St. Boniface Industrial Park
Phase 2
Municipal Servicing Report

PROVINCE OF MANITOBA
D.P.
MAGES
MEMBER
23458
REGISTERED PROFESSIONAL ENGINEER

Stantec

Prepared for:
City of Winnipeg

Prepared by:
Stantec Consulting Ltd.

APEGM
Certificate of Authorization
Stantec Consulting Ltd.
No. 1301

File: 116809351

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Table of Contents

LIST OF FIGURES

APPENDICES

1.0 Introduction

This brief has been prepared for submission to the City of Winnipeg as a requirement of their development review and subsequent approval on behalf of the developer, the City of Winnipeg. The brief covers the design criteria and parameters utilized for the water, wastewater and land drainage systems. The required Servicing Criteria Forms are also included in this brief.

The proposed Light Industrial development encompasses approximately 96.42 hectares and is bounded:

- on the north by the City of Winnipeg Aqueduct Right of Way;
- on the west by Lagimodiere Boulevard;
- on the south by Symington Yards; and
- on the east by the Symington Yards Spur line, west of Plessis Road.

The development will be constructed in multiple phases based on demand.

2.0 Water

The Stage 1 water service area, including the required pipe sizing and available fire flows are shown in Figure 1.0 and the ultimate water service system is shown in Figure 2.0. Future phasing will be analyzed as development proceeds. The external feedpoints will be located at:

- the dead end watermain on Mazenod Road, approximately 180m south of Camiel Sys Street off a 300 mm watermain.
- the intersection of Camiel Sys Street and Ray Marius Road off a 300 mm watermain.

The developer will be responsible for installing all internal watermains.

The systems performance was analyzed under various operating conditions using EPA NET 2.0, a computer simulation program produced by the Environmental Protection Agency (EPA).

For our analysis, the City of Winnipeg's Water and Waste Department provided us with simulated conditions at the above feedpoints. The simulated simultaneous feedpoint pressures used were 443 kPa (64.3 psi) and 447 kPa (64.8 psi) and are representative of peak hour demand conditions in the distribution system.

The following design criteria and assumptions were used in the analysis of the watermains:

1. Hazen-Williams coefficient of friction ("C" value) was assumed to be 120 for watermains with diameters of 200 mm or smaller and 130 for watermains with diameters larger than 200 mm.

2. The assumed average daily consumption for Light Industrial is 22,500 l/ha/day. However, there is a 6.417 Ha site (Parmalat) on the west side of Mazenod Road that have specified that their average consumption will be 50,000 l/hr (1,200,000 l/day). Based on, 6.417 Ha x 22,500 l/ha/day, the assumed average daily consumption would have been 144,382 l/day. This difference has been taken into account in the model.

3. The maximum day demand used was 1.6 x average day rate.

4. The peak hour multiplier used was 2.5. The 6.417 Ha Parmalat site has specified that their peak hour consumption rate would be 150,000 l/hr. This value was used in the model for the Parmalat node and no multiplier was considered. All other nodes in the model considered the assumed average daily consumption of 22,500 l/ha/day and the 2.5 peak hour multiplier.

5. Minimum design fire flows to be provided with maximum day demand on the system to be 250 l/s for Industrial or greater based on an FUS calculation that was performed for the Parmalat Site. The calculations were based the following FUS Criteria;

    - Fire Flow = $220xCxA^{0.50}$ = 19,000 l/m, C= 0.80 (non-combustible construction), A = 12,000 m^2 (Building size)

- The Fire Flow calculated above can be reduced by 15% because the fire hazard rating for the buildings contents are considered 'limited combustible'. There FF = 19,000 – 19,000x0.15 = 16,150 l/s

- We have assumed a 0% reduction for sprinklers as there will not be any and 0% increase for exposure because the buildings separated by more than 45 m.

- Therefore, the fire flow requirement for Parmalat is 16,150 l/m (267 l/s). We have runded down to 250 l/s as a requirement for the development because most other buildings will be smaller in scale.

6. For analysis purposes, the watermains were assumed to be at a constant elevation considering the subdivision's ground elevations vary slightly. The watermain system was tied into feedpoint nodes where simulated hydrant flow test data was provided by the City of Winnipeg.

7. Hydrant losses were accounted for by calculating available fire flows using 25 psi as opposed to 20 psi.

Based on the above conditions, the proposed watermain system can meet the required operating criteria of:

- A minimum pressure of 207 kPa (30 psi) under maximum hour consumption.
- The minimum fire flow specified above at 140 kPa (20 psi) with maximum day consumption.

The available fire flows at various locations throughout the development are shown in Figure 1.0 (Phase 1) and Figure 2.0 (Ultimate Development).

We are providing adequate fire flow protection within the right-of-ways around the industrial sites. It will be the responsibility of the design engineer for the sites to design an internal watermain system to provide adequate fire protection within the site.

Below are the average water demand calculations for the entire development:

- Light Industrial = 70.88 hectares x 22,500 l/day/hectare = 1,594,800 l/day
- Parmalat = 50,000 l/hour x 24 hours = 1,200,000 l/day

- **Total = 2,794,800 l/day**

3.0 Wastewater

The proposed development is located in Area 21 and 22 of the Dugald Road Interceptor Sewer. Its wastewater sewer system is designed to flow to a proposed lift station located south of the existing aqueduct line on Mazenod Road. The sewage will be pumped into the existing wastewater sewer line on Mazenod Road and flow north into a sewer on Dugald Road. The sewage will then flow north to the North End Pollution Control Centre.

A schematic of the overall wastewater sewer system and sewer subcatchments are shown in Figure 3.0.

The design criteria and assumptions for the wastewater sewer system are:

1. Peak Design Flow = (domestic sewage x peaking factor) + extraneous flow.
   The extraneous flows include groundwater infiltration and manhole cover inflow.

2. Peak Industrial Flow: 37,600 L/hectare/day. However, there is a 6.417 Ha site (Parmalat) on the west side of Mazenod Road that has specified that their average domestic sewage will be 70,000 l/hr. Applying a peaking factor of 1.67, which is consistent with the average to peak industrial ratio, the peak flow for the Parmalat site is 70,000 l/hr x 1.67 = 116,900 l/h. This difference has been taken into account in the sewer sizing spreadsheet.

3. Extraneous Flow
   a) Groundwater Infiltration: 2200 L/hectare/day
   b) Manhole Infiltration: 12 L/min/MH
      Manhole Spacing: 1.0 Manholes/hectare (Industrial)

4. Pipe selection was based on full flow pipe with Manning's n = 0.013 and minimum velocity of 0.60 m/sec. Adequate pipe cover and slope will be illustrated on the detailed design drawings.

The wastewater sewer system design for this subdivision for peak design flows is presented in Appendix A. The table shows that pipe sizes presented are sufficient to handle flows produced within this development.

4.0 Land Drainage

4.1 BACKGROUND

The proposed subdivision encompasses roughly 93.65 hectares and is located within South Transcona Drainage Area. The proposed subdivision (93.65 ha) and 0.03 hectares of runoff from the aqueduct bridges will flow to the proposed retention pond that will have a normal water level set at 227.4. The development will utilize land drainage sewers and surface ditches to convey water to the proposed retention pond. From there the water will outlet to the north to SRB 5-1 in the St. Boniface Industrial Park where it will be pumped to the Dugald ditch. The overall drainage plan is shown on Figure 4, Figure 5 and Figure 6.

4.2 DESIGN CRITERIA AND DETAILED ANALYSIS

4.2.1 Retention Lakes

The specific City of Winnipeg criteria guidelines applicable to the Industrial Retention Lakes are as follows:

- 1.80 m max pond rise for a 25 year storm (Industrial).
- Able to control the 100 year design storms.
- Maintain a drawdown time of 120 hours for the 100 year storm and 48 hours for the 25 year storm.
- Freeboard Elevation 0.90 m above High Water Level (HWL).
- 7:1 side slopes above normal water level and 4:1 side slopes below water.
- 2.5 m minimum water depth.
- Lake designed as naturalized; Full naturalization to be completed in Stage 2.

Some additional conditions imposed in this Development are as follows;

- Pond to be designed to accommodate two back to back 25 year design storms and the May 2010 historical event with assuming zero discharge.

SWMM 5.1 was used to simulate the City of Winnipeg 5, 25 and 100 year design storms, as well as the 2010 Bernie Wolfe historic rainfall event.

The retention lakes were modeled as storage nodes with 7H:1V side slopes above the NWL and 4H:1V below NWL. Runoff was modeled using a subcatchment for each ditch segment, a subcatchment for each land drainage sewer outfall and a subcatchment for direct runoff to the proposed retention pond. See Figures 5 and 6 for reference.

Subcatchments were modeled using the following assumptions

- Industrial Land Use is 60% Impervious (Based on Parmalat Site)
- Manning's roughness for runoff:
  - Impervious n=0.015
  - Pervious n=0.20
- Depression Storage – Impervious 3.0mm, Pervious 6mm.
- Pond and surrounding side slopes area is 90% Impervious.
- Horton infiltration Parameters for Pervious Surfaces are
  - f_o = 75 mm/hr
  - f_c = 3 mm/hr
  - a = 4.14 hr^{-1}

The NWL elevation in the proposed retention pond will be maintained by the pump in the downstream lake (SRB 5-1) at 227.4 m.

4.2.2 Surface Ditches

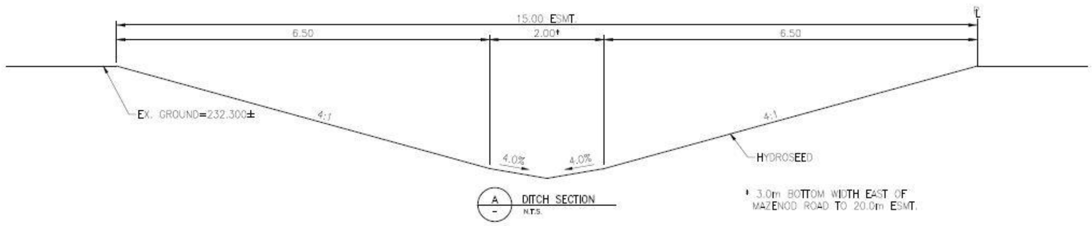
This section details the parameters, and assumptions used in the design of the surface ditches. See Figure 5 for reference. The ditch system was designed using the modelling software "SWMM 5.1" and was based on the following criteria:

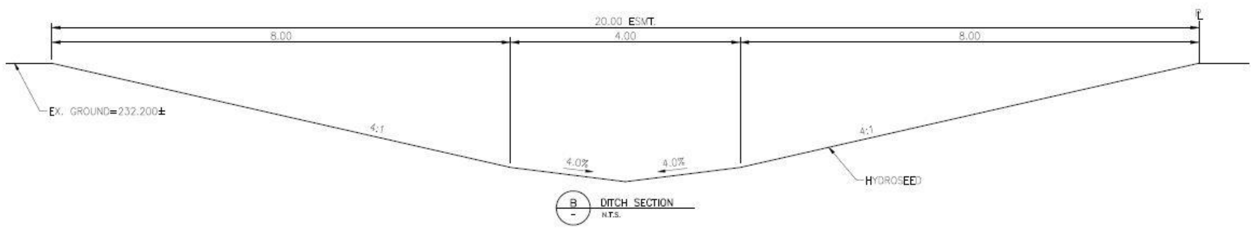
- Ditch friction factor (Manning's n) : 0.05
- Culvert friction factor (Manning's n): 0.013 (Ultra-Flow Culverts).
- The 1:25 year return frequency was used for the design of the ditch system, however the banks of the ditches were set at an elevation that contains the100 year storm event.

<u>Catchment Areas</u>

Multiple lots were grouped together to produce catchment areas, these catchments areas are shown in Figure 6.0. The catchments were modelled using the same criteria mentioned in section 4.2.1.

The Surface Ditch cross-sections for the development are shown below;





4.2.3 Rainfall Intensity

The Rainfall / Intensity Values for the 5, 25 and 100 year storms were calculated by the following Intensity Duration Formulas:

$$i_5\ (\text{mm/hr}) = \frac{1199}{(t+8)^{0.828}}$$

$$i_{25}\ (\text{mm/hr}) = \frac{1842}{(t+9)^{0.842}}$$

$$i_{100}\ (\text{mm/hr}) = \frac{2318}{(t+8)^{0.856}}$$

Additionally, the May 2010 Bernie Wolfe historic rainfall record was input as a rainfall event to analyze the pond system's response to back to back storms.

4.2.4 Pipe Roughness

A Manning's roughness of n = 0.013 was assumed for all LDS and culvert piping. All culverts will be ultra-flow culvert that have an n = 0.013.

4.2.5 Results

The proposed retention pond response to the design storms is summarized in Table 4.2.4.1 and detailed plots of the proposed retention pond are shown in Figures 7.0.

Table 4.2.4.1 – Proposed Retention Pond Response

Pond	**Storm**	**HWL (m)**	**Rise (m)**	**Active Storage (m^3)**
Retention Pond	5 yr	228.05	0.65	31,770
	25 yr	228.40	1.00	49,967
	100 yr	228.61	1.21	61,509
	2010 Design Storm	229.20	1.80	95,645
	Back to Back 25 yr Storms	229.39	1.99	106,775

Based on the maximum HWL elevation of 229.39 m (Back to Back 25 yr Storms), plus the prescribed free board of 0.90 m, the Freeboard elevation within the development will be set at 230.49 m.

Figure 5 lists the 25 yr high water levels at various locations along the rear lot ditches. These water levels should be used by future designers to determine their peak discharges from the individual parcels. The discharges to the rear lot ditches should be controlled to the 5 yr peak based on a c-value of 0.6 with two thirds of the lot area being directed to the rear lot ditch.

4.2.6 Land Drainage Sewers

This section details the design criteria, parameters, and assumptions used in the design of the land drainage sewers. The piped system was designed using the Rational Design method and was based on the following criteria:

- 5 year storm intensity equation I (mm/hr) = $1198/(t+8)^{0.828}$ ---> (MacLaren 1974).
- Pipe friction factor (Manning's n): 0.013 (Concrete and PVC).
- Minimum full flow velocity: 0.90 m/s.
- Maximum full flow velocity: 3.05 m/s.
- The 1:5 year return frequency was used for the design of the storm sewer system.
- Tailwater Condition at the pond = 227.85 m (0.45m above NWL)

<u>Runoff Design Criteria</u>

The rational design method was used to estimate rainfall runoff to be handled by the piped system:

$$Q = (1/360)\ CiA$$

Where:

Q = runoff (CMS)

C = runoff coefficient

i = rainfall intensity (mm/hr)

A = area (hectares)

The drainage catchments assume an industrial runoff with a C-value = 0.6.

System Design Criteria

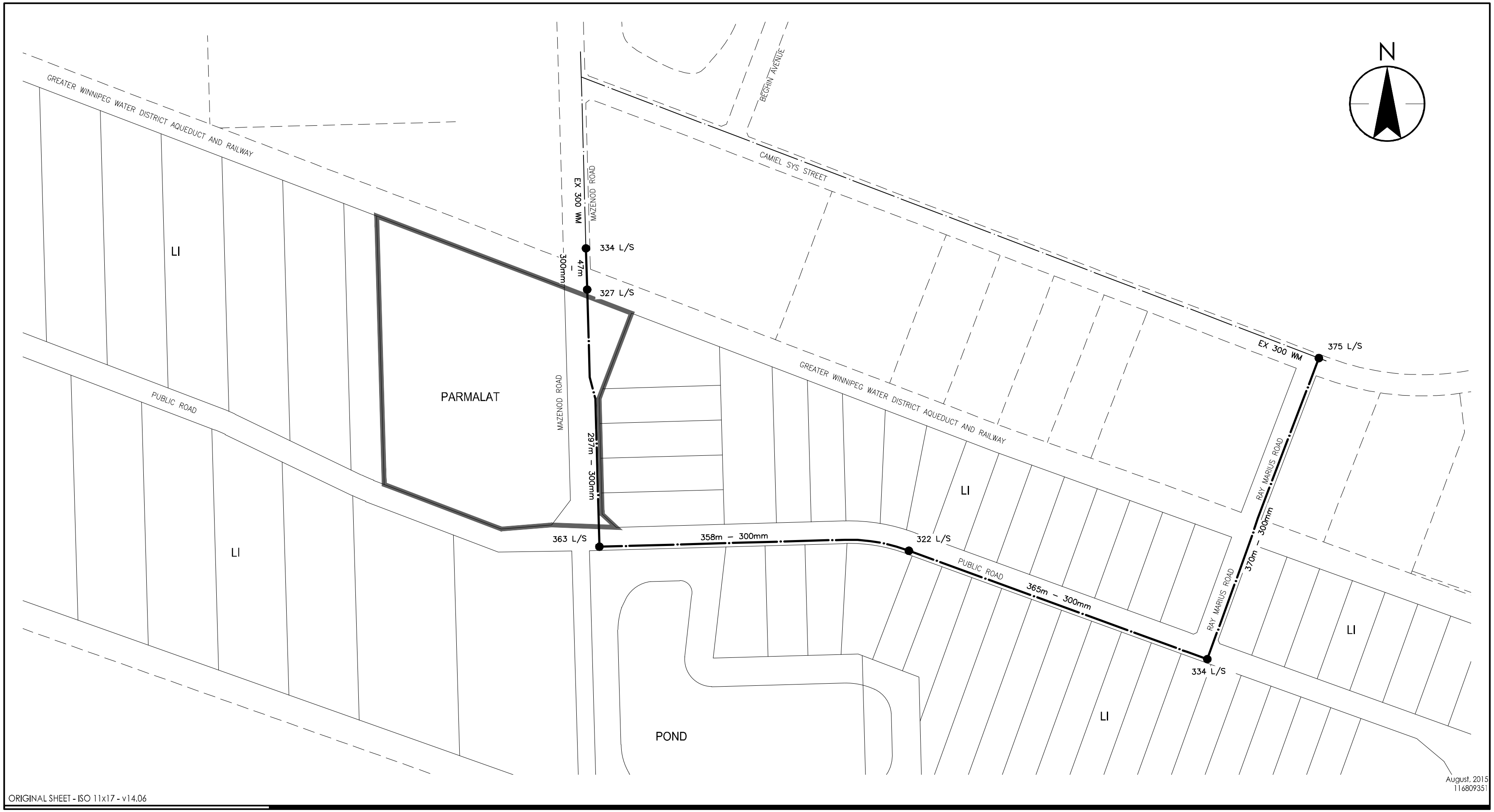
Figure 4.0 shows the land drainage sewers and the detailed sub-catchment areas for St. Boniface Industrial Park.

The City of Winnipeg will be installing all the required land drainage sewers within the development. During a storm event, runoff will flow to the proposed retention pond and then flow through an interconnecting pipe to Lake 5-1 that's NWL is controlled by a pumping station discharges to Dugald Road Ditch.

The land drainage sewers in this subdivision were designed as surcharged pipe systems to accommodate the calculated runoffs. The surcharge level of the system was designed to be at a minimum of 0.15m below the proposed gutter elevations. The Manning's Equation with an N = 0.013 for concrete or PVC pipe was used to determine pipe sizes and hydraulic losses within the system. At the outfalls to the lakes, the hydraulic grade line was assumed to be 0.45 m above the NWL elevation to ensure that the pipes could discharge the peak flows as the lake rose during the storm event.

Appendix B contains the Detailed Rational Method Design spreadsheets for each of the outfalls to the retention lake.

FIGURES



V:\1168\active\116809351\0300_drawing\0301_sketches\9351_catchments_aug2415.dwg FIG 1 - WM ST 1
2015/11/05 4:17 PM By: Devisser, Kyle

ORIGINAL SHEET - ISO 11x17 - v14.06

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Suite 500, 311 Portage Avenue
Winnipeg MB Canada R3B 2B9
Tel. 204.489.5900 Fax. 204.453.9012
www.stantec.com

Legend

(thick grey line)	SERVICE AREA (7.658 ha)
(thin dash-dot line)	EXISTING WATERMAIN
(thick dash-dot line)	PROPOSED WATERMAIN
●	NODE
250 L/S	AVAILABLE FIRE FLOW

Notes

LI = LIGHT INDUSTRIAL

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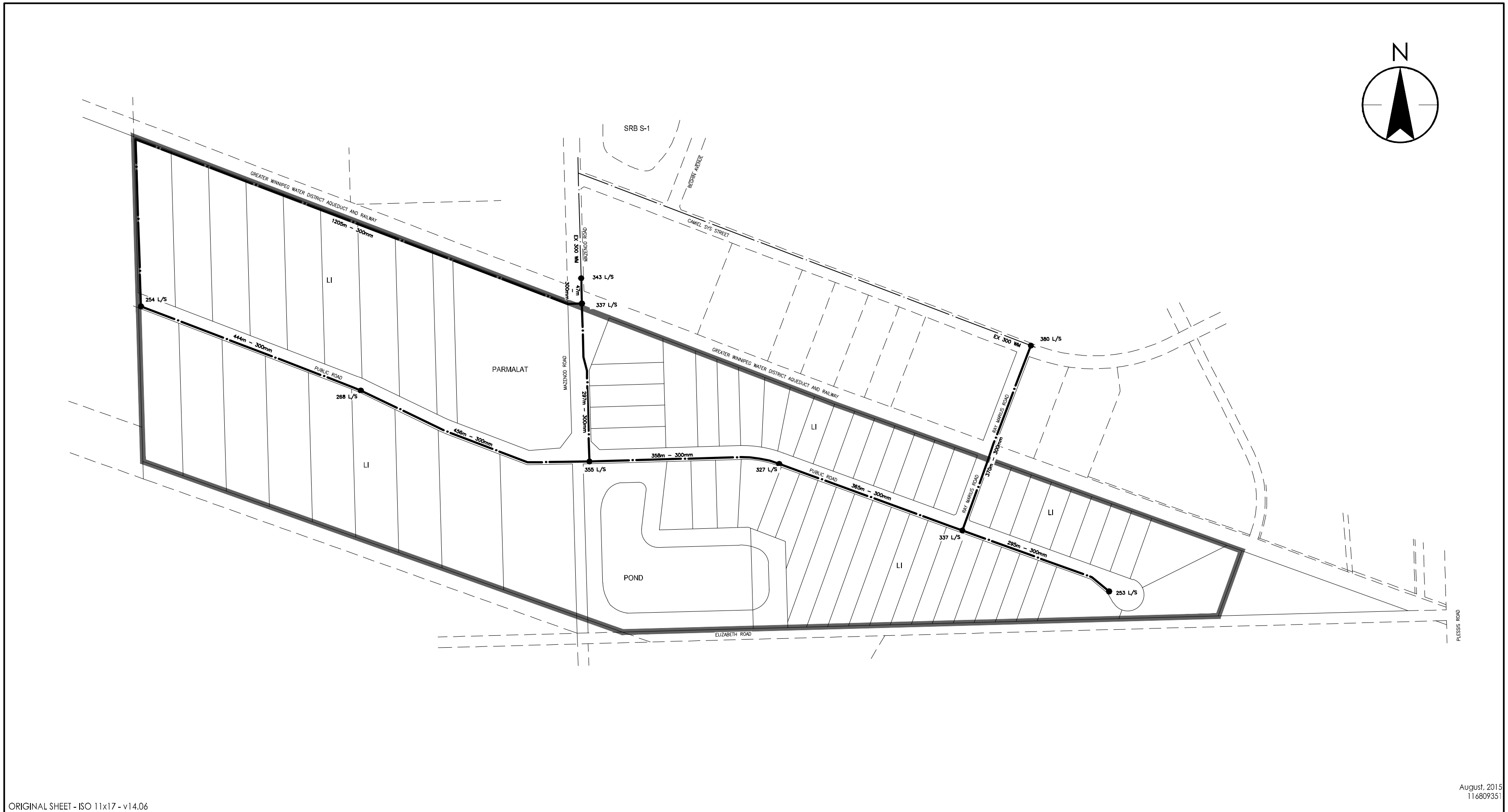
PHASE 2

Figure No.
1

Title
WATERMAIN - STAGE 1
AVAILABLE FIRE FLOW AND PIPE SIZING



ORIGINAL SHEET - ISO 11x17 - v14.06

V:\1168\active\116809351\0300_drawing\0301_sketches\9351_catchments_aug2415.dwg FIG 2 - ULTIMATE
2015/11/05 4:18 PM By: Devisser, Kyle

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SITE BOUNDARY (95.802 ha)
EXISTING WATERMAIN
PROPOSED WATERMAIN
NODE
250 L/S AVAILABLE FIRE FLOW

Notes

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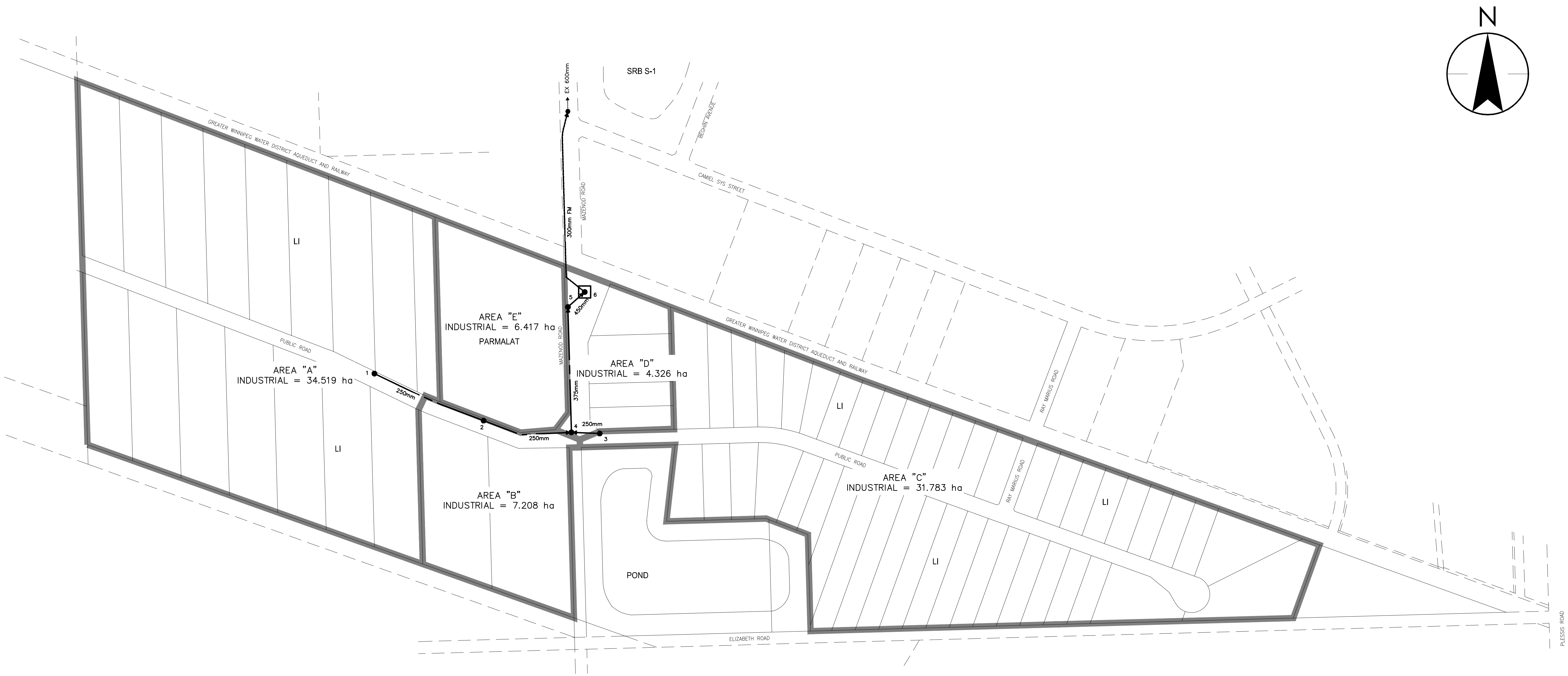
Figure No.
2

Title
WATERMAIN - ULTIMATE SYSTEM
AVAILABLE FIRE FLOWS AND PIPE SIZING



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ORIGINAL SHEET - ISO 11x17 - v14.06

V:\1168\active\116809351\0300_drawing\0301_sketches\9351_catchments_aug2415.dwg FIG 3 - WWS
2015/11/06 8:22 AM By: Devisser, Kyle

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Legend

- WASTEWATER SEWER CATCHMENTS
- PROPOSED WASTEWATER SEWER
- EXISTING WASTEWATER SEWER
- PROPOSED FORCEMAIN
- PROPOSED LIFT STATION

Notes

LI = LIGHT INDUSTRIAL

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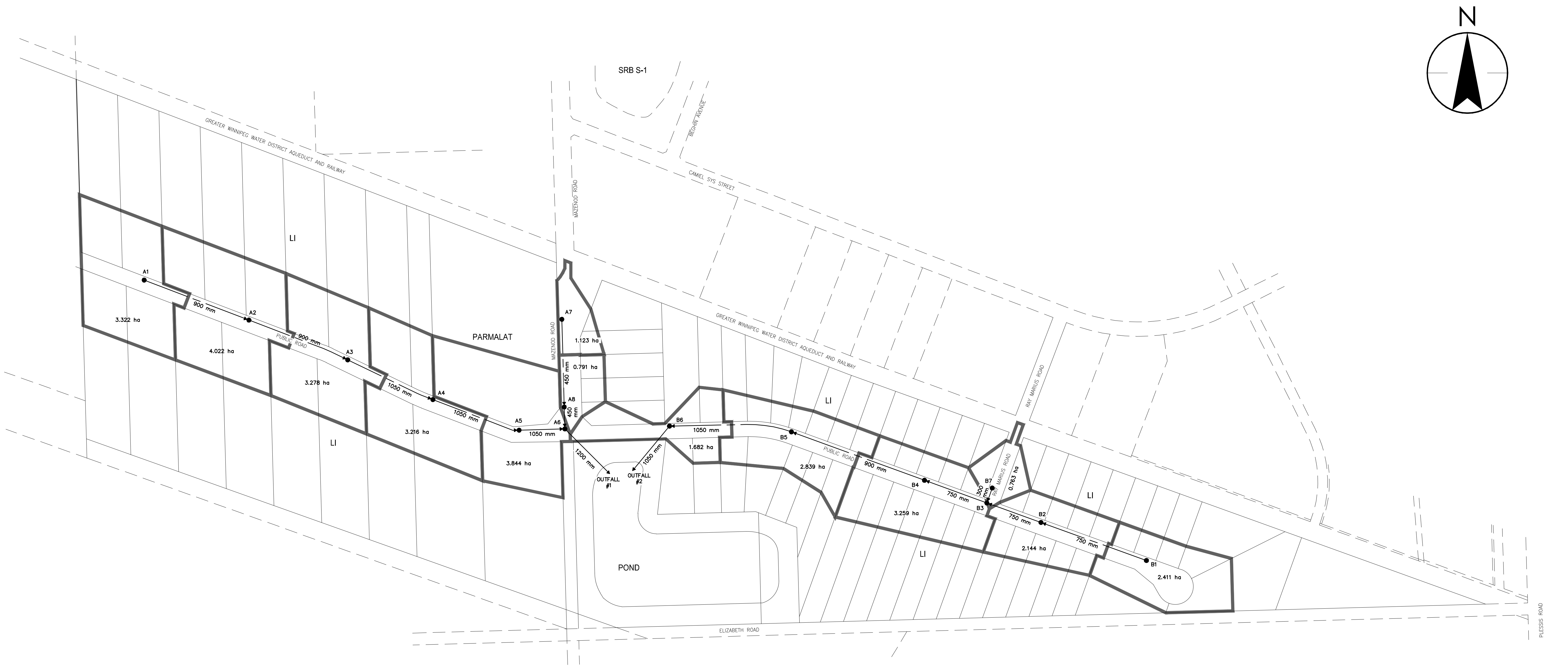
PHASE 2

Figure No.
3

Title
WASTEWATER SEWER
PIPE SIZING AND CATCHMENTS



V:\1168\active\116809351\0300_drawing\0301_sketches\9351_catchments_aug2415.dwg FIG 4 - LDS
2015/11/06 8:24 AM By: Devisser, Kyle

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Legend

LAND DRAINAGE SEWER CATCHMENTS

PROPOSED LAND DRAINAGE SEWER

Notes

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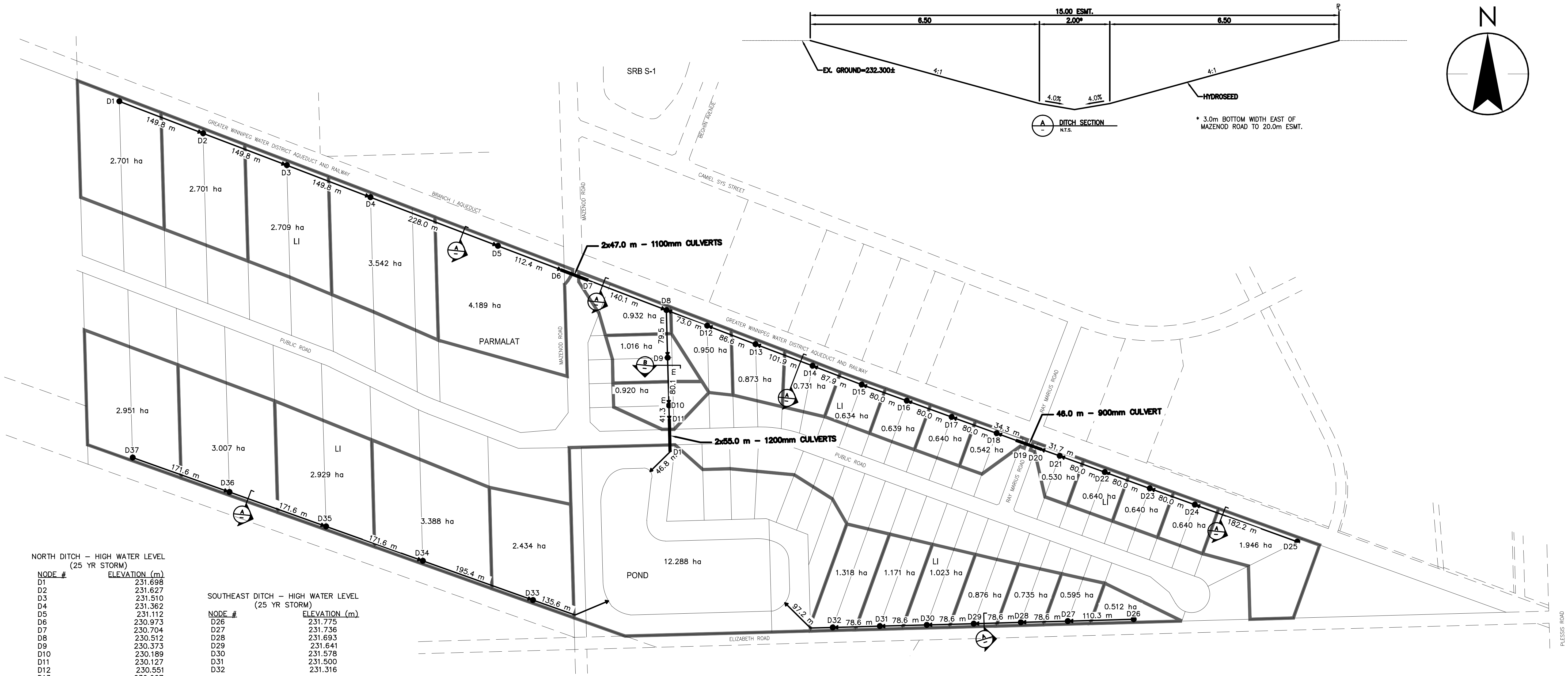
ST. BONIFACE INDUSTRIAL PARK
PHASE 2

Figure No.

4

Title

LAND DRAINAGE SEWER
PIPE SIZING AND CATCHMENTS



NORTH DITCH – HIGH WATER LEVEL
(25 YR STORM)

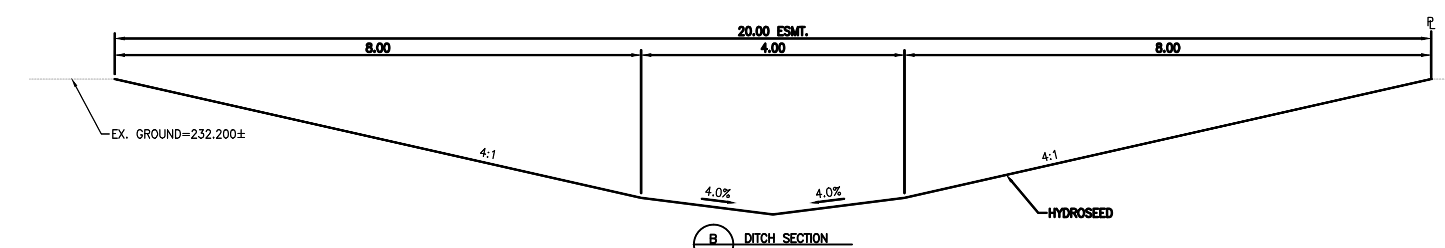
NODE #	ELEVATION (m)
D1	231.698
D2	231.627
D3	231.510
D4	231.362
D5	231.112
D6	230.973
D7	230.704
D8	230.512
D9	230.373
D10	230.189
D11	230.127
D12	230.551
D13	230.627
D14	230.769
D15	230.921
D16	231.065
D17	231.206
D18	231.345
D19	231.403
D20	231.730
D21	231.740
D22	231.778
D23	231.857
D24	231.958
D25	232.272

SOUTHEAST DITCH – HIGH WATER LEVEL
(25 YR STORM)

NODE #	ELEVATION (m)
D26	231.775
D27	231.736
D28	231.693
D29	231.641
D30	231.578
D31	231.500
D32	231.316

SOUTHWEST DITCH – HIGH WATER LEVEL
(25 YR STORM)

NODE #	ELEVATION (m)
D33	230.660
D34	231.224
D35	231.367
D36	231.512
D37	231.619



August, 2015
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ORIGINAL SHEET - ISO 11x17 - v14.06

V:\1168\active\116809351\0300_drawing\0301_sketches\9351_catchments_aug2415.dwg FIG 5 - DITCHES
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Legend
- DITCH CATCHMENTS
- PROPOSED DITCHES
- PROPOSED CULVERTS
- NODES

Notes
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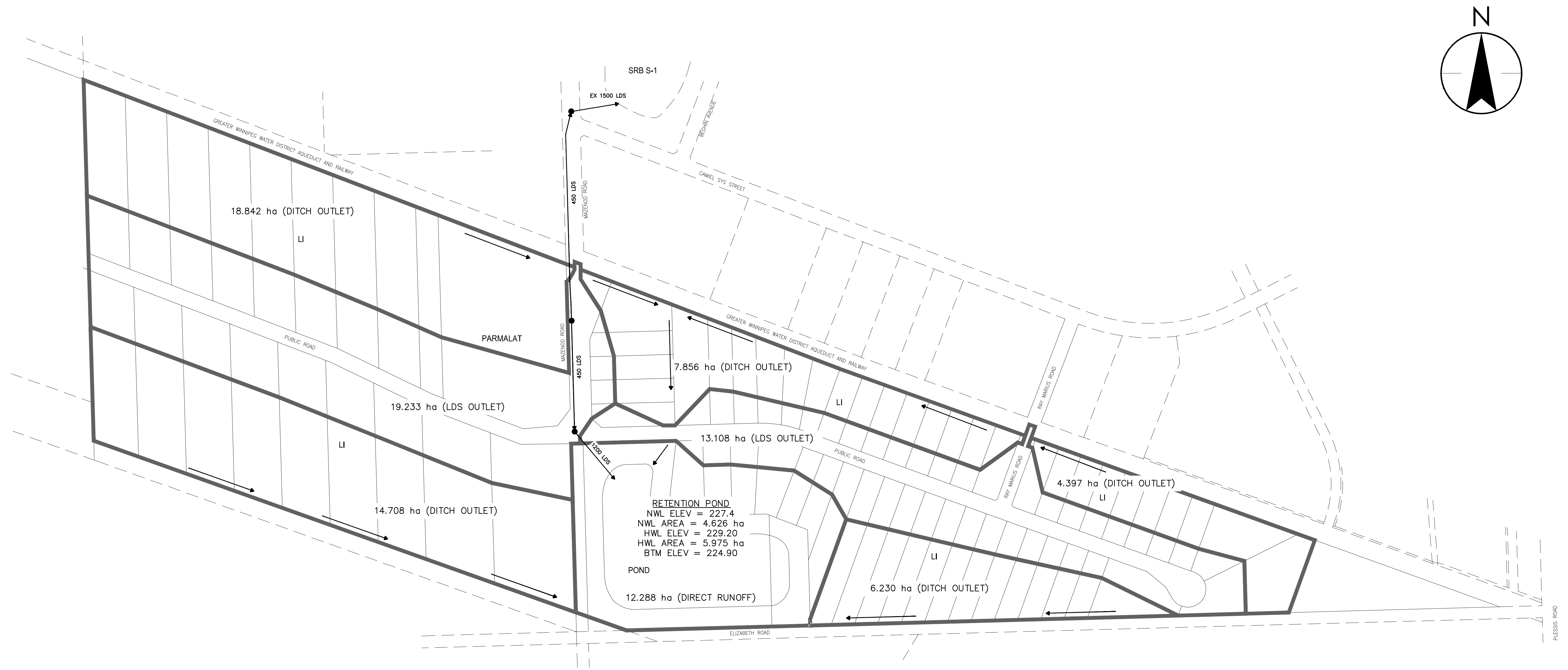
Figure No.
5

Title
DRAINAGE DITCH
CATCHMENTS AND DITCH LENGTHS



August, 2015
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ORIGINAL SHEET - ISO 11x17 - v14.06

V:\1168\active\116809351\0300_drawing\0301_sketches\9351_catchments_aug2415.dwg FIG 6 - POND
2015/11/06 8:27 AM By: Devisser, Kyle

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Winnipeg MB Canada R3B 2B9
Tel. 204.489.5900 Fax. 204.453.9012
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Legend

- POND CATCHMENTS
- INTERCONNECTING PIPE
- NODES
- DITCH OUTLETS

Notes

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Figure No.
6

Title
RETENTION POND CATCHMENTS
AND INTERCONNECTING PIPE

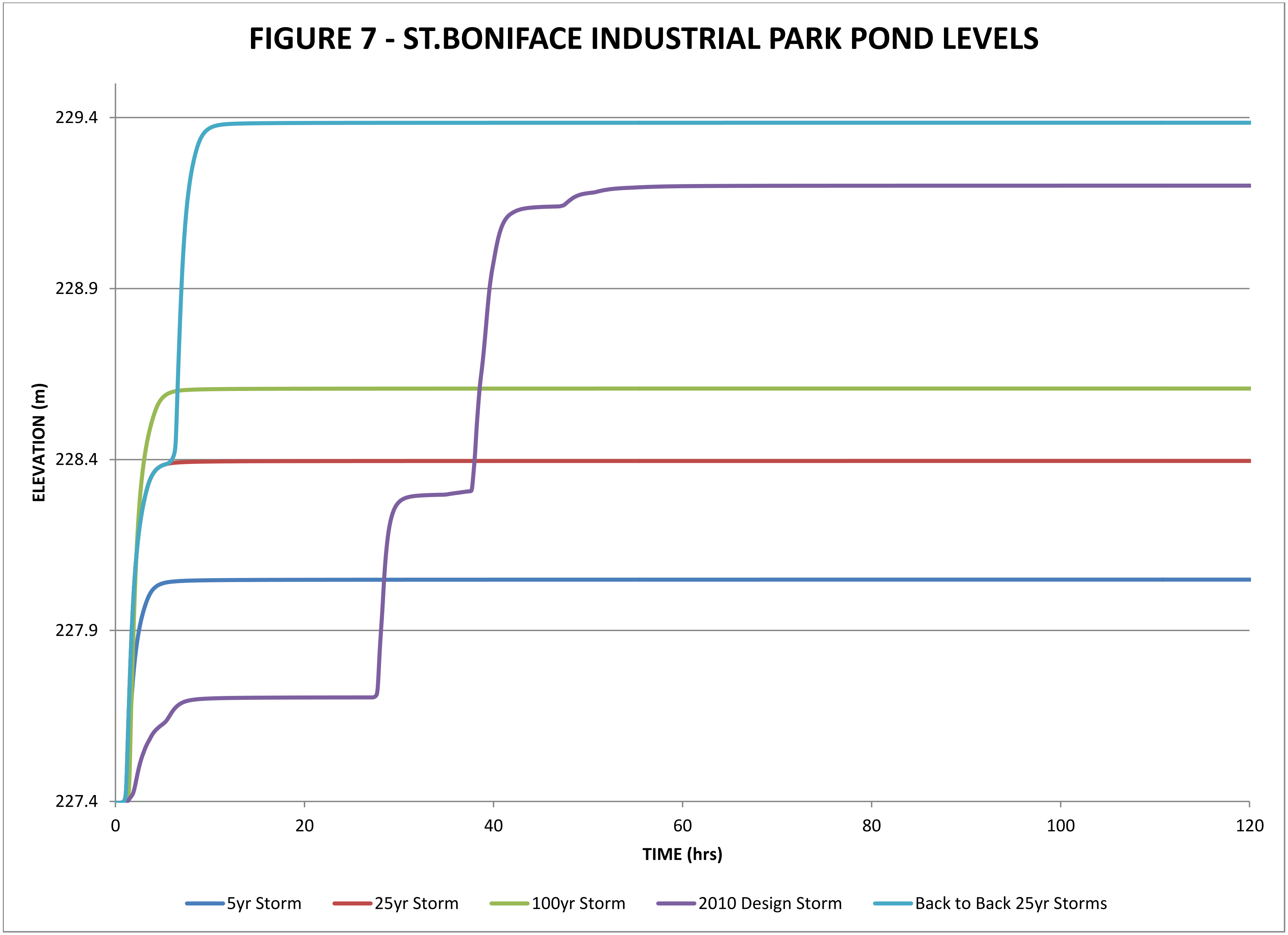

FIGURE 7 - ST.BONIFACE INDUSTRIAL PARK POND LEVELS
ELEVATION (m)
229.4
228.9
228.4
227.9
227.4
0
20
40
60
80
100
120
TIME (hrs)
5yr Storm
25yr Storm
100yr Storm
2010 Design Storm
Back to Back 25yr Storms

APPENDIX A

Sanitary Sewer
Design Spreadsheet

WASTEWATER SEWER DESIGN SHEET **DESCRIPTION:**

OWNER City of Winnipeg
SUBDIV. NAME St. Boniface Industrial Park

Area No.	M.H. From	M.H. To	No. of SF Dwelling Units	No. of MF Dwelling Units	Incremental SF Area (ha)	Incremental MF Area (ha)	Cumulative SF Area (ha)	Cumulative MF Area (ha)	Incremental SF Population (Persons)	Incremental MF Population (Persons)	Incremental Total Population (Persons)	Cumulative Population (Persons)	Peaking Factor M	Peak Res Flow (l/s)	Incremental Com. Area (Ha)	Cumulative Com. Area (Ha)
A	**1**	**2**	**0**	**0**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0**	**0**	**0**	**0**	**4.500**	**0.00**	**0.0000**	**0.0000**
B	**2**	**4**	**0**	**0**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0**	**0**	**0**	**0**	**4.500**	**0.00**	**0.0000**	**0.0000**
C	**3**	**4**	**0**	**0**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0**	**0**	**0**	**0**	**4.500**	**0.00**	**0.0000**	**0.0000**
D	**4**	**5**	**0**	**0**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0**	**0**	**0**	**0**	**4.500**	**0.00**	**0.0000**	**0.0000**
E (Parmalat)	**5**	**6**	**0**	**0**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0**	**0**	**0**	**0**	**4.500**	**0.00**	**0.0000**	**0.0000**

Area No.	Incremental Ind. Area (Ha)	Cumulative Ind. Area (Ha)	Cumulative Total Area (Ha)	Ground Water Infiltration (l/s)	Manhole Inflow (l/s)	Peak Com. Flow (l/s)	Cum Com. Flow (l/s)	Peak Ind. Flow (l/s)	Cum Ind. Flow (l/s)	Peak Design Flow (l/s)	Proposed Sewer Dia. (mm)	Slope %	Crit. Slope %	Des.Slope %	Capacity Q. (l/s)	Velocity (m/s)
A	**34.5190**	**34.5190**	**34.5190**	**0.88**	**6.90**	**0.00**	**0.00**	**15.02**	**15.02**	**22.80**	**250**	**0.25%**	**1.43%**	**0.25%**	**29.73**	**0.61**
B	**7.2080**	**41.7270**	**41.7270**	**1.06**	**8.35**	**0.00**	**0.00**	**3.14**	**18.15**	**27.56**	**250**	**0.30%**	**1.43%**	**0.30%**	**32.57**	**0.66**
C	**31.7830**	**31.7830**	**31.7830**	**0.81**	**6.36**	**0.00**	**0.00**	**13.83**	**13.83**	**20.99**	**250**	**0.25%**	**1.43%**	**0.25%**	**29.73**	**0.61**
D	**4.3260**	**77.8360**	**77.8360**	**1.98**	**15.57**	**0.00**	**0.00**	**1.88**	**33.86**	**51.41**	**375**	**0.15%**	**1.25%**	**0.15%**	**67.91**	**0.61**
E (Parmalat)	**6.4170**	**84.2530**	**84.2530**	**2.15**	**16.85**	**0.00**	**0.00**	**32.47**	**66.33**	**85.32**	**450**	**0.12%**	**1.17%**	**0.12%**	**98.76**	**0.62**

Notes:

Single Family
3.05 Persons per Unit (Single Family)
12.29 Dwellings per Hectare (Single Family)
2.3 Persons per Unit (Multi Family)
74.13 Dwellings per Hectare (Multi Family)

Design Flow Factor, F = 0.003125 l/sec/person
60 I. Gal/person/day = 270 l/person/day
Harmon Factor Pf=1+(14/(4+(p)^.5) P = thousands of persons
2<=Pf<=4.5

Infiltration Factor, Fi = 2200 l/Ha/day
Manhole Inflow 12 l/MH/min
Manhole Quantity 1 MH/Ha

Peak Commerical Flow	28100	L/day/Ha	0.325	L/sec/Ha
Peak Industrial Flow	37600	L/day/Ha	0.435	L/sec/Ha

Calculated By : K. DeVisser
Checked By : D. Mages
Date: Oct. 6, 2015
File: 116809351

based on Parmalat provided avg 70,000 l/h x 1.67 peaking factor = 116,900 l/h = 32.47 l/s as provided by parmalat

APPENDIX B

Detailed Rational Design Spreadsheets

St. Boniface Industrial Park - Outfall #1
SPREADSHEET FOR SEWER DESIGN BY RATIONAL METHOD

Date: 28-Sep-15
Design By: KD

$I=1198/(t+8)^{.828}$ (MacLaren 1974) N = 0.013 Design S= 0.00488169

From	To	Area ha	"c"	A x c	Accum A x c	Time Conc	" I " mm/hr	" Q " m^3/sec	Pipe Diam (mm)	Target Hyd Drop	Design Hyd Drop	v m/sec	L metres	Time min.	Top of Water High (m)	Low TARGET (m)	Low DESIGN	Ground Elev. @ U/S MH m	Actual HGL @ U/S MH m	Actual HGL @ D/S MH m	HGL Depth Below Gutter m	Minimum Pipe Slope %	" Q-full " m^3/sec	Q-des / Q-full
A1	**A2**	**3.322**	**0.6**	**1.99**	**1.99**	**10.0000**	**109.50**	**0.607**	**900**	**0.93**	**0.21**	**0.95**	**190.0**	**3.32**	**232.10**	**231.17**	**231.89**	**232.10**	**231.25**	**231.04**	**0.85**	**0.1**	**0.2610**	**2.32**
A2	**A3**	**4.022**	**0.6**	**2.41**	**4.41**	**13.3203**	**95.18**	**1.166**	**900**	**0.88**	**0.75**	**1.83**	**180.6**	**1.64**	**231.17**	**230.29**	**231.14**	**231.90**	**231.04**	**230.29**	**0.86**	**0.1**	**0.2610**	**4.47**
A3	**A4**	**3.278**	**0.6**	**1.97**	**6.37**	**14.9626**	**89.51**	**1.586**	**1050**	**0.78**	**0.54**	**1.83**	**159.4**	**1.45**	**230.29**	**229.51**	**230.60**	**231.50**	**230.29**	**229.75**	**1.21**	**0.08**	**0.4325**	**3.67**
A4	**A5**	**3.216**	**0.6**	**1.93**	**8.30**	**16.4133**	**85.08**	**1.964**	**1050**	**0.76**	**0.81**	**2.27**	**155.7**	**1.14**	**229.51**	**228.75**	**229.79**	**231.30**	**229.75**	**228.95**	**1.55**	**0.08**	**0.4325**	**4.54**
A5	**A6**	**3.844**	**0.6**	**2.31**	**10.61**	**17.5575**	**81.91**	**2.416**	**1050**	**0.38**	**0.61**	**2.79**	**77.6**	**0.46**	**228.75**	**228.37**	**229.19**	**231.70**	**228.95**	**228.34**	**2.75**	**0.08**	**0.4325**	**5.59**
A7	A8	1.123	0.6	0.67	0.67	10.0000	109.50	0.205	450	0.73	0.77	1.29	148.7	1.92	231.70	230.97	230.93	231.70	229.58	228.81	2.12	0.26	0.0263	7.80
A8	A6	0.791	0.6	0.47	1.15	11.9217	100.68	0.321	450	0.18	0.47	2.02	37.0	0.31	230.97	230.79	230.46	231.70	228.81	228.34	2.89	0.26	0.0263	12.22
A6	**END**	**0.000**	**0.6**	**0.00**	**11.76**	**18.0211**	**80.70**	**2.638**	**1200**	**0.52**	**0.49**	**2.33**	**107.3**	**0.77**	**228.37**	**227.85**	**228.70**	**232.20**	**228.34**	**227.85**	**3.86**	**0.07**	**0.6902**	**3.82**
												SUM L =	**870.6**					Lower Critical HGL by		0.85				

Target = T.O.W. (227.40+0.45=227.85)

Note: Rows are coloured to assist in differentiate between branches off the critical path

St. Boniface Industrial Park - Outfall #2
SPREADSHEET FOR SEWER DESIGN BY RATIONAL METHOD

Date: 28-Sep-15
Design By: KD

$I=1198/(t+8)^{.828}$ (MacLaren 1974) N = 0.013 Design S= 0.00459928

From	To	Area ha	"c"	A x c	Accum A x c	Time Conc	" I " mm/hr	" Q " m^3/sec	Pipe Diam (mm)	Target Hyd Drop	Design Hyd Drop	v m/sec	L metres	Time min.	Top of Water High (m)	Low TARGET (m)	Low DESIGN	Ground Elev. @ U/S MH m	Actual HGL @ U/S MH m	Actual HGL @ D/S MH m	HGL Depth Below Gutter m	Minimum Pipe Slope %	" Q-full " m^3/sec	Q-des / Q-full
B1	**B2**	**2.411**	**0.6**	**1.45**	**1.45**	**10.0000**	**109.50**	**0.440**	**750**	**0.87**	**0.30**	**1.00**	**190.0**	**3.18**	**232.20**	**231.33**	**231.90**	**232.20**	**231.43**	**231.13**	**0.77**	**0.13**	**0.1435**	**3.07**
B2	**B3**	**2.144**	**0.6**	**1.29**	**2.73**	**13.1770**	**95.71**	**0.727**	**750**	**0.45**	**0.42**	**1.65**	**97.4**	**0.99**	**231.33**	**230.88**	**231.49**	**231.90**	**231.13**	**230.72**	**0.77**	**0.13**	**0.1435**	**5.07**
B7	B3	0.763	0.6	0.46	0.46	10.0000	109.50	0.139	300	0.12	0.56	1.97	26.9	0.23	232.10	231.98	231.54	232.10	231.28	230.72	0.82	0.45	0.0068	20.39
B3	**B4**	**0.000**	**0.6**	**0.00**	**3.19**	**14.1632**	**92.17**	**0.818**	**750**	**0.52**	**0.61**	**1.85**	**112.5**	**1.01**	**230.88**	**230.36**	**230.88**	**232.60**	**230.72**	**230.11**	**1.88**	**0.13**	**0.1435**	**5.70**
B4	**B5**	**3.259**	**0.6**	**1.96**	**5.15**	**15.1763**	**88.82**	**1.271**	**900**	**1.10**	**1.18**	**2.00**	**240.0**	**2.00**	**230.36**	**229.26**	**229.70**	**231.90**	**230.11**	**228.93**	**1.79**	**0.1**	**0.2610**	**4.87**
B5	**B6**	**2.839**	**0.6**	**1.70**	**6.85**	**17.1789**	**82.93**	**1.579**	**1050**	**0.96**	**0.70**	**1.82**	**208.1**	**1.90**	**229.26**	**228.30**	**229.00**	**231.70**	**228.93**	**228.23**	**2.77**	**0.08**	**0.4325**	**3.65**
B6	**END**	**1.682**	**0.6**	**1.01**	**7.86**	**19.0807**	**78.08**	**1.706**	**1050**	**0.45**	**0.38**	**1.97**	**97.8**	**0.83**	**228.30**	**227.85**	**228.62**	**231.30**	**228.23**	**227.85**	**3.07**	**0.08**	**0.4325**	**3.94**
												SUM L =	**945.8**					Lower Critical HGL by		0.77				

Target = T.O.W. (227.40+0.45=227.85)

Note: Rows are coloured to assist in differentiate between branches off the critical path

APPENDIX C

Servicing Criteria Sheets

CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

SERVICING CRITERIA

TO BE SUBMITTED AS PART OF
APPROVAL PROCESS WITH SERVICING PLANS

LOCATION: St. Boniface Industrial Park

DRAWING REFERENCES: Figures 1.0 – 7.0, Appendix A - C

SUBMITTED BY (FIRM): Stantec Consulting Inc. DATE: Nov 2015

WATER:

SERVICE AREA: (See Figure 1.0)

Present: 7.66 ha
Ultimate: 84.25 ha

FEEDPOINT LOCATIONS: Plug on Mazenod Road, south of Camiel Sys Street
Plug on Ray Marius Road at Camiel Sys Street

FEEDPOINT DESIGN PRESSURE (max day demand conditions):
-440 kPa and 444 kPa

DESIGN FLOWS:

	Average		Peak		Fire	
Residential (single family)		L/c/d		L/c/d		L/s
Residential (multi family)		L/c/d		L/c/d		L/s
Commercial		L/d/ha		L/c/d		L/s
Industrial	22,500	L/c/d		L/c/d	250	L/s

MINIMUM SYSTEM PRESSURES:

Max. Hour: 207 (30) kPa (psi)

Fire: 140 (20) kPa (psi)

WASTEWATER

SERVICE AREA: (See Figure 2.0)

Present: 7.66 ha
Ultimate: 84.55 ha

DESIGN FLOWS:

		Average		Peak
Residential			L/c/d	Harmon's Peaking Factor
Commercial			L/c/d	28,100 L/hectare/day
Industrial			L/c/d	37,600 L/hectare/day

EXTRANEOUS FLOW ALLOWANCE:

Ground Water Infiltration: 2200 L/hectare/day
Manhole Inflow : 12 l/mh/min

GENERATED FLOWS FROM TOTAL SYSTEM:

Maximum: 85.32 l/s

LIFT STATION:

N/A

Note: See attached Appendix A for detailed computations.

LAND DRAINAGE

SERVICE AREA: (See Figure 4.0, 5.0 & 6.0)

Present: 9.85 ha

Ultimate: 93.58 ha

PIPE SYSTEM:

Method Used: Rational X , Hydrograph ____.

Design Storm: (State formula used) $i = 1198/(t+8)^{0.828}$ (MacLaren 1974)

Design Hydraulic Grade Line - Minimum distance below gutter
(Degree of surcharge): Top of water at minimum 0.15m below gutter elevation

Describe any runoff retardation devices employed: Retention Pond

Runoff Coefficients or % Imperviousness:

	Rational Method			Hydrograph Method
	Coefficient	Inlet Time		% Imperviousness
Single Family Dwelling				
- conventional				
- zero lot line				
Multiple Family				
Apartments				
Commercial				
Parks				
Industrial	0.60	10	Min.	

See Detailed Rational Spreadsheets for maximum generated flows from each outfall (Appendix B)

All Industrial Sites are to be controlled to a C-Value of 0.60.

RETENTION SYSTEM:

Rainfall Formula: 25-year storm; $i = 1842/(t+9)^{0.842}$ (MacLaren 1974)
100-year storm; $i = 2318/(t+8)^{0.8555}$ (Acres 1978)

Normal Water Level (Elevation): 227.400 m

For Selected Rainfall Storms: See results in report section.

SUBMITTED BY: D. Mages, C.E.T, P.Eng.

DATE: November 2015

SEAL:

PROVINCE OF MANITOBA
D.P. MAGES
MEMBER
23458
REGISTERED PROFESSIONAL ENGINEER

APEGM
Certificate of Authorization
Stantec Consulting Ltd.
No. 1301 Date: October 2015

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