

Technical Memorandum

330 Trillium Drive, Unit D • Kitchener, ON N2E 3J2 • 519.748.1440

Via Email: Darren.mackenzie@notl.com

To: Darren MacKenzie, C.Tech., rcsi, Town of Niagara-on-the-Lake

From: Patricia Wiebe, P.Eng., GEI Consultants

cc: Sarah Primmer, P.Eng., GEI Consultants

Date: May 23, 2025

Re: Contributing Catchments Analysis Tech Memo
Vineyard Creek Estates Stormwater Management Pond Review
Niagara-on-the-Lake, ON

Project No. 2408081

GEI has been retained to review drainage and flooding issues within the Sandalwood Crescent area of Niagara-on-the-Lake, including at the stormwater management pond and the ditch and culvert adjacent to 1225 Queenston Road. The following table lists the intended ponding elevations in the stormwater management pond on Sandalwood Crescent as per the Vineyard Creek Estates Stormwater Management Report (dated June 2005).

Table 1. Pond Function – Per Stormwater Management Design Report

Stage	Design Storm Event	Peak Outflow (m ³ /s)	Storage Volume (m ³)	Water Elevation (m)
Bottom of Active Storage	--	--	0	116.59
--	2	0.157	989	117.38
--	5	0.245	1,824	117.71
--	100	1.262	2,887	118.22
Top of Pond	--	--	2,960	118.25

As these ponding elevations are higher than the pre-development flow rates listed in the report, it has been assumed that the allowable release rates were the pond's release rates as shown in the report.

Existing Conditions

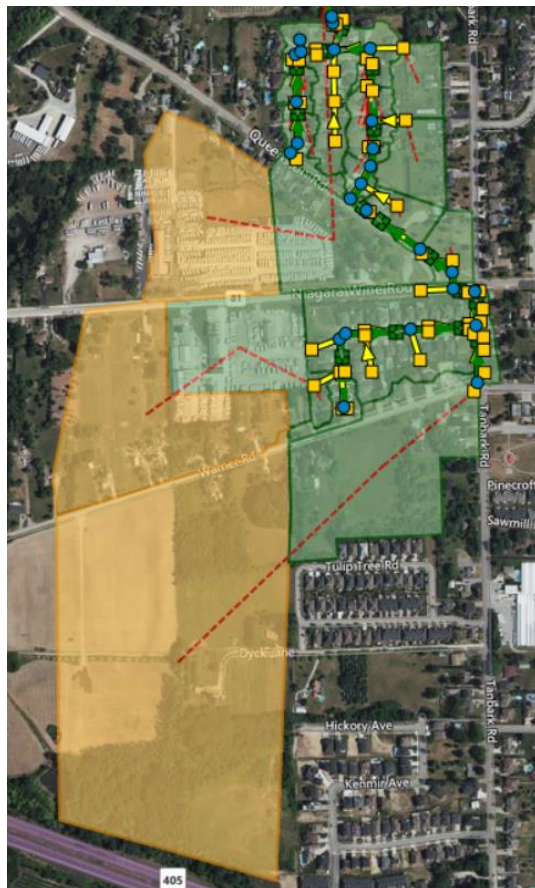
The Vineyard Creek Estates stormwater management facility was designed for a contributing area of 27.57 ha at an imperviousness of 27.03%. Under existing conditions, we estimate the total contributing area to the stormwater management facility is 55.1 ha at 33% imperviousness, 25.3 ha of which is limited to an inflow of 0.250 m³/s or less by a catchbasin in the roadside ditch at Warner Road and Tanbark Road. Flows exceeding the capacity of the catchbasin would overflow east on Tanbark Road. Based on those limitations, we anticipate that the existing pond operates as follows:

Table 2. Pond Function – Existing Conditions

Stage	Design Storm Event	Peak Outflow (m ³ /s)	Storage Volume (m ³)	Water Elevation (m)
Bottom of Active Storage	--	--	0	116.40
--	2	0.975	3,158	118.17
--	5	2.637	3,635	118.38
--	100	9.970	3,760	118.44
Top of Pond	--	--	3,834	118.47

Therefore, under existing conditions the peak flow rates and peak water elevations in the pond exceed the design values. The associated MIDUSS modelling has been appended to this memo.

Figure 1. Screenshot of Existing Conditions Catchments, based on Ontario DEM, aerial imaging, and Town GIS data



The two reasons for the discrepancy between the design and existing conditions appear to be as follows:

- There are areas outside of the urban boundary, shown in orange on Figure 1, that are directed to this stormwater management pond that were not intended to be as per the design
- The imperviousness of the design includes 30% for residential lots, which is consistent with the Town's standards for single residential lots. However, many of the houses built have additional

accessory structures, larger driveways, pools, etc. which raise the imperviousness to approximately 55%

Culvert at 1225 Queenston Road

The maximum elevation of ponding within the stormwater management pond at the 100-year design storm event is more than 2m below the invert of the culvert adjacent to 1225 Queenston, and therefore the pond’s elevation is not causing ponding at the culvert and ditch. We are unaware of any analysis that was completed to determine the impacts of the Niagara Trailers Ltd. property on the ditch and culvert at the time of its’ development. Based on our own preliminary analysis, the ditch and culvert have capacity for approximately the 2-year design storm event from the contributing area. Runoff which exceeds a 2-year design storm event would result in the ponding adjacent to 1225 Queenston Road. The associated MIDUSS modelling has been appended to this memo.

Redirection of Areas Outside of Urban Boundary

The orange areas in Figure 1 are outside of the urban boundary. Should these be redirected away from the stormwater management facility, the remaining contributing area would be approximately 24.27 ha at 52% imperviousness. Based on those limitations, we anticipate that the existing pond would operate as follows when areas outside of the urban boundary are redirected:

Table 3. Pond Function – Only Areas Within Urban Boundary

Stage	Design Storm Event	Peak Outflow (m³/s)	Storage Volume (m³)	Water Elevation (m)
Bottom of Active Storage	--	--	0	116.40
--	2	0.327	2,564	117.91
--	5	0.901	3,084	118.14
--	100	5.010	3,693	118.41
Top of Pond	--	--	3,834	118.47

Therefore, redirection of the areas outside of the urban boundary still results in exceedances of peak flow rate and water elevation in the existing stormwater management pond when compared to the original design. The associated MIDUSS modelling has been appended to this memo.

Tawny Ridge Estates (Phase 2)

The inclusion of the proposed development Tawny Ridge Estates Phase 2, as per the Functional Servicing Report (Upper Canada Consultants, dated December 2024), will convey runoff via a proposed storm sewer extension on Warner Road. This will remove the existing 0.250 m³/s inflow restriction on Warner Road and convey flows from approximately the 5-year design storm event to the Vineyard Creek Estates stormwater management pond at an imperviousness of 30%. With redirection of areas outside of the urban boundary, this development would result in the following water elevations in the existing stormwater management pond:

Table 4. Pond Function – Proposed Development and Areas Within Urban Boundary

Stage	Design Storm Event	Peak Outflow (m ³ /s)	Storage Volume (m ³)	Water Elevation (m)
Bottom of Active Storage	--	--	0	116.40
--	2	0.459	2,683	117.96
--	5	1.087	3,259	118.22
--	100	5.217	3,702	118.41
Top of Pond	--	--	3,834	118.47

The associated MIDUSS modelling has been appended to this memo.

Recommendations for Future Stormwater Management

To prevent the discrepancy between design and implementation of stormwater management designs in the future, we recommend the following:

- Stormwater management ponds should account for emergency overland flow paths and/or 0.3m freeboard from the largest storm event.
- Stormwater management designs should incorporate the maximum imperviousness allowed on a lot, including a reasonable estimate for accessory buildings and driveway extent, or zoning bylaw should incorporate a maximum imperviousness for the proposed lots.

Next Steps

We will look at options on how to maximize storage volumes within the current stormwater management pond property limits to better meet the intended quality and quantity controls per the original design.

Closing

This memo has been prepared to provide an update to the Town of the status of the current analysis. If you have any questions, please feel free to contact me at 519-546-3463.

Sincerely,

GEI CONSULTANTS CANADA LTD.



Patricia Wiebe, P.Eng.
Project Engineer

Appendices

Appendix A Modelling Results

PW/SP

B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\2408081 Stormwater Catchment and Pond Review\Work in Progress\GEI-Technical Memo 2_2025-05-23.docx

Appendix A Modelling Results

Existing Conditions
Modelling Results

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"          MIDUSS created                      Sunday, February 7, 2010"
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" 33      CATCHMENT 200"
"          1  Triangular SCS"
"          3  Specify values"
"          2  Horton equation"
"          200  Catchment 200"
"          6.000  % Impervious"
"          25.300 Total Area"
"          250.000 Flow length"
"          2.500  Overland Slope"
"          23.782 Pervious Area"
"          450.000 Pervious length"
"          2.500  Pervious slope"
"          1.518  Impervious Area"
"          450.000 Impervious length"
"          2.500  Impervious slope"
"          0.250 Pervious Manning 'n'"
"          125.000 Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250 Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015 Impervious Manning 'n'"
"          0.000 Impervious Max.infiltration"
"          0.000 Impervious Min.infiltration"
"          0.050 Impervious Lag constant (hours)"

```

"	1.500	Impervious Depression storage"			
"	0.260	0.000	0.000	0.000	c.m/sec"
"	Catchment 200	Pervious	Impervious	Total Area	"
"	Surface Area	23.782	1.518	25.300	hectare"
"	Time of concentration	---	10.559	10.559	minutes"
"	Time to Centroid	0.000	128.979	128.979	minutes"
"	Rainfall depth	32.777	32.777	32.777	mm"
"	Rainfall volume	7795.00	497.55	8292.55	c.m"
"	Rainfall losses	32.777	1.591	30.906	mm"
"	Runoff depth	0.000	31.186	1.871	mm"
"	Runoff volume	0.00	473.40	473.40	c.m"
"	Runoff coefficient	0.000	0.951	0.057	"
"	Maximum flow	0.000	0.260	0.260	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"	0.260	0.260	0.000	0.000	"
" 56	DIVERSION"				
"	200	Node number"			
"	0.250	Overflow threshold"			
"	1.000	Required diverted fraction"			
"	0	Conduit type; 1=Pipe;2=Channel"			
"	Peak of diverted flow	0.010	c.m/sec"		
"	Volume of diverted flow	3.033	c.m"		
"	DIV00200.002hyd"				
"	Major flow at 200"				
"	0.260	0.260	0.250	0.000	c.m/sec"
" 40	HYDROGRAPH Next link "				
"	5	Next link "			
"	0.260	0.250	0.250	0.000	"
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"	3	Specify values"			
"	2	Horton equation"			
"	100	Catchment 100"			
"	56.000	% Impervious"			
"	29.800	Total Area"			
"	450.000	Flow length"			
"	2.500	Overland Slope"			
"	13.112	Pervious Area"			
"	450.000	Pervious length"			
"	2.500	Pervious slope"			
"	16.688	Impervious Area"			
"	450.000	Impervious length"			
"	2.500	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	125.000	Pervious Max.infiltration"			
"	5.000	Pervious Min.infiltration"			
"	0.250	Pervious Lag constant (hours)"			
"	5.000	Pervious Depression storage"			
"	0.015	Impervious Manning 'n'"			

"	0.000	Impervious Max.infiltration"			
"	0.000	Impervious Min.infiltration"			
"	0.050	Impervious Lag constant (hours)"			
"	1.500	Impervious Depression storage"			
"		2.859	0.250	0.250	0.000 c.m/sec"
"		Catchment 100	Pervious	Impervious	Total Area "
"		Surface Area	13.112	16.688	29.800 hectare"
"		Time of concentration	---	10.559	10.559 minutes"
"		Time to Centroid	0.000	128.979	128.979 minutes"
"		Rainfall depth	32.777	32.777	32.777 mm"
"		Rainfall volume	4297.71	5469.81	9767.52 c.m"
"		Rainfall losses	32.777	1.591	15.313 mm"
"		Runoff depth	0.000	31.186	17.464 mm"
"		Runoff volume	0.00	5204.26	5204.26 c.m"
"		Runoff coefficient	0.000	0.951	0.533 "
"		Maximum flow	0.000	2.859	2.859 c.m/sec"
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"	4	Add Runoff "			
"		2.859	3.109	0.250	0.000"
" 54		POND DESIGN"			
"	3.109	Current peak flow	c.m/sec"		
"	0.419	Target outflow	c.m/sec"		
"	5674.6	Hydrograph volume	c.m"		
"	19.	Number of stages"			
"	116.400	Minimum water level	metre"		
"	118.470	Maximum water level	metre"		
"	116.400	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"	116.400	0.000	0.000"		
"	116.500	0.00500	108.100"		
"	116.600	0.00800	223.800"		
"	116.700	0.01000	348.000"		
"	116.800	0.01200	482.200"		
"	116.900	0.01400	627.100"		
"	117.000	0.01500	781.800"		
"	117.100	0.01700	944.900"		
"	117.200	0.01800	1116.200"		
"	117.300	0.02600	1295.900"		
"	117.420	0.07500	1523.000"		
"	117.500	0.1170	1681.200"		
"	117.600	0.1530	1886.600"		
"	117.700	0.1800	2100.300"		
"	117.810	0.2060	2344.200"		
"	117.890	0.2850	2524.800"		
"	118.320	1.358	3495.400"		
"	118.370	1.641	3608.300"		
"	118.470	14.152	3834.000"		
"		Peak outflow	0.975	c.m/sec"	
"		Maximum level	118.170	metre"	

"	Maximum storage	3157.812	c.m"
"	Centroidal lag	6.843	hours"
"	2.859 3.109 0.975	0.000	c.m/sec"
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"	3 Runoff Totals on EXIT"		
"	Total Catchment area	55.100	hectare"
"	Total Impervious area	18.206	hectare"
"	Total % impervious	33.042"	
" 19	EXIT"		

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"          23.782  Pervious Area"
"          450.000  Pervious length"
"          2.500  Pervious slope"
"          1.518  Impervious Area"
"          450.000  Impervious length"
"          2.500  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          125.000  Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"

```

"	1.500	Impervious Depression storage"				
"		0.427	0.000	0.000	0.000 c.m/sec"	
"		Catchment 200	Pervious	Impervious	Total Area	"
"		Surface Area	23.782	1.518	25.300	hectare"
"		Time of concentration	93.692	8.907	49.553	minutes"
"		Time to Centroid	169.249	125.411	146.427	minutes"
"		Rainfall depth	42.500	42.500	42.500	mm"
"		Rainfall volume	1.0107	0.0645	1.0753	ha-m"
"		Rainfall losses	40.097	1.614	37.788	mm"
"		Runoff depth	2.403	40.886	4.712	mm"
"		Runoff volume	571.54	620.65	1192.20	c.m"
"		Runoff coefficient	0.057	0.962	0.111	"
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"	0.250	Overflow threshold"				
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"		Peak of diverted flow	0.177		c.m/sec"	
"		Volume of diverted flow	86.579		c.m"	
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"		0.427	0.250	0.250	0.000"	
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"	2.500	Overland Slope"				
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"	450.000	Pervious length"				
"	2.500	Pervious slope"				
"	16.688	Impervious Area"				
"	450.000	Impervious length"				
"	2.500	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	125.000	Pervious Max.infiltration"				
"	5.000	Pervious Min.infiltration"				
"	0.250	Pervious Lag constant (hours)"				
"	5.000	Pervious Depression storage"				
"	0.015	Impervious Manning 'n'"				

"	0.000	Impervious Max.infiltration"			
"	0.000	Impervious Min.infiltration"			
"	0.050	Impervious Lag constant (hours)"			
"	1.500	Impervious Depression storage"			
"		4.530	0.250	0.250	0.000 c.m/sec"
"		Catchment 100	Pervious	Impervious	Total Area "
"		Surface Area	13.112	16.688	29.800 hectare"
"		Time of concentration	93.692	8.907	12.649 minutes"
"		Time to Centroid	169.249	125.411	127.346 minutes"
"		Rainfall depth	42.500	42.500	42.500 mm"
"		Rainfall volume	0.5573	0.7092	1.2665 ha-m"
"		Rainfall losses	40.097	1.614	18.547 mm"
"		Runoff depth	2.403	40.886	23.954 mm"
"		Runoff volume	315.12	6823.09	7138.20 c.m"
"		Runoff coefficient	0.057	0.962	0.564 "
"		Maximum flow	0.065	4.522	4.530 c.m/sec"
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"	4	Add Runoff "			
"		4.530	4.780	0.250	0.000"
" 54		POND DESIGN"			
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"	0.419	Target outflow	c.m/sec"		
"	8243.8	Hydrograph volume	c.m"		
"	19.	Number of stages"			
"	116.400	Minimum water level	metre"		
"	118.470	Maximum water level	metre"		
"	116.400	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"	116.400	0.000	0.000"		
"	116.500	0.00500	108.100"		
"	116.600	0.00800	223.800"		
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"	117.200	0.01800	1116.200"		
"	117.300	0.02600	1295.900"		
"	117.420	0.07500	1523.000"		
"	117.500	0.1170	1681.200"		
"	117.600	0.1530	1886.600"		
"	117.700	0.1800	2100.300"		
"	117.810	0.2060	2344.200"		
"	117.890	0.2850	2524.800"		
"	118.320	1.358	3495.400"		
"	118.370	1.641	3608.300"		
"	118.470	14.152	3834.000"		
"		Peak outflow	2.637	c.m/sec"	
"		Maximum level	118.382	metre"	

"	Maximum storage	3634.577	c.m"
"	Centroidal lag	5.638	hours"
"	4.530 4.780 2.637	0.000	c.m/sec"
" 38	START/RE-START TOTALS 100"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	55.100	hectare"
"	Total Impervious area	18.206	hectare"
"	Total % impervious	33.042"	
" 19	EXIT"		

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"          MIDUSS Output ----->"
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"          5.000  Time Step"
"          240.000 Max. Storm length"
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" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1815.300 Coefficient A"
"          3.090  Constant B"
"          0.847  Exponent C"
"          0.400  Fraction R"
"          240.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                295.424  mm/hr"
"          Total depth                      69.225  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 200"
"          1  Triangular SCS"
"          3  Specify values"
"          2  Horton equation"
"          200  Catchment 200"
"          6.000  % Impervious"
"          25.300 Total Area"
"          250.000 Flow length"
"          2.500  Overland Slope"
"          23.782 Pervious Area"
"          450.000 Pervious length"
"          2.500  Pervious slope"
"          1.518  Impervious Area"
"          450.000 Impervious length"
"          2.500  Impervious slope"
"          0.250 Pervious Manning 'n'"
"          125.000 Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250 Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015 Impervious Manning 'n'"
"          0.000 Impervious Max.infiltration"
"          0.000 Impervious Min.infiltration"
"          0.050 Impervious Lag constant (hours)"

```

"	1.500	Impervious Depression storage"			
"	2.145	0.000	0.000	0.000	c.m/sec"
"	Catchment 200	Pervious	Impervious	Total Area	"
"	Surface Area	23.782	1.518	25.300	hectare"
"	Time of concentration	41.553	6.830	36.045	minutes"
"	Time to Centroid	148.745	120.576	144.277	minutes"
"	Rainfall depth	69.225	69.225	69.225	mm"
"	Rainfall volume	1.6463	0.1051	1.7514	ha-m"
"	Rainfall losses	46.597	2.385	43.944	mm"
"	Runoff depth	22.628	66.840	25.281	mm"
"	Runoff volume	5381.45	1014.63	6396.08	c.m"
"	Runoff coefficient	0.327	0.966	0.365	"
"	Maximum flow	2.049	0.884	2.145	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"	2.145	2.145	0.000	0.000"	
" 56	DIVERSION"				
"	200	Node number"			
"	0.250	Overflow threshold"			
"	1.000	Required diverted fraction"			
"	0	Conduit type; 1=Pipe;2=Channel"			
"	Peak of diverted flow	1.895	c.m/sec"		
"	Volume of diverted flow	4446.016	c.m"		
"	DIV00200.100hyd"				
"	Major flow at 200"				
"	2.145	2.145	0.250	0.000 c.m/sec"	
" 40	HYDROGRAPH Next link "				
"	5	Next link "			
"	2.145	0.250	0.250	0.000"	
" 33	CATCHMENT 100"				
"	1	Triangular SCS"			
"	3	Specify values"			
"	2	Horton equation"			
"	100	Catchment 100"			
"	56.000	% Impervious"			
"	29.800	Total Area"			
"	450.000	Flow length"			
"	2.500	Overland Slope"			
"	13.112	Pervious Area"			
"	450.000	Pervious length"			
"	2.500	Pervious slope"			
"	16.688	Impervious Area"			
"	450.000	Impervious length"			
"	2.500	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	125.000	Pervious Max.infiltration"			
"	5.000	Pervious Min.infiltration"			
"	0.250	Pervious Lag constant (hours)"			
"	5.000	Pervious Depression storage"			
"	0.015	Impervious Manning 'n'"			

"	0.000	Impervious Max.infiltration"			
"	0.000	Impervious Min.infiltration"			
"	0.050	Impervious Lag constant (hours)"			
"	1.500	Impervious Depression storage"			
"		10.017	0.250	0.250	0.000 c.m/sec"
"		Catchment 100	Pervious	Impervious	Total Area "
"		Surface Area	13.112	16.688	29.800 hectare"
"		Time of concentration	41.553	6.830	14.126 minutes"
"		Time to Centroid	148.745	120.576	126.495 minutes"
"		Rainfall depth	69.225	69.225	69.225 mm"
"		Rainfall volume	0.9077	1.1552	2.0629 ha-m"
"		Rainfall losses	46.597	2.385	21.838 mm"
"		Runoff depth	22.628	66.840	47.387 mm"
"		Runoff volume	0.2967	1.1154	1.4121 ha-m"
"		Runoff coefficient	0.327	0.966	0.685 "
"		Maximum flow	1.130	9.714	10.017 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		10.017	10.267	0.250	0.000"
" 54		POND DESIGN"			
"	10.267	Current peak flow	c.m/sec"		
"	0.419	Target outflow	c.m/sec"		
"	16071.3	Hydrograph volume	c.m"		
"	19.	Number of stages"			
"	116.400	Minimum water level	metre"		
"	118.470	Maximum water level	metre"		
"	116.400	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"	116.400	0.000	0.000"		
"	116.500	0.00500	108.100"		
"	116.600	0.00800	223.800"		
"	116.700	0.01000	348.000"		
"	116.800	0.01200	482.200"		
"	116.900	0.01400	627.100"		
"	117.000	0.01500	781.800"		
"	117.100	0.01700	944.900"		
"	117.200	0.01800	1116.200"		
"	117.300	0.02600	1295.900"		
"	117.420	0.07500	1523.000"		
"	117.500	0.1170	1681.200"		
"	117.600	0.1530	1886.600"		
"	117.700	0.1800	2100.300"		
"	117.810	0.2060	2344.200"		
"	117.890	0.2850	2524.800"		
"	118.320	1.358	3495.400"		
"	118.370	1.641	3608.300"		
"	118.470	14.152	3834.000"		
"		Peak outflow	9.970	c.m/sec"	
"		Maximum level	118.437	metre"	

"	Maximum storage	3760.310	c.m"
"	Centroidal lag	3.023	hours"
"	10.017 10.267 9.970	0.000	c.m/sec"
" 38	START/RE-START TOTALS 100"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	55.100	hectare"
"	Total Impervious area	18.206	hectare"
"	Total % impervious	33.042"	
" 19	EXIT"		

Ditch and Culvert Capacity - Modelling Results



UNITS, AND IS TO BE READ IN
PLAN PREPARED BY MATTHEWS, CAMERON,
SURVEYING LIMITED.

CONCORDANCE WITH THE RELEVANT SECTIONS
STANDARD SPECIFICATIONS AND
WHICHEVER IS MORE STRINGENT.

LIMITS OF WORK SHALL BE REMOVED.

AND STOCKPILED ON SITE.

MAXIMUM 300mm THICK LOOSE LIFTS AND
SPINDS.

PROOFROLL. SOFT AREAS ARE TO BE
GRANULAR "B" FILL MATERIAL.

300mm GRANULAR "A" OVER 300mm

ALVET SHALL HAVE 2MM THICK

CONTROL MEASURES SHALL BE INSTALLED
THE DRAWINGS AND INCLUDE
R OPSD 219.110

PER OPSD 219.180

CONTROL MEASURES SHALL BE REGULARLY
GOOD WORKING ORDER BY THE
BE REMOVED ONCE GRASS VEGETATION

INCLUDING ROADWAY BOULEVARD, DITCHES,
HAVE 100mm TOPSOIL PLACED AND
DA #1 LAWN GRASS SEED MIXTURE) AND
HALL WARRANTY GRASS FOR 1 YEAR AND
REQUIRED DURING THE WARRANTY

Disposal of Excess Material

and Removal of Surface Boulders

Materials

and Sediment Control Measures

ELEVATION

ELEVATION

SECTION RECORD ELEVATION

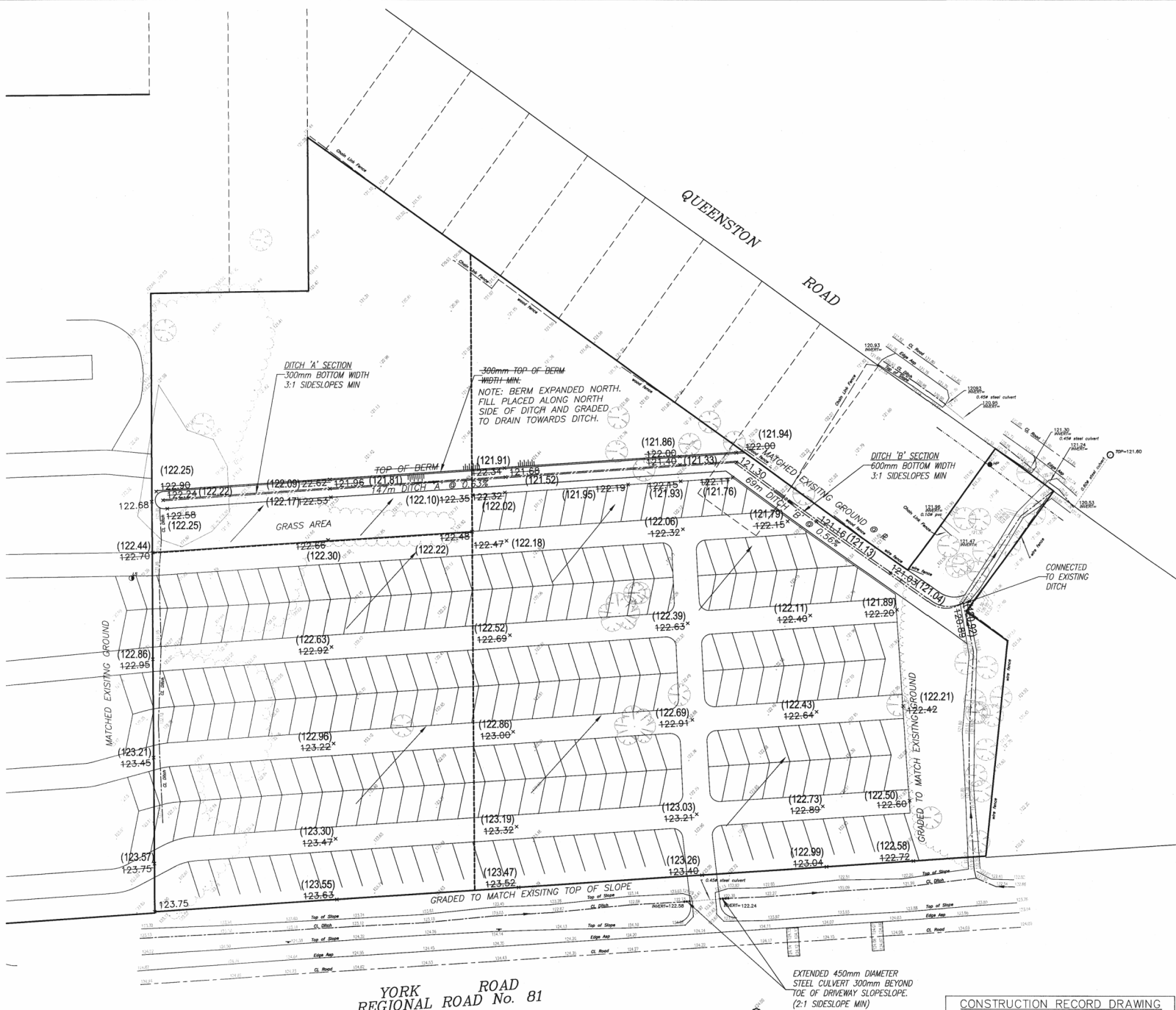
DITCH

DIRECTION

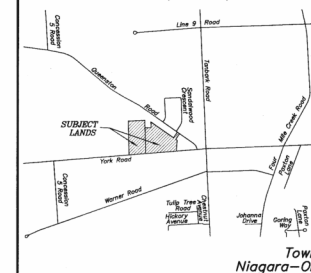
lines, conduits, watermain,
terground and above ground
is not necessarily shown on the
s, where shown the accuracy of
utilities and structures is not
starting work, the contractor shall
tion of all such utilities and
assume liability for damage to

and report any inconsistencies to
proceeding with the work - DO

Instrument of Professional Service
se only in connection with the
Engineering Agreement
Management Inc., does not
itly for losses, damages, and
or misuse of this drawing by
operations without prior written
Environmental Management Inc.,
Environmental Management Inc.,
ved. No part of this drawing
any form or by any means
mission of Urban &
ment Inc.



KEY PLAN (NOT TO SCALE)



TOWN OF NIAGARA-ON-THE-LAKE PUBLIC WORKS

SIGNATURE

DATE

NAME

POSITION

NOTES

1. Dimensions, Areas, & Locations
The dimensions, areas and locations shown on this plan may be slightly altered in the final design, providing the intent of the original plan is maintained and all relevant zoning with.

METRIC NOTE

Distances/elevations shown on this plan are in metres and converted to feet by dividing by 0.3048

OWNER

NIAGARA TRAILERS
PART OF LOT 96
NIAGARA-ON-THE-LAKE
ONTARIO

OWNER'S CERTIFICATE

I HEREBY AUTHORIZE URBAN AND ENVIRONMENTAL INC. TO SUBMIT THIS PLAN TO THE TOWN OF NIAGARA-ON-THE-LAKE FOR THEIR APPROVAL.

Date

JOHN PETER
NIAGARA TRAILERS



URBAN & ENVIRONMENTAL
MANAGEMENT INC.
PROFESSIONAL CONSULTANT

BENCHMARK

Top of the north face of the hydrant located on the S.E. corner of Tanbark Road and Regional Road 81 - York Road - Elevation = 123.852

GRADING PLAN

LEGAL DESCRIPTION

TOWN OF NIAGARA-ON-THE-LAKE
MUNICIPALITY OF NIAGARA, AND
PART OF NIAGARA TOWNSHIP LOT

SCALE 1:500

MATTHEWS, CAMERON, HEYWOOD - KERRY T. HOWE SUR
5235 Steeles Avenue - Unit #1, Mississauga, Ontario L3R 7C2 Phone (905) 888-3863
www.thesurveyors.ca

LLN:39334

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"      10  Units used:                          ie METRIC"
"          Job folder:                        B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\
"          2408081 Stormwater Catchment and Pond Review\Work in
Progress\Calculations\2025-05-21"
"          Output filename:                    DitchandCulvert_2yr.out"
"          Licensee name:                      "
"          Company                            "
"          Date & Time last used:              5/22/2025 at 1:37:35 PM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          240.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          719.650 Coefficient A"
"          5.849  Constant B"
"          0.813  Exponent C"
"          0.400  Fraction R"
"          240.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                    99.424  mm/hr"
"          Total depth                        32.777  mm"
"          6  002hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 1000"
"          1  Triangular SCS"
"          3  Specify values"
"          2  Horton equation"
"          1000  Contributing to Ditch"
"          75.000  % Impervious"
"          5.590  Total Area"
"          110.000 Flow length"
"          2.500  Overland Slope"
"          1.398  Pervious Area"
"          450.000 Pervious length"
"          2.500  Pervious slope"
"          4.193  Impervious Area"
"          450.000 Impervious length"
"          2.500  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          125.000 Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"

```

```

"      1.500  Impervious Depression storage"
"      0.718      0.000      0.000      0.000 c.m/sec"
"      Catchment 1000      Pervious      Impervious      Total Area  "
"      Surface Area      1.398      4.193      5.590      hectare"
"      Time of concentration      ---      10.559      10.559      minutes"
"      Time to Centroid      0.000      128.979      128.979      minutes"
"      Rainfall depth      32.777      32.777      32.777      mm"
"      Rainfall volume      458.06      1374.17      1832.23      c.m"
"      Rainfall losses      32.777      1.591      9.388      mm"
"      Runoff depth      0.000      31.186      23.389      mm"
"      Runoff volume      0.00      1307.46      1307.46      c.m"
"      Runoff coefficient      0.000      0.951      0.714      "
"      Maximum flow      0.000      0.718      0.718      c.m/sec"
" 40      HYDROGRAPH Add Runoff  "
"      4      Add Runoff  "
"      0.718      0.718      0.000      0.000"
" 52      CHANNEL DESIGN"
"      0.718      Current peak flow      c.m/sec"
"      0.040      Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      0.000      Basewidth      metre"
"      3.000      Left bank slope"
"      3.000      Right bank slope"
"      0.500      Channel depth      metre"
"      0.750      Gradient      %"
"      Depth of flow      0.528      metre"
"      Velocity      0.860      m/sec"
"      Channel capacity      0.622      c.m/sec"
"      Critical depth      0.411      metre"
" 38      START/RE-START TOTALS 1000"
"      3      Runoff Totals on EXIT"
"      Total Catchment area      5.590      hectare"
"      Total Impervious area      4.193      hectare"
"      Total % impervious      75.000"
" 19      EXIT"

```

```

"                MIDUSS Output ----->"
"                MIDUSS version                      Version 2.25  rev. 473"
"                MIDUSS created                      Sunday, February 7, 2010"
"            10  Units used:                          ie METRIC"
"                Job folder:                          B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\
"                2408081 Stormwater Catchment and Pond Review\Work in
Progress\Calculations\2025-05-21"
"                Output filename:                     DitchandCulvert_5yr.out"
"                Licensee name:                       "
"                Company                               "
"                Date & Time last used:                5/22/2025 at 1:34:32 PM"
" 31            TIME PARAMETERS"
"                5.000  Time Step"
"                240.000 Max. Storm length"
"                1500.000 Max. Hydrograph"
" 32            STORM Chicago storm"
"                1  Chicago storm"
"                996.920 Coefficient A"
"                4.233  Constant B"
"                0.826  Exponent C"
"                0.400  Fraction R"
"                240.000 Duration"
"                1.000  Time step multiplier"
"                Maximum intensity          152.144  mm/hr"
"                Total depth                42.500  mm"
"                6  005hyd  Hydrograph extension used in this file"
" 33            CATCHMENT 1000"
"                1  Triangular SCS"
"                3  Specify values"
"                2  Horton equation"
"                1000  Contributing to Ditch"
"                75.000  % Impervious"
"                5.590  Total Area"
"                110.000 Flow length"
"                2.500  Overland Slope"
"                1.398  Pervious Area"
"                450.000 Pervious length"
"                2.500  Pervious slope"
"                4.193  Impervious Area"
"                450.000 Impervious length"
"                2.500  Impervious slope"
"                0.250  Pervious Manning 'n'"
"                125.000 Pervious Max.infiltration"
"                5.000  Pervious Min.infiltration"
"                0.250  Pervious Lag constant (hours)"
"                5.000  Pervious Depression storage"
"                0.015  Impervious Manning 'n'"
"                0.000  Impervious Max.infiltration"
"                0.000  Impervious Min.infiltration"
"                0.050  Impervious Lag constant (hours)"

```

```

"      1.500  Impervious Depression storage"
"      1.137      0.000      0.000      0.000 c.m/sec"
"      Catchment 1000      Pervious      Impervious      Total Area  "
"      Surface Area      1.398      4.193      5.590      hectare"
"      Time of concentration  93.692      8.907      10.536      minutes"
"      Time to Centroid      169.249      125.411      126.253      minutes"
"      Rainfall depth      42.500      42.500      42.500      mm"
"      Rainfall volume      593.94      1781.83      2375.78      c.m"
"      Rainfall losses      40.097      1.614      11.235      mm"
"      Runoff depth      2.403      40.886      31.265      mm"
"      Runoff volume      33.59      1714.15      1747.74      c.m"
"      Runoff coefficient      0.057      0.962      0.736      "
"      Maximum flow      0.007      1.136      1.137      c.m/sec"
" 40      HYDROGRAPH Add Runoff  "
"      4      Add Runoff  "
"      1.137      1.137      0.000      0.000"
" 52      CHANNEL DESIGN"
"      1.137      Current peak flow      c.m/sec"
"      0.040      Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      0.000      Basewidth      metre"
"      3.000      Left bank slope"
"      3.000      Right bank slope"
"      0.500      Channel depth      metre"
"      0.750      Gradient      %"
"      Depth of flow      0.627      metre"
"      Velocity      0.965      m/sec"
"      Channel capacity      0.622      c.m/sec"
"      Critical depth      0.494      metre"
" 38      START/RE-START TOTALS 1000"
"      3      Runoff Totals on EXIT"
"      Total Catchment area      5.590      hectare"
"      Total Impervious area      4.193      hectare"
"      Total % impervious      75.000"
" 19      EXIT"

```

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\
"          2408081 Stormwater Catchment and Pond Review\Work in
Progress\Calculations\2025-05-21"
"          Output filename:                    DitchandCulvert_100yr.out"
"          Licensee name:                      "
"          Company                            "
"          Date & Time last used:              5/22/2025 at 1:27:58 PM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          240.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1815.300 Coefficient A"
"          3.090  Constant B"
"          0.847  Exponent C"
"          0.400  Fraction R"
"          240.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                295.424  mm/hr"
"          Total depth                      69.225  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 1000"
"          1  Triangular SCS"
"          3  Specify values"
"          2  Horton equation"
"          1000  Contributing to Ditch"
"          75.000  % Impervious"
"          5.590  Total Area"
"          110.000 Flow length"
"          2.500  Overland Slope"
"          1.398  Pervious Area"
"          450.000 Pervious length"
"          2.500  Pervious slope"
"          4.193  Impervious Area"
"          450.000 Impervious length"
"          2.500  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          125.000 Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"

```

```

"      1.500  Impervious Depression storage"
"      2.473      0.000      0.000      0.000 c.m/sec"
"      Catchment 1000      Pervious      Impervious      Total Area  "
"      Surface Area      1.398      4.193      5.590      hectare"
"      Time of concentration 41.553      6.830      10.351      minutes"
"      Time to Centroid 148.745      120.576      123.432      minutes"
"      Rainfall depth      69.225      69.225      69.225      mm"
"      Rainfall volume      967.42      2902.26      3869.68      c.m"
"      Rainfall losses      46.597      2.385      13.438      mm"
"      Runoff depth      22.628      66.840      55.787      mm"
"      Runoff volume      316.23      2802.27      3118.50      c.m"
"      Runoff coefficient      0.327      0.966      0.806      "
"      Maximum flow      0.120      2.440      2.473      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"      2.473      2.473      0.000      0.000"
" 52      CHANNEL DESIGN"
"      2.473      Current peak flow      c.m/sec"
"      0.040      Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      0.000      Basewidth      metre"
"      3.000      Left bank slope"
"      3.000      Right bank slope"
"      0.500      Channel depth      metre"
"      0.750      Gradient      %"
"      Depth of flow      0.839      metre"
"      Velocity      1.171      m/sec"
"      Channel capacity      0.622      c.m/sec"
"      Critical depth      0.673      metre"
" 38      START/RE-START TOTALS 1000"
"      3      Runoff Totals on EXIT"
"      Total Catchment area      5.590      hectare"
"      Total Impervious area      4.193      hectare"
"      Total % impervious      75.000"
" 19      EXIT"

```

Redirection of Areas Outside of Urban Boundary - Modelling Results

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"      10  Units used:                          ie METRIC"
"          Job folder:                        B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\
"          2408081 Stormwater Catchment and Pond Review\Work in
Progress\Calculations\2025-05-21"
"          Output filename:                    RedirectUrbanBoundary_2yr.out"
"          Licensee name:                      "
"          Company                            "
"          Date & Time last used:                5/22/2025 at 10:29:07 AM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          240.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          719.650 Coefficient A"
"          5.849  Constant B"
"          0.813  Exponent C"
"          0.400  Fraction R"
"          240.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                    99.424  mm/hr"
"          Total depth                          32.777  mm"
"          6  002hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 200"
"          1  Triangular SCS"
"          3  Specify values"
"          2  Horton equation"
"          200  Catchment 200"
"          10.000 % Impervious"
"          5.590  Total Area"
"          130.000 Flow length"
"          2.500  Overland Slope"
"          5.031  Pervious Area"
"          450.000 Pervious length"
"          2.500  Pervious slope"
"          0.559  Impervious Area"
"          450.000 Impervious length"
"          2.500  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          125.000 Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"

```

"	1.500	Impervious Depression storage"			
"		0.096	0.000	0.000	0.000 c.m/sec"
"		Catchment 200	Pervious	Impervious	Total Area "
"		Surface Area	5.031	0.559	5.590 hectare"
"		Time of concentration	---	10.559	10.559 minutes"
"		Time to Centroid	0.000	128.979	128.979 minutes"
"		Rainfall depth	32.777	32.777	32.777 mm"
"		Rainfall volume	1649.01	183.22	1832.23 c.m"
"		Rainfall losses	32.777	1.591	29.658 mm"
"		Runoff depth	0.000	31.186	3.119 mm"
"		Runoff volume	0.00	174.33	174.33 c.m"
"		Runoff coefficient	0.000	0.951	0.095 "
"		Maximum flow	0.000	0.096	0.096 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.096	0.096	0.000	0.000"
" 56		DIVERSION"			
"	200	Node number"			
"	0.250	Overflow threshold"			
"	1.000	Required diverted fraction"			
"	0	Conduit type; 1=Pipe;2=Channel"			
"		Peak of diverted flow	0.000	c.m/sec"	
"		Volume of diverted flow	0.000	c.m"	
"		DIV00200.002hyd"			
"		Major flow at 200"			
"		0.096	0.096	0.096	0.000 c.m/sec"
" 40		HYDROGRAPH Next link "			
"	5	Next link "			
"		0.096	0.096	0.096	0.000"
" 33		CATCHMENT 100"			
"	1	Triangular SCS"			
"	3	Specify values"			
"	2	Horton equation"			
"	100	Catchment 100"			
"	65.000	% Impervious"			
"	18.680	Total Area"			
"	275.000	Flow length"			
"	2.500	Overland Slope"			
"	6.538	Pervious Area"			
"	450.000	Pervious length"			
"	2.500	Pervious slope"			
"	12.142	Impervious Area"			
"	450.000	Impervious length"			
"	2.500	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	125.000	Pervious Max.infiltration"			
"	5.000	Pervious Min.infiltration"			
"	0.250	Pervious Lag constant (hours)"			
"	5.000	Pervious Depression storage"			
"	0.015	Impervious Manning 'n'"			

"	0.000	Impervious Max.infiltration"			
"	0.000	Impervious Min.infiltration"			
"	0.050	Impervious Lag constant (hours)"			
"	1.500	Impervious Depression storage"			
"		2.081	0.096	0.096	0.000 c.m/sec"
"		Catchment 100	Pervious	Impervious	Total Area "
"		Surface Area	6.538	12.142	18.680 hectare"
"		Time of concentration	---	10.559	10.559 minutes"
"		Time to Centroid	0.000	128.979	128.979 minutes"
"		Rainfall depth	32.777	32.777	32.777 mm"
"		Rainfall volume	2142.95	3979.77	6122.72 c.m"
"		Rainfall losses	32.777	1.591	12.506 mm"
"		Runoff depth	0.000	31.186	20.271 mm"
"		Runoff volume	0.00	3786.56	3786.56 c.m"
"		Runoff coefficient	0.000	0.951	0.618 "
"		Maximum flow	0.000	2.081	2.081 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		2.081	2.176	0.096	0.000"
" 54		POND DESIGN"			
"	2.176	Current peak flow	c.m/sec"		
"	0.419	Target outflow	c.m/sec"		
"	3960.9	Hydrograph volume	c.m"		
"	19.	Number of stages"			
"	116.400	Minimum water level	metre"		
"	118.470	Maximum water level	metre"		
"	116.400	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"	116.400	0.000	0.000"		
"	116.500	0.00500	108.100"		
"	116.600	0.00800	223.800"		
"	116.700	0.01000	348.000"		
"	116.800	0.01200	482.200"		
"	116.900	0.01400	627.100"		
"	117.000	0.01500	781.800"		
"	117.100	0.01700	944.900"		
"	117.200	0.01800	1116.200"		
"	117.300	0.02600	1295.900"		
"	117.420	0.07500	1523.000"		
"	117.500	0.1170	1681.200"		
"	117.600	0.1530	1886.600"		
"	117.700	0.1800	2100.300"		
"	117.810	0.2060	2344.200"		
"	117.890	0.2850	2524.800"		
"	118.320	1.358	3495.400"		
"	118.370	1.641	3608.300"		
"	118.470	14.152	3834.000"		
"		Peak outflow	0.327	c.m/sec"	
"		Maximum level	117.907	metre"	

"	Maximum storage	2563.601	c.m"
"	Centroidal lag	8.458	hours"
"	2.081 2.176 0.327 0.000		c.m/sec"
" 38	START/RE-START TOTALS 100"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	24.270	hectare"
"	Total Impervious area	12.701	hectare"
"	Total % impervious	52.332"	
" 19	EXIT"		

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"      10  Units used:                          ie METRIC"
"          Job folder:                        B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\
"          2408081 Stormwater Catchment and Pond Review\Work in
Progress\Calculations\2025-05-21"
"          Output filename:                    RedirectUrbanBoundary_5yr.out"
"          Licensee name:                      "
"          Company                            "
"          Date & Time last used:              5/22/2025 at 10:27:07 AM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          240.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          996.920 Coefficient A"
"          4.233  Constant B"
"          0.826  Exponent C"
"          0.400  Fraction R"
"          240.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          152.144  mm/hr"
"          Total depth                42.500  mm"
"          6  005hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 200"
"          1  Triangular SCS"
"          3  Specify values"
"          2  Horton equation"
"          200  Catchment 200"
"          10.000 % Impervious"
"          5.590  Total Area"
"          130.000 Flow length"
"          2.500  Overland Slope"
"          5.031  Pervious Area"
"          450.000 Pervious length"
"          2.500  Pervious slope"
"          0.559  Impervious Area"
"          450.000 Impervious length"
"          2.500  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          125.000 Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"

```

"	1.500	Impervious Depression storage"			
"	0.155	0.000	0.000	0.000	c.m/sec"
"	Catchment 200	Pervious	Impervious	Total Area	"
"	Surface Area	5.031	0.559	5.590	hectare"
"	Time of concentration	93.692	8.907	38.241	minutes"
"	Time to Centroid	169.249	125.411	140.578	minutes"
"	Rainfall depth	42.500	42.500	42.500	mm"
"	Rainfall volume	2138.20	237.58	2375.78	c.m"
"	Rainfall losses	40.097	1.614	36.249	mm"
"	Runoff depth	2.403	40.886	6.252	mm"
"	Runoff volume	120.91	228.55	349.46	c.m"
"	Runoff coefficient	0.057	0.962	0.147	"
"	Maximum flow	0.025	0.151	0.155	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"	0.155	0.155	0.000	0.000"	
" 56	DIVERSION"				
"	200	Node number"			
"	0.250	Overflow threshold"			
"	1.000	Required diverted fraction"			
"	0	Conduit type; 1=Pipe;2=Channel"			
"	Peak of diverted flow	0.000	c.m/sec"		
"	Volume of diverted flow	0.000	c.m"		
"	DIV00200.005hyd"				
"	Major flow at 200"				
"	0.155	0.155	0.155	0.000	c.m/sec"
" 40	HYDROGRAPH Next link "				
"	5	Next link "			
"	0.155	0.155	0.155	0.000"	
" 33	CATCHMENT 100"				
"	1	Triangular SCS"			
"	3	Specify values"			
"	2	Horton equation"			
"	100	Catchment 100"			
"	65.000	% Impervious"			
"	18.680	Total Area"			
"	275.000	Flow length"			
"	2.500	Overland Slope"			
"	6.538	Pervious Area"			
"	450.000	Pervious length"			
"	2.500	Pervious slope"			
"	12.142	Impervious Area"			
"	450.000	Impervious length"			
"	2.500	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	125.000	Pervious Max.infiltration"			
"	5.000	Pervious Min.infiltration"			
"	0.250	Pervious Lag constant (hours)"			
"	5.000	Pervious Depression storage"			
"	0.015	Impervious Manning 'n'"			

```

"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.050  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"          3.294      0.155      0.155      0.000 c.m/sec"
"      Catchment 100      Pervious      Impervious      Total Area  "
"      Surface Area      6.538      12.142      18.680      hectare"
"      Time of concentration  93.692      8.907      11.508      minutes"
"      Time to Centroid      169.249      125.411      126.756      minutes"
"      Rainfall depth      42.500      42.500      42.500      mm"
"      Rainfall volume      2778.68      5160.41      7939.09      c.m"
"      Rainfall losses      40.097      1.614      15.083      mm"
"      Runoff depth      2.403      40.886      27.417      mm"
"      Runoff volume      157.13      4964.40      5121.53      c.m"
"      Runoff coefficient      0.057      0.962      0.645      "
"      Maximum flow      0.033      3.290      3.294      c.m/sec"
40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"          3.294      3.449      0.155      0.000"
54  POND DESIGN"
"      3.449  Current peak flow      c.m/sec"
"      0.419  Target outflow      c.m/sec"
"      5471.0  Hydrograph volume      c.m"
"      19.  Number of stages"
"      116.400  Minimum water level      metre"
"      118.470  Maximum water level      metre"
"      116.400  Starting water level      metre"
"      0  Keep Design Data: 1 = True; 0 = False"
"          Level Discharge      Volume"
"      116.400      0.000      0.000"
"      116.500      0.00500      108.100"
"      116.600      0.00800      223.800"
"      116.700      0.01000      348.000"
"      116.800      0.01200      482.200"
"      116.900      0.01400      627.100"
"      117.000      0.01500      781.800"
"      117.100      0.01700      944.900"
"      117.200      0.01800      1116.200"
"      117.300      0.02600      1295.900"
"      117.420      0.07500      1523.000"
"      117.500      0.1170      1681.200"
"      117.600      0.1530      1886.600"
"      117.700      0.1800      2100.300"
"      117.810      0.2060      2344.200"
"      117.890      0.2850      2524.800"
"      118.320      1.358      3495.400"
"      118.370      1.641      3608.300"
"      118.470      14.152      3834.000"
"      Peak outflow      0.901      c.m/sec"
"      Maximum level      118.138      metre"

```

"	Maximum storage	3084.358	c.m"
"	Centroidal lag	6.994	hours"
"	3.294 3.449 0.901 0.000		c.m/sec"
" 38	START/RE-START TOTALS 100"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	24.270	hectare"
"	Total Impervious area	12.701	hectare"
"	Total % impervious	52.332	"
" 19	EXIT"		

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\
"          2408081 Stormwater Catchment and Pond Review\Work in
Progress\Calculations\2025-05-21"
"          Output filename:                    RedirectUrbanBoundary_100yr.out"
"          Licensee name:                      "
"          Company                            "
"          Date & Time last used:              5/22/2025 at 9:38:47 AM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          240.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1815.300 Coefficient A"
"          3.090  Constant B"
"          0.847  Exponent C"
"          0.400  Fraction R"
"          240.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                295.424  mm/hr"
"          Total depth                      69.225  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 200"
"          1  Triangular SCS"
"          3  Specify values"
"          2  Horton equation"
"          200  Catchment 200"
"          10.000 % Impervious"
"          5.590  Total Area"
"          130.000 Flow length"
"          2.500  Overland Slope"
"          5.031  Pervious Area"
"          450.000 Pervious length"
"          2.500  Pervious slope"
"          0.559  Impervious Area"
"          450.000 Impervious length"
"          2.500  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          125.000 Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"

```

"	1.500	Impervious Depression storage"			
"		0.469	0.000	0.000	0.000 c.m/sec"
"		Catchment 200	Pervious	Impervious	Total Area "
"		Surface Area	5.031	0.559	5.590 hectare"
"		Time of concentration	41.553	6.830	32.973 minutes"
"		Time to Centroid	148.745	120.576	141.785 minutes"
"		Rainfall depth	69.225	69.225	69.225 mm"
"		Rainfall volume	3482.72	386.97	3869.68 c.m"
"		Rainfall losses	46.597	2.385	42.176 mm"
"		Runoff depth	22.628	66.840	27.049 mm"
"		Runoff volume	1138.43	373.64	1512.06 c.m"
"		Runoff coefficient	0.327	0.966	0.391 "
"		Maximum flow	0.433	0.325	0.469 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.469	0.469	0.000	0.000"
" 56		DIVERSION"			
"	200	Node number"			
"	0.250	Overflow threshold"			
"	1.000	Required diverted fraction"			
"	0	Conduit type; 1=Pipe;2=Channel"			
"		Peak of diverted flow	0.219		c.m/sec"
"		Volume of diverted flow	350.937		c.m"
"		DIV00200.100hyd"			
"		Major flow at 200"			
"		0.469	0.469	0.250	0.000 c.m/sec"
" 40		HYDROGRAPH Next link "			
"	5	Next link "			
"		0.469	0.250	0.250	0.000"
" 33		CATCHMENT 100"			
"	1	Triangular SCS"			
"	3	Specify values"			
"	2	Horton equation"			
"	100	Catchment 100"			
"	65.000	% Impervious"			
"	18.680	Total Area"			
"	275.000	Flow length"			
"	2.500	Overland Slope"			
"	6.538	Pervious Area"			
"	450.000	Pervious length"			
"	2.500	Pervious slope"			
"	12.142	Impervious Area"			
"	450.000	Impervious length"			
"	2.500	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	125.000	Pervious Max.infiltration"			
"	5.000	Pervious Min.infiltration"			
"	0.250	Pervious Lag constant (hours)"			
"	5.000	Pervious Depression storage"			
"	0.015	Impervious Manning 'n'"			

"	0.000	Impervious Max.infiltration"			
"	0.000	Impervious Min.infiltration"			
"	0.050	Impervious Lag constant (hours)"			
"	1.500	Impervious Depression storage"			
"		7.219	0.250	0.250	0.000 c.m/sec"
"		Catchment 100	Pervious	Impervious	Total Area "
"		Surface Area	6.538	12.142	18.680 hectare"
"		Time of concentration	41.553	6.830	12.184 minutes"
"		Time to Centroid	148.745	120.576	124.919 minutes"
"		Rainfall depth	69.225	69.225	69.225 mm"
"		Rainfall volume	0.4526	0.8405	1.2931 ha-m"
"		Rainfall losses	46.597	2.385	17.859 mm"
"		Runoff depth	22.628	66.840	51.366 mm"
"		Runoff volume	1479.43	8115.72	9595.16 c.m"
"		Runoff coefficient	0.327	0.966	0.742 "
"		Maximum flow	0.563	7.068	7.219 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		7.219	7.469	0.250	0.000"
" 54		POND DESIGN"			
"	7.469	Current peak flow	c.m/sec"		
"	0.419	Target outflow	c.m/sec"		
"	10756.3	Hydrograph volume	c.m"		
"	19.	Number of stages"			
"	116.400	Minimum water level	metre"		
"	118.470	Maximum water level	metre"		
"	116.400	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"	116.400	0.000	0.000"		
"	116.500	0.00500	108.100"		
"	116.600	0.00800	223.800"		
"	116.700	0.01000	348.000"		
"	116.800	0.01200	482.200"		
"	116.900	0.01400	627.100"		
"	117.000	0.01500	781.800"		
"	117.100	0.01700	944.900"		
"	117.200	0.01800	1116.200"		
"	117.300	0.02600	1295.900"		
"	117.420	0.07500	1523.000"		
"	117.500	0.1170	1681.200"		
"	117.600	0.1530	1886.600"		
"	117.700	0.1800	2100.300"		
"	117.810	0.2060	2344.200"		
"	117.890	0.2850	2524.800"		
"	118.320	1.358	3495.400"		
"	118.370	1.641	3608.300"		
"	118.470	14.152	3834.000"		
"		Peak outflow	5.010	c.m/sec"	
"		Maximum level	118.408	metre"	

"	Maximum storage	3693.280	c.m"
"	Centroidal lag	6.030	hours"
"	7.219 7.469 5.010	0.000	c.m/sec"
" 38	START/RE-START TOTALS 100"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	24.270	hectare"
"	Total Impervious area	12.701	hectare"
"	Total % impervious	52.332"	
" 19	EXIT"		

Proposed Tawny Ridge
Phase 2 Development -
Modelling Results

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\
"          2408081 Stormwater Catchment and Pond Review\Work in
Progress\Calculations\2025-05-21"
"          Output filename:                    ProposedDevelopment_2yr.out"
"          Licensee name:                      "
"          Company                            "
"          Date & Time last used:              5/23/2025 at 8:34:47 AM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          240.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          719.650 Coefficient A"
"          5.849  Constant B"
"          0.813  Exponent C"
"          0.400  Fraction R"
"          240.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                    99.424  mm/hr"
"          Total depth                        32.777  mm"
"          6  002hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 200"
"          1  Triangular SCS"
"          3  Specify values"
"          2  Horton equation"
"          200  Catchment 200"
"          30.000 % Impervious"
"          5.590  Total Area"
"          80.000 Flow length"
"          2.500  Overland Slope"
"          3.913  Pervious Area"
"          450.000 Pervious length"
"          2.500  Pervious slope"
"          1.677  Impervious Area"
"          450.000 Impervious length"
"          2.500  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          125.000 Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"

```

"	1.500	Impervious Depression storage"				
"		0.287	0.000	0.000	0.000 c.m/sec"	
"		Catchment 200	Pervious	Impervious	Total Area	"
"		Surface Area	3.913	1.677	5.590	hectare"
"		Time of concentration	---	10.559	10.559	minutes"
"		Time to Centroid	0.000	128.979	128.979	minutes"
"		Rainfall depth	32.777	32.777	32.777	mm"
"		Rainfall volume	1282.56	549.67	1832.23	c.m"
"		Rainfall losses	32.777	1.591	23.421	mm"
"		Runoff depth	0.000	31.186	9.356	mm"
"		Runoff volume	0.00	522.98	522.98	c.m"
"		Runoff coefficient	0.000	0.951	0.285	"
"		Maximum flow	0.000	0.287	0.287	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.287	0.287	0.000	0.000"	
" 33		CATCHMENT 100"				
"	1	Triangular SCS"				
"	3	Specify values"				
"	2	Horton equation"				
"	100	Catchment 100"				
"	65.000	% Impervious"				
"	18.680	Total Area"				
"	275.000	Flow length"				
"	2.500	Overland Slope"				
"	6.538	Pervious Area"				
"	450.000	Pervious length"				
"	2.500	Pervious slope"				
"	12.142	Impervious Area"				
"	450.000	Impervious length"				
"	2.500	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	125.000	Pervious Max.infiltration"				
"	5.000	Pervious Min.infiltration"				
"	0.250	Pervious Lag constant (hours)"				
"	5.000	Pervious Depression storage"				
"	0.015	Impervious Manning 'n'"				
"	0.000	Impervious Max.infiltration"				
"	0.000	Impervious Min.infiltration"				
"	0.050	Impervious Lag constant (hours)"				
"	1.500	Impervious Depression storage"				
"		2.081	0.287	0.000	0.000 c.m/sec"	
"		Catchment 100	Pervious	Impervious	Total Area	"
"		Surface Area	6.538	12.142	18.680	hectare"
"		Time of concentration	---	10.559	10.559	minutes"
"		Time to Centroid	0.000	128.979	128.979	minutes"
"		Rainfall depth	32.777	32.777	32.777	mm"
"		Rainfall volume	2142.95	3979.77	6122.72	c.m"
"		Rainfall losses	32.777	1.591	12.506	mm"
"		Runoff depth	0.000	31.186	20.271	mm"

"	Runoff volume	0.00	3786.56	3786.56	c.m"
"	Runoff coefficient	0.000	0.951	0.618	"
"	Maximum flow	0.000	2.081	2.081	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"		2.081	2.368	0.000	0.000"
" 54	POND DESIGN"				
"	2.368	Current peak flow	c.m/sec"		
"	0.419	Target outflow	c.m/sec"		
"	4309.5	Hydrograph volume	c.m"		
"	19.	Number of stages"			
"	116.400	Minimum water level	metre"		
"	118.470	Maximum water level	metre"		
"	116.400	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"	116.400	0.000	0.000"		
"	116.500	0.00500	108.100"		
"	116.600	0.00800	223.800"		
"	116.700	0.01000	348.000"		
"	116.800	0.01200	482.200"		
"	116.900	0.01400	627.100"		
"	117.000	0.01500	781.800"		
"	117.100	0.01700	944.900"		
"	117.200	0.01800	1116.200"		
"	117.300	0.02600	1295.900"		
"	117.420	0.07500	1523.000"		
"	117.500	0.1170	1681.200"		
"	117.600	0.1530	1886.600"		
"	117.700	0.1800	2100.300"		
"	117.810	0.2060	2344.200"		
"	117.890	0.2850	2524.800"		
"	118.320	1.358	3495.400"		
"	118.370	1.641	3608.300"		
"	118.470	14.152	3834.000"		
"	Peak outflow	0.459	c.m/sec"		
"	Maximum level	117.960	metre"		
"	Maximum storage	2682.878	c.m"		
"	Centroidal lag	8.036	hours"		
"	2.081	2.368	0.459	0.000	c.m/sec"
" 38	START/RE-START TOTALS 100"				
"	3	Runoff Totals on EXIT"			
"	Total Catchment area		24.270	hectare"	
"	Total Impervious area		13.819	hectare"	
"	Total % impervious		56.939"		
" 19	EXIT"				

```

"                MIDUSS Output ----->"
"                MIDUSS version                      Version 2.25  rev. 473"
"                MIDUSS created                      Sunday, February 7, 2010"
"            10  Units used:                          ie METRIC"
"                Job folder:                        B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\
"                2408081 Stormwater Catchment and Pond Review\Work in
Progress\Calculations\2025-05-21"
"                Output filename:                    ProposedDevelopment_5yr.out"
"                Licensee name:                      "
"                Company                              "
"                Date & Time last used:                5/23/2025 at 9:01:48 AM"
" 31            TIME PARAMETERS"
"                5.000  Time Step"
"                240.000  Max. Storm length"
"            1500.000  Max. Hydrograph"
" 32            STORM Chicago storm"
"                1  Chicago storm"
"            996.920  Coefficient A"
"                4.233  Constant B"
"                0.826  Exponent C"
"                0.400  Fraction R"
"            240.000  Duration"
"                1.000  Time step multiplier"
"                Maximum intensity                    152.144  mm/hr"
"                Total depth                          42.500  mm"
"                6  005hyd  Hydrograph extension used in this file"
" 33            CATCHMENT 200"
"                1  Triangular SCS"
"                3  Specify values"
"                2  Horton equation"
"            200  Catchment 200"
"            30.000  % Impervious"
"            5.590  Total Area"
"            80.000  Flow length"
"            2.500  Overland Slope"
"            3.913  Pervious Area"
"            450.000  Pervious length"
"            2.500  Pervious slope"
"            1.677  Impervious Area"
"            450.000  Impervious length"
"            2.500  Impervious slope"
"            0.250  Pervious Manning 'n'"
"            125.000  Pervious Max.infiltration"
"            5.000  Pervious Min.infiltration"
"            0.250  Pervious Lag constant (hours)"
"            5.000  Pervious Depression storage"
"            0.015  Impervious Manning 'n'"
"            0.000  Impervious Max.infiltration"
"            0.000  Impervious Min.infiltration"
"            0.050  Impervious Lag constant (hours)"

```

"	1.500	Impervious Depression storage"				
"	0.457	0.000	0.000	0.000	c.m/sec"	
"	Catchment 200	Pervious	Impervious	Total Area	"	
"	Surface Area	3.913	1.677	5.590	hectare"	
"	Time of concentration	93.692	8.907	19.133	minutes"	
"	Time to Centroid	169.249	125.411	130.698	minutes"	
"	Rainfall depth	42.500	42.500	42.500	mm"	
"	Rainfall volume	1663.04	712.73	2375.78	c.m"	
"	Rainfall losses	40.097	1.614	28.552	mm"	
"	Runoff depth	2.403	40.886	13.948	mm"	
"	Runoff volume	94.04	685.66	779.70	c.m"	
"	Runoff coefficient	0.057	0.962	0.328	"	
"	Maximum flow	0.020	0.454	0.457	c.m/sec"	
" 40	HYDROGRAPH Add Runoff "					
"	4	Add Runoff "				
"	0.457	0.457	0.000	0.000"		
" 33	CATCHMENT 100"					
"	1	Triangular SCS"				
"	3	Specify values"				
"	2	Horton equation"				
"	100	Catchment 100"				
"	65.000	% Impervious"				
"	18.680	Total Area"				
"	275.000	Flow length"				
"	2.500	Overland Slope"				
"	6.538	Pervious Area"				
"	450.000	Pervious length"				
"	2.500	Pervious slope"				
"	12.142	Impervious Area"				
"	450.000	Impervious length"				
"	2.500	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	125.000	Pervious Max.infiltration"				
"	5.000	Pervious Min.infiltration"				
"	0.250	Pervious Lag constant (hours)"				
"	5.000	Pervious Depression storage"				
"	0.015	Impervious Manning 'n'"				
"	0.000	Impervious Max.infiltration"				
"	0.000	Impervious Min.infiltration"				
"	0.050	Impervious Lag constant (hours)"				
"	1.500	Impervious Depression storage"				
"	3.294	0.457	0.000	0.000	c.m/sec"	
"	Catchment 100	Pervious	Impervious	Total Area	"	
"	Surface Area	6.538	12.142	18.680	hectare"	
"	Time of concentration	93.692	8.907	11.508	minutes"	
"	Time to Centroid	169.249	125.411	126.756	minutes"	
"	Rainfall depth	42.500	42.500	42.500	mm"	
"	Rainfall volume	2778.68	5160.41	7939.09	c.m"	
"	Rainfall losses	40.097	1.614	15.083	mm"	
"	Runoff depth	2.403	40.886	27.417	mm"	

"	Runoff volume	157.13	4964.40	5121.53	c.m"
"	Runoff coefficient	0.057	0.962	0.645	"
"	Maximum flow	0.033	3.290	3.294	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"		3.294	3.751	0.000	0.000"
" 54	POND DESIGN"				
"	3.751	Current peak flow	c.m/sec"		
"	0.419	Target outflow	c.m/sec"		
"	5901.2	Hydrograph volume	c.m"		
"	19.	Number of stages"			
"	116.400	Minimum water level	metre"		
"	118.470	Maximum water level	metre"		
"	116.400	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"	116.400	0.000	0.000"		
"	116.500	0.00500	108.100"		
"	116.600	0.00800	223.800"		
"	116.700	0.01000	348.000"		
"	116.800	0.01200	482.200"		
"	116.900	0.01400	627.100"		
"	117.000	0.01500	781.800"		
"	117.100	0.01700	944.900"		
"	117.200	0.01800	1116.200"		
"	117.300	0.02600	1295.900"		
"	117.420	0.07500	1523.000"		
"	117.500	0.1170	1681.200"		
"	117.600	0.1530	1886.600"		
"	117.700	0.1800	2100.300"		
"	117.810	0.2060	2344.200"		
"	117.890	0.2850	2524.800"		
"	118.320	1.358	3495.400"		
"	118.370	1.641	3608.300"		
"	118.470	14.152	3834.000"		
"	Peak outflow	1.087	c.m/sec"		
"	Maximum level	118.215	metre"		
"	Maximum storage	3258.891	c.m"		
"	Centroidal lag	6.614	hours"		
"	3.294	3.751	1.087	0.000	c.m/sec"
" 38	START/RE-START TOTALS 100"				
"	3	Runoff Totals on EXIT"			
"	Total Catchment area		24.270	hectare"	
"	Total Impervious area		13.819	hectare"	
"	Total % impervious		56.939"		
" 19	EXIT"				

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"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        B:\Working\NIAGARA-ON-THE-LAKE, TOWN OF\
"          2408081 Stormwater Catchment and Pond Review\Work in
Progress\Calculations\2025-05-21"
"          Output filename:                    ProposedDevelopment_100yr.out"
"          Licensee name:                      "
"          Company                            "
"          Date & Time last used:              5/23/2025 at 9:05:15 AM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          240.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1815.300 Coefficient A"
"          3.090  Constant B"
"          0.847  Exponent C"
"          0.400  Fraction R"
"          240.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          295.424  mm/hr"
"          Total depth                69.225  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 200"
"          1  Triangular SCS"
"          3  Specify values"
"          2  Horton equation"
"          200  Catchment 200"
"          30.000 % Impervious"
"          5.590  Total Area"
"          80.000 Flow length"
"          2.500  Overland Slope"
"          3.913  Pervious Area"
"          450.000 Pervious length"
"          2.500  Pervious slope"
"          1.677  Impervious Area"
"          450.000 Impervious length"
"          2.500  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          125.000 Pervious Max.infiltration"
"          5.000  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"

```

"	1.500	Impervious Depression storage"			
"		1.067	0.000	0.000	0.000 c.m/sec"
"		Catchment 200	Pervious	Impervious	Total Area "
"		Surface Area	3.913	1.677	5.590 hectare"
"		Time of concentration	41.553	6.830	22.154 minutes"
"		Time to Centroid	148.745	120.576	133.008 minutes"
"		Rainfall depth	69.225	69.225	69.225 mm"
"		Rainfall volume	2708.78	1160.91	3869.68 c.m"
"		Rainfall losses	46.597	2.385	33.333 mm"
"		Runoff depth	22.628	66.840	35.892 mm"
"		Runoff volume	885.44	1120.91	2006.35 c.m"
"		Runoff coefficient	0.327	0.966	0.518 "
"		Maximum flow	0.337	0.976	1.067 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		1.067	1.067	0.000	0.000"
" 56		DIVERSION"			
"	200	Node number"			
"	0.457	Overflow threshold"			
"	1.000	Required diverted fraction"			
"	0	Conduit type; 1=Pipe;2=Channel"			
"		Peak of diverted flow	0.610	c.m/sec"	
"		Volume of diverted flow	298.659	c.m"	
"		DIV00200.100hyd"			
"		Major flow at 200"			
"		1.067	1.067	0.457	0.000 c.m/sec"
" 40		HYDROGRAPH Next link "			
"	5	Next link "			
"		1.067	0.457	0.457	0.000"
" 33		CATCHMENT 100"			
"	1	Triangular SCS"			
"	3	Specify values"			
"	2	Horton equation"			
"	100	Catchment 100"			
"	65.000	% Impervious"			
"	18.680	Total Area"			
"	275.000	Flow length"			
"	2.500	Overland Slope"			
"	6.538	Pervious Area"			
"	450.000	Pervious length"			
"	2.500	Pervious slope"			
"	12.142	Impervious Area"			
"	450.000	Impervious length"			
"	2.500	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	125.000	Pervious Max.infiltration"			
"	5.000	Pervious Min.infiltration"			
"	0.250	Pervious Lag constant (hours)"			
"	5.000	Pervious Depression storage"			
"	0.015	Impervious Manning 'n'"			

"	0.000	Impervious Max.infiltration"			
"	0.000	Impervious Min.infiltration"			
"	0.050	Impervious Lag constant (hours)"			
"	1.500	Impervious Depression storage"			
"		7.219	0.457	0.457	0.000 c.m/sec"
"		Catchment 100	Pervious	Impervious	Total Area "
"		Surface Area	6.538	12.142	18.680 hectare"
"		Time of concentration	41.553	6.830	12.184 minutes"
"		Time to Centroid	148.745	120.576	124.919 minutes"
"		Rainfall depth	69.225	69.225	69.225 mm"
"		Rainfall volume	0.4526	0.8405	1.2931 ha-m"
"		Rainfall losses	46.597	2.385	17.859 mm"
"		Runoff depth	22.628	66.840	51.366 mm"
"		Runoff volume	1479.43	8115.72	9595.16 c.m"
"		Runoff coefficient	0.327	0.966	0.742 "
"		Maximum flow	0.563	7.068	7.219 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		7.219	7.676	0.457	0.000"
" 54		POND DESIGN"			
"	7.676	Current peak flow	c.m/sec"		
"	0.419	Target outflow	c.m/sec"		
"	11302.8	Hydrograph volume	c.m"		
"	19.	Number of stages"			
"	116.400	Minimum water level	metre"		
"	118.470	Maximum water level	metre"		
"	116.400	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"	116.400	0.000	0.000"		
"	116.500	0.00500	108.100"		
"	116.600	0.00800	223.800"		
"	116.700	0.01000	348.000"		
"	116.800	0.01200	482.200"		
"	116.900	0.01400	627.100"		
"	117.000	0.01500	781.800"		
"	117.100	0.01700	944.900"		
"	117.200	0.01800	1116.200"		
"	117.300	0.02600	1295.900"		
"	117.420	0.07500	1523.000"		
"	117.500	0.1170	1681.200"		
"	117.600	0.1530	1886.600"		
"	117.700	0.1800	2100.300"		
"	117.810	0.2060	2344.200"		
"	117.890	0.2850	2524.800"		
"	118.320	1.358	3495.400"		
"	118.370	1.641	3608.300"		
"	118.470	14.152	3834.000"		
"		Peak outflow	5.217	c.m/sec"	
"		Maximum level	118.411	metre"	

"	Maximum storage	3701.595	c.m"
"	Centroidal lag	6.480	hours"
"	7.219 7.676 5.217	0.000	c.m/sec"
" 38	START/RE-START TOTALS 100"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	24.270	hectare"
"	Total Impervious area	13.819	hectare"
"	Total % impervious	56.939	"
" 19	EXIT"		