ENGINEERING REPORT

BARRON HEIGHTS
BARRON ROAD, THOROLD

PREPARED FOR

Ottavio Colantonio
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Vaughn, Ontario

August 1, 2019

PREPARED BY

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INTRODUCTION

The proposed development is a residential subdivision consisted of 7 single-family lots, 10 semi-detached lots, 16 multi-residential blocks and one block for stormwater management facility. The subject site is approximately 5.435 hectare and a total of 93 residential units will be developed on this property. The site is located on the south side of Barron Road between Centre Street and Allanport Road within Village of Allan Allanburg in Thorold. It is legally known as part Unit 8, Plan D-5 in the City of Thorold, Regional Municipality of Niagara. The subject property is a vacant land consisted of open fields covered by trees, shrubs and other wild vegetation.

The proposed development is surrounded residential development on the north and east side, railway tracks on the west and south side. The site is within a short distance from Highway 20 and Highway 58.

Since, the proposed subdivision is within the urban area boundary, and adjacent to the existing residential developments, therefore, municipal services and utilities are readily available. There is a 200 mm diameter watermain and 200 mm sanitary sewer on Barron Road. Stormwater from the site drains into existing ditch along the railway tracks.

The purpose of this report is to review the servicing aspects of the proposed subdivision and develop a suitable servicing and stormwater management scheme that will meet the requirements of the City of Thorold, Niagara Region, Niagara Peninsula Conservation Authority, Ministry of Environment, Canadian National Railway and other approving agencies.

We have also met in Pre-con meeting with the engineering and planning staff of the City, Region, NPCA and MOEE and discussed the drainage, stormwater management, water and wastewater servicing issues. Based on our review of the existing services and our discussion with the Regional and City's engineering staff, we are able to offer the following comments for servicing aspects of the proposed subdivision:

WATER DISTRIBUTION SYSTEM

Existing Water Distribution System

The City water distribution system is available for the proposed development. A 200 mm diameter watermain exists on Barron Road. As per Village of Allanburg Community Improvement Plan & Watermain Services report the proposed development was included in the design of watermain on Barron Road.

Proposed Water Distribution System

The proposed water distribution system will be consisted of a 200 mm diameter watermain looped through Street "A" and a 150 mm diameter on Street "B" & "C". The proposed water distribution system will meet the MOE requirements for domestic and fire flow standards.

All lots and multiple units will be provided with individual 20 mm water service with main stop and curb stop. A network of fire hydrants spaced maximum of 150 meters apart will be installed for fire protection.

Please refer to the attached General Plan of Services for additional details.

SANITARY SEWAGE SYSTEM

Existing Sanitary Sewer System

There is a 200 mm diameter sanitary sewer on Barron Road. The sanitary flow from Barron Road eventually ends up in Port Weller water treatment plant after passing through several pumping stations and sanitary sewer systems.

Proposed Sanitary Sewer System

The proposed sanitary sewage system will be consisted of 200 mm diameter sanitary sewer on all proposed streets. Each residential unit will be provided with 125 mm diameter service. The sanitary sewage system will be connected to existing 200 mm diameter sanitary sewer on Barron Road. Please refer to sanitary sewer design sheet and drainage area plan for details. The following sanitary design criteria have been used to design the proposed sanitary sewer system:

Design Criteria	
Average Density	60 persons per hectare
Average Sewage Flow:	400 litres per capita per day
Base Infiltration:	0.018 litres per second per hectare

The City has indicated that allocation for sanitary sewage capacity will be first come first serve bases. Please refer to the attached General Plan of Services for additional details.

STORMWATER DRAINAGE

Existing Drainage

The stormwater run-off from the site is generally draining in the northwest direction to a ditch running north along CN railway tracks.

Proposed Drainage

The proposed stormwater drainage system will be consisted of a stormwater management facility for quality and quantity control, including grassed swales and underground storm sewer system for stormwater conveyance to the SWM facility. The post-development flow will be controlled to pre-development flow for 5 to 100 year storm frequencies.

Perimeter swales have been provided to prevent any storm flow to adjacent properties. Storm run-off from these swales and rearyard catchbasins will flow to street storm sewer system and eventually to the proposed SWM facility.

Lot Grading

The lot grading will be carried out in such a way that front yard of the house will slope towards road and rearyard will slope towards rear property line to proposed swale conveyance system.

STORMWATER MANAGEMENT PLAN

Topography, Soil and Bedrock

The site for the proposed development has moderate grade ranging from 1.20% to 1.60%. The site is generally sloping in the northwest direction towards the existing CNR ditch. The underlying soil is sandy loam. No bed rock was encounter during the construction of sanitary sewer on Barron Road.

Stormwater Lot Level Control

To improve the quality of stormwater, to increase stormwater detention and to reduce the run-off rates the following lot level control will be applied:

- Reduce lot grades to allow greater ponding of stormwater and natural infiltration.
- Directing roof leader discharge to rearyard.
- Sump pumping of foundation drains to rearyard.

Reduced Lot Grading

The proposed development site has flat to moderate grades, therefore, it would be possible to achieve 1.0% to 1.5% lot grades to promote recharge, reduce flooding and control erosion. This will also increase natural infiltration and help maintain the base flows. To avoid flooding near the building and prevent foundation drainage problems the building apron will be kept minimum 100 mm above the surrounding lands.

Rear-yard Grassed Swale Conveyance

The lot grading will be carried out in such a way that grassed swales will be created on the side lot lines and at the rear lot lines for the conveyance of stormwater. All rearyard drainage (including roof leaders) will be directed to these swales. The swale will drain into rearyard catchbasin, which will be connected to the street storm sewer system. The slope of swales will be maintained between 0.50% and 2.0% where possible.

Soil Compaction

Generally building aprons will be kept 100 mm to 400 mm higher than the existing ground to utilize the basement excavation. This will enhance natural infiltration quality of the soil as well.

Roof Leaders to Rearyard

The stormwater flow from most of the roof leaders will be discharged to the ground surface and directed towards the rearyard area and then to the proposed swale system.

Sump Pumping of Foundation Drains

The current policy of the municipality with respect to the foundation drainage is to connect a foundation drain (with or without sump pump) to the storm sewer system. The surface discharge is not allowed due to potential flooding and winter freezing problems.

The municipality is encouraged to consider the surface discharge option of the foundation drainage. Should the municipality adopt this option, then all foundation flow will be pumped to the surface and will be directed towards the rear-yard swale system.

Sediment and Erosion Control

During and after construction, sediment and erosion controls will be implemented to minimise soil erosion and sediment. To prevent flow of silt into the existing drainage system, all catchbasin tops will be fitted with filter cloth. Retention of vegetation where possible will also prevent erosion. A parameter silt fence will be installed during construction to prevent any silt flowing to adjacent properties. To prevent soil erosion, all topsoil piles will be seeded and immediately after the construction all, disturbed areas will be revegetated

End-of-Pipe Facility

The Niagara Peninsula Conservation Authority has recommended that stormwater management controls for achieving the required stormwater quality shall be implemented and stormwater run-off shall be treated to a Normal standard prior to discharge from the site. Similarly, the CNR require that all post-development stormwater peak flows be attenuated to pre-development conditions for up to and including the 100 Year storm return prior to discharge to CNR ditch.

The following SWM scheme has been developed in order to achieve the stormwater management quality and quantity objectives:

- A Wet Pond, designed in accordance with the MOE guidelines will be provided within Block 34 at the west end of the subject property. A flow control structure will be provided at the outlet point of the pond to control the stormwater runoff to pre-development level up to and including 100 Year. This structure will also provide emergency spillway.

Storm Drainage Area

The storm drainage area considered for the design of SWM detention facility is shown on the attached storm drainage area plan. The rearyard drainage system consisted of swales from the existing homes to the north of property has been included in the storm drainage system design.

All stormwater run-off from the site will be contained within the subject lands and will not adversely impact the adjacent properties.

Drainage Area Characteristics

The following drainage area characteristics have been considered in the design of stormwater management detention facility:

Total Drainage Area	= 5.62 ha
Buildings, driveways and roads	= 1.90 ha
Grassed Area	= 3.72 ha

Composite Run-off Co-efficient = (1.90x0.90+3.72x0.20)/5.62 = 0.44

A run-off co-efficient of 0.45 has been used in the storm drainage system design.

Erosion Control and Storage

The pre and post development flow have been computed for the site using the MIDUSS stormwater management software for a three hour Chicago storm in accordance with the City's SWM guidelines. The following information has been extracted from the attached computer printout:

Storm Duration	Predevelopment Flow in lps	Post development Flow in lps	Storage Required	Storage Provided	Depth of water in meters
5 Year	128.00	465.00	501 cu.m	522 cu.m	0.50
100 Year	425.00	874.00	659 cu.m	701 cu.m	0.65

Storage capacity of the proposed SWM detention facility (pond) has been calculated as follows:

5 Year Storage Capacity = average water surface area times depth of water

= 0.50(1154+934)0.50 m = 522 cu.m > required 501 cu.m

100 Year Storage Capacity = average water surface area times depth of water

= 0.50(1223+934)0.65 m = 701 cu.m > required 659 cu.m

The proposed pond will be constructed with 3:1 side slopes and maximum depth of 1.3 meters including a 300 mm freeboard. The pond will be seeded and appropriate landscaping will be provided for aesthetic purposes. All landscaping will be in accordance with the NPCA's Guidelines and will be provided at the final design stage. Riprap over filter cloth will be placed at inlet and outlet of the pond for erosion protection.

Maintenance of Stormwater Management Facility

Proper operation and maintenance of stormwater management facility is utmost important to prevent SWMP failure. For owner guidance a maintenance manual will be prepared at a later date under a separate cover and submitted for review and approval.

ROADS

All roads within the proposed subdivision will be in accordance with the City's Urban Road Cross Section consisted of 8.0 m wide asphalt pavement, concrete curb & gutter, perforated sub-drain. The proposed road system will be connected to Barron Road.

UTILITIES

Hydro, Gas, Bell and cable will be available upon development of the subdivision. Development agreement with Hydro will be required prior to registration of the plan of subdivision.

CONCLUSION

All necessary services such as roads, sanitary sewers, water; storm outlet and utilities are available and have sufficient capacity to accommodate the proposed development. The proposed subdivision does not require extension of any serviced, instead, will utilize the existing services and increase the efficiency of the exiting systems.

The proposed stormwater management plan will prevent flooding & erosion, provide stormwater quantity and quality controls and maintain the integrity of the existing drainage system.

Based on the availability of municipal services and other utilities and the fact that the proposed development is compatible with the existing land use and complements the existing landscape, we are confident that the proposed servicing scheme for the development will be satisfactory and acceptable to the City and other agencies.

Report prepared by:

Zakir Ali, P.Eng.

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      36   60    5.000        are MAXDT MAXHYD & DTMIN values
    Licensee: NIAGARA ENGINEERING
35   COMMENT
     5    line(s) of comment
    BARRON HEIGHTS SUBDIVISION
    STORMWATER MANAGEMENT
    5 YEAR PRE-DEVELOPMENT FLOW
    USING ST. CATHARINES IDF CURVE
    ******************************
 2   STORM
       1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   664.000    Coefficient  a
    4.700    Constant  b   (min)
     .744    Exponent  c
     .450    Fraction to peak  r
   180.000    Duration ó  180 min
         41.023 mm     Total depth
 3   IMPERVIOUS
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
     .015    Manning "n"
    98.000    SCS Curve No or C
     .100    Ia/S Coefficient
     .518    Initial Abstraction
 4   CATCHMENT
    1.000     ID No.ó 99999
    5.620     Area in hectares
   40.000     Length (PERV) metres
    1.500     Gradient (%)
    5.000     Per cent Impervious
   10.000     Length (IMPERV)
     .000    %Imp. with Zero Dpth
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
     .250    Manning "n"
   75.000     SCS Curve No or C
     .100    Ia/S Coefficient
    8.467     Initial Abstraction
       1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .128      .000      .000      .000 c.m/s
          .220      .853      .252    C perv/imperv/total
15   ADD RUNOFF
          .128      .128      .000      .000 c.m/s
20   MANUAL
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35    COMMENT
     5    line(s) of comment
     BARRON HEIGHTS SUBDIVISION
     STORMWATER MANAGEMENT
     5 YEAR POST-DEVELOPMENT FLOW
     USING ST. CATHARINES IDF CURVE
     *******************************
 2    STORM
        1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   664.000     Coefficient  a
     4.700     Constant  b    (min)
      .744     Exponent  c
      .450     Fraction to peak  r
   180.000     Duration ó  180 min
           41.023 mm     Total depth
 3    IMPERVIOUS
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .015     Manning "n"
    98.000     SCS Curve No or C
      .100     Ia/S Coefficient
      .518     Initial Abstraction
 4    CATCHMENT
     1.000     ID No.ó 99999
     5.620     Area in hectares
    40.000     Length (PERV) metres
     1.200     Gradient (%)
    34.000     Per cent Impervious
    40.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .240     Manning "n"
    80.000     SCS Curve No or C
      .100     Ia/S Coefficient
     6.350     Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .465      .000      .000      .000 c.m/s
          .298      .863      .490     C perv/imperv/total
15    ADD RUNOFF
          .465      .465      .000      .000 c.m/s
10    POND
     3 Depth - Discharge - Volume sets
       .000       .000        .0
      1.000       .128      501.0
      2.000       .289     1140.0
     Peak Outflow    =      .128 c.m/s
     Maximum Depth   =     1.000 metres
     Maximum Storage =       501. c.m
          .465      .465      .128      .000 c.m/s
20    MANUAL
```

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Units used are defined by G = 9.810
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Licensee: NIAGARA ENGINEERING

35 COMMENT
5 line(s) of comment
BARRON HEIGHTS SUBDIVISION
STORMWATER MANAGEMENT
100 YEAR PRE-DEVELOPMENT FLOW
USING ST. CATHARINES IDF CURVE
****

2 STORM
1 1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
980.000 Coefficient a
3.700 Constant b (min)
.732 Exponent c
.450 Fraction to peak r
180.000 Duration ó 180 min
64.716 mm Total depth

3 IMPERVIOUS
1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
.015 Manning "n"
98.000 SCS Curve No or C
.100 Ia/S Coefficient
.518 Initial Abstraction

4 CATCHMENT
1.000 ID No.ó 99999
5.620 Area in hectares
40.000 Length (PERV) metres
1.500 Gradient (%)
5.000 Per cent Impervious
10.000 Length (IMPERV)
.000 %Imp. with Zero Dpth
1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
.250 Manning "n"
75.000 SCS Curve No or C
.100 Ia/S Coefficient
8.467 Initial Abstraction
1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
.425 .000 .000 .000 c.m/s
.347 .885 .374 C perv/imperv/total

15 ADD RUNOFF
.425 .425 .000 .000 c.m/s

20 MANUAL

```
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35   COMMENT
    5   line(s) of comment
    BARRON HEIGHTS SUBDIVISION
    STORMWATER MANAGEMENT
    100 YEAR POSTDEVELOPMENT FLOW
    USING ST. CATHARINES IDF CURVE
    ******************************
 2   STORM
       1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   980.000    Coefficient  a
    3.700    Constant  b   (min)
     .732    Exponent  c
     .450    Fraction to peak  r
   180.000    Duration ó  180 min
          64.716 mm     Total depth
 3   IMPERVIOUS
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
     .015    Manning "n"
    98.000    SCS Curve No or C
     .100    Ia/S Coefficient
     .518    Initial Abstraction
 4   CATCHMENT
    1.000    ID No.ó 99999
    5.620    Area in hectares
   40.000    Length (PERV) metres
    1.200    Gradient (%)
   34.000    Per cent Impervious
   40.000    Length (IMPERV)
     .000    %Imp. with Zero Dpth
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
     .240    Manning "n"
    80.000    SCS Curve No or C
     .100    Ia/S Coefficient
    6.350    Initial Abstraction
       1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        .874      .000      .000      .000 c.m/s
        .431      .903      .591    C perv/imperv/total
15   ADD RUNOFF
        .874      .874      .000      .000 c.m/s
10   POND
    3 Depth - Discharge - Volume sets
      .000       .000       .0
     1.000       .425     659.0
     2.000      1.390    2160.0
    Peak Outflow    =     .425 c.m/s
    Maximum Depth   =    1.000 metres
    Maximum Storage =     659. c.m
        .874      .874      .425      .000 c.m/s
20   MANUAL
```

STORM SEWER DESIGN SHEET

Q= 2.78AIR

Where Q peak flow in litres per second (L/s)
A area in hectares
I rainfall in millimetres per hour (mm/hr)
R runoff coefficient

STREET			AREAS (ha)				Indivi.	Accum	Time of	Rainfall	Peak	SEWER DATA							
STREET	FROM	TO	R= 0.25	R= 0.45	R= 0.90	R=	2.78AR	2.78AR	Conc.	Intensity 5 Yr St I=664.0/(t+4.7)^.744 mm/hr	Flow Q (L/s)	Diameter (mm)	Slope %	Length (m)	Capacity (L/s) n= .013	Velocity (m/s) m/s	Flow Time (min)	Percent Capacity	Rem-arks
STREET A	MH1	MH2	-	0.38			0.48	0.48	10.00	89.88	42.7	300	0.30	52.0	53.0	0.75	1.16	80.67	OK
STREET B	MH3	MH2	-	1.02			1.28	1.28	10.00	89.88	114.7	375	0.50	66.6	124.0	1.12	0.99	92.51	OK
STREET A	MH2	MH5	-	0.66			0.83	2.58	10.99	85.63	220.7	450	0.60	92.9	220.8	1.39	1.12	99.93	OK
STREET A	MH5	MH8	-	0.77			0.96	3.54	12.10	81.37	288.1	525	0.45	86.8	288.5	1.33	1.09	99.85	OK
STREET C	MH9	MH8		0.84			1.05	1.05	10.00	89.88	94.5	375	0.50	59.5	124.0	1.12	0.88	76.19	OK
STREET A	MH8	MH11	-	0.80			1.00	5.59	13.19	77.67	434.3	525	2.90	58.7	732.4	3.38	0.29	59.30	OK
STREET A	MH11	MH12						5.59	13.19	77.67	434.3	525	1.30	58.7	490.4	2.27	0.43	88.57	OK
STREET A	MH1	MH14		0.59			0.74	0.74	10.00	89.88	66.3	300	1.80	65.0	129.7	1.84	0.59	51.14	OK
STREET A	MH14	MH15	-	0.56			0.70	1.44	10.59	87.29	125.6	300	1.80	68.0	129.7	1.84	0.62	96.79	OK
BARRON	MH15	MH12	-	-			0.00	1.44	11.21	84.76	121.9	450	0.40	248.0	180.3	1.13	3.65	67.62	OK
STREET A	MH12	POND	-	-			0.00	7.03	14.85	72.69	511.1	750	0.50	24.0	787.2	1.78	0.22	64.92	OK
														20					

Calc by ZA Checked ZA Date 26/7/2019	Project: BARRON HEIGHTS SUBDIVISION BARRON STREET, THOROLD	Sheet No. 1

SANITARY SEWER DESIGN SHEET

Density		60 ppha	
Q=	average daily per capita flow (L/Cap,d)	400	
I=	unit of peak extraneous flow(L/ha,d)	18	
M=	peaking factor		
Q(p)=	peak population flow (L/s)		
Q(I)=	peak extraneous flow (L/s)		
Q(d)=	peak design flow (L/s)		

M=	1+14/(4+(P)^.5)	Where P population in 1000's
Q(p)=	PqM/86.4 (L/s)	
Q(I)=	IA (L/s)	Where A= area in hectares
Q(d)=	Q(p) + Q((L/s)	

LOCATION			INDIVIDUAL		COMMULATIVE		Peaking	Pop.	Peak	Peak	PROPOSED SEWER							
Street	From	To	Pop.	Area A (hectares)	Pop.	Area A (hectares)	factor M	flow Q(p) (l/s)	Extraneous flow Q(I) (L/s)	Design flow Q(d) (L/s)	Legth Sewer (m)	Pipe size (mm)	Type of Pipe	Grade %	Capacity (L/s) n=.013	Full flow Velocity (m/s)	Actual velocity (m/s)
STREET A	MH1	MH2	28	0.46	28	0.46	4.36	0.33	0.13	0.45	55.7	200	PVC	0.6	24.8	0.79	0.32
STREET B	MH3	MH2	37	0.62	65	1.08	4.29	0.75	0.30	1.06	67.6	200	PVC	0.6	24.8	0.79	0.37
STREET A	MH2	MH4	28	0.46	92	1.54	4.25	1.06	0.43	1.50	49.9	200	PVC	0.5	22.6	0.72	0.43
STREET A	MH4	MH5	23	0.39	116	1.93	4.23	1.33	0.54	1.87	39.6	200	PVC	0.5	22.6	0.72	0.44
STREET A	MH5	MH6	21	0.35	137	2.28	4.20	1.56	0.64	2.20	40.7	200	PVC	0.5	22.6	0.72	0.45
STREET A	MH6	MH7	16	0.26	152	2.54	4.19	1.73	0.71	2.44	25.1	200	PVC	0.5	22.6	0.72	0.46
STREET A	MH7	MH8	16	0.26	168	2.8	4.17	1.90	0.78	2.68	26.6	200	PVC	0.5	22.6	0.72	0.48
STREET C	MH9	MH8	30	0.5	198	3.3	4.15	2.23	0.92	3.15	62	200	PVC	0.6	24.8	0.79	0.55
STREET A	MH8	MH10	13	0.21	211	3.51	4.14	2.36	0.98	3.34	22	200	PVC	0.6	24.8	0.79	0.56
STREET A	MH10	MH11	19	0.32	230	3.83	4.13	2.57	1.07	3.64	34	200	PVC	0.6	24.8	0.79	0.58
STREET A	MH11	MH12	19	0.31	248	4.14	4.11	2.77	1.16	3.93	69.5	200	PVC	0.4	20.2	0.64	0.50
STREET A	MH12	EXIST MH	0	0	248	4.14	4.11	2.77	1.16	3.93	12	200	PVC	0.4	20.2	0.64	0.49
BARRON ST	EXISTING	SEWER										200	PVC	0.78	28.2	0.90	
STREET A	MH1	M13	17	0.29	17	0.29	4.39	0.21	0.08	0.29	26.6	200	PVC	1.9	44.1	1.40	0.34
STREET A	MH13	MH14	20	0.34	38	0.63	4.34	0.44	0.18	0.62	52.4	200	PVC	1.9	44.1	1.40	0.35
STREET A	MH14	EXIST MH	31	0.52	69	1.15	4.28	0.80	0.32	1.12	60	200	PVC	0.5	22.6	0.72	0.36
BARRON ST	EXISTING	SEWER										200	PVC	0.5	22.6	0.72	

Calc by	ZA	Project:	Sheet No. 1 of 1
Checked	ZA	BARRON HEIGHTS SUBDIVISION	
Date	26-Jul-19	BARRON STREET, THOROLD	