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March 8, 2019 SBM-17-2126

Corporation of the Municipality of Central Elgin
450 Sunset Drive
St. Thomas, ON N5R 5V1

Attention: Mr. Lloyd Perrin, Director of Physical Services

Re: Servicing and Stormwater Management Feasibility Study
Proposed Subdivision Development – Craigholme Phase 6

1. INTRODUCTION

This Servicing and Preliminary Stormwater Management (SWM) Feasibility Study (Study) has been prepared by Strik Baldinelli Moniz Ltd (SBM) to provide preliminary servicing and stormwater management design flows and storage requirements for the Craigholme subdivision, Phase 6 in Belmont, Ontario.

The site is bordered by the Seventh Ave Right-of-way (R.O.W.) to the north, existing single-family residential lands to the east and agricultural/open space to the south and west. It is our understanding that the proposed development is to include 236 single family residential units and 48 semi-detached units and a block for stormwater management.

2. SANITARY SERVICING

As per the Craigholme Subdivision Phase 5 Drawings by Parsons provided in Appendix A, there is a 250 mm diameter sanitary service stub, capped at the southeast of the development limit within a servicing easement. The existing stub capped at property line has been designed for a population of 800 people with a total area of 16.456 ha. The design sheet provided in Appendix A, for the Phase 5 lands has a peak flow for the Phase 6 lands of 17.59 L/s. The Phase 6 residential subdivision sanitary sewers are to be connected to the existing sanitary manhole SA-2 within the Kettle Creek Drive Right-of-Way via the existing plug.

This proposed development is to include 236 single family units and 48 semi-detached units. The population for the entire development was calculated using the population density of 3.5 people per unit, as per the Municipality of Central Elgin Design Guidelines and Construction Standards (DG&CS). The sanitary peak flow was calculated by multiplying population for the entire site by the average usage of 400 litres per day per capita, and the Harmon peaking factor “M”. The sanitary design flow peak for the entire site area was calculated by adding residential and the infiltration allowance of 0.20 litres per second per hectare. These calculations are provided in the sanitary sewer design sheet provided in Appendix B by SBM. The sanitary sewer design sheet shows that the proposed 250 mm diameter sanitary sewers at the proposed slopes have sufficient capacity to convey the peak design flow of 20.76 L/s to existing sanitary manhole SA-2.

As per Parsons Sanitary Design Sheet for the Phase 5 lands provided in Appendix A, the existing sanitary stub capped at the property limit within the municipal easement was designed for a catchment area of 16.456 ha and a population of 800 people. As per Parsons design sheets the designed flow from the Phase 6 Lands is 17.59 L/s which is 3.17 L/s less than the calculated flows per SBM’s design sheet in Appendix B. Design sheets provided by Parsons show that the minimum additional capacity downstream prior to the ultimate outlet is 11.76 L/s and therefore it is determined there is available capacity within

the downstream sanitary sewers for the increase in flows of 3.71 L/s. Municipality to review and advise if downstream sewers, lift station, treatment plant etc. have capacity for the slight increase in original design flows.

3. STORM WATER MANAGEMENT AND STORM SERVICING

2.1 Design Criteria

The following SWM management criteria were established for this site:

- Quantity Controls
  - The post-development flows generated from the site during the 2-year to 100-year design storms are to be attenuated to the pre-development levels.

- *Grading and Drainage Controls*
  - Grading will direct overland flows to the proposed on-site dry pond and released to the existing creek/wetland via outlets within the SWM Block matching pre-development levels or less for each storm event.

- Quality Controls
  - A normal level of stormwater quality control (70% total suspended solids [TSS] removal) is proposed on site and will be accomplished through a treatment train approach using soakaway pits, snouts in road catch basins and Oil/Grit Separator (OGS) units.

2.2 Hydrologic Model

Hydrologic modelling was performed using SWMM 5.1, a widely-accepted model for urban developments, to generate runoff hydrographs and route flows through the storage structures.

2.2.1 Rainfall Data

Based on Municipal requirements, St. Thomas intensity-duration-frequency (IDF) curves for the 2, 5, 10, 25, 50 and 100-year return periods are as follows:

Return Period (Years)	Parameters			Duration (Hours)
	a	b	c	
2	747.965	7.4671	0.80481	3
5	1007.053	7.382	0.80404	3
10	1181.284	7.382	0.80397	3
25	1373.601	7.1064	0.80091	3
50	1507.588	6.8754	0.79819	3
100	1660.599	6.8754	0.79783	3

Table 1: St. Thomas IDF Curves

A Chicago storm distribution with the IDF curves provided in Table 1 and the fraction r = 0.35 was used in the SWMM model.

2.2.2 Pre-Development Conditions

Under pre-development conditions, the site is an open field with a wetland feature at the south of the property. As per the topographic survey completed by MTE Consultants Inc., the entire site drains to the south west corner of the property. Refer to the provided figure attached for the pre-development catchment area.

SCS curve numbers of 86 and 80 were determined for the pervious areas (Pre and Post Development) and 98 for impervious areas, based on an assumed Hydrologic Soil Group D and 'good' contoured row crops for pre-development and 'good' pasture/range for post-development based on Ministry of Transportation (MTO) Design Chart 1.09.

The pre-development catchment parameters are as follows:

Catchment	Area (ha)	% Impervious	Overland Flow Width (m)	Overland Slope (%)	SCS Curve Number
A100	19.659	0	278	3	86

Table 2: Pre-Development Catchment Parameters

The pre-development catchment parameters provided in Table 2 were used in the SWMM 5.1 model and pre-development peak flow rates of 0.08 m^3/s and 0.65 m^3/s at OUT100 (inlet to proposed SWM dry pond for the post-development catchment area), were generated for the 2 and 100-year design storms.

2.2.3 Post-Development Conditions.

The post-development conditions and catchment areas are shown on the attached figure.

The post-development catchment parameters are as follows:

Catchment	Area (ha)	% Impervious	Width (m)	Overland Slope (%)	SCS Curve Number
A200	19.659	37.39	278	3	80

Table 3: Post-Development Catchment Parameters

The post-development catchment parameters provided in Table 3 were used in the SWMM 5 model and post-development flow rates, flowing from ST200 (Dry Pond Facility) via the proposed 295 mm orifice (O200) and 3.5m by 0.3m weir (W200), were generated for the 2 to 100-year design storms and can be seen in Table 4. Table 4 shows no flows through the weir during any of the design storms due to maximizing the dry pond for the available space within the SWM block. This will be further refined in detailed design, but post-development flows will remain equal to or less than pre-development flows. The 2 and 100-year post-development output files are attached.

SWMM5 Model Result Summary							
Design Storm Event	**Existing Conditions Peak Runoff (m^3/s)**	**Proposed Conditions Peak Discharge - Orifice (m^3/s)**	**Proposed Conditions Peak Discharge - Weir (m^3/s)**	**Proposed Conditions Total Peak Discharge (m^3/s)**	**Dry-Basin Peak Attenuation (m^3)**	**Dry-Basin Peak Ponding Elev. (m)**	**Dry-Basin Peak Ponding Depth. (m)**
2-Year	0.08	0.079	0.000	0.079	1,880	257.43	0.58
5-Year	0.18	0.112	0.000	0.112	2,942	257.71	0.86
10-Year	0.27	0.134	0.000	0.134	3,773	257.92	1.07
25-Year	0.41	0.159	0.000	0.159	4,913	258.18	1.33
50-Year	0.52	0.176	0.000	0.176	5,822	258.38	1.53
100-Year	0.65	0.191	0.000	0.191	6,787	258.57	1.72

Table 4: Model Result Summary

The post-development flows generated from the site during the 2-year design storm are to be attenuated to the 2-year pre-development levels via a 295mm orifice. Larger storms up to the 100-year design storm are to be released at a maximum of 0.65m^3/s through the proposed orifice and weir matching pre-development conditions of the site. The outlet pipe will be directed to a spreader swale to distribute the flows to the wetland as sheet flow rather than a concentrated flow.

Through completion of a water balance for the wetland feature, the quantity of additional flows to the upstream portion of the wetland will be accommodated through rear yard drainage, if necessary, a second pipe system conveying clean roof/rear yard water to the feature.

The preliminary SWM Block, based on a constant top of pond elevation of 259.85, internal side slopes of 4:1 and external side slopes of 3:1 with a max depth of 3.00m (top of pond = 259.85 m.a.s.l minus outlet invert of 256.85 m.a.s.l), yields a total storage volume of approximately 14,323 m^3. This calculated preliminary storage volume, based on the revised draft plan would be sufficient to attenuate the 2 to 100-year design storms to pre-development levels as shown above but would further be refined within detailed design.

2.3 Quality Controls

To achieve quality control for the proposed development, we are proposing a treatment train approach. We will be implementing side and rear yard grassed swales and low-slope grading (where feasible) to promote pre-treatment and polishing, increase flow length/time of concentration and promote evapotranspiration. It is proposed to implement soakaway pits on each lot to infiltrate 20mm off of the rooftops where grading and groundwater levels allow and snouts within the on street catch basins. Prior to discharging to the existing creek/wetland, an OGS unit will be incorporated downstream of the pond outlet to provide a normal level of treatment (70% T.S.S removal).

4. WATER SERVICING

As per the Craigholme Subdivision Phase 4 & 5 Drawings by Parsons., there are 200 mm diameter water services stubbed at the R.O.W. limits of Snyders Avenue adjacent to Landon Lane and Anita Court. There is also a 200mm diameter watermain stubbed at property line within the municipal easement off of Kettle Creek Drive. Through the construction of the Phase 3 development, a 300 mm watermain was extended from Kettle Creek Drive to Snyders Avenue within the Seventh Ave R.O.W. Through detailed design, the proposed development of the Phase 6 lands, will connect into existing water services through the extension of Landon Lane and the water service within the municipal easement. If required, the 300mm diameter watermain along Seventh Ave will be extended to the development's entrance for a third water connection to provide a sufficient looped system.

It is our understanding that watermain modelling of the water distribution system was not completed for the previous phases to confirm capacity for the proposed development, however, this will be completed during the detailed design phase for Phase 6 to confirm required watermain sizing to provide for the domestic and fire demands.

5. SUMMARY

Based on the above, the proposed stormwater quantity controls will restrict flows to pre-development levels or less and quality controls utilizing a "treatment train" approach will provide the required normal level of treatment (70% TSS removal) or greater.

6. LIMITATIONS

This Brief was prepared by Strik, Baldinelli, Moniz Ltd. for Craigholme Estates Ltd., the Municipality of Central Elgin, and Kettle Creek Conservation Authority. Use of this Brief by any third party, or any reliance upon its findings, is solely the responsibility of that party. Strik, Baldinelli, Moniz Ltd. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions undertaken as a result of this report. Third party use of this report, without the express written consent of the Consultant, denies any claims, whether in contract, tort, and/or any other cause of action in law, against the Consultant

All findings and conclusions presented in this Brief are based on the conditions as they appeared during the period of the review. This Brief is not intended to be exhaustive in scope or to imply a risk-free property. It should be recognised that the passage of time may alter the opinions, conclusions, and recommendations provided herein.

SBM's review was limited to the documents referenced above and/or on the SBM drawings provided separately. SBM Ltd. accepts no responsibility for the accuracy of the information provided by others. All designs and recommendations presented in this brief are based on the information available at the time of the review. If you have any questions or require additional information, please do not hesitate to contact the undersigned.

Respectfully submitted,

Strik, Baldinelli, Moniz Ltd.
Civil • Structural • Mechanical • Electrical

Kevin Moniz, P.Eng.
Principal, Civil Engineering

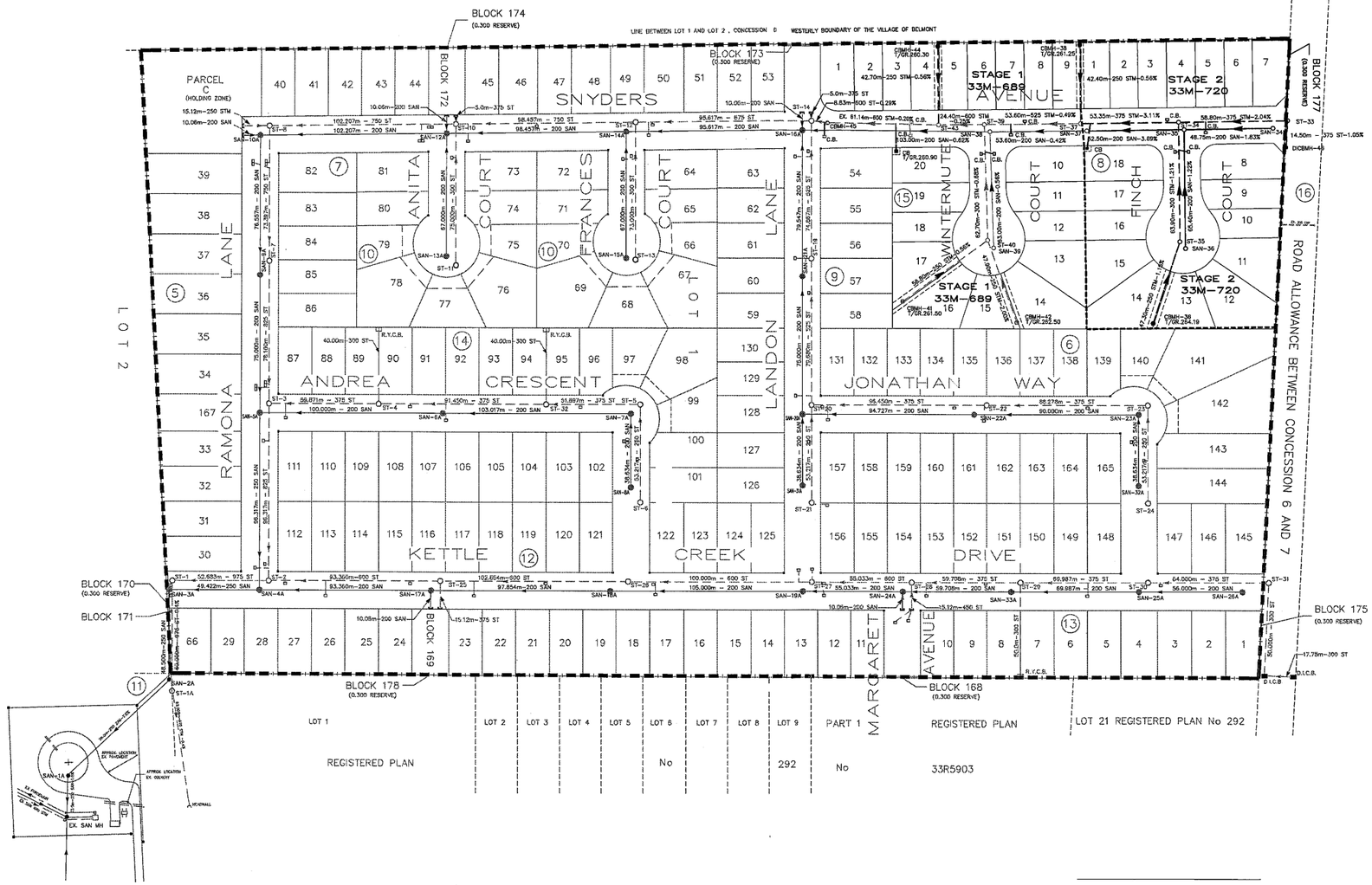
Ryan Maguire, E.I.T.
Engineer In Training

APPENDIX A

Parsons's Phase 4 Storm and Sanitary Key Plan
Parson's Phase 4 Water Distribution System
Parsons's Phase 5 Sanitary Drainage Key Plan
Parsons's Phase 5 Sanitary Design Sheet
Parsons's Phase 5 Watermain Key Plan
Parson's Phase 5 Kettle Creek & Sanitary Easement Plan and Profile Drawings

PART 1

REGISTERED PLAN No 33R



LEGEND:

- EXISTING SANITARY SEWER/MANHOLE
- NEW SANITARY SEWER/MANHOLE
- EXISTING STORM SEWER/MANHOLE
- NEW STORM SEWER/MANHOLE
- SINGLE CATCHBASIN
- CURB INLET CATCHBASIN
- CATCHBASIN – MANHOLE
- 25.4mm SQUARE IRON BAR
- (7) REFERENCE NUMBER FOR PLAN & PROFILE DRAWING
- STAGE 2 BOUNDARY

AS CONSTRUCTED NOTES
1 SEE DRAWING No. FOR FURTHER DETAIL
2 SEWER DESIGN; TRANSITION WIDTH OR AS NOTED
3 REFERENCE B.M. No. ELEVATION
4
5

AS CONSTRUCTED SERVICES	COMPLETION
SAN. SEWERS, P.D.C.'S & M.H.'S	NOV. 2016
ST. SEWERS, P.D.C.'S & M.H.'S	NOV. 2016
W.M. & W.S.C.'S	NOV. 2016
GRANULAR BASE	MAR. 2017
CURBS & GUTTER	APR. 2017
PAVING – BASE	APR. 2017
– SURFACE	

DESIGN	D.M.
DRAWN	D.M.
CHECKED	R.P.
APPROVED	T.L.F.
DATE	DEC/2005

DELCAN
PROJECT No.
07-1681

NO	REVISIONS	DATE	BY
1.	REVISED AS PER CENTRAL ELGIN COMMENTS	APRIL 17/06	RG
2.	APPROVED DRAWING	SEPT. 02/14	D.M.
3.	AS CONSTRUCTED – STAGE 1	SEPT. 2015	D.M.
4.	AS CONSTRUCTED – STAGE 2	JUNE 2017	D.M.

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ENGR'S STAMP

LICENSED PROFESSIONAL ENGINEER
H.E. HUOTARI
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The Corporation of the Municipality of Central Elgin

SCALE
10m 0 30m
Horizontal 1:1250

CRAIGHOLME ESTATES LTD.
JOE SNYDER CONSTRUCTION LTD. BELMONT ONT.

PHASE 4
STORM & SANITARY KEY PLAN

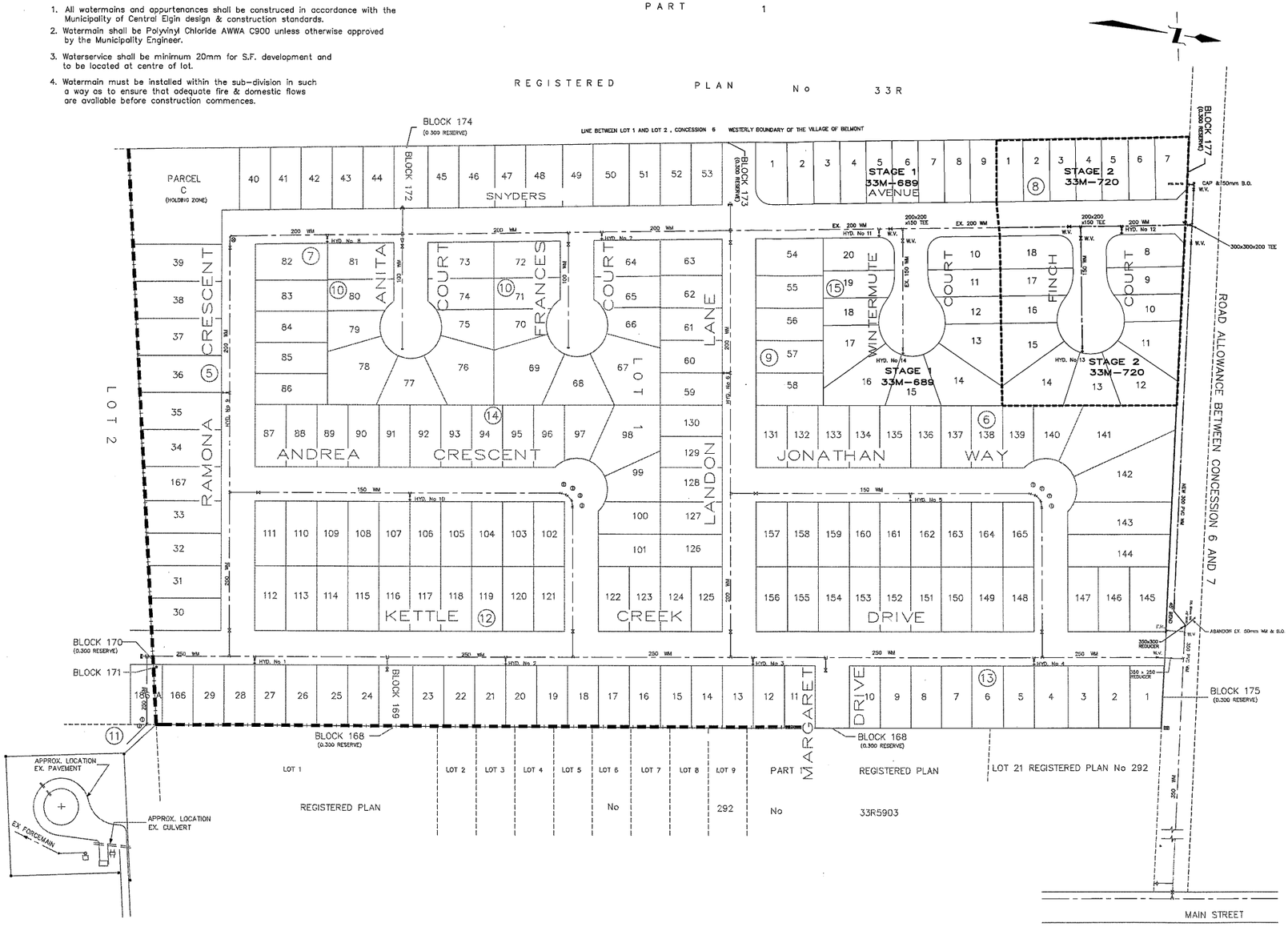
PROJECT No.
SHEET No.
DRAWING No. 1
PLAN FILE No.

NOTES RE: WATERMAINS:

1. All watermains and appurtenances shall be constructed in accordance with the Municipality of Central Elgin design & construction standards.
2. Watermain shall be Polyvinyl Chloride AWWA C900 unless otherwise approved by the Municipality Engineer.
3. Waterservice shall be minimum 20mm for S.F. development and to be located at centre of lot.
4. Watermain must be installed within the sub-division in such a way as to ensure that adequate fire & domestic flows are available before construction commences.

PART 1

REGISTERED PLAN No 33R



AS CONSTRUCTED NOTES	AS CONSTRUCTED SERVICES	COMPLETION
1 SEE DRAWING No. FOR FURTHER DETAIL		
2 SEWER DESIGN; TRANSITION WIDTH OR AS NOTED		
3 REFERENCE B.M. No. ELEVATION		
4		
5		

DESIGN	D.M.
DRAWN	D.M.
CHECKED	R.P.
APPROVED	T.L.F.
DATE	DEC/2005
DELCAN PROJECT No.	07-1681

NO	REVISIONS	DATE	BY
1.	REVISED AS PER CENTRAL ELGIN COMMENTS	APRIL 17/06	RG
2.	APPROVED DRAWING	SEPT. 02/14	D.M.
3.	STAGE 2 SUBMISSION	JUNE 13/16	D.M.
4.	REVISED 350 WM CONNECTION AT KETTLE CREEK DRIVE	OCT. 27/16	D.M.
5.	REVISED MANNING DRIVE W.M. TO 300mm	NOV. 22/16	D.M.
6.	AS CONSTRUCTED - STAGE 1	SEPT. 2015	D.M.
7.	AS CONSTRUCTED - STAGE 2	JUNE 2017	D.M.

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SCALE

10m 0 30m
Horizontal 1:1250

CRAIGHOLME ESTATES LTD.
JOE SNYDER CONSTRUCTION LTD. BELMONT ONT.

PHASE 4
WATER DISTRIBUTION SYSTEM

DRAWING No. 4

PROJECT No.
SHEET No.
PLAN FILE No.

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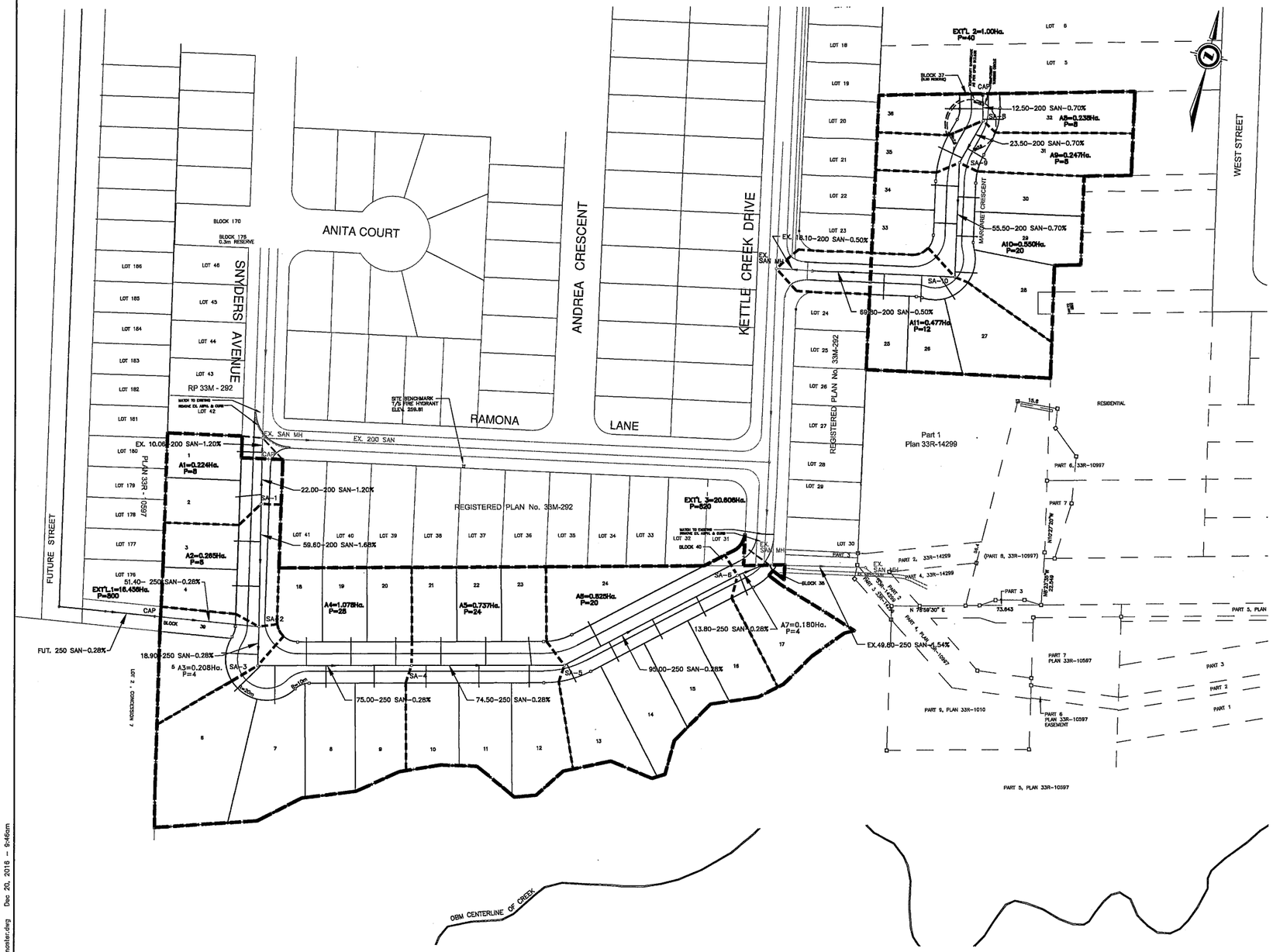

LEGEND

- EX. STORM SEWER
- PROPOSED STORM SEWER
- STORM MANHOLE
- CATCHBASIN/ DITCH INLET C.B.
- EX. SANITARY SEWER
- PROPOSED SANITARY SEWER
- SANITARY MANHOLE
- SUBDIVISION BOUNDARY

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1 SEE DRAWING No. FOR FURTHER DETAIL		
2 SEWER DESIGN; TRANSITION WIDTH OR AS NOTED		
3 REFERENCE B.M. No. ELEVATION		
4		
5		

DESIGN	D.M.
DRAWN	D.M.
CHECKED	R.P.
APPROVED	H.H.
DATE	JUNE 2012
DELCAN PROJECT No.	07-1681

NO	REVISIONS	DATE	BY
1.	REVISION PER MUNICIPALITY REVIEW NOV. 17, 2012	NOV. 23, 2012	D.M.
2.	ENVIRONMENTAL COMPLIANCE APPROVAL APPLICATION	DEC. 19, 2016	D.M.

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SCALE

SCALE - 1 : 1000
10 0 20m
HORIZONTAL

CRAIGHOLME ESTATES LTD.
JOE SNYDER CONSTRUCTION LTD. BELMONT ONT.

PHASE 5
SANITARY KEY PLAN

PROJECT No.	
SHEET No.	
DRAWING No.	3
PLAN FILE No.	

BELMONT ,ONTARIO LOND O.K. 1.000 1000.000
ENTER FREQUENCY YEAR: 2.000 O.K.
PROJECT: CRAIGHOLME ESTATES-PHASE 5
JOB NO: EM1681
DATE : 19-Dec-16

CITY: BELMONT 2.000 YEAR CURVE

STORM SEWER DESIGN SHEET

AREA NO.	LOCATION STREET	NODE FROM	NODE TO	ACCUMULATED STORMWATER FLOWS: INCR. AREA (ha)	ACCUM. AREA (ha)	C	INCR. AxC	TOT. SECT. AxC	TOT. SWR AxC	TOTAL AxCx2.78	TIME OF SECT. (min)	ACCUM. TIME (min)	INTENSITY I	PEAK FLOWS (l/s)	SEWER DESIGN: PIPE DIA. (mm)	SLOPE %	n	CAPACITY (l/s)	VELOCITY (m/s)	LENGTH (m)	TIME (min)	LOSSES (m)	DROP IN NODE (m)	FALL IN SEWER (m)	PROFILE: INVERT ELEV. U/S	INVERT ELEV. D/S
A1	KETTLE CREEK DRIVE	ST-1	ST-2	0.594	0.594	0.35	0.208	0.208	0.208	0.578	20.00	20.00	53.1	30.671	300	0.50	0.013	68.4	1.0	78.80	1.36	0.000	0.000	0.394	257.000	256.606
A2	KETTLE CREEK DRIVE	ST-2	ST-3	0.520	1.114	0.35	0.182	0.182	0.390	1.084	1.36	21.36	50.8	55.081	300	0.50	0.013	68.378	0.967	75.00	1.29	0.100	0.000	0.375	256.506	256.131
A3	KETTLE CREEK DRIVE	ST-3	ST-4	0.460	1.574	0.35	0.161	0.161	0.551	1.532	1.29	20.00	53.1	81.274	375	0.50	0.013	123.977	1.123	76.70	1.14	0.000	0.075	0.384	256.056	255.673
A4	KETTLE CREEK DRIVE	ST-4	ST-5	0.327	1.901	0.35	0.114	0.114	0.665	1.850	1.14	20.00	53.1	98.159	375	0.50	0.013	123.977	1.123	53.80	0.80	0.060	0.000	0.269	255.613	255.344
A5	KETTLE CREEK DRIVE	ST-5	*EX.ST-2*	0.176	2.077	0.35	0.062	0.062	0.727	2.021	0.80	20.00	53.1	107.246	375	0.50	0.013	123.977	1.123	50.00	0.74	0.030	0.000	0.250	255.314	255.064
EXT'L.				1.000	1.000	0.35	0.350	0.350	0.350	0.973	1.29	22.65	48.9	47.564												
A6	MARGARET CRESCENT	CAP	ST-6	0.128	1.128	0.35	0.045	0.045	0.395	1.098	0.00	22.65	48.9	53.653	300	0.50	0.013	68.378	0.967	11.50	0.20	0.000	0.150	0.058	258.965	258.908
A7	MARGARET CRESCENT	ST-6	ST-7	0.128	1.256	0.35	0.045	0.045	0.440	1.222		20.00	53.1	64.854	300	0.50	0.013	68.378	0.967	23.50	0.40	0.030	0.000	0.118	258.878	258.760
A8	MARGARET CRESCENT	ST-7	ST-8	0.291	1.547	0.35	0.102	0.102	0.541	1.505	0.20	22.85	48.6	73.160	375	0.50	0.013	123.977	1.123	53.20	0.79	0.000	0.075	0.266	258.685	258.419
A8	MARGARET CRESCENT	ST-8	*EX.ST-26*	0.240	1.787	0.35	0.084	0.084	0.625	1.739	0.40	20.40	52.4	91.060	375	0.50	0.013	123.977	1.123	89.30	1.33	0.100	0.000	0.447	258.319	257.873
EX.EXT'L.	*KETTLE CREEK DRIVE*	*EX.ST-26*	*EX.ST-25*	*8.370*	*10.157*	*0.35*	*2.930*	*2.930*	*2.930*	*8.144*	*1.09*	*24.54*	*46.4*	*377.602*	*600*	*0.60*	*0.013*	*475.612*	*1.682*	*102.85*	*1.02*	*0.025*	*0.000*	*0.617*	*258.482*	*257.823*
EX.EXT'L.	*KETTLE CREEK DRIVE*	*EX.ST-25*	*EX.ST-2*	*0.855*	*11.012*	*0.35*	*0.299*	*0.299*	*3.229*	*8.975*	*1.02*	*25.56*	*45.1*	*405.116*	*600*	*2.75*	*0.013*	*1018.2*	*3.6*	*93.36*	*0.43*	*0.000*	*0.000*	*2.567*	*257.822*	*255.254*
EX.EXT'L.	*RAMONA LANE*	*EX.ST-3*	*EX.ST-2*	*0.621*	*19.160*	*0.35*	*0.217*	*6.706*	*6.706*	*18.643*	*29.05*	*29.05*	*55.3*	*1030.940*	*825*	*0.45*	*0.013*	*962.921*	*1.801*	*96.32*	*0.89*	*0.093*	*0.000*	*0.433*	*255.413*	*254.980*
EX.EXT'L.	*EASEMENT*	*EX.ST-2*	*EX.ST-1*	*0.330*	*32.579*	*0.35*	*0.116*	*0.116*	*10.777*	*29.960*	*0.89*	*29.94*	*40.7*	*1218.193*	*975*	*0.40*	*0.013*	*1417.369*	*1.898*	*52.68*	*0.46*	*0.225*	*0.000*	*0.211*	*254.755*	*254.544*
EX.EXT'L.	*EASEMENT*	*EX.ST-1*	*EX.ST-1A*	*0.000*	*32.579*	*0.35*	*0.000*	*0.000*	*10.777*	*29.960*	*0.46*	*30.40*	*40.3*	*1205.931*	*975*	*0.40*	*0.013*	*1417.369*	*1.898*	*60.00*	*0.53*	*0.075*	*0.000*	*0.240*	*254.469*	*254.229*
EX.EXT'L.	*EASEMENT*	*EX.ST-1A*	*OUTFALL*	*0.000*	*32.579*	*0.35*	*0.000*	*0.000*	*10.777*	*29.960*	*0.53*	*30.93*	*39.8*	*1192.337*	*975*	*0.40*	*0.013*	*1417.369*	*1.898*	*62.00*	*0.54*	*0.036*	*0.000*	*0.248*	*254.193*	*253.945*

Project: Craigholme Subdivision, Phase 5
Job Number: EM-1681
Date: 07-Apr-16
File: J:\DATA\071681\Phase 5\6a-Docs
City: Belmont

Infiltration Factor (l/s/ha): 0.2
Under Development Factor: 1
Litres/Person/Day: 400

SANITARY DESIGN SHEET

AREA NO.	STREET	MANHOLES FROM	MANHOLES TO	RESIDENTIAL: AREA (ha)	ACCUM. AREA	POP. PER Ha	NO. LOTS	POP. PER LOT	COMMERCIAL: AREA (ha)	POP. PER Ha	POPULATION: INCRES. POP.	ACCUM. POP.	INDUSTRIAL: AREA (ha)	LITRES/ Ha/DAY (l/ha/day)	DESIGN FLOW: PEAKING FACTOR (Harmon)	POP. FLOW (l/s)	Peak Infiltration Flow (l/s)	PEAK FLOW (l/s)	PIPE DATA: DIA. (mm)	SLOPE (%)	n	VEL. (m/s)	CAPACITY (l/s)	LENGTH (m)	DROP IN (m)	FALL IN SEWER (m)	PROFILE: UPSTREAM INVERT (m)	DOWNSTREAM INVERT (m)
A-1	KETTLE CREEK DRIVE	SAN-1	EX. SAN MH	0.224	0.224		2	4			8	8			4.42	0.16	0.04	0.21	200	1.20	0.013	1.14	35.93	22.00	0.030	0.264	256.065	255.801
A-2	KETTLE CREEK DRIVE	SAN-1	SAN-2	0.265	0.265		2	4			8	8			4.42	0.16	0.05	0.22	200	1.68	0.013	1.35	42.51	59.60	0.455	1.001	256.000	254.999
EXT'L. 1			CAP	16.456	16.456		200	4			800	800			3.86	14.30	3.29	17.59	250	0.28	0.013	0.64	31.47					
	EASEMENT	CAP	SAN-2	0.000	16.456		0	4			0	800			3.86	14.30	3.29	17.59	250	0.28	0.013	0.64	31.47	51.40	0.455	0.144	255.097	254.953
A-3	KETTLE CREEK DRIVE	SAN-2	SAN-3	0.208	16.929		1	4			4	812			3.86	14.50	3.39	17.88	250	0.28	0.013	0.64	31.47	18.90	0.100	0.053	254.853	254.800
A-4	KETTLE CREEK DRIVE	SAN-3	SAN-4	1.078	18.007		7	4			28	840			3.85	14.96	3.60	18.56	250	0.28	0.013	0.64	31.47	75.00	0.058	0.210	254.742	254.532
A-5	KETTLE CREEK DRIVE	SAN-4	SAN-5	0.737	18.744		6	4			24	864			3.84	15.36	3.75	19.11	250	0.28	0.013	0.64	31.47	74.50	0.030	0.209	254.502	254.294
A-6	KETTLE CREEK DRIVE	SAN-5	SAN-6	0.825	19.569		5	4			20	884			3.83	15.69	3.91	19.60	250	0.28	0.013	0.64	31.47	95.00	0.030	0.266	254.264	253.998
A-7	KETTLE CREEK DRIVE	SAN-6	EX. SAN MH	0.180	19.749		1	4			4	888			3.83	15.76	3.95	19.71	250	0.28	0.013	0.64	31.47	13.80	0.030	0.039	253.968	253.929
EXT'L 2			CAP	1.000	1.000		10	4			40	40			4.33	0.80	0.20	1.00										
A-8	MARGARET CRESCENT	CAP	SAN-8	0.238	1.238		2	4			8	48			4.32	0.96	0.25	1.21	200	0.70	0.013	0.87	27.44	12.50	0.000	0.088	258.248	258.161
A-9	MARGARET CRESCENT	SAN-8	SAN-9	0.247	1.485		2	4			8	56			4.30	1.12	0.30	1.41	200	0.70	0.013	0.87	27.44	23.50	0.030	0.165	258.131	257.966
A-10	MARGARET CRESCENT	SAN-9	SAN-10	0.550	2.035		5	4			20	76			4.27	1.50	0.41	1.91	200	0.70	0.013	0.87	27.44	55.50	0.030	0.389	257.936	257.548
A-11	MARGARET CRESCENT	SAN-10	CAP	0.477	2.512		3	4			12	88			4.26	1.73	0.50	2.24	200	0.50	0.013	0.74	23.19	69.80	0.100	0.349	257.448	257.099
	MARGARET CRESCENT	CAP	EX. SAN MH	0.000	2.512		0	4			0	88			4.26	1.73	0.50	2.24	200	0.50	0.013	0.74	23.19	18.10	0.000	0.091	*257.099*	*257.008*
EXT'L. 3	EX. KETTLE CREEK DRIVE	EX.SAN MH	EX.SAN MH	20.606	20.606		205	4			820	820			*3.85*	*14.63*	*4.12*	*18.75*	*250*	*0.44*	*0.013*	*0.80*	*39.45*	*50.80*	*0.455*	*0.224*	*254.090*	*253.865*
	EASEMENT	EX.SAN MH	EX.SAN MH	0.000	42.867		0	4			0	1796			*3.62*	*30.11*	*8.57*	*38.69*	*250*	*1.54*	*0.013*	*1.50*	*73.80*	*49.80*	*0.098*	*0.767*	*253.831*	*253.064*

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AS CONSTRUCTED NOTES
1 SEE DRAWING No. FOR FURTHER DETAIL
2 SEWER DESIGN; TRANSITION WIDTH OR AS NOTED
3 REFERENCE B.M. No. ELEVATION
4
5

AS CONSTRUCTED SERVICES | COMPLETION

DESIGN D.M.
DRAWN D.M.
CHECKED R.P.
APPROVED M.H.
DATE JUNE 2012
DELCAN
PROJECT No. 07-1681

NO	REVISIONS	DATE	BY
1.	REVISION PER MUNICIPALITY REVIEW NOV. 17, 2012	NOV. 23, 2012	D.M.
2.	ENVIRONMENTAL COMPLIANCE APPROVAL APPLICATION	DEC. 19, 2016	D.M.

CONSULTANT OR DIVISION
PARSONS
1099 WELLINGTON ROAD SOUTH, SUITE 214
LONDON, ONTARIO, CANADA
N6E 2H6 TEL (519) 681-8771 FAX: (519) 681-4995

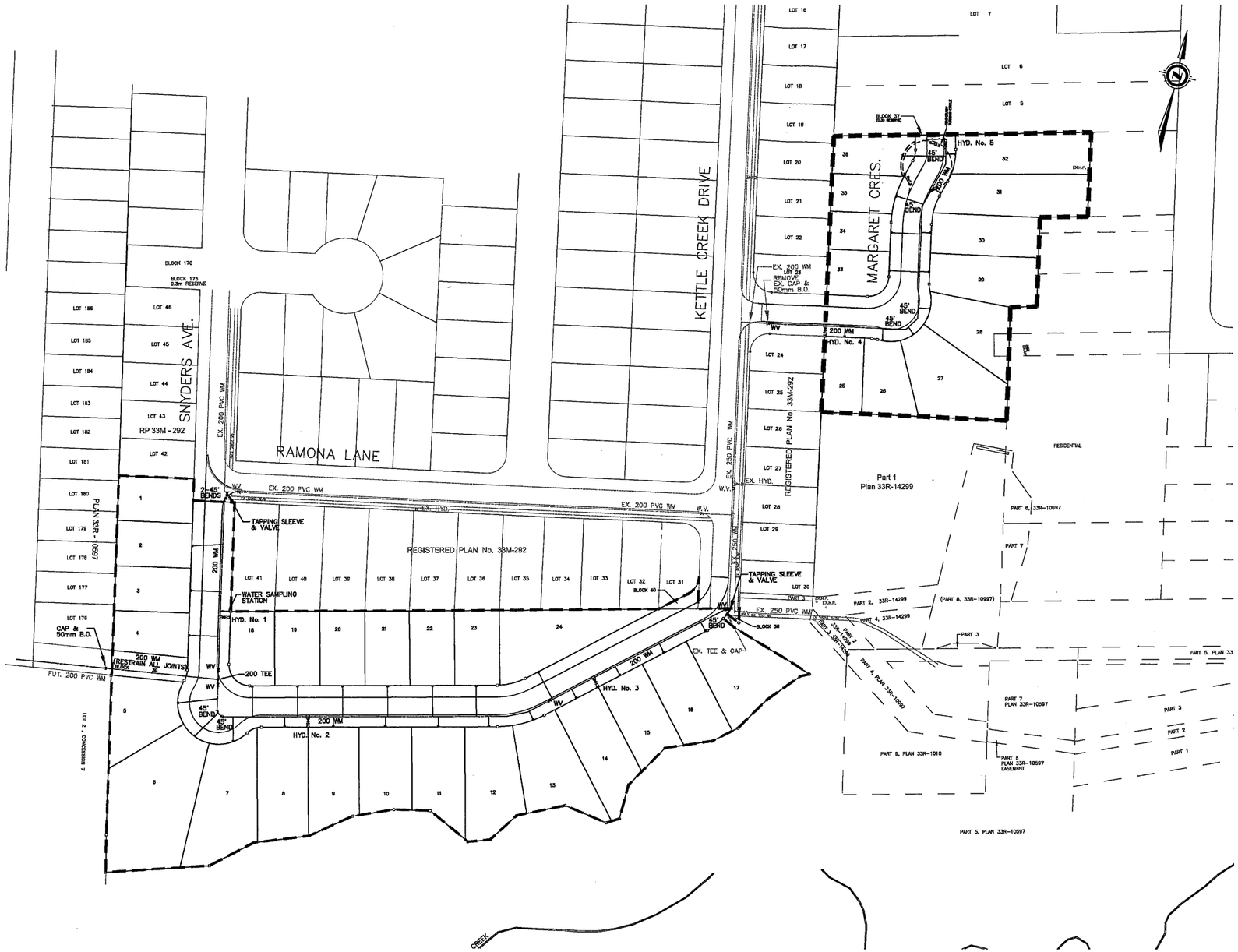
ENGR'S STAMP
LICENSED PROFESSIONAL ENGINEER
H.E. HOOTARI
Dec. 19/16
PROVINCE OF ONTARIO

The Corporation of the Municipality of Central Elgin

SCALE

CRAIGHOLME ESTATES LTD.
JOE SNYDER CONSTRUCTION LTD. BELMONT ONT.
PHASE 5
STORM & SANITARY DESIGN SHEETS
DRAWING No. 4

PROJECT No.
SHEET No.
PLAN FILE No.



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AS CONSTRUCTED NOTES	AS CONSTRUCTED SERVICES	COMPLETION
1 SEE DRAWING No. FOR FURTHER DETAIL		
2 SEWER DESIGN; TRANSITION WIDTH OR AS NOTED		
3 REFERENCE B.M. No. ELEVATION		
4		
5		

DESIGN	D.M.
DRAWN	D.M.
CHECKED	R.P.
APPROVED	H.H.
DATE	JUNE 2012

E.N.G.I.N.

PROJECT No. 07-1681

NO	REVISIONS	DATE	BY
1.	REVISIONS PER MUNICIPALITY REVIEW NOV. 17, 2012	NOV. 23, 2012	D.M.
2.	ENVIRONMENTAL COMPLIANCE APPROVAL APPLICATION	DEC. 19, 2016	D.M.

CONSULTANT OR DIVISION

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1069 WELLINGTON ROAD SOUTH, SUITE 214
LONDON, ONTARIO, CANADA
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ENGR'S STAMP

LICENSED PROFESSIONAL ENGINEER
H.E. HOOTARI
Dec 19/16
PROVINCE OF ONTARIO

The Corporation of the Municipality of Central Elgin

SCALE

SCALE - 1 : 1000
10 0 20m
HORIZONTAL

CRAIGHOLME ESTATES LTD.
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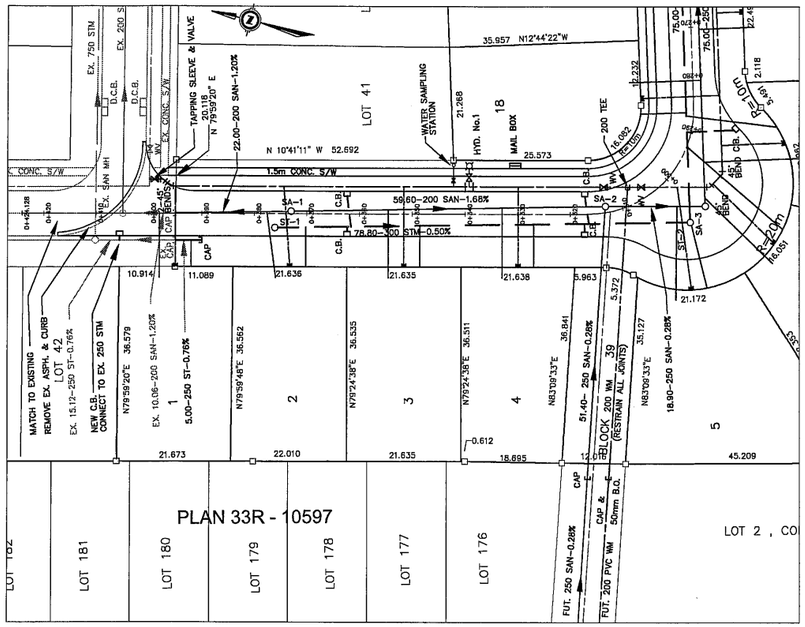
PHASE 5
WATERMAIN KEY PLAN

PROJECT No.

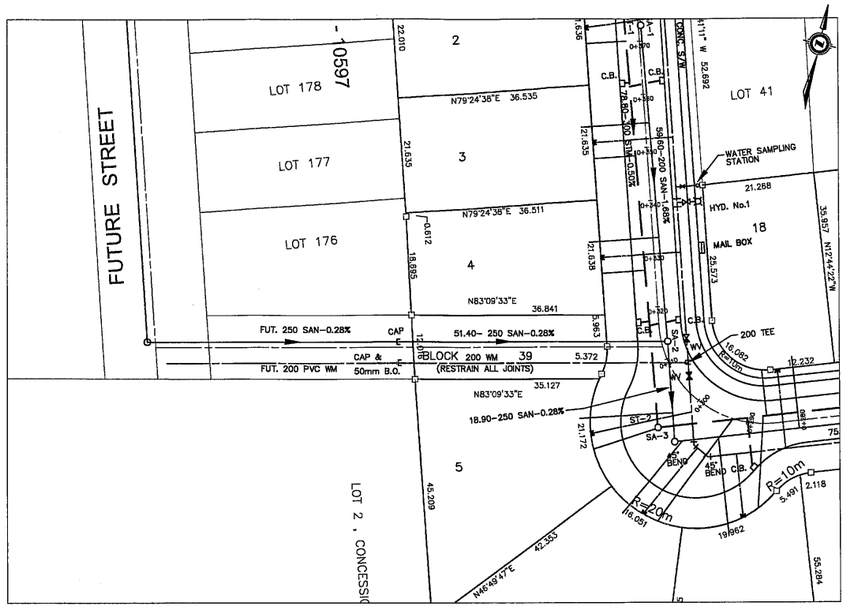
SHEET No.

DRAWING No. 5

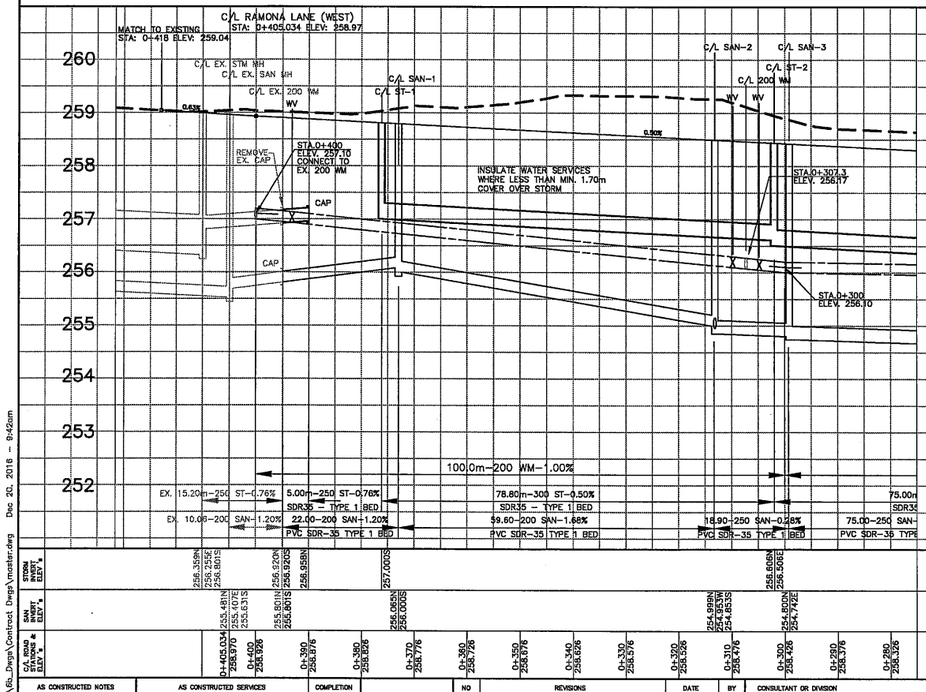
PLAN FILE No.

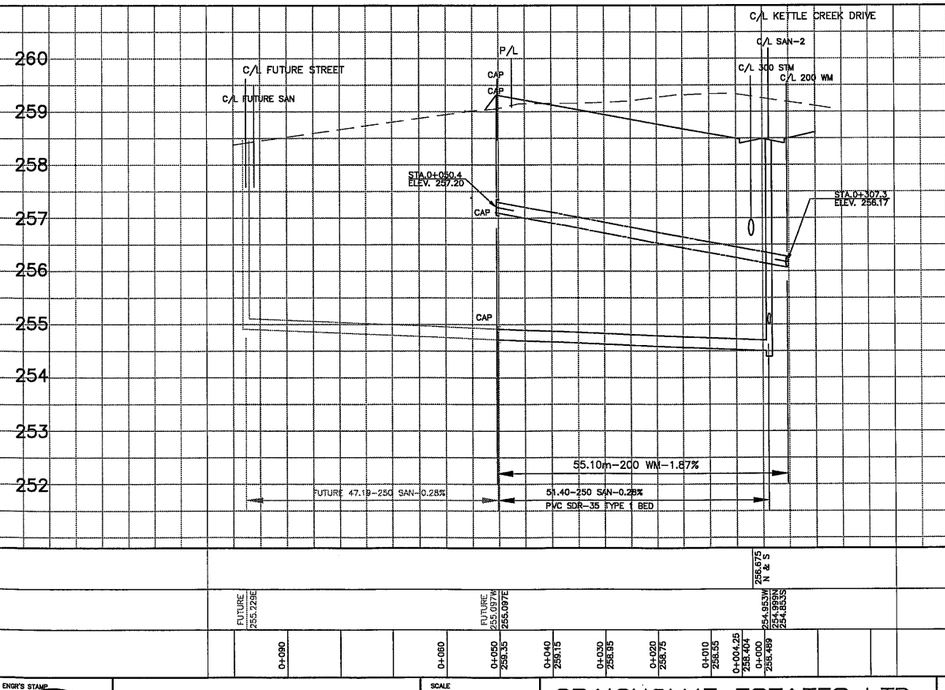


KETTLE CREEK DRIVE



SANITARY EASEMENT





AS CONSTRUCTED NOTES	AS CONSTRUCTED SERVICES	COMPLETION
1 SEE DRAWING No. FOR FURTHER DETAIL		
2 SEWER DESIGN: TRANSITION WIDTH OR AS NOTED		
3 REFERENCE B.M. No. ELEVATION		
4		
5		

DESIGN	D.M.
DRAWN	D.M.
CHECKED	R.P.
APPROVED	H.H.
DATE	JUNE 2012

KELLAM
PROJECT No. 07-1681

NO	REVISIONS	DATE	BY
1.	REVISION PER MUNICIPALITY REVIEW NOV. 17, 2012	NOV. 23, 2012	D.M.
2.	ENVIRONMENTAL COMPLIANCE APPROVAL APPLICATION	DEC. 19, 2016	D.M.

CONSULTANT OR DIVISION

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1999 WELLINGTON ROAD SOUTH, SUITE 214
LONDON, ONTARIO, CANADA
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ENGR'S STAMP
LICENSED PROFESSIONAL ENGINEER
H.E. HOOTARI
Dec. 19/16
PROVINCE OF ONTARIO

The Corporation of the Municipality of Central Elgin

SCALE
SCALE - 1 : 500
5 0 10m
HORIZONTAL
SCALE - 1 : 50
0.5 0 1m
VERTICAL

CRAIGHOLME ESTATES LTD.
JOE SNYDER CONSTRUCTION LTD. BELMONT ONT.

PHASE 5
KETTLE CREEK DRIVE & SANITARY EASEMENT

PROJECT No.
SHEET No.
DRAWING No. 6
PLAN FILE No.

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Appendix B:

Sanitary Design Sheet for Phase 6 by SBM

STRIK BALDINELLI MONIZ
CIVIL • STRUCTURAL • MECHANICAL • ELECTRICAL

ARVA LOCATION
CIVIL / STRUCTURAL DIVISION
14361 Medway Rd., P.O. Box 29
Arva, Ont, N0M 1C0
P: 519.471.6667

NORTH LONDON LOCATION
MECHANICAL / ELECTRICAL DIVISION
1510 Woodcock St., Unit #7
London, Ont, N6H 5S1
P: 519.641.3040

KITCHENER LOCATION
1415 Huron Rd., Unit 225
Kitchener, Ont, N2R 0L3
P: 519.725.8093

www.sbmltd.ca sbm@sbmltd.ca

Date: March 8, 2019
Job Number: SBM-17-2126
Client: Craigholme Estates Ltd.
Project: Belmont Phase 6
Designed By: RM
Reviewed By: KM
Project File No.: SBM-17-2126

Sanitary Sewer Design Sheet

Municipality of Central Elgin

Single Family Units: 236
Semi-Detached Units: 48

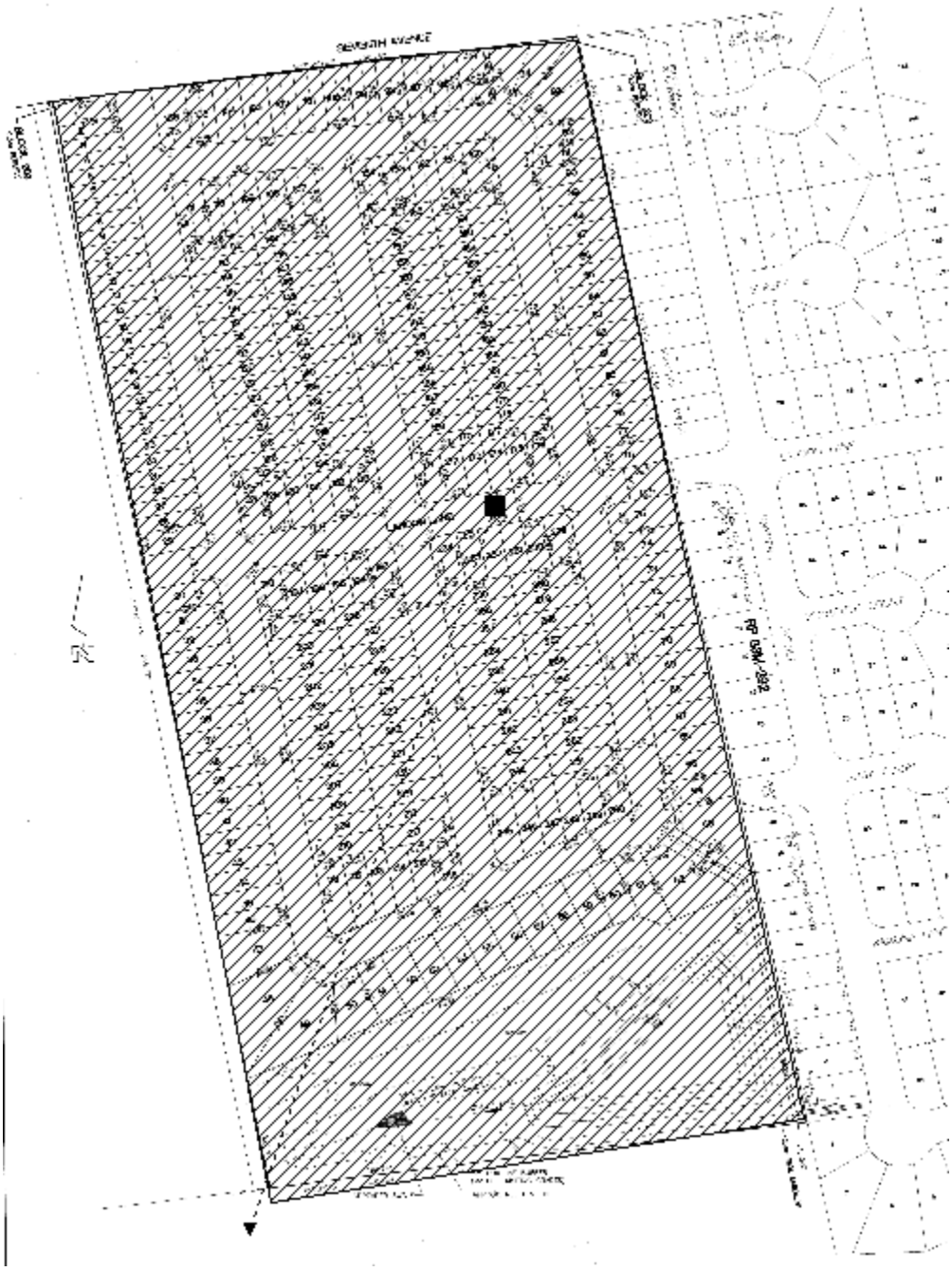
Design Critera (Litres/capita/day) 400
Sewage Infiltration (Litres/hectare/day) 17280
Harmon Formula (Peaking Factor)
M = (1 + 14/(4+P^0.5))

Location				Area						Sewage Flows				Sewer design					Profile Design					
Area No.	Street Name	From MH	To MH	Delta Hectare	Total Hectare	People Per Unit	No. of Units	*Delta Pop.	Total Pop.	Harmon Peaking Factor	Infilt L/S	Sewage L/S	Total L/S	n	Pipe Slope %	Dia. mm	Capacity L/S	Velocity m/s	Length m	Fall in Sewer	Headloss	Drop in U.S. MH	U.S. Invert	D.S. Invert
Total Site Area		Phase 6 Lands	Existing Sanitary Stub	16.34	16.34	3.5	284	994	994	3.80	3.27	17.49	20.76	0.013	0.28%	250	31.49	0.64				-		

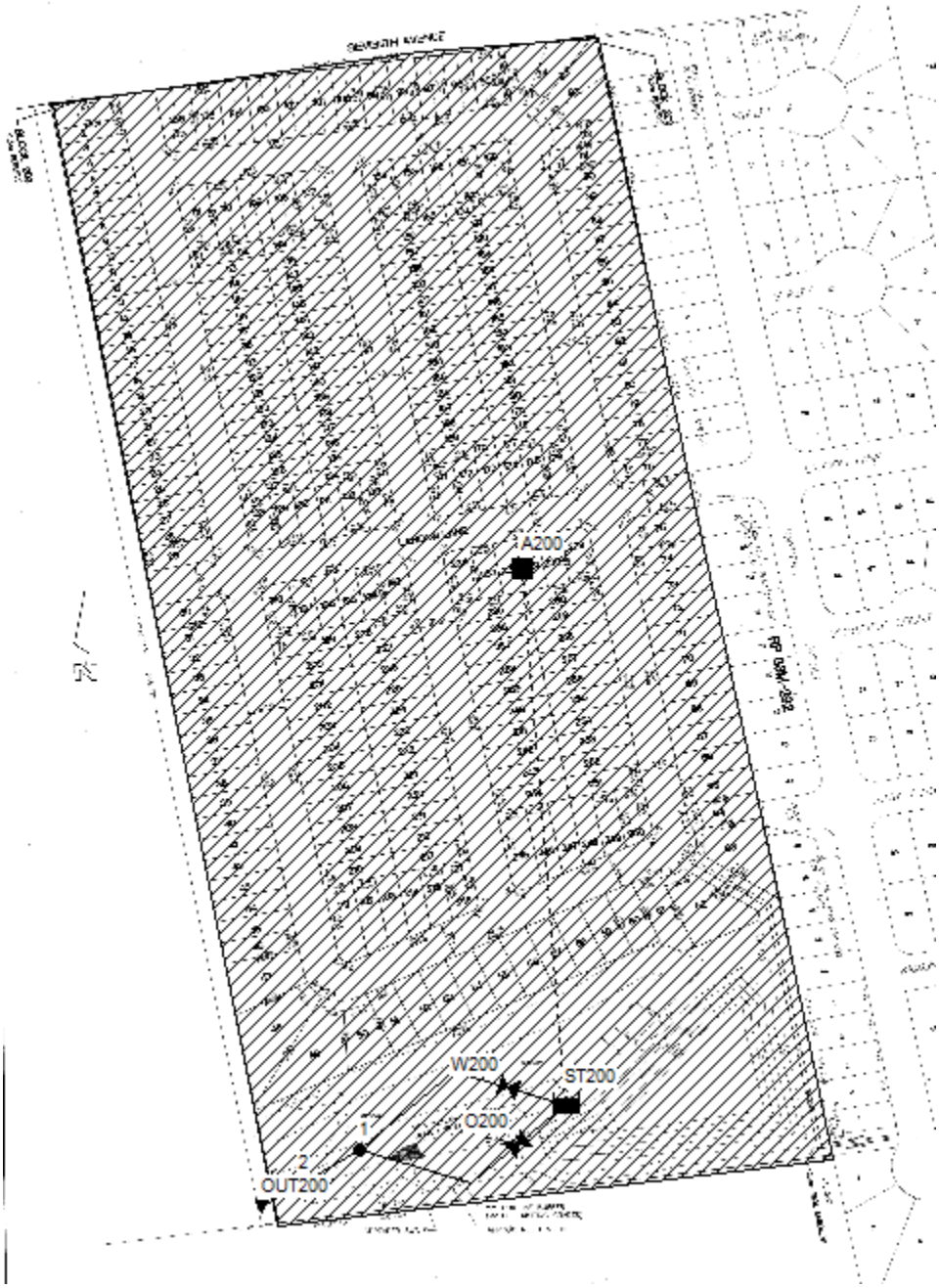
Appendix C:

Pre and Post-Development Catchment Area Plans
EPASWMM 5 Output Files (2 and 100 Year Pre and Post-Development)

Pre-Development Catchment Area



Post-Development Catchment Area



EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Belmont Subdivision

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... YES
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date 01/01/2015 00:00:00
Ending Date 01/04/2015 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 30.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.654	33.245
Evaporation Loss	0.000	0.000
Infiltration Loss	0.363	18.466
Surface Runoff	0.262	13.334
Final Storage	0.030	1.533
Continuity Error (%)	-0.262	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr

Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.262	2.621
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.254	2.541
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.008	0.080
Continuity Error (%)	0.019	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	29.50 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
A200	33.25	0.00	0.00	18.47	13.33	2.62	1.22	0.401

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Meters
1	JUNCTION	0.11	0.41	257.26	0	03:18	0.41
OUT200	OUTFALL	0.00	0.00	254.50	0	00:00	0.00
ST200	STORAGE	0.12	0.58	257.43	0	03:08	0.58

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
1	JUNCTION	0.000	0.079	0	01:18	0	2.54	0.133
OUT200	OUTFALL	0.000	0.075	0	03:18	0	2.54	0.000
ST200	STORAGE	1.224	1.224	0	01:05	2.62	2.62	0.000

Node Surcharge Summary

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
ST200	0.368	3	0	0	1.880	13	0 03:08	0.079

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OUT200	98.59	0.010	0.075	2.541
System	98.59	0.010	0.075	2.541

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth

```
  2                    CONDUIT     0.075     0  03:18      0.12    0.08
0.23
  O200                 ORIFICE     0.079     0  01:18
1.00
  W200                 WEIR        0.000     0  00:00
0.00


  ***************************
  Flow Classification Summary
  ***************************

  -------------------------------------------------------------------------
--------------
                       Adjusted    ---------- Fraction of Time in Flow
Class ----------
                        /Actual         Up    Down  Sub   Sup   Up    Down
Norm  Inlet
  Conduit                Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit
Ltd   Ctrl
  -------------------------------------------------------------------------
--------------
  2                        1.00   0.01  0.00  0.00  0.00  0.00  0.00  0.99
0.00  0.00


  ************************
  Conduit Surcharge Summary
  ************************

  No conduits were surcharged.


  Analysis begun on:  Fri Mar 08 08:15:41 2019
  Analysis ended on:  Fri Mar 08 08:15:41 2019
  Total elapsed time: < 1 sec
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

Belmont Subdivision

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... YES
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date 01/01/2015 00:00:00
Ending Date 01/04/2015 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 30.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---	---
Total Precipitation	1.509	76.749
Evaporation Loss	0.000	0.000
Infiltration Loss	0.564	28.693
Surface Runoff	0.920	46.792
Final Storage	0.030	1.529
Continuity Error (%)	-0.344	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---	---

Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.920	9.199
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.910	9.099
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.010	0.099
Continuity Error (%)	0.013	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	29.50 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
A200	76.75	0.00	0.00	28.69	46.79	9.20	3.67	0.610

```
  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------
----------
                                  Average  Maximum  Maximum  Time of Max
Reported
                                    Depth    Depth      HGL   Occurrence
Max Depth
  Node                  Type       Meters   Meters   Meters  days hr:min
Meters
  ---------------------------------------------------------------------
----------
  1                     JUNCTION     0.19     0.62   257.47     0  03:49
0.62
  OUT200                OUTFALL      0.00     0.00   254.50     0  00:00
0.00
  ST200                 STORAGE      0.33     1.72   258.57     0  03:37
1.72


  ******************
  Node Inflow Summary
  ******************

  ---------------------------------------------------------------------
--------------------------
                                  Maximum  Maximum
Lateral       Total        Flow
                                  Lateral    Total  Time of Max
Inflow      Inflow     Balance
                                   Inflow   Inflow   Occurrence
Volume      Volume       Error
  Node                  Type          CMS      CMS  days hr:min    10^6
ltr    10^6 ltr     Percent
  ---------------------------------------------------------------------
--------------------------
  1                        JUNCTION     0.000    0.191     0  03:35
0         9.1       0.053
  OUT200                   OUTFALL      0.000    0.191     0  03:49
0         9.1       0.000
  ST200                    STORAGE      3.673    3.673     0  01:05
9.2         9.2       0.000


  **********************
  Node Surcharge Summary
  **********************

  No nodes were surcharged.
```

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
ST200	1.157	8	0	0	6.787	47	0 03:37	0.191

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OUT200	99.00	0.035	0.191	9.099
System	99.00	0.035	0.191	9.099

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth

```
  2                    CONDUIT     0.191     0  03:49      0.18    0.21
0.35
  O200                 ORIFICE     0.191     0  03:35
1.00
  W200                 WEIR        0.000     0  00:00
0.00


  ***************************
  Flow Classification Summary
  ***************************

  -------------------------------------------------------------------------
--------------
                       Adjusted    ---------- Fraction of Time in Flow
Class ----------
                        /Actual         Up    Down  Sub   Sup   Up    Down
Norm  Inlet
  Conduit                Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit
Ltd   Ctrl
  -------------------------------------------------------------------------
--------------
  2                        1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00
0.00  0.00


  ************************
  Conduit Surcharge Summary
  ************************

  No conduits were surcharged.


  Analysis begun on:  Fri Mar 08 08:13:17 2019
  Analysis ended on:  Fri Mar 08 08:13:17 2019
  Total elapsed time: < 1 sec
```