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U.S. Fish and Wildlife Service, Kenai National Wildlife Refuge

Physical, Chemical, and Biological Data for Two Sites on the Upper Kenai River, Alaska, 1998

Open-File Report 99-258

U.S. Department of the Interior
U.S. Geological Survey

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by Joseph M. Dorava and Lee Ness

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Anchorage, Alaska
1999

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATIONS

Multiply	by	To obtain
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
cubic foot per second (ft^3/s)	0.02832	cubic meter per second

Degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) by the following equation: °F = 1.8 (°C) + 32

Vertical Datum

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929—A geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Abbreviations:

Certain chemical concentrations and biological measurements are given only in metric units.

Chemical

mg/L, milligram per liter

µg/L, microgram per liter

µS/cm, microsiemen per centimeter at 25 °C

col/100 mL, fecal coliform colonies per 100 milliliters of water

Biological

m, meter

mm, millimeter

µm, micrometer

m^2, square meter

g, gram

µg/g, microgram per gram

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ABSTRACT

Water-quality data were collected and stream characteristics were documented from two sites along the upper Kenai River in the Kenai National Wildlife Refuge, Alaska. These data were collected to describe the current status of the sites and to provide baseline information from which changes in the future could be evaluated. Physical characteristics included channel geometry surveys, and measurements of channel widths and water discharge at each site. Chemical data included stream water temperature, dissolved-oxygen concentration, pH, specific conductance, E. coli and fecal coliform counts, and nutrient concentration. Data on concentrations of trace elements and various organic compounds in bed sediments and the tissue of slimy sculpin were also collected. Biological characteristics were evaluated using measurements of the bacteria, benthic macroinvertebrate, and fish communities.

INTRODUCTION

During Federal Fiscal Year 1998 (FY98) the U.S. Geological Survey (USGS) and the U.S. Fish and Wildlife Service, Kenai National Wildlife Refuge (Refuge) entered into a cooperative agreement that authorized the USGS, National Water-Quality Assessment, Cook Inlet Study Unit Team (NAWQA) to use NAWQA techniques to obtain baseline water-quality data for two sites along the upper Kenai River. The primary uses of these data are to establish the current status of the sites and to provide baseline information from which changes in the future could be evaluated. This report describes the USGS accomplishments towards the goals of this agreement and summarizes the data from the water-quality investigations at these sites.

The two sites are along the upper Kenai River in the Kenai National Wildlife Refuge, Alaska: Sportman's Landing at mile 55 on the Sterling Highway and Jim's Landing on Skilak River Road near mile 58 on the Sterling Highway (fig 1; table 1). On April 18, 1998, a reconnaissance of the two sites was made and a site investigation strategy was developed. A reach, approximately 3,300 feet long, was identified at each site. Between May 28 and June 15, 1998, the sites were revisited and data were collected to determine the physical, chemical, and biological characteristics of the two sites.

PHYSICAL CHARACTERISTICS

Collection of stream physical characteristics included field notes, sketches, and photographs; channel geometry surveys; measurements of channel width and water discharge at each site (table 1). Characterization of the physical features at each site also included quantification of the riparian and instream aquatic habitat components. These habitat components include measurements of the riparian density, mid-channel sun angles, the river's flow aspect, and the presence of any submerged components such as woody debris. These physical data were collected according to protocols described in detail by Fitzpatrick and others (1998).

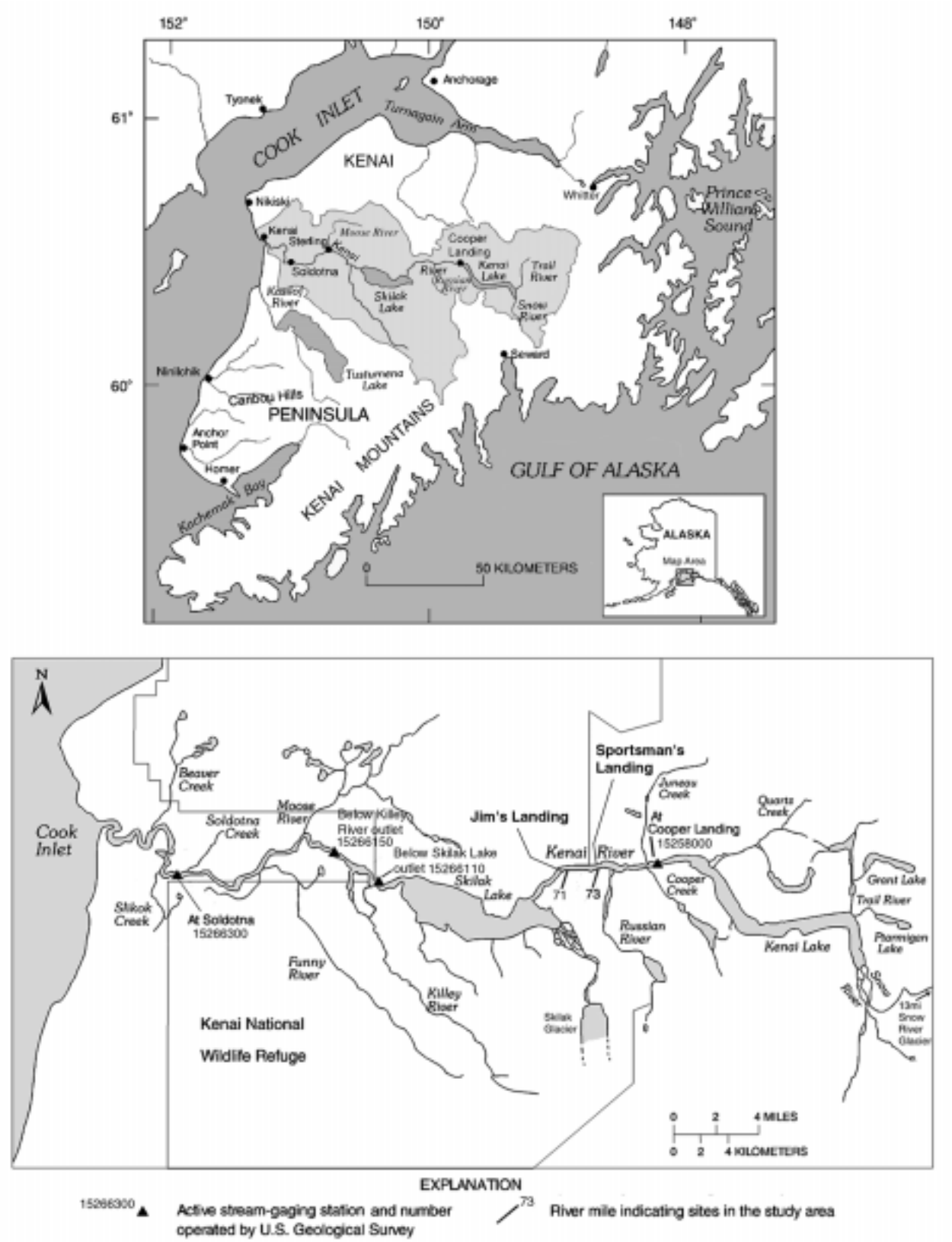


Figure 1. Kenai River, Kenai National Wildlife Refuge boundaries, and the sampling sites at Sportsman's Landing and Jim's Landing.

Table 1. Water-quality sampling sites on the Kenai River in the Kenai National Wildlife Refuge
[ft^3/s, cubic feet per second]

Site name (fig. 1)	USGS station name	USGS station No.	Kenai River location	Width[1] (feet)	Discharge[1] (ft^3/s)
Sportman's Landing	Kenai River below Russian River near Cooper Landing	15266010	Mile 73	189	2,490
Jim's Landing	Kenai River at Jim's Landing near Cooper Landing	15266020	Mile 71	203	2,510

[1]Measured on May 28, 1998

Field Notes, Sketches, and Photographs

The physical features of each site were initially documented with a set of notes and photographs taken during a site visit on May 27-29, 1998. These observations included an annotated hand sketch of each site (figs. 2, 3, and 4). The sketches depict important geomorphic features such as sloughs, riffles, and rapids that occur within the identified study reach and detailed descriptions of any permanent surveying monuments at the sites. These documents will be used for detecting future changes in instream and riparian habitat at each site.

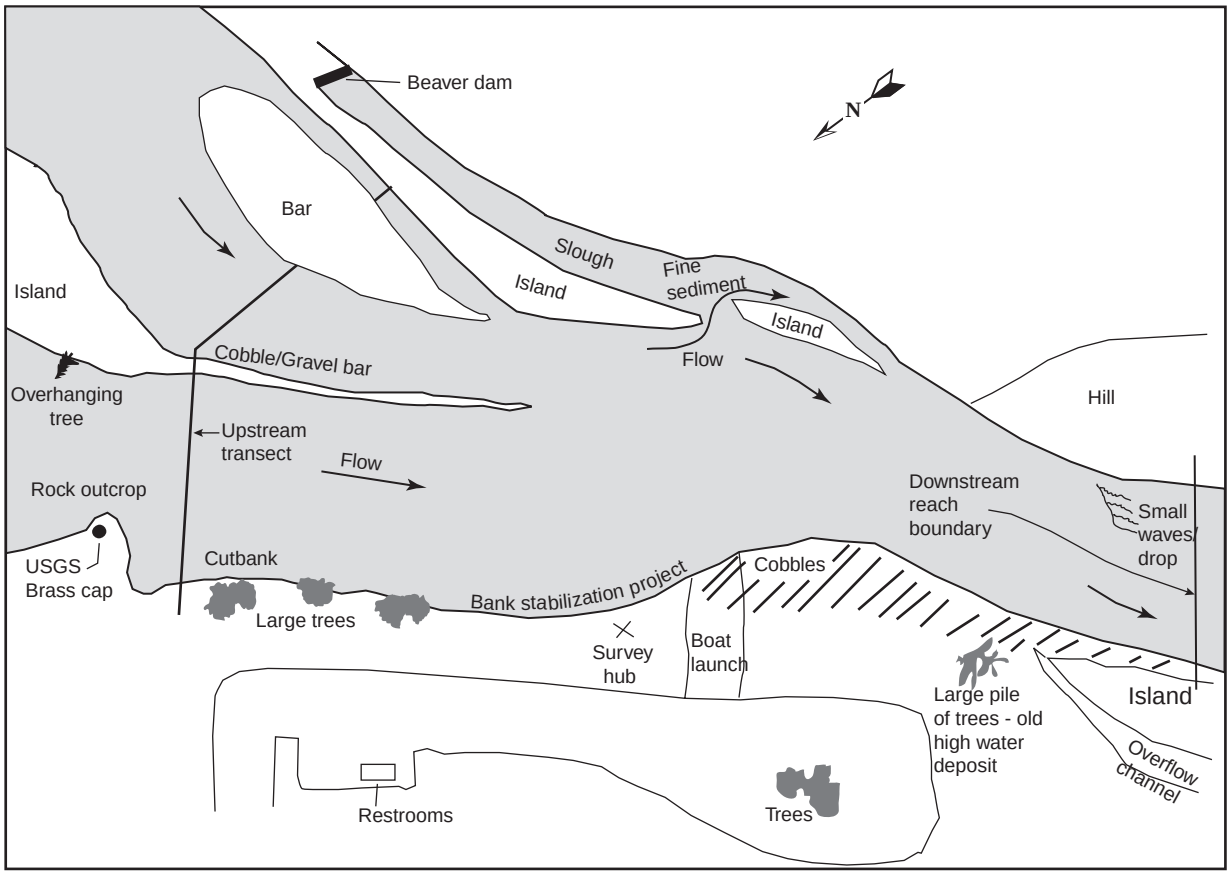


Figure 2. Sketch of major geomorphic features at Jim's Landing near river mile 71 along the Kenai River.

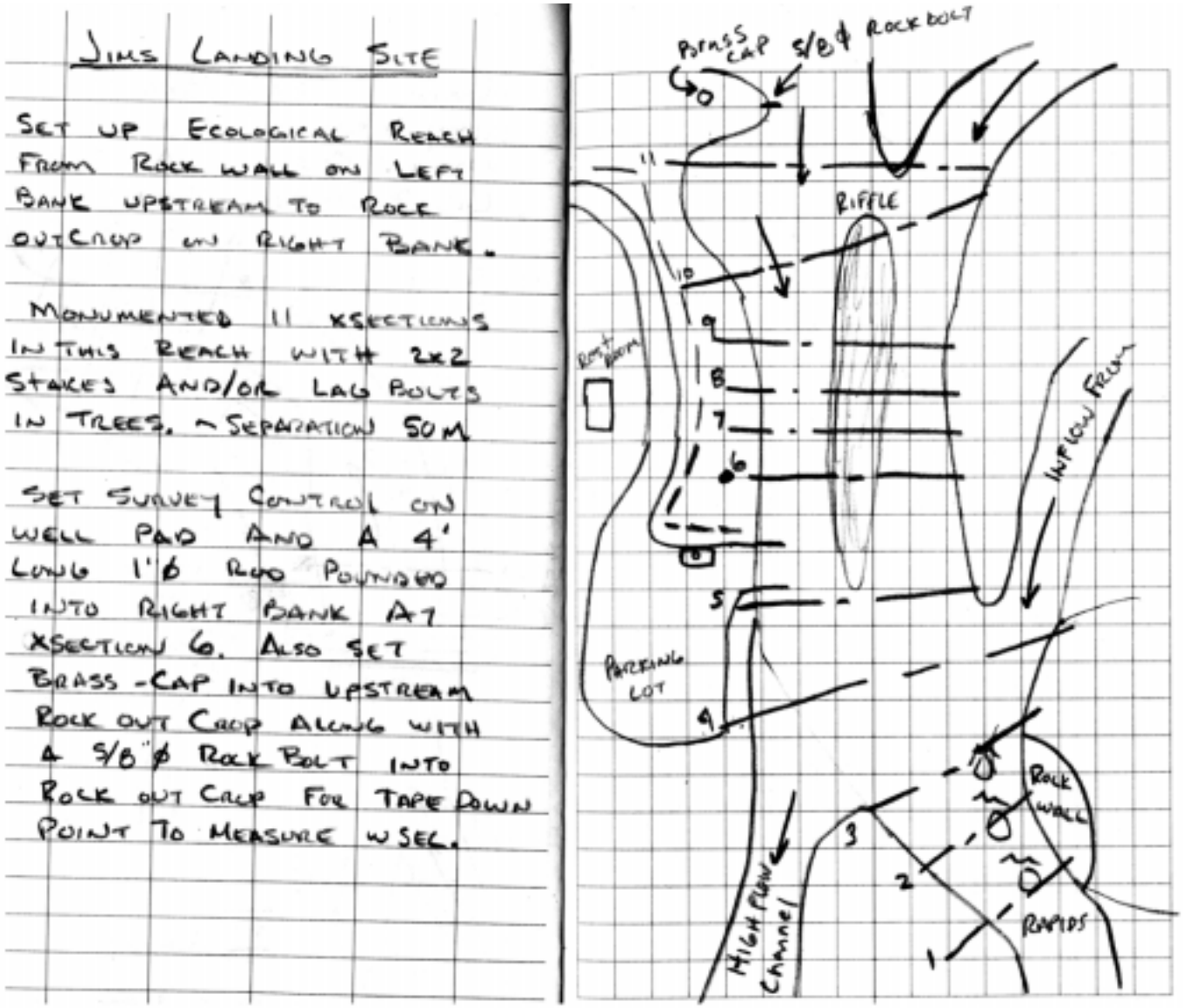


Figure 3. Selected field notes and sketches from Jim's Landing near river mile 71 along the Kenai River.

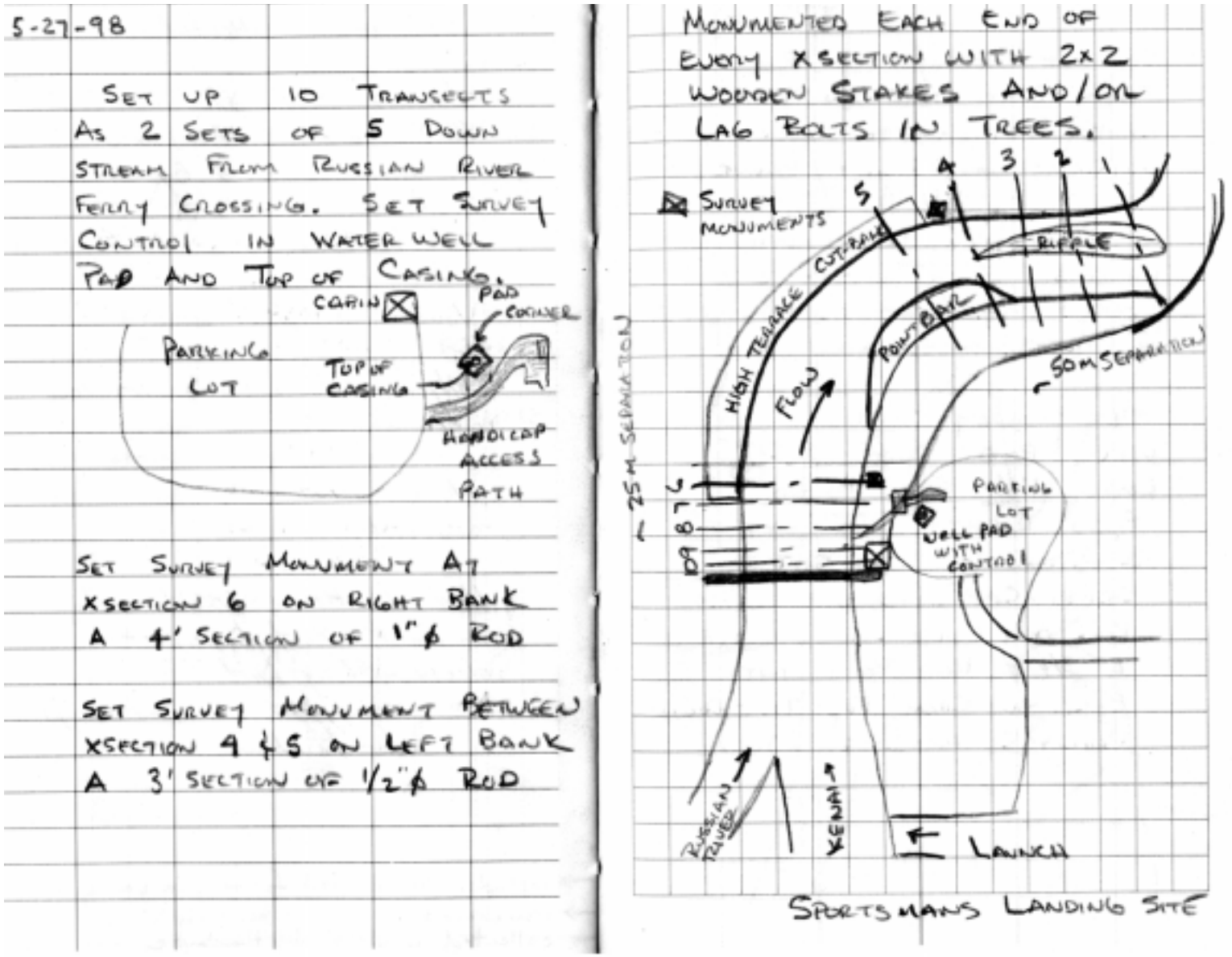
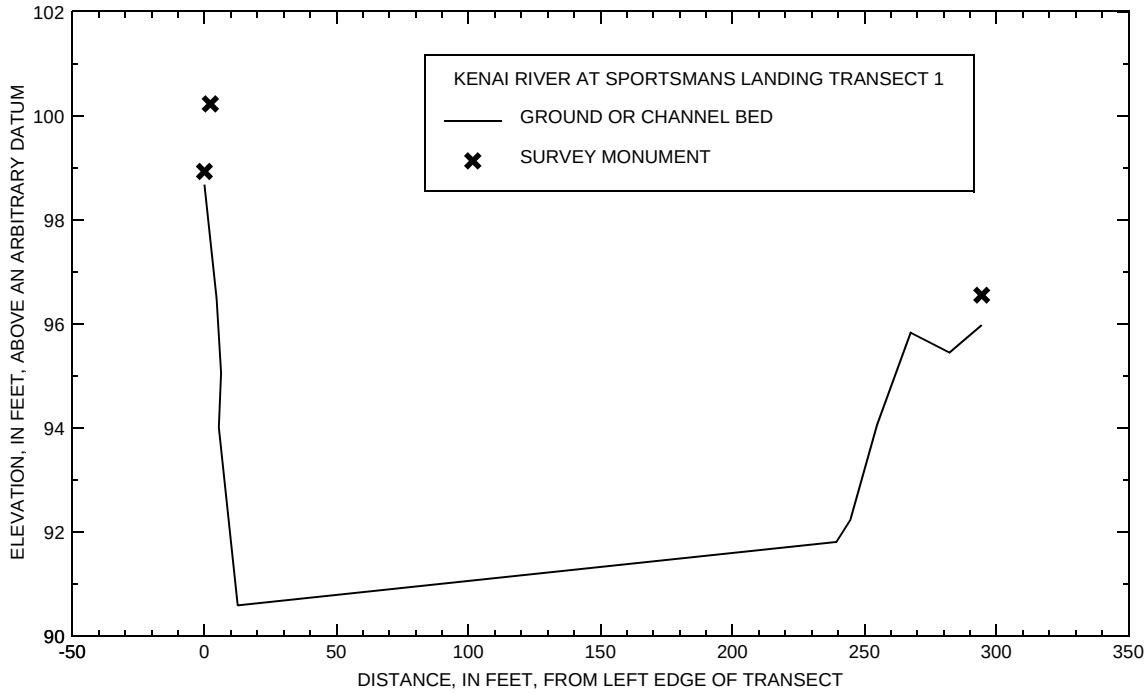


Figure 4. Sample hand sketch of major geomorphic features at Sportsman's Landing with field note descriptions of surveying monuments.

Channel Geometry Surveys

The hand sketch was followed by a more detailed survey of the stream channel geometry and riparian areas along the 3,300 foot-long reaches at the two sites. These surveys were done with a total station surveying instrument and include 10 river transects at Sportsman's Landing (fig. 5) and 11 river transects at Jim's Landing (fig. 6; the survey of transect 10 at Jim's Landing was not completed and is not shown on figure 6.) A primary surveying instrument site for each reach was permanently monumented with a round metal bar driven into the ground below the depth of freezing. The location of this primary point was also carefully identified with local permanent features. These local features included items such as a concrete well pad at Sportsman's Landing (fig. 4), or a standard USGS Brass Cap Surveying Monument attached to a rock outcrop at Jim's Landing (fig. 2). In addition, each transect was monumented with survey tape, wooden stakes, and nails driven into the base of trees. Only the wadeable parts of the stream channels were surveyed, such as sloughs, islands, and channel banks, which contain much of the critical instream habitat.

The detailed surveys will be useful when quantifying changes in instream and riparian habitat that take place over time at each site. The surveyed locations of land surface points along each transect at each reach are included in appendix 1. Detailed analysis of the channel geometry is beyond the scope of this study because the deeper parts of the main channel were not surveyed and because only one set of surveys of each transect was completed. Erosion at the Sportsman's Landing site includes both natural and human-induced erosion (figs. 7 and 8). High water that typically flows during the peak snowmelt and glacier-melt periods in mid-summer removes streambank material, but this process can be aggravated and accelerated by foot traffic. This type of erosion is significantly different from the protected bank near Jim's Landing (fig. 9) where fencing and restoration have produced a well-vegetated waterfront.



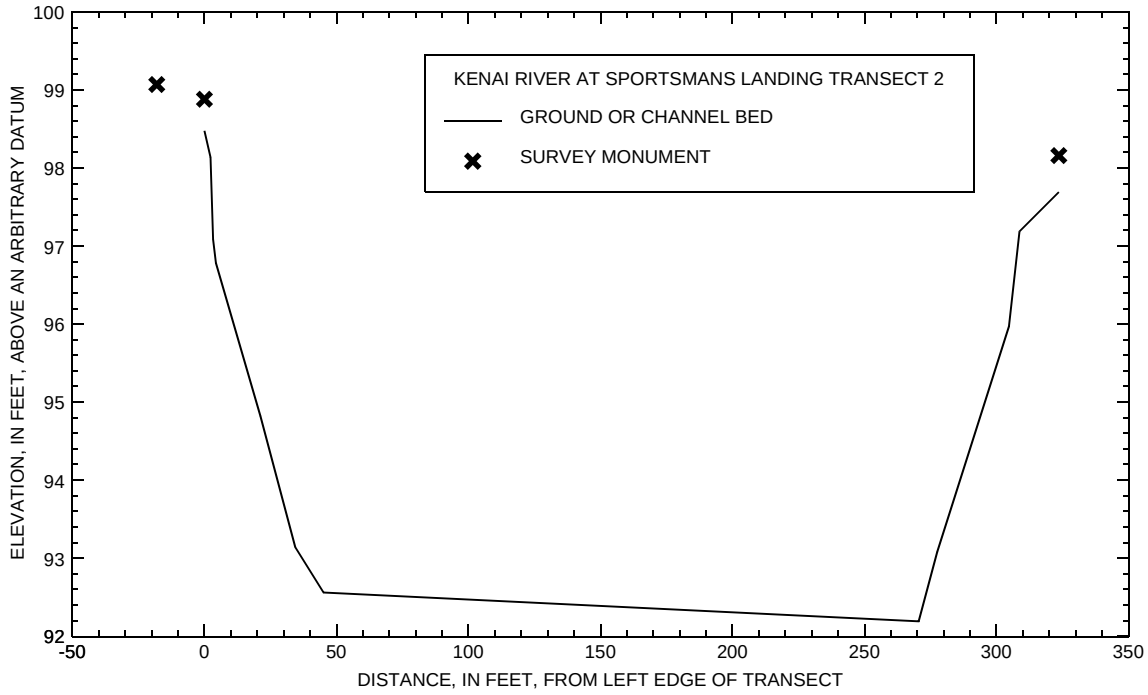
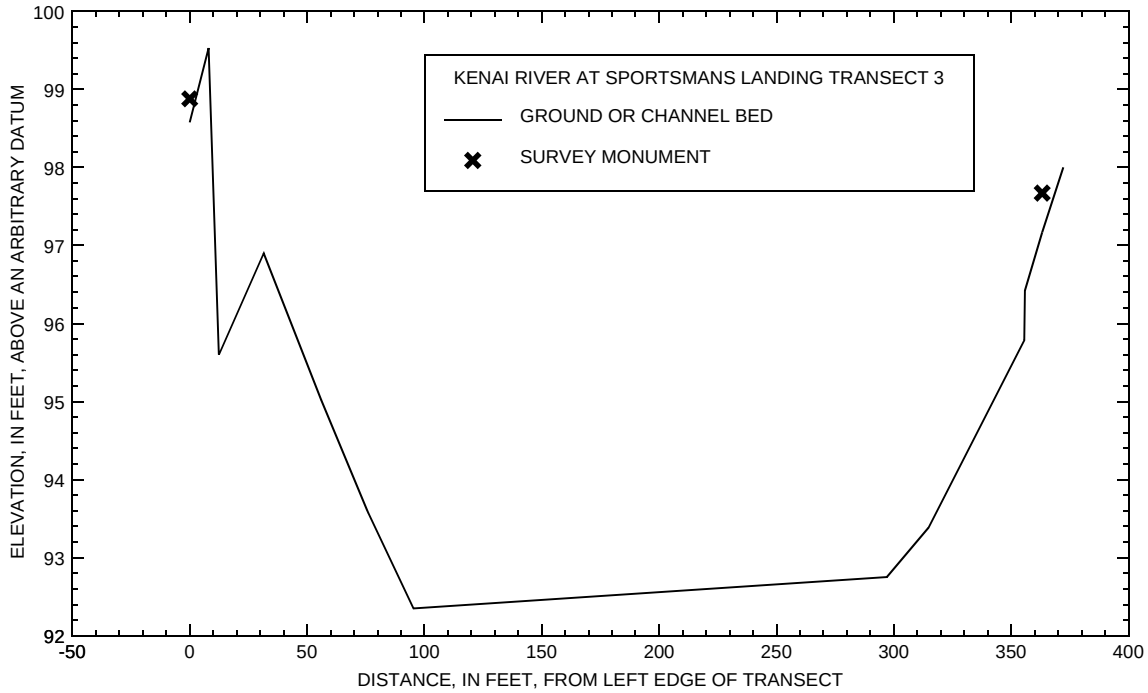
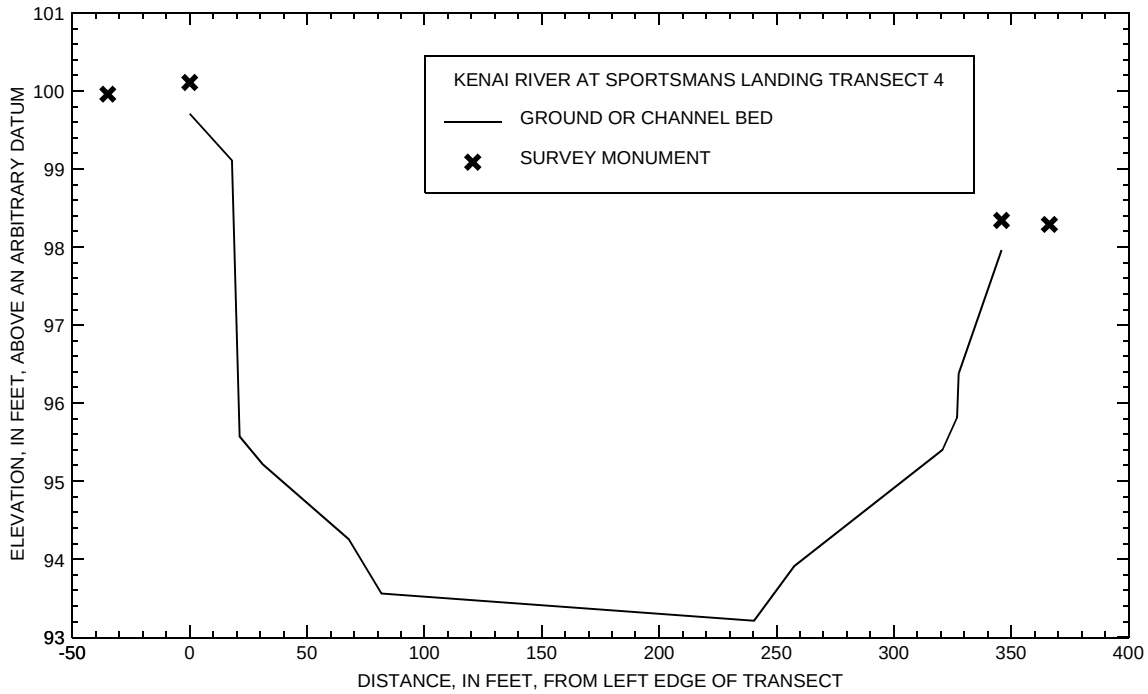


Figure 5. Elevation of land surface, channel banks, and wadeable parts of the channel along the 10 transects near Sportsman's Landing, Kenai River. (Note: horizontal and vertical scales may be different between transects.)





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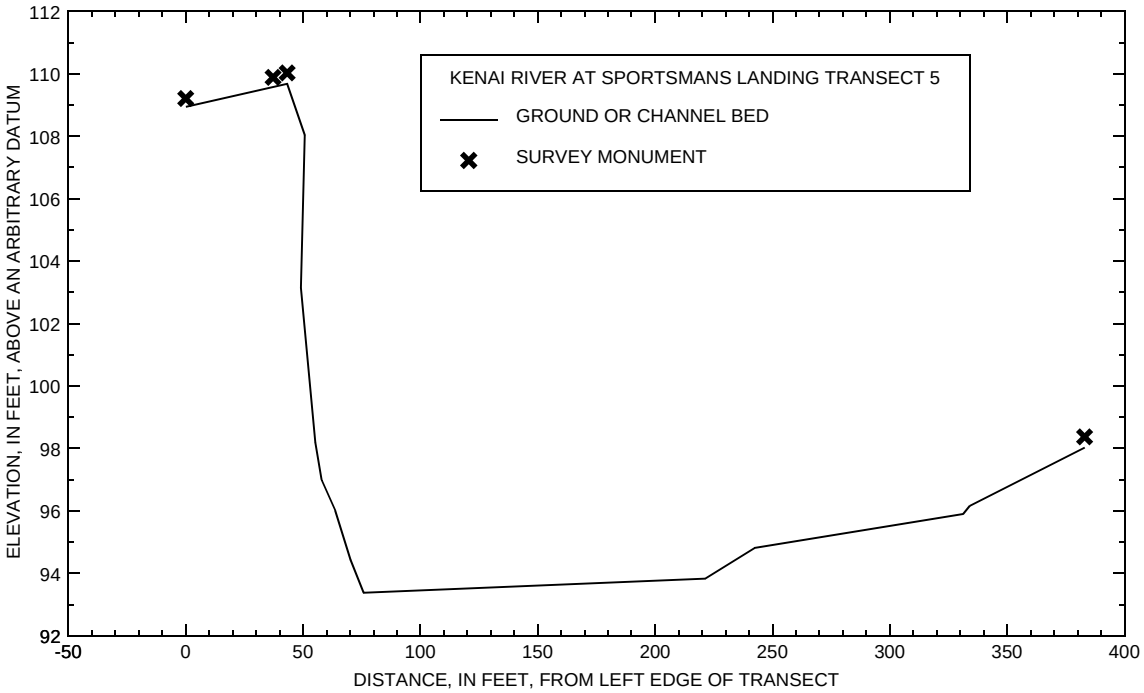

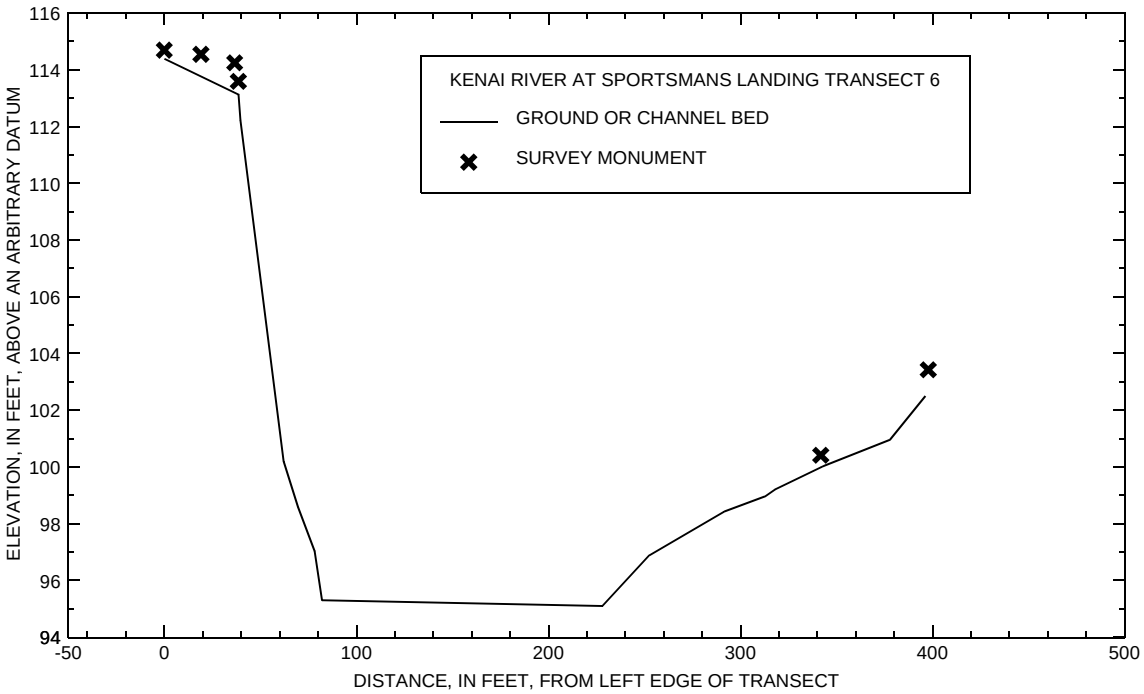

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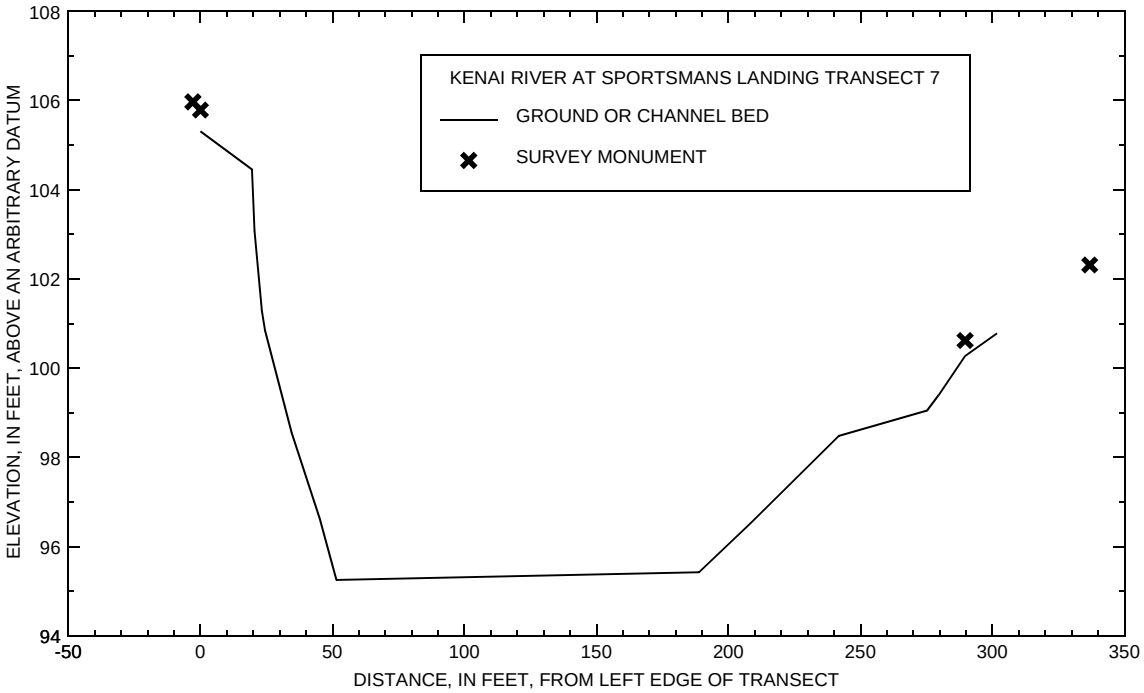

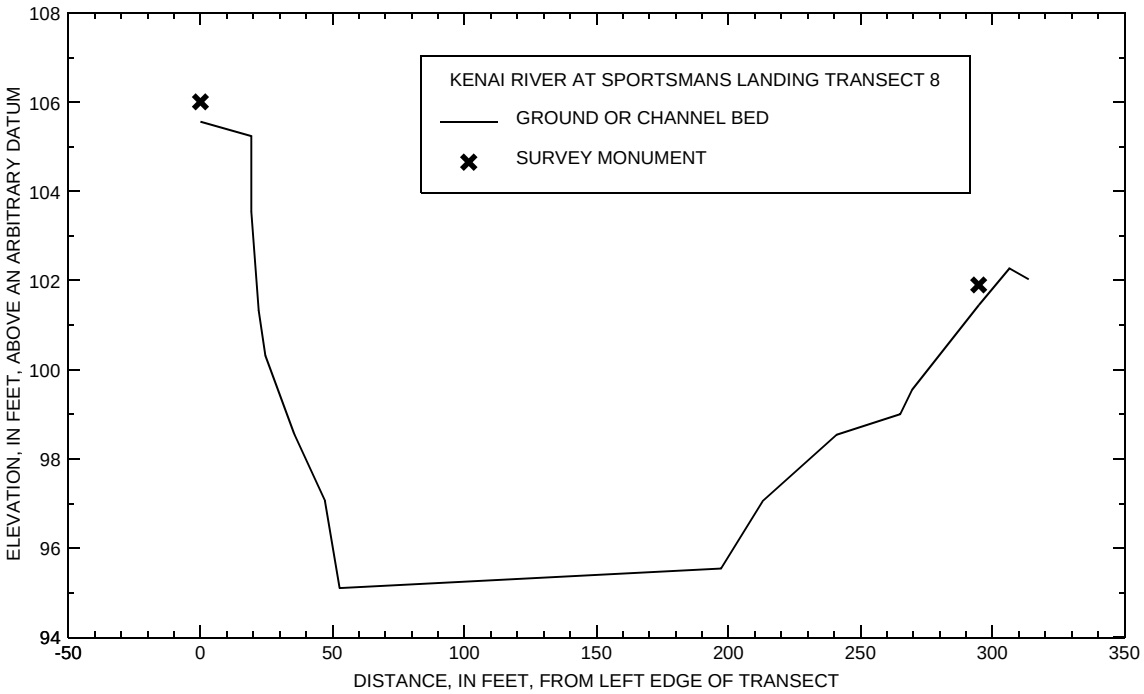

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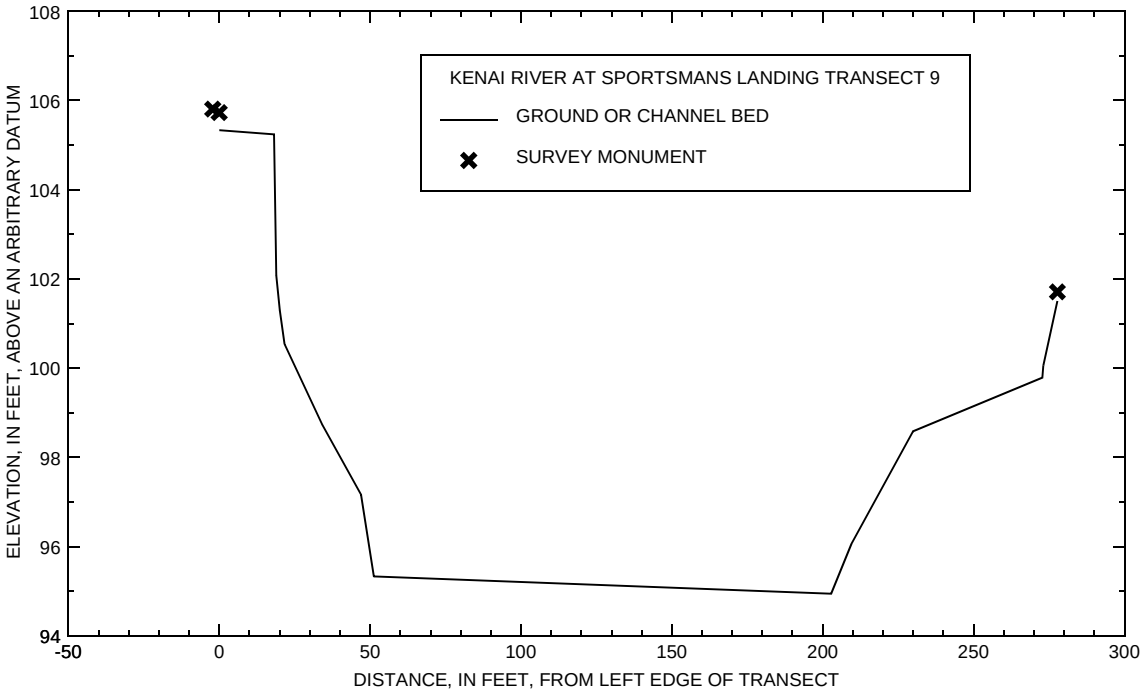

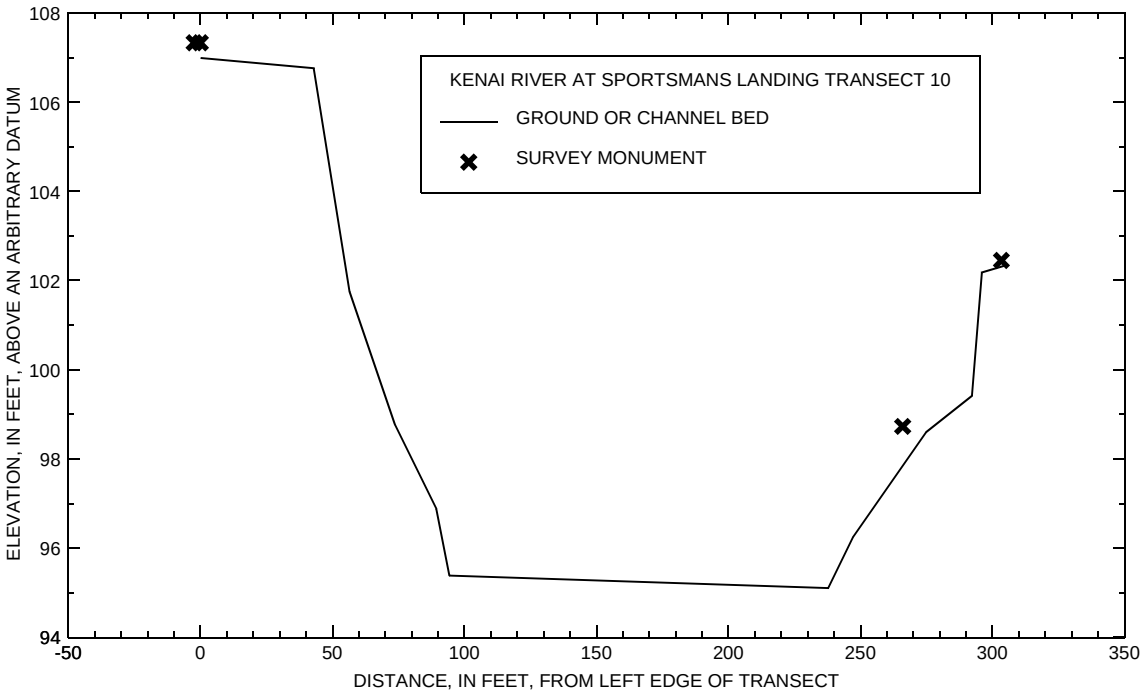

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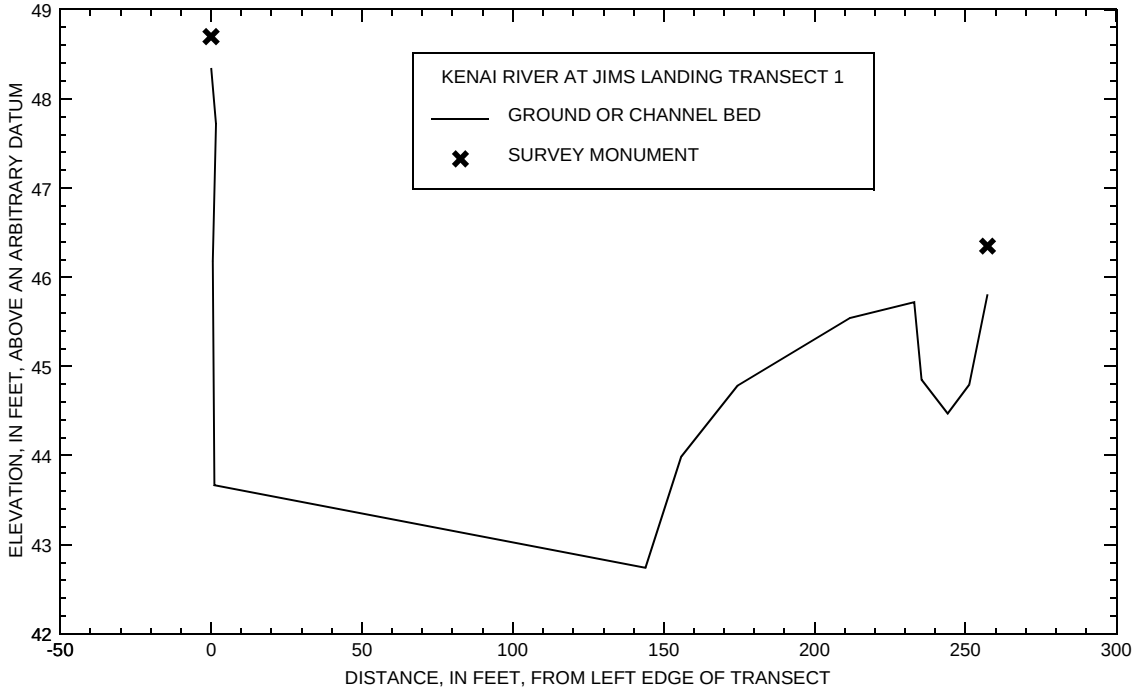


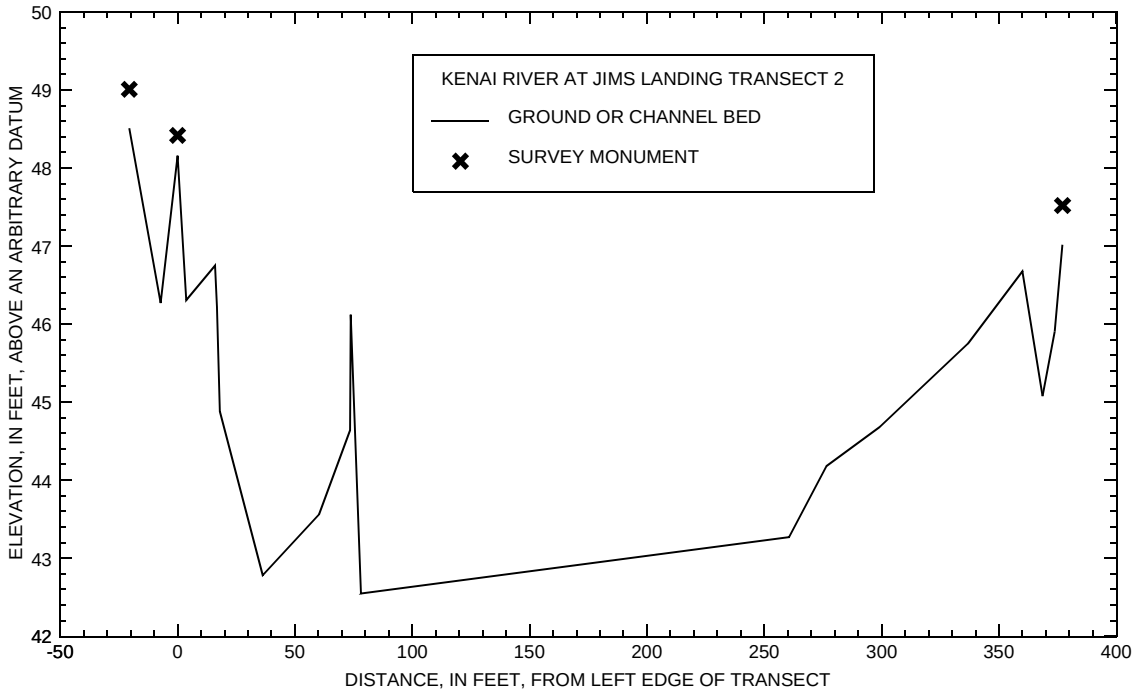
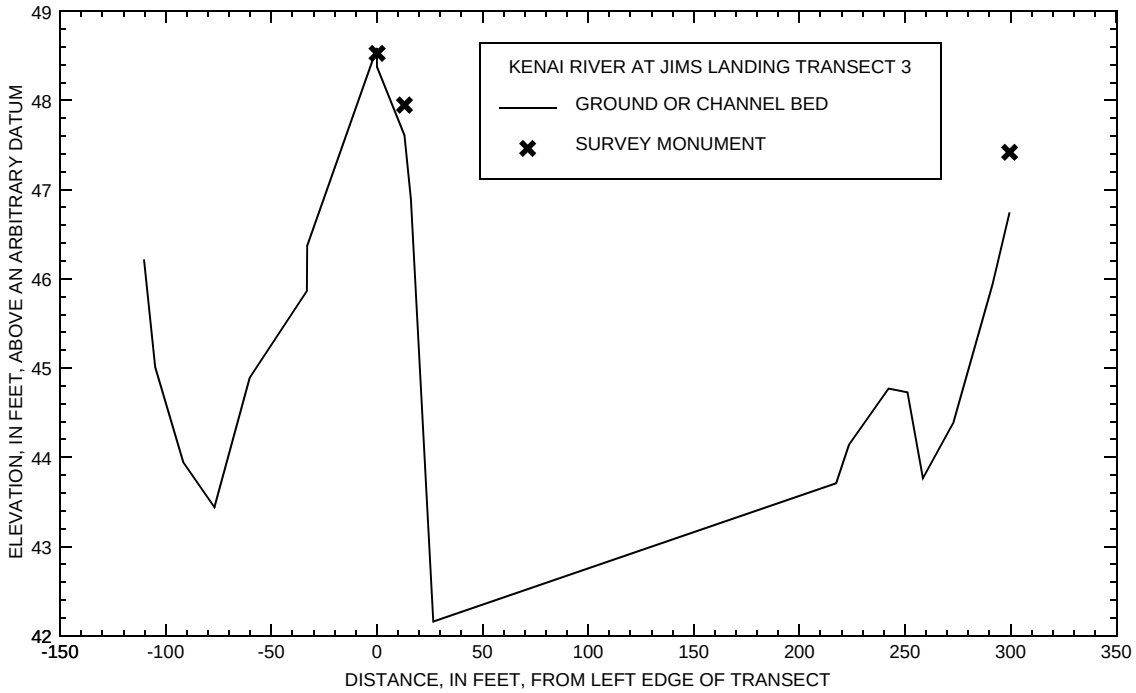
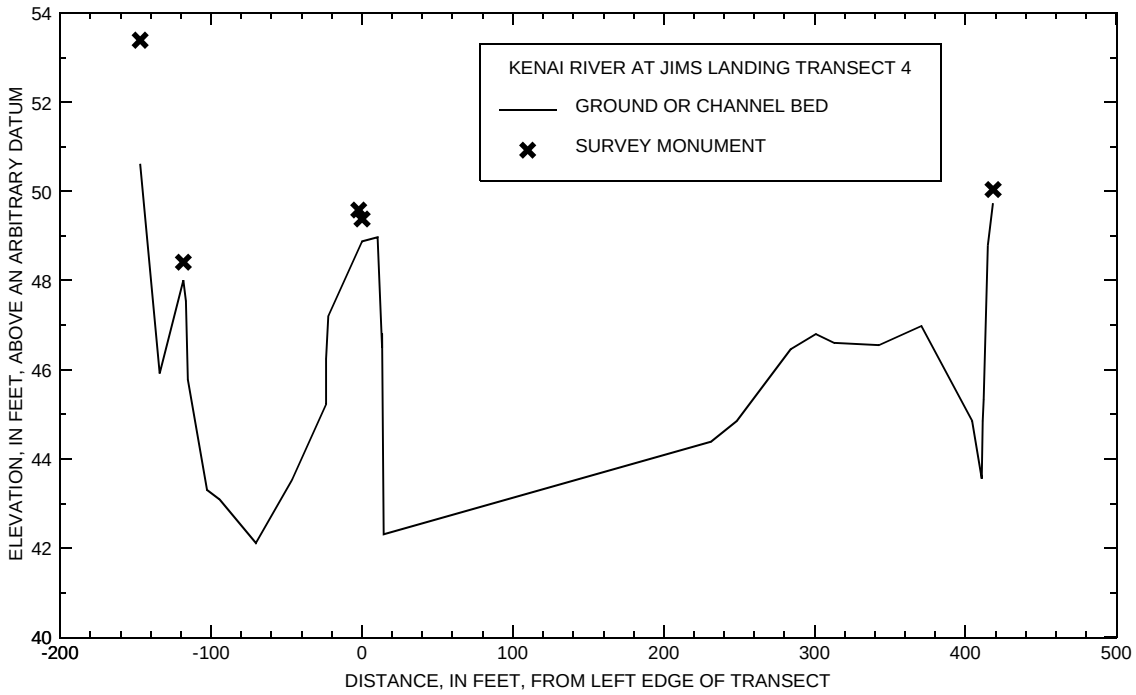


Figure 6. Elevation of land surface, channel banks, and wadeable parts of the channel along transects 1-9 and 11, near Jim's Landing, Kenai River. (Note: horizontal and vertical scales may be different between transects.)





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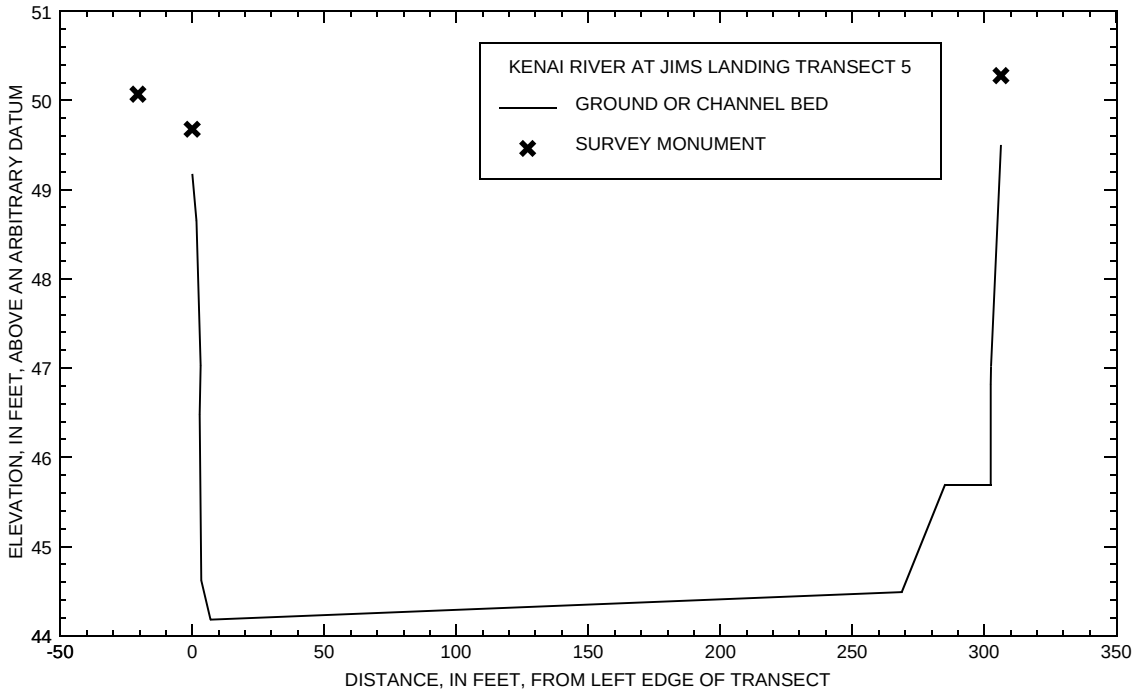

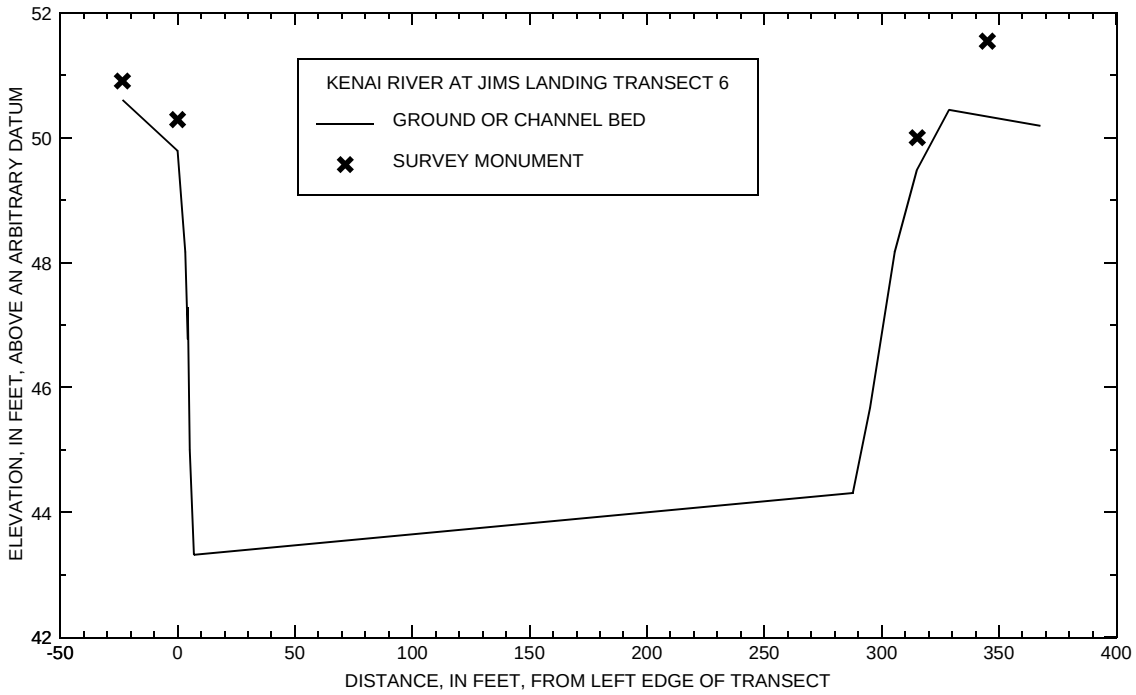

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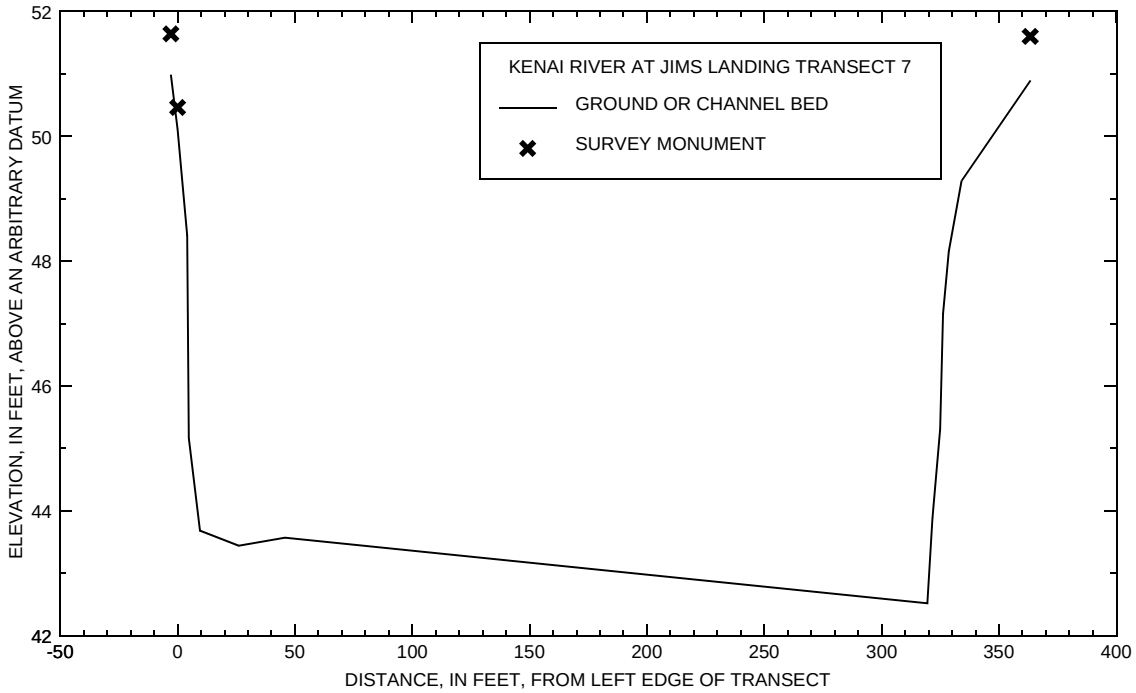

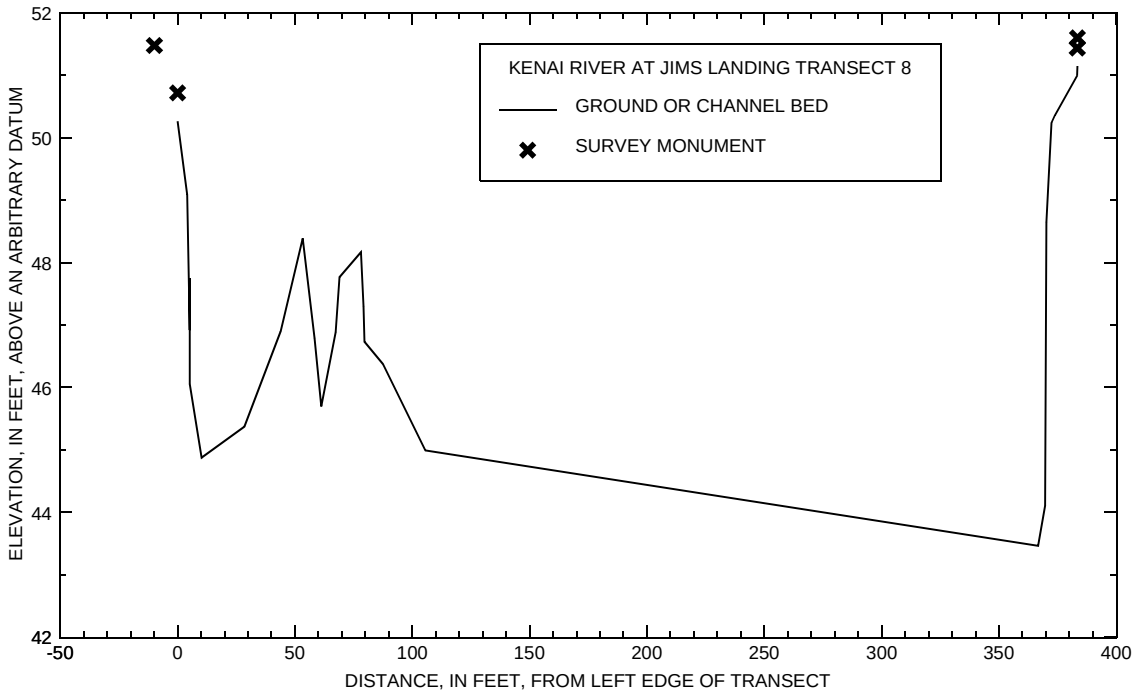

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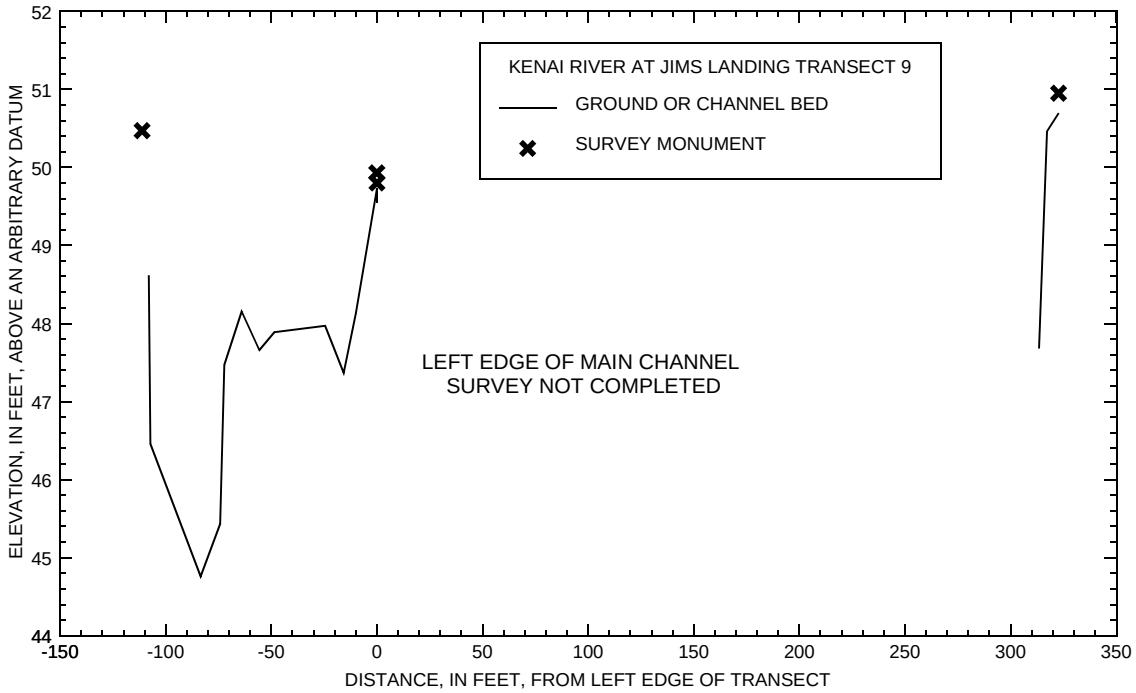

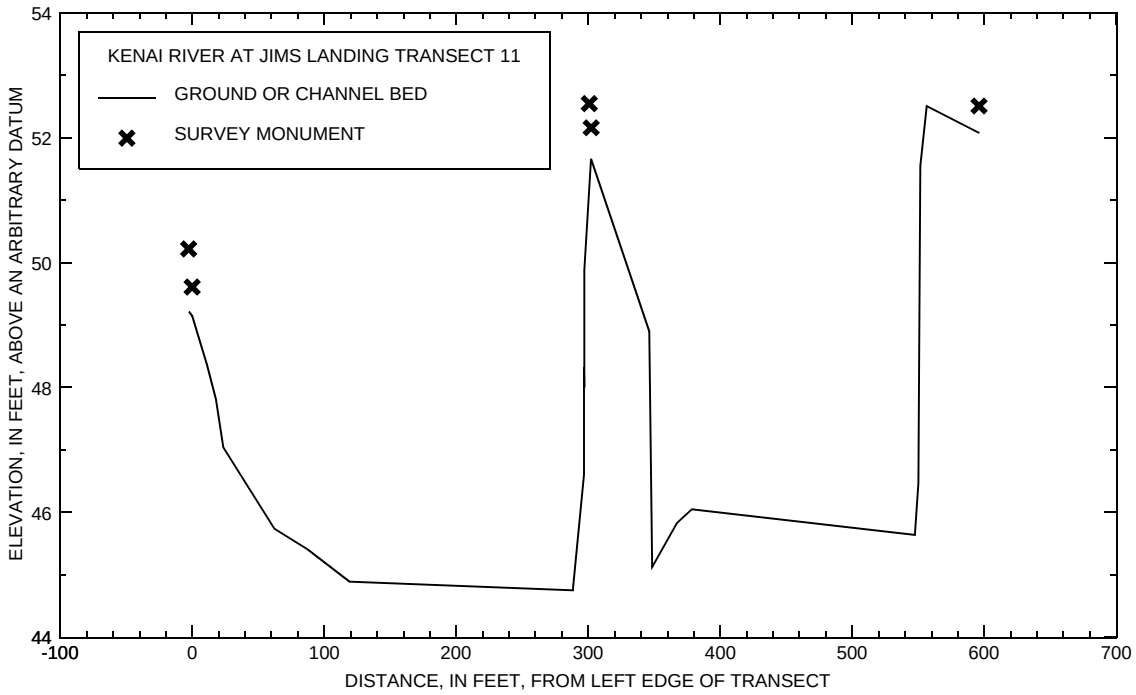

Figure 6. Continued.

Figure 7. Eroding streambank at Sportsman's Landing. Southern bank of the Kenai River near the Russian River ferry crossing. View is upstream looking to the east.

Figure 8. Eroding streambank at Sportsman's Landing. Southern bank of the Kenai River near the Russian River ferry crossing. View is downstream looking to the west.

Figure 9. Vegetated streambank at Jim's Landing on the north bank of Kenai River. View is looking downstream to the west.

CHEMICAL METHODS AND RESULTS

All samples for chemical analyses at the two sites were collected according to published protocols (Crawford and Luoma,1993; Shelton, 1994; and Shelton and Capel, 1994). Chemical characteristics of the water included field measurements of specific conductance, pH, stream water temperature, barometric pressure, and dissolved-oxygen concentration (table 2). In addition, water samples were collected for analyses of E. coli and fecal coliform counts, and nutrient concentrations (table 3).

Streambed sediments at both sites were collected for analysis of trace elements (table 4) and various organic compounds concentrations. The trace element concentrations shown in table 4 are from streambed sediments field-sieved to less than 0.063 mm. Analyses of organic compounds were made from streambed sediment samples field-sieved to less than 2.0 mm. Results of these analyses are published by Bertrand and others (1999). None of the 32 organochlorine pesticides and PCBs analyzed were detected at either site. Tissues of slimy sculpin were also collected for analysis of trace elements and various organic compounds.

A total of 78 semivolatile organic compounds were analyzed from the streambed samples. Detection of two phthalate compounds at Sportsman's Landing are a result of laboratory contamination (Gilliom and others, 1998). At the Jim's Landing site, laboratory contamination again was responsible for detection of two phthalate compounds. Three other semivolatile organic compounds were detected at Jim's Landing: 2,6-dimethylnapthalene (52 µg/kg); phenol (55 µg/kg); and p-cresol (650 µg/kg). Organochlorine pesticides and total PCBs also were analyzed in whole slimy sculpin and no compounds were detected at either site.

Table 2. Field water-quality properties measured across cross sections of the Kenai River at Sportsman's Landing and Jim's Landing, May 28, 1998

[µS/cm, microsiemen per centimeter at 25 degrees Celsius; °C, degree Celsius; mm of Hg, millimeters of mercury; mg/L, milligram per liter]

Distance from right bank (feet)	Time	Specific conductance (µS/cm)	pH	Water temperature (°C)	Barometric pressure (mm of Hg)	Dissolved oxygen	
						(mg/L)	(percent saturation)
Sportsman's Landing							
213	1509	68	7.8	9.74	765	10.7	94
153	1511	68	7.8	9.30	765	10.8	94
128	1513	69	7.8	7.5	765	12.0	100
108	1515	67	7.8	7.3	765	12.4	102
88	1517	67	7.8	7.3	765	12.3	102
68	1519	65	7.8	7.4	765	12.2	101
30	1520	71	7.9	7.7	765	11.9	99
Jim's Landing							
41	1332	66	7.7	7.15	767	12.2	100
75	1334	66	7.7	7.10	767	12.2	100
110	1336	63	7.7	7.06	767	12.3	101
143	1338	66	7.7	7.05	767	12.2	100
175	1340	68	7.7	7.44	767	12.1	100

Table 3. Bacteria counts and nutrients measured in the Kenai River at Sportsman's Landing and Jim's Landing, May 28-29, 1998

[cols/100 mL, fecal coliform colonies per 100 milliliters of water; mgL, milligram per liter]

Fecal coliform[1] (cols/100 mL)	E. coli[1] (cols/100 mL)	Nitrite, dissolved (mg/L as N)	Nitrate + nitrate, dissolved (mg/L as N)	Ammonia, dissolved (mg/L as N)	Ammonia + organic, total (mg/L as N)	Ammonia + organic, dissolved (mg/L as N)	Phosphorus, total (mg/L as P)	Phos-phorus, dissolved (mg/L as P)	Orthohos-phorus, dissolved (mg/L as P)
Sportsman's Landing									
13	5	0.02	0.29	0.11	<0.1	<0.1	<0.01	0.02	<0.01
Jim's Landing									
7	4	0.02	0.30	0.03	<0.1	<0.1	0.05	0.02	<0.01

[1]Results based on colony count outside the acceptance range (non-ideal) colony count

Table 4. Trace elements in bed sediments of the Kenai River, Sportsman's Landing and Jim's Landing, May 27-28, 1998

[%, percent; µg/g, microgram per gram]

Trace element (unit)	Value		Trace element (unit)	Value	
	Sportman's Landing	Jim's Landing		Sportman's Landing	Jim's Landing
Aluminum (%)	7.4	6.9	Molybdenum (µg/g)	1	.6
Antimony (µg/g)	2	1	Neodymium (µg/g)	29	23
Arsenic (µg/g)	17	11	Nickel (µg/g)	52	54
Barium (µg/g)	880	910	Niobium (µg/g)	11	10
Beryllium (µg/g)	1	1	Phosphorus (%)	.17	.15
Bismuth (µg/g)	<1	<1	Scandium (µg/g)	17	16
Cadmium (µg/g)	.3	.3	Selenium (µg/g)	.3	.7
Chromium (µg/g)	110	110	Silver (µg/g)	.2	.2
Copper (µg/g)	46	45	Sodium (%)	2.0	1.7
Calcium (%)	1.2	1.1	Strontium (µg/g)	280	240
Cobalt (µg/g)	18	16	Sulfur (µg/g)	<.05	.08
Cerium (µg/g)	58	50	Tantalum (µg/g)	<1	<1
Europium (µg/g)	2	1	Thorium (µg/g)	7.1	6.1
Gold (µg/g)	<.05	<.05	Tin (µg/g)	2	2
Gallium (µg/g)	14	14	Titanium (%)	.6	.4
Holmium (µg/g)	1	<1	Uranium (µg/g)	3.2	2.2
Iron (%)	3.9	3.8	Vanadium (µg/g)	130	130
Lanthanum (µg/g)	33	27	Yttrium (µg/g)	29	23
Lead (µg/g)	16	17	Ytterbium (µg/g)	3	2
Lithium (µg/g)	40	40	Zinc (µg/g)	110	110
Magnesium (µg/g)	1.5	1.6	Carbon, organic (%)	1.51	2.61
Manganese (µg/g)	1100	660	Carbon, inorganic (%)	.01	.01
Mercury (µg/g)	.07	.09	Carbon, org.+ inorg. (%)	1.52	2.62

BIOLOGICAL METHODS AND RESULTS

Biological characteristics of each site were evaluated with measurements of the bacteria, benthic macroinvertebrate, and fish communities. All biological samples were collected with published protocols (Cuffney and others, 1993; Meador and others, 1993; Myers, and Wilde, 1997).

Bacteria

Bacteriological investigations included a sampling of water and laboratory processing to determine the number of specific indicator bacteria present. Although they are not typically disease causing, fecal indicator bacteria are commonly used to assess the quality of water because they are correlated to the presence of several water-borne disease-causing organisms (pathogens). The concentration of fecal indicator bacteria is a measure of water safety for body contact recreation or for consumption.

Bacteriological tests are used to assess the sanitary quality of water and the potential public health risk from water-borne diseases. For potable waters, the detection of 1 colony of fecal coliform or E. coli per 100 mL of water is cause for concern for public health. For water contact recreation, a fecal coliform bacteria concentration of 200 col/100 mL of water was the accepted threshold for many years (U.S. Environmental Protection Agency, 1976). However, recent modifications recommend that other indicators (E. coli and enterococci bacteria) be used because they are better indicators of swimming-associated gastroenteritis (U.S. Environmental Protection Agency, 1986). Bacteriological tests done at the Kenai National Wildlife Refuge sites include both fecal coliform bacteria and E. coli bacteria assessments (table 3). In Alaska, the Department of Environmental Conservation (ADEC) water-quality standards for a drinking-water supply state that in a 30-day period, the geometric mean of samples may not exceed 20 col/100 mL, and not more than 10 percent of the samples may exceed 40 col/100 mL (ADEC, 1999, p. 7).

Benthic Macroinvertebrates

Benthic macroinvertebrates were sampled using two methods. (1) The NAWQA Richest Targeted Habitat (RTH) method (Cuffney and others, 1993) was used to quantify the relative density of macroinvertebrates at each site by sampling an area of the suspected richest habitat at each site. (2) The NAWQA Qualitative Multi-Habitat (QMH) method (Cuffney and others, 1993) was used to determine the presence or absence of macroinvertebrate species at the sites by sampling all the available habitats.

The RTH sample was a composite of five 0.25-m^2 areas from shallow riffles. Those areas are disturbed to a depth of 0.10 m and the macroinvertebrates are washed by the current into a 425-μm mesh net. Analysis of the RTH sample is done using a 300-organism subsample. For example, if a sample must be subsampled to one-tenth of its original volume to yield 300 or fewer organisms and two individuals of a particular taxon are counted, then the reported abundance would be 20 (2 x 10).

The QMH sample was a composite of samples collected from all wadeable habitats at the site. A 210-μm mesh net is used for the collection of the QMH samples. Analysis of the sample is a timed, 2-hour visual sort and the data are reported only as the presence, with no abundance determined. These macroinvertebrate analyses are summarized in tables 5 and 6.

Table 5. Benthic macroinvertebrate data for Kenai River at Sportsman's Landing, May 1998

[Life stage: A, adult; L, larva; P, pupa; Abundance for Richest Targeted Habitat sample is per 1.25 square meter, based on a 300-organism subsample; NA, not applicable]

Class	Order	Family	Lowest taxonomic level	Life stage	Abundance
Richest Targeted Habitat Sample					
	Acari		Hydrachnidia		14
Insecta	Ephemeroptera	Baetidae	Baetidae	L	14
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	L	98
Insecta	Plecoptera	Chloroperlidae	Plumiperla diversa (Frison)	L	14
Insecta	Trichoptera	Limnephilidae	Limnephilidae	L	14
Insecta	Trichoptera	Limnephilidae	Onocosmoecus unicolor (Banks)	L	14
Insecta	Coleoptera	Staphylinidae	Staphylinidae	A	14
Insecta	Diptera	Chironomidae	Chironomidae	A	42
Insecta	Diptera	Chironomidae	Chironomidae	L	14
Insecta	Diptera	Chironomidae	Chironomidae	P	28
Insecta	Diptera	Chironomidae	Rheotanytarsus sp.	L	28
Insecta	Diptera	Chironomidae	Stempellina sp.	L	14
Insecta	Diptera	Chironomidae	Diamesa sp.	L	1022
Insecta	Diptera	Chironomidae	Pagastia sp.	L	112
Insecta	Diptera	Chironomidae	Orthocladiinae	L	28
Insecta	Diptera	Chironomidae	Orthocladiinae	P	28
Insecta	Diptera	Chironomidae	Cricotopus/Orthocladius sp.	L	84
Insecta	Diptera	Chironomidae	Heterotrissocladius sp.	L	14
Insecta	Diptera	Chironomidae	Parakiefferiella sp.	L	28
Insecta	Diptera	Chironomidae	Boreochlus sp.	P	14
Insecta	Diptera	Tipulidae	Hesperoconopa sp.	L	14
Qualitative Multi-Habitat Sample					
Oligochaeta		Lumbriculidae	Lumbriculidae		NA
Insecta	Ephemeroptera	Baetidae	Baetis bicaudatus Dodds	L	NA
Insecta	Ephemeroptera	Baetidae	Baetis tricaudatus Dodds	L	NA
Insecta	Plecoptera	Capniidae	Capniidae	A	NA
Insecta	Plecoptera	Capniidae	Capniidae	L	NA
Insecta	Plecoptera	Chloroperlidae	Plumiperla diversa (Frison)	L	NA
Insecta	Plecoptera	Perlodidae	Isoperla sp.	L	NA
Insecta	Trichoptera	Limnephilidae	Limnephilidae	L	NA
Insecta	Trichoptera	Limnephilidae	Ecclisomyia sp.	L	NA
Insecta	Trichoptera	Limnephilidae	Onocosmoecus unicolor (Banks)	L	NA
Insecta	Lepidoptera	Pyralidae	Crambus sp.	L	NA
Insecta	Diptera	Chironomidae	Chironomidae	L	NA
Insecta	Diptera	Chironomidae	Polypedilum sp.	L	NA
Insecta	Diptera	Chironomidae	Diamesa sp.	L	NA
Insecta	Diptera	Chironomidae	Cricotopus/Orthocladius sp.	L	NA
Insecta	Diptera	Chironomidae	Corynoneura sp.	L	NA
Insecta	Diptera	Chironomidae	Tvetenia sp.	L	NA
Insecta	Diptera	Tipulidae	Hesperoconopa sp.	L	NA
Insecta	Diptera	Tipulidae	Dicranota sp.	L	NA

Table 6. Benthic macroinvertebrate data for Kenai River at Jim's Landing, May 1998

[Life stage: A, adult; L, larva; P, pupa; Abundance for Richest Targeted Habitat sample is per 1.25 square meter, based on a 300-organism subsample; NA, not applicable]

Class	Order	Family	Lowest taxonomic level	Life stage	Abundance
Richest Targeted Habitat Sample					
		Hydridae	Hydra sp.		21
Oligochaeta		Enchytraeidae	Enchytraeidae		11
Insecta	Ephemeroptera	Baetidae	Baetidae	L	53
Insecta	Ephemeroptera	Baetidae	Acentrella sp.	L	11
Insecta	Ephemeroptera	Baetidae	Baetis tricaudatus Dodds	L	11
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	L	21
Insecta	Plecoptera	Chloroperlidae	Plumiperla diversa (Frison)	L	11
Insecta	Trichoptera	Limnephilidae	Limnephilidae	L	11
Insecta	Diptera	Chironomidae	Chironomidae	A	95
Insecta	Diptera	Chironomidae	Chironomidae	P	42
Insecta	Diptera	Chironomidae	Chironominae	P	11
Insecta	Diptera	Chironomidae	Micropsectra sp.	L	21
Insecta	Diptera	Chironomidae	Stempellina sp.	L	21
Insecta	Diptera	Chironomidae	Diamesa sp.	L	315
Insecta	Diptera	Chironomidae	Pagastia sp.	L	32
Insecta	Diptera	Chironomidae	Orthocladiinae	L	63
Insecta	Diptera	Chironomidae	Orthocladiinae	P	74
Insecta	Diptera	Chironomidae	Cricotopus/Orthocladius sp.	L	252
Insecta	Diptera	Chironomidae	Corynoneura sp.	L	11
Insecta	Diptera	Chironomidae	Eukiefferiella sp.	L	53
Insecta	Diptera	Chironomidae	Parakiefferiella sp.	L	84
Insecta	Diptera	Chironomidae	Tvetenia sp.	L	21
Insecta	Diptera	Chironomidae	Thienemannimyia group sp.	L	11
Insecta	Diptera	Simuliidae	Simuliidae	L	11
Qualitative Multi-Habitat Sample					
Gastropoda		Lymnaeidae	Fossaria sp.		NA
Bivalvia		Sphaeriidae	Musculium sp.		NA
Bivalvia		Sphaeriidae	Sphaerium sp.		NA
Oligochaeta		Lumbriculidae	Lumbriculidae		NA
Oligochaeta		Tubificidae	Tubificidae		NA
Insecta	Ephemeroptera	Siphlonuridae	Siphlonurus sp.	L	NA
Insecta	Plecoptera	Pteronarcyidae	Pteronarcella badia (Hagen)	L	NA
Insecta	Trichoptera	Limnephilidae	Limnephilidae	L	NA
Insecta	Trichoptera	Limnephilidae	Onocosmoecus unicolor (Banks)	L	NA
Insecta	Trichoptera	Limnephilidae	Asynarchus sp.	L	NA
Insecta	Diptera	Chironomidae	Chironomidae	L	NA
Insecta	Diptera	Chironomidae	Einfeldia sp.	L	NA
Insecta	Diptera	Chironomidae	Phaenopsectra sp.	L	NA
Insecta	Diptera	Chironomidae	Diamesa sp.	L	NA
Insecta	Diptera	Chironomidae	Pseudodiamesa sp.	L	NA
Insecta	Diptera	Chironomidae	Cricotopus/Orthocladius sp.	L	NA
Insecta	Diptera	Chironomidae	Psectrocladius sp.	L	NA
Insecta	Diptera		Brachycera	L	NA
Insecta	Diptera	Empididae	Chelifera/Hemerodromia sp.	P	NA

Fish

Fish community assessments were used to evaluate the relative abundance of fish at each site (table 7), the presence or absence of certain species of fish, and their health. The fish were collected using backpack electrofishing equipment in combination with dip nets and seines. The health of the fish community was evaluated by measuring the length and weight of the first 30 fish of each different species collected (table 8). In addition to length and weight measurements, the health of fish sampled was also noted by identifying any observed abnormalities, such as lesions, present on the fish. Jeff Breakfield, a fisheries biologist from the Alaska Department of Fish and Game, identified fish captured at the Kenai National Wildlife Refuge sites. The identity of six juvenile salmonids at each site was questionable, and therefore listed as "unknown" on table 7.

Slimy sculpins were sampled for analysis of trace-element concentrations. The results of these analyses were not yet available at the time of this report's publication (September 1999), but will be included in future USGS reports.

Table 7. Fish species collected by electrofishing at Sportsman's Landing and Jim's Landing on the Kenai River, May 1998

Species	Abundance	Species	Abundance
Sportman's Landing		**Jim's Landing**	
Chinook salmon	143	Chinook salmon	223
Sockeye salmon	48	Sockeye salmon	398
Slimy sculpin	40	Slimy sculpin	58
Rainbow trout	8	Rainbow trout	2
Dolly Varden	13	Dolly Varden	3
Unknown	6	Threespine stickleback	1
		Unknown	6

Table 8. Fish community data from Sportman's Landing and Jim's Landing, Kenai River, May 28-30, 1998

Species ID	Standard length (millimeters)	Total length (millimeters)	Weight (grams)
Sportman's Landing			
Chinook	37	45	0.5
Chinook	40	47	0.6
Chinook	40	48	0.7
Chinook	42	49	0.8
Chinook	37	45	0.5
Chinook	39	46	0.7
Chinook	38	45	0.6
Chinook	37	44	0.5
Chinook	38	44	0.6
Chinook	39	46	0.7
Chinook	39	45	0.6
Chinook	42	50	0.6
Chinook	35	41	0.4
Chinook	39	46	0.6
Chinook	37	43	0.6
Chinook	39	47	0.5
Chinook	37	45	0.5
Chinook	37	43	0.6
Chinook	37	43	0.5
Chinook	42	51	0.9
Chinook	37	45	0.5
Chinook	38	46	0.5
Chinook	37	45	0.6
Chinook	37	44	0.5
Chinook	39	46	0.6
Chinook	39	47	0.6
Chinook	35	42	0.5
Chinook	39	47	0.6
Chinook	39	47	0.6
Chinook	43	52	0.9
Sockeye	32	37	0.2
Sockeye	32	37	0.3
Sockeye	30	36	0.2
Sockeye	32	37	0.2
Sockeye	31	36	0.2
Sockeye	30	35	0.2
Sockeye	31	36	0.3
Sockeye	31	36	0.2
Sockeye	32	37	0.3

Species ID	Standard length (millimeters)	Total length (millimeters)	Weight (grams)
Jim's Landing			
Chinook	37	43	0.4
Chinook	38	44	0.5
Chinook	39	46	0.4
Chinook	40	47	1.0
Chinook	37	42	0.5
Chinook	38	44	0.4
Chinook	37	43	0.5
Chinook	40	48	0.9
Chinook	38	44	0.7
Chinook	36	42	0.6
Chinook	38	43	0.7
Chinook	37	43	0.5
Chinook	39	45	0.5
Chinook	38	45	0.5
Chinook	39	45	0.7
Chinook	38	44	0.5
Chinook	40	46	0.6
Chinook	38	45	0.6
Chinook	35	41	0.5
Chinook	37	43	0.7
Chinook	37	44	0.6
Chinook	43	50	0.9
Chinook	41	48	0.9
Chinook	37	43	0.6
Chinook	39	45	0.6
Chinook	43	51	0.8
Chinook	41	48	0.7
Chinook	40	47	0.7
Chinook	39	45	0.7
Chinook	36	42	0.5
Sockeye	33	37	0.4
Sockeye	31	35	0.2
Sockeye	31	35	0.2
Sockeye	29	32	0.2
Sockeye	31	34	0.2
Sockeye	30	34	0.2
Sockeye	30	34	0.2
Sockeye	31	35	0.2
Sockeye	31	35	0.2

Table 8. Fish community data from Sportman's Landing and Jim's Landing, Kenai River, May 28-30, 1998--Continued

Species ID	Standard length (millimeters)	Total length (millimeters)	Weight (grams)
Sportman's Landing			
Sockeye	31	36	0.2
Sockeye	29	34	0.2
Sockeye	30	35	0.3
Sockeye	31	37	0.3
Sockeye	30	35	0.2
Sockeye	31	36	0.3
Sockeye	30	35	0.1
Sockeye	28	33	0.2
Sockeye	31	36	0.3
Sockeye	30	35	0.2
Sockeye	30	35	0.3
Sockeye	31	36	0.3
Sockeye	30	35	0.3
Sockeye	32	37	0.3
Sockeye	29	34	0.2
Sockeye	31	36	0.3
Sockeye	29	34	0.2‘
Sockeye	31	36	0.3
Sockeye	31	37	0.2
Sockeye	30	35	0.3
Sockeye	30	35	0.3
Slimy sculpin	34	41	0.9
Slimy sculpin	43	52	1.3
Slimy sculpin	26	30	0.2
Slimy sculpin	46	54	2.2
Slimy sculpin	30	36	0.4
Slimy sculpin	50	57	1.9
Slimy sculpin	52	61	2.2
Slimy sculpin	45	52	1.9
Slimy sculpin	46	56	2.0
Slimy sculpin	49	58	1.5
Slimy sculpin	98	117	22.8
Slimy sculpin	78	89	8.6
Slimy sculpin	74	90	9.0
Slimy sculpin	85	103	14.0
Slimy sculpin	86	103	16.0
Slimy sculpin	75	93	10.9
Slimy sculpin	68	84	8.0
Slimy sculpin	78	92	8.3
Slimy sculpin	74	85	7.1

Species ID	Standard length (millimeters)	Total length (millimeters)	Weight (grams)
Jim's Landing			
Sockeye	20	24	0.2
Sockeye	30	34	0.2
Sockeye	31	35	0.2
Sockeye	32	36	0.3
Sockeye	31	35	0.2
Sockeye	30	34	0.2
Sockeye	31	35	0.2
Sockeye	29	33	0.2
Sockeye	34	39	0.3
Sockeye	31	35	0.2
Sockeye	31	35	0.2
Sockeye	29	33	0.2
Sockeye	31	35	0.2
Sockeye	31	36	0.2
Sockeye	29	33	0.1
Sockeye	30	34	0.2
Sockeye	30	33	0.2
Sockeye	30	34	0.2
Sockeye	29	33	0.2
Sockeye	28	32	0.2
Rainbow trout	48	55	1.6
Rainbow trout	59	68	3.0
Dolly Varden	68	77	4.1
Dolly Varden	70	80	4.4
Dolly Varden	30	34	0.3
Threespine stickleback	27	31	0.2
Slimy sculpin	37	45	0.8
Slimy sculpin	33	38	0.6
Slimy sculpin	30	34	0.4
Slimy sculpin	33	38	0.6
Slimy sculpin	40	47	1.3
Slimy sculpin	30	35	0.4
Slimy sculpin	72	86	8.8
Slimy sculpin	66	79	7.0
Slimy sculpin	76	89	7.0
Slimy sculpin	59	71	5.0
Slimy sculpin	59	70	4.4
Slimy sculpin	64	78	4.2
Slimy sculpin	68	71	3.2
Slimy sculpin	72	87	6.0

Table 8. Fish community data from Sportman's Landing and Jim's Landing, Kenai River, May 28-30, 1998--Continued

Species ID	Standard length (millimeters)	Total length (millimeters)	Weight (grams)
Sportman's Landing			
Slimy sculpin	79	94	9.1
Slimy sculpin	52	62	2.5
Slimy sculpin	55	65	2.5
Slimy sculpin	46	55	1.8
Slimy sculpin	50	59	2.0
Slimy sculpin	45	55	1.8
Slimy sculpin	58	69	4.2
Slimy sculpin	46	56	1.5
Slimy sculpin	56	67	2.8
Slimy sculpin	54	64	2.2
Slimy sculpin	55	66	3.0
Rainbow trout	37	45	0.5
Rainbow trout	38	44	0.6
Rainbow trout	40	46	0.6
Rainbow trout	39	45	0.7
Rainbow trout	39	45	0.6
Rainbow trout	39	45	0.6
Rainbow trout	39	46	0.6
Rainbow trout	39	47	0.7
Dolly Varden	23	26	0.1
Dolly Varden	64	76	3.4
Dolly Varden	59	70	2.5
Dolly Varden	51	60	2.0
Dolly Varden	47	55	2.8
Dolly Varden	53	63	1.7
Dolly Varden	24	28	0.1
Dolly Varden	52	61	1.6
Dolly Varden	53	62	2.1
Dolly Varden	47	55	1.4
Dolly Varden	24	27	0.1
Dolly Varden	26	30	0.1
Dolly Varden	25	28	0.1
Unknown	29	34	0.2
Unknown	29	33	0.2
Unknown	31	36	0.2
Unknown	31	36	0.3
Unknown	29	33	0.3
Unknown	30	34	0.3

Species ID	Standard length (millimeters)	Total length (millimeters)	Weight (grams)
Jim's Landing			
Slimy sculpin	45	54	1.4
Slimy sculpin	54	63	2.5
Slimy sculpin	29	36	0.4
Slimy sculpin	51	61	2.9
Slimy sculpin	45	55	2.1
Slimy sculpin	55	66	3.6
Slimy sculpin	48	57	2.1
Slimy sculpin	66	80	4.7
Slimy sculpin	46	56	1.8
Slimy sculpin	55	64	2.3
Slimy sculpin	51	59	1.8
Slimy sculpin	48	58	2.2
Slimy sculpin	64	75	4.5
Slimy sculpin	46	55	1.6
Slimy sculpin	46	56	1.9
Slimy sculpin	56	67	2.7
Unknown	20	23	>0
Unknown	19	21	>0
Unknown	25	27	>0
Unknown	23	26	>0
Unknown	21	23	>0
Unknown	23	26	>0

HUMAN USE SURVEYS

Another component of the site investigation was counting the number of human visitors at each site during five separate week-long periods from May through September. The visitor counts targeted expected minimum and maximum levels of use and included identification of the type of visitor use at each site. The survey started on May 22 and ended on September 8, 1998 at both the Sportsman's Landing and the Jim's Landing sites. Activities at each site usually centered on the river. Human use was observed and recorded from a distance at both sites. Human use at each site was observed from 2 to 8 hours a day, for 5 to 6 days every month during the study period. The number of people at each site was recorded along with the activity that they were pursuing and the mode of transportation that they used to get to the site (tables 9 and 10). Boat, foot, and motor vehicle traffic were recorded and each was categorized by activity or vehicle used according to the following list: catarafts, drift boats, inflatable boats, total boats, total passengers, boats that used ramp, boats that drifted by, commercial boats, private boats, cars, trucks, recreational vehicles, vehicles with a trailer, total vehicles, fishing, picnic, resting, restroom, and total people. Appendix 2 contains the field notes.

Table 9. Human use survey at Sportsman's Landing on the Kenai River, 1998

	May 22-27	June 23-27	July 22-25	August 18-21	September 4-8	Total
Boats and passengers						
Cataraft	0	6	7	12	13	
Drift boat	2	54	23	22	39	
Inflatable boat	12	41	13	30	33	
Total boats	14	101	43	64	85	307
Passengers	76	444	193	267	286	1266
Boats that used ramp	2	77	30	37	48	
Boats that drifted by	12	26	18	25	37	
Commercial boats	9	44	29	39	32	
Private boats	5	59	19	23	53	
Vehicles						
Cars	8	528	76	101	95	
Trucks	16	846	64	118	142	
Recreational vehicles	7	450	55	45	68	
Vehicles with trailer	6	135	33	53	96	
Total vehicles	37	1959	228	317	401	2942
Activities and people						
Fishing	0	530	57	171	144	
Picnic	1	5	16	18	12	
Resting	16	165	73	242	83	
Restroom	16	10	0	0	66	
Total people	33	710	146	431	305	2891

Table 10. Human use survey at Jim's Landing on the Kenai River, 1998

	May 22-27	June 23-27	July 22-25	August 18-21	September 4-8	Total
Boats and passengers						
Cataraft	2	9	13	18	24	
Drift boat	12	80	49	52	84	
Inflatable boat	28	72	31	51	64	
Total boats	42	161	93	121	172	589
Passengers	207	725	372	508	656	2468
Boats that used ramp	30	129	59	83	122	
Boats that drifted by	20	35	32	35	49	
Commercial boats	24	90	59	79	90	
Private boats	26	73	33	39	81	
Vehicles						
Cars	36	608	161	143	187	
Trucks	54	965	154	158	285	
Recreational vehicles	11	471	112	60	97	
Vehicles with trailer	20	200	78	104	210	
Total vehicles	121	2244	505	465	779	4114
Activities and people						
Fishing	0	600	153	242	201	
Picnic	4	5	31	28	14	
Resting	31	173	168	309	148	
Restroom	49	21	35	48	146	
Total people	84	799	387	627	509	4874

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APPENDIX 1

Surveyed Locations of Land Surface Points Along Each Transect at

Sportman's Landing and Jim's Landing

Explanation of Table Headings

(All data are in feet)

Recorded Survey Data	
Xsec	Cross section number
Block	Recording block
East	Arbitrary easting
North	Arbitrary northing
Elev	Arbitrary elevation
HI	Height of instrument
IS	Instrument station
Rod	Rod height
Computed Survey Data	
Dist	Distance from left end of transect
Off	Distance up (+) or down (-) stream from transect
Elev	Arbitrary elevation

Surveyed locations of land surface points along each transect at Sportman’s Landing

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
1.1	100	8563.30	10306.51	93.76							LEFT (UPSTREAM) CORNER FOR ROTATION
1.1	163	8801.12	10480.10								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
1.1	100	8563.30	10306.51	98.93	5.17	1	5.17	0.00	0.00	98.93	2x2 stake, top of hub .25 ft high
1.1	1001	8563.30	10306.51	98.93	5.17	1	5.42	0.00	0.00	98.68	base of hub
1.1	101	8562.83	10310.99	100.16	5.17	1	5.10	2.26	3.90	100.23	bolt in ctnwds, upstrm 4" abve grnd
1.1	102	8566.42	10310.07	96.42	5.17	1	5.10	4.62	1.04	96.49	bankfull
1.1	103	8568.33	10310.39	94.99	5.17	1	5.10	6.35	0.17	95.06	base of bank
1.1	104	8566.42	10311.50	93.94	5.17	1	5.10	5.46	2.19	94.01	l.e.w. pws @ 17:20
1.1	105	8569.89	10313.14	92.19	5.17	1	5.10	9.23	1.47	92.26	streambed
1.1	106	8572.81	10314.94	92.49	5.17	1	7.07	12.65	1.20	90.59	streambed, too deep to wade beyond pogo 7.07
1.1	163	8801.12	10480.10	97.75	5.17	2	6.37	294.43	0.00	96.55	top of RB, mon .57 ft high top floodplain
1.1	1631	8801.12	10480.10	97.75	5.17	2	6.94	294.43	0.00	95.98	base of monument
1.1	164	8790.71	10473.66	95.45	5.17	2	5.17	282.23	0.94	95.45	low spot
1.1	165	8779.56	10464.04	95.83	5.17	2	5.17	267.55	-0.26	95.83	top of bank, bankfull
1.1	166	8769.71	10455.81	94.06	5.17	2	5.17	254.74	-1.10	94.06	r.e.w. base of bank, pws @ 18:57
1.1	167	8763.03	10447.92	92.24	5.17	2	5.17	244.70	-3.54	92.24	streambed
1.1	168	8759.94	10442.98	91.81	5.17	2	5.17	239.29	-5.70	91.81	streambed, deeper
2.1	107	8626.35	10179.17	93.71							LEFT (UPSTREAM) CORNER FOR ROTATION
2.1	157	8891.61	10364.56								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
2.1	107	8626.35	10179.17	98.88	5.17	1	5.17	0.00	0.00	98.88	top of mon XS 2, hub .4 ft abve grnd
2.1	1071	8626.35	10179.17	98.88	5.17	1	5.57	0.00	0.00	98.48	base of monument
2.1	108	8613.08	10166.64	99.07	5.17	1	5.17	-18.05	-2.67	99.07	strmwrd side of 3rd ctnwd tree, bolt
2.1	109	8628.14	10180.72	98.14	5.17	1	5.17	2.36	0.25	98.14	top of bank
2.1	110	8628.71	10181.57	97.09	5.17	1	5.17	3.31	0.62	97.09	base of bank
2.1	111	8629.37	10182.47	96.58	5.17	1	4.97	4.37	0.97	96.78	bankfull
2.1	112	8644.34	10190.56	94.62	5.17	1	4.97	21.27	-0.97	94.82	l.e.w. pws @ 17:32
2.1	113	8654.84	10198.41	92.94	5.17	1	4.97	34.37	-0.55	93.14	streambed
2.1	114	8663.26	10204.94	92.36	5.17	1	4.97	45.02	-0.02	92.56	streambed, too deep to wade more
2.1	157	8891.61	10364.56	100.06	5.17	2	7.07	323.62	0.00	98.16	top of mon, XS 2
2.1	1571	8891.61	10364.56	100.06	5.17	2	7.54	323.62	0.00	97.69	base of monument
2.1	158	8879.34	10356.09	97.19	5.17	2	5.17	308.71	0.09	97.19	top of bank
2.1	159	8876.53	10353.14	95.97	5.17	2	5.17	304.72	-0.72	95.97	bankfull
2.1	160	8866.71	10344.64	94.63	5.17	2	5.17	291.80	-2.06	94.63	r.e.w. base of bank, pws @ 18:49
2.1	161	8856.98	10333.72	93.08	5.17	2	5.17	277.57	-5.44	93.08	streambed
2.1	162	8851.02	10329.91	92.19	5.17	2	5.17	270.50	-5.15	92.19	deeper, faster streambed

Surveyed locations of land surface points along each transect at Sportman's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
3.1	115	8743.41	9986.85	93.71							LEFT (UPSTREAM) CORNER FOR ROTATION
3.1	150	8991.52	10252.10								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
3.1	115	8743.41	9986.85	98.68	5.17	1	4.97	0.00	0.00	98.88	XS 3, LB mon 3, 2x2 stake .3 ft high
3.1	1151	8743.41	9986.85	98.68	5.17	1	5.27	0.00	0.00	98.58	base of monument
3.1	116	8749.18	9992.49	99.33	5.17	1	4.97	8.06	-0.36	99.53	top of bank
3.1	117	8748.87	9998.81	96.40	5.17	1	5.97	12.46	4.18	95.60	base of bank
3.1	118	8747.47	9996.02	101.85	5.17	1	9.16	9.47	3.30	97.86	ledge
3.1	119	8762.96	10011.64	96.90	5.17	1	5.17	31.46	2.66	96.90	bankfull
3.1	120	8779.28	10030.05	95.02	5.17	1	5.17	56.05	3.31	95.02	wsel l.e.w. pws @ 17:50
3.1	121	8792.64	10044.83	93.57	5.17	1	5.17	75.97	3.65	93.57	streambed
3.1	122	8806.23	10058.51	92.35	5.17	1	5.17	95.25	3.07	92.35	streambed, too deep to wade beyond XS 3
3.1	150	8991.52	10252.10	97.67	5.17	2	5.17	363.20	0.00	97.67	top of mon, hub .5 feet high
3.1	1501	8991.52	10252.10	97.67	5.17	2	5.67	363.20	0.00	97.17	base of monument
3.1	151	8996.87	10259.54	98.00	5.17	2	5.17	372.29	1.18	98.00	flood plain elevation
3.1	152	8990.10	10243.49	96.42	5.17	2	5.17	355.94	-4.84	96.42	bankfull
3.1	153	8989.94	10243.23	95.79	5.17	2	5.17	355.65	-4.91	95.79	base of bank
3.1	154	8980.05	10235.45	95.06	5.17	2	5.17	343.21	-3.00	95.06	wsel r.e.w. pws @ 18:42
3.1	155	8962.67	10212.59	93.38	5.17	2	5.17	314.64	-5.92	93.38	stream saddle
3.1	156	8952.11	10198.34	92.75	5.17	2	5.17	297.02	-7.94	92.75	streambed, deeper
4.1	124	8886.67	9894.43	94.94							LEFT (UPSTREAM) CORNER FOR ROTATION
4.1	144	9107.10	10161.01								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
4.1	123	8861.38	9870.00	99.96	5.17	1	5.17	-34.94	3.92	99.96	lag b in ctnwd, strmwrd side,.18 ft abv grnd
4.1	124	8886.67	9894.43	100.11	5.17	1	5.17	0.00	0.00	100.11	top of LB mon 4 .4ft high
4.1	1241	8886.67	9894.43	100.11	5.17	1	5.57	0.00	0.00	99.71	base of monument
4.1	125	8897.69	9908.62	99.11	5.17	1	5.17	17.96	0.55	99.11	top of bank
4.1	126	8900.46	9909.86	96.54	5.17	1	5.17	20.68	-0.79	96.54	bankfull
4.1	127	8900.75	9910.35	95.57	5.17	1	5.17	21.24	-0.71	95.57	base of bank
4.1	128	8905.98	9918.28	95.23	5.17	1	5.17	30.69	0.32	95.23	l.e.w. pws @ 17:58
4.1	129	8930.87	9945.61	94.26	5.17	1	5.17	67.61	-1.45	94.26	streambed
4.1	130	8941.14	9955.35	93.56	5.17	1	5.17	81.66	-3.16	93.56	streambed, deeper
4.1	144	9107.10	10161.01	98.34	5.17	2	5.17	345.91	0.00	98.34	RB mon .38 ft high, top of bank
4.1	1441	9107.10	10161.01	98.34	5.17	2	5.55	345.91	0.00	97.96	base of monument
4.1	145	9099.18	10143.76	96.38	5.17	2	5.17	327.57	-4.89	96.38	bankfull
4.1	146	9098.69	10143.31	95.82	5.17	2	5.17	326.91	-4.80	95.82	base of bank
4.1	147	9095.31	10137.95	95.40	5.17	2	5.17	320.63	-5.61	95.40	r.e.w. pws @ 18:36
4.1	148	9057.22	10087.60	93.91	5.17	2	5.17	257.55	-8.34	93.91	streambank
4.1	149	9051.42	10070.06	93.21	5.17	2	5.17	240.34	-15.05	93.21	streambed, deeper
4.1	169	9116.95	10179.39	98.29	5.17	3	5.17	366.35	4.12	98.29	lag bolt in 4" poplar, dwnstrm .3 ft abve gr

Surveyed locations of land surface points along each transect at Sportman's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
5.1	131	9026.23	9778.37	104.04							LEFT (UPSTREAM) CORNER FOR ROTATION
5.1	139	9236.70	10098.39								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
5.1	131	9026.23	9778.37	109.21	5.17	1	5.17	0.00	0.00	109.21	LB mon, top of hub .27 ft high
5.1	1311	9026.23	9778.37	109.21	5.17	1	5.44	0.00	0.00	108.94	base of monument
5.1	132	9046.51	9809.54	109.89	5.17	1	5.17	37.19	0.18	109.89	lag bolt in root of 6" spruce
5.1	133	9050.01	9814.42	110.03	5.17	1	5.17	43.19	-0.06	110.03	top of hub 2, mid LB mon .35 ft high
5.1	1331	9050.01	9814.42	110.03	5.17	1	5.52	43.19	-0.06	109.68	base of monument
5.1	134	9053.53	9820.99	108.04	5.17	1	5.17	50.61	0.61	108.04	edge of bank
5.1	135	9064.02	9837.53	94.43	5.17	1	5.17	70.19	0.93	94.43	streambed
5.1	136	9066.79	9842.47	93.38	5.17	1	5.17	75.84	1.33	93.38	streambed, deeper
5.1	137	9059.50	9832.67	101.51	5.17	1	10.67	63.65	2.04	96.01	l.e.w. pws @ 18:09
5.1	138	9049.48	9821.79	108.65	5.17	1	10.67	49.05	4.43	103.15	top of bank ledge, bank undercut 2 ft
5.1	139	9236.70	10098.39	98.37	5.17	1	5.17	383.03	0.00	98.37	top of RB mon 5, hub .34 ft high
5.1	1391	9236.70	10098.39	98.37	5.17	1	5.51	383.03	0.00	98.03	base of monument
5.1	140	9206.13	10059.87	96.16	5.17	1	5.17	334.05	4.37	96.16	bankfull, base of bank
5.1	141	9204.58	10057.52	95.90	5.17	1	5.17	331.23	4.38	95.90	r.e.w. pws @ 18:22
5.1	142	9166.93	9975.79	94.81	5.17	1	5.17	242.26	-9.07	94.81	streambed
5.1	143	9155.79	9957.80	93.82	5.17	1	5.17	221.11	-9.65	93.82	streambed, deeper
5.1	171	9045.78	9831.55	106.89	5.17	2	13.87	55.17	12.89	98.19	bankfull stage
5.1	172	9049.47	9832.38	105.68	5.17	2	13.87	57.90	10.26	96.98	base of bank
6.1	50	10177.87	9735.58	109.59							LEFT (UPSTREAM) CORNER FOR ROTATION
6.1	37	10012.98	10035.07								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
6.1	37	10012.98	10035.07	100.41	5.10	1	5.10	341.88	0.00	100.41	top of hub, hub .42 ft abve grnd
6.1	371	10012.98	10035.07	100.41	5.10	1	5.52	341.88	0.00	99.99	base of monument
6.1	38	10002.35	10070.09	100.96	5.10	1	5.10	377.69	-7.58	100.96	floodplain
6.1	39	9996.75	10088.11	102.50	5.10	1	5.10	396.17	-11.36	102.50	floodplain @ base of tree
6.1	40	9996.04	10089.60	103.43	5.10	1	5.10	397.82	-11.46	103.43	nail @ base of ctnwd tree
6.1	41	10024.08	10013.91	99.21	5.10	1	5.10	317.99	0.48	99.21	bankfull
6.1	42	10027.56	10009.56	98.96	5.10	1	5.10	312.50	-0.47	98.96	base of bank
6.1	43	10039.18	9991.36	98.42	5.10	1	5.10	290.96	-1.87	98.42	r.e.w. pws @ 14:45
6.1	44	10061.89	9960.01	96.89	5.10	1	5.10	252.54	-6.64	96.89	streambed
6.1	45	10075.71	9939.73	95.10	5.10	1	5.10	228.11	-8.97	95.10	streambed, too deep to wade
6.1	50	10177.87	9735.58	114.49	5.10	2	4.90	0.00	0.00	114.69	top of hub, hub .3 ft abve grnd, LB
6.1	501	10177.87	9735.58	114.49	5.10	2	5.20	0.00	0.00	114.39	base of monument
6.1	51	10168.71	9752.30	114.54	5.10	2	5.10	19.06	-0.04	114.54	far LB mon, nail in spruce base
6.1	52	10160.91	9768.04	114.24	5.10	2	5.10	36.61	-0.80	114.24	near LB monument
6.1	53	10159.92	9769.67	113.59	5.10	2	5.10	38.52	-0.72	113.59	top of hub, .47 abve grnd
6.1	531	10159.92	9769.67	113.59	5.10	2	5.57	38.52	-0.72	113.12	base of monument
6.1	54	10159.23	9770.37	112.23	5.10	2	5.10	39.47	-0.45	112.23	ledge on bank, undercut .4 ft
6.1	55	10149.48	9788.29	101.37	5.10	2	5.10	59.87	-0.55	101.37	bankfull
6.1	56	10148.57	9790.27	100.20	5.10	2	5.10	62.04	-0.71	100.20	base of bank
6.1	57	10144.18	9796.52	98.58	5.10	2	5.10	69.63	0.12	98.58	l.e.w. pws @ 15:19
6.1	58	10139.26	9803.63	97.03	5.10	2	5.10	78.23	1.00	97.03	streambed
6.1	59	10136.94	9806.63	95.30	5.10	2	5.10	81.98	1.59	95.30	streambed, too deep to wade further

Surveyed locations of land surface points along each transect at Sportman's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
7.1	61	10226.38	9802.85	100.69							LEFT (UPSTREAM) CORNER FOR ROTATION
7.1	29	10082.69	10054.29								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
7.1	29	10082.69	10054.29	100.62	5.10	1	5.10	289.60	0.00	100.62	top of hub, hub .35 abve grnd
7.1	291	10082.69	10054.29	100.62	5.10	1	5.45	289.60	0.00	100.27	base of monument
7.1	30	10074.83	10063.67	100.78	5.10	1	5.10	301.65	2.17	100.78	top of floodplain
7.1	31	10058.08	10094.63	102.31	5.10	1	5.10	336.84	1.35	102.31	lag bolt in ctnwd base (1' diam)
7.1	32	10088.80	10046.20	99.39	5.10	1	5.10	279.55	-1.29	99.39	bankfull
7.1	33	10091.56	10042.69	99.05	5.10	1	5.10	275.13	-1.95	99.05	base of bank
7.1	34	10108.91	10014.23	98.48	5.10	1	5.10	241.81	-2.89	98.48	r.e.w. pws @ 14:37
7.1	35	10128.56	9986.91	96.52	5.10	1	5.10	208.34	-6.39	96.52	streambed
7.1	36	10139.62	9970.81	95.42	5.10	1	5.10	188.87	-8.01	95.42	streambed, too deep to wade beyond
7.1	60	10227.07	9800.00	105.97	5.10	2	5.10	-2.82	0.81	105.97	nail in base of spruce, dwnstrm, f.l.b. mon
7.1	61	10226.38	9802.85	105.79	5.10	2	5.10	0.00	0.00	105.79	LB, top of hub, hub .48 abve grnd
7.1	611	10226.38	9802.85	105.79	5.10	2	5.58	0.00	0.00	105.31	base of monument
7.1	62	10213.66	9817.97	104.46	5.10	2	5.10	19.44	3.54	104.46	top of bank
7.1	63	10213.11	9818.86	103.08	5.10	2	5.10	20.48	3.58	103.08	ledge on bank, undercut .6 ft
7.1	64	10210.69	9820.68	101.29	5.10	2	5.10	23.27	4.78	101.29	bankfull
7.1	65	10210.47	9821.92	100.84	5.10	2	5.10	24.45	4.35	100.84	base of bank
7.1	66	10202.97	9829.28	98.55	5.10	2	5.10	34.56	7.21	98.55	l.e.w. pws @ 15:24
7.1	67	10201.41	9840.62	96.62	5.10	2	5.10	45.18	2.94	96.62	streambed
7.1	68	10199.24	9846.66	95.25	5.10	2	5.10	51.50	1.83	95.25	streambed, too deep to wade beyond
8.1	71	10277.95	9836.30	100.91							LEFT (UPSTREAM) CORNER FOR ROTATION
8.1	21	10144.93	10099.36								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
8.1	21	10144.93	10099.36	101.90	5.10	1	5.10	294.78	0.00	101.90	RB top of hub, hub .45 ft abve grnd
8.1	211	10144.93	10099.36	101.90	5.10	1	5.55	294.78	0.00	101.45	base of monument
8.1	22	10140.17	10109.94	102.27	5.10	1	5.10	306.37	-0.53	102.27	top of floodplain, r of hub
8.1	23	10136.65	10116.37	102.03	5.10	1	5.10	313.70	-0.29	102.03	RB, floodplain
8.1	24	10158.15	10077.71	99.55	5.10	1	5.10	269.49	-2.03	99.55	bankfull
8.1	25	10161.76	10074.38	99.00	5.10	1	5.10	264.89	-3.75	99.00	base of bank
8.1	26	10176.77	10055.10	98.54	5.10	1	5.10	240.91	-8.44	98.54	r.e.w. pws @ 14:27
8.1	27	10199.84	10035.33	97.05	5.10	1	5.10	212.86	-20.11	97.05	streambed
8.1	28	10213.28	10024.47	95.54	5.10	1	5.10	197.10	####	95.54	streambed, too deep to wade
8.1	70	10269.58	9853.63	105.24	5.10	2	5.10	19.24	-0.35	105.24	top of bank
8.1	71	10277.95	9836.30	106.01	5.10	2	5.10	0.00	0.00	106.01	top of hub, hub .45 abve grnd
8.1	711	10277.95	9836.30	106.01	5.10	2	5.55	0.00	0.00	105.56	base of monument
8.1	72	10269.36	9853.61	103.54	5.10	2	5.10	19.32	-0.15	103.54	LB, ledge, undercut .5 ft
8.1	73	10268.10	9855.94	101.33	5.10	2	5.10	21.97	-0.07	101.33	bankfull
8.1	74	10266.82	9858.16	100.31	5.10	2	5.10	24.53	0.07	100.31	base of bank
8.1	75	10262.47	9868.42	98.54	5.10	2	5.10	35.65	-0.68	98.54	l.e.w. pws @ 15:35
8.1	76	10255.31	9877.59	97.06	5.10	2	5.10	47.06	1.57	97.06	streambed
8.1	77	10251.78	9882.09	95.10	5.10	2	5.10	52.67	2.69	95.10	streambed, deeper

Surveyed locations of land surface points along each transect at Sportman's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
9.1	79	10336.43	9870.30	100.63							LEFT (UPSTREAM) CORNER FOR ROTATION
9.1	15	10211.61	10118.43								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
9.1	15	10211.61	10118.43	101.71	5.10	1	5.10	277.76	0.00	101.71	RB, top of hub, hub .2 abve grnd
9.1	151	10211.61	10118.43	101.71	5.10	1	5.30	277.76	0.00	101.51	base of monument
9.1	16	10215.44	10115.10	100.06	5.10	1	5.10	273.06	-1.93	100.06	bankfull
9.1	17	10215.67	10114.97	98.99	5.10	1	4.30	272.84	-2.07	99.79	base of bank
9.1	18	10245.30	10081.67	98.58	5.10	1	5.10	229.78	-13.58	98.58	r.e.w. pws @ 14:09
9.1	19	10271.66	10072.57	96.10	5.10	1	5.10	209.80	####	96.10	streambed
9.1	20	10282.02	10069.94	94.94	5.10	1	5.10	202.80	-41.11	94.94	streambed, too deep to wade
9.1	78	10338.29	9868.81	105.81	5.10	2	5.10	-2.17	-0.99	105.81	nail in base of 4" spruce
9.1	79	10336.43	9870.30	105.73	5.10	2	5.10	0.00	0.00	105.73	top of hub, hub .39 abve grnd
9.1	791	10336.43	9870.30	105.73	5.10	2	5.49	0.00	0.00	105.34	base of monument
9.1	80	10328.36	9886.59	105.24	5.10	2	5.10	18.18	-0.11	105.24	top of bank
9.1	81	10327.91	9887.09	102.08	5.10	2	5.10	18.83	0.07	102.08	LB ledge, undercut 1.2 ft
9.1	82	10327.38	9888.22	101.30	5.10	2	5.10	20.08	0.03	101.30	bankfull
9.1	83	10326.40	9889.46	100.53	5.10	2	5.10	21.62	0.35	100.53	base of bank
9.1	84	10319.87	9900.11	98.74	5.10	2	5.10	34.07	1.40	98.74	l.e.w. pws @ 15:42
9.1	85	10312.47	9910.83	97.16	5.10	2	5.10	46.97	3.19	97.16	streambed
9.1	86	10311.02	9914.87	95.33	5.10	2	5.10	51.23	2.67	95.33	streambed, too deep to wade
10.1	88	10493.48	9942.32	102.23							LEFT (UPSTREAM) CORNER FOR ROTATION
10.1	6	10278.33	10156.22								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
10.1	6	10278.33	10156.22	100.95	5.10	1	3.60	303.39	0.00	102.45	RB top of hub
10.1	7	10277.12	10157.31	102.14	5.10	1	4.90	305.01	0.08	102.34	floodplain, to R of hub
10.1	8	10284.49	10151.84	103.58	5.10	1	6.50	295.93	-1.24	102.18	top of bank
10.1	9	10284.99	10150.20	101.16	5.10	1	5.10	294.42	-0.43	101.16	bank full (ohw)
10.1	10	10287.54	10149.73	98.62	5.10	1	4.30	292.28	-1.89	99.42	base of bank
10.1	11	10297.12	10134.55	98.60	5.10	1	5.10	274.78	2.12	98.60	pws @ 13:54
10.1	12	10300.38	10125.29	98.73	5.10	1	5.10	265.94	6.39	98.73	top of stake, measuring water surface
10.1	13	10316.06	10114.39	96.25	5.10	1	5.10	247.14	3.06	96.25	bottom of stake (in water)
10.1	14	10322.67	10107.57	95.10	5.10	1	5.10	237.64	3.24	95.10	stream bottom
10.1	87	10495.00	9940.54	107.33	5.10	2	5.10	-2.33	0.19	107.33	nail in base of 4" spruce, strmside
10.1	88	10493.48	9942.32	107.33	5.10	2	5.10	0.00	0.00	107.33	LB, top of hub, hub .34 ft high
10.1	881	10493.48	9942.32	107.33	5.10	2	5.44	0.00	0.00	106.99	base of monument
10.1	89	10463.00	9972.44	106.76	5.10	2	5.10	42.85	0.13	106.76	top of bank
10.1	90	10452.45	9981.13	101.75	5.10	2	5.10	56.46	1.41	101.75	base of bank, and bankfull
10.1	91	10441.31	9994.31	98.76	5.10	2	5.10	73.65	-0.09	98.76	l.e.w. pws @ 15:47
10.1	92	10430.70	10005.86	96.88	5.10	2	5.10	89.32	-0.80	96.88	streambed
10.1	93	10427.66	10009.89	95.38	5.10	2	5.10	94.32	-1.51	95.38	streambed, deeper

Surveyed locations of land surface points along each transect at Jim's Landing

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
1.1	423	1811.21	1316.03	43.36							LEFT (UPSTREAM) CORNER FOR ROTATION
1.1	401	1675.18	1534.44								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
1.1	401	1675.18	1534.44	46.41	5.40	2	5.46	257.31	0.00	46.35	0.54 above ground RB monument 1
1.1	401	1675.18	1534.44	46.41	5.40	2	6.00	257.31	0.00	45.81	base RB monument 1
1.1	402	1679.46	1530.03	44.86	5.40	2	5.46	251.30	-1.30	44.80	backwater r.e. / slough
1.1	403	1684.18	1524.41	44.53	5.40	2	5.46	244.04	-2.34	44.47	middle of backwater
1.1	404	1689.76	1517.78	44.91	5.40	2	5.46	235.46	-3.57	44.85	l.e. backwater
1.1	405	1691.89	1516.25	45.78	5.40	2	5.46	233.03	-4.57	45.72	cobble
1.1	406	1708.02	1500.92	45.60	5.40	2	5.46	211.49	-10.15	45.54	r.e.w. main chanel, pws 18:08
1.1	407	1732.93	1472.90	44.85	5.40	2	5.46	174.54	-16.49	44.79	stream bed
1.1	408	1745.07	1458.49	44.05	5.40	2	5.46	155.89	-19.17	43.99	deeper streambed, begin drop off
1.1	409	1754.57	1450.29	42.80	5.40	2	5.46	143.91	####	42.74	really deep streambed
1.1	423	1811.21	1316.03	50.36	5.40	2	7.41	0.00	0.00	48.35	base of LB m #1
1.1	423	1811.21	1316.03	50.36	5.40	2	7.06	0.00	0.00	48.70	LB m 1, 3" lag bolt, DS side of spruce .35 abv grnd
1.1	424	1810.54	1316.30	46.24	5.40	2	5.46	0.58	0.43	46.18	pws @ 18:34, l.e.w.
1.1	425	1810.35	1316.75	43.73	5.40	2	5.46	1.07	0.35	43.67	base of bank, steep rock wall
1.1	426	1808.69	1316.44	47.78	5.40	2	5.46	1.68	1.92	47.72	bank full
2.1	382	1990.05	1315.09	43.02							LEFT (UPSTREAM) CORNER FOR ROTATION
2.1	390	1728.90	1587.14								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
2.1	382	1990.05	1315.09	48.48	5.40	2	5.46	0.00	0.00	48.42	LB mon 2, .26 ft above grnd
2.1	382	1990.05	1315.09	48.48	5.40	2	5.72	0.00	0.00	48.16	base of monument
2.1	383	2006.17	1302.09	49.07	5.40	2	5.96	-20.54	-2.63	48.51	base LB mon 2 bolt in 6" spruce tree DS side
2.1	383	2006.17	1302.09	49.07	5.40	2	5.46	-20.54	-2.63	49.01	LB mon 2 bolt in 6" spruce tree DS side .5 ft abv base
2.1	384	1978.93	1326.49	46.81	5.40	2	5.46	15.92	0.13	46.75	top of terrace, bank full
2.1	385	1978.47	1327.23	46.28	5.40	2	5.46	16.78	-0.05	46.22	pws, lew @ 17.49
2.1	386	1977.79	1328.24	44.94	5.40	2	5.46	17.98	-0.26	44.88	base of bank streambed
2.1	387	1967.36	1343.51	42.84	5.40	2	5.46	36.22	-3.31	42.78	streambed, middle of channel
2.1	388	1952.93	1363.05	43.62	5.40	2	5.46	60.30	-6.43	43.56	deeper top of bar
2.1	389	1941.50	1376.78	42.61	5.40	2	5.46	78.13	-7.70	42.55	deep, streambed
2.1	390	1728.90	1587.14	47.58	5.40	2	5.46	377.11	0.00	47.52	top of RB mon 2, .5 ft above grnd
2.1	390	1728.90	1587.14	47.58	5.40	2	5.96	377.11	0.00	47.02	base of RB mon 2
2.1	391	1731.77	1585.38	45.97	5.40	2	5.46	373.85	-0.85	45.91	slope change
2.1	392	1735.55	1581.69	45.14	5.40	2	5.46	368.57	-1.02	45.08	low pt. w/ backwater
2.1	393	1742.03	1576.03	46.74	5.40	2	5.46	360.00	-1.78	46.68	vegetation line
2.1	394	1758.24	1559.21	45.81	5.40	2	5.46	336.64	-1.82	45.75	r.e.w. pws @ 17.57
2.1	395	1784.89	1533.20	44.75	5.40	2	5.46	299.42	-3.04	44.69	streambed
2.1	396	1801.90	1517.55	44.24	5.40	2	5.46	276.35	-4.47	44.18	streambed deeper
2.1	397	1813.56	1506.63	43.33	5.40	2	5.46	260.40	-5.32	43.27	
2.1	419	1979.36	1407.08	46.18	5.40	2	5.46	73.77	####	46.12	edge water, base island
2.1	420	1978.92	1406.21	44.70	5.40	2	5.46	73.44	####	44.64	base of bank
2.1	421	2008.03	1337.39	46.37	5.40	2	5.46	3.64	-28.41	46.31	l.e.w. pws @ 18.25
2.1	422	2052.38	1364.95	46.33	5.40	2	5.46	-7.19	####	46.27	l.e.w. further upstream

Surveyed locations of land surface points along each transect at Jim's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
3.1	331	2052.30	1474.07	43.24							LEFT (UPSTREAM) CORNER FOR ROTATION
3.1	314	1807.19	1646.18								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
3.1	314	1807.19	1646.18	47.49	5.35	1	6.09	299.50	0.00	46.75	base mon 2
3.1	314	1807.19	1646.18	47.49	5.35	1	5.42	299.50	0.00	47.42	mon 2, hub .67 above grnd
3.1	315	1814.39	1642.25	46.00	5.35	1	5.42	291.35	-0.92	45.93	r.e.w. pws @ 15:00
3.1	316	1829.21	1631.25	44.47	5.35	1	5.42	272.90	-0.44	44.40	stream channel
3.1	317	1841.31	1623.16	43.84	5.35	1	5.42	258.35	-0.77	43.77	break in slope
3.1	318	1847.54	1619.51	44.80	5.35	1	5.42	251.15	-1.36	44.73	top of submerged bar
3.1	319	1855.03	1614.23	44.84	5.35	1	5.42	241.99	-1.34	44.77	top of bar
3.1	320	1869.91	1603.42	44.22	5.35	1	5.42	223.60	-1.05	44.15	deeper streambed
3.1	321	1875.08	1599.92	43.78	5.35	1	5.42	217.36	-1.15	43.71	
3.1	331	2052.30	1474.07	48.66	5.35	1	5.42	0.00	0.00	48.59	RB
3.1	333	2040.55	1479.90	48.02	5.35	1	5.76	12.97	1.98	47.61	base LB mon
3.1	333	2040.55	1479.90	48.02	5.35	1	5.42	12.97	1.98	47.95	top LB mon, 10 ft strwrd of steel rod, .34 abv grnd
3.1	334	2036.45	1482.40	46.36	5.35	1	5.42	17.76	2.29	46.29	
3.1	335	2038.28	1481.91	46.97	5.35	1	5.42	15.98	1.64	46.90	l.e.w. main channel pws @ 15:55
3.1	336	2032.24	1483.47	44.66	5.35	1	5.42	21.82	3.83	44.59	bank full
3.1	337	2027.87	1485.70	42.23	5.35	1	5.42	26.68	4.52	42.16	base of bank
3.1	398	2085.15	1463.16	44.93	5.40	2	4.46	-33.15	-9.95	45.87	r.e.w. o.c. base bank
3.1	399	2085.07	1463.12	45.43	5.40	2	4.46	-33.11	-9.87	46.37	r.e.w. pws @ 18:02
3.1	400	2052.33	1474.19	48.59	5.40	2	5.46	0.04	-0.12	48.53	top of rod, r.m. .15 above grnd
3.1	400	2052.33	1474.19	48.59	5.40	2	5.61	0.04	-0.12	48.38	base of rod, r.m.
3.1	414	2160.89	1436.70	46.28	5.40	2	5.46	-110.34	-31.82	46.22	l.e.w. pws 18:18
3.1	415	2155.62	1438.32	45.07	5.40	2	5.46	-105.10	-30.12	45.01	base of bank
3.1	416	2142.38	1442.95	44.00	5.40	2	5.46	-91.60	####	43.94	stream channel
3.1	417	2128.02	1447.98	43.50	5.40	2	5.46	-76.96	-22.16	43.44	stream channel
3.1	418	2111.78	1453.99	44.96	5.40	2	5.46	-60.22	-17.75	44.90	r.e.w. stream channel
4.1	302	2099.29	1565.74	44.03							LEFT (UPSTREAM) CORNER FOR ROTATION
4.1	287	1765.50	1817.93								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
4.1	287	1765.50	1817.93	50.10	5.35	1	5.71	418.35	0.00	49.74	base of hub
4.1	287	1765.50	1817.93	50.10	5.35	1	5.41	418.35	0.00	50.04	hub is .3 above grnd, top of hub
4.1	288	1767.41	1814.76	48.85	5.35	1	5.41	414.91	1.38	48.79	edge of terrace
4.1	289	1769.25	1812.74	45.39	5.35	1	5.41	412.23	1.88	45.33	top of bank
4.1	290	1769.59	1812.10	44.91	5.35	1	5.41	411.57	2.19	44.85	pws @ 14:20
4.1	291	1770.37	1812.01	45.21	5.35	1	7.00	410.89	1.79	43.56	thalweg of overflow channel, #1
4.1	292	1775.08	1807.78	46.50	5.35	1	7.00	404.59	2.32	44.85	l.e.w. over channel #1
4.1	293	1795.93	1779.09	47.05	5.35	1	5.42	370.66	12.65	46.98	top of bar
4.1	294	1813.07	1755.08	46.62	5.35	1	5.42	342.51	21.47	46.55	r.e.w. over channel #2
4.1	295	1838.40	1739.63	46.67	5.35	1	5.42	312.98	18.53	46.60	l.e.w. over channel #2
4.1	296	1848.72	1732.88	46.87	5.35	1	5.42	300.68	17.69	46.80	center bar, 14:25
4.1	297	1862.81	1724.37	46.53	5.35	1	5.42	284.31	15.99	46.46	pws r.e.w @ 14:25
4.1	298	1893.76	1705.74	44.92	5.35	1	5.42	248.38	12.20	44.85	streambed

Surveyed locations of land surface points along each transect at Jim's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
4.1	299	1908.74	1696.94	44.45	5.35	1	5.42	231.13	10.19	44.38	streambed, deeper
4.1	300	2088.71	1569.05	49.04	5.35	1	5.42	10.44	3.74	48.97	top of island
4.1	301	2101.18	1564.55	49.65	5.35	1	5.42	-2.23	-0.19	49.58	3 in lag bolt, in spruce, 10 ft inland
4.1	302	2099.29	1565.74	49.45	5.35	1	5.42	0.00	0.00	49.38	top of LB mon 4, .5 ft high
4.1	302	2099.29	1565.74	49.45	5.35	1	5.92	0.00	0.00	48.88	base of LB mon 4,
4.1	303	2085.16	1569.04	46.88	5.35	1	5.42	13.26	5.88	46.81	bank full
4.1	304	2084.83	1568.58	46.56	5.35	1	5.42	13.25	6.45	46.49	l.e.w main channel, pws @ 14:34
4.1	305	2083.57	1568.95	42.38	5.35	1	5.42	14.48	6.92	42.31	streambed, base of bank
4.1	309	2119.30	1552.70	46.31	5.35	1	5.42	-23.83	-1.66	46.24	r.e.w. pws @ 14:42
4.1	310	2117.85	1553.27	47.28	5.35	1	5.42	-22.33	-1.24	47.21	top of island
4.1	311	2119.65	1553.05	45.30	5.35	1	5.42	-23.89	-2.15	45.23	base of bank, r.e.w.
4.1	312	2139.58	1542.20	43.61	5.35	1	5.42	-46.34	-5.51	43.54	thalweg of channel
4.1	313	2155.19	1522.79	42.18	5.35	1	5.42	-70.49	0.57	42.11	streambed, deeper
4.1	339	2180.04	1476.37	48.48	5.35	1	5.82	-118.30	22.63	48.01	base of mon
4.1	339	2180.04	1476.37	48.48	5.35	1	5.42	-118.30	22.63	48.41	stake .4 above grnd, top of mon
4.1	340	2178.74	1477.37	47.61	5.35	1	5.42	-116.66	22.61	47.54	top of floodplain
4.1	341	2178.18	1477.79	46.82	5.35	1	5.42	-115.96	22.62	46.75	bank full
4.1	342	2178.17	1477.87	46.41	5.35	1	5.42	-115.91	22.56	46.34	l.e.w. @ overflow channel, 16:03
4.1	343	2177.89	1478.26	45.85	5.35	1	5.42	-115.45	22.42	45.78	base of bank, streambed
4.1	344	2168.97	1487.80	43.38	5.35	1	5.42	-102.58	20.18	43.31	stream channel
4.1	345	2163.88	1493.75	43.17	5.35	1	5.42	-94.93	18.50	43.10	stream channel
4.1	346	2203.55	1460.03	52.46	5.35	1	7.19	-146.91	21.49	50.62	r.m. LB left channel, nail in dead spruce
4.1	346	2203.55	1460.03	52.46	5.35	1	4.42	-146.91	21.49	53.39	r.m. LB left chan, nail in dead spruce 2.77 above grnd
4.1	347	2191.97	1466.09	45.99	5.35	1	5.42	-134.02	23.64	45.92	base of bank (below tree)
4.1	348	2163.02	1459.55	46.36	5.35	1	5.42	-114.86	46.31	46.29	l.e.w. of far LB, downstrm xs4, pws 16:12
5.1	280	2161.51	1696.19	44.34							LEFT (UPSTREAM) CORNER FOR ROTATION
5.1	264	1925.88	1891.99								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
5.1	264	1925.88	1891.99	50.34	5.35	1	5.41	306.36	0.00	50.28	.78 hub above grnd, top of hub
5.1	264	1925.88	1891.99	50.34	5.35	1	6.19	306.36	0.00	49.50	base of hub
5.1	265	1928.96	1889.65	47.08	5.35	1	5.41	302.50	-0.17	47.02	top of bank
5.1	266	1929.00	1889.60	46.88	5.35	1	5.41	302.44	-0.16	46.82	r.e.w. pws @ 13.53
5.1	267	1929.01	1889.66	45.76	5.35	1	5.41	302.47	-0.21	45.70	base of bank, undercut 1 ft
5.1	268	1942.45	1878.68	45.75	5.35	1	5.41	285.11	-0.35	45.69	streambed
5.1	269	1954.87	1867.94	44.55	5.35	1	5.41	268.70	-0.03	44.49	streambed deeper
5.1	280	2161.51	1696.19	49.75	5.35	1	5.42	0.00	0.00	49.68	top of LB mon 5, 3 ft inland, .5 ft abv grnd
5.1	280	2161.51	1696.19	49.75	5.35	1	5.92	0.00	0.00	49.18	base of LB mon 5, 3 ft inland
5.1	281	2179.23	1685.26	50.13	5.35	1	5.41	-20.61	-2.92	50.07	lagblt in root, dwnstrm of spruce, grnd elev
5.1	282	2159.88	1696.84	48.71	5.35	1	5.41	1.67	0.54	48.65	just above l.e.w.
5.1	283	2158.18	1697.11	47.09	5.35	1	5.41	3.15	1.42	47.03	bank full
5.1	284	2157.78	1696.22	45.55	5.35	1	4.42	2.89	2.36	46.48	pws @ 14:13
5.1	285	2157.75	1696.98	44.69	5.35	1	5.42	3.40	1.80	44.62	base of bank
5.1	286	2155.58	1699.87	44.24	5.35	1	5.41	6.91	0.96	44.18	channel

Surveyed locations of land surface points along each transect at Jim's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
6.1	271	2216.26	1770.69	44.95							LEFT (UPSTREAM) CORNER FOR ROTATION
6.1	251	2008.58	1994.90								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
6.1	175	2000.00	2000.00	50.00	5.35	1	5.35	315.19	2.83	50.00	RM1
6.1	175	2000.00	2000.00	50.00	5.35	1	5.85	315.19	2.83	49.50	base RM1, hub ht is assumed 0.5'
6.1	248	2011.24	1991.12	47.06	5.35	1	5.41	301.04	0.62	47.00	pws @ 13:34
6.1	249	2016.74	1988.08	45.74	5.35	1	5.41	295.07	-1.35	45.68	gradual slope
6.1	250	2023.21	1983.94	44.37	5.35	1	5.41	287.63	-3.29	44.31	streambed, deeper
6.1	251	2008.58	1994.90	48.23	5.35	1	5.41	305.62	0.00	48.17	top of bank, near sign, top of terrace 4 ft
6.1	270	2232.93	1754.07	50.48	5.35	1	5.22	-23.52	-0.94	50.61	base LB r.m. 6, strmwrd of spruce
6.1	270	2232.93	1754.07	50.48	5.35	1	4.92	-23.52	-0.94	50.91	LB r.m. 6, strmwrd of spruce, hub .3 abve grnd
6.1	271	2216.26	1770.69	50.36	5.35	1	5.42	0.00	0.00	50.29	LB mon 6, stake .5 abve grnd
6.1	271	2216.26	1770.69	50.36	5.35	1	5.92	0.00	0.00	49.79	base LB mon 6
6.1	272	2213.94	1773.15	48.23	5.35	1	5.41	3.38	0.03	48.17	top of floodplain
6.1	273	2213.40	1773.91	47.35	5.35	1	5.41	4.31	-0.09	47.29	bank full
6.1	274	2213.35	1773.85	46.83	5.35	1	5.41	4.30	-0.01	46.77	pws @ 14:00, l.e.w.
6.1	275	2212.92	1774.63	45.06	5.35	1	5.41	5.16	-0.23	45.00	base of bank
6.1	276	2211.25	1775.54	43.38	5.35	1	5.41	6.96	0.38	43.32	stream channel, 2 ft from bank
6.1	177	1978.90	2021.14	51.61	5.35	1	5.41	345.04	3.94	51.55	corner of concrete pump pad
6.1	370	1994.37	2013.12	50.52	5.35	1	5.42	328.64	-1.96	50.45	
6.1	371	1962.70	2036.98	50.26	5.35	1	5.42	367.66	5.06	50.19	
7.1	254	2300.92	1845.61	45.11							LEFT (UPSTREAM) CORNER FOR ROTATION
7.1	219	2061.27	2118.68								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
7.1	219	2061.27	2118.68	51.67	5.35	1	5.42	363.32	0.00	51.60	top of hub, hub .70 above grnd
7.1	219	2061.27	2118.68	51.67	5.35	1	6.12	363.32	0.00	50.90	base of hub
7.1	220	2082.14	2098.20	49.35	5.35	1	5.41	334.16	-2.18	49.29	break in slope #1
7.1	221	2086.40	2094.61	48.22	5.35	1	5.41	328.65	-3.01	48.16	break in slope #2
7.1	222	2088.35	2092.97	47.22	5.35	1	5.41	326.13	-3.39	47.16	r.e.w. pws @ 13:16
7.1	223	2088.16	2091.21	45.37	5.35	1	5.41	324.93	-2.09	45.31	streambed
7.1	224	2090.58	2089.03	43.95	5.35	1	5.41	321.70	-2.47	43.89	deeper streambed
7.1	225	2092.25	2087.56	42.58	5.35	1	5.41	319.49	-2.76	42.52	streambed, deeper, mat of logs slipping in
7.1	253	2303.31	1843.89	51.71	5.35	1	6.07	-2.87	-0.66	50.99	base tree, 3 in lagblt in ctnwd tree
7.1	254	2300.92	1845.61	50.52	5.35	1	5.76	0.00	0.00	50.11	base LB mon 7
7.1	253	2303.31	1843.89	51.71	5.35	1	5.42	-2.87	-0.66	51.64	3 in lagblt in ctnwd trees, .65 ft abve grnd
7.1	254	2300.92	1845.61	50.52	5.35	1	5.41	0.00	0.00	50.46	trees 8 ft inlnd, LB mon 7, .35 abve grnd
7.1	255	2297.59	1848.13	48.47	5.35	1	5.41	4.09	0.84	48.41	top of terrace, floodplain
7.1	256	2297.15	1848.29	47.63	5.35	1	5.41	4.50	1.07	47.57	bank full, top of bank
7.1	257	2296.84	1848.21	46.94	5.35	1	5.41	4.65	1.35	46.88	pws @ 13:46
7.1	258	2296.54	1848.10	45.23	5.35	1	5.41	4.76	1.65	45.17	base of bank
7.1	259	2293.34	1851.71	43.74	5.35	1	5.41	9.58	1.67	43.68	streambed
7.1	260	2282.21	1863.81	43.50	5.35	1	5.41	26.02	2.06	43.44	streambed, deeper
7.1	261	2268.62	1878.00	43.63	5.35	1	5.41	45.65	2.91	43.57	streambed, deeper
7.1	262	2280.66	1824.54	46.90	5.35	1	5.41	-2.47	29.13	46.84	X pws @ 13:50, b/w 6 + 7 LB don't plot
7.1	263	2280.67	1824.08	47.21	5.35	1	5.41	-2.82	29.42	47.15	X bank full, b/w 6 + 7 LB don't plot

Surveyed locations of land surface points along each transect at Jim's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
8.1	228	2443.29	1953.45	45.37							LEFT (UPSTREAM) CORNER FOR ROTATION
8.1	472	2153.91	2204.86								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
8.1	214	2153.89	2204.91	51.67	5.35	1	5.42	383.39	-0.02	51.60	top of hub, .45 abve grnd
8.1	214	2153.89	2204.91	51.67	5.35	1	5.87	383.39	-0.02	51.15	base of hub
8.1	215	2161.37	2198.91	50.42	5.35	1	5.41	373.80	-0.40	50.36	top of terrace
8.1	216	2163.27	2196.96	49.00	5.35	1	7.00	371.09	-0.18	47.35	r.e.w. 10 deg pogo, pws @ 13:03
8.1	217	2166.97	2194.46	48.39	5.35	1	10.28	366.66	-0.71	43.46	streambed on R13
8.1	226	2450.00	1946.15	51.54	5.35	1	5.41	-9.85	1.11	51.48	lagbolt in ctnwd upstrm side
8.1	228	2443.29	1953.45	50.78	5.35	1	5.41	0.00	0.00	50.72	top of 2x2 stake, .45 ft above grnd
8.1	228	2443.29	1953.45	50.78	5.35	1	5.86	0.00	0.00	50.27	base of 2x2 stake
8.1	229	2440.38	1956.37	49.15	5.35	1	5.41	4.11	-0.30	49.09	top of floodplain, l.e.w. pws @ 13:23
8.1	230	2439.77	1957.26	47.81	5.35	1	5.41	5.16	-0.57	47.75	bank full
8.1	231	2439.73	1957.21	46.98	5.35	1	5.41	5.15	-0.50	46.92	pws @ 13:23
8.1	232	2439.70	1957.22	46.12	5.35	1	5.41	5.18	-0.49	46.06	base of bank
8.1	233	2436.43	1961.07	44.94	5.35	1	5.41	10.18	-1.25	44.88	thalweg on backside channel
8.1	234	2423.38	1973.95	45.44	5.35	1	5.41	28.47	-2.42	45.38	change in slope
8.1	235	2412.20	1984.47	46.96	5.35	1	5.41	43.81	-3.03	46.90	island, r.e.w. pws @ 13:26
8.1	236	2405.55	1991.26	48.45	5.35	1	5.41	53.29	-3.79	48.39	top of island
8.1	237	2401.75	1994.52	46.85	5.35	1	5.41	58.29	-3.76	46.79	20 ft from main channel, pws @ 13:28
8.1	238	2400.06	1997.02	45.76	5.35	1	5.41	61.21	-4.54	45.70	on small channel thru island
8.1	239	2396.18	2001.92	46.95	5.35	1	5.41	67.35	-5.69	46.89	thalweg in little channel
8.1	240	2394.93	2002.93	47.83	5.35	1	5.41	68.96	-5.64	47.77	r.e.w. of little channel, 13:29
8.1	241	2388.72	2009.80	48.23	5.35	1	5.41	78.15	-6.75	48.17	top of island
8.1	242	2387.86	2010.86	47.00	5.35	1	5.41	79.50	-6.99	46.94	top of island on LB main
8.1	243	2387.75	2010.90	46.79	5.35	1	5.41	79.61	-6.94	46.73	base of bank
8.1	244	2387.52	2010.06	47.36	5.35	1	5.41	79.23	-6.16	47.30	bank full
8.1	245	2382.22	2016.59	46.43	5.35	1	5.41	87.51	-7.61	46.37	streambed
8.1	246	2369.35	2029.29	45.05	5.35	1	5.41	105.56	-8.76	44.99	deeper streambed
8.1	468	2166.85	2199.41	47.54	4.81	3	4.96	369.99	-4.37	47.39	WS elev, RB @ 2018
8.1	469	2167.08	2199.24	44.26	4.81	3	4.96	369.71	-4.39	44.11	bottom of bank, undercut
8.1	470	2166.84	2199.68	48.80	4.81	3	4.96	370.18	-4.57	48.65	land surface, above undercut
8.1	471	2164.77	2200.69	50.40	4.81	3	4.96	372.40	-3.97	50.25	root in top of terrace, stable
8.1	472	2153.91	2204.86	51.59	4.81	3	5.40	383.34	0.00	51.00	base of hub
8.1	472	2153.91	2204.86	51.59	4.81	3	4.96	383.34	0.00	51.44	top of hub, hub .44 abve grnd

Surveyed locations of land surface points along each transect at Jim's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
9.1	452	2507.67	2124.46	44.49							LEFT (UPSTREAM) CORNER FOR ROTATION
9.1	207	2238.93	2303.02								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
9.1	207	2238.93	2303.02	51.01	5.35	1	5.41	322.65	0.00	50.95	top of hub .25 ft above grnd
9.1	207	2238.93	2303.02	51.01	5.35	1	5.66	322.65	0.00	50.70	top of hub .25 ft above grnd
9.1	208	2242.56	2298.77	50.53	5.35	1	5.41	317.28	1.53	50.47	top of terrace
9.1	209	2245.88	2296.79	47.74	5.35	1	5.41	313.42	1.34	47.68	2' strmwrd rew, 12:48, wtr 3.25 deep
9.1	218	2507.77	2124.39	50.00	5.35	1	5.42	-0.12	0.00	49.93	LB mon 9, hub .20 abve grnd
9.1	218	2507.77	2124.39	50.00	5.35	1	5.62	-0.12	0.00	49.73	base LB mon 9
9.1	452	2507.67	2124.46	49.95	4.81	3	4.96	0.00	0.00	49.80	LB mon 9, stake in island, .25 abve grnd
9.1	452	2507.67	2124.46	49.95	4.81	3	5.21	0.00	0.00	49.55	base LB mon 9
9.1	453	2515.77	2118.42	48.28	4.81	3	4.96	-10.09	0.55	48.13	edge of island
9.1	454	2520.74	2115.56	47.52	4.81	3	4.96	-15.81	0.18	47.37	base of channel
9.1	455	2527.83	2110.44	48.12	4.81	3	4.96	-24.55	0.52	47.97	channel
9.1	456	2548.46	2097.72	48.04	4.81	3	4.96	-48.77	-0.30	47.89	channel
9.1	457	2553.89	2093.13	47.81	4.81	3	4.96	-55.84	0.52	47.66	other edge of channel
9.1	458	2559.87	2087.04	48.30	4.81	3	4.96	-64.19	2.28	48.15	top of vegetated island (back slough)
9.1	459	2566.35	2082.11	47.62	4.81	3	4.96	-72.31	2.80	47.47	top of island @ slough's edge (r.e.)
9.1	460	2566.60	2081.79	46.98	4.81	3	4.96	-72.70	2.93	46.83	pws, lew @ 20:04
9.1	461	2568.00	2081.11	45.58	4.81	3	4.96	-74.24	2.72	45.43	base of bank
9.1	462	2573.78	2072.93	44.91	4.81	3	4.96	-83.58	6.33	44.76	thalweg of slough
9.1	463	2595.13	2062.28	48.61	4.81	3	6.96	-107.26	3.39	46.46	base of LB slough
9.1	464	2595.14	2062.09	48.96	4.81	3	6.96	-107.37	3.54	46.81	l.e.w. pws @ 20:07, slough
9.1	465	2595.65	2061.71	50.77	4.81	3	6.96	-108.01	3.58	48.62	top of floodplain
9.1	466	2597.74	2058.96	56.53	4.81	3	10.87	-111.27	4.71	50.47	rm 9, spike in 3" spruce, 4ft shorewrd of slough
10.1	213	2666.83	2203.57	42.96							LEFT (UPSTREAM) CORNER FOR ROTATION
10.1	203	2297.79	2411.04								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
10.1	203	2297.79	2411.04	52.24	5.35	1	5.42	423.36	0.00	52.17	hub .38 above ground
10.1	203	2297.79	2411.04	52.24	5.35	1	5.80	423.36	0.00	51.79	base hub
10.1	213	2666.83	2203.57	48.37	5.35	1	5.42	0.00	0.00	48.30	top of hub, LB .55 ft abve grnd
10.1	213	2666.83	2203.57	48.37	5.35	1	5.97	0.00	0.00	47.75	base of hub, LB
10.1	443	2697.84	2177.79	50.49	4.81	3	4.96	-39.66	7.28	50.34	LB rm 10 nail in birch, strmwrd side 1.6 ft off grnd
10.1	443	2697.84	2177.79	50.49	4.81	3	6.92	-39.66	7.28	48.38	grnd at LB rm 10 nail in birch
10.1	444	2691.38	2186.67	49.57	4.81	3	4.96	-29.68	2.70	49.42	ground surface
10.1	445	2666.30	2200.41	48.46	4.81	3	4.96	-1.09	3.01	48.31	bank full
10.1	446	2666.88	2201.46	47.94	4.81	3	4.96	-1.08	1.81	47.79	l.e.w. pws @ 19:55
10.1	447	2666.75	2203.40	48.33	4.81	3	4.96	-0.01	0.19	48.18	top of hub, .55 abve strmbed, .35 abve wtr
10.1	447	2666.75	2203.40	48.33	4.81	3	5.51	-0.01	0.19	47.63	base of hub
10.1	448	2627.39	2230.82	46.20	4.81	3	4.96	47.73	-4.43	46.05	channel bottom, near woody debris
10.1	449	2616.10	2237.12	47.84	4.81	3	4.96	60.66	-4.38	47.69	log (1 ft diam.) about pws
10.1	450	2581.11	2257.90	44.59	4.81	3	4.96	101.35	-5.35	44.44	deeper streambed

Surveyed locations of land surface points along each transect at Jim's Landing--Continued

Xsec	Block	East	North	Elev	HI	IS	Rod	Dist	Off	Elev	Comments
11.1	432	2871.51	2199.33	44.30							LEFT (UPSTREAM) CORNER FOR ROTATION
11.1	190	2368.59	2519.37								RIGHT (DOWNSTREAM) CORNER FOR ROTATION
11.1	190	2368.59	2519.37	52.06	5.35	1	4.90	596.12	0.00	52.51	RB top of hub, hub .43 abve grnd
11.1	190	2368.59	2519.37	52.06	5.35	1	5.33	596.12	0.00	52.08	RB base of hub,
11.1	191	2627.00	2375.41	50.80	5.35	1	3.60	300.82	-17.28	52.55	mon 11, RB for left chnl, 3.6 abve steel pin
11.1	192	2629.04	2371.43	49.94	5.35	1	5.41	296.96	-15.02	49.88	RB top of island for left channel
11.1	193	2628.95	2370.82	48.38	5.35	1	5.41	296.71	-14.45	48.32	top of bank, far channel, RB
11.1	194	2628.53	2370.59	48.06	5.35	1	5.41	296.94	-14.04	48.00	r.e.w. far channel, pws @ 12:28
11.1	195	2628.79	2370.47	46.67	5.35	1	5.41	296.65	-14.07	46.61	streambed, left channel, RB
11.1	196	2592.09	2404.88	48.96	5.35	1	5.41	346.09	####	48.90	top of island, LB main channel
11.1	197	2591.57	2404.82	48.31	5.35	1	5.41	346.50	####	48.25	bank full, LB main channel
11.1	198	2591.46	2404.71	48.08	5.35	1	5.41	346.53	####	48.02	r.e.w. pws @ 12:31, main channel
11.1	199	2590.83	2404.67	47.47	5.35	1	5.41	347.04	####	47.41	streambed, LB main
11.1	200	2589.43	2404.77	45.19	5.35	1	5.41	348.28	-21.88	45.13	streambed, LB main
11.1	201	2573.72	2414.64	45.88	5.35	1	5.41	366.83	-21.77	45.82	streambed, LB main
11.1	202	2564.11	2421.09	46.11	5.35	1	5.41	378.40	####	46.05	streambed, LB main
11.1	204	2635.97	2366.33	44.81	5.35	1	5.41	288.37	-14.44	44.75	streambed
11.1	205	2629.05	2381.25	51.23	5.35	1	4.42	302.22	-23.31	52.16	bolt in spruce, .5 fr abve grnd
11.1	205	2629.05	2381.25	51.23	5.35	1	4.92	302.22	-23.31	51.66	ground at bolt in spruce
11.1	210	2803.23	2255.54	45.46	5.35	1	5.41	87.78	-10.76	45.40	streambed, 20 ft out
11.1	211	2778.19	2274.62	44.95	5.35	1	5.41	119.15	-13.42	44.89	streambed, deeper
11.1	431	2873.25	2196.96	50.37	4.81	3	4.96	-2.74	1.07	50.22	FLB mon, nail in 2'spruce, 8'shwrd, 1 ft abv grnd
11.1	431	2873.25	2196.96	50.37	4.81	3	5.96	-2.74	1.07	49.22	base FLB mon, nail in 2'spruce
11.1	432	2871.51	2199.33	49.76	4.81	3	4.96	0.00	0.00	49.61	LB mon 11, 2x2 stake .47 abve grnd
11.1	432	2871.51	2199.33	49.76	4.81	3	5.43	0.00	0.00	49.14	base LB mon 11, 2x2 stake
11.1	433	2862.16	2205.60	48.51	4.81	3	4.96	11.25	-0.27	48.36	bank full
11.1	434	2856.58	2209.55	47.96	4.81	3	4.96	18.08	-0.61	47.81	l.e.w. pws @ 19:39
11.1	435	2852.48	2213.27	47.19	4.81	3	4.96	23.54	-1.54	47.04	streambed
11.1	436	2821.43	2236.12	45.89	4.81	3	4.96	62.00	-4.15	45.74	deeper
11.1	437	2404.83	2502.00	52.66	4.81	3	4.96	556.22	-4.80	52.51	top of terrace
11.1	438	2408.95	2499.62	51.70	4.81	3	4.96	551.46	-5.01	51.55	edge of cut bank
11.1	439	2409.72	2499.40	48.23	4.81	3	4.96	550.69	-5.23	48.08	pws @ 19:48 r.e.w.
11.1	440	2410.34	2499.46	46.62	4.81	3	4.96	550.20	-5.62	46.47	base of bank
11.1	441	2412.64	2497.86	45.79	4.81	3	4.96	547.40	-5.50	45.64	streambed
11.1	442	2368.48	2519.24	52.56	4.81	3	4.96	596.14	0.17	52.41	top of stake, RB mon 11

APPENDIX 2

Kenai River Human Use Survey

Field Notes

Kenai River Human Use Survey
Field Notes

Explanation:

AR: arrival time at each site

DP: departure time.

- DP Anchorage on 5/22/98 at 1:30 p.m.
- AR Sportsman's Lodge on 5/22/98 at 4:00 p.m.-- No activity -No vehicles, DP at 5:00p.m.
- AR Jim's Landing on 5/22/98 at 5:20 p.m.-- 1 car, 1 truck, 1 person used facilities, DP at 6:30 p.m.
- AR Jim's Landing on 5/23/98 at 7:30 a.m.-- 3 Inflat. Rafts (Total 13 pass.), 3 used ramp, 3 private, 9 cars, 6 trucks, 3 w/trailer, 6 resting, 7 used facilities, DP at 12:00 p.m.
- AR Sportsman's Lodge on 5/23/98 at 4 p.m.-- 1 truck, 3 camping, DP 8:00 p.m.
- AR Sportsman's Lodge on 5/24/98 at 7 a.m.-- 1 Inflat. Raft (Total 3 pass.), 1drifted by, 1 private, 1 car, 1 truck, 1 RV, 2 w/trailer, 1 picnic, 2 resting, 1 camping, 5 used facilities, DP at 10:30 a.m.
- AR Jim's Landing on 5/24/98 at 11 a.m.-- 13 Inflat. Rafts, 5 Drift Boats, 6 Catarafts (Total 77 pass.), 17 used Ramp, 6 Drifted by, 9 comm., 14 private, 12 cars, 25 trucks, 1 RV, 7 w/trailer, 1 picnic, 4 resting, 15 used facilities, DP at 3:15 p.m.
- AR Jim's Landing on 5/25/98 at 8 a.m.-- 2 Catarafts, 5 drift boats, 3 Inflat. Rafts (Total 41 pass.), 8 used ramp, 2 drifted by, 6 comm., 4 private, 13 cars, 6 trucks, 3 RV, 4 w/trailer, 2 picnic, 5 resting, 10 used facilities, DP at 4 p.m.
- AR Sportsman's Lodge on 5/26/98 at 8 a.m.-- 2 drift boats, 6 Inflat. Raft (Total 46 pass.), 2 used ramp, 6 drifted by, 4 comm., 4 private, 5 cars, 10 trucks, 4 RV, 2 w/trailer, 5 resting, 7 used facilities, DP at 4 p.m.
- AR Sportsman's Lodge on 5/27/96 at 7 a.m.-- 5 Inflat. Rafts (Total 27 pass.), 5 drifted by, 5 comm., 5 cars, 4 trucks, 2 RV, 2 w/trailer, 9 resting, 4 used facilities, DP at 12 p.m.
- AR Sportsman's Lodge on 6/23/98 at 1 p.m.-- 2 Inflat. Rafts (Total 12 pass.), 1 used ramp, 1 drifted by, 1 comm., 1 private, 66 cars, 114 trucks, 70 RV, 11 w/trailer, DP at 5 p.m.
- AR Jim's Landing on 6/24/98 at 8 a.m.-- 1 Cataraft, 11 drift boats, 5 Inflat. Rafts (Total 64 pass.), 14 used ramp, 3 drifted by, 12 comm., 5 private, 24 cars, 49 trucks, 3 RV, 23 w/trailer, 10 fishing, 5 boating, 6 resting, 10 used facilities, DP at 2:30 p.m.
- AR Sportsman's Lodge on 6/24/98 at 2:45 p.m.-- 2 Catarafts, 8 drift boats, 8 Inflat. Rafts (Total 73 pass.), 15 used ramp, 3 drifted by, 5 comm., 13 private, 73 cars, 142 trucks, 72 RV, 22 w/trailer, 150 fishing, 40 resting, DP at 4:15 p.m.
- AR Sportsman's Lodge on 6/24/98 at 6:30 p.m.-- 5 drift boats, 2 Inflat. Rafts (Total 21 pass.), 5 used ramp, 1 drifted by, 3 comm., 3 private, 62 cars, 93 trucks, 50 RV, 16 w/trailer, 95 fishing, 25 resting, DP at 10:30 p.m.
- AR Sportsman's Lodge on 6/25/98 at 9 a.m.-- 7 drift boats 5 Inflat. Rafts (Total 41 pass.), 6 used ramp, 6 drifted by, 7 comm., 5 private, 85 cars, 120 trucks, 79 RV, 17 w/trailer, 90 fishing, 3

boating, 20 resting, DP at 5 p.m.

- AR Jim's Landing on 6/26/98 at 8 a.m.-- 1 Cataraft, 9 drift boats, 11 Inflat. Rafts (Total 97 pass.), 18 used ramp, 4 drifted by, 14 comm., 7 private, 33 cars, 45 trucks, 8 RV, 12 w/trailer, 45 fishing, 7 boating, 2 resting, 1 used facilities, DP at 1:15 p.m.
- AR Sportsman's Lodge on 6/26/98 at 1:30 p.m.-- 2 Catarafts, 9 drift boats, 10 Inflat. Rafts (Total 95 pass.), 15 used ramp, 6 drifted by, 10 comm., 11 private, 60 cars, 120 trucks, 65 RV, 19 w/trailer, 55 fishing, 20 resting, 10 used facilities, DP at 4:00 p.m.
- AR Sportsman's Lodge on 6/26/98 at 8 p.m.-- 5 drift boats, 6 Inflat. Rafts (Total 43 pass.), 9 used ramp, 2 drifted by, 11 private, 33 cars, 57 trucks 29 RV, 8 w/trailer, 50 fishing, 5 picnic, 3 boating, 40 resting, DP at 10:30 p.m.
- AR sportsman's Lodge on 6/27/98 at 7 a.m.-- 2 Catarafts, 21 drift boats, 10 Inflat. Rafts (Total 159 pass.), 26 used ramp, 7 drifted by, 18 comm., 15 private, 153 cars, 200 trucks, 85 RV, 42 w/trailer, 90 fishing, 20 resting, DP at 12 p.m.
- AR Jim's Landing on 6/27/98 at 12:30 p.m.-- 1 Cataraft, 6 drift boats 15 Inflat. Rafts (Total 109 pass.), 20 used ramp, 2 drifted by, 20 comm., 2 private, 25 cars, 25 trucks, 10 RV, 30 w/trailer, 15 fishing, DP at 3:30 p.m.
- AR Jim's Landing on 7/22/98 at 9:15 a.m.-- 3 Catarafts, 6 drift boats, 3 Inflat. Rafts (Total 42 pass.), 8 used ramp, 3 drifted by, 9 comm., 3 private, 14 cars, 13 trucks, 12 RV, 9 w/trailer, 21 fishing, 4 picnic, 31 resting, 10 used facilities, DP at 1:15 p.m.
- AR Sportsman's Lodge on 7/22/98 at 1:30 p.m.-- 2 Catarafts, 7 drift boats, 5 Inflat. Rafts (Total 65 pass.), 8 used ramp, 6 drifted by, 11 comm., 3 private, 19 cars, 16 trucks, 19 RV, 9 w/trailer, 20 fishing, 4 picnic, 4 boating, 16 resting, DP at 5:30 p.m.
- AR Jim's Landing on 7/23/98 at 9:30 a.m.-- 1 Cataraft, 3 drift boats, 4 Inflat. Rafts (Total 28 pass.), 6 used ramp, 2 drifted by, 6 comm., 2 private, 14 cars, 22 trucks, 12 RV, 14 w/trailer, 22 fishing, 3 picnic, 3 boating, 15 resting, 15 used facilities, DP at 1:30 p.m.
- AR Sportsman's Lodge on 7/23/98 at 2 p.m.-- 4 drift boats, 2 Inflat. Rafts (Total 25 pass.), 4 used ramp, 2 drifted by, 3 comm., 3 private, 17 cars, 13 trucks, 14 RV, 8 w/trailer, 9 fishing, 6 picnic, 18 resting, DP at 3 p.m.
- AR Sportsman's Lodge on 7/23/98 at 5 p.m.-- 2 Catarafts, 9 drift boats, 3 Inflat. Rafts (Total 57 pass.), 7 used ramp, 7 drifted by, 7 comm., 7 private, 15 cars, 12 trucks, 8 RV, 4 w/trailer, 5 fishing, 4 picnic, 3 boating, 7 resting, DP at 8 p.m.
- AR Jim's Landing on 7/24/98 at 8 a.m.-- 6 drift boats, 5 Inflat. Rafts (Total 50 pass.), 9 used ramp, 2 drifted by, 7 comm., 4 private, 23 cars, 17 trucks, 18 RV, 10 w/trailer, 12 fishing, 5 picnic, 2 boating, 15 resting, 10 used facilities, DP at 1 p.m.
- AR Sportsman's Lodge on 7/24/98 at 2 p.m.-- 3 Catarafts, 8 drift boats, 3 Inflat. Rafts (Total 46 pass.), 11 used ramp, 3 drifted by, 8 comm., 6 private, 25 cars, 23 trucks, 14 RV, 12 w/trailer, 23 fishing, 2 picnic, 5 boating, 29 resting, DP at 5 p.m.
- AR Jim's Landing on 7/25/98 at 9 a.m.-- 2 Catarafts, 5 drift boats, 6 Inflat. Rafts (total 48 pass.), 6 used ramp, 7 drifted by, 8 comm., 5 private, 34 cars, 38 trucks, 15 RV, 12 w/trailer, 41 fishing, 3 picnic, 6 boating, 34 resting, DP at 1 p.m.
- AR Sportsman's Lodge on 8/17/98 at 2 p.m.-- 2 drift boats, 3 Inflat. Rafts (Total 17 pass.), 1 used

ramp, 4 drifted by, 3 comm., 2 private, 15 cars, 25 trucks, 11 RV, 9 w/trailer, 66 fishing, 2 picnic, 2 boating, 44 resting, DP at 4:30 p.m.

- AR Jim's Landing on 8/17/98 at 4:45 p.m.-- 2 Catarafts, 4 drift boats, 4 Inflat. Rafts (Total 43 pass.), 10 used ramp, 8 comm., 2 private, 4 cars, 6 trucks, 1 RV, 8 w/trailer, 10 fishing, 14 resting, 13 used facilities, DP at 6:45 p.m.
- AR Jim's Landing on 8/18/98 at 8 a.m.-- 4 drift boats, 2 Inflat. Rafts (Total 18 pass.), 3 used ramp, 3 drifted by, 3 comm., 3 private, 10 cars, 8 trucks, 4 RV, 5 w/trailer, 7 fishing, 3 picnic, 16 resting, 3 used facilities, DP at 12 p.m.
- AR Sportsman's Lodge on 8/18/98 at 12:30 p.m.-- 1 Cataraft, 6 drift boats, 6 Inflat. Rafts (Total 49 pass.), 8 used ramp, 5 drifted by, 8 comm., 5 private, 33 cars, 27 trucks, 17 RV, 13 w/trailer, 37 fishing, 8 picnic, 72 resting, DP at 4:30 p.m.
- AR Jim's Landing on 8/19/98 at 12:30 p.m.-- 4 Catarafts, 11 drift boats, 8 Inflat. Rafts (Total 102 pass.), 18 used ramp, 4 drifted by, 14 comm., 8 private, 15 cars, 14 trucks, 5 RV, 16 w/trailer, 27 fishing, 7 picnic, 11 resting, 12 used facilities, DP at 4:30 p.m.
- AR Sportsman's Lodge on 8/19/98 at 4:40 p.m.-- 5 Catarafts, 9 drift boats, 10 Inflat. Rafts (Total 95 pass.), 18 used ramp, 6 drifted by, 15 comm., 9 private, 31 cars, 31 trucks, 17 w/trailer, 35 fishing, 5 picnic, 45 resting, DP at 8:40 p.m.
- AR Sportsman's Lodge on 8/20/98 at 9 a.m.-- 1 Cataraft, 2 drift boats, 6 Inflat. Rafts (Total 41 pass.), 4 used ramp, 5 drifted by, 6 comm., 3 private, 13 cars, 16 trucks, 10 RV, 7 w/trailer, 18 fishing, 3 picnic, 60 resting, DP at 12 p.m.
- AR Jim's Landing on 8/20/98 at 12:10 p.m.-- 11 drift boats, 6 Inflat. Rafts (Total 74 pass.), 14 used ramp, 3 drifted by, 14 comm., 3 private, 9 cars, 11 trucks, 3 RV, 17 w/trailer, 22 fishing, 25 resting, 20 used facilities, DP at 5:10 p.m.
- AR Jim's Landing on 8/21/98 at 7 a.m.-- 1 Inflat. Raft (Total 4 pass.), 1 used ramp, 1 comm., 4 cars, 1 truck, 2 RV, 5 w/trailer, 5 fishing, 1 resting, DP at 11 a.m.
- AR Sportsman's Lodge on 8/21/98 at 11:10 a.m.-- 3 Catarafts, 3 drift boats, 5 Inflat. Rafts (Total 65 pass.), 6 used ramp, 5 drifted by, 7 comm., 4 private, 9 cars, 19 trucks, 7 RV, 7 w/trailer, 15 fishing, 21 resting, DP at 12:30 p.m.
- AR Sportsman's Lodge on 9/4/98 at 3:30 p.m.-- 3 drift boats, 1 Inflat. Raft (Total 15 pass.), 3 used ramp, 1 drifted by, 4 private, 9 cars, 9 trucks, 3 RV, 10 w/trailer, 12 fishing, 4 picnic, 5 resting, 5 used facilities, DP at 5:30 p.m.
- AR Jim's Landing on 9/4/98 at 5:40 p.m.-- 5 drift boats, 4 Inflat. Rafts (Total 41 Pass.), 9 used ramp, 8 comm., 1 private, 5 cars, 6 trucks, 2 RV, 13 w/trailer, 3 fishing, 3 resting, 10 used facilities, DP at 8:15 p.m.
- AR Jim's Landing on 9/5/98 at 8:15 a.m.-- 8 drift boats, 2 Inflat. Rafts (Total 37 pass.), 4 used ramp, 5 drifted by, 6 comm., 3 private, 11 cars, 20 trucks, 3 RV, 12 w/trailer, 5 fishing, 5 resting, 6 used facilities, DP at 12:15 p.m.
- AR Sportsman's Lodge on 9/5/98 at 12:30 p.m.-- 3 Catarafts, 8 drift boats, 12 Inflat. Rafts (Total 70 pass.), 13 used ramp, 10 drifted by, 6 comm., 17 private, 22 cars, 35 trucks, 11 RV, 24 w/trailer, 40 fishing, 10 resting, 10 used facilities, DP at 4:30 p.m.
- AR Sportsman's Lodge on 9/6/98 at 12:30 p.m.-- 3 Catarafts, 17 drift boats, 16 Inflat. Rafts

(Total 119 pass.), 19 used ramp, 17 drifted by, 16 comm., 20 private, 19 cars, 39 trucks, 15 RV, 24 w/trailer, 44 fishing, 30 resting, 10 used facilities, DP at 4 p.m.

- AR Jim's Landing on 9/6/98 at 4:15 p.m.-- 7 Catarafts, 24 drift boats, 20 Inflat. Rafts (Total 206 pass.), 49 used ramp, 2 drifted by, 33 comm., 18 private, 38 cars, 52 trucks, 10 RV, 52 w/trailer, 22 fishing, 2 picnic, 23 resting, 29 used facilities, DP at 8:45 p.m.
- AR Jim's Landing on 9/7/98 at 7 a.m.-- 2 Catarafts, 5 drift boats, 2 Inflat. Rafts (Total 48 pass.), 7 used ramp, 2 drifted by, 5 comm., 4 private, 16 cars, 37 trucks, 7 RV, 18 w/trailer, 20 fishing, 24 resting, 18 used facilities, DP at 12:30 p.m.
- AR Sportsman's Lodge on 9/7/98 at 12:45 p.m.-- 2 Catarafts, 4 drift boats (Total 17 pass.), 5 used ramp, 1 drifted by, 2 comm., 4 private, 13 cars, 21 trucks, 13 RV, 14 w/trailer, 13 fishing, 5 picnic, 10 resting, 7 used facilities, DP at 1:45 p.m.
- AR Sportsman's Lodge on 9/7/98 at 2:15 p.m.-- 4 Catarafts, 4 drift boats, 3 Inflat. Rafts (Total 45 pass.), 6 used ramp, 5 drifted by, 5 comm., 6 private, 17 cars, 13 trucks, 16 RV, 9 w/trailer, 25 fishing, 13 resting, 14 used facilities, DP at 3:45 p.m.
- AR Jim's Landing on 9/8/98 at 10 a.m.-- 2 Cataraft, 3 drift boats, 3 Inflat. Raft (Total 38 pass.), 5 used ramp, 3 drifted by, 6 comm., 2 private, 22 cars, 28 trucks, 7 RV, 19 w/trailer, 7 fishing, 13 resting, 17 used facilities, DP at 12 p.m.
- AR Sportsman's Lodge on 9/8/98 at 12:15 p.m.-- 1 Cataraft, 3 drift boats, 1 Inflat. Raft (Total 20 pass.), 2 used ramp, 3 drifted by, 3 comm., 2 private, 15 cars, 25 trucks, 10 RV, 15 w/trailer, 10 fishing, 3 picnic, 15 resting, 20 used facilities, DP at 2:15 p.m. LAST DAY!