

**MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS
USING A FLEXIBLE WALL PERMEAMETER
ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL
FLUID: DEAIRED TAP WATER WITH 0.005 N CaSO4**

PROJECT NAME: GeoPro Inc.	PROJECT NUMBER: 02106307.0001
LOCATION:	DATE: 2/8/2010
SAMPLE ID: GEOPRO'S THERMAL GROUT LITE 0.45	PANEL IDENTIFICATION: Lenexa Perm Board
SAMPLE DESCR.: BENTONITE ("THERMAL GROUT LITE"): 30.00% DEIONIZED WATER: 70.00%	BURETTE AREA: 0.312 cm ² BURETTE INCREMENT LENGTH: 1.000 cm VOLUME PER INCREMENT: 0.312 cm ³

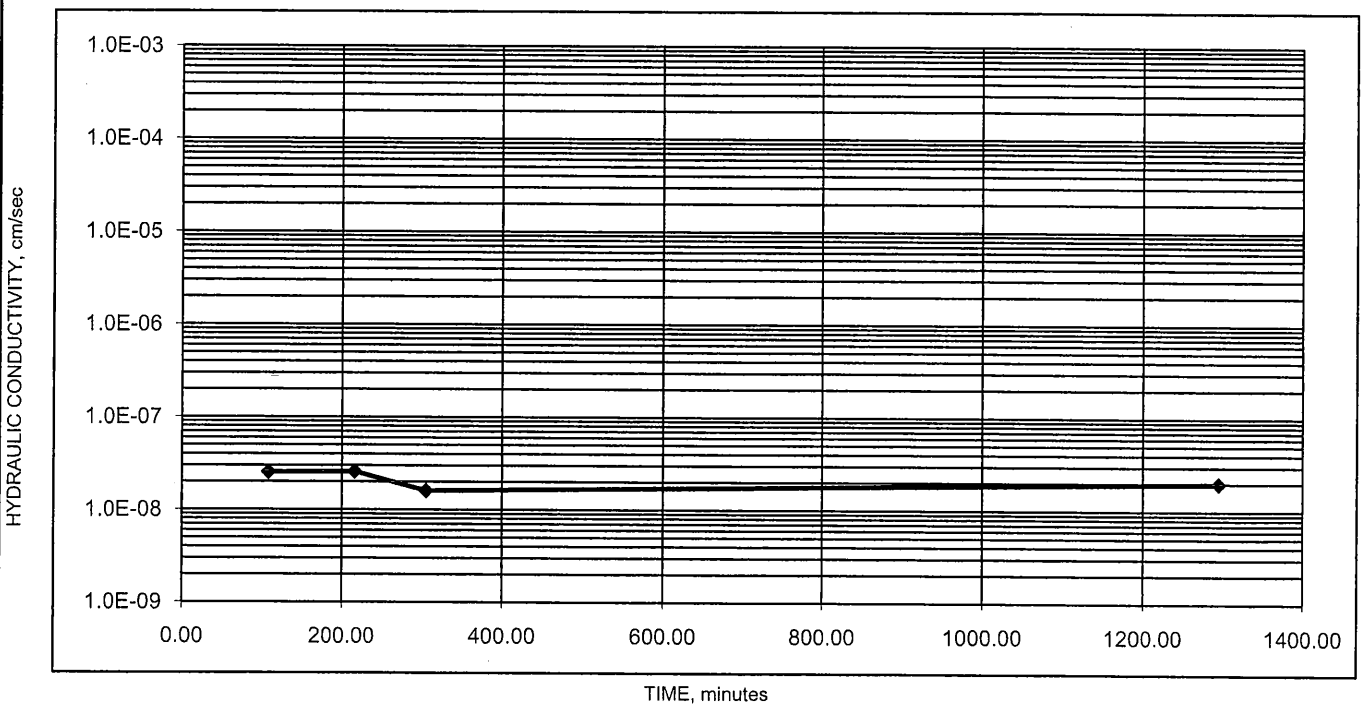
INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	135.7		SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
D & T, g	DIA, in	2.424	6.16	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	0.990	2.51	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA		29.77	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	113.1	PCF WET				
	DENSITY:		PCF DRY				

SATURATION:	LATERAL PRESS.: 104.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi	
DURING TEST:	LATERAL PRESS.: 104.0 psi	H2: 100.0 psi	H1: 100.0 psi
	BIAS PRESSURE (=H1-H2) 0.0 psi		

H1 VALUE	H2 VALUE	ELAPSED TIME min	DELTA H cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm ³	IN FLOW cm ³	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP.: C	TEMP. CORR.:
8.1	63.7	0.00	55.6									
8.5	63.3	108.00	54.8	0.014493	2.54E-08	0.12	0.12	1.00	21.8	17	26.5	0.860
8.9	62.9	216.00	54.0	0.014706	2.57E-08	0.12	0.12	1.00	21.5	18	26.6	0.858
9.1	62.7	305.00	53.6	0.007435	1.60E-08	0.06	0.06	1.00	21.3	26	25.9	0.871
12.0	60.3	1295.00	48.3	0.104118	1.99E-08	0.91	0.75	1.21	19.2	8	26.4	0.862

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 2.2E-08 cm/sec**

MAXIMUM	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
HYDRAULIC GRADIENT	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
	1.0E-05 TO 1.0E-06	10	<1.25	HYDRAULIC GRADIENT	OR % < 50 AT
	1.0E-06 TO 1.0E-07	20		ALLOWED	< 1.0E-8
	less than 1.0E-07	30			



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ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL
FLUID: DEAERED TAP WATER WITH 0.005 N CaSO4**

PROJECT NAME: GeoPro Inc.	PROJECT NUMBER: 02106307.0002
LOCATION:	DATE: 2/8/2010
SAMPLE ID: GEOPRO'S THERMAL GROUT LITE 0.57	PANEL IDENTIFICATION: Lenexa Perm Board
SAMPLE DESCR.: BENTONITE ("THERMAL GROUT LITE"): 22.65%	BURETTE AREA: 0.312 cm ²
SAND (SHORT MOUNTAIN GLASS): 22.65% DEIONIZED WATER: 54.71%	BURETTE INCREMENT LENGTH: 1.000 cm
	VOLUME PER INCREMENT: 0.312 cm ³

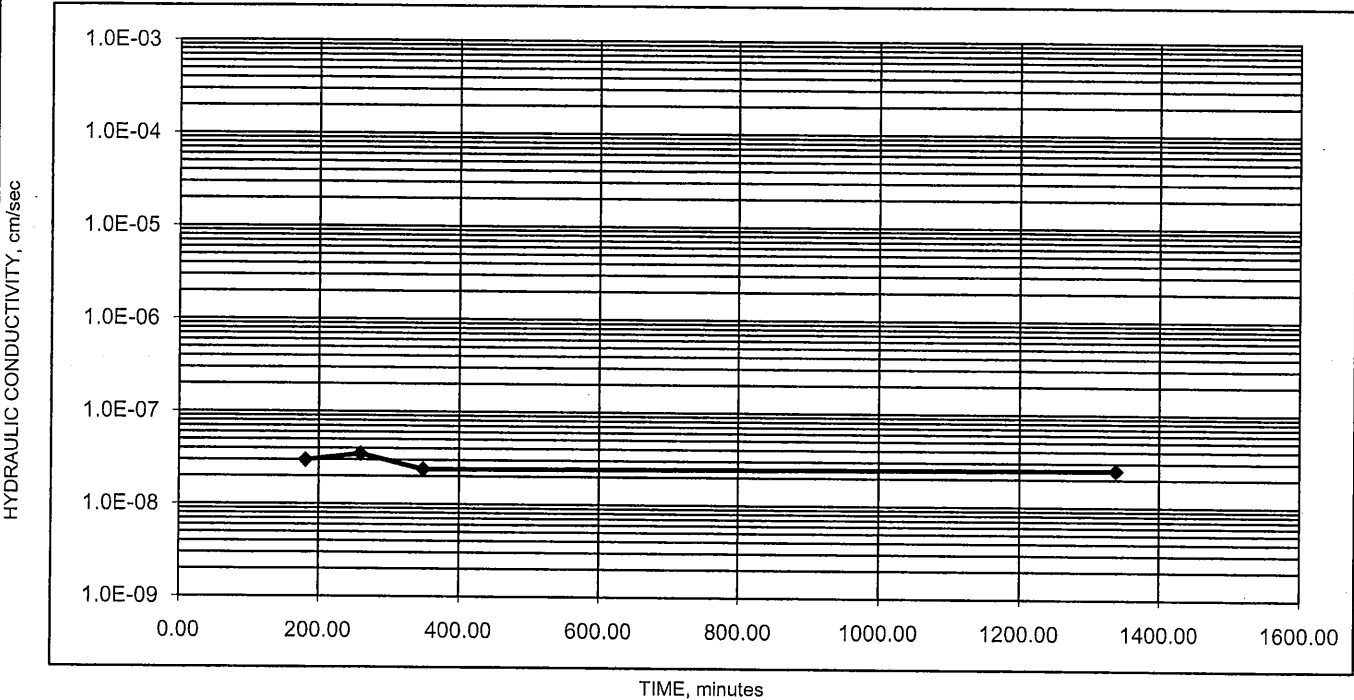
INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	103.2		SPECIFIC GRAVITY: ASSUMED		PROCTOR, pcf:	NA
D & T, g	DIA, in	2.422	6.15 cm	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	0.995	2.53 cm	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA		29.72 cm ²	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	85.8	PCF WET				
	DENSITY:		PCF DRY				

SATURATION:	LATERAL PRESS.: 104.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi	
DURING TEST:	LATERAL PRESS.: 104.0 psi	H2: 100.0 psi	H1: 100.0 psi
		BIAS PRESSURE (=H1-H2) 0.0 psi	

H1 VALUE	H2 VALUE	ELAPSED TIME, min	DELTA H, cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm ³	IN FLOW cm ³	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP.: C	TEMP. CORR.:
8.0	65.2	0.00	57.2									
8.8	64.4	181.00	55.6	0.028371	2.98E-08	0.25	0.25	1.00	22.0	5	26.5	0.860
9.2	64.0	260.00	54.8	0.014493	3.48E-08	0.12	0.12	1.00	21.7	23	26.6	0.858
9.5	63.7	349.00	54.2	0.011009	2.39E-08	0.09	0.09	1.00	21.4	16	25.9	0.871
13.1	60.7	1338.00	47.6	0.129848	2.50E-08	1.12	0.94	1.20	18.8	12	26.4	0.862

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 2.8E-08 cm/sec**

MAXIMUM HYDRAULIC GRADIENT	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
	1.0E-05 TO 1.0E-06	10	<1.25	HYDRAULIC GRADIENT	OR
	1.0E-06 TO 1.0E-07	20		% < 50 AT	
	less than 1.0E-07	30		ALLOWED	< 1.0E-8



**MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS
USING A FLEXIBLE WALL PERMEAMETER
ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL
FLUID: DEAIRED TAP WATER WITH 0.005 N CaSO4**

PROJECT NAME: GeoPro Inc.	PROJECT NUMBER: 02106307.0003
LOCATION:	DATE: 2/8/2010
SAMPLE ID: GEOPRO'S THERMAL GROUT LITE 0.88	PANEL IDENTIFICATION: Lenexa Perm Board
SAMPLE DESCR.: BENTONITE ("THERMAL GROUT LITE"): 12.63%	BURETTE AREA: 0.312 cm ²
SAND (SHORT MOUNTAIN GLASS): 50.53% DEIONIZED WATER: 30.83%	BURETTE INCREMENT LENGTH: 1.000 cm
	VOLUME PER INCREMENT: 0.312 cm ³

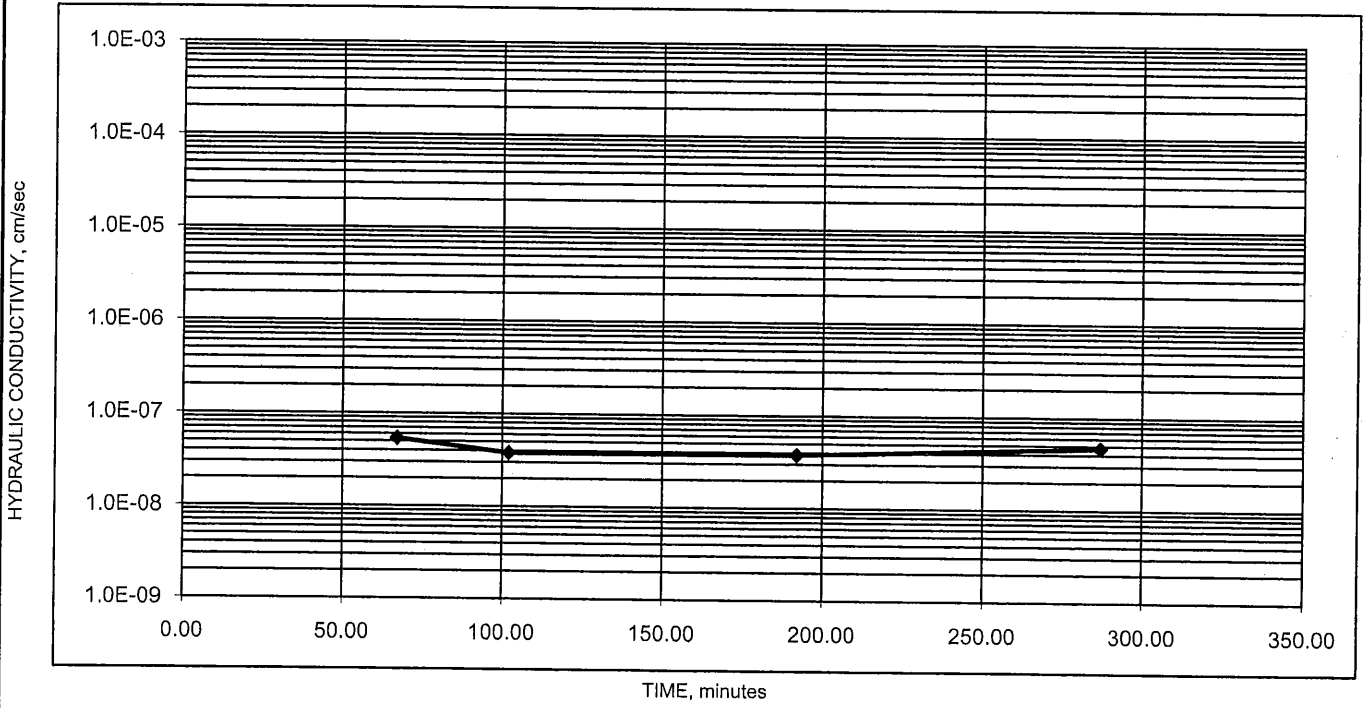
INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	127.8		SPECIFIC GRAVITY: ASSUMED		PROCTOR, pcf:	NA
D & T, g	DIA, in	2.424	6.16 cm	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	1.001	2.54 cm	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA	29.78 cm ²		VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	105.4	PCF WET				
	DENSITY:		PCF DRY				

SATURATION:	LATERAL PRESS.: 104.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi	
DURING TEST:	LATERAL PRESS.: 104.0 psi	H2: 100.0 psi	H1: 100.0 psi
	BIAS PRESSURE (=H1-H2) 0.0 psi		

H1 VALUE	H2 VALUE	ELAPSED TIME min	DELTA H cm	L _n H1/H2	HYD CON k, cm/sec	OUT FLOW cm ³	IN FLOW cm ³	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP. C	TEMP. CORR.:
7.5	66.4	0.00	58.9									
8.1	65.9	67.00	57.8	0.018852	5.38E-08	0.19	0.16	1.20	22.7	22	26.5	0.860
8.3	65.7	102.00	57.4	0.006944	3.78E-08	0.06	0.06	1.00	22.6	14	26.6	0.858
8.8	65.2	192.00	56.4	0.017575	3.78E-08	0.16	0.16	1.00	22.2	14	25.9	0.871
9.4	64.5	287.00	55.1	0.023319	4.70E-08	0.19	0.22	0.86	21.7	7	26.4	0.862

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 4.4E-08 cm/sec**

MAXIMUM HYDRAULIC GRADIENT	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
	1.0E-05 TO 1.0E-06	10	<1.25	HYDRAULIC	OR
	1.0E-06 TO 1.0E-07	20		GRADIENT	% < 50 AT
	less than 1.0E-07	30		ALLOWED	< 1.0E-8



**MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS
USING A FLEXIBLE WALL PERMEAMETER
ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL
FLUID: DEAIRED TAP WATER WITH 0.005 N CaSO4**

PROJECT NAME: GeoPro Inc.	PROJECT NUMBER: 02106307.0004B
LOCATION:	DATE: 2/24/2010
SAMPLE ID: GEOPRO'S THERMAL GROUT LITE 1.00	PANEL IDENTIFICATION: Lenexa Perm Board
SAMPLE DESCR.: BENTONITE ("THERMAL GROUT LITE"): 11.01%	BURETTE AREA: 0.312 cm ²
SAND (SHORT MOUNTAIN GLASS): 55.05% DEIONIZED WATER: 33.94%	BURETTE INCREMENT LENGTH: 1.000 cm
	VOLUME PER INCREMENT: 0.312 cm ³

INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	127.5		SPECIFIC GRAVITY: ASSUMED		PROCTOR, pcf:	NA
D & T, g	DIA, in	2.428	6.17	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	0.990	2.51	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA		29.87	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	105.9	PCF WET				
	DENSITY:		PCF DRY				

SATURATION:	LATERAL PRESS.: 104.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi
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DURING TEST:	LATERAL PRESS.: 104.0 psi	H2: 100.0 psi	H1: 100.0 psi	BIAS PRESSURE (=H1-H2) 0.0 psi
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H1 VALUE	H2 VALUE	ELAPSED TIME, min	DELTA H, cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm ³	IN FLOW cm ³	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP. C	TEMP. CORR.:
8.4	65.6	0.00	57.2									
8.6	65.4	51.00	56.8	0.007018	2.63E-08	0.06	0.06	1.00	22.6	3	25.8	0.873
8.8	65.2	112.00	56.4	0.007067	2.21E-08	0.06	0.06	1.00	22.4	13	25.9	0.871
9.0	65.0	174.00	56.0	0.007117	2.18E-08	0.06	0.06	1.00	22.3	15	26.1	0.867
9.3	64.7	238.00	55.4	0.010772	3.19E-08	0.09	0.09	1.00	22.0	25	26.3	0.864

HYDRAULIC CONDUCTIVITY (k_{20}) = **AVERAGE 2.6E-08 cm/sec**

MAXIMUM HYDRAULIC GRADIENT	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
	1.0E-05 TO 1.0E-06	10	<1.25	HYDRAULIC	OR
	1.0E-06 TO 1.0E-07	20		GRADIENT	% < 50 AT
	less than 1.0E-07	30		ALLOWED	< 1.0E-8

