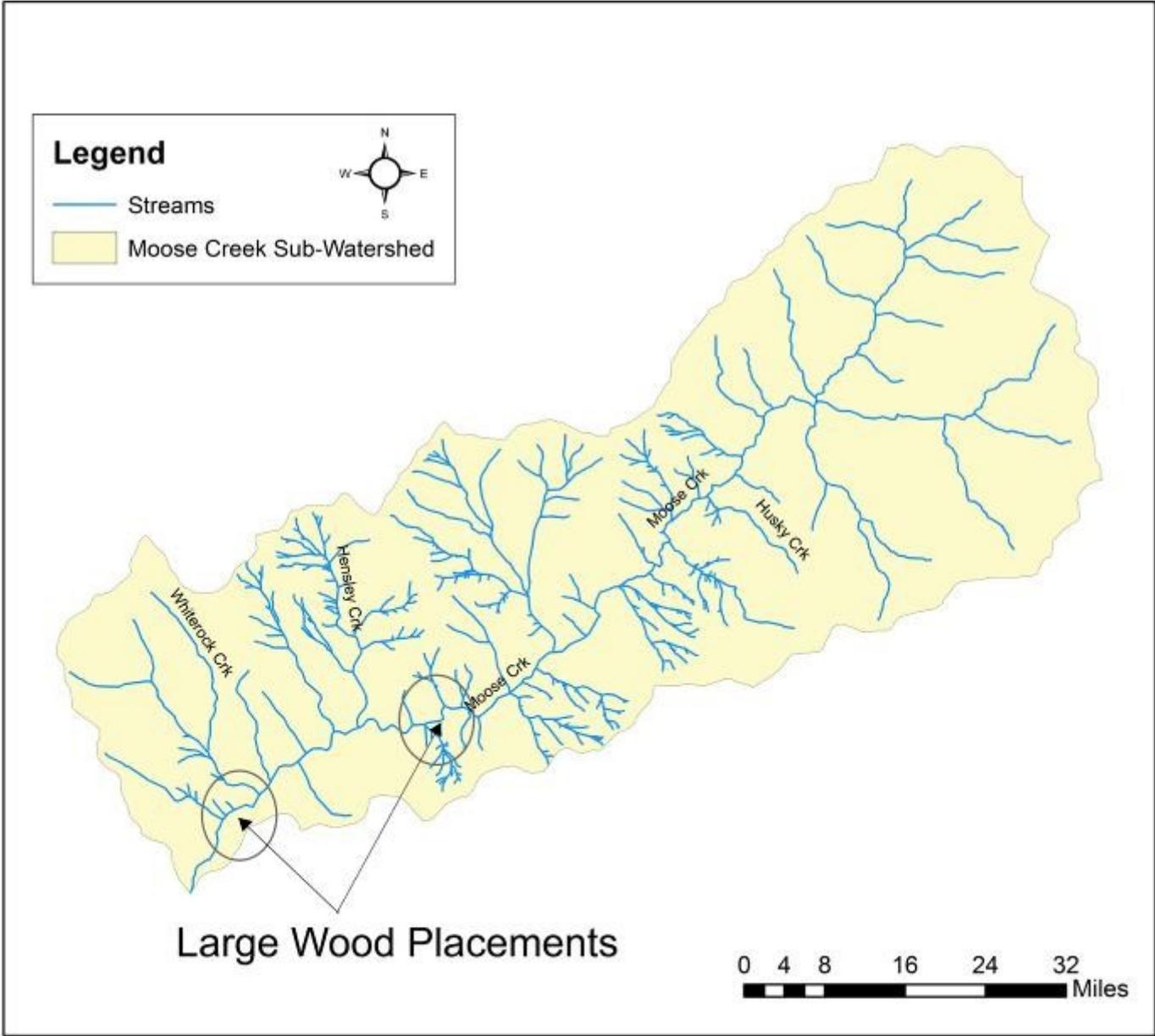
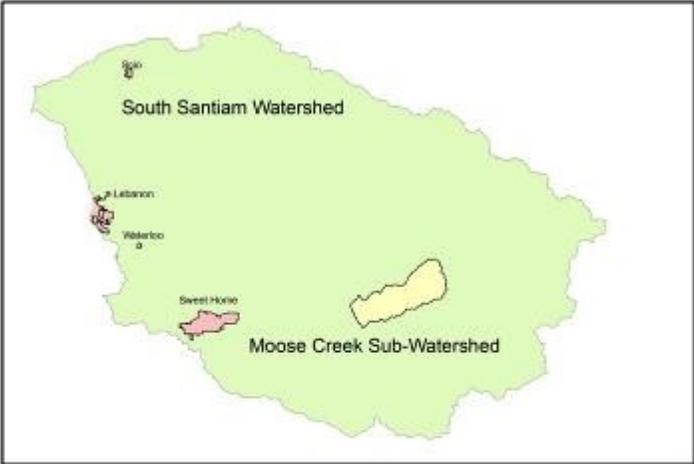


**Interim Project Effectiveness Report
Moose Creek Steelhead Improvement Project
OWEB #208-3057-6820
South Santiam Watershed Council
January, 2010**



Cover Photo: Moose Creek cross-section #5, looking downstream. Photo taken 6/16/2009

Moose Creek Steelhead Habitat Improvement Project



I. Background and Summary:

The Moose Creek Steelhead Improvement Project was implemented in August, 2008. Over 60 trees were placed in the creek through a variety of methods. These included direct falling from the streambank, cable-assisted pulling to preserve the tree root wad, and helicopter log placement. This interim report includes data collected pre-project 2008 and during the summer of 2009. While the project is largely complete, it should be noted that additional work occurred during the 2009 summer season after much of these data were collected. This included some manipulation of placed wood with cables throughout the length of the project. In addition, gravel augmentation may take place in summer 2010.



Photo #1: Looking upstream at cross-section #4

The limited timeframe after project implementation does not allow for definitive statements of project success or failure. What the project proponents have learned thus far is that the wood placed in 2008 was retained in Moose Creek through the first winter high flows. Spawning sized gravels for winter steelhead appear to be increasing as sediment is dropped near the wood structures. Further data collection will be required to properly assess juvenile and adult winter steelhead abundance, nutrient retention in Moose Creek, and any impact the project has on stream temperatures. Initial data analysis will inform the project proponents on the necessity of gravel augmentation in 2010. This project will also influence the design of large wood placement projects in nearby sub-watersheds that are severely lacking large wood (i.e., Canyon/Owl Creeks and Soda Fk.).

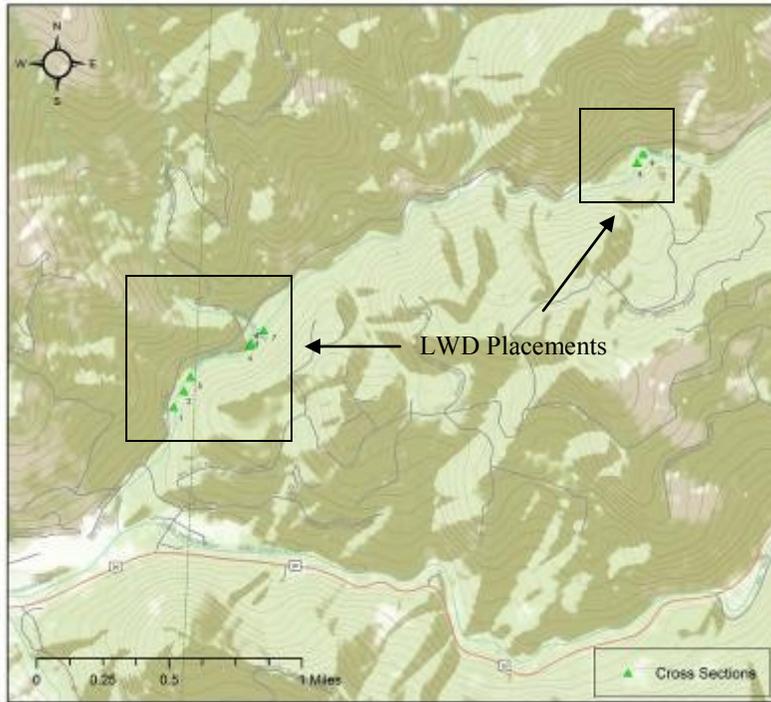
Survey protocols and methods are described in the relevant sections. A sampling design was created to measure the effects of the large wood treatment on Moose Creek. The project proponents are particularly interested in increases in available steelhead spawning and rearing habitat.

There were no major changes to the original proposal, to date. A minor modification occurred in the upper wood placement area. Initial plans called for wood placed in this area to be only directly felled and likely to be transported out of the area in high water. Subsequent analysis by USFS personnel led to the inclusion of wood through cable assisted methods that kept the root-wad attached which should allow for greater wood retention in these areas.

Monitoring data is held by the USFS, Sweet Home Ranger District and the South Santiam Watershed Council, and can be obtained upon request. A copy of this report will be posted on the South Santiam Watershed Council website and may also be shared with the Linn County Resource Advisory Committee, other funders, or interested parties.

II. Cross-Sections

Stream cross-sections were conducted pre-project in 2008 at seven locations that were selected as sites that would reflect any changes in channel morphology after project implementation. These are numbered 1-7 in Map #1. Post project cross-sections were conducted in 2009 at these seven locations, and at two other locations higher in the watershed, numbered 8 and 9. Over time, it is expected that the stream cross-sections will demonstrate aggregation of the stream as sediment is retained by the place large woody debris structures. Cross-section graphs and photopoints are found in the appendix of this document.



Map #1: Location of LWD placements in relation to stream cross-section points.

Along with cross-sections, a pebble count was conducted to monitor the amount of spawning-size gravels (8-90mm) were present before the project was implemented and those present one year post-project. Initial analysis of the pebble counts show a 4.5% increase in steelhead spawning size gravels in 2009 compared to 2008. Spawning sized gravels increased in 5 of the 7 cross-section locations. The percentage of bed material at each cross-section is graphed in the appendix. Protocols used for the cross-sections were provided by the *USFS Stream Channel Reference Sites: An Illustrated Guide to Field Technique*.

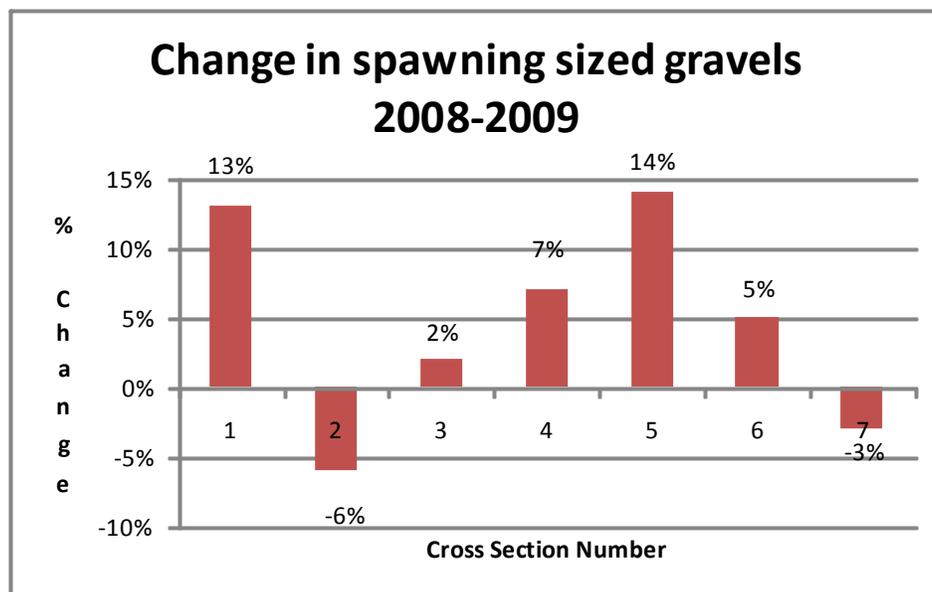
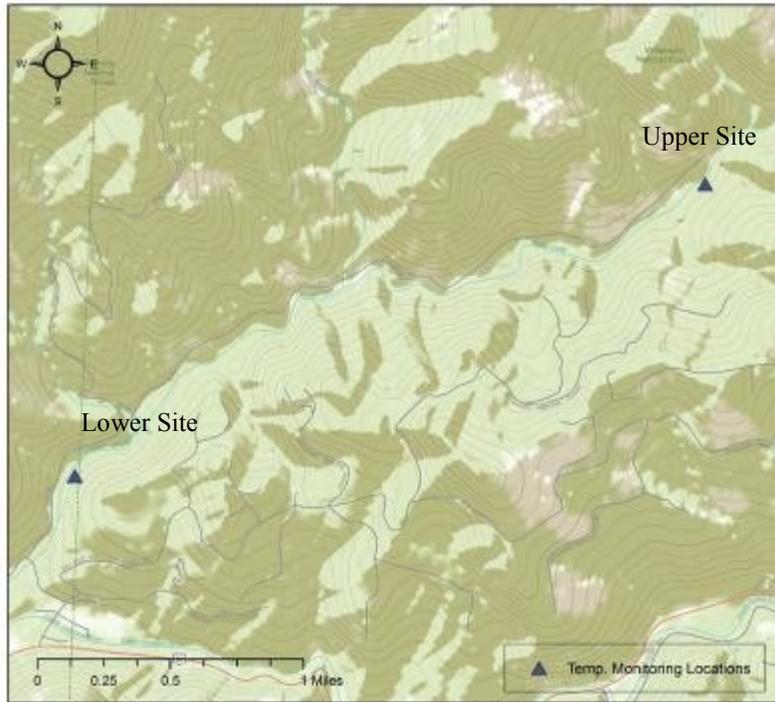


Figure #1: Change in spawning gravels (8-90 mm) in 7 cross sections between 2008-2009.

III. Temperature Monitoring

Stream temperature data has been collected on Moose Creek, and may be used to measure the project effectiveness in terms of creating habitat conditions that promote cool water temperatures. These habitat conditions include LWD providing shade over the water and accumulated sediment encouraging development of a hyporheic exchange. Data collected and presented here are from 2006-2009. Data were collected by USFS personnel using Onset dataloggers and reflect the maximum seven-day moving averages over the summer months. Data were collected



Map#2: Location of Water Temperature Probes

at two sites, reflected in Map #2, and are categorized as low and high in the Moose Creek sub-watershed. It must be noted that temperature collected in the “upper site” in 2006 was actually much higher in the watershed, and should not be directly associated with data collected at the upper site 2007-2009. However, it is included here for reference purposes.

As seen in figure #2, data collected in 2009 show warmer water temperatures. Further investigation and data collection are warranted to see if this trend continues and is associated with air temperature, hydrology of Moose Lake, or some other influence.

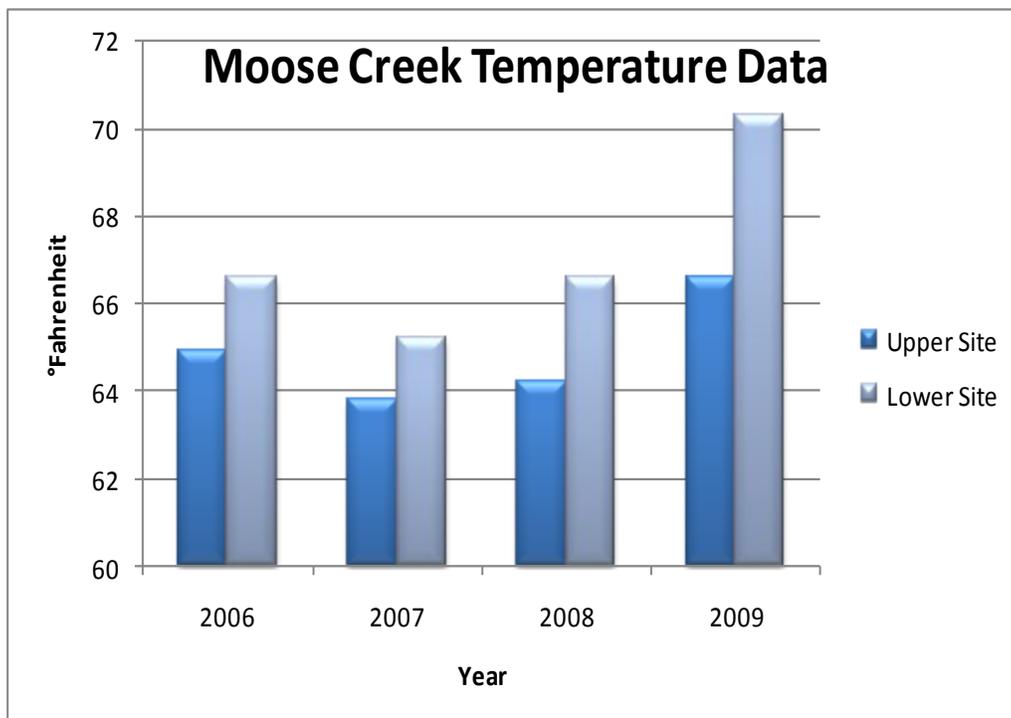
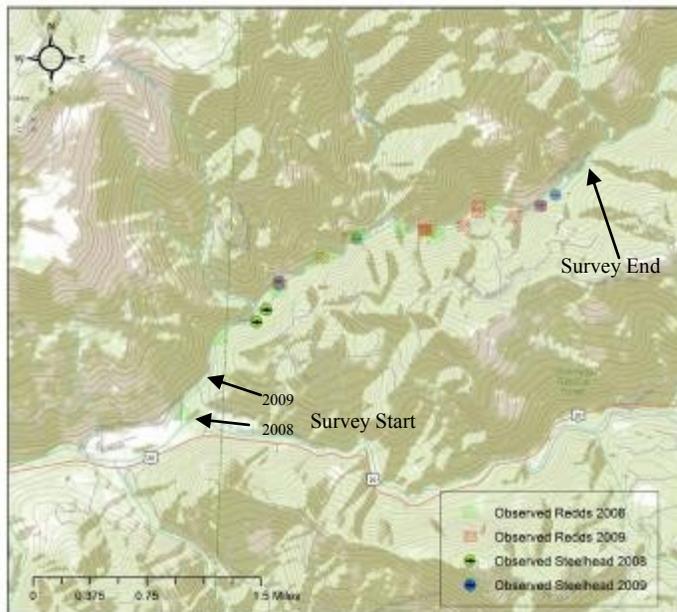


Figure #2: Moose Creek Temperature Graph. 2006 “Upper Site” at different location than “Upper Site” 2007-2009. Temperatures are maximum seven-day moving averages June-September.

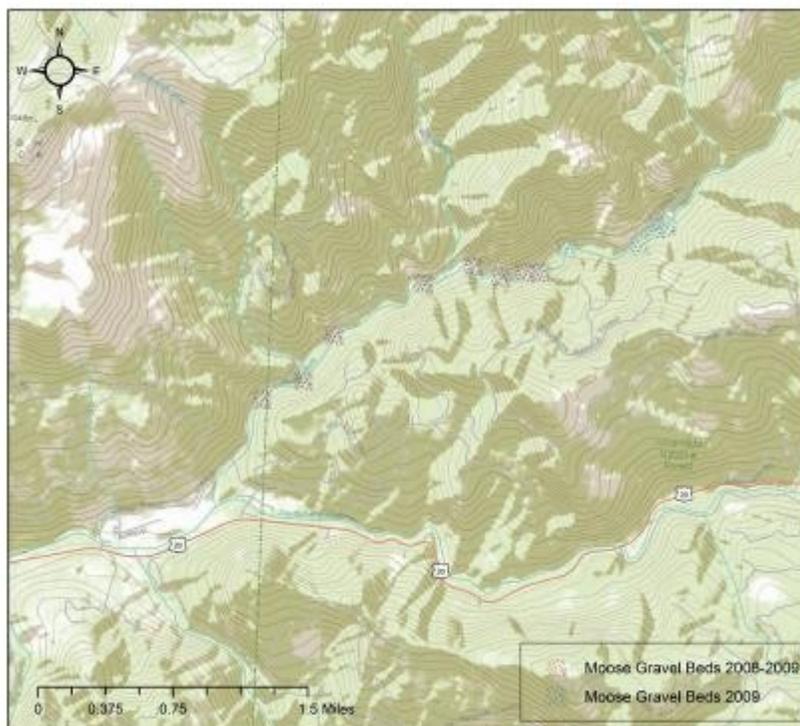
IV. Steelhead Spawning

Spawning surveys in Moose Creek have been conducted prior to project implementation in the spring of 2008 and post-project in the spring of 2009. In both years, Moose Creek was surveyed for adult steelhead and steelhead redds in the April-June timeframe. In 2008, five complete surveys were conducted between the Moose Creek confluence with the South Santiam River and the junction of USFS roads 2025 and 580. In 2009, five complete surveys were conducted along a similar 4 mile-long span (only differing from the 2008 survey in that it began 0.25 miles from the confluence in 2009). The same observer was present in both 2008 and 2009. As referenced in Map #3 adult steelhead and redds were observed and their location marked in 2008 and 2009. In addition, the location of all gravel beds suitable for spawning, and measuring at least 50 feet in length, were recorded and are seen below in Map #4. It should be noted that there appeared to be an increased amount of spawning activity observed in 2009. As



Map #3. Observed spawning activity 2008-2009

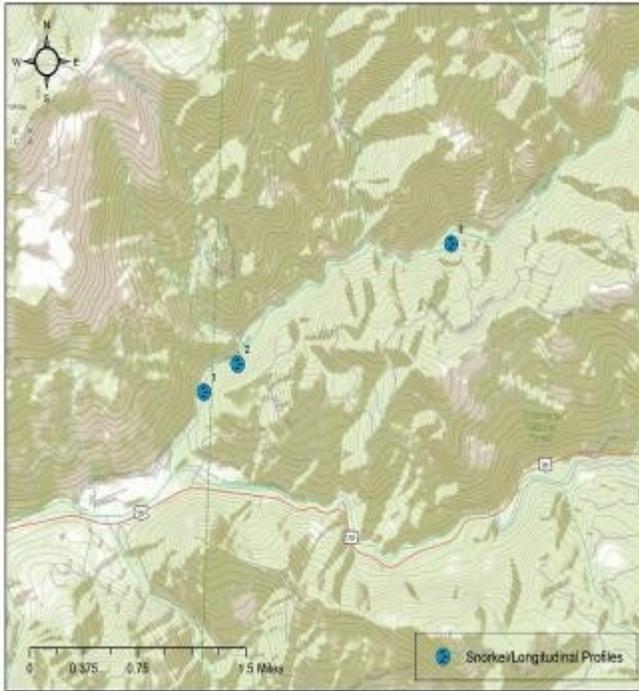
spawning size gravel beds continue to develop, it will be interesting to see if the trend continues to develop in future surveys.



Map #4: All large gravel beds in 2008 were observed in the same location in 2009. In addition, four more beds were noted in the upper survey reaches.

V. Longitudinal Profiles and Snorkel Surveys

Longitudinal profiles of Moose Creek were conducted in 2008 and 2009 in accordance with *USFS Stream Channel Reference Sites: An Illustrated Guide to Field Technique*. These profiles will document stream elevation changes over time. Sample sites were selected to reflect possible changes below, above, and in the middle of wood placements. Profile lines reflect the “center line”, water surface points were also collected but not shown here. The first profile begins at the lower end of the wood placements and extends over 800 ft. to cross section #3. The second profile begins downstream of cross section #4 and extends over 700 ft. to just above cross-section #7. An additional longitudinal profile was conducted in 2009, and extends approximately 760 ft. through cross-sections #8 and #9.



Map #5: Location of snorkel surveys and longitudinal profiles.

Each longitudinal profile was also snorkeled by two surveyors. Results of the snorkel surveys are graphed in figures #3-#5. Snorkel surveys in longitudinal profile #3 were conducted only in 2009. In 2009, fewer fish were observed in all size classes.

Each longitudinal profile was also snorkeled by two surveyors. Results of the snorkel surveys are graphed in figures #3-#5. Snorkel surveys in longitudinal profile #3 were conducted only in 2009. In 2009, fewer fish were observed in all size classes.

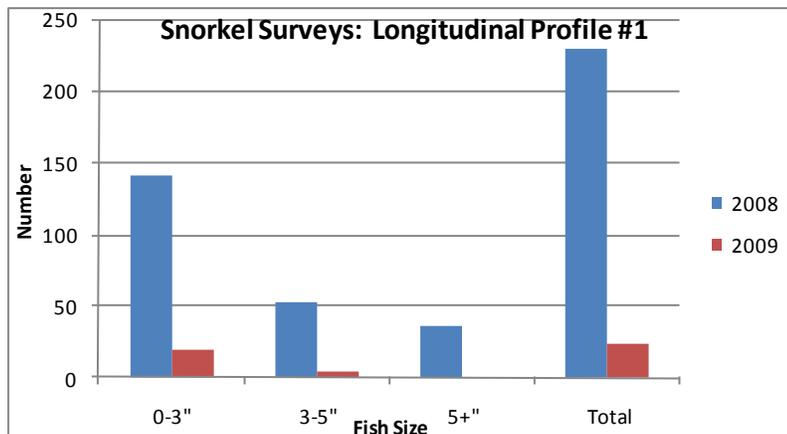
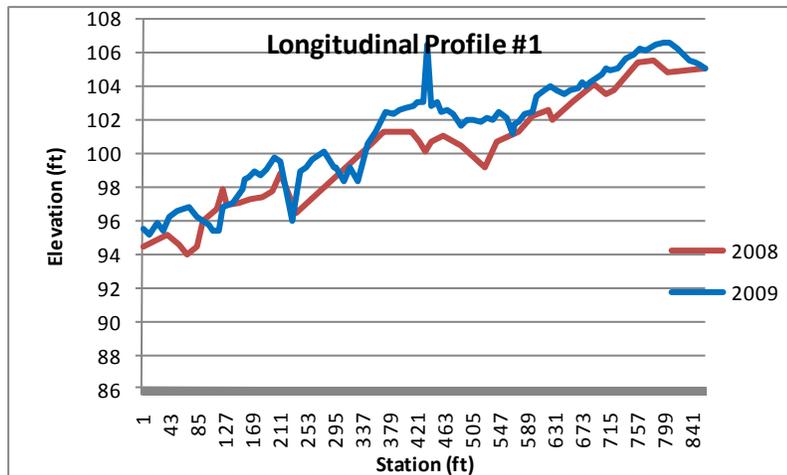


Figure #3: Longitudinal Profile and Snorkel Survey #1

V. Longitudinal Profiles and Snorkel Surveys, Ctd.

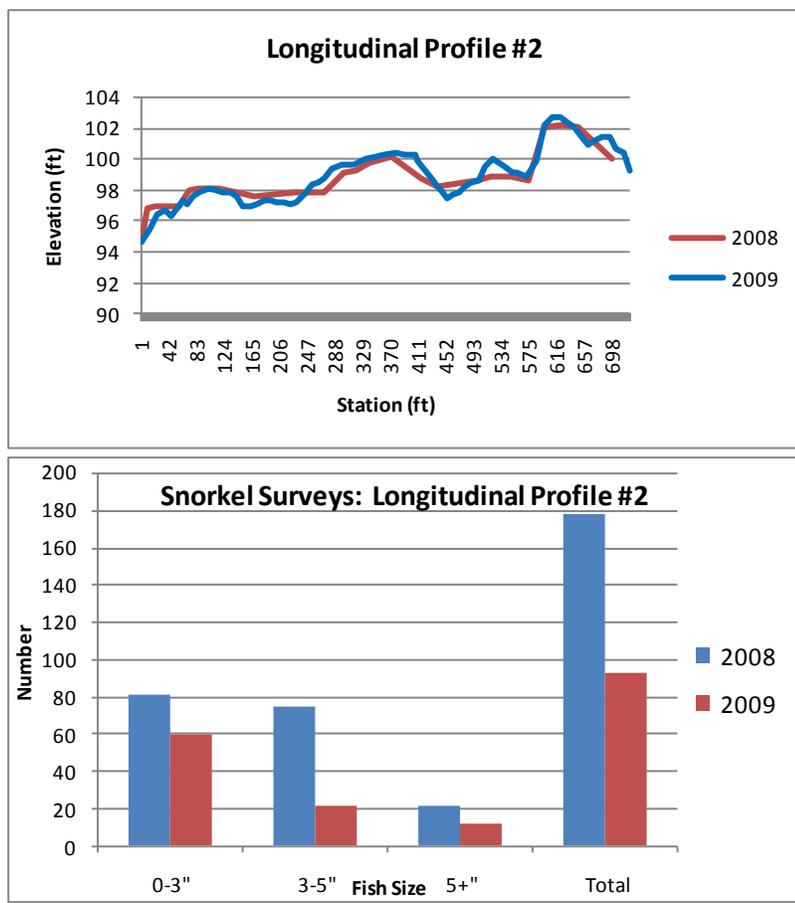


Figure #4: Longitudinal Profile and Snorkel Survey #2

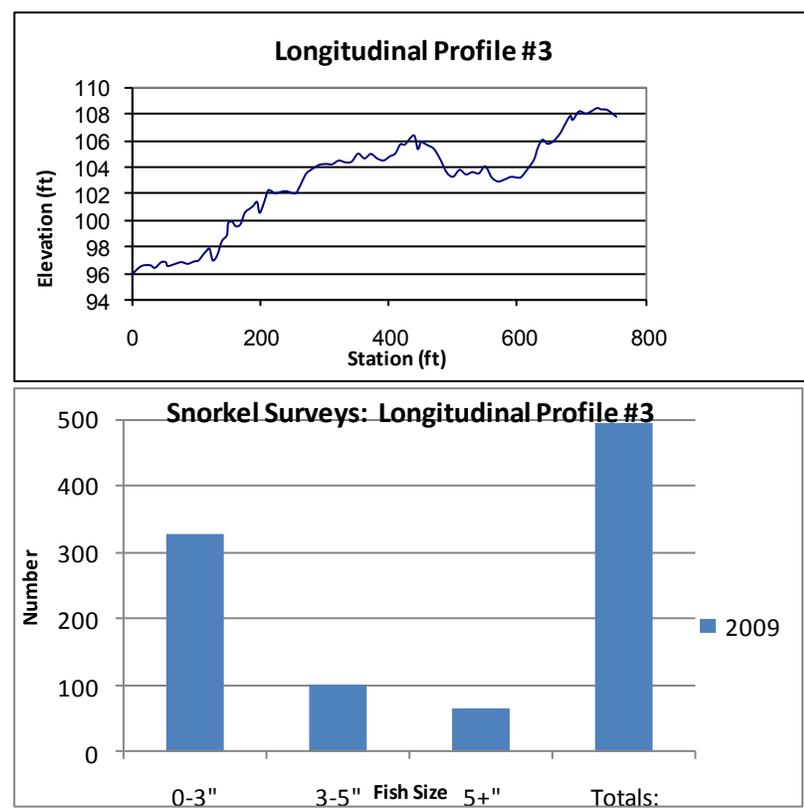
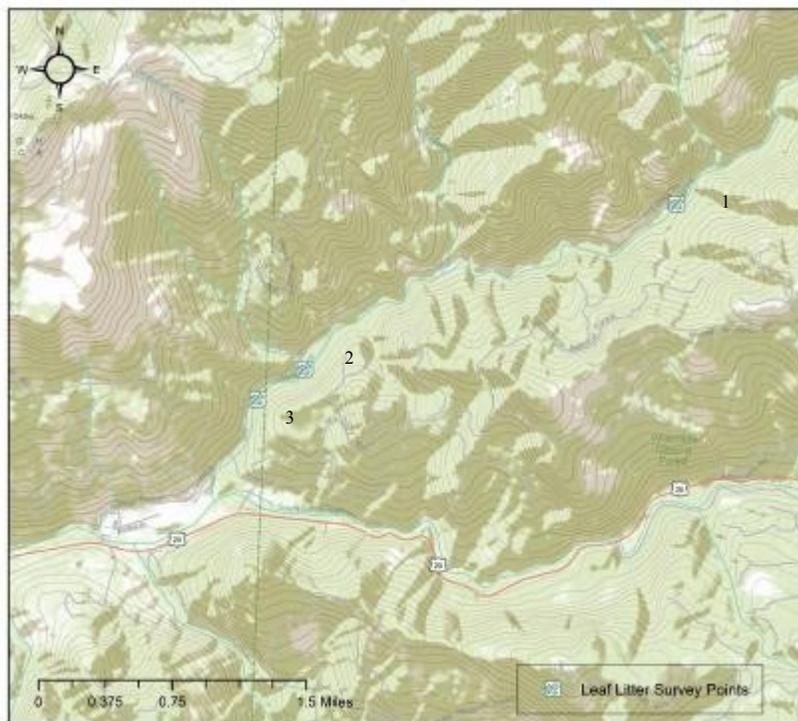


Figure #5: Longitudinal Profile and Snorkel Survey #3

VI. Nutrient Retention

Three leaf litter collection points were established in 2008. Leaf packs were prepared using 4 species of tree leaves for a total of 20 grams per sample. They were tied around rocks and submerged in Moose Creek in October, 2008. There were four leaf packs per site for a total of 12 leaf packs. Site #1 is the furthest upstream. Site #2 is located at the White Rock Creek confluence with Moose Creek and the leaf packs were placed right in the wood placement area. Site



Map #6: Location of leaf litter survey collection points.

#3 is further downstream at the water temperature monitoring structure, and leaf packs were also placed within a wood placement area. Packs were left in the creek throughout October until they were recovered by students from the Santiam Wilderness Academy and taken back to their classroom for analyses. Eleven of the twelve leaf packs were recovered; one broke off and was lost. Leaf packs were placed in October, 2009 and lost to high water. The surveys will continue on a yearly basis. Protocols were derived from the Stroud Water Research Center and are included in a “Pack Stream Ecology Kit” manual.

Results

A total of eight leaf packs were sorted and analyzed (the other three were not processed correctly and are not included in the analyses). A total of 235 individual macro invertebrates were found from a total of 8 orders (see table below), with the highest number occurring in leaf packs from site #1 (28 individuals/sample) compared to site #2 (22 individuals/sample) and site #3 (12 individuals/sample). Shredders, a functional group whose feeding activity takes larger leaf particles and releases smaller particles to flow downstream (represented here by stoneflies) were more abundant in leaf packs from site #1 (average 13.6/sample) than site #2 (10.6/sample) or site #3 (5/sample). Grazers or scrapers, a functional group that feeds by scraping algae from rocks and gravel, (represented by mayflies) were also more abundant in site #1 (29/sample) than site #2 (4/sample) and site #3 (1.5/sample). Only one individual from the predator functional group was found, and it was from site #3. These data provide a baseline from which we can compare changes to the macro invertebrate community over subsequent years.

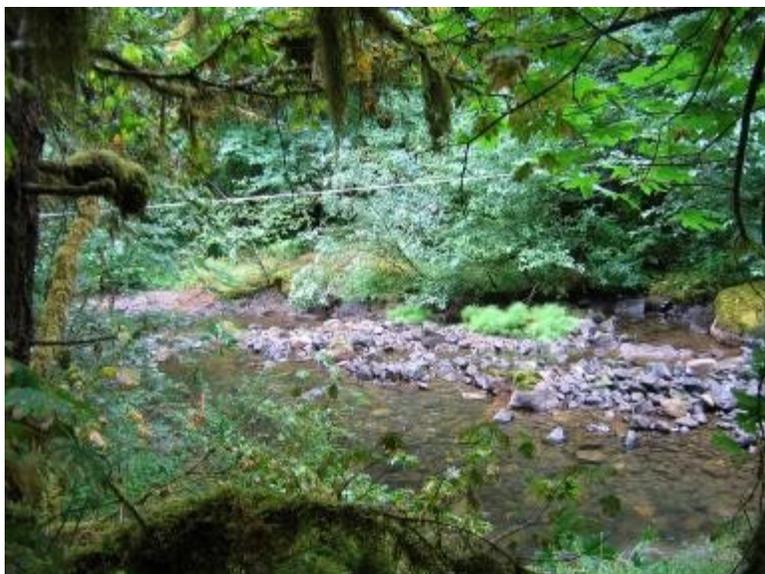
Site	Ephemeroptera	Plecoptera	Trichoptera	Odenata	Coleoptera	Hemiptera	Diptera	Turbellaria	Other	Total
Site 1	50	4	5				5			64
Site 1	18	16	1				3	1		39
Site 1	19	21	2							42
Site 2	3	18	6		5		9		6	47
Site 2	6	8	0							14
Site 2	3	6				2				11
Site 3	2	2	1	1						6
Site 3	1	8	2		3		4			18
Total	102	83	17	1	8	2	21	1	6	241

Appendix

Cross-Section Photos and Graphs

**Interim Project Effectiveness Report
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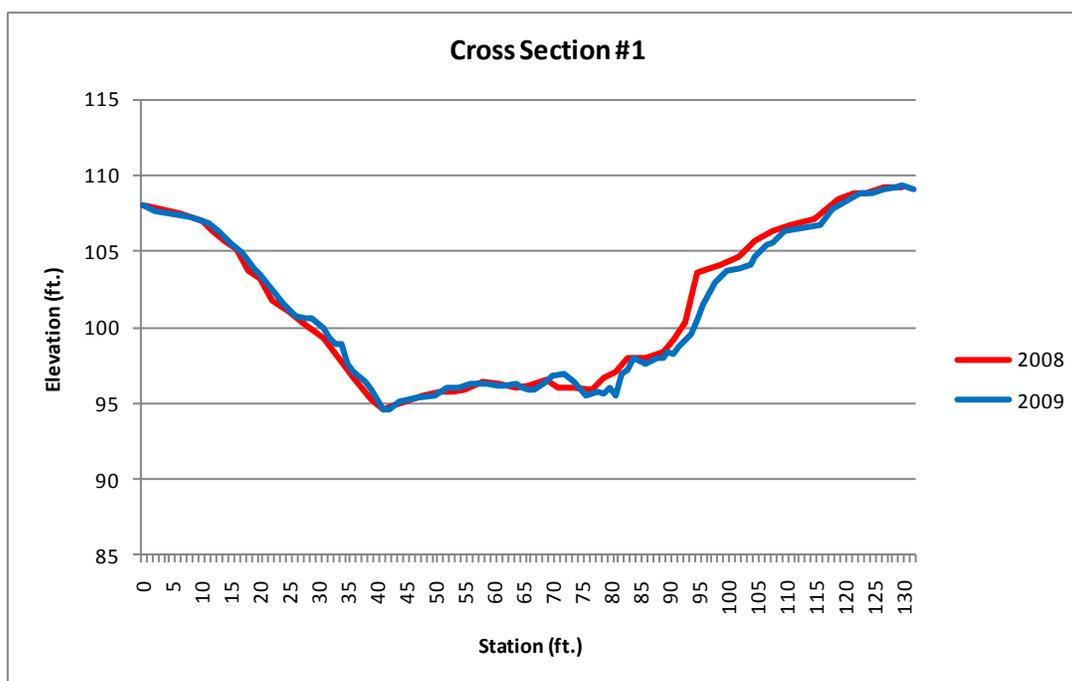
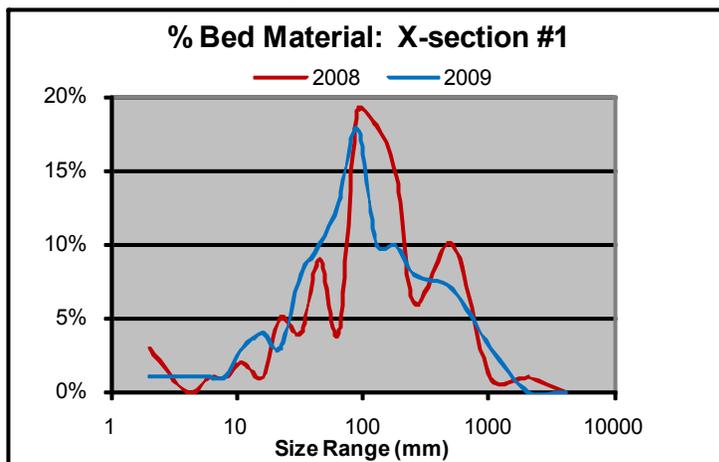
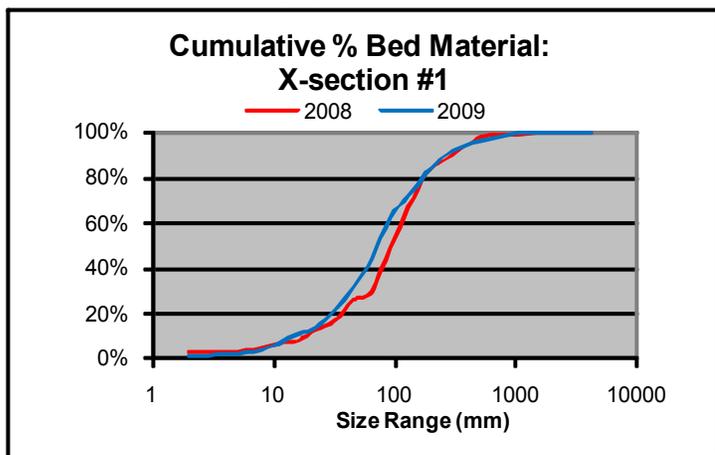
Moose Creek Cross-Section #1



Pre-project: 7/30/2008



Post-project: 6/16/2009

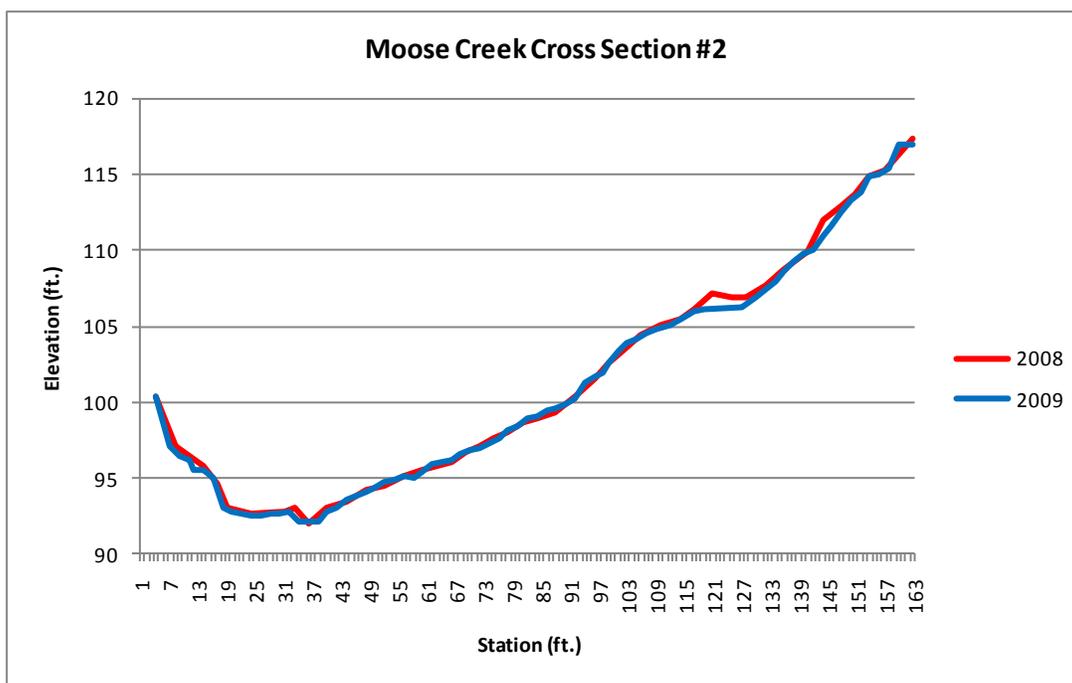
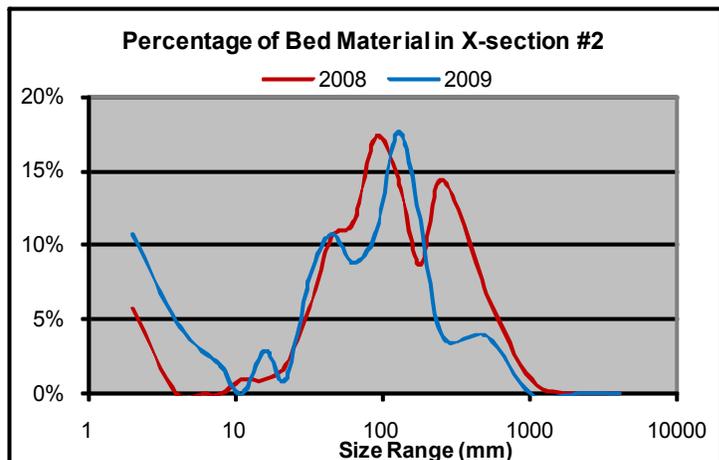
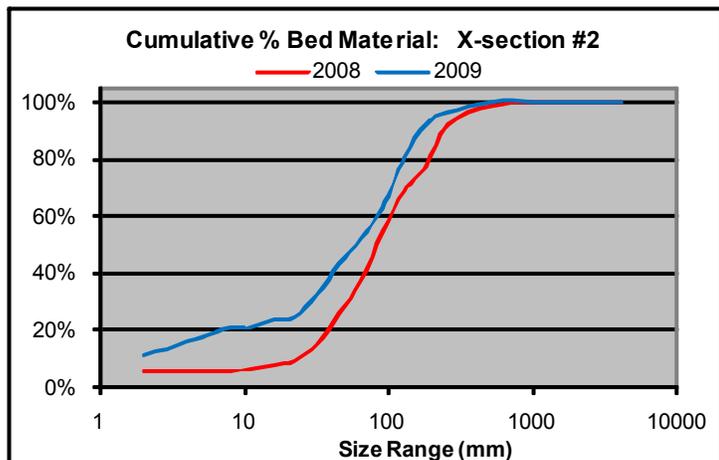


Moose Creek Cross-Section #2



Pre-project 7/30/2008

Post-project 6/16/2009



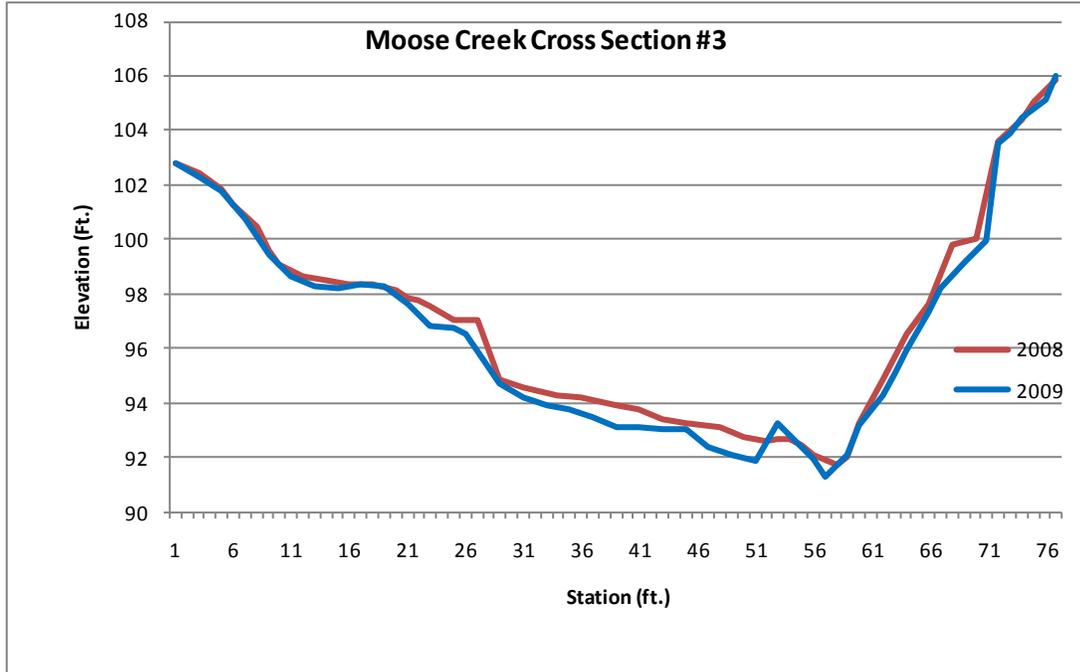
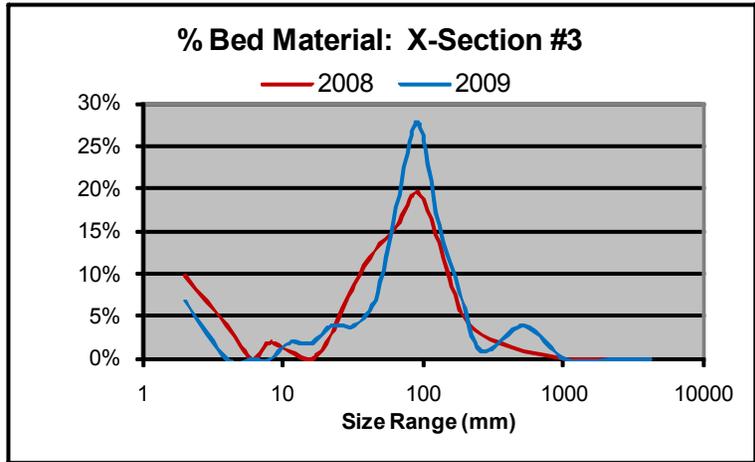
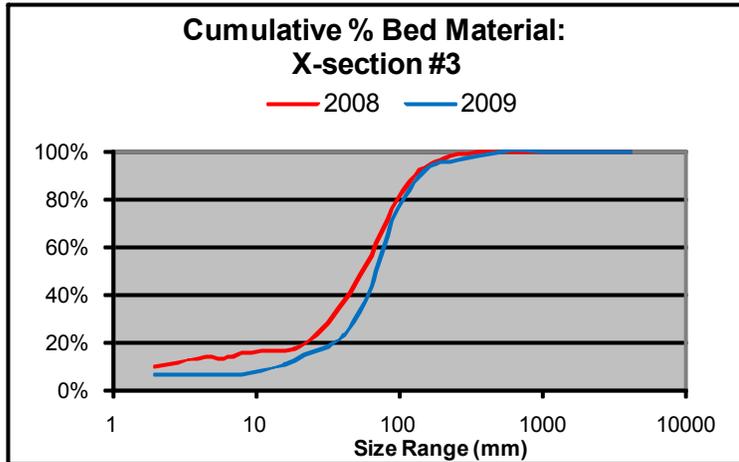
Moose Creek Cross-Section #3



Pre-project 7/30/2008



Post-project 6/16/2009



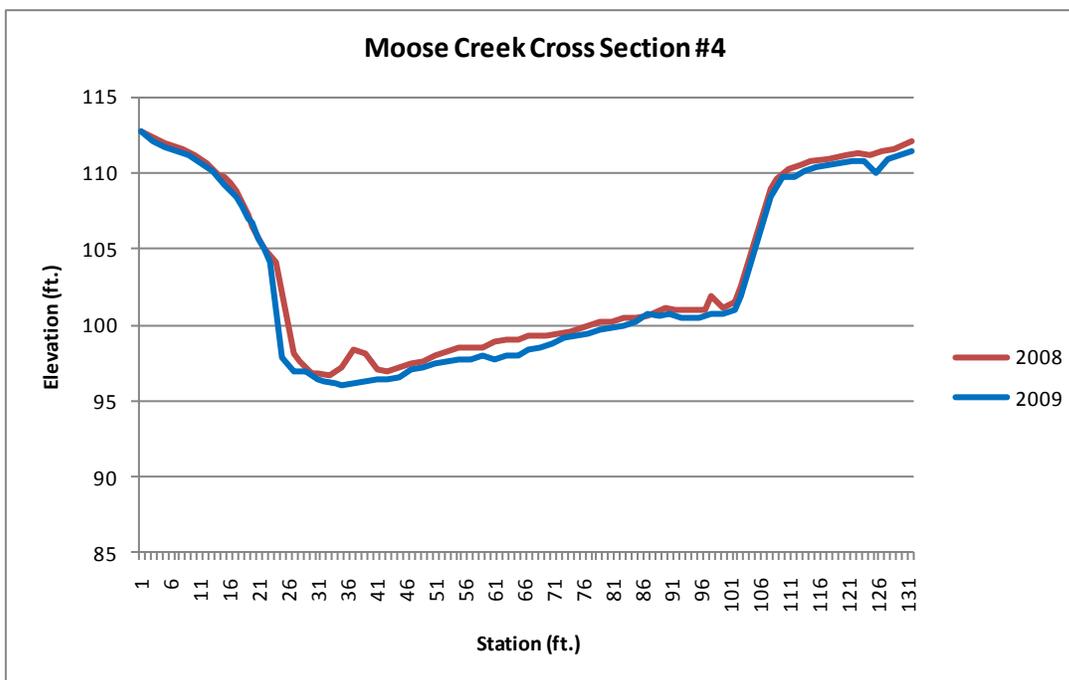
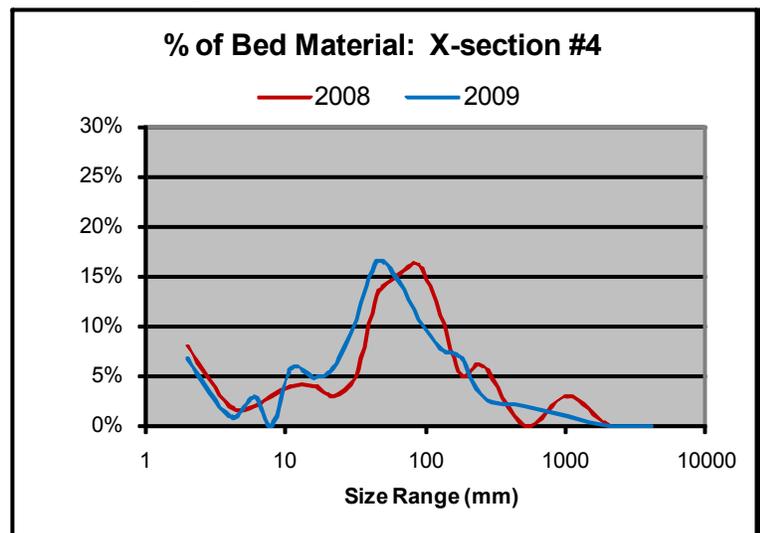
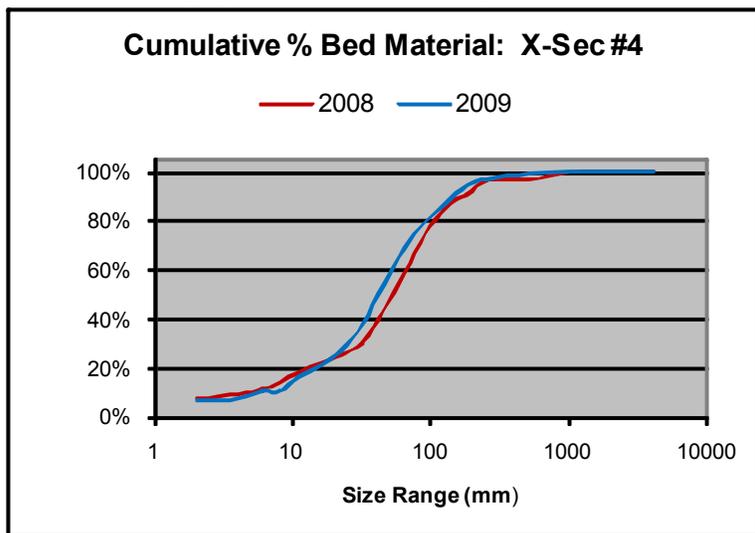
Moose Creek Cross-Section #4



Pre-project 7/31/2008: Looking Downstream



Post-project 6/16/2009: Looking Downstream

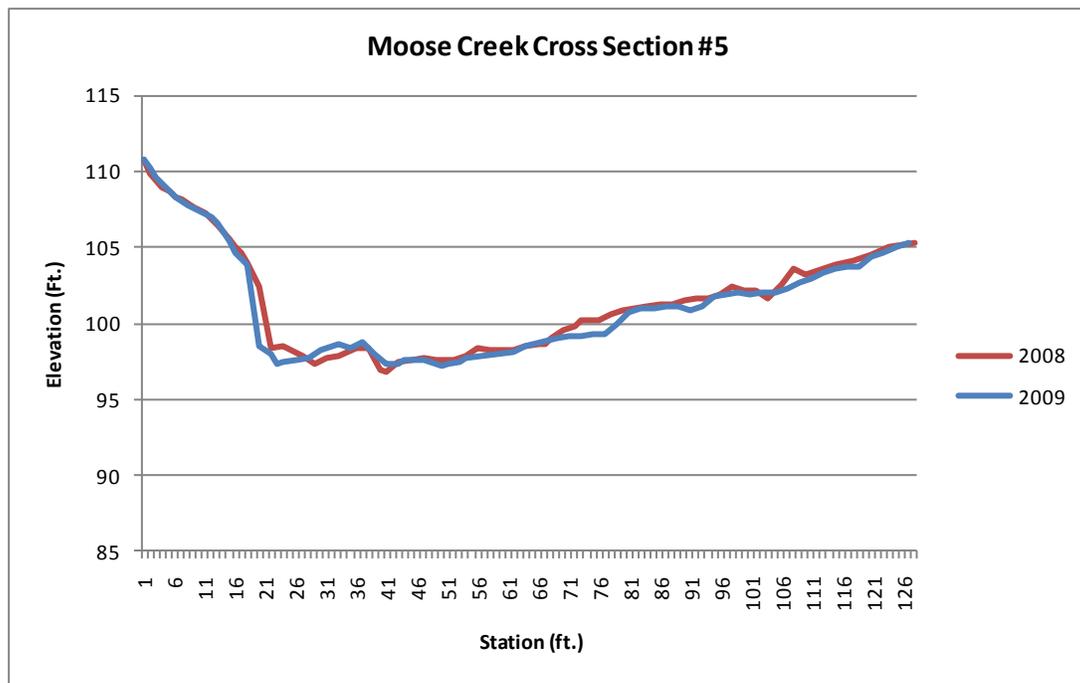
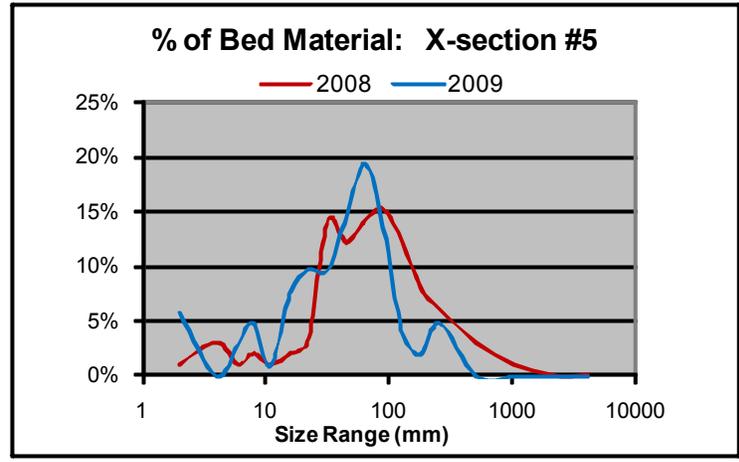
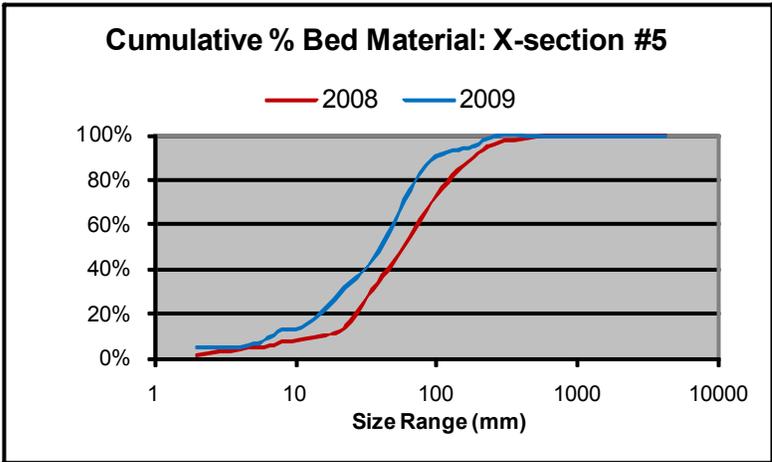


Moose Creek Cross-Section #5



Pre-project 7/31/2008

Post-project 6/16/2009



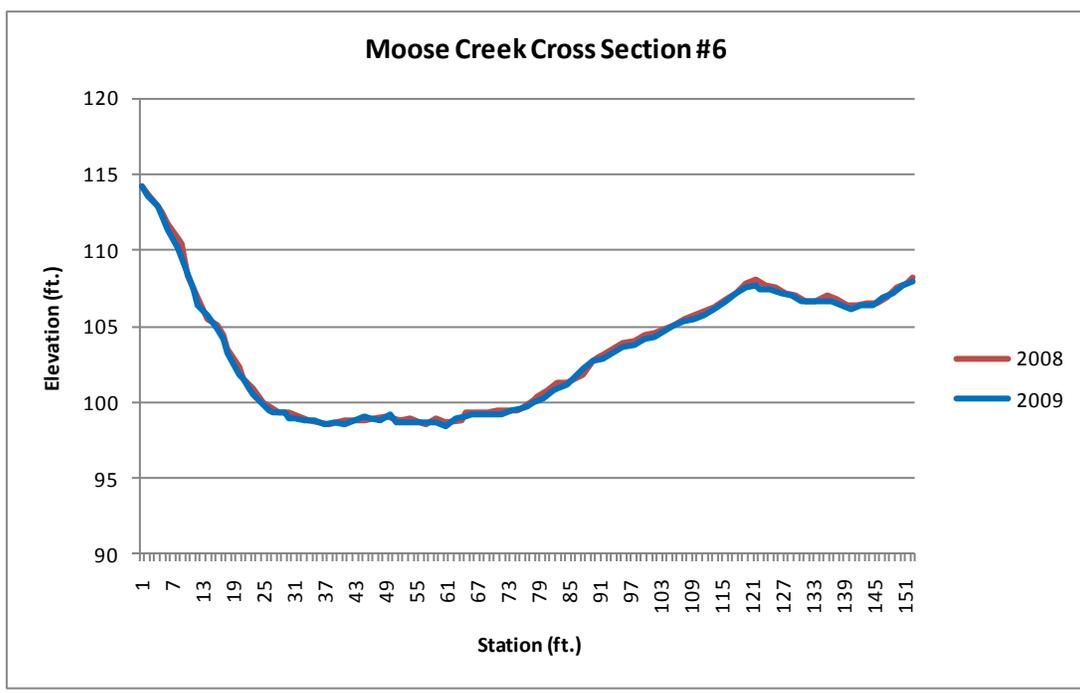
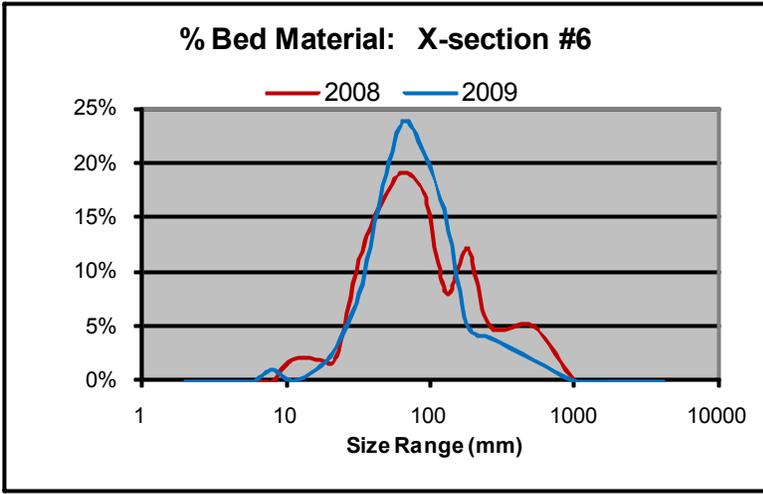
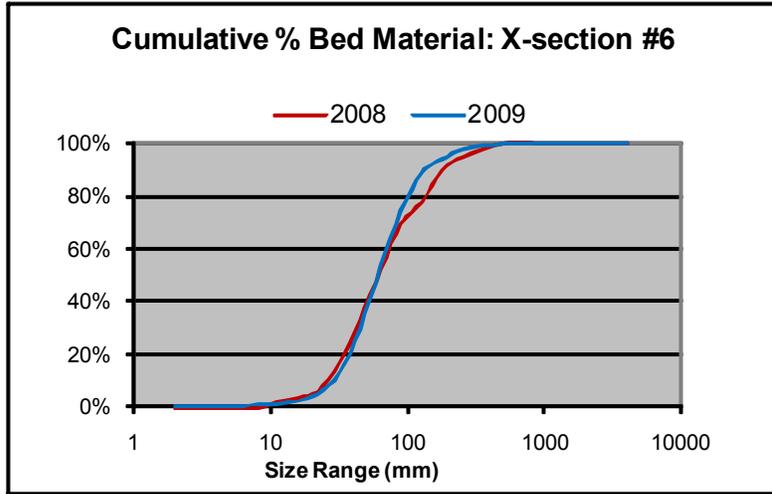
Moose Creek Cross-Section #6



Pre-project 7/31/2008



Post-project 6/16/2009



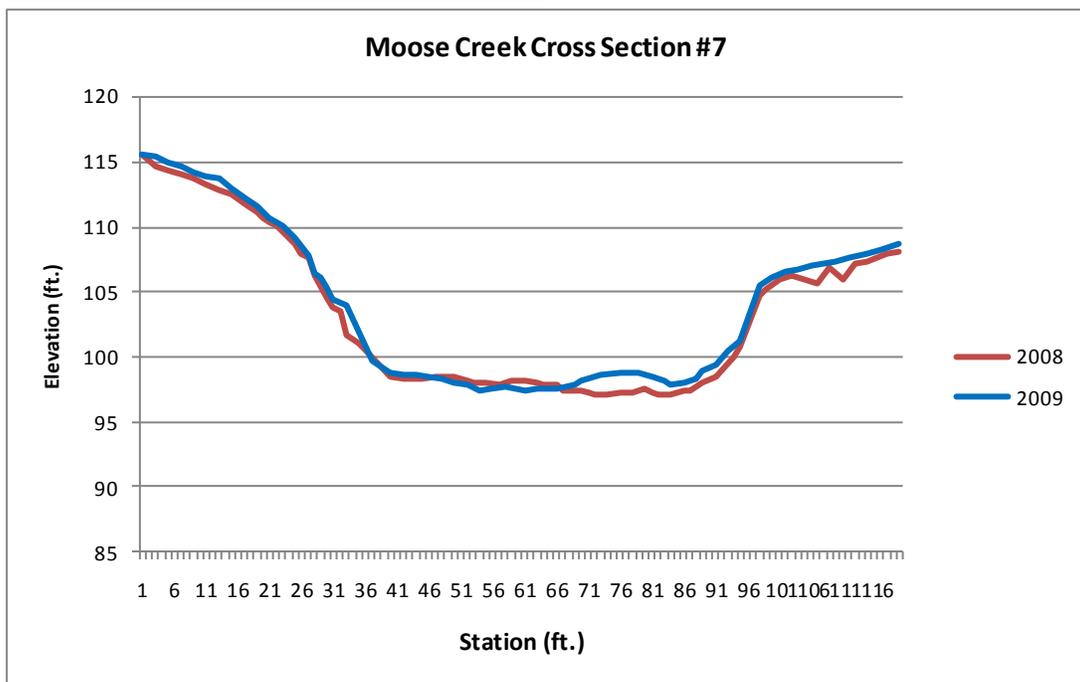
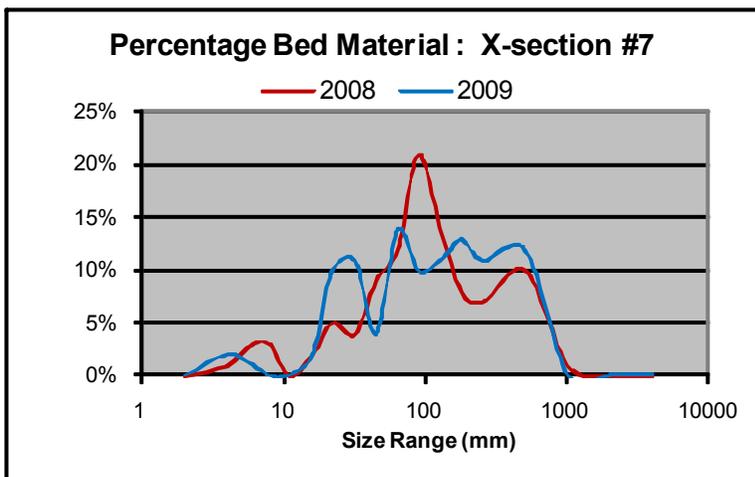
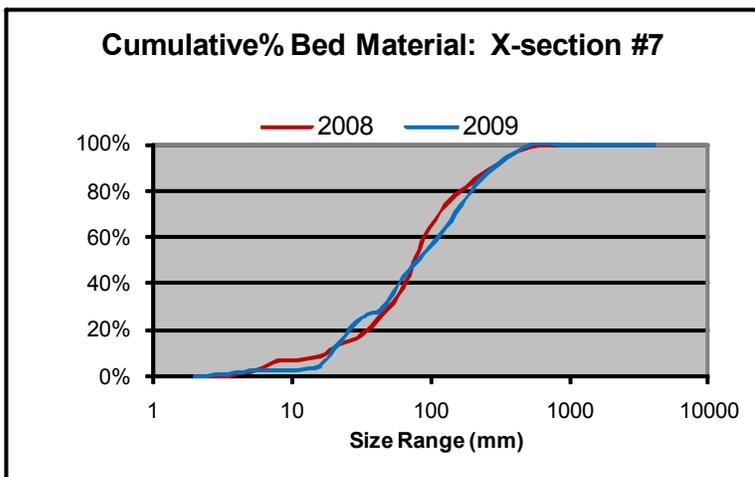
Moose Creek Cross-Section #7



Pre-project 7/31/2008



Post-project 6/16/2009



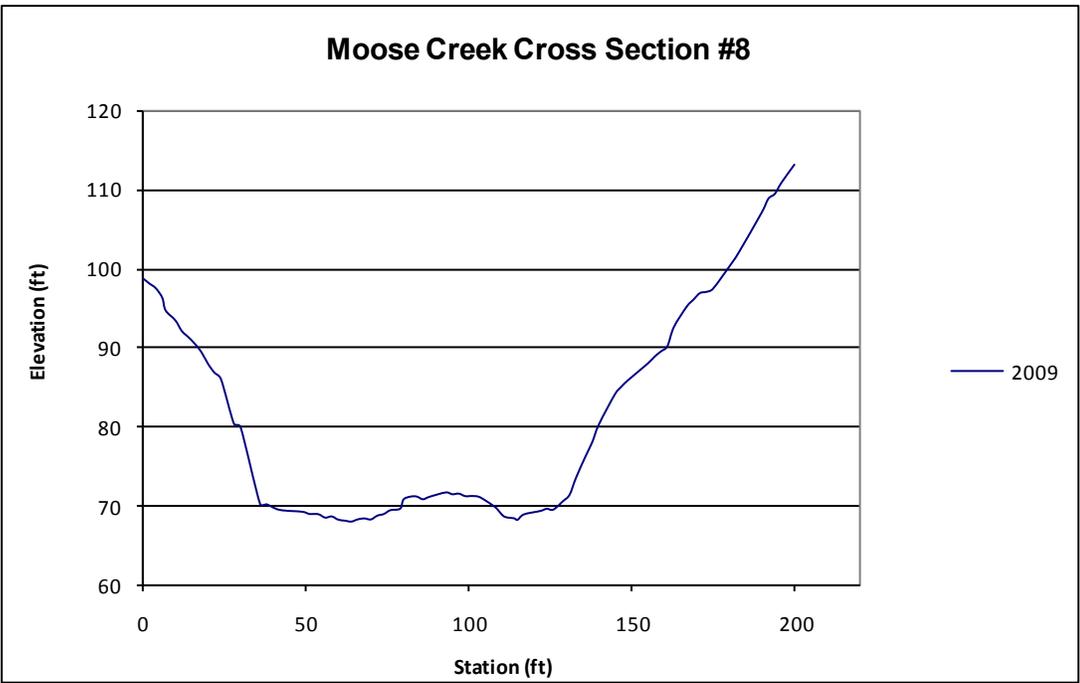
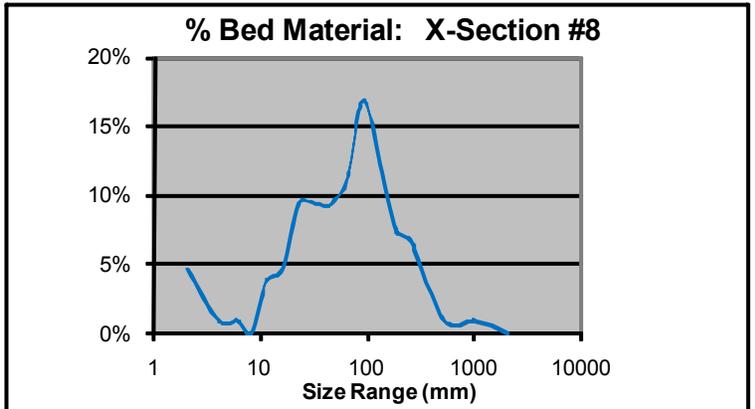
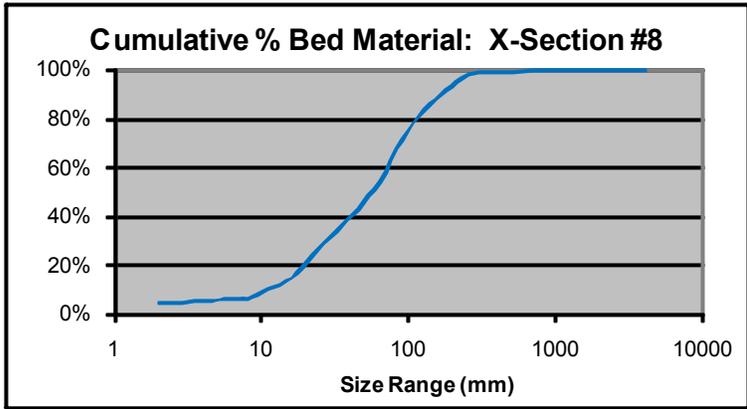
Moose Creek Cross-Section #8: Data from 2009 Only



Cross Section #8, Post-project 9/1/2009



Cross Section #8, Looking Downstream, Post-project 9/1/2009



Moose Creek Cross-Section #9: Data from 2009 Only



Cross Section #9, Post-project 9/1/2009



Cross Section #9, Looking Downstream, Post-project 9/1/2009

