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:	02126306.0007
LOCATION:		DATE:	3/1/2012
SAMPLE ID:	GEOPRO'S THERMAL GROUT SELECT 0.45	PANEL IDENTIFICATION:	Lenexa Perm Board
	BENTONITE(Thermal Grout Select) - 30.80%	BURETTE AREA:	0.312 cm^2
	DEIONIZED WATER - 69.20%	BURETTE INCREMENT LENGTH:	1.000 cm
		VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%	DENSITY			
W & T, g	WET WT, g	92.6		
D & T, g	DIA, in	2.428	6.17	cm
T, g	HT, in	0.999	2.54	cm
	AREA		29.87	cm^2
MOIST-	DENSITY:	76.2	PCF WET	
URE, % NA	DENSITY:	NA	PCF DRY	

ADDITIONAL DATA

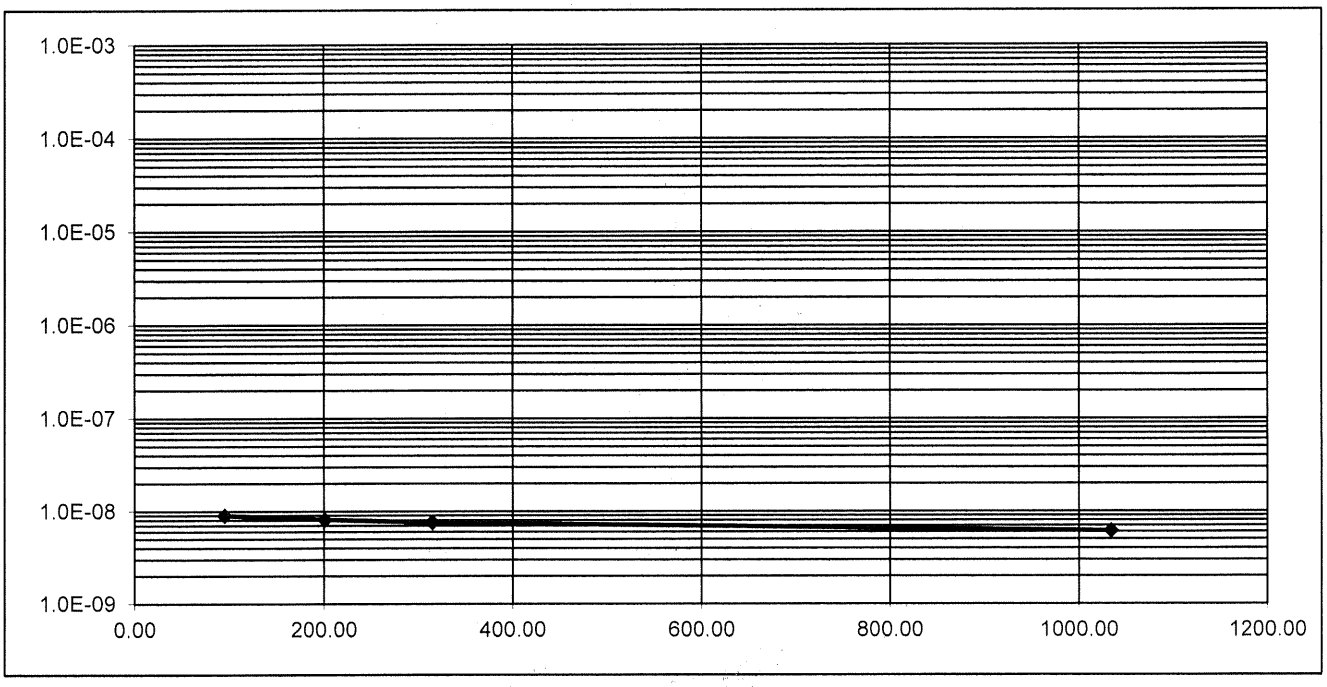
SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	NA	OPTIMUM, %:	NA
SATURATION, %:	NA	COMPACTION, %:	NA
VOID RATIO:	NA	OVER OPTIMUM, %:	NA

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.:
11.6	57.6	0.00	46.0									
11.7	57.5	95.00	45.8	0.004357	9.00E-09	0.03	0.03	1.00	18.0	17	25.1	0.887
11.8	57.4	201.00	45.6	0.004376	8.10E-09	0.03	0.03	1.00	18.0	5	25.1	0.887
11.9	57.3	315.00	45.4	0.004396	7.58E-09	0.03	0.03	1.00	17.9	2	25.0	0.889
12.4	56.8	1034.00	44.4	0.022273	6.12E-09	0.16	0.16	1.00	17.5	21	24.8	0.893

HYDRAULIC CONDUCTIVITY (k_{20}) = **AVERAGE 7.7E-09 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



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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:	02126306.0008
LOCATION:		DATE:	3/1/2012
SAMPLE ID:	GEOPRO'S THERMAL GROUT SELECT 0.57	PANEL IDENTIFICATION:	Lenexa Perm Board
	BENTONITE(Thermal Grout Select) - 23.05%	BURETTE AREA:	0.312 cm^2
	SAND (5010) - 23.05%	BURETTE INCREMENT LENGTH:	1.000 cm
	DEIONIZED WATER - 53.90%	VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%	DENSITY			
W & T, g	WET WT, g	103.3		
D & T, g	DIA, in	2.428	6.17	cm
T, g	HT, in	1.002	2.54	cm
	AREA		29.87	cm^2
MOIST-	DENSITY:	84.8	PCF WET	
URE, % NA	DENSITY:	NA	PCF DRY	

ADDITIONAL DATA

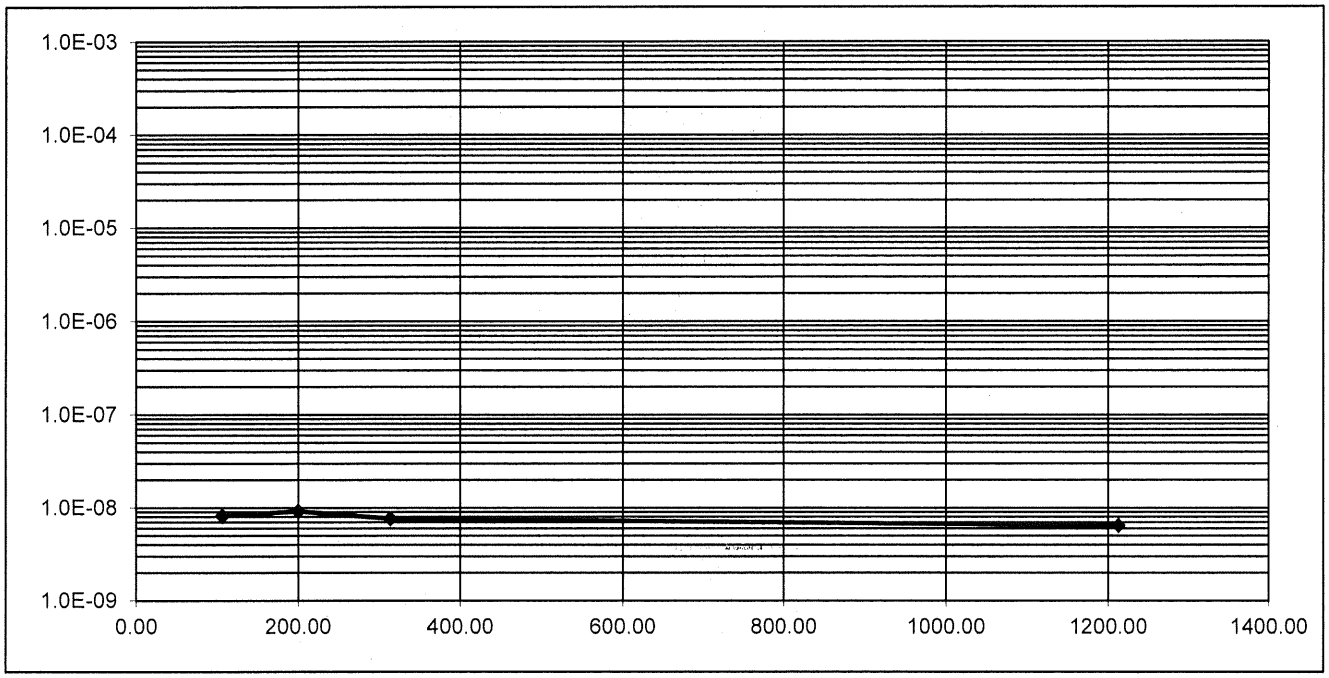
SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	NA	OPTIMUM, %:	NA
SATURATION, %:	NA	COMPACTION, %:	NA
VOID RATIO:	NA	OVER OPTIMUM, %:	NA

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.:
14.2	59.9	0.00	45.7									
14.3	59.8	106.00	45.5	0.004386	8.14E-09	0.03	0.03	1.00	17.9	4	25.1	0.887
14.4	59.7	200.00	45.3	0.004405	9.22E-09	0.03	0.03	1.00	17.8	17	25.1	0.887
14.5	59.6	314.00	45.1	0.004425	7.65E-09	0.03	0.03	1.00	17.7	3	25.0	0.889
15.2	59.0	1213.00	43.8	0.029248	6.44E-09	0.22	0.19	1.17	17.2	18	24.8	0.893

HYDRAULIC CONDUCTIVITY (k_{20}) = AVERAGE 7.9E-09 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



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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:	02126306.0005
LOCATION:		DATE:	3/1/2012
SAMPLE ID:	GEOPRO'S THERMAL GROUT SELECT 1.00	PANEL IDENTIFICATION:	Lenexa Perm Board
	BENTONITE(Thermal Grout Select) - 11.10%	BURETTE AREA:	0.312 cm^2
	SAND (5010) - 55.50%	BURETTE INCREMENT LENGTH:	1.000 cm
	DEIONIZED WATER - 33.40%	VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%	DENSITY			
W & T, g	WET WT, g	126.1		
D & T, g	DIA, in	2.431	6.17	cm
T, g	HT, in	0.990	2.52	cm
	AREA		29.95	cm^2
MOIST-	DENSITY:	104.5	PCF WET	
URE, % NA	DENSITY:	NA	PCF DRY	

ADDITIONAL DATA

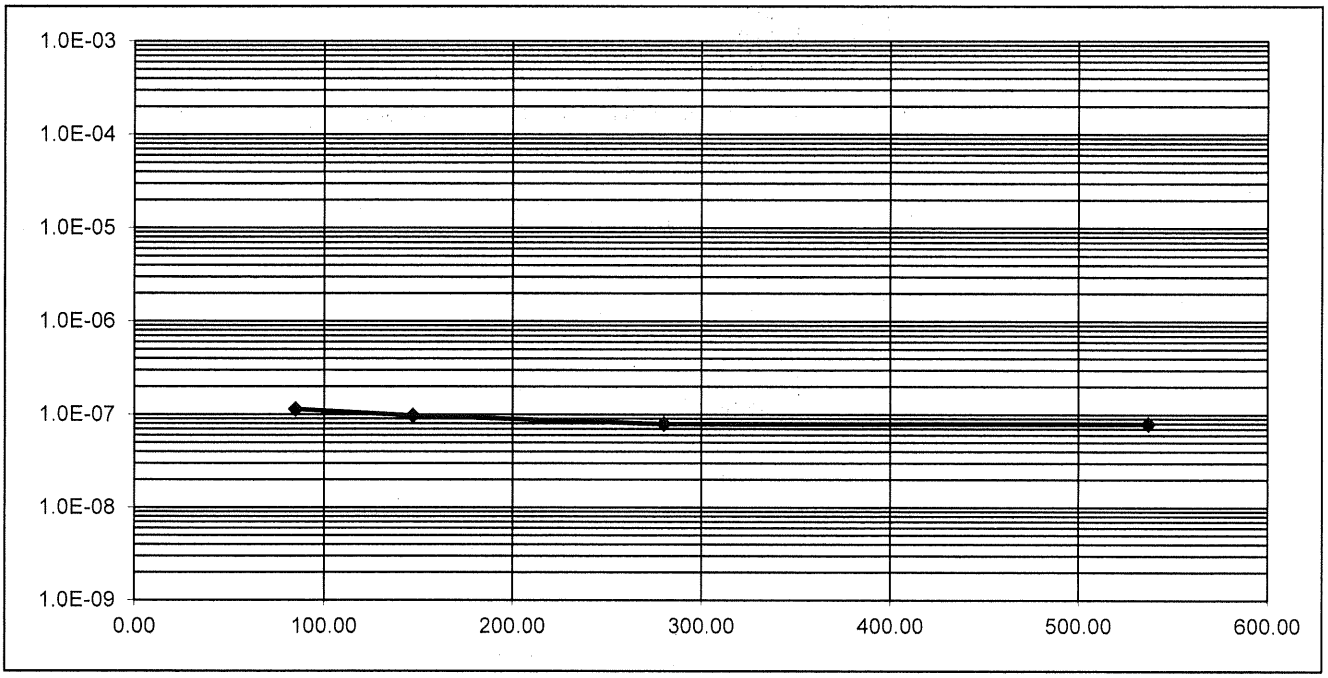
SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	NA	OPTIMUM, %:	NA
SATURATION, %:	NA	COMPACTION, %:	NA
VOID RATIO:	NA	OVER OPTIMUM, %:	NA

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.:
13.0	33.6	0.00	20.6									
13.5	33.1	85.00	19.6	0.049762	1.14E-07	0.16	0.16	1.00	7.8	23	25.0	0.889
13.8	32.8	147.00	19.0	0.031091	9.73E-08	0.09	0.09	1.00	7.6	5	25.1	0.887
14.3	32.3	280.00	18.0	0.054067	7.90E-08	0.16	0.16	1.00	7.2	14	25.0	0.889
15.2	31.4	537.00	16.2	0.105361	7.92E-08	0.28	0.28	1.00	6.4	14	25.3	0.883

HYDRAULIC CONDUCTIVITY (k_{20}) = AVERAGE 9.2E-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



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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:	02126306.0006
LOCATION:		DATE:	3/1/2012
SAMPLE ID:	GEOPRO'S THERMAL GROUT SELECT 1.20	PANEL IDENTIFICATION:	Lenexa Perm Board
	BENTONITE(Thermal Grout Select) - 7.90%	BURETTE AREA:	0.312 cm^2
	SAND (5010) - 63.50%	BURETTE INCREMENT LENGTH:	1.000 cm
	DEIONIZED WATER - 28.60%	VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%		DENSITY			
W & T, g		WET WT, g	135.3		
D & T, g		DIA, in	2.431	6.17	cm
T, g		HT, in	0.990	2.52	cm
		AREA		29.95	cm^2
MOIST-		DENSITY:	112.1	PCF WET	
URE, %	NA	DENSITY:	NA	PCF DRY	

ADDITIONAL DATA

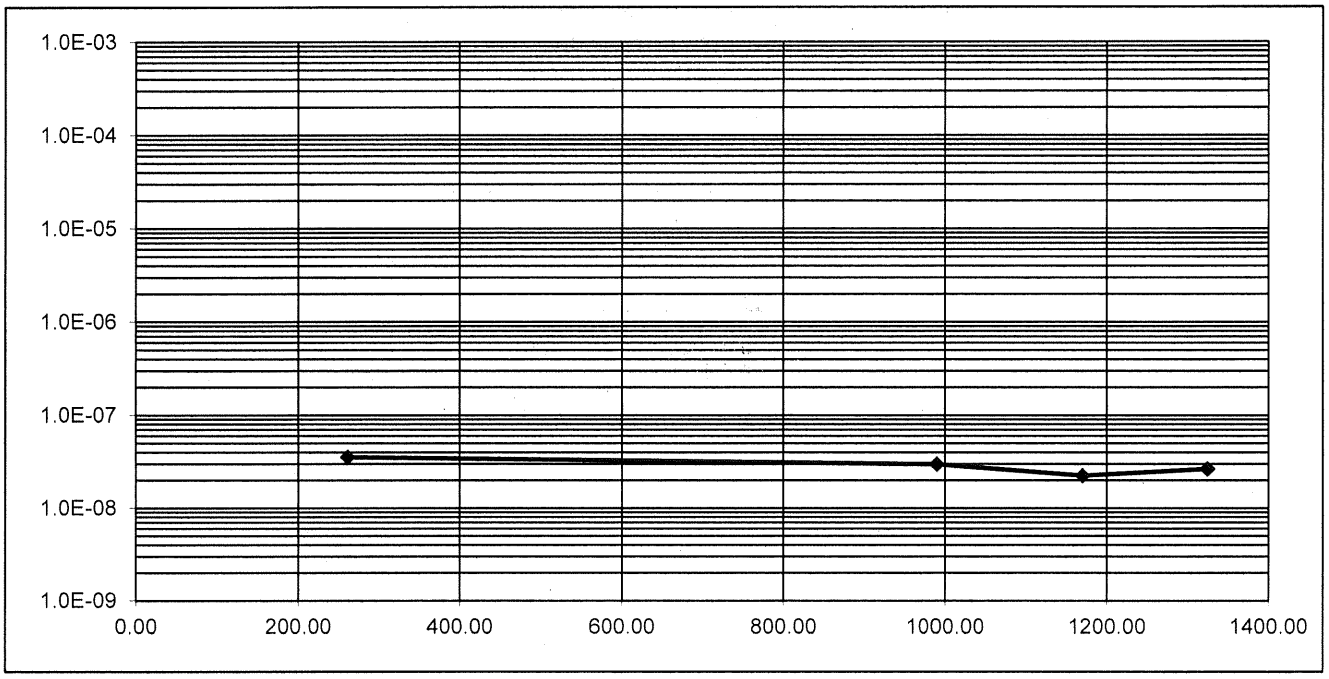
SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	NA	OPTIMUM, %:	NA
SATURATION, %:	NA	COMPACTION, %:	NA
VOID RATIO:	NA	OVER OPTIMUM, %:	NA

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.:
9.7	43.9	0.00	34.2									
10.5	43.1	261.00	32.6	0.047913	3.55E-08	0.25	0.25	1.00	13.0	24	25.3	0.883
12.2	41.4	990.00	29.2	0.110144	2.98E-08	0.53	0.53	1.00	11.6	4	24.4	0.902
12.5	41.1	1170.00	28.6	0.020762	2.24E-08	0.09	0.09	1.00	11.4	21	25.0	0.889
12.8	40.8	1325.00	28.0	0.021202	2.65E-08	0.09	0.09	1.00	11.1	7	25.1	0.887

HYDRAULIC CONDUCTIVITY (k_{20}) = AVERAGE **2.9E-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



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