

APPENDIX D

Ground Gas Monitoring and Flow Results

Project/Site Name Penistone Grammar School
Project Number AG2882-18

Date and Time of Monitoring 05/07/2018 - PM
Phase of Monitoring 1 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Methane % LEL		Carbon dioxide % v/v		Oxygen % v/v		VOC (ppm)	Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Base of installation check (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady					
DCS1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	1.1	1.1	20.1	20.1	5.4	5.00	50.00	DRY	4.94
DCS2	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	2.2	2.2	18.1	18.1	1.1	4.00	50.00	DRY	3.96
DCS3	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	0.6	0.6	20.5	20.5	0.5	3.00	50.00	DRY	2.66

Meteorological Data

Atmospheric Pressure (mb)	991
Pressure Rising or Falling	Falling
Weather Conditions	0/8 Cloud Cover
Atmospheric Oxygen (% vol)	21.2
Wind Speed & Direction	14 km/h
Ambient Air Temperature (°C)	24

Site Data

Monitoring Personnel	Jordan Swales		
GPS Instrument			
Equipment Used	Gasmeter	PID	Flowmeter
Equipment Serial Number	10347	108308-NLW	10347
Ground Conditions (vegetation stress, visual contamination)			

General Notes

Instrument specification data and calibration information is provided on a separate data sheet
APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project/Site Name Penistone Grammar School
Project Number AG2882-18

Date and Time of Monitoring 11/07/2018 - PM
Phase of Monitoring 2 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Methane % LEL		Carbon dioxide % v/v		Oxygen % v/v		VOC (ppm)	Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Base of installation check (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady					
DCS1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	1.7	1.7	17.5	17.5	6.5	5.00	50.00	4.80	4.94
DCS2	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	2.4	2.4	17.9	17.9	1.3	4.00	50.00	DRY	3.96
DCS3	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	21.0	21.0	0.9	3.00	50.00	DRY	2.66

Meteorological Data

Atmospheric Pressure (mb)	998
Pressure Rising or Falling	Steady
Weather Conditions	3/8 Cloud Cover
Atmospheric Oxygen (% vol)	21.3
Wind Speed & Direction	6 mp/h
Ambient Air Temperature (°C)	23

Site Data

Monitoring Personnel	Jordan Swales		
GPS Instrument			
Equipment Used	Gasmeter	PID	Flowmeter
Equipment Serial Number	10347	108308-NLW	10347
Ground Conditions (vegetation stress, visual contamination)			

General Notes

Instrument specification data and calibration information is provided on a separate data sheet
APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project/Site Name Penistone Grammar School
Project Number AG2882-18

Date and Time of Monitoring 18/07/2018 - PM
Phase of Monitoring 3 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Methane % LEL		Carbon dioxide % v/v		Oxygen % v/v		VOC (ppm)	Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Base of installation check (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady					
DCS1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	1.7	1.7	16.4	16.4	4.6	5.00	50.00	4.76	4.94
DCS2	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	3.2	3.2	16.2	16.2	1.3	4.00	50.00	DRY	3.96
DCS3	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	0.0	0.0	21.3	21.3	0.8	3.00	50.00	DRY	2.66

Meteorological Data

Atmospheric Pressure (mb)	994
Pressure Rising or Falling	Steady
Weather Conditions	8/8 Cloud Cover
Atmospheric Oxygen (% vol)	21.3
Wind Speed & Direction	13 km/h
Ambient Air Temperature (°C)	20

Site Data

Monitoring Personnel	Jordan Swales		
GPS Instrument			
Equipment Used	Gasmeter	PID	Flowmeter
Equipment Serial Number	10347	108308-NLW	10347
Ground Conditions (vegetation stress, visual contamination)			

General Notes

Instrument specification data and calibration information is provided on a separate data sheet
APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project/Site Name Penistone Grammar School
Project Number AG2882-18

Date and Time of Monitoring 25/07/2018 - PM
Phase of Monitoring 4 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Methane % LEL		Carbon dioxide % v/v		Oxygen % v/v		VOC (ppm)	Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Base of installation check (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady					
DCS1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	2.1	2.1	17.2	17.2	5.0	5.00	50.00	4.77	4.94
DCS2	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	4.0	4.0	15.4	15.4	1.1	4.00	50.00	DRY	3.96
DCS3	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	21.0	21.0	0.8	3.00	50.00	DRY	2.66

Meteorological Data

Atmospheric Pressure (mb)	994
Pressure Rising or Falling	Steady
Weather Conditions	3/8 Cloud Cover
Atmospheric Oxygen (% vol)	21.2
Wind Speed & Direction	10 km/h
Ambient Air Temperature (°C)	22

Site Data

Monitoring Personnel	Jordan Swales		
GPS Instrument			
Equipment Used	Gasmeter	PID	Flowmeter
Equipment Serial Number	10347	108308-NLW	10347
Ground Conditions (vegetation stress, visual contamination)			

General Notes

Instrument specification data and calibration information is provided on a separate data sheet
APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project/Site Name Penistone Grammar School
Project Number AG2882-18

Date and Time of Monitoring 03/08/2018 - PM
Phase of Monitoring 5 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Methane % LEL		Carbon dioxide % v/v		Oxygen % v/v		VOC (ppm)	Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Base of installation check (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady					
DCS1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	1.0	1.0	19.8	19.8	3.2	5.00	50.00	4.77	4.94
DCS2	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	3.7	3.7	11.8	11.8	1.0	4.00	50.00	DRY	3.96
DCS3	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	0.4	0.4	20.7	20.7	0.4	3.00	50.00	2.47	2.66

Meteorological Data

Atmospheric Pressure (mb)	998
Pressure Rising or Falling	Rising
Weather Conditions	8/8 Cloud Cover
Atmospheric Oxygen (% vol)	21.2
Wind Speed & Direction	10 km/h
Ambient Air Temperature (°C)	21

Site Data

Monitoring Personnel	Jordan Swales		
GPS Instrument			
Equipment Used	Gasmeter	PID	Flowmeter
Equipment Serial Number	10347	108308-NLW	10347
Ground Conditions (vegetation stress, visual contamination)			

General Notes

Instrument specification data and calibration information is provided on a separate data sheet
APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project/Site Name Penistone Grammar School
Project Number AG2882-18

Date and Time of Monitoring 09/08/2018 - AM
Phase of Monitoring 6 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Methane % LEL		Carbon dioxide % v/v		Oxygen % v/v		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	VOC (ppm)	Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Base of installation check (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady							
DCS1	< 0.1	< 0.1	< 0.1	< 1	< 0.1	< 0.1	< 0.1	< 0.1	2.4	2.4	15.1	15.1	< 1	< 1	2.8	5.00	50.00	4.79	4.94
DCS2	< 0.1	< 0.1	< 0.1	< 1	< 0.1	< 0.1	< 0.1	< 0.1	4.5	4.5	14.1	14.1	< 1	< 1	0.8	4.00	50.00	DRY	3.96
DCS3	< 0.1	< 0.1	< 0.1	< 1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	0.2	20.7	20.7	< 1	< 1	0.1	3.00	50.00	2.50	2.66

Meteorological Data

Atmospheric Pressure (mb)	989
Pressure Rising or Falling	Falling
Weather Conditions	8/8 cloud cover
Atmospheric Oxygen (% vol)	21.2
Wind Speed & Direction	8 km/h from W
Ambient Air Temperature (°C)	17

Site Data

Monitoring Personnel	Jordan Swales		
GPS Instrument			
Equipment Used	Gasmeter	PID	Flowmeter
Equipment Serial Number	10347	108308-NLW	10347
Ground Conditions (vegetation stress, visual contamination)			

General Notes

Instrument specification data and calibration information is provided on a separate data sheet
APPLIED GEOLOGY

Gas Monitoring Equipment Specification and Accuracy Details

Instrument Specifications


Instrument	Atmospheric Pressure Range	Temperature Range	Flow Range	Flow Resolution	Borehole Pressure Range
GFM 430	800 to 1200 mbar +/- 1m bar	-10°C to + 40°C	-30 to +30 l/hr	0.1l/hr	+1000 to - 1000 Pa
GA5000	500-1500 mb +/- 5 mb	-10°C to + 50°C	0-20 lt/hr +/- 0.3 l/hr	0.1l/hr	+.500/-500 mbar +/- 4 mbar
Pro Check Tiger	-	-20 to + 60°C (Certified to -15 to + 45°C)	-	-	-

Instrument Accuracy

Instrument		Methane	Lower Explosive Limit	Carbon Dioxide	Oxygen	Volatile Organic Compounds	Hydrogen Sulphide	Carbon Monoxide
GFM430	Detection Range	0-100%	0-100%	0 -100%	0-25%	NA	1500ppm response 30 secs	1000ppm response 30 Secs
	Detection Accuracy	+/- 0.2% @ 5% 1.0% @30% 3.0% @ 100% Response 20 secs	+/-4% of LEL Response 40 secs	Accuracy 0.1% @10% 3.0% @40% 3% @ 100% Response 20 Secs	+/- 0.5% Response 20 secs	NA	5% of fs	5% of fs
GA5000	Detection Range	0-100%	-	0 -100%	0-25%	NA	0 -50ppm response <30 secs	0 - 1000ppm response <30 Secs
	Detection Accuracy	+/- 0.5% @ 0 to 70%, +/-1.5% @ 70 to 100% Response < 10 secs	N/A	+/- 0.5% @ 0 to 60%, +/-1.5% @ 60 to 100% Response < 10 secs	+/- 1.0% @ 0 to 25%, Response < 20 secs	NA	./- 1.5% FS	./- 2% of FS
Pro Check Tiger	Detection Range	N/A	N/A	N/A	N/A	1 ppb - 10,000 ppm	N/A	N/A
	Detection Accuracy	N/A	N/A	N/A	N/A	+/- 1ppb +/- 5% of actual displayed accuracy +/- One digit Response < 2sec	N/A	N/A

Calibration Frequency

Equipment Serial Numbers

<p>Instruments are calibrated annually.</p> <p>Details of the instrument calibration certificates and service records are available if required.</p>		
	GA5000 (G503948)	
	GFM430 - (10072, 10347)	
	Pro Check Tiger - (T-108308, T-109597, T-109598, T-110423)	

APPENDIX E

SOIL CHEMICAL RESULTS COMPARED AGAINST SCREENING VALUES FOR HUMAN HEALTH

Site: Penistone Grammar School
Job No: AG2882-18
Land Use: Public Open Space (Residential)
 Residential without Plant Uptake
Dataset: All results
Soil Organic Matter (%): 2.5 %

Exploratory Hole Reference		DCS1-ES1	DCS1-ES2	DCS2-ES1	DCS3-ES1	BH1-ES1	DCS3-ES2	No. of samples (n)	Residential without Plant Uptake	Public Open Space (Residential)	Source/Justification
Depth (m)		0.4	1.8	0.4	0.4	0.4	2.7				
Strata		MG	MG	MG	MG	MG	PLCM				
	Units										
Organic Matter (%)	%	1.5	1.9	2.6	0.7	3.6	0.6	6			
pH		9.1	8.1	8.4	8.4	7.6	8.3	6			
Arsenic	mg/kg	9.5	2.2	11	13	16	3	6		79	LQM/CIEH S4UL (2015)
Cadmium	mg/kg	0.2	0.2	0.2	0.2	0.2	0.2	6		120	LQM/CIEH S4UL (2015)
Chromium	mg/kg	19	17	26	24	24	28	6		1500	LQM/CIEH S4UL (2015)
Chromium (Hexavalent)	mg/kg	4	4	4	4	4	-	5		7.7	LQM/CIEH S4UL (2015)
Copper	mg/kg	19	18	50	23	30	27	6		12000	LQM/CIEH S4UL (2015)
Lead	mg/kg	20	510	36	13	60	15	6		630	C4SL (2014)
Mercury	mg/kg	0.3	0.3	0.3	0.3	0.3	0.3	6		120	LQM/CIEH S4UL (2015)
Nickel	mg/kg	22	10	24	34	20	36	6		230	LQM/CIEH S4UL (2015)
Selenium	mg/kg	1	1	1	1	3	1	6		1100	LQM/CIEH S4UL (2015)
Zinc	mg/kg	65	170	100	69	120	86	6		81000	LQM/CIEH S4UL (2015)
Naphthalene	mg/kg	0.05	0.05	0.05	0.05	0.05	0.05	6	5.6		LQM/CIEH S4UL (2015)
Acenaphthylene	mg/kg	0.05	0.18	0.05	0.05	0.05	0.05	6		15000	LQM/CIEH S4UL (2015)
Acenaphthene	mg/kg	0.05	0.22	0.05	0.05	0.05	0.05	6		15000	LQM/CIEH S4UL (2015)
Fluorene	mg/kg	0.05	0.48	0.05	0.05	0.05	0.05	6		9900	LQM/CIEH S4UL (2015)
Phenanthrene	mg/kg	0.4	3.3	0.79	0.05	1.4	0.05	6		3100	LQM/CIEH S4UL (2015)
Anthracene	mg/kg	0.05	1.1	0.17	0.05	0.44	0.05	6		74000	LQM/CIEH S4UL (2015)
Fluoranthene	mg/kg	1.2	4.7	1.8	0.05	2.4	0.05	6		3100	LQM/CIEH S4UL (2015)
Pyrene	mg/kg	1.1	4.2	1.6	0.05	2.4	0.05	6		7400	LQM/CIEH S4UL (2015)
Benzo[a]anthracene	mg/kg	0.51	2.9	0.8	0.05	1.4	0.05	6		29	LQM/CIEH S4UL (2015)
Chrysene	mg/kg	0.49	2.3	0.73	0.05	1.1	0.05	6		57	LQM/CIEH S4UL (2015)
Benzo[b]fluoranthene	mg/kg	0.66	2.7	0.72	0.05	1.5	0.05	6		7.2	LQM/CIEH S4UL (2015)
Benzo[k]fluoranthene	mg/kg	0.24	1.3	0.55	0.05	0.62	0.05	6		190	LQM/CIEH S4UL (2015)
Benzo[a]pyrene	mg/kg	0.59	2.5	0.79	0.05	1.5	0.05	6		5.7	LQM/CIEH S4UL (2015)
Dibenzo[a,h]anthracene	mg/kg	0.28	1.4	0.42	0.05	0.84	0.05	6		0.58	LQM/CIEH S4UL (2015)
Indeno[1,2,3-cd]pyrene	mg/kg	0.05	0.05	0.05	0.05	0.05	0.05	6		82	LQM/CIEH S4UL (2015)
Benzo[g,h,i]perylene	mg/kg	0.36	1.6	0.5	0.05	0.89	0.05	6		640	LQM/CIEH S4UL (2015)
Total of 16 PAHs	mg/kg	5.83	28.8	8.89	0.8	14.6	0.8				
Phenols (Total)	mg/kg	1	1	1	1	1	-	5		690	LQM/CIEH S4UL (2015)
Benzene	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	0.7		LQM/CIEH S4UL (2015)
Toluene	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	1900		LQM/CIEH S4UL (2015)
Ethylbenzene	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	190		LQM/CIEH S4UL (2015)
m&p Xylene	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	180		LQM/CIEH S4UL (2015)
o-Xylene	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	210		LQM/CIEH S4UL (2015)
Aliphatic TPH >C5-C6	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	78		LQM/CIEH S4UL (2015)
Aliphatic TPH >C6-C8	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	230		LQM/CIEH S4UL (2015)
Aliphatic TPH >C8-C10	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	65		LQM/CIEH S4UL (2015)
Aliphatic TPH >C10-C12	mg/kg	1	1	1	1	1	1	6	330		LQM/CIEH S4UL (2015)
Aliphatic TPH >C12-C16	mg/kg	2	3.6	2	2	2	2	6		13000	LQM/CIEH S4UL (2015)
Aliphatic TPH >C16-C21	mg/kg	8	11	8	8	8	8	6		-	-
Aliphatic TPH >C21-C35	mg/kg	8.9	88	8	8	8	8	6		250000	LQM/CIEH S4UL (2015)
Aliphatic TPH >C35-C44	mg/kg	8.4	41	8.4	8.4	8.4	8.4	6		250000	LQM/CIEH S4UL (2015)
Total Aliphatic Hydrocarbons	mg/kg	10	140	10	10	10	10	6			
Aromatic TPH >C5-C7	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	690		LQM/CIEH S4UL (2015)
Aromatic TPH >C7-C8	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	1800		LQM/CIEH S4UL (2015)
Aromatic TPH >C8-C10	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	6	110		LQM/CIEH S4UL (2015)
Aromatic TPH >C10-C12	mg/kg	1	1.2	1	1	1	1	6	590		LQM/CIEH S4UL (2015)
Aromatic TPH >C12-C16	mg/kg	2	11	2	2	2	2	6		5100	LQM/CIEH S4UL (2015)
Aromatic TPH >C16-C21	mg/kg	10	40	10	10	10	10	6		3800	LQM/CIEH S4UL (2015)
Aromatic TPH >C21-C35	mg/kg	44	160	32	10	28	10	6		3800	LQM/CIEH S4UL (2015)
Aromatic TPH >C35-C44	mg/kg	8.4	75	8.4	8.4	8.4	8.4	6		3800	LQM/CIEH S4UL (2015)
Total Aromatic Hydrocarbons	mg/kg	52	290	40	10	39	10				
Total Petroleum Hydrocarbons	mg/kg	52	430	40	10	39	10				
Asbestos in Soils		Not Dectected	Not Dectected	Not Dectected	Not Dectected	Not Dectected	Not Dectected	6			

Key -
 Value within sample set exceeds screening value
 Statistical value exceeds screening value

LQM/CIEH S4UL Reference No. S4UL3159 (2015)
 Values in **bold** are reported at the laboratory limit of detection
 Benzo(a)pyrene has been used as a 'surrogate marker for genotoxic PAH' as discussed in Appendix E of CL:AIRE SP1010 'Development of C4SL for Assessment of Land Affected by Contamination', December 2013.
 This allows assessment of the combined carcinogenic risk associated with genotoxic PAH using only b(a)p. Genotoxic PAHs include Benz(a)pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(ah)anthracene, Indeno(12

SUMMARY OF LEACHATE TEST RESULTS

Site Penistone Grammar School
 Job Number AG2882-18
 Type of Water Leachate

Determinand	Limit of Detection	Hazardous or Non-Hazardous [^]	Sample Identity Depth Sampled Date	DCS1-ES1 0.4 26/06/2018	DCS3-ES1 0.4 26/06/2018	No. of samples (n)	Waters Screening Value	Source & Justification
pH		-	-	7.8	7.7	2	-	-
TOC		-	mg l ⁻¹	6.2	6.92	2	-	-
Arsenic		Haz	µg l ⁻¹	1.1	1.1	2	1.1	Detection Limit
Cadmium		Non Haz	µg l ⁻¹	0.08	0.08	2	0.08	Detection Limit
Chromium (Total)		<i>Non Haz</i>	µg l ⁻¹	2.1	4.8	2	50	UK Drinking Water Standards (2010)
Chromium (III)		<i>Non Haz</i>	µg l ⁻¹	2.1	4.8	2	50	UK Drinking Water Standards (2010)
Chromium (VI)		Haz	µg l ⁻¹	5	5	2	5	Detection Limit
Copper		Non Haz	µg l ⁻¹	11	9.2	2	2000	UK Drinking Water Standards (2010)
Lead		Haz	µg l ⁻¹	1.4	1.2	2	10	UK Drinking Water Standards (2010)
Mercury		Haz	µg l ⁻¹	0.5	0.5	2	0.5	Detection limit
Nickel		Non Haz	µg l ⁻¹	1.1	3.7	2	20	UK Drinking Water Standards (2010)
Selenium		Non Haz	µg l ⁻¹	4	4	2	4	Detection Limit
Zinc		Non Haz	µg l ⁻¹	5.9	4.2	2	5000	UK Drinking Water Standards (2010)
Boron		<i>Non Haz</i>	µg l ⁻¹	10	11	2	1000	UK Drinking Water Standards (2010)
Beryllium		<i>Non Haz</i>	µg l ⁻¹	0.2	0.2	2	0.2	Detection Limit
Vanadium		<i>Non Haz</i>	µg l ⁻¹	1.7	1.7	2	1.7	Detection Limit
Sulphate		<i>Non Haz</i>	mg l ⁻¹	1.4	4.8	2	250	UK Drinking Water Standards (2010)
Phenol		Non Haz	µg l ⁻¹	2.1	5.1	2	7.7	WFD Environmental Standard, 2010
Naphthalene		Non Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Acenaphthylene		<i>Haz</i>	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Acenaphthene		Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Fluorene		<i>Haz</i>	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Phenanthrene		<i>Haz</i>	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Anthracene		Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Fluoranthene		Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Pyrene		Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[a]anthracene		<i>Haz</i>	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Chrysene		<i>Haz</i>	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[b]fluoranthene		Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[k]fluoranthene		Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[a]pyrene		Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Dibenz(a,h)Anthracene		<i>Haz</i>	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Indeno(1,2,3-c,d)Pyrene		Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[g,h,i]perylene		Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit

Key-
Result exceeds test Detection Limit (for Haz determinands)
Result exceeds Screening Value (for Non Haz determinands)
Values in bold at the limit of detection

[^] Note: Hazardous and non-hazardous substances determined by JAGDAG (Jan 2017) and published at <http://www.wfduk.org/sites/default/files/Media/170116%20Substance%20Determinationsfinal.c>
 For substances not assessed by JAGDAG, Applied Geology has assumed a determination based on our understanding of the behaviour of the chemical. These determinations are highlighted



Jordan Swales
Applied Geology Ltd
Centrix House
Crow Lane East
Newton-Le-Willows
Merseyside
WA12 9UY

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: jordan.swales@appliedgeology.co.uk

Analytical Report Number : 18-90795

Project / Site name:	Penistone Grammar School	Samples received on:	28/06/2018
Your job number:	AG2882-18	Samples instructed on:	28/06/2018
Your order number:	13074	Analysis completed by:	05/07/2018
Report Issue Number:	1	Report issued on:	05/07/2018
Samples Analysed:	2 leachate samples - 6 soil samples		

Signed: _____

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Analytical Report Number: 18-90795

Project / Site name: Penistone Grammar School

Your Order No: 13074

Lab Sample Number				991783	991784	991785	991786	991787
Sample Reference				DCS1-ES1	DCS1-ES2	DCS2-ES1	DCS3-ES1	DCS3-ES2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.80	0.40	0.40	2.70
Date Sampled				26/06/2018	26/06/2018	26/06/2018	26/06/2018	26/06/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	9.3	16	7.3	7.2	5.2
Total mass of sample received	kg	0.001	NONE	0.89	0.38	0.88	0.90	0.44

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.1	8.1	8.4	8.4	8.3
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	21	3100	72	85	45
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.010	1.6	0.036	0.042	0.023
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	10.4	1560	35.8	42.3	22.5
Organic Matter	%	0.1	MCERTS	1.5	1.9	2.6	0.7	0.6

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.18	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.22	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.48	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.40	3.3	0.79	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	1.1	0.17	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	1.2	4.7	1.8	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	1.1	4.2	1.6	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.51	2.9	0.80	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.49	2.3	0.73	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.66	2.7	0.72	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.24	1.3	0.55	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.59	2.5	0.79	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.28	1.4	0.42	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.36	1.6	0.50	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	5.83	28.8	8.89	< 0.80	< 0.80

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.5	2.2	11	13	3.0
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.65	0.63	0.73	0.92	1.1
Boron (total)	mg/kg	1	MCERTS	2.1	9.2	2.9	2.0	2.1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	-
Chromium (III)	mg/kg	1	NONE	18	17	25	24	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	17	26	24	28
Copper (aqua regia extractable)	mg/kg	1	MCERTS	19	18	50	23	27
Lead (aqua regia extractable)	mg/kg	1	MCERTS	20	510	36	13	15
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	22	10	24	34	36
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	21	19	26	23	24
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	65	170	100	69	86

Magnesium (water soluble)	mg/kg	5	NONE	8.0	400	13	5.5	11

Analytical Report Number: 18-90795

Project / Site name: Penistone Grammar School

Your Order No: 13074

Lab Sample Number	991783			991784			991785			991786			991787			
Sample Reference	DCS1-ES1			DCS1-ES2			DCS2-ES1			DCS3-ES1			DCS3-ES2			
Sample Number	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied			
Depth (m)	0.40			1.80			0.40			0.40			2.70			
Date Sampled	26/06/2018			26/06/2018			26/06/2018			26/06/2018			26/06/2018			
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status													

Monoaromatics

Compound	Units	Limit of detection	Accreditation Status	991783	991784	991785	991786	991787
Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

Compound	Units	Limit of detection	Accreditation Status	991783	991784	991785	991786	991787
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	3.6	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	11	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	8.9	88	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4	41	< 8.4	< 8.4	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	100	< 10	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC44)	mg/kg	10	NONE	< 10	140	< 10	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	1.2	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	11	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	40	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	44	160	32	< 10	< 10
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4	75	< 8.4	< 8.4	< 8.4
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	52	210	40	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC44)	mg/kg	10	NONE	52	290	40	< 10	< 10
TPHCWG - Total C5 - C44 Aliphatic & Aromatic	mg/kg	10	NONE	52	430	40	< 10	< 10

Analytical Report Number: 18-90795

Project / Site name: Penistone Grammar School

Your Order No: 13074

Lab Sample Number				991788				
Sample Reference				BH1-ES1				
Sample Number				None Supplied				
Depth (m)				0.40				
Date Sampled				26/06/2018				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	8.4				
Total mass of sample received	kg	0.001	NONE	0.42				

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected				
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.6				
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	69				
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.035				
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	34.5				
Organic Matter	%	0.1	MCERTS	3.6				

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0				
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05				
Fluorene	mg/kg	0.05	MCERTS	< 0.05				
Phenanthrene	mg/kg	0.05	MCERTS	1.4				
Anthracene	mg/kg	0.05	MCERTS	0.44				
Fluoranthene	mg/kg	0.05	MCERTS	2.4				
Pyrene	mg/kg	0.05	MCERTS	2.4				
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.4				
Chrysene	mg/kg	0.05	MCERTS	1.1				
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.5				
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.62				
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.5				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.84				
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.89				

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	14.6				
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.90				
Boron (total)	mg/kg	1	MCERTS	2.0				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (III)	mg/kg	1	NONE	24				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	30				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	60				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	3.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	27				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	120				

Magnesium (water soluble)	mg/kg	5	NONE	25				
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Analytical Report Number: 18-90795

Project / Site name: Penistone Grammar School

Your Order No: 13074

Lab Sample Number				991788				
Sample Reference				BH1-ES1				
Sample Number				None Supplied				
Depth (m)				0.40				
Date Sampled				26/06/2018				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Monoaromatics

Benzene	ug/kg	1	MCERTS	< 1.0				
Toluene	ug/kg	1	MCERTS	< 1.0				
Ethylbenzene	ug/kg	1	MCERTS	< 1.0				
p & m-xylene	ug/kg	1	MCERTS	< 1.0				
o-xylene	ug/kg	1	MCERTS	< 1.0				
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	< 1.0				

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0				
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0				
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0				
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4				
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10				
TPH-CWG - Aliphatic (EC5 - EC44)	mg/kg	10	NONE	< 10				

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0				
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	10				
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	28				
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4				
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	39				
TPH-CWG - Aromatic (EC5 - EC44)	mg/kg	10	NONE	39				

TPHCWG - Total C5 - C44 Aliphatic & Aromatic	mg/kg	10	NONE	39				
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Analytical Report Number: 18-90795

Project / Site name: Penistone Grammar School

Your Order No: 13074

Lab Sample Number				991789	991790			
Sample Reference				DCS1-ES1	DCS3-ES1			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.40	0.40			
Date Sampled				26/06/2018	26/06/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status					

General Inorganics

pH	pH Units	N/A	ISO 17025	7.8	7.7			
Sulphate as SO ₄	mg/l	0.1	ISO 17025	1.4	4.8			
Total Organic Carbon (TOC)	mg/l	0.1	NONE	6.20	6.92			

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	2.1	5.1			
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01			
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01			
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01			

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2			
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1.1	ISO 17025	< 1.1	< 1.1			
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2			
Boron (dissolved)	µg/l	10	ISO 17025	< 10	11			
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08			
Chromium (hexavalent)	µg/l	5	NONE	< 5.0	< 5.0			
Chromium (III)	µg/l	1	NONE	2.1	4.8			
Chromium (dissolved)	µg/l	0.4	ISO 17025	2.1	4.8			
Copper (dissolved)	µg/l	0.7	ISO 17025	11	9.2			
Lead (dissolved)	µg/l	1	ISO 17025	1.4	1.2			
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5			
Nickel (dissolved)	µg/l	0.3	ISO 17025	1.1	3.7			
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0			
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7	< 1.7			
Zinc (dissolved)	µg/l	0.4	ISO 17025	5.9	4.2			

Magnesium (dissolved)	mg/l	0.005	ISO 17025	1.1	0.41			
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Analytical Report Number : 18-90795

Project / Site name: Penistone Grammar School

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
991783	DCS1-ES1	None Supplied	0.40	Grey loam and clay with gravel and vegetation.
991784	DCS1-ES2	None Supplied	1.80	Grey clay and gravel with coal.
991785	DCS2-ES1	None Supplied	0.40	Brown loam and clay with gravel and vegetation.
991786	DCS3-ES1	None Supplied	0.40	Brown clay and loam with gravel and vegetation.
991787	DCS3-ES2	None Supplied	2.70	Light brown clay and sand.
991788	BH1-ES1	None Supplied	0.40	Brown loam and sand with gravel and vegetation.

Analytical Report Number : 18-90795

Project / Site name: Penistone Grammar School

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS

Analytical Report Number : 18-90795

Project / Site name: Penistone Grammar School

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total organic carbon in leachate	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding.	L076-PL	D	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L088/76-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



Jordan Swales
Applied Geology Ltd
Centrix House
Crow Lane East
Newton-Le-Willows
Merseyside
WA12 9UY

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: jordan.swales@appliedgeology.co.uk

Analytical Report Number : 18-91140

Project / Site name:	Penistone Grammar School	Samples received on:	28/06/2018
Your job number:	AG2882-18	Samples instructed on:	28/06/2018
Your order number:	13074	Analysis completed by:	05/07/2018
Report Issue Number:	1	Report issued on:	05/07/2018
Samples Analysed:	5 soil samples		

Signed: _____

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Analytical Report Number: 18-91140

Project / Site name: Penistone Grammar School

Your Order No: 13074

Lab Sample Number	993543	993544	993545	993546	993547			
Sample Reference	DCS1	DCS2	BH1	BH1	BH2			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	2.55-3.00	2.00-3.00	0.00-0.70	3.00-3.50	0.70-1.00			
Date Sampled	26/06/2018	26/06/2018	26/06/2018	26/06/2018	26/06/2018			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	5.5	7.1	9.8	13	8.2
Total mass of sample received	kg	0.001	NONE	2.0	2.0	2.0	2.0	2.0

General Inorganics

Parameter	Units	Limit of detection	Accreditation Status					
pH - Automated	pH Units	N/A	MCERTS	8.5	8.2	8.4	8.0	8.2
Total Sulphate as SO ₄	%	0.005	MCERTS	0.023	0.018	0.071	0.021	0.111
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.059	0.046	0.084	0.053	0.31
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	59.1	45.8	83.6	52.8	315
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	18	9.9	-	12
Total Sulphur	%	0.005	MCERTS	0.008	0.007	0.043	0.007	0.058
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	< 2.0	3.8	-	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	-	9.5	36	-	38
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	4.8	18	-	19



Analytical Report Number : 18-91140

Project / Site name: Penistone Grammar School

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
993543	DCS1	None Supplied	2.55-3.00	Brown clay and sand.
993544	DCS2	None Supplied	2.00-3.00	Brown clay and sand.
993545	BH1	None Supplied	0.00-0.70	Brown clay and loam with rubble and vegetation.
993546	BH1	None Supplied	3.00-3.50	Brown clay and sand.
993547	BH2	None Supplied	0.70-1.00	Brown clay and loam with rubble and vegetation.

Analytical Report Number : 18-91140

Project / Site name: Penistone Grammar School

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests. 2:1 extraction.	L082-PL	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests"	L038	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038	W	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



4041

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



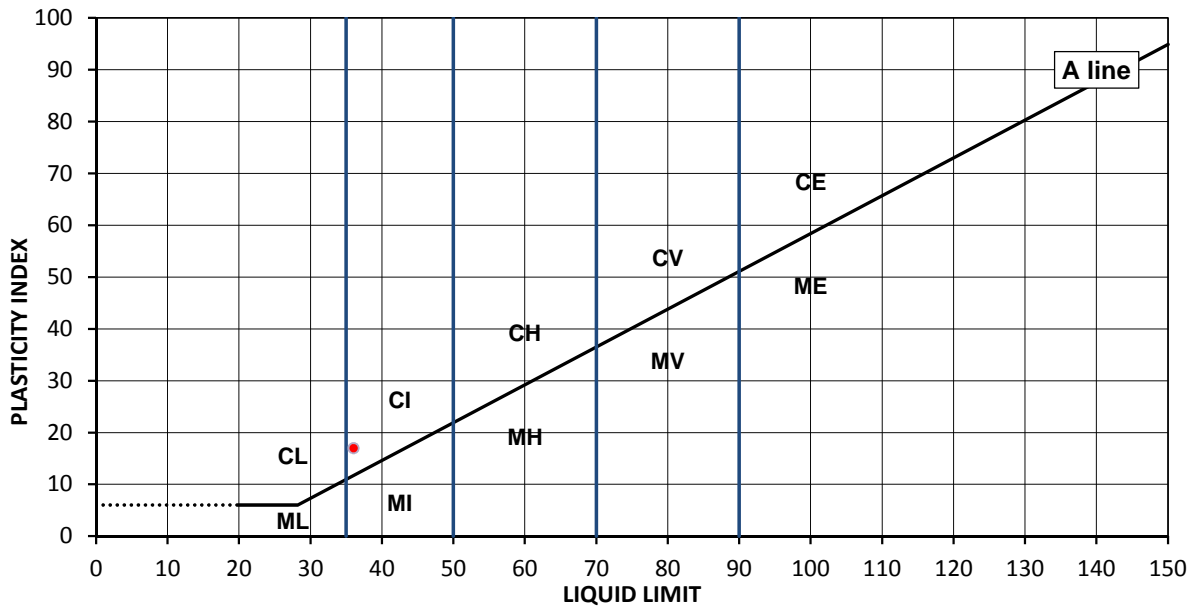
Client: Applied Geology Ltd
Client Address: Centrix House
Crow Lane East
Newton-Le-Willows
Merseyside
WA12 9UY
Contact: Jordan Swales
Site Name: Penistone Grammar School
Site Address: Not Given

Client Reference: AG28882-18
Job Number: 18-91794
Date Sampled: 26/06/2018
Date Received: 28/06/2018
Date Tested: 13/07/2018
Sampled By: J.S

Test Results

Laboratory Reference: 997087 Depth Top [m]: 3.70
Hole No.: DCS2 Depth Base [m]: Not Given
Sample Reference: Not Given Sample Type: D
Soil Description: Brown sandy CLAY
Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
12	36	19	17	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity		Liquid Limit	
M	Silt	L	Low		below 35
		I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material (eg CHO)		

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 19/07/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Applied Geology Ltd
Client Address: Centrix House
Crow Lane East
Newton-Le-Willows
Merseyside
WA12 9UY
Contact: Jordan Swales
Site Name: Penistone Grammar School
Site Address: Not Given

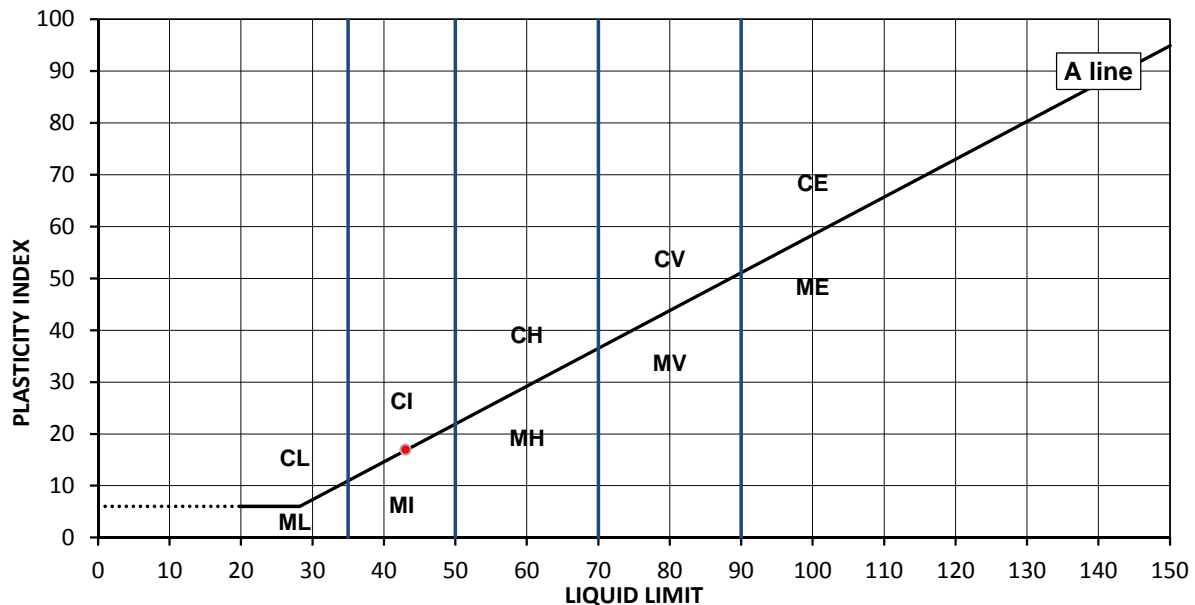
Client Reference: AG28882-18
Job Number: 18-91794
Date Sampled: 26/06/2018
Date Received: 28/06/2018
Date Tested: 13/07/2018
Sampled By: J.S

Test Results

Laboratory Reference: 997088
Hole No.: BH1
Sample Reference: Not Given
Soil Description: Brown sandy CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 1.20
Depth Base [m]: 1.70
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	43	26	17	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material (eg CHO)			

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 19/07/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
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Croxley Green Business Park
Watford Herts WD18 8YS



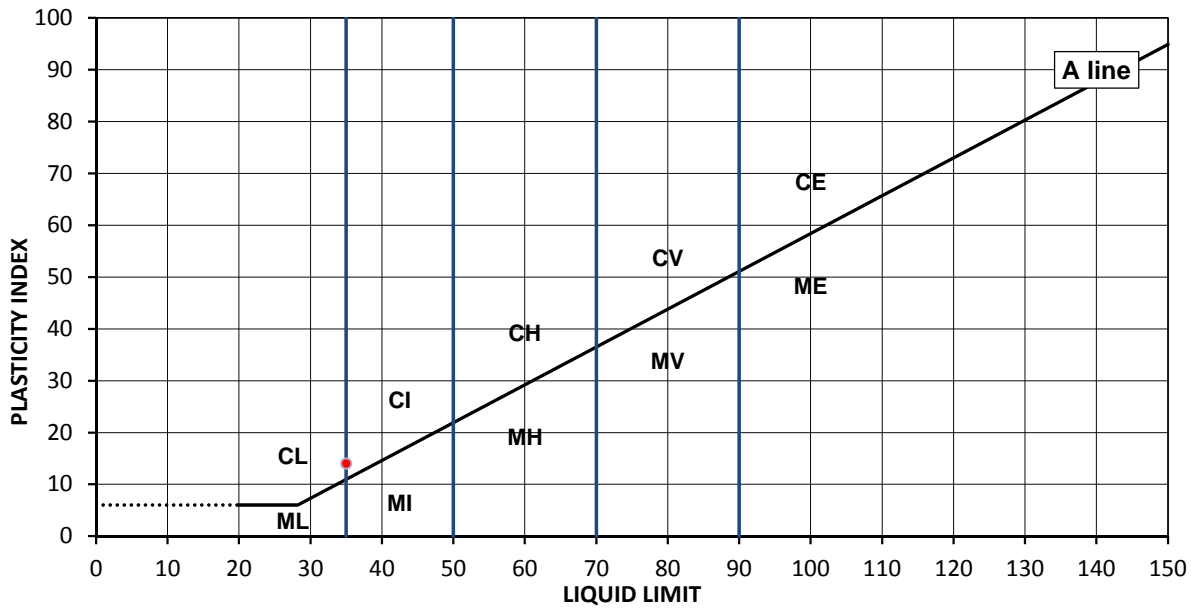
Client: Applied Geology Ltd
Client Address: Centrix House
Crow Lane East
Newton-Le-Willows
Merseyside
WA12 9UY
Contact: Jordan Swales
Site Name: Penistone Grammar School
Site Address: Not Given

Client Reference: AG28882-18
Job Number: 18-91794
Date Sampled: 26/06/2018
Date Received: 28/06/2018
Date Tested: 13/07/2018
Sampled By: J.S

Test Results

Laboratory Reference: 997090
Hole No.: DCS3
Sample Reference: Not Given
Soil Description: Brown gravelly very sandy CLAY
Sample Preparation: Tested after washing to remove >425um
Depth Top [m]: 1.70
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
14	35	21	14	60



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material (eg CHO)			

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 19/07/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Applied Geology Ltd
Client Address: Centrix House
Crow Lane East
Newton-Le-Willows
Merseyside
WA12 9UY
Contact: Jordan Swales
Site Name: Penistone Grammar School
Site Address: Not Given

Client Reference: AG28882-18
Job Number: 18-91794
Date Sampled: 26/06/2018
Date Received: 28/06/2018
Date Tested: 13/07/2018
Sampled By: J.S

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	M/C %	Atterberg				Density		Total Porosity Mg/m3
		Reference	Top depth [m]	Base depth [m]	Type			% Passing 425um	LL	PL	PI	bulk Mg/m3	PD Mg/m3	
997088	BH1	Not Given	1.20	1.70	D	Brown sandy CLAY	22	100	43	26	17			
997087	DCS2	Not Given	3.70	Not Given	D	Brown sandy CLAY	12	100	36	19	17			
997090	DCS3	Not Given	1.70	Not Given	D	Brown gravelly very sandy CLAY	14	60	35	21	14			

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 19/07/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland.*



4041

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Tested in Accordance with BS1377:Part 2:1990, clause 9.2

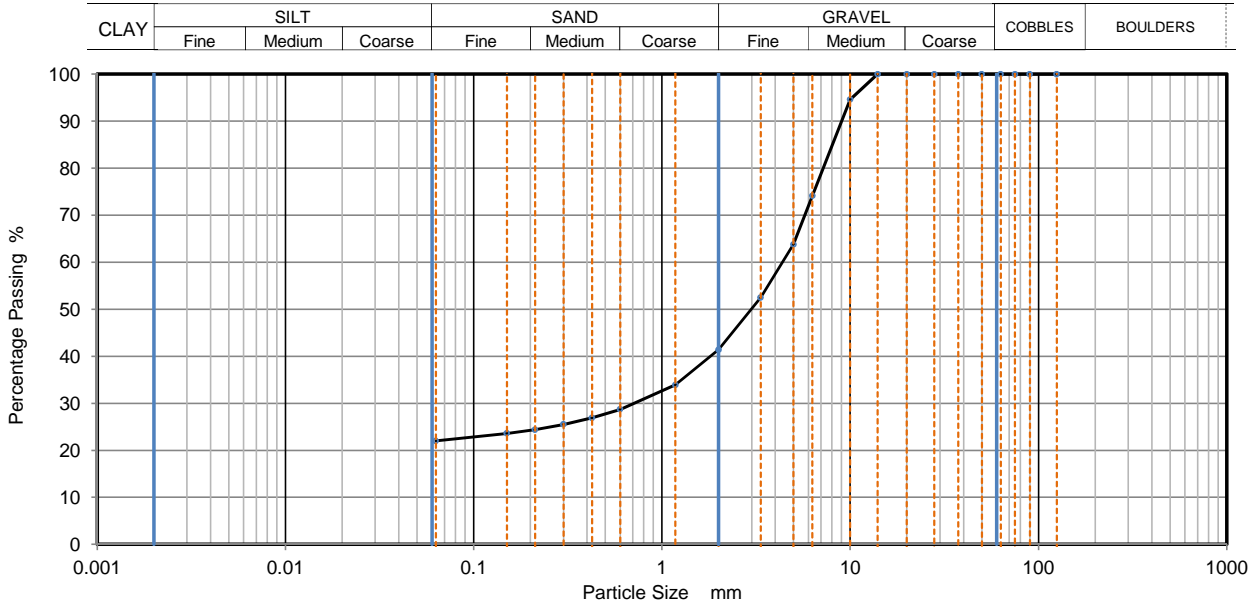
Client: Applied Geology Ltd
Client Address: Centrix House
Crow Lane East
Newton-Le-Willows
Merseyside
WA12 9UY
Contact: Jordan Swales
Site Name: Penistone Grammar School
Site Address: Not Given

Client Reference: AG28882-18
Job Number: 18-91794
Date Sampled: 26/06/2018
Date Received: 28/06/2018
Date Tested: 13/07/2018
Sampled By: J.S

TEST RESULTS

Laboratory Reference: 997089
Sample description: Brown sandy very clayey GRAVEL
Location: DCS3
Supplier: Not Given

Sample Reference: Not Given
Sample Type: B
Depth Top [m]: 2.30
Depth Base [m]: 3.00



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	95		
6.3	74		
5	64		
3.35	53		
2	41		
1.18	34		
0.6	29		
0.425	27		
0.3	26		
0.212	24		
0.15	24		
0.063	23		

Dry Mass of sample [g]: 123

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	58.60
Sand	19.00
Fines <0.063mm	22.50

Grading Analysis		
D100	mm	14
D60	mm	4.37
D30	mm	0.71
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below
The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General
Manager

Date Reported: 19/07/2018

for and on behalf of i2 Analytical Ltd

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APPENDIX F

APPENDIX F

STANDARD FIELDWORK AND ASSESSMENT PROCEDURES

Scope of Work

The scope of work undertaken is defined in Section 1 of the Report. It should be noted that Applied Geology Limited does not provide arboricultural surveys, specialist surveys for the detection of invasive plant species (such as Japanese Knotweed) or protected species of wildlife. Information from environmental and ecological datasets is included from a review of the MAGIC (Multi-Agency Geographic Information for the Countryside) website, however, if a full assessment of Environmental or Ecological aspects is required, it is recommended that other specialists are consulted. Similarly, information on flood risk is included; obtained from the Environment Agency Web site and the GroundSure report; but this is not intended to be a full hydrological study and, if a flood risk assessment is needed, additional analysis by others is recommended to confirm this aspect of the development. Also, whilst our field staff have undergone asbestos awareness training, Applied Geology does not undertake asbestos surveys or provide specific advice relating to asbestos-containing materials. Any suspected asbestos-containing materials observed by our field staff will be mentioned in the report but further assessment by others may be required.

Fieldwork

Fieldwork is generally carried out in accordance with BS5930 (2015) "Code of Practice for Site Investigations" and BS10175 (2011) Investigation of Potentially Contaminated Sites, unless otherwise stated.

Prior to commencement on site, statutory services plans are generally obtained and verbal enquiries are also made regarding the positions of private or statutory services on site. Prior to excavation or drilling, locations are scanned with a cable avoidance tool (CAT) and service pits are generally excavated at borehole positions, where possible.

Descriptions and depths of the various strata recovered are presented on the exploratory hole records, reproduced in the report appendices, together with sample depths, the results of in-situ testing, comments on groundwater inflows, and any other pertinent information. The strata descriptions are in general accordance with BS5930:2015. Disturbed plastic pot and glass amber jar samples are recovered from the various strata and stored and transported in cool boxes, where relevant, for possible future laboratory testing.

Light cable percussion boreholes are generally drilled using a Pilcon Wayfarer or Dando rig and are advanced using equipment to bore 200/150mm diameter boreholes. Disturbed plastic pot samples are recovered from all deposits encountered to allow examination and laboratory testing. Certain strata are cased off due to their tendency to collapse, particularly in the presence of groundwater inflows and/or to reduce the risk of cross contamination. In situ Standard Penetration Tests, using Split Spoon (SPT) and Cone (CPT) are undertaken in the boreholes to provide a measure of the relative density of the granular (coarse grained) deposits or shear strength of the clay/chalk/ weathered rock deposits using industry recognised correlation guidelines of shear strength against SPT "N" value results. Within the fine grained (cohesive) deposits, "undisturbed" 100mm driven open tube samples were recovered from the various deposits to provide samples for examination and laboratory testing. On encountering groundwater, boring is usually suspended for 20 minutes while any rise in water level is recorded. Full details of the groundwater observations and monitoring results during boring operations are included on the borehole records. All boreholes without monitoring wells installed are usually backfilled with arisings upon completion, unless otherwise stated on the individual logs.

Unless otherwise stated on the relevant logs, trial pits are excavated using a wheeled backhoe excavator, usually with a 0.6m wide bucket. The excavations are logged from the ground surface by an Engineering Geologist / Geo-environmental Engineer and relevant field testing, appropriate to the soils encountered, is carried out on samples brought to the surface. Representative disturbed soil

samples are collected from selected horizons for subsequent laboratory testing. The trial pits are usually unshored and where reasonable, left open for a period of time to allow observations of pit stability and depth and inflow rate of any groundwater ingress. The excavations are backfilled with arisings prior to moving on to the next position. Any trial pits carried out as part of this or previous investigations may represent soft spots and conduits/sumps for groundwater or surface water. In excavations, such materials may also be loose and unstable.

Driven Continuous Sampling (DCS) boreholes are drilled using a track mounted Global mini-rig or similar using sampling tubes of varying diameter (decreasing with depth). Samples of the deposits encountered are recovered in 1m long clear plastic liners, which are logged and sub-sampled on site by an Engineering Geologist. Generally for geotechnical investigations, during the drilling process in-situ Standard Penetration Tests (SPTs) are undertaken at selected depths to provide a measure of the relative density of the granular (coarse grained) deposits or shear strength of the clay/chalk/ weathered rock deposits using industry recognised correlation guidelines of shear strength against SPT "N" value results. Groundwater seepages are noted during drilling if encountered. All boreholes without monitoring wells installed are usually backfilled with arisings upon completion.

Unless specifically stated in the report, exploratory hole locations should be regarded as approximate. Consideration should be given to accurate location of the exploratory holes where it is considered they may impact on proposed development.

It should be noted that groundwater levels at any particular site may fluctuate due to rainfall, seasonal variations etc and, therefore, levels may be different to those measured during the course of the fieldwork and monitoring period.

Laboratory Testing

The geotechnical testing was carried out in accordance with BS 1377:1990 Method of Tests for Soils for Civil Engineering Purposes and was undertaken by a UKAS accredited specialist laboratory. Chemical testing was undertaken by a UKAS accredited specialist chemical testing laboratory and MCERTS accredited methods, in accordance with Environment Agency recommendations, were specified where available.

Contamination Assessment – Human Health

Applied Geology Limited has followed the guidance given in the CLR 11 publication and other available guidance to assess the contaminant concentrations. Details of the methodology followed are briefly outlined below.

The available chemical data is sorted into appropriate datasets depending on sampling regime and ground conditions. An initial generic quantitative risk assessment is undertaken on this data using statistical tests, where appropriate, and relevant screening values. Risk to human health has been initially assessed by comparing soil results against various published screening criteria. These have been sourced from the following, in order of preference:

- DEFRA. Category 4 Screening Levels (C4SL), March 2014;
- LQM/CIEH S4UL for Human Health Risk Assessment (S4UL), 2015*;
- Environment Agency/DEFRA, Soil Guideline Values (SGV) published in 2009;
- EIC/AGS/CL:AIRE Soil Generic Assessment Criteria (GAC), 2010.

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Except for lead and benzo(a)pyrene, the assessments will be carried out by comparing results against the LQM/CIEH S4UL in the first instance, where these values are exceeded, then reference will be made to the C4SLs where such exist. Lead will only be compared to the C4SL because no S4UL exists for lead. For Benzo(a)pyrene, Applied Geology has chosen to adopt the approach presented by the C4SL committee rather than the approach proposed by LQM/CIEH. Further discussion on this is presented below.

It is our view, and the view of others in the industry, that the C4SL were derived for use in both the Part IIA system and through the planning system, as they allow identification of those sites that fall within Category 4 (not contaminated) and are therefore able to be developed with no further remedial action. The C4SLs are considered to represent a contamination level that is 'low' from a toxicological view point, which we therefore consider to be 'acceptable' under planning.

Historically, the level of contamination has been assessed with reference to SGV values which were derived to represent a 'minimal' level of contamination. The SGVs are still valid and can be used alongside C4SL, however both screening values are only intended to provide guidance as to the level of contamination and, where concentrations fall below these screening values, the site is not contaminated (and is within Category 4). Exceedance of a SGV/S4UL/C4SL does not automatically indicate that an 'unacceptable' risk exists at a site; simply that further consideration of that particular contaminant is required.

At this time, there are two toxicological methodologies that can be used in the derivation of screening criteria for PAHs; Relative Potency Factor (RPFs) or the Surrogate Marker approach. Applied Geology has chosen (based on the latest guidance from the Health Protection Agency (HPA) to use the surrogate marker approach proposed in the C4SL methodology, whereby benzo(a)pyrene can be used as a surrogate marker for all 'genotoxic' (gene damaging) PAHs. The surrogate marker approach estimates the toxicity of a mixture of PAHs in an environmental matrix by using data from toxicity studies in which a PAH mixture of known composition was tested. Exposure to the surrogate marker benzo(a)pyrene is assumed to represent exposure to all the PAHs in the environmental matrix. Thus, the level of toxicity ascribed to the surrogate represents the toxicity of the PAH mixture. This allows an assessment of the combined carcinogenic risk associated with genotoxic PAHs using only benzo(a)pyrene. In order to confirm that the mixture of genotoxic PAH in the soil is similar to the coal tar mixture used in the toxicological study, various PAH ratios are plotted and checked to see that they fall within the limits set in HPA, 2010.

Contamination Assessment – Water Quality

Risks to water quality has been assessed by following the Environment Agency guidance on groundwater protection (previously known as GP3), updated on their website in March 2017, see <https://www.gov.uk/government/policies/water-quality> and 'The Environment Agency's approach to groundwater protection' (March 2017 Version 1.0).

For hazardous substances, which should be prevented from entering groundwater, the screening criteria are initially set as the limit of detection, however, if groundwater has already been impacted, an appropriate environmental standard will then be used. For hazardous substances, background quality may also be taken into account.

For non-hazardous compounds, their release should not result in any pollution or significant risk of pollution in the future, as such comparison with UK DWS or EQS standards will allow determination of whether pollution could occur. Typically screening criteria will be sourced from the following:

- Environmental Standards (ES), which are defined in European legislation such as the Water Framework Directive (WFD) (2000/60/EC) and the Priority Substances Directive (PSD) (2008/105/EC) a daughter directive of the WFD.
- The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Direction, 2010.
- UK Water Supply (Water Quality) Regulations, 2010.
- UK quality standards for water to be used for direct abstraction to potable supply e.g. Surface Water (Abstraction for Drinking Water) (Classification) Regulations, 1996.
- World Health Organisation (WHO) Guidelines for Drinking Water Quality.

Re-use of Soils and Waste Soil Disposal

It is noted that if any excavated material is to be reused on site, a Waste Management Plan (WMP) and / or a Materials Management Plan (MMP) will probably be required. Any such materials must be suitable for re-use without further treatment, and only the quantity necessary for the specified works should be used. Any materials not within these definitions may need to be considered as waste whereby a Waste Management Licence Exemption may also be required.

A specific categorisation and assessment of potential waste soils arising from the proposed development has not been undertaken as part of the investigation, unless otherwise detailed in the report text. However, generic comments and advice are made below for the reader.

All waste soils should be sorted to prevent mixtures of waste types. Where possible, any waste soil should be recycled and the volume of soil to be disposed of should be minimised. Any excavated soil material and excess spoil disposed of off-site should be treated as Waste and classified as Inert, Non-hazardous or Hazardous, prior to removal from site, as required by the "Duty of Care" (Environmental Protection Act, 1990) legislation together with Annex II of Directive 1999/31/EC ("Landfill Directive"). Initially, Basic Characterisation of the waste is required whereby the material should be described and its source of origin recorded (a site plan, exploratory hole records and the certificates of chemical analysis in this report should be included). This should also include data on its composition and leaching behaviour, its European Waste Catalogue (EWC) code, and where relevant any hazardous properties according to Annex III of Directive 91/689/EEC. This information should be provided to the licensed waste contractor.

Soils excavated on many sites would generally fall under the EWC description "Soil and Stones", EWC code 17 05 04. Waste Acceptance Criteria (WAC) testing is required for many Inert wastes and generally for all Hazardous Waste but not for non-hazardous waste. There are certain restrictions for inert wastes regarding topsoil and peat. Any asbestos must be disposed of by suitably licensed contractors to a suitably licensed facility.

Health & Safety Aspects

As outlined within the HSE publication 'Successful Health and Safety Management - HSG65', this report should inform your development of safe systems of work and information as an input into the safety management system.

When developing risk control systems we suggest making reference to the CIRIA report 132 "A guide for safe working on contaminated sites" and the HSE document "Protection of workers and the general public during the development of contaminated land – HSG66". All risk control measures should be in accordance with the guidelines laid down within the Management of Health and Safety at Work Regulations 1999.

The contents of this report may be used to supplement the contents of the Health and Safety File as required under the Construction Design and Management (CDM) Regulations.

Where excavations are undertaken on site, trench support or the angle of batter should be designed by an appropriately qualified engineer or competent person to suit the required depth and the ground and groundwater conditions. Care should be taken when digging excavations to prevent undermining or causing loss of support to the foundations of the nearby adjoining structures. Surcharging such as from spoil or vehicle movements close to excavation sides should be avoided. Practical guidance on trench excavation is given in CIRIA Report 97 Trenching Practice. Guidance on groundwater control is given in CIRIA Report 113 Control of groundwater for temporary works. Temporary works should be designed by a suitably qualified engineer or a competent person particularly where personnel access is necessary, in accordance with the requirements of the Construction (Design and Management) (CDM) Regulations.