APPENDIX C

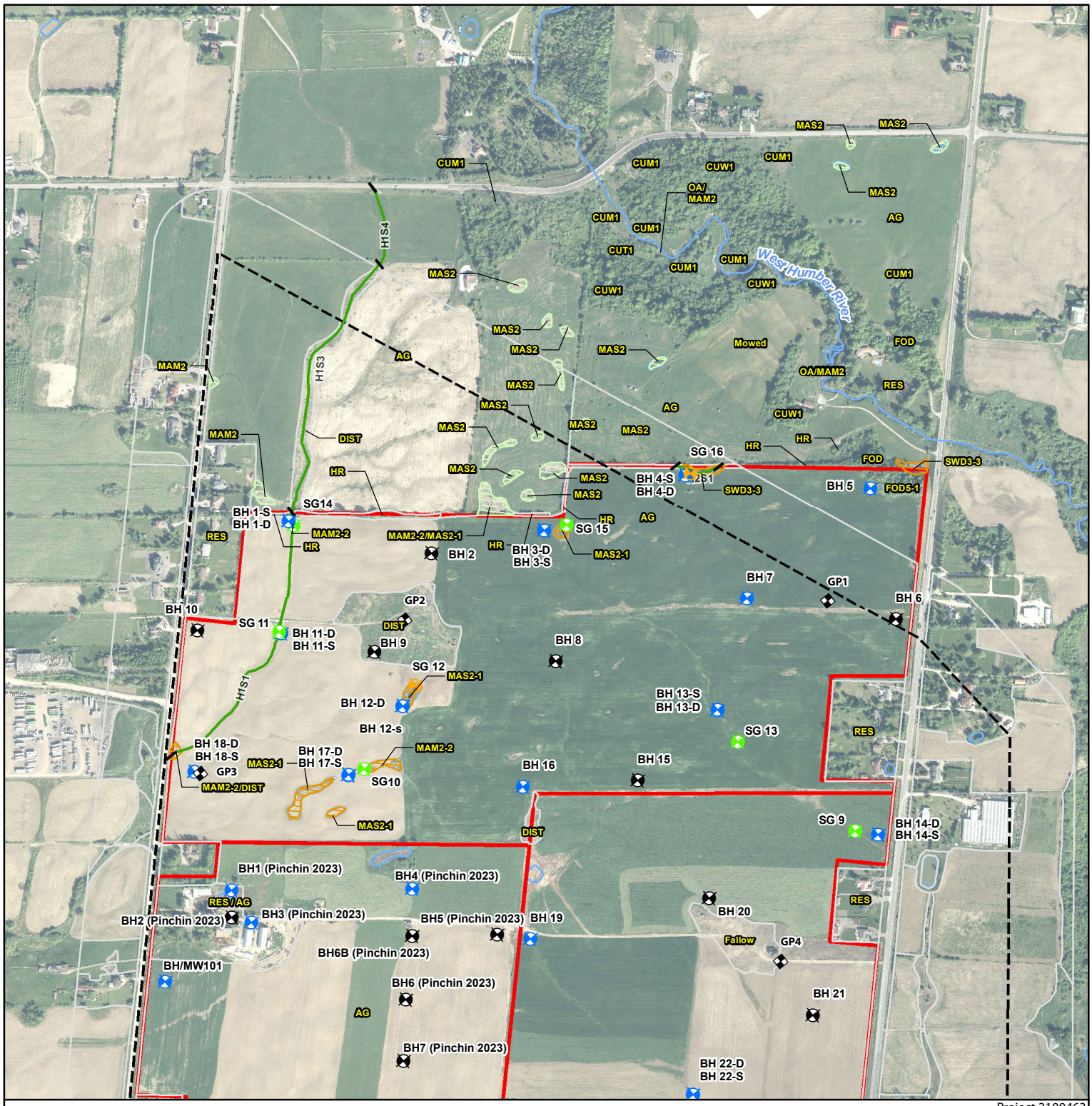
GROUNDWATER

SCS consulting group ltd

GEI Consultants

APPENDIX C1

FIGURES



Project 2100463

NOTES:

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* Non-participating lands were assessed through air photo interpretation to the ELC Ecosite level.

Legend

- Wildfield Village Study Area
- Participating Landowner
- Ecological Land Classification *
- Waterbody
- Watercourse (TRCA)
- Borehole Location
- Borehole/Monitoring Well Location
- Staff Gauge Location
- Staff Gauge/Seepage Meter Location
- Guelph Permeameter

Headwater Drainage Feature

Management Recommendations

- Mitigation
- Conservation
- Protection

Wetland Evaluation (GEI Consultants Ltd.)

- Other Wetland
- Unevaluated Wetland

ELC LEGEND

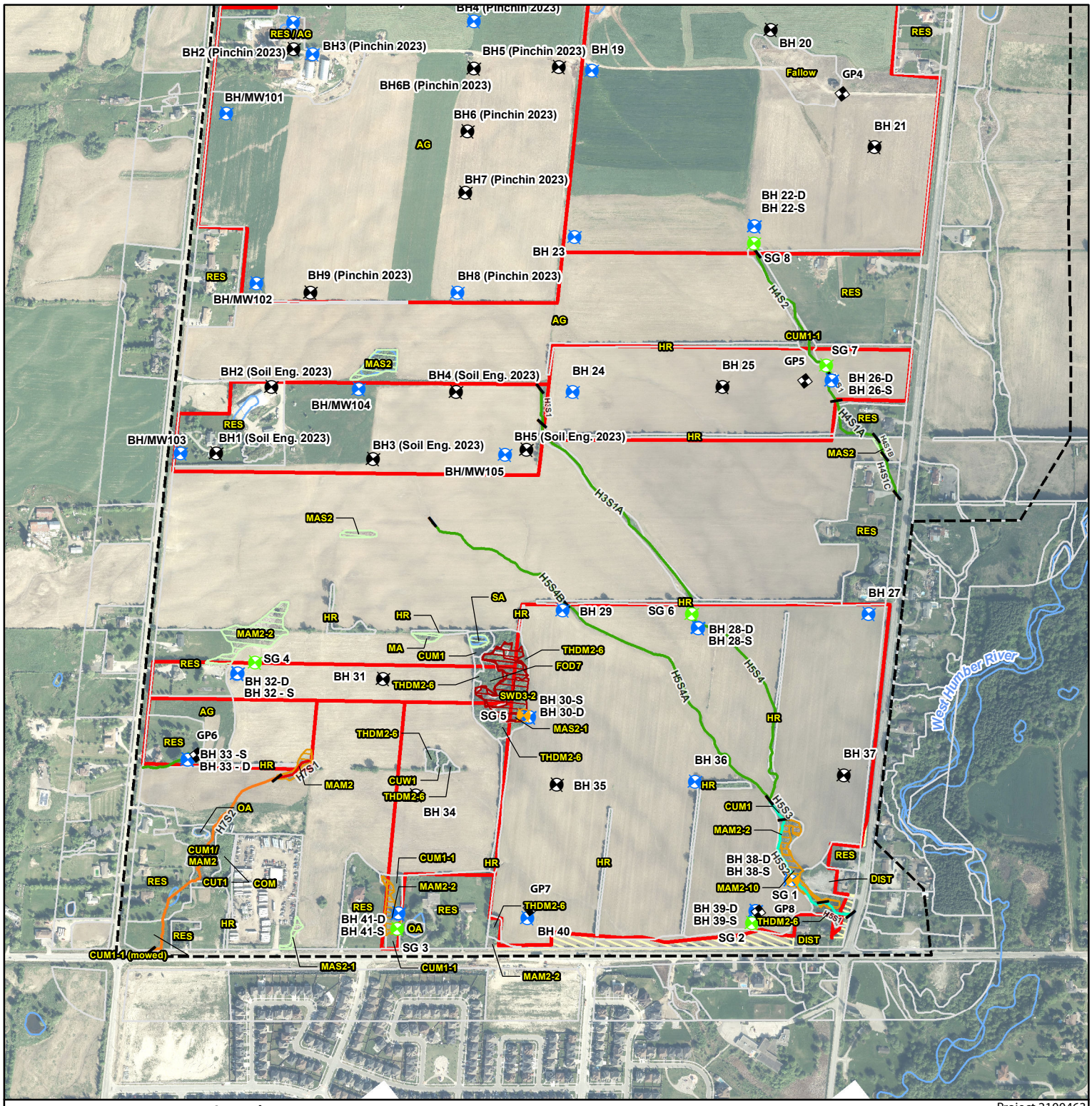
AG, Agricultural
COM, Commercial
CUM1, Mineral Cultural Meadow
CUM1-1, Mineral Cultural Meadow
CUT1, Mineral Cultural Thicket
CUW1, Mineral Cultural Woodland
DIST, Disturbed
FOD, Deciduous Forest
FOD5-1, Dry – Fresh Sugar Maple Deciduous Forest
FOD7, Fresh – Moist Lowland Deciduous Forest
Fallow, Fallow
HR, Hedgerow
MA, Marsh
MAM2, Mineral Meadow Marsh
MAM2-10, Forb Mineral Meadow Marsh
MAM2-2, Reed Canary Grass Mineral Meadow Marsh
MAS2, Mineral Shallow Marsh
MAS2-1, Cattail Mineral Shallow Marsh
Mowed, Mowed
OA, Open Aquatic
OA/MAM2, Open Aquatic/Mineral Meadow Marsh
RES, Residential
SA, Shallow Aquatic
SWD3-2, Silver Maple Mineral Deciduous Swamp
SWD3-3, Swamp Maple Mineral Deciduous Swamp
THDM2-6, Buckthorn Deciduous Shrub Thicket

Hydrogeological Investigation
Wildfield Village Landowner Group

Figure 3.1
Observed Natural Heritage Features with Borehole Locations

0 100 m
1:10,000

GEI Consultants



Project 2100463

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Legend

- Wildfield Village Study Area
- Road Easement
- Participating Landowner
- Ecological Land Classification *
- Watercourse (GEI Consultants Ltd.)
- Waterbody
- Watercourse (TRCA)
- Borehole Location
- Borehole/Monitoring Well Location
- Staff Gauge Location
- Staff Gauge/Seepage Meter Location
- Guelph Permeameter

Headwater Drainage Feature Management Recommendations

- Mitigation
- Conservation
- Protection

Wetland Evaluation (GEI Consultants Ltd.)

- Significant Wetland
- Other Wetland
- Unevaluated Wetland

ELC LEGEND

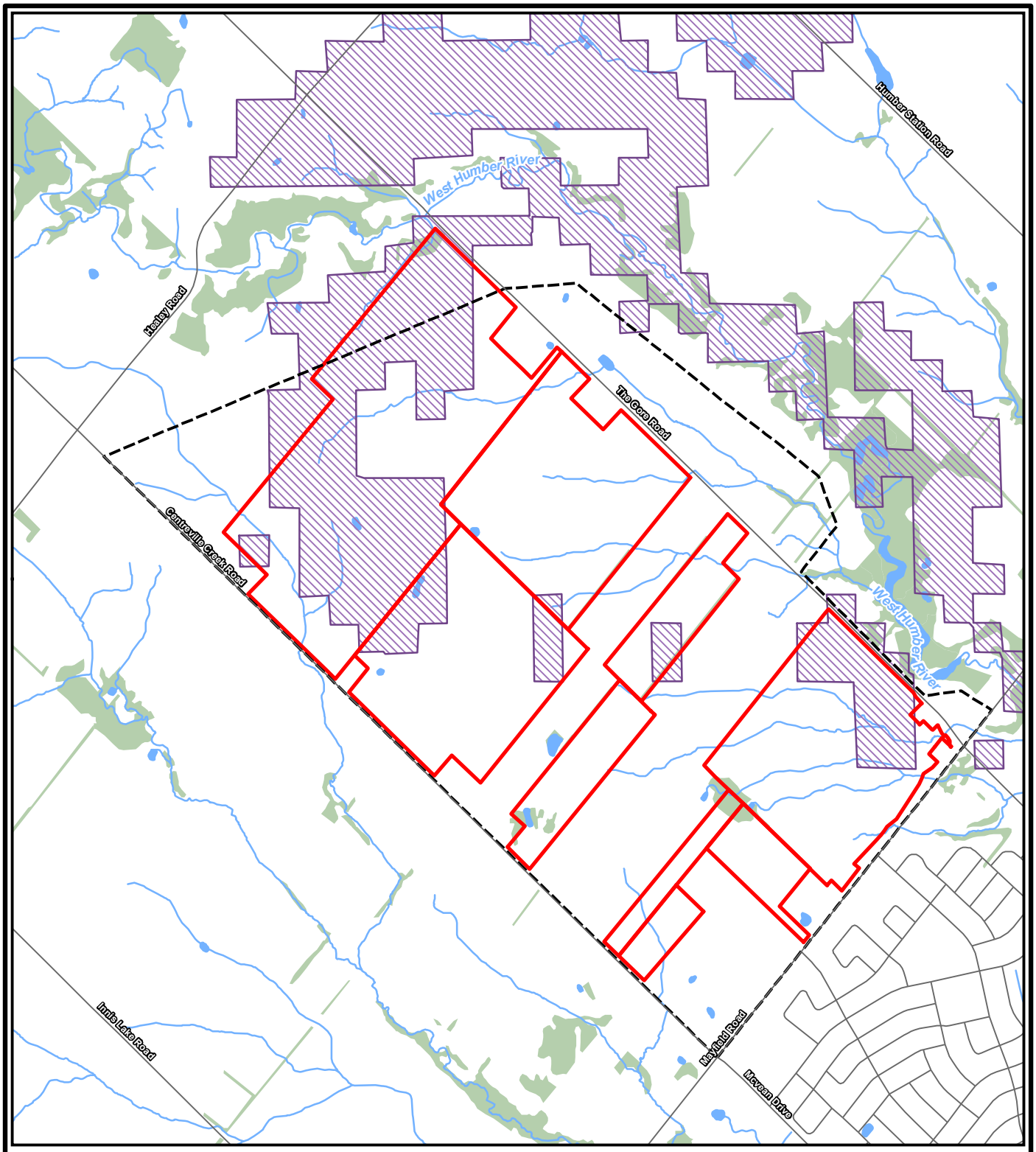
AG, Agricultural
COM, Commercial
CUM1, Mineral Cultural Meadow
CUM1-1, Mineral Cultural Meadow
CUT1, Mineral Cultural Thicket
CUW1, Mineral Cultural Woodland
DIST, Disturbed
FOD, Deciduous Forest
FOD5-1, Dry – Fresh Sugar Maple Deciduous Forest
FOD7, Fresh – Moist Lowland Deciduous Forest
Fallow, Fallow
HR, Hedgerow
MA, Marsh
MAM2, Mineral Meadow Marsh
MAM2-10, Forb Mineral Meadow Marsh
MAM2-2, Reed Canary Grass Mineral Meadow Marsh
MAS2, Mineral Shallow Marsh
MAS2-1, Cattail Mineral Shallow Marsh
Mowed, Mowed
OA, Open Aquatic
OA/MAM2, Open Aquatic/Mineral Meadow Marsh
RES, Residential
SA, Shallow Aquatic
SWD3-2, Silver Maple Mineral Deciduous Swamp
SWD3-3, Swamp Maple Mineral Deciduous Swamp
THDM2-6, Buckthorn Deciduous Shrub Thicket

Hydrogeological Investigation
Wildfield Village Landowner Group

Figure 3.2
Observed Natural Heritage Features with Borehole Locations

0 100 m
1:10,000

GEI Consultants



NOTES:
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Legend

- Participating Properties
- Wildfield Village Secondary Plan Area
- Road
- Watercourse
- Waterbody
- Wooded Area
- Highly Vulnerable Aquifer (TRCA 2023)

N

0 150 300 m

1:19,000

Hydrogeological Investigation
Wildfield

Wildfield Village Landowners Group Inc.

GEI Consultants

Project 2100463

HIGHLY VULNERABLE AQUIFER

January 2025

Fig. 3.3

APPENDIX C2

TABLES

Table 3.1: Typical Drawdown Assumed for Various Construction Dewatering Efforts and Corresponding Radius of Influence

Potential Dewatering Location	Potential Drawdown (m)	ROI (m)[1]
Typical Site Servicing	5.0	10.6
Typical Residential Block	3.0	6.4
Typical Urban Corridor Block	7.0	14.8
Typical SWM Facility	4.0	8.5

1- Radius of Influence computed using the Sichardt equation.

Table 3.2: Estimated Rates of Construction Dewatering for Various Scenarios in the Proposed Development.

Potential Dewatering Location	Construction Dewatering Flow Estimate Without Safety Factor (L/day)[1]	Construction Dewatering Flow Estimate Including Safety Factor of 2.0 (L/day)[1]	Construction Dewatering Flow Estimate Including Safety Factor of 2.0 and a 10 mm Rainfall Event (L/day)
Typical Site Servicing	31,900	63,700	69,700
Typical Residential Block	7,300	14,600	63,600
Typical Urban Corridor Block	78,100	156,200	254,200
Typical SWM Facility	93,800	187,600	587,600

1- Accounts for contributions from groundwater only (i.e., precipitation is excluded).

Table 3.3: Typical Drawdown Assumed for Long-Term Foundation Drainage at Proposed Buildings and Corresponding Radius of Influence

Potential Dewatering Location	Potential Drawdown (m)	ROI (m)
Assumed Typical Residential Building (Single Detached Home or Smaller)	2.8	5.9
Assumed Urban Corridor Building	6.8	14.4

1- Accounts for contributions from groundwater only (i.e., precipitation is excluded).

Table 3.4: Estimated Rates for Long-Term Foundation Drainage for Anticipated Buildings.

Potential Dewatering Location	Permanent Dewatering Flow Estimate Without Safety Factor (L/day)	Permanent Dewatering Flow Estimate Including Safety Factor of 2.0 (L/day)
Assumed Typical Residential Building (Single Detached Home or Smaller)	6,060	12,120
Assumed Urban Corridor Building	76,300	152,600

Table 3.5: Summary of Subwatershed Catchment Characteristics used in Water Balance Estimation.

Subwatershed	Developable Area	Overall Percent Imperviousness
36.10	38.43 ha	71%
36.11	53.83 ha	78%
38.04	105.68 ha	76%
38.05	5.80 ha	71%
38.06	149.65	74%

Table 3.6: Summary of Results of Water Balance Estimates.

Condition	Permeable Areas	Impermeable Areas	Average Annual Runoff Volume (m^3/year)	Average Annual Infiltration Volume (m^3/year)
Pre-Development Land Use	95% (Farmland, Forest)	5% (Impermeable Areas)	681,781	307,550
Post-Development from Land Use Plan	25% (Lawns, Parkland, Open Space)	75% (Roads, Buildings, SWMPs, etc.)	1,913,649	115,399

APPENDIX C3

DEWATERING CALCULATIONS

SCS consulting group ltd

GEI Consultants

Equivalent Well Radius Method

Typical Site Servicing - Construction

Inputs

Rs (m)	Ro (m)	H (m)	h (m)	k (m/s)	Trench Length, x (m)	Trench Width, b (m)
3.4	10.6	6.0	1.0	5.00E-07	100	6

Unconfined (Equation 6.10b)

Elevations (m)	
Ground Surface	230
Highest Water Level	229.5
Base of Excavation	225
Drawdown Target	224.5
Aquifer Bottom	223.5

Groundwater Flows		
Flow Rate, Q=	0.0003687	m3/s
Q=	31,858	L/day
Safety Factor	2	
Q factored =	**63,716**	L/day

Precipitation		
Rainfall Event	10	mm
Excavation Area	600	m2
Rainfall Q =	**6,000**	L/day

TOTAL Factored Q =	**69,716**	**L/day**

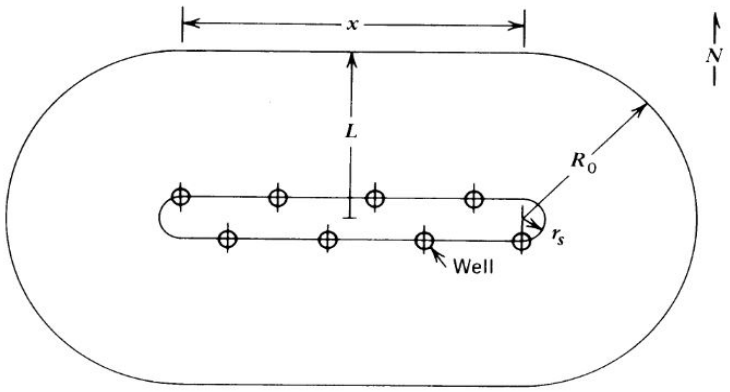

Figure 6.8 Approximate analysis of long, narrow systems.

The total flow to the system may be approximated by adding Eqs. 6.1 and 6.6 for a confined aquifer, or Eqs. 6.3 and 6.7 for a water table aquifer:

$$Q = \frac{2\pi KB(H - h)}{\ln R_0/r_s} + 2\left[\frac{xKB(H - h)}{L}\right] \qquad (6.10a)$$

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

Equivalent Well Radius Method

Typical Residential Block - Construction

Inputs

Rs (m)	Ro (m)	H (m)	h (m)	k (m/s)	Trench Length, x (m)	Trench Width, b (m)
19.7	6.4	4.0	1.0	5.00E-07	140	35

Unconfined (Equation 6.10b), excluding second term

Elevations (m)	
Ground Surface	230
Highest Water Level	229.5
Base of Excavation	227
Drawdown Target	226.5
Aquifer Bottom	225.5

Groundwater Flows		
Flow Rate, Q=	0.0000843	m3/s
Q=	7,287	L/day
Safety Factor	2	
Q factored =	**14,574**	L/day

Precipitation		
Rainfall Event	10	mm
Excavation Area	4900	m2
Rainfall Q =	**49,000**	L/day

TOTAL Factored Q =	**63,574**	**L/day**

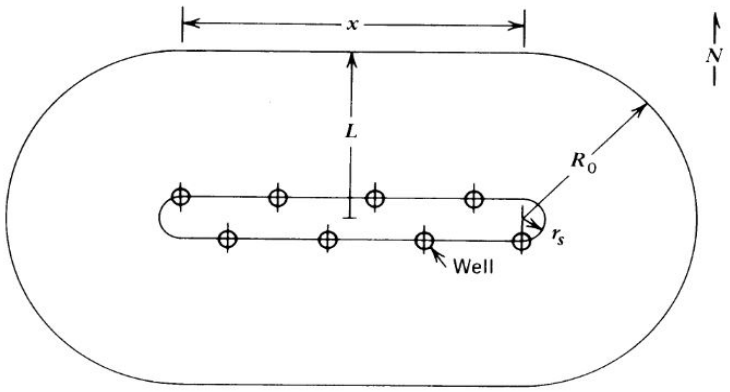

Figure 6.8 Approximate analysis of long, narrow systems.

The total flow to the system may be approximated by adding Eqs. 6.1 and 6.6 for a confined aquifer, or Eqs. 6.3 and 6.7 for a water table aquifer:

$$Q = \frac{2\pi KB(H - h)}{\ln R_0/r_s} + 2\left[\frac{xKB(H - h)}{L}\right] \qquad (6.10a)$$

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

Equivalent Well Radius Method

Typical Urban Block - Construction

Inputs

Rs (m)	Ro (m)	H (m)	h (m)	k (m/s)	Trench Length, x (m)	Trench Width, b (m)
39.5	14.8	8.0	1.0	5.00E-07	140	70

Unconfined (Equation 6.10b), excluding second term

Elevations (m)	
Ground Surface	230
Highest Water Level	229.5
Base of Excavation	223
Drawdown Target	222.5
Aquifer Bottom	221.5

Groundwater Flows		
Flow Rate, Q=	0.0009040	m3/s
Q=	78,107	L/day
Safety Factor	2	
Q factored =	**156,214**	L/day

Precipitation		
Rainfall Event	10	mm
Excavation Area	9800	m2
Rainfall Q =	**98,000**	L/day

TOTAL Factored Q =	**254,214**	**L/day**

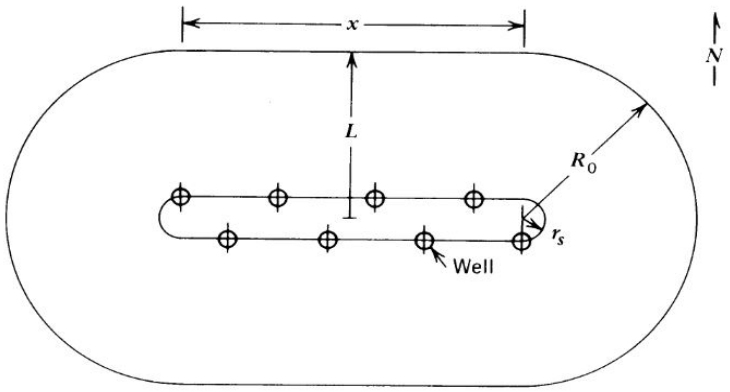

Figure 6.8 Approximate analysis of long, narrow systems.

The total flow to the system may be approximated by adding Eqs. 6.1 and 6.6 for a confined aquifer, or Eqs. 6.3 and 6.7 for a water table aquifer:

$$Q = \frac{2\pi KB(H - h)}{\ln R_0/r_s} + 2\left[\frac{xKB(H - h)}{L}\right] \qquad (6.10a)$$

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

Equivalent Well Radius Method

Typical SWM Facility - Construction

Inputs

Rs (m)	Ro (m)	H (m)	h (m)	k (m/s)	Trench Length, x (m)	Trench Width, b (m)
112.8	8.5	5.0	1.0	5.00E-07	200	200

Unconfined (Equation 6.10b), excluding second term

Elevations (m)	
Ground Surface	230
Highest Water Level	229.5
Base of Excavation	226
Drawdown Target	225.5
Aquifer Bottom	224.5

Groundwater Flows		
Flow Rate, Q=	0.0010856	m3/s
Q=	93,799	L/day
Safety Factor	2	
Q factored =	**187,597**	L/day

Precipitation		
Rainfall Event	10	mm
Excavation Area	40000	m2
Rainfall Q =	**400,000**	L/day

TOTAL Factored Q =	**587,597**	**L/day**

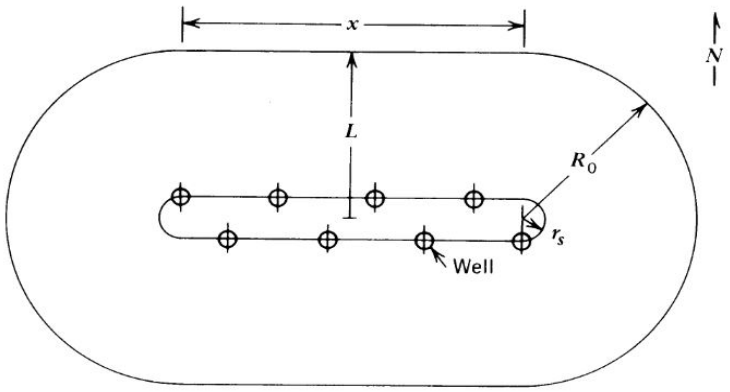

Figure 6.8 Approximate analysis of long, narrow systems.

The total flow to the system may be approximated by adding Eqs. 6.1 and 6.6 for a confined aquifer, or Eqs. 6.3 and 6.7 for a water table aquifer:

$$Q = \frac{2\pi KB(H - h)}{\ln R_0/r_s} + 2\left[\frac{xKB(H - h)}{L}\right] \qquad (6.10a)$$

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

Equivalent Well Radius Method

Typical Residential Building - Permanent

Inputs

Rs (m)	Ro (m)	H (m)	h (m)	k (m/s)	Trench Length, x (m)	Trench Width, b (m)
16.9	5.9	3.8	1.0	5.00E-07	20	30

Unconfined (Equation 6.10b), excluding second term

Elevations (m)	
Ground Surface	230
Highest Water Level	229.5
Base of Excavation	226.7
Drawdown Target	226.7
Aquifer Bottom	225.7

Groundwater Flows		
Flow Rate, Q=	0.0000702	m3/s
Q=	6,064	L/day
Safety Factor	2	
Q factored =	**12,128**	L/day

Precipitation		
Rainfall Event	0	mm
Excavation Area	600	m2
Rainfall Q =	-	L/day

TOTAL Factored Q =	**12,128**	**L/day**

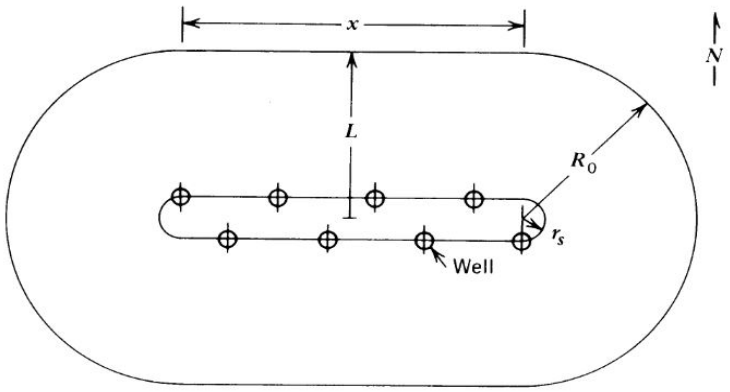

Figure 6.8 Approximate analysis of long, narrow systems.

The total flow to the system may be approximated by adding Eqs. 6.1 and 6.6 for a confined aquifer, or Eqs. 6.3 and 6.7 for a water table aquifer:

$$Q = \frac{2\pi KB(H - h)}{\ln R_0/r_s} + 2\left[\frac{xKB(H - h)}{L}\right] \qquad (6.10a)$$

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

Equivalent Well Radius Method

Typical Urban Block - Permanent

Inputs

Rs (m)	Ro (m)	H (m)	h (m)	k (m/s)	Trench Length, x (m)	Trench Width, b (m)
39.5	14.4	7.8	1.0	5.00E-07	140	70

Unconfined (Equation 6.10b), excluding second term

Elevations (m)	
Ground Surface	230
Highest Water Level	229.5
Base of Excavation	222.7
Drawdown Target	222.7
Aquifer Bottom	221.7

Groundwater Flows		
Flow Rate, Q=	0.0008827	m3/s
Q=	76,264	L/day
Safety Factor	2	
Q factored =	**152,527**	L/day

Precipitation		
Rainfall Event	0	mm
Excavation Area	9800	m2
Rainfall Q =	-	L/day

TOTAL Factored Q =	**152,527**	**L/day**

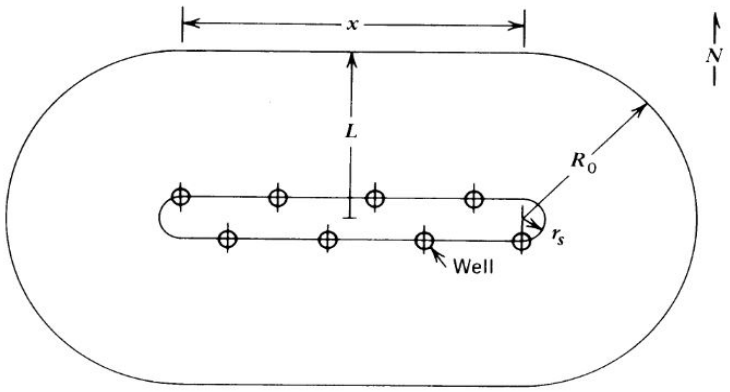

Figure 6.8 Approximate analysis of long, narrow systems.

The total flow to the system may be approximated by adding Eqs. 6.1 and 6.6 for a confined aquifer, or Eqs. 6.3 and 6.7 for a water table aquifer:

$$Q = \frac{2\pi KB(H - h)}{\ln R_0/r_s} + 2\left[\frac{xKB(H - h)}{L}\right] \qquad (6.10a)$$

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

APPENDIX C4

WATER BALANCE CALCULATIONS

SCS consulting group ltd

GEI Consultants

WVSP Area - Post Development Water Balance

MONTHLY AND YEARLY WATER BALANCE COMPONENTS (Post-Development)

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Potential Evapotranspiration Calculation	Average Temperature: T (^{o}C)	-6.6	-4.8	-0.4	6.6	12.9	18.1	20.8	19.6	15.4	9	3.1	-2.8	7.6
	Heat Index: i=(T/5)$^{1.514}$	0.00	0.00	0.00	1.52	4.20	7.01	8.66	7.91	5.49	2.43	0.48	0.00	37.7
	Unadjusted Daily Potential Evapotranspiration: U (mm)	0.0	0.0	0.0	29.5	61.5	89.1	103.7	97.2	74.7	41.5	12.9	0.0	510.1
	Adjusting Factor for U (Latitude 44^{o})	0.81	0.81	1.02	1.13	1.27	1.28	1.30	1.20	1.04	0.94	0.80	0.76	-
	Adjusted Potential Evapotranspiration - PET (mm)	0.0	0.0	0.0	33.4	78.1	114.0	134.9	116.7	77.6	39.0	10.3	0.0	604.0
Pervious Components	Precipitation: P (mm)	50.3	44.2	49.2	63.3	79.1	76.3	70.4	80.4	84.6	66.5	78.3	57.4	800.0
	Adjusted Potential Evapotranspiration: PET (mm)	0.0	0.0	0.0	33.4	78.1	114.0	134.9	116.7	77.6	39.0	10.3	0.0	604.0
	P - PET	50.3	44.2	49.2	29.9	1.0	-37.7	-64.5	-36.3	7.0	27.5	68.0	57.4	196.0
	Change in Soil Moisture Storage (mm)	0.0	0.0	0.0	0.0	0.0	-37.7	-64.5	-36.3	7.0	27.5	0.0	0.0	-
	Water Holding Capacity (max. 75 mm)	75.0	75.0	75.0	75.0	75.0	37.3	0.0	0.0	7.0	34.5	75.0	75.0	-
	Water Surplus Available for Infiltration or Runoff	50.3	44.2	49.2	29.9	1.0	0.0	0.0	0.0	0.0	0.0	27.5	57.4	259.5
	Potential Infiltration based on MECP Infiltration Factor (mm)	25.2	22.1	24.6	15.0	0.5	0.0	0.0	0.0	0.0	0.0	13.7	28.7	129.7
	Potential Surface Water Runoff (mm)	25.2	22.1	24.6	15.0	0.5	0.0	0.0	0.0	0.0	0.0	13.7	28.7	129.7
Impervious Components	Precipitation: P (mm)	-												800.0
	Potential Evaporation: PE (mm), Assume 15%	-												120.0
	Potential Surface Water Runoff: P - PE (mm)	-												680.0

POST-DEVELOPMENT WATER BALANCE (NO LOW IMPACT DEVELOPMENT MEASURES IN PLACE)

		Total Land Area (m^2)	Impervious Factor	Impervious Area (m^2)	Pervious Area (m^2)	Runoff (m^3/annum)	Infiltration (m^3/annum)	**Runoff Increase Pre to Post**
Existing Land Use (Pre-Development)	See Phase 1 Report							181%
								Infiltration Decrease Pre to Post
								-62%
Proposed Land Use (Post-Development)	Subwatershed 36.10	384,300	71%	272,853	111,447	200,000	14,460	**Infiltration Required to Meet Pre-Development Conditions (m^3)**
	Subwatershed 36.11	538,300	78%	419,874	118,426	300,880	15,365	
	Subwatershed 38.04	1,056,800	76%	803,168	253,632	579,062	32,908	
	Subwatershed 38.05	58,000	71%	41,180	16,820	30,185	2,182	
	Subwatershed 38.06	1,496,500	74%	1,107,410	389,090	803,522	50,483	192,151
	TOTAL	3,533,900	75%	2,644,485	889,415	1,913,649	115,399	

Notes

1. Both potential infiltration and surface water runoff are independent of temperature
2. Assumption is in January maximum soil moisture storage value is present (75mm)
3. Water Holding Capacity & Infiltration Factors taken from Table 3.1 of MOE SWMPDM, 2003
4. Average Temp. and Precip. taken from Environment Canada station "Woodbridge" between 1981 and 2010
5. Adjusting Factor for U based on Lorente, 1961

Infiltration Criteria	**Site Description - Post Development**	**Infiltration Factor**
Topography	Flat Land - Average Slope Less Than 0.6 m/km	0.3
Soils	Tight Impervious Clay	0.1
Cover	Cultivated Land/AGR/ANTH/CGL	0.1
	Sum of Infiltration Factors	**0.5**