State of Alaska
Department of Fish and Game
Nomination for Waters
Important to Anadromous Fish

Region: SOUTHEAST ⬇ | USGS Quad: Juneau A-1

Anadromous Water Catalog Number of Waterway: 111-40-10820 ~~111-50-10670~~

Name of Waterway: Nevada Creek | ☒ USGS Name | ☐ Local Name

☒ Addition ☐ Deletion ☐ Correction ☐ Backup Information

Ok LLT 1/25/2000

For Office Use

Nomination #	99 001	Regional Supervisor	Date 3-27-98
Revision Year:	00		
Revision to:	Atlas ____ Catalog ____	AWC Project Biologist	Date 11/3/99
	Both X		
Revision Code:	A-2 E-9	Drafted	Date

OBSERVATION INFORMATION

Species	Date(s) Observed	Spawning	Rearing	Present	Anadromous
ink salmon	August to Sept. 1996	Yes		170 peak	☒
Chum	July to October 1996	Yes		32 peak	☒
Coho	1-Oct-96	Yes		1	☒
					☐
					☐

IMPORTANT: Provide all supporting documentation that this water body is important for the spawning, rearing or migration of anadromous fish, including: number of fish and life stages observed; sampling methods, sampling duration and area sampled; copies of field notes; etc. Attach a copy of a map showing location of mouth and observed upper extent of each species, as well as other information such as: specific stream reaches observed as spawning or rearing habitat; locations, types, and heights of any barriers; etc.

Comments: CH2M Hill report attached.

ALASKA DEPT. OF FISH & GAME
APR 01 1998
REGION II
HABITAT AND RESTORATION DIVISION

Name of Observer (please print): Clayton Hawkes for CH2M Hill

Date: 9 to 11/1996 Signature: _____

Address: ADF&G Habitat and Restoration Division

Box 240020 Douglas 99824

This certifies that in my best professional judgment and belief the above information is evidence that this waterbody should be included in or deleted from the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes per AS 16.05.870.

Signature of Area Biologist: Clayton R. Hawkes III

Revision 11/96

Technical Memorandum

Task 12.3 Fresh Water Aquatics

Nevada Creek Surveys

AJ Mine Project
Juneau, Alaska

Prepared for

U.S. Environmental Protection Agency
Region 10

DECEMBER 1996

CH2M HILL

AJ Mine Project

Task 12.3, Fresh Water Aquatics

Nevada Creek Surveys

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DATE: December 3, 1996

Introduction

The dry tailings disposal option of the AJ Mine Project Supplemental Environmental Impact Statement (SEIS) would place a tailings filtration facility and tailings disposal pile adjacent to Nevada Creek on Douglas Island (Figure 1). Stormwater runoff from these facilities has the potential to affect the creek flow and water quality.

A reconnaissance survey was conducted along the lower 1.0 mile of Nevada Creek in September 1995 by CH2M HILL staff to identify information needs and to characterize the setting. A brief report describing Nevada Creek was submitted to the Environmental Protection Agency (EPA) and the Alaska Department of Fish and Game (ADFG) for review in December 1995. Based on the review comments for that report, it was determined that additional resource characterization of Nevada Creek was necessary. This technical memorandum documents the methods and results of the additional characterization effort.

This survey program had five components: a physical habitat inventory, a fish use survey, a macroinvertebrate inventory, an adult salmon spawner survey, and water quality sampling. The methods used to characterize the aquatic resources at Nevada Creek are not intended to establish a baseline for all factors for future monitoring. It is assumed that, if this option becomes a component of the preferred alternative, a more comprehensive baseline assessment will be made prior to project startup.

Methods

Physical Habitat Survey

Physical habitat survey was conducted by CH2M HILL staff on August 21, 1996. The survey methology followed protocols developed over the years by CH2M HILL fisheries

biologists. The protocols used in the existing physical habitat survey provide information that could subsequently be used for assessing potential impacts on the physical and some of the biological characteristics of the stream environment. These methods are generally equivalent to a U.S. Forest Service Level 4 survey. The methods used are equivalent to or quantitatively exceed those described in the *EPA Rapid Bioassessment Protocols for use in Streams and Rivers* (EPA, 1989). A complete description of CH2M HILL physical habitat survey methods is given in Appendix A.

Fish Use Survey

The survey of fish use was conducted on August 20, 1996, with electrofishing gear. A permit for the electrofishing was obtained from ADFG. Because a population estimate was not proposed, block nets and multiple-pass methods were not employed. As stipulated in the permit, no electrofishing was conducted in the presence or vicinity of salmon spawners. The areas covered included about half of the reach between tide water and the impassable cascade (the distance covered was about 50 yards in length), and a reach of about 100 yards in length just above the cascades. The types of habitat fished included pools, runs, pocket water, riffles, and the lower gradient areas of rapids. No cascades were fished for safety reasons and because of the low probability of capturing fish there.

Stunned fish were collected with a dipnet and transferred to a 5-gallon bucket. When a half-dozen or more fish had accumulated in the bucket, they were anesthetized with MS-222 (tricane methanesulfonate) and processed. Processing consisted of identification and length measurement. The fish were then immediately returned to backwater or pool areas of the stream via net transfer. The MS-222 solution was then discarded well away from the stream.

Macroinvertebrate Survey

Macroinvertebrates were sampled in riffle areas within rapid habitat units because of the lack of discrete riffle units. A 1.0-m^2 area was disturbed ahead of a 1.0-m-wide kick net for each sample. All of the substrate particles (mostly cobble and large gravel) were either kicked over or turned over by hand. The contents of the net were carefully concentrated and delivered into 500-mL jars containing 10 percent formalin. Three days later, the contents were washed with clean fresh water and then placed in 70 percent isopropyl alcohol for later processing.

The samples were processed by the CH2M HILL laboratory in Milwaukee. Macroinvertebrates were identified to the family level and enumerated. The level of treatment is equivalent to EPA Rapid Bioassessment Protocol II for macroinvertebrates, except that a Coarse Particulate Organic Matter (CPOM) sample was not taken because none could be found. The stream is swift, and the amount of slow water where organic materials might accumulate is sparse. Shredders were probably well represented in the samples taken in the riffle areas, however. There were many fir and hemlock needles embedded under the cobbles and small boulders where the samples were taken, and these represented the only organic material accumulations seen.

Spawner Survey

Adult salmon spawner surveys were conducted on a weekly basis on 11 occasions from July 14 to October 1, 1996. During the first trip, a base map was sketched of the reach

accessible to salmon (up to the cascades). On subsequent trips, the number and position of live and dead salmon were noted on the map/data sheets. Notes were taken regarding bear activity. The carcasses of dead salmon were removed from the stream channel area on each trip so that no double counts could be made. Other information taken included weather, stream temperature, water clarity, and estimated discharge.

Water Quality Sampling

A water quality sample was taken from Nevada Creek for total metals, dissolved metals, various common cations and anions, pH, specific conductance, total suspended solids, total dissolved solids, and turbidity. The sample that was submitted for dissolved metals analysis was filtered with a 0.45-micron disposable filter. The sample was analyzed by Columbia Analytical Services, Inc., in Anchorage. Matrix spikes and matrix spike duplicates were run on the total metals parameters. The full list of parameters and detection limits is presented in the Results Section.

Results

Physical Habitat Survey

Nevada Creek is a small second-order stream on the north side of Douglas Island. The creek originates on the east side of McDonough Peak and flows generally north for about 2.0 miles to discharge into Gastineau Channel adjacent to Dupont. There is one unnamed tributary that joins with Nevada Creek about 1.0 mile upstream from the mouth. The watershed is mountainous, which is typical for the area, and appears to be relatively undisturbed. The reaches examined in this survey were covered by mature forest and successional timber.

Gradient

A previous reconnaissance survey revealed two distinct reaches by gradient below the unnamed tributary. The first 0.5 mile below the tributary is fairly steep, with an average gradient of about 9.5 percent slope. This reach is characterized by nearly continuous high-gradient rapids. The channel is incised about 100 to 200 feet in a steep-walled gorge. The lower 0.5 mile (the area that would be adjacent to the tailings processing facility) has a lower gradient.

Nevada Creek is a moderate- to high-gradient stream in the 0.5-mile reach surveyed (the lower 0.5 mile of the creek) averaging about 5.7 percent slope. The overall gradient of the system from the headwaters to the mouth is 17 percent. In general, the channel is well confined by hill slopes, with little or no floodplain. The surveyed reach is mostly incised about 10 to 12 feet. A series of bedrock cascades about 500 feet upstream from tide water defines the upper limit of anadromous salmonid use. The gradient in the anadromous zone averages about 4.5 percent. The tide water reach is a delta of gravel and small cobble. The channel splits just below the high tide mark into two channels of unequal size. The proportion of flow in these two distributary channels is not consistent over time. In September 1995 the eastern channel conveyed about 65 percent of the flow, whereas in August 1996 the western channel conveyed about 65 percent of the flow.

Habitat Unit Types

The habitat in the survey reach can be described as mostly rapids with a scattering of small but high-quality pools and an abundance of cascades. Overall, 66 percent of the stream's surface area was found to be either rapids or cascade (Table 1, Figure 2). Pools, which constitute about 22 percent of the available area, are formed mostly by channel constriction/bedrock, boulders, or, to a lesser extent, large woody debris (LWD). The pool quality was found to be generally very good with a pool quality index average of 4.6 out of a possible 5.0. There are a few large, deep plunge pools that provide excellent habitat. Glides, riffles and runs are generally scarce. Most of these types of habitat are found as subunits of rapids. Pocket water, which is coded as "boulder rapids," would be an example of a type of rapids that provides a complex of microhabitat types in a mesohabitat unit classification system. Cascades are common and form partial and complete blockages to anadromous fish in the lower reaches. The pool/riffle ratio was calculated to be 1:3.5.

There are three distinct reaches by habitat function within the surveyed area: the intertidal area, the short reach upstream to the impassable cascades, and the reach above the cascades. The habitat in the two distributary channels in the delta is almost entirely riffle. At low tide, the lengths of these two channels are about 400 and 300 feet long for the larger and smaller channels, respectively. There is a high-quality pool at the head of tide water that serves as a staging area for fish moving upstream. The reach between tide water and the impassable cascades (about 400 feet) is a complex of rapids, riffles, and small pools. Above the impassable cascades, rapids become increasingly more dominant as the gradient increases slightly. Plunge pools and cascades become more common.

Substrate Composition

Substrate composition in this relatively high-gradient system is skewed towards boulder-sized materials (Figure 3). The rapids are mostly boulder (36 percent) and cobble (26 percent) and have the appearance of good food-producing areas. The cascades are mostly over bedrock. All habitat types including pools and glides have a very low proportion of sand and silt/organic material. Gravels are generally embedded to a low degree. There are an estimated 48 yd^2 of spawning gravel in the reach between tide water and the barrier. Most of the available spawning areas are in the tail-outs of the small pools and not in riffles. The intertidal reach has abundant clean spawning gravels, an estimated 136 yd^2 between the +4- and +12-foot tide elevations. Gravel deposits upstream from the cascade barrier appear to be entirely adequate for the presumed population density, based on rearing habitat for cutthroat trout (*Oncorhynchus clarki*) and Dolly Varden char (*Salvelinus malma*).

Riparian Community. The riparian community along Nevada Creek for the approximately 0.5-mile reach surveyed is dominated by mature, dense, coniferous forest. The dominant overstory species is Sitka spruce (*Picea sitchensis*). Western hemlock (*Tsuga hertophylla*) and red alder (*Alnus rubra*) are subdominants. In some locations, overstory trees are young and sparse. Understory vegetation is not always present; where it occurs, it is dominated by devil's club (*Oplopanax horridus*), blueberries (*Vaccinium alaskaense* and *V. ovalifolium*), ferns, and mosses.

Although not dominant, three additional riparian communities are associated with Nevada Creek, occurring within several hundred feet from Gastineau Channel landward. First, an herbaceous community dominated by sedges (*Carex* spp.) and grasses extends approximately 150 feet from Gastineau Channel shoreward to the maximum extent of tidal

influence. Second, a 50-foot band of young, dense alder forest occurs on the shore from the extent of tidal surge upstream. Third, the alder forest transitions upstream into approximately 100 feet of young, dense mixed forest of spruce and alder.

The riparian conditions appear to result from both natural and human disturbances. Natural disturbances to the riparian zone appear to include wind-throw and flooding. Human disturbances appear to include timber and fuel wood harvest, mineral mining, and trail construction. Several cut stumps were observed in the riparian zone and several cut logs in the creek. A footbridge once constructed over the lowermost bedrock cascades had collapsed and substantially decayed. Portions of old flumes, pipes, and a settling basin are potential evidence of mining activities. Also, a large old steam engine and boiler were located at the lower reach of the creek near the shore. Judging from the size of trees growing out of nursery logs, these human-generated disturbances probably occurred at least 50 years ago. Shading throughout the riparian corridor is heavy, with near canopy closure in most places.

Large Woody Debris

LWD is moderately abundant all along Nevada creek. LWD provides overhead and instream cover but, for the most part, embedded logs do little to create pools. This appears to be a result of the high-gradient and coarse substrate of the system. There are, however, a few log jams upstream from the cascades that create plunge pools on the downstream side and spawning riffles on the upstream sides. The recruitment potential for LWD along the stream corridor is high, with abundant mature-sized trees at streamside and within falling distance from the channel.

Fish Use Survey

Four species of fish were caught while electrofishing in Nevada Creek: cutthroat trout (*Oncorhynchus clarki*), Dolly Varden char (*Salvelinus malma*), coho salmon (*O. kisutch*), and a sculpin (*Cottus* sp.). Four cutthroat trout were caught, ranging from 71 to 112 mm in length. These were all found in riffle/rapids/edge-water environments. Two Dolly Varden were caught in the large, deep bedrock pools and measured 110 and 190 mm in length. A total of 10 coho fingerlings were caught, ranging in length from 57 to 75 mm. Most of these were caught in small pools. A group of approximately 30 to 40 juvenile coho were observed in the pool at tide water but could not be sampled with electrofishing gear because of the pink salmon spawners present. A number of these fish were caught with a dip net to verify that they were indeed coho juveniles. Sculpins were by far the most abundant fish caught while electrofishing. A total of 28 sculpin were caught ranging from 45 to 111 mm in length. The only species that were found to be present above the cascade barrier were cutthroat trout and sculpins.

Macroinvertebrate Survey

A total of six orders and 11 families of aquatic invertebrates were collected as a result of the macroinvertebrate survey (Table 2). The organism count densities were 86, 65, and 44 per m^2. Because the three samples were taken in nearly identical habitat and were spatially separated by only about 50 feet, they are essentially replicates. Nearly all feeding guilds are represented by the organisms captured in this survey. A detailed analysis of trophic structure of this community is not possible, however, because of the taxonomic level to which

organisms were identified. Despite this lack of precision, it is apparent that the community present represents that of a relatively undisturbed watershed with relatively clean water.

Adult Salmon Spawner Survey

Salmon spawner surveys were conducted in Nevada Creek on 11 occasions during the months of July, August, September, and October. A total of 284 live salmon and 78 dead salmon were observed during this period (Table 3). Pink salmon (*O. gorbuscha*) were by far the most abundant, with a total of 275 live fish. The pink salmon run started in the middle of August and continued until the middle of September, peaking on August 27. A total of eight live chum (*O. keta*) and one coho (*O. kisutch*) were observed. The chum salmon were the first salmon spawners observed in Nevada Creek, on August 3, 1996. A lone coho salmon was observed on September 15.

A population estimate is not determinable for several reasons. First, the number of dead salmon was different from the live count. Second, we did not build a weir to prevent fish from leaving the system. Some of the salmon observed might have been strays destined for the DIPAC hatchery, and, after observation, might have dropped back into Gastineau Channel and resumed their migration to that destination. Third, there was evidence of extensive bear use of fresh (live) salmon. Carcasses were found along side the stream and back in the forest away from the stream. The data sheets for this task are included in Appendix B.

Water Quality Results

The results of the water quality sampling for Nevada Creek are shown in Table 4. This sample was taken on August 20, 1996. The trace metals detected in the total (unfiltered) analysis were aluminum, barium, copper, iron, and manganese. These same metals, except for copper, were detected in the dissolved (filtered) analysis.

Conclusions

Overall, the habitat value in the surveyed portion of Nevada Creek is fair to good. Overhead cover is excellent, gravels are clean and adequate for resident species, and some spawning area is available for salmon, especially in the intertidal area. The pool/riffle ratio is only fair, however, and the food supply appears to be greater than the rearing habitat available. Instream cover is only fair, mostly limited to substrate. Large pools are rare.

References

Platts, W.S., et al. 1987. *Methods for Evaluating Riparian Habitats with Applications to Management*. U.S. Forest Service. General Technical Report INT-221. (1987).

U.S. Forest Service (USFS). *Integrated Riparian Evaluation Guide*. Intermountain Region. Ogden, Utah. 1992.

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Table 1
Summary of Physical Habitat Parameters

Habitat Type	No. of Units	Total Length (ft)	Avg. Length (ft)	% of Total Length	Avg. Width (ft)	Total Area (sq ft)	Avg. Area (sq ft)	% of Total Area	Avg. Depth (ft)	Avg. Slope	Avg. PQI[b]	Percent Substrate							Total Spawning Area (sq yd)	% of Total Spawning Area	LWD[d]		Total Cover[e]		
												S/O[c]	Snd	sGrvl	lGrvl	Cble	Bldr	Bdrc			6-12"	>12"	Avg. % of Area	Dom	sDom
Pools	25	458	18.3	21%	12.9	5,905	236	22%	1.2	0.1	4.6	0	10	22	22	19	11	17	27	36%	155	260	10%	T	
Glides	1	39	39.0	2%	16.0	624	624	2%	0.5	1.0		0	10	20	30	35	5	0	1	1%	0	0	0%	---	---
Riffles	4	126	31.5	6%	15.0	1,988	497	7%	0.4	2.6		0	4	19	25	35	16	0	15	20%	20	50	4%	variable	
Runs	2	48	24.0	2%	12.0	590	295	2%	0.5	1.0		0	12	13	16	25	7	27	14	19%	2	0	3%	T	---
Rapids	15	1,058	70.5	49%	12.3	12,824	855	47%	0.5	5.3		0	3	11	17	26	36	7	18	24%	237	170	8%	T	S
Cascades	7	424	60.6	20%	10.7	4,910	701	18%	0.5	14.8		0	1	5	6	5	11	71	0	0%	153	275	37%	T	S
Steps[a]	3	12	4.0	1%	13.7	160	53	1%	0.4	26.7		0	0	10	10	36	44	0	0	0%	30	50	19%	T	S
Total/Average	57	2,165	38.0	100%	0.6	27,001	2.8	100%	0.6	5.7	4.6	0	4	13	17	22	24	20	75	100%	597	805	81%	T	S
Total Pool Length (ft)		458																							
Total Riffle, Rapid, Cascade Length (ft)		1,608																							
Pool:Riffle Ratio		1:35																							

[a]A step is a short (less than the width of the stream), abrupt change in stream elevation; e.g., a falls over a log.

[b]PQI = pool quality index, where 1 = poor and 5 = excellent. This parameter is an indication of suitable depth and cover (see Appendix A).

[c]S/O = silt and organic material.

[d]LWD = large woody debris (see Appendix A).

[e]Dom = dominant, sDom = subdominant. T = turbulence, S = substrate (see Appendix A).

Table 2
Results of Macroinvertebrate Survey, August 22, 1996

		Station 1		Station 2		Station 3		Average		Feeding Guilds					
Order	Family	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total	Scrapers	Collector-Gatherers	Shredders	Scavengers	Predators	Filterers
Diptera	Chironomidae	22	26	6	9	3	7	10	14		X			X	X
	Pupae	5	6			1	2	2	3						
Oligochaeta	Naididae	18	21	23	35	3	7	15	21		X				
	Tubificidae					1	2	0	1		X				
Ephemeroptera	Heptageniidae	13	15	6	9	6	14	8	13	X	X				
	Baetidae	3	3	3	5	4	9	3	6	X	X				
	Ephemerellidae			1	2	2	5	1	2	X	X	X		X	
Plecoptera	Chloroperlidae	21	24	21	32	16	36	19	31		X	X	X	X	
Trichoptera	Odontoceridae	2	2	2	3	6	14	3	6			X			
	Glossosomatidae	2	2			1	2	1	2	X					
	Philopotamidae			2	3	1	2	1	2		X				
Ledidoptera	Pyralidae			1	2			0	1			X			
	Total	86	---	65	---	44	---	65	---						

Table 3
Results of Salmon Spawner Survey, July-October 1996

Date	Live Pink	Dead Pink	Live Chum	Dead Chum	Dead Salmon	Live Coho	Dead Coho	Total
14 Jul								0
23 Jul								0
3 Aug			8		2			10
12 Aug	1			2				3
21 Aug	31			4				35
27 Aug	170							170
4 Sep	51				32			83
8 Sep	17				26			43
15 Sep	5				9	1		15
24 Sep					3			3
1 Oct								0
Total	275	0	8	6	72	1	0	362

Table 4
1996 Water Quality Sampling in Nevada Creek

Analysis	Results	
Lab pH	7.7	
Lab Conductivity (umhos/cm @ 25C)	164	
Total Dissolved Solids (mg/L)	103	
Fluoride (mg/L)	<0.2	
Ammonia Nitrogen as N (mg/L)	<0.1	
Nitrate Nitrogen as N (mg/L)	<0.1	
Nitrite Nitrogen as N (mg/L)	<0.1	
Ortho-phosphorus as P (mg/L)	<0.01 mg/L	
Total Suspended Solids (mg/L)	<0.5	
Turbidity (NTU)	<0.5	
MAJOR ANIONS AND CATIONS		
Bicarbonate as HC03 (mg/L)	46	
Carbonate as CO3 (mg/L)	<6	
Chloride (mg/L)	<0.2	
Nitrate + Nitrate as N (mg/L)	<0.1	
Sulfate (mg/L)	36	
METALS (µg/L)	TOTAL	DISSOLVED
Calcium	28,900	27,700
Magnesium	1,280	1,330
Potassium	<200	<200
Sodium	2,100	2,100
Aluminum	30	30
Arsenic	<0.5	<0.5
Barium	9	10
Boron	<50	<50
Cadmium	<0.1	<0.1
Chromium	<5	<5
Copper	1	<1
Iron	30	20
Lead	<1	<1
Manganese	2	2
Mercury	<0.2	<0.2
Molybdenum	<10	<10
Nickel	<10	<10
Selenium	<2	<2
Silver	<0.1	<0.1
Zinc	<5	<5

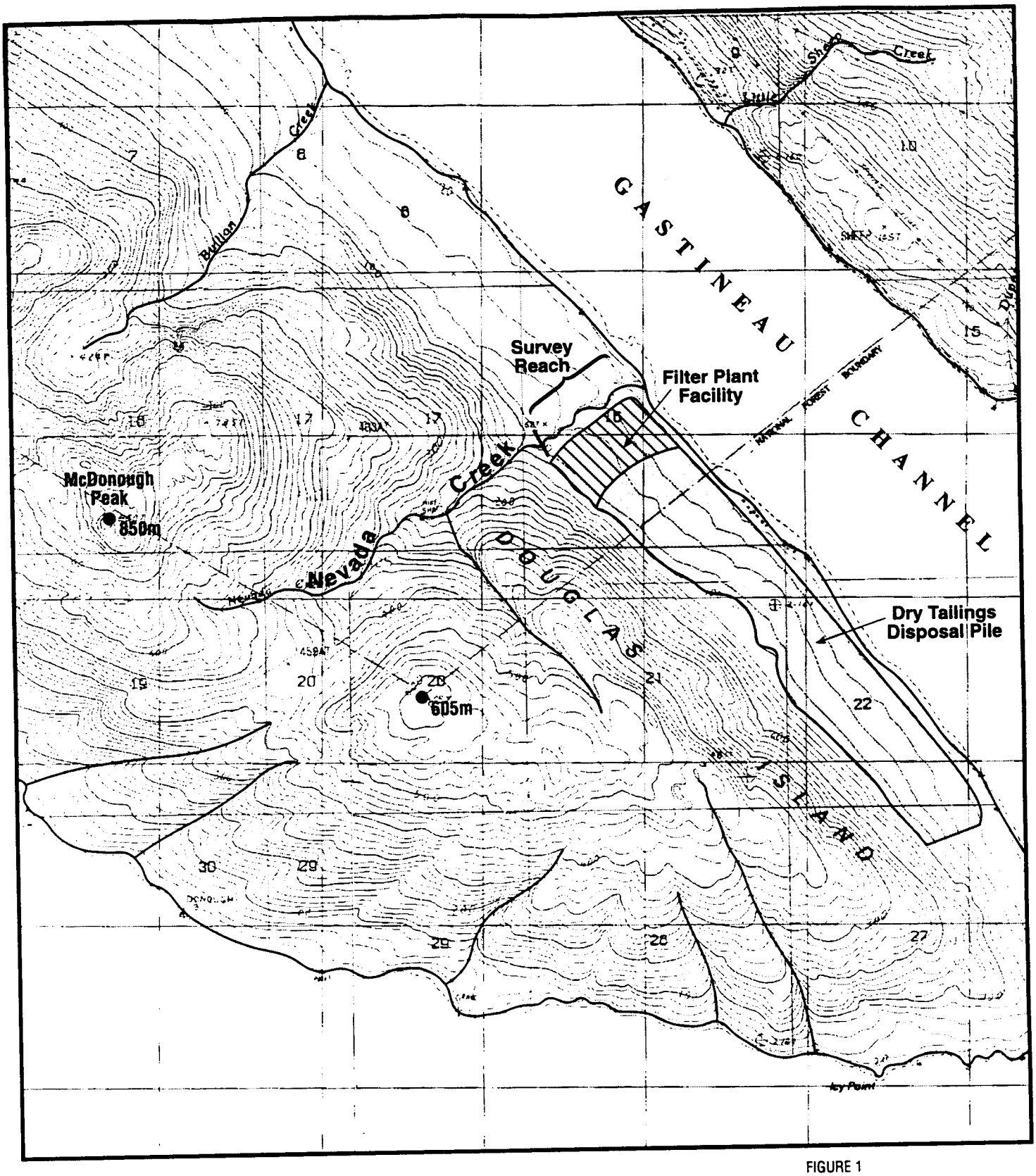

FIGURE 1

Nevada Creek Study Area

Figure 2. Relative Proportion of Habitat Types

Habitat Type	No. of Units	Length			Avg. Width (ft)	Area		
		Total Length (ft)	Average (ft)	Percent of Total		Total Area (sq ft)	Avg. Area (sq ft)	Percent of Total
Pools	25	458	18.3	21%	12.9	5,905	236	22%
Glides	1	39	39.0	2%	16.0	624	624	2%
Riffles	4	126	31.5	6%	15.0	1,988	497	7%
Runs	2	48	24.0	2%	12.0	590	295	2%
Rapids	15	1,058	70.5	49%	12.3	12,824	855	47%
Cascades	7	424	60.6	20%	10.7	4,910	701	18%
Steps	3	12	4.0	1%	13.7	160	53	1%
Total/Avg.	57	2165	38.0	100%	0.6	27,001	2.8	100%

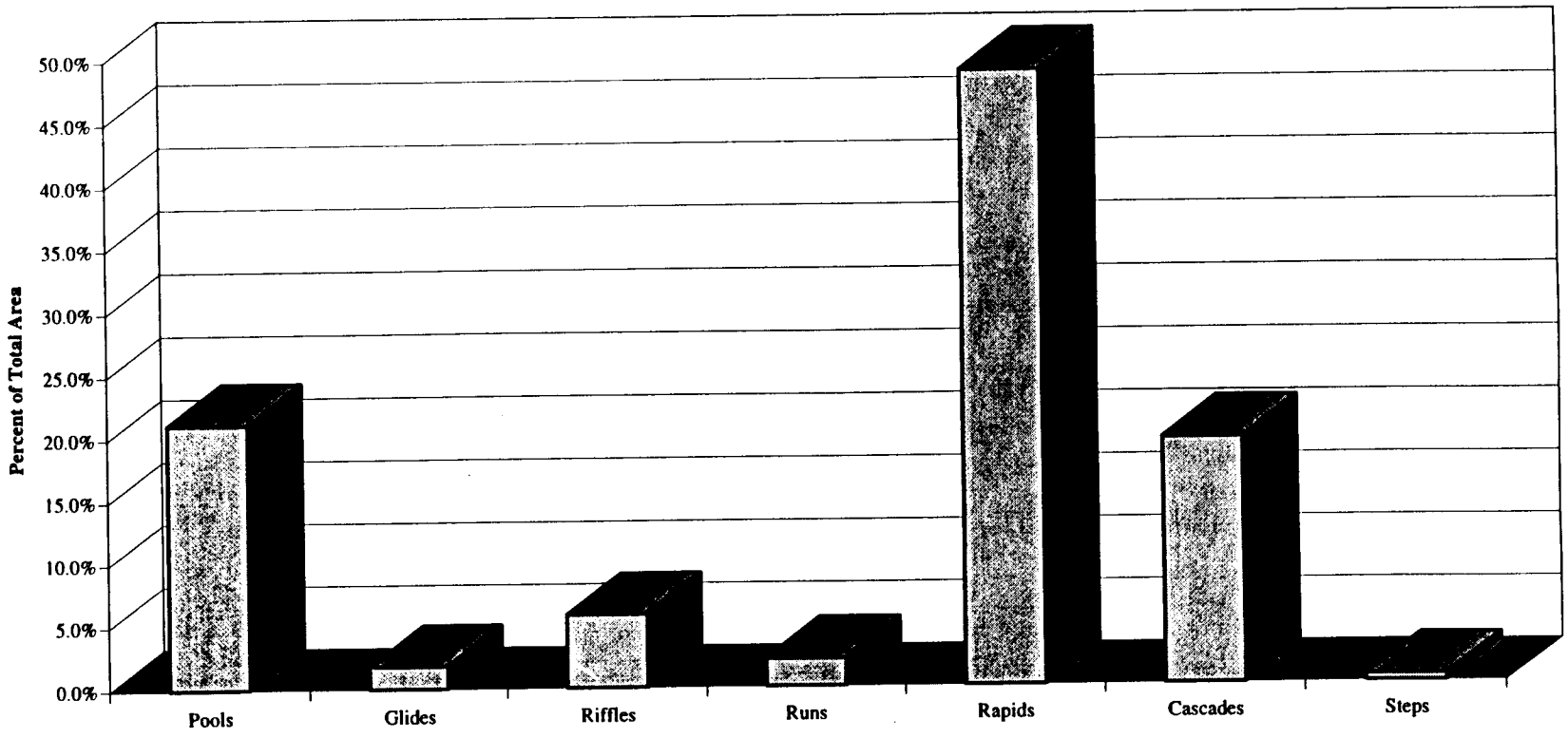

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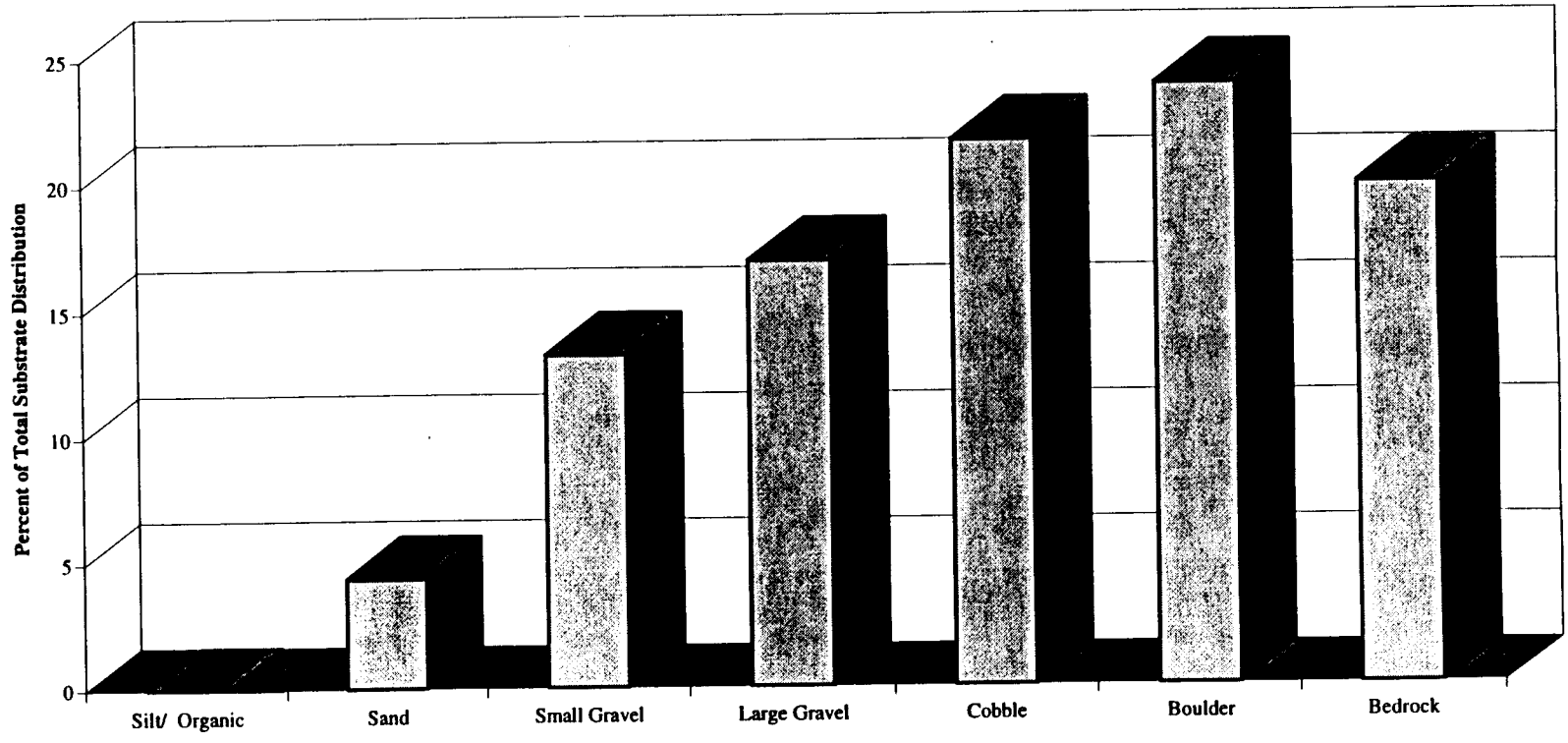
Figure 3. Relative Proportion of Substrate Composition

Habitat Type	Average Substrate Composition (%, weighted by area)						
	Silt/ Organic	Sand	Small Gravel	Large Gravel	Cobble	Boulder	Bedrock
Pools	0	10	22	22	19	11	17
Glides	0	10	20	30	35	5	0
Riffles	0	4	19	25	35	16	0
Runs	0	12	13	16	25	7	27
Rapids	0	3	11	17	26	36	7
Cascades	0	1	5	6	5	11	71
Steps	0	0	10	10	36	44	0
Overall	0	4	13	17	22	24	20



Appendix A
Physical Habitat Inventory Methods

APPENDIX A

Physical Habitat Inventory Methods

The fish habitat inventory methodology developed by CH2M HILL for assessing environmental impact analyses in the Pacific Northwest and southeast Alaska is based primarily on protocols of the Oregon Department of Fish and Wildlife (ODFW). Values for some parameters were taken from the U.S. Forest Service Integrated Riparian Evaluation Guide: Intermountain Region (USFS, 1992). The pool quality index used was developed by Platts et al. (1987). The equivalent FS Region 10 protocol is a Level 4 survey.

Each habitat characteristic (parameter) measured or assessed during the field study and the rationale for including the parameter are described below. The data provide five categories of information:

1. Channel morphology
2. Substrate composition
3. Bank cover/riparian community
4. Large woody debris
5. Instream cover

Some of these categories have many descriptive parameters, others only a few. For purposes of field data collection, parameters were recorded by habitat unit, or type, in accordance with ODFW methodology. For each reach, all habitat unit data were recorded on two unit data sheets, with an experienced fisheries biologist responsible for each sheet. A reach data sheet, primarily consisting of a photograph log, also was prepared by one of the biologists.

The following text discusses each parameter listed on the data sheets.

Unit Data Sheet 1

Unit Number. Habitat surveys were always conducted moving upstream because habitat units (HUs) are most easily delineated from an upstream view. HUs were numbered sequentially as encountered. Where side channels were encountered, numbering was continued in the main channel to the upstream end of the side channel, then the side channel was numbered from downstream to upstream.

Unit Type. Habitat units (mesotypes) were delineated using ODFW criteria. This system recognizes 24 different habitat types, including 8 different pool types. "Run" and rapids ("rap") were added to the ODFW list to differentiate them from "glide" or "riffle." Habitat types are as follows:

PP	Plunge pool
LP	Lateral scour pool
SP	Straight scour pool
TP	Trench pool
DP	Dammed pool
AL	Alcove
BW	Backwater pool
IP	Isolated pool

RU	Run
GL	Glide
RI	Riffle
RP	Riffle with pocket water
RAP	Rapids without protruding boulders
RB	Rapids with protruding boulders
RR	Rapids over bedrock
CB	Cascade over boulders
CR	Cascade over bedrock
SB	Step over boulders
SR	Step over bedrock
SL	Step over log(s)
SC	Step over face of cobble bar
SS	Step created by structure (culvert, weir, dam)
BP	Beaver pond
CC	Culvert crossing
DU	Dry unit (puddled channel)
DC	Dry channel (whole reach is dry)

Appendix B provides descriptions and definitions of these habitat types.

Channel Type. This is an ordering of multiple channels by size, separating main channels, designated by (01), from secondary (02) and tertiary (03) channels. A single channel was designated by (00). Isolated pools, alcoves, or backwater pools were designated by (10).

Percent Flow. This is a visual estimate of the relative amount of flow in each channel where multiple channels occur. A single channel was always 100 percent. The total combined percent was also 100 percent, by definition.

Unit Length. All unit lengths were measured directly using a hip chain. Increments were measured in tenths of feet.

Unit Width. Unit widths on wide channels (greater than 20 feet) were visually estimated and checked periodically using a hip chain for calibration. Channels less than 20 feet wide were measured directly with a hip chain or an incrementally marked wading staff with a precision of 0.1 foot. Estimates and measurements were based on wetted width observed during the survey, which roughly corresponded to low-flow conditions.

Bankfull Width. Bankfull widths were visually estimated to represent an assumed wetted width at the ordinary high water mark (OHWM). The OHWM was visually assessed on the basis of vegetation age, condition, and species; water marks on rocks; position of debris piles; and inflections in bank slope.

Average Depth. While walking upstream in the channel, multiple depth measurements were made using a wading staff marked in 0.1-foot increments. Depths were averaged, which was influenced by factors such as channel uniformity and percent boulder protrusion.

Maximum Depth. This was the maximum depth measured. Sometimes, where water depth exceeded staff length or was too deep to wade, depth was estimated visually from pool morphology.

Bankfull Depth. The unit's maximum depth was added to the estimated distance (depth) between the water surface and the OHWM.

Pool Quality Index (PQI). PQI is a rating derived using a key developed by Platts et al. (1987). The scale is from 1 to 5, with 1 denoting "poor" and 5 denoting "excellent." Criteria used include depth, cover, and width of pool relative to average channel width.

Slope. The unit's gradient was measured as percent slope at the water surface using a clinometer. Slopes were often visually estimated and periodically checked. Estimated slopes were preceded by a "~" on the data sheet.

Shade. Shade was measured with the clinometer as the degrees of shading by riparian vegetation and landforms perpendicular to the channel unit on the left and right banks. This variable required integrating topographic shading and canopy closure. The values, combined with aspect data, provided an estimate of potential solar input to the channel unit.

Aspect. Aspect is the compass heading looking upstream along the central axis of the unit. Irregular units are averaged. Corner pools use a line tangent to the curve. Measurements are rounded to the nearest 5 degrees. Measurements were recorded as read on the compass dial and not corrected for magnetic declination.

Notes: Specific habitat unit (e.g., cover types) were described further, where needed.

Unit Data Sheet 2

Unit Number. This corresponds to the same number on Unit Data Sheet 1.

Unit Type. This corresponds to the same type on Unit Data Sheet 1.

Unit Length and Width (Shaded). These parameters were included for calibration checks of visual estimates. Lengths were measured and not estimated in this survey, while widths were estimated visually when the channel was wide. Calibrations were checked periodically with a hip chain.

Percent Substrate. Substrate composition was estimated visually as a percent of the total substrate. Size classes were defined as follows:

Material	Diameter	Description
Silt and organic material	Less than 0.1 mm	Very fine
Sand	0.1 to 2 mm	Very fine to pea size
Gravel	2 to 64 mm	Pea to baseball size
Cobble	64 to 256 mm	Baseball to bowling ball size
Boulder	Exceeds 256 mm	Exceeds bowling ball size
Bedrock	–	Solid rock

Size classes were generally rounded to the nearest 5 percent, except when that fraction fell below 5 percent of the total. The entire habitat unit was averaged.

Percent Embeddedness. This is a measure (percent) of how much silt and sand fill interstitial spaces among gravels and cobbles. A visual estimate was made using Forest Service criteria.

The FS standard for maximum embeddedness in otherwise suitable gravel for spawning is 35 percent.

Spawning Area. Suitable spawning area in square yards within a habitat unit was visually estimated.

Vegetation Class. Vegetation class refers to the type of vegetation in the riparian zone. Riparian zone width is defined roughly as the plant community that is influenced by the stream or can influence the stream. Anything within the floodplain and any tree that can fall into the channel is considered part of the riparian community. Vegetation types and codes are as follows:

N	=	No vegetation (base soil, rock)
G	=	Grasses and forbs (herbs)
S	=	Shrubs (e.g., willow, sage)
D	=	Deciduous trees
M	=	Mixed conifer and deciduous trees
C	=	Coniferous dominated (greater than 50 percent conifers)

The vegetation class was broken into dominant and subdominant types.

Bank Class. Bank classification is a general description of the streambank at the active channel margin, focusing on erodibility. The left and right banks were considered separately and classified as follows:

NE Nonerodible. Bedrock or boulder-lined banks.

VS Vegetation-stabilized. Vegetated and/or overhanging erodible bank, partly or wholly stabilized by vegetation or roots.

AE Actively eroding. Actively or recently eroding banks with little or no vegetative cover, mostly exposed soil.

Percent Undercut Bank. This is a visual estimate of the percent of the habitat unit's perimeter composed of undercut bank (at least 0.5-meter undercut). It included the length of undercut rootwads and was a combined average of both banks.

Large Woody Debris (LWD). LWD was separated into three diameter-based size classes: less than 6 inches, 6 to 12 inches, and over 12 inches. The total combined length of woody debris in each size class was visually estimated.

Total Cover. This is the estimated cover for each habitat unit as a percent of the surface area. Cover is estimated based on structures with size required by 1+ age trout. A code was recorded to represent percentages as follows:

1 = 0 to 5 percent total cover
2 = 6 to 20 percent total cover
3 = 21 to 40 percent total cover
4 = greater than 40 percent total cover

Cover Type. The dominant and subdominant cover types were recorded for each habitat unit using the following cover codes:

U = undercut banks

S	=	substrate
D	=	depth exceeds 3 feet
H	=	overhanging vegetation within 10 inches of the water surface
W	=	wood material
T	=	turbulence
A	=	aquatic/emergent vegetation

Reach Data Sheet

Unit Number. This corresponds to the same number on Unit Data Sheets 1 and 2.

Channel Form. Channel form is determined by the morphology of the active channel, hillslopes, terraces, and floodplains. Channel constraints occur when adjacent landforms restrict lateral channel movement. In constrained channels, streamflows associated with all but the largest flood events are confined to the existing channel. Two conditions can occur:

- **Valley Floor Width (VFW).** Less than 2.5 times active channel width (ACW). Always constrained, defined by the characteristics of the constraining feature as follows:

CB	=	Constrained by bedrock
CH	=	Constrained by hillslope
CF	=	Constrained by alluvial fan
CL	=	Constrained by road, dike, landfill, etc.

- **VFW more than 2.5 times ACW.** Can be constrained or unconstrained. Unconstrained types might have low terraces, overflow channels, or floodplains adjacent to the active channel as follows:

US = Unconstrained-predominantly single channel

UA = Unconstrained-anastomosing (several complex, interconnecting channels)

UB = Unconstrained-braided channels (numerous, small channels often flowing over alluvial deposits)

Valley Width Index (VWI). VWI is the ratio of active stream channel width to valley floor width. This was recorded as estimates of average channel width (in feet) and valley floor width (in feet) separated by a "/".

Stream Temperature. Stream water temperature was measured with a hand thermometer about three times per day: morning, midday, and afternoon. Temperatures were taken in riffles where water is turbulent and well mixed.

Streamflow. Streamflow was gaged on days when transect measurements were taken at locations with a relatively smooth and uniform cross section.

Photographs. Photographs were taken throughout each reach to document notable features, at the beginning and end of a reach, anywhere major habitat degradation was occurring, and where tributaries entered. The photographs recorded typical habitat, unusual habitat, and representations of habitat-type designations. Photographs were almost always taken facing up-

stream. About one roll (36 frames) was used per reach (about 1 day's effort), with roll and frame numbers recorded.

Notes. This was a description of what was seen in each photograph and constitutes a photograph log or documentary.

Appendix B
Physical Habitat and Spawner Survey Data

Unit Data - 1

Stream Name: Nevada Creek **Date: 8/21/96**

Reach: 1 **Estimator: Whitman**

Unit No.	Unit Type	Channel Type	Percent Flow	Unit Length	Unit Width	Bankfull Width	Avg. Depth	Max Depth	Bankfull Depth	PQI	Slope	Shade		Aspect	Notes
												Left	Right		
1	RI	1	66	384	10	11	0.5	0.6	1.5		1.8	0	0	140	5 live pink salmon
2	RB	1	66	39	7.5	15	0.6	0.9	2		4.5	0	0	140	
3	RI	2	33	153	5	12	0.4	0.5	1		1.5	0	0	120	2 dead chum salmon
4	GL	2	33	36	17	20	0.3	0.4	1		0.5	0	0	120	2 dead chum salmon
5	RI	2	33	255	10	20	0.3	0.5	1.5		1.2	0	0	120	
6	LP	0	100	38	11	18	1	1.5	3	5	0	0	0	80	
7	RI	0	100	35	14	18	0.6	1.1	3.5		3	0	0	80	6 live pink salmon
8	RB	0	100	33	10	13	0.5	1	2.5		5	100	100	80	
9	LP	0	100	20	16	18	1	1.7	3	4	0	100	100	160	4 live pink salmon
10	SB	0	100	5	16	12	0.3	0.5	3		10	100	100	160	
11	RU	0	100	17	11	16	0.7	1.2	3.5		1	100	100	160	10 - 12 live pink salmon
12	RB	0	100	68	11	14	0.6	1.1	3		6	100	100	160	
13	PP	0	100	10	10	40	0.9	1.1	3	3	0	100	100	160	
14	SB	0	100	3	20	40	0.5	0.9	3		10	100	100	160	
15	BP	0	100	18	17	17	1	1.5	2.5	3	1	100	100	160	4 live pinks, spawning area
16	CR	0	100	40	9	13	0.3	0.5	---		13	65	90	110	limit for pinks
17	PP	0	100	16	10	12	0.8	1.7	5	4	0	90	90	110	bedrock
18	CR	0	100	41	8	20	0.5	0.7	---		8	90	90	40	bedrock - 2nd cascade
19	RU	0	100	31	13	35	0.4	0.6	4		1	90	90	120	bedrock
20	CR	0	100	69	12	40	0.4	0.8	3		10	90	90	120	3rd cascade
21	PP	0	100	10	17	23	2	4	5	5	0	90	90	120	bedrock
22	CR	0	100	120	15	35	0.5	1	3		20	90	90	120	estimating
23	PP	0	100	12	10	40	0.8	1.2	4.5	4	0	90	90	160	
24	PW	0	100	105	13	30	0.6	1.8	5.5		6	90	90	180	
25	SP	0	100	25	14	30	0.5	1.6	5.5	4	0	90	90	220	

Unit Data - 1

Stream Name: Nevada Creek **Date: 8/21/96**

Reach: 1 **Estimator: Whitman**

Unit Numbe	Unit Type	Channel Type	Percent Flow	Unit Length	Unit Width	Bankfull Width	Avg. Depth	Max Depth	Bankfull Depth	PQI	Slope	Shade		Aspect	Notes
												Left	Right		
26	RB	0	100	32	17	25	0.4	0.8	3		6	90	90	220	
27	PP	0	100	29	16	18	1.5	2.3	6	5	0	90	90	220	
28	RB	0	100	76	10	40	0.5	1	4		6	90	90	220	
29	PP	0	100	17	12	25	0.5	2	5.5	5	0	90	90	170	
30	RB/PW	0	100	174	12	90	0.5	1	4		5	90	90	170	small musky drainage from south
31	PP	0	100	15	11	17	1	1.9	5	5	0	90	90	140	channel widens
32	RB	0	100	53	10	18	0.5	1	4		5	90	90	140	
33	PP	0	100	8	13	40	1.7	2.5	4	5	0	90	70	140	log jam falls
34	SL	0	100	4	5	40	0.5	1	3		60	90	90	140	4.5' falls
35	PP	0	100	20	10	70	1	1.2	3.5	5	0.5	90	90	140	LWD
36	PP	0	100	21	10	80	1	1.5	?	5	0	90	90	120	
37	RI	0	100	55	18	100+	0.3	0.8	?		3	90	90	100	
38	LP	0	100	18	8	100+	1	1.5	?	5	0	90	90	100	
39	RB	0	100	32	14	50	0.4	0.6	3		3	90	90	130	
40	PP	0	100	13	20	35	0.9	1.5	5	5	0	90	90	130	LWD
41	RB	0	100	49	11	16	0.6	1.2	4		5.5	90	90	130	
42	PP	0	100	15	13	15	1.1	2.6	6	5	0	90	90	130	LWD
43	GL	0	100	39	16	19	0.5	1	1.5		1	90	90	130	
44	RB	0	100	60	11	18	0.5	1	3		6	60	80	130	
45	SP	0	100	13	14	19	2	2.7	6	5	0	90	90	90	
46	RB	0	100	51	13	19	0.4	0.6	4		5	90	90	110	
47	PP	0	100	17	13	17	0.9	1.5	4.5	4	0	90	90	120	
48	RB	0	100	81	15	17	0.5	1.5	4.5		7	90	90	130	
49	PP	0	100	19	15	16	1	2	5	5	0	70	60	140	
50	PP	0	100	27	13	15	1	2.4	5.5	5	0	65	90	140	

Unit Data - 1

Stream Name: Nevada Creek **Date: 8/21/96**

Reach: 1 **Estimator: Whitman**

Unit Number	Unit Type	Channel Type	Percent Flow	Unit Length	Unit Width	Bankfull Width	Avg. Depth	Max Depth	Bankfull Depth	PQI	Slope	Shade		Aspect	Notes
												Left	Right		
51	CR	0	100	32	10	16	0.3	0.6	3.5		20	90	90	150	
52	RB	0	100	123	12	14	0.4	0.6	4		4	70	90	150	
53	LP	0	100	19	8	11	1.2	1.9	6	5	0	80	90	150	
54	RB	0	100	63	10	15	0.6	1	4		7	90	80	140	
55	PP	0	100	20	20	24	2.5	3.5	7.5	5	0	80	60	140	
56	CR	0	100	54	11	25	0.7	1	7		10	100	100	180	
57	RI	0	100	20	15	40	0.5	0.6	3		3	65	65	180	
58	CB	0	100	68	10	60	0.4	1	6		13	80	90	160	
59	RP	0	100	16	13	20	0.5	2	3	4	0	90	60	60	
60	RB	0	100	37	15	19	0.5	0.8	3		4	70	65	60	
61	PP	0	100	22	12	17	1.3	2.6	8	5	0	70	65	60	
62	RB	0	100	126	13	22	0.5	1.3	4		4.5	60	80	120	
63	LP	0	100	16	10	17	1.2	2.2	7	5	0	90	90	140	

Note: See Appendix A for parameter descriptions and codes.

Unit Data - 2

Stream Name: Nevada Creek **Date: 8/21/96**

Reach: 1 **Estimator: Ehlert**

Unit No.	Unit Type	Unit Lngth	Unit Wdth	Percent Substrate							% Embd	Spwn Area	Veg Class		Bank Class	% Undcut	LWD		SWD Jam	Total Cover		
				S/O	Snd	sGrvl	lGrvl	Cble	Bldr	Bdrc			Dom	sDom			6-12"	>12"		%	Dom	sDom
1	RI				10	20	40	30			40	80	N	N	NE	0	0	0	0	0		
2	RB				5	15	30	40	10		10	6	G		NE	0	0	0	0	5	V	
3	RI				5	20	40	30	5		30	0	N	N	NE	0	0	0	0	0		
4	GL				20	30	40	5	5		50	0	N	N	NE	0	0	0	0	0		
5	RI				5	40	40	10	5		30	56	G		NE	0	4	0	0	0		
6	LP				20	15	25	25	15		20	6	G		NE	0	0	0	0	5	V	
7	RI				10	25	35	25	5		10	15	G		NE	0	0	0	0	5	V	
8	RB				5	10	30	40	15		10	0	DY	G	NE	0	10	65	0	10	T	
9	LP				15	30	20	20	15		20	0	DY	MP	NE	0	15	35	0	10	W	S
10	SB					10	10	40	40		10	0	DY	MP	NE	0	0	0	0	0		
11	RU				5	20	30	35	10		10	10	MY		NE	0	0	0	0	0		
12	RB				5	10	20	40	25		5	12	MY		NE	0	45	0	0	5	T	S
13	PP				5	20	25	30	20		10	0	MY		NE	0	0	0	0	5	T	S
14	SB					10	10	30	50		5	0	MY		NE	0	0	0	0	50	T	S
15	BP				20	30	20	15	15		20	5	MY		NE	0	0	0	0	5	T	
16	CR					5	5			90	0	0	MY		NE	0	3	15	0	50	T	
17	PP					10	10			80	0	0	MY	SS	NE	0	0	35	0	10	T	
18	CR					5	5			90	0	0	MY	SS	NE	0	15	50	0	50	T	
19	RU				15	10	10	20	5	40	10	4	CM	SS	NE	0	2	0	0	5	T	
20	CR				5	5	10	10	30	40	0	0	CM		NE	0	75	10	0	25	T	S
21	PP				15	20	25	25	5	10	10	0	CM		NE	0	0	0	0	25	T	
22	CR					5	5			90	0	0	CM		NE	0	0	0	0	50	T	S
23	PP					10	10	10	5	65	0	0.5	CM		NE	0	0	0	0	10	T	
24	PW				5	15	20	30	30		10	4	CM	SS	NE	0	25	0	0	10	T	S
25	SP				10	20	35	30	5		10	1	CM	SS	NE	0	0	0	0	5	T	

Stream Name: Nevada Creek **Date: 8/21/96**

Reach: 1 **Estimator: Ehlert**

Unit	Unit	Unit	Unit	Percent Substrate							%	Spwn	Veg Class		Bank	%			SWD	Total Cover		
Number	Type	Lngth	Wdth	S/O	Snd	sGrvl	lGrvl	Cble	Bldr	Bdrc	Embd	Area	Dom	sDom	Class	Undcut	6-12"	>12"	Jam	%	Dom	sDom
26	RB				5	10	15	30	40		10	0	CY	SS	NE	0	0	0	0	5	T	S
27	PP				15	15	15	15	10	30	15	0.5	CY	SS	NE	5	10	10	0	5	T	U
28	RB				5	10	10	10	15	50	5	0	CY	SS	NE	0	0	0	0	5	T	S
29	PP				5	40	20	15	10	10	20	6	CM	SS	NE	0	0	0	0	10	T	
30	RB/PW				5	10	15	20	30	20	5	2	CM		NE	0	5	20	0	5	T	
31	PP				10	25	35	15	15		15	0	CM		NE	5	0	0	0	5	T	U
32	RB				5	10	15	30	40		5	0	CM		NE	5	50	10	0	10	W	
33	PP				5	25	50	15	5		20	3	CM		NE	0	15	50	0	30	T	W
34	SL												CM		---		30	50	0			
35	PP				5	30	35	30			15	0.5	CM		NE	0	10	10	0	0		
36	PP				5	20	30	45			10	0	CM		NE	0	25	0	0	0		
37	RI					20	25	45	10		5	0	CM		NE		20	30	0	5	W	
38	LP				5	25	30	20	20		10	0	CM		NE	40	0	0	0	50	U	T
39	RB					5	10	15	60		10	0	CM		NE	0	7	0	0	5	T	
40	PP				15	30	20	15	20		20	0	CM		NE	0	0	30	0	20	T	W
41	RB					15	20	25	40		5	0	CM		NE	0	0	0	0	5	T	
42	PP				5	25	30	20	20		10	0	CM		NE	5	25	10	0	30	T	W
43	GL				10	20	30	35	5		25	1	CM	SS	NE	0	0	0	0	0		
44	RB					10	15	35	40		5	0	CM	SS	NE	0	30	0	0	10	T	
45	SP				5	15	10	5	5	50	10	1	CM	SS	NE	5	20	0	0	5	T	W
46	RB					5	20	20	50	5	5	0	CM	SS	NE	0	0	0	0	5	T	
47	PP				15	25	20	30	10		10	0.5	CM	SS	NE	0	0	0	0	10	T	
48	RB					15	15	25	40	5		0	CM	SS	NE	0	35	30	0	10	T	W
49	PP				10	25	30	10	10	15	15	1	CY	SS	NE	0	0	35	0	15	T	W
50	PP				5	30	15	5	5	40	10	2	CY	SS	NE	0	0	0	0	10	T	V

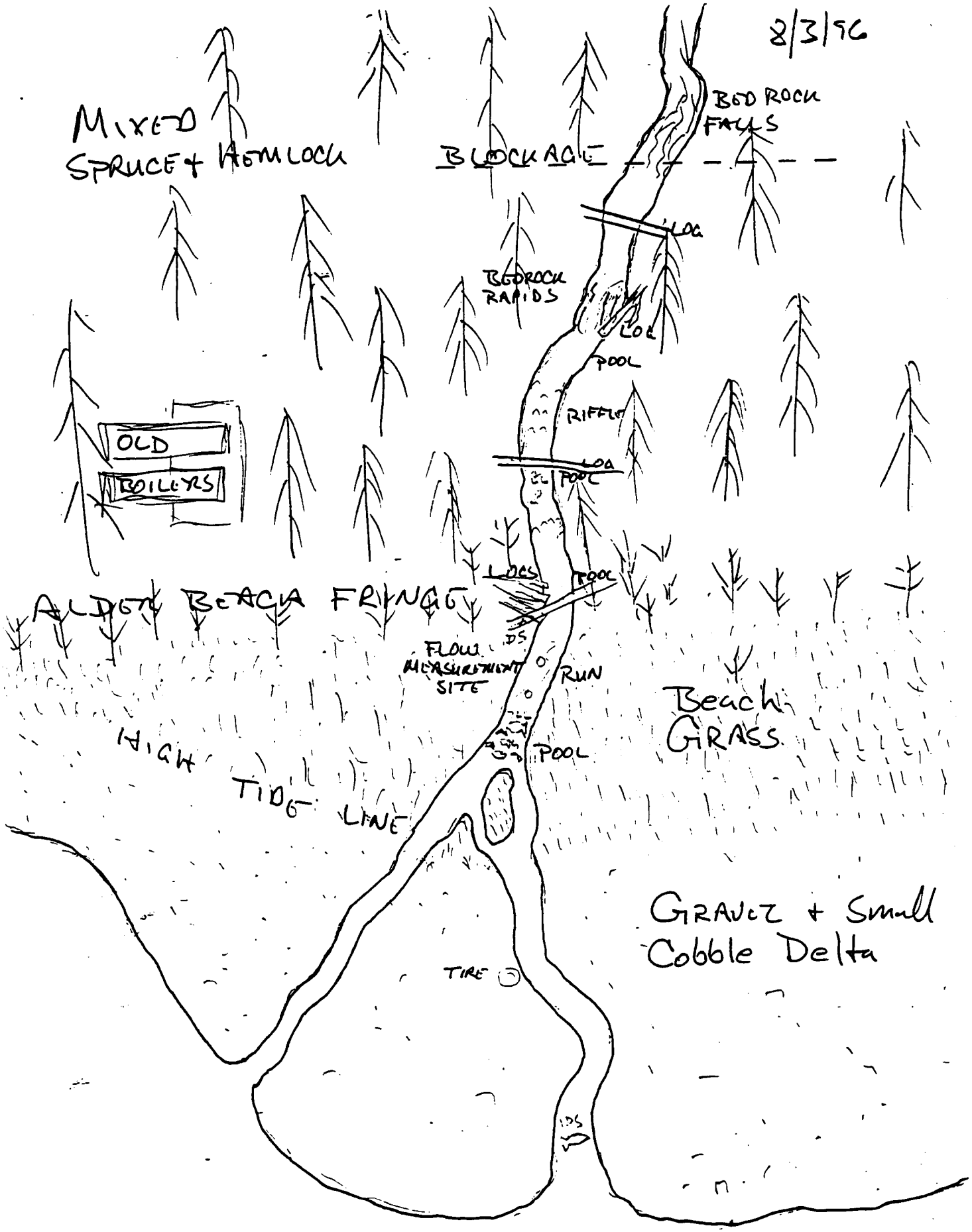
Unit Data - 2

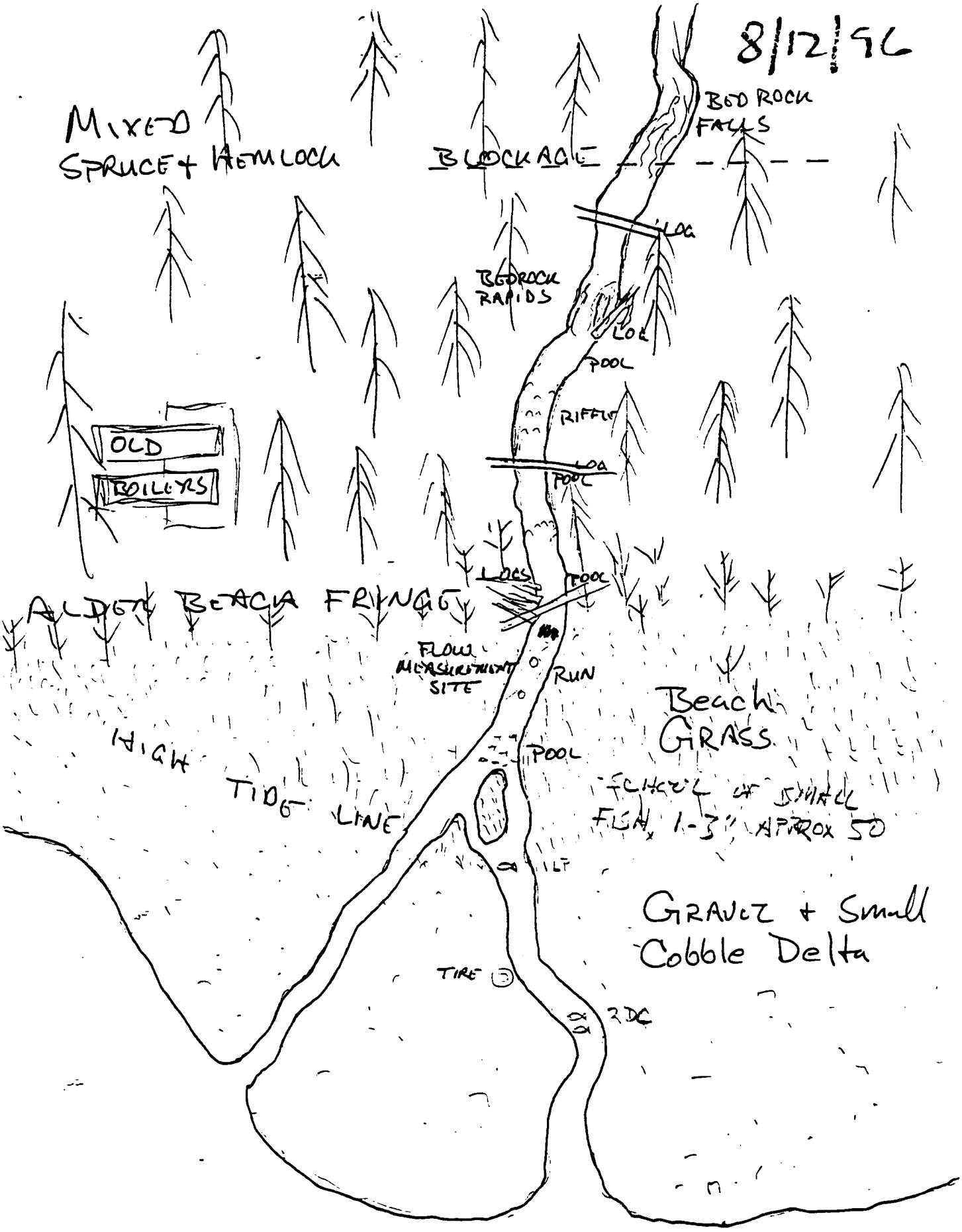
Stream Name: Nevada Creek **Date: 8/21/96**

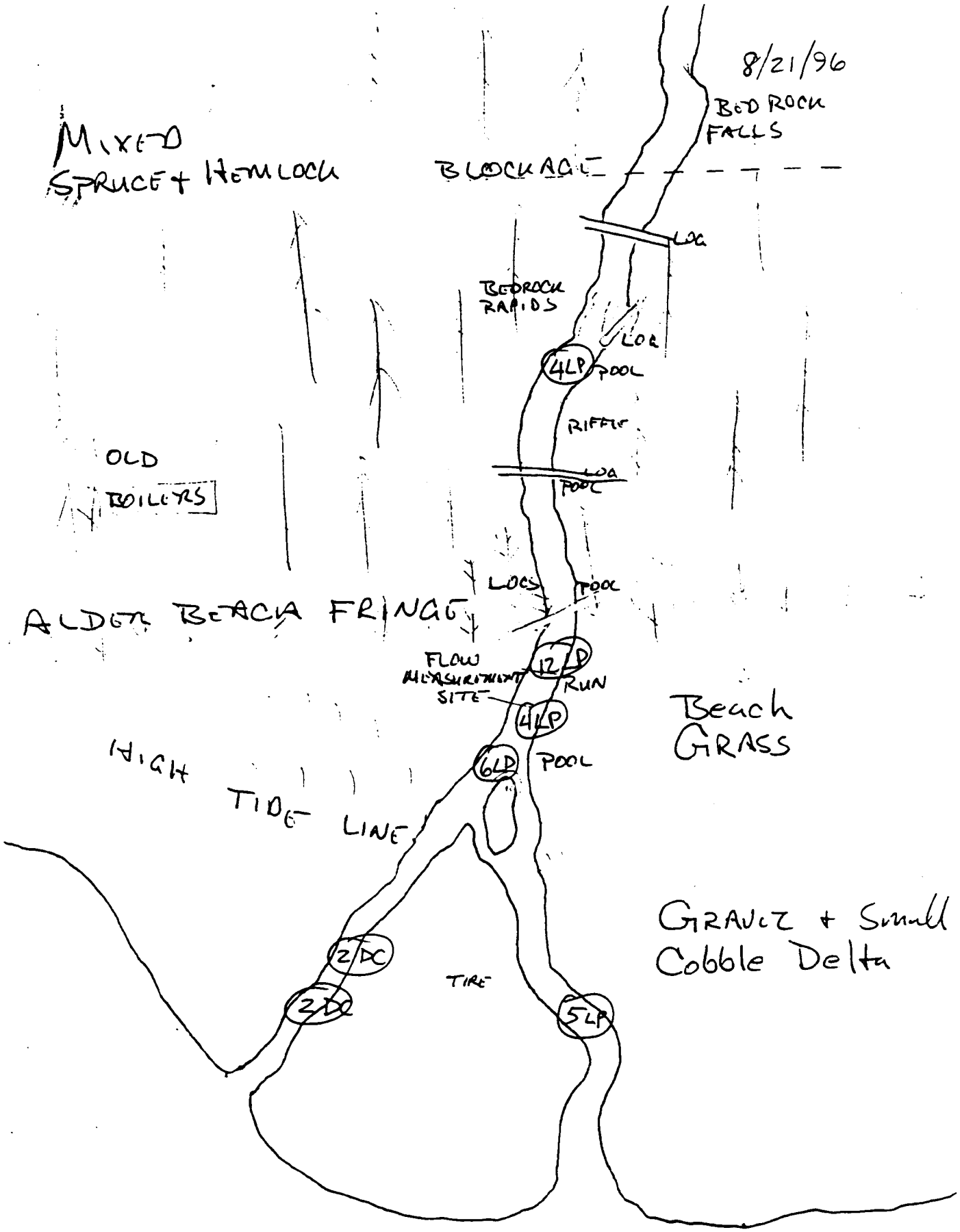
Reach: 1 **Estimator: Ehlert**

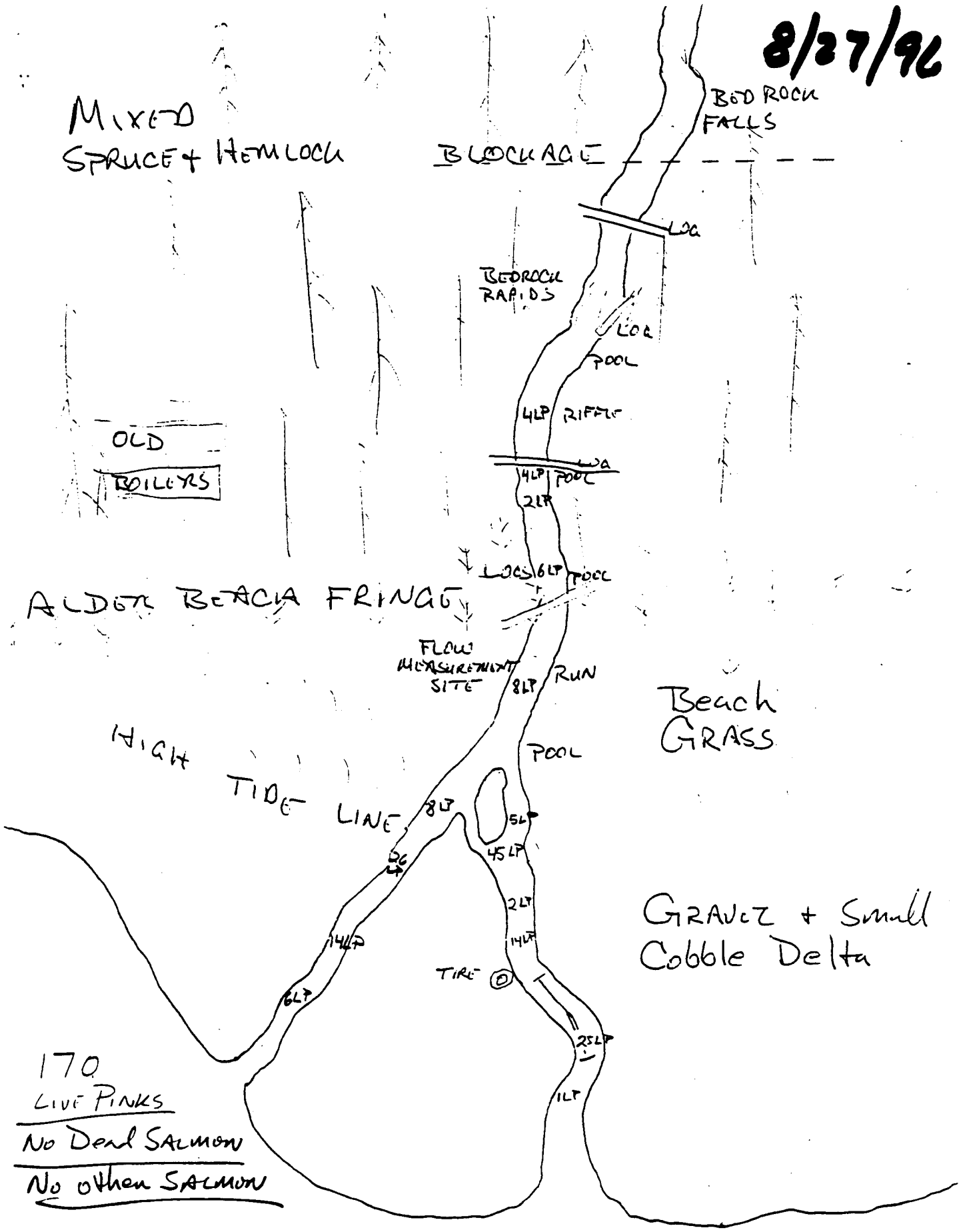
Unit Number	Unit Type	Unit Lngth	Unit Wdth	Percent Substrate							% Embd	Spwn Area	Veg Class		Bank Class	% Undcut			SWD Jam	Total Cover		
				S/O	Snd	sGrvl	lGrvl	Cble	Bldr	Bdrc			Dom	sDom			6-12"	>12"		%	Dom	sDom
51	CR								25	75		0	CY	SS	NE		0	0	0	50	T	S
52	RB				5	15	15	25	40		5	0	CM	SS	NE		20	10	0	5	S	V
53	LP				5	20	25	5	20	25	10	0	CM	SS	NE			25	0	5	T	
54	RB					10	15	20	40	15		0	CM	SS	NE		0	0	0	5	V	
55	PP				5	15	10	20	10	40		0	CM	SS	NE		15	0	0	5	T	
56	CR					5	5	5	5	80		0	CM	SS	NE		10	50	0	10	T	W
57	RI				5	10	15	25	45			0	CM	SS	NE			20	0	0		
58	CB					10	10	20	30	30		0	MY	SS	NE		50	150	0	20	W	T
59	RP				5	15	20	30	30			0	CY	SS	NE		0		0	5	T	
60	RB				5	10	15	30	40			0	CY	SS	NE		10		0	0		
61	PP				5	10	20	20	10	35		0	CY	SS	NE		20	20	0	10	T	
62	RB					10	20	30	40			0	CM	SS	NE			35	0	20	T	
63	LP				5	10	15	10	25	35		0	CM	SS	NE					5	T	

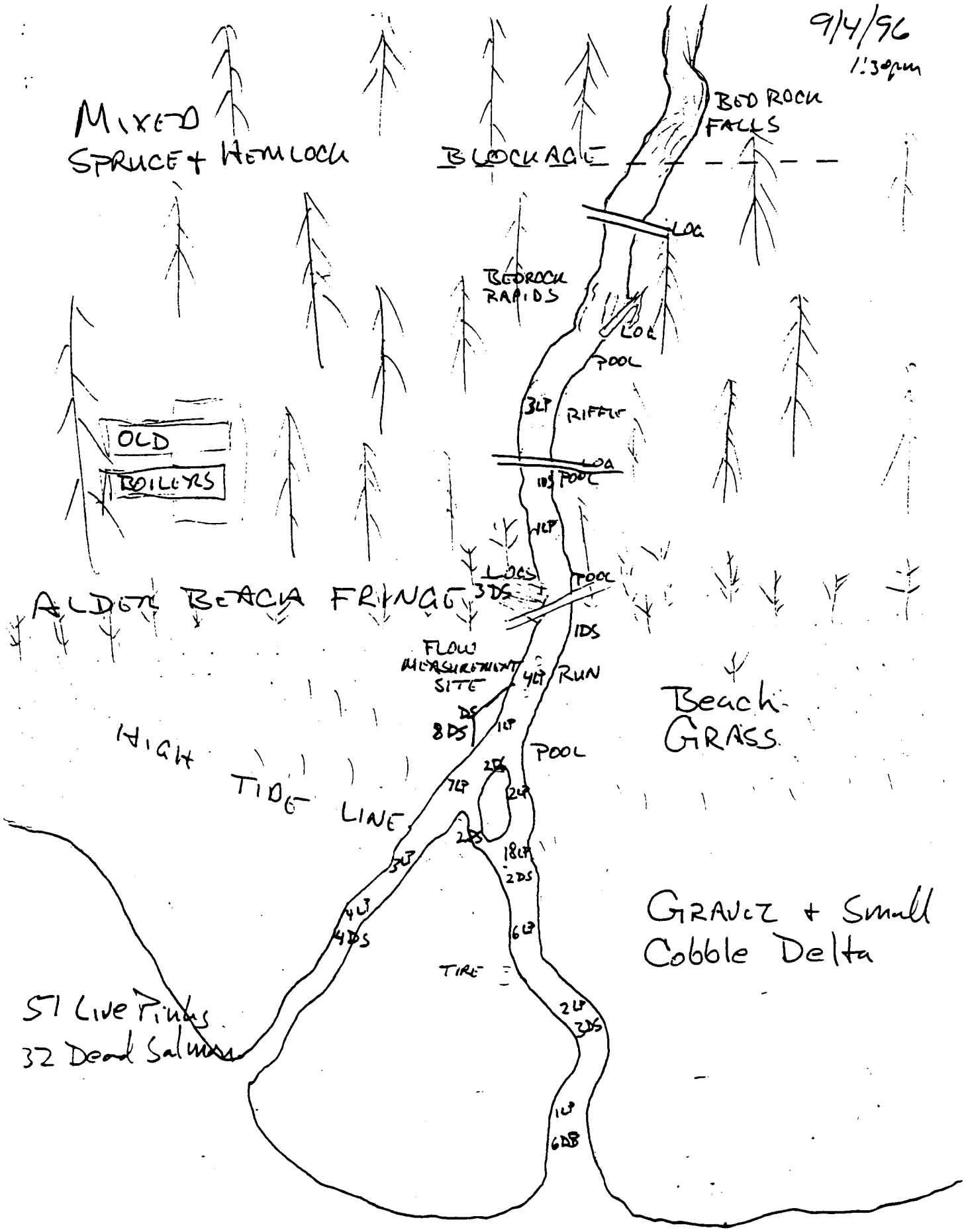
Note: See Appendix A for parameter descriptions and codes.

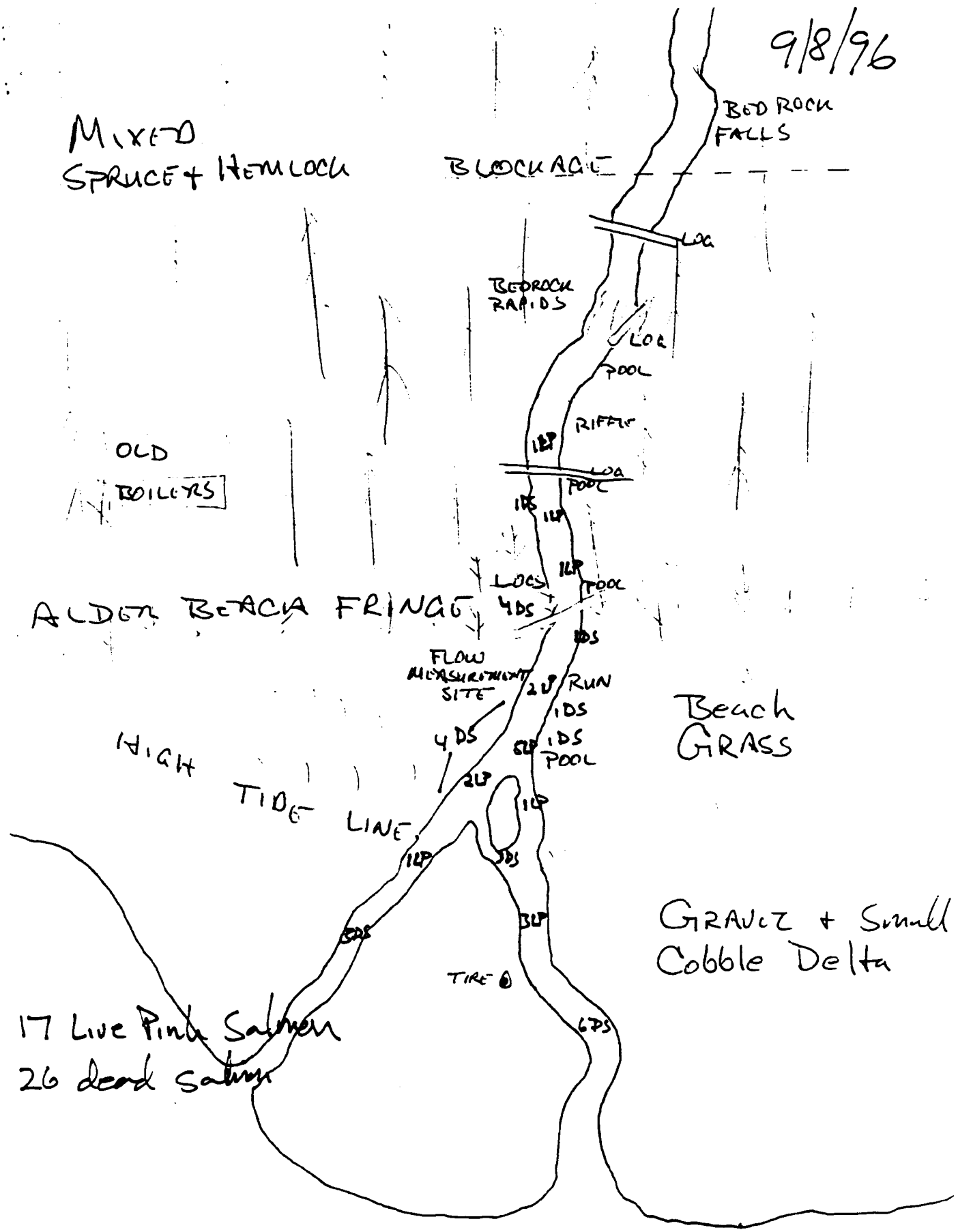

8/3/96
MIXED SPRUCE + HEMLOCK
BLOCKAGE
BED ROCK FALLS
LOG
BEDROCK RAPIDS
LOG
POOL
RIFFLE
OLD BOILERS
LOG
POOL
LOGS
POOL
ALDER BEACH FRINGE
DS
FLOW MEASUREMENT SITE
RUN
POOL
Beach GRASS
HIGH TIDE LINE
TIRE
DS
GRAVEL + Small Cobble Delta

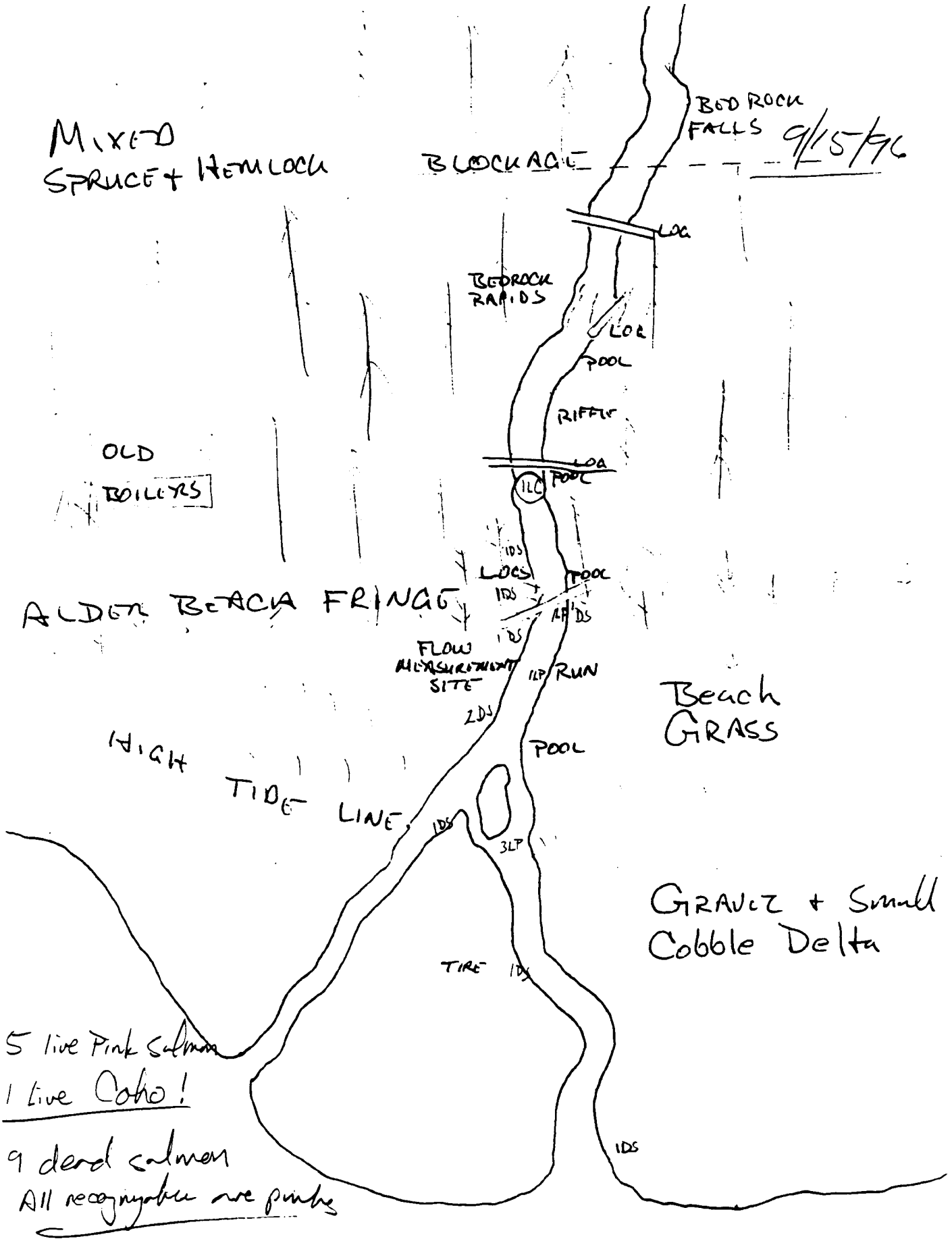

8/12/96
MIXED SPRUCE + HEMLOCK
BLOCKAGE
BED ROCK FALLS
LOG
BEDROCK RAPIDS
LOG
POOL
RIFFLE
OLD BOILERS
LOG
POOL
LOGS
POOL
ALDER BEACH FRINGE
FLOW MEASUREMENT SITE
RUN
Beach GRASS
POOL
HIGH TIDE LINE
SCHOOL OF SMALL FISH, 1-3", APPROX 50
LOG
GRAVEL + Small Cobble Delta
TIRE
LOG

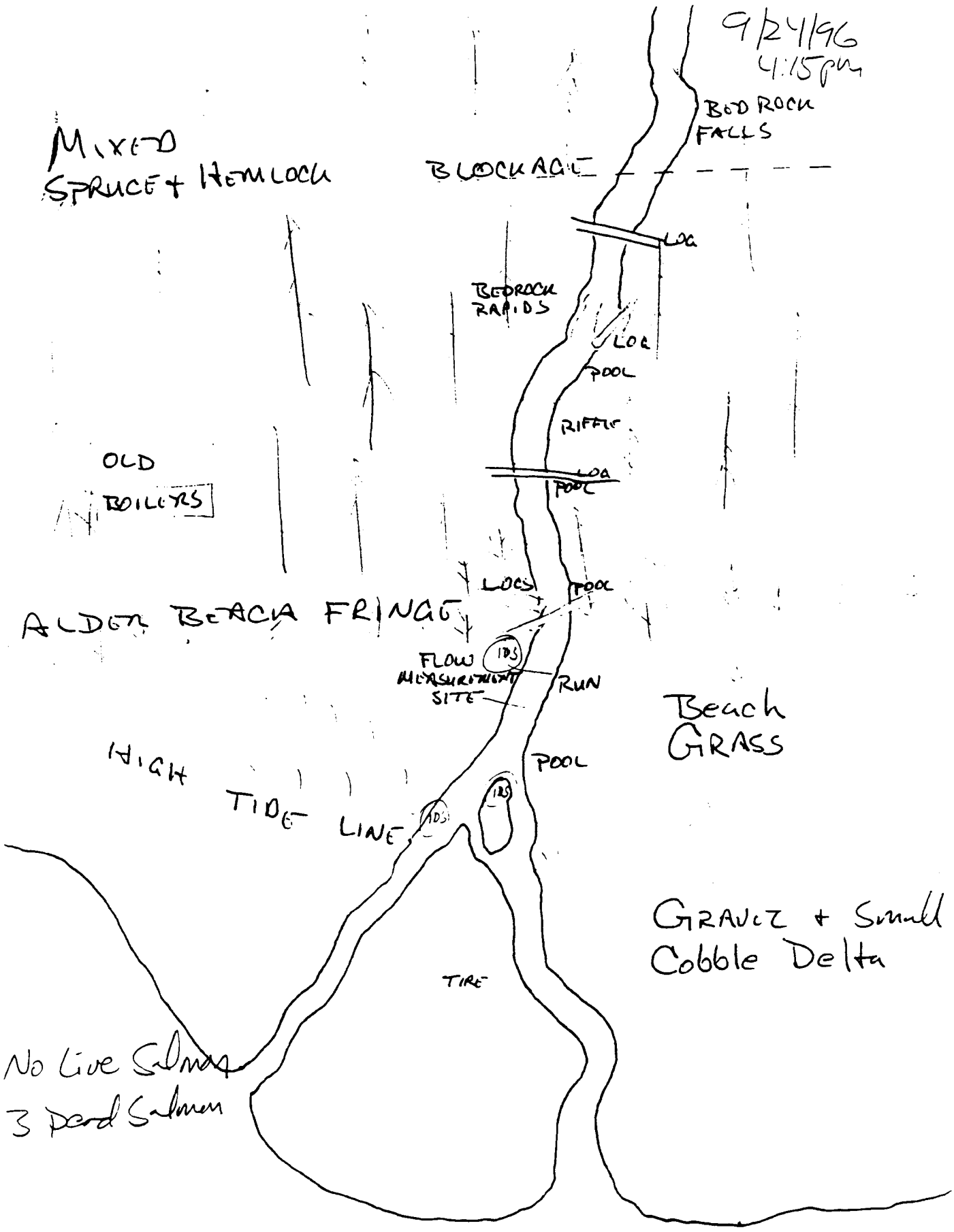

8/21/96
BED ROCK FALLS
MIXED SPRUCE + HEMLOCK
BLOCKAGE
LOG
BEDROCK RAPIDS
LOG
4LP
POOL
RIFFLE
OLD BOILERS
LOG
POOL
LOGS
POOL
ALDER BEACH FRINGE
FLOW MEASUREMENT SITE
12LP
RUN
4LP
6LP
POOL
Beach GRASS
HIGH TIDE LINE
GRAVEL + Small Cobble Delta
2DC
2DC
TIRE
5LP

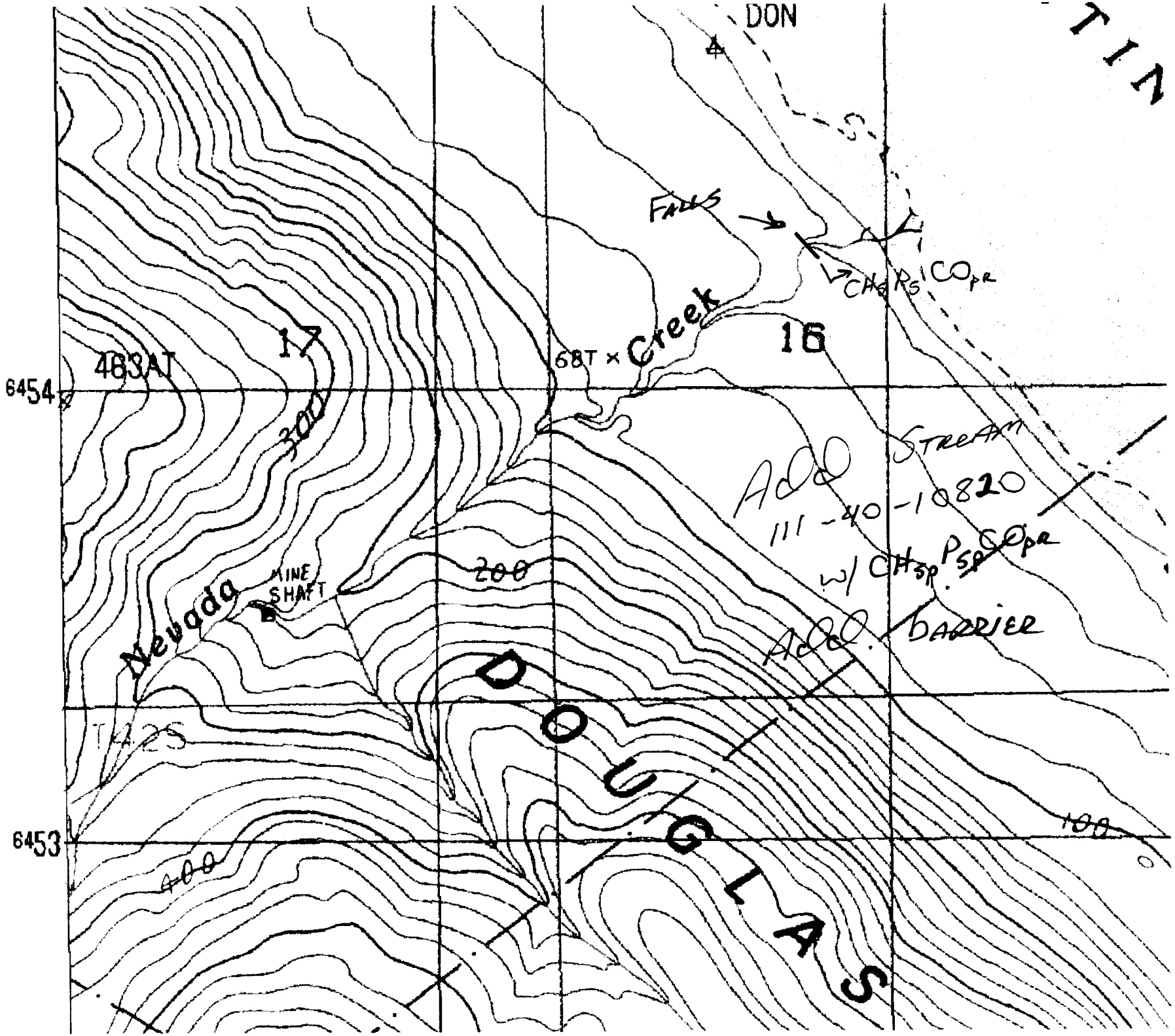

8/27/96
MIXED
SPRUCE + HEMLOCK
BLOCKAGE
BED ROCK
FALLS
LOG
BEDROCK
RAPIDS
LOG
POOL
4LP
RIFFLE
OLD
BOILERS
LOG
4LP
POOL
2LP
LOGS
6LP
POOL
ALDER BEACH FRINGE
FLOW
MEASUREMENT
SITE
8LP
RUN
Beach
GRASS
HIGH
TIDE
LINE
POOL
8LP
5LP
45LP
2LP
14LP
TIRE
6LP
25LP
1LP
GRAVEL + Small
Cobble Delta
170
LIVE PINKS
No Dead SALMON
No other SALMON


9/4/96
1:30pm
MIXED SPRUCE + HEMLOCK
BLOCKAGE
BED ROCK FALLS
LOG
BEDROCK RAPIDS
LOG
POOL
3LP
RIFFLE
LOG
OLD BOILERS
10S POOL
4LP
LOGS
3DS
POOL
ALDER BEACH FRINGE
1DS
FLOW MEASUREMENT SITE
4LP
RUN
Beach Grass
8DS
1LP
POOL
HIGH TIDE LINE
2DS
7LP
2LP
2DS
3LP
18LP
2DS
4LP
4DS
6LP
TIRE
GRAVEL + Small Cobble Delta
2LP
3DS
1LP
6DS
51 Live Pinks
32 Dead Salmon


9/8/96
MIXED
SPRUCE + HEMLOCK
BLOCKAGE
BED ROCK
FALLS
LOG
BEDROCK
RAPIDS
LOG
POOL
RIFFLE
1LP
OLD
BOILERS
LOG
POOL
1DS
1LP
LOGS
1LP
POOL
ALDER BEACH FRINGE
4DS
1DS
FLOW
MEASUREMENT
SITE
2LP
RUN
1DS
Beach
GRASS
4DS
1DS
POOL
HIGH
TIDE
LINE
2LP
1LP
1LP
3DS
3LP
GRAVEL + Small
Cobble Delta
TIRE
6DS
17 Live Pink Salmon
26 dead salmon


MIXED
SPRUCE + HEMLOCK
BLOCKAGE
BOD ROCK FALLS
9/15/96
LOG
BEDROCK RAPIDS
LOG
POOL
RIFFLE
LOG
POOL
OLD
BOILERS
ALDER BEACH FRINGE
LOGS
POOL
FLOW MEASUREMENT SITE
RUN
Beach GRASS
HIGH TIDE LINE
POOL
GRAVEL + Small Cobble Delta
5 live Pink Salmon
1 Live Coho!
9 dead salmon
All recognizable are pinks


9/24/96
4:15pm
BED ROCK FALLS
MIXED SPRUCE + HEMLOCK
BLOCKAGE
LOG
BEDROCK RAPIDS
LOG
POOL
RIFFLE
OLD BOILERS
LOG
POOL
LOGS
POOL
ALDER BEACH FRINGE
FLOW MEASUREMENT SITE
RUN
Beach GRASS
HIGH TIDE LINE
POOL
GRAVEL + Small Cobble Delta
TIRE
No Live Salmon
3 Dead Salmon


DON
T 1 N
FALLS
CH4 Ps CO pr
Creek
16
17
483AT
6454
300
68T ×
Add STREAM
111-40-1820
w/ CH3P Ps CO pr
Add. BARRIER
200
MINE SHAFT
Nevada
DOUGLAS
T 42S
6453
400
100