

**Geotechnical Report**

**Appendix D**

**Groundwater Monitoring Results**



Project: Koneson Underpass  
 UMA Job No.: 4231-040-09

Piezometer VW-04-29A

Location: 10.0 m  
 Depth of VW: 234.07 m  
 Ground Elev.: 224.07 m  
 Tip Elevation:  
 Baseline Reading (Atm, taken prior to  
 installation with VW to be installed):  
 Date 10-Dec-04  
 Reading (R<sub>i</sub>) 8820.3  
 Temp. °C (T<sub>i</sub>) 25.1

This sheet is based on the formulas:

$$\text{Pressure} = \text{AIR}^2 + \text{BR} + \text{C}$$

$$P_{\text{corrected}} = P + P_T - P_B = P + (T - T_0) \text{K} - (S - S_0)$$

Installed VW Piezometer:

Information from VW Calibration Report:  
 Supplier: Geokon  
 Serial No.: 04-14194  
 Polynomial Gage Factors (metric):  
 A 7.59E-08  
 B -0.1001  
 C 888.11  
 Thermal Factor ( ) -0.1209 kPa/°C  
 Calculated C: 886.88 kPa, Based on P=0, Using R<sub>0</sub>

Barometric VW Piezometer:  
 Original Calibration Information:

Supplier: 25976  
 Serial No.: 18-Feb-94  
 Date: 8941.6 F<sup>2</sup>x10<sup>-3</sup>  
 R<sub>0</sub> = 15.0 C  
 T<sub>0</sub> = 0.016184 psi/digit  
 G = -0.021039 psi/C rise  
 C = 29.15 in. of Hg  
 Pressure: 98.71 kPa

Date	Installed Piezometer Reading (F <sup>2</sup> x10 <sup>-3</sup> ) R <sub>i</sub>	Temperature T <sub>i</sub> (°C)	Barometric Reading R <sub>i</sub> (F <sup>2</sup> x10 <sup>-3</sup> )	Temperature T <sub>i</sub> (°C)	Barometric Reading S <sub>i</sub> (P+P <sub>T</sub> +S <sub>0</sub> ) (kPa)	Barometric Correction P <sub>B</sub> (kPa)	Installed P+P <sub>T</sub> (kPa)	Uncorrected Ground Water above tip (m)	Uncorrected Depth Below Ground (m)	Installed P <sub>corrected</sub> P+P <sub>T</sub> -P <sub>B</sub> (kPa)	Height of Ground Water above tip (m)	Ground Water Elevation (m)	Depth Below Ground (m)	Comments:
10-Dec-04	8820.3	25.1	8935.7	-6.3	102.46	0.00	80.24	8.18	1.82	80.24	8.18	232.25	1.82	Prior to installation
10-Dec-04	8130.0	7.3	8935.7	-6.3	102.46	0.00	80.24	8.18	1.82	80.24	8.18	232.25	1.82	Water in hole during installation, reading taken after piezometer backfilled.
16-Dec-04	8467.3	6.8	8930.5	-12.3	103.91	1.45	46.96	4.79	5.21	45.51	4.64	228.71	5.36	
23-Dec-04	8452.0	6.7	8928.1	-17.1	104.88	2.41	48.48	4.94	5.06	46.07	4.70	228.77	5.30	
6-Jan-05	8466.7	6.7	8944.3	-20.9	103.62	1.16	44.07	4.49	5.51	42.91	4.38	228.45	5.62	
26-Jan-05	8462.5	6.7	8906.7	-12.6	106.61	4.15	47.45	4.84	5.16	43.30	4.41	228.48	5.59	
4-Feb-05	8473.6	6.7	8991.9	-0.1	106.45	3.99	46.35	4.73	5.27	42.36	4.32	228.39	5.68	

Project: Kenaston Underpass  
 UMA Job No.: 4231-040-09

This sheet is based on the formulas:

$$P_{corrected} = AR^2 + BR + C$$

$$P_{corrected} = P + P_T - P_B = P + (T - T_0)k - (S_1 - S_0)$$

Piezometer: VW-04-29B  
 Location: 6.7 m  
 Depth of VW: 234.07 m  
 Ground Elev.: 227.37 m  
 Tip Elevation: 227.37 m  
 Baseline Reading (Atm, taken prior to installation with VW to be installed):  
 Date: 13-Dec-04  
 Reading (R<sub>i</sub>): 8747.6  
 Temp. °C (T<sub>i</sub>): 20.5

Installed VW Piezometer:  
 Information from VW Calibration Report:  
 Supplier: Geokon  
 Serial No.: 04-13873  
 Polynomial Gage Factors (metric):  
 A: -8.33E-08  
 B: -0.1092  
 C: 963.27  
 Thermal Factor: -0.0073 kPa/°C  
 Calculated C: 961.61 kPa, Based on P=0, Using R<sub>0</sub>

Barometric VW Piezometer:  
 Original Calibration Information:  
 Supplier: 25976  
 Serial No.: 18-Feb-94  
 Date: 8941.6 F<sup>2</sup>x10<sup>-3</sup>  
 R<sub>0</sub>: 15.0 C  
 T<sub>0</sub>: 0.016184 psi/°C  
 G: -0.021039 psi/°C rise  
 C: 29.15 in. of Hg  
 Pressure: 98.71 kPa

Date	Installed Piezometer Reading (F <sup>2</sup> x 10 <sup>-3</sup> ) R <sub>i</sub>	Installed Piezometer Temperature T <sub>i</sub> (°C)	Barometric Reading (F <sup>2</sup> x 10 <sup>-3</sup> ) R <sub>i</sub>	Barometric Temperature T <sub>i</sub> (°C)	Barometric S <sub>1</sub> P+P <sub>T</sub> +S <sub>B</sub> (kPa)	Barometric Correction P <sub>B</sub> (kPa)	Installed P+P <sub>T</sub> (kPa)	Uncorrected Ground Water above tip (m)	Uncorrected Depth Below Ground (m)	Installed P <sub>corrected</sub> P+P <sub>T</sub> -P <sub>B</sub> (kPa)	Height of Ground Water above tip (m)	Ground Water Elevation (m)	Depth Below Ground (m)	Comments:
13-Dec-04	8747.6	20.5	8635.7	-6.3	102.46	0.00	0.00	5.44	1.26	53.40	5.44	232.81	1.26	Prior to installation
13-Dec-04	8265.7	6.2	8635.7	-6.3	102.46	0.00	53.40	5.44	1.26	53.40	5.44	232.81	1.26	Water in hole during installation, reading taken after piezometer backfilled.
16-Dec-04	8434.8	7.1	8930.5	-12.3	103.91	1.45	34.70	3.54	3.16	33.25	3.39	230.76	3.31	
23-Dec-04	8425.3	7.1	8928.1	-17.1	104.86	2.41	35.75	3.65	3.05	33.34	3.40	230.77	3.30	
6-Jan-05	8469.0	7.2	8944.3	-20.9	103.62	1.16	30.92	3.15	3.55	29.76	3.03	230.40	3.87	
26-Jan-05	8437.8	7.3	8906.7	-12.6	106.61	4.15	34.37	3.50	3.20	30.22	3.08	230.45	3.62	



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Piezometer VW-04-30B  
 Location: 8.4 m  
 Depth of VW: 234.16 m  
 Ground Elev.: 225.76 m  
 Tip Elevation:  
 Baseline Reading (Atm, taken prior to  
 installation with VW to be installed):  
 Date 10-Dec-04  
 Reading (R<sub>i</sub>) 8616.8  
 Temp. °C (T<sub>0</sub>) 22.8

This sheet is based on the formulas:

$$P_{measured} = P + P_1 - P_0 = P + (T_1 - T_0) \times K - (S_1 - S_0)$$

Installed VW Piezometer:

Information from VW Calibration Report:  
 Supplier: Geokon  
 Serial No.: 04-13874  
 Polynomial Gage Factors (metric):  
 A -2.48E-07  
 B -0.1163  
 C \* Factory Value  
 Thermal Factor (-0.0253 kPa/°C)  
 Calculated C: 1020.56 kPa, Based on P=0, Using R<sub>0</sub>

Barometric VW Piezometer:

Original Calibration Information:  
 Supplier: 25976  
 Serial No.: 19-Feb-94  
 Date: 8941.6 F\*2x10<sup>-3</sup>  
 R<sub>0</sub>: 15.0 C  
 T<sub>0</sub>: 0.016184 psi/digit  
 G = -0.021039 psi/C rise  
 C = 28.15 in. of Hg  
 Pressure: 98.71 kPa

Date	Installed Piezometer		Barometric Piezometer		Barometric		Barometric		Installed		Uncorrected		Uncorrected		Installed		Comments:		
	R <sub>i</sub> (F*2x10 <sup>-3</sup> )	T <sub>i</sub> (°C)	R <sub>i</sub> (F*2x10 <sup>-3</sup> )	T <sub>i</sub> (°C)	P+P+S <sub>0</sub> (kPa)	S <sub>1</sub> (kPa)	P <sub>B</sub> (kPa)	P+P <sub>1</sub> (kPa)	Ground Water above tip (m)	Ground Depth Below Ground (m)	P <sub>measured</sub> P+P <sub>1</sub> -P <sub>0</sub> (kPa)	Height of Ground Water above tip (m)	Ground Water Elevation (m)	Ground Depth Below Ground (m)	Prior to Installation				
10-Dec-04	8616.8	22.8	8935.7	-6.3	102.46	102.46	0.00	0.00	8.45	8.45	-0.46	-0.05	225.71	8.45	Prior to Installation	Water in hole during installation, reading taken after piezometer backfilled.			
10-Dec-04	8624.7	3.2	8935.7	-6.3	102.46	102.46	-0.46	-0.46	8.45	8.45	-0.46	-0.05	225.71	8.45					
16-Dec-04	8549.2	6.9	8930.5	-12.3	103.91	103.91	8.55	8.55	7.53	7.53	7.10	0.87	226.48	7.68					
23-Dec-04	8462.4	6.8	8928.1	-17.1	104.88	104.88	19.02	19.02	6.46	6.46	16.60	1.94	227.45	6.71					
6-Jan-05	8375.3	6.8	8944.3	-20.9	103.62	103.62	28.51	28.51	5.39	5.39	28.35	3.01	228.65	5.51					
26-Jan-05	8170.2	7.0	8906.7	-12.6	106.61	106.61	54.20	54.20	2.87	2.87	50.05	5.53	230.86	3.30					

Project: Kenaston Underpass  
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Piezometer VW-04-30C

Location: 4.5 m  
 Depth of VW: 234.16 m  
 Ground Elev.: 229.66 m  
 Tip Elevation:  
 Baseline Readings:  
 Date 4-Dec-93  
 Reading (R<sub>0</sub>) 9735  
 Temp. (T<sub>0</sub>) 0.0  
 Bar. (S<sub>0</sub>) 100.1

This sheet is based on the formula:

$$P_{corrected} = ((R_0 - R_1) \times G) + (T_1 - T_0) \times K - (S_1 - S_0) - P_a$$

$$P_{corrected} = P + P_T + P_a$$

Installed VW Piezometer:

Supplier: 24459  
 Serial No.: 0.00274 psi/digit  
 Linear Gage Factor (G) = -0.00274 psi/C  
 Thermal Factor (K) =

Original Calibration Information:

Supplier: 25976  
 Serial No.: 18-Feb-94  
 Date: 8941.6 F<sup>2</sup>x10<sup>-3</sup>  
 R<sub>0</sub> = 15.0 C  
 T<sub>0</sub> = 0.016184 psi/digit  
 G = -0.021039 psi/C rise  
 C = 29.15 in. of Hg  
 Pressure: 98.71 kPa

Date	Installed Piezometer Reading (F <sup>2</sup> x10 <sup>-3</sup> )	Temperature (°C)	Barometric Reading (F <sup>2</sup> x10 <sup>-3</sup> )	Temperature (°C)	Barometric Correction (kPa)	Barometric S <sub>0</sub> (kPa)	Installed P+P <sub>T</sub> (kPa)	Uncorrected Ground Water above tip (m)	Uncorrected Depth Below Ground (m)	Installed P <sub>corrected</sub> P+P <sub>T</sub> -P <sub>a</sub> (kPa)	Height of Ground Water above tip (m)	Ground Water Elevation (m)	Depth Below Ground (m)	Comments:
Baseline Readings (Atm. taken prior to installation, with VW to be installed):														
9-Dec-04	9811.9	10.0	8839.1	-7.5	0.00	102.26	-0.41	-0.04	4.54	-0.41	-0.04	229.62	4.54	Prior to installation
9-Dec-04	8635.7	7.8	8639.1	-7.5	0.00	102.26	-0.41	-0.04	4.54	-0.41	-0.04	229.62	4.54	No water in hole during installation, reading taken after piezometer backfilled.
16-Dec-04	9521.5	8.1	8930.5	-12.3	1.66	103.91	1.74	0.18	4.32	0.09	0.01	229.67	4.49	
23-Dec-04	8578.6	8.1	8928.1	-17.1	2.62	104.88	19.56	1.99	2.51	16.94	1.73	231.39	2.77	
6-Jan-05	8595.4	8.0	8944.3	-20.9	1.38	103.62	19.24	1.96	2.54	17.88	1.82	231.48	2.68	
26-Jan-05	8200.4	7.8	8906.7	-12.6	4.36	106.61	26.71	2.72	1.78	22.35	2.28	231.94	2.22	







**Project:** Kenaston Underpass  
**UMA Job No.:** 4231-040-09

**Location:**  
**Piezometer** PN-04-35  
**Ground Elevation (m)** 233.51  
**I.D.** **Gnd Elev** **Tip Depth** **Tip Elevation**  
(m) (m) (m)  
**PN-04-35** 9.2 224.31

Date	Time	Pneumatic	
		Reading (psi)	Ground Water Elev. (m)
January 26, 2005		8.70	230.43



