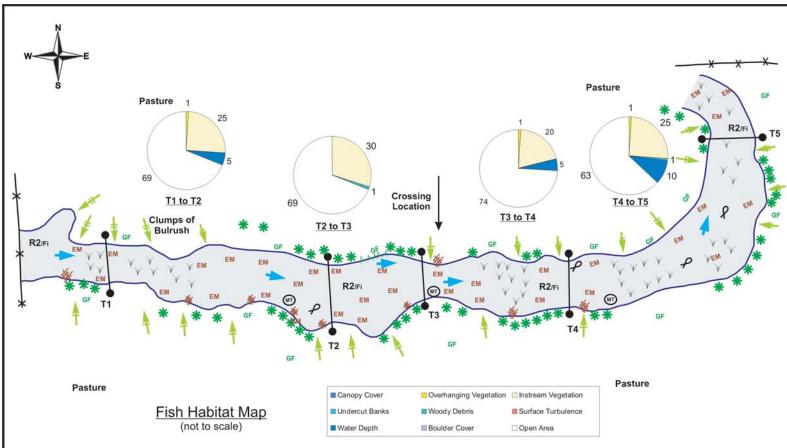
Appendix H: Fisheries Baseline Information and Field Results

Attachment H-1

Fish Habitat Maps







	Quality at ng Site:	pH: 7.	69	Temp (*	C): 19.8	EC (µS/cn	1): 1168	DO (r	ng/L): 2.7	Turb (N	TU): 0.59	Gradient (%): <1					
				Distance	Bankfull	Bankfull Depth	Wetted	Wett	ed Depth at % W	idth (m)	Veloc	cities at % Width (m/s)	Groundwate			
Transect	UTM-E	UTM-N	Zone/ WPT	from Crossing	Width (m)	(m)	Width (m)	25%	50%	75%	25%	50%	75%	Seeps			
1	608224	5558828	Wc2T1	100 m	11.0	2.0	8.0	1.02	1.02	0.69	-		-				
2	608279	5558813	Wc2T2	50 m	18.0	1.0	12.0	0.91	0.72	0.52			-				
3 (Crossing)	608327	5558811	Wc2T3	0 m	12.6	1.0	9.4	0.43	0.90	0.77	< 0.03	0.11	0.01	Unknown			
4	608437	5558785	Wc2T4	150 m	16.0	1.5	12.0	1.02	0.89	0.51		-					
5	608508	5558805	Wc2T5	300 m	14.0	1.0	10.0	0.41	0.92	1.03							
	LDB / RDB	LDB / RDB	LDB/RDB		Bank M	Material (%)			Sut	ostrate Composit	ion (%)						
Transect	Bank Slope (deg)	Bank Stability (L/M/H)	Bank Erosion (L/M/H)	Fines (< 2mm)	Gravel (2-64mm)	Cobbles (64-256mm)	Boulders (>256mm)	Fines (<2mm)	Sm Gravel (3-16mm)	Lg Gravel (17-64mm)	Cobble (65-256mm)	Boulder (>256mm)		Embeddedness (None/Low/Mod./High)			
1	80/25	H/H	L/L	100	0	0	0	100	0	0	0	0					
2	70/40	H/H	L/L	100	0	0	0	100	0	0	0	0					
3 (Crossing)	80/40	H/H	L/L	100	0	0	0	100	0	0	0	0		***			
4	80/45	H/H	E/L	100	0	0	0	100	0	0	0	0					
5	35/50	H/M	L/L	100	0	0	0	100	0	0	0	0					
Transect		Cover Habitat (%)								Habitat Type Ratio Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)							
transect	Canopy Cover	Overhanging Veg.	Instream Veg.	Undercut Banks	Woody Debris	Surface Turbulence	Water Depth	Boulder Cover	(Pool/Riffle/Run)		Spawn	Rearing	Migration	Overwinterin			
T1 to T2	0	- 11	25	0	0	0	5	0	0/0	/ 100	Poor / Poor	Poor / Mod	Poor / Mod	None / None			
T2 to T3	0	0	30	0	1	0	0	0	0/0	/ 100	Poor / Poor	Poor / Mod	Poor / Mod	None / None			
T3 to T4	0	1	20	0	0	0	5	0	0/0	/ 100	Poor / Poor	Poor / Mod	Poor / Mod	None / None			
T4 to T5	0	1	25	0	1	0	10	0	0/0	/ 100	Poor / Poor	Poor / Mod	Poor / Mod	None / None			
		Minnow Trapping			Electrofishi	ng		Pole Seinin	g		Cast Netting						
No. Fish Observed	No. Captured	Effort (hrs)	CPUE (# fish/hr)	No. Captured	Effort (s)	CPUE (# fish/100m)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	No. Captured	Effort (s)	CPUE (# fish/10m²)	Restricted	Activity Period			
1	1-PRDC	10.5	0.1	0	387	0	Unfeasible d	lue to high inst density	ream vegetation	Unfeasible due	to high instream v	regetation density	October 1	st to May 31st			
Proposed Cr	ossing Period	Propose	d Pipeline Cross	sing	Contin	gency Pipeline C	rossing	Proposed Vehicle Crossing			Site Se	ensitivity	Watercourse Crossing Risk				
Sun	nmer	Iso	lated Open-cut			Open-cut		Terr	porary Single-Spar	n Bridge	idge Low to Moderate			Low			



Plate 1: Looking upstream towards the proposed pipeline crossing at Maple Creek (Site 2; August 22, 2010).



Plate 2: Looking upstream from Transect 5 (T5) approximately 300 m downstream of the proposed pipeline crossing (August 22, 2010).



Plate 3: View downstream towards the proposed pipeline crossing from Transect 2 (T2), approximately 50 m upstream of the proposed crossing (August 22, 2010).



Plate 4: View looking upstream from approximately 150 m downstream of the proposed crossing (August 22, 2010).



•—•	Transect
\rightarrow	Flow Direction
>>>>>	Beaver Dam
	Beaver Lodge
¥	Vegetated Drainage Drav
BM	Bench Mark
(MT)	Minnow Trap

Water Depth (m)

>> Fish Observation

Habitat Type RF Class 1 Run (>1 m deep) Class 2 Run (0.75-1 m deep) Class 3 Run (0.5-0.75 m deep) R3 Class 1 Pool(>1.5 m deep) P1 Class 2 Pool (mod quality) P2 P3 Class 3 Pool (low quality) FL Flat FA Falls **BW** Backwater Impoundment

Fish Habitat Cover

Substrate Fi Organic Fines Sand Si Gr Gravel Co Cobble Bo Boulder

Bd Bedrock Ba Bare Ground GB Gravel Bar

Habitat Cover Emergent Macrophytes SM Submergent Macrophytes FM Floating Macrophytes Debris Pile DP WD Woody Debris

LWD Large Woody Debris RW Rootwad V OHV Overhanging Vegetation -- UCB Undercut Bank

USB Unstable Bank Fallen Tree

Riparian Vegetation Banks / Approaches

Shrub MW Mixedwood Forest Coniferous Forest DF **Deciduous Forest** Sedges SE GF Grass/Forbs MO Moss Shrubs

3

Trees

 Shallow Slope Moderate Slope Moderately Steep Slope Steep Slope Escarpment



Vantage Pipeline Project

Maple Creek (Site 2) Fish Habitat Data (W1/2 15-14-26 W3M)

January 2011 REF.: 1282 (Fisheries)

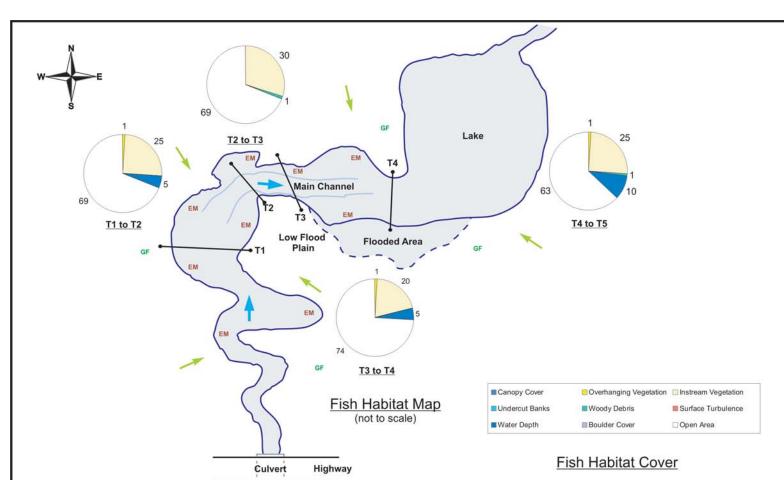




Plate 2: View upstream towards the proposed Site 3 crossing location. Picture by Jacques Whitford AXYS during fisheries assessment for the Keystone pipeline project (June 17, 2008).

Water C	Quality at ng Site:	pH: *8	3.67	Temp (*	C): *21.4	EC (µS/cm): *777	DO (n	ng/L): *6.6	Turb (NT	U): *0.75	Gradient (%): <1			
			7	Distance	Bankfull	Bankfull Depth	Wetted	Wett	ted Depth at % W	fidth (m)	Veloc	cities at % Width	(m/s)	Groundwate	
Transect	UTM-E	UTM-N	Zone/ WPT	from Crossing	Width (m)	(m)	Width (m)	25%	50%	75%	25%	50%	75%	Seeps	
1			6775		*18.0	*0.3	*16.0			****			2000		
2				****	*12.0	*3.0	*10.5	****			****			A. S.	
3	634331	5542259	12U	55 m	*13.0	0.0	*8.0		*1.60	***	***	*0.01		Unknown	
4	-			***	*48.0	*0.0	*45.0								
5			- 144	-	*35.0	*0.0	*30.0		322			-			
5	LDB / RDB	LDB / RDB	LDB/RDB		Bank Material (%)				Sul	ostrate Compositi	ion (%)		5-5.0	28. 57	
Transect	Bank Slope (deg)	Bank Stability (L/M/H)	Bank Erosion (L/M/H)	Fines (< 2mm)	Gravel (2-64mm)	Cobbles (64-256mm)	Boulders (>256mm)	Fines (<2mm)	Sm Gravel (3-16mm)	Lg Gravel (17-64mm)	Cobble (65-256mm)	Boulder (>256mm)	Embeddedness (None/Low/Mod./High)		
1		*L/L		100	0	.0	0				****				
2		*L / M		100	0	0	0	*85	944	*0	*15	•0			
3		*L/L		100	0	0	0	*70	***	*10	*20	*0	5		
4		*L/L	***	100	0	0	0	***		***	***				
5		*L/L	***	100	0	0	0	***		***	****				
Transect				Cover Hat	oitat (%)				Habitat T	ype Ratio	ŀ		- Sport/Forage Fish Moderate/Good)		
Transect		Overhead	d Cover		Instream Cover			(Pool/Riffle/Run)		Spawn	Rearing	Migration	Overwintering		
T1 to T2		*0	N.			*20			***						
T2 to T3		*0			*35				****			8500 BGG S	4000000000	740 OR 0	
T3 to T4		*0				*40					*None / Mod	*None / Good	*Mod / Mod	*Poor / Mod	
T4 to T5		*0				*35			1	223					
		Minnow Trapping	g		Electrofishi	ng	-	Pole Seinin	ng	1	Cast Netting				
No. Fish Observed	No. Captured	Effort (hrs)	CPUE (# fish/hr)	No. Captured	Effort (s)	CPUE (# fish/100m)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	Restricted	Activity Period	
		2000	Fishing effort co	nducted during	Keystone surv	ey in 2008 resulted i	n BRMN throug	h minnow trapp	oing and electrofish	ing		Sall Control of Contro	October 1:	st to May 31st	
roposed Cr	ossing Period	Dennes	ed Pipeline Cros			gency Pipeline Cr			posed Vehicle C		Cit- C	ensitivity		Crossing Risk	
roposea Cri	ussing Period	Propose	u ripeline cros	sing	Contir	igency Pipeline Ci	ossing	Pro	posed venicle C	ossing	Site Se	nisiuvity	vvatercourse	crossing Risk	
Summer		Horizontal Directional Drill			1	Isolated Open-cut Tem			Temporary Single-Span Bridge		* Unkown		* Unkown		

^{*} Data from 2008 Jacques Whitford AXYS Keystone XL Pipeline Fisheries Assessment

Due to restricted landowner access this site was not assessed during the 2010 field program. A field program is scheduled for spring 2011. Proposed timing window, and pipeline crossing method were determined in consultation with DFO and were based on the potential presence of fall spawning trout species (Schweitzer, pers. comm.). Proposed crossing method is subject to results of the spring 2011 survey.

Fish Habitat Data



Plate 3: Inlet to the lake downstream of the crossing location at Site 3. Picture by Jacques Whitford AXYS during fisheries assessment for the Keystone pipeline project (June 17, 2008).



Plate 4: Looking south towards the flooded area present in the spring of 2008 downstream of the proposed pipeline crossing location. Picture by Jacques Whitford AXYS during fisheries assessment for the Keystone pipeline project (June 17, 2008).

(June 17, 2008). By: By: Date: No. AS TLR November 3, 2010 0 Diagram Not to Scale ospine Environmental Services Ltd.

Plate 1: Site overview of Piapot Creek immediately downstream of

(Site 3). Picture by Jacques Whitford AXYS during

the proposed Vantage pipeline crossing of Piapot Creek

fisheries assessment for the Keystone pipeline project

LEGEND Transect Flow Direction >>>> Beaver Dam Beaver Lodge Vegetated Drainage Draw Bench Mark

BM MT Minnow Trap

Water Depth (m) >> Fish Observation

Hahita	t Type
Tabita	LIYPO

Substrate Fi Organic Fines Class 1 Run (>1 m deep) Sand Class 2 Run (0.75-1 m deep) Si Silt Class 3 Run (0.5-0.75 m deep) Gr Gravel Co Cobble

R3 Class 1 Pool(>1.5 m deep) P1 P2 Class 2 Pool (mod quality) P3 Class 3 Pool (low quality)

FL Flat FA Falls **BW** Backwater

Impoundment

Bo Boulder

Bd Bedrock

Ba Bare Ground

GB Gravel Bar

Habitat Cover **Emergent Macrophytes** SM Submergent Macrophytes FM Floating Macrophytes DP Debris Pile Woody Debris

₩ WD RW

LWD Large Woody Debris Rootwad V OHV Overhanging Vegetation

-- UCB Undercut Bank USB Unstable Bank Fallen Tree

Riparian Vegetation

Shrub MW Mixedwood Forest Coniferous Forest CF DF **Deciduous Forest** SE Sedges Grass/Forbs GF MO Moss Shrubs

Trees

3

Banks / Approaches Shallow Slope

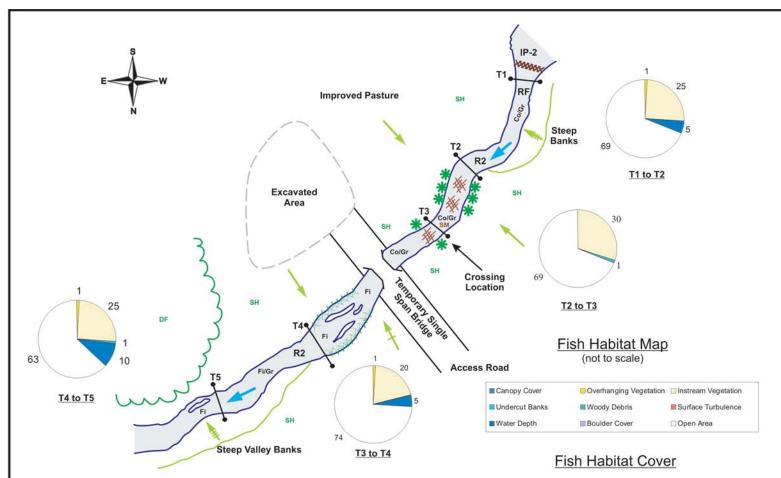
Moderate Slope Moderately Steep Slope Steep Slope ****** Escarpment



Vantage Pipeline Project

Piapot Creek (Site 3) Fish Habitat Data (NE 19-12-23 W3M)

January 2011 REF.: 1282 (Fisheries)



Water C Crossii	Quality at ng Site:	pH:	9.1	Temp (*	C): *14.6	EC (µS/cm): *532	DO (n	ng/L); *8.7	Turb (NT	'U): *6.3	Gradient (%): <1			
-				Distance	Bankfull	Bankfull Depth	Wetted	Wett	ed Depth at % W	fidth (m)	Velo	cities at % Width ((m/s)	Groundwater	
Transect	UTM-E	UTM-N	Zone/ WPT	from Crossing	Width (m)	(m)	Width (m)	25%	50%	75%	25%	50%	75%	Seeps	
111	(2000)	0.000	200	-	*2.8	*1.5	*2.8	*0.25	*0.24	*0.18	*0.31	*0.95	*0.05		
2	***		***	***	*4.6	*0.5	*4.6	*0.36	*0.37	*0.37	*0.06	*0.17	*0.18		
3 (Crossing)	648589	5532245	NLFR1	0 m	4.5	0.4	4.5	0.38	0.38	0.44				Unknown	
4		***		***	*4.8	*0.3	*3.1	*0.31	*0.31	*0.29	*0.34	*0.26	*0.16		
5			***	-	*4.2	*0.3	*4.2	*0.25	*0.25	*0.31	*0.08	*0.20	*0.07		
	LDB / RDB	LDB / RDB	LDB/RDB	*	Bank Material (%)				Sut	ostrate Compositi	on (%)				
Transect	Bank Slope (deg)	Bank Stability (L/M/H)	Bank Erosion (L/M/H)	Fines (< 2mm)	Gravel (2-64mm)	Cobbles (64-256mm)	Boulders (>256mm)	Fines (<2mm)	Sm Gravel (3-16mm)	Lg Gravel (17-64mm)	Cobble (65-256mm)	Boulder (>256mm)		Embeddedness (None/Low/Mod./High)	
1.		*L/L	Fee: 2	100	0	0	0	*20	- C-0-1	*30	*48	*2			
2		*L/L		100	0	0	0	*50	-	*50	*0	*0			
3 (Crossing)	90 / 90	L/L	M/M	100	0	0	0	50	0	35	10	5		***	
4	9449	*L/L		100	0	0	0	*20	***	*50	*30	*0			
5	144	*L/L		100	0	0	0	*50	5244	*30	*18	*2			
Transect				Cover Hal	bitat (%)				Habitat T	ype Ratio	Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)				
110110000		Overhead	d Cover		Instream Cover			(Pool/Riffle/Run)		Spawn	Rearing	Migration	Overwintering		
T1 to T2		*28	3			*25		-	(m)						
T2 to T3		*68	5		*45			10 / 10 / 80			0		No. of Particular Part		
T3 to T4		*5				*5			0 / 10	0/90	Poor / Mod	Good / Good	Poor / Mod	None / Poor	
T4 to T5		*70)			*20				-					
		Minnow Trapping	9		Electrofishi	ng		Pole Seinin	g		Cast Netting				
No. Fish Observed	No. Captured	Effort (hrs)	CPUE (# fish/hr)	No. Captured	Effort (s)	CPUE (# fish/100m)	No. Captured	Effort (s)	CPUE (# fish/10m²)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	Restricted	Activity Period	
		Fis	hing effort conduct	ted during Keys	tone survey in 2	2008 resulted in WH	SC and BRST t	hrough minnow	trapping and elect	rofishing			April 1st	to May 31st	
Proposed Cr	ossing Period	Propose	ed Pipeline Cross	sing	Contin	gency Pipeline Cr	rossing	Pro	posed Vehicle Co	rossing	Site Se	ensitivity	Watercours	e Crossing Risk	
Sun	nmer	Iso	olated Open-cut			Open-cut			Temporary Single-Span Bridge			Low to Moderate		Low	

Data from 2008 Jacques Whitford AXYS Keystone XL Pipeline Fisheries Assessment

Fish Habitat Data



Plate 1: View of the riparian area of Skull Creek at the proposed pipeline crossing (Site 4; October 18, 2010.)



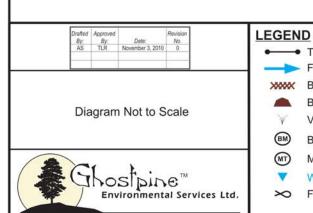
Plate 2: View of habitat observed at the proposed pipeline crossing (Site 4; October 18, 2010).



Plate 3: Single span bridge at an active construction site immediately downstream of the proposed pipeline crossing at the time of October survey (October 18, 2010).



Plate 4: View of Skull Creek from high grade gravel road looking at outlet from the existing culvert, approximately 1.0 km downstream of the proposed crossing (August 22, 2010).



Transect Flow Direction >>>> Beaver Dam Beaver Lodge Vegetated Drainage Draw BM Bench Mark

MT Minnow Trap Water Depth (m) >> Fish Observation

Habitat Type

Impoundment

R3

Substrate Fi Organic Fines Class 1 Run (>1 m deep) Sand Class 2 Run (0.75-1 m deep) Si Class 3 Run (0.5-0.75 m deep) Gr Gravel Co Cobble

Bo Boulder

Bd Bedrock

Ba Bare Ground

GB Gravel Bar

Class 1 Pool(>1.5 m deep) P1 P2 Class 2 Pool (mod quality) P3 Class 3 Pool (low quality) FL Flat FA Falls **BW** Backwater

Habitat Cover

Emergent Macrophytes SM Submergent Macrophytes FM Floating Macrophytes DP Debris Pile WD Woody Debris LWD Large Woody Debris Rootwad

V OHV Overhanging Vegetation -- UCB Undercut Bank USB Unstable Bank

Fallen Tree

Riparian Vegetation

Shrub MW Mixedwood Forest CF Coniferous Forest Deciduous Forest DF Sedges SE Grass/Forbs GF MO Moss Shrubs

3

Trees

Banks / Approaches

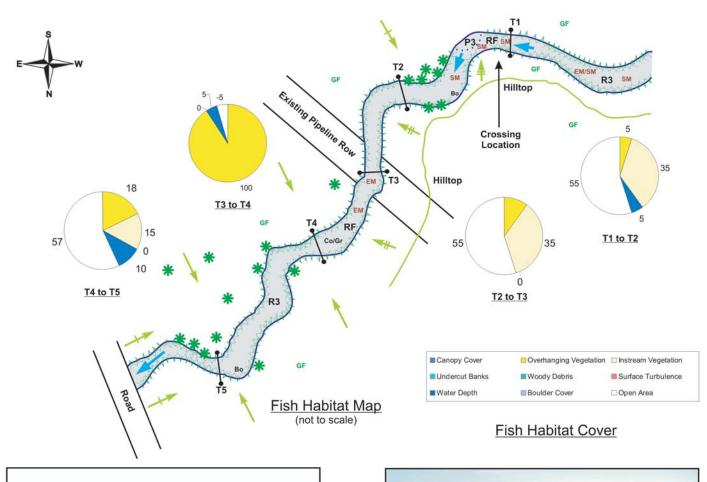
 Shallow Slope Moderate Slope Moderately Steep Slope Steep Slope ----- Escarpment



Vantage Pipeline Project

Skull Creek (Site 4) Fish Habitat Data (NW 22-11-22 W3M)

January 2011 REF.: 1282 (Fisheries)



	Quality at ing Site:	pH: *8	3.91	Temp (*	C): *19.2	EC (µS/cm): *1460	DO (r	mg/L): *8.8	Turb (NT	U): *0.05	Gradient (%): <1		
_				Distance	Bankfull	Bankfull Depth	Wetted	Wett	ted Depth at % W	fidth (m)	Velo	cities at % Width (m/s)	Groundwate
Transect	UTM-E	UTM-N	Zone/ WPT	from Crossing	Width (m)	(m)	Width (m)	25%	50%	75%	25%	50%	75%	Seeps
1 (Crossing)	651768	5529649	5	0	3.0	0.5	3.0	0.25	0.33	0.41	***	***	***	
2		***	***	***	*0.6	*0.7	*0.6	***	*0.15	***	***	*0.72	***	53000
3		***	· · · · ·	***	*1.0	*0.5	*1.0	***	*0.26	***	***	*0.26	***	Unknown
4			(***	*6.5	*2.5	*6.5	***	*0.44	***	***	*0.04	***	
5			***	***	*1,3	*0.7	*1.3	***	*0.50	***	***	*0.11	***	
	LDB / RDB	DB LDB / RDB LDB/RDB			Bank N	Naterial (%)			Sub	ostrate Composit	ion (%)		121.	
Transect	Bank Slope (deg)	Bank Stability (L/M/H)	Bank Erosion (L/M/H)	Fines (< 2mm)	Gravel (2-64mm)	Cobbles (64-256mm)	Boulders (>256mm)	Fines (<2mm)	Sm Gravel (3-16mm)	Lg Gravel (17-64mm)	Cobble (65-256mm)	Boulder (>256mm)		ddedness w/Mod./High)
1 (Crossing)	90 / 90	M/L	L/L	100	0	0	0	75	5	20	0	0		High
2		*L/L		100	0	0	0	*20	***	*80	•0	*0	High	
3		*L/L	(****)	100	0	0	0	*10	***	*60	*30	*0	High	
4	***	*L/L	2000	100	0	0	0	*100	***	*0	*0	*0	High	
5		*L/L	944	100	0	0	0	*50	***	*50	*0	*0	High	
Transect				Cover Hat	bitat (%)				Habitat T	ype Ratio		Habitat Potential - (None/Poor/M	Sport/Forage F oderate/Good)	ish
1100000		Overhead	d Cover			Instream Cover			(Pool/Ri	ffle/Run)	Spawn	Rearing	Migration	Overwinterin
T1 to T2		*5	ē.		3	*35	0	-	5/75	5 / 20				
T2 to T3		*10)		*35				0/5/95					
T3 to T4		*10	0			*0						Poor / Mod	Poor / Mod	None / None
T4 to T5		*18	3			*15	10							
	i i	Minnow Trapping	9		Electrofishin	ng		Pole Seinir	ng		Cast Netting			
No. Fish Observed	No. Captured	Effort (hrs)	CPUE (# fish/hr)	No. Captured	Effort (s)	CPUE (# fish/100m)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	Restricted	Activity Period
			Fishing effort	conducted durin	ng Keystone su	rvey in 2008 resulte	d in the capture	of FTMN and o	observation of BRS	r		•	Un	known
Proposed Cr	rossing Period	Propose	ed Pipeline Cross	sing	Contin	igency Pipeline C	rossing	Pro	posed Vehicle Cr	rossing	Site Se	ensitivity	Watercourse	e Crossing Risk
Sun	nmer	Iso	olated Open-cut			Open-cut		Ramp and Culvert			L	ow	Low	



Plate 1: Looking south from high grade gravel road towards the proposed pipeline crossing at Bridge Creek (Site 5) during the August survey (August 19, 2010).



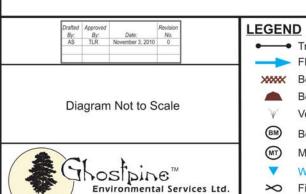
Plate 2: View towards the crossing location at Site 5 looking upstream (October 19, 2010).



Plate 3: At the proposed crossing location looking upstream (October 19, 2010).



Plate 4: Looking south towards traversed area of Bridge Creek (October 19, 2010).



LOLIN	<u> </u>
•—•	Transect
\rightarrow	Flow Direction
>>>>>	Beaver Dam
	Beaver Lodge
\forall	Vegetated Drainage Draw
BM	Bench Mark
MT	Minnow Trap
	Water Depth (m)

>> Fish Observation

	Habi	tat Type
	RF	Riffle
	R1	Class
	R2	Class :
	R3	Class
Draw	P1	Class
	P2	Class :
	P3	Class
	FL	Flat
	FA	Falls
	BW	Backw
	ID	Impou

Riffle	Fi	Organic Fines
Class 1 Run (>1 m deep)	Sa	Sand
Class 2 Run (0.75-1 m deep)	Si	Silt
Class 3 Run (0.5-0.75 m deep)	Gr	Gravel
Class 1 Pool(>1.5 m deep)	Co	Cobble
Class 2 Pool (mod quality)	Bo	Boulder
Class 3 Pool (low quality)	Bd	Bedrock
Flat	Ba	Bare Ground
Falls	GB	Gravel Bar
Backwater		
Impoundment		

Substrate

Habita	at Cover
EM	Emergent Macrophytes
SM	Submergent Macrophytes
FM	Floating Macrophytes
DP	Debris Pile
WD WD	Woody Debris
LWD	Large Woody Debris
RW	Rootwad

XX VVD	woody Debris
X LWD	Large Woody Debris
RW	Rootwad
V OHV	Overhanging Vegetation
UCB	Undercut Bank
USB	Unstable Bank
- Chi	Fallen Tree

Riparian Vegetation Shrub MW Mixedwood Forest CF Coniferous Forest Steep Slope **Deciduous Forest** Sedges ******* Escarpment Grass/Forbs

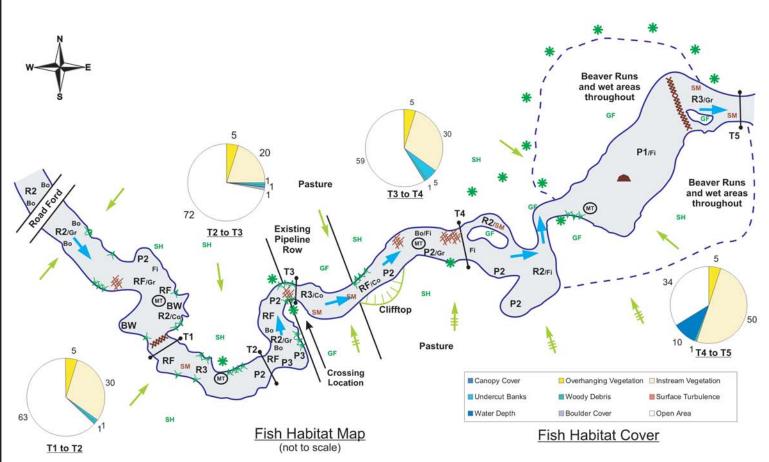
DF SE GF MO Moss Shrubs 0 Trees



Vantage Pipeline Project

Bridge Creek (Site 5) **Fish Habitat Data** (NW 12-11-22 W3M)

January 2011 REF.: 1282 (Fisheries)



	Quality at ng Site:	pH: 8.	62	Temp ("C): 4.0	EC (µS/cr	n): 460	DO (m	ng/L): 14.6	Turb (NT	TU): 3.05	Gradient (%): <1			
1925 65.7	100000000	0.00000000	E-03 1550 (E-03)	Distance	Bankfull	Bankfull Depth	Wetted	Wett	ed Depth at % W	/idth (m)	Velor	cities at % Width	(m/s)	Groundwater	
Transect	UTM-E	UTM-N	Zone/ WPT	from Crossing	Width (m)	(m)	Width (m)	25%	50%	75%	25%	50%	75%	Seeps	
1	661177	5520564	WC7 T1	100 m	5.0	0.5	5.0	0.22	0.32	0.30	-	-			
2	661248	5520576	WC7 T2	50 m	3.7	0.7	3.7	0.28	0.30	0.28					
3 (Crossing)	661304	5520596	WC7 T3	0 m	3.2	0.7	3.2	0.42	0.48	0.42	0.50	0.52	0.17	Unknown	
4	661407	5520683	WC7 T4	150 m	2.2	0.7	2.2	0.53	0.65	0.55	0.000				
5	661445	5520795	WC7 T5	300 m	4.5	0.6	4.5	0.42	0.60	0.36					
	LDB / RDB	LDB / RDB	LDB/RDB	1	Bank I	Material (%)	0		Sul	bstrate Compositi	ion (%)	i i			
Transect	Bank Slope (deg)	Bank Stability (L/M/H)	Bank Erosion (L/M/H)	Fines (< 2mm)	Gravel (2-64mm)	Cobbles (64-256mm)	Boulders (>256mm)	Fines (<2mm)	Sm Gravel (3-16mm)	Lg Gravel (17-64mm)	Cobble (65-256mm)	Boulder (>256mm)		ddedness w/Mod./High)	
1	90 / 90	H/H	M/M	100	0	0	0	20	0	40	40	0	- 1	LOW	
2	90 / 90	H/H	M/M	100	0	0	0	20	0	60	20	0	1	LOW	
3 (Crossing)	90 / 90	H/H	M/M	100	0	0	0	65	0	30	5	0	,	MOD	
4	90 / 90	H/H	M/M	100	0	0	0	40	0	45	15	0	+	HIGH	
5	90 / 90	H/H	M/M	100	0	0	0	45	0	45	10	0	MOD		
Transect		Cover Habitat (%)								ype Ratio	,	Habitat Potential (None/Poor/N	Sport/Forage F Moderate/Good)	ish	
Transect	Canopy Cover	Overhanging Veg.	Instream Veg.	Undercut Banks	Woody Debris	Surface Turbulence	Water Depth	Boulder Cover	(Pool/Ri	(Pool/Riffle/Run) Spawn Rearing		Migration	Overwintering		
T1 to T2	0	5	30	1	1	0	0	0	5/4	0 / 55	Mod / Good	Mod / Mod	Good / Good	Poor / Poor	
T2 to T3	0	5	20	1	1	0	0	1	10/5	60 / 40	Mod / Good	Mod / Mod	Good / Good	Poor / Poor	
T3 to T4	0	5	30	5	1	0	0	0	0/5	6/95	Mod / Good	Good / Good	Good / Good	Poor / Poor	
T4 to T5	0	5	50	0	1	0	10	0	60 / 1	5 / 35	Mod / Good	Good / Good	Mod / Mod	Mod / Mod	
No. Fish		Minnow Trapping	į.		Electrofishi	ng		Pole Seinin	g		Cast Netting				
Observed	No. Captured	Effort (hrs)	CPUE (# fish/hr)	No. Captured	Effort (s)	CPUE (# fish/100m)	No. Captured	Effort (s)	CPUE (# fish/10m²)	No. Captured	Effort (s)	CPUE (# fish/10m²)	Restricted	Activity Period	
86	3-BRST	23	0.13	13-BRST 8-FTMN 1-PRDC 2-BRMN 23-LNDC 13-WHSC	604	52.87	Unfeasib	e due to veget		Unfeasib	ble due to lack of la		October 1	st to May 31st	
Proposed Cr	ossing Period	Propose	d Pipeline Cross	sing	Contir	ngency Pipeline C	rossing	Proposed Vehicle Crossing			Site Se	ensitivity	Watercourse	e Crossing Risk	
Sun	nmer	Horizon	Horizontal Directional Drill			Isolated Open-cut			Temporary Single-Span Bridge			te to High	Moderate		



Plate 1: View towards the proposed pipeline crossing of Bone Creek (Site 7) looking northwest (October 19, 2010).



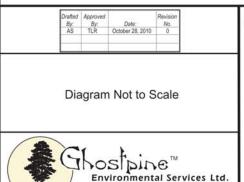
Plate 2: Looking downstream from Site 7 at the proposed crossing location (October 19, 2010).



Plate 3: Typical bank vegetation and submerged vegetation observed within the reach upstream of the proposed crossing location (October 19, 2010).



Plate 4: Typical habitat observed within the reach between Transect 4 and Transect 5 (150 m to 300 m downstream) in the area impacted by beaver activity (October 19, 2010).



Transect Flow Direction >>>> Beaver Dam Beaver Lodge Vegetated Drainage Draw

LEGEND

BM Bench Mark MT Minnow Trap

Water Depth (m) >> Fish Observation

Habitat Type

BW Backwater

Impoundment

Class 1 Run (>1 m deep) Class 2 Run (0.75-1 m deep) Class 3 Run (0.5-0.75 m deep) R3

Class 1 Pool(>1.5 m deep) P1 Class 2 Pool (mod quality) P2 **P3** Class 3 Pool (low quality) FL Flat FA Falls

Fi Organic Fines Sand Si Silt

Substrate

Gr Gravel Co Cobble Bo Boulder Bd Bedrock Ba Bare Ground GB Gravel Bar

Habitat Cover

Emergent Macrophytes SM Submergent Macrophytes FM Floating Macrophytes DP Debris Pile WD Woody Debris LWD Large Woody Debris Rootwad

V OHV Overhanging Vegetation -- UCB Undercut Bank USB Unstable Bank

Fallen Tree

Riparian Vegetation

Trees

3

Shrub MW Mixedwood Forest CF Coniferous Forest DF Deciduous Forest Sedges SE GF Grass/Forbs MO Moss Shrubs

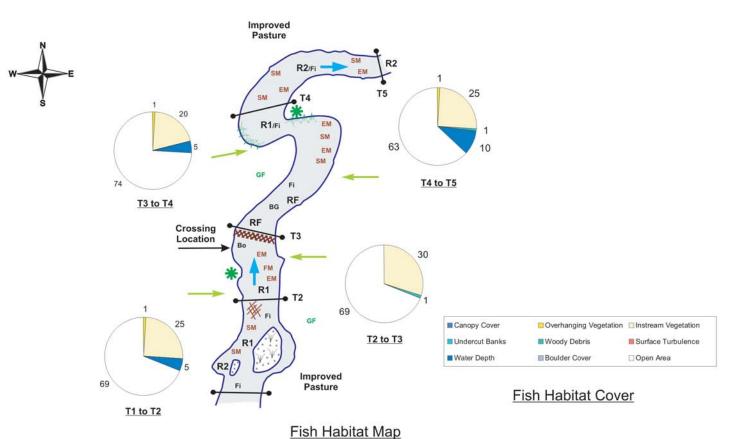
Banks / Approaches Shallow Slope Moderate Slope ← H Moderately Steep Slope Steep Slope



Vantage Pipeline Project

Bone Creek (Site 7) **Fish Habitat Data** (SW 14-10-21 W3M)

January 2011 REF.: 1282 (Fisheries)



(not to scale)

Water C	Quality at ng Site:	pH: *8	3.76	Temp (°	C): *18.5	EC (µS/cm)	: *1138	DO (n	ng/L): *6.3	Turb (NT	'U): *1.2	Gradient (%): <1			
250	Canasa 1	0.000	Test Attack	Distance	Bankfull	Bankfull Depth	Wetted	Wett	ed Depth at % W	fidth (m)	Velo	cities at % Width (m/s)	Groundwat	
Transect	UTM-E	UTM-N	Zone/ WPT	from Crossing	Width (m)	(m)	Width (m)	25%	50%	75%	25%	50%	75%	Seeps	
1	-	***			*19.0	*1.6	*5.9	*0.73	*1.50	-		*0.02			
2		***		***	*6.5	*1.0	*4.5	*0.92	*1.60	***		*0.06	***		
3 (Crossing)	672433	5512629	11	0 m	10.0	0.1	10.0	1.08		***	***			Unknown	
4			***		*7.1	*0.1	*7.6	*0.18	*0.21	*0.23	*0.62	*0.37	*0.49		
5	50+Hr 5			****	*8.0	*1:2	*6.2	*0.74	*1.30	*1.10	*0.02	*0.02	*0.02		
	LDB / RDB	LDB / RDB	LDB/RDB		Bank N	Material (%)			Sub	ostrate Compositi	on (%)		2.0	55 59	
Transect	Bank Slope (deg)	Bank Stability (L/M/H)	Bank Erosion (L/M/H)	Fines (< 2mm)	Gravel (2-64mm)	Cobbles (64-256mm)	Boulders (>256mm)	Fines (<2mm)	Sm Gravel (3-16mm)	Lg Gravel (17-64mm)	Cobble (65-256mm)	Boulder (>256mm)		ddedness w/Mod./High)	
1		*M/M		100	0	0	0	*100		*0	*0	*0			
2	1.00	*H/M		100	0	0	0	*100		*0	*0	*0			
3 (Crossing)	30 / 30	H/H	L/L	100	0	0	0	100	0	0	0	0		***	
4	-	*H / M		100	0	0	0	*10		*45	*40	*5			
5		*M / M		100	0	0	0	*100		*0	*0	*0			
Transect	Cover Habitat (%) Habitat Type Ratio								ype Ratio		Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)				
Transcot		Overhead	d Cover		Instream Cover				(Pool/Ri	ffle/Run)	Spawn	Rearing	Migration	Overwinter	
T1 to T2		*10)		*80					-		-			
T2 to T3		*10)			*80			0/0/100		10001000 100 N N N N N N N N N N N N N N	11.752.75	0.00049300	20.02	
T3 to T4		*0				*30			0/5/95		Mod / Good Mod / Good	Mod / Good	Mod / Mod	Poor / Poor	
T4 to T5		*10)			*80			1 2						
		Minnow Trapping	9		Electrofishing Pole Se				19		Cast Netting				
No. Fish Observed	No. Captured	Effort (hrs)	CPUE (# fish/hr)	No. Captured	Effort (s)	CPUE (# fish/100m)	No. Captured	Effort (s)	CPUE (# fish/10m²)	No. Captured	Effort (s)	CPUE (# fish/10m²)	Restricted	Activity Period	
			F	ishing effort co	nducted during	Keystone survey in	2008 resulted in	the capture of	no fish	dri di			October 1	st to May 31st	
Proposed Cr	ossing Period	Propose	ed Pipeline Cross	sing	Contingency Pipeline Crossing			Pro	Proposed Vehicle Crossing			Site Sensitivity		Watercourse Crossing Risi	
Sun	nmer	Horizo	ntal Directional Dr	ill		Isolated Open-cut			Temporary Single-Span Bridge			Moderate		Low	

Fish Habitat Data



Plate 1: View looking northwest towards Swift Current Creek and the associated coulee surrounding the proposed pipeline crossing (Site 11; August 22, 2010).



Plate 2: Looking northwest towards the beaver impounded area and boulder substrate immediately downstream of the proposed crossing location (October 20, 2010).



Plate 3: Area immediately upstream of the proposed crossing location at Site 11 from the crossing location (October 20, 2010).



Plate 4: View south looking at the reach upstream of the proposed crossing location (October 20, 2010).

LEGEND Diagram Not to Scale Environmental Services Ltd.

Transect Flow Direction >>>> Beaver Dam Beaver Lodge Vegetated Drain BM Bench Mark MT Minnow Trap Water Depth (m

:GEN	<u>D</u>	1.1.
-	Transect	Ha
-	Flow Direction	RF
XXXXX	Beaver Dam	R1
_		R2
	Beaver Lodge	R3
¥	Vegetated Drainage Draw	P1
(BM)	Bench Mark	P2
	Deficit Walk	P3
MT	Minnow Trap	FL
-	Water Depth (m)	FA
~	The state of the s	BV
\sim	Fish Observation	ID

labi	tat Type	Subs	strate
F	Riffle	Fi	Organic Fines
1	Class 1 Run (>1 m deep)	Sa	Sand
2	Class 2 Run (0.75-1 m deep)	Si	Silt
3	Class 3 Run (0.5-0.75 m deep)	Gr	Gravel
1	Class 1 Pool(>1.5 m deep)	Co	Cobble
2	Class 2 Pool (mod quality)	Bo	Boulder
3	Class 3 Pool (low quality)	Bd	Bedrock
L	Flat	Ba	Bare Ground
Α	Falls	GB	Gravel Bar
W	Backwater		
•	Impoundment		

Habitat Cover

Emergent Macrophytes SM Submergent Macrophytes FM Floating Macrophytes Debris Pile DP ₩ WD Woody Debris LWD Large Woody Debris RW Rootwad V OHV Overhanging Vegetation -- UCB Undercut Bank

USB Unstable Bank

Fallen Tree

Riparian Vegetation

Shrub MW Mixedwood Forest CF Coniferous Forest DF **Deciduous Forest** Sedges SE GF Grass/Forbs MO Moss Shrubs 3 Trees

Banks / Approaches Shallow Slope

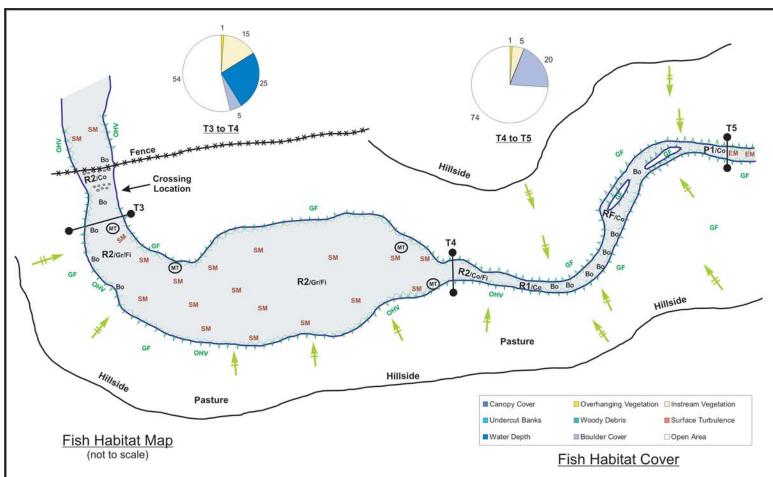
Moderate Slope Moderately Steep Slope Steep Slope Escarpment



Vantage Pipeline Project

Swift Current Creek (Site 11) **Fish Habitat Data** (NE 14-9-20 W3M)

January 2011 REF.: 1282 (Fisheries)



	Quality at ing Site:	pH; 8.	91	Temp (°	°C): 16.8	EC (µS/ci	m): 929	DO (mg/L): 2.3	Turb (N1	TU): 15.7		Gradient (%):	1
Transect	UTM-E	UTM-N	Zone/ WPT	Distance	Bankfull	Bankfull Depth	Wetted	Wet	ted Depth at % W	/idth (m)	Velocities at % Width		(m/s)	Groundwater
Transect	O I M-E	OTW-N	ZOTIE/ VVF I	Crossing	Width (m)	(m)	Width (m)	25%	50%	75%	25%	50%	75%	Seeps
1 2						Acc	ess Restricted at	the time of th	e field surveys					
3 (Crossing)	683029	5507387	WC12 T3	0 m	16.0	0.3	16.0	0.45	0.68	0.53				1
4	682874	5507596	WC12 T4	150 m	9.0	0.2	9.0	0.25	0.23	0.28				Unknown
5	682790	5507612	WC12 T5	300 m	3.0	0.2	2.7	0.15	0.15	0.10	< 0.03	0.27	0.17	
	LDB / RDB	LDB / RDB	LDB/RDB		Bank N	Material (%)			Sul	ostrate Composit	ion (%)			el Nacional de la composition della composition
Transect	Bank Slope (deg)	Bank Stability (L/M/H)	Bank Erosion (L/M/H)	Fines (< 2mm)	Gravel (2-64mm)	Cobbles (64-256mm)	Boulders (>256mm)	Fines (<2mm)	Sm Gravel (3-16mm)	Lg Gravel (17-64mm)	Cobble (65-256mm)	Boulder (>256mm)		ddedness w/Mod./High)
1 2		51 W	00 100			Acc	ess Restricted at	the time of the	e field surveys				57	
3 (Crossing)	90 / 90	H/H	L/L	65	0	30	5	35	10	40	10	5	[]	MOD
4	90 / 90	H/H	M/M	90	0	10	0	30	15	5	35	15	,	ONE
5	90 / 90	H/H	L/L	80	0	20	0	10	20	45	20	5	NONE	
Transect	17:			Cover Hal	bitat (%)		Habitat T	tat Type Ratio Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)						
Transcot	Canopy Cover	Overhanging Veg.	Instream Veg.	Undercut Banks	Woody Debris	Surface Turbulence	Water Depth	Boulder Cover	(Pool/Riffle/Run)		Spawn	Rearing	Migration	Overwintering
T1 to T2 T2 to T3						Acc	ess Restricted at	the time of th	e field surveys					
T3 to T4	0	1	15	0	0	0	25	5	0/0	/ 100	Poor / Poor	Mod / Mod	Mod / Mod	None / None
T4 to T5	0	1	5	0	0	0	0	20	0/7	0 / 30	Poor / Poor	Mod / Mod	Mod / Mod	None / None
No. Fish	/*	Minnow Trapping		Electrofishing				Pole Seining			Cast Netting			
Observed	No. Captured	Effort (hrs)	CPUE (# fish/hr)	No. Captured	Effort (s)	CPUE (# fish/100m)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	Restricted	Activity Period
90	7-BRST	10.3	0.68	13-BRST 46-FTMN 2-LNDC	374	0.36	15-BRST	300	0.27	2-FTMN	1200	0.22	October 1	st to May 31st
Proposed Cr	rossing Period	11000000000	d Pipeline Cross		Contin	gency Pipeline C	rossing	1,010,00	posed Vehicle C		Site Se	ensitivity	Watercours	e Crossing Risk
Sun	nmer	Horizo	ntal Directional Dr	il		Isolated Open-cut		Ten	nporary Single-Spa	n Bridge	Low to I	Moderate		Low
Sun Notes:	nmer	Horizo	ntal Directional Dr	II		Isolated Open-cut		Ten	nporary Single-Spa	n Bridge	Low to I	Moderate		Low

Proposed pipeline crossing method was determined in consultation with DFO and was based on the potential presence of fall spawning trout species, such as brook trout, and sedimentation concerns during construction (Schweitzer, pers. comm.).

Fish Habitat Data



Plate 1: Looking downstream from Transect 5 (T5), approximately 300 m downstream of the proposed crossing at the proposed pipeline crossing of Rock Creek (Site 12; August 23, 2010).



Plate 2: Looking upstream along the large pond area of Rock Creek from Transect 4 (T4) approximately 150 m downstream of the proposed crossing (August 23, 2010).



Plate 3: Typical boulder substrate observed between T4 and T5, and at the proposed crossing location at Site 12 (August 23, 2010).



Plate 4: View towards the proposed crossing location of Rock Creek at Site12 (August 23, 2010).

LEGEND By: By: Date: No. AS TLR October 28, 2010 0 Diagram Not to Scale ospine' Environmental Services Ltd.

Transect Flow Direction >>>> Beaver Dam Beaver Lodge Vegetated Drainage Draw BM Bench Mark MT Minnow Trap

Water Depth (m) >> Fish Observation

Habitat Type Class 1 Run (>1 m deep) Class 2 Run (0.75-1 m deep) R3 Class 3 Run (0.5-0.75 m deep) P1

Class 1 Pool(>1.5 m deep) Class 2 Pool (mod quality) P2 P3 Class 3 Pool (low quality) FL Flat FA Falls **BW** Backwater

Impoundment

Substrate

Fi Organic Fines Sand Si Silt Gr Gravel Co Cobble Bo Boulder Bd Bedrock Ba Bare Ground

GB Gravel Bar

Habitat Cover

Emergent Macrophytes SM Submergent Macrophytes FM Floating Macrophytes DP Debris Pile ₩ WD Woody Debris LWD Large Woody Debris RW Rootwad V OHV Overhanging Vegetation

-- UCB Undercut Bank USB Unstable Bank

Fallen Tree

Riparian Vegetation

Shrub MW Mixedwood Forest CF Coniferous Forest DF **Deciduous Forest** Sedges SE GF Grass/Forbs MO Moss Shrubs 3 Trees

Banks / Approaches

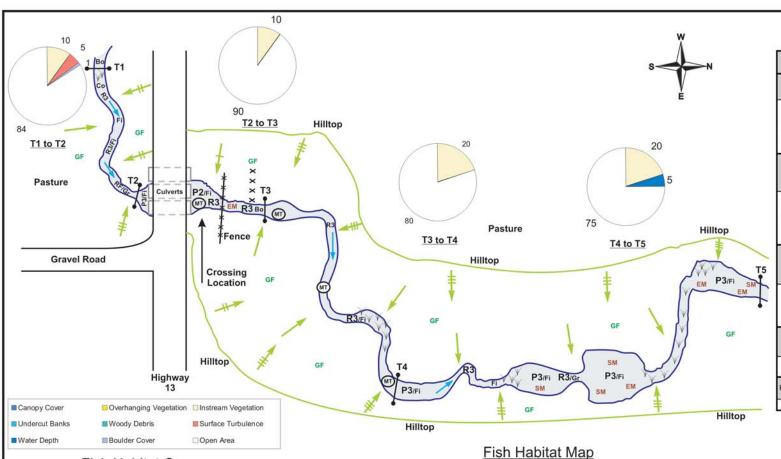
 Shallow Slope Moderate Slope Moderately Steep Slope Steep Slope Escarpment



Vantage Pipeline Project

Rock Creek (Site 12) **Fish Habitat Data** (NW 36-8-19 W3M)

January 2011 REF.: 1282 (Fisheries)



	Quality at ing Site:	pH: 8	42	Temp (°C): 4.5	EC (µS/cm	n): 3312	DO (r	mg/L): 6.3	Turb (N7	TU): 16.4		Gradient (%): <	1	
				Distance	Bankfull	Bankfull Depth	Wetted	Wett	ted Depth at % W	fidth (m)	Velocities at % Width		m/s)	Groundwate	
Transect	UTM-E	UTM-N	Zone/ WPT	from Crossing	Width (m)	(m)	Width (m)	25%	50%	75%	25%	50%	75%	Seeps	
1	697408	5511901	WC13 T1	100 m	1.9	0.3	1.9	0.20	0.21	0.24	***				
2	697452	5511929	WC13 T2	50 m	1.0	0.1	1.0	0.30	0.13	0.13					
3 (Crossing)	697480	5511977	WC13 T3	0 m	2.0	0.1	2.0	0.38	0.35	0.31	< 0.03	< 0.03	< 0.03	Unknown	
4	697600	5512013	WC13 T4	150 m	1.8	0.2	1.8	0.23	0.26	0.24	_		_		
5	697692	5512126	WC13 T5	300 m	4.6	0.3	4.6	0.28	0.32	0.32					
	LDB / RDB	LDB / RDB	LDB/RDB		Bank N	Material (%)			Sut	ostrate Composit	ion (%)				
Transect	Bank Slope (deg)	Bank Stability (L/M/H)	Bank Erosion (L/M/H)	Fines (< 2mm)	Gravel (2-64mm)	Cobbles (64-256mm)	Boulders (>256mm)	Fines (<2mm)	Sm Gravel (3-16mm)	Lg Gravel (17-64mm)	Cobble (65-256mm)	Boulder (>256mm)		ddedness v/Mod./High)	
1	90 / 45	H/L:	M/M	100	0	0	0	75	20	0	4	1.	L	ow	
2	10 / 10	H/H	L/L	100	0	0	0	75	25	0	0	0		OD	
3 (Crossing)	90 / 90	M/M	L/L	100	0	0	0	99	0	0	0	17	MOD		
4	30 / 90	H7M	L/L	100	0	0	0	100	0	0	0	0	***		
5	90 / 10	M/H	L/L	100	0	0	0	99	1	0	0	0	HIGH		
Transect									Habitat Potential - (None/Poor/M	Sport/Forage F oderate/Good)	ish				
Transcot	Canopy Cover	Overhanging Veg	Instream Veg.	Undercut Banks	Woody Debris	Surface Turbulence	Water Depth	Boulder Cover	(Pool/Ri	ffle/Run)	Spawn	Rearing	Migration	Overwinteri	
T1 to T2	0	0	10	0	0	5	0	1	0/0	/ 100	Poor / Poor	Poor / Poor	Poor / Mod	None / Non	
T2 to T3	0	0	10	0	0	0	0	0	75/	5/20	Poor / Poor	Poor / Poor	Poor / Mod	None / Non	
T3 to T4	0	0	20	0	0	0	0	0	10/0	0/90	Poor / Poor	Poor / Poor	Poor / Mod	None / Non	
T4 to T5	0	0	20	0	0	0	5	0	75/	0 / 25	Poor / Poor	Poor / Poor	Poor / Mod	None / Non	
No. Fish		Minnow Trapping			Electrofishi	9		Pole Seining			Cast Netting				
Observed	No. Captured	Effort (hrs)	CPUE (# fish/hr)	No. Captured	Effort (s)	CPUE (# fish/100m)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	Restricted	Activity Period	
116	37-BRST 71-FTMN	15.25	7.08	2-BRST	455	1.55	6-BRST	180	0.5	Unfeasible due	to vegetation & la	ck of deep pools	Un	known	
Proposed Cr	rossing Period	Period Proposed Pipeline Crossing			Contin	Contingency Pipeline Crossing			Proposed Vehicle Crossing			Site Sensitivity		Watercourse Crossing Ris	
Sun	nmer	Isc	lated Open-cut			Open-cut		Existin	ng Culvert Crossing	(Hwy 13)	Low to I	Moderate		.ow	



Plate 1: View upstream towards Highway 13 from the proposed pipeline crossing location at Grassy Creek (Site 13; October 21, 2010).



(not to scale)

Plate 2: View looking upstream from Transect 5 (T5) approximately 300 m downstream of the proposed pipeline crossing at Site 13 (October 21, 2010).



Plate 3: View southwest towards the proposed crossing location at Site 13 looking at the area surrounding Grassy Creek (October 21, 2010).



Plate 4: Culvert inlets crossing Highway 13 looking downstream from Transect 2 (T2), approximately 50 m upstream of the proposed pipeline crossing location (October 21, 2010).



Transect
Flow Direction
Beaver Dam
Beaver Lodge
Vegetated Drainage Draw
Bench Mark
Minnow Trap

▼ Water Depth (m)
➤ Fish Observation

Habitat Type

RF Riffle
R1 Class 1 Run (>1 m deep)
R2 Class 2 Run (0.75-1 m deep)
R3 Class 3 Run (0.5-0.75 m deep)

P1 Class 3 Run (0.5-0.75 m deep)
P2 Class 2 Pool (mod quality)
P3 Class 3 Pool (low quality)
FL Flat

FA Falls
BW Backwater
IP Impoundment

Substrate

Fi Organic Fines
Sa Sand
Si Silt
Gr Gravel
Co Cobble

Gr Gravel
Co Cobble
Bo Boulder
Bd Bedrock
Ba Bare Ground
GB Gravel Bar

Habitat Cover

EM Emergent Macrophytes

SM Submergent Macrophytes
FM Floating Macrophytes
DP Debris Pile
WD Woody Debris
LwD Large Woody Debris

RW Rootwad

V OHV Overhanging Vegetation

USB Undercut Bank
Unstable Bank

Fallen Tree

Riparian Vegetation

3

Trees

SH Shrub

MW Mixedwood Forest

CF Coniferous Forest

DF Deciduous Forest

SE Sedges

GF Grass/Forbs

MO Moss

Shrubs

Banks / Approaches

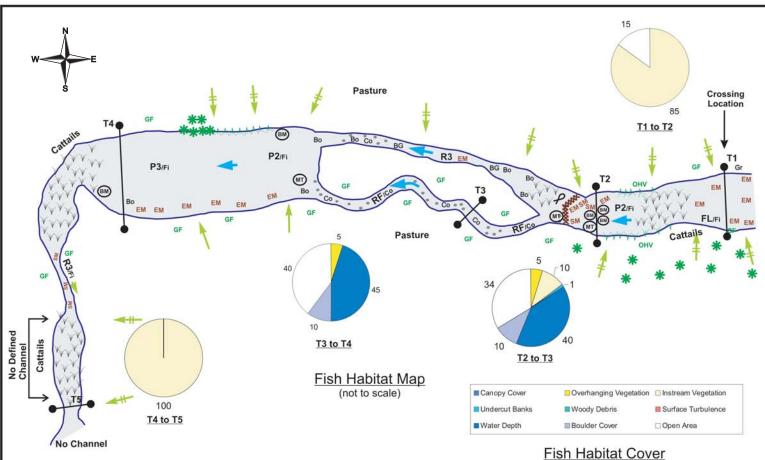
Shallow Slope
Moderate Slope
Moderately Steep Slope
Steep Slope
Escarpment



Vantage Pipeline Project

Grassy Creek (Site 13) Fish Habitat Data (SW 16-9-17 W3M)

January 2011 REF.: 1282 (Fisheries)



	Quality at ing Site:	pH: 8.	62	Temp (°C): 18.6	EC (µS/cn	n): 3352	DO (ng/L): 7.9	Turb (NT	U): 10.76		Gradient (%): <	1	
	1 1000000000000000000000000000000000000	Vennest wat		Distance	Bankfull	Bankfull Depth	Wetted	Wett	ed Depth at % W	fidth (m)	Veloc	cities at % Width	(m/s)	Groundwate	
Transect	UTM-E	UTM-N	Zone/ WPT	from Crossing	Width (m)	(m)	Width (m)	25%	50%	75%	25%	50%	75%	Seeps	
1 (Crossing)	700658	5512611	WC14 T1	100 m	18.0	0.0	1.5	0.23	0.10	***	***				
2	700586	5512599	WC14 T2	150 m	8.0	0.5	8.0	0.50	0.61	0.61	2000				
3	700546	5512598	WC14 T3	200 m	1.5	0.1	1.4	0.14	0.16	0.12	0.13	0.36	0.03	Unknown	
4	700524	5512535	WC14 T4	350 m	11.0	0.5	11.0	0.50	0.51	0.49			_	5-740-772340	
5	700537	5512471	WC14 T5	500 m	0.3	0.0	0.3		0.20			-			
	LDB / RDB	LDB / RDB	LDB/RDB		Bank N	Material (%)			Sut	ostrate Composit	on (%)				
Transect	Bank Slope (deg)	Bank Stability (L/M/H)	Bank Erosion (L/M/H)	Fines (< 2mm)	Gravel (2-64mm)	Cobbles (64-256mm)	Boulders (>256mm)	Fines (<2mm)	Sm Gravel (3-16mm)	Lg Gravel (17-64mm)	Cobble (65-256mm)	Boulder (>256mm)		ddedness w/Mod./High)	
1 (Crossing)	90 / 90	H/H	L/L	100	0	0	0	100	0	0	0	0			
2	90 / 90	M/M	L/L	85	10	4	1 :	90	0	0	10	0		MOD	
3	90 / 90	H/H	E7E:	90	0	5	5	5	25	35	25	10	NONE		
4	90 / 90	H/H	L/L	100	0	0	0	99	0	0	0	31	LOW		
5	90 / 90	H/H	L/L	100	0	0	0	100	0	0	0	0			
Transect		Cover Habitat (%)								ype Ratio		- Sport/Forage Fish Moderate/Good)			
Hallscot	Canopy Cover	Overhanging Veg.	Instream Veg.	Undercut Banks	Woody Debris	Surface Turbulence	Water Depth	Boulder Cover	(Pool/Riffle/Run)		Spawn	Rearing	Migration	Overwinter	
T1 to T2	0	0	85	0	0	0	0	0	50 / 0	0 / 50	None / Mod	Poor / Mod	None / Poor	None / No	
T2 to T3	0	5	10	1	0	0	40	10	90 /	10/0	None / Mod	Poor / Mod	Poor / Mod	None / No	
T3 to T4	0	5	0	0	0	0	45	10	90 /	10/0	None / Mod	Poor / Mod	Poor / Mod	None / No	
T4 to T5	0	0	100	0	0	0	0	0	0/0	/ 100	None / Mod	Mod / Mod	None / Poor	None / Nor	
No. Fish		Minnow Trapping			Electrofishing				Pole Seining						
Observed	No. Captured	Effort (hrs)	CPUE (# fish/hr)	No. Captured	Effort (s)	CPUE (# fish/100m)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	No. Captured	Effort (s)	CPUE (# fish/10m ²)	Restricted	Activity Perior	
983	875-FTMN	10	87.5	5-BRST	271	5.49	31-BRST 72-FTMN	300	19.07	0	900	0	April 1st	to May 31st	
Proposed Cr	rossing Period	riod Proposed Pipeline Crossing			Contingency Pipeline Crossing			Proposed Vehicle Crossing			Site Sensitivity		Watercourse Crossing Ri		
Sur	nmer	Isc	lated Open-cut		Open-cut			Swamp Matting			Moderate		Low		



Plate 1: View upstream from Transect 1 (T1), approximately 100 m upstream of the proposed pipeline crossing of Notukeu Creek in SW 14-9-17 W3M (Site 14) during August survey (August 26, 2010).



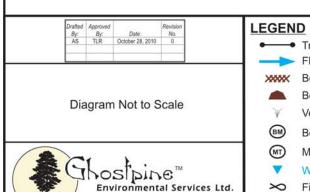
Plate 2: View upstream from T1 during the October survey, following beaver impoundment (October 21, 2010).



Plate 3: Beaver dam observed during the October survey upstream of the proposed pipeline crossing location (October 21, 2010).



Plate 4: View downstream from the proposed pipeline crossing location at Site 14 (August 26, 2010).



Transect Flow Direction >>>> Beaver Dam Beaver Lodge

Vegetated Drainage Draw BM Bench Mark

MT Minnow Trap Water Depth (m) >> Fish Observation

Habitat Type

Class 1 Run (>1 m deep) Class 2 Run (0.75-1 m deep) R3 Class 3 Run (0.5-0.75 m deep) Class 1 Pool(>1.5 m deep) P1

Class 2 Pool (mod quality) P2 P3 Class 3 Pool (low quality) FL Flat FA Falls

Bo Boulder Bd Bedrock Ba Bare Ground GB Gravel Bar **BW** Backwater Impoundment

Substrate

Si

Fi Organic Fines

Sand

Silt

Gr Gravel

Co Cobble

Habitat Cover **Emergent Macrophytes** SM Submergent Macrophytes FM Floating Macrophytes Debris Pile DP WD Woody Debris LWD Large Woody Debris Rootwad

V OHV Overhanging Vegetation -- UCB Undercut Bank USB Unstable Bank Fallen Tree

Riparian Vegetation

Shrub MW Mixedwood Forest CF Coniferous Forest DF **Deciduous Forest** Sedges SE GF Grass/Forbs MO Moss Shrubs 3 Trees

Banks / Approaches

 Shallow Slope Moderate Slope Moderately Steep Slope Steep Slope ******* Escarpment



Vantage Pipeline Project

Notukeu Creek (Site 14) **Fish Habitat Data** (SW 14-9-17 W3M)

January 2011 REF.: 1282 (Fisheries)