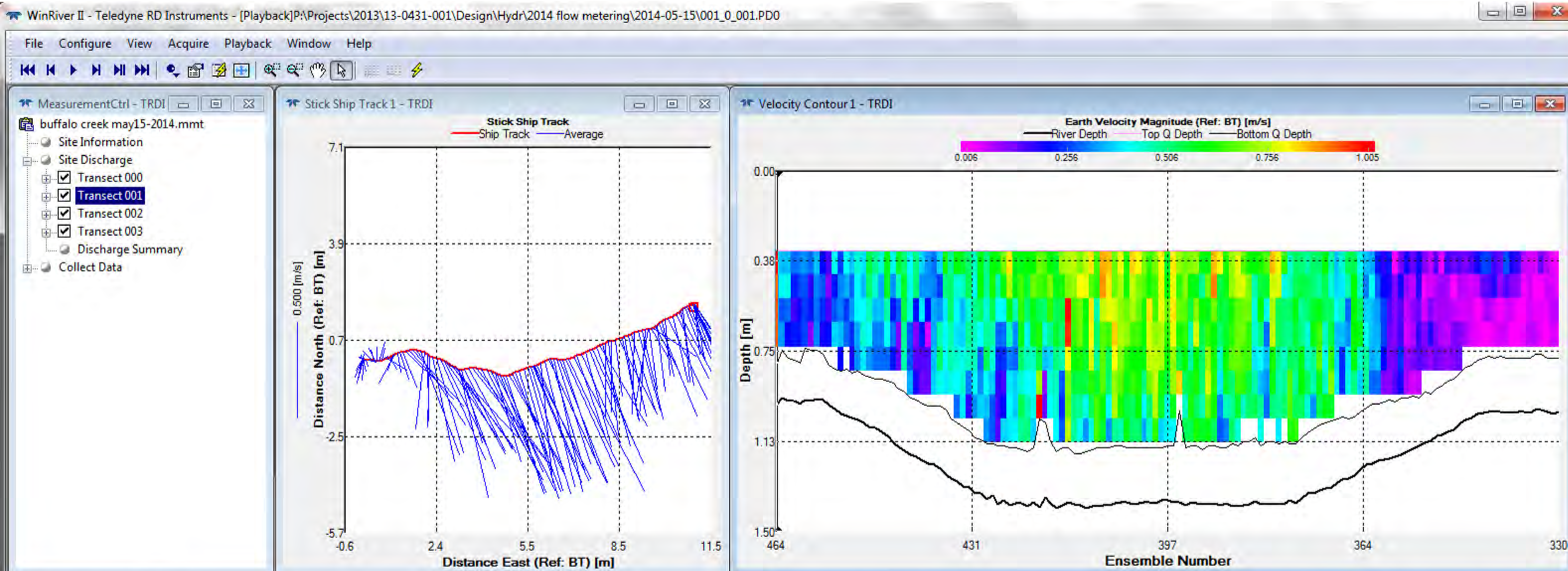


Discharge Summary - TRDI

Transect	Start Bank	# Ens.	Start Time	Total Q m³/s	Delta Q %	Top Q m³/s	Meas. Q m³/s	Bottom Q m³/s	Left Q m³/s	Left Dist. m	Right Q m³/s	Right Dist. m	Width m	Total Area m²	Q/Area m/s	Boat Speed m/s	Flow Speed m/s	Flow Dir. °	End Time	Dura s
001000	Left	246	14:49:37	6.463	0.64	1.811	3.366	1.134	0.194	2.00	-0.043	1.00	15.29	16.42	0.394	0.105	0.367	162.68	14:52:25	167.
001001	Right	135	14:52:44	6.180	-3.78	1.728	3.378	0.980	0.087	1.00	0.006	1.00	13.10	15.27	0.405	0.130	0.409	159.33	14:54:19	94.
001002	Left	128	14:54:31	6.373	-0.76	1.776	3.398	1.092	0.086	1.00	0.022	1.00	13.15	15.27	0.417	0.133	0.407	158.41	14:56:01	89.
001003	Right	141	14:56:09	6.673	3.91	1.866	3.654	1.054	0.092	1.00	0.008	1.00	13.08	15.21	0.439	0.143	0.433	160.98	14:57:48	98.
Average		162		6.422	0.00	1.795	3.449	1.065	0.115	1.25	-0.002	1.00	13.65	15.54	0.414	0.128	0.404			
Std Dev.		56		0.205	3.19	0.058	0.137	0.065	0.053	0.50	0.028	0.00	1.09	0.58	0.019	0.016	0.028			
Std./|Avg.|		0.35		0.03	0.00	0.03	0.04	0.06	0.46	0.40	15.09	0.00	0.08	0.04	0.05	0.13	0.07			

PHOTOS

Photo 1. Dauphin River, turbidity probe location - North Shore

Photo 2. Dauphin River turbidity probe location, looking upstream.

Photo 3: Dauphin River turbidity probe location, looking downstream.

Photo 4: Turbidity probe installation, Dauphin River.

Photo 5: Turbidity probe install and old gauge board, Buffalo Creek. Circle indicates approximate location of re-deployed probe.

Photo 6: New gauge board location, looking upstream at turbidity probe and float.

Photo 7. New gauge board installation, Gauge Reading is 0.78 m.

Photo 8. Flow metering site, upstream of turbidity probe. Arrow indicates direction of flow.

Photo 9. Metering location looking upstream

Photo 10. Metering location looking downstream

KGS GROUP CONSULTING ENGINEERS

Client:	**MIT**		
File No:	**11-0300-08 - 1000.5**		
Project:	**13-0431-01**		
	Flow Metering - Buffalo Creek		
Sheet:	**1**	**of**	**1**
Date:	**23-Jun-14**	**By:**	**GW**
Checked:		**By:**	

Measurement

Info:	Buffalo Creek
Date:	17-Jun-14
Time:	2:00:00 PM
Station ID:	BC-TM
Site No.:	001

Crew Patrice Leclercq
Garrett Wellwood

Discharge Summary

Equipment: ADCP - RDI River Ray 600 without GPS
Metering Location: BC-TM

Transect	Start Bank	Total Q (m^3/s)	Delta Q %	Corrected Q for Bed Movement (m^3/s)
000	Left	5.74	2.86	-
001	Right	5.73	2.65	-
002	Left	5.36	-3.85	-
003	Right	5.49	-1.66	-

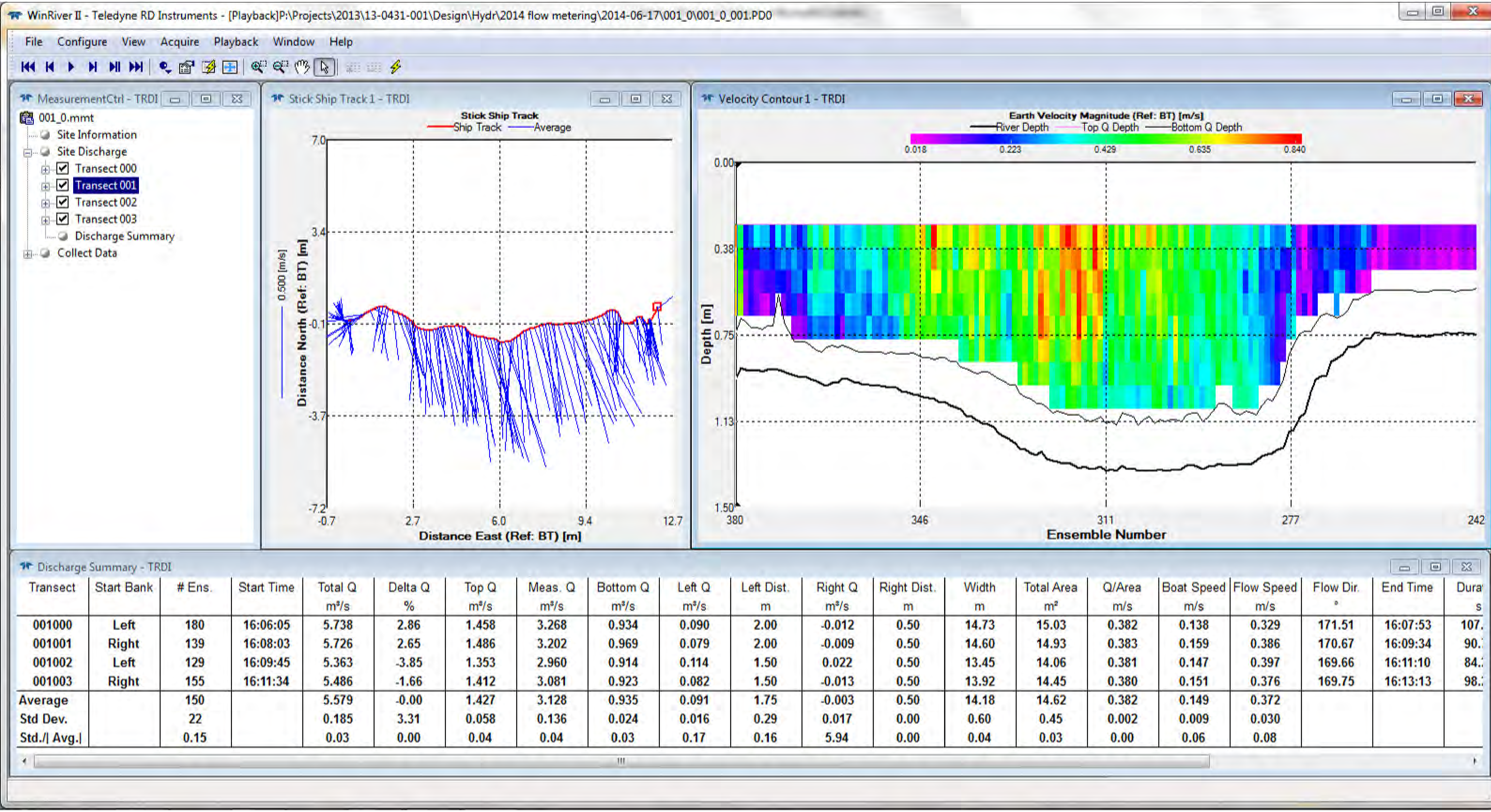
Average (m^3/s): 5.58
St. Dev. (m^3/s): 0.19
St. Dev. / avg: 0.033

Water Level: 221.44 m

Gauge: 0.77

Note: Moving bed not observed. Measurement did not include a loop test to correct for a potential moving bed.

Final Discharge: 5.6 m^3/s
197 ft^3/s



Transect	Start Bank	# Ens.	Start Time	Total Q m³/s	Delta Q %	Top Q m³/s	Meas. Q m³/s	Bottom Q m³/s	Left Q m³/s	Left Dist. m	Right Q m³/s	Right Dist. m	Width m	Total Area m²	Q/Area m/s	Boat Speed m/s	Flow Speed m/s	Flow Dir. °	End Time	Dura s
001000	Left	180	16:06:05	5.738	2.86	1.458	3.268	0.934	0.090	2.00	-0.012	0.50	14.73	15.03	0.382	0.138	0.329	171.51	16:07:53	107.
001001	Right	139	16:08:03	5.726	2.65	1.486	3.202	0.969	0.079	2.00	-0.009	0.50	14.60	14.93	0.383	0.159	0.386	170.67	16:09:34	90.
001002	Left	129	16:09:45	5.363	-3.85	1.353	2.960	0.914	0.114	1.50	0.022	0.50	13.45	14.06	0.381	0.147	0.397	169.66	16:11:10	84.
001003	Right	155	16:11:34	5.486	-1.66	1.412	3.081	0.923	0.082	1.50	-0.013	0.50	13.92	14.45	0.380	0.151	0.376	169.75	16:13:13	98.
Average		150		5.579	-0.00	1.427	3.128	0.935	0.091	1.75	-0.003	0.50	14.18	14.62	0.382	0.149	0.372			
Std Dev.		22		0.185	3.31	0.058	0.136	0.024	0.016	0.29	0.017	0.00	0.60	0.45	0.002	0.009	0.030			
Std./|Avg.|		0.15		0.03	0.00	0.04	0.04	0.03	0.17	0.16	5.94	0.00	0.04	0.03	0.00	0.06	0.08			

PHOTOS

Photo 1. Buffalo Creek, turbidity and pressure logger location - North Shore

Photo 2. Buffalo Creek, old staff gauge location, looking downstream.

Photo 3: Buffalo Creek flow metering, looking upstream.

Photo 4: Turbidity probe installation, Dauphin River.

Photo 5: Buffalo Creek, looking upstream from gauge board. Flow metering in background.

Photo 6: Buffalo Creek, looking downstream from gauge board.

KGS GROUP CONSULTING ENGINEERS

Client:	**MIT**			
File No:	**13-0431-01**			
Project:	**LSM emergency channel Monitoring**			
Sheet:	**1**	**of**	**1**	
Date:	**6-Sep-14**	**By:**	**PAL**	
Checked:	**8-Sep-14**	**By:**	**APP**	

Measurement

Info:	Reach 1
Date:	6-Sep-14
Time:	3:00:00 PM
Station ID:	Reach 1 Cableway
Site No.:	

Crew Patrice Leclercq

Discharge Summary

Equipment: ADCP - RDI River Ray 600 without GPS
Metering Location: Reach 1 Cableway

Transect	Start Bank	Total Q (m^3/s)	Delta Q %	Corrected Q for Bed Movement (m^3/s)
001	Right	111.87	-0.05	-
002	Right	112.47	0.02	-
004	Left	112.90	0.40	-
005	Left	112.54	0.08	-

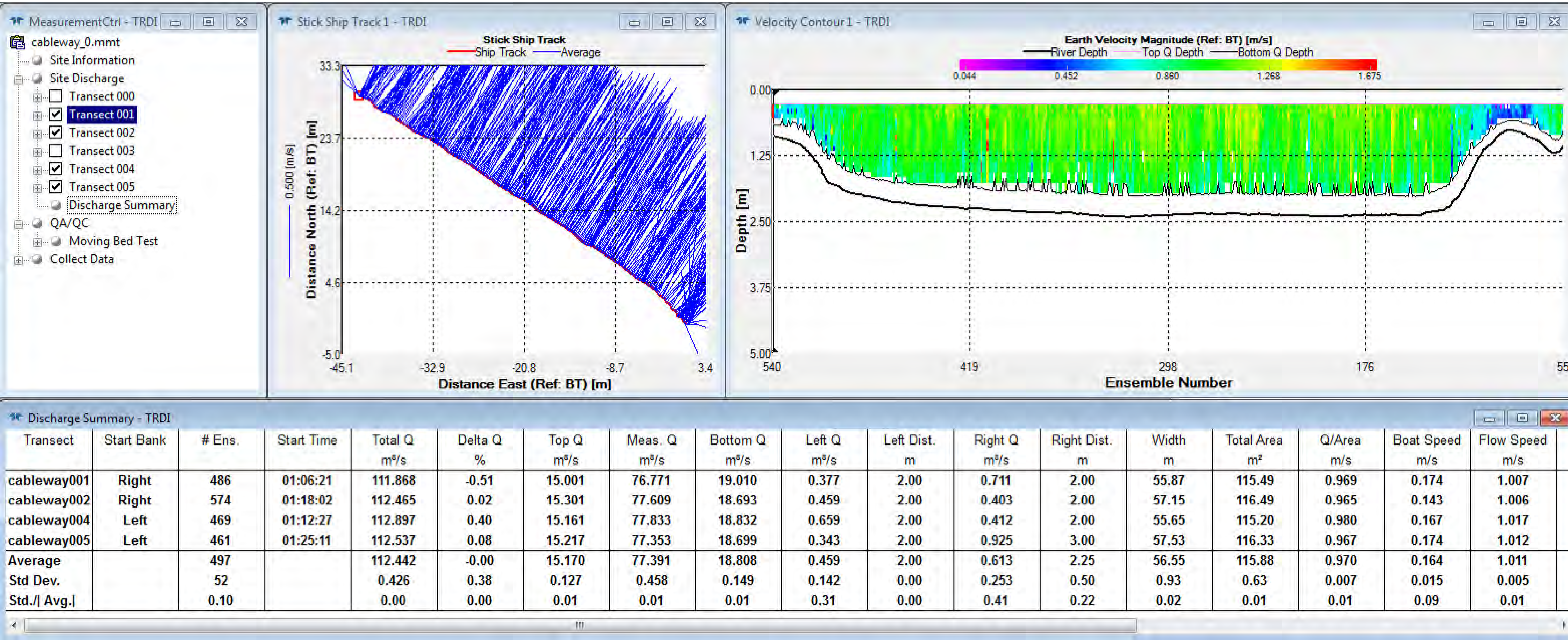
Average (m^3/s): 112.44
St. Dev. (m^3/s): 0.43
St. Dev. / avg: 0.004

Water Level: m

Gauge: 0.39 m taken from "high" gauge board

Note: Loop Test Performed - No moving bed
Transects 001 & 002 were subsectioned from Transects 004 & 005

Final Discharge: 112.4 m^3/s
3970 ft^3/s



Transect	Start Bank	# Ens.	Start Time	Total Q m³/s	Delta Q %	Top Q m³/s	Meas. Q m³/s	Bottom Q m³/s	Left Q m³/s	Left Dist. m	Right Q m³/s	Right Dist. m	Width m	Total Area m²	Q/Area m/s	Boat Speed m/s	Flow Speed m/s
cableway001	Right	486	01:06:21	111.868	-0.51	15.001	76.771	19.010	0.377	2.00	0.711	2.00	55.87	115.49	0.969	0.174	1.007
cableway002	Right	574	01:18:02	112.465	0.02	15.301	77.609	18.693	0.459	2.00	0.403	2.00	57.15	116.49	0.965	0.143	1.006
cableway004	Left	469	01:12:27	112.897	0.40	15.161	77.833	18.832	0.659	2.00	0.412	2.00	55.65	115.20	0.980	0.167	1.017
cableway005	Left	461	01:25:11	112.537	0.08	15.217	77.353	18.699	0.343	2.00	0.925	3.00	57.53	116.33	0.967	0.174	1.012
Average		497		112.442	-0.00	15.170	77.391	18.808	0.459	2.00	0.613	2.25	56.55	115.88	0.970	0.164	1.011
Std Dev.		52		0.426	0.38	0.127	0.458	0.149	0.142	0.00	0.253	0.50	0.93	0.63	0.007	0.015	0.005
Std./|Avg.|		0.10		0.00	0.00	0.01	0.01	0.01	0.31	0.00	0.41	0.22	0.02	0.01	0.01	0.09	0.01

PHOTOS

Photo 1. Reach 1 Cableway, South Shore

Photo 2. Reach 1 Cableway, South Shore looking downstream.

Photo 3: Reach 1 Cableway, South Shore looking upstream.

Photo 4: Gauge Board, Reach 1 Cableway, Gauge Reading 0.39 m.

Photo 5: Reach 1 Inlet, looking downstream.

Client:	MIT			
File No:	13-0431-01			
Project:	LSM emergency channel Monitoring			
Sheet:	1	of	1	
Date:	19-Nov-14	By:	APP	
Checked:		By:		

Measurement

Info: Reach 1
Date: 18-Nov-14
Time: 12:00:00 PM
Station ID: Reach 1 Cableway
Site No.:

Crew Ambroise Percheron

Discharge Summary

Equipment: ADCP - RDI River Ray 600 without GPS
Metering Location: Reach 1 Cableway

Transect	Start Bank	Total Q (m^3/s)	Delta Q %	Corrected Q for Bed Movement (m^3/s)
001	Left	89.74	1.85	-
002	Right	86.20	2.61	-
004	Left	84.82	-1.44	-
005	Right	84.82	-3.02	-

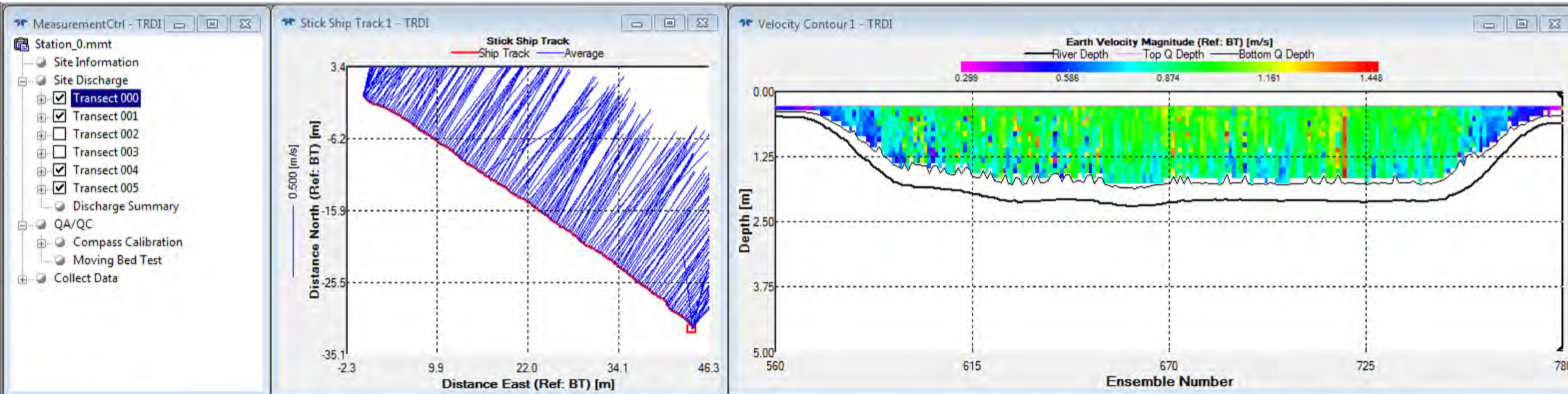
Average (m^3/s): 86.40
St. Dev. (m^3/s): 2.32
St. Dev. / avg: 0.027

Water Level: m

Gauge: m

Note: Moving bed not observed. Measurement did not include a loop test to correct for a potential moving bed.

Final Discharge: 86.4 m^3/s
3050 ft^3/s



Discharge Summary - TRDI

Transect	Start Bank	# Ens.	Start Time	Total Q m³/s	Delta Q %	Top Q m³/s	Meas. Q m³/s	Bottom Q m³/s	Left Q m³/s	Left Dist. m	Right Q m³/s	Right Dist. m	Width m	Total Area m²	Q/Area m/s	Boat Speed m/s	Flow Speed m/s	Flow Dir. °	End Time	Du
Station000	Left	221	11:31:40	89.075	1.85	14.106	59.769	15.023	0.081	1.00	0.096	1.00	56.15	104.39	0.853	0.372	0.890	34.09	11:34:09	1
Station001	Right	207	11:35:30	89.741	2.61	14.188	60.259	15.022	0.160	1.00	0.111	1.00	56.05	104.32	0.860	0.385	0.906	31.31	11:37:52	1
Station004	Left	201	11:38:13	86.198	-1.44	10.502	60.683	14.788	0.076	1.00	0.150	1.00	56.20	100.47	0.858	0.407	0.898	34.23	11:40:28	1
Station005	Right	179	11:44:28	84.818	-3.02	10.377	59.850	14.412	0.088	1.00	0.092	1.00	56.22	99.95	0.849	0.464	0.895	31.59	11:46:28	1
Average		202		87.458	0.00	12.293	60.140	14.811	0.101	1.00	0.112	1.00	56.16	102.28	0.855	0.407	0.897			
Std Dev.		17		2.337	2.67	2.141	0.421	0.288	0.040	0.00	0.026	0.00	0.08	2.40	0.005	0.041	0.007			
Std./| Avg.|		0.08		0.03	0.00	0.17	0.01	0.02	0.39	0.00	0.23	0.00	0.00	0.02	0.01	0.10	0.01			

PHOTOS

Photo 1. Reach 1 Cableway, South Shore, looking upstream.

Photo 2. Reach 1 Inlet, looking downstream.

Client:	MIT
File No:	1006.18
Project:	13-0431-01
	Flow Metering - Reach 1
Sheet:	1 of 1
Date:	4-May-15 By: GW
Checked:	By:

KGS GROUP
CONSULTING ENGINEERS

Measurement

Info: Buffalo Creek
Date: 1-May-15
Time: 2:30:00 PM
Station ID: R1-C
Site No.: 001

Crew Garrett Wellwood
Elaine Salter

Discharge Summary

Equipment: ADCP - RDI River Ray 600 without GPS
Metering Location: R1-C (Cableway)

Transect	Start Bank	Total Q (m^3/s)	Delta Q %	Corrected Q for Bed Movement (m^3/s)
000	Right	95.15	1.16	-
001	Left	93.37	-0.74	-
002	Right	93.27	-0.84	-
003	Left	94.46	0.42	-

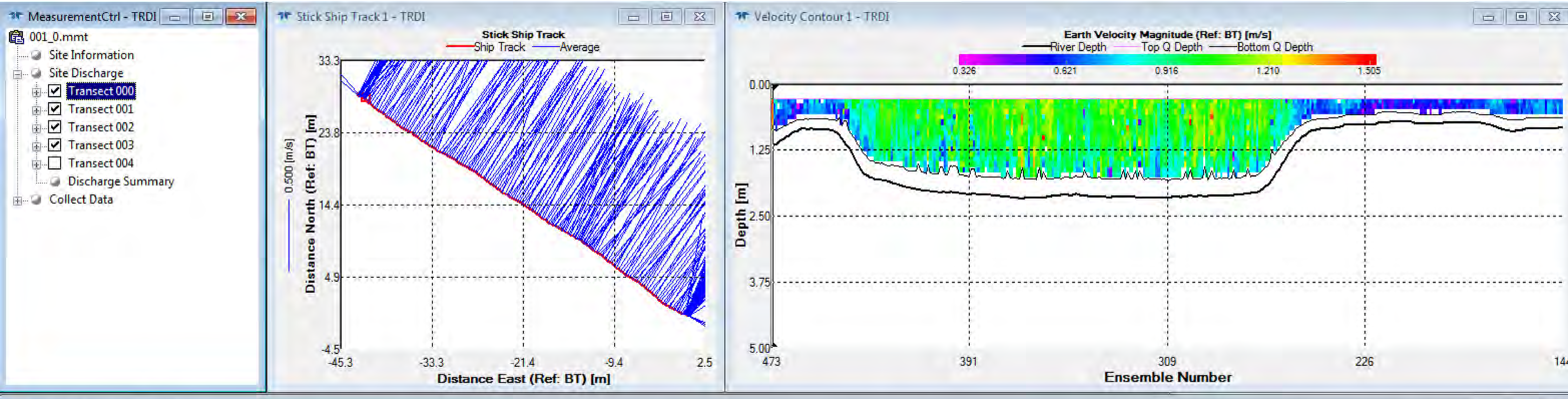
Average (m^3/s): 94.06
St. Dev. (m^3/s): 0.90
St. Dev. / avg: 0.010

Water Level: 242.69 m

Gauge: Damaged

Note: Moving bed not observed. Measurement did not include a loop test to correct for a potential moving bed.

Final Discharge: 94.1 m^3/s
3322 ft^3/s



Discharge Summary - TRDI

Transect	Start Bank	# Ens.	Start Time	Total Q m³/s	Delta Q %	Top Q m³/s	Meas. Q m³/s	Bottom Q m³/s	Left Q m³/s	Left Dist. m	Right Q m³/s	Right Dist. m	Width m	Total Area m²	Q/Area m/s	Boat Speed m/s	Flow Speed m/s	Flow Dir. °	End Time	Durat s
001000	Right	330	13:15:50	95.159	1.16	14.655	64.439	15.050	0.714	3.00	0.302	1.50	55.20	102.84	0.925	0.271	0.918	33.16	13:19:16	205.
001001	Left	269	13:19:52	93.366	-0.74	14.212	63.904	13.911	0.942	3.00	0.397	2.00	55.13	102.77	0.908	0.275	0.922	36.11	13:23:00	187.
001002	Right	268	13:23:10	93.274	-0.84	14.189	63.212	14.478	1.102	3.00	0.294	2.00	54.23	101.69	0.917	0.293	0.936	33.22	13:26:18	187.
001003	Left	279	13:27:05	94.456	0.42	14.484	63.828	14.868	0.917	3.00	0.359	2.00	55.57	103.03	0.917	0.267	0.937	35.76	13:30:19	194.
Average		286		94.064	0.00	14.385	63.846	14.577	0.919	3.00	0.338	1.88	55.03	102.58	0.917	0.276	0.928			
Std Dev.		29		0.906	0.96	0.224	0.502	0.504	0.159	0.00	0.049	0.25	0.57	0.61	0.007	0.011	0.010			
Std./| Avg.|		0.10		0.01	0.00	0.02	0.01	0.03	0.17	0.00	0.14	0.13	0.01	0.01	0.01	0.04	0.01			

Photos

Photo 1. Reach 1 Bench Mark R1-D-A, looking east D/S

Photo 2. Reach 1 Bench Mark R1-D-A, looking west U/S

Photo 3: Bench Mark R1-D-A, anchor to staff gauge

Photo 4: Submerged gauge board at Bench Mark R1-D-A

Photo 5: Bench Mark R1-M-B, looking north-west

Photo 6: Bench Mark R1-M-B looking west, U/S

Photo 7. Bench Mark R1-M-B looking east, D/S

Photo 8. Flow metering with ADCP at Cableway, looking north

Photo 9. Cableway and staff gauge at R1-C-A, looking north

Photo 10. Bench Mark R1-I-A looking west, U/S

Photo 11. At Bench Mark R1-I-A, damaged gauge board

Photo 12. Bench Mark R1-I-A looking east, D/S

KGS GROUP
CONSULTING ENGINEERS

Client:	**MIT**
File No:	**1006.18**
Project:	**13-0431-01**
	Flow Metering - Reach 1
Sheet:	**1** **of** **1**
Date:	**12-Jun-15** **By:** **ALW**
Checked:	**By:**

Measurement

Info:	Buffalo Creek
Date:	11-Jun-15
Time:	10:15:00 AM
Station ID:	R1-C
Site No.:	001

Crew Andrew Weiss
Dan Leitch

Discharge Summary

Equipment: ADCP - RDI River Ray 600 without GPS
Metering Location: R1-C (Cableway)

Transect	Start Bank	Total Q (m^3/s)	Delta Q %	Corrected Q for Bed Movement (m^3/s)
000	Right	91.76	0.73	-
001	Left	91.69	0.66	-
002	Right	90.80	-0.32	-
003	Left	90.13	-1.06	-

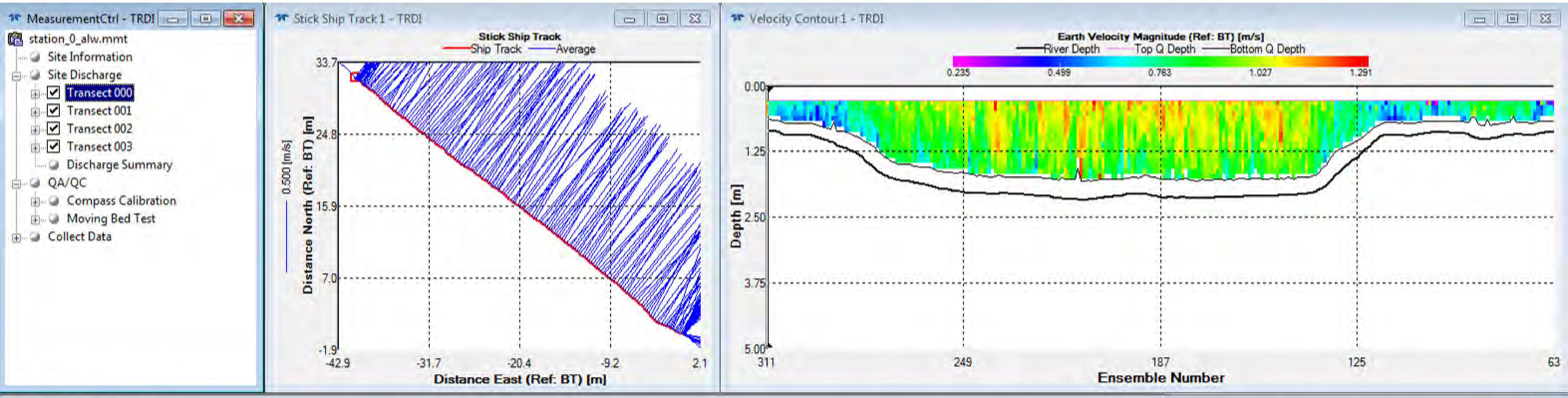
Average (m^3/s): 91.09
St. Dev. (m^3/s): 0.78
St. Dev. / avg: 0.009

Water Level: 242.77 m

Gauge: Damaged

Note: A loop correction moving bed test was performed. A moving bed was not indicated and as such no correction was applied to the data.

Final Discharge: 91.1 m^3/s
3217 ft^3/s



Discharge Summary - TRDI

Transect	Start Bank	# Ens.	Start Time	Total Q m³/s	Delta Q %	Top Q m³/s	Meas. Q m³/s	Bottom Q m³/s	Left Q m³/s	Left Dist. m	Right Q m³/s	Right Dist. m	Width m	Total Area m²	Q/Area m/s	Boat Speed m/s	Flow Speed m/s	Flow Dir. °	End Time	Durat s
Station000	Right	249	08:10:58	91.765	0.73	14.265	62.940	13.553	0.560	3.00	0.447	3.00	57.78	103.73	0.885	0.313	0.890	37.17	08:13:50	172.
Station001	Left	266	08:14:25	91.692	0.65	14.244	62.483	13.812	0.357	3.00	0.797	3.00	57.69	103.31	0.888	0.303	0.899	33.88	08:17:20	174.
Station002	Right	242	08:17:41	90.801	-0.32	14.050	61.872	13.636	0.520	3.00	0.723	3.00	57.33	103.26	0.879	0.328	0.890	36.38	08:20:24	163.
Station003	Left	247	08:20:49	90.126	-1.06	14.086	61.482	13.906	0.333	3.00	0.319	3.00	58.01	103.68	0.869	0.335	0.885	34.38	08:23:29	159.
Average		251		91.096	0.00	14.161	62.194	13.727	0.442	3.00	0.571	3.00	57.70	103.50	0.880	0.320	0.891			
Std Dev.		10		0.781	0.86	0.109	0.646	0.161	0.114	0.00	0.226	0.00	0.29	0.24	0.008	0.014	0.006			
Std./| Avg.|		0.04		0.01	0.00	0.01	0.01	0.01	0.26	0.00	0.40	0.00	0.00	0.00	0.01	0.05	0.01			

Photos

Photo 1. Damaged Gaugeboard at Reach 1 Bench Mark R1-I-A, looking east D/S

Photo 2. R1-I-A, looking west U/S

Photo 3. Damaged Gaugeboard at Reach 1 Bench Mark R1-C-A, looking east D/S

Photo 4. R1-C-A, looking west U/S

KGS GROUP CONSULTING ENGINEERS

Client:	**MIT**		
File No:			
Project:	**13-0431-001**		
	Flow Metering - Buffalo Creek		
Sheet:	**1**	**of**	**1**
Date:	**17-Sep-15**	**By:**	**GW**
Checked:		**By:**	

Measurement

Info:	Buffalo Creek
Date:	14-Sep-15
Time:	1:15:00 PM
Station ID:	BC-TM
Site No.:	n/a

Crew Garrett Wellwood
Steve Offman

Discharge Summary

Equipment: ADCP - RDI River Ray 600 without GPS
Metering Location: At logger

Transect	Start Bank	Total Q (m^3/s)	Delta Q %	Corrected Q for Bed Movement (m^3/s)
001	Right	0.47	-2.71	-
002	Left	0.48	0.00	-
003	Right	0.50	3.76	-
004	Left	0.47	-1.04	-

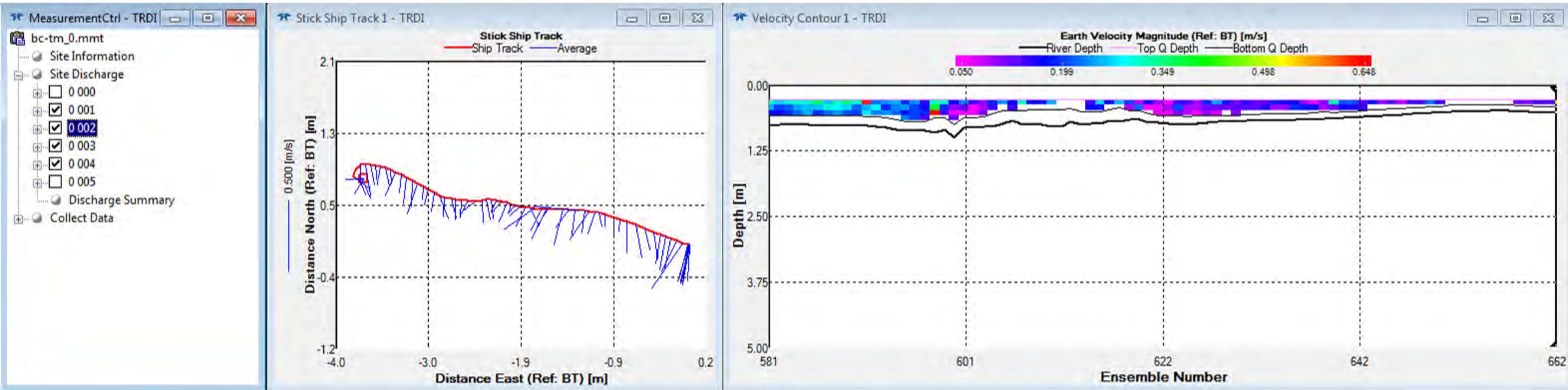
Average (m^3/s): 0.48
St. Dev. (m^3/s): 0.01
St. Dev. / avg: 0.027

Upstream Water Level: - m
Downstream Water Level: 220.90 m

Gauge: n/a

Note: Measurement did not include a loop test; a moving bed was not identified.

Final Discharge: 0.5 m^3/s
17 ft^3/s



Discharge Summary - TRDI

Transect	Start Bank	# Ens.	Start Time	Total Q m^3/s	Delta Q %	Top Q m^3/s	Meas. Q m^3/s	Bottom Q m^3/s	Left Q m^3/s	Left Dist. m	Right Q m^3/s	Right Dist. m	Width m	Total Area m^2	Q/Area m/s	Boat Speed m/s	Flow Speed m/s	Flow Dir. °	End Time	Durat s
bc-tm001	Right	121	00:07:44	0.466	-2.71	0.173	0.111	0.109	0.059	1.00	0.014	1.00	5.96	3.36	0.139	0.083	0.159	181.94	00:08:42	58.4
bc-tm002	Left	82	00:08:54	0.479	-0.00	0.165	0.127	0.099	0.067	1.00	0.021	1.00	5.51	3.20	0.150	0.106	0.167	191.54	00:09:34	40.0
bc-tm003	Right	119	00:09:45	0.497	3.76	0.179	0.127	0.113	0.061	1.00	0.018	1.00	5.92	3.39	0.147	0.070	0.160	188.35	00:10:44	58.3
bc-tm004	Left	114	00:11:08	0.474	-1.04	0.167	0.117	0.103	0.064	1.00	0.022	1.00	5.97	3.39	0.140	0.078	0.167	189.44	00:12:03	54.9
Average		109		0.479	-0.00	0.171	0.121	0.106	0.063	1.00	0.019	1.00	5.84	3.34	0.144	0.084	0.163			
Std Dev.		18		0.013	2.74	0.006	0.008	0.006	0.004	0.00	0.004	0.00	0.22	0.09	0.005	0.015	0.004			
Std./| Avg.|		0.17		0.03	0.00	0.04	0.07	0.06	0.06	0.00	0.19	0.00	0.04	0.03	0.04	0.18	0.03			

Photos

Photo 1. Looking D/S at BC-TM from metering cross section.

Photo 2. Looking U/S from metering cross section.

Photo 3: Looking north across metering cross section.

Photo 4: Turbidity meter at BC-TM, as found.

Photo 5: Damaged gauge board and slope failure, looking D/S from BC-TM.

APPENDIX D

TURBIDITY AND PRESSURE LOGGER DATA

(PROVIDED ON CD)

APPENDIX E

2011, 2013 AND 2014 VEGETATION SURVEY PHOTOGRAPH LOGS

(PROVIDED ON CD)

APPENDIX F

2011 BUFFALO CREEK VEGETATION COVER SURVEY

KGS GROUP
CONSULTING ENGINEERS

MEMORANDUM

TO: Colin Siepman

FROM: Foster Karcha

cc: Tony Ng, Brian Bodnaruk, Bert Smith

DATE: October 7, 2011

PROJECT NO: 11-0300-18

RE: Lake Manitoba and Lake St. Martin Emergency Channel
Buffalo Creek Vegetation Cover Survey Results
Station 13+500 m to Station 28+000 m

1.0 INTRODUCTION

As part of the Sediment Erosion Monitoring Program for the Lake St Martin Flood Relief project, KGS Group completed 30 vegetation survey transects along Buffalo Creek between station 13+500 m and 28+000 m (Figure 1). All field work was completed between September 21, 2011 and September 26, 2011. The field work required helicopter support for site access each day.

The purpose of the vegetation survey program was to document vegetation type characteristics along the till embankments of buffalo Creek as part of the Sediment Erosion Monitoring program. The vegetation survey program involved running perpendicular 100m transects on both sides of the stream centerline, and documenting the cover types along this transect. Vegetation cover types were used to estimate the amount of protection from erosion afforded to the soil via plant cover. Representative sample photos were taken. The soil organic layer depth was measured to quantify the amount of organic fines that may be moved downstream.

In addition to the vegetation cover survey program, a test pit/till sampling program was completed during the same time frame and a detailed cross section survey is currently being completed. The results of the test pit/till sampling program and detailed cross section survey will be presented as stand alone reports.

2.0 METHODOLOGY

A systematic sampling method was chosen in order to get detailed results. Sampling locations were set every 500m along the channel length beginning at station 13+500 m and continuing to just upstream of the confluence with the Dauphin River at station 28+000 (Figure 1). The vegetation survey transects were run perpendicular to channel when possible, starting approximately from centreline of the stream and continuing for a distance of a approximately 100 m on either side of the creek. Orientation of the transects were modified for those locations where the meander of the creek resulted in overlap of a transect from another location.

The investigator recorded cardinal direction of transect, start and end location for each transect, general description of cover types, start and end distance of each cover type within the transect, and depth of soil organic layer. A photo log (Appendix A) was completed using photographs of representative and unique substrate cover types. Cover types were placed in four broad categories:

- Bare: exposed mineral soil with no vegetation or soil organic layer;
- Grass: vegetation cover consists of Grass, sedge, or rush families;
- Shrub : vegetation cover consists of woody species which do not form distinct trunks or canopies of leaves, especially those which do not normally exceed 10m in height;
- Treed: vegetation cover consists of woody species which form distinct trunks and leaf canopies, and which normally can or do exceed 10m in height.

Composites or matrices of these four types were possible, and their corresponding ground cover was provided e.g. 50% area covered by Grass 50% area covered by Shrubs. Due to plant morphology and habit, total percentages greater than 100 were possible.

3.0 RESULTS

The following subsections detail the results found for each transect, including orientation, description of terrain, cover types, and organic layer depths in soil. Unique features related to the investigation are also mentioned where appropriate. Full records for each transect are found in Appendix B with the transect data broken into subsection A (left bank, as facing downstream) and subsection B (right bank). The data was comparable to existing known cover type data (only available at a broad level), taken from GeoBase 2000 data (Appendix C).

3.1 13+500

This transect ran in a northwest-southeast orientation. The environment consisted of a matrix of drained wetlands with exposed mineral soil and sedge-Grass vegetation (Grass type) with a minor component of Shrub cover. The organic layer of the soil ranged from 0 cm to 5 cm. The area encountered was level to hummocky.

3.2 14+000

This transect ran in a northwest-southeast orientation. The environment consisted of a steady transition from Grass type to Shrub type to Treed type as transect progressed away from the channel. A matrix of these types was also found. This transect was level. Organic soil layers ranged from 2 cm to 15 cm.

3.3 14+500

This transect ran in a northwest-southeast orientation and consisted of a steady transition from Grass type to Shrub type to Treed type cover on both sides of the channel. The site was level to gradually rising away from the channel. The organic layer of soil ranged from 2 cm to 15 cm in depth.

3.4 15+000

This transect ran in a northwest-southeast orientation. Shrub and Shrub-Grass matrix types dominated this transect. The Treed type was located on side A of this transect. The final 25 m of the southeast transect consisted of Shrub type muskeg, with organic soil layers greater than 30 cm.

This was anomalous for this transect where the remaining cover types had organic soil layers between 2 cm and 5 cm.

3.5 15+500

The orientation of this transect followed a northwest-southeast direction. This transect has a steady progression of Grass type to Shrub type to Treed type on both sides of the channel. The organic layer depths ranged from 1 cm to 20 cm.

3.6 16+000

This transect was oriented northwest-southeast. Side A initially contained a matrix of Grass type (50%) and Bare mineral soil (50%), indicating it was recently drained. Grass, Shrub, and Treed types were prevalent with clearly defined boundaries between types. Depth of the organic layer varied from 0 cm to 6 cm.

3.7 16+500

This transect turns to a north-south orientation and consists exclusively of the Shrub cover type. The terrain rises steeply on the B side with soil organic layers decreasing along the slope from 12 cm at the toe, to 8 cm mid-slope, and 5 cm at the top of the slope. The final 40 m of the B side consists of muskeg Shrub type cover with the organic layer of soil greater than 30 cm. The A side consists entirely of the Shrub cover type with 1 cm organic soil layer.

3.8 17+000

This transect runs southeast and north-northwest. Cover types alternate between Shrub type and Grass type with no inter-matrix. Organic layer varies from 1 cm up 8 cm depths.

3.9 17+500

This transect runs east-west across level terrain. Cover types include Shrub and Grass cover, along with Shrub-Grass, Grass-Shrub, and Treed-Grass-Shrub matrices. Muskeg type cover with organic layer depth greater than 30cm was found on the last 64 m of the B side transect; otherwise, organic layer depth varied from 4 cm to 15 cm.

3.10 18+000

This transect was run east-west across level terrain. The cover types include Grass, Shrub, and Treed, along with Treed-Shrub and Grass-Shrub mixtures. Significant sections with organic soils (organic layer depth >30 cm) were found. The remainder of soils had variable organic layer depths from 8 cm to 25 cm.

3.11 18+500

This transect was run east-west through level terrain. The first 50 m of the B side (Grass 70% Shrub 30%) was found to be inundated due to beaver dam impoundment downstream: no measurement of soil organic layer was taken here. The remaining cover types included Shrub, Grass, and Shrub 90% Grass 10%. Muskeg type environments with organic layer depths greater than 30 cm were encountered on the A side under Shrub cover type. Remaining measurements of the organic layer depth of soil produced results of 2 cm and 7 cm.

3.12 19+000

This transect was run in a northeast-southwest orientation in terrain level terrain. The first 12 m to 20 m on either side of the channel was inundated due to water impoundment downstream by beaver activity: no measurement of the soil organic layer was possible in these areas. Cover types on this transect include Grass and Shrub types, and mixtures of Grass-Shrub, Treed-Grass, and Shrub-Treed types. The last 10 m of the B side was muskeg type Shrub habitat with an organic layer greater than 30 cm. Other findings for organic layer measurements varied from 7 cm to 25 cm.

3.13 19+500

This transect followed an east-west line. Inundation of the first 11 m of the B side was discovered, again due to impoundment of water by beaver activity. Cover types including Shrub, Treed, Shrub-Bare, Grass-Bare, Grass-Shrub, and Treed-Shrub. The final 25 m of the A side transect had organic layers greater than 30 cm. The remaining measured values vary between 0 cm and 12 cm.

3.14 20+000

This transect was run in a north-south orientation. Inundation of the first 40m of the A side was discovered, likely due to beaver activity downstream. Cover types include Shrub, and various combinations of Grass and Shrub cover. The final 30 m of the B side had organic layers >30 cm; while the rest of this transect organic layer depth varied from 4 cm to 10 cm.

3.15 20+500

This transect was oriented southeast-northwest. Grass, Shrub, Treed, and Grass-Shrub cover types were encountered. Muskeg type cover, with organic layer depths greater than 30 cm, were encounter for the last 75 m of the B side transect. Remaining organic soil depths varied between 5 cm and 10 cm.

3.16 21+000

Cover types for this east-west transect include Shrub, Shrub-Grass composites, and Treed types. No areas were found to be inundated. The last 55 m of the B side included muskeg type habitat with organic layers in the soil >30 cm. The remaining organic layer depths measured vary between 5 cm and 10 cm.

3.17 21+500

This transect ran southwest-northwest, with the first 10m of the A side being inundated due to beaver activity downstream. Level terrain was encountered, and cover types consisted of Shrub-Grass and Treed-Shrub composites and Treed sections. Significant lengths on both sides of this transect consisted of organic soil (organic layer depth greater than 30cm): the final 50 m on the A side, and the final 40 m on the B side. Organic layers were generally 20 cm, deeper than most transect, though one section on the A side presented a depth of 6 cm.

3.18 22+000

This transect is similar to 21+000, running in a northeast-southwest direction and being dominated by Treed cover types. The other cover types are Shrub-Grass composites. Terrain along this transect is level to slightly rising. Both sides have their lengths dominated by organic soils (organic layer depth >30 cm): 60 m and 80 m respectively. Remaining depths measured vary between 8 cm and 20 cm.

3.19 22+500

This east-west transect is also dominated on both sides by muskeg type organic soils: 55 m and 80 m respectively. Cover on these soils was of the Treed type. Remaining cover types are Shrub, and Shrub-Grass with organic layer depths of 6 cm.

3.20 23+000

This level southwest-northeast transect is similar to the previous transect in that it is dominated – 50 m and 95 m respectively -- by muskeg type environments. Treed cover type is dominant, with Grass-Shrub and Grass-Shrub-Treed composites making up the balance. Organic layers in the remaining parts of the transect measure 3 cm and 25 cm.

3.21 23+500

This north-south oriented transect is dominated by Treed type cover. The other cover type exhibited is Grass-Shrub composite. Organic layer depths of greater than 30 cm were exhibited in the last 30 m of the B side. Remaining measurements were from 6 cm to 10 cm.

3.22 24+000

This east west oriented transect on a bend in Buffalo Creek is dominated by organic soils. Cover types were Treed and Shrub-Grass composites. Only one measurement of organic layer depth was less than 30 cm, at 8 cm. This transect was on level to gently rising terrain.

3.23 24+500

This transect was oriented east-west. This transect is similar to station 24+000 and is dominated by organic soils and Treed cover type. The other cover types are Shrub and Shrub-Grass composite. Remaining organic layer measurements were 9 cm and 10 cm. Terrain was level to gently rising.

3.24 25+000

This transect was originally orient east-west, however due to the proximity of the downstream portion of the river, the A side had to be adjusted northward in order to include the full 100 m length of the transect: the final orientation was east-northwest. Treed, Shrub, and composites of the two were the cover types exhibited. Mineral soils had organic layer depths of 7 cm and 22 cm, and there were significant lengths of organic soils (depths > 30 cm).

3.25 25+500

This east-west transect had a much smaller component of organic soils than the previous transect, and Treed cover types were no longer a dominant component. Only the last 10 m to 15 m of each transect side had organic soils (organic layers greater than 30 cm). Otherwise organic layer depth varied from 3 cm to 8 cm. Cover types were dominated by Shrub, and Shrub-Grass composites.

3.26 26+000

This east-west transect contain Grass, Shrub, and Grass-Shrub composite cover types on level terrain within the flood plain of Buffalo Creek. No organic soils were found, and the organic layer had varied between 4 cm and 17 cm.

3.27 26+500

This transect occurs on a bend in the river, and runs north-south. The cover types are Shrub-Grass composites, Shrub, and Treed. There are no organic soils, and the organic depths vary widely from 2 cm to 20 cm.

3.28 27+000

This transect runs east-west on a bend in the river. The A side rises sharply from the channel before rounding off to a gentle slope. The B side is dominated by a flood plain area. Grass-Shrub composite, Shrub, and Treed types are exhibited with no one type being dominant across this transect. The final 30 m of side B consists of organic soil (organic layer great than 30 cm). Remaining sections of this transect consists of organic layers between 5 cm and 22 cm.

3.29 27+500

This east-west transect sharply rises from the channel towards side A, and gently rises from the channel across a flood plain to side B. No single type dominates this transect, with Grass Shrub, Treed, and composites such as Grass-Shrub and Treed-Shrub present. No organic soils were found. Measure organic layers varied between 5 and 25 cm.

3.30 28+000

This east-west transect contains three cover types: Grass, Shrub and Treed. The terrain rises gently from the channel, with the Grass or Shrub type dominating the flood plain area before the site transitions to Treed type. No organic soils were found, and organic layers on mineral soil had depths of 6 cm (Grass type), 8 cm (Shrub type) and 23 cm to 25 cm (Treed type).

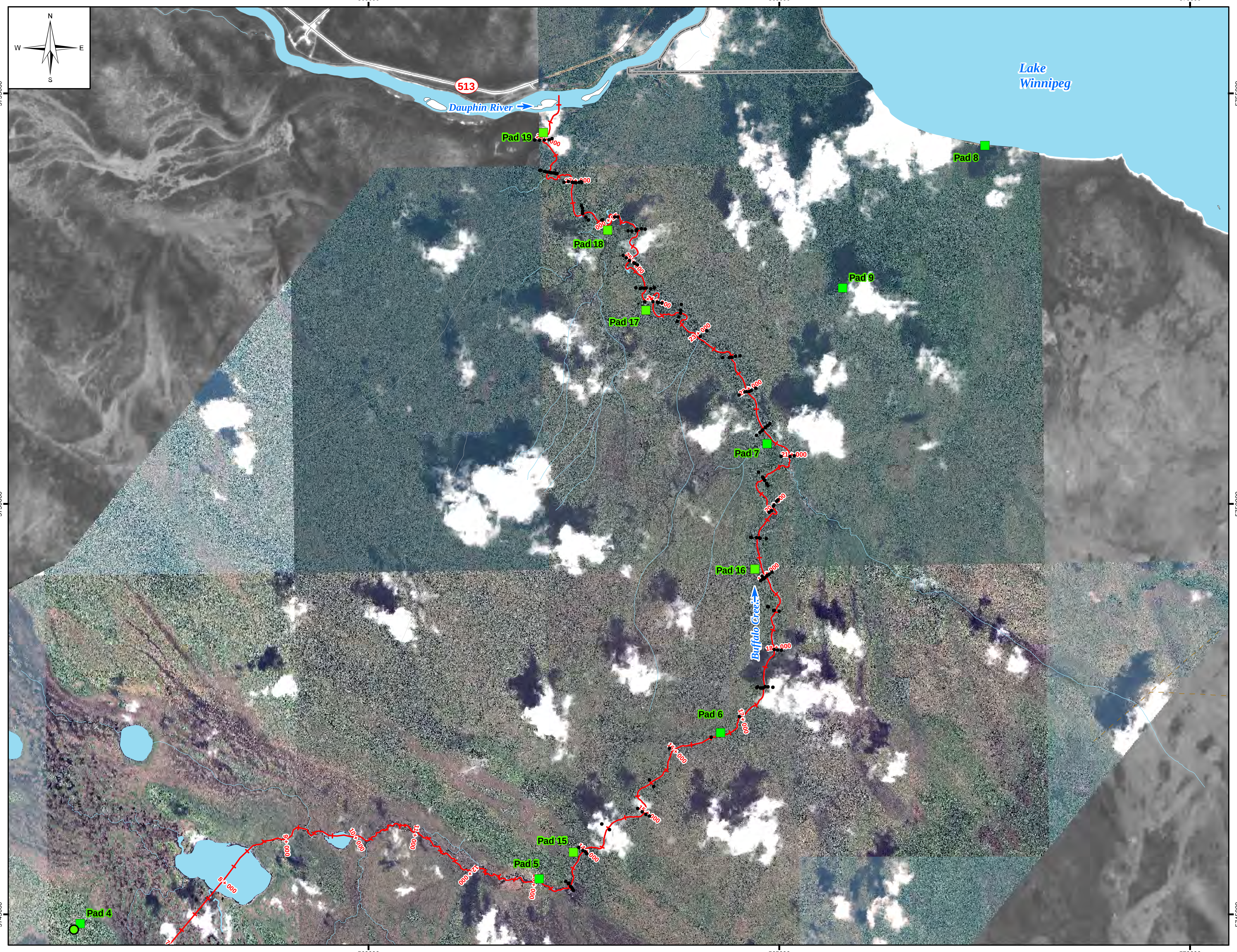
Prepared By:

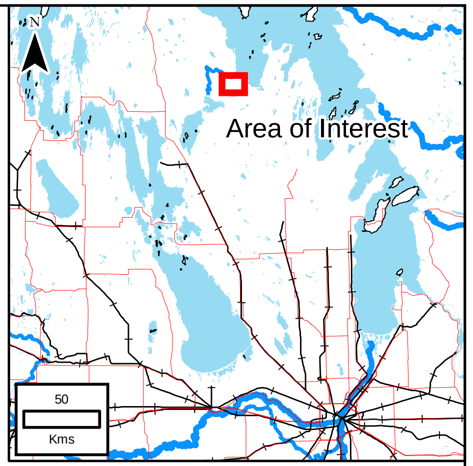
Foster Karcha, B. Sc.
Environmental Scientist

FK/sml
Attachment

FIGURE

Portions of data presented are owned by the Province of Manitoba and are produced under the licence agreement with the Province of Manitoba 2011 Queen's Printer.





LEGEND:

- Vegetation Survey Transect Waypoints
- Helicopter Landing Pad
- Lake St. Martin Channel Option L
- Road Paved 2 or more lanes
- Paved Street or Road
- Gravel Road
- Unclassified Road
- Accessway or Backlane
- Trail
- Railway
- Ditch
- River/Stream, Indefinite
- River/Stream
- Dugout; Pond;
- Lake
- Aboriginal Lands

0.5 0 0.5 1 1.5

Kilometres

SCALE: 1:45,000 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 14
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
0	11/10/06	ISSUED WITH MEMO	JB

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

AECOM

Manitoba INFRASTRUCTURE AND TRANSPORTATION

LAKE MANITOBA AND LAKE ST. MARTIN EMERGENCY CHANNELS

TRANSECT LOCATIONS FOR VEGETATION COVER SURVEY

OCTOBER 2011 | FIGURE 01 | REV: 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\VEGETATION_TRANSECTS\11-0300-18-F01-REV0.mxd
11"x17" PLOT SCALE 1:1

APPENDIX A

SITE PHOTOGRAPHIC LOG

Photo 1 – 'Bare' cover type at Station 13+500

Photo 2 – 'Grass' cover type at Station 15+000

Photo 3 – 'Shrub' cover type at Station 19+000

Photo 4 – 'Treed' cover type at Station 22+500

Photo 5 – Example of a muskeg organic soil under the 'Shrub' cover type. Station 15+500

Photo 6 – Example of a muskeg organic soil under the 'Treed' cover type. Station 21+000

Photo 7 – Example of a composite cover type. Grass and shrub type at Station 17+000.

APPENDIX B

FULL RECORDS FOR EACH TRANSECT

APPENDIX B
RESULTS OF VEGETATION COVER SURVEY

Station	SubSection	Bank [*1]	Transect Orientation	Cover Type	Start (m)	End (m)	Organic Layer (cm)
13+500	A	Left	Northwest	Grass 30% Open Water 20% Bare 50%	0	40	2
				Shrub 50 Grass 50	40	45	5
				Shrub	45	85	3
				Grass	85	90	5
				Shrub	90	100	5
	B	Right	South-East	Grass	0	10	5
				Shrub 20% Grass 80%	10	25	5
				Shrub (30%) Grass 70%	25	40	5
				Bare soil	40	45	1
				Grass 80% Shrub 20%	45	60	3
				Grass 30% Bare 70%	60	100	1
14+000	A	Left	Northwest	Grass	0	13	10
				Shrub	13	22	5
				Shrub 50% Grass 50%	22	73	5
				Shrub 75% Treed 25%	73	100	4
	B	Right	South-East	Grass	0	6	5
				Shrub	6	40	10
				Treed	40	100	6
14+500	A	Left	Northwest	Grass	0	14	14
				Shrub	14	40	4
				Treed	40	100	4
	B	Right	South-East	Grass	0	23	15
				Shrub	23	45	2
				Treed	45	100	2
15+000	A	Left	Northwest	Shrub 50% Grass 50%	0	24	2
				Shrub	24	55	2
				Treed	55	100	5
	B	Right	South-East	Shrub	0	75	4
				Shrub	75	100	>30
15+500	A	Left	Northwest	Grass	0	10	20
				Shrub	10	20	6
				Treed	20	70	1
				Shrub	70	100	6
15+500	B	Right	South-East	Grass	0	15	20
				Shrub	15	50	8
				Treed	50	80	6
				Shrub	80	100	10
16+000	A	Left	Northwest	Bare 50% Grass 50%	0	5	1
				Shrub	5	12	0
				Treed	12	33	1
				Shrub	33	100	2
	B	Right	South-East	Grass	0	30	1
				Shrub	30	100	6
16+500	A	Left	North	Shrub	0	100	1
	B	Right	South	Shrub	0	60	12cm at toe of slope, 8cm mid slope, 5cm top of slope
				shrub	60	100	>30
17+000	A	Left	North-Northwest	Grass	0	2	1
				Shrub	2	4	1
				Grass	4	10	1
				Shrub	10	100	2
	B	Right	South-East	Grass	0	35	2
				Shrub	35	100	8
17+500	A	Left	West	Grass 70% Shrub 30%	0	16	15
				Shrub	16	35	12
				Shrub	35	80	6
				Teed 50% Grass 30% Shrub 20%	80	100	4
	B	Right	East	Grass 50% Shrub 50%	0	2	10
				Shrub 80% Grass 20%	2	25	5
				Shrub	25	36	5
				Shrub	36	100	>30

APPENDIX B
RESULTS OF VEGETATION COVER SURVEY

Station	SubSection	Bank *1	Transect Orientation	Cover Type	Start (m)	End (m)	Organic Layer (cm)
18+000	A	Left	West	Grass	0	25	>30
				Grass 50 Shrub 50	25	37	20
				Shrub	37	61	9
				Treed 70% Shrub 30%	61	85	8
				Treed	85	100	8
	B	Right	East	Grass	0	8	25
				Shrub	8	40	10
				Shrub	40	85	>30
				Treed	85	100	>30
18+500	A	Left	West	Shrubs	0	82	2
				Shrub	82	100	>30
	B	Right	East	Grass 70% Shrub 40%	0	50	Unknown - inudated with water
				Shrub 90% Grass 10%	50	100	7
19+000	A	Left	Southwest	Grass 80% Shrub 20%	0	20	Unknown - inudated with water
				Shrub	20	34	12
				Shrub 60% Treed 40%	34	40	8
				Shrub	40	55	7
				Treed 80% Grass 50%	55	80	18
				Shrub 60% Treed 40%	80	100	20
	B	Right	Northeast	Grass	0	12	Unknown - inudated with water
				Shrub 80% Grass 20%	12	18	9
				Shrub	18	30	9
				Shrub 60% Grass 80%	30	46	25
				Treed 60% Shrub 40%	46	91	13
				Shrub	91	100	>30cm
19+500	A	Left	West	Grass 70% Bare 30%	0	21	0
				Treed	21	75	12
				Treed	75	91	>30
				Shrub	91	100	>30
	B	Right	East	Shrub 50% Bare 50%	0	11	Unknown - inudated with water
				Shrub 60% Grass 40%	11	21	2
				Treed 90% Shrub 10%	21	100	5
20+000	A	Left	South	Grass 80% Shrub 20%	0	40	Unknown - inudated with water
				Shrub 90% Gras 10%	40	74	4
				Grass 50% Shrub 50%	74	100	4
	B	Right	North	Grass 50% Shrub 50%	0	20	7
				Shrub	20	70	10
				Shrub	70	100	>30
20+500	A	Left	Northwest	Grass	0	15	5
				Shrub 50% Grass 50%	15	25	5
				Treed	25	100	>30
	B	Right	South east	Grass	0	20	19
				Shrub	20	65	15
				Treed	65	100	10
21+000	A	Left	West	Shrub 50% Grass 80%	0	27	10
				Shrub	27	100	8
21+000	B	Right	East	Grass 100% Shrub 20%	0	10	5
				Shrub	10	45	10
				Treed	45	100	>30
21+500	A	Left	Southwest	Shrub 90% Grass 10%	0	10	Unknown - inudated with water
				Teed 60% Shrub 40%	10	50	6
				Treed	50	100	>30
	B	Right	Northeast	Shrub 50% Grass 50%	0	30	20
				Treed	30	60	20
				Treed	60	100	>30
22+000	A	Left	Southwest	Shrub 70% Grass 30%	0	20	21
				Treed	20	100	>30
	B	Right	Northeast	Shrub 50% Grass 50%	0	10	11
				Treed	10	40	8
				Treed	40	100	>30

APPENDIX B
RESULTS OF VEGETATION COVER SURVEY

Station	SubSection	Bank *1	Transect Orientation	Cover Type	Start (m)	End (m)	Organic Layer (cm)
22+500	A	Left	West	Shrub 90% Grass 10%	0	20	6
				Treed	20	100	>30
	B	Right	East	Shrub	0	45	6
				Treed	45	100	>30
23+000	A	Left	Southwest	Grass 50% Shrub 50%	0	15	3
				Treed	15	50	25
				Treed	50	100	>30
	B	Right	Northeast	Grass 33% Shrub 33% Tree 33%	0	5	No measurement
				Treed	5	100	>30
23+500	A	Left	South	Grass 50% Shrub 80%	0	42	6
				Treed	42	100	8
	B	Right	North	Treed	0	30	10
				Treed	30	100	>30
24+000	A	Left	West	Shrub	0	50	8
				Treed	50	100	>30
	B	Right	East	Shrub 50% Grass 80%	0	25	>30
				Treed	25	100	>30
24+500	A	Left	West	Shrub	0	40	10
				Treed	40	100	>30
	B	Right	East	Shrub 75% Grass 25%	0	55	9
				Treed	55	100	>30
25+000	A	Left	Northwest	Shrub	0	53	7
				Treed	53	100	>30
25+000	B	Right	East	Shrub	0	55	22
				Shrub	55	68	>30
				Treed 20% Shrub 80%	68	100	>30
25+500	A	Left	West	Shrubs 80% Grass 20%	0	50	4
				Grass 40% Shrub 60%	50	90	8
				Shrub	90	100	>30
	B	Right	East	Shrub	0	85	3
				Shrub	85	100	>30
26+000	A	Left	East	Grass	0	63	4
				Shrub	63	100	6
	B	Right	West	Shrub	0	92	5
				Grass 80% Shrub 20%	92	100	17
26+500	A	Left	South	Grass 100% Shrub 40%	0	53	6
				Shrub 80% Grass 40%	53	100	14
	B	Right	North	Shrub 70% Grass 40%	0	30	2
				Shrub	30	65	5
				Treed	65	100	20
27+000	A	Left	West	Grass 50% Shrub 50%	0	15	5
				Shrub	15	45	10
				Treed	45	100	15
	B	Right	East	Grass 80% Shrub 40%	0	30	9
				Shrub	30	70	22
				Shrub	70	85	>30
				Treed	85	100	>30
27+500	A	Left	West	Grass 50% Shrub 50%	0	15	5
				Shrub	15	40	7
				Treed	40	85	25
				Shrub	85	100	25
	B	Right	East	Grass	0	25	8
				Shrub 50% Grass 50%	25	40	8
				Shrub	40	60	21
				Tree 40% Shrub 60%	60	80	13
				Shrub	80	100	No measurement
28+000	A	Left	West	Shrub	0	40	6
				Treed	40	100	23
	B	Right	East	Grass	0	60	8
				Treed	60	100	15

*1 Note: Bank left or bank right is based on facing downstream.

APPENDIX C

BIG BUFFALO LAKE LAND COVER

Coordinate System: UTM Zone 14, NAD 83
Data Source: Canvec © Her Majesty the Queen in Right of Canada, Department of Natural Resources.

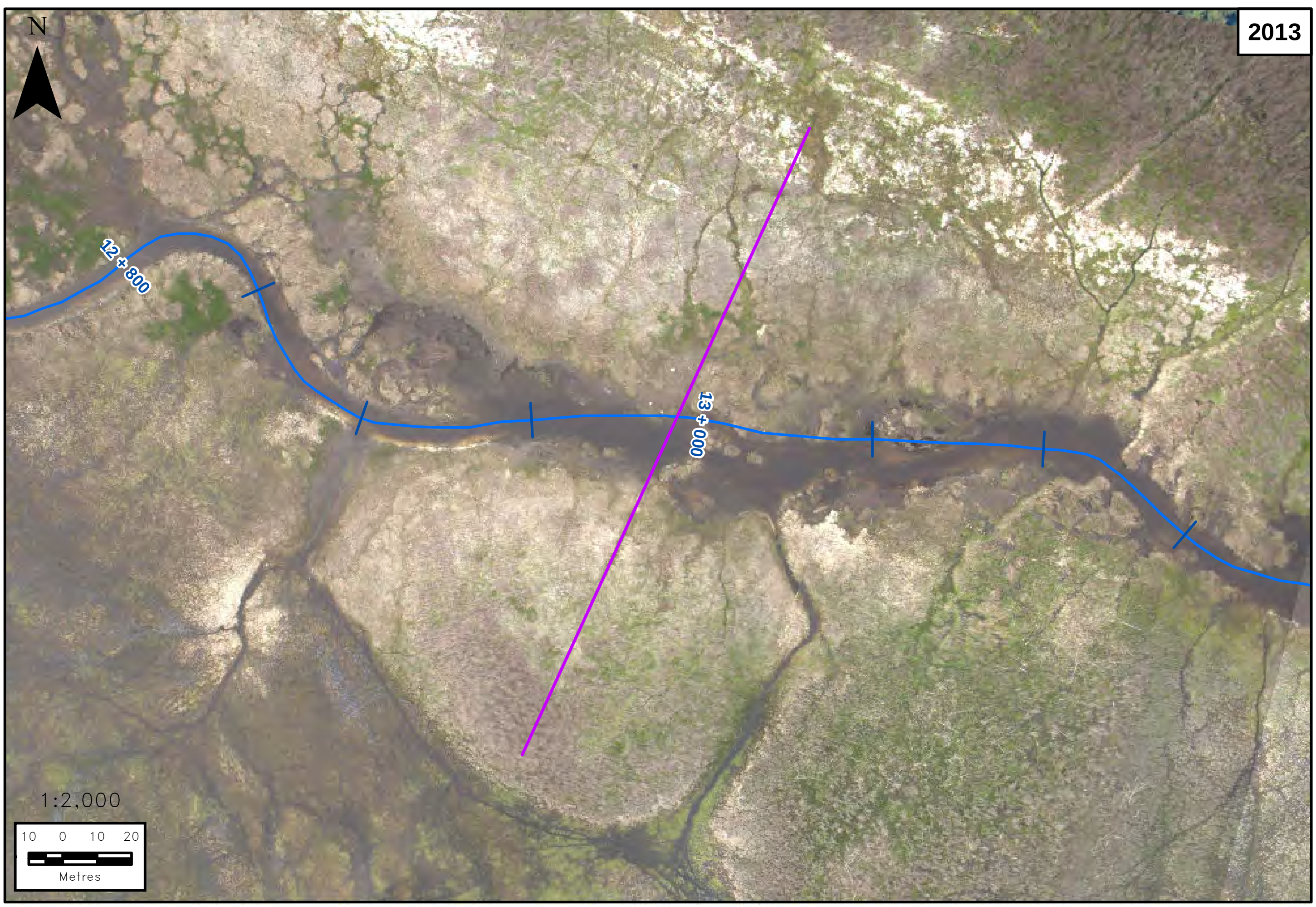
Created By: North/South Consultants
Date Created: 05/10/2011

Big Buffalo Lake Land Cover

Buffalo Creek Vegetation Cover Survey

APPENDIX G

2011, 2013 AND 2014 GAIM IMAGERY COMPARISON



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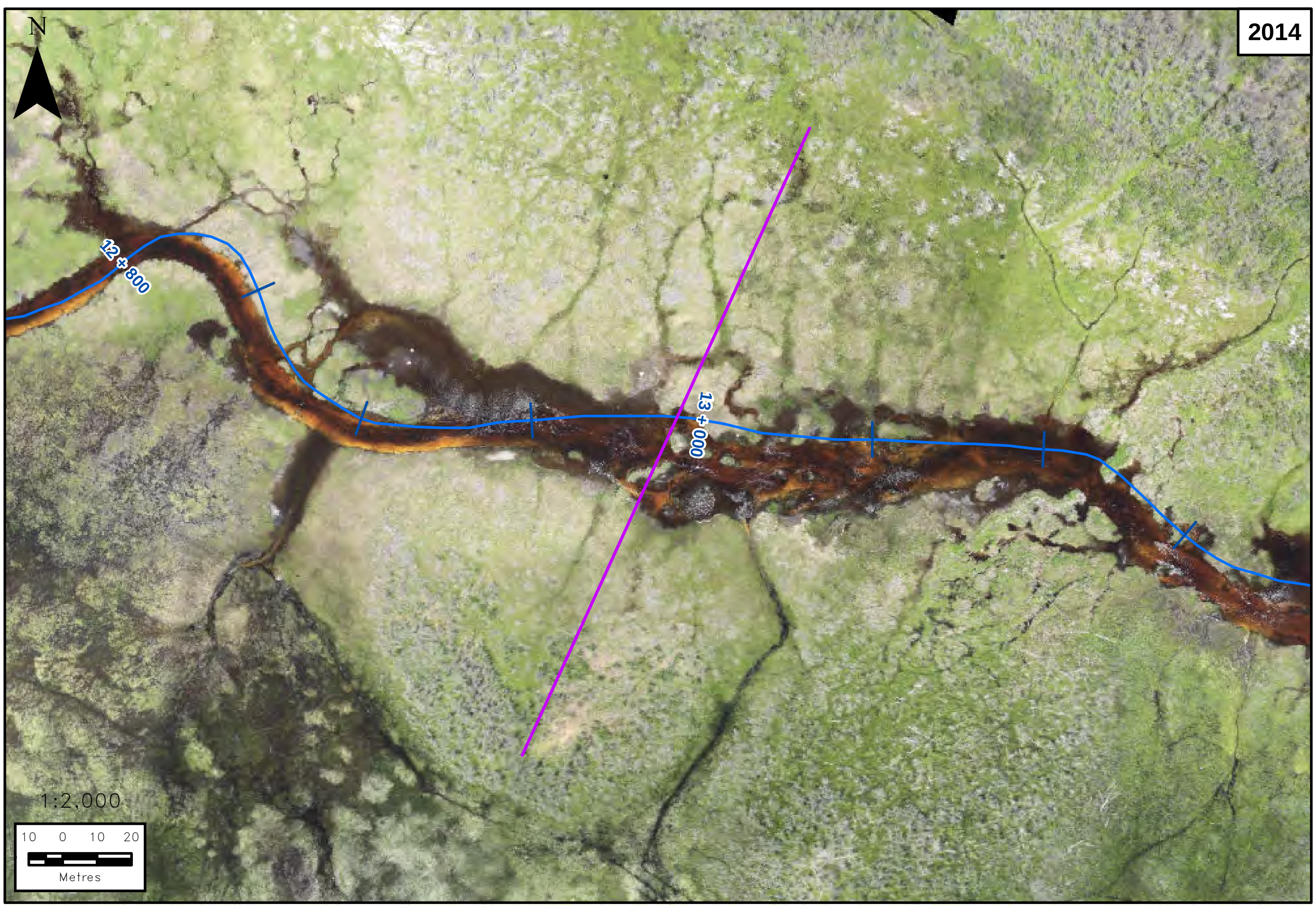

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13 + 400
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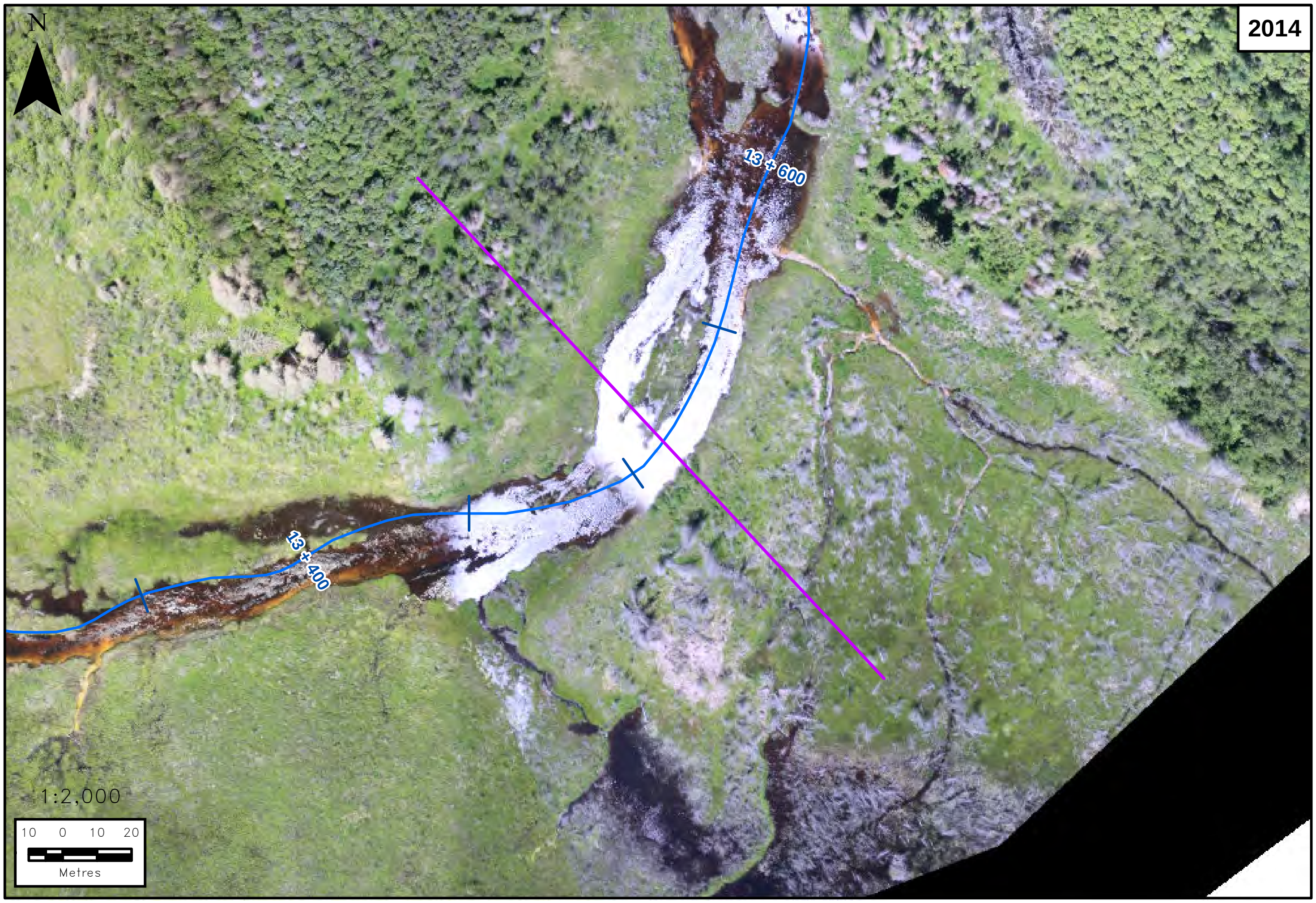
Metres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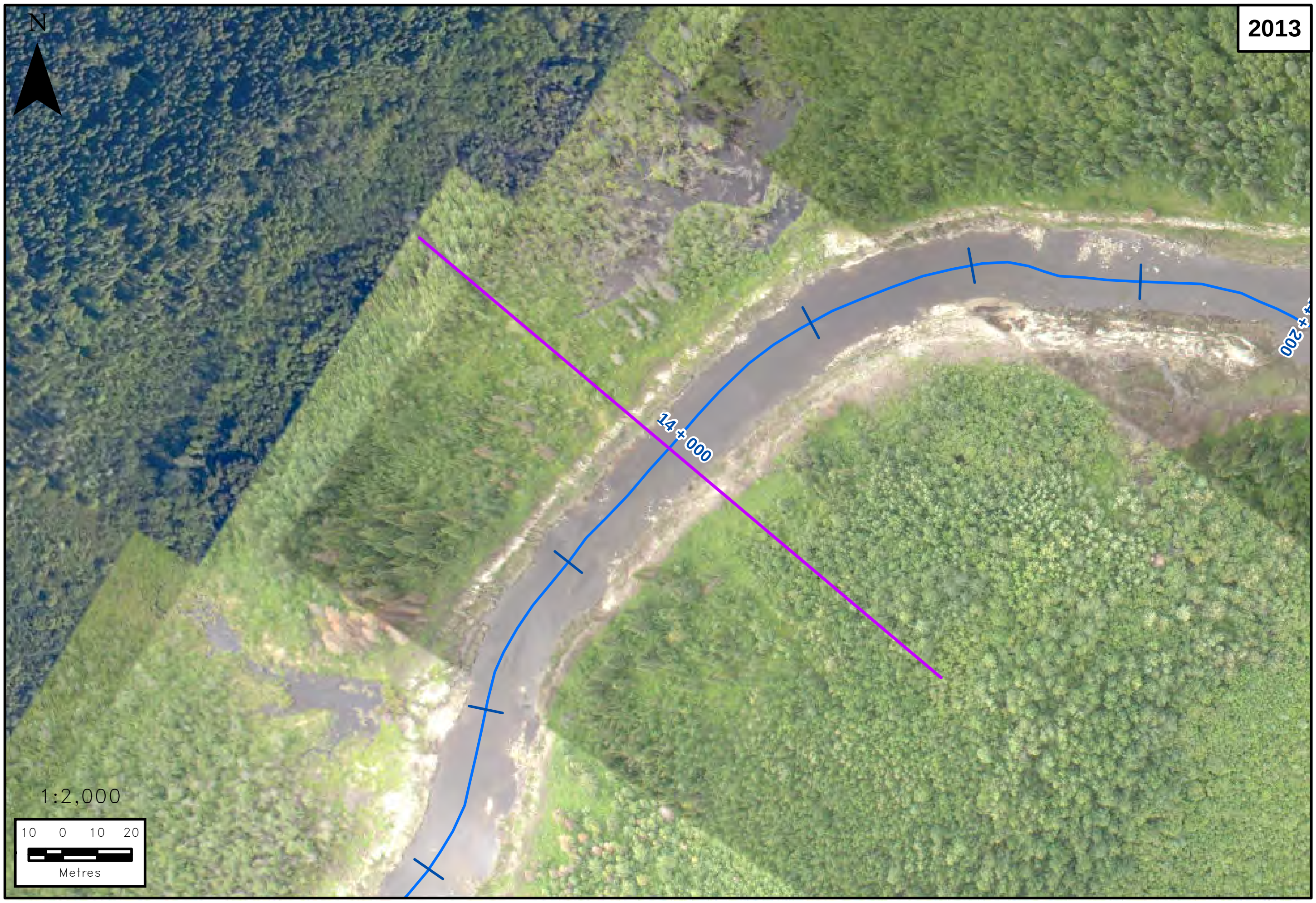
Metres



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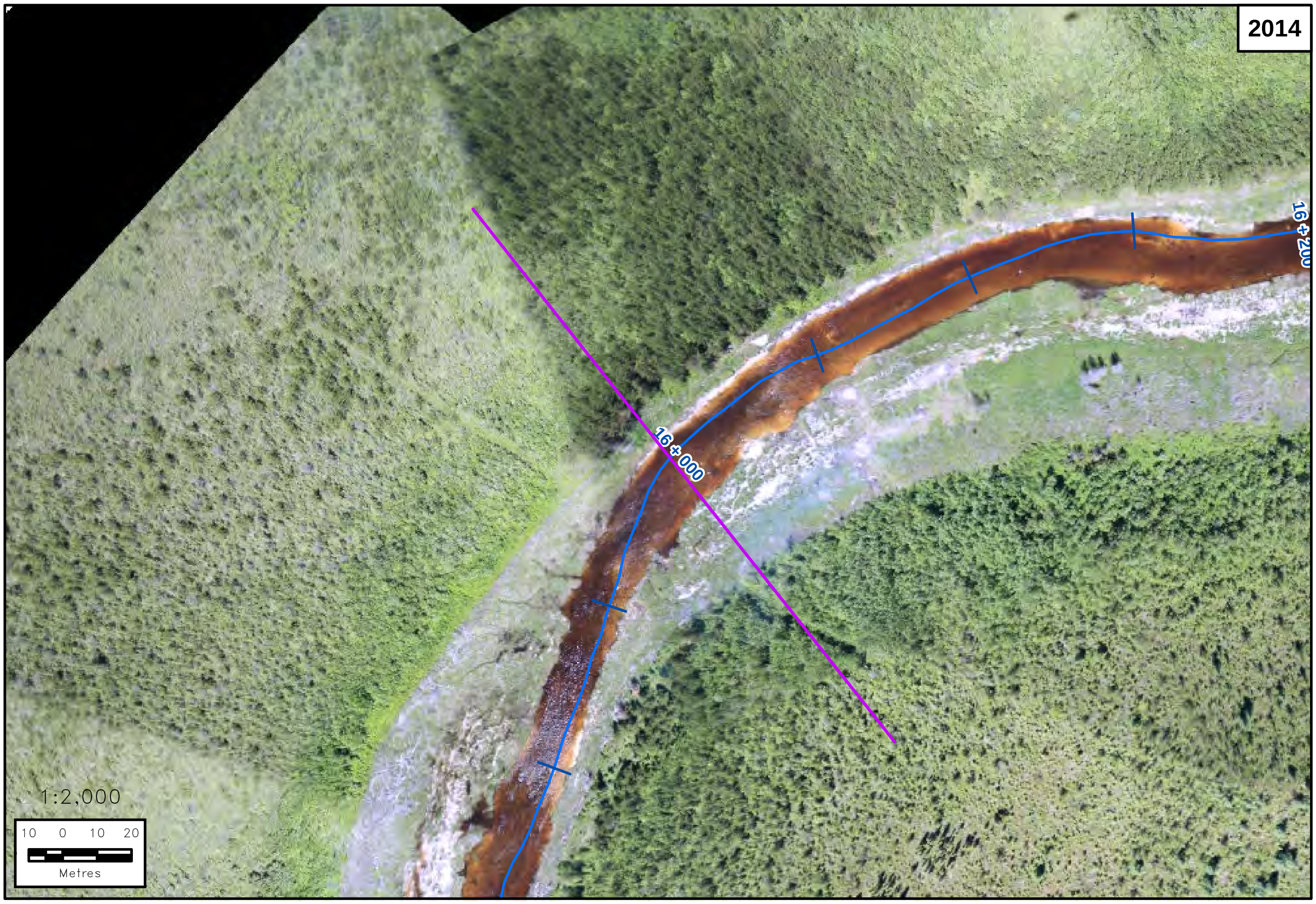

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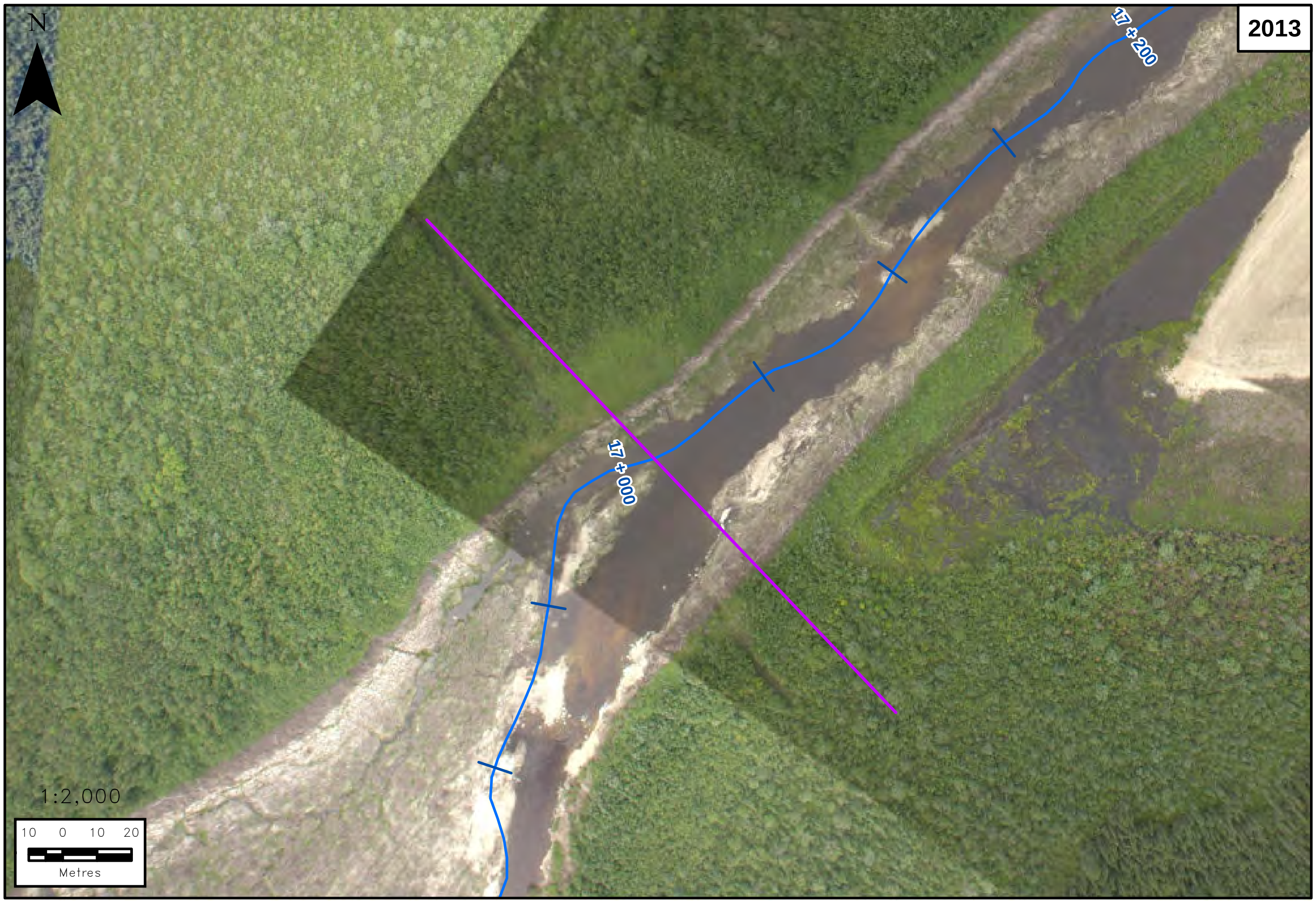

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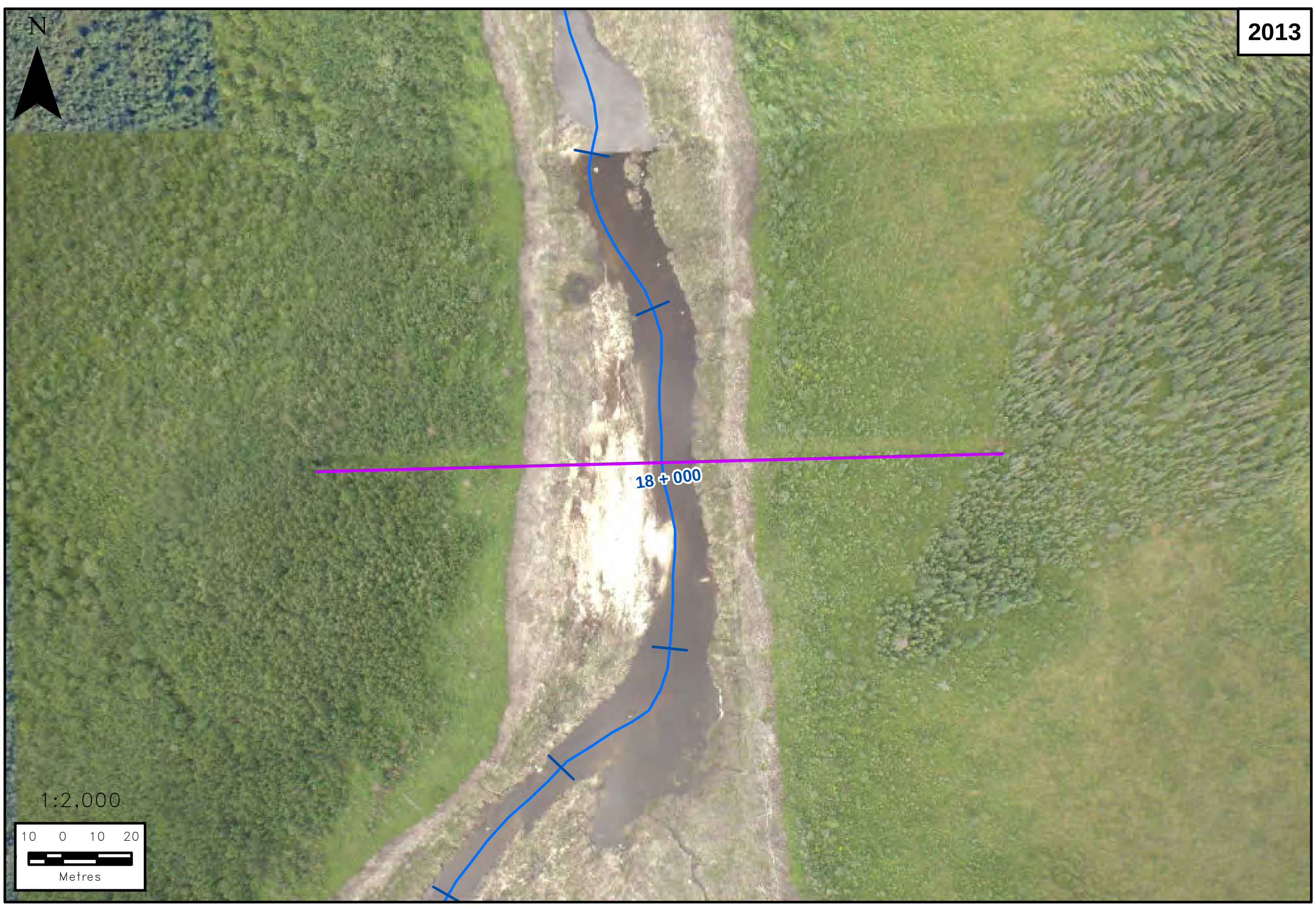

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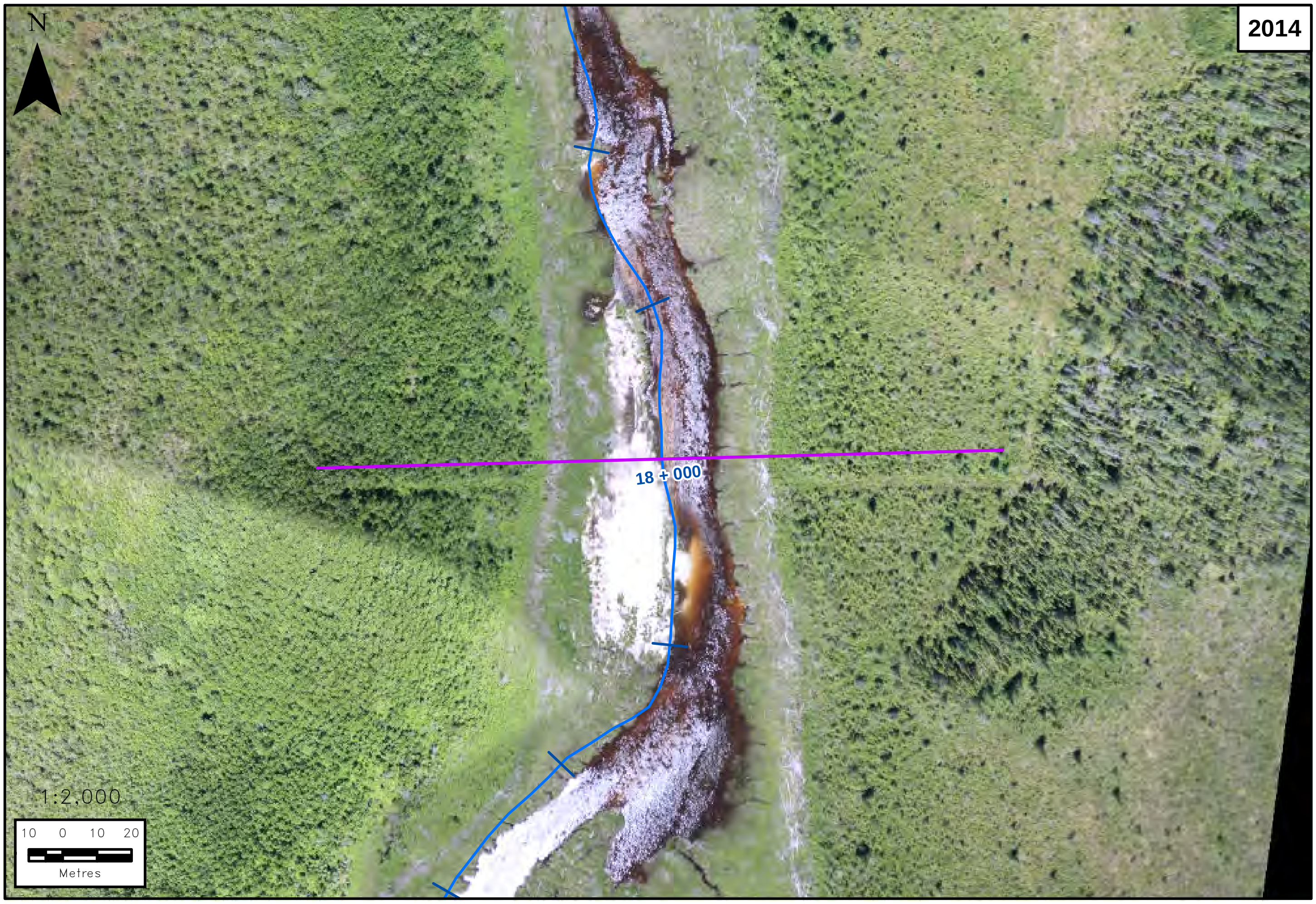

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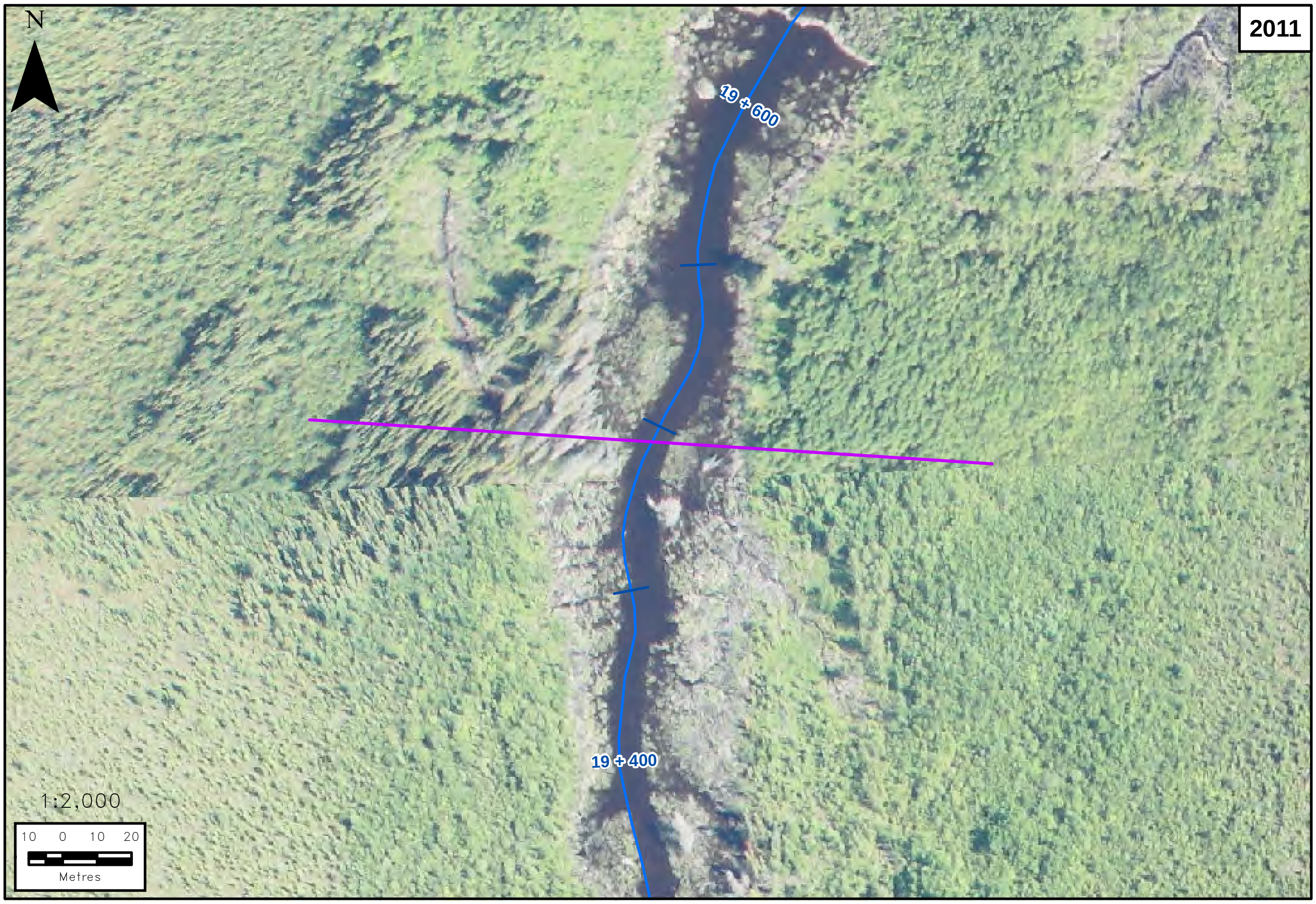

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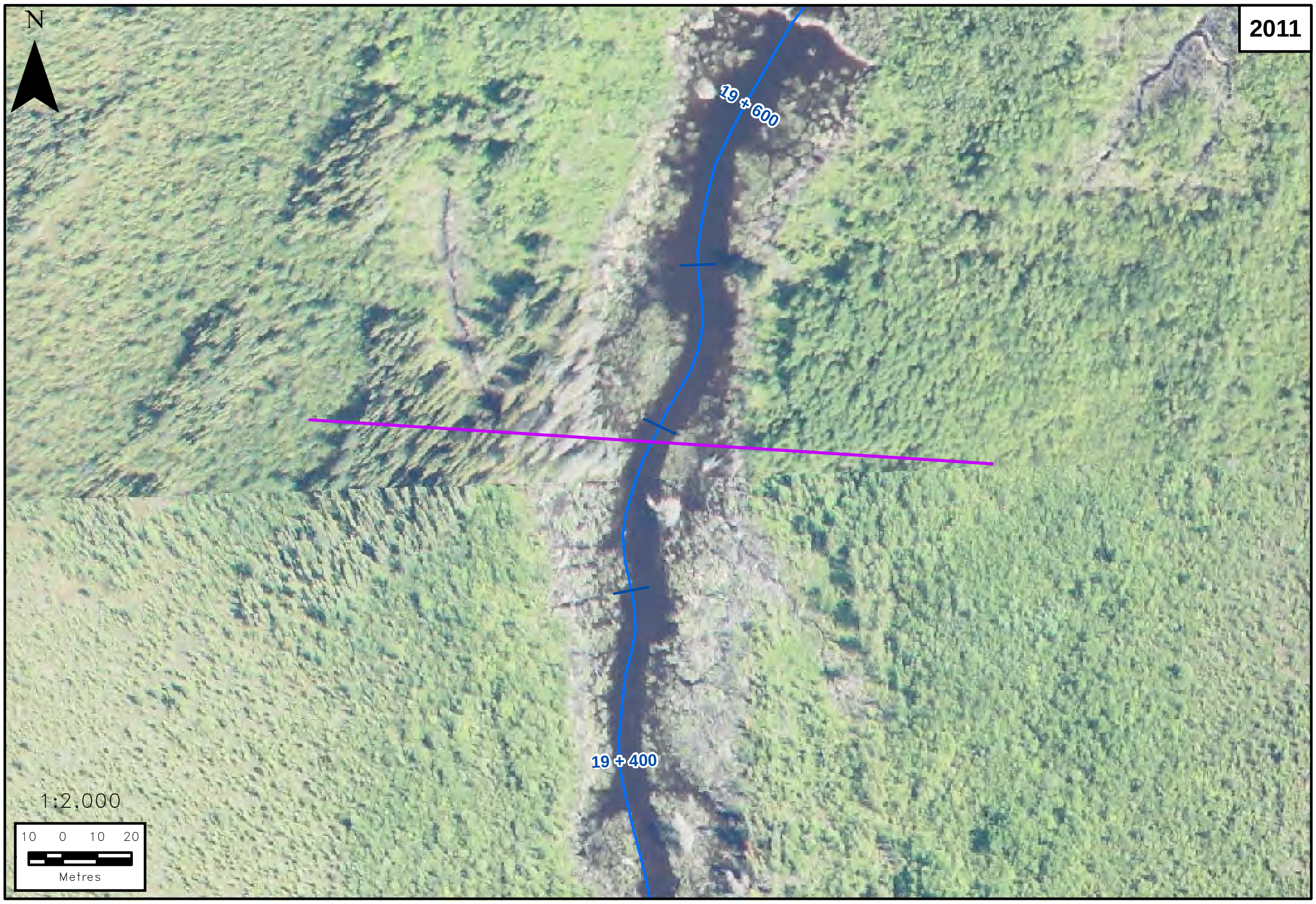

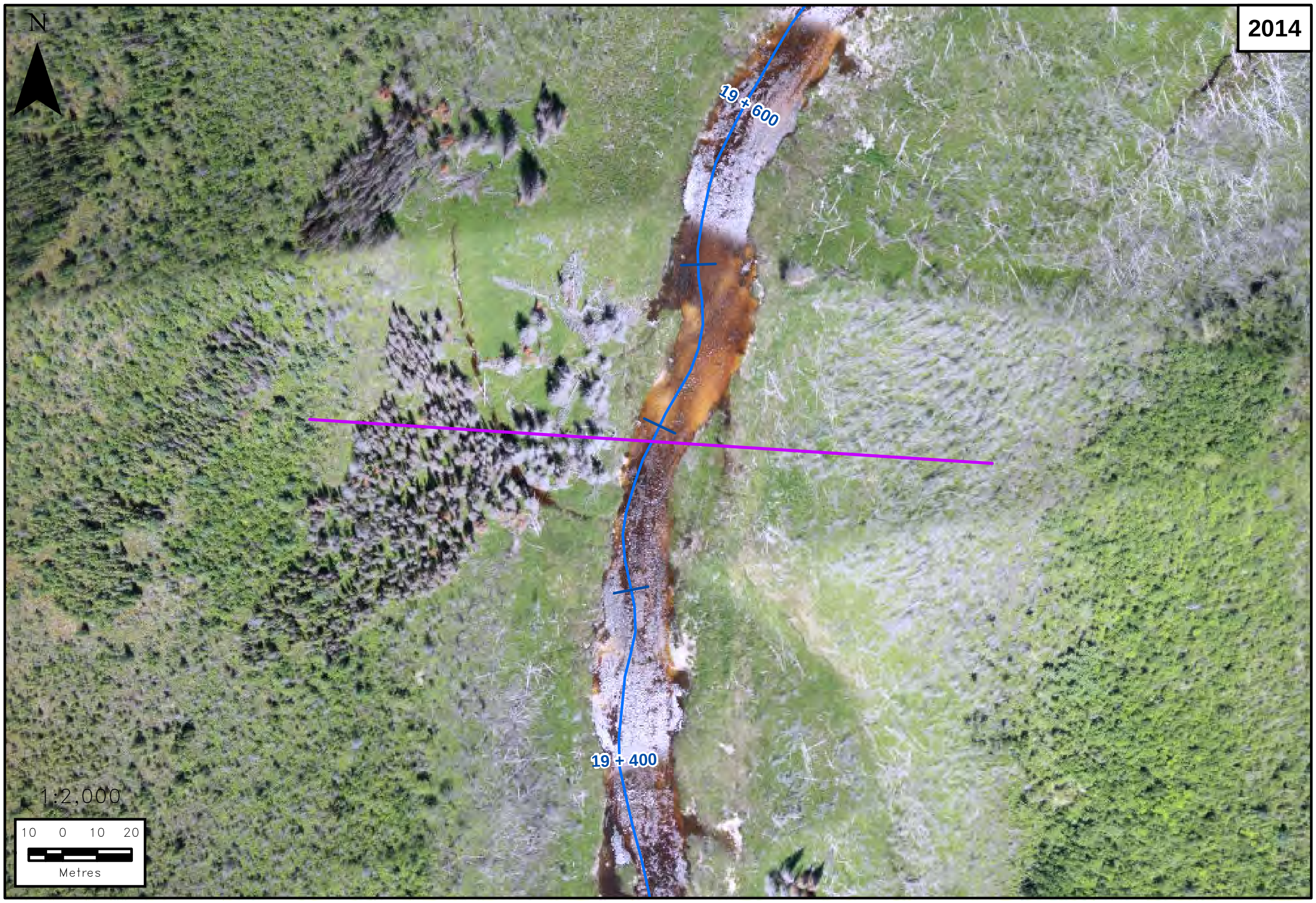

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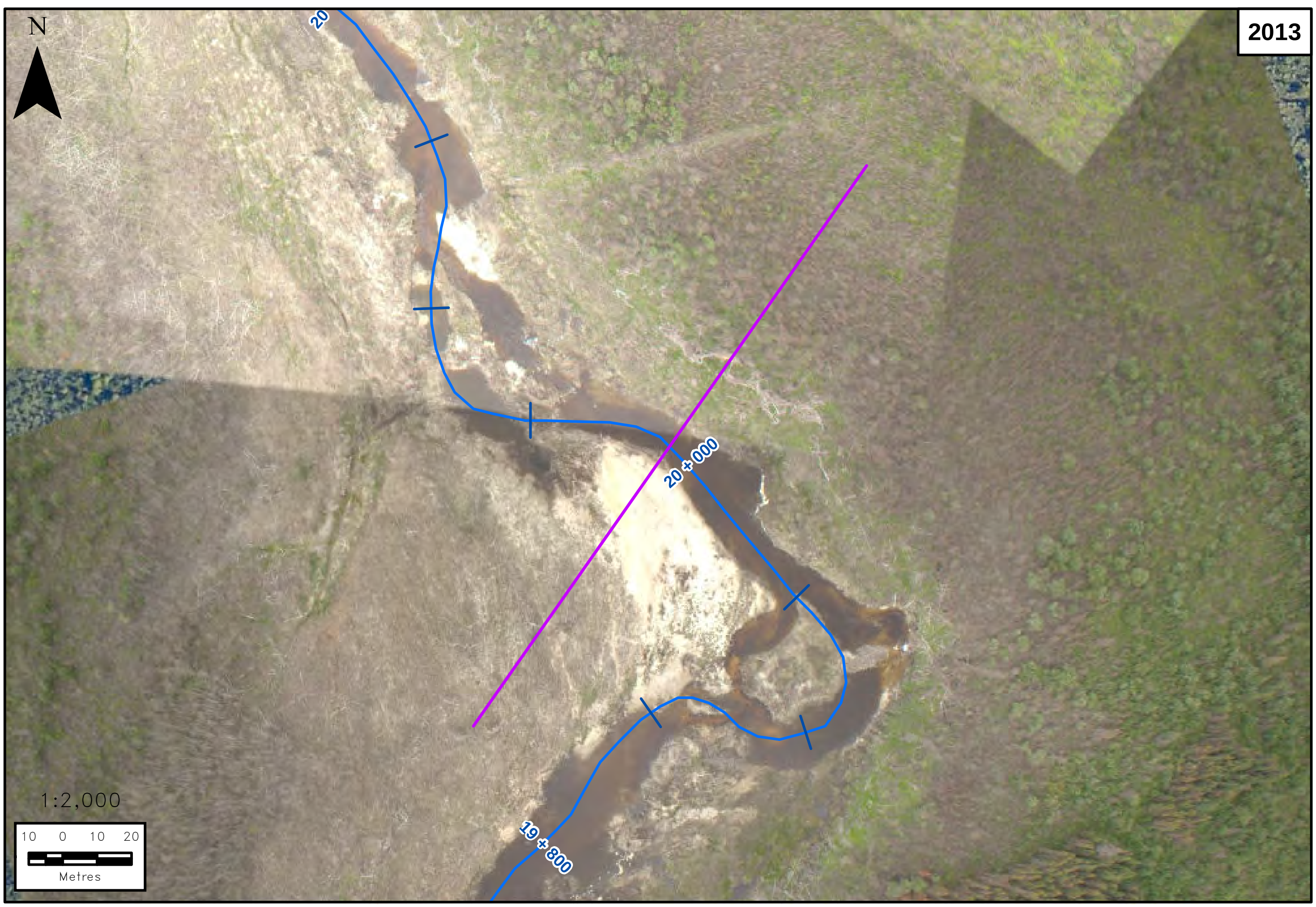

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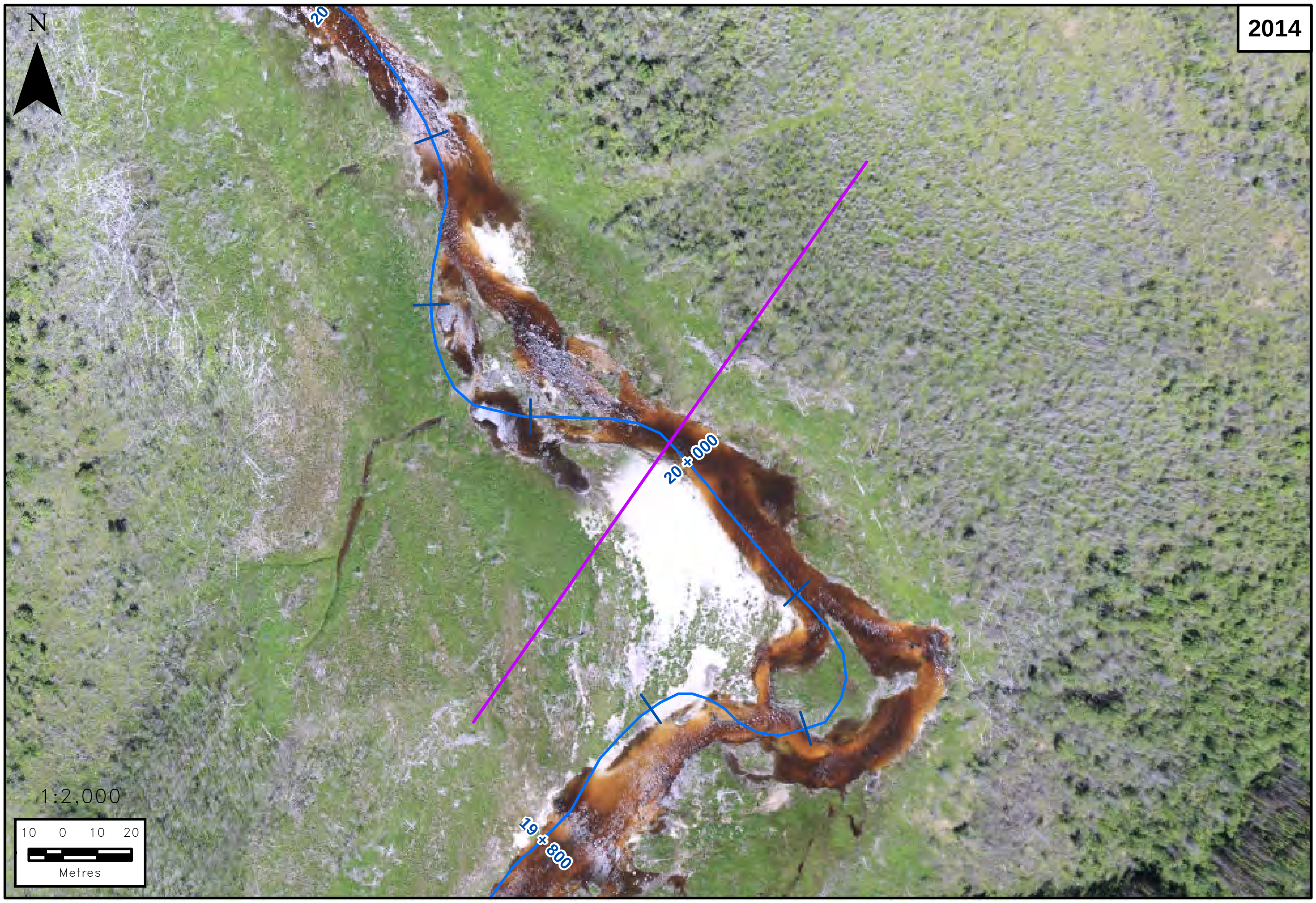

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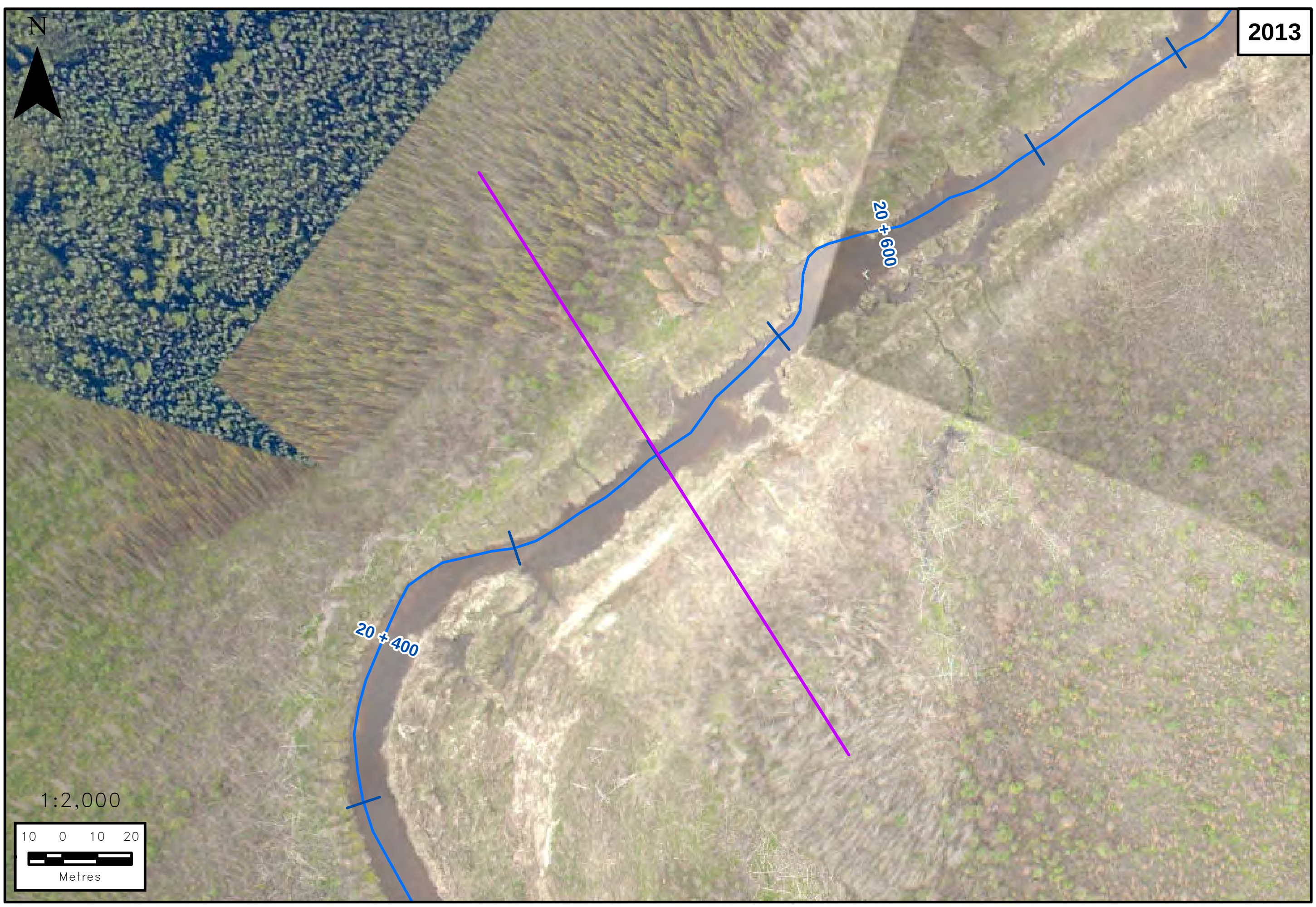

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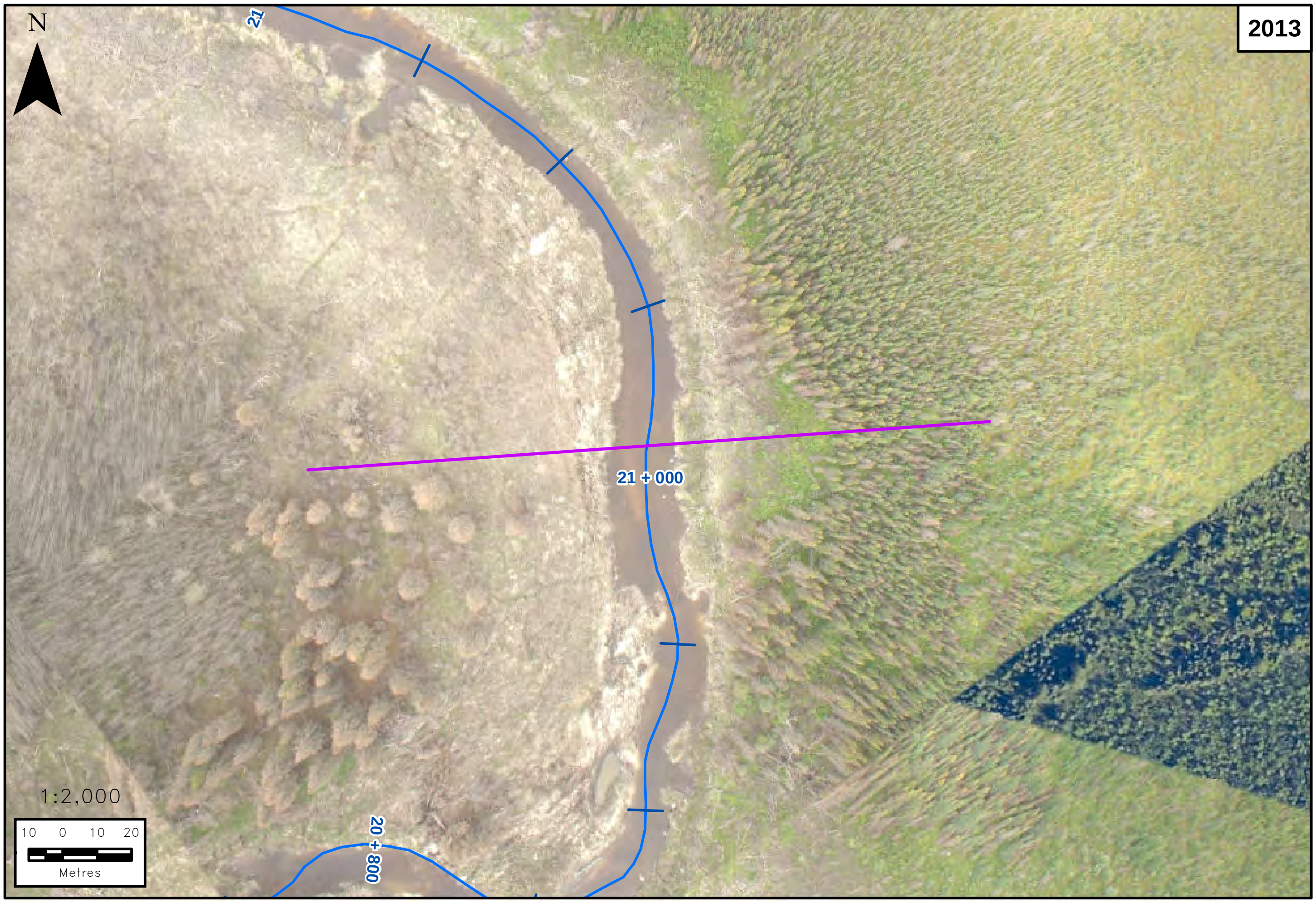

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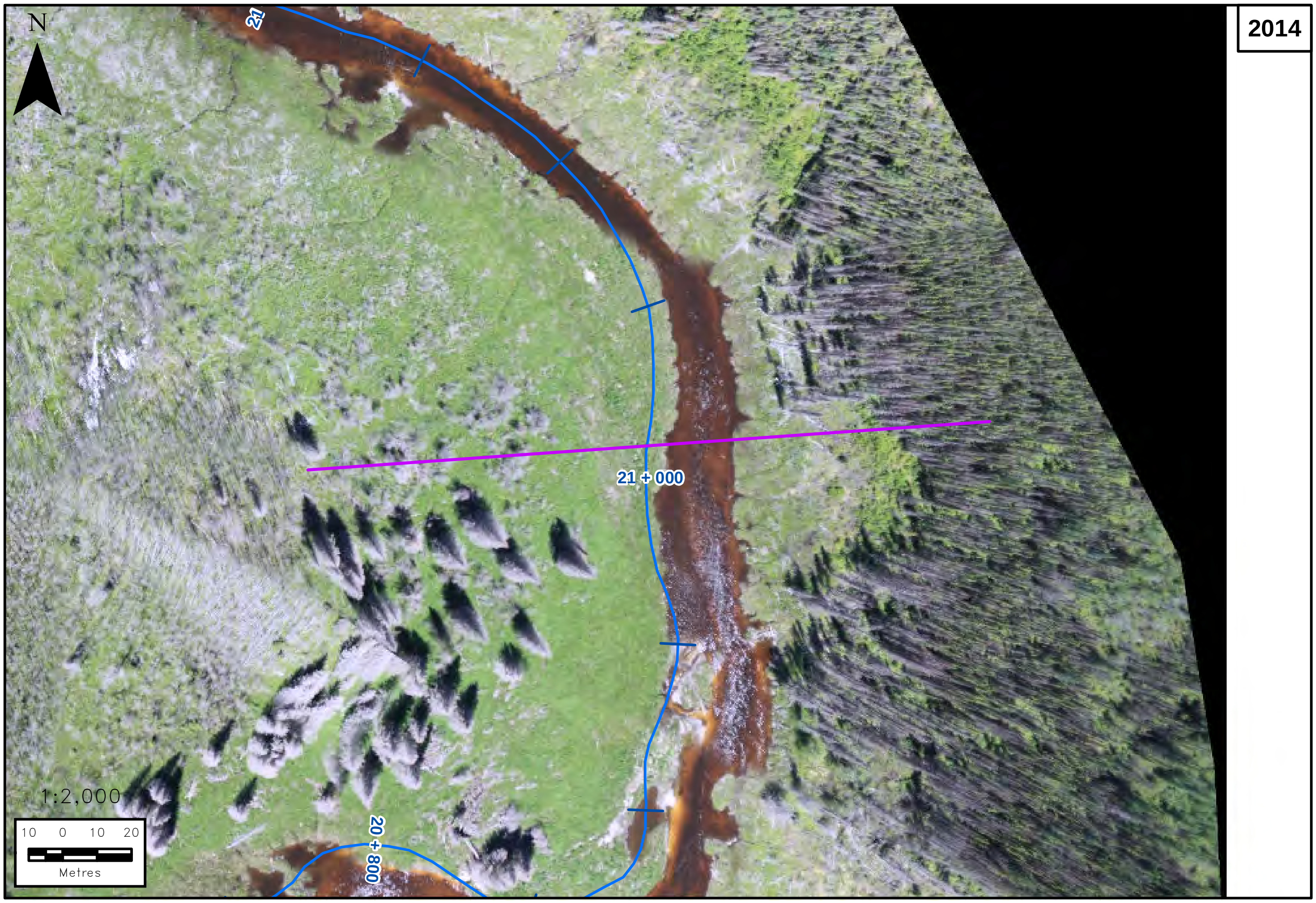

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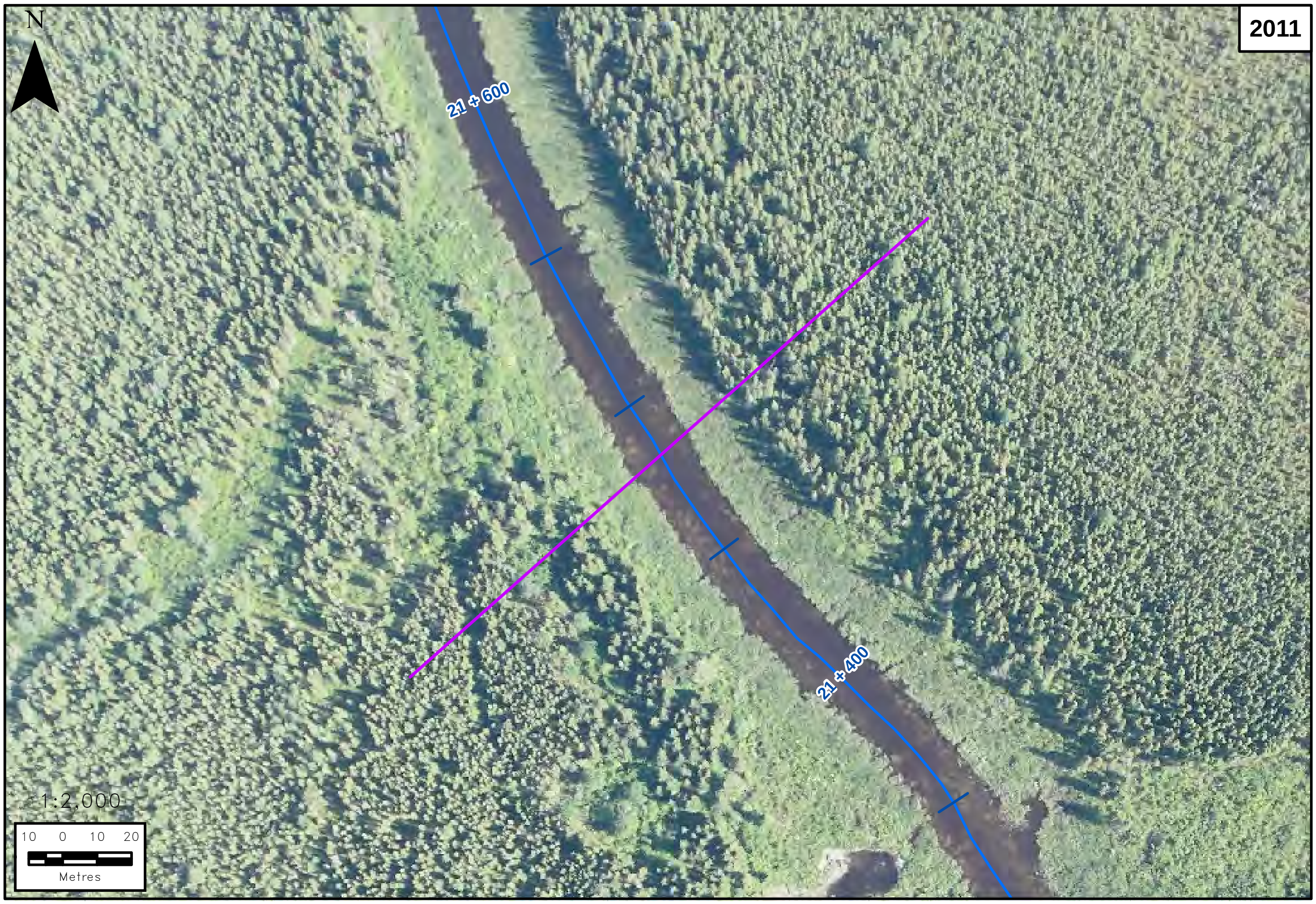

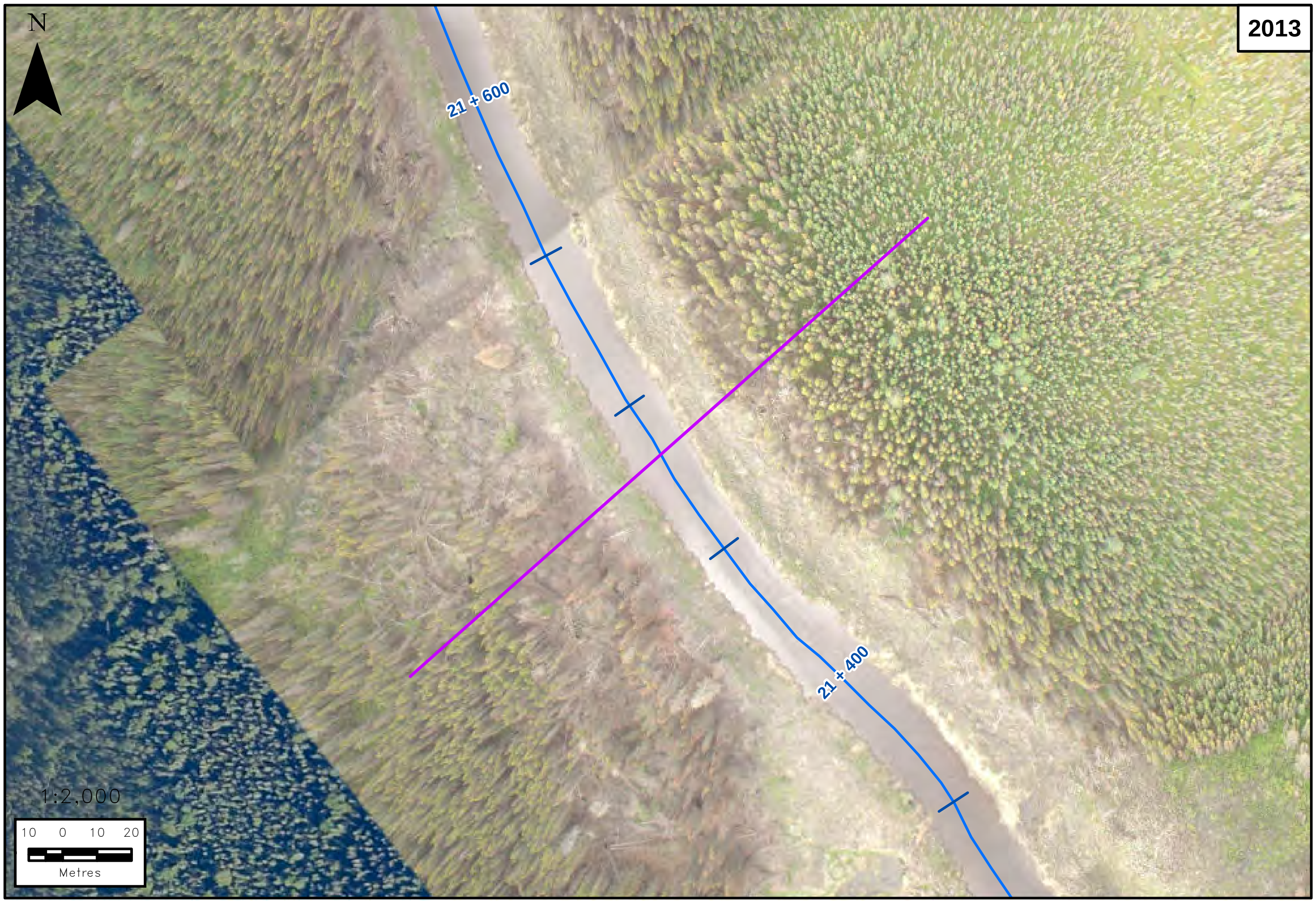

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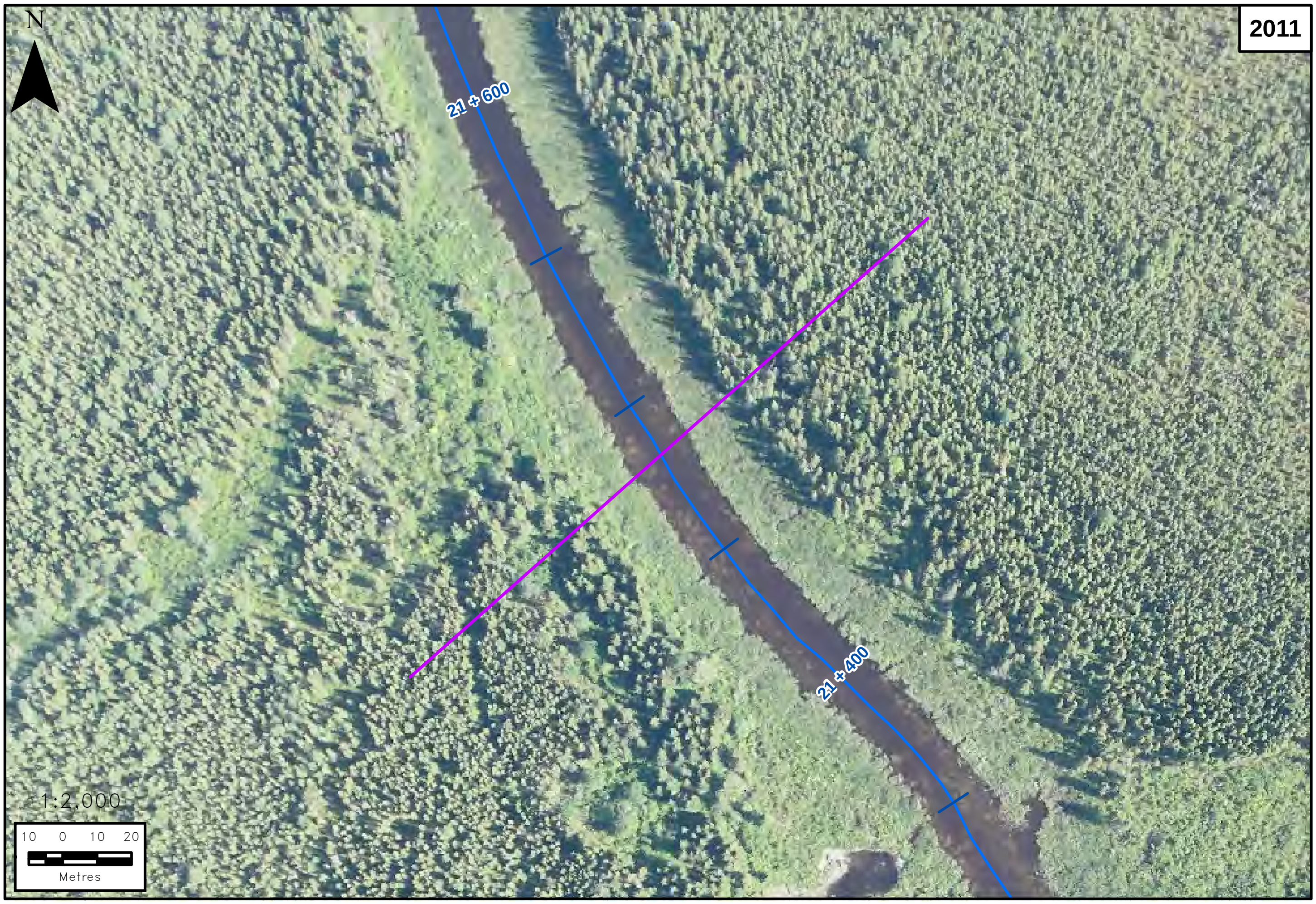

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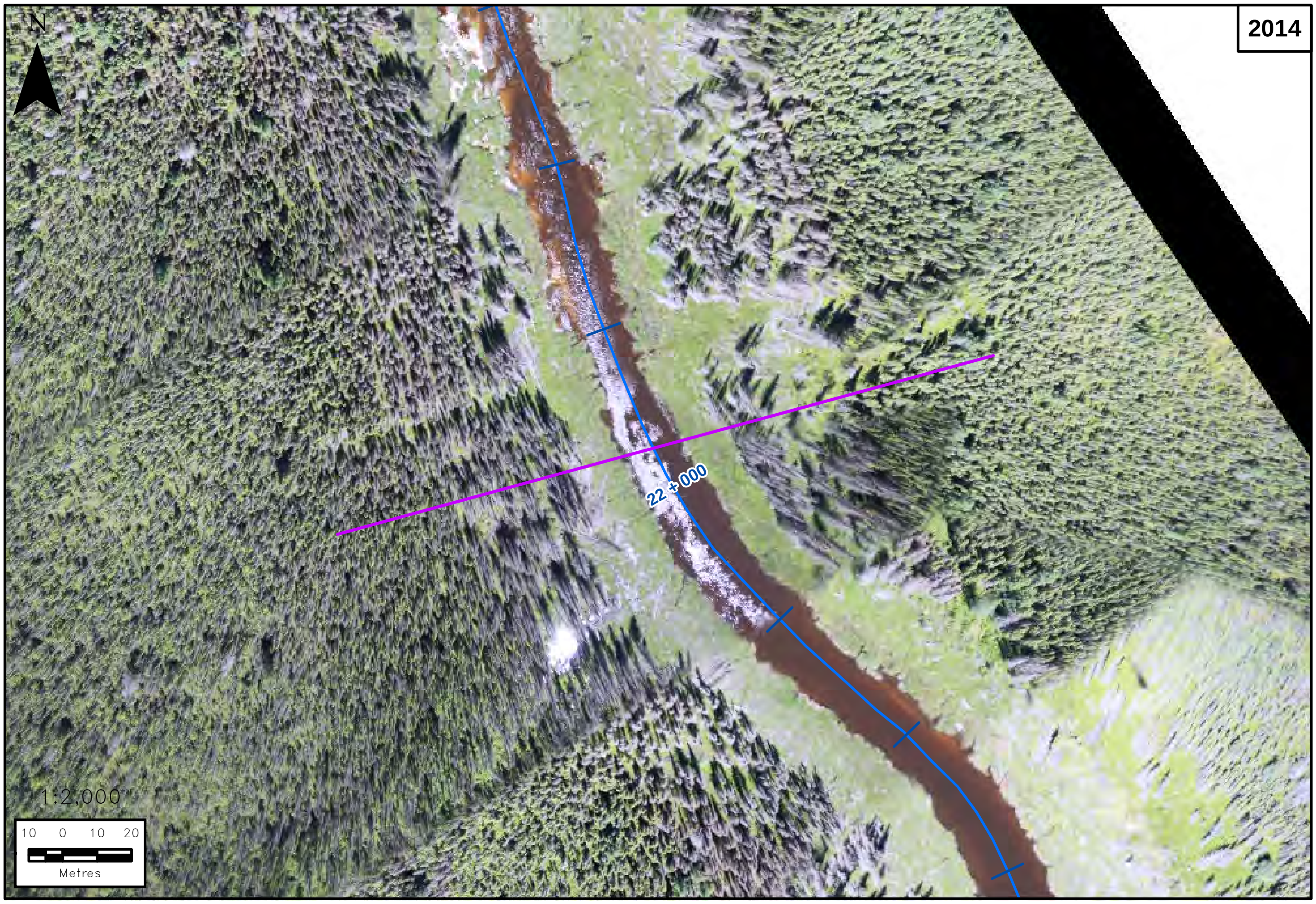

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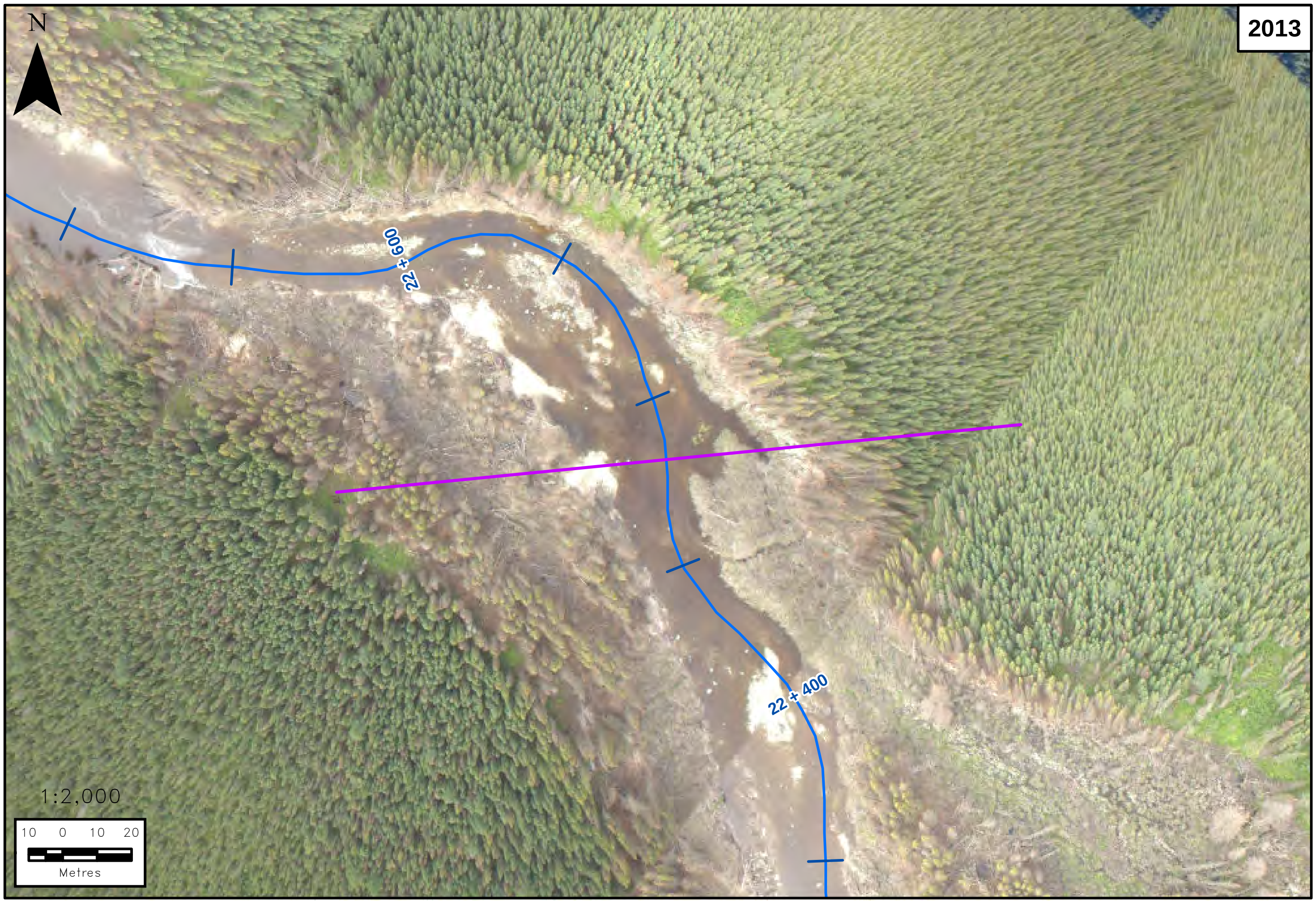

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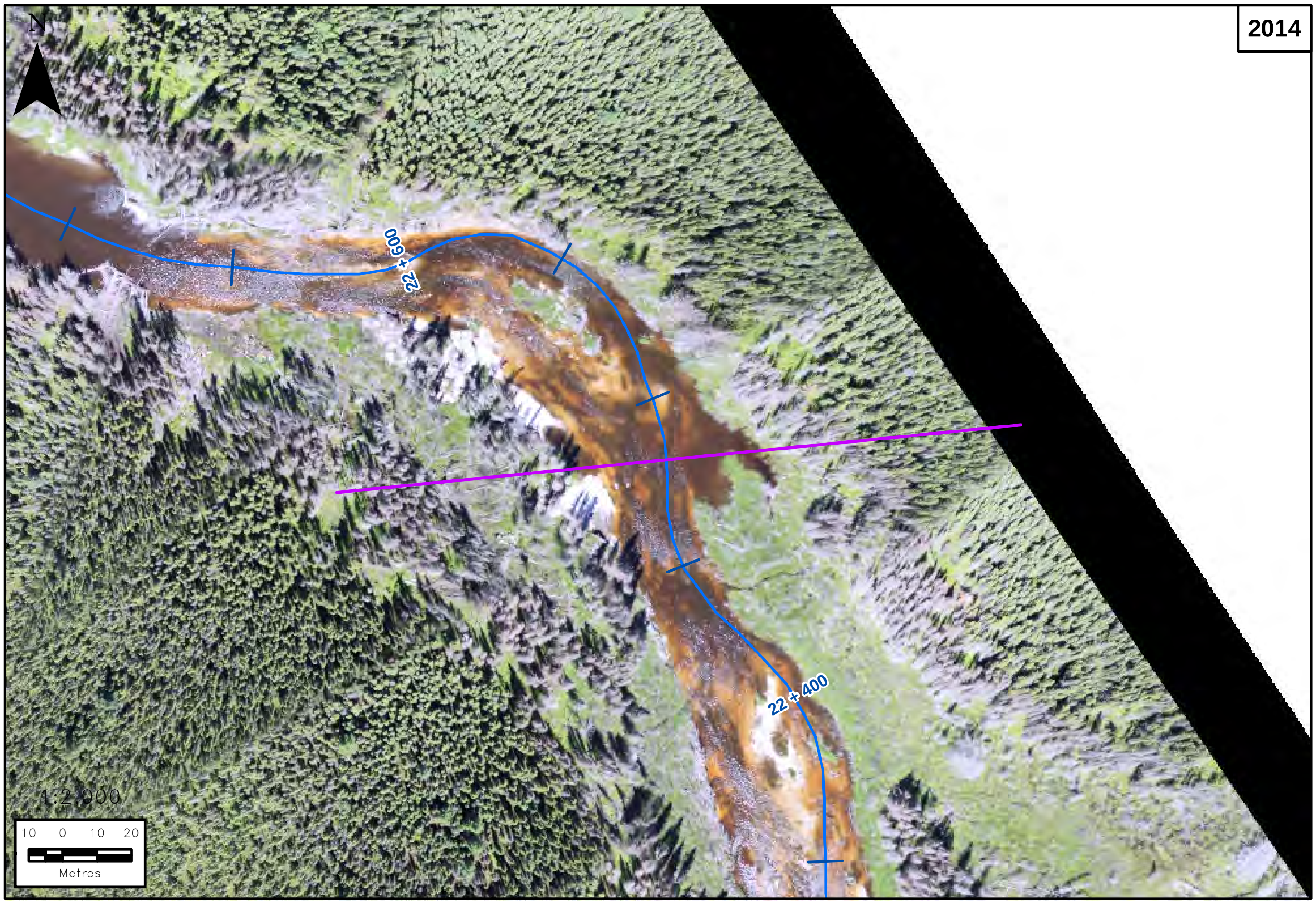

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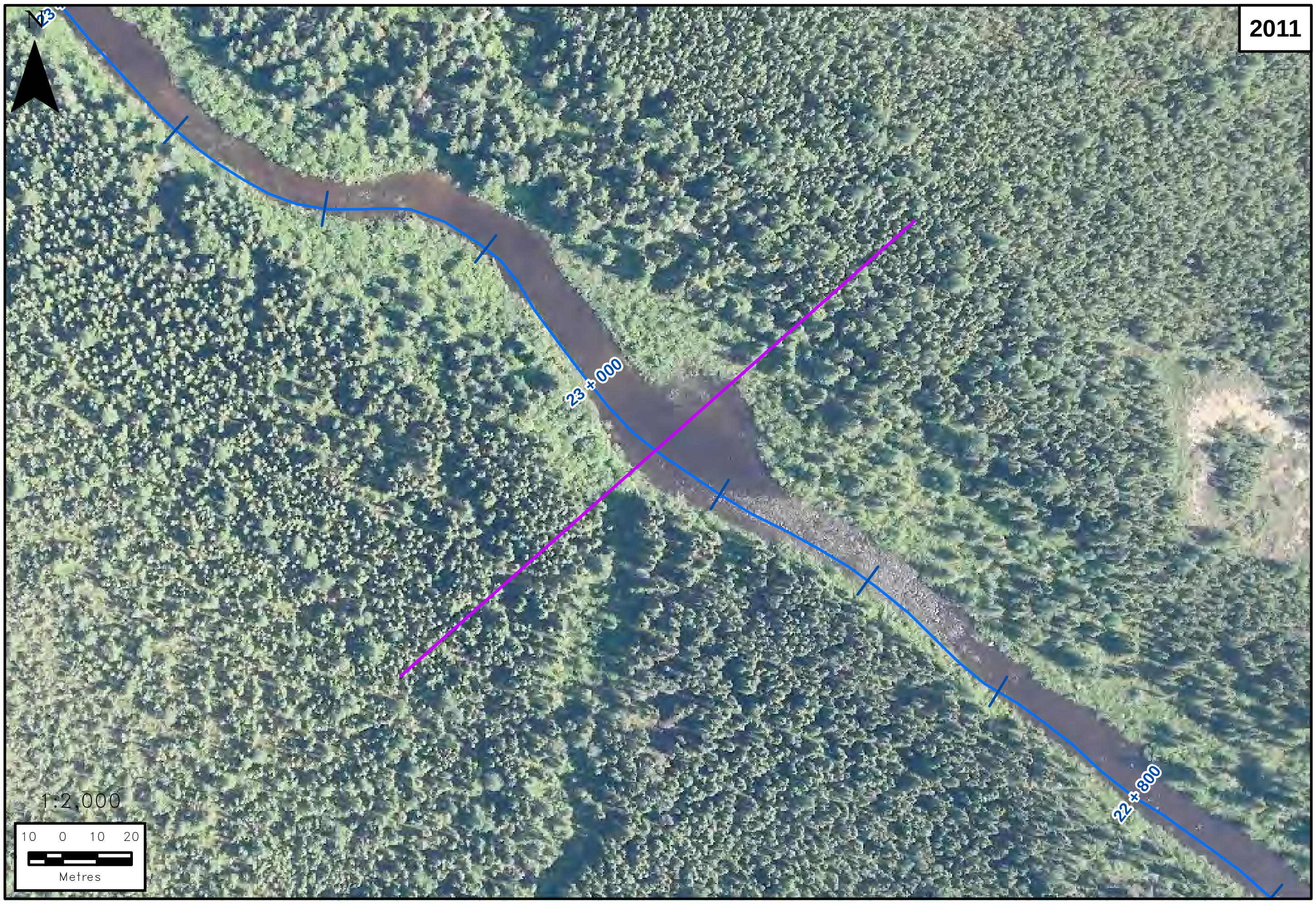

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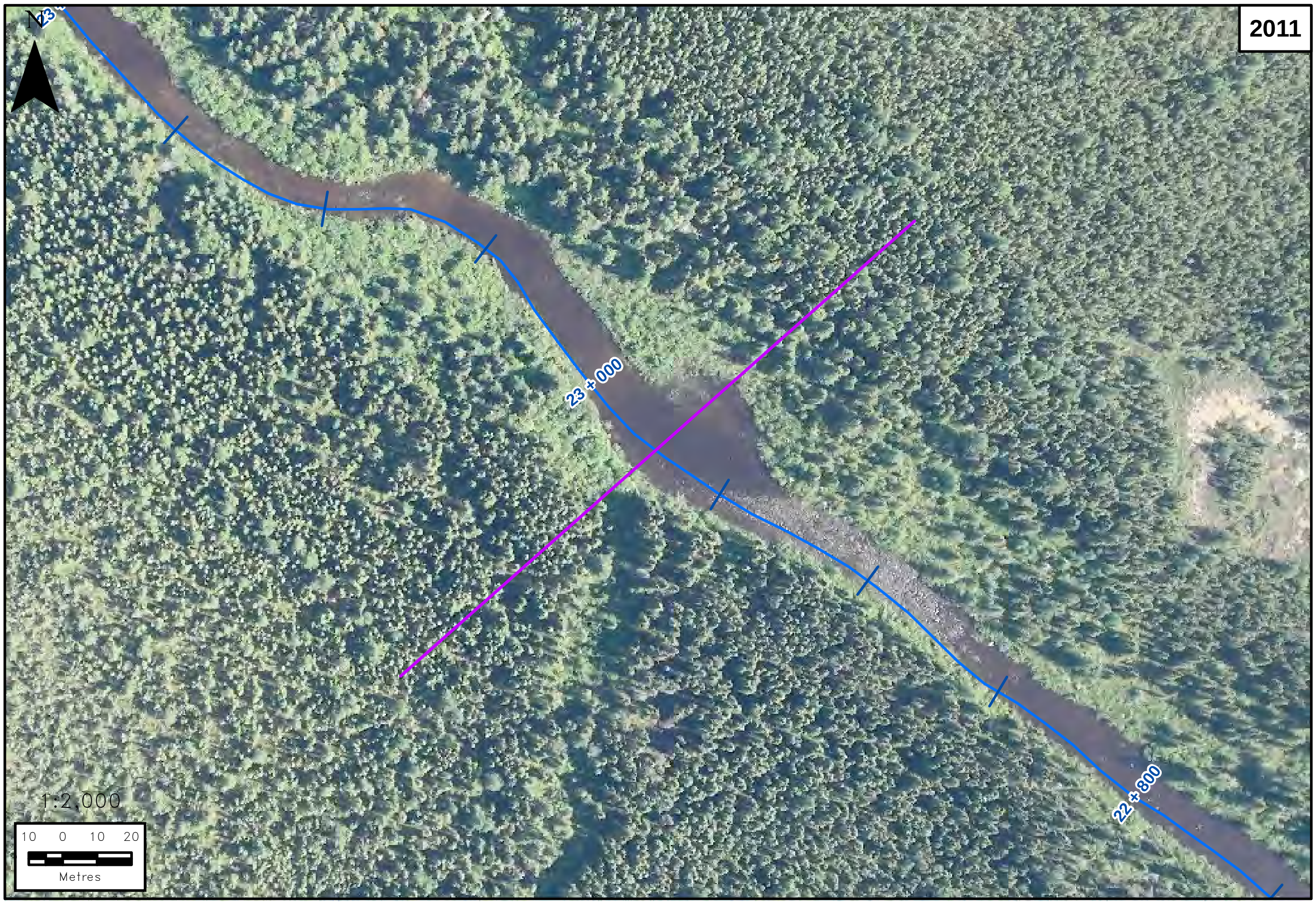

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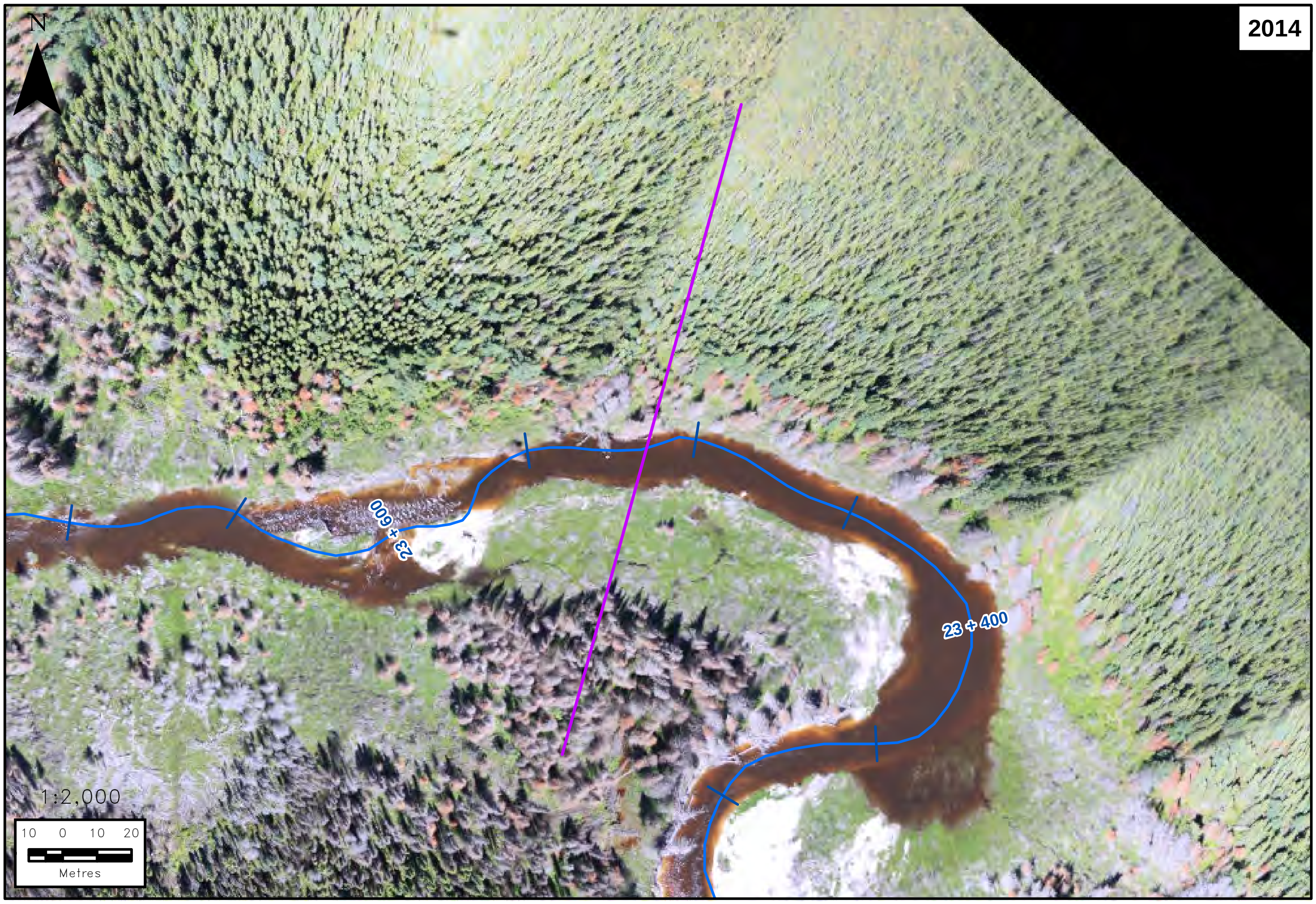

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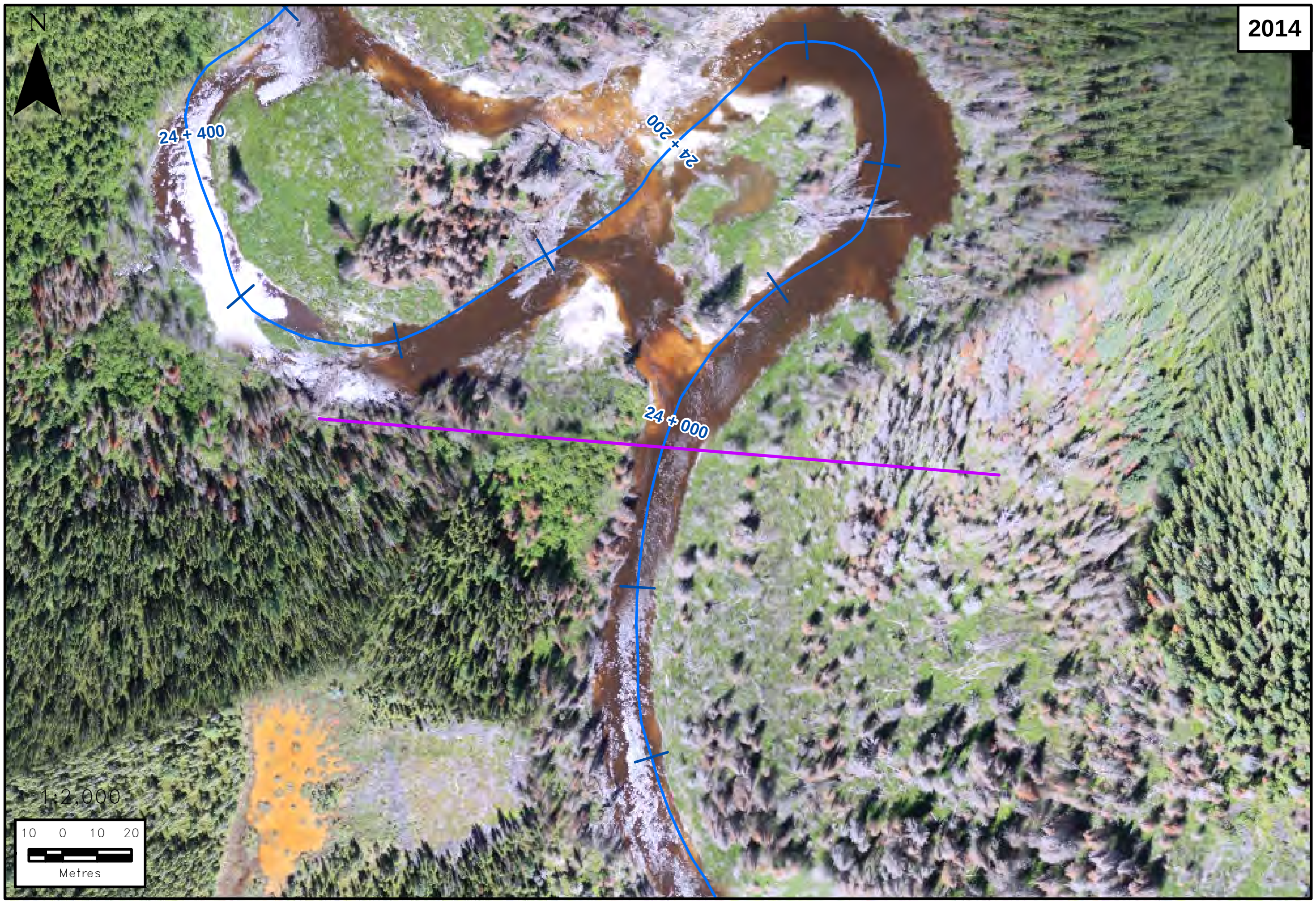

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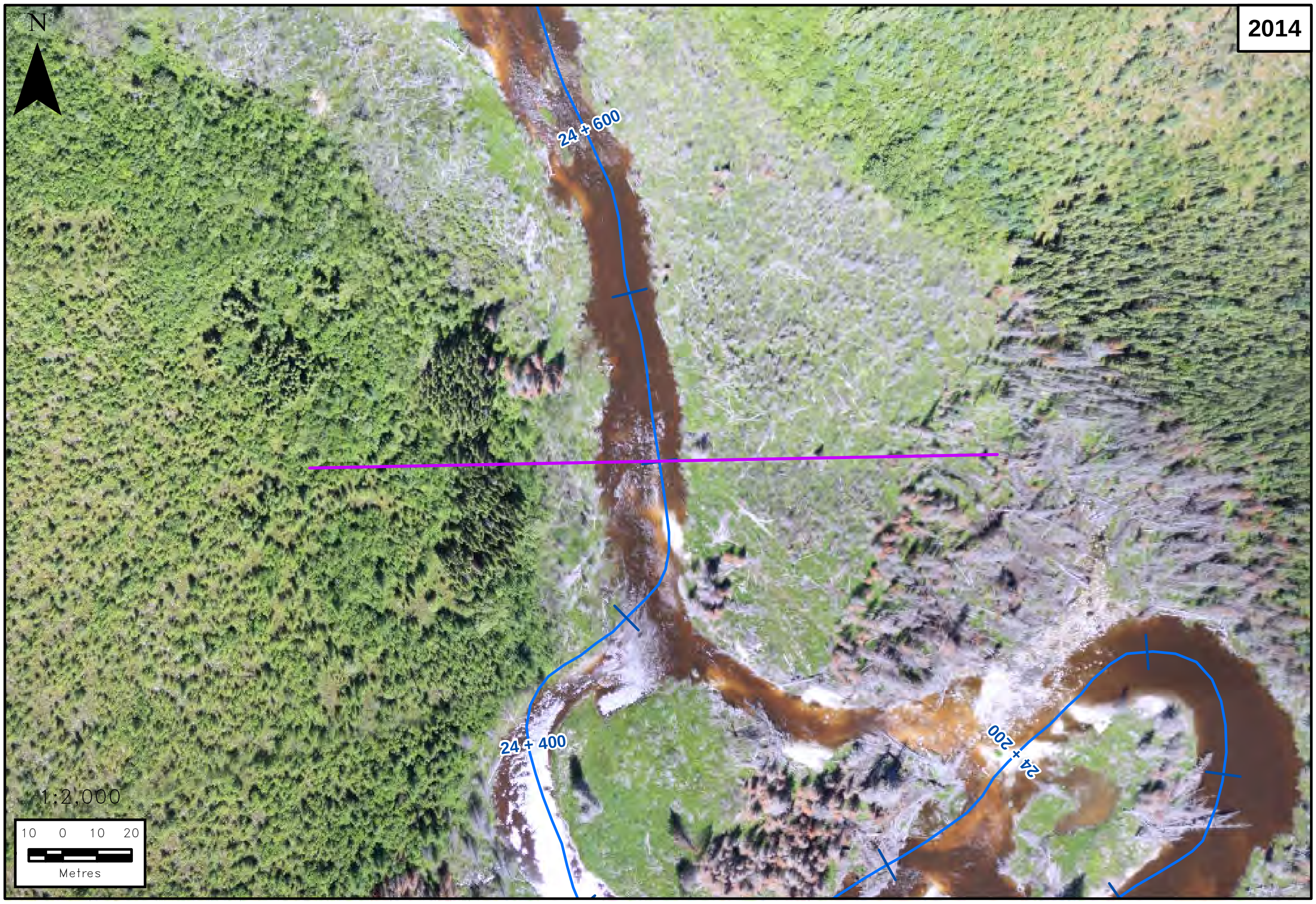

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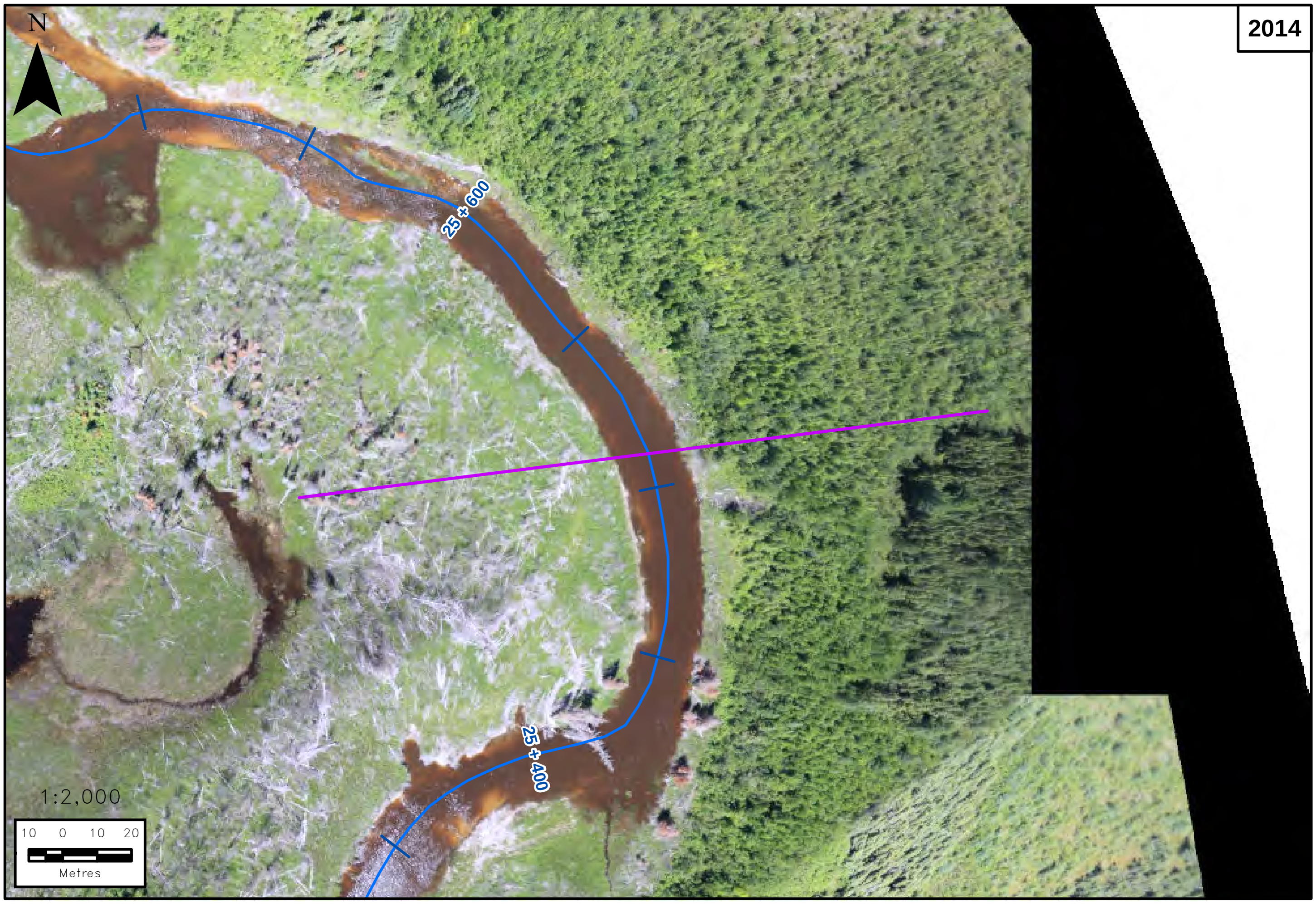

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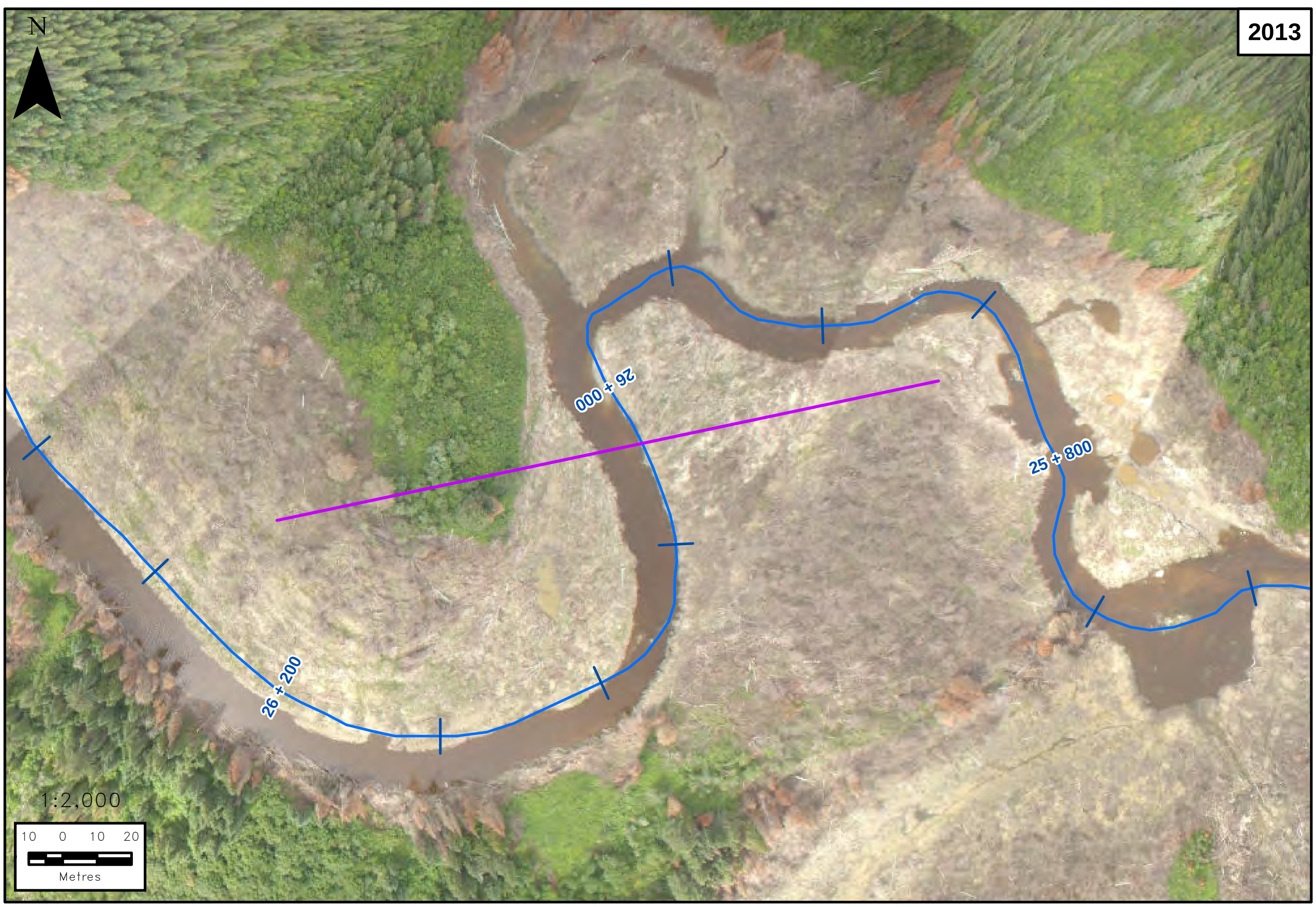

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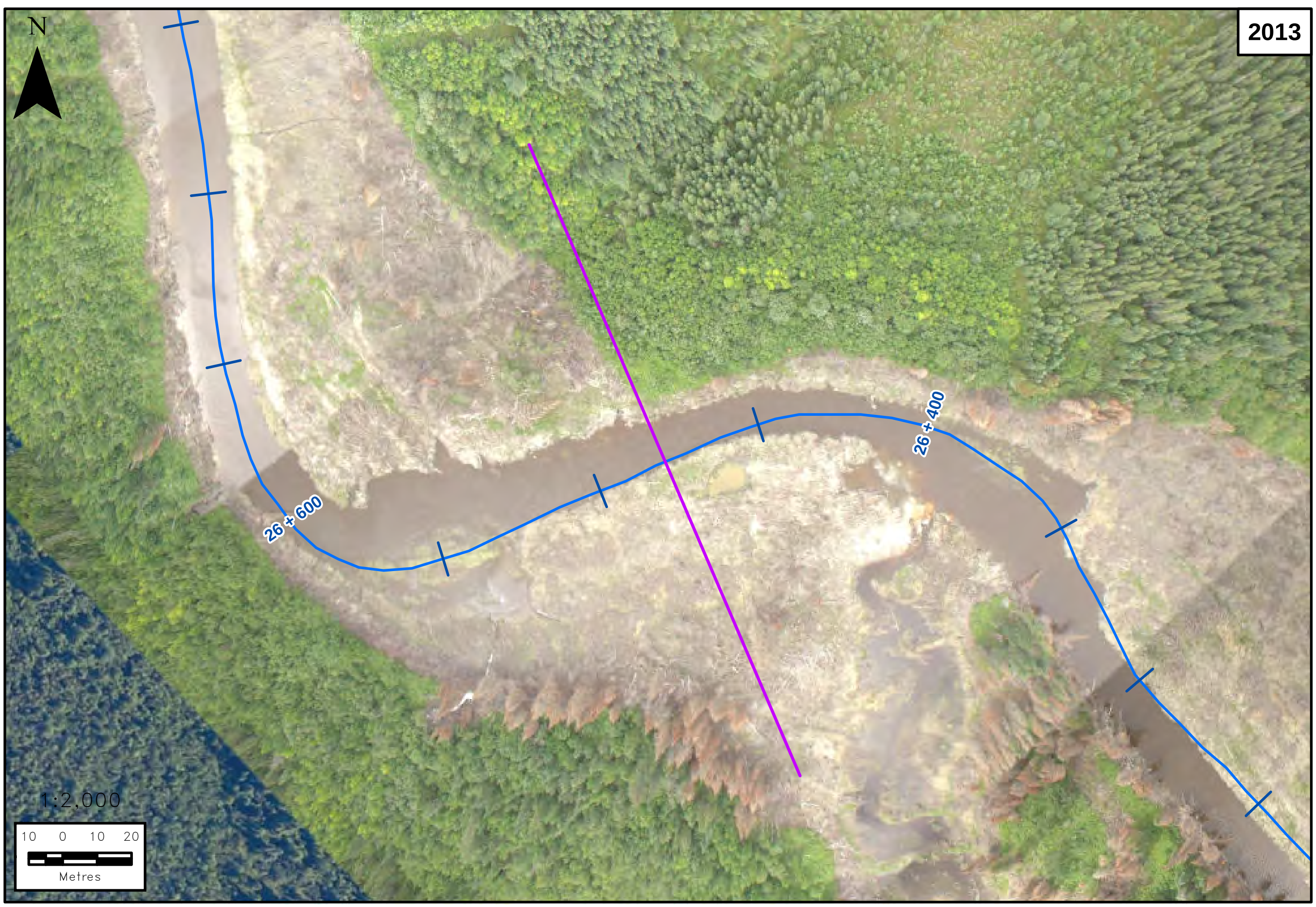

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8.5"x11' PLOT SCALE 1:1


N
2011
26 + 600
26 + 400
1:2,000
10 0 10 20
Metres


N
2014
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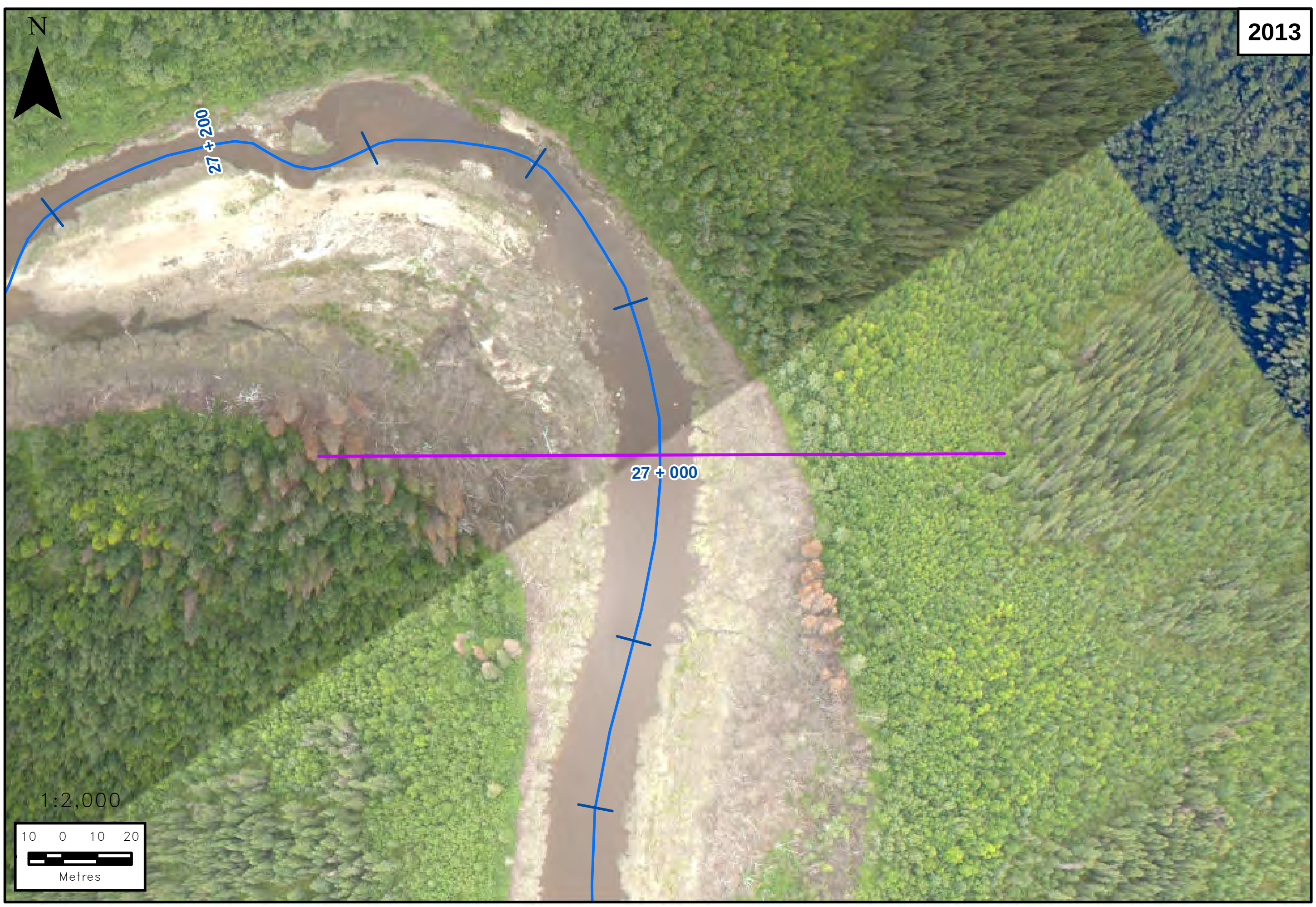
10 0 10 20
Metres



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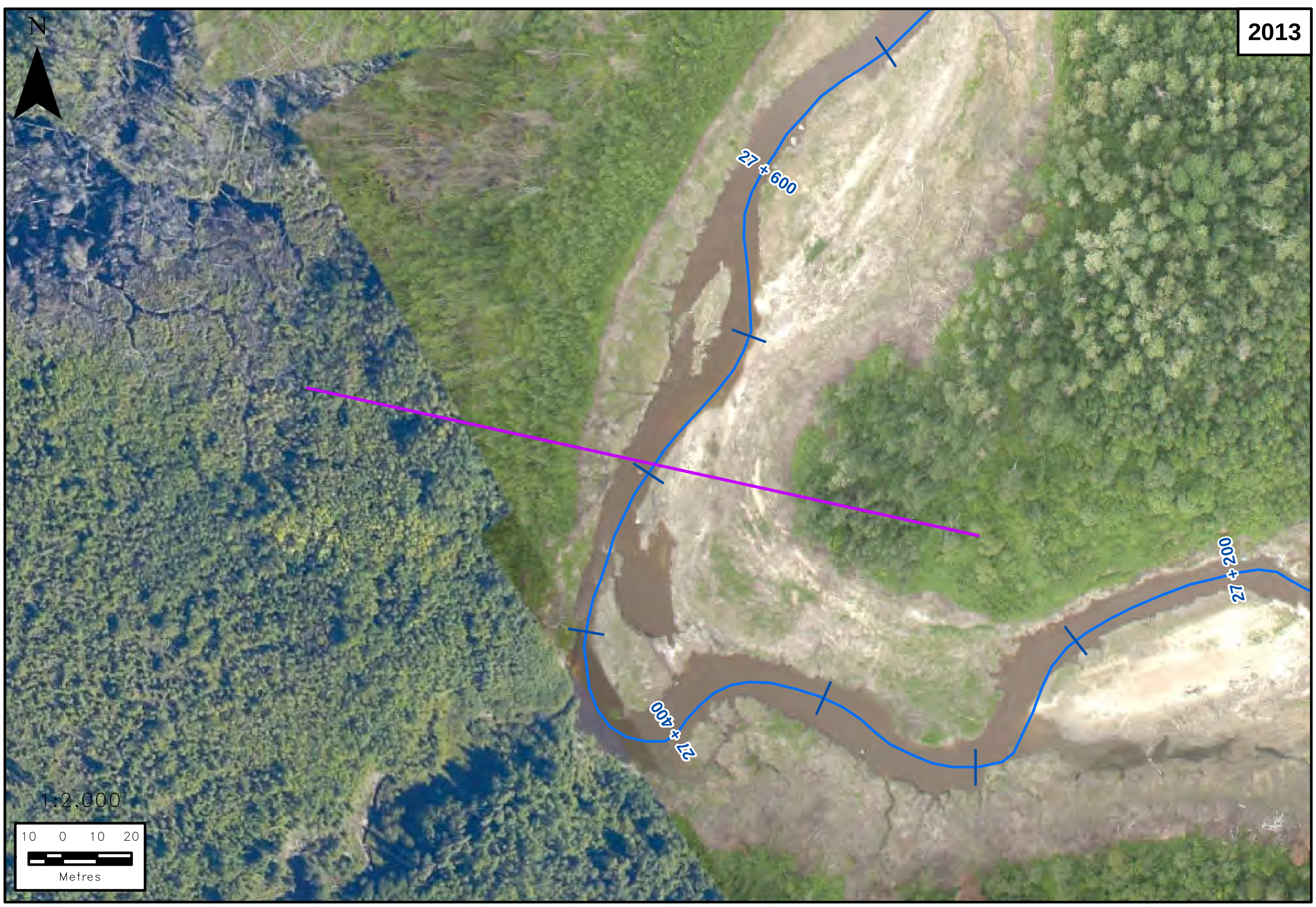

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8.5"x11" PLOT SCALE 1:1


2011
N
28 + 000
1:2,000
10 0 10 20
Metres


2014
N
28 + 000
1:2,000
10 0 10 20
Metres

APPENDIX H

KGS GROUP MEMORANDUM JULY 12, 2012

BUFFALO CREEK BASELINE SURVEY

MEMORANDUM

TO: Colin Siepman, P.Eng.

FROM: John Burns, P.Geo.

Cc: Tony Ng, Jinny Ching, Mark Wilcox, Steve Offman, Patrice LeClerq, Brian Bodnaruk

DATE: July 12, 2012

FILE NO: 11-0300-18

RE: Emergency Reduction of Lake Manitoba and Lake St. Martin Water Levels
Sediment Erosion Monitoring Program
Buffalo Creek Baseline Survey

1.0 INTRODUCTION

As part of the Sediment Erosion Monitoring Program for the Emergency Reduction of Lake Manitoba and Lake St. Martin Water Levels project, KGS Group completed a Baseline survey along Buffalo Creek.

The program consisted of field work that was completed in two parts, September 29th through October 9th, 2011 and October 18th through October 24th. The survey program required helicopter support for daily access and for transportation of equipment (including boats) which was required for field activities. Brush clearing equipment was also necessary to remove obstructions at each survey transect and for establishing additional helicopter pads for access and egress.

The primary purpose of the survey program was to collect survey data along defined transect locations. These transects were used to delineate ground elevation profiles in order to collect baseline elevations to monitor potential erosion in the creek resulting from the increased flow expected following the diversion of water from Lake St. Martin through Buffalo Creek. The limits of the survey were identified as a 15 km length of Buffalo Creek between stations 13+000 and 27+500 (Figures 1 & 2). The survey was completed by BearPaw Corporation under the guidance of KGS Group and the results were compared to existing LiDAR data (Figure 3).

2.0 WORK PROGRAM AND METHODOLOGY

BearPaw Corporation was retained by KGS Group to complete the required survey program. KGS Group established horizontal and vertical control at helicopter pads shown in Figure 1, the coordinates and elevations of which were provided to the BearPaw Project Team. KGS Group also provided the project scale factor and identifier for each cross-section location for total station survey components. The upstream limit (Stn13+000) was chosen based on the soil material of the creek and the amount of flow expected along the channel as well as upstream of any proposed major earthworks. The downstream limit of the survey investigation (Stn 27+500) ended approximately 1 km upstream of the mouth of Buffalo Creek as the last 1 km was not accessible due to backwater effects from the Dauphin River.

The survey consisted of clearing survey lines at 500 meter intervals along Buffalo Creek. Each line extended 100 to 150 meters to either side of the creek centerline. All survey lines were blazed, flagged, and had survey pins installed for control purposes and to allow for repetition of the survey in the future. An elevation survey was then completed to monitor stream bank erosion.

Equipment required for the survey, as outlined by BearPaw included:

- 2 complete GPS RTK systems
- 1 complete Total Station System
- 2 ruggedized data collectors
- 2 WAAS-enabled handheld GPS Units

A complete copy of the work plan developed by KGS Group and BearPaw is included in Appendix A.

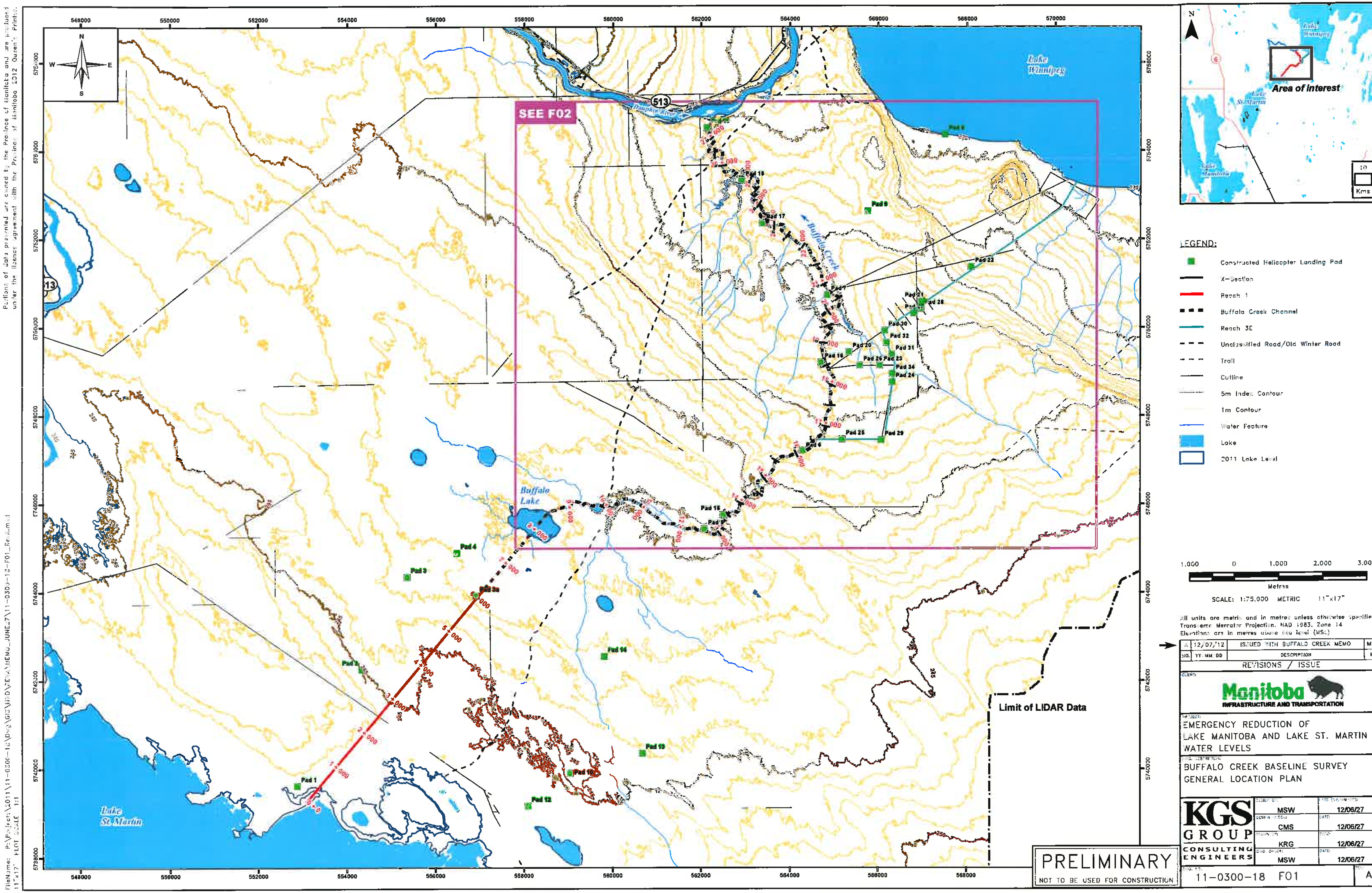
3.0 RESULTS

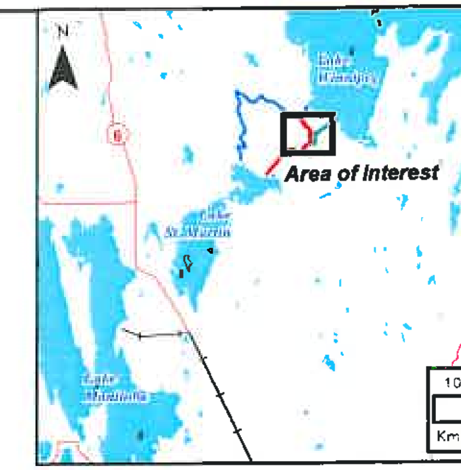
A location map of the surveyed cross-sections is shown in Figure 2. The raw data collected during the survey can be found in Appendix B. A photo log depicting typical cross-sections and control points and a copy of the field notes collected during the field activities can be found in Appendix C. The downstream section of Buffalo Creek from Station 23+500 to 27+500 contained increasing amounts of peat bogs adjacent to the creek. These sections where observed during field surveys to be wet and the completion of the survey transect was difficult. These sections show large differences between the LiDAR data and ground survey in some areas. At the centre of the channel this can be attributed to the water level in the creek during the LiDAR survey. The comparison of LiDAR and ground survey data has been provided for information only as the ground survey will provide the baseline for future investigations.

4.0 FUTURE WORK

The scope of future work involves repeating the program immediately after the closure of the Reach 1 Emergency Channel and subsequent natural draw down of the drainage system to accurately monitor the extent of erosion in Buffalo Creek. The proposed date of closure is August 31st, 2012, but could be extended as late as November 1st, 2012. This could delay the survey program until spring of 2013 due to snow and freezing conditions. Following the completed survey, results would be compared to establish the extent and location of erosion throughout Buffalo Creek resulting from the flood relief program. This would included cross-sections, contour plans and photo documentation from the field investigations.

FIGURES


SEE F02
Lake Winnipeg
Dauphin River
513
Buffalo Creek
Buffalo Lake
Lake St. Martin
Limit of LiDAR Data
Area of interest
LEGEND:
Constructed Helicopter Landing Pad
X-Section
Reach 1
Buffalo Creek Channel
Reach 3E
Unclassified Road/Old Winter Road
Trail
Cutline
5m Index Contour
1m Contour
Water Feature
Lake
2011 Lake Level
1,000 0 1,000 2,000 3,000
Metres
SCALE: 1:75,000 METRIC 11"x17"
All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection. NAD 1983. Zone 14
Elevations are in metres above sea level (MSL)
A 12/07/12 ISSUED WITH BUFFALO CREEK MEMO MSW
NO. YY-MM-DD DESCRIPTION BY
REVISIONS / ISSUE
CLIENT:
Manitoba INFRASTRUCTURE AND TRANSPORTATION
PROJECT:
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS
BUFFALO CREEK BASELINE SURVEY GENERAL LOCATION PLAN
KGS GROUP CONSULTING ENGINEERS
MSW 12/06/27
CMS 12/06/27
KRG 12/06/27
MSW 12/06/27
11-0300-18 F01
A
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION



LEGEND:

- Survey Control
- Constructed Helicopter Landing Pad
- X-Section
- Reach 1
- Buffalo Creek Channel
- Reach 3E
- Unclassified Road/Old Winter Road
- Trail
- Cutline
- 5m Index Contour
- 1m Contour
- Water Feature
- Lake

500 0 500 1,000 1,500

Metres

SCALE: 1:40,000 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 14
Elevations are in metres above sea level (MSL)

NO	YY/MM/DD	DESCRIPTION	BY
A	12/07/12	ISSUED WITH BUFFALO CREEK MEMO	MSW

REVISIONS / ISSUE

CLIENT:

Manitoba
INFRASTRUCTURE AND TRANSPORTATION

PROJECT:

EMERGENCY REDUCTION OF
LAKE MANITOBA AND LAKE ST. MARTIN
WATER LEVELS

DWG. DESCRIPTION:

BUFFALO CREEK BASELINE SURVEY
LIMITS OF INVESTIGATIONS

KGS GROUP
CONSULTING ENGINEERS

DESIGN BY:	MSW	DATE (YY/MM/DD):	12/06/27
DESIGN CHECK:	CMS	DATE:	12/06/27
DRAWN BY:	KRG	DATE:	12/06/27
DWG. CHECK:	MSW	DATE:	12/06/27

DWG. NO. 11-0300-18 F02

REV. A

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

File Name: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV\FIELD_JUNE27\11-0300-18-F02_Rev.mxd
11"x17" PLOT SCALE 1:1

FIGURE 3 (1 OF 2)
JULY 12/12
1:2500
10X VERTICAL

DRAFT

BUFFALO CREEK BASELINE SURVEY
LiDAR VS SURVEY CROSS SECTIONS

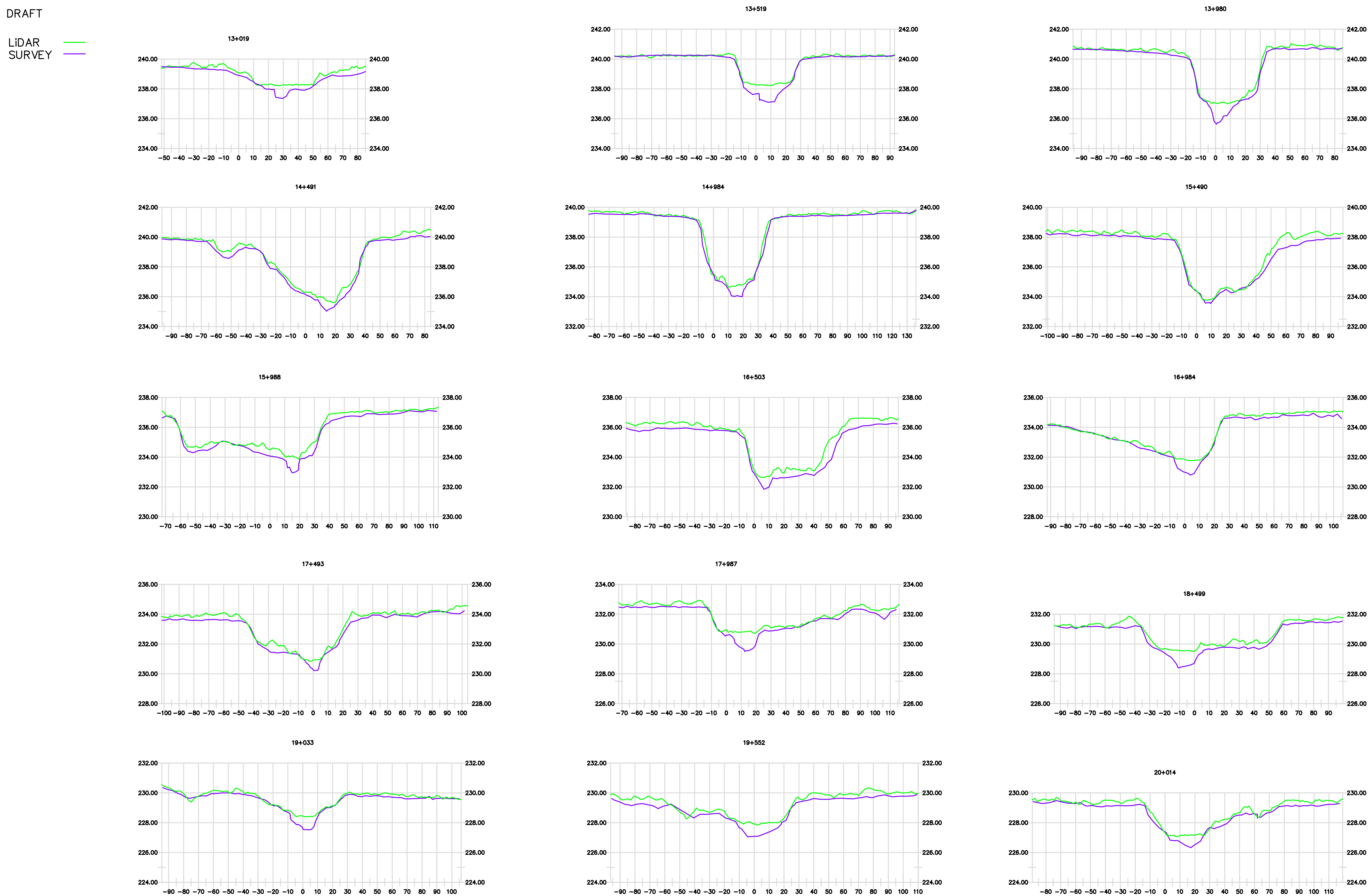
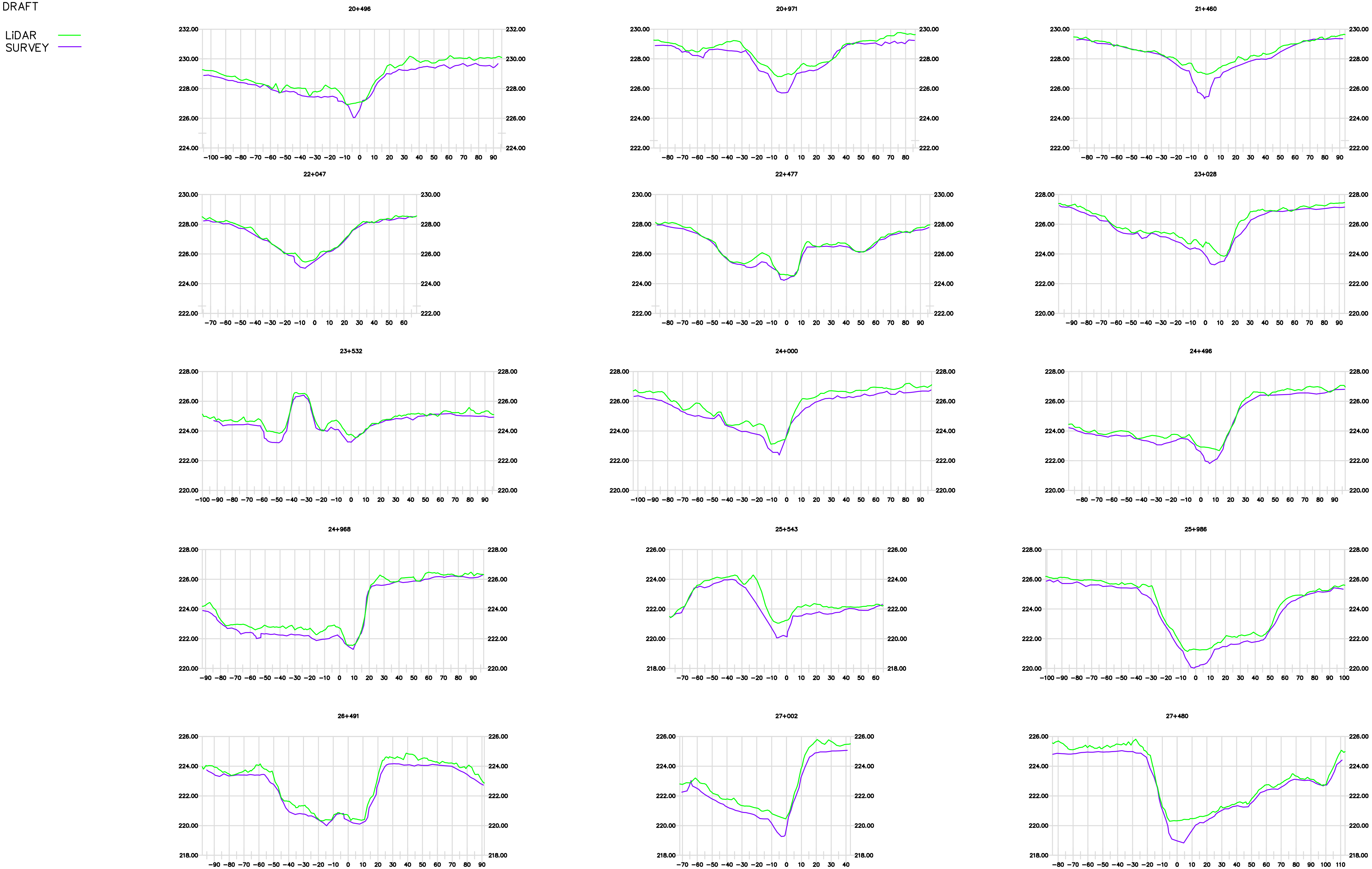


FIGURE 3 (2 OF 2)
JULY 12/12
1:2500
10X VERTICAL

DRAFT

BUFFALO CREEK BASELINE SURVEY
LiDAR VS SURVEY CROSS SECTIONS



APPENDICES

APPENDIX A

WORK PLAN

1.0 PURPOSE

This procedure provides instructions for the baseline survey of the Buffalo Creek between Lake St. Martin and the Dauphin River. The purpose of the baseline survey is to establish ground elevations to monitor potential erosion in the Creek in the future relating to an increase in water flow expected to result from diversion of water from Lake St. Martin through the Buffalo Creek.

2.0 SCOPE

2.1 Location

- Buffalo Creek, connects Lake St. Martin and Dauphin River.

2.2 Map

- Attached Figure 1.

2.3 Boundaries of survey

- Approximately 15 kms of Creek
- Begin and end locations identified on Figure 2.

3.0 SURVEY METHODOLOGY

3.1 Equipment Required

3.1.1 Survey Equipment Required

- 2 - complete GPS RTK systems each consisting of :
  2 - Glonass capable GPS receivers
  1 - UHF data radio
  1 - tripod
  1 - tribach
  Carbon fiber range pole
  All necessary, cables, batteries and chargers

- 1 -Total Station system consisting of:
  Total station 5" precision (must be compatible with ruggedized data collector listed above)
  1 -tripod
  1 -range pole with prisim

- 2 - ruggedized data collector

- 2 - WAAS enabled handheld GPS units
  (with spare batteries)

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3.1.2 Bush Clearing Equipment

- 2 Chainsaws

  Complete with cases, spare chains (2 per saw), 2 stroke oil, bar oil, sharpening files (2 per saw), gas can (1 per saw)
- 1 Brush saw

  Complete with 2 spare blades, 2 stroke oil, gas can

3.1.3 Other Equipment Required

- 2 Canoes
- Food and drinks
- Cooler for Lunches
- Bugspray
- First Aid Kit
- Survival Kit (tent, matches, emergency blankets, etc.) *need to be prepared to stay overnight*.
- 4 sets of Hip waders (THOUGHT WE HAD CREW OF 5? 6 with me?)
- 4 Life Jackets (CREW OF 5-6?)
- Satellite Phone
- Satellite beacon (i.e. Spot Locator)
- Cordless grinder with cutoff wheel (with spare battery and spare cutoff wheels)
- 4 ft Rebar
- Notebooks
- Pens
- Pencils
- 8lb sledge hammer, 2lb sledge hammer
- Personal Protective Equipment

  Project Team (work gloves, safety glasses,) Bear Spray?, possible wildlife?

  Brush Cutters (in addition to above, protective chaps, hard hat with face shield and hearing protection)

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3.2 Survey

- KGS to establish horizontal and vertical control at green helicopter landing pads shown on Figure 2. and to provide the coordinates and elevations to the Project team.

- KGS will also provide the project scale factor for each cross section location as well as a name or identifying number for each cross section location.

- At the start of each day the Team surveyors will set up 1 GPS Receiver on a know control point in Big Rock and set it to log a static file for the duration of the work day (KGS to supply control point location, coordinates and elevations). Once project Team is past Pad 7 KGS to set up a GPS receiver in Dauphin River to log a static file each day for the duration of the job. (KGS to confirm when they will be logging in Dauphin River)

- At a mutually agreed upon time each day Project Team will be flown in to one of the existing helicopter pad locations.

- Project team will load the all necessary equipment into a boat and proceed to the closest proposed cross section location. The cross sections will be spaced approximately 500m apart. (Approximate cross section locations to be provided by KGS in a format that can be uploaded into a handheld GPS.)

- Upon arrival at the cross section location the Team lead will select a suitable location for the cross section based on terrain, access and overall representation of the general drainage channel. The cross section shall be perpendicular to alignment of the creek.

- Once the location has been selected for the cross section the Team surveyors will install 2 – 4 ft pieces of re-bar to act as permanent fixed control points. One on each side of the creek.

- While the surveyors install the re-bar for control points the brush cutters will begin to clear bush on each side of the creek back to approximately 100 - 150 m from the centerline of the creek. All underbrush, tree limbs, or trees online shall be removed to allow an unobstructed view along the line of the cross section. This path will be perpendicular to the river alignment and in line with the two control points. This clearing shall be 1.0-1.5m wide.

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- The re-bar shall be installed in locations that will be protected, and remain undisturbed so that they can be used on an ongoing basis. As well these points should be installed such that they are inter-visible. Also keeping in mind these points will need to be occupied by a GPS receiver the surveyors shall insure that they will have an unobstructed view of the sky.

- The 4 ft. rebar shall be driven into the ground until only 4-6" of the bar is remaining above ground or until refusal. If the bar reaches refusal and has in excess of the specified 4-6" exposed the excess shall be cut off.

- Once the re-bar has been installed the surveyors will set up 1 of the GPS receiver as a RTK base station over one of the newly installed control points. This receiver will be set to log a static file as well as broadcast RTK corrections. This receiver will be set up using autonomous control and will be corrected later by KGS when post processing the static data.

- The static occupation time for the one control point will be a minimum of 2hrs (KGS to confirm this time).

- The surveyors will then set up another GPS receiver on a tripod and tribrach over the second control point and take a RTK corrected control shot lasting 180 epcohs.

- Once the RTK base station is up and running the surveyors will survey the river channel using a GPS receiver as a RTK rover and logging shots in standard topo mode. These shots will be for a minimum of 3 epochs lasting a minimum of 5 seconds and the accuracy will be set to a minimum of 10mm in the horizontal and 15mm in the vertical.

- The team surveyors will survey as much of the cross section as possible without entering the treeline on either side of the creek. When shooting the topo shots the surveyors shall ensure that they pick up any and grade breaks and that the shot spacing does not exceed 5m. As well they will need to pick-up the water's edge.

- Shot coding will be chosen by the Project Team surveyors but it must be consistent and a code list must be provided to KGS at the end of the project. When choosing the code the Team surveyors need to ensure that they are also noting the existing ground type at each shot (i.e. Rock, soil, vegetation). They will also need to indicate when shooting the creek bottom.

- At the start and end of the RTK topo shots the Team surveyors will need to take a check shot with the rover in topo mode.

- Once the cross section of the river channel is completed and the sight lines have been cleared into the bush the surveyors will set up the total station on one of the newly established control points and set up a tripod mounted prism over the other to act as a back sight.

- Once the total station has been setup and back sighted the surveyors will take another shot on the back sight and store it as a check. The remaining shots into the tree line on either side of the creek with the total station back to the limits specified above.

- Upon completion of the total station shots the surveyor will take a final shot on the back sight and store it as another check shot.

- The surveyors will then tear down the equipment and pack it away.

- The Project team will then pack the equipment into the boat and proceed to the next cross section location and repeat the procedure.

- At the end of the work day the Project Team will proceed to the nearest helicopter landing pad for pick up by the helicopter. If the pick-up point is not the same as the drop off point the team will need to return to that day's drop off point and collect the GPS receiver that was left to log the static file.

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3.3 Preparation Meetings

- Initial preparatory meeting held Friday September 23rd, 2011 at BearPaw office (KGS and BearPaw)
- Preparatory meeting to be held Monday, September 26th, 2011 at BearPaw office (BearPaw staff required)
- Final preparatory meeting to be held Tuesday, September 27th at KGS office (all)

4.0 PERSONNEL

Name	Title	Contact Information	Location
Mark Wilcox	Lead KGS Project Manager	204-896-1209, cell:	Winnipeg KGS Office
Jinny Ching	Second Lead KGS Project Manager	204-896-1209, cell: 204-470-6890	Winnipeg KGS Office
Keith Flett	AECOM	Cell: 223-6382	
Brock Campbell	Lead BearPaw Project Manager	204-421-9199, cell: 204-891-2327, home: 204-257-8320	Winnipeg, BearPaw Office
Andrew Lawson	Second Lead BearPaw Survey Coordinator	204-421-9199, cell: 204-793-5567	On site 1-2 days and in Winnipeg BearPaw Office
Denelle Bushie	Site Lead	204-421-9199, cell: 204-470-8022	On site
Hans Perera	Site Second Lead	204-421-9199, cell: 204-391-1776	On site
Travis Hudson	Site Tech	204-421-9199, cell: 204-226-1920	On site

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5.0 HEALTH AND SAFETY

KGS and BearPaw will each prepare their respective Health and Safety Plans.

3.2 FIELD OPERATIONS DOCUMENTATION

- Field notebooks will be utilized
- Issues will be communicated and mitigated either by satellite phone if requiring immediate attention or at the end of the day by land line if possible

3.2 DATA ACQUISITION

- All static data will be logged to the receivers and downloaded to the data collector at the end of each day
- All RTK and GPS topo shots will be logged to the data collector
- All data on the data collector (topo and static data) will be backed up to a USB memory stick at the end of each day and the memory stick will be kept at the accomidations
- All HI's for each instrument and backsight setup will be logged in the field book as well as the start and stop times for the static loggings.
- Data will be supplied to KGS in the file type of:
  Static Data - Rinex files
  Topo Data - Trimble DC file

6.0 SCHEDULE

Approximately 12 days.

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APPENDIX B

RAW SURVEY DATA

The following descriptors were used during the 30 cross-section along Bufflo Creek:

CB	CREEK BOTTOM
GD_CLAY	GROUND CLAY
GD_GR BOT	GROUND BOTTOM OF BANK GRASS
GD_GR TOP	GROUND TOP OF BANK GRASS
GD_RC TOP	GROUND TOP OF BANK ROCK
GD_RC/ GD_RK	GROUND ROCK
GD_RK	GROUND GRASS
GD_SWMP	GROUND SWAMP
GD_TR	GROUND TREED AREA
REBAR	REBAR
REBAR	CONTROL POINT
REBAR CHECK	CONTROL POINT CHECK
REBAR CHECKOUT	CONTROL POINT CHECK OUT
TS CHECKOUT	TOTAL STATION CHECKOUT
WE	WATERS EDGE
WE BOT	WATERS EDGE BOTTOM
WL	WATER LEVEL
GD_SWAMP BOT	GROUND BOTTOM OF BANK SWAMP
GD_SWAMP TOP	GROUND TOP OF BANK SWAMP

Section 1

100	5745341	562408.3	239.026	REBAR-CHECK
101	5745344	562406.2	238.868	GD_GR
102	5745347	562403.8	239.025	GD_GR
103	5745350	562401	239.237	GD_GR
104	5745354	562398.8	239.289	GD_GR
105	5745357	562396.9	239.26	GD_GR
106	5745361	562394.3	239.329	GD_GR
107	5745364	562391.5	239.351	GD_GR
108	5745367	562389.2	239.335	GD_GR
109	5745370	562386.4	239.387	GD_GR
110	5745374	562383.8	239.411	GD_GR
111	5745378	562381.1	239.498	GD_GR
112	5745338	562410.1	238.682	GD_GR
113	5745336	562411.8	238.577	GD_GR
114	5745334	562413.7	238.353	GD_GR
115	5745330	562415.5	238.074	GD_GR
116	5745327	562416.8	237.941	GD_GR
117	5745325	562418.1	237.985	GD_GR
118	5745322	562419.5	237.893	WE
119	5745321	562420.3	237.049	WE
120	5745315	562424.1	237.206	CB
121	5745318	562422.1	236.87	CB
122	5745311	562428.8	237.992	GD_SWMP
123	5745307	562429.8	237.929	GD_SWMP
124	5745305	562431.2	237.901	GD_SWMP
125	5745302	562432.9	238.023	GD_SWMP
126	5745300	562434.4	238.198	GD_SWMP
127	5745297	562436.1	238.429	GD_GR
128	5745295	562437.9	238.643	GD_GR
129	5745292	562440.3	238.793	GD_GR
130	5745289	562441.8	238.954	GD_GR
131	5745287	562444.1	238.857	GD_GR
132	5745283	562446.8	238.869	GD_GR
133	5745280	562448.8	238.882	GD_GR
134	5745276	562451.4	238.964	GD_GR
135	5745274	562453.2	239.029	GD_GR
136	5745272	562455.8	239.185	GD_GR
137	5745295	562437.7	238.607	GD_GR TOP
138	5745302	562432.4	237.982	GD_GR BOT
139	5745314	562425.6	237.82	WE
140	5745320	562422.3	236.887	CB
141	5745330	562415.9	237.995	GD_GR BOT
142	5745335	562412.6	238.499	GD_GR TOP
143	5745341	562408.3	239.017	REBAR_CHECKOUT
144	5745293	562439.4	238.979	REBAR-CHECK
145	5745379	562381.5	239.463	GD_GR
146	5745383	562379.4	239.485	GD_GR
147	5745384	562378.3	239.495	GD_GR
CP01A	5745293	562439.4	238.982	REBAR
CP01B	5745341	562408.3	239.039	REBAR

Section 2

CP02A	5745736	562628.2	240.239	REBAR
CP02B	5745778	562589.6	240.347	REBAR
144	5745778	562589.6	240.351	REBAR_CHECK
145	5745780	562588.1	240.213	GD_GR
146	5745782	562586.1	240.263	GD_GR
147	5745785	562583.6	240.211	GD_GR
148	5745786	562581.7	240.247	GD_GR
149	5745788	562579.7	240.268	GD_GR
150	5745790	562577.9	240.234	GD_GR
151	5745791	562576.3	240.268	GD_GR
152	5745793	562574.5	240.257	GD_GR
153	5745795	562572.9	240.228	GD_GR
154	5745797	562570.9	240.254	GD_GR
155	5745798	562569.4	240.266	GD_GR
156	5745800	562568.1	240.249	GD_GR
157	5745802	562566.5	240.285	GD_GR
158	5745804	562564.7	240.27	GD_GR
159	5745806	562563.2	240.255	GD_GR
160	5745808	562561.4	240.266	GD_GR
161	5745810	562559.6	240.247	GD_GR
162	5745812	562557.6	240.251	GD_GR
163	5745813	562555.7	240.217	GD_GR
164	5745815	562554.4	240.211	GD_GR
165	5745817	562552.6	240.205	GD_GR
166	5745819	562551.2	240.205	GD_CLAY
167	5745821	562549.5	240.148	GD_CLAY
168	5745822	562548	240.134	GD_CLAY
169	5745824	562546.5	240.174	GD_CLAY
170	5745826	562545.3	240.122	GD_CLAY
171	5745828	562543.6	240.17	GD_CLAY
172	5745829	562542.6	240.213	GD_CLAY
173	5745776	562591.1	240.162	GD_GR
174	5745774	562593.4	240.126	GD_GR
175	5745773	562595.1	240.113	GD_GR
176	5745770	562597.1	239.961	GD_GR TOP
177	5745768	562599.1	239.202	GD_GR
178	5745767	562599.9	238.709	GD_GR
179	5745766	562601.1	238.067	GD_GR BOT
180	5745764	562602.8	237.895	GD_GR
181	5745762	562605.3	237.599	GD_GR
182	5745759	562608.3	237.732	WE
183	5745757	562609.3	236.814	CB
184	5745756	562610.6	236.643	CB
185	5745755	562612.5	236.722	CB
186	5745754	562612	236.656	CB
187	5745752	562614	236.918	CB
188	5745748	562617.7	237.623	CB
189	5745747	562618.9	237.724	WE
190	5745745	562619.6	237.793	GD_GR BOT
191	5745742	562623.1	238.261	GD_GR

192	5745741	562624.4	238.926	GD_GR
193	5745740	562625.2	239.426	GD_GR
194	5745738	562626.5	239.817	GD_GR TOP
195	5745737	562627.9	239.977	GD_GR
196	5745735	562630	240.006	GD_GR
197	5745733	562631.5	240.054	GD_GR
198	5745732	562632.8	240.084	GD_GR
199	5745730	562634.6	240.133	GD_GR
200	5745728	562636.3	240.125	GD_GR
201	5745726	562637.8	240.145	GD_GR
202	5745724	562639.3	240.154	GD_GR
203	5745722	562641.1	240.238	GD_GR
204	5745721	562643	240.156	GD_GR
205	5745719	562644.8	240.184	GD_GR
206	5745717	562645.9	240.134	GD_GR
207	5745715	562647.6	240.154	GD_GR
208	5745714	562649.1	240.139	GD_GR
209	5745711	562651.2	240.153	GD_GR
210	5745709	562653.2	240.159	GD_GR
211	5745708	562654.8	240.163	GD_GR
212	5745706	562656.6	240.156	GD_GR
213	5745704	562658	240.217	GD_GR
214	5745702	562659.5	240.175	GD_GR
215	5745700	562662.1	240.192	GD_GR
216	5745698	562664.1	240.187	GD_GR
217	5745695	562667.1	240.206	GD_GR
218	5745692	562669.8	240.241	GD_GR
219	5745778	562589.6	240.342	REBAR_CHECKOUT

Section 3

CP03A	5745998	562923.7	240.86	REBAR
CP03B	5746027	562871.5	240.324	REBAR
100	5746027	562871.5	240.33	REBAR_CHECK
101	5746028	562870.2	240.186	GD_GR
102	5746029	562867.4	240.238	GD_GR
103	5746030	562864.8	240.258	GD_GR
104	5746032	562862.3	240.347	GD_GR
105	5746033	562860.3	240.342	GD_GR
106	5746034	562857.8	240.396	GD_TR
107	5746035	562854.3	240.41	GD_TR
108	5746037	562851.9	240.432	GD_TR
109	5746038	562849.3	240.443	GD_TR
110	5746039	562847	240.491	GD_TR
111	5746040	562843.7	240.491	GD_TR
112	5746042	562841	240.54	GD_TR
113	5746043	562838.6	240.523	GD_TR
114	5746044	562835.9	240.552	GD_TR
115	5746045	562832.6	240.565	GD_TR
116	5746047	562830.1	240.6	GD_TR
117	5746048	562827.4	240.601	GD_TR
118	5746050	562825	240.608	GD_TR
119	5746051	562822.4	240.631	GD_TR
120	5746053	562819.3	240.657	GD_TR
121	5746054	562816.5	240.636	GD_TR
122	5746055	562814.1	240.664	GD_TR
123	5746057	562811.4	240.657	GD_TR
124	5746058	562808.8	240.653	GD_TR
125	5746060	562805.8	240.662	GD_TR
126	5746059	562807.9	240.67	GD_TR
127	5746025	562874	240.096	GD_GR
128	5746024	562876.3	239.936	GD_GR TOP
129	5746023	562878.1	239.247	GD_GR
130	5746022	562880.2	238.012	GD_GR
131	5746022	562882	237.366	GD_GR BOT
132	5746020	562884	237.212	GD_GR
133	5746019	562885.9	237.116	GD_GR
134	5746018	562888.2	236.682	WE
135	5746017	562890.1	235.866	CB
136	5746016	562891.7	235.635	CB
137	5746015	562893.6	235.708	CB
138	5746014	562895.8	236.169	CB
139	5746013	562897.9	236.216	CB
140	5746011	562900.3	236.655	WE
141	5746009	562902.5	236.915	GD_GR
142	5746008	562905.1	237.191	GD_GR
143	5746007	562908.5	237.295	GD_GR
144	5746006	562910.8	237.313	GD_GR
145	5746005	562912.4	237.454	GD_GR
146	5746003	562914.4	237.724	GD_GR BOT

147	5746002	562916	238.284	GD_GR
148	5746001	562917.6	239.276	GD_GR
149	5745999	562921.1	240.496	GD_GR TOP
150	5745998	562924.3	240.657	GD_GR
151	5745997	562927	240.696	GD_GR
152	5745996	562929.4	240.678	GD_TR
153	5745995	562932.1	240.736	GD_TR
154	5745994	562934.7	240.638	GD_TR
155	5745993	562936.8	240.662	GD_TR
156	5745991	562939.3	240.665	GD_TR
157	5745990	562941.9	240.693	GD_TR
158	5745989	562944	240.682	GD_TR
159	5745988	562946.1	240.664	GD_TR
160	5745986	562948.6	240.778	GD_TR
161	5745985	562951.7	240.729	GD_TR
162	5745984	562953.7	240.649	GD_TR
163	5745984	562955.2	240.676	GD_TR
164	5745982	562958.7	240.712	GD_TR
165	5745981	562961.1	240.697	GD_TR
166	5745980	562964.1	240.663	GD_TR
167	5745980	562967.2	240.712	GD_TR
168	5746027	562871.5	240.329	REBAR_CHECKOUT

Section 4

CP04A	5746195	563355.4	239.929	REBAR
CP04B	5746227	563314.3	236.727	REBAR
100	5746227	563314.3	236.729	REBAR_CHECK
101	5746225	563316.9	236.296	GD_GR BOT
102	5746226	563315.1	236.362	GD_GR
103	5746228	563313.8	236.541	GD_GR
104	5746229	563312.4	236.707	GD_GR
105	5746230	563310.8	237.035	GD_GR
106	5746232	563309.3	237.327	GD_GR
107	5746234	563307.6	237.551	GD_GR
108	5746235	563305.9	237.825	GD_GR
109	5746236	563304.5	237.851	GD_GR
110	5746238	563302.8	237.885	GD_GR
111	5746239	563301.2	238.189	GD_GR
112	5746241	563299.1	238.885	GD_GR
113	5746243	563296.9	239.146	GD_GR TOP
114	5746245	563294.7	239.227	GD_GR
115	5746247	563291.7	239.232	GD_GR
116	5746248	563290.2	239.339	GD_GR
117	5746250	563288.1	239.19	GD_GR TOP
118	5746196	563352.7	239.614	GD_GR TOP
119	5746194	563355	239.719	GD_GR
120	5746193	563357	239.774	GD_GR
121	5746191	563359.3	239.769	GD_GR
122	5746189	563362	239.831	GD_GR
123	5746188	563363.6	239.843	GD_GR
124	5746186	563366	239.782	GD_GR
125	5746184	563368.4	239.838	GD_GR
126	5746183	563370.3	239.846	GD_GR
127	5746181	563372.3	239.873	GD_GR
128	5746180	563373.9	239.903	GD_GR
129	5746178	563375.7	240.039	GD_GR
130	5746177	563377.5	240.018	GD_GR
131	5746176	563378.9	240.084	GD_GR
132	5746174	563381.2	240.104	GD_GR
133	5746173	563383.3	240	GD_GR
134	5746171	563386.1	240.032	GD_GR
135	5746198	563351	238.798	GD_GR
136	5746199	563349.6	238.044	GD_GR
137	5746200	563348.4	237.564	GD_GR
138	5746202	563346.7	237.042	GD_GR
139	5746203	563345	236.662	GD_GR
140	5746204	563343	236.315	GD_GR
141	5746206	563341.5	236.008	GD_GR BOT
142	5746208	563339.4	235.943	GD_GR
143	5746209	563338.5	235.738	GD_GR
144	5746209	563338	235.53	WE
145	5746210	563336.7	235.469	CB
146	5746212	563335.2	235.168	CB

147	5746212	563334.2	235.001	CB
148	5746214	563333.8	235.032	CB
149	5746214	563332.3	235.046	CB
150	5746214	563330.2	235.62	WE
151	5746215	563329.1	235.823	GD_GR
152	5746217	563327.8	235.745	GD_GR
153	5746219	563325.8	235.782	GD_GR
154	5746220	563323.7	235.958	GD_GR
155	5746222	563321.5	236.077	GD_GR
156	5746223	563319.1	236.195	GD_GR
157	5746251	563286.8	239.166	GD_GR
158	5746253	563284.9	238.934	GD_GR
159	5746254	563283.3	238.713	GD_GR
160	5746268	563266.3	239.7	GD_RC
161	5746269	563264.3	239.714	GD_RC
162	5746271	563261.7	239.786	GD_RC
163	5746273	563259.5	239.768	GD_RC
164	5746274	563257.3	239.808	GD_RC
165	5746276	563255	239.828	GD_RC
166	5746278	563252.9	239.851	GD_RC
167	5746279	563250.2	239.81	GD_RC
168	5746282	563247.5	239.866	GD_RC
169	5746283	563245.8	239.872	GD_RC
170	5746265	563269.6	239.748	GD_RC TOP
171	5746263	563272	239.469	GD_RC
172	5746261	563274.1	239.112	GD_GR
173	5746259	563276.4	238.873	GD_GR
174	5746258	563278.3	238.653	GD_GR BOT
175	5746266	563268.2	239.72	GD_RC
176	5746256	563281.1	238.561	GD_GR BOT
178	5746227	563314.2	236.721	REBAR_CHECKOUT

Section 5

CP05A	5746558	563434	239.507	REBAR
CP05B	5746601	563401	239.296	REBAR
100	5746601	563401	239.303	REBAR_CHECK
101	5746658	563357.5	239.53	GD_TR
102	5746654	563360.1	239.594	GD_TR
103	5746651	563362.9	239.553	GD_TR
104	5746647	563365.9	239.54	GD_TR
105	5746641	563369.7	239.525	GD_TR
106	5746637	563372.7	239.523	GD_TR
107	5746633	563375.4	239.491	GD_TR
108	5746630	563377.9	239.57	GD_TR
109	5746626	563380.8	239.54	GD_TR
110	5746622	563384.5	239.474	GD_TR
111	5746618	563387.4	239.391	GD_TR
112	5746613	563390.8	239.401	GD_TR
113	5746610	563393.9	239.372	GD_TR
114	5746605	563397.6	239.295	GD_TR
115	5746601	563400.7	239.132	GD_TR
116	5746600	563401.9	239.052	GD_GR TOP
117	5746598	563403.4	238.259	GD_RC
118	5746596	563405.2	236.78	GD_RC
119	5746594	563408	235.258	GD_GR BOT
120	5746591	563409.7	235.105	GD_GR
121	5746589	563412.1	234.986	GD_GR
122	5746586	563413.6	235.032	GD_GR
123	5746585	563414.6	234.597	WE
124	5746585	563414.8	234.079	CB
125	5746583	563416.3	234.058	CB
126	5746581	563417.7	234.019	CB
127	5746580	563418.7	234.076	CB
128	5746578	563420.2	234.006	CB
129	5746577	563421.1	233.987	CB
130	5746576	563421.6	234.524	WE
131	5746575	563422.8	234.811	GD_GR
132	5746572	563424.5	235.058	GD_GR
133	5746570	563425.4	235.096	GD_GR BOT
134	5746568	563426.8	236.095	GD_RC
135	5746566	563428.7	236.761	GD_RC
136	5746564	563429.7	237.99	GD_RC
137	5746561	563431.5	239.175	GD_RC TOP
138	5746558	563433.2	239.301	GD_TR
139	5746555	563436.1	239.34	GD_TR
140	5746551	563439.4	239.411	GD_TR
141	5746548	563442.2	239.393	GD_TR
142	5746543	563445.1	239.389	GD_TR
143	5746540	563447.3	239.418	GD_TR
144	5746537	563450.1	239.502	GD_TR
145	5746534	563453.2	239.437	GD_TR
146	5746531	563456.1	239.401	GD_TR

147	5746528	563458.8	239.432	GD_TR
148	5746524	563462.1	239.448	GD_TR
149	5746520	563465.2	239.457	GD_TR
150	5746516	563468.6	239.486	GD_TR
151	5746512	563472.1	239.498	GD_TR
152	5746508	563475.1	239.536	GD_TR
153	5746503	563479.3	239.613	GD_TR
154	5746500	563481.5	239.592	GD_TR
155	5746497	563484.1	239.617	GD_TR
156	5746493	563487.3	239.603	GD_TR
157	5746489	563490.7	239.598	GD_TR
158	5746485	563493.1	239.827	GD_TR
168	5746601	563401	239.315	REBAR_CHECKOUT

Section 6

CP06A	5746949	563735.2	237.478	REBAR
CP06B	5746988	563669.4	238.031	REBAR
100	5746988	563669.4	238.023	REBAR_CHECK
101	5746989	563667.6	237.869	GD_TR
102	5746990	563665.7	237.833	GD_TR
103	5746992	563663.6	237.866	GD_TR
104	5746993	563661.4	237.899	GD_TR
105	5746994	563659	237.851	GD_TR
106	5746996	563656.2	237.925	GD_TR
107	5746997	563654.4	237.909	GD_TR
108	5746998	563651.6	238.003	GD_TR
109	5747000	563649.3	238.05	GD_TR
110	5747002	563646.9	238.046	GD_TR
111	5747003	563644.7	238.072	GD_TR
112	5747005	563641.8	238.1	GD_TR
113	5747006	563639.5	238.02	GD_TR
114	5747008	563636.9	238.136	GD_TR
115	5747010	563634.2	238.085	GD_TR
116	5747012	563631.4	238.114	GD_TR
117	5747013	563628.6	238.155	GD_TR
118	5747014	563626.1	238.112	GD_TR
119	5747016	563624	238.094	GD_TR
120	5747017	563621.4	238.135	GD_TR
121	5747019	563618.7	238.203	GD_TR
122	5747021	563615.5	238.096	GD_TR
123	5747023	563612.4	238.111	GD_TR
124	5747024	563610.1	238.225	GD_TR
125	5747026	563607.3	238.216	GD_TR
126	5747027	563604.7	238.237	GD_TR
127	5747029	563602	238.201	GD_TR
128	5747031	563599.6	238.129	GD_TR
129	5747032	563597.7	238.256	GD_TR
130	5746987	563670.8	237.821	GD_TR TOP
131	5746985	563673.8	237.178	GD_GR
132	5746984	563676.2	236.167	GD_GR
133	5746982	563679.1	234.755	GD_GR BOT
134	5746980	563681.6	234.526	GD_GR
135	5746979	563684.4	234.288	GD_GR
136	5746978	563686.2	234.148	GD_GR
137	5746978	563687	233.846	WE
138	5746977	563688.7	233.558	CB
139	5746976	563689.9	233.598	CB
140	5746975	563691.2	233.635	CB
141	5746974	563692.8	233.41	CB
142	5746973	563694	233.391	CB
143	5746973	563695.3	233.85	WE
144	5746972	563696.9	234.329	GD_GR
145	5746970	563700.9	234.511	GD_GR
146	5746968	563704.1	234.238	GD_GR

147	5746967	563707.2	234.343	GD_GR BOT
148	5746965	563710.1	234.551	GD_GR
149	5746964	563712.6	234.641	GD_GR
150	5746962	563715	234.766	GD_GR BOT
151	5746960	563717.8	235.132	GD_GR
152	5746959	563720	235.282	GD_TR
153	5746957	563722.6	235.688	GD_TR
154	5746955	563725.6	236.289	GD_TR
155	5746953	563728	236.736	GD_TR
156	5746951	563730.6	237.196	GD_TR TOP
157	5746950	563733.6	237.242	GD_TR
158	5746948	563736	237.321	GD_TR
159	5746947	563738.5	237.451	GD_TR
160	5746945	563741	237.427	GD_TR
161	5746944	563743.4	237.497	GD_TR
162	5746943	563746.1	237.679	GD_TR
163	5746942	563748.3	237.749	GD_TR
164	5746940	563751.2	237.768	GD_TR
165	5746939	563754	237.837	GD_TR
166	5746937	563756.9	237.816	GD_TR
167	5746936	563759.7	237.927	GD_TR
168	5746935	563761.5	237.869	GD_TR
169	5746934	563763.7	237.894	GD_TR
170	5746933	563765.9	237.915	GD_TR
171	5746932	563767.8	237.917	GD_TR
172	5746988	563669.4	238.027	REBAR_CHECKOUT

Section 7

CP07A	5747119	564150.4	236.497	REBAR
CP07B	5747214	564104.7	236.998	REBAR
100	5747214	564104.7	236.99	REBAR_CHECK
101	5747218	564102.8	236.632	GD_RC
102	5747216	564104	236.776	GD_RC
103	5747213	564105.4	236.732	GD_RC
104	5747211	564106.7	236.586	GD_RC TOP
105	5747209	564107.5	236.125	GD_RC
106	5747207	564108.5	235.444	GD_RC
107	5747205	564109.3	234.698	GD_RC BOT
108	5747203	564110.7	234.408	GD_RC
109	5747200	564112.5	234.295	GD_RC
110	5747197	564113.9	234.421	GD_RC
111	5747194	564115.4	234.474	GD_RC
112	5747191	564116.5	234.445	GD_RC
113	5747188	564117.7	234.61	GD_RC
114	5747186	564118.5	234.759	GD_RC BOT
115	5747184	564119.4	234.991	GD_RC
116	5747182	564120.1	235.087	GD_RC TOP
117	5747179	564121.1	235.034	GD_RC
118	5747176	564122.4	234.926	GD_RC
119	5747173	564123.7	234.815	GD_RC
120	5747171	564124.8	234.779	GD_RC
121	5747168	564126	234.702	GD_RC TOP
122	5747166	564127.4	234.569	GD_RC
123	5747163	564128.6	234.375	GD_RC
124	5747160	564129.7	234.318	GD_GR BOT
125	5747158	564131.1	234.25	GD_GR
126	5747156	564132.4	234.158	GD_GR
127	5747153	564133.9	234.07	GD_GR
128	5747151	564135.3	234.036	GD_GR
129	5747149	564136.7	234.001	GD_GR
130	5747147	564137.8	233.909	GD_GR
131	5747145	564139.2	233.911	GD_GR
132	5747143	564139.6	233.808	WE
133	5747143	564139.7	233.109	CB
134	5747141	564140.5	233.191	CB
135	5747140	564141.1	232.946	CB
136	5747138	564141.9	232.995	CB
137	5747136	564142.9	233.146	CB
138	5747135	564143.4	233.867	WE
139	5747132	564144.8	233.917	GD_GR
140	5747129	564145.6	234.127	GD_GR
141	5747128	564146.2	234.082	GD_GR BOT
142	5747125	564147.4	234.679	GD_GR
143	5747122	564148.7	235.767	GD_GR
144	5747119	564149.7	236.222	GD_GR TOP
145	5747116	564151.8	236.438	GD_TR
146	5747112	564154.2	236.566	GD_TR

147	5747108	564156.5	236.726	GD_TR
148	5747104	564158.4	236.762	GD_TR
149	5747098	564161.1	236.719	GD_TR
150	5747095	564162.9	236.912	GD_TR
151	5747090	564165.4	236.914	GD_TR
152	5747087	564166.7	236.856	GD_TR
153	5747082	564168.3	236.881	GD_TR
154	5747078	564170.1	236.893	GD_TR
155	5747073	564172.2	236.962	GD_TR
156	5747069	564174.6	237.11	GD_TR
157	5747065	564176.3	237.066	GD_TR
158	5747061	564178.1	237.04	GD_TR
159	5747057	564179.4	237.138	GD_TR
160	5747052	564182.2	237.07	GD_TR
161	5747214	564104.7	236.996	REBAR_CHECKOUT

Section 8

CP08A	5747354	564549.4	235.944	REBAR
CP08B	5747412	564510	235.909	REBAR
100	5747412	564510	235.908	REBAR_CHECK
101	5747412	564510.4	235.715	GD_GR TOP
102	5747410	564511.7	235.272	GD_RC
103	5747408	564513.3	234.104	GD_RC
104	5747406	564514.7	233.034	GD_GR BOT
105	5747404	564515.9	232.743	GD_GR
106	5747402	564517	232.431	WE
107	5747402	564517.7	231.993	CB
108	5747400	564519.4	231.858	CB
109	5747398	564520	231.834	CB
110	5747397	564521.1	232.015	CB
111	5747396	564522	231.974	CB
112	5747395	564522.4	232.292	WE
113	5747395	564522.9	232.712	GD_GR
114	5747391	564525.4	232.613	GD_GR
115	5747388	564527.1	232.61	GD_GR
116	5747383	564530.5	232.687	GD_GR
117	5747380	564532.5	232.742	GD_GR
118	5747377	564535.5	232.909	GD_GR
119	5747372	564538.8	232.773	GD_GR
120	5747368	564541.4	233.131	GD_GR
121	5747366	564542.7	233.336	GD_TR BOT
122	5747362	564544.8	233.791	GD_TR
123	5747359	564547.1	234.965	GD_TR
124	5747356	564549	235.627	GD_TR TOP
125	5747352	564551.6	235.857	GD_TR
126	5747348	564553.7	235.928	GD_TR
127	5747344	564556	236.096	GD_TR
128	5747341	564558.2	236.115	GD_TR
129	5747337	564561	236.214	GD_TR
130	5747334	564562.8	236.225	GD_TR
131	5747331	564564.8	236.198	GD_TR
132	5747327	564567.3	236.276	GD_TR
133	5747325	564568.9	236.236	GD_TR
134	5747414	564508.5	235.712	GD_TR
135	5747417	564506.8	235.71	GD_TR
136	5747419	564505.4	235.77	GD_TR
137	5747421	564503.6	235.786	GD_TR
138	5747424	564501.9	235.798	GD_TR
139	5747427	564500.4	235.821	GD_TR
140	5747429	564498.9	235.764	GD_TR
141	5747431	564497.5	235.835	GD_TR
142	5747434	564495.8	235.851	GD_TR
143	5747437	564493.7	235.867	GD_TR
144	5747440	564491.9	235.906	GD_TR
145	5747442	564490.7	235.955	GD_TR
146	5747444	564489.5	235.944	GD_TR

147	5747447	564488.3	235.933	GD_TR
148	5747449	564486.9	235.92	GD_TR
149	5747452	564485.1	235.889	GD_TR
150	5747455	564482.9	235.944	GD_TR
151	5747457	564481.6	235.926	GD_TR
152	5747459	564480.4	235.962	GD_TR
153	5747462	564478.4	235.843	GD_TR
154	5747464	564476.8	235.778	GD_TR
155	5747467	564475.2	235.802	GD_TR
156	5747470	564473.4	235.709	GD_TR
157	5747472	564471.8	235.796	GD_TR
158	5747474	564470.3	235.825	GD_TR
159	5747477	564468.5	235.937	GD_TR
160	5747412	564510	235.918	REBAR_CHECKOUT

Section 9

CP09A	5747749	564839.3	234.882	REBAR
CP09B	5747768	564746.9	233.901	REBAR
100	5747768	564746.9	233.897	REBAR_CHECK
101	5747772	564722.6	234.136	GD_RC
102	5747772	564725	234.131	GD_RC
103	5747771	564728.7	234.119	GD_RC
104	5747770	564731.7	234.039	GD_RC
105	5747769	564735.3	234.052	GD_RC
106	5747769	564738.4	233.946	GD_RC
107	5747768	564741.5	233.857	GD_RC
108	5747768	564744.7	233.73	GD_RC
109	5747767	564748	233.691	GD_RC
110	5747767	564751.3	233.638	GD_RC
111	5747766	564754.5	233.549	GD_RC
112	5747765	564757.6	233.436	GD_RC
113	5747765	564760.6	233.373	GD_RC
114	5747764	564763.5	233.245	GD_RC
115	5747764	564766.4	233.172	GD_RC
116	5747763	564769.3	233.137	GD_RC
117	5747763	564772.4	233.091	GD_RC
118	5747762	564775.1	233.054	GD_RC
119	5747761	564778.5	232.864	GD_RC
120	5747761	564781.4	232.682	GD_RC
121	5747761	564784.3	232.584	GD_RC
122	5747760	564786.8	232.546	GD_RC
123	5747759	564790.4	232.454	GD_RC
124	5747758	564793.3	232.38	GD_RC
125	5747758	564797.4	232.185	GD_GR
126	5747757	564800	232.122	GD_GR
127	5747757	564802.1	232.051	GD_GR
128	5747756	564804.1	232.027	GD_GR
129	5747755	564806.7	231.933	GD_GR
130	5747755	564807.3	231.885	WE
131	5747754	564809.4	231.241	CB
132	5747754	564812.4	230.996	CB
133	5747752	564815.8	230.775	CB
134	5747752	564819.6	230.951	CB
135	5747752	564819.7	230.987	CB
136	5747751	564822.4	231.228	CB
137	5747750	564823.3	231.851	WE
138	5747750	564826.9	231.93	GD_GR BOT
139	5747750	564829.7	232.457	GD_GR
140	5747749	564832.9	233.281	GD_GR
141	5747749	564835.7	234.158	GD_GR
142	5747749	564837.8	234.605	GD_GR TOP
143	5747748	564842.5	234.638	GD_TR
144	5747748	564845.7	234.699	GD_TR
145	5747747	564848.7	234.662	GD_TR
146	5747746	564851.9	234.599	GD_TR

147	5747745	564855.9	234.683	GD_TR
148	5747745	564858.9	234.489	GD_TR
149	5747744	564861.9	234.582	GD_TR
150	5747744	564864.7	234.695	GD_TR
151	5747743	564867.6	234.591	GD_TR
152	5747743	564870.3	234.685	GD_TR
153	5747742	564873.9	234.656	GD_TR
154	5747741	564876.8	234.863	GD_TR
155	5747741	564880.7	234.785	GD_GR
156	5747740	564884	234.767	GD_GR
157	5747739	564887	234.797	GD_GR
158	5747738	564890.3	234.836	GD_GR
159	5747737	564893.7	234.778	GD_GR
160	5747737	564897	234.956	GD_GR
161	5747736	564900.3	234.734	GD_GR
162	5747736	564902.8	234.658	GD_GR
163	5747735	564906.9	234.818	GD_GR
164	5747734	564910.2	234.731	GD_GR
165	5747733	564912.8	234.89	GD_GR
166	5747733	564915.6	234.584	GD_GR
167	5747768	564746.9	233.896	REBAR_CHECKOUT

Section 10

CP10A	5748227	564971.5	233.938	REBAR
CP10B	5748226	564892.5	233.706	REBAR
100	5748226	564892.5	233.706	REBAR_CHECK
101	5748226	564893.7	233.42	GD_TR TOP
102	5748226	564896.3	233.059	GD_GR
103	5748226	564898.2	232.497	GD_GR
104	5748226	564901.4	231.956	GD_GR BOT
105	5748226	564904.1	231.824	GC_GR
106	5748226	564909.6	231.448	GC_GR
107	5748227	564914.5	231.402	GC_GR
108	5748227	564918.7	231.45	GC_GR
109	5748227	564923.6	231.386	GC_GR
110	5748227	564928.7	231.319	GC_GR
111	5748227	564932.4	231	WE
112	5748227	564933.5	230.611	CB
113	5748227	564936.2	230.443	CB
114	5748228	564938.7	230.21	CB
115	5748227	564941.3	230.234	CB
116	5748227	564943.1	230.425	CB
117	5748228	564943.6	230.969	WE
118	5748227	564946.5	231.354	GD_GR
119	5748227	564950.3	231.599	GD_GR
120	5748227	564953.4	231.74	GD_GR BOT
121	5748227	564956.1	232.263	GD_GR
122	5748227	564959.3	232.813	GD_GR
123	5748227	564963.5	233.503	GD_TR TOP
124	5748228	564967.4	233.561	GD_TR
125	5748228	564970.7	233.724	GD_TR
126	5748228	564974.7	233.752	GD_TR
127	5748228	564978.1	233.96	GD_TR
128	5748228	564983.1	233.935	GD_TR
129	5748228	564987.4	233.763	GD_TR
130	5748228	564992.8	233.996	GD_TR
131	5748228	564997.4	233.907	GD_TR
132	5748229	565002.6	233.891	GD_TR
133	5748228	565007.6	233.806	GD_TR
134	5748228	565013	234.053	GD_TR
135	5748228	565017.9	234.159	GD_TR
136	5748229	565025	234.188	GD_TR
137	5748229	565031.5	234.049	GD_TR
138	5748229	565036.3	234.007	GD_TR
139	5748229	565039.6	234.23	GD_TR
140	5748226	564889.8	233.557	GD_TR
141	5748226	564886.6	233.556	GD_TR
142	5748225	564883.7	233.538	GD_TR
143	5748225	564881.2	233.624	GD_TR
144	5748225	564878.3	233.618	GD_TR
145	5748225	564875.2	233.61	GD_TR
146	5748225	564872.3	233.651	GD_TR

147	5748224	564869.1	233.631	GD_TR
148	5748224	564866	233.628	GD_TR
149	5748224	564863.2	233.57	GD_TR
150	5748224	564859.7	233.598	GD_TR
151	5748224	564856.9	233.581	GD_TR
152	5748224	564853.8	233.608	GD_TR
153	5748224	564850.5	233.696	GD_TR
154	5748224	564847.6	233.627	GD_TR
155	5748224	564844.4	233.594	GD_TR
156	5748224	564841.8	233.694	GD_TR
157	5748224	564839.2	233.596	GD_TR
158	5748224	564836.9	233.588	GD_TR
159	5748226	564892.5	233.707	REBAR_CHECKOUT

Section 11

CP11	5748666	565000.3	231.892	
CP11B	5748701	564928.7	232.743	REBAR
100	5748701	564928.7	232.741	REBAR_CHECK
101	5748702	564926.6	232.486	GD_TR
102	5748703	564924.4	232.472	GD_TR
103	5748704	564922.1	232.472	GD_TR
104	5748706	564919.5	232.509	GD_TR
105	5748707	564917.1	232.499	GD_TR
106	5748708	564914.7	232.448	GD_TR
107	5748709	564912.4	232.51	GD_TR
108	5748710	564909.8	232.499	GD_TR
109	5748711	564907.4	232.495	GD_TR
110	5748713	564904.4	232.535	GD_TR
111	5748714	564901.7	232.501	GD_TR
112	5748715	564899.7	232.446	GD_TR
113	5748716	564896.9	232.466	GD_TR
114	5748718	564894.2	232.523	GD_TR
115	5748719	564891.2	232.442	GD_TR
116	5748720	564888.7	232.481	GD_TR
117	5748722	564885.7	232.45	GD_TR
118	5748723	564883.4	232.539	GD_TR
119	5748725	564880.9	232.438	GD_TR
120	5748725	564878.6	232.482	GD_TR
121	5748700	564931.5	232.443	GD_TR TOP
122	5748699	564933.8	232.131	GD_GR
123	5748698	564935.3	231.587	GD_GR
124	5748697	564937.6	231.006	WE
125	5748696	564939.9	230.823	CB
126	5748694	564942.4	230.544	CB
127	5748693	564944.9	230.631	CB
128	5748692	564948	230.331	CB
129	5748691	564950.9	229.829	CB
130	5748688	564953.5	229.504	CB
131	5748686	564955.6	229.558	CB
132	5748684	564960.3	229.9	CB
133	5748684	564962.3	230.58	CB
134	5748683	564964.3	230.796	CB
135	5748682	564966.1	230.948	WE
136	5748681	564968.5	230.867	GD_GR
137	5748680	564971.5	230.892	GD_GR
138	5748679	564974.4	230.936	GD_GR
139	5748677	564977	231.009	GD_GR
140	5748677	564979.6	231.073	GD_GR
141	5748675	564982.2	231.031	GD_GR
142	5748674	564985	231.134	GD_GR
143	5748673	564988	231.147	GD_GR
144	5748671	564990.9	231.304	GD_TR
145	5748669	564994.4	231.516	GD_TR
146	5748668	564997.4	231.55	GD_TR

147	5748667	564999.9	231.705	GD_TR
148	5748665	565002.4	231.71	GD_TR
149	5748664	565005.2	231.704	GD_TR
150	5748663	565007.9	231.69	GD_TR
151	5748662	565010.4	231.627	GD_TR BOT
152	5748660	565013.2	231.83	GD_TR
153	5748659	565015.7	232.07	GD_TR
154	5748657	565018.7	232.306	GD_TR TOP
155	5748656	565021.6	232.349	GD_TR
156	5748655	565024.9	232.337	GD_TR
157	5748654	565027.4	232.276	GD_TR
158	5748652	565029.9	232.135	GD_TR
159	5748651	565032.9	232.09	GD_TR
160	5748650	565035.3	231.948	GD_SWAMP
161	5748648	565038.8	231.667	GD_SWAMP
162	5748647	565041.5	231.979	GD_SWAMP
163	5748646	565043.6	232.202	GD_SWAMP
164	5748644	565045.9	232.314	GD_SWAMP
165	5748701	564928.7	232.739	REBAR_CHECKOUT

Section 12

CP12A	5749109	564777.8	231.281	
CP12B	5749158	564883	231.308	REBAR
100	5749158	564883	231.319	REBAR_CHECK
101	5749158	564884.1	231.342	GD_TR TOP
102	5749160	564886.4	231.269	GD_TR
103	5749161	564888.7	231.355	GD_TR
104	5749162	564891.6	231.393	GD_TR
105	5749163	564893.8	231.429	GD_TR
106	5749164	564896.7	231.388	GD_TR
107	5749166	564899.1	231.481	GD_TR
108	5749167	564902.1	231.488	GD_TR
109	5749168	564904.6	231.428	GD_TR
110	5749169	564907.1	231.467	GD_TR
111	5749170	564910	231.418	GD_TR
112	5749172	564912.6	231.428	GD_TR
113	5749173	564915.2	231.501	GD_TR
114	5749174	564917.9	231.455	GD_TR
115	5749175	564920.5	231.538	GD_TR
116	5749157	564880.7	230.719	GD_TR
117	5749155	564877.2	230.144	GD_TR BOT
118	5749154	564874.5	229.875	GD_TR
119	5749151	564869.7	229.634	GD_TR
120	5749149	564866.8	229.778	GD_TR
121	5749147	564863	229.669	GD_TR
122	5749146	564860.8	229.806	GD_TR
123	5749146	564857.8	229.677	GD_TR
124	5749144	564854.3	229.77	GD_TR
125	5749142	564851.1	229.778	GD_TR
126	5749140	564847.9	229.789	GD_TR
127	5749139	564844.8	229.725	GD_TR
128	5749138	564841.7	229.626	GD_GR
129	5749137	564838.8	229.686	GD_GR
130	5749135	564835.9	229.575	GD_GR
131	5749135	564834.3	229.575	WE
132	5749134	564833.1	229.188	CB
133	5749132	564830.8	228.697	CB
134	5749129	564826.4	228.518	CB
135	5749127	564821.2	228.395	CB
136	5749125	564817.2	229.127	CB
137	5749122	564812.7	229.387	CB
138	5749122	564810.4	229.502	WE
139	5749120	564807.9	229.689	GD_GR BOT
140	5749119	564805	229.861	GD_GR
141	5749118	564802.6	230.128	GD_GR
142	5749116	564798.4	231.182	GD_GR TOP
143	5749115	564794.9	231.226	HELI PAD
144	5749114	564791.4	231.118	HELI PAD
145	5749113	564788.6	231.054	HELI PAD
146	5749112	564785.7	231.126	HELI PAD

147	5749112	564783.5	231.147	HELI PAD
148	5749111	564780.7	231.149	HELI PAD
149	5749110	564778.1	231.075	GD_TR
150	5749109	564774.4	231.128	GD_TR
151	5749108	564770.9	231.194	GD_TR
152	5749105	564766.1	231.16	GD_TR
153	5749103	564763.1	231.17	GD_TR
154	5749102	564760.6	231.137	GD_TR
155	5749101	564757.7	231.022	GD_TR
156	5749100	564755.1	231.159	GD_TR
157	5749099	564752.6	231.064	GD_TR
158	5749098	564750.2	231.093	GD_TR
159	5749097	564748.1	231.148	GD_TR
160	5749095	564745.2	231.22	GD_TR
161	5749158	564883	231.305	REBAR_CHECKOUT

Section 13

CP13A	5749643	564803.5	230.01	REBAR
CP13B	5749652	564686.5	229.957	REBAR
100	5749652	564686.5	229.971	REBAR_CHECK
101	5749655	564659.3	230.347	GD_TR
102	5749654	564662.7	230.22	GD_TR
103	5749654	564665.6	230.157	GD_TR
104	5749654	564668.6	230.008	GD_TR
105	5749654	564671.5	229.894	GD_TR
106	5749654	564675	229.685	GD_TR
107	5749653	564677.2	229.625	GD_TR TOP
108	5749653	564678.3	229.268	GD_TR BOT
109	5749653	564679.5	229.513	GD_TR TOP
110	5749653	564682.3	229.651	GD_TR
111	5749653	564685.3	229.802	GD_TR
112	5749652	564688.5	229.791	GD_TR
113	5749652	564691.9	229.948	GD_TR
114	5749652	564694.9	229.953	GD_TR
115	5749652	564698	229.99	GD_TR
116	5749651	564701.2	230.002	GD_TR
117	5749651	564704.1	229.996	GD_TR
118	5749650	564707.4	229.929	GD_TR
119	5749650	564710.3	229.958	GD_TR
120	5749650	564712.9	229.888	GD_TR
121	5749650	564715.9	229.845	GD_TR
122	5749650	564718.6	229.812	GD_TR
123	5749649	564721.3	229.724	GD_TR
124	5749649	564724.3	229.62	GD_TR
125	5749649	564727.2	229.544	GD_TR
126	5749648	564730.4	229.314	GD_GR TOP
127	5749647	564733.3	229.136	GD_GR
128	5749647	564736.1	229.115	GD_GR
129	5749648	564740.4	228.792	GD_GR
130	5749647	564744.4	228.613	WE
131	5749647	564747.1	227.846	CB
132	5749647	564764.1	228.638	GD_GR BOT
133	5749647	564768.6	228.989	GD_GR
134	5749647	564771.7	229.014	GD_GR
135	5749647	564775	229.179	GD_GR
136	5749646	564778.2	229.529	GD_GR
137	5749646	564781.4	229.829	GD_TR TOP
138	5749646	564784.3	229.905	GD_TR TOP
139	5749645	564787	229.88	GD_TR
140	5749645	564789.8	229.768	GD_TR
141	5749645	564792.9	229.748	GD_TR
142	5749645	564795.3	229.813	GD_TR
143	5749644	564798	229.767	GD_TR
144	5749644	564800.9	229.809	GD_TR
145	5749644	564804.3	229.801	GD_TR
146	5749643	564807.3	229.722	GD_TR

147	5749643	564810.3	229.751	GD_TR
148	5749642	564813.1	229.704	GD_TR
149	5749642	564816.1	229.676	GD_TR
150	5749642	564818.8	229.68	GD_TR
151	5749642	564821.4	229.597	GD_TR
152	5749642	564824.2	229.6	GD_TR
153	5749641	564826.7	229.612	GD_TR
154	5749641	564829.4	229.613	GD_TR
155	5749641	564832.1	229.644	GD_TR
156	5749641	564834.9	229.635	GD_TR
157	5749641	564837.6	229.764	GD_TR
158	5749640	564839.9	229.554	GD_TR
159	5749640	564842.3	229.631	GD_TR
160	5749640	564845.4	229.636	GD_TR
161	5749640	564847.9	229.664	GD_TR
162	5749640	564850.3	229.604	GD_TR
163	5749640	564852.6	229.617	GD_TR
164	5749640	564855.1	229.606	GD_TR
165	5749640	564857.6	229.607	GD_TR
166	5749647	564760.5	227.749	CB
167	5749647	564758.5	227.533	CB
168	5749648	564756.5	227.518	CB
169	5749648	564753.2	227.546	CB
170	5749648	564749.9	227.883	CB
171	5749652	564686.5	229.962	REBAR_CHECKOUT

Section 14

CP14A	5750038	564888.8	229.651	REBAR
CP14B	5750011	564801.9	229.259	REBAR
100	5750011	564801.9	229.255	REBAR_CHECK
101	5749999	564766.1	229.616	GD_TR
102	5750001	564769.8	229.44	GD_TR
103	5750002	564774.7	229.225	GD_TR
104	5750004	564778.5	229.138	GD_TR
105	5750005	564782.2	229.251	GD_TR
106	5750006	564785.5	229.28	GD_TR
107	5750007	564789	229.205	GD_TR
108	5750008	564792.2	229.146	GD_TR
109	5750009	564796	228.937	GD_TR
110	5750009	564799.8	229.123	GD_TR
111	5750011	564804	229.255	GD_TR
112	5750012	564805.1	229.139	GD_GR TOP
113	5750012	564806.8	228.967	GD_GR
114	5750013	564809.1	228.622	GD_GR
115	5750014	564811.3	228.409	GD_GR BOT
116	5750015	564815.1	228.312	GD_GR
117	5750016	564818.6	228.314	GD_GR
118	5750017	564822.8	228.568	GD_GR
119	5750019	564827.1	228.558	GD_GR
120	5750020	564831.4	228.605	GD_GR
121	5750021	564835	228.623	GD_GR
122	5750022	564839.3	228.287	GD_GR
123	5750023	564842.2	228.202	GD_GR
124	5750024	564845.2	228.086	GD_GR
125	5750025	564846.9	227.831	WE
126	5750025	564847.6	227.068	CB
127	5750030	564866	227.564	CB
128	5750030	564862	227.188	CB
129	5750026	564850.7	226.932	CB
130	5750027	564856.1	226.96	CB
131	5750033	564872.3	227.851	WE
132	5750033	564875	228.026	GD_GR
133	5750034	564877.9	228.131	GD_GR BOT
134	5750034	564880.2	228.723	GD_GR
135	5750035	564882.2	229.126	GD_GR
136	5750036	564884.3	229.361	GD_GR TOP
137	5750037	564887.5	229.418	GD_TR
138	5750038	564891.3	229.492	GD_TR
139	5750040	564895.5	229.619	GD_TR
140	5750041	564900.3	229.564	GD_TR
141	5750043	564905.4	229.565	GD_TR
142	5750044	564909.3	229.622	GD_TR
143	5750045	564913.4	229.641	GD_TR
144	5750046	564917.1	229.609	GD_TR
145	5750048	564920.7	229.599	GD_TR
146	5750049	564924.5	229.655	GD_TR

147	5750050	564929.3	229.742	GD_TR
148	5750052	564932.9	229.671	GD_TR
149	5750053	564936.7	229.798	GD_TR
150	5750054	564940.9	229.867	GD_TR
151	5750055	564945.9	229.734	GD_TR
152	5750057	564950.7	229.78	GD_TR
153	5750058	564955.3	229.778	GD_TR
154	5750059	564959.3	229.796	GD_TR
155	5750060	564961.7	229.881	GD_TR
156	5750033	564868.5	227.55	CB
157	5750027	564859.1	226.999	CB
158	5750027	564862.2	227.364	CB
159	5750031	564866.7	227.536	CB
160	5750025	564851.4	227.094	CB
161	5750027	564855.2	227.121	CB
162	5749982	564851	228.518	WL
163	5749984	564850.9	227.763	WL
164	5749981	564857.9	228.527	WL
165	5749984	564857.1	227.867	WL
166	5749981	564866.8	228.517	WL
167	5749982	564868.4	227.916	WL
168	5750011	564801.9	229.263	REBAR_CHECKOUT

Section 15

CP15A	5750328	564888.4	228.604	REBAR
CP15B	5750384	564850.3	229.398	REBAR
100	5750384	564850.3	229.398	REBAR_CHECK
101	5750381	564852.2	229.238	GD_TR
102	5750367	564862.5	227.349	WE
103	5750369	564860.7	227.521	GD_GR BOT
104	5750372	564858.5	227.823	GD_GR
105	5750374	564856.9	228.141	GD_TR
106	5750377	564855.3	228.513	GD_TR
107	5750386	564849.3	229.146	GD_TR
108	5750389	564847.5	229.136	GD_TR
109	5750365	564864	226.866	CB
110	5750364	564865.3	226.747	CB
111	5750360	564866.5	226.803	CB
112	5750357	564869.7	226.472	CB
113	5750353	564871.4	226.33	CB
114	5750350	564874.8	226.694	CB
115	5750346	564876.3	226.861	CB
116	5750345	564877.7	227.255	WE
117	5750345	564877.8	227.473	GD_GR
118	5750343	564878.6	227.673	GD_GR
119	5750340	564879.8	227.589	GD_GR
120	5750338	564880.9	227.687	GD_GR
121	5750335	564882.8	227.813	GD_GR BOT
122	5750333	564884.1	227.925	GD_GR
123	5750329	564887.1	228.427	GD_GR TOP
124	5750327	564888.7	228.497	GD_TR
125	5750324	564890.4	228.521	GD_TR
126	5750322	564891.9	228.645	GD_TR
127	5750320	564893.5	228.53	GD_TR
128	5750318	564895	228.598	GD_TR
129	5750316	564896.8	228.577	GD_TR TOP
130	5750314	564898.9	228.598	GD_TR TOP
131	5750314	564898.1	228.097	GD_TR BOT
132	5750310	564900.6	228.658	GD_TR BOT
133	5750308	564902.7	228.769	GD_TR
134	5750305	564905.2	229.084	GD_TR TOP
135	5750302	564906.9	229.111	GD_TR
136	5750300	564908.5	229.156	GD_TR
137	5750298	564909.8	229.084	GD_TR
138	5750295	564911.4	229.177	GD_TR
139	5750293	564912.9	229.097	GD_TR
140	5750291	564914.8	229.143	GD_TR
141	5750289	564916.3	229.128	GD_TR
142	5750287	564917.8	229.186	GD_TR
143	5750285	564919.7	229.114	GD_TR
144	5750283	564921.4	229.111	GD_TR
145	5750280	564923.4	229.183	GD_TR
146	5750278	564925.2	229.224	GD_TR

147	5750276	564926.9	229.225	GD_TR
148	5750274	564928.2	229.251	GD_TR
149	5750272	564929.4	229.279	GD_TR
150	5750379	564854.1	229.168	GD_TR TOP
151	5750395	564844.3	229.155	GD_TR
152	5750398	564842.2	229.11	GD_TR
153	5750401	564840.4	229.127	GD_TR
154	5750403	564838.6	229.061	GD_TR
155	5750406	564836.7	229.089	GD_TR
156	5750409	564834.4	229.17	GD_TR
157	5750411	564832	229.108	GD_TR
158	5750384	564850.3	229.403	REBAR_CHECKOUT
159	5750414	564830	229.364	GD_TR
160	5750418	564827.3	229.283	GD_TR
161	5750422	564825	229.308	GD_TR
162	5750428	564820.9	229.479	GD_TR
163	5750432	564818.1	229.335	GD_TR
164	5750436	564815.1	229.277	GD_TR
165	5750440	564811.7	229.421	GD_TR

Section 16

CP16A	5750665	565122.7	228.832	REBAR
CP16B	5750623	565064	228.088	REBAR
100	5750623	565064	228.083	REBAR_CHECK
101	5750621	565062.1	227.926	GD_TR
102	5750620	565060.2	228.137	GD_TR
103	5750619	565058.2	228.292	GD_TR
104	5750617	565055.9	228.086	GD_TR
105	5750615	565053.6	228.247	GD_TR
106	5750614	565051.3	228.27	GD_TR
107	5750612	565049.1	228.301	GD_TR
108	5750611	565047.1	228.396	GD_TR
109	5750610	565044.8	228.398	GD_TR
110	5750609	565042.6	228.453	GD_TR
111	5750607	565040.5	228.553	GD_TR
112	5750605	565038.4	228.546	GD_TR
113	5750604	565036.6	228.605	GD_TR
114	5750603	565034.6	228.705	GD_TR
115	5750600	565032.6	228.775	GD_TR
116	5750599	565030.3	228.836	GD_TR
117	5750598	565027.5	228.912	GD_TR
118	5750596	565024.6	228.881	GD_TR
119	5750624	565065.8	227.81	GD_TR
120	5750625	565066.8	227.698	GD_TR TOP
121	5750625	565067.7	227.722	GD_TR TOP
122	5750625	565067.3	227.53	GD_TR BOT
123	5750627	565070.2	227.853	GD_TR
124	5750629	565072.4	227.773	GD_TR
125	5750630	565074.4	227.815	GD_TR
126	5750632	565076.5	227.619	GD_TR
127	5750633	565079	227.515	GD_TR
128	5750634	565081.5	227.474	GD_TR
129	5750635	565083.6	227.411	GD_TR TOP
130	5750636	565084.5	227.439	GD_TR TOP
131	5750636	565084.1	227.127	GD_TR BOT
132	5750637	565086.5	227.42	GD_TR
133	5750639	565088.4	227.479	GD_TR
134	5750640	565090.2	227.392	GD_GR
135	5750642	565091.9	227.481	GD_GR
136	5750643	565093.6	227.433	GD_GR
137	5750645	565095.8	227.495	GD_GR
138	5750647	565098.2	227.361	GD_GR
139	5750648	565100.4	227.345	GD_GR
140	5750649	565101.9	227.462	GD_GR
141	5750649	565102.2	226.965	WE
142	5750649	565104.2	226.354	CB
143	5750657	565111.2	226.928	WE
144	5750657	565111.4	227.129	GD_GR
145	5750659	565113.7	227.224	GD_GR BOT
146	5750660	565115.7	227.468	GD_GR

147	5750662	565117.9	227.879	GD_GR
148	5750663	565119.9	228.405	GD_GR
149	5750665	565122.5	228.658	GD_GR
150	5750667	565125.1	229.008	GD_GR TOP
151	5750669	565127.4	228.979	GD_TR
152	5750670	565129.7	229.124	GD_TR
153	5750672	565131.5	229.313	GD_TR
154	5750674	565133.4	229.235	GD_TR
155	5750676	565135.8	229.21	GD_TR
156	5750677	565137.9	229.312	GD_TR
157	5750679	565140	229.292	GD_TR
158	5750681	565141.9	229.419	GD_TR
159	5750682	565144.2	229.464	GD_TR
160	5750684	565146.3	229.498	GD_TR
161	5750686	565148.1	229.441	GD_TR
162	5750687	565150.4	229.373	GD_TR
163	5750689	565152.9	229.528	GD_TR
164	5750691	565155.2	229.611	GD_TR
165	5750693	565158.3	229.352	GD_TR
166	5750695	565160.4	229.517	GD_TR
167	5750697	565162.5	229.565	GD_TR
168	5750699	565165.1	229.715	GD_TR
169	5750701	565167.2	229.504	GD_TR
170	5750703	565169.3	229.59	GD_TR
171	5750704	565171.5	229.706	GD_TR
172	5750706	565173.6	229.552	GD_TR
173	5750709	565176.6	229.526	GD_TR
174	5750711	565178.7	229.571	GD_TR
175	5750712	565180.5	229.387	GD_TR
176	5750713	565181.9	229.502	GD_TR
177	5750714	565183.3	229.673	GD_TR
178	5750655	565110.5	226.303	CB
179	5750654	565108.8	226.091	CB
180	5750653	565106.6	226.019	CB
181	5750651	565104.6	226.022	CB
182	5750623	565064	228.079	REBAR_CHECKOUT

Section 17

cp17		5751014	564845.9	229.436	REBAR
	100	5751014	564845.9	229.433	REBAR_CHECK
cp17b		5750960	564749.4	228.724	REBAR
	101	5751016	564848.9	229.248	GD_TR
	102	5751014	564845.7	229.292	GD_TR
	103	5751013	564843.3	229.016	GD_TR
	104	5751012	564841.2	229.121	GD_TR
	105	5751011	564838.8	229.032	GD_TR
	106	5751010	564837.1	229.208	GD_TR
	107	5751008	564834.1	229.03	GD_TR
	108	5751007	564831.5	229.174	GD_TR
	109	5750986	564794.5	227.464	GD_TR BOT
	110	5750985	564791.7	227.279	GD_GR
	111	5750984	564789.3	227.205	GD_GR
	112	5750982	564786.9	227.23	GD_GR
	113	5750981	564784.3	227.122	GD_GR
	114	5750980	564782.3	227.103	GD_GR
	115	5750979	564780.2	227.027	GD_GR
	116	5750977	564777	226.92	GD_GR
	117	5750977	564776.9	226.87	WE
	118	5750970	564764.5	226.88	WE
	119	5750969	564762.5	227.026	GD_GR BOT
	120	5750967	564760.5	227.151	GD_GR
	121	5750965	564757.6	227.193	GD_GR
	122	5750963	564754.8	227.739	GD_GR
	123	5750962	564752.4	228.201	GD_GR
	124	5750961	564750	228.568	GD_GR TOP
	125	5750959	564747.2	228.426	GD_TR
	126	5750958	564745	228.518	GD_TR
	127	5750956	564742.6	228.538	GD_TR
	128	5750955	564740.6	228.543	GD_TR
	129	5750954	564738.2	228.581	GD_TR
	130	5750953	564735.6	228.626	GD_TR
	131	5750951	564733.5	228.664	GD_TR
	132	5750950	564730.9	228.631	GD_TR
	133	5750949	564728.3	228.614	GD_TR TOP
	134	5750948	564726.5	228.223	GD_TR
	135	5750948	564724.2	227.899	GD_TR BOT
	136	5750947	564723	228.105	GD_TR TOP
	137	5750946	564721	228.249	GD_TR
	138	5750944	564718.1	228.223	GD_TR
	139	5750943	564716	228.474	GD_TR
	140	5750942	564714	228.516	GD_TR
	141	5750941	564712.1	228.438	GD_TR
	142	5750940	564709.9	228.695	GD_TR
	143	5750938	564708.1	228.783	GD_TR
	144	5750937	564705.7	228.92	GD_TR
	145	5750936	564703	228.879	GD_TR
	146	5750934	564701.1	228.925	GD_TR

147	5750931	564697.1	228.889	GD_TR
148	5750971	564765.2	226.132	CB
149	5750972	564766.9	225.815	CB
150	5750974	564769.9	225.691	CB
151	5750976	564773.8	225.732	CB
152	5750977	564776.5	226.037	CB
153	5750992	564805.8	228.979	GD_TR TOP
154	5751004	564825.9	229.082	GD_TR
155	5751006	564829.5	228.869	GD_TR
156	5751002	564822.6	229.046	GD_TR
157	5751001	564819.1	228.995	GD_TR
158	5751014	564845.9	229.438	REBAR_CHECKOUT
159	5750999	564815.8	229.075	GD_TR
160	5750998	564813	229.102	GD_TR
161	5750996	564810.4	228.962	GD_TR
162	5750993	564806.5	228.973	GD_TR
163	5750991	564803.3	228.532	GD_TR
164	5750990	564800.3	227.953	GD_TR
165	5750988	564797.5	227.695	GD_TR
166	5751014	564845.9	229.432	CHECK_OUT

Section 18

cp18a	5751418	564622.5	227.942	REBAR
cp18b	5751404	564575.3	227.968	REBAR
100	5751404	564575.3	227.96	REBAR_CHECK
101	5751418	564621	227.644	GD_TR
102	5751418	564624.5	227.822	GD_TR TOP
103	5751420	564627.8	227.981	GD_TR
104	5751421	564630.8	227.993	GD_TR
105	5751423	564633.9	227.973	GD_TR
106	5751423	564637.3	228.057	GD_TR
107	5751410	564601.7	226.99	WE
108	5751410	564597.4	225.373	CB
109	5751409	564594.7	225.315	CB
110	5751408	564591.8	225.723	CB
111	5751407	564589.1	225.89	CB
cp18c	5751418	564620.8	227.827	REBAR
112	5751418	564620.8	227.839	REBAR_CHECKOUT
113	5751402	564570.2	228.094	GD_TR
114	5751400	564565.7	228.315	GD_TR
115	5751399	564559.3	228.46	GD_TR
116	5751397	564554.2	228.518	GD_TR
117	5751395	564547.6	228.662	GD_TR
118	5751393	564541.9	228.818	GD_TR
119	5751391	564537.1	228.923	GD_TR
120	5751390	564532.1	229.015	GD_TR
121	5751389	564525.8	229.046	GD_TR
122	5751387	564520.8	229.249	GD_TR
123	5751386	564515.7	229.316	GD_TR
124	5751385	564512.3	229.276	GD_TR
125	5751403	564576.3	227.663	GD_TR TOP
126	5751404	564579.8	227.369	GD_TR
127	5751405	564583.8	227.191	GD_TR BOT
128	5751406	564587.9	227.192	GD_GR
129	5751406	564588.4	226.997	GD_GR
130	5751412	564606.8	227.105	GD_GR
131	5751414	564612.1	227.373	GD_GR
132	5751416	564617	227.574	GD_TR
133	5751418	564620.8	227.684	GD_TR BOT
134	5751425	564643.2	228.477	GD_TR TOP
135	5751425	564643.2	228.473	GD_TR
136	5751427	564651.7	228.909	GD_TR
137	5751429	564657.8	229.159	GD_TR
138	5751431	564664.6	229.327	GD_TR
139	5751433	564672.8	229.317	GD_TR
140	5751435	564678.6	229.366	GD_TR
141	5751437	564683.4	229.357	GD_TR
142	5751418	564622.5	227.933	REBAR_CHECKOUT

Section 19

CP19A	5751855	564305.8	226.187	REBAR
CP19B	5751827	564287.1	226.753	REBAR
100	5751827	564287.1	226.723	REBAR_CHECK
101	5751852	564304.1	225.85	GD_TR
102	5751827	564287.1	226.711	REBAR_CHECKOU
103	5751831	564289.7	226.306	GD_TR
104	5751833	564291.3	226.109	GD_TR
105	5751836	564293.1	225.891	GD_TR
106	5751839	564294.8	225.84	GD_TR
107	5751841	564296.2	225.196	WE
108	5751843	564298.5	224.993	CB
109	5751845	564299.8	224.898	CB
110	5751848	564301	225.031	CB
111	5751852	564303.7	225.883	GD_TR
112	5751854	564305.3	226.072	GD_TR
113	5751858	564307.6	226.099	GD_TR
114	5751861	564309.4	226.252	GD_TR
115	5751863	564311.3	226.462	GD_TR
116	5751863	564311.3	226.462	GD_TR
117	5751866	564313	226.783	GD_TR
118	5751869	564314.8	227.149	GD_TR
119	5751872	564316.5	227.592	GD_TR
120	5751874	564318.4	227.787	GD_TR
121	5751878	564320.6	228.011	GD_TR
122	5751881	564322.5	228.152	GD_TR
123	5751883	564324.1	228.1	GD_TR
124	5751886	564326.3	228.136	GD_TR
125	5751889	564328.1	228.343	GD_TR
126	5751892	564330.3	228.261	GD_TR
127	5751895	564331.9	228.321	GD_TR
128	5751898	564333.5	228.423	GD_TR
129	5751901	564335.8	228.371	GD_TR
130	5751904	564337.7	228.526	GD_TR
131	5751907	564339.3	228.495	GD_TR
132	5751824	564285.2	226.891	GD_TR
133	5751821	564283.4	226.962	GD_TR
134	5751818	564281.5	227.147	GD_TR
135	5751816	564279.8	227.329	GD_TR
136	5751813	564278	227.517	GD_TR
137	5751811	564276.2	227.703	GD_TR
138	5751808	564274.2	227.733	GD_TR
139	5751805	564272.3	227.892	GD_TR
140	5751802	564270.2	228.058	GD_TR
141	5751799	564268.3	228.018	GD_TR
142	5751796	564266.6	228.16	GD_TR
143	5751793	564264.6	228.146	GD_TR
144	5751791	564263	228.259	GD_TR
145	5751788	564261	228.226	GD_TR
146	5751855	564305.8	226.187	TS CHECKOUT

Section 20

CP20A	5752073	563943.9	225.645	REBAR
CP20B	5752119	563974.5	226.835	REBAR
100	5752119	563974.5	226.834	REBAR CHECK
101	5752122	563976.7	226.458	GD_TR
102	5752127	563979.3	226.1	GD_TR
103	5752093	563957	224.895	WE
104	5752091	563955.6	224.502	CB
105	5752089	563954.3	224.447	CB
106	5752087	563953.2	224.31	CB
107	5752085	563952.2	224.226	CB
108	5752083	563951.1	224.281	CB
109	5752082	563949.6	224.859	WE
110	5752077	563947.2	225.152	GD_TR
111	5752075	563945.7	225.401	GD_TR
112	5752073	563943.7	225.475	GD_TR
113	5752069	563941.5	225.166	GD_TR
114	5752067	563939.5	225.081	GD_TR
115	5752064	563937.7	225.121	GD_TR
116	5752061	563935.7	225.28	GD_TR
117	5752119	563974.6	226.848	REBAR_CHECKOUT
118	5752116	563972.8	226.558	GD_TR
119	5752113	563970.2	226.47	GD_TR
120	5752109	563967.6	226.523	GD_TR
121	5752106	563965.6	226.503	GD_TR
122	5752102	563962.8	226.465	GD_TR
123	5752098	563960.5	226.471	GD_TR_TOP
124	5752096	563958.8	225.987	GD_TR
125	5752094	563957.6	225.437	GD_TR
126	5752127	563980.2	226.122	GD_TR
127	5752132	563983	226.22	GD_TR
128	5752135	563985.6	226.479	GD_TR
129	5752138	563987.8	226.93	GD_TR
130	5752142	563989.9	227.018	GD_TR
131	5752145	563991.8	227.265	GD_TR
132	5752148	563994	227.334	GD_TR
133	5752152	563996.3	227.474	GD_TR
134	5752155	563998.6	227.449	GD_TR
135	5752159	564001.3	227.592	GD_TR
136	5752162	564003.8	227.624	GD_TR
137	5752166	564006.7	227.776	GD_TR
138	5752060	563933.5	225.315	GD_TR
139	5752056	563930.9	225.474	GD_TR
140	5752052	563928.5	225.834	GD_TR
141	5752048	563925.8	226.43	GD_TR
142	5752045	563923.2	226.912	GD_TR
143	5752041	563920.6	227.134	GD_TR
144	5752038	563918.1	227.377	GD_TR
145	5752034	563915.9	227.516	GD_TR
146	5752030	563913.2	227.695	GD_TR

147	5752025	563909.4	227.759	GD_TR
148	5752021	563907.1	227.848	GD_TR
149	5752018	563904.9	227.96	GD_TR
150	5752015	563903.1	227.945	GD_TR

Section 21

CP21A	5752242	563645.8	226.131	REBAR
CP21B	5752340	563647.2	226.646	REBAR
100	5752340	563647.2	226.641	REBAR_CHECK
101	5752353	563647.4	226.867	GD_TR
102	5752350	563647.5	226.9	GD_TR
103	5752347	563647.4	226.8	GD_TR
104	5752344	563647.2	226.651	GD_TR
105	5752341	563647.2	226.566	GD_TR
106	5752339	563647.1	226.44	GD_TR
107	5752336	563646.9	226.302	GD_TR
108	5752332	563646.9	225.76	GD_TR
109	5752329	563646.9	225.348	GD_TR
110	5752325	563646.9	225.057	GD_TR
111	5752323	563646.9	224.543	GD_TR
112	5752320	563646.9	223.828	WE BOT
113	5752318	563646.6	223.436	CB
114	5752315	563646.2	223.248	CB
115	5752306	563646.5	223.575	CB
116	5752309	563646.6	223.299	CB
117	5752309	563646.6	223.301	CB
118	5752312	563646.7	223.268	CB
119	5752314	563647	223.258	CB
120	5752305	563646.4	223.919	WE
121	5752301	563647	224.34	GD_ SWAMP TR
122	5752298	563646.8	224.419	GD_ SWAMP TR
123	5752295	563646.4	224.296	GT_TR
124	5752292	563646.4	224.48	GD_SWAMP TR
125	5752289	563646.3	224.727	GD_SWAMP TR
126	5752285	563646.4	224.84	GD_SWAMP TR
127	5752282	563646.7	224.975	GT_TR
128	5752278	563646.6	225.155	GD_SWAMP TR
129	5752275	563646.2	225.167	GD_SWAMP TR
130	5752272	563645.9	225.325	GD_SWAMP TR
131	5752269	563645.8	225.415	GD_SWAMP TR
132	5752266	563645.9	225.114	GD_SWAMP TR
133	5752263	563646.2	225.019	GD_SWAMP TR BOT
134	5752259	563646.1	225.431	GD_SWAMP TR
135	5752257	563646.2	225.323	GD_SWAMP TR
136	5752253	563645.8	225.351	GD_SWAMP TR
137	5752250	563646	225.388	GD_SWAMP TR
138	5752246	563645.8	225.552	GD_SWAMP TR
139	5752243	563645.7	225.84	GD_SWAMP TR
140	5752240	563645.7	226.22	GD_SWAMP TR
141	5752237	563645.5	226.216	GD_SWAMP TR
142	5752234	563645.5	226.263	GD_SWAMP TR
143	5752231	563645.6	226.548	GD_SWAMP TR
144	5752228	563645.5	226.564	GD_SWAMP TR
145	5752224	563646	226.804	GD_SWAMP TR
146	5752220	563645.5	226.901	GD_SWAMP TR

147	5752217	563645.5	227.049	GD_SWAMP TR
148	5752213	563645.3	227.178	GD_SWAMP TR
149	5752340	563647.1	226.64	REBAR CHECKOUT
150	5752357	563647.4	226.858	GD_TR
151	5752361	563647.4	226.931	GD_TR
152	5752365	563647.4	226.965	GD_TR
153	5752372	563647.4	227.038	GD_TR
154	5752376	563647.6	227.056	GD_TR
155	5752380	563647.8	226.996	GD_TR
156	5752384	563647.8	227.038	GD_TR
157	5752387	563647.9	227.078	GD_TR
158	5752392	563648.1	227.142	GD_TR
159	5752395	563648	227.122	GD_TR
160	5752399	563648.2	227.151	GD_TR
161	5752211	563645.6	227.14	GD_TR
162	5752209	563645.5	227.152	GD_TR
163	5752207	563645.7	227.257	GD_TR_TOP
164	5752242	563645.8	226.14	TS CHECKOUT

Section 22

CP22A	5752592	563406.7	225.157	REBAR
CP22B	5752514	563495.7	226.568	REBAR
100	5752514	563495.7	226.569	REBAR_CHECK
101	5752512	563497.7	226.294	GD_TR
102	5752511	563498.6	226.161	GD_TR TOP
103	5752510	563500.6	225.265	GD_TR
104	5752508	563502.2	223.867	WE BOT
105	5752507	563504.7	223.383	CB
106	5752505	563506.7	223.178	CB
107	5752505	563507.2	223.207	CB
108	5752503	563508.5	223.217	CB
109	5752502	563509.6	223.224	CB
110	5752501	563510.8	223.251	CB
111	5752500	563512.3	223.357	CB
112	5752499	563513.5	223.478	CB
113	5752498	563514.4	223.791	WE
114	5752497	563515.7	224.362	GD_TR
115	5752495	563517.5	224.361	GD_TR
116	5752493	563519	224.421	GD_TR
117	5752491	563521.1	224.471	GD_TR
118	5752516	563493.4	226.424	GD_TR TOP
119	5752518	563491.7	226.215	GD_TR
120	5752519	563490	225.481	GD_TR
121	5752521	563487.4	224.205	GD_TR BOT
122	5752523	563485	224.047	GD_TR BOT
123	5752524	563483.5	224.063	GD_TR
124	5752526	563481.6	223.937	GD_TR
125	5752528	563479.6	224.31	GD_TR
126	5752530	563477.8	224.067	GD_TR
127	5752531	563476.3	224.101	GD_TR
128	5752533	563474.5	223.759	WE
129	5752535	563471.5	223.247	CB
130	5752537	563469.5	223.204	CB
131	5752538	563468.2	223.441	CB
132	5752541	563465.5	223.786	WE
133	5752542	563463.3	223.88	GD_TR
134	5752545	563460.6	224.259	GD_TR
136	5752514	563495.7	226.57	REBAR_CHECKOUT
137	5752545	563460.1	224.324	GR_TR
138	5752547	563457.5	224.449	GR_TR
139	5752549	563454.8	224.544	GR_TR
140	5752552	563451.8	224.712	GR_TR
141	5752554	563449.5	224.734	GR_TR
142	5752557	563446.9	224.832	GR_TR
143	5752559	563444.2	224.812	GR_TR
144	5752561	563441.4	224.927	GR_TR
145	5752564	563438.4	224.738	GR_TR
146	5752566	563435.7	224.979	GR_TR
147	5752569	563432.9	225.017	GR_TR

148	5752571	563430.1	225.063	GR_TR
149	5752574	563427.7	225.128	GR_TR
150	5752576	563425.1	225.128	GR_TR
151	5752578	563422.1	225.153	GR_TR
152	5752581	563419.4	225.17	GR_TR
153	5752583	563416.3	225.044	GR_TR
154	5752586	563413.4	225.009	GR_TR
155	5752589	563410.6	225.011	GR_TR
156	5752591	563408.1	225.005	GR_TR
157	5752593	563405.4	224.975	GR_TR
158	5752595	563402.8	225.006	GR_TR
159	5752598	563399.9	224.91	GR_TR
160	5752600	563397.1	224.925	GR_TR
161	5752493	563518.8	224.378	GR_TR
162	5752488	563523.6	224.417	GR_TR
163	5752484	563529.1	224.41	GR_TR
164	5752482	563531.5	224.413	GR_TR
165	5752479	563534.2	224.328	GR_TR
166	5752477	563535.9	224.621	GR_TR
167	5752475	563538.4	224.697	GR_TR
168	5752592	563406.7	225.152	REBAR_CHECKOUT

Section 23

CP23A	5752798	563316.1	225.379	
CP23B	5752733	563271.3	225.481	REBAR
100	5752733	563271.3	225.481	REBAR_CHECK
101	5752705	563253.6	226.324	GD_TR
102	5752707	563254.9	226.373	GD_TR
103	5752710	563256.3	226.284	GD_TR
104	5752712	563257.9	226.174	GD_TR
105	5752714	563259.3	226.172	GD_TR
106	5752717	563260.8	226.15	GD_TR
107	5752719	563261.9	226.063	GD_TR
108	5752721	563263.3	226.045	GD_TR
109	5752723	563264.6	225.925	GD_TR
110	5752725	563266	225.805	GD_TR
111	5752727	563267.4	225.713	GD_TR
112	5752728	563268.4	225.571	GD_TR
113	5752731	563269.6	225.45	GD_TR
114	5752733	563270.9	225.27	GD_TR
115	5752735	563272.5	225.177	GD_TR
116	5752737	563274.5	225.079	GD_TR
117	5752739	563276.2	224.985	GD_TR
118	5752741	563277.7	225.032	GD_TR
119	5752743	563279.2	224.937	GD_TR
120	5752745	563280.7	224.876	GD_TR
121	5752748	563282.1	224.84	GD_TR
122	5752750	563283.7	224.828	GD_TR BOT
123	5752752	563285.7	225.129	GD_TR TOP
124	5752754	563287.3	224.713	GD_TR
125	5752755	563288.2	224.397	GD_TR BOT
126	5752758	563289.6	224.287	GD_TR
127	5752760	563291.2	224.226	GD_TR
128	5752762	563292.6	224.103	GD_TR
129	5752765	563294.6	223.949	GD_TR
130	5752767	563295.9	223.973	GD_TR
131	5752770	563297.6	223.867	GD_TR
132	5752775	563301.3	223.731	GD_TR
133	5752777	563302.6	223.541	GD_TR
134	5752779	563304.2	223.321	WE
135	5752781	563304.6	223.115	CB
136	5752790	563311	223.33	WE
137	5752790	563311.4	223.465	GD_TR BOT
138	5752792	563312.8	224.36	GD_TR
139	5752795	563314.2	224.931	GD_TR
140	5752798	563315.8	225.206	GD_TR
141	5752801	563317.6	225.541	GD_TR
142	5752803	563318.9	225.639	GD_TR
143	5752806	563320.3	225.859	GD_TR
144	5752808	563321.8	225.99	GD_TR
145	5752810	563323.2	226.082	GD_TR
146	5752812	563324.9	226.172	GD_TR

147	5752814	563326.4	226.205	GD_TR TOP
148	5752816	563327.6	226.141	GD_TR
149	5752819	563329.6	226.376	GD_TR
150	5752821	563330.9	226.233	GD_TR
151	5752823	563332.5	226.225	GD_TR
152	5752825	563334	226.328	GD_TR
153	5752827	563336	226.228	GD_TR
154	5752829	563337.1	226.311	GD_TR
155	5752831	563338.7	226.348	GD_TR
156	5752834	563340.3	226.484	GD_TR
157	5752836	563342.1	226.367	GD_TR
158	5752839	563343.4	226.406	GD_TR
159	5752841	563345.2	226.519	GD_TR
160	5752844	563346.8	226.558	GD_TR
161	5752846	563348.1	226.679	GD_TR
162	5752849	563349.3	226.451	GD_TR
163	5752851	563350.9	226.447	GD_TR
164	5752854	563352.6	226.688	GD_TR
165	5752856	563354.3	226.552	GD_TR
166	5752858	563356	226.578	GD_TR
167	5752861	563357.6	226.606	GD_TR
168	5752864	563359.8	226.662	GD_TR
169	5752866	563360.7	226.679	GD_TR
170	5752868	563361.6	226.679	GD_TR
171	5752870	563362.6	226.666	GD_TR
172	5752872	563363.6	226.758	GD_TR
173	5752789	563309.3	222.562	CB
174	5752786	563308.1	222.365	CB
175	5752783	563306.2	222.371	CB
177	5752733	563271.3	225.47	REBAR_CHECKOUT

Section 24

CP24A	5753136	563264.6	225.996	REBAR
CP24B	5753048	563196.4	224.037	REBAR
100	5753048	563196.4	224.036	REBAR_CHECK
101	5753042	563191.8	224.215	GD_TR TOP
102	5753044	563193.6	224.166	GD_TR
103	5753046	563195.6	223.985	GD_TR
104	5753049	563197.3	223.895	GD_TR
105	5753051	563198.8	223.815	GD_TR
106	5753053	563200.7	223.81	GD_TR
107	5753055	563201.9	223.784	GD_TR
108	5753056	563203.3	223.693	GD_TR
109	5753059	563205.3	223.678	GD_TR
110	5753065	563209.3	223.629	GD_TR
111	5753063	563207.5	223.562	GD_TR
112	5753067	563211	223.73	GD_TR
113	5753070	563213.3	223.658	GD_TR
114	5753072	563215.2	223.655	GD_TR
115	5753074	563217	223.699	GD_TR
116	5753076	563218.8	223.496	GD_TR
117	5753078	563220.3	223.451	GD_TR
118	5753081	563222.2	223.37	GD_TR
119	5753083	563223.8	223.337	GD_TR
120	5753085	563225.4	223.27	GD_TR
121	5753087	563226.6	223.213	GD_TR
122	5753089	563228.3	223.057	GD_TR
123	5753091	563230.2	223.061	GD_TR
124	5753094	563232	223.182	GD_TR
125	5753096	563234.3	223.268	GD_TR
126	5753098	563236.2	223.349	GD_TR
127	5753101	563237.8	223.466	GD_TR
128	5753102	563238.8	223.511	GD_TR
129	5753105	563240.7	223.447	GD_TR TOP
130	5753113	563244.8	222.735	WE
131	5753109	563243.1	223.079	GD_TR
132	5753115	563247.8	221.922	CB
133	5753117	563249.7	221.801	UUUUUUU
134	5753120	563252.8	222.138	CB
135	5753122	563255.1	222.055	CB
136	5753123	563255.5	222.803	WE
137	5753124	563255.8	222.979	GD_GR BOT
138	5753126	563257.9	223.717	GD_GR
139	5753129	563259.7	224.575	GD_GR
140	5753132	563262	225.457	GD_GR
141	5753135	563264	225.794	GD_GR
142	5753140	563267.6	226.154	GD_GR TOP
143	5753144	563270.6	226.416	GD_TR
144	5753148	563274.3	226.407	GD_TR
145	5753151	563277.3	226.415	GD_TR
146	5753155	563280.3	226.435	GD_TR

147	5753159	563283.2	226.468	GD_TR
148	5753163	563286.3	226.547	GD_TR
149	5753166	563288.2	226.561	GD_TR
150	5753169	563290.6	226.556	GD_TR
151	5753173	563294.3	226.481	GD_TR
152	5753178	563297.5	226.558	GD_TR
153	5753183	563302.4	226.787	GD_TR
154	5753188	563306.2	226.801	GD_TR
156	5753048	563196.4	224.039	REBAR_CHECKOUT

Section 25

CP25A	5753449	563140.8	225.703	REBAR
CP25B	5753340	563117.8	224.038	REBAR
100	5753340	563117.9	224.037	REBAR_CHECK
101	5753337	563117.2	223.897	GD_TR TOP
102	5753340	563117.9	223.83	GD_TR
103	5753343	563118.3	223.664	GD_TR
104	5753346	563118.7	223.46	GD_TR
105	5753348	563119.3	223.064	GD_TR
106	5753350	563120.1	222.914	GD_TR
107	5753353	563120.7	222.696	GD_TR BOT
108	5753356	563121.4	222.727	GD_TR
109	5753359	563122.2	222.62	GD_TR BOT
110	5753362	563122.6	222.307	GD_TR
111	5753365	563123.2	222.421	GD_GR
112	5753368	563124.4	222.425	GD_GR
113	5753370	563124.8	222.364	WE
114	5753371	563125.4	222.157	CB
115	5753374	563126.3	221.899	CB
116	5753375	563126.3	222.393	WE
117	5753378	563126.7	222.337	GD_GR
118	5753381	563127.3	222.284	GD_GR
119	5753384	563127.9	222.317	GD_GR
120	5753386	563128.6	222.258	GD_GR
121	5753389	563128.9	222.244	GD_GR
122	5753392	563129.2	222.192	GD_GR
123	5753395	563129.9	222.316	GD_GR
124	5753397	563130.5	222.256	GD_GR
125	5753400	563131.2	222.268	GD_GR
126	5753403	563131.7	222.189	GD_GR
127	5753406	563132.3	222.215	GD_GR TOP
128	5753409	563132.7	222.018	GD_GR
129	5753412	563133.2	221.879	GD_GR BOT
130	5753414	563133.6	221.942	GD_GR
131	5753417	563133.9	221.97	GD_GR TOP
132	5753420	563134.6	222.014	GD_GR
133	5753423	563135.2	222.162	GD_GR
134	5753425	563136.1	222.264	GD_GR TOP
135	5753428	563136.8	222.156	GD_GR
136	5753430	563136.8	221.708	WE
137	5753432	563137.3	221.383	CB
138	5753435	563138.5	221.253	CB
139	5753436	563138.6	221.256	CB
140	5753438	563139.2	221.651	WE
141	5753439	563139.1	221.747	GD BOT
142	5753441	563139.7	222.349	GD GR
143	5753443	563140	223.469	GD GR
144	5753445	563140	224.884	GD GR
145	5753448	563140.5	225.56	GD TR TOP
146	5753451	563141.3	225.626	GD TR

147	5753454	563141.9	225.594	GD TR
148	5753457	563142.5	225.617	GD TR
149	5753460	563143.3	225.68	GD TR
150	5753463	563143.8	225.796	GD TR
151	5753466	563144.3	225.864	GD TR
152	5753469	563144.9	225.77	GD TR
153	5753472	563145.9	225.814	GD TR
154	5753474	563146.6	225.856	GD TR
155	5753477	563147.5	225.887	GD TR
156	5753480	563148	225.869	GD TR
157	5753483	563148.6	226.006	GD TR
158	5753486	563148.9	226.024	GD TR
159	5753489	563149.2	226.154	GD TR
160	5753493	563149.8	226.188	GD TR
161	5753496	563150.6	226.135	GD TR
162	5753499	563151.3	226.199	GD TR
163	5753502	563152	226.23	GD TR
164	5753505	563152.5	226.179	GD TR
165	5753512	563154.1	226.095	GD TR
166	5753508	563153.2	226.182	GD TR
167	5753515	563154.5	226.096	GD TR
168	5753518	563155	226.137	GD TR
169	5753521	563155.7	226.293	GD TR
170	5753340	563117.9	224.041	REBAR_CHECKOUT

Section 26

106	5753458	562775.1	220.962	CB
128	5753462	562781.2	219.968	CB
129	5753464	562784.7	220.287	CB
130	5753466	562786	220.877	CB
131	5753461	562777.9	220.168	CB
132	5753458	562776	220.781	CB
101	5753413	562724.5	221.418	GD_GR
102	5753415	562727.6	221.696	GD_GR
103	5753418	562730.3	221.74	GD_GR
107	5753467	562786.5	221.553	GD_GR
108	5753469	562788.4	221.507	GD_GR
109	5753472	562790.5	221.534	GD_GR
110	5753474	562792.9	221.689	GD_GR
111	5753476	562795.3	221.657	GD_GR
112	5753478	562797.6	221.74	GD_GR
113	5753479	562799.5	221.817	GD_GR
114	5753481	562801.5	221.681	GD_GR
115	5753483	562803.6	221.649	GD_GR
116	5753485	562805.7	221.687	GD_GR
117	5753487	562807.3	221.76	GD_GR
118	5753489	562809.2	221.777	GD_GR
104	5753422	562735.1	222.935	GD_TR
105	5753447	562762.8	223.363	GD_TR
119	5753491	562811.8	221.957	GD_TR
120	5753493	562814.2	222.049	GD_TR
121	5753496	562816.5	222.014	GD_TR
122	5753498	562818.8	221.918	GD_TR
123	5753500	562820.8	221.908	GD_TR
124	5753502	562823.4	221.896	GD_TR
125	5753505	562826.2	222.077	GD_TR
126	5753506	562828.4	222.206	GD_TR
127	5753509	562830	222.317	GD_TR
133	5753446	562761.7	223.49	GD_TR
136	5753442	562758.2	223.926	GD_TR
137	5753440	562756.1	223.997	GD_TR
138	5753438	562753.9	223.962	GD_TR
139	5753436	562752.1	223.959	GD_TR
175	5753426	562739.9	223.543	GD_TR
176	5753423	562736.6	223.434	GD_TR
134	5753444	562760.2	223.638	GD_TR BOT
135	5753442	562758.2	223.927	GD_TR TOP
CP26A	5753502	562822.5	222.045	REBAR
CP26B	5753435	562751.2	223.953	REBAR
100	5753435	562751.2	223.967	REBAR_CHECK
178	5753435	562751.1	223.962	REBAR_CHECKOUT
171	5753434	562749.6	223.801	
172	5753432	562747	223.723	
173	5753430	562744.6	223.512	
174	5753428	562742.2	223.428	

Section 27

139	5753660	562483.5	220.168	CB
137	5753660	562486.8	220.029	CB
136	5753659	562490.3	220.168	CB
135	5753660	562493.6	220.285	CB
134	5753662	562496	220.184	CB
147	5753655	562455	224.916	GD_GR
146	5753655	562458	224.668	GD_GR
145	5753656	562461.7	224.103	GD_GR
144	5753656	562465	223.287	GD_GR
143	5753657	562468.6	222.693	GD_GR
142	5753658	562471.7	222.135	GD_GR
132	5753663	562500.6	221.262	GD_GR
131	5753663	562502.7	221.317	GD_GR
130	5753663	562505.7	221.473	GD_GR
129	5753663	562508.3	221.469	GD_GR
128	5753664	562511.1	221.648	GD_GR
127	5753664	562513.9	221.62	GD_GR
126	5753664	562516.9	221.657	GD_GR
125	5753664	562519.8	221.803	GD_GR
124	5753664	562522.3	221.851	GD_GR
123	5753664	562525	221.752	GD_GR
122	5753665	562527.5	221.789	GD_GR
121	5753665	562530	221.836	GD_GR
141	5753658	562475.2	221.559	GD_GR BOT
169	5753648	562388	225.874	GD_TR
168	5753648	562390.1	225.959	GD_TR
167	5753649	562392.5	225.809	GD_TR
166	5753649	562395.4	225.944	GD_TR
165	5753650	562398.5	225.705	GD_TR
164	5753650	562401.8	225.713	GD_TR
163	5753650	562405.3	225.726	GD_TR
162	5753650	562408.5	225.819	GD_TR
161	5753651	562411.5	225.69	GD_TR
160	5753651	562414.3	225.509	GD_TR
159	5753652	562417.3	225.619	GD_TR
158	5753652	562420.2	225.622	GD_TR
157	5753652	562422.8	225.642	GD_TR
156	5753652	562425.8	225.519	GD_TR
155	5753652	562428.7	225.539	GD_TR
154	5753653	562431.7	225.554	GD_TR
153	5753653	562435.1	225.446	GD_TR
152	5753653	562437.7	225.425	GD_TR
151	5753653	562441.6	225.416	GD_TR
150	5753654	562444.8	225.401	GD_TR
149	5753654	562448.6	225.433	GD_TR
119	5753665	562534.9	222.197	GD_TR
118	5753665	562537.8	222.659	GD_TR
117	5753665	562540.8	223.037	GD_TR
116	5753666	562543.6	223.597	GD_TR

115	5753666	562546.3	223.977	GD_TR
114	5753666	562549	224.293	GD_TR
113	5753667	562551.7	224.519	GD_TR
112	5753667	562554.2	224.587	GD_TR
111	5753668	562556.7	224.745	GD_TR
109	5753668	562562.9	224.986	GD_TR
108	5753669	562566.8	225.084	GD_TR
107	5753669	562569.2	225.178	GD_TR
106	5753670	562572.4	225.138	GD_TR
105	5753670	562574.8	225.158	GD_TR
104	5753670	562577.7	225.207	GD_TR
103	5753670	562580	225.434	GD_TR
102	5753670	562582.8	225.389	GD_TR
101	5753671	562586.2	225.341	GD_TR
120	5753665	562532.8	221.891	GD_TR BOT
148	5753655	562451.8	225.038	GD_TR TOP
110	5753668	562559.2	224.853	GD_TR TOP
CP27A	5753655	562454.5	225.059	REBAR
138	5753666	562555.1	224.715	REBAR_CHECK
CP27B	5753666	562555.1	224.716	REBAR_CHECK
100	5753666	562555.1	224.748	REBAR_CHECK
170	5753666	562555.1	224.729	REBAR_CHECKOUT
140	5753659	562479	221.172	WE
133	5753662	562499.7	221.213	WE

Section 28

167	5753921	562311.4	223.532	GD
166	5753921	562311.4	223.533	REBAR_CHECKOUT
165	5754069	562300.1	222.729	GD_TR BOT
164	5754067	562300.2	222.823	GD_TR BOT
163	5754064	562300.2	223.026	GD_TR BOT
162	5754061	562300.4	223.203	GD_TR
161	5754059	562300.7	223.391	GD_TR
160	5754056	562301.3	223.58	GD_TR
159	5754053	562301.7	223.722	GD_TR
158	5754050	562301.9	223.878	GD_TR TOP
157	5754047	562302.1	223.998	GD_TR
156	5754045	562302.5	224.017	GD_TR
155	5754041	562303	224.05	GD_TR
154	5754038	562303.2	224.077	GD_TR
153	5754035	562303.2	224.123	GD_TR
152	5754032	562303.1	224.039	GD_TR
151	5754028	562303.3	224.042	GD_TR
150	5754025	562303.3	224.098	GD_TR
149	5754023	562303.5	224.008	GD_TR
148	5754019	562303.8	224.088	GD_TR
147	5754016	562304.2	224.068	GD_TR
146	5754012	562304.6	224.157	GD_TR
145	5754009	562305	224.16	GD_TR
144	5754005	562305.8	224.152	GD_TR
143	5754003	562306.2	223.979	GD_GR TOP
142	5754000	562307	223.482	GD_GR
141	5753998	562307.5	222.552	GD_GR
140	5753995	562308.7	221.619	GD_GR
139	5753992	562310.7	220.575	WE
138	5753991	562310.8	219.905	CB
137	5753988	562310.5	219.664	CB
136	5753984	562312.2	219.884	CB
135	5753979	562310	220.3	WE
134	5753978	562310.3	220.728	GD_GR
133	5753976	562310.7	220.807	GD_GR
132	5753973	562311	220.799	GD_GR
131	5753970	562311.2	220.729	GD_GR TOP
130	5753968	562310.9	220.363	GD_GR
129	5753964	562311	219.983	GD_SWAMP
128	5753959	562311	220.365	GD_GR
127	5753956	562310.5	220.557	GD_GR TOP
126	5753954	562310.4	220.649	GD_GR
125	5753952	562310.1	220.636	GD_GR
124	5753949	562310	220.778	GD_GR
123	5753946	562310.3	220.821	GD_GR
122	5753943	562310.1	220.732	GD_GR
121	5753939	562310.3	220.921	GD_GR BOT
120	5753937	562310.4	221.197	GD_GR
119	5753933	562310.6	221.78	GD_GR

118	5753931	562310.8	222.34	GD_TR
117	5753928	562311.3	222.784	GD_TR
116	5753926	562311.4	222.953	GD_TR
115	5753923	562311.5	223.413	GD_TR TOP
114	5753920	562311.5	223.367	GD_TR
113	5753918	562311.6	223.408	GD_TR
112	5753916	562311.9	223.395	GD_TR
111	5753913	562312.3	223.439	GD_TR
110	5753910	562312.5	223.395	GD_TR
109	5753907	562312.8	223.398	GD_TR
108	5753904	562313.2	223.417	GD_TR
107	5753901	562313.5	223.374	GD_TR
106	5753898	562313.7	223.333	GD_TR
105	5753895	562313.7	223.483	GD_TR
104	5753892	562313.6	223.302	GD_TR
103	5753889	562313.7	223.377	GD_TR
102	5753886	562313.7	223.584	GD_TR
101	5753883	562314.1	223.736	GD_TR
100	5753921	562311.4	223.525	REBAR_CHECK
CP28B	5753921	562311.5	223.533	REBAR
CP28A	5754006	562305.6	224.339	REBAR

Section 29

CP29A	5754306	562268	225.18	REBAR
CP29B	5754252	562206.2	222.894	REBAR
100	5754252	562206.2	222.885	REBAR_CHECK
101	5754246	562199.8	222.245	GD_SWAMP
102	5754248	562202.2	222.334	GD_SWAMP BOT
103	5754250	562204.1	223.033	GD_SWAMP TOP
104	5754251	562204.8	222.662	GD_TR BOT
105	5754254	562208.1	222.442	GD_TR
106	5754256	562211.2	222.085	GD_TR
107	5754260	562214.6	221.79	GD_TR
108	5754262	562218	221.557	GD_GR
109	5754264	562220.7	221.433	GD_GR
110	5754267	562223.9	221.17	GD_GR
111	5754270	562226.7	221.022	GD_GR
112	5754273	562229.9	220.904	GD_GR
113	5754274	562232.3	220.87	GD_GR
114	5754276	562234.6	220.809	GD_GR
115	5754278	562237	220.703	GD_GR
116	5754280	562239.6	220.469	GD_GR
117	5754282	562241.4	220.447	GD_GR
118	5754283	562243.2	220.454	GD_GR
119	5754284	562244.5	220.395	GD_GR
120	5754285	562245.1	220.141	WE
121	5754286	562245.9	219.899	CB
122	5754287	562247.6	219.362	CB
123	5754287	562248.7	219.283	CB
124	5754289	562249.1	219.278	CB
125	5754290	562250.6	219.257	CB
126	5754291	562252.4	219.308	CB
127	5754292	562253.5	220.067	WE BOT
128	5754294	562255.4	221.045	GD_GR
129	5754295	562257.9	221.876	GD_GR
130	5754298	562260.6	223.239	GD_GR
131	5754302	562264.4	224.604	GD_GR
132	5754305	562267.2	224.902	GD_TR TOP
133	5754307	562269.7	224.955	GD_TR
134	5754310	562272.5	224.962	GD_TR
135	5754312	562275.9	225.017	GD_TR
136	5754316	562280.2	225.028	GD_TR
137	5754319	562283.6	225.066	GD_TR
139	5754252	562206.1	222.88	REBAR_CHECKOUT

Section 30

CP30A	5754687	562203.5	224.959	REBAR
CP30B	5754672	562256.7	221.315	REBAR
100	5754672	562256.7	221.311	REBAR_CHECK
101	5754672	562259.1	221.113	GD_GR
102	5754672	562256.7	221.124	GD_GR
103	5754673	562253.8	220.983	GD_GR
104	5754673	562250.7	220.757	GD_GR
105	5754674	562248.1	220.529	GD_GR
106	5754676	562246	220.377	GD_GR
107	5754677	562243.3	220.186	GD_GR
108	5754678	562241	220.211	GD_GR
109	5754679	562237.3	220.032	GD_GR
110	5754680	562236.3	220.08	WE
111	5754679	562232.1	218.78	CB
112	5754681	562229.4	218.872	CB
113	5754684	562226.1	218.933	CB
114	5754681	562222.1	219.09	CB
115	5754680	562223.4	219.004	CB
116	5754682	562219.7	219.981	WE BOT
117	5754683	562216.9	220.831	GD_GR
118	5754684	562214.3	221.787	GD_GR
119	5754685	562211	223.328	GD_GR
120	5754687	562206	224.597	GD_TR TOP
121	5754688	562202.4	224.875	GD_TR
122	5754688	562199.3	224.878	GD_TR
123	5754689	562197.2	224.979	GD_TR
124	5754690	562193.9	224.975	GD_TR
125	5754691	562190.2	225.05	GD_TR
126	5754672	562256.7	221.304	REBAR_CHECKOUT
127	5754694	562178	224.946	GD_TR
128	5754695	562174.8	224.98	GD_TR
129	5754696	562171.3	224.932	GD_TR
130	5754697	562167.6	224.948	GD_TR
131	5754698	562163.6	224.914	GD_TR
132	5754699	562160.1	224.846	GD_TR
133	5754700	562156.9	224.805	GD_TR
134	5754700	562153.8	224.816	GD_TR
135	5754701	562150.7	224.837	GD_TR
136	5754702	562147.8	224.863	GD_TR
137	5754703	562145.2	224.796	GD_TR
138	5754693	562181.6	224.96	GD_TR
139	5754692	562185.9	224.989	GD_TR
140	5754670	562261.7	221.278	GD_GR
141	5754670	562264.9	221.337	GD_GR
142	5754669	562268.6	221.24	GD_GR
143	5754668	562271.8	221.258	GD_TR
144	5754667	562274.9	221.627	GD_TR
145	5754666	562279.8	222.232	GD_TR
146	5754665	562284.1	222.397	GD_TR

147	5754664	562287.2	222.465	GD_TR
148	5754662	562291.1	222.44	GD_TR
149	5754661	562295.2	222.702	GD_TR
150	5754660	562298.1	222.959	GD_TR
151	5754660	562301.8	223.118	GD_TR
152	5754659	562305.1	223.07	GD_TR
153	5754659	562308.3	223.029	GD_TR
154	5754658	562311.4	223.061	GD_TR TOP
155	5754657	562314.4	222.935	GD_TR
156	5754656	562317.7	222.764	GD_TR
157	5754655	562320.6	222.673	GD_TR
158	5754655	562323	222.687	GD_TR BOT
159	5754654	562325.7	223.171	GD_TR
160	5754652	562329.4	224.107	GD_TR
161	5754651	562332.8	224.412	GD_TR TOP
162	5754672	562256.7	221.312	TS CHECKOUT

APPENDIX C

PHOTO LOGS AND FIELD NOTES

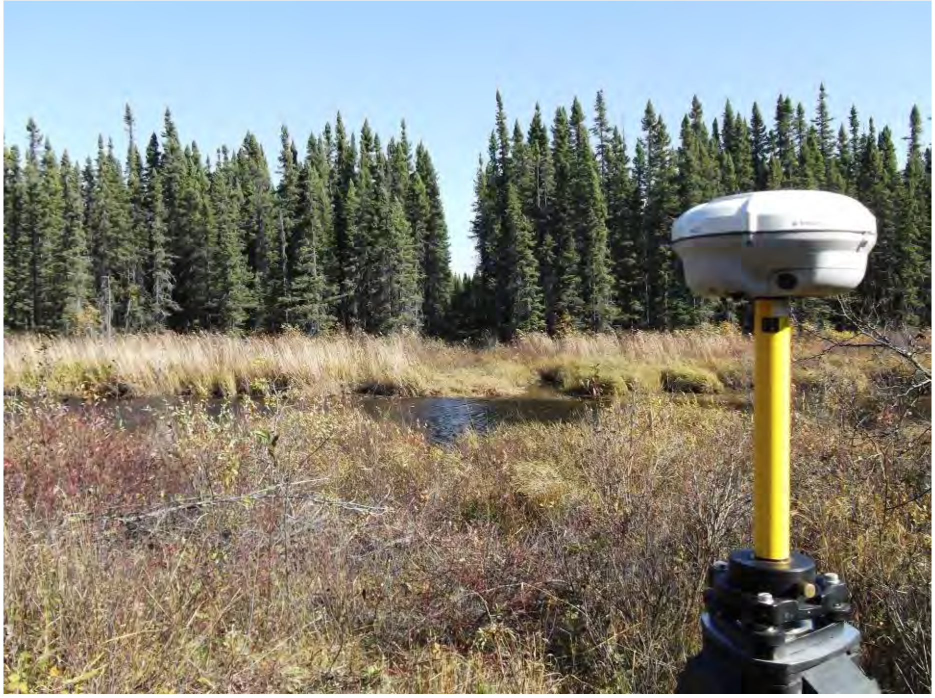

Photo 1 – Example of a typical cross-section in heavily treed area.

Photo 2 – Example of a typical cross-section in heavy brush area.

Photo 3 – Example of a typical cross-section with strong change in elevation.

Photo 4 – Example of a typical control point at each cross-section.

No .... Date .... Page........

No .... Date .... Page........

GROUND GT
GROUND GRASS GD_GR
GROUND ROCK GD_RK
GROUND CLAY GD_CY
GROUND SWAMP GD_SWAMP [illegible]
[illegible] SHOT [illegible]
CHECK SHOT [illegible]
[illegible]
CREEK BOTTOM CB
GROUND TOP OF BANK GRASS
GD_GR TOP

GROUND BANK BOTTOM GRASS
GD_GR_BOT

GROUND ROCK GD_RC

TREED AREA GD_TR

WATER LEVEL - WL

No ..KAS BUFF CREEK BASELINE..........
Date ..SEPT 28 2011.................Page...1...

3K [illegible]	M 2 N	5 [illegible] 1234	793 E 54	778.353	EL 295.[illegible]
SETUP 1	TBM 2	⊼ H	1.545		
STATIC	START	8:53 AM	STOP	6:15	
STATIC	⊼H	1.487	CP01 A		
SECTION	START	1:54 PM			
SETUP 2	END	4:03 PM			
	⊼ H	1.545	CP01 B		
RTK CHK	SHOT	CP01 B	ΔH	0.003	
			ΔV	-0.0[illegible]1	
RTK CHK	SHOT	CP01 B	ΔH	0.010	
			ΔV	0.019	
TS					
SETUP 3	TBM	CP01 B	ΔH	-0.004	
			ΔV	0.002	
	⊼H	1.353			
	BS	1.285			

No ..R. BUSHIE, HANS K. TRAVIS H..........
Date ....Page.........

No. KGS BUFF CREEK SURVEY
Date SEPT 30, 2011 Page 2

No. D BUSHIE, HANS P, TRAVIS HUDSON
Date Page

BR TBM2					
SETUP1	TBM2	⊼	1.798		
STATIC	START	7:26AM	END	6:14PM	
STATIC	⊼	1.501	CP02A		
SECTION1	START	8:45 PM			
RTK+STA	END	11:02			
SECTION2					
CP02B	⊼	1.505			
RTK CHK	ΔH	0.013			
CP02B	ΔV	0.004			
RTK CHKOUT	ΔH	0.008			
CP02B	ΔV	-0.005			
SETUP3	⊼	1.555			
CP03A	START	1:47			
	END	3:57			
RTK+STA	ΔH	0.014			
	ΔV	0.006			
CP03B	⊼	1.643			
RTKCHKOUT	ΔH	0.012			
	ΔV	0.005			

No KGS BUFFALO CREEK SURVEY Page 3
Date Oct 1, 2011

BR_TBM2				
SETUP 1	⊼		1.777	
		START	7:25	
		END		
SETUP 2	⊼		1.723	
SEC 4		START	8:40	
CP04A		END	11:31	
RTK+STA				
CP04B	⊼		~~1.556~~	1.457
CHECK		ΔH	0.015	
		ΔV	0.002	
CHECKOUT		ΔH	0.018	
		ΔV	-0.006	
SETUP 3	⊼		1.575	
SEC 5		START	2:38	
CP05A		END	4:39	-RESTART
RTK+STA		ΔH	0.008	
CHECK		ΔV	0.006	

*CONT NEXT PAGE

No D. BUSHIE, HANS P, TRAVIS H Page
Date

GROUND TREED AREA
GD_TR

No KGS : BUFF CREEK SURVEY Page 4
Date OCT 1, 2011

No D. BUSHIE, HANS P., T. HUDSON Page
Date

SETUP3					
SEC 5	⊼		1.575		
CP05A		START	2:38		
		END	4:39		
RTK STA					
CP05B	⊼		1.443		
CHECK		ΔH	0.008		
		ΔV	0.006		
CHECKOUT		ΔH	0.020		
		ΔV	0.018		

No KGS BUFF CREEK SURVEY
Date OCT 2, 2011 Page 5

BR_TBM2					
SETUP 1	⊼		1.718		
	START	7:30	END	6:15	
SETUP2					
CP06A	⊼		1.550		
	START	9:02	END	11:03	
RTK+STA					
CP06B	⊼		1.554		
CHECK		ΔH	0.016		
		ΔV	-0.008		
CHECKOUT		ΔH	0.009		
		ΔV	-0.004		
SETUP 3					
CP07A	⊼		1.410		
	START	11:30	END	1:54	
RTK+STA					
CP07B	⊼		1.635		
CHECK		ΔH	0.007		
		ΔV	-0.008		
CHECKOUT		ΔH	0.009		
		ΔV	-0.002		

No D. BUSHIE, HANS P., TRAVIS H.
Date Page

No KGS BUFF CREEK SURVEY
Date OCT 2, 2011 Page 6

SETUP 4				
CPO8A	⊼		1.632	
	START	3:40	END	5:43
RTK+STA				
CPO8B	⊼		1.575	
CHECK		ΔH	0.007	
		ΔV	-0.001	
CHECKOUT		ΔH	0.010	
		ΔV	0.009	

No D BOSHIE, HANS P, TRAVIS H
Date Page

No KGS BUFF CR. SURVEY
Date OCT 3, 2011 Page 7

BR_TRAV.					
SETUP 1	⊼		1.719		
	START	7:32	END	6:40	
SETUP 2					
CP09A	⊼		1.500	1.499	
	START	3:15	END	5:30	
RTK + STA					
CP09B	⊼		1.540		
CHECK		ΔH	0.006		
		ΔV	-0.004		
CHECKOUT		ΔH	0.002		
		ΔV	-0.005		

No D. BUSHIE, HANS P., TRAVIS H.
Date Page

No KGS BUFF CREEK SURVEY
Date OCT 4, 2011 Page 8

BR_TBM2				
SETUP 1	⊼		1.668	
	START	7:30	END	6:14
SETUP 2				
CP10A	⊼		1.618	
	START	8:42	END	10:42
RTK + STA				
CP10B	⊼		~~1.618~~	1.504
	~~START~~	~~8:42~~	~~END~~	~~10:42~~
CHECK		ΔH	0.010	
		ΔV	-0.001	
CHECKOUT		ΔH	0.008	
		ΔV	0.001	
SETUP 3				
CP11A	⊼		1.555	
	START	11:47	END	1:47
RTK+STA				
CP11B	⊼		1.565	
CHECK		ΔH	0.006	
		ΔV	-0.002	
CHECKOUT		ΔH	0.010	
		ΔV	-0.004	

No DENELE B, HANS P, TRAVIS H
Date Page

No KGS - BUFF. CR. SURVEY
Date OCT 4, 2011 Page 9

SETUP 4					
CP12A	⊼		1.548		
	START	3:59	END	5:59	
CP12B	⊼		1.572		
CHECK		ΔH	0.020		
		ΔV	0.011		
CHECKOUT		ΔH	0.003		
		ΔV	-0.003		

No
Date Page

No KGS - BUFF. CR. SURVEY
Date OCT 5, 2011 Page 12

SETUP 1				
BR TBM2	⊼		1.679	
	START	7:27	END	7:29 P.M.
SETUP 2				
CP13A	⊼		1.570	
	START	8:58	END	10:59
RTK+STA				
CP13B	⊼		1.433	
CHECK		ΔH	0.002	
		ΔV	0.004	
CHECKOUT		ΔH	0.010	
		ΔV	0.006	
SETUP 3				
CP14A	⊼		1.547	
	START	12:00	END	2:00
RTK+STA				
CP14B	⊼			
CHECK		ΔH	0.011	
		ΔV	-0.004	
CHECKOUT		ΔH	0.006	
		ΔV	0.004	

No D. BISHIE, H. Perrera, T. HUDSON
Date Page

WL - WATER LEVEL

THE PLACEMENT OF THIS SECTION WAS DECIDED UPON INSPECTION OF A BEAVER DAM

WL SHOTS ARE WATER LEVELS OBSERVED ON EITHER SIDE

No KGS - BUFF CR. SURVEY
Date OCT 5, 2011 Page 11

SETUP 4					
CP15A	π		1.573		
	START	2:41	END	5:15	
~~CHECK~~					
CP15B	π		1.434		
CHECK		ΔH	0.010		
		ΔV	0.004		
CHECKOUT		ΔH	0.004		
		ΔV	0.010		
SETUP 5	T.S.				
	π @	CP15B	1.368		
	B.S. @	CP15A	1.367		
		ΔH	-0.003		
		ΔV	-0.004		

No D. BUSHIE, H. PERRERA, T. HUDSON
Date Page

No KGS – BUFF. CR. SURVEY
Date OCT 6 2011 Page 12

SETUP1				
BR_TBM2	⊼		1.678	
	START	7:36	END	6:42
SETUP2				
CP16A	⊼		1.694	
	START	8:57	END	10:58
BK+STA				
CP16B	⊼		1.527	
CHECK		ΔH	0.003	
		ΔV	-0.005	
CHECKOUT		ΔH	0.002	
		ΔV	-0.009	
SETUP3				
CP17A	⊼		1.571	
	START	11:26	END	2:00
BK+STA				
CP17B	⊼		1.487	
CHECK		ΔH	0.005	
		ΔV	-0.003	
CHECKOUT		ΔH	0.006	
		ΔV	0.002	

No DENELLE B., HANS P., TRAVIS H.
Date Page

No KGS - BUFF. CR. SURVEY
Date OCT 6, 2011 Page 13

SETUP4	T.S.				
	⊼ @	CP17A	1.393		
	B.S. @	CP17B	1.232		
		ΔH	0.001		
		ΔV	-0.002		
		ΔH	0.006		
		ΔV	-0.004		
SETUP 5					
CP18A	⊼		1.541		
	START	3:04	END		
BK+STA					
CP18B	⊼		1.375		
CHECK		ΔH	0.017		
		ΔV	-0.007		
CHECKOUT		ΔH			
		ΔV			
CP18C	⊼		1.403		
	ΔH	0.003	ΔV	0.012	
SETUP6	T.S.				
	⊼ @	CP18B	1.202		
	B.S. @	CP18C	1.401		
		ΔH			
		ΔV			

No AGS BUFF. CR. SURVEY
Date OCT 7, 2011 Page 14

SETUP 1	⊼	1.676			
BR-1BM2	START	7:24	END	6:36	
SETUP 2	T.S				
	⊼ @	CP18A	1.404		
	B.S. @	CP18B	1.600		
		ΔH	0.019		
		ΔV	-0.008		
SETUP 3					
CP19A	⊼		1.689		
	START	11:14	END		
RIS+STA					
CP19B	⊼		1.522		
CHECK		ΔH			
		ΔV			
CHECKOUT		ΔH			
		ΔV			
SETUP 4	T.S.				
	⊼ @	CP18A	1.299		
	B.S. @	CP18B	1.301		
CHECK		ΔH	-0.007		
		ΔV	-0.001		

No D. BUSHIE, H. PERREAH, THUDSON
Date Page

No. KGS BUFF CR. SURVEY
Date OCT 27, 2011 Page 15

CHEK OUT	T.S.	HI 1.301	ΔH	0.009	
			ΔV	0.009	
SETUP					

No
Date Page

No KGS BUFF. CB SURVEY
Date OCT 8, 2011 Page 16

SETUP1					
BR_TEM2	⊼	1.715			
	START	7:37	END		
SETUP 2					
CP23A	⊼		1.560		
	START	11:18	END	1:34	
RTK+STA					
CP23B	⊼		1.512		
CHECK		ΔH	0.008		
		ΔV	0.000		
CHECKOUT		ΔH	~~0.008~~	0.014	
		ΔV	~~0.000~~	-0.011	
SETUP3					
CP24A	⊼		1.588		
	START	2:11	END		
RTK+STA					
CP24B	⊼		1.572		
CHECK		ΔH	0.014		
		ΔV	-0.001		
CHECKOUT		ΔH	~~0.010~~	~~0.002~~	0.004
		ΔV		~~0.004~~	0.002

No
Date Page

SOME CONTROL POINTS
SUBJECT TO SINKING

No KGS - BUFF. CR. SURVEY
Date OCT 4, 2011 Page 17

SETUP1					
BR TBM2	⊼	1.714			
	START	7:32	END	4:59	
SETUP2					
CP25A	⊼		~~1.565~~	1.564	
	START	10:04	END	12:46	
BR+TH					
CP25B	⊼		1.505		
CHECK		ΔH	0.008		
		ΔV	-0.001		
CHECKOUT		ΔH	0.009		
		ΔV	0.003		
SETUP3					
CP26A	⊼		1.542		
	START	1:39	END	3:56	
BTM+STH					
CP26B	⊼		~~1.628~~	1.548	
CHECK		ΔH	0.004		
		ΔV	0.014		
CHECKOUT		ΔH	0.013		
		ΔV	0.010		

No
Date Page

SECTION 26 SOME POINTS
INCONCLUSIVE DUE TO
POOR SATTELAITE
PRECISIONS

No 86
Date 8/7/18 Page

TuP1	T	1.661			
[illegible]	START	8:04	END	~~4:36~~ 6.28	
[illegible]					
TuP2	T	1.556			
[illegible]	START	8:35	END	11.36	
[illegible]					
275	CHECK	ΔH	[illegible]		
		ΔV	-0.001		
	CHECKOUT	ΔH	0.025		
		ΔV	0.013		
uP3	T	1.482			
28A	START	12:20	END		
[illegible]					
P28B	T	1.506			
C29	CHECKIN	ΔH	-0.021		
		ΔV	+ 0.00[illegible]		
	CHECKOUT	ΔH	0.017		
		ΔV	-0.002		

No
Date Page

→ THIS POINT IS MOVING
BECAUSE OF THE SOFTNESS
OF THE [illegible]

No .... Date OCT 19 .... Page ....

SETUP1	⊼	1.6[illegible]			
STATIC	START	[illegible]	END		
SETUP2	⊼	1.489			
STATIC	START	10:05	END	12:07	
[illegible]					
CP22B	CHECK	⊼	1.510		
	CHECK	ΔH	0.207m	≤02.0m	
		ΔV	-0.010m	≤015m	
	[illegible]	ΔH	[illegible]		
		ΔV	[illegible]		
SETUP3	BS	1.781	⊼	1.341	
TS	ΔH	0.002m			
	ΔE	0.00[illegible]			
	Δ[illegible]	-0.00[illegible]			
	CHECK 22B	0.207	ΔH		
		0.000	ΔV		
SETUP4					
	⊼	1-462			
RTK +STA	START	2:57	END	5:00	

No .... Date .... Page ....

No
Date Oct 2?

Page.

SECTION 21

SETUP#1	⊼	1.661		
STATIC	Start	7:46	END	
TS				
SETUP2	BS	1.256	⊼	1.301
TS	ΔN	0.000 m		
	ΔE	0.000 m		
	ΔELEV	-0.004 m		
CHEKOUT	ΔH	0.012 m		
	ΔV	0.013 m		
Sec 2?				
SETUP	⊼	1.507		CP20A
# 3	START	1:23	END	3:36
STA RTK				
20				
SETUP	⊼	1.448		
# 4	CHECK	ΔH	0.017	
CP20B		ΔV	-0.014	
	CHECKOUT	ΔH	0.015	
		ΔV	0.001	

1.256

No

Date

Page.

No ....
Date .... Page ....

SETUP	TS			
※5	BS	1.304	$\overline{\wedge}$	1.270
TS	ΔN	0.004		
	ΔE	0.002		
	ΔElev.	-0.028		
		~~[illegible]~~		
CHECKOUT	ΔH			
	ΔV			

Date .... Page ....

No ....
Date .... Page ....

Date .... Page ....

SETUP	$\overline{\Lambda}$	1.472	
* 5	CHECK	ΔH	0.004
CP21B		ΔV	0.008
	CHECK #	ΔH	0.019
		ΔV	-0.010

No
Date OCT 21, 2011 Page

SETUP1	⊼	1.661		
STATIC	START	7:39	END	4:50
		$\boxed{\text{SEC 19}}$		
SETUP2	⊼	1.517		
RTK STA	START	10:18	END	12:30
CP19A				
SETUP3	⊼	1.557		
CP19B	CHECK	ΔH	0.020	
		ΔV	-0.013	
	CHECKOUT	ΔH	0.027	
		ΔV	-0.001	
SETUP4	⊼	1.379	BS	1.311
TS	ΔN	-0.007		
	ΔE	-0.005		
	ΔELEV.	-0.004		
CHECKOUT	ΔH	0.008		
	ΔV	0.004		

No
Date Page

No
Date Oct 24, 2011 Page

SETUP1	⊼	1.689		
TBM2	START	8:30		
BR				
	END	5:54		
SETUP2	⊼	1.580		
RTK+[illegible]	START	11:44		
CP30				
	END	1:48		
RTK	⊼	1.559		
	CHECK	ΔH	0.008	
		ΔV	0.007	
	CHECKOUT	ΔH	0.007	
		ΔV	0	
TS	⊼	1.397		
	BS ⊼	1.318	N	0.001
		CHECK	E	-0.003
			ELEV	-0.002
		CHECKOUT	N	
			E	
			ELEV	

No
Date Page

APPENDIX I

KGS GROUP LETTER REPORT JANUARY 29, 2013

DAUPHIN RIVER BATHYMETRIC SURVEY INVESTIGATION

Kontzamanis Graumann Smith MacMillan Inc.

KGS GROUP
CONSULTING ENGINEERS

January 29, 2013

File No. 11-0300-18

Manitoba Infrastructure and Transportation
7th Floor, 215 Garry Street
Winnipeg, Manitoba
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ATTENTION: Mr. Ron Kaatz
Senior Hydraulic Engineer

RE: Emergency Reduction of Lake Manitoba and Lake St. Martin Water Levels
Dauphin River Bathymetric Survey Investigation - FINAL

Dear Mr. Kaatz:

1.0 INTRODUCTION

KGS Group completed a bathymetric survey investigation along the Dauphin River. The program was undertaken July 1st to July 4th, 2011 and June 18th to 20th, 2012. This letter report describes the survey program and the results of the survey investigation completed.

2.0 WORK PROGRAM AND METHODOLOGY

2011 Survey Program

The 2011 survey program was undertaken along the Dauphin River during high flows occurring in the summer of the 2011 flood, prior to the operation of the Lake St. Martin Emergency Outlet Channel (LSMEOC). The water condition along the Dauphin River was at bank full, the water surface elevation of Lake St. Martin at the Dauphin River inlet was 804.1 ft. (245.1 metres) and the water surface elevation of Lake Winnipeg at the mouth of Dauphin River was 716.9 ft. (218.5 metres). A local boat operator from the Dauphin River ANA Community was hired to provide water vessel and transportation along the river for the required field tasks.

The 2011 bathymetry was completed from the inlet of the Dauphin River at Lake St Martin to the mouth of the river at Lake Winnipeg, adjacent to the Dauphin River First Nation community. All rapids and natural water drops were fully submerged at the time of the bathymetric survey and a continuous survey was able to be conducted along the complete reach length.

Access along the banks of the river was limited during the survey. Most of the banks could not be captured as unknown flow conditions were occurring at the river's edge as well as trees and submerged vegetation was observed. Local knowledge of the area from the boat operator was essential for the safe navigation and capture of the Dauphin River bathymetry data.

2012 Survey Program

The 2012 survey program was undertaken along the Dauphin River from upstream of Buffalo Creek at station 42+200 to the mouth of the river at Lake Winnipeg. The water surface elevation of Lake Winnipeg at the mouth of the Dauphin River at the time of the bathymetric survey was 714.2 ft. (217.7 metres). The LSMEOC was in operation during the 2012 survey program (LSMEOC was operated from November 2011 to November 2012). The focus of the survey was to capture the river bottom to develop river bottom contours, profile and river cross-sections where possible. The same boat operator that was hired in 2011 provided services for the 2012 survey program. Figure 1 shows the limits of the field investigation completed by KGS Group.

For both the 2011 and the 2012 survey program, the bathymetric survey was completed with two KGS Group personnel using a sonar device mounted on the rear of the provided boat. A Lowrance HDS-8 chartplotter computer was used to power and log sonar data from a dual transducer configuration using survey grade narrow cone multi-beam sonar and a high frequency side scanner. The chartplotter was used to record a continuous log of sonar data from both transducers and stored the sonar traces on the chartplotter device. All sonar point locations were referenced by linking the sonar unit to a survey grade Topcon Global Positioning System (GPS) RTK receiver and positional data was recorded at an interval of 1 second. The objective was to conduct the sonar survey at 20 to 30 metre sections to adequately capture changes in the river bottom. Survey controls were established for the bathymetric survey and are shown on Figure 1. All controls established were set by completing a static GPS network for the entire project area and were referenced to known GPS 3D monuments set along PTH 6 from Lundar to Fairford and along PR 513.

3.0 RESULTS

The completed bathymetric survey was compiled and compared against the 2011 survey data collected for the same reach length collected in June 2012. Figure 2 shows the locations of the sonar tracks collected from both years from Station 46+200 to 53+200. The bathymetry data was interpolated to produce a bottom profile of the Dauphin River from Station 48+000 to Station 53+200 for both the 2011 and 2012 data. The water level was on average 0.5 metre lower during the 2012 investigation than the previous water level during the 2011 program for the downstream reach of the river. The average depth of water observed at different locations in the river during the 2012 survey is outlined below:

- 0.7 m from Station 46+000 to Station 47+300,
- 1.4 m from Station 47+300 to Station 50+500,
- 2.7 m from Station 50+500 to Station 52+000,
- 3.0 m from Station 52+000 to the mouth of the river.

Cross sections were computed from the 2011 and 2012 bathymetric data and also from LiDAR data collected for the project and are shown on Figure 3. The sections are shown at 500 m intervals and also at additional locations where there was a noticeable change in bathymetry between the 2011 and 2012 surveys (i.e. station 51+250 and 52+050). The section locations are shown on Figure 1. The rock rip-rap placed during the construction of the DRFN emergency diking has been shown on sections where rock was placed.

A centreline profile of the river from station 46+000 to the mouth of the river is provided on Figure 4. The profile shows the water surface of the river during each survey as well as the channel bottom at the centre of the channel captured during each survey (the profile does not necessarily represent the invert as this may meander away from the centre of the channel).

River bottom bathymetric contours with geodetic elevations for the 2011 and 2012 surveys, and a plan showing incremental changes in bathymetry between the surveys with depth ranges coded in colour have been developed for the lower Dauphin River (Figures 5 and 6).

A preliminary volumetric comparison was completed from Station 46+000 to 52+000 and an approximate net difference of 39,600 m^3 was calculated. Table 1 shows the net and cumulative difference in volume every 200 m detected in 2012 compared to 2011. The calculated volumes are based only on sonar data located within the “volume boundary” shown on Figures 5 and 6 as this is considered to be the most reliable data. The lack of reliable data at the edge of the survey may result in a substantial variation to the actual and calculated volumes.

TABLE 1
DAUPHIN RIVER BOTTOM VOLUME CHANGES

Sta From	Sta To	Decrease in Volume (m^3)	Increase in Volume (m^3)	Net Volume (m^3)	Cumulative Volume (m^3)
46000	46200	-	919	919	919
46200	46400	-	6,341	6,341	7,260
46400	46600	69	3,007	2,937	10,197
46600	46800	105	2,138	2,033	12,230
46800	47000	1,469	793	- 675	11,554
47000	47200	789	971	182	11,737
47200	47400	3,516	436	- 3,080	8,657
47400	47600	2,049	390	- 1,659	6,997
47600	47800	581	990	409	7,406
47800	48000	1,162	67	- 1,096	6,311
48000	48200	1,060	239	- 820	5,490
48200	48400	2,373	21	- 2,352	3,138
48400	48600	3,675	575	- 3,099	39
48600	48800	2,469	607	- 1,863	- 1,823
48800	49000	2,979	470	- 2,508	- 4,332
49000	49200	219	2,745	2,525	- 1,807
49200	49400	161	2,767	2,606	799
49400	49600	739	2,016	1,278	2,077
49600	49800	162	3,389	3,227	5,304
49800	50000	305	3,899	3,595	8,899
50000	50200	1,248	3,313	2,065	10,964
50200	50400	518	3,737	3,219	14,183
50400	50600	304	1,902	1,598	15,781
50600	50800	2,274	1,657	- 616	15,165
50800	51000	1,056	5,057	4,001	19,166
51000	51200	481	6,129	5,649	24,814
51200	51400	1,864	4,733	2,869	27,683
51400	51600	457	7,836	7,378	35,061
51600	51800	674	3,636	2,962	38,024
51800	52000	2,192	3,725	1,533	39,557
	SUM	**34,950**	**74,506**	**39,557**	**39,557**

The river bottom side scanning imagery was briefly examined to compare the bed material types during the 2011 survey to the 2012 survey. However, observations made from the side scanner imagery would require confirmation with river bed samples to verify the results and is beyond the scope of the current investigation. Samples already collected by North/South Consultants can be reviewed and included in future discussions.

4.0 DISCUSSION

The comparison between the 2011 and 2012 bathymetry show that there were areas which saw an increase in the river bed elevation and other areas which saw a decrease in elevation. This is shown on the cross sections, the profile and the bathymetry comparison attached with this memo (Figures 3, 4 and 6). The difference in elevation appears to occur at random throughout the surveyed portion of the Dauphin River, as made evident on Figure 6, and does not show obvious or consistent patterns in changes to the river bed.

When looking at the centreline profile (Figure 4), the river bed elevation in 2012 is on average similar to the bed elevation in 2011 upstream of station 51+250. Downstream of station 51+250 the river bed elevation in 2012 is more variable and alternates between lower and higher elevations when compared to the 2011 river bed. This is consistent with preliminary substrate surveys of the area completed by North/South Consultants, which indicated that the river bed material downstream of station 51+250 was comprised mostly of gravels and sands compared to the material upstream of 51+250 which was more compact and contained more cobbles and boulders. A river bed which has a material containing more sands is more likely to experience movement, and therefore changes in bed elevations.

Results from Table 1 show a net increase in volume between station 46+000 to 52+000. This is consistent with the preliminary sediment transport analysis of the Dauphin River completed by KGS Group which indicated a decrease in total sediment runoff in this reach of the river. However, the calculated volumes are based on the sonar data located within the “volume boundary” as discussed in the results. The volume does not account for changes that may have occurred outside the boundary.

The position and elevation of each sonar depth sounding was obtained by Survey Grade GPS. The resultant accuracy for each discrete survey/sonar point is approximately 50 mm. Of more significance is the accuracy of the digital surface model developed from the survey data. Assumptions are made when developing the surface and linear interpolations are required between data points in the model. The accuracy of the surface varies depending on the number of survey points collected and the proximity of the survey points between each other. Sudden changes in the river bed or the presence of large cobbles and boulders are examples of conditions which may affect the accuracy of the surface model. When comparing two different surfaces of the same area developed from two separate surveys, the accuracy of the comparison is highly dependent on the proximity of the survey points collected between the two surveys. The difference in calculated volumes presented in this memo, as well as the differences in river bed elevation shown on the figures attached may be significantly influenced by the accuracy of the interpolation between survey points (the digital surface model) in locations where fewer survey points were collected, or of sudden changes in the river bed, as discussed above.

An area of degradation was noted at the mouth of the river where the 2012 bed elevations were lower than the 2011 bed elevations (station 52+100). However, this area is only approximately 150 m long and the bed levels upstream and downstream from this location are higher in 2012. Also the lake bottom elevations from 52+100 to 53+000 are generally higher in 2012. This could be caused a number of ways including the effect of littoral drift in the bay with lower stream flow current influences in 2012, allowing movement of sand in the lake to occur.

Discharges in the river varied considerably between the two surveys. In 2011, discharges on the Dauphin River were at highest recorded flows at more than 20,000 cfs (570 m^3/s). By June 2012 the discharge had receded to approximately half of the peak of the previous year 11,800 cfs (330 m^3/s).

From backwater model results for these two flow conditions, the flow velocity in the reach of the Dauphin River covered by the 2011 survey ranged from 9.5 ft/s (2.9 m/s) at the upstream end of the reach to 3.5 ft/s (1.0 m/s) in Lake Winnipeg 300 m downstream from the mouth of the river. Corresponding velocities in 2012 were 8 ft/s (2.5 m/s) and 2.5 ft/s (0.75 m/s).

While the discharge in the river has changed during the period since spring 2011, the flow velocity in the channel has remained in the same general range. Though some changes in river bed elevation between the 2011 and 2012 surveys were observed, the hydraulic conditions in the river have remained fairly constant, and do not suggest a substantial change compared to the natural sedimentation/erosion processes of the river.

The discharge in the lower Dauphin River downstream of Buffalo Creek was influenced by the Buffalo Creek discharge during the period from November 2011 to present. However, if the diversion of flow into Buffalo Creek had not occurred with the opening of the Lake St. Martin Emergency Outlet Channel on November 1, 2011, the water level on Lake St. Martin would have staged accordingly to a higher level such that the total inflow to Lake St. Martin would have been released down the Dauphin River and the discharge on the river downstream from the Buffalo Creek confluence would have been the same with or without the LSMEOC in operation. The potential influence of the Buffalo Creek discharge on the lower Dauphin River during operation of the LSMEOC is discussed further in the Sediment Transport Analysis report issued by KGS Group in August 2012.

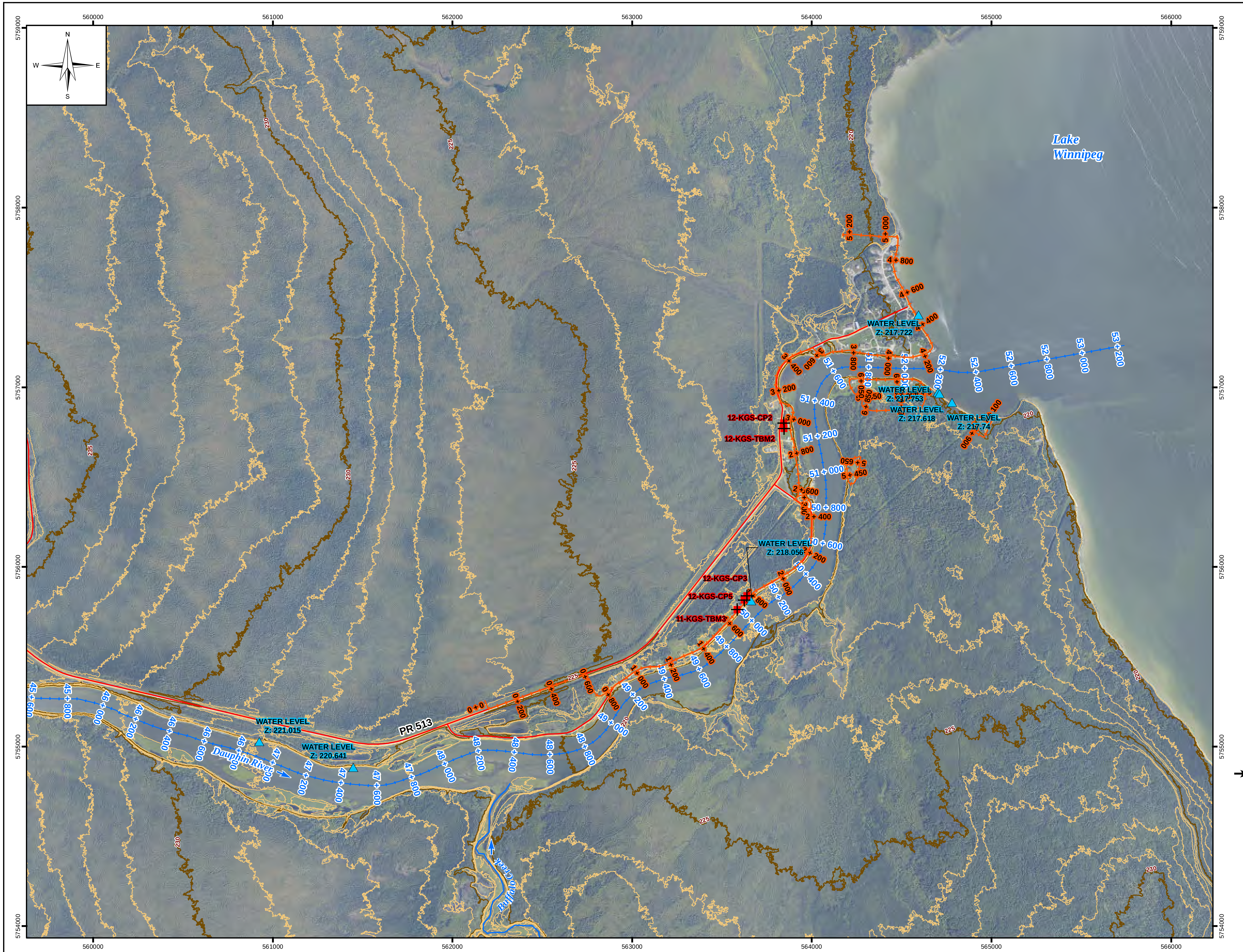
Prepared By: Approved By:

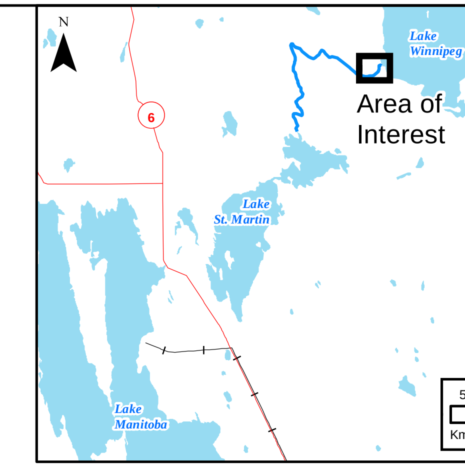
<Original signed by> <Original signed by>

Mark Wilcox, C.E.T., B.Sc.
Geomatics Specialist

Colin Siepman, P.Eng.
Senior Project Manager

MW/jr





LEGEND:

- Water Level (June 20, 2012)
- Control
- As–Built Dike Alignment (2011)
- Dauphin River Centreline

TRANSPORTATION

- Gravel Road
- Trail

LiDAR CONTOURS

- 5m Index Contour
- 1m Contour

NOTES:

1. 2011 Sonar completed by KGS Group on July 2nd, 2011
   2012 Sonar completed by KGS Group on June 20, 2012
2. Satelite image provided by Atlis Geomatics, July 2011
3. Original ground surface based on LiDAR provided by Atlis Geomatics (June/July 2011)
4. All units are metric and in metres unless otherwise specified
   Transverse Mercator Projection, NAD 1983, Zone 14
   Elevations are in metres above sea level (MSL)

250 0 250 500 750

Metres

SCALE: 1:20,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

Manitoba INFRASTRUCTURE AND TRANSPORTATION

EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

LOWER DAUPHIN RIVER BATHYMETRY OVERVIEW

JANUARY 2013 | FIGURE 01 | REV: 0

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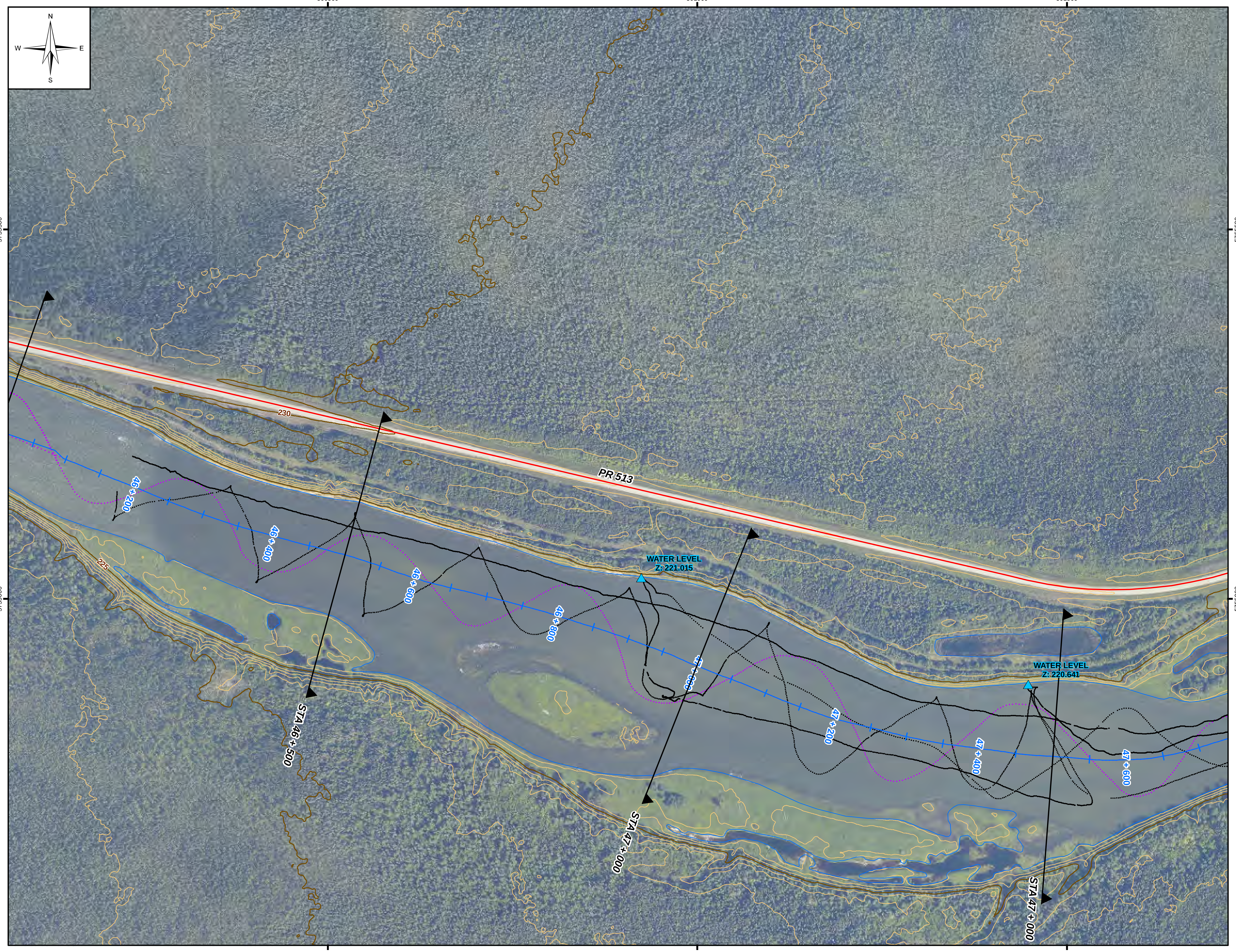

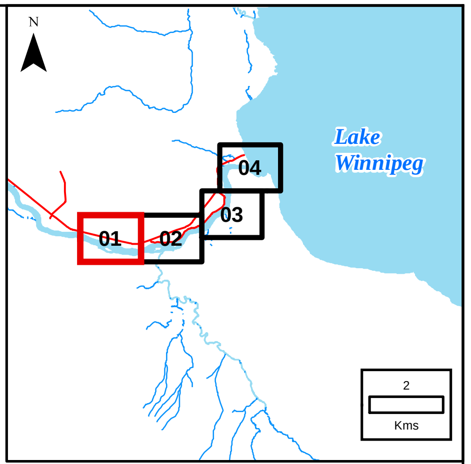

LEGEND:

- Water Level (June 20, 2012)
- Control
- 2012 Sonar Point
- 2011 Sonar Point
- X–Section
- Dauphin River Centreline

TRANSPORTATION

- Gravel Road
- Trail

LiDAR CONTOURS

- 5m Index Contour
- 1m Contour
- Edge of Water (LiDAR)

NOTES:

1. 2011 Sonar completed by KGS Group on July 2nd, 2011
   2012 Sonar completed by KGS Group on June 20, 2012
2. Satelite image provided by Atlis Geomatics, July 2011
3. Original ground surface based on LiDAR provided by Atlis Geomatics (June/July 2011)
4. All units are metric and in metres unless otherwise specified
   Transverse Mercator Projection, NAD 1983, Zone 14
   Elevations are in metres above sea level (MSL)

50 0 50 100 150

Metres

SCALE: 1:5,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

Manitoba INFRASTRUCTURE AND TRANSPORTATION

EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY (SHEET 1 OF 4)

JANUARY 2013 | FIGURE 02 | REV: 0

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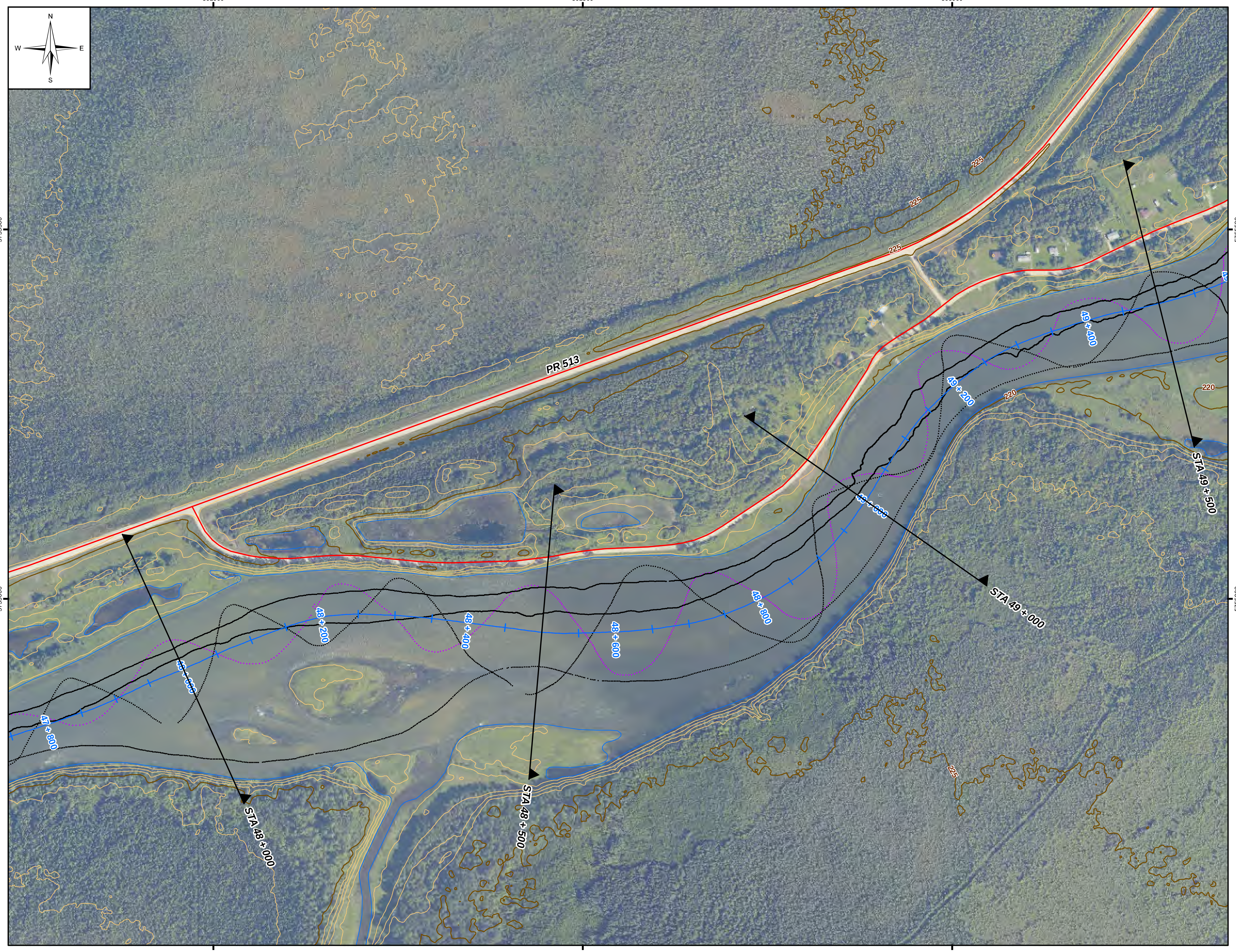

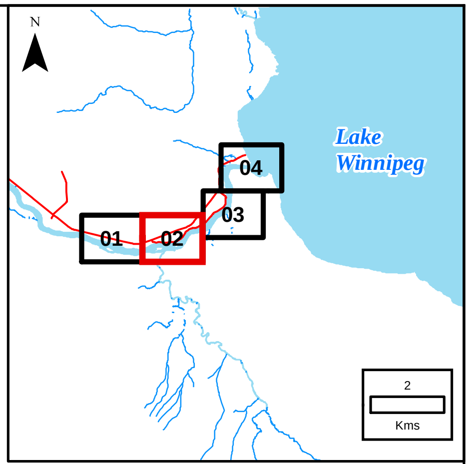

LEGEND:

- Water Level (June 20, 2012)
- Control
- 2012 Sonar Point
- 2011 Sonar Point
- X-Section
- Dauphin River Centreline

TRANSPORTATION

- Gravel Road
- Trail

LiDAR CONTOURS

- 5m Index Contour
- 1m Contour
- Edge of Water (LiDAR)

NOTES:

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   2012 Sonar completed by KGS Group on June 20, 2012
2. Satelite image provided by Atlis Geomatics, July 2011
3. Original ground surface based on LiDAR provided by Atlis Geomatics (June/July 2011)
4. All units are metric and in metres unless otherwise specified
   Transverse Mercator Projection, NAD 1983, Zone 14
   Elevations are in metres above sea level (MSL)

50 0 50 100 150

Metres

SCALE: 1:5,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

Manitoba INFRASTRUCTURE AND TRANSPORTATION

EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY
(SHEET 2 OF 4)

JANUARY 2013 | FIGURE 02 | REV: 0

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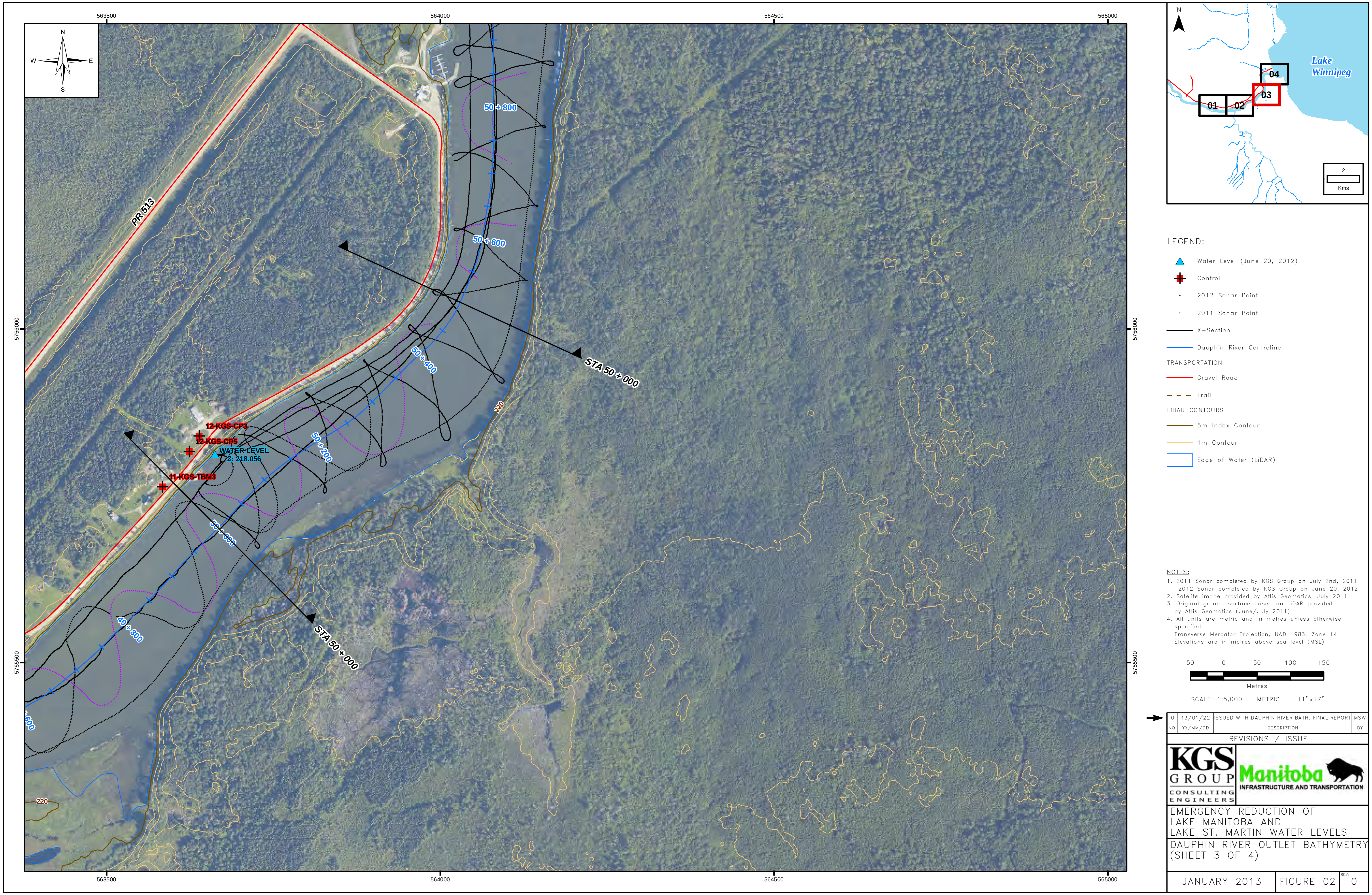

LEGEND:

- Water Level (June 20, 2012)
- Control
- 2012 Sonar Point
- 2011 Sonar Point
- X–Section
- Dauphin River Centreline

TRANSPORTATION

- Gravel Road
- Trail

LiDAR CONTOURS

- 5m Index Contour
- 1m Contour
- Edge of Water (LiDAR)

NOTES:

1. 2011 Sonar completed by KGS Group on July 2nd, 2011
   2012 Sonar completed by KGS Group on June 20, 2012
2. Satelite image provided by Atlis Geomatics, July 2011
3. Original ground surface based on LiDAR provided by Atlis Geomatics (June/July 2011)
4. All units are metric and in metres unless otherwise specified
   Transverse Mercator Projection, NAD 1983, Zone 14
   Elevations are in metres above sea level (MSL)

50 0 50 100 150

Metres

SCALE: 1:5,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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KGS GROUP CONSULTING ENGINEERS

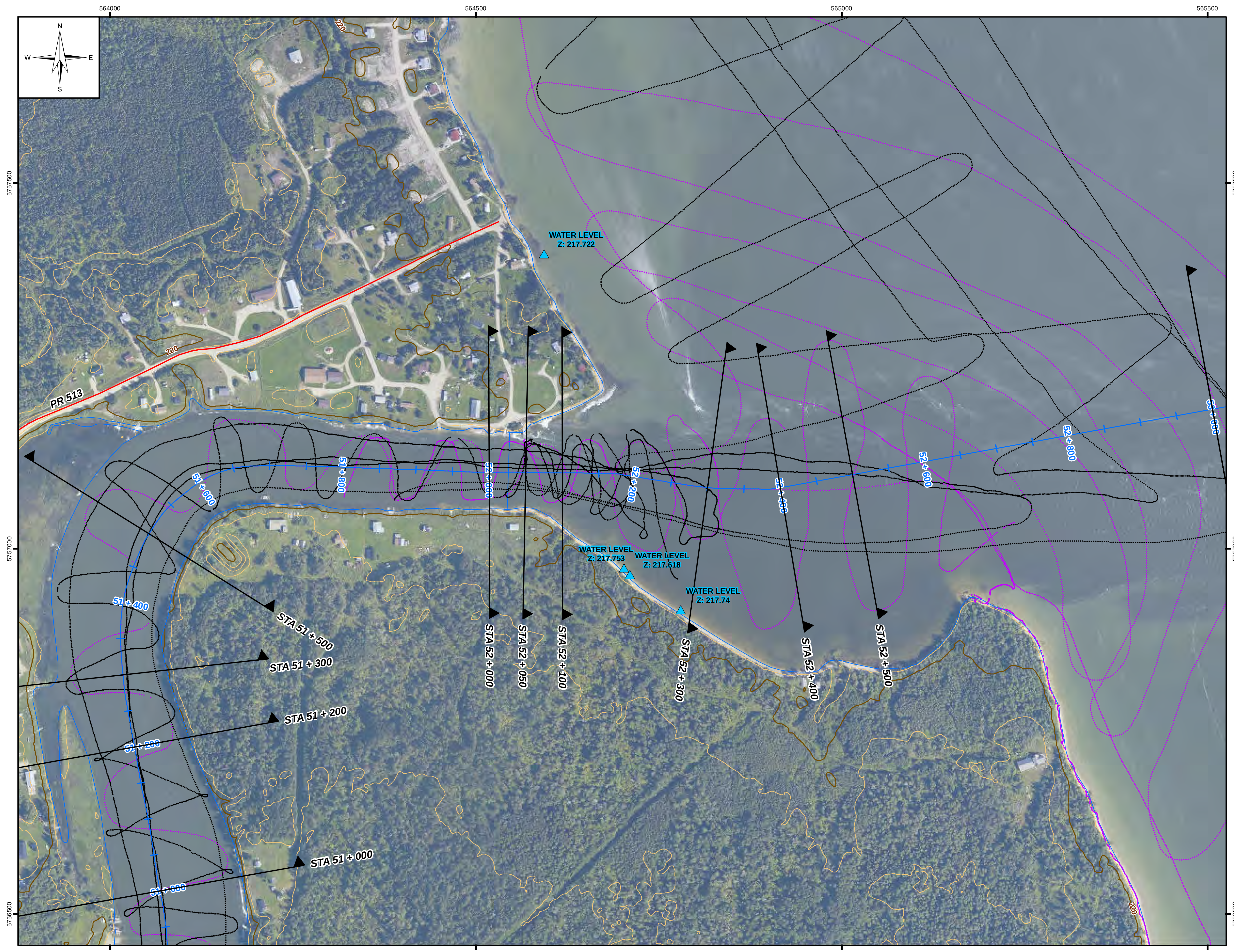
Manitoba INFRASTRUCTURE AND TRANSPORTATION

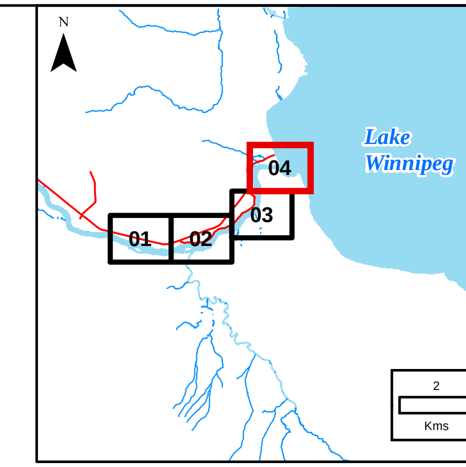
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY (SHEET 3 OF 4)

JANUARY 2013 | FIGURE 02 | REV: 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F02_Rev0.mxd
11"x17" PLOT SCALE 1:1





LEGEND:

- Water Level (June 20, 2012)
- Control
- 2012 Sonar Point
- 2011 Sonar Point
- X-Section
- Dauphin River Centreline

TRANSPORTATION

- Gravel Road
- Trail

LiDAR CONTOURS

- 5m Index Contour
- 1m Contour
- Edge of Water (LiDAR)

NOTES:

1. 2011 Sonar completed by KGS Group on July 2nd, 2011
   2012 Sonar completed by KGS Group on June 20, 2012
2. Satelite image provided by Atlis Geomatics, July 2011
3. Original ground surface based on LiDAR provided by Atlis Geomatics (June/July 2011)
4. All units are metric and in metres unless otherwise specified
   Transverse Mercator Projection, NAD 1983, Zone 14
   Elevations are in metres above sea level (MSL)

50 0 50 100 150

Metres

SCALE: 1:5,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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Manitoba INFRASTRUCTURE AND TRANSPORTATION

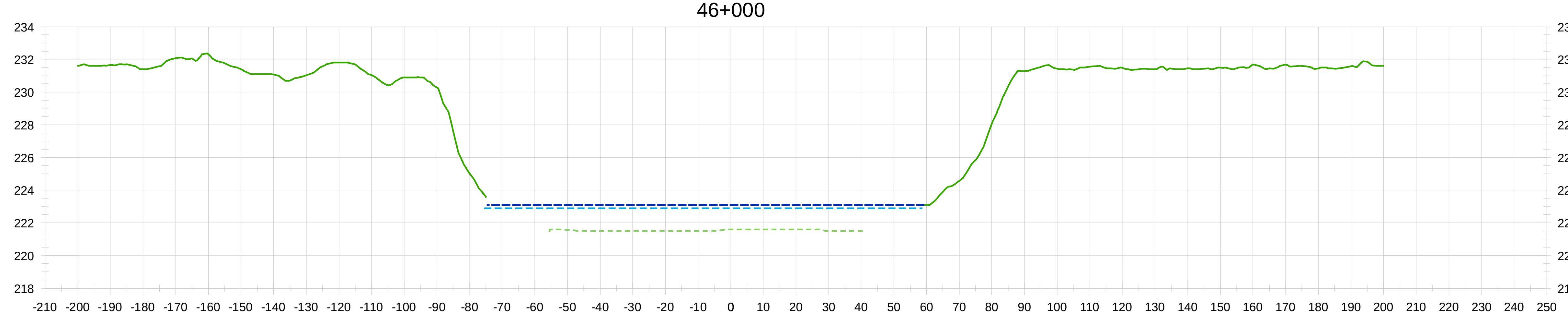
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY (SHEET 4 OF 4)

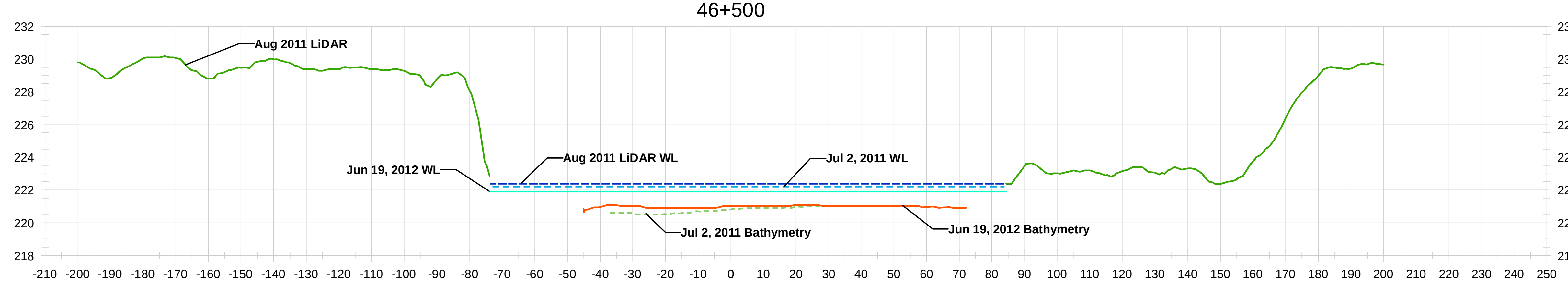
JANUARY 2013 | FIGURE 02 | REV: 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F02_Rev0.mxd
11"x17" PLOT SCALE 1:1

46+000



46+500



LEGEND:

- August 2011 LiDAR
- July 2, 2011 WL
- August 2011 LiDAR WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry

1:300 – Vertical Scale (5x Vertical Exaggeration)
5 0 5 10
Metres

1:1,500 – Horizontal Scale METRIC 11"x17"
25 0 25 50
Metres

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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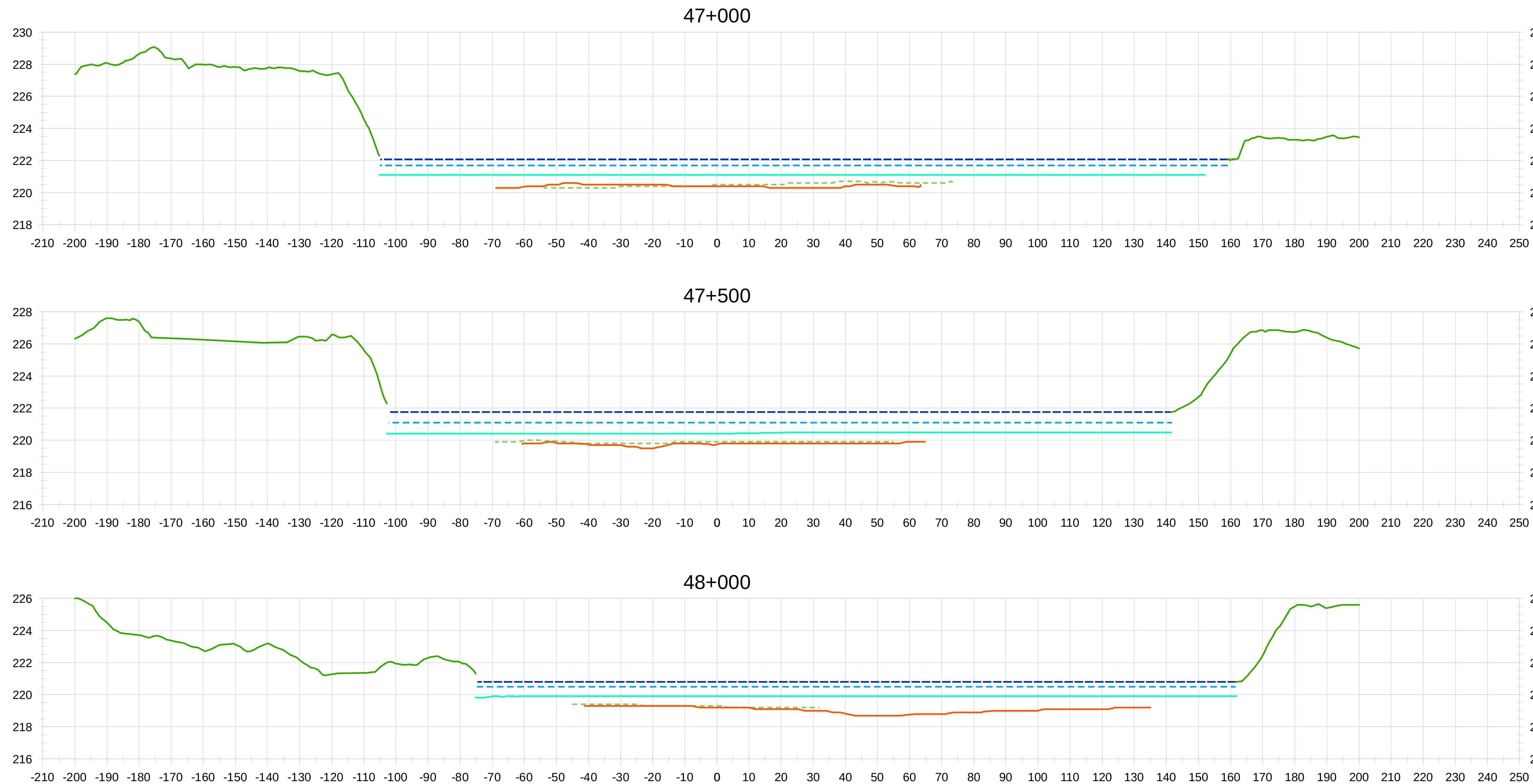
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY CROSS SECTIONS (SHEET 1 OF 9)

JANUARY 2013 | FIGURE 03 | REV: 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F03_Rev0.mxd
11"x17" PLOT SCALE 1:1



LEGEND:

- August 2011 LiDAR
- July 2, 2011 WL
- August 2011 LiDAR WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry

1:300 – Vertical Scale (5x Vertical Exaggeration)

5 0 5 10

Metres

1:1,500 – Horizontal Scale METRIC 11"x17"

25 0 25 50

Metres

NO.	YY/MM/DD	DESCRIPTION	BY
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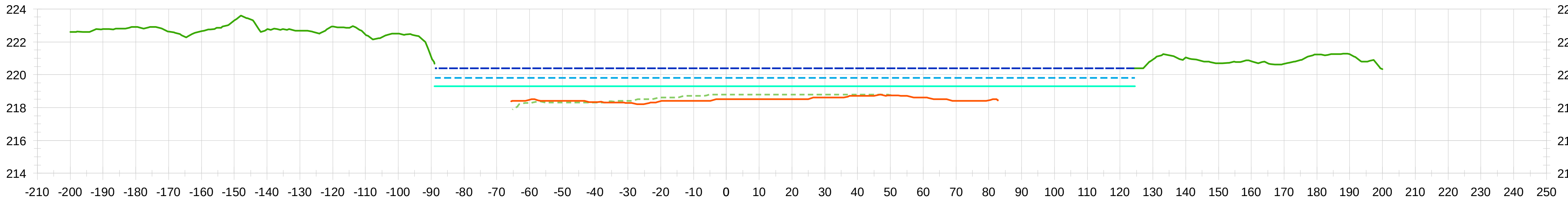
Manitoba INFRASTRUCTURE AND TRANSPORTATION

EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

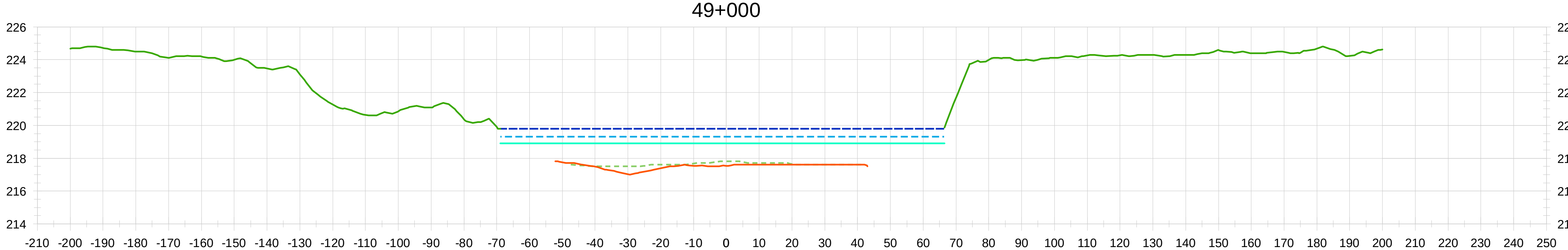
DAUPHIN RIVER OUTLET BATHYMETRY CROSS SECTIONS (SHEET 2 OF 9)

JANUARY 2013 | FIGURE 03 | REV. 0

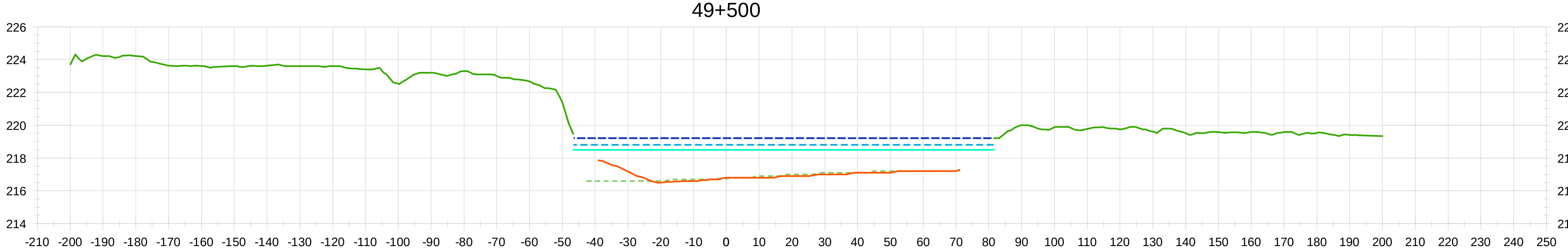
48+500



49+000



49+500



LEGEND:

- August 2011 LiDAR
- July 2, 2011 WL
- August 2011 LiDAR WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry

1:300 – Vertical Scale (5x Vertical Exaggeration)
5 0 5 10
Metres

1:1,500 – Horizontal Scale METRIC 11"x17"
25 0 25 50
Metres

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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Manitoba INFRASTRUCTURE AND TRANSPORTATION

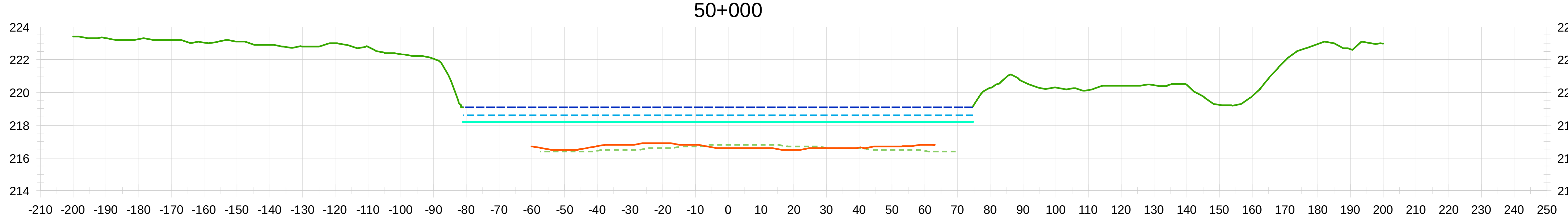
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY CROSS SECTIONS (SHEET 3 OF 9)

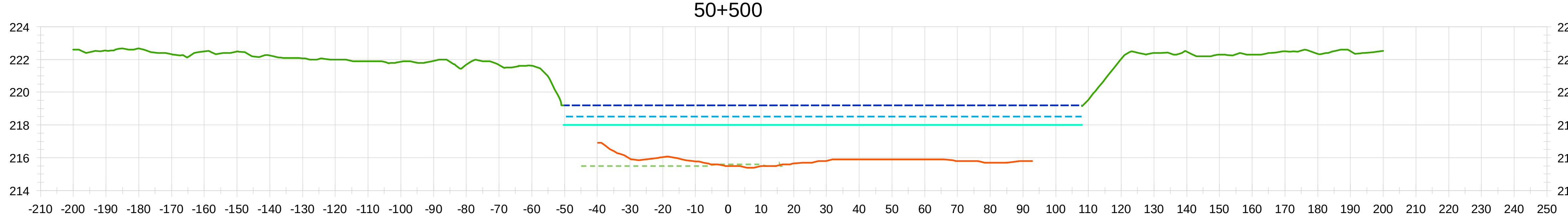
JANUARY 2013 | FIGURE 03 | REV. 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F03_Rev0.mxd
11"x17" PLOT SCALE 1:1

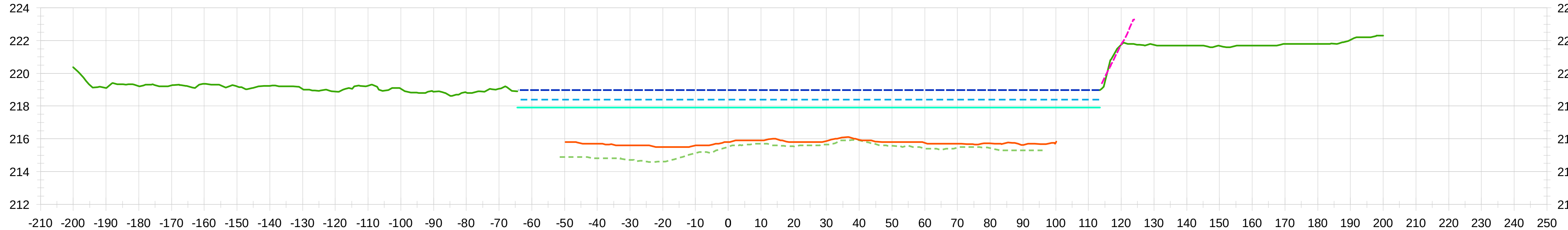
50+000



50+500



51+000



LEGEND:

- August 2011 LiDAR
- July 2, 2011 WL
- August 2011 LiDAR WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry
- Asbuilt Rip Rap, 2011

1:300 – Vertical Scale (5x Vertical Exaggeration)

5 0 5 10

Metres

1:1,500 – Horizontal Scale METRIC 11"x17"

25 0 25 50

Metres

NO.	YY/MM/DD	DESCRIPTION	BY
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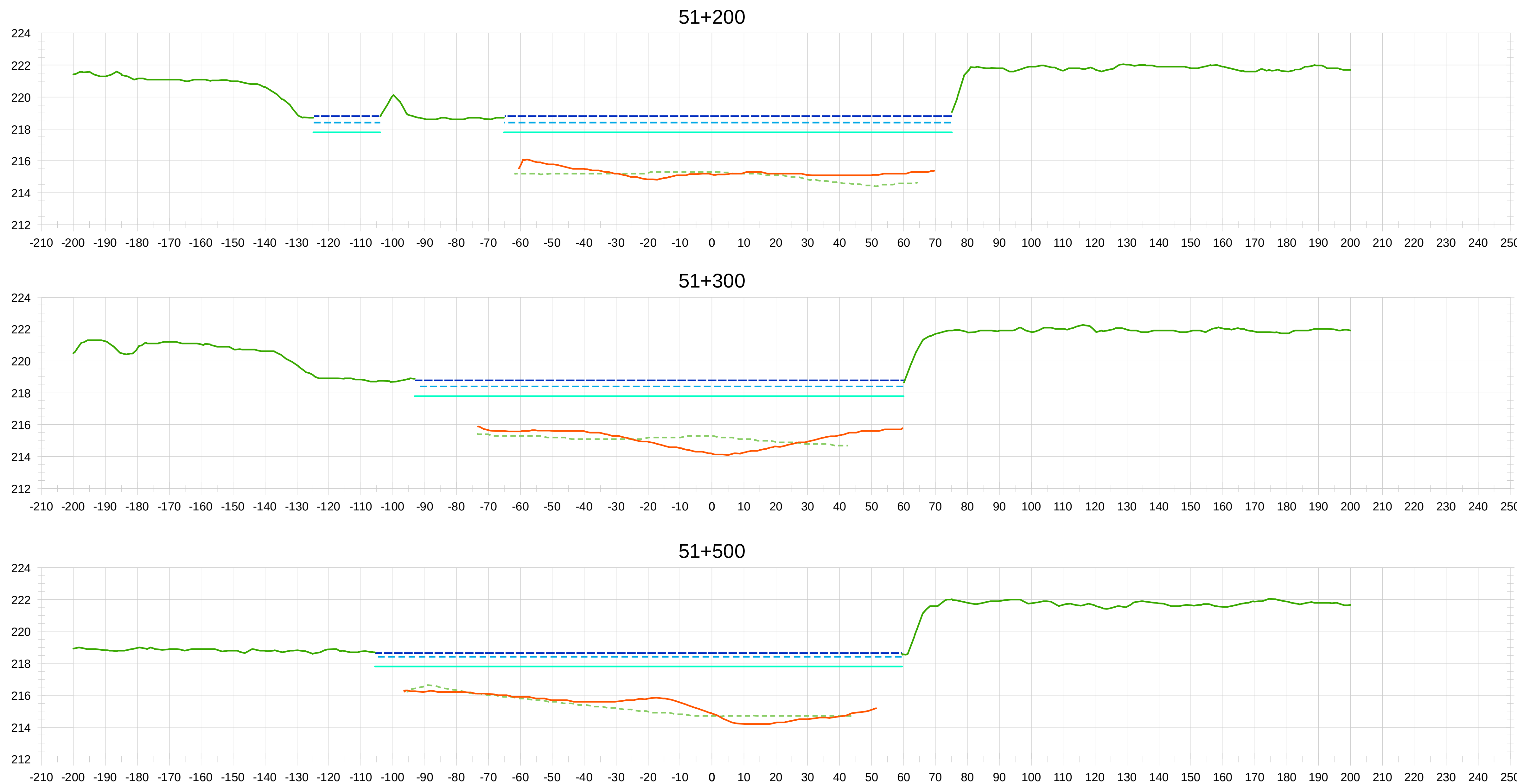
Manitoba INFRASTRUCTURE AND TRANSPORTATION

EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY CROSS SECTIONS (SHEET 4 OF 9)

JANUARY 2013 | FIGURE 03 | REV. 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F03_Rev0.mxd
11"x17" PLOT SCALE 1:1



LEGEND:

- August 2011 LiDAR
- July 2, 2011 WL
- August 2011 LiDAR WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry

1:300 – Vertical Scale (5x Vertical Exaggeration)

5 0 5 10

Metres

1:1,500 – Horizontal Scale METRIC 11"x17"

25 0 25 50

Metres

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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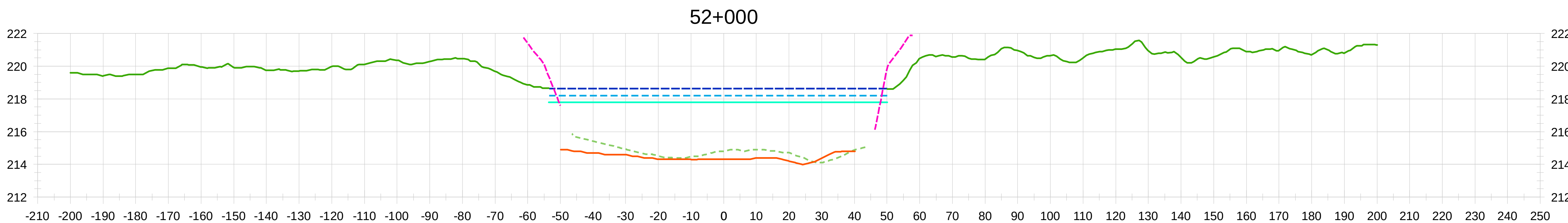
Manitoba INFRASTRUCTURE AND TRANSPORTATION

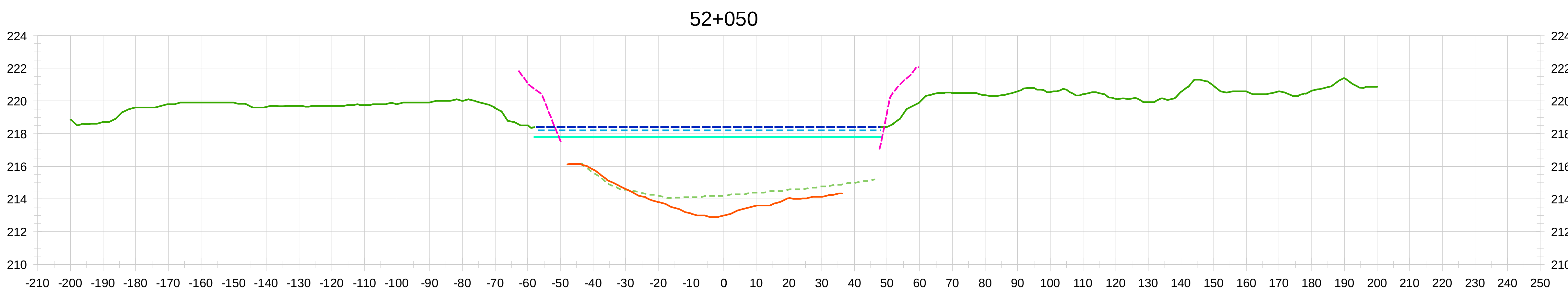
EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY
CROSS SECTIONS
(SHEET 5 OF 9)

JANUARY 2013 | FIGURE 03 | REV. 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F03_Rev0.mxd
11"x17" PLOT SCALE 1:1





LEGEND:

- August 2011 LiDAR
- July 2, 2011 WL
- August 2011 LiDAR WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry
- Asbuilt Rip Rap, 2011

1:300 – Vertical Scale (5x Vertical Exaggeration)

5 0 5 10

Metres

1:1,500 – Horizontal Scale METRIC 11"x17"

25 0 25 50

Metres

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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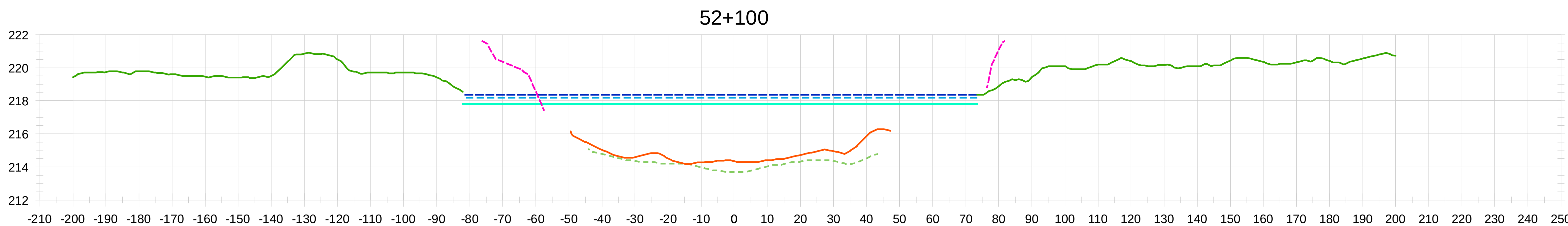
Manitoba INFRASTRUCTURE AND TRANSPORTATION

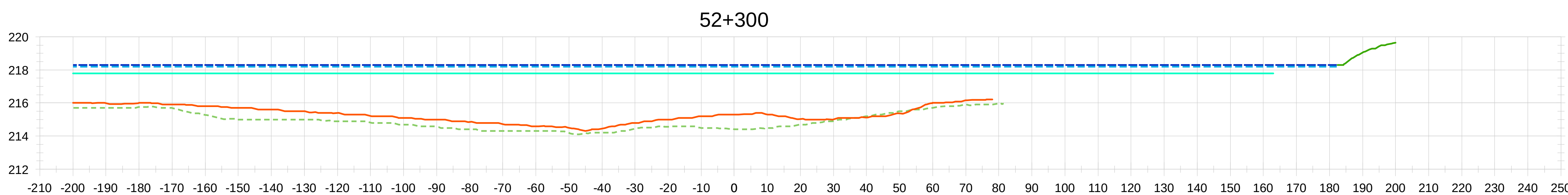
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

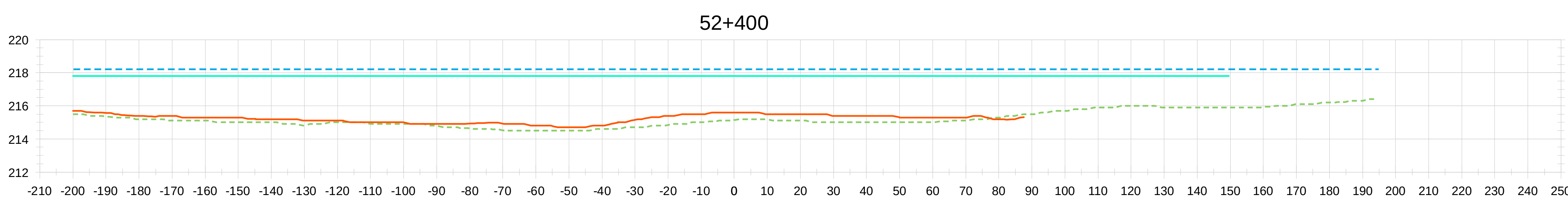
DAUPHIN RIVER OUTLET BATHYMETRY CROSS SECTIONS (SHEET 6 OF 9)

JANUARY 2013 | FIGURE 03 | REV: 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F03_Rev0.mxd
11"x17" PLOT SCALE 1:1







LEGEND:

- August 2011 LiDAR
- July 2, 2011 WL
- August 2011 LiDAR WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry
- Asbuilt Rip Rap, 2011

1:300 – Vertical Scale (5x Vertical Exaggeration)
5 0 5 10
Metres

1:1,500 – Horizontal Scale METRIC 11"x17"
25 0 25 50
Metres

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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Manitoba INFRASTRUCTURE AND TRANSPORTATION

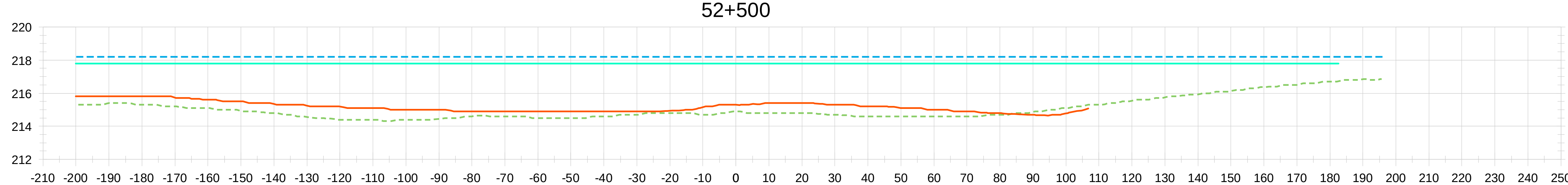
EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY
CROSS SECTIONS
(SHEET 7 OF 9)

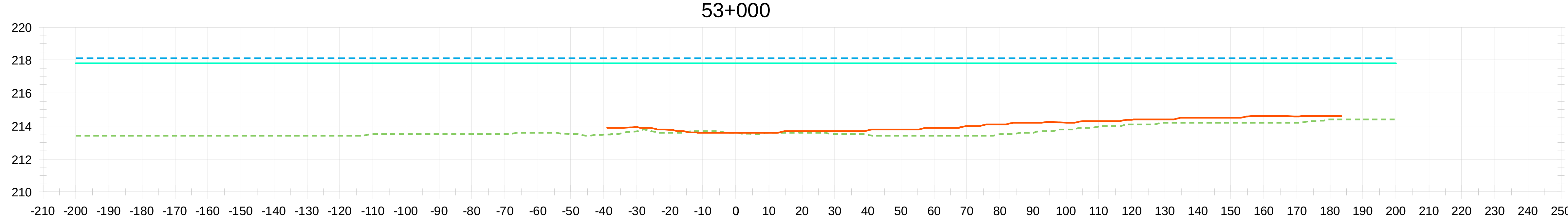
JANUARY 2013 | FIGURE 03 | REV: 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F03_Rev0.mxd
11"x17" PLOT SCALE 1:1

52+500



53+000



LEGEND:

- August 2011 LiDAR
- July 2, 2011 WL
- August 2011 LiDAR WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry

1:300 – Vertical Scale (5x Vertical Exaggeration)

5 0 5 10

Metres

1:1,500 – Horizontal Scale METRIC 11"x17"

25 0 25 50

Metres

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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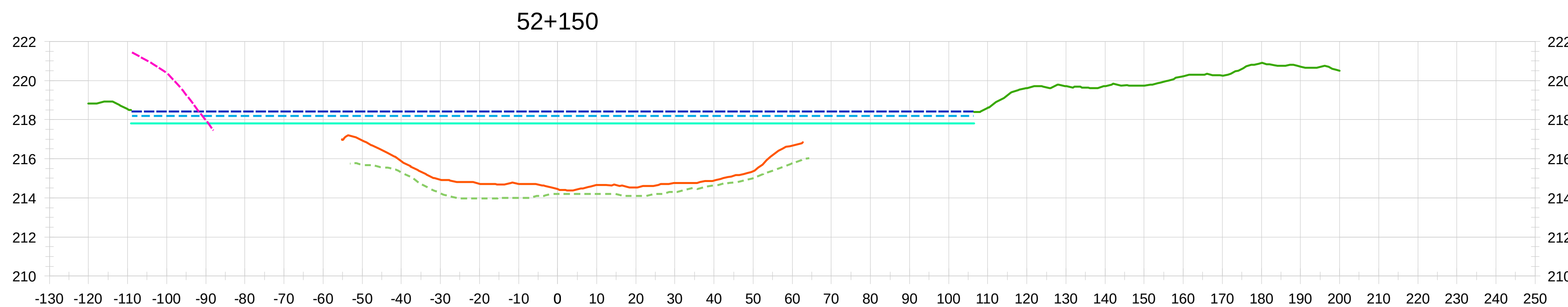
Manitoba INFRASTRUCTURE AND TRANSPORTATION

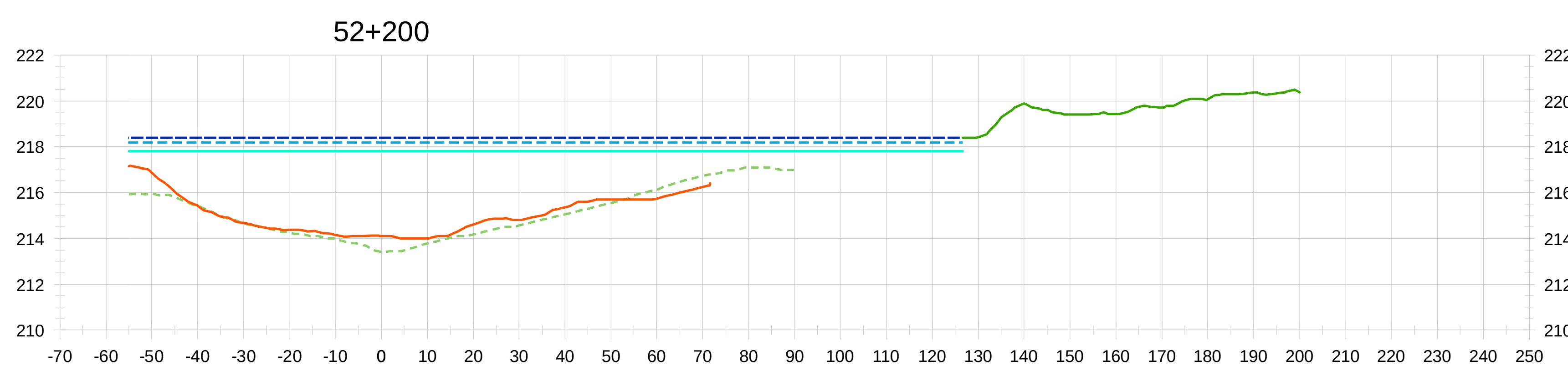
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY CROSS SECTIONS (SHEET 8 OF 9)

JANUARY 2013 | FIGURE 03 | REV. 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F03_Rev0.mxd
11"x17" PLOT SCALE 1:1





LEGEND:

- August 2011 LiDAR
- July 2, 2011 WL
- August 2011 LiDAR WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry
- Asbuilt Rip Rap, 2011

1:300 – Vertical Scale (5x Vertical Exaggeration)

5 0 5 10

Metres

1:1,500 – Horizontal Scale METRIC 11"x17"

25 0 25 50

Metres

NO.	YY/MM/DD	DESCRIPTION	BY
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Manitoba INFRASTRUCTURE AND TRANSPORTATION

EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER OUTLET BATHYMETRY CROSS SECTIONS (SHEET 9 OF 9)

JANUARY 2013 | FIGURE 03 | REV. 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F03_Rev0.mxd
11"x17" PLOT SCALE 1:1

DAUPHIN RIVER PROFILE VIEW

LEGEND:

- July 2, 2011 WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry

1:100 – Vertical Scale (100x Vertical Exaggeration)

1 0 1 2 3 4

Metres

1:10,000 – Horizontal Scale METRIC 11"x17"

100 0 100 200 300 400

Metres

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Manitoba INFRASTRUCTURE AND TRANSPORTATION

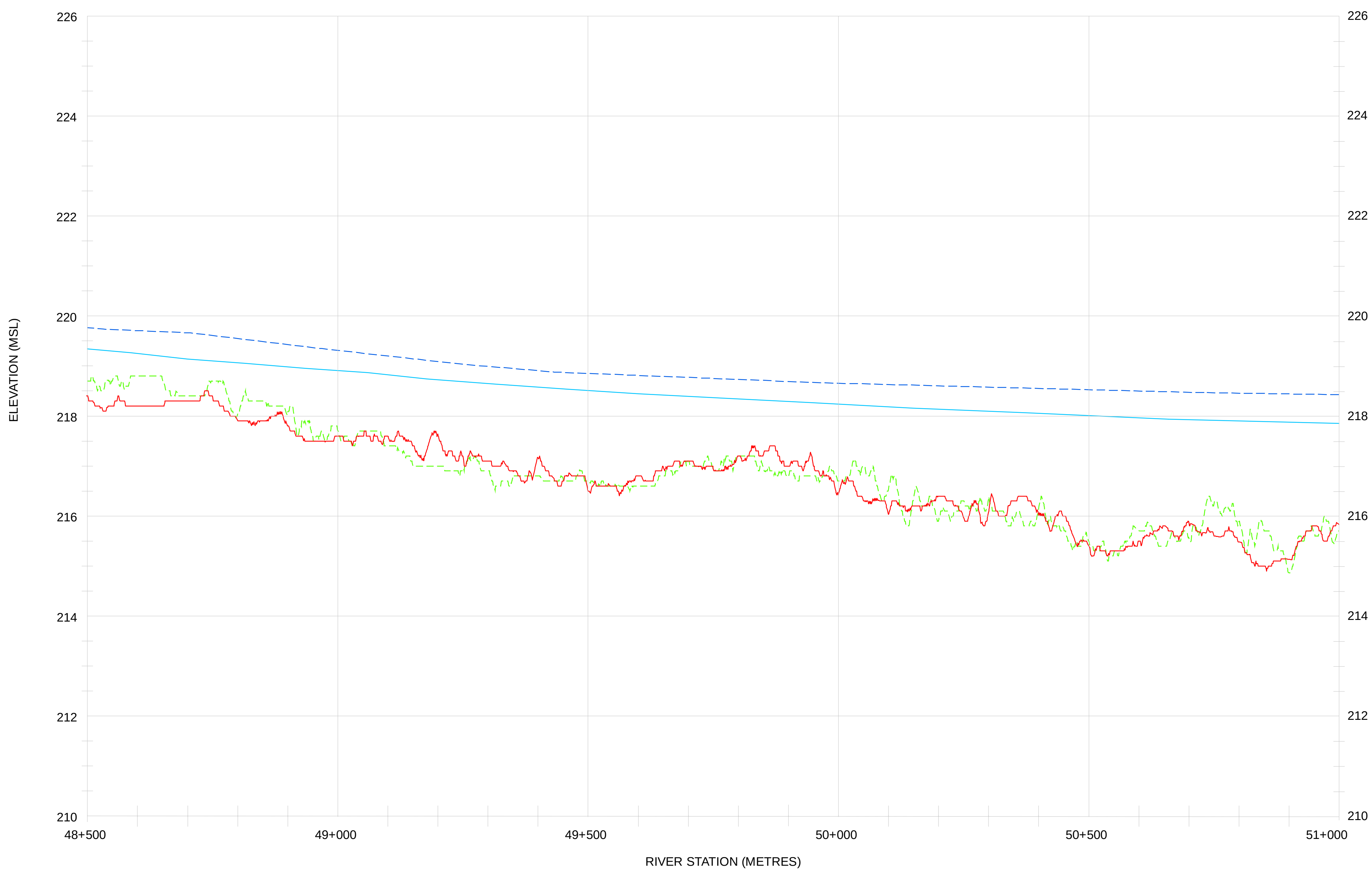
EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER BATHYMETRY
PROFILE
(SHEET 1 OF 3)

JANUARY 2013 | FIGURE 04 | REV. 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F04_Rev0.mxd
11"x17" PLOT SCALE 1:1

DAUPHIN RIVER PROFILE VIEW



LEGEND:

- July 2, 2011 WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry

1:100 – Vertical Scale (100x Vertical Exaggeration)

1 0 1 2 3 4

Metres

1:10,000 – Horizontal Scale METRIC 11"x17"

100 0 100 200 300 400

Metres

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER BATHYMETRY PROFILE (SHEET 2 OF 3)

JANUARY 2013 | FIGURE 04 | REV. 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F04_Rev0.mxd
11"x17" PLOT SCALE 1:1

DAUPHIN RIVER PROFILE VIEW

LEGEND:

- July 2, 2011 WL
- June 19, 2012 WL
- July 2, 2011 Bathymetry
- June 19, 2012 Bathymetry

1:100 – Vertical Scale (100x Vertical Exaggeration)

1 0 1 2 3 4

Metres

1:10,000 – Horizontal Scale METRIC 11"x17"

100 0 100 200 300 400

Metres

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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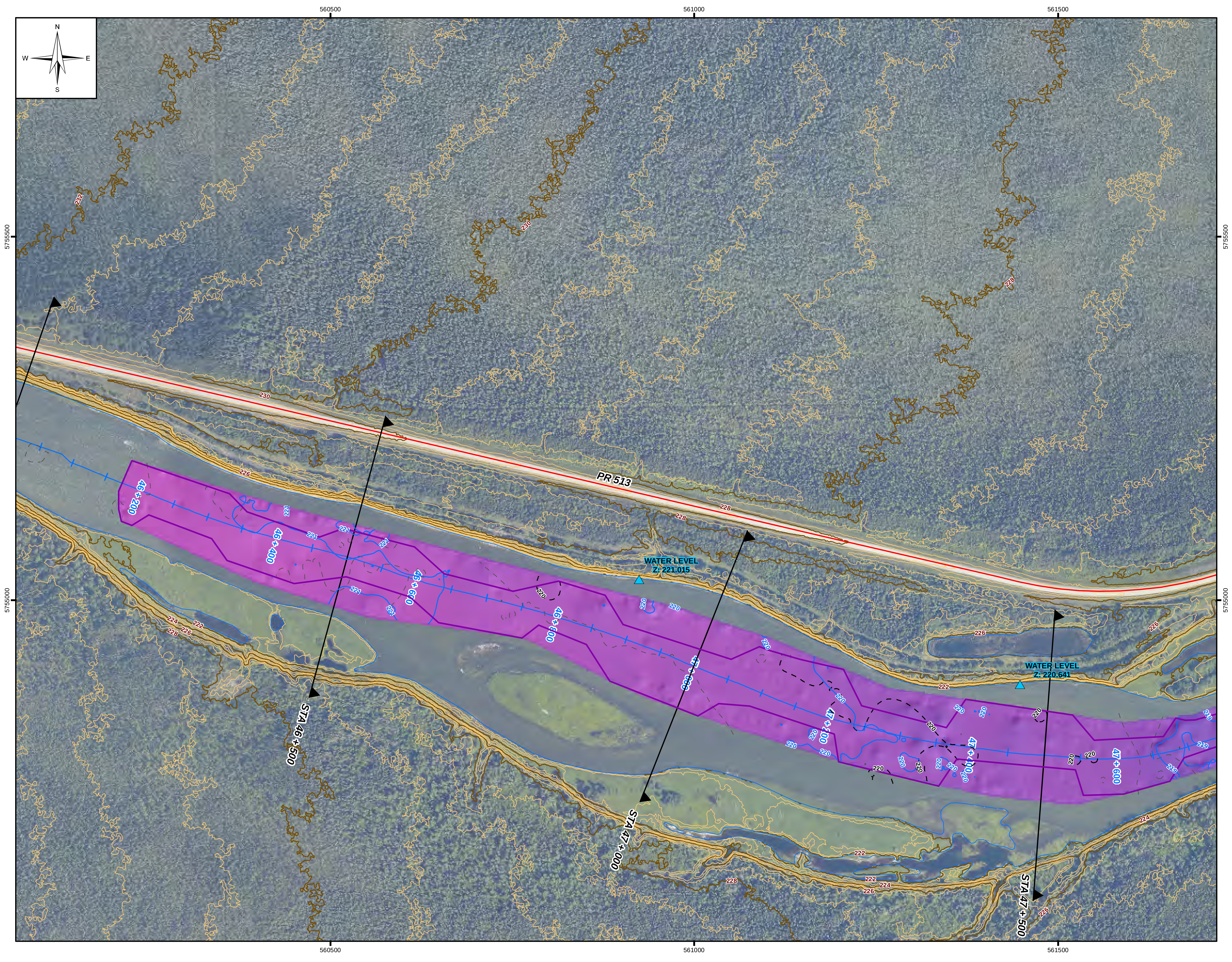
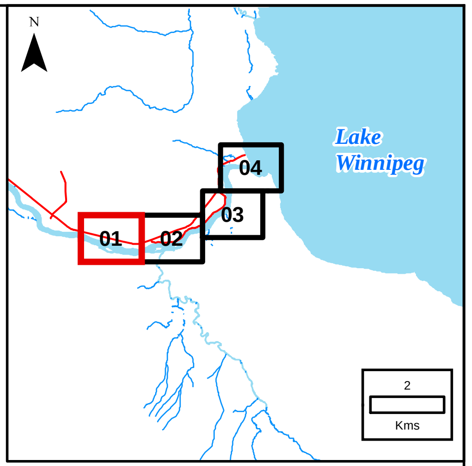
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

DAUPHIN RIVER BATHYMETRY PROFILE (SHEET 3 OF 3)

JANUARY 2013 | FIGURE 04 | REV. 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F04_Rev0.mxd 11"x17" PLOT SCALE 1:1





LEGEND:

- Water Level (June 20, 2012)
- Control
- X-Section
- Dauphin River Centreline
- Volume Boundary

TRANSPORTATION

- Gravel Road
- Trail

BATHYMETRIC CONTOURS

2011 Bathymetry

- 2m
- 0.5m

2012 Bathymetry

- 1m Bathymetric Contour

2012 Bathymetry

High : 221.8m

Low : 212.3m

LiDAR CONTOURS

- 2m Index Contour
- 0.5m Contour
- Edge of Water (LiDAR)

NOTES:

1. 2011 Sonar completed by KGS Group on July 2nd, 2011
   2012 Sonar completed by KGS Group on June 20, 2012
2. Satelite image provided by Atlis Geomatics, July 2011
3. Original ground surface based on LiDAR provided by Atlis Geomatics (June/July 2011)
4. All units are metric and in metres unless otherwise specified
   Transverse Mercator Projection, NAD 1983, Zone 14
   Elevations are in metres above sea level (MSL)

50 0 50 100 150

Metres

SCALE: 1:5,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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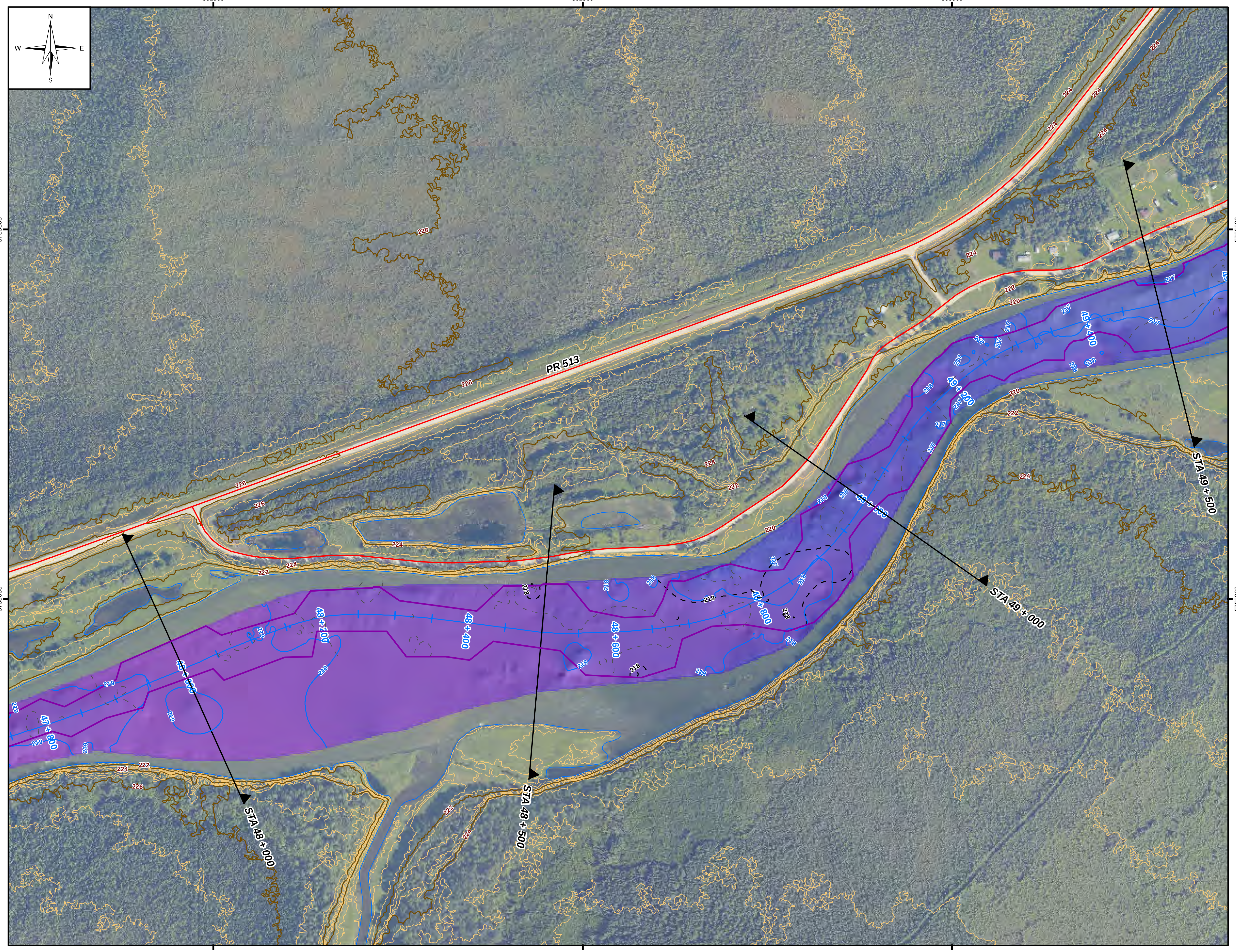
Manitoba INFRASTRUCTURE AND TRANSPORTATION

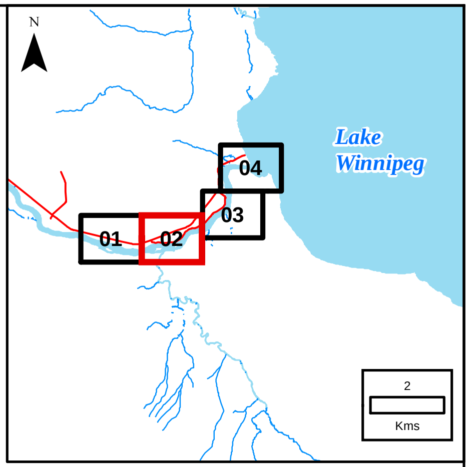
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

LOWER DAUPHIN RIVER BATHYMETRY COMPARISON OF 2011 TO 2012 (SHEET 1 OF 4)

JANUARY 2013 | FIGURE 05 | REV. 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F05_Rev0.mxd
11"x17" PLOT SCALE 1:1





LEGEND:

- Water Level (June 20, 2012)
- Control
- X-Section
- Dauphin River Centreline
- Volume Boundary

TRANSPORTATION

- Gravel Road
- Trail

BATHYMETRIC CONTOURS

2011 Bathymetry

- 2m
- 0.5m

2012 Bathymetry

- 1m Bathymetric Contour

2012 Bathymetry

High : 221.8m

Low : 212.3m

LiDAR CONTOURS

- 2m Index Contour
- 0.5m Contour
- Edge of Water (LiDAR)

NOTES:

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50 0 50 100 150

Metres

SCALE: 1:5,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW

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KGS GROUP CONSULTING ENGINEERS

Manitoba INFRASTRUCTURE AND TRANSPORTATION

EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

LOWER DAUPHIN RIVER BATHYMETRY COMPARISON OF 2011 TO 2012 (SHEET 2 OF 4)

JANUARY 2013 | FIGURE 05 | REV: 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F05_Rev0.mxd
11"x17" PLOT SCALE 1:1

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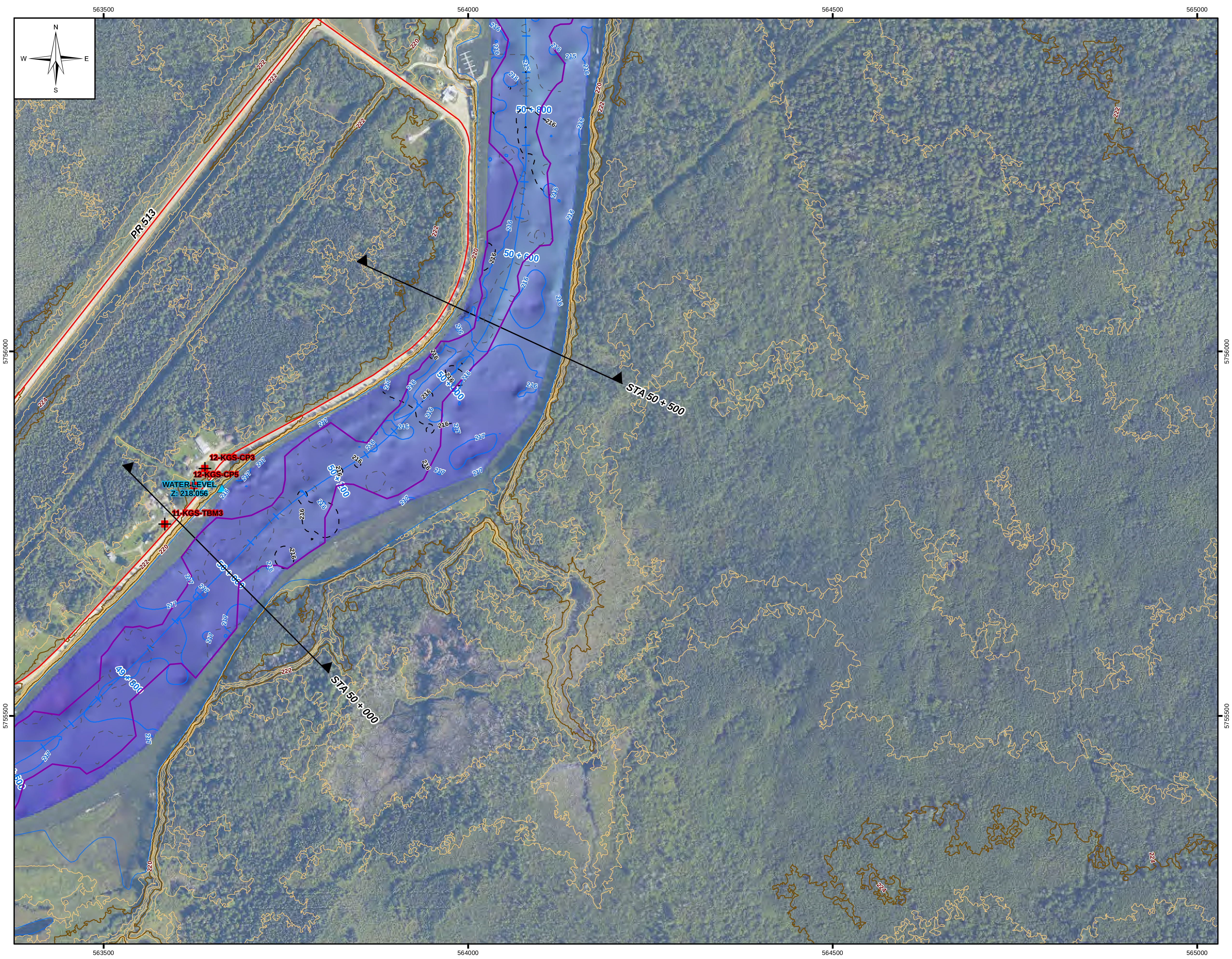

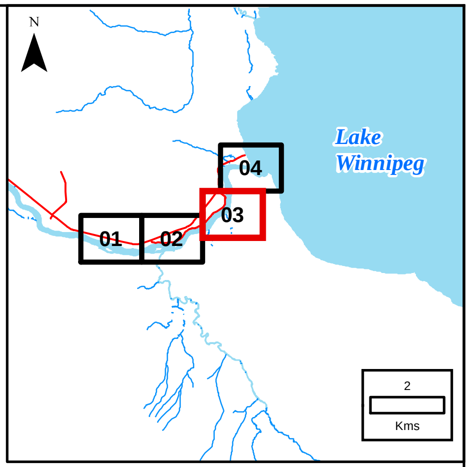

LEGEND:

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Manitoba INFRASTRUCTURE AND TRANSPORTATION

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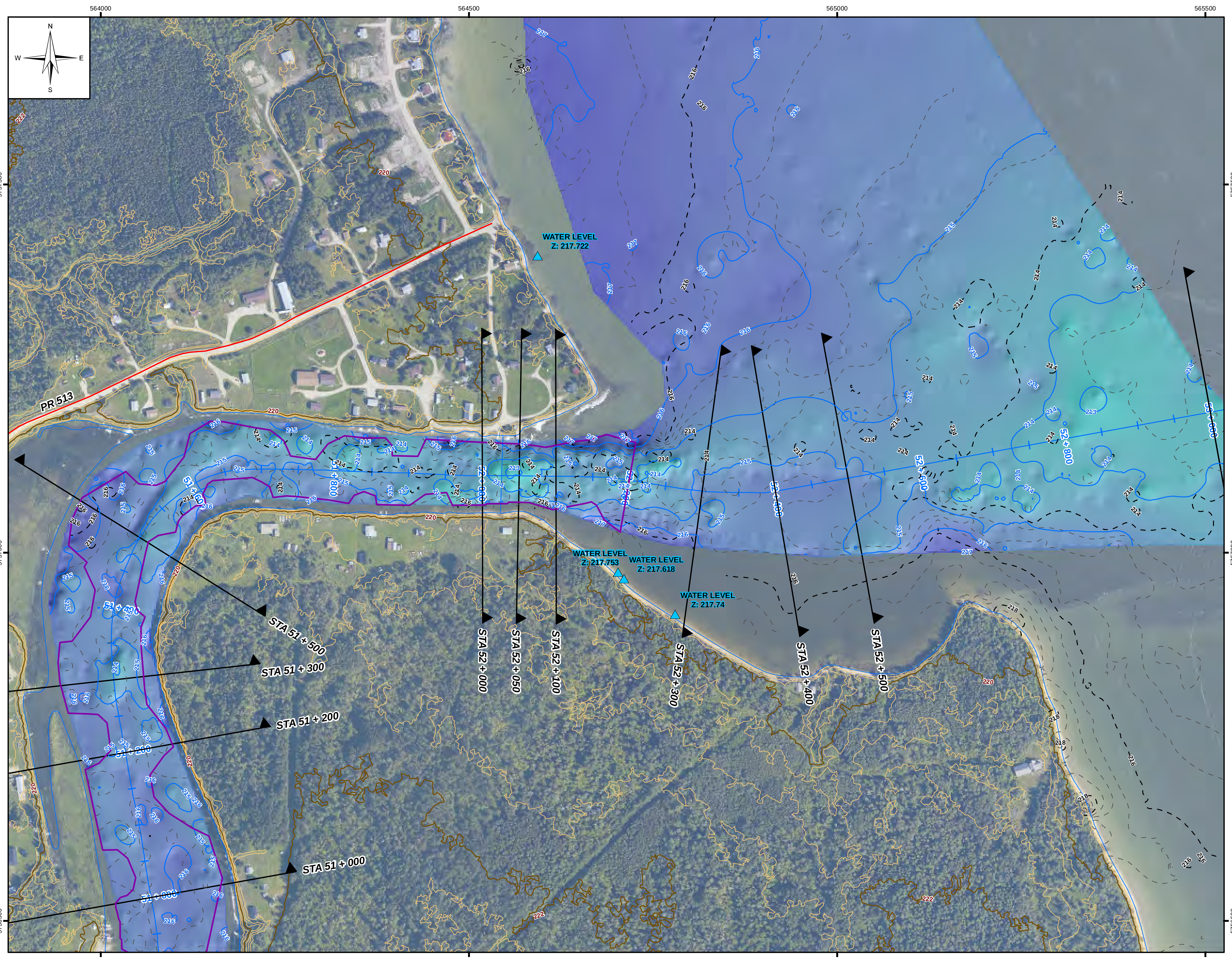

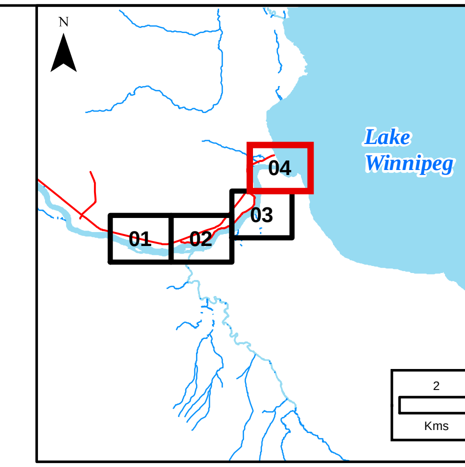

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Manitoba INFRASTRUCTURE AND TRANSPORTATION

EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

LOWER DAUPHIN RIVER BATHYMETRY COMPARISON OF 2011 TO 2012 (SHEET 4 OF 4)

JANUARY 2013 | FIGURE 05 | REV. 0

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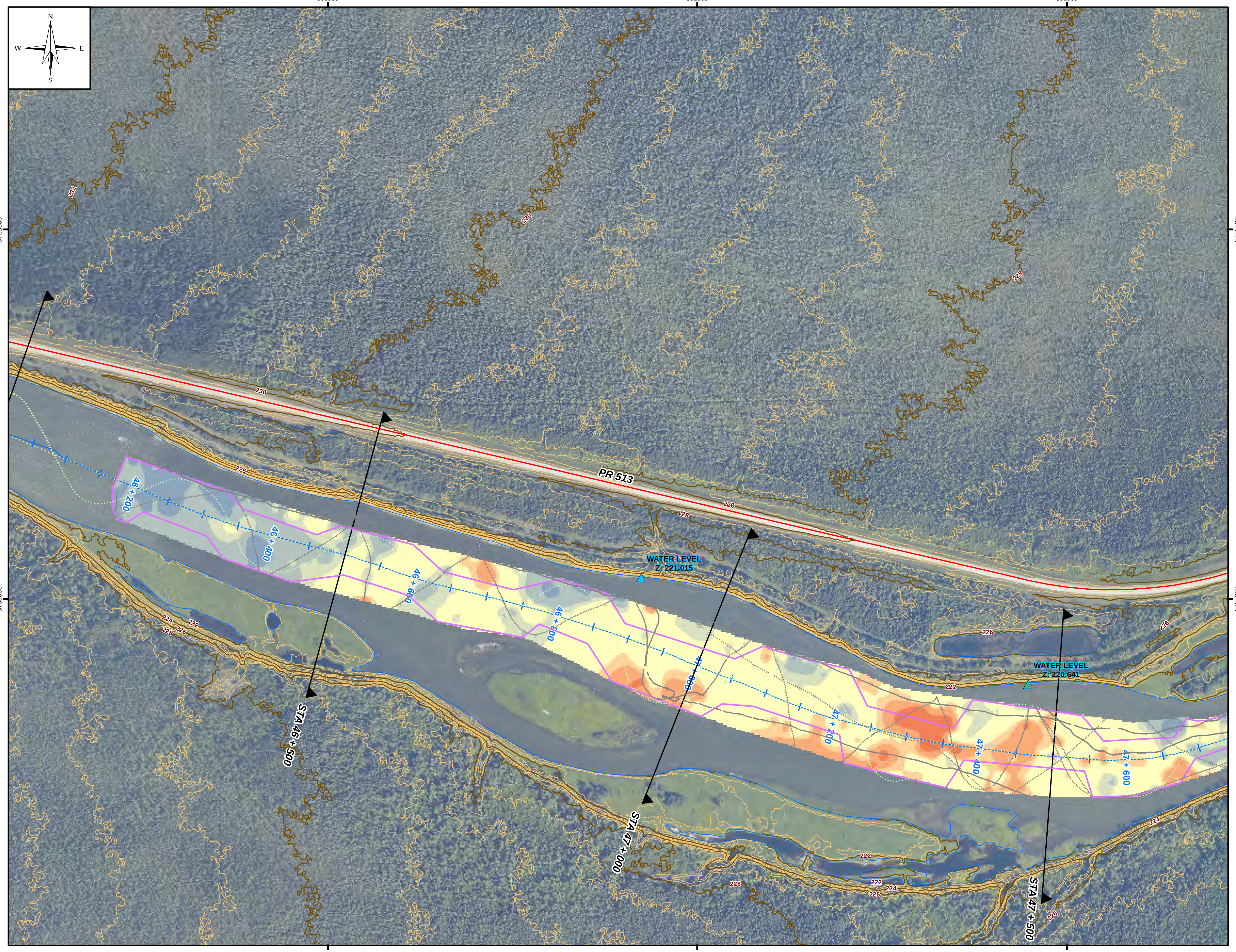

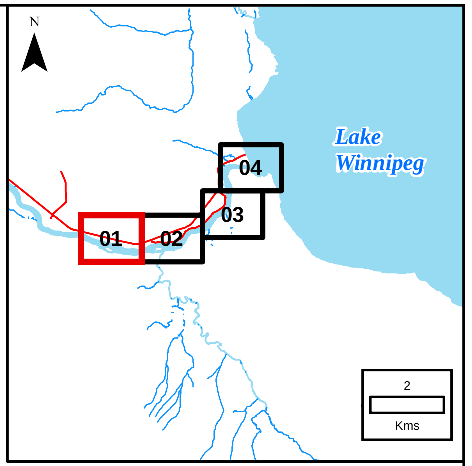

LEGEND:

- 2012 Sonar Point
- 2011 Sonar Point
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- Control
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2012 vs 2011
Elevation Variation (m)

- < -2.0
- -2.0 – -1.0
- -1.0 – -0.5
- -0.5 – -0.25
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- -0.15 – 0.15
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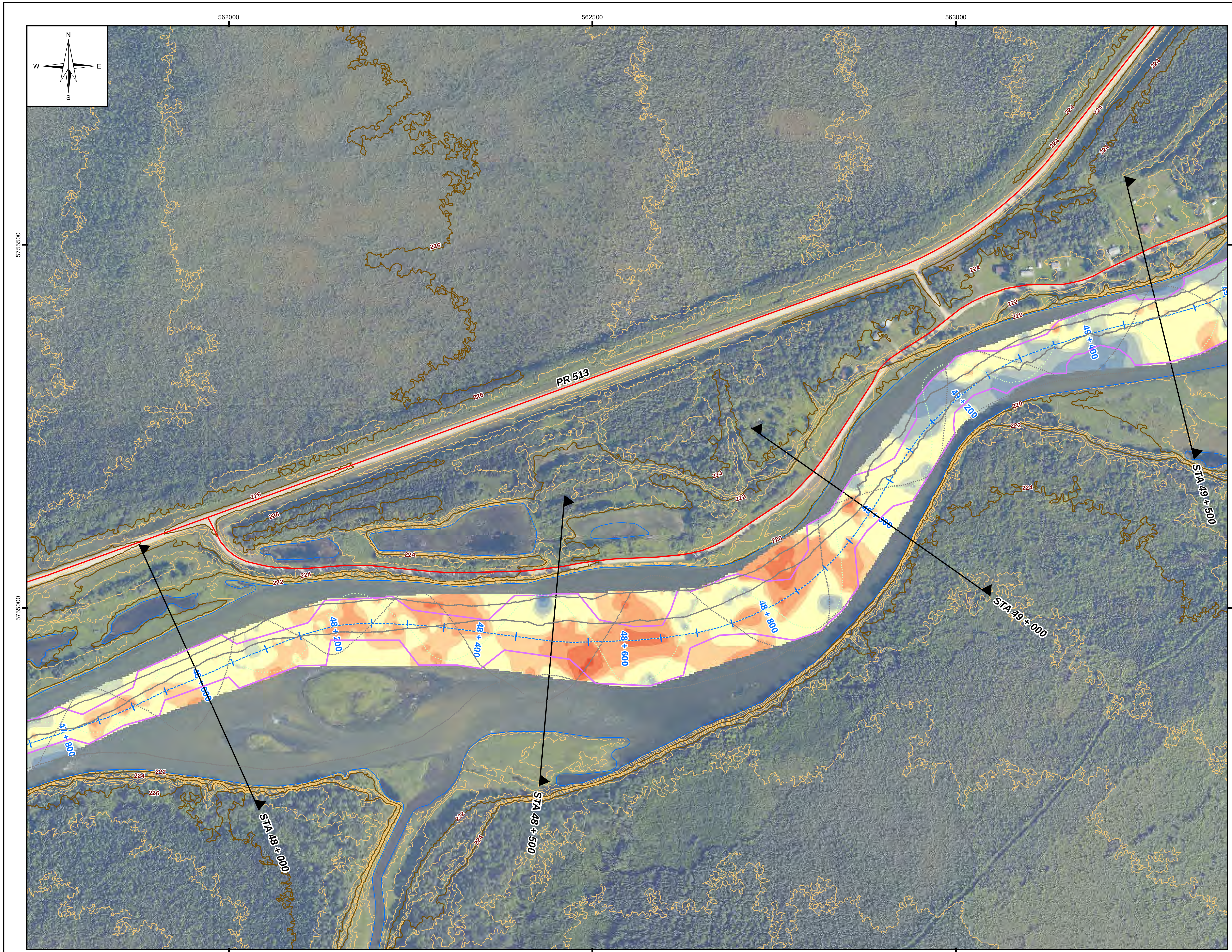
INFRASTRUCTURE AND TRANSPORTATION

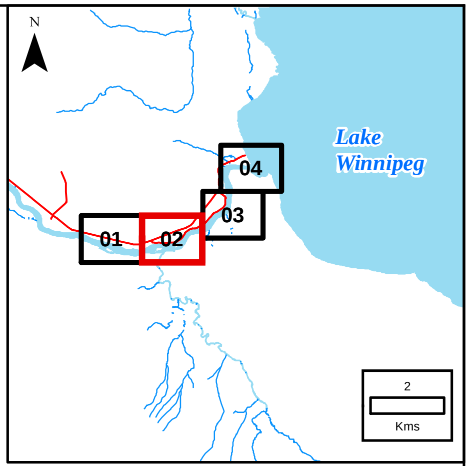
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

LOWER DAUPHIN RIVER BATHYMETRY DIFFERENCES OF 2011 TO 2012 (SHEET 1 OF 4)

JANUARY 2013 | FIGURE 06 | REV: 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\DAUPHIN_R_BATH\11-0300-18-F06_Rev0.mxd
11"x17" PLOT SCALE 1:1





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Manitoba INFRASTRUCTURE AND TRANSPORTATION

EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

LOWER DAUPHIN RIVER BATHYMETRY DIFFERENCES OF 2011 TO 2012 (SHEET 2 OF 4)

JANUARY 2013 | FIGURE 06 | REV. 0

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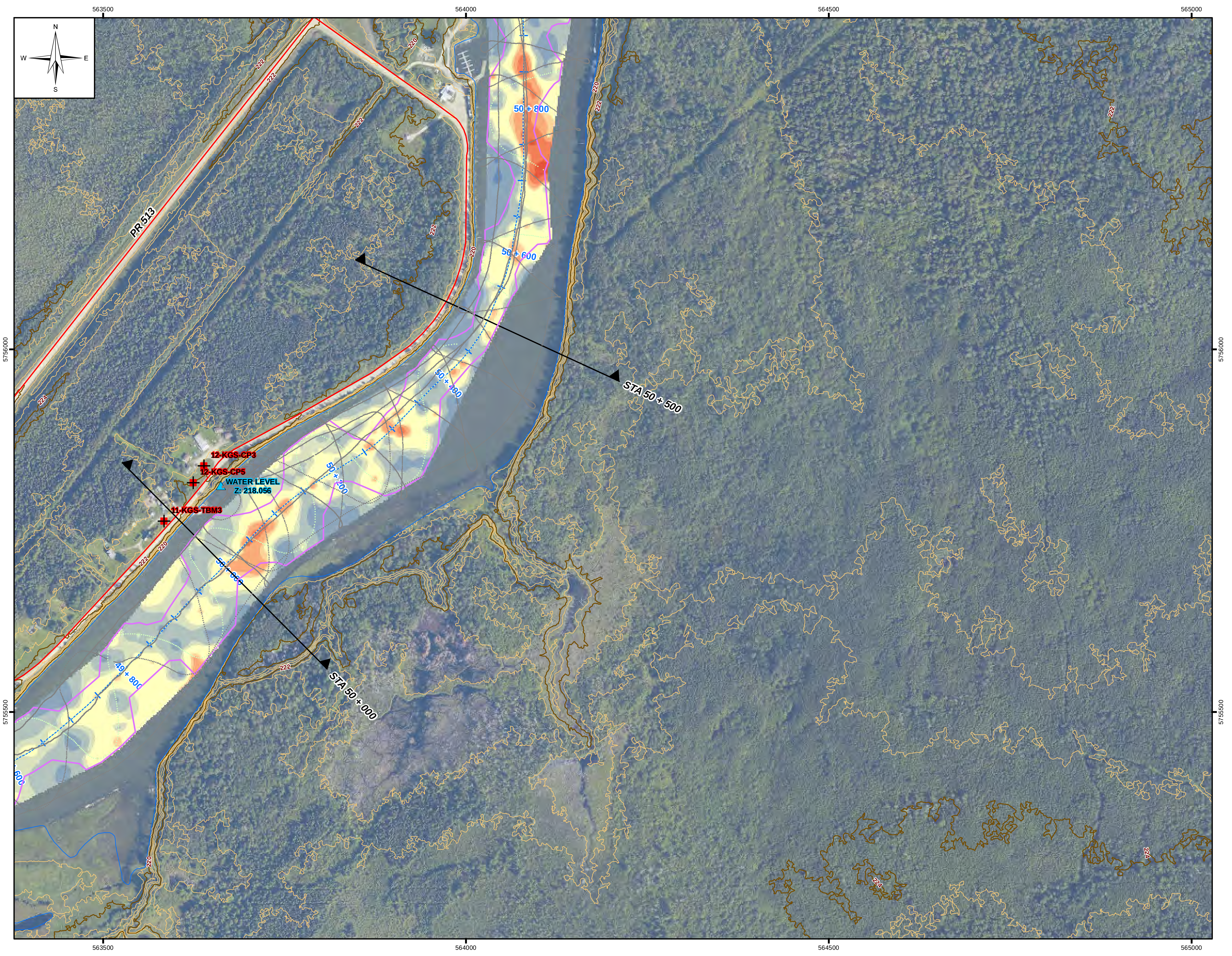

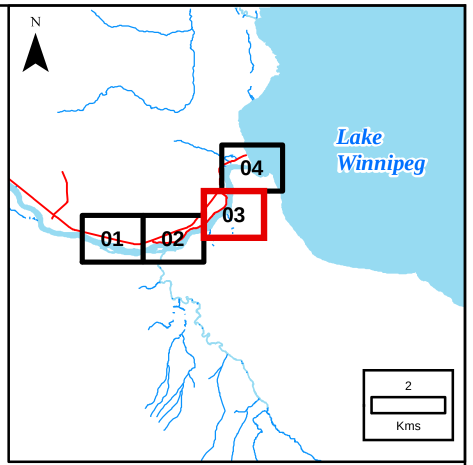

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LOWER DAUPHIN RIVER BATHYMETRY
DIFFERENCES OF 2011 TO 2012
(SHEET 3 OF 4)

JANUARY 2013 | FIGURE 06 | REV: 0

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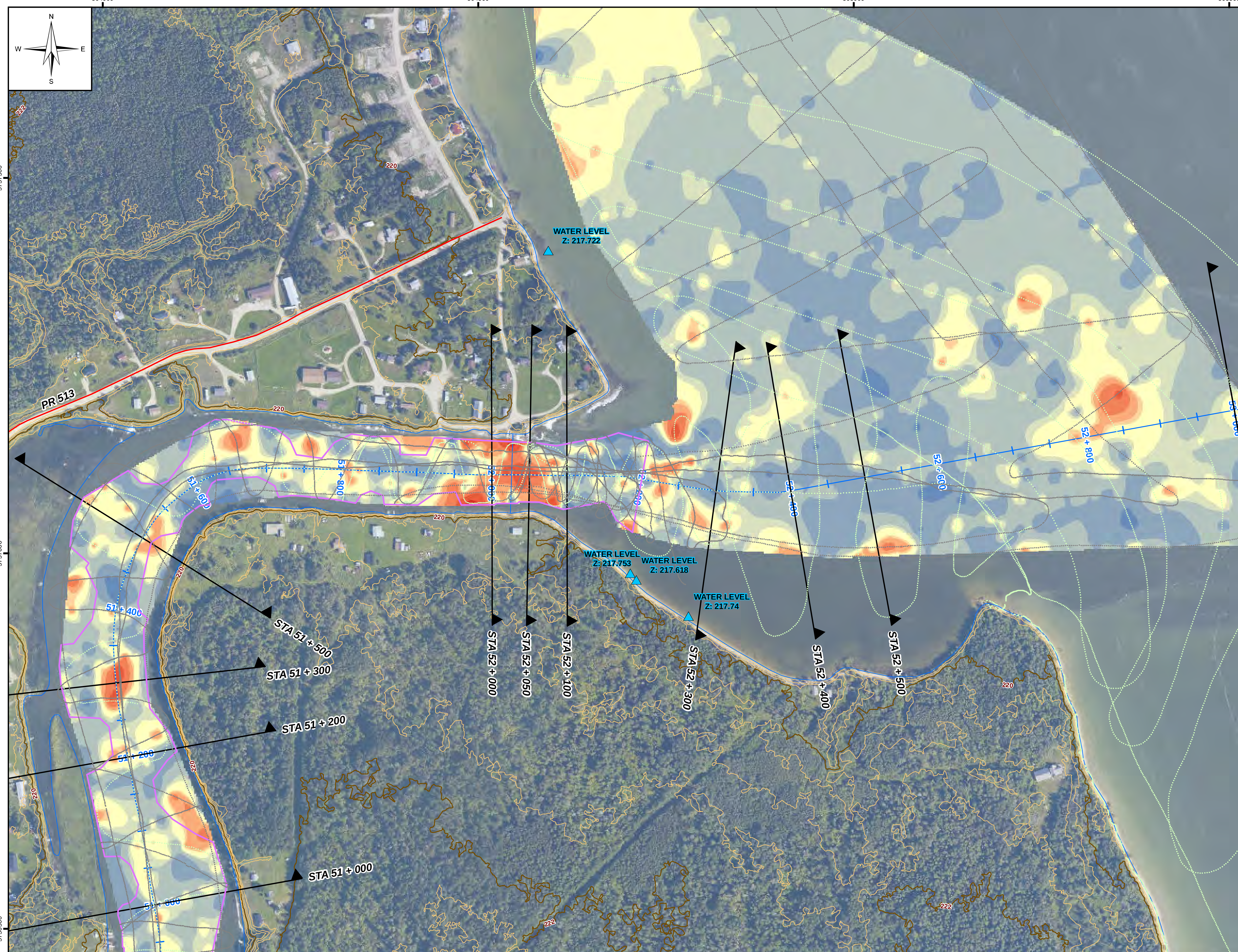

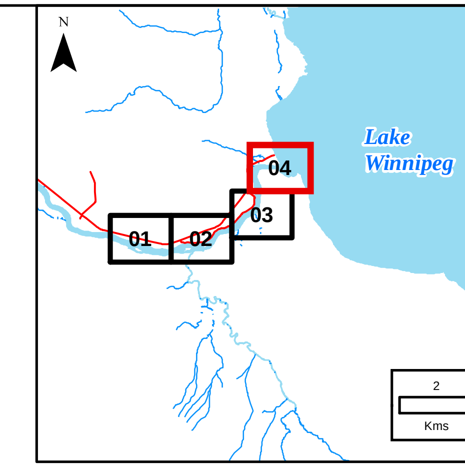

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APPENDIX J

KGS GROUP MEMORANDUM OCTOBER 7, 2011

TESTPITTING AND TILL SAMPLING PROGRAM ALONG BUFFALO CREEK

MEMORANDUM

TO: **Colin Siepman**

FROM: **John Burns**

cc: **Tony Ng, Brian Bodnaruk, Bert Smith**

DATE: **October 7, 2011**

PROJECT NO: **11-0300-18**

RE: **Testpitting and Till Sampling Program along Buffalo Creek, Lake St. Martin Outlet Sediment Erosion Monitoring**

1.0 INTRODUCTION

As part of the Sediment Erosion Monitoring Program for the Lake St Martin Flood Relief project, KGS Group completed 15 testpits and collected till samples along Buffalo Creek between station 13+500 and 27+500 m (Figure 1). All field work was completed between September 21, 2011 and September 26, 2011. The field work required helicopter support for site access each day. Five additional helipads (#15 to #19) were cut immediately prior to the start of the testpitting program.

The purpose of the testpitting program was to document the soil characteristics in the till embankments along Buffalo Creek as part of the Sediment Erosion Monitoring program. The testpit program involved the excavation of approximately 1.0 m^3 of soil, then separating the coarse fraction (>50 mm ø) from the fine soil fraction. The coarse fraction is the material that is expected to remain in place to armour the new flood relief channel. The fine material is expected to erode away by stream flow. A soil sample of the fine grained material (smaller than 50 mm ø) from each testpit was collected for grain size analysis.

In addition to the testpit/till sampling program, a vegetation survey was completed during the same time frame and a detailed cross section survey is currently being completed. The results of the vegetation survey and detailed cross section survey will be presented as stand alone reports.

2.0 WORK PROGRAM

The testpitting program included the following components:

- Cutting of 5 additional helipads
- Excavation of 1.0 m^3 testpits at 1 km spacings between Helipad #5 and the Dauphin River
- Separating the fine soil fraction from coarse soil fraction and calculating the volume of coarse material by water displacement method

- Collecting a representative sample of the fine soil fraction (smaller than 50 mm ø) for laboratory grain size analysis.
- Photographing the testpit, recording the GPS coordinate of the testpit, and backfilling the testpit.

3.0 METHODOLOGY

A crew of four was mobilized to the closest helipad to the work area each day. Field equipment included 20 L pails with graduation marks, a 2 L measuring cup with graduations, digging tools, tarps, and a screen with a 50 mm mesh.

The crew took turns digging and placed excavated soils adjacent to the testpit. Depending on the soil texture, the coarse gravel, cobbles, and boulders were either separated by hand or by using the screen (50 mm mesh) as excavation continued. In general, two people sorted the soils as the other two dug the testpit.

Digging ceased when approximately 1 m^3 of soil had been excavated. The testpit walls were squared-up and the testpit was measured so the in-situ volume could be calculated.

The coarse fragments were brushed clean, and then placed into a 20 L pail. The 20 L pail was then filled to either the 10 L mark or 20 L mark with water using the graduated 2 L measuring cup. The water displaced by the coarse fragments was then recorded and the percent (by volume) of coarse fragments was calculated for the testpit.

A representative sample of the fine fraction from the testpit was then collected. The field crew collected this sample from a portion of the testpit wall that looked most representative of the entire testpit. It was decided (in the field) not to collect the sample from the stockpile of excavated soil, because any changes in the soil texture with depth could skew the sampling results – if the soils near the base of the testpit were coarser grained or finer grained than the upper soils, these soils would end up on the top of the soil pile, and potentially skew the sampling results.

After a 5 kg soil sample was collected from the testpit wall (with fragments larger than 50 mm ø removed) the sample was labelled with the testpit name and depth-interval (i.e. TP7, 0.25-0.40 m). After the first 5 testpits were completed, it was decided to use a hand auger to probe deeper from the base of the testpit. This enabled the field crew to determine if there were any significant changes in the soil characteristics below the testpits. The testpit stratigraphy and the stratigraphic information gathered with the hand auger testhole were recorded on field logs. The data on the field logs also includes the GPS coordinate of the testpit, the volume of material larger than 50 mm ø, the dimensions of the testpit, and the percent by volume of coarser material (Appendix A).

Prior to backfilling the testpits, the coarse fragments and the excavation were photographed. The photographs of each testpit are attached to the field logs in Appendix A.

4.0 LABORATORY ANALYTICAL RESULTS

One soil sample from each of the 15 testpits was submitted to the MIT Materials Engineering Branch Central Laboratory for grain size analyses. The laboratory analytical report is included as Appendix B.

All soil samples except the sample from testpit TP5 contained a large proportion of fine material (clay and silt). The clay and silt contents ranged from a high of 98% at TP14 to 45% at TP13.

Excluding TP5, the average clay and silt content was 70.4%. The sand size fraction (0.075 mm to 4.75 mm) ranged from a high of 46% at TP8 down to 2% at TP14 (average=24%). The fine to medium grained gravel fraction (4.75 mm to 50 mm) ranged from a high of 22% at TP3 to 0% at TP10, TP11, TP12, TP14 and TP15 (average=6%).

The soils at testpit TP5 are discussed separately because of the vast difference in the soil texture at this location. At TP5, the silt and clay content was 5%, the sand size fraction was 40% and the fine to medium gravel fraction was 55%.

5.0 PERCENT BY VOLUME LARGER THAN 50 MM Ø

Testpit TP5 contained 11.3% (by volume) material larger than 50 mm in size. This location was anomalous compared to the remaining 14 testpit locations, and is not factored into the following discussion.

The remaining 14 testpits contained between 0% material larger than 50 mm (TP8, TP10, TP12 and TP13) and 3.2% material larger than 50 mm (TP2). Testpit 14 contained a very small amount of coarse material (less than 0.1%). Twelve (12) of the fourteen (14) testpits contained 1% or less coarse material. Excluding TP5, only TP2 and TP4 contained more than 1% coarse material.

6.0 CONCLUSIONS

The soils along Buffalo Creek can be classified as a silty clay till. The silt and clay content combined average approximately 70%. The sand size fraction averages approximately 24%, and the fine to medium gravel content is approximately 6%.

Factoring out the results from TP5, the percent by volume of material exceeding 50 mm in size is approximately 0.65%. With the results from TP5 factored in, the percent by volume of material exceeding 50 mm in size is 1.37%.

If you have any questions regarding the three work programs described above, contact Colin Siepman or John Burns.

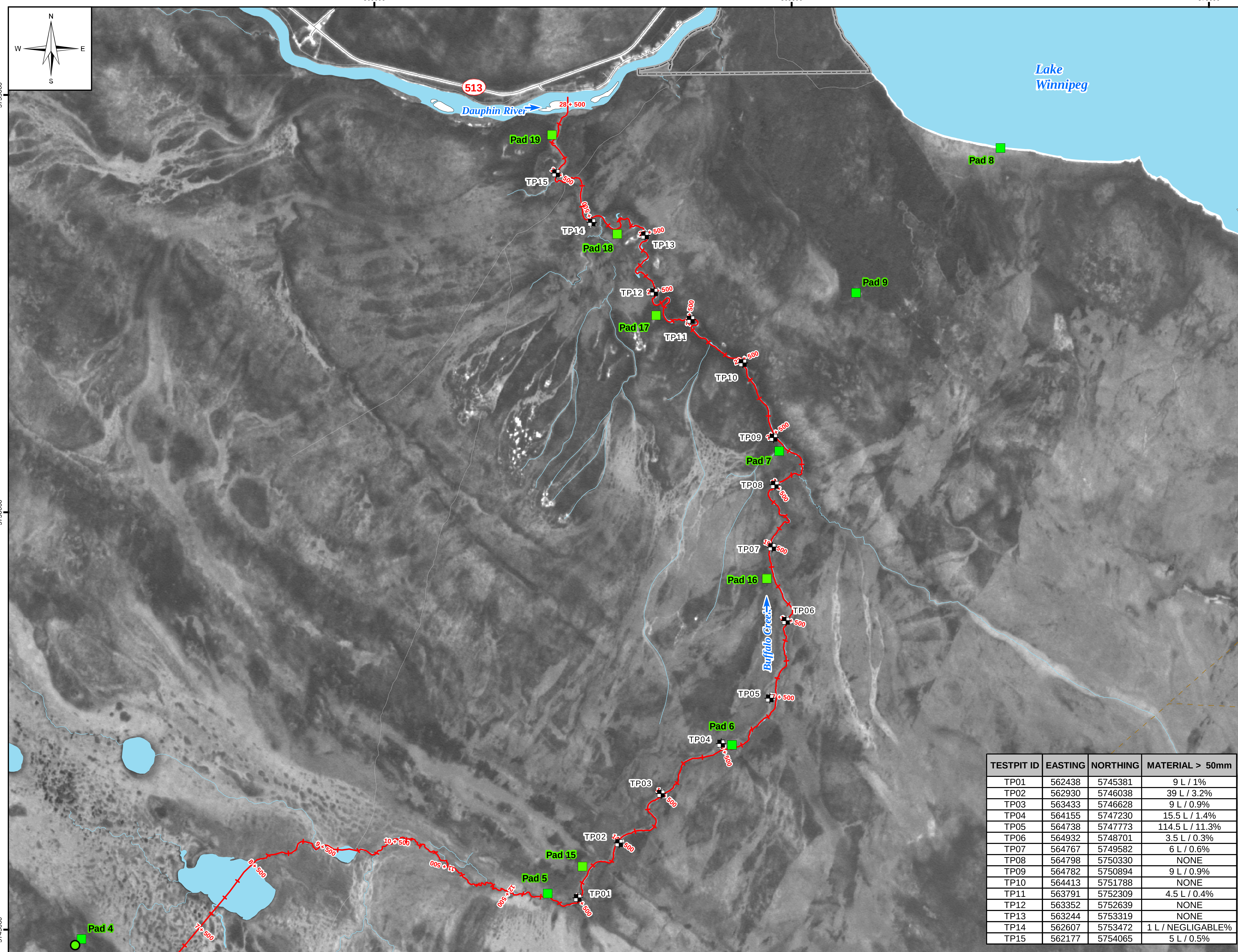
Prepared By:

<Original signed by>

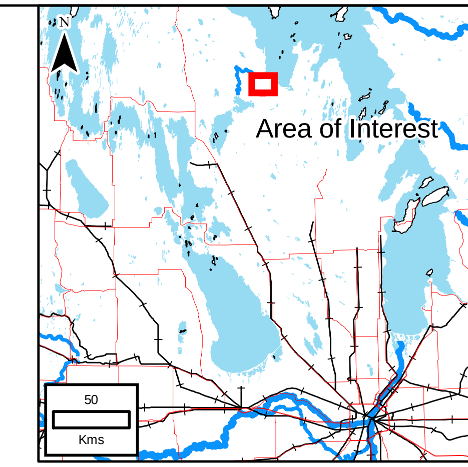
John Burns, P.Geo.
Senior Environmental Geologist

JB/sl
Attachment

FIGURE



TESTPIT ID	EASTING	NORTHING	MATERIAL > 50mm
TP01	562438	5745381	9 L / 1%
TP02	562930	5746038	39 L / 3.2%
TP03	563433	5746628	9 L / 0.9%
TP04	564155	5747230	15.5 L / 1.4%
TP05	564738	5747773	114.5 L / 11.3%
TP06	564932	5748701	3.5 L / 0.3%
TP07	564767	5749582	6 L / 0.6%
TP08	564798	5750330	NONE
TP09	564782	5750894	9 L / 0.9%
TP10	564413	5751788	NONE
TP11	563791	5752309	4.5 L / 0.4%
TP12	563352	5752639	NONE
TP13	563244	5753319	NONE
TP14	562607	5753472	1 L / NEGLIGABLE%
TP15	562177	5754065	5 L / 0.5%



LEGEND:

- Testpit
- Helicopter Landing Pad
- Lake St. Martin Channel Option L
- Road Paved 2 or more lanes
- Paved Street or Road
- Gravel Road
- Unclassified Road
- Accessway or Backlane
- Trail
- Railway
- Ditch
- River/Stream, Indefinite
- River/Stream
- Dugout; Pond;
- Lake
- Aboriginal Lands

0.5 0 0.5 1 1.5

Kilometres

SCALE: 1:45,000 METRIC 11"x17"

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0	11/10/06	ISSUED FOR INFORMATION	JB

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AECOM

Manitoba INFRASTRUCTURE AND TRANSPORTATION

LAKE MANITOBA AND LAKE ST. MARTIN EMERGENCY CHANNELS

TESTPIT LOCATIONS FOR SEDIMENT EROSION PROGRAM

OCTOBER 2011 | FIGURE 01 | REV: 0

FileName: P:\Projects\2011\11-0300-18\Dwg\GIS\MXD\REV0\SEDIMENT_EROSION\11-0300-18-F01-REV0.mxd
11"x17" PLOT SCALE 1:1

APPENDIX A

TESTPIT LOGS

Photo 1 – Helipad 5 area, Inundated

Photo 2 – Helipad 5 area, Inundated

Photo 3 – Helipad 5 area

KGS GROUP

SUMMARY LOG

HOLE NO. **TP01**

SHEET 1 of 1

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
SITE	Buffalo Creek	TOP OF PVC ELEV.	
		WATER ELEV.	
LOCATION	West Bank Sta. 13+500	DATE DRILLED	9/21/2011
DRILLING METHOD	Shovel	UTM (m)	N 5,745,381 E 562,438

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆ 20 40 60 80; PL MC LL % 20 40 60 80
			ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
			SILTY CLAY (CH) - Grey, moist, soft, high plasticity, some fine to medium grained sand, some gravel, trace cobbles (up to 125 mm x 125 mm x 200 mm), occasional silt seams up to 25 mm thick.	Shovel	S1			
			END OF TESTPIT AT 0.49 m.					
			Notes: 1.) Recovered 9 L of material larger than 50 mm Ø (1% by volume).					

Depth scale: (m) 1, 2, 3; (ft) 5

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Completed Testpit

Photo 2 – Coarse material >50 mm ø from testpit

Photo 3 – Material passing 50 mm ø screen

Photo 4 – Backfilled testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP02**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
SITE	Buffalo Creek	TOP OF PVC ELEV.	
LOCATION	West Bank Sta. 14+500	WATER ELEV.	
DRILLING METHOD	Shovel	DATE DRILLED	9/22/2011
		UTM (m)	N 5,746,038 E 562,930

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
			ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
			SILTY CLAY (CH) - Dark grey, moist, soft to firm, high plasticity, some gravel, trace sand.					
			SANDY CLAY (CI) - Light grey, moist to wet, soft, low to intermediate plasticity, some fine grained gravel, trace to some medium to coarse grained grael, trace cobbles (subrounded to subangular and up to 225 mm Ø), increasing silt content and decreasing plasticity with depth.	Shovel	S1			
			END OF TESTPIT AT 0.7 m.					

Notes:
1.) Recovered 39 L of material larger than 50 mm Ø (3.2% by volume).
2.) Water infiltration at base of testpit.
3.) GPS point didn't save, coordinates scaled off from drawing.

Depth scale: 1, 2, 3 (m); 5 (ft)

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Side view of testpit

Photo 2 – End view of testpit

Photo 3 – Gravel <50 mm ø from testpit

Photo 4 – Fine material from testpit

Photo 5 – Coarse material >50 mm ø from testpit

Photo 6 – Backfilling testpit

Photo 7 – View of work area

Photo 8 – Testpit backfilled

KGS GROUP

SUMMARY LOG

HOLE NO. **TP03**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
		TOP OF PVC ELEV.	
SITE	Buffalo Creek	WATER ELEV.	
LOCATION	West Bank Sta. 15+500	DATE DRILLED	9/22/2011
DRILLING METHOD	Shovel	UTM (m)	N 5,746,628 E 563,433

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
				CLAYEY SILT (CL-ML) - Brown, dry, firm to stiff, friable, low plasticity, some fine to coarse grained sand, trace subangular gravel (mostly 20 mm to 40 mm Ø). - Some tan, dry, hard silt pockets (up to 75 mm Ø) below 0.3 m.	Shovel	S1			
				END OF TESTPIT AT 0.6 m. Notes: 1.) Recovered 9 L of material larger than 50 mm Ø (0.9% by volume). 2.) Water infiltration at base of testpit.					
	1								
		5							
	2								
	3								

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Creek embankment/work area

Photo 2 – Coarse material >50 mm ø

Photo 3 – View of testpit

Photo 4 – Surficial boulder near testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP04**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
		TOP OF PVC ELEV.	
SITE	Buffalo Creek	WATER ELEV.	
LOCATION	West Bank Sta. 16+500	DATE DRILLED	9/22/2011
		UTM (m)	N 5,747,230
DRILLING METHOD	Shovel		E 564,155

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
			ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
			SILT WITH GRAVEL (GP) - Brown, damp, firm to stiff, medium grained subrounded to rounded gravel (up to 50 mm Ø), trace coarse grained gravel, trace cobbles. - 50 mm thick sand seam at 0.25 m, medium to coarse grained sand, trace fine grained gravel.					
			SAND AND CLAY (CL) - Grey/Brown, damp, stiff/dense, low plasticity, some medium grained gravel (up to 50 mm Ø), trace coarse grained gravel, trace cobbles, trace boulders (up to 250 mm Ø).	Shovel	S1			
			SILTY CLAY (CI) - Grey, moist, firm, intermediate plasticity, some silt pockets (up to 20 mm Ø), trace cobbles.					
			END OF TESTPIT AT 0.75 m. Notes: 1.) Recovered 15.5 L of material larger than 50 mm Ø (1.4% by volume).					
	1							
	5 (ft)							
	2							
	3							

SAMPLE TYPE ⌧ Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Side view of testpit

Photo 2 – End view of testpit

Photo 3 – Coarse material >50 mm ø from testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP05**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
SITE	Buffalo Creek	TOP OF PVC ELEV.	
		WATER ELEV.	
LOCATION	West Bank Sta. 17+500	DATE DRILLED	9/23/2011
DRILLING METHOD	Shovel	UTM (m)	N 5,747,773 E 564,738

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆ 20 40 60 80; PL MC LL % 20 40 60 80
			ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
			GRAVELLY SAND (SW) - Brown, damp, dense, well graded, trace subangular to subrounded cobbles.	Shovel	S1			
			END OF TESTPIT AT 0.85 m.					
	1		Notes: 1.) Recovered 114.5 L of material larger than 50 mm Ø (11.3% by volume).					
	5 (ft)							
	2							
	3							

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – View of testpit

Photo 2 – Sidewall of testpit

Photo 3 – Screening testpit material

Photo 4 – Coarse material >50 mm ø from testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP06**

CLIENT	**MANITOBA INFRASTRUCTURE AND TRANSPORTATION**	JOB NO.	11-0300-18
PROJECT	**Buffalo Creek Sediment Survey**	GROUND ELEV.	
SITE	**Buffalo Creek**	TOP OF PVC ELEV.	
LOCATION	**West Bank Sta. 18+500**	WATER ELEV.	
		DATE DRILLED	9/23/2011
DRILLING METHOD	**Shovel and Hand Auger**	UTM (m)	N 5,748,701 E 564,932

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
				ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
				SILTY CLAY (CH) - Grey, dry to damp, stiff to very stiff, friable (high plasticity when wetted), occasional silt pockets (up to 50 mm thick), trace silt seams.	Shovel	S1			
				- Switched to hand auger at 0.85 m.					
	1								
		5							
				AUGER REFUSAL ON SUSPECTED COBBLE/BOULDER AT 1.68 m.					
				Notes: 1.) Recovered 3.5 L of material larger than 50 mm Ø (0.3% by volume). 2.) Found a 600 mm by 450 mm Ø boulder first encountered at 0.15 m depth, moved testpit beside boulder.					
	2								
	3								

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – End view of testpit

Photo 2 – Rock in testpit wall

Photo 3 – Recording GPS coordinate of testpit

Photo 4 – Coarse material >50 mm ø from testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP07**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION
PROJECT	Buffalo Creek Sediment Survey
SITE	Buffalo Creek
LOCATION	East Bank Sta. 19+500
DRILLING METHOD	Shovel and Hand Auger
JOB NO.	11-0300-18
GROUND ELEV.	
TOP OF PVC ELEV.	
WATER ELEV.	
DATE DRILLED	9/23/2011
UTM (m)	N 5,749,582 E 564,767

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ / PL MC LL %
			ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
			SILTY CLAY (CI) - Brown, dry, stiff to very stiff, friable (low to intermediate plasticity when wetted), some medium grained sand, trace gravel, trace cobbles (up to 150 mm Ø), some silt seams (up to 25 mm thick), roots to 0.3 m.	Shovel	S1			
			- Switched to hand auger below 0.9 m.					
	1							
		5	**SANDY SILT (ML)** - Tan, moist, soft, non-plastic, some medium to coarse grained sand.	Auger Grab	S2			
			SAND (SW) - Brown, moist, compact, well graded medium to coarse grained sand.	Auger Grab	S3			
	2		**END OF HOLE AT 1.97 m.**					
	3							

Notes:
1.) Recovered 6 L of material larger than 50 mm Ø (0.6% by volume).
2.) Water entering hole from sand at end of drilling.

SAMPLE TYPE: Shovel; Auger Grab

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Side wall of testpit

Photo 2 – End wall of testpit

Photo 3 – Base of testpit showing auger hole

Photo 4 – Coarse material >50 mm ø from testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP08**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
		TOP OF PVC ELEV.	
SITE	Buffalo Creek	WATER ELEV.	
LOCATION	West Bank Sta. 20+500	DATE DRILLED	9/24/2011
DRILLING METHOD	Shovel and Hand Auger	UTM (m)	N 5,750,330 E 564,798

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
				ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
				SANDY CLAY (CL) - Grey/Black, dry, firm, low plsticity, some silt, trace gravel (up to 25 mm Ø), some roots.					
				SILTY CLAY (CH) - Grey, dry to damp, stiff, friable (high plasticity when wet), trace gravel (up to 40 mm Ø), trace sand, some silt pockets (up to 25 mm Ø).	Shovel	S1			
				- Switched to hand auger at 0.7 m.					
	1								
		5							
				END OF HOLE AT 1.65 m.					
				Notes: 1.) No material larger than 50 mm Ø was encountered. 2.) Water entering hole at 1.36 m, rising to base of testpit at end of digging.					
	2								
	3								

SAMPLE TYPE Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Side wall of testpit

Photo 2 – End wall of testpit

Photo 3 – Base of testpit

Photo 4 – Fine material excavated from testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP09**

SHEET 1 of 1

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
SITE	Buffalo Creek	TOP OF PVC ELEV.	
		WATER ELEV.	
LOCATION	West Bank Sta. 21+500	DATE DRILLED	9/24/2011
DRILLING METHOD	Shovel and Hand Auger	UTM (m)	N 5,750,894 E 564,782

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
			ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
			SANDY CLAY (CL) - Grey/Black, dry, firm, low plsticity, some silt, trace gravel (up to 25 mm Ø), some roots.					
			SILTY CLAY (CH) - Grey, dry to damp, stiff, friable (high plasticity when wet), trace boulders (up to 280 mm Ø), trace cobbles, trace gravel (up to 40 mm Ø), trace sand, some silt pockets (up to 25 mm Ø).	Shovel	S1			
	1		- Switched to hand auger below 0.85 m.					
	(5 ft)							
			END OF HOLE AT 1.8 m.					
	2		Notes: 1.) Recovered 9 L of material larger than 50 mm Ø (0.9% by volume).					
	3							

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Base of testpit

Photo 2 – Coarse material >50 mm ø from testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP10**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
		TOP OF PVC ELEV.	
SITE	Buffalo Creek	WATER ELEV.	
LOCATION	West Bank Sta. 22+500	DATE DRILLED	9/24/2011
DRILLING METHOD	Shovel and Hand Auger	UTM (m)	N 5,751,788 E 564,413

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %
			ORGANICS - Black, moist, soft, non to low plastic, with rootlets.			
			SILTY CLAY (CH) - Grey, damp to moist, stiff, friable (high plasticity when wet), trace fine grained sand, some silt pockets (up to 25 mm Ø).	Shovel	S1	
			SILT (ML) - Grey, moist, soft, low plasticity, with clay, trace fine grained sand. - Switched to hand auger below 0.8 m.			
	1					
			GRAVELLY SILT (ML) - Tan, wet, soft, non plastic, fine grained gravel, some sand, some clay.	Auger Grab	S2	
			AUGER REFUSAL ON SUSPECTED COBBLE AT 1.26 m.			
		5	Notes: 1.) No material larger than 50 mm Ø was encountered. 2.) Water entering hole at 1.26 m, rising to base of testpit at end of digging.			
	2					
	3					

SPT (N) blows/0.15 m ▲ — DYNAMIC CONE (N) blows/ft △ — 20 40 60

Cu POCKET PEN (kPa) ★ — Cu TORVANE (kPa) ◆ — 20 40 60 80

PL — MC — LL — % — 20 40 60 80

SAMPLE TYPE: Shovel; Auger Grab

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Base and side wall of testpit

Photo 2 – End wall of testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP11**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
SITE	Buffalo Creek	TOP OF PVC ELEV.	
		WATER ELEV.	
LOCATION	West Bank Sta. 23+500	DATE DRILLED	9/25/2011
DRILLING METHOD	Shovel and Hand Auger	UTM (m)	N 5,752,309 E 563,791

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
	0		**ORGANICS** - Black, moist, soft, non to low plastic, with rootlets.					
			SILTY CLAY (CH) - Grey, damp to moist, stiff, friable (high plasticity when wet), trace cobbles.	Shovel	S1			
			- Switched to hang auger at 0.7 m.					
	1							
	(5 ft)							
	1.62		**END OF HOLE AT 1.62 m.**					
			Notes: 1.) Recovered 4.5 L of material larger than 50 mm Ø (0.4% by volume).					
	2							
	3							

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Base and side wall of testpit

Photo 2 – End wall of testpit

Photo 3 – View of testpit

Photo 4 – Coarse material >50 mm ø from testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP12**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
		TOP OF PVC ELEV.	
SITE	Buffalo Creek	WATER ELEV.	
LOCATION	West Bank Sta. 24+500	DATE DRILLED	9/25/2011
DRILLING METHOD	Shovel and Hand Auger	UTM (m)	N 5,752,639 E 563,352

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80); PL MC LL % (20 40 60 80)
			ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
			SILTY CLAY (CH) - Grey, damp to moist, stiff, friable (high plasticity when wet).					
			- Light grey, moist below 0.4 m.	Shovel	S1			
			- Switched to hang auger at 0.7 m.					
	1							
			GRAVELLY SAND (SW) - Grey, wet, compact, well graded, fine grained gravel, some silt.					
			AUGER REFUSAL ON SUSPECTED COBBLE AT 1.2 m.					
	5 (ft)		Notes: 1.) No material larger than 50 mm Ø was encountered. 2.) Water entering hole at 1.05 m, rising to 0.75 m at end of digging.					
	2							
	3							

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Side wall of testpit

Photo 2 – End wall of testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP13**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
SITE	Buffalo Creek	TOP OF PVC ELEV.	
		WATER ELEV.	
LOCATION	West Bank Sta. 25+500	DATE DRILLED	9/25/2011
DRILLING METHOD	Shovel and Hand Auger	UTM (m)	N 5,753,319 E 563,244

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
			ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
			SILTY CLAY (CH) - Grey, damp to moist, stiff, friable (high plasticity when wet), trace cobbles.					
			- Moist to wet, decreased plasticity, increased silt content, some sand and gravel below (up to 25 mm Ø) below 0.45 m.	Shovel	S1			
			- Switched to hang auger at 0.7 m.					
	1							
	5		**AUGER REFUSAL IN DENSE SANDY CLAY AT 1.37 m.**					
			Notes: 1.) No material larger than 25 mm Ø was encountered. 2.) Water entering testhole from 1.3 m, rising to base of testpit at end of digging.					
	2							
	3							

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – End wall of testpit

Photo 2 – Close up of fine textured soils in testpit

Photo 3 – General view of testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP14**

CLIENT	MANITOBA INFRASTRUCTURE AND TRANSPORTATION	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
		TOP OF PVC ELEV.	
SITE	Buffalo Creek	WATER ELEV.	
LOCATION	West Bank Sta. 26+500	DATE DRILLED	9/25/2011
DRILLING METHOD	Shovel and Hand Auger	UTM (m)	N 5,753,472 E 562,607

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
				ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
				SILTY CLAY (CH) - Brown/Grey, damp, stiff to very stiff, high plasticity, trace sand, trace subangular gravel (up to 50 mm Ø), occasional silt seams (up to 25 mm thick), trace rootlets.	Shovel	S1			
				- Switched to hang auger at 0.83 m.					
	1								
		5							
				END OF HOLE AT 1.85 m.					
	2			Notes: 1.) Recovered less than 1 L of material larger than 50 mm Ø (negligable amount by volume).					
	3								

SAMPLE TYPE: Shovel

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – End wall of testpit

Photo 2 – Side wall of testpit

Photo 3 – Auger cuttings from below

Photo 4 – Auger hole at base of testpit

KGS GROUP

SUMMARY LOG

HOLE NO. **TP15**

CLIENT	**MANITOBA INFRASTRUCTURE AND TRANSPORTATION**	JOB NO.	11-0300-18
PROJECT	Buffalo Creek Sediment Survey	GROUND ELEV.	
		TOP OF PVC ELEV.	
SITE	Buffalo Creek	WATER ELEV.	
LOCATION	West Bank Sta. 27+500	DATE DRILLED	9/26/2011
DRILLING METHOD	Shovel and Hand Auger	UTM (m)	N 5,754,065 E 562,177

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
				ORGANICS - Black, moist, soft, non to low plastic, with rootlets.					
				SILTY CLAY (CH) - Grey, moist, firm, high plasticity, trace sand, trace gravel (majority less than 50 mm Ø), trace cobbles (up to 75 mm x 75 mm x 100 mm in size)	Shovel	S1			
				- Switched to hang auger at 0.75 m, increased medium to coarse grained gravel (up to 50 mm Ø) below.					
	1								
		5							
				GRAVELLY SILT (ML) - Brown, wet, soft, non plastic, fine grained gravel, some sand, some clay.	Auger Grab	S2			
				END OF HOLE AT 1.66 m.					
				Notes: 1.) Recovered 5 L of material larger than 50 mm Ø (0.5% by volume). 2.) Water entering hole at 1.8 m, rising to 0.9 m at end of digging.					
	2								
	3								

SAMPLE TYPE: Shovel; Auger Grab

CONTRACTOR	INSPECTOR	APPROVED	DATE
KGS Group	C. ROBAK	DRAFT	9/28/11

Photo 1 – Side wall of testpit

Photo 2 – End wall of testpit

Photo 3 – Coarse material >50 mm ø from testpit

Photo 4 – Fine textured soil from testpit and auger cuttings

APPENDIX B

LABORATORY ANALYTICAL RESULTS
GRAIN SIZE ANALYSES

Manitoba Infrastructure and Transportation
MATERIALS ENGINEERING BRANCH - CENTRAL LAB
GEOTECHNICAL SOIL PROPERTY SUMMARY SHEET

Client: Water Control and Structures	Site/File No. :		Date Requisitioned Sep 28, 2011
Project: Buffalo Creek Sediment Survey - LSM	Internal Order No. :		Date Reported: Oct 3, 2011
Location: Buffalo Creek Station 13+500 to 27+500	Sampled By:	KGS Group	Report To: Alena James
Municipality:	Date Sampled:		Page: 1 of 1

Lab No.	SAMPLE DATA					Unified Classification	Moisture Content %	ATTERBERG LIMITS			GRAIN SIZE					Organic Content %	STRENGTH						
	Test Hole No.	Sample No.	Station	Centerline	Depth(m)			Liquid Limit %	Plastic Limit %	Plasticity Index %	Gravel % (pass 75mm)	Sand % (pass 4.75mm)	Silt % (pass 0.075mm)	Clay % (pass 0.005 mm)	Silt/Clay % (pass 0.075 mm)		SPT (N)	Field PP (kpa)	Unconfined qu (kpa)	Direct Shear Performed	Bulk Density (kg/cu.m.)		
WGT110568		TP1			0.45-0.60						6	18	16	60	76								
WGT110569		TP2			0.45-0.60						15	30	36	19	55								
WGT110570		TP3			0.45-0.60						22	19	29	30	59								
WGT110571		TP4			0.30-0.60						6	44	20	30	50								
WGT110572		TP5			0.45-0.60						55	40	3	2									
WGT110573		TP6			0.45-0.60						6	7	17	70	87								
WGT110574		TP7			0.25-0.40						9	16	16	59	75								
WGT110575		TP8			0.45-0.60						1	46	23	30	53								
WGT110576		TP9			0.45-0.60						6	6	12	76	88								
WGT110577		TP10			0.30-0.60							31	28	41	69								
WGT110578		TP11			0.45-0.60							32	26	42	68								
WGT110579		TP12			0.45-0.60							22	24	54	78								
WGT110580		TP13			0.45-0.60						13	42	20	25	45								
WGT110581		TP14			0.30-0.45							2	8	90	98								
WGT110582		TP15			0.30-0.45							15	19	66	85								
															986 ÷ 14 = 70.4%								

APPENDIX K

BUFFALO CREEK AND DAUPHIN RIVER

SUSPENDED SOLIDS LABORATORY RESULTS

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Submitted To: Judy Dalmaijer
ALS Laboratory Group
Unit 12 - 1329 Niakwa Rd. E.
Winnipeg MB R2J 3T4

Test Report

1/25/12

REFERENCE DATA

Sample Type:	Suspended Solids
Method Reference:	Particle Sizing by Transmission Electron Microscopy (TEM)
Client Sample Nos.:	L1105100-10 HYD-1 and L1105100-11 HYD-2
Sample Location:	L1105100
PO No.:	L1105100
ALS Work Order No.:	1201305
ALS Sample Nos.:	1201305-01 and 1201305-02
Sample Receipt Date	1/19/2012
Preparation Date:	1/19/2012 – 1/20/2012
Analysis Date:	1/22/2012 – 1/25/2012

The samples on the following data sheets were analyzed in accordance with the ALS Laboratory Group procedure for particle sizing using Transmission Electron Microscopy (TEM). The range of particle sizes detectable is approximately 0.05 microns to approximately 100 microns. The size ranges reported are based on client specifications and the nature of the samples.

Results are tabulated on the following pages. Particles are categorized by their longest dimension. Report applies only to portions of samples analyzed. Samples will be disposed of after 60 days unless otherwise instructed.

<Original signed by>

Anna Marie Ristich
Analyst

<Original signed by>

Angela Sohn
Reviewer

CASE NARRATIVE:

Samples L1105100-10 HYD-1 and L1105100-11 HYD-2 were samples of sediment suspended in water. To prepare the samples, we briefly sonicated the samples in their containers, then filter a portion of each onto a 0.22 micron MCE filter. Portions of the filters were mounted on TEM grids for analysis.

The anaysis was performed in 3 phases: detection of particles >10 microns (maximum area analyzed), particles from 2 to 10 microns, and particles <2 microns. For each sample, the analyst scanned grid openings until at least 15 particles >10 microns were detected. She analyzed 1 grid opening per sample for particles from 2 to 10 microns; and 20 fields of view for particles <2 microns in size. For each sample, we normalized the particles detected to the number of openings analyzed in Phase 1: Paricles >10 microns in size.

Both samples contained 4 major particle shapes: fibers; flat ribbons and platelets; angular, equant particles; and spheriodal partilces. The fibers have biological features and structures typcial of water-borne bacteria fragments. The ribbons amorphous, flat, elongated ribbons with high C and O compositions. They no longer show biological features or structures, and may be decomposed plant material. The platelets are less common than the ribbons; their compositions and structures indicate that they are other amorphous biological particles, clay minerals, and micas. The angular, equant grains are mineral particles. Nearly all of them are composed of Fe-Mg-K-Al-Si, indicative of micas or feldspars. One Mg-Ca-carbonate grain was detected. The spheroidal particles are biological, most likely bateria fragments.

ALS Laboratory Group
4388 Glendale-Milford Road, Cincinnati, Ohio 45242
Phone (513) 733 5336 Fax (513) 733 5347 www.alsenviro.com
A Campbell Brothers Limited Company

CLIENT: ALS Laboratory Group
SAMPLE LOCATION: L1066595

Client Sample No.:	L1105100-10 HYD-1		Nomalized to 25 Grid Openings		
ALS Sample No.:	**1201305-01**				
Fibers					
SIZE IN MICRONS:	**<2**	**≥2<6**	**≥6<10**	**≥10**	**TOTAL**
COUNT		0	0	15	15
NUMBER PERCENT		0	0	100	100
TOTAL VOLUME (μm^3)		0	0	202,609	202,609
VOLUME PERCENT		0	0	100	100
Ribbons and Platelets					
SIZE IN MICRONS:	**<2**	**≥2<6**	**≥6<10**	**≥10**	**TOTAL**
COUNT		675	25	39	739
NUMBER PERCENT		91.3	3.4	5.3	100
TOTAL VOLUME (μm^3)		174	24	80	278
VOLUME PERCENT		62.6	8.6	28.8	100
Angular Equant Particles					
SIZE IN MICRONS:	**<2**	**≥2<6**	**≥6<10**	**≥10**	**TOTAL**
COUNT		50	0	1	51
NUMBER PERCENT		98	0	2	100
TOTAL VOLUME (μm^3)		1,603	0	1,614	3,217
VOLUME PERCENT		50	0	50	100
Spheroidal Particles					
SIZE IN MICRONS:	**<2**	**≥2<6**	**≥6<10**	**≥10**	**TOTAL**
COUNT		50	25	2	77
NUMBER PERCENT		65	32	3	100
TOTAL VOLUME (μm^3)		124	2,636	1,567	4,327
VOLUME PERCENT		3	61	36	100
Total All Shapes					
SIZE IN MICRONS:	**<2**	**≥2<6**	**≥6<10**	**≥10**	**TOTAL**
COUNT	20,586	775	50	57	21,468
NUMBER PERCENT	95.9	3.6	0.2	0.3	100
TOTAL VOLUME (μm^3)	16,168	1,901	2,660	205,870	226,599
VOLUME PERCENT	7	1	1	91	100

The 2 largest particles detected in Sample L1105110-10 HYD-1 are a biological fiber 192 microns long and an organic ribbon 61 microns long.

CLIENT: ALS Laboratory Group
SAMPLE LOCATION: L1066595

Client Sample No.:	L1105100-11 HYD-2			Normalized to 25 Grid Openings	
ALS Sample No.:	**1201305-02**				
Fibers					
SIZE IN MICRONS:	**<2**	**>2<6**	**>6<10**	**>10**	**TOTAL**
COUNT		25	0	7	32
NUMBER PERCENT		78	0.0	22	100
TOTAL VOLUME (μm^3)		173	0	23,694	23,867
VOLUME PERCENT		1	0	99	100
Ribbons and Platelets					
SIZE IN MICRONS:	**<2**	**>2<6**	**>6<10**	**>10**	**TOTAL**
COUNT		650	50	27	727
NUMBER PERCENT		89	7	4	100
TOTAL VOLUME (μm^3)		248	37	24,781	25,066
VOLUME PERCENT		1.0	0.1	98.9	100
Angular Equant Particles					
SIZE IN MICRONS:	**<2**	**>2<6**	**>6<10**	**>10**	**TOTAL**
COUNT		25	0	1	26
NUMBER PERCENT		96	0	4	100
TOTAL VOLUME (μm^3)		354	0	1,853	2,207
VOLUME PERCENT		16	0	84	100
Spheroidal Particles					
SIZE IN MICRONS:	**<2**	**>2<6**	**>6<10**	**>10**	**TOTAL**
COUNT		25	0	1	26
NUMBER PERCENT		96	0	4	100
TOTAL VOLUME (μm^3)		61	0	11,502	11,563
VOLUME PERCENT		1	0	99	100
Total All Shapes					
SIZE IN MICRONS:	**<2**	**>2<6**	**>6<10**	**>10**	**TOTAL**
COUNT	23,579	725	50	36	24,390
NUMBER PERCENT	96.7	3.0	0.2	0.1	100
TOTAL VOLUME (μm^3)	18,519	836	37	61,830	81,222
VOLUME PERCENT	23	1	0	76	100

The 2 largest particles detected in Sample L1105110-11 HYD-2 are an organic ribbon 117 microns long and a biological fiber 114 microns long.

KGS Group Consultants (Winnipeg)
ATTN: S HNATIUK STEWART
83 SCURFIELD BLVD
Winnipeg MB R3T 5P4

Date Received: 25-JUL-14
Report Date: 02-SEP-14 15:29 (MT)
Version: FINAL

Client Phone: 204-287-3366

Certificate of Analysis

Lab Work Order #: L1492743

Project P.O. #: NOT SUBMITTED
Job Reference: LAKE ST MARTIN
C of C Numbers:
Legal Site Desc:

<Original signed by>

Craig Riddell
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1492743-1 BC3 - LHB							
Sampled By: nw/mm on 24-JUL-14							
Matrix: sw							
Miscellaneous Parameters							
Special Request	See Attached					22-AUG-14	R2934546
L1492743-2 BC3 - LHB							
Sampled By: nw/mm on 24-JUL-14							
Matrix: sw							
Miscellaneous Parameters							
Special Request	See Attached					22-AUG-14	R2934546
L1492743-3 DR1 - LHB							
Sampled By: nw/mm on 24-JUL-14							
Matrix: sw							
Miscellaneous Parameters							
Special Request	See Attached					22-AUG-14	R2934546
L1492743-4 DR1 - LHB							
Sampled By: nw/mm on 24-JUL-14							
Matrix: sw							
Miscellaneous Parameters							
Special Request	See Attached					22-AUG-14	R2934546
L1492743-5 DR2C - LHB							
Sampled By: nw/mm on 24-JUL-14							
Matrix: sw							
Miscellaneous Parameters							
Special Request	See Attached					22-AUG-14	R2934546
L1492743-6 DR2C - LHB							
Sampled By: nw/mm on 24-JUL-14							
Matrix: sw							
Miscellaneous Parameters							
Special Request	See Attached					22-AUG-14	R2934546

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
SPECIAL REQUEST-AD	Misc.	Special Request Datachem Ohio	SEE SUBLET LAB RESULTS

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
AD	ALS DATACHEM LABORATORIES

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1492743 Report Date: 02-SEP-14

Client: KGS Group Consultants (Winnipeg)
83 SCURFIELD BLVD
Winnipeg MB R3T 5P4
Contact: S HNATIUK STEWART

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Submitted To:	Chantal Bouchard ALS Laboratory Group Unit 12 - 1329 Niakwa Rd. E. Winnipeg MB R2J 3T4	Test Report Page 1 of 4 8/25/14

REFERENCE DATA	**Particle Sizing by TEM**
Sample Type:	Water
Method Reference:	Particle Sizing by TEM
Client Sample Nos.:	L1492743-1 through L1492743-6
Sample Location:	L1492743
PO No.:	L1492743
ALS Work Order No.:	1407942
ALS Sample Nos.:	1407942-01 through 1407942-06
Date Received:	7/30/2014
Filtration Date and Time:	8/4/2014 & 10:00
Preparation Date:	8/4/2014
Analysis Date:	8/22/2014

The samples in this report were analyzed in accordance with the ALS Laboratory Group procedure for particle sizing using Transmission Electron Microscopy (TEM). The samples were analyzed using a Tecnai G2 Spirit Twin TEM with Electron Dispersive X-Ray Analysis (EDXA) capabilities. Representative images were collected using Gatan Digital Micrograph and image analysis was performed using Image J software. Representative photomicrographs and EDXA spectra were collected and are included in this report.

The samples were submitted as sediment in water and were sonicated in their original containers for 15 minutes. A 1mL aliquot was filtered onto a 0.22µm MCE filter and mounted on grids for analysis by TEM.

All of the samples submitted contained a mixture of primarily angular grains and cleavage fragments (mineral particles including quartz, other silicates and oxides). To a much lesser degree, platelets (biological particles and platy minerals), and fibers (primarily biological) were also detected.

The range of particle sizes detectable is approximately 0.05 µm to 50µm. The size ranges reported are based on client specifications. Results are tabulated on the following pages. Particles are categorized by total area in microns. Report applies only to portions of samples analyzed. Samples will be disposed after 60 days.

<Original signed by>

<Original signed by>

Pamela Johnson
Analyst

Shawn Smythe
Project Manager

ALS Laboratory Group
4388 Glendale-Milford Road, Cincinnati, Ohio 45242
Phone (513) 733 5336 Fax (513) 733 5347 www.alsenviro.com
A Campbell Brothers Limited Company

Client Sample No.:	L1492743-1				
ALS Sample No.:	1407942-01				
		Particle Size Data			
Area (µm):	<2	>2<6	>6<20	≥20	TOTAL
Count:	81	3	1	0	85
Percent:	95	4	1	0	100

Client Sample No.:	L1492743-2				
ALS Sample No.:	1407942-02				
		Particle Size Data			
Area (µm):	<2	>2<6	>6<20	≥20	TOTAL
Count:	101	3	1	0	105
Percent:	96	3	1	0	100

Client Sample No.:	L1492743-3				
ALS Sample No.:	1407942-03				
		Particle Size Data			
Area (µm):	<2	>2<6	>6<20	≥20	TOTAL
Count:	52	2	2	1	57
Percent:	91	4	4	2	100

Client Sample No.:	L1492743-4				
ALS Sample No.:	1407942-04				
		Particle Size Data			
Area (µm):	<2	>2<6	>6<20	≥20	TOTAL
Count:	98	2	0	0	100
Percent:	98	2	0	0	100

Client Sample No.:	L1492743-5				
ALS Sample No.:	1407942-05				
		Particle Size Data			
Area (µm):	<2	>2<6	>6<20	≥20	TOTAL
Count:	76	1	0	1	78
Percent:	97	1	0	1	100

Client Sample No.:	L1492743-6				
ALS Sample No.:	1407942-06				
		Particle Size Data			
Area (µm):	<2	>2<6	>6<20	≥20	TOTAL
Count:	106	0	1	0	107
Percent:	99	0	1	0	100

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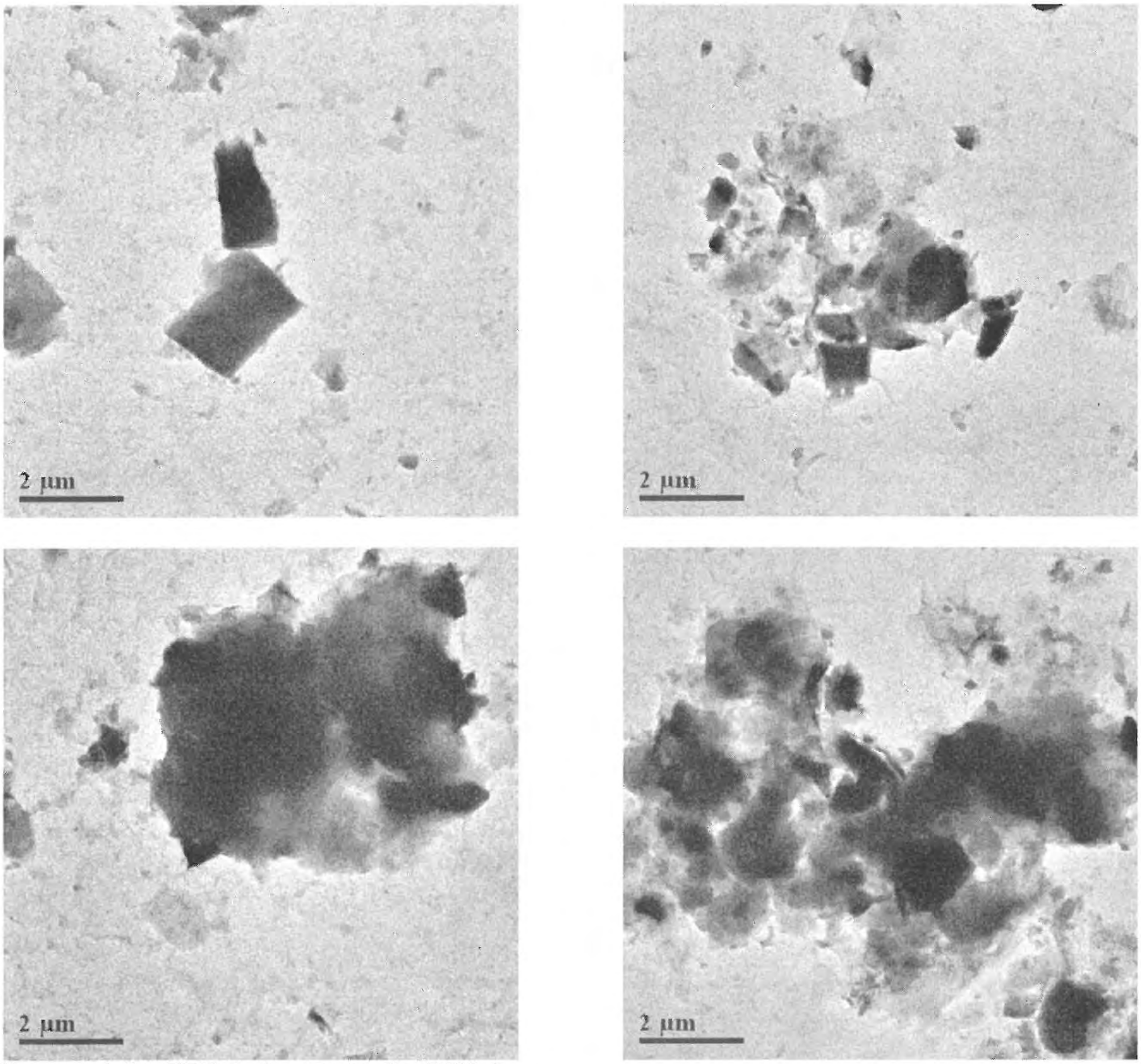
A Campbell Brothers Limited Company

Photomicrographs:



Representative TEM photomicrographs (1100x)

ALS Laboratory Group
4388 Glendale-Milford Road, Cincinnati, Ohio 45242
Phone (513) 733 5336 Fax (513) 733 5347 www.alsenviro.com
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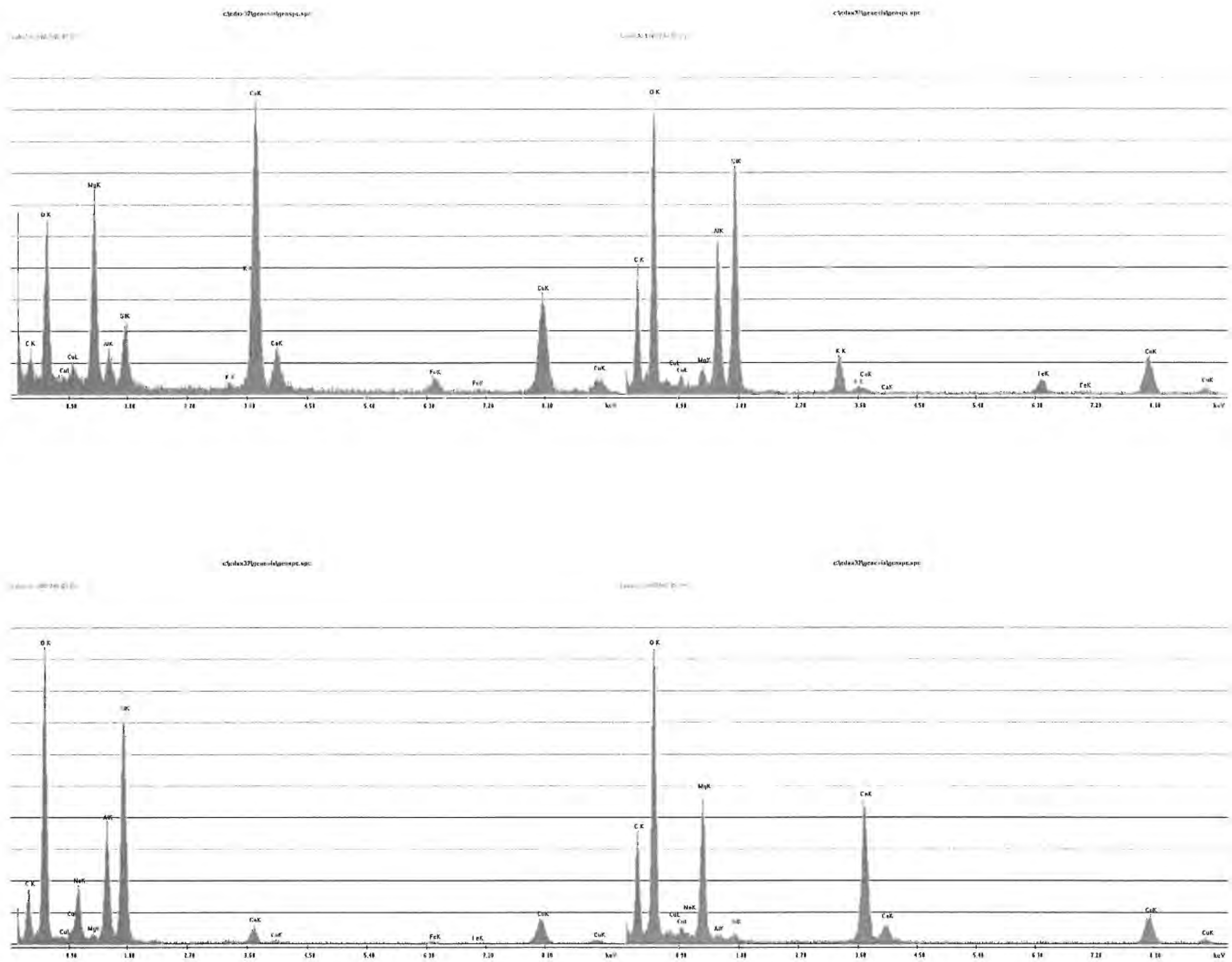
EDXA Spectra:



Representative EDXA Spectra

<Original signed by>

<Original signed by>

Pamela Johnson
Analyst

Shawn Smythe
Project Manager

ALS Laboratory Group
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L1492743-COFC

Cooler #1 14°
#2 20°C
#3 18°C

10-308244

ALS Environmental

Page 1 of 1

Report To		Report Format / Distribution		Service Request:(Rush subject to availability - Contact ALS to confirm TAT)	
Company:	North/South Consultants Inc.	Standard: X Other (specify):		X	Regular (Standard Turnaround Times - Business Days)
Contact:	Shnatuk, Steward	Select: PDF X Excel X Digital Fax			Priority(2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
Address:	83 Scurfield Blvd.	Email 1:	soffman@kgsgroup.com		Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT
	Wpg MB	Email 2:	wbernhardt@nscons.ca		Same Day or Weekend Emergency - Contact ALS to confirm TAT
Phone: (204) 287-3366	Fax:		Shnatuk@nscons.ca	Analysis Request	

Invoice To	Same as Report ? (circle) Yes or No (if No, provide details)	Client / Project Information	
	Copy of Invoice with Report? (circle) Yes or No	Job #:	Lake St. Martin
Company:	KGS Group	PO / AFE:	
Contact:	Phuong Nguyen	LSD:	
Address:	865 Waverley St. Wpg. MB		
Phone: 204-896-1209	Fax:	Quote #:	Q33012
Lab Work Order # (lab use only)		ALS Contact: Judy	Sampler: NW/MM

(Indicate Filtered or Preserved, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Special Request - AD												Number of Containers
	BC3 LHB	24-07-14		Surf, H2O	✓												
	BC3 LHB	24-07-14			✓												
	BR3 - LHB				✓												
	DR3 - LHB				✓												
	DR2C - LHB				✓												
	DR2C - LHB				✓												

Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/ETC) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by: <Original signed by>	Date: 07/25/14	Time: 2:35	Temperature: 20°C °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY GENF 18.01 Front

APPENDIX L

DAUPHIN RIVER BEDLOAD SURVEY LABORATORY RESULTS

North/South Consultants
ATTN: STACY HNATIUK STEWART
83 SCURFIELD BLVD
WINNIPEG MB R3Y 1G4

Date Received: 25-SEP-14
Report Date: 10-OCT-14 11:06 (MT)
Version: FINAL

Client Phone: 204-284-3366

Certificate of Analysis

Lab Work Order #: L1523532

Project P.O. #: NOT SUBMITTED
Job Reference: LAKE ST MARTIN - BEDLOAD
C of C Numbers:
Legal Site Desc:

<Original signed by>

Judy Dalmaijer
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1523532-1 MIDDLE REP 1							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	26.0		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	93.1		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	27.3		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	397		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-2 MIDDLE REP 2							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	96.6		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	9.55		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	280		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-3 MIDDLE REP 3							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	13.8		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	94.8		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	14.1		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	271		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-4 MIDDLE REP 4							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	10.1		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.5		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	10.6		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	704		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-5 MIDDLE REP 5							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	2.46		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.0		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	2.55		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	262		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-6 RIGHT BANK REP 1							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	5.91		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.6		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	6.17		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	428		1.0	g	08-OCT-14	08-OCT-14	R2977928

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1523532-7 RIGHT BANK REP 2							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	94.9		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	20.4		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	401		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-8 RIGHT BANK REP 3							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	1.03		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.5		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	1.42		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	313		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-9 RIGHT BANK REP 4							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	22.6		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	93.9		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	23.1		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	379		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-10 RIGHT BANK REP 5							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	23.6		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	95.4		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	24.4		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	531		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-11 RIGHT QUARTER REP 1							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	9.39		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	91.9		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	9.64		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	119		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-12 RIGHT QUARTER REP 2							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	3.53		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.5		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	4.05		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	264		1.0	g	08-OCT-14	08-OCT-14	R2977928

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1523532-13 RIGHT QUARTER REP 3							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	4.44		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	97.5		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	4.79		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	193		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-14 RIGHT QUARTER REP 4							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	3.39		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.9		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	4.00		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	365		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-15 RIGHT QUARTER REP 5							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	5.25		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.0		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	5.57		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	277		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-16 LEFT BANK REP 1							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	1.77		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.4		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	2.83		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	499		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-17 LEFT BANK REP 2							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	3.35		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.3		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	3.66		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	508		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-18 LEFT BANK REP 3							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	5.45		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.9		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	5.89		0.01	g	08-OCT-14	08-OCT-14	R2977928

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1523532-18 LEFT BANK REP 3							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
Total Sample Weight	518		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-19 LEFT BANK REP 4							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	85.2		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	88.8		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	600		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-20 LEFT BANK REP 5							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	6.11		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.7		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	7.07		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	528		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-21 LEFT QUARTER REP 1							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	1.99		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.4		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	2.09		0.1	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	352		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-22 LEFT QUARTER REP 2							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	5.91		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.3		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	6.02		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	357		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-23 LEFT QUARTER REP 3							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	88.7		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	37.0		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	326		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-24 LEFT QUARTER REP 4							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1523532-24 LEFT QUARTER REP 4							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	86.3		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	50.6		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	369		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-25 LEFT QUARTER REP 5							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	91.4		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	30.6		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	357		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-26 SITE 1-A							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	3.02		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.2		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	5.01		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	592		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-27 SITE 1-B							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	12.4		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.3		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	13.8		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	830		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-28 SITE 1-C							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	3.38		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.0		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	4.41		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	436		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-29 SITE 1-D							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	7.41		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.0		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	8.92		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	435		1.0	g	08-OCT-14	08-OCT-14	R2977928

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1523532-30 SITE 1-E							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	3.85		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.3		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	5.00		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	749		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-31 SITE 2-A							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	9.49		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	97.8		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	9.87		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	449		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-32 SITE 2-B							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	92.2		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	49.5		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	632		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-33 SITE 2-C							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	1.58		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.7		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	1.82		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	722		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-34 SITE 2-D							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.67		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.8		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.84		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	496		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-35 SITE 2-E							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.54		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.8		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.69		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	459		1.0	g	08-OCT-14	08-OCT-14	R2977928

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1523532-36 SITE 3-A							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	60.8		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	63.3		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	161		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-37 SITE 3-B							
Sampled By: WB/NW/JA on 03-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	17.2		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	94.6		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	17.2		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	317		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-38 SITE 3-C							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	15.7		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	90.0		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	15.7		1.0	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	157		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-39 SITE 3-D							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.03		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	100		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.07		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	455		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-40 SITE 3-E							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	8.26		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	97.3		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	8.46		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	317		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-41 SITE 4-A							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	1.65		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.4		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	1.74		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	283		1.0	g	08-OCT-14	08-OCT-14	R2977928

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1523532-42 SITE 4-B							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.18		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.9		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.22		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	317		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-43 SITE 4-C							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.31		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.9		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.36		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	419		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-44 SITE 4-D							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.43		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.9		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.48		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	332		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-45 SITE 4-E							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	1.95		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.5		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	2.02		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	425		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-46 SITE 5-A							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.02		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	100		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.07		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	414		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-47 SITE 5-B							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.03		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	100		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.06		0.01	g	08-OCT-14	08-OCT-14	R2977928

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1523532-47 SITE 5-B							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
Total Sample Weight	396		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-48 SITE 5-C							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.03		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	100		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.07		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	465		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-49 SITE 5-D							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.16		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	100		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.21		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	482		1.0	g	08-OCT-14	08-OCT-14	R2977928
L1523532-50 SITE 5-E							
Sampled By: WB/NW/JA on 17-JUL-14							
Matrix: SEDIMENT							
Miscellaneous Parameters							
Dry Ash	0.10		0.010	g		09-OCT-14	R2979104
Moisture, Dry & Wet weight -whole sample							
% Moisture	100		0.10	%	08-OCT-14	08-OCT-14	R2977928
Dry Weight	0.14		0.01	g	08-OCT-14	08-OCT-14	R2977928
Total Sample Weight	597		1.0	g	08-OCT-14	08-OCT-14	R2977928

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WS-SK	Misc.	Moisture, Dry & Wet weight -whole sample	ASTM D2974-00 B

The weighed portion of soil is placed in a 105°C oven overnight. The dried soil is allowed to cooled to room temperature, weighed and the % moisture, dry sample weight and wet sample weight are calculated.

Reference: ASTM D2216-80

SPECIAL REQUEST-SK	Misc.	Special Request Sask Lab	SEE SUBLET LAB RESULTS

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1523532 Report Date: 10-OCT-14

Client: North/South Consultants
83 SCURFIELD BLVD
WINNIPEG MB R3Y 1G4
Contact: STACY HNATIUK STEWART

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Quality Control Report

Workorder: L1523532 Report Date: 10-OCT-14

Client: North/South Consultants
83 SCURFIELD BLVD
WINNIPEG MB R3Y 1G4
Contact: STACY HNATIUK STEWART

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Moisture, Dry & Wet weight -whole sample							
	1	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	2	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	3	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	4	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	5	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	6	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	7	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	8	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	9	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	10	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	11	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	12	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	13	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	14	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	15	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	16	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	17	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	18	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	19	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	20	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	21	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	22	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	23	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	24	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	25	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	26	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	27	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	28	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	29	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	30	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	31	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	32	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	33	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	34	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	35	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	36	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	37	03-JUL-14	08-OCT-14 00:00	14	97	days	EHTR
	38	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	39	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	40	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	41	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	42	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	43	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	44	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	45	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	46	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	47	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	48	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	49	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR
	50	17-JUL-14	08-OCT-14 00:00	14	83	days	EHTR

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1523532 were received on 25-SEP-14 11:10.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

L1523532-COFC

Form

COC #

Page 1 of 5

Report To	
Company:	North/South Consultants Inc.
Contact:	Stacy Hnatiuk Stewart
Address:	83 Scurfield Blvd. Winnipeg, Mb.
Phone:	204-284-3366 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
[redacted] Lab Work Order # [redacted] (lab use only)	[redacted]

☐ Other

☑ PDF ☑ Excel ☐ Digital ☐ Fax

Email 1:	shnatiuk@nscons.ca
Email 2:	wbernhardt@nscons.ca
Email 3:	soffman@kgsgroup.com
Client / Project Information	
Job #:	Lake St. Martin - Bedload
PO / AFE:	
LSD:	
Quote #:	Q31864
ALS Contact:	Judy
Sampler:	WB/NW/JA

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please Indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MOISTURE-WS-SK	PREP-DRY/GRIND-SK	PSA-3-SK	Number of Containers
[redacted]	Middle Rep 1	03-Jul-14		Sediment	X	X	X	1
[redacted]	Middle Rep 2	03-Jul-14		Sediment	X	X	X	1
[redacted]	Middle Rep 3	03-Jul-14		Sediment	X	X	X	1
[redacted]	Middle Rep 4	03-Jul-14		Sediment	X	X	X	1
[redacted]	Middle Rep 5	03-Jul-14		Sediment	X	X	X	1
[redacted]	Right Bank Rep 1	03-Jul-14		Sediment	X	X	X	1
[redacted]	Right Bank Rep 2	03-Jul-14		Sediment	X	X	X	1
[redacted]	Right Bank Rep 3	03-Jul-14		Sediment	X	X	X	1
[redacted]	Right Bank Rep 4	03-Jul-14		Sediment	X	X	X	1
[redacted]	Right Bank Rep 5	03-Jul-14		Sediment	X	X	X	1
[redacted]	Right Quarter Rep 1	03-Jul-14		Sediment	X	X	X	1
[redacted]	Right Quarter Rep 2	03-Jul-14		Sediment	X	X	X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by: <Original signed by>	Date: Sept 25/14	Time: 11:10	Temperature: 15 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 18.01 Front

ALS Environmental

L1523532-COFC

Report To	
Company:	North/South Consultants Inc.
Contact:	Stacy Hnatiuk Stewart
Address:	83 Scurfield Blvd. Winnipeg, Mb.
Phone:	204-284-3366 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	

☑ PDF ☑ Excel ☐ Digital ☐ Fax

Email 1: shnatiuk@nscons.ca

Email 2: wbernhardt@nscons.ca

Email 3: soffman@kgsgroup.com

Client / Project Information

Job #: Lake St. Martin - Bedload

PO / AFE:

LSD:

Quote #: Q31864

ALS Contact: Judy

Sampler: WB/NW/JA

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MOISTURE-WS-SK	PREP-DRY/GRIND-SK	PSA-3-SK										Number of Containers
	Right Quarter Rep 3	03-Jul-14		Sediment	X	X	X										1
	Right Quarter Rep 4	03-Jul-14		Sediment	X	X	X										1
	Right Quarter Rep 5	03-Jul-14		Sediment	X	X	X										1
	Left Bank Rep 1	03-Jul-14		Sediment	X	X	X										1
	Left Bank Rep 2	03-Jul-14		Sediment	X	X	X										1
	Left Bank Rep 3	03-Jul-14		Sediment	X	X	X										1
	Left Bank Rep 4	03-Jul-14		Sediment	X	X	X										1
	Left Bank Rep 5	03-Jul-14		Sediment	X	X	X										1
	Left Quarter Rep 1	03-Jul-14		Sediment	X	X	X										1
	Left Quarter Rep 2	03-Jul-14		Sediment	X	X	X										1
	Left Quarter Rep 3	03-Jul-14		Sediment	X	X	X										1
	Left Quarter Rep 4	03-Jul-14		Sediment	X	X	X										1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

ALS Environmental

L1523532-COFC

COC #

Report To	
Company:	North/South Consultants Inc.
Contact:	Stacy Hnatiuk Stewart
Address:	83 Scurfield Blvd. Winnipeg, Mb.
Phone:	204-284-3366 Fax:

☑ PDF ☑ Excel ☐ Digital ☐ Fax

Email 1: shnatiuk@nscons.ca

Email 2: wbernhardt@nscons.ca

Email 3: soffman@kgsgroup.com

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:

Client / Project Information

Job #:	Lake St. Martin - Bedload
PO / AFE:	
LSD:	
Quote #:	Q31864
ALS Contact:	Judy
Sampler:	WB/NW/JA

Lab Work Order # (lab use only) [redacted]

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MOISTURE-WS-SK	PREP-DRY/GRIND-SK	PSA-3-SK										Number of Containers
[redacted]	Left Quarter Rep 5	03-Jul-14		Sediment	X	X	X										1
[redacted]	Site 1-A	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 1-B	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 1-C	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 1-D	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 1-E	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 2-A	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 2-B	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 2-C	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 2-D	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 2-E	17-Jul-14		Sediment	X	X	X										1
[redacted]	Site 3-A	17-Jul-14		Sediment	X	X	X										1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 18.01 Front

![ALS Environmental]

L1523532-COFC

…orm

COC # ____

Report To		Report Format / Distribution	
Company:	North/South Consultants Inc.	☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Contact:	Stacy Hnatiuk Stewart	Email 1:	shnatiuk@nscons.ca
Address:	83 Scurfield Blvd. Winnipeg, Mb.	Email 2:	wbernhardt@nscons.ca
Phone:	204-284-3366 Fax:	Email 3:	soffman@kgsgroup.com
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information	
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Lake St. Martin - Bedload
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #:	Q31864
Lab Work Order # (lab use only)		ALS Contact: Judy	Sampler: WB/NW/JA

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MOISTURE-WS-SK	PREP-DRY/GRIND-SK	PSA-3-SK	Number of Containers
	Site 3-B	03-Jul-14		Sediment	X	X	X	1
	Site 3-C	17-Jul-14		Sediment	X	X	X	1
	Site 3-D	17-Jul-14		Sediment	X	X	X	1
	Site 3-E	17-Jul-14		Sediment	X	X	X	1
	Site 4-A	17-Jul-14		Sediment	X	X	X	1
	Site 4-B	17-Jul-14		Sediment	X	X	X	1
	Site 4-C	17-Jul-14		Sediment	X	X	X	1
	Site 4-D	17-Jul-14		Sediment	X	X	X	1
	Site 4-E	17-Jul-14		Sediment	X	X	X	1
	Site 5-A	17-Jul-14		Sediment	X	X	X	1
	Site 5-B	17-Jul-14		Sediment	X	X	X	1
	Site 5-C	17-Jul-14		Sediment	X	X	X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

ALS Environmental

L1523532-COFC

Request Form

COC #

Page 5 of 5

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	North/South Consultants Inc.	☑ Standard		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Stacy Hnatiuk Stewart	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	83 Scurfield Blvd. Winnipeg, Mb.	Email 1:	shnatiuk@nscons.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
		Email 2:	wbernhardt@nscons.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	204-284-3366 Fax:	Email 3:	soffman@kgsgroup.com	Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Lake St. Martin - Bedload	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q31864	
Lab Work Order # (lab use only)		ALS Contact: Judy	Sampler: WB/NW/JA	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MOISTURE-WS-SK	PREP-DRY/GRIND-SK	PSA-3-SK										Number of Containers
	Site 5-D	17-Jul-14		Sediment	X	X	X										1
	Site 5-E	17-Jul-14		Sediment	X	X	X										1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

KGS Group Consultants (Winnipeg)
ATTN: Phuong Ngyuen
865 Waverly Street - 3rd Floor
Winnipeg MB R3T 5P4

Date Received: 28-AUG-15
Report Date: 17-SEP-15 15:56 (MT)
Version: FINAL

Client Phone: 204-896-1209

Certificate of Analysis

Lab Work Order #: L1664936
Project P.O. #: NOT SUBMITTED
Job Reference: 13-0431-001
C of C Numbers:
Legal Site Desc:

<Original signed by>

Hua Wo
Chemistry Laboratory Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1664936-1 SITE 1-1							
Sampled By: DAN LEITCH on 29-JUL-15 @ 13:56							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	77.6		0.10	%	01-SEP-15	02-SEP-15	R3269041
Dry Weight	139.1		1.0	g	01-SEP-15	02-SEP-15	R3269041
Total Sample Weight	621		1.0	g	01-SEP-15	02-SEP-15	R3269041
Note: Analysis done to 40C not 105C due to insufficient samples							
L1664936-2 SITE 2-1							
Sampled By: DAN LEITCH on 29-JUL-15 @ 15:25							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.6		0.10	%	01-SEP-15	02-SEP-15	R3269041
Dry Weight	2.0		1.0	g	01-SEP-15	02-SEP-15	R3269041
Total Sample Weight	477		1.0	g	01-SEP-15	02-SEP-15	R3269041
Note: Analysis done to 40C not 105C due to insufficient samples							
L1664936-3 SITE 3-1							
Sampled By: DAN LEITCH on 29-JUL-15 @ 16:40							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.0		0.10	%	01-SEP-15	02-SEP-15	R3269041
Dry Weight	5.6		1.0	g	01-SEP-15	02-SEP-15	R3269041
Total Sample Weight	558		1.0	g	01-SEP-15	02-SEP-15	R3269041
Note: Analysis done to 40C not 105C due to insufficient samples							
L1664936-4 SITE 4-1							
Sampled By: DAN LEITCH on 29-JUL-15 @ 17:53							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.6		0.10	%	01-SEP-15	02-SEP-15	R3269041
Dry Weight	1.5		1.0	g	01-SEP-15	02-SEP-15	R3269041
Total Sample Weight	338		1.0	g	01-SEP-15	02-SEP-15	R3269041
Note: Analysis done to 40C not 105C due to insufficient samples							
L1664936-5 SITE 5-1							
Sampled By: DAN LEITCH on 29-JUL-15 @ 19:03							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	98.3		0.10	%	01-SEP-15	02-SEP-15	R3269041
Dry Weight	9.2		1.0	g	01-SEP-15	02-SEP-15	R3269041
Total Sample Weight	549		1.0	g	01-SEP-15	02-SEP-15	R3269041
Note: Analysis done to 40C not 105C due to insufficient samples							
L1664936-6 SITE 1-1, 2-1, 3-1, 4-1, 5-1 COMPOSITE							
Sampled By: Dan Leitch on 29-JUL-15 @ 19:03							
Matrix: SEDIMENT							
Particle size - Pipette removal OM & CO3							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1664936-6 SITE 1-1, 2-1, 3-1, 4-1, 5-1 COMPOSITE							
Sampled By: Dan Leitch on 29-JUL-15 @ 19:03							
Matrix: SEDIMENT							
Particle size - Pipette removal OM & CO3							
% Sand (2.0mm - 0.05mm)	80.8		0.10	%	14-SEP-15	15-SEP-15	R3266685
% Silt (0.05mm - 2um)	13.8		0.10	%	14-SEP-15	15-SEP-15	R3266685
% Clay (<2um)	5.32		0.10	%	14-SEP-15	15-SEP-15	R3266685
Texture	Loamy sand				14-SEP-15	15-SEP-15	R3266685

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WS-SK	Misc.	Moisture, Dry & Wet weight -whole sample	ASTM D2974-00 B

The weighed portion of soil is placed in a 105°C oven overnight. The dried soil is allowed to cooled to room temperature, weighed and the % moisture, dry sample weight and wet sample weight are calculated.

Reference: ASTM D2216-80

ALS Test Code	Matrix	Test Description	Method Reference**
PSA-3-SK	Soil	Particle size - Pipette removal OM & CO3	Forestry Canada (1991) p. 46-53

Dry, < 2 mm soil is treated hydrochloric acid top remove carbonates, then hydrogen peroxide to remove organic matter. The remaining soil is treated with sodium hexametaphosphate to ensure complete dispersion of primary soil particles. The homogenized suspension is allowed to settle in accordance with Stoke's Law so that only clay particles remain in suspension.To determine the clay fraction, an aliquot of the clay suspension is removed, then dried and weighed. The sand fraction is determined by wet sieving the remaining suspension, then drying and weighing the sand retained on the sieve. The silt fraction is determined by calculation where % Silt = 100 - (%Sand+%Clay)

Reference:
Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: KGS Group Consultants (Winnipeg)
865 Waverly Street - 3rd Floor
Winnipeg MB R3T 5P4
Contact: Phuong Ngyuen

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PSA-3-SK	**Soil**							
Batch R3266685								
WG2167141-3	**IRM**	**FARM2010**						
% Sand (2.0mm - 0.05mm)			35.2		%		29-49	15-SEP-15
% Silt (0.05mm - 2um)			39.1		%		28-48	15-SEP-15
% Clay (<2um)			25.7		%		18-28	15-SEP-15

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Moisture, Dry & Wet weight -whole sample							
	1	29-JUL-15 13:56	02-SEP-15 00:00	14	34	days	EHTR
	2	29-JUL-15 15:25	02-SEP-15 00:00	14	34	days	EHTR
	3	29-JUL-15 16:40	02-SEP-15 00:00	14	34	days	EHTR
	4	29-JUL-15 17:53	02-SEP-15 00:00	14	34	days	EHTR
	5	29-JUL-15 19:03	02-SEP-15 00:00	14	34	days	EHTR

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1664936 were received on 28-AUG-15 14:55.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1664936-COFC

COC Number: 14 - 455375

Page 1 of 1

Report To	
Company:	KGS Group
Contact:	Phuong Nguyen
Address:	865 Waverley St. Winnipeg, MB R3T 5P4
Phone:	204-896-1209

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ Yes ☐ No
☐ Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	pnguyen@kgsgroup.com
Email 2	Soffman@kgsgroup.com

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)	
R ☑	Regular (Standard TAT if received by 3pm)
P ☐	Priority (2-4 business days if received by 3pm)
E ☐	Emergency (1-2 business days if received by 3pm)
E2 ☐	Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Specify Date Required for E2,E or P:	

Invoice To		
Same as Report To	☑ Yes	☐ No
Copy of Invoice with Report	☐ Yes	☑ No
Company:		
Contact:		

Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Project Information	
ALS Quote #:	31864
Job #:	13-0431-001
PO / AFE:	
LSD:	
ALS Lab Work Order # (lab use only)	

Oil and Gas Required Fields (client use)	
Approver ID:	Cost Center:
GL Account:	Routing Code:
Activity Code:	
Location:	
ALS Contact: Judy	Sampler: Dan Leitch

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MOISTURE-WS-SK	PREP-DRY/GRIND-SK	PSA-3-SK	Number of Containers
	Site 1-1	29-JUL-15	13:56	Sediment	X	X	X	1
	Site 2-1	↓	15:25	↓	X	X	X	1
	Site 3-1	↓	16:40	↓	X	X	X	1
	Site 4-1	↓	17:53	↓	X	X	X	1
	Site 5-1	↓	19:03	↓	X	X	X	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ Yes ☐ No

Are samples for human drinking water use?
☐ Yes ☐ No

Special Instructions / Specify Criteria to add on report (client Use)

If insufficient quantities, please combine samples. Please weigh various components (sand, silt, clay) of each prior to any combining of samples.
Please do not discard sample. Please return to KGS Group

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐		SIF Observations	Yes ☐ No ☐
Ice packs	Yes ☐ No ☐	Custody seal intact	Yes ☐ No ☐
Cooling Initiated ☐			
INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: <Original signed by>	Date: Aug 28/15	Time: 14:55	Received by: <Original signed by>	Date: 28-8-15	Time: 14:55	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION   WHITE - LABORATORY COPY   YELLOW - CLIENT COPY

NA FM 0326a v09 Front/03 October 2013

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

KGS Group Consultants (Winnipeg)
ATTN: Phuong Ngyuen
865 Waverly Street - 3rd Floor
Winnipeg MB R3T 5P4

Date Received: 17-SEP-15
Report Date: 28-SEP-15 15:58 (MT)
Version: FINAL

Client Phone: 204-896-1209

Certificate of Analysis

Lab Work Order #: L1674364

Project P.O. #: NOT SUBMITTED
Job Reference: 13-0431-001
C of C Numbers:
Legal Site Desc:

<Original signed by>

Barb Bayer, B.Sc.
General Manager, Winnipeg

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1674364-1 SITE 1							
Sampled By: DAN LEITCH on 15-SEP-15 @ 13:00							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.7		0.10	%	21-SEP-15	28-SEP-15	R3277929
Dry Weight	<1.0		1.0	g	21-SEP-15	28-SEP-15	R3277929
Total Sample Weight	101		1.0	g	21-SEP-15	28-SEP-15	R3277929
L1674364-2 SITE 2							
Sampled By: DAN LEITCH on 15-SEP-15 @ 14:00							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	93.2		0.10	%	21-SEP-15	28-SEP-15	R3277929
Dry Weight	7.4		1.0	g	21-SEP-15	28-SEP-15	R3277929
Total Sample Weight	110		1.0	g	21-SEP-15	28-SEP-15	R3277929
L1674364-3 SITE 3							
Sampled By: DAN LEITCH on 15-SEP-15 @ 15:37							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.1		0.10	%	21-SEP-15	28-SEP-15	R3277929
Dry Weight	<1.0		1.0	g	21-SEP-15	28-SEP-15	R3277929
Total Sample Weight	85.3		1.0	g	21-SEP-15	28-SEP-15	R3277929
L1674364-4 SITE 4							
Sampled By: DAN LEITCH on 15-SEP-15 @ 16:45							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.6		0.10	%	21-SEP-15	28-SEP-15	R3277929
Dry Weight	<1.0		1.0	g	21-SEP-15	28-SEP-15	R3277929
Total Sample Weight	48.3		1.0	g	21-SEP-15	28-SEP-15	R3277929
L1674364-5 SITE 5							
Sampled By: DAN LEITCH on 15-SEP-15 @ 17:33							
Matrix: SEDIMENT							
Moisture, Dry & Wet weight -whole sample							
% Moisture	99.6		0.10	%	21-SEP-15	28-SEP-15	R3277929
Dry Weight	<1.0		1.0	g	21-SEP-15	28-SEP-15	R3277929
Total Sample Weight	69.6		1.0	g	21-SEP-15	28-SEP-15	R3277929
L1674364-6 SITE 1-5 COMP							
Sampled By: DAN LEITCH on 15-SEP-15							
Matrix: SEDIMENT							
Particle size - Pipette removal OM & CO3							
% Sand (2.0mm - 0.05mm)	96.7		0.10	%	27-SEP-15	28-SEP-15	R3278088
% Silt (0.05mm - 2um)	1.93		0.10	%	27-SEP-15	28-SEP-15	R3278088
% Clay (<2um)	1.41		0.10	%	27-SEP-15	28-SEP-15	R3278088
Texture	Sand				27-SEP-15	28-SEP-15	R3278088

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WS-SK	Misc.	Moisture, Dry & Wet weight -whole sample	ASTM D2974-00 B

The weighed portion of soil is placed in a 105°C oven overnight. The dried soil is allowed to cooled to room temperature, weighed and the % moisture, dry sample weight and wet sample weight are calculated.

Reference: ASTM D2216-80

ALS Test Code	Matrix	Test Description	Method Reference**
PSA-3-SK	Soil	Particle size - Pipette removal OM & CO3	Forestry Canada (1991) p. 46-53

Dry, < 2 mm soil is treated hydrochloric acid top remove carbonates, then hydrogen peroxide to remove organic matter. The remaining soil is treated with sodium hexametaphosphate to ensure complete dispersion of primary soil particles. The homogenized suspension is allowed to settle in accordance with Stoke’s Law so that only clay particles remain in suspension.To determine the clay fraction, an aliquot of the clay suspension is removed, then dried and weighed. The sand fraction is determined by wet sieving the remaining suspension, then drying and weighing the sand retained on the sieve. The silt fraction is determined by calculation where % Silt = 100 - (%Sand+%Clay)

Reference:
Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: KGS Group Consultants (Winnipeg)
865 Waverly Street - 3rd Floor
Winnipeg MB R3T 5P4

Contact: Phuong Ngyuen

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PSA-3-SK	**Soil**							
Batch **R3278088**								
WG2173243-4 **IRM**		**FARM2010**						
% Sand (2.0mm - 0.05mm)			39.8		%		29-49	28-SEP-15
% Silt (0.05mm - 2um)			37.7		%		28-48	28-SEP-15
% Clay (<2um)			22.5		%		18-28	28-SEP-15

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1674364-COFC

COC Number: 14 - 455378

Page 1 of 1

L1674364

Report To	
Company:	KGS Group
Contact:	Phuong Nguyen
Address:	865 Waverley St
Phone:	204-896-1209

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ Yes ☐ No
☐ Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	pnguyen@kgsgroup.com
Email 2	[illegible]@kgsgroup.com

(Rush Turnaround Time (TAT) is not available for all tests)

R	☑	...ceived by 3pm)
P	☐	Priority (2-4 business days if received by 3pm)
E	☐	Emergency (1-2 business days if received by 3pm)
E2	☐	Same day or weekend emergency if received by 10am – contact ALS for surcharge.

Specify Date Required for E2,E or P:

Invoice To	
Same as Report To	☑ Yes ☐ No
Copy of Invoice with Report	☐ Yes ☑ No
Company:	
Contact:	

Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Project Information	
ALS Quote #:	31864
Job #:	13-0431-001
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
Approver ID:	Cost Center:
GL Account:	Routing Code:
Activity Code:	
Location:	

ALS Lab Work Order # (lab use only)

ALS Contact: Judy

Sampler: Dan Leitch

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	moisture-ws-sk	Dep-dry/grind-sk	PSA-3-SK	Number of Containers
	Site 1	Sep 15/15	13:00	Sediment	X	X	X	1
	Site 2	↓	14:00	↓	↓	↓	↓	1
	Site 3	↓	15:37	↓	↓	↓	↓	1
	Site 4	↓	16:45	↓	↓	↓	↓	1
	Site 5	↓	17:33	↓	↓	↓	↓	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☐ No

Are samples for human drinking water use? ☐ Yes ☐ No

Special Instructions / Specify Criteria to add on report (client Use)

If insufficient quantities, please combine samples. Please provide weight of each sample if combining samples. Please do not discard samples. Please return to KGS Group.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice packs	Yes ☐	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☐				

INITIAL COOLER TEMPERATURES °C

FINAL COOLER TEMPERATURES °C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: <Original signed by>	Date: Sept 17/15	Time: 8:35	Received by: <Original signed by>	Date: 9-17-15	Time: 850	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

14°C