UPPER CANADA
CONSULTANTS
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UCC File: 21132

FUNCTIONAL SERVICING REPORT

Northland Estates
City of Port Colborne
Revised June 2024

INTRODUCTION

Upper Canada Consultants has been retained to undertake and provide a Functional Servicing Report to address the servicing needs and requirements for the proposed residential development known as Northland Estates as part of the Red Line of Draft Plan of Subdivision application process for the City of Port Colborne.

The project site is located in the City of Port Colborne as part of Lot 31 and Concession 2 and is situated north of Coronation Drive North, east of Minor Road, south of Barrick Road and west of West Side Road (Regional Road 58) with site entrances on Northland Avenue. The site is bound by a Locally Significant Wetland at the west limits of the site, and the development area has historically been agricultural/vacant land.

The development site is approximately 16.67 hectares and has been previously Draft Approved to accommodate 120 single family dwellings, 46 townhouse units, and a mixed commercial/residential block with 50 residential units for a total unit count of 216 units. The proposed Red-Line Draft Plan submission has revised the previous design to now incorporate 44 single family dwellings and 189 townhouse units with the commercial residential block remaining unchanged for a new total unit count of 287. The site shall include associated asphalt road, concrete curb, catch basins, storm sewers, sanitary sewers, and watermain.

The objectives of this study are as follows:

1. Identify domestic and fire protection water service 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 300mm diameter Ductile Iron watermain located on the north side of Northland Avenue as well as a municipal 400mm diameter PVC watermain on the west side of West Side Road (Regional Road 58). Two connections will be made to the Northland Avenue watermain to provide an internal loop within the development to provide both domestic water supply and fire protection. Four single family dwellings are to be constructed fronting West Side Road and will be provided service via the 400mm diameter watermain fronting the units.

The sizes and locations of the proposed internal watermain will be finalized as part of the future detailed design. At this time, a preliminary internal watermain design can be found in Appendix A. The proposed development will continue the 300mm diameter watermain westerly from its' current limit on Northland Avenue to Street 'E'. A second watermain connection to the existing West Main Street 400mm diameter watermain will be made through the access path between #339 and #335 West Main Street. As well a 200mm diameter watermain will be constructed on Street 'A' from Northland Avenue to the northerly limit with the intention of eventually connecting to the existing 300mm diameter watermain on Barrick Road through future development. Watermains constructed on Streets 'B' and 'E' will both be 200mm diameter and watermains constructed on Streets 'D' and 'C' are expected to be 150mm in diameter.

Fire protection will be provided to the proposed development with municipal fire hydrants within the subdivision and private fire hydrants within the mixed-use condominium block. The spacing and location shall be identified as part future detailed design. Fire protection will be provided to the four proposed units fronting West Side Road via an existing hydrant fronting #339 West Side Road.

Upper Canada Consultants has undertaken a watermain analysis using the EPANET software to model flows and pressures within the existing and proposed system as a result of the proposed development under various conditions. The software was used to model the conditions utilizing average day, maximum day, and peak unit consumption rates per MECP standards. The model has been calibrated utilizing hydrant test flow data provided by the municipality from tests conducted in May/June of this year and have ensured supportable conclusions for this development.

The EPANET model has utilized flow test data from four hydrants located at the following locations:

1. Fronting #341 West Side Road
2. Fronting #311 West Side Road
3. North-west corner of West Side Road and Northland Avenue
4. South-east corner of West Side Road and Northland Avenue

The results of the conducted modelling have been included in Appendix A along with images depicting the existing and proposed conditions utilized for this model. The existing testing outlines the existing watermain system having static pressures within the preferred system pressure range of 50-80 PSI and above the minimum pressures of 40 PSI. The modelled static pressures and residual pressures were within 5% (typical) of the results when compared to existing conditions provided by the hydrant flow tests. The existing hydrant fronting #341 West Side Road has the lowest theoretical flow rate of 3069 GPM under fire flow conditions (at 20 PSI). This flow rate would be attributed a BLUE rating (>1499GPM) and has ample flow to provide both domestic and fire flow protection to the surrounding residential properties.

Overall, mainly due to the elevation difference between the north and south ends of the site, the existing hydrant fronting #341 West Side Road as well as the most north-easterly proposed hydrant experience the lowest pressures (and therefore flow rates) through the modelling. However, even under peak daily conditions (720 LPCD), both noted hydrants will experience almost identical pressures with an approximate drop of 0.7% under future conditions. All hydrants will maintain static pressures of approximately 50PSI under future developed conditions. Therefore, it is expected that the existing municipal watermain system will have adequate capacity to provide both domestic and fire water supply for the proposed development.

Unfortunately, due to the complicated nature of this model, theoretical flows calculated by the model are not comparable to theoretical flows modelled during the municipal hydrant flow tests. Therefore, the model has been utilized to model the difference between pressures observed in the system. It should be noted that the pressures and flow rates observed by this model are purely theoretical, attempting to replicate information provided by the City's hydrant flow test data for hydrants within the immediate vicinity of the proposed development site. Without a complete model of the city's entire water system, a highly accurate model providing reliable flow rate data for the future development is unobtainable.

SANITARY SERVICING

There is an existing 200mm diameter municipal sanitary sewer on the west side of West Side Road (Regional Road 58) as well as a 200mm diameter sanitary sewer on Northland Avenue. The three proposed single-family dwellings fronting West Side Road will be provided service via the existing 200mm diameter sewer on West Side Road, with the remaining majority of the development block discharging sanitary flows to the existing sanitary sewer on Northland Avenue. All sanitary sewers will convey flows via gravity to their respective outlets.

An overall sanitary analysis has been conducted and included in Appendix B for the municipal sanitary sewer system downstream of the proposed development site from the site connection to the Regional Sanitary Sewer at the Steele Street Sanitary Pumping Station (SPS). The analysis utilizes a flow rate of 28 m^3/ha/day for commercial and institutional land uses as well a residential flow rate of 255 L/person/day as per the 2021 Niagara Regional Wastewater Master Servicing Plan (MSP) Update. An infiltration rate of 0.28 L/s/ha has been used for residential land uses as well as drainage areas consisting of solely commercial/institutional land uses (containing a reduced sewer system with a highly reduced number of infiltration points). Per Plan and Profile information provided by the municipality, sanitary flows from the Oxford Boulevard Pumping Station and north od Steele Street on Barrick Road have been removed from the revised analysis as it has been determined sanitary flows continue flowing east on Barrick Road.

Three separate analyses have been completed and included in Appendix B:

1. Municipal Sanitary System under existing conditions with current Northland Estates Draft Plan.
2. Municipal Sanitary System with the proposed Red-Lined Draft Plan

3. Municipal Sanitary System with the proposed Red-Lined Draft Plan and potential future development north east of the site.

The analysis has concluded that the existing downstream municipal sanitary sewer system will theoretically reach capacities of approximately 83% on Northland Avenue, east of the proposed development, under currently approved Northland Estates Draft Plan. The development will produce a dry weather flow of 6.32L/s and total peak wet weather flow of 9.01L/s to the municipal system. The downstream sanitary sewers will experience a maximum capacity of 83.2% at the east end of Northland Avenue and will discharge a peak wet weather flow of 24.08L/s to the Steele Street SPS.

Under future conditions proposed by the Red-Lined Draft Plan, the development will discharge an increased dry weather flow of 8.16L/s and wet weather flow of 10.84L/s to the downstream sanitary sewer system. This will increase peak wet weather flow capacities experienced within the downstream sanitary sewer system to approximately 90.6% at the east end of Northland Avenue and will discharge a peak wet weather flow of 25.84L/s to the Steele Street SPS.

The analysis concludes that the existing downstream municipal sanitary sewer system from the proposed development to the Steele Street SPS will have adequate capacity for the proposed Northland Estates Subdivision development. The analysis also concludes that the existing municipal system would have capacity to accommodate sanitary flows from an additional 23 residential dwellings - shown as part of Drainage Area 'NEX' immediately north-west of the proposed development. The proposed internal sanitary sewer system for this development will be design to include capacity for future development in this area. It should be noted that any additional development occurring upstream of the existing 200mm diameter sanitary sewer system on Northland Avenue, east of West Side Road, may result in further capacity issues and would require upgrades to the existing sanitary sewer system.

The proposed development will discharge sanitary flows to the existing municipal sanitary sewer system ultimately conveying flows to the Regional Steele Street Pumping Station. Per the Water and Wastewater Master Servicing Plan Update (2021), the capacities and performance of the Steele Street SPS are included in the following table:

Steele Street Pumping Station Characteristics	
Criteria	**Flow (L/s)**
Operational Firm Capacity	25.2
ECA Firm Capacity	35.0
2021 Existing 5-Yr Peak Wet Weather Flow	48.8
2051 Design 5-Yr Peak Wet Weather Flow	53.0
Forcemain Capacity @ 2.5m/s	78.5

According to the MSP Update and values included in the previous table, the existing Steele Street SPS does not have the capacity to accommodate existing flows from its' drainage area under the current Operational Firm Capacity. With the additional sanitary flows from the proposed development, the Steele Street SPS will be inadequate in providing the necessary sanitary infrastructure required for the population in this area. Upgrades to the Regional Steel Street Sanitary Pumping Station will be required in order to provide the adequate downstream infrastructure required for this development.

STORMWATER MANAGEMENT PLAN

As part of the site development, the following is a summary of the stormwater management plan for the proposed residential development.

The criteria provided by the City of Port Colborne and Region of Niagara for this development includes the requirement to control peak stormwater flows from the proposed development area up to and including the 100 year design storm event and improve stormwater quality levels to MECP Normal (70% TSS removal) Protection levels prior to discharge from the development.

To limit future stormwater flows to allowable levels, and improve stormwater quality to the required TSS removal levels, a stormwater management wetpond facility will provide the necessary controls for this development. Stormwater quality levels will be provided to a Normal Standard before outletting from the development site. A channel will be created to convey stormwater flows from the proposed stormwater management facility and surrounding lands to the Eagle Marsh Drain. Roadway overland flows will be directed to the stormwater management facility at the south end of the site. A Stormwater Management Plan for this development has been created and can be found in Appendix C.

CONCLUSIONS AND RECOMMENDATIONS

Therefore, based on the above comments and design calculations provided for this site, the following summarizes the servicing for this site.

1. The existing municipal watermain system will have sufficient capacity to provide both domestic and fire protection water supply.

2. The existing municipal sanitary sewer system downstream of the site will have adequate capacity for the proposed residential development. Upgrades may be required to the Steele Street Sanitary Pumping Station.

3. Stormwater quality controls are being provided to Normal Protection (70% TSS removal) levels by a stormwater wetpond facility before outletting to the Eagle Marsh Drain.

4. Stormwater quantity controls are being provided by a stormwater management wetpond facility up to the 100-year design storm event prior to discharging from the site.

5. The site stormwater overland route from the road system is to the proposed stormwater management facility before outletting to the Eagle Marsh Drain.

6. A channel will be created as an extension to the Eagle Marsh Drain to convey stormwater flows from the proposed stormwater management facility and surrounding lands to the Eagle Marsh Drain.

Based on the above and the accompanying Stormwater Management Brief, 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.
Revised June 10, 2024

LICENSED PROFESSIONAL ENGINEER
J. P. SCHOOLEY
PROVINCE OF ONTARIO

Encl.

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APPENDICES

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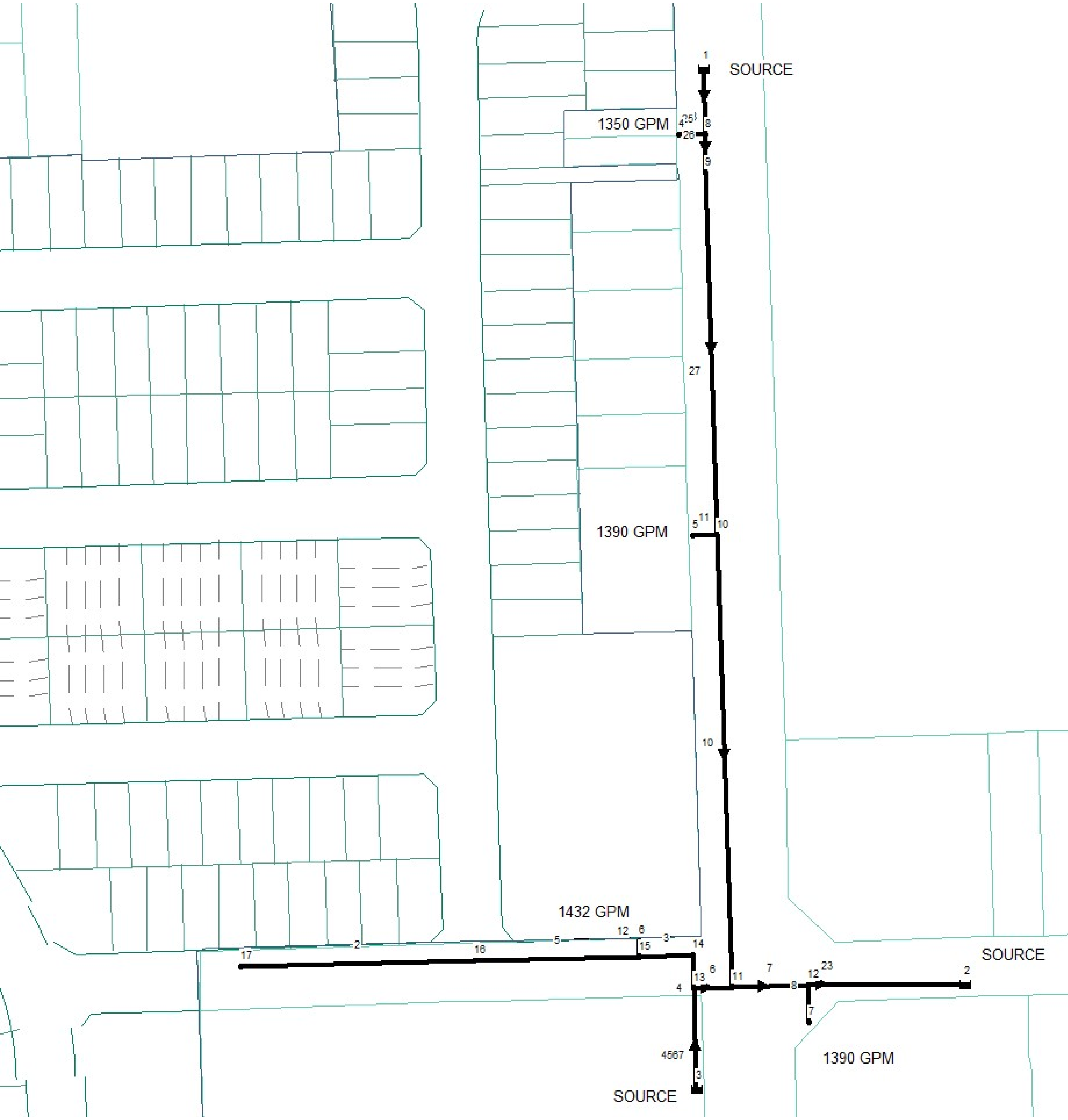
APPENDIX A

EPANET Analysis – Existing Conditions Imagery
EPANET Analysis Calculations

EPANET Analysis

Northland Estates Subdivision
Existing Conditions



WATERMAIN ANALYSIS

Software Utilized: EPANET

Upper Canada Consultants

Project Name: Northland Estates

Project Number: 21132

Date: June 10, 2024

Provided Hydrant Test Data

Model Node No.	Physical Location	Test Static Pressure (PSI)	*Modelled Static Pressures (PSI)*	Test Residual Pressures (PSI)	*Modelled Residual Pressures (PSI)*	Actual Flow Rate (GPM)
4	Fronting #341	50	*50.2*	43	*43.2*	1350
5	Fronting #311	53	*51.9*	45	*44.7*	1390
6	NW Corner	54	*53.1*	46	*45.6*	1432
7	SE Corner	53	*53.5*	43	*44.7*	1390

Hydrant with Lowest Modelled Pressures: Node #20

Table 1. Modelled Average Day Pressures and Flow Rates

Hydrant Node Number	Number of Units	Population	Average Daily Load (LPM)	Existing Static Pressures (PSI)	Future Static Pressures (PSI)	% Change
Existing Hydrants						
4	10	24	4.0	50.2	50.1	0.20%
5	3	7	1.2	51.9	51.8	0.19%
6	0	0	0.0	53.1	53.0	0.16%
7	19	46	7.6	53.5	53.4	0.19%
Northlands Estates Subdivision						
18	82	197	32.8	-	51.5	-
19	54	130	21.6	-	51.1	-
20	47	113	18.8	-	50.1	-
21	38	91	15.2	-	51.2	-
22	41	98	16.4	-	51.5	-
23	22	53	8.8	-	51.8	-
Note: Average Daily Unit Consuption Rate of 240 LPCD Utilized per 2021 MSPU						

Table 2. Modelled Maximum Day Pressures and Flow Rates						
Hydrant Node Number	Number of Units	Population	Average Daily Load (LPM)	Existing Static Pressures (PSI)	Future Static Pressures (PSI)	% Change
Existing Hydrants						
4	10	24	7.6	50.2	50.0	0.40%
5	3	7	2.3	51.9	51.7	0.36%
6	0	0	0.0	53.0	52.9	0.35%
7	19	46	14.4	53.5	53.3	0.35%
Northlands Estates Subdivision						
18	82	197	62.3	-	51.4	-
19	54	130	41.0	-	51.0	-
20	47	113	35.7	-	50.0	-
21	38	91	28.9	-	51.1	-
22	41	98	31.2	-	51.4	-
23	22	53	16.7	-	51.7	-
Note: Maximum Daily Unit Consuption Rate of 456 LPCD Utilized based on peaking factor of 1.9 (MECP Peaking Factor)						

Table 3. Modelled Peak Pressures and Flow Rates						
Hydrant Node Number	Number of Units	Population	Average Daily Load (LPM)	Existing Static Pressures (PSI)	Future Static Pressures (PSI)	% Change
Existing Hydrants						
4	10	24	12.0	50.2	49.9	0.60%
5	3	7	3.6	51.9	51.6	0.60%
6	0	0	0.0	53.0	52.7	0.56%
7	19	46	22.8	53.5	53.2	0.56%
Northlands Estates Subdivision						
18	82	197	98.4	-	51.3	-
19	54	130	64.8	-	50.9	-
20	47	113	56.4	-	49.9	-
21	38	91	45.6	-	50.9	-
22	41	98	49.2	-	51.3	-
23	22	53	26.4	-	51.6	-
Note: Peak Hourly Unit Consuption Rate of 720 LPCD Utilized based on peaking factor of 3.0 (2021 MSPU)						

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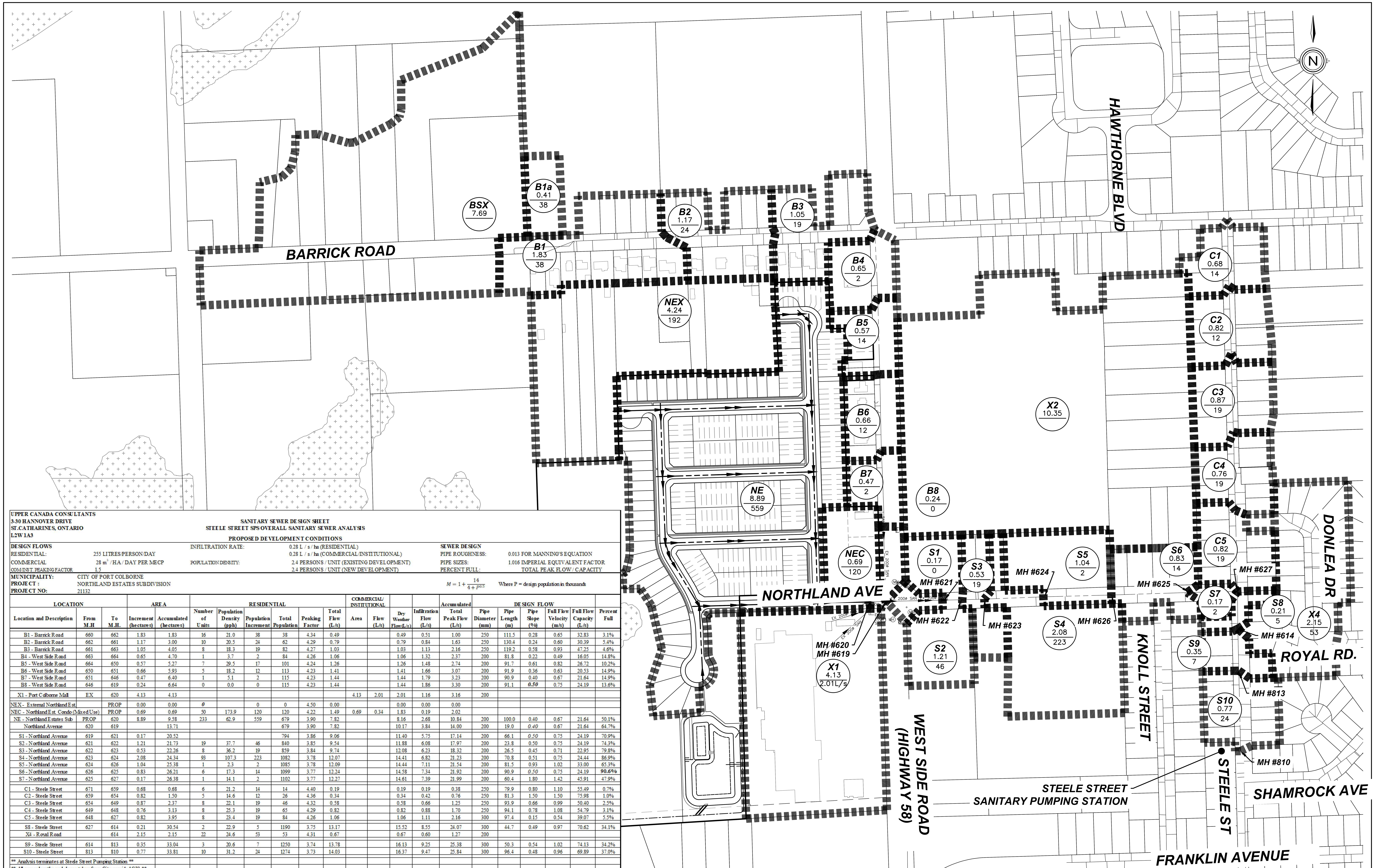
APPENDIX B

Overall Sanitary Drainage Area Plan – Proposed Conditions
Overall Sanitary Calculations – Existing Conditions
Overall Sanitary Calculations – Proposed Conditions with Additional Development



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SANITARY SEWER DESIGN SHEET
STEELE STREET SPS OVERALL SANITARY SEWER ANALYSIS

PROPOSED DEVELOPMENT CONDITIONS

DESIGN FLOWS
RESIDENTIAL: 255 LITRES/PERSON/DAY
COMMERCIAL: 28 m^3 / HA / DAY PER MECP
COM/INST. PEAKING FACTOR: 1.5

INFILTRATION RATE: 0.28 L / s / ha (RESIDENTIAL)
0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL)
POPULATION DENSITY: 2.4 PERSONS / UNIT (EXISTING DEVELOPMENT)
2.4 PERSONS / UNIT (NEW DEVELOPMENT)

SEWER DESIGN
PIPE ROUGHNESS: 0.013 FOR MANNING'S EQUATION
PIPE SIZES: 1.016 IMPERIAL EQUIVALENT FACTOR
PERCENT FULL: TOTAL PEAK FLOW / CAPACITY

MUNICIPALITY: CITY OF PORT COLBORNE
PROJECT : NORTHLAND ESTATES SUBDIVISION
PROJECT NO: 21132

$$M = 1 + \frac{14}{4 + P^{0.5}}$$ Where P = design population in thousands

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Dry Weather Flow (L/s)	Infiltration Flow (L/s)	Total Peak Flow (L/s)	Pipe Diameter (mm)	Pipe Length (m)	Pipe Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Percent Full
B1 - Barrick Road	660	662	1.83	1.83	16	21.0	38	38	4.34	0.49			0.49	0.51	1.00	250	111.5	0.28	0.65	32.83	3.1%
B2 - Barrick Road	662	661	1.17	3.00	10	20.5	24	62	4.29	0.79			0.79	0.84	1.63	250	130.4	0.24	0.60	30.39	5.4%
B3 - Barrick Road	661	663	1.05	4.05	8	18.3	19	82	4.27	1.03			1.03	1.13	2.16	250	119.2	0.58	0.93	47.25	4.6%
B4 - West Side Road	663	664	0.65	4.70	1	3.7	2	84	4.26	1.06			1.06	1.32	2.37	200	81.8	0.22	0.49	16.05	14.8%
B5 - West Side Road	664	650	0.57	5.27	7	29.5	17	101	4.24	1.26			1.26	1.48	2.74	200	91.7	0.61	0.82	26.72	10.2%
B6 - West Side Road	650	651	0.66	5.93	5	18.2	12	113	4.23	1.41			1.41	1.66	3.07	200	91.9	0.36	0.63	20.53	14.9%
B7 - West Side Road	651	646	0.47	6.40	1	5.1	2	115	4.23	1.44			1.44	1.79	3.23	200	90.9	0.40	0.67	21.64	14.9%
B8 - West Side Road	646	619	0.24	6.64	0	0.0	0	115	4.23	1.44			1.44	1.86	3.30	200	91.1	*0.50*	0.75	24.19	13.6%
X1 - Port Colborne Mall	EX	620	4.13	4.13							4.13	2.01	2.01	1.16	3.16	200					
NEX - External Northland Est.		PROP	0.00	0.00	*0*		0	0	4.50	0.00			0.00	0.00	0.00						
NEC - Northland Est. Condo (Mixed Use)		PROP	0.69	0.69	50	173.9	120	120	4.22	1.49	0.69	0.34	1.83	0.19	2.02						
NE - Northland Estates Sub	PROP	620	8.89	9.58	233	62.9	559	679	3.90	7.82			8.16	2.68	10.84	200	100.0	0.40	0.67	21.64	50.1%
Northland Avenue	620	619		13.71				679	3.90	7.82			10.17	3.84	14.00	200	19.0	*0.40*	0.67	21.64	64.7%
S1 - Northland Avenue	619	621	0.17	20.52				794	3.86	9.06			11.40	5.75	17.14	200	66.1	*0.50*	0.75	24.19	70.9%
S2 - Northland Avenue	621	622	1.21	21.73	19	37.7	46	840	3.85	9.54			11.88	6.08	17.97	200	23.8	0.50	0.75	24.19	74.3%
S3 - Northland Avenue	622	623	0.53	22.26	8	36.2	19	859	3.84	9.74			12.08	6.23	18.32	200	26.5	0.45	0.71	22.95	79.8%
S4 - Northland Avenue	623	624	2.08	24.34	93	107.3	223	1082	3.78	12.07			14.41	6.82	21.23	200	70.8	0.51	0.75	24.44	86.9%
S5 - Northland Avenue	624	626	1.04	25.38	1	2.3	2	1085	3.78	12.09			14.44	7.11	21.54	200	81.5	0.93	1.02	33.00	65.3%
S6 - Northland Avenue	626	625	0.83	26.21	6	17.3	14	1099	3.77	12.24			14.58	7.34	21.92	200	90.9	*0.50*	0.75	24.19	**90.6%**
S7 - Northland Avenue	625	627	0.17	26.38	1	14.1	2	1102	3.77	12.27			14.61	7.39	21.99	200	60.4	1.80	1.42	45.91	47.9%
C1 - Steele Street	671	659	0.68	0.68	6	21.2	14	14	4.40	0.19			0.19	0.19	0.38	250	79.9	0.80	1.10	55.49	0.7%
C2 - Steele Street	659	654	0.82	1.50	5	14.6	12	26	4.36	0.34			0.34	0.42	0.76	250	81.3	1.50	1.50	75.98	1.0%
C3 - Steele Street	654	649	0.87	2.37	8	22.1	19	46	4.32	0.58			0.58	0.66	1.25	250	93.9	0.66	0.99	50.40	2.5%
C4 - Steele Street	649	648	0.76	3.13	8	25.3	19	65	4.29	0.82			0.82	0.88	1.70	250	94.1	0.78	1.08	54.79	3.1%
C5 - Steele Street	648	627	0.82	3.95	8	23.4	19	84	4.26	1.06			1.06	1.11	2.16	300	97.4	0.15	0.54	39.07	5.5%
S8 - Steele Street	627	614	0.21	30.54	2	22.9	5	1190	3.75	13.17			15.52	8.55	24.07	300	44.7	0.49	0.97	70.62	34.1%
X4 - Royal Road		614	2.15	2.15	22	24.6	53	53	4.31	0.67			0.67	0.60	1.27	200					
S9 - Steele Street	614	813	0.35	33.04	3	20.6	7	1250	3.74	13.78			16.13	9.25	25.38	300	50.3	0.54	1.02	74.13	34.2%
S10 - Steele Street	813	810	0.77	33.81	10	31.2	24	1274	3.73	14.03			16.37	9.47	25.84	300	96.4	0.48	0.96	69.89	37.0%
** Analysis terminates at Steele Street Pumping Station **																					
** All sewer lengths and slopes taken from City provided GIS **																					

#	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 K.T.
DESIGN K.T.
CHECKED BY K.T.
APPROVED BY J.S.

PORT COLBORNE

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

NORTHLAND ESTATES SUBDIVISION
CITY OF PORT COLBORNE

OVERALL SANITARY DRAINAGE AREA PLAN

CONSULTANT FILE No. 21132
DATE 2024-06-10
PRINTED 2024-06-10
SCALE 1:2000 m
REF No.
DWG No. 21132-OSANDA
REV 0

DRAWING FILE: F:\21132\Engineering\21132-BASE-R1.dwg PLOTTED: Jun 10, 2024 - 1:17pm PLOTTED BY: kurt

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

SANITARY SEWER DESIGN SHEET
STEELE STREET SPS OVERALL SANITARY SEWER ANALYSIS
EXISTING CONDITIONS WITH CURRENT NORTHLAND ESTATES DRAFT APPROVED SUBDIVISION

DESIGN FLOWS		INFILTRATION RATE:	0.28 L / s / ha (RESIDENTIAL)
RESIDENTIAL:	255 LITRES/PERSON/DAY		0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL)
COMMERCIAL	28 m^3 / HA / DAY PER MECP	POPULATION DENSITY:	2.4 PERSONS / UNIT (EXISTING DEVELOPMENT)
COM/INST. PEAKING FACT(	1.5		2.4 PERSONS / UNIT (NEW DEVELOPMENT)

SEWER DESIGN	
PIPE ROUGHNESS:	0.013 FOR MANNING'S EQUATION
PIPE SIZES:	1.016 IMPERIAL EQUIVALENT FACTOR
PERCENT FULL:	TOTAL PEAK FLOW / CAPACITY

MUNICIPALITY: CITY OF PORT COLBORNE
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$$M = 1 + \frac{14}{4 + P^{0.5}}$$

Where P = design population in thousands

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Dry Weather Flow (L/s)	Infiltration Flow (L/s)	Total Peak Flow (L/s)	Pipe Diameter (mm)	Pipe Length (m)	Pipe Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Percent Full
B1 - Barrick Road	660	662	1.83	1.83	16	21.0	38	38	4.34	0.49			0.49	0.51	1.00	250	111.5	0.28	0.65	32.83	3.1%
B2 - Barrick Road	662	661	1.17	3.00	10	20.5	24	62	4.29	0.79			0.79	0.84	1.63	250	130.4	0.24	0.60	30.39	5.4%
B3 - Barrick Road	661	663	1.05	4.05	8	18.3	19	82	4.27	1.03			1.03	1.13	2.16	250	119.2	0.58	0.93	47.25	4.6%
B4 - West Side Road	663	664	0.65	4.70	1	3.7	2	84	4.26	1.06			1.06	1.32	2.37	200	81.8	0.22	0.49	16.05	14.8%
B5 - West Side Road	664	650	0.57	5.27	5	21.1	12	96	4.25	1.20			1.20	1.48	2.68	200	91.7	0.61	0.82	26.72	10.0%
B6 - West Side Road	650	651	0.66	5.93	5	18.2	12	108	4.23	1.35			1.35	1.66	3.01	200	91.9	0.36	0.63	20.53	14.7%
B7 - West Side Road	651	646	0.47	6.40	1	5.1	2	110	4.23	1.38			1.38	1.79	3.17	200	90.9	0.40	0.67	21.64	14.7%
B8 - West Side Road	646	619	0.24	6.64	0	0.0	0	110	4.23	1.38			1.38	1.86	3.24	200	91.1	***0.50***	0.75	24.19	13.4%
X1 - Port Colborne Mall	EX	620	4.13	4.13							4.13	2.01	2.01	1.16	3.16	200					
NEX - External Northland Est.		PROP																			
NEC - Northland Est. Condo (Mixed Us		PROP	0.69	0.69	50	173.9	120	120	4.22	1.49	0.69	0.34	1.83	0.19	2.02						
NE - Northland Estates Sub	PROP	620	8.89	9.58	163	44.0	391	511	3.97	5.99			6.32	2.68	9.01	200	100.0	0.40	0.67	21.64	41.6%
Northland Avenue	620	619		13.71				511	3.97	5.99			8.33	3.84	12.17	200	19.0	*0.40*	0.67	21.64	56.2%
S1 - Northland Avenue	619	621	0.17	20.52				622	3.92	7.20			9.54	5.75	15.29	200	66.1	*0.50*	0.75	24.19	63.2%
S2 - Northland Avenue	621	622	1.21	21.73	19	37.7	46	667	3.91	7.69			10.04	6.08	16.12	200	23.8	0.50	0.75	24.19	66.6%
S3 - Northland Avenue	622	623	0.53	22.26	8	36.2	19	686	3.90	7.90			10.24	6.23	16.48	200	26.5	0.45	0.71	22.95	71.8%
S4 - Northland Avenue	623	624	2.08	24.34	93	107.3	223	910	3.83	10.27			12.61	6.82	19.43	200	70.8	0.51	0.75	24.44	79.5%
S5 - Northland Avenue	624	626	1.04	25.38	1	2.3	2	912	3.83	10.30			12.64	7.11	19.75	200	81.5	0.93	1.02	33.00	59.8%
S6 - Northland Avenue	626	625	0.83	26.21	6	17.3	14	926	3.82	10.45			12.79	7.34	20.13	200	90.9	*0.50*	0.75	24.19	**83.2%**
S7 - Northland Avenue	625	627	0.17	26.38	1	14.1	2	929	3.82	10.47			12.82	7.39	20.20	200	60.4	1.80	1.42	45.91	44.0%
C1 - Steele Street	671	659	0.68	0.68	6	21.2	14	14	4.40	0.19			0.19	0.19	0.38	250	79.9	0.80	1.10	55.49	0.7%
C2 - Steele Street	659	654	0.82	1.50	5	14.6	12	26	4.36	0.34			0.34	0.42	0.76	250	81.3	1.50	1.50	75.98	1.0%
C3 - Steele Street	654	649	0.87	2.37	8	22.1	19	46	4.32	0.58			0.58	0.66	1.25	250	93.9	0.66	0.99	50.40	2.5%
C4 - Steele Street	649	648	0.76	3.13	8	25.3	19	65	4.29	0.82			0.82	0.88	1.70	250	94.1	0.78	1.08	54.79	3.1%
C5 - Steele Street	648	627	0.82	3.95	8	23.4	19	84	4.26	1.06			1.06	1.11	2.16	300	97.4	0.15	0.54	39.07	5.5%
S8 - Steele Street	627	614	0.21	30.54	2	22.9	5	1018	3.80	11.40			13.74	8.55	22.29	300	44.7	0.49	0.97	70.62	31.6%
X4 - Royal Road		614	2.15	2.15	22	24.6	53	53	4.31	0.67			0.67	0.60	1.27	200					
S9 - Steele Street	614	813	0.35	33.04	3	20.6	7	1078	3.78	12.02			14.36	9.25	23.61	300	50.3	0.54	1.02	74.13	31.9%
S10 - Steele Street	813	810	0.77	33.81	10	31.2	24	1102	3.77	12.27			14.61	9.47	24.08	300	96.4	0.48	0.96	69.89	34.4%

** Analysis terminates at Steele Street Pumping Station **

** All sewer lengths and slopes taken from City provided GIS **

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

SANITARY SEWER DESIGN SHEET
STEELE STREET SPS OVERALL SANITARY SEWER ANALYSIS

FULLY DEVELOPED CONDITIONS

DESIGN FLOWS				SEWER DESIGN	
RESIDENTIAL:	255 LITRES/PERSON/DAY	INFILTRATION RATE:	0.28 L / s / ha (RESIDENTIAL)	PIPE ROUGHNESS:	0.013 FOR MANNING'S EQUATION
			0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL)		
COMMERCIAL	28 m^3 / HA / DAY PER MECP	POPULATION DENSITY:	2.4 PERSONS / UNIT (EXISTING DEVELOPMENT)	PIPE SIZES:	1.016 IMPERIAL EQUIVALENT FACTOR
COM/INST. PEAKING FACT(	1.5		2.4 PERSONS / UNIT (NEW DEVELOPMENT)	PERCENT FULL:	TOTAL PEAK FLOW / CAPACITY

MUNICIPALITY: CITY OF PORT COLBORNE
PROJECT : NORTHLAND ESTATES SUBDIVISION
PROJECT NO: 21132

$$M = 1 + \frac{14}{4 + P^{0.5}}$$ Where P = design population in thousands

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Dry Weather Flow (L/s)	Infiltration Flow (L/s)	Total Peak Flow (L/s)	Pipe Diameter (mm)	Pipe Length (m)	Pipe Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Percent Full
BSX - Barrick Road West (Not Included)			***7.69***	*7.69*	***240***	***74.9***	*576*	*576*	*3.94*	*6.70*			*6.70*	*2.15*	*8.85*						
B1a - Future Dev *(towns)*		660	0.41	0.41	16	93.7	38	38	4.34	0.49			0.49	0.11	0.61	200	90.0	0.40	0.67	21.64	
B1 - Barrick Road	660	662	1.83	2.24	16	21.0	38	77	4.27	0.97			0.97	0.63	1.60	250	111.5	0.28	0.65	32.83	4.9%
B2 - Barrick Road	662	661	1.17	3.41	10	20.5	24	101	4.24	1.26			1.26	0.95	2.22	250	130.4	0.24	0.60	30.39	7.3%
B3 - Barrick Road	661	663	1.05	4.46	8	18.3	19	120	4.22	1.49			1.49	1.25	2.74	250	119.2	0.58	0.93	47.25	5.8%
B4 - West Side Road	663	664	0.65	5.11	1	3.7	2	122	4.22	1.52			1.52	1.43	2.95	200	81.8	0.22	0.49	16.05	18.4%
B5 - West Side Road	664	650	0.57	5.68	6	25.3	14	137	4.20	1.70			1.70	1.59	3.29	200	91.7	0.61	0.82	26.72	12.3%
B6 - West Side Road	650	651	0.66	6.34	5	18.2	12	149	4.19	1.84			1.84	1.78	3.62	200	91.9	0.36	0.63	20.53	17.6%
B7 - West Side Road	651	646	0.47	6.81	1	5.1	2	151	4.19	1.87			1.87	1.91	3.78	200	90.9	0.40	0.67	21.64	17.5%
B8 - West Side Road	646	619	0.24	7.05	0	0.0	0	151	4.19	1.87			1.87	1.97	3.84	200	91.1	***0.50***	0.75	24.19	15.9%
X1 - Port Colborne Mall	EX	620	4.13	4.13		0.0					4.13	2.01	2.01	1.16	3.16	200					
NEX - External Northland Est.		PROP	4.24	4.24	***23***	13.0	55	55	4.31	0.70			0.70	1.19	1.89						
NEC - Northland Est. Condo (Mixed Us		PROP	0.69	0.69	50	173.9	120	120	4.22	1.49	0.69	0.34	1.83	0.19	2.02						
NE - Northland Estates Sub	PROP	620	8.89	13.82	233	62.9	559	734	3.88	8.42			8.75	3.87	12.62	200	100.0	0.40	0.67	21.64	58.3%
Northland Avenue	620	619		17.95				734	3.88	8.42			8.75	5.03	13.78	200	19.0	*0.40*	0.67	21.64	63.7%
S1 - Northland Avenue	619	621	0.17	25.17				886	3.83	10.02			12.36	7.05	19.41	200	66.1	*0.50*	0.75	24.19	80.2%
S2 - Northland Avenue	621	622	1.21	26.38	19	37.7	46	931	3.82	10.50			12.84	7.39	20.23	200	23.8	0.50	0.75	24.19	83.6%
S3 - Northland Avenue	622	623	0.53	26.91	8	36.2	19	950	3.81	10.70			13.04	7.53	20.58	200	26.5	0.45	0.71	22.95	89.6%
S4 - Northland Avenue	623	624	2.08	28.99	93	107.3	223	1174	3.75	13.00			15.35	8.12	23.46	200	70.8	0.51	0.75	24.44	96.0%
S5 - Northland Avenue	624	626	1.04	30.03	1	2.3	2	1176	3.75	13.03			15.37	8.41	23.78	200	81.5	0.93	1.02	33.00	72.1%
S6 - Northland Avenue	626	625	0.83	30.86	6	17.3	14	1190	3.75	13.17			15.52	8.64	24.16	200	90.9	*0.50*	0.75	24.19	**99.9%**
S7 - Northland Avenue	625	627	0.17	31.03	1	14.1	2	1193	3.75	13.20			15.54	8.69	24.23	200	60.4	1.80	1.42	45.91	52.8%
C1 - Steele Street	671	659	0.68	0.68	6	21.2	14	14	4.40	0.19			0.19	0.19	0.38	250	79.9	0.80	1.10	55.49	0.7%
C2 - Steele Street	659	654	0.82	1.50	5	14.6	12	26	4.36	0.34			0.34	0.42	0.76	250	81.3	1.50	1.50	75.98	1.0%
C3 - Steele Street	654	649	0.87	2.37	8	22.1	19	46	4.32	0.58			0.58	0.66	1.25	250	93.9	0.66	0.99	50.40	2.5%
C4 - Steele Street	649	648	0.76	3.13	8	25.3	19	65	4.29	0.82			0.82	0.88	1.70	250	94.1	0.78	1.08	54.79	3.1%
C5 - Steele Street	648	627	0.82	3.95	8	23.4	19	84	4.26	1.06			1.06	1.11	2.16	300	97.4	0.15	0.54	39.07	5.5%
S8 - Steele Street	627	614	0.21	35.19	2	22.9	5	1282	3.73	14.10			16.44	9.85	26.30	300	44.7	0.49	0.97	70.62	37.2%
X4 - Royal Road		614	2.15	2.15	22	24.6	53	53	4.31	0.67			3.01	0.60	3.62	200					
S9 - Steele Street	614	813	0.35	37.69	3	20.6	7	1342	3.71	14.71			17.05	10.55	27.60	300	50.3	0.54	1.02	74.13	37.2%
S10 - Steele Street	813	810	0.77	38.46	10	31.2	24	1366	3.71	14.95			17.29	10.77	28.06	300	96.4	0.48	0.96	69.89	40.1%

** Analysis terminates at Steele Street Pumping Station **
** All sewer lengths and slopes taken from City provided GIS **

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

APPENDIX C

Northland Estates – Stormwater Management Plan

STORMWATER MANAGEMENT PLAN

NORTHLAND ESTATES

CITY OF PORT COLBORNE

Prepared for:

2600261 Ontario Inc.

Prepared by:

Upper Canada Consultants
3-30 Hannover Drive
St. Catharines, Ontario
L2W 1A3

Revised May 2024

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REFERENCES

1. Stormwater Management Planning and Design Manual
Ontario Ministry of Environment (March 2003)

STORMWATER MANAGEMENT PLAN

NORTHLAND ESTATES

CITY OF PORT COLBORNE

1.0 INTRODUCTION

1.1 Study Area

The proposed residential development is located in the City of Port Colborne as part of Lot 31 and Concession 2. As shown on the enclosed Site Location Plan (Figure 1), the subject property is situated north of Coronation Drive North, east of Minor Road, south of Barrick Road and west of West Side Road (Regional Road 58) with site entrances on Northland Avenue. This Stormwater Management Plan has been written to obtain approvals as part of the Redline of Draft Plan of Subdivision process.

The approximately 16.67ha property is bound by a Locally Significant Wetland to the west, a commercial plaza at the south east corner, and multiple residential properties to the north, east and south. The drainage areas contributing to this stormwater management plan consist primarily of the subject lands, though incorporate surrounding residential areas that convey stormwater flows through the development lands. The receiving body of water for the proposed stormwater flows will be the Eagle Marsh Drain.

1.2 Objectives

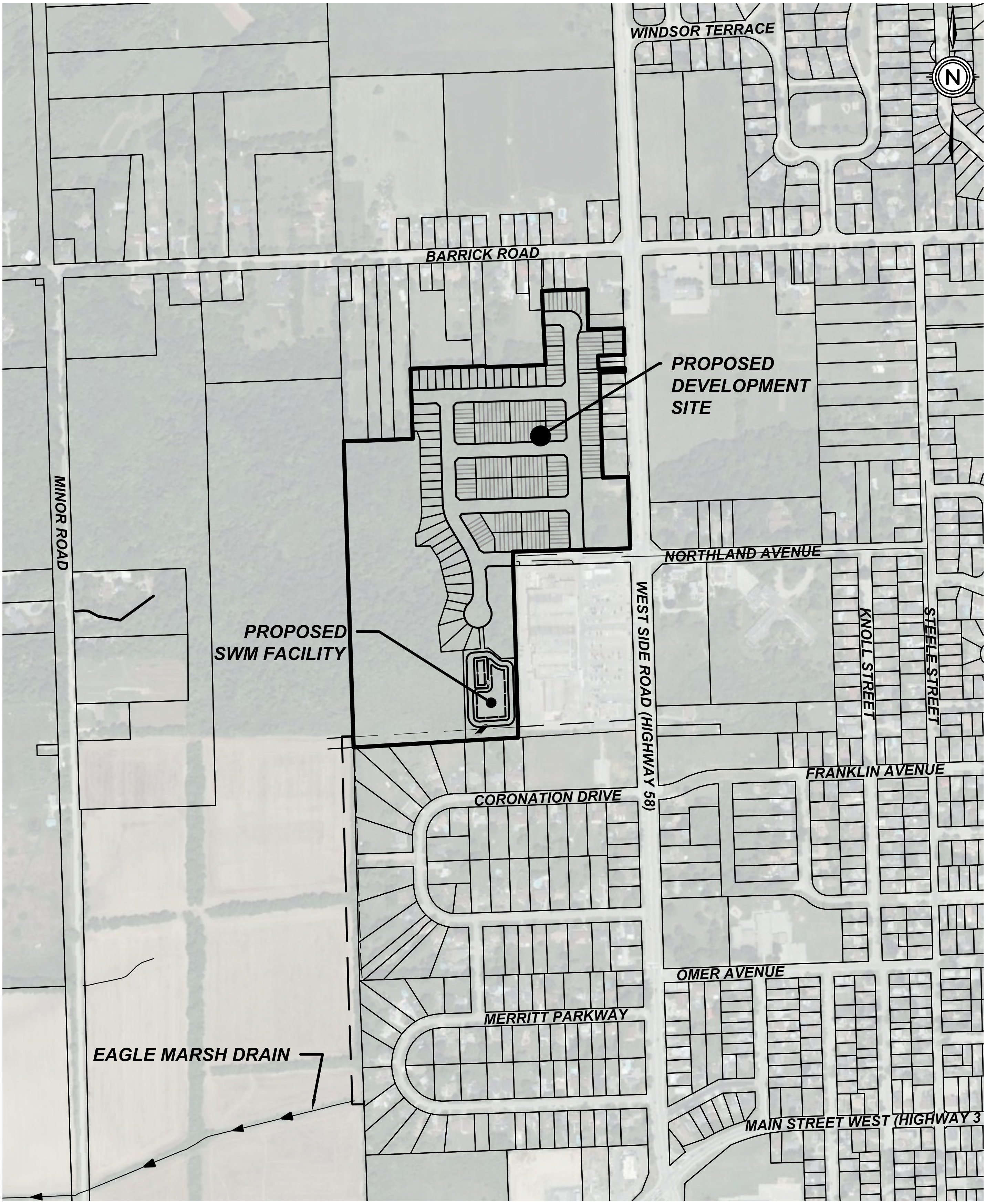
The objectives of this study are as follows:

1. Establish specific criteria for the management of stormwater from this site.

2. Determine the impact of development on the stormwater peak flow & volume from this site.

3. Investigate alternatives for controlling the quantity and quality of stormwater from this site.

4. Establish property requirements for the Stormwater Management Facility for the Draft Plan of Subdivision.



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NORTHLAND ESTATES

CITY OF PORT COLBORNE

SITE LOCATION PLAN

DATE	2024-05-24
SCALE	1:7,500 m
REF No.	21132
DWG No.	FIGURE 1

DRAWING FILE: F:\21132\Engineering\21132-BASE-R1.dwg PLOTTED: May 24, 2024 - 3:22pm PLOTTED BY: kurt

1.3 Existing & Proposed Conditions

a) Existing Conditions

Historically, the site has been used for agricultural purposes, though more recently has been vacant land. The approximately 16.67-hectare property includes 5.83 hectares of undevelopable lands along the western limits comprised of an existing Locally Significant Wetland. The proposed development is located within the upper reaches of the Eagle Marsh Drain drainage area, with the current actual drain upstream limit located approximately 500m south of the south-west corner of the site. The existing topography of the site generally directs flows to the south-east to the adjacent Locally Significant Wetland or Eagle Marsh Drain with all flows ultimately outletting to the Eagle Marsh Drain.

The majority of native soils within the study area have been characterized as imperfectly drained loam/clay loam Franktown Soils (hydrologic soil group CB) with bedrock located less than 1m below the surface. Within the south-western portion of the site, the soil transitions to a low permeability clay and silt resulting in the perched water necessary to create the Locally Significant Wetlands.

b) Proposed Conditions

Approximately 11.0 hectares of the site is proposed to be developed, consisting of 44 single family dwellings, 4 semi-detached units, 189 townhouse units, and a mixed-use commercial/residential block with 50 units, resulting in a total unit count of 287 units. The site shall be provided with full municipal services including sanitary sewers, storm sewers and watermain with asphalt pavement, concrete curbs and gutters. The proposed stormwater management plan discusses the proposed development under fully developed conditions.

The Northland Estates Subdivision development was previously draft approved with an associated Stormwater Management (SWM) Plan detailing the construction of a swale from the proposed SWM Facility to the current upstream limit of the Eagle Marsh Drain approximately 500m south of the south-east corner of the site providing a sufficient outlet. Since this approval, a design was set into motion by the City's Municipal Drain Engineering Consultant to extend the Eagle Marsh Drain from its' current upstream limit, through the rear yards of houses on Coronation Drive to the south-east corner of the site. It is expected that the Eagle Marsh Drain extension will be constructed prior to the development of the Northland Estates Subdivision and will therefore become the focus stormwater outlet for this development.

2.0 STORMWATER MANAGEMENT CRITERIA

New developments are required to provide stormwater management in accordance with provincial and municipal policies including:

- Stormwater Quality Guidelines for New Development (MECP/MNRF, May 1991)

- Stormwater Management Planning and Design Manual (MECP, March 2003)

Based on the comments and outstanding policies from various agencies (City of Port Colborne, Regional Municipality of Niagara, Niagara Peninsula Conservation Authority

(NPCA), and the Ministry of the Environment, Conservation and Parks (MECP), and others) the following site-specific considerations were identified:

- The receiving watercourse, Eagle Marsh Drain has been identified by the Ministry of Natural Resources watercourse evaluation as a **Type 2** (*Important*) fish habitat. Based on this fish habitat, the corresponding MECP level of protection for stormwater management quality practices on all new developments shall be *Normal*.

- The site outlets to the Eagle Marsh Drain which contains lands that would be negatively impacted by increased flooding levels, and, therefore, stormwater quantity control is considered necessary to maintain the downstream peak water elevations.

Based on the above policies and site specific considerations, the following stormwater management criteria have been established for this site.

- Stormwater **quality** controls are to be provided for the internal storm system of the development according to MECP guidelines. It is proposed to provide Normal Protection (70% TSS removal) to the stormwater before outletting to the Eagle Marsh Drain.

- Stormwater **quantity** controls are to be provided for the outlet to limit the proposed development peak flows from the 2, 5, 10, 25, 50, and 100 year storm events to existing peak flow levels

3.0 STORMWATER ANALYSIS

A stormwater analysis has been conducted by Upper Canada Consultants as part of the design of the Northland Estates development using the MIDUSS computer modelling program. A new stormwater analysis was conducted to represent the existing and future conditions to the Eagle Marsh Drain.

This program was selected because it is applicable to an urban drainage area like the study area, it is relatively easy to use and modify for the proposed drainage conditions and control facilities, and it readily allows for the use of design storm hyetographs for the various return periods being investigated. Copies of the current model output files are enclosed in Appendix B.

3.1 Design Storms

Design storm hyetographs were developed using a Chicago distribution based on the Ministry of Transportations (MTO) Intensity-Duration-Frequency curves for the development area in Port Colborne. These curves were utilized due to the developments' proximity to West Side Road (Highway 58) and review requirements of the MTO. Hyetographs for the 25mm, 2, 5, 10, 25, 50 and 100 year events were developed using a 4-hour Chicago distribution. Table 1 summarizes the rainfall data.

Table 1. Rainfall Data

Design Storm (Return Period)	Chicago Distribution Parameters		
	a	**b**	**c**
25mm	512.000	0.0	0.699
2 Year	397.149	0.0	0.699
5 Year	524.867	0.0	0.699
10 Year	608.845	0.0	0.699
25 Year	715.568	0.0	0.699
50 Year	794.298	0.0	0.699
100 Year	871.279	0.0	0.699

$$\text{Intensity}\ (mm/hr) = \frac{a}{(t_d + b)^c}$$

3.2 Existing Conditions

The existing conditions were modelled to establish the stormwater peak flows and volumes prior to development within this site. The existing drainage areas for this subwatershed are shown on Figure 2 with a schematic depicting the modelling strategy detailed on Figure 4. This area was determined from field investigations and a combination of recent topographic surveys as well as topographic information gathered from the Niagara Peninsula Conservation Authority (NPCA).

Stormwater flows from the majority of the development site are conveyed southerly overland towards the natural gas easement under existing conditions shown by Drainage Area EX10. Flows from the rear of the adjacent commercial property (EX20) join and are directed through EX30 to the south-west corner of the development property (Outlet A). Stormwater flows from Drainage Area EX40 are conveyed through the wetland to EX50 and ultimately directed south to Outlet A, confluencing with the previously described drainage areas. Under existing conditions, stormwater flows are directed south from Outlet A to ultimately discharge to the Eagle Marsh Drain (Outlet B).

Input parameters for the computer model for the existing conditions are shown in Table 2. Table 3 details the stormwater peak flows and volumes generated by the various design storm events.

3.3 Proposed Conditions

The future drainage areas for the proposed development, shown in Figure 3, were modelled to establish the stormwater peak flows and volumes once development has been completed at the proposed site.

It is proposed to construct and internal storm sewer system to collect peak flows from the proposed development, and discharge to a proposed Stormwater Management (SWM) Facility. The facility has been designed to accommodate potential future development north-east of the site fronting Barrick Road. Stormwater flows discharging from the SWM facility will outlet to a proposed channel conveying flows westerly through a channel within the existing natural gas easement to the south-west corner of the site (Outlet A) to the expected future upstream limit of the Eagle Marsh Drain. As stated previously, it is expected the Drain Extension will be completed prior to construction of this development.

Stormwater flows from the rear of lots 20 to 43 as part of Drainage Area A40 will outlet uncontrolled to the adjacent Locally Significant Wetland to maintain runoff volumes as required by the Water Balance Study (Terra-Dynamics, 2022). Stormwater flows directed southerly from the existing residential properties north of the site, fronting Barrick Road, will be captured and conveyed via swales and rear yard catch basins located on the proposed properties backing onto the Barrick road properties.

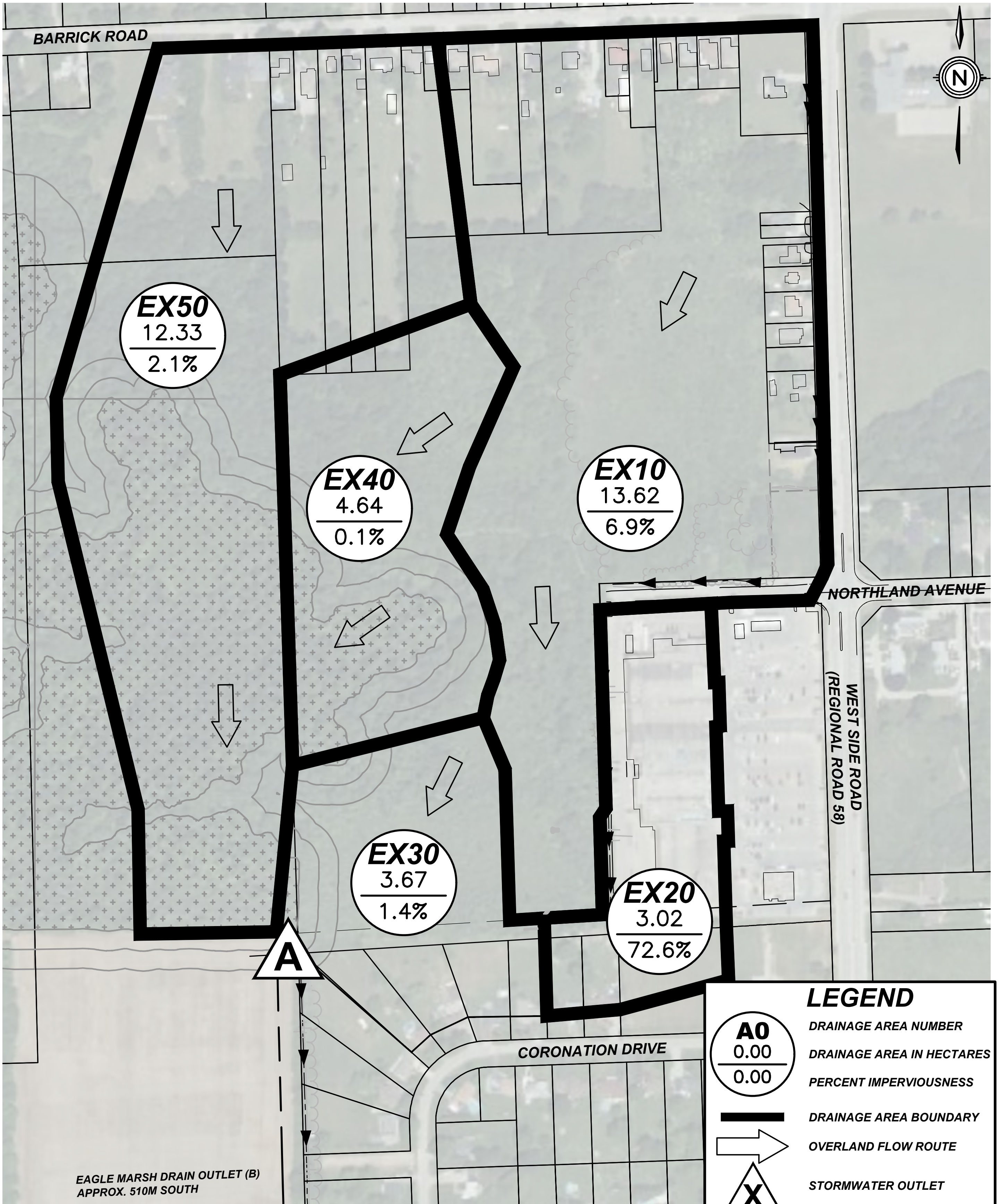
Input parameters for the computer model with the proposed development conditions are shown in Table 2. Impervious Calculations for existing conditions are included in Appendix A.

Table 2. Hydrologic Parameters					
Area No.	**Area (ha)**	**Length (m)**	**Slope (%)**	**SCS CN**	**Percent Impervious**
Existing Conditions					
EX10	13.62	500	2.0	77	6.9
EX20	3.02	100	0.5	77	72.6
EX30	3.67	80	0.5	77	1.4
EX40	4.64	100	0.5	77	0.1
EX50	12.33	350	1.0	77	2.1
	37.28	**Total Area**			
Future Conditions					
A10	17.99	500	1.0	77	75.0
A20	3.02	100	0.5	77	72.6
A30	3.21	80	0.5	77	1.6
A40	3.89	100	0.5	77	3.7
A50	9.18	350	1.0	77	1.3
	37.29	**Total Area**			

The results of the modelling are shown in Table 3, where the peak flows and runoff volumes were calculated for the 2, 5, 10, 25, 50 and 100 year design storm events.

Table 3. Peak Flows and Volumes at Outlet A						
Design Storm	**Peak Flow (m^3/s)**			**Volume (m^3)**		
	Existing	**Future***	**Change**	**Existing**	**Future***	**Change**
2 Year	0.327	1.588	+386%	3,364	6,093	+2,729
5 Year	0.513	2.192	+327%	5,645	8,952	+3,307
10 Year	0.668	2.682	+301%	7,329	11,015	+3,686
25 Year	0.916	3.377	+269%	9,637	13,758	+4,121
50 Year	1.168	3.900	+234%	11,443	15,825	+4,382
100 Year	1.451	4.424	+205%	13,268	17,899	+4,631
*Note: Future stormwater values depict conditions without stormwater quantity controls						

As seen above in Table 3, stormwater quantity controls are considered necessary for the proposed development since the peak flows and volumes outletting from the proposed development area increase as a result of the proposed development. The existing and future stormwater drainage areas shown on Figures 2 and 3 were used to assess the stormwater management plan for this study. Figure 4 outlines the stormwater schematic used to model the conditions for this development.



UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

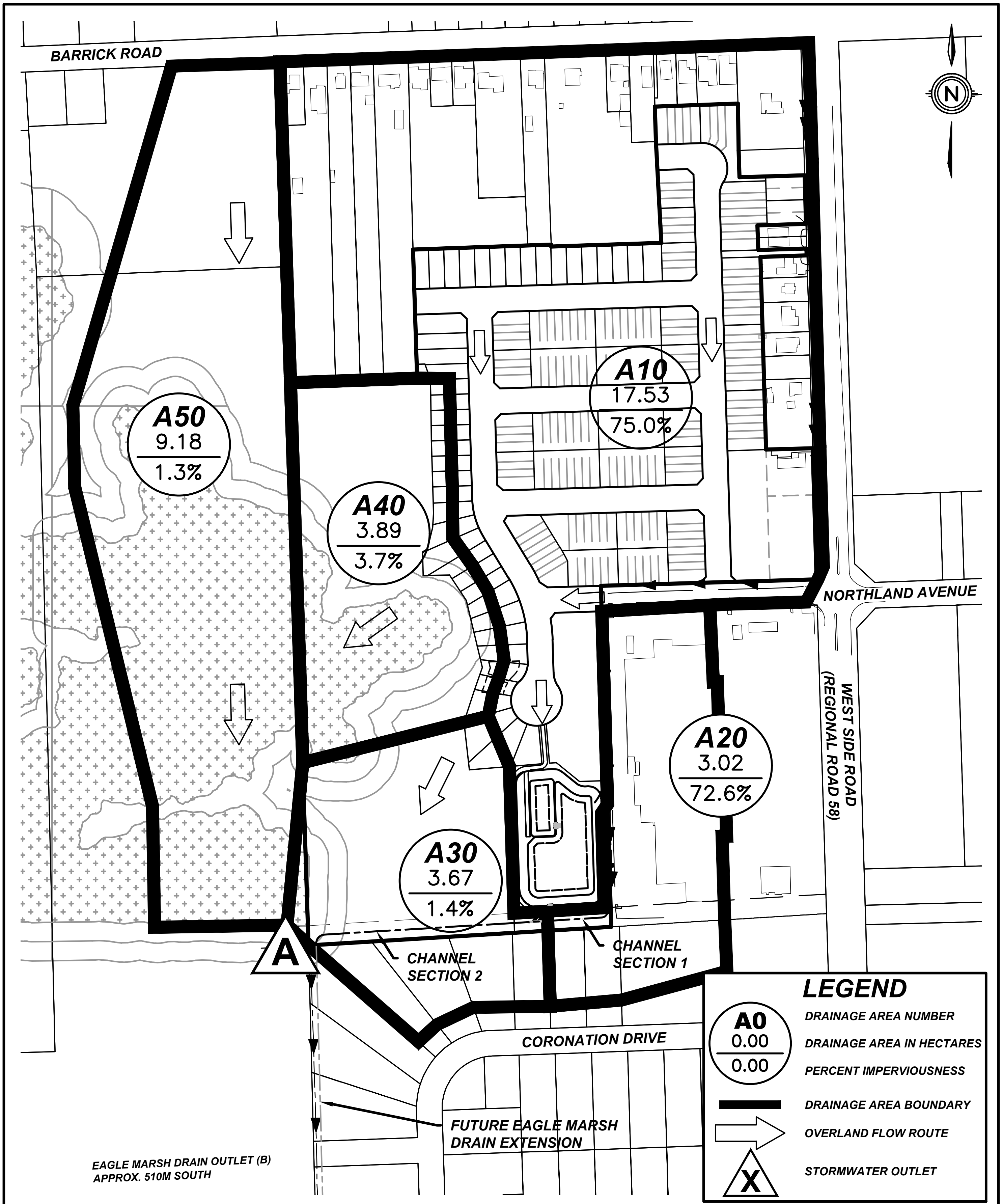
NORTHLAND ESTATES

CITY OF PORT COLBORNE

EXISTING OVERALL STORM DRAINAGE AREA PLAN

DATE	2024–05–24
SCALE	1:4000 m
REF No.	21132
DWG No.	FIGURE 2

DRAWING FILE: F:\21132\Engineering\21132-BASE-R1.dwg PLOTTED: May 24, 2024 – 3:19pm PLOTTED BY: kurt



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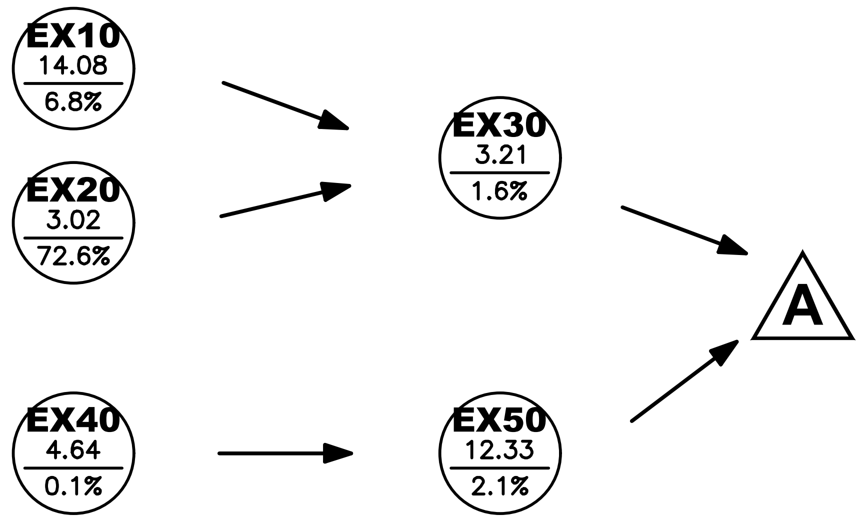
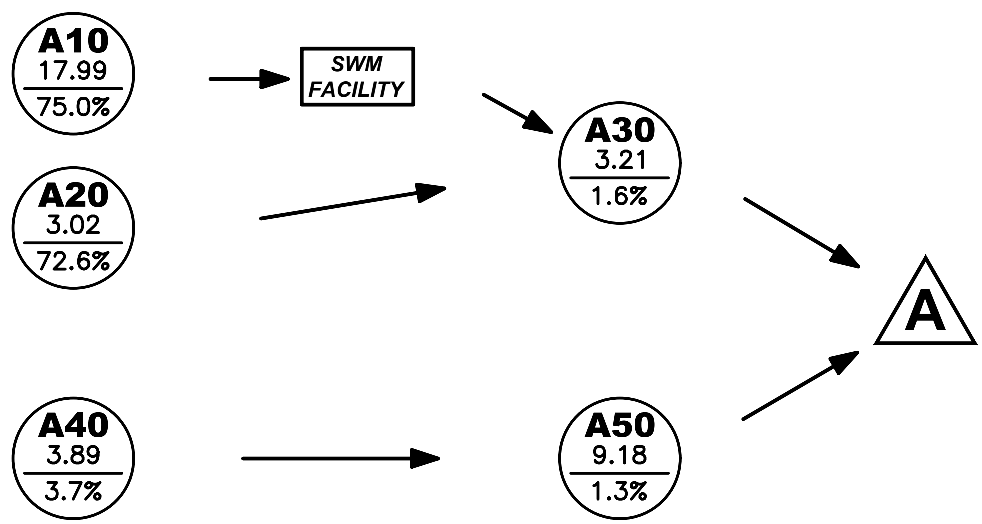
CITY OF PORT COLBORNE

PROPOSED OVERALL STORM DRAINAGE AREA PLAN

DATE	2024–05–24
SCALE	1:4000 m
REF No.	*21132*
DWG No.	*FIGURE 3*

DRAWING FILE: F:\21132\Engineering\21132-BASE-R1.dwg PLOTTED: May 24, 2024 – 3:29pm PLOTTED BY: kurt





LEGEND

A0 / 0.00 / 0.00

- DRAINAGE AREA NUMBER
- DRAINAGE AREA IN HECTARES
- PERCENT IMPERVIOUSNESS

X — STORMWATER OUTLET

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STORMWATER MODELLING SCHEMATIC

DATE	2024–05–24
SCALE	1:4000 m
REF No.	21132
DWG No.	FIGURE 4

DRAWING FILE: F:\21132\Engineering\21132–BASE–R1.dwg PLOTTED: May 24, 2024 – 3:34pm PLOTTED BY: kurt

4.0 STORMWATER MANAGEMENT ALTERNATIVES

4.1 Screening of Stormwater Management Alternatives

A variety of stormwater management alternatives are available to control the quality of stormwater, most of which are described in the Stormwater Management Planning and Design Manual (MECP, March 2003). Alternatives for the proposed and ultimate developments were considered in the following broad categories: lot level, vegetative, infiltration, and end-of-pipe controls. General comments on each category are provided below. Individual alternatives for the proposed development are listed in Table 4 with comments on their effectiveness and applicability to the proposed outlet.

a) Lot Level Controls

Lot level controls are not generally suitable as the primary control facility for quality control. They are generally used to enhance stormwater quality in conjunction with other types of control facilities.

b) Vegetative Alternatives

Vegetative stormwater management practices are not generally suitable as the primary control facility for quality control. They are generally used to enhance stormwater quality in conjunction with other types of control facilities.

c) Infiltration Alternatives

Where soils are suitable, infiltration techniques can be very effective in providing quantity and quality control. However, the very small amount of surface area on this site dedicated to permeable surfaces such as greenspace and landscaping make this an impractical option. Therefore, infiltration techniques will not be considered for this development.

d) End-of-Pipe Alternatives

Surface storage techniques can be very effective in providing quality and quantity control. Dry facilities are effective practices for stormwater erosion and flood control for large drainage areas.

Wet facilities are effective practices for stormwater erosion, quality and quantity control for large drainage areas.

Table 4. Evaluation of Stormwater Management Practices

Northland Estates	Criteria for Implementation of Stormwater Management Practices (SWMP)					Technical Effectiveness (10 high)	Recommend Implementation Yes / No	Comments
	Topography	**Soils**	**Bedrock**	**Groundwater**	**Area**			
Site Conditions	***Variable 1 to 3%***	***Clay Loam <12mm/hr***	***At Considerable Depth***	***At Considerable Depth***	***± 17.99ha***			
Lot Level Controls								
Lot Grading	<5%	nlc	nlc	nlc	nlc	2	Yes	Quality/quantity benefits
Roof Leaders to Surface	nlc	nlc	nlc	nlc	nlc	2	Yes	Quality/quantity benefits
Roof Ldrs.to Soakaway Pits	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 0.5 ha	6	No	Unsuitable site conditions
Sump Pump Fdtn. Drains	nlc	nlc	nlc	nlc	nlc	2	No	Unsuitable site conditions
Vegetative								
Grassed Swales	< 5 %	nlc	nlc	nlc	nlc	7	Yes	Quality/quantity benefits
Filter Strips(Veg. Buffer)	< 10 %	nlc	nlc	>.5m Below Bottom	< 2 ha	5	No	Unsuitable site conditions
Infiltration								
Infiltration Basins	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 5 ha	2	No	Unsuitable site conditions
Infiltration Trench	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 2 ha	4	No	Unsuitable site conditions
Rear Yard Infiltration	< 2.0 %	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 0.5 ha	7	No	Unsuitable site conditions
Perforated Pipes	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	nlc	4	No	Unsuitable site conditions
Pervious Catch basins	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	nlc	3	No	Unsuitable site conditions
Sand Filters	nlc	nlc	nlc	>.5m Below Bottom	< 5 ha	5	No	High maintenance/poor aesthetics
Surface Storage								
Dry Ponds	nlc	nlc	nlc	nlc	> 5 ha	7	No	No quality control
Wet Ponds	nlc	nlc	nlc	nlc	> 5 ha	9	Yes	Very effective quality control
Wetlands	nlc	nlc	nlc	nlc	> 5 ha	10	No	Very effective quality control
Other								
Oil/Grit Separator	nlc	nlc	nlc	nlc	<2 ha	3	No	Limited benefit/area too large

Reference: Stormwater Management Practices Planning and Design Manual - 1994
nlc - No Limiting Criteria

4.2 Selection of Stormwater Management Alternatives

Stormwater management alternatives were screened based on technical effectiveness, physical suitability for this site, and their ability to meet the stormwater management criteria established for proposed and future development areas. The following stormwater management alternatives are recommended for implementation on the proposed development:

- **Lot grading** to be kept as flat as practical, while remaining consistent with municipal standards, in order to slow down stormwater and encourage infiltration.
- **Roof leaders to be discharged to the ground surface** in order to slow down stormwater and encourage infiltration.
- **Grassed swales** to be used to collect rear lot drainage. Grassed swales tend to filter sediments and slow down the rate of stormwater.
- A **wet pond facility** to be constructed to provide stormwater quality enhancement for frequent storms.

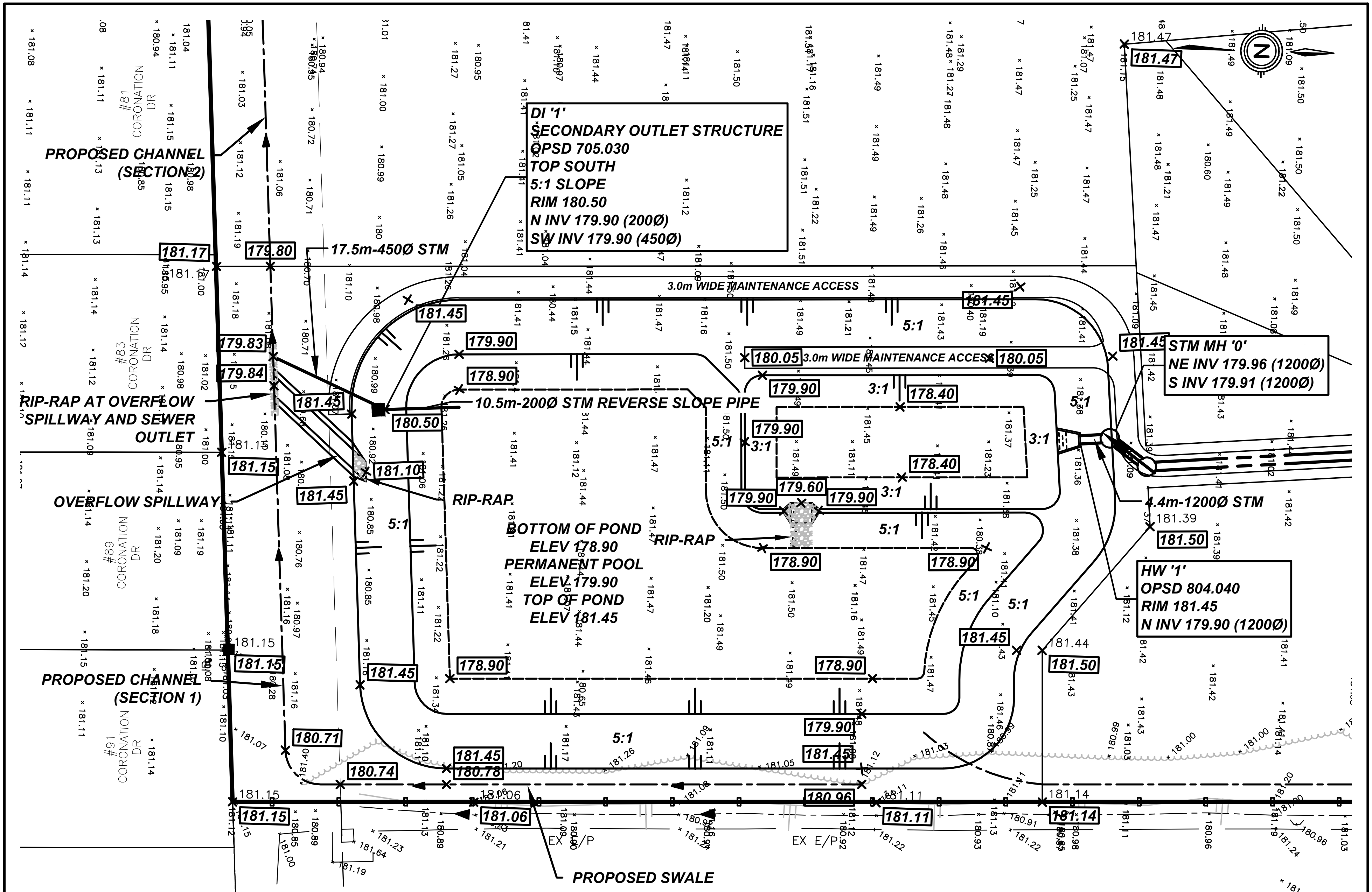
5.0 STORMWATER MANAGEMENT PLAN

A MIDUSS model was created to assess existing, future and ultimate development peak flows and stormwater volumes generated by the proposed subdivision. The stormwater management facility was sized according to MECP Guidelines (MECP, March 2003) as follows:

5.1 Proposed Stormwater Management Facility

5.1.1 Stormwater Quality

The stormwater drainage outlet for the proposed development is the Eagle Marsh Drain, which has been identified by the Ministry of Natural Resources watercourse evaluation as a **Type 2** fish habitat. Based on this fish habitat, the corresponding MECP level of protection for stormwater management quality practices on all new developments shall be *Normal* (70% TSS removal). Based on Table 3.2 of SWMP & Design Manual, the water quality storage requirement is approximately 136.7m^3/ha for *Normal* protection for developments with 75% impervious areas. The drainage area requiring stormwater quality improvement draining to the proposed facility is 17.99 hectares. The storage volumes required for this proposed facility are shown in Table 5.



**NOTE: CONTRACTOR TO MATCH EXISTING GRADE AT PROPERTY LINE

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CITY OF PORT COLBORNE
PROPOSED STORMWATER MANAGEMENT FACILITY

DATE	2024-05-24
SCALE	1:750 m
REF No.	21132
DWG No.	FIGURE 5

DRAWING FILE: F:\21132\Engineering\21132-BASE-R1.dwg PLOTTED: May 24, 2024 – 3:56pm PLOTTED BY: kurt

<table>
<tr><th colspan="2">Table 5. Stormwater Quality Volume Calculations</th></tr>
<tr><td>Total Water Quality Volume
= 17.53 ha x 136.7 m^3/ha
= 2,396.4 m^3
→ 5,588.0 m^3 (provided)</td><td>Reference: Table 3.2, SWMP & Design Manual (MECP 2003)</td></tr>
<tr><td>Permanent Pool Volume
= 17.53 ha x 96.7 m^3/ha
= 1,695.2 m^3
→ 2,745 m^3 (provided)</td><td>Extended Detention Volume
= 17.53 ha x 40 m^3/ha
= 701.2 m^3
→ 2,843 m^3 (provided)</td></tr>
</table>

5.1.3 Stormwater Quantity Control

As shown in the previous Table 3, stormwater management quantity controls are required to reduce the peak flows from the development area to existing conditions up to and including the 100-year design storm event. The stormwater peak flows from the proposed development shall be reduced to existing levels by providing stormwater quantity storage. It is proposed to construct a control structure outlet to reduce the peak stormwater flows discharging from the proposed facility.

5.1.4 Stormwater Management Facility Configuration

As seen on the Proposed Stormwater Management Facility detail (Figure 5), the layout of the stormwater management facility is providing a single sewer outlet to a proposed ditch immediately south of the proposed SWM facility. The ditch will convey flows west through the natural gas easement to the future Eagle Marsh Drain outlet (Outlet A) at the south-west corner of the site.

It is proposed to construct a three-stage outlet for the stormwater management facility as shown in Figure 5. The first stage of control consists of a reverse slope pipe acting as a 200mm diameter orifice to provide the required quality controls. The second stage of control consists of a ditch inlet catch basin and outlet pipe which provides an outlet for flows exceeding the extended detention volume. An emergency spillway will provide an outlet for flows exceeding the capacity of the ditch inlet catch basin and outlet pipe.

The proposed effective bottom elevation of the facility is 178.90m, and the permanent pool water level is 179.90m for a water depth of 1.0 metres. The configuration of the facility provides 2,745m^3 of permanent pool volume, which is more than the required 1,695m^3. The proposed top of pond is at an elevation of 181.45m which provides a total active volume of 8,479m^3. As stated previously, it is known that the bedrock elevation is quite close (+/- 1.0m) to the surface. It is expected that a considerable amount of rock excavation will be necessary to provide the depths required for the stormwater quality and quantity controls.

Based on the configuration of the proposed facility, the 200mm diameter quality orifice shall provide 24.2 hours (24 hrs is MECP minimum) of detention during the 25mm design storm event. The rim elevation for the proposed ditch inlet chamber is 180.50m and will provide an extended detention volume of 2,842m^3, which is more than the required 701m^3.

The outflow pipe from the stormwater management facility is to be 450mm in diameter and will convey the stormwater flows from the ditch inlet to the proposed channel ultimately conveying flows to the Eagle Marsh Drain. The emergency overflow spillway will be constructed at an elevation of 181.10m with a base width of 2.0m and side slopes of 2:1 to the top of the facility. A stage-storage-discharge relationship was determined for the facility and is included in Appendix A for reference purposes.

The proposed on-site storm sewer system will convey stormwater flows up to and including the 5-year design storm event directly to the stormwater management facility. During extreme storm events greater than the 5-year event, overland flows from the development area shall be directed to the proposed stormwater management facility. The storm sewer system will be design to convey stormwater flows from the development site as well as the expected future development area to the north-east. As well, stormwater flows from the private condo development at the north-west corner of the intersection of Northland Avenue and West Side Road will discharge stormwater flows directly to the Subdivision storm sewer system without the need for quantity or quality controls.

Table 6 summarizes the peak inflows and outflows for the stormwater management facility along with corresponding pond elevations. Based on the MIDUSS model, Table 6 shows the maximum wet pond elevation of 181.15m, and an active storage volume of 6,580m^3 for the 100-year design storm event. This will provide a freeboard of 0.30m during the 100 year design storm event.

Table 6. Stormwater Management Wet Pond Facility Characteristics

Design Storm (Return Period)	Peak Flows (L/s)			Maximum Elevation (m)	Maximum Volume (m^3)
	Existing	Future			
		Inflow	Outflow		
25mm	84	924	48	180.36	2,183
2 Year	129	1,646	87	180.56	3,185
5 Year	191	2,324	155	180.73	4,113
10 Year	238	2,767	203	180.85	4,769
25 Year	304	3,322	281	180.99	5,590
50 Year	397	3,762	342	181.09	6,171
100 Year	484	4,115	468	181.15	6,580

As seen in Table 6 above, the proposed stormwater management facility will restrict flows from the proposed development area to existing storm levels up to and including the 100-year design storm event.

Table 7 details the difference in peak stormwater flows for existing and future conditions with the constructed and operational stormwater management facility.

Table 7. Impacts of Wet Pond Facility on Peak Flows at Outlet A

Design Storm	Peak Flow (m^3/s)		
	Existing	**Future with SWM**	**Change***
2 Year	0.327	0.285	-12.8%
5 Year	0.513	0.431	-15.4%
10 Year	0.668	0.559	-16.3%
25 Year	0.916	0.757	-17.4%
50 Year	1.168	0.957	-18.1%
100 Year	1.451	1.182	-18.5%

Note: *indicates the percent change between existing conditions and future conditions with stormwater management controls in place.

As shown in Table 7 above, peak stormwater flows discharging from the proposed development site to Outlet A at the south-west corner will ultimately be reduced as a result of the proposed development plan during all storm events.

The proposed facility has a single storm sewer inlet, therefore, the sediment forebay was designed to minimize the transport of heavy sediment from the storm sewer outlet throughout the facility and to localize maintenance activities. Calculations for the forebay sizing follow MECP Guidelines and are shown in Tables 8 for the storm sewer outlet.

Table 8. Stormwater Management Facility Forebay Sizing

a) Forebay Settling Length (MOECC SWMP&D, Equation 4.5)

$$Settling\ Length = \sqrt{\frac{r * Q_p}{V_s}}$$

r =	3.5	:1	(Length:Width Ratio)
Q_p =	0.048	m^3/s	(25mm Storm Pond Discharge)
V_s =	0.0003	m/s	(Settling Velocity)

Settling Length = **23.66 m**

b) Dispersion Length (MOECC SWMP&D, Equation 4.6)

$$Dispersion\ Length = \frac{8 * Q}{D * V_f}$$

Q =	2.324	m^3/s	(5 Yr Stm Sew Design Inflow)
D =	1.50	m	(Depth of Forebay)
V_f =	0.5	m/s	(Desired Velocity)

Dispersion Length = **24.79 m**

c) Minimum Forebay Deep Zone Bottom Width (MOECC SWMP&D, Equation 4.7)

$$Width = \frac{Dispersion\ Length}{8}$$

Minimum Forebay Length from Equations 3.3 and 3.4

24.79 m (minimum required length)

Width = **3.10 m** (minimum required width)

d) Average Velocity of Flow

$$Average\ Velocity = \frac{Q}{A}$$

Q =	0.924	m^3/s	(Quality Design Inflow)
A =	21.75	m^2	(Cross Sectional Area)
D =	1.50	m	(Depth of Forebay)
W =	10.00	m	(Proposed Bottom Width)
S =	3	:1	(Side slopes - minimum)

Average Velocity = **0.04 m/s**

Is this Acceptable? **Yes** (Maximum velocity of flow = 0.15 m/s)

e) Cleanout Frequency

Is this Acceptable? **Yes**

L =	35.0	m	(Proposed Bottom Length)
ASL =	3.13	m^3/ha	(Annual Sediment Loading)
A =	17.58	ha	(Drainage Area)
FRC =	70	%	(Facility Removal Efficiency)
FV =	889.50	m^3	(Forebay Volume)

Cleanout Frequency = **11.3 years**

Is this Acceptable? **Yes** (10 year minimum cleanout frequency)

5.1.5 Proposed Channel

As part of the proposed stormwater management plan, a channel will be constructed to provide an outlet for stormwater flows discharged from the stormwater management facility and surrounding lands. The proposed channel will begin at the south-east corner of the site, providing an outlet for stormwater flows discharging from the adjacent commercial property (287 West Side Road) and surrounding residential lands (Drainage Area A20). The channel will continue west within the existing natural gas easement to the south-west corner of the development and discharge to the future upstream Eagle Marsh Drain limit (Outlet A) at the south-west corner of the site.

As part of the stormwater analysis of this development, the channel has been modelled using the MIDUSS computer modelling program to have capacity for flows up to and including the 100-year design storm event. The channel has been modelled in three sections as follows:

1. Start of channel at south-east corner of development to proposed stormwater management facility outlet.

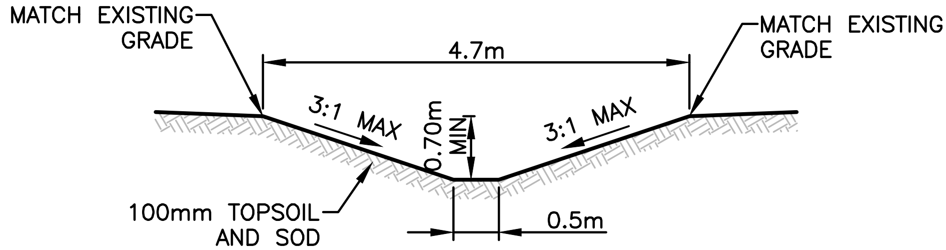
2. SWM facility outlet to south-west corner (Outlet A) of development property.

The modelled sections of the channel have been noted on the Proposed Overall Storm Drainage Area Plan (Figure 3) included previously on Page 9 of this report. The channel modelling was incorporated into the overall development MIDUSS stormwater management model and utilizes input parameters noted previously in the report.

The proposed channel has been modelled to have capacity for stormwater flows from the proposed development and surrounding lands for storm events up to and including the 100-year design storm event. Table 10 below details the stormwater characteristics of the proposed channel conveying stormwater flows from upstream of the SWM facility outlet to the Eagle Marsh Drain during the 100-year design storm event. It is proposed to construct a channel with dimensions and side slopes as detailed in Table 10. Cross sections of the proposed channel have been included on the next page.

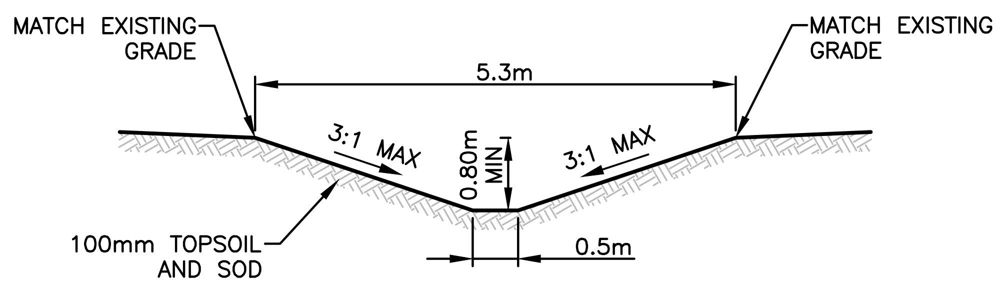
Table 9. Channel Characteristics

Channel Section	Length (m)	Base Width (m)	Slope (%)	Side Slopes	Minimum Proposed Channel Depth (m)	Peak Flow Rate (m^3/s)	100-Year Peak Flow Depth (m)
1 – Start	50	0.5	0.30	3:1	0.70m	0.694	0.64
2 – End	200	0.5	0.20	3:1	0.80m	0.843	0.76



CHANNEL CROSS SECTION '1'

CONSTRUCTED FROM SOUTH -EAST CORNER OF DEVELOPMENT TO SWM FACILITY OUTLET



CHANNEL CROSS SECTION '2'

CONSTRUCTED FROM SWM FACILITY OUTLET TO SOUTH-WEST CORNER OF DEVELOPMENT SITE (OUTLET 'A')

UPPER CANADA CONSULTANTS *ENGINEERS / PLANNERS*	***NORTHLAND ESTATES***	DATE	2024–05–24
	CITY OF PORT COLBORNE	SCALE	N.T.S.
		REF No.	***21132***
	CHANNEL CROSS SECTIONS	DWG No.	***FIGURE 6***

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6.0 SEDIMENT AND EROSION CONTROL

Sediment and erosion controls are required during all construction phases of this development to limit the transport of sediment into the adjacent Locally Significant Wetland as well as the Eagle Marsh Drain.

The following additional erosion and sediment controls will also be implemented during construction:

- Install silt control fencing along the limits of construction of the development to collect sediment in overland flows before discharging to downstream systems. The silt control fence installed along east end of site will be installed along the wetland buffer to act as the limit of construction.

- Re-vegetate disturbed areas as soon as possible after grading works have been completed.

- Lot grading and siltation controls plans will be provided with sediment and erosion control measures to the appropriate agencies for approval during the final design stage.

7.0 STORMWATER MANAGEMENT FACILITY MAINTENANCE

7.1 Wetpond Facility

Maintenance is a necessary and important aspect of urban stormwater quality and quantity measures such as constructed wetlands. Many pollutants (ie. nutrients, metals, bacteria, etc.) bind to sediment and therefore removal of sediment on a scheduled basis is required.

The wet pond for this development is subject to frequent wetting and deposition of sediments as a result of frequent low intensity storm events. The purpose of the wet pond is to improve post development sediment and contaminant loadings by detaining the 'first flush' flow for a 24 hour period. For the initial operation period of the stormwater management facility, the required frequency of maintenance is not definitively known and many of the maintenance tasks will be performed on an 'as required' basis. For example, during the home construction phase of the development there will be a greater potential for increased maintenance frequency, which depends on the effectiveness of sediment and erosion control techniques employed.

Inspections of the wet pond will indicate whether or not maintenance is required. Inspections should be made after every significant storm during the first two years of operation or until all development is completed to ensure the wet pond is functioning properly. This may translate into an average of six inspections per year. Once all building activity is finalized, inspections shall be performed annually. The following points should be addressed during inspections of the facility.

a) Standing water above the inlet storm sewer invert a day or more after a storm may indicate a blockage in the reverse slope pipe or orifice. The blockage may be caused by trash or sediment and a visual inspection would be required to determine the cause.

b) The vegetation around the wet pond should be inspected to ensure its function and aesthetics. Visual inspections will indicate whether replacement of plantings are required. A decline in vegetation habitat may indicate that other aspects of the constructed wet pond are operating improperly, such as the detention times may be inadequate or excessive.

c) The accumulation of sediment and debris at the wet pond inlet sediment forebay or around the high water line of the wet pond should be inspected. This will indicate the need for sediment removal or debris clean up.

d) The wet pond has been created by excavating a detention area. The integrity of the embankments should be periodically checked to ensure that it remains watertight and the side slopes have not sloughed.

Grass cutting is a maintenance activity that is done solely for aesthetic purposes. It is recommended that grass cutting be eliminated. It should be noted that municipal by-laws may require regular grass maintenance for weed control.

Trash removal is an integral part of maintenance and an annual cleanup, usually in the spring, is a minimum requirement. After this, trash removal is performed as required basis on observation of trash build-up during inspections.

To ensure long term effectiveness, the sediment that accumulates in the forebay area should be removed periodically to ensure that sediment in not deposited throughout the facility. For sediment removal operations, typical grading/excavating equipment should be used to remove sediment from the inlet forebay and detention areas. Care should be taken to ensure that limited damage occurs to existing vegetation and habitat.

Generally, the sediment which is removed from the detention pond will not be contaminated to the point that it would be classified as hazardous waste. However, the sediment should be tested to determine the disposal options.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this study, the following conclusions are offered:

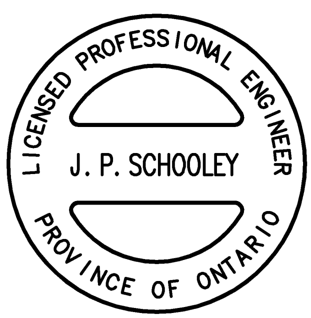
- Infiltration techniques are not suitable for this site as the primary control facility due to the low soil infiltration rates and the large drainage area for this development.
- The proposed stormwater management facilities will provide stormwater quality and quantity controls for the approximately 17.99-hectare catchment area.
- The proposed channel will convey stormwater flows from the proposed stormwater management facility and surrounding lands directly to the Eagle Marsh Drain.
- Various lot level vegetative stormwater management practices can be implemented to enhance stormwater quality.
- This report was prepared in accordance with the provincial guidelines contained in "Stormwater Management Planning and Design Manual, March 2003".

The above conclusions lead to the following recommendations:

- That the stormwater management criteria established in this report be accepted.
- That a stormwater management wet pond facility be constructed to provide stormwater quality protection to MECP *Normal* Protection levels and quantity controls as outlined in this report.
- That additional lot level controls and vegetative stormwater management practices as described previously in this report be implemented.

Prepared By:

Kurt Tiessen, E.I.T.



Reviewed By:

Jason Schooley, P.Eng.
Revised May 24, 2024

APPENDICES

APPENDIX A

Weighted Impervious Calculation Sheet
Stormwater Management Facility Calculations

Weighted Imperviousness Percentage Calculation Worksheet

Project Name:	Northland Estates
Project Number:	21132
Date:	May 2024
Person:	K. Tiessen E.I.T

EX10 - EXISTING CONDITIONS

	Footprint	*% Impervious*		*Effective Impervious Area*
Residential Dwellings	5108.1 m^2	100.0%	ea	5108.1 m^2
Open Space	129385.9 m^2	2%	ea	2587.7 m^2
Northland Roadway	1731.0 m^2	100%	ea	1731.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS				9,427 m^2
TOTAL CATCHMENT AREA				136,225 m^2
		EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**6.9 %**
		RUNOFF COEFFICIENT		**0.25**

EX30 - EXISTING CONDITIONS

	Footprint	*% Impervious*		*Effective Impervious Area*
Residential Dwellings	468.4 m^2	100.0%	ea	468.4 m^2
Open Space	36193.6 m^2	0%	ea	36.2 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS				505 m^2
TOTAL CATCHMENT AREA				36,662 m^2
		EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**1.4 %**
		RUNOFF COEFFICIENT		**0.21**

EX50 - EXISTING CONDITIONS

	Footprint	*% Impervious*		*Effective Impervious Area*
Residential Dwellings	2519.7 m^2	100.0%	ea	2519.7 m^2
Open Space	120794.5 m^2	0%	ea	120.8 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS				2,640 m^2
TOTAL CATCHMENT AREA				123,314 m^2
		EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**2.1 %**
		RUNOFF COEFFICIENT		**0.21**

EX20/A20 - EXISTING/FUTURE CONDITIONS

	Footprint	*% Impervious*		*Effective Impervious Area*
Residential Dwellings	265.2 m^2	100.0%	ea	265.2 m^2
Commercial Area	21633.8 m^2	100%	ea	21633.8 m^2
Open Space	8284.3 m^2	0%	ea	8.3 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS				21,907 m^2
TOTAL CATCHMENT AREA				30,183 m^2
		EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**72.6 %**
		RUNOFF COEFFICIENT		**0.71**

A30 - FUTURE CONDITIONS				
	Footprint	*% Impervious*		*Effective Impervious Area*
Residential Dwellings	468.4 m^2	100.0%	ea	468.4 m^2
Open Space	36193.6 m^2	0%	ea	36.2 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS				505 m^2
TOTAL CATCHMENT AREA				36,662 m^2
			EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS	**1.4 %**
			RUNOFF COEFFICIENT	**0.21**

A40 - FUTURE CONDITIONS				
	Footprint	*% Impervious*		*Effective Impervious Area*
Future Single Residential	4968.4 m^2	28.6%	ea	1421.0 m^2
Open Space	33977.2 m^2	0%	ea	34.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS				1,455 m^2
TOTAL CATCHMENT AREA				38,946 m^2
			EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS	**3.7 %**
			RUNOFF COEFFICIENT	**0.23**

A50 - FUTURE CONDITIONS				
	Footprint	*% Impervious*		*Effective Impervious Area*
Existing Residential Dwellings	1079.7 m^2	100.0%	ea	1079.7 m^2
Open Space	90692.0 m^2	0%	ea	90.7 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS				1,170 m^2
TOTAL CATCHMENT AREA				91,772 m^2
			EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS	**1.3 %**
			RUNOFF COEFFICIENT	**0.21**

Upper Canada Consultants
30 HANNOVER DRIVE, UNIT 3
St. Catharines, Ontario L2W 1A3
DATE: MAY 2024
PROJECT NAME: NORTHLAND ESTATES
PROJECT NO.: 21132

STORMWATER MANAGEMENT FACILITY WETPOND

Quality Requirements		Quality Orifice	Ditch Inlet Weir	Outflow Pipe Orifice	Overflow Spillway
Drainage Area (ha) = 17.53		Diameter (m) = 0.203	Length (m) = 0.60	Diameter (m) = 0.457	Minor Length (m) = 2.00
Normal (m^3/ha) = 137	(@ 75% Imp)	Cd = 0.63	Width (m) = 0.60	Cd = 0.63	Slopes (X:1) = 2.00
Perm Pool (m^3/ha) = 97		Invert (m) = 179.90	Grate Slope (X:1) = 5	Invert (m) = 179.90	Minor Invert (m) = 181.10
Perm Pool Vol (m^3) = 1,695			Inlet Elevation (m) = 180.50	Overt (m) = 180.36	
Active Vol (m^3) 701			Cd = 1.84		
25mm MOEE (m^3) 2,447	m^3			MOE Equation 4.11 Drawdown Coefficient 'C2' =	1,624
Perm. Pool Elev. = 179.90	m			MOE Equation 4.11 Drawdown Coefficient 'C3' =	4,251
				MOE Equation 4.11 Drawdown Time (h) =	**24.2**

Elevation	Increment Depth (m)	Active Depth (m)	Surface Area (m^2)	Average Surface Area (m^2)	Increment Volume (m^3)	Permanent Volume (m^3)	Active Volume (m^3)	Quality Orifice (m^3/s)	Ditch Inlet (m^3/s)	Max Pipe Orifice (m^3/s)	Overflow Spillway (m^3/s)	Total Outflow (m^3/s)	Average Discharge (m^3/s)	Average Drawdown Time (hr)
178.90		-1.00	2,147			0								
	0.50			2,440	1,220									
179.40		-0.50	2,733			1,220								
	0.50			3,050	1,525									
179.90		0.00	**3,368**			**2,745**								
	0.00			3,809	0									
179.90		0.00	4,251				0.0	0.000	0.000	0.00	0.00	0.000		
	0.60			4,738	2,843								0.031	
180.50		0.60	5,225				**2842.9**	0.062	0.000	0.249	0.000	0.062		25.65
	0.40			5,519	2,208								0.143	
180.90		1.00	5,813				5050.5	0.084	0.140	0.382	0.000	0.224		29.95
	0.20			5,964	1,193								0.287	
181.10		1.20	6,116				6243.3	0.093	0.257	0.433	0.000	0.350		31.11
	0.15			6,231	935								0.514	
181.25		1.35	6,347				7177.9	0.100	0.359	0.468	0.220	0.678		31.61
	0.20			6,504	1,301								1.038	
181.45		1.55	6,661				**8478.7**	0.107	0.511	0.511	0.888	1.399		31.96

Notes
1. Quality Orifice flow is the orifice controlling for the 24 hour detention period and uses an orifice formula.
2. Pipe Orifice flow is calculated using an orifice formula on the pipe from the ditch inlet to the outlet and uses the total head on the orifice.
3. Overflow Weir flow is calculated using a trapezondial weir to convey outflow for less frequent storms through the embankment with an emergency spillway.
4. Total Outflow is calculated by adding the Overflow Spillway with the lowest of Quality Orifice plus Ditch Inlet or Max Pipe Orifice.

APPENDIX B

MIDUSS Output Files

Existing Conditions

```
        Output File (4.7) EX.OUT      opened 2024-05-24  14:20
        Units used are defined by G =    9.810
           24  144   10.000       are MAXDT MAXHYD & DTMIN values
        Licensee: UPPER CANADA CONSULTANTS
 35     COMMENT
       4    line(s) of comment
        PROJECT NAME: NORTHLAND ESTATES, PORT COLBORNE
        PROJECT NO.:  21132
        STORMWATER MANAGEMENT ANALYSIS MAY 2022
        EXISTING CONDITIONS
 14     START
       1    1=Zero; 2=Define
 35     COMMENT
       3    line(s) of comment
        ****************************
        ** 25mm DESIGN STORM EVENT **
        ****************************
  2     STORM
           1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     512.000    Coefficient  a
       6.000    Constant  b   (min)
        .800    Exponent  c
        .400    Fraction to peak  r
     240.000    Duration ó  240 min
              25.036 mm    Total depth
  3     IMPERVIOUS
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013    Manning "n"
      98.000    SCS Curve No or C
        .100    Ia/S Coefficient
        .518    Initial Abstraction
  4     CATCHMENT
      20.000    ID No.ó 99999
       3.020    Area in hectares
     100.000    Length (PERV) metres
        .500    Gradient (%)
      72.600    Per cent Impervious
     100.000    Length (IMPERV)
        .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250    Manning "n"
      77.000    SCS Curve No or C
        .100    Ia/S Coefficient
       7.587    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .202      .000      .000      .000 c.m/s
             .130      .797      .614    C perv/imperv/total
 15     ADD RUNOFF
             .202      .202      .000      .000 c.m/s
 27     HYDROGRAPH DISPLAY
       5    is # of Hyeto/Hydrograph chosen
        Volume  =  .4636960E+03 c.m
 11     CHANNEL
        .500    Base Width    =
      10.000    Left  bank slope  1:
      10.000    Right bank slope  1:
        .060    Manning's "n"
       1.000    O/a Depth in metres
        .100    Select Grade in %
       Depth         =     .326 metres
       Velocity      =     .164 m/s
       Flow Capacity  =    3.531 c.m/s
       Critical depth =     .130 metres
  9     ROUTE
      50.000    Conduit Length
        .000    Supply X-factor <.5
     228.369    Supply K-lag (sec)
        .808    Beta weighting factor
     600.000    Routing timestep
           1    No. of sub-reaches
             .202      .202      .179      .000 c.m/s
 17     COMBINE
       1    Junction Node No.
             .202      .202      .179      .179 c.m/s
 14     START
       1    1=Zero; 2=Define
  4     CATCHMENT
      10.000    ID No.ó 99999
      13.620    Area in hectares
     500.000    Length (PERV) metres
       2.000    Gradient (%)
       6.900    Per cent Impervious
     500.000    Length (IMPERV)
        .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250    Manning "n"
      77.000    SCS Curve No or C
        .100    Ia/S Coefficient
       7.587    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .084      .000      .179      .179 c.m/s
             .130      .804      .177    C perv/imperv/total
 15     ADD RUNOFF
             .084      .084      .179      .179 c.m/s
 27     HYDROGRAPH DISPLAY
       5    is # of Hyeto/Hydrograph chosen
        Volume  =  .6027209E+03 c.m
  9     ROUTE
        .000    Conduit Length
        .500    Supply X-factor <.5
        .000    Supply K-lag (sec)
        .500    Beta weighting factor
     600.000    Routing timestep
           1    No. of sub-reaches
             .084      .084      .084      .179 c.m/s
 17     COMBINE
       1    Junction Node No.
             .084      .084      .084      .263 c.m/s
 18     CONFLUENCE
       1    Junction Node No.
             .084      .263      .084      .000 c.m/s
  4     CATCHMENT
      30.000    ID No.ó 99999
       3.670    Area in hectares
      80.000    Length (PERV) metres
        .500    Gradient (%)
       1.400    Per cent Impervious
      80.000    Length (IMPERV)
```

```
        .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250    Manning "n"
      77.000    SCS Curve No or C
        .100    Ia/S Coefficient
       7.587    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .010      .263      .084      .000 c.m/s
             .130      .785      .139    C perv/imperv/total
 15     ADD RUNOFF
             .010      .269      .084      .000 c.m/s
 11     CHANNEL
        .500    Base Width    =
      10.000    Left  bank slope  1:
      10.000    Right bank slope  1:
        .060    Manning's "n"
       1.000    O/a Depth in metres
        .100    Select Grade in %
       Depth         =     .366 metres
       Velocity      =     .177 m/s
       Flow Capacity  =    3.531 c.m/s
       Critical depth =     .148 metres
  9     ROUTE
     200.000    Conduit Length
        .135    Supply X-factor <.5
     849.757    Supply K-lag (sec)
        .500    Beta weighting factor
     600.000    Routing timestep
           1    No. of sub-reaches
             .010      .269      .193      .000 c.m/s
 17     COMBINE
       2    Junction Node No.
             .010      .269      .193      .193 c.m/s
 14     START
       1    1=Zero; 2=Define
  4     CATCHMENT
      40.000    ID No.ó 99999
       4.640    Area in hectares
     100.000    Length (PERV) metres
        .500    Gradient (%)
        .100    Per cent Impervious
     100.000    Length (IMPERV)
        .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250    Manning "n"
      77.000    SCS Curve No or C
        .100    Ia/S Coefficient
       7.587    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .011      .000      .193      .193 c.m/s
             .130      .797      .131    C perv/imperv/total
 15     ADD RUNOFF
             .011      .011      .193      .193 c.m/s
  4     CATCHMENT
      50.000    ID No.ó 99999
      12.330    Area in hectares
     350.000    Length (PERV) metres
       1.000    Gradient (%)
       2.100    Per cent Impervious
     350.000    Length (IMPERV)
        .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250    Manning "n"
      77.000    SCS Curve No or C
        .100    Ia/S Coefficient
       7.587    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .024      .011      .193      .193 c.m/s
             .130      .803      .144    C perv/imperv/total
 15     ADD RUNOFF
             .024      .029      .193      .193 c.m/s
  9     ROUTE
        .000    Conduit Length
        .500    Supply X-factor <.5
        .000    Supply K-lag (sec)
        .500    Beta weighting factor
     600.000    Routing timestep
           1    No. of sub-reaches
             .024      .029      .029      .193 c.m/s
 17     COMBINE
       2    Junction Node No.
             .024      .029      .029      .214 c.m/s
 18     CONFLUENCE
       2    Junction Node No.
             .024      .214      .029      .000 c.m/s
 27     HYDROGRAPH DISPLAY
       5    is # of Hyeto/Hydrograph chosen
        Volume  =  .1786801E+04 c.m
 14     START
       1    1=Zero; 2=Define
 35     COMMENT
       3    line(s) of comment
        *******************************
        ** 2 YEAR DESIGN STORM EVENT **
        *******************************
  2     STORM
           1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     397.149    Coefficient  a
        .000    Constant  b   (min)
        .699    Exponent  c
        .400    Fraction to peak  r
     240.000    Duration ó  240 min
              34.453 mm    Total depth
  3     IMPERVIOUS
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013    Manning "n"
      98.000    SCS Curve No or C
        .100    Ia/S Coefficient
        .518    Initial Abstraction
  4     CATCHMENT
      20.000    ID No.ó 99999
       3.020    Area in hectares
     100.000    Length (PERV) metres
        .500    Gradient (%)
      72.600    Per cent Impervious
     100.000    Length (IMPERV)
        .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250    Manning "n"
      77.000    SCS Curve No or C
        .100    Ia/S Coefficient
```

```
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .275      .000      .029      .000 c.m/s
           .204      .828      .657    C perv/imperv/total
15    ADD RUNOFF
           .275      .275      .029      .000 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
     Volume  =  .6835738E+03 c.m
11    CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
      .100    Select Grade in %
     Depth        =     .369 metres
     Velocity      =     .178 m/sec
     Flow Capacity  =    3.531 c.m/s
     Critical depth =     .150 metres
 9    ROUTE
    50.000    Conduit Length
      .000    Supply X-factor <.5
   211.250    Supply K-lag (sec)
      .842    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .275      .275      .257      .000 c.m/s
17    COMBINE
     1    Junction Node No.
           .275      .275      .257      .257 c.m/s
14    START
     1    1=Zero; 2=Define
 4    CATCHMENT
    10.000    ID No.ó 99999
    13.620    Area in hectares
   500.000    Length (PERV) metres
     2.000    Gradient (%)
     6.900    Per cent Impervious
   500.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .129      .000      .257      .257 c.m/s
           .204      .847      .248    C perv/imperv/total
15    ADD RUNOFF
           .129      .129      .257      .257 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
     Volume  =  .1164711E+04 c.m
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .129      .129      .129      .257 c.m/s
17    COMBINE
     1    Junction Node No.
           .129      .129      .129      .386 c.m/s
18    CONFLUENCE
     1    Junction Node No.
           .129      .386      .129      .000 c.m/s
 4    CATCHMENT
    30.000    ID No.ó 99999
     3.670    Area in hectares
    80.000    Length (PERV) metres
      .500    Gradient (%)
     1.400    Per cent Impervious
    80.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .025      .386      .129      .000 c.m/s
           .204      .838      .213    C perv/imperv/total
15    ADD RUNOFF
           .025      .399      .129      .000 c.m/s
11    CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
      .100    Select Grade in %
     Depth        =     .428 metres
     Velocity      =     .195 m/sec
     Flow Capacity  =    3.531 c.m/s
     Critical depth =     .177 metres
 9    ROUTE
   200.000    Conduit Length
      .077    Supply X-factor <.5
   769.853    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .025      .399      .284      .000 c.m/s
17    COMBINE
     2    Junction Node No.
           .025      .399      .284      .284 c.m/s
14    START
     1    1=Zero; 2=Define
 4    CATCHMENT
    40.000    ID No.ó 99999
     4.640    Area in hectares
   100.000    Length (PERV) metres
      .500    Gradient (%)
      .100    Per cent Impervious
   100.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .028      .000      .284      .284 c.m/s
           .204      .828      .205    C perv/imperv/total
15    ADD RUNOFF
           .028      .028      .284      .284 c.m/s
 4    CATCHMENT
    50.000    ID No.ó 99999
    12.330    Area in hectares
   350.000    Length (PERV) metres
     1.000    Gradient (%)
     2.100    Per cent Impervious
   350.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .051      .028      .284      .284 c.m/s
           .204      .848      .217    C perv/imperv/total
15    ADD RUNOFF
           .051      .078      .284      .284 c.m/s
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .051      .078      .078      .284 c.m/s
17    COMBINE
     2    Junction Node No.
           .051      .078      .078      .327 c.m/s
18    CONFLUENCE
     2    Junction Node No.
           .051      .327      .078      .000 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
     Volume  =  .3363599E+04 c.m
14    START
     1    1=Zero; 2=Define
35    COMMENT
     3    line(s) of comment
     *******************************
     ** 5 YEAR DESIGN STORM EVENT **
     *******************************
 2    STORM
        1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   524.867    Coefficient  a
      .000    Constant  b   (min)
      .699    Exponent  c
      .400    Fraction to peak  r
   240.000    Duration ó  240 min
            45.533 mm    Total depth
 3    IMPERVIOUS
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .013    Manning "n"
    98.000    SCS Curve No or C
      .100    Ia/S Coefficient
      .518    Initial Abstraction
 4    CATCHMENT
    20.000    ID No.ó 99999
     3.020    Area in hectares
   100.000    Length (PERV) metres
      .500    Gradient (%)
    72.600    Per cent Impervious
   100.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .364      .000      .078      .000 c.m/s
           .278      .869      .707    C perv/imperv/total
15    ADD RUNOFF
           .364      .364      .078      .000 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
     Volume  =  .9720645E+03 c.m
11    CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
      .100    Select Grade in %
     Depth        =     .413 metres
     Velocity      =     .191 m/sec
     Flow Capacity  =    3.531 c.m/s
     Critical depth =     .170 metres
 9    ROUTE
    50.000    Conduit Length
      .000    Supply X-factor <.5
   196.842    Supply K-lag (sec)
      .873    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .364      .364      .350      .000 c.m/s
17    COMBINE
     1    Junction Node No.
           .364      .364      .350      .350 c.m/s
14    START
     1    1=Zero; 2=Define
 4    CATCHMENT
    10.000    ID No.ó 99999
    13.620    Area in hectares
   500.000    Length (PERV) metres
     2.000    Gradient (%)
     6.900    Per cent Impervious
   500.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
```

```
       1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .191      .000      .350      .350 c.m/s
          .278      .884      .320    C perv/imperv/total
15    ADD RUNOFF
          .191      .191      .350      .350 c.m/s
27    HYDROGRAPH DISPLAY
    5    is # of Hyeto/Hydrograph chosen
     Volume  =  .1982292E+04 c.m
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
       1    No. of sub-reaches
          .191      .191      .191      .350 c.m/s
17    COMBINE
    1    Junction Node No.
          .191      .191      .191      .541 c.m/s
18    CONFLUENCE
    1    Junction Node No.
          .191      .541      .191      .000 c.m/s
 4    CATCHMENT
    30.000    ID No.ó 99999
     3.670    Area in hectares
    80.000    Length (PERV) metres
      .500    Gradient (%)
     1.400    Per cent Impervious
    80.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
       1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .059      .541      .191      .000 c.m/s
          .278      .877      .286    C perv/imperv/total
15    ADD RUNOFF
          .059      .570      .191      .000 c.m/s
11    CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
      .100    Select Grade in %
     Depth         =     .493 metres
     Velocity      =     .213 m/sec
     Flow Capacity  =    3.531 c.m/s
     Critical depth =     .208 metres
 9    ROUTE
   200.000    Conduit Length
      .016    Supply X-factor <.5
   703.815    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
       1    No. of sub-reaches
          .059      .570      .414      .000 c.m/s
17    COMBINE
    2    Junction Node No.
          .059      .570      .414      .414 c.m/s
14    START
    1    1=Zero; 2=Define
 4    CATCHMENT
    40.000    ID No.ó 99999
     4.640    Area in hectares
   100.000    Length (PERV) metres
      .500    Gradient (%)
      .100    Per cent Impervious
   100.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
       1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .069      .000      .414      .414 c.m/s
          .278      .869      .278    C perv/imperv/total
15    ADD RUNOFF
          .069      .069      .414      .414 c.m/s
 4    CATCHMENT
    50.000    ID No.ó 99999
    12.330    Area in hectares
   350.000    Length (PERV) metres
     1.000    Gradient (%)
     2.100    Per cent Impervious
   350.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
       1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .119      .069      .414      .414 c.m/s
          .278      .884      .291    C perv/imperv/total
15    ADD RUNOFF
          .119      .178      .414      .414 c.m/s
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
       1    No. of sub-reaches
          .119      .178      .178      .414 c.m/s
17    COMBINE
    2    Junction Node No.
          .119      .178      .178      .513 c.m/s
18    CONFLUENCE
    2    Junction Node No.
          .119      .513      .178      .000 c.m/s
27    HYDROGRAPH DISPLAY
    5    is # of Hyeto/Hydrograph chosen
     Volume  =  .5645400E+04 c.m
14    START
    1    1=Zero; 2=Define
35    COMMENT
    3    line(s) of comment
```

```
      ********************************
      ** 10 YEAR DESIGN STORM EVENT **
      ********************************
 2    STORM
       1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   608.845    Coefficient  a
      .000    Constant  b   (min)
      .699    Exponent  c
      .400    Fraction to peak  r
   240.000    Duration ó  240 min
            52.818 mm    Total depth
 3    IMPERVIOUS
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .013    Manning "n"
    98.000    SCS Curve No or C
      .100    Ia/S Coefficient
      .518    Initial Abstraction
 4    CATCHMENT
    20.000    ID No.ó 99999
     3.020    Area in hectares
   100.000    Length (PERV) metres
      .500    Gradient (%)
    72.600    Per cent Impervious
   100.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
       1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .442      .000      .178      .000 c.m/s
          .320      .887      .732    C perv/imperv/total
15    ADD RUNOFF
          .442      .442      .178      .000 c.m/s
27    HYDROGRAPH DISPLAY
    5    is # of Hyeto/Hydrograph chosen
     Volume  =  .1167105E+04 c.m
11    CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
      .100    Select Grade in %
     Depth         =     .446 metres
     Velocity      =     .200 m/sec
     Flow Capacity  =    3.531 c.m/s
     Critical depth =     .186 metres
 9    ROUTE
    50.000    Conduit Length
      .000    Supply X-factor <.5
   187.592    Supply K-lag (sec)
      .894    Beta weighting factor
   600.000    Routing timestep
       1    No. of sub-reaches
          .442      .442      .411      .000 c.m/s
17    COMBINE
    1    Junction Node No.
          .442      .442      .411      .411 c.m/s
14    START
    1    1=Zero; 2=Define
 4    CATCHMENT
    10.000    ID No.ó 99999
    13.620    Area in hectares
   500.000    Length (PERV) metres
     2.000    Gradient (%)
     6.900    Per cent Impervious
   500.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
       1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .238      .000      .411      .411 c.m/s
          .320      .898      .360    C perv/imperv/total
15    ADD RUNOFF
          .238      .238      .411      .411 c.m/s
27    HYDROGRAPH DISPLAY
    5    is # of Hyeto/Hydrograph chosen
     Volume  =  .2587458E+04 c.m
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
       1    No. of sub-reaches
          .238      .238      .238      .411 c.m/s
17    COMBINE
    1    Junction Node No.
          .238      .238      .238      .649 c.m/s
18    CONFLUENCE
    1    Junction Node No.
          .238      .649      .238      .000 c.m/s
 4    CATCHMENT
    30.000    ID No.ó 99999
     3.670    Area in hectares
    80.000    Length (PERV) metres
      .500    Gradient (%)
     1.400    Per cent Impervious
    80.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
       1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
       1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .093      .649      .238      .000 c.m/s
          .320      .893      .328    C perv/imperv/total
15    ADD RUNOFF
          .093      .695      .238      .000 c.m/s
11    CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
```

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      .100    Select Grade in %
     Depth        =     .533 metres
     Velocity     =     .224 m/sec
     Flow Capacity =    3.531 c.m/s
     Critical depth =     .227 metres
 9   ROUTE
   200.000    Conduit Length
      .000    Supply X-factor <.5
   669.769    Supply K-lag (sec)
      .524    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .093      .695      .511      .000 c.m/s
17   COMBINE
    2    Junction Node No.
           .093      .695      .511      .511 c.m/s
14   START
    1    1=Zero; 2=Define
 4   CATCHMENT
    40.000    ID No.ó 99999
     4.640    Area in hectares
   100.000    Length (PERV) metres
      .500    Gradient (%)
      .100    Per cent Impervious
   100.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .101      .000      .511      .511 c.m/s
           .320      .887      .320    C perv/imperv/total
15   ADD RUNOFF
           .101      .101      .511      .511 c.m/s
 4   CATCHMENT
    50.000    ID No.ó 99999
    12.330    Area in hectares
   350.000    Length (PERV) metres
     1.000    Gradient (%)
     2.100    Per cent Impervious
   350.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .181      .101      .511      .511 c.m/s
           .320      .898      .332    C perv/imperv/total
15   ADD RUNOFF
           .181      .269      .511      .511 c.m/s
 9   ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .181      .269      .269      .511 c.m/s
17   COMBINE
    2    Junction Node No.
           .181      .269      .269      .668 c.m/s
18   CONFLUENCE
    2    Junction Node No.
           .181      .668      .269      .000 c.m/s
27   HYDROGRAPH DISPLAY
    5    is # of Hyeto/Hydrograph chosen
     Volume  =  .7329000E+04 c.m
14   START
    1    1=Zero; 2=Define
35   COMMENT
    3    line(s) of comment
     ********************************
     ** 25 YEAR DESIGN STORM EVENT **
     ********************************
 2   STORM
        1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   715.568    Coefficient  a
      .000    Constant  b   (min)
      .699    Exponent  c
      .400    Fraction to peak  r
   240.000    Duration ó  240 min
            62.077 mm    Total depth
 3   IMPERVIOUS
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .013    Manning "n"
    98.000    SCS Curve No or C
      .100    Ia/S Coefficient
      .518    Initial Abstraction
 4   CATCHMENT
    20.000    ID No.ó 99999
     3.020    Area in hectares
   100.000    Length (PERV) metres
      .500    Gradient (%)
    72.600    Per cent Impervious
   100.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .543      .000      .269      .000 c.m/s
           .367      .905      .757    C perv/imperv/total
15   ADD RUNOFF
           .543      .543      .269      .000 c.m/s
27   HYDROGRAPH DISPLAY
    5    is # of Hyeto/Hydrograph chosen
     Volume  =  .1419536E+04 c.m
11   CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
      .100    Select Grade in %
     Depth        =     .484 metres
     Velocity     =     .211 m/sec
     Flow Capacity =    3.531 c.m/s
     Critical depth =     .204 metres
 9   ROUTE
    50.000    Conduit Length
      .000    Supply X-factor <.5
   178.126    Supply K-lag (sec)
      .916    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .543      .543      .485      .000 c.m/s
17   COMBINE
    1    Junction Node No.
           .543      .543      .485      .485 c.m/s
14   START
    1    1=Zero; 2=Define
 4   CATCHMENT
    10.000    ID No.ó 99999
    13.620    Area in hectares
   500.000    Length (PERV) metres
     2.000    Gradient (%)
     6.900    Per cent Impervious
   500.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .304      .000      .485      .485 c.m/s
           .367      .911      .404    C perv/imperv/total
15   ADD RUNOFF
           .304      .304      .485      .485 c.m/s
27   HYDROGRAPH DISPLAY
    5    is # of Hyeto/Hydrograph chosen
     Volume  =  .3418805E+04 c.m
 9   ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .304      .304      .304      .485 c.m/s
17   COMBINE
    1    Junction Node No.
           .304      .304      .304      .789 c.m/s
18   CONFLUENCE
    1    Junction Node No.
           .304      .789      .304      .000 c.m/s
 4   CATCHMENT
    30.000    ID No.ó 99999
     3.670    Area in hectares
    80.000    Length (PERV) metres
      .500    Gradient (%)
     1.400    Per cent Impervious
    80.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .137      .789      .304      .000 c.m/s
           .367      .908      .374    C perv/imperv/total
15   ADD RUNOFF
           .137      .865      .304      .000 c.m/s
11   CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
      .100    Select Grade in %
     Depth        =     .580 metres
     Velocity     =     .237 m/sec
     Flow Capacity =    3.531 c.m/s
     Critical depth =     .250 metres
 9   ROUTE
   200.000    Conduit Length
      .000    Supply X-factor <.5
   634.232    Supply K-lag (sec)
      .570    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .137      .865      .651      .000 c.m/s
17   COMBINE
    2    Junction Node No.
           .137      .865      .651      .651 c.m/s
14   START
    1    1=Zero; 2=Define
 4   CATCHMENT
    40.000    ID No.ó 99999
     4.640    Area in hectares
   100.000    Length (PERV) metres
      .500    Gradient (%)
      .100    Per cent Impervious
   100.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .162      .000      .651      .651 c.m/s
           .367      .905      .367    C perv/imperv/total
15   ADD RUNOFF
           .162      .162      .651      .651 c.m/s
 4   CATCHMENT
    50.000    ID No.ó 99999
    12.330    Area in hectares
   350.000    Length (PERV) metres
     1.000    Gradient (%)
     2.100    Per cent Impervious
   350.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
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     77.000    SCS Curve No or C
       .100    Ia/S Coefficient
      7.587    Initial Abstraction
         1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .270      .162      .651      .651 c.m/s
            .367      .911      .378    C perv/imperv/total
15    ADD RUNOFF
            .270      .404      .651      .651 c.m/s
 9    ROUTE
       .000    Conduit Length
       .500    Supply X-factor <.5
       .000    Supply K-lag (sec)
       .500    Beta weighting factor
    600.000    Routing timestep
         1    No. of sub-reaches
            .270      .404      .404      .651 c.m/s
17    COMBINE
     2    Junction Node No.
            .270      .404      .404      .916 c.m/s
18    CONFLUENCE
     2    Junction Node No.
            .270      .916      .404      .000 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
      Volume  =  .9636599E+04 c.m
14    START
     1    1=Zero; 2=Define
35    COMMENT
     3    line(s) of comment
      *******************************
      ** 50 YEAR DESIGN STORM EVENT **
      *******************************
 2    STORM
         1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    794.298    Coefficient  a
       .000    Constant  b   (min)
       .699    Exponent  c
       .400    Fraction to peak  r
    240.000    Duration ó  240 min
             68.907 mm    Total depth
 3    IMPERVIOUS
         1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .013    Manning "n"
     98.000    SCS Curve No or C
       .100    Ia/S Coefficient
       .518    Initial Abstraction
 4    CATCHMENT
     20.000    ID No.ó 99999
      3.020    Area in hectares
    100.000    Length (PERV) metres
       .500    Gradient (%)
     72.600    Per cent Impervious
    100.000    Length (IMPERV)
       .000    %Imp. with Zero Dpth
         1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250    Manning "n"
     77.000    SCS Curve No or C
       .100    Ia/S Coefficient
      7.587    Initial Abstraction
         1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .619      .000      .404      .000 c.m/s
            .397      .913      .772    C perv/imperv/total
15    ADD RUNOFF
            .619      .619      .404      .000 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
      Volume  =  .1606272E+04 c.m
11    CHANNEL
       .500    Base Width    =
     10.000    Left  bank slope  1:
     10.000    Right bank slope  1:
       .060    Manning's "n"
      1.000    O/a Depth in metres
       .100    Select Grade in %
      Depth        =     .509 metres
      Velocity      =     .218 m/sec
      Flow Capacity  =    3.531 c.m/s
      Critical depth =      .216 metres
 9    ROUTE
     50.000    Conduit Length
       .000    Supply X-factor <.5
    172.375    Supply K-lag (sec)
       .930    Beta weighting factor
    600.000    Routing timestep
         1    No. of sub-reaches
            .619      .619      .539      .000 c.m/s
17    COMBINE
     1    Junction Node No.
            .619      .619      .539      .539 c.m/s
14    START
     1    1=Zero; 2=Define
 4    CATCHMENT
     10.000    ID No.ó 99999
     13.620    Area in hectares
    500.000    Length (PERV) metres
      2.000    Gradient (%)
      6.900    Per cent Impervious
    500.000    Length (IMPERV)
       .000    %Imp. with Zero Dpth
         1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250    Manning "n"
     77.000    SCS Curve No or C
       .100    Ia/S Coefficient
      7.587    Initial Abstraction
         1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .397      .000      .539      .539 c.m/s
            .398      .918      .434    C perv/imperv/total
15    ADD RUNOFF
            .397      .397      .539      .539 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
      Volume  =  .4069199E+04 c.m
 9    ROUTE
       .000    Conduit Length
       .500    Supply X-factor <.5
       .000    Supply K-lag (sec)
       .500    Beta weighting factor
    600.000    Routing timestep
         1    No. of sub-reaches
            .397      .397      .397      .539 c.m/s
17    COMBINE
     1    Junction Node No.
            .397      .397      .397      .898 c.m/s
18    CONFLUENCE
     1    Junction Node No.
            .397      .898      .397      .000 c.m/s
 4    CATCHMENT
     30.000    ID No.ó 99999
      3.670    Area in hectares
     80.000    Length (PERV) metres
       .500    Gradient (%)
      1.400    Per cent Impervious
     80.000    Length (IMPERV)
       .000    %Imp. with Zero Dpth
         1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250    Manning "n"
     77.000    SCS Curve No or C
       .100    Ia/S Coefficient
      7.587    Initial Abstraction
         1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .173      .898      .397      .000 c.m/s
            .397      .916      .404    C perv/imperv/total
15    ADD RUNOFF
            .173     1.001      .397      .000 c.m/s
11    CHANNEL
       .500    Base Width    =
     10.000    Left  bank slope  1:
     10.000    Right bank slope  1:
       .060    Manning's "n"
      1.000    O/a Depth in metres
       .100    Select Grade in %
      Depth        =     .614 metres
      Velocity      =     .245 m/sec
      Flow Capacity  =    3.531 c.m/s
      Critical depth =      .266 metres
 9    ROUTE
    200.000    Conduit Length
       .000    Supply X-factor <.5
    611.414    Supply K-lag (sec)
       .600    Beta weighting factor
    600.000    Routing timestep
         1    No. of sub-reaches
            .173     1.001      .767      .000 c.m/s
17    COMBINE
     2    Junction Node No.
            .173     1.001      .767      .767 c.m/s
14    START
     1    1=Zero; 2=Define
 4    CATCHMENT
     40.000    ID No.ó 99999
      4.640    Area in hectares
    100.000    Length (PERV) metres
       .500    Gradient (%)
       .100    Per cent Impervious
    100.000    Length (IMPERV)
       .000    %Imp. with Zero Dpth
         1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250    Manning "n"
     77.000    SCS Curve No or C
       .100    Ia/S Coefficient
      7.587    Initial Abstraction
         1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .206      .000      .767      .767 c.m/s
            .397      .913      .398    C perv/imperv/total
15    ADD RUNOFF
            .206      .206      .767      .767 c.m/s
 4    CATCHMENT
     50.000    ID No.ó 99999
     12.330    Area in hectares
    350.000    Length (PERV) metres
      1.000    Gradient (%)
      2.100    Per cent Impervious
    350.000    Length (IMPERV)
       .000    %Imp. with Zero Dpth
         1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250    Manning "n"
     77.000    SCS Curve No or C
       .100    Ia/S Coefficient
      7.587    Initial Abstraction
         1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .357      .206      .767      .767 c.m/s
            .398      .918      .409    C perv/imperv/total
15    ADD RUNOFF
            .357      .523      .767      .767 c.m/s
 9    ROUTE
       .000    Conduit Length
       .500    Supply X-factor <.5
       .000    Supply K-lag (sec)
       .500    Beta weighting factor
    600.000    Routing timestep
         1    No. of sub-reaches
            .357      .523      .523      .767 c.m/s
17    COMBINE
     2    Junction Node No.
            .357      .523      .523     1.168 c.m/s
18    CONFLUENCE
     2    Junction Node No.
            .357     1.168      .523      .000 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
      Volume  =  .1143120E+05 c.m
14    START
     1    1=Zero; 2=Define
35    COMMENT
     3    line(s) of comment
      ********************************
      ** 100 YEAR DESIGN STORM EVENT **
      ********************************
 2    STORM
         1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    871.279    Coefficient  a
       .000    Constant  b   (min)
       .699    Exponent  c
       .400    Fraction to peak  r
    240.000    Duration ó  240 min
             75.585 mm    Total depth
 3    IMPERVIOUS
         1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .013    Manning "n"
     98.000    SCS Curve No or C
       .100    Ia/S Coefficient
       .518    Initial Abstraction
```

```
 4    CATCHMENT
    20.000    ID No.ó 99999
     3.020    Area in hectares
   100.000    Length (PERV) metres
      .500    Gradient (%)
    72.600    Per cent Impervious
   100.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .694      .000      .523      .000 c.m/s
          .425      .921      .785    C perv/imperv/total
15    ADD RUNOFF
          .694      .694      .523      .000 c.m/s
27    HYDROGRAPH DISPLAY
    5     is # of Hyeto/Hydrograph chosen
     Volume  =  .1792627E+04 c.m
11    CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
      .100    Select Grade in %
     Depth         =     .532 metres
     Velocity      =     .224 m/sec
     Flow Capacity =    3.531 c.m/s
     Critical depth =     .227 metres
 9    ROUTE
    50.000    Conduit Length
      .000    Supply X-factor <.5
   167.518    Supply K-lag (sec)
      .943    Beta weighting factor
   600.000    Routing timestep
        1     No. of sub-reaches
          .694      .694      .591      .000 c.m/s
17    COMBINE
    1     Junction Node No.
          .694      .694      .591      .591 c.m/s
14    START
    1     1=Zero; 2=Define
 4    CATCHMENT
    10.000    ID No.ó 99999
    13.620    Area in hectares
   500.000    Length (PERV) metres
     2.000    Gradient (%)
     6.900    Per cent Impervious
   500.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .484      .000      .591      .591 c.m/s
          .425      .922      .459    C perv/imperv/total
15    ADD RUNOFF
          .484      .484      .591      .591 c.m/s
27    HYDROGRAPH DISPLAY
    5     is # of Hyeto/Hydrograph chosen
     Volume  =  .4729494E+04 c.m
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1     No. of sub-reaches
          .484      .484      .484      .591 c.m/s
17    COMBINE
    1     Junction Node No.
          .484      .484      .484     1.003 c.m/s
18    CONFLUENCE
    1     Junction Node No.
          .484     1.003      .484      .000 c.m/s
 4    CATCHMENT
    30.000    ID No.ó 99999
     3.670    Area in hectares
    80.000    Length (PERV) metres
      .500    Gradient (%)
     1.400    Per cent Impervious
    80.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .210     1.003      .484      .000 c.m/s
          .425      .922      .432    C perv/imperv/total
15    ADD RUNOFF
          .210     1.137      .484      .000 c.m/s
11    CHANNEL
      .500    Base Width    =
    10.000    Left  bank slope  1:
    10.000    Right bank slope  1:
      .060    Manning's "n"
     1.000    O/a Depth in metres
      .100    Select Grade in %
     Depth         =     .646 metres
     Velocity      =     .253 m/sec
     Flow Capacity =    3.531 c.m/s
     Critical depth =     .281 metres
 9    ROUTE
   200.000    Conduit Length
      .000    Supply X-factor <.5
   592.153    Supply K-lag (sec)
      .626    Beta weighting factor
   600.000    Routing timestep
        1     No. of sub-reaches
          .210     1.137      .891      .000 c.m/s
17    COMBINE
    2     Junction Node No.
          .210     1.137      .891      .891 c.m/s
14    START
    1     1=Zero; 2=Define
 4    CATCHMENT
    40.000    ID No.ó 99999
     4.640    Area in hectares
   100.000    Length (PERV) metres
      .500    Gradient (%)
      .100    Per cent Impervious
   100.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .252      .000      .891      .891 c.m/s
          .425      .921      .425    C perv/imperv/total
15    ADD RUNOFF
          .252      .252      .891      .891 c.m/s
 4    CATCHMENT
    50.000    ID No.ó 99999
    12.330    Area in hectares
   350.000    Length (PERV) metres
     1.000    Gradient (%)
     2.100    Per cent Impervious
   350.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250    Manning "n"
    77.000    SCS Curve No or C
      .100    Ia/S Coefficient
     7.587    Initial Abstraction
        1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .437      .252      .891      .891 c.m/s
          .425      .922      .436    C perv/imperv/total
15    ADD RUNOFF
          .437      .645      .891      .891 c.m/s
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1     No. of sub-reaches
          .437      .645      .645      .891 c.m/s
17    COMBINE
    2     Junction Node No.
          .437      .645      .645     1.451 c.m/s
18    CONFLUENCE
    2     Junction Node No.
          .437     1.451      .645      .000 c.m/s
27    HYDROGRAPH DISPLAY
    5     is # of Hyeto/Hydrograph chosen
     Volume  =  .1326780E+05 c.m
20    MANUAL
```

Developed Conditions – NO SWM

```
         Output File (4.7) NOSWM.OUT    opened 2024-05-24  15:09
         Units used are defined by G =    9.810
             24   144    10.000        are MAXDT MAXHYD & DTMIN values
         Licensee: UPPER CANADA CONSULTANTS
  35     COMMENT
        3     line(s) of comment
         PROJECT NAME: NORTHLAND ESTATES
         PROJECT NO.:  21132
         PROPOSED CONDITIONS WITH SWM
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        3     line(s) of comment
         *******************************
         ** 2 YEAR DESIGN STORM EVENT **
         *******************************
   2     STORM
             1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
       397.149     Coefficient  a
          .000     Constant  b    (min)
          .699     Exponent  c
          .400     Fraction to peak  r
       240.000     Duration ó  240 min
                34.453 mm     Total depth
   3     IMPERVIOUS
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .013     Manning "n"
        98.000     SCS Curve No or C
          .100     Ia/S Coefficient
          .518     Initial Abstraction
   4     CATCHMENT
        20.000     ID No.ó 99999
         3.020     Area in hectares
       100.000     Length (PERV) metres
          .500     Gradient (%)
        72.600     Per cent Impervious
       100.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .275       .000       .025       .000 c.m/s
               .204       .828       .657     C perv/imperv/total
  15     ADD RUNOFF
               .275       .275       .025       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .6835738E+03 c.m
  11     CHANNEL
          .500     Base Width     =
         3.000     Left  bank slope  1:
         3.000     Right bank slope  1:
          .060     Manning's "n"
         1.500     O/a Depth in metres
          .300     Select Grade in %
         Depth          =      .433 metres
         Velocity       =      .353 m/sec
         Flow Capacity  =     5.657 c.m/s
         Critical depth =      .211 metres
   9     ROUTE
        50.000     Conduit Length
          .000     Supply X-factor <.5
       106.220     Supply K-lag (sec)
          .567     Beta weighting factor
       200.000     Routing timestep
             1     No. of sub-reaches
               .275       .275       .270       .000 c.m/s
  17     COMBINE
        1     Junction Node No.
               .275       .275       .270       .270 c.m/s
  14     START
        1     1=Zero; 2=Define
   4     CATCHMENT
        10.000     ID No.ó 99999
        17.530     Area in hectares
       500.000     Length (PERV) metres
         1.000     Gradient (%)
        75.000     Per cent Impervious
       500.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              1.646       .000       .270       .270 c.m/s
               .204       .852       .690     C perv/imperv/total
  15     ADD RUNOFF
              1.646      1.646       .270       .270 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .4165142E+04 c.m
   9     ROUTE
          .000     Conduit Length
          .500     Supply X-factor <.5
          .000     Supply K-lag (sec)
          .500     Beta weighting factor
       600.000     Routing timestep
             1     No. of sub-reaches
              1.646      1.646      1.646       .270 c.m/s
  17     COMBINE
        1     Junction Node No.
              1.646      1.646      1.646      1.916 c.m/s
  18     CONFLUENCE
        1     Junction Node No.
              1.646      1.916      1.646       .000 c.m/s
   4     CATCHMENT
        30.000     ID No.ó 99999
         3.670     Area in hectares
        80.000     Length (PERV) metres
```

```
          .500     Gradient (%)
         1.400     Per cent Impervious
        80.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .025      1.916      1.646       .000 c.m/s
               .204       .838       .213     C perv/imperv/total
  15     ADD RUNOFF
               .025      1.929      1.646       .000 c.m/s
  11     CHANNEL
          .500     Base Width     =
         3.000     Left  bank slope  1:
         3.000     Right bank slope  1:
          .060     Manning's "n"
         1.500     O/a Depth in metres
          .200     Select Grade in %
         Depth          =     1.059 metres
         Velocity       =      .495 m/sec
         Flow Capacity  =     4.619 c.m/s
         Critical depth =      .533 metres
   9     ROUTE
       200.000     Conduit Length
          .000     Supply X-factor <.5
       303.041     Supply K-lag (sec)
          .516     Beta weighting factor
       600.000     Routing timestep
             1     No. of sub-reaches
               .025      1.929      1.557       .000 c.m/s
  17     COMBINE
        2     Junction Node No.
               .025      1.929      1.557      1.557 c.m/s
  14     START
        1     1=Zero; 2=Define
   4     CATCHMENT
        40.000     ID No.ó 99999
         3.890     Area in hectares
       100.000     Length (PERV) metres
          .500     Gradient (%)
         3.700     Per cent Impervious
       100.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .025       .000      1.557      1.557 c.m/s
               .204       .828       .227     C perv/imperv/total
  15     ADD RUNOFF
               .025       .025      1.557      1.557 c.m/s
   4     CATCHMENT
        50.000     ID No.ó 99999
         9.180     Area in hectares
       350.000     Length (PERV) metres
         1.000     Gradient (%)
         1.300     Per cent Impervious
       350.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .038       .025      1.557      1.557 c.m/s
               .204       .848       .212     C perv/imperv/total
  15     ADD RUNOFF
               .038       .061      1.557      1.557 c.m/s
   9     ROUTE
          .000     Conduit Length
          .500     Supply X-factor <.5
          .000     Supply K-lag (sec)
          .500     Beta weighting factor
       600.000     Routing timestep
             1     No. of sub-reaches
               .038       .061       .061      1.557 c.m/s
  17     COMBINE
        2     Junction Node No.
               .038       .061       .061      1.588 c.m/s
  18     CONFLUENCE
        2     Junction Node No.
               .038      1.588       .061       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .6093000E+04 c.m
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        3     line(s) of comment
         *******************************
         ** 5 YEAR DESIGN STORM EVENT **
         *******************************
   2     STORM
             1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
       524.867     Coefficient  a
          .000     Constant  b    (min)
          .699     Exponent  c
          .400     Fraction to peak  r
       240.000     Duration ó  240 min
                45.533 mm     Total depth
   3     IMPERVIOUS
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .013     Manning "n"
        98.000     SCS Curve No or C
          .100     Ia/S Coefficient
          .518     Initial Abstraction
   4     CATCHMENT
        20.000     ID No.ó 99999
         3.020     Area in hectares
       100.000     Length (PERV) metres
          .500     Gradient (%)
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     72.600     Per cent Impervious
    100.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .364       .000       .061       .000 c.m/s
            .278       .869       .707     C perv/imperv/total
 15    ADD RUNOFF
            .364       .364       .061       .000 c.m/s
 27    HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
      Volume  =  .9720645E+03 c.m
 11    CHANNEL
       .500     Base Width      =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
       .060     Manning's "n"
      1.500     O/a Depth in metres
       .300     Select Grade in %
      Depth          =       .489 metres
      Velocity       =       .379 m/sec
      Flow Capacity  =      5.657 c.m/s
      Critical depth =       .243 metres
  9    ROUTE
     50.000     Conduit Length
       .000     Supply X-factor <.5
     98.911     Supply K-lag (sec)
       .598     Beta weighting factor
    200.000     Routing timestep
          1     No. of sub-reaches
            .364       .364       .364       .000 c.m/s
 17    COMBINE
     1     Junction Node No.
            .364       .364       .364       .364 c.m/s
 14    START
     1     1=Zero; 2=Define
  4    CATCHMENT
     10.000     ID No.ó 99999
     17.530     Area in hectares
    500.000     Length (PERV) metres
      1.000     Gradient (%)
     75.000     Per cent Impervious
    500.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           2.324       .000       .364       .364 c.m/s
            .278       .874       .725     C perv/imperv/total
 15    ADD RUNOFF
           2.324      2.324       .364       .364 c.m/s
 27    HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
      Volume  =  .5784277E+04 c.m
  9    ROUTE
       .000     Conduit Length
       .500     Supply X-factor <.5
       .000     Supply K-lag (sec)
       .500     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
           2.324      2.324      2.324       .364 c.m/s
 17    COMBINE
     1     Junction Node No.
           2.324      2.324      2.324      2.688 c.m/s
 18    CONFLUENCE
     1     Junction Node No.
           2.324      2.688      2.324       .000 c.m/s
  4    CATCHMENT
     30.000     ID No.ó 99999
      3.670     Area in hectares
     80.000     Length (PERV) metres
       .500     Gradient (%)
      1.400     Per cent Impervious
     80.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .059      2.688      2.324       .000 c.m/s
            .278       .877       .286     C perv/imperv/total
 15    ADD RUNOFF
            .059      2.717      2.324       .000 c.m/s
 11    CHANNEL
       .500     Base Width      =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
       .060     Manning's "n"
      1.500     O/a Depth in metres
       .200     Select Grade in %
      Depth          =      1.215 metres
      Velocity       =       .539 m/sec
      Flow Capacity  =      4.619 c.m/s
      Critical depth =       .622 metres
  9    ROUTE
    200.000     Conduit Length
       .000     Supply X-factor <.5
    278.130     Supply K-lag (sec)
       .549     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
            .059      2.717      2.118       .000 c.m/s
 17    COMBINE
     2     Junction Node No.
            .059      2.717      2.118      2.118 c.m/s
 14    START
     1     1=Zero; 2=Define
```

```
  4    CATCHMENT
     40.000     ID No.ó 99999
      3.890     Area in hectares
    100.000     Length (PERV) metres
       .500     Gradient (%)
      3.700     Per cent Impervious
    100.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .060       .000      2.118      2.118 c.m/s
            .278       .869       .299     C perv/imperv/total
 15    ADD RUNOFF
            .060       .060      2.118      2.118 c.m/s
  4    CATCHMENT
     50.000     ID No.ó 99999
      9.180     Area in hectares
    350.000     Length (PERV) metres
      1.000     Gradient (%)
      1.300     Per cent Impervious
    350.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .088       .060      2.118      2.118 c.m/s
            .278       .884       .286     C perv/imperv/total
 15    ADD RUNOFF
            .088       .138      2.118      2.118 c.m/s
  9    ROUTE
       .000     Conduit Length
       .500     Supply X-factor <.5
       .000     Supply K-lag (sec)
       .500     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
            .088       .138       .138      2.118 c.m/s
 17    COMBINE
     2     Junction Node No.
            .088       .138       .138      2.192 c.m/s
 18    CONFLUENCE
     2     Junction Node No.
            .088      2.192       .138       .000 c.m/s
 27    HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
      Volume  =  .8952002E+04 c.m
 14    START
     1     1=Zero; 2=Define
 35    COMMENT
     3     line(s) of comment
      *******************************
      ** 10 YEAR DESIGN STORM EVENT **
      *******************************
  2    STORM
          1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    608.845     Coefficient  a
       .000     Constant  b    (min)
       .699     Exponent  c
       .400     Fraction to peak  r
    240.000     Duration ó  240 min
               52.818 mm     Total depth
  3    IMPERVIOUS
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .013     Manning "n"
     98.000     SCS Curve No or C
       .100     Ia/S Coefficient
       .518     Initial Abstraction
  4    CATCHMENT
     20.000     ID No.ó 99999
      3.020     Area in hectares
    100.000     Length (PERV) metres
       .500     Gradient (%)
     72.600     Per cent Impervious
    100.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .442       .000       .138       .000 c.m/s
            .320       .887       .732     C perv/imperv/total
 15    ADD RUNOFF
            .442       .442       .138       .000 c.m/s
 27    HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
      Volume  =  .1167105E+04 c.m
 11    CHANNEL
       .500     Base Width      =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
       .060     Manning's "n"
      1.500     O/a Depth in metres
       .300     Select Grade in %
      Depth          =       .531 metres
      Velocity       =       .398 m/sec
      Flow Capacity  =      5.657 c.m/s
      Critical depth =       .267 metres
  9    ROUTE
     50.000     Conduit Length
       .000     Supply X-factor <.5
     94.229     Supply K-lag (sec)
       .618     Beta weighting factor
    200.000     Routing timestep
          1     No. of sub-reaches
            .442       .442       .425       .000 c.m/s
 17    COMBINE
     1     Junction Node No.
            .442       .442       .425       .425 c.m/s
```

```
14     START
     1     1=Zero; 2=Define
 4     CATCHMENT
     10.000     ID No.ó 99999
     17.530     Area in hectares
    500.000     Length (PERV) metres
      1.000     Gradient (%)
     75.000     Per cent Impervious
    500.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          2.767      .000      .425      .425 c.m/s
           .320      .892      .749     C perv/imperv/total
15     ADD RUNOFF
          2.767     2.767      .425      .425 c.m/s
27     HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
     Volume  =  .6933451E+04 c.m
 9     ROUTE
       .000     Conduit Length
       .500     Supply X-factor <.5
       .000     Supply K-lag (sec)
       .500     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
          2.767     2.767     2.767      .425 c.m/s
17     COMBINE
     1     Junction Node No.
          2.767     2.767     2.767     3.192 c.m/s
18     CONFLUENCE
     1     Junction Node No.
          2.767     3.192     2.767      .000 c.m/s
 4     CATCHMENT
     30.000     ID No.ó 99999
      3.670     Area in hectares
     80.000     Length (PERV) metres
       .500     Gradient (%)
      1.400     Per cent Impervious
     80.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .093     3.192     2.767      .000 c.m/s
           .320      .893      .328     C perv/imperv/total
15     ADD RUNOFF
           .093     3.238     2.767      .000 c.m/s
11     CHANNEL
       .500     Base Width     =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
       .060     Manning's "n"
      1.500     O/a Depth in metres
       .200     Select Grade in %
     Depth          =     1.303 metres
     Velocity       =      .564 m/sec
     Flow Capacity  =     4.619 c.m/s
     Critical depth =      .672 metres
 9     ROUTE
    200.000     Conduit Length
       .000     Supply X-factor <.5
    266.193     Supply K-lag (sec)
       .565     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
           .093     3.238     2.571      .000 c.m/s
17     COMBINE
     2     Junction Node No.
           .093     3.238     2.571     2.571 c.m/s
14     START
     1     1=Zero; 2=Define
 4     CATCHMENT
     40.000     ID No.ó 99999
      3.890     Area in hectares
    100.000     Length (PERV) metres
       .500     Gradient (%)
      3.700     Per cent Impervious
    100.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .086      .000     2.571     2.571 c.m/s
           .320      .887      .341     C perv/imperv/total
15     ADD RUNOFF
           .086      .086     2.571     2.571 c.m/s
 4     CATCHMENT
     50.000     ID No.ó 99999
      9.180     Area in hectares
    350.000     Length (PERV) metres
      1.000     Gradient (%)
      1.300     Per cent Impervious
    350.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .134      .086     2.571     2.571 c.m/s
           .320      .898      .327     C perv/imperv/total
15     ADD RUNOFF
           .134      .208     2.571     2.571 c.m/s
 9     ROUTE
       .000     Conduit Length
```

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       .500     Supply X-factor <.5
       .000     Supply K-lag (sec)
       .500     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
           .134      .208      .208     2.571 c.m/s
17     COMBINE
     2     Junction Node No.
           .134      .208      .208     2.682 c.m/s
18     CONFLUENCE
     2     Junction Node No.
           .134     2.682      .208      .000 c.m/s
27     HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
     Volume  =  .1101540E+05 c.m
14     START
     1     1=Zero; 2=Define
35     COMMENT
     3     line(s) of comment
     *******************************
     ** 25 YEAR DESIGN STORM EVENT **
     *******************************
 2     STORM
          1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    715.568     Coefficient  a
       .000     Constant  b    (min)
       .699     Exponent  c
       .400     Fraction to peak  r
    240.000     Duration ó  240 min
            62.077 mm     Total depth
 3     IMPERVIOUS
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .013     Manning "n"
     98.000     SCS Curve No or C
       .100     Ia/S Coefficient
       .518     Initial Abstraction
 4     CATCHMENT
     20.000     ID No.ó 99999
      3.020     Area in hectares
    100.000     Length (PERV) metres
       .500     Gradient (%)
     72.600     Per cent Impervious
    100.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .543      .000      .208      .000 c.m/s
           .367      .905      .757     C perv/imperv/total
15     ADD RUNOFF
           .543      .543      .208      .000 c.m/s
27     HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
     Volume  =  .1419536E+04 c.m
11     CHANNEL
       .500     Base Width     =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
       .060     Manning's "n"
      1.500     O/a Depth in metres
       .300     Select Grade in %
     Depth          =      .579 metres
     Velocity       =      .419 m/sec
     Flow Capacity  =     5.657 c.m/s
     Critical depth =      .295 metres
 9     ROUTE
     50.000     Conduit Length
       .000     Supply X-factor <.5
     89.446     Supply K-lag (sec)
       .640     Beta weighting factor
    200.000     Routing timestep
          1     No. of sub-reaches
           .543      .543      .500      .000 c.m/s
17     COMBINE
     1     Junction Node No.
           .543      .543      .500      .500 c.m/s
14     START
     1     1=Zero; 2=Define
 4     CATCHMENT
     10.000     ID No.ó 99999
     17.530     Area in hectares
    500.000     Length (PERV) metres
      1.000     Gradient (%)
     75.000     Per cent Impervious
    500.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          3.322      .000      .500      .500 c.m/s
           .367      .910      .774     C perv/imperv/total
15     ADD RUNOFF
          3.322     3.322      .500      .500 c.m/s
27     HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
     Volume  =  .8425626E+04 c.m
 9     ROUTE
       .000     Conduit Length
       .500     Supply X-factor <.5
       .000     Supply K-lag (sec)
       .500     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
          3.322     3.322     3.322      .500 c.m/s
17     COMBINE
     1     Junction Node No.
          3.322     3.322     3.322     3.822 c.m/s
18     CONFLUENCE
     1     Junction Node No.
          3.322     3.822     3.322      .000 c.m/s
 4     CATCHMENT
```

```
       30.000     ID No.ó 99999
        3.670     Area in hectares
       80.000     Length (PERV) metres
         .500     Gradient (%)
        1.400     Per cent Impervious
       80.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .137      3.822      3.322      .000 c.m/s
             .367       .908       .374     C perv/imperv/total
 15     ADD RUNOFF
             .137      3.898      3.322       .000 c.m/s
 11     CHANNEL
         .500     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .060     Manning's "n"
        1.500     O/a Depth in metres
         .200     Select Grade in %
        Depth         =     1.403 metres
        Velocity      =      .590 m/sec
        Flow Capacity  =     4.619 c.m/s
        Critical depth =      .730 metres
  9     ROUTE
      200.000     Conduit Length
         .000     Supply X-factor <.5
      254.140     Supply K-lag (sec)
         .582     Beta weighting factor
      600.000     Routing timestep
            1     No. of sub-reaches
             .137      3.898      3.213       .000 c.m/s
 17     COMBINE
       2     Junction Node No.
             .137      3.898      3.213      3.213 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
       40.000     ID No.ó 99999
        3.890     Area in hectares
      100.000     Length (PERV) metres
         .500     Gradient (%)
        3.700     Per cent Impervious
      100.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .138       .000      3.213      3.213 c.m/s
             .367       .905       .387     C perv/imperv/total
 15     ADD RUNOFF
             .138       .138      3.213      3.213 c.m/s
  4     CATCHMENT
       50.000     ID No.ó 99999
        9.180     Area in hectares
      350.000     Length (PERV) metres
        1.000     Gradient (%)
        1.300     Per cent Impervious
      350.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .200       .138      3.213      3.213 c.m/s
             .367       .911       .374     C perv/imperv/total
 15     ADD RUNOFF
             .200       .313      3.213      3.213 c.m/s
  9     ROUTE
         .000     Conduit Length
         .500     Supply X-factor <.5
         .000     Supply K-lag (sec)
         .500     Beta weighting factor
      600.000     Routing timestep
            1     No. of sub-reaches
             .200       .313       .313      3.213 c.m/s
 17     COMBINE
       2     Junction Node No.
             .200       .313       .313      3.377 c.m/s
 18     CONFLUENCE
       2     Junction Node No.
             .200      3.377       .313       .000 c.m/s
 27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .1375860E+05 c.m
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        ********************************
        ** 50 YEAR DESIGN STORM EVENT **
        ********************************
  2     STORM
            1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
      794.298     Coefficient  a
         .000     Constant  b    (min)
         .699     Exponent  c
         .400     Fraction to peak  r
      240.000     Duration ó  240 min
               68.907 mm     Total depth
  3     IMPERVIOUS
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .013     Manning "n"
       98.000     SCS Curve No or C
         .100     Ia/S Coefficient
         .518     Initial Abstraction
  4     CATCHMENT
       20.000     ID No.ó 99999
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        3.020     Area in hectares
      100.000     Length (PERV) metres
         .500     Gradient (%)
       72.600     Per cent Impervious
      100.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .619       .000       .313       .000 c.m/s
             .397       .913       .772     C perv/imperv/total
 15     ADD RUNOFF
             .619       .619       .313       .000 c.m/s
 27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .1606272E+04 c.m
 11     CHANNEL
         .500     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .060     Manning's "n"
        1.500     O/a Depth in metres
         .300     Select Grade in %
        Depth         =      .612 metres
        Velocity      =      .433 m/sec
        Flow Capacity  =     5.657 c.m/s
        Critical depth =      .314 metres
  9     ROUTE
       50.000     Conduit Length
         .000     Supply X-factor <.5
       86.544     Supply K-lag (sec)
         .653     Beta weighting factor
      200.000     Routing timestep
            1     No. of sub-reaches
             .619       .619       .553       .000 c.m/s
 17     COMBINE
       1     Junction Node No.
             .619       .619       .553       .553 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
       10.000     ID No.ó 99999
       17.530     Area in hectares
      500.000     Length (PERV) metres
        1.000     Gradient (%)
       75.000     Per cent Impervious
      500.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            3.726       .000       .553       .553 c.m/s
             .398       .920       .789     C perv/imperv/total
 15     ADD RUNOFF
            3.726      3.726       .553       .553 c.m/s
 27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .9530810E+04 c.m
  9     ROUTE
         .000     Conduit Length
         .500     Supply X-factor <.5
         .000     Supply K-lag (sec)
         .500     Beta weighting factor
      600.000     Routing timestep
            1     No. of sub-reaches
            3.726      3.726      3.726       .553 c.m/s
 17     COMBINE
       1     Junction Node No.
            3.726      3.726      3.726      4.279 c.m/s
 18     CONFLUENCE
       1     Junction Node No.
            3.726      4.279      3.726       .000 c.m/s
  4     CATCHMENT
       30.000     ID No.ó 99999
        3.670     Area in hectares
       80.000     Length (PERV) metres
         .500     Gradient (%)
        1.400     Per cent Impervious
       80.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .173      4.279      3.726       .000 c.m/s
             .397       .916       .404     C perv/imperv/total
 15     ADD RUNOFF
             .173      4.382      3.726       .000 c.m/s
 11     CHANNEL
         .500     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .060     Manning's "n"
        1.500     O/a Depth in metres
         .200     Select Grade in %
        Depth         =     1.469 metres
        Velocity      =      .608 m/sec
        Flow Capacity  =     4.619 c.m/s
        Critical depth =      .768 metres
  9     ROUTE
      200.000     Conduit Length
         .000     Supply X-factor <.5
      246.805     Supply K-lag (sec)
         .593     Beta weighting factor
      600.000     Routing timestep
            1     No. of sub-reaches
             .173      4.382      3.687       .000 c.m/s
 17     COMBINE
       2     Junction Node No.
```

```
           .173      4.382      3.687      3.687 c.m/s
 14    START
        1     1=Zero; 2=Define
  4    CATCHMENT
      40.000     ID No.ó 99999
       3.890     Area in hectares
     100.000     Length (PERV) metres
        .500     Gradient (%)
       3.700     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .174       .000      3.687      3.687 c.m/s
           .397       .913       .416     C perv/imperv/total
 15    ADD RUNOFF
           .174       .174      3.687      3.687 c.m/s
  4    CATCHMENT
      50.000     ID No.ó 99999
       9.180     Area in hectares
     350.000     Length (PERV) metres
       1.000     Gradient (%)
       1.300     Per cent Impervious
     350.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .265       .174      3.687      3.687 c.m/s
           .398       .918       .404     C perv/imperv/total
 15    ADD RUNOFF
           .265       .404      3.687      3.687 c.m/s
  9    ROUTE
        .000     Conduit Length
        .500     Supply X-factor <.5
        .000     Supply K-lag (sec)
        .500     Beta weighting factor
     600.000     Routing timestep
           1     No. of sub-reaches
           .265       .404       .404      3.687 c.m/s
 17    COMBINE
        2     Junction Node No.
           .265       .404       .404      3.900 c.m/s
 18    CONFLUENCE
        2     Junction Node No.
           .265      3.900       .404       .000 c.m/s
 27    HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1582500E+05 c.m
 14    START
        1     1=Zero; 2=Define
 35    COMMENT
        3     line(s) of comment
       ***********************************
       **  100 YEAR DESIGN STORM EVENT  **
       ***********************************
  2    STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     871.279     Coefficient  a
        .000     Constant  b    (min)
        .699     Exponent  c
        .400     Fraction to peak  r
     240.000     Duration ó  240 min
             75.585 mm     Total depth
  3    IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
        .518     Initial Abstraction
  4    CATCHMENT
      20.000     ID No.ó 99999
       3.020     Area in hectares
     100.000     Length (PERV) metres
        .500     Gradient (%)
      72.600     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .694       .000       .404       .000 c.m/s
           .425       .921       .785     C perv/imperv/total
 15    ADD RUNOFF
           .694       .694       .404       .000 c.m/s
 27    HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1792627E+04 c.m
 11    CHANNEL
        .500     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .060     Manning's "n"
       1.500     O/a Depth in metres
        .300     Select Grade in %
       Depth          =      .642 metres
       Velocity       =      .446 m/sec
       Flow Capacity  =     5.657 c.m/s
       Critical depth =      .332 metres
  9    ROUTE
      50.000     Conduit Length
        .000     Supply X-factor <.5
      84.095     Supply K-lag (sec)
        .665     Beta weighting factor
     200.000     Routing timestep
           1     No. of sub-reaches
           .694       .694       .615       .000 c.m/s
 17    COMBINE
        1     Junction Node No.
           .694       .694       .615       .615 c.m/s
 14    START
        1     1=Zero; 2=Define
  4    CATCHMENT
      10.000     ID No.ó 99999
      17.530     Area in hectares
     500.000     Length (PERV) metres
       1.000     Gradient (%)
      75.000     Per cent Impervious
     500.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          4.115       .000       .615       .615 c.m/s
           .425       .926       .801     C perv/imperv/total
 15    ADD RUNOFF
          4.115      4.115       .615       .615 c.m/s
 27    HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1061312E+05 c.m
  9    ROUTE
        .000     Conduit Length
        .500     Supply X-factor <.5
        .000     Supply K-lag (sec)
        .500     Beta weighting factor
     600.000     Routing timestep
           1     No. of sub-reaches
          4.115      4.115      4.115       .615 c.m/s
 17    COMBINE
        1     Junction Node No.
          4.115      4.115      4.115      4.721 c.m/s
 18    CONFLUENCE
        1     Junction Node No.
          4.115      4.721      4.115       .000 c.m/s
  4    CATCHMENT
      30.000     ID No.ó 99999
       3.670     Area in hectares
      80.000     Length (PERV) metres
        .500     Gradient (%)
       1.400     Per cent Impervious
      80.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .210      4.721      4.115       .000 c.m/s
           .425       .922       .432     C perv/imperv/total
 15    ADD RUNOFF
           .210      4.855      4.115       .000 c.m/s
 11    CHANNEL
       1.000     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .060     Manning's "n"
       2.000     O/a Depth in metres
        .200     Select Grade in %
       Depth          =     1.454 metres
       Velocity       =      .623 m/sec
       Flow Capacity  =    10.613 c.m/s
       Critical depth =      .734 metres
  9    ROUTE
     200.000     Conduit Length
        .000     Supply X-factor <.5
     240.715     Supply K-lag (sec)
        .600     Beta weighting factor
     600.000     Routing timestep
           1     No. of sub-reaches
           .210      4.855      4.155       .000 c.m/s
 17    COMBINE
        2     Junction Node No.
           .210      4.855      4.155      4.155 c.m/s
 14    START
        1     1=Zero; 2=Define
  4    CATCHMENT
      40.000     ID No.ó 99999
       3.890     Area in hectares
     100.000     Length (PERV) metres
        .500     Gradient (%)
       3.700     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .211       .000      4.155      4.155 c.m/s
           .425       .921       .443     C perv/imperv/total
 15    ADD RUNOFF
           .211       .211      4.155      4.155 c.m/s
  4    CATCHMENT
      50.000     ID No.ó 99999
       9.180     Area in hectares
     350.000     Length (PERV) metres
       1.000     Gradient (%)
       1.300     Per cent Impervious
     350.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .325       .211      4.155      4.155 c.m/s
           .425       .922       .432     C perv/imperv/total
 15    ADD RUNOFF
```

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              .325       .499      4.155      4.155 c.m/s
  9     ROUTE
          .000     Conduit Length
          .500     Supply X-factor <.5
          .000     Supply K-lag (sec)
          .500     Beta weighting factor
       600.000     Routing timestep
             1     No. of sub-reaches
              .325       .499       .499      4.155 c.m/s
 17     COMBINE
         2     Junction Node No.
              .325       .499       .499      4.424 c.m/s
 18     CONFLUENCE
         2     Junction Node No.
              .325      4.424       .499       .000 c.m/s
 27     HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
        Volume  =  .1789860E+05 c.m
 20     MANUAL
```

Developed Conditions – FULL SWM

```
        Output File (4.7) SWM.OUT      opened 2024-05-24  14:19
        Units used are defined by G =    9.810
            24   144    10.000        are MAXDT MAXHYD & DTMIN values
        Licensee: UPPER CANADA CONSULTANTS
 35     COMMENT
       3     line(s) of comment
        PROJECT NAME: NORTHLAND ESTATES
        PROJECT NO.:  21132
        PROPOSED CONDITIONS WITH SWM
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        *****************************
        ** 25MM DESIGN STORM EVENT **
        *****************************
  2     STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     512.000     Coefficient  a
       6.000     Constant  b    (min)
        .800     Exponent  c
        .400     Fraction to peak  r
     240.000     Duration ó  240 min
              25.036 mm     Total depth
  3     IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
        .518     Initial Abstraction
  4     CATCHMENT
      20.000     ID No.ó 99999
       3.020     Area in hectares
     100.000     Length (PERV) metres
        .500     Gradient (%)
      72.600     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .202       .000       .000       .000 c.m/s
            .130       .797       .614     C perv/imperv/total
 15     ADD RUNOFF
            .202       .202       .000       .000 c.m/s
 27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .4636960E+03 c.m
 11     CHANNEL
        .500     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .060     Manning's "n"
       1.000     O/a Depth in metres
        .300     Select Grade in %
        Depth          =      .378 metres
        Velocity       =      .326 m/sec
        Flow Capacity  =     2.047 c.m/s
        Critical depth =      .180 metres
  9     ROUTE
      50.000     Conduit Length
        .000     Supply X-factor <.5
     114.938     Supply K-lag (sec)
        .531     Beta weighting factor
     200.000     Routing timestep
           1     No. of sub-reaches
            .202       .202       .192       .000 c.m/s
 17     COMBINE
       1     Junction Node No.
            .202       .202       .192       .192 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
      10.000     ID No.ó 99999
      17.530     Area in hectares
     500.000     Length (PERV) metres
       1.000     Gradient (%)
      75.000     Per cent Impervious
     500.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .924       .000       .192       .192 c.m/s
            .130       .806       .637     C perv/imperv/total
 15     ADD RUNOFF
            .924       .924       .192       .192 c.m/s
 27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .2788153E+04 c.m
 10     POND
       6 Depth - Discharge - Volume sets
        179.900        .000          .0
        180.500       .0620      2842.9
        180.900        .224      5050.5
        181.100        .350      6243.3
        181.250        .678      7177.9
        181.450       1.399      8478.7
        Peak Outflow    =      .048 c.m/s
        Maximum Depth   =   180.361 metres
        Maximum Storage =     2183. c.m
            .924       .924       .048       .192 c.m/s
 17     COMBINE
       1     Junction Node No.
            .924       .924       .048       .204 c.m/s
 18     CONFLUENCE
       1     Junction Node No.
            .924       .204       .048       .000 c.m/s
  4     CATCHMENT
      30.000     ID No.ó 99999
       3.670     Area in hectares
      80.000     Length (PERV) metres
        .500     Gradient (%)
       1.400     Per cent Impervious
      80.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .010       .204       .048       .000 c.m/s
            .130       .785       .139     C perv/imperv/total
 15     ADD RUNOFF
            .010       .210       .048       .000 c.m/s
 11     CHANNEL
        .500     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .060     Manning's "n"
       1.000     O/a Depth in metres
        .200     Select Grade in %
        Depth          =      .420 metres
        Velocity       =      .283 m/sec
        Flow Capacity  =     1.671 c.m/s
        Critical depth =      .184 metres
  9     ROUTE
     200.000     Conduit Length
        .271     Supply X-factor <.5
     529.337     Supply K-lag (sec)
        .500     Beta weighting factor
     600.000     Routing timestep
           1     No. of sub-reaches
            .010       .210       .185       .000 c.m/s
 17     COMBINE
       2     Junction Node No.
            .010       .210       .185       .185 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
      40.000     ID No.ó 99999
       3.890     Area in hectares
     100.000     Length (PERV) metres
        .500     Gradient (%)
       3.700     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .014       .000       .185       .185 c.m/s
            .130       .797       .155     C perv/imperv/total
 15     ADD RUNOFF
            .014       .014       .185       .185 c.m/s
  4     CATCHMENT
      50.000     ID No.ó 99999
       9.180     Area in hectares
     350.000     Length (PERV) metres
       1.000     Gradient (%)
       1.300     Per cent Impervious
     350.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .015       .014       .185       .185 c.m/s
            .130       .803       .139     C perv/imperv/total
 15     ADD RUNOFF
            .015       .025       .185       .185 c.m/s
  9     ROUTE
        .000     Conduit Length
        .500     Supply X-factor <.5
        .000     Supply K-lag (sec)
        .500     Beta weighting factor
     600.000     Routing timestep
           1     No. of sub-reaches
            .015       .025       .025       .185 c.m/s
 17     COMBINE
       2     Junction Node No.
            .015       .025       .025       .202 c.m/s
 18     CONFLUENCE
       2     Junction Node No.
            .015       .202       .025       .000 c.m/s
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        ******************************
        ** 2 YEAR DESIGN STORM EVENT **
        ******************************
  2     STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     397.149     Coefficient  a
        .000     Constant  b    (min)
        .699     Exponent  c
        .400     Fraction to peak  r
     240.000     Duration ó  240 min
              34.453 mm     Total depth
  3     IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
        .518     Initial Abstraction
  4     CATCHMENT
      20.000     ID No.ó 99999
       3.020     Area in hectares
     100.000     Length (PERV) metres
```

```
        .500     Gradient (%)
      72.600     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .275       .000       .025       .000 c.m/s
            .204       .828       .657     C perv/imperv/total
 15    ADD RUNOFF
            .275       .275       .025       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .6835738E+03 c.m
 11    CHANNEL
        .500     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .060     Manning's "n"
       1.000     O/a Depth in metres
        .300     Select Grade in %
       Depth          =      .433 metres
       Velocity       =      .353 m/sec
       Flow Capacity  =     2.047 c.m/s
       Critical depth =      .211 metres
  9    ROUTE
      50.000     Conduit Length
        .000     Supply X-factor <.5
     106.220     Supply K-lag (sec)
        .567     Beta weighting factor
     200.000     Routing timestep
           1     No. of sub-reaches
            .275       .275       .270       .000 c.m/s
 17    COMBINE
      1     Junction Node No.
            .275       .275       .270       .270 c.m/s
 14    START
      1     1=Zero; 2=Define
  4    CATCHMENT
      10.000     ID No.ó 99999
      17.530     Area in hectares
     500.000     Length (PERV) metres
       1.000     Gradient (%)
      75.000     Per cent Impervious
     500.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           1.646       .000       .270       .270 c.m/s
            .204       .852       .690     C perv/imperv/total
 15    ADD RUNOFF
           1.646      1.646       .270       .270 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .4165142E+04 c.m
 10    POND
      6 Depth - Discharge - Volume sets
       179.900        .000         .0
       180.500       .0620      2842.9
       180.900        .224      5050.5
       181.100        .350      6243.3
       181.250        .678      7177.9
       181.450       1.399      8478.7
       Peak Outflow    =      .087 c.m/s
       Maximum Depth   =   180.562 metres
       Maximum Storage =     3185. c.m
           1.646      1.646       .087       .270 c.m/s
 17    COMBINE
      1     Junction Node No.
           1.646      1.646       .087       .290 c.m/s
 18    CONFLUENCE
      1     Junction Node No.
           1.646       .290       .087       .000 c.m/s
  4    CATCHMENT
      30.000     ID No.ó 99999
       3.670     Area in hectares
      80.000     Length (PERV) metres
        .500     Gradient (%)
       1.400     Per cent Impervious
      80.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .025       .290       .087       .000 c.m/s
            .204       .838       .213     C perv/imperv/total
 15    ADD RUNOFF
            .025       .303       .087       .000 c.m/s
 11    CHANNEL
        .500     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .060     Manning's "n"
       1.000     O/a Depth in metres
        .200     Select Grade in %
       Depth          =      .492 metres
       Velocity       =      .311 m/sec
       Flow Capacity  =     1.671 c.m/s
       Critical depth =      .221 metres
  9    ROUTE
     200.000     Conduit Length
        .237     Supply X-factor <.5
     482.477     Supply K-lag (sec)
        .500     Beta weighting factor
     600.000     Routing timestep
           1     No. of sub-reaches
            .025       .303       .254       .000 c.m/s
```

```
 17    COMBINE
      2     Junction Node No.
            .025       .303       .254       .254 c.m/s
 14    START
      1     1=Zero; 2=Define
  4    CATCHMENT
      40.000     ID No.ó 99999
       3.890     Area in hectares
     100.000     Length (PERV) metres
        .500     Gradient (%)
       3.700     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .025       .000       .254       .254 c.m/s
            .204       .828       .227     C perv/imperv/total
 15    ADD RUNOFF
            .025       .025       .254       .254 c.m/s
  4    CATCHMENT
      50.000     ID No.ó 99999
       9.180     Area in hectares
     350.000     Length (PERV) metres
       1.000     Gradient (%)
       1.300     Per cent Impervious
     350.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .038       .025       .254       .254 c.m/s
            .204       .848       .212     C perv/imperv/total
 15    ADD RUNOFF
            .038       .061       .254       .254 c.m/s
  9    ROUTE
        .000     Conduit Length
        .500     Supply X-factor <.5
        .000     Supply K-lag (sec)
        .500     Beta weighting factor
     600.000     Routing timestep
           1     No. of sub-reaches
            .038       .061       .061       .254 c.m/s
 17    COMBINE
      2     Junction Node No.
            .038       .061       .061       .285 c.m/s
 18    CONFLUENCE
      2     Junction Node No.
            .038       .285       .061       .000 c.m/s
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      3     line(s) of comment
       *******************************
       ** 5 YEAR DESIGN STORM EVENT **
       *******************************
  2    STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     524.867     Coefficient  a
        .000     Constant  b    (min)
        .699     Exponent  c
        .400     Fraction to peak  r
     240.000     Duration ó  240 min
              45.533 mm     Total depth
  3    IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
        .518     Initial Abstraction
  4    CATCHMENT
      20.000     ID No.ó 99999
       3.020     Area in hectares
     100.000     Length (PERV) metres
        .500     Gradient (%)
      72.600     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .364       .000       .061       .000 c.m/s
            .278       .869       .707     C perv/imperv/total
 15    ADD RUNOFF
            .364       .364       .061       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .9720645E+03 c.m
 11    CHANNEL
        .500     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .060     Manning's "n"
       1.000     O/a Depth in metres
        .300     Select Grade in %
       Depth          =      .489 metres
       Velocity       =      .379 m/sec
       Flow Capacity  =     2.047 c.m/s
       Critical depth =      .243 metres
  9    ROUTE
      50.000     Conduit Length
        .000     Supply X-factor <.5
      98.910     Supply K-lag (sec)
        .598     Beta weighting factor
     200.000     Routing timestep
           1     No. of sub-reaches
            .364       .364       .364       .000 c.m/s
 17    COMBINE
```

```
     1     Junction Node No.
           .364      .364      .364      .364 c.m/s
 14    START
     1     1=Zero; 2=Define
  4    CATCHMENT
    10.000     ID No.ó 99999
    17.530     Area in hectares
   500.000     Length (PERV) metres
     1.000     Gradient (%)
    75.000     Per cent Impervious
   500.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          2.324      .000      .364      .364 c.m/s
           .278      .874      .725     C perv/imperv/total
 15    ADD RUNOFF
          2.324     2.324      .364      .364 c.m/s
 27    HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
    Volume  =  .5784277E+04 c.m
 10    POND
     6 Depth - Discharge - Volume sets
    179.900        .000        .0
    180.500       .0620      2842.9
    180.900        .224      5050.5
    181.100        .350      6243.3
    181.250        .678      7177.9
    181.450       1.399      8478.7
    Peak Outflow    =      .155 c.m/s
    Maximum Depth   =   180.730 metres
    Maximum Storage =     4113. c.m
          2.324     2.324      .155      .364 c.m/s
 17    COMBINE
     1     Junction Node No.
          2.324     2.324      .155      .397 c.m/s
 18    CONFLUENCE
     1     Junction Node No.
          2.324      .397      .155      .000 c.m/s
  4    CATCHMENT
    30.000     ID No.ó 99999
     3.670     Area in hectares
    80.000     Length (PERV) metres
      .500     Gradient (%)
     1.400     Per cent Impervious
    80.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .059      .397      .155      .000 c.m/s
           .278      .877      .286     C perv/imperv/total
 15    ADD RUNOFF
           .059      .426      .155      .000 c.m/s
 11    CHANNEL
      .500     Base Width     =
     3.000     Left  bank slope  1:
     3.000     Right bank slope  1:
      .060     Manning's "n"
     1.000     O/a Depth in metres
      .200     Select Grade in %
    Depth          =      .570 metres
    Velocity       =      .339 m/sec
    Flow Capacity  =     1.671 c.m/s
    Critical depth =      .262 metres
  9    ROUTE
   200.000     Conduit Length
      .200     Supply X-factor <.5
   442.546     Supply K-lag (sec)
      .500     Beta weighting factor
   600.000     Routing timestep
         1     No. of sub-reaches
           .059      .426      .357      .000 c.m/s
 17    COMBINE
     2     Junction Node No.
           .059      .426      .357      .357 c.m/s
 14    START
     1     1=Zero; 2=Define
  4    CATCHMENT
    40.000     ID No.ó 99999
     3.890     Area in hectares
   100.000     Length (PERV) metres
      .500     Gradient (%)
     3.700     Per cent Impervious
   100.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .060      .000      .357      .357 c.m/s
           .278      .869      .299     C perv/imperv/total
 15    ADD RUNOFF
           .060      .060      .357      .357 c.m/s
  4    CATCHMENT
    50.000     ID No.ó 99999
     9.180     Area in hectares
   350.000     Length (PERV) metres
     1.000     Gradient (%)
     1.300     Per cent Impervious
   350.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
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           .088      .060      .357      .357 c.m/s
           .278      .884      .286     C perv/imperv/total
 15    ADD RUNOFF
           .088      .138      .357      .357 c.m/s
  9    ROUTE
      .000     Conduit Length
      .500     Supply X-factor <.5
      .000     Supply K-lag (sec)
      .500     Beta weighting factor
   600.000     Routing timestep
         1     No. of sub-reaches
           .088      .138      .138      .357 c.m/s
 17    COMBINE
     2     Junction Node No.
           .088      .138      .138      .431 c.m/s
 18    CONFLUENCE
     2     Junction Node No.
           .088      .431      .138      .000 c.m/s
 14    START
     1     1=Zero; 2=Define
 35    COMMENT
     3     line(s) of comment
    ********************************
    ** 10 YEAR DESIGN STORM EVENT **
    ********************************
  2    STORM
         1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   608.845     Coefficient  a
      .000     Constant  b    (min)
      .699     Exponent  c
      .400     Fraction to peak  r
   240.000     Duration ó  240 min
          52.818 mm     Total depth
  3    IMPERVIOUS
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .013     Manning "n"
    98.000     SCS Curve No or C
      .100     Ia/S Coefficient
      .518     Initial Abstraction
  4    CATCHMENT
    20.000     ID No.ó 99999
     3.020     Area in hectares
   100.000     Length (PERV) metres
      .500     Gradient (%)
    72.600     Per cent Impervious
   100.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .442      .000      .138      .000 c.m/s
           .320      .887      .732     C perv/imperv/total
 15    ADD RUNOFF
           .442      .442      .138      .000 c.m/s
 27    HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
    Volume  =  .1167105E+04 c.m
 11    CHANNEL
      .500     Base Width     =
     3.000     Left  bank slope  1:
     3.000     Right bank slope  1:
      .060     Manning's "n"
     1.000     O/a Depth in metres
      .300     Select Grade in %
    Depth          =      .531 metres
    Velocity       =      .398 m/sec
    Flow Capacity  =     2.047 c.m/s
    Critical depth =      .267 metres
  9    ROUTE
    50.000     Conduit Length
      .000     Supply X-factor <.5
    94.229     Supply K-lag (sec)
      .618     Beta weighting factor
   200.000     Routing timestep
         1     No. of sub-reaches
           .442      .442      .425      .000 c.m/s
 17    COMBINE
     1     Junction Node No.
           .442      .442      .425      .425 c.m/s
 14    START
     1     1=Zero; 2=Define
  4    CATCHMENT
    10.000     ID No.ó 99999
    17.530     Area in hectares
   500.000     Length (PERV) metres
     1.000     Gradient (%)
    75.000     Per cent Impervious
   500.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          2.767      .000      .425      .425 c.m/s
           .320      .892      .749     C perv/imperv/total
 15    ADD RUNOFF
          2.767     2.767      .425      .425 c.m/s
 27    HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
    Volume  =  .6933451E+04 c.m
 10    POND
     6 Depth - Discharge - Volume sets
    179.900        .000        .0
    180.500       .0620      2842.9
    180.900        .224      5050.5
    181.100        .350      6243.3
    181.250        .678      7177.9
    181.450       1.399      8478.7
    Peak Outflow    =      .203 c.m/s
    Maximum Depth   =   180.849 metres
    Maximum Storage =     4769. c.m
          2.767     2.767      .203      .425 c.m/s
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 17    COMBINE
     1    Junction Node No.
           2.767      2.767      .203       .468 c.m/s
 18    CONFLUENCE
     1    Junction Node No.
           2.767      .468       .203       .000 c.m/s
  4    CATCHMENT
    30.000     ID No.ó 99999
     3.670     Area in hectares
    80.000     Length (PERV) metres
      .500     Gradient (%)
     1.400     Per cent Impervious
    80.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .093       .468       .203       .000 c.m/s
            .320       .893       .328     C perv/imperv/total
 15    ADD RUNOFF
            .093       .514       .203       .000 c.m/s
 11    CHANNEL
      .500     Base Width     =
     3.000     Left  bank slope  1:
     3.000     Right bank slope  1:
      .060     Manning's "n"
     1.000     O/a Depth in metres
      .200     Select Grade in %
     Depth          =       .616 metres
     Velocity       =       .355 m/sec
     Flow Capacity  =      1.671 c.m/s
     Critical depth =       .287 metres
  9    ROUTE
   200.000     Conduit Length
      .177     Supply X-factor <.5
   422.150     Supply K-lag (sec)
      .500     Beta weighting factor
   600.000     Routing timestep
         1     No. of sub-reaches
            .093       .514       .439       .000 c.m/s
 17    COMBINE
     2    Junction Node No.
            .093       .514       .439       .439 c.m/s
 14    START
     1    1=Zero; 2=Define
  4    CATCHMENT
    40.000     ID No.ó 99999
     3.890     Area in hectares
   100.000     Length (PERV) metres
      .500     Gradient (%)
     3.700     Per cent Impervious
   100.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .086       .000       .439       .439 c.m/s
            .320       .887       .341     C perv/imperv/total
 15    ADD RUNOFF
            .086       .086       .439       .439 c.m/s
  4    CATCHMENT
    50.000     ID No.ó 99999
     9.180     Area in hectares
   350.000     Length (PERV) metres
     1.000     Gradient (%)
     1.300     Per cent Impervious
   350.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .134       .086       .439       .439 c.m/s
            .320       .898       .327     C perv/imperv/total
 15    ADD RUNOFF
            .134       .208       .439       .439 c.m/s
  9    ROUTE
      .000     Conduit Length
      .500     Supply X-factor <.5
      .000     Supply K-lag (sec)
      .500     Beta weighting factor
   600.000     Routing timestep
         1     No. of sub-reaches
            .134       .208       .208       .439 c.m/s
 17    COMBINE
     2    Junction Node No.
            .134       .208       .208       .559 c.m/s
 18    CONFLUENCE
     2    Junction Node No.
            .134       .559       .208       .000 c.m/s
 14    START
     1    1=Zero; 2=Define
 35    COMMENT
     3    line(s) of comment
     ********************************
     ** 25 YEAR DESIGN STORM EVENT **
     ********************************
  2    STORM
         1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   715.568     Coefficient  a
      .000     Constant  b    (min)
      .699     Exponent  c
      .400     Fraction to peak  r
   240.000     Duration ó  240 min
             62.077 mm     Total depth
  3    IMPERVIOUS
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .013     Manning "n"
    98.000     SCS Curve No or C
      .100     Ia/S Coefficient
      .518     Initial Abstraction
  4    CATCHMENT
    20.000     ID No.ó 99999
     3.020     Area in hectares
   100.000     Length (PERV) metres
      .500     Gradient (%)
    72.600     Per cent Impervious
   100.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .543       .000       .208       .000 c.m/s
            .367       .905       .757     C perv/imperv/total
 15    ADD RUNOFF
            .543       .543       .208       .000 c.m/s
 27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
     Volume  =  .1419536E+04 c.m
 11    CHANNEL
      .500     Base Width     =
     3.000     Left  bank slope  1:
     3.000     Right bank slope  1:
      .060     Manning's "n"
     1.000     O/a Depth in metres
      .300     Select Grade in %
     Depth          =       .579 metres
     Velocity       =       .419 m/sec
     Flow Capacity  =      2.047 c.m/s
     Critical depth =       .295 metres
  9    ROUTE
    50.000     Conduit Length
      .000     Supply X-factor <.5
    89.446     Supply K-lag (sec)
      .640     Beta weighting factor
   200.000     Routing timestep
         1     No. of sub-reaches
            .543       .543       .500       .000 c.m/s
 17    COMBINE
     1    Junction Node No.
            .543       .543       .500       .500 c.m/s
 14    START
     1    1=Zero; 2=Define
  4    CATCHMENT
    10.000     ID No.ó 99999
    17.530     Area in hectares
   500.000     Length (PERV) metres
     1.000     Gradient (%)
    75.000     Per cent Impervious
   500.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           3.322       .000       .500       .500 c.m/s
            .367       .910       .774     C perv/imperv/total
 15    ADD RUNOFF
           3.322      3.322       .500       .500 c.m/s
 27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
     Volume  =  .8425626E+04 c.m
 10    POND
     6 Depth - Discharge - Volume sets
     179.900       .000        .0
     180.500      .0620      2842.9
     180.900       .224      5050.5
     181.100       .350      6243.3
     181.250       .678      7177.9
     181.450      1.399      8478.7
     Peak Outflow    =      .281 c.m/s
     Maximum Depth   =   180.990 metres
     Maximum Storage =     5590. c.m
           3.322      3.322       .281       .500 c.m/s
 17    COMBINE
     1    Junction Node No.
           3.322      3.322       .281       .555 c.m/s
 18    CONFLUENCE
     1    Junction Node No.
           3.322       .555       .281       .000 c.m/s
  4    CATCHMENT
    30.000     ID No.ó 99999
     3.670     Area in hectares
    80.000     Length (PERV) metres
      .500     Gradient (%)
     1.400     Per cent Impervious
    80.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    77.000     SCS Curve No or C
      .100     Ia/S Coefficient
     7.587     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .137       .555       .281       .000 c.m/s
            .367       .908       .374     C perv/imperv/total
 15    ADD RUNOFF
            .137       .631       .281       .000 c.m/s
 11    CHANNEL
      .500     Base Width     =
     3.000     Left  bank slope  1:
     3.000     Right bank slope  1:
      .060     Manning's "n"
     1.000     O/a Depth in metres
      .200     Select Grade in %
     Depth          =       .671 metres
     Velocity       =       .374 m/sec
     Flow Capacity  =      1.671 c.m/s
     Critical depth =       .317 metres
  9    ROUTE
   200.000     Conduit Length
```

```
         .151     Supply X-factor <.5
      401.078     Supply K-lag (sec)
         .500     Beta weighting factor
      600.000     Routing timestep
            1     No. of sub-reaches
              .137      .631      .560      .000 c.m/s
 17    COMBINE
       2     Junction Node No.
              .137      .631      .560      .560 c.m/s
 14    START
       1     1=Zero; 2=Define
  4    CATCHMENT
       40.000     ID No.ó 99999
        3.890     Area in hectares
      100.000     Length (PERV) metres
         .500     Gradient (%)
        3.700     Per cent Impervious
      100.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .138      .000      .560      .560 c.m/s
              .367      .905      .387     C perv/imperv/total
 15    ADD RUNOFF
              .138      .138      .560      .560 c.m/s
  4    CATCHMENT
       50.000     ID No.ó 99999
        9.180     Area in hectares
      350.000     Length (PERV) metres
        1.000     Gradient (%)
        1.300     Per cent Impervious
      350.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .200      .138      .560      .560 c.m/s
              .367      .911      .374     C perv/imperv/total
 15    ADD RUNOFF
              .200      .313      .560      .560 c.m/s
  9    ROUTE
         .000     Conduit Length
         .500     Supply X-factor <.5
         .000     Supply K-lag (sec)
         .500     Beta weighting factor
      600.000     Routing timestep
            1     No. of sub-reaches
              .200      .313      .313      .560 c.m/s
 17    COMBINE
       2     Junction Node No.
              .200      .313      .313      .757 c.m/s
 18    CONFLUENCE
       2     Junction Node No.
              .200      .757      .313      .000 c.m/s
 14    START
       1     1=Zero; 2=Define
 35    COMMENT
       3     line(s) of comment
        ********************************
        ** 50 YEAR DESIGN STORM EVENT **
        ********************************
  2    STORM
            1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
      794.298     Coefficient  a
         .000     Constant  b    (min)
         .699     Exponent  c
         .400     Fraction to peak  r
      240.000     Duration ó  240 min
                68.907 mm     Total depth
  3    IMPERVIOUS
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .013     Manning "n"
       98.000     SCS Curve No or C
         .100     Ia/S Coefficient
         .518     Initial Abstraction
  4    CATCHMENT
       20.000     ID No.ó 99999
        3.020     Area in hectares
      100.000     Length (PERV) metres
         .500     Gradient (%)
       72.600     Per cent Impervious
      100.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .619      .000      .313      .000 c.m/s
              .397      .913      .772     C perv/imperv/total
 15    ADD RUNOFF
              .619      .619      .313      .000 c.m/s
 27    HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .1606272E+04 c.m
 11    CHANNEL
         .500     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .060     Manning's "n"
        1.000     O/a Depth in metres
         .300     Select Grade in %
        Depth         =      .612 metres
        Velocity      =      .433 m/sec
        Flow Capacity  =     2.047 c.m/s
        Critical depth =      .314 metres
  9    ROUTE
       50.000     Conduit Length
         .000     Supply X-factor <.5
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       86.544     Supply K-lag (sec)
         .653     Beta weighting factor
      200.000     Routing timestep
            1     No. of sub-reaches
              .619      .619      .553      .000 c.m/s
 17    COMBINE
       1     Junction Node No.
              .619      .619      .553      .553 c.m/s
 14    START
       1     1=Zero; 2=Define
  4    CATCHMENT
       10.000     ID No.ó 99999
       17.530     Area in hectares
      500.000     Length (PERV) metres
        1.000     Gradient (%)
       75.000     Per cent Impervious
      500.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             3.726      .000      .553      .553 c.m/s
              .398      .920      .789     C perv/imperv/total
 15    ADD RUNOFF
             3.726     3.726      .553      .553 c.m/s
 27    HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .9530810E+04 c.m
 10    POND
        6 Depth - Discharge - Volume sets
        179.900       .000         .0
        180.500      .0620     2842.9
        180.900       .224     5050.5
        181.100       .350     6243.3
        181.250       .678     7177.9
        181.450      1.399     8478.7
        Peak Outflow    =      .342 c.m/s
        Maximum Depth   =   181.088 metres
        Maximum Storage =     6171. c.m
             3.726     3.726      .342      .553 c.m/s
 17    COMBINE
       1     Junction Node No.
             3.726     3.726      .342      .624 c.m/s
 18    CONFLUENCE
       1     Junction Node No.
             3.726      .624      .342      .000 c.m/s
  4    CATCHMENT
       30.000     ID No.ó 99999
        3.670     Area in hectares
       80.000     Length (PERV) metres
         .500     Gradient (%)
        1.400     Per cent Impervious
       80.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .173      .624      .342      .000 c.m/s
              .397      .916      .404     C perv/imperv/total
 15    ADD RUNOFF
              .173      .727      .342      .000 c.m/s
 11    CHANNEL
         .500     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .060     Manning's "n"
        1.000     O/a Depth in metres
         .200     Select Grade in %
        Depth         =      .712 metres
        Velocity      =      .388 m/sec
        Flow Capacity  =     1.671 c.m/s
        Critical depth =      .339 metres
  9    ROUTE
      200.000     Conduit Length
         .132     Supply X-factor <.5
      387.012     Supply K-lag (sec)
         .500     Beta weighting factor
      600.000     Routing timestep
            1     No. of sub-reaches
              .173      .727      .660      .000 c.m/s
 17    COMBINE
       2     Junction Node No.
              .173      .727      .660      .660 c.m/s
 14    START
       1     1=Zero; 2=Define
  4    CATCHMENT
       40.000     ID No.ó 99999
        3.890     Area in hectares
      100.000     Length (PERV) metres
         .500     Gradient (%)
        3.700     Per cent Impervious
      100.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .174      .000      .660      .660 c.m/s
              .397      .913      .416     C perv/imperv/total
 15    ADD RUNOFF
              .174      .174      .660      .660 c.m/s
  4    CATCHMENT
       50.000     ID No.ó 99999
        9.180     Area in hectares
      350.000     Length (PERV) metres
        1.000     Gradient (%)
        1.300     Per cent Impervious
      350.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
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          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .265       .174       .660       .660 c.m/s
             .398       .918       .404     C perv/imperv/total
 15    ADD RUNOFF
             .265       .404       .660       .660 c.m/s
  9    ROUTE
       .000     Conduit Length
       .500     Supply X-factor <.5
       .000     Supply K-lag (sec)
       .500     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
             .265       .404       .404       .660 c.m/s
 17    COMBINE
     2     Junction Node No.
             .265       .404       .404       .957 c.m/s
 18    CONFLUENCE
     2     Junction Node No.
             .265       .957       .404       .000 c.m/s
 14    START
     1     1=Zero; 2=Define
 35    COMMENT
     3     line(s) of comment
       ***********************************
       **  100 YEAR DESIGN STORM EVENT  **
       ***********************************
  2    STORM
          1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    871.279     Coefficient  a
       .000     Constant  b    (min)
       .699     Exponent  c
       .400     Fraction to peak  r
    240.000     Duration ó  240 min
            75.585 mm     Total depth
  3    IMPERVIOUS
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .013     Manning "n"
     98.000     SCS Curve No or C
       .100     Ia/S Coefficient
       .518     Initial Abstraction
  4    CATCHMENT
     20.000     ID No.ó 99999
      3.020     Area in hectares
    100.000     Length (PERV) metres
       .500     Gradient (%)
     72.600     Per cent Impervious
    100.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .694       .000       .404       .000 c.m/s
             .425       .921       .785     C perv/imperv/total
 15    ADD RUNOFF
             .694       .694       .404       .000 c.m/s
 27    HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1792627E+04 c.m
 11    CHANNEL
       .500     Base Width     =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
       .060     Manning's "n"
      1.000     O/a Depth in metres
       .300     Select Grade in %
       Depth          =      .642 metres
       Velocity       =      .446 m/sec
       Flow Capacity  =     2.047 c.m/s
       Critical depth =      .332 metres
  9    ROUTE
     50.000     Conduit Length
       .000     Supply X-factor <.5
     84.095     Supply K-lag (sec)
       .665     Beta weighting factor
    200.000     Routing timestep
          1     No. of sub-reaches
             .694       .694       .615       .000 c.m/s
 17    COMBINE
     1     Junction Node No.
             .694       .694       .615       .615 c.m/s
 14    START
     1     1=Zero; 2=Define
  4    CATCHMENT
     10.000     ID No.ó 99999
     17.530     Area in hectares
    500.000     Length (PERV) metres
      1.000     Gradient (%)
     75.000     Per cent Impervious
    500.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           4.115       .000       .615       .615 c.m/s
             .425       .926       .801     C perv/imperv/total
 15    ADD RUNOFF
           4.115      4.115       .615       .615 c.m/s
 27    HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1061312E+05 c.m
 10    POND
     6 Depth - Discharge - Volume sets
       179.900        .000          .0
       180.500       .0620      2842.9
       180.900        .224      5050.5
       181.100        .350      6243.3
       181.250        .678      7177.9
       181.450       1.399      8478.7
       Peak Outflow    =      .468 c.m/s
       Maximum Depth   =   181.154 metres
       Maximum Storage =     6580. c.m
           4.115      4.115       .468       .615 c.m/s
 17    COMBINE
     1     Junction Node No.
           4.115      4.115       .468       .709 c.m/s
 18    CONFLUENCE
     1     Junction Node No.
           4.115       .709       .468       .000 c.m/s
  4    CATCHMENT
     30.000     ID No.ó 99999
      3.670     Area in hectares
     80.000     Length (PERV) metres
       .500     Gradient (%)
      1.400     Per cent Impervious
     80.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .210       .709       .468       .000 c.m/s
             .425       .922       .432     C perv/imperv/total
 15    ADD RUNOFF
             .210       .843       .468       .000 c.m/s
 11    CHANNEL
       .500     Base Width     =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
       .060     Manning's "n"
      1.000     O/a Depth in metres
       .200     Select Grade in %
       Depth          =      .757 metres
       Velocity       =      .402 m/sec
       Flow Capacity  =     1.671 c.m/s
       Critical depth =      .364 metres
  9    ROUTE
    200.000     Conduit Length
       .111     Supply X-factor <.5
    372.831     Supply K-lag (sec)
       .500     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
             .210       .843       .775       .000 c.m/s
 17    COMBINE
     2     Junction Node No.
             .210       .843       .775       .775 c.m/s
 14    START
     1     1=Zero; 2=Define
  4    CATCHMENT
     40.000     ID No.ó 99999
      3.890     Area in hectares
    100.000     Length (PERV) metres
       .500     Gradient (%)
      3.700     Per cent Impervious
    100.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .211       .000       .775       .775 c.m/s
             .425       .921       .443     C perv/imperv/total
 15    ADD RUNOFF
             .211       .211       .775       .775 c.m/s
  4    CATCHMENT
     50.000     ID No.ó 99999
      9.180     Area in hectares
    350.000     Length (PERV) metres
      1.000     Gradient (%)
      1.300     Per cent Impervious
    350.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .325       .211       .775       .775 c.m/s
             .425       .922       .432     C perv/imperv/total
 15    ADD RUNOFF
             .325       .499       .775       .775 c.m/s
  9    ROUTE
       .000     Conduit Length
       .500     Supply X-factor <.5
       .000     Supply K-lag (sec)
       .500     Beta weighting factor
    600.000     Routing timestep
          1     No. of sub-reaches
             .325       .499       .499       .775 c.m/s
 17    COMBINE
     2     Junction Node No.
             .325       .499       .499      1.182 c.m/s
 18    CONFLUENCE
     2     Junction Node No.
             .325      1.182       .499       .000 c.m/s
 20    MANUAL
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