TATHAM ENGINEERING

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File 121088

July 23, 2025

John Rodgers
Rhemm Properties Ltd.
119 Fieldcrest Court
Clarksburg, Ontario N0H 1J0

Re: 372 Grey Road 21, Town of the Blue Mountains
Hydrogeological Water Balance Assessment

Dear John:

Tatham Engineering (Tatham) is pleased to provide Rhemm Properties Ltd. with the following Technical Letter summarizing the results of our Water Balance Assessment in support of the Official Plan Amendment (OPA) application, Zoning By-Law Amendment, and a Draft Plan of Subdivision for the property located at 372 Grey Road 21, Blue Mountains (the "site") as shown on Figure 1.

This letter was prepared in response to the Pre-Application Review comments received from The Town of Blue Mountains (the "Town") in February 2025 and subsequent correspondence with Grey County in March 2025. Specifically, this letter addresses the comments regarding the impact to the adjacent wetland complex through a water balance assessment. This assessment includes a scoped site-only feature-based water balance, comparing pre-to-post development conditions.

PRE-DEVELOPMENT SITE CONDITIONS

The total site area is 7.00 ha and bounded by the Georgian Trail to the northwest, the future Eden Oaks and Home Farm developments to the west, and undeveloped wooded lands to the south and east. The site is currently undeveloped, and tree covered, gently sloping from the southwest to the northeast towards an existing watercourse (Watercourse 6) along the Georgian Trail. Watercourse 6 travels along the property limits immediately adjacent to the Georgian trail and is regulated by the Grey Sauble Conservation Authority (GSCA). It is noted the catchment area for Watercourse 6 is considerably large, including at least 489.8 hectares of land, as illustrated on the Subwatershed Plan prepared by Crozier & Associated and enclosed for reference.

A 1.4 ha wetland complex is located in the northeastern corner of the site, within the catchment area for Watercourse 6. Approximately 3.47 ha of the site drains directly to the wetland complex overland as sheet flow, representing 0.7% of the overall catchment area for the wetland complex.

Subsurface and Groundwater Conditions

A geotechnical investigation was conducted for the site by Soil Engineers Ltd. (SEL) in 2022 and consisted of advancing seven boreholes to depths of 0.6 to 3.4 m bgs. In general, subsurface conditions consists of a surficial layer of topsoil, underlain by a sand and gravel deposit, overlying probable bedrock at a depth of 0.6 to 3.4 m. The boreholes were checked for groundwater upon completion of drilling. Groundwater was recorded at depths ranging from 0.4 to 2.4 m.

Based on measurements made over April to June 2023, groundwater levels are high on site and range from 0.47 to 3.01 m bgs across site Shallow groundwater is expected to flow northeastwards across site based on spring high groundwater levels collected by SEL in April 2022 as seen in Figure 1 enclosed for reference.

POST-DEVELOPMENT SITE CONDITIONS

It is our understanding the proposed development includes 53 single family detached homes and internal roadways. Access roads and Stormwater Management Facilities will be located on the proposed Eden Oak development lands.

Generally, development can alter drainage patterns through grading and reduce the amount of pervious surface due to the introduction of impervious features such as roads, driveways, and rooftops. This results in an increase in runoff and decline in infiltration.

WATER BALANCE ASSESSMENT

To assess the proposed development's impact to the adjacent wetland complex considering both pre- and post-development conditions, a feature-based water balance assessment was completed and is enclosed for reference. The assessment was limited to the site only; external drainage to wetland was excluded from the assessment.

The primary objective of a feature-based water balance (FBWB) is to reasonably estimate the current annual runoff and infiltration inputs for a specific feature, and then minimize the potential impacts to the feature as a result of development.

The site-only FBWB was completed in accordance with the *Hydrogeological Assessment Submissions – Conservation Authority Guidelines for Development Applications (2013)* using the Thornthwaite and Mather simplified engineering method for predicting annual rainfall surplus, as outlined by Steenhuis and Van Der Molen (1986).

Monthly precipitation and temperature normals from 1981 to 2010 were obtained from Environment Canada's Thornbury SLAMA Weather Station, located approximately 17 km west of the site. For this site,

the water surplus was calculated to be 406.6 mm/yr. The total water surplus represents the water available for either runoff or infiltration inputs.

Infiltration Input

The infiltration portion of the surplus is estimated using infiltration factors available from the Ministry of Environment and Energy (MOEE) Hydrogeological Technical Information Requirements for Land Development Applications (1995). The factors consider the slope of the site, the soil conditions, and land cover. To determine the site-specific infiltration factor for the site the following was considered:

- The topography on site has rolling land, with an average slope of 1.7% from an east to west direction, and a slope of 3.8% from a north to south direction.
- The native soils consist of coarse-textured deposits of sand, gravel, with minor silt and clay, however, it should be noted that infiltration is limited by outcrops of Paleozoic bedrock and shallow drift cover.
- The existing landcover predominantly consists of woodland.

Based on this information, the pre-development infiltration factor for the site was determined to be 0.55.

Under pre-development site conditions, the annual infiltration input from the site to the wetland complex is 7,760 m^3.

As previously described, the shallow groundwater is generally expected to flow toward the wetland complex. Because groundwater flow direction is controlled by subsurface gradients and cannot be altered through site grading, the infiltration catchment contributing to the wetland will remain the same under proposed conditions.

Based on the available Site Plan (Tatham, 2025), the post-development condition infiltration factor was determined to be 0.52.

Based on the available Site Plan (Tatham, 2025), the post-development annual infiltration input from the site to the wetland complex will be 6,228 m^3.

The annual infiltration deficit of 1,531 m^3 is the result of increased impervious areas including new roads, rooftops and driveways.

Runoff Input

The runoff portion of the surplus is calculated as the remainder of the surplus after infiltration.

Under pre-development site conditions, the annual runoff input from the site to the wetland complex is 6,349 m^3.

The surface runoff catchment is anticipated to change under proposed conditions as a result of site grading. A localized portion of the site that drains toward the wetland complex under existing conditions will be redirected through grading, thereby reducing the surface runoff contribution to the wetland.

Based on the available Site Plan (Tatham, 2025), the post-development annual runoff input from the site to the wetland complex will be 5,630 m^3.

The annual runoff deficit of 719 m^3 is the result of proposed grading, which reduces the area draining to the wetland complex.

MITIGATED POST-DEVELOPMENT CONDITIONS

To address the annual infiltration and runoff deficit contributing to the wetland complex, a proposed water balance assessment incorporating mitigative strategies was prepared.

Minor revisions to the site grading plan can be made during preliminary and detailed design to redirect more runoff from rooftops and rear yards towards the wetland complex. Additionally, topsoil depths will be increased through fill management to increase infiltration potential. The deficit in annual surplus can be reduced from 2,250 m^3 without mitigation to 462 m^3 through this regrading strategy, reflecting a best effort to achieve water balance for the wetland complex.

As previously noted, Watercourse 6 drains a substantial catchment area of approximately 489.8 hectares. The subject site contributes only 0.7% of this total area, indicating that any changes on-site will have a negligible influence on the overall hydrologic function of the wetland complex. Detailed calculations are enclosed for reference.

CLOSURE

This letter summarizes the results of the site-only FBWB assessment and demonstrates that a preliminary mitigation plan can be implemented through mitigative regrading and increased topsoil depths during preliminary and detailed design to provide a best effort to achieve site-only water balance to the wetland complex. Given that the site represents only a small fraction of the overall catchment, the influence of any changes from this development on the wetland complex is expected to be negligible.

Yours truly,

Tatham Engineering Limited

Alysse Overholt, P.Eng.
Engineer
ARO/SS: ha

Supriya Singh, M.Sc., P.Geo.
Hydrogeologist, Project Manager

O:\Collingwood\2021 Projects\121088 - 372 Grey Road 21\Documents\Reports\HydroG- FBWB\Report\L - 121088 372 Grey Rd 21 Water Balance Assessment (July 11 2025).docx

REFERENCES

Armstrong and Dodge, 2007. Paleozoic Geology of Southern Ontario.

Crozier Consulting Engineers, 2020. Eden Oak Servicing & Stormwater Management Implementation Report.

Lake Simcoe Region Conservation Authority (LSRCA), 2013. Hydrogeological Assessment Submissions – Conservation Authority Guidelines for Development Applications.

Ministry of Environment and Energy (MOEE), 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications.

Ontario Geological Survey (OGS), 2003. Surficial Geology of Ontario.

Soil Engineers Ltd., 2022. Geotechnical Investigation for Proposed Residential Development. 372 Grey Road 21 West, Town of Blue Mountain.

Soil Engineers Ltd., 2023. Draft Hydrogeological Study for Proposed Residential Development. 372 Grey Road 21 West, Town of Blue Mountain.

Steenhuis and Van Der Molen, 1986. The Thornthwaite-Mather Procedure as a Simple Engineering Method to Predict Recharge.

Tatham, 2024. 372 Grey Road 21 West. Preliminary Stormwater Management Report.

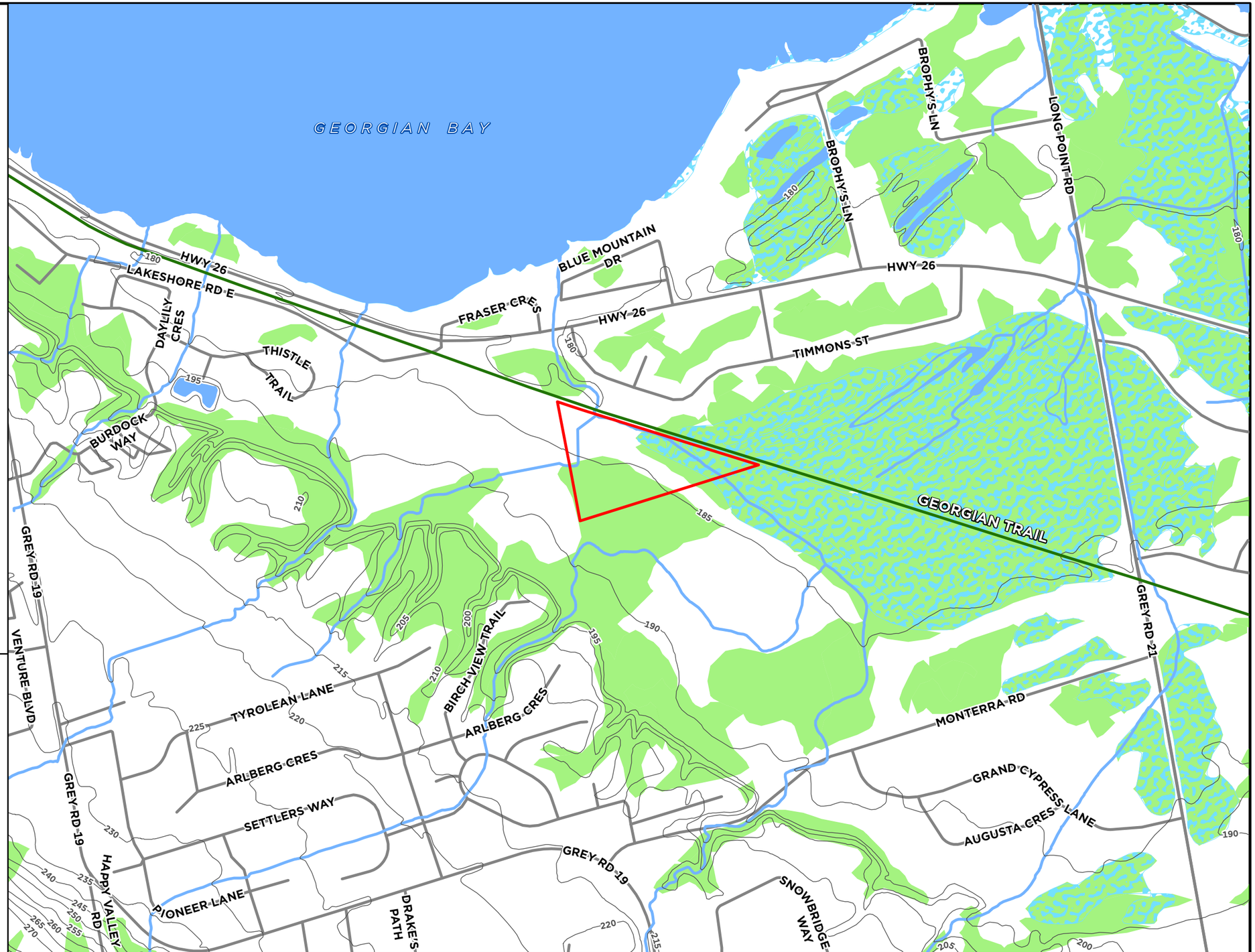
Attachments

N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- CONTOUR
- GEORGIAN TRAIL
- WETLAND
- ROADS
- WATERCOURSE
- WOODED AREA
- WATERBODY



0 200 400 800 METERS

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372 GREY ROAD 21
WATER BALANCE
SITE LOCATION PLAN

DWG. No. **FIG-1**

SCALE: 1:10,000	DRAWN: AO	DATE: MAY. 2025	JOB NO. 121088

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LEGEND

- EX. 5.0m CONTOUR
- EX. DRAINAGE FEATURE
- EX. ROAD
- DRAINAGE CATCHMENT
- 701 / 146.7 — CATCHMENT I.D. / AREA (ha)
- SUBJECT PROPERTY

372 GREY RD. 21

GEORGIAN BAY

CRAIGLEITH

NODE 1 (SWMF INLET)

NODE 2

NODE 3

HWY 26

GEORGIAN TRAIL

WATERCOURSE 7 (REGIONAL EVENT) 9.7m³/s

WATERCOURSE 6

WATERCOURSE 7

ROAD 19

6071	25.8
6062	11.7
6065	5.6
6064	7.5
6063	26.3
7021	34.5
6061	23.5
605	63.0
701	146.7
602	123.0
603	136.0
601	144.3

NOTES:

1. 5.0m CONTOURS (2.5m CONTOURS ARE INTERPOLATED)
2. CFCA UPDATED SUBWATERSHED DELINEATIONS

Project: EDEN OAK
TOWN of THE BLUE MOUNTAINS

Drawing: CFCA REVISED DELINEATION OF SUBWATERSHEDS 6 & 7
POST-DEVELOPMENT – CONTROLLED

CROZIER & ASSOCIATES Consulting Engineers
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www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	J.R.S.	Design By	K.M.	Project	218-2659
Scale	1: 15 000	Date	07/28/2020	Check By	K.M.
				Drawing	FIG. 5

J:\200\218 - Eden Oak\2659\CAD_Sheets\2659_203, 207.dwg, 207 - FIG. 5, 2020-09-25 8:59:41 AM, jpereira

N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

KIMHEATHER COURT

TIMMONS STREET

GEORGIAN TRAIL

BH/MW3
▽183.22

183

183.5

BH/MW7
▽183.73

184

BH/MW10
▽184.6

184.5

185

BH/MW9
▽184.59

LEGEND

- SITE
- MONITORING WELLS (DRILLED BY SOIL ENGINEERS LTD.)
- WOODED AREA
- WATERCOURSE
- ROAD
- WETLAND
- GEORGIAN TRAIL
- GROUNDWATER CONTOUR
- GROUNDWATER ELEVATION (MEASURED APRIL 27, 2022)
- GROUNDWATER FLOW DIRECTION

0 37.5 75 150 METERS

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372 GREY ROAD 21
FEATURE BASED WATER BALANCE REPORT
GROUNDWATER CONTOUR

DWG. No. **FIG-1**

SCALE: 1:2,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 121088

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LEGEND

EX. MAJOR OVERLAND FLOW DIRECTION

WATERCOURSE 6

INFILTRATION DRAINAGE BOUNDARY

RUNOFF DRAINAGE BOUNDARY

AREA (HA) | I.F. | IMP%

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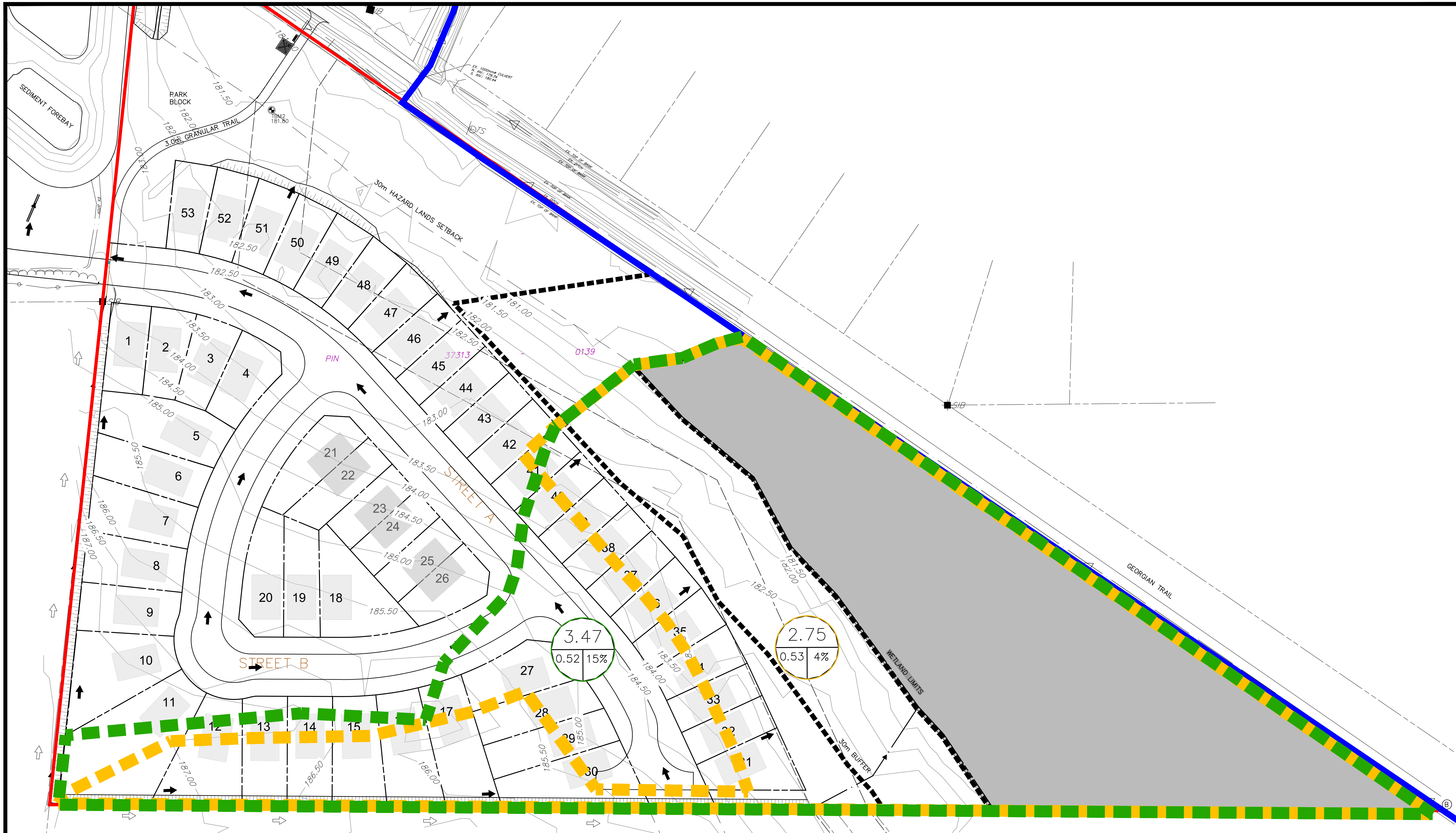
372 GREY ROAD 21
TOWN OF THE BLUE MOUNTAINS
FEATURE BASED WATER BALANCE
PRE-DEVELOPMENT CONDITIONS

DWG. No. **FBWB.1**

SCALE: 1:1250 | DRAWN: ARO | DATE: JUL2025 | JOB NO. 121088

Drawing Name: 121088-FBWB01.dwg, Plotted: Jul 14, 2025



LEGEND

PROP. MAJOR OVERLAND FLOW DIRECTION	➔
WATERCOURSE 6	(blue line)
INFILTRATION DRAINAGE BOUNDARY	(green dashed line)
RUNOFF DRAINAGE BOUNDARY	(orange dashed line)

AREA (HA)
I.F. | IMP%

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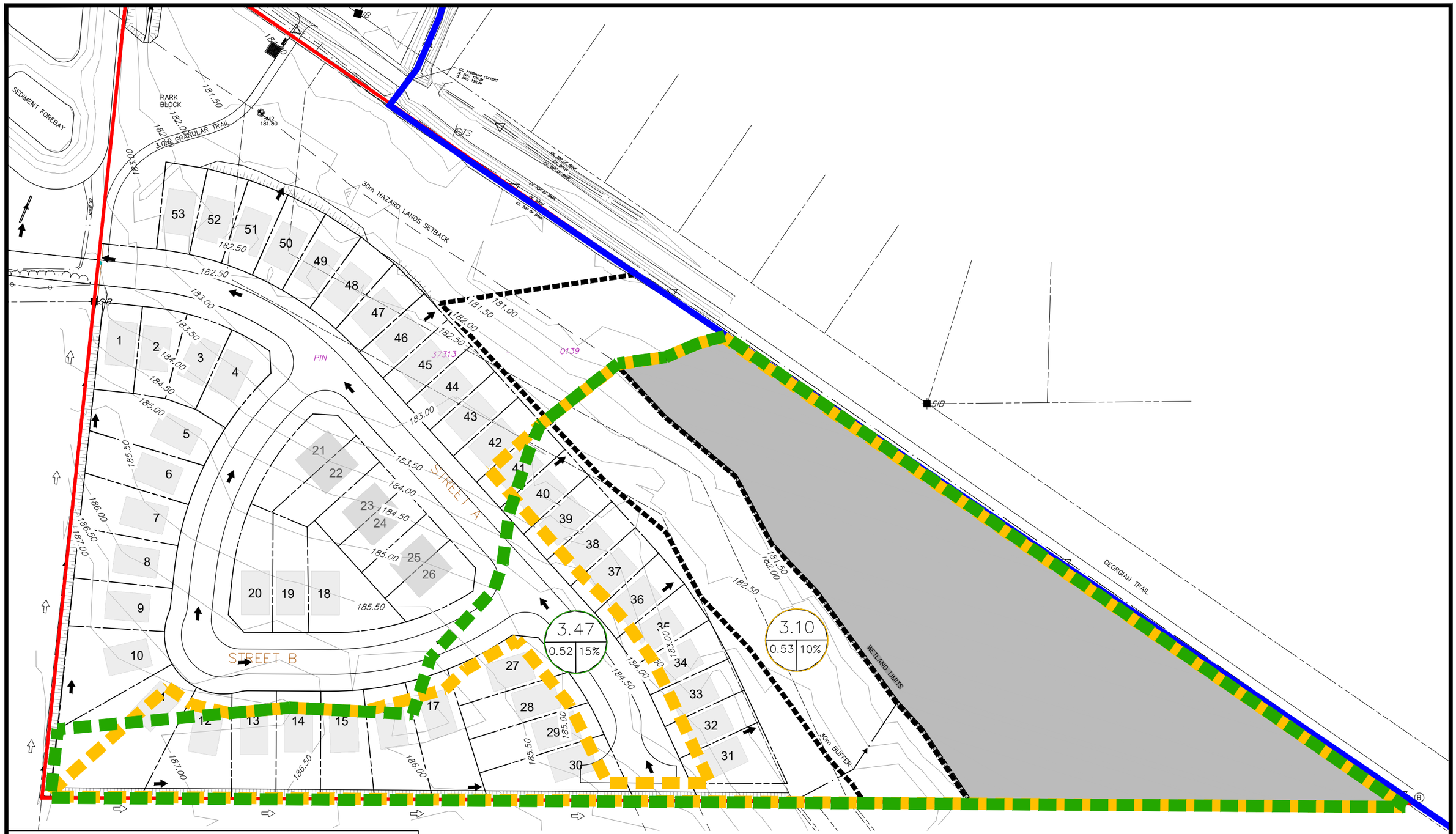
372 GREY ROAD 21
TOWN OF THE BLUE MOUNTAINS
FEATURE BASED WATER BALANCE
POST-DEVELOPMENT CONDITIONS

DWG. No. **FBWB.2**

SCALE: 1:1250	DRAWN: ARO	DATE: JUL2025	JOB NO. 121088

Drawing Name: 121088-FBWB01.dwg, Plotted: Jul 14, 2025



LEGEND

PROP. MAJOR OVERLAND FLOW DIRECTION

WATERCOURSE 6

INFILTRATION DRAINAGE BOUNDARY

RUNOFF DRAINAGE BOUNDARY

AREA (HA) | I.F. | IMP%

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372 GREY ROAD 21
TOWN OF THE BLUE MOUNTAINS
FEATURE BASED WATER BALANCE
MITIGATED POST-DEVELOPMENT CONDITIONS

DWG. No. **FBWB.3**

SCALE: 1:1250 | DRAWN: ARO | DATE: JUL2025 | JOB NO. 121088

Drawing Name: 121088-FBWB01.dwg, Plotted: Jul 14, 2025

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Water Budget
Climate Normal Data

Project Details

372 Grey Road 21	121088

Prepared By

ARO	July 3 2025

Water Budget Details

Methodology	Thornthwaite Method
Climate Data & Source	Thornbury SLAMA
	Climate Normal Data for 1984 to 2003 (Environment Canada)
Thornthwaite Coefficient	1.056

Month	Temp (°C)	Precip (mm)	Heat Index	PET (mm)	Daylight Factor	Days	Average Day Length	Adjusted PET (mm)	AET (mm)	Surplus (mm)	Deficit (mm)
Jan.	-6.3	100	0.0	0.0	0.77	31	9.290	0.0	0.0	100.0	0.0
Feb.	-5.4	68.4	0.0	0.0	0.87	28	10.464	0.0	0.0	68.4	0.0
Mar.	-1.5	64	0.0	0.0	1.00	31	11.941	0.0	0.0	64.0	0.0
Apr.	5.5	65.3	1.2	25.7	1.12	30	13.483	28.9	28.9	36.4	0.0
May	11.5	82.7	3.5	56.0	1.23	31	14.800	71.4	71.4	11.3	0.0
Jun.	16.7	79.1	6.2	83.0	1.29	30	15.477	107.1	79.1	0.0	28.0
Jul.	19.8	72.1	8.0	99.4	1.26	31	15.144	129.6	72.1	0.0	57.5
Aug.	19.2	78.2	7.7	96.2	1.17	31	13.989	115.9	78.2	0.0	37.7
Sep.	15.5	95.9	5.5	76.7	1.04	30	12.513	80.0	80.0	15.9	0.0
Oct.	9.1	87.3	2.5	43.7	0.92	31	10.983	41.4	41.4	45.9	0.0
Nov.	3.1	99.6	0.5	14.0	0.80	30	9.625	11.3	11.3	88.3	0.0
Dec.	-2.7	99.4	0.0	0.0	0.74	31	8.909	0.0	0.0	99.4	0.0
Total	**-**	**992**	**35.1**	**494.8**	**-**	**365**	**-**	**585.4**	**462.3**	**529.7**	**123.1**
Total Water Surplus											**406.6**

Additional Notes

PET = Potential Evapotranspiration; AET = Actual Evapotranspiration

Equations

$PET = 16\left(\frac{L}{12}\right)\left(\frac{N}{30}\right)\left(\frac{10T_d}{I}\right)^{\alpha}$ Where

PET is the estimated potential evapotranspiration (mm/month)

T_d is the average daily temperature (degrees Celsius; if this is negative, use 0) of the month being calculated

N is the number of days in the month being calculated

L is the average day length (hours) of the month being calculated

$\alpha = (6.75 \times 10^{-7})I^3 - (7.71 \times 10^{-5})I^2 + (1.792 \times 10^{-2})I + 0.49239$

$I = \sum_{i=1}^{12}\left(\frac{T_{m_i}}{5}\right)^{1.514}$ is a heat index which depends on the 12 monthly mean temperatures T_{m_i}.[1]

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Feature Base Water Budget

Pre and Post Development Comparison

Project Details

372 Grey Road 21	121088

Prepared By

ARO	July 3 2025

Pre-Development Catchment Details

	Infiltration	Runoff
Area (ha)	3.47	3.47
Pervious Area (ha)	3.47	3.47
Impervious Area (ha)	0.00	0.00

Post Development Catchment Details

	Infiltration	Runoff
Area (ha)	3.47	2.75
Pervious Area (ha)	2.96	2.64
Impervious Area (ha)	0.51	0.11

Infiltration Factor

	Pre-Development	
Infiltration Factor	Pervious	Impervious
Topography	0.150	0.0
Soil	0.200	0.0
Land Cover	0.200	0.0
Infiltration Factor	0.550	0.0

	Post Development	
	Pervious	Impervious
	0.150	0.0
	0.200	0.0
	0.168	0.0
	0.518	0.0

Water Budget	Pre-Development					Post-Development				
	Infiltration		Runoff			Infiltration		Runoff		
Water Budget	Pervious	Impervious	Pervious	Impervious	Total	Pervious	Impervious	Pervious	Impervious	Total
Water Surplus (m^3)	14,109	0	14,109	0		12,025	2,084	10,718	464	
Infiltration (m^3)	7,760	0			7,760	6,228	0			6,228
Runoff (m^3)			6,349	0	6,349			5,166	464	5,630
Reduction in Volume to Wetland (m^3)										**2,250**

Additional Notes

Assessment limited to development site, external drainage to wetland not accounted for.

Infiltration Factors

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

(Stormwater Planning and Design Manual. MOE, 2003.)

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Feature Base Water Budget

Pre and Post Development Comparison

Project Details

372 Grey Road 21	121088

Prepared By

ARO	July 3 2025

Pre-Development Catchment Details

	Infiltration	Runoff
Area (ha)	3.47	3.47
Pervious Area (ha)	3.47	3.47
Impervious Area (ha)	0.00	0.00

Mitigated Post Development Catchment Details

	Infiltration	Runoff
Area (ha)	3.47	3.10
Pervious Area (ha)	2.96	2.77
Impervious Area (ha)	0.51	0.33

Infiltration Factor

	Pre-Development	
Infiltration Factor	Pervious	Impervious
Topography	0.150	0.0
Soil	0.200	0.0
Land Cover	0.200	0.0
Infiltration Factor	0.550	0.0

	Post Development	
	Pervious	Impervious
	0.150	0.0
	0.200	0.0
	0.168	0.0
	0.518	0.0

Water Budget	Pre-Development					Post-Development				
	Infiltration		Runoff			Infiltration		Runoff		
Water Budget	Pervious	Impervious	Pervious	Impervious	Total	Pervious	Impervious	Pervious	Impervious	Total
Water Surplus (m^3)	14,109	0	14,109	0		12,025	2,084	11,271	1,334	
Infiltration (m^3)	7,760	0			7,760	6,228	0			6,228
Runoff (m^3)			6,349	0	6,349			5,433	1,334	6,766
Reduction in Volume to Wetland (m^3)										**1,114**

Additional Notes

Assessment limited to development site, external drainage to wetland not accounted for.

Infiltration Factors

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

(Stormwater Planning and Design Manual. MOE, 2003.)

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Water Budget

Mitigation Measures - Increase Topsoil Depth

Project Details

372 Grey Road 21	121088

Prepared By

ARO	July 3 2025

Increase Topsoil Depth Design

Existing Topsoil Depth (m)	0.28
Proposed Lawn Area (ha)	0.95
Proposed Topsoil Depth (m)	0.43
Percentage of Pervious Area	32%
Percent Reduction in Runoff	35%
Reduction in Pervious Runoff	11%
Reduction in Pervious Runoff (m^3)	652

Additional Notes

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Water Budget
Summary

Project Details

372 Grey Road 21	121088

Prepared By

ARO	July 3 2025

Summary

	Pre-Development	Post-Development	Change
Infiltration (m^3)	7,760	6,228	-1,531
Runoff (m^3)	6,349	5,630	-719
Total (m^3)	14,109	11,858	-2,250

Proposed Infiltration Measures

- x Mitigative Grading
- x Increase Topsoil Depth

Mitigation - Mitigative Grading (m^3)	1,137
Mitigation - Increase Topsoil Reduction in Pervious Runoff (m^3)	652
Proposed Runoff (m^3)	6,766
Runoff Change after Mitigation (m^3)	418
Proposed Infiltration (m^3)	6,880
Infiltration Change after Mitigation (m^3)	-879
Total Change after Mitigation (m^3)	-462

Additional Notes