

**BLACK CANYON BOATER PROGRAM
RAMP RATE STUDY,
BEAR RIVER HYDROELECTRIC PROJECT,
FERC PROJECT NO. 20**

**YEAR 1 ANNUAL REPORT – FISH
STRANDING FOLLOWING BOATER-FLOW
RELEASES**

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1.0 INTRODUCTION

PacifiCorp engaged Cirrus Ecological Solutions (Cirrus) of Logan, Utah, to implement a fish stranding study plan developed by the Bear River Hydroelectric Project Environmental Coordination Committee (ECC). The purpose of the study is to measure fish stranding during the down-ramping following the release of flows provided for recreational boating on 6.2 miles of the Bear River through the Black Canyon below the Grace Dam. These releases are substantially greater (700 – 1,200 cfs) than the minimum instream flow requirement (65 cfs) and are provided for whitewater recreation between April 1 and July 15, pursuant to the new operating license from the Federal Energy Regulatory Commission (FERC) granted on December 22, 2003.

The initial study plan, as developed by Oasis Environmental, Bigfork, Montana, and the ECC prescribed monitoring during three Scheduled Ramp Rate Test Flows in each of the next three years. A different ramp-down rate is to be used each year: 0.25 feet per hour in year one, with rates of 0.5 or 1.0 feet per hour to be used in years two and three. Five study plots of at least 1,000 square feet each were to be established to represent areas of high, medium, and low fish stranding potential, with the distribution of plots to be roughly proportional to the representation of high, medium and low stranding potential along the 6.2 miles. The potential for stranding was to be determined prior to the Scheduled Ramp Rate Test Flows by evaluating variables including bank slope, vegetation, substrate composition, and presence of depressions that could hold water that might trap fish.

Cirrus undertook preliminary mapping of stranding potential in early April 2008 following initial visits with PacifiCorp personnel to better define the most significant stranding factors. On April 14, 2008, PacifiCorp provided a release of 1,200 cfs to enable mapping of the varial zone, the area of river bank inundated by high flows. After this release, Cirrus personnel monitored several areas along the river representing different potentials for fish stranding, but found no stranded fish during or immediately after the test flow event. PacifiCorp also began implementation of its Article 409 Fish Stranding Minimization Plan (hereafter Fish Rescue) during this release, per the license requirement.

Two days after the April 14 Varial Mapping Flow, Cirrus presented information to the ECC summarizing the results of stranding-potential mapping. This presentation and discussion led to minor changes to the study plan in order to increase the probability of finding stranded fish. Cirrus offered to attempt to monitor more and larger study plots during the 2008 releases scheduled for April 20, June 1, and July 13, 2008. This report documents the methods used, including locations and characteristics of the study plots, and the results of the fish stranding studies conducted on these three Scheduled Ramp Rate Test Flow days.

This report also includes data on stage change during one Scheduled Ramp Rate Test Flow, electro-fishing results, and water quality monitoring that was conducted by other parties in 2008.

2.0 METHODS

This section describes the methods used to map high, medium, and low hazard zones, the locations and sizes of the study plots used, and the procedures used to search for stranded fish during and after each boater-flow event.

2.1 STRANDING POTENTIAL MAPPING

PacifiCorp provided a series of 188 true-color aerial photographs that were taken July 28, 2006, during typical minimum instream flows through the Black Canyon section. These photos were integrated into 16 mosaics that were laminated for field use.

On April 8, prior to any releases, Cirrus met with PacifiCorp personnel to visit representative samples of the study area to discuss how to assess the four variables thought most relevant for fish stranding: bank slope, vegetation, substrate composition, and presence of depressions that could hold water that might trap fish. Cirrus personnel then applied these guidelines to map approximately 80 percent of the river banks on April 9 and 10, delineating the expected varial zones on the laminated maps as having high, medium, or low stranding potential.

On April 14, PacifiCorp provided a 1,200 cfs Varial Mapping Flow through Black Canyon to enable mapping of the varial zones. During the release Cirrus used a helicopter to acquire aerial photography of the extent of the varial zone. During the down-ramp following this release, Cirrus and PacifiCorp personnel visited portions of the river to evaluate possible study plot locations. Criteria used for the selection of plots included:

- Size: plots were to be at least 1,000 square feet along the river bank above base flow and below the high flow river levels.
- Representation: the number of high, medium, and low stranding potential plots were to be distributed according to the relative total sizes of hazard zones.
- Safety: plots were to be safely accessible by monitoring personnel.
- Consistency: plots were preferred near sites being monitored for other purposes, such as macroinvertebrates, substrate, etc.

Cirrus presented the results of the stranding potential mapping to the ECC on April 18. As a result of the discussion on how to improve the potential for detecting stranded fish, several adjustments to the study plan were approved, including:

1. Make plots larger than 1,000 square feet and, if possible, cover an entire mapped stranding potential polygon; proceed with the original designation of 10 subplots in each.
2. Designate at least two high, one medium, and two low stranding potential plots.
3. Plan enough time to complete monitoring each plot during each hour.

4. Survey more than five plots if time allows, but always in the same sequence, noting the start and end times for each polygon to ensure similar levels of effort in future monitoring.
5. Complete plots in Reach 2 immediately below the Grace Dam on the same day as the down-ramp, even if it means working after dark, to preempt any taking of stranded fish by predators.
6. Return to the plots as early as possible the next morning to search again for stranded fish at the minimum flow level; begin with the plots that had not reached minimum flows the previous day (Reaches 3 and 4).
7. Quantify level of search effort by documenting start and end times.
8. Designate high, medium, and low stranding potential in Reach 2 and Reach 4 if possible, as these were more accessible.
9. Move the start of the down-ramp earlier to provide enough time for the river to return to normal flows in the section immediately below the dam on the same day. The time of initiating the down-ramp was accordingly adjusted from 16:00 to 15:00 hours and Scheduled Ramp Rate Test Flow levels were planned to decrease from 900 to 700 cfs starting at 15:00 hours. Boater flow threshold per PacifiCorp commitments is 700 cfs and above.

2.2 STUDY PLOT DIMENSIONS AND LOCATIONS

The distributions and river bank lengths of the final study plots are shown in Table 1. The width – horizontal distance between high and minimum flows – and the areal extent differed with each boater-flow event, as a result of different flows and minor changes in river boundary between boater-flow events.

The locations of the study plots in Reaches 2, 3 and 4 are shown in Figures 1, 2, and 3, respectively¹. Two observers monitored the four Reach 2 study plots, each person monitoring two plots on either side of the river. Due to the difficulty of access and consequent safety concerns, two observers were used to monitor the two study plots in Reach 3. In Reach 4, it was thought that one observer could monitor both study plots, especially as, since Reach 4 was furthest downstream of the dam, river levels would still be well above minimum flows and the varial zone would still be largely inundated at dark.

¹ For consistency, this study used the same reach designations as in the six-year Black Canyon Monitoring Study. Reach 1 is a control reach, above Alexander Reservoir at Soda Springs.

Table 1. Stranding plot distribution and river bank length.

Reach	Plot	River Bank Length (feet)	Initial Assessment of Stranding Potential	Final Assessment of Stranding Potential ¹
2 (0.25 mile below Grace Dam)	1	317	High	High
	2	270	Low	Low
	3	317	Medium	High
	4	211	Low	Medium
3 (3.4 miles below Grace Dam)	2	182	High	High
	4	217	High	High
4 (5.9 miles below Grace Dam)	1	260	Medium	Medium
	2	250	Low	Low

Notes:

1. Stranding potential was reassessed after observing the effects of the 0.25 feet per hour down ramp rate on the first boater-flow day.

2.3 FISH STRANDING MONITORING ON BOATER-FLOW DAYS

On April 20, June 1, and July 13, PacifiCorp began releasing the Scheduled Ramp Rate Test Flows at approximately 08:30 hours, reaching the maximum flow for the release by 10:00 hours. Cirrus crews reached each study plot during the maximum flow period in early to mid-afternoon. Each plot was divided into 10 subplots with roughly equal shoreline distance, and stakes were placed along the high-water edge at the boundaries between these subplots.

Ramp-down began at Grace Dam at 15:00 hours for the April 20, June 1, and July 13 releases. Fish stranding monitoring efforts commenced at Reach 2 between 14:00 and 14:30 hours. Previous observations found that it could take several hours for levels to decline downstream following the initiation of down-ramp, so monitoring began somewhat later in Reach 3, between 16:22 and 16:42 hours, and in Reach 4, between 15:46 and 17:00 hours. Where an observer was assigned two study plots to monitor, they began monitoring the downstream plot on the top of the hour and attempted to begin the next plot upstream at 30 minutes after the top of the hour.

At the beginning of each monitoring period, observers placed stakes on the boundaries between subplots at the river's edge on a line perpendicular to the direction of the river. They measured the horizontal distance the river had receded from the previous stake to allow calculation of the areal extent of the varial zone. As they placed stakes at the river's edge, observers also searched for fish stranded in thick vegetation or in pools that had become separated from the main flow. These efforts continued until dark, as late as 22:30 hours at Reach 2 (the minimum flows from Grace Dam should have been reached by 21:30), 20:47 hours at Reach 3, and 20:57 hours at Reach 4.

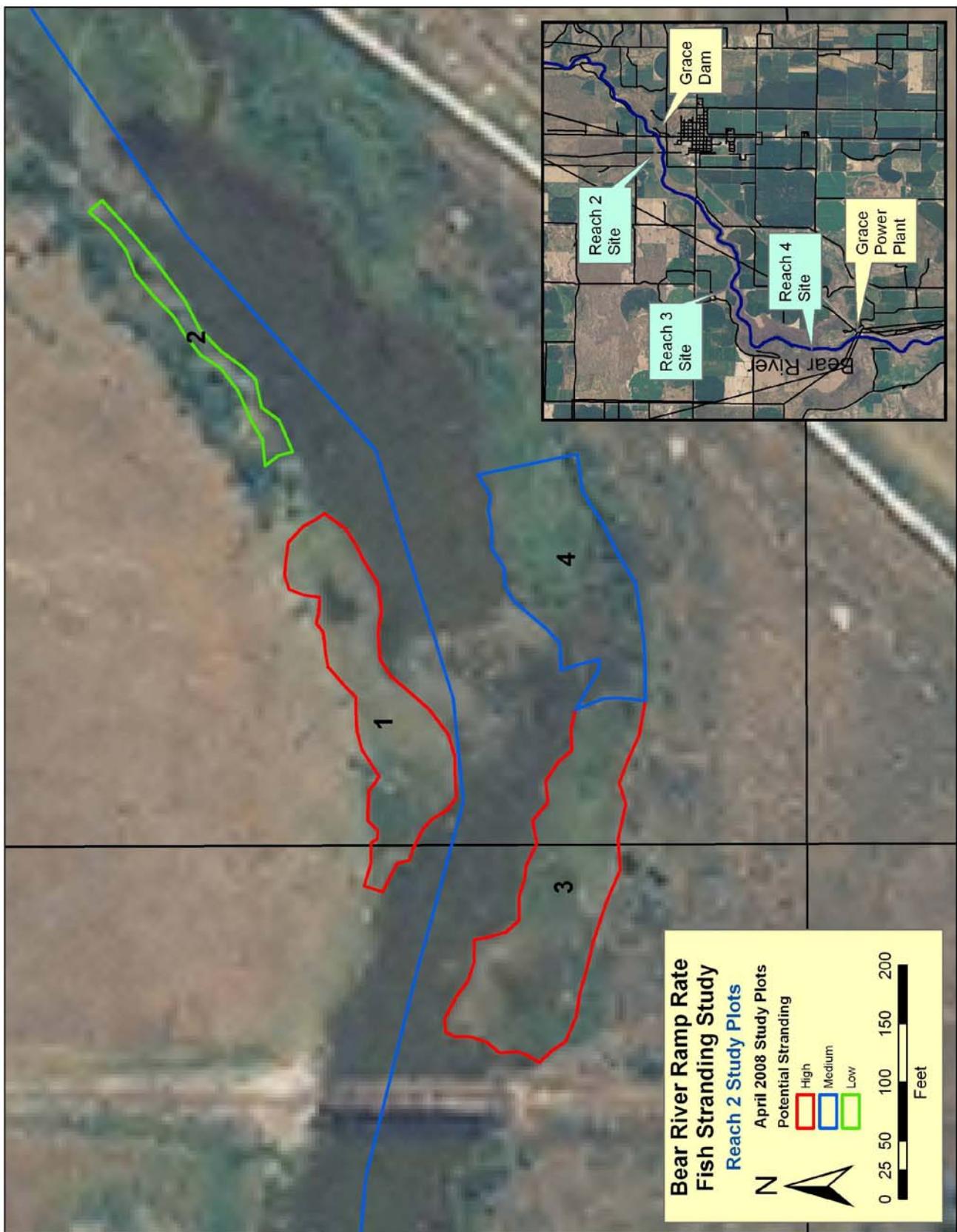


Figure 1. Location of study plots in Reach 2.



Figure 2. Location of study plots in Reach 3.



Figure 3. Location of study plots in Reach 4.

Because flows typically had not reached minimum instream levels by dark on the Scheduled Ramp Rate Test Flow days (especially in Reaches 3 and 4), two observers returned to the sites the following day to search for stranded fish or the tracks of predators that might have taken stranded fish from pools. They also documented the final location of the river's edge.

Data, including species, size, and subplot location of stranded fish, and the time and horizontal distance the river had receded each hour in each subplot, were recorded in handheld computers enabled with GPS positioning.

2.4 WATER QUALITY, STAGE CHANGE MONITORING AND FISH ELECTRO-SHOCKING

Because there were no stranded fish observed following either the Varial Mapping Flow on April 14 or the first Scheduled Ramp Rate Test Flow on April 20, there were concerns that the turbid conditions and unusually high flows of these two events had either killed the fish that had been in these reaches or flushed them downstream. Some discussion ensued among ECC members on the effects of the turbid water quality conditions during these releases. These concerns are largely documented in a series of emails reproduced in Appendix A.

To assess whether any fish remained in Black Canyon after the Varial Mapping Flow and first Scheduled Ramp Rate Test Flow, the Idaho Division of Fish and Game (IDFG) offered to search for fish using electro-shocking techniques. PacifiCorp hired Cirrus to assist this effort, which was conducted on May 1 along a 100-meter transect in each of Reaches 2 and 4.

During the first Varial Mapping Flow release on April 14, a high level of turbidity was observed, prompting a representative from the Idaho Department of Environmental Quality to take a single grab sample from the footbridge in Reach 4 for analysis. For the first Scheduled Ramp Rate Test Flow release on April 20, personnel from the Idaho Department of Water Quality monitored water quality, including turbidity and dissolved oxygen (DO), immediately before, during, and after the release, using a YSI 6920 sonde equipped with 6136 turbidity probe. Measurements were taken at the bottom of Black Canyon near the footbridge in Reach 4 at approximately 1-minute intervals, beginning in the morning before water levels began to rise and continuing into the late afternoon when water levels began to drop. Because of interest by members of the ECC, particularly IDFG and IDEQ, PacifiCorp thereafter hired Ecosystems Research Institute (ERI) to monitor Water Quality during the remaining releases on June 1 and July 13 in 2008 and during the releases in subsequent years of the study.

In order to acquire a temporal profile of river levels during a ramp-down, stage change was monitored by PacifiCorp at five locations during the Scheduled Ramp Rate Test Flow on June 1. Level loggers were placed in the river at the following locations: below the Grace Dam at the boater put-in, just above the established USGS stream gage in Reach 2, mid-canyon in Reach 3, above the boater take-out in Reach 4, and downstream in the Cove Powerhouse tailrace.

2.5 FISH STRANDING MINIMIZATION PLAN (FISH RESCUE)

As required in PacifiCorp's License Article 409, a fish stranding minimization plan was developed and approved by the ECC, and carried out by Cirrus personnel on each release, including the Flow Dependent Boater Event on Saturday, July 12, during which the fish stranding study was not conducted. The protocol involved two personnel walking the banks of the river within the first 0.25 mile below Grace Dam, beginning when down-ramp commenced and ending at dark. These personnel used nets to probe any isolated pools to look for stranded fish. They attempted to rescue any fish found and return them to the river.

3.0 RESULTS

This section describes the sizes and characteristics of the stranding potential zones and study plots, as well as the stranded fish found during the Scheduled Ramp Rate Test Flows.

3.1 WEATHER CONDITIONS

Weather conditions for the Varial Mapping and Scheduled Ramp Rate Flow days, as recorded by Mesowest (<http://www.met.utah.edu>) from a weather station ("KU78") in Soda Springs, ID are shown in Table 2.

Table 2. Weather conditions within 24 hours after noon on flow days at Soda Springs, ID.				
	Flow Date			
	April 14	April 20	June 1	July 13¹
Air Temp Min/Max (F)	32-57	28-33	39.2 – 73.4	66.2-77.0
Wind Speed Min/Max (mph)	0-24	7-18	0 – 21	Calm
Sky and precipitation	Occasional light snow and ice fog	Overcast	Partly cloudy	Mostly clear

Notes:
¹Only two observations available.

3.2 STRANDING POTENTIAL MAPPING

Preliminary estimation of stranding potential identified approximately 60 percent of the river bank as high potential, 20 percent as medium, and 20 percent as low. The river boundaries for minimum instream flow, 1,200 cfs flow and different stranding potential zones were documented on the laminated aerial photo mosaics. Study plots were then delineated from these field maps and recorded in mapping software (see Figures 1, 2, and 3 above).

3.3 FLOWS AND STUDY PLOT CHARACTERISTICS

Target maximum flow for the April 14 Varial Mapping Flow was 1,200 cfs. Target flows for the April 20, June 1 and July 13 Scheduled Ramp Rate Test Flows were initially 900 cfs. However, the Black Canyon Boater Program described in the Project's Settlement Agreement and License requires up to 16 releases of water for boaters between April 1 and July 15 when the inflow to Grace Forebay is 700 cfs or greater. On the weekend of July 12 and 13, the inflow to Grace Forebay was forecasted to be 1,200 cfs, so the requirement to release this amount superseded the 900 cfs Scheduled Ramp Rate Test Flow targeted for July 13. The target down-ramp rate for all 2008 releases was 0.25 feet per hour measured at the Grace gage below Grace Dam. Figure 4 shows the river levels actually measured at five river locations for the June 1 event. (See Appendix F for a table of river stage at these locations.)

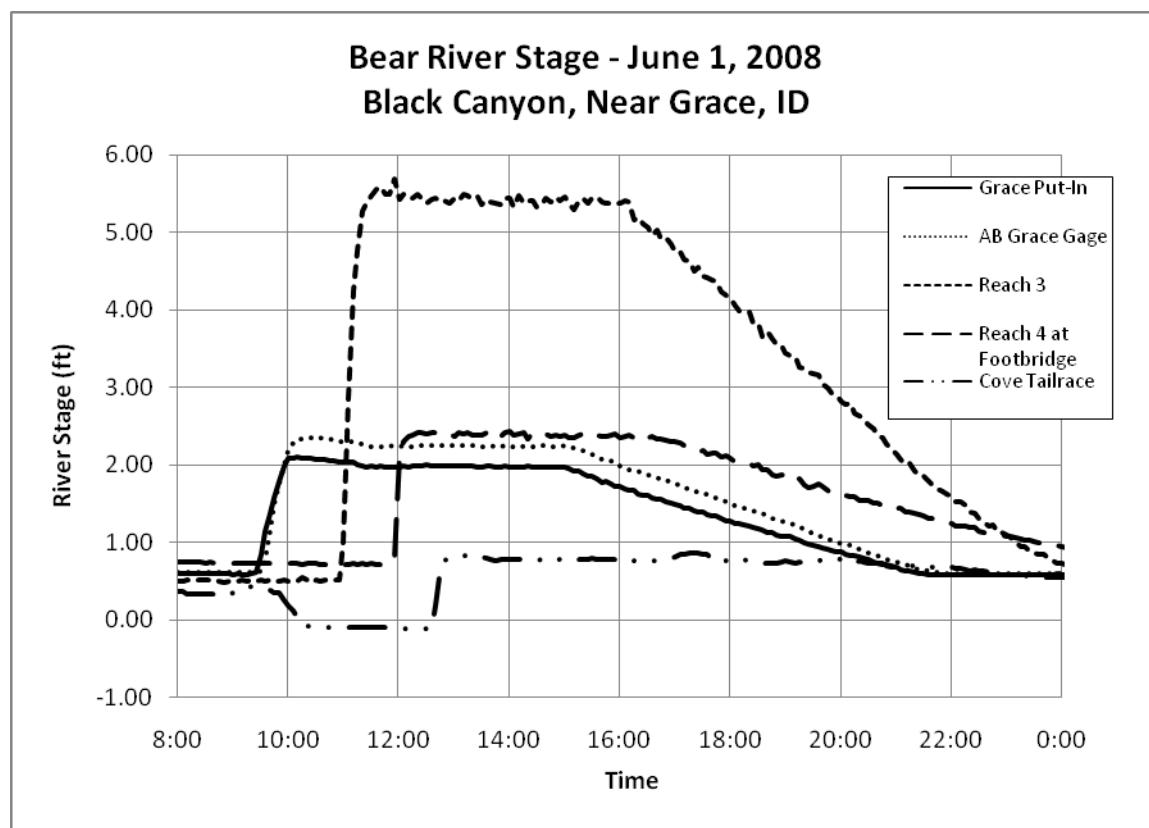


Figure 4. Bear River stage change (ft) at five monitoring locations June 1, 2008.

First, note that the down-ramp rate was very close to the target at the Grace Put-in. Second, note the lag of approximately 1.5 hours for the river to begin rising at Reach 3, approximately 3.4 miles below the put-in at the Grace Dam, and 2.5 hours for the river level to begin rising at the footbridge below Reach 4, approximately 6.0 miles below the Grace Dam. Third, note the slightly longer lag times for flows to return to minimum levels - approximately 3.5 hours from the dam to Reach 3, and 4.5 hours from the dam to Reach 4. The greater lag for flow decreases is consistent with temporary storage of water in small pools and vegetation. Finally, note the initial drop in water level at the Cove tailrace to below typical minimum flows as the water was diverted from

the pipeline into Black Canyon. River flows weren't restored until the pulse flowing down the river channel rejoined the power plant outlet below Reach 4. Data from PacifiCorp operators indicated that down-ramp rates for the other days were very similar.

The areal extents of the study plots measured during the down-ramp periods for each boater-flow day were different in Reaches 2, 3, and 4, and are shown in Table 3.

Vegetation patterns also differed between the plots. In Reach 2, the river banks on river right² are denuded of shrubs and forbs due to heavy grazing. On river left, shrubs and small trees are still growing on the banks and wetland plants occupy the shallows. Flat areas with small pools are found after down-ramp on both sides, particularly in plots 1 and 3. Exposed areas on river right also include numerous small pockets created by the hooves of livestock.

Reach 3 lies in the bottom of the canyon below steep lava boulder fields. Dense, thick shrubs grow along the river's edge, some of which are inundated during high flows. Several wide, flat areas are exposed at low water with small pools remaining after releases. Study plots were chosen to monitor these pools in particular. By the July release date, extensive nettle and wetland plants were growing throughout the shallows.

Reach 4 is somewhat different from either Reach 2 or 3. The river is wide but constrained by steep banks of basalt boulders, resulting in only small increases in river width during the 900 – 1,200 cfs flows. Thick stands of wetland plants (primarily cattail) grow along the river's edge and are inundated during high flows. Lowering water levels trapped silts in the cattails, but created only a few small isolated pools.

There are also occasional islands with shrubs and wetland-specific plants in Reaches 2 and 4. These were not surveyed due to the difficulty of safe access.

Table 3. Dimensions and areal extent of study plots.

Reach	Plot	Stranding Potential	Total Plot Length (ft)	Average Width (ft)			Total Plot Area (sq ft)		
				Study Day 1 Apr 20	Study Day 2 Jun 1	Study Day 3 Jul 13	Study Day 1 Apr 20	Study Day 2 Jun 1	Study Day 3 Jul 13
2	1	High	317	43.9	50.7	49.3	13,903	16,184	15,712
2	2	Low	270	5.8	6.1	6.9	1,565	1,647	1,879
2	3	High	317	84.0	73.4	64.4	26,943	23,538	20,948
2	4	Medium	211	41.5	33.0	25.8	8,645	6,823	5,344
3	2	High	182	37.5	37.0	40.4	6,792	6,787	7,354
3	4	High	217	29.9	35.1	37.7	6,531	7,566	8,163
4	1	Medium	260	12.4	12.7	12.7	3,236	3,305	3,314
4	2	Low	250	11.4	11.9	11.8	2,848	2,968	2,956

² "River right" and "river left" refer to the respective sides of the river when facing downstream.

As a result of monitoring plots in Reach 2, the two plots on the south bank were reassessed as having a greater potential for stranding. The downstream plot was reassigned from medium to high stranding potential, and the upstream plot was reassigned from low to medium.

3.4 STRANDED FISH

Table 4 summarizes the fish found stranded on each of the three study days. No stranded fish were found in any of the study plots following the first Scheduled Ramp Rate Test Flow on April 20, either during down-ramp or the next day. Observers made special efforts to find fish, listening and probing in the cattails and looking under and around rocks. Air temperatures the night after the release dropped to below freezing, which resulted in ice covering the depressions in some of the study plots. However, insects were observed on the surface of the receding water beneath the ice, indicating a lack of insect predators and corresponding low probability of trapped fish.

Table 4. Fish species, numbers, and approximate sizes found stranded in study plots.				
Reach	Plot	Study Day 1 – Apr 20	Study Day 2 – Jun 1	Study Day 3 – Jul 13
2	1	0	1 longnose dace (~76 mm)	~ 10 redside shiners (13 mm); ~ 50 redside shiners (6 mm)
2	2	0	0	0
2	3	0	0	~ 10 redside shiners (19 mm); ~ 50 redside shiners (13 mm); ~ 50 redside shiners (6 mm)
2	4	0	0	1 redside shiner (13 mm); ~ 40 redside shiners (6 mm)
3	2	0	0	0
3	4	0	0	0
4	1	0	1 longnose dace (~76 mm)	0
4	2	0	1 unknown (~76 mm)	0

On the second Scheduled Ramp Rate Test Flow, only three small fish were found, all of which were discovered the afternoon of the down-ramp. The two identified fish were both longnose dace. The third was glimpsed for only a moment before it disappeared in dense vegetation and the water became too cloudy for pursuit.

After the third Scheduled Ramp Rate Test Flow, no fish were found during daylight hours. However, because this day became a Flow Dependent Boater Event, the flows were higher than earlier (1,200 cfs instead of 900 cfs), and river levels had not fully retreated to minimum instream flows by dark. The next day, crews found numerous small fish trapped in isolated pools in Reach 2 in plots 1, 3, and 4. It was not possible to get accurate numbers or rescue most of these small

fish, as the fish scattered to hide in the vegetation on the edge of the pools and efforts to probe the pools caused immediate re-suspension of fine sediments that obscured visibility. Observers reported that they had immediately noticed the stranded fish, increasing their confidence that, if fish *had* been stranded in isolated pools during previous monitoring, they would likely have been discovered. Observers also reported some frustration at not being able to adequately probe the denser stands of vegetation without destroying it, especially in Reach 4.

Detailed observations over all of the study days on Reach 2 included:

1. Stranding conditions:
 - a. When fish were found after the last Scheduled Ramp Rate Test Flow, larger pools had larger numbers of fish.
 - b. Lowering river levels left approximately 20 – 40 pools.
 - c. Most pools averaged 10 sq ft; one was >200 sq ft.
 - d. Depths in the pools ranged from 1 – 24 in.
 - e. Even on the last Scheduled Ramp Rate Test Flow day, not many fish were found in the deepest (18 – 24 in) pool.
2. Differences right and left:
 - a. River flows were faster on river right (plots 1 and 2); smaller fish may have congregated on river left (plots 3 and 4) in the shallows to avoid aquatic predators.
 - b. Horses on river right were walking around in the pools during the last Scheduled Ramp Rate Test Flow Day (when significant numbers of fish were found stranded) and this disturbance may have reduced stranding by pushing fish back into the main flow as water levels were dropping.
 - c. Hoof prints from livestock created small pools on river right but did not strand fish.
 - d. Ground on river left was not grazed and there were no hoof prints in the exposed varial zone.
 - e. The only predators found were garter snakes, and they were only found only on the last study day and only on river right.
3. River scouring may have created new drainage channels over the course of the study. By the third Scheduled Ramp Rate Test Flow, the largest pool in the lowest part of plot 3 had become connected to the river.
4. Stranded fish were found in both vegetated and open pools.
5. Approximately three person-hours were devoted to search efforts on the days following the Scheduled Ramp Rate Test Flows.

Detailed observations on Reach 3 included:

1. Nettle grew to dense thickets by mid-July.
2. By the end of the third Scheduled Ramp Rate Test Flow day, springs had cut channels across pools from shoreline to the main river channel, so pools were not as isolated as earlier. Bars were very silty, but the bottoms of channels created by the

springs were gravel. There were three springs flowing through plot 2; two springs flowing through plot 4.

3. Streambank vegetation was very thick, making it difficult or impossible to reach the river's edge until levels had dropped 2 – 3 feet from the highest point.
4. River levels had not dropped enough by dark on the last boater-flow day (1,200 cfs) for any isolated pools to form.
5. Stranding hazards probably exist only in pools, not in streamside vegetation.
6. Approximately three person-hours were devoted to search efforts on the days following the Scheduled Ramp Rate Test Flows.
7. The stranding potential still seems high based on the observed morphology, despite not finding fish.

Detailed observations on Reach 4 included:

1. Reach 4 is more difficult to search than the other reaches due to dense stands of cattails and other emergent wetland plants. Large openings between the bases of the plants could provide possible refuges (and stranding potential). Mud and silt had accumulated around base of many of the plants, creating new channels that could isolate pockets of water.
2. At the end of the last Scheduled Ramp Rate Test Flow there were only approximately five small pockets of standing water – the largest was less than 1 square foot in area.
3. Approximately three person-hours were devoted to search efforts on the days following the Scheduled Ramp Rate Test Flows.

3.5 FISH ELECTRO-SHOCKING AND WATER QUALITY MEASUREMENTS

The results of the May 1 fish shocking efforts are shown in Table 5. Extensive efforts were not made to probe every rock and deep pool, so these results probably understate the number of fish present. Rainbow trout were identified as hatchery fish based on freeze brands.

Detailed results from the water quality monitoring during five release events are included in Appendix B, C, D, and E. Data have not been scrubbed for outliers. Summary statistics shown in Table 6 below show the maximum and minimum DO concentrations and turbidity at each monitoring location for the respective release. DO does not appear to have been a problem during any of the releases. Note that the maximum turbidity on July 13 was lower than on other test days, presumably because there had been a flushing flow the day before.

Table 5. Fish detected from electro-fish sampling on the Black Canyon section of the Bear River, May 1, 2008.

Reach 2 Species	Length (mm)	Mass (g)
Hatchery rainbow trout	271	212
Hatchery rainbow trout	323	324
Hatchery rainbow trout	281	178
Hatchery rainbow trout	249	176
Redside shiner	89	5
Redside shiner	63	3
Redside shiner	94	8
Redside shiner	91	10
Redside shiner	80	4
Utah sucker	189	68
Utah sucker	290	290
Reach 4 Species	Length (mm)	Mass (g)
Hatchery rainbow trout	410	750
Hatchery rainbow trout	285	218
Hatchery rainbow trout	366	595
Hatchery rainbow trout	273	191
Hatchery rainbow trout	284	227
Hatchery rainbow trout	281	230
Hatchery rainbow trout	266	218
Hatchery rainbow trout	260	198
Hatchery rainbow trout	324	364
Hatchery rainbow trout	355	445
Hatchery rainbow trout	260	182
Hatchery rainbow trout	394	609
Hatchery rainbow trout	310	302
Hatchery rainbow trout	382	511
Hatchery rainbow trout	348	441
Hatchery rainbow trout	278	161
Hatchery rainbow trout	370	427
Hatchery rainbow trout	340	386
Hatchery rainbow trout	288	268
Redside shiner	91	20
Redside shiner	99	15
Redside shiner	95	20
Redside shiner	92	20
Redside shiner	81	15
Longnose dace	92	15
Longnose dace	81	10
Longnose dace	106	20
Longnose dace	98	20
Longnose dace	92	15
Longnose dace	108	30
Longnose dace	96	15
Longnose dace	92	15
Sculpin	74	10

Table 6. Minimum and maximum dissolved oxygen (DO) and turbidity measured on the Bear River above Grace Dam and below Black Canyon on each release.

Release	Description	Date and Time Range	Grace Forebay DO Concentration (mg/L)	Reach 4 Footbridge DO Concentration (mg/L)	Grace Forebay Turbidity (NTU)	Reach 4 Footbridge Turbidity (NTU)
1	Varial Mapping: Flow = 1,200 cfs	April 14	N/A	N/A	N/A	1,380 ¹
2	Scheduled Ramp Rate Test Flow = 900 cfs	April 20 10:20-15:50 (1 min intervals)	N/A	Min 9.62 Max 11.47	N/A	Min 7 Max 178
3	Scheduled Ramp Rate Test Flow = 900 cfs	May 30 14:16 - June 2 14:01 (15 min intervals)	Min 7.59 Max 14.36	Min 8.04 Max 11.6	Min 11 Max 20	Min 4 Max 1,781
4	Flow Dependent Boater Event = 1,200 cfs	July 11 12:01 – July 13 08:00 (15 min intervals)	Min 7.64 Max 9.08	Min 8.97 Max 12.76	Min 16 Max 33	Min 2 Max 514
5	Scheduled Ramp Rate Test Flow superseded by Flow Dependent Boater Event = 1,200 cfs	July 13 08:01 – July 15 12:01 (15 min intervals)	Min 7.81 Max 8.85	Min 8.7 Max 11.46	Min 22 Max 40	Min 6 Max 101

Note:

1. One informal grab sample taken; not analyzed until after 48 hour holding time expired. See Appendix B.

3.6 FISH STRANDING MINIMIZATION (FISH RESCUE)

Personnel monitoring the first 0.25 – mile section of river below Grace Dam to rescue any fish found reported no stranded fish on April 14 or 20, July 12, or July 13. They did observe one rainbow trout stranded in a pool on June 1. An attempt to rescue the fish resulted in it perishing.

4.0 DISCUSSION

Very few fish were found following the 0.25-foot-per-hour down-ramps in 2008. There were concerns expressed by various observers that the Varial Mapping Flow on April 14, after no large flows for several years, had created such turbidity that fish were either killed or flushed downstream. Turbidity levels were lower on April 20, but still very high, increasing from 7.1 NTU to over 130 NTU within 5 minutes. The electro-shocking effort on May 1, however, demonstrated that there were still fish in the upper reaches of the river, although it is unknown whether they had returned from downstream or simply emerged from safe places after the releases.

The presence of significant numbers of stranded redside shiners after the July 13 release is consistent with the life stage of this species. Redside shiners probably did not spawn until water temperatures warmed up in mid to late June, and an ideal spawning area exists in the shallows created by a beaver dam just upstream of the Reach 2 study plots. Cutthroat and rainbow trout spawn earlier in the spring, but there is little or no suitable spawning habitat below the dam above Reach 2, consistent with no fish having been found stranded.

It is still possible, of course, that fish were stranded but not detected. This is especially true in Reach 4 where vegetation grows in very thick stands along the edge of the river. Levels of effort were similar across the study plots, but some consideration should be given to increasing this level of effort in Reach 4 in future years.

Based on experience finding fish and observing changing water levels and vegetation, stranding potential may be justifiably increased to high in Reach 2 on plot 4. If spring channels continue to provide exit routes from pools in Reach 3, perhaps the hazard rating should be reduced to moderate. In Reach 4, the hazard ratings still seem reasonable; i.e., moderate for plot 1 and low for plot 2.

It may make sense to reduce the frequency of measuring river levels in the study plots, especially in Reach 3 where streamside vegetation is very difficult to navigate. Stranding potential conditions do not seem to occur until the river reaches the lowest levels. Alternatively, other plots may be selected or vegetation could be cleared at access points for each subplot.

Future years will use faster down-ramp rates which may increase or decrease stranding potential. The faster down-ramp rates will also make it more likely that minimum instream flows will be reached before dark on the boater-flow day, especially in Reach 2.

Varial zones and stranding potential for the entire Black Canyon section were delineated on hard-copy laminated maps in order to estimate relative percentages of different stranding categories for allocating study plots. Before more accurate calculations of the areal extent of the different stranding potentials can be made for statistical analysis, these zones will have to be digitized.

APPENDIX A. DISCUSSION AMONG ENVIRONMENTAL COORDINATING COMMITTEE MEMBERS REGARDING EFFECTS OF TURBIDITY ON FISH POPULATIONS

-----Original Message-----

From: "Stenberg, Mark" <Mark.Stenberg@PacifiCorp.com>
To: "Arn Berglund" 05/01/2008 11:30 AM <Arn_Berglund@blm.gov>, "Blaine Newman" <blaine_newman@blm.gov>, "Charlie Vincent" <charliev@xmission.com>, "Damien Miller" (Damien_Miller@fws.gov) <Damien_Miller@fws.gov>, "Davies, Eve" <Eve.Davies@PacifiCorp.com>, "Greg Mladenka" <Greg.Mladenka@deq.idaho.gov>, "Hunter Osborne" <hosborne@shoshonebannocktribes.com>, "Jim Capurso" <jcapurso@fs.fed.us>, "Jim Mende" <jmende@idfg.idaho.gov>, "Kevin Colburn" <kcolburn@amwhitewater.org>, "Kevin Lewis" <kevin@idahorivers.org>, "Kit McGurn" <kmcgurn@greateryellowstone.org>, "Lynn Van Every" <Lynn.VanEvery@deq.idaho.gov>, "Marv Hoyt" <mhoyt@greateryellowstone.org>, "Mary Lucachick" <mlucachi@idpr.state.id.us>, "Miriam Hugentobler" <yazoo@xmission.com>, "Stenberg, Mark" <Mark.Stenberg@PacifiCorp.com>, "Susan_Rosebrough@nps.gov" <Susan_Rosebrough@nps.gov>, "Teuscher,David" <dteuscher@idfg.idaho.gov>, "Warren Colyer" <wcolyer@tu.org>, "Yvette A. Tuell (ytuell@shoshonebannocktribes.com)" <ytuell@shoshonebannocktribes.com>
Cc: "j.gangemi@oasisenviro.com" <j.gangemi@oasisenviro.com>, nartz@cirruses.com <nartz@cirruses.com>, "bdixon@cirruses.com" <bdixon@cirruses.com>
Subject: PreliminaryStrandingReport20080428.doc

Good Morning, here is quick report that I asked Cirrus to provide on the actions leading up to the April 20 stranding test and the results of that test. We can discuss at our upcoming ECC meeting.

Mark

(See attached file: PreliminaryStrandingReport20080428.doc)

-----Original Message-----

From: James Capurso [mailto:jcapurso@fs.fed.us]
Sent: Monday, May 05, 2008 7:31 AM
To: Stenberg, Mark
Cc: Arn Berglund; 'bdixon@cirruses.com'; Blaine Newman; Charlie Vincent; Damien Miller (Damien_Miller@fws.gov); Teuscher,David; Davies, Eve; Greg Mladenka; Hunter Osborne; Jim Mende; 'j.gangemi@oasisenviro.com'; 'Kevin Colburn'; Kevin Lewis; Kit McGurn; Lynn Van Every; Stenberg, Mark; Marv Hoyt; Mary Lucachick; nartz@cirruses.com; Susan_Rosebrough@nps.gov; Warren Colyer; Miriam Hugentobler; Yvette A. Tuell (ytuell@shoshonebannocktribes.com)
Subject: Re: PreliminaryStrandingReport20080428.doc

Mark,

I did not see a section in this prelim report that speaks to the potential of the study being compromised by the high flow released the week previous to the study in which fish could have

been flushed, injured/killed by high turbidity, or stranded. I suggest that gets included for proper documentation.

jim

James Hammer Capurso
Forest Fisheries Biologist
Caribou-Targhee National Forest
1405 Hollipark Drive
Idaho Falls, ID 83401
Office: 208-557-5780
Cell: 208-313-7799
Fax: 208-557-5826

-----Original Message-----

From: Stenberg, Mark [mailto:Mark.Stenberg@PacifiCorp.com]
Sent: Monday, May 05, 2008 7:43 AM
To: James Capurso
Cc: Arn Berglund; 'bdixon@cirruses.com'; Blaine Newman; Charlie Vincent; Damien Miller
(Damien_Miller@fws.gov); Teuscher,David; Davies, Eve; Greg Mladenka; Hunter Osborne; Jim
Mende; 'j.gangemi@oasisenviro.com'; 'Kevin Colburn'; Kevin Lewis; Kit McGurn; Lynn Van
Every; Marv Hoyt; Mary Lucachick; nartz@cirruses.com; Susan_Rosebrough@nps.gov; Warren
Colyer; Miriam Hugentobler; Yvette A. Tuell (ytuell@shoshonebannocktribes.com) Subject: RE:
PreliminaryStrandingReport20080428.doc

Good Morning,

Let me know what you think about Jim's concerns. If folks think the study is compromised at this point all we can do is cancel the remaining scheduled releases and tests for this year and start again this coming year with three tests. We can't get to the end of this study and have questions about the validity of the results.

Mark Stenberg
PacifiCorp Energy
(208) 547-7305

-----Original Message-----

From: Kevin Colburn [mailto:kevin@americanwhitewater.org]
Sent: Monday, May 05, 2008 11:21 AM
To: 'Stenberg, Mark'; 'James Capurso'
Cc: 'Arn Berglund'; bdixon@cirruses.com; 'Blaine Newman'; 'Charlie Vincent'; 'Damien Miller';
Teuscher,David; 'Davies, Eve'; 'Greg Mladenka'; 'Hunter Osborne'; Mende,Jim;
j.gangemi@oasisenviro.com; 'Kevin Colburn'; 'Kevin Lewis'; 'Kit McGurn'; 'Lynn Van Every';
'Marv Hoyt'; 'Mary Lucachick'; nartz@cirruses.com; Susan_Rosebrough@nps.gov; 'Warren
Colyer'; 'Miriam Hugentobler'; 'Yvette A. Tuell' Subject: RE:
PreliminaryStrandingReport20080428.doc

All,

The first pulse flow down any dewatered river mobilizes sediment and some vegetation and likely some lentic type macroinvertebrates. This marks the transformation of the river from essentially a chain of lentic systems to a single lotic system. Any "impacts" are to sediment, plants, and bugs that do not belong in the places where they have come to be in the river. Essentially the "impact" of the release fixes the impact of dewatering and resets the system to a more natural state. I describe it as like brushing your teeth for the first time in a few years. It can be a bit gross but the result is vastly preferable, and subsequent brushings are not nearly as gross. It is a normal and anticipated part of any regulated river restoration project involving a bypassed river reach. We have seen similar situations on many rivers we have worked on, where the first release in years does a lot of work, and subsequently the rivers are exponentially healthier. It is pretty exciting to me, as I have watched systems that had almost become terrestrial become fully/mostly functional rivers again based on restored base and pulse flows.

With that said, I would propose that any specific impacts of the FIRST pulse flow are moot since those impacts were likely unique to that release, caused as much by the duration of dewatering as by the pulse flow, and will not re-occur under any release protocol that includes annual and somewhat regular pulse flows. If the impacts are not unique then we'll see them again and address them, if they are unique then they are moot because they were inevitable, intentional and will not re-occur. Essentially it is water under the bridge. What we are really interested in is the effects of season, volume, ramp rate, and pulse flows in general on an ongoing basis as part of an annual program. Our study will yield exactly those results and has in no way been compromised in my opinion.

If large numbers of fish were "flushed, injured/killed by high turbidity, or stranded" during the first pulse flow I suspect we'll see those results in subsequent population monitoring, and the stranding/flushing effects should re-occur with subsequent releases. Big picture, Every time the Black Canyon has received a spill after a period of dewatering lasting a year or more a big sediment event surely happened. We can't keep spills from ever happening again and mobilizing sediment, but regular pulse flows will reduce the sediment mobilization of any subsequent spill that does occur. Point to ponder.

One of the things our group has not discussed in detail is what ecological shifts we should expect or desire from this pulse flow program. Given that the anticipated movement of sediment with the first release caused some concern when it occurred, I think we should start some discussions of other anticipated changes. For example, we may see fewer diptera and more ephemeroptera or plecoptera which would likely be viewed as a good thing. In some systems pulse flows may select against newts and for salamanders, against sunfish and for trout, against some plants and for others, etc. We obviously would not say that all change is bad (the Bear is not perfect and/or natural now), so we should think ahead about what both positive and negative changes might look like. You may have had these conversations before my involvement, if so, disregard these last comments as the ramblings of the new guy.

Kevin Colburn
National Stewardship Director
American Whitewater
1035 Van Buren St
Missoula, MT 59802
(O) 406-543-1802
(C) 828-712-4825
kevin@amwhitewater.org

-----Original Message-----

From: Teuscher, David [mailto:dteusche@idfg.idaho.gov]
Sent: Monday, May 05, 2008 7:10 PM
To: Kevin Colburn; Stenberg, Mark; James Capurso
Cc: Arn Berglund; bdixon@cirus.com; Blaine Newman; Charlie Vincent; Damien Miller; Davies, Eve; Greg Mladenka; Hunter Osborne; Mende, Jim; j.gangemi@oasisenviro.com; Kevin Colburn; Kevin Lewis; Kit McGurn; Lynn Van Every; Marv Hoyt; Mary Lucachick; nartz@cirus.com; Susan_Rosebrough@nps.gov; Warren Colyer; Miriam Hugentobler; Yvette A. Tuell
Subject: RE: PreliminaryStrandingReport20080428.doc

If the whitewater flows were modeled after a normal spring runoff event, I would agree with many of the comments made by Kevin Colburn. However, the 6 to 8 hour pulse is not a normal river flow event and could result in very different impacts to aquatic and terrestrial wildlife.

I agree with Jim Capurso that the preliminary fish stranding report should include discussion of the initial flow event. Additionally, in our study plan development, the ECC overlooked the potential impacts to nesting waterfowl and other riparian wildlife species. The first pulse of water likely destroyed waterfowl nests. I should have been thinking broader when reviewing the Black Canyon monitoring plan. Those kinds of oversights need to be discussed further and if appropriate included in our final analysis.

Dave

David Teuscher
Regional Fishery Manager
Idaho Department of Fish and Game
208-232-4703

-----Original Message-----

From: Kevin Colburn [mailto:kevin@americanwhitewater.org]
Sent: Tuesday, May 06, 2008 9:13 AM
To: 'Teuscher,David'; Stenberg, Mark; 'James Capurso'
Cc: 'Arn Berglund'; bdixon@cirus.com; 'Blaine Newman'; 'Charlie Vincent'; 'Damien Miller'; Davies, Eve; 'Greg Mladenka'; 'Hunter Osborne'; 'Mende, Jim'; j.gangemi@oasisenviro.com; 'Kevin Colburn'; 'Kevin Lewis'; 'Kit McGurn'; 'Lynn Van Every'; 'Marv Hoyt'; 'Mary Lucachick'; nartz@cirus.com; Susan_Rosebrough@nps.gov; 'Warren Colyer'; 'Miriam Hugentobler'; 'Yvette A. Tuell'
Subject: RE: PreliminaryStrandingReport20080428.doc

All,

I certainly have no problem with any/all reports discussing the first flow. I just don't think that the first flow rendered the study invalid, especially since the first flow was in the study plan and design.

At risk of getting stranded in the weeds myself, I would like to respond to the flow issues brought up in the past two emails. Dave and Arn are presumably correct that the pulse flows do not mimic the natural flow regime perfectly. Neither does the un-naturally flat and low base flow, and neither do the semi-annual spills and occasional irrigation delivery or maintenance flows.

This is a totally manipulated hydrograph. The base flows were designed not based on the historic flows so much as on the habitat they cover, this is functional restoration rather than structural restoration. We cannot put the structure of the hydrograph back so long as water is being diverted for hydro and irrigation. All we can hope to do is restore ecological (and recreational) functions using relatively small amounts of water. Pulse flows can do that - we have apparently already shown that they can move sediment and emergent vegetation out that builds up - which is a vital ecological function of high flows. Pulse flow variables that are worth considering are frequency, magnitude, timing, and duration. We can't have all these things but we can at least get a couple. We are in the right ball park for the magnitude of a moderate pulse and the timing, not sure about the frequency and the duration is definitely shorter than natural. Just because the flows are not 100% natural does not mean that they cannot have some ecological functions that are shared with natural high flows. I understand and respect the concern that the differences may have unintended consequences - just as the similarities may have benefits. That is why we are investing in a robust study - to tease out any impacts and address them.

At this point we are talking in hypotheticals since we have no data on the first release, but I think our study remains valid and that we should push on. We do have 3 years for things to pan out, and next year we can analyze the first release of the season in detail. I support discussing the first release in any reports in the appropriate context. I also am sensitive to your concerns and want to make the pulse flows have as many benefits and as few impacts as possible. Hopefully we'll learn enough through the study to do just that. Lastly, I appreciate this dialog and am glad that we can respectfully and openly talk/write through this stuff.

Kevin Colburn
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American Whitewater
1035 Van Buren St
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(O) 406-543-1802
(C) 828-712-4825
kevin@amwhitewater.org

-----Original Message-----

From: Stenberg, Mark [mailto:Mark.Stenberg@PacifiCorp.com]
Sent: Tuesday, May 06, 2008 2:07 PM
To: Arn Berglund; Blaine Newman; Charlie Vincent; Damien Miller (Damien_Miller@fws.gov); Davies, Eve; Greg Mladenka; Hunter Osborne; Jim Capurso; Jim Mende; 'Kevin Colburn'; Kevin Lewis; Kit McGurn; Lynn Vanevery; Marv Hoyt; Mary Lucachick; Miriam Hugentobler; Stenberg, Mark; Susan_Rosebrough@nps.gov; Teuscher, David; Warren Colyer; Yvette A. Tuell (ytuell@shoshonebannocktribes.com)
Subject: RE: PreliminaryStrandingReport20080428.doc

Good Afternoon:

I would encourage everyone to get their points out via email. I will append these emails to the preliminary report and we will have a thorough discussion at the ECC meeting of all of these points and where we are going with this study.

I am very concerned, based on your comments, that our 1,200 cfs varial mapping flow may have effected a change that resulted in the zero fish stranding rate measured during the 4/20 stranding

test. If this is the case we do not have the information, or confidence in it, that will allow us to look closely at stranding as a comparative function of downramp rate/velocity of retreating water.

Please note that the preliminary report you received was not included in the study plan scope. The study plan required the consultant to provide the raw numbers from the stranding plots (Zero). I thought it would be to our benefit to have a more detailed description and maps of the stranding plots and the level of effort exerted looking for fish so I requested that they produce it.

Thank you for your thoughts on this complicated matter. I look forward to discussing with all of you later this month.

Sincerely,

Mark Stenberg
PacifiCorp Energy
(208) 547-7305

-----Original Message-----

<Lynn.Vanevery@deq.idaho.gov>

To: <Mark.Stenberg@PacifiCorp.com>, <Arn_Berglund@blm.gov>, <blaine_newman@blm.gov>, <charliev@xmission.com>, <Damien_Miller@fws.gov>, <Eve.Davies@PacifiCorp.com>, <Greg.Mladenka@deq.idaho.gov>, <hosborne@shoshonebannocktribes.com>, <jcapurso@fs.fed.us>, <jmende@idfg.idaho.gov>, <kcolburn@amwhitewater.org>, <kevin@idahorivers.org>, <kmcgurn@greateryellowstone.org>, <mhoyt@greateryellowstone.org>, <m lucachi@idpr.state.id.us>, <yazoo@xmission.com>, <Susan_Rosebrough@nps.gov>, <dteuscher@idfg.idaho.gov>, <wcolyer@tu.org>, <ytuell@shoshonebannocktribes.com>

Cc:

Subject

RE: PreliminaryStrandingReport20080428.doc

05/07/2008 03:24 PM

Folks:

Just a short note to weigh into this discussion. I appreciate the comments from those of you already weighing in. We have debated at length in the past the potential ecological consequences of short-duration, quickly ramped (both up and down) flows in the Black Canyon and have put together, based on the best technical and financial resources we have at hand, a monitoring plan to address those impacts be they positive or negative. That being said, there are obviously things we may not have fully understood, such as short-term impacts on water quality, and thus did not include the right type of monitoring to document those events. In DEQ's opinion we have the responsibility to ensure that water quality standards are being achieved, however, we certainly have some latitude to interpret potential exceedances of criteria as they pertain to ultimate attainment or violation of criteria (in this instance - turbidity). As Kevin has pointed out, the first flush will likely be the worst (we know we busted the turbidity criteria during that release), but we also monitored the second event a few days later and also busted the turbidity criteria in that event.

I would propose (somewhat based on the law of unintended consequences) that we continue to monitor water quality during the remaining releases this year (DEQ is meeting with PacifiCorp tomorrow to discuss how to effect this) to see how the system is responding. At least this gives us the documentation of a few more variables and an additional mechanism to evaluate compliance of the project with state water quality standards.

We are also of the opinion that the initial flows do not negate the study effort for this year. We have too much invested already and I would hate to pull the plug now. Thanks for all your input.

Lynn Van Every
Regional Water Quality Manager
444 Hospital Way #300
Pocatello ID 83201
208.236.6160 (office)
208.236.6168 (fax)
208.251.8830 (cell)
lynn.vanevery@deq.idaho.gov

-----Original Message-----

From: <Damien_Miller@fws.gov>
To: <Lynn.Vanevery@deq.idaho.gov>
Cc: <Arn_Berglund@blm.gov>, <blaine_newman@blm.gov>, <charliev@xmission.com>, <dteuscher@idfg.idaho.gov>, "Davies, Eve" <Eve.Davies@PacifiCorp.com>, <Greg.Mladenka@deq.idaho.gov>, <chosborne@shoshonebannocktribes.com>, <jcapurso@fs.fed.us>, <jmende@idfg.idaho.gov>, <kcolburn@amwhitewater.org>, <kevin@idahorivers.org>, <kmcgurn@greateryellowstone.org>, "Stenberg, Mark" <Mark.Stenberg@PacifiCorp.com>, <mhoyst@greateryellowstone.org>, <mlucachi@idpr.state.id.us>, <Susan_Rosebrough@nps.gov>, <wcolyer@tu.org>, <yazoo@xmission.com>, <ytuell@shoshonebannocktribes.com>, <gary_burton@fws.gov>
Subject: RE: PreliminaryStrandingReport20080428.doc
Date: Wed, 7 May 2008 16:32:43 -0600

Hello All,

Good information, dialogue and discussion on all points. I support moving forward with the study as planned and suggest we continue to monitor and discuss outcomes as we gather more information from the next scheduled releases. I support including these discussion topics, concerns, background information and conclusions in the study plan reports.

Regards,
Damien

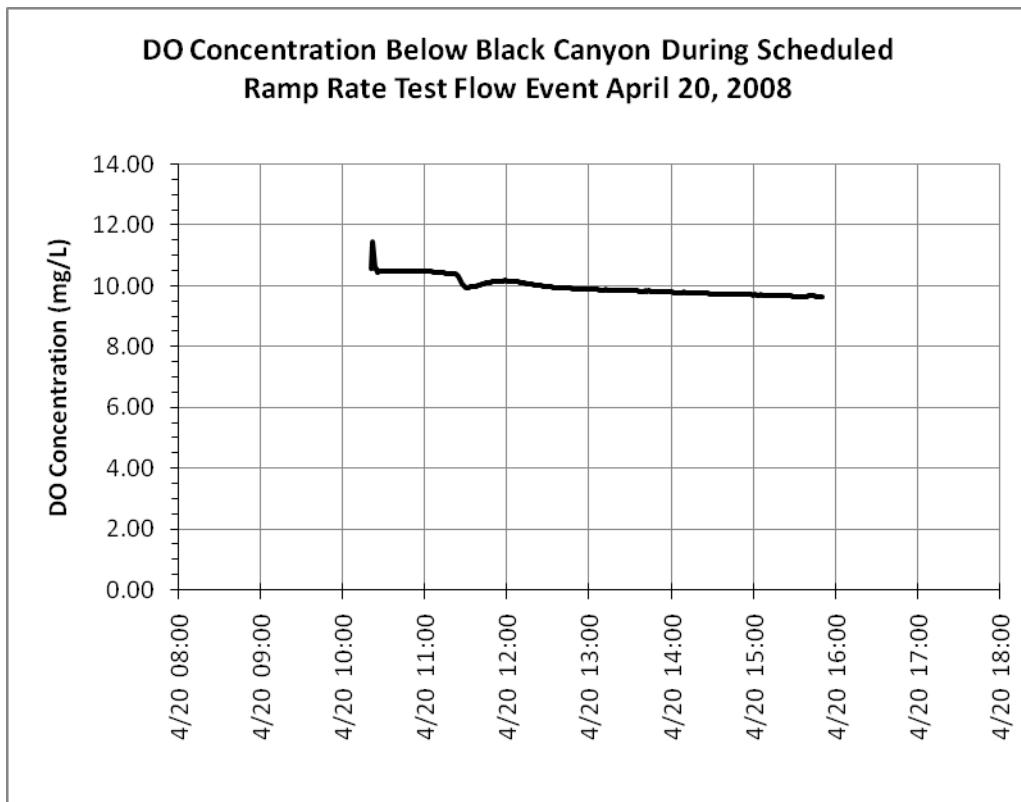
Damien Miller
Field Office Supervisor
4425 Burley Dr, Suite A
Chubbuck, ID 83202
phone: 208-237-6975 ext 31
Fax: 208-237-8213
damien_miller@fws.gov

APPENDIX B. IDFG WATER QUALITY GRAB SAMPLE ANALYSIS, APRIL 14, 2008 FLOW

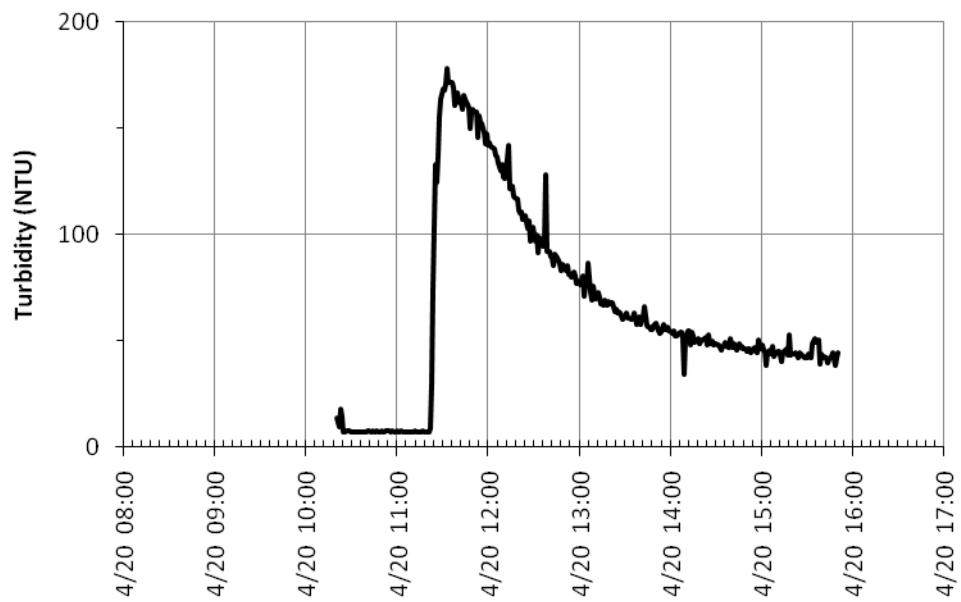
		IDAHO DEPARTMENT OF HEALTH & WELFARE			
G.L. "BUTCH" OTTER - Governor RICHARD M. ARMSTRONG - Director		COS			
Dept. of Env. Quality - Pocatello Office Attention: Greg Mladenka 444 Hospital Way Suite 300 Pocatello, ID 83201		<p>Laboratory Order ID 042108-02 (Please refer to this number when contacting the lab)</p>			
Customer ID:	DEQP	Date Collected:	4/14/2008		
Project ID:	8601	Time Collected:	12:00 PM		
Site:	TM03	Date/Time Received:	4/18/2008		
Matrix:	Surface Water	Collected By:	IDF&G		
Customer Sample ID:	Bear R - Black Canyon	Lab Sample Number:	0804-0354		
Test	Method	Result	Units	Analysis Date	Analyst
Residue, Total Suspended Solids	EPA 160.2	3480	mg/L	4/21/2008	S.Harrington
Residue, Total Volatile	EPA 160.4	307	mg/L	4/23/2008	S.Mathews
Turbidity	EPA 180.1	1380	NTU	4/18/2008	S.Mathews
This sample arrived in the laboratory after the 48 hour holding time of turbidity samples had expired.					

APPENDIX C. IDEQ WATER QUALITY MEASUREMENTS ON APRIL 20, 2008 AT BOTTOM OF BLACK CANYON.

Below are DO and turbidity data – in chart and table form – for a monitoring site on the Bear River at the bottom of Black Canyon, during a Scheduled Ramp Rate Test Flow event on April 20, 2008. These data have not been scrubbed for outliers in turbidity.



**Turbidity Below Black Canyon During Scheduled
Ramp Rate Test Flow Event April 20, 2008**



BLACK CANYON AT FOOT BRIDGE, 20 APRIL 2008.

DATE/TIME	DO CONCENTRATION (MG/L)	TURBIDITY (NTU)
4/20 10:20	10.55	13.5
4/20 10:21	11.47	9.6
4/20 10:22	10.56	17.8
4/20 10:23	10.56	14.2
4/20 10:24	10.45	7.2
4/20 10:25	10.46	7.1
4/20 10:26	10.48	7.4
4/20 10:27	10.48	7.5
4/20 10:28	10.48	7.4
4/20 10:29	10.48	7.2
4/20 10:30	10.48	7.1
4/20 10:31	10.48	7.3
4/20 10:32	10.48	7.3
4/20 10:33	10.48	7.1
4/20 10:34	10.48	7.2
4/20 10:35	10.47	7.2
4/20 10:36	10.48	7.2
4/20 10:37	10.47	7.3
4/20 10:38	10.48	7.2
4/20 10:39	10.48	7.3
4/20 10:40	10.48	7.4

BLACK CANYON AT FOOT BRIDGE, 20 APRIL 2008.		
DATE/TIME	DO CONCENTRATION (MG/L)	TURBIDITY (NTU)
4/20 10:41	10.48	7.6
4/20 10:42	10.47	7.2
4/20 10:43	10.47	7.4
4/20 10:44	10.47	7.2
4/20 10:45	10.48	7.2
4/20 10:46	10.48	7.4
4/20 10:47	10.48	7.3
4/20 10:48	10.48	7.3
4/20 10:49	10.48	7.4
4/20 10:50	10.48	7.2
4/20 10:51	10.47	7.3
4/20 10:52	10.48	7.4
4/20 10:53	10.48	7.4
4/20 10:54	10.48	7.5
4/20 10:55	10.48	7.1
4/20 10:56	10.49	7.6
4/20 10:57	10.48	7.1
4/20 10:58	10.48	7.2
4/20 10:59	10.49	7.5
4/20 11:00	10.49	7.1
4/20 11:01	10.47	7.1
4/20 11:02	10.47	7.4
4/20 11:03	10.46	7.3
4/20 11:04	10.46	7.3
4/20 11:05	10.45	7.1
4/20 11:06	10.45	7.1
4/20 11:07	10.45	7.1
4/20 11:08	10.45	7.1
4/20 11:09	10.44	7
4/20 11:10	10.44	7.3
4/20 11:11	10.43	7.4
4/20 11:12	10.42	7.2
4/20 11:13	10.42	7.1
4/20 11:14	10.41	7.1
4/20 11:15	10.41	7.2
4/20 11:16	10.4	7.5
4/20 11:17	10.4	7
4/20 11:18	10.39	7.3
4/20 11:19	10.39	7.1
4/20 11:20	10.39	7.1
4/20 11:21	10.38	8.9
4/20 11:22	10.37	29.3
4/20 11:23	10.31	74.8
4/20 11:24	10.22	132.8
4/20 11:25	10.13	124.6

BLACK CANYON AT FOOT BRIDGE, 20 APRIL 2008.		
DATE/TIME	DO CONCENTRATION (MG/L)	TURBIDITY (NTU)
4/20 11:26	10.07	137.5
4/20 11:27	9.99	155.1
4/20 11:28	9.96	163.5
4/20 11:29	9.94	168.7
4/20 11:30	9.94	168.2
4/20 11:31	9.94	170.9
4/20 11:32	9.95	178.2
4/20 11:33	9.96	171.6
4/20 11:34	9.96	171.7
4/20 11:35	9.97	171.8
4/20 11:36	9.98	169.4
4/20 11:37	10	160.6
4/20 11:38	10.01	166.1
4/20 11:39	10.02	166.9
4/20 11:40	10.04	161.9
4/20 11:41	10.05	162.6
4/20 11:42	10.06	158.7
4/20 11:43	10.08	165.8
4/20 11:44	10.08	163.7
4/20 11:45	10.09	161.4
4/20 11:46	10.1	159.6
4/20 11:47	10.11	150.1
4/20 11:48	10.12	157.1
4/20 11:49	10.13	159.1
4/20 11:50	10.13	157.5
4/20 11:51	10.14	157.6
4/20 11:52	10.14	145.4
4/20 11:53	10.15	155.6
4/20 11:54	10.15	152.8
4/20 11:55	10.15	152.1
4/20 11:56	10.15	148.2
4/20 11:57	10.16	142.6
4/20 11:58	10.16	147.4
4/20 11:59	10.15	142.1
4/20 12:00	10.15	143.4
4/20 12:01	10.15	141.5
4/20 12:02	10.14	140.8
4/20 12:03	10.14	140.2
4/20 12:04	10.13	137.4
4/20 12:05	10.13	136.9
4/20 12:06	10.12	133.8
4/20 12:07	10.12	129.8
4/20 12:08	10.11	133.1
4/20 12:09	10.1	127.2
4/20 12:10	10.09	126.3

BLACK CANYON AT FOOT BRIDGE, 20 APRIL 2008.		
DATE/TIME	DO CONCENTRATION (MG/L)	TURBIDITY (NTU)
4/20 12:11	10.09	129.2
4/20 12:12	10.08	142.1
4/20 12:13	10.07	121.7
4/20 12:14	10.06	121.6
4/20 12:15	10.05	122.6
4/20 12:16	10.04	118.2
4/20 12:17	10.04	117.4
4/20 12:18	10.03	116.5
4/20 12:19	10.02	111
4/20 12:20	10.02	109.8
4/20 12:21	10.01	110.5
4/20 12:22	10.01	107.2
4/20 12:23	10	109
4/20 12:24	9.99	106.1
4/20 12:25	9.98	102.8
4/20 12:26	9.98	106.7
4/20 12:27	9.97	97.1
4/20 12:28	9.97	103.7
4/20 12:29	9.96	99.7
4/20 12:30	9.96	96.9
4/20 12:31	9.95	100
4/20 12:32	9.95	91.1
4/20 12:33	9.94	98.5
4/20 12:34	9.93	95.1
4/20 12:35	9.93	94.4
4/20 12:36	9.93	95.5
4/20 12:37	9.92	128.1
4/20 12:38	9.92	92.1
4/20 12:39	9.92	92.1
4/20 12:40	9.91	89.4
4/20 12:41	9.91	89.2
4/20 12:42	9.91	85.4
4/20 12:43	9.9	90.8
4/20 12:44	9.9	88.9
4/20 12:45	9.9	87.8
4/20 12:46	9.9	86
4/20 12:47	9.89	82.9
4/20 12:48	9.89	86.2
4/20 12:49	9.89	85.5
4/20 12:50	9.89	83.2
4/20 12:51	9.88	85.3
4/20 12:52	9.88	81
4/20 12:53	9.88	81.3
4/20 12:54	9.88	80.1
4/20 12:55	9.87	82.1

BLACK CANYON AT FOOT BRIDGE, 20 APRIL 2008.		
DATE/TIME	DO CONCENTRATION (MG/L)	TURBIDITY (NTU)
4/20 12:56	9.87	80.4
4/20 12:57	9.87	76.8
4/20 12:58	9.87	78.3
4/20 12:59	9.86	77.5
4/20 13:00	9.86	76.6
4/20 13:01	9.86	80.8
4/20 13:02	9.86	70.6
4/20 13:03	9.86	76.2
4/20 13:04	9.86	75.8
4/20 13:05	9.86	86.5
4/20 13:06	9.86	72.8
4/20 13:07	9.85	69.3
4/20 13:08	9.85	75.5
4/20 13:09	9.85	72
4/20 13:10	9.85	69.8
4/20 13:11	9.86	73
4/20 13:12	9.85	70.3
4/20 13:13	9.85	67
4/20 13:14	9.85	68.3
4/20 13:15	9.84	66.9
4/20 13:16	9.84	68.9
4/20 13:17	9.84	66.7
4/20 13:18	9.84	68.4
4/20 13:19	9.84	67.2
4/20 13:20	9.84	67.7
4/20 13:21	9.83	68
4/20 13:22	9.83	63.4
4/20 13:23	9.83	64.8
4/20 13:24	9.83	63.3
4/20 13:25	9.83	63.9
4/20 13:26	9.83	63.3
4/20 13:27	9.82	60.3
4/20 13:28	9.82	61.5
4/20 13:29	9.82	61.8
4/20 13:30	9.82	62.8
4/20 13:31	9.82	60.7
4/20 13:32	9.82	60.7
4/20 13:33	9.82	60.3
4/20 13:34	9.82	60.5
4/20 13:35	9.82	62.9
4/20 13:36	9.81	60.8
4/20 13:37	9.81	57.5
4/20 13:38	9.81	61.3
4/20 13:39	9.81	57.4
4/20 13:40	9.82	60.8

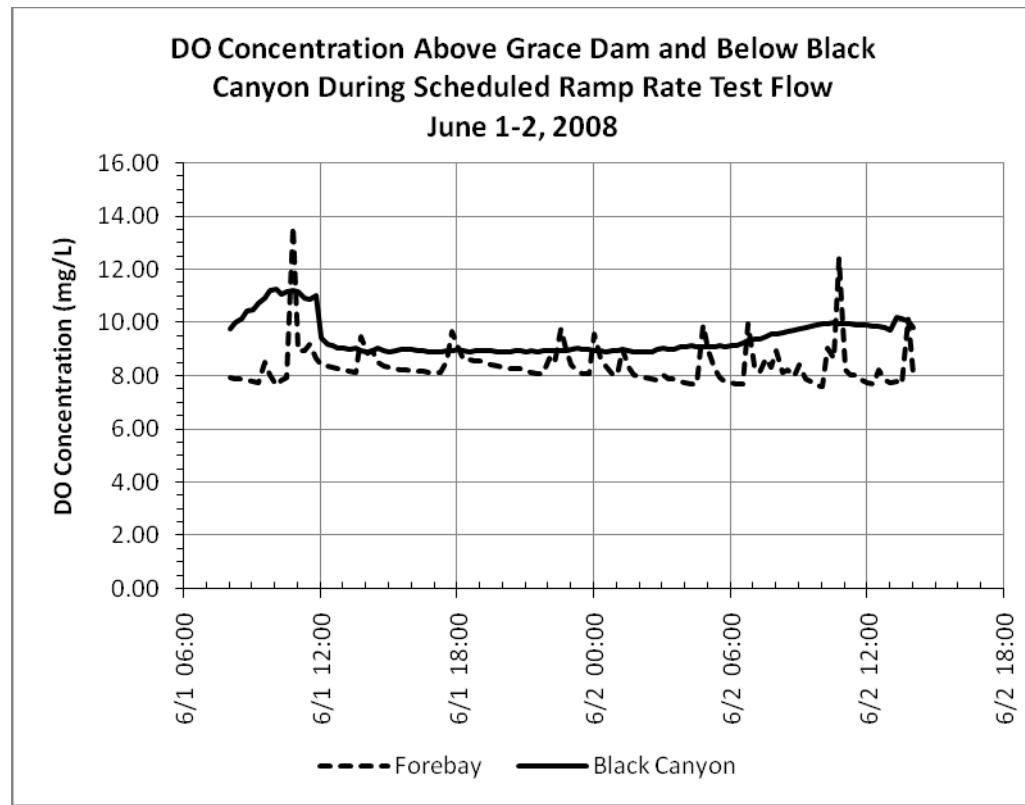
BLACK CANYON AT FOOT BRIDGE, 20 APRIL 2008.		
DATE/TIME	DO CONCENTRATION (MG/L)	TURBIDITY (NTU)
4/20 13:41	9.81	61
4/20 13:42	9.82	66.3
4/20 13:43	9.82	57.3
4/20 13:44	9.81	56.5
4/20 13:45	9.81	56.3
4/20 13:46	9.81	55.4
4/20 13:47	9.81	55
4/20 13:48	9.81	56.8
4/20 13:49	9.8	58.3
4/20 13:50	9.8	56.2
4/20 13:51	9.8	54.7
4/20 13:52	9.8	53.6
4/20 13:53	9.8	54
4/20 13:54	9.79	57.9
4/20 13:55	9.79	55.3
4/20 13:56	9.79	55
4/20 13:57	9.79	56.3
4/20 13:58	9.78	54.4
4/20 13:59	9.78	54.9
4/20 14:00	9.77	53.7
4/20 14:01	9.77	54.6
4/20 14:02	9.77	52.3
4/20 14:03	9.76	52.4
4/20 14:04	9.76	52.6
4/20 14:05	9.76	54.1
4/20 14:06	9.75	54.2
4/20 14:07	9.76	50.9
4/20 14:08	9.79	34.4
4/20 14:09	9.75	50.8
4/20 14:10	9.76	54.6
4/20 14:11	9.76	54.6
4/20 14:12	9.76	48
4/20 14:13	9.76	54.2
4/20 14:14	9.75	52.3
4/20 14:15	9.75	49.1
4/20 14:16	9.74	50.7
4/20 14:17	9.74	51.3
4/20 14:18	9.74	48.7
4/20 14:19	9.73	50.1
4/20 14:20	9.74	50.7
4/20 14:21	9.73	51.3
4/20 14:22	9.73	51.8
4/20 14:23	9.73	48.1
4/20 14:24	9.73	53.1
4/20 14:25	9.73	48.4

BLACK CANYON AT FOOT BRIDGE, 20 APRIL 2008.		
DATE/TIME	DO CONCENTRATION (MG/L)	TURBIDITY (NTU)
4/20 14:26	9.72	49.7
4/20 14:27	9.72	47.8
4/20 14:28	9.72	48.8
4/20 14:29	9.72	48.5
4/20 14:30	9.72	47.7
4/20 14:31	9.72	48.2
4/20 14:32	9.71	45.6
4/20 14:33	9.71	47.4
4/20 14:34	9.71	47.4
4/20 14:35	9.71	49
4/20 14:36	9.71	47.2
4/20 14:37	9.71	46.5
4/20 14:38	9.71	51
4/20 14:39	9.71	48.3
4/20 14:40	9.71	46.5
4/20 14:41	9.71	48.8
4/20 14:42	9.71	45.3
4/20 14:43	9.72	46.8
4/20 14:44	9.71	48.7
4/20 14:45	9.7	46.7
4/20 14:46	9.7	47.5
4/20 14:47	9.7	46.2
4/20 14:48	9.7	46.3
4/20 14:49	9.7	45
4/20 14:50	9.7	46
4/20 14:51	9.7	46.2
4/20 14:52	9.7	44.5
4/20 14:53	9.69	46.4
4/20 14:54	9.69	46.7
4/20 14:55	9.69	45.2
4/20 14:56	9.69	44.5
4/20 14:57	9.69	50.2
4/20 14:58	9.68	46.3
4/20 14:59	9.69	48
4/20 15:00	9.69	45.7
4/20 15:01	9.68	45
4/20 15:02	9.68	38.5
4/20 15:03	9.68	44.1
4/20 15:04	9.69	45.3
4/20 15:05	9.68	43.7
4/20 15:06	9.68	47.1
4/20 15:07	9.68	42.3
4/20 15:08	9.68	44
4/20 15:09	9.68	45.2
4/20 15:10	9.68	45.1

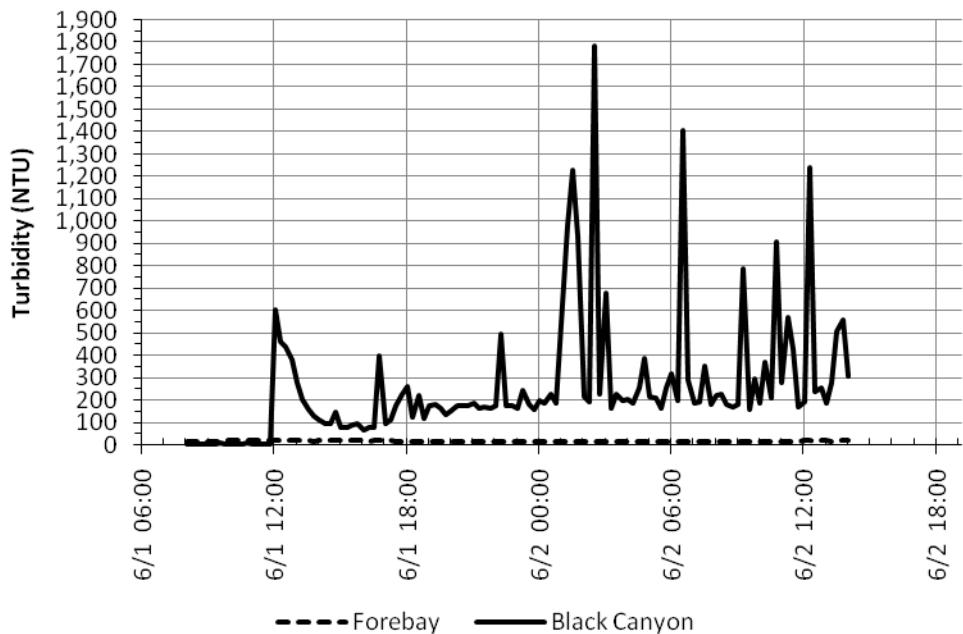
BLACK CANYON AT FOOT BRIDGE, 20 APRIL 2008.		
DATE/TIME	DO CONCENTRATION (MG/L)	TURBIDITY (NTU)
4/20 15:11	9.67	43.4
4/20 15:12	9.67	39.9
4/20 15:13	9.67	44.1
4/20 15:14	9.67	45.2
4/20 15:15	9.66	46.3
4/20 15:16	9.67	43.2
4/20 15:17	9.66	52.8
4/20 15:18	9.66	43.2
4/20 15:19	9.66	44
4/20 15:20	9.66	44
4/20 15:21	9.66	44.4
4/20 15:22	9.65	43
4/20 15:23	9.65	42.1
4/20 15:24	9.65	44.3
4/20 15:25	9.65	43.1
4/20 15:26	9.65	42.7
4/20 15:27	9.64	42.2
4/20 15:28	9.64	42.5
4/20 15:29	9.64	42.1
4/20 15:30	9.64	43.8
4/20 15:31	9.64	42.1
4/20 15:32	9.64	48.8
4/20 15:33	9.63	49.8
4/20 15:34	9.63	50.9
4/20 15:35	9.64	48.9
4/20 15:36	9.64	50.3
4/20 15:37	9.63	39.1
4/20 15:38	9.63	43.5
4/20 15:39	9.66	42.1
4/20 15:40	9.65	42.6
4/20 15:41	9.65	41.8
4/20 15:42	9.66	39.4
4/20 15:43	9.66	41.6
4/20 15:44	9.62	42
4/20 15:45	9.63	42.5
4/20 15:46	9.63	44.2
4/20 15:47	9.64	38.1
4/20 15:48	9.64	41.7
4/20 15:49	9.64	44.4

APPENDIX D. ERI WATER QUALITY MEASUREMENTS IN FOREBAY ABOVE GRACE DAM AND AT FOOTBRIDGE BELOW BLACK CANYON ON BEAR RIVER NEAR GRACE, ID, MAY 30 - JUNE 2, 2008.

Below are DO and turbidity data – in chart and table form – for two monitoring sites on the Bear River, in the forebay above Grace Dam and at the bottom of Black Canyon, during the Scheduled Ramp Rate Test Flow event on June 1, 2008. These data have not been scrubbed for outliers in turbidity.



**Turbidity Above Grace Dam and Below Black Canyon
During Scheduled Ramp Rate Test Flow
June 1-2, 2008**



DO AND TURBIDITY DURING JUNE 1-2, 2008 SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
5/30 14:16	13.73	10.82	17.4	4.8
5/30 14:31	12.37	10.91	17.9	5.1
5/30 14:46	11.37	10.79	19.4	5
5/30 15:01	14.36	10.55	18.3	5
5/30 15:16	13.08	10.49	18.1	5.9
5/30 15:31	11.95	10.25	17.7	4.9
5/30 15:46	11.2	10.19	17.8	6.2
5/30 16:01	10.68	10.14	18.1	5.1
5/30 16:16	10.3	10.53	17.8	5.1
5/30 16:31	9.93	10.72	17.3	5
5/30 16:46	9.65	9.97	16.9	5
5/30 17:01	9.52	9.58	17.4	5.2
5/30 17:16	10.22	9.28	18.4	5.2
5/30 17:31	9.86	8.98	16.7	5.1
5/30 17:46	9.57	8.75	18	5.3
5/30 18:01	9.29	9.23	18.1	5.4
5/30 18:16	12.36	9.88	18	5.2

DO AND TURBIDITY DURING JUNE 1-2, 2008 SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
5/30 18:31	10.08	9.98	17.4	6.1
5/30 18:46	9.76	9.82	17.6	5.1
5/30 19:01	9.64	9.35	17.1	5.5
5/30 19:16	9.78	8.92	16	5.4
5/30 19:31	11.03	8.96	15.3	5.6
5/30 19:46	11.11	8.99	15.5	5.5
5/30 20:01	10.63	8.72	14.8	5.8
5/30 20:16	10.28	8.52	15.2	5.4
5/30 20:31	10.06	8.39	15.5	5.6
5/30 20:46	9.81	8.3	15.8	5.1
5/30 21:01	9.45	8.22	15.7	5.6
5/30 21:16	9.43	8.09	16.6	5.4
5/30 21:31	10.06	8.06	16.1	6.6
5/30 21:46	9.92	8.04	15.5	9.5
5/30 22:01	9.74	8.06	15.3	5.6
5/30 22:16	9.5	8.12	15.6	5.5
5/30 22:31	9.35	8.12	15.1	5.7
5/30 22:46	9.22	8.16	14.8	5.6
5/30 23:01	9.1	8.15	15	5.7
5/30 23:16	9	8.15	15.2	5.6
5/30 23:31	8.91	8.17	14.8	5.3
5/30 23:46	9.8	8.07	15.1	5.6
5/31 00:01	9.49	8.14	14.5	5.4
5/31 00:16	9.25	8.08	15.3	5.8
5/31 00:31	9.01	8.17	14.7	6.3
5/31 00:46	8.86	8.26	14.7	5.9
5/31 01:01	8.75	8.26	14.8	7.8
5/31 01:16	9.76	8.26	14.6	6.2
5/31 01:31	9.55	8.34	14.5	5.7
5/31 01:46	9.12	8.4	14.4	5.9
5/31 02:01	8.93	8.45	14.2	6.2
5/31 02:16	8.76	8.49	14.6	6.5
5/31 02:31	9.5	8.46	14.6	6.2
5/31 02:46	9.01	8.42	14.4	6.2
5/31 03:01	8.73	8.41	14.1	6.3
5/31 03:16	8.58	8.4	14.1	6.5
5/31 03:31	9.22	8.41	14.5	6.4

DO AND TURBIDITY DURING JUNE 1-2, 2008 SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
5/31 03:46	8.81	8.42	14.3	6.6
5/31 04:01	8.5	8.45	14.7	6.4
5/31 04:16	8.37	8.48	14.5	7.1
5/31 04:31	8.27	8.51	14.8	7
5/31 04:46	9.45	8.55	14.7	9.3
5/31 05:01	9.03	8.56	15.4	6.5
5/31 05:16	8.66	8.6	14.7	6.5
5/31 05:31	8.37	8.61	14.9	7.5
5/31 05:46	12.74	8.64	15.1	7.3
5/31 06:01	9.3	8.68	15.3	7.1
5/31 06:16	8.71	8.78	15.8	7.7
5/31 06:31	8.43	8.9	15.7	6.7
5/31 06:46	8.28	9.08	15.2	6.8
5/31 07:01	8.23	9.22	15.1	6.5
5/31 07:16	8.98	9.35	15	6.5
5/31 07:31	8.56	9.51	15.9	6.3
5/31 07:46	8.25	9.68	14.8	6.1
5/31 08:01	8.12	9.8	15.1	6.5
5/31 08:16	8.01	9.94	17	6.2
5/31 08:31	7.9	10.06	14.7	6.8
5/31 08:46	8.85	10.18	15.1	5.9
5/31 09:01	8.36	10.34	15.7	5.6
5/31 09:16	8.07	10.49	16.1	5.6
5/31 09:31	9.76	10.72	15.3	5.4
5/31 09:46	9.12	10.9	15.1	5.6
5/31 10:01	8.43	11.02	15.6	5.3
5/31 10:16	8.18	11.13	16.1	5.2
5/31 10:31	8.07	11.25	17.8	5.1
5/31 10:46	7.98	11.28	15.6	5
5/31 11:01	8.54	11.31	16.3	5
5/31 11:16	8.16	11.41	17.1	5.1
5/31 11:31	8.61	11.47	17.2	5.3
5/31 11:46	8.1	11.54	17.5	4.8
5/31 12:01	7.92	11.57	16.6	4.7
5/31 12:16	7.94	11.53	17.5	5.3
5/31 12:31	8.62	11.6	16.2	5
5/31 12:46	8.21	11.28	17.3	5

DO AND TURBIDITY DURING JUNE 1-2, 2008 SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
5/31 13:01	8	10.7	16.2	4.7
5/31 13:16	8.13	10.26	15.9	5.5
5/31 13:31	8.08	10.1	15.1	4.8
5/31 13:46	8.01	10.49	15.8	4.7
5/31 14:01	8.1	10.24	17	4.8
5/31 14:16	12.47	10.1	16.4	4.5
5/31 14:31	8.81	10.47	15.8	5
5/31 14:46	8.6	10.33	16.7	4.8
5/31 15:01	8.48	10.32	13.1	5
5/31 15:16	9.31	10.47	13.4	4.8
5/31 15:31	9.1	11.03	13.3	4.7
5/31 15:46	8.87	11.33	13	4.7
5/31 16:01	8.7	11.4	12.5	6.8
5/31 16:16	8.32	11.33	15.1	4.8
5/31 16:31	8.27	11.15	15.1	5.7
5/31 16:46	8.23	11.02	14.6	4.8
5/31 17:01	8.44	10.98	14.8	5.2
5/31 17:16	8.54	10.63	13.1	5.5
5/31 17:31	9.89	10.25	13.1	4.5
5/31 17:46	9.24	9.93	12.1	4.7
5/31 18:01	9.6	9.62	12.2	4.8
5/31 18:16	9.17	9.63	13.1	4.7
5/31 18:31	8.98	9.63	11.7	4.8
5/31 18:46	9.01	9.76	12.1	6.5
5/31 19:01	8.96	9.72	11.7	4.6
5/31 19:16	8.91	9.58	12.3	4.8
5/31 19:31	9.79	9.37	11.7	5.1
5/31 19:46	9.36	9.11	11	5.4
5/31 20:01	9.07	8.81	11.4	4.9
5/31 20:16	9.06	8.63	11.4	5.1
5/31 20:31	8.95	8.45	11.5	4.9
5/31 20:46	8.96	8.37	11.4	5.7
5/31 21:01	8.78	8.28	12.2	5
5/31 21:16	9.76	8.25	11.9	5.6
5/31 21:31	9.16	8.24	11.5	5.3
5/31 21:46	8.83	8.25	11.5	5.7
5/31 22:01	8.71	8.26	11.9	5.1

DO AND TURBIDITY DURING JUNE 1-2, 2008 SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
5/31 22:16	8.63	8.27	11.3	5.4
5/31 22:31	8.61	8.28	11.5	5.2
5/31 22:46	8.63	8.29	11.2	5.4
5/31 23:01	8.53	8.3	12	7.1
5/31 23:16	8.51	8.32	11.8	7.3
5/31 23:31	8.93	8.32	11.4	5.6
5/31 23:46	8.78	8.31	11.5	5.3
6/1 00:01	8.9	8.33	10.9	5.1
6/1 00:16	8.72	8.33	11.7	5.5
6/1 00:31	8.51	8.33	11.3	5.7
6/1 00:46	8.46	8.32	11.5	5.5
6/1 01:01	8.41	8.31	11.4	5.9
6/1 01:16	8.37	8.33	10.8	5.6
6/1 01:31	8.35	8.35	11.2	5.5
6/1 01:46	8.31	8.37	11.5	5.9
6/1 02:01	9.53	8.36	11.3	5.9
6/1 02:16	8.97	8.37	11.6	6.5
6/1 02:31	8.62	8.38	11.5	6.4
6/1 02:46	8.42	8.41	12.2	6.4
6/1 03:01	8.31	8.45	11.9	6.2
6/1 03:16	8.28	8.47	11.5	6.3
6/1 03:31	8.26	8.51	12.3	6.8
6/1 03:46	8.22	8.52	12.1	6.4
6/1 04:01	8.2	8.52	12.8	6.8
6/1 04:16	8.17	8.53	12.7	6.6
6/1 04:31	8.12	8.52	12.8	6.8
6/1 04:46	11.12	8.54	12.5	7
6/1 05:01	8.33	8.57	12.8	6.8
6/1 05:16	8.09	8.59	12.5	6.9
6/1 05:31	7.97	8.6	12.6	7.5
6/1 05:46	7.98	8.63	13.3	7.6
6/1 06:01	7.93	8.67	12.2	7.8
6/1 06:16	7.89	8.73	12.4	7.5
6/1 06:31	7.88	8.86	12.1	7.2
6/1 06:46	7.85	9.01	13.4	7.5
6/1 07:01	11.72	9.18	13.2	7.3
6/1 07:16	8.65	9.35	13.7	7

DO AND TURBIDITY DURING JUNE 1-2, 2008 SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
6/1 07:31	8.23	9.47	13.4	11.4
6/1 07:46	8.11	9.59	12.8	8.3
6/1 08:01	7.94	9.75	14.1	6.7
6/1 08:16	7.88	10.01	13.5	6.6
6/1 08:31	7.86	10.13	13.7	6.2
6/1 08:46	7.84	10.41	12.9	5.8
6/1 09:01	7.77	10.49	12.8	5.7
6/1 09:16	7.72	10.74	13.1	5.8
6/1 09:31	8.48	10.89	14.6	7.3
6/1 09:46	8.01	11.18	16.1	5.4
6/1 10:01	7.62	11.25	19.5	5.7
6/1 10:16	7.81	11.08	19.4	5
6/1 10:31	7.91	11.13	18.1	5.3
6/1 10:46	13.6	11.21	16.9	10
6/1 11:01	8.94	11.16	16.4	4.7
6/1 11:16	8.96	10.89	16.5	5.4
6/1 11:31	9.16	10.87	17.5	4.3
6/1 11:46	8.63	11.03	16.2	4.2
6/1 12:01	8.4	9.41	16.1	604.6
6/1 12:16	8.34	9.19	15.5	460.4
6/1 12:31	8.3	9.11	15.6	437.5
6/1 12:46	8.26	9.05	16.3	379.1
6/1 13:01	8.2	9.03	16.4	276.9
6/1 13:16	8.17	8.98	15.9	203.5
6/1 13:31	8.14	9.02	17	156.1
6/1 13:46	9.47	8.92	15.3	132.3
6/1 14:01	8.85	8.91	16.7	110.9
6/1 14:16	8.96	8.93	15.9	98.2
6/1 14:31	8.52	9.02	16.6	94.1
6/1 14:46	8.34	8.96	16.4	146.8
6/1 15:01	8.3	8.91	17	79.4
6/1 15:16	8.25	8.95	18	76.7
6/1 15:31	8.23	8.97	17.8	87.6
6/1 15:46	8.23	8.97	16	95.4
6/1 16:01	8.18	8.97	16.6	68.6
6/1 16:16	8.17	8.95	15.4	77.5
6/1 16:31	8.17	8.92	15.8	80.3

DO AND TURBIDITY DURING JUNE 1-2, 2008 SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
6/1 16:46	8.12	8.89	17.4	395.8
6/1 17:01	8.12	8.91	15.9	96.9
6/1 17:16	8.12	8.91	16.7	113.8
6/1 17:31	8.53	8.94	12.9	176.2
6/1 17:46	9.65	8.96	12.6	228.6
6/1 18:01	9.01	8.97	12.5	263.4
6/1 18:16	8.59	8.95	13.7	123.4
6/1 18:31	8.61	8.91	12.5	220.1
6/1 18:46	8.56	8.95	12	118.4
6/1 19:01	8.53	8.95	12.4	173.4
6/1 19:16	8.46	8.94	12.2	184
6/1 19:31	8.39	8.92	12.3	164.8
6/1 19:46	8.36	8.9	12.3	133.6
6/1 20:01	8.32	8.89	12.2	154.7
6/1 20:16	8.28	8.91	12.8	175.7
6/1 20:31	8.27	8.94	12.3	177
6/1 20:46	8.24	8.92	12.6	173.4
6/1 21:01	8.17	8.91	12	184.7
6/1 21:16	8.12	8.92	12.1	164.9
6/1 21:31	8.09	8.91	12	168
6/1 21:46	8.06	8.92	12.5	164.9
6/1 22:01	8.63	8.92	12.2	176.1
6/1 22:16	8.44	8.95	12	496.6
6/1 22:31	9.76	8.95	12.8	178
6/1 22:46	8.99	8.95	12.6	172.9
6/1 23:01	8.39	8.99	12.2	163.8
6/1 23:16	8.17	9.04	12.2	242.9
6/1 23:31	8.09	9	11.9	183.2
6/1 23:46	8.06	8.97	12.2	159.7
6/2 00:01	9.54	8.96	12.1	196.7
6/2 00:16	8.63	8.94	12.4	189.8
6/2 00:31	8.34	8.91	11.4	226.3
6/2 00:46	8.07	8.92	13	185.3
6/2 01:01	8	8.93	11.6	540.3
6/2 01:16	9	9	12	978.8
6/2 01:31	8.33	8.94	12.2	1224.6
6/2 01:46	8.04	8.91	11.5	929.2

DO AND TURBIDITY DURING JUNE 1-2, 2008 SCHEDULED RAMP RATE TEST FLOW.

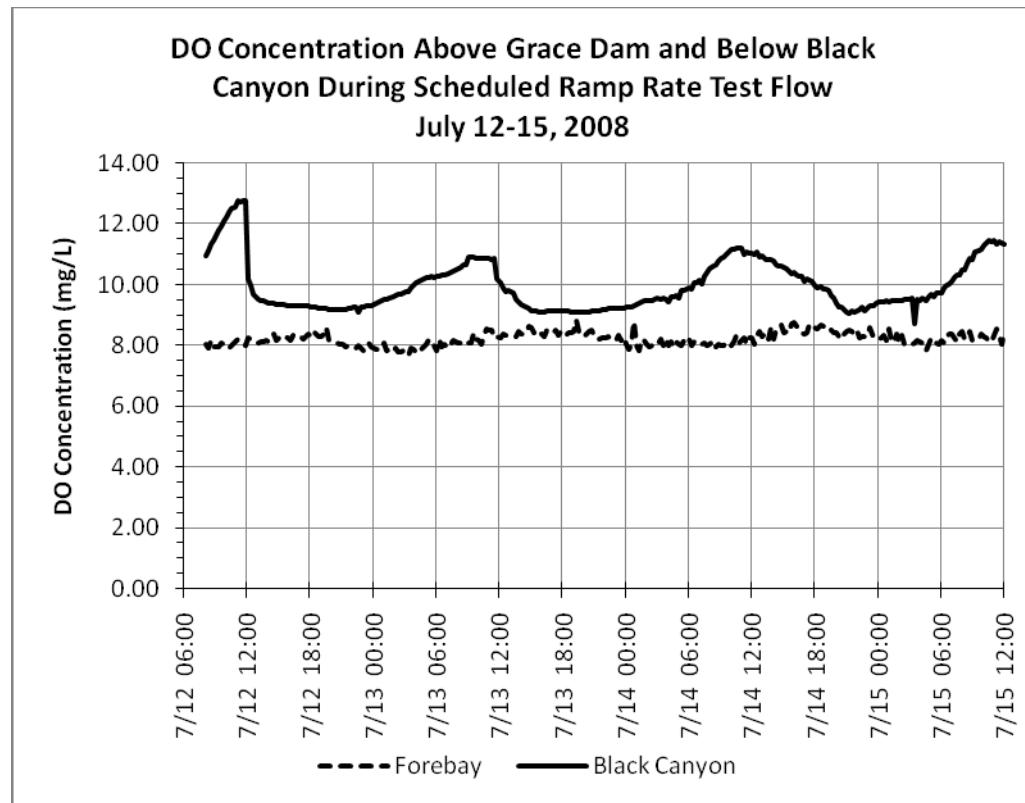
DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
6/2 02:01	7.96	8.89	12.1	216.8
6/2 02:16	7.91	8.89	11.3	194
6/2 02:31	7.87	8.91	11.7	1781.5
6/2 02:46	7.83	8.99	12.2	229.3
6/2 03:01	8.01	9.02	12.1	676.1
6/2 03:16	7.87	8.98	12.4	162.4
6/2 03:31	7.87	8.99	12.3	227.3
6/2 03:46	7.8	9.07	12.5	199.8
6/2 04:01	7.74	9.1	12	203.4
6/2 04:16	7.68	9.12	11.9	186.4
6/2 04:31	7.67	9.08	12.6	254.7
6/2 04:46	9.88	9.07	12	384.4
6/2 05:01	8.93	9.07	12.8	214.4
6/2 05:16	8.24	9.09	12.5	212
6/2 05:31	7.91	9.11	11.9	165.1
6/2 05:46	7.8	9.1	12.1	257.3
6/2 06:01	7.75	9.11	12.6	319.7
6/2 06:16	7.68	9.15	12.1	200.4
6/2 06:31	7.69	9.22	12.5	1404.6
6/2 06:46	9.95	9.3	12.5	289.4
6/2 07:01	8.34	9.35	12.9	187.6
6/2 07:16	8.12	9.38	13.4	191.4
6/2 07:31	8.66	9.48	13	353.1
6/2 07:46	8.31	9.56	13.1	179
6/2 08:01	8.95	9.55	13	222.5
6/2 08:16	8.1	9.6	14.2	225.7
6/2 08:31	8.22	9.65	13.7	182.1
6/2 08:46	7.96	9.71	12.4	171.3
6/2 09:01	8.39	9.76	14.9	178.7
6/2 09:16	7.86	9.8	14.1	789.9
6/2 09:31	7.76	9.85	14.5	156.9
6/2 09:46	7.65	9.89	13.4	297.7
6/2 10:01	7.59	9.96	14.6	185.2
6/2 10:16	9.01	9.94	14.8	370.1
6/2 10:31	8.63	9.98	13.7	210.5
6/2 10:46	12.38	9.97	15.1	905.6
6/2 11:01	8.2	9.97	14.7	278

DO AND TURBIDITY DURING JUNE 1-2, 2008 SCHEDULED RAMP RATE TEST FLOW.

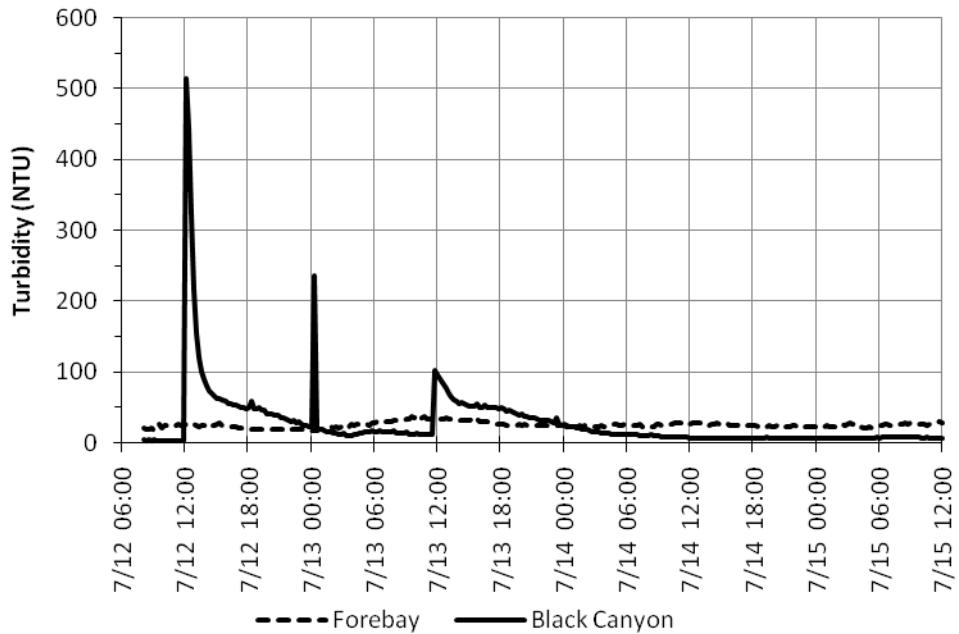
DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
6/2 11:16	8	9.95	14	572.5
6/2 11:31	8.01	9.91	14.5	429.7
6/2 11:46	7.82	9.88	14.7	171.1
6/2 12:01	7.73	9.91	16.2	190.7
6/2 12:16	7.69	9.85	15.6	1240.8
6/2 12:31	8.22	9.84	14.7	241
6/2 12:46	7.85	9.81	15.8	256.9
6/2 13:01	7.75	9.7	16.4	187.6
6/2 13:16	7.77	10.19	15.4	276.3
6/2 13:31	7.69	10.16	17.6	504.4
6/2 13:46	10.15	10.03	15.9	556.5
6/2 14:01	8.02	9.8	15.5	307

APPENDIX E. ERI WATER QUALITY MEASUREMENTS IN FOREBAY ABOVE GRACE DAM AND AT FOOTBRIDGE BELOW BLACK CANYON ON BEAR RIVER NEAR GRACE, ID, JULY 11-15, 2008

Below are DO and turbidity data – in chart and table form – for two monitoring sites on the Bear River, in the forebay above Grace Dam and at the bottom of Black Canyon, during the Flow Dependent Boater Flow event on July 12 and the Scheduled Ramp Rate Test Flow event on July 13, 2008. These data have not been scrubbed for outliers in turbidity.



**Turbidity Above Grace Dam and Below Black Canyon
During Scheduled Ramp Rate Test Flow
July 12-15, 2008**



**DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW
EVENT AND SCHEDULED RAMP RATE TEST FLOW.**

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/11/08 12:01	8.1	12.22	20	28.9
7/11/08 12:16	8.14	12.22	20.5	3
7/11/08 12:31	8.16	12.13	19.3	2.6
7/11/08 12:46	8.26	12.09	19.1	2.3
7/11/08 13:01	8.32	12.14	18.2	2.6
7/11/08 13:16	8.45	12.11	18.3	2.5
7/11/08 13:31	8.44	12.05	17.7	2.6
7/11/08 13:46	8.48	12.03	17.4	2
7/11/08 14:01	8.42	12.02	17.5	2.2
7/11/08 14:16	8.44	11.96	17.2	5.7
7/11/08 14:31	8.48	11.9	17.4	172.9
7/11/08 14:46	8.73	11.82	17.5	4.3
7/11/08 15:01	8.47	11.82	16.8	2.3
7/11/08 15:16	8.5	11.78	17.5	2.3
7/11/08 15:31	8.55	11.62	16.9	2.3

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/11/08 15:46	8.73	11.63	17.2	2.6
7/11/08 16:01	8.68	11.54	17.1	2.2
7/11/08 16:16	8.74	11.48	16.7	2.2
7/11/08 16:31	8.74	11.42	17.3	2
7/11/08 16:46	8.78	11.32	16.7	2.2
7/11/08 17:01	8.65	11.26	17.5	2.1
7/11/08 17:16	8.73	11.21	16.9	2.2
7/11/08 17:31	8.78	11.1	17	2.3
7/11/08 17:46	8.77	11.01	17	2
7/11/08 18:01	8.74	10.9	17.7	2.1
7/11/08 18:16	8.61	10.8	17.7	2.1
7/11/08 18:31	8.6	10.69	17.4	2.3
7/11/08 18:46	8.6	10.59	17.4	1.9
7/11/08 19:01	8.67	10.46	16.7	2.5
7/11/08 19:16	8.86	10.29	15.9	2.2
7/11/08 19:31	9.08	10.14	15.8	2
7/11/08 19:46	8.5	9.93	18.3	2
7/11/08 20:01	8.66	9.56	16.7	2.1
7/11/08 20:16	8.41	9.3	17.3	2.1
7/11/08 20:31	8.37	9.17	17.7	1.9
7/11/08 20:46	8.36	9.05	17.3	2.3
7/11/08 21:01	8.43	9.03	17.6	2.1
7/11/08 21:16	8.24	8.98	18.1	2.1
7/11/08 21:31	8.3	8.97	18.1	2.3
7/11/08 21:46	8.18	8.99	17.2	2
7/11/08 22:01	8.28	9.05	17.4	2.3
7/11/08 22:16	8.15	9.07	17.5	2.3
7/11/08 22:31	8.12	9.14	18.2	2.5
7/11/08 22:46	8.12	9.17	17.7	2.3
7/11/08 23:01	8.15	9.22	18.3	3.9
7/11/08 23:16	8.16	9.26	17.8	2.5
7/11/08 23:31	8.18	9.35	18.4	2.5
7/11/08 23:46	8.08	9.37	18.5	2.6
7/12/08 0:01	8.08	9.41	17.4	2.5
7/12/08 0:16	8.07	9.46	17.7	2.6
7/12/08 0:31	8.02	9.47	16.7	2.6
7/12/08 0:46	8.06	9.52	17.8	2.7

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/12/08 1:01	8.18	9.52	18.1	2.6
7/12/08 1:16	8.11	9.53	17.6	2.8
7/12/08 1:31	8.06	9.58	18.6	2.9
7/12/08 1:46	8.02	9.59	18.2	2.9
7/12/08 2:01	8.02	9.63	18.3	3.1
7/12/08 2:16	8.06	9.65	18.9	3.1
7/12/08 2:31	8.07	9.71	18.3	3.1
7/12/08 2:46	8.07	9.71	18.6	3.1
7/12/08 3:01	8.12	9.76	17.7	3.4
7/12/08 3:16	7.95	9.78	16.6	3.4
7/12/08 3:31	7.86	9.8	18.2	3.2
7/12/08 3:46	7.98	9.87	17	3.4
7/12/08 4:01	7.96	9.9	16.3	3.4
7/12/08 4:16	8	9.88	16.2	3.7
7/12/08 4:31	7.89	9.9	15.5	3.9
7/12/08 4:46	8.01	9.92	18.2	3.9
7/12/08 5:01	7.94	9.95	20	4
7/12/08 5:16	7.97	9.98	18.5	5.1
7/12/08 5:31	7.88	9.99	18.1	4.2
7/12/08 5:46	7.99	10.02	18.7	4.5
7/12/08 6:01	7.99	10.05	18.6	4.7
7/12/08 6:16	7.96	10.12	21	4.4
7/12/08 6:31	7.91	10.24	17.3	4.7
7/12/08 6:46	7.79	10.34	18.3	4.7
7/12/08 7:01	7.79	10.43	19.8	4.7
7/12/08 7:16	7.88	10.55	18.9	4.3
7/12/08 7:31	7.93	10.65	18.1	4.2
7/12/08 7:46	7.9	10.82	18	4.4
7/12/08 8:01	8.01	10.93	20.5	4.2
7/12/08 8:16	7.9	11.12	19.3	3.7
7/12/08 8:31	8.15	11.33	19.6	4.2
7/12/08 8:46	7.93	11.45	20.7	3.6
7/12/08 9:01	7.93	11.61	18.3	3.9
7/12/08 9:16	7.93	11.78	19.5	3.6
7/12/08 9:31	8.08	11.93	26.9	3.5
7/12/08 9:46	8.03	12.07	22.2	3.8
7/12/08 10:01	7.92	12.21	24.7	3.5

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/12/08 10:16	7.91	12.36	24.2	3.4
7/12/08 10:31	7.99	12.5	23.8	3.2
7/12/08 10:46	8.11	12.57	25.3	3.5
7/12/08 11:01	8.19	12.74	24.6	3.3
7/12/08 11:16	8.1	12.72	27.1	3
7/12/08 11:31	8.06	12.74	24.2	3.1
7/12/08 11:46	7.99	12.76	25	2.9
7/12/08 12:01	8.26	10.18	27.2	514.2
7/12/08 12:16	8.21	9.98	25.6	444.3
7/12/08 12:31	8.11	9.69	24.7	323.4
7/12/08 12:46	8.11	9.59	26.6	216.1
7/12/08 13:01	8.08	9.53	24.5	154.6
7/12/08 13:16	8.11	9.49	23.8	121
7/12/08 13:31	8.11	9.45	24.5	100.6
7/12/08 13:46	8.18	9.42	25.9	88.9
7/12/08 14:01	8.12	9.39	26.1	80.2
7/12/08 14:16	8.22	9.38	23.9	72.9
7/12/08 14:31	8.37	9.38	25.5	68.9
7/12/08 14:46	8.15	9.36	25.8	66.1
7/12/08 15:01	8.26	9.35	27.5	62.5
7/12/08 15:16	8.21	9.34	29.2	62.5
7/12/08 15:31	8.3	9.33	24.3	60.3
7/12/08 15:46	8.26	9.28	23.4	58.8
7/12/08 16:01	8.14	9.31	24.1	56
7/12/08 16:16	8.33	9.32	23.1	54.8
7/12/08 16:31	8.3	9.29	22.6	53.7
7/12/08 16:46	8.31	9.29	22.3	53.4
7/12/08 17:01	8.27	9.3	21.3	51.5
7/12/08 17:16	8.22	9.31	21.7	50.4
7/12/08 17:31	8.28	9.29	20.6	49.9
7/12/08 17:46	8.36	9.28	19.8	48.5
7/12/08 18:01	8.28	9.26	18.8	49
7/12/08 18:16	8.47	9.26	18.8	58.2
7/12/08 18:31	8.36	9.24	19.3	47.7
7/12/08 18:46	8.27	9.23	18.8	48.4
7/12/08 19:01	8.27	9.22	19.1	49.3
7/12/08 19:16	8.39	9.2	20.3	45.7

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/12/08 19:31	8.6	9.2	19.2	45.7
7/12/08 19:46	8.15	9.19	18.8	41.3
7/12/08 20:01	8.11	9.17	19	40.2
7/12/08 20:16	8.11	9.16	19.2	40.9
7/12/08 20:31	8.06	9.17	20.2	39.4
7/12/08 20:46	8.03	9.17	19.8	38.6
7/12/08 21:01	8.02	9.17	19.7	35.6
7/12/08 21:16	7.95	9.18	18.8	35.7
7/12/08 21:31	7.99	9.2	20.5	33.9
7/12/08 21:46	7.95	9.22	19.4	31.8
7/12/08 22:01	7.93	9.24	20	29.9
7/12/08 22:16	7.92	9.25	19.2	32.4
7/12/08 22:31	8	9.09	19.7	27.5
7/12/08 22:46	7.92	9.25	20	30
7/12/08 23:01	7.82	9.27	20.3	26.4
7/12/08 23:16	7.96	9.3	19.7	24.5
7/12/08 23:31	8.08	9.31	19.1	24.3
7/12/08 23:46	7.93	9.32	18.8	23
7/13/08 0:01	7.92	9.34	17.7	22.8
7/13/08 0:16	7.86	9.38	18	235.6
7/13/08 0:31	7.84	9.44	18.6	20.7
7/13/08 0:46	7.87	9.46	19.4	19.5
7/13/08 1:01	8.09	9.5	20.3	19.8
7/13/08 1:16	7.82	9.53	18.9	18.2
7/13/08 1:31	7.87	9.56	20.8	15.6
7/13/08 1:46	7.78	9.61	22.8	14.7
7/13/08 2:01	7.9	9.65	20.6	13.6
7/13/08 2:16	7.76	9.66	22.5	13
7/13/08 2:31	7.78	9.7	21.7	12
7/13/08 2:46	7.83	9.73	23.1	11.4
7/13/08 3:01	7.73	9.76	24.6	14.6
7/13/08 3:16	7.64	9.78	20.5	10.2
7/13/08 3:31	7.88	9.89	23.4	10.4
7/13/08 3:46	7.84	9.98	26.7	10
7/13/08 4:01	7.79	10.05	25.1	11.5
7/13/08 4:16	7.92	10.11	26	12.2
7/13/08 4:31	7.86	10.16	26.1	14.1

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/13/08 4:46	7.95	10.2	26.3	14.2
7/13/08 5:01	8.05	10.23	27.9	15.6
7/13/08 5:16	8.19	10.24	27.4	15.5
7/13/08 5:31	8.12	10.25	25	15.7
7/13/08 5:46	7.98	10.22	27.9	17.3
7/13/08 6:01	7.81	10.26	27.8	16.2
7/13/08 6:16	8.19	10.26	30	15.8
7/13/08 6:31	7.95	10.3	28.8	16.7
7/13/08 6:46	8.05	10.33	29.9	16.2
7/13/08 7:01	7.92	10.36	30	15.9
7/13/08 7:16	8.02	10.39	30.4	15.1
7/13/08 7:31	8.17	10.44	30.7	15.6
7/13/08 7:46	8.13	10.48	33.2	16.5
7/13/08 8:01	8.07	10.54	32.7	13.6
7/13/08 8:16	8.07	10.58	33.1	13.2
7/13/08 8:31	8.12	10.63	32.9	13.5
7/13/08 8:46	8.02	10.65	33.2	13.7
7/13/08 9:01	8.08	10.91	35.1	15
7/13/08 9:16	8.06	10.91	34	12.8
7/13/08 9:31	8.4	10.9	37.8	12.3
7/13/08 9:46	8.22	10.88	36.1	12
7/13/08 10:01	8.14	10.88	39.7	13.7
7/13/08 10:16	8.05	10.88	34.4	12.4
7/13/08 10:31	8.33	10.87	36.5	12.5
7/13/08 10:46	8.53	10.86	37.1	12.6
7/13/08 11:01	8.5	10.85	34.7	12.3
7/13/08 11:16	8.51	10.83	35	12.7
7/13/08 11:31	8.26	10.86	34.5	12.8
7/13/08 11:46	8.27	10.19	34.7	101.6
7/13/08 12:01	8.25	10.07	34.9	93.9
7/13/08 12:16	8.37	9.89	33.9	87.5
7/13/08 12:31	8.31	9.78	34.9	82.7
7/13/08 12:46	8.35	9.79	35.2	76.9
7/13/08 13:01	8.33	9.77	34.7	69.5
7/13/08 13:16	8.34	9.73	34.3	64.9
7/13/08 13:31	8.29	9.53	33.5	60.2
7/13/08 13:46	8.46	9.41	33	59

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/13/08 14:01	8.36	9.33	32.2	56.1
7/13/08 14:16	8.38	9.29	32	57
7/13/08 14:31	8.4	9.26	32.2	54.9
7/13/08 14:46	8.62	9.23	32.5	53.1
7/13/08 15:01	8.59	9.15	32.8	51.9
7/13/08 15:16	8.42	9.14	34.2	52.3
7/13/08 15:31	8.52	9.15	31.3	51.5
7/13/08 15:46	8.5	9.11	33.3	56.1
7/13/08 16:01	8.37	9.1	30.7	50.6
7/13/08 16:16	8.29	9.1	30.4	49.9
7/13/08 16:31	8.49	9.12	30	52.9
7/13/08 16:46	8.41	9.12	29.7	49.8
7/13/08 17:01	8.41	9.14	28.4	49.3
7/13/08 17:16	8.49	9.13	27.3	49.5
7/13/08 17:31	8.32	9.13	26.4	49.6
7/13/08 17:46	8.46	9.13	26.9	48
7/13/08 18:01	8.47	9.13	27.5	49.1
7/13/08 18:16	8.32	9.12	26.7	48.6
7/13/08 18:31	8.43	9.12	25.7	44.5
7/13/08 18:46	8.42	9.1	25.4	45.5
7/13/08 19:01	8.47	9.1	25.3	44.5
7/13/08 19:16	8.85	9.1	25.9	43
7/13/08 19:31	8.44	9.1	25.6	40.8
7/13/08 19:46	8.4	9.1	26	39.6
7/13/08 20:01	8.3	9.11	25.6	40.2
7/13/08 20:16	8.36	9.11	26.1	37.9
7/13/08 20:31	8.46	9.11	25.2	37.9
7/13/08 20:46	8.51	9.13	24.7	36.1
7/13/08 21:01	8.32	9.14	25.5	35.5
7/13/08 21:16	8.31	9.15	25.2	36.1
7/13/08 21:31	8.2	9.15	25.7	34.3
7/13/08 21:46	8.26	9.17	25.6	32.5
7/13/08 22:01	8.23	9.19	25	32.1
7/13/08 22:16	8.27	9.21	25.2	31.3
7/13/08 22:31	8.2	9.21	24.5	31.2
7/13/08 22:46	8.17	9.22	24.9	30.5
7/13/08 23:01	8.18	9.22	24.7	28.1

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/13/08 23:16	8.32	9.2	25	34.9
7/13/08 23:31	8.15	9.22	24.3	25.6
7/13/08 23:46	8.27	9.2	24.2	25.3
7/14/08 0:01	8.05	9.26	24.9	26.2
7/14/08 0:16	7.87	9.25	22.4	23.8
7/14/08 0:31	8.05	9.24	24.5	22.7
7/14/08 0:46	8.82	9.29	22.2	23
7/14/08 1:01	7.99	9.35	21.9	22.8
7/14/08 1:16	7.81	9.39	22.2	22.5
7/14/08 1:31	8.22	9.41	24.2	20.8
7/14/08 1:46	8.14	9.45	24.1	19.4
7/14/08 2:01	8.03	9.45	24.5	20
7/14/08 2:16	7.96	9.48	23	18.6
7/14/08 2:31	8	9.48	23.4	17.3
7/14/08 2:46	8.02	9.5	24	16.1
7/14/08 3:01	8	9.54	23.8	15.8
7/14/08 3:16	8.19	9.51	23.8	15.3
7/14/08 3:31	7.99	9.54	24.5	14.1
7/14/08 3:46	8.21	9.53	23.3	13.2
7/14/08 4:01	7.99	9.42	25.3	13
7/14/08 4:16	8.12	9.6	25.6	14.3
7/14/08 4:31	7.94	9.59	26.1	12.5
7/14/08 4:46	8.11	9.63	26	12.5
7/14/08 5:01	8.03	9.57	26.1	12.1
7/14/08 5:16	7.99	9.79	24.3	12.2
7/14/08 5:31	8.16	9.8	24.8	11.5
7/14/08 5:46	8.07	9.83	26.6	11.4
7/14/08 6:01	8.19	9.88	26	11.9
7/14/08 6:16	7.97	9.83	24.3	11.7
7/14/08 6:31	8.11	10.04	24.6	11.4
7/14/08 6:46	8.07	10.06	25.2	11.6
7/14/08 7:01	8	10.16	25	11.4
7/14/08 7:16	8.01	10.02	26.4	10.8
7/14/08 7:31	8.08	10.25	22.8	10.9
7/14/08 7:46	8	10.41	24.2	10.8
7/14/08 8:01	8.03	10.54	24.1	10.2
7/14/08 8:16	8.15	10.61	23.5	11.2

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/14/08 8:31	7.93	10.63	23	9.7
7/14/08 8:46	8.05	10.76	26.9	9.4
7/14/08 9:01	8	10.87	27.2	9.7
7/14/08 9:16	8	10.9	25.7	9.2
7/14/08 9:31	8.1	10.98	27.2	8.9
7/14/08 9:46	8.04	11.09	27.1	8.7
7/14/08 10:01	8	11.14	27.1	8.9
7/14/08 10:16	8.1	11.15	27.6	8.4
7/14/08 10:31	8.35	11.21	27.9	8.2
7/14/08 10:46	8.08	11.18	27.8	8.2
7/14/08 11:01	8.18	11.19	28.3	7.8
7/14/08 11:16	8.26	11	29	7.9
7/14/08 11:31	8.04	11.07	27.5	7.9
7/14/08 11:46	8.24	11.04	28.9	8.1
7/14/08 12:01	8.25	11.04	27.5	7.4
7/14/08 12:16	8.05	11	28.3	7.3
7/14/08 12:31	8.32	11.06	28.1	7.3
7/14/08 12:46	8.45	10.91	28.9	6.8
7/14/08 13:01	8.27	10.96	28.2	6.9
7/14/08 13:16	8.41	10.82	28.4	7
7/14/08 13:31	8.2	10.81	28.5	6.6
7/14/08 13:46	8.58	10.82	25.7	6.7
7/14/08 14:01	8.22	10.79	27.7	6.3
7/14/08 14:16	8.54	10.63	27.2	6.5
7/14/08 14:31	8.65	10.59	28.5	6.4
7/14/08 14:46	8.66	10.6	27.1	6.5
7/14/08 15:01	8.43	10.57	26.4	6.3
7/14/08 15:16	8.46	10.51	27.1	6.2
7/14/08 15:31	8.4	10.45	28.3	6.2
7/14/08 15:46	8.74	10.37	25.3	6.4
7/14/08 16:01	8.75	10.41	25.2	6.1
7/14/08 16:16	8.63	10.31	25.2	5.9
7/14/08 16:31	8.61	10.27	24.6	6.1
7/14/08 16:46	8.42	10.28	27.7	7.1
7/14/08 17:01	8.38	10.12	26.7	6.1
7/14/08 17:16	8.43	10.17	26.1	6.4
7/14/08 17:31	8.73	10.15	24.7	6.1

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/14/08 17:46	8.65	10.1	25	6.2
7/14/08 18:01	8.57	9.99	24.9	6.1
7/14/08 18:16	8.56	9.9	25	5.9
7/14/08 18:31	8.68	9.93	23.9	6.1
7/14/08 18:46	8.62	9.84	23.3	6.1
7/14/08 19:01	8.59	9.83	24.5	6.1
7/14/08 19:16	8.62	9.79	23.9	7.8
7/14/08 19:31	8.51	9.64	25	5.9
7/14/08 19:46	8.43	9.54	23.4	6.1
7/14/08 20:01	8.43	9.38	22.6	5.9
7/14/08 20:16	8.3	9.25	24.3	6.1
7/14/08 20:31	8.47	9.26	22.8	5.9
7/14/08 20:46	8.38	9.18	24.8	6.2
7/14/08 21:01	8.47	9.08	24	5.9
7/14/08 21:16	8.49	9.04	23.5	6.2
7/14/08 21:31	8.47	9.13	23.9	6.2
7/14/08 21:46	8.39	9.1	24.5	6.2
7/14/08 22:01	8.49	9.15	24.6	6.1
7/14/08 22:16	8.23	9.17	23.9	6.2
7/14/08 22:31	8.28	9.27	23.9	5.9
7/14/08 22:46	8.29	9.14	24.3	6
7/14/08 23:01	8.3	9.22	24	6.1
7/14/08 23:16	8.58	9.31	23.9	6.1
7/14/08 23:31	8.25	9.3	23.1	6
7/14/08 23:46	8.23	9.4	23.9	6.5
7/15/08 0:01	8.21	9.44	24.1	6.2
7/15/08 0:16	8.23	9.42	24.4	6.4
7/15/08 0:31	8.31	9.44	25.5	6.1
7/15/08 0:46	8.14	9.45	24.1	6.1
7/15/08 1:01	8.54	9.44	24.8	6.2
7/15/08 1:16	8.11	9.45	23.7	6.4
7/15/08 1:31	8.13	9.49	23.2	6.3
7/15/08 1:46	8.36	9.47	23.8	6.4
7/15/08 2:01	8.06	9.46	23.9	6.3
7/15/08 2:16	8.31	9.48	26.9	6.4
7/15/08 2:31	8.02	9.52	26.4	6.4
7/15/08 2:46	8.02	9.53	25.1	6.4

DO AND TURBIDITY DURING JULY 12-13, 2008 FLOW DEPENDENT BOATER FLOW EVENT AND SCHEDULED RAMP RATE TEST FLOW.

DATE/TIME	DO (MG/L)		TURBIDITY (NTU)	
	FOREBAY	BLACK CANYON	FOREBAY	BLACK CANYON
7/15/08 3:01	8	9.53	26	6.4
7/15/08 3:16	8.03	9.54	28.3	6.4
7/15/08 3:31	8.07	8.71	26.4	7
7/15/08 3:46	8.15	9.51	28	7.2
7/15/08 4:01	8.11	9.45	27.4	6.7
7/15/08 4:16	8.06	9.54	23.8	6.7
7/15/08 4:31	7.83	9.46	21.7	6.7
7/15/08 4:46	8.03	9.58	22	6.7
7/15/08 5:01	8.23	9.67	23.2	7.2
7/15/08 5:16	8.12	9.59	22.1	6.7
7/15/08 5:31	8.07	9.74	23.4	7.1
7/15/08 5:46	8.01	9.74	23.4	7.6
7/15/08 6:01	8.14	9.71	25.3	7.4
7/15/08 6:16	8.07	9.88	25.5	7.6
7/15/08 6:31	8.3	9.99	26	8.7
7/15/08 6:46	8.36	10.02	26.1	9.2
7/15/08 7:01	8.36	10.1	25.5	7.9
7/15/08 7:16	8.26	10.24	25.7	8.1
7/15/08 7:31	8.13	10.3	25.9	7.9
7/15/08 7:46	8.38	10.32	26.3	7.9
7/15/08 8:01	8.44	10.5	26.6	7.8
7/15/08 8:16	8.21	10.48	27	8.1
7/15/08 8:31	8.24	10.69	27.8	7.9
7/15/08 8:46	8.46	10.86	26.7	7.8
7/15/08 9:01	8.16	10.81	28.5	7.8
7/15/08 9:16	8.21	11.08	26.9	7.7
7/15/08 9:31	8.22	11.1	26.3	7.7
7/15/08 9:46	8.36	11.17	27.4	7.7
7/15/08 10:01	8.28	11.27	27.3	7.4
7/15/08 10:16	8.25	11.35	26.3	7.3
7/15/08 10:31	8.11	11.44	24.8	9.1
7/15/08 10:46	8.12	11.4	26.7	7.3
7/15/08 11:01	8.35	11.46	27.3	7.3
7/15/08 11:16	8.55	11.34	27.8	7.2
7/15/08 11:31	8.33	11.4	30.7	7.2
7/15/08 11:46	8.04	11.37	30.4	7
7/15/08 12:01	8.45	11.33	28.9	7.2

**APPENDIX F. RIVER STAGE (FT) AT FIVE LOCATIONS ON THE BEAR RIVER
DURING SCHEDULED RAMP RATE TEST FLOW ON JUNE 1, 2008.**

DATE AND TIME	GRACE PUT-IN	AB GRACE GAGE	REACH 3	REACH 4 AT FOOT-BRIDGE	COVE TAIL-RACE
6/1/08 8:00	0.59	0.61	0.49	0.75	0.36
6/1/08 8:05	0.59	0.61	0.49	0.75	0.36
6/1/08 8:10	0.59	0.61	0.51	0.75	0.34
6/1/08 8:15	0.59	0.61	0.52	0.75	0.33
6/1/08 8:20	0.59	0.61	0.51	0.75	0.33
6/1/08 8:25	0.59	0.61	0.50	0.75	0.33
6/1/08 8:30	0.59	0.61	0.51	0.75	0.33
6/1/08 8:35	0.59	0.61	0.51	0.75	0.33
6/1/08 8:40	0.59	0.61	0.51	0.74	0.33
6/1/08 8:45	0.59	0.61	0.50	0.74	0.35
6/1/08 8:50	0.59	0.61	0.48	0.74	0.31
6/1/08 8:55	0.59	0.61	0.50	0.74	0.33
6/1/08 9:00	0.59	0.61	0.50	0.74	0.34
6/1/08 9:05	0.59	0.61	0.50	0.74	0.38
6/1/08 9:10	0.59	0.61	0.50	0.74	0.41
6/1/08 9:15	0.59	0.61	0.50	0.74	0.39
6/1/08 9:20	0.59	0.61	0.51	0.74	0.42
6/1/08 9:25	0.61	0.61	0.49	0.74	0.40
6/1/08 9:30	0.85	0.62	0.51	0.74	0.40
6/1/08 9:35	1.15	0.77	0.50	0.74	0.39
6/1/08 9:40	1.37	1.15	0.50	0.74	0.38
6/1/08 9:45	1.58	1.49	0.50	0.74	0.35
6/1/08 9:50	1.79	1.76	0.49	0.74	0.34
6/1/08 9:55	1.98	2.01	0.50	0.73	0.25
6/1/08 10:00	2.08	2.19	0.50	0.73	0.18
6/1/08 10:05	2.08	2.29	0.50	0.73	0.12
6/1/08 10:10	2.10	2.34	0.50	0.73	0.03
6/1/08 10:15	2.09	2.34	0.54	0.73	-0.08
6/1/08 10:20	2.08	2.35	0.51	0.73	-0.09
6/1/08 10:25	2.08	2.35	0.48	0.73	-0.09
6/1/08 10:30	2.07	2.34	0.52	0.73	-0.09
6/1/08 10:35	2.07	2.35	0.50	0.73	-0.10
6/1/08 10:40	2.07	2.34	0.51	0.73	-0.10

DATE AND TIME	GRACE PUT-IN	AB GRACE GAGE	REACH 3	REACH 4 AT FOOT-BRIDGE	COVE TAIL-RACE
6/1/08 10:45	2.06	2.33	0.52	0.73	-0.10
6/1/08 10:50	2.04	2.32	0.52	0.73	-0.10
6/1/08 10:55	2.03	2.30	0.52	0.73	-0.10
6/1/08 11:00	2.03	2.30	1.00	0.73	-0.10
6/1/08 11:05	2.03	2.30	2.87	0.72	-0.10
6/1/08 11:10	2.03	2.30	4.25	0.73	-0.10
6/1/08 11:15	1.99	2.29	4.77	0.73	-0.10
6/1/08 11:20	1.98	2.27	5.28	0.73	-0.10
6/1/08 11:25	1.97	2.25	5.37	0.73	-0.11
6/1/08 11:30	1.98	2.24	5.46	0.73	-0.11
6/1/08 11:35	1.97	2.24	5.56	0.72	-0.11
6/1/08 11:40	1.98	2.23	5.59	0.73	-0.11
6/1/08 11:45	1.97	2.24	5.49	0.73	-0.11
6/1/08 11:50	1.97	2.25	5.48	0.73	-0.11
6/1/08 11:55	1.97	2.23	5.68	0.80	-0.11
6/1/08 12:00	1.98	2.24	5.42	2.13	-0.11
6/1/08 12:05	1.98	2.24	5.49	2.31	-0.12
6/1/08 12:10	1.98	2.24	5.49	2.36	-0.12
6/1/08 12:15	1.98	2.24	5.43	2.38	-0.11
6/1/08 12:20	1.98	2.24	5.49	2.41	-0.11
6/1/08 12:25	1.98	2.25	5.43	2.41	-0.12
6/1/08 12:30	1.99	2.24	5.37	2.40	-0.12
6/1/08 12:35	1.99	2.26	5.43	2.41	-0.12
6/1/08 12:40	1.98	2.25	5.44	2.41	0.18
6/1/08 12:45	1.99	2.25	5.39	2.39	0.68
6/1/08 12:50	1.98	2.25	5.40	2.36	0.76
6/1/08 12:55	1.98	2.26	5.37	2.40	0.80
6/1/08 13:00	1.99	2.25	5.44	2.37	0.81
6/1/08 13:05	1.98	2.25	5.41	2.41	0.82
6/1/08 13:10	1.99	2.25	5.48	2.39	0.83
6/1/08 13:15	1.98	2.25	5.47	2.41	0.83
6/1/08 13:20	1.98	2.25	5.42	2.38	0.80
6/1/08 13:25	1.98	2.25	5.45	2.37	0.80
6/1/08 13:30	1.98	2.24	5.35	2.38	0.82
6/1/08 13:35	1.98	2.24	5.41	2.41	0.79
6/1/08 13:40	1.98	2.24	5.38	2.33	0.78
6/1/08 13:45	1.97	2.25	5.36	2.35	0.77

DATE AND TIME	GRACE PUT-IN	AB GRACE GAGE	REACH 3	REACH 4 AT FOOT-BRIDGE	COVE TAIL-RACE
6/1/08 13:50	1.98	2.24	5.36	2.37	0.77
6/1/08 13:55	1.98	2.24	5.43	2.41	0.78
6/1/08 14:00	1.97	2.24	5.43	2.43	0.78
6/1/08 14:05	1.97	2.24	5.32	2.37	0.78
6/1/08 14:10	1.97	2.24	5.46	2.39	0.77
6/1/08 14:15	1.97	2.24	5.37	2.41	0.79
6/1/08 14:20	1.98	2.24	5.40	2.33	0.79
6/1/08 14:25	1.97	2.24	5.40	2.41	0.79
6/1/08 14:30	1.98	2.25	5.33	2.39	0.79
6/1/08 14:35	1.97	2.25	5.36	2.39	0.76
6/1/08 14:40	1.97	2.24	5.44	2.39	0.75
6/1/08 14:45	1.97	2.24	5.39	2.37	0.80
6/1/08 14:50	1.97	2.24	5.45	2.39	0.79
6/1/08 14:55	1.96	2.24	5.41	2.37	0.77
6/1/08 15:00	1.97	2.25	5.45	2.37	0.79
6/1/08 15:05	1.95	2.24	5.36	2.36	0.77
6/1/08 15:10	1.92	2.22	5.28	2.35	0.77
6/1/08 15:15	1.91	2.20	5.41	2.38	0.77
6/1/08 15:20	1.88	2.19	5.44	2.40	0.77
6/1/08 15:25	1.85	2.15	5.37	2.41	0.78
6/1/08 15:30	1.85	2.13	5.44	2.37	0.80
6/1/08 15:35	1.83	2.11	5.46	2.37	0.78
6/1/08 15:40	1.78	2.08	5.38	2.37	0.78
6/1/08 15:45	1.78	2.05	5.37	2.36	0.77
6/1/08 15:50	1.75	2.05	5.37	2.38	0.77
6/1/08 15:55	1.72	2.01	5.36	2.39	0.78
6/1/08 16:00	1.72	1.99	5.38	2.34	0.79
6/1/08 16:05	1.68	1.98	5.40	2.37	0.77
6/1/08 16:10	1.66	1.95	5.39	2.38	0.79
6/1/08 16:15	1.67	1.93	5.16	2.35	0.76
6/1/08 16:20	1.63	1.92	5.19	2.39	0.77
6/1/08 16:25	1.61	1.89	5.11	2.40	0.77
6/1/08 16:30	1.61	1.87	5.06	2.35	0.77
6/1/08 16:35	1.57	1.85	4.96	2.36	0.76
6/1/08 16:40	1.55	1.83	5.03	2.33	0.76
6/1/08 16:45	1.55	1.80	4.91	2.33	0.78
6/1/08 16:50	1.52	1.80	4.92	2.32	0.78

DATE AND TIME	GRACE PUT-IN	AB GRACE GAGE	REACH 3	REACH 4 AT FOOT-BRIDGE	COVE TAIL-RACE
6/1/08 16:55	1.50	1.77	4.83	2.29	0.80
6/1/08 17:00	1.49	1.75	4.74	2.29	0.80
6/1/08 17:05	1.48	1.74	4.75	2.28	0.84
6/1/08 17:10	1.45	1.71	4.65	2.24	0.85
6/1/08 17:15	1.44	1.69	4.62	2.25	0.86
6/1/08 17:20	1.41	1.67	4.49	2.18	0.86
6/1/08 17:25	1.39	1.64	4.54	2.17	0.85
6/1/08 17:30	1.39	1.63	4.42	2.19	0.84
6/1/08 17:35	1.36	1.62	4.40	2.13	0.85
6/1/08 17:40	1.34	1.59	4.38	2.14	0.78
6/1/08 17:45	1.33	1.57	4.36	2.14	0.81
6/1/08 17:50	1.30	1.55	4.24	2.11	0.78
6/1/08 17:55	1.28	1.52	4.18	2.12	0.75
6/1/08 18:00	1.28	1.50	4.14	2.09	0.74
6/1/08 18:05	1.25	1.48	4.04	2.04	0.75
6/1/08 18:10	1.24	1.46	3.98	2.02	0.74
6/1/08 18:15	1.23	1.44	3.96	2.04	0.77
6/1/08 18:20	1.21	1.43	3.97	2.02	0.74
6/1/08 18:25	1.19	1.40	3.82	1.98	0.73
6/1/08 18:30	1.18	1.38	3.82	2.00	0.72
6/1/08 18:35	1.15	1.37	3.65	1.94	0.72
6/1/08 18:40	1.13	1.34	3.71	1.93	0.72
6/1/08 18:45	1.13	1.32	3.61	1.87	0.73
6/1/08 18:50	1.10	1.30	3.55	1.86	0.73
6/1/08 18:55	1.08	1.27	3.53	1.88	0.74
6/1/08 19:00	1.08	1.25	3.44	1.87	0.75
6/1/08 19:05	1.07	1.24	3.41	1.79	0.75
6/1/08 19:10	1.04	1.22	3.38	1.83	0.73
6/1/08 19:15	1.03	1.19	3.26	1.83	0.74
6/1/08 19:20	0.99	1.17	3.24	1.74	0.73
6/1/08 19:25	0.97	1.14	3.20	1.71	0.73
6/1/08 19:30	0.97	1.11	3.17	1.73	0.76
6/1/08 19:35	0.94	1.09	3.16	1.75	0.75
6/1/08 19:40	0.92	1.07	3.04	1.72	0.77
6/1/08 19:45	0.92	1.04	3.00	1.67	0.78
6/1/08 19:50	0.90	1.02	2.93	1.63	0.77
6/1/08 19:55	0.88	1.00	2.90	1.65	0.76

DATE AND TIME	GRACE PUT-IN	AB GRACE GAGE	REACH 3	REACH 4 AT FOOT-BRIDGE	COVE TAIL-RACE
6/1/08 20:00	0.89	0.98	2.81	1.60	0.79
6/1/08 20:05	0.85	0.97	2.78	1.60	0.78
6/1/08 20:10	0.83	0.96	2.79	1.59	0.76
6/1/08 20:15	0.83	0.93	2.67	1.59	0.73
6/1/08 20:20	0.81	0.92	2.63	1.54	0.76
6/1/08 20:25	0.79	0.89	2.57	1.54	0.74
6/1/08 20:30	0.78	0.87	2.51	1.54	0.72
6/1/08 20:35	0.75	0.85	2.46	1.52	0.73
6/1/08 20:40	0.73	0.83	2.38	1.51	0.72
6/1/08 20:45	0.73	0.80	2.35	1.48	0.71
6/1/08 20:50	0.70	0.78	2.27	1.49	0.70
6/1/08 20:55	0.69	0.76	2.20	1.45	0.69
6/1/08 21:00	0.67	0.74	2.13	1.45	0.68
6/1/08 21:05	0.65	0.73	2.07	1.44	0.69
6/1/08 21:10	0.63	0.71	2.00	1.40	0.67
6/1/08 21:15	0.63	0.69	2.01	1.39	0.68
6/1/08 21:20	0.61	0.67	1.92	1.38	0.71
6/1/08 21:25	0.59	0.65	1.86	1.36	0.71
6/1/08 21:30	0.59	0.64	1.85	1.34	0.70
6/1/08 21:35	0.58	0.63	1.79	1.31	0.69
6/1/08 21:40	0.58	0.62	1.74	1.31	0.68
6/1/08 21:45	0.58	0.62	1.69	1.28	0.66
6/1/08 21:50	0.58	0.61	1.65	1.25	0.68
6/1/08 21:55	0.58	0.60	1.62	1.26	0.65
6/1/08 22:00	0.58	0.60	1.59	1.25	0.68
6/1/08 22:05	0.58	0.60	1.53	1.22	0.67
6/1/08 22:10	0.58	0.60	1.52	1.21	0.65
6/1/08 22:15	0.58	0.60	1.47	1.21	0.64
6/1/08 22:20	0.58	0.60	1.39	1.19	0.62
6/1/08 22:25	0.59	0.60	1.37	1.19	0.65
6/1/08 22:30	0.58	0.60	1.30	1.15	0.63
6/1/08 22:35	0.58	0.60	1.25	1.14	0.62
6/1/08 22:40	0.58	0.60	1.21	1.12	0.61
6/1/08 22:45	0.58	0.60	1.22	1.11	0.60
6/1/08 22:50	0.58	0.60	1.13	1.10	0.60
6/1/08 22:55	0.58	0.60	1.11	1.10	0.62
6/1/08 23:00	0.58	0.60	1.08	1.08	0.58

DATE AND TIME	GRACE PUT-IN	AB GRACE GAGE	REACH 3	REACH 4 AT FOOT-BRIDGE	COVE TAIL-RACE
6/1/08 23:05	0.59	0.60	1.06	1.08	0.59
6/1/08 23:10	0.59	0.60	0.99	1.06	0.58
6/1/08 23:15	0.59	0.60	0.94	1.05	0.58
6/1/08 23:20	0.59	0.60	0.93	1.04	0.56
6/1/08 23:25	0.59	0.60	0.88	1.03	0.58
6/1/08 23:30	0.58	0.60	0.86	1.02	0.57
6/1/08 23:35	0.59	0.60	0.85	1.01	0.55
6/1/08 23:40	0.59	0.60	0.84	1.00	0.55
6/1/08 23:45	0.58	0.60	0.79	0.98	0.54
6/1/08 23:50	0.59	0.60	0.75	0.96	0.54
6/1/08 23:55	0.59	0.60	0.73	0.96	0.55
6/2/08 0:00	0.59	0.60	0.73	0.95	0.54
6/2/08 0:05	0.59	0.60	0.69	0.94	0.54
6/2/08 0:10	0.59	0.60	0.67	0.92	0.52
6/2/08 0:15	0.59	0.60	0.67	0.93	0.52
6/2/08 0:20	0.59	0.60	0.62	0.91	0.53
6/2/08 0:25	0.59	0.60	0.63	0.91	0.52
6/2/08 0:30	0.58	0.60	0.63	0.90	0.51
6/2/08 0:35	0.59	0.60	0.62	0.88	0.51
6/2/08 0:40	0.59	0.60	0.57	0.86	0.49
6/2/08 0:45	0.59	0.60	0.57	0.85	0.48
6/2/08 0:50	0.59	0.60	0.55	0.84	0.48
6/2/08 0:55	0.58	0.60	0.53	0.83	0.46
6/2/08 1:00	0.59	0.60	0.54	0.83	0.48
6/2/08 1:05	0.59	0.60	0.53	0.83	0.48
6/2/08 1:10	0.58	0.60	0.52	0.83	0.47
6/2/08 1:15	0.59	0.60	0.54	0.82	0.48
6/2/08 1:20	0.59	0.60	0.52	0.82	0.47
6/2/08 1:25	0.59	0.60	0.52	0.81	0.47
6/2/08 1:30	0.58	0.60	0.51	0.80	0.48
6/2/08 1:35	0.59	0.60	0.52	0.80	0.43
6/2/08 1:40	0.58	0.60	0.52	0.79	0.47
6/2/08 1:45	0.58	0.60	0.54	0.79	0.46
6/2/08 1:50	0.59	0.60	0.53	0.79	0.45
6/2/08 1:55	0.59	0.60	0.52	0.77	0.46
6/2/08 2:00	0.58	0.60	0.53	0.77	0.45
6/2/08 2:05	0.59	0.60	0.53	0.77	0.46

DATE AND TIME	GRACE PUT-IN	AB GRACE GAGE	REACH 3	REACH 4 AT FOOT-BRIDGE	COVE TAIL-RACE
6/2/08 2:10	0.59	0.60	0.52	0.77	0.45
6/2/08 2:15	0.59	0.60	0.52	0.77	0.45
6/2/08 2:20	0.59	0.60	0.51	0.76	0.46
6/2/08 2:25	0.58	0.60	0.49	0.75	0.43
6/2/08 2:30	0.59	0.60	0.52	0.76	0.46
6/2/08 2:35	0.59	0.60	0.52	0.76	0.44
6/2/08 2:40	0.59	0.60	0.54	0.76	0.45
6/2/08 2:45	0.59	0.60	0.54	0.76	0.44
6/2/08 2:50	0.59	0.61	0.52	0.75	0.45
6/2/08 2:55	0.59	0.60	0.49	0.74	0.46
6/2/08 3:00	0.59	0.60	0.52	0.76	0.47
6/2/08 3:05	0.59	0.60	0.51	0.75	0.44
6/2/08 3:10	0.59	0.60	0.49	0.74	0.45
6/2/08 3:15	0.59	0.61	0.52	0.75	0.44
6/2/08 3:20	0.59	0.61	0.50	0.74	0.45
6/2/08 3:25	0.59	0.60	0.52	0.75	0.43
6/2/08 3:30	0.58	0.60	0.52	0.74	0.43
6/2/08 3:35	0.59	0.60	0.51	0.74	0.42
6/2/08 3:40	0.59	0.60	0.51	0.75	0.42
6/2/08 3:45	0.59	0.60	0.53	0.75	0.43
6/2/08 3:50	0.59	0.60	0.50	0.74	0.43
6/2/08 3:55	0.59	0.60	0.49	0.74	0.43
6/2/08 4:00	0.59	0.61	0.51	0.75	0.44
6/2/08 4:05	0.59	0.60	0.51	0.74	0.45
6/2/08 4:10	0.59	0.60	0.50	0.74	0.43
6/2/08 4:15	0.59	0.61	0.51	0.75	0.45
6/2/08 4:20	0.59	0.60	0.50	0.75	0.44
6/2/08 4:25	0.59	0.61	0.51	0.75	0.43
6/2/08 4:30	0.59	0.60	0.49	0.75	0.46
6/2/08 4:35	0.59	0.60	0.50	0.74	0.45
6/2/08 4:40	0.59	0.60	0.50	0.75	0.45
6/2/08 4:45	0.59	0.60	0.52	0.75	0.46
6/2/08 4:50	0.59	0.60	0.50	0.75	0.44
6/2/08 4:55	0.59	0.61	0.51	0.75	0.44
6/2/08 5:00	0.59	0.61	0.51	0.75	0.44
6/2/08 5:05	0.59	0.61	0.50	0.75	0.45
6/2/08 5:10	0.59	0.61	0.52	0.74	0.43

DATE AND TIME	GRACE PUT-IN	AB GRACE GAGE	REACH 3	REACH 4 AT FOOT-BRIDGE	COVE TAIL-RACE
6/2/08 5:15	0.59	0.61	0.49	0.74	0.43
6/2/08 5:20	0.59	0.61	0.51	0.75	0.44
6/2/08 5:25	0.59	0.61	0.53	0.75	0.43
6/2/08 5:30	0.59	0.61	0.51	0.75	0.44
6/2/08 5:35	0.59	0.61	0.51	0.75	0.46
6/2/08 5:40	0.59	0.61	0.51	0.75	0.46
6/2/08 5:45	0.59	0.61	0.50	0.75	0.45
6/2/08 5:50	0.59	0.61	0.51	0.75	0.44
6/2/08 5:55	0.59	0.61	0.52	0.75	0.44
6/2/08 6:00	0.59	0.61	0.49	0.75	0.43
6/2/08 6:05	0.59	0.61	0.51	0.75	0.44
6/2/08 6:10	0.59	0.61	0.51	0.75	0.45
6/2/08 6:15	0.60	0.61	0.53	0.75	0.44
6/2/08 6:20	0.59	0.61	0.50	0.75	0.45
6/2/08 6:25	0.60	0.61	0.51	0.75	0.45
6/2/08 6:30	0.59	0.60	0.52	0.75	0.43
6/2/08 6:35	0.59	0.61	0.52	0.74	0.45
6/2/08 6:40	0.60	0.61	0.49	0.75	0.44
6/2/08 6:45	0.60	0.61	0.51	0.74	0.43
6/2/08 6:50	0.59	0.61	0.50	0.75	0.45
6/2/08 6:55	0.59	0.61	0.51	0.75	0.45
6/2/08 7:00	0.59	0.61	0.53	0.75	0.44
6/2/08 7:05	0.59	0.61	0.51	0.75	0.43
6/2/08 7:10	0.59	0.61	0.49	0.75	0.44
6/2/08 7:15	0.59	0.61	0.52	0.75	0.46
6/2/08 7:20	0.59	0.61	0.50	0.75	0.44
6/2/08 7:25	0.59	0.61	0.51	0.75	0.46
6/2/08 7:30	0.59	0.61	0.50	0.75	0.44
6/2/08 7:35	0.59	0.60	0.51	0.75	0.44
6/2/08 7:40	0.59	0.61	0.48	0.75	0.46
6/2/08 7:45	0.59	0.60	0.51	0.74	0.44
6/2/08 7:50	0.59	0.61	0.49	0.75	0.44
6/2/08 7:55	0.59	0.60	0.52	0.74	0.44
6/2/08 8:00	0.59	0.60	0.48	0.74	0.46