

**APPENDIX 9a**

October 25, 2021

Project No. 213955-12A

Mr. Viraj Patel  
**c/o Alex Hann**  
511 North Main Street  
Lake Elsinore, CA 92530

**Subject: Infiltration Testing for Water Quality Treatment Areas, Proposed Commercial Development, Assessor Parcel Numbers 1201-311-02, 1201-311-03, 1201-311-04, 1201-311-05, 1201-301-14, 1201-301-15, and 1201-301-19, Located at the Southeast Corner of Palm Avenue and Meines Street, City of Highland, San Bernardino County, California**

### **INTRODUCTION**

Earth Strata Geotechnical Services is pleased to present this infiltration feasibility report for the proposed commercial development, located on at the southeast corner of Palm Avenue and Meines Street, Assessor Parcel Numbers 1201-311-02 through 05, 1201-301-14, 1201-301-15, and 1201-301-19, in the City of Highland, San Bernardino County, California. The purpose of our study was to determine the infiltration rates and physical characteristics of the subsurface earth materials at the approximate depth of the proposed WQMP area within the proposed development. This feasibility report provides the infiltration rates to be used for the design and the development of the water quality management plan, where applicable.

### **PROPERTY DESCRIPTION**

The subject property is located at the southeast corner of Palm Avenue and Meines Street in the City of Highland, San Bernardino County, California. The approximate location of the site is shown on the Vicinity Map, Figure 1.

The subject property is comprised of approximately 1.87 acres of previously developed land. The site has not been graded. Topographic relief at the subject property is relatively low with the terrain being generally flat. Elevations at the site range from approximately 1,190 to 1,193 feet above mean sea level (msl), for a difference of about 3± feet across the entire site. Drainage within the subject property generally flows to the southwest.

The site is currently bordered by commercial development to the north and east, as well as Palm Avenue to the west, and West 5<sup>th</sup> Street to the south. Most of the vegetation on the site consists of light amounts of annual weeds/grasses.

## **PROPOSED CONSTRUCTION**

Based on the conceptual site plan provided by Empire Design Group, the proposed development as illustrated on the conceptual grading plans will consist of a commercial development complete with interior streets, utilities, parking and an onsite water quality treatment basin.

## **SUBSURFACE EXPLORATION**

### **Subsurface Exploration**

Subsurface exploration within the subject site was performed on October 13, 2021, for the exploratory excavations. A truck mounted hollow-stem-auger drill rig was utilized to drill six (6) borings throughout the site to a maximum depth of 10 feet. The exploratory holes were excavated for geotechnical evaluation purposes with respect to the proposed developments and to interpret whether groundwater or impermeable soil layers were present. An underground utilities clearance was obtained from Underground Service Alert of Southern California, prior to the subsurface exploration. The approximate locations of the exploratory excavations are shown on the attached Infiltration Location Map, Plate 1 and descriptive logs are presented in Appendix A.

Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions may have been reconciled to reflect laboratory test results with regard to ASTM D 2487.

### **Earth Materials**

A general description of the earth materials observed on site is provided below.

Quaternary Gravel (Qg): Quaternary Gravel was encountered directly from the surface to a maximum depth of 15 feet. This bedrock unit consists predominately of interbedded gray to medium brown, fine to medium grained silty sand, fine to coarse grained sandstone, with occasional siltstone and claystone layers.

## **INFILTRATION TESTING**

The double ring infiltrometer test method was utilized to perform a total of two (2) infiltration tests on October 22, 2021 to evaluate near surface infiltration rates in order to estimate the amount of storm water runoff that can infiltrate into the onsite water quality treatment plan areas. The infiltration tests were performed in general accordance with the requirements of double ring infiltration testing, ASTM D3385 and the guidelines of the San Bernardino County Local Agency Management Program (LAMP).

The infiltration tests were performed using double ring infiltrometer and Mariotte tubes at a depth of 3 feet below existing grades. The locations of the infiltration tests are indicated on the attached infiltration Location Map, Plate 1. The double ring infiltrometer tests were located by property boundary measurement on the site plan and by using geographic features. Infiltration test data recorded in the field are summarized in the following table and is included within Appendix B including the graph of Infiltration Rate versus Elapsed Time.

**Infiltration Test Summary**

TEST NUMBER	INFILTRATION HOLE DEPTH (ft.)	INFILTRATION RATE (in/hr)	DESCRIPTION
DR-1	5	6.48	Poorly Graded SAND
DR-2	5	-*	Poorly Graded SAND

\* Reliable testing data was unable to be obtained as water infiltrated at too fast a rate to measure

The infiltration test rate was 6.48 inches per hour (in/hr).

**CONCLUSIONS AND RECOMMENDATIONS**

**General**

From geotechnical and engineering geologic points of view, the proposed WQMP areas, where tested, is considered suitable for infiltration for the proposed development, provided the following conclusions and recommendations are incorporated into the plans and are implemented during construction.

**Groundwater**

Groundwater was not observed during our subsurface exploration to a total depth of 10 feet. Potential groundwater impact is considered very low. Local well data indicates regional groundwater highs approximately 50 feet below existing surface, which meets the minimum separation of >10 feet from the bottom of infiltration facility to the groundwater mark.

**Geologic/ Geotechnical Screening**

The proposed WQMP areas (see Plate 1) are located at a lower elevation than the proposed structures in competent native earth materials.

The proposed structures will be supported by compacted fill and competent earth materials, with groundwater at a depth of approximately 50 feet. According to the County of San Bernardino reports, the subject site is located in an area where liquefaction potential is considered low. As such, the potential for earthquake induced liquefaction and lateral spreading beneath the proposed structures is considered low due to the recommended compacted fill, relatively low groundwater level, and the dense nature of the deeper onsite earth materials.

Preliminary laboratory test results indicate onsite earth materials exhibit an expansion potential of **VERY LOW** as classified in accordance with 2019 CBC Section 1803.5.3 and ASTM D4829.

Therefore, infiltration within the proposed WQMP areas will not encroach on any proposed structures and will not increase the risk of geologic hazards.

### **Recommended Factor of Safety**

The recommended factor of safety for the infiltration design is 3.

Based on the data presented in this report and the recommendations set forth herein, it is the opinion of Earth Strata Geotechnical Services that the WQMP area can be designed for an infiltration rate of 2.16 inches per hour in the vicinity of DR-1 and DR-2.

### **GRADING PLAN REVIEW AND CONSTRUCTION SERVICES**

This report has been prepared for the exclusive use of **Mr. Viraj Patel** and their authorized representative. It likely does not contain sufficient information for other parties or other uses. Earth Strata should be engaged to review the final design plans and specifications prior to construction. This is to verify that the recommendations contained in this report have been properly incorporated into the project plans and specifications. Should Earth Strata not be accorded the opportunity to review the project plans and specifications, we are not responsible for misinterpretation of our recommendations.

Earth Strata should be retained to provide observations during construction to validate this report. In order to allow for design changes in the event that the subsurface conditions differ from those anticipated prior to construction.

Earth Strata should review any changes in the project and modify and approve in writing the conclusions and recommendations of this report. This report and the drawings contained within are intended for design input purposes only and are not intended to act as construction drawings or specifications. In the event that conditions encountered during grading or construction operations appear to be different than those indicated in this report, this office should be notified immediately, as revisions may be required.

## **REPORT LIMITATIONS**

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists, practicing at the time and location this report was prepared. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

Earth materials vary in type, strength, and other geotechnical properties between points of observation and exploration. Groundwater and moisture conditions can also vary due to natural processes or the works of man on this or adjacent properties. As a result, we do not and cannot have complete knowledge of the subsurface conditions beneath the subject property. No practical study can completely eliminate uncertainty with regard to the anticipated geotechnical conditions in connection with a subject property.

The conclusions and recommendations within this report are based upon the findings at the points of observation and are subject to confirmation by Earth Strata during construction. This report is considered valid for a period of one year from the time the report was issued.

This report was prepared with the understanding that it is the responsibility of the owner or their representative, to ensure that the conclusions and recommendations contained herein are brought to the attention of the other project consultants and are incorporated into the plans and specifications. The owners' contractor should properly implement the conclusions and recommendations during grading and construction, and notify the owner if they consider any of the recommendations presented herein to be unsafe or unsuitable.

Respectfully submitted,

EARTH STRATA GEOTECHNICAL SERVICES

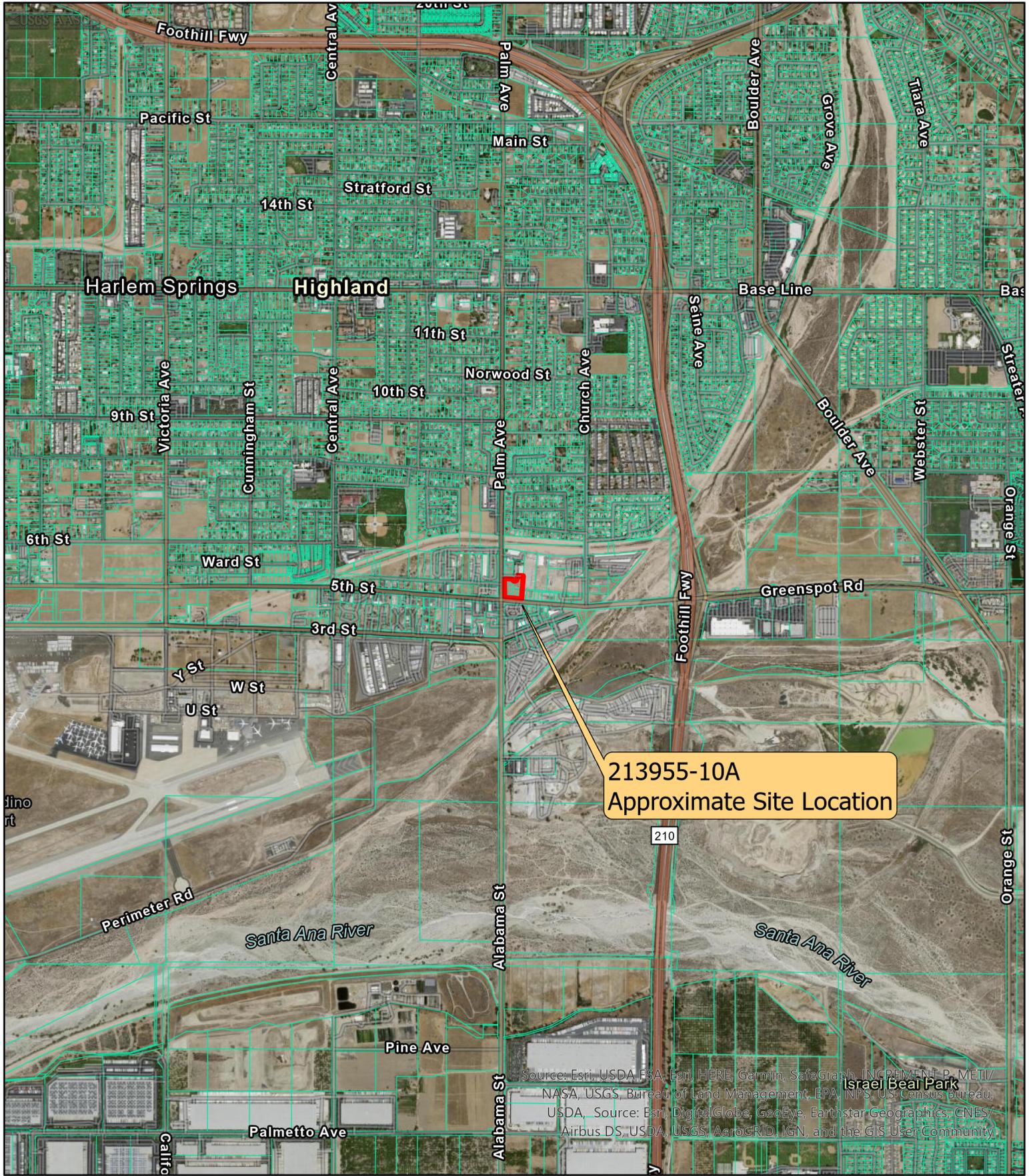
Stephen M. Poole, PE 40219  
President  
Principal Engineer

SMP/jmr

Distribution: (1) Addressee

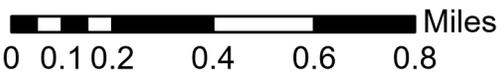
Attachments: Figure 1 – Vicinity Map (*Rear of Text*)  
Appendix A – Exploratory Logs (*Rear of Text*)  
Appendix B – Infiltration Test Sheets (*Rear of Text*)  
Appendix C – Historic Groundwater Data (*Rear of Text*)  
Plate 1 – Infiltration Location Map (*Rear of Text*)

**FIGURE 1**  
**VICINITY MAP**



213955-10A  
Approximate Site Location

Source: Esri, USDA FSA, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/  
NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau,  
USDA, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/  
Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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**APPENDIX A**  
**EXPLORATORY LOGS**

# Geotechnical Boring Log B-1

Date: October 13, 2021	Project Name: Palm Avenue, Highland	Page: 1 of 1
Project Number: 213955-10B	Logged By: JMR	
Drilling Company: Drilling It	Type of Rig: B-61	
Drive Weight (lbs): 140	Drop (in): 30	Hole Diameter (in): 8
Top of Hole Elevation (ft): See Map	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						<u>Topsoil</u>
					SM	Silty SAND; light brown, dry, loose, fine to coarse sand
	19	2.5'	106.1	1.3		<u>Quaternary Alluvial Sand and Clay of Valley Areas (Qa)</u>
					SP-SM	Poorly-Graded SAND with Silt; light to dark brown, dry, medium dense, medium to co
5						Dense 5 to 7 feet
	48	5'	97.7	2.1		
	50/4"	7.5'	121.6	1.4		Becomes very dense, gravel and cobbles below 7 feet
10						Practical Refusal at 10.5 feet
	50/6"	10'	-	4.5		
						Total Depth: 10.5 feet
						No Groundwater
15						
20						
25						
30						

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# Geotechnical Boring Log B-2

Date: October 13, 2021	Project Name: Palm Avenue, Highland	Page: 1 of 1
Project Number: 213955-10B	Logged By: JMR	
Drilling Company: Drilling It	Type of Rig: B-61	
Drive Weight (lbs): 140	Drop (in): 30	Hole Diameter (in): 8
Top of Hole Elevation (ft): See Map	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						<u>Topsoil</u>
					SM	Silty SAND; light brown, dry, loose, fine to coarse sand
	30	2.5'	110.0	1.5		<u>Quaternary Alluvial Sand and Clay of Valley Areas (Qa)</u>
					SM	Silty SAND; dark brown, dry, medium dense, medium to coarse sand
5					SP	Poorly-Graded SAND; light to dark brown, dry, very dense, coarse sand with gravel
	68/11"	5'	101.4	2.3		
		5-10'				
	50/4"	7.5'	-	1.3		
10						Practical Refusal at 10 feet
						Total Depth: 10 feet
						No Groundwater
15						
20						
25						
30						

# Geotechnical Boring Log B-3

Date: October 13, 2021	Project Name: Palm Avenue, Highland	Page: 1 of 1
Project Number: 213955-10B	Logged By: JMR	
Drilling Company: Drilling It	Type of Rig: B-61	
Drive Weight (lbs): 140	Drop (in): 30	Hole Diameter (in): 8
Top of Hole Elevation (ft): See Map	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						<u>Topsoil</u>
					SM	Silty SAND; light brown, dry, loose, fine to coarse sand
	28	2.5'	-	1.1		<u>Quaternary Alluvial Sand and Clay of Valley Areas (Qa)</u>
					SM	Silty SAND; light to dark brown, dry, medium dense, medium to coarse sand
5					SP-SM	Poorly-Graded SAND with Silt; light brown, dry, very dense, coarse sand with gravel and
	65/8"	5'	-	1.3		
						Total Depth: 7 feet
						No Groundwater
10						
15						
20						
25						
30						

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# Geotechnical Boring Log B-4

Date: October 13, 2021	Project Name: Palm Avenue, Highland	Page: 1 of 1
Project Number: 213955-10B	Logged By: JMR	
Drilling Company: Drilling It	Type of Rig: B-61	
Drive Weight (lbs): 140	Drop (in): 30	Hole Diameter (in): 8
Top of Hole Elevation (ft): See Map	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						<u>Topsoil</u>
					SM	Silty SAND; light brown, dry, loose, fine to coarse sand
	10	2.5'	-	1.2		<u>Quaternary Alluvial Sand and Clay of Valley Areas (Qa)</u>
					SM	Silty SAND; dark brown, dry, loose, medium to coarse sand
5					SP-SM	Poorly-Graded SAND with Silt; light brown, dry, very dense, coarse sand with gravel and
	58/11"	5'	-	-		No Recovery at 5 feet
	50/4"	7.5'	-	1.5		Practical Refusal at 8 feet
						Total Depth: 8 feet
10						No Groundwater
15						
20						
25						
30						

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# Geotechnical Boring Log B-5

Date: October 13, 2021	Project Name: Palm Avenue, Highland	Page: 1 of 1
Project Number: 213955-10B	Logged By: JMR	
Drilling Company: Drilling It	Type of Rig: B-61	
Drive Weight (lbs): 140	Drop (in): 30	Hole Diameter (in): 8
Top of Hole Elevation (ft): See Map	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						<u>Topsoil</u>
					SM	Silty SAND; light brown, dry, loose, fine to coarse sand
	14	2.5'	-	1.5		<u>Quaternary Alluvial Sand and Clay of Valley Areas (Qa)</u>
					SM	Silty SAND; dark brown, dry, loose, medium to coarse sand
5					SP-SM	Poorly-Graded SAND with Silt; light brown, dry, dense, coarse sand with gravel and co
	34	5'	108.4	1.5		
						Becomes very dense at 7 feet
	50/4"	7.5'	-	0.9		Practical Refusal at 8 feet
						Total Depth: 8 feet
10						No Groundwater
15						
20						
25						
30						

# Geotechnical Boring Log B-6

Date: October 13, 2021	Project Name: Palm Avenue, Highland	Page: 1 of 1
Project Number: 213955-10B	Logged By: JMR	
Drilling Company: Drilling It	Type of Rig: B-61	
Drive Weight (lbs): 140	Drop (in): 30	Hole Diameter (in): 8
Top of Hole Elevation (ft): See Map	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0		0-5'				<u>Topsoil</u>
					SM	Silty SAND; light brown, dry, loose, fine to coarse sand
	50/6"	2.5'	-	-		<u>Quaternary Alluvial Sand and Clay of Valley Areas (Qa)</u>
					SM	Silty SAND; reddish brown, dry, very dense, medium to coarse sand
						No Recovery at 2.5 feet
5	50/4"	5'	108.6	0.9		Practical Refusal at 5.5 feet
						Total Depth: 5.5 feet
						No Groundwater
10						
15						
20						
25						
30						

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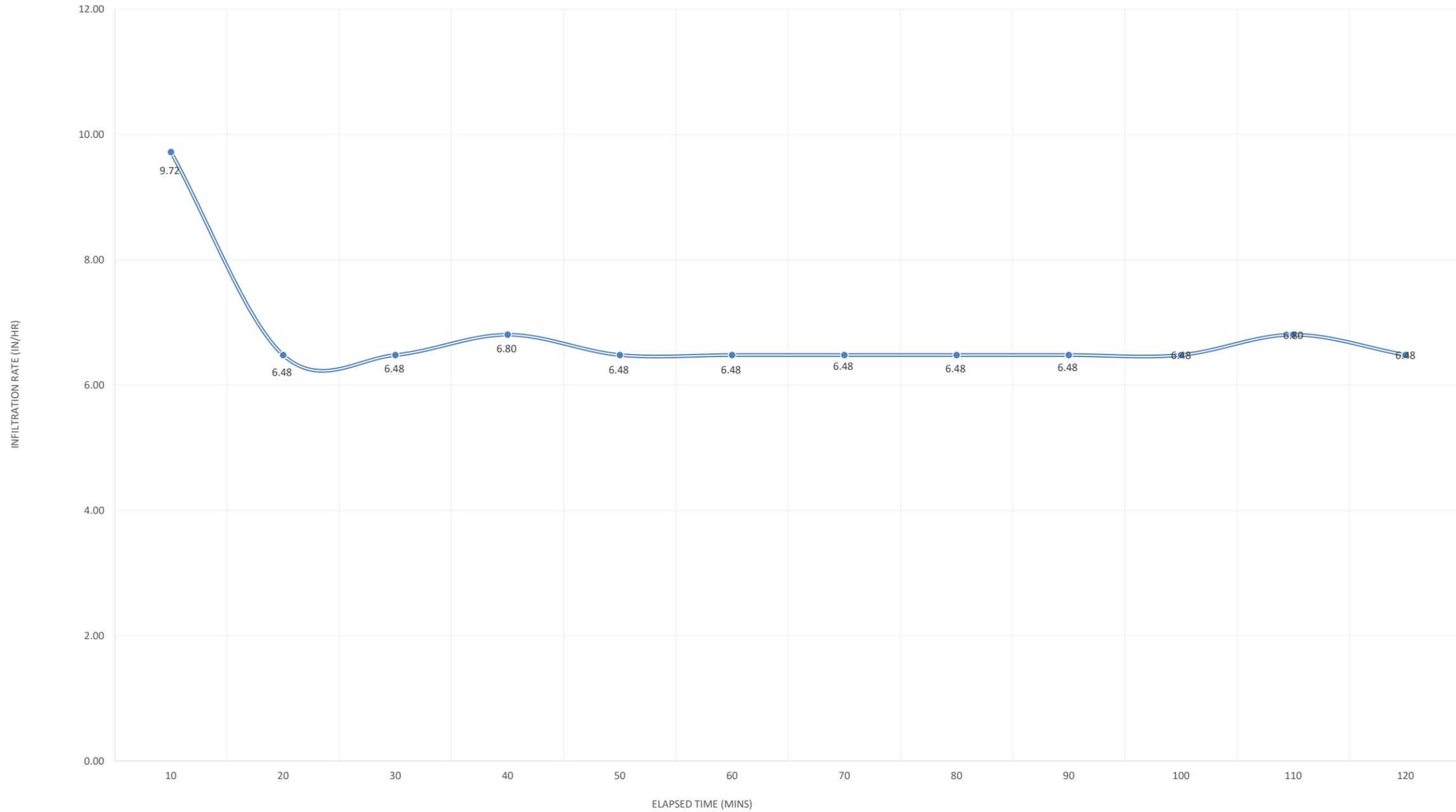
**APPENDIX B**  
**INFILTRATION TEST SHEETS**



<b>Project Identification:</b>	Palm and Meines - Highland		
<b>Test Location:</b>	DR-1		
<b>Liquid Used:</b>	TAP WATER	<b>pH:</b>	8.0
<b>Tested By:</b>	JMR		
<b>Depth to water table:</b>	0		

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**ELAPSED TIME VS. INFILTRATION RATE**

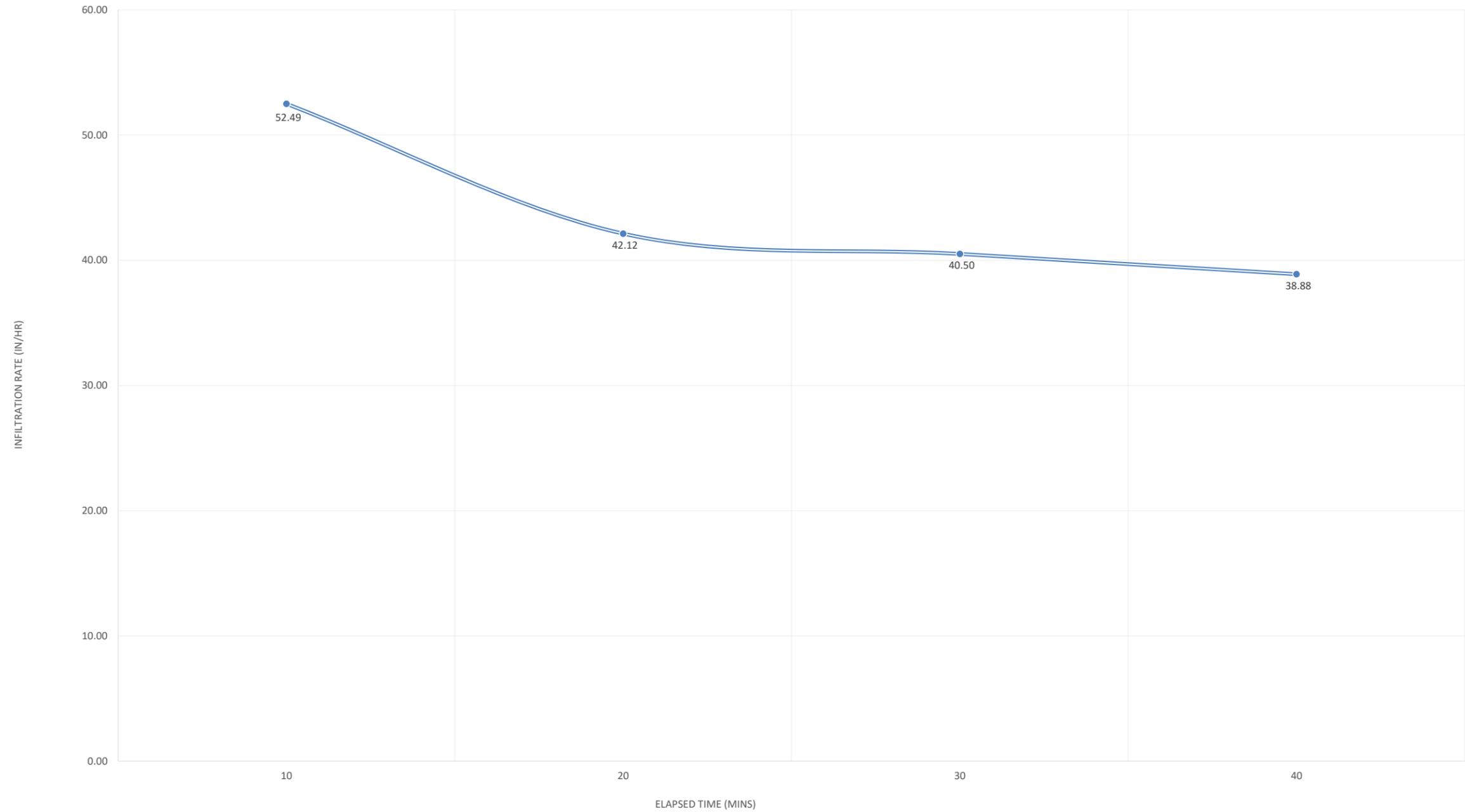




<b>Project Identification:</b>	Palm and Meines - Highland		
<b>Test Location:</b>	DR-2		
<b>Liquid Used:</b>	TAP WATER	<b>pH:</b>	8.0
<b>Tested By:</b>	JMR		
<b>Depth to water table:</b>	> 30 Feet		

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**ELAPSED TIME VS. INFILTRATION RATE**



**APPENDIX C**  
**HISTORIC GROUNDWATER**  
**DATA**

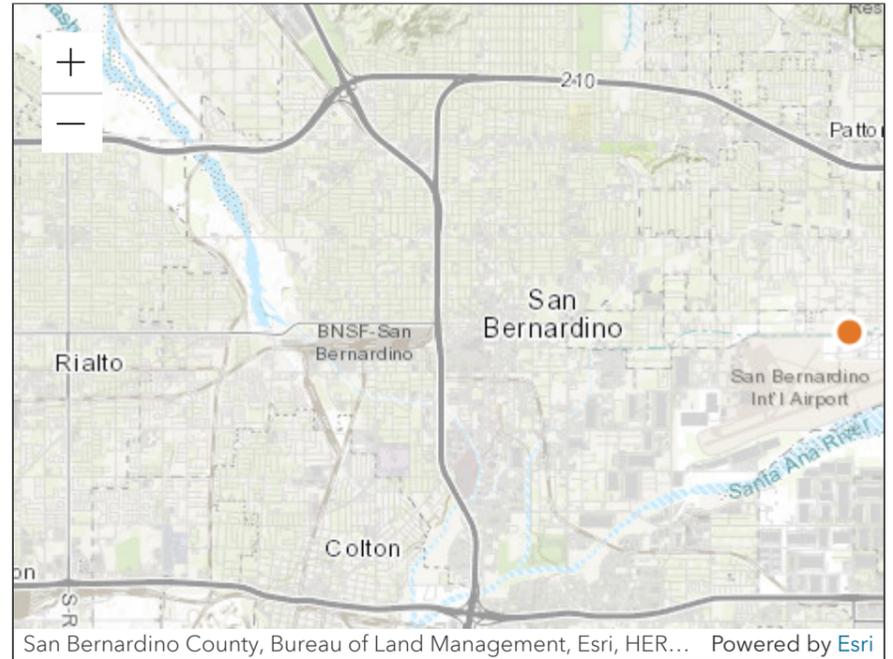


# Groundwater Level Report

## Station 341070N1172268W001

Station Data Groundwater Level Data

State Well Number:	01S03W05N006S
Local Well Name:	
Site Code:	341070N1172268W001
Latitude (NAD83):	34.107
Longitude (NAD83):	-117.2268
Basin Subbasin Name (Code):	San Bernardino (8-002.06)
Well Use Type:	Unknown
Well Status:	Active
WCR Number:	
Reference Point Elevation (NAVD88 ft):	1145.500
Ground Surface Elevation (NAVD88 ft):	1145.500
Well Depth (feet bgs):	
Perforated Interval Depths (feet bgs):	



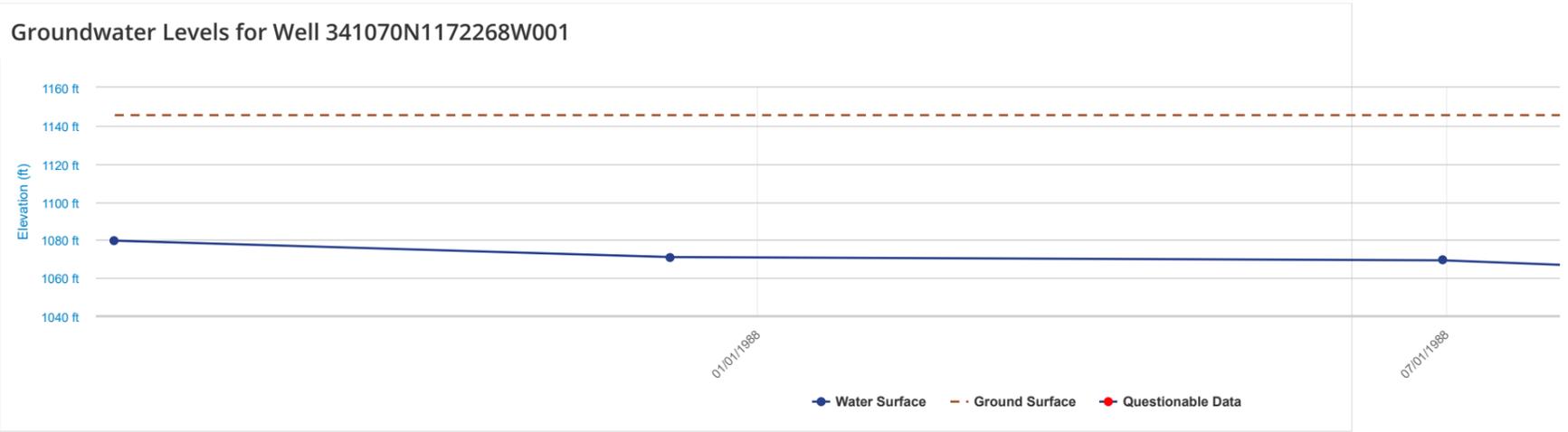


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# Groundwater Level Report

Station 341070N1172268W001

Station Data [Groundwater Level Data](#)



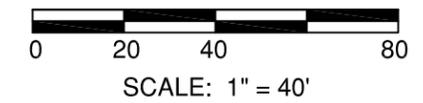
[Download Data](#)

Measurement Date (PST)	Reference Point Elevation	Ground Surface Elevation	Distance from RP to WS	Groundwater Elevation	Ground Surface to Water Surface	Measurement Issue	Collecting Agency	Water Level Measurement Comments
07/15/1987 00:00:00	1145.500	1145.500	65.9	1079.6	65.9		Department of Water Resou...	
12/09/1987 00:00:00	1145.500	1145.500	74.51	1070.99	74.51		Department of Water Resou...	
06/30/1988 00:00:00	1145.500	1145.500	76.23	1069.27	76.23		Department of Water Resou...	
11/23/1988 00:00:00	1145.500	1145.500	87.3	1058.2	87.3		Department of Water Resou...	
4 records								

**LEGEND**  
Locations are Approximate

**Symbols**

-  - Limits of Report
-  - Double Ring Test Location



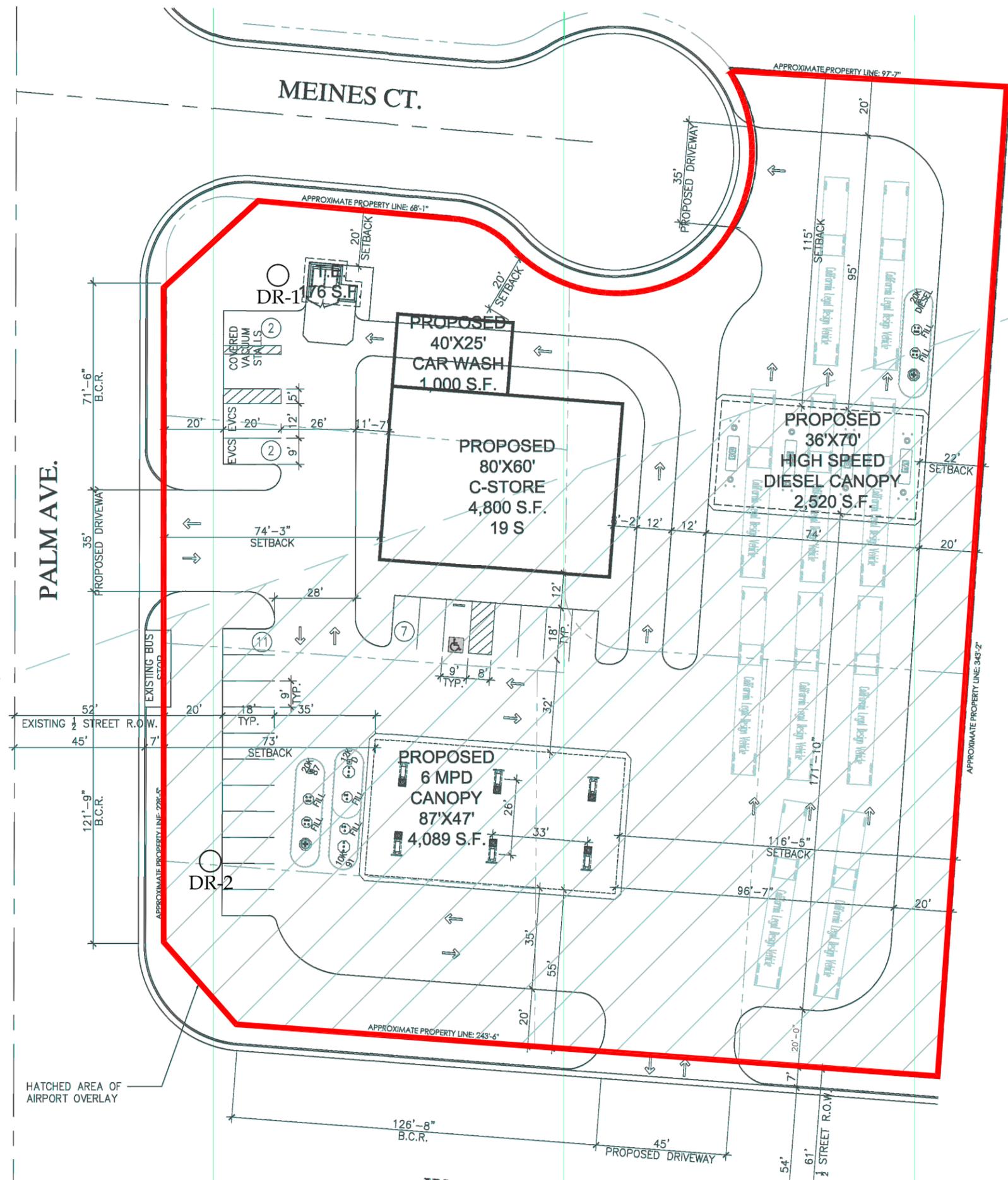
**INFILTRATION MAP**

LOCATED ON THE SOUTHWEST CORNER OF PALM AVENUE AND MEINES STREET  
CITY OF HIGHLAND, SAN BERNARDINO COUNTY, CALIFORNIA  
APN 1201-311-02, 1201-311-03, 1201-311-04, 1201-311-05, 1201-301-14, 1201-301-15, & 1201-301-19

PROJECT	PROPOSED COMMERCIAL DEVELOPMENT		
CLIENT	MR. JEAN EDY MATLOCK		
PROJECT NO.	213955-12A		
DATE	OCTOBER 2021		
SCALE	1" = 40'		
DWG XREFS			
REVISION			
DRAWN BY	JDG	PLATE	1 OF 1

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HATCHED AREA OF AIRPORT OVERLAY