

# Fisheries Evaluation



*Prepared for:*



**State of Alaska  
Department of Transportation and  
Public Facilities**

*Prepared by:*  
**HDR Alaska, Inc.  
2525 C Street, Suite 305  
Anchorage, Alaska 99503**

**March 2011**



## **CONTENTS**

1.0	Introduction.....	1
2.0	Project Alternatives.....	1
	No Build Alternative.....	2
	Cooper Creek Alternative .....	2
	G South Alternative .....	2
	Juneau Creek Alternative.....	3
3.0	Study Purpose and History.....	3
4.0	Methodology .....	3
5.0	Results.....	4
	Sites Common to All Project Alternatives.....	4
	Cooper Creek Alternative .....	8
	Cooper Creek and G South Alternatives.....	11
	G South Alternative .....	15
	G South and Juneau Creek Alternatives .....	18
	Juneau Creek Alternative.....	19
6.0	Summary Discussion .....	24
7.0	References.....	24

## **Tables**

Table 5–1:	Summary of sites common to all alternatives.....	7
Table 5–2:	Summary of Cooper Creek Alternative sample sites.....	10
Table 5–3:	Summary of sites common to Cooper Creek and G South Alternatives .....	13
Table 5–4:	Summary of G South Alternative sample sites.....	17
Table 5–5:	Summary of sites common to G South and Juneau Creek Alternatives .....	18
Table 5–6:	Summary of Juneau Creek Alternative sample sites .....	22

## **Figures**

- Figure 1: Index Map
- Figure 2: Detailed map of project area
- Figure 3: Detailed map of project area
- Figure 4: Detailed map of project area
- Figure 5: Detailed map of project area
- Figure 6: Detailed map of project area
- Figure 7: Detailed map of project area
- Figure 8: Detailed map of project area
- Figure 9: Detailed map of project area
- Figure 10: Detailed map of project area
- Figure 11: Detailed map of project area

## 1.0 Introduction

The Alaska Department of Transportation and Public Facilities (DOT&PF) is evaluating alternatives to improve the Sterling Highway in the Cooper Landing area, between mileposts (MP) 45 and 60. DOT&PF has recognized the need to resolve several interrelated problems:

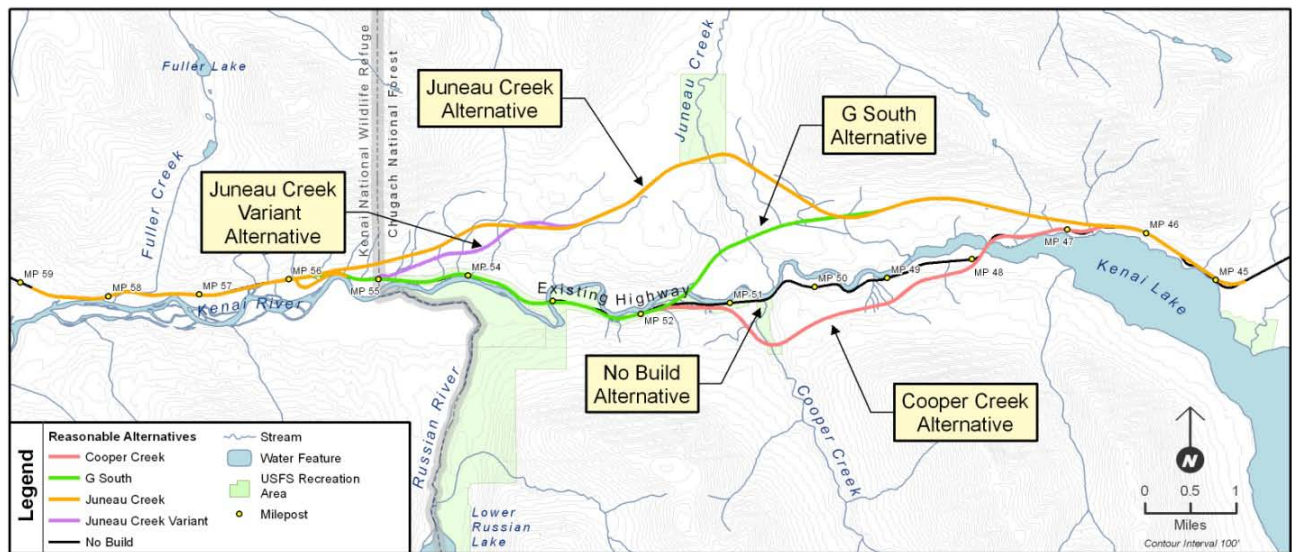
- The highway’s capacity is not adequate to accommodate through traffic.
- Physical highway design features do not conform to “Rural Principal Arterial” standards.
- System linkage between urban areas and other highways is poor.
- Local traffic cannot efficiently move on and off the highway.

The project purpose is to resolve these problems, thereby reducing congestion and providing for more consistent flow of traffic at typical highway speeds, while also accommodating the sizable minority of traffic bound for local destinations. HDR Alaska, Inc. (HDR) has been contracted by DOT&PF to provide engineering and environmental support for preparation of a Supplemental Environmental Impact Statement (SEIS).

## 2.0 Project Alternatives

Four alternatives are being evaluated as part of the SEIS currently under preparation. Each alternative begins at the intersection of Quartz Creek Road with the Sterling Highway, at MP 45, and ends just east of the highway’s intersection with Skilak Lake Road, at MP 58. Project alternatives are shown in Figure 1 and briefly described below.

**Figure 1: Project Alternatives**



### ***No Build Alternative***

The No Build Alternative will not change the existing highway in the project area. The existing highway has one lane in each direction, limited shoulder space, tight curves, low sight distance, and a posted speed limit of 35 miles per hour (mph) in areas. Although normal highway maintenance would continue along this segment of roadway, no improvements would occur. The existing bridges along the Sterling Highway will be replaced as part of the normal bridge replacement program, but would not be conducted as part of this project.

### ***Cooper Creek Alternative***

The Cooper Creek Alternative follows the existing Sterling Highway from MP 45 to the south side of the Cooper Landing Bridge, where it turns south from the existing highway and climbs the hillside to a maximum elevation of approximately 275 feet above the Kenai River. The alignment traverses the hillside before descending to cross Cooper Creek with an 846-foot-long curved bridge. The alternative rejoins the existing Sterling Highway corridor at MP 51.3. The length of the alternative, including those areas that overlap with the existing highway, would be widened to meet current standards and would include the addition of west- and east-bound passing lanes. The Cooper Landing Bridge would be replaced with a new bridge that would be 78 feet wide and 670 feet long, and would accommodate 2 lanes, 1 turning lane, and 1 center lane, as well as shoulders and a pedestrian walkway on the downstream side. The existing Schooner Bend Bridge would be replaced with a similar structure located approximately 80 feet downstream.

Due to the terrain surrounding the alternative, frequent rock and soil cuts are necessary, with the largest cut on the east side of the Cooper Creek Bridge being 1,500 feet long and 180 feet high.

### ***G South Alternative***

The G South Alternative uses the existing highway corridor at both ends of the project area, with a new alignment north of the Kenai River between MP 46.3 and MP 51.9. In areas where the G South Alternative occupies the footprint of the existing highway, the roadway will be widened to meet Rural Principal Arterial standards, and would include west-and eastbound passing lanes. The G South Alternative departs the existing highway at approximately MP 46 and gradually climbs to a maximum elevation of 776 feet on the hillside north of Bean Creek, where it then descends to cross Juneau Creek Canyon. The Juneau Creek Canyon Bridge would be 1,320 feet long and 62 feet wide with 2 lanes, an additional eastbound climbing lane, shoulders on both sides of the road, and a walkway on the south side of the bridge. On the west side of Juneau Creek Canyon, the alternative flattens to a new crossing of the Kenai River shortly before rejoining the existing highway corridor at MP 51.9. The new Kenai River Bridge would be approximately 490 feet long and 78 feet wide, with 2 lanes, an additional eastbound climbing lane, a center turn lane, shoulders on both sides of the road, and a walkway on the upstream (south) side of the bridge. The Schooner Bend Bridge would be replaced as part of the G South Alternative, in the same manner described for the Cooper Creek Alternative.

### ***Juneau Creek Alternative***

The Juneau Creek Alternative would straighten and widen the existing highway at both ends of the project area, with a new alignment north of the existing roadway between approximately MP 46.3 and 55.8. The alternative diverges from the existing highway at MP 46.3 and climbs the hillside to its crossing of the Juneau Creek Canyon with a new bridge (825 to 1,211 feet long, depending on the bridge type selected). The new Juneau Creek Bridge would be 62 feet wide with two traffic lanes, one additional westbound climbing lane, shoulders on both sides of the road, and a pathway on the downstream (south) side of the bridge. Based on the conceptual alignment and profile for this alternative, Juneau Creek is approximately 230 feet below the canyon rim and approximately 425 feet from rim to rim of the canyon at the crossing.

On the west side of Juneau Creek, the alignment continues to climb to its maximum elevation of approximately 300 feet above the Juneau Creek canyon floor. The existing highway would be reconfigured to provide a T-intersection connection with the Juneau Creek Alternative at approximately MP 55.8 of the existing highway. The alignment then follows the existing highway west for the remaining three miles to the end of the project.

### **3.0 Study Purpose and History**

The objectives of the fisheries evaluation were to determine which species of fish reside in streams crossed by the project alternatives and to identify streams with high probabilities of fish use, either seasonally or year-round. This information will be used as part of the project's essential fish habitat section of the SEIS and to assist in stream crossing design.

The initial fisheries evaluation was conducted in 2004, and some sample sites were not surveyed due to insufficient water levels. A hydrology and hydraulics investigation was completed in May 2005, and streams or water bodies not surveyed during the 2004 fisheries evaluation but identified during the hydrology study as potentially containing fish were noted.

A second fisheries field investigation was conducted in August 2005. Because the summer of 2004 was an unusually warm and dry season, streams that were thought to contain sufficient flow in normal years were revisited in 2005. Sites identified during the hydrology study but not surveyed during the 2004 fisheries program were added to the 2005 investigation, and sites where fish were either not observed or observed in low numbers in 2004 were sampled again in 2005.

This report summarizes findings of the fish presence studies conducted in 2004 and 2005. The field study was completed by HDR biologists with assistance from an Alaska Department of Natural Resources staff member under permit numbers SEW243 (2004 event) and SEW272 (2005 event).

### **4.0 Methodology**

Site locations were determined according to where the proposed alignments would intersect streams. In general, points of intersection between streams and the proposed alignments were sampled. During the 2004 effort, each site that had sufficient water level was sampled using Gee ¼-inch mesh minnow traps baited with cured salmon eggs. Traps were not set at sites with insufficient water levels. Between one and four traps were used at each site, and were left at the

site for 24 hours. The 2005 field methods included electro-fishing surveys and direct observation (visual surveys). Electro-fishing surveys were conducted using a backpack electro-fisher (Smith-Root Model LR-24). The length of stream sampled at each sample site varied, but generally electro-fishing occurred within a 65.62 to 164.04 feet (20 to 50 meter) reach.

During both field events, all captured fish were identified, counted, and measured before being released live at their point of capture. Additional data collected included stream gradient, channel width, average water depth, culvert condition (where applicable), primary substrate, and macrohabitat type. Aerial photos, maps, and Global Positioning System (GPS) units were used to locate each site.

## **5.0 Results**

Sample sites were identified based on their intersection with project alternatives. Sites identified with the “ALL” prefix are common to the No Build, Cooper Creek, G South, and Juneau Creek alternatives. Sites with the “CCGS” prefix are common to the Cooper Creek and G South alternatives. Sites with the “GSJC” prefix are common to the G South and Juneau Creek alternatives. Sites with the “CC”, “GS”, or “JC” prefix are specific to the Cooper Creek, G South, or Juneau Creek alternative, respectively. Sampling nomenclature used for new sites during the 2005 sampling event varied.

Individual sample sites are described below. Sites correspond to locations identified on Figures 2 through 11, and GPS coordinates are included in Tables 5-1 through 5-6. Site and sample measurements were originally recorded in metric units, and have been converted to feet and inches in compliance with DOT&PF standards.

### ***Sites Common to All Project Alternatives***

#### **Sampling Site ALL1—Figure 11**

During the 2004 sampling event this stream had low flow, with a water depth that ranged between 0.10 and 0.98 feet (0.03 and 0.30 meters). Habitat was primarily riffles and step-pools. The channel was less than 3.258 feet (1 meter) wide and had a 15 percent gradient. A small pool was identified on the upstream side of the culvert. Approximately 19.68 feet (6 meters) upstream from the confluence with Kenai Lake there is a 1.48-foot (0.45-meter) bedrock step. Substrate was predominantly large gravels. Minnow traps were set at this site, but no fish were captured or observed. This sample site was not revisited in 2005.

#### **Sampling Site ALL2—Figure 11**

This ephemeral stream was dry at the Sterling Highway road crossing during the 2004 event, with very low flow approximately 492.12 feet (150 meters) upstream. The channel width averaged 0.66 feet (0.2 meters) with a depth of 0.13 feet (0.04 meters). The substrate was predominately large gravel at the sample site and organic/gravel upstream, with a 10 percent grade. The culvert outlet was set in rip-rap and perched approximately 59.05 feet (18 meters) above the lake surface, and appeared to act as a fish barrier. No traps were set due to insufficient water depth. This sample site was not revisited in 2005.



Sampling Site ALL22—Figure 4

This perennial stream exhibited moderate flow during the 2004 sampling event, was less than 3.28 feet (1 meter) wide and had a 25 percent gradient. Water depth ranged from 0.26 to 0.98 feet (0.08 to 0.30 meters). Habitat was made up of step-pools and was overgrown, with organic and small cobble substrate. An 8.20-foot (2.5-meter) cascade waterfall was noted directly upstream of the culvert; this appeared to be a fish barrier. The culvert was in good structural condition but was perched a few inches above the stream bed on the downstream side. Minnow traps were set at this sample site, but no fish were captured or observed. This sample site was not revisited in 2005.

Sampling Site ALL23—Figure 4

Minnow traps were placed at this site during the 2004 field effort but no fish were captured. It was noted in 2004 that the culvert was approximately 1.48-foot (0.45-meter) above the stream bed. The site was revisited in 2005 and electro-fished just north of the highway near the culvert, which was not perched during the 2005 event. No fish were captured. The stream was 3.28 feet (1 meter) wide with a 35-percent gradient during both events, with moderate stream flow. Water depth was noted between 0.33 to 1.18 feet (0.10 and 0.36 meters) in 2004 and between 0.33 to 1.15 feet (0.10 and 0.35 meters) in 2005. Habitat was primarily steep, terraced step-pools, with gravel to large cobble substrate. Locations further upstream were not surveyed due to the steepness of the terrain; this stream is not likely to be occupied by anadromous fish upstream of the sampling site due to the steep terrain.

Sampling Site ALL24—Figure 4

The stream channel was dry during the 2004 sampling event, and overgrown with no recent signs of scour. Large gravels were observed in the channel bed. No minnow traps were set due to lack of water. This sample site was not revisited in 2005.

Sampling Site ALL25—Figure 4

This perennial stream had moderate flow during the 2004 sampling event and was less than 3.28 feet (1 meter) wide with an average depth of 0.66 feet (0.20 meters). A 14.76-foot (4.5-meter) bedrock cascade was observed directly upstream of the culvert, likely a fish passage barrier. The substrate was large gravel in the lower reaches and smaller gravels upstream. Minnow traps were set above the waterfall to verify resident fish population, but no fish were captured. The site was not revisited in 2005.

Sampling Site ALL26—Figure 4

This channel was dry during the 2004 sampling event, overgrown, and showed no recent signs of flow. Large gravels were observed in the substrate. No minnow traps were set due to lack of water. This sample site was not revisited in 2005.

Sampling Site ALL27—Figure 4

This site was visited during the 2004 sampling event and the streambed was observed to have been dry for many years, as it was being used as a trail. Large gravels were observed in the

streambed. Neither culverts nor sign of a new channel were observed. No minnow traps were set due to lack of water. This sample site was not revisited in 2005.

#### Sampling Site ALL28—Figure 3

At the time of the 2004 field survey, this perennial stream (Fuller Creek) was dry due to seasonal conditions. No minnow traps were set due to lack of water. Because this stream was verified as flowing in September 2003 and is listed as anadromous in the Alaska Department of Fish and Game (ADF&G) Anadromous Waters Catalog, it was revisited during 2005 survey.

During the 2005 survey the stream was approximately 4.92 feet (1.5 meters) wide, 0.49 feet (0.15 meters) deep, and had a moderate flow. The 164.04 feet (50 meters) reach that was electrofished consisted mainly of riffles intermixed with small pools and cascades. This reach was dominated by large gravels and some small cobbles, with a gradient of approximately 15 percent. Signs of erosion were evident near the culvert downstream from the sample site. The small pools in the vicinity of culvert on the north side of the road were also electrofished. No fish were captured or observed within this stream.

#### Sampling Site ALL29—Figure 3

This site was visited in 2004 and observed as dry with no defined channel. Large gravel and small cobbles were observed. A ditch relief culvert was observed between sites ALL29 and ALL28. No minnow traps were set due to lack of water. This sample site was not revisited in 2005.

#### Sampling Site ALL30—Figure 3

The stream channel was dry during the 2004 sampling event, overgrown, and showed no recent signs of flow. Substrate consisted of large gravel to small cobbles. No minnow traps were set due to lack of water. This sample site was not revisited in 2005.

#### Sampling Site C19—Figure 4

This site was not sampled in 2004, but was identified during the 2005 hydrology and hydraulics field investigation and added to the 2005 fisheries sampling event. The site was approximately 3.28 feet (1 meter) wide and less than 0.33 feet (0.1 meter) deep, with a gradient of approximately 2 to 3 percent. Substrate consisted mainly of sands and gravels. Tall grasses and other herbaceous plants dominated the riparian vegetation. This sample site was electrofished, but no fish were captured or observed.

**Table 5–1: Summary of sites common to all alternatives**

Site No.	Sample Year	Location	Status	Species	Substrate	Habitat	Width		Depth		Gradient (%)
							ft	m	ft	m	
ALL1	2004	N60° 29.222' W149° 44.176'	no fish	—	large gravel	riffles; step-pools	<3.28	<1	0.01 to 0.98	0.03 to 0.30	15
ALL2	2004	N60° 29.486' W149° 44.902'	dry	—	large gravel	—	0.66	0.2	0.13	0.04	10
ALL22	2004	N60° 29.312' W150° 01.420'	no fish	—	organic/small cobble	step-pools	<3.28	<1	0.26 to 0.98	0.08 to 0.30	25
ALL23	2004 2005	N60° 29.272' W150° 01.954'	no fish	—	gravel to large cobble	terraced step-pools	3.28	1	0.33 to 1.18	0.10 to 0.36	35
ALL24	2004	N60° 29.226' W150° 02.499'	dry	—	large gravel	—	—	—	—	—	—
ALL25	2004	N60° 29.209' W150° 02.658'	no fish	—	small to large gravel	—	<3.28	<1	0.66	0.2	—
ALL26	2004	N60° 29.135' W150° 03.174'	dry	—	large gravel	—	—	—	—	—	—
ALL27	2004	N60° 29.106' W150° 03.475'	dry	—	large gravel	—	—	—	—	—	—
ALL28	2004 2005	N60° 29.127' W150° 04.720'	no fish	—	large gravel to small cobble	riffles; small pools; cascades	4.92	1.5	0.49	0.15	15
ALL29	2004	N60° 29.142' W150° 05.069'	dry	—	large gravel/ small cobble	—	—	—	—	—	—
ALL30	2004	N60° 29.078' W150° 05.702'	dry	—	large gravel/ small cobble	—	—	—	—	—	—
C19	2005	N 60° 29.2879' W150° 1.4207'	no fish	—	sand; small to large gravels	riffles	3.28	1	0.33	<0.1	2 to 3

## ***Cooper Creek Alternative***

### **Sampling Site CC31—Figure 11**

This site was visited in 2004 and observed as a completely dry channel, approximately 0.98 feet (0.3 meters) wide, with a large gravel substrate. The sample site is approximately 1,400.90 feet (427 meters) downstream from sample site GSJC04, which had moderate flow. An 11.81-foot (3.6-meter) bedrock cascade was observed approximately 997.36 feet (304 meter) upstream, and likely acted as a passage barrier. Approximately 803.80 feet (245 meters) upstream of the sample site the stream is either subterranean or is being pumped out; a black hose was found in the stream bed. No minnow traps were set due to lack of water. This sample site was not revisited in 2005.

### **Sampling Site CC32—Figure 10**

During the 2004 sampling event this stream exhibited low flow and was approximately 0.13 feet (0.04 meters) deep with a few deeper pools, with stream width ranging between 3.28 to 4.92 feet (1.0 and 1.5 meters). The stream gradient was approximately 1 percent, with organic and medium gravel substrate. Stream habitats were mainly riffle and glide. This tributary flows along the Sterling Highway and passes under Snug Harbor Road. The site is close to the Kenai River (59.05 feet [18 meters]) and provides off-channel rearing habitat for coho salmon fry. Ten juvenile coho salmon, ranging from 1.38 to 2.40 inches (35 to 61 millimeters), and one 2.09-inch (53-millimeter) Dolly Varden were captured. This sample site was not revisited in 2005.

### **Sampling Site CC33—Figure 10**

In 2004, the stream at this sample site had low flow with insufficient water depth (approximately 0.10 to 0.33 feet [0.03 to 0.10 m]) to set minnow traps, with an average channel width less than 1.64 feet (0.50 meters) and a 3 percent stream gradient. The stream had an organic and gravel substrate. No minnow traps were set due to insufficient water depth. This sample site is located 597.11 feet (182 meters) upstream from a road in a housing development.

The site was revisited in 2005 and the stream channel was completely dry. A stream channel with flowing water was identified approximately 98.42 feet (30 meters) east of this location. This channel was very narrow with abundant vegetative cover and large woody debris, but flowed underground in many places. The electrofisher wands were too large for effective use in this habitat and so were not used to sample this location. No fish were observed, although visibility was limited within this stream channel.

### **Sampling Site CC34—Figure 9**

Located in Cooper Creek, this site was sampled in 2004 and identified as a perennial stream with moderate flow. The stream gradient was 3 percent, with primarily boulder and gravel substrate. The stream channel varied between 32.81 and 49.21 feet (10 and 15 meters) wide, and stream habitat was pools and riffle/glide. Coho salmon, sockeye salmon, and Dolly Varden are present at this sample site based on personal communication with Paul McLarnon (HDR 2004). The ADF&G Anadromous Waters Catalog lists rearing coho in both upper and lower reaches of Cooper Creek (ADF&G 2004). No minnow traps were set at this sample site because fish presence was already verified. This sample site was not revisited in 2005.

Sampling Site CC35—Figure 9

During the 2004 sampling event this stream was noted as ephemeral with a predominately organic substrate. The channel width was less than 1.64 feet (0.5 meters). Previous studies in the project area indicated that no fish were present (HDR 2004). This sample site was not revisited in 2005.

Sampling Site CC36—Figure 7

This perennial stream had low flow during the 2004 sampling event. The stream channel was 6.56 feet (2 meters) wide with 1 percent gradient and organic substrate. Stream flow was noted as spreading into surrounding muskeg and several small ponds. One Dolly Varden (4.45 inches [113 millimeters]) was captured.

The site was revised in 2005 and identified as between 0.66 and 1.64 feet (0.2 and 0.5 meters) wide. Depths were variable but averaged approximately 0.66 feet (0.2 meters). Stream gradient was approximately 3 percent. Channel substrate consisted mainly of sands and organic material (small branches and other small woody debris). No fish were captured or observed during 2005 electrofishing.

**Table 5–2: Summary of Cooper Creek Alternative sample sites**

Site No.	Sample Year	Location	Status	Species	Length		Substrate	Habitat	Width		Depth		Gradient (%)
					in	mm			ft	m	ft	m	
CC31	2004	N60° 29.640' W149° 48.087'	dry	—	—	—	large gravel	—	0.98	0.3	—	—	—
CC32	2004	N60° 29.477' W149° 48.647'	fish present	coho	2.09	53	organic/ med. gravels	riffle/glide	3.28 to 4.92	1 to 1.5	—	0.04	1
				coho	1.77	46							
				coho	1.54	39							
				coho	1.38	35							
				coho	1.73	44							
				coho	2.17	55							
				coho	2.4	61							
				coho	1.89	48							
				coho	1.89	48							
				DV	2.09	53							
CC33	2004 2005	N60° 29.270' W149° 49.455'	too shallow	—	—	—	organic/ gravel	—	<1.64	<0.5	—	0.30 to 0.10	3
CC34	2004	—	fish present *	coho, DV sockeye	—	—	boulder/ gravel	pool/riffle glide	32.80 to 49.21	10 to 15	—	—	3
CC35	2004	—	no fish*	—	—	—	organic	—	<1.64	<0.5	—	—	—
CC36	2004	N60° 29.007' W149° 54.155'	fish present	DV	4.45	113	organic	—	6.56	2	—	—	1
	2005		no fish	—	—	—							

\* HDR 2004

### ***Cooper Creek and G South Alternatives***

#### **Sampling Site CCGS38—Figure 7**

During the 2004 sampling event this stream had low flow and was approximately 0.16 to 0.98 feet (0.05 to 0.30 meters) deep. The stream gradient was 1 percent. The channel substrate was organic and ran through a marshy area. Minnow traps were set in a pond directly below the channel, but no fish were captured. This sample site was not revisited in 2005.

#### **Sampling Site CCGS39—Figure 5**

The stream channel was noted as completed dry in 2004, but recent signs of scour were noticeable. No minnow traps were set due to lack of water.

The site was revisited in 2005, when ponded water was present on the north side of the road in the vicinity of a small perched culvert, but no surface flow was observed. This area was electrofished, but no fish were captured or observed.

#### **Sampling Site CCGS40—Figure 5**

This site was visited during the 2004 sampling event, exhibited moderate flow, and was 8.20 feet (2.5 meters) wide and 0.82 feet (0.25 meters) deep. The stream channel substrate consisted mostly of large gravel and had a gradient of 5 percent. The culvert outlet was perched 0.98 feet (0.3 meters) above the streambed. Seven Dolly Varden were captured, with lengths ranging from 1.97 to 5.87 inches (50 to 149 millimeters). This sample site was not revisited in 2005.

#### **Sampling Site CCGS41—Figure 5**

During the 2004 sampling event the stream at this site had low flow with a few pools upstream of a culvert. The habitat was riffle/pool, and the stream ranged between 0.16 to 0.66 feet (0.05 and 0.20 meters) deep. Channel substrate was mainly large gravel and the stream gradient was 3 percent. Seven coho salmon (1.62 to 2.29 inches [41 to 58 millimeters]) and one sculpin (3.11 inches [79 millimeters]) were captured. This sample site was not revisited in 2005.

#### **Sampling Site CCGS42—Figure 5**

The stream had low flow with shallow, terraced step-pools during the 2004 sampling event. The stream channel was 0.66 feet (0.2 meters) wide and had a gradient of 25 percent. Channel substrate consisted of organics and large gravel. Minnow traps were set at this sample site, but no fish were captured. This sample site was not revisited in 2005.

#### **Sampling Site CCGS43—Figure 4**

During the 2004 sampling event the stream channel was completely dry, so the site was revisited in 2005.

A stream flowing from a pond was observed in 2005. The stream was approximately 3.28 to 3.94 feet (1 to 1.2 meters) wide and 0.33 feet (0.1 meters) deep. The stream gradient varied between 4 percent near the pond and approximately 35 percent at the crest of the hill. Small gravels dominated the stream substrate, and a thick organic layer dominated the pond substrate. Portions of both the pond and the stream near the pond were electrofished; however, no fish were captured or observed.

Sampling Site CCGS44—Figure 4

The stream, visited in 2004, consisted of a series of small pools with no observable surface flow. The channel was 0.98 feet (0.3 meters) wide with a stream gradient of 15 percent. The stream channel substrate consisted of organics and gravel. The outlet of the culvert was 24.93 feet (7.6 meters) above the existing stream bed, creating a barrier. No minnow traps were set and no fish were observed. This sample site was not revisited in 2005.

Sampling Site C07—Figure 5

This site was not sampled in 2004, but was identified during the 2005 hydrology study and sampled during the 2005 fisheries sample event. The stream channel was approximately 3.94 to 4.92 feet (1.2 to 1.5 meters) wide and 0.49 feet (0.15 meters) deep, with an average gradient of 3 percent. Substrate consisted mainly of cobbles, gravels, and sand. The stream channel contained abundant woody debris and overhanging vegetation. A total of 10 fish, including 8 juvenile Chinook salmon ranging in size from 1.34 to 1.93 inches (34 to 49 millimeters), 1 coho salmon (1.34 inches [34 millimeters]) and 1 Dolly Varden (1.38 inches [35 millimeters]) were captured during the electrofishing survey at this site.

Sampling Site C33—Figure 7

This site was not sampled in 2004, but was identified during the 2005 hydrology study and sampled during the 2005 fisheries sample event. The site consisted of multiple ponded areas in the vicinity of a culvert, without a defined stream channel. No flow was observed. The ponded areas were electrofished, but no fish were captured or observed.



**Table 5-3: Summary of sites common to Cooper Creek and G South Alternatives**

Site No.	Sample Year	Location	Status	Species	Length		Substrate	Habitat	Width		Depth		Gradient (%)
					in	mm			ft	m	ft	m	
CCGS38	2004	N60° 28.832' W149° 55.685'	no fish	—	—	—	organic	pond	—	—	1.16 to 1.98	0.05 to 0.30	1
CCSG39	2004 2005	N60° 29.282' W149° 58.634'	dry	—	—	—	—	—	—	—	—	—	—
CCGS40	2004	N60° 29.310' W149° 58.743'	fish present	DV	5.52	140	large gravel	—	8.2	2.5	0.82	0.25	5
				DV	4.33	110							
				DV	3.62	92							
				DV	4.1	104							
				DV	5.87	149							
				DV	3.15	80							
				DV	1.97	50							
CCGS41	2004	N60° 29.252' W149° 59.034'	fish present	coho	1.89	48	large gravel	riffle/pool	—	—	0.16 to 0.66	0.05 to 0.20	3
				coho	2.13	51							
				coho	1.65	42							
				coho	1.62	41							
				coho	2.17	55							
				coho	2.29	58							
				coho	1.93	49							
				sculpin	3.11	79							
CCGS42	2004	N60° 29.270' W149° 59.981'	no fish	—	—	—	organic/large gravel	step- pools	0.66	0.2	—	—	25
CCGS43	2004	N60° 29.277' W150° 00.576'	dry	—	—	—	—	—	—	—	—	—	—
	2005		no fish	—	—	—	small gravels	riffles	3.28 to 3.93	1 to 1.2	0.33	0.1	4-35

**Table 5–3: Summary of sites common to Cooper Creek and G South Alternatives (cont.)**

Site No.	Sample Year	Location	Status	Species	Length		Substrate	Habitat	Width		Depth		Gradient (%)
					in	mm			ft	m	ft	m	
CCGS44	2004	N60° 29.297' W150° 00.980'	no flow	—	—	—	organic/gravel	stagnant pools	0.98	0.3		—	15
C07	2005	N60° 29.2535' W149° 59.0436'	fish present	DV	1.38	35	sands, gravels, cobbles	riffles	3.93 to 4.92	1.2 to 1.5	0.49	0.15	3
				Chinook	1.34	34							
				Chinook	1.34	34							
				Chinook	1.34	44							
				Chinook	1.77	45							
				Chinook	1.77	45							
				Chinook	1.85	47							
				Chinook	1.93	49							
				Chinook	1.93	49							
			coho	1.34	34								
C33	2005	N60° 29.2708' W149° 49.475'	no fish	—	—	—	—	—	—	—	—	—	—

## ***G South Alternative***

### **Sampling Site GS8—Figure 8**

This tributary of Bean Creek was visited in 2004, and moderate flow and a 7 percent gradient were observed. The channel substrate was composed of small to large gravels and small cobbles. Channel width averaged 3.28 feet (1 meter), with a depth of 0.26 to 0.66 feet (0.08 to 0.20 meters). The habitat consisted of riffles and pools. Four Dolly Varden (3.11 to 5.12 inches [79 to 130 millimeters] long) were captured. This sample site was not revisited in 2005.

### **Sampling Site GS9—Figure 8**

This sample site, the main stem of Bean Creek, was visited in 2004 but no fish were captured. Because this stream is listed for sockeye, Chinook, coho, pink, and chum salmon; Dolly Varden; and whitefish in the ADF&G Anadromous Streams Catalog, it was revisited during the August 2005 sampling event. During the initial sampling in 2004, this stream had a moderate flow, a gradient of approximately 5 percent, an average channel width of 4.92 feet (1.5 meters), and water depth of 0.66 to 0.82 feet (0.2 to 0.25 meters). During the 2005 sampling event the stream had a moderate flow and a gradient of approximately 6 percent. Channel width averaged 5.58 feet (1.7 meters), and the average depth was 0.98 feet (0.3 meters). The streambed was observed as small to large gravels during both events, with primarily riffle habitat with small cascades and plunge pools. Abundant overhanging vegetation and woody debris with some undercut bank habitat was observed. No fish were captured during the 2005 event.

### **Sampling Site GS10—Figure 6**

During 2004 sampling event the channel was completely dry upstream at site GS11. No traps were set. This site was not revisited in 2005.

### **Sampling Site GS11—Figure 6**

During the 2004 sampling event the channel was completely dry with no evidence of recent scour. A previously existing log bridge had been removed. Channel width was less than 3.28 feet (1 meter) with a large and small gravel substrate and at a 2 percent gradient. This sample site was not revisited in 2005.

### **Sampling Site GS37—Figure 7**

This stream had a moderate flow in 2004 with an average width of 3.28 feet (1 meter), and a gradient of 5 percent. Stream depth ranged from 0.16 to 0.66 feet (0.05 to 0.20 meters). Channel substrate was comprised of organic material and silt. Three coho salmon were captured (2.05 to 2.76 inches [52 to 70 millimeter] long). This sample site was not revisited in 2005.

### **Sampling Site C34—Figure 7**

This site was not sampled in 2004, but was identified during the 2005 hydrology study and sampled during the 2005 fisheries sample event. The site consisted of multiple ponded areas near a culvert, but no defined stream channel was observed. No surface flow was observed in this area. Although electrofishing was conducted, no fish were captured or observed.

Sampling Site D29—Figure 8

This site was not sampled in 2004, but was identified during the 2005 hydrology study and sampled during the 2005 fisheries sample event. The stream had an average width of 5.25 feet (1.6 meters) and depth of 0.98 feet (0.3 meters), with a gradient of approximately 4 percent. Stream habitat consisted of riffles and small deep pools (approximately 1.64 feet [0.5 meters] deep). Stream substrate consisted mainly of sands and small gravels with abundant woody debris and some organic matter. Undercut banks and overhanging vegetation were observed. One Dolly Varden (6.30 inch [160 millimeter]) was captured. No other fish were captured or observed.

Sampling Site D42—Figure 7

This site was not sampled in 2004, but was identified during the 2005 hydrology study and sampled during the 2005 fisheries sample event. The stream was approximately 2.95 feet (0.9 meters) wide and 0.66 feet (0.2 meters) deep, with a gradient of approximately 2 to 3 percent. Stream substrate consisted mainly of sands and organic matter. Tall grasses and other herbaceous plants dominated the riparian vegetation. No fish were captured or observed.

**Table 5–4: Summary of G South Alternative sample sites**

Site No.	Sample Year	Location	Status	Species	Length		Substrate	Habitat	Width		Depth		Gradient (%)
					in	mm			ft	m	ft	m	
GS8	2004	N60° 29.743' W149° 51.305'	fish present	DV	3.11	79	small gravel to small cobbles	riffle/pool	3.28	1	0.26 to 0.66	0.08 to 0.20	7
				DV	5.12	130							
				DV	3.15	80							
				DV	4.33	110							
GS9	2004	N60° 29.731' W149° 51.903'	no fish	—	—	—	gravel; small cobble	riffles; some cascades and pools	4.92	1.5	0.66 to 0.82	0.20 to 0.25	5
	2005								5.58	1.7	0.98	0.3	6
GS10	2004	N60° 29.486' W149° 53.651'	dry	—	—	—	—	—	—	—	—	—	—
GS11	2004	N60° 29.904' W149° 54.452'	dry	—	—	—	Small to large gravel	—	<3.28	<1	—	—	2
GS37	2004	N60° 28.855' W149° 55.623'	fish present	coho	2.05	52	Silt and organic	—	3.28	1	0.16 to 0.66	0.05 to 0.20	5
				coho	2.76	70							
				coho	2.56	65							
C34	2005	N60° 29.0110' W149° 54.4034'	no fish	—	—	—	—	—	—	—	—	—	—
D29	2005	N60° 29.764' W149° 52.374'	fish present	DV	6.3	160	Sands and small gravels	Riffles and pools	5.25	1.6	0.98 to 1.64	0.3 to 0.5	4
D42	2005	N60° 29.054' W149° 54.539'	no fish	—	—	—	Sands and organics	Riffle-run	2.95	0.9	0.66	0.2	2 to 3

**G South and Juneau Creek Alternatives**

Sampling Site GSJC3—Figure 11

This stream channel was completely dry during the 2004 sampling event. A culvert was noted perched approximately 5.91 feet (1.80 meters) above the stream bank on the downstream side. This sample site was not revisited in 2005.

Sampling Site GSJC4—Figure 10

This stream had moderate flow with large step pool habitat during the 2004 sampling event. The 4.27 feet (1.3 meters) wide channel had medium to large gravels and a gradient of 25 percent, with a depth of 0.33 to 0.82 feet (0.10 to 0.25 meters). Approximately 413.38 feet (126 meters) downstream was an 11.81 feet (3.6 meters) bedrock cascade which appeared to create a fish barrier. The stream flowed underground approximately 597.11 feet (182 meters) downstream, and the channel was completely dry below that point. This sample site was not revisited in 2005.

Sampling Site GSJC5—Figure 10

This site and surrounding area was dry in 2004, with no evidence of an old channel. A dry channel and culvert were observed at the inferred intersection of the channel with Bean Creek Road. This sample site was not revisited in 2005.

**Table 5–5: Summary of sites common to G South and Juneau Creek Alternatives**

Site No.	Sample Year	Location	Status	Substrate	Habitat	Width		Depth		Gradient (%)
						ft	m	ft	m	
GSJC3	2004	N60°29.696' W149°46.56 7'	dry	—	—	—	—	—	—	—
GSJC4	2004	N60°29.822' W149°47.76 9'	no fish	small cobble	step- pools	4.27	1.3	0.33 to 0.82	0.10 to 0.25	25
GSJC5	2004	N60°29.887' W149°48.37 1'	dry	—	—	—	—	—	—	—

### ***Juneau Creek Alternative***

#### **Sampling Site JC6—Figure 8**

This site was visited in 2004. The stream exhibited low flow, averaged 0.10 to 0.16 feet (0.03 to 0.05 meters) deep, 1.64 feet (0.5 meters) wide, and had a 12 percent gradient. Organics and small gravel were the predominant substrate, and the habitat was step-pool and riffle. The stream was flagged as a “Streamside Management Zone.” The stream channel was observed to narrow and flow underground intermittently. Five Dolly Varden (2.68 to 4.93 inches [68 to 125 millimeters] long) were captured. This sample site was not revisited in 2005.

#### **Sampling Site JC7—Figure 8**

During the 2004 sampling event, this small ephemeral tributary of Bean Creek had very low flow. The stream was channel terraced with roots and small cobbles and was 0.33 feet (0.1 meters) wide with a gradient of 25 percent and organic and small cobble substrate. The stream channel was very overgrown, incised, and flowed underground intermittently. The channel was narrow and shallow; no traps were set. No fish were observed. This site was not revisited in 2005.

#### **Sampling Site JC12—Figure 5**

This perennial stream had a moderate flow during the 2004 event. Habitat conditions consisted primarily of riffles with small pools and abundant overhanging vegetation, downed trees, and other woody debris. Small cobbles and large gravels dominated the substrate. The stream channel was 6.56 feet (2 meters) wide, and 0.33 to 0.82 feet (0.10 to 0.25 meters) deep, with an 8-percent gradient. No fish were captured.

The site was revisited in 2005, and the stream noted as approximately 4.59 feet (1.4 meters) wide and 0.49 feet (0.15 meters) deep. No fish were captured or observed during the 2005 sampling event. A culvert located downstream of this site was inspected during the 2005 survey and found to be passable by fish.

#### **Sampling Site JC13—Figure 5**

This perennial stream exhibited moderate flow during the 2004 sampling event. The habitat was composed of riffles and pools; the channel was 6.56 feet (2 meters) wide, had a gradient of 6 percent, and water depth averaged 0.33 to 0.82 feet (0.10 to 0.25 meters). The substrate was mainly large gravels and sand with large woody debris throughout. No fish were captured. This sample site was not revisited in 2005.

#### **Sampling Site JC14—Figure 5**

This stream exhibited moderate flow during the 2004 sampling event. The habitat was composed of riffles and pools; the channel was 6.56 feet (2 meters) wide, had a gradient of 3 percent, and water depth averaged 0.49 to 0.98 feet (0.15 to 0.30 meters). The substrate was mainly large gravels and sand with large woody debris throughout. No fish were captured. This sample site was not revisited in 2005.

#### Sampling Site JC15—Figure 5

This stream exhibited moderate flow during the 2004 sampling event. The habitat was composed of riffles and pools; the channel was 8.20 feet (2.5 meters) wide, had a gradient of 3 percent, and water depth was 0.49 to 0.98 feet (0.15 to 0.30 meters). The substrate was mainly large gravels and sand with large woody debris throughout. No fish were captured. This sample site was not revisited in 2005.

#### Sampling Site JC16—Figure 5

No evidence of a stream channel was found at this site during the 2004 sampling event. The stream channel began approximately 698.81 feet (213 meters) downslope, with a 0.66-foot (0.2-meter) wide stream and very light trickle flow. The substrate was comprised of highly of organic material. No traps were set here due to insufficient water depth. Sampling site CCGS41 is located downstream. This sample site was not revisited in 2005.

#### Sampling Site JC17—Figure 5

During the 2004 sampling event this stream exhibited very light flow with water depth less than 0.16 feet (0.05 meters). The stream channel was overgrown, less than 0.66 feet (0.2 meters) wide and flowed underground at several points. This sample site was not revisited in 2005.

#### Sampling Site JC18—Figure 5

This stream exhibited light flows during the 2004 sampling event. The habitat was mainly step-pools with an organic substrate. Stream channel width was 0.98 feet (0.3 meters) and water depth ranged from 0.16 to 0.82 feet (0.05 to 0.25 meters). The stream flowed underground at multiple points, and the channel was heavily overgrown. No fish were captured. This sample site was not revisited in 2005.

#### Sampling Site JC19—Figures 4 and 5

This stream exhibited low flow during the 2004 sampling event. The habitat was step-pool with organic substrate. The stream channel was less than 6.56 feet (2 meters) wide, and the average water depth was 0.16 feet (0.05 meters). The stream flowed underground at multiple points, and was too shallow to set traps.

The site was revisited during the 2005 sampling event, and light flow was again observed. The stream channel gradient was approximately 3 percent, and the stream was primarily step-pool habitat with an organic substrate. The channel was approximately 3.28 feet (1 meter) wide and the average water depth was 0.33 feet (0.1 meters). As observed in 2004, the stream flowed underground at multiple points. Electro-fishing was difficult in this area due to abundant, thick riparian vegetation. No fish were captured or observed.

#### Sampling Site JC20—Figures 4 and 5

This site was visited during the 2004 sampling event and noted as shallow and approximately 0.07 feet (0.02 meters) deep. The majority of flow was underground with small shallow pools emerging sparsely throughout the channel. The substrate was organic and large gravel. No traps were set due to shallow water.



The stream was revisited in 2005 and observed to be approximately 3.94 feet (1.2 meters) wide, 0.33 feet (0.1 meters) deep, and with a 2 percent gradient. As observed in 2004, the majority of flow was traveling underground and the habitat had not changed. No fish were captured or observed within this stream channel during the 2005 electrofishing survey.

#### Sampling Site Pond—Figure 4

This site was identified downstream of sites JC19 and JC20 during the 2004 sampling event. Both a main stem and tributary flowed into the pond, but both were too shallow for trap installation. The pond was used for traps since it was directly connected to both upstream sites. The pond was approximately 2.95 feet (0.9 meters) deep at the center and consisted of organic and sandy substrate. No fish were captured. This sample site was not revisited in 2005.

#### Sampling Site JC21—Figure 4

This ephemeral stream was dry during the 2004 sampling event with an organic and small gravel substrate. The site was not revisited in 2005.

#### Sampling Site D46—Figure 4

This site was not sampled in 2004, but was identified during the 2005 hydrology study and sampled during the 2005 fisheries sample event. The stream was between 2.46 and 3.28 feet (0.75 and 1 meter) wide and approximately 0.33 feet (0.10 meters) deep, with a gradient of approximately 3 percent. The substrate consisted of sand and organic material with abundant small woody debris. No fish were captured or observed.

**Table 5–6: Summary of Juneau Creek Alternative sample sites**

Site No.	Sample Year	Location	Status	Species	Length		Substrate	Habitat	Width		Depth		Gradient (%)
					in	mm			ft	m	ft	m	
JC6	2004	N60° 29.977' W149° 51.024'	fish present	DV	4.93	125	organic and small gravel	step-pool/ riffle	1.64	0.5	0.10 to 0.16	0.03 to 0.05	12
				DV	4.29	109							
				DV	4.73	120							
				DV	2.68	68							
				DV	2.99	76							
JC7	2004	N60° 29.912' W149° 51.222'	too narrow	—	—	—	organic and small cobble	—	0.33	0.1	—	—	25
JC12	2004	N60° 29.782' W149° 57.126'	no fish	—	—	—	large gravels and small cobbles	riffle; pool	4.59	1.4	0.49	0.15	8
	2005						gravel and sand		6.56	2	0.33 to 0.82	0.10 to 0.25	
JC13	2004	N60° 29.841' W149° 57.949'	no fish	—	—	—	large gravel and sand	riffle; pool	6.56	2	0.33 to 0.82	0.10 to 0.25	6
JC14	2004	N60° 29.796' W149° 58.098'	no fish	—	—	—	large gravel and sand	riffle; pool	6.56	2	0.49 to 0.98	0.15 to 0.30	3
JC15	2004	N60° 29.752' W149° 58.432'	no fish	—	—	—	large gravel and sand	riffle; pool	8.2	2.5	0.49 to 0.98	0.15 to 0.30	3
JC16	2004	N60° 29.496' W149° 59.359'	dry	—	—	—	organic	—	0.66	0.2	—	—	—
JC17	2004	N60° 29.432' W149° 59.651'	too shallow	—	—	—	—	—	<0.66	<0.2	<0.1 6	<0.0 5	—
JC18	2004	N60° 29.354' W149° 59.853'	no fish	—	—	—	organic	step-pool	0.98	0.3	0.16 to 0.82	0.05 to 0.25	—

**Table 5–6: Summary of Juneau Creek Alternative sample sites (cont.)**

Site No.	Sample Year	Location	Status	Species	Length		Substrate	Habitat	Width		Depth		Gradient (%)
					in	mm			ft	m	ft	m	
JC19	2004 2005	N60° 29.350' W150° 00.489'	no fish	—	—	—	organic	step-pool	3.28	1	0.16 to 0.33	0.05 to 0.1	3
JC20	2004 2005	N60° 29.344' W150° 00.561'	no fish	—	—	—	organic and large gravel	riffle; pool	3.94	1.2	0.07 to 0.33	0.02 to 0.1	2
Pond	2004	N60° 29.305' W150° 00.558'	no fish	—	—	—	organic/sandy	—	—	—	2.95	0.9	—
JC21	2004	N60° 29.348' W150° 00.900'	dry	—	—	—	organic and small gravel	—	—	—	—	—	—
D46	2005	N60° 29.231' W150°1.4336'	no fish	—	—	—	sands and organics	riffle; run	2.46 to 3.28	0.75 to 1	0.33	0.1	3

## **6.0 Summary Discussion**

The 2004 effort conducted sampling at 45 sites. The 2005 effort re-sampled 10 of the 2004 sites and added 7 new sites to the sampling program. In total, 52 unique sampling sites were visited, and fish were present at 9 of these sites. Fish were captured individually or in small concentrations, and overall density appeared low at all sample sites where fish were found.

During the 2004 effort, 45 sampling sites were located within the project area. Fish were found at 8 of the 45 sites, and 39 fish (20 coho salmon, 18 Dolly Varden, and 1 sculpin) were captured by trapping. It is noted that some of the streams visited in 2004 and identified as dry or ephemeral may support flow during periods of greater precipitation.

A total of 17 sample sites were visited during the 2005 survey. Fish were identified at 2 of the 17 sites, and 11 fish (8 Chinook salmon, 2 Dolly Varden, and 1 coho salmon) were captured by electro-fishing.

## **7.0 References**

Alaska Department of Fish and Game 2004. Anadromous Streams Catalog. Anadromous streams listing for upper and lower Cooper Creek and Kenai Lake.

HDR Alaska, Inc. 2004. Personal communication with Paul McLarnon regarding the Cooper Lake Project Report (FERC No. 2170) for fisheries information on sites within Cooper Creek.

Johnson, J. and P. Blanche. 2010. Catalog of waters important for spawning, rearing, or migration of anadromous fishes – Southcentral Region, Effective June 1, 2010. Alaska Department of Fish and Game, Special Publication No. 10-06, Anchorage.