Condit Hydroelectric Project Decommissioning

FERC Project No. 2342

PRELIMINARY SEDIMENT BEHAVIOR REPORT

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Prepared for:

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A DIVISION OF PACIFICORP

December 18, 2011

Preliminary Sediment Behavior Report

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1.0 Introduction

1.1 Project Description

PacifiCorp Energy owns and operates the Condit Hydroelectric Project, which was completed in 1913 on the White Salmon River in Skamania County and Klickitat County, Washington. In 1991, PacifiCorp Energy filed an application with the FERC for a new license authorizing the continued operation and maintenance of the project. PacifiCorp Energy evaluated the economic impacts of the FERC recommendations contained within the Final Environmental Impact Statement (FEIS) and determined that the mandatory conditions would render the project uneconomic to operate. After consultation with project stakeholders, the Condit Settlement Agreement was signed by PacifiCorp Energy and project stakeholders to resolve all issues in the proceeding for relicensing the project. The Condit Hydroelectric Project is currently being removed as outlined in the Project Removal Design Report dated March 15, 2011, 12 supporting management plans, the Washington Department of Ecology 401 Certification, the US Army Corps of Engineers 404 Permit, and the FERC Surrender Order.

A specific Management Plan was developed (Sediment Assessment, Stabilization, and Management Plan, PacifiCorp Energy, 2011) to address sediment stability and management issues that were expected to occur in the decommissioning process. This plan identified general goals and procedures for 1) performing a post-dewatering-assessment, 2) mapping the sediment which remains in the reservoir area, 3) estimating the quantity of sediment remaining in the reservoir area, 4) evaluating the stability of sediment slopes and banks in the reservoir area, 5) determining corrective actions as needed, and 6) evaluating fish passage through the former reservoir.

1.2 Regulatory Requirements

A Section 404 Permit was issued for this project (US Army Corps of Engineers, Regulatory Division, May 13, 2011). The 404 Permit requires that the applicant (PacifiCorp Energy) implement the Management Plan (Sediment Assessment, Stabilization, and Management Plan, PacifiCorp Energy, 2011) as approved by the FERC.

A Section 401 Permit was issued for this project (Washington Department of Ecology, Water Quality Certification Order No. 8049, October 12, 2010). The 401 Certification requires that the applicant (PacifiCorp Energy) implement the Management Plan (Sediment Assessment, Stabilization, and Management Plan, PacifiCorp Energy, 2011). The 401 Certification establishes “Interim Limits" to assess and manage reservoir sediments, including 1) mapping the sediment which remains in the reservoir area, 2) estimating the quantity of sediment remaining in the reservoir area, 3) evaluating the stability of sediment slopes and banks in the reservoir area, 4) determining corrective actions as needed, and 5) evaluating fish passage through the former reservoir. The 401 Certification also requires preparation of a report “that compares observed sediment transport dynamics and geomorphic response to assumptions and modeling results presented in the 2004 Sediment Behavior Analysis” report (G&G Associates, 2004). This report is intended to satisfy this requirement.

The Federal Energy Regulatory Commission (FERC) has issued the Order Accepting Surrender of License, Authorizing Removal of Project Facilities, and Dismissing Application for New License (FERC, December 16, 2010 (FERC December 2010 SO)); Order on Rehearing, Denying Stay, and Dismissing

Extension of Time Request (FERC, April 21, 2011 (FERC April 2011 SO)); and Order Modifying and Approving Sediment Assessment, Stabilization and Management Plan (FERC, May 12, 2011) for the project. The FERC April 2011 SO slightly modified Ordering Paragraph M of the FERC December 2010 SO regarding the Reservoir Sediment Assessment and Stabilization Plan. The FERC April 2011 SO required PacifiCorp Energy to submit a Sediment Assessment, Stabilization, and Management Plan in accordance with the Ecology 401 Certification. The FERC Order Modifying and Approving Sediment Assessment, Stabilization, and Management Plan (FERC, May 12, 2011) incorporated elements of the Sediment Assessment, Stabilization, and Management Plan into their requirements. Part of the May 2011 FERC Order requires PacifiCorp Energy to submit a Draft Sediment Behavior Report 90 days post-breach after submitting it to the Washington Department of Ecology for review and comment. This report is intended to satisfy this requirement. The May 2011 FERC Order also requires that the results of the analysis of the effects of post-reservoir-dewatering on reservoir sediments (Sediment Assessment Report) be submitted within 120 days of the dam breach.

2.0 Post Reservoir Dewatering Sediment Behavior

2.1 Initial Response – the First 6 hours

The explosive charges were detonated at approximately 12:08 PM on October 26, 2011. The drain tunnel was opened, sending a rush of water and sediment down the White Salmon River. A time-lapse video of the dam breach event created by an independent film maker can be seen at:

http://vimeo.com/31305629

It took just over one hour from the opening of the drain tunnel, to evacuate all the standing water in the reservoir. During this same time period, the majority of sediment within the first 1,500-feet upstream of the dam (in the historic river canyon) flushed downstream. These fine-grained sediments in the lower part of the reservoir were estimated to be 15-30 feet thick. Given their unconsolidated and fully saturated condition, these sediments sluiced through the drain tunnel as a hyper-concentrated water flow. The historic basalt outcrops upstream of the dam that form a river canyon were exposed almost immediately. To view photographs of this reach please see Photo Points #6 and #9, in Appendix A.

Over the course of the next five hours reservoir sediments continued to mobilize, with erosion and mass wasting being the primary mechanisms. Many rotational failures of large sediment masses were observed, and as these sediments fell in to the free-flowing river they were entrained in the flow. The primary area of sediment mobilization on the afternoon of October 26, 2011, was between STA 0+00 (Condit dam) and STA 40+00 (4,000-feet upstream of the dam). Within this reach an active head-cut of approximately 40-feet height was slowly migrating upstream. As thick deposits of sediment lost lateral support, mass wasting of sediment on either side of the evolving river channel proceeded in a rapid fashion. The cover photograph of this report taken from Photo Point #9 shows the head-cut and mass wasting processes on the afternoon of October 26, 2011. Failure modes observed included: slumping, rotational failures, and vertical plan failures. High pore pressures in these sediments increased the instability. Water seeps appeared in many places showing drainage of the sediment layers. Tension cracks appeared on the surface of many sediment deposits.

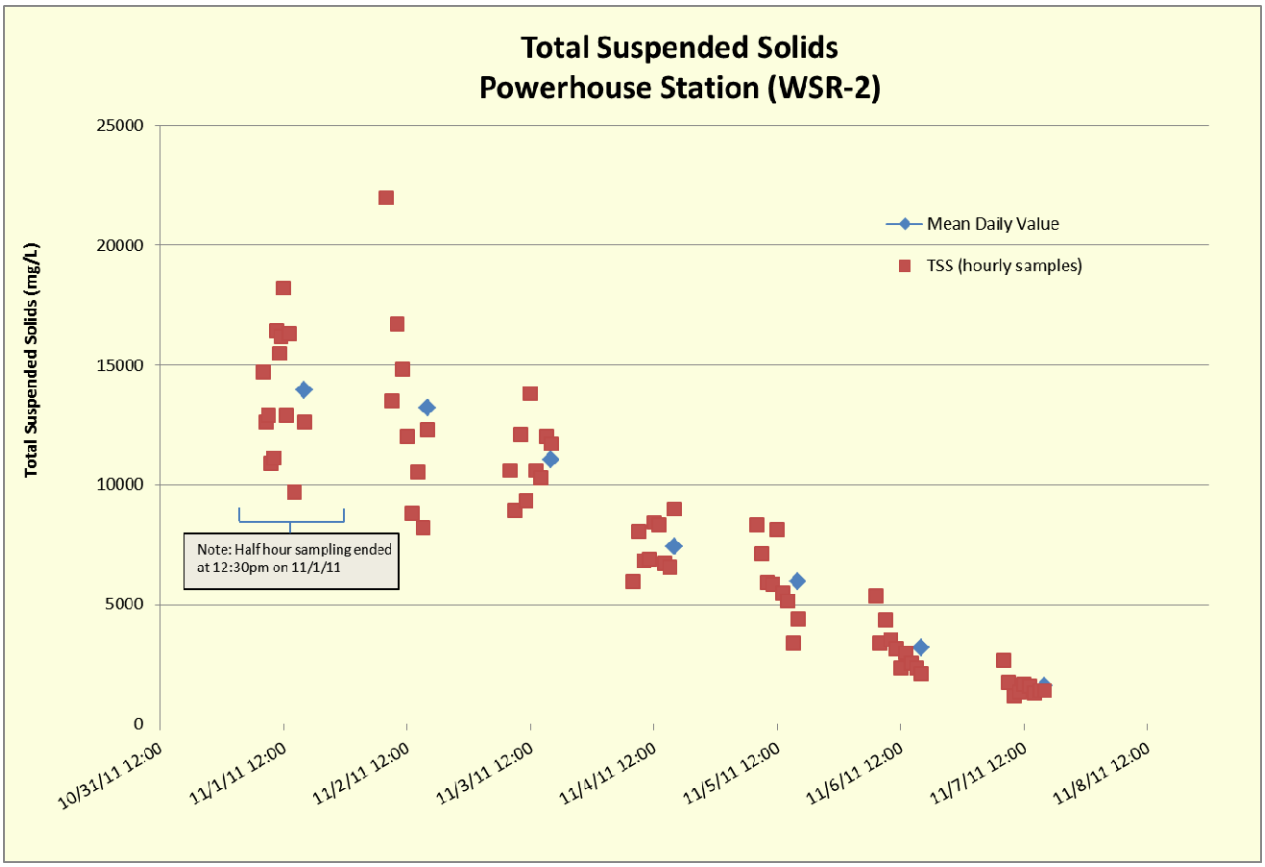
2.2 Sediment Mobilization Upstream of the Dam

Sediments within the (former) reservoir area continued to erode throughout the time period covered by this preliminary report: the first six weeks post-breach. As was predicted, the rates of erosion and mass wasting of sediment has steadily declined in this time period. The first two weeks post-breach saw dramatic changes in the reservoir sediments.

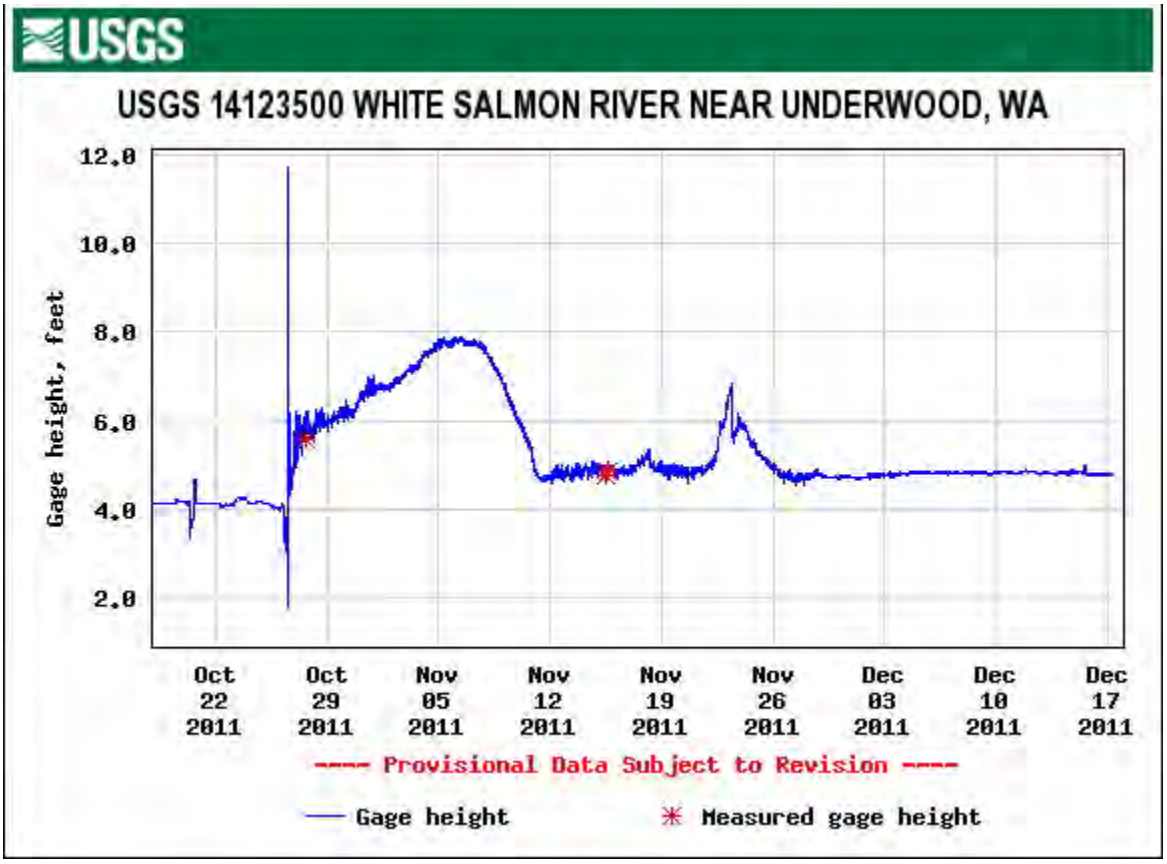
It should be noted that the samples of reservoir sediment described in the "Sediment Assessment, Stabilization, and Management Plan" (PacifiCorp Energy, March 15, 2011) showed the predominance of sediment in the reservoir to be classified as sand size particles.

2.3 Sediment in the Canyon Reach Downstream of the Dam

Sediment concentrations in the White Salmon River proved to be consistently larger than predicted in the Sediment Assessment, Stability and Management Plan (PacifiCorp Energy, 2011). The initial flood wave had a high concentration of suspended sediments (primarily silt size material) which quickly exceeded the upper limits for detection in the turbidity probes installed in the river. The probes had an upper limit for detection of 4,000 Nephelometric Turbidity Units (NTUs). Manual collection of water and suspended sediment samples were commenced immediately and continued for the following two weeks, until the concentrations came down enough to be detected by the 4,000 NTU turbidity probe. Suspended sediment samples collected manually were tested in the laboratory for Total Suspended Solids (TSS). Measured data points are shown in the figure below. The TSS fraction of the total sediment load was significant, but indirect observations suggest that a large amount of bedload sediment transport was occurring simultaneously. Bedload sampling was not performed during or after the breach event, so there is no quantitative means to estimate the peak concentration of total sediment load in the White Salmon River. Based on field observations, it is possible that the peak sediment load was in the range of 50,000 - 100,000 parts per million (PPM).



Bedload concentrations certainly increased in the days after the breach event, as high volumes of sand-size particles were mobilized from the reservoir area. Field observations at the Powerhouse showed the water surface rising daily for the first 10-11 days post breach. It is believed that this rise in water surface was due to a rising channel bed: sand-size sediments temporarily filling up the bottom of the channel. Anecdotal observations at a staff gage upstream of the reservoir suggest that water flow in the river did not change substantially during this 10-day period, remaining at around 700 cubic feet per second (CFS). Direct measurement of water surface (stage) has been recorded continuously at the USGS stream gage (USGS Gage No. 14123500) in the lower White Salmon River. Assuming the water flow in the river remained consistent during the first two weeks post breach, then the USGS stage data is analogous to the changes in river bed elevation from temporary sand deposits. During this two-week period, sediment supply to the canyon reach exceeded the sediment transport capacity of the river, allowing the excess sediments to be deposited in the riverbed. Beginning on approximately November 8, 2011, the sediment supply began to decrease, the sediment transport capacity of the river exceeded the supply, and channel bed elevations began to decrease. By November 12, 2011, (approximately) the river bed had returned to an elevation close to the pre-breach grade, and water stage readings stabilized.

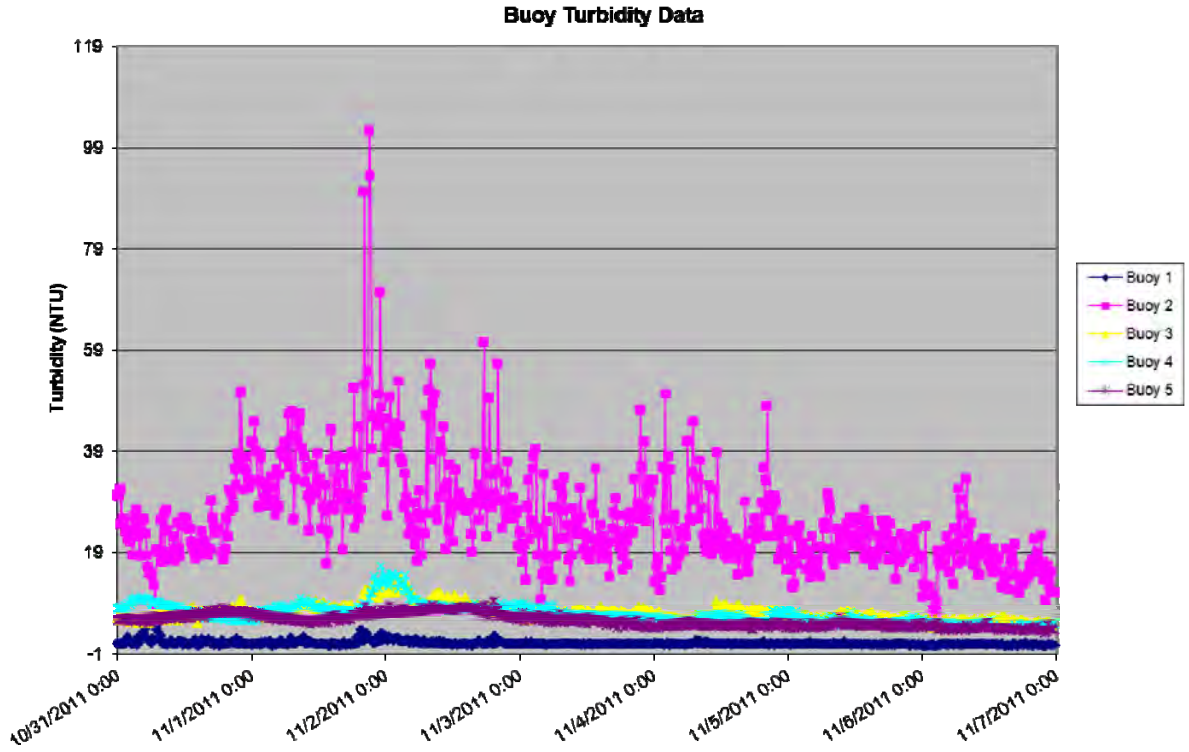


As the water levels dropped at the Powerhouse, the level of temporary sediment filling of the channel bed could be seen. The photograph below shows what is left of the temporary channel bed fill, with the sediment drape line on river right (view is looking downstream).

White Salmon River at the powerhouse. View downstream. Temporary bed sediment levels can be inferred from the deposition on river right. On river left the powerhouse tailrace is presently filled with sediment. 12-7-2011.

2.4 Sediment Influx to the Columbia River

The dam breach event had an estimated peak flow rate of approximately 14,000 CFS, somewhat larger than the pre-breach estimate discharge of 10,000 - 11,000 CFS. Flows throughout the first week had significant suspended sediment concentrations (see Section 2.5). On the afternoon of October 26, 2011, a plume of muddy water was visible flowing out of the White Salmon River mouth and into the Columbia River. Increases in turbidity measured at buoys anchored in the Columbia River showed the progression of turbid water westward from the White Salmon River. The graph below shows the head of the suspended sediment plume reaching the Bonneville dam locks approximately seven days after the breach. The turbidity data collected at the buoys shows a general pattern of dilution as the sediment plume moved down the Columbia River. Buoy No. 2 is at the mouth of the White Salmon River, and buoys Nos. 3, 4, and 5 are progressively further downstream. Buoy No. 1 is also in the Columbia River, but it is upstream of the White Salmon River confluence.



Visible evidence of turbidity on the surface of the Columbia River was notably absent during the first four weeks post breach. It is believed that the majority of the sediment discharged to the Columbia River was sand-size particles, moving as fluid bed sediment. On breach day the USGS attempted to measure discharge from the White Salmon River under the railroad bridge at the confluence with the Columbia River. Verbal accounts say that this measurement effort was abandoned when it was determined that the majority of surface water was flowing in an upstream direction. This suggests a powerful current flowing along the bed of the White Salmon River out into the Columbia River, consistent with a high bedload concentration and a density greater than that of clear water.

Sand-size sediment accumulated at the "Underwood In-Lieu site" on the White Salmon River, just upstream of the Columbia River confluence. At this location the width of the White Salmon River doubles from the typical channel width upstream, and the gradient of the river is quickly reduced because of backwater effects from the Bonneville Pool. It took only a few days for the Underwood In-Lieu site to fill almost completely with sand, creating a wide and shallow flow of water and sediment across the new bed surface. Conversely, it took almost four weeks

post breach before sand deposits were visible on the surface of the Columbia River at the mouth of the White Salmon River.

Columbia River at the mouth of the White Salmon River. Sand bars visible. 12-8-2011.

Bathymetric surveys conducted in the Columbia River at the mouth of the White Salmon River in the first week post breach revealed approximately 433,000 cubic yards deposited. It is apparent that the bulk of the bedload sediment volume had taken weeks rather than days to reach the Columbia River. A limited number of sediment depth data points were collected on November 30, 2011. These data points and depth are shown on the figure below, as is the commercial navigation channel (faint yellow line). The Coast Guard has placed a lighted, warning buoy at the outer extent off the sediment deposition area to prevent small craft from running aground.

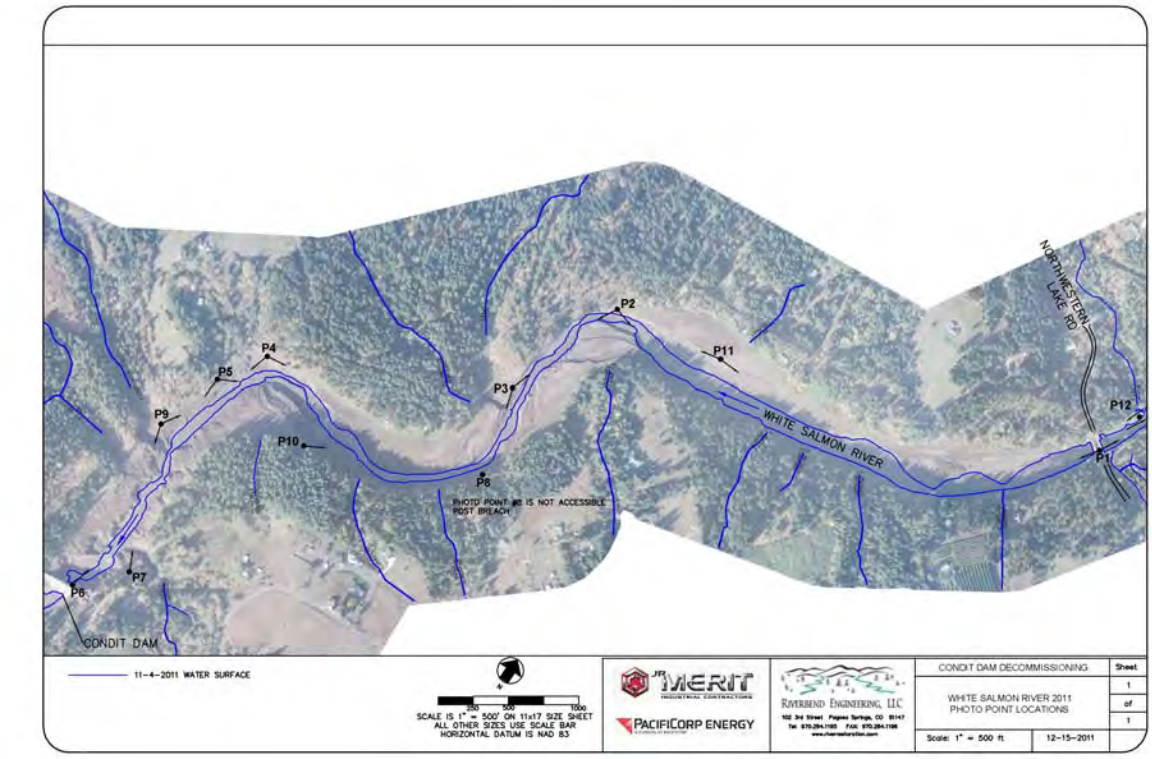
Columbia River at the mouth of the White Salmon River. Depth to sediment surface, measurements taken on 11-30-2011. Note: photography is from an earlier date.

3.0 Remaining Sediments in the Former Reservoir Area

3.1 Sediment Changes Observed with Repeated Photography

Photographs of the changes in reservoir sediments were collected at 12 Photo point locations. Photos were taken on breach day, on each of the following six days, and then weekly for a total of six weeks. These photo sequences show the evolution and erosion of sediments within the former reservoir area. Photo point locations (P1, P2, etc...) are shown in the plan view below. In some locations repeat photos were taken looking upstream and downstream. All of the photo

sequences are provided in Appendix A. Each photo sequence in the Appendix was continued until visible changes to the reservoir sediments were no longer evident. Data from Photo point No. 8 had to be terminated when the soil at that location collapsed into the river. Data from Photo point No. 12 commenced once the headcutting and erosion had moved upstream past Northwestern Lake Bridge.



Notes of field observations were taken at each photo point on a weekly basis. Summaries of the field notes are provided below. All elevations, distances and heights described below are estimates made by a field geologist.

P1: *On 11/3/2011 riverbed cutting downstream from P1 ranged from 2 to 5 feet (ft) and upstream riverbed cutting was minimal. Increased riverbed cutting was observed on 11/10/2011 with maximum downstream bank height of approximately 8 ft. River width directly downstream from P1 had decreased by approximately 50 ft over the period 11/3/2011 to 11/10/2011. Minimal riverbed cutting was observed upstream from P1 on 11/10/2011. On 11/17/2011 down-cutting of approximately 3 to 5 feet was observed upstream from P1. On 11/30/2011 upstream and downstream riverbed cutting had increased to 10 feet upriver of P1 and 15 to 20 ft downriver of P1. Over this same period, the river path near the bridge had shifted to river right*

and the river throughout the reach exhibited increased meander. From 11/30/2011 to 12/8/2011 an additional 2 to 3 ft of riverbed cutting had occurred and river meander continued to increase.

P2: *On 10/28/2011 the bank height was approximately 30 ft and increased to approximately 50 to 60 ft by 11/3/2011. Over this time period the river channel narrowed approximately 75 ft. From 11/10/2011 to 12/8/2011 the bank remained relatively stable with no visible mass wasting activity, other than grading of the river right bank by a trackhoe between 11/10/2011 and 11/17/2011. From 11/10/2011 to 12/8/2011 approximately 2 to 4 feet of additional riverbed cutting was observed.*

P3: *On 10/28/2011 the bank height ranged from 20 to 30 ft, increasing to 40 to 50 ft between 10/28/2001 and 11/32011. The river banks remained stable between 11/3/2011 and 11/10/2011 with minor mass wasting directly across from P3. Between 11/10/2011 and 11/17/2011 river bank slumping and loss of approximately 15 ft of bank across from P3 was observed. Upstream from P3 the river banks remained stable. From 11/17/2011 to 12/8/2011 riverbed down-cutting of 1 to 2 ft occurred. River banks remained relatively stable over this time.*

P4: *On 10/28/2011 left and right bank height ranged from 70 to 80 ft. From 10/28/2011 to 11/3/2011 there was 8 to 10 ft of riverbed down-cutting. Loss of approximately a 10 ft section of river right bank was observed upriver from P4 during this period. From 11/3/2011 to 11/10/2011 an additional 3 ft of riverbed down-cutting occurred. No visible riverbed or bank activity occurred between 11/10/2011 and 11/17/2011. From 11/17/2011 to 11/30/2011 there was loss of 2 to 8 ft of sediment deposits on river left, ranging from 2 to 5 ft in height. No significant changes were observed from 11/30/2011 to 12/8/2011 and river right and river left banks appeared stable.*

P5: *On 10/28/2011 left and right bank height ranged from 70 to 80 ft. From 10/28/2011 to 11/3/2011 there was approximately 8 ft of riverbed down-cutting. From 11/3/2011 to 11/10/2011 there was removal of sediment deposits near point across from P5 and approximately 3 to 4 ft of riverbed down-cutting. From 11/10/2011 to 12/8/2011 there were no significant changes observed and river right and river left banks appeared stable.*

P6 & P7: *On 10/28/2011 left and right bank height ranged from 70 to 80 ft. From 10/28/2011 to 11/10/2011 approximately 10 ft of riverbed down-cutting occurred. From 10/28/2011 and 11/10/2011 an additional 5 ft of riverbed down-cutting occurred below the coffer dam and 1 to 2 ft of riverbed down-cutting above the coffer dam. From 11/10/2011 to 12/8/2011 there was limited bed and bank activity, with the banks being relatively stable throughout the monitoring period.*

P8: *Photo point removed.*

P9: *On 11/3/2011 left and right bank height ranged from 70 to 80 ft. From 11/3/2011 to 11/10/2011 there was one to two ft of riverbed down-cutting and removal of 1 to 4 ft of sediment deposits on river right. From 11/10/2011 to 12/8/2011 there were no significant changes observed and river right and river left banks appeared stable.*

P10: *On 11/3/2011 riverbank height ranged from approximately 60 to 70 ft. From 11/3/2011 to 11/10/2011 there was approximately 3 ft of riverbed down-cutting. From 11/10/2011 to 11/17/2011 there was no significant change in bed cutting or bank conditions. From 11/17/2011 to 11/30/2011 minor bank sloughing was observed across from P10 and approximately two feet of riverbed down-cutting had occurred. From 11/30/2011 to 12/8/2011 there were no significant changes observed and river left bank and point appeared stable.*

P11: *On 11/3/2011 a tiered bank existed on river right, totaling approximately 40 ft high. From 11/3/2011 to 11/17/2011 there was approximately 4 ft of riverbed down-cutting. Grading of the river right bank with a trackhoe occurred over this time period. From 11/17/2011 to 11/30/2011 there was removal of small sediment deposits on river left and 1 to 2 ft of additional riverbed down-cutting occurred. From 11/30/2011 to 12/8/2011 riverbed and banks were relatively stable with no significant changes observed.*

P12: *Photo point P12 was established on 11/10/2011 in response to active cutting observed upstream from P1. On 11/10/2011 riverbed cutting at this point was approximately 1 to 2 ft. By 11/17/2011 riverbed cutting had increased to approximately 4 ft, with no cutting observed approximately 100 ft upstream of P12. Between 11/17/2011 and 11/30/2011 P12 was lost due to the river cutting into the river right bank approximately 15 ft. During this period the bank height increased, ranging from 7 to 15 ft with bank height decreasing up river from P12. Down-cutting continued from 11/30/2011 to 12/8/2011 having increased by approximately 2 ft and increased river meandering.*

Powerhouse: *From 11/3/2011 to 11/10/2011 there was approximately 3 ft of down-cutting through riverbed sediment deposits and the river channel had narrowed by approximately 6 ft. From 11/10/2011 to 11/17/2011 approximately 3 ft of the sediment deposit on river right was removed. All sediment on river right was removed by 11/30/2011. No changes in conditions were observed from 11/30/2011 to 12/8/2011.*

3.2 Preliminary Assessment of Sediment Stability

Lands beneath the former reservoir surface area are a mix of exposed rock outcrops, sediment deposits that are no longer eroding but which still have stability issues, side drainages that are eroding through reservoir sediment deposits, and a river channel which has down-cut to an elevation and profile believed to be similar to the form which existed prior to the dam

construction. Figures B4, B5, and B6 in Appendix B show the locations of different "Sediment Stability Zones" (Zones) within the former reservoir footprint. These Zones are used to identify land forms with similar geotechnical and slope stability characteristics. Descriptions of each Zone type are included below. This Zonal classification of sediment stability is based on field observations completed through December 15, 2011. Please note that the larger sediment deposition locations have been labeled on Figures B4-B6 in Appendix B, along with river centerline stationing. Both systems of reference have been used in the following text.

Rock Outcrop Zone – *Locations where bedrock is exposed*. These locations are considered stable from a geotechnical perspective. These are primarily basalt deposits from several geologic time periods, exposed and cut through by the White Salmon River. The rock formations create a steep-sided canyon between STA 0+00 and STA 15+00. From STA 16+00 to STA 55+00 near vertical rock faces are observed on alternating sides of the river on the outside of each meander bend. Rock Outcrops have been observed between STA 15+00 and STA 25+00 on river left (looking downstream), creating what is believed to be a solid "bench" beneath the more recent reservoir sediment deposits. Smaller rock formations have been observed on the inside of the meander bend between STA 45+00 and STA 52+00 at a relatively low elevation, suggesting (but not confirming) a potential solid bench beneath the "point bar" on river left. The Rock Outcrop Zone has also been applied to locations where observed slope angles are 1:1 or steeper, there is little observed reservoir sediment remaining, and where the side slopes match the angle of the side slope visible above the former reservoir water level. In other words, theses slopes appear to be part of the valley side slope that existed before the reservoir, and are inferred to be underlain by bedrock because of the stable slope angle observed. Within the Rock Outcrop Zone there are numerous small pockets of reservoir sediment remaining. These small pockets of sediment are expected to erode during the winter rain events predicted over the next four months. Soil that does not erode will probably be small enough in volume that they would not be considered a geotechnical hazard. Likely, these sediment pockets will provide a soil substrate for new vegetation growth.

High Instability Zone – *Locations where the slope angle of exposed side faces of reservoir sediments are steeper than 1.7:1 (30 degrees).* These locations occur where river down-cutting or mass wasting has left a steep face on the remaining sediment. The High Instability Zone also includes the landforms adjacent to side creeks and ephemeral drainages into the White Salmon River, where flowing water has de-stabilized the reservoir sediments and active mass wasting and channel incision continues on a small scale.

Medium Instability Zone – *Locations where the exposed surface of the reservoir sediment is less than a 30 degree angle, but steeper than a 10 degree angle.* These locations do not pose an imminent threat of slope failure (slumping or rotational). However these sediment deposits are poorly consolidated due to the lacustrine depositional process, and they are capable

of being easily mobilized when saturated or exposed to flowing water. Instability increases with a decrease in the sediment size, so that Location M1 is less stable than Location M8. This Zone is where the majority of site grading is likely to occur in the summer of 2012. The Medium Instability Zone includes some locations adjacent to the river channel where old stumps have become visible. The appearance of the stumps indicates the land surface prior to filling of the reservoir. The stumps have been submerged for the past 99 years, and the wood is well preserved as are the intact root systems. It is not known at this time if the slopes beneath the stumps will remain stable after the river has reached its final elevation, profile, and alignment.

Low Instability Zone – *Locations where the exposed surface of the reservoir sediment is less than a 10 degree angle or the sediment has a stable bedrock toe.* These locations typically occur in the upper reaches of the former reservoir on river right, between STA 58+00 and STA 66+00, and intermittently from STA 66+00 to STA 87+00. These areas represent a fringe depositional zone within the former reservoir, where water velocities were very low. This Zone covers sediment deposits that are geotechnicaly stable and have a low likelihood of being eroded or mobilized. They are typically bounded by a Medium Instability Zone or Rock Outcrop Zone on the river side and by a vegetated uplands slope on the other side.

River Channel Zone – This Zone represents the active channel of the river as recently observed (12/15/11). Sediment stability within this Zone is considered "Low" from a hazard perspective. Stability has been evaluated in terms of the stable profile and meander pattern that the river is expected to achieve. Until the LiDAR data has been collected researchers will not be able to make a quantitative comparison of the river's vertical profile. However qualitative observations suggest that the river is nearing its pre-dam profile. These observations include 1) coarse size bed sediments observed throughout the former reservoir area, 2) a marked decrease in sediment supply to the river (compared to a few weeks ago) due to upstream head-cutting and side slope mass wasting, 3) a visible improvement in river water clarity in the reservoir area, and 4) exposed tree stumps that are close to the observed water surface and that (in some locations) are aligned in a gently curved riverbank form. In terms of lateral channel stability, the river has exposed rock or stumps along its sides for at least 60 percent of the reservoir length, leaving only a few locations where a new meander pattern could potential develop. Even then, the lateral extension of any new meander would be limited by the valley side slopes and also by the moderately steep average river slope. Higher river flows are expected during the winter months. Higher river flows create increased shear stress, allowing the river bed sediments to be mobilized more completely. These events are expected to complete the river's vertical adjustment process.

3.3 Comparison of Estimated Sediment Quantities

The volume of sediment remaining in the reservoir area has been estimated by identifying and quantifying areas of relative sediment instability, and then visually estimating the thickness of

the sediment deposits at each location. The tabular data shown below forms the basis for the volumetric calculation included herein. The calculated remaining sediment volume at just over 700,000 cubic yards (CY) is consistent with the Sediment Behavior Analysis Report (G&G Associates, 2004) where a residual volume of 200,000 to 700,000 CY was estimated.

Condit Dam Decommissioning Project				
Estimated Volume of Sediment Remaining in the Reservoir Area				
Location	**Area**	**Estimated**	**Estimated**	
		Thickness	**Volume**	
	(sq-ft)	**(ft)**	**(CY)**	
L1	34610	4	5127	
L2	147127	4	21797	
L3	38608	3	4290	
L4	24948	3	2772	
L5	362401	6	80534	
M1	110605	10	40965	
M2	130017	10	48154	
M3	224182	12	99636	
M4	113136	18	75424	
M5	98234	12	43660	
M6	182169	4	26988	
M7	20876	4	3093	
M8	41594	5	7703	
M9	33597	4	4977	
H1	51195	15	28442	
H2	127964	10	47394	
H3	23700	15	13167	
H4	34168	2	2531	
H5	12135	15	6742	
H6	64217	8	19027	
H7	151405	15	84114	
H8	95539	12	42462	
H9	17191	10	6367	
H10	17974	4	2663	

		Total Estimate Sediment Volume Remaining:	**718,027**	**CY**

3.4 Short Term Sediment Management Objectives

The PacifiCorp Energy management team and the Decommissioning Contractor (J R Merit) have identified locations within the former reservoir area which 1) have been classified as High Instability Zones, 2) that are accessible with heavy equipment, and 3) which are firm enough to drive heavy equipment on. These locations are all upstream of STA 30+00. The focus of short term sediment management efforts in this Zone will be to grade the exposed sediment edges to a slope angle less than 30 degrees. This effort is planned for January 2012. This is considered an interim measure to reduce geotechnical hazards within the project boundaries. Some of these locations will be included in a more comprehensive grading plan to be accomplished in the summer of 2012.

3.5 Public Access and Safety Considerations

PacifiCorp Energy and the Contractor began a public information campaign several months before the dam breach. An aggressive public safety signage commenced several days before the breach event. On the day of the breach Contractor personnel were stationed throughout the dam and reservoir area as a safety precaution, along with local and state law enforcement personnel stationed around the project perimeter. There were no reported safety incidents of project personnel or members of the general public on breach day. For the first few weeks after the breach, a steady stream of curious members of the public came to the project to get a first-hand look. Access to the dam itself could be tightly controlled, but access to the reservoir area, particularly at Northwestern Lake Park, was difficult to control. The Contractor installed numerous signs and barricade tape, warning of the danger from sediment bank collapse. These public safety warnings were moved multiple times as the unstable bank lines changed locations. It has been impossible to prevent all of the public from walking right up to an unstable edge. In areas of frequent public access, the Contractor has sloped back the worst of the steep sediment edges and the rapid lateral movements of the unstable sediment deposits have decreased significantly.

4.0 Continuing Sediment Management Activities

4.1 Additional Photo Documentation

Within the former reservoir area and upstream of Northwestern Lake Road, photo documentation from the established photo points will continue until 90 days post breach. The observed rate-of-change has slowed considerably in some locations. For this reason, repeat photo documentation

will be accomplished every two to three weeks, or after significant river flow events have occurred.

4.2 LiDAR Surveys

LiDAR surveys are required by the "Sediment Assessment, Stabilization, and Management Plan" (PacifiCorp Energy, March 15, 2011) and by the FERC Surrender Order. The first LiDAR survey occurred on December 20, 2011. The results of this first LiDAR survey will be used to quantify the locations, elevations and volumes of sediment remaining in the former reservoir area.

The topographic contour data from this LiDAR flight will be included in the Final Sediment Assessment Report, due to be submitted to the FERC and the Washington Department of Ecology no later than 120 days post breach.

4.3 Final Sediment Assessment Report

A final Sediment Assessment Report will be completed within the required 120 day post breach time frame. That report will include some of the sediment stability assessments contained in this preliminary report. In addition, the final report will have the benefit of the LiDAR elevation and contour data. This topographic quantification of the remaining reservoir sediments will allow for a quantitative estimate of the volume of sediment that was not naturally eroded by the river. It will also provide a base drawing from which PacifiCorp Energy and the Contractor will develop a grading plan. The grading plan will show the final proposed grades in the reservoir area, confirming the ultimate stability of any remaining sediment deposits. The grading plan will address the revegetation goals of the project, defining the resultant land forms where soil moisture and aspect can be optimized for target plant species.

5.0 References

Federal Energy Regulatory Commission (FERC), 2010, Order Accepting Surrender of License, Authorizing Removal of Project Facilities, and Dismissing Application for New License, Project Nos. 2342-005 & 2342-011, December 16, 2010.

FERC, 2011a, Order on Rehearing, Denying Stay, and Dismissing Extension of Time Request, Project No. 2342-021, April 21, 2011.

FERC, 2011b, Order Modifying and Approving Sediment Assessment, Stabilization, and Management Plan, Project No. 2342-025, May 11, 2011.

G&G Associates, 2004, Sediment Behavior Analysis Report

PacifiCorp Energy, 2011a, Project Removal Design Report, March 15, 2011.

PacifiCorp Energy, 2011b, Sediment Assessment, Stabilization, and Management Plan. March 15, 2011.

Washington Department of Ecology, 2010, Condit Dam Decommissioning Project 401 Water Quality Certification order No. 8049, , October 12, 2010.

US Department of the Army, 2011, Section 404 Permit, Corps of Engineers Action No. NWP-2004-523, May 13, 2011.