samples also will be performed with a Ponar grab, hand corer, shovel, or stainless steel scoops, as feasible depending on conditions. The same general surficial sediment horizon will be targeted as for the lakes, but samples of any surficial vegetation layer will be excluded from the samples.

A 13 x 3 x 50 cm Wildco stainless steel box corer will be used to obtain a sediment core from the center of Cedar Lake, near the point of maximum lake depth. The same device was used at Black Lake. The EAP SOP for collecting box cores of freshwater sediments will be followed (Furl and Meredith, 2008).

As with Black Lake, the Cedar Lake core will be sectioned at intervals of 1-2 cm thickness, increasing to 5 cm for the deeper layers. The core will be age-dated using the lead-210 technique (Furl, 2007). The 40 cm core from Black Lake was partitioned into 15 discrete layers. Each layer was analyzed to create a vertical profile with specific age markers identified; a similar approach is anticipated for the Cedar Lake core, depending on conditions.

Vertical variation in metals concentrations in subsurface sediments from four lakes and wetlands will be investigated: tentatively Silver Crown Lake, Phillips Lake, the wetland near Cedar Lake, and the Dry Lake wetland. A gravity coring device or hand corer consisting of a stainless steel tube with plastic core liner and core catcher will initially be used. If that method is unsuccessful the sediment/soil profile will be obtained by hand coring or digging a shallow pit along the margins in unsaturated soils (i.e., no standing water) and taking samples from the sidewalls with stainless steel implements. A lower level of vertical resolution will be pursued for these sites. Three increments will be analyzed: 0-10 cm, 10-20 cm, and >20 cm. These samples will not be age-dated.

Table 1. Lakes and Wetlands Selected for Sediment Sampling in 2012.

Name	Longitude	Latitude	Township and Range	Topo Quad	Notes	Planned Action
Silver Crown Lake	-117.77764	48.909341	SW1/4 Sec4 T39N R40E	Northport	immediately east of Northport; foot trail access	surface/subsurface profile
Elbow Lake	-117.98424	48.947674	sec 21 T40N R38E	Belshazzar	NW of Pepoon Lk.; Crown Creek drainage; Colville NF; small boat portage required	surface grab
Phalon Lake	-117.89791	48.78342	NW1/4 sec21 T38N R39E	China Bend	NE of Williams Lk.; restricted access managed by WDFW; small boat launch	surface grab (alternate box core site)
Glasgo Lakes (Dilly or Ryan)	-118.04859	48.78991	sec13 T38N R38E	Bossburg	Dilly Lk. (primary) or Ryan Lk. (secondary); west of North Gorge Campground; private access; short small boat portage required	surface grab
Bowen Lake*	-117.94283	48.839043	N1/2 sec35 T39N R38E	China Bend	NW of China Bend; private access; short small boat portage required	surface grab
Phillips Lake	-117.76729	48.953788	sec19	Northport	Small remote pond; access via 4WD logging road; private access; short small boat portage required	surface/subsurface profile
Peterson Swamp*	-117.91082	48.714047	NW1/4 sec16 T37N R39E	Eco Valley	extensive wetland with possible ag-related drainage control near north end; near well used dirt road; south portion on state land is undisturbed; foot access	surface grab
Wetland near Cedar Lake* (west of Red Top Mtn.)	-117.58122	48.969277	SW1/4 sec13 T40N R41E	Leadpoint	access via logging roads; N-NE of Cedar Lk. near base of Red Top Mtn.	surface/subsurface profile
Dry Lake wetland*	-117.97093	48.712454	sec13 T37N R38E	Echo Valley	elongate wetland complex; access ~1 mile south of intersection of Evans Cutoff Rd and Echo Valley Rd; state land; foot access	surface/subsurface profile

Name	Longitude	Latitude	Township and Range	Topo Quad	Notes	Planned Action
Bodie-Stoddard Mtn. Wetland*	-117.77941	48.86236	NE1/4 sec29 T39N R40E	Onion Cr.	Wetland complex SE of Bodie Mtn.; access via dirt road off of Bodie Mtn. Rd.; short small boat portage required	surface grab
Cedar Lake	-117.594	48.943		Leadpoint	sampled in 2010; boat ramp access	box core
Williams Lake	-117.968	48.755	sec36 T38N R38E	China Bend	alternate site - sampled in 2010; boat ramp access	alternate box core site

* wetland dominated

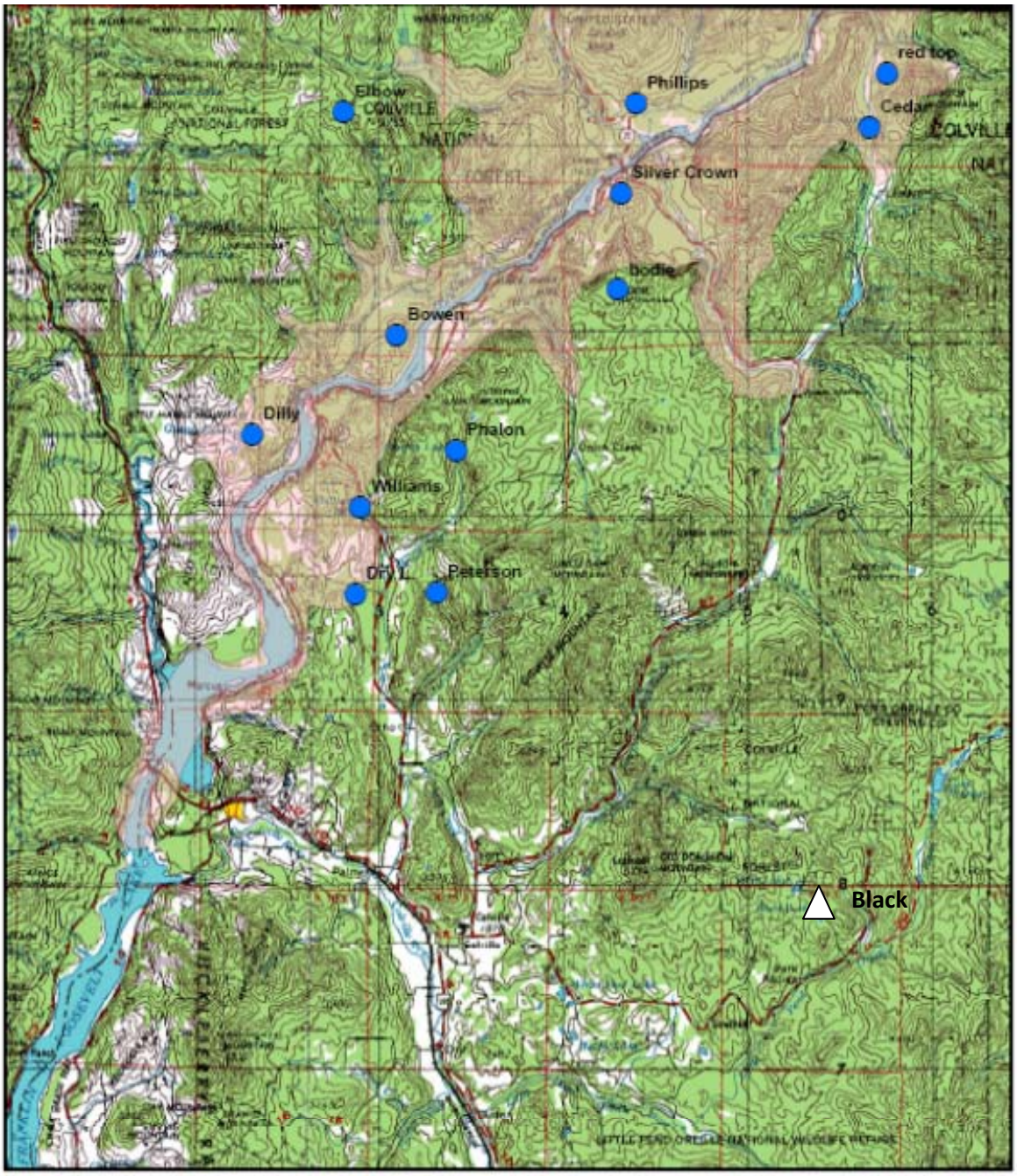

Figure 1. Location of Lakes and Wetlands Selected for Sediment Sampling in Relation to the General Area Impacted by the Historic Trail, BC SO_2 Smelter Plume (red shade).

Black Lake coring site for the 2010-11 study also shown as triangle.

Chemical Analysis

All sediment samples will be analyzed for antimony, arsenic, cadmium, lead, mercury, and zinc using the same procedures and laboratory (Manchester) as employed for the 2010-11 samples. Metals will be analyzed using inductively-coupled plasma/mass spectrometry (ICP/MS) by EPA 3050B/200.8 and cold vapor atomic absorbance (CVAA – mercury only). These metals were identified as contaminants of concern in northeast Washington lake sediments. Grain size (percent gravel, sand, silt, and clay) and total organic carbon (TOC) will be analyzed, except for grain size in the box core increments due to small sample size. A separate Ponar grab for grain size will be taken of the top-10 cm layer at the box core site.

Lead-210 activity will be determined in the box core samples to establish time horizons, consistent with the 2010-11 study. These samples will be analyzed using gas flow proportional counting (EPA Method 9310, SW-846). The core from Black Lake collected in 2009 was analyzed by this method.

The same types of quality control (QC) samples will be used for the 2012 sampling as in 2010/2011. Duplicate (split) samples will be prepared in the field to assess the variability in the data. Laboratory QC samples will include method blanks, matrix spikes, and laboratory control samples, as appropriate.

Lab Cost Estimate

Table 2. Estimated Cost of Sediment Sample Analyses.

Sample Type & Analysis	Samples	QC Duplicates	Cost	Subtotals
Surface Sediments (1 composite per waterbody)				
As, Cd, Pb, Sb, Zn	10	1	$118	$1,298
Hg	10	1	$50	$550
Grain Size	11	1	$100	$1,200
TOC	10	1	$46	$506
				$3,554
Box Core Increments (15 per core)				
As, Cd, Pb, Sb, Zn	15	1	$118	$1,888
Hg	15	1	$50	$800
Pb210*	15	1	$200	$4,000
TOC	15	1	$46	$920
				$7,608
Gravity or Hand Core Increments (3 per core)				
As, Cd, Pb, Sb, Zn	12	1	$118	$1,534
Hg	12	1	$50	$650
Grain Size	12	1	$100	$1,300
TOC	12	1	$46	$598
				$4,082
			Total Lab =	**$15,244**

*includes 25% surcharge for contracting and data review by MEL

Reporting

Data from this investigation will be compiled, analyzed, and reported. EAP will prepare a supplemental summary report as requested by TCP. A draft of the report will be provided to TCP on or before March 2013.

Schedule

Field and laboratory work	Due date	Lead staff
Field work completed	October 2012	Randy Coots, Michael Friese
Laboratory analyses completed	December 2012	
Environmental Information System (EIM) database		
EIM user study ID	ID number AJOH0066	
Product	Due date	Lead staff
EIM data loaded	April 2013	Michael Friese
EIM quality assurance	May 2013	Michael Friese
EIM complete	June 2013	Michael Friese
Final report		
Author lead / support staff	Art Johnson / Michael Friese	
Schedule		
Draft due to supervisor	February 2013	
Draft due to client/peer reviewer	March 2013	
Draft due to external reviewer(s)	April 2013	
Final (all reviews done) due to publications coordinator	May 2013	
Final report due on web	June 2013	

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