NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS
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September 4, 2018 Project Number 20529-18

Molto Properties
18W140 Butterfield Road, Suite 750
Oakbrook Terrace, Illinois 60181

RE: **Supplemental Infiltration Testing** - Proposed Warehouse Development - Located at the Southeast Corner of Perry Street and Seaton Avenue, Mead Valley, in the County of Riverside, California

Dear Sir or Madam:
As requested, supplemental infiltration testing has been completed to further assess the site for stormwater capture/infiltration systems. Four additional test sites and depths were selected by Thienes Engineering and supplement the earlier tests as detailed in our *Geotechnical Investigation* report dated July 23, 2018. Logs of the test pits are included in Appendix A.

1.0 INFILTRATION TESTING

The infiltration test consisted of the double ring infiltration test per ASTM Method D 3385. The double ring infiltrometer method consists of driving two open cylinders, one inside the other, into the ground, partially filling the ring with water, and then maintaining the liquid at a constant level. The volume of liquid added to the inner ring, to maintain the liquid level constant is the measure of the volume of liquid that infiltrates into the soil.

The volume infiltrated during timed intervals is converted to an incremental infiltration velocity, usually expressed in centimeters per hour or inches per hour and plotted verses elapsed time. The maximum-steady state or average incremental infiltration velocity, depending on the purpose/application of the test is equivalent to the infiltration rate.

Water levels were maintained at a constant level in both the inner ring and annular space between rings throughout the test, to prevent flow of water from one ring to the other.

The volume of liquid used during each measured time interval was converted into an incremental infiltration velocity of both the inner ring in the annular space using the following equations:

For the inner ring calculated as follows:

$Vir=\Delta Vir/(Air\Delta t)$

where:

Vir = inner ring incremental infiltration velocity, cm/hr

ΔVir = volume of water used during time interval to maintain constant head in the inner ring, cm^3

Air = internal area of the inner ring, cm^2

Δt = time interval, hr

An average of the final readings obtained was used for design purposes in each of the basins. The testing data sheets are attached in Appendix B and summarized below.

The use of on-site disposal system by means of retention/infiltration basins appears to be geotechnically feasible for future development. The field infiltration rates given below may be utilized in the final basin design with a safety factor of 2.0 or greater.

Test No.	Depth (feet bgs)	Soil Type	Infiltration Rate (cm/hr)	(in/hr)
ST-1	13.3	silty Sand	14.0	5.6
ST-2	12.6	silty Sand	7.2	2.9
ST-3	11.0	slightly clayey Sand	0.2	0.1
ST-4	11.0	slightly clayey Sand	0.2	0.1

Soils in all excavations at test elevations consisted of a moderately to very slightly weathered granitic bedrock classifying as silty and clayey Sand. Difficulty in excavating the materials was very evident in ST-3 and ST-4. It is our opinion that the soils in test excavations ST-1 and ST-2 are suitable for infiltration without increasing the potential of settlement of proposed and existing structures or adversely affecting retaining/basement walls located either on or adjacent to the subject site. In addition, the potential for hydro-consolidation and the susceptibility for any ground settlements are considered low. Soils at ST-3 and ST-4 are *not* suitable for infiltration at the depths tested due to very dense/hard bedrock conditions. All systems shall meet the California Regional Water Quality Control Board (CRWQCB) requirements.

2.0 CLOSURE

The recommendations and conclusions contained in this supplemental report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

This firm should have the opportunity to review the final plans (72 hours for review required) to verify that all our recommendations are incorporated. This report and all conclusions are subject to the review of the controlling authorities for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and soil engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

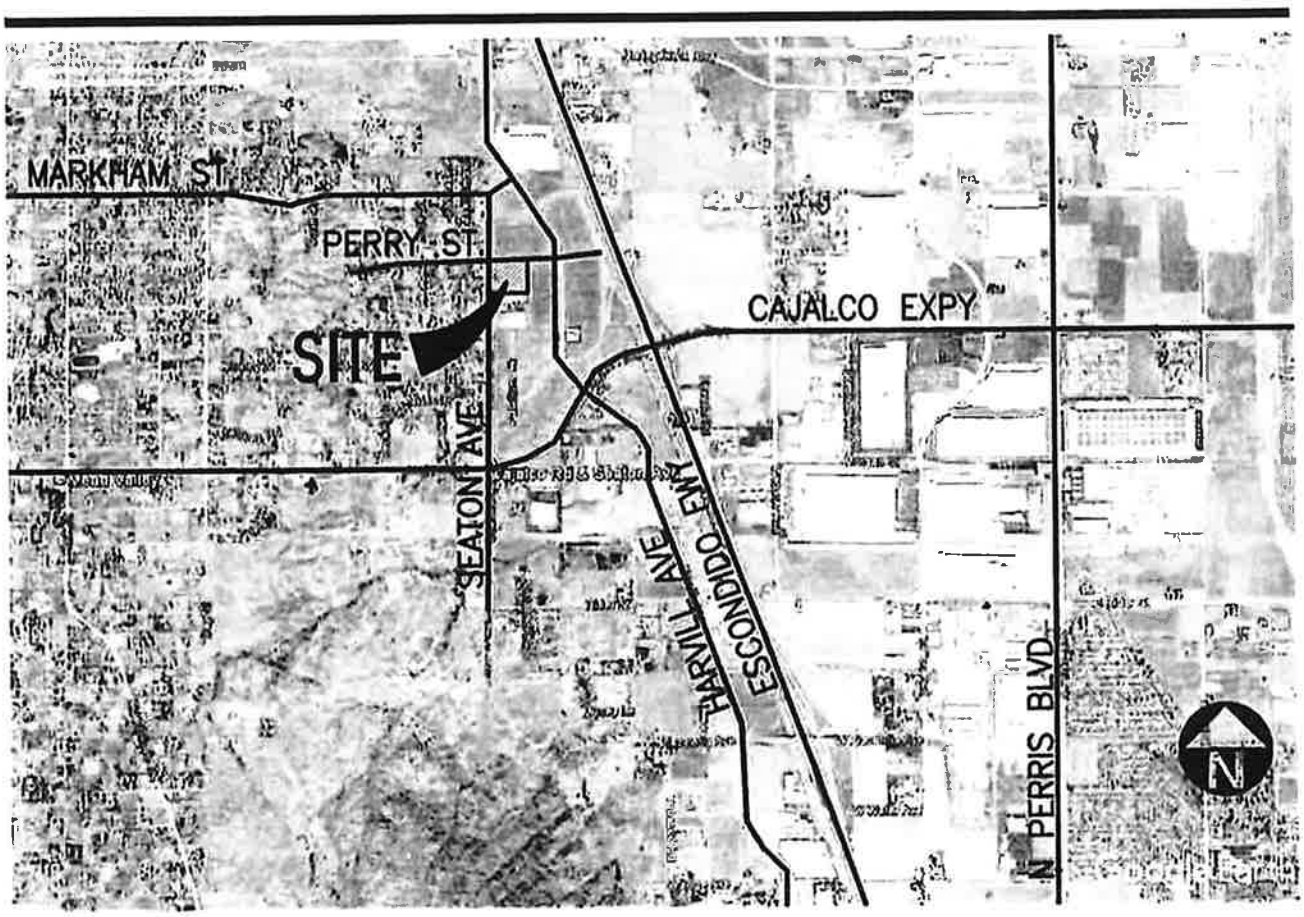
The testing described has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D. Tucker
Project Engineer
R.G.E. 841

Mark A. Burkholder
Project Manager



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VICINITY MAP

FIGURE 1

PROJECT 20529-18 | DATE 9/2018

PERRY STREET

SEATON AVENUE

BUILDING AREA
203,029 S.F.

POTENTIAL OFFICE

POTENTIAL OFFICE

19 DOCK DOORS

ST-1

ST-2

ST-3

ST-4

PROPERTY LINE

0 40 80 160 240

SCALE:1"=80'

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PROJECT 20529-18 | DATE 9/2018

INFILTRATION TEST LOCATIONS

FIG. 2

APPENDIX A

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL. SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINE (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

 Indicates 2.5-inch Inside Diameter. Ring Sample.

 Indicates 2-inch OD Split Spoon Sample (SPT).

 Indicates Shelby Tube Sample.

 Indicates No Recovery.

 Indicates SPT with 140# Hammer 30 in. Drop.

 Indicates Bulk Sample.

 Indicates Small Bag Sample.

 Indicates Non-Standard

 Indicates Core Run.

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

Molto Properties 20529-18	Log of Trench ST-1
Boring Location: SEC Perrt St & Seaton Ave, Mead Valley	
Date of Drilling: 8/30/18	Groundwater Depth: None Encountered
Drilling Method: Excavator	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL SOILS/ DISTURBED TOP SOILS Sandy Clayey SILT with occasional gravel and rootlets Brown, Soft, Dry					
		NATURAL SOILS Sandy Silty CLAY Brown Medium Stiff, Damp					
5		Decomposed Granite BEDROCK Silty SAND Brown Dense, Damp					
		GWT not encountered					
10							
		Boring completed at depth of 13.3'					
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\20529-18.log Date: 9/5/2018

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Molto Properties
20529-18

Log of Trench ST-2

Boring Location: SEC Perrt St & Seaton Ave, Mead Valley

Date of Drilling: 8/30/18 | Groundwater Depth: None Encountered

Drilling Method: Excavator

Hammer Weight: | Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL SOILS/ DISTURBED TOP SOILS Sandy Clayey SILT with Rootlets Brown, Soft, Dry					
		NATURAL SOILS Sandy Silty CLAY Brown, Stiff, Moist					
5		GWT not encountered					
		Decomposed Granite BEDROCK Silty SAND Brown, Dense, Damp					
10		Boring completed at depth of 12.6'					
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\20529-18.log Date: 9/5/2018

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Molto Properties
20529-18

Log of Trench ST-3

Boring Location: SEC Perrt St & Seaton Ave, Mead Valley

Date of Drilling: 8/30/18 | **Groundwater Depth:** None Encountered

Drilling Method: Excavator

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL SOILS/ DISTURBED TOP SOILS Sandy Clayey SILT with occasional gravel and rootlets Brown, Soft, Dry					
		NATURAL SOILS Sandy Silty CLAY Brown, Stiff, Moist					
5		GWT not encountered					
10		Slightly Decomposed Granite BEDROCK Slightly Clayey SAND Grey, Hard, Damp					
		Boring completed at depth of 11'					
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\20529-18.log Date: 9/5/2018

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Molto Properties 20529-18	Lof of Trench ST-4

Boring Location: SEC Perrt St & Seaton Ave, Mead Valley

Date of Drilling: 8/30/18 | Groundwater Depth: None Encountered

Drilling Method: Excavator

Hammer Weight: | Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL SOIL/ DISTURBED TOP SOILS Sandy, Clayey SILT with rootlets Brown, Soft, Dry					
		NATURAL SOILS Sandy SILT with some Clay Brown, Stiff, Moist					
5		GWT not encountered					
		Slightly Decomposed Granite BEDROCK Grey, Very Hard, Damp					
10		Boring completed at depth of 11'					
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\20529-18.log Date: 9/5/2018

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APPENDIX B

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Project:	**Molto Properties**
Project No:	20529-18
Date:	8/30/18
Test No.	ST-1
Depth:	13.3'
Tested By:	D.R.

	TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE (cm)	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
1	9:00			105.7			49.2					
	9:00	5	5	108.8	3.1		52.4	3.2				
2	9:05			104.0			47.5					
	9:05	5	10	106.1	2.1		49.8	2.3				
3	9:10			101.7			45.1					
	9:10	5	15	103.3	1.6		46.8	1.7				
4	9:15			103.3			46.8					
	9:15	5	20	105.0	1.7		48.6	1.8				
5	9:20			105.0			48.6					
	9:20	5	25	106.5	1.5		50.1	1.5				
6	9:25			104.5			48.0					
	9:25	5	30	105.6	1.1		49.2	1.2				
7	9:30			105.6			49.2					
	9:35	5	35	106.8	1.2		50.4	1.2		14.4	14.4	
8	9:35			103.1			46.8					
	9:40	5	40	104.1	1.0		47.8	1.0		12.0	12.0	
9	9:40			104.1			47.8					
	9:45	5	45	105.3	1.2		49.2	1.4		14.4	16.8	
10	9:45			105.3			49.2					
	9:50	5	50	106.7	1.4		50.6	1.4		16.8	16.8	
11	9:50			101.3			44.8					
	9:55	5	55	102.4	1.1		46.0	1.2		13.2	14.4	
12	9:55			102.4			46.0					
	10:00	5	60	103.5	1.1		47.1	1.1		13.2	13.2	

Average = 14.0/14.6 cm/hr

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Project:	**Molto Properties**
Project No:	20529-18
Date:	8/30/18
Test No.	ST-2
Depth:	12.6'
Tested By:	D.R.

	TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE (cm)	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
1	12:00			106.2			50.4					
	12:05	5	5	107.8	1.6		52.4	2.0				
2	12:05			106.5			50.0					
	12:10	5	10	107.9	1.2		51.7	1.7				
3	12:10			107.9			51.7					
	12:15	5	15	108.7	0.8		52.8	1.1				
4	12:15			107.0			51.2					
	12:20	5	20	107.5	0.5		51.8	0.6				
5	12:20			107.5			51.8					
	12:25	5	25	108.3	0.8		52.6	0.8				
6	12:25			107.3			51.5					
	12:30	5	30	108.0	0.7		52.3	0.8				
7	12:30			108.0			52.3					
	12:35	5	35	108.7	0.7		53.0	0.7		8.4	8.4	
8	12:35			106.0			50.5					
	12:40	5	40	106.5	0.5		51.1	0.6		6.0	7.2	
9	12:40			106.5			51.1					
	12:45	5	45	107.1	0.6		51.8	0.7		7.2	8.4	
10	12:45			107.1			51.8					
	12:50	5	50	107.7	0.6		52.5	0.7		7.2	8.4	
11	12:50			106.1			51.0					
	12:55	5	55	106.7	0.6		51.7	0.7		7.2	8.4	
12	12:55			106.7			51.7					
	1:00	5	60	107.3	0.6		52.3	0.6		7.2	7.2	

Average = 7.2/8.0 cm/hr

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Project:	**Molto Properties**
Project No:	20529-18
Date:	8/30/18
Test No.	ST-3
Depth:	11'
Tested By:	D.R.

	TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE (cm)	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
1	1:40			106.8			50.4					
	1:45	5	5	107.0	0.2		50.6	0.2				
2	1:45			107.0			50.6					
	1:50	5	10	107.0	0		50.8	0.2				
3	1:50			107.0			50.8					
	1:55	5	15	107.0	0		50.8	0				
4	1:55			107.0			50.8					
	2:00	5	20	107.0	0		50.8	0				
5	2:00			107.0			50.8					
	2:05	5	25	107.1	0.1		50.9	0.1				
6	2:05			107.1			50.9					
	2:10	5	30	107.1	0		50.9	0				
7	2:10			107.1			51.0					
	2:15	5	35	107.2	0.1		51.0	0.1		1.2	1.2	
8	2:15			107.2			51.0					
	2:20	5	40	107.2	0		51.0	0		0	0	
9	2:020			107.2			51.0					
	2:25	5	45	107.2	0		51.0	0		0	0	
10	2:25			107.2			51.0					
	2:30	5	50	107.2	0		51.0	0		0	0	
11	2:30			107.2			51.0					
	2:35	5	55	107.2	0		51.0	0		0	0	
12	2:35			107.2			51.0					
	2:40	5	60	107.2	0		51.0	0		0	0	

Average = 0.2/0.2cm/hr

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Project:	**Molto Properties**
Project No:	20529-18
Date:	8/30/18
Test No.	ST-4
Depth:	11'
Tested By:	D.R.

	TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE (cm)	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
1	3:00			103.8			47.3					
	3:05	5	5	104.0	0.2		47.4	0.1				
2	3:05			104.0			47.4					
	3:10	5	10	104.1	0.1		47.6	0.2				
3	3:10			104.1			47.6					
	3:15	5	15	104.1	0		47.7	0.1				
4	3:15			104.1			47.7					
	3:20	5	20	104.1	0		47.7	0				
5	3:20			104.1			47.7					
	3:25	5	25	104.1	0		47.7	0				
6	3:25			104.1			47.7					
	3:30	5	30	104.1	0		47.7	0				
7	3:30			104.1			47.8					
	3:35	5	35	104.1	0		47.8	0.1		0	1.2	
8	3:35			104.1			47.8					
	3:40	5	40	104.1	0		47.8	0		0	0	
9	3:40			104.1			47.8					
	3:45	5	45	104.1	0		47.8	0		0	0	
10	3:45			104.1			47.8					
	3:50	5	50	104.2	0.1		47.8	0		1.12	0	
11	3:50			104.2			47.8					
	3:55	5	55	104.2	0		47.8	0		0	0	
12	3:55			104.2			47.8					
	4:00	5	60	104.2	0		47.8	0		0	0	

Average = 0.2/0.2 cm/hr