



Managing, Assessing, and Presenting Imperfect Chlorinated Solvent Data in Support of Environmental Litigation

Battelle 2024

Prepared by: Kerry-Anne Pumphrey,
M.Sc., EP, P.Geo., QP_{ESA}

June 4, 2024



BlueFrog
Environmental Consulting Inc.

Introduction



Alchemy

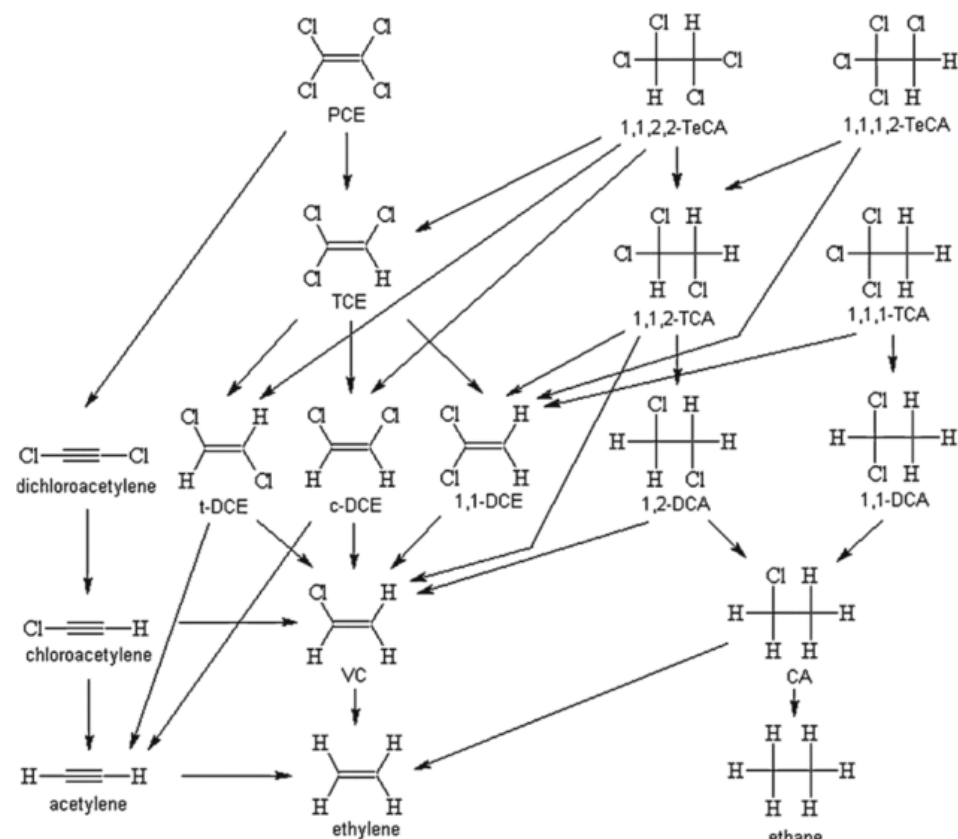


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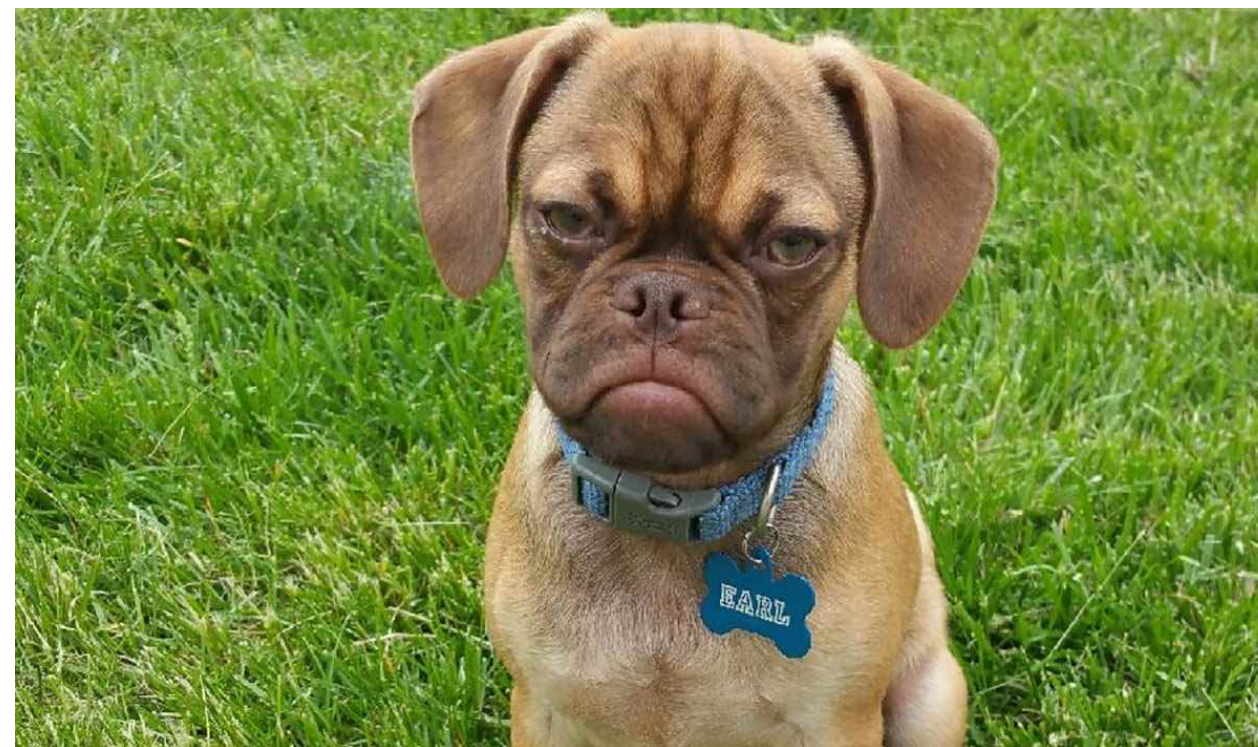


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Purpose



Tobiszewski & Namiesnik 2012



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PCE = Tetrachloroethylene TCE = Trichloroethylene

Cis-DCE = 1,2-Cis-Dichloroethylene

Managing, Assessing, and Presenting Imperfect Data



Assemble the Available Data



Organize the Data for Analysis



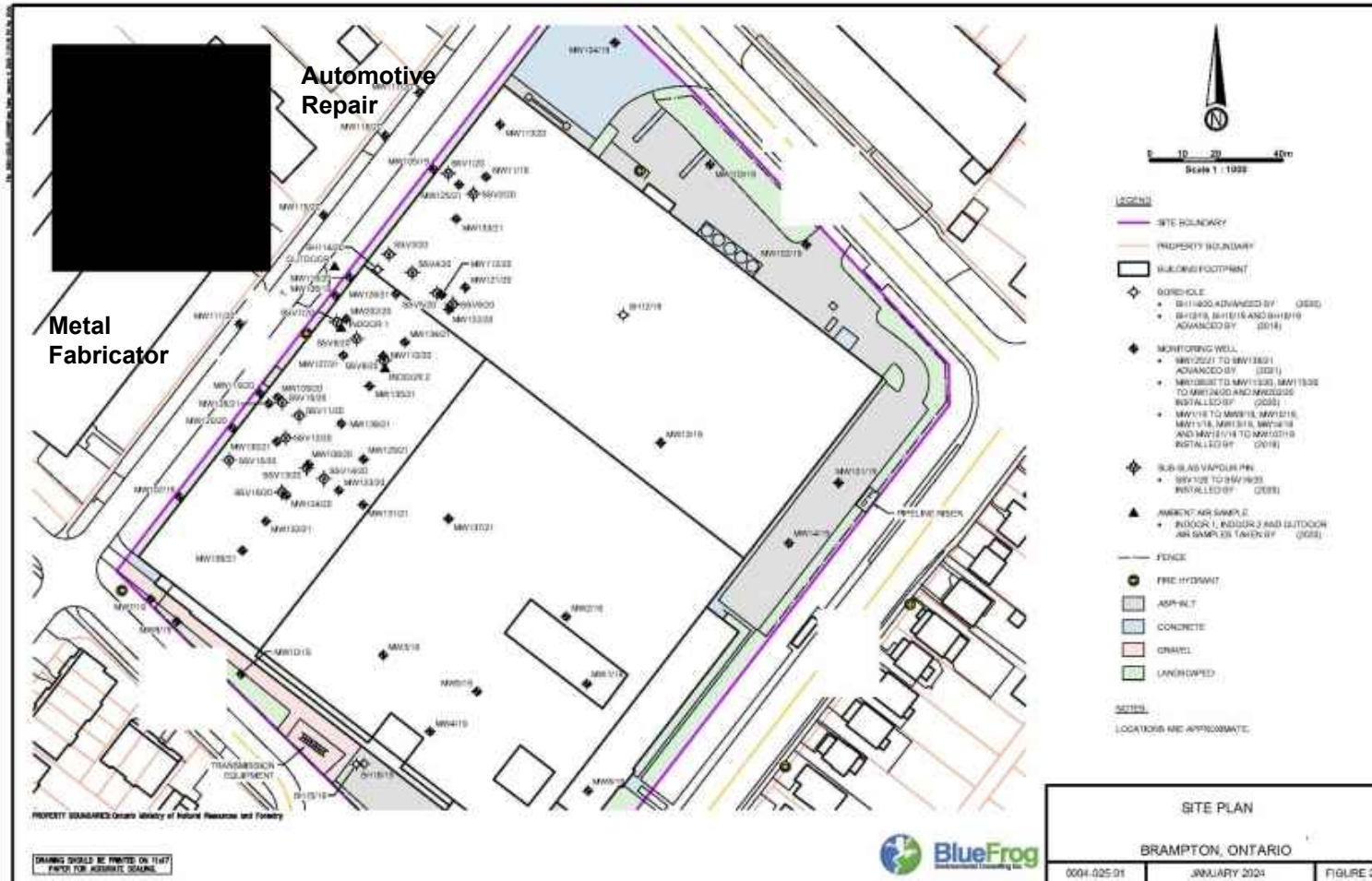
Tell the Story

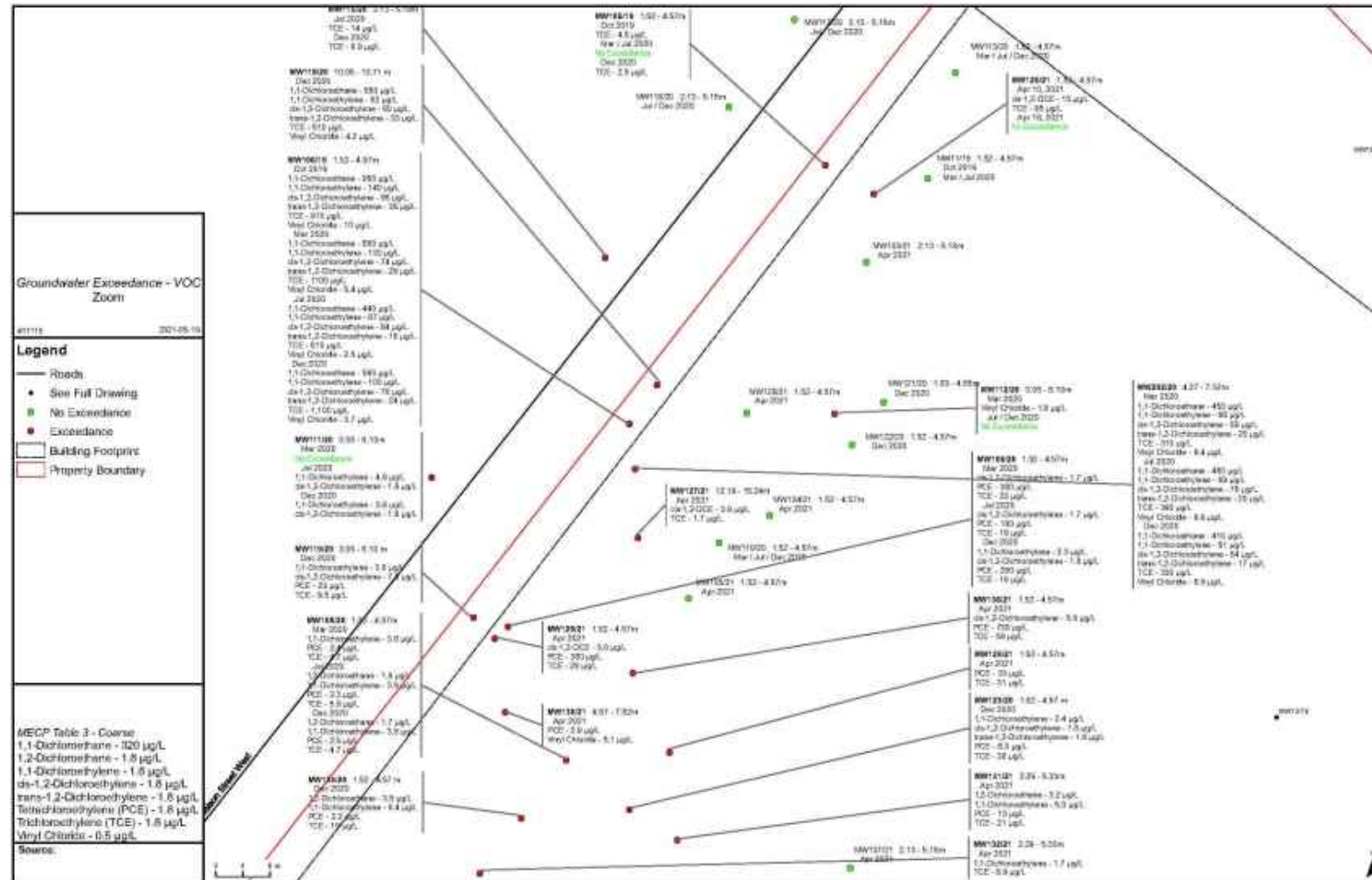
Visualize the Data



Analyze the Data

Landlord vs Tenant, Possible Off-Site Sources, Till, Brampton, Ontario





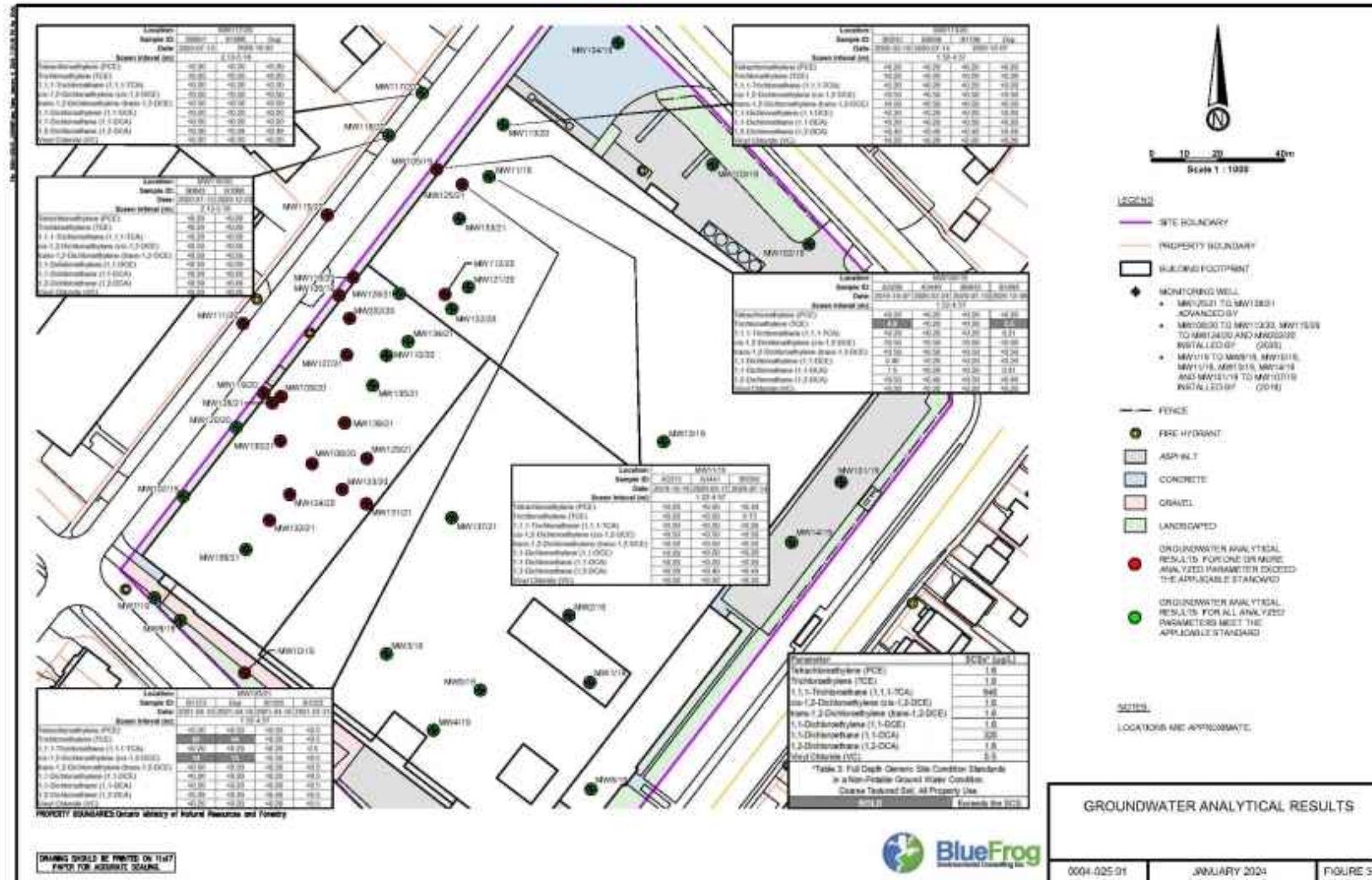
Landlord vs Tenant, Possible Off-Site Sources, Till, Brampton, Ontario



Assembled the Available Data



Organize the Data



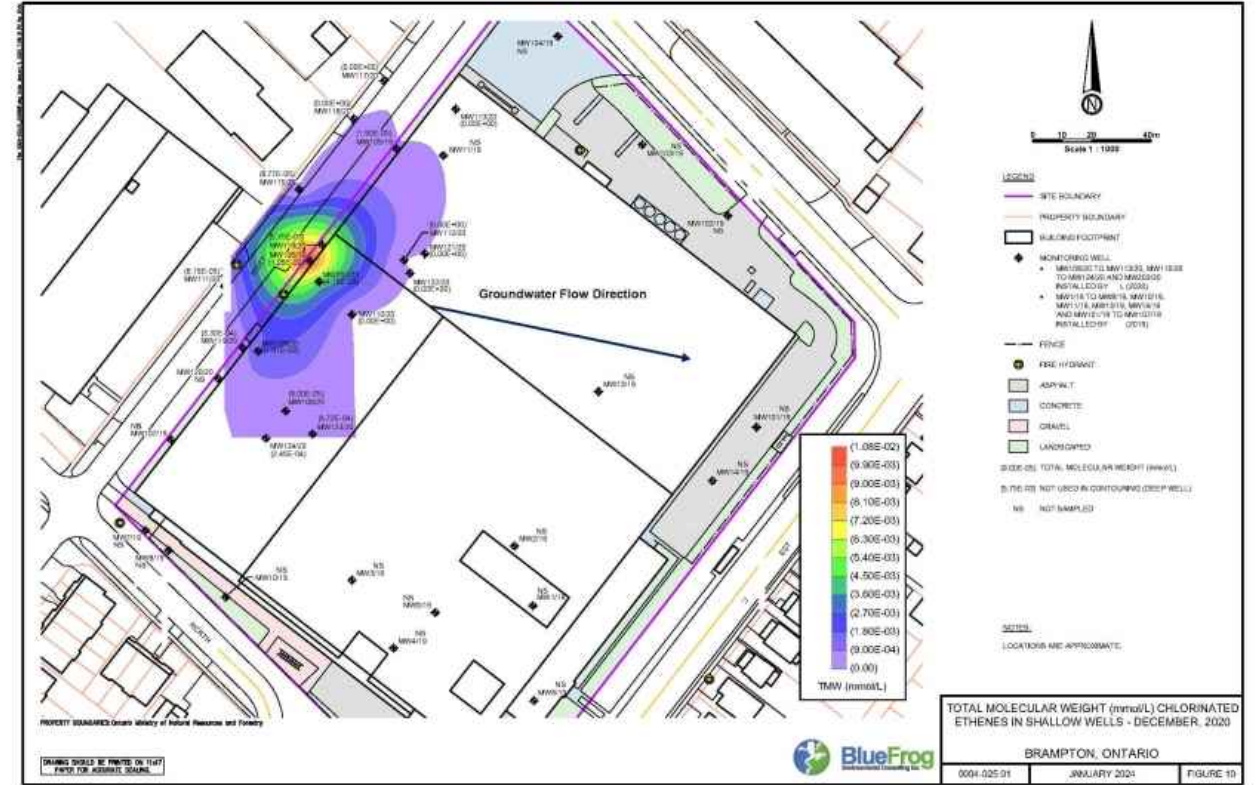
Landlord vs Tenant, Possible Off-Site Sources, Till, Brampton, Ontario



Visualize the Data



Analyze the Data

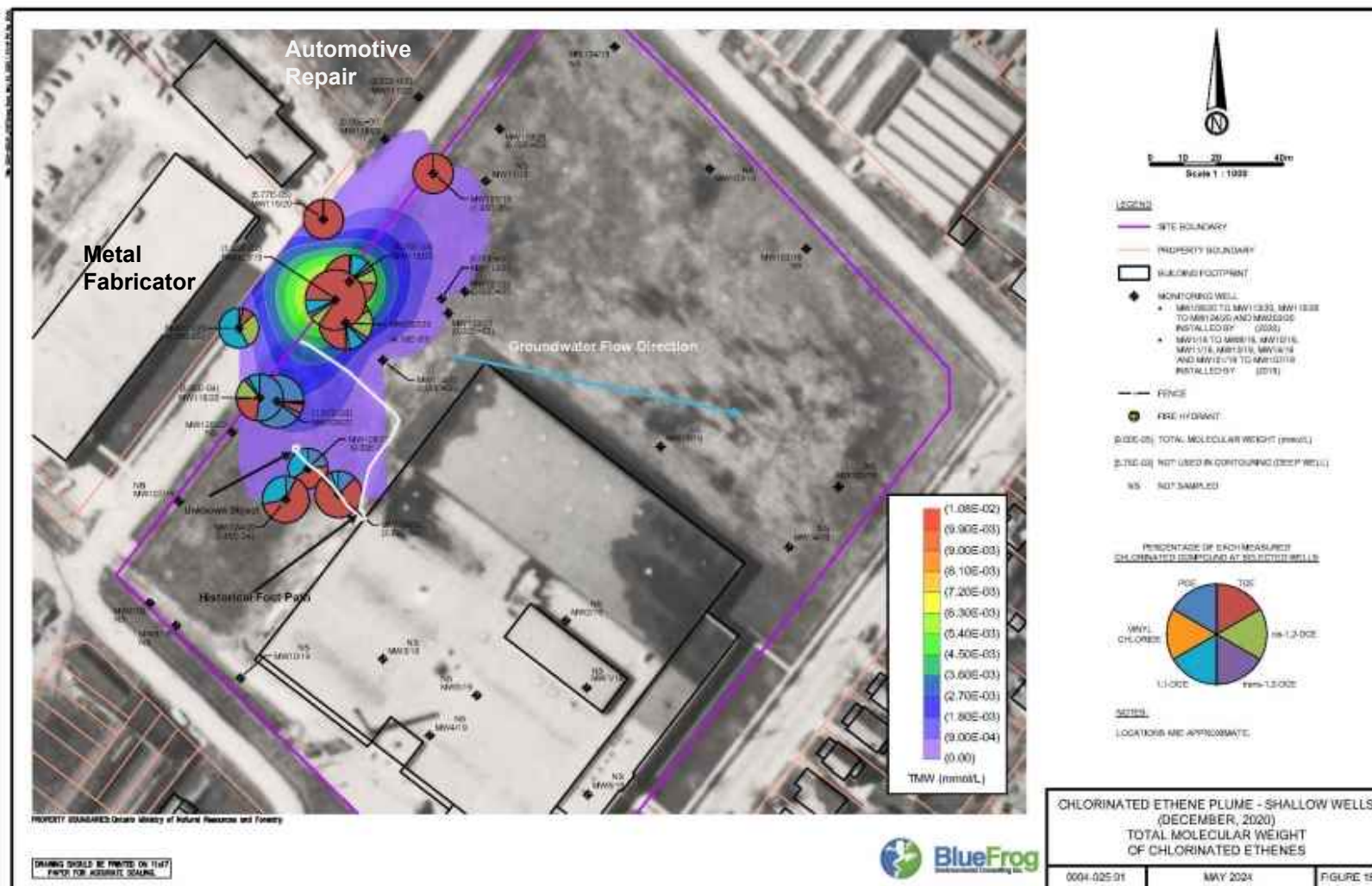




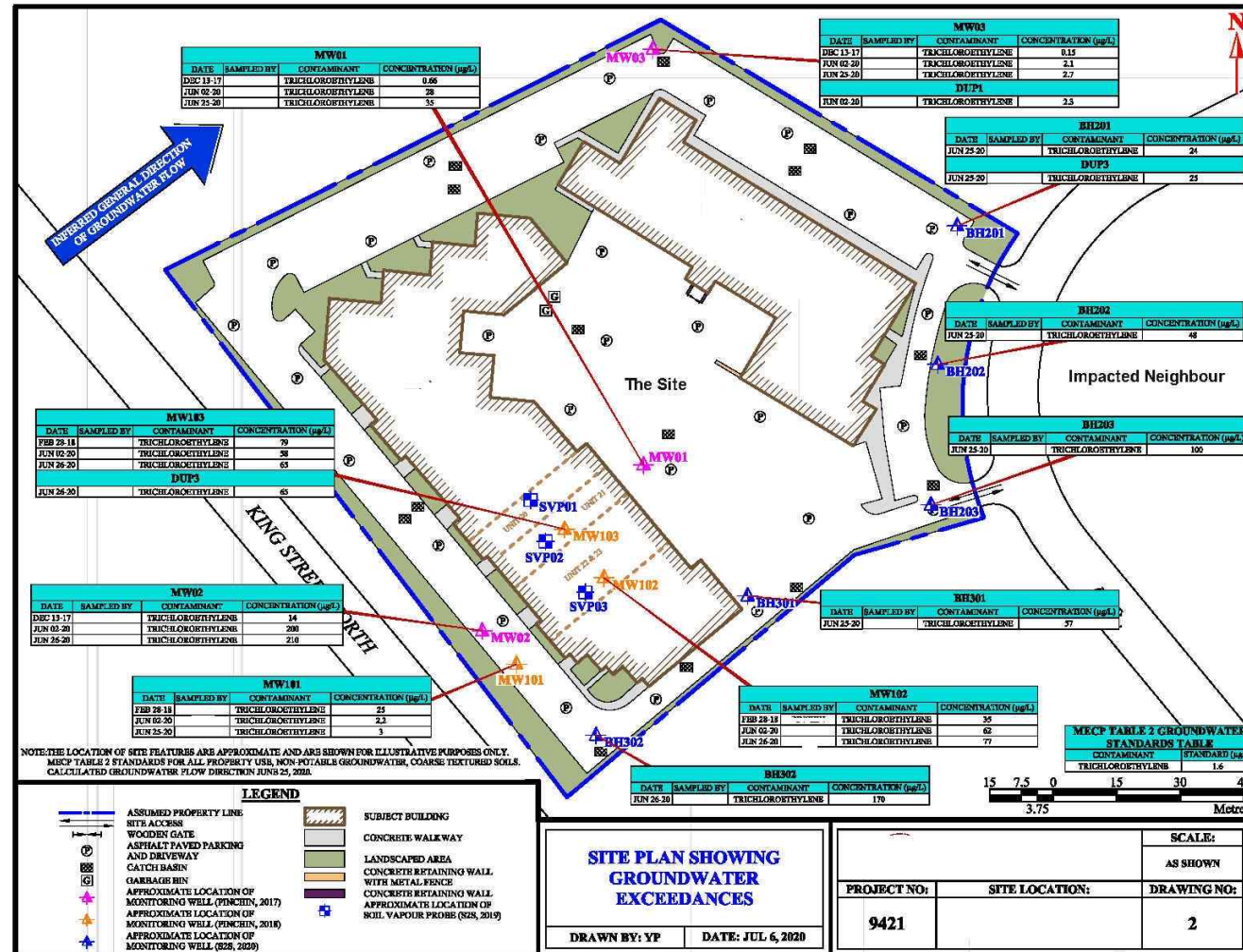
Landlord vs Tenant, Possible Off-Site Sources, Till, Brampton, Ontario – Visualize and Analyze the Data

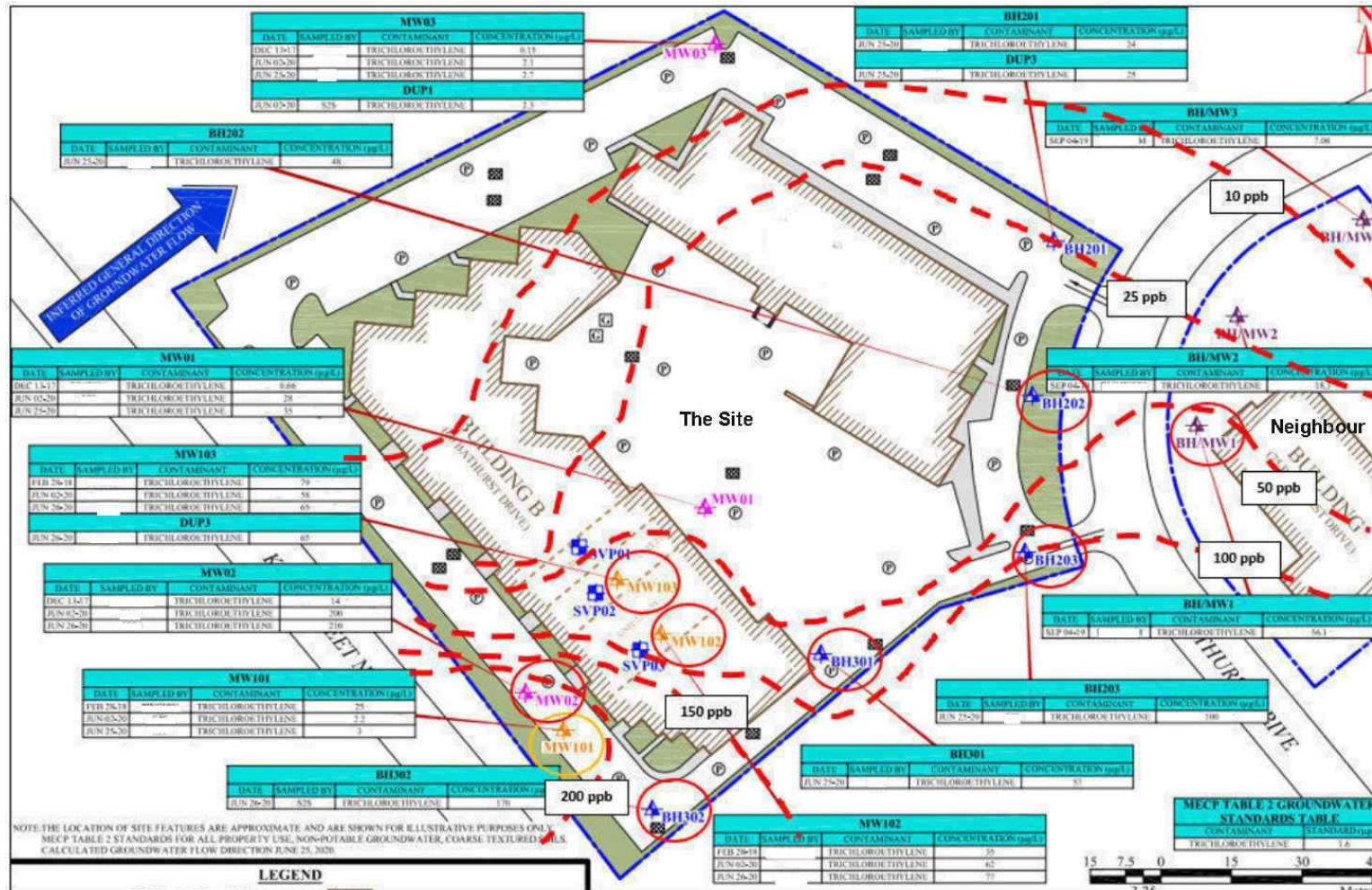


Landlord vs Tenant, Possible Off-Site Sources, Till, Brampton, Ontario – Telling the Story



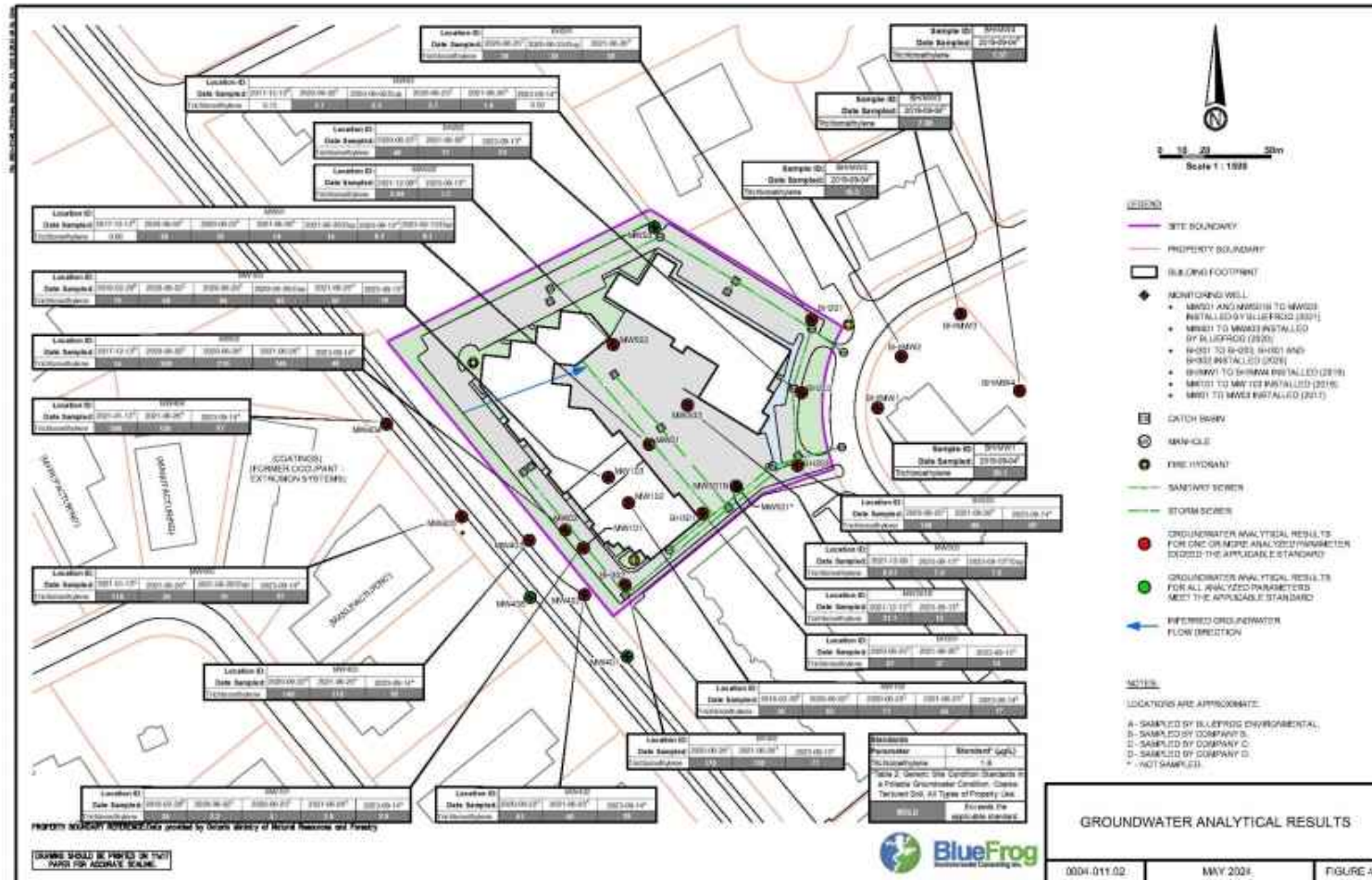
TCE, No Degradation Products, Glacial Fluvial & Till Deposits, Waterloo, Ontario



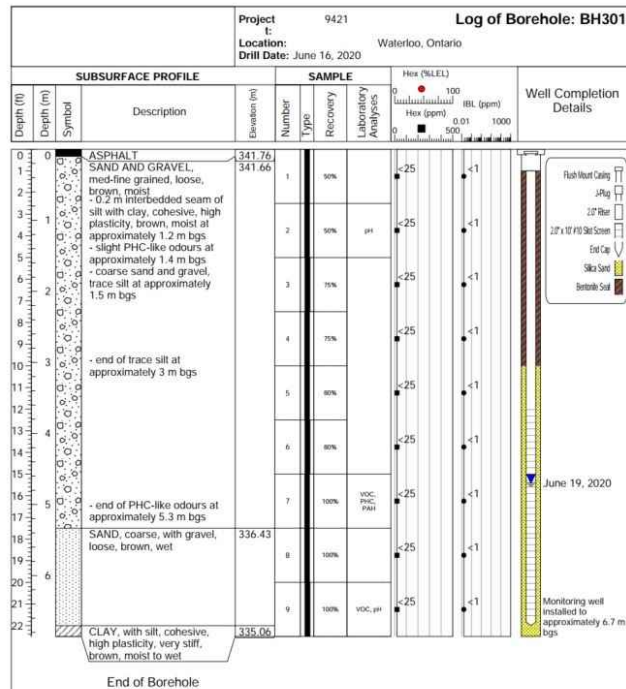
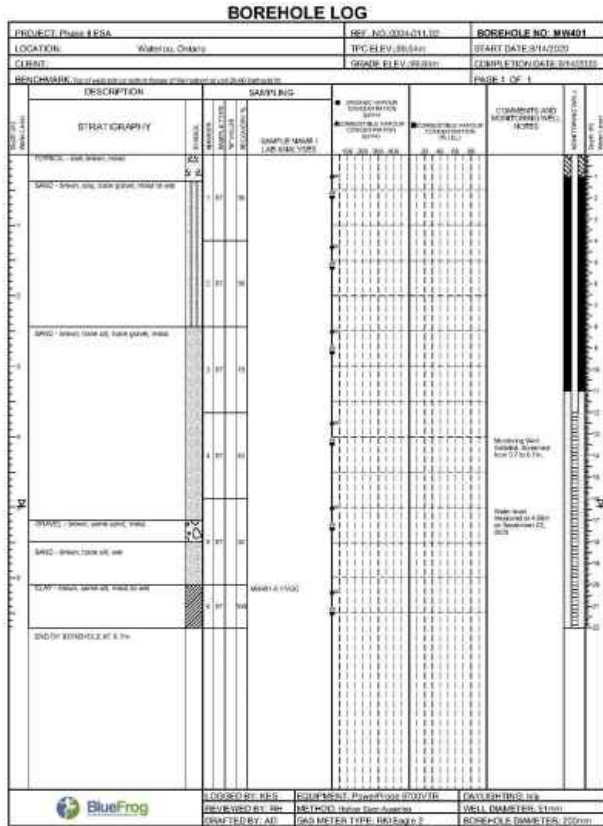


TCE, No Degradation Products, Glacial Fluvial & Till Deposits, Waterloo, Ontario – Assembling the Data





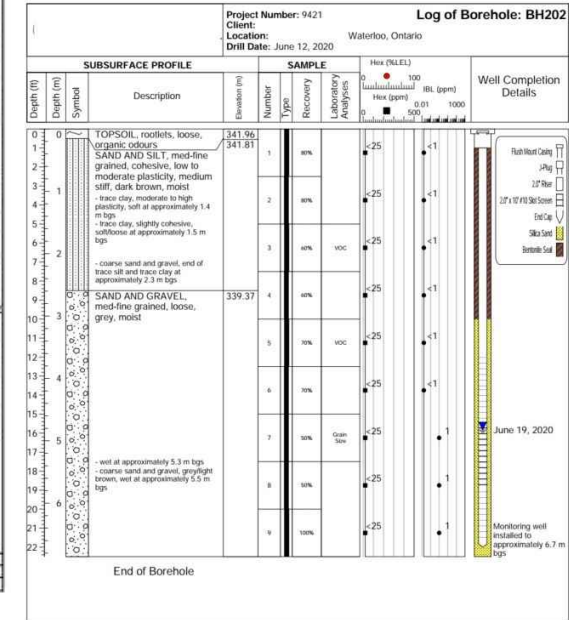
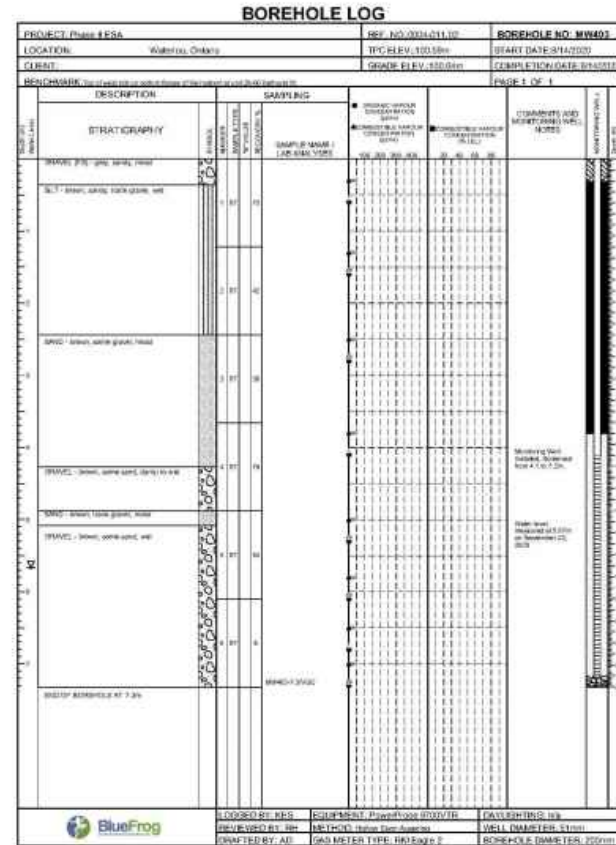
TCE, No Degradation Products, Glacial Fluvial & Till Deposits, Waterloo, Ontario – Assembling the Data



Drill Rig: Track-Mounted Geoprobe 7822DT
 Hole Size/Drill Method: 203 mm / HSA
 Easting: 537255 E
 Northing: 4817318 N
 Datum: Geodetic

Notes: One groundwater sample (D01) was collected on June 25, 2020 and submitted for laboratory analyses of selected VOCs, PHCs and selected PAHs.

Logged by: BG
 Checked by: GC
 Sheet: 1 of 1

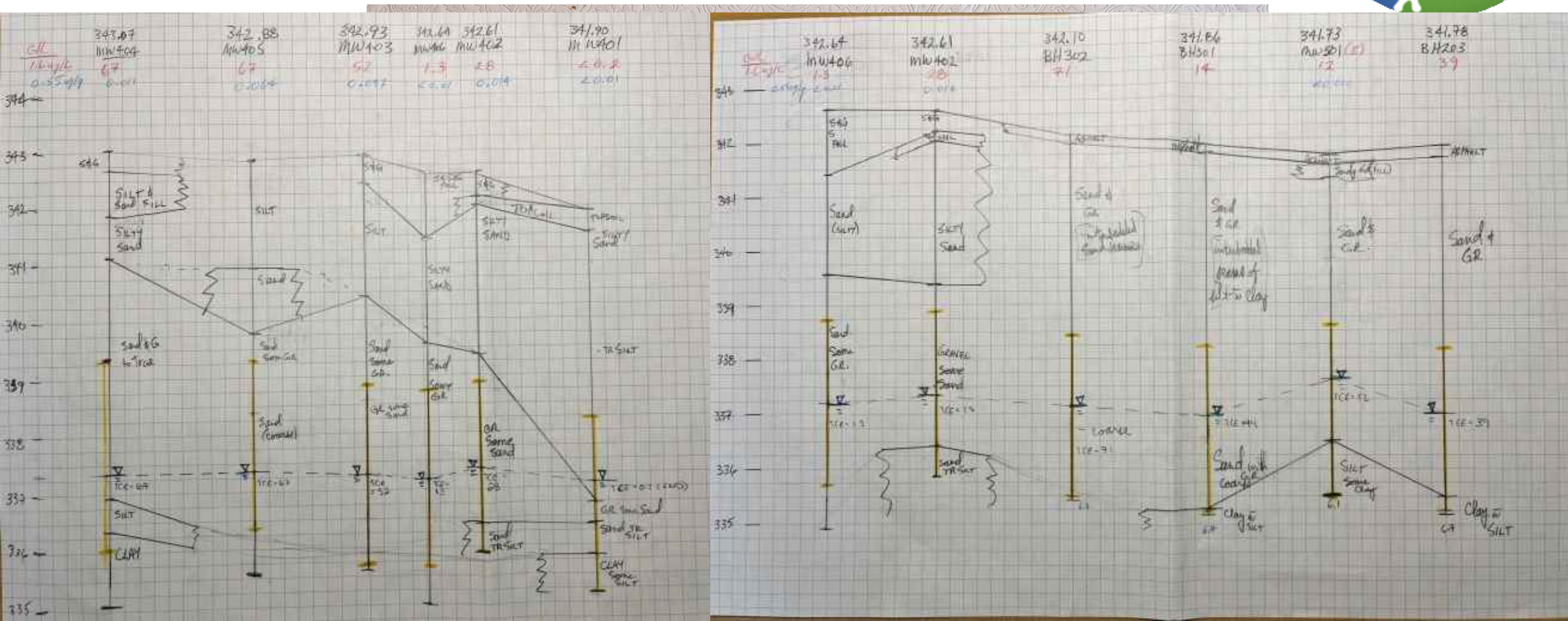


Drill Rig: Track-Mounted Geoprobe 7822DT
 Hole Size/Drill Method: 203 mm / HSA
 Easting: 537299.9 E
 Northing: 4817370 N
 Datum: Geodetic

Notes: One groundwater sample (D02) was collected on June 25, 2020 and submitted for laboratory analyses of selected VOCs.

Logged by: BG
 Checked by: GC
 Sheet: 1 of 1

TCE, No Degradation Products, Glacial Fluvial & Till Deposits, Waterloo, Ontario – Organize and Visualize the Data



TCE, No Degradation Products, Glacial Fluvial & Till Deposits, Waterloo, Ontario – Analyze the Data and Tell the Story



PCE & TCE Industrial Solvent Use, Coarse Glacial Lacustrine Deposit , Alliston, Ontario



A trend in ground water quality cannot be established at this stage of the monitoring program and continue monitoring is recommended.

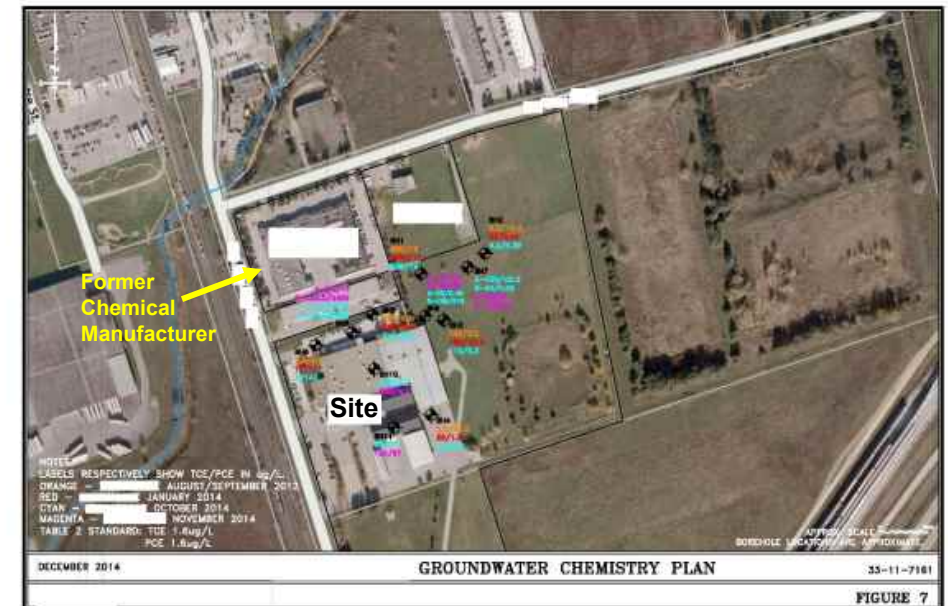
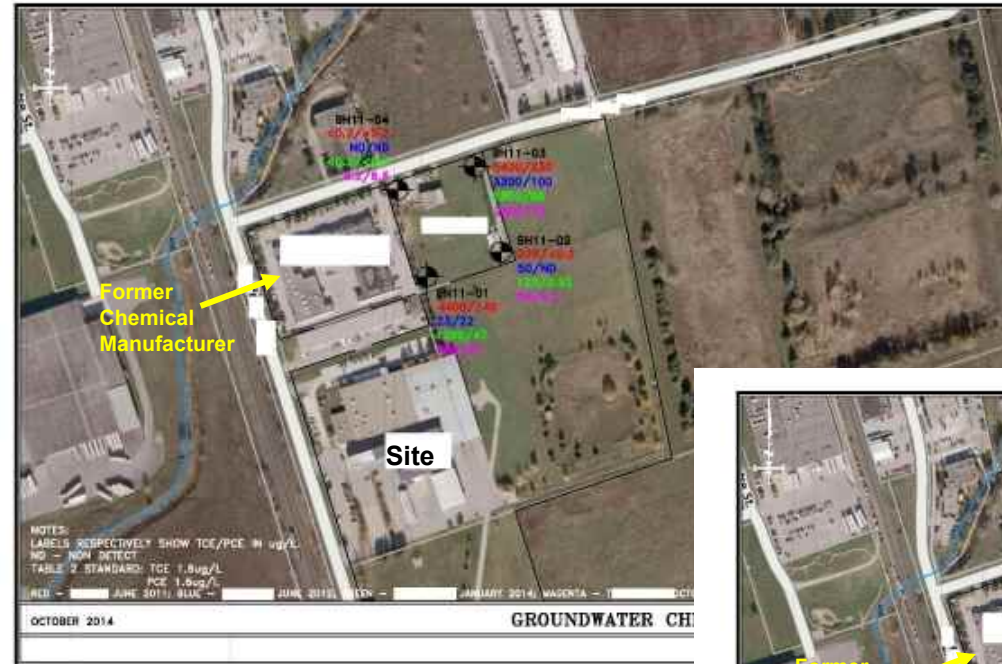
It is noted that cis-1,2-dichloroethylene (Cis-1,2-DCE) has been detected within all monitoring wells by applicable Site Condition Standards during the monitoring events conducted on June 19, 2019 and August 7

Table 1

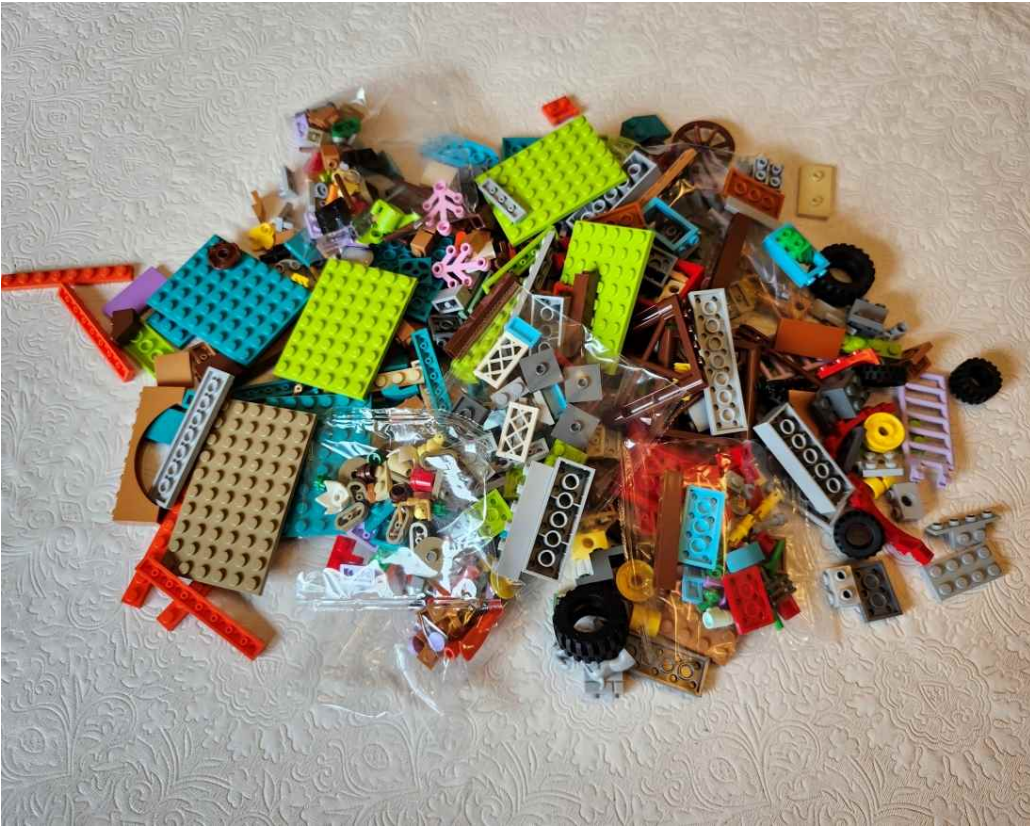
Location	Date	TCE (ug/L)	PCE (ug/L)	Cis-1,2-DCE
BH1	2014	620	19	<4.00
	2016	830	70	<2.00
	2017	560	17	<2.00
	2018	500	8.7	<0.80
	2019 JUNE	341	10.6	<0.5
BH5	2014	420	250	<0.80
	2016	210	240	13
	2017	240	160	16
	2018	210	140	4.3
	2019 JUNE	98.2	98.4	0.5
BH9A	2014	5.6	210	<0.80
	2016	8.0	5.3	<0.20
	2017	2.0	3.2	<0.20
	2018	<0.20	<0.20	<0.20
	2019 JUNE	1.5	156	<0.5
BH9B	2014	<0.5	0.5	<0.5
	2016	<20.0	3600	<20.0
	2017	12	3100	<4.00
	2018	12	2400	<8.00
	2019 JUNE	9.2	3500	<4.00
BH10	2014	14.2	6780	<0.5
	2016	15.3	6990	<0.5
	2017	210	3.2	<0.80
	2018	360	12	<0.20
	2019 JUNE	160	4.0	<0.20
BH11-03	2014	110	5.0	<0.20
	2016	99.2	4.4	<0.5
	2017	2600	73	<20.0
	2018	980	95	<2.00
	2019 JUNE	770	56	<2.00
BH11-01	2014	400	12	<0.80
	2016	292	32.6	<0.5
	2017	770	56	<2.00
	2018	400	12	<0.80
	2019 JUNE	292	32.6	<0.5

Note: MECP Table 2 Standards(ug/L)

- TCE: 1.6 ug/L
- PCE: 1.6 ug/L
- Cis-1,2-DCE: 1.6 ug/L



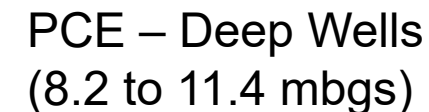
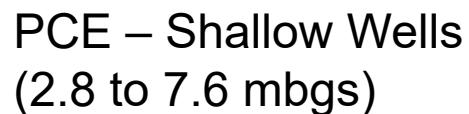
PCE & TCE Industrial Solvent Use, Coarse Glacial Lacustrine Deposit , Alliston, Ontario – Assemble the Data



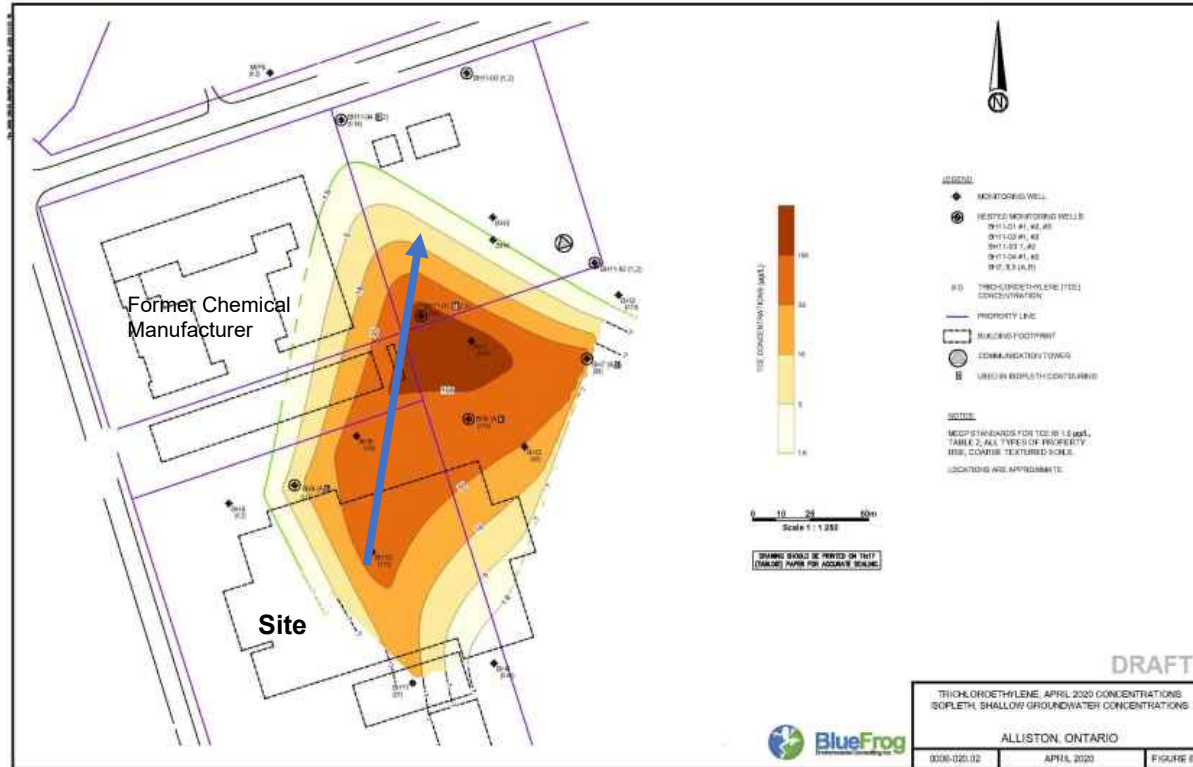
Assemble the Data



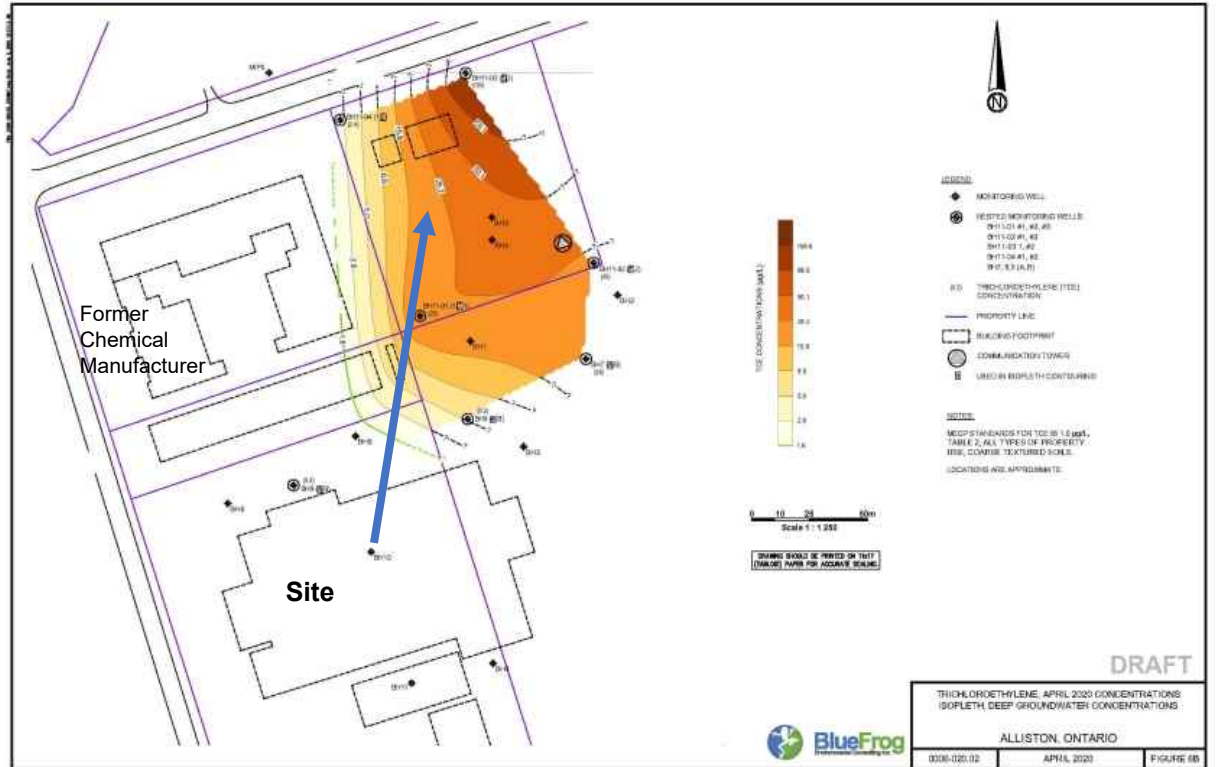
Organize the Data



PCE & TCE Industrial Solvent Use, Coarse Glacial Lacustrine Deposit , Alliston, Ontario – Visualize the Data

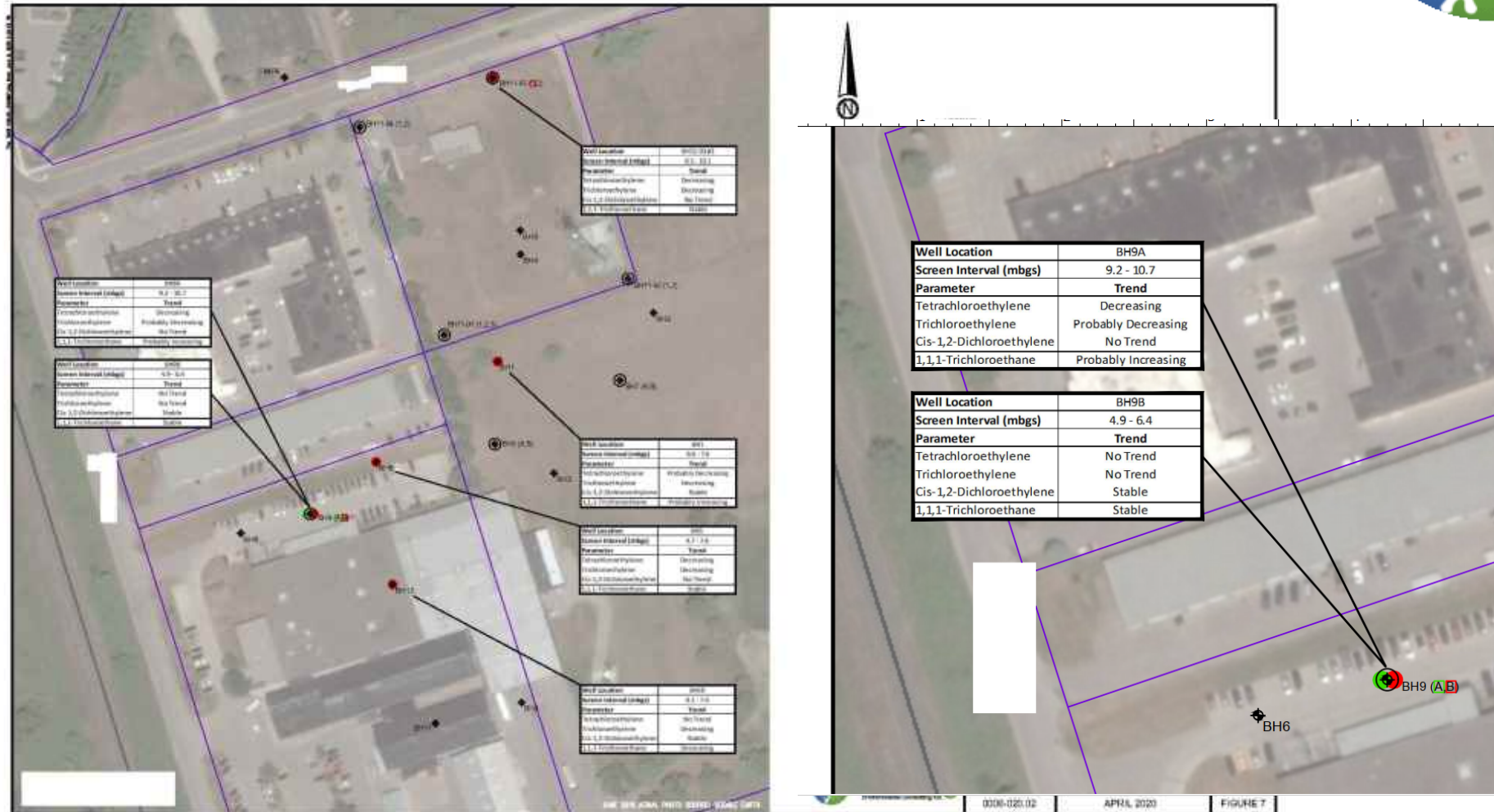


TCE – Shallow Wells
(2.8 to 7.6 mbgs)



TCE – Deep Wells
(8.2 to 11.4 mbgs)

PCE & TCE Industrial Solvent Use, Coarse Glacial Lacustrine Deposit , Alliston, Ontario – Analyse the Data and Tell the Story



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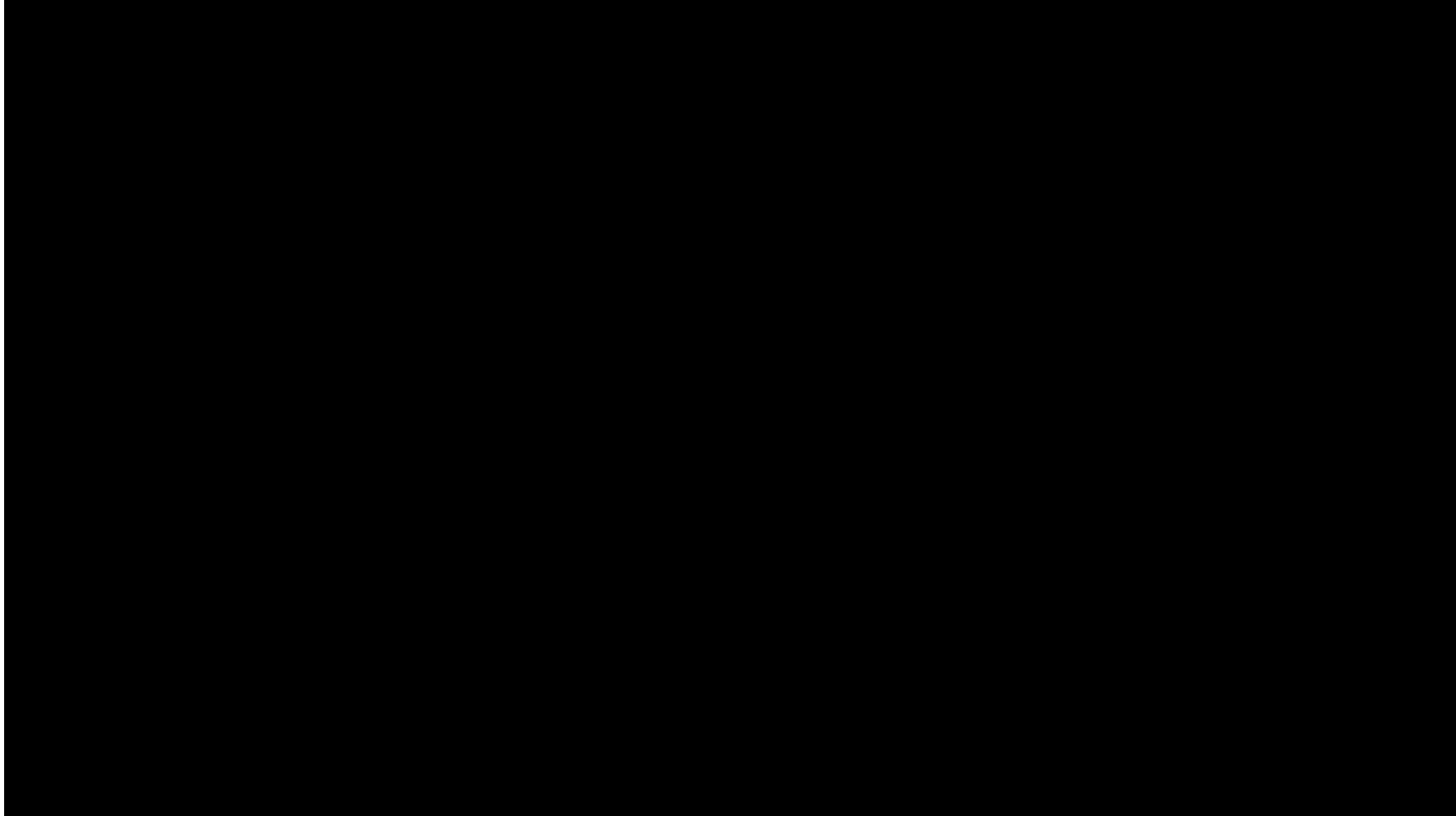
APRIL, 2020

FIGURE 7

Telling the Story



Telling the Story



Telling the Story



MW-09-18 (Source Zone)

Days After Bioaugmentation	Date Sampled	Units	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	Total Molecular Weight
Molecular Weights (g/mol)			165.83	131.40	96.94	62.50	
0	2018-06-27	(µg/L)	41	0.62	0.0	0.0	
		(mmol/L)	2.47E-04	4.72E-06	0.00E+00	0.00E+00	2.52E-04
		Molar Ratio	9.81E-01	1.87E-02	0.00E+00	0.00E+00	
	2019-08-02	Bioaugmentation with EHC-L Initiated					
35	2019-09-06	(µg/L)	5.6	2.7	16	0.0	
		(mmol/L)	3.38E-05	2.05E-05	1.65E-04	0.00E+00	2.19E-04
		Molar Ratio	1.54E-01	9.37E-02	7.52E-01	0.00E+00	
154	2020-01-03	(µg/L)	0.0	5.9	7.3	0.0	
		(mmol/L)	0.00E+00	4.49E-05	7.53E-05	0.00E+00	1.20E-04
		Molar Ratio	0.00E+00	3.74E-01	6.26E-01	0.00E+00	
286	2020-05-14	(µg/L)	0.0	4.0	37	0.4	
		(mmol/L)	0.00E+00	3.04E-05	3.82E-04	6.40E-06	4.19E-04
		Molar Ratio	0.00E+00	7.27E-02	9.12E-01	1.53E-02	
405	2020-09-10	(µg/L)	0.0	0.31	50	0.67	
		(mmol/L)	0.00E+00	2.36E-06	5.16E-04	1.07E-05	5.29E-04
		Molar Ratio	0.00E+00	4.46E-03	9.75E-01	2.03E-02	
	2020-09-23	Bioaugmentation with EHC-L (gravity feed)					
479	2020-11-23	(µg/L)	0.0	0.2	40	0.49	
		(mmol/L)	0.00E+00	1.52E-06	4.13E-04	7.84E-06	4.22E-04
		Molar Ratio	0.00E+00	3.61E-03	9.78E-01	1.86E-02	
	2021-05-118	Bioaugmentation with EHC-L & KB 1 (Direct Injection)					
748	2021-08-19	(µg/L)	0.0	0.57	45	0.58	
		(mmol/L)	0.00E+00	4.34E-06	4.64E-04	9.28E-06	4.78E-04
		Molar Ratio	0.00E+00	9.08E-03	9.71E-01	1.94E-02	
844	2021-11-23	(µg/L)	0.0	0.0	21.6	0.0	
		(mmol/L)	0.00E+00	0.00E+00	2.23E-04	0.00E+00	2.23E-04
		Molar Ratio	0.00E+00	0.00E+00	1.00E+00	0.00E+00	
	2022-03-08	Bioaugmentation with EDS-ER & KB1 (Direct Injection)					
1040	2022-06-07	(µg/L)	0.0	0.0	28.0	6.6	
		(mmol/L)	0.00E+00	0.00E+00	2.89E-04	1.06E-04	3.94E-04
		Molar Ratio	0.00E+00	0.00E+00	7.32E-01	2.68E-01	

Managing, Assessing, and Presenting Imperfect Data



Assemble the Available Data



Organize the Data for Analysis



Tell the Story

Visualize the Data



Analyze the Data

Lego Construction Crew



THANK YOU