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January 29, 2013 File No. 11-0300-18

Manitoba Infrastructure and Transportation
7th Floor, 215 Garry Street
Winnipeg, Manitoba
R3C 3P3

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).

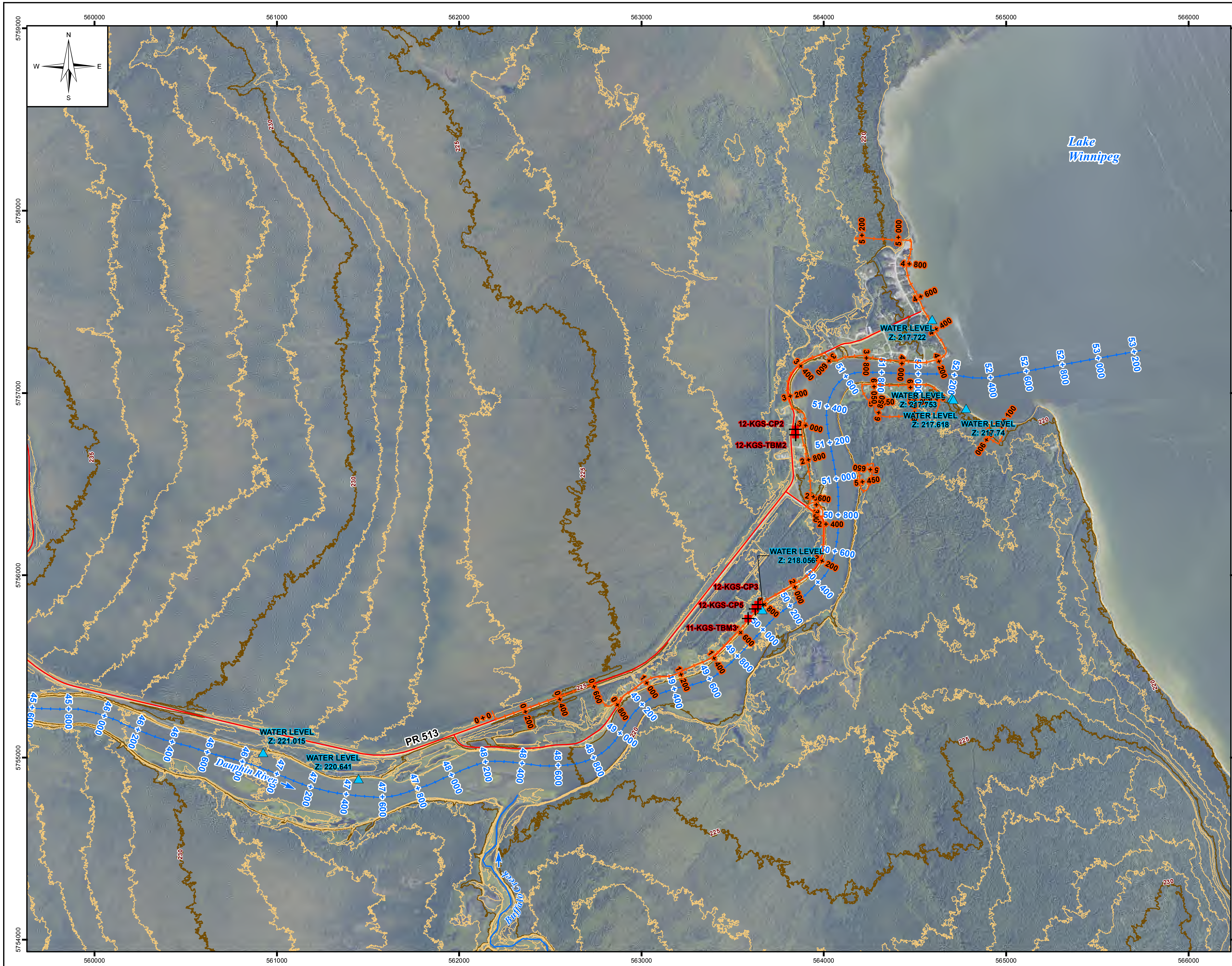
From backwater model results for these two flow conditions, the flow velocity in the reach of the Dauphin River covered by the 2011 survey ranged from 9.5 ft/s (2.9 m/s) at the upstream end of the reach to 3.5 ft/s (1.0 m/s) in Lake Winnipeg 300 m downstream from the mouth of the river. Corresponding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

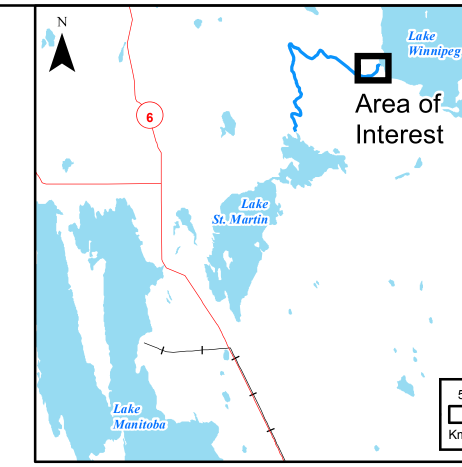
While the discharge in the river has changed during the period since spring 2011, the flow velocity in the channel has remained in the same general range. Though some changes in river bed elevation between the 2011 and 2012 surveys were observed, the hydraulic conditions in the river have remained fairly 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"

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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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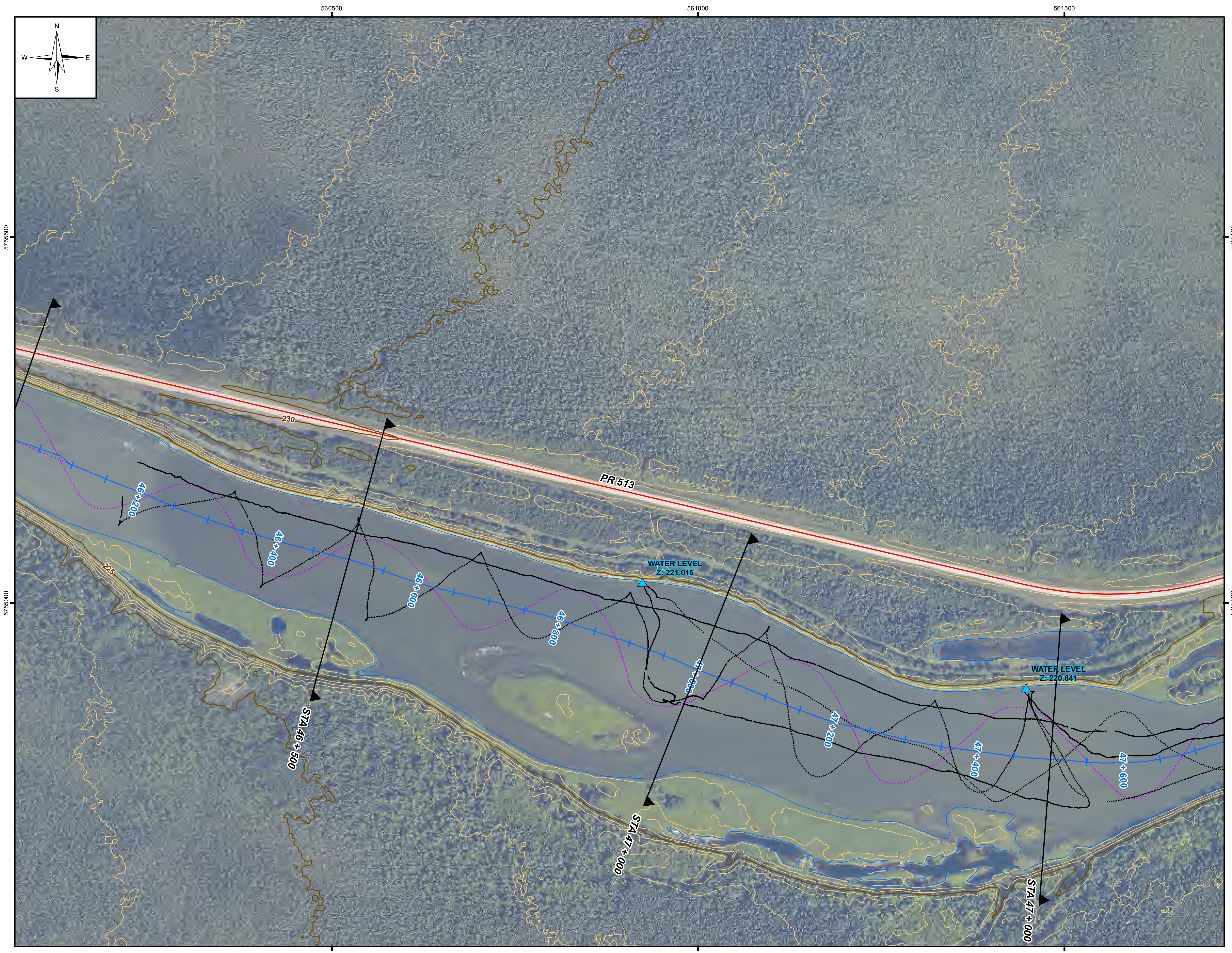

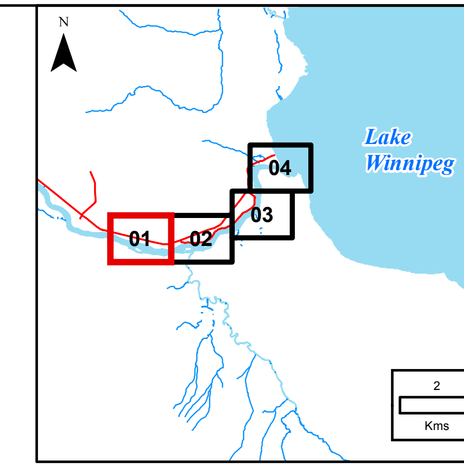

LEGEND:

- 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
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Transverse Mercator Projection, NAD 1983, Zone 14
Elevations are in metres above sea level (MSL)

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Metres

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

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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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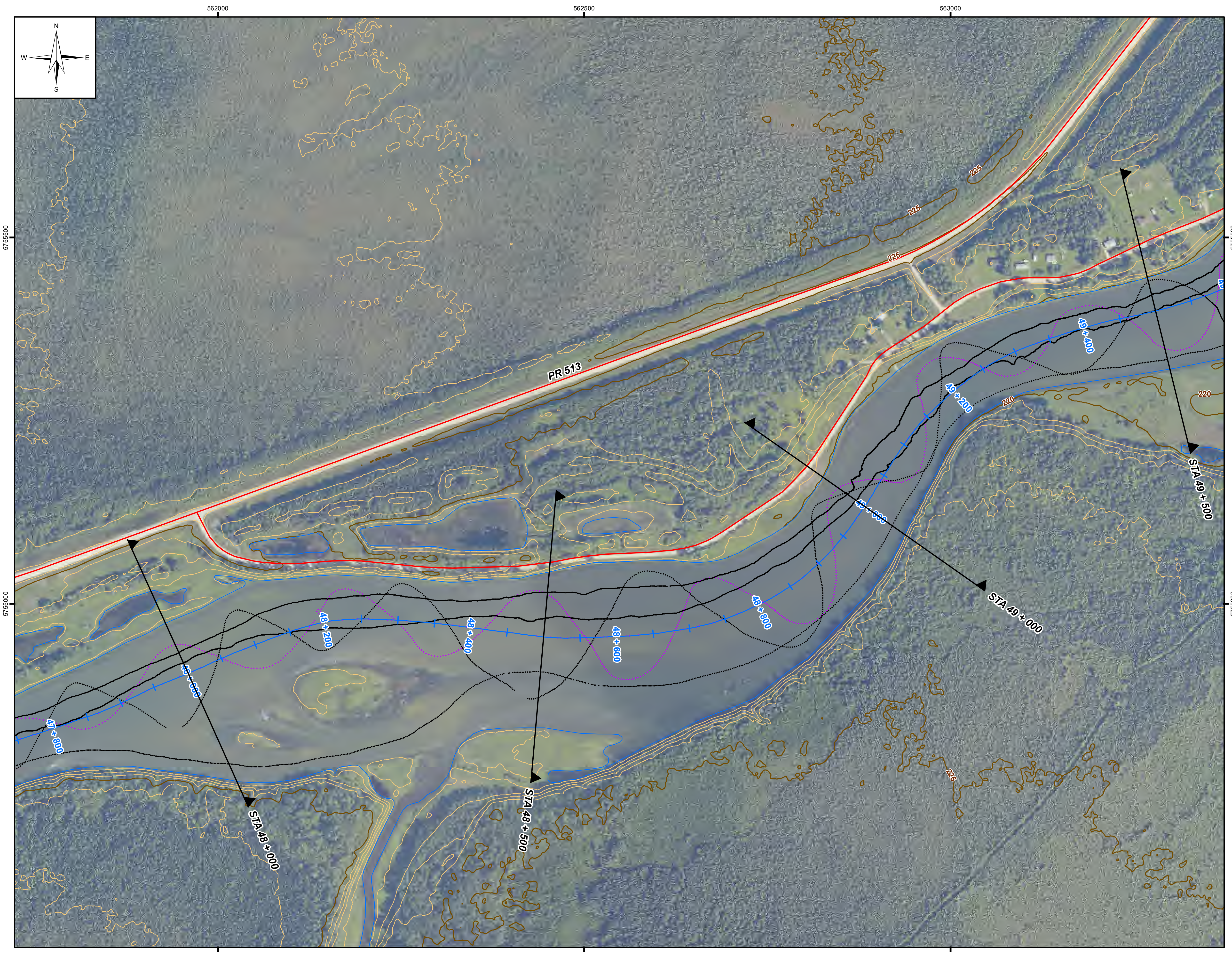

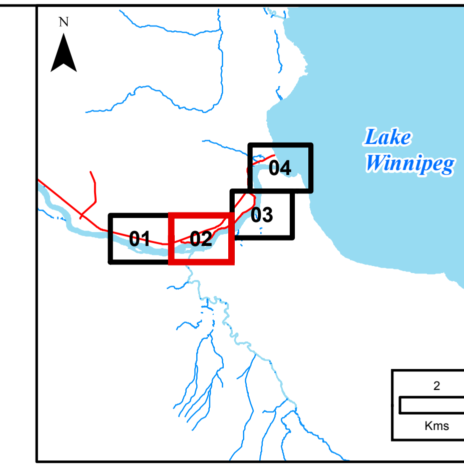

LEGEND:

- 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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50 0 50 100 150

Metres

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

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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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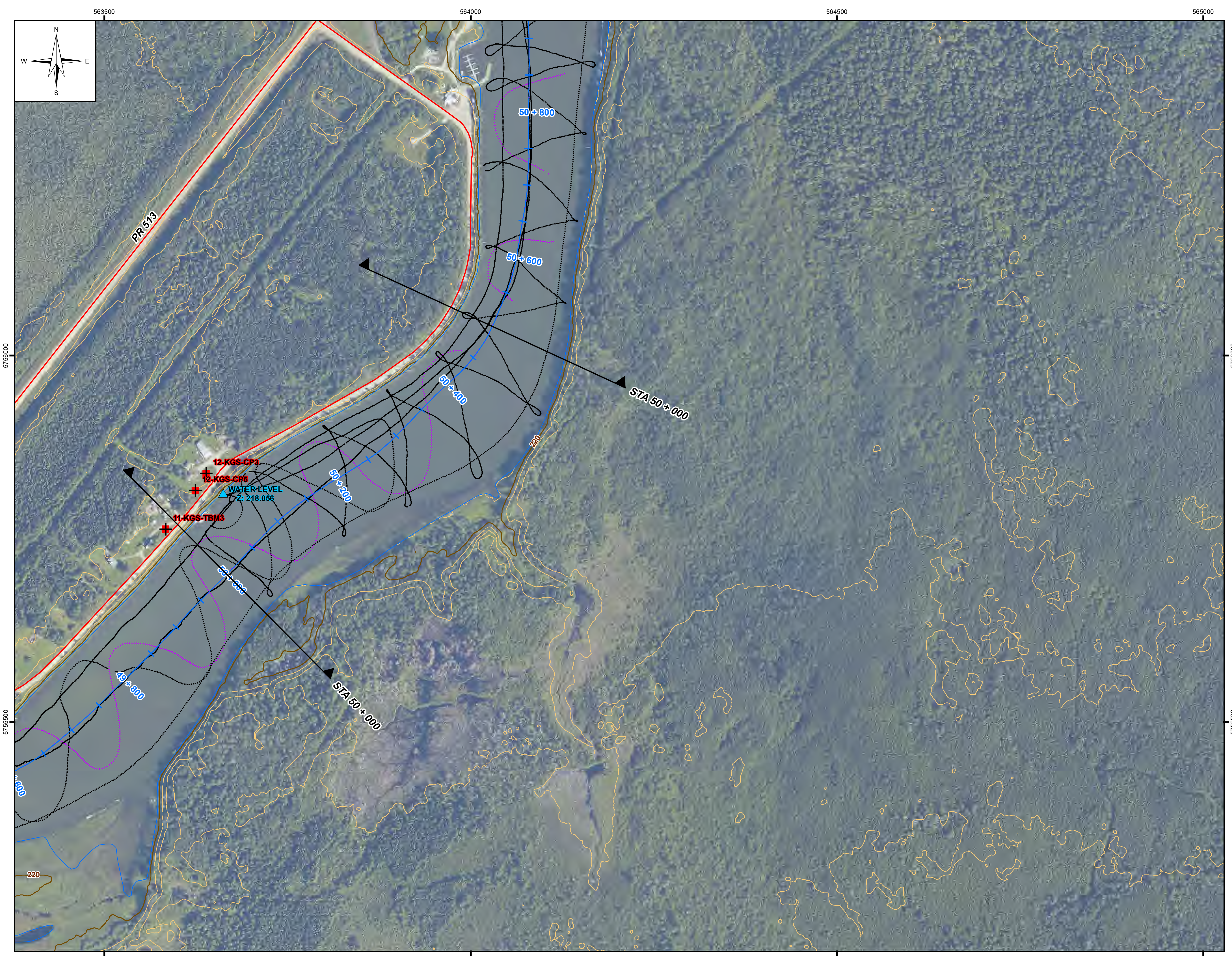

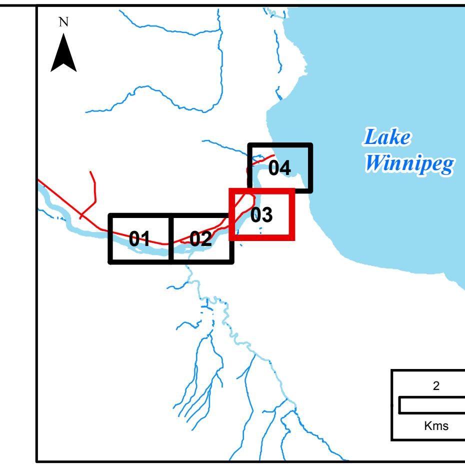

LEGEND:

- 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:

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50 0 50 100 150

Metres

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

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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

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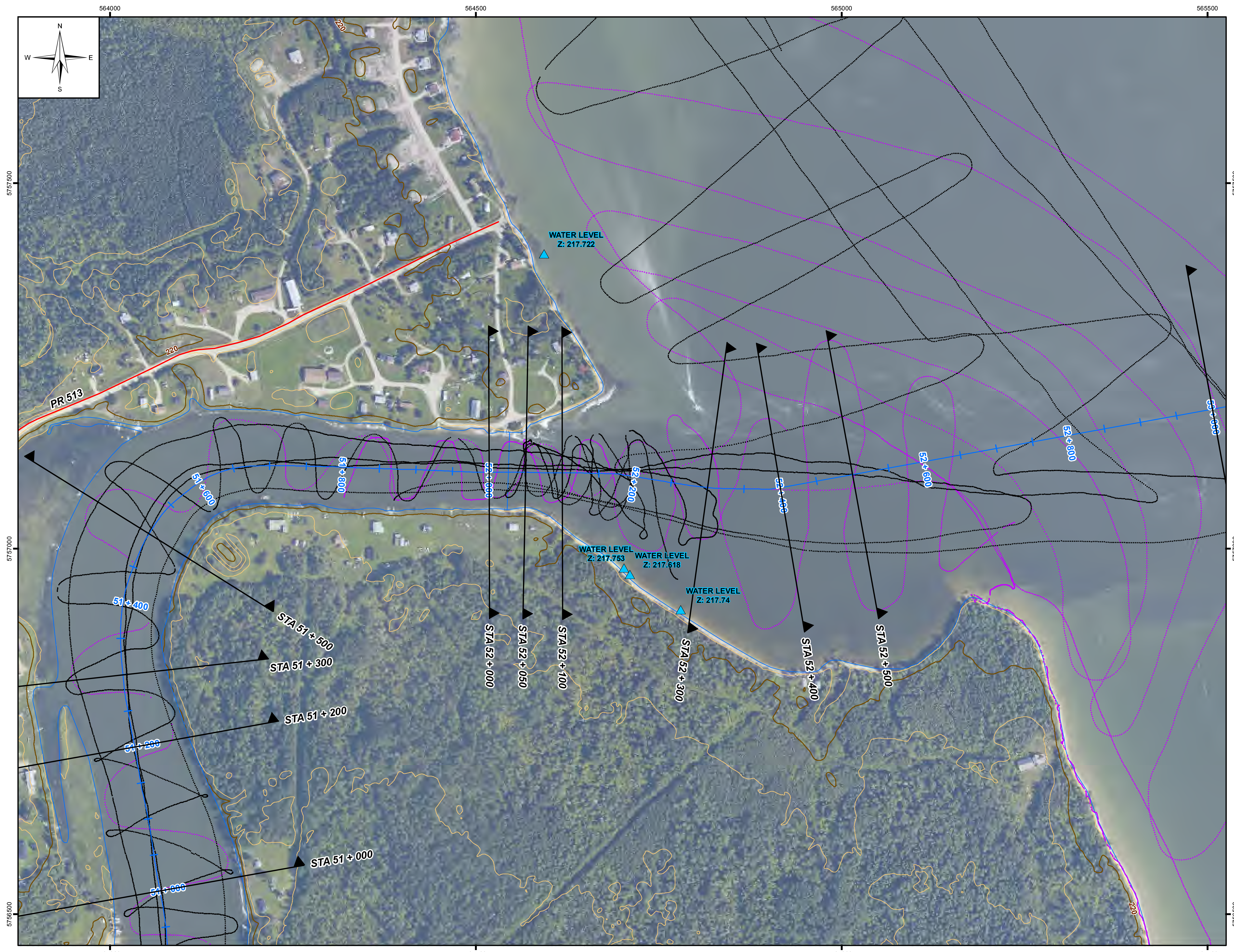

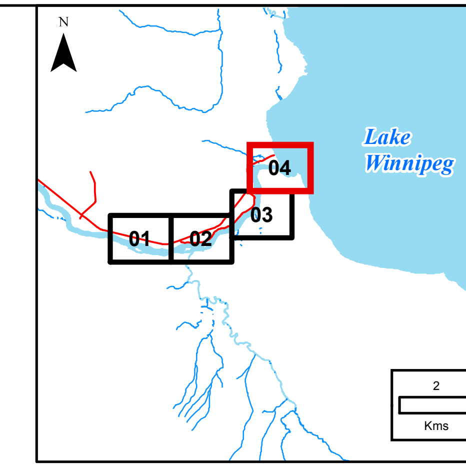

LEGEND:

- 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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50 0 50 100 150

Metres

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

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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

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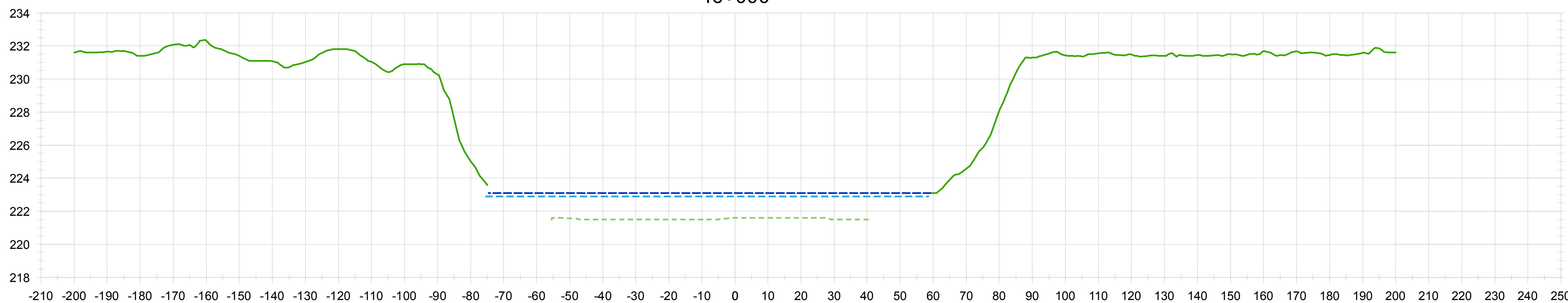
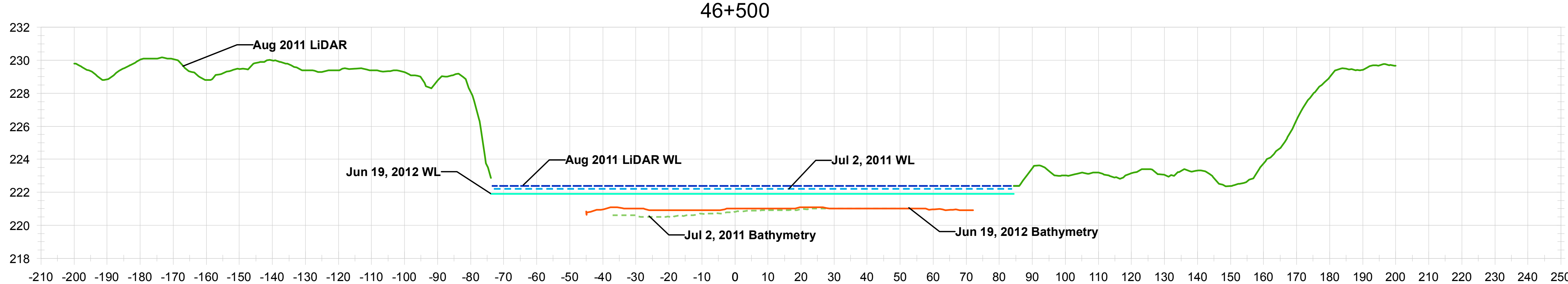
46+000



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
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INFRASTRUCTURE AND TRANSPORTATION

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

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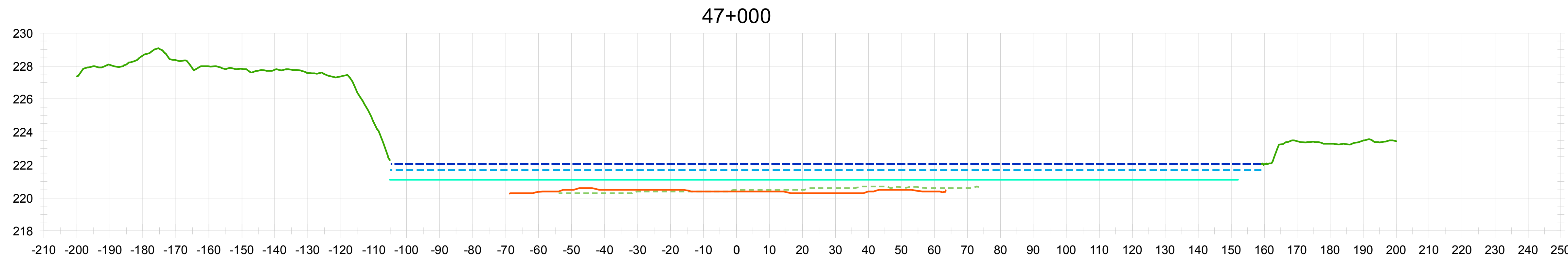

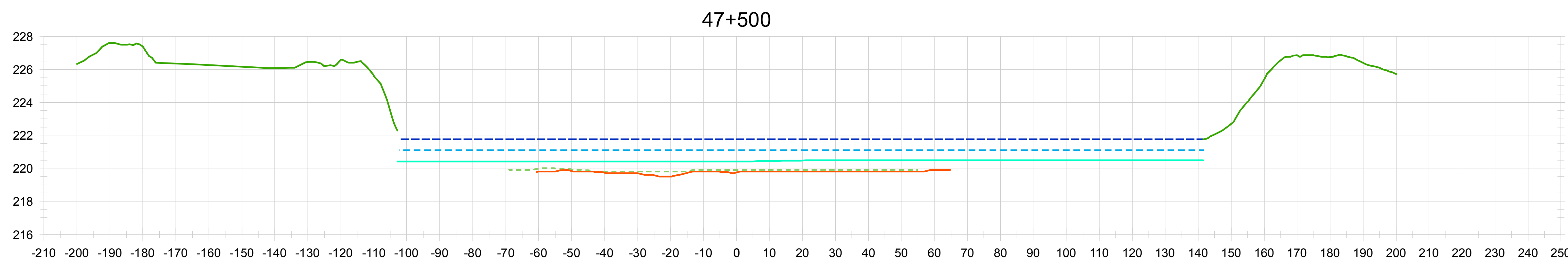

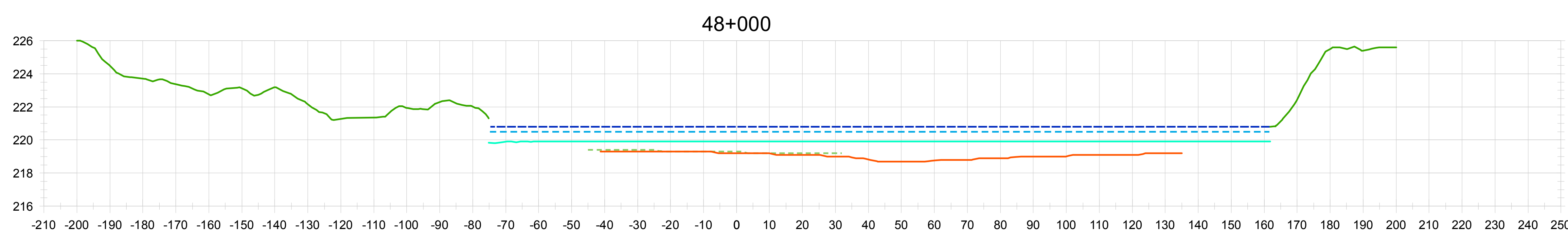

LEGEND:

- 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

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

JANUARY 2013 | FIGURE 03 | REV. 0

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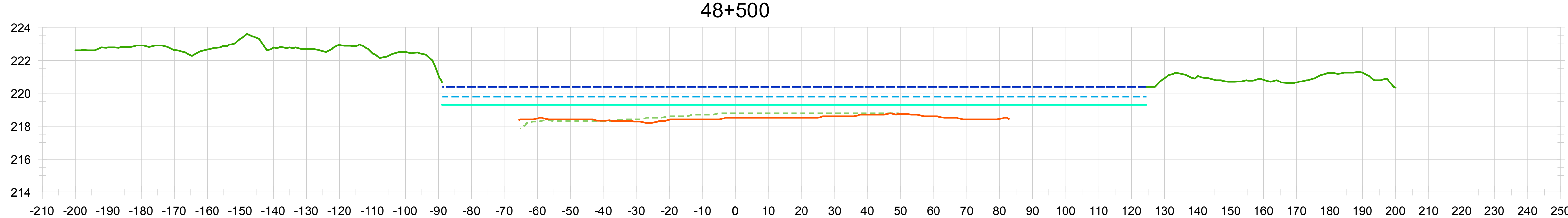
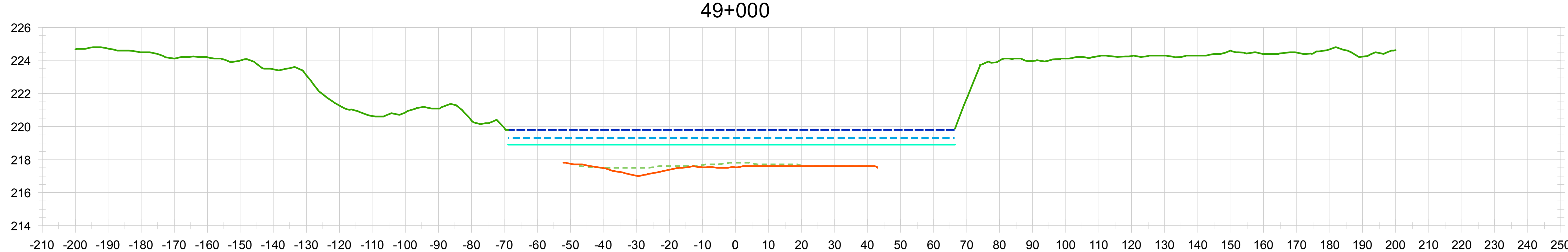
11"x17" PLOT SCALE 1:1

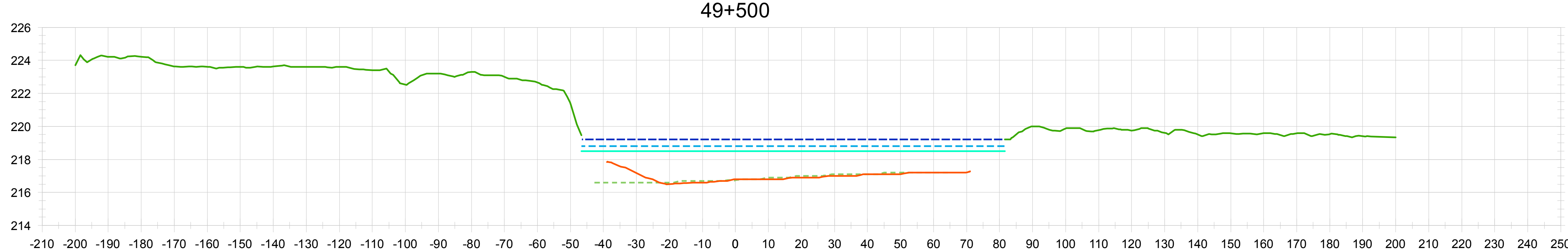
48+500



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

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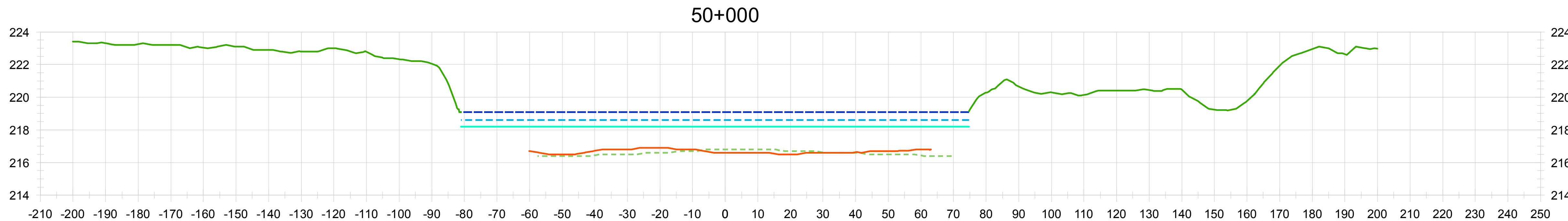
Manitoba
INFRASTRUCTURE AND TRANSPORTATION

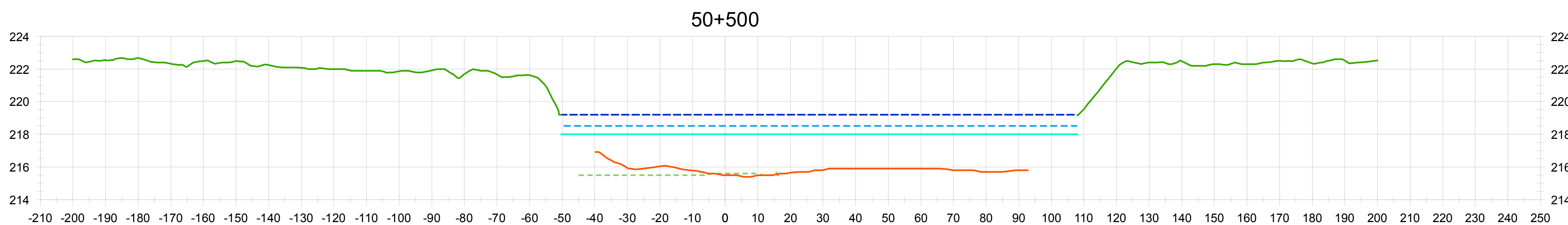
EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

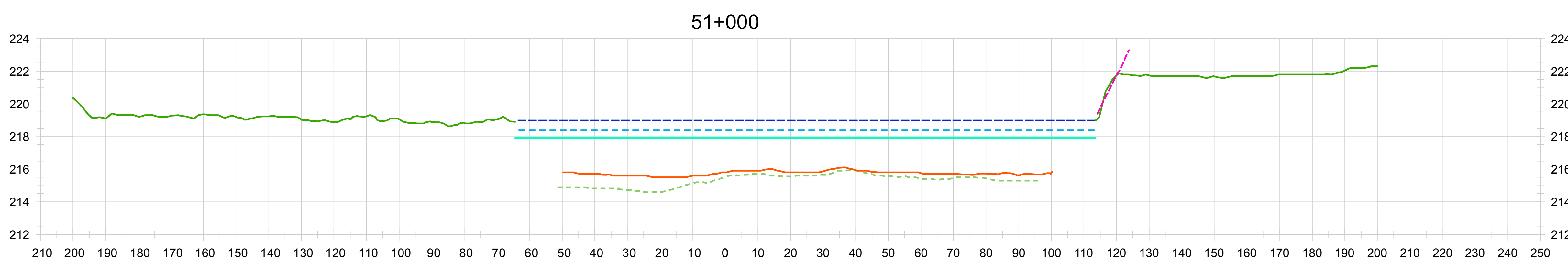
DAUPHIN RIVER OUTLET BATHYMETRY
CROSS SECTIONS
(SHEET 3 OF 9)

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







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

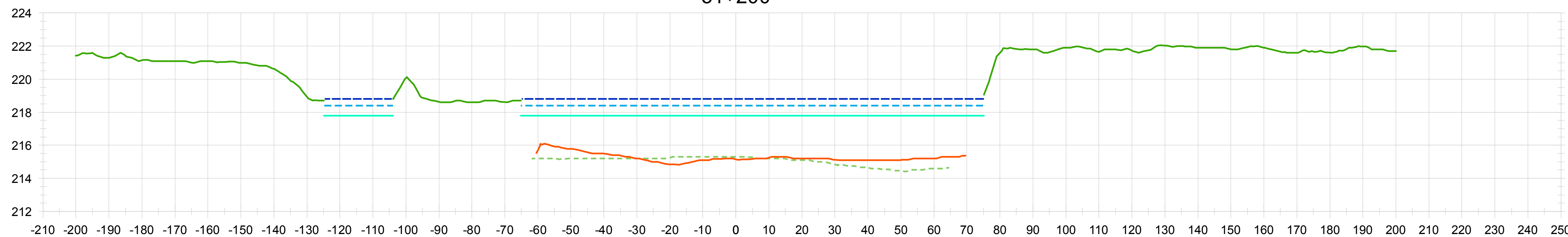
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

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

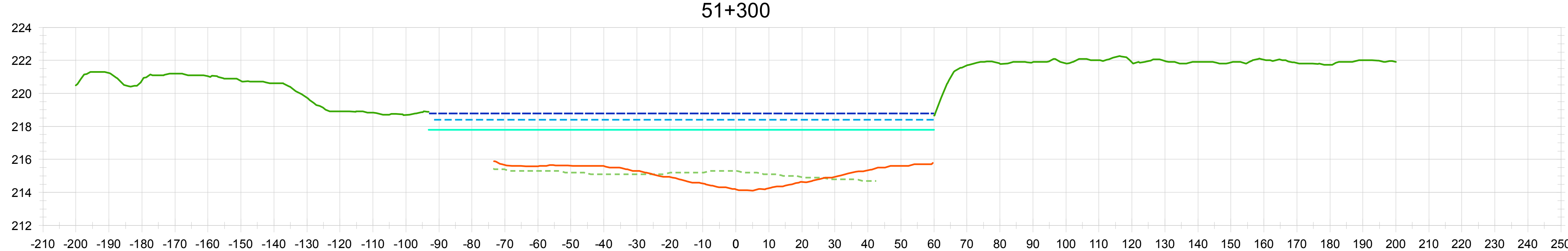
JANUARY 2013 | FIGURE 03 | REV: 0

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

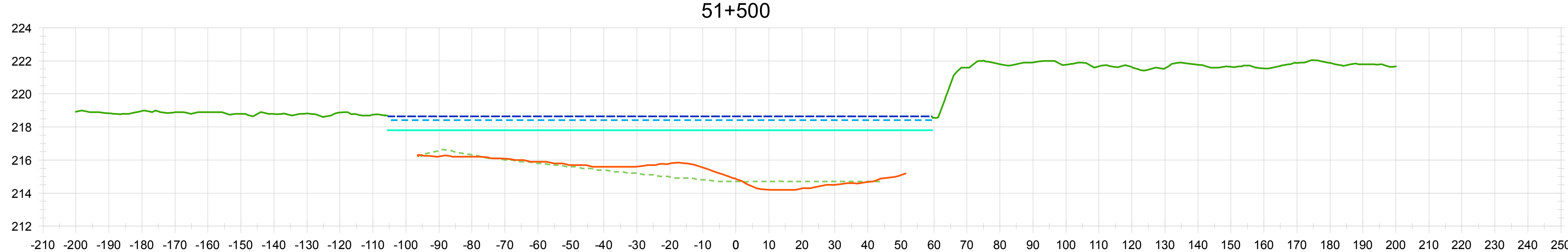
51+200



51+300



51+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

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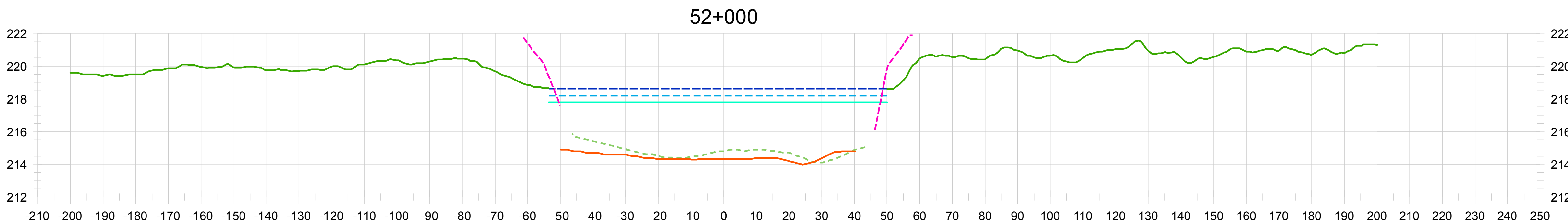
INFRASTRUCTURE AND TRANSPORTATION

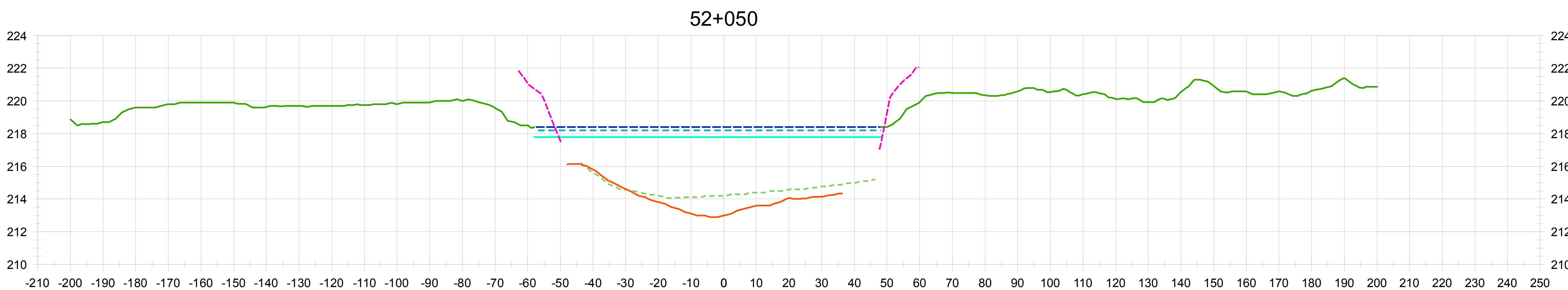
EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

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
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Manitoba INFRASTRUCTURE AND TRANSPORTATION

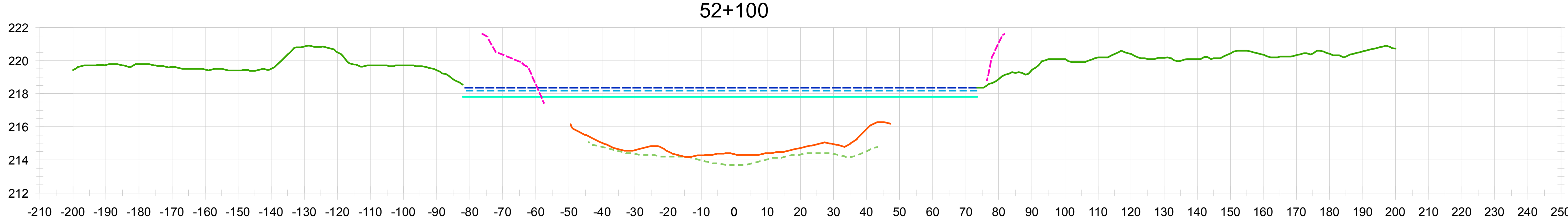
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

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

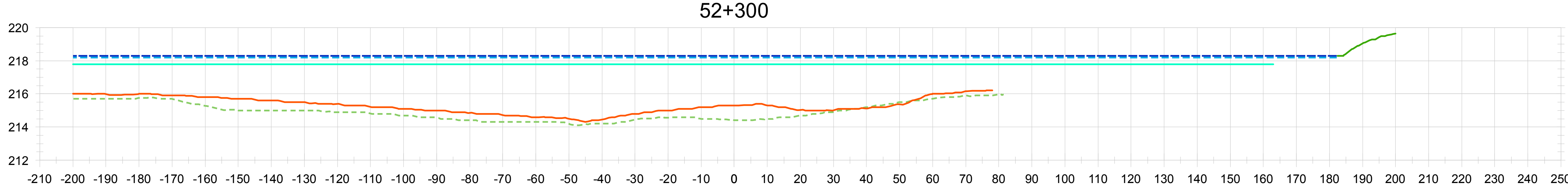
JANUARY 2013 | FIGURE 03 | REV: 0

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

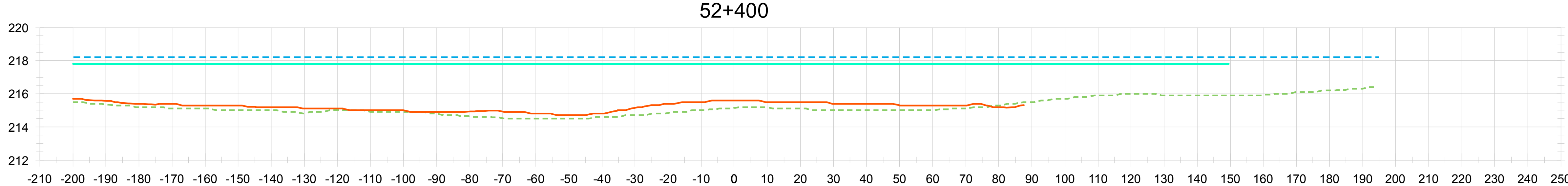
52+100



52+300



52+400



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

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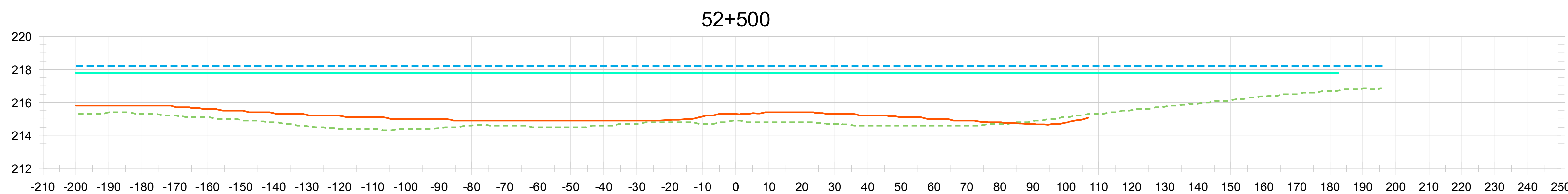
INFRASTRUCTURE AND TRANSPORTATION

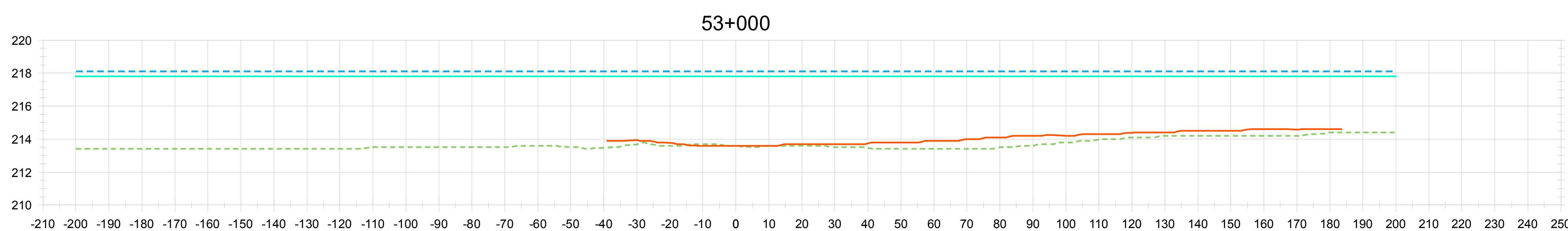
EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

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





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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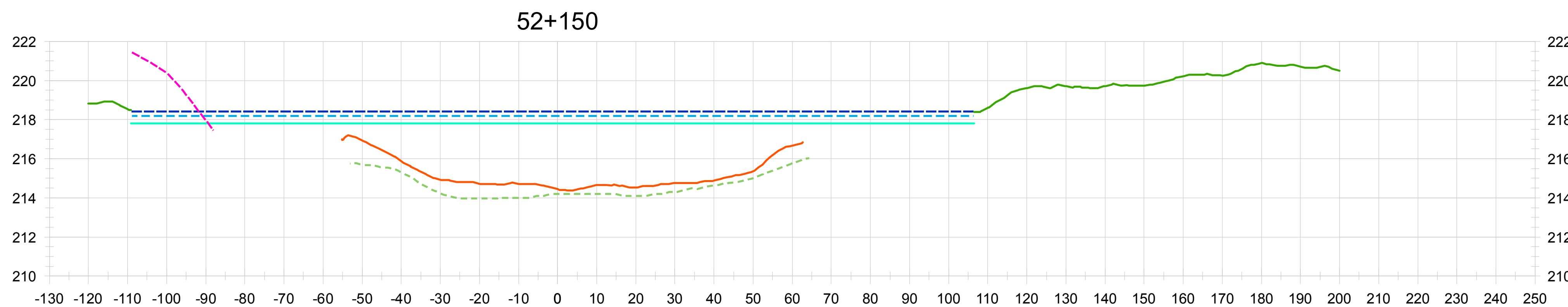
INFRASTRUCTURE AND TRANSPORTATION

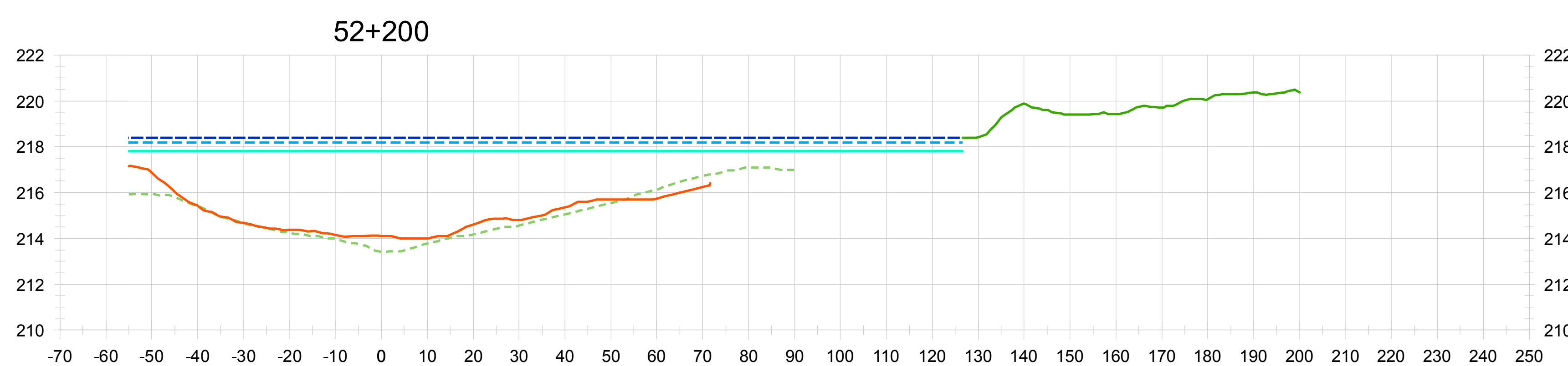
EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

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

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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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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

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

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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

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
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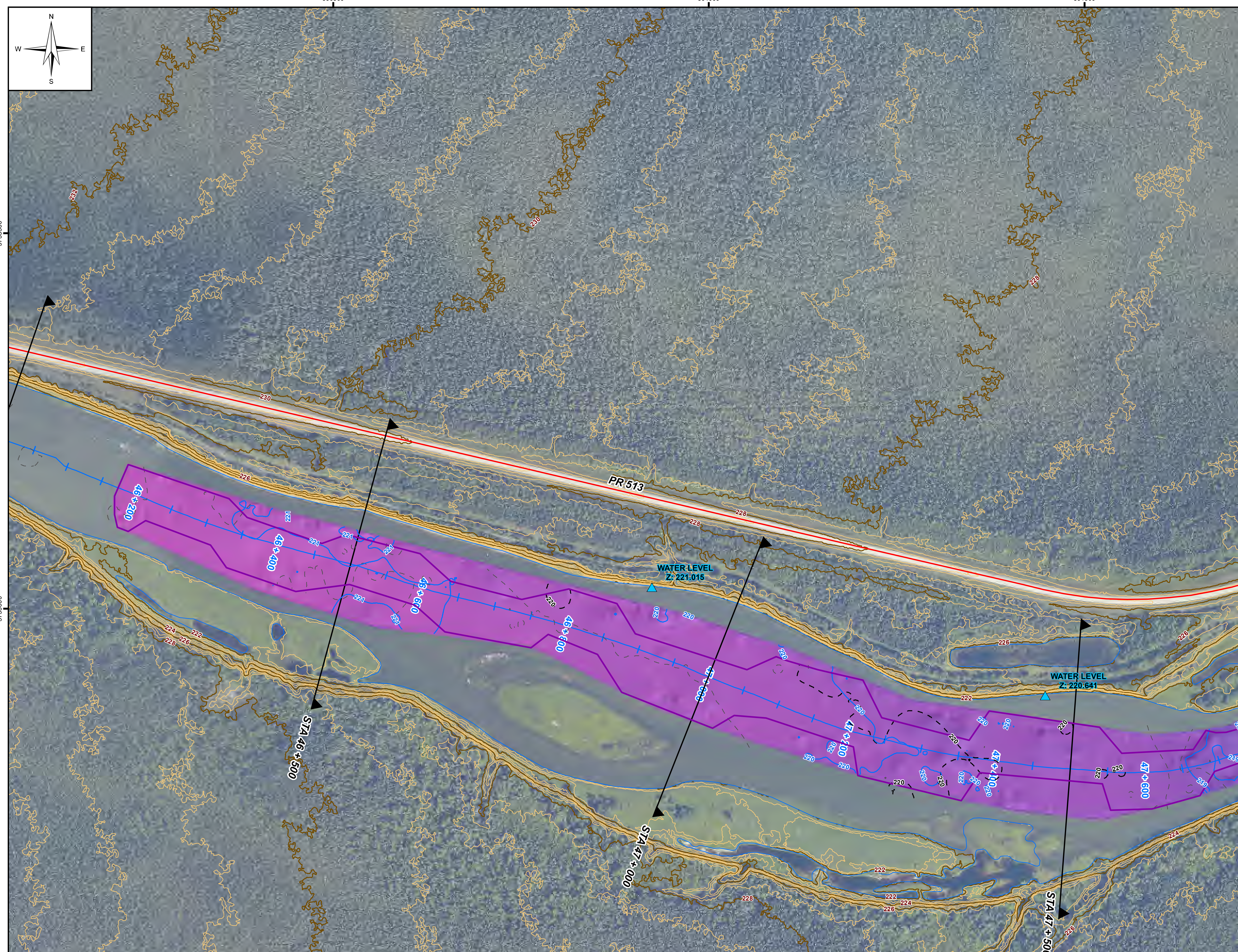
INFRASTRUCTURE AND TRANSPORTATION

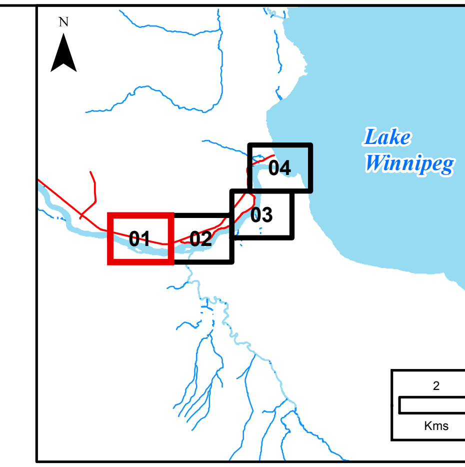
EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

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"

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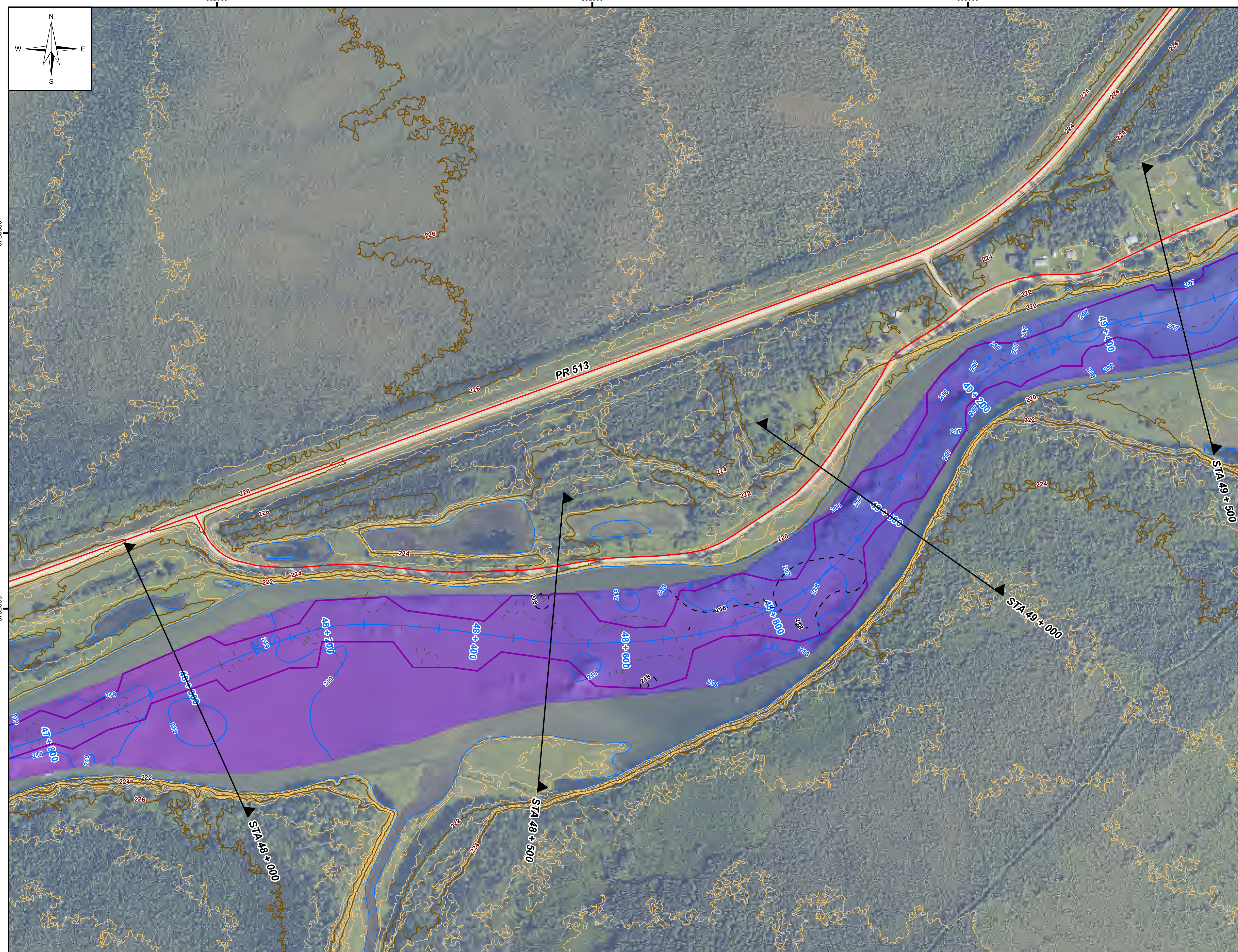
Manitoba INFRASTRUCTURE AND TRANSPORTATION

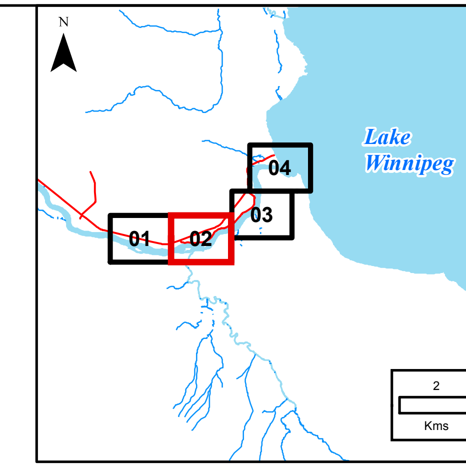
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

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:

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"

0	13/01/22	ISSUED WITH DAUPHIN RIVER BATH. FINAL REPORT	MSW
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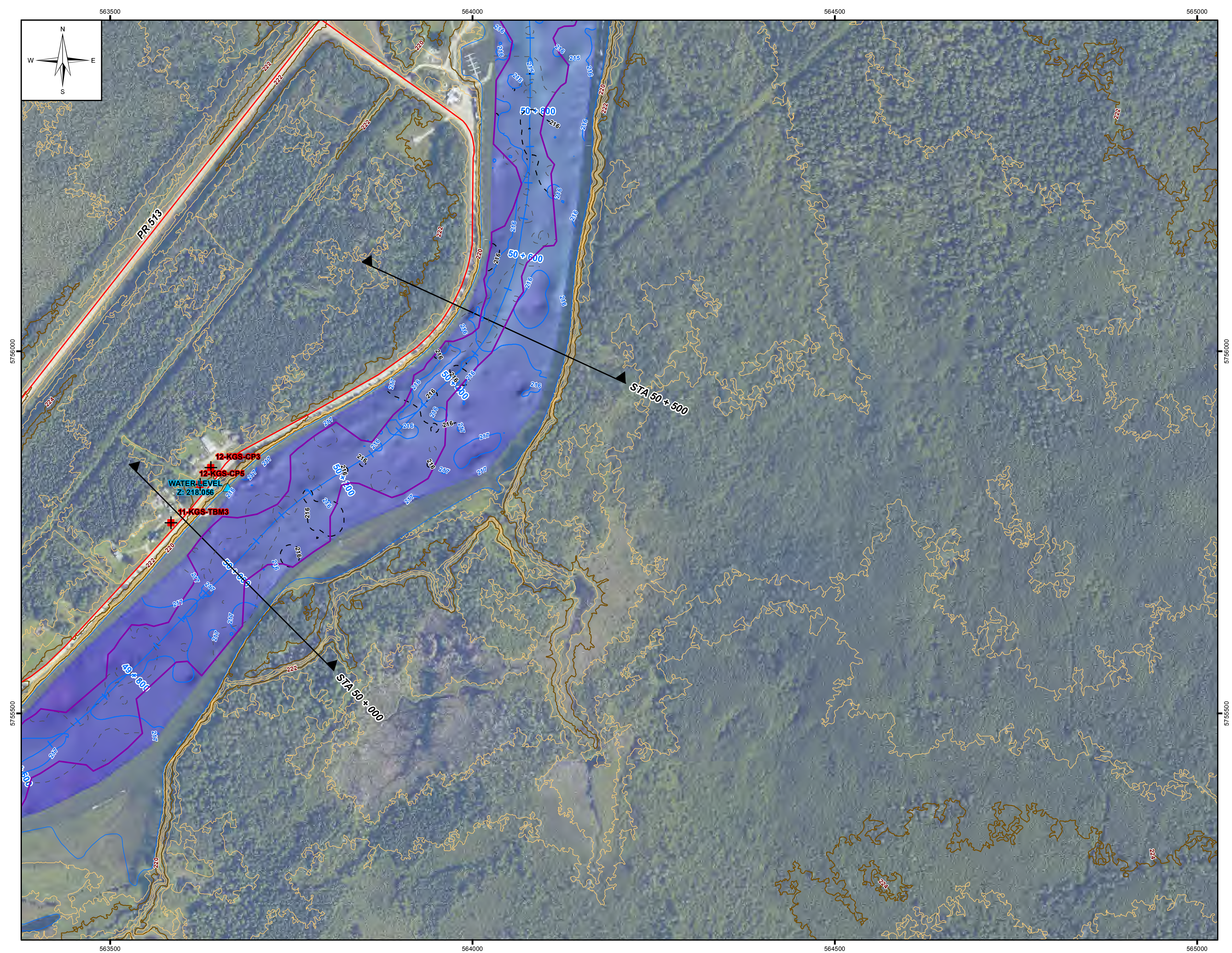
Manitoba INFRASTRUCTURE AND TRANSPORTATION

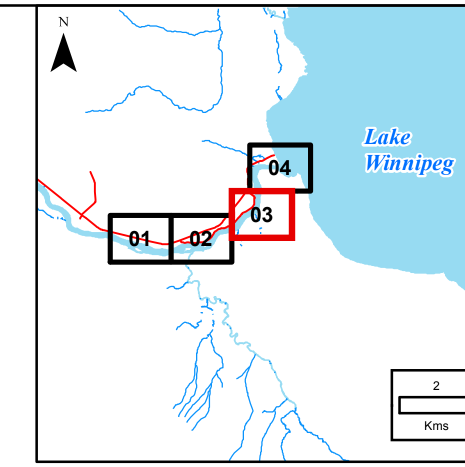
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

LOWER DAUPHIN RIVER BATHYMETRY COMPARISON OF 2011 TO 2012 (SHEET 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





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. Satellite 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"

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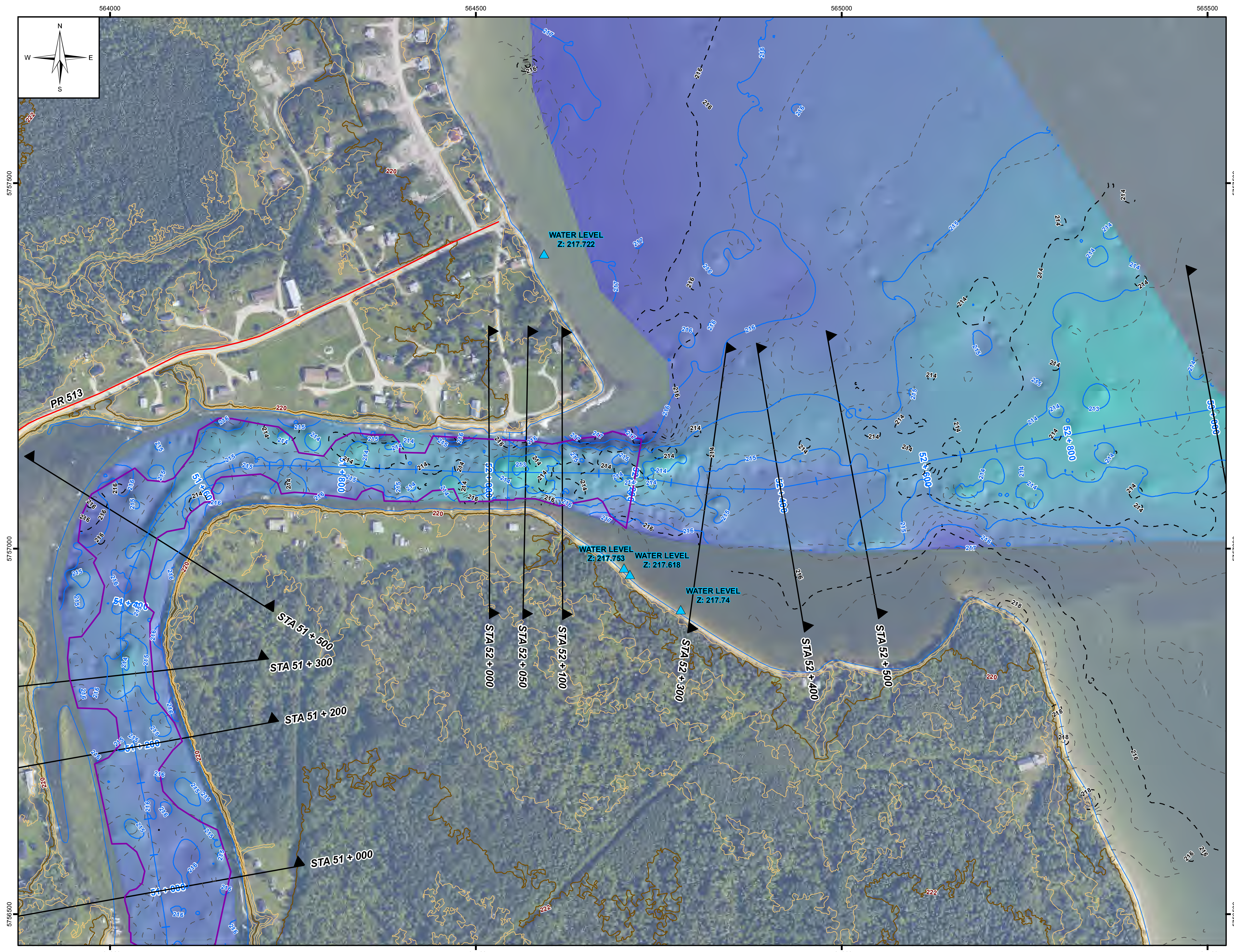
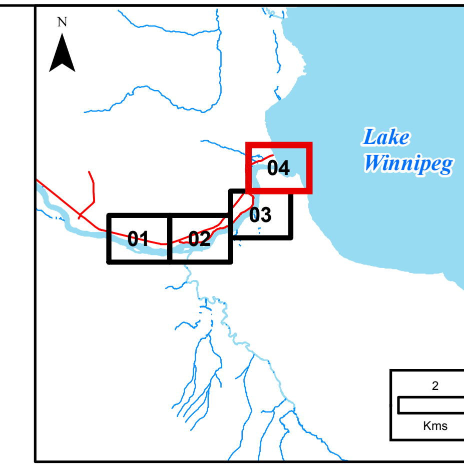
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

LOWER DAUPHIN RIVER BATHYMETRY COMPARISON OF 2011 TO 2012 (SHEET 3 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





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:

1. 2011 Sonar completed by KGS Group on July 2nd, 2011
   2012 Sonar completed by KGS Group on June 20, 2012
2. Satellite 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"

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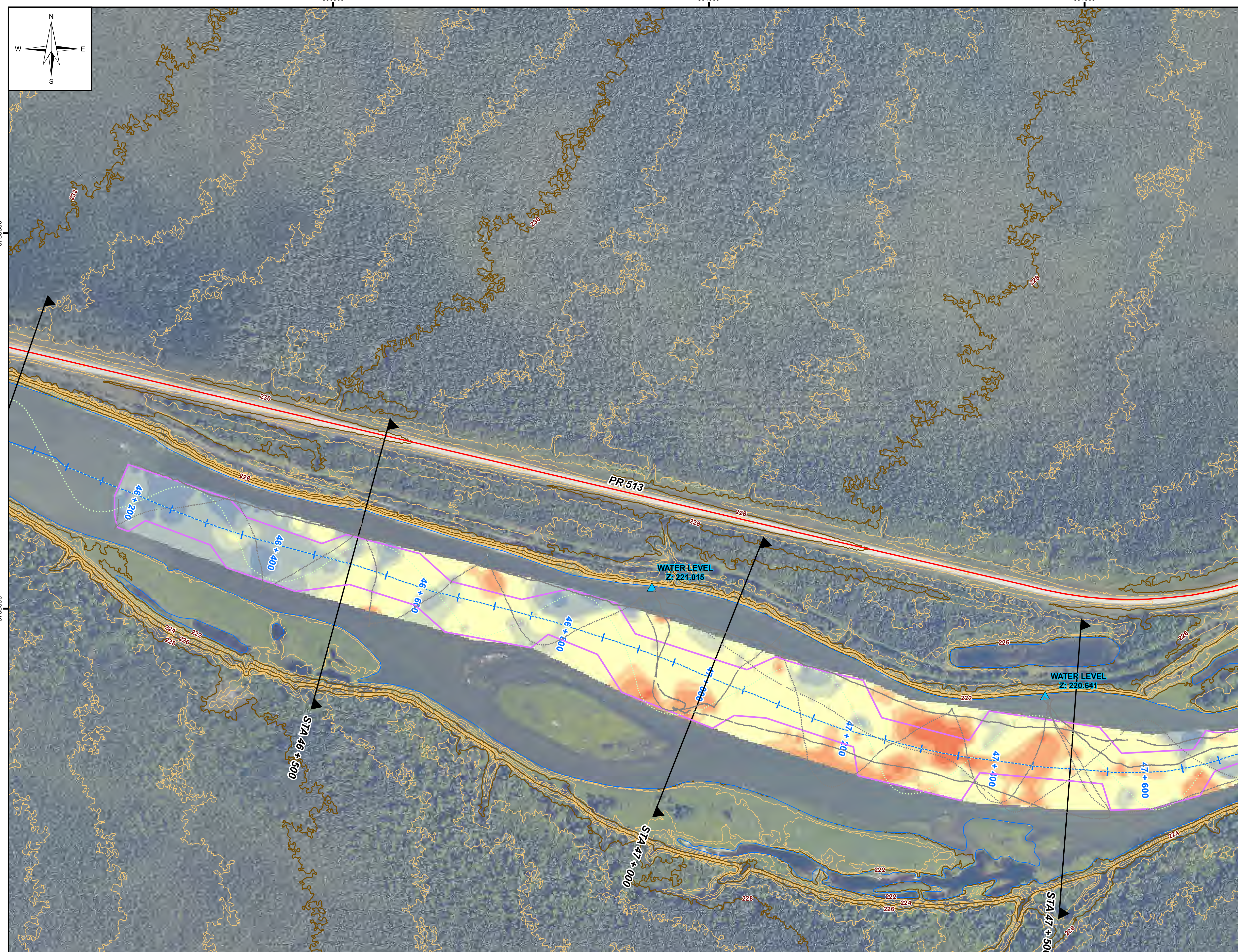
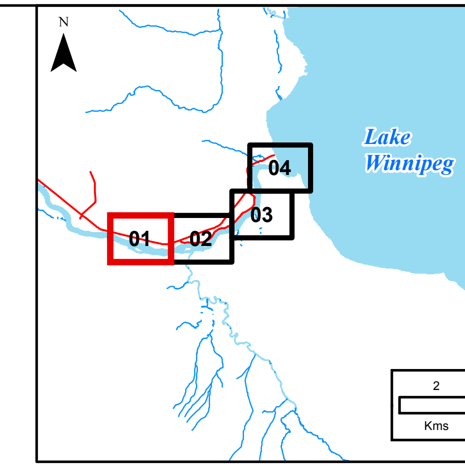
Manitoba INFRASTRUCTURE AND TRANSPORTATION

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





LEGEND:

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

TRANSPORTATION
- Gravel Road
- Trail

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

2012 vs 2011
Elevation Variation (m)
- < -2.0
- -2.0 - -1.0
- -1.0 - -0.5
- -0.5 - -0.25
- -0.25 - -0.15
- -0.15 - 0.15
- 0.15 - 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

NOTES:
1. 2011 Sonar completed by KGS Group on July 2nd, 2011
   2012 Sonar completed by KGS Group on June 20, 2012
2. Satellite 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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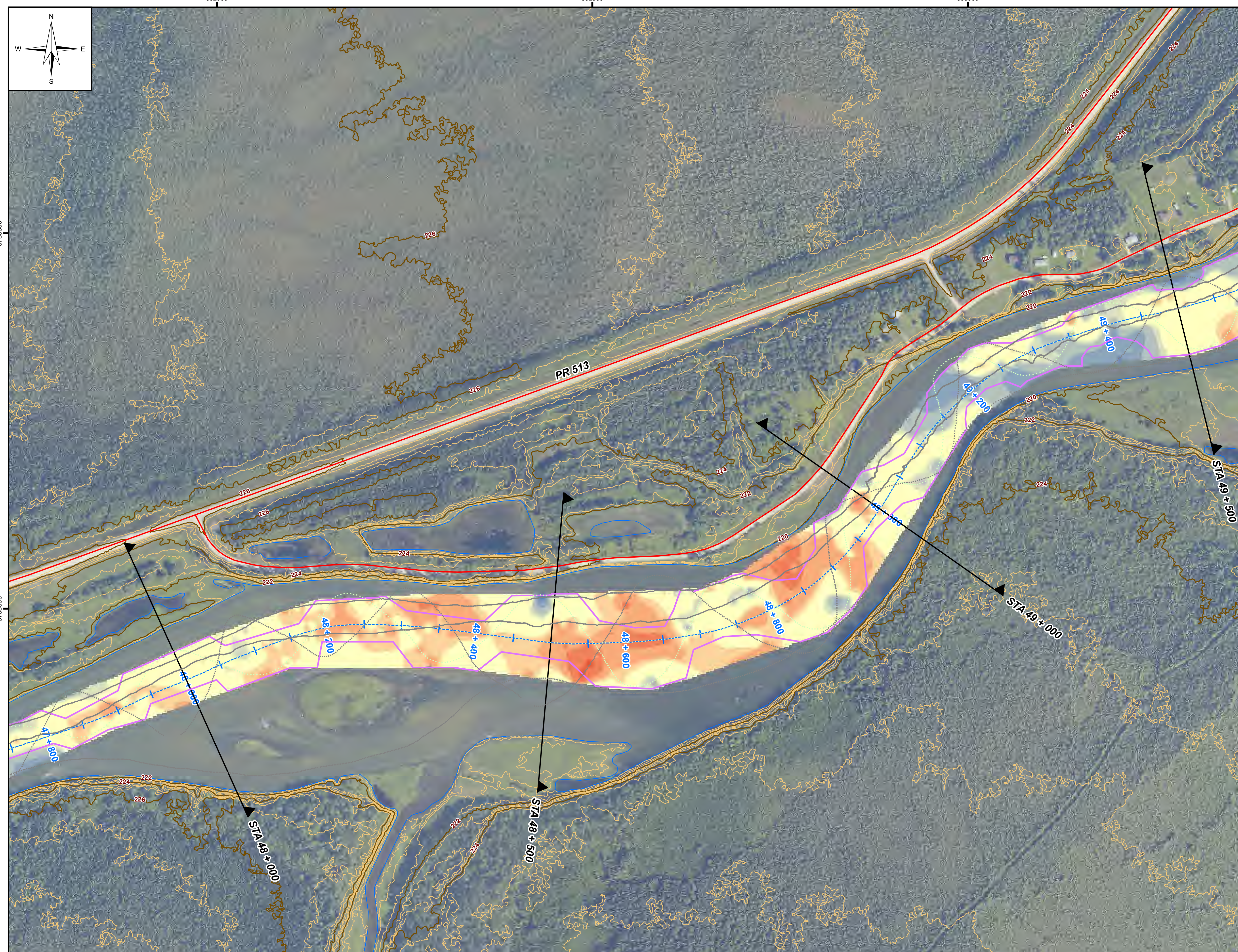
Manitoba
INFRASTRUCTURE AND TRANSPORTATION

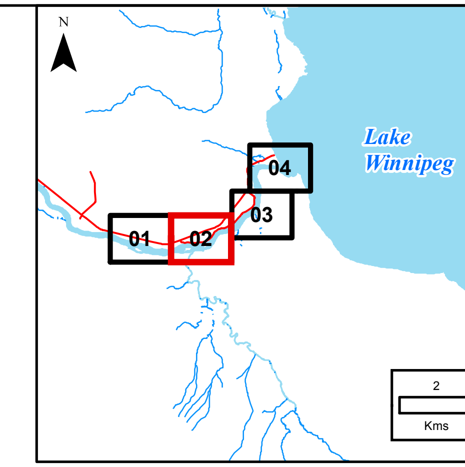
EMERGENCY REDUCTION OF
LAKE MANITOBA AND
LAKE ST. MARTIN WATER LEVELS

LOWER DAUPHIN RIVER BATHYMETRY
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





LEGEND:

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

TRANSPORTATION

- Gravel Road
- Trail

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2012 vs 2011
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50 0 50 100 150
Metres

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

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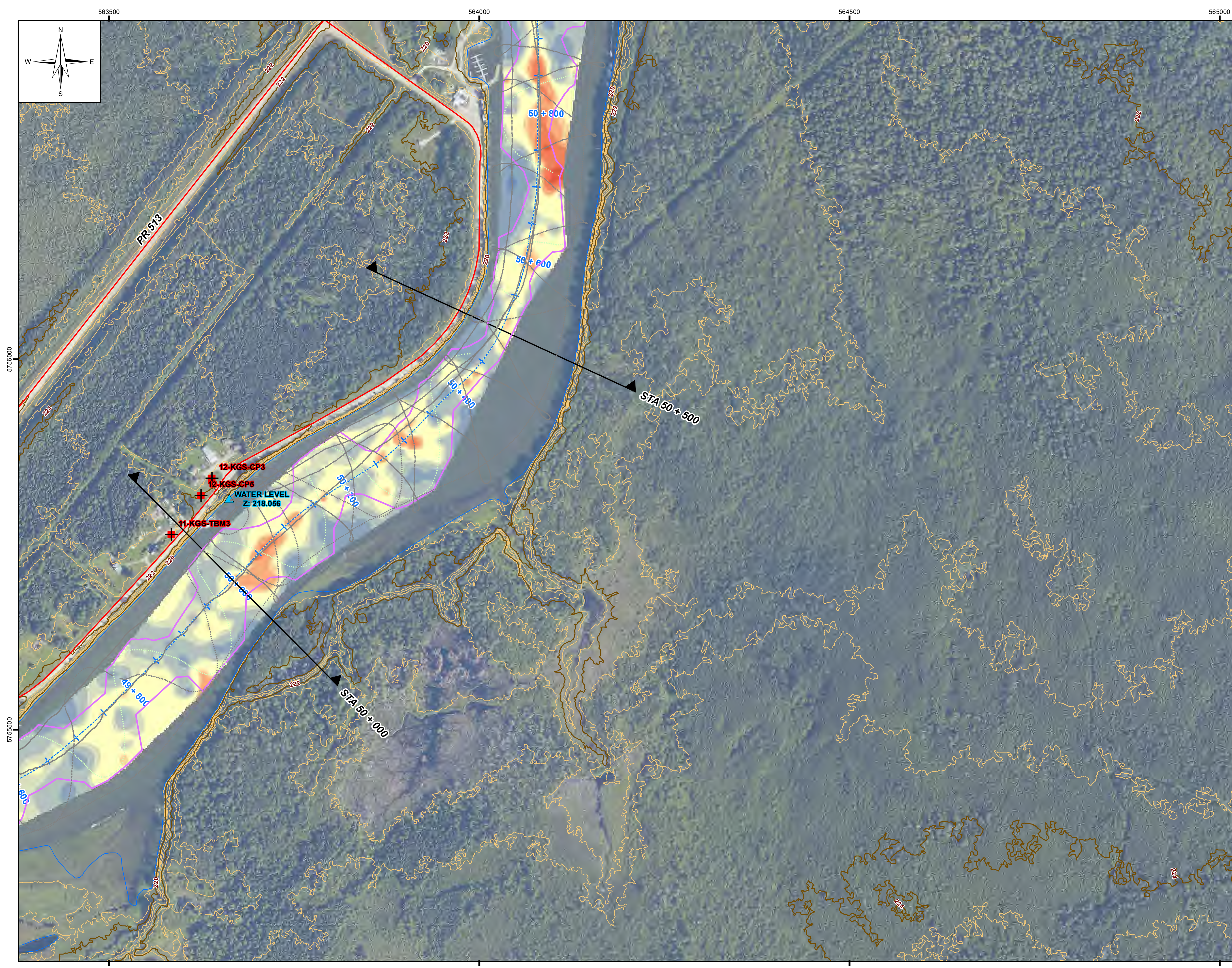
Manitoba INFRASTRUCTURE AND TRANSPORTATION

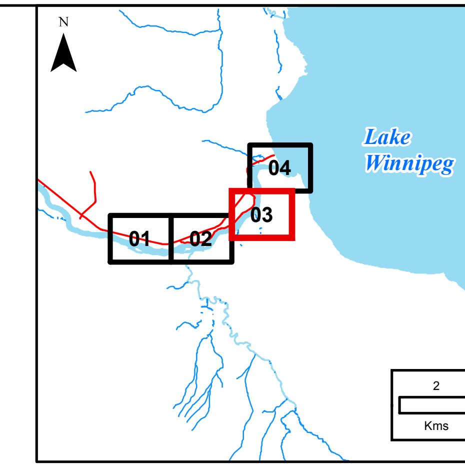
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

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

JANUARY 2013 | FIGURE 06 | REV: 0

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





LEGEND:

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

TRANSPORTATION

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- 0.5 − 1.0
- 1.0 − 2.0
- > 2.0

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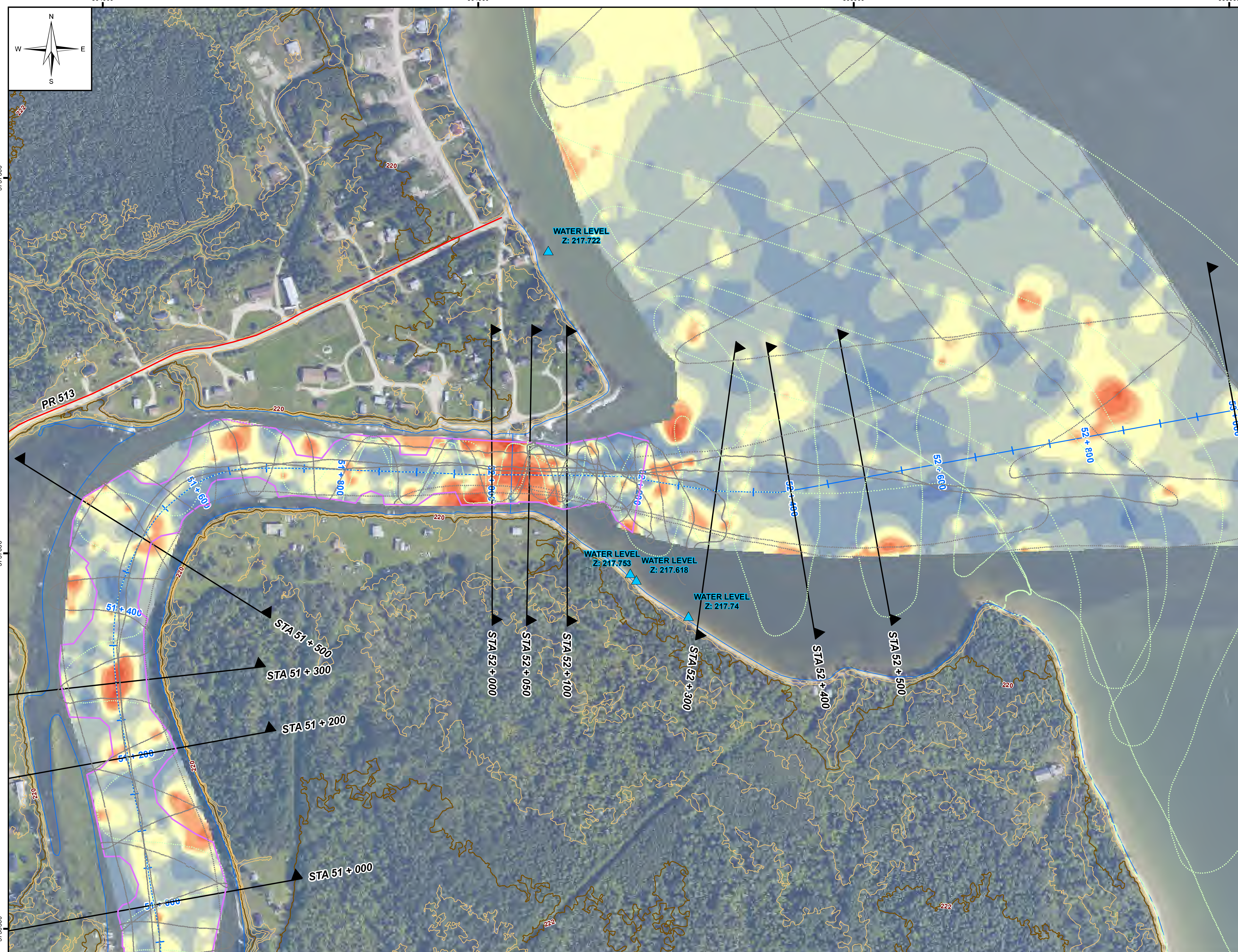
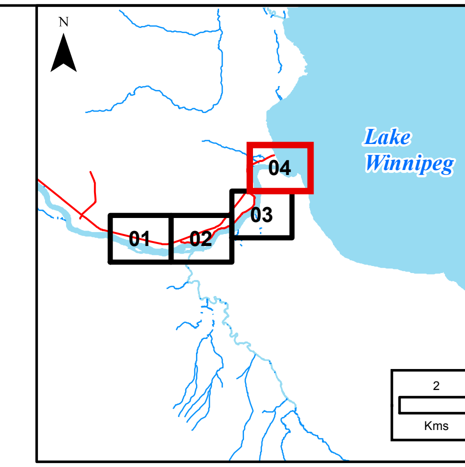
EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN WATER LEVELS

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





LEGEND:

2012 Sonar Point	
2011 Sonar Point	
Water Level (June 20, 2012)	
Control	
X–Section	
Dauphin River Centreline	
Volume Boundary	
TRANSPORTATION	
Gravel Road	
Trail	
LiDAR CONTOURS	
2m Index Contour	
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Edge of Water (LiDAR)	

2012 vs 2011 Elevation Variation (m)

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

JANUARY 2013 | FIGURE 06 | REV. 0

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11"x17" PLOT SCALE 1:1