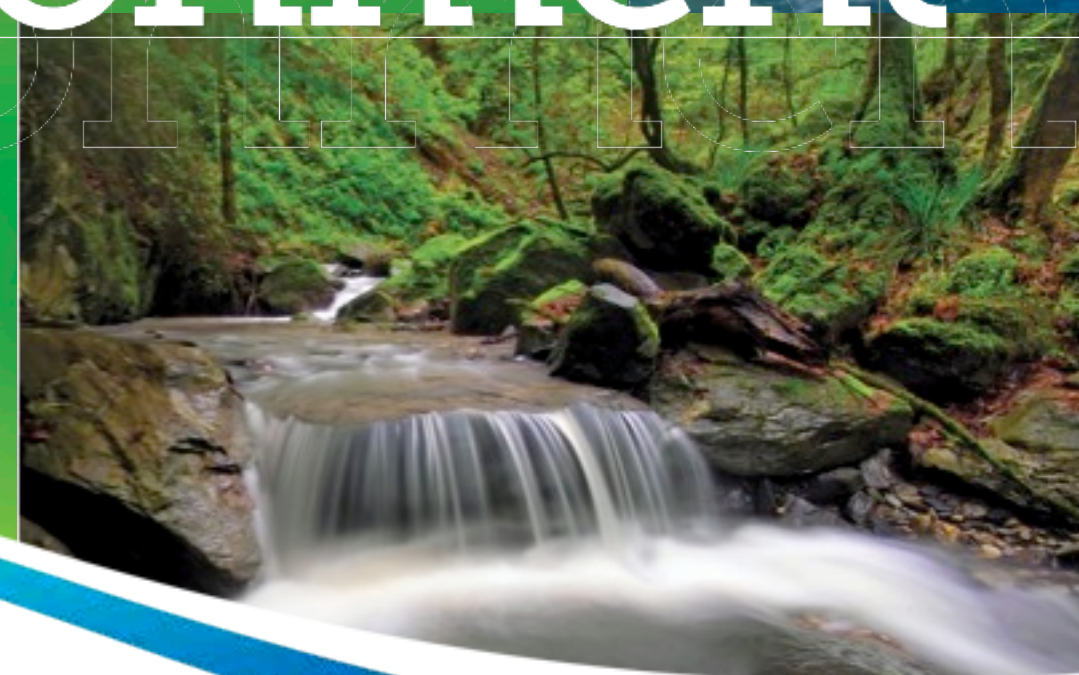


Biogénie



A New Take on the

Environment





Environmental Remediation of a Former Wood Treatment Facility Cochrane Alberta

Philippe Gingras, P.Eng.
Biogenie, a division of EnGlobe Corp.

5/13/2002

N

23 ha

45 ha

Image © 2013 DigitalGlobe

Google earth

2002

Imagery Date: 5/13/2002 11 U 676751.70 m E 5673657.34 m N elev 1150 m eye alt 2.80 km















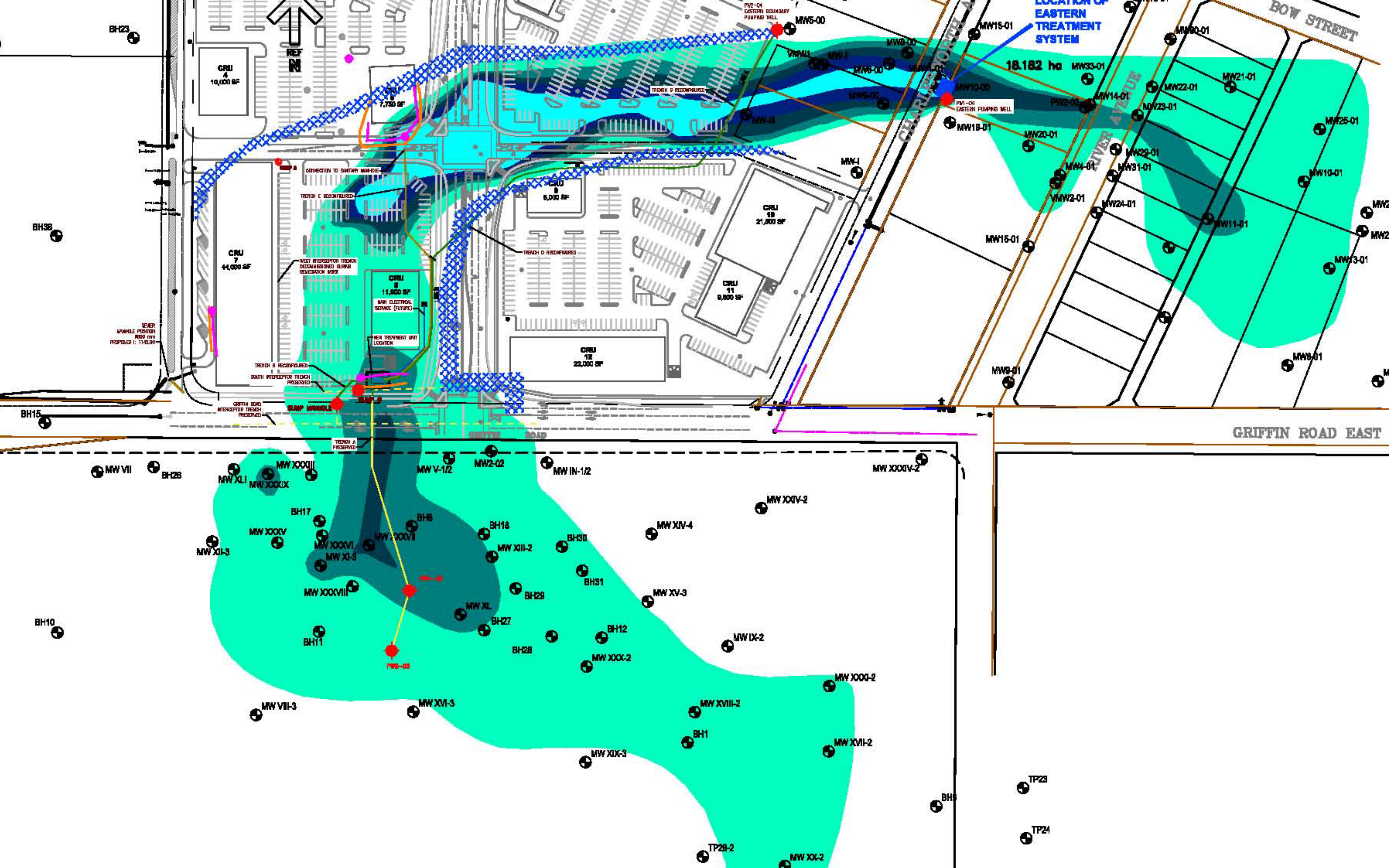












Creosote

- Mixture of coal tar and pentachlorophenol (PCP)
- Main contaminants:
 - Polycyclic Aromatic Hydrocarbons (PAHs)
 - Phenols (chlorinated and non-chlorinated)
 - Dioxins and furans
 - Petroleum hydrocarbons (carrier fluid)



A Division of EnGlobe Corp.

Challenges

- Stockpiles: 250,000 tonnes
- Generalized surface soil impacts: >500k tonnes
- Deep soil impacts: >500k tonnes
- About 50% of soil classified as hazardous waste
- Generalized dioxins and furans impacts
- Generalized groundwater impacts
- 2 years to do the project



A Division of EnGlobe Corp.

Remediation Objectives

- Protect groundwater from future impacts
- Protect ecological and human receptors
 - Contact
 - Inhalation
- Allow commercial development to proceed



A Division of EnGlobe Corp.

Site-Specific Remediation Criteria

	COMMERCIAL LAND USE	
	Generic Criteria	Risk Management
Direct Soil Contact - Human		•
Vapour Inhalation	•	
Protection of Domestic Use Aquifer		•
Direct Soil Contact - Ecological	•	
Protection of Freshwater Aquatic Life		•



A Division of EnGlobe Corp.

The Solution

- Demolition and disposal/recycling of all debris
- Excavation of all impacted soil
 - Screening and beneficial reuse of coarse fraction
 - Biological treatment of leachable/volatile soil
 - Consolidation in Special Management Area (SMA)
- Construction of contingency measures
- Long-term monitoring















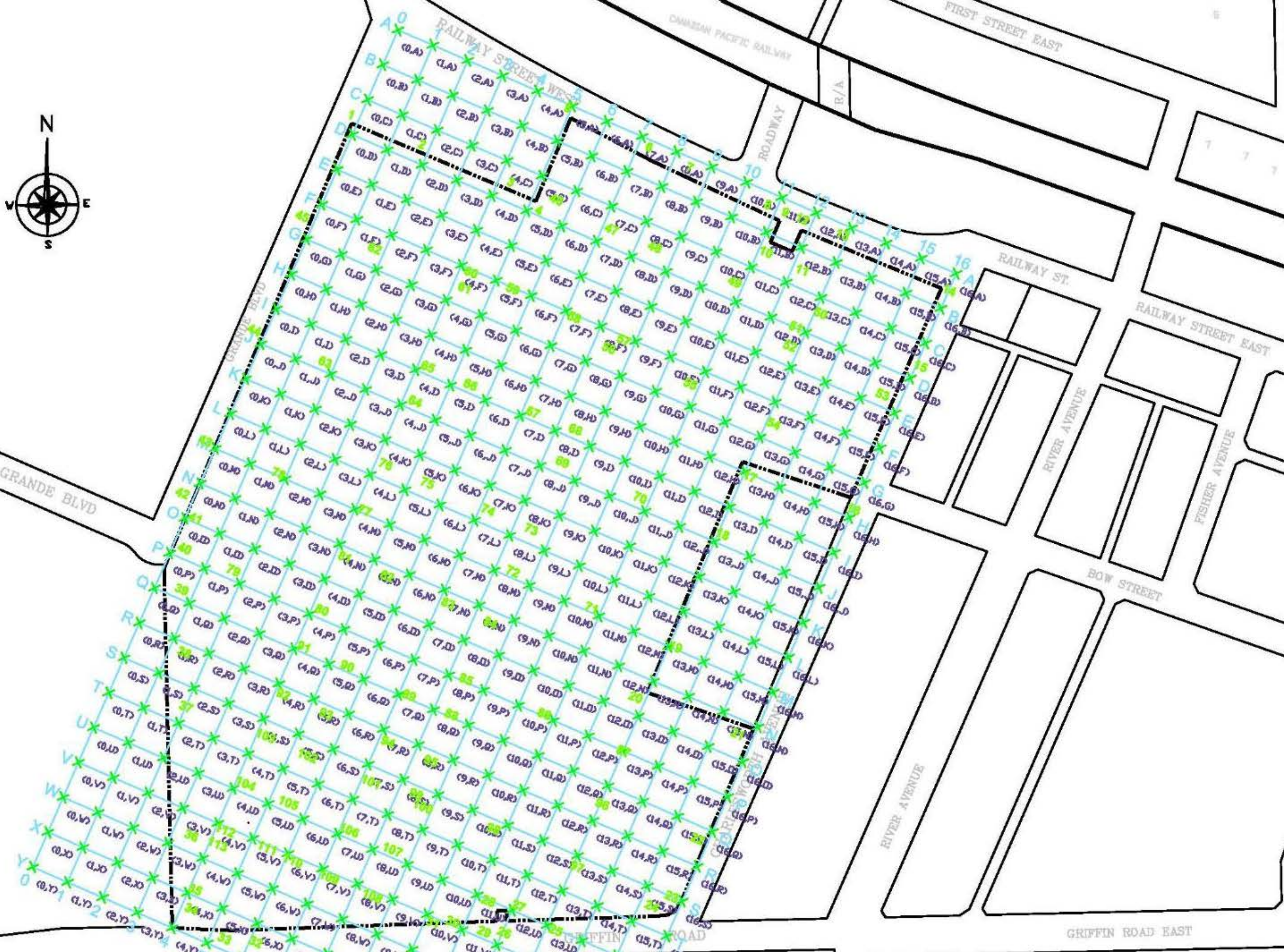




































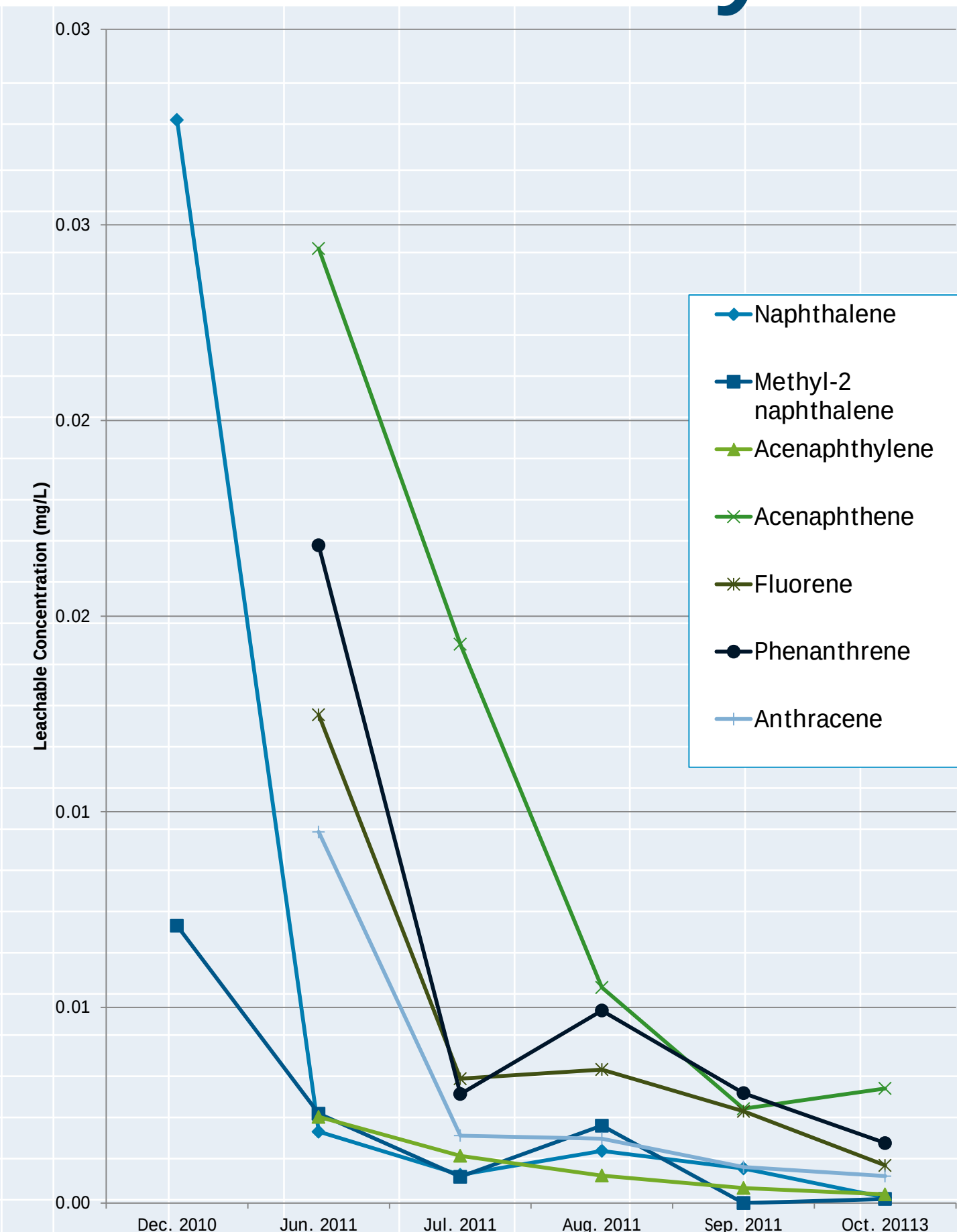






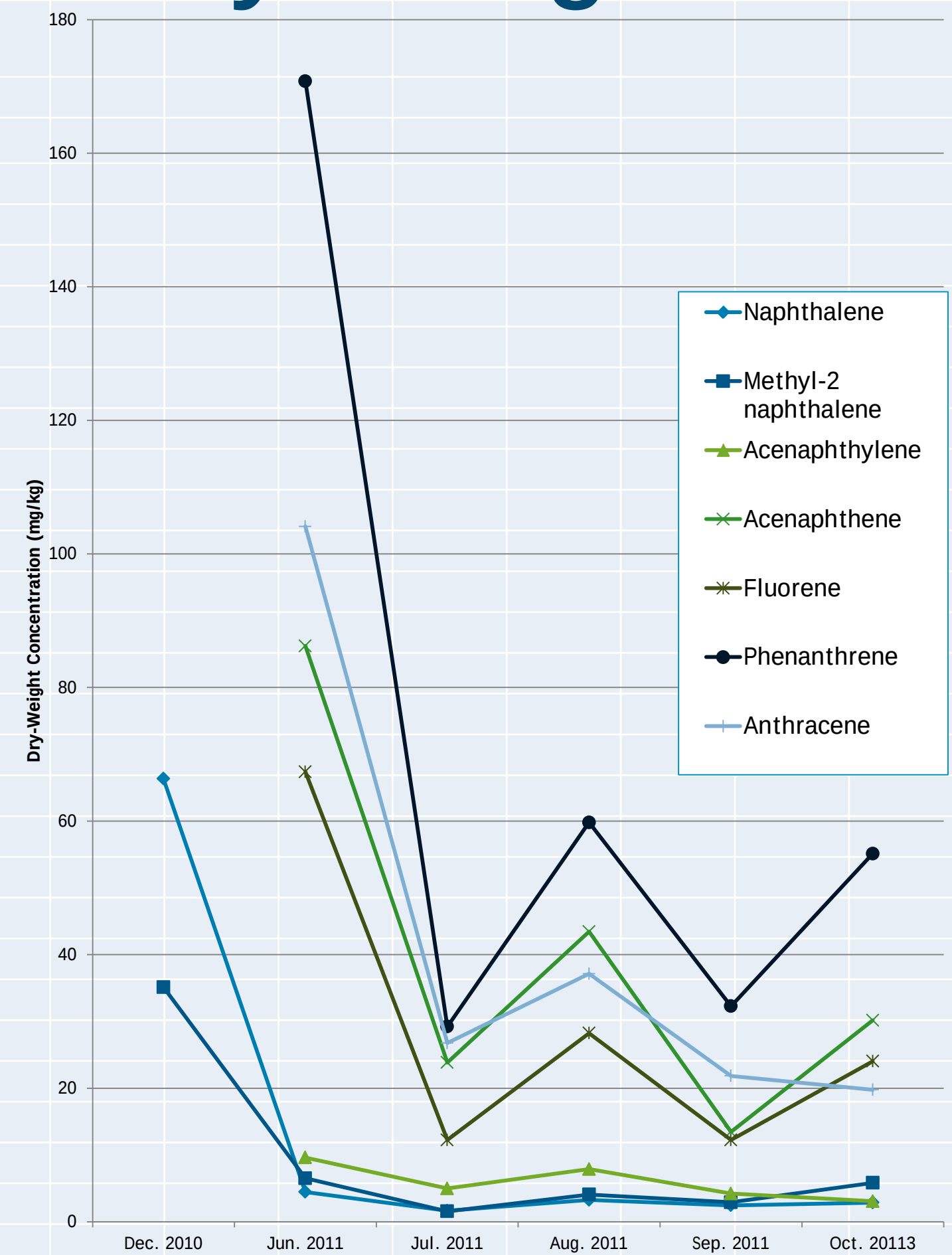
Treatment Results - Leachability

Parameter ¹	Unit	Pre-treatment Data	Sampling Event #1	Sampling Event #2	Sampling Event #3	Sampling Event #4	Sampling Event #5	%
		Dec. 2010	Jun. 2011	Jul. 2011	Aug. 2011	Sep. 2011	Oct. 2011	
Naphthalene	mg/L	0.028	0.0018	0.0007	0.0013	0.0009	0.0001	99%
Methyl-2 naphthalene	mg/L	0.007	0.0023	0.0007	0.0020	0.0000	0.0001	99%
Acenaphthylene	mg/L		0.0022	0.0012	0.0007	0.0004	0.0002	90%
Acenaphthene	mg/L		0.0244	0.0143	0.0055	0.0024	0.0029	88%
Fluorene	mg/L		0.0125	0.0032	0.0034	0.0023	0.0010	92%
Phenanthrene	mg/L		0.0168	0.0028	0.0049	0.0028	0.0015	91%
Anthracene	mg/L		0.0095	0.0017	0.0016	0.0009	0.0007	93%
TOTAL 2-3 rings	mg/L		0.1001	0.0246	0.0195	0.0097	0.0066	93%
Fluoranthene	mg/L		0.0125	0.0178	0.0097	0.0073	0.0049	61%
Pyrene	mg/L		0.0114	0.0127	0.0104	0.0076	0.0043	62%
Benzo(a)anthracene	mg/L		0.0025	0.0025	0.0034	0.0016	0.0006	75%
Chrysene	mg/L		0.0031	0.0022	0.0032	0.0022	0.0014	57%
TOTAL 4 rings	mg/L		0.0295	0.0352	0.0268	0.0188	0.0112	62%
Benzo(b+j)fluoranthene	mg/L		0.0016	0.0023	0.0027	0.0028	0.0007	55%
Benzo(k)fluoranthene	mg/L		0.0015	0.0012	0.0028	0.0017	0.0008	49%
Benzo(a)pyrene	mg/L		0.0009	0.0012	0.0027	0.0018	0.0006	37%
Indeno(1,2,3-c,d)pyrene	mg/L		0.0004	0.0007	0.0009	0.0007	0.0002	55%
Dibenzo(a,h)anthracene	mg/L		0.0002	0.0005	0.0005	0.0004	0.0001	49%
Benzo(g,h,i)perylene	mg/L		0.0004	0.0007	0.0010	0.0007	0.0002	47%
TOTAL 5-6 rings	mg/L		0.0051	0.0067	0.0106	0.0080	0.0026	49%
TOTAL PAHs	mg/L		0.1347	0.0664	0.0569	0.0365	0.0203	85%
PAHs (2-3 rings)	%		74%	37%	34%	27%	32%	
PAHs (4 rings)	%		22%	53%	47%	51%	55%	
PAHs (5-6 rings)	%		4%	10%	19%	22%	13%	
PCP	mg/L		0.452	0.472	0.456	0.311	1.925	-326%



Treatment Results – Dry Weight

Parameter ¹	Unit	Pre-treatment Data	Sampling Event #1	Sampling Event #2	Sampling Event #3	Sampling Event #4	Sampling Event #5	%
		Dec. 2010	Jun. 2011	Jul. 2011	Aug. 2011	Sep. 2011	Oct. 2011	
Naphthalene	mg/kg	66.34	4.46	1.64	3.27	2.46	2.87	96%
Methyl-2 naphthalene	mg/kg	35.13	6.52	1.57	4.07	2.92	5.84	83%
Acenaphthylene	mg/kg		9.61	4.99	7.89	4.22	3.07	68%
Acenaphthene	mg/kg		86.22	23.84	43.43	13.46	30.17	65%
Fluorene	mg/kg		67.38	12.25	28.23	12.24	24.04	64%
Phenanthrene	mg/kg		170.79	29.22	59.80	32.28	55.12	68%
Anthracene	mg/kg		104.10	26.76	37.13	21.84	19.76	81%
TOTAL 2-3 rings	mg/kg		539.57	100.27	183.83	89.41	140.87	74%
Fluoranthene	mg/kg		245.91	129.30	151.51	72.84	81.52	67%
Pyrene	mg/kg		175.03	107.32	120.23	82.47	77.32	56%
Benzo(a)anthracene	mg/kg		46.56	43.05	47.83	26.39	30.96	33%
Chrysene	mg/kg		53.38	41.13	53.05	30.40	21.29	60%
TOTAL 4 rings	mg/kg		520.88	320.80	372.63	212.10	211.09	59%
Benzo(b+j)fluoranthene	mg/kg		31.21	36.82	33.67	29.57	33.42	-7%
Benzo(k)fluoranthene	mg/kg		29.59	18.04	26.99	19.90	8.72	71%
Benzo(a)pyrene	mg/kg		20.27	27.75	27.87	22.71	17.45	14%
Indeno(1,2,3-c,d)pyrene	mg/kg		8.75	12.46	14.81	12.31	7.85	10%
Dibenzo(a,h)anthracene	mg/kg		3.05	7.04	7.79	4.72	2.55	16%
Benzo(g,h,i)perylene	mg/kg		9.60	17.03	15.07	11.30	5.69	41%
TOTAL 5-6 rings	mg/kg		102.47	119.13	126.21	100.51	75.68	26%
TOTAL PAHs	mg/kg		1162.93	540.19	682.67	402.02	427.63	63%
PAHs (2-3 rings)	%		46%	19%	27%	22%	33%	
PAHs (4 rings)	%		45%	59%	55%	53%	49%	
PAHs (5-6 rings)	%		9%	22%	18%	25%	18%	



The Project at a Glance

- Soil Treated: 85,000 tonnes
- Gravel beneficially reused offsite: 325,000 tonnes
- Total earthmoving quantities: 1,250,000 tonnes
- 1,891 soil samples
- Project completed in 18 months
- Impacted soil sent offsite: 0 tonnes



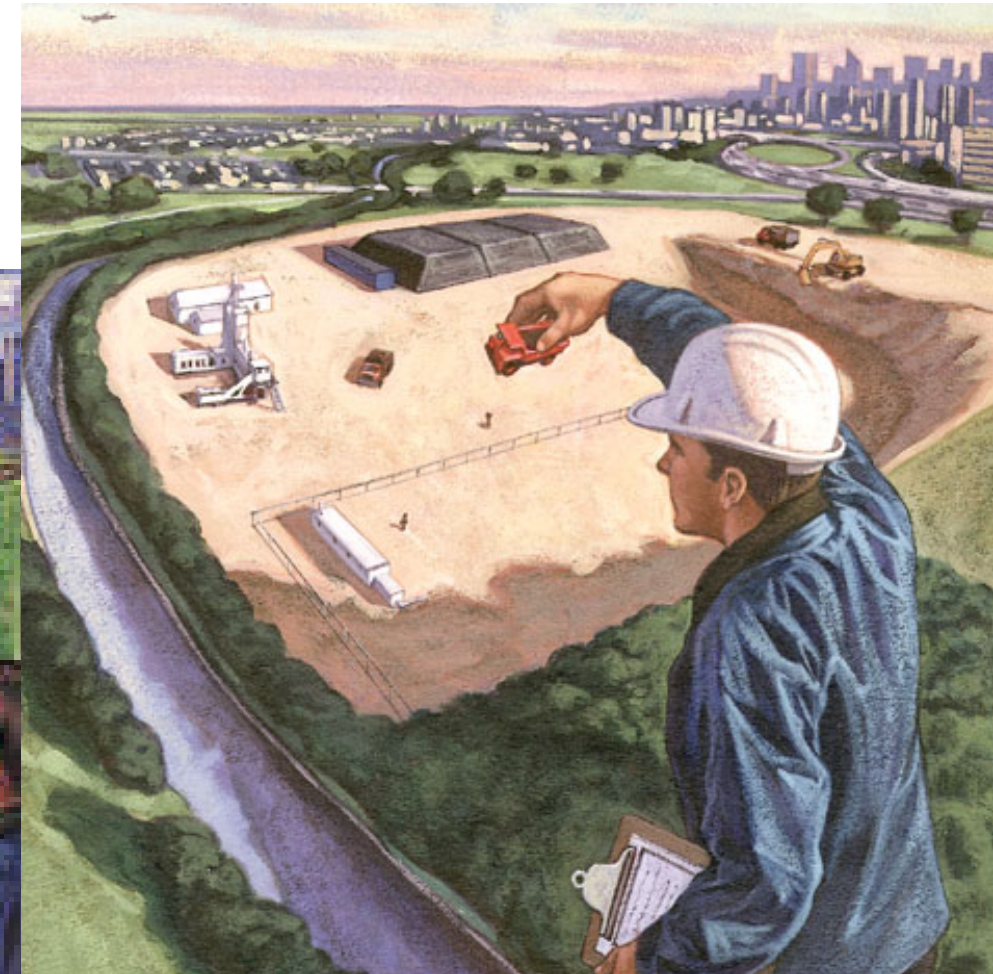
A Division of EnGlobe Corp.

Conclusion

Execute

Assess

Design



A Division of EnGlobe Corp.