ALR ENGINEERING & TESTING

Civil & Geotechnical Engineering w/ Material Testing
18361 Symeron Road, Apple Valley, Ca. 92307
760-810-2031 Cell # - 760-242-3130 Office #
(alrengineeringtesting@gmail.com)

November 22, 2014

INFILTROMETER TEST

APN 3066-251-07

PROPOSED COMMERCIAL DEVELOPMENT

Infiltrometer test for designing the stormwater drainage retention ponds on the 8.43 acre parcel for a proposed 76,473 sqft Shopping Center Development.

Located on the Southwest corner of Phelan Road, and Valley Vista Road, in Phelan, San Bernardino County, California

Prepared for

VVR, LLC.
3936 Phelan Road, Ste. B1
Phelan, Ca. 92371

Project No. 1410057

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Project No. 1410057

November 22, 2014

VVR, LLC.
3936 Phelan Road, Suite B1
Phelan, CA. 92371

Attention: Mr. Ken Anderson,

Subject: Report on the Infiltrometer Percolation Testing for Storm Water Retention for the **Proposed 76,473 sqft Shopping Center Development**, APN 3066-251-07, located on the Southwest corner of Phelan Road and Valley Vista Road, in the community of Phelan, County of San Bernardino, California

As per you your authorization, we performed a ***Preliminary Geotechnical Investigation,***and a ***Double Ring Infiltrometer Test*** (ASTM D3385-09) to determine the rate of absorption for the retention basins, and a ***Percolation Test*** by the ***Seepage Pit Method*** to determine the rate of absorption that can be used to design the on-site treatment plant.

Site Location:

The site is located on the Southwest corner of Phelan Road and Valley Vista Road in Phelan. The test location for the retention basins are located along the frontage and behind the commercial buildings proposed on the property as shown on the tentative site plan.

Test Date:

We excavated the test trenches on ***November 22, 2014*** and began testing per ***(ASTM D3385-09).*** The infiltrometer test trenches were presoaked and tested all on the same day due to the nature of the soils.

Weather Conditions:

The weather was slightly cloudy with an ambient temperature of **72°** and a slight breeze blowing from the southwest.

Testing Personnel:

The engineers on site per***forming the infiltrometer testing were John Longoria, Senior Associate Engineer*** and ***Leroy Longoria, Senior Engineer Technician.***

Description of Test Site:

The site is relatively flat with a slight gradient slope to the Northeast corner. The trenches excavated on site showed that the soil encountered were of a Well graded **SAND** with silts and much gravel and some rock to **3"** ***(SW-SM)*** down to approximately a fourteen foot depth.

Depth to Water Table:

The water table depth at this location is shown to be approximately **680'** beneath the surface profile. These depths are averaged and furnished by the water district maps and recorded data from the local well sites.

Equipment Used for the Test:

The test trenches were excavated with a CAT backhoe with a **30"** bucket. The Double-Ring Infiltrometer ***(ASTM D3385-09)*** apparatus was used with a sufficient water supply.

Area of the Rings:

We used two rings for this test, a **12"** diameter ring and a **24"** diameter ring both rings are **20"** high. The area of the rings are calculated as **113 in^2** and **452 in^2** respectively and the annular area is **339 in^2**.

Volume Constants:

The Mariotte Tubes used were **3,000 cc** for the small mariotte tube and **10,000 cc** for the large mariotte tube. The small mariotte tube uses a **5.352 cc/mm** and the large mariotte tube uses a **16.753 cc/mm**.

Scope of Work:

Field investigation by excavating trenches to a depth of **15** feet in the approximate area of the retention ponds. Visual classifications of sub-surface soils encountered in the trenches. Perform infiltrometer percolation testing in a **3'- 4'** deep excavated trench. Prepare this report with our infiltration-percolation recommendations.

Sub-surface Condition:

Our field investigation revealed that the sub-surface soils of well-graded **SAND** with some silt and gravel encountered to the depth explored. **Figures A-1** contains the logs of the trenches.

Scope of the Infiltrometer Test:

This test method is a procedure for measuring the rate of infiltration of water into soils using the double-ring infiltrometer. This test method is particularly applicable to relatively uniform fine-grained soils, with an absence of very plastic clays and gravel-size particles with moderate to low resistance to ring penetration. This test method may be conducted at the ground surface or at given depths, and on bare soil or with vegetation in place, depending on the conditions for which infiltration rates are desired.

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Summary of Test Method:

The double-ring infiltrometer method consists of driving two open cylinders, one inside the other, into the ground, partially filling the rings with water, and then maintaining the water level at a constant level. The volume of liquid added to the inner ring, to maintain the water level constant is the measure of the volume of water that infiltrates the soil. The volume infiltrated during timed intervals is converted to an incremental infiltration velocity, usually expressed in centimeters per hour or inch per hour and plotted versus 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.

Significance and Use:

This test method is useful for field measurement of the infiltration rate of soils. Infiltration rates have application to such studies as liquid waste disposal, evaluation of potential septic-tank disposal fields, leaching and drainage efficiencies, irrigation requirements, water spreading and recharge. The purpose of the outer ring is to promote one-dimensional, vertical flow beneath the inner ring. Many factors affect the infiltration rate, for example the soil structure, soil layering, condition of the soil surface, degree of saturation of the soil, chemical and physical nature of the soil and of the applied water, and diameter and depth of embedment of the rings. Thus, tests made at the same site are not likely to give identical results and the rate measured by the test method described in this standard is primarily for comparative use.

Double-Ring Infiltrometer Testing in a Shallow Trench:

Infiltration testing was performed in the bottom of the test trench at a depth of **3-4** feet. This testing was performed to provide an infiltration rate for the on-site retention basins. The testing included using approximately **80** gallons of water percolated over **160** minutes, resulting with a **1.60** in/hour rate. After applying a factor of safety of **2.0** the design rate will be **0.81** in/hr. Results of the testing and graphing are attached within.

General Recommendations for Retention Basin:

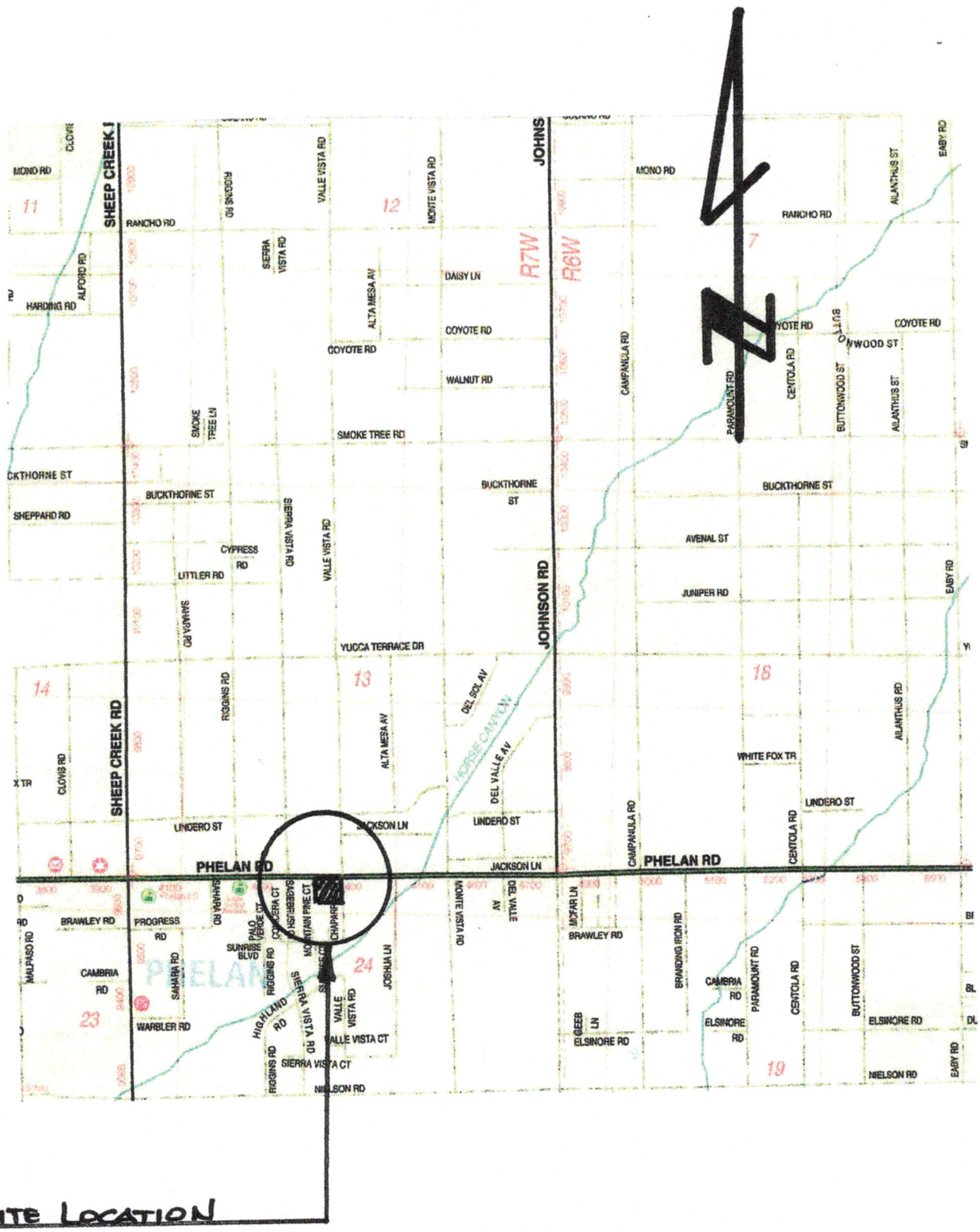
The retention basin is designed to accommodate the total runoff volume while considering the time it takes to percolate into the ground. Storm flow is generated by rainfall runoff that is significantly larger and limited to the storm event. This requires first storing it in the retention basin and then allowing percolation to occur slowly in to the ground.

Sincerely,

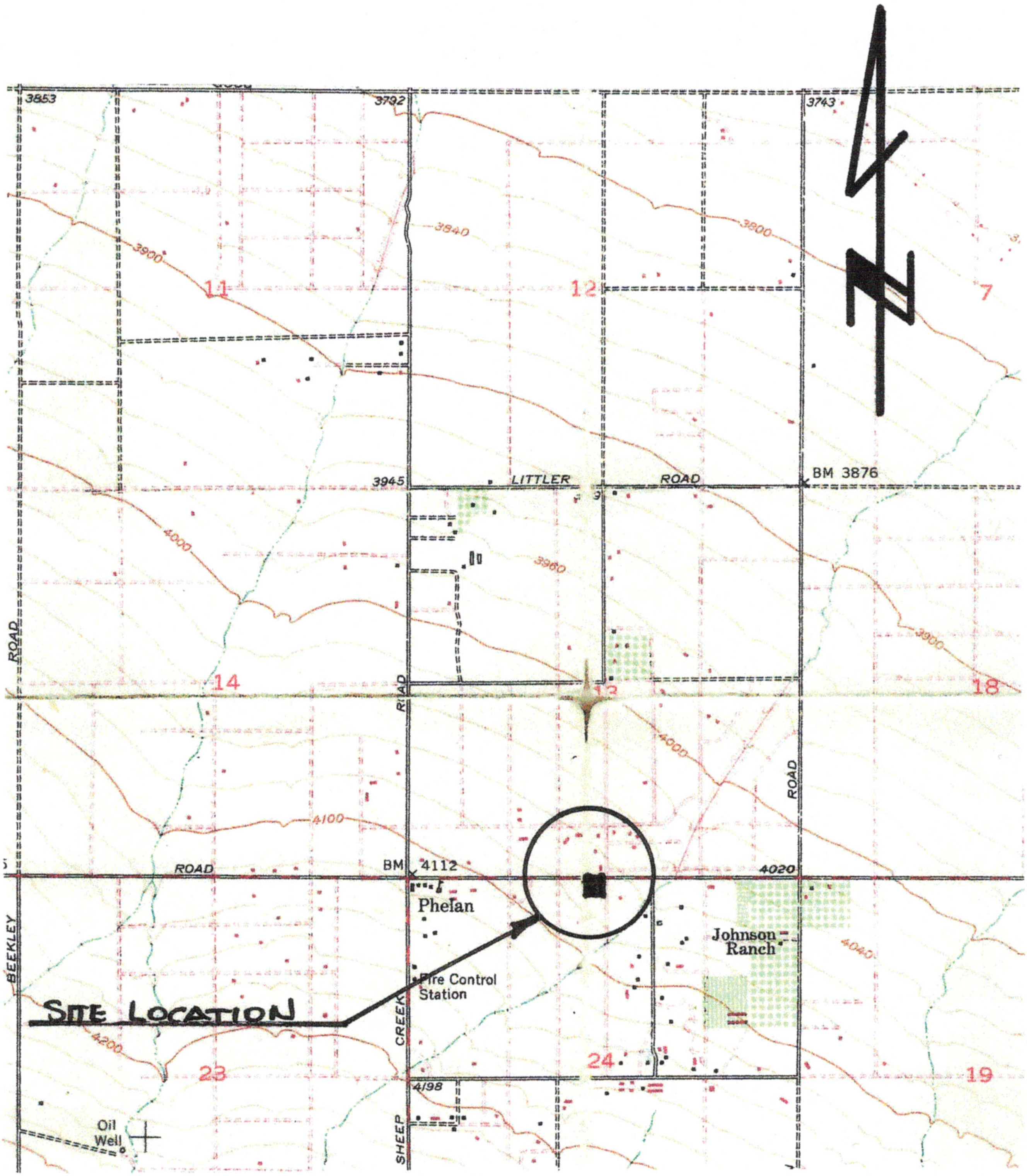
ALR ENGINEERING & TESTING

John Longoria, EIT, NICET III, QSP, CESSWI	**Stephan M. Longoria, PE 74782, QSD**
Senior Associate Engineer	Registered Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
STEPHAN M. LONGORIA
No. 74782
EXP. 12/31/15
CIVIL
STATE OF CALIFORNIA



ALR ENGINEERING & TESTING	Phelan			Project No. 1410057
Civil & Geotechnical Engineering w/ Material testing	APN 3066-251-07			
18361 Symeron Road	VVR, LLC.			
Apple Valley, Ca. 92307	Vicinity Map			Figure No. 1
(760) 810-2031 Cell # - (760) 242-3130 Office #				



ALR ENGINEERING & TESTING	Phelan			Project No. 1410057
Civil & Geotechnical Engineering w/ Material testing	APN 3066-251-07			
18361 Symeron Road	VVR, LLC.			
Apple Valley, Ca. 92307	USGS Topo			Figure No. 2
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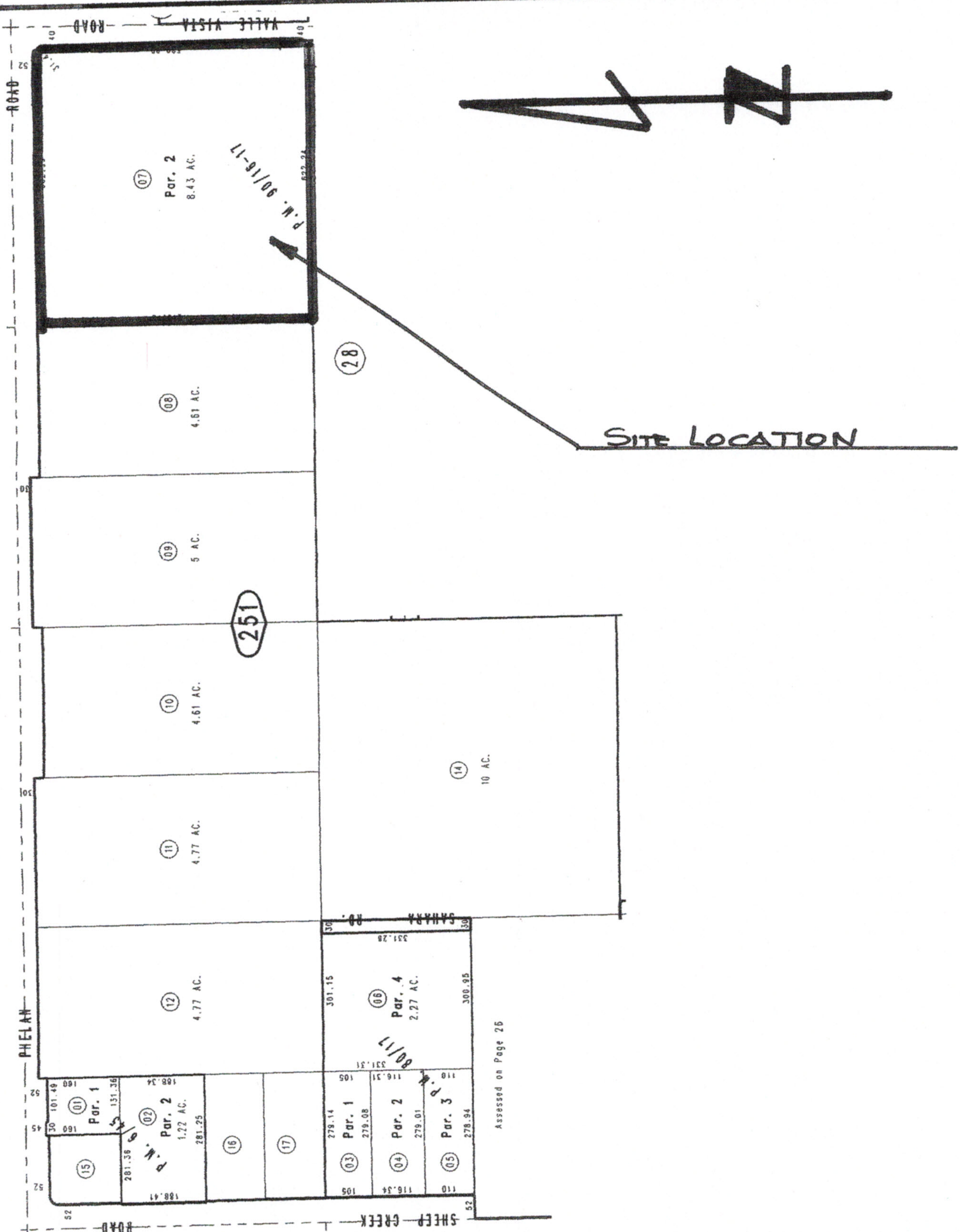

ALR ENGINEERING & TESTING Civil & Geotechnical Engineering w/ Material testing 18361 Symeron Road Apple Valley, Ca. 92307 (760) 810-2031 Cell # - (760) 242-3130 Office #	Phelan			Project No. 1410057
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	VVR, LLC.			
	Assessor's Map			Figure No. 3

TABLE 1 Soil Classification Chart

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50 % retained on No. 200 sieve	Gravels More than 50 % of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5 % fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12 % fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50 % or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5 % fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12 % fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,J]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50 % or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	$\frac{\text{Liquid limit – oven dried}}{\text{Liquid limit – not dried}} < 0.75$	OL	Organic clay[K,L,M,N] Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	$\frac{\text{Liquid limit – oven dried}}{\text{Liquid limit – not dried}} < 0.75$	CH	Organic clay[K,L,M,P] Organic silt[K,L,M,Q]
Highly organic soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12 % fines require dual symbols:
- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12 % fines require dual symbols:
- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15 % sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15 % gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30 % plus No. 200, predominantly sand, add "sandy" to group name.

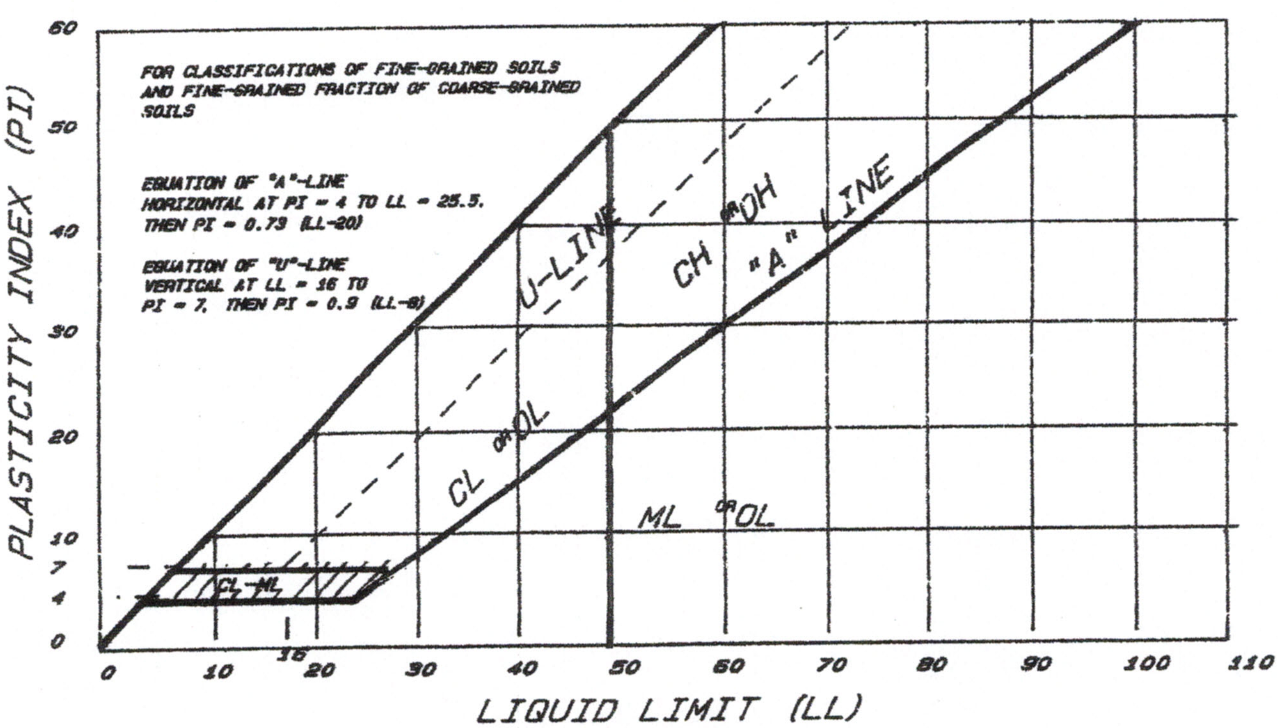
[M] If soil contains ≥ 30 % plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM D2487

ALR ENGINEERING AND TESTING
TEST PIT NO. TP-7

Project: APN 3066-251-07 **Project #** 1410057

Client: VVR, LLC **Date:** 11-22-2014

Depth Feet	Sample Type	Moisture Content %	Dry Density pcf.	Lab Test Type	Soil Class		Geotechnical Description
0.5'					SP		Poorly graded SAND with silts, much gravel, and rock to 10", Dark Tan, Dry, Loose
1.0'							
1.5'							
2.0'	BAG			SIEVE SE			
2.5'							
3.0'							
3.5'							
4.0'							
4.5'							
5.0'							
5.5'							
6.0'					SM		Silty SAND with much gravel, Coarse to medium, Dark Tan, Damp, Medium Dense
6.5'							
7.0'							
7.5'							
8.0'							
8.5'							
9.0'							
10.0'							
11.0'							
12.0'							
13.0'							
14.0'							Bottom of Exploratory Trench

Date: 11/22/2014 | **Double Ring Infiltrometer** | **ALR Engineering and Testing**

	Area (cm2)	Di (cm)	Factor
Inner	1216	5.08	53.52
Annular	3649	5.08	167.53

Test Location: **Burrtec Waste Industries** Performed by: John & Leroy Longoria

Penetration of Rings:

Inner:	7.62	cm
Outer:	7.62	cm

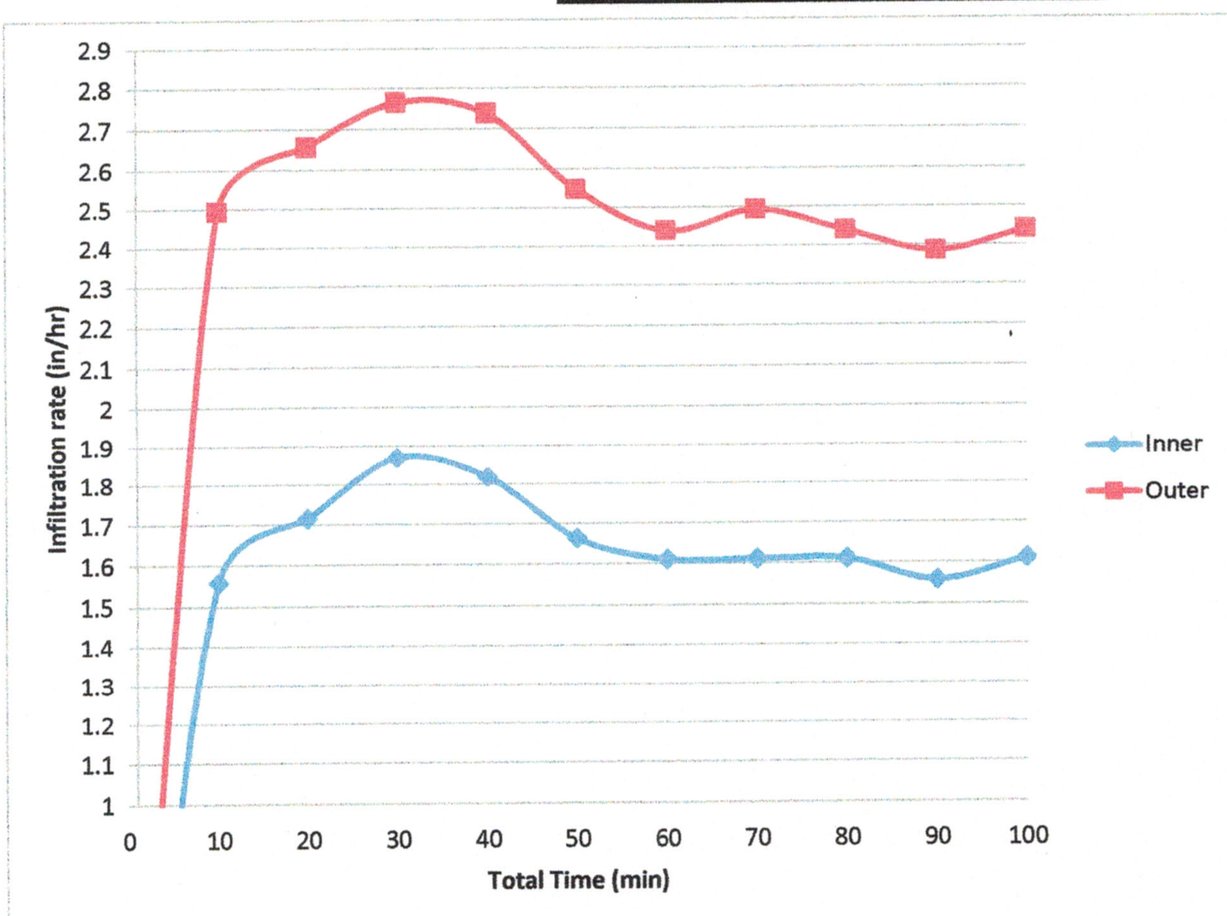
Both were started at 58.5 cm

60 min pre soak

Test No.	Time (hr:mm)	Delta Time / Total Time (min)	Inner Reading (cm)	Inner Flow (cm3)	Annular Reading (cm)	Annular Flow (cm3)	Inner Rate (cm/hr)	Annular Rate (cm/hr)	Comments
1		10	58.5	802.8	58.5	3853.2	3.96	6.34	
		10	43.5		35.5				
2		10	58.5	883.08	58.5	4104.5	4.36	6.75	
		20	42.0		34.0				
3		10	58.5	963.36	58.5	4272	4.75	7.02	
		30	40.5		33.0				
4		10	58.5	936.6	58.5	4230.1	4.62	6.96	
		40	41.0		33.25				
5		10	58.5	856.32	58.5	3937	4.23	6.47	
		50	42.5		35.0				
6		10	58.5	829.56	58.5	3769.4	4.09	6.20	
		60	43.0		36				
7		10	58.5	829.56	58.5	3853.2	4.09	6.34	
		70	43.0		35.5				
8		10	58.5	829.56	58.5	3769.4	4.09	6.20	
		80	43.0		36.0				
9		10	58.5	802.8	58.5	3685.7	3.96	6.06	
		90	43.5		36.5				
10		10	58.5	829.56	58.5	3769.4	4.09	6.20	
		100	43.0		36				
11									
12									
13									
14									
15									
16									

	IN cm/hr	OUT cm/hr	IN in/hr	OUT in/hr	
0			0	0	
10	3.96	6.34	1.6	2.5	
20	4.36	6.75	1.7	2.7	
30	4.75	7.02	1.9	2.8	
40	4.62	6.96	1.8	2.7	
50	4.23	6.47	1.7	2.5	
60	4.09	6.20	1.6	2.4	
70	4.09	6.34	1.6	2.5	
80	4.09	6.20	1.6	2.4	1.7
90	3.96	6.06	1.6	2.4	1.6
100	4.09	6.20	1.6	2.4	1.6
					1.6
					1.6

AVERAGE	1.61	in/hr
Factor of Saftey=	2.00	
Design Rate =	**0.81**	**in/hr**



Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) $p = w * v$
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$	S_A		1
B	Design	Tributary area size	0.25	2	0.5
		Level of pretreatment/expected sediment loads	0.25	2	0.5
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$	S_B		2
Combined Safety Factor, $S_{TOT} = S_A * S_B$					2
Safety Factor, $FS_{min} = 2$					2.00
Measured Infiltration Rate, inch/hr, K_M					1.61
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M \div FS_{min}$					0.8
Supporting Data					

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Factor of Safety Guidelines

Suitability Assessment S_A

Consideration	High Concern	Medium Concern	Low Concern
Assessment methods (see explanation below)	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates	Direct measurement of ≥ 20 percent of infiltration area with localized infiltration measurement methods (e.g., infiltrometer)	Direct measurement of ≥ 50 percent of infiltration area with localized infiltration measurement methods or Use of extensive test pit infiltration measurement methods
Texture Class	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site soil variability	Highly variable soils indicated from site assessment or limited soil borings collected during site assessment	Soil borings/test pits indicate moderately homogeneous soils	Multiple soil borings/test pits indicate relatively homogeneous soils
Depth to groundwater/ impervious layer	<5 ft below facility bottom	5-10 ft below facility bottom	>10 below facility bottom

Design S_B

Consideration	High Concern	Medium Concern	Low Concern
Tributary area size	Greater than 10 acres.	Greater than 2 acres but less than 10 acres.	2 acres or less.
Level of pretreatment/ expected influent sediment loads	Pretreatment from gross solids removal devices only, such as hydrodynamic separators, racks and screens AND tributary area includes landscaped areas, steep slopes, high traffic areas, or any other areas expected to produce high sediment, trash, or debris loads.	Good pretreatment with BMPs that mitigate coarse sediments such as vegetated swales AND influent sediment loads from the tributary area are expected to be relatively low (e.g., low traffic, mild slopes, disconnected impervious areas, etc.).	Excellent pretreatment with BMPs that mitigate fine sediments such as bioretention or media filtration OR sedimentation or facility only treats runoff from relatively clean surfaces, such as rooftops.
Redundancy of treatment	No redundancy in BMP treatment train.	Medium redundancy, other BMPs available in treatment train to maintain at least 50% of function of facility in event of failure.	High redundancy, multiple components capable of operating independently and in parallel, maintaining at least 90% of facility functionality in event of failure.
Compaction during construction	Construction of facility on a compacted site or elevated probability of unintended/ indirect compaction.	Medium probability of unintended/ indirect compaction.	Heavy equipment actively prohibited from infiltration areas during construction and low probability of unintended/ indirect compaction.