WILLS

PARTNERS IN ENGINEERING, PLANNING & ENVIRONMENTAL SERVICES

September 17, 2024

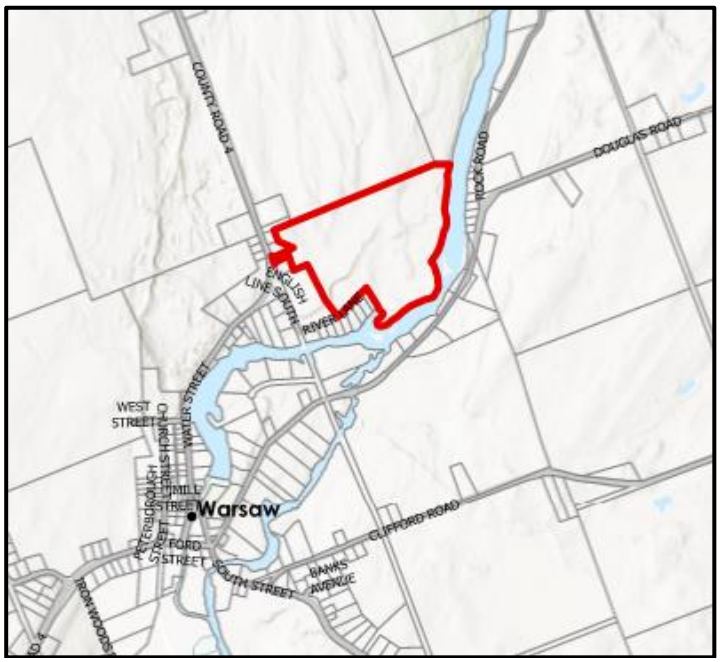
Riel Contracting Inc.
1407 County Road 4
Douro-Dummer, ON
K0L 3A0

Attention: Jason Riel

Re: Preliminary Water Balance Analysis
Riel Subdivision
Warsaw, ON
D.M. Wills Associates Project No. 19-85010

D.M. Wills Associates Limited (Wills) has been retained by Jason Riel to prepare a Preliminary Water Balance Analysis for the proposed residential subdivision located on Part of Lot 13, Concession 2, within the settlement area of Warsaw, Township of Douro-Dummer, County of Peterborough (Subject Property). The site location is illustrated on **Figure 1**.

Figure 1 – Site Location



The purpose of this analysis is to evaluate the impact that the proposed development will have on the existing water budget for the Subject Property, particularly as it relates to infiltration volumes on an average annual basis.

Professional Engineers Ontario

ASSOCIATION OF CONSULTING ENGINEERING COMPANIES ONTARIO

PGO

Health and Safety Excellence program Member wsib 2023

Catchment Characterization

Wills prepared a Preliminary Stormwater Management (SWM) Report for the development in April 2024, which divided the subject property into six internal catchments and two external catchments for both existing and proposed conditions. For the purpose of the Water Balance Analysis, the same internal catchments, land uses and slopes were used as the SWM Report; however, external catchments were excluded. A summary of the key hydrologic parameters from the SWM Report, included in the Water Balance Analysis are provided in **Table 1** and the existing and proposed catchment areas are provided in **Appendix A**.

Table 1 – Existing and Proposed Hydrologic Parameters

Catchment ID	Area (ha)	Impervious %	Slope %	No. Houses
EX-100	0.59	0	5.8	-
EX-101	3.22	0	2.4	-
EX-102	1.80	0	2.0	-
EX-103	0.66	0	1.2	-
EX-104	4.30	0	2.0	-
EX-200	13.44	0	2.6	-
PR-100	1.72	9.9	0.8	0
PR-101	1.38	4.3	3.2	2
PR-102	0.59	0	0.9	0
PR-103	5.06	12.1	0.9	8
PR-200	13.44	0	2.6	0
PR-201	1.82	2.2	5.2	2

Water Balance Analysis

The water balance analysis has been completed in accordance with the method described in the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013). The water budget was calculated using 1981-2010 Climate Normals for the Peterborough Airport Climate Station resulting in a total water surplus of 281.2 mm/year. Infiltration factors for each catchment were derived using Table 3.1 of the Stormwater Management Planning and Design Manual (MOE, 2003) based on topography, soil type and land use.

Without accounting for the additional groundwater recharge that occurs as a result of the proposed infiltration features, the development would reduce average annual infiltration rates. However, infiltration features are proposed within the roadside ditches and soak away pits are proposed on each residential lot to capture and infiltrate the building runoff, which should be considered in the proposed condition.

A typical building footprint of 200 m^2 was assumed for each lot. As these areas will be captured and infiltrated within soak away pits, they have been modelled as grass for the purpose of the water balance calculations. The average annual infiltration volume provided by the roadside ditches was calculated by completing a daily water balance analysis using precipitation and temperature data for the Peterborough Airport from 1981 to 2010.

A summary of the water balance analysis results is shown in **Table 2** and detailed water balance calculations are provided in **Appendix B**.

Table 2 – Water Balance Summary

Catchment Parameters	Existing	Proposed Without Infiltration Features	Change Without Infiltration Features	Proposed with Infiltration Features	Change With Infiltration Features
Precipitation (mm/year)	855.4				
Precipitation (m^3/year)	205,382	205,382	0.0%	205,382	0.0%
Evapotranspiration (m^3/year)	137,858	135,278	-1.9%	135,278	-1.9%
Infiltration (m^3/year)	48,283	45,308	-6.2%	51,242	6.1%
Runoff (m^3/year)	19,240	24,796	28.9%	18,862	-2.0%

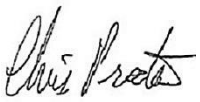
Notes: 1. No infiltration has been calculated for LID features during months with a negative average temperature.

A review of **Table 2** shows that the average annual infiltration volume for the proposed condition will increase from the existing condition when accounting for the additional infiltration provided by the infiltration features proposed for the development.

Conclusion

A Preliminary Water Balance Analysis has been completed for the proposed development using the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013). Based on the results of this analysis, the proposed development will increase the average annual infiltration volume by 6.1% from existing conditions, when accounting for the additional infiltration provided within the roadside ditches and soak away pits to capture rooftop runoff. As such, the proposed development will meet the water balance requirements. During detailed design, these calculations will be updated based on the final grading and Stormwater Management Report.

Respectfully submitted,



Chris Proctor, P.Eng.
Water Resources Engineer
Manager, Land Development Engineering

CP/jh

Appendix A

Figures

TOTAL SITE AREA = 23.87 ha

COUNTY ROAD 4

EX-100
0.59

EXT-300
1.32

EXT-301
5.16

LOW AREA WITH
NO OUTLET

EX-101
3.22

EX-104
4.30

OUTLET 1

VEGETATION
PROTECTION
AREA

EX-200
13.44

EX-102
1.80

ENGLISH LINE
SOUTH

OUTLET 3

INDIAN RIVER
REGULATORY
FLOODLINE

LOW AREA WITH
NO OUTLET

RIVER LANE

EX-103
0.66

OUTLET 2

INDIAN RIVER

EX-100 / 0.66 — CATCHMENT ID / CATCHMENT AREA (ha)

SUBWATERSHED BOUNDARY

INDIAN RIVER FLOODPLAIN

SUBJECT PROPERTY LINE

OUT — OUTLET LOCATION

OVERLAND FLOW DIRECTION

Sketch No.

FIGURE 2
RIEL SUBDIVISION
EXISTING DRAINAGE AREA PLAN

WILLS

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

P. 705.742.2297
F. 705.741.3568
E. wills@dmwills.com

Drawn By: M.W.	Scale: 1:3000
Designed By: M.W.	Plot Date: MARCH 2024
Checked By: C.P.	Project No.: 23-85010
Engineer: C.P.	Drawing File No.: SWM FIGURE 2

TOTAL SITE AREA = 23.87 ha

COUNTY ROAD 4

EXT-300
1.32

EXT-301
5.16

PR-100
1.72

PR-103
5.06

INFILTRATION TRENCHES
TOTAL STORAGE - 38.4 m^3

BLOCK 'A'

OUTLET 1

PR-101
1.38

1
2
3
4
5
6
7
8
9
10
11
12

VEGETATION PROTECTION AREA

PR-200
13.44

INFILTRATION TRENCHES
TOTAL STORAGE - 105.6 m^3

PR-201
1.82

2.0m WALKWAY

3.0m

OTHER LANDS OWNED BY APPLICANT

ENGLISH LINE SOUTH

BLOCK 'B'

BLOCK 'C'

OUTLET 3

INDIAN RIVER REGULATORY FLOODLINE

RIVER LANE

PR-102
0.59

OUTLET 2

INDIAN RIVER

PR-100
0.66

CATCHMENT ID

CATCHMENT AREA (ha)

SUBWATERSHED BOUNDARY

INDIAN RIVER FLOODPLAIN

SUBJECT PROPERTY LINE

OUT OUTLET LOCATION

OVERLAND FLOW DIRECTION

Sketch No.

FIGURE 3
RIEL SUBDIVISION
PROPOSED DRAINAGE AREA PLAN

WILLS

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

P. 705.742.2297
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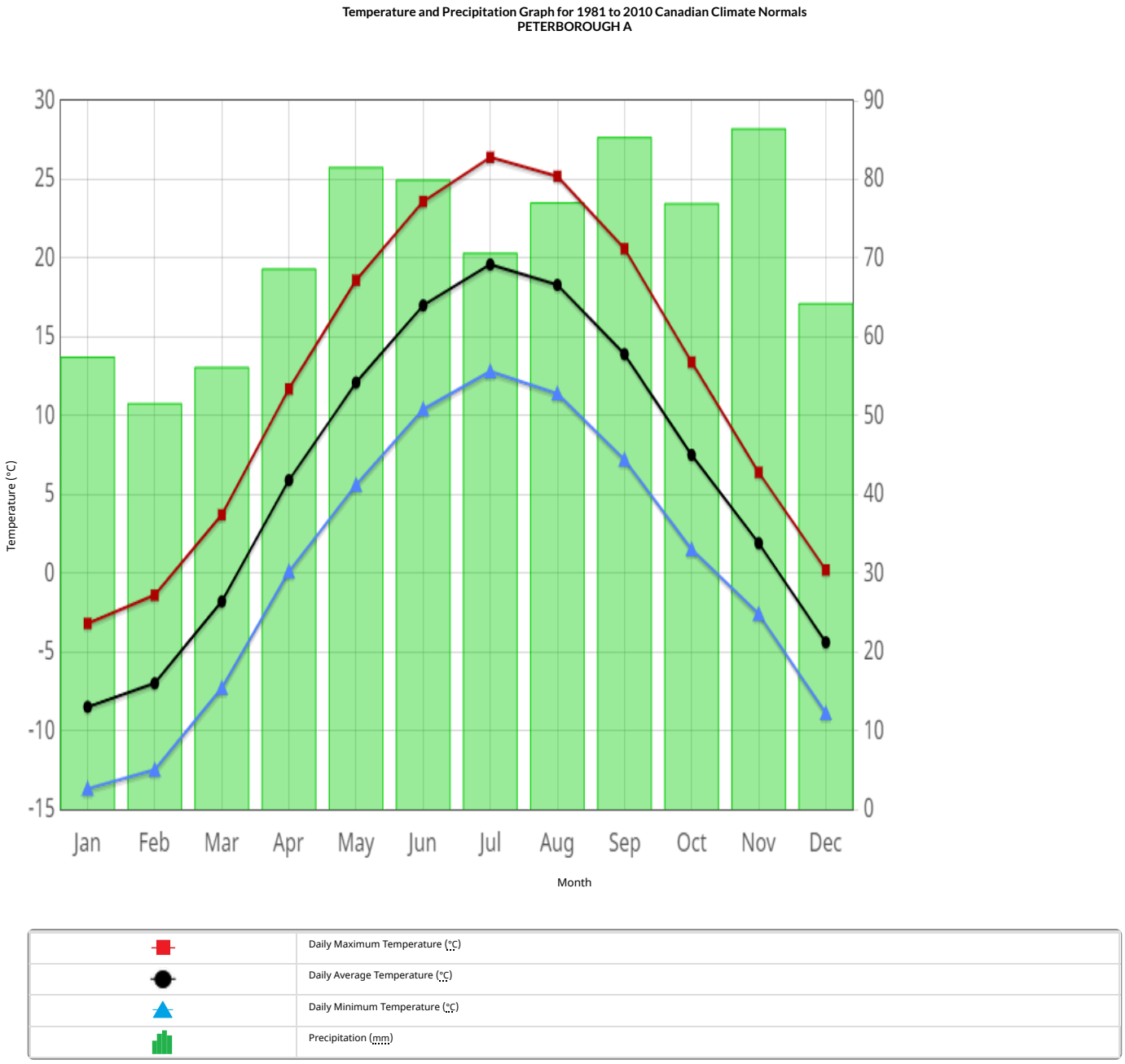
Appendix B

Water Balance Calculations

Government of Canada Gouvernement du Canada

Canadian Climate Normals 1981-2010 Station Data

▼ Temperature and Precipitation Graph



▼ Normals Data

The minimum number of years used to calculate these Normals is indicated by a code for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

PETERBOROUGH A
ONTARIO

Latitude:	44°14'00.000" N
Longitude:	78°22'00.000" W
Elevation:	191.40 m
Climate ID:	6166418
WMO ID:	
TC ID:	

▼ Temperature

Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-8.5	-7.0	-1.8	5.9	12.1	17.0	19.6	18.3	13.9	7.5	1.9	-4.4	6.2	A
Standard Deviation	3.6	2.6	2.1	1.5	1.7	1.4	1.3	1.3	1.3	1.2	1.5	3.2	1.0	A
Daily Maximum (°C)	-3.2	-1.4	3.7	11.7	18.6	23.6	26.4	25.2	20.6	13.4	6.4	0.2	12.1	A
Daily Minimum (°C)	-13.7	-12.5	-7.3	0.1	5.6	10.4	12.8	11.4	7.2	1.5	-2.6	-8.9	0.3	A
Extreme Maximum (°C)	12.2	12.5	24.3	29.7	32.5	34.4	36.1	**36.2**	33.9	28.9	22.8	19.2		
Date (yyyy/dd)	1995/14	1984/23	1998/30+	1990/26	2006/30	1988/14	1988/08	**2001/08**	2002/09	1971/02	1974/01	1982/03		
Extreme Minimum (°C)	**-37.9**	-37.8	-31.4	-15.0	-7.7	-0.7	3.5	0.0	-6.3	-9.4	-19.2	-33.9		
Date (yyyy/dd)	**1984/15+**	1979/18	2003/07	1972/07	1995/04	1980/12	2001/27	1976/31	1991/30	1969/23+	1994/24	1977/11		

▼ Precipitation

Precipitation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Rainfall (mm)	24.5	24.7	30.8	60.5	81.4	79.9	70.6	77.0	84.5	75.2	71.7	31.8	712.5	C
Snowfall (cm)	40.0	29.2	24.6	6.7	0.0	0.0	0.0	0.0	0.0	1.4	15.2	34.0	151.2	C
Precipitation (mm)	57.4	51.5	56.1	68.6	81.5	79.9	70.6	77.0	85.3	76.9	86.4	64.2	855.3	C
Average Snow Depth (cm)	14	16	8	0	0	0	0	0	0	0	1	6	4	A
Median Snow Depth (cm)	13	16	8	0	0	0	0	0	0	0	0	5	4	A
Snow Depth at Month-end (cm)	17	13	1	0	0	0	0	0	0	0	1	9	3	A
Extreme Daily Rainfall (mm)	43.2	35.4	59.8	46.7	50.6	56.6	**83.8**	70.0	52.8	42.6	55.6	37.2		
Date (yyyy/dd)	1995/15	1985/23	1980/21	1973/01	1995/17	1998/25	**2004/15**	1995/31	1989/01	1995/05	1999/02	2006/01		
Extreme Daily Snowfall (cm)	20.7	33.2	22.4	16.8	1.5	0.0	0.0	0.0	0.0	10.4	17.0	**33.2**		
Date (yyyy/dd)	2004/27	2001/08	1985/04	1975/03	1977/08	1969/01+	1969/01+	1969/01+	1969/01+	1981/22	1995/04	**1992/11**		
Extreme Daily Precipitation (mm)	43.2	35.4	61.3	46.7	50.6	56.6	**83.8**	70.0	52.8	42.6	55.6	41.0		
Date (yyyy/dd)	1995/15	1985/23	1980/21	1973/01	1995/17	1998/25	**2004/15**	1995/31	1989/01	1995/05	1999/02	1990/03		
Extreme Snow Depth (cm)	61	70	**71**	38	0	0	0	0	0	7	25	64		
Date (yyyy/dd)	1978/25	1982/06+	**1971/12**	1971/01	1970/01+	1970/01+	1970/01+	1970/01+	1970/01+	1992/19	1971/30	1992/12		

Monthly Water Budget Calculations

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

CANADIAN CLIMATE NORMALS FOR 'PETERBOROUGH A (48952)' (1981-2010)

Climate ID = 6166418
Latitude = 44.23
Longitude = 48.37

Thornthwaite (1948) Inputs				Monthly Water Budget Analysis				
Month	Mean Temperature (°C)[1]	Total Precipitation (mm)[1]	Heat Index	PET (mm)	Daylight Correction Factor	Adjusted PET (mm)	Surplus (mm)	Deficit (mm)
January	-8.5	57.4	0.00	0.0	0.77	0.0	57.4	0.0
February	-7.0	51.5	0.00	0.0	0.87	0.0	51.5	0.0
March	-1.8	56.1	0.00	0.0	0.99	0.0	56.1	0.0
April	5.9	68.6	1.28	28.8	1.12	32.3	39.8	0.0
May	12.1	81.5	3.81	62.3	1.23	76.8	19.2	0.0
June	17.0	79.9	6.38	85.6	1.29	110.2	0.0	30.3
July	19.6	70.6	7.91	102.4	1.26	129.0	0.0	58.4
August	18.3	77.0	7.13	95.4	1.17	111.1	0.0	34.1
September	13.9	85.3	4.70	69.6	1.04	72.6	15.7	0.0
October	7.5	76.9	1.85	38.1	0.92	34.9	38.8	0.0
November	1.9	86.4	0.23	9.0	0.80	7.2	77.4	0.0
December	-4.4	64.2	0.00	0.0	0.74	0.0	64.2	0.0
Totals		**855.4**	33.30			**574.2**	**420.1**	**122.9**
	Thornthwaite Coefficient (α)		**1.028**			Total Water Surplus (mm)		**281.2**

Notes:

1. Temperature and Precipitation are taken from Canadian Climate Normals 1981-2010
2. Water budget adjusted for latitude and length of daylight
3. Potential Evapotranspiration (PET) is calculated based on the Thornthwaite 1948 equation
4. Total Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted evapotranspiration

Water Balance Calculations for Existing Conditions

WILLS

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Catchment Parameters	EX-100	EX-101	EX-102	EX-103	EX-200						**Total**
Drainage Area (m^2)	5900	75200	14000	6600	138400						**240100**
Pervious Area (m^2)	5900	75200	14000	6600	138400						**240100**
Impervious Area (m^2)	0	0	0	0	0						**0**
Evapotranspiration Factors											
Pervious PET Ratio	0.67	0.67	0.67	0.67	0.67						**0.67**
Impervious Evapotranspiration[3]	0.20	0.20	0.20	0.20	0.20						**0.00**
Infiltration Factors											
Topography Infiltration Factor	0.15	0.25	0.25	0.25	0.25						**0.25**
Soil Infiltration Factor	0.30	0.30	0.30	0.30	0.30						**0.30**
Land Cover Infiltration Factor	0.13	0.17	0.13	0.12	0.18						**0.17**
MOE Infiltration Factor	0.58	0.72	0.68	0.67	0.73						**0.72**
Actual Infiltration Factor	0.58	0.72	0.68	0.67	0.73						**0.72**
Run-Off Coefficient	0.42	0.28	0.32	0.33	0.27						**0.28**
Runoff from Impervious Surfaces	0.80	0.80	0.80	0.80	0.80						
Inputs (mm/yr)											
Precipitation	855.4	855.4	855.4	855.4	855.4						**855.4**
Run-On	0.0	0.0	0.0	0.0	0.0						**0.0**
Other Inputs	0.0	0.0	0.0	0.0	0.0						**0.0**
Total Inputs	855.4	855.4	855.4	855.4	855.4						**855.4**
Outputs (mm/yr)											
Precipitation Surplus	281.2	281.2	281.2	281.2	281.2						**281.2**
Net Surplus	281.2	281.2	281.2	281.2	281.2						**281.2**
Evapotranspiration	574.2	574.2	574.2	574.2	574.2						**574.2**
Infiltration	161.8	201.1	191.8	187.1	204.4						**201.1**
Infiltration Features[4]	0.0	0.0	0.0	0.0	0.0						**0.0**
Total Infiltration	**161.8**	**201.1**	**191.8**	**187.1**	**204.4**						**201.1**
Runoff Pervious Areas	119.4	80.1	89.4	94.2	76.9						**80.1**
Runoff Impervious Areas	0.0	0.0	0.0	0.0	0.0						**0.0**
Total Unadjusted Runoff	119.4	80.1	89.4	94.2	76.9						**80.1**
Total Adjusted Runoff[5]	**119.4**	**80.1**	**89.4**	**94.2**	**76.9**						**80.1**
Total Outputs	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**						**855.4**
Inputs (m^3/yr)											
Precipitation	5,047	64,326	11,976	5,646	118,387						**205,382**
Run-On	0	0	0	0	0						**0**
Other Inputs	0	0	0	0	0						**0**
Total Inputs	**5,047**	**64,326**	**11,976**	**5,646**	**118,387**						**205,382**
Outputs (m^3/yr)											
Precipitation Surplus	1,659	21,149	3,937	1,856	38,922						**67,524**
Net Surplus	1,659	21,149	3,937	1,856	38,922						**67,524**
Evapotranspiration	3,388	43,178	8,038	3,790	79,465						**137,858**
Infiltration	955	15,122	2,686	1,235	28,286						**48,283**
Infiltration Features[4]	0	0	0	0	0						**0**
Total Infiltration	955	15,122	2,686	1,235	28,286						**48,283**
Runoff Pervious Areas	704	6,027	1,251	622	10,636						**19,240**
Runoff Impervious Areas	0	0	0	0	0						**0**
Total Unadjusted Runoff	704	6,027	1,251	622	10,636						**19,240**
Total Adjusted Runoff[5]	704	6,027	1,251	622	10,636						**19,240**
Total Outputs	**5,047**	**64,326**	**11,976**	**5,646**	**118,387**						**205,382**

Notes:

1. Water Balance Calculations area in based on methodology described in the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013)
2. Annual Precipitation and Evapotranspiration values were determined using the Thornthwaite (1948) method for monthly water budget calculations
3. Evaporation from impervious areas was assumed to be 0% of Precipitation
4. Infiltration Features are calculated using daily Precipitation data and averaged over the number of years of available data. The entire Catchment is assumed to contribute with no infiltration occuring during months with a negative average temperature.
5. Total Adjusted Runoff is calculated as (Pervious Runoff + Impervious Runoff) - (Infiltration Features)

Water Balance Calculations for Proposed Conditions

WILLS

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Catchment Parameters	PR-100	PR-101	PR-102	PR-103	PR-200	PR-201					Total
Drainage Area (m^2)	17200	13800	5900	50600	138400	14200					**240100**
Pervious Area (m^2)	15500	13600	5900	46100	138400	14200					**233700**
Impervious Area (m^2)	1700	200.0	0	4500	0	0					**6400**
Evapotranspiration Factors											
Pervious PET Ratio	0.67	0.67	0.67	0.67	0.67	0.67					**0.67**
Impervious Evapotranspiration[3]	0.20	0.20	0.20	0.20	0.20	0.20					**0.20**
Infiltration Factors											
Topography Infiltration Factor	0.25	0.25	0.25	0.25	0.25	0.15					**0.24**
Soil Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30					**0.30**
Land Cover Infiltration Factor	0.10	0.10	0.10	0.10	0.18	0.10					**0.15**
MOE Infiltration Factor	0.65	0.65	0.65	0.65	0.73	0.55					**0.69**
Actual Infiltration Factor	0.65	0.65	0.65	0.65	0.73	0.55					**0.69**
Run-Off Coefficient	0.35	0.35	0.35	0.35	0.27	0.45					**0.31**
Runoff from Impervious Surfaces	0.80	0.80	0.80	0.80	0.80	0.80					**0.80**
Inputs (mm/yr)											
Precipitation	855.4	855.4	855.4	855.4	855.4	855.4					**855.4**
Run-On	0.0	0.0	0.0	0.0	0.0	0.0					**0.0**
Other Inputs	0.0	0.0	0.0	0.0	0.0	0.0					**0.0**
Total Inputs	855.4	855.4	855.4	855.4	855.4	855.4					**855.4**
Outputs (mm/yr)											
Precipitation Surplus	321.1	287.1	281.2	317.1	281.2	281.2					**292.0**
Net Surplus	321.1	287.1	281.2	317.1	281.2	281.2					**292.0**
Evapotranspiration	534.3	568.3	574.2	538.3	574.2	574.2					**563.4**
Infiltration	164.7	180.2	182.8	166.5	204.4	154.7					**188.7**
Infiltration Features[4]	87.0	0.0	0.0	87.7	0.0	0.0					**24.7**
Total Infiltration	**251.7**	**180.2**	**182.8**	**254.2**	**204.4**	**154.7**					**213.4**
Runoff Pervious Areas	98.4	98.4	98.4	98.4	76.9	126.6					**87.4**
Runoff Impervious Areas	684.3	684.3	0.0	684.3	0.0	0.0					**684.3**
Total Unadjusted Runoff	156.3	106.9	98.4	150.5	76.9	126.6					**103.3**
Total Adjusted Runoff[5]	69.3	106.9	98.4	62.8	76.9	126.6					**78.6**
Total Outputs	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**					**855.4**
Inputs (m^3/yr)											
Precipitation	14,713	11,805	5,047	43,283	118,387	12,147					**205,382**
Run-On	0	0	0	0	0	0					**0**
Other Inputs	0	0	0	0	0	0					**0**
Total Inputs	**14,713**	**11,805**	**5,047**	**43,283**	**118,387**	**12,147**					**205,382**
Outputs (m^3/yr)											
Precipitation Surplus	5,522	3,962	1,659	16,044	38,922	3,993					**70,103**
Net Surplus	5,522	3,962	1,659	16,044	38,922	3,993					**70,103**
Evapotranspiration	9,190	7,843	3,388	27,239	79,465	8,153					**135,278**
Infiltration	2,833	2,486	1,079	8,427	28,286	2,196					**45,308**
Infiltration Features[4]	1,497	0	0	4,437	0	0					**5,934**
Total Infiltration	4,330	2,486	1,079	12,864	28,286	2,196					**51,242**
Runoff Pervious Areas	1,526	1,339	581	4,538	10,636	1,797					**20,416**
Runoff Impervious Areas	1,163	137	0	3,079	0	0					**4,380**
Total Unadjusted Runoff	2,689	1,476	581	7,617	10,636	1,797					**24,796**
Total Adjusted Runoff[5]	1,192	1,476	581	3,180	10,636	1,797					**18,862**
Total Outputs	**14,713**	**11,805**	**5,047**	**43,283**	**118,387**	**12,147**					**205,382**

Notes:

1. Water Balance Calculations area in based on methodology described in the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013)
2. Annual Precipitation and Evapotranspiration values were determined using the Thornthwaite (1948) method for monthly water budget calculations
3. Evaporation from impervious areas was assumed to be 20% of Precipitation
4. Infiltration Features are calculated using daily Precipitation data and averaged over the number of years of available data. The entire Catchment is assumed to contribute with no infiltration occuring during months with a negative average temperature.
5. Total Adjusted Runoff is calculated as (Pervious Runoff + Impervious Runoff) - (Infiltration Features)

Water Balance Assessment

WILLS

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Characteristic	Existing	Proposed No Mitigation	Change	Proposed With Mitigation	Change
Inputs (m^3/yr)					
Precipitation	205,382	205,382	0.0%	205,382	0.0%
Run-On	0	0	0.0%	0	0.0%
Other Inputs	0	0	0.0%	0	0.0%
Total Inputs	205,382	205,382	0.0%	205,382	0.0%
Outputs (m^3/yr)					
Precipitation Surplus	67,524	70,103	3.8%	70,103	3.8%
Net Surplus	67,524	70,103	3.8%	70,103	3.8%
Evapotranspiration	137,858	135,278	-1.9%	135,278	-1.9%
Infiltration	48,283	45,308	-6.2%	45,308	-6.2%
Infiltration Features	0	0	0.0%	5,934	0.0%
Total Infiltration	**48,283**	**45,308**	**-6.2%**	**51,242**	**6.1%**
Runoff Pervious Areas	19,240	20,416	6.1%	20,416	6.1%
Runoff Impervious Areas	0	4,380	0.0%	4,380	0.0%
Total Runoff	**19,240**	**24,796**	**28.9%**	**18,862**	**-2.0%**
Total Outputs	205,382	205,382	0.0%	205,382	0.0%

Infiltration Factor Calculations for EX-100	Sheet 1 of 1

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	5.83%
Slope Description	Rolling/Hilly Land
Topography Infiltration Factor	**0.15**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	0.59	0.59
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range	0.44	0.10
Grass		
Woods	0.15	0.20
Wetland		
Bare Earth (>70% Rock)		
Impervious		
Total[3]	0.59	**0.13**

MOE Infiltration Factor	**0.58**
Actual Infiltration Factor	**0.58**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for EX-101	Sheet 1 of 1

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	1.57%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	7.52	7.52
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range	2.63	0.10
Grass		
Woods	4.89	0.20
Wetland		
Bare Earth (>70% Rock)		
Impervious		
Total[3]	7.52	**0.17**

MOE Infiltration Factor	**0.72**
Actual Infiltration Factor	**0.72**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for EX-102	Sheet 1 of 1

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	2.00%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	1.40	1.40
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range	0.95	0.10
Grass		
Woods	0.45	0.20
Wetland		
Bare Earth (>70% Rock)		
Impervious		
Total[3]	1.40	**0.13**

MOE Infiltration Factor	**0.68**
Actual Infiltration Factor	**0.68**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for EX-103	Sheet 1 of 1

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	1.20%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	0.66	0.66
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range	0.56	0.10
Grass		
Woods	0.10	0.20
Wetland		
Bare Earth (>70% Rock)		
Impervious		
Total[3]	0.66	**0.12**

MOE Infiltration Factor	**0.67**
Actual Infiltration Factor	**0.67**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for EX-200	Sheet 1 of 1

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	2.61%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	13.84	13.84
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range	3.22	0.10
Grass		
Woods	8.00	0.20
Wetland	2.62	0.20
Bare Earth (>70% Rock)		
Impervious		
Total[3]	13.84	**0.18**

MOE Infiltration Factor	**0.73**
Actual Infiltration Factor	**0.73**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-100

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	0.75%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	1.72	1.72
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range		
Grass	1.49	0.10
Woods		
Wetland		
Gravel	0.06	
Impervious	0.17	
Total[3]	1.49	**0.10**

MOE Infiltration Factor	**0.65**
Actual Infiltration Factor	**0.65**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-100

Sheet 2 of 2

WILLS

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Infiltration Features Summary		
Total Storage Volume[1]	32.2	m^3
Contributing Area[2]	17200	m^2
Pervious Area	15500	m^2
Impervious Area	1700	m^2
Maximum Drawdown	24	hrs
Average Infiltration Volume[3]	**1497**	**m^3/yr**
	87.0	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features
3. Average Infiltration Volume is calculated using daily climate data and averaged over the number of years of available data. No benefit is assumed for Infiltration Features during months with a negative average temperature.
4. Daily climate data is taken from Environment Canada Station 'PETERBOROUGH A' from 1981-2010

Infiltration Factor Calculations for PR-101

Sheet 1 of 1

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	0.75%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	1.38	1.38
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	1.36	0.10
Impervious	0.02	
Total[3]	1.36	**0.10**

MOE Infiltration Factor	**0.65**
Actual Infiltration Factor	**0.65**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-102

Sheet 1 of 1

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	0.86%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	0.59	0.59
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range	0.30	0.10
Grass	0.29	0.10
Woods		
Wetland		
Bare Earth (>70% Rock)		
Impervious		
Total[3]	0.59	**0.10**

MOE Infiltration Factor	**0.65**
Actual Infiltration Factor	**0.65**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-103

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	0.93%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	5.06	5.06
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range		
Grass	4.48	0.10
Woods		
Wetland		
Gravel	0.13	
Impervious	0.45	
Total[3]	4.48	**0.10**

MOE Infiltration Factor	**0.65**
Actual Infiltration Factor	**0.65**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-103

Sheet 2 of 2

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Infiltration Features Summary		
Total Storage Volume[1]	97.5	m^3
Contributing Area[2]	50600	m^2
Pervious Area	46100	m^2
Impervious Area	4500	m^2
Maximum Drawdown	24	hrs
Average Infiltration Volume[3]	**4437**	**m^3/yr**
	87.7	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features
3. Average Infiltration Volume is calculated using daily climate data and averaged over the number of years of available data. No benefit is assumed for Infiltration Features during months with a negative average temperature.
4. Daily climate data is taken from Environment Canada Station 'PETERBOROUGH A' from 1981-2010

Infiltration Factor Calculations for PR-200

Sheet 1 of 1

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	2.61%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	13.84	13.84
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range	3.22	0.10
Grass		
Woods	8.00	0.20
Wetland	2.62	0.20
Gravel		
Impervious		
Total[3]	13.84	**0.18**

MOE Infiltration Factor	**0.73**
Actual Infiltration Factor	**0.73**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-201

Sheet 1 of 1

Project No: 19-85010
Project Name: Reil Subdivision
Designed/Checked By: MW / CP
Date: 17-Sep-24

Topography	
Average Slope	5.21%
Slope Description	Rolling/Hilly Land
Topography Infiltration Factor	**0.15**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Dummer Loam	
Area (ha)	1.42	1.42
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Gravel Impervious	1.42	0.10
Total[3]	1.42	**0.10**

MOE Infiltration Factor	**0.55**
Actual Infiltration Factor	**0.55**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only