

MEMORANDUM

To: Brendan Dowling, Washington State
Department of Ecology

Date: April 16, 2009

From: James Keithly and Clay Patmont, Anchor QEA

Project: 080306-01

Cc: Doug Pottratz and Kevin Booth, Avista Utilities

Re: Year 2 Upriver Dam Cap Monitoring Results

In accordance with the Washington Department of Ecology (Ecology)-approved Operations, Monitoring and Maintenance Plan (OMMP; Anchor 2008), Year 2 cap monitoring activities at the Upriver Dam PCB Sediment Site were performed in October and November 2008. The primary performance standards for the Year 2 monitoring include documentation of the integrity of the cap and verification that PCB concentrations within the cap isolation layer (i.e., the intermediate sand layer below the cap armor and above the coal layer) have been maintained below the site-specific cleanup standard of 62 micrograms per kilogram ($\mu\text{g}/\text{kg}$; dry weight basis). A bathymetric survey of the cap area was conducted and compared with the 2006 post-construction bathymetry. This comparison was used to target follow-on core sampling locations (e.g., focusing on areas of apparent settling). Surface sediment samples were also collected to allow Ecology to verify the effectiveness of upstream source control actions (i.e., separate from cap performance).

The Year 2 monitoring results are summarized below and verify the continued integrity of the cap in two ways:

1. The cap was intact at all locations and intact layers of the gravel armor, sand and coal were observed at all core locations.
2. PCBs were not detected in cap samples collected from the sand isolation layer or the underlying coal layer (Table 1), verifying remedial design predictions of insignificant upward migration of PCBs.

The remainder of this memorandum presents the details of the Year 2 monitoring event, including discussion of the bathymetric survey, Spokane River flows that occurred during the 2-year post-construction period, visual observations during sampling, sample collection activities, validation of the analytical chemistry data, and a summary of the validated chemical analyses.

Bathymetric Survey

The 2008 bathymetric survey was used to provide an initial evaluation of cap thickness, by comparing 2008 surface elevations at the top of the cap with the 2006 post-construction as-built survey. The results of these comparisons were discussed with Ecology, and the sampling locations adjusted to target areas of apparent settling (Figure 1). Appendix A contains figures presenting the results of these comparisons. Consistent with observations at other sediment capping sites, this analysis shows that the weight of the constructed cap has consolidated the underlying soft sediments in Deposit 1 over the approximately two years that has elapsed since the cap was placed. This is apparent in a net lowering of the elevation of the surface of the cap in some areas since completion of construction. However, follow-on core sampling data (see below) did not reveal any erosion or loss of cap material.

25 Year Flood Event

Figure 1 summarizes the flows of the Spokane River during the 2-year post construction period which included normal flow conditions in 2007 and a peak flow of 40,600 cubic feet per second (cfs) in May of 2008. The May 2008 high flow event is equivalent to a 25 year flood. Anchor QEA has calculated that the 25, 50 and 100-year flood events to be 40,900, 43,800, and 46,500 cfs, respectively.

Visual Cap Observations

Visual and limited excavation observations performed by divers during sample collection noted that one foot or more of sand had deposited over the southern portions of the cap. Gravel armor was observed in all areas where it was not covered by this sand (i.e., generally the northern portion of the cap). The newly deposited sand is likely the result of sediment transport into the Upriver Dam area that occurred during the May 2008 flood event. The divers also performed occasional shallow hand-dug excavations to confirm the presence of the gravel armor below the newly deposited sand; they encountered the gravel armor in all such excavations. The apparent "mound" depicted on the bathymetric surveys at the west end of Deposit 1 was also investigated during the dive sampling operations and was determined to be woody debris and sand deposited after construction.

Sample Collection

Five subsurface sediment cores were collected from the Deposit 1 cap. Three of the locations corresponded to pre-design sampling stations that were adjusted slightly based upon the

bathymetric surveys and another two locations were targeted towards settled areas, as determined from bathymetric surveys (Appendix A). Two surface sediment grab locations were also selected in consultation with Ecology, and were focused on areas on the cap that contained sufficient accumulated sediment (mostly sand) to allow sample collection.

Sediment cores were collected using diver assisted piston coring. The diver carefully removed the overlying sand (if any) and gravel armor to allow the piston corer to penetrate and collect the underlying cap isolation sand layer, coal layer, and sediments present immediately below the cap. Once positioned, the piston core was driven until refusal or until it completely penetrated the cap materials. The minimum acceptable penetration depth for a successful core was 1 foot or more below the bottom of the Deposit 1 cap. The core was then retrieved, capped underwater by the diver, and delivered onshore for processing. Following core collection at each location, the gravel armor materials were re-placed as practicable within each core location. The core processing logs are presented in Appendix B and photographs of the sediments collected are presented in Appendix C.

The cores were processed by cutting each core open, logging descriptions for each core (Appendix B) and collecting samples of each target interval into pre-cleaned stainless steel bowls and spoons. Included in the core logs is the physical sediment description, odor (e.g., hydrogen sulfide), observations of woody material and other debris, biological activity, the presence and depth of the redox potential discontinuity layer and any other distinguishing characteristics or features. Sample intervals targeted three layers: the isolation sand layer, the coal layer, and the 1-foot sediment layer below the cap, avoiding the interfaces between these layers where mixing may have occurred.

Two surface sediment samples were collected for chemical and physical testing using a diver grab sampler in general accordance with Puget Sound Estuary Program (PSEP) protocols (PSEP 1997). The samples were collected by positioning the boat to the target location, deploying a marked buoy, recording water depth, collecting the surface sediment sample with a diver-assisted decontaminated sampler, and returning the sample to the boat for processing. The sediment was homogenized using a stainless steel spoon, placed into pre-labeled sample containers and stored on ice for transport to the laboratory. The surface sample collection logs are presented in Appendix B and photographs of the surface sediments collected are presented in Appendix D.

Data Validation

Chemical analysis requirements for sediment samples are summarized in the *Upriver Dam 2006 PCB Sediments Site Sampling and Analysis Plan* (SAP) presented in Appendix E. Chemical analyses were performed by Test America, Inc. (TA) in Tacoma, Washington. All samples were stored at 4°C until analysis.

The following section details an assessment and validation of analytical data reported by TA, along with a description of several pertinent aspects of the chemical analyses. Data validation was performed by Laboratory Data Consultants (LDC) in Carlsbad, California. The complete validation report and analytical data can be found in Appendix F and the chain-of-custody forms are found in Appendix G.

Chemical data were validated in accordance with the analytical methods and USEPA National Functional Guidelines for Inorganic and Organic Data Review and the SAP. Full Contract Laboratory Program (CLP)-equivalent raw data deliverables were provided by TA. Level three validations were performed on the data and the validation findings are summarized here.

All analyses were conducted within method specifications and all requested sample analyses were completed. All samples were properly preserved and analyses were conducted within holding time requirements. Quality control criteria were met with a few exceptions. No data were rejected. Some PCB and total organic carbon (TOC) results were qualified as estimated due to calibration, matrix spike recovery, and/or relative percent difference values outside of the specified control criteria.

Reporting limits were deemed acceptable as reported. All values were reported using the laboratory's reporting limits. The reporting limits outlined in the SAP were met with the exception of PCBs in one of the sediment samples collected from below the cap. This sample was analyzed at a dilution. Values were either reported as undiluted, or when diluted, the reporting limit accurately reflects the dilution factor.

Based on the independent data validation, all data were determined to be useable for the purposes of the OMMP as qualified.

Analytical Results and Conclusions

Validated chemical data for the two surface stations and the five subsurface stations are presented in Table 1. Total PCBs were not detected in the isolation sand layer or the underlying coal layer, verifying that the cap is functioning as designed. PCB Aroclors 1242 and 1248 were detected in 4 of the 5 samples of native sediment collected below the cap, at concentrations ranging from 22 to 1,100 µg/kg dw. Total PCBs were also detected (Aroclor 1248, 26 µg/kg) at surface sediment station G1, whereas total PCBs were not detected in surface sediment collected from station G2.

Combined with the visual observations of the cap integrity made by the divers and during the grab and core sampling activities, these analytical results verify that the integrity of the cap has been maintained even through high flow river conditions that occurred in 2008. These results will be supplemented with future OMMP required data collection activities.

References

- Anchor 2008. Operations, Monitoring, and Maintenance Plan (OMMP). Upriver Dam PCB Sediments Site. Prepared for Avista Development, Inc. by Anchor Environmental L.L.C. November 2008.
- PSEP. 1997. Puget Sound Estuary Program: Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound. Prepared for the U.S. Environmental Protection Agency Region 10, and the Puget Sound Water Quality Authority. Puget Sound Water Quality Authority, Olympia, Washington.
- USGS 1985. Streamflow Statistics and Drainage-Basin Characteristics for the Southwestern and Eastern Regions, Washington. Washington State Department of Ecology and U.S. Geological Survey. R29 No. 84-145.

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Appendix F Laboratory and Validation Data

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Table 1
2008 Upriver Dam Monitoring Surface and Subsurface Results

Location ID:	SC-01	SC-01	SC-01	SC-02	SC-02	SC-02	SC-03	SC-03	SC-03
Sample ID:	URD-SC-01-A-081107	URD-SC-01-B-081107	URD-SC-01-C-081107	URD-SC-02-A-081107	URD-SC-02-B-081107	URD-SC-02-C-081107	URD-SC-03-A-081107	URD-SC-03-B-081107	URD-SC-03-C-081107
Sample Date:	11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/7/2008
Depth:	0 - 7 in	7 - 10.5 in	12 - 24 in	0 - 7.5 in	7.5 - 11.5 in	14 - 26 in	0 - 8 in	9 - 13 in	14 - 26 in
Cap Material Type:	Sand	Coal	Native	Sand	Coal	Native	Sand	Coal	Native
Sample Type:	N	N	N	N	N	N	N	N	N
Conventional Parameters (mg/kg)									
Total organic carbon	7600	480000	97000	7000	440000	140000	9400 J	460000 J	6000
Conventional Parameters (pct)									
Total solids	84	65	39	85	65	36	83	64	92
Grain Size (pct)									
Total Gravel	9.4	2.7	3	10	16	3.2	11	4.3	59
Total Sand	90	93	85	90	78	91	88	92	41
Total Silt	0.6	3.2	10	0.2	5.3	5	1	2.4	0.3
Total Clay	0.1	1.5	1.5	0	0.4	1.2	0.2	1.8	0
Total Fines (Silt + Clay)	0.7	4.7	11.5	0.2	5.7	6.2	1.2	4.2	0.3
PCB Aroclors (µg/kg)									
Aroclor 1016	4.8 U	4.8 U	48 U	4.7 U	5.1 U	4.7 U	4.9 U	4.8 U	4.9 U
Aroclor 1221	4.8 U	4.8 U	48 U	4.7 U	5.1 U	4.7 U	4.9 U	4.8 U	4.9 U
Aroclor 1232	4.8 U	4.8 U	48 U	4.7 U	5.1 U	4.7 U	4.9 U	4.8 U	4.9 U
Aroclor 1242	4.8 U	4.8 U	48 U	4.7 UJ	5.1 U	86	4.9 UJ	4.8 U	4.9 U
Aroclor 1248	4.8 U	4.8 U	1100	4.7 UJ	5.1 U	4.7 U	4.9 UJ	4.8 U	4.9 U
Aroclor 1254	4.8 U	4.8 U	48 U	4.7 UJ	5.1 U	4.7 U	4.9 UJ	4.8 U	4.9 U
Aroclor 1260	4.8 U	4.8 U	48 U	4.7 UJ	5.1 U	26	4.9 UJ	4.8 U	4.9 U
Total PCB	4.8 U	4.8 U	1100	4.7 U	5.1 U	112	4.9 U	4.8 U	4.9 U

Notes:

Bold = Detected result

U = Compound analyzed, but not detected above detection limit

J = Estimated concentration

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

Validated level III by LDC

N = Normal Field Sample

FD = Field Duplicate

Data measured in dry weight basis

Totals are calculated as the sum of all detected results. If all are undetected results, the highest reporting limit value is reported as the sum.

Table 1
2008 Upriver Dam Monitoring Surface and Subsurface Results

Location ID:	SC-04	SC-04	SC-04	SC-05	SC-05	SC-05	G1	G2
Sample ID:	URD-SC-04-A-081107	URD-SC-04-B-081107	URD-SC-04-C-081107	URD-SC-05-A-081107	URD-SC-05-B-081107	URD-SC-05-C-081107	URD-SS-01-081106	URD-SS-02-081106
Sample Date:	11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/6/2008	11/6/2008
Depth:	0 - 9 in	9 - 11 in	12 - 24 in	0 - 6.5 in	6.5 - 9.5 in	11 - 23 in	0 - 10 cm	0 - 5 cm
Cap Material Type:	Sand	Coal	Native	Sand	Coal	Native	Surface Sediment	Surface Sediment
Sample Type:	N	N	N	N	N	N	N	N
Conventional Parameters (mg/kg)								
Total organic carbon	8900 J	450000 J	13000 J	9700 J	450000 J	99000 J	9300	9400
Conventional Parameters (pct)								
Total solids	83	64	72	92	67	33	77	76
Grain Size (pct)								
Total Gravel	35	8.9	12	33	0.5	3.6	36	1.1
Total Sand	65	78	87	66	94	89	63	98
Total Silt	0.2	10	0.5	0.4	4.2	7	0.3	0.6
Total Clay	0	3.1	0	0	1.8	0.7	0.1	0.1
Total Fines (Silt + Clay)	0.2	13.1	0.5	0.4	6	7.7	0.4	0.7
PCB Aroclors (µg/kg)								
Aroclor 1016	4.7 U	5.1 U	4.8 U	4.8 U	5 U	4.9 U	4.9 U	5 U
Aroclor 1221	4.7 U	5.1 U	4.8 U	4.8 U	5 U	4.9 U	4.9 U	5 U
Aroclor 1232	4.7 U	5.1 U	4.8 U	4.8 U	5 U	4.9 U	4.9 U	5 U
Aroclor 1242	4.7 UJ	5.1 U	4.8 U	4.8 UJ	5 U	4.9 U	4.9 U	5 U
Aroclor 1248	4.7 UJ	5.1 U	22	4.8 UJ	5 U	420	26	5 U
Aroclor 1254	4.7 UJ	5.1 U	4.8 U	4.8 UJ	5 U	4.9 U	4.9 U	5 U
Aroclor 1260	4.7 UJ	5.1 U	4.8 U	4.8 UJ	5 U	4.9 U	4.9 U	5 U
Total PCB	4.7 U	5.1 U	22	4.8 U	5 U	420	26	5 U

Notes:

Bold = Detected result

U = Compound analyzed, but not detected above detection limit

J = Estimated concentration

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

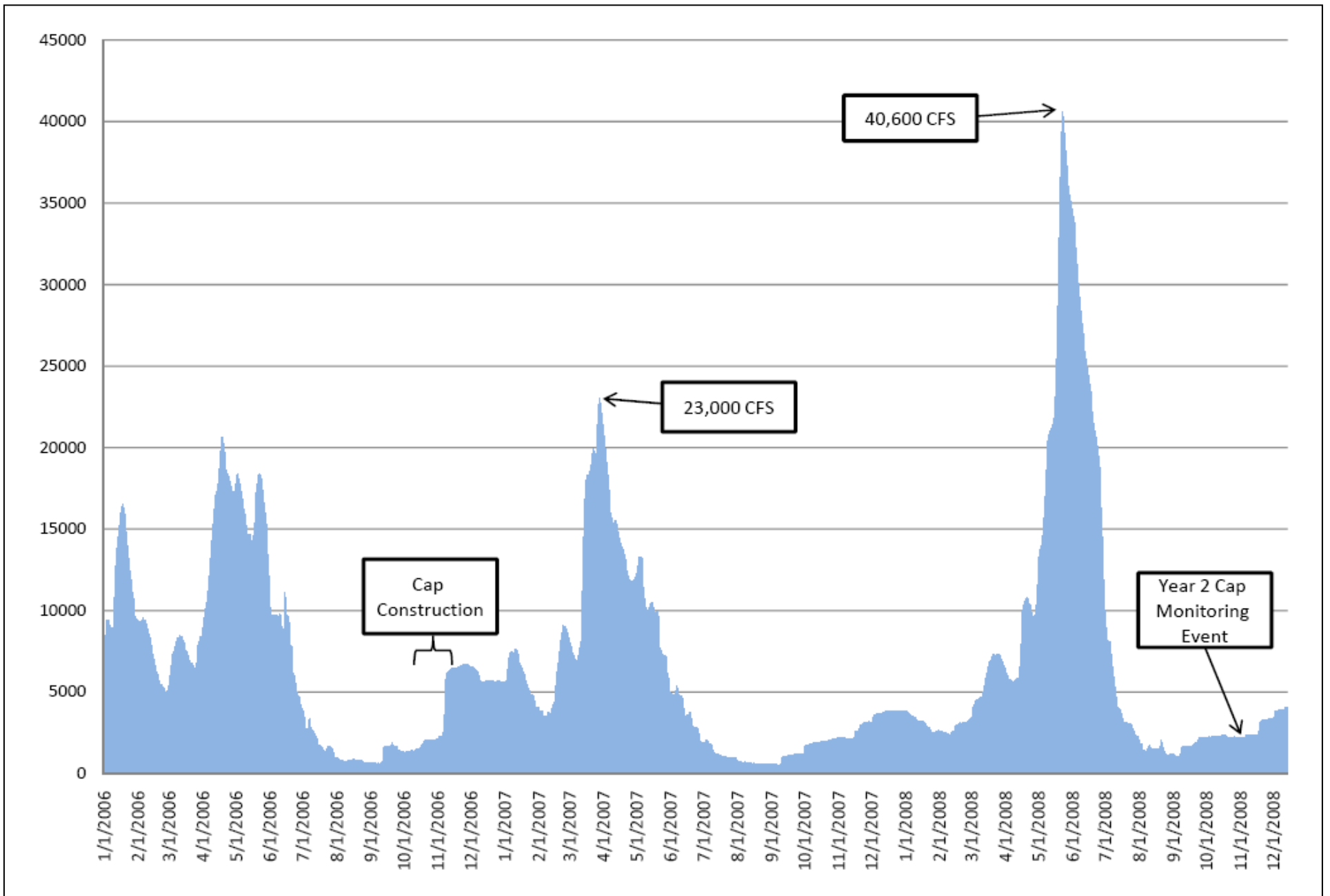
Validated level III by LDC

N = Normal Field Sample

FD = Field Duplicate

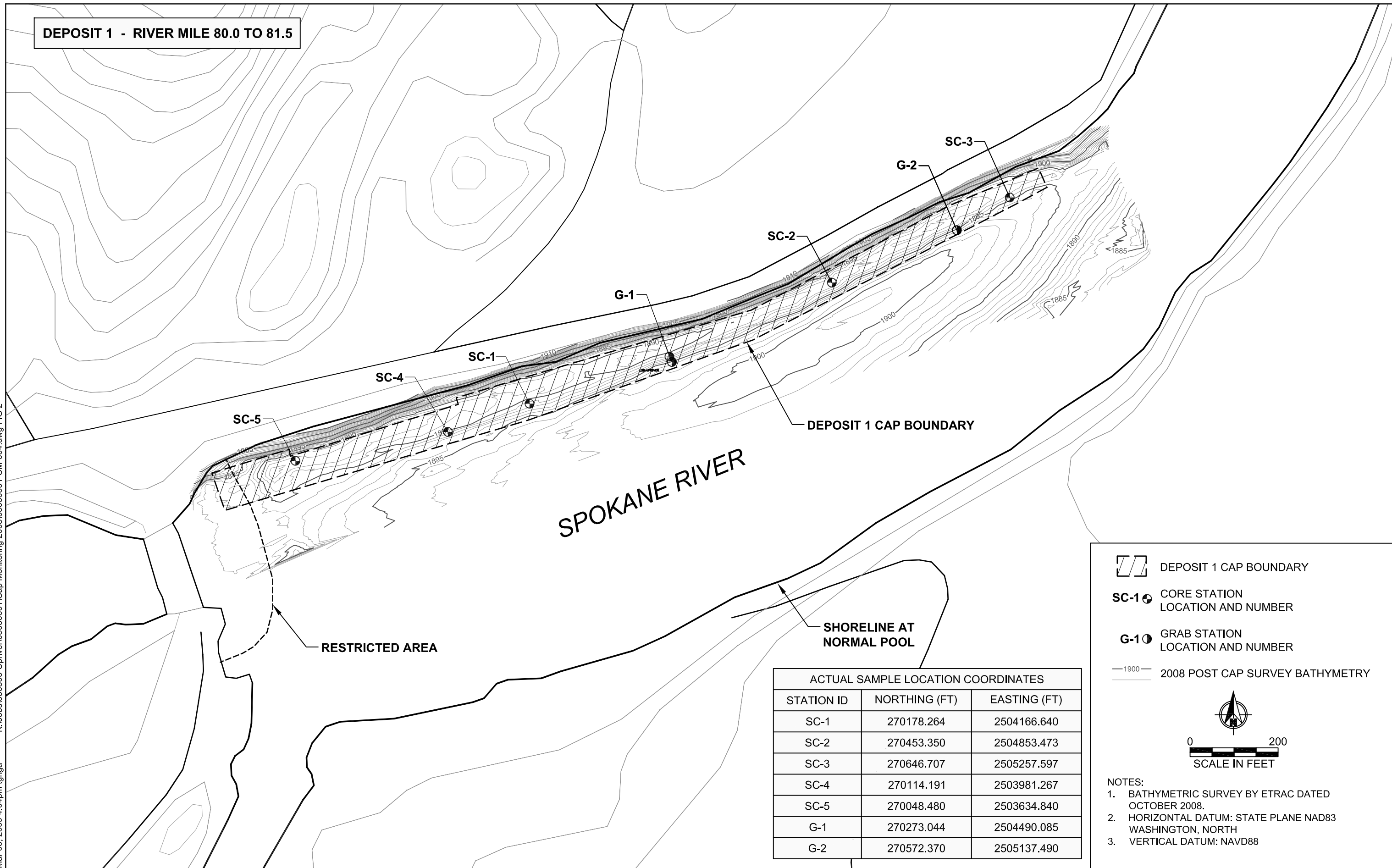
Data measured in dry weight basis

Totals are calculated as the sum of all detected results. If all are undetected results, the highest reporting limit value is reported as the sum.







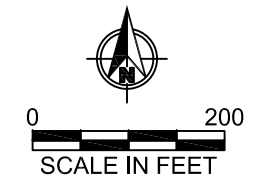
DEPOSIT 1 - RIVER MILE 80.0 TO 81.5

K:\Jobs\05030306-Upriver\0503030601\Cap Monitoring 2008\0503030601-CM-004.dwg FIG 2
Mar 03, 2009 4:04pm tgriga



ACTUAL SAMPLE LOCATION COORDINATES		
STATION ID	NORTHING (FT)	EASTING (FT)
SC-1	270178.264	2504166.640
SC-2	270453.350	2504853.473
SC-3	270646.707	2505257.597
SC-4	270114.191	2503981.267
SC-5	270048.480	2503634.840
G-1	270273.044	2504490.085
G-2	270572.370	2505137.490

-  DEPOSIT 1 CAP BOUNDARY
- SC-1**  CORE STATION LOCATION AND NUMBER
- G-1**  GRAB STATION LOCATION AND NUMBER
-  1900 2008 POST CAP SURVEY BATHYMETRY



- NOTES:**
- BATHYMETRIC SURVEY BY ETRAC DATED OCTOBER 2008.
 - HORIZONTAL DATUM: STATE PLANE NAD83 WASHINGTON, NORTH
 - VERTICAL DATUM: NAVD88