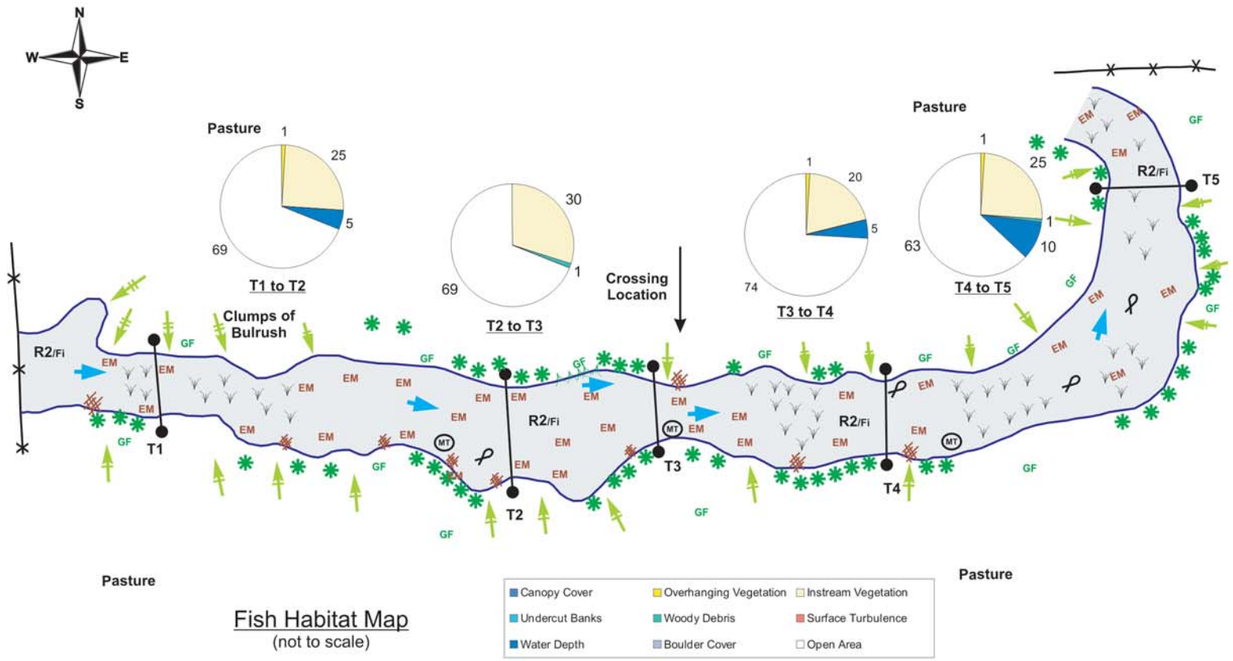
Attachment H-1

Fish Habitat Maps



Fish Habitat Map
(not to scale)

Fish Habitat Cover

Water Quality at Crossing Site:	pH: 7.69	Temp (°C): 19.8	EC (µS/cm): 1168	DO (mg/L): 2.7	Turb (NTU): 0.59	Gradient (%): <1

Transect	UTM-E	UTM-N	Zone/ WPT	Distance from Crossing	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth at % Width (m)			Velocities at % Width (m/s)			Groundwater Seeps
								25%	50%	75%	25%	50%	75%	
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	---	---	---	

Transect	LDB / RDB	LDB / RDB	LDB/RDB	Bank Material (%)				Substrate Composition (%)					Embeddedness (None/Low/Mod./High)
	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)	
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	L / 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)			
	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	0	1	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

No. Fish Observed	Minnow Trapping			Electrofishing			Pole Seining			Cast Netting			Restricted Activity Period
	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)	
1	1-PRDC	10.5	0.1	0	387	0	Unfeasible due to high instream vegetation density			Unfeasible due to high instream vegetation density			October 1st to May 31st

Proposed Crossing Period	Proposed Pipeline Crossing	Contingency Pipeline Crossing	Proposed Vehicle Crossing	Site Sensitivity	Watercourse Crossing Risk
Summer	Isolated Open-cut	Open-cut	Temporary Single-Span Bridge	Low to Moderate	Low

Fish Habitat Data

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).

Drafted By:	Approved By:	Date:	Revision No.
AS	TLR	October 28, 2010	0

Diagram Not to Scale

Ghostpine™ Environmental Services Ltd.

LEGEND

- Transect
- Flow Direction
- Beaver Dam
- Beaver Lodge
- Vegetated Drainage Draw
- (BM) Bench Mark
- (MT) 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 1 Pool(>1.5 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
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
OHV	Overhanging Vegetation
UCB	Undercut Bank
USB	Unstable Bank
	Fallen Tree

Riparian Vegetation

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

Banks / Approaches

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

VANTAGE PIPELINE

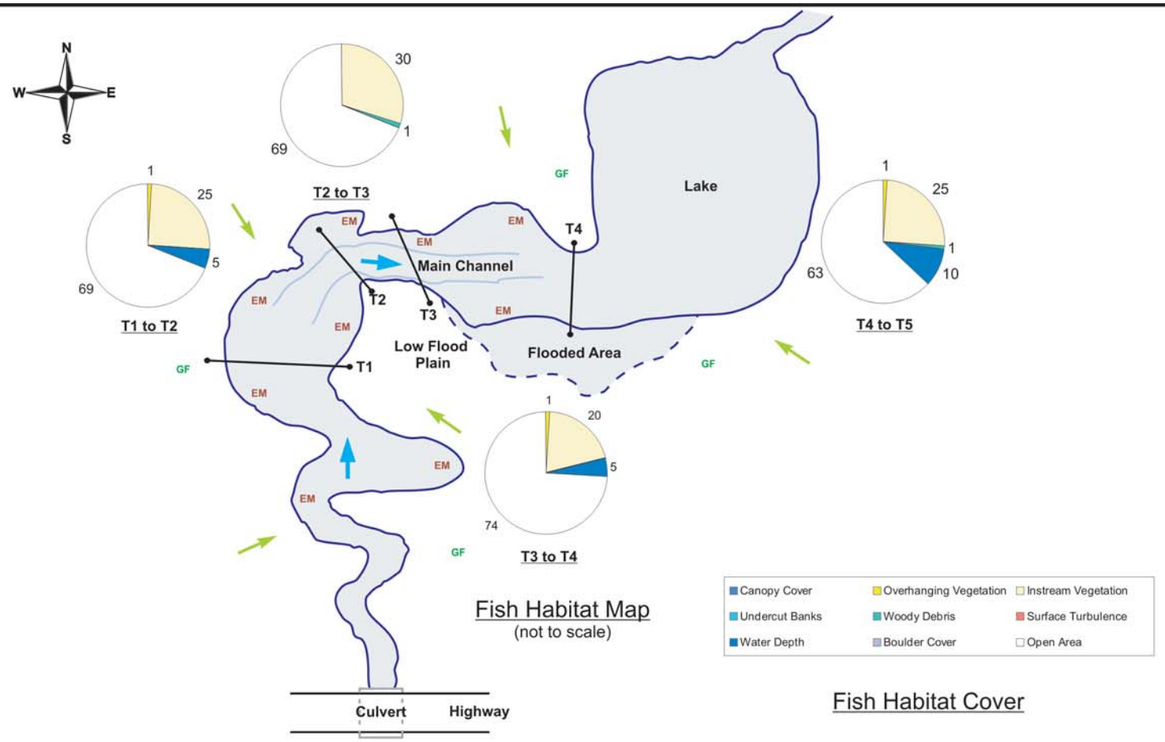
Vantage Pipeline Project

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

January 2011

REF: 1282 (Fisheries)

Attachment H1-1



Fish Habitat Map
(not to scale)

Fish Habitat Cover

Water Quality at Crossing Site:	pH: *8.67	Temp (°C): *21.4	EC (µS/cm): *777	DO (mg/L): *6.6	Turb (NTU): *0.75	Gradient (%): <1

Transect	UTM-E	UTM-N	Zone/ WPT	Distance from Crossing	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth at % Width (m)			Velocities at % Width (m/s)			Groundwater Seeps
								25%	50%	75%	25%	50%	75%	
1	---	---	---	---	*18.0	*0.3	*16.0	---	---	---	---	---	---	
2	---	---	---	---	*12.0	*3.0	*10.5	---	---	---	---	---	---	
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	---	---	---	---	*35.0	*0.0	*30.0	---	---	---	---	---	---	

Transect	LDB / RDB	LDB / RDB	LDB/RDB	Bank Material (%)				Substrate Composition (%)					Embeddedness (None/Low/Mod./High)
	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)	
1	---	*L / L	---	100	0	0	0	---	---	---	---	---	
2	---	*L / M	---	100	0	0	0	*85	---	*0	*15	*0	
3	---	*L / L	---	100	0	0	0	*70	---	*10	*20	*0	---
4	---	*L / L	---	100	0	0	0	---	---	---	---	---	
5	---	*L / L	---	100	0	0	0	---	---	---	---	---	

Transect	Cover Habitat (%)		Habitat Type Ratio	Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)			
	Overhead Cover	Instream Cover	(Pool/Riffle/Run)	Spawn	Rearing	Migration	Overwintering
T1 to T2	*0	*20	---				
T2 to T3	*0	*35	---				
T3 to T4	*0	*40	---	*None / Mod	*None / Good	*Mod / Mod	*Poor / Mod
T4 to T5	*0	*35	---				

No. Fish Observed	Minnow Trapping			Electrofishing			Pole Seining			Cast Netting			Restricted Activity Period
	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)	
Fishing effort conducted during Keystone survey in 2008 resulted in BRMN through minnow trapping and electrofishing													October 1st to May 31st

Proposed Crossing Period	Proposed Pipeline Crossing	Contingency Pipeline Crossing	Proposed Vehicle Crossing	Site Sensitivity	Watercourse Crossing Risk
Summer	Horizontal Directional Drill	Isolated Open-cut	Temporary Single-Span Bridge	* Unkown	* Unkown

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

Notes:
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 1: Site overview of Piapot Creek immediately downstream of the proposed Vantage pipeline crossing of Piapot Creek (Site 3). Picture by Jacques Whitford AXYS during fisheries assessment for the Keystone pipeline project (June 17, 2008).

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).

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).

Drafted By:	Approved By:	Date:	Revision No.
AS	TLR	November 3, 2010	0

Diagram Not to Scale

Ghostpine™ Environmental Services Ltd.

LEGEND

- Transect
- Flow Direction
- Beaver Dam
- Beaver Lodge
- Vegetated Drainage Draw
- (BM) Bench Mark
- (MT) 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 1 Pool(>1.5 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
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
OHV	Overhanging Vegetation
UCB	Undercut Bank
USB	Unstable Bank
	Fallen Tree

Riparian Vegetation

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

Banks / Approaches

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

VANTAGE PIPELINE

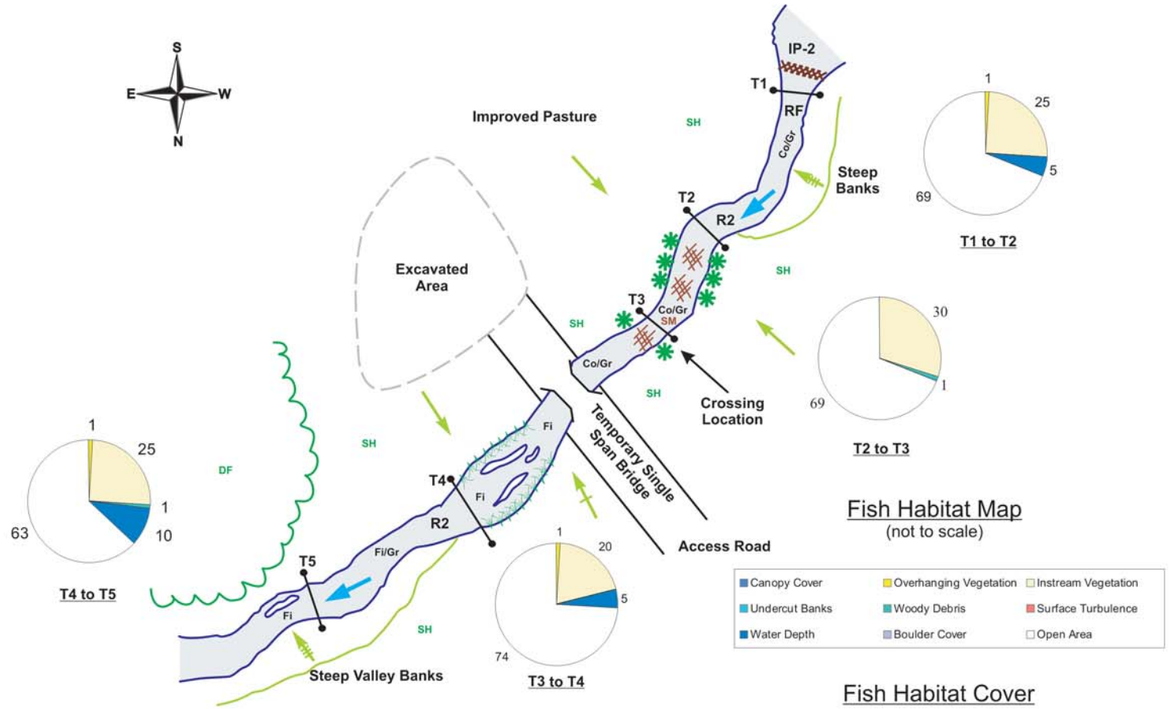
Vantage Pipeline Project

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

January 2011

REF: 1282 (Fisheries)

Attachment H1-2



Fish Habitat Map
(not to scale)

Canopy Cover | Overhanging Vegetation | Instream Vegetation
Undercut Banks | Woody Debris | Surface Turbulence
Water Depth | Boulder Cover | Open Area

Fish Habitat Cover

Water Quality at Crossing Site:	pH: *9.1	Temp (°C): *14.6	EC (µS/cm): *532	DO (mg/L): *8.7	Turb (NTU): *6.3	Gradient (%): <1

Transect	UTM-E	UTM-N	Zone/ WPT	Distance from Crossing	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth at % Width (m)			Velocities at % Width (m/s)			Groundwater Seeps
								25%	50%	75%	25%	50%	75%	
1	---	---	---	---	*2.8	*1.5	*2.8	*0.25	*0.24	*0.18	*0.31	*0.95	*0.05	Unknown
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	---	---	---	
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	

Transect	LDB / RDB	LDB / RDB	LDB/RDB	Bank Material (%)				Substrate Composition (%)					Embeddedness (None/Low/Mod./High)
	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)	
1	---	*L / L	---	100	0	0	0	*20	---	*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	---	*L / L	---	100	0	0	0	*20	---	*50	*30	*0	
5	---	*L / L	---	100	0	0	0	*50	---	*30	*18	*2	

Transect	Cover Habitat (%)		Habitat Type Ratio	Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)			
	Overhead Cover	Instream Cover	(Pool/Riffle/Run)	Spawn	Rearing	Migration	Overwintering
T1 to T2	*28	*25	---	Poor / Mod	Good / Good	Poor / Mod	None / Poor
T2 to T3	*65	*45	10 / 10 / 80				
T3 to T4	*5	*5	0 / 10 / 90				
T4 to T5	*70	*20	---				

No. Fish Observed	Minnow Trapping			Electrofishing			Pole Seining			Cast Netting			Restricted Activity Period
	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)	
Fishing effort conducted during Keystone survey in 2008 resulted in WHSC and BRST through minnow trapping and electrofishing													April 1st to May 31st

Proposed Crossing Period	Proposed Pipeline Crossing	Contingency Pipeline Crossing	Proposed Vehicle Crossing	Site Sensitivity	Watercourse Crossing Risk
Summer	Isolated 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).

Drafted By:	Approved By:	Date:	Revision No.
AS	TLR	November 3, 2010	0

Diagram Not to Scale

Ghostpine™ Environmental Services Ltd.

LEGEND

- Transect
- Flow Direction
- Beaver Dam
- Beaver Lodge
- Vegetated Drainage Draw
- (BM) Bench Mark
- (MT) 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 1 Pool(>1.5 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
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
OHV	Overhanging Vegetation
UCB	Undercut Bank
USB	Unstable Bank
	Fallen Tree

Riparian Vegetation

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

Banks / Approaches

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

VANTAGE PIPELINE

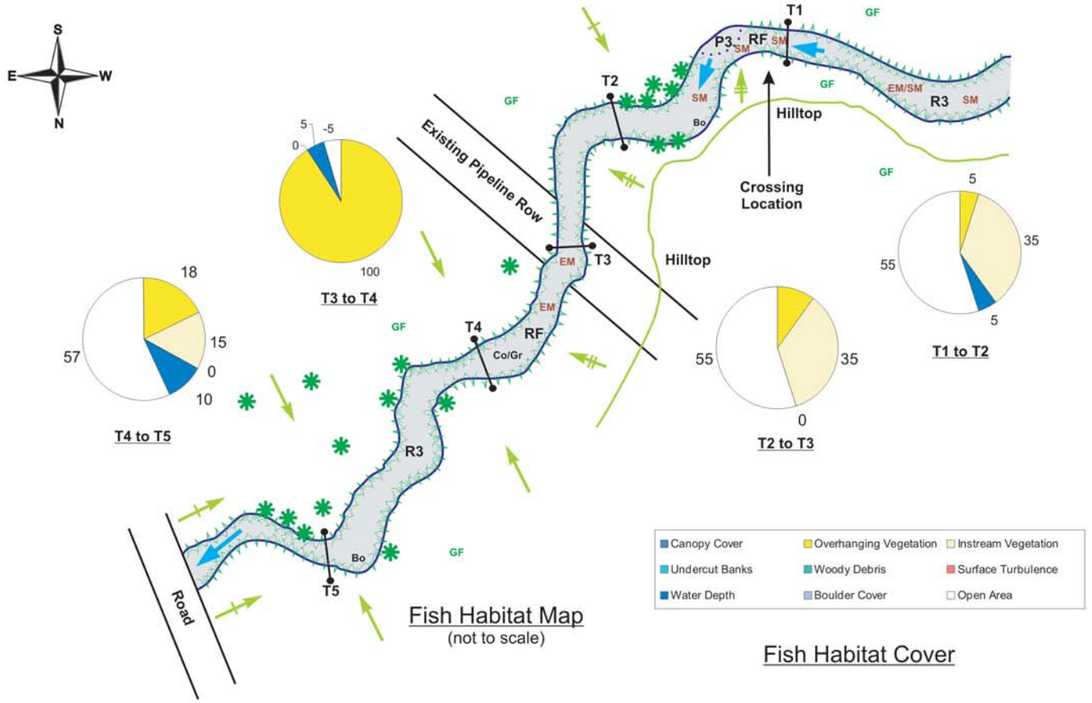
Vantage Pipeline Project

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

January 2011

REF: 1282 (Fisheries)

Attachment H1-3



Fish Habitat Map
(not to scale)

Fish Habitat Cover

Water Quality at Crossing Site:	pH: *8.91	Temp (°C): *19.2	EC (µS/cm): *1460	DO (mg/L): *8.8	Turb (NTU): *0.05	Gradient (%): <1

Transect	UTM-E	UTM-N	Zone/ WPT	Distance from Crossing	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth at % Width (m)			Velocities at % Width (m/s)			Groundwater Seeps
								25%	50%	75%	25%	50%	75%	
1 (Crossing)	651768	5529649	5	0	3.0	0.5	3.0	0.25	0.33	0.41	---	---	---	Unknown
2	---	---	---	---	*0.6	*0.7	*0.6	---	*0.15	---	---	*0.72	---	
3	---	---	---	---	*1.0	*0.5	*1.0	---	*0.26	---	---	*0.26	---	
4	---	---	---	---	*6.5	*2.5	*6.5	---	*0.44	---	---	*0.04	---	
5	---	---	---	---	*1.3	*0.7	*1.3	---	*0.50	---	---	*0.11	---	

Transect	LDB / RDB	LDB / RDB	LDB/RDB	Bank Material (%)				Substrate Composition (%)					Embeddedness (None/Low/Mod./High)
	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)	
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	---	100	0	0	0	*100	---	*0	*0	*0	High
5	---	*L / L	---	100	0	0	0	*50	---	*50	*0	*0	High

Transect	Cover Habitat (%)		Habitat Type Ratio	Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)			
	Overhead Cover	Instream Cover	(Pool/Riffle/Run)	Spawn	Rearing	Migration	Overwintering
T1 to T2	*5	*35	5 / 75 / 20	Poor / Mod	Poor / Mod	Poor / Mod	None / None
T2 to T3	*10	*35	0 / 5 / 95				
T3 to T4	*100	*0	---				
T4 to T5	*18	*15	---				

No. Fish Observed	Minnow Trapping			Electrofishing			Pole Seining			Cast Netting			Restricted Activity Period
	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)	
Fishing effort conducted during Keystone survey in 2008 resulted in the capture of FTMN and observation of BRST													Unknown

Proposed Crossing Period	Proposed Pipeline Crossing	Contingency Pipeline Crossing	Proposed Vehicle Crossing	Site Sensitivity	Watercourse Crossing Risk
Summer	Isolated Open-cut	Open-cut	Ramp and Culvert	Low	Low

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

Fish Habitat Data

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).

Drafted By:	Approved By:	Date:	Revision No.
AS	TLR	November 3, 2010	0

Diagram Not to Scale

Ghostpine™ Environmental Services Ltd.

LEGEND

- Transect
- Flow Direction
- Beaver Dam
- Beaver Lodge
- Vegetated Drainage Draw
- (BM) Bench Mark
- (MT) 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 1 Pool(>1.5 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
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
OHV	Overhanging Vegetation
UCB	Undercut Bank
USB	Unstable Bank
	Fallen Tree

Riparian Vegetation

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

Banks / Approaches

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

VANTAGE PIPELINE

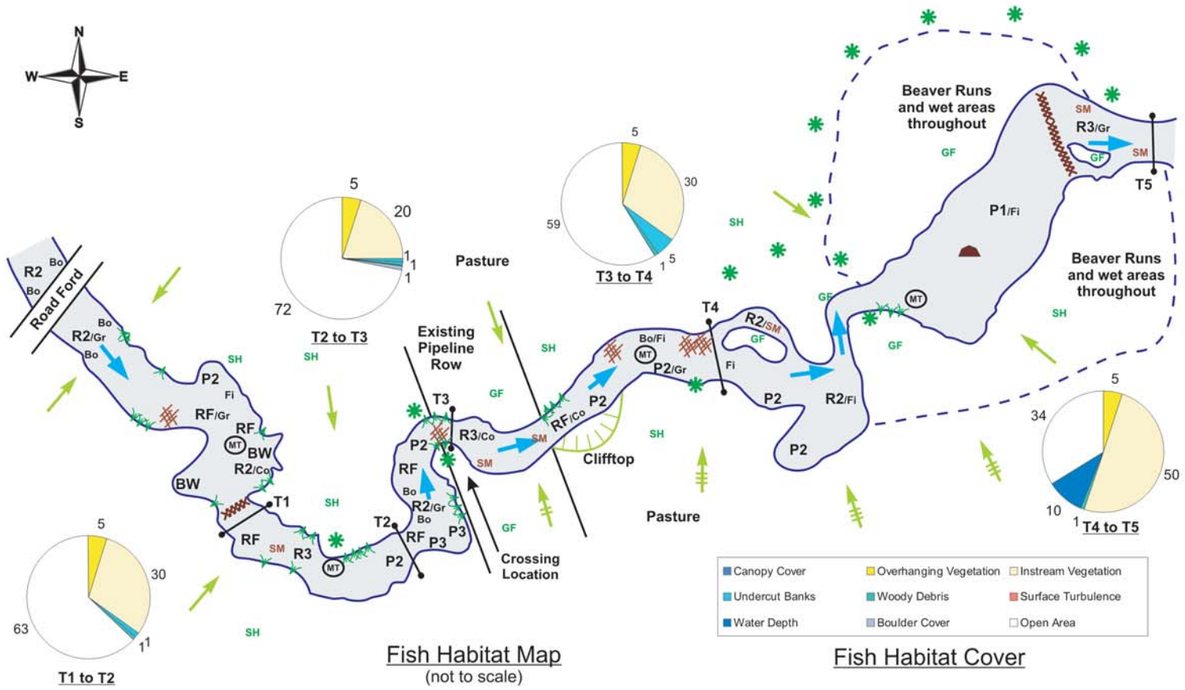
Vantage Pipeline Project

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

January 2011

REF: 1282 (Fisheries)

Attachment H1-4



Fish Habitat Map
(not to scale)

Fish Habitat Cover

Water Quality at Crossing Site:	pH: 8.62	Temp (°C): 4.0	EC (µS/cm): 460	DO (mg/L): 14.6	Turb (NTU): 3.05	Gradient (%): <1

Transect	UTM-E	UTM-N	Zone/ WPT	Distance from Crossing	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth at % Width (m)			Velocities at % Width (m/s)			Groundwater Seeps
								25%	50%	75%	25%	50%	75%	
1	661177	5520564	WC7 T1	100 m	5.0	0.5	5.0	0.22	0.32	0.30	---	---	---	Unknown
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	
4	661407	5520683	WC7 T4	150 m	2.2	0.7	2.2	0.53	0.65	0.55	---	---	---	
5	661445	5520795	WC7 T5	300 m	4.5	0.6	4.5	0.42	0.60	0.36	---	---	---	

Transect	LDB / RDB	LDB / RDB	LDB/RDB	Bank Material (%)				Substrate Composition (%)					Embeddedness (None/Low/Mod./High)
	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)	
1	90 / 90	H / H	M / M	100	0	0	0	20	0	40	40	0	LOW
2	90 / 90	H / H	M / M	100	0	0	0	20	0	60	20	0	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 (%)								Habitat Type Ratio	Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)			
	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	0	5	30	1	1	0	0	0	5 / 40 / 55	Mod / Good	Mod / Mod	Good / Good	Poor / Poor
T2 to T3	0	5	20	1	1	0	0	1	10 / 50 / 40	Mod / Good	Mod / Mod	Good / Good	Poor / Poor
T3 to T4	0	5	30	5	1	0	0	0	0 / 5 / 95	Mod / Good	Good / Good	Good / Good	Poor / Poor
T4 to T5	0	5	50	0	1	0	10	0	60 / 5 / 35	Mod / Good	Good / Good	Mod / Mod	Mod / Mod

No. Fish Observed	Minnow Trapping			Electrofishing			Pole Seining			Cast Netting			Restricted Activity Period
	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)	
86	3-BRST	23	0.13	13-BRST 8-FTMN 1-PRDC 2-BRMN 23-LNDC 13-WHSC	604	52.87	Unfeasible due to vegetation density			Unfeasible due to lack of large pools			October 1st to May 31st

Proposed Crossing Period	Proposed Pipeline Crossing	Contingency Pipeline Crossing	Proposed Vehicle Crossing	Site Sensitivity	Watercourse Crossing Risk
Summer	Horizontal Directional Drill	Isolated Open-cut	Temporary Single-Span Bridge	Moderate to High	Moderate

Fish Habitat Data

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).

Drafted By:	Approved By:	Date:	Revision No.
AS	TLR	October 28, 2010	0

Diagram Not to Scale

Ghostpine™ Environmental Services Ltd.

LEGEND

- Transect
- Flow Direction
- Beaver Dam
- Beaver Lodge
- Vegetated Drainage Draw
- BM Bench Mark
- MT 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 1 Pool(>1.5 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
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
OHV	Overhanging Vegetation
UCB	Undercut Bank
USB	Unstable Bank
	Fallen Tree

Riparian Vegetation

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

Banks / Approaches

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

VANTAGE PIPELINE

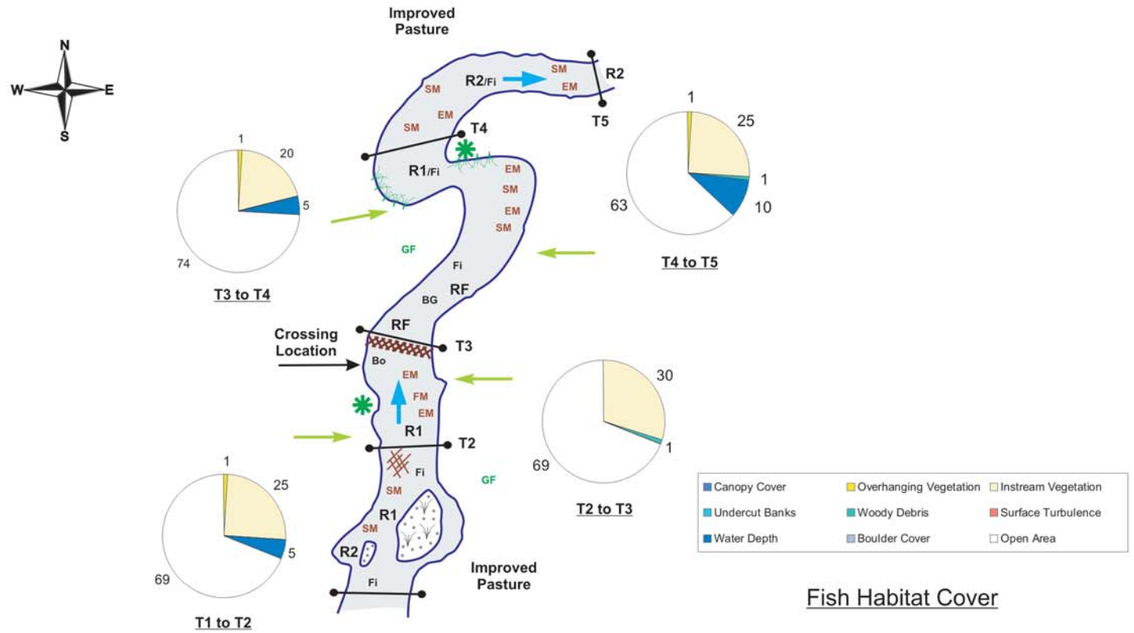
Vantage Pipeline Project

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

January 2011

REF: 1282 (Fisheries)

Attachment H1-5



Fish Habitat Map
(not to scale)

Fish Habitat Cover

Water Quality at Crossing Site:	pH: *8.76	Temp (°C): *18.5	EC (µS/cm): *1138	DO (mg/L): *6.3	Turb (NTU): *1.2	Gradient (%): <1

Transect	UTM-E	UTM-N	Zone/ WPT	Distance from Crossing	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth at % Width (m)			Velocities at % Width (m/s)			Groundwater Seeps
								25%	50%	75%	25%	50%	75%	
1	---	---	---	---	*19.0	*1.6	*5.9	*0.73	*1.50	---	---	*0.02	---	Unknown
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	---	---	---	---	---	
4	---	---	---	---	*7.1	*0.1	*7.6	*0.18	*0.21	*0.23	*0.62	*0.37	*0.49	
5	---	---	---	---	*8.0	*1.2	*6.2	*0.74	*1.30	*1.10	*0.02	*0.02	*0.02	

Transect	LDB / RDB	LDB / RDB	LDB/RDB	Bank Material (%)				Substrate Composition (%)					Embeddedness (None/Low/Mod./High)
	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)	
1	---	*M / M	---	100	0	0	0	*100	---	*0	*0	*0	---
2	---	*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	Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)			
	Overhead Cover	Instream Cover	(Pool/Riffle/Run)	Spawn	Rearing	Migration	Overwintering
T1 to T2	*10	*80	---	Mod / Good	Mod / Good	Mod / Mod	Poor / Poor
T2 to T3	*10	*80	0 / 0 / 100				
T3 to T4	*0	*30	0 / 5 / 95				
T4 to T5	*10	*80	---				

No. Fish Observed	Minnow Trapping			Electrofishing			Pole Seining			Cast Netting			Restricted Activity Period
	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)	
Fishing effort conducted during Keystone survey in 2008 resulted in the capture of no fish													October 1st to May 31st

Proposed Crossing Period	Proposed Pipeline Crossing	Contingency Pipeline Crossing	Proposed Vehicle Crossing	Site Sensitivity	Watercourse Crossing Risk
Summer	Horizontal Directional Drill	Isolated Open-cut	Temporary Single-Span Bridge	Moderate	Low

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

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).

Drafted By:	Approved By:	Date:	Revision No.
AS	TLR	November 3, 2010	0

Diagram Not to Scale

Ghostpine™ Environmental Services Ltd.

LEGEND

- Transect
- Flow Direction
- Beaver Dam
- Beaver Lodge
- Vegetated Drainage Draw
- (BM) Bench Mark
- (MT) 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 1 Pool(>1.5 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
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
OHV	Overhanging Vegetation
UCB	Undercut Bank
USB	Unstable Bank
	Fallen Tree

Riparian Vegetation

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

Banks / Approaches

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

VANTAGE PIPELINE

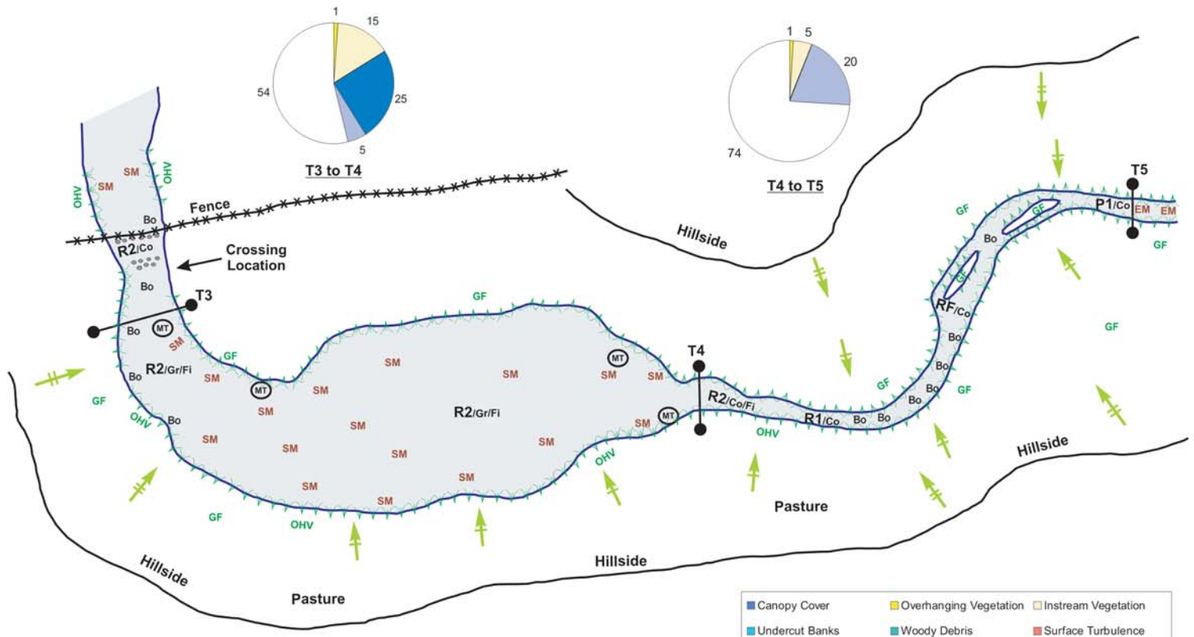
Vantage Pipeline Project

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

January 2011

REF: 1282 (Fisheries)

Attachment H1-6



Fish Habitat Map
(not to scale)

Fish Habitat Cover

Water Quality at Crossing Site:	pH: 8.91	Temp (°C): 16.8	EC (µS/cm): 929	DO (mg/L): 2.3	Turb (NTU): 15.7	Gradient (%): <1

Transect	UTM-E	UTM-N	Zone/ WPT	Distance from Crossing	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth at % Width (m)			Velocities at % Width (m/s)			Groundwater Seeps
								25%	50%	75%	25%	50%	75%	
1	Access Restricted at the time of the field surveys													
2														
3 (Crossing)	683029	5507387	WC12 T3	0 m	16.0	0.3	16.0	0.45	0.68	0.53	---	---	---	Unknown
4	682874	5507596	WC12 T4	150 m	9.0	0.2	9.0	0.25	0.23	0.28	---	---	---	
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	

Transect	LDB / RDB	LDB / RDB	LDB/RDB	Bank Material (%)				Substrate Composition (%)					Embeddedness (None/Low/Mod./High)
	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)	
1	Access Restricted at the time of the field surveys												
2													
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	NONE
5	90 / 90	H / H	L / L	80	0	20	0	10	20	45	20	5	NONE

Transect	Cover Habitat (%)								Habitat Type Ratio	Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)			
	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	Access Restricted at the time of the field surveys												
T2 to T3													
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 / 70 / 30	Poor / Poor	Mod / Mod	Mod / Mod	None / None

No. Fish Observed	Minnow Trapping			Electrofishing			Pole Seining			Cast Netting			Restricted Activity Period
	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)	
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 1st to May 31st

Proposed Crossing Period	Proposed Pipeline Crossing	Contingency Pipeline Crossing	Proposed Vehicle Crossing	Site Sensitivity	Watercourse Crossing Risk
Summer	Horizontal Directional Drill	Isolated Open-cut	Temporary Single-Span Bridge	Low to Moderate	Low

Notes:
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).

Drafted By:	Approved By:	Date:	Revision No.
AS	TLR	October 28, 2010	0

Diagram Not to Scale

Ghostpine™ Environmental Services Ltd.

LEGEND

- Transect
- Flow Direction
- Beaver Dam
- Beaver Lodge
- Vegetated Drainage Draw
- (BM) Bench Mark
- (MT) 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 1 Pool(>1.5 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
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
OHV	Overhanging Vegetation
UCB	Undercut Bank
USB	Unstable Bank
	Fallen Tree

Riparian Vegetation

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

Banks / Approaches

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

VANTAGE PIPELINE

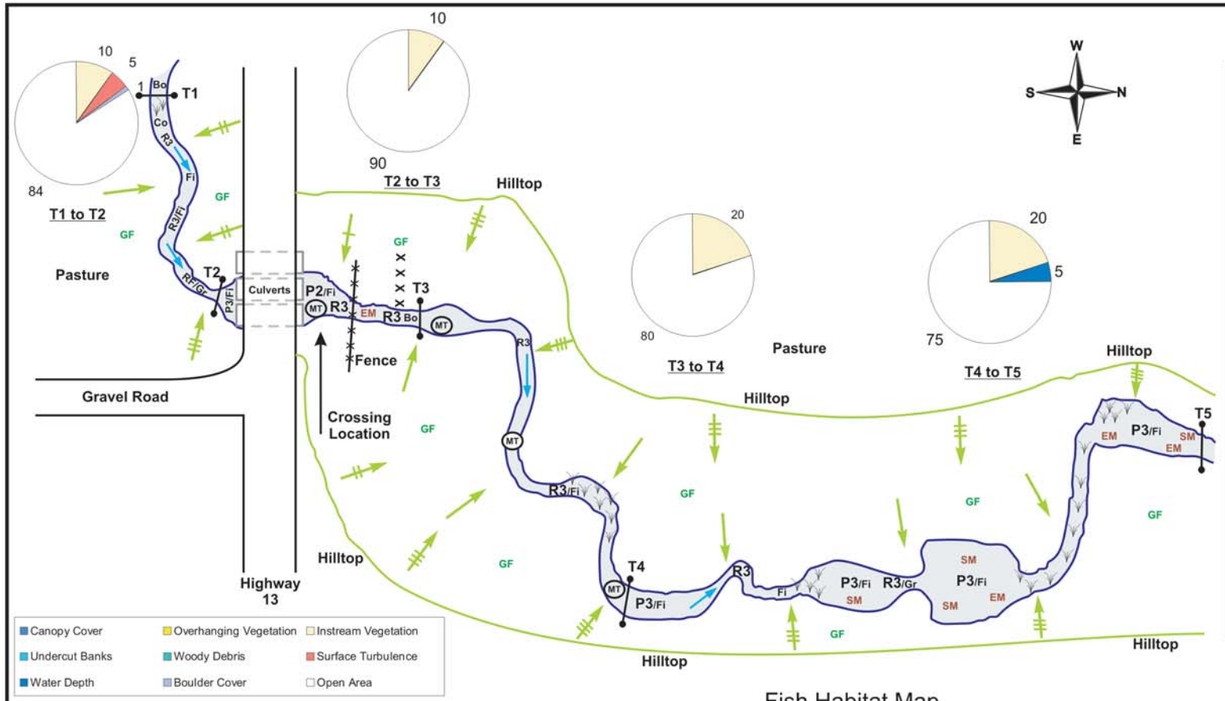
Vantage Pipeline Project

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

January 2011

REF: 1282 (Fisheries)

Attachment H1-7



Fish Habitat Cover

Fish Habitat Map
(not to scale)

Water Quality at Crossing Site:	pH: 8.42	Temp (°C): 4.5	EC (µS/cm): 3312	DO (mg/L): 6.3	Turb (NTU): 16.4	Gradient (%): <1

Transect	UTM-E	UTM-N	Zone/ WPT	Distance from Crossing	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth at % Width (m)			Velocities at % Width (m/s)			Groundwater Seeps
								25%	50%	75%	25%	50%	75%	
1	697408	5511901	WC13 T1	100 m	1.9	0.3	1.9	0.20	0.21	0.24	---	---	---	Unknown
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	
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	---	---	---	

Transect	LDB / RDB	LDB / RDB	LDB/RDB	Bank Material (%)				Substrate Composition (%)					Embeddedness (None/Low/Mod./High)
	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)	
1	90 / 45	H / L	M / M	100	0	0	0	75	20	0	4	1	LOW
2	10 / 10	H / H	L / L	100	0	0	0	75	25	0	0	0	MOD
3 (Crossing)	90 / 90	M / M	L / L	100	0	0	0	99	0	0	0	1	MOD
4	30 / 90	H / M	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	Cover Habitat (%)							Habitat Type Ratio	Habitat Potential - Sport/Forage Fish (None/Poor/Moderate/Good)			
	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	0	0	10	0	0	5	0	1	0 / 0 / 100	Poor / Poor	Poor / Poor	Poor / Mod	None / None
T2 to T3	0	0	10	0	0	0	0	0	75 / 5 / 20	Poor / Poor	Poor / Poor	Poor / Mod	None / None
T3 to T4	0	0	20	0	0	0	0	0	10 / 0 / 90	Poor / Poor	Poor / Poor	Poor / Mod	None / None
T4 to T5	0	0	20	0	0	0	5	0	75 / 0 / 25	Poor / Poor	Poor / Poor	Poor / Mod	None / None

No. Fish Observed	Minnow Trapping			Electrofishing			Pole Seining			Cast Netting			Restricted Activity Period
	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)	
116	37-BRST 71-FTMN	15.25	7.08	2-BRST	455	1.55	6-BRST	180	0.5	Unfeasible due to vegetation & lack of deep pools			Unknown

Proposed Crossing Period	Proposed Pipeline Crossing	Contingency Pipeline Crossing	Proposed Vehicle Crossing	Site Sensitivity	Watercourse Crossing Risk
Summer	Isolated Open-cut	Open-cut	Existing Culvert Crossing (Hwy 13)	Low to Moderate	Low

Fish Habitat Data

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

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).

Drafted By:	Approved By:	Date:	Revision No.
AS	TLR	October 28, 2010	0

Diagram Not to Scale

Ghostpine™ Environmental Services Ltd.

LEGEND

- Transect
- Flow Direction
- Beaver Dam
- Beaver Lodge
- Vegetated Drainage Draw
- BM Bench Mark
- MT 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 1 Pool(>1.5 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
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
OHV	Overhanging Vegetation
UCB	Undercut Bank
USB	Unstable Bank
	Fallen Tree

Riparian Vegetation

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

Banks / Approaches

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

VANTAGE PIPELINE

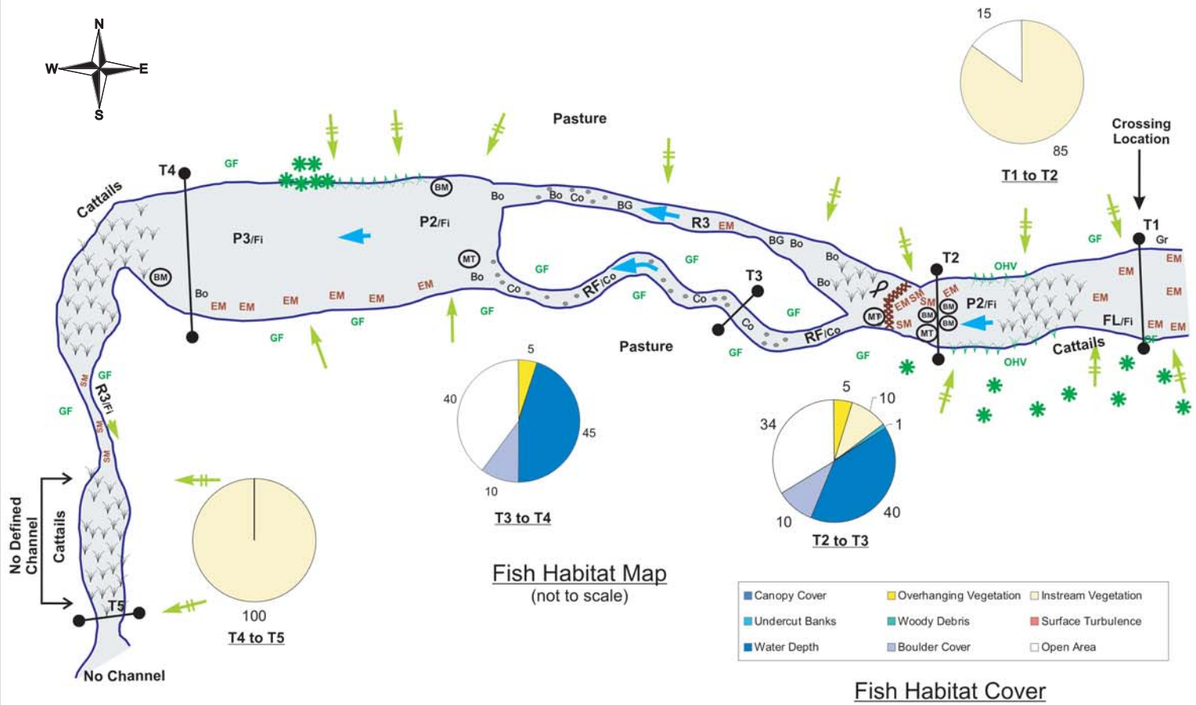
Vantage Pipeline Project

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

January 2011

REF: 1282 (Fisheries)

Attachment H1-8



Fish Habitat Map
(not to scale)

Fish Habitat Cover

Water Quality at Crossing Site:	pH: 8.62	Temp (°C): 18.6	EC (µS/cm): 3352	DO (mg/L): 7.9	Turb (NTU): 10.76	Gradient (%): <1

Transect	UTM-E	UTM-N	Zone/ WPT	Distance from Crossing	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth at % Width (m)			Velocities at % Width (m/s)			Groundwater Seeps
								25%	50%	75%	25%	50%	75%	
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	---	---	---	
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	700537	5512471	WC14 T5	500 m	0.3	0.0	0.3	---	0.20	---	---	---	---	

Transect	LDB / RDB	LDB / RDB	LDB/RDB	Bank Material (%)				Substrate Composition (%)					Embeddedness (None/Low/Mod./High)
	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)	
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	L / L	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	1	LOW
5	90 / 90	H / H	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)			
	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	0	0	85	0	0	0	0	0	50 / 0 / 50	None / Mod	Poor / Mod	None / Poor	None / None
T2 to T3	0	5	10	1	0	0	40	10	90 / 10 / 0	None / Mod	Poor / Mod	Poor / Mod	None / None
T3 to T4	0	5	0	0	0	0	45	10	90 / 10 / 0	None / Mod	Poor / Mod	Poor / Mod	None / None
T4 to T5	0	0	100	0	0	0	0	0	0 / 0 / 100	None / Mod	Mod / Mod	None / Poor	None / None

No. Fish Observed	Minnow Trapping			Electrofishing			Pole Seining			Cast Netting			Restricted Activity Period
	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)	
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 Crossing Period	Proposed Pipeline Crossing	Contingency Pipeline Crossing	Proposed Vehicle Crossing	Site Sensitivity	Watercourse Crossing Risk
Summer	Isolated Open-cut	Open-cut	Swamp Matting	Moderate	Low

Fish Habitat Data

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).

Drafted By:	Approved By:	Date:	Revision No.
AS	TLR	October 28, 2010	0

Diagram Not to Scale

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LEGEND

- Transect
- Flow Direction
- Beaver Dam
- Beaver Lodge
- Vegetated Drainage Draw
- BM Bench Mark
- MT 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 1 Pool(>1.5 m deep)
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- Moderate Slope
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- Steep Slope
- Escarpment

VANTAGE PIPELINE

Vantage Pipeline Project

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

January 2011

REF: 1282 (Fisheries)

Attachment H1-9