
2009–2010 COLVILLE RIVER ICE BRIDGE MONITORING



SUMMARY REPORT

Submitted to:


ConocoPhillips
Alaska

Submitted by


Baker

Michael Baker, Jr., Inc.

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April 2010

118274-MBJ-RPT-001

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Project Trip Report

Baker

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: November 6, 2009
Project Code: 118274	Submitted By: Julie Shewman

Weather: 6° F, 10-15 mph wind; Windchill -11° F

Haley Runa and Julie Shewman arrived at Alpine on Thursday, November 5, 2009 at 5:30 p.m. Upon arrival Ms. Runa and Ms. Shewman met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event. Ms. Runa and Ms. Shewman completed the LCMF snowmobile orientation training, assembled field gear and calibrated the YSI-30 meter.

At 6:00 a.m. on November 6, Ms. Runa and Ms. Shewman attended LCMFs daily health and safety meeting. Chris Zeimet of LCMF accompanied Runa and Shewman to the Colville River Ice Bridge site via snowmobile departing Alpine at approximately 7:30 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (conductivity and salinity). Dissolved oxygen and temperature were measured using a Hach HQ40 LDO meter. Water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline, to determine the presence of flow. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The DO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on November 5 upon arrival to Alpine.

Specific conductance at all sampling locations ranged from a maximum of 343 μ S/cm to a minimum of 325 μ S/cm, both at a depth of 2.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Overall, specific conductance increased only slightly with increasing depth.

Dissolved oxygen saturation remained fairly consistent with respect to depth and distance up and downstream from bridge centerline; all values were between 86% and 90%. The

average dissolved oxygen saturation was 88.6%. Overall there was little change in dissolved oxygen values with increasing depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were indicative of flow. Velocities ranged from 0.18 feet per second at the lowest depth sampled (11 feet) to 0.29 feet per second at a depth of 6 feet (in the middle of the water column) with an average velocity of 0.24 ft/second.

Locations approximately 2, 4 and 6 miles downstream from the proposed bridge centerline were sampled for conductivity near the bottom of the channel at sample depths ranging from 10 to 12 feet. Values for conductivity and salinity at those sampling locations were consistent with values obtained in close proximity to the proposed bridge centerline. At 6 miles downstream specific conductance was calculated based on observed temperature and conductivity. Specific conductance at this location was 363 μ S/cm. This value is only slightly higher than those values obtained in the proposed ice bridge vicinity. No salt and fresh water stratification was identified.

The next sampling event is scheduled for November 21, 2009.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: November 6, 2009

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 10:10 a.m.	12.3	1.0	0.0	1	-	-	-	-	-	-	-
				2	0.0	175	343	12.9	89.3	0.2	-
				3	-	-	-	-	-	-	-
				4	0.5	173	333	12.7	88.7	0.2	-
				5	-	-	-	-	-	-	-
				6	0.2	174	338	12.8	89.3	0.2	-
				7	-	-	-	-	-	-	-
				8	0.1	174	340	12.9	89.3	0.2	-
				9	-	-	-	-	-	-	-
				10	0.1	174	341	12.9	89.2	0.2	-
				11	-	-	-	-	-	-	-
				11.5	0.1	175	341	12.9	89.2	0.2	-
12	-	-	-	-	-	-	-				
800-ft Upstream N70°14'10.6" W150°50'06.4" 9:50 a.m.	12.5	0.7	0.0	1	-	-	-	-	-	-	-
				2	0.3	174	337	12.7	88.7	0.2	-
				3	-	-	-	-	-	-	-
				4	0.1	173	338	12.8	89.1	0.2	-
				5	-	-	-	-	-	-	-
				6	0.1	173	338	12.8	89.0	0.2	-
				7	-	-	-	-	-	-	-
				8	0.1	173	338	12.8	89.0	0.2	-
				9	-	-	-	-	-	-	-
				10	0.1	174	340	12.8	88.9	0.2	-
				11	-	-	-	-	-	-	-
				12	0.1	175	341	12.8	88.7	0.2	-
				13	-	-	-	-	-	-	-
				14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 9:10 a.m.	13.0	0.9	0.0	1	-	-	-	-	-	-	-
				2	0.7	170	325	12.6	89.6	0.2	-
				3	-	-	-	-	-	-	-
				4	0.5	170	327	12.7	89.6	0.2	-
				5	-	-	-	-	-	-	-
				6	0.4	172	332	12.8	89.7	0.2	-
				7	-	-	-	-	-	-	-
				8	0.2	172	335	12.8	89.8	0.2	-
				9	-	-	-	-	-	-	-
				10	0.2	173	337	12.9	89.6	0.2	-
				11	-	-	-	-	-	-	-
				12	0.2	174	338	12.8	89.5	0.2	-
				13	-	-	-	-	-	-	-
				14	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Salinity, and conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen and temperature were measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
 Water Quality - Main Channel Downstream of Bridge



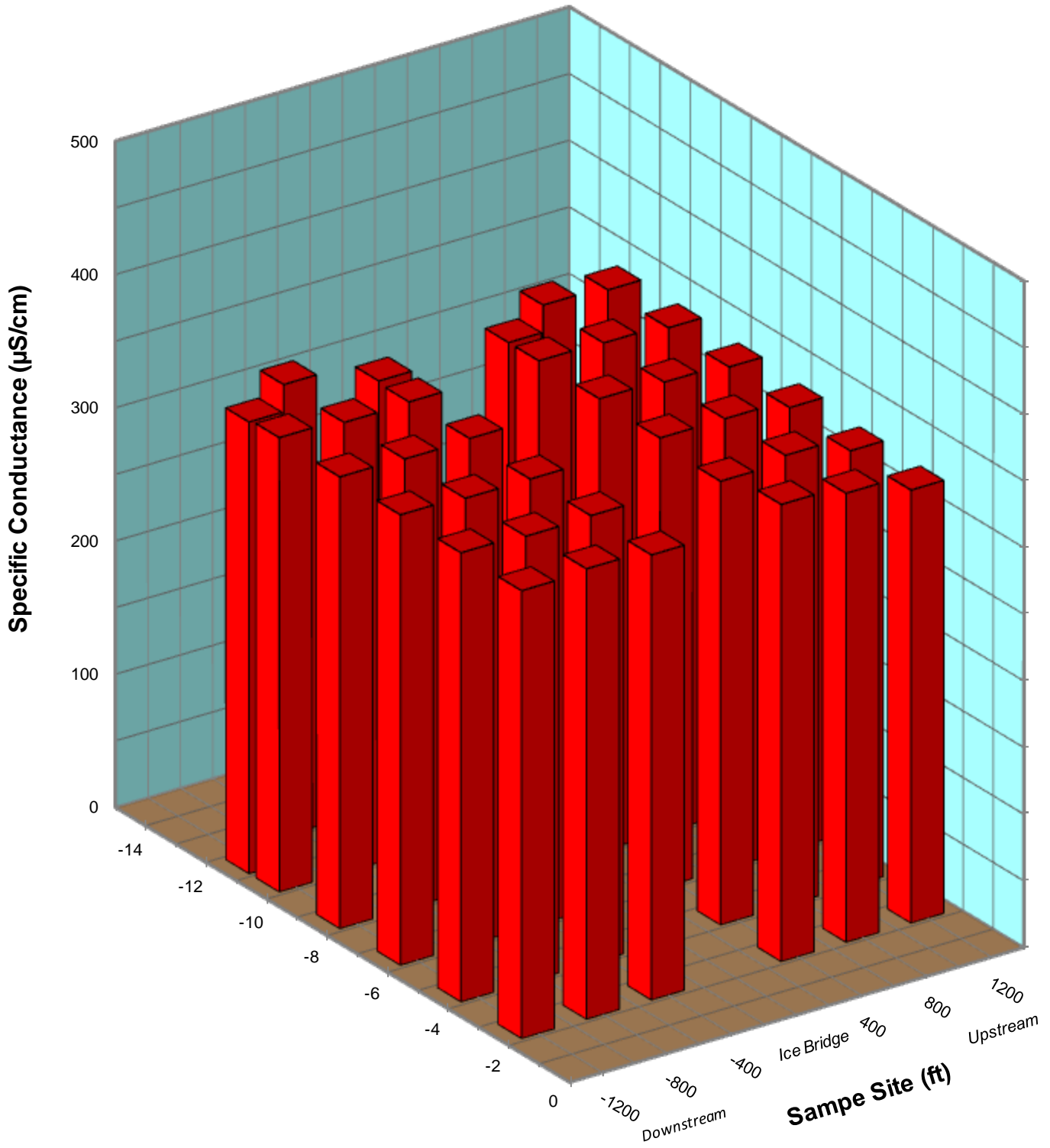
Sample Date: November 6, 2009

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 10:35 a.m.	12.0	0.6	0.0	1	-	-	-	-	-	-	-
				2	0.4	173	334	12.5	87.4	0.2	-
				3	-	-	-	-	-	-	-
				4	0.2	173	336	12.6	87.9	0.2	-
				5	-	-	-	-	-	-	-
				6	0.2	173	336	12.7	88.0	0.2	-
				7	-	-	-	-	-	-	-
				8	0.1	174	339	12.7	88.1	0.2	-
				9	-	-	-	-	-	-	-
				10	0.1	173	339	12.7	88.2	0.2	-
				11.5	0.1	175	341	12.7	88.2	0.2	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 10:50 a.m.	12.5	0.7	0.0	1	-	-	-	-	-	-	-
				2	0.3	174	338	12.5	87.0	0.2	-
				3	-	-	-	-	-	-	-
				4	0.1	172	335	12.7	88.0	0.1	-
				5	-	-	-	-	-	-	-
				6	0.1	172	336	12.7	88.1	0.1	-
				7	-	-	-	-	-	-	-
				8	0.1	173	338	12.7	88.2	0.2	-
				9	-	-	-	-	-	-	-
				10	0.1	173	338	12.7	88.2	0.2	-
				11	-	-	-	-	-	-	-
				12	0.1	173	339	12.5	86.6	0.2	-
				13	-	-	-	-	-	-	-
				14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 11:05 a.m.	11.7	0.6	0.0	1	-	-	-	-	-	-	-
				2	0.1	172	336	12.6	87.6	0.1	0.23
				3	-	-	-	-	-	-	-
				4	0.1	173	337	12.7	88.0	0.2	0.26
				5	-	-	-	-	-	-	-
				6	0.0	173	338	12.7	88.2	0.2	0.29
				7	-	-	-	-	-	-	-
				8	0.0	173	339	12.8	88.3	0.2	0.24
				9	-	-	-	-	-	-	-
				10	0.0	174	341	12.8	88.3	0.2	0.21
				11	0.0	173	339	12.8	88.3	0.2	0.18
				12	-	-	-	-	-	-	-
				13	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Salinity, and conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen and temperature were measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring November 6, 2009



Project Trip Report

Baker

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: November 14, 2009
Project Code: 118274	Submitted By: Elijah Keib

Weather: -18° F, 10-15 mph wind; Windchill -41° F

Elijah Keib arrived at Alpine on Friday, November 13, 2009 at 5:30 p.m. Upon arrival Mr. Keib met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event. Mr. Keib completed the LCMF snowmobile orientation training and assembled field gear.

At 6:00 a.m. on November 14, Mr. Keib attended LCMFs daily health and safety meeting. Chris Zeimet of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via snowmobile departing Alpine at approximately 8:00 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ40 LDO meter. Water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline, to determine the presence of flow. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The DO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on November 14 prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 373 μ S/cm at a depth of 11.0 feet to a minimum of 60 μ S/cm at a depth of 13.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Overall, specific conductance increased only slightly with increasing depth. Baker attempted to locate the leading edge of the ocean salt water intrusion into the Colville River. Baker traveled downstream along the main channel of the Colville River and took in-situ measurements at 2 miles, 4 miles, 6 miles, 9 miles, and 12 miles downstream of the ice bridge centerline. While conductivity did increase slightly with distance downstream of the Colville River Ice Bridge centerline, specific conductance did not

exceed 400 μ S/cm. No salt and fresh water stratification was identified

Dissolved oxygen saturation remained fairly consistent with respect to depth and distance up and downstream from bridge centerline; all values were between 88% and 98%. The average DO saturation was 92.0%. Generally there was little change in DO values with increasing depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of flow since velocity was 0.0 ft/sec at all depths.

The average ice thickness was 1.2 feet (roughly 14.5 inches).

The next sampling event is scheduled for November 21, 2009.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: November 14, 2009

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 12:05 p.m.	11.7	1.5	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	0.3	179	346	13.0	91.7	0.2	-
				4	-	-	-	-	-	-	-
				5	0.3	177	343	13.1	91.7	0.2	-
				6	-	-	-	-	-	-	-
				7	0.3	176	341	13.1	91.8	0.2	-
				8	-	-	-	-	-	-	-
				9	0.3	172	333	13.1	91.8	0.2	-
				10	-	-	-	-	-	-	-
				11	0.3	170	330	13.1	91.6	0.2	-
				12	-	-	-	-	-	-	-
				13	-	-	-	-	-	-	-
800-ft Upstream N70°14'10.6" W150°50'06.4" 11:30 a.m.	12.8	1.2	0.1	1	-	-	-	-	-	-	-
				2	0.2	178	346	13.1	91.8	0.1	-
				3	-	-	-	-	-	-	-
				4	0.2	175	340	13.1	91.8	0.1	-
				5	-	-	-	-	-	-	-
				6	0.1	170	332	13.0	91.9	0.1	-
				7	-	-	-	-	-	-	-
				8	0.1	179	349	12.9	92.0	0.1	-
				9	-	-	-	-	-	-	-
				10	0.1	179	350	12.8	91.8	0.1	-
				11	-	-	-	-	-	-	-
				12	0.1	179	350	11.4	88.0	0.1	-
				13	-	-	-	-	-	-	-
				14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 10:05 a.m.	13.3	1.4	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	0.4	165	319	13.1	91.3	0.1	-
				4	-	-	-	-	-	-	-
				5	0.3	166	321	13.2	91.7	0.1	-
				6	-	-	-	-	-	-	-
				7	0.3	166	321	13.2	96.0	0.1	-
				8	-	-	-	-	-	-	-
				9	0.3	162	314	13.0	91.0	0.1	-
				10	-	-	-	-	-	-	-
				11	0.2	158	307	13.1	91.6	0.1	-
				12	-	-	-	-	-	-	-
				13	0.1	31	60	TOR	TOR	0.0	-
				14	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) TOR = Temperature out of Range for Hach HQ-40d LDO

Colville River Ice Bridge Monitoring Program
 Water Quality - Main Channel Downstream of Bridge



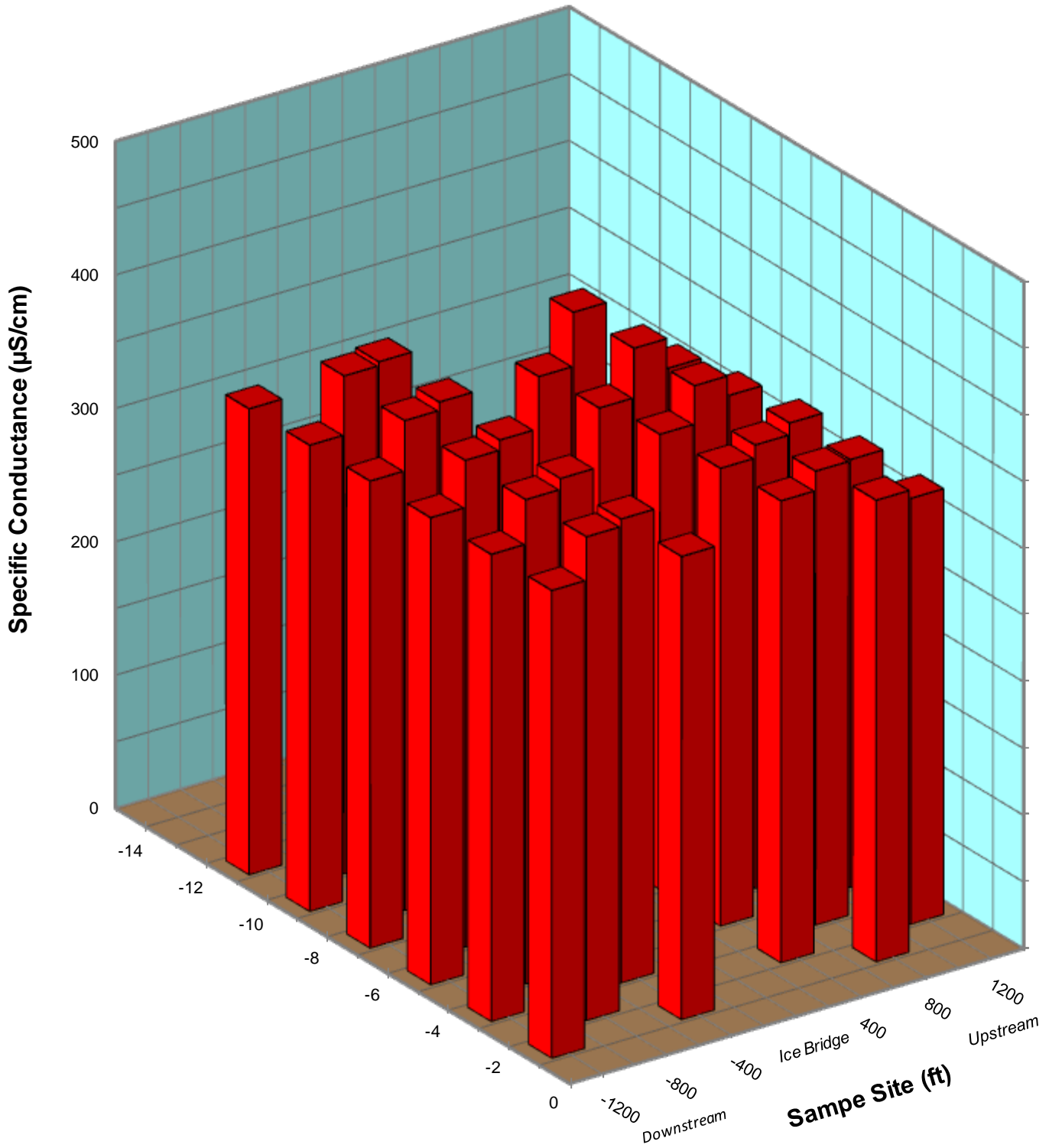
Sample Date: November 14, 2009

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 12:40 p.m.	12.2	1.1	0.1	1	-	-	-	-	-	-	-
				2	0.1	178	347	13.1	98.4	0.2	-
				3	-	-	-	-	-	-	-
				4	0.1	178	348	13.0	98.3	0.2	-
				5	-	-	-	-	-	-	-
				6	0.1	180	351	12.9	92.2	0.2	-
				7	-	-	-	-	-	-	-
				8	0.1	180	352	12.8	90.2	0.2	-
				9	-	-	-	-	-	-	-
				10	0.2	181	353	12.7	91.6	0.2	-
				11	-	-	-	-	-	-	-
				12	0.3	184	356	12.4	90.7	0.2	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 1:05 p.m.	11.8	1.3	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	0.1	186	363	13.1	92.0	0.2	-
				4	-	-	-	-	-	-	-
				5	0.1	186	363	13.1	92.0	0.2	-
				6	-	-	-	-	-	-	-
				7	0.1	187	365	13.1	91.9	0.2	-
				8	-	-	-	-	-	-	-
				9	0.1	188	367	13.1	91.9	0.2	-
				10	-	-	-	-	-	-	-
				11	0.1	191	373	13.0	91.6	0.2	-
				12	-	-	-	-	-	-	-
				13	-	-	-	-	-	-	-
				14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 1:30 p.m.	12.1	1.0	0.0	1	-	-	-	-	-	-	-
				2	0.2	180	350	13.0	91.8	0.3	0.00
				3	-	-	-	-	-	-	-
				4	0.2	180	350	13.0	91.8	0.2	0.00
				5	-	-	-	-	-	-	-
				6	0.2	180	350	13.0	91.7	0.2	0.00
				7	-	-	-	-	-	-	-
				8	0.2	180	350	13.0	91.6	0.2	0.00
				9	-	-	-	-	-	-	-
				10	0.2	180	349	13.0	91.5	0.2	0.00
				11	-	-	-	-	-	-	-
				12	0.2	180	349	13.0	91.4	0.2	0.00
				13	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring November 14, 2009



Project Trip Report

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: November 26, 2009
Project Code: 118274	Submitted By: Elijah Keib

Weather: 3° F, 20-25 mph wind; Wind-chill -25°F

Elijah Keib arrived at Alpine on Friday, November 25, 2009 at 5:30 p.m. Upon arrival Mr. Keib met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on November 26, Mr. Keib attended LCMFs daily health and safety meeting. Daren Saxowsky of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via snowmobile departing Alpine at approximately 8:00 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ40 LDO meter. Water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline, to determine the presence of flow. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The DO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on November 26 prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 364 μ S/cm at a depth of 12.0 feet to a minimum of 348 μ S/cm at a depth of 11.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Overall, specific conductance increased only slightly with increasing depth. Baker attempted to locate the leading edge of the ocean salt water intrusion into the Colville River. Baker traveled downstream along the main channel of the Colville River and took a single in-situ measurement at 5 miles downstream of the ice bridge centerline. Conductivity did increase slightly with distance downstream of the Colville River Ice Bridge centerline however specific conductance did not exceed 400 μ S/cm. No salt and fresh water stratification was identified.

Dissolved oxygen saturation remained fairly consistent with respect to depth and distance up and downstream from bridge centerline; all values were between 79% and 82%. The average DO saturation was 80.0%. Generally there was little change in DO values with increasing depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of flow. The average measured velocity was 0.0 ft/sec.

The average ice thickness was 1.8 feet (roughly 19 inches).

The next sampling event is scheduled for December 10, 2009.

Colville River Ice Bridge Monitoring Program
 Water Quality - Main Channel Upstream of Bridge



Sample Date: November 26, 2009

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 11:20 a.m.	11.9	2.1	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	0.1	179	350	11.6	80.1	0.2	-
				4	-	-	-	-	-	-	-
				5	0.1	180	351	11.6	80.0	0.2	-
				6	-	-	-	-	-	-	-
				7	0.1	181	353	11.6	80.1	0.2	-
				8	-	-	-	-	-	-	-
				9	0.1	181	354	11.6	80.3	0.2	-
				10	-	-	-	-	-	-	-
				11	0.1	182	355	11.7	81.0	0.2	-
				13	-	-	-	-	-	-	-
				800-ft Upstream N70°14'10.6" W150°50'06.4" 9:45 a.m.	12.7	1.7	0.1	1	-	-	-
2	0.1	178	348					11.4	80.1	0.2	-
3	-	-	-					-	-	-	-
4	0.1	179	349					11.3	80.0	0.2	-
5	-	-	-					-	-	-	-
6	0.1	179	350					11.2	79.9	0.2	-
7	-	-	-					-	-	-	-
8	0.1	181	353					11.2	79.9	0.2	-
9	-	-	-					-	-	-	-
10	0.1	182	355					11.2	80.4	0.2	-
11	-	-	-					-	-	-	-
12	0.2	187	363					10.9	80.2	0.2	-
13	-	-	-					-	-	-	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 8:45 a.m.	13.2	1.9	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	0.1	184	359	11.4	78.9	0.2	-
				4	-	-	-	-	-	-	-
				5	0.1	184	359	11.4	79.1	0.2	-
				6	-	-	-	-	-	-	-
				7	0.1	184	359	11.4	79.2	0.2	-
				8	-	-	-	-	-	-	-
				9	0.1	186	364	11.5	79.6	0.2	-
				10	-	-	-	-	-	-	-
				11	0.1	178	348	11.5	79.7	0.2	-
				12	-	-	-	-	-	-	-
				13	0.1	180	352	11.6	81.2	0.1	-
				14	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of the ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
 Water Quality - Main Channel Downstream of Bridge



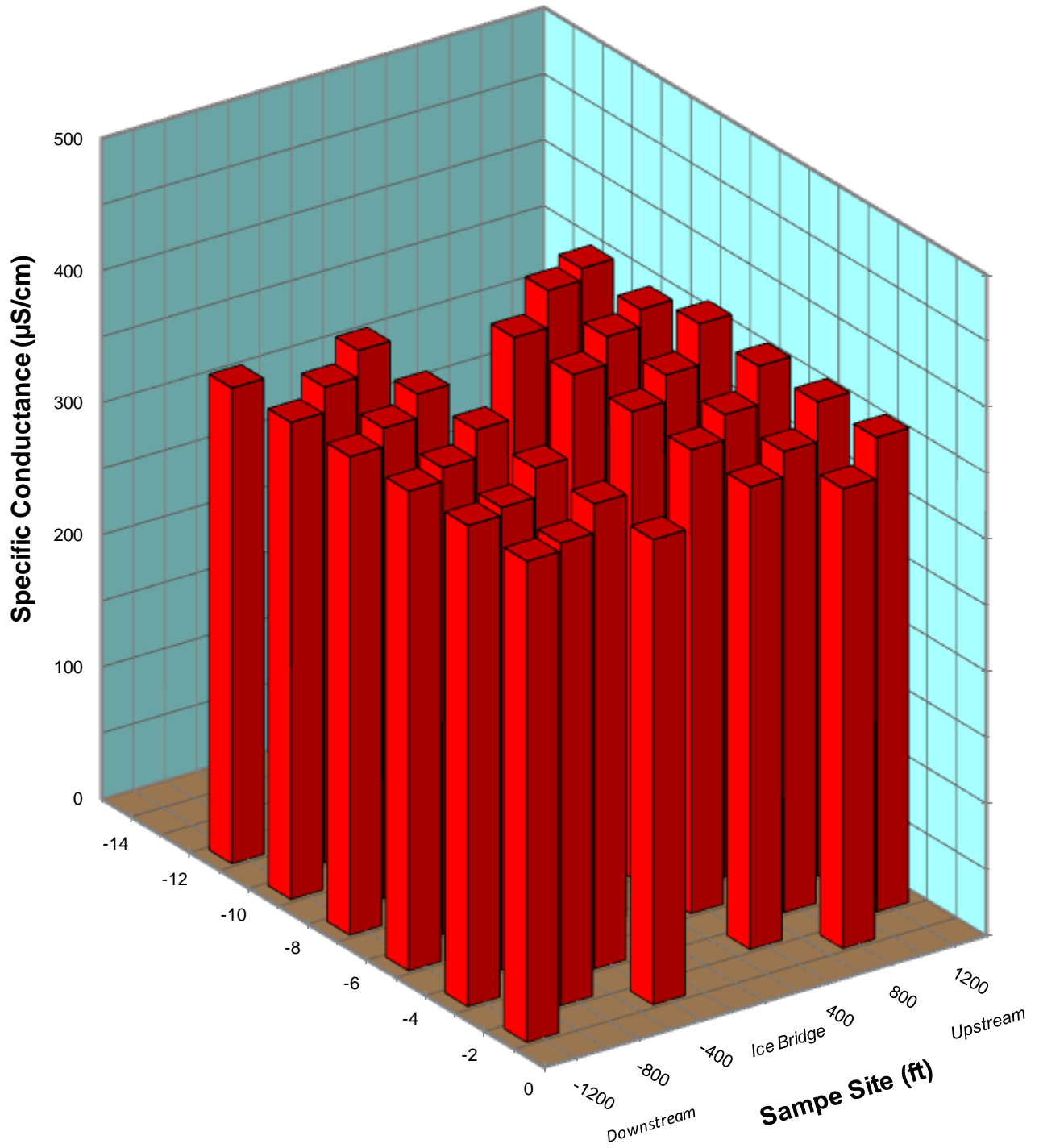
Sample Date: November 26, 2009

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 11:50 a.m.	12.5	1.7	0.1	1	-	-	-	-	-	-	-
				2	0.1	180	352	11.6	80.3	0.2	-
				3	-	-	-	-	-	-	-
				4	0.1	180	352	11.6	80.3	0.2	-
				5	-	-	-	-	-	-	-
				6	0.1	180	352	11.7	80.8	0.2	-
				7	-	-	-	-	-	-	-
				8	0.2	182	354	11.8	81.6	0.2	-
				9	-	-	-	-	-	-	-
				10	0.2	182	354	11.7	81.4	0.2	-
				11	-	-	-	-	-	-	-
				12	0.2	185	360	11.7	81.5	0.2	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 11:45 a.m.	11.9	2.1	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	0.2	180	350	11.6	80.3	0.2	-
				4	-	-	-	-	-	-	-
				5	0.2	180	350	11.6	80.3	0.2	-
				6	-	-	-	-	-	-	-
				7	0.2	181	353	11.6	80.8	0.2	-
				8	-	-	-	-	-	-	-
				9	0.2	183	356	11.7	81.1	0.2	-
				10	-	-	-	-	-	-	-
				11	0.2	185	360	11.7	81.8	0.2	-
				12	-	-	-	-	-	-	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 11:55 a.m.	12.3	1.6	0.1	1	-	-	-	-	-	-	-
				2	0.2	187	364	11.6	80.6	0.2	-0.01
				3	-	-	-	-	-	-	-
				4	0.2	187	364	11.6	80.3	0.2	-0.01
				5	-	-	-	-	-	-	-
				6	0.2	187	363	11.6	80.2	0.2	0.00
				7	-	-	-	-	-	-	-
				8	0.2	186	362	11.6	80.2	0.2	0.00
				9	-	-	-	-	-	-	-
				10	0.2	185	361	11.6	80.2	0.2	0.00
				11	-	-	-	-	-	-	-
				12	0.2	185	360	11.6	80.1	0.2	0.02
				13	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring November 26, 2009



Project Trip Report

Baker

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: December 9, 2009
Project Code: 118274	Submitted By: Haley Runa and Sara Eickelman

Weather: 10-15° F, 5-10 mph wind; Wind-chill -1° F

Haley Runa and Sara Eickelman arrived at Alpine on Tuesday, December 8, 2009 at 1:30 p.m. Upon arrival Ms. Runa and Ms. Eickelman met with LCMF and coordinated tasks and access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on December 9, Ms. Runa and Ms. Eickelman attended LCMFs daily health and safety meeting. AJ Griffen of LCMF accompanied Ms. Runa and Ms. Eickelman to the Colville River Ice Bridge site via snowmobile departing Alpine at approximately 7:45 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ40 LDO meter. Water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline, to determine the presence of flow. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The DO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on December 9 prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 386 μ S/cm at a depth of 11.0 feet to a minimum of 355 μ S/cm at a depth of 3.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Overall, specific conductance increased slightly with increasing depth. Baker attempted to locate the leading edge of the ocean salt water intrusion into the Colville River. Baker traveled downstream along the main channel of the Colville River and took in-situ measurements at approximately 2.5 and 5 miles downstream of the ice bridge centerline. Conductivity did increase slightly with distance downstream of the Colville River Ice Bridge centerline however specific conductance did not exceed 400 μ S/cm. No salt and fresh water stratification was identified.

Dissolved oxygen saturation remained fairly consistent with respect to depth and distance up and downstream from bridge centerline; all values were between 70.6% and 73.6%. The average DO saturation was 72.0%.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of flow. The average measured velocity was -0.01 ft/sec.

The average ice thickness was 2.4 feet (roughly 28 inches).

The next sampling event is scheduled for December 24, 2009.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: December 09, 2009

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)	
1200-ft Upstream N70°14'06.7" W150°50'3.4" 8:45 a.m.	12.6	2.5	0.1	1	-	-	-	-	-	-	-	
				2	-	-	-	-	-	-	-	-
				3	1.3	195	364	10.1	71.3	0.2	-	
				4	-	-	-	-	-	-	-	-
				5	0.9	191	362	10.2	71.2	0.2	-	
				6	-	-	-	-	-	-	-	-
				7	0.7	191	365	10.3	71.4	0.2	-	
				8	-	-	-	-	-	-	-	-
				9	0.4	196	378	10.4	71.6	0.2	-	
				10	-	-	-	-	-	-	-	-
				11	0.3	197	381	10.4	71.6	0.2	-	
				12	-	-	-	-	-	-	-	-
				13	0.3	197	382	10.4	71.5	0.2	-	
800-ft Upstream N70°14'10.6" W150°50'06.4" 9:15 a.m.	12.4	2.0	0.0	1	-	-	-	-	-	-	-	
				2	-	-	-	-	-	-	-	-
				3	0.0	191	374	10.7	72.3	0.2	-	
				4	-	-	-	-	-	-	-	-
				5	0.0	195	382	10.7	72.7	0.2	-	
				6	-	-	-	-	-	-	-	-
				7	0.0	195	382	10.6	71.5	0.2	-	
				8	-	-	-	-	-	-	-	-
				9	0.0	196	385	10.4	70.6	0.2	-	
				10	-	-	-	-	-	-	-	-
				11	0.0	196	384	10.5	71.0	0.2	-	
				12	-	-	-	-	-	-	-	-
				13	0.0	196	384	10.5	71.0	0.2	-	
				14	-	-	-	-	-	-	-	-
400-ft Upstream N70°14'14.4" W150°50'09.7" 10:06 a.m.	11.0	2.4	0.0	1	-	-	-	-	-	-	-	
				2	-	-	-	-	-	-	-	-
				3	2.6	202	360	9.9	72.4	0.2	-	
				4	-	-	-	-	-	-	-	-
				5	1.1	193	363	10.3	72.2	0.2	-	
				6	-	-	-	-	-	-	-	-
				7	0.5	192	369	10.4	72.1	0.2	-	
				8	-	-	-	-	-	-	-	-
				9	0.3	195	377	10.5	72.0	0.2	-	
				10	0.3	195	379	10.5	72.0	0.2	-	
				11	-	-	-	-	-	-	-	-
				12	-	-	-	-	-	-	-	-
				13	-	-	-	-	-	-	-	-
				13.5	-	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Salinity, conductivity, and temperature were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Downstream of Bridge



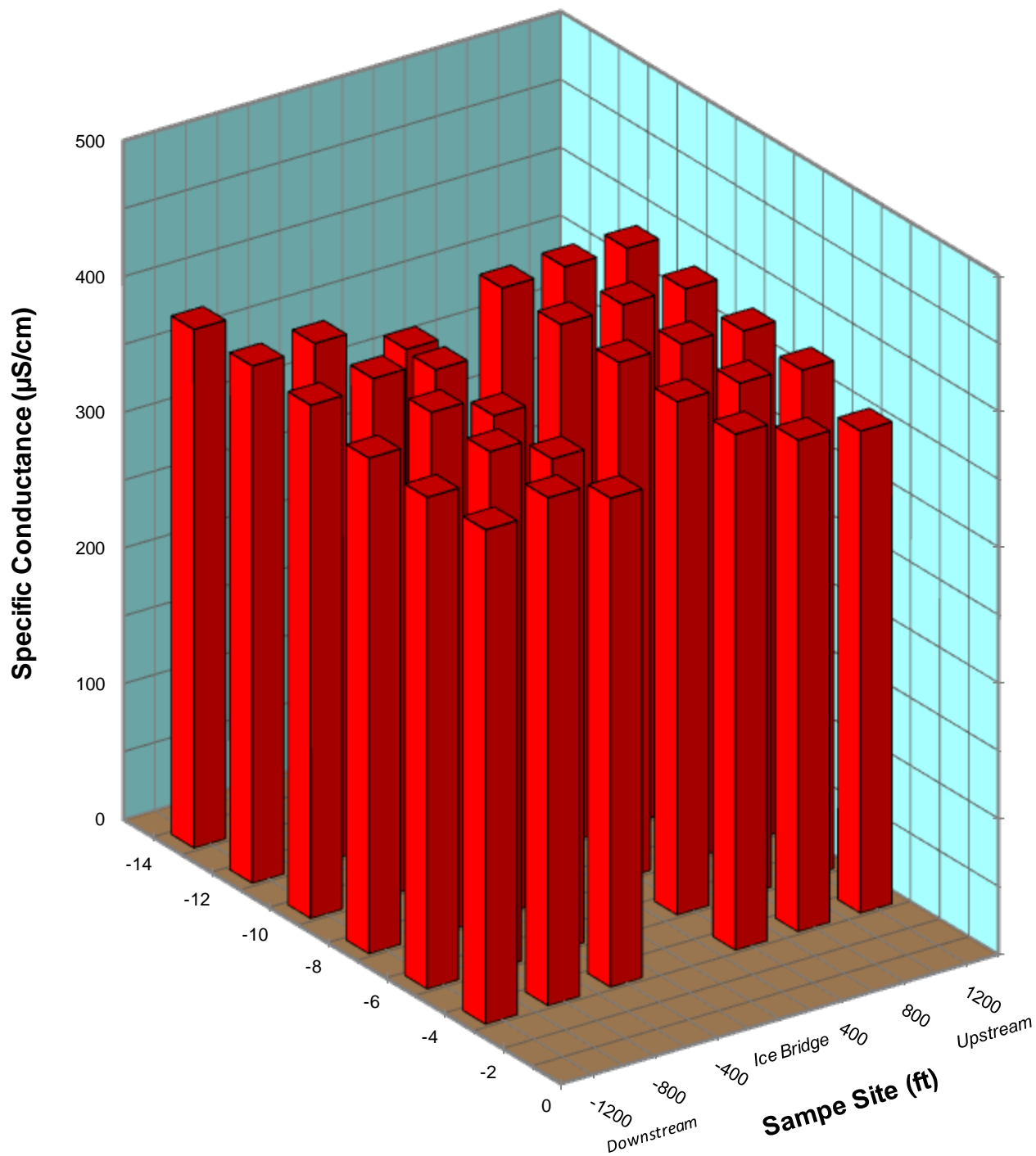
Sample Date: December 09, 2009

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 10:50 a.m.	12.4	2.4	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	0.2	196	380	9.3	70.9	0.2	-
				4	-	-	-	-	-	-	-
				5	0.2	194	378	10.6	72.4	0.2	-
				6	-	-	-	-	-	-	-
				7	0.2	196	381	10.6	72.3	0.2	-
				8	-	-	-	-	-	-	-
				9	0.1	196	383	10.6	72.3	0.2	-
				10	-	-	-	-	-	-	-
				11	0.1	196	384	10.6	72.2	0.2	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 11:20 a.m.	11.5	2.5	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	1.4	194	362	10.2	72.3	0.2	-
				4	-	-	-	-	-	-	-
				5	0.3	195	378	10.6	72.4	0.2	-
				6	-	-	-	-	-	-	-
				7	0.2	196	381	10.6	72.3	0.2	-
				8	-	-	-	-	-	-	-
				9	0.2	197	384	10.6	72.3	0.2	-
				10	-	-	-	-	-	-	-
				11	0.1	197	386	10.6	72.3	0.2	-
				12	-	-	-	-	-	-	-
				13	-	-	-	-	-	-	-
				14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 11:45 a.m.	11.8	2.2	0.0	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	2.3	197	355	10.1	73.6	0.2	-0.03
				4	-	-	-	-	-	-	-
				5	0.7	196	374	10.4	72.3	0.2	-0.02
				6	-	-	-	-	-	-	-
				7	0.5	196	377	10.5	72.2	0.2	-0.02
				8	-	-	-	-	-	-	-
				9	0.4	198	382	10.5	72.1	0.2	0.00
				10	-	-	-	-	-	-	-
				11	0.3	199	386	10.5	72.1	0.2	0.01
				12	-	-	-	-	-	-	-
				13	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Salinity, conductivity, and temperature were measured using a YSI-30 meter
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A negative value for velocity indicates flow from the downstream side to the upstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring December 9, 2009



Project Trip Report

Baker

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: December 24, 2009
Project Code: 118274	Submitted By: Elijah Keib

Weather: -20° F, 15 mph wind

Elijah Keib arrived at Alpine on Wednesday, December 23, 2009 at 2:00 p.m. Upon arrival Mr. Keib met with LCMF and coordinated tasks and access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on December 24, Mr. Keib attended LCMFs daily health and safety meeting. Chris Zeimet of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via Hägglund BV -206 departing Alpine at approximately 8:05 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ40 LDO meter. Water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline, to determine the presence of flow. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The DO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on December 23 prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 399 μ S/cm at a depth of 11.0 feet to a minimum of 381 μ S/cm at a depth of 12.5 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Overall, specific conductance increased slightly with increasing depth.

Dissolved oxygen saturation remained fairly consistent with respect to depth and distance up and downstream from bridge centerline; all values were between 67.5% and 80.6%. The average DO saturation was 70.0%.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of flow.

The average ice thickness was 2.6 feet (roughly 31 inches).

The next sampling event is scheduled for January 7, 2010.

Colville River Ice Bridge Monitoring Program
 Water Quality - Main Channel Upstream of Bridge



Sample Date: December 24, 2009

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 10:00 a.m.	12.4	2.5	0.0	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	0.0	195	383	10.0	67.9	0.2	-
				5	-	-	-	-	-	-	-
				6	0.0	196	383	10.0	67.9	0.2	-
				7	-	-	-	-	-	-	-
				8	0.1	197	384	9.9	67.8	0.2	-
				9	-	-	-	-	-	-	-
				10	0.1	196	382	9.9	67.7	0.2	-
				11	-	-	-	-	-	-	-
				12	0.2	197	382	10.1	68.6	0.2	-
800-ft Upstream N70°14'10.6" W150°50'06.4" 9:50 a.m.	13.0	2.6	0.0	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	0.0	195	382	9.9	67.7	0.2	-
				4	-	-	-	-	-	-	-
				5	0.0	195	382	9.9	67.8	0.2	-
				6	-	-	-	-	-	-	-
				7	0.0	195	383	10.0	68.0	0.2	-
				8	-	-	-	-	-	-	-
				9	0.0	196	385	9.9	67.7	0.2	-
				10	-	-	-	-	-	-	-
				11	0.2	196	382	9.9	67.6	0.2	-
				12	-	-	-	-	-	-	-
				12.5	0.2	196	381	9.9	68.3	0.2	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 9:30 a.m.	12.2	2.6	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	0.0	195	382	9.9	67.5	0.2	-
				5	-	-	-	-	-	-	-
				6	0.0	195	382	9.9	67.8	0.2	-
				7	-	-	-	-	-	-	-
				8	0.1	195	382	9.9	68.1	0.2	-
				9	-	-	-	-	-	-	-
				10	0.1	197	385	9.9	67.9	0.2	-
				11	-	-	-	-	-	-	-
				12	0.3	197	382	9.7	67.6	0.2	-
				13	-	-	-	-	-	-	-
				14	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
 Water Quality - Main Channel Downstream of Bridge



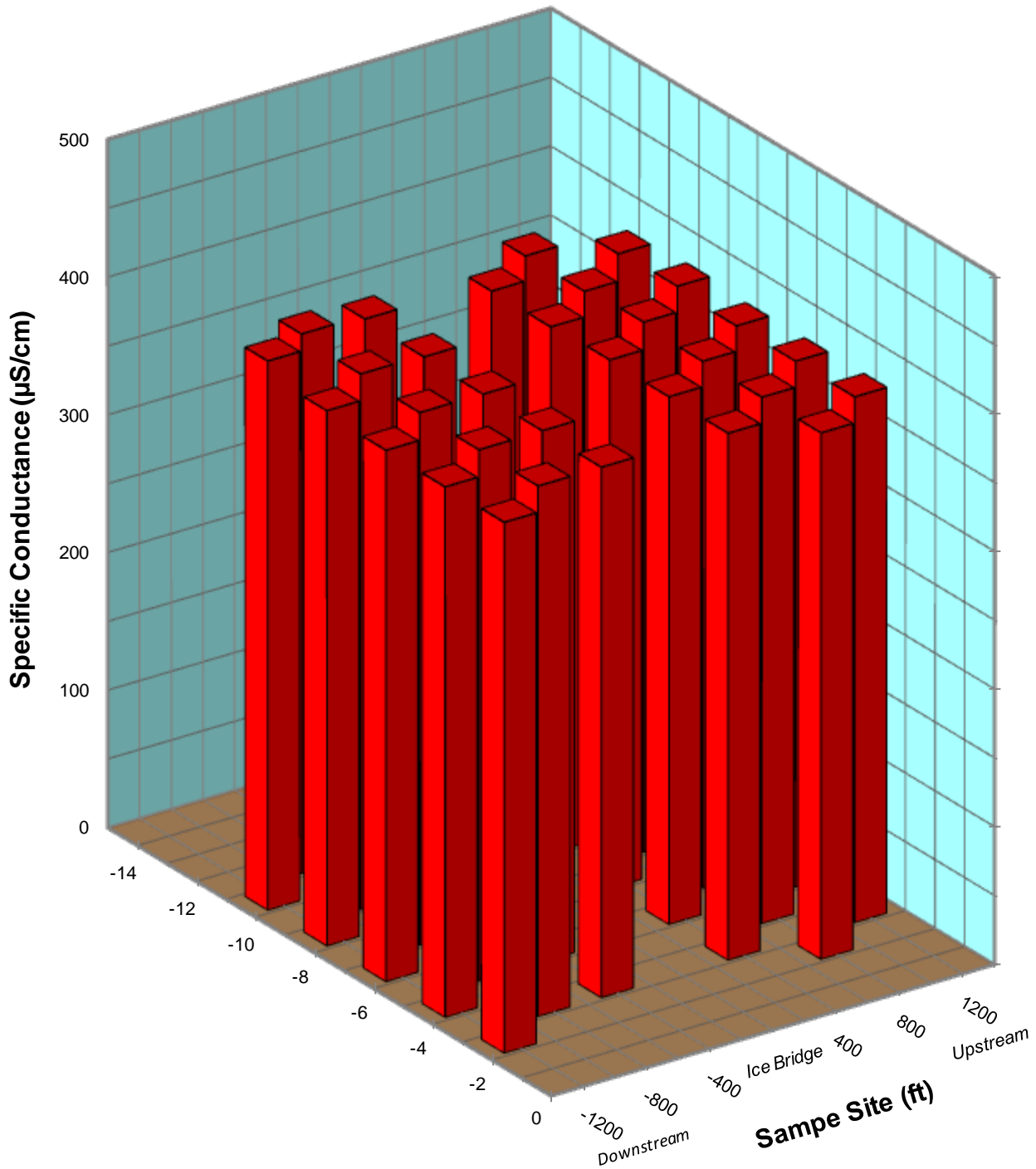
Sample Date: December 24, 2009

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)	
400-ft Downstream N70°14'21.2" W150°50'18.9" 10:10 a.m.	12.0	2.6	0.0	1	-	-	-	-	-	-	-	
				2	-	-	-	-	-	-	-	
				3	-	-	-	-	-	-	-	-
				4	0.0	197	385	10.0	68.3	0.2	-	
				5	-	-	-	-	-	-	-	
				6	0.0	197	386	10.0	68.4	0.2	-	
				7	-	-	-	-	-	-	-	
				8	0.1	198	387	10.0	68.3	0.2	-	
				9	-	-	-	-	-	-	-	
				10	0.1	199	388	10.0	68.5	0.2	-	
				11	-	-	-	-	-	-	-	
11.5	0.1	199	389	10.2	69.5	0.2	-					
800-ft Downstream N70°14'24.5" W150°50'19.8" 10:20 a.m.	12.3	2.7	0.0	1	-	-	-	-	-	-	-	
				2	-	-	-	-	-	-	-	
				3	-	-	-	-	-	-	-	
				4	0.0	197	385	9.9	67.9	0.2	-	
				5	-	-	-	-	-	-	-	
				6	0.0	197	386	9.9	67.9	0.2	-	
				7	-	-	-	-	-	-	-	
				8	0.1	198	387	9.9	67.9	0.2	-	
				9	-	-	-	-	-	-	-	
				10	0.1	199	389	9.9	67.9	0.2	-	
				11	-	-	-	-	-	-	-	
12	0.1	201	392	9.9	68.2	0.2	-					
1200-ft Downstream N70°14'29.1" W150°50'20.3" 10:40 a.m.	11.8	2.5	0.0	1	-	-	-	-	-	-	-	
				2	-	-	-	-	-	-	-	
				3	0.0	197	385	9.7	80.6	0.2	0.00	
				4	-	-	-	-	-	-	-	
				5	0.0	197	385	9.7	80.3	0.2	0.03	
				6	-	-	-	-	-	-	-	
				7	0.1	198	386	9.7	80.2	0.2	0.05	
				8	-	-	-	-	-	-	-	
				9	0.2	200	389	9.5	80.2	0.2	-0.08	
				10	-	-	-	-	-	-	-	
				11	0.3	206	399	9.4	80.2	0.2	-0.03	
				12	-	-	-	-	-	-	-	
				13	-	-	-	-	-	-	-	

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring December 24, 2009



Project Trip Report

Baker

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: January 6, 2010
Project Code: 118274	Submitted By: Elijah Keib

Weather: -10° F, 0-5 mph wind

Elijah Keib arrived at Alpine on Tuesday, January 5, 2010 at 5:30 p.m. Upon arrival Mr. Keib met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on January 6, Mr. Keib attended LCMFs daily health and safety meeting. AJ Griffen of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via Hägglund BV206 departing Alpine at approximately 8:20 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a YSI ProODO meter. Water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline, to determine the presence of flow. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The ProODO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on January 6 prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 408 μ S/cm at a depth of 11.0 feet to a minimum of 390 μ S/cm at a depth of 4.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Overall, specific conductance increased only slightly with increasing depth. Baker attempted to locate the leading edge of the ocean salt water intrusion into the Colville River. Baker traveled downstream along the main channel of the Colville River and took a single in-situ measurement at 9 miles downstream of the Colville River ice bridge centerline. Conductivity did increase slightly with distance downstream of the Colville River Ice Bridge centerline however specific conductance did not exceed 475 μ S/cm. No stratification of salt and fresh water was identified.

Dissolved oxygen saturation remained fairly consistent with respect to depth and distance up and downstream from ice bridge centerline; all values were between 57.9% and 64.7%. The average DO saturation was 60.6%. Generally there was little change in DO values with increasing depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of flow.

The average ice thickness was 3.2 feet (roughly 38.4 inches).

The next sampling event is scheduled for January 20, 2010.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: January 6, 2010

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 9:50 a.m.	11.7	4.1	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.0	201	394	8.7	59.7	0.2	-
				6	-	-	-	-	-	-	-
				7	0.0	201	394	8.8	60.1	0.2	-
				8	-	-	-	-	-	-	-
				9	0.2	202	393	8.8	60.4	0.2	-
				10	-	-	-	-	-	-	-
				11	0.3	203	394	8.8	61.5	0.2	-
				12	-	-	-	-	-	-	-
800-ft Upstream N70°14'10.6" W150°50'06.4" 9:30 a.m.	12.9	2.8	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	0.0	201	394	8.7	59.2	0.2	-
				5	-	-	-	-	-	-	-
				6	0.0	201	394	8.7	59.5	0.2	-
				7	-	-	-	-	-	-	-
				8	0.0	201	394	8.7	59.7	0.2	-
				9	-	-	-	-	-	-	-
				10	0.2	201	392	8.6	58.9	0.2	-
				11	-	-	-	-	-	-	-
				12	0.2	201	392	8.6	59.3	0.2	-
				13	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 9:00 a.m.	13.0	3.2	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.0	201	394	8.7	58.9	0.2	-
				6	-	-	-	-	-	-	-
				7	0.0	201	393	8.7	59.3	0.2	-
				8	-	-	-	-	-	-	-
				9	0.1	201	392	8.5	58.6	0.2	-
				10	-	-	-	-	-	-	-
				11	0.2	202	393	8.4	57.9	0.2	-
				12	-	-	-	-	-	-	-
				12.5	0.4	204	395	8.5	58.5	0.2	-
13	-	-	-	-	-	-	-				

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of the ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a YSI ProODO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
 Water Quality - Main Channel Downstream of Bridge



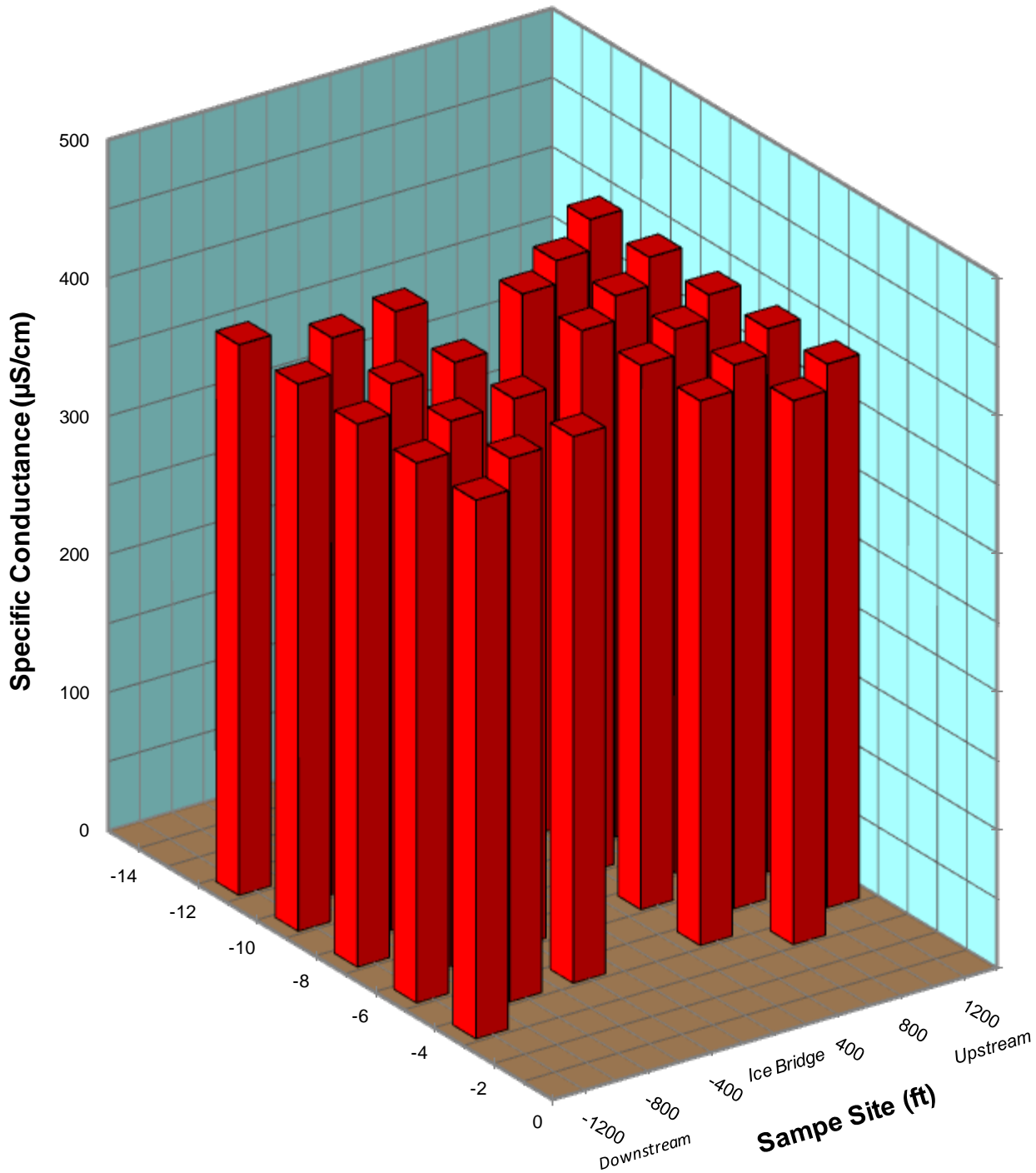
Sample Date: January 6, 2010

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 10:10 a.m.	11.9	3.0	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.0	202	396	9.1	61.8	0.2	-
				6	-	-	-	-	-	-	-
				7	0.0	203	397	9.1	62.2	0.2	-
				8	-	-	-	-	-	-	-
				9	0.0	203	397	9.1	63.0	0.2	-
				10	-	-	-	-	-	-	-
				11	0.3	211	408	9.1	64.7	0.2	-
				12	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 10:20 a.m.	11.9	3.3	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.0	201	394	8.8	60.5	0.2	-
				6	-	-	-	-	-	-	-
				7	0.0	201	395	8.9	60.9	0.2	-
				8	-	-	-	-	-	-	-
				9	0.0	202	395	8.9	61.4	0.2	-
				10	-	-	-	-	-	-	-
				11	0.1	206	403	9.0	63.0	0.2	-
				12	-	-	-	-	-	-	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 10:30 a.m.	12.2	2.6	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	0.0	199	390	8.9	61.0	0.2	0.01
				5	-	-	-	-	-	-	-
				6	0.0	199	391	8.9	61.5	0.2	0.03
				7	-	-	-	-	-	-	-
				8	0.0	200	393	8.9	61.7	0.2	0.00
				9	-	-	-	-	-	-	-
				10	0.1	203	396	8.9	62.0	0.2	-0.01
				11	-	-	-	-	-	-	-
				12	0.9	210	399	8.4	62.0	0.2	-0.01
				13	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a YSI ProODO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring January 6, 2010



Project Trip Report

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: January 20, 2010
Project Code: 118274	Submitted By: Elijah Keib

Weather: -27° F, 0-5 mph wind

Elijah Keib arrived at Alpine on Tuesday, January 19, 2010 at 5:30 p.m. Upon arrival Mr. Keib met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on January 20, Mr. Keib attended LCMFs daily health and safety meeting. Chris Zeimet of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via Hägglund BV206 departing Alpine at approximately 7:50 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ-40d LDO meter. To determine the presence of flow, water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The Hach HQ-40d LDO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on January 20 prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 475 μ S/cm at a depth of 13.0 feet to a minimum of 415 μ S/cm at a depth of 11.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Overall, specific conductance increased only slightly with increasing depth.

Dissolved oxygen saturation remained fairly consistent with respect to depth and distance up and downstream from ice bridge centerline; all values were between 58.1% and 62.3%. The average DO saturation was 60.0%. Generally there was little change in DO values with increasing depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of flow.

The average ice thickness was 3.6 feet (roughly 43.2 inches).

The next sampling event is scheduled for February 3, 2010.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: January 20, 2010

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 9:45 a.m.	13.4	4.3	0.5	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.0	213	418	8.6	60.0	0.2	-
				6	-	-	-	-	-	-	-
				7	0.0	213	418	8.6	60.0	0.2	-
				8	-	-	-	-	-	-	-
				9	0.1	213	416	8.6	59.9	0.2	-
				10	-	-	-	-	-	-	-
				11	0.3	214	415	8.5	59.4	0.2	-
				12	-	-	-	-	-	-	-
				13	0.4	216	417	8.8	61.9	0.2	-
800-ft Upstream N70°14'10.6" W150°50'06.4" 9:30 a.m.	13.4	3.4	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.0	213	418	8.6	60.0	0.2	-
				6	-	-	-	-	-	-	-
				7	0.0	214	419	8.6	60.1	0.2	-
				8	-	-	-	-	-	-	-
				9	0.1	214	417	8.5	59.7	0.2	-
				10	-	-	-	-	-	-	-
				11	0.2	217	421	8.3	58.8	0.2	-
				12	-	-	-	-	-	-	-
				13	0.4	218	421	8.2	59.5	0.2	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 8:50 a.m.	14.0	3.6	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.0	214	419	8.6	59.9	0.2	-
				6	-	-	-	-	-	-	-
				7	0.0	214	419	8.6	59.8	0.2	-
				8	-	-	-	-	-	-	-
				9	0.1	214	417	8.5	59.4	0.2	-
				10	-	-	-	-	-	-	-
				11	0.2	218	423	8.2	58.2	0.2	-
				12	-	-	-	-	-	-	-
				13	0.3	218	422	8.1	58.1	0.2	-
				14	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
 Water Quality - Main Channel Downstream of Bridge



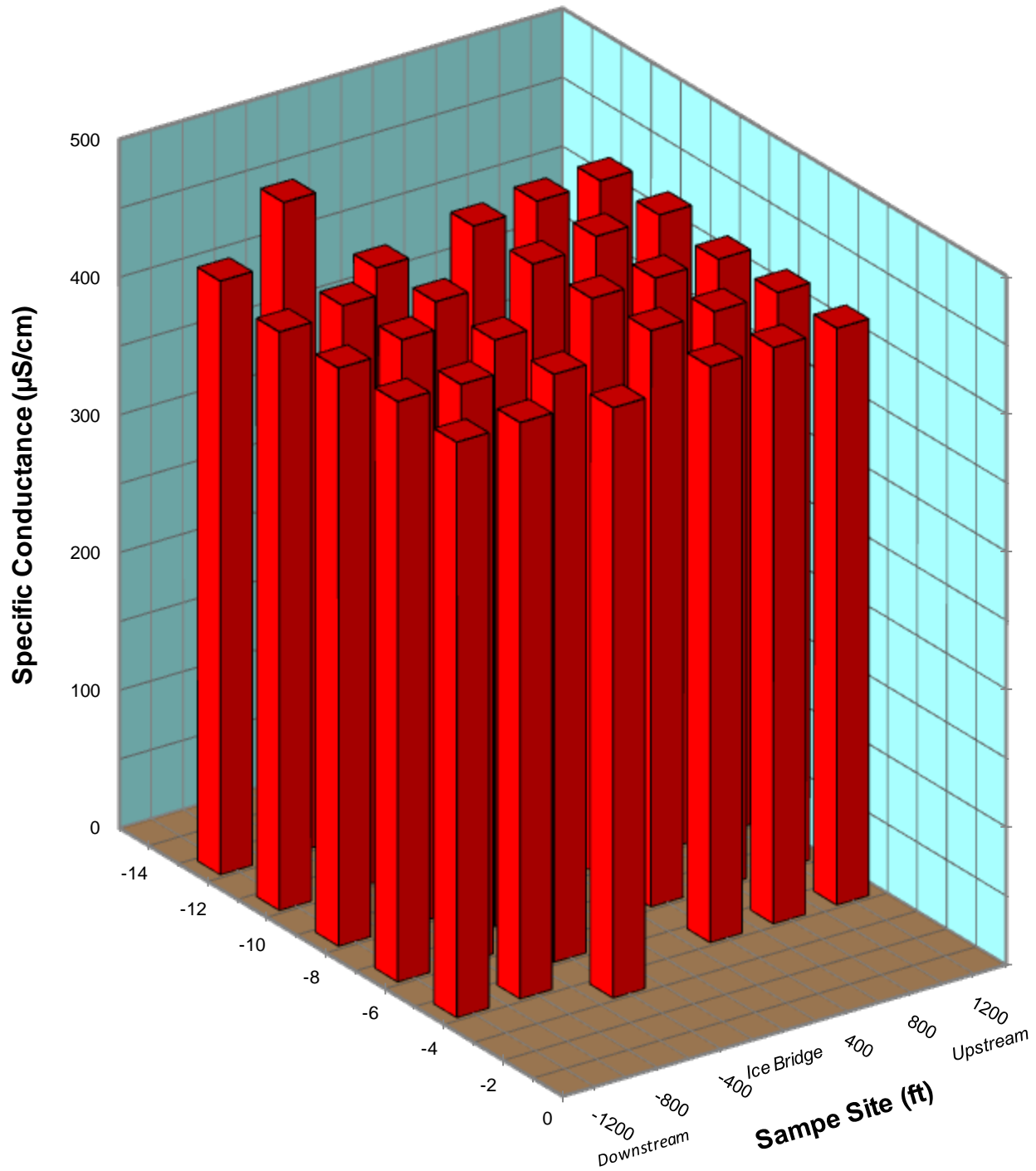
Sample Date: January 20, 2010

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 10:00 a.m.	12.9	3.5	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-0.1	218	429	8.8	61.0	0.2	-
				5	-	-	-	-	-	-	-
				6	0.0	218	427	8.8	61.1	0.2	-
				7	-	-	-	-	-	-	-
				8	0.1	218	426	8.8	61.4	0.2	-
				9	-	-	-	-	-	-	-
				10	0.1	219	428	8.8	61.7	0.2	-
				11	-	-	-	-	-	-	-
				12	0.4	221	426	8.8	62.3	0.2	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 10:10 a.m.	13.0	3.3	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.0	213	418	8.5	59.4	0.2	-
				6	-	-	-	-	-	-	-
				7	0.0	214	420	8.4	59.5	0.2	-
				8	-	-	-	-	-	-	-
				9	0.0	218	427	8.4	59.8	0.2	-
				10	-	-	-	-	-	-	-
				11	0.1	218	426	8.2	58.8	0.2	-
				12	-	-	-	-	-	-	-
				13	0.1	243	475	8.0	59.3	0.2	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 10:20 a.m.	13.0	3.3	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.1	214	418	8.6	60.0	0.2	-0.02
				6	-	-	-	-	-	-	-
				7	0.0	215	421	8.5	60.1	0.2	0.03
				8	-	-	-	-	-	-	-
				9	0.1	215	420	8.5	60.0	0.2	0.01
				10	-	-	-	-	-	-	-
				11	0.2	216	420	8.3	59.9	0.2	0.01
				12	-	-	-	-	-	-	-
				13	0.3	222	431	8.2	59.8	0.2	0.00

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring January 20, 2010



Project Trip Report

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: February 4, 2010
Project Code: 118274	Submitted By: Elijah Keib

Weather: -28° F, 10-15 mph wind

Elijah Keib arrived at Alpine on Wednesday, February 3, 2010 at 3:00 p.m. Upon arrival Mr. Keib met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on February 4, Mr. Keib attended LCMFs daily health and safety meeting. AJ Griffen of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via Håggglund BV206 departing Alpine at approximately 8:00 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ-40d LDO meter. Water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline, to determine the presence of flow. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The Hach HQ-40d LDO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on February 4, 2010 prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 511 μ S/cm at a depth of 12.0 feet to a minimum of 440 μ S/cm at a depth of 11.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Overall, specific conductance increased only slightly with increasing depth.

Dissolved oxygen saturation remained fairly consistent with respect to depth and distance up and downstream from ice bridge centerline; all values were between 54.2% and 60.8%. The average DO saturation was 56.5%. Generally there was little change in DO values with increasing depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of flow.

The average ice thickness was 4.2 feet (roughly 50.4 inches).

The next sampling event is scheduled for February 17, 2010.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: February 4, 2010

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)		
400-ft Upstream N70°14'14.4" W150°50'09.7" 9:40 a.m.	13.0	4.7	0.4	1	-	-	-	-	-	-	-		
				2	-	-	-	-	-	-	-	-	
				3	-	-	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-	-	-
				5	0.0	229	448	8.1	55.7	0.2	-		
				6	-	-	-	-	-	-	-		
				7	0.1	228	446	8.0	55.4	0.2	-		
				8	-	-	-	-	-	-	-		
				9	0.2	228	443	8.0	55.1	0.2	-		
				10	-	-	-	-	-	-	-		
				11	0.3	229	443	7.9	55.0	0.2	-		
				12	-	-	-	-	-	-	-		
12.5	0.5	233	448	7.8	54.9	0.2	-						
800-ft Upstream N70°14'10.6" W150°50'06.4" 9:30 a.m.	13.5	4.0	0.1	1	-	-	-	-	-	-	-		
				2	-	-	-	-	-	-	-	-	
				3	-	-	-	-	-	-	-	-	
				4	-	-	-	-	-	-	-	-	
				5	0.0	230	450	8.2	56.5	0.2	-		
				6	-	-	-	-	-	-	-		
				7	0.1	229	448	8.2	56.3	0.2	-		
				8	-	-	-	-	-	-	-		
				9	0.2	229	446	8.0	55.6	0.2	-		
				10	-	-	-	-	-	-	-		
				11	0.3	229	444	7.8	55.0	0.2	-		
				12	-	-	-	-	-	-	-		
				13	0.7	249	475	7.6	54.6	0.2	-		
1200-ft Upstream N70°14'06.7" W150°50'03.4" 9:15 a.m.	13.8	4.1	0.1	1	-	-	-	-	-	-	-		
				2	-	-	-	-	-	-	-	-	
				3	-	-	-	-	-	-	-	-	
				4	-	-	-	-	-	-	-	-	
				5	-0.1	230	452	8.2	56.4	0.2	-		
				6	-	-	-	-	-	-	-		
				7	0.0	229	450	8.2	56.2	0.2	-		
				8	-	-	-	-	-	-	-		
				9	0.1	229	447	8.0	54.9	0.2	-		
				10	-	-	-	-	-	-	-		
				11	0.3	227	440	7.8	54.2	0.2	-		
				12	-	-	-	-	-	-	-		
				13	0.5	229	441	7.8	54.7	0.2	-		
				14	-	-	-	-	-	-	-		

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Downstream of Bridge



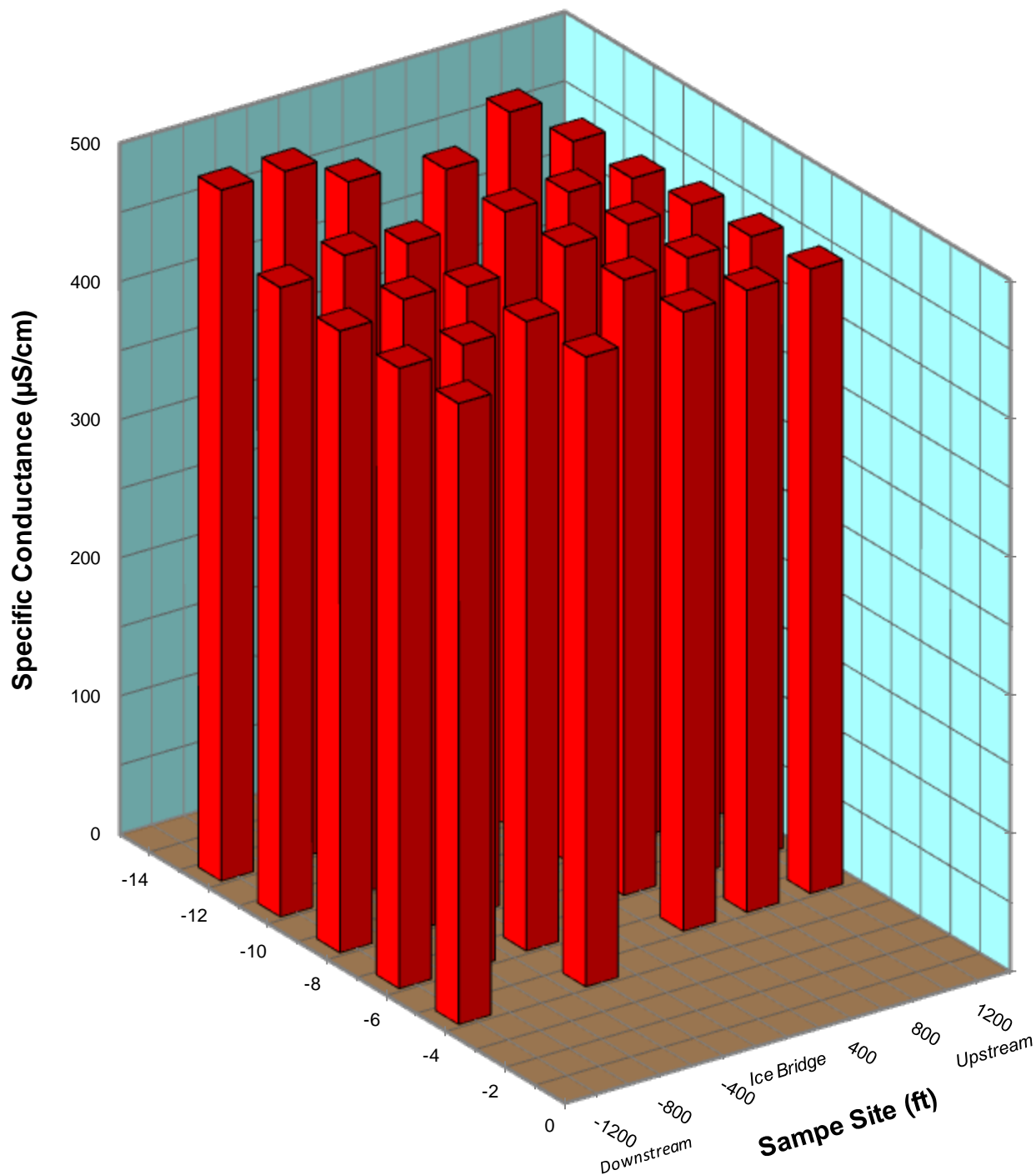
Sample Date: February 4, 2010

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 10:00 a.m.	12.3	4.0	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4.5	0.0	232	456	8.3	57.5	0.2	-
				5	-	-	-	-	-	-	-
				6	0.0	232	455	8.1	57.2	0.2	-
				7	-	-	-	-	-	-	-
				8	0.2	234	455	7.9	56.7	0.2	-
				9	-	-	-	-	-	-	-
				10	0.3	237	460	7.7	56.8	0.2	-
				11	-	-	-	-	-	-	-
				12	0.6	250	479	7.6	58.4	0.2	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 10:10 a.m.	12.0	4.4	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.1	232	452	8.3	57.3	0.2	-
				7	-	-	-	-	-	-	-
				8	0.2	236	459	8.2	57.5	0.2	-
				9	-	-	-	-	-	-	-
				10	0.3	240	465	8.2	57.6	0.2	-
				11	-	-	-	-	-	-	-
				12	0.7	263	501	8.4	60.8	0.2	-
				13	-	-	-	-	-	-	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 10:25 a.m.	12.5	3.7	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	0.1	230	449	8.2	56.8	0.2	-0.01
				5	-	-	-	-	-	-	-
				6	0.1	230	449	8.2	56.9	0.2	-0.01
				7	-	-	-	-	-	-	-
				8	0.2	231	450	8.2	57.3	0.2	-0.01
				9	-	-	-	-	-	-	-
				10	0.3	235	455	8.2	57.9	0.2	0.00
				11	-	-	-	-	-	-	-
				12	1.3	274	511	8.2	60.0	0.2	-0.04
				13	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring February 4, 2010



Project Trip Report

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: February 17, 2010
Project Code: 118274	Submitted By: Haley Runa

Weather: -5 to 5° F, 0-5 mph wind, clear

Haley Runa arrived at Alpine on Tuesday, February 16, 2010 at 5:30 p.m. Upon arrival Ms. Runa met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on February 17, Ms. Runa attended LCMFs daily health and safety meeting. Mike Rourick of LCMF accompanied Ms. Runa to the Colville River Ice Bridge site via Hägglund BV206 departing Alpine at approximately 7:45 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ-40d LDO meter. To determine the presence of flow, water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The Hach HQ-40d LDO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on February 17, prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 516 μ S/cm at a depth of 12.0 feet to a minimum of 457 μ S/cm at a depth of 11.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Specific conductance increased only slightly with increasing depth at all downstream locations only.

Dissolved oxygen saturation remained fairly consistent with respect to depth at all locations, and was slightly lower upstream from ice bridge centerline; all values were between 53.5% and 61.5%. The average DO saturation was 57.1%. Generally there was little change in DO values with increasing depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of significant flow.

The average ice thickness was 4.4 feet (53.2 inches).

The next sampling event is scheduled for March 3, 2010.

Colville River Ice Bridge Monitoring Program
 Water Quality - Main Channel Upstream of Bridge



Sample Date: February 17, 2010

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 9:40 a.m.	12.1	5.1	0.5	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5.5	0.1	237	463	8.0	54.7	0.2	-
				6	-	-	-	-	-	-	-
				7	0.2	237	461	8.0	55.0	0.2	-
				8	-	-	-	-	-	-	-
				9	0.3	237	459	7.9	55.0	0.2	-
				10	-	-	-	-	-	-	-
				11	0.4	237	457	7.9	55.5	0.2	-
				12	-	-	-	-	-	-	-
12.5	0.5	239	460	8.0	57.2	0.2	-				
800-ft Upstream N70°14'10.6" W150°50'06.4" 9:15 a.m.	11.9	4.1	0.5	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.2	238	462	7.8	54.0	0.2	-
				6	-	-	-	-	-	-	-
				7	0.3	237	459	7.8	53.8	0.2	-
				8	-	-	-	-	-	-	-
				9	0.3	238	460	7.6	53.5	0.2	-
				10	-	-	-	-	-	-	-
				11	0.5	239	460	7.6	54.0	0.2	-
				12	0.8	243	462	7.5	54.8	0.2	-
				13	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 8:45 a.m.	13.0	4.4	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.1	240	468	7.9	55.0	0.2	-
				6	-	-	-	-	-	-	-
				7	0.1	239	467	7.9	55.0	0.2	-
				8	-	-	-	-	-	-	-
				9	0.2	239	466	7.8	54.8	0.2	-
				10	-	-	-	-	-	-	-
				11	0.3	239	463	7.8	55.0	0.2	-
				12	-	-	-	-	-	-	-
				12.5	0.7	245	468	7.5	55.2	0.2	-
				14	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the ice surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Downstream of Bridge



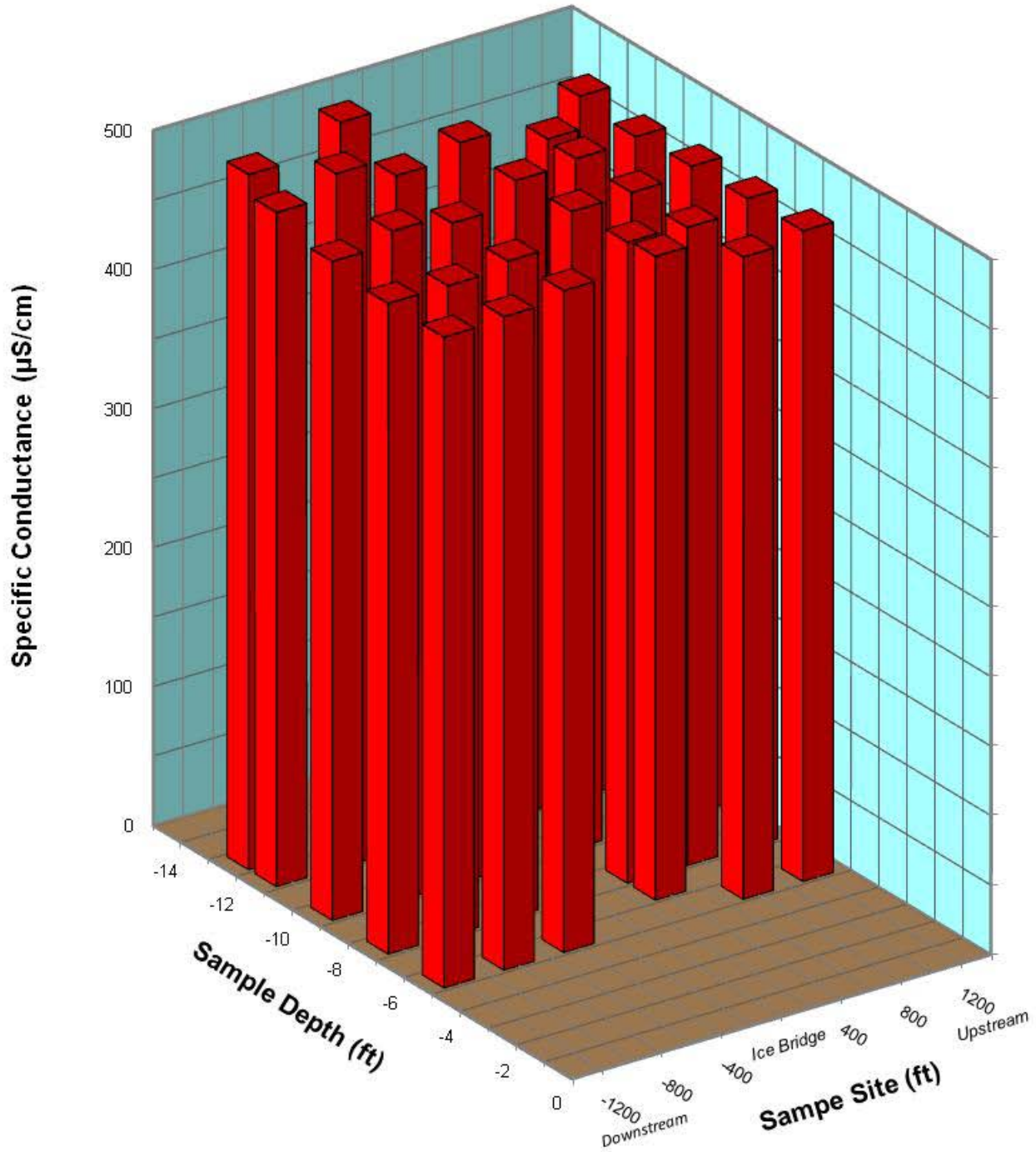
Sample Date: February 17, 2010

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 10:20 a.m.	12.3	4.5	0.5	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.1	244	476	8.5	58.3	0.2	-
				6	-	-	-	-	-	-	-
				7	0.3	244	473	8.5	58.6	0.2	-
				8	-	-	-	-	-	-	-
				9	0.4	246	476	8.5	59.0	0.2	-
				10	-	-	-	-	-	-	-
				11	0.6	254	486	8.7	61.3	0.2	-
12.5	1.2	268	503	8.1	61.5	0.2	-				
800-ft Downstream N70°14'24.5" W150°50'19.8" 11:00 a.m.	11.6	4.5	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.1	241	470	8.1	56.1	0.2	-
				6	-	-	-	-	-	-	-
				7	0.2	240	468	8.3	57.8	0.2	-
				8	-	-	-	-	-	-	-
				9	0.4	250	483	8.4	59.1	0.2	-
				10	-	-	-	-	-	-	-
				11.5	0.9	264	500	8.1	61.3	0.2	-
				12	-	-	-	-	-	-	-
				13	-	-	-	-	-	-	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 11:30 a.m.	11.8	4.0	0.4	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.2	241	468	8.0	60.0	0.2	0.14
				6	-	-	-	-	-	-	-
				7	0.3	241	468	8.2	60.1	0.2	-0.04
				8	-	-	-	-	-	-	-
				9	0.4	245	474	8.4	60.0	0.2	0.26
				10	-	-	-	-	-	-	-
				11	0.6	253	485	8.2	59.9	0.2	1.26
				12	1.0	273	516	7.7	59.9	0.2	0.85
				13	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the ice surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring February 17, 2010



Project Trip Report

Baker

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: March 3, 2010
Project Code: 118274	Submitted By: Elijah Keib

Weather: -8° F, 0 mph wind

Elijah Keib arrived at Alpine on Tuesday, March 2, 2010 at 5:30 p.m. Upon arrival Mr. Keib met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on March 3, Mr. Keib attended LCMFs daily health and safety meeting. AJ Griffen of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via Hägglund BV206 departing Alpine at approximately 8:15 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ-40d LDO meter. To determine the presence of flow, water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The Hach HQ-40d LDO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on March 3, prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 583 μ S/cm at a depth of 12.0 feet to a minimum of 475 μ S/cm at a depth of 11.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations. Specific conductance increased only slightly with increasing depth at all downstream locations only.

Dissolved oxygen saturation remained fairly consistent with respect to depth at all locations, and was slightly lower upstream from ice bridge centerline; all values were between 54.0% and 64.0%. The average DO saturation was 57.3% and generally increased slightly with depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of significant flow.

The average ice thickness was 4.8 feet (57.6 inches).

The next sampling event is scheduled for March 17, 2010.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: March 3, 2010

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 10:20 a.m.	13.1	5.5	0.8	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.1	248	483	7.9	54.8	0.2	-
				7	0.2	247	481	7.8	54.6	0.2	-
				8	-	-	-	-	-	-	-
				9	0.3	247	479	7.8	54.0	0.2	-
				10	-	-	-	-	-	-	-
				11	0.5	249	479	8.0	56.6	0.2	-
				12	-	-	-	-	-	-	-
				13	1.1	274	515	8.0	57.8	0.2	-
800-ft Upstream N70°14'10.6" W150°50'06.4" 10:10 a.m.	13.8	4.7	0.1	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.1	249	486	7.8	54.5	0.2	-
				6	-	-	-	-	-	-	-
				7	0.3	248	481	7.8	54.6	0.2	-
				8	-	-	-	-	-	-	-
				9	0.3	248	480	7.8	54.9	0.2	-
				10	-	-	-	-	-	-	-
				11	0.4	248	478	7.8	55.6	0.2	-
				12	-	-	-	-	-	-	-
				13	0.7	266	508	8.1	58.1	0.2	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 9:55 a.m.	13.7	4.4	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.2	249	484	7.9	55.2	0.2	-
				6	-	-	-	-	-	-	-
				7	0.3	248	481	7.8	55.1	0.2	-
				8	-	-	-	-	-	-	-
				9	0.4	247	478	7.8	55.1	0.2	-
				10	-	-	-	-	-	-	-
				11	0.5	247	475	7.8	55.7	0.2	-
				12	-	-	-	-	-	-	-
				13	0.6	248	475	8.0	57.3	0.2	-
				14	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Downstream of Bridge



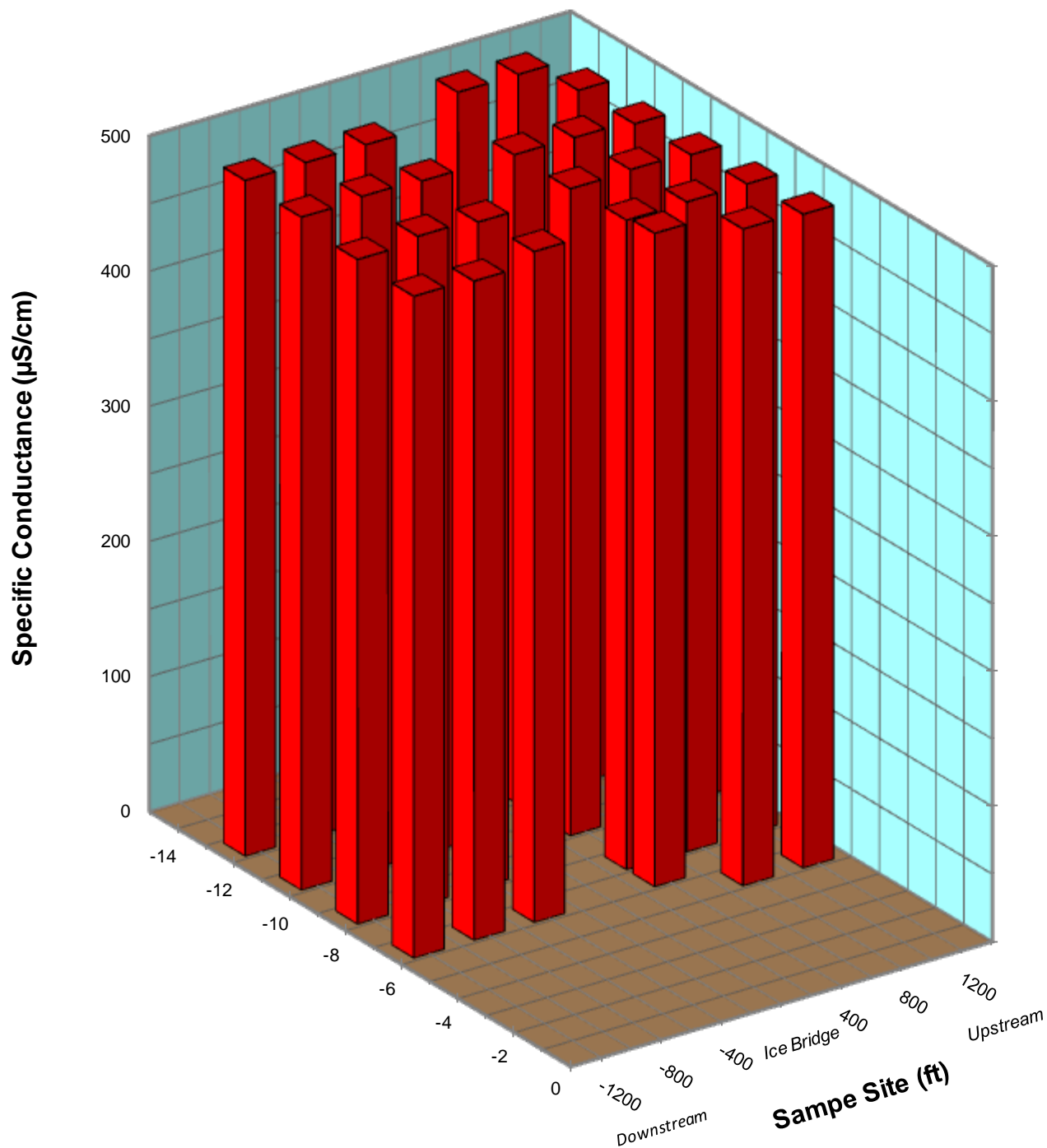
Sample Date: March 3, 2010

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 10:35 a.m.	12.9	4.7	0.4	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.1	254	496	8.3	58.0	0.2	-
				7	-	-	-	-	-	-	-
				8	0.4	255	493	8.3	58.3	0.2	-
				9	-	-	-	-	-	-	-
				10	0.6	260	498	8.6	61.5	0.2	-
				11	-	-	-	-	-	-	-
				12	1.0	281	531	8.8	64.0	0.2	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 10:50 a.m.	12.9	4.9	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.2	251	488	8.0	56.0	0.2	-
				7	-	-	-	-	-	-	-
				8	0.4	257	496	8.2	58.3	0.2	-
				9	-	-	-	-	-	-	-
				10	0.6	265	508	8.3	60.0	0.2	-
				11	-	-	-	-	-	-	-
				12	0.9	308	583	8.6	62.5	0.2	-
				13	-	-	-	-	-	-	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 11:05 a.m.	12.6	4.5	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.2	252	490	8.1	56.9	0.2	0.00
				7	-	-	-	-	-	-	-
				8	0.5	256	492	8.1	57.9	0.2	-0.01
				9	-	-	-	-	-	-	-
				10	0.6	260	498	8.2	59.1	0.2	-0.01
				11	-	-	-	-	-	-	-
				12	1.0	292	551	8.3	62.0	0.2	-0.02
				13	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring March 3, 2010



Project Trip Report

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: March 17, 2010
Project Code: 118274	Submitted By: Elijah Keib

Weather: -28° F, 5 mph wind

Elijah Keib arrived at Alpine on Tuesday, March 16, 2010 at 5:30 p.m. Upon arrival Mr. Keib met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on March 17, Mr. Keib attended LCMFs daily health and safety meeting. Chris Zeimet of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via Hägglund BV206 departing Alpine at approximately 8:00 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ-40d LDO meter. To determine the presence of flow, water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The Hach HQ-40d LDO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on March 17, prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 677 μ S/cm at a depth of 13.0 feet to a minimum of 498 μ S/cm at a depth of 9.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations.

Dissolved oxygen saturation remained fairly consistent with respect to depth at all locations, and was slightly lower upstream from ice bridge centerline; all values were between 53.8% and 60.2%. The average DO saturation was 56.5% and generally increased slightly with depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of significant flow.

The average ice thickness was 4.9 feet (58.8 inches).

The next sampling event is scheduled for March 31, 2010.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: March 17, 2010

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 9:20 a.m.	13.6	5.7	0.5	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	-	-	-	-	-	-	-
				7	0.3	258	500	7.8	53.9	0.2	-
				8	-	-	-	-	-	-	-
				9	0.4	258	499	7.7	54.0	0.2	-
				10	-	-	-	-	-	-	-
				11	0.6	264	505	7.8	55.0	0.2	-
				12	-	-	-	-	-	-	-
				13	1.0	291	549	8.1	58.6	0.3	-
800-ft Upstream N70°14'10.6" W150°50'06.4" 9:10 a.m.	13.9	4.7	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.1	260	508	7.8	53.8	0.2	-
				6	-	-	-	-	-	-	-
				7	0.3	259	502	7.8	54.1	0.2	-
				8	-	-	-	-	-	-	-
				9	0.5	259	498	7.8	54.2	0.2	-
				10	-	-	-	-	-	-	-
				11	0.6	263	505	8.0	55.9	0.2	-
				12	-	-	-	-	-	-	-
				13	0.7	289	552	8.0	56.8	0.3	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 8:50 a.m.	14.4	4.9	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.2	260	506	8.0	54.8	0.2	-
				7	-	-	-	-	-	-	-
				8	0.3	259	502	7.8	54.2	0.2	-
				9	-	-	-	-	-	-	-
				10	0.5	260	499	7.8	54.2	0.2	-
				11	-	-	-	-	-	-	-
				12	0.7	264	505	8.0	56.0	0.2	-
				13	-	-	-	-	-	-	-
				14	0.8	302	574	8.2	59.2	0.3	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Downstream of Bridge



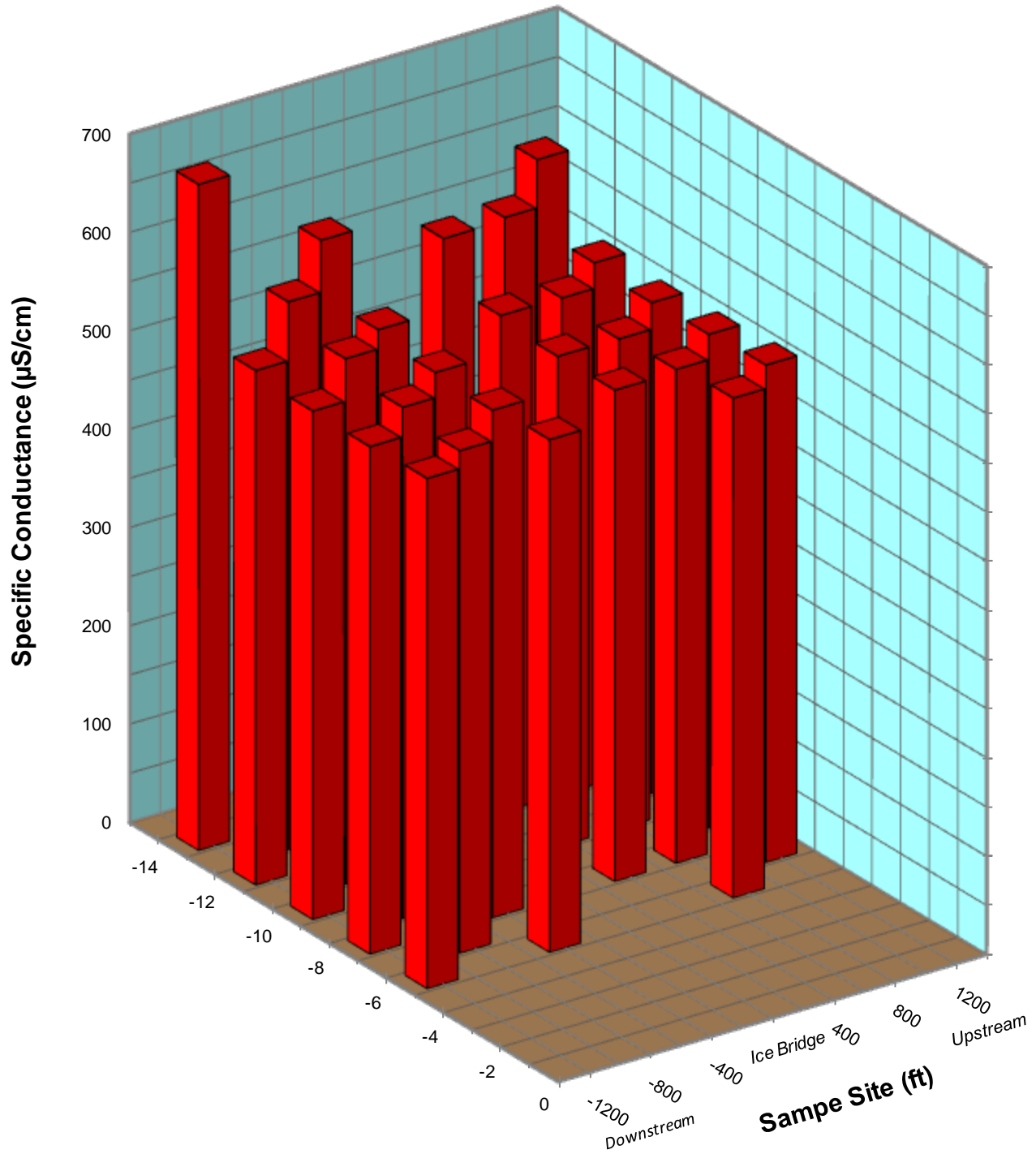
Sample Date: March 17, 2010

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 9:35 a.m.	13.4	4.9	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.1	267	521	8.0	55.1	0.2	-
				6	-	-	-	-	-	-	-
				7	0.3	266	516	8.1	56.1	0.2	-
				8	-	-	-	-	-	-	-
				9	0.5	270	519	8.2	57.0	0.2	-
				10	-	-	-	-	-	-	-
				11	0.6	275	528	8.3	58.6	0.2	-
				12	-	-	-	-	-	-	-
				13	0.9	308	584	8.4	60.2	0.3	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 9:45 a.m.	13.0	5.0	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.3	264	511	8.1	55.0	0.2	-
				7	-	-	-	-	-	-	-
				8	0.5	270	520	8.2	56.6	0.2	-
				9	-	-	-	-	-	-	-
				10	0.6	279	534	8.3	57.9	0.2	-
				11	-	-	-	-	-	-	-
				12	0.8	293	557	8.5	60.0	0.3	-
				13	-	-	-	-	-	-	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 10:00 a.m.	13.1	4.5	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	0.1	266	519	8.4	57.2	0.2	0.02
				6	-	-	-	-	-	-	-
				7	0.4	267	516	8.3	57.1	0.2	0.03
				8	-	-	-	-	-	-	-
				9	0.6	270	517	8.3	57.6	0.2	-0.01
				10	-	-	-	-	-	-	-
				11	0.8	275	523	8.3	58.5	0.2	-0.01
				12	-	-	-	-	-	-	-
				13	1.1	360	677	8.4	60.1	0.3	-0.03

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring March 17, 2010



Project Trip Report

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: March 31, 2010
Project Code: 118274	Submitted By: Elijah Keib

Weather: -22° F, 15-20 mph wind

Elijah Keib arrived at Alpine on Tuesday, March 30, 2010 at 5:30 p.m. Upon arrival Mr. Keib met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on March 31, Mr. Keib attended LCMFs daily health and safety meeting. Lance Bennett of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via Hägglund BV206 departing Alpine at approximately 8:15 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI-30 meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ-40d LDO meter. To determine the presence of flow, water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The Hach HQ-40d LDO meter was calibrated prior to the trip by TTT Environmental. Baker personnel calibrated the YSI-30 on March 31, prior to sampling.

Specific conductance at all sampling locations ranged from a maximum of 698 μ S/cm at a depth of 13.0 feet to a minimum of 535 μ S/cm at a depth of 8.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations.

Dissolved oxygen saturation remained fairly consistent with respect to depth at all locations, with lower values encountered upstream from ice bridge centerline; all values were between 53.9% and 66.3%. The average DO saturation was 59.9% and generally increased slightly with depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of significant flow.

The average ice thickness was 5.2 feet (62.4 inches).

The next sampling event is scheduled for April 14, 2010.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: March 31, 2010

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 9:15 a.m.	12.9	5.9	0.4	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.1	278	542	8.3	53.9	0.2	-
				7	-	-	-	-	-	-	-
				8	0.4	279	538	8.5	53.9	0.2	-
				9	-	-	-	-	-	-	-
				10	0.5	286	551	8.6	54.0	0.3	-
				11	-	-	-	-	-	-	-
				12	0.7	300	573	8.8	55.0	0.3	-
				13	-	-	-	-	-	-	-
800-ft Upstream N70°14'10.6" W150°50'06.4" 9:00 a.m.	12.9	4.9	0.0	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.2	279	542	8.4	59.0	0.2	-
				7	-	-	-	-	-	-	-
				8	0.6	281	539	8.4	59.3	0.2	-
				9	-	-	-	-	-	-	-
				10	0.6	292	560	8.8	62.4	0.3	-
				11	-	-	-	-	-	-	-
				12	0.8	307	585	9.0	64.0	0.3	-
				13	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 8:50 a.m.	14.4	5.3	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.4	279	538	8.3	58.8	0.2	-
				7	-	-	-	-	-	-	-
				8	0.6	279	535	8.2	58.6	0.2	-
				9	-	-	-	-	-	-	-
				10	0.7	284	542	8.3	59.6	0.2	-
				11	-	-	-	-	-	-	-
				12	0.8	291	554	8.4	60.5	0.3	-
				13	-	-	-	-	-	-	-
				14	0.9	328	622	8.5	61.7	0.3	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Downstream of Bridge



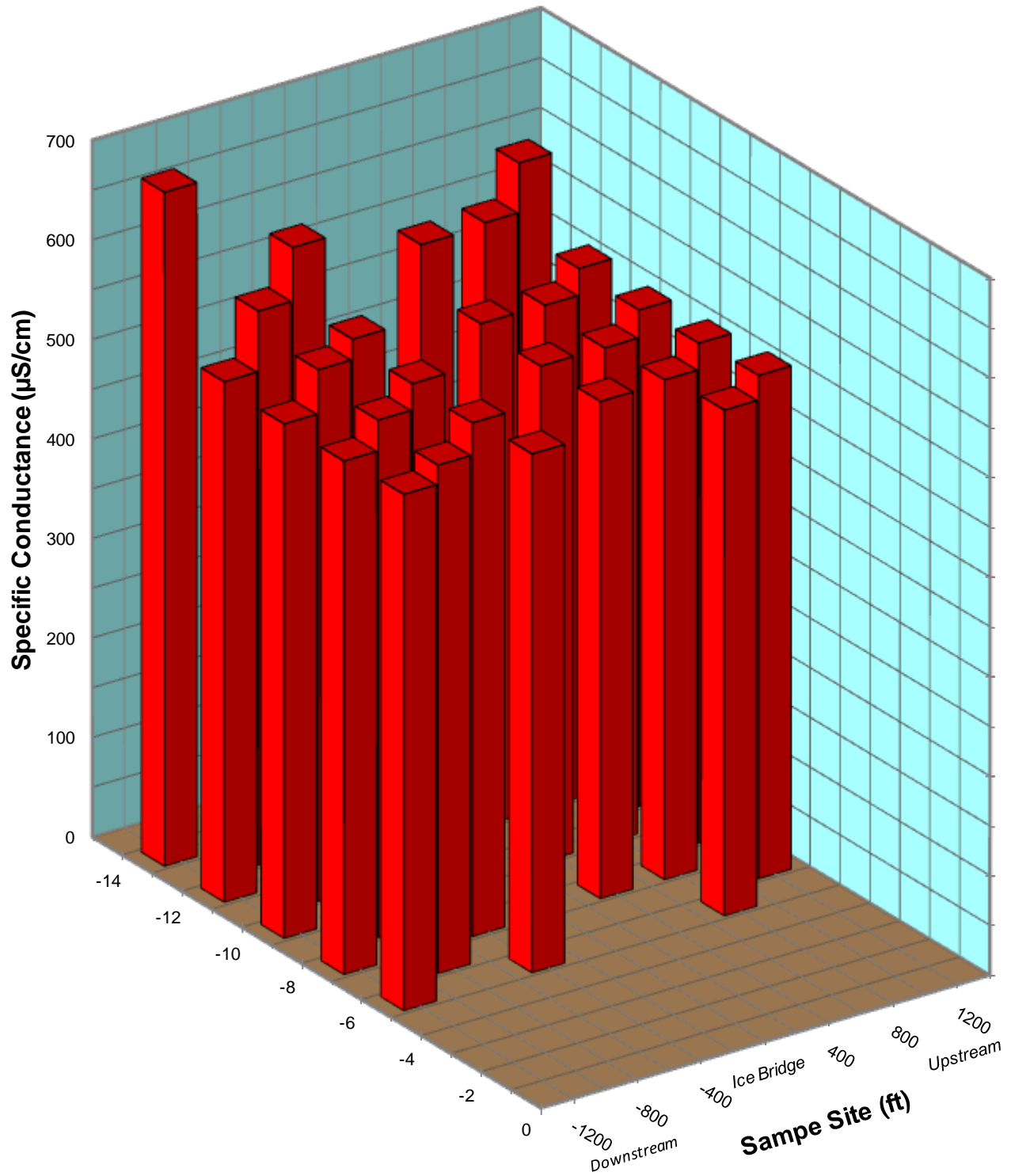
Sample Date: March 31, 2010

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 9:30 a.m.	13.9	5.5	0.6	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	-	-	-	-	-	-	-
				7	0.4	287	554	8.2	59.1	0.3	-
				8	-	-	-	-	-	-	-
				9	0.6	291	557	8.4	60.7	0.3	-
				10	-	-	-	-	-	-	-
				11	0.9	303	573	8.4	62.2	0.3	-
				12	-	-	-	-	-	-	-
				13	1.1	368	692	8.1	61.4	0.3	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 9:45 a.m.	13.0	5.0	0.2	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	-	-	-	-	-	-	-
				7	0.4	285	550	8.5	60.1	0.3	-
				8	-	-	-	-	-	-	-
				9	0.6	292	559	8.6	61.2	0.3	-
				10	-	-	-	-	-	-	-
				11	0.8	303	577	8.8	62.0	0.3	-
				12	-	-	-	-	-	-	-
				13	1.0	370	698	8.5	60.9	0.3	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 10:00 a.m.	12.9	4.7	0.4	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.2	282	548	8.6	61.3	0.3	0.00
				7	-	-	-	-	-	-	-
				8	0.6	285	547	8.5	61.3	0.3	0.03
				9	-	-	-	-	-	-	-
				10	0.8	295	562	8.4	62.1	0.3	-0.03
				11	-	-	-	-	-	-	-
				12	1.8	342	627	8.6	66.3	0.3	-0.01
				13	-	-	-	-	-	-	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-30 meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring March 31, 2010



Project Trip Report

Project Name: Colville River Ice Bridge Monitoring	Date of Trip: April 15, 2010
Project Code: 118274	Submitted By: Elijah Keib

Weather: 12° F, 5-10 mph wind

Elijah Keib arrived at Alpine on Wednesday, April 14, 2010 at 3:30 p.m. Upon arrival Mr. Keib met with LCMF and coordinated access to the Colville River for the planned ice bridge monitoring event.

At 6:00 a.m. on April 15, Mr. Keib attended LCMF's daily health and safety meeting. Mike Rourick of LCMF accompanied Mr. Keib to the Colville River Ice Bridge site via Hägglund BV206 departing Alpine at approximately 7:30 a.m.

Ice thickness, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) were collected at predetermined locations. Sampling took place at 400, 800, and 1200 feet both upstream and downstream of the proposed ice bridge centerline. Water velocities were obtained at 1200 feet downstream of the proposed bridge centerline. Specific conductance was calculated from observed temperatures and conductivity. Results are tabulated and graphed in the attached sheets.

In-situ water quality parameters were recorded using a YSI Professional Plus meter (temperature, conductivity, and salinity). Dissolved oxygen was measured using a Hach HQ-40d LDO meter. To determine the presence of flow, water velocities were measured using a Marsh McBirney Model 2000 at a single location, 1200 feet downstream of proposed bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals. The Hach HQ-40d LDO and the YSI Professional Plus meter were calibrated prior to the trip by TTT Environmental.

Specific conductance at all sampling locations ranged from a maximum of 645 μ S/cm at a depth of 13.0 feet to a minimum of 545 μ S/cm at a depth of 7.0 feet. Specific conductance values were relatively consistent at each sampling location with no evidence of stratification of salt and fresh water. Low observed salinity and conductivity values indicate salt water was not present in significant amounts at the monitoring locations.

Dissolved oxygen saturation remained fairly consistent with respect to depth at all locations, with slightly lower values encountered upstream from ice bridge centerline; all values were between 54.3% and 59.5%. The average DO saturation was 56.7% and generally increased slightly with depth.

Measured velocities at 1200 feet downstream from the proposed bridge centerline were not indicative of significant flow.

The average ice thickness was 5.4 feet (64.8 inches).

The next sampling event is scheduled for April 28, 2010.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Upstream of Bridge



Sample Date: April 15, 2010

Upstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'14.4" W150°50'09.7" 8:45 a.m.	13.6	6.2	0.5	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	-	-	-	-	-	-	-
				7	0.4	282	545	8.0	56.2	0.3	-
				8	-	-	-	-	-	-	-
				9	0.5	287	551	8.0	56.0	0.3	-
				10	-	-	-	-	-	-	-
				11	0.7	291	555	7.9	56.3	0.3	-
				12	-	-	-	-	-	-	-
				13	1.0	296	558	7.8	56.5	0.3	-
800-ft Upstream N70°14'10.6" W150°50'06.4" 8:30 a.m.	13.8	5.1	0.0	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	-	-	-	-	-	-	-
				7	0.3	287	556	8.1	56.7	0.3	-
				8	-	-	-	-	-	-	-
				9	0.6	289	554	8.0	56.8	0.3	-
				10	-	-	-	-	-	-	-
				11	1.1	296	558	8.0	57.2	0.3	-
				12	-	-	-	-	-	-	-
				13	1.3	304	567	7.4	54.9	0.3	-
1200-ft Upstream N70°14'06.7" W150°50'03.4" 8:15 a.m.	14.6	5.1	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	0.0	294	575	8.4	58.0	0.3	-
				7	-	-	-	-	-	-	-
				8	0.3	283	549	8.1	56.3	0.3	-
				9	-	-	-	-	-	-	-
				10	0.5	285	549	7.9	55.3	0.3	-
				11	-	-	-	-	-	-	-
				12	0.7	295	563	7.8	54.3	0.3	-
				13	-	-	-	-	-	-	-
				14	0.9	304	577	7.9	55.8	0.3	-

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-Professional Plus meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.

Colville River Ice Bridge Monitoring Program
Water Quality - Main Channel Downstream of Bridge



Sample Date: April 15, 2010

Downstream Location Time	Water Depth (ft)	Ice Thickness (ft)	Free Board (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (Percent Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.2" W150°50'18.9" 9:05 a.m.	13.5	5.3	0.4	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	-	-	-	-	-	-	-
				7	0.4	296	572	7.9	55.4	0.3	-
				8	-	-	-	-	-	-	-
				9	0.9	308	583	7.9	56.0	0.3	-
				10	-	-	-	-	-	-	-
				11	1.2	316	592	7.9	57.1	0.3	-
				12	-	-	-	-	-	-	-
				13	2.0	342	623	7.8	57.9	0.3	-
800-ft Downstream N70°14'24.5" W150°50'19.8" 9:20 a.m.	13.5	5.4	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5	-	-	-	-	-	-	-
				6	-	-	-	-	-	-	-
				7	0.4	294	567	8.2	57.0	0.3	-
				8	-	-	-	-	-	-	-
				9	0.7	310	592	8.2	57.7	0.3	-
				10	-	-	-	-	-	-	-
				11	0.9	318	602	8.5	59.5	0.3	-
				12	-	-	-	-	-	-	-
				13	1.1	341	642	8.3	58.9	0.3	-
1200-ft Downstream N70°14'29.1" W150°50'20.3" 9:35 a.m.	13.3	5.0	0.3	1	-	-	-	-	-	-	-
				2	-	-	-	-	-	-	-
				3	-	-	-	-	-	-	-
				4	-	-	-	-	-	-	-
				5.5	0.3	287	557	8.0	56.6	0.3	0.03
				6	-	-	-	-	-	-	-
				7	0.6	291	557	7.9	55.9	0.3	0.02
				8	-	-	-	-	-	-	-
				9	0.9	308	584	7.9	56.4	0.3	0.03
				10	-	-	-	-	-	-	-
				11	1.2	313	587	7.8	56.7	0.3	0.01
				12	-	-	-	-	-	-	-
				13	1.5	348	645	8.0	58.8	0.3	-0.01

Notes:

- (1) All sample location coordinates referenced to NAD83 datum.
- (2) Freeboard is the distance from the top of ice to the water surface.
- (3) Sample depth is measured from the water surface.
- (4) Temperature, Salinity, and Conductivity were measured using a YSI-Professional Plus meter.
- (5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
- (6) Dissolved oxygen was measured using a Hach HQ-40d LDO.
- (7) Time shown indicates the start of the measurement.
- (8) Velocity was measured using a Marsh-McBirney Model 2000.
- (9) A positive value for velocity indicates flow from the upstream side to the downstream side of the ice bridge.

2009/2010 Colville River Ice Bridge Monitoring April 15, 2010

