UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

Upper Canada
Planning &
Engineering Ltd.
3-30 Hannover Drive
St. Catharines, ON
L2W 1A3
Phone 905-688-9400
Fax 905-688-5274

File: 22249

FUNCTIONAL SERVICING REPORT

731 King Street, Niagara-On-The-Lake

April 2023

INTRODUCTION

The purpose of this report is to address the servicing needs for the proposed residential subdivision development in support of the applications for Zoning By-Law Amendment. The subject lands are located between 727 and 733 King Street in the Old Town Community of the Town of Niagara-on-the-Lake; north of King Street, west of Cottage Street, and south of Meritage Lane.

The development site is approximately 0.32 hectare and shall consist of 17 apartment units in a 3 storey building, and will include associated asphalt access and parking areas, concrete curb, catch basins, storm sewers, and sanitary sewers.

The objectives of this report are as follows:

1. Identify domestic and fire protection water servicing needs for the site;
2. Identify sanitary servicing needs for the site; and,
3. Identify stormwater management needs for the site.

WATER SERVICING

There is an existing municipal 150mm diameter watermain on King Street. It is proposed to connect a 150mm diameter water service to the existing 150mm watermain on King Street to provide both domestic water supply and fire protection. A private fire hydrant is required to provide fire protection, the location will be determined as part of the detailed engineering design.

Therefore, the existing water service on king Street will adequately provide domestic water supply and fire protection to the 17 unit building apartment.

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

SANITARY SERVICING

There is an existing 250mm diameter sanitary sewer on King Street which conveys sanitary flows to the northeast to Cottage Street. It is proposed to connect the new apartment building to the existing sanitary sewer on King Street and extend it within the site.

The proposed 0.32 hectare, 17 unit apartment building will produce a peak of approximately 0.91L/s, occupying 4.2% of the total capacity of the existing 250mm diameter sanitary sewer. Then, it is expected that this will be and adequate addition to the current capacity of the existing sanitary sewer.

STORMWATER MANAGEMENT

There are existing 450mm storm sewer on King Street, which convey stormwater flows southwest to Niagara Street, then southerly to Rye Street.

A Stormwater Drainage Area Plan was prepared in May 8, 2008 by Denco Engineering Ltd. (Denco) for the Town, as part of the King Street new storm sewer project, which delineated the storm drainage areas associated to the existing storm sewer system on King Street as shown in Appendix A.

In addition to the Stormwater Drainage Area Plan prepared by Denco Engineering, a new Stormwater Drainage Area plan was prepared by Upper Canada Consultants (UCC) as a part of the Royal Albion subdivision. As shown in the UCC plan attached in Appendix A, the storm drainage flows from the storm sewer on King Street, flow to Cottage Street and conveyed to the northwest towards Simcoe Street.

Figure 1, shows the Storm Drainage Areas from the original storm sewer design proposed by Denco where the 0.61 hectare with an associated Runoff Coefficient of 0.45 covers a portion. The original storm sewer calculations can be found in Appendix A.

The proposed and adjusted drainage areas and associated Runoff Coefficient is shown on Figure 2. The site stormwater system will collect a drainage area of 0.32 hectare at a Runoff Coefficient of 0.70. As shown in the proposed storm sewer calculation on Appendix A, the proposed conditions will produce a peak flow of 209.6 L/s, occupying 79.3% of the total capacity of the existing 450mm diameter storm sewer.

Therefore, since the majority the drainage areas A10 and A11 proposed by Denco will be conveyed to the existing Cottage Street storm sewer and the future proposed peak flows will be 11.0% less than the original peak flow proposed by Denco. It has been demonstrated that there will be adequate stormwater servicing capacity in the existing sewer network to serve the site without stormwater quantity controls.

To improve the quality of stormwater, an oil/grit separator will be utilized to provide MECP Normal Protection (70% TSS removal levels) as required for this type of development. It is estimated that a Hydroworks HD4 will provide 93% TSS removal. The complete stormwater design for this development will be identified as part of the future detailed design.

CONCLUSIONS AND RECOMMENDATIONS

Therefore, based on the above comments, drainage area plans and calculations provided for this site, the following summarizes the servicing for this site:

1. The existing 150mm diameter watermain on King Street is expected to have adequate capacity to provide both domestic water supply and fire protection to service the proposed 17 unit apartment building.

2. The receiving 250mm diameter sanitary sewers on King Street will have adequate capacity to service the Site.

3. The existing 450mm diameter stormwater sewer on King Street already has adequate capacity to serve the site.

4. Stormwater quality control will be provided to MECP Normal protection (70% TSS removal) levels prior to discharge from the site.

In conclusion, there exists adequate municipal servicing for this development. We trust the above comments and enclosed calculations are satisfactory for approval. If you have any questions or require additional information, please do not hesitate to contact our office.

Yours very truly,

Jason Schooley, P.Eng.

LICENSED PROFESSIONAL ENGINEER
J. P. SCHOOLEY
PROVINCE OF ONTARIO

Encl.

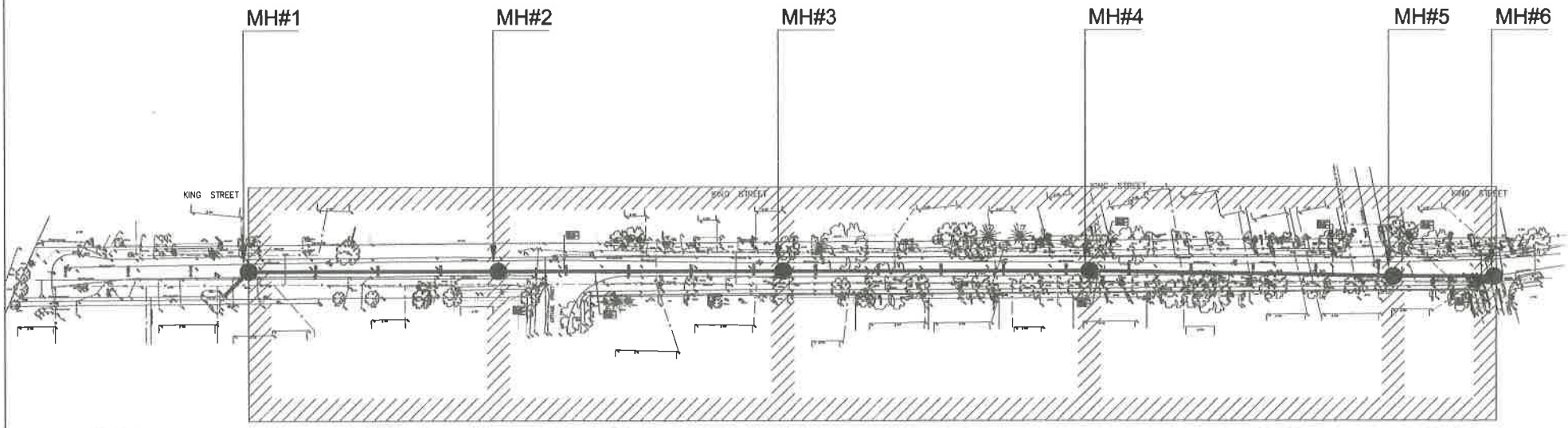
UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

APPENDICES

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

APPENDIX A

Drainage Area Plan, King Street, Denco Engineering Ltd.
Drainage Area Plan, Royal Albion Place, (UCC).
Figure 1. Existing Strom Drainage Area Plan.
Figure 2. Proposed Strom Drainage Area Plan.
Original Storm Sewer Design Sheet.
Proposed Storm Sewer Design Sheet.
Hydroworks – HydroDome Simulation.



SUB CATCHMENT AREA NUMBER

RUNOFF COEFF. | AREA (ha.)

3	2	1	4	5
0.45 | 0.60	0.45 | 0.68	0.45 | 0.73	0.45 | 0.73	0.45 | 0.25

REGISTERED PROFESSIONAL ENGINEER
J. R. DENHAM
May 8/08

No.	REFERENCE	DATE	INIT.
1	DESIGN ADDED	OCT. 22/07	J.R.D.

THE POSITION OF PIPE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWING AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH IS NOT GUARANTEED. BEFORE STARTING WORK THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM, AND ADDITIONAL COSTS ASSOCIATED WITH REDESIGNING OR REVISING NEWLY INSTALLED WORKS TO MAKE FOR PROPER ADJUSTMENTS IF TEST HOLES ARE NOT UNDERTAKEN PRIOR TO COMMENCING THE WORKS.

ALL WORK IS TO BE CONSTRUCTED TO ONTARIO PROVINCIAL SPECIFICATIONS AND DRAWINGS (O.P.S.S. & O.P.S.D.) AND APPROPRIATE MUNICIPAL STANDARDS AND SPECIFICATIONS. IN CASES OF CONFLICT, THE MUNICIPAL REQUIREMENTS HAVE PRECEDENCE.

INSTALLATION OF P.V.C. WATERMAINS AND SERVICES IS TO INCLUDE CATHODIC PROTECTION AND DETECT TAPE.

THIS IS NOT A LEGAL PLAN OF SURVEY. ANY BOUNDARY LENGTHS OR BEARINGS SHOWN ON THIS DRAWING ARE FOR GENERAL REFERENCE ONLY AND SHOULD NOT BE USED AS SPECIFIC BOUNDARY DATA.

DESIGNED BY: R.A.D.
DRAWN BY: J.R.D
CHECKED BY: J.R.D
DESIGN STAMP

TOWN OF NIAGARA ON THE LAKE

DENCO
281 MARTINDALE ROAD, UNIT #17
ST. CATHARINES, ONTARIO.
L2W 1A2
(905) 641-2364 Fax: 641-5449

KING STREET

STORM DRAINAGE AREA PLAN

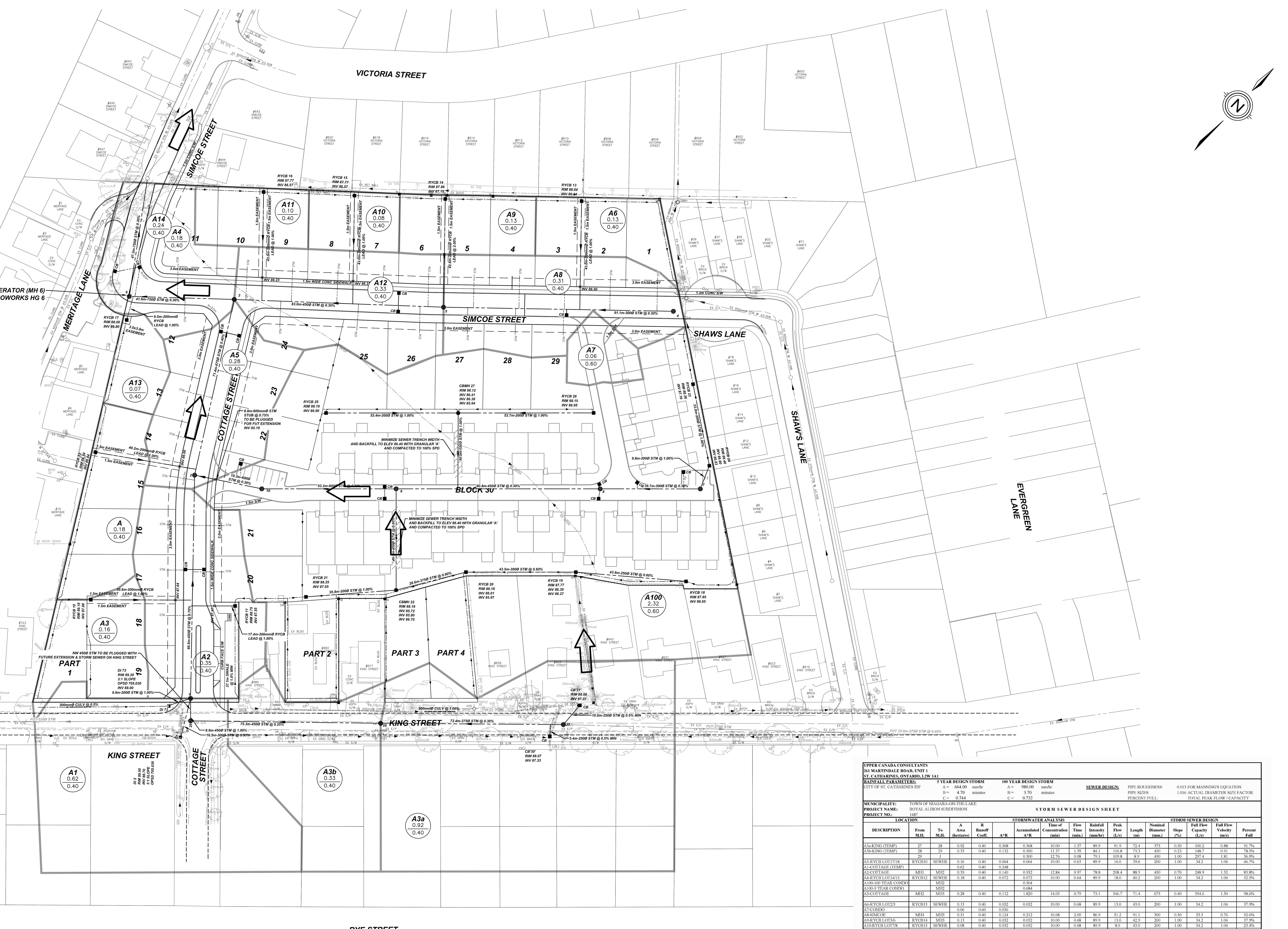
FIELD NOTES:
DATE: DEC. 14/07
SCALE: HORZ. 1:250
VERT. 1:50
DWG. No. 07014-DP
REF.
HOR. REF. NO

Niagara-on-the-Lake EST. 1781

OPERATIONS DEPARTMENT APPROVAL

SIGNATURE | DATE

BRETT RUCK — NAME | **ENGINEERING SUPERVISOR** — POSITION



LEGEND

- A0 — DRAINAGE AREA NUMBER
- 0.00 — DRAINAGE AREA IN HECTARES
- 0.00 — RUN-OFF COEFFICIENT
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE

UPPER CANADA CONSULTANTS
261 MARTINDALE ROAD, UNIT 1
ST. CATHARINES, ONTARIO, L2W 1A1

RAINFALL PARAMETERS: CITY OF ST. CATHARINES IDF

5 YEAR DESIGN STORM A = 664.00 mm/hr; B = 4.70 minutes; C = 0.744

100 YEAR DESIGN STORM A = 980.00 mm/hr; B = 3.70 minutes; C = 0.732

SEWER DESIGN: PIPE ROUGHNESS: 0.013 FOR MANNING'S EQUATION; PIPE SIZES: 1.016 ACTUAL DIAMETER SIZE FACTOR; PERCENT FULL: TOTAL PEAK FLOW / CAPACITY

MUNICIPALITY: TOWN OF NIAGARA-ON-THE-LAKE
PROJECT NAME: ROYAL ALBION SUBDIVISION
PROJECT NO.: 1487

STORM SEWER DESIGN SHEET

LOCATION			STORMWATER ANALYSIS								STORM SEWER DESIGN					
DESCRIPTION	From M.H.	To M.H.	A Area (hectares)	R Runoff Coeff.	A*R	Accumulated A*R	Time of Concentration (min)	Flow Time (min.)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Length (m)	Nominal Diameter (mm.)	Slope (%)	Full Flow Capacity (L/s)	Full Flow Velocity (m/s)	Percent Full
A3a-KING (TEMP)	27	28	0.92	0.40	0.368	0.368	10.00	1.37	89.9	91.9	72.4	375	0.30	100.2	0.88	91.7%
A3b-KING (TEMP)	28	29	0.33	0.40	0.132	0.500	11.37	1.39	84.1	116.8	75.3	450	0.25	148.7	0.91	78.5%
	29	1				0.500	12.76	0.08	79.1	109.8	8.9	450	1.00	297.4	1.81	36.9%
A3-RYCB LOT17/18	RYCB10	SEWER	0.16	0.40	0.064	0.064	10.00	0.63	89.9	16.0	39.6	200	1.00	34.2	1.06	46.7%
A1-COTTAGE (TEMP)			0.62	0.40	0.248											
A2-COTTAGE	MH1	MH2	0.35	0.40	0.140	0.952	12.84	0.97	78.8	208.4	88.5	450	0.70	248.9	1.52	83.8%
A4-RYCB LOT14/15	RYCB12	SEWER	0.18	0.40	0.072	0.072	10.00	0.64	89.9	18.0	40.2	200	1.00	34.2	1.06	52.5%
A100-100 YEAR CONDO		MH2				0.504										
A100-5 YEAR CONDO		MH2				0.684										
A5-COTTAGE	MH2	MH3	0.28	0.40	0.112	1.820	14.03	0.79	75.1	546.7	71.4	675	0.40	554.6	1.50	98.6%
A6-RYCB LOT2/3	RYCB13	SEWER	0.13	0.40	0.052	0.052	10.00	0.68	89.9	13.0	43.0	200	1.00	34.2	1.06	37.9%
A7-CONDO			0.06	0.60	0.036											
A8-SIMCOE	MH4	MH5	0.31	0.40	0.124	0.212	10.68	2.00	86.9	51.2	91.1	300	0.30	55.3	0.76	92.6%
A9-RYCB LOT5/6	RYCB14	MH5	0.13	0.40	0.052	0.052	10.00	0.68	89.9	13.0	42.9	200	1.00	34.2	1.06	37.9%
A10-RYCB LOT7/8	RYCB15	SEWER	0.08	0.40	0.032	0.032	10.00	0.68	89.9	8.0	43.0	200	1.00	34.2	1.06	23.4%
A11-RYCB LOT9/10	RYCB16	SEWER	0.10	0.40	0.040	0.040	10.00	0.68	89.9	10.0	43.0	200	1.00	34.2	1.06	29.2%
A12-SIMCOE	MH5	MH3	0.33	0.40	0.132	0.468	14.82	1.39	72.8	94.6	83.0	450	0.30	162.9	0.99	58.1%
A13-RYCB LOT12	RYCB17	MH12	0.07	0.40	0.028	0.028	10.00	0.15	89.9	7.0	9.5	200	1.00	34.2	1.06	20.4%
A14-SIMCOE	MH3	MH6	0.24	0.40	0.096	2.412	16.22	0.50	69.1	616.8	41.6	750	0.30	636.1	1.39	97.0%
	MH6	EXMH				2.412	16.71	0.57	67.9	606.0	47.3	750	0.30	636.1	1.39	95.3%

#	REVISION	DATE	INIT
1	ISSUED FOR MOE APPROVAL	2016-06-29	M.C.
0	ISSUED FOR REVIEW	2016-04-27	M.C.

NOTES/LEGEND

1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
2. PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.
3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

DRAFTING: MIKE C.
DESIGN: M.H./J.S.
CHECKED BY: J.S.
APPROVED BY: M.H.

LICENSED PROFESSIONAL ENGINEER — J. P. SCHOOLEY — Jun 29/16 — PROVINCE OF ONTARIO

Niagara-on-the-Lake EST. 1781

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS
261 Martindale Road
Unit #1
St. Catharines, ON
L2W 1A1
Phone: (905)688-9400
Fax: (905)688-5274

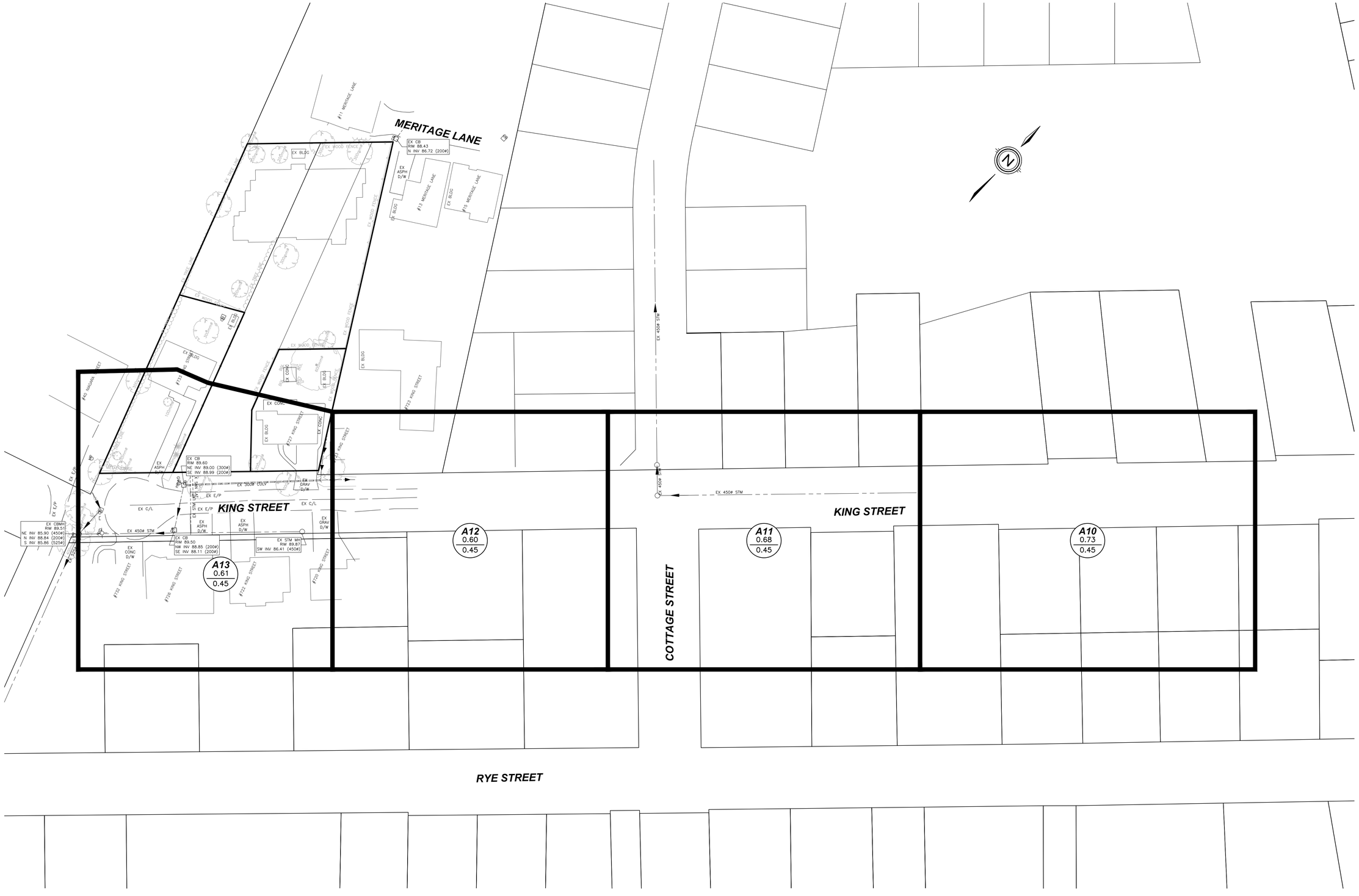
OWNER:
GATTA HOMES INC.
1624707 ONTARIO INC.

ROYAL ALBION PLACE

TOWN OF NIAGARA-ON-THE-LAKE
STORM DRAINAGE AREA PLAN

CONSULTANT FILE No. 1487
DATE 2016-01-20
PRINTED 2016-06-29
SCALE Hor : 1:750 m
REF. No. -
DWG No. **1487-STMDA**
REV. 1

DRAWING FILE: F:\1487\Engineering\1487_BASE1.dwg PLOTTED: Jun 29, 2016 – 3:52pm PLOTTED BY: MCook



#	REVISION	DATE	INIT

NOTES:

1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER, AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
2. PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.
3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

DRAFTING	.
DESIGN	.
CHECKED BY	.
APPROVED BY	.

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

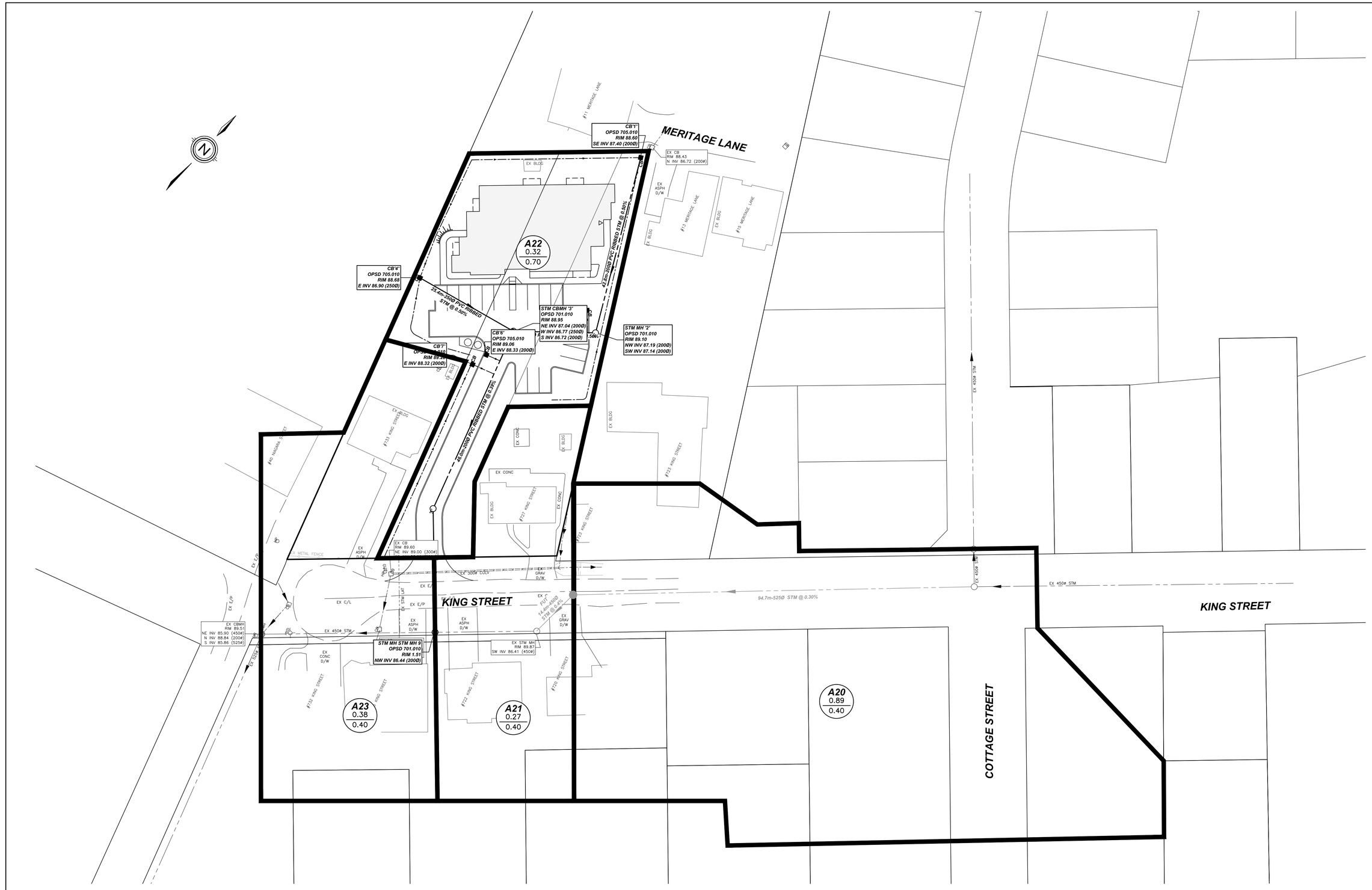
LEGEND

- A0 / 0.00 / 0.00 — DRAINAGE AREA NUMBER / DRAINAGE AREA IN HECTARES / RUN-OFF COEFFICIENT
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE

BICE APARTMENT
727-733 KING STREET
TOWN OF NIAGARA-ON-THE-LAKE
EXISTING STORM DRAINAGE PLAN

CONSULTANT FILE No.	22249
DATE	2023-04-04
PRINTED	2023-04-11
SCALE	1:500 m
REF No.	
DWG No.	FIGURE 1
REV	0

DRAWING FILE: F:\22249\Engineering\22249 BASE.dwg PLOTTED: Apr 11, 2023 - 2:38pm PLOTTED BY: roberto



NOTES:

1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER, AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
2. PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.
3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

#	REVISION	DATE	INIT

DRAFTING	.
DESIGN	.
CHECKED BY	.
APPROVED BY	.

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

LEGEND

- A0 / 0.00 / 0.00 — DRAINAGE AREA NUMBER / DRAINAGE AREA IN HECTARES / RUN-OFF COEFFICIENT
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE

BICE APARTMENT
727-733 KING STREET
TOWN OF NIAGARA-ON-THE-LAKE
FUTURE STORM DRAINAGE PLAN

CONSULTANT FILE No.	22249
DATE	2023-04-04
PRINTED	2023-04-06
SCALE	1:500 m
REF No.	
DWG No.	FIGURE 2
REV	0

DRAWING FILE: F:\22249\Engineering\22249 BASE.dwg PLOTTED: Apr 06, 2023 - 2:09pm PLOTTED BY: roberto

UPPER CANADA CONSULTANTS
3-30 HANNOVER DRIVE
ST. CATHARINES, ON L2W 1A3

RAINFALL PARAMETERS: **5 YEAR DESIGN STORM**

CITY OF ST. CATHARINES IDF

A = 664.00 mm/hr
B = 4.70 minutes
C = 0.744

SEWER DESIGN:

PIPE ROUGHNESS: 0.013 FOR MANNING'S EQUATION
PIPE SIZES: 1.016 ACTUAL DIAMETER SIZE FACTOR
PERCENT FULL: TOTAL PEAK FLOW / CAPACITY

MUNICIPALITY: TOWN OF NIAGARA-ON-THE-LAKE
PROJECT NAME: 727-733 KING STREET
PROJECT NO.: 22249

ORIGINAL STORM SEWER DESIGN SHEET

LOCATION			STORMWATER ANALYSIS								STORM SEWER DESIGN					
DESCRIPTION	From M.H.	To M.H.	A Area (hectares)	R Runoff Coeff.	A*R	Accumulated A*R	Time of Concentration (min)	Flow Time (min.)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Length (m)	Nominal Diameter (mm.)	Slope (%)	Full Flow Capacity (L/s)	Full Flow Velocity (m/s)	Percent Full
A10-KING	MH4	MH3	0.73	0.45	0.329	0.329	10.00	2.17	89.9	82.0	98.0	375	0.22	85.8	0.75	95.6%
A11-KING	MH3	MH2	0.68	0.45	0.306	0.635	12.17	1.67	81.1	143.0	91.0	450	0.25	148.7	0.91	96.2%
A12-KING	MH2	MH1	0.60	0.45	0.270	0.905	13.84	1.10	75.6	190.0	80.0	450	0.45	199.5	1.22	95.2%
KING	MH1	EX MH				0.905	14.94	0.16	72.5	182.0	11.2	450	0.41	190.5	1.16	95.6%
A13-KING	EX MH	EX MH	0.61	0.45	0.275	1.179	15.10	0.67	72.0	235.8	64.9	450	0.79	264.4	1.61	89.2%

UPPER CANADA CONSULTANTS
3-30 HANNOVER DRIVE
ST. CATHARINES, ON L2W 1A3

RAINFALL PARAMETERS: **5 YEAR DESIGN STORM**

CITY OF ST. CATHARINES IDF

A = 664.00 mm/hr
B = 4.70 minutes
C = 0.744

SEWER DESIGN:

PIPE ROUGHNESS: 0.013 FOR MANNING'S EQUATION
PIPE SIZES: 1.016 ACTUAL DIAMETER SIZE FACTOR
PERCENT FULL: TOTAL PEAK FLOW / CAPACITY

MUNICIPALITY: TOWN OF NIAGARA-ON-THE-LAKE
PROJECT NAME: 727-733 KING STREET
PROJECT NO.: 22249

P R O P O S E D S T O R M S E W E R D E S I G N S H E E T

LOCATION			STORMWATER ANALYSIS								STORM SEWER DESIGN					
DESCRIPTION	From M.H.	To M.H.	A Area (hectares)	R Runoff Coeff.	A*R	Accumulated A*R	Time of Concentration (min)	Flow Time (min.)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Length (m)	Nominal Diameter (mm.)	Slope (%)	Full Flow Capacity (L/s)	Full Flow Velocity (m/s)	Percent Full
A20-KING	EX MH	MH1	0.89	0.45	0.401	0.401	10.00	1.44	89.9	100.0	94.7	525	0.30	245.7	1.10	40.7%
	FUT	EX MH				0.401	11.44	0.17	83.9	93.3	11.4	450	0.40	188.1	1.15	49.6%
A21-KING	EX MH	MH9	0.27	0.45	0.122	0.522	11.60	0.25	83.2	120.7	24.0	450	0.79	264.4	1.61	45.7%
A22-SITE	MH8	MH9	0.32	0.70	0.224	0.224	11.12	0.34	85.1	53.0	17.6	300	0.40	63.8	0.87	83.0%
A23-KING	MH9	EX CBMH	0.38	0.45	0.171	0.917	11.85	0.42	82.3	209.6	40.1	450	0.79	264.4	1.61	79.3%

```
     ************************************************
     *      Storm Water Management Sizing Model     *
     *               Hydroworks, LLC                *
     *                Version 4.4                   *
     *                                              *
     *        Continuous Simulation Program         *
     *              Based on SWMM 4.4H              *
     *              Hydroworks, LLC                 *
     *               Graham Bryant                  *
     *                2003 - 2021                   *
     ************************************************

                    Developed by

     ************************************************
     *               Hydroworks, LLC                *
     *             Metcalf & Eddy, Inc.             *
     *            University of Florida             *
     *       Water Resources Engineers, Inc.        *
     *      (Now Camp Dresser & McKee, Inc.)        *
     *             Modified SWMM 4.4                *
     ************************************************

              Distributed and Maintained by

     ************************************************
     *                                              *
     *               Hydroworks, LLC                *
     *                888-290-7900                  *
     *              www.hydroworks.com              *
     *                                              *
     ************************************************

     ************************************************
     *     If any problems occur executing this     *
     *     model, contact Mr. Graham Bryant at      *
     *     Hydroworks, LLC by phone at 888-290-7900 *
     *     or by e-mail: support@hydroworks.com     *
     ************************************************

     ************************************************
     *     This model is based on EPA SWMM 4.4      *
     *  "Nature is full of infinite causes which    *
     *   have never occurred in experience" da Vinci *
     ************************************************


     ************************************************
     * Entry made to the Rain Block                 *
     * Created by the University of Florida - 1988  *
     * Updated by Oregon State University, March 2000 *
     ************************************************



     727 - 733 KING STREET
     NIAGRA ON THE LAKE

     HydroDome Simulation


 ########################################
 #  Precipitation Block Input Commands  #
 ########################################

Station Name.........................  St. Catherines A
Station Location.....................  Ontario
Station, ISTA........................    7287
Beginning date, IYBEG (Yr/Mo/Dy)......  1971/ 1/ 1
Ending date, IYEND (Yr/Mo/Dy).........  2005/12/31
Minimum interevent time, MIT..........     1
Number of ranked storms, NPTS.........    10
NWS format, IFORM (See text)..........     1
Print storm summary, ISUM (O-No 1-Yes)     0
Print all rainfall, IYEAR (O-No 1-Yes)     0
Save storm event data on NSCRAT(1)....     0
(IFILE =0 -Do not save, =1 -Save data)
IDECID 0 - Create interface file
       1 - Create file and analyze
       2 - Synoptic analysis..........     2
Plotting position parameter, A........  0.40
Storm event statistics, NOSTAT........  1100

KODEA (from optional group B0)........     2
 = 0, Do not include NCDC cumulative values.
 = 1, Average NCDC cumulative values.
 = 2, Use NCDC cumulative value as inst. rain.

KODEPR (from optional group B0).......     0
 Print NCDC special codes in event summary:
 = 0, only on days with events.
 = 1, on all days with codes present.
 Codes: A = accumulated value, I = incomplete value,
        M = missing value,     O = other code present
```

```
*******************************************************
*  Precipitation output created using the Rain block   *
*  Number of precipitation stations...        1        *
*******************************************************

Location Station Number
-------- --------------
       1.     7287

STATION ID ON PRECIP. DATA INPUT FILE = 7287
REQUESTED STATION ID =     7287  CHECK TO BE SURE THEY MATCH.

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
Note, 15-min. data are being processed, but hourly
print-out, summaries, and statistics are based on
hourly totals only.  Data placed on interface file
are at correct 15-min. intervals.
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

###################################################
# Entry made to the Runoff Block, last updated by #
# Oregon State University, and Camp, Dresser and  #
# McKee, Inc., March 2002.                        #
###################################################
# "And wherever water goes, amoebae go along for  #
#  the ride"                      Tom Robbins     #
###################################################

Snowmelt parameter - ISNOW.....................          0
Number of rain gages - NRGAG...................          1
Horton infiltration equation used - INFILM.....          2
Maximum infiltration volume is limited to RMAXINF input on  subcatchment lines.
Infiltration volume regenerates during  non rainfall periods.
Quality is simulated - KWALTY..................          1
IVAP is negative.  Evaporation will be set to zero
    during time steps with rainfall.
Read evaporation data on line(s) F1 (F2) - IVAP..          1
Hour of day at start of storm - NHR............          1
Minute of hour at start of storm - NMN.........          1
Time TZERO at start of storm (hours)...........      1.017
Use Metric units for I/O - METRIC..............          1
 ===> Ft-sec units used in all internal computations
Runoff input print control...                             0
Runoff graph plot control....                             1
Runoff output print control..                             0
Print headers every 50 lines - NOHEAD (0=yes, 1=no)       0
Print land use load percentages -LANDUPR (0=no, 1=yes)    0
Limit number of groundwater convergence messages to 10000 (if simulated)
Month, day, year of start of storm is:             1/ 1/1971
Wet time step length (seconds).......                  300.
Dry time step length (seconds).......                  900.
Wet/Dry time step length (seconds)...                  450.
Simulation length is......                     20051231.0 Yr/Mo/Dy
Percent of impervious area with zero detention depth    25.0

Horton infiltration model being used
Rate for regeneration of infiltration = REGEN * DECAY
DECAY is read in for each subcatchment
REGEN = ........................................   0.01000


*******************************************************
*   Processed Precipitation will be read from file    *
*******************************************************

  ############################
  #        Data Group F1     #
  # Evaporation Rate (mm/day) #
  ############################

 JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV.  DEC.
 ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----
 0.00  0.00  0.00  2.54  2.54  3.81  3.81  3.81  2.54  2.54  0.00  0.00

*******************************************************
*         C H A N N E L  A N D  P I P E  D A T A       *
*******************************************************

Input   NAMEG:     Drains                          Invert  L Side   R Side  Intial     Max  Mann-   Full
equen  Channel      to     Channel  Width  Length    Slope   Slope    Slope   Depth   Depth   ings   Flow
umber    ID #      NGTO:    Type     (m)    (m)     (m/m)   (m/m)    (m/m)     (m)     (m)   "N"   (cms)
-----  ------------------ -------- ------ --------  ------- -------- ------- ------- ------- -----  -----
  1        201         200   Dummy     0.0     0.0    0.0000   0.0000  0.0000     0.0     0.0  0.0000 0.00E+00


 ***************************************************
 *          S U B C A T C H M E N T  D A T A       *
 ***************************************************

*NOTE. SEE LATER TABLE FOR OPTIONAL SUBCATCHMENT PARAMETERS*
      SUBCATCH-  CHANNEL      WIDTH     AREA  PERCENT    SLOPE    RESISTANCE  FACTOR    DEPRES. STORAGE(MM) INFILTRATION    DECAY RATE GAGE  MAXIMUM
       MENT NO.  OR INLET       (M)     (HA)  IMPERV.    (M/M)      IMPERV.     PERV.    IMPERV.     PERV.      RATE(MM/HR)     (1/SEC)    NO.  VOLUME
                                                                                                             MAXIMUM MINIMUM                      (MM)
 ---  --------   -------- --------- --------  -----   -------     -------  --------    ------    ------     ----   -------  -------  ------ -------
  1        300         200     56.57     0.32  71.42    0.0200      0.015     0.250     0.510     5.080    63.50   10.16    0.00055     1  101.60000
```

```
TOTAL NUMBER OF SUBCATCHMENTS...              1
TOTAL TRIBUTARY AREA (HECTARES).          0.32
IMPERVIOUS AREA (HECTARES)......          0.23
PERVIOUS AREA (HECTARES)........          0.09
TOTAL WIDTH (METERS)............         56.57
PERCENT IMPERVIOUSNESS..........         71.42
```

****
* G R O U N D W A T E R I N P U T D A T A *
****

SUB-CATCH NUMBER	CHANNEL OR INLET	ELEVATIONS GROUND (M)	BOTTOM (M)	STAGE (M)	BC (M)	TW (M)	FLOW CONSTANTS A1 (MM/HR-M^B1)	B1	A2 (MM/HR-M^B2)	B2	A3 (MM/HR-M^2)
0	602	3.05	0.00	0.00	0.61	0.61	3.484E-04	2.600	0.000E+00	1.000	0.00E+00

****
* G R O U N D W A T E R I N P U T D A T A (CONTINUED) *
****

S O I L P R O P E R T I E S

SUBCAT. NO.	POROSITY	SATURATED HYDRAULIC CONDUCTIVITY (mm/hr)	WILTING POINT	FIELD CAPACITY	INITIAL MOISTURE	MAX. DEEP PERCOLATION (mm/hr)	PERCOLATION PARAMETERS HCO	PCO	ET PARAMETERS DEPTH OF ET (m)	FRACTION OF ET TO UPPER ZONE
0	.4000	127.000	.1500	.3000	.3000	5.080E-02	10.00	4.57	4.27	0.350

****
* Arrangement of Subcatchments and Channel/Pipes *
****
* See second subcatchment output table for connectivity *
* of subcatchment to subcatchment flows. *
****

Channel or Pipe
201 No Tributary Channel/Pipes
No Tributary Subareas.....

INLET
200 Tributary Channel/Pipes... 201
Tributary Subareas........ 300

****
* Hydrographs will be stored for the following 1 INLETS *
****
200

##########
Quality Simulation
##########
General Quality Control Data Groups
##########

Description	Variable	Value	
Number of quality constituents.....	NQS.....	1	
Number of land uses.....	JLAND.....	1	
Standard catchbasin volume.....	CBVOL.....	1.22	cubic meters
Erosion is not simulated.....	IROS.....	0	
DRY DAYS PRIOR TO START OF STORM...	DRYDAY.....	3.00	DAYS
DRY DAYS REQUIRED TO RECHARGE CATCHBASIN CONCENTRATION TO INITIAL VALUES.....	DRYBSN.....	5.00	DAYS
DUST AND DIRT STREET SWEEPING EFFICIENCY.....	REFFDD.....	0.300	
DAY OF YEAR ON WHICH STREET SWEEPING BEGINS.....	KLNBGN.....	120	
DAY OF YEAR ON WHICH STREET SWEEPING ENDS.....	KLNEND.....	270	

##########
Land use data on data group J2
##########

AND USE LNAME)	BUILDUP EQUATION TYPE (METHOD)	FUNCTIONAL DEPENDENCE OF BUILDUP PARAMETER(JACGUT)	LIMITING BUILDUP QUANTITY (DDLIM)	BUILDUP POWER (DDPOW)	BUILDUP COEFF. (DDFACT)	CLEANING INTERVAL IN DAYS (CLFREQ)	AVAIL. FACTOR FRACTION (AVSWP)	DAYS SINCE LAST SWEEPING (DSLCL)
Urban De	EXPONENTIAL(1)	AREA(1)	2.802E+01	0.500	67.250	30.000	0.300	30.000

```
##############################################
#     Constituent data on data group J3      #
##############################################

                              Total Su
                              --------
Constituent units........      mg/l
Type of units............           0
KALC.....................           2
Type of buildup calc.....    EXPONENTIAL(2)
KWASH....................           0
Type of washoff calc.....  POWER EXPONEN.(0)
KACGUT...................           1
Dependence of buildup....         AREA(1)
LINKUP...................           0
Linkage to snowmelt......   NO SNOW LINKAGE
Buildup param 1 (QFACT1).         28.020
Buildup param 2 (QFACT2).          0.500
Buildup param 3 (QFACT3).         67.250
Buildup param 4 (QFACT4).          0.000
Buildup param 5 (QFACT5).          0.000
Washoff power (WASHPO)...          1.100
Washoff coef. (RCOEF)....          0.086
Init catchb conc (CBFACT)        100.000
Precip. conc. (CONCRN)...          0.000
Street sweep effic (REFF)          0.300
Remove fraction (REMOVE).          0.000
1st order QDECAY, 1/day..          0.000
Land use number.........              1

************************************************
* Constant Groundwater Quality Concentration(s) *
************************************************

 Total Susp has a concentration of..    0.0000   mg/l

************************************************
* REMOVAL FRACTIONS FOR SELECTED CHANNEL/PIPES *
* FROM J7 LINES                                *
************************************************

  CHANNEL/   CONSTITUENT
     PIPE Total Susp
----------  ---------
       201     0.000

******************************************************
*     Subcatchment surface quality on data group L1 *
******************************************************



                            Total   Number   Input
                     Land    Gutter     of    Loading
                Land  Use    Length   Catch-  load/ha
           No.  Usage  No.      Km     Basins   Total Su
        ------ -------- ----  -------- --------  -------
   1        300 Urban De  1         0.11     2.00  0.0E+00
   Totals (Loads in kg or other)    0.11     2.00  0.0E+00

    **********************
    *    DATA GROUP M1    *
    **********************

TOTAL NUMBER OF PRINTED GUTTERS/INLETS...NPRNT..        1
NUMBER OF TIME STEPS BETWEEN PRINTINGS..INTERV..        0
STARTING AND STOPPING PRINTOUT DATES.....               0        0

    **********************
    *    DATA GROUP M3    *
    **********************

CHANNEL/INLET PRINT DATA GROUPS......       -200


          ****************************************
          * Rainfall from Nat. Weather Serv. file  *
          * in units of hundredths of an inch      *
          ****************************************

Rainfall Station    St. Catherines A
State/Province      Ontario

Rainfall Depth Summary (mm)

Year     Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec    Total

1971.     31.    0.    0.    0.    0.    0.  126.   93.   52.   60.   29.    0.    391.
1972.      0.    0.    0.   47.   65.  100.   39.  115.   63.   90.    1.    0.    521.
1973.      0.    0.    0.  103.   77.   71.   53.   29.   63.  139.    0.    0.    534.
1974.      0.    0.    0.   67.  105.   62.   50.   31.   74.   37.  110.    0.    536.
1975.      0.    0.    0.    0.    0.   94.   78.   76.   73.   56.   59.    6.    442.
1976.      0.    0.    0.  119.  136.   87.  101.   60.   72.   73.   13.    1.    662.
1977.      0.    0.    0.   94.   29.   69.   57.  150.  230.   71.    0.    1.    701.
1978.      0.    0.    0.   72.   43.   72.   43.   86.  156.   95.    0.    0.    567.
```

1979.	0.	0.	0.	84.	92.	33.	91.	88.	84.	129.	71.	0.	673.
1980.	0.	0.	0.	81.	39.	122.	60.	32.	79.	96.	45.	0.	554.
1981.	0.	0.	0.	91.	71.	106.	122.	61.	123.	91.	84.	0.	749.
1982.	0.	0.	0.	28.	65.	97.	36.	66.	82.	25.	143.	0.	544.
1983.	0.	0.	0.	78.	100.	65.	55.	106.	75.	122.	92.	0.	694.
1984.	0.	0.	0.	31.	113.	136.	19.	51.	144.	24.	44.	0.	562.
1985.	0.	0.	67.	32.	52.	64.	40.	94.	42.	109.	0.	1.	501.
1986.	0.	0.	0.	93.	113.	60.	85.	83.	98.	80.	43.	65.	719.
1987.	0.	2.	11.	77.	42.	80.	122.	97.	99.	71.	94.	34.	730.
1988.	0.	0.	41.	71.	42.	21.	110.	82.	70.	68.	75.	5.	585.
1989.	0.	0.	13.	63.	137.	108.	36.	45.	89.	73.	84.	0.	647.
1990.	0.	2.	38.	99.	124.	44.	68.	95.	56.	112.	96.	0.	735.
1991.	0.	0.	86.	124.	67.	31.	85.	57.	79.	64.	61.	28.	682.
1992.	0.	0.	29.	127.	56.	92.	185.	116.	77.	47.	103.	38.	869.
1993.	3.	0.	7.	83.	56.	86.	32.	61.	71.	92.	80.	38.	610.
1994.	0.	0.	44.	88.	105.	124.	48.	77.	117.	15.	0.	15.	633.
1995.	112.	23.	16.	48.	37.	60.	123.	66.	8.	137.	94.	0.	724.
1998.	0.	0.	0.	0.	51.	54.	64.	29.	9.	0.	1.	0.	207.
1999.	0.	0.	0.	79.	59.	35.	61.	58.	116.	78.	0.	0.	487.
2000.	0.	0.	0.	123.	134.	216.	51.	0.	0.	0.	10.	0.	534.
2001.	0.	0.	0.	56.	88.	45.	25.	30.	81.	129.	0.	0.	454.
2002.	0.	0.	0.	73.	104.	64.	53.	49.	52.	65.	8.	0.	468.
2003.	0.	0.	0.	10.	163.	77.	81.	64.	67.	73.	2.	0.	537.
2004.	0.	0.	0.	131.	126.	99.	115.	40.	88.	17.	0.	0.	616.
2005.	0.	0.	0.	38.	42.	78.	53.	120.	112.	0.	0.	0.	443.

Total Rainfall Depth for Simulation Period 19310. (mm)

Rainfall Intensity Analysis (mm/hr)

(mm/hr)	(#)	(%)	(mm)	(%)
2.50	21481	74.6	6454.	33.4
5.00	3585	12.4	3088.	16.0
7.50	1973	6.8	2886.	14.9
10.00	575	2.0	1233.	6.4
12.50	389	1.4	1070.	5.5
15.00	194	0.7	660.	3.4
17.50	210	0.7	846.	4.4
20.00	66	0.2	306.	1.6
22.50	92	0.3	487.	2.5
25.00	39	0.1	232.	1.2
27.50	37	0.1	246.	1.3
30.00	34	0.1	245.	1.3
32.50	29	0.1	228.	1.2
35.00	5	0.0	42.	0.2
37.50	10	0.0	90.	0.5
40.00	10	0.0	97.	0.5
42.50	12	0.0	124.	0.6
45.00	9	0.0	99.	0.5
47.50	1	0.0	12.	0.1
50.00	3	0.0	37.	0.2
>50.00	49	0.2	829.	4.3

Total # of Intensities 28803

Daily Rainfall Depth Analysis (mm)

(mm)	(#)	(%)	(mm)	(%)
2.50	1077	38.9	1247.	6.5
5.00	507	18.3	1850.	9.6
7.50	326	11.8	2006.	10.4
10.00	226	8.2	1958.	10.1
12.50	150	5.4	1672.	8.7
15.00	111	4.0	1495.	7.7
17.50	100	3.6	1620.	8.4
20.00	67	2.4	1260.	6.5
22.50	45	1.6	958.	5.0
25.00	37	1.3	881.	4.6
27.50	23	0.8	609.	3.2
30.00	20	0.7	575.	3.0
32.50	20	0.7	631.	3.3
35.00	12	0.4	405.	2.1
37.50	8	0.3	290.	1.5
40.00	9	0.3	350.	1.8
42.50	4	0.1	165.	0.9
45.00	4	0.1	173.	0.9
47.50	2	0.1	91.	0.5
50.00	4	0.1	192.	1.0
>50.00	15	0.5	882.	4.6

Total # Days with Rain 2767

```
************************************************
*      End of time step DO-loop in Runoff      *
************************************************

Final Date (Mo/Day/Year)   =                  1/ 1/2006
Total number of time steps =                    2056358
Final Julian Date  =                            2006001
Final time of day  =                                 2. seconds.
Final time of day  =                               0.00   hours.
Final running time =                          306816.0000   hours.
Final running time =                           12784.0000    days.
```

```
************************************************
*     Extrapolation Summary for Watersheds       *
* # Steps ==> Total Number of Extrapolated Steps *
* # Calls ==> Total Number of OVERLND Calls      *
************************************************

 Subcatch   # Steps   # Calls  Subcatch   # Steps   # Calls  Subcatch   # Steps   # Calls
 --------   -------   -------  --------   -------   -------  --------   -------   -------
      300   6155517   1559211

************************************************
*     Extrapolation Summary for Channel/Pipes    *
* # Steps ==> Total Number of Extrapolated Steps *
* # Calls ==> Total Number of GUTNR Calls        *
************************************************

Chan/Pipe   # Steps   # Calls Chan/Pipe   # Steps   # Calls Chan/Pipe   # Steps   # Calls
 --------   -------   -------  --------   -------   -------  --------   -------   -------
      201         0         0

*********************************************
*       Continuity Check for Surface Water   *
*********************************************
                                                          Millimeters over
                                                cubic meters  Total Basin
Total Precipitation (Rain plus Snow)                 61640.     19263.
Total Infiltration                                   17516.      5474.
Total Evaporation                                     4316.      1349.
Surface Runoff from Watersheds                       40288.     12590.
Total Water remaining in Surface Storage                 0.         0.
Infiltration over the Pervious Area...               17516.     19152.
                    --------
Infiltration + Evaporation +
Surface Runoff + Snow removal +
Water remaining in Surface Storage +
Water remaining in Snow Cover.........               62119.     19413.
Total Precipitation + Initial Storage.               61640.     19263.


The error in continuity is calculated as
*************************************
* Precipitation + Initial Snow Cover  *
*      - Infiltration -               *
*Evaporation - Snow removal -         *
*Surface Runoff from Watersheds -     *
*Water in Surface Storage -           *
*Water remaining in Snow Cover        *
*-----------------------------------*
* Precipitation + Initial Snow Cover  *
*************************************
Error.................................       -0.778 Percent


*********************************************
*       Continuity Check for Channel/Pipes   *
*********************************************
                                                          Millimeters over
                                                cubic meters  Total Basin
Initial Channel/Pipe Storage.................            0.         0.
Final Channel/Pipe Storage...................            0.         0.
Surface Runoff from Watersheds...............        40288.     12590.
Baseflow.....................................            0.
Groundwater Subsurface Inflow................            0.         0.
Evaporation Loss from Channels...............            0.         0.
Channel/Pipe/Inlet Outflow...................        40288.     12590.
Initial Storage + Inflow.....................        40288.     12590.
Final Storage + Outflow......................        40288.     12590.
*******************************************
* Final Storage + Outflow + Evaporation  - *
* Watershed Runoff - Groundwater Inflow  - *
*     Initial Channel/Pipe Storage         *
*     ----------------------------------   *
*  Final Storage + Outflow  + Evaporation  *
*******************************************
Error.........................................      0.000 Percent


*************************************************
*     Continuity Check for Subsurface Water       *
*************************************************

                                                          Millimeters over
                                                cubic meters  Subsurface Basin

Total Infiltration                                       0.         0.
Total Upper Zone ET                                      0.         0.
Total Lower Zone ET                                      0.         0.
Total Groundwater flow                                   0.         0.
Total Deep percolation                                   0.         0.
Initial Subsurface Storage                            2926.       914.
Final Subsurface Storage                              2926.       914.
Upper Zone ET over Pervious Area                         0.         0.
Lower Zone ET over Pervious Area                         0.         0.
```

```
*****************************************
* Infiltration + Initial Storage - Final *
* Storage - Upper and Lower Zone ET -    *
* Groundwater Flow - Deep Percolation    *
* -------------------------------------- *
*     Infiltration + Initial Storage     *
*****************************************
Error .....................................     0.000 Percent
```

SUMMARY STATISTICS FOR SUBCATCHMENTS

SUBCATCHMENT NO.	GUTTER OR INLET NO.	AREA (HA)	PERCENT IMPER.	TOTAL SIMULATED RAINFALL (MM)	PERVIOUS AREA TOTAL RUNOFF DEPTH (MM)	PERVIOUS AREA TOTAL LOSSES (MM)	PERVIOUS AREA PEAK RUNOFF RATE (CMS)	IMPERVIOUS AREA RUNOFF DEPTH (MM)	IMPERVIOUS AREA PEAK RUNOFF RATE (CMS)	TOTAL SUBCATCHMENT AREA RUNOFF DEPTH (MM)	TOTAL SUBCATCHMENT AREA PEAK RUNOFF RATE (CMS)	TOTAL SUBCATCHMENT AREA PEAK UNIT RUNOFF (MM/HR)
300	200	0.32	71.419	262.47	113.458********	0.033	175	80.303	0.124	12588.278	0.158	178.977

*** NOTE *** IMPERVIOUS AREA STATISTICS AGGREGATE IMPERVIOUS AREAS WITH AND WITHOUT DEPRESSION STORAGE

SUMMARY STATISTICS FOR CHANNEL/PIPES

CHANNEL NUMBER	FULL FLOW (CMS)	FULL VELOCITY (M/S)	FULL DEPTH (M)	MAXIMUM COMPUTED INFLOW (CMS)	MAXIMUM COMPUTED OUTFLOW (CMS)	MAXIMUM COMPUTED DEPTH (M)	MAXIMUM COMPUTED VELOCITY (M/S)	TIME OF OCCURRENCE DAY	TIME OF OCCURRENCE HR.	LENGTH OF SURCHARGE (HOUR)	MAXIMUM SURCHARGE VOLUME (CU-M)	RATIO OF MAX. TO FULL FLOW	RATIO OF MAX. DEPTH TO FULL DEPTH
201				0.00				1/ 0/1900	0.00				
200				0.16				8/14/1972	14.25				

TOTAL NUMBER OF CHANNELS/PIPES = 2

*** NOTE *** THE MAXIMUM FLOWS AND DEPTHS ARE CALCULATED AT THE END OF THE TIME INTERVAL

```
##################################################
#             Runoff Quality Summary Page        #
# If NDIM = 0 Units for:   loads    mass rates   #
#             METRIC = 1    lb        lb/sec     #
#             METRIC = 2    kg        kg/sec     #
# If NDIM = 1 Loads are in units of quantity     #
#             and mass rates are quantity/sec    #
# If NDIM = 2 loads are in units of concentration#
#             times volume and mass rates have units#
#             of concentration times volume/second #
##################################################

Total Su NDIM =  0
METRIC =  2
```

	Total Su
Inputs	
1. INITIAL SURFACE LOAD.....	7.
2. TOTAL SURFACE BUILDUP.....	5642.
3. INITIAL CATCHBASIN LOAD.....	0.
4. TOTAL CATCHBASIN LOAD.....	0.
5. TOTAL CATCHBASIN AND SURFACE BUILDUP (2+4).....	5642.
Remaining Loads	
6. LOAD REMAINING ON SURFACE...	3.
7. REMAINING IN CATCHBASINS....	0.
8. REMAINING IN CHANNEL/PIPES..	0.
Removals	
9. STREET SWEEPING REMOVAL.....	473.
10. NET SURFACE BUILDUP (2-9)...	5169.
11. SURFACE WASHOFF.....	5166.
12. CATCHBASIN WASHOFF.....	0.
13. TOTAL WASHOFF (11+12).....	5166.
14. LOAD FROM OTHER CONSTITUENTS	0.
15. PRECIPITATION LOAD.....	0.
15a.SUM SURFACE LOAD (13+14+15).	5166.
16. TOTAL GROUNDWATER LOAD.....	0.
16a.TOTAL I/I LOAD.....	0.
17. NET SUBCATCHMENT LOAD (15a-15b-15c-15d+16+16a)....	5166.
>>Removal in channel/pipes (17a, 17b):	
17a.REMOVE BY BMP FRACTION.....	0.
17b.REMOVE BY 1st ORDER DECAY...	0.
18. TOTAL LOAD TO INLETS.....	5166.
19. FLOW WT'D AVE.CONCENTRATION mg/l (INLET LOAD/TOTAL FLOW).....	128.

Percentages
---

20. STREET SWEEPING (9/2).....	8.
21. SURFACE WASHOFF (11/2).....	92.
22. NET SURFACE WASHOFF(11/10)..	100.
23. WASHOFF/SUBCAT LOAD(11/17)..	100.
24. SURFACE WASHOFF/INLET LOAD (11/18).....	100.
25. CATCHBASIN WASHOFF/ SUBCATCHMENT LOAD (12/17)...	0.
26. CATCHBASIN WASHOFF/ INLET LOAD (12/18).....	0.
27. OTHER CONSTITUENT LOAD/ SUBCATCHMENT LOAD (14/17)...	0.
28. INSOLUBLE FRACTION/ INLET LOAD (14/18).....	0.
29. PRECIPITATION/ SUBCATCHMENT LOAD (15/17)...	0.
30. PRECIPITATION/ INLET LOAD (15/18).....	0.
31. GROUNDWATER LOAD/ SUBCATCHMENT LOAD (16/17)...	0.
32. GROUNDWATER LOAD/ INLET LOAD (16/18).....	0.
32a.INFILTRATION/INFLOW LOAD/ SUBCATCHMENT LOAD (16a/17)..	0.
32b.INFILTRATION/INFLOW LOAD/ INLET LOAD (16a/18).....	0.
32c.CH/PIPE BMP FRACTION REMOVAL/ SUBCATCHMENT LOAD (17a/17)..	0.
32d.CH/PIPE 1st ORDER DECAY REMOVAL/ SUBCATCHMENT LOAD (17b/17)..	0.
33. INLET LOAD SUMMATION ERROR (18+8+6a+17a+17b-17)/17.....	0.

CAUTION. Due to method of quality routing (Users Manual, Appendix IX)
quality routing through channel/pipes is sensitive to the time step.
Large "Inlet Load Summation Errors" may result.
These can be reduced by adjusting the time step(s).
Note: surface accumulation during dry time steps at end of simulation is
not included in totals. Buildup is only performed at beginning of
wet steps or for street cleaning.

****
* TSS Particle Size Distribution *
****

Diameter (um)	%	Specific Gravity	Settling Velocity (m/s)	Critical Peclet Number
20.	20.0	2.65	0.000267	0.080977
60.	20.0	2.65	0.002319	0.160673
150.	20.0	2.65	0.012234	0.284537
400.	20.0	2.65	0.047806	0.524584
2000.	20.0	2.65	0.180097	1.431405

****
*
* Summary of TSS Removal *
*
****

TSS Removal based on Lab Performance Curve

Model #	Low Q Treated (cms)	High Q Treated (cms)	Runoff Treated (%)	TSS Removed (%)
Unavailabl	0.056	0.056	99.7	89.3
HD 4	0.056	0.056	99.7	93.1
HD 5	0.056	0.056	99.7	95.7
HD 6	0.056	0.056	99.7	97.5
Unavailabl	0.056	0.056	99.7	98.4
HD 8	0.056	0.056	99.7	98.9
HD 10	0.056	0.056	99.7	99.4
HD 12	0.056	0.056	99.7	99.7

****
*
* Summary of Annual Flow Treatmnet & TSS Removal *
*
****

Year	Unavailabl Flow Vol (m3)	Flow Treated (m3)	TSS In (kg)	TSS Rem (kg)	TSS Out (kg)	TSS Byp (kg)	Flow Treated (%)	TSS Removal (%)
1971.	4210.	4195.	102.	88.	14.	0.	99.7	86.2
1972.	5414.	5025.	134.	120.	13.	4.	92.8	87.3
1973.	5371.	5371.	144.	129.	15.	0.	100.0	89.7
1974.	5486.	5468.	154.	142.	12.	0.	99.7	92.1
1975.	4647.	4647.	132.	116.	16.	0.	100.0	87.9
1976.	6916.	6849.	165.	149.	16.	1.	99.0	89.5
1977.	7413.	7320.	161.	136.	25.	1.	98.7	84.0
1978.	5913.	5913.	153.	133.	20.	0.	100.0	87.1
1979.	7080.	7031.	176.	158.	18.	0.	99.3	89.3
1980.	5705.	5705.	164.	147.	17.	0.	100.0	89.7

1981.	7872.	7872.	184.	168.	15.	0.	100.0	91.7
1982.	5544.	5544.	150.	137.	13.	0.	100.0	91.5
1983.	7309.	7308.	191.	170.	21.	0.	100.0	89.1
1984.	5890.	5890.	148.	131.	17.	0.	100.0	88.7
1985.	5140.	5140.	145.	131.	14.	0.	100.0	90.2
1986.	7489.	7489.	199.	181.	17.	0.	100.0	91.3
1987.	7743.	7728.	199.	179.	20.	0.	99.8	89.7
1988.	6197.	6197.	167.	152.	16.	0.	100.0	90.7
1989.	6820.	6820.	162.	149.	13.	0.	100.0	91.8
1990.	7730.	7730.	204.	187.	17.	0.	100.0	91.5
1991.	7243.	7243.	192.	174.	18.	0.	100.0	90.7
1992.	9209.	9209.	223.	196.	27.	0.	100.0	88.1
1993.	6272.	6272.	188.	174.	14.	0.	100.0	92.5
1994.	6721.	6705.	155.	132.	23.	0.	99.8	84.8
1995.	7783.	7783.	185.	161.	24.	0.	100.0	87.1
1998.	2033.	2033.	71.	63.	8.	0.	100.0	88.3
1999.	4954.	4954.	143.	128.	15.	0.	100.0	89.8
2000.	5684.	5684.	124.	105.	19.	0.	100.0	84.4
2001.	4512.	4512.	117.	110.	7.	0.	100.0	94.1
2002.	4712.	4712.	136.	124.	12.	0.	100.0	91.1
2003.	5360.	5360.	140.	125.	16.	0.	100.0	88.7
2004.	6414.	6414.	144.	128.	16.	0.	100.0	88.8
2005.	4642.	4623.	110.	92.	17.	0.	99.6	84.2

HD 4

Year	Flow Vol (m3)	Flow Treated (m3)	TSS In (kg)	TSS Rem (kg)	TSS Out (kg)	TSS Byp (kg)	Flow Treated (%)	TSS Removal (%)
1971.	4210.	4195.	102.	91.	10.	0.	99.7	90.0
1972.	5414.	5025.	134.	125.	8.	4.	92.8	91.0
1973.	5371.	5371.	144.	135.	10.	0.	100.0	93.4
1974.	5486.	5468.	154.	148.	7.	0.	99.7	95.5
1975.	4647.	4647.	132.	122.	10.	0.	100.0	92.1
1976.	6916.	6849.	165.	156.	10.	1.	99.0	93.6
1977.	7413.	7320.	161.	145.	16.	1.	98.7	89.1
1978.	5913.	5913.	153.	140.	13.	0.	100.0	91.2
1979.	7080.	7031.	176.	163.	13.	0.	99.3	92.5
1980.	5705.	5705.	164.	152.	12.	0.	100.0	92.5
1981.	7872.	7872.	184.	175.	9.	0.	100.0	95.2
1982.	5544.	5544.	150.	143.	6.	0.	100.0	95.8
1983.	7309.	7308.	191.	178.	13.	0.	100.0	92.9
1984.	5890.	5890.	148.	137.	11.	0.	100.0	92.6
1985.	5140.	5140.	145.	137.	9.	0.	100.0	94.1
1986.	7489.	7489.	199.	188.	11.	0.	100.0	94.6
1987.	7743.	7728.	199.	186.	13.	0.	99.8	93.4
1988.	6197.	6197.	167.	158.	9.	0.	100.0	94.7
1989.	6820.	6820.	162.	154.	8.	0.	100.0	95.2
1990.	7730.	7730.	204.	195.	9.	0.	100.0	95.4
1991.	7243.	7243.	192.	180.	12.	0.	100.0	93.9
1992.	9209.	9209.	223.	206.	16.	0.	100.0	92.6
1993.	6272.	6272.	188.	179.	9.	0.	100.0	95.1
1994.	6721.	6705.	155.	141.	14.	0.	99.8	90.6
1995.	7783.	7783.	185.	170.	15.	0.	100.0	91.8
1998.	2033.	2033.	71.	66.	5.	0.	100.0	92.8
1999.	4954.	4954.	143.	133.	10.	0.	100.0	93.2
2000.	5684.	5684.	124.	110.	14.	0.	100.0	89.0
2001.	4512.	4512.	117.	112.	4.	0.	100.0	96.3
2002.	4712.	4712.	136.	129.	7.	0.	100.0	94.8
2003.	5360.	5360.	140.	129.	12.	0.	100.0	91.8
2004.	6414.	6414.	144.	134.	10.	0.	100.0	93.3
2005.	4642.	4623.	110.	97.	13.	0.	99.6	88.0

```
**************************************************
*  Summary of Quantity and Quality Results at      *
*  Location         200  INFlow in cms.             *
*  Values are instantaneous at indicated time step *
**************************************************

     Date     Time        Flow   Total Su
 Mo/Da/Year  Hr:Min       cum/s  mg/l
 ----------  -------    -------  --------
Flow wtd means.....        0.000      128.
Flow wtd std devs..        0.001       66.
Maximum value......        0.158      292.
Minimum value......        0.000        0.
Total loads........       40281.     5169.
                        Cub-Met  KILOGRAM

===> Runoff simulation ended normally.

===> SWMM 4.4    simulation ended normally.
     Always check output file for possible warning messages.

**************************************************
*       SWMM 4.4    Simulation Date and Time Summary  *
**************************************************
* Starting Date... April       5, 2023               *
*          Time...         14:57:12.691               *
*   Ending Date... April       5, 2023               *
*          Time...         14:57:16.237               *
*  Elapsed Time...               0.059 minutes.       *
*  Elapsed Time...               3.546 seconds.       *
**************************************************
```