RESURRECTION CREEK RESTORATION
2006-2007 Channel Morphology and Vegetation Monitoring Report

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October 2007

SUMMARY

Stream restoration was conducted on a 1-mile reach of Resurrection Creek between 2005 and 2007. This report compiles data for channel morphology and vegetation monitoring conducted in the project area in 2006 and 2007.

Monitoring tasks included the following:

- Established channel cross sections, measured longitudinal profiles, and measured substrate to provide baseline data and characterize the dimensions, pattern, and profile of channels created during the 2006 construction season.
- Re-measured established cross sections along the lower project reach to quantify channel changes that have occurred since 2005.
- Qualitatively assessed the growth rates and success of vegetation on the floodplains, and the presence of invasive plants.
- Qualitatively assessed ice conditions in the winter and the effects of ice on channel morphology and riparian vegetation.
- Monitored a series of 45 photo points throughout the project reach to show changes in channel morphology and vegetation.

Results of monitoring in 2006 and 2007 show that some channel changes are occurring in portions of the project reach. Many of the observed changes are the result of expected natural channel adjustments. Bank erosion is occurring in localized areas, and deposition in low-energy areas is resulting in the development of point bars. Little sediment deposition has been observed in the pools, as the flow dynamics caused by meander geometry and logjams scour deep pools and maintain good habitat features. The rate of vegetation growth on the floodplains is related to the quality of soils. The success rate of planted vegetation in 2006 is very high, and the majority of the project area is rapidly returning to its natural condition.

Monitoring will be conducted again during the summer of 2008. This and future monitoring will concentrate on quantifying future channel changes, measuring success and growth rates of vegetation planted in 2007, and detecting the presence of invasive plants.

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1 INTRODUCTION

The Chugach National Forest conducted a stream restoration project on Resurrection Creek between 2005 and 2007. This project successfully restored a 1-mile reach of Resurrection Creek on National Forest Service lands about 5 miles upstream of Hope, Alaska (**figure 1**). This reach was impacted by historic placer mining activities that left a steep, riffle-dominated stream channel highly confined by tailings piles. Aspects of the restoration included construction of a new meandering channel, distribution of historic tailings piles to create new floodplains, construction of side channels and other off-channel habitat, spreading of soil on new floodplains, and revegetation of floodplains and riparian areas. The completed restored reach is shown in **figure 2**.

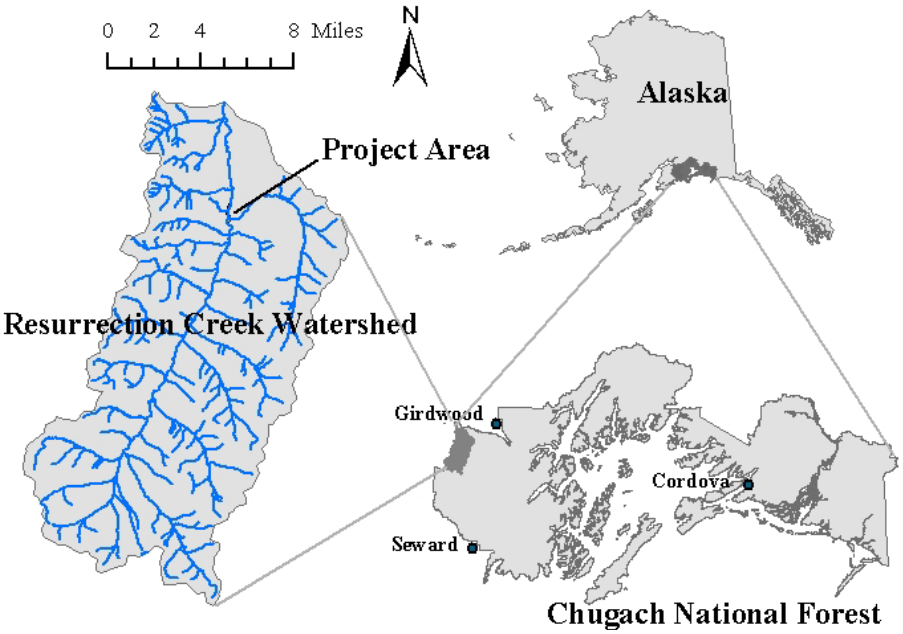


Figure 1: Location of the 2005-2007 Resurrection Creek Restoration Project.

Project details are described in the *Resurrection Creek Stream and Riparian Restoration Project Final Environmental Impact Statement* (FEIS) (USDA Forest Service, 2004). Watershed characteristics, hydrologic data, and more detailed hydrologic information for the watershed are available in the *Resurrection Creek Watershed Association Hydrologic Condition Assessment* (Kalli and Blanchet, 2001) and the *Resurrection Creek Landscape Analysis* (Hart Crowser, 2002). A full analysis of the project reach and the reference reach was also conducted prior to restoration (Bair et al., 2002), and a channel morphology monitoring report was completed following the first year of restoration (MacFarlane, 2006). These reports, progress reports, and additional information are available on the Chugach National Forest website at:

http://www.fs.fed.us/r10/chugach/news_releases/res_creek_rest.html

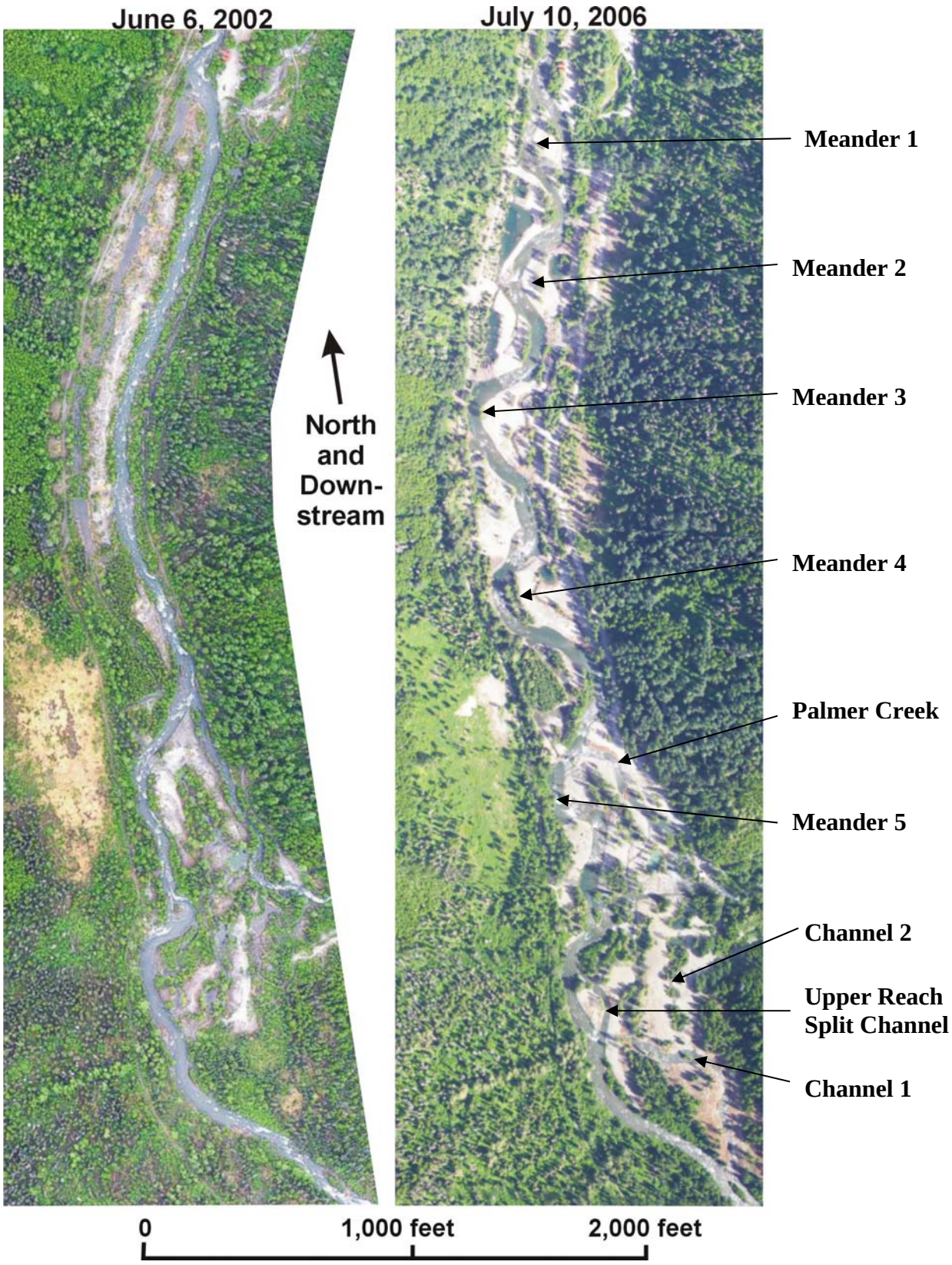


Figure 2: Resurrection Creek project reach aerial view before restoration (left) and after restoration (right).

1.1 History

Tasks completed in 2005: The FEIS for this project was completed in November 2004, and permits were in place by early May 2005. The first season of construction occurred from mid-May to mid-July 2005. The following tasks were accomplished in 2005:

- Redistributed about 120,000 cubic yards of tailings piles and developed a new stream channel and floodplain,
- Constructed 5 meander bends with natural pool-riffle sequences, increasing the channel length by 20%, increasing sinuosity, and decreasing average slope,
- Shaped about 40 acres of new floodplains,
- Constructed 1 mile of new side channels, side channel ponds, and other off-channel habitat,
- Spread about 5,000 cubic yards of soil and woody debris on the floodplains,
- Placed hundreds of trees into 10 engineered logjams along the channel, and
- Monitored channel morphology, photo points, vegetation, and aquatic species.

Tasks completed in 2006: In 2006, construction work on the restored channel and floodplains was completed, and revegetation work was conducted on the areas that were restored in 2005. The second season of construction work was conducted between mid-May and early July 2006. The following tasks were accomplished in 2006:

- Constructed 1.2 miles of additional side channels and connected ponds,
- Reconstructed the lower 0.2 miles of Palmer Creek,
- Redistributed about 40,000 cubic yards of tailings piles to shape the channels and floodplains,
- Placed hundreds of trees into engineered logjams,
- Spread 3,000 cubic yards of soil and woody debris on the floodplains,
- Through a partnership with the Youth Restoration Corps, planted over 4000 birch seedlings, 600 spruce seedlings, and 4000 willow cuttings along the banks and on the floodplains, and
- Monitored channel morphology, photo points, vegetation, and aquatic species.

Tasks completed in 2007: In 2007, revegetation was conducted on the areas that were restored in 2006 through a partnership with the Youth Restoration Corps. Work was conducted in June 2007. The following tasks were accomplished in 2007:

- Planted about 1000 spruce seedlings, 1800 birch, and 500 to 1000 sod transplants on the newly created floodplains,
- Planted about 4000 willow stems and 150 feet of sod and willow wraps along the banks of newly created side channels, and
- Monitored channel morphology, photo points, vegetation, and aquatic species.

1.2 Monitoring Objectives

Channel morphology monitoring of this restored reach has been conducted on this project since August 2005. Short term and long term monitoring of the project will satisfy the following needs:

- Compare channel dimensions of the restored reach with the intended channel design by measuring the channel dimensions, pattern, and profile, and compare to the project objectives as described in Bair et al. (2002) and MacFarlane (2006).
- Establish baseline data to measure future channel changes, including changes in channel width and pool volume from scour and deposition, changes associated with bank erosion, and changes in side channel morphology.
- Provide information that can be used to improve channel design conducted in future channel restoration projects elsewhere on Resurrection Creek and the Chugach National Forest.
- Provide information about channel dynamics as they relate to fish habitat, including sediment size and distribution, pool depths, and instream cover.
- Provide information on the establishment and growth of vegetation on the floodplains and channel banks.

This monitoring report presents the data collected in 2006 and 2007. A monitoring report for previous monitoring work conducted in 2005 was completed in March 2006 (MacFarlane, 2006). The 2006 and 2007 monitoring data include remeasurements of data collected in 2005 and additional data collected on channel segments that were restored during the 2006 construction season. This report presents the data that were collected, as well as comparisons between the restored reach and the pre-restoration reach, and addresses the above needs and potential channel changes that are expected to occur in the future. Fish population monitoring is not presented in this report.

Monitoring tasks during 2006 and 2007 were conducted on the following dates:

May 12, 2006	Installed staff gauge and surveyed cross section
May-Oct, 2006	Monitored flows on project reach staff gauge, photo points
July 6, 2006	Photo points, Palmer Creek, discharge measurements
July 11, 2006	Aerial photography taken of Resurrection Creek
July 26, 2006	Cross section setup on Channel 1 and Palmer Creek
Aug 1 and Aug 17, 2006	Cross section surveys, longitudinal profile surveys, and pebble counts on Palmer Creek, photo points
Sept 22 and Oct 2, 2006	Channel 1 longitudinal profile and cross section survey, photo points
Oct 5, 2006	Upper reach valley cross section survey
Oct 12, 2006	LIDAR data acquired for project area, 2-foot contour map
Oct 24, 2006	Cross section remeasurements, Channel 1 pebble counts
Nov 14 and Nov 22, 2006; April 28, 2007	Ice reconnaissance, photo points
Aug 31 and Sept 12, 2007	Photo points, cross section remeasurements

Channel morphology monitoring was conducted by Bill MacFarlane, Chugach National Forest hydrologist, with assistance from Dean Davidson and Sean Meade. Vegetation monitoring was conducted by Dean Davidson, Rob DeVelice, and Bill MacFarlane. The July 11, 2006 aerial photography was taken by the Chugach National Forest. In addition to the channel morphology monitoring, fish escapement counts were conducted weekly in July and August of 2005, 2006, and 2007 by Aaron Martin and the Seward Ranger District Fish crew.

2 METHODS AND MONITORING TASKS

Channel profile: Longitudinal profiles were surveyed using Rosgen stream survey techniques (Harrelson et al., 1994; Rosgen, 2006). Channel distance was measured along the left bank (facing downstream), starting at the upstream end, and wood stakes were placed every 100 feet along the bank for reference. Thalweg and water surface points were surveyed at such a frequency to capture the variability in bed features, including the start and end of each riffle, run, pool, and glide (**figure 3**). Data were stored and processed using *Rivermorph* Stream Restoration Software (Rivermorph LLC, 2004). Bankfull measurements had to be estimated in newly constructed channels. The longitudinal profile point elevations were tied to existing benchmarks.

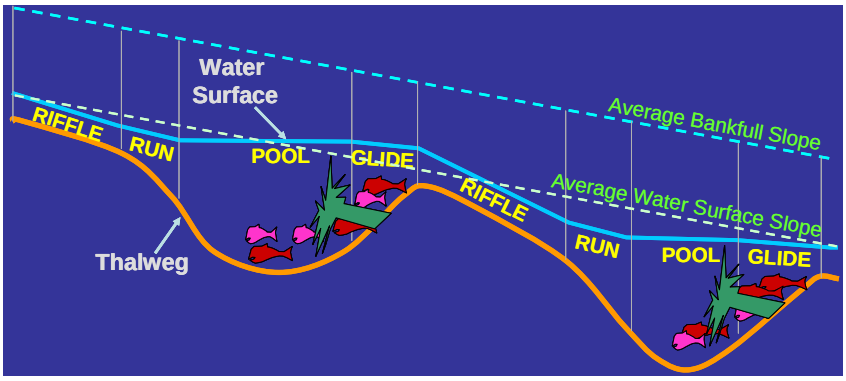


Figure 3: Typical pool-riffle channel morphology.

Channel dimensions: Cross sections were surveyed using Rosgen stream survey techniques (Harrelson et al., 1994; Rosgen, 2006). Cross sections were surveyed in representative channel features, or in some cases, where monitoring of future channel changes is desired. Bankfull elevations had to be estimated in newly constructed channels. The floodprone elevation is defined as twice the maximum bankfull depth. At each cross section, a measuring tape was stretched tightly between two permanent rebar pins, with the zero-point on the tape at the left (facing downstream) pin. Elevations at points along the tape were measured using a laser level and rod. Rebar pins for each cross section were marked with blue caps and labeled. Data were stored and processed using *Rivermorph* Stream Restoration Software (Rivermorph LLC, 2004).

Substrate: Pebble counts were conducted at the riffle and glide cross sections only. Pebble counts were not conducted at the pool and run cross sections because of deep flows and high velocities. For each pebble count, the intermediate axis was measured for 100 particles, taken at even intervals across the cross section line between the approximate locations of bankfull on each bank. Results of pebble counts are presented in terms of the pebble size for which 50% of the substrate is finer (D50) and for which 84% of the substrate is finer (D84).

Channel pattern: Sinuosity (channel length divided by valley length) was measured using aerial photography, LIDAR, and channel measurements. Meander wavelength and radius of curvature were measured using aerial photography and LIDAR.

Photo points: Photo points were established at 45 locations along and upstream of the project reach in 2005 and 2006. These photo points were monitored during and after the first phase of the project to show changes as a result of restoration. The locations of these photo points are permanently marked, generally with blue-capped rebar pins, and will continue to be monitored in the future.

Aerial photos: Aerial photos of the project reach were taken in July 2006, following completion of the channel construction. These photos provide an accurate depiction of the work that was completed in 2005 and 2006, as well as a comparison with low-level aerial photography collected in 2002 and 2005.

Streamflows: Streamflow discharges were measured in the main channel to establish a rating curve for a staff gauge. Discharges were also measured in the side channels to show the distribution of flows in each of the channels. Discharge measurements were conducted using a Price #622 flow meter, using standard methods (Harrelson et al., 1994).

Ice: Buildup of ice during the winter was monitored qualitatively and mapped during the winter of 2006-2007 to characterize the ice dynamics of the new channel morphology and its potential impacts on channel morphology and vegetation.

Vegetation: The success and growth of vegetation planted in 2006 were monitored qualitatively during several visits in the 2007 season. Invasive plant occurrence was surveyed in 2007.

3 CHANNEL 1 CHARACTERIZATION

During the 2006 construction season, an 1825-foot long side channel was constructed on the east side of Resurrection Creek near the upstream end of the project reach (**figure 4**). This channel, called "Channel 1," takes up to 20% of the flow of Resurrection Creek, but a "splash dam" constructed of boulders just downstream of the channel inlet bleeds high flows from this channel. Channel morphology surveys were conducted to characterize the dimensions, pattern, and profile of the channel, and provide baseline data to measure future changes in channel form.

Figure 4: Upper Resurrection Creek project area, showing Channel 1 (outlined in black) and the established cross sections. The flow is to the north.

3.1 Channel profile

Channel 1 is 1825 feet long, with an average water surface slope of 1.4% (**figure 5**). The channel exhibits a pool-riffle character, with riffle slopes ranging from about 1.7% to 4.4%. The ratio of riffle slope to average slope ranges from 1.2 to 3.1. Pools are well defined, with estimated bankfull pool depths ranging from 2.2 to 5.0 feet. The average

bankfull riffle depth, as measured in representative riffle cross sections, is about 1.4 feet, and the ratio of pool depth to average riffle depth ranges from 1.6 to 3.6. Pool-to-pool spacing ranges from about 70 to 180 feet, with pools occurring every 1.8 to 5.5 bankfull widths.

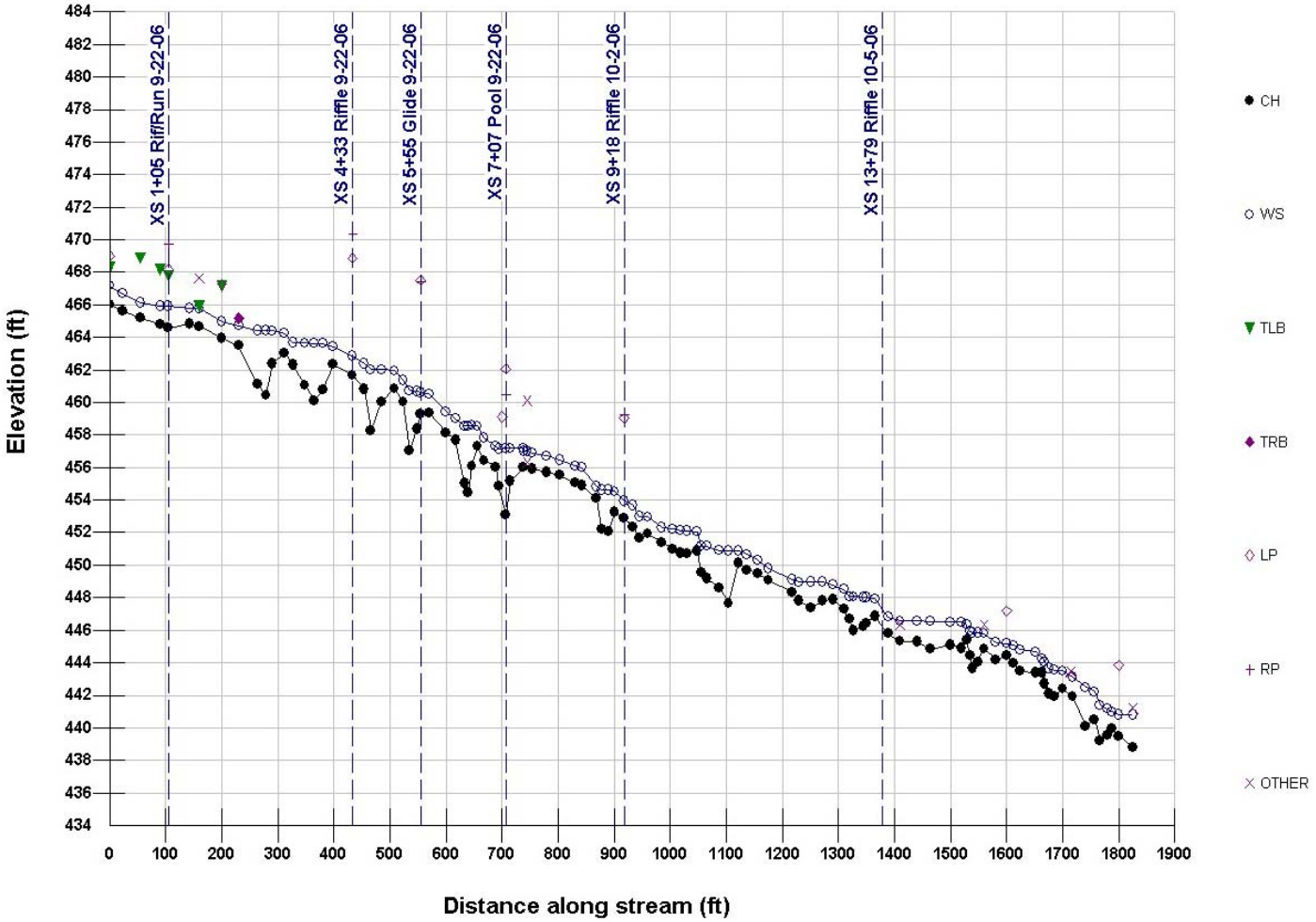
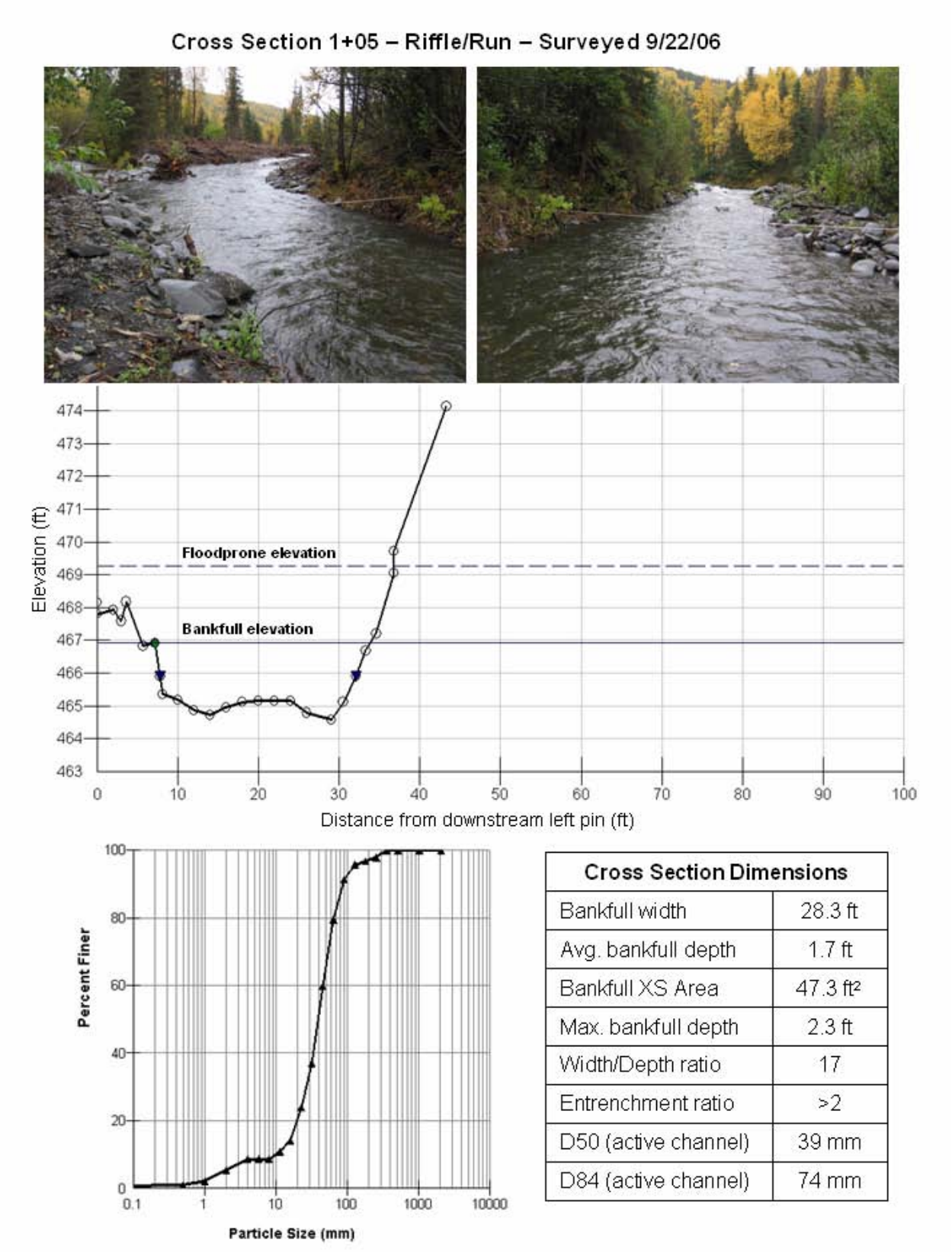


Figure 5: Longitudinal profile for Channel 1, with locations of surveyed cross sections.

3.2 Channel dimensions

A total of 6 cross sections were surveyed in Channel 1 in 2006, representing various bedform types. Cross section locations are shown in **figure 4** and **figure 5**. Cross sections, photos, pebble count data, and data summaries for each cross section are presented in **figure 6 to 11**. Representative riffle cross sections in this channel have bankfull widths of about 33 to 38 feet and average bankfull depths of about 1.4 feet. Width-to-depth ratios in Channel 1 range from 15 to 28. Entrenchment ratios range from 1.5 to greater than 3, with most of the channel slightly to moderately confined. The typical riffle substrate is small cobbles, with gravel in the pools and glides.



Cross Section Dimensions	
Bankfull width	28.3 ft
Avg. bankfull depth	1.7 ft
Bankfull XS Area	47.3 ft²
Max. bankfull depth	2.3 ft
Width/Depth ratio	17
Entrenchment ratio	>2
D50 (active channel)	39 mm
D84 (active channel)	74 mm

Figure 6: Channel 1 Cross Section 1+05 channel dimensions.

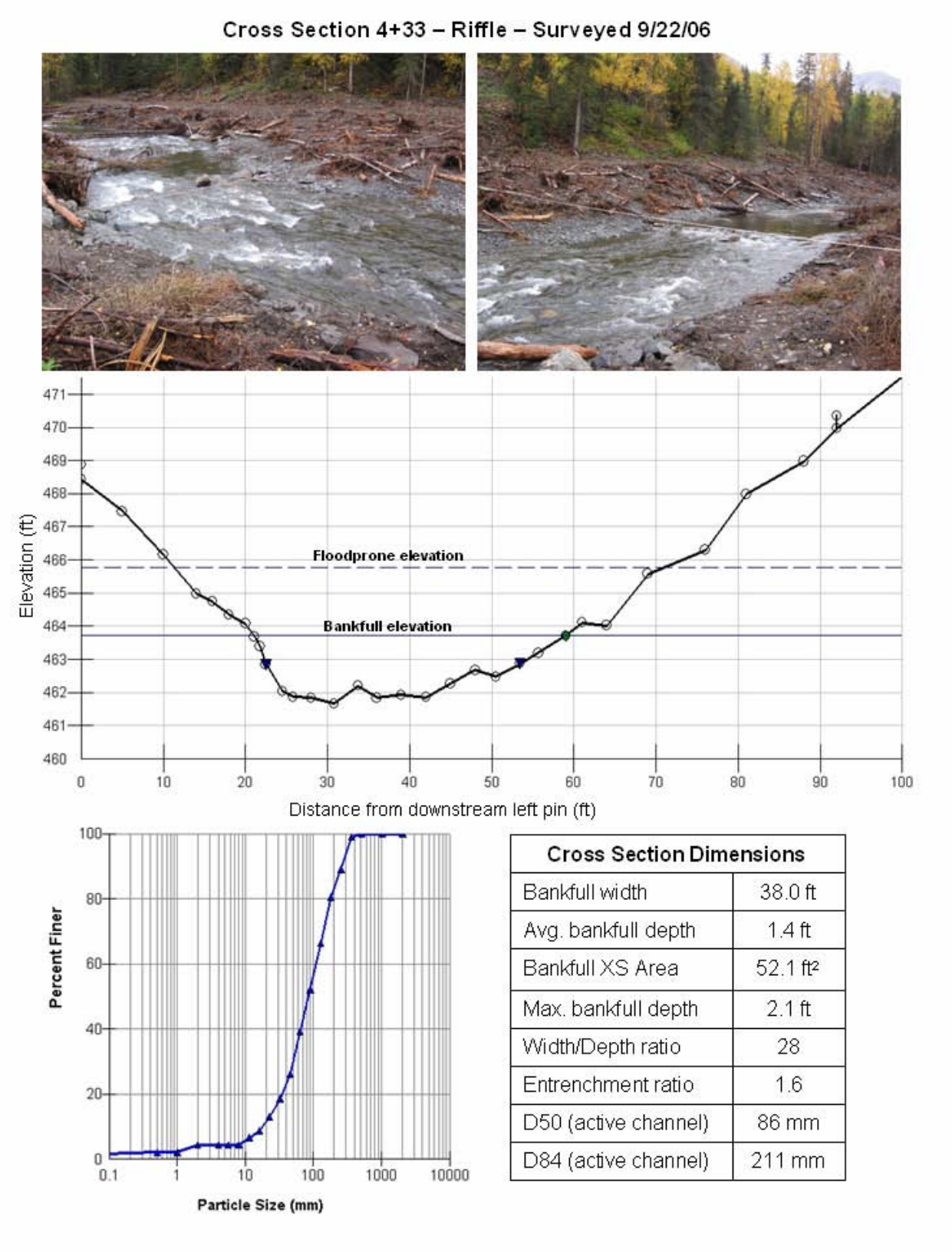


Figure 7: Channel 1 Cross Section 4+33 channel dimensions.

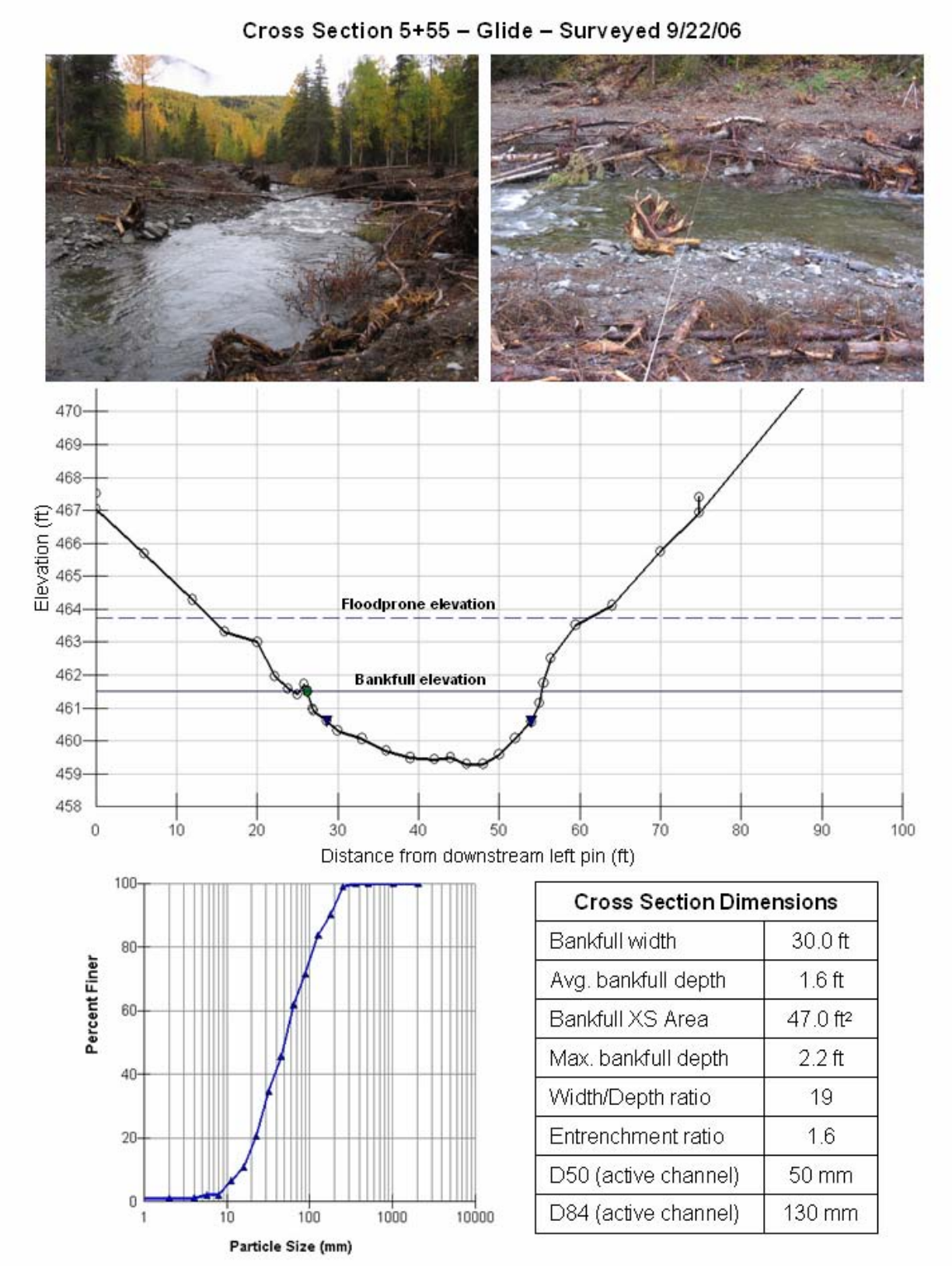


Figure 8: Channel 1 Cross Section 5+55 channel dimensions.

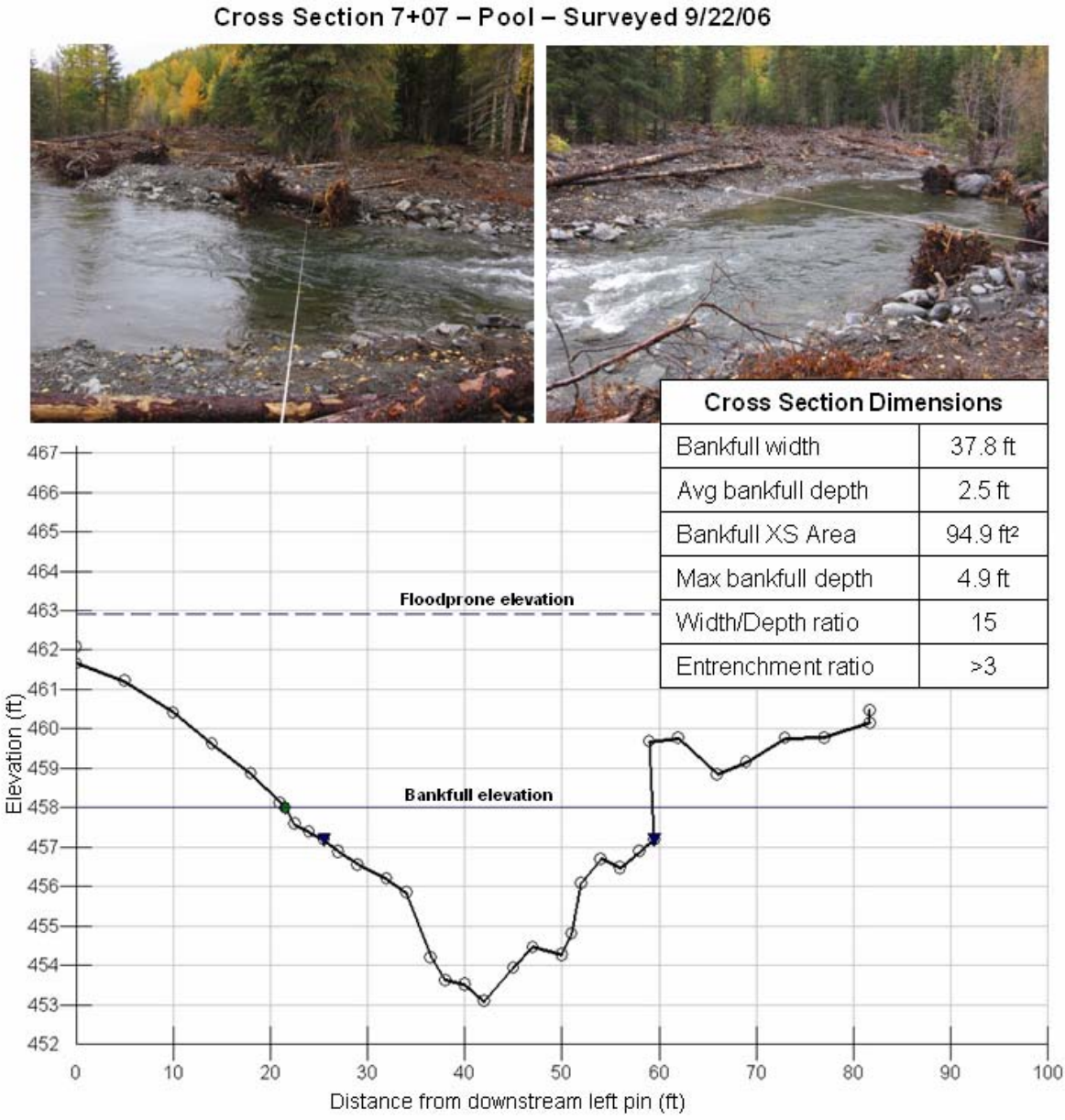
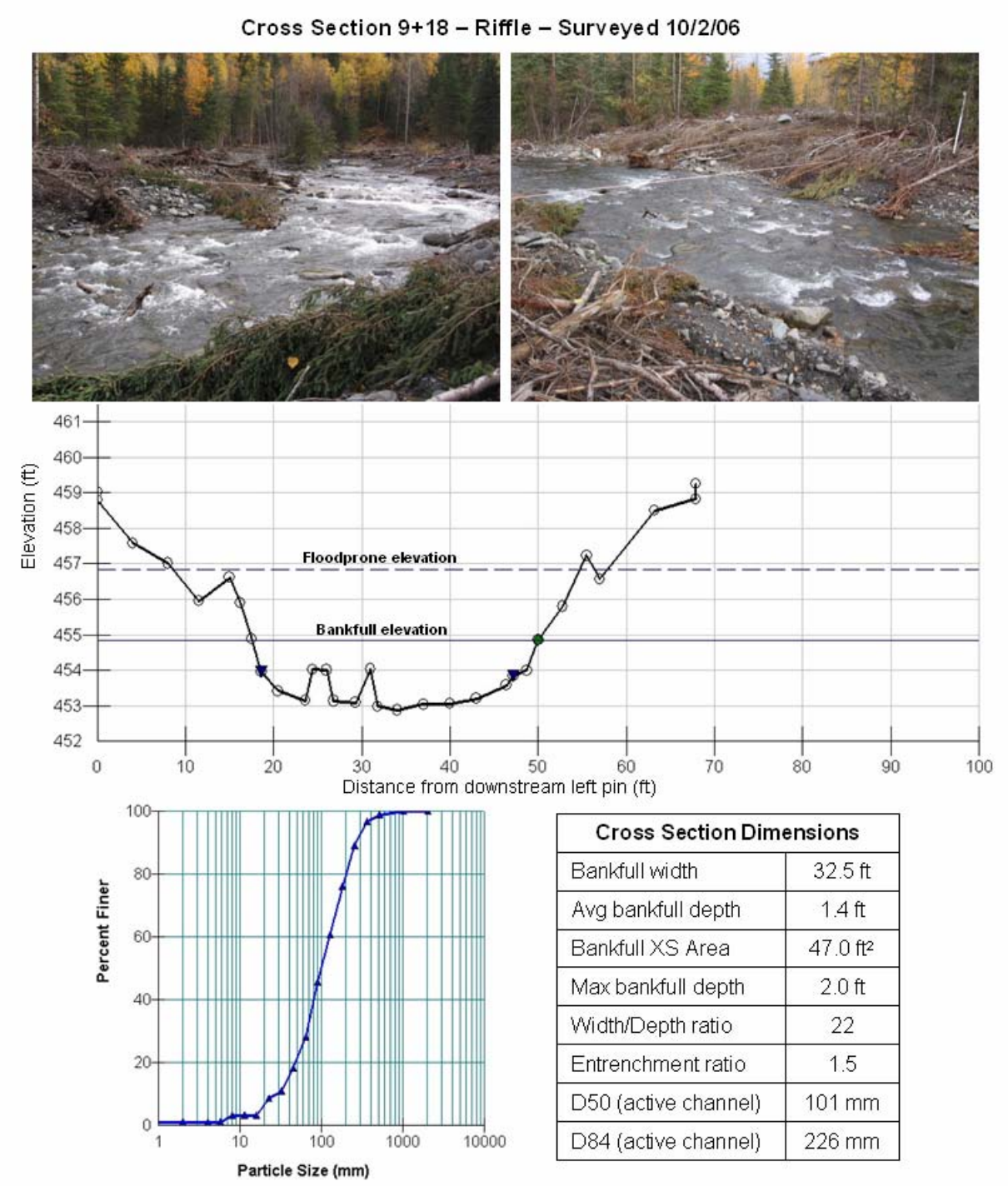


Figure 9: Channel 1 Cross Section 7+07 channel dimensions.



Cross Section Dimensions	
Bankfull width	32.5 ft
Avg bankfull depth	1.4 ft
Bankfull XS Area	47.0 ft²
Max bankfull depth	2.0 ft
Width/Depth ratio	22
Entrenchment ratio	1.5
D50 (active channel)	101 mm
D84 (active channel)	226 mm

Figure 10: Channel 1 Cross Section 9+18 channel dimensions.

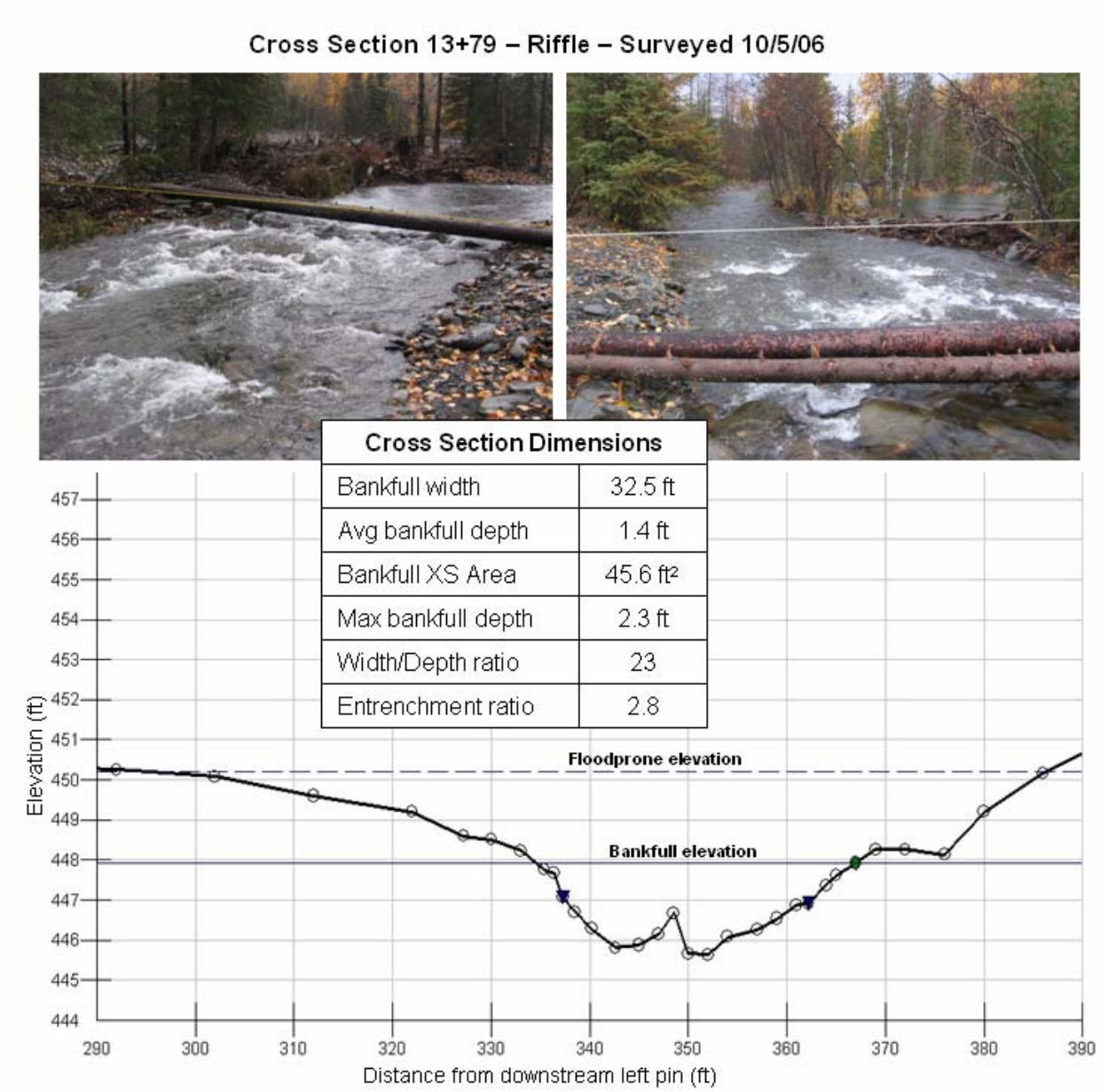


Figure 11: Channel 1 Cross Section 13+79 channel dimensions.

3.3 Channel pattern

The sinuosity of Channel 1 is about 1.2 (**figure 4**). The reach contains 3 meander wavelengths. The meander wavelength ranges from about 290 to 730 feet, or 7.6 to 22.1 channel widths. The radius of curvature ranges from 70 to 160 feet, or 1.8 to 4.8 channel widths. The meander wavelength and radius of curvature decrease downstream in Channel 1, as the upper section of the channel is more confined by topography, and the lower section is more characteristic of an unconfined floodplain channel.

3.4 Channel 1 summary

Characteristics of Channel 1, based on the 2006 surveys, are presented in **table 1**. This side channel has a pool-riffle character, with well defined pools. The channel is somewhat sinuous, but much of the upper channel is moderately contained by low-angle side slopes. The Rosgen channel type (Rosgen, 1996) varies from a B4c in the upper portion of the reach, where the channel is entrenched with a gradient typical of a C channel, to a C4 channel in the lower portion of the reach, where wider floodplains exist.

Table 1: Summary channel characteristics of Channel 1.

Approximate bankfull riffle width	33 - 38 ft
Approx average bankfull riffle depth	1.4 ft
Approx bankfull pool depths	2.2 – 5.0 ft
W/D ratio (at riffle)	15 – 28
Entrenchment ratio (at riffle)	1.5 - >3
Average Water Surface Slope	1.4%
Riffle Slope	1.7 – 4.4%
Riffle D50	86 – 101 mm
Riffle D84	211 – 226 mm
Pool-to-pool spacing	70 – 180 ft
Sinuosity	1.2
Meander Wavelength	290 – 730 ft
Radius of Curvature	70 – 160 ft
Channel Type	B4c, C4

4 PALMER CREEK CHARACTERIZATION

Palmer Creek is a major tributary that drains a 21-square mile watershed and joins Resurrection Creek in the upstream half of the project reach. During the 2006 construction season, the lower 850-foot reach of Palmer Creek (in the Resurrection Creek floodplain to the confluence with Resurrection Creek) was reconstructed (**figure 12**). Channel morphology surveys were conducted on Lower Palmer Creek to characterize the dimensions, pattern, and profile of the channel, and provide baseline data to measure changes in channel form.

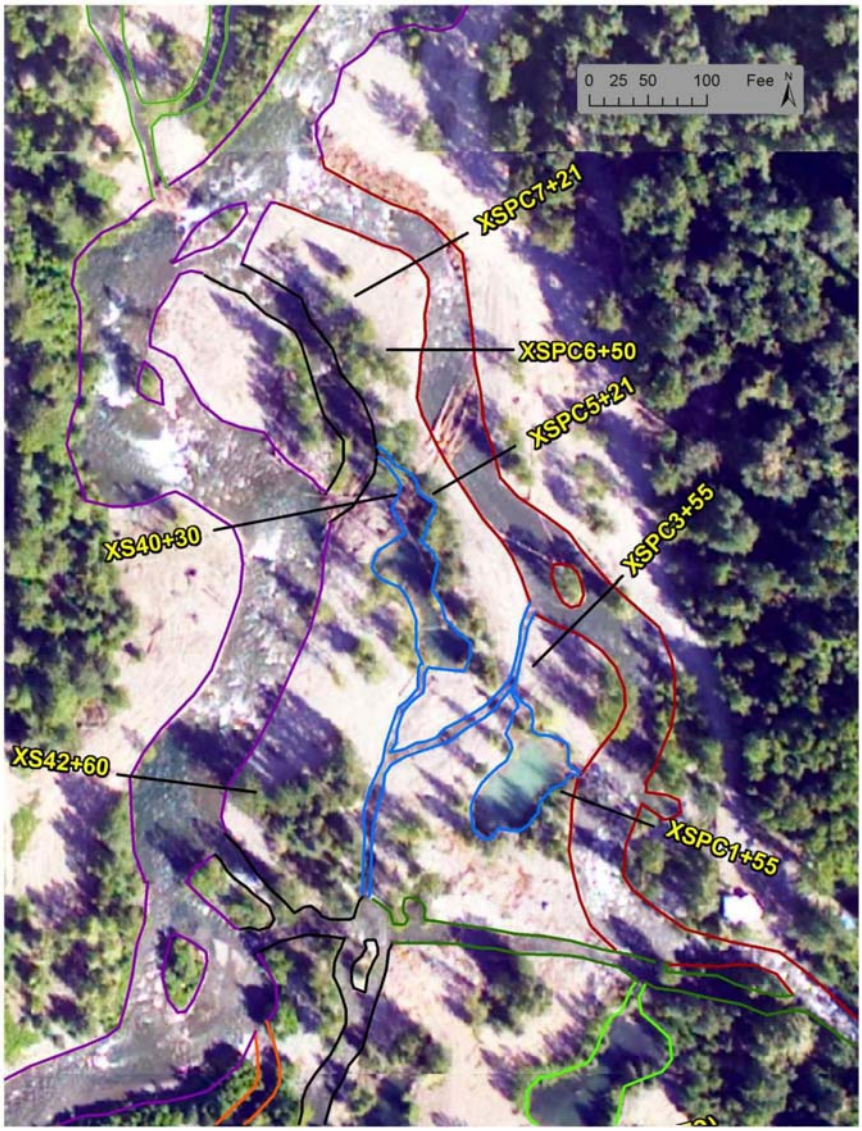


Figure 12: Lower Palmer Creek in the Resurrection Creek floodplain. The main channel of Resurrection Creek is on the left. The flow is to the north.

4.1 Channel profile

The surveyed reach of lower Palmer Creek is 1000 feet long, with an average water surface slope of 1.5% (**figure 13**). However, the average slope varies from 2.8% in the upper 350 feet of the reach to 0.4% in the middle 400 feet of the reach, to 2.2% in the lower 250 feet of the reach. Riffle slopes range from 0.4% in the middle of the reach to as high as 6.1% in the upper portion of the reach where the channel turns north and drops onto the Resurrection Creek floodplain. Only 3 well-defined pools exist in this reach, with bankfull depths ranging from 3.2 to 5.1 feet. Pool-to-pool spacing varies from 135 to 300 feet, and pools occur every 2.8 to 7.9 channel widths. A cross-channel logjam lies in the center of the reach, from station 5+50 to station 6+00.

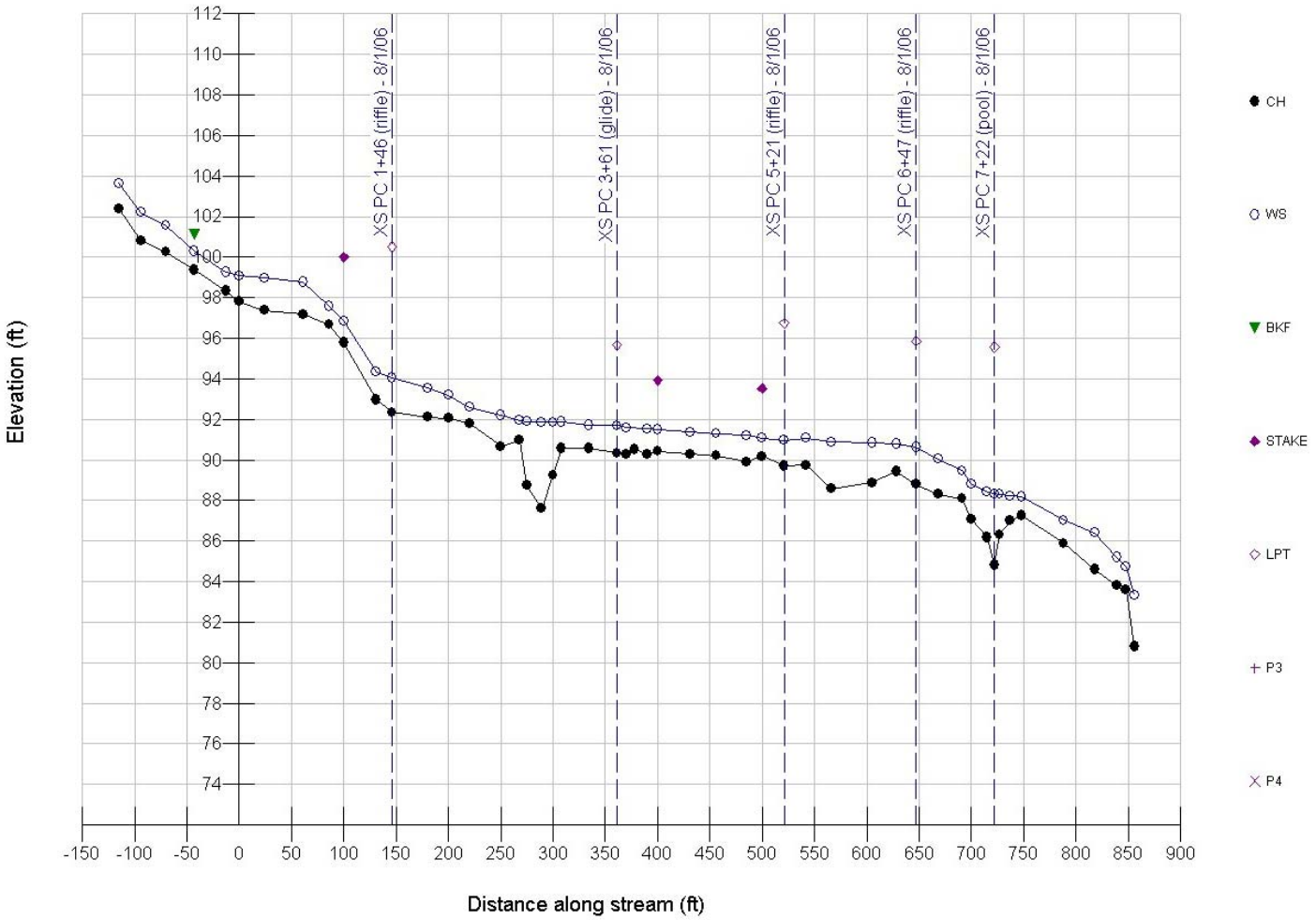


Figure 13: Longitudinal profile for the lower 1000 feet of Palmer Creek.

4.2 Channel dimensions

A total of 5 cross sections were surveyed in lower Palmer Creek in 2006, representing various bedform types. Cross section locations are shown in **figures 12 and 13**. Cross sections, photos, pebble count data, and data summaries for each cross section are presented in **figure 14 to 18**. Representative riffle cross sections in this reach have bankfull widths of 38 to 49 feet and average bankfull depths of 1.4 to 1.7 feet. Width-to-depth ratios in lower Palmer Creek range from 25 to 35. Entrenchment ratios range from 1.4 to greater than 2.5, with much of the channel moderately confined by moderate angle sideslopes. Narrow floodplains exist in some areas. The typical riffle substrate varies from very coarse gravel to small cobbles. Larger boulders exist in the steep riffle at the upstream end of the reach, and the substrate is predominantly gravel in the low gradient portion in the middle of the reach.

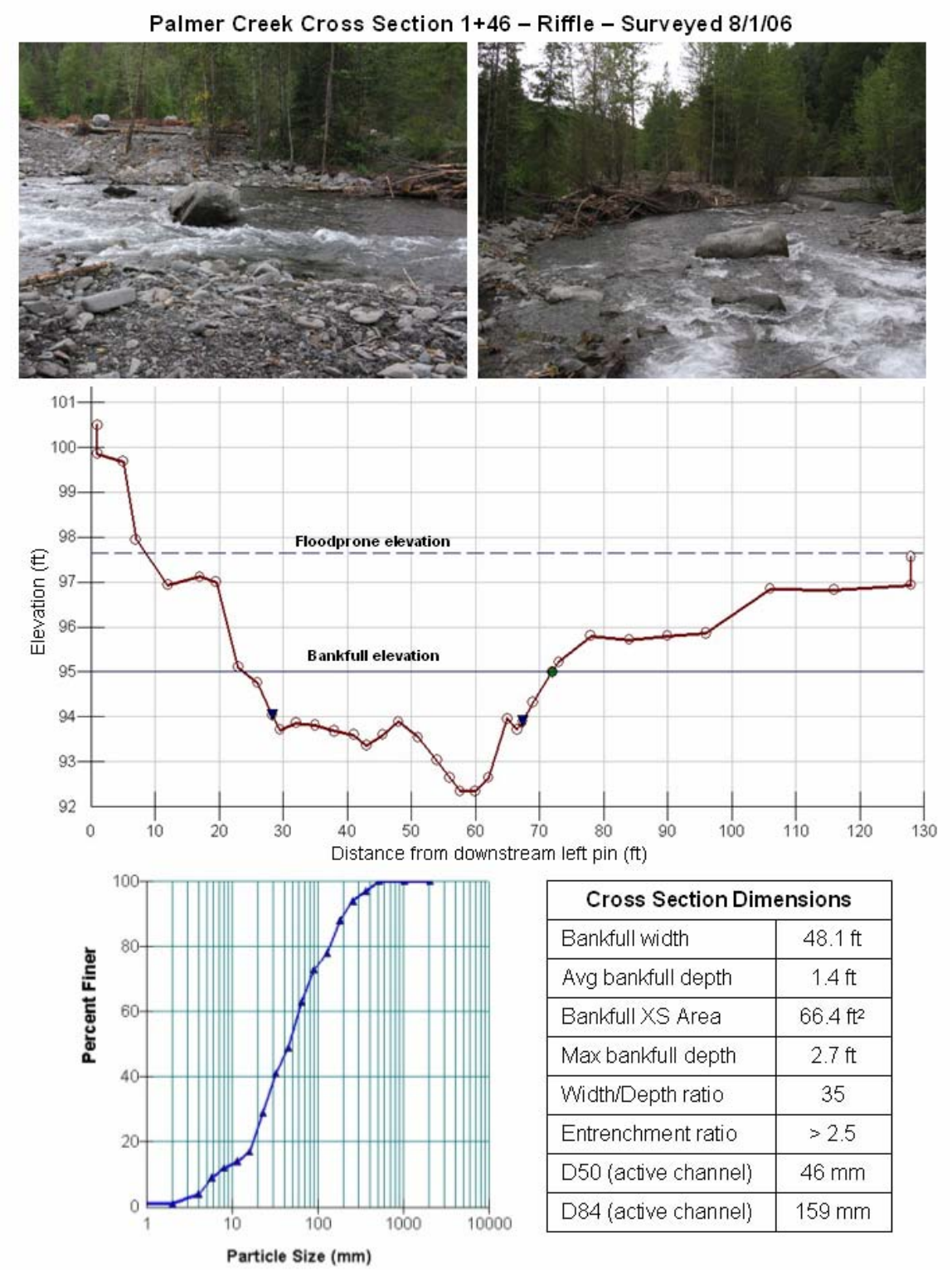
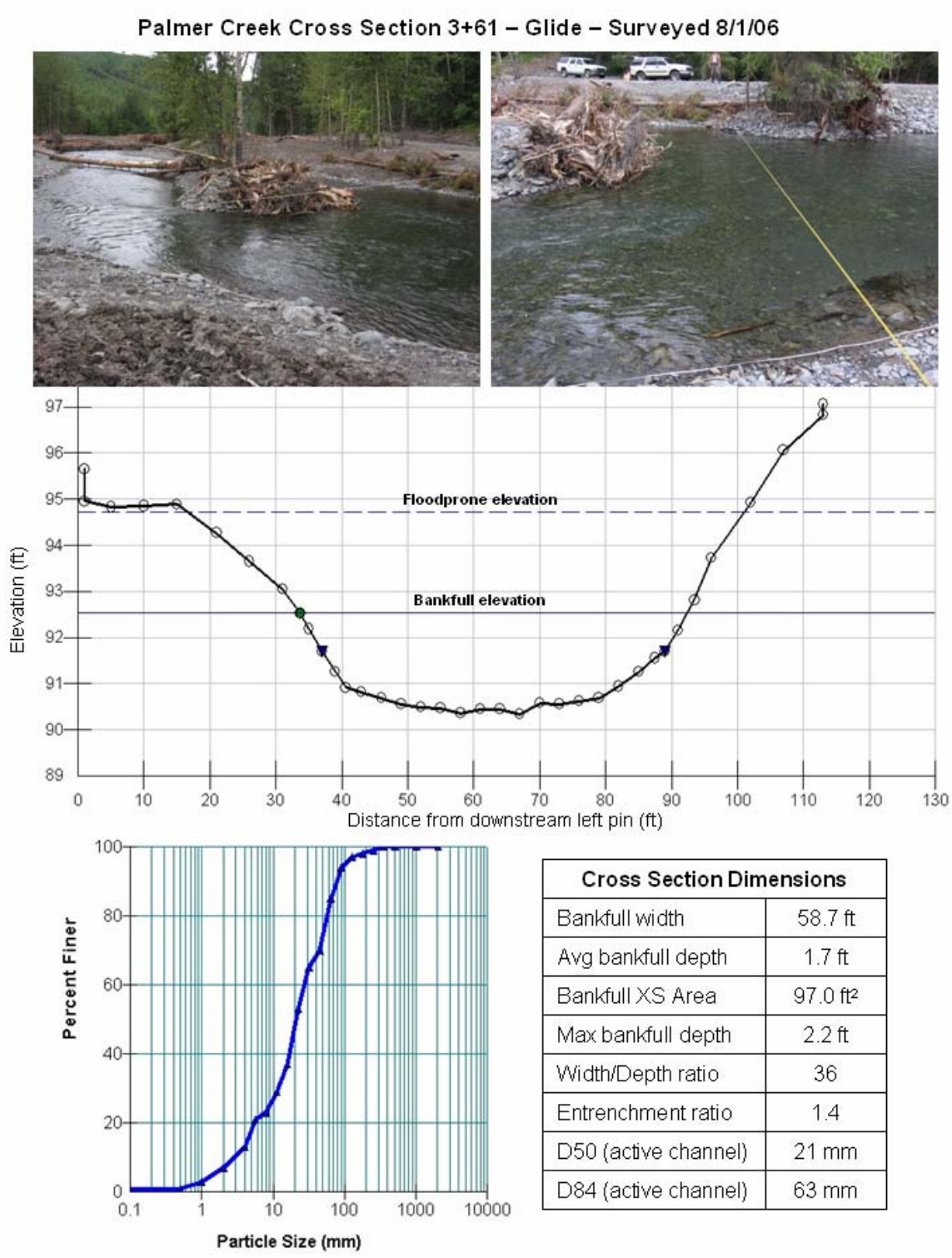


Figure 14: Palmer Creek Cross Section 1+46 channel dimensions.



Cross Section Dimensions	
Bankfull width	58.7 ft
Avg bankfull depth	1.7 ft
Bankfull XS Area	97.0 ft²
Max bankfull depth	2.2 ft
Width/Depth ratio	36
Entrenchment ratio	1.4
D50 (active channel)	21 mm
D84 (active channel)	63 mm

Figure 15: Palmer Creek Cross Section 3+61 channel dimensions.

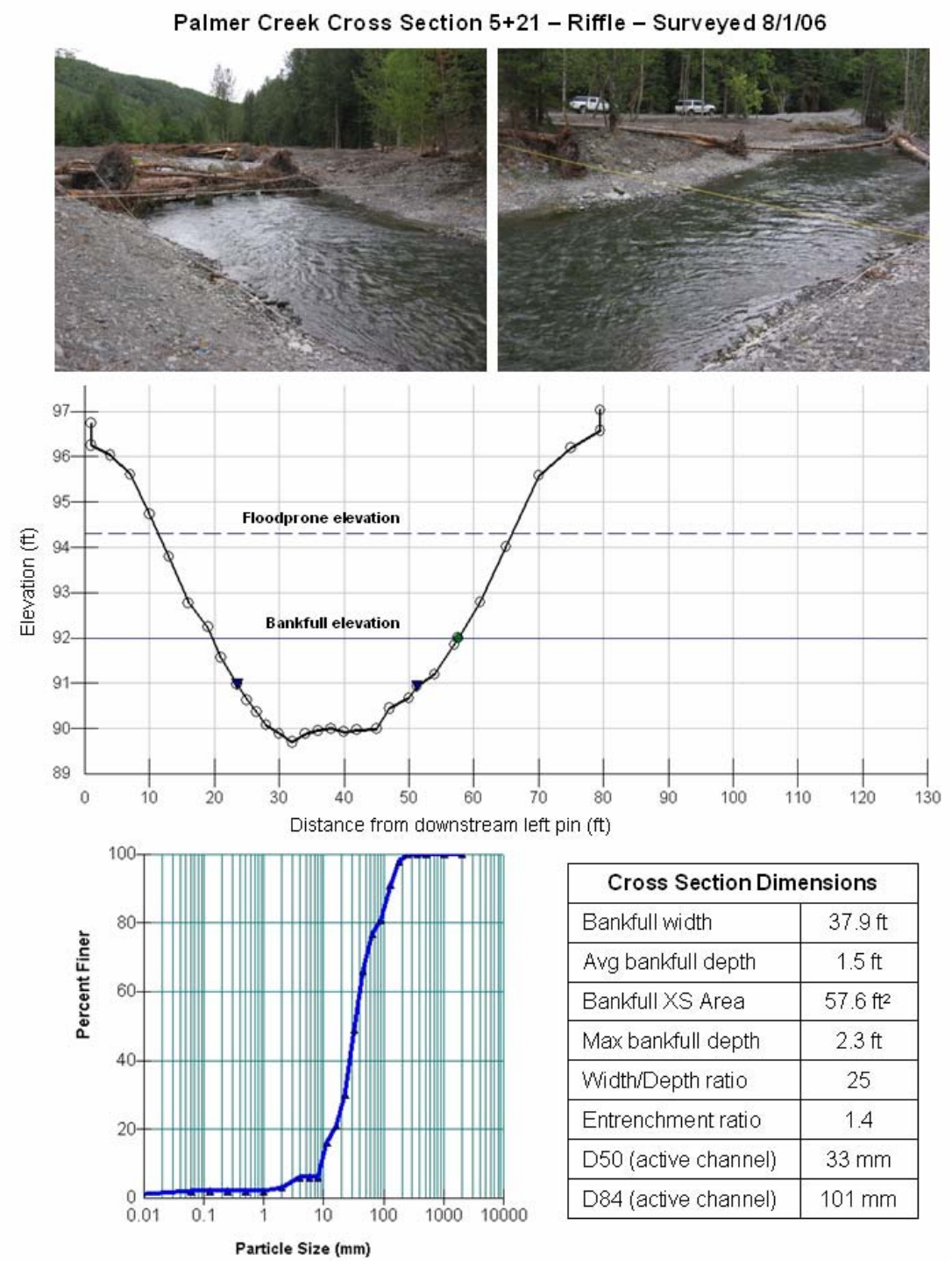


Figure 16: Palmer Creek Cross Section 5+21 channel dimensions.

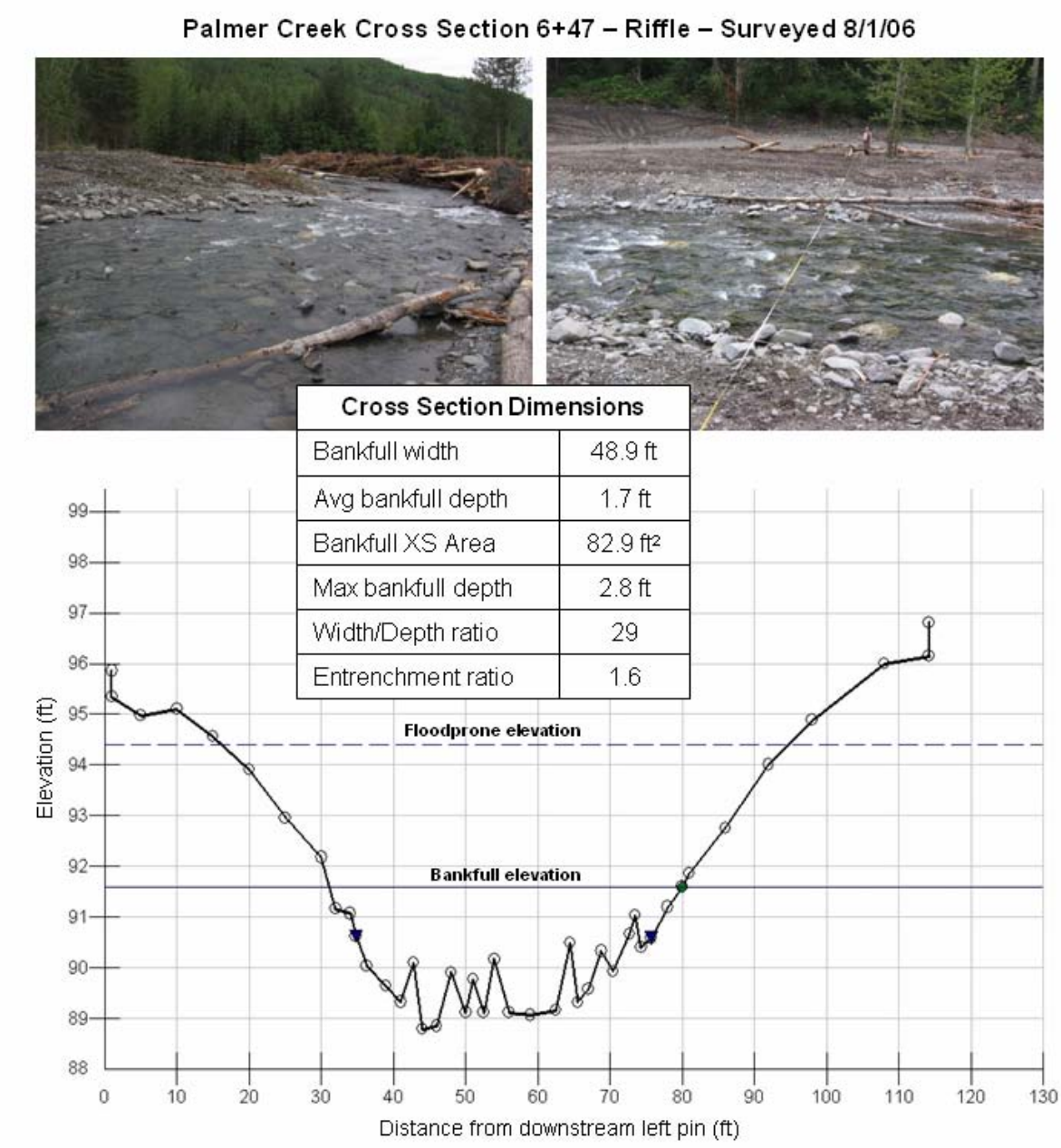


Figure 17: Palmer Creek Cross Section 6+47 channel dimensions. A pebble count was not conducted. The estimated D50 is in the small cobble range and the estimated D84 is in the large cobble range.

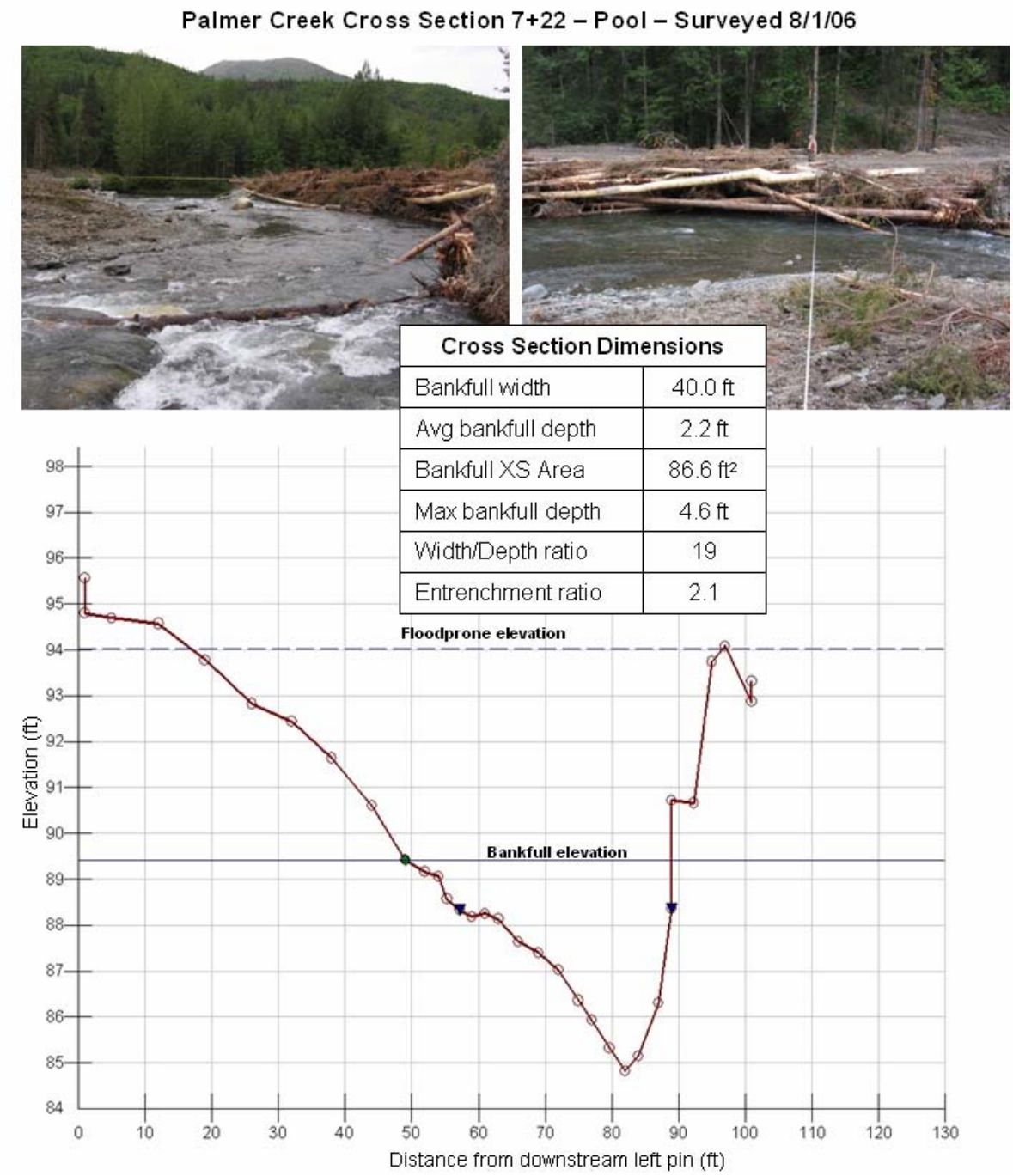


Figure 18: Palmer Creek Cross Section 7+22 channel dimensions.

4.3 Channel pattern

Sinuosity in the reconstructed lower Palmer Creek section is about 1.2 (**figure 12**). The reach contains 2 to 3 meander wavelengths. The meander wavelength varies from about 310 to 410 feet, or 6.3 to 10.8 channel widths. The radius of curvature ranges from 88 to 148 feet, or 1.8 to 3.9 channel widths.

4.4 Palmer Creek summary

Characteristics of the reconstructed section of lower Palmer Creek, based on the 2006 surveys, are presented in **table 2**. This channel has a pool-riffle character, although the channel varies considerably in form and slope. Much of the reach is confined by angled sideslopes. Rosgen channel type (Rosgen, 1996) varies throughout this reach. The upper section is a C4b channel with a high entrenchment ratio and high slope. The middle section is a B4c channel with a lower entrenchment ratio and lower slope, and the lower section is a B4 channel. Adjustments to the channel profile and dimension are likely to occur in this reach in the future because of the wide range in channel slopes and the presence of a channel spanning logjam. However, the channel pattern is well established because of the moderate degree of channel entrenchment.

Table 2: Summary channel characteristics of Lower Palmer Creek.

Approximate bankfull riffle width	38 – 49 ft
Approx average bankfull riffle depth	1.4 – 1.7 ft
Approx bankfull pool depths	3.2 – 5.1 ft
W/D ratio (at riffle)	25 - 35
Entrenchment ratio (at riffle)	1.4 - >2.5
Average Water Surface Slope	1.5% (0.4 – 2.8%)
Riffle Slope	0.4 – 6.1%
Riffle D50	33mm – sm cobble
Riffle D84	101mm – lg cobble
Pool-to-pool spacing	135 – 300 ft
Sinuosity	1.2
Meander Wavelength	310 – 410 ft
Radius of Curvature	88 – 148 ft
Channel Type(s)	C4b, B4c, B4

5 RESURRECTION CREEK LOWER REACH

In 2005, eleven cross sections and a longitudinal profile were surveyed in the lower 4300 feet of the project reach (MacFarlane, 2006). These were established in part to provide baseline data to measure future change. Five of these cross sections were re-measured in 2007 to assess the changes taking place in the lower reach, and one new cross section was established. The 2005 longitudinal profile was not re-surveyed in 2006 or 2007. Cross section locations are shown in **figure 19**.

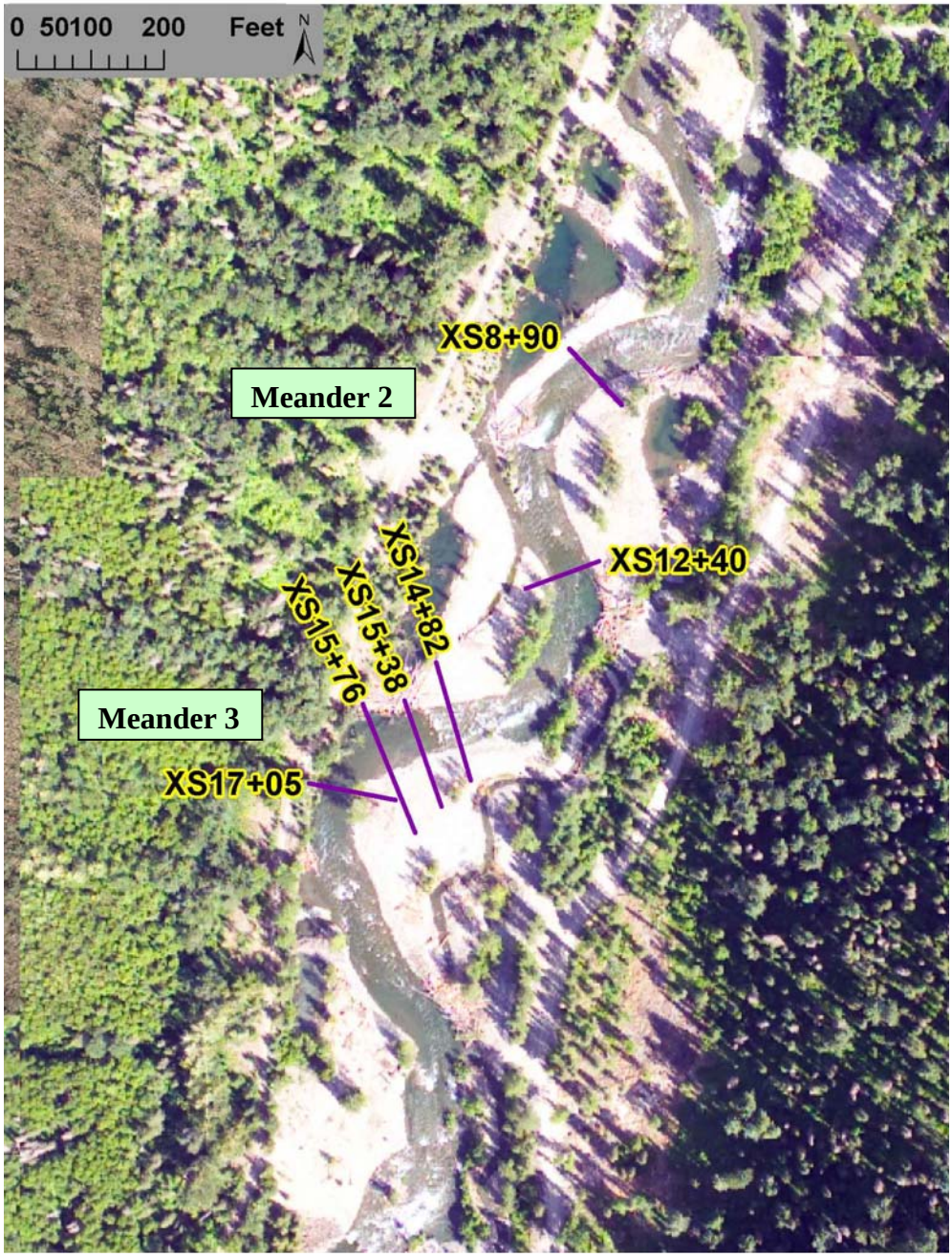


Figure 19: Locations of cross sections surveyed on the lower Resurrection Creek project reach in Meanders 2 and 3 in 2006 and 2007. Flow is to the north.

5.1 Meander 2

Channel changes have been observed in Meander 2. As shown in **figure 20**, the left (outer) bank along the riffle on the lower portion of Meander 2 has been eroding. The left bank is on a berm separating the main channel from the pond on the western side channel. This erosion is the result of deep flows along the bank and the 4-foot high, gravel and cobble bank with little protection from existing vegetation. Cross section 8+90 showed some notable changes between initial survey on 8/10/05 and re-survey on 8/31/07 (**figure 21**). As a result of high flows, this bank has eroded up to 3.5 feet in 2 years. The top of the berm is only sparsely vegetated, and the vegetation currently provides little bank stabilization. With the thalweg against the bank and a slight channel bend to the right, this bank may continue to erode during high flows, although the presence of large boulders in the berm will likely prevent erosion at some point. Up to a foot of bed erosion also occurred along the channel bed on the right side of the channel between 2005 and 2007.

Figure 20: View downstream at Meander 2, from Photo Point 15a. Erosion is occurring along the left bank downstream of the logjam.

The steep riffle leading into the small pool at the logjam on Meander 2 is continuing to change as well. This 2-foot ledge is headcutting upstream slightly, and the ledge currently concentrates most of the flow directly into the logjam on the left bank (**figure 20**). This scours a pool at the logjam that provides good fish habitat. Further headcutting may possibly occur in the future.

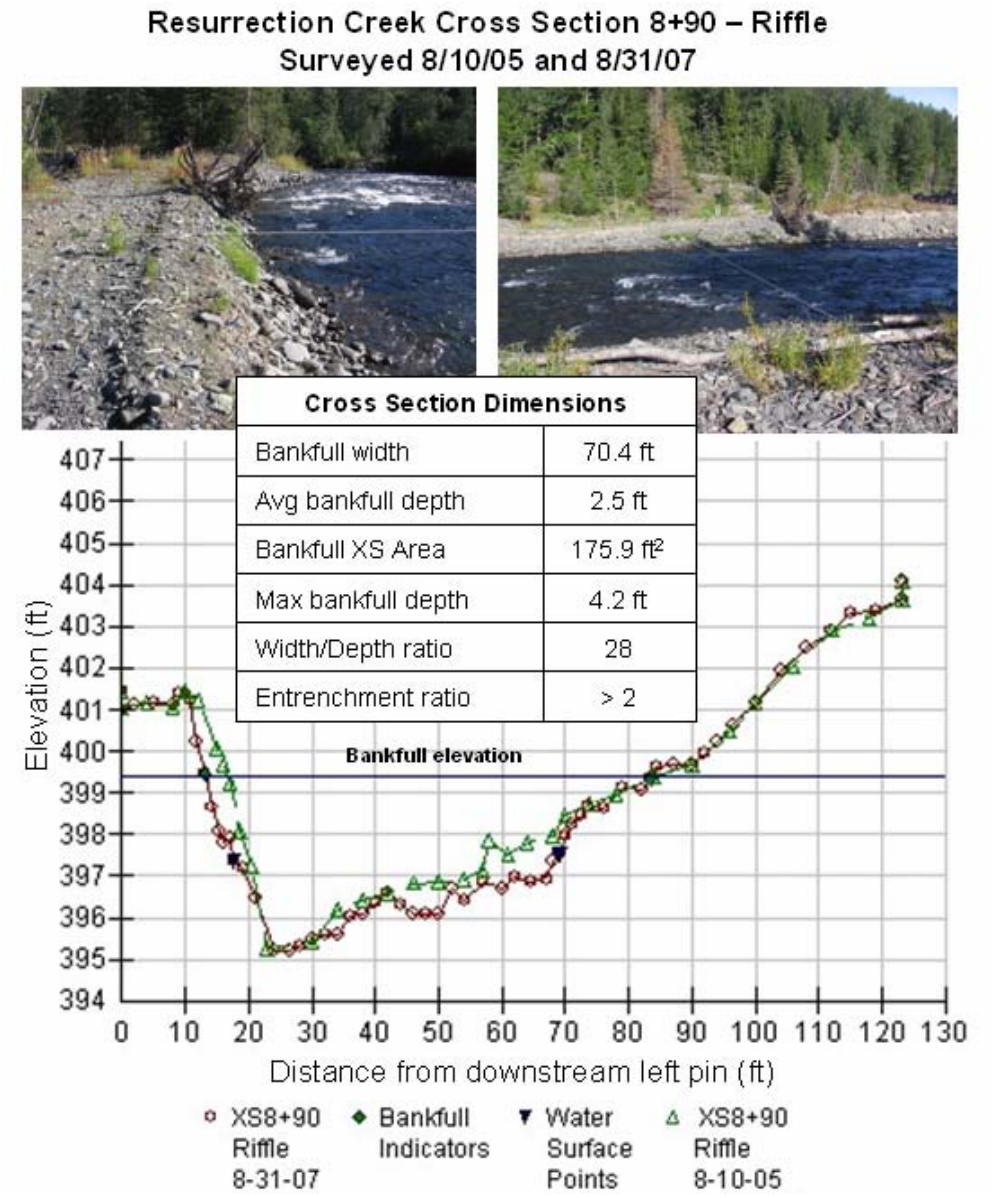


Figure 21: Changes in Resurrection Creek Cross Section 8+90 from 2005 to 2007. Erosion is occurring along the left bank, and deposition is occurring along the right side of the channel bed.

Cross Section 12+40, established in 2005 in the glide leading into Meander 2, showed only minor changes between initial survey on 8/10/05 and re-survey on 8/31/07 (**figure 22**). The right bank has changed little, as it is composed of mostly larger boulders placed during construction. The left bank has also changed very little, as it is well secured by trees on the bank just upstream that were not disturbed during channel construction. However, up to about 1 foot of downcutting has occurred in the center of the channel. The lack of gravel deposition here suggests that the source of new sediment is limited, shear stresses on the channel are high, or any incoming gravel is being deposited in the pool upstream instead.

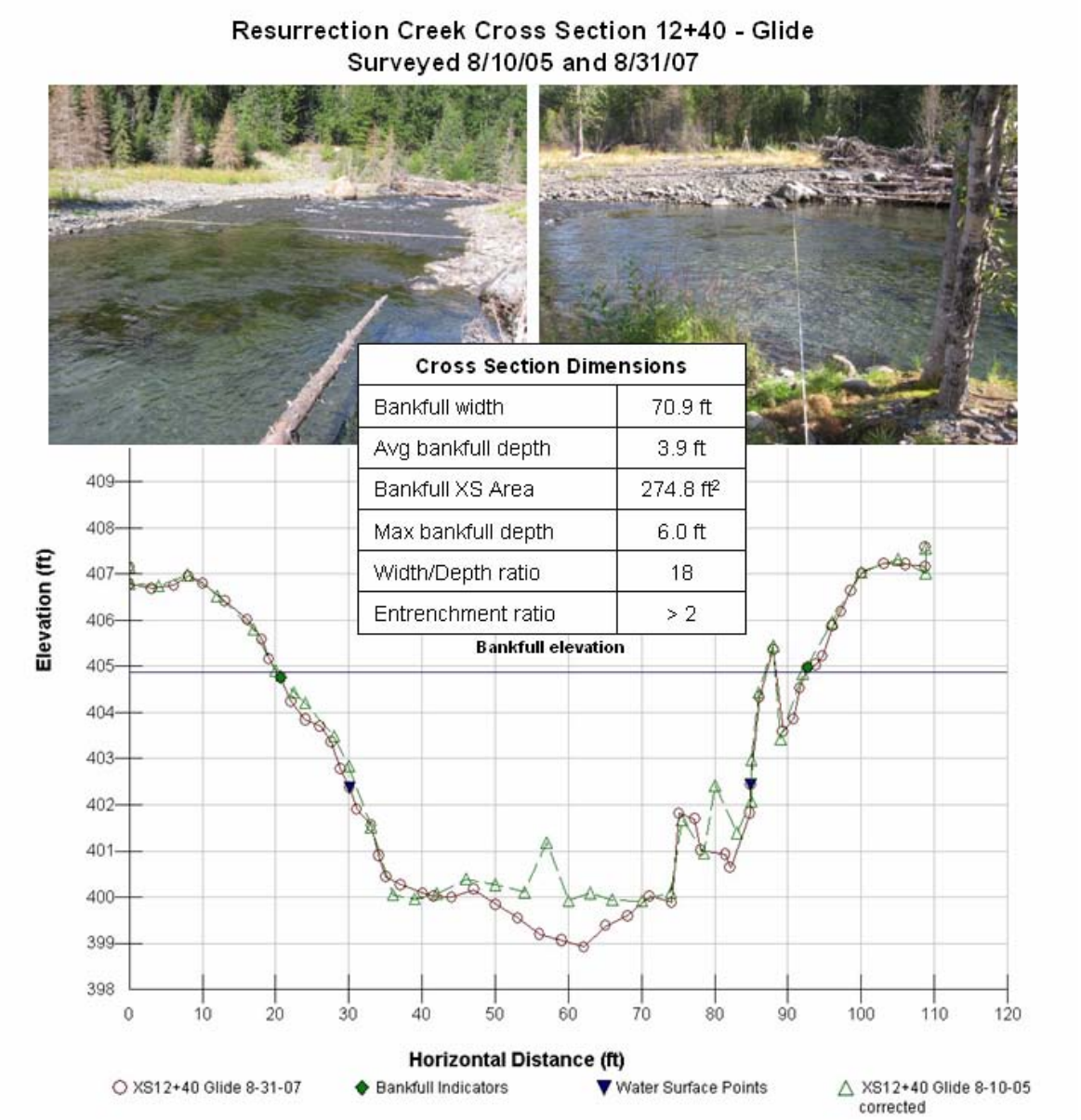


Figure 22: Changes in Resurrection Creek Cross Section 12+40 from 2005 to 2007. Downcutting has occurred in the center of the channel.

5.2 Meander 3

Some channel changes have also occurred in the Meander 3 area. The riffle on the downstream end of Meander 3 has changed little. Cross Section 14+82 has shown up to about 1 foot of degradation on the riffle bed surface, with no major changes occurring along the banks (**figure 23**). The glide at Cross Section 15+38 showed very little change between its initial survey on 8/19/05 and re-survey on 9/12/07 (**figure 24**). This is a glide with a logjam on the left bank. Observed changes on the right floodplain in both of these cross sections are the result of construction work to build the Meander 3 eastern side channel in 2006.

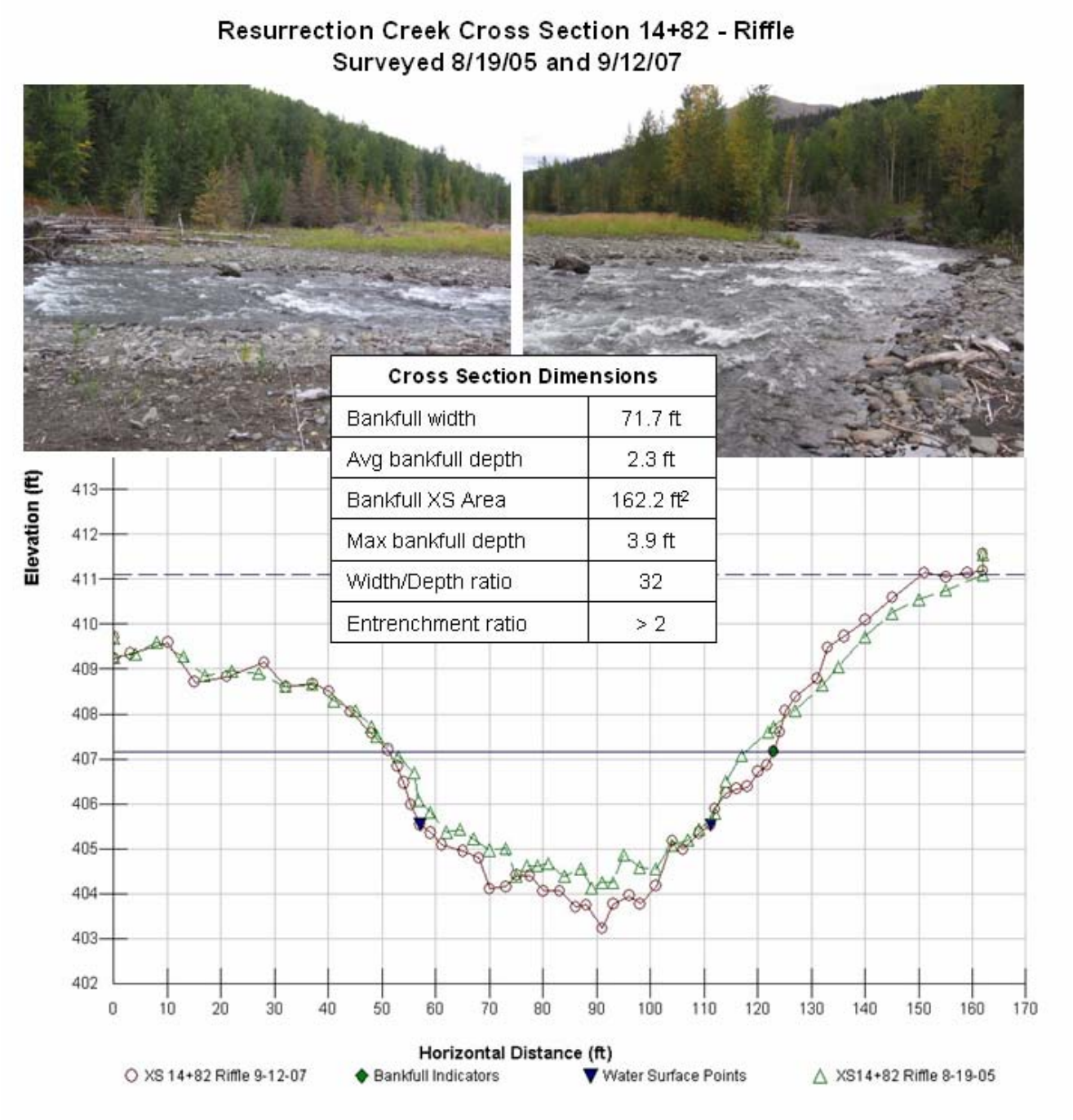


Figure 23: Changes in Resurrection Creek Cross Section 14+82 from 2005 to 2007.

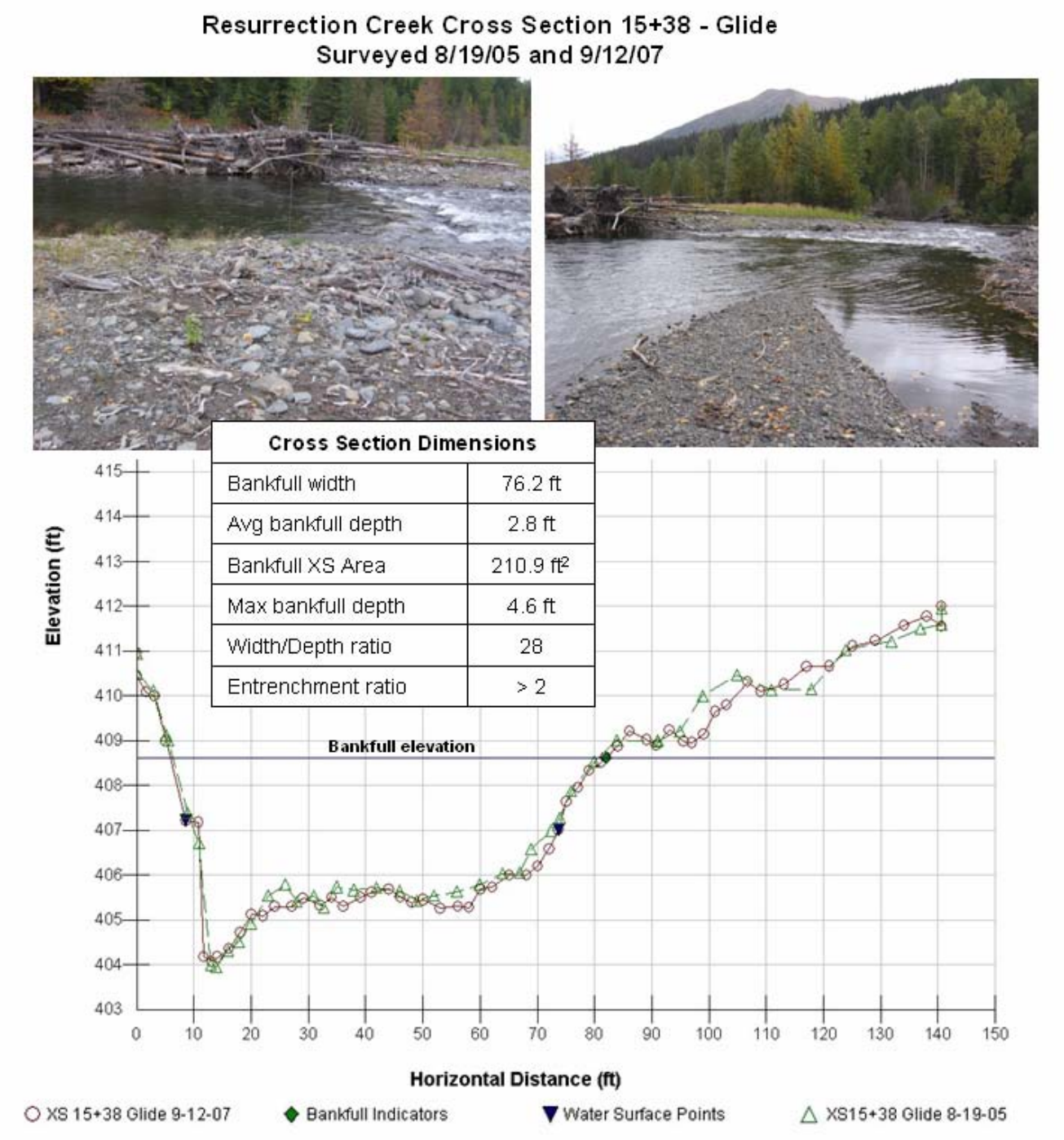


Figure 24: Changes in Resurrection Creek Cross Section 15+38 from 2005 to 2007.

Observed changes that have occurred at Meander 3 include the development of a point bar on the inside of the bend (**figure 25**). Small gravel is accumulating in this low-energy area. This is also an area where numerous fish carcasses accumulate late in the summer. The point bar extends into the pool. The 103-foot bankfull width of the pool was constructed greater than the 70-foot design width, and the channel appears to be

adjusting accordingly by extending its point bar on the right bank. The main flow of the channel stays against the logjam on the outside of the bend and continues to scour out the pool while depositing material on the point bar. The channel will likely deposit material until it achieves its natural channel width of about 70 feet. Some evidence of beaver activity was seen in this area, but no beaver dams were observed on the main channel or side channels.

Figure 25: New point bar deposition at Meander 3.

Cross Section 15+76 shows changes at the pool on the downstream end of Meander 3 (**figure 26**). The pool depth remained the same between initial survey in 2005 and re-survey in 2007, indicating that pools are not filling with sediment, and the scour created by the meander bend and the wood in the logjam is preventing deposition in this slow-water area. Deposition is occurring on the point bar, with about 1 foot of newly deposited fine gravels along the right bank. The deposition shown in the cross section is the downstream end of a larger point bar that has developed on this meander bend. Sediment will likely be deposited in this area until a new bank is built with the design bankfull width of about 70 feet.

Cross Section 17+05 was established in 2006 to characterize the baseline channel characteristics in a run and for stream gauging purposes (**figure 27**). A staff gauge was set up at this cross section on May 12, 2006. The gauge height was referenced to the established rebar pins of the cross section. Gauge readings were taken periodically at this site in 2006 (see section 7).

5.3 Meanders 4 and 5

No channel morphology data were collected between 2005 and 2007 to measure changes that have occurred in Meanders 4 and 5. Visual observations during and after the high water event in early June 2006 indicated that the riffle leading into Meander 4 and the riffles leading out of Meander 5 were too constricted and were experiencing high shear stresses, and it appeared that headcutting was beginning to occur. Following the high water event in June 2006, these riffles were manually widened, and overflow channels were constructed to reduce the amount of shear stress on the channel during high flows. This helped reduce the shear stress, although these riffles should be monitored visually for future changes. Gravel point bar development is occurring in depositional areas along Meanders 4 and 5.

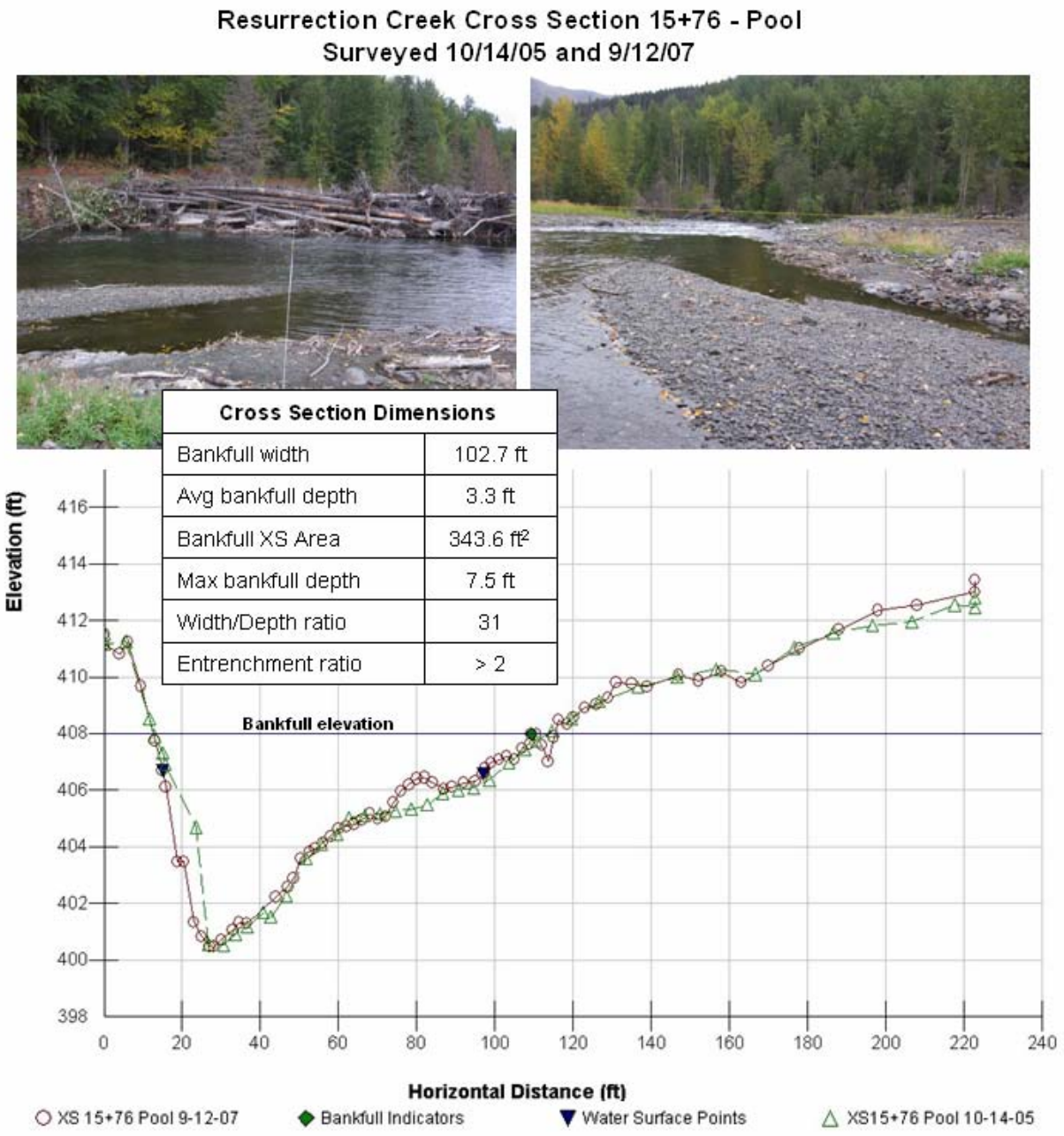


Figure 26: Changes in Resurrection Creek Cross Section 15+76 from 2005 to 2007. Gravel bar deposition has occurred along the right bank.

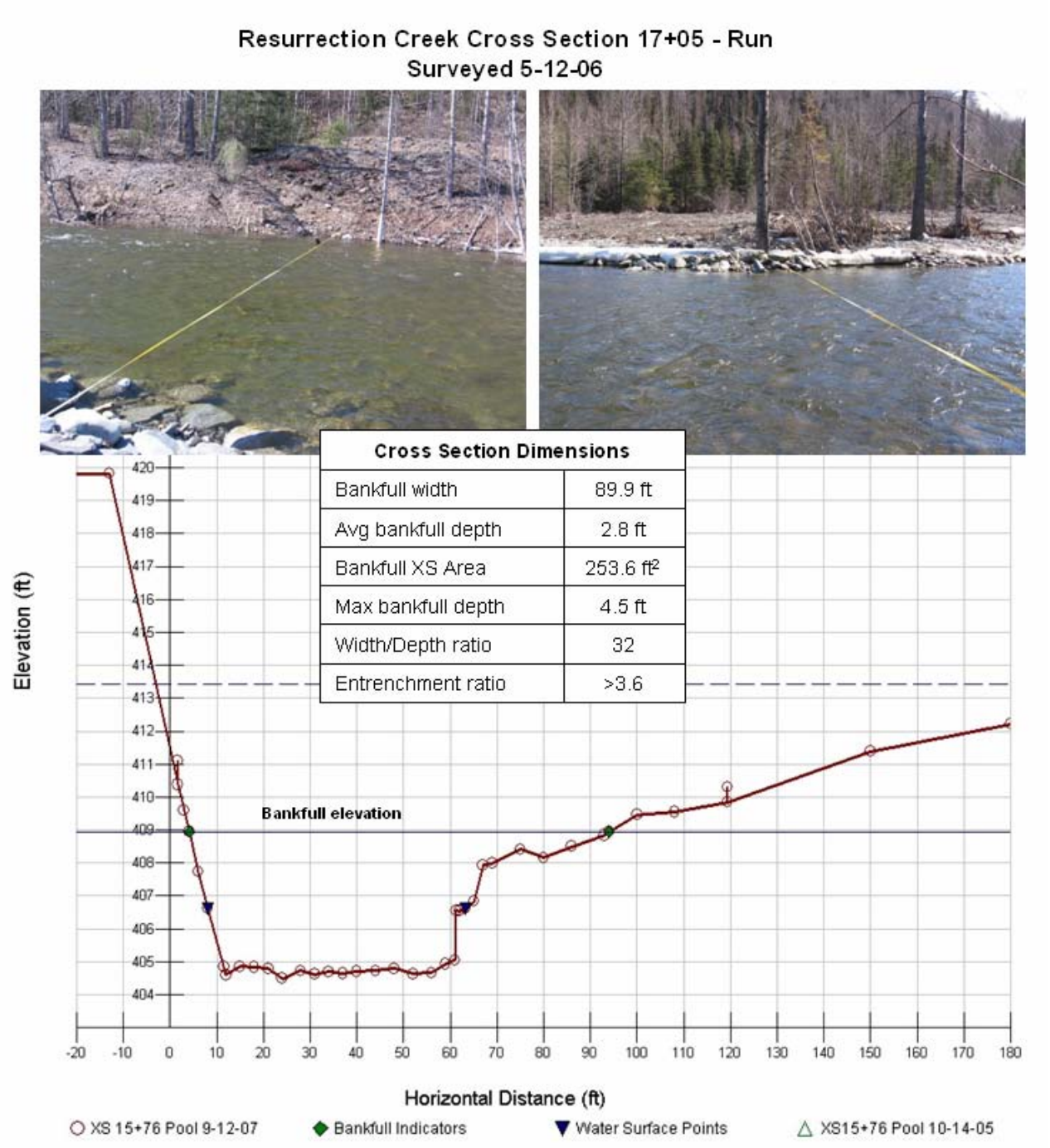


Figure 27: Resurrection Creek Cross Section 17+05. This cross section was also established for stream gauging purposes.

6 ICE

Ice in the Resurrection Creek project reach was monitored in the winter of 2006-2007 qualitatively and through the use of repeat photography at photo points. Ice buildup during the winter of 2006-2007 was higher than normal for a variety of reasons. First, cold early season temperatures occurred in November, causing ice to form early in the season. Second, heavy rainfall in September and October caused high flows in Resurrection Creek. These high flows persisted into the early winter, even during periods of cold temperatures, as springs continued to drain groundwater. This resulted in frequent overflow conditions and buildup of ice. Third, little snow fell in the early winter, causing the ground and stream channels to freeze, as they were not insulated by snowpack.

Ice in the project reach was able to spread out onto the floodplain, and much of the floodplain was covered by ice during the winter (**figure 28**). Ice built up in mid-November as overflow conditions existed, with much of the flow of Resurrection Creek running over the anchor ice attached to the bed surface (**figure 29**). Ice thickness in the channel ranged from about 3 to 6 feet. Although flows were relatively low, anchor ice in the channel caused flows to reach elevations considerably higher than the bankfull elevation, and ice conditions pushed much of the water into the side channels. By the end of November, the flows on top of the ice began to incise into the ice, and most of the water generally remained in the main channel during the remainder of the winter (**figure 30**).

A consequence of ice buildup can be the formation of ice dams and ice dam breakout floods. No ice dams were observed on the Resurrection Creek project reach during the winters of 2005-2006 or 2006-2007. However, a large ice dam was observed about 800 feet downstream of the end of the project reach along the private property just upstream of the Paystreke footbridge (**figure 31**). This ice dam built up in November to a height of about 10 feet, causing minor flooding to the property on the east side of the river and the Resurrection Pass Trail on the west side of the river. Streamflows cut into this ice dam by the end of November, and no ice dam breakout flood was observed.

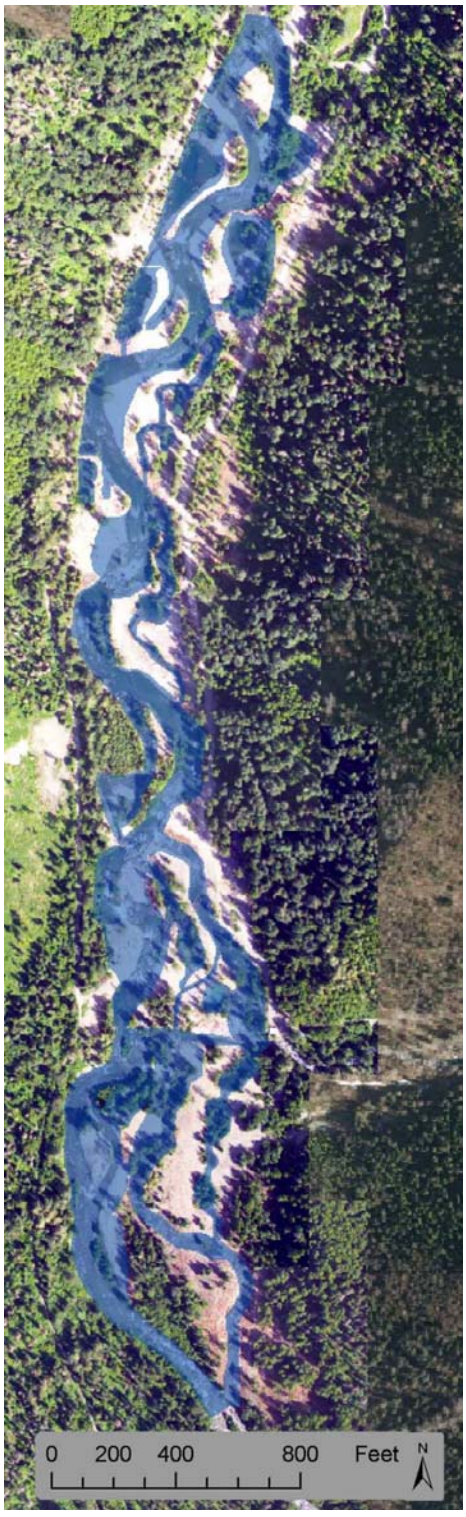


Figure 28: Approximate extent of ice in the Resurrection Creek project reach, November 2006.

Figure 29: Overflow on anchor ice, near Meander 5, November 14, 2006. ←

Figure 30: Incised flows with remnants of ice along banks, lower Meander 5 riffle, April 28, 2006. →

Figure 31: Ice dam at the Paystreke property, about 800 feet downstream of the end of the project reach, November 22 (left), and December 15, 2006 (right).

The channel in the Paystreke area is similar to the pre-restoration conditions of the Resurrection Creek channel, with a narrow, constricted channel, steep banks, and no floodplain. Under these conditions, ice will generally build up vertically, with nowhere to spread out. The restoration work restored the floodplain in the project reach, allowing ice and overflow to spread out over the floodplain and side channels, likely decreasing the risk of ice dams and ice dam breakout floods.

Ice in the Resurrection Creek project reach during the winter of 2006-2007, despite having larger than normal ice buildup conditions, had no major effects on channel morphology or bank erosion in the reach. Some newly planted vegetation was damaged by ice (see Section 8). Large chunks of ice moving during spring breakup and winter thaws can have the potential to cause channel changes and damage riparian vegetation.

7 STREAMFLOWS

7.1 Gauge data

Streamflow discharges were measured in Resurrection Creek, some of its side channels, and Palmer Creek in 2006 for a variety of objectives. First, it is useful to know the magnitude of floods that occur following restoration, to relate any observed channel changes to flood events. Second, correlation between flows in Resurrection Creek and other gauges allows us to more easily determine the flows in Resurrection Creek. Third, it is important to determine the distribution of flows between the main channel and the side channels at different times of the year, in order to assess whether the objectives of the side channels have been met, and how well they function during different flow levels on Resurrection Creek.

A staff gauge was set up on the main channel of Resurrection Creek on May 12, 2006 at station 17+05. A cross section was measured (**figure 27**), and flows at several gauge heights were measured to develop a rudimentary rating curve for the staff gauge (**figure 32**). The two highest discharge measurements in the rating curve were visually estimated, as it was not possible to wade across the channel.

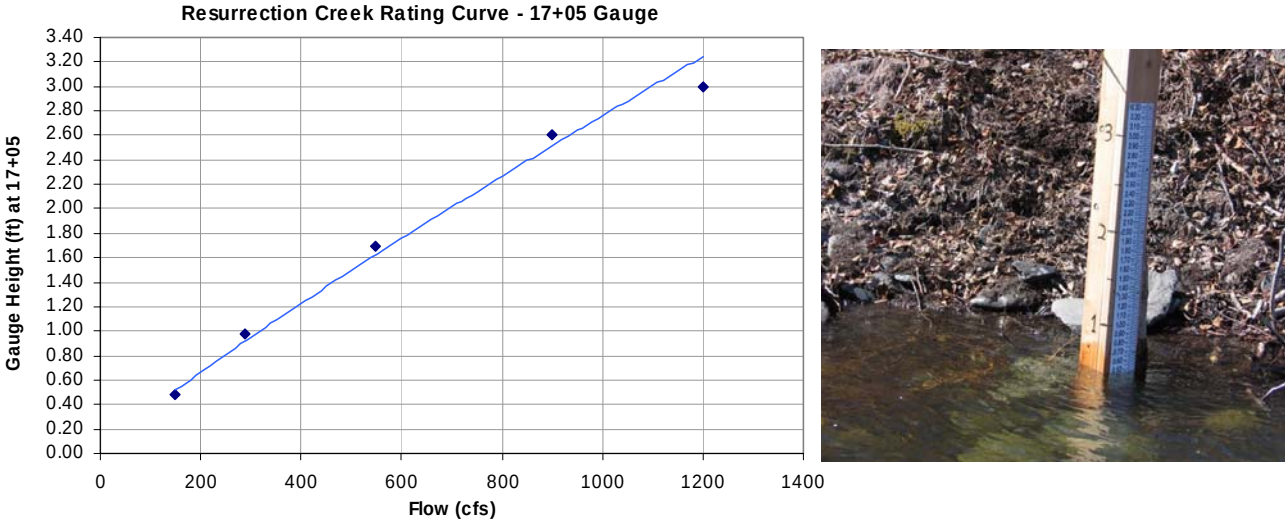


Figure 32: Rating curve for Resurrection Creek 17+05 staff gauge. The estimated bankfull stage is at about 2.8 feet on the gauge.

The staff gauge at station 17+05 was visually monitored periodically throughout the 2006 season. Although measurements were not frequent enough to produce an accurate hydrograph, the data give a sense of what the flows were over the course of the summer (**figure 33**).

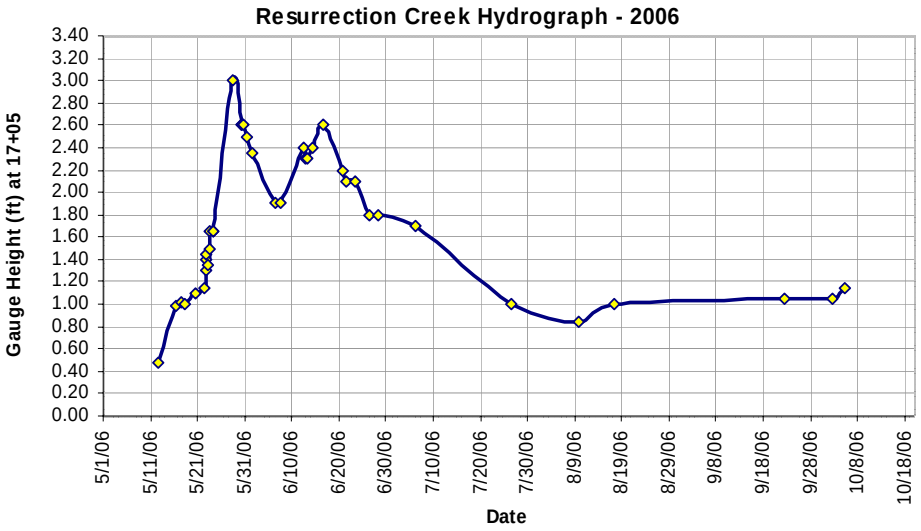


Figure 33: 2006 hydrograph for Resurrection Creek at the 17+05 gauge, based on visual observations during the summer of 2006.

The existing staff gauge on Resurrection Creek at the Hope Highway Bridge near Hope was also monitored periodically throughout the 2006 season. A linear correlation was observed between the gauge heights at station 17+05 and the Hope Highway Bridge (**figure 34**). This correlation allows flows to be estimated based on readings from the Hope Highway Bridge staff gauge, provided that channel changes do not occur at either cross section.

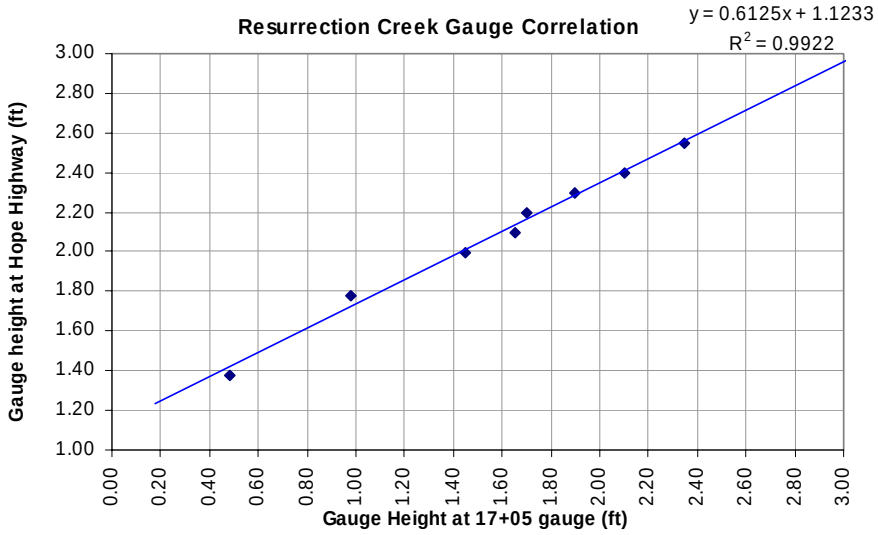


Figure 34: Correlation between staff gauges at the 17+05 gauge and the Hope Highway Bridge gauge.

Streamflows in 2006 were considerably higher than in 2005, with the snowmelt peak occurring on May 28, 2006. This flow was over the bankfull stage, cresting at 3.0 feet on the 17+05 gauge, or approximately 1100 cfs. The estimated bankfull elevation is about 2.8 feet on the 17+05 gauge. The second peak, cresting at 2.6 feet on June 16, corresponds with the peak flow coming primarily from runoff in the Palmer Creek watershed. This is based on observations made at the temporary culvert crossing during construction work in 2006.

The 2006 hydrograph for Sixmile Creek roughly mirrors the 2006 hydrograph for Resurrection Creek, with the snowmelt peak also occurring on May 28, 2006 (**figure 35**). The instantaneous peak flow of 5020 cfs on Sixmile Creek was between the 2-year and 5-year flow (Curran et al., 2003; US Geological Survey, 2007). It is likely that the May 28 flow on Resurrection Creek was also a 2 to 5-year flood event. The Sixmile Creek real-time gauge data can be used as a rough surrogate for flows on Resurrection Creek. However, it must be noted that although they are in close proximity, the Sixmile Creek watershed has differing climatic and watershed conditions than the Resurrection Creek watershed.

The Resurrection Creek staff gauges were not monitored during the summer of 2007. However, the Sixmile Creek hydrograph for 2007 shows that Sixmile Creek experienced a similar summer snowmelt peak flow as in 2006, but in general, flows were considerably less in 2007 than they were in 2006 (**figure 35**). Resurrection Creek likely experienced similar conditions in 2007, with a similar peak, but overall lower flows than in 2006.

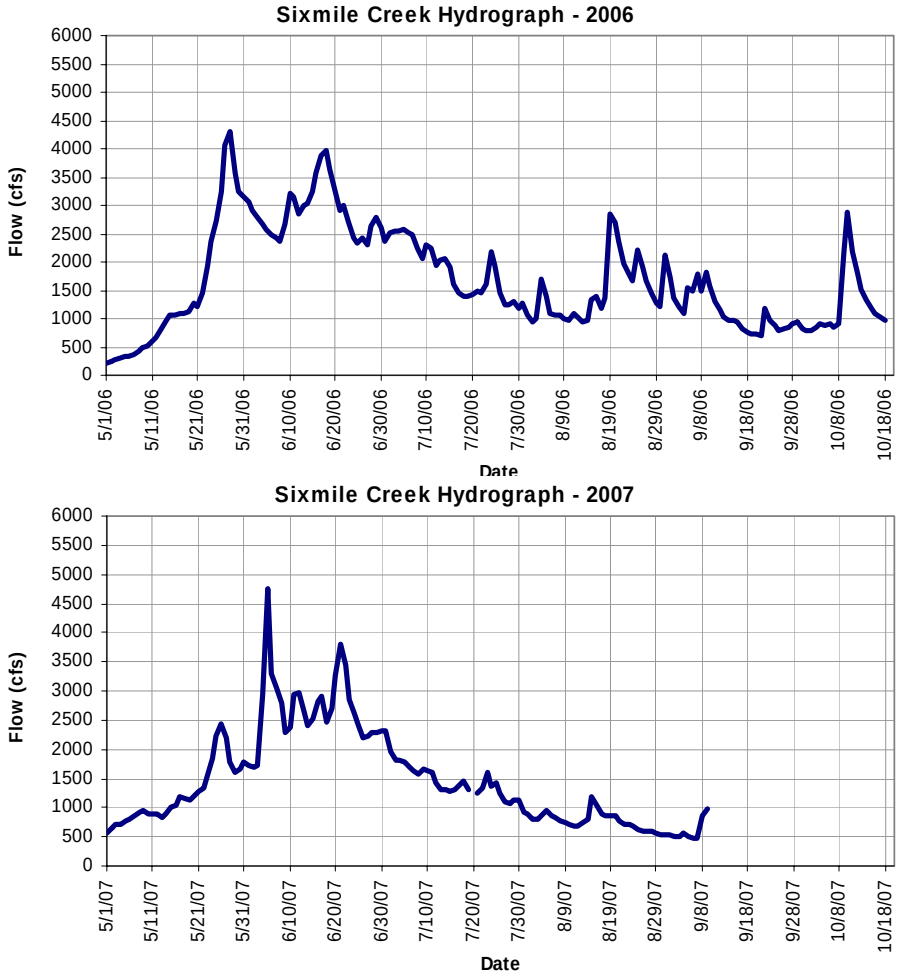


Figure 35: Sixmile Creek hydrographs for 2006 and 2007. Data from US Geological Survey (2007).

7.2 Distribution of flows

Discharges were measured on Resurrection Creek, Palmer Creek, and various side channels on May 16, 2006 and July 6, 2006 in order to show the distribution of flows between the channels. The following discharges were measured in various channels at low and moderate flow levels.

Flows measured on **May 16, 2006** (low flow conditions):

Palmer Creek near mouth:	54 cfs (19% of Res Cr flow)
Resurrection Creek at 17+05 gauge:	287 cfs (100% of Res Cr flow)

Flows measured on **July 6, 2006** (moderate flow conditions):

Main (left) channel at split channel:	259 cfs (47% of Res Cr flow)
Right channel at split channel:	81 cfs (15% of Res Cr flow)
Channel 1 near split channel:	73 cfs (13% of Res Cr flow)
Palmer Creek near mouth:	127 cfs (23% of Res Cr flow)
Palmer Cr overflow channel + Channel 2	9 cfs (est) (2% of Res Cr flow)
Total Flow in Resurrection Creek:	549 cfs (sum of flows)

Side channels in the lower project reach generally carry from a trickle up to about 20 cfs. Observations in 2006 and 2007 show that several of these side channels are dry during low flow conditions. Channels that have no incoming flow during low flow conditions include the following:

- Meander 2 east side channel
- Meander 2 west side channel
- Meander 3 east side channel
- Meander 3 west side channel
- Meander 4/5 west side channel
- Palmer Creek connector channel
- Channel 2

The inlet structures to most of these side channels are through logjams. While these logjams were constructed so that the channels receive perennial flow throughout the year, in some cases the channel inlets were not constructed deep enough to provide this flow at times of low water. However, these channels receive some flow downstream of their inlets as a result of groundwater seepage. At low flows, the ponds in the Meander 2 east and west side channels and the Meander 4 east side channel cannot maintain their water elevations, as the inflow drains through the substrate. At some point, deposition of fine sediment and organic material in the ponds may prevent this by sealing the porous substrate.

8 VEGETATION

With assistance from the Youth Restoration Corps (YRC), most of the floodplain areas along the restored reach were revegetated in 2006 and 2007. All revegetation efforts have been directed toward the acceleration of the establishment of native plant species that typify the local ecosystem and plant species at the early successional stage. Plant species used were based on the soil and hydrologic conditions of the planting sites. Major woody species included Alaska paper birch, White/Lutz spruce, Feltleaf willow, Undergreen willow, Sitka willow, and Barclay willow. Native seeds of grasses and forbs collected in the local area and by the Plant Materials Center in Palmer, Alaska were also use on some of the sites.

In 2006, the YRC crew conducted revegetation on the east and west sides of Meanders 1, 2, 3, and 4. Revegetation work included planting over 4,000 birch seedlings and saplings and 600 spruce seedlings on the floodplains, as well as 4,000 Feltleaf, Sitka, Under-green, and Barclay willow cuttings along the main and side channels. Additional hand seeding of bluejoint grass and fireweed was undertaken to enhance the natural revegetation.

Additional work was conducted with the YRC in 2007 to revegetate about 10 acres of the upper project area, including the area around Palmer Creek, Channel 1, and the upper reach split channel. In 2007, revegetation included planting 4000 willow stems, 1000 spruce seedlings, 300 18-month old birch, and 1500 6-month old birch. In addition, 150 feet of sod and willow wraps were constructed along the banks of side channels, and 500 to 1000 sod transplants were planted in the floodplains.

Revegetation work with the YRC was concentrated in areas where natural revegetation was not occurring quickly. During construction in 2005 and 2006, some floodplain areas were spread with soils transplanted from nearby forests. These were primarily on the west side of Resurrection Creek, where these soils were accessible. Areas on the east side of Resurrection Creek, however, were more often spread with a mixture of clay and gravel because sources of natural soils were lacking on the east side.

Observations in 2007 and photo point monitoring show that overall, revegetation on the newly created floodplains is occurring relatively quickly throughout the project area. **Figures 38, 39, and 42** show photo point monitoring of floodplain revegetation in areas that were restored in 2005. Areas that were spread with natural soils included a natural seed source and showed strong natural regeneration in 2006 and 2007 (**figure 36**). Areas that were spread with the mixture of clay and gravel showed little natural regeneration by 2007 (**figure 37**). Seedlings planted by the YRC in these floodplains will help greatly to promote future revegetation. Little or no natural revegetation has been observed on areas that were left as bare gravel and cobble. In many cases, the soil that was spread on the floodplains was not spread all the way to the bankfull elevation, leaving an area of bare cobbles and gravel on the lower floodplain. The YRC planted willow plantings in some of these areas.

←
Figure 36: Revegetated floodplain on natural transplanted soils at Meander 5, with slower revegetation rates occurring on clay soils on the far side of the river (August 31, 2007).

Figure 37: Sod transplant in clay soils on Resurrection Creek floodplain. Little natural regeneration is occurring in the clay soils (August 31, 2007).
→

Survival rates of the various species of vegetation planted in 2006 were between 75% and 100%. Birch planted on the floodplains had high survival rates and showed extensive new growth in 2007, although ice may have affected some of the birch planted closer to the channels. Many of the spruce planted closer to the banks were affected by ice, and some of these plantings did not survive. Spruce on the higher floodplain areas were healthy and showed new growth. Willow cuttings planted along the banks had very high survival rates, with rapid growth rates in 2006 and 2007. Also, preliminary observations showed some successful germination of seed broadcast over the floodplain areas.

In field surveys during the summer of 2007, 23 non-native plant species (**table 3**) were observed across 11 infestation sites within the Resurrection Creek restoration project area. The total area of these sites is approximately 5 acres. Most of the non-native plant occurrences may have been accidentally brought into the area in the soil associated with tree plantings. Individual species cover of most of the occurrences is currently less than

one percent (i.e., trace). Of the 23 species, 21 received manual control treatment and only white sweet clover and bird vetch break the 60 threshold of invasiveness[1]. Annual pulls and ever increasing competition with native plants will potentially keep these species in check. If not, more aggressive treatments (e.g., chemical control) may be necessary in the future.

Table 3: Invasive plant species observed in the Resurrection Creek project area.

Common Name	Scientific Name	Controlled?	Rank
field mustard	*Brassica napus*	Y	
shepherd's purse	*Capsella bursa-pastoris*	Y	40
larger mouse-eared chickweed	*Cerastium fontanum*	Y	39
lamb's quarters	*Chenopodium album*	Y	35
annual hawksbeard	*Crepis tectorum*	Y	54
quackgrass	*Elymus repens*	Y	59
wormseed wallflower	*Erysimum cheiranthoides*	Y	
brittlestem hempnettle	*Galeopsis tetrahit*	Y	40
pineappleweed	*Matricaria discoidea*	Y	32
white sweet clover	*Melilotus alba*	Y	80
Timothy	*Phleum pratense*	Y	56
common plantain	*Plantago major*	Y	44
annual bluegrass	*Poa annua*	N	46
Kentucky bluegrass	*Poa pratensis*	N	52
knotweed	*Polygonum aviculare*	Y	45
sheep sorel	*Rumex acetosella*	Y	51
night-flowering catchfly	*Silene noctiflora*	Y	45
purple sand spurry	*Spergularia rubra*	Y	
common dandelion	*Taraxacum officinale*	Y	58
alsike clover	*Trifolium hybridum*	Y	57
white clover	*Trifolium repens*	Y	59
thyme-leaf speedwell	*Veronica serpyllifolia*	Y	
bird vetch, dog pea	*Vicia cracca*	Y	73

[1] http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm

9 PHOTO POINTS

A total of 55 photo points were established along the Resurrection Creek project reach between 2005 and 2007. Photo points 1 through 26 are presented in the 2005 channel morphology monitoring report (MacFarlane, 2006). Some of the photo points established in 2005 were discontinued, and 45 photo points remain. Photos were taken with a Canon Powershot A520 digital camera.

A location map, descriptions, and recent reference photos for all photo points are presented in **Appendix B**. Photo points 5a, 15a, 29, 52, 16, and 42 clearly show some of the important changes that have occurred along the project reach between 2005 and 2007. These are presented in **figures 38 to 42**.

- The photo point 5a sequence shown in **figure 38** shows floodplain revegetation that has occurred in the 2 years since restoration occurred. Natural regeneration is occurring especially well on the west (near) side of the channel. This photo point also shows ice spreading across much of the floodplain, above the high water levels that are typical in the summer. The side channels at Meander 2 have no inflow during low water conditions.

- The photo point 15a sequence shown in **figure 39** shows floodplain revegetation that has occurred in the 2 years since restoration on the east side of the channel, an area where natural soils were not spread. Willow plantings along the right bank are shown to be growing. The lower floodplain, where soil was not spread, has little or no natural regeneration.

- The photo point 29 sequence shown in **figure 40** shows the construction of the upper reach split channel and one year of floodplain revegetation. Natural revegetation is occurring in this area. High ice levels in November 2006 covered the channels and floodplains in most of this area.

- The photo point 52 sequence shown in **figure 41** shows the construction of Channel 1 and one year of revegetation. Natural revegetation is occurring in this area. Soil cover on these slopes and floodplains is limited, but abundant organic material was scattered to promote natural regeneration.

- The photo point 16 and photo point 42 sequences shown in **figure 42** show floodplain revegetation that has occurred in the 2 years since restoration occurred. Revegetation is much faster on the west side of the channel, where natural soils were transplanted.

Figure 38: Photo point 5 (panorama) progression from June 2005 to August 2007, showing revegetation at Meander 2.

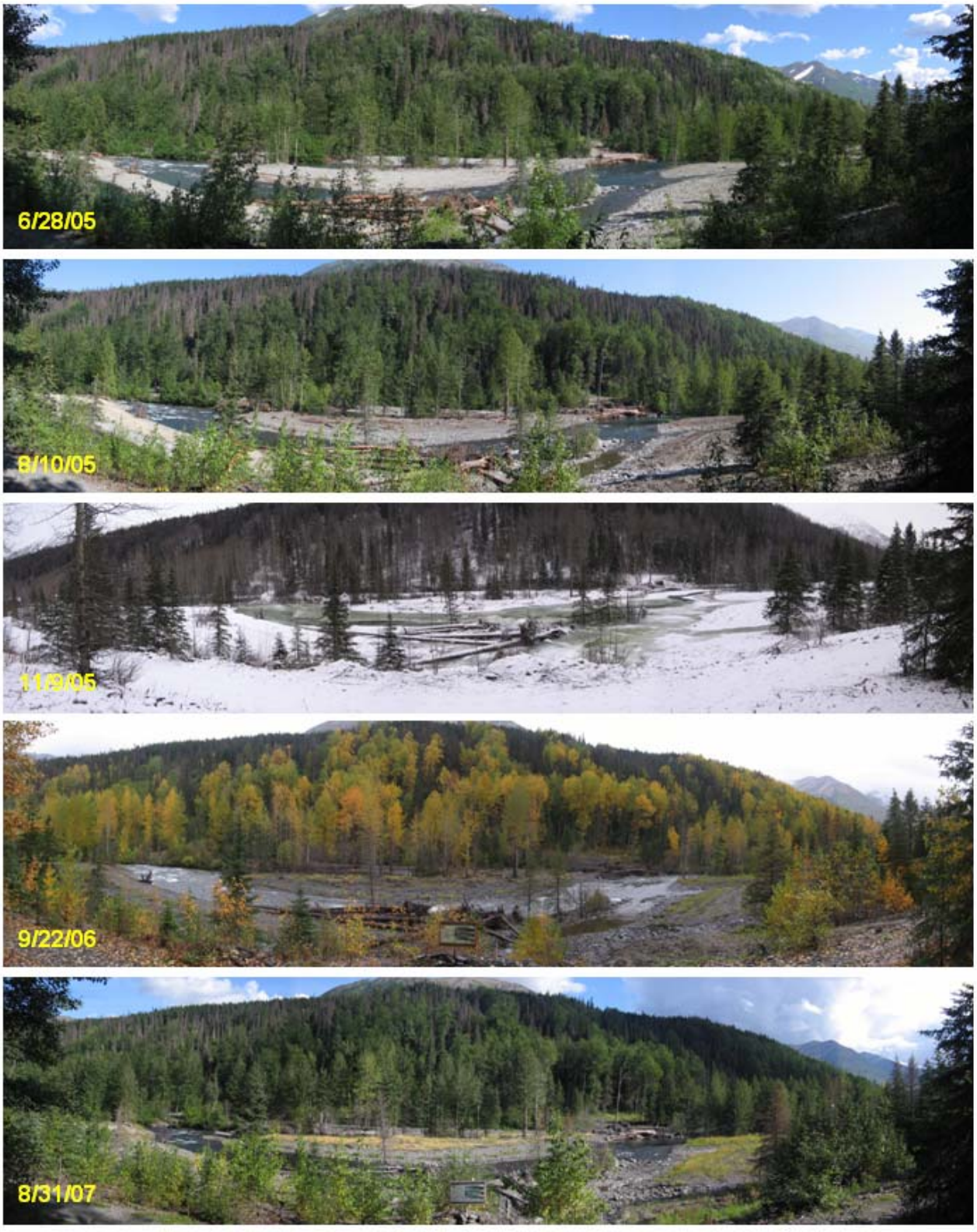


Figure 39: Photo point 15a (panorama) progression from July 2005 to August 2007, showing seasonal variations and revegetation at Meander 2.

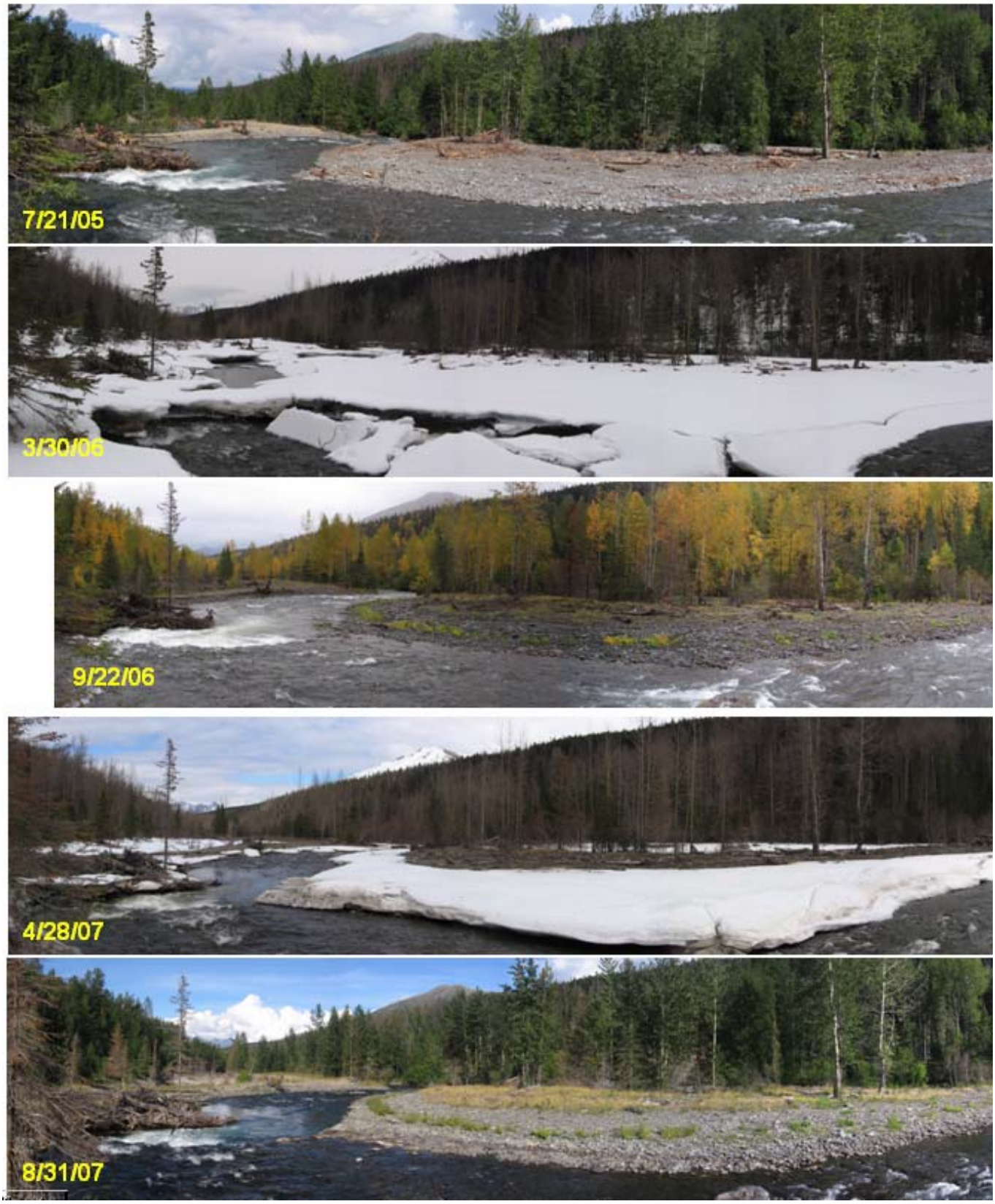


Figure 40: Photo point 29 (panorama) progression from May 2006 to August 2007, showing construction of side channels in the upper project reach.

Figure 41: Photo point 52 (panorama) progression from June 2006 to August 2007, showing construction of Channel 1.

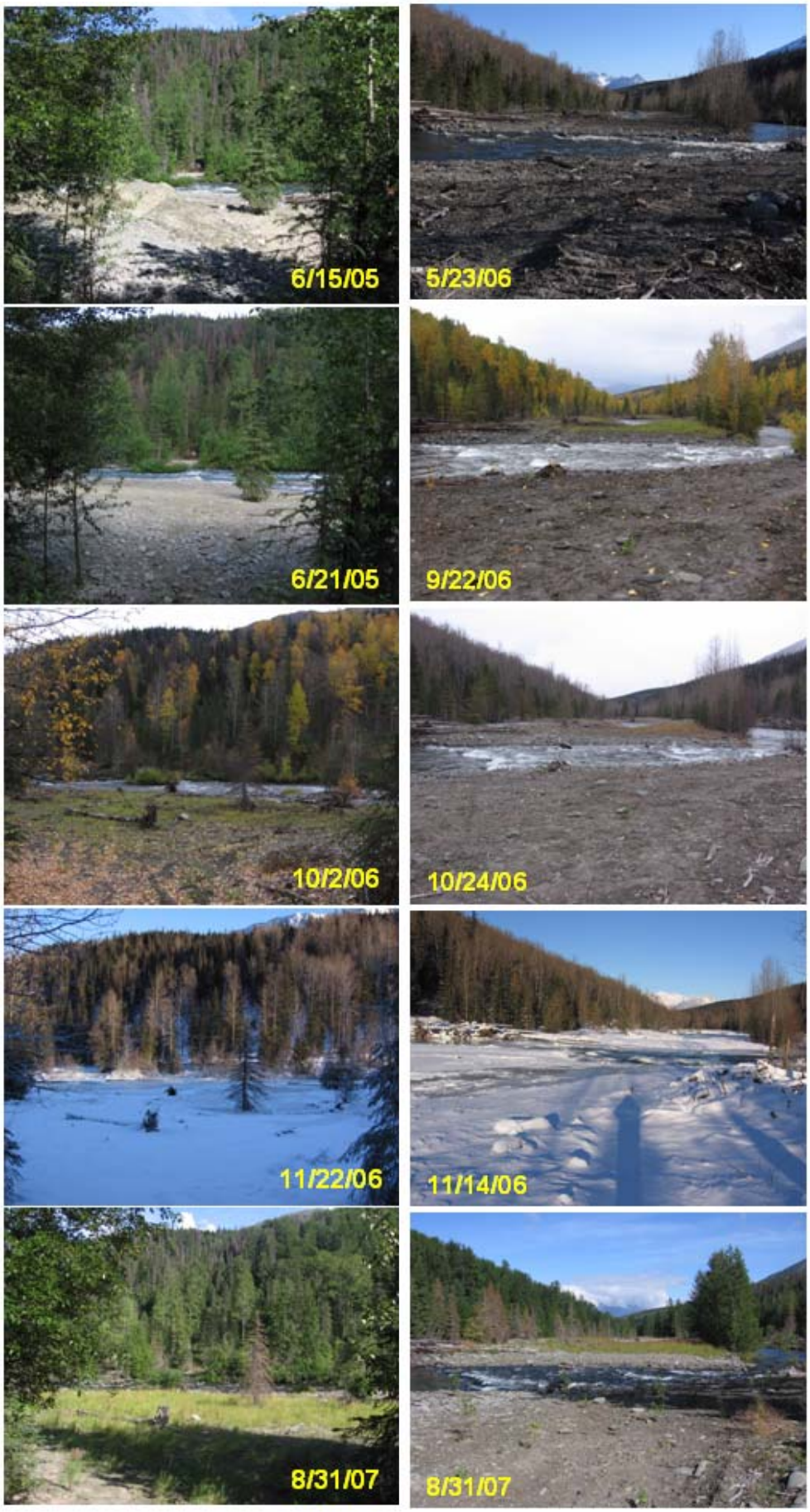


Figure 42: Photo point 16 (left) showing floodplain revegetation at Meander 4, and photo point 42 (right), showing floodplain revegetation at Meander 3.

10 DISCUSSION

10.1 Summary

The results of monitoring of the Resurrection Creek restoration project in 2006 and 2007 show the important processes occurring in this reach. Because restoration was just completed in 2006 and revegetation efforts were conducted in 2006 and 2007, further monitoring will be required to determine the short-term and long-term response of the ecosystem to the restoration. Processes and changes that were observed in 2006 and 2007 are summarized below:

- **Stream channel**: Few major changes were observed in the morphology of the restored stream channel over the last two years. The restored channel is expected to be somewhat dynamic and adjustable. Re-surveys of cross sections established in 2005 on the main channel show areas of bank erosion on cut banks and deposition of gravel on point bars. These processes may continue to occur as the channel adjusts itself. In some cases, the channel was constructed wider than the design dimensions. These areas are experiencing deposition that will ultimately narrow the channel. Designed features of the main channel are functioning as anticipated, including the engineered logjams, which continue to provide excellent fish habitat and maintain deep pools.

- **Side channels**: Because the majority of the side channels were constructed in 2006, monitoring data collected in 2007 provide only baseline data to measure future change. Observations show that many of the side channels along the lower reach have little or no inflow during low water conditions. No major changes have been observed in side channel morphology.

- **Revegetation**: Rates of natural floodplain revegetation depend on the composition of the soils spread on the floodplains, with the most rapid regeneration occurring on soils transplanted from nearby forests. Vegetation plantings accomplished by the Youth Restoration Corps has helped speed revegetation rates, and the success of these plantings has been high. Invasive species have been observed in the project area, but currently comprise only a very small percentage of the total plant cover.

Additional changes are expected to occur in the project area in the future. This will include the maturing of the floodplain and riparian vegetation, and minor channel adjustments. Overall, changes to the ecosystem as a result of restoration activities are working to improve the overall function of the ecosystem. The channel has maintained its designed form, even during two relatively high water runoff years, and the highly beneficial fish habitat created during restoration has been maintained.

10.2 Points of emphasis

In light of the monitoring results, the following summarizes some of the particular points that should be addressed during future restoration efforts on other reaches of Resurrection Creek, or on other impaired streams on the Kenai Peninsula:

- ***Adequate soils should be spread on the floodplains***: Revegetation success is more limited in areas where natural transplanted soils were not spread. Adequate soils should be spread across the entire floodplain, down to the bankfull water elevation, so that sufficient revegetation occurs to stabilize the tops of the banks.

- ***Invasive plant species must be controlled***: Invasive plants were found in the soil associated with some of the vegetation plantings. Invasive plant species observed in the project area present a potential future issue. Although natural regeneration will preclude many of these species over time, the presence of the road and trail through the project area may be additional pathways for new seeds to enter the area.

- ***Side channels should provide perennial flows***: During low flow conditions, some of the side channels have little or no inflow because the inlets were not constructed deep enough. Although the intent was for these channels to carry perennial flow, this was not achieved in some cases because of problems associated with creating the channels in the coarse material beneath the logjams.

- ***Spruce should not be planted where continually damaged by ice***: Spruce planted too close to the main channel in 2006 had lower survival rates, but spruce planted in higher floodplain areas of the project area remained healthy.

- ***Banks along outsides of meander bends should be stabilized by vegetation to prevent accelerated rates of erosion***: As is shown at Cross Section 8+90, cut banks composed of gravel and cobbles on the outsides of meander bends can erode rapidly. Efforts should be made to design channels so that shear stresses are minimized along these banks. Extra efforts to spread soil and revegetate these banks should be made to take advantage of the stabilizing effects of riparian vegetation.

10.3 Future monitoring

Additional monitoring of the Resurrection Creek project area should be conducted in 2008, the third year since project implementation. Monitoring in 2008 should address the following tasks and objectives:

- Take photos at photo points throughout the year, including once in winter, once in early to mid-summer, and once in late summer or fall, to characterize and document channel changes and revegetation.

- Re-measure cross sections established in 2006 in Channel 1 and lower Palmer Creek to characterize how these channels are adjusting and changing. Re-measure sediment distribution at these cross sections.

- Re-measure cross sections established in 2005 on the lower project reach, including the pool cross sections, to characterize how the channel is adjusting and changing.

- Re-measure the longitudinal profile surveyed in 2005 on the lower project reach to characterize how the channel slope and depths are changing.

- Measure the distribution of flows in the channel and various side channels at moderate flow to characterize how the side channels are functioning.

- Survey the project area for invasive plant species to show any spread of these species, and recommend methods to control these species if necessary.

- Measure growth and success rates of vegetation planted in 2006 and 2007.

- Re-measure vegetation permanent plots established in 2005 to characterize growth of floodplain and riparian vegetation.

- Complete a monitoring report for 2008.

Following the 2008 monitoring, it is recommended that some scale of monitoring occur every 2 to 3 years for the next 15 years. The frequency and scope of monitoring will depend on the magnitude and types of changes that are observed. However, it is important to document changes that are occurring in the long term and relate these changes to the long term goals and objectives for the project.

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APPENDIX A: CHANNEL MORPHOLOGY DATA

Main Channel Surveys

Resurrection Creek XS8+90 - Riffle - Surveyed 8/31/07

Dist	FS	Elev	Notes
0	8.62	401.42	LPT
0	9.03	401.01	LPB
2.1	8.95	401.09	On berm
5.1	8.86	401.18	On berm
8.1	8.91	401.13	On berm
9.1	8.65	401.39	Lip of berm
10.1	8.68	401.36	Lip of berm
10.8	8.8	401.24	Edge of berm/TLB
11.7	9.81	400.23	Eroding LB
13.1	10.57	399.47	BKF - ?? - High flow mark
14.3	11.38	398.66	LB - Cobbles
15.3	11.97	398.07	LB - Cobbles
16.1	12.24	397.8	LB - Cobbles
17.1	12.15	397.89	LB - Cobbles
17.7	12.66	397.38	LEW
19.1	12.87	397.17	CH
21.1	13.59	396.45	CH
24.1	14.85	395.19	TWG
26.6	14.84	395.2	CH
28.1	14.71	395.33	CH
30.1	14.57	395.47	CH
32.1	14.43	395.61	CH
34.1	14.45	395.59	CH
36.1	14.02	396.02	CH
38.1	13.96	396.08	CH
40.1	13.65	396.39	CH
42.1	13.43	396.61	CH
44.1	13.74	396.3	CH
46.1	13.95	396.09	CH
48.1	13.93	396.11	CH
50.1	13.96	396.08	CH
52.1	13.32	396.72	CH
54.1	13.64	396.4	CH
57.1	13.16	396.88	CH
60.1	13.33	396.71	CH
62.1	13.05	396.99	CH
64.6	13.19	396.85	CH
67.1	13.1	396.94	CH
68.1	12.7	397.34	CH
69.1	12.51	397.53	REW
70.1	12.05	397.99	RB - Cobbles
71.1	11.81	398.23	RB - Cobbles
72.6	11.6	398.44	RB - Cobbles
73.6	11.33	398.71	RB - Cobbles
76.1	11.41	398.63	RB
79.1	10.94	399.1	RB - willow planting
82.1	10.98	399.06	RB - willow planting
83.4	10.68	399.36	BKF - ?? - High flow mark
84.4	10.41	399.63	RB - FP
87.1	10.34	399.7	RB - FP
90.1	10.37	399.67	RB - FP
92.1	10.1	399.94	RB - FP
94.1	9.83	400.21	RB - FP
96.5	9.4	400.64	Edge of spread soil with Veg
100.1	8.87	401.17	FP with veg
104.1	8.1	401.94	FP with veg
108.1	7.53	402.51	FP with veg
112.1	7.13	402.91	FP with veg
115.1	6.72	403.32	FP with veg
119.1	6.66	403.38	FP with veg
123.2	6.4	403.64	RPB
123.2	5.93	404.11	RPT

Surveying Abbreviations

LPT	Left Pin Top
RPT	Right Pin Top
LPB	Left Pin Bottom
RPB	Right Pin Bottom
CH	Channel
LEW	Water surface at left edge of water
REW	Water surface at right edge of water
TWG	Thalweg
BKF	Bankfull
RB	Right Bank
LB	Left Bank
FP	Floodplain
TLB	Top of left bank
BLB	Bottom of left bank
TRB	Top of right bank
BRB	Bottom of right bank

Resurrection Creek XS12+40 - Glide - Surveyed 8/31/07

Dist	FS	Elev	Notes
0	5.74	407.14	LPT
0	6.1	406.78	LPB
3.1	6.2	406.68	Vegetated Fldpln
6.1	6.13	406.75	Vegetated Fldpln
8.1	5.93	406.95	Vegetated Fldpln
10.1	6.08	406.8	Vegetated Fldpln
13.1	6.47	406.41	Vegetated Fldpln
16.1	6.87	406.01	Vegetated Fldpln
18.1	7.3	405.58	Vegetated Fldpln
19.1	7.72	405.16	LB - cobbles
20.7	8.12	404.76	BKF? - highest depositional gravel
22.1	8.64	404.24	LB - cobbles
24.1	9.04	403.84	LB - cobbles
26.1	9.18	403.7	LB - cobbles
27.6	9.52	403.36	LB - cobbles
28.9	10.1	402.78	LB - cobbles
30.1	10.51	402.37	LEW
31.1	10.98	401.9	CH
33.1	11.33	401.55	CH
34.1	11.98	400.9	CH
35.1	12.45	400.43	CH
37.1	12.62	400.26	CH
40.1	12.8	400.08	CH
41.6	12.86	400.02	CH
44.1	12.89	399.99	CH
47.1	12.72	400.16	CH
50.1	13.04	399.84	CH
53.1	13.34	399.54	CH
56.1	13.69	399.19	CH
59.1	13.82	399.06	CH
62.1	13.96	398.92	CH
65.1	13.5	399.38	CH
68.1	13.29	399.59	CH
71.1	12.87	400.01	CH
74.1	13	399.88	CH
75.1	11.07	401.81	On boulder
77.3	11.19	401.69	On boulder
78.1	11.87	401.01	Boulders
81.5	11.96	400.92	Boulders
82.1	12.24	400.64	Boulders
84.8	11.06	401.82	BRB - below boulders
84.9	10.45	402.43	REW
86.1	8.55	404.33	On boulder
88	7.52	405.36	On boulder
89.3	9.3	403.58	RB - cobbles
90.8	9.02	403.86	RB - cobbles
91.6	8.35	404.53	RB - cobbles
92.7	7.9	404.98	BKF? Bench w/ sm depositional gravel
93.8	7.85	405.03	RB
94.7	7.67	405.21	RB
96.1	7.01	405.87	RB
97.3	6.69	406.19	RB
98.6	6.24	406.64	Edge of soil/veg
100.1	5.86	407.02	FP with veg
103.1	5.66	407.22	FP with veg
106.1	5.67	407.21	FP with veg
108.8	5.72	407.16	RPB
108.8	5.3	407.58	RPT

Resurrection Creek XS14+82 - Riffle - Surveyed 9/12/07

Dist	FS	Elev	Notes
0	6.44	409.7	LPT
0	6.91	409.23	LPB
3.1	6.8	409.34	FP - reveged with grass/spruce/birch
10.1	6.56	409.58	FP - reveged with grass/spruce/birch
15.1	7.43	408.71	FP - reveged with grass/spruce/birch
21.1	7.32	408.82	FP - reveged with grass/spruce/birch
28.1	6.99	409.15	FP - reveged with grass/spruce/birch
32.1	7.54	408.6	FP - reveged with grass/spruce/birch
37.1	7.47	408.67	FP - reveged with grass/spruce/birch
40.1	7.64	408.5	FP - edge of spread soil
44.1	8.09	408.05	LB - cobbles
48.1	8.57	407.57	LB - high flow mark - BKF?
51.1	8.94	407.2	LB - cobbles
52.9	9.31	406.83	LB - cobbles
54.1	9.67	406.47	LB - cobbles
55.4	10.17	405.97	LB - cobbles
57.1	10.6	405.54	LEW
59.1	10.79	405.35	CH
61.1	11.05	405.09	CH
65.1	11.19	404.95	CH
68.1	11.34	404.8	CH
70.1	12.03	404.11	CH
73.1	11.98	404.16	CH
75.1	11.73	404.41	CH
77.6	11.74	404.4	CH
80.1	12.08	404.06	CH
83.1	12.08	404.06	CH
86.1	12.44	403.7	CH
88.1	12.39	403.75	CH
91.1	12.91	403.23	CH
93.1	12.38	403.76	CH
96.1	12.18	403.96	CH
98.1	12.36	403.78	CH
101.1	11.97	404.17	CH
104.1	10.96	405.18	CH
106.1	11.16	404.98	CH
109.1	10.79	405.35	CH
111.3	10.61	405.53	REW
112.1	10.25	405.89	RB- cobbles
114.1	9.9	406.24	RB- cobbles
116.1	9.81	406.33	RB- cobbles
118.1	9.76	406.38	RB- cobbles
120.1	9.43	406.71	RB- cobbles
121.8	9.29	406.85	RB- cobbles
123	8.98	407.16	BKF * (small gravel deposition)
124.1	8.55	407.59	FP - gravel and cobbles
125.1	8.08	408.06	FP - gravel and cobbles
127.1	7.76	408.38	FP - gravel and cobbles
131.1	7.36	408.78	FP - edge of spread soil
133.1	6.66	409.48	FP - reveged with grass/spruce/birch
136.1	6.42	409.72	FP - reveged with grass/spruce/birch
140.1	6.05	410.09	FP - reveged with grass/spruce/birch
145.1	5.56	410.58	FP - reveged with grass/spruce/birch
151.1	5	411.14	FP - reveged with grass/spruce/birch
155.1	5.1	411.04	FP - reveged with grass/spruce/birch
159.1	5	411.14	FP - reveged with grass/spruce/birch
162	4.96	411.18	RPB
162	4.59	411.55	RPT

Resurrection Creek XS15+38 - Glide - Surveyed 9/12/07

Dist	FS	Elev	Notes
0	6.3	410.95	LPT
0	6.81	410.44	LPB
1.6	7.17	410.08	Under log jam
3.1	7.25	410	Under log jam
5.1	8.26	408.99	Under log jam
8.6	10.03	407.22	LEW
10.8	10.07	407.18	Boulder
11.7	13.07	404.18	CH
13.1	13.18	404.07	CH
14.1	13.08	404.17	CH
16.1	12.9	404.35	CH
18.1	12.53	404.72	CH
20.1	12.13	405.12	CH
22.1	12.16	405.09	CH
24.1	11.95	405.3	CH
27.1	11.95	405.3	CH
29.1	11.77	405.48	CH
32.1	11.92	405.33	CH
34.1	11.75	405.5	CH
36.1	11.94	405.31	CH
39.1	11.75	405.5	CH
41.1	11.63	405.62	CH
44.1	11.56	405.69	CH
46.1	11.74	405.51	CH
48.1	11.86	405.39	CH
50.1	11.8	405.45	CH
53.1	11.99	405.26	CH
56.1	11.94	405.31	CH
58.1	11.98	405.27	CH
60.1	11.56	405.69	CH
62.1	11.52	405.73	CH
65.1	11.25	406	CH
68.1	11.25	406	CH
70.1	11.04	406.21	CH
72.1	10.66	406.59	CH
73.7	10.23	407.02	REW
75.1	9.6	407.65	RB - gravel and cobbles
77.1	9.29	407.96	RB - gravel and cobbles
79.1	8.91	408.34	RB - gravel and cobbles
81.1	8.74	408.51	RB - gravel and cobbles
82	8.63	408.62	BKF - high water mark
84.1	8.37	408.88	FP - Gravel and cobbles
86.1	8.03	409.22	FP - Gravel and cobbles
89.1	8.23	409.02	FP - Gravel and cobbles
90.8	8.35	408.9	FP - Gravel and cobbles
93.1	8.01	409.24	FP - Gravel and cobbles
95.6	8.27	408.98	FP - Gravel and cobbles
97.1	8.3	408.95	FP - Gravel and cobbles
99.1	8.1	409.15	FP - edge of spread soil
101.1	7.6	409.65	FP - revegetated
103.1	7.46	409.79	FP - revegetated
106.8	6.94	410.31	FP - revegetated
109.1	7.15	410.1	FP - revegetated
113.1	6.99	410.26	FP - revegetated
117.1	6.6	410.65	FP - revegetated
121.1	6.59	410.66	FP - revegetated
125.1	6.14	411.11	FP - revegetated
129.1	6.02	411.23	FP - revegetated
134.1	5.67	411.58	FP - revegetated
138.1	5.47	411.78	FP - revegetated
140.6	5.7	411.55	RPB
140.6	5.25	412	RPT

Resurrection Creek XS15+76 - Pool - Surveyed 9/12/07

Dist	FS	Elev	Notes
0	5.61	411.5	LPT
0	5.97	411.14	LPB
4	6.31	410.8	Under log jam
6	5.87	411.24	Under log jam
9.5	7.44	409.67	Under log jam
13	9.38	407.73	Under log jam
15	10.43	406.68	LEW
15.8	11.01	406.1	CH - under log jam
18.7	13.64	403.47	CH - under log jam
20.5	13.63	403.48	CH - under log jam
23	15.77	401.34	CH - under log jam (depth = 5.34)
25	16.28	400.83	CH - under log jam (depth = 5.85)
27	16.64	400.47	CH - under log jam (depth = 6.21)
28	16.65	400.46	CH - under log jam (depth = 6.22)
30	16.39	400.72	CH - under log jam (depth = 5.96)
33	16.04	401.07	CH - edge of log jam (depth = 5.61)
34.5	15.8	401.31	CH (depth = 5.37)
36.5	15.83	401.28	CH (Depth = 5.40)
44	14.88	402.23	CH (Depth = 4.45)
47	14.53	402.58	CH (Depth = 4.10)
48.5	14.22	402.89	CH
50.3	13.52	403.59	CH
52.5	13.29	403.82	CH
54	13.18	403.93	CH
56	12.97	404.14	CH
58	12.74	404.37	CH
60	12.49	404.62	CH
62	12.4	404.71	CH
64	12.33	404.78	CH
66	12.15	404.96	CH
68	11.95	405.16	CH
70	12.13	404.98	CH
72	12.04	405.07	CH - sand/gravel bar
74	11.55	405.56	CH - sand/gravel bar
76	11.15	405.96	CH - sand/gravel bar
78	10.92	406.19	CH - sand/gravel bar
80	10.71	406.4	CH - sand/gravel bar
82	10.67	406.44	CH - sand/gravel bar
84	10.85	406.26	CH - sand/gravel bar
87	11.07	406.04	CH - sand/gravel bar
89	11.01	406.1	CH - sand/gravel bar
92	10.85	406.26	CH - sand/gravel bar
95	10.8	406.31	CH - sand/gravel bar
97	10.53	406.58	REW
97.5	10.36	406.75	Gravel bar
99	10.14	406.97	Gravel bar
101	10.03	407.08	Gravel bar
103	9.92	407.19	Gravel bar
105	10.02	407.09	Gravel bar
107	9.64	407.47	RB - cobbles
109	9.48	407.63	RB - cobbles
109.4	9.12	407.99	BKF - ??
110.6	9.15	407.96	RB - cobbles
112	9.53	407.58	RB - cobbles
113.6	10.1	407.01	Hole dug for revegetation
115	9.23	407.88	RB - cobbles
116.3	8.63	408.48	RB - cobbles
118.5	8.79	408.32	RB - cobbles
120	8.55	408.56	Edge of spread soil
123	8.19	408.92	FP - revegetated
126	8.09	409.02	FP - revegetated
129	7.85	409.26	FP - revegetated
131	7.31	409.8	FP - revegetated
135	7.36	409.75	FP - revegetated
139	7.45	409.66	FP - revegetated
147	7.05	410.06	FP - revegetated
152	7.24	409.87	FP - revegetated
158	6.92	410.19	FP - revegetated
163	7.32	409.79	FP - revegetated
170	6.72	410.39	FP - revegetated
178	6.11	411	FP - revegetated
188	5.45	411.66	FP - revegetated
198	4.76	412.35	FP - revegetated
208	4.58	412.53	FP - revegetated
222.8	4.1	413.01	RPB
222.8	3.7	413.41	RPT (rebar reestablished 9/12/07)

Resurrection Creek XS 17+05 - Run - Surveyed 5/12/06

Dist	FS	Elev	Notes
-23	3.9	419.82	Res Pass Trail (est elevation)
-13	3.9	419.82	Berm at edge of Res Pass Trail
1.6	13.34	410.38	LPB
1.6	12.62	411.1	LPT
1.6	13.34	410.38	LPB
3	14.14	409.58	LB
4.1	14.77	408.95	BKF - est (2.8ft on staff gauge)
6	15.99	407.73	LB
8	17.1	406.62	LEW (0.47 on staff gauge)
11.5	18.86	404.86	Channel
12	19.12	404.6	Channel
15	18.86	404.86	Channel
18	18.89	404.83	Channel
21	18.92	404.8	Channel
24	19.23	404.49	Channel
28	18.99	404.73	Channel
31	19.1	404.62	Channel
34	19.03	404.69	Channel
37	19.08	404.64	Channel
40	19.02	404.7	Channel
44	18.99	404.73	Channel
48	18.93	404.79	Channel
52	19.09	404.63	Channel
56	19.05	404.67	Channel
59	18.79	404.93	Channel
61	18.67	405.05	Channel
61.3	17.17	406.55	Boulder
62	17.18	406.54	Boulder
63.2	17.11	406.61	REW
65	16.89	406.83	RB
67	15.78	407.94	RB
69	15.74	407.98	RB
75	15.31	408.41	RB
80	15.57	408.15	RB
86	15.22	408.5	Edge of spread soil
93	14.88	408.84	FP
94	14.77	408.95	BKF - est (2.8ft on staff gauge)
100	14.26	409.46	FP
108	14.17	409.55	FP
119.3	13.87	409.85	RPB
119.3	13.43	410.29	RPT
119.3	13.87	409.85	RPB
150	12.33	411.39	FP
180	11.51	412.21	FP
210	11.08	412.64	FP
240	10.74	412.98	FP
300	10.64	413.08	Lower Road

Channel 1 Surveys

Channel 1 - XS1+05 - Riffle/Run - Surveyed 9/22/06

Dist	FS	Elev	Notes
0	6.78	468.15	LPT
0	7.13	467.80	LPB - TLB
2	7.00	467.93	Boulder
3	7.34	467.59	LB
3.6	6.76	468.17	Boulder
5.7	8.10	466.83	LB
7.2	8.01	466.92	BKF -estimated - Boulder on LB
7.8	9.02	465.91	LEW
8.1	9.57	465.36	BLB
10	9.74	465.19	CH
12	10.06	464.87	CH
14	10.21	464.72	CH
16	9.98	464.95	CH
18	9.82	465.11	CH
20	9.78	465.15	CH
22	9.78	465.15	CH
24	9.77	465.16	CH
26	10.14	464.79	CH
29	10.35	464.58	TWG
30.5	9.82	465.11	CH
32.1	9.02	465.91	REW
33.3	8.24	466.69	RB
34.6	7.72	467.21	Base of steep bank
36.8	5.89	469.04	RPB - on steep slope
36.8	5.21	469.72	RPT
43.3	0.80	474.13	Top of steep RB slope

Channel 1 - XS4+33 - Riffle - Surveyed 9/22/06

Dist	FS	Elev	Notes
0	7.00	468.88	LPT
0	7.45	468.43	LPB - On gentle slope
5	8.41	467.47	LB Slope
10	9.72	466.16	LB Slope
14	10.90	464.98	Bottom of slope
16	11.14	464.74	Low bench
18	11.53	464.35	Low bench
20	11.80	464.08	TLB
21.1	12.20	463.68	LB
21.8	12.50	463.38	LB - high water mark
22.5	13.03	462.85	LEW
24.5	13.84	462.04	CH
25.8	14.01	461.87	CH
28	14.04	461.84	CH
30.8	14.21	461.67	CH
33.7	13.68	462.20	CH
36	14.04	461.84	CH
39	13.95	461.93	CH
42	14.02	461.86	CH
45	13.61	462.27	CH
48	13.21	462.67	CH
50.5	13.40	462.48	CH
53.4	13.01	462.87	REW
55.7	12.68	463.20	G-bar - RB
59	12.16	463.72	BKF - estimated
61	11.77	464.11	RB
64	11.86	464.02	Rt Slope
69	10.30	465.58	Rt Slope
76	9.58	466.30	Rt Slope
81	7.89	467.99	Rt Slope
88	6.90	468.98	Rt Slope
92	5.91	469.97	RPB - on Rt slope
92	5.52	470.36	RPT
92	5.91	469.97	RPB
122	0.00	475.88	Edge of forest (gets steeper)

Channel 1 - XS5+55 - Glide - Surveyed 9/22/06

Dist	FS	Elev	Notes
0	8.37	467.51	LPT
0	8.85	467.03	LPB - on gentle slope
6	10.20	465.68	LB slope
12	11.60	464.28	LB slope
16	12.57	463.31	LB slope
20	12.88	463.00	LB slope
22.2	13.92	461.96	LB
23.8	14.30	461.58	LB
25	14.47	461.41	LB
25.8	14.17	461.71	Boulder
26.2	14.38	461.50	BKF - estimated
26.9	14.91	460.97	High water mark (on boulder)
27	14.97	460.91	G-bar with clay
28.6	15.28	460.60	LEW
30	15.58	460.30	CH
33	15.82	460.06	CH
36	16.19	459.69	CH
39	16.40	459.48	CH
42	16.45	459.43	CH
44	16.40	459.48	CH
46	16.60	459.28	CH
48	16.59	459.29	CH
50	16.31	459.57	CH
52	15.81	460.07	CH
54	15.30	460.58	REW
55	14.74	461.14	RB
55.5	14.12	461.76	RB
56.4	13.39	462.49	TRB
59.5	12.37	463.51	RB slope
64	11.77	464.11	RB slope
70	10.13	465.75	RB slope
74.8	8.96	466.92	RPB - on right slope
74.8	8.49	467.39	RPT
74.8	8.96	466.92	RPB
95	3.00	472.88	Edge of forest

Channel 1 - XS7+07 - Pool - Surveyed 9/22/06

Dist	FS	Elev	Notes
0	7.27	462.07	LPT
0	7.69	461.65	LPB
5	8.13	461.21	LB Slope
10	8.93	460.41	LB Slope
14	9.73	459.61	LB Slope
18	10.48	458.86	LB Slope
21	11.23	458.11	LB
21.5	11.34	458.00	BKF - estimated
22.5	11.76	457.58	LB - high water mark
24	11.96	457.38	LB - gravel
25.5	12.16	457.18	LEW
27	12.46	456.88	Channel - eddy
29	12.79	456.55	Channel - eddy
32	13.15	456.19	Channel - eddy
34	13.50	455.84	Channel - eddy
36.5	15.14	454.20	Channel - current
38	15.72	453.62	Channel - current
40	15.83	453.51	Channel - current
42	16.25	453.09	Channel - current
45	15.40	453.94	Channel - current
47	14.88	454.46	Channel - eddy
50	15.07	454.27	Channel - eddy
51	14.53	454.81	Channel - eddy
52	13.27	456.07	Channel - on boulder
54	12.65	456.69	Channel - eddy
56	12.87	456.47	Behind root wad
58	12.45	456.89	Behind root wad
59.5	12.15	457.19	REW (under log)
59	9.67	459.67	Top of log
62	9.58	459.76	RB
66	10.50	458.84	RB
69	10.19	459.15	RB
73	9.58	459.76	RB
77	9.57	459.77	RB
81.7	9.20	460.14	RPB
81.7	8.87	460.47	RPT

Channel 1 - XS9+18 - Riffle - Surveyed 10/2/06

Dist	FS	Elev	Notes
0	8.36	459.02	LPT
0	8.60	458.78	LPB - on LB slope
4	9.80	457.58	LB Slope
8	10.37	457.01	LB Slope
11.5	11.43	455.95	LB - Berm
15	10.77	456.61	Boulder on berm
16.2	11.48	455.90	Edge of berm
17.5	12.49	454.89	LB
18.6	13.43	453.95	LEW
20.5	13.97	453.41	CH
23.6	14.24	453.14	CH
24.4	13.36	454.02	Boulder
26	13.38	454.00	Boulder
26.8	14.25	453.13	CH
29.3	14.30	453.08	CH
31	13.35	454.03	Boulder
31.8	14.40	452.98	CH
34	14.51	452.87	TWG
37	14.34	453.04	CH
40	14.32	453.06	CH
43	14.18	453.20	CH
46.4	13.81	453.57	CH
47.2	13.55	453.83	REW (uneven WS)
48.7	13.39	453.99	RB
50	12.53	454.85	bkf - estimated
52.8	11.59	455.79	RB
55.5	10.15	457.23	Cat berm
57	10.81	456.57	Cat track
63.2	8.88	458.50	Top of RB slope
67.9	8.56	458.82	RPB - on top of RB slope
67.9	8.14	459.24	RPT

Channel 1 - XS13+79 - Riffle - Surveyed 10/5/06

Dist	FS	Elev	Notes
274	9.32	450.75	Middle Pin top - rebar
282	9.71	450.36	FP
292	9.81	450.26	FP
302	9.99	450.08	FP
312	10.47	449.60	FP
322	10.86	449.21	FP
327.2	11.47	448.60	Edge of spread soil (7/06)
330	11.56	448.51	LB - CH1
333	11.84	448.23	LB - CH1
335.4	12.31	447.76	LB - CH1
336.4	12.40	447.67	LB - CH1
337.3	13.00	447.07	LEW - CH1
338.5	13.37	446.70	CH (CH1)
340.2	13.78	446.29	CH (CH1)
342.6	14.26	445.81	CH (CH1)
345	14.19	445.88	CH (CH1)
347	13.91	446.16	CH (CH1)
348.5	13.39	446.68	CH (CH1) (on boulder - loose)
350	14.40	445.67	CH (CH1)
352	14.43	445.64	TWG
354	13.98	446.09	CH (CH1)
357	13.81	446.26	CH (CH1)
359	13.53	446.54	CH (CH1)
361	13.19	446.88	CH (CH1)
362.2	13.15	446.92	REW (CH1)
364	12.70	447.37	RB (CH1)
365	12.45	447.62	RB (CH1)
367	12.14	447.93	BKF - estimated - RB (CH1)
369	11.81	448.26	FP (btw logs)
372	11.81	448.26	FP
376	11.94	448.13	FP
380	10.86	449.21	Slope to terrace
386	9.90	450.17	Slope to terrace
394	8.92	451.15	Terrace
402	8.47	451.60	Terrace
412	8.19	451.88	Terrace
422	8.04	452.03	Terrace
430	8.44	451.63	Terrace (cat track)
440	7.58	452.49	Terrace
450	7.30	452.77	Terrace (old access road)
456	6.61	453.46	Terrace
464	5.95	454.12	Terrace
467.5	6.10	453.97	RPB (top of terrace)
467.5	5.61	454.46	RPT

Channel 1 Pebble Counts 10-24-06

Size Class (mm)	XS1+05 Bankfull Channel	XS1+05 Active Channel	XS4+33 Bankfull Channel	XS4+33 Active Channel	XS5+55 Bankfull Channel	XS5+55 Active Channel	XS9+18 Bankfull Channel	XS9+18 Active Channel
0 - 0.062	0	0	0	0	0	0	1	0
0.062 - 0.125	0	0	0	0	0	0	0	0
0.125 - 0.25	0	0	0	0	0	0	0	0
0.25 - 0.50	4	1	2	2	0	0	0	0
0.50 - 1.0	1	1	0	0	1	0	0	0
1.0 - 2.0	3	3	4	2	2	1	1	1
2.0 - 4.0	3	3	1	0	0	0	0	0
4.0 - 5.7	0	0	0	0	1	1	1	0
5.7 - 8.0	0	0	0	0	0	0	2	2
8.0 - 11.3	2	2	2	2	4	4	0	0
11.3 - 16.0	3	3	2	2	5	4	0	0
16.0 - 22.6	10	9	4	4	10	9	6	5
22.6 - 32.0	12	12	6	5	13	13	2	2
32 - 45	21	21	8	7	11	10	7	7
45 - 64	19	18	13	12	15	15	11	9
64 - 90	11	11	12	12	9	9	16	16
90 - 128	4	4	14	13	12	11	14	14
128 - 180	3	1	14	13	6	6	15	14
180 - 256	1	1	8	8	9	8	14	12
256 - 362	2	2	9	9	2	1	7	7
362 - 512	1	0	1	1	0	0	2	2
512 - 1024	0	0	0	0	0	0	1	1
1024 - 2048	0	0	0	0	0	0	0	0
2048 -	0	0	0	0	0	0	0	0

Channel 1 Longitudinal Profile - Surveyed 9-22-06

Distance	Channel	Water Surface	Top of Left Bank	Top of Right Bank	Left Pin	Right Pin	Other	Notes
-30		467.84						Top of rapid 30 ft upstream of channel 1 inlet
0	466.01	467.17	468.31		469.00			Riffle, LP=top of 0+00 stake
23	465.63	466.68						Riffle
55	465.19	466.13	468.86					Riffle
90	464.81	465.93	468.15					Riffle/Run
105	464.58	465.91	467.80		468.15	469.72		XS 1+05 (Riffle/Run)
143	464.84	465.77						Riffle/Run - wide
160	464.66	465.79	465.92				467.67	Start riffle (TLB=spillover pt on LB btw boulders, OTHER=top of boulders on splash dam)
200	463.96	464.96	467.13		467.27			Riffle, LP=top of 2+00 stake
230	463.49	464.71		465.16				Start Run (RB low bench)
264	461.11	464.42						Start pool (under log jam)
279	460.46	464.42						Pool
290	462.39	464.39						Start glide
312	463.03	464.24						Start Riffle
327	462.32	463.68						Start Run
348	461.06	463.65						Start pool - just d/s of logs across channel
365	460.11	463.62						Pool
380	460.78	463.62						Start Glide
399	462.34	463.42						Start Riffle
433	461.67	462.85			468.88	470.36		XS 4+33 (Riffle)
454	460.80	462.37						Start Run
466	458.28	462.03						Start Pool (Fast)
485	460.02	462.03						Start Glide
508	460.86	461.94						Start Riffle (Wide)
524	460.02	461.36						Start Run (pool head)
535	457.03	460.72						Start Pool
548	458.37	460.69						Start Glide
555	459.28	460.60			467.51	467.39		XS 5+55 (Glide)
570	459.35	460.52						Start Riffle
600	458.15	459.42						Riffle
617	457.69	459.00						Start Run
633	455.04	458.55						Start Pool
640	454.44	458.55						Pool
646	456.09	458.60						Start Glide
656	457.30	458.55						Start Riffle
668	456.44	457.82						Riffle
689	456.02	457.29						Start Run
694	454.85	457.13						Start Pool
700					459.11			Top of 7+00 Stake
707	453.09	457.18			462.07	460.47		XS 7+07 (pool)
715	455.17	457.18						Start Glide
738	456.00	457.17						Start Riffle at island - right (main) channel
739	456.03	457.01						Start riffle, upstream end of Channel 2 inlet, END UPPER REACH
745		457.02					456.33	Channel inlet, elevation of grade control at entrance to channel
745							460.14	Top center of lg boulder at us end of island
754	455.91	456.88						Riffle (Right Channel)
780	455.71	456.71						Riffle - Right channel, downstream end of island
803	455.54	456.46						Start steeper riffle, wide channel
830	455.06	456.10						Riffle
842	454.89	456.00						Start steep riffle (2 boulder ledges)
869	454.09	454.84						Top of rock ledge (riffle)
878	452.21	454.62						Pool downstream of rock ledge
890	452.09	454.62						Start glide (short)

901	453.27	454.53				Start Riffle
918	452.87	453.95	459.02	459.24		Cross section 9+18 (pool)
934	452.36	453.66				Riffle
945	451.65	452.99				Mini-pool below rock ledge
960	451.93	452.97				Start Riffle
985	451.39	452.31				Riffle
1004	451.00	452.23				Start run (poorly defined run)
1019	450.76	452.12				Start pool - at upstream end of logjam
1030	450.70	452.11				Start glide
1048	450.88	452.06				Start short riffle that slams into logjam
1055	449.55	451.18				Start run (below ledge on RB)
1065	449.18	451.18				Pool/Run - at root wad #1
1088	448.62	450.90				Pool - under logjam - at 2nd root wad
1104	447.67	450.87				Start glide - under logjam
1122	450.13	450.89				Start Riffle
1137	449.69	450.65				Riffle (across from alcove)
1156	449.49	450.30				Start steeper riffle
1175	449.05	449.78				Riffle
1218	448.33	449.11				Start Run
1230	447.83	448.95				Start Pool (at alcove)
1251	447.37	448.97				Pool
1272	447.81	448.97				Start glide (poor glide)
1290	447.89	448.80				Start Riffle
1310	447.31	448.52				Riffle
1320	446.67	448.07				Start run
1327	446.00	448.07				Start pool
1345	446.25	448.01				Pool
1350	446.45	448.03				Start glide
1365	446.86	447.92				Start riffle
1389	445.80	446.82				End steep riffle/start mellow riffle
1410	445.33	446.56			446.34	Riffle, pond inlet on RB (through logjam), OTHER=WS of pond
1440	445.30	446.57				Run/Riffle
1464	444.85	446.54				Run/Riffle
1500	445.09	446.51				Run/Riffle
1520	444.89	446.50				Start glide (poor glide)
1529	445.38	446.34				Start short riffle
1535	444.47	445.94				Start short run
1539	443.66	445.84				Start pool - pool on sides, current through middle, straight
1549	444.07	445.84				Start glide
1560	444.87	445.80			446.34	Start riffle, OTHER=pond ws elevation at outlet
1581	444.19	445.25				Riffle
1600	444.44	445.18	447.18			Riffle - widens upstream of island, LP=top of 16+00 stake
1613	443.99	445.06				Riffle - upstream end of island - left channel
1624	443.48	444.79				Left channel - start run (no pool)
1652	443.39	444.67				Left channel - start riffle
1664	443.40	444.27				Left channel - Riffle, top of final drop before confluence with Palmer Cr spillover channel
1668	442.73	444.06				WS of Palmer Cr spillover channel at confluence
1675	442.10	443.66				Start run (no pool), on old Palmer Creek diversion channel
1686	441.91	443.56				Start glide (no pool before)
1700	442.41	443.51				Start riffle
1715					443.48	WS on LB - left channel (not flowing)
1715					443.47	TWG of left channel (not flowing) at crest (spill-over point), only 0.01ft of water going over
1718	441.92	443.12				Riffle - Right channel
1741	440.12	442.49				Riffle - right channel, at log across channel, very fast and narrow
1757	440.52	442.20				Top of step
1767	439.23	441.40				Bottom of step
1780	439.54	441.17				Small pool below boulder
1788	439.95	440.99				Start riffle
1800	439.49	440.81	443.84			Backwater of Resurrection Creek, LP=top of 18+00 stake
1825	438.81	440.81			441.23	Actual conf with Res Cr (bckwtr 25 ft up ch), OTHER=WS of Res Cr at conf of left ch

Palmer Creek Surveys

Palmer Creek - XS1+46 - Riffle - Surveyed 8/1/06

Dist	FS	Elev	Notes
1	7.04	100.50	LPT
1	7.68	99.86	LPB
5	7.86	99.68	LFP
7	9.59	97.95	LFP (in hole by tree)
12	10.60	96.94	LFP
17	10.42	97.12	LFP
19.5	10.54	97.00	TLB (boulders)
23	12.44	95.10	LB (gravel)
26	12.79	94.75	LB (gravel)
28.3	13.50	94.04	LEW
29.5	13.83	93.71	Channel
32	13.68	93.86	Channel
35	13.73	93.81	Channel
38	13.86	93.68	Channel
41	13.94	93.60	Channel
43	14.18	93.36	Channel
45.5	13.94	93.60	Channel (behind left side of boulder)
48	13.65	93.89	Channel (Gravel bar behind rock)
51	14.00	93.54	Channel
54	14.51	93.03	Channel (behind right side of boulder)
56	14.90	92.64	Fast current
57.6	15.20	92.34	TWG
60	15.20	92.34	TWG
62	14.90	92.64	Channel
65	13.58	93.96	Boulder
66.5	13.82	93.72	Channel
67.4	13.64	93.90	REW
69	13.21	94.33	RFP
72	12.54	95.00	BKF - estimated (about 1 ft above WS)
73	12.32	95.22	RFP
78	11.74	95.80	RFP
84	11.82	95.72	RFP
90	11.74	95.80	RFP
96	11.68	95.86	RFP
106	10.69	96.85	RFP
116	10.71	96.83	RFP
128	10.60	96.94	RPB
128	9.98	97.56	RPT

Palmer Creek - XS3+61 - Glide - Surveyed 8/1/06

Dist	FS	Elev	Notes
1	5.58	95.65	LPT
1	6.28	94.95	LPB
5	6.40	94.83	LFP
10	6.38	94.85	LFP
15	6.34	94.89	LFP
21	6.96	94.27	LFP
26	7.58	93.65	LFP
31	8.18	93.05	LFP
33.7	8.70	92.53	BKF - estimated
35	9.04	92.19	LFP
37	9.53	91.70	LEW
39	9.96	91.27	CH
40.6	10.31	90.92	CH
43	10.41	90.82	CH
46	10.54	90.69	CH
49	10.68	90.55	CH
52	10.74	90.49	CH
55	10.76	90.47	CH
58	10.87	90.36	CH
61	10.78	90.45	CH
64	10.78	90.45	CH
67	10.89	90.34	TWG
70	10.65	90.58	CH
73	10.68	90.55	CH
76	10.61	90.62	CH
79	10.54	90.69	CH
82	10.29	90.94	CH
85	9.98	91.25	CH
87.5	9.68	91.55	CH
89	9.53	91.70	REW
91	9.07	92.16	RB
93.5	8.42	92.81	RB
96	7.51	93.72	RB
102	6.30	94.93	RB
107	5.17	96.06	RB
113	4.41	96.82	RPB
113	4.17	97.06	RPT

Palmer Creek - XS5+21 - Riffle - Surveyed 8/1/06

Dist	FS	Elev	Notes
1	5.24	96.74	LPT
1	5.73	96.25	LPB
4	5.95	96.03	LB
7	6.37	95.61	LB
10	7.24	94.74	LB
13	8.19	93.79	LB
16	9.21	92.77	LB
19	9.74	92.24	LB
21	10.41	91.57	LB
23.5	11.01	90.97	LEW
25	11.35	90.63	CH
26.5	11.61	90.37	CH
28	11.91	90.07	CH
30	12.09	89.89	CH
32	12.28	89.70	TWG
34	12.10	89.88	CH
36	12.03	89.95	CH
38	11.98	90.00	CH
40	12.06	89.92	CH
42	12.01	89.97	CH
45	11.99	89.99	CH
47	11.54	90.44	CH
50	11.31	90.67	CH
51.2	11.05	90.93	REW
54	10.78	91.20	RB
57	10.13	91.85	RB
57.6	9.98	92.00	BKF - estimated
61	9.19	92.79	RB
65	7.96	94.02	RB
70	6.40	95.58	RB
75	5.79	96.19	RB
79.5	5.40	96.58	RPB
79.5	4.95	97.03	RPT

Palmer Creek - XS6+47 - Riffle - Surveyed 8/1/06

Dist	FS	Elev	Notes
1	6.12	95.86	LPT
1	6.64	95.34	LPB
5	7.00	94.98	LB
10	6.87	95.11	LB
15	7.42	94.56	LB
20	8.07	93.91	LB
25	9.02	92.96	LB
30	9.80	92.18	LB
32	10.82	91.16	LB
34	10.91	91.07	LB
34.8	11.35	90.63	LEW
36.3	11.95	90.03	CH
39	12.34	89.64	CH
41	12.65	89.33	CH
42.8	11.88	90.10	CH
44	13.19	88.79	TWG
46	13.13	88.85	CH
48	12.07	89.91	CH
50	12.86	89.12	CH
51	12.21	89.77	CH
52.5	12.86	89.12	CH
54	11.81	90.17	CH
56	12.86	89.12	CH
59	12.91	89.07	CH
62.5	12.82	89.16	CH
64.5	11.49	90.49	CH
65.5	12.66	89.32	CH
67	12.40	89.58	CH
68.8	11.65	90.33	CH
70.4	12.05	89.93	CH
72.7	11.31	90.67	CH
73.5	10.95	91.03	CH
74.3	11.58	90.40	CH
75.7	11.39	90.59	REW
78	10.78	91.20	RB
80	10.38	91.60	BKF - estimated
81	10.12	91.86	RB
86	9.22	92.76	RB
92	7.97	94.01	RB
98	7.09	94.89	RB
108	5.98	96.00	RB
114.2	5.83	96.15	RPB
114.2	5.17	96.81	RPT

Palmer Creek - XS7+22 - Pool - Surveyed 8/1/06

Dist	FS	Elev	Notes
1	6.42	95.56	LPT
1	7.18	94.80	LPB
5	7.29	94.69	LB
12	7.41	94.57	LB
19	8.20	93.78	LB
26	9.16	92.82	LB
32	9.55	92.43	LB
38	10.34	91.64	LB
44	11.38	90.60	LB
49	12.56	89.42	BKF - estimated
52	12.82	89.16	LB
54	12.92	89.06	LB
55.3	13.41	88.57	LB
57.2	13.65	88.33	LEW
59	13.79	88.19	CH
61	13.73	88.25	CH
63	13.85	88.13	CH
66	14.34	87.64	CH
69	14.58	87.40	CH
72	14.96	87.02	CH
75	15.62	86.36	CH
77	16.05	85.93	CH
79.7	16.66	85.32	CH
82	17.16	84.82	TWG (under log)
84	16.83	85.15	CH (under log)
87	15.68	86.30	CH (under log)
89	13.62	88.36	REW (under log)
89	11.26	90.72	Top of log
92.3	11.32	90.66	log jam
95	8.24	93.74	TRB
97	7.90	94.08	RB
101	9.11	92.87	RPB
101	8.67	93.31	RPT

Palmer Creek Pebble Counts 8-18-06

Size Class (mm)	XS1+46 Bankfull Channel	XS3+61 Bankfull Channel	XS5+21 Bankfull Channel
0 - 0.062	0	0	2
0.062 - 0.125	0	0	0
0.125 - 0.25	0	0	0
0.25 - 0.50	0	1	0
0.50 - 1.0	0	2	0
1.0 - 2.0	1	4	1
2.0 - 4.0	0	6	3
4.0 - 5.7	0	8	0
5.7 - 8.0	2	2	0
8.0 - 11.3	0	6	10
11.3 - 16.0	0	8	5
16.0 - 22.6	5	16	9
22.6 - 32.0	2	12	19
32 - 45	7	5	17
45 - 64	9	15	11
64 - 90	16	9	4
90 - 128	14	3	10
128 - 180	14	1	7
180 - 256	12	1	2
256 - 362	7	1	0
362 - 512	2	0	0
512 - 1024	1	0	0
1024 - 2048	0	0	0
2048 -	0	0	0

Palmer Creek Longitudinal Profile - Surveyed 8-1-06

Distance	Channel	Water Surface	Top of Left Bank	Top of Right Bank	Left Pin	Notes
-115	102.39	103.64				At JD's ford upstream of trailer
-94	100.81	102.21				Riffle
-70	100.26	101.56				Riffle
-43	99.37	100.28	101.13			Riffle/bank at BKF?
-13	98.34	99.27				End steep riffle
0	97.81	99.08				Start run, start diversion, end of island
24	97.38	98.98				Run (by logs on LB)
61	97.18	98.77				Start steep riffle
86	96.67	97.59				Just ds of Channel 2 outlet
100	95.78	96.85		100.00		Steep riffle/Top of 1+00 stake (BM)
131	92.96	94.34				End steep riffle, start run (just us of lg boulder)
146	92.34	94.04			100.50	XS PC 1+46/LPT
180	92.10	93.53				Run (pocket pool against logjam on LB)
200	92.06	93.19				Start riffle, end run
220	91.80	92.60				Riffle (across from ds end of alcove on RB)
250	90.67	92.20				Start run
268	90.97	91.96				Run
275	88.75	91.90				Start pool
289	87.61	91.86				Pool
300	89.24	91.86				Start glide
308	90.56	91.89				Glide
334	90.56	91.72				Glide
361	90.34	91.70			95.65	XS PC 3+61/LPT
370	90.28	91.59				Glide (top of island)
378	90.52					Start low gradient riffle, end glide
390	90.28	91.54				Low gradient riffle, us end of side ch outlet
400	90.43	91.49		93.91		Riffle/top of 4+00 stake
431	90.29	91.38				Riffle, end of island
456	90.21	91.29				Riffle
485	89.89	91.22				Riffle (clay exposed 485 to 500)
500	90.17	91.07		93.53		Riffle/top of 5+00 stake
521	89.70	90.97			96.74	XS PC 5+21 / LPT
542	89.74	91.07				Start run, top of logjam
566	88.59	90.88				Start pool, middle of logjam
605	88.88	90.86				Start glide, end pool
628	89.44	90.79				Start riffle
647	88.79	90.63			95.86	XS PC 6+47 / LPT
668	88.32	90.05				Steep riffle
691	88.10	89.46				Steep riffle
700	87.08	88.82				End riffle, start run
715	86.17	88.42				Start pool
722	84.82	88.33			95.56	XS PC 7+22 / LPT
727	86.31	88.30				End pool, start glide
737	87.01	88.23				Glide
748	87.26	88.18				Start riffle
788	85.89	87.03				Riffle
818	84.61	86.42				Riffle (at LB rock structure)
839	83.81	85.20				Riffle (top of steep part at end)
848	83.59	84.73				Riffle (top of final ledge)
856	80.81	83.33				Confluence with Res Creek (pool)

APPENDIX B: PHOTO POINTS

The following photo points, established in 2005 and 2006, have been monitored. Photo point locations are shown in **figure B1**. **Figure B2** shows the most recent image taken from each of these photo points.

Photo Point Location Descriptions:

2. From high terrace E of Res Pass Trail, 6ft from edge of high eroding bank, view d/s at new Palmer Cr confluence.
3. From tailings pile 20ft W of Res Pass Trail, 2190ft u/s of Paystreke Bridge, at lower end of Meander 3 (3a, 3b, 3c, 3pan).
4. From tailings pile 20ft W of Res Pass Trail, 2040ft u/s of Paystreke Bridge, 150ft d/s of PP3, at Meander 2-3 (4a, 4b, 4pan).
5. From tailings pile 24ft W of Res Pass Trail, 1710ft u/s of Paystreke Bridge, 330ft d/s of PP4, at Meander 2 (5a, 5b, 5pan).
6. From tailings pile 20ft W of Res Pass Trail, 1440ft u/s of Paystreke Bridge, 270ft d/s of PP5, at Meander 1-2 (6a, 6b, 6c, 6pan).
7. From high bank 25ft E of Res Pass Trail, straight across from twin cabins, 840ft u/s of Paystreke Bridge, view upstream.
8. From east side of valley, at apex of clearing below small hollow along old Palmer Cr, 2610 ft u/s of USFS boundary (8a, 8b).
9. From steep hillslope 30ft east of east-side road, 2070 ft u/s of USFS boundary, 200ft d/s of old Palmer Cr confluence, view u/s.
10. From lower hillside 1800ft u/s of USFS boundary, 270ft d/s of PP9, Meander 4, btw upper and lower roads, view u/s (10a, 10b).
11. From S end of Paystreke property, S of twin cabins, view u/s (11, 11pan).
12. From lower hillside, 600ft u/s of staging area, 15ft E of lower road, at SRD3144 BM, Meander 2-3 (12a, 12b, 12pan).
14. From lower hillside between upper and lower roads, just downhill from SRD 3142 BM, 90ft upstream of connector rd, on 1.5ft-diam stump, Meander 3-4, view W (14a, 14b).
15. From flat surface on upstream side of large pointy boulder at Meander 2 (15a-d/s, 15b-u/s, 15a-pan, 15b-pan).
16. From hillside just west of Res Pass Trail, 600ft u/s of PP3, through gap in trees at Meander 3-4, at SRD3137 BM, view E.
17. From cut bank on left bank of Meander 4 (17a-d/s, 17b-u/s).
18. From east-side road, 3ft E of road, 50ft d/s of old JD Hahn mining road, view d/s through gap in trees at Meander 4.
19. From bench just below Res Pass Trail, near side ch entrance of Meander 2, view u/s.
20. From tailings pile W of Res Pass Trail, view d/s over d/s half of Meander 2.
21. From high terrace just E of Res Pass Trail, at apex of Meander 3, view u/s through large gap in Cottonwoods.
22. From tailings pile W of Res Pass Trail, under Cottonwood grove, view straight across valley out over lower Meander 3 (22, 22pan to left).

23. From low fldpln on E side of Res Cr, 3ft from active channel, across from lg boulder in river, view d/s into Meander 5 through meander cutoff.
24. From log jam on right bank of M5, on point of land between side channel entrance and main channel, at base of birch tree (24a, 24b, 24pan).
25. From point bar on right bank at d/s end of Meander 5, on boulder just right of first tree on point bar, by cross vein structure (25a, 25b, 25pan).
26. From hillside/tailings pile 30ft East of Res Pass Trail at edge of cleared area, 30ft upvalley from edge of trees, view across river and d/s.
27. At 38+50, left bank, looking up steep lower Meander 5 riffle (27, 27pan).
29. On Left bank terrace across from 6:00 channel, 15-20 feet above water, looking across (29a, 29b, 29c, 29pan)
30. On left bank terrace across from entrance to 6:00 channel, on small bench, looking across (30a, 30b, 30c, 30pan)
31. From just west of JD's trailer, looking west down Palmer Creek overflow, summit of mountain at upper right corner.
33. From east side of JD's road, 150 ft downstream from JD's camp, looking WNW, in sm clearing of trees, 20ft east of road.
36. Right bank, at meander 5, near top of upper riffle, by furthest downstream spruce tree, looking NW.
38. Just downstream of PP37 on another knob on left bank, looking downstream.
40. On downstream end of 6:00 island, looking upstream.
41. From edge of logjam above meander 3 looking up meander 4 east side channel.
42. At RPT XS15+38 looking downstream toward Meander 2 (42, 42pan),
43. Looking upstream from end of Meander 3 East Side Channel, from upstream end of Meander 2 logjam.
44. Meander 3 East Side Channel – looking downstream from logjam at top of Meander 3.
45. Right bank meander 5, 50ft upstream of Meander 5 logjam, looking downstream toward steep riffle.
46. Left bank at Meander 5, at 40+20, 15ft from bkf bank, looking downstream at Lower Meander 5 riffle.
49. From right hillslope overlooking Palmer Creek, from where old upper road joined lower road (49a, 49b, 49pan).
50. From logjam at Palmer Creek outlet on right bank, looking upstream.
51. From left bank of Palmer Creek just downstream of pond looking upstream at steep section.
52. From right bank of Channel 1at steep section – looking upstream and downstream (52pan).
53. Along right side of Channel 1 at 2+30, about 30 feet up hill from bank, on uphill side of dead spruce, looking down channel 1.
54. From right pin of Channel 1 cross section 5+55, looking downstream.
55. From left bank of Res Cr, across from Palmer Creek confluence, by M4 West side channel inlet, looking across.

Figure B1: Resurrection Creek photo point locations.

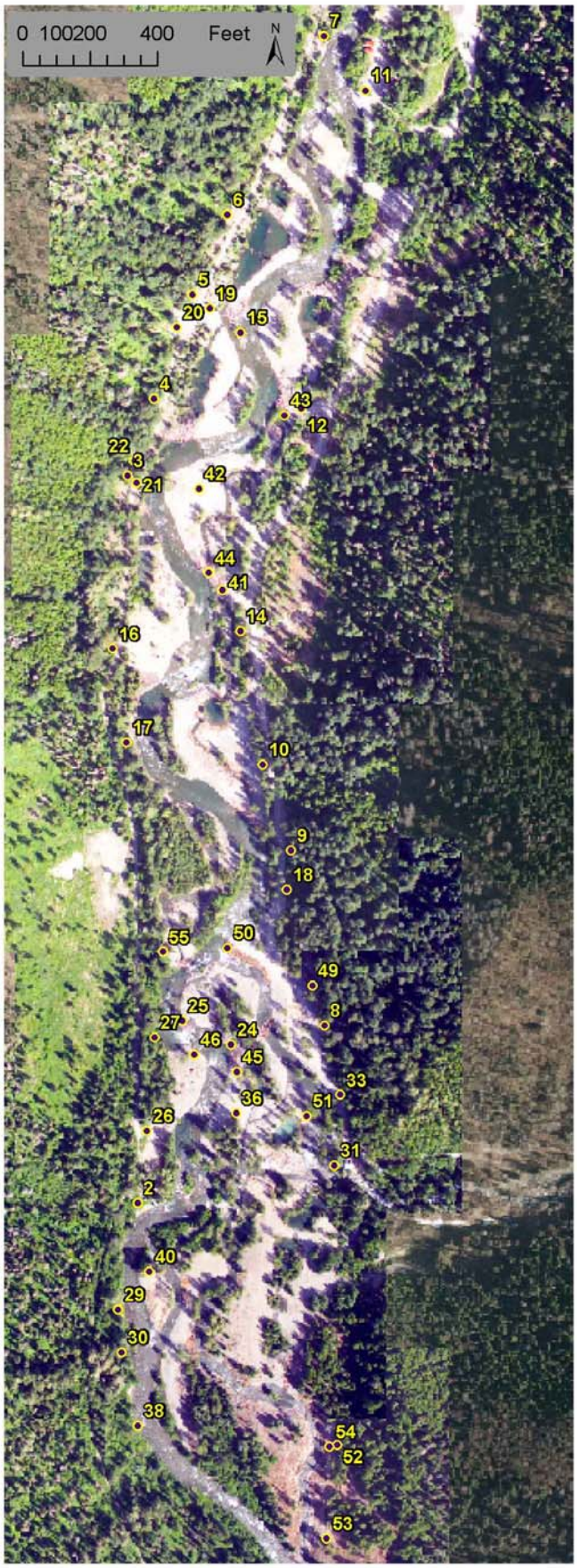


Figure B2: Photo point reference photos for the Resurrection Creek project reach.

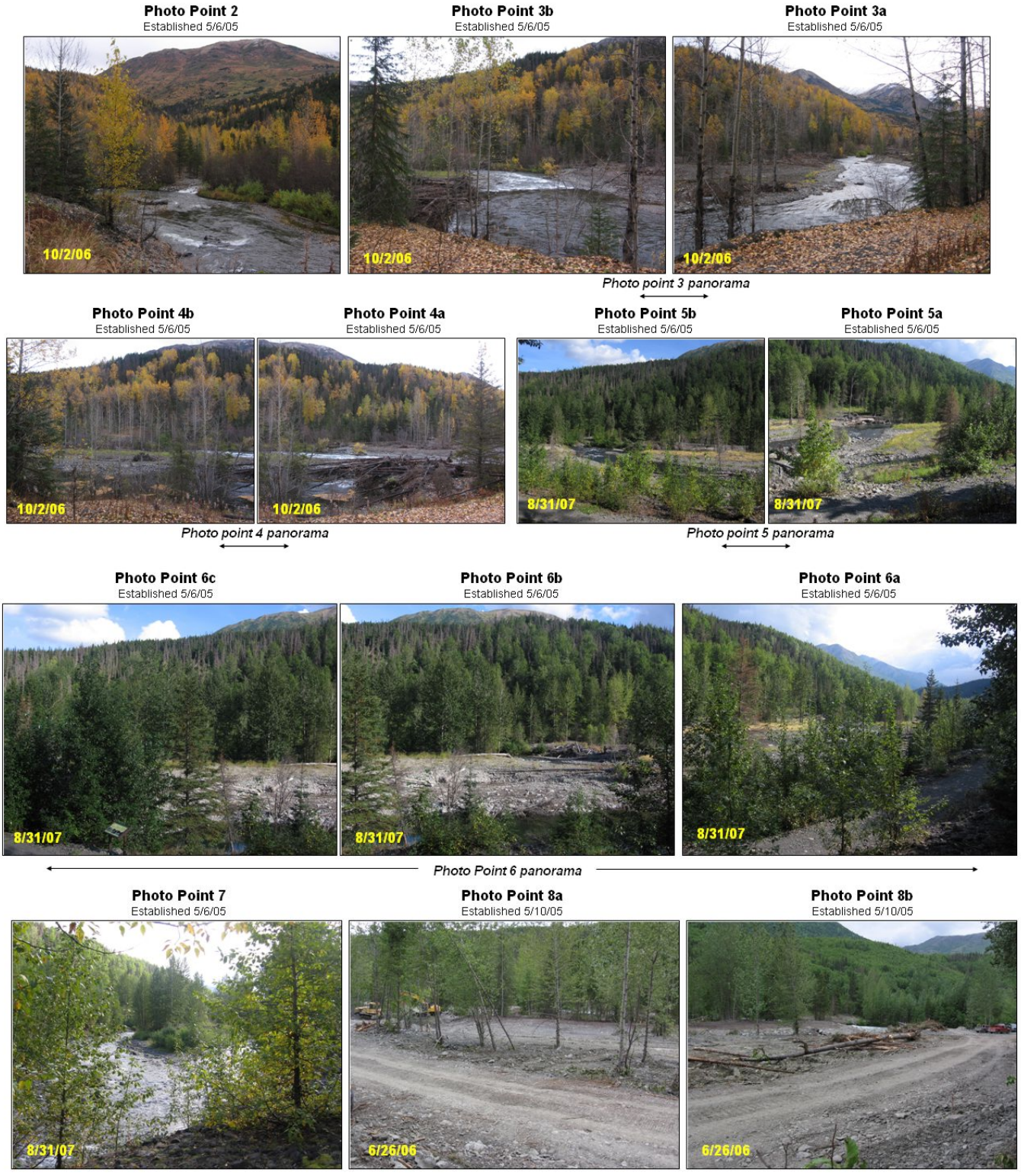


Photo Point 9
Established 5/10/05

Photo Point 10a
Established 5/10/05

Photo Point 10b
Established 5/10/05

Photo Point 11
Established 5/10/05

Also do Panorama for 11

Photo Point 12a
Established 5/19/05

Photo Point 12b
Established 5/19/05

Photo point 12 panorama

Photo Point 14a
Established 5/25/05

Photo Point 14b
Established 5/25/05

Photo Point 15a
Established 5/31/05

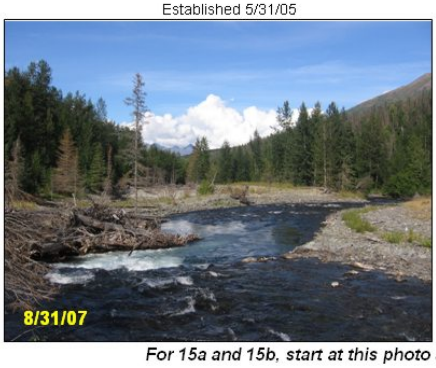


Photo Point 15b
Established 5/31/05

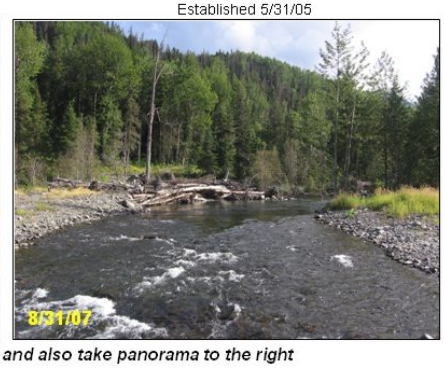


Photo Point 16
Established 6/6/05

For 15a and 15b, start at this photo and also take panorama to the right

Photo Point 17a
Established 6/7/05

Photo Point 17b
Established 6/7/05

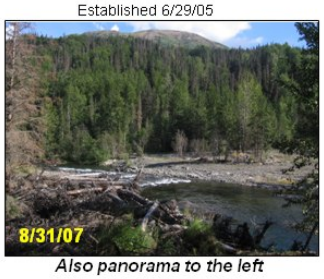
Photo Point 18
Established 6/8/05

Photo Point 19
Established 6/16/05

Photo Point 20
Established 6/21/05

Photo Point 21
Established 6/21/05

Photo Point 22
Established 6/29/05



Also panorama to the left

Photo Point 24a
Established 7/5/05

Photo Point 24b
Established 7/5/05

Photo Point 26
Established 7/11/05

← *Photo point 24 panorama* →

Photo Point 25a
Established 7/9/05

Photo Point 25b
Established 7/9/05

Photo Point 27
Established 5/12/06

Also do 3-shot panorama to expand view on either side

← *Photo point 25 panorama* →

Photo Point 29a
Established 5/12/06

Photo Point 29b
Established 5/12/06

Photo Point 29c
Established 5/12/06

These fit together as a 3-shot panorama

Photo Point 30a
Established 5/12/06

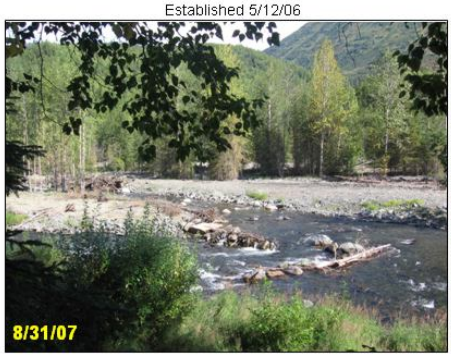


Photo Point 30b
Established 5/12/06

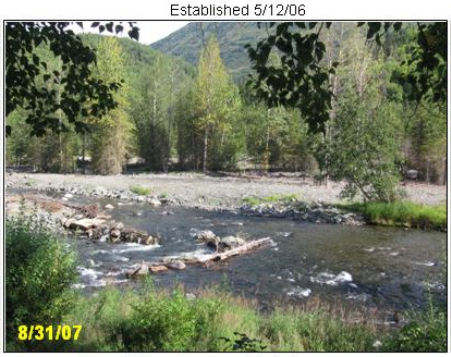


Photo Point 30c
Established 5/12/06

These fit together as a 3-shot panorama

Photo Point 31
Established 5/16/06

Photo Point 33
Established 5/16/06

Photo Point 36
Established 5/16/06

Photo Point 38
Established 5/16/06

Photo Point 40
Established 5/17/06

Photo Point 41
Established 5/22/06

Photo Point 42
Established 5/23/06

Photo Point 43
Established 5/23/06

Photo Point 44
Established 5/23/06

Also take a 3-shot panorama to the right and left

Photo Point 45
Established 5/30/06

Photo Point 46
Established 5/30/06

Photo Point 49a
Established 6/6/06

Photo Point 49b
Established 6/6/06

49a and 49b fit together as a panorama

Photo Point 50
Established 6/21/06

Photo Point 52
Established 9/22/06

Photo Point 51
Established 6/26/06

Photo Point 53
Established 9/22/06

Photo Point 54
Established 9/22/06

Photo Point 55
Established 11/22/06