

Geotechnical Engineering Report

In-Situ Falling Head Infiltration Testing

Tijeras Arroyo

Geotechnical Exploratory Borings and Laboratory Services

Kirtland AFB NOV Response

W9128F-12-D0003 Task Order 0025

Bernalillo County, New Mexico

December 12, 2015

Terracon Project No. 66155092

Prepared for:

CB&I Federal Services
Albuquerque, New Mexico

Prepared by:

Terracon Consultants, Inc.
Albuquerque, New Mexico



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Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

December 12, 2015



CB&I Federal Services
2440 Louisiana Boulevard NE, Suite 200
Albuquerque, New Mexico 87110

Attn: Mr. Jon Vail
P: (303) 263-0425
E: Jon.Vail@cbifederalservices.com

Re: Geotechnical Engineering Report
In-Situ Falling Head Infiltration Testing
Tijeras Arroyo
Geotechnical Exploratory Borings and Laboratory Services
Kirtland AFB NOV Response
W9128F-12-D0003 Task Order 0025
Bernalillo County, New Mexico
Terracon Project No. 66155092

Dear Mr. Vail:

Terracon has completed the geotechnical services for the referenced project to be located at Kirtland Air Force Base in Bernalillo County, New Mexico. Refer to the Site Location Map, Figure A1, for the project location.

The scope of the services performed for this project included site reconnaissance by a geotechnical field engineer, a subsurface exploration program, field testing and laboratory testing. The scope of work was performed in general accordance with the "Statement of Work for In Situ Falling Head Infiltration Testing, Geotechnical Exploratory Borings and Geotechnical Laboratory Services" prepared by CB&I Federal Services dated September 2015. The purpose of these services is to provide geotechnical information to assist CB&I Federal Services in the design and construction of a well injection field for the disposal of treated water from the Groundwater Extraction Pilot Implementation Project associated with the Bulk Fuels Facility.

1.0 PROJECT DESCRIPTION

ITEM	DESCRIPTION
Project	The project will include the design and construction of a well injection field for the disposal of treated water from the Groundwater Extraction Pilot Implementation Project associated with the Bulk Fuels Facility.

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Albuquerque, New Mexico

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ITEM	DESCRIPTION
Location	Within the channel of the existing Tijeras Arroyo, Kirtland Air Force Base in Bernalillo County, New Mexico.
Depth of treated water disposal/injection	0 to 20 feet below existing site grade

2.0 SUBSURFACE EXPLORATION AND TESTING PROCEDURES

A total of 18 test borings were drilled at the site during the period of November 4 through 19, 2015. The borings were drilled to depths of approximately 6-½ to 51-½ feet below the ground surface at the approximate locations shown on the attached Site Location Map and Exploration Location Plan. The test borings were located as follows:

Boring Designation	Phase/Location	Total Depth (feet)
TAB-01 through TAB-06	Exploratory Borings	51-½
TAPT-01A through TAPT-06A	Shallow Infiltration Test Borings	6-½
TAPT-01 through TAPT-06	Deep Infiltration Test Borings	12 to 21-½

The test borings were advanced with a truck-mounted CME-75 drill rig utilizing 8-inch diameter hollow-stem augers.

CB&I Federal Services located the boring locations in the field. Latitude and longitude were determined at each boring location using a hand-held GPS unit. The accuracy of boring locations should only be assumed to the level implied by the methods used.

Lithologic logs of the borings were recorded by the geotechnical field engineer during the drilling operations. Samples of the subsurface materials were taken at a maximum of 5-foot intervals by driving split-spoon or ring-barrel samplers.

Penetration resistance measurements were obtained by driving the split-spoon and ring-barrel samplers into the subsurface materials using a 140-pound hammer falling 30 inches. The number of blows required to advance the samplers the last 12 inches, or less if hard/very dense materials were present, of an 18-inch sampling interval was recorded as the standard penetration resistance value (N). The samples were sealed in the field and then returned to our laboratory for testing and classification. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Groundwater measurements were made in the test borings during and at the completion of drilling.

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Upon the completion of drilling and sampling operations and to maintain borehole stability in the infiltration test borings, polyvinyl chloride (PVC) casing was placed to the bottom of the boring excavations. Per the request of CB&I, 5 feet of slotted PVC casing was placed between the following intervals:

Boring Designation	Screened/Slotted Interval (feet)	Total Boring Depth (feet)
TAPTB-01A through TAPTB-06A	0 to 5	5
TAPTB-06	7 to 12	12
TAPTB-01, TAPTB-03 and TAPTB-04	10 to 15	15
TAPTB-02 and TAPTB-05	15 to 20	20

Upon installation of the PVC casing, the infiltration borings were left open (not backfilled) in preparation for subsequent field falling head infiltration testing. Within 24 hours of the falling head infiltration testing, the borings were filled with water and allowed to drain for two (2) cycles to saturate the soils.

After completion of the borings and installation of PVC casing, field falling head infiltration tests were performed in the infiltration test borings. Per the request of CB&I, testing was performed over the following depth interval intervals:

Boring Designation	Infiltration Test Starting Water Interval Depth (feet)
TAPTB-01A through TAPTB-06A	0 to 5
TAPTB-06	2 to 12
TAPTB-01, TAPTB-03 and TAPTB-04	5 to 15
TAPTB-02 and TAPTB-05	10 to 20

The tests were performed by recording the drop in water level within the casing over time. Measurements were performed at incremental time intervals until less than 30 percent of the initial water height remains to provide data points beyond the 37 percent required in the Basic Time Lag Method (Lambe, T. William and Whitman, Robert V., 1969). Per the Statement of Work (SOW), the water level readings with depth were graphed on semi-log paper in the field to confirm steady state conditions and consistent results.

Upon completion of the field infiltration tests, the casing was removed and the borings backfilled. For the exploratory and deep infiltration test borings, the borings were backfilled with soil cuttings and a bentonite plug was installed within the upper 10 feet of the boring. Within the shallow infiltration test borings, the borings were backfilled with bentonite.

3.0 LABORATORY TESTING PROGRAM

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer. As part of the laboratory testing program, the soil samples were examined in the laboratory by the geotechnical technician and project engineer. Based on the material’s texture and plasticity, the soil samples were described and classified in accordance with the attached *General Notes* and the *Unified Soil Classification System (USCS)*, respectively. The estimated group symbols for the USCS are shown in the appropriate column on the boring logs. A brief description of the USCS is included in Appendix A.

Laboratory tests were conducted on selected soil samples and the test results are presented in Appendix B. Laboratory tests were performed in general accordance with the applicable ASTM standard noted below.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Sieve Analysis (ASTM D422)
- Sieve Analysis (ASTM D6913)
- Atterberg Limits (ASTM D4318)
- In-situ Water Content (ASTM D2216)
- Soil Classification (ASTM D2487)

Per the request of CB&I, testing was performed on the following samples:

Boring Designation	Sample Depth (feet)
TAB-01	5 and 15
TAB-02	15
TAB-03	10 and 15
TAB-04	10
TAB-05	15
TAB-06	15 and 25
TAPTB-02A	5
TAPTB-03A	5
TAPTB-04A	5
TAPTB-05A	5
TAPTB-06A	5 and 10

The graphical laboratory test results have been included in Appendix B.

4.0 SUBSURFACE CONDITIONS

4.1 Subsurface Conditions

Specific conditions encountered at the boring locations are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for the borings can be found on the attached boring logs. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency/Density
Stratum 1	1 to 3	Well Graded Sand. The clay, silt and gravel content varied.	Very Loose to Medium Dense
Stratum 2	6-½ to 20	Lean Clay. The sand, silt and gravel content varied	Very Soft to Very Stiff
Stratum 3	16 to 30	Silt. The clay, sand and gravel content varied	Soft to Medium Stiff
Stratum 4	25 to 51- ½	Sand. The silt, clay and gravel content varied	Loose to Dense
Stratum 5	28 to 51-½	Lean Clay. The sand, silt and gravel content varied	Soft to Very Stiff

5.0 GROUND WATER INFORMATION

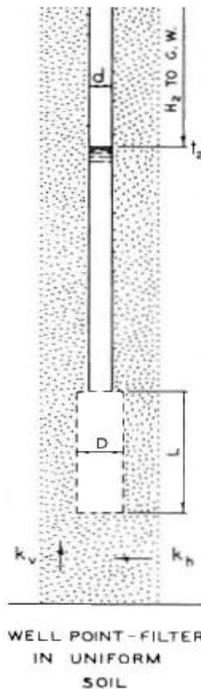
Groundwater was not observed in the test borings at the time of field exploration, nor when checked upon completion of drilling. However, elevated moisture contents and saturated soils were encountered in several borings. Due to the interbedded clay layers encountered in the borings, it is our opinion that “perched” groundwater zones are likely to result during storm, precipitation, or flow events within the arroyo. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

Fluctuations in groundwater levels can best be determined by implementation of a groundwater monitoring plan. Such a plan would include installation of groundwater monitoring wells, and periodic measurement of groundwater levels over a sufficient period of time.

6.0 GEOTECHNICAL ANALYSIS

6.1 Hydraulic Conductivity

The hydraulic conductivity calculations were based upon the Basic Time Lag Method for Falling Head Method (Lambe, T. William and Whitman, Robert V., 1969). The equation used to calculate hydraulic conductivity was based upon “Case G Well Point-Filter in Uniform Sand” (from Hvorslev, 1951) using a variable/falling head condition. The Case G profile and hydraulic conductivity equation are outlined below:



$$k_h = \frac{d^2 \cdot \ln \left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D} \right)^2} \right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{d^2 \cdot \ln \left(\frac{2mL}{D} \right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{FOR } \frac{mL}{D} > 4$$

Where:

- kh** Horizontal Permeability (cm/s)
- D** Intake Diameter/Diameter of borehole (cm)
- d** Standpipe Diameter - Solid PVC Casing Diameter above 5 feet/Borehole Diameter below 5 feet (cm)
- L** Intake Length or Slotted PVC Casing Length (cm)
- T** Basic Time Lag - Change in time between readings (s)
- m** Transformation Ratio (unitless)
- H1** Depth to water level (cm) at time 1
- H2** Depth to water level (cm) at time 2

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A summary of the range of hydraulic conductivity values for each Infiltration Boring are summarized below:

Boring No.	Test Interval (feet)	Hydraulic Conductivity (cm/sec)*	Hydraulic Conductivity (gpd/ft ²)*
TAPTB-01	10 to 15	1.32×10^{-4} to 2.91×10^{-6}	0.1 to 2.8
TAPTB-01A	0 to 5	1.94×10^{-2} to 5.21×10^{-4}	11 to 412
TAPTB-02	15 to 20	3.85×10^{-5} to 4.77×10^{-6}	0.1 to 0.8
TAPTB-02A	0 to 5	9.46×10^{-3} to 7.66×10^{-5}	1.6 to 201
TAPTB-03	10 to 15	1.17×10^{-4} to 8.19×10^{-6}	0.2 to 2.5
TAPTB-03A	0 to 5	1.55×10^{-2} to 2.35×10^{-5}	0.5 to 328
TAPTB-04	10 to 15	2.46×10^{-4} to 1.74×10^{-7}	0.1 to 5.2
TAPTB-04A	0 to 5	2.10×10^{-3} to 5.76×10^{-5}	0.4 to 44
TAPTB-05	15 to 20	4.01×10^{-5} to 4.81×10^{-6}	0.1 to 0.9
TAPTB-05A	0 to 5	1.41×10^{-2} to 2.54×10^{-5}	0.5 to 298
TAPTB-06	7 to 12	2.09×10^{-4} to 3.19×10^{-6}	0.1 to 4.4
TAPTB-06A	0 to 5	1.05×10^{-2} to 3.21×10^{-5}	0.7 to 224

It should be noted that particle size, void ratio, cementation, unit weight, soil lithology, relative density/consistency, structure, pressure head, and degree of saturation along with other factors will affect the infiltration rates. Therefore, the actual infiltration rates in the well point injection areas may vary from the values reported in the borings.

The hydraulic conductivity values at varying depths for each boring are included in Appendix C.

7.0 GENERAL COMMENTS

The analysis presented in this report is based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

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The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

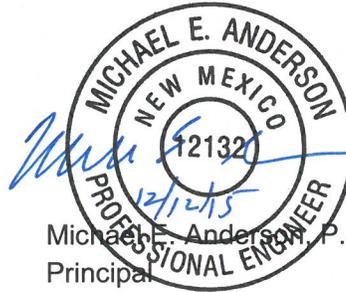
This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

We have appreciated being of service to you in the geotechnical field and laboratory testing phases of this project. If you have any questions concerning this letter, test results, and consulting services, please do not hesitate to contact us.

Sincerely,

Terracon Consultants, Inc.

Meagan J. Duneman, P.E.
Project Engineer



Michael E. Anderson, P.E.
Principal

Enclosures: Appendix A

- Site Location Map
- Exploration Location Plans
- Boring Logs
- General Notes
- Unified Soil Classification System

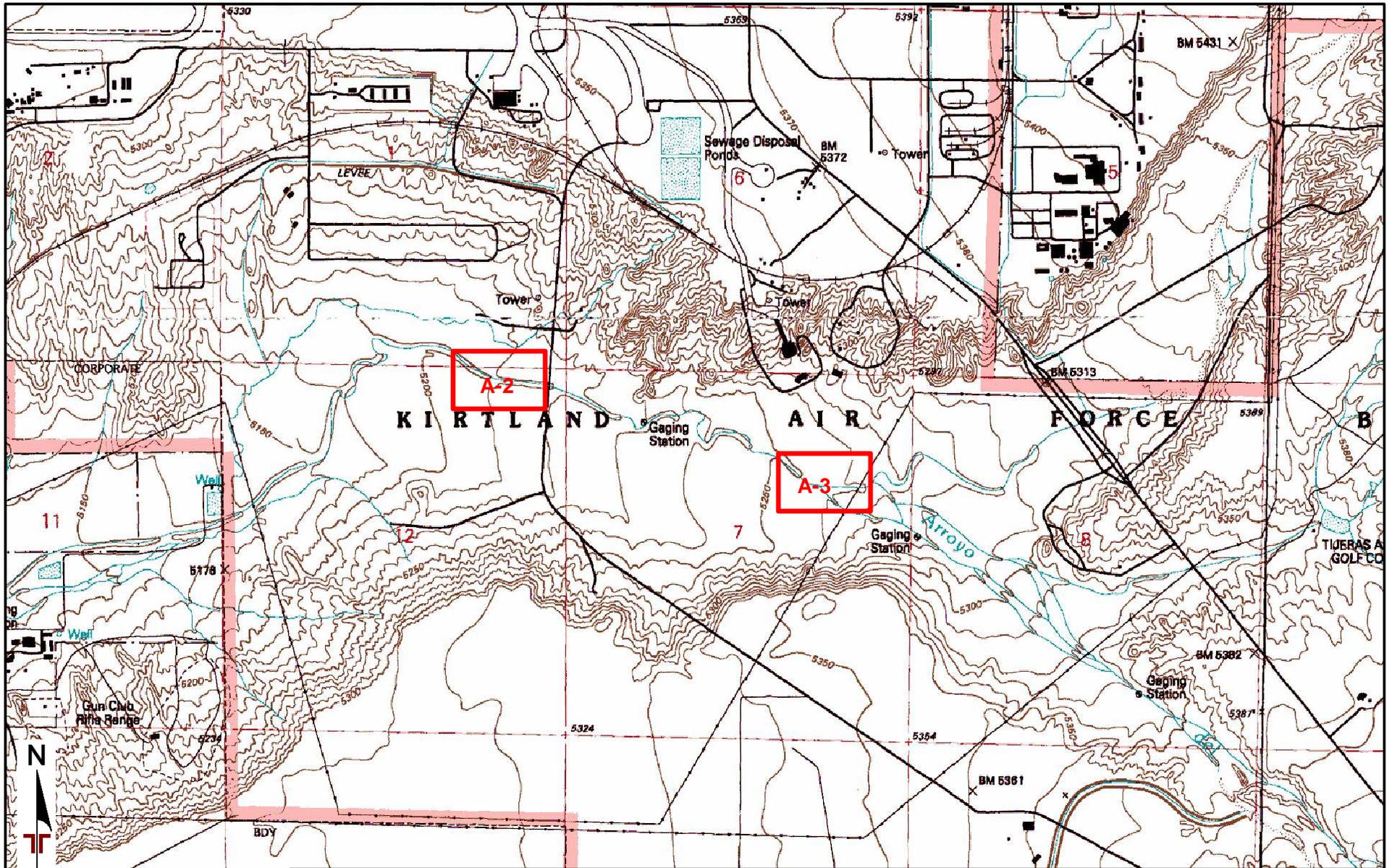
Appendix B

- Laboratory Test Results

Appendix C

- Percolation Test Results
- Falling Head Hydraulic Conductivity Calculations

APPENDIX A
FIELD EXPLORATION



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
 QUADRANGLES INCLUDE: ALBUQUERQUE EAST, NM (1/1/1990).

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: MJD
 Drawn by: MRA
 Checked by: MEA
 Approved by: MEA

Project No. 66155092
 Scale: 1"=24,000 SF
 File Name:
 Date: 12/11/2015

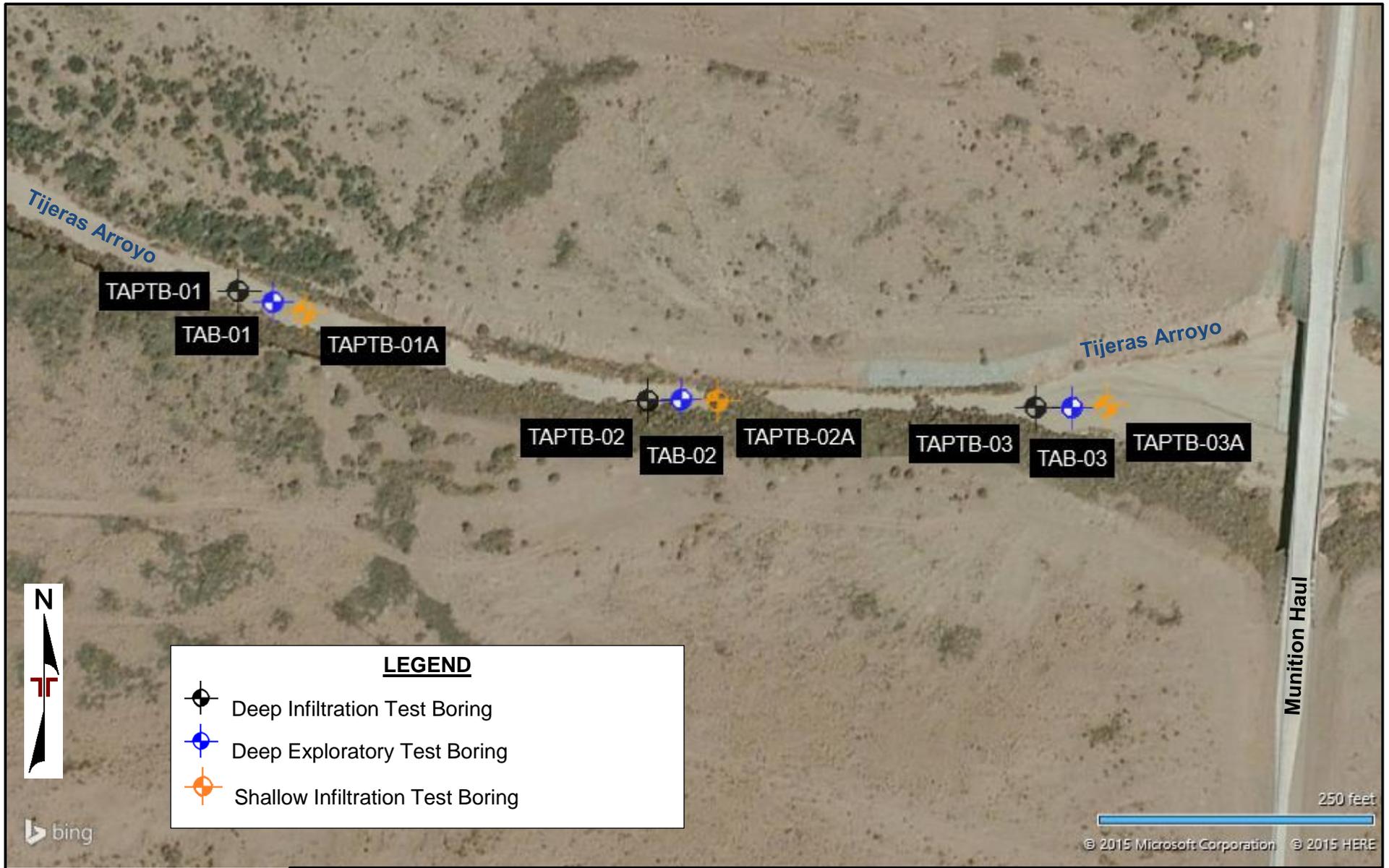
Terracon
 4905 Hawkins NE
 Albuquerque, NM 87109

SITE LOCATION MAP

In-Situ Falling Head Infiltration Testing
 Tijeras Arroyo - KAFB
 Albuquerque, NM

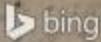
Exhibit

A-1



LEGEND

-  Deep Infiltration Test Boring
-  Deep Exploratory Test Boring
-  Shallow Infiltration Test Boring



250 feet
© 2015 Microsoft Corporation © 2015 HERE

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	MJD
Drawn by:	MRA
Checked by:	MEA
Approved by:	MEA

Project No.	66155092
Scale:	AS SHOWN
File Name:	
Date:	12/11/2015

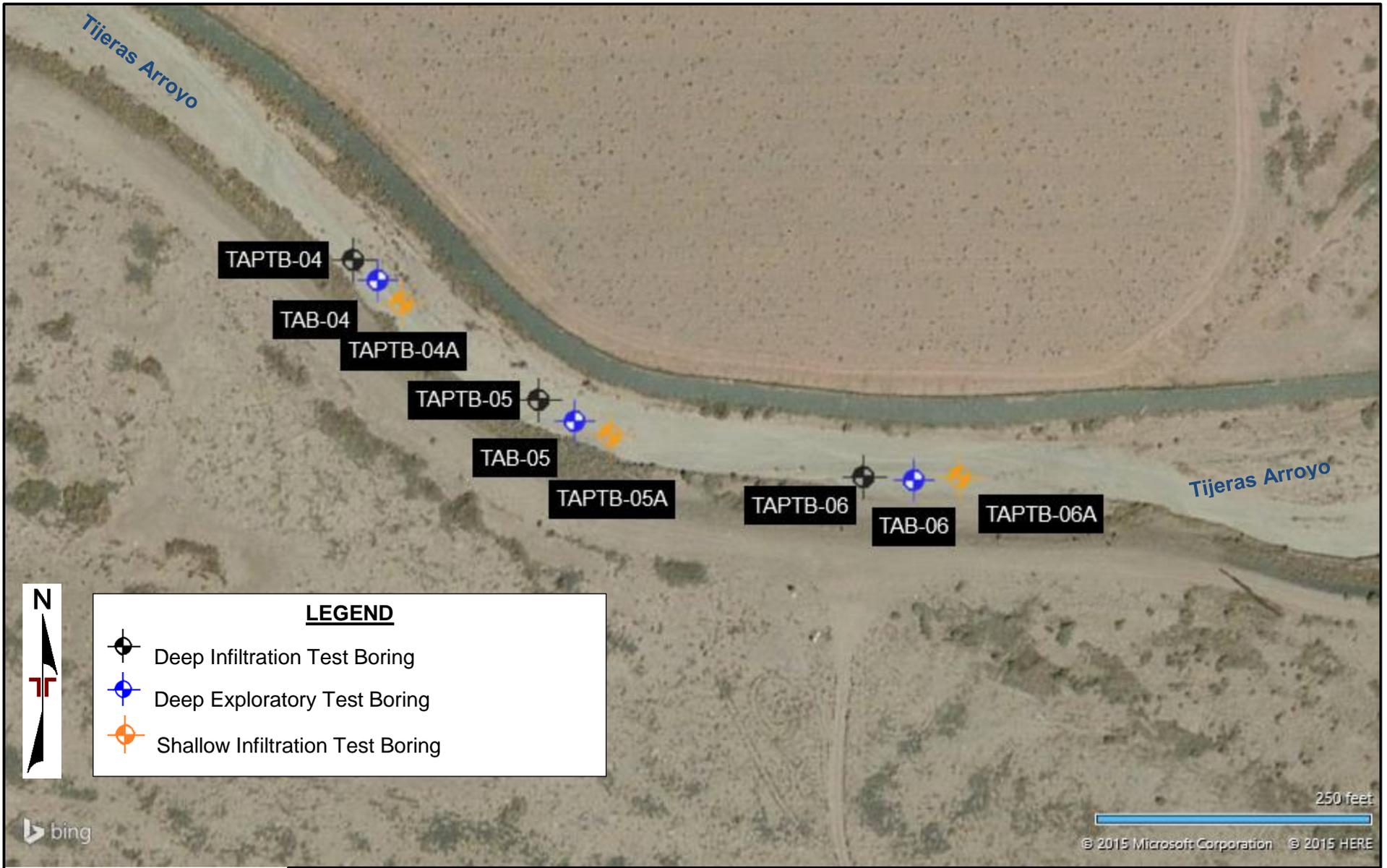
Terracon

4905 Hawkins NE
Albuquerque, NM 87109

EXPLORATION PLAN

In-Situ Falling Head Infiltration Testing
Tijeras Arroyo - KAFB
Albuquerque, NM

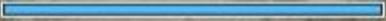
Exhibit
A-2



LEGEND

-  Deep Infiltration Test Boring
-  Deep Exploratory Test Boring
-  Shallow Infiltration Test Boring



250 feet

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AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	MJD
Drawn by:	MRA
Checked by:	MEA
Approved by:	MEA

Project No.	66155092
Scale:	AS SHOWN
File Name:	?
Date:	12/11/2015

Terracon

4905 Hawkins NE
 Albuquerque, NM 87109

EXPLORATION PLAN

In-Situ Falling Head Infiltration Testing
 Tijeras Arroyo - KAFB
 Albuquerque, NM

Exhibit
A-3

BORING LOG NO. TAB-01

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.028776° Longitude: -106.573084°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH							LL-PL-PI	
2.0	WELL GRADED SAND (SW) , varying amounts of gravel, trace silt, light brown, loose LEAN CLAY WITH SAND (CL) , trace gravel, brown, very soft	2.0		X	2-3-4 N=7	30/50/20			
5.0		5.0		X	0-0-1 N=1		27	33-20-13	73
10.0	SILTY CLAY WITH SAND (CL-ML) , brown, soft silty sand lenses	10.0		X	1-1-2 N=3				
15.0		15.0		X	1-2-1 N=3		28	28-22-6	85
20.0	SILTY SAND TO SANDY SILT (SM) , brown, loose	20.0		X	2-2-4 N=6	0/0/100			
25.0		25.0		X	3-4-3 N=7				
29.0	WELL GRADED SAND (SW) , varying amounts of gravel, light brown, loose to dense, weak cementation trace cobbles with clay lenses	29.0		X	12-20-18 N=38	30/50/20			
35.0		35.0		X	14-6-2 N=8				
40.0	WELL GRADED TO POORLY GRADED SAND (SW) , trace gravel, light brown, medium dense with clay lenses LEAN CLAY (CL) , brown to reddish-brown, stiff to very stiff	40.0		X	9-20-8 N=28	20/40/40			
42.0		42.0		X	6-2-14 N=16				
51.5		51.5		X	6-5-5 N=10				
Boring Terminated at 51.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/4/2015

Boring Completed: 11/4/2015

Drill Rig:

Driller: Juan

Project No.: 66155092

Exhibit: A-4

BORING LOG NO. TAB-02

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.028564° Longitude: -106.57182°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS		PERCENT FINES
								LL-PL-PI		
DEPTH										
3.0	WELL GRADED SAND (SW) , varying amounts of gravel, trace silt, light brown, medium dense	3.0		X	4-7-8 N=15	30/50/20				
5.0	SANDY LEAN CLAY TO LEAN CLAY (CL) , brown, medium stiff to very stiff	5.0		X	2-4-3 N=7					
10.0	well-graded sand lenses	10.0		X	10-10-5 N=15					
15.0	SILTY SAND (SM) , trace clay and gravel, brown, loose to medium dense	15.0		X	3-9-7 N=16		13	NP	48	
20.0		20.0		X	1-2-3 N=5					
25.0		25.0		X	3-3-3 N=6					
30.0	WELL GRADED SAND , varying amounts of gravel, light brown, dense, weak cementation	30.0		X	23-17-30 N=47	40/50/10				
35.0		35.0		X	17-18-18 N=36					
40.0	SILTY SAND TO SANDY SILT (SM) , light brown, loose	40.0		X	4-5-4 N=9	0/0/100				
43.0	LEAN CLAY (CL) , brown, medium stiff to stiff	43.0		X	3-3-3 N=6					
45.0	with silty clay lenses	45.0		X	3-4-4 N=8					
51.5	Boring Terminated at 51.5 Feet	51.5		X						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/4/2015

Boring Completed: 11/4/2015

Drill Rig:

Driller: Juan

Project No.: 66155092

Exhibit: A-5

BORING LOG NO. TAB-03

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.028506° Longitude: -106.570627°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS		PERCENT FINES
								LL-PL-PI		
	DEPTH									
3.0	WELL GRADED SAND (SW) , varying amounts of gravel, light brown, medium dense			X	4-7-7 N=14					
8.0	LEAN CLAY (CL) , brown, soft	5		X	1-1-1 N=2					
16.0	SANDY SILT (ML) , brown, soft lean clay lenses	10		X	1-1-2 N=3		17	NP	62	
51.5	LEAN CLAY (CL) , brown, soft to very stiff sandy silt lenses	15		X	1-1-2 N=3		16	NP	57	
		20		X	1-2-1 N=3					
		25		X	16-5-5 N=10					
		30		X	2-1-1 N=2					
		35		X	2-3-3 N=6					
		40		X	3-3-4 N=7					
		45		X	5-3-4 N=7					
		50		X	9-6-11 N=17					
	Boring Terminated at 51.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/4/2015

Boring Completed: 11/4/2015

Drill Rig:

Driller: Juan

Project No.: 66155092

Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAB-04

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.024752° Longitude: -106.557249°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS		PERCENT FINES
								LL-PL-PI		
DEPTH										
	WELL GRADED SAND (SW) , varying amounts of gravel, light brown, medium dense, with clay lenses	5.0		X	4-6-11 N=17	30/50/20				
	SILTY CLAYEY SAND (SC-SM) , varying amounts of gravel, brown, very loose to dense	10.0		X	9-15-10 N=25	20/50/30				
	SILTY CLAYEY SAND (SC-SM) , varying amounts of gravel, brown, very loose to dense	18.0		X	9-15-19 N=34	40/30/20	9	23-19-4	30	
	LEAN CLAY (CL) , brown, stiff	21.0		X	6-1-1 N=2	40/30/20				
	SILTY SAND (SM) , varying amounts of gravel, light brown, loose to medium dense	25.0		X	4-5-5 N=10					
	SILTY SAND (SM) , varying amounts of gravel, light brown, loose to medium dense	30.0		X	13-17-11 N=28	50/30/20				
	LEAN CLAY (CL) , brown, stiff silty clay lenses	39.0		X	6-8-17 N=25	40/40/20				
	LEAN CLAY (CL) , brown, stiff silty clay lenses	44.0		X	4-4-5 N=9					
	SILTY CLAY (CL-ML) , brown, stiff	48.0		X	3-3-6 N=9					
	SILTY CLAY (CL-ML) , brown, stiff	51.5		X	3-3-7 N=10					
	SILTY SAND (SM) , varying amounts of gravel, brown and light brown, medium dense, with well-graded sand and gravel lenses	51.5		X	10-9-7 N=16	40/30/30				
Boring Terminated at 51.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/9/2015

Boring Completed: 11/9/2015

Drill Rig:

Driller: Juan

Project No.: 66155092

Exhibit: A-7

BORING LOG NO. TAB-05

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.024309° Longitude: -106.556704°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS		PERCENT FINES
	DEPTH							LL-PL-PI		
	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown to brown, medium dense silty sand lenses lean clay lenses increase in amount of gravel	5		X	5-6-10 N=16	50/40/10				
		10.0		X	28-16-13 N=29	50/30/20				
	SILTY SAND (SM) , varying amounts of gravel, brown, medium dense to dense lean clay lenses medium dense	15		X	18-16-19 N=35	30/30/40				
		20.0		X	7-11-7 N=18	30/40/30	8	19-16-3	25	
	SILTY CLAY (CL-ML) , brown, soft to medium stiff silty sand lenses	25		X	4-2-2 N=4					
		28.0		X	2-2-2 N=4					
	LEAN CLAY (CL) , brown, medium stiff	30		X	6-3-2 N=5					
		32.0		X	3-4-5 N=9					
	SILTY CLAY (CL-ML) , brown, stiff silty sand lenses	40		X	4-4-7 N=11					
		45		X	5-4-5 N=9					
	50.0		X	11-16-18 N=34	40/50/10					
	51.5									
Boring Terminated at 51.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/9/2015

Boring Completed: 11/9/2015

Drill Rig:

Driller: Juan

Project No.: 66155092

Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAB-06

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.024194° Longitude: -106.555647°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS		PERCENT FINES
	DEPTH							LL-PL-PI		
2.0	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, medium dense			X	4-5-6 N=11	50/40/10				
	SILTY SAND (SM) , varying amounts of gravel, brown, dense									
	2 foot thick gravel layer lean clay lenses	5		X	9-14-18 N=32	30/35/35				
	2 foot thick gravel layer	10		X	14-24-15 N=39	60/30/10				
	sandy silt lenses	15		X	11-20-19 N=39	50/30/20	8	NP	33	
		20		X	23-23-12 N=35	40/40/20				
25.0	SANDY SILT (ML) , light brown to brown, medium stiff	25		X	3-3-3 N=6	0/10/90	11	NP	55	
	SILTY CLAY (CL-ML) , brown, stiff	30		X	3-4-5 N=9					
	sandy silt lenses	35		X	4-7-6 N=13	0/10/90				
	SILTY SAND (SM) , brown to light brown, medium dense	40		X	5-6-4 N=10					
	lean clay lenses	45		X	4-6-6 N=12					
	SILTY CLAY (CL-ML) , brown to dark brown, stiff	50		X	8-12-9 N=21	50/40/10				
	silty sand lenses	51.5		X						
	WELL GRADED SAND WITH GRAVEL (SW) , light brown, medium dense									
	Boring Terminated at 51.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/10/2015

Boring Completed: 11/10/2015

Drill Rig:

Driller: Juan

Project No.: 66155092

Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPT B-01

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.028793° Longitude: -106.573216°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI								
	DEPTH								
1.0	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, very loose	1.0		X	1-1-1 N=2	20/30/50 50/30/20			
3.0	SILTY SAND (SM) , trace gravel, brown LEAN CLAY (CL) , trace sand, brown, medium stiff	3.0		X	2-2-3 N=5				
10.0	silty sand to sandy silt lenses SILTY CLAY (CL-ML) , brown, medium stiff	10.0		X	1-2-4 N=6				
16.5	Boring Terminated at 16.5 Feet	16.5		X	2-3-3 N=6				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
3" diameter PVC casing installed
Screened interval 10-15 feet

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/13/2015

Boring Completed: 11/13/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-10

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPT B-01A

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

**SITE: Kirtland Air Force Base
Albuquerque, New Mexico**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.028773° Longitude: -106.573132°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH									
2.0	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, very loose	5		X	4-2-1 N=3	50/30/20			
6.5	LEAN CLAY TO SILTY CLAY (CL) , trace silt, brown, medium stiff			X	2-2-4 N=6				
Boring Terminated at 6.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
3" diameter PVC casing installed
Screened interval 0-5 feet

Abandonment Method:
Borings backfilled with bentonite upon completion.

WATER LEVEL OBSERVATIONS
No free water observed



Boring Started: 11/13/2015

Boring Completed: 11/13/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPT B-02

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.028629° Longitude: -106.571949°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH							LL-PL-PI	
3.0	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, medium dense	3.0		X	4-7-7 N=14	50/30/20			
12.0	LEAN CLAY (CL) , brown, medium stiff, with silty sand to sandy silt lenses	5		X	2-2-4 N=6				
12.0		10		X	4-3-3 N=6				
21.5	SANDY SILT (ML) , brown to light brown, medium stiff, with silty clay lenses	15		X	3-4-3 N=7				
21.5		20		X	3-3-4 N=7				
Boring Terminated at 21.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
3" diameter PVC casing installed
Screened interval 15-20 feet

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/13/2015

Boring Completed: 11/13/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPT B-02A

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

**SITE: Kirtland Air Force Base
Albuquerque, New Mexico**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.030031° Longitude: -106.569874°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH							LL-PL-PI	
3.0	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, medium dense	5		X	3-7-9 N=16	50/30/20			
6.5	SANDY SILTY CLAY (CL-ML) , brown, medium stiff, with silty sand lenses			X	2-2-3 N=5		16	24-20-4	60
Boring Terminated at 6.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
3" diameter PVC casing installed
Screened interval 0-5 feet

Abandonment Method:
Borings backfilled with bentonite upon completion.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/13/2015

Boring Completed: 11/13/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-13

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPTB-03

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

**SITE: Kirtland Air Force Base
Albuquerque, New Mexico**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.028528° Longitude: -106.57073°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH									
3.0	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, loose	5	X	3-4-3 N=7		50/30/20			
16.5	SANDY SILT (ML) , brown to light brown, soft to medium stiff, with lean clay lenses	10	X	1-1-3 N=4					
16.5	Boring Terminated at 16.5 Feet	15	X	2-2-2 N=4					
16.5	Boring Terminated at 16.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
3" diameter PVC casing installed
Screened interval 10-15 feet

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/13/2015

Boring Completed: 11/13/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-14

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPT B-03A

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

**SITE: Kirtland Air Force Base
Albuquerque, New Mexico**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.028481° Longitude: -106.570581°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH									
2.0	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, loose	5		X	4-3-5 N=8	50/30/20			
6.5	SANDY LEAN CLAY (CL) , brown, medium stiff			X	2-2-4 N=6		25	34-18-16	62
Boring Terminated at 6.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
3" diameter PVC casing installed
Screened interval 0-5 feet

Abandonment Method:
Borings backfilled with bentonite upon completion.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/13/2015

Boring Completed: 11/13/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-15

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPT B-04

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.024844° Longitude: -106.557261°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS		PERCENT FINES
								LL-PL-PI		
DEPTH										
1.0	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, medium dense SILTY SAND (SM) , varying amounts of gravel, brown, medium dense	5		X	4-10-10 N=20	40/30/20 30/50/20				
8.0	SILTY CLAYEY SAND WITH GRAVEL (SC-SM) , brown, medium dense to dense, with lean clay lenses	10		X	7-12-14 N=26	30/40/30				
16.5	Boring Terminated at 16.5 Feet	15		X	19-16-26 N=42	50/40/10				
				X	8-10-6 N=16	30/40/30				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:
3" diameter PVC casing installed
Screened interval 10-15 feet

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

See Appendix C for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/19/2015

Boring Completed: 11/19/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-16

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPT B-04A

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.024816° Longitude: -106.557234°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS		PERCENT FINES
								LL-PL-PI		
DEPTH										
1.5	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, medium dense	5		X	5-9-9 N=18	40/30/20 50/40/10				
6.5	SILTY SAND WITH GRAVEL (SM) , brown, medium dense, with lean clay lenses			X	7-9-9 N=18	30/40/30	8	NP	23	
Boring Terminated at 6.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:

3" diameter PVC casing installed
Screened interval 0-5 feet

Abandonment Method:

Borings backfilled with bentonite upon completion.

See Appendix C for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

No free water observed



4905 Hawkins, NE
Albuquerque, New Mexico

Boring Started: 11/19/2015

Boring Completed: 11/19/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-17

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPTB-05

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

**SITE: Kirtland Air Force Base
Albuquerque, New Mexico**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.024393° Longitude: -106.556774°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH							LL-PL-PI	
1.5	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, medium dense SILTY SAND (SM) , varying amounts of gravel, brown, loose to dense lean clay lenses increase in gravel content lean clay lenses	5		X	6-8-14 N=22				
		10		X	9-14-11 N=25				
		15		X	13-16-29 N=45				
		19.0		X	5-3-1 N=4				
19.0	SILTY CLAY (CL-ML) , brown, stiff, with silty sand lenses	20		X	7-6-4 N=10				
21.5	Boring Terminated at 21.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:
3" diameter PVC casing installed
Screened interval 15-20 feet

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

See Appendix C for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/19/2015

Boring Completed: 11/19/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-18

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPT B-05A

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

**SITE: Kirtland Air Force Base
Albuquerque, New Mexico**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.024386° Longitude: -106.556717°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI								
DEPTH									
1.5	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, medium dense	5		X	6-6-10 N=16	50/40/10 40/30/30			
6.5	SILTY SAND (SM) , varying amounts of gravel, brown, medium dense, with lean clay lenses			X	9-7-16 N=23	30/40/30	9	NP	28
Boring Terminated at 6.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:
3" diameter PVC casing installed
Screened interval 0-5 feet

Abandonment Method:
Borings backfilled with bentonite upon completion.

See Appendix C for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS
No free water observed



Boring Started: 11/19/2015

Boring Completed: 11/19/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-19

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPTB-06

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.024166° Longitude: -106.555669°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
								LL-PL-PI	
DEPTH									
1.5	<p>WELL GRADED SAND (SW), varying amounts of gravel and cobbles, light brown, dense</p> <p>SILTY SAND (SM), varying amounts of gravel, brown, medium dense to dense, with lean clay lenses</p> <p>lean clay lenses</p>	5		X	10-15-18 N=33	50/40/10			
		5		X	10-10-15 N=25	50/30/20	7	NP	27
12.0	<p>Boring Terminated at 12 Feet</p>	10		X	10-11-20 N=31	40/30/30	8	NP	23

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
3" diameter PVC casing installed
Screened interval 7-12 feet

Abandonment Method:
Borings backfilled with soil cuttings upon completion with upper 10' bentonite plug.

WATER LEVEL OBSERVATIONS

No free water observed



Boring Started: 11/19/2015

Boring Completed: 11/19/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-20

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

BORING LOG NO. TAPT B-06A

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

CLIENT: CB&I Federal Services

SITE: Kirtland Air Force Base
Albuquerque, New Mexico

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 35.024196° Longitude: -106.555599°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Visual Sand Grain Size % (CG/MG/FG)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH									
1.5	WELL GRADED SAND (SW) , varying amounts of gravel and cobbles, light brown, dense	5		X	4-15-18 N=33	50/40/10			
6.5	SILTY SAND (SM) , varying amounts of gravel, brown, dense, with lean clay lenses			X	6-15-15 N=30	30/40/30		NP	27
Boring Terminated at 6.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
3" diameter PVC casing installed
Screened interval 0-5 feet

Abandonment Method:
Borings backfilled with bentonite upon completion.

WATER LEVEL OBSERVATIONS
No free water observed



Boring Started: 11/19/2015

Boring Completed: 11/19/2015

Drill Rig:

Driller: Ed

Project No.: 66155092

Exhibit: A-21

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_66155092 (12-10-15).GPJ TERRACON2015.GDT 12/12/15

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING				WATER LEVEL		Water Initially Encountered	FIELD TESTS	(HP) Hand Penetrometer
						Water Level After a Specified Period of Time		(T) Torvane
						Water Level After a Specified Period of Time		(b/f) Standard Penetration Test (blows per foot)
	<p>Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.</p>					(OVA) Organic Vapor Analyzer		

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS	RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
	Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-Value Blows/Ft.
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 5
With	5 - 12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

<u>Major Component of Sample</u>	<u>Particle Size</u>
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

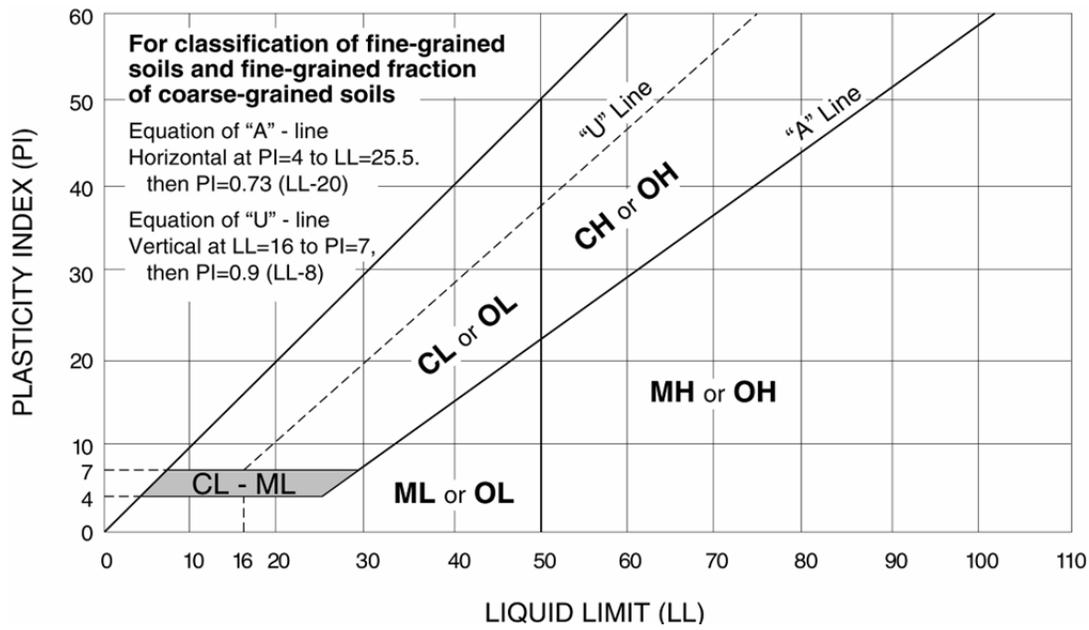
PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification		
				Group Symbol	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	
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GP	Poorly graded gravel ^F	
			Fines classify as CL or CH	GM	Silty 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	GC	Clayey gravel ^{F,G,H}
	Sands with Fines: More than 12% fines ^D		Fines classify as ML or MH	SW	Well-graded sand ^I	
			Fines classify as CL or CH	SP	Poorly graded sand ^I	
	Silts and Clays: Liquid limit less than 50		Inorganic:	$PI > 7$ and plots on or above "A" line ^J	SM	Silty sand ^{G,H,I}
		Organic:	Liquid limit - oven dried < 0.75	SC	Clayey sand ^{G,H,I}	
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit 50 or more	Inorganic:	$PI < 4$ or plots below "A" line ^J	CL	Lean clay ^{K,L,M}	
		Organic:	Liquid limit - not dried < 0.75	ML	Silt ^{K,L,M}	
			PI plots on or above "A" line	OL	Organic clay ^{K,L,M,N}	
		Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots below "A" line	OH	Organic silt ^{K,L,M,O}
	Organic:		Liquid limit - oven dried < 0.75	CH	Fat clay ^{K,L,M}	
			Liquid limit - not dried < 0.75	MH	Elastic Silt ^{K,L,M}	
	Highly organic soils:		Primarily organic matter, dark in color, and organic odor			OH
					PT	Organic silt ^{K,L,M,Q}

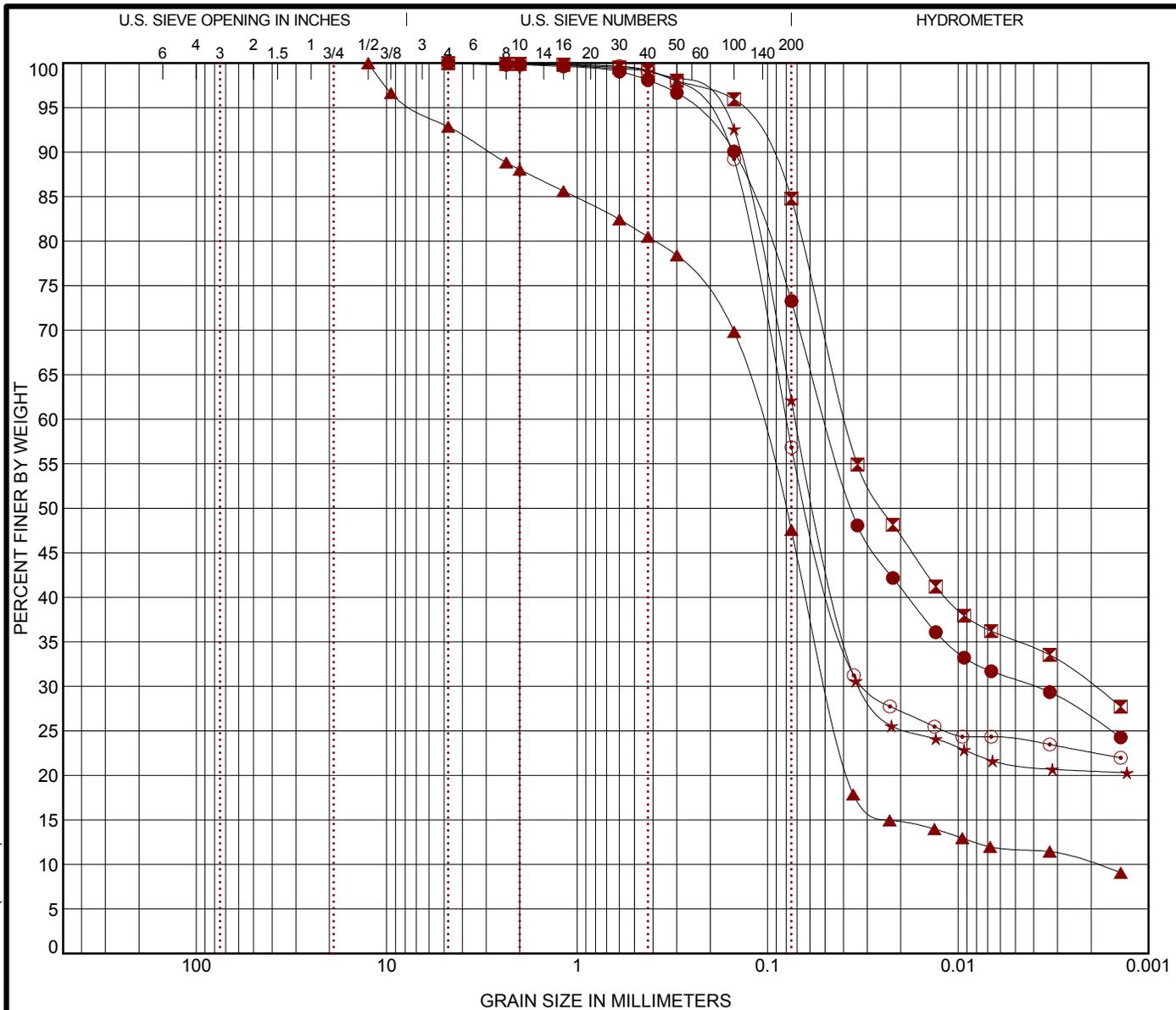
- ^A Based on the material passing the 3-inch (75-mm) sieve
- ^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
- ^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, 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 $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
- ^F If soil contains $\geq 15\%$ 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 $\geq 15\%$ gravel, add "with gravel" to group name.
- ^J If Atterberg limits plot in shaded 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 $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.
- ^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.
- ^N $PI \geq 4$ 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.



APPENDIX B
LABORATORY TESTING

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
● TAB-01	5 - 6.5	LEAN CLAY with SAND(CL)	33	20	13		
☒ TAB-01	15 - 16.5	SILTY CLAY with SAND(CL-ML)	28	22	6		
▲ TAB-02	15 - 16.5	SILTY SAND(SM)	NP	NP	NP	10.73	56.35
★ TAB-03	10 - 11.5	SANDY SILT(ML)	NP	NP	NP		
⊙ TAB-03	15 - 16.5	SANDY SILT(ML)	NP	NP	NP		

Boring ID	Depth	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Gravel	%Sand	%Fines	
● TAB-01	5 - 6.5	4.75	0.049	0.004		0.0	26.7	42.5	30.7
☒ TAB-01	15 - 16.5	4.75	0.039	0.002		0.0	15.2	49.7	35.1
▲ TAB-02	15 - 16.5	12.5	0.11	0.048	0.002	7.2	45.3	35.8	11.8
★ TAB-03	10 - 11.5	2.36	0.071	0.033		0.0	37.9	40.9	21.3
⊙ TAB-03	15 - 16.5	4.75	0.08	0.03		0.0	43.2	32.9	24.0

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66155092 (12-10-15).GPJ TERRACON2012.GDT 12/12/15

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

SITE: Kirtland Air Force Base
Albuquerque, New Mexico



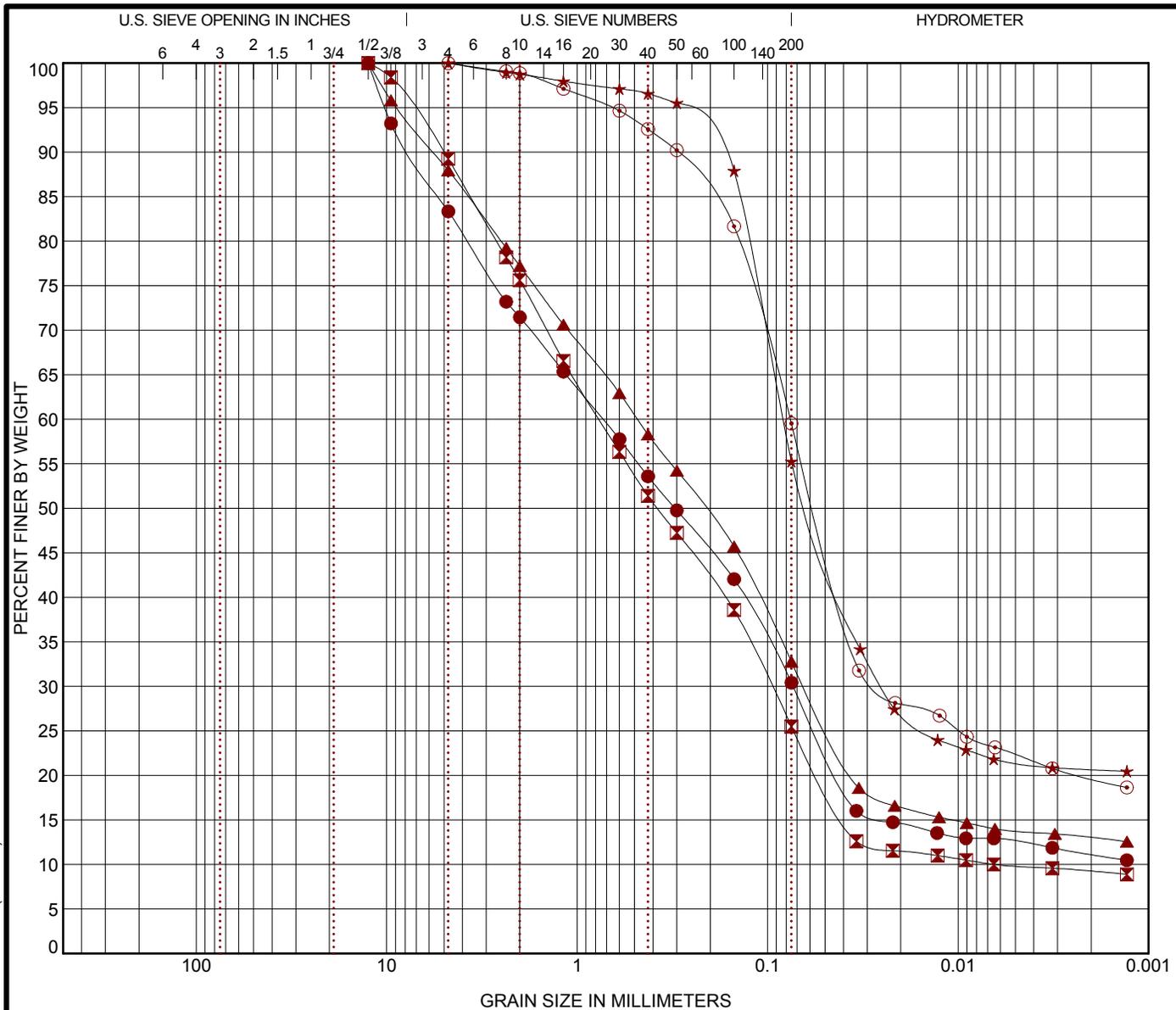
PROJECT NUMBER: 66155092

CLIENT: CB&I Federal Services

EXHIBIT: B-1

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification				LL	PL	PI	Cc	Cu
● TAB-04	10 - 11.5	SILTY, CLAYEY SAND with GRAVEL(SC-SM)				23	19	4		
☒ TAB-05	15 - 16.5	SILTY SAND(SM)				19	16	3	1.84	118.49
▲ TAB-06	15 - 16.5	SILTY SAND(SM)				23	69	NP		
★ TAB-06	25 - 26.5	SANDY SILT(ML)				NP	NP	NP		
⊙ TAPT-02A	5 - 6.5	SANDY SILTY CLAY(CL-ML)				24	20	4		
Boring ID	Depth	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Gravel	%Sand	%Fines		
● TAB-04	10 - 11.5	12.5	0.733	0.073		16.7	52.9	17.9	12.5	
☒ TAB-05	15 - 16.5	12.5	0.765	0.095	0.006	10.8	63.7	15.7	9.8	
▲ TAB-06	15 - 16.5	12.5	0.482	0.064		12.1	55.2	19.0	13.8	
★ TAB-06	25 - 26.5	4.75	0.083	0.025		0.0	44.7	33.8	21.5	
⊙ TAPT-02A	5 - 6.5	4.75	0.076	0.027		0.0	40.5	37.2	22.3	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66155092 (12-10-15).GPJ TERRACON2012.GDT 12/12/15

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

SITE: Kirtland Air Force Base
Albuquerque, New Mexico



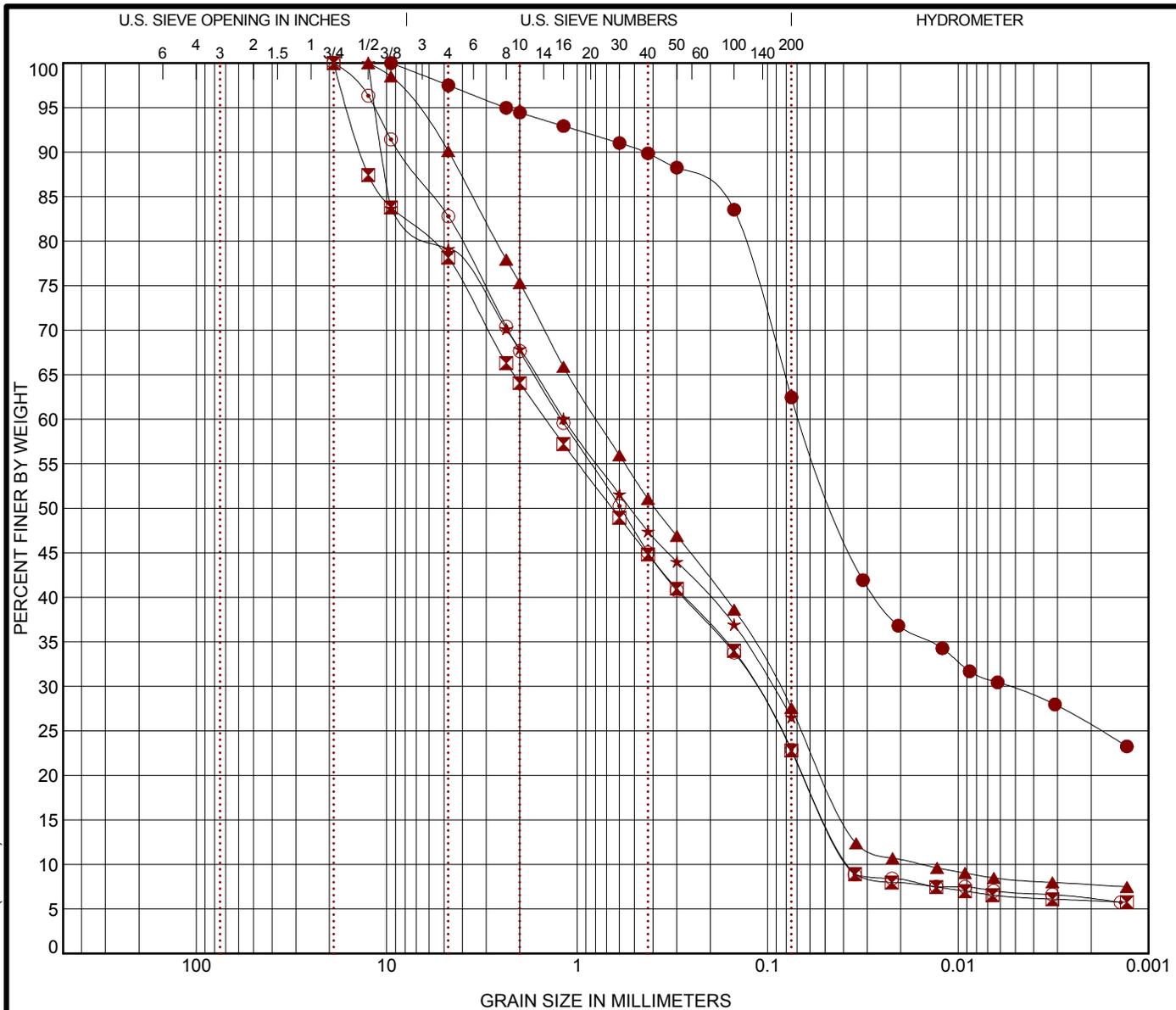
PROJECT NUMBER: 66155092

CLIENT: CB&I Federal Services

EXHIBIT: B-2

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
● TAPT-03A	5 - 6.5	SANDY LEAN CLAY(CL)	34	18	16		
⊠ TAPT-04A	5 - 6.5	SILTY SAND with GRAVEL(SM)	NP	NP	NP	0.25	39.69
▲ TAPT-05A	5 - 6.5	SILTY SAND(SM)	NP	NP	NP	0.62	50.51
★ TAPT-06	5 - 6.5	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
⊙ TAPT-06	10 - 11.5	SILTY SAND with GRAVEL(SM)	NP	NP	NP	0.31	32.70

Boring ID	Depth	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Gravel	%Sand	%Fines	
● TAPT-03A	5 - 6.5	9.5	0.068	0.005		2.5	35.1	32.8	29.7
⊠ TAPT-04A	5 - 6.5	19	1.463	0.117	0.037	21.8	55.4	16.4	6.4
▲ TAPT-05A	5 - 6.5	12.5	0.79	0.087	0.016	9.9	62.5	19.3	8.3
★ TAPT-06	5 - 6.5	12.5	1.174	0.094		20.9	52.6	26.5	
⊙ TAPT-06	10 - 11.5	19	1.213	0.118	0.037	17.2	59.9	16.0	6.9

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66155092 (12-10-15).GPJ TERRACON2012.GDT 12/12/15

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo

SITE: Kirtland Air Force Base
Albuquerque, New Mexico



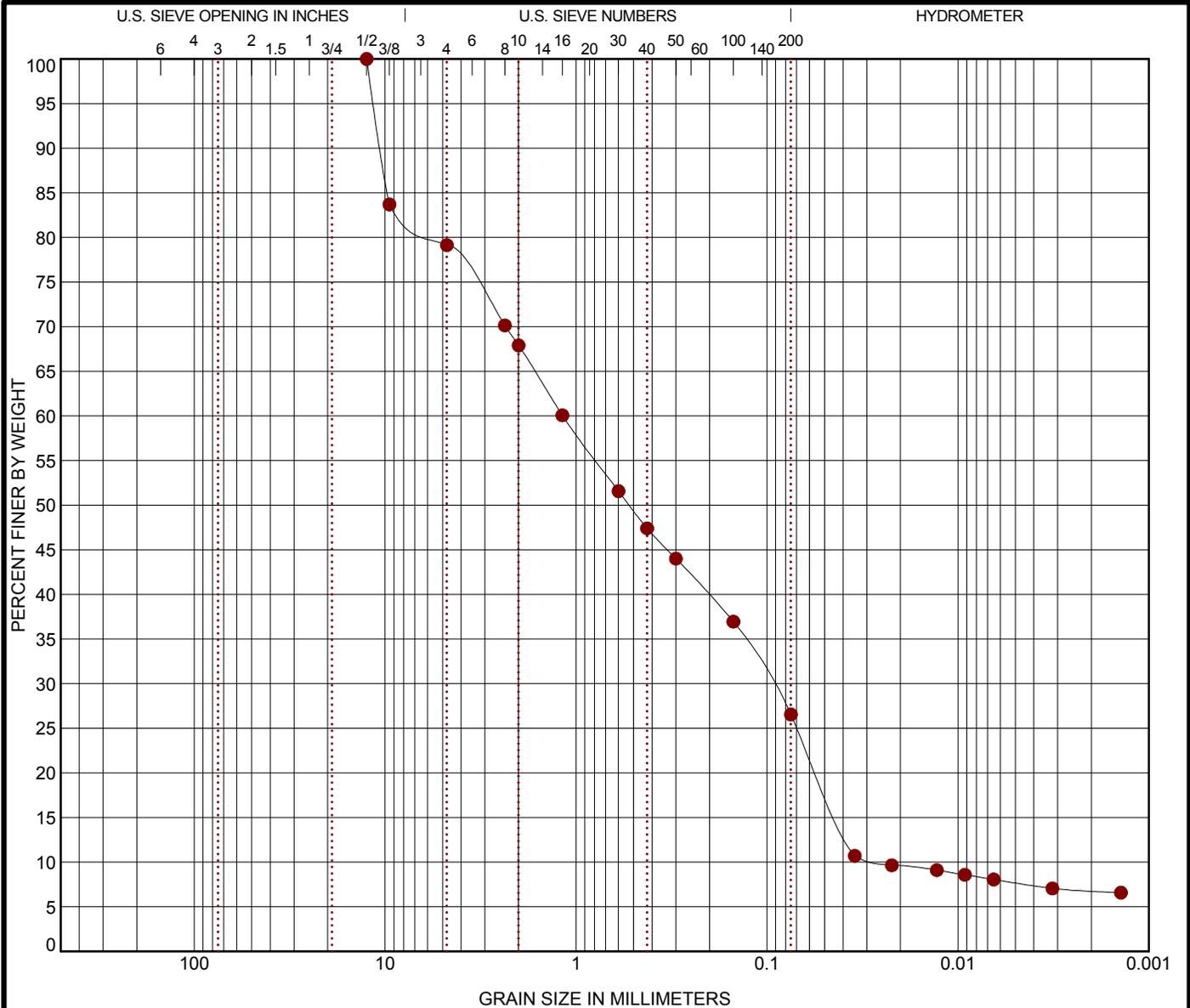
PROJECT NUMBER: 66155092

CLIENT: CB&I Federal Services

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
● TAPT-06A	5 - 6.5	SILTY SAND with GRAVEL(SM)	NP	NP	NP	0.29	45.51

Boring ID	Depth	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Gravel	%Sand	%Fines
● TAPT-06A	5 - 6.5	12.5	1.174	0.094	0.026	20.9	52.6	18.9

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66155092 (12-10-15).GPJ TERRACON2012.GDT 12/12/15

PROJECT: In-Situ Falling Head Infiltration Tests - Tijeras Arroyo SITE: Kirtland Air Force Base Albuquerque, New Mexico	<p style="color: #8B0000; font-weight: bold; font-size: 0.8em;">4905 Hawkins, NE Albuquerque, New Mexico</p>	PROJECT NUMBER: 66155092 CLIENT: CB&I Federal Services EXHIBIT: B-4
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APPENDIX C
PERCOLATION AND FALLING HEAD HYDRAULIC
CONDUCTIVITY CALCULATIONS

Project Name: KAFB Infiltration Testing - Tijerras Arroyo
 Project Number: 66155092

Boring Number: TAPTБ-01
 Date of Test: 11/23/2015

	Δ Time	Water Level	Δ Level	Perc Rate	Perc Rate	Perc Rate
Time	min	ft	in	Min/in	Min/cm	cm/s
8:10:00 AM		6.88	0			
8:11:00 AM	1	7.16	3.36	0.30	0.76	2.20E-02
8:12:00 AM	1	7.43	3.24	0.31	0.78	2.13E-02
8:14:00 AM	2	7.73	3.60	0.56	1.41	1.18E-02
8:16:00 AM	2	8.08	4.20	0.48	1.21	1.38E-02
8:18:00 AM	2	8.31	2.76	0.72	1.84	9.06E-03
8:20:00 AM	2	8.55	2.88	0.69	1.76	9.45E-03
8:25:00 AM	5	9.12	6.84	0.73	1.86	8.98E-03
8:30:00 AM	5	9.45	3.96	1.26	3.21	5.20E-03
8:35:00 AM	5	9.77	3.84	1.30	3.31	5.04E-03
8:40:00 AM	5	10.04	3.24	1.54	3.92	4.25E-03
8:50:00 AM	10	10.47	5.16	1.94	4.92	3.39E-03
9:00:00 AM	10	10.80	3.96	2.53	6.41	2.60E-03
9:10:00 AM	10	11.10	3.60	2.78	7.06	2.36E-03
9:20:00 AM	10	11.27	2.04	4.90	12.45	1.34E-03
9:30:00 AM	10	11.43	1.92	5.21	13.23	1.26E-03
10:03:00 AM	33	11.84	4.92	6.71	17.04	9.78E-04
10:30:00 AM	27	12.20	4.32	6.25	15.88	1.05E-03
11:00:00 AM	30	12.41	2.52	11.90	30.24	5.51E-04
12:00:00 PM	60	12.88	5.64	10.64	27.02	6.17E-04
1:00:00 PM	60	13.41	6.36	9.43	23.96	6.96E-04
2:00:00 PM	60	14.88	17.64	3.40	8.64	1.93E-03
Average				3.50	8.90	6.08E-03

Project Name: KAFB Infiltration Testing - Tijerras Arroyo
 Project Number: 66155092

Boring Number: TAPTБ-03
 Date of Test: 11/24 and 25/2015

	Δ Time	Water Level	Δ Level	Perc Rate	Perc Rate	Perc Rate
Time	min	ft	in	Min/in	Min/cm	cm/s
7:36:00 AM		5.30	0			
7:37:00 AM	1	5.33	0.36	2.78	7.06	2.36E-03
7:39:00 AM	2	5.40	0.84	2.38	6.05	2.76E-03
7:41:00 AM	2	5.53	1.56	1.28	3.26	5.12E-03
7:46:00 AM	5	5.76	2.76	1.81	4.60	3.62E-03
7:51:00 AM	5	5.92	1.92	2.60	6.61	2.52E-03
8:01:00 AM	10	5.96	0.48	20.83	52.92	3.15E-04
8:31:00 AM	30	6.58	7.44	4.03	10.24	1.63E-03
9:01:00 AM	30	7.08	6.00	5.00	12.70	1.31E-03
9:55:00 AM	54	7.68	7.20	7.50	19.05	8.75E-04
10:55:00 AM	60	8.26	6.96	8.62	21.90	7.61E-04
11:55:00 AM	60	8.68	5.04	11.90	30.24	5.51E-04
12:55:00 PM	60	9.06	4.56	13.16	33.42	4.99E-04
1:52:00 PM	57	9.50	5.28	10.80	27.42	6.08E-04
2:54:00 PM	62	9.90	4.80	12.92	32.81	5.08E-04
3:55:00 PM	61	10.35	5.40	11.30	28.69	5.81E-04
4:55:00 PM	60	10.93	6.96	8.62	21.90	7.61E-04
7:32:00 AM*	877	14.33	40.80	21.50	54.60	3.05E-04
			Average	8.65	21.97	1.48E-03

*11/25/15

Project Name: KAFB Infiltration Testing - Tijerras Arroyo
 Project Number: 66155092

Boring Number: TAPTБ-04
 Date of Test: 11/24 and 25/2015

	Δ Time	Water Level	Δ Level	Perc Rate	Perc Rate	Perc Rate
Time	min	ft	in	Min/in	Min/cm	cm/s
8:00:00 AM		6.45	0			
8:01:00 AM	1	7.03	6.96	0.14	0.36	4.57E-02
8:02:00 AM	1	7.14	1.32	0.76	1.92	8.66E-03
8:03:00 AM	1	7.20	0.72	1.39	3.53	4.72E-03
8:04:00 AM	1	7.24	0.48	2.08	5.29	3.15E-03
8:06:00 AM	2	7.30	0.72	2.78	7.06	2.36E-03
8:08:00 AM	2	7.33	0.36	5.56	14.11	1.18E-03
** 8:10:00 AM	2	7.00	-3.96	-0.51	-1.28	-1.30E-02
8:15:00 AM	5	7.34	4.08	1.23	3.11	5.35E-03
8:20:00 AM	5	7.45	1.32	3.79	9.62	1.73E-03
8:30:00 AM	10	7.57	1.44	6.94	17.64	9.45E-04
9:00:00 AM	30	7.87	3.60	8.33	21.17	7.87E-04
10:00:00 AM	60	8.45	6.96	8.62	21.90	7.61E-04
11:00:00 AM	60	8.95	6.00	10.00	25.40	6.56E-04
12:00:00 PM	60	9.00	0.60	100.00	254.00	6.56E-05
1:00:00 PM	60	9.32	3.84	15.63	39.69	4.20E-04
2:00:00 PM	60	9.52	2.40	25.00	63.50	2.62E-04
3:00:00 PM	60	9.97	5.40	11.11	28.22	5.91E-04
** 4:00:00 PM	60	9.88	-1.08	-55.56	-141.11	-1.18E-04
5:00:00 PM	60	9.92	0.48	125.00	317.50	5.25E-05
7:39:00 AM*	879	10.21	3.48	252.59	641.57	2.60E-05
			Average	26.24	66.66	3.21E-03

*11/25/15

**Caving soil during test

Project Name: KAFB Infiltration Testing - Tijerras Arroyo
 Project Number: 66155092

Boring Number: TAPTB-06
 Date of Test: 11/24 and 25/2015

	Δ Time	Water Level	Δ Level	Perc Rate	Perc Rate	Perc Rate
Time	min	ft	in	Min/in	Min/cm	cm/s
9:17:00 AM		1.90	0			
9:18:00 AM	1	2.00	1.20	0.83	2.12	7.87E-03
9:19:00 AM	1	2.08	0.96	1.04	2.65	6.30E-03
9:21:00 AM	2	2.25	2.04	0.98	2.49	6.69E-03
9:23:00 AM	2	2.40	1.80	1.11	2.82	5.91E-03
9:27:00 AM	4	2.65	3.00	1.33	3.39	4.92E-03
9:32:00 AM	5	2.90	3.00	1.67	4.23	3.94E-03
9:37:00 AM	5	3.13	2.76	1.81	4.60	3.62E-03
9:47:00 AM	10	3.25	1.44	6.94	17.64	9.45E-04
10:17:00 AM	30	3.31	0.72	41.67	105.83	1.57E-04
11:17:00 AM	60	3.94	7.56	7.94	20.16	8.27E-04
12:17:00 PM	60	4.18	2.88	20.83	52.92	3.15E-04
1:17:00 PM	60	4.45	3.24	18.52	47.04	3.54E-04
2:17:00 PM	60	4.72	3.24	18.52	47.04	3.54E-04
3:17:00 PM	60	5.05	3.96	15.15	38.48	4.33E-04
4:17:00 PM	60	5.30	3.00	20.00	50.80	3.28E-04
5:17:00 PM	60	5.52	2.64	22.73	57.73	2.89E-04
7:45:00 AM*	868	7.82	27.60	31.45	79.88	2.09E-04
			Average	12.50	31.75	2.56E-03

*11/25/15

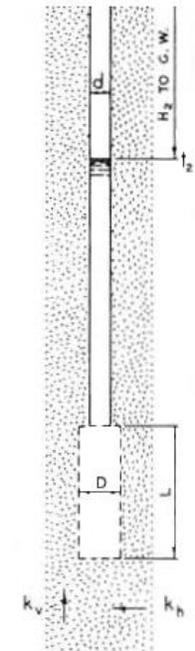
Project Name: KAFB Infiltration Testing - Tijeras Arroyo
 Project Number: 66155092

Boring Number: TAPTB-01
 Date of Test: 11/23/2015

D	d	H1	H2	L	T	m	k_h (cm/s)	k_h (gpd/ft ²)
20.32	7.62	134.7	143.3	152.4	60	1	1.32E-04	2.8
20.32	7.62	143.3	151.5	152.4	60	1	1.20E-04	2.5
20.32	7.62	151.5	160.6	152.4	120	1	6.30E-05	1.3
20.32	7.62	160.6	171.3	152.4	120	1	6.91E-05	1.5
20.32	7.62	171.3	178.3	152.4	120	1	4.31E-05	0.9
20.32	7.62	178.3	185.6	152.4	120	1	4.32E-05	0.9
20.32	7.62	185.6	203.0	152.4	300	1	3.85E-05	0.8
20.32	7.62	203.0	213.1	152.4	300	1	2.08E-05	0.4
20.32	7.62	213.1	222.8	152.4	300	1	1.92E-05	0.4
20.32	7.62	222.8	231.0	152.4	300	1	1.56E-05	0.3
20.32	7.62	231.0	244.1	152.4	600	1	1.19E-05	0.3
20.32	7.62	244.1	254.2	152.4	600	1	8.68E-06	0.2
20.32	7.62	254.2	263.3	152.4	600	1	7.60E-06	0.2
20.32	7.62	263.3	268.5	152.4	600	1	4.19E-06	0.1
20.32	7.62	268.5	273.4	152.4	600	1	3.87E-06	0.1
20.32	7.62	273.4	285.9	152.4	1980	1	2.91E-06	0.1
20.32	7.62	285.9	296.9	152.4	1620	1	3.00E-06	0.1
20.32	7.62	296.9	303.3	152.4	1800	1	1.53E-06	0.0
20.32	20.32	303.3	317.6	138.1	3600	1	1.25E-05	0.3
20.32	20.32	317.6	333.8	121.9	3600	1	1.45E-05	0.3
20.32	20.32	333.8	378.6	77.1	3600	1	4.75E-05	1.0

$$k_h = \frac{d^2 \cdot \ln \left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D} \right)^2} \right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{d^2 \cdot \ln \left(\frac{2mL}{D} \right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \text{ FOR } \frac{mL}{D} > 4$$



WELL POINT - FILTER
 IN UNIFORM
 SOIL

- k_h Horizontal Permeability (cm/s) and (gpd/ft²)
- D Intake Diameter/Diameter of borehole (cm)
- d Standpipe Diameter - Solid PVC Casing Diameter above 5 feet/Borehole Diameter below 5 feet (cm)
- L Intake Length or Slotted PVC Casing Length (cm)
- T Basic Time Lag - Change in time between readings (s)
- m Transformation Ratio (unitless)
- H1 Depth to water level (cm) at time 1
- H2 Depth to water level (cm) at time 2

Note: 3" Diameter PVC Casing installed with Screened Interval From 10-15 Feet

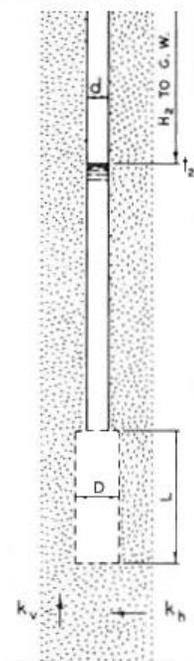
Project Name: KAFB Infiltration Testing - Tijeras Arroyo
 Project Number: 66155092

Boring Number: TAPTB-02
 Date of Test: 11/23/2015

D	d	H1	H2	L	T	m	k_h (cm/s)	k_h (gpd/ft ²)
20.32	7.62	300.7	305.6	152.4	60	1	3.46E-05	0.7
20.32	7.62	305.6	309.9	152.4	60	1	2.98E-05	0.6
20.32	7.62	309.9	314.5	152.4	120	1	1.57E-05	0.3
20.32	7.62	314.5	320.5	152.4	120	1	2.06E-05	0.4
20.32	7.62	320.5	325.7	152.4	120	1	1.72E-05	0.4
20.32	7.62	325.7	337.6	152.4	120	1	3.85E-05	0.8
20.32	7.62	337.6	346.5	152.4	300	1	1.11E-05	0.2
20.32	7.62	346.5	355.3	152.4	300	1	1.08E-05	0.2
20.32	7.62	355.3	366.6	152.4	300	1	1.34E-05	0.3
20.32	7.62	366.6	377.5	152.4	300	1	1.27E-05	0.3
20.32	7.62	377.5	387.6	152.4	600	1	5.65E-06	0.1
20.32	7.62	387.6	410.5	152.4	600	1	1.23E-05	0.3
20.32	7.62	410.5	427.2	152.4	600	1	8.60E-06	0.2
20.32	7.62	427.2	450.7	152.4	600	1	1.15E-05	0.2
20.32	7.62	450.7	483.9	152.4	600	1	1.53E-05	0.3
20.32	20.32	483.9	512.6	119.2	1980	1	3.10E-05	0.7
20.32	20.32	512.6	516.2	115.5	1620	1	4.77E-06	0.1

$$k_h = \frac{d^2 \cdot \ln \left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D} \right)^2} \right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{d^2 \cdot \ln \left(\frac{2mL}{D} \right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \text{ FOR } \frac{mL}{D} > 4$$



- k_h Horizontal Permeability (cm/s) and (gpd/ft²)
- D Intake Diameter/Diameter of borehole (cm)
- d Standpipe Diameter - Solid PVC Casing Diameter above 5 feet/Borehole Diameter below 5 feet (cm)
- L Intake Length or Slotted PVC Casing Length (cm)
- T Basic Time Lag - Change in time between readings (s)
- m Transformation Ratio (unitless)
- H1 Depth to water level (cm) at time 1
- H2 Depth to water level (cm) at time 2

Note: 3" Diameter PVC Casing installed with Screened Interval From 15-20 Feet

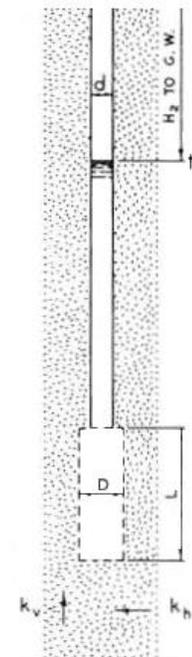
Project Name: KAFB Infiltration Testing - Tijeras Arroyo
 Project Number: 66155092

Boring Number: TAPTB-03
 Date of Test: 11/23 -24/2015

D	d	H1	H2	L	T	m	k_h (cm/s)	k_h (gpd/ft ²)
20.32	7.62	140.6	141.5	152.4	60	1	1.39E-05	0.3
20.32	7.62	141.5	143.6	152.4	60	1	3.22E-05	0.7
20.32	7.62	143.6	147.6	152.4	120	1	2.92E-05	0.6
20.32	7.62	147.6	154.6	152.4	120	1	4.99E-05	1.1
20.32	7.62	154.6	159.5	152.4	120	1	3.34E-05	0.7
20.32	7.62	159.5	160.7	152.4	120	1	8.19E-06	0.2
20.32	7.62	160.7	179.6	152.4	300	1	4.78E-05	1.0
20.32	7.62	179.6	194.8	152.4	300	1	3.50E-05	0.7
20.32	7.62	194.8	213.1	152.4	300	1	3.86E-05	0.8
20.32	7.62	213.1	230.8	152.4	300	1	3.43E-05	0.7
20.32	7.62	230.8	243.6	152.4	600	1	1.16E-05	0.2
20.32	7.62	243.6	255.2	152.4	600	1	9.98E-06	0.2
20.32	7.62	255.2	268.6	152.4	600	1	1.10E-05	0.2
20.32	7.62	268.6	280.8	152.4	600	1	9.54E-06	0.2
20.32	7.62	280.8	294.5	152.4	600	1	1.03E-05	0.2
20.32	20.32	294.5	312.2	134.7	1980	1	2.92E-05	0.6
20.32	20.32	312.2	361.8	85.1	1620	1	1.17E-04	2.5

$$k_h = \frac{d^2 \cdot \ln \left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D} \right)^2} \right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{d^2 \cdot \ln \left(\frac{2mL}{D} \right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \text{ FOR } \frac{mL}{D} > 4$$



WELL POINT - FILTER
 IN UNIFORM
 SOIL

- k_h Horizontal Permeability (cm/s) and (gpd/ft²)
- D** Intake Diameter/Diameter of borehole (cm)
- d** Standpipe Diameter - Solid PVC Casing Diameter above 5 feet/Borehole Diameter below 5 feet (cm)
- L** Intake Length or Slotted PVC Casing Length (cm)
- T** Basic Time Lag - Change in time between readings (s)
- m** Transformation Ratio (unitless)
- H1** Depth to water level (cm) at time 1
- H2** Depth to water level (cm) at time 2

Note: 3" Diameter PVC Casing installed with Screened Interval From 10-15 Feet

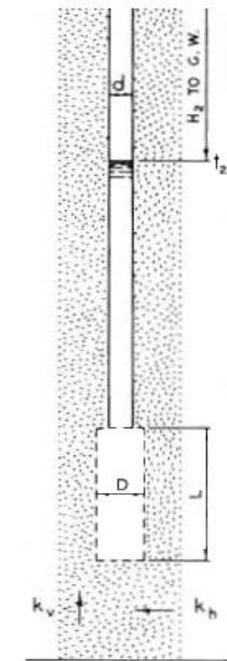
Project Name: KAFB Infiltration Testing - Tijeras Arroyo
 Project Number: 66155092

Boring Number: TAPTB-04
 Date of Test: 11/24 - 25/2015

D	d	H1	H2	L	T	m	k_h (cm/s)	k_h (gpd/ft ²)
20.32	7.62	145.7	163.4	152.4	60	1	2.46E-04	5.2
20.32	7.62	163.4	166.7	152.4	60	1	4.37E-05	0.9
20.32	7.62	166.7	168.6	152.4	120	1	1.17E-05	0.2
20.32	7.62	168.6	169.8	152.4	120	1	7.75E-06	0.2
20.32	7.62	169.8	171.6	152.4	120	1	1.15E-05	0.2
20.32	7.62	171.6	172.5	152.4	120	1	5.71E-06	0.1
* 20.32	7.62	172.5	162.5	152.4	300	1	-2.58E-05	-0.5
20.32	7.62	162.5	172.8	152.4	300	1	2.66E-05	0.6
20.32	7.62	172.8	176.2	152.4	300	1	8.26E-06	0.2
20.32	7.62	176.2	179.8	152.4	300	1	8.83E-06	0.2
20.32	7.62	179.8	189.0	152.4	600	1	1.07E-05	0.2
20.32	7.62	189.0	206.7	152.4	600	1	1.92E-05	0.4
20.32	7.62	206.7	221.9	152.4	600	1	1.53E-05	0.3
20.32	7.62	221.9	223.4	152.4	600	1	1.47E-06	0.0
20.32	7.62	223.4	233.2	152.4	600	1	9.18E-06	0.2
20.32	7.62	233.2	239.3	152.4	1980	1	1.68E-06	0.0
20.32	7.62	239.3	253.0	152.4	1620	1	4.44E-06	0.1
* 20.32	7.62	253.0	250.2	152.4	1800	1	-7.81E-07	0.0
20.32	7.62	250.2	251.5	152.4	3600	1	1.74E-07	0.0
20.32	7.62	251.5	260.3	152.4	3600	1	1.24E-06	0.0

$$k_h = \frac{d^2 \cdot \ln \left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D} \right)^2} \right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{d^2 \cdot \ln \left(\frac{2mL}{D} \right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \text{ FOR } \frac{mL}{D} > 4$$



WELL POINT - FILTER
 IN UNIFORM
 SOIL

* Caving Soil During Test

- k_h Horizontal Permeability (cm/s) and (gpd/ft²)
- D Intake Diameter/Diameter of borehole (cm)
- d Standpipe Diameter - Solid PVC Casing Diameter above 5 feet/Borehole Diameter below 5 feet (cm)
- L Intake Length or Slotted PVC Casing Length (cm)
- T Basic Time Lag - Change in time between readings (s)
- m Transformation Ratio (unitless)
- H1 Depth to water level (cm) at time 1
- H2 Depth to water level (cm) at time 2

Note: 3" Diameter PVC Casing installed with Screened Interval From 10-15 Feet

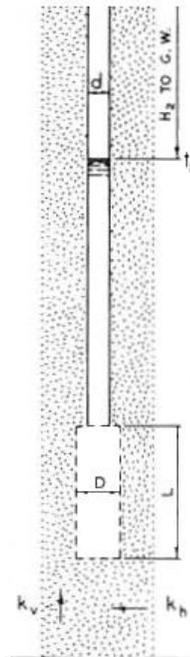
Project Name: KAFB Infiltration Testing - Tijeras Arroyo
 Project Number: 66155092

Boring Number: TAPT-05
 Date of Test: 11/24/2015

D	d	H1	H2	L	T	m	k_h (cm/s)	k_h (gpd/ft ²)
20.32	7.62	290.8	293.5	152.4	60	1	2.02E-05	0.4
20.32	7.62	293.5	295.4	152.4	60	1	1.34E-05	0.3
20.32	7.62	295.4	298.7	152.4	120	1	1.21E-05	0.3
20.32	7.62	298.7	302.4	152.4	120	1	1.31E-05	0.3
20.32	7.62	302.4	309.7	152.4	120	1	2.57E-05	0.5
20.32	7.62	309.7	315.2	152.4	120	1	1.89E-05	0.4
20.32	7.62	315.2	320.7	152.4	300	1	7.42E-06	0.2
20.32	7.62	320.7	330.7	152.4	300	1	1.33E-05	0.3
20.32	7.62	330.7	355.7	152.4	300	1	3.13E-05	0.7
20.32	7.62	355.7	372.8	152.4	300	1	2.01E-05	0.4
20.32	7.62	372.8	399.9	152.4	600	1	1.51E-05	0.3
20.32	7.62	399.9	419.4	152.4	600	1	1.02E-05	0.2
20.32	7.62	419.4	431.0	152.4	600	1	5.86E-06	0.1
20.32	7.62	431.0	440.7	152.4	600	1	4.81E-06	0.1
20.32	7.62	440.7	453.5	152.4	600	1	6.15E-06	0.1
20.32	20.32	453.5	488.3	117.7	1980	1	4.01E-05	0.9
20.32	20.32	488.3	506.9	99.1	1620	1	2.74E-05	0.6

$$k_h = \frac{d^2 \cdot \ln \left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D} \right)^2} \right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{d^2 \cdot \ln \left(\frac{2mL}{D} \right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \text{ FOR } \frac{mL}{D} > 4$$



WELL POINT-FILTER
 IN UNIFORM
 SOIL

- k_h Horizontal Permeability (cm/s) and (gpd/ft²)
- D Intake Diameter/Diameter of borehole (cm)
- d Standpipe Diameter - Solid PVC Casing Diameter above 5 feet/Borehole Diameter below 5 feet (cm)
- L Intake Length or Slotted PVC Casing Length (cm)
- T Basic Time Lag - Change in time between readings (s)
- m Transformation Ratio (unitless)
- H1 Depth to water level (cm) at time 1
- H2 Depth to water level (cm) at time 2

Note: 3" Diameter PVC Casing installed with Screened Interval From 15-20 Feet

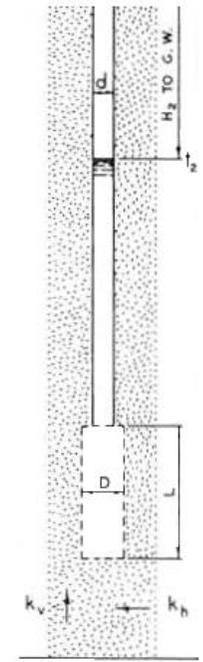
Project Name: KAFB Infiltration Testing - Tijeras Arroyo
 Project Number: 66155092

Boring Number: TAPT8-06
 Date of Test: 11/24 -25/2015

D	d	H1	H2	L	T	m	k_h (cm/s)	k_h (gpd/ft ²)
20.32	7.62	29.9	32.9	152.4	60	1	2.09E-04	4.4
20.32	7.62	32.9	35.4	152.4	60	1	1.54E-04	3.3
20.32	7.62	35.4	40.5	152.4	120	1	1.47E-04	3.1
20.32	7.62	40.5	45.1	152.4	120	1	1.15E-04	2.4
20.32	7.62	45.1	52.7	152.4	120	1	1.68E-04	3.6
20.32	7.62	52.7	60.4	152.4	120	1	1.45E-04	3.1
20.32	7.62	60.4	67.4	152.4	300	1	4.72E-05	1.0
20.32	7.62	67.4	71.0	152.4	300	1	2.27E-05	0.5
20.32	7.62	71.0	72.8	152.4	300	1	1.09E-05	0.2
20.32	7.62	72.8	92.1	152.4	300	1	1.01E-04	2.1
20.32	7.62	92.1	99.4	152.4	600	1	1.64E-05	0.3
20.32	7.62	99.4	107.6	152.4	600	1	1.71E-05	0.4
20.32	7.62	107.6	115.8	152.4	600	1	1.58E-05	0.3
20.32	7.62	115.8	125.9	152.4	600	1	1.79E-05	0.4
20.32	7.62	125.9	133.5	152.4	600	1	1.26E-05	0.3
20.32	7.62	133.5	140.2	152.4	1980	1	3.19E-06	0.1
20.32	7.62	140.2	210.3	152.4	1620	1	3.23E-05	0.7

$$k_h = \frac{d^2 \cdot \ln \left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D} \right)^2} \right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{d^2 \cdot \ln \left(\frac{2mL}{D} \right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \text{ FOR } \frac{mL}{D} > 4$$



WELL POINT-FILTER
 IN UNIFORM
 SOIL

- k_h Horizontal Permeability (cm/s) and (gpd/ft²)
- D** Intake Diameter/Diameter of borehole (cm)
- d** Standpipe Diameter - Solid PVC Casing Diameter above 5 feet/Borehole Diameter below 5 feet (cm)
- L** Intake Length or Slotted PVC Casing Length (cm)
- T** Basic Time Lag - Change in time between readings (s)
- m** Transformation Ratio (unitless)
- H1** Depth to water level (cm) at time 1
- H2** Depth to water level (cm) at time 2

Note: 3" Diameter PVC Casing installed with Screened Interval From 7-12 Feet

