NorCal Engineering
Soils and Geotechnical Consultants
10641 Humbolt Street Los Alamitos, CA 90720
(562) 799-9469 Fax (562) 799-9459

October 3, 2017

Project Number 19902-17

Fontana Slover, LLC
11777 San Vicente Boulevard, Suite 780
Los Angeles, California 90049

Attn: Matt Englhard

RE: **Soil Infiltration Study** - Proposed Warehouse Development - Located at the Southwest Corner of Slover Avenue and Cypress Avenue, Fontana, in the County of San Bernardino, California

Dear Mr. Englhard:

Pursuant to your request, this firm has performed a Soil Infiltration Study for the above referenced project. The purpose of this study is to evaluate the feasibility of on-site drainage disposal systems on the subject site. The scope of current work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration; 3) double ring infiltration testing at two locations; 4) engineering analysis of field test data; and 5) preparation of this report.

Proposed Development

It is currently proposed to construct a new 188,460 square feet concrete tilt-up structure on the 8.65-acre parcel. Asphaltic and concrete pavement areas and landscaping will also be installed. Grading for the development is expected to include cut and fill procedures. It is also proposed to install detention/infiltration basin on the property to capture and infiltrate storm water runoff. Depth of system is assumed to be within the upper 10 feet below existing grades.

Site Description

The rectangular shaped property is located at the southwest corner of Slover Avenue and Cypress Avenue, in the Fontana area of the County of San Bernardino, as shown on the vicinity map on Figure 1. An unimproved alley borders along the south along with a residence. Land to the west is vacant.

The site is currently occupied by two residences in the northwest portion of the site along with storage sheds, block wall and some concrete slabs. The remainder of the site is covered with a low growth of vegetation and some trees.

The site topography appears to descend very gently from north to south and drainage is via sheetflow in this direction.

Field Exploration

The excavations were completed on September 19, 2017 and testing was completed on that day. The testing consisted of using the double ring infiltrometer at three locations to determine the infiltration rate of the proposed retention/infiltration system. The locations of the tests are shown on the attached Figure 2. The test locations were excavated by backhoe to depths ranging from 5 to 10 feet below existing ground surface (bgs). Excavations were trimmed at 1:1 (horizontal to vertical) inclinations in order to provide safe entry into the excavations. No significant caving occurred to the depths of these test excavations. Detailed descriptions of the subsurface soils are given in the attached test excavations logs in Appendix B. The excavations were backfilled at the conclusion of testing with the soil cuttings and tamped, but were *not* compacted to 90% relative compaction.

In general, the test areas were found to be underlain by surficial fill soils overlying native soils. The soils at test locations consisted of silty SANDS with some gravel and small cobbles. These soils were noted to be medium dense and dry to damp.

Groundwater

Groundwater was not encountered in any of our test excavations. Historic high groundwater in the vicinity has been recorded greater than 200 feet below grade, based upon nearby groundwater monitoring well information from the California Department of Water Resources database http://www.water.ca.gov/waterdatalibrary/.

Infiltration Test Procedure

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 ting, cm^2

Δt = time interval, hr

The last reading obtained was used for design purposes in each of the basin. The testing data sheets are attached in Appendix B and summarized in the *Discussion of Results* section below.

Discussion of Results

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 basin design with a safety factor of 2.0 or greater.

Test No.	Depth (feet bgs)	Soil Type	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
T-1	5.0	silty SAND	6.7	2.7
T-2	10.0	silty SAND	7.1	2.8
T-3	7.5	silty SAND	237	94.8

It is our opinion that the site is suitable for stormwater 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. All systems shall meet the California Regional Water Quality Control Board (CRWQCB) requirements.

Closure

The recommendations and conclusions contained in this 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. This firm should have the opportunity to review the final plans 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. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This infiltration study 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. All work was performed under the supervision of the Geotechnical Engineer. No other warranty, expressed or implied is made. 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

REGISTERED PROFESSIONAL ENGINEER
KEITH TUCKER
No. 841
Exp. 12/31/18
GEOTECHNICAL
STATE OF CALIFORNIA

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

Mark A. Burkholder
Project Manager

List of Appendices
(in order of appearance)

Appendix A

Vicinity Map and Test Location Exhibits – Figures 1 and 2

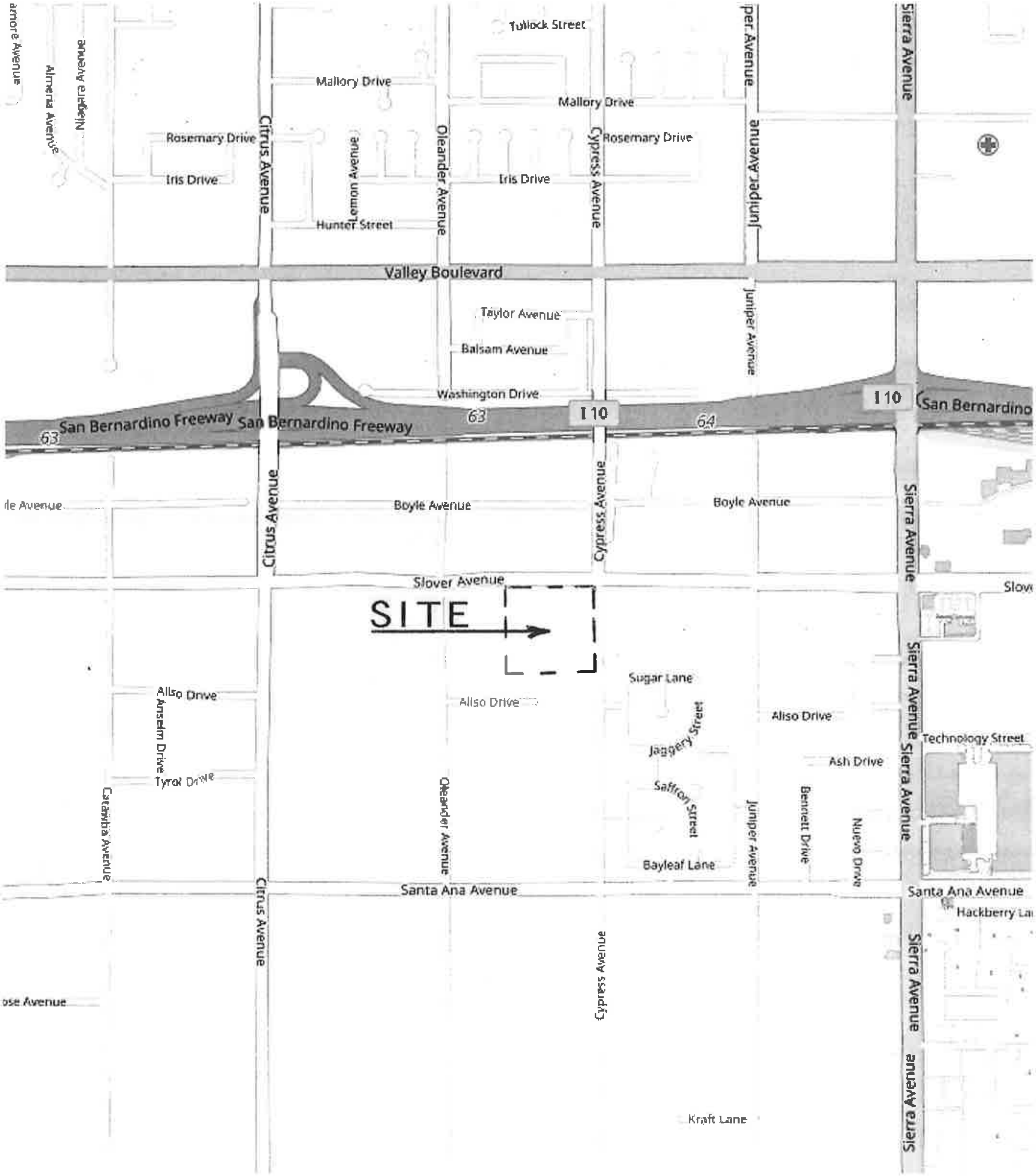
Appendix B

Logs of Test Excavations T-1 to T-3

Field Test Data

Calculations

Appendix A



NorCal Engineering

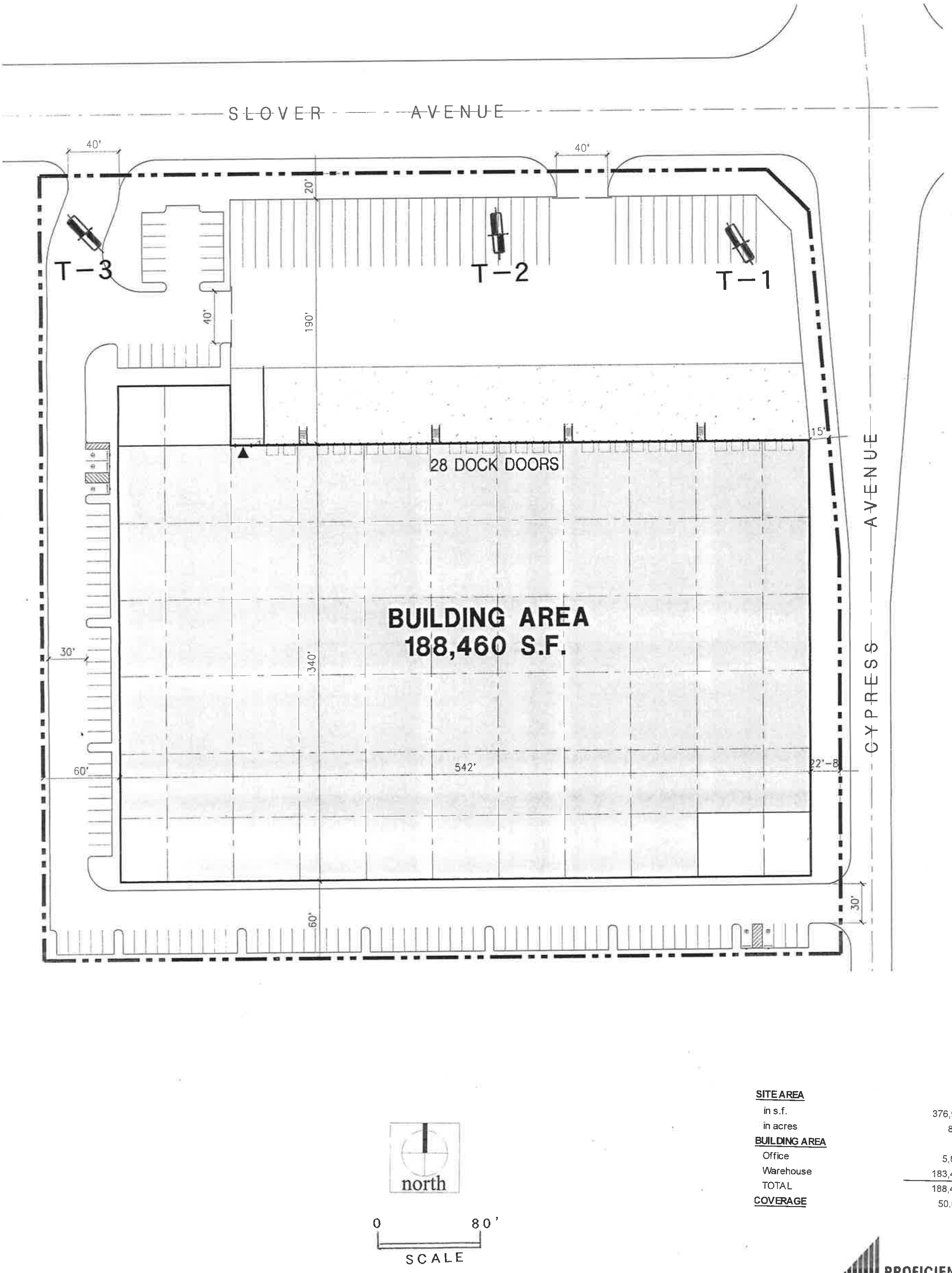
SOILS AND GEOTECHNICAL CONSULTANTS

VICINITY MAP

PROJECT 19902-17

DATE 10/2017

FIG. 1



SITE AREA	
in s.f.	376,971 s.f.
in acres	8.65 ac
BUILDING AREA	
Office	5,000 s.f.
Warehouse	183,460 s.f.
TOTAL	188,460 s.f.
COVERAGE	50.0%

PROFICIENCY CAPITAL LLC

August 31, 2017 / Job #17322

Scheme 3

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT 19902-17
DATE 10/2017

LOCATION OF FIELD EXPLORATIONS

FIG. 2

Appendix B

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	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
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▥	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	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
		SANDS WITH FINE (APPRECIABLE AMOUNT OF FINES)	▥	SM	SILTY SANDS, SAND-SILT MIXTURES
			▨	SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	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
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 5O	▥	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 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)

COMPONENT PROPORTIONS

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

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

Fontana Slover, LLC
19902-17

Log of Boring B-1

Boring Location: Slover and Cypress, Fontana

Date of Drilling: 10/6/17

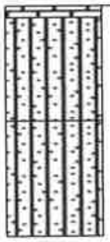
Groundwater Depth: None Encountered

Drilling Method: Drill Rig

Hammer Weight: 140 lbs

Drop: 30"

Surface Elevation: Not Measured

Depth (feet)	Lith- ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	 GWT not encountered	3" Concrete Slab					
		FILL SOILS Silty SAND with concrete, metal, chickenwire, gravel and small cobbles Brown, loose, dry					
5		NATURAL SOILS Silty SAND with gravel and small cobbles Brown, medium dense, damp					
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\1990217-2.log Date: 7/17/2018

Fontana Slover, LLC
19902-17

Log of Boring B-2

Boring Location: Slover and Cypress, Fontana

Date of Drilling: 10/6/17

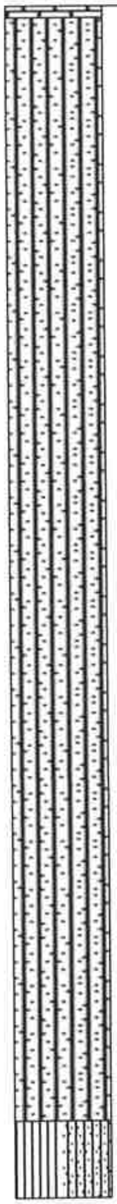
Groundwater Depth: None Encountered

Drilling Method: Drill Rig

Hammer Weight: 140 lbs

Drop: 30"

Surface Elevation: Not Measured



Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		3" Concrete Slab					
	GWT not encountered	FILL SOILS Silty SAND with gravel, small cobbles, concrete and metal pieces Brown, loose, dry Decrease in debris below 24"					
5							
10							
15							
20		Chicken bones in sample at 20'					
25							
30		NATURAL SOILS Sandy SILT to Silty SAND with occasional gravel Brown, medium stiff, moist					
		Boring completed at depth of 31'					
35							

NorCal Engineering

Fontana Slover, LLC
19902-17

Log of Boring B-3

Boring Location: Slover and Cypress, Fontana

Date of Drilling: 10/6/17 | **Groundwater Depth: None Encountered**

Drilling Method: Drill Rig

Hammer Weight: 140 lbs | **Drop: 30"**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		GWT not encountered	FILL SOILS Silty SAND with gravel and small cobbles Brown, loose, damp					
5								
10			Chicken bones in sample at 10'					
			NATURAL SOILS Silty SAND with gravel and small cobbles Brown, dense, moist					
15								
			Boring completed at depth of 16.5'					
20								
25								
30								
35								

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\1990217-2.log Date: 7/17/2018

NorCal Engineering

Fontana Slover, LLC
19902-17

Log of Boring B-4

Boring Location: Slover and Cypress, Fontana

Date of Drilling: 10/6/17

Groundwater Depth: None Encountered

Drilling Method: Drill Rig

Hammer Weight: 140 lbs

Drop: 30"

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 Silty SAND with gravel Brown, loose, damp					
5		GWT not encountered					
10		Chicken bones in sample at 10'					
		NATURAL SOILS Silty SAND with gravel and small cobbles Brown, medium dense, damp					
15							
		Boring completed at depth of 16.5'					
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\1990217-2.log Date: 7/17/2018

NorCal Engineering

NORCAL
ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project:	**Fontana Slover, LLC**
Project No:	19902-17
Date:	9/19/17
Test No.	T-1
Depth:	5'
Tested By:	J.S.

	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	7:30			101.8			43.8					
	7:40	10	10	104.6	2.8		47.2	3.4				
2	7:40			104.6			47.2					
	7:50	10	20	106.3	1.7		49.5	2.3				
3	7:50			101.7			44.4					
	8:00	10	30	102.9	1.2		46.5	2.1				
4	8:00			102.9			46.5					
	8:10	10	40	104.7	1.8		48.7	2.2				
5	8:10			104.7			48.7					
	8:20	10	50	105.9	1.2		50.7	2.0				
6	8:20			102.1			45.0					
	8:30	10	60	103.4	1.3		47.0	2.0				
7	8:30			103.4			47.0					
	8:40	10	70	104.5	1.1		49.0	2.0		6.6	12.0	
8	8:40			104.5			49.0					
	8:50	10	80	105.6	1.1		50.7	1.7		6.6	10.2	
9	8:50			100.1			43.0					
	9:00	10	90	101.8	1.7		44.9	1.9		10.2	11.4	
10	9:00			101.8			44.9					
	9:10	10	100	102.5	0.7		46.5	1.6		4.2	9.6	
11	9:10			102.5			46.5					
	9:20	10	110	103.5	1.0		48.3	1.8		6.0	10.8	
12	9:20			103.5			48.3					
	9:30	10	120	104.6	1.1		50.0	1.7		6.6	10.2	
									Average =	6.7 /	10.7	

NORCAL
ENGINEERING
SOILS AND GEOTECHNICAL CONSULTANTS

Project: Fontana Slover, LLC
Project No: 19902-17
Date: 9/19/17
Test No. T-2
Depth: 10’
Tested By: J.S.

	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	9:50			100.0			43.0					
	10:00	10	10	102.0	2.0		44.9	1.9				
2	10:00			102.0			44.9					
	10:10	10	20	103.4	1.4		46.5	1.6				
3	10:10			103.4			46.5					
	10:20	10	30	104.9	1.5		47.9	1.4				
4	10:20			104.9			47.9					
	10:30	10	40	106.0	1.1		49.1	1.2				
5	10:30			106.0			49.1					
	10:40	10	50	107.1	1.1		50.1	1.0				
6	10:40			107.1			50.1					
	10:50	10	60	108.2	1.1		51.7	1.6		6.6	9.6	
7	10:50			98.1			42.4					
	11:00	10	70	100.0	1.9		44.0	1.6		11.4	9.6	
8	11:00			100.0			44.0					
	11:10	10	80	101.2	1.2		45.1	1.1		7.2	6.6	
9	11:10			101.2			45.1					
	11:20	10	90	102.3	1.1		46.4	1.3		6.6	7.8	
10	11:20			102.3			46.4					
	11:30	10	100	103.3	1.0		47.8	1.4		6.0	8.4	
11	11:30			103.3			47.8					
	11:40	10	110	104.5	1.2		48.9	1.1		7.2	6.6	
12	11:40			104.5			48.9					
	11:50	10	120	105.3	0.8		50.0	1.1		4.8	6.6	
									Average =	7.1	/ 7.9	

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: Fontana Slover, LLC
Project No: 19902-17
Date: 9/19/17
Test No. T-3
Depth: 7.5'
Tested By: J.S.

	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	12:29			101.5			46.0					
	12:30	1	1	107.5	6.0		51.0	5.0				
2	12:30			98.9			44.5					
	12:31	1	2	105.4	6.5		49.8	5.3				
3	12:31			99.0			44.0					
	12:32	1	3	104.6	5.6		49.0	5.0				
4	12:32			99.0			43.5					
	12:33	1	4	104.6	5.6		49.0	5.5				
5	12:33			98.8			45.5					
	12:34	1	5	104.0	5.2		49.5	4.0				
6	12:34			98.5			43.5					
	12:35	1	6	103.0	4.5		48.3	4.8				
7	12:35			98.5			42.5					
	12:36	1	7	103.0	4.5		47.7	5.2		270	312	
8	12:36			98.0			42.0					
	12:37	1	8	102.2	4.2		47.3	5.3		252	318	
9	12:37			98.0			41.1					
	12:38	1	9	101.8	3.8		46.9	5.8		228	348	
10	12:38			98.0			42.6					
	12:39	1	10	101.7	3.7		47.7	5.1		222	306	
11	12:39			98.5			42.0					
	12:40	1	11	102.2	3.7		47.0	5.0		222	300	
12	12:40			99.1			45.5					
	12:41	1	12	102.9	3.8		49.0	4.5		228	270	

Average = 237 / 309