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PH4905-LET.03.REV.01

Ottawa Sivan Temple
2104 Roger Stevens Drive
Ottawa, Ontario
K0A 2T0

Attention: **Kula Sellathurai**

Subject: **Water Budget Assessment**
Proposed Temple Redevelopment
2104 Roger Stevens Drive Ottawa, Ontario

INTRODUCTION

Further to your request, Paterson Group (Paterson) has conducted a Water Budget Assessment in support of the stormwater management strategy for the proposed temple redevelopment located at 2104 Roger Stevens Drive in Ottawa, Ontario hereinafter referred to as the "subject site". Please refer to the attached Figure 1 - Key Plan for the approximate site location.

The area within the subject site that was considered for the water budget assessment has a footprint of approximately 10,206 m^2 and is currently occupied by the existing temple with associated private infrastructure and urban lawns / shallow rooted crops. A detailed description of the subject site including geological and hydrogeological conditions can be found in the most recent Paterson Group Reports PH4905-LET.02 and PG6832-1.

This report should be read in conjunction with the most recent Paterson Group Reports mentioned above and D.B. Gray Engineering Inc. Site Servicing Study, Stormwater Management And Development Within A Floodplain Report (Report No. 23024).

WATER BUDGET ASSESMENT

Thornthwaite and Mather Water Balance Calculations

When falling precipitation intercepts the ground, three possible outcomes arise. The water can either evaporate/transpire back into the atmosphere (evaporation/evapotranspiration), infiltrate into the surface soils (infiltration) or leave the area as runoff.

The method employed by Thornthwaite and Mather (1957) was used along with modelling software by Environment Canada's Engineering Climate Services Unit (EC-ECS) to determine the partitioning of water throughout various portions of the hydrologic cycle. Inputs into the modelling program included monthly temperature, precipitation, water holding capacities and site latitude. Using the long-term averages of these variables, it was possible to calculate annual potential and actual evapotranspiration, change in soil moisture storage and the water surplus.

The formula employed by Thornthwaite and Mather is as follows:

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

Where: S = surplus (mm/year)
R = annual runoff (mm/year)
I = annual infiltration (mm/year)
P = annual precipitation (mm/year)
ET = annual evapotranspiration (mm/year).

Shallow unsaturated soils within the study area generally consisted of topsoil or fill overlying a glacial till deposit with a silty sand to sandy silt matrix. Given the similar soil profiles across the entire study area, the above noted calculations were carried out for the soil water holding capacity of a fine sandy loam.

Based on the location of the site within the Ottawa area, climatic data was obtained from the climate station located at the McDonald-Cartier International Airport covering the period of January 1939 to December 2022. The information was provided by EC-ECS and is attached to this report.

Table 1, below, displays the soil types present within the study area and their associated water holding capacities (WHC) as well as the actual evapotranspiration (AET) and surplus data. For the purposes of this study, AET values were used as they account for accumulated soil moisture deficit. This deficit represents the volume of water retained within the available pore spaces of the soil and is subtracted from the potential evapotranspiration (PET) value to more accurately calculate the water surplus. The EC-ECS monthly/annual water budget data used in this assessment is attached to this report.

Table 1 - Site Specific Water Surplus Information			
Land Use Unit	**Water Holding Capacity (mm)**	**Actual Evapotranspiration (mm/year)**	**Surplus Water (mm/year)**
Impervious Surfaces	5	457	449
Permeable Pavers	5	457	449
Urban Lawns / Shallow Rooted Crops (Fine Sandy Loam)	75	525	378
Table reproduced using WHC values from MOE (2003) - Stormwater Management Planning and Design Manual and modelling data from Environment Canada's Engineering Climate Services Unit.			

Infiltration Factors

In order to break down the surplus water values for the various materials into infiltration and runoff, various factors must be considered. The MOE Stormwater Management Planning and Design Manual (2003) lists three main factors that contribute to surface water infiltration rates.

The first factor is topography, which is broken down further into three sections: flat and average slope, rolling land and hilly land. Flat and average slope provides the greatest potential for infiltration and has the largest infiltration factor applied to it (0.3), while the other two have progressively lower infiltration factors (rolling land is 0.2 and hilly land is 0.1).

The second factor is soil, which is also broken down further into three sections: tight impervious clay, medium combinations of clay and loam and open sandy loam. Open sandy loam provides the greatest potential for infiltration (infiltration factor of 0.4) while the other two have progressively lower potential for infiltration to occur (infiltration factor for medium combinations of clay and loam is 0.2 and for tight impervious clay is 0.1).

The final factor the MOE manual uses to partition infiltration from runoff is land cover. It is broken down into two sections: open fields/cultivated lands and woodlands. Woodlands have greater infiltration potential and an infiltration factor of 0.2. Open fields and cultivated lands have lower potential with an infiltration factor of 0.1. A summary of the MOE manual's descriptors and their associated infiltration factors is shown below in Table 2.

Table 2 - MOE (2003) Infiltration Factors	
Description of Area/Development Site	**Value of Infiltration Factor**
Topography	
Flat and average slope (<0.6 m/km)	0.30
Rolling land (slope of 2.8-3.8 m/km)	0.20
Hilly land (slope of 28-47 m/km)	0.10
Soil	
Tight impervious clay	0.10
Medium combinations of clay and loam	0.20
Open sandy loam	0.40
Cover	
Open fields/cultivated lands	0.10
Woodlands	0.20
Table reproduced from MOE (2003) - Stormwater Management Planning and Design Manual.	

The topography of the study area is classified as rolling land (generally 2 to 4 m/km throughout the subject site) under pre and post-development conditions. Therefore, a topography infiltration factor of 0.2 was given for the fine sandy loam materials analysed on this property. An infiltration factor of 0 was assigned to the impervious surfaces due to its negligible infiltration capacity.

The soils within the study area generally consisted of topsoil or fill overlying a glacial till deposit with a silty sand to sandy silt matrix. Therefore, a pre and post-development soil infiltration factor of 0.4 was given for the fine sandy loam materials analysed on this property. An infiltration factor of 0 was assigned to the impervious surfaces due to its negligible infiltration capacity.

At the time of the field investigations, the subject site generally consisted of urban lawns / shallow rooted crops and impervious surfaces. Under post-development conditions, the land cover will either remain unchanged in select areas or change to be urban lawns or impervious surfaces. A vegetation infiltration factor of 0.1 was assigned to fine sandy loam materials and 0 for the impervious surfaces.

Given that the permeable pavers are being proposed by the stormwater management design team as a mitigation measure to reduce the infiltration deficit under post-development conditions, a total infiltration factor of 0.7 was assigned to those areas since infiltration will be controlled by the infiltration potential of the subsoil materials (fine sandy loam).

It is important to note that the water budget analysis for the subject site does not consider any potential infiltration of impervious surfaces (100% runoff was taken as a conservative approach). In reality, some portion of surface water that lands on impervious surfaces either evaporates, infiltrates (asphalt is not 100% impervious) or is diverted to grassed areas where additional infiltration may occur. As such, the impervious surface runoff volumes should be considered a conservative estimate and not expected to definitively represent existing conditions.

The infiltration factors noted above are displayed on Tables 3-15 attached to this report.

Water Budget Calculations

Annual and Monthly water budget calculations were completed for the study area. It should be noted that the landcover areas used in the water budget calculations were based on the Site Plan that was available at the time of report preparation and are shown on the attached Paterson Drawings PH4905-1 Pre-Development Plan and PH4905-2 Post-Development Plan.

Details of the annual and monthly water budget assessments are provided in Table 3 and Tables 4-15, respectively, attached to this report. Details from the annual water budget assessment are also summarized below.

Pre-Development Water Budget

The annual pre-development water budget analysis conducted for the study area determined that an estimated 2,042,712 L/year of surplus water currently infiltrates the surface soils. The remaining estimated 1,991,662 L/year of surplus leaves the site as runoff.

Post-Development Water Budget Assessment – No Mitigation

The annual post-development water budget analysis without mitigation measures determined that an estimated 1,248,383 L/year of surplus water will infiltrate the surface soils and approximately 2,999,133 L/year will leave the site as runoff. These values equate to an approximate 39% decrease in infiltration and 51% increase in runoff.

Post-Development Water Budget Assessment – Mitigation

To reduce the estimated infiltration deficit as a result of the proposed redevelopment, the stormwater management design team has proposed replacing approximately 1,231 m^2 of impervious surfaces with permeable pavers as a mitigation measure. Therefore, by implementing this mitigation measure, the post-development water budget analyses determined that an estimated 1,635,286 L/year of surplus water will infiltrate the surface soils and approximately 2,612,230 L/year will leave the site as runoff. These values equate to an approximate 20% decrease in infiltration and 31 % increase in runoff.

CONCLUSIONS

As previously discussed, surficial soils at the subject site generally consisted of topsoil overlying a fill, which was overlying a glacial till deposit with a silty sand to sandy silt matrix.

As noted above, the results of the annual water budget analyses completed at the subject site indicated that an estimated 2,042,712 L/year of infiltration and 1,991,662 L/year of surface runoff are occurring under pre-development conditions. Under post development conditions, it is expected that there will be an approximate 39% infiltration deficit and a 51% increase in runoff if mitigation measures are not implemented to reduce the infiltration deficit. The stormwater management design team has developed a strategy to mitigate the infiltration deficit by installing approximately 1,231 m^2 of permeable pavers to increase the infiltration potential of the hard surfaces. This mitigation measure will reduce the infiltration deficit and increase in runoff to 20% and 31%, respectively.

We trust that the current submission satisfies your immediate requirements.

Best Regards,

Paterson Group Inc.

Oliver Blume, P.Geo.

Michael Laflamme, P.Geo.

Attachments:

- ❑ Figure 1 - Key Plan
- ❑ Table 3 - Annual Water Budget Calculation Tables
- ❑ Tables 4-15 - Monthly Water Calculation Tables
- ❑ Drawing PH4905-1 - Pre-Development Plan
- ❑ Drawing PH4905-2 - Post-Development Plan
- ❑ Environment Canada's Engineering Climate Services Water Budget Data

FIGURE 1

KEY PLAN

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Table 3 - Annual Water Budget Calculations

Pre-Development Annual Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
Impervious Surfaces	2,486	449	0	0	0	0	1	0	0	449	1,116,214
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	378	0.2	0.4	0.1	0.7	0.3	264.6	2,042,712	113.4	875,448
Total	**10,206**								**2,042,712**		**1,991,662**

Post-Development Annual Water Budget Calculations - No Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
Impervious Surfaces	5,488	449	0	0	0	0	1	0	0	449	2,464,112
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	378	0.2	0.4	0.1	0.7	0.3	264.6	1,248,383	113.4	535,021
Total	**10,206**								**1,248,383**		**2,999,133**
Difference (L/year)									**-794,329**		**1,007,471**
Percentage Variation									**-39%**		**51%**

Post-Development Annual Water Budget Calculations - Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
Impervious Surfaces	4,257	449	0	0	0	0	1	0	0	449	1,911,393
Permeable Pavers	1,231	449	0	0	0	0.7	0.3	314.3	386,903	134.7	165,816
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	378	0.2	0.4	0.1	0.7	0.3	264.6	1,248,383	113.4	535,021
Total	**10,206**								**1,635,286**		**2,612,230**
Difference (L/year)									**-407,426**		**620,568**
Percentage Variation									**-20%**		**31%**

Table 4 - January Water Budget Calculations

Pre-Development January Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	25	0	0	0	0	1	0	0	25	62,150
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	25	0.2	0.4	0.1	0.7	0.3	17.5	135,100	7.5	57,900
Total	**10,206**								**135,100**		**120,050**

Post-Development January Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	25	0	0	0	0	1	0	0	25	137,200
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	25	0.2	0.4	0.1	0.7	0.3	17.5	82,565	7.5	35,385
Total	**10,206**								**82,565**		**172,585**
Difference (L/year)									**-52,535**		**52,535**

Post-Development January Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	25	0	0	0	0	1	0	0	25	106,425
Permeable Pavers	1,231	25	0	0	0	0.7	0.3	17.5	21,543	7.5	9,233
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	25	0.2	0.4	0.1	0.7	0.3	17.5	82,565	7.5	35,385
Total	**10,206**								**104,108**		**151,043**
Difference (L/year)									**-30,993**		**30,993**

Table 5 - February Water Budget Calculations

Pre-Development February Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	27	0	0	0	0	1	0	0	27	67,122
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	26	0.2	0.4	0.1	0.7	0.3	18.2	140,504	7.8	60,216
Total	**10,206**								**140,504**		**127,338**

Post-Development February Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	27	0	0	0	0	1	0	0	27	148,176
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	26	0.2	0.4	0.1	0.7	0.3	18.2	85,868	7.8	36,800
Total	**10,206**								**85,868**		**184,976**
Difference (L/year)									**-54,636**		**57,638**

Post-Development February Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	27	0	0	0	0	1	0	0	27	114,939
Permeable Pavers	1,231	27	0	0	0	0.7	0.3	18.9	23,266	8.1	9,971
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	26	0.2	0.4	0.1	0.7	0.3	18.2	85,868	7.8	36,800
Total	**10,206**								**109,134**		**161,711**
Difference (L/year)									**-31,371**		**34,373**

Table 6 - March Water Budget Calculations

Pre-Development March Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	103	0	0	0	0	1	0	0	103	256,058
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	103	0.2	0.4	0.1	0.7	0.3	72.1	556,612	30.9	238,548
Total	**10,206**								**556,612**		**494,606**

Post-Development March Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	103	0	0	0	0	1	0	0	103	565,264
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	103	0.2	0.4	0.1	0.7	0.3	72.1	340,168	30.9	145,786
Total	**10,206**								**340,168**		**711,050**
Difference (L/year)									**-216,444**		**216,444**

Post-Development March Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	103	0	0	0	0	1	0	0	103	438,471
Permeable Pavers	1,231	103	0	0	0	0.7	0.3	72.1	88,755	30.9	38,038
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	103	0.2	0.4	0.1	0.7	0.3	72.1	340,168	30.9	145,786
Total	**10,206**								**428,923**		**622,295**
Difference (L/year)									**-127,689**		**127,689**

Table 7 - April Water Budget Calculations

Pre-Development April Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	110	0	0	0	0	1	0	0	110	273,460
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	110	0.2	0.4	0.1	0.7	0.3	77	594,440	33	254,760
Total	**10,206**								**594,440**		**528,220**

Post-Development April Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	110	0	0	0	0	1	0	0	110	603,680
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	110	0.2	0.4	0.1	0.7	0.3	77	363,286	33	155,694
Total	**10,206**								**363,286**		**759,374**
Difference (L/year)									**-231,154**		**231,154**

Post-Development April Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	110	0	0	0	0	1	0	0	110	468,270
Permeable Pavers	1,231	110	0	0	0	0.7	0.3	77	94,787	33	40,623
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	110	0.2	0.4	0.1	0.7	0.3	77	363,286	33	155,694
Total	**10,206**								**458,073**		**664,587**
Difference (L/year)									**-136,367**		**136,367**

Table 8 - May Water Budget Calculations											
Pre-Development May Water Budget Calculations											
Land Use Unit	**Area (m^2)**	**Water Surplus (mm)**	**Topography Factor**	**Soil Factor**	**Vegetation Factor**	**Infiltration Factor**	**Runoff Factor**	**Total Infiltration (mm/month)**	**Total Infiltration (L/month)**	**Total Runoff (mm/month)**	**Total Runoff (L/month)**
Impervious Surfaces	2,486	14	0	0	0	0	1	0	0	14	34,804
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	14	0.2	0.4	0.1	0.7	0.3	9.8	75,656	4.2	32,424
Total	**10,206**								**75,656**		**67,228**
Post-Development May Water Budget Calculations											
Land Use Unit	**Area (m^2)**	**Water Surplus (mm)**	**Topography Factor**	**Soil Factor**	**Vegetation Factor**	**Infiltration Factor**	**Runoff Factor**	**Total Infiltration (mm/month)**	**Total Infiltration (L/month)**	**Total Runoff (mm/month)**	**Total Runoff (L/month)**
Impervious Surfaces	5,488	14	0	0	0	0	1	0	0	14	76,832
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	14	0.2	0.4	0.1	0.7	0.3	9.8	46,236	4.2	19,816
Total	**10,206**								**46,236**		**96,648**
Post-Development May Water Budget Calculations With Mitigation											
Land Use Unit	**Area (m^2)**	**Water Surplus (mm)**	**Topography Factor**	**Soil Factor**	**Vegetation Factor**	**Infiltration Factor**	**Runoff Factor**	**Total Infiltration (mm/month)**	**Total Infiltration (L/month)**	**Total Runoff (mm/month)**	**Total Runoff (L/month)**
Impervious Surfaces	4,257	14	0	0	0	0	1	0	0	14	59,598
Permeable Pavers	1,231	14	0	0	0	0.7	0.3	9.8	12,064	4.2	5,170
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	14	0.2	0.4	0.1	0.7	0.3	9.8	46,236	4.2	19,816
Total	**10,206**								**58,300**		**84,584**
Difference (L/year)									**-17,356**		**17,356**

Table 9 - June Water Budget Calculations											
Pre-Development June Water Budget Calculations											
Land Use Unit	**Area (m^2)**	**Water Surplus (mm)**	**Topography Factor**	**Soil Factor**	**Vegetation Factor**	**Infiltration Factor**	**Runoff Factor**	**Total Infiltration (mm/month)**	**Total Infiltration (L/month)**	**Total Runoff (mm/month)**	**Total Runoff (L/month)**
Impervious Surfaces	2,486	5	0	0	0	0	1	0	0	5	12,430
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	4	0.2	0.4	0.1	0.7	0.3	2.8	21,616	1.2	9,264
Total	**10,206**								**21,616**		**21,694**
Post-Development June Water Budget Calculations											
Land Use Unit	**Area (m^2)**	**Water Surplus (mm)**	**Topography Factor**	**Soil Factor**	**Vegetation Factor**	**Infiltration Factor**	**Runoff Factor**	**Total Infiltration (mm/month)**	**Total Infiltration (L/month)**	**Total Runoff (mm/month)**	**Total Runoff (L/month)**
Impervious Surfaces	5,488	5	0	0	0	0	1	0	0	5	27,440
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	4	0.2	0.4	0.1	0.7	0.3	2.8	13,210	1.2	5,662
Total	**10,206**								**13,210**		**33,102**
Difference (L/year)									**-8,406**		**11,408**
Post-Development June Water Budget Calculations With Mitigation											
Land Use Unit	**Area (m^2)**	**Water Surplus (mm)**	**Topography Factor**	**Soil Factor**	**Vegetation Factor**	**Infiltration Factor**	**Runoff Factor**	**Total Infiltration (mm/month)**	**Total Infiltration (L/month)**	**Total Runoff (mm/month)**	**Total Runoff (L/month)**
Impervious Surfaces	4,257	5	0	0	0	0	1	0	0	5	21,285
Permeable Pavers	1,231	5	0	0	0	0.7	0.3	3.5	4,309	1.5	1,847
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	4	0.2	0.4	0.1	0.7	0.3	2.8	13,210	1.2	5,662
Total	**10,206**								**17,519**		**28,793**
Difference (L/year)									**-4,097**		**7,099**

Table 10 - July Water Budget Calculations

Pre-Development July Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	5	0	0	0	0	1	0	0	5	12,430
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	3	0.2	0.4	0.1	0.7	0.3	2.1	16,212	0.9	6,948
Total	**10,206**								**16,212**		**19,378**

Post-Development July Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	5	0	0	0	0	1	0	0	5	27,440
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	3	0.2	0.4	0.1	0.7	0.3	2.1	9,908	0.9	4,246
Total	**10,206**								**9,908**		**31,686**
Difference (L/year)									**-6,304**		**12,308**

Post-Development July Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	5	0	0	0	0	1	0	0	5	21,285
Permeable Pavers	1,231	5	0	0	0	0.7	0.3	3.5	4,309	1.5	1,847
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	3	0.2	0.4	0.1	0.7	0.3	2.1	9,908	0.9	4,246
Total	**10,206**								**14,216**		**27,378**
Difference (L/year)									**-1,996**		**8,000**

Table 11 - August Water Budget Calculations

Pre-Development August Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	5	0	0	0	0	1	0	0	5	12,430
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	1	0.2	0.4	0.1	0.7	0.3	0.7	5,404	0.3	2,316
Total	**10,206**								**5,404**		**14,746**

Post-Development August Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	5	0	0	0	0	1	0	0	5	27,440
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	1	0.2	0.4	0.1	0.7	0.3	0.7	3,303	0.3	1,415
Total	**10,206**								**3,303**		**28,855**
Difference (L/year)									**-2,101**		**14,109**

Post-Development August Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	5	0	0	0	0	1	0	0	5	21,285
Permeable Pavers	1,231	5	0	0	0	0.7	0.3	3.5	4,309	1.5	1,847
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	1	0.2	0.4	0.1	0.7	0.3	0.7	3,303	0.3	1,415
Total	**10,206**								**7,611**		**24,547**
Difference (L/year)									**2,207**		**9,801**

Table 12 - September Water Budget Calculations

Pre-Development September Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	17	0	0	0	0	1	0	0	17	42,262
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	3	0.2	0.4	0.1	0.7	0.3	2.1	16,212	0.9	6,948
Total	**10,206**								**16,212**		**49,210**

Post-Development September Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	17	0	0	0	0	1	0	0	17	93,296
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	3	0.2	0.4	0.1	0.7	0.3	2.1	9,908	0.9	4,246
Total	**10,206**								**9,908**		**97,542**
Difference (L/year)									**-6,304**		**48,332**

Post-Development September Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	17	0	0	0	0	1	0	0	17	72,369
Permeable Pavers	1,231	17	0	0	0	0.7	0.3	11.9	14,649	5.1	6,278
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	3	0.2	0.4	0.1	0.7	0.3	2.1	9,908	0.9	4,246
Total	**10,206**								**24,557**		**82,893**
Difference (L/year)									**8,345**		**33,683**

Table 13 - October Water Budget Calculations

Pre-Development October Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	41	0	0	0	0	1	0	0	41	101,926
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	14	0.2	0.4	0.1	0.7	0.3	9.8	75,656	4.2	32,424
Total	**10,206**								**75,656**		**134,350**

Post-Development October Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	41	0	0	0	0	1	0	0	41	225,008
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	14	0.2	0.4	0.1	0.7	0.3	9.8	46,236	4.2	19,816
Total	**10,206**								**46,236**		**244,824**
Difference (L/year)									**-29,420**		**110,474**

Post-Development October Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	41	0	0	0	0	1	0	0	41	174,537
Permeable Pavers	1,231	41	0	0	0	0.7	0.3	28.7	35,330	12.3	15,141
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	14	0.2	0.4	0.1	0.7	0.3	9.8	46,236	4.2	19,816
Total	**10,206**								**81,566**		**209,494**
Difference (L/year)									**5,910**		**75,144**

Table 14 - November Water Budget Calculations

Pre-Development November Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	56	0	0	0	0	1	0	0	56	139,216
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	38	0.2	0.4	0.1	0.7	0.3	26.6	205,352	11.4	88,008
Total	**10,206**								**205,352**		**227,224**

Post-Development November Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	56	0	0	0	0	1	0	0	56	307,328
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	38	0.2	0.4	0.1	0.7	0.3	26.6	125,499	11.4	53,785
Total	**10,206**								**125,499**		**361,113**
Difference (L/year)									**-79,853**		**133,889**

Post-Development November Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	56	0	0	0	0	1	0	0	56	238,392
Permeable Pavers	1,231	56	0	0	0	0.7	0.3	39.2	48,255	16.8	20,681
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	38	0.2	0.4	0.1	0.7	0.3	26.6	125,499	11.4	53,785
Total	**10,206**								**173,754**		**312,858**
Difference (L/year)									**-31,598**		**85,634**

Table 15 - December Water Budget Calculations

Pre-Development December Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	2,486	41	0	0	0	0	1	0	0	41	101,926
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	37	0.2	0.4	0.1	0.7	0.3	25.9	199,948	11.1	85,692
Total	**10,206**								**199,948**		**187,618**

Post-Development December Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	5,488	41	0	0	0	0	1	0	0	41	225,008
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	37	0.2	0.4	0.1	0.7	0.3	25.9	122,196	11.1	52,370
Total	**10,206**								**122,196**		**277,378**
Difference (L/year)									**-77,752**		**89,760**

Post-Development December Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
Impervious Surfaces	4,257	41	0	0	0	0	1	0	0	41	174,537
Permeable Pavers	1,231	41	0	0	0	0.7	0.3	28.7	35,330	12.3	15,141
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	37	0.2	0.4	0.1	0.7	0.3	25.9	122,196	11.1	52,370
Total	**10,206**								**157,526**		**242,048**
Difference (L/year)									**-42,422**		**54,430**

PATERSON GROUP
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NO.	REVISIONS	DATE	INITIAL

OTTAWA SIVAN TEMPLE
WATER BUDGET ASSESSMENT
PROPOSED TEMPLE RE-DEVELOPMENT
2104 ROGER STEVENS DRIVE
OTTAWA, **ONTARIO**

Title:

PRE-DEVELOPMENT PLAN

Scale: 1:1000	**Date:** 04/2025
Drawn by: GK	**Report No.:** PH4905-LET.03
Checked by: OB	**Dwg. No.:** PH4905-1
Approved by: ML	**Revision No.:**

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OTTAWA SIVAN TEMPLE
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POST-DEVELOPMENT PLAN

Scale: 1:1000	Date: 04/2025
Drawn by: GK	Report No.: PH4905-LET.03
Checked by: OB	Dwg. No.: PH4905-2
Approved by: ML	Revision No.:

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Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2022 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY... 5 MM HEAT INDEX... 36.77
LONG... 75.67 LOWER ZONE..... 3 MM A..... 1.081

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	62	12	14	0	0	0	25	82	5	294
28- 2	-9.0	56	11	16	1	1	0	27	111	5	350
31- 3	-2.8	65	31	77	6	6	0	103	67	5	416
30- 4	5.7	73	68	72	31	31	0	110	0	5	489
31- 5	13.1	75	75	0	80	64	-16	14	0	2	565
30- 6	18.3	85	85	0	116	82	-35	5	0	1	650
31- 7	20.9	88	88	0	136	83	-53	5	0	1	738
31- 8	19.7	85	85	0	118	80	-38	5	0	1	823
30- 9	14.8	82	82	0	75	64	-12	17	0	2	906
31-10	8.3	77	77	0	37	35	-2	41	0	4	78
30-11	1.3	76	59	8	10	10	0	56	9	5	154
31-12	-6.8	79	27	15	1	1	0	41	46	5	233
AVE	6.0 TTL	904	700	202	611	457	-156	449			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2022 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	26	15	17	1	1	0	28	44	0	59
28- 2	2.6	26	14	25	1	1	0	34	59	0	63
31- 3	2.6	28	22	48	5	5	0	55	87	0	70
30- 4	1.8	32	32	88	9	9	1	88	2	1	79
31- 5	1.8	34	34	2	12	16	20	24	0	2	94
30- 6	1.2	37	37	0	8	28	30	16	0	2	104
31- 7	1.2	44	44	0	8	32	34	20	0	2	116
31- 8	1.3	39	39	0	9	29	32	14	0	2	127
30- 9	1.4	39	39	0	8	17	17	27	0	2	131
31-10	1.5	37	37	1	7	7	7	34	0	2	37
30-11	1.8	27	27	8	4	4	0	26	13	0	45
31-12	3.0	30	22	14	1	1	0	29	34	0	54

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2022 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY... 75 MM HEAT INDEX... 36.77
LONG... 75.67 LOWER ZONE..... 45 MM A..... 1.081

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	62	12	14	0	0	0	25	82	74	294
28- 2	-9.0	56	11	16	1	1	0	26	111	74	350
31- 3	-2.8	65	31	77	6	6	0	103	67	75	416
30- 4	5.7	73	68	72	31	31	0	110	0	75	489
31- 5	13.1	75	75	0	80	80	0	14	0	56	565
30- 6	18.3	85	85	0	116	107	-9	4	0	30	650
31- 7	20.9	88	88	0	136	104	-32	3	0	11	738
31- 8	19.7	85	85	0	118	84	-34	1	0	11	823
30- 9	14.8	82	82	0	75	65	-10	3	0	25	906
31-10	8.3	77	77	0	37	36	-1	14	0	52	78
30-11	1.3	76	59	8	10	10	0	38	9	71	154
31-12	-6.8	79	27	15	1	1	0	37	46	74	233
AVE	6.0 TTL	904	700	202	611	525	-86	378			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2022 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	26	15	17	1	1	0	28	44	3	59
28- 2	2.6	26	14	25	1	1	0	34	59	3	63
31- 3	2.6	28	22	48	5	5	0	55	87	0	70
30- 4	1.8	32	32	88	9	9	0	88	2	1	79
31- 5	1.8	34	34	2	12	12	0	24	0	22	94
30- 6	1.2	37	37	0	8	17	18	16	0	29	104
31- 7	1.2	44	44	0	8	31	33	16	0	22	116
31- 8	1.3	39	39	0	9	29	31	4	0	22	127
30- 9	1.4	39	39	0	8	16	16	15	0	29	131
31-10	1.5	37	37	1	7	7	2	21	0	27	37
30-11	1.8	27	27	8	4	4	0	31	13	12	45
31-12	3.0	30	22	14	1	1	0	30	34	4	54