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:	GEO PRO, INC.	PROJECT NUMBER:	02116310 .0001
LOCATION:		DATE:	4/6/2011
SAMPLE ID:	GEOPRO'S THERMAL GROUT LITE 0.45	PANEL IDENTIFICATION:	Lenexa Perm Board
		BURETTE AREA:	0.312 cm^2
		BURETTE INCREMENT LENGTH:	1.000 cm
		VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%		DENSITY			
W & T, g		WET WT, g	105.6		
D & T, g		DIA, in	2.432	6.18	cm
T, g		HT, in	1.000	2.54	cm
		AREA		29.96	cm^2
MOIST-		DENSITY:	86.6	PCF WET	
URE, %	NA	DENSITY:	NA	PCF DRY	

ADDITIONAL DATA

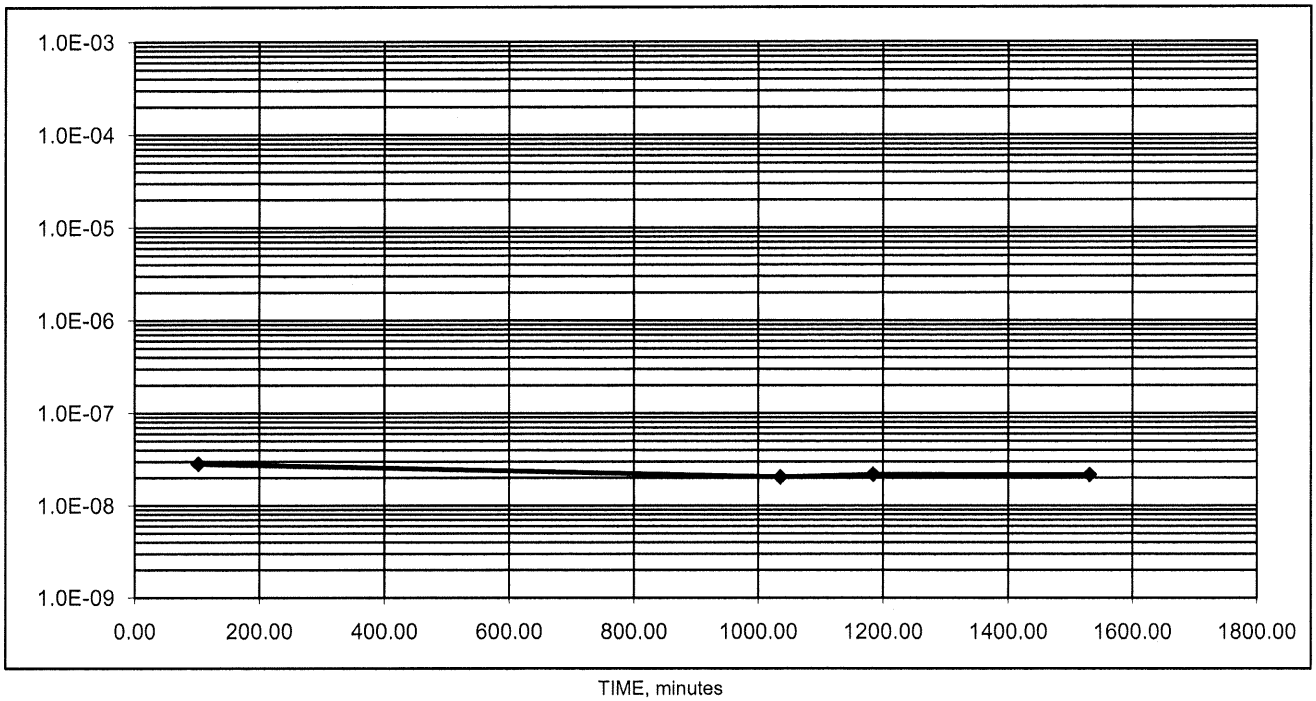
SPECIFIC GRAVITY:	2.60	RECOMPACTED?:	YES
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	NA	OPTIMUM, %:	NA
SATURATION, %:	NA	COMPACTION, %:	NA
VOID RATIO:	NA	OVER OPTIMUM, %:	NA

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.:
10.6	65.3	0.00	54.7									
11.0	64.9	102.00	53.9	0.014733	2.83E-08	0.12	0.12	1.00	21.2	23	25.0	0.889
13.6	62.5	1036.00	48.9	0.097353	2.05E-08	0.81	0.75	1.08	19.3	11	25.0	0.889
14.0	62.1	1184.00	48.1	0.016495	2.18E-08	0.12	0.12	1.00	18.9	6	25.2	0.885
14.8	61.1	1531.00	46.3	0.038140	2.16E-08	0.25	0.31	0.80	18.2	6	24.9	0.891

HYDRAULIC CONDUCTIVITY (k_{20}) = AVERAGE 2.3E-08 cm/sec

MAXIMUM	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
HYDRAULIC	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
GRADIENT	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



Terracon

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:	GEO PRO, INC.	PROJECT NUMBER:	02116310 .0002
LOCATION:		DATE:	4/6/2011
SAMPLE ID:	GEOPRO'S THERMAL GROUT LITE 0.57	PANEL IDENTIFICATION:	Lenexa Perm Board
		BURETTE AREA:	0.312 cm^2
		BURETTE INCREMENT LENGTH:	1.000 cm
		VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%		DENSITY			
W & T, g		WET WT, g	107.4		
D & T, g		DIA, in	2.397	6.09	cm
T, g		HT, in	0.995	2.53	cm
		AREA		29.11	cm^2
MOIST-		DENSITY:	91.1	PCF WET	
URE, %	**NA**	DENSITY:	**NA**	PCF DRY	

ADDITIONAL DATA

SPECIFIC GRAVITY:	2.60	RECOMPACTED?:	YES
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	NA	OPTIMUM, %:	NA
SATURATION, %:	NA	COMPACTION, %:	NA
VOID RATIO:	NA	OVER OPTIMUM, %:	NA

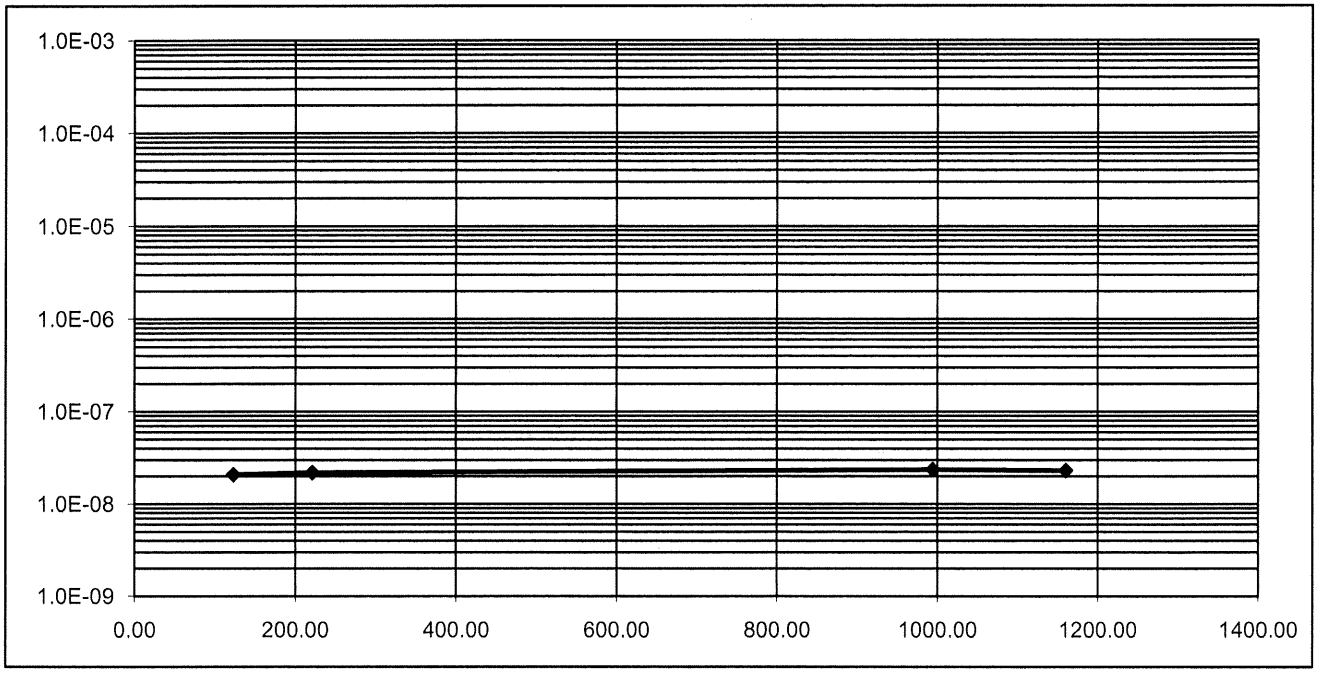
SATURATION:	LATERAL PRESS.:	104.0	psi	BACK PRESSURE (=UPPER=LOWER):	100.0	psi	
DURING TEST:	LATERAL PRESS.:	104.0	psi	H2: 100.0 psi	H1:	100.0	psi
				BIAS PRESSURE (=H1-H2)		0.0	psi

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.:
12.6	59.7	0.00	47.1									
12.9	59.4	123.00	46.5	0.012821	2.08E-08	0.09	0.09	1.00	18.4	7	25.2	0.885
13.2	59.2	221.00	46.0	0.010811	2.19E-08	0.09	0.06	1.50	18.2	2	25.6	0.877
15.6	57.6	994.00	42.0	0.090972	2.36E-08	0.75	0.50	1.50	16.6	6	25.1	0.887
16.0	57.2	1160.00	41.2	0.019231	2.31E-08	0.12	0.12	1.00	16.3	3	25.4	0.881

Chk Data

HYDRAULIC CONDUCTIVITY (k_{20}) = AVERAGE 2.2E-08 cm/sec

MAXIMUM	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
HYDRAULIC	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
GRADIENT	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



Terracon

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:	GEO PRO, INC.	PROJECT NUMBER:	02116310 .0003
LOCATION:		DATE:	4/6/2011
SAMPLE ID:	GEOPRO'S THERMAL GROUT LITE 0.88	PANEL IDENTIFICATION:	Lenexa Perm Board
		BURETTE AREA:	0.312 cm^2
		BURETTE INCREMENT LENGTH:	1.000 cm
		VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%	DENSITY			
W & T, g	WET WT, g	123.4		
D & T, g	DIA, in	2.402	6.10	cm
T, g	HT, in	0.999	2.54	cm
	AREA		29.24	cm^2
MOIST-	DENSITY:	103.8	PCF WET	
URE, % NA	DENSITY:	NA	PCF DRY	

ADDITIONAL DATA

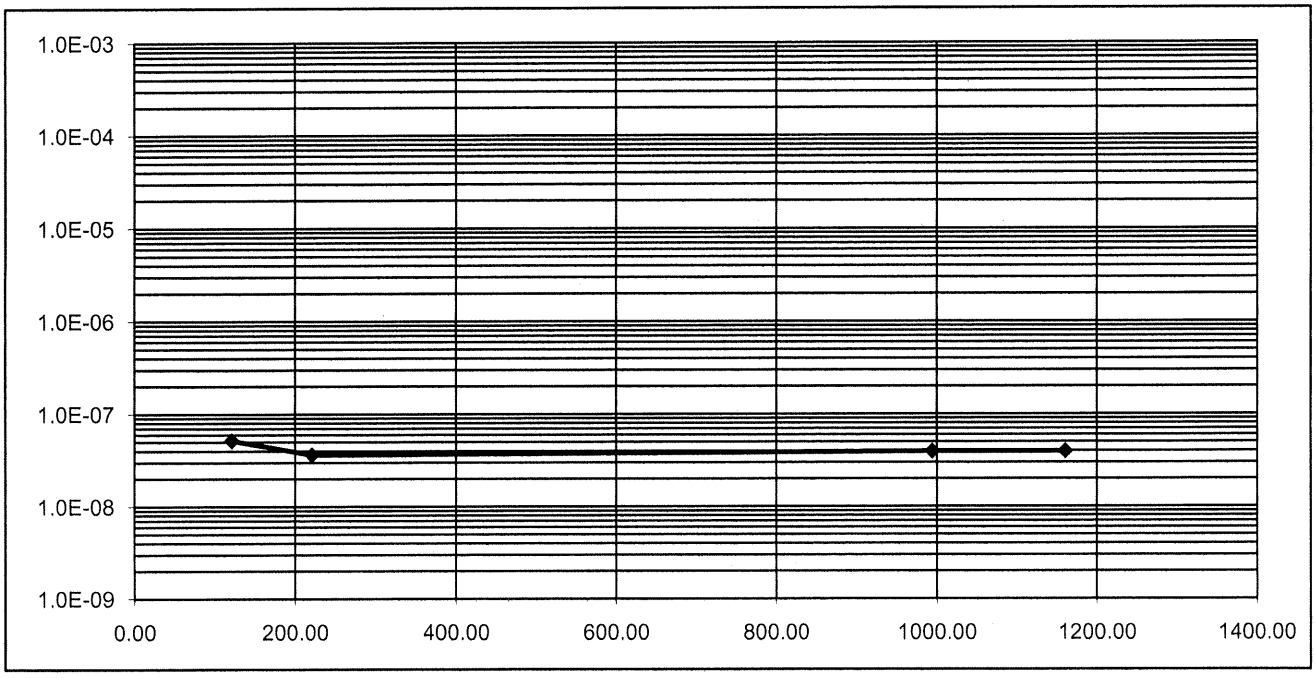
SPECIFIC GRAVITY:	2.60	RECOMPACTED?:	YES
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	NA	OPTIMUM, %:	NA
SATURATION, %:	NA	COMPACTION, %:	NA
VOID RATIO:	NA	OVER OPTIMUM, %:	NA

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.:
13.1	58.4	0.00	45.3									
13.7	57.6	121.00	43.9	0.031393	5.19E-08	0.19	0.25	0.75	17.3	24	25.2	0.885
14.1	57.2	221.00	43.1	0.018391	3.65E-08	0.12	0.12	1.00	17.0	13	25.6	0.877
17.4	54.4	994.00	37.0	0.152605	3.96E-08	1.03	0.87	1.18	14.6	5	25.1	0.887
18.0	53.8	1160.00	35.8	0.032970	3.95E-08	0.19	0.19	1.00	14.1	6	25.4	0.881

HYDRAULIC CONDUCTIVITY (k_{20}) = AVERAGE 4.2E-08 cm/sec

MAXIMUM	1.0E-03 TO 1.0E-04	2	0.75<	30 % < 25 AT
HYDRAULIC	1.0E-04 TO 1.0E-05	5	RATIO	MAX > 1.0E-8
GRADIENT	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



Terracon

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:	GEO PRO, INC.	PROJECT NUMBER:	02116310 .0004
LOCATION:		DATE:	4/6/2011
SAMPLE ID:	GEOPRO'S THERMAL GROUT LITE 1.00	PANEL IDENTIFICATION:	Lenexa Perm Board
		BURETTE AREA:	0.312 cm^2
		BURETTE INCREMENT LENGTH:	1.000 cm
		VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%		DENSITY			
W & T, g		WET WT, g	128.6		
D & T, g		DIA, in	2.414	6.13	cm
T, g		HT, in	0.996	2.53	cm
		AREA		29.53	cm^2
MOIST-		DENSITY:	107.5	PCF WET	
URE, %	NA	DENSITY:	NA	PCF DRY	

ADDITIONAL DATA

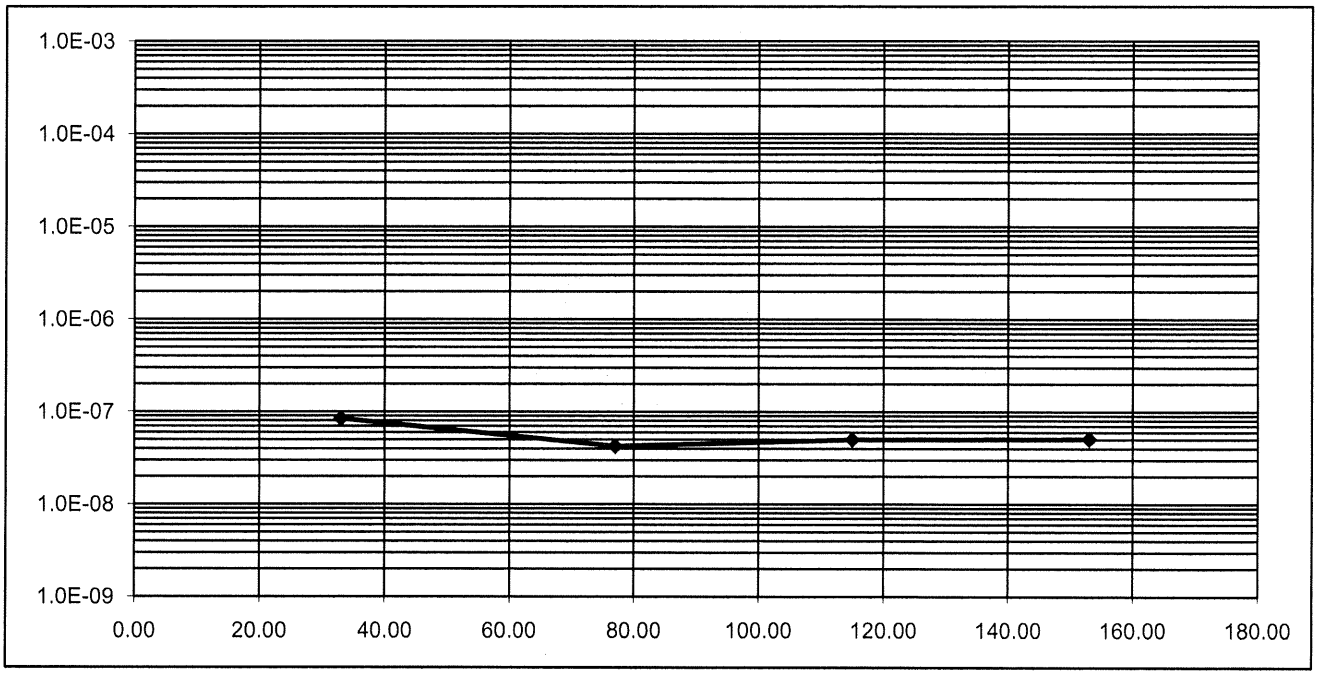
SPECIFIC GRAVITY:	2.60	RECOMPACTED?:	YES
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	NA	OPTIMUM, %:	NA
SATURATION, %:	NA	COMPACTION, %:	NA
VOID RATIO:	NA	OVER OPTIMUM, %:	NA

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.:
14.8	57.3	0.00	42.5									
15.1	57.0	33.00	41.9	0.014218	8.41E-08	0.09	0.09	1.00	16.6	48	25.7	0.875
15.3	56.8	77.00	41.5	0.009592	4.26E-08	0.06	0.06	1.00	16.4	25	25.7	0.875
15.5	56.6	115.00	41.1	0.009685	5.00E-08	0.06	0.06	1.00	16.2	12	25.5	0.879
15.7	56.4	153.00	40.7	0.009780	5.07E-08	0.06	0.06	1.00	16.1	11	25.3	0.883

HYDRAULIC CONDUCTIVITY (k_{20}) = AVERAGE 5.7E-08 cm/sec

MAXIMUM	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
HYDRAULIC	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
GRADIENT	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



Terracon