AUGUST 14, 2025

PROJECT NO: 2433-6646

SENT VIA: EMAIL
SHAWN@TIMBERWORX.CA

Timberworx Custom Homes
Shawn Marsh
275 Hanlon Creek Boulevard, Unit 5
Guelph, ON N1C 0A1

Attention: Shawn Marsh

RE: WATER BALANCE ASSESSMENT
ARKELL DEVELOPMENTS
PART OF LOTS 7 & 8, CONCESSION 10
TOWNSHIP OF PUSLINCH, WELLINGTON COUNTY

Dear Shawn,

C.F. Crozier & Associates has been retained by Timberworx Custom Homes to prepare a preliminary water balance assessment for the site located on parts of lots 7 and 8, concession 10 in the Township of Puslinch. The water balance assessment has been prepared to define the pre-development infiltration and runoff conditions and determine the impact on infiltration and runoff in the post-development scenario. Please note that this assessment should be read in conjunction with the Functional Servicing and Stormwater Management Report (Crozier, August 2025).

Introduction
The Site encompasses an area of 20.45 ha with a developable area of approximately 17.45 ha. The Site currently consists of a single detached dwelling, garage, existing woodlot, and agricultural fields. The Site is bounded by agricultural fields to the north, Arkell Road to the West, Guelph Junction Railway (GJR) to the East, Watson Road, and existing detached homes to the South.

According to the Conceptual Plan prepared by Stovel and Associates Inc. (July 29, 2025), it is understood that the Site will consist of the following elements:

- Forty-Four (44) residential lots with associated onsite sewage systems and private wells.
- One (1) stormwater management facility for flood control.
- One (1) bioswale to act as a bypass for drainage external to the Site and one (1) bioswale
  to infiltrate and convey Site stormwater during minor and major storm events.
- A half (0.5) hectare of land to remain undeveloped.
- An access road connecting to Watson Road in the southwest and a secondary access road connecting to Arkell Road in the northwest.

Methodology

A water balance assessment is conducted to determine the pre to post change in groundwater recharge across a property where overall imperviousness is to increase post-development. Runoff increases where permanent structures, asphalt, concrete, and impermeable surfaces are added and therefore infiltration is reduced. A Thornthwaite and Mather water balance has been conducted to assess the proposed development's impact on groundwater recharge. The water balance has been conducted in accordance with accepted site condition values from 6.3 of the Urban Storm Drainage Criteria Manual: Volume 1 (Urban Drainage and Flood Control District, 2016) and Table 3.1 of the MECP Stormwater Management Planning and Design Manual (MECP, 2003). The appropriate reference tables are provided in enclosed Appendix A.

The water balance on a site can be estimated from the following equation described in Thornthwaite and Mather 1957:

$$P = S + R + I + ET$$

Where: P = precipitation

S = change in groundwater storage

R = surface water runoff

I = infiltration

ET = evapotranspiration/evaporation

The components of the water balance equation can be estimated using field observations of drainage conditions, land cover, soil types, groundwater conditions and local climate records.

The nearest climate data available for the Puslinch area is the data captured by the Kitchener/Waterloo composite station. Climate normals from 1991-2020 for the Kitchener/Waterloo Station was used to prepare the water balance assessment. Table 1 below summarizes the temperature and precipitation data referenced.

Table 1: Climate Normals for Kitchener/Waterloo Composite Station 1991-2020 (WMO: 71368)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOT
Temp. (C◦)	-6.3	-5.9	-0.8	5.9	12.6	17.8	20.2	19.1	15.2	8.8	2.6	-2.8	7.2
Precipitation (mm)	66.3	46.1	57.0	81.2	80.2	80.5	96.2	67.2	75.2	71.0	74.9	54.9	850

The total average temperature is approximately 7.2◦C and the average annual precipitation is 850.6 mm/year for the area.

The rate of evapotranspiration on a property is a function of the water holding capacity of the soil, soil and vegetation type and land cover. Through the Thornthwaite and Mather method or a soil moisture balance approach and local climate data, the Potential Evapotranspiration (PET) and the Actual Evapotranspiration (AET) can be calculated (see Appendix A) using the following equations:

$$PET=16 \times \left(\frac{10Ta}{H_i}\right)^a$$

Where: T_a = average daily temperature, 0 degrees for negative temperature months

Hi = heat index value, assuming 12 hours per day, 30 days a month of daylight

The average heat index value is estimated using the following equation:

$$Hi=\sum_{i=1}^{12}\left(\frac{10Ta}{5}\right)^{1.514}$$

The evapotranspiration factor (α) is determined using the following equation:

$$\alpha = 0.49 + (0.0179 \times H_i) - (0.0000771 \times H_i^2) + (0.000000675 \times H_i^3)$$

PET is adjusted to account for the average number of hours of daylight per month for a given location. The adjustment factor is dependent on the subject property's latitude and is presented in Appendix A (Thornthwaite and Mather, 1957). The PET is multiplied by the adjustment factor per month to determine the Adjusted Potential Evapotranspiration (PET_{adj}).

The Actual Evapotranspiration (AET) is determined using the following equation:

$$AET = PET_{adj} - \Delta S$$

The Change in Soil Storage (ΔS) is depended on the types of soil on the property and the Accumulated Potential Water Loss (APWL) per month. The Change in Soil Storage and Accumulated Potential Water Loss can be calculated using the following equations:

$$\Delta S = S_{mc} \text{ x}$$

Where: S_{mc} = soil moisture capacity

APWL = accumulated potential water loss

For ΔP < 0: $APWL = -\Sigma_{i=0}^{12} PET_i$

For ΔP < 0: $APWL = \frac{ln\left(\frac{|AET-PET|}{S_{mc}}\right)}{S_{mc}}$

Existing land use is primarily agricultural with some woodlot and existing rural residential. According to local studies, existing soils are sandy and are estimated to be conducive to infiltration. Using the Ministry Environment, Conservation and Parks (MECP) Stormwater Management and Design Manual Table 3.1. (2003), the soil moisture capacity was estimated to be 250 mm for woodlots with sandy soil and 50 mm for shallow rooted crops and residential lawn with sandy soil. Therefore, based on local climate conditions the Actual Evapotranspiration (AET) is calculated to be approximately 591 mm/year.

The difference between mean annual P and mean annual ET outputs the amount of water surplus for the Site. The water surplus either infiltrates (I) into the soil or travels across the site as runoff (R).

The distribution of water that infiltrates into the soil is a function of an infiltration factor as described in Table 3.1 of the MECP Stormwater Management Planning and Design Manual (MECP, 2003). The infiltration factor for each land use was determined using the MECP methodology. The water balance components were used to estimate the pre-development and post-development water balance scenarios. Detailed water balance calculations for the subject property can be seen in Appendix A.

Results

Based on the assumptions above, pre-development infiltration is estimated to be 251 mm/yr and post-development infiltration is estimated to be 152 mm/yr. An infiltration deficit of 99 mm/yr is expected due to the development. Low-impact development (LID) structures can be implemented to improve post-development infiltration. Design of low impact development structures is beyond the scope of this report and is recommended to be completed at detailed design.

Although the onsite soils are coarse-grained, it is recommended that local infiltration testing be conducted in the area of any low impact development structures to confirm potential enhanced infiltration.

Conclusions and Recommendations

Based on the above water balance assessment, a deficit of 99 mm/yr is expected due to the development. In order to maintain pre-development infiltration and preserve groundwater recharge on the site, it is recommended that LIDs are employed such that pre-development infiltration volumes are maintained to the greatest extent possible. Clean runoff should be directed towards infiltration features to prevent groundwater contamination from runoff (e.g. salt from roads). Infiltration testing should be conducted at detailed design to confirm where LIDs are feasible.

Should you have any questions or require any further information, please do not hesitate to contact the undersigned.

Sincerely,

C.F. CROZIER & ASSOCIATES INC.

Caitlyn MacPhee, EIT, GIT
Hydrogeology
cm/tc

C.F. CROZIER & ASSOCIATES INC.

Chris Gerrits, M.Sc., P.Eng.
Director, Land Development

c.c.

Enclosure
Appendix A – Water Balance Assessment Calculations

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Project Information

Thornthwaite & Mather Method

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By:
Date: 05-Aug-25

Pre-Development Conditions

Landuse	Woods	Agricultural	Lawn						
Area (m^2)	64690	69926	54384						
Pervious Area (m^2)	64690	69926	53538						
Impervious Area (m^2)	0	0	846						
Percent Imperviousness (%)	0%	0%	2%						
Infiltration Factors									
Topography - Description	Rolling	Flat	Flat						
Topography - Infiltration Factor	0.20	0.30	0.30						
Soil - Description	Fine Sand	Fine Sand	Fine Sand						
Soil - Infiltration Factor	0.40	0.40	0.40						
Cover - Description	Mature Forests	Shallow Rooted Crops	Urban Lawns						
Cover - Infiltration Factor	0.20	0.10	0.10						
Total Infiltration Factor	0.80	0.80	0.80						
Soil Moisture Capacity (mm)	250	50	50						

Post-Development Conditions

Landuse	Woods	Roads	Single-Family Dwellings	Exclusion Lands	SWM	Drainage Swale			
Area (m^2)	49758	48294.04	70400	5311	3702.26	11534.7			
Pervious Area (m^2)	49758	4829.404	42240	5311	1851.13	11534.7			
Impervious Area (m^2)	0	43464.636	28160	0	1851.13	0			
Percent Imperviousness (%)	0%	90%	40%	0%	50%	0%			
Infiltration Factors									
Topography - Description	Rolling	Flat	Flat	Flat	Flat	Flat			
Topography - Infiltration Factor	0.20	0.30	0.30	0.30	0.30	0.30			
Soil - Description	Fine Sand	Fine Sand	Fine Sand	Fine Sand	Fine Sand	Fine Sand			
Soil - Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40			
Cover - Description	Mature Forests	Urban Lawns	Urban Lawns	Urban Lawns	Urban Lawns	Urban Lawns			
Cover - Infiltration Factor	0.20	0.10	0.10	0.10	0.10	0.10			
Total Infiltration Factor	0.80	0.80	0.80	0.80	0.80	0.80			
Soil Moisture Capacity (mm)	250	50	50	50	50	50			

Canadian Climate Normals 1991-2020 Data

Composite Station Metadata

All stations used in the composite for all Normals and Extremes elements are listed. Station metadata includes station name, station identifiers, coordinates, and elevation.
Composite Station Name: KITCHENER/WATERLOO

Station Name	Climate ID	WMO ID	TC ID	Latitude	Longitude	Elevation (m)
WATERLOO WELLINGTON A	6149387			43°27'00.000" N	80°23'00.000" W	317
REGION OF WATERLOO INT'L AIRPORT	6149388			43°27'32.000" N	80°22'39.000" W	321.3
KITCHENER/WATERLOO	6144239	71368	YKZ	43°27'39.000" N	80°22'43.000" W	321.6

Code Legend

A = WMO "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation)
B = At least 25 years
C = At least 20 years
D = At least 15 years

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Temperature														
Daily Average (°C)	-6.3	-5.9	-0.8	5.9	12.6	17.8	20.2	19.1	15.2	8.8	2.6	-2.8	7.2	A
Precipitation														
Precipitation (mm)	66.3	46.1	57	81.2	80.2	80.5	96.2	67.2	75.2	71	74.9	54.9	850.6	D
Days with Rainfall														
Days with Rainfall >= 0.2 mm	17.7	12.9	13.2	13.5	13.4	12.7	13.2	11.2	12	14.7	14.8	15	164	D
Days with Rainfall >= 5 mm	4.3	2.8	3.5	5	4.9	5.8	4.9	4.2	4.8	4.4	4.4	3.7	52.6	D
Days with Rainfall >= 10 mm	1.6	1.4	1.5	2.6	2.8	3.1	3.1	2.4	2.6	2.6	2	1.6	27.1	D
Days with Rainfall >= 25 mm	0.13	0.14	0.19	0.32	0.43	0.28	0.89	0.37	0.57	0.26	0.57	0.09	4.2	D
Days with Rainfall >= 50 mm	0	0	0	0.05	0.04	0	0.16	0	0.05	0	0.1	0	0.4	D
Days with Rainfall >= 100 mm	0	0	0	0	0	0	0.05	0	0	0	0	0	0.05	D

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Climate Parameters

Thornthwaite & Mather Method

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By:
Date: 05-Aug-25

PROJECT LOCATION Arkell
PROJECT LATITUDE ° **43**

Month	Mean Temperature (C°)[1]	Heat Index [i =(t/5)$^{1.514}$]	α	Potential Evapotranspiration (PET) (mm)	Correction Factor[2]	Adjusted Potential Evapotranspiration (APET) (mm)	Precipitation (P) (mm)[1]
January	-6.3	0.00		0.0	1.37	0.0	66.3
February	-5.9	0.00		0.0	0.82	0.0	46.1
March	-0.8	0.00		0.0	1.02	0.0	57.0
April	5.9	1.28		27.0	1.12	30.3	81.2
May	12.6	4.05		60.9	1.26	76.8	80.2
June	17.8	6.84		88.3	1.28	113.0	80.5
July	20.2	8.28		101.1	1.29	130.4	96.2
August	19.1	7.61		95.2	1.2	114.2	67.2
September	15.2	5.38		74.5	1.04	77.5	75.2
October	8.8	2.35		41.5	0.95	39.4	71.0
November	2.6	0.37		11.2	0.81	9.1	74.9
December	-2.8	0.00		0.0	0.77	0.0	54.9
TOTAL	7.2	**36.2**	**1.1**	**499.7**		**590.7**	**850.7**

NOTES: 1. Precipitation and temperature data referenced from the City of Guelph's Stormwater Management Master Plan, Appendix F.
2. Latitude adjustment/correction factors determined based on site location assuming 12 hours of sunlight per day for 30 days

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By:CG
Date: 05-Aug-25

Pre-Development Water Balance

Thornthwaite & Mather Method

Landuse	**Woods**												
Parameters	**Pervious Area**			6.47 ha	**Impervious Area**			0.00 ha	**Total Area**			6.47 ha	
	Soil Moisture Holding Capacity			250 mm	**Infiltration Factor**			0.80	**% Impervious Evaporation**			15%	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Pervious Area Water Balance													
Evapotranspiration (mm)	0	0	0	30	77	111	124	100	77	39	9	0	**567**
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	5	55	**283**
Infiltration (mm)	53	37	46	41	3	0	0	0	0	0	4	44	**227**
Surface Water Runoff (mm)	13	9	11	10	1	0	0	0	0	0	1	11	**57**
Impervious Area Water Balance													
Evaporation (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Surface Water Runoff (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	1958	4968	7177	8038	6471	4959	2550	589	0	**36710**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	3431	2386	2950	2636	176	0	0	0	0	0	238	2841	**14658**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	858	596	737	659	44	0	0	0	0	0	59	710	**3664**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Pre-Development Water Balance Summary: Woods				
Pre-Development Evapotranspiration	36710	m^3/yr	567	mm/yr
Pre-Development Infiltration	14658	m^3/yr	227	mm/yr
Pre-Development Runoff	3664	m^3/yr	57	mm/yr

NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.
2. Assumptions:
- Evapotranspiration does not occur when average temperature is below zero.
- Infiltration does not occur when average temperature is below zero.
- Approximately 15% of the precipitation on impervious surfaces will evaporate.

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Pre-Development Water Balance

Thornthwaite & Mather Method

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By: CG
Date: 05-Aug-25

Landuse	**Agricultural**												
Parameters	**Pervious Area**			6.99 ha	**Impervious Area**			0.00 ha	**Total Area**			6.99 ha	
	Soil Moisture Holding Capacity			50 mm	**Infiltration Factor**			0.80	**% Impervious Evaporation**			15%	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Pervious Area Water Balance													
Evapotranspiration (mm)	0	0	0	30	77	104	109	75	75	39	9	0	**520**
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	52	55	**331**
Infiltration (mm)	53	37	46	41	3	0	0	0	0	0	42	44	**265**
Surface Water Runoff (mm)	13	9	11	10	1	0	0	0	0	0	10	11	**66**
Impervious Area Water Balance													
Evaporation (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Surface Water Runoff (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	2117	5370	7299	7631	5261	5275	2756	636	0	**36345**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	3709	2579	3189	2849	191	0	0	0	0	0	2926	3071	**18513**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	927	645	797	712	48	0	0	0	0	0	732	768	**4628**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Pre-Development Water Balance Summary: Agricultural				
Pre-Development Evapotranspiration	36344.8	m^3/yr	519.8	mm/yr
Pre-Development Infiltration	18513.0	m^3/yr	264.8	mm/yr
Pre-Development Runoff	4628.3	m^3/yr	66.2	mm/yr

NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.

2. Assumptions:

- Surplus water is unavailable for runoff and recharge in months where water losses from APET exceed precipitation inputs.
- Evapotranspiration does not occur when average temperature is below zero.
- Approximately 15% of the precipitation on impervious surfaces will evaporate.

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Pre-Development Water Balance

Thornthwaite & Mather Method

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By: CG
Date: 05-Aug-25

Landuse	**Lawn**												
Parameters	**Pervious Area**			5.35 ha	**Impervious Area**			0.08 ha	**Total Area**			5.44 ha	
	Soil Moisture Holding Capacity			50 mm	**Infiltration Factor**			0.80	**% Impervious Evaporation**			15%	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Pervious Area Water Balance													
Evapotranspiration (mm)	0	0	0	30	77	104	109	75	75	39	9	0	**520**
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	52	55	**331**
Infiltration (mm)	53	37	46	41	3	0	0	0	0	0	42	44	**265**
Surface Water Runoff (mm)	13	9	11	10	1	0	0	0	0	0	10	11	**66**
Impervious Area Water Balance													
Evaporation (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Surface Water Runoff (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	1621	4111	5588	5843	4028	4038	2110	487	0	**27827**
Impervious ET (m^3)	8	6	7	10	10	10	12	9	10	9	10	7	**108**
Pervious Infiltration (m^3)	2840	1974	2441	2181	146	0	0	0	0	0	2240	2351	**14174**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	710	494	610	545	36	0	0	0	0	0	560	588	**3544**
Impervious Runoff (m^3)	48	33	41	58	58	58	69	48	54	51	54	39	**612**

Pre-Development Water Balance Summary: Lawn				
Pre-Development Evapotranspiration	27934.9	m^3/yr	513.7	mm/yr
Pre-Development Infiltration	14174.3	m^3/yr	260.6	mm/yr
Pre-Development Runoff	4155.3	m^3/yr	76.4	mm/yr

NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.

2. Assumptions:

- Surplus water is unavailable for runoff and recharge in months where water losses from APET exceed precipitation inputs.
- Evapotranspiration does not occur when average temperature is below zero.
- Approximately 15% of the precipitation on impervious surfaces will evaporate.

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By: CG
Date: 05-Aug-25

Post-Development Water Balance

Thornthwaite & Mather Method

Project Name: **Arkell Subdivision**
Location: **Arkell, Guelph, Ontario**

Landuse	**Woods**												
Parameters	**Pervious Area**			4.98 ha	**Impervious Area**			0.00 ha	**Total Area**			4.98 ha	
	Soil Moisture Holding Capacity			250 mm	**Infiltration Factor**			0.80	**% Impervious Evaporation**			15%	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Pervious Area Water Balance													
Evapotranspiration (mm)	0	0	0	30	77	111	124	100	77	39	9	0	**567**
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	5	55	**283**
Infiltration (mm)	53	37	46	41	3	0	0	0	0	0	4	44	**227**
Surface Water Runoff (mm)	13	9	11	10	1	0	0	0	0	0	1	11	**57**
Impervious Area Water Balance													
Evaporation (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Surface Water Runoff (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	1506	3821	5521	6183	4977	3814	1961	453	0	**28236**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	2639	1835	2269	2027	136	0	0	0	0	0	183	2185	**11274**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	660	459	567	507	34	0	0	0	0	0	46	546	**2819**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Post-Development Water Balance Summary: Woods				
Post-Development Evapotranspiration	28236.2	m^3/yr	567.5	mm/yr
Post-Development Infiltration	11274.3	m^3/yr	226.6	mm/yr
Post-Development Runoff	2818.6	m^3/yr	56.6	mm/yr

NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.
2. Assumptions:
- Surplus water is unavailable for runoff and recharge in months where water losses from APET exceed precipitation inputs.
- Evapotranspiration does not occur when average temperature is below zero.
- Approximately 15% of the precipitation on impervious surfaces will evaporate.

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By: CG
Date: 05-Aug-25

Post-Development Water Balance

Thornthwaite & Mather Method

Project Name: **Arkell Subdivision**
Location: **Arkell, Guelph, Ontario**

Landuse	**Roads**												
Parameters	**Pervious Area**			0.48 ha	**Impervious Area**			4.35 ha	**Total Area**			4.83 ha	
	Soil Moisture Holding Capacity			50 mm	**Infiltration Factor**			0.80	**% Impervious Evaporation**			15%	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Pervious Area Water Balance													
Evapotranspiration (mm)	0	0	0	30	77	104	109	75	75	39	9	0	**520**
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	52	55	**331**
Infiltration (mm)	53	37	46	41	3	0	0	0	0	0	42	44	**265**
Surface Water Runoff (mm)	13	9	11	10	1	0	0	0	0	0	10	11	**66**
Impervious Area Water Balance													
Evaporation (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Surface Water Runoff (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	146	371	504	527	363	364	190	44	0	**2510**
Impervious ET (m^3)	432	301	372	529	523	525	627	438	490	463	488	358	**5546**
Pervious Infiltration (m^3)	256	178	220	197	13	0	0	0	0	0	202	212	**1279**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	64	45	55	49	3	0	0	0	0	0	51	53	**320**
Impervious Runoff (m^3)	2449	1703	2106	3000	2963	2974	3554	2483	2778	2623	2767	2028	**31429**

Post-Development Water Balance Summary: Roads				
Post-Development Evapotranspiration	8056.4	m^3/yr	166.8	mm/yr
Post-Development Infiltration	1278.6	m^3/yr	26.5	mm/yr
Post-Development Runoff	31748.7	m^3/yr	657.4	mm/yr

NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.
2. Assumptions:
- Surplus water is unavailable for runoff and recharge in months where water losses from APET exceed precipitation inputs.
- Evapotranspiration does not occur when average temperature is below zero.
- Approximately 15% of the precipitation on impervious surfaces will evaporate.

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By: CG
Date: 05-Aug-25

Post-Development Water Balance

Thornthwaite & Mather Method

Project Name: **Arkell Subdivision**
Location: **Arkell, Guelph, Ontario**

Landuse	**Single-Family Dwellings**												
Parameters	**Pervious Area**			4.22 ha	**Impervious Area**			2.82 ha	**Total Area**			7.04 ha	
	Soil Moisture Holding Capacity			50 mm	**Infiltration Factor**			0.80	**% Impervious Evaporation**			15%	

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Pervious Area Water Balance													
Evapotranspiration (mm)	0	0	0	30	77	104	109	75	75	39	9	0	**520**
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	52	55	**331**
Infiltration (mm)	53	37	46	41	3	0	0	0	0	0	42	44	**265**
Surface Water Runoff (mm)	13	9	11	10	1	0	0	0	0	0	10	11	**66**
Impervious Area Water Balance													
Evaporation (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Surface Water Runoff (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	1279	3244	4409	4610	3178	3186	1665	384	0	**21955**
Impervious ET (m^3)	280	195	241	343	339	340	406	284	318	300	316	232	**3593**
Pervious Infiltration (m^3)	2240	1558	1926	1721	115	0	0	0	0	0	1768	1855	**11183**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	560	389	482	430	29	0	0	0	0	0	442	464	**2796**
Impervious Runoff (m^3)	1587	1103	1364	1944	1920	1927	2303	1608	1800	1699	1793	1314	**20362**

Post-Development Water Balance Summary: Single-Family Dwellings				
Post-Development Evapotranspiration	25548.1	m^3/yr	362.9	mm/yr
Post-Development Infiltration	11183.1	m^3/yr	158.9	mm/yr
Post-Development Runoff	23158.1	m^3/yr	329.0	mm/yr

NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.
2. Assumptions:
- Surplus water is unavailable for runoff and recharge in months where water losses from APET exceed precipitation inputs.
- Evapotranspiration does not occur when average temperature is below zero.
- Approximately 15% of the precipitation on impervious surfaces will evaporate.

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By: CG
Date: 05-Aug-25

Post-Development Water Balance

Thornthwaite & Mather Method

Project Name: **Arkell Subdivision**
Location: **Arkell, Guelph, Ontario**

Landuse	**Exclusion Lands**												
Parameters	**Pervious Area**			0.53 ha	**Impervious Area**			0.00 ha	**Total Area**			0.53 ha	
	Soil Moisture Holding Capacity			50 mm	**Infiltration Factor**			0.80	**% Impervious Evaporation**			15%	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Pervious Area Water Balance													
Evapotranspiration (mm)	0	0	0	30	77	104	109	75	75	39	9	0	**520**
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	52	55	**331**
Infiltration (mm)	53	37	46	41	3	0	0	0	0	0	42	44	**265**
Surface Water Runoff (mm)	13	9	11	10	1	0	0	0	0	0	10	11	**66**
Impervious Area Water Balance													
Evaporation (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Surface Water Runoff (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	161	408	554	580	400	401	209	48	0	**2760**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	282	196	242	216	14	0	0	0	0	0	222	233	**1406**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	70	49	61	54	4	0	0	0	0	0	56	58	**352**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Post-Development Water Balance Summary: Exclusion Lands				
Post-Development evapotranspiration	2760.4	m^3/yr	519.8	mm/yr
Post-Development Infiltration	1406.1	m^3/yr	264.8	mm/yr
Post-Development Runoff	351.5	m^3/yr	66.2	mm/yr

NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.
2. Assumptions:
- Surplus water is unavailable for runoff and recharge in months where water losses from APET exceed precipitation inputs.
- Evapotranspiration does not occur when average temperature is below zero.
- Approximately 15% of the precipitation on impervious surfaces will evaporate.

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
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Post-Development Water Balance

Thornthwaite & Mather Method

Project Name: **Arkell Subdivision**
Location: **Arkell, Guelph, Ontario**

Landuse	**SWM**												
Parameters	**Pervious Area**			0.19 ha	**Impervious Area**			0.19 ha	**Total Area**			0.37 ha	
	Soil Moisture Holding Capacity			50 mm	**Infiltration Factor**			0.80	**% Impervious Evaporation**			15%	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Pervious Area Water Balance													
Evapotranspiration (mm)	0	0	0	30	77	104	109	75	75	39	9	0	**520**
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	52	55	**331**
Infiltration (mm)	53	37	46	41	3	0	0	0	0	0	42	44	**265**
Surface Water Runoff (mm)	13	9	11	10	1	0	0	0	0	0	10	11	**66**
Impervious Area Water Balance													
Evaporation (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Surface Water Runoff (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	56	142	193	202	139	140	73	17	0	**962**
Impervious ET (m^3)	18	13	16	23	22	22	27	19	21	20	21	15	**236**
Pervious Infiltration (m^3)	98	68	84	75	5	0	0	0	0	0	77	81	**490**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	25	17	21	19	1	0	0	0	0	0	19	20	**123**
Impervious Runoff (m^3)	104	73	90	128	126	127	151	106	118	112	118	86	**1339**

Post-Development Water Balance Summary: SWM				
Post-Development evapotranspiration	1198.4	m^3/yr	323.7	mm/yr
Post-Development Infiltration	490.1	m^3/yr	132.4	mm/yr
Post-Development Runoff	1461.1	m^3/yr	394.6	mm/yr

NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.
2. Assumptions:
- Surplus water is unavailable for runoff and recharge in months where water losses from APET exceed precipitation inputs.
- Evapotranspiration does not occur when average temperature is below zero.
- Approximately 15% of the precipitation on impervious surfaces will evaporate.

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By: CG
Date: 05-Aug-25

Post-Development Water Balance

Thornthwaite & Mather Method

Project Name: **Arkell Subdivision**
Location: **Arkell, Guelph, Ontario**

Landuse	**Drainage Swale**												
Parameters	**Pervious Area**			1.15 ha	**Impervious Area**			0.00 ha	**Total Area**			1.15 ha	
	Soil Moisture Holding Capacity			50 mm	**Infiltration Factor**			0.80	**% Impervious Evaporation**			15%	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Pervious Area Water Balance													
Evapotranspiration (mm)	0	0	0	30	77	104	109	75	75	39	9	0	**520**
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	52	55	**331**
Infiltration (mm)	53	37	46	41	3	0	0	0	0	0	42	44	**265**
Surface Water Runoff (mm)	13	9	11	10	1	0	0	0	0	0	10	11	**66**
Impervious Area Water Balance													
Evaporation (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Surface Water Runoff (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	349	886	1204	1259	868	870	455	105	0	**5995**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	612	425	526	470	31	0	0	0	0	0	483	507	**3054**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	153	106	131	117	8	0	0	0	0	0	121	127	**763**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Post-Development Water Balance Summary: Drainage Swale				
Post-Development evapotranspiration	5995.3	m^3/yr	519.8	mm/yr
Post-Development Infiltration	3053.8	m^3/yr	264.8	mm/yr
Post-Development Runoff	763.5	m^3/yr	66.2	mm/yr

NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.
2. Assumptions:
- Surplus water is unavailable for runoff and recharge in months where water losses from APET exceed precipitation inputs.
- Evapotranspiration does not occur when average temperature is below zero.
- Approximately 15% of the precipitation on impervious surfaces will evaporate.

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Site Water Balance Summary

Thornthwaite & Mather Method

Project: Arkell Subdivsion
Project No.: 2433-6646
Created By: CM
Checked By: CG
Date: 05-Aug-25

Pre-Development Water Balance							
Catchment ID	Area	Evapotranspiration		Infiltration		Runoff	
	(ha)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)
Woods	6.469	36710	567	14658	227	3664	57
Agricultural	6.9926	36345	520	18513	265	4628	66
Lawn	5.4384	27935	514	14174	261	4155	76
Total	**18.9**	**100989**	**534**	**47345**	**251**	**12448**	**66**

Post-Development Water Balance							
Catchment ID	Area	Evapotranspiration		Infiltration		Runoff	
	(ha)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)
Woods	4.9758	28236	567	11274	227	2819	57
Roads	4.829404	8056	167	1279	26	31749	657
Single-Family Dwellings	7.04	25548	363	11183	159	23158	329
Exclusion Lands	0.5311	2760	520	1406	265	352	66
SWM	0.370226	1198	324	490	132	1461	395
Drainage Swale	1.15347	5995	520	3054	265	763	66
Total	**18.9**	**71795**	**380**	**28686**	**152**	**60301**	**319**

Site Water Balance Summary							
Scenario	Area	Evapotranspiration		Infiltration		Runoff	
	(ha)	(m^3)	(mm)	(m^3)	(mm)	(m^3)	(mm)
Pre-Dev.	18.9	100989	534	47345	251	12448	66
Post-Dev.	18.9	71795	380	28686	152	60301	319
Difference	0	-29195	-154	-18659	-99	47853	253
% Difference	0%	-29%	-29%	-39%	-39%	384%	384%

Annual Infiltration Deficit **18659 m^3**

Soil Moisture Capacity	50 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	50	50	50	50	50	26	13	5	5	37	50	50	
Change in Storage (mm)	0	0	0	0	0	-24	-13	-8	0	32	13	0	
Evapotranspiration (mm)	0	0	0	30	77	104	109	75	75	39	9	0	520
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	52	55	331

Soil Moisture Capacity	75 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	75	75	75	75	75	49	31	16	16	48	75	75	
Change in Storage (mm)	0	0	0	0	0	-26	-18	-14	0	32	27	0	
Evapotranspiration (mm)	0	0	0	30	77	107	114	82	76	39	9	0	534
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	38	55	317

Soil Moisture Capacity	100 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	100	100	100	100	100	72	51	32	31	63	100	100	
Change in Storage (mm)	0	0	0	0	0	-28	-21	-19	-1	32	37	0	
Evapotranspiration (mm)	0	0	0	30	77	108	117	86	76	39	9	0	543
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	29	55	307

Soil Moisture Capacity	125 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	125	125	125	125	125	96	73	50	49	81	125	125	
Change in Storage (mm)	0	0	0	0	0	-29	-23	-23	-1	32	44	0	
Evapotranspiration (mm)	0	0	0	30	77	109	119	90	76	39	9	0	550
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	22	55	300

Soil Moisture Capacity	150 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	150	150	150	150	150	121	96	70	69	101	150	150	
Change in Storage (mm)	0	0	0	0	0	-29	-25	-26	-1	32	49	0	
Evapotranspiration (mm)	0	0	0	30	77	110	121	93	76	39	9	0	555
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	17	55	295

Soil Moisture Capacity	200 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	200	200	200	200	200	170	143	113	112	144	200	200	
Change in Storage (mm)	0	0	0	0	0	-30	-27	-30	-1	32	56	0	
Evapotranspiration (mm)	0	0	0	30	77	110	123	97	76	39	9	0	563
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	9	55	288

Soil Moisture Capacity	250 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	250	250	250	250	250	220	191	159	157	189	250	250	
Change in Storage (mm)	0	0	0	0	0	-30	-28	-33	-1	32	61	0	
Evapotranspiration (mm)	0	0	0	30	77	111	124	100	77	39	9	0	567
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	5	55	283

Soil Moisture Capacity	300 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	300	300	300	300	300	269	240	205	204	235	300	300	
Change in Storage (mm)	0	0	0	0	0	-31	-29	-35	-2	32	65	0	
Evapotranspiration (mm)	0	0	0	30	77	111	125	102	77	39	9	0	571
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	1	55	280

Soil Moisture Capacity	350 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	350	350	350	350	350	319	289	253	251	283	349	350	
Change in Storage (mm)	0	0	0	0	0	-31	-30	-36	-2	32	66	1	
Evapotranspiration (mm)	0	0	0	30	77	112	126	104	77	39	9	0	573
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	0	54	277

Soil Moisture Capacity	400 mm												
Evapotranspiration Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	66	46	57	81	80	81	96	67	75	71	75	55	851
Adjusted Potential Evapotranspiration (APET)	0	0	0	30	77	113	130	114	78	39	9	0	591
P-APET	66	46	57	51	3	-32	-34	-47	-2	32	66	55	260
Cummulative moisture deficit	0	0	0	0	0	-32	-67	-114	-116	0	0	0	
Storage (S) (mm)	400	400	400	400	400	369	339	301	299	331	397	400	
Change in Storage (mm)	0	0	0	0	0	-31	-30	-38	-2	32	66	3	
Evapotranspiration (mm)	0	0	0	30	77	112	126	105	77	39	9	0	575
Water Surplus (mm)	66	46	57	51	3	0	0	0	0	0	0	52	275

Adjustment Factors Based on Site Latitude Based on 12 hours of Sunlight per day for 30 days

Latitude °	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50	0.74	0.78	1.02	1.15	1.33	1.36	1.37	1.25	1.06	0.92	0.76	0.70
49	0.75	0.79	1.02	1.14	1.32	1.34	1.35	1.24	1.05	0.93	0.76	0.71
48	0.76	0.80	1.02	1.14	1.31	1.33	1.34	1.23	1.05	0.93	0.77	0.72
47	0.77	0.80	1.02	1.14	1.30	1.32	1.33	1.22	1.04	0.93	0.78	0.73
46	0.79	0.81	1.02	1.13	1.29	1.31	1.32	1.22	1.04	0.94	0.79	0.74
45	0.80	0.81	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75
44	0.81	0.82	1.02	1.13	1.27	1.29	1.30	1.20	1.04	0.95	0.80	0.76
43	0.81	0.82	1.02	1.12	1.26	1.28	1.29	1.20	1.04	0.95	0.81	0.77
42	0.82	0.83	1.03	1.12	1.26	1.27	1.28	1.19	1.04	0.95	0.82	0.79
41	0.83	0.83	1.03	1.11	1.25	1.26	1.27	1.19	1.04	0.96	0.82	0.80
40	0.84	0.83	1.03	1.11	1.24	1.25	1.27	1.18	1.04	0.96	0.83	0.81
39	0.85	0.84	1.03	1.11	1.23	1.24	1.26	1.18	1.04	0.96	0.84	0.82
38	0.85	0.84	1.03	1.10	1.23	1.24	1.25	1.17	1.04	0.96	0.84	0.83
37	0.86	0.84	1.03	1.10	1.22	1.23	1.25	1.17	1.03	0.97	0.85	0.83
36	0.87	0.85	1.03	1.10	1.21	1.22	1.24	1.16	1.03	0.97	0.86	0.84
35	0.87	0.85	1.03	1.09	1.21	1.21	1.23	1.16	1.03	0.97	0.86	0.85
34	0.88	0.85	1.03	1.09	1.20	1.20	1.22	1.16	1.03	0.97	0.87	0.86
33	0.88	0.86	1.03	1.09	1.19	1.20	1.22	1.15	1.03	0.97	0.88	0.86
32	0.89	0.86	1.03	1.08	1.19	1.19	1.21	1.15	1.03	0.98	0.88	0.87
31	0.90	0.87	1.03	1.08	1.18	1.18	1.20	1.14	1.03	0.98	0.89	0.88
30	0.90	0.87	1.03	1.08	1.18	1.17	1.20	1.14	1.03	0.98	0.89	0.88
29	0.91	0.87	1.03	1.07	1.17	1.16	1.19	1.13	1.03	0.98	0.90	0.89
28	0.91	0.88	1.03	1.07	1.16	1.16	1.18	1.13	1.02	0.98	0.90	0.90
27	0.92	0.88	1.03	1.07	1.16	1.15	1.18	1.13	1.02	0.99	0.90	0.90
26	0.92	0.88	1.03	1.06	1.15	1.15	1.17	1.12	1.02	0.99	0.91	0.91
25	0.93	0.89	1.03	1.06	1.15	1.14	1.17	1.12	1.02	0.99	0.91	0.91
20	0.95	0.90	1.03	1.05	1.13	1.11	1.14	1.11	1.02	1.00	0.93	0.94
15	0.97	0.91	1.03	1.04	1.11	1.08	1.12	1.08	1.02	1.01	0.95	0.97
10	1.00	0.91	1.03	1.03	1.08	1.06	1.08	1.07	1.02	1.02	0.98	0.99
5	1.02	0.93	1.03	1.02	1.06	1.03	1.06	1.05	1.01	1.03	0.99	1.02
0	1.04	0.94	1.04	1.01	1.04	1.01	1.04	1.04	1.01	1.04	1.01	1.04
-5	1.06	0.91	1.04	1.00	1.02	0.99	1.02	1.03	1.00	1.05	1.03	1.06
-10	1.08	0.97	1.05	0.99	1.01	0.96	1.00	1.01	1.00	1.06	1.05	1.10
-15	1.12	0.98	1.05	0.98	0.98	0.94	0.97	1.00	1.00	1.07	1.07	1.12
-20	1.14	1.00	1.05	0.97	0.96	0.91	0.95	0.99	1.00	1.08	1.09	1.15
-25	1.17	1.01	1.05	0.96	0.94	0.88	0.93	0.98	1.00	1.10	1.11	1.18
-30	1.20	1.03	1.06	0.95	0.92	0.85	0.90	0.96	1.00	1.12	1.14	1.21
-35	1.23	1.04	1.06	0.94	0.89	0.82	0.87	0.94	1.00	1.13	1.17	1.25
-45	1.27	1.06	1.07	0.93	0.86	0.78	0.84	0.92	1.00	1.15	1.20	1.29
-42	1.28	1.07	1.07	0.92	0.85	0.76	0.82	0.92	1.00	1.16	1.22	1.31
-44	1.30	1.08	1.07	0.92	0.83	0.74	0.81	0.91	0.99	1.17	1.23	1.33
-46	1.32	1.10	1.07	0.91	0.82	0.72	0.79	0.90	0.99	1.17	1.25	1.35
-48	1.34	1.11	1.08	0.90	0.80	0.70	0.76	0.89	0.99	1.18	1.27	1.37
-50	1.37	1.12	1.08	0.89	0.77	0.67	0.74	0.88	0.99	1.19	1.29	1.41

Source: Dunne, T. and Leopold, L.B., 1978. Water in environmental planning, Freeman Publishers.