Geotechnical Data Report

Dallas CBD Second Light Rail Alignment - DART D-2

Dallas, Texas

August 27, 2019

This Report was Prepared for DART
General Planning Consultant Six Managed by HDR/HNTB

Document Revision Record

Project Name: DART D-2	**AGG Report Number:** E17-0811R1
Project Manager: Click here to enter text.	**PIC:** Click here to enter text.

Revision Number: 1	**Date:** August 27, 2019
Version 1	*Date: Click here to enter text.*
Version 2	*Date: Click here to enter text.*

Originator	
Name: Samuel Tran, P.E.	**Firm: Alliance Geotechnical Group**
Title: Project Engineer	**Date: August 27, 2019**

Commentors		
Name: Click here to enter text. **Firm:** Click here to enter text. **Date:** Click here to enter text.	**Name:** Click here to enter text. **Firm:** Click here to enter text. **Date:** Click here to enter text.	**Name:** Click here to enter text. **Firm:** Click here to enter text. **Date:** Click here to enter text.
Name: Click here to enter text. **Firm:** Click here to enter text. **Date:** Click here to enter text.	**Name:** Click here to enter text. **Firm:** Click here to enter text. **Date:** Click here to enter text.	**Name:** Click here to enter text. **Firm:** Click here to enter text. **Date:** Click here to enter text.

Approval	
Task Manager: Click here to enter text.	**Date:** Click here to enter text.
Verified/Approved By: Click here to enter text.	**Date:** Click here to enter text.

Distribution		
Name: Click here to enter text.	**Title:** Click here to enter text.	**Firm:** Click here to enter text.
Name: Click here to enter text.	**Title:** Click here to enter text.	**Firm:** Click here to enter text.

CONTENTS

1 INTRODUCTION 1

1.1 PROJECT INFORMATION 1

2 SCOPE OF INVESTIGATION 5

3 FIELD OPERATIONS 5

4 LABORATORY TESTING 6

5 SURFACE CONDITIONS 9

5.1 SITE GEOLOGY 9

5.2 SUBSURFACE CONDITIONS 10

5.3 GROUNDWATER 11

6 LIMITATIONS 11

TABLES

TABLE 1 – BORING SUMMARY FOR B4 LAMAR-YOUNG ALIGNMENT 1

TABLE 2 - DEPTH SUMMARY OF BORINGS FOR ALTERNATIVE ANALYSES 2

TABLE 3 – DEPTH SUMMARY OF BORINGS ALONG GRIFFIN ST, ELM ST & COMMERCE ST 4

TABLE 4 – LABORATORY TESTS AND TESTING STANDARDS PERFORMED ON OVERBURDEN SOILS 7

TABLE 5 – LABORATORY TESTS AND TESTING STANDARDS PERFORMED ON ROCK CORE SAMPLES 8

TABLE 6 – STRATA DEPTH SUMMARY FOR ALL BORINGS 10

APPENDICES

PLANS OF BORINGS ----------A-1 THRU A-6

BORING LOGS----------B-1 THRU B-3

LAMAR-YOUNG ALIGNMENT BORING LOGS (2016)---------- B-1

GRIFFIN-ELM-COMMERCE ALIGNMENT PRELIMINARY BORING LOGS (2017) ----- B-2

GRIFFIN-ELM-COMMERCE ALIGNMENT BORING LOGS (2017-2019) ---------- B-3

DISCONTINUITY LOGS ---------- C

ROCK CORE PHOTOS ---------- D

OVERBURDEN SOIL LAB TEST RESULTS ---------- E

CONSOLIDATION TEST ----------E-1

CONSOLIDATED UNDRAINED TRIAXIAL TEST ----------E-2

COROSSIVITY TEST ----------E-3

DIRECT SHEAR TEST ----------E-4

SIEVE ANALYSIS & HYDROMETER TESTS ----------E-5

SPECIFIC GRAVITY ----------E-6

SWELL TEST – METHOD A, B & C ----------E-7

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST ----------E-8

ORGANIC CONTENT TEST----------E-9

APPENDICES (CONT.)

ROCK CORE LAB TEST RESULTS ---------- F

ABRASIVENESS OF ROCK USING CERCHAR METHOD ---------- F-1

AXIAL SWELLING TEST ---------- F-2

DIRECT SHEAR TEST ---------- F-3

DRILLABILITY INDICES ---------- F-4

POINT LOAD STRENGTH INDEX OF ROCK ---------- F-5

PUNCH PENETRATION TEST ---------- F-6

PULSE VELOCITY AND DYNAMIC ELASTIC CONSTANTS ---------- F-7

SCHMIDT HAMMER REBOUND HARDNESS ---------- F-8

SLAKE DURABILITY ---------- F-9

SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE ---------- F-10

THIN SECTION PETROGRAPHIC ANALYSIS ---------- F-11

TRIAXIAL COMPRESSIVE STRENGTH – METHOD A ---------- F-12

UNCONFINED COMPRESSSIVE STRENGTH WITH MODULI – METHOD D ---------- F-13

UNCONFINED COMPRESSIVE STRENGTH WITHOUT MODULI – METHOD C ---------- F-14

UNIT WEIGHT & DIMENSIONAL /SHAPE TOLERANCES OF SPECIMENS ---------- F-15

UNIT WEIGHT, POROSITY, AND SPECIFIC GRAVITY ---------- F-16

GEOLOGICAL FORMATION LIMITS WITH BORING LAYOUT ---------- G

WATER LEVEL READINGS & PIEZOMETER REPORTS ---------- H

1 INTRODUCTION

The Dallas Central Business District (CBD) Second Light Rail Alignment is DART's second phase in evaluating transit improvements through Downtown Dallas known as DART D-2. Alignment alternative analyses for DART D-2 begin in 2007 and extended to September of 2015 where DART Board of Directors passed a resolution selecting the Locally Preferred Alternative (LPA) Lamar-Young with a modified Jackson alignment.

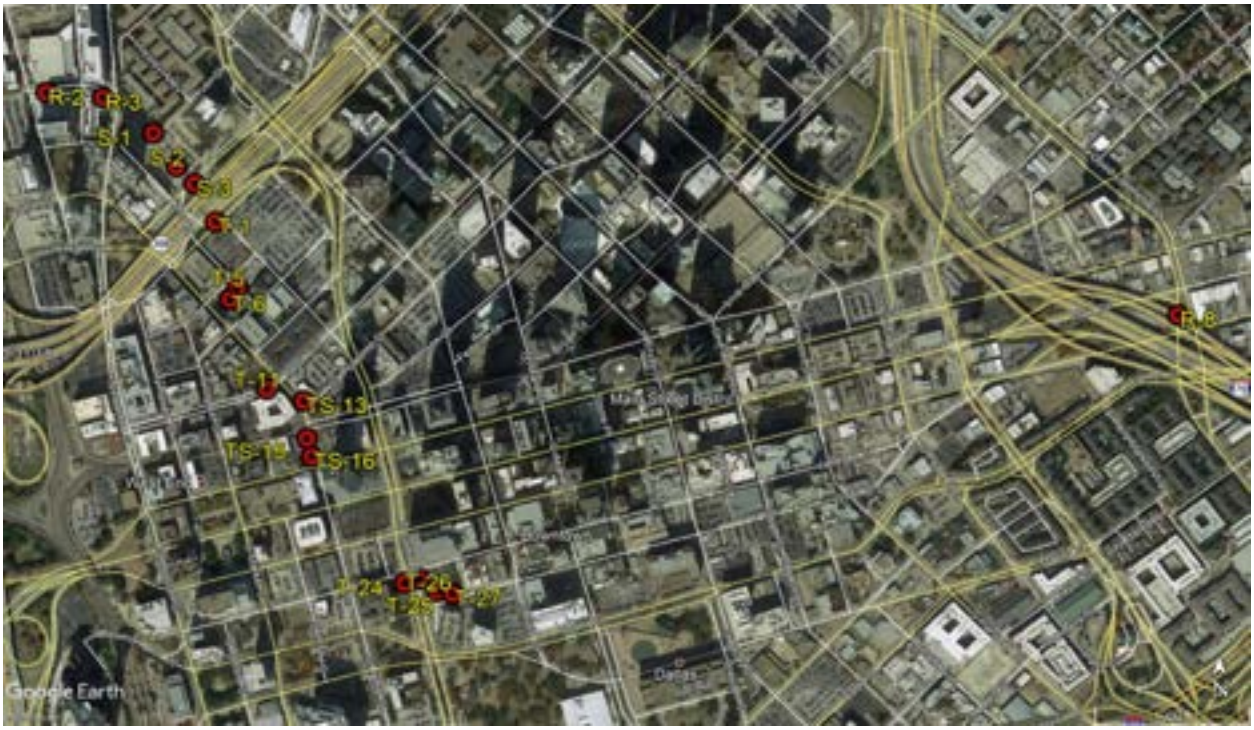
1.1 Project Information

The geotechnical exploration efforts for the Lamar-Young Alignment begin in February of 2016. The exploration efforts prior to the drilling operation consisted of staking the boring locations, performing the utility clearance with franchise locators and municipal locators, developing traffic control plans, submitting traffic control permits and submitting the City of Dallas Right of Way permits. A total of sixty-six (66) borings were proposed for the Lamar-Young alignment. These test borings were designated as "R," "S," "T" and "TS" for the at-grade rail alignment, at-grade station area, tunnel alignment and tunnel station area, respectively. As directed by the client, a total of seventeen (17) test borings were completed as listed in Table 1. See Aerial 1 for the locations of the drilled test borings for the Lamar-Young Alignment. Deep piezometers were installed in Borings T-1 and T-11 with flush mounts installed at grade.

TABLE 1 – BORING SUMMARY FOR B4 LAMAR-YOUNG ALIGNMENT

BORING ID	TERMINATED DEPTH
R-2	50 feet
R-3	50 feet
S-1	80 feet
S-2	80 feet
S-3	120 feet
T-1	120 feet
T-5	120 feet
T-6	120 feet
T-11	120 feet
TS-13	120 feet
TS-15	121 feet
TS-16	120 feet
T-24	120 feet
T-25	120 feet
T-26	120 feet
T-27	120 feet
R-8	33 feet

AERIAL 1 – AS-DRILLED BORINGS FOR LAMAR-YOUNG ALIGNMENT



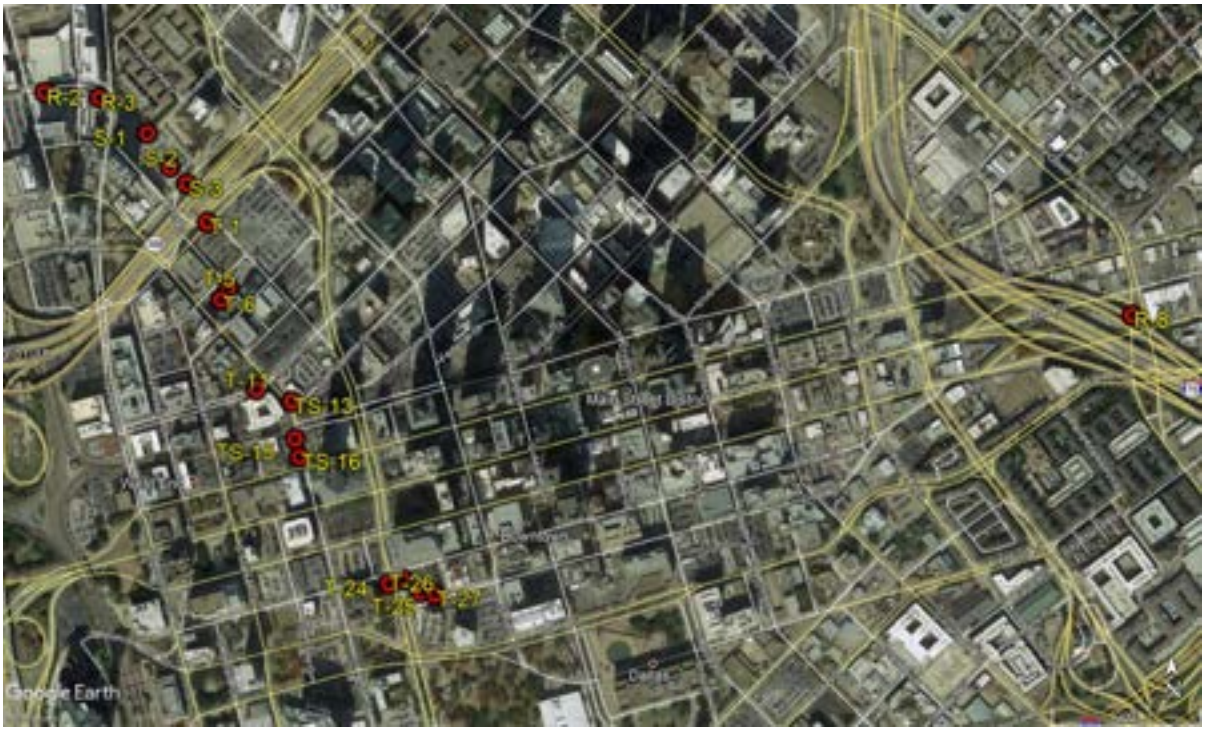
Majority of the remaining borings were either omitted or placed on indefinite hold due to these test borings having utility conflicts, located within private property, located above parking basement/pedestrian tunnel, and due to pending alignment selection by DART at the east end of the alignment. In the midst of the exploration around July of 2016, the preferred alignment was suggested to shift from Lamar Street to Griffin Street. Three (3) "G" borings were proposed along Griffin Street near the Pacific Ave intersection, Elm St intersection and Main Street intersection. The utility clearance efforts were performed for these borings, but the geotechnical efforts were suspended until the preferred alignment was confirmed with DART.

In January of 2017, five (5) test borings (designated as B-1 thru B-5) were proposed along North Field Street, North Griffin Street, Elm St and Lane St to provide geotechnical data to assist the Design Team in analyzing alternative alignments for DART D-2. See Aerial 2 for the location of the drilled test borings for the alternative analyses. See Table 2 for the depth summary of these test borings.

TABLE 2 – DEPTH SUMMARY OF BORINGS FOR ALTERNATIVE ANALYSES

BORING ID	TERMINATED DEPTH
B-1	121 feet
B-2	120 feet
B-3	120 feet
B-4	120 feet
B-5	120.5 feet

AERIAL 2 – AS-DRILLED BORINGS FOR ALTERNATIVE ANALYSIS



In August of 2017, additional geotechnical exploration was proposed to be performed along Griffin Street, Elm Street and Commerce Street. Twenty-two (22) test borings were proposed for these proposed alternative alignments. Sixteen (16) of the borings were completed as listed in Table 3. See Aerial 3 for the location of the drilled test borings for these proposed alternative alignments. These borings were designated as "P," "T" and "TS" for the portal area, tunnel alignment and tunnel station area, respectively. A total of 14 piezometers were installed during this phase. Seven (7) deep piezometers were installed in the TS-Borings upon drilling completion. Then an additional shallow piezometer was installed a few feet from each of the seven (7) TS-Borings. See Section 5.3 of this report. Flush mounts were installed at grade for all the piezometers.

Five (5) of the remaining test borings (T-105 thru T-109) were along Elm St and were eliminated from the boring program due to the preference of the Commerce alignment. The last remaining boring (P-101) is located in a private parking lot and permission to access was not granted.

TABLE 3 – DEPTH SUMMARY OF BORINGS ALONG GRIFFIN ST, ELM ST & COMMERCE ST

BORING ID	TERMINATED DEPTH
T-102	121 feet
T-103	121 feet
TS-104	120 feet
T-201	120 feet
TS-202	121 feet
T-203	120 feet
T-204	120 feet
T-205	122 feet
TS-206	121 feet
TS-207	120 feet
TS-208	120 feet
TS-209	120 feet
T-110	121 feet
TS-111	120 feet
T-112	121 feet
P-102	121 feet

AERIAL 3 – AS-DRILLED BORINGS ALONG GRIFFIN ST, ELM ST & COMMERCE ST

The information presented in this report reflects the geotechnical exploration and laboratory testing performed to date. The field exploration included in this data report was completed by February 28, 2019. See Aerial 4 for all the borings that have been drilled for this DART D-2 project to date.

AERIAL 4 – ALL AS-DRILLED BORINGS TO DATE FOR DART D-2

2 SCOPE OF INVESTIGATION

The purposes of the exploration were to: 1) explore the subsurface conditions at the site, 2) characterize the subsurface conditions by testing the physical and engineering properties of the underlying soil and rock strata and by observing groundwater conditions and 3) evaluate the pertinent engineering properties of the subsurface materials. This report was prepared in general accordance with Contract No. C-2012668-02 Task Order 28.

3 FIELD OPERATIONS

The field exploration consisted of drilling a total of thirty-eight (38) test borings. The test borings were sampled continuously to 10 feet and every 5 feet thereafter until rock was encountered. CME-55 and CME-75 truck-mounted drilling rigs were used to advance the test borings. Hollow stem augers were used to advance the test borings to the top of rock. Undisturbed specimens of the cohesive soils were obtained using standard, thin-walled, seamless tube samplers. These specimens were extruded in the field, logged, sealed, and packaged in plastic sample bags to protect them from disturbance and maintain their in-situ moisture content during transportation to our laboratory.

Foundation bearing properties of the granular soil was evaluated by the Standard Penetration Test in conjunction with split spoon sampling. The Standard Penetration Test involves driving a standard 2 inch diameter sampler a total of 18 inches and recording the blow counts and driving distances for each 6 inch or 50 blow increment. The first 6 inch drive is for seating purposes. The results of the Standard Penetration Test is recorded at the respective testing depths on the Logs of Borings.

Foundation bearing properties of the rock encountered in the borings were evaluated by the Texas Department of Transportation Penetrometer (TxDOT Cone) test. The TxDOT Cone test consists of driving a 3-inch diameter cone with the resulting penetration in inches recorded for two successive intervals of 50 blows. The TxDOT Penetrometer test was performed at the top of rock. The results of the TxDOT Penetrometer test are recorded at the respective testing depths on the Logs of Borings.

Wet rotary drilling method was used to continuously core the rock. The core runs were retrieved in in 5-foot and 10-foot intervals. A logger was present on site to log the rock cores, record the recovery, record the RQD and stored the rock cores in wooden core boxes. The rock cores were wrapped with saran wrap prior to storing into the wooden core boxes.

Upon drilling completion, the test borings were grouted to the surface with the exception of the borings that required piezometers to be installed within the bore holes. The boring location plans, boring logs, and key to the descriptive terms and symbols used on the logs are provided in Appendix A of this report.

4 LABORATORY TESTING

The soil samples, rock cores and boring logs were reviewed at our laboratory by the project geotechnical engineer and/or by a geologist. Upon review completion, the boring logs were submitted to the Design Team and laboratory testing programs were developed and the laboratory assignments were provided to AGG.

The overburden soil was subjected to various classification tests, strength tests, compressibility tests, swell tests and corrosivity tests as assigned by the Design Team. See Table 4 for the list of laboratory tests and its respective testing standards performed on the overburden samples. Results of these tests are provided in the Boring Logs and Appendix E-1 thru E-11 to this data report. See Table 5 for the list of laboratory tests and its respective testing standards performed on the rock core samples. Results of these tests are provided in Appendix F-1 thru F-13 to this data report.

TABLE 4 – LABORATORY TESTS AND TESTING STANDARDS PERFORMED ON OVERBURDEN SOILS

Types of Laboratory Tests	Laboratory Test	Testing Procedure	Location of Test Results
Classification Tests	Atterberg Limits	ASTM D4318	Appendix B Boring Logs
	Density (unit weight)	ASTM D7263	Appendix B Boring Logs
	Grain-size distribution by hydrometer	ASTM D7928	Appendix E-5
	Grain-size distribution by sieve analysis	ASTM D6913	
	Specific Gravity	ASTM D854	Appendix E-6
	Water Content Determination	ASTM D2216	Appendix B Boring Logs
	Organic Content	ASTM D2974	Appendix E-9
Strength, Compressibility and Swell Tests	Consolidation Testing loading up to 32 tsf with reload cycle	ASTM D2435	Appendix E-1
	Direct Shear (with residual cycles) 3-point and 5 residual cycles	ASTM D3080	Appendix E-4
	One-Dimensional Swell Test	ASTM D 4546-A	Appendix E-7
	One-Dimensional Swell Test	ASTM D 4546-B	
	Swell of Cohesive Soil (Free swell)	ASTM D4546-C	
	Triaxial Compression - Consolidated Drained (CD)	ASTM D7181	N/A*
	Triaxial Compression - Consolidated Isotropic Undrained (CIU) 3-points	ASTM D4767	Appendix E-2
	Triaxial Compression - Unconsolidated Undrained (UU) 1-point	ASTM D2850	Appendix E-8
	Unconfined Compressive Strength of Cohesive Soil	ASTM D2166	Appendix B Boring Logs
Corrosivity Tests	Chloride Content, Sulfide Content, Water Soluble Sulfate Ion	SM4500-CI-B SW-846 9038 TEX145-E	Appendix E-3
	Determination of pH	TEX 128-E & EPA 9045C	
	Electrical Resistivity	AASHTO T-288	

Consolidated Drained Triaxial Compressive Tests were assigned but all of the samples were untestable.

TABLE 5 – LABORATORY TESTS AND TESTING STANDARDS PERFORMED ON ROCK CORE SAMPLES

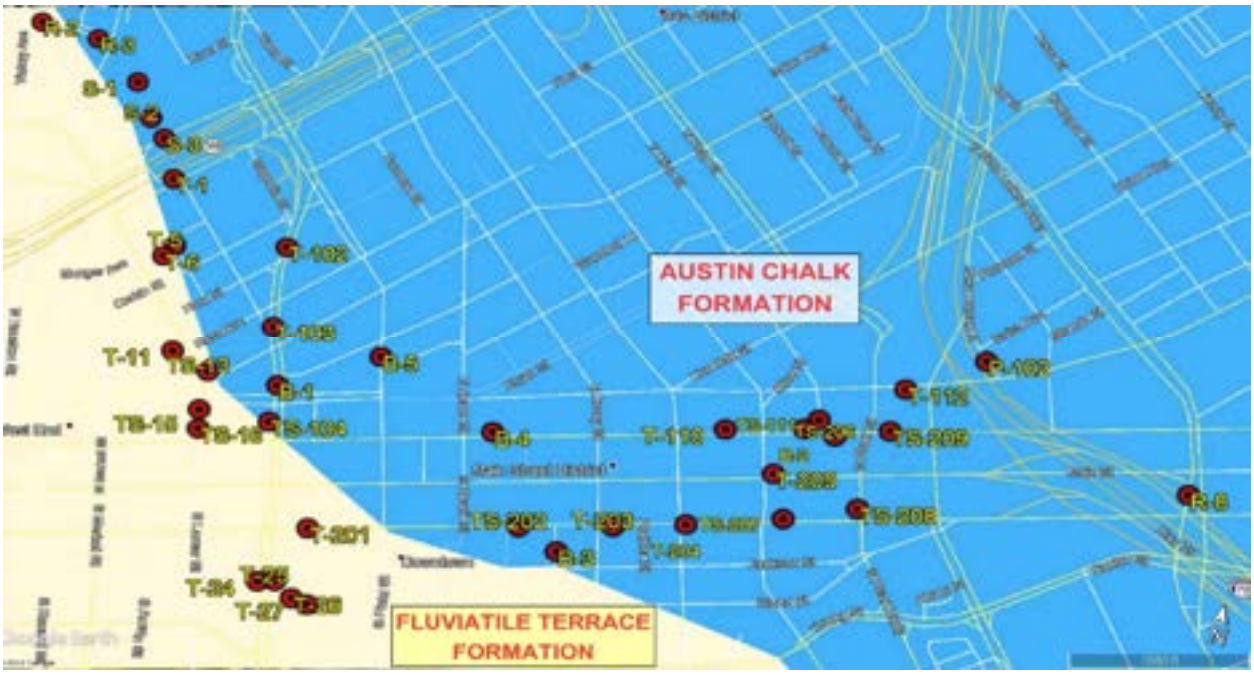
Laboratory Test	Testing Standard	Location of Test Results
Abrasiveness of Rock using the Cerchar Method	ASTM D7625	Appendix F-1
Axial Swelling Test	ISRM	Appendix F-2
Direct Shear Test (3 normal loads)	ASTM D5607	Appendix F-3
Drillability Indices	NTNU 13A-98 DRILLABILITY Test Methods	Appendix F-4
Point Load Strength Index of Rock	ASTM D5731	Appendix F-5
Punch Penetration Test	Handewith Method	Appendix F-6
Pulse Velocity and Dynamic Elastic Constants	ASTM D2845	Appendix F-7
Schmidt Hammer Rebound Hardness	ASTM D5873	Appendix F-8
Slake Durability	ASTM D4644	Appendix F-9
Splitting Tensile Strength of Intact Rock Core	ASTM D3967	Appendix 10
Thin Section Petrographic Analysis	ISRM	Appendix F-11
Triaxial Compressive Strength (3 points)	ASTM D7012-A	Appendix F-12
Unconfined Compressive Strength with moduli	ASTM D7012-D	Appendix F-13
Unconfined Compressive Strength without moduli	ASTM D7012-C	Appendix F-14
Unit weight & dimensional/ shape tolerances of specimens	ASTM D4543	Appendix F-15
Unit Weight, Porosity, and Specific Gravity	ISRM	Appendix F-16

5 SURFACE CONDITIONS

5.1 Site Geology

As shown on the Dallas Sheet of the Geologic Atlas of Texas, the site is located in an area underlain by Terrace deposits over the Austin Chalk Limestone formation and Eagle Ford formation. Fluviatile Terrace is Quaternary Age deposits consisting of gravel, sand, silt and clay. The Austin Chalk formation typically consists of limestone with interbedded layers of clay. The underlying Eagle Ford Formation typically consists of shale strata. Soils derived from the Austin Chalk and Eagle Ford formations are typically plastic clays exhibiting a moderate to high shrink/swell potential with variations in moisture content. The Eagle Ford shaley clay soils typically have very high soluble sulfate levels. See Aerial 5 for the approximated limits of the geological formation along the locations of the test borings that have been drilled to date.

AERIAL 5 – APPROXIMATED GEOLOGICAL FORMATION ALONG DART D-2 ALIGNMENT



The limits of the Austin Chalk formation is highlighted in baby blue. The limits of the Fluviatile Terrace deposits are highlighted in yellow. The Fluviatile Terrace deposits overlain the Austin Chalk formation. The Eagle Ford formation underlain the Austin Chalk formation, hence it's not visible in Aerial 5. As shown in Table 6, the Eagle Ford Shale was present below the Austin Chalk Limestone at majority of the test borings along the west end of the proposed alignments.

5.2 SUBSURFACE CONDITIONS

Subsurface conditions encountered in the boring, including descriptions of the various strata and their depths and thicknesses, are presented on the Logs of Borings. Note that depth on the borings refers to the depth from the existing grade or ground surface present at the time of the investigation. Boundaries between the various soil types are approximate. See Table 6 for a summary of the approximate depths to the bottom of the respective geological formation within each drilled borings.

TABLE 6 – STRATA DEPTH SUMMARY FOR ALL BORINGS

Boring ID	Alignment	Boring Elevation	Austin Chalk/Terrace Deposits		Austin Chalk Formation				Eagle Ford Formation	
			Overburden		Weathered Rock		Unweathered Rock		Unweathered Rock	
			Bottom Depth of Formation	Bottom Elevation of Formation	Bottom Depth of Formation	Bottom Elevation of Formation	Bottom Depth of Formation	Bottom Elevation of Formation	Bottom Depth of Formation	Bottom Elevation of Formation
R-2	Lamar & Griffin	412.44	50	362.44						
R-3	Lamar & Griffin	417.62	7	410.62	25	392.62	39	378.62	50	367.62
S-1	Lamar & Griffin	422.70	13	409.70	18	404.70	47	375.70	80	342.70
S-2	Lamar & Griffin	427.14	18.5	408.64	20	407.14	46	381.14	80	347.14
S-3	Lamar & Griffin	428.61	18	410.61	20	408.61	47	381.61	120	308.61
T-1	Lamar & Griffin	431.15	23	408.15	25	406.15	56.5	374.65	120	311.15
T-5	Lamar	429.97	21.5	408.47	24	405.97	51	378.97	120	309.97
T-6	Lamar	430.93	23	407.93	25	405.93	52	378.93	120	310.93
T-11	Lamar	429.66	21	408.66	24	405.66	53	376.66	120	309.66
TS-13	Lamar	430.28	23.5	406.78	25	405.28	56.5	373.78	120	310.28
TS-15	Lamar	429.29	23	406.29	25	404.29	57	372.29	120	309.29
TS-16	Lamar	430.18	21	409.18	25	405.18	56	374.18	120	310.18
T-24	Lamar	422.86	19	403.86	20	402.86	59	363.86	120	302.86
T-25	Lamar	423.60	19	404.60	20	403.60	62.5	361.10	120	303.60
T-26	Lamar	424.36	24	400.36	25	399.36	64	360.36	120	304.36
T-27	Lamar	425.12	20	405.12	N/A		66	359.12	120	305.12
T-102	Griffin	427.65	22.5	405.15	25	402.65	56.5	371.15	121	306.65
T-103	Griffin	429.39	23	406.39	N/A		65.5	363.89	121	308.39
B-1	Griffin	428.44	25	403.44	29	399.44	66	362.44	120	308.44
TS-104	Griffin	427.71	22.5	405.21	25	402.71	61.5	366.21	120	307.71
T-201	Griffin & Commerce	422.60	18.5	404.10	21	401.60	65	357.60	120	302.60
TS-202	Griffin & Commerce	432.67	13.5	419.17	16	416.67	92.5	340.17	121	311.67
B-3	Griffin & Commerce	435.23	17	418.23	20	415.23	97	338.23	120	315.23
T-203	Griffin & Commerce	438.43	6	432.43	10	428.43	103.5	334.93	120	318.43
T-204	Griffin & Commerce	448.77	9	439.77	14	434.77	120	328.77		
TS-207	Griffin & Commerce	458.50	28.5	430.00	38	420.50	120	338.50		
T-205	Griffin & Commerce	461.02	29.5	431.52	40	421.02	122	339.02		
TS-208	Griffin & Commerce	456.99	10	446.99	15	441.99	120	336.99		
TS-209	Griffin & Commerce	461.17	38	423.17	40	421.17	120	341.17		
T-112	Griffin & Commerce	467.46	28.5	438.96	34.5	432.96	121	346.46		
P-102	Griffin & Commerce	469.61	15	454.61	22.5	447.11	121	348.61		
B-5	Griffin & Elm	433.39	30.5	402.89	35.5	397.89	75.5	357.89	120.5	312.89
B-4	Griffin & Elm	435.05	2	433.05	6	429.05	97	338.05	120	315.05
T-110	Griffin & Elm	464.25	27.5	436.75	31	433.25	121	343.25		
B-2	Griffin & Elm	465.52	35.5	430.02	40	425.52	120	345.52	121	344.52
TS-111	Griffin & Elm	464.79	41.5	423.29	45	419.79	120	344.79		
TS-206	Griffin & Elm	463.73	29.5	434.23	33	430.73	121	342.73		
R-8		464.91	15	449.91	22.5	442.41	33	431.91		

NOTE: See the Boring Logs in Appendix B-1 thru B-3 to review the depths and elevations listed above.

5.3 Groundwater

The borings were advanced with continuous flight auger and hollow stem augers. This method allows relatively accurate groundwater observations to be made while drilling. Groundwater was encountered at various depths during drilling. See the boring logs in Appendix A for the depths of the groundwater table. The subsurface water conditions are subject to change with variations in climatic conditions and are also functions of subsurface soil conditions and rainfall.

In order to obtain water level readings over time, piezometers were installed along the proposed alignment. A total of nine (9) deep piezometers were installed along the alignment at the proposed tunnel stations. Piezometers were installed at the following borings: T-1, T-11, TS-104, TS-202, TS-206, TS-207, TS-208, TS-209 and TS-111. The deep piezometers consisted of installing a 10-foot screen at the transition of the Austin Chalk formation to the Eagle Ford formation. The 10-foot screen was installed at the bottom of the bore hole if the Eagle Ford formation was not encountered within the borehole. In addition to these deep piezometers, a total of seven (7) shallow piezometers were installed along the alignment; one adjacent to each of the following borings: TS-104, TS-202, TS-206, TS-207, TS-208, TS-209 and TS-111. These shallow piezometers consisted of installing a 10-foot screen at the transition of the overburden soils to the Austin Chalk formation. See Appendix H for the summary of the water readings and piezometer reports.

6 LIMITATIONS

The professional services that have been performed and the findings obtained were accomplished in accordance with currently accepted geotechnical engineering principles and practices. The possibility always exists that the subsurface conditions at the site may vary somewhat from those encountered in the boreholes. The number and spacing of test borings were selected by the Design Team in such a manner as to decrease the possibility of undiscovered abnormalities, while considering the nature of loading, size, and cost of the project. If there are any unusual conditions differing significantly from those described herein, Alliance Geotechnical Group should be notified.

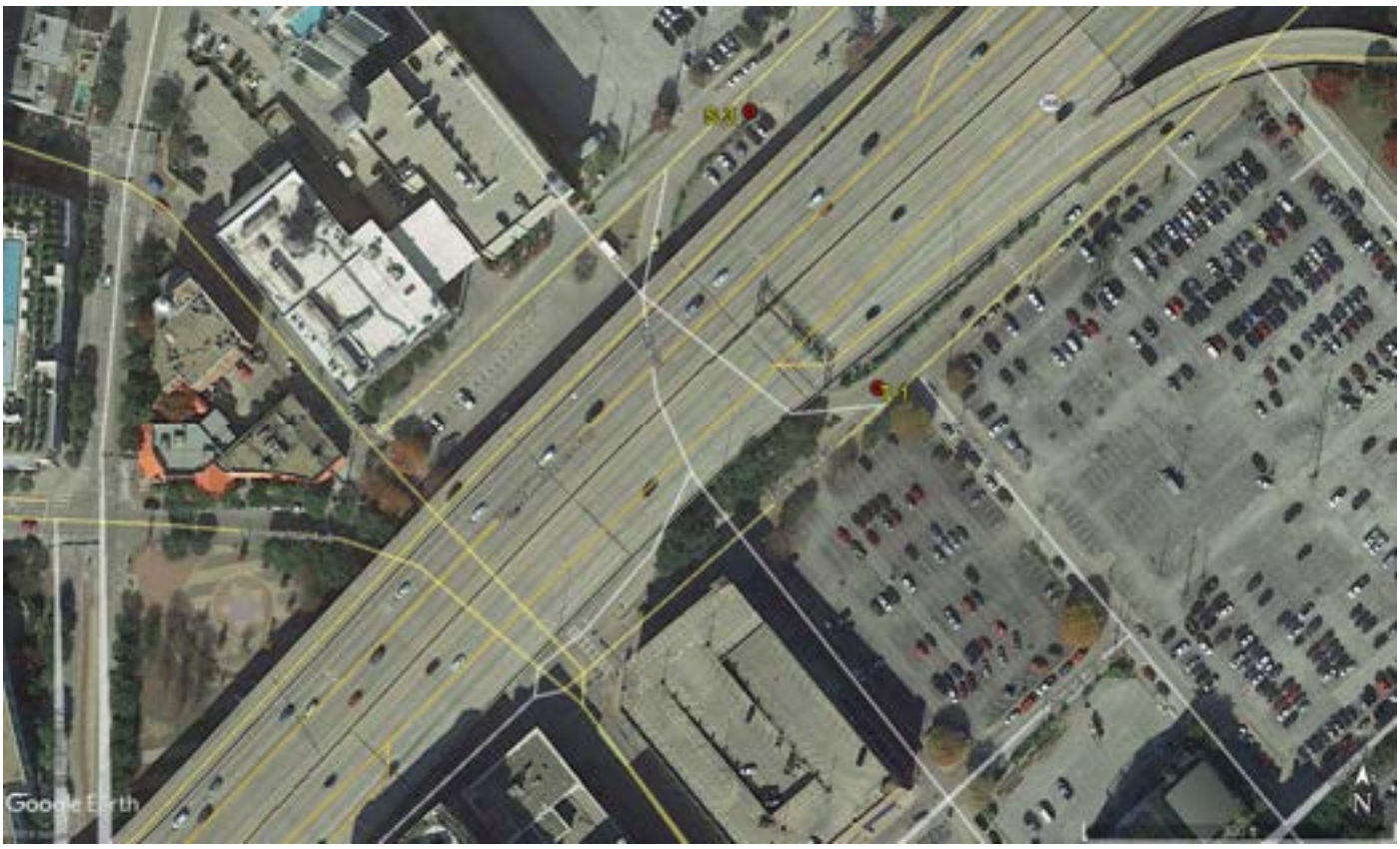
The subsurface information and laboratory testing results given in this report were prepared exclusively for the use of client, their client, and their consultants. The information supplied herein is applicable only for the design of the previously described development to be constructed at locations indicated at this site and should not be used for any other structures, locations, or for any other purpose.

APPENDIX A

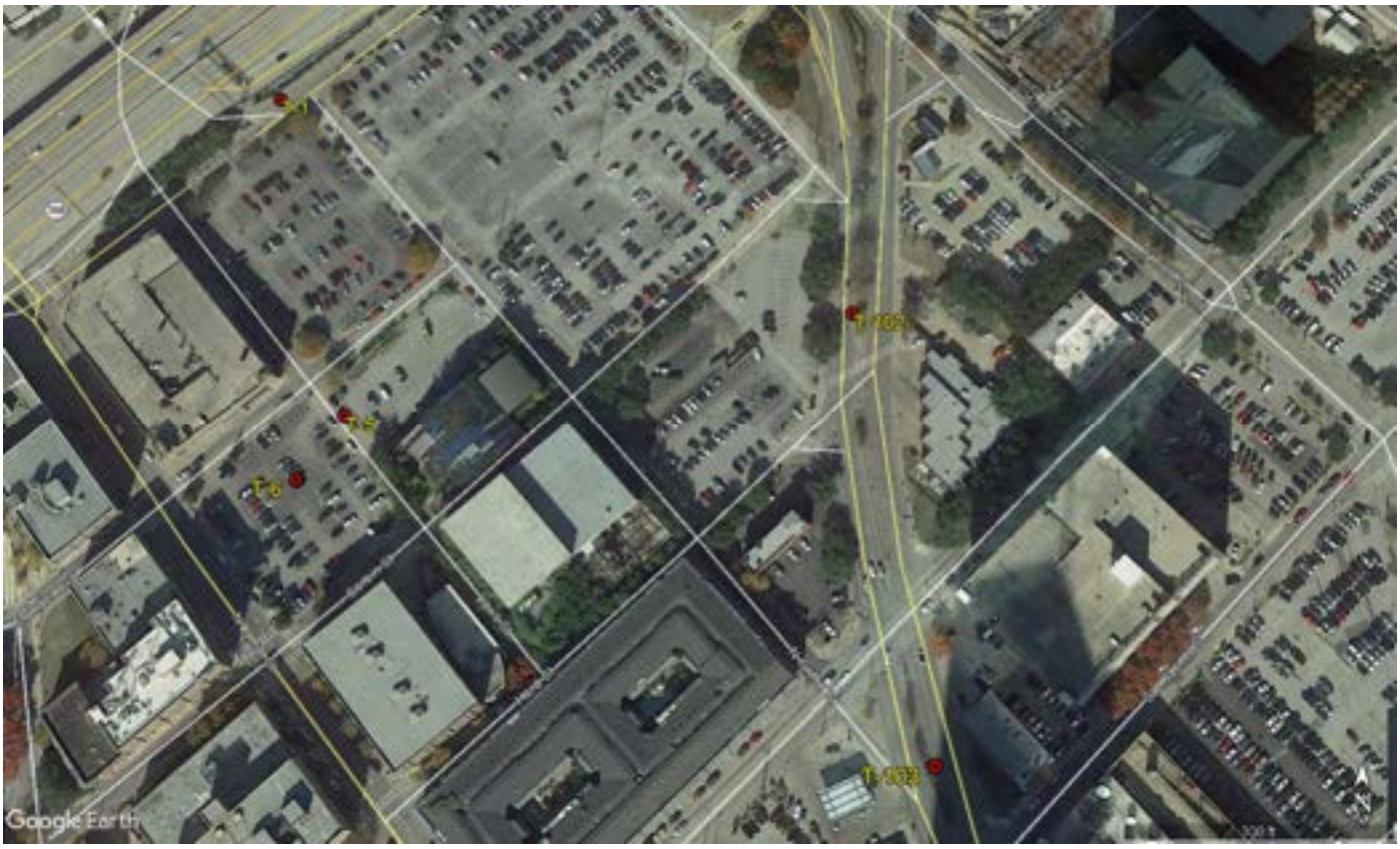
PLANS OF BORINGS

MASTER BORING PLAN

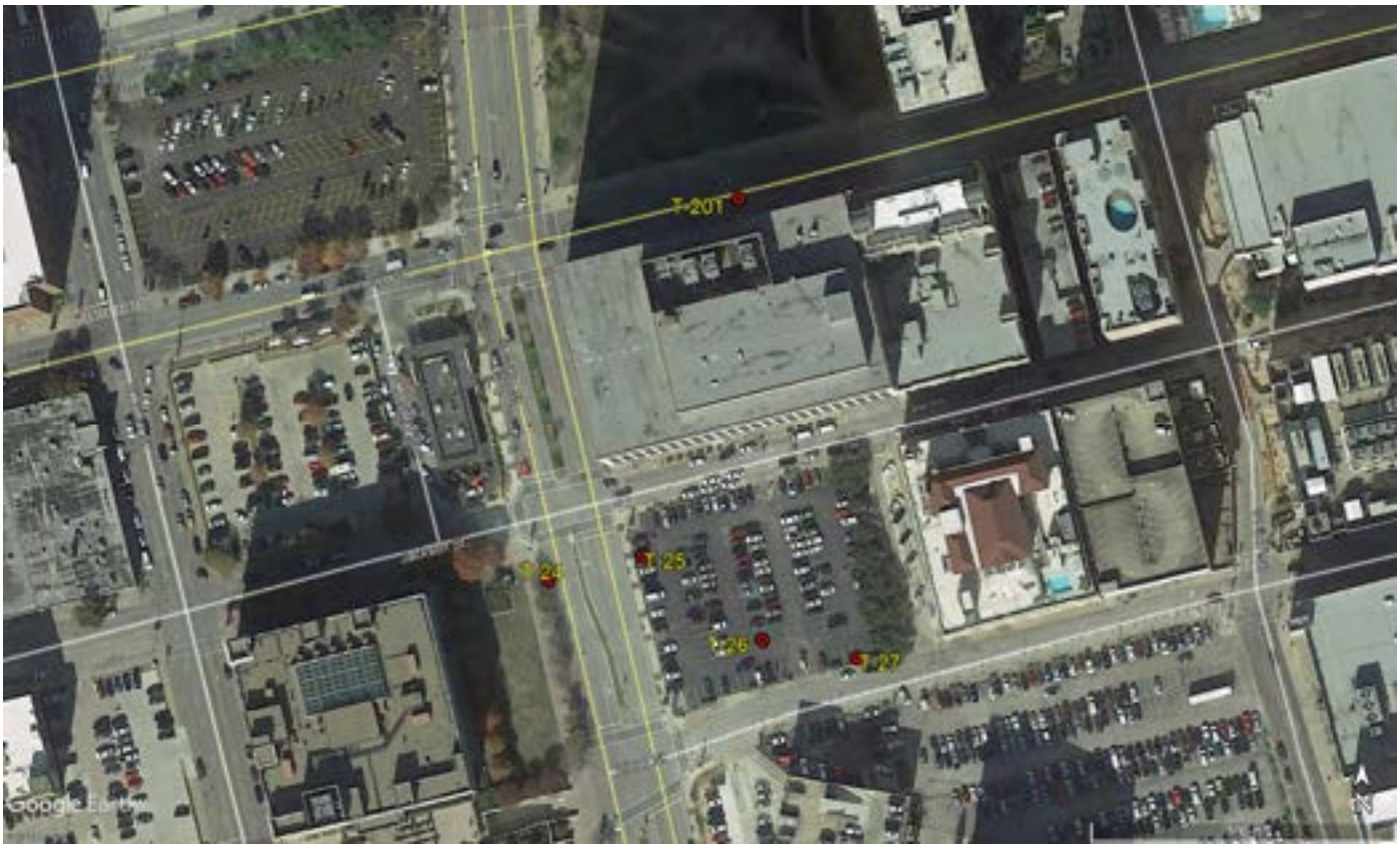
ALLIANCE GEOTECHNICAL GROUP	PROJECT NO: E17-0811	PLANS OF BORINGS
	DART D-2 DALLAS, TEXAS	APPENDIX A-1



ALLIANCE GEOTECHNICAL GROUP	PROJECT NO: E17-0811	**PLANS OF BORINGS**
	DART D-2 DALLAS, TEXAS	APPENDIX A-2



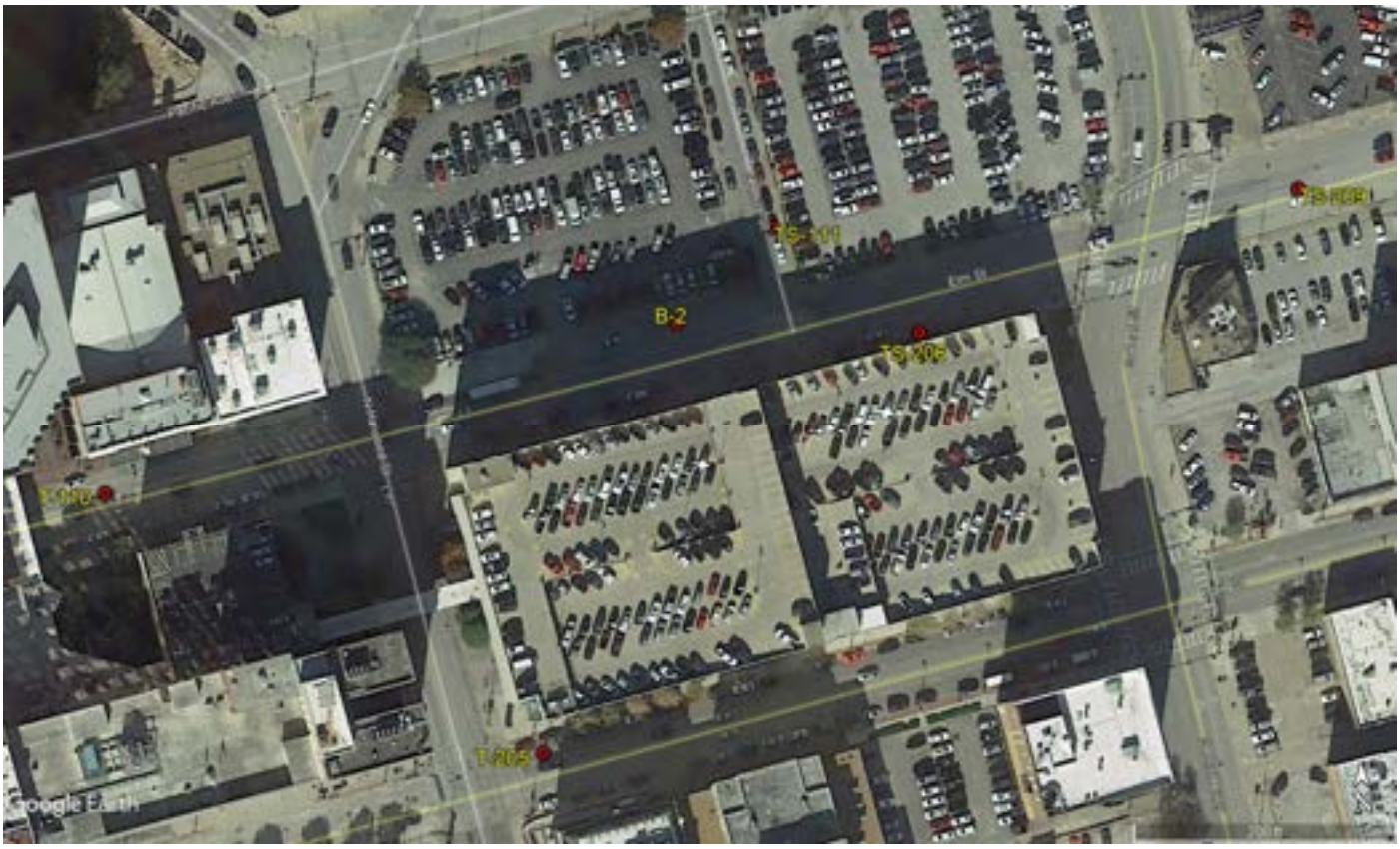
ALLIANCE GEOTECHNICAL GROUP	PROJECT NO: E17-0811	PLANS OF BORINGS
	DART D-2 DALLAS, TEXAS	APPENDIX A-3



ALLIANCE GEOTECHNICAL GROUP

PROJECT NO: E17-0811	PLANS OF BORINGS	
DART D-2 DALLAS, TEXAS		APPENDIX A-4

ALLIANCE GEOTECHNICAL GROUP	PROJECT NO: E17-0811	**PLANS OF BORINGS**
	DART D-2 DALLAS, TEXAS	APPENDIX A-5



ALLIANCE GEOTECHNICAL GROUP	PROJECT NO: E17-0811	**PLANS OF BORINGS**
	DART D-2 DALLAS, TEXAS	APPENDIX A-6

APPENDIX B

BORING LOGS

APPENDIX B-1

LAMAR-YOUNG ALIGNMENT

BORING LOGS (2016)

LOG OF BORING R-2

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6974485.868E 2488138.635

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 412.44

Advancement Method: HSA / Wet Rotary
Date Started: 05/04/2016 Completed: 05/04/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				11" CONCRETE									
	ST-1			CLAY, stiff to very stiff, moist, grayish brown, with some to numerous limestone fragments and traces of sandy clay, asphalt and gravel (FILL) (CH)							4.5		
410	ST-2										3.0		
	ST-3										4.5 2.7		
	ST-4										3.6 3.1		
5	ST-5										4.4		
	ST-6										3.7		
405	ST-7										3.7		
	ST-8										3.2		
	ST-9			-stiff below 9'							2.0		
10													
400													
	ST-10										1.6		
15													
395				CLAY, stiff, moist, dark brown (CH)									
	ST-11										2.0		
20													
390				CLAY, stiff, moist, grayish brown (CH)									
	ST-12										2.0		
25													
385				CLAY, stiff, moist, yellowish brown and grayish brown (CH)									
	ST-13										2.8		
30													
380				CLAY, very stiff, dry, yellowish brown and gray (CH)									
	ST-14										4.0		
35													

Notes:

LOG OF BORING R-2

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6974485.868 E 2488138.635

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 412.44

Advancement Method: HSA / Wet Rotary
Date Started: 05/04/2016 Completed: 05/04/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
375				CLAY, very stiff, dry, yellowish brown and gray (CH)									
40	ST-15										3.5		
370				-trace of sand below 42'									
45	ST-16			-soft to medium stiff below 45'							0.5 1.0		
365													
50	ST-17										0.8		
				Boring terminated at 50'									
360													
55													
355													
60													
350													
65													
345													
70													
340													

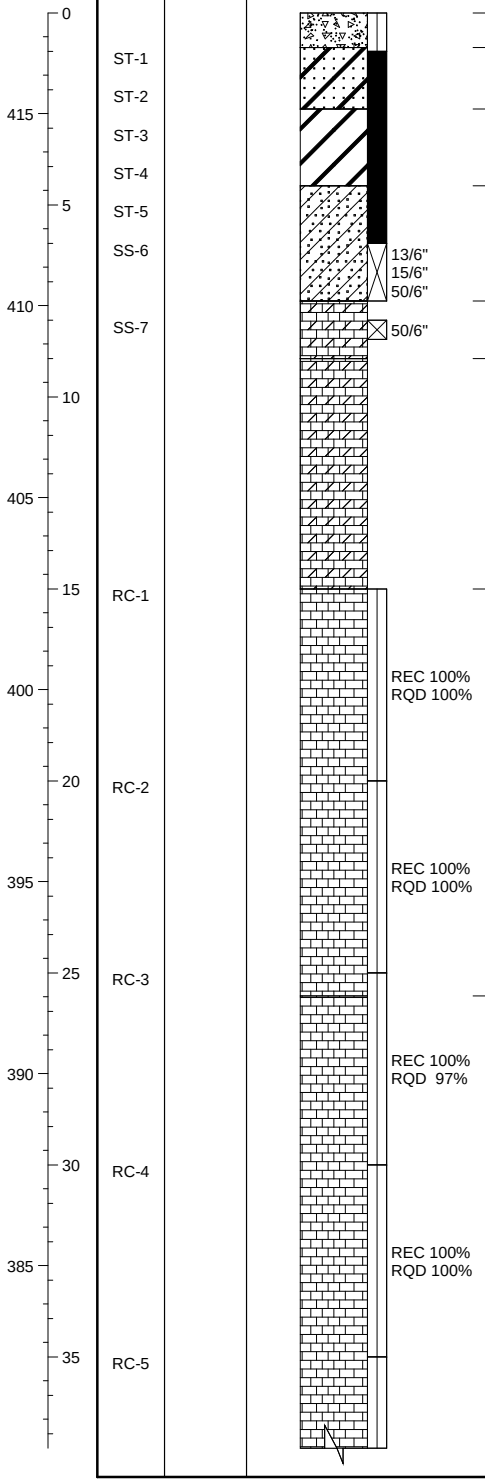
Notes:

LOG OF BORING R-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6974449 E 2488508

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 417.62

Advancement Method: HSA / Wet Rotary
Date Started: 05/04/2016 Completed: 05/04/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah



DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
9.5" CONCRETE									
SANDY CLAY, dry, grayish brown, with some gravel (possibly cement treated) (FILL) (CL)							2.2		
CLAY, stiff to very stiff, moist, dark gray, mixed with limestone (FILL) (CH)							4.0 3.5 4.0 2.2		
CLAYEY SAND, stiff to very stiff, moist, reddish brown, yellowish brown and gray, with sand layers (SC) -some gravel below 6'							3.5 4.5+		
WEATHERED LIMESTONE, moderately hard to hard, tan, fractured									
WEATHERED LIMESTONE, moderately hard to hard, gray, slightly weathered, with occasional joints and fractures									
WEATHERED LIMESTONE, moderately hard to hard, gray and tan, slightly weathered, with occasional joints and fractures -tan at 25' to 26'									
LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									

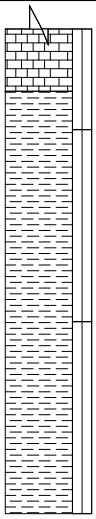
Notes:

LOG OF BORING R-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6974449 E 2488508

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 417.62

Advancement Method: HSA / Wet Rotary
Date Started: 05/04/2016 Completed: 05/04/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
380			 REC 68% RQD 68%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
40	RC-6		REC 93% RQD 93%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
375													
45	RC-7												
370			REC 95% RQD 92%										
50				Boring terminated at 50'									
365													
55													
360													
60													
355													
65													
350													
70													
345													

Notes:

LOG OF BORING R-8

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973015 E 2495418

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 464.91

Advancement Method: HSA / Wet Rotary
Date Started: 06/14/2016 Completed: 06/14/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				3" ASPHALT OVER 10" CONCRETE									
	ST-1			SANDY CLAY, stiff to very stiff, moist, dark brown and dark gray (CL)							2.5		
											3.0		
	ST-2										1.5		
	ST-3										2.5		
460 5	ST-4										3.0		
											2.0		
	ST-5			-hard below 6'							3.0		
	ST-6										2.5		
											4.0		
	ST-7										3.0		
											4.5+		
455 10											4.0		
	ST-8			SANDY CLAY/CLAYEY SAND, loose, moist, light tan (CL/SC)									
450 15	RC-1			WEATHERED LIMESTONE, hard, dry, tan, fractured									
			REC 23% RQD 23%	-(15'-22.1') burrows and calcite infilling									
445 20	RC-2												
			REC 60% RQD 60%	-(22.4') burrows and calcite infilling									
				-(22.4') burrows and calcite infilling									
				LIMESTONE, hard to very hard, dry, gray, unweathered, slightly fractured with occasional joints and fractures									
440 25	RC-3												
			REC 95% RQD 93%	-very hard, dark gray, limestone									
435 30	RC-4												
			REC 60% RQD 60%	-calcite infilling									
				Boring terminated at 33'									
430 35													

Notes:

LOG OF BORING S-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6974213 E 2488830

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.7

Advancement Method: HSA / Wet Rotary
Date Started: 06/10/2016 Completed: 6/10/2016
Abandonment Method: Grouted
Groundwater During Drilling: 9'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				6" ASPHALT									
	ST-1			SAND, loose, soft, moist, tan and yellowish brown, with clay seams (SP)									
	ST-2			SAND, fine, loose, soft, moist, reddish brown, with clay seams (SP)									
420	ST-3										2.0		
	ST-4			SAND, stiff, wet, reddish brown and yellowish brown (SP)							2.5 2.5		
5	ST-5			SAND, very stiff, moist, reddish brown and yellowish brown (SP)							4.0		
	ST-6												
	ST-7			-with iron staining and roots at 7' to 8'							1.0		
415	ST-8												
	ST-9			SAND/GRAVEL, coarse, stiff, wet, tan and reddish brown with clay layer							2.0		
10	TCP		50/1.5" 50/1"								2.5		
410				WEATHERED LIMESTONE, hard to very hard, tan, fractured									
15	RC-1		REC 50% RQD 50%										
405				LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
20	RC-2		REC 100% RQD 100%	-burrows -calcite infilling									
400													
25	RC-3		REC 100% RQD 100%										
395													
30	RC-4		REC 100% RQD 100%	-pyrite infilling -calcite infilling									
390													
35	RC-5												

Notes:

LOG OF BORING S-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6974213 E 2488830

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.7

Advancement Method: HSA / Wet Rotary
Date Started: 06/10/2016 Completed: 6/10/2016
Abandonment Method: Grouted
Groundwater During Drilling: 9'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
385			REC 100% RQD 100%	LIMESTONE, hard to very hard, dark gray, unweathered, with occasional joints and fractures									
40	RC-6												
380			REC 97% RQD 97%	-calcite infilling									
45	RC-7												
375			REC 90% RQD 86%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
50	RC-8												
370			REC 65% RQD 65%	-pyrite infilling									
55	RC-9			-core damaged									
365			REC 80% RQD 80%										
60	RC-10												
360			REC 100% RQD 100%	-pyrite infilling									
65	RC-11												
355			REC 100% RQD 100%										
70	RC-12												
350			REC 100% RQD 100%										
				SHALE, moderately hard, dark gray, unweathered,									

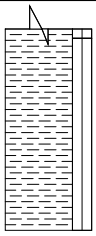
Notes:

LOG OF BORING S-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6974213 E 2488830

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.7

Advancement Method: HSA / Wet Rotary
Date Started: 06/10/2016 Completed: 6/10/2016
Abandonment Method: Grouted
Groundwater During Drilling: 9'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC-13		 REC 70% RQD 70%	with occasional joints and fractures									
345													
80				Boring terminated at 80'									
340													
85													
335													
90													
330													
95													
325													
100													
320													
105													
315													
110													

Notes:

LOG OF BORING S-2

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973989 E 2488985

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.14

Advancement Method: HSA / Wet Rotary
Date Started: 06/08/2016 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				5" ASPHALT									
	ST-1			7" GRAVEL, moist									
425	ST-2			SAND, very dense, moist, reddish brown, with some gravel (FILL) (SP)									
	ST-3			SAND, dense, moist, reddish brown and yellowish (SP)									
	ST-4			SAND, stiff, moist, reddish brown and yellowish brown (SP)									
5	ST-5			SAND, loose, moist, reddish brown and yellowish brown (SP)									
	ST-6			-with iron staining and roots at 6' to 8'									
420	ST-7												
	ST-8			SAND/GRAVEL, coarse, soft, moist, tan and reddish brown with rock pieces									
10													
415													
	SS-6		11/6" 17/6" 19/6"	SAND/GRAVEL, very loose, moist, tannish gray and tanning brown									
15													
410													
	TCP		50/0.75" 50/0.25"	WEATHERED LIMESTONE, hard to very hard, tan, fractured									
20	RC-1			LIMESTONE, hard to very hard, gray, dry unweathered, with occasional joints and fractures									
405			REC 100% RQD 100%										
25	RC-2			-few burrows									
400			REC 100% RQD 100%										
30	RC-3												
395			REC 95% RQD 95%	-calcite infilling									
35	RC-4												
390													

Notes:

LOG OF BORING S-2

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973989 E 2488985

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.14

Advancement Method: HSA / Wet Rotary
Date Started: 06/08/2016 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 100% RQD 100%	LIMESTONE, hard to very hard, dark gray, unweathered, with occasional joints and fractures									
40	RC-5												
385			REC 100% RQD 100%										
45	RC-6												
380			REC 88% RQD 88%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
50	RC-7												
375			REC 100% RQD 100%	-thin limestone seams									
55	RC-8												
370			REC 100% RQD 100%										
60	RC-9												
365			REC 97% RQD 97%										
65	RC-10			-thin limestone seams									
360			REC 100% RQD 100%										
70	RC-11			-pyrite infilling									
355			REC 100% RQD 100%										
				SHALE, moderately hard, dark gray, unweathered,									

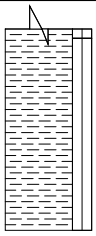
Notes:

LOG OF BORING S-2

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973989 E 2488985

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.14

Advancement Method: HSA / Wet Rotary
Date Started: 06/08/2016 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC-12		 REC 100% RQD 100%	with occasional joints and fractures									
350													
80				Boring terminated at 80'									
345													
85													
340													
90													
335													
95													
330													
100													
325													
105													
320													
110													

Notes:

LOG OF BORING S-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973874 E 2489102

Drilling Contractor:
Driller:
Rig:
Boring Diameter:
Ground Surface Elevation: 428.61

Advancement Method:
Date Started: 4/29/2016 Completed: 5/4/2016
Abandonment Method:
Groundwater During Drilling: 18'
Field Representative:

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				9.5" CONCRETE									
	ST-1			SANDY CLAY, medium stiff to very stiff, moist, reddish brown to yellowish brown (CL)							1.75		
	ST-2										4.25		
	ST-3										4.0		
425	ST-4			-very sandy below 4'							3.4		
5	ST-5			CLAYEY SAND, medium stiff to stiff, moist, reddish brown and yellowish brown, with occasional fine grained sand layers and sandy clay layers (SC)							1.5		
	SS-6		3/6" 4/6" 4/6"		16								
	SS-7		3/6" 3/6" 4/6"										
420													
10													
415													
	SS-8		2/6" 4/6" 7/6"		11								
15													
				-seepage at 18'									
410				WEATHERED LIMESTONE, moderately hard to hard tan and gray, fractured									
	TCP		50/0.75"										
20	RC 1		50/0.5"	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures, and occasional shaley limestone layers									
			REC 100% RQD 100%		13					123.8		210.2	1.6
405													
25	RC 2												
					16					116.7		227.5	1.2
			REC 100% RQD 100%										
400													
30	RC 3												
			REC 100% RQD 100%		13					123.5		246.6	1.4
395													
35	RC 4												
					13					124.9		66.0	0.8

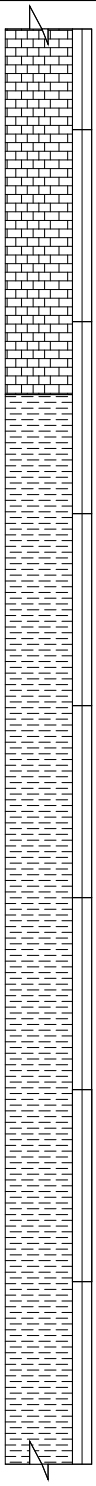
Notes:

LOG OF BORING S-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973874 E 2489102

Drilling Contractor:
Driller:
Rig:
Boring Diameter:
Ground Surface Elevation: 428.61

Advancement Method:
Date Started: 4/29/2016 Completed: 5/4/2016
Abandonment Method:
Groundwater During Drilling: 18'
Field Representative:



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
390				LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures, and occasional shaley limestone layers									
40	RC 5												
385					10					128		313.9	2.0
45	RC 6												
380				SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures	14					121.7		24.7	1.7
50	RC 7												
375					15					120.5		28.8	2.2
55	RC 8												
370					20					109.3		15.5	0.9
60	RC 9												
365					20					109.4		13.4	1.0
65	RC 10 RC 10				18					113.7		29.2	2.1
360													
70	RC 11												
355													

Notes:

LOG OF BORING S-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973874 E 2489102

Drilling Contractor:
Driller:
Rig:
Boring Diameter:
Ground Surface Elevation: 428.61

Advancement Method:
Date Started: 4/29/2016 Completed: 5/4/2016
Abandonment Method:
Groundwater During Drilling: 18'
Field Representative:

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC 12		REC 100% RQD 98%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
350													
80	RC 13		REC 100% RQD 100%										
345				-limestone layer at (83.5' to 84.3')									
85	RC 14		REC 80% RQD 77%										
340													
90	RC 15		REC 100% RQD 100%										
335													
95	RC 16		REC 100% RQD 100%	LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures									
330													
100	RC 17		REC 100% RQD 100%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
325													
105	RC 18		REC 100% RQD 100%										
320													
110	RC 19			SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									

Notes:

LOG OF BORING S-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973874 E 2489102

Drilling Contractor:
Driller:
Rig:
Boring Diameter:
Ground Surface Elevation: 428.61

Advancement Method:
Date Started: 4/29/2016 Completed: 5/4/2016
Abandonment Method:
Groundwater During Drilling: 18'
Field Representative:

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
315 / 115	RC 20		REC 100% RQD 100%										
			REC 63% RQD 63%										
310 / 120				Boring terminated at 120'									
305 / 125													
300 / 130													
295 / 135													
290 / 140													
285 / 145													
280													

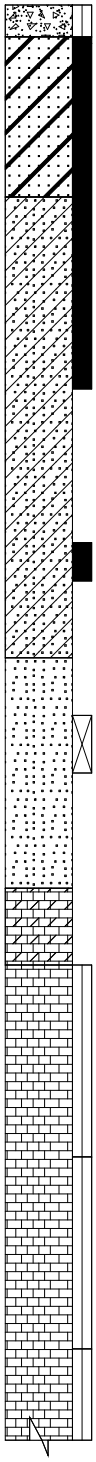
Notes:

LOG OF BORING T-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973620 E 2489240

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 431.15

Advancement Method: HSA / Wet Rotary
Date Started: 04/26/2016 Completed: 04/28/2016
Abandonment Method: Piezometer Installed
Groundwater During Drilling:
Field Representative: Hassan Shah



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				10" CONCRETE									
430				SANDY CLAY, stiff to very stiff, moist to dry, reddish brown, yellowish brown, and brown, with trace of clay and gravel (FILL) (CL)									
	ST-1										4.5+		
	ST-2										2.6		
	ST-3										3.4		
5	ST-4			CLAYEY SAND, medium stiff to very stiff, moist to dry, reddish brown and yellowish brown (SC)							4.5+		
425	ST-5				12	26	13	13	38.2	119.2	4.5+	2.9	11.3
	ST-6										3.5		
	ST-7										4.0 4.0		
	ST-8			- with fine grained sand layers below 9'							4.5+ 1.5		
10													
420													
	ST-9				13						2.5		
15													
415				SAND, medium to coarse, with trace gravel (SP)									
	SS-10		11/6" 13/6" 14/6"										
20													
410													
				WEATHERED LIMESTONE, moderately hard to hard, gray, fractured									
25	RC 1			LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures - (26') calcite infilling									
405			REC 95% RQD 95%	- (28') fossils									
30	RC 2			- shaley limestone layers									
400			REC 100% RQD 98%	- (33') calcite infilling	11					130.9		117.7	2.2
35	RC 3												
395													

Notes: *** slickensided along failure plane**

LOG OF BORING T-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973620 E 2489240

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 431.15

Advancement Method: HSA / Wet Rotary
Date Started: 04/26/2016 Completed: 04/28/2016
Abandonment Method: Piezometer Installed
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 90% RQD 90%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures - (37.5'-38') calcite infilling									
40	RC 4				13					123.8		340.8	1.5
390			REC 100% RQD 95%										
45	RC 5			- (45.5-46') calcite infilling	13					124.2		365.7	1.9
385			REC 100% RQD 98%	-shaley below 48'									
50	RC 6												
380			REC 83% RQD 82%										
					11					122.5		315.4	2.0
55	RC 7												
375				- (56.8'-57') calcite infilling									
			REC 87% RQD 83%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures	9					135.6		86.9	1.1
60	RC 8			- (60'-61.5') calcite infilling	15					118.4		4.8*	2.7
370			REC 85% RQD 82%	- (62.7') 1/2" limestone seam - (63.1') thin limestone seam -(63.8'-64.1') thin core diameter									
65	RC 9												
365			REC 100% RQD 97%										
70	RC 10				21					109.8		29.7	1.4
360				-(71') fossils									
			REC 100% RQD 100%	- (72.1') thin limestone seam									

Notes: *** slickensided along failure plane**

LOG OF BORING T-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973620 E 2489240

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 431.15

Advancement Method: HSA / Wet Rotary
Date Started: 04/26/2016 Completed: 04/28/2016
Abandonment Method: Piezometer Installed
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75 / 355	RC 11		REC 95% RQD 95%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures	17					116.2		29.4	3.0
				- (77'7") thin limestone seam									
				- (79.2') thin limestone seam									
80 / 350	RC 12		REC 80% RQD 75%										
				- (83.2') pyrite infilling									
				- (83.9') pyrite infilling									
85 / 345	RC 13		REC 95% RQD 90%		19					109.1		9.6*	2.3
90 / 340	RC 14		REC 100% RQD 100%	- (91.7) 12 inch, hard, sandy, shaley limestone layer									
95 / 335	RC 15		REC 100% RQD 100%	-(95.3') pyrite infilling	18					114.9		8.7*	0.4
100 / 330	RC 16		REC 100% RQD 100%										
105 / 325	RC 17		REC 100% RQD 100%	LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures									
110 / 320	RC 18			SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
				SHALE, moderately hard, dark gray, unweathered,									

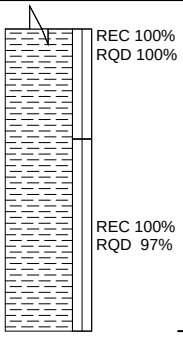
Notes: *** slickensided along failure plane**

LOG OF BORING T-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973620 E 2489240

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 431.15

Advancement Method: HSA / Wet Rotary
Date Started: 04/26/2016 Completed: 04/28/2016
Abandonment Method: Piezometer Installed
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
115 / 315	RC 19			with occasional joints and fractures - (113.9' to 115') hard sandy shaley limestone layer									
120 / 310				Boring terminated at 120'									
125 / 305													
130 / 300													
135 / 295													
140 / 290													
145 / 285													

Notes: *** slickensided along failure plane**

LOG OF BORING T-5

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973188 E 2489380

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.97

Advancement Method: HSA / Wet Rotary
Date Started: 05/05/2016 Completed: 05/06/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				5" CONCRETE									
	ST-1			SANDY CLAY, very stiff, moist to dry, reddish brown (CL)							4.3		
	ST-2										3.6		
	ST-3										4.2		
	ST-4			SANDY CLAY, very stiff, moist to dry, reddish brown and yellowish brown (CL)							3.3		
425 5	ST-5			CLAYEY SAND, medium stiff to very stiff, moist, reddish brown and yellowish brown, with fine grained sand layers (SC)							1.3		
	ST-6										1.3		
	ST-7										1.7		
	ST-8			-occasional sandy clay layers at 8' to 10'							1.0		
	ST-9										1.2		
420 10													
	ST-10										-		
415 15													
	SS-10		4/6" 7/6" 18/6"	SAND, medium coarse to coarse (SW)									
410 20													
	TCP		50/0.5" 50/0.5"	WEATHERED LIMESTONE, moderately hard to hard, tan, fractured									
405 25	RC 1		REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
				- (26') calcite infilling									
				- (28') calcite infilling	10					130.1		216.8	2.2
400 30	RC 2		REC 100% RQD 100%	- (32') burrows									
395 35	RC 3			- (35') calcite infilling									

Notes: ***slightly slickensided along fracture**

LOG OF BORING T-5

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973188 E 2489380

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.97

Advancement Method: HSA / Wet Rotary
Date Started: 05/05/2016 Completed: 05/06/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures	13					124.3		244.1	1.3
390 — 40	RC 4												
			REC 100% RQD 100%	- (42') calcite infilling									
385 — 45	RC 5												
			REC 100% RQD 97%	- (47.4'-48.3') calcite infilling	11					124.7		358.2	2.2
380 — 50	RC 6			- (50.3') pyrite infilling									
			REC 80% RQD 80%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
				- (54') fossils									
375 — 55	RC 7			- calcite infilling									
			REC 95% RQD 95%	-(56.4') thin limestone seams - (57.4') 0.75" limestone seam	14					122.4		27.2	2.4
370 — 60	RC 8												
			REC 97% RQD 97%										
365 — 65	RC 9												
			REC 100% RQD 100%	- (66.5') pyrite infilling	18					112.4		25.7	1.1
360 — 70	RC 10			- (71.5') pyrite infilling									
			REC 85% RQD 85%										
				- (73.9'-74.1') limestone infilling									

Notes: ***slightly slickensided along fracture**

LOG OF BORING T-5

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973188 E 2489380

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.97

Advancement Method: HSA / Wet Rotary
Date Started: 05/05/2016 Completed: 05/06/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
355 — 75	RC 11		REC 100% RQD 100%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures	16					118.8		30.2	1.7
				-(78.8'-79.6') thin limestone seams									
350 — 80	RC 12		REC 100% RQD 97%	-(80.2') pyrite infilling									
345 — 85	RC 13		REC 95% RQD 92%	SHALE, moderately hard, dark gray, unweathered, moderately fractured -(85.8'-89.9') thin limestone seams -(87.1'-88.2') hard sandy shaley limestone layer	10					127.9		19.1	2.3
340 — 90	RC 14		REC 87% RQD 85%	- (92.6', 97.4' & 100.3') pyrite infilling									
335 — 95	RC 15		REC 100% RQD 98%		17					116.0		28.0	1.0
330 — 100	RC 16		REC 100% RQD 93%	LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures									
325 — 105	RC 17		REC 100% RQD 100%	SHALE, moderately hard, dark gray, unweathered, w/ occasional joints and fractures	15					118.9		24.9*	1.0
320 — 110	RC 18			SHALE, moderately hard, dark gray, unweathered,									

Notes: ***slightly slickensided along fracture**

LOG OF BORING T-5

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973188 E 2489380

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.97

Advancement Method: HSA / Wet Rotary
Date Started: 05/05/2016 Completed: 05/06/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
315 — 115	RC 19		REC 100% RQD 100%	w/ occasional joints and fractures									
			REC 100% RQD 100%	-(116') thin limestone seams - fossils	16					115.7		15.6	4.6
310 — 120				Boring terminated at 120'									
305 — 125													
300 — 130													
295 — 135													
290 — 140													
285 — 145													

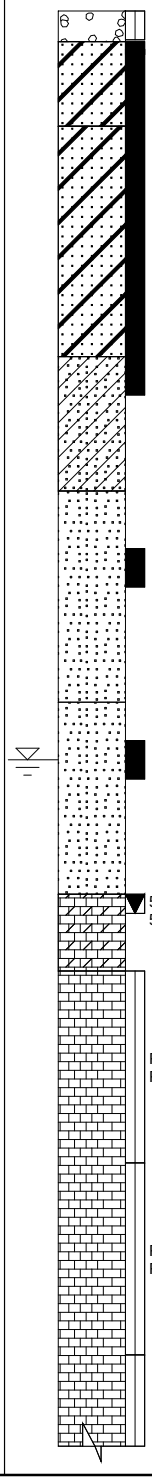
Notes: ***slightly slickensided along fracture**

LOG OF BORING T-6

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973105 E 2489332

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.93

Advancement Method: HSA / Wet Rotary
Date Started: 5/20/2016 Completed: 05/23/2016
Abandonment Method: Grouted
Groundwater During Drilling: 19.5'
Field Representative: Hassan Shah



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				1.5" ASPHALT over 6" FLEX BASE									
430	ST-1			SANDY CLAY, medium stiff to stiff, moist, reddish brown and gray, with asphalt and gravel (CL) (FILL)							1.2		
	ST-2										2.0		
											-		
	ST-3			SANDY CLAY, medium stiff to very stiff, moist, reddish brown (CL)							1.4		
	ST-4										4.5+		
5	ST-5										4.5+		
425	ST-6										4.5+		
	ST-7			-very sandy below 7' with clayey sand layers							2.2		
	ST-8										4.5		
	ST-9			CLAYEY SAND, stiff, moist, reddish brown (SC)							2.75		
10													
420													
				SAND, moist, tan, fine grained, with occasional clayey sand layers (SP)									
	ST-10										-		
15													
415													
				SAND, moist, yellowish brown, with a trace gravel (SP)									
	SS-11			-seepage at 19.5'							-		
20													
410													
	TCP			WEATHERED LIMESTONE, hard, tan and gray, fractured									
25	RC 1			LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
405					13					124.7		290.0	1.6
				-shaley limestone layer at 27.7' to 29.4'									
				-burrows									
30	RC 2												
400													
				-calcite infilling									
				-3" shaley limestone layer at 34.1									
35	RC 3												
395				-6" shaley limestone layer at 36.4'									

Notes: *** slickensided along failure plane**

LOG OF BORING T-6

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973105 E 2489332

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.93

Advancement Method: HSA / Wet Rotary
Date Started: 5/20/2016 Completed: 05/23/2016
Abandonment Method: Grouted
Groundwater During Drilling: 19.5'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures	13					123.4		428.1	2.1
40 / 390	RC 4												
			REC 100% RQD 100%	-pyrite infilling -24" shaley limestone layer at 43'									
45 / 385	RC 5												
			REC 100% RQD 100%		12					125.6		399.4	2.0
				SHALEY LIMESTONE, hard, dark gray, unweathered, with occasional joints and fractures									
50 / 380	RC 6												
			REC 97% RQD 93%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
55 / 375	RC 7												
			REC 100% RQD 100%	- thin limestone seams	15					119.6		4.8*	4.9
60 / 370	RC 8												
			REC 97% RQD 90%										
65 / 365	RC 9												
			REC 100% RQD 95%	-pyrite infilling	19					107.2		26.9	2.7
70 / 360	RC 10												
			REC 100% RQD 100%										

Notes: *** slickensided along failure plane**

LOG OF BORING T-6

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973105 E 2489332

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.93

Advancement Method: HSA / Wet Rotary
Date Started: 5/20/2016 Completed: 05/23/2016
Abandonment Method: Grouted
Groundwater During Drilling: 19.5'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75 / 355	RC 11		REC 100% RQD 100%	SHALE, moderately hard, dark gray, unweathered with occasional joints and fractures	19					111.6		23.9	0.8
80 / 350	RC 12		REC 93% RQD 90%										
85 / 345	RC 13		REC 72% RQD 70%	-7" shaley limestone layer at 87.2'	9					132.2		42.4	1.5
90 / 340	RC 14		REC 100% RQD 100%										
95 / 335	RC 15		REC 100% RQD 100%										
100 / 330	RC 16		REC 100% RQD 98%	LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures	17					115.8		35.1	2.4
105 / 325	RC 17		REC 100% RQD 100%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures	16					118.1		27.5	1.9
110 / 320	RC 18												

Notes: *** slickensided along failure plane**

LOG OF BORING T-6

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973105 E 2489332

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.93

Advancement Method: HSA / Wet Rotary
Date Started: 5/20/2016 Completed: 05/23/2016
Abandonment Method: Grouted
Groundwater During Drilling: 19.5'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
115 / 315	RC 19		REC 98% RQD 98% / REC 100% RQD 100%		16					119.2		29.2	1.6
120 / 310				Boring terminated at 120'									
125 / 305													
130 / 300													
135 / 295													
140 / 290													
145 / 285													

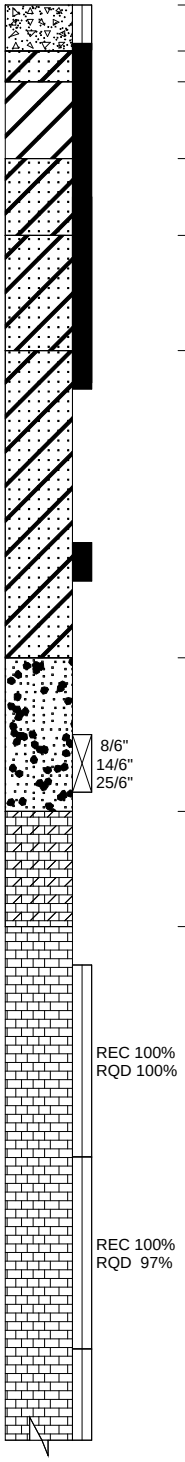
Notes: *** slickensided along failure plane**

LOG OF BORING T-11

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972510 E 2489570

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.66

Advancement Method: HSA / Wet Rotary
Date Started: 05/16/2016 Completed: 05/18/2016
Abandonment Method: Piezometer Installed
Groundwater During Drilling:
Field Representative: Hassan Shah



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				1" ASPHALT over 13" CONCRETE									
	ST-1			Very SANDY CLAY, very stiff, dry, grayish brown (CL) (FILL)							3.7		
	ST-2										2.7		
	ST-3			CLAY, stiff, moist, grayish brown, dark brown, and gray (CH) (FILL)							1.7		
	ST-4			-3 inch sand layer at 3'							3.0		
425 5	ST-5			SANDY CLAY, stiff to very stiff, moist, grayish brown and gray (CL-CH)							4.5		
	ST-6			SANDY CLAY, very stiff, dry, gray and reddish brown (CL)							4.5+		
	ST-7										4.5+		
	ST-8										4.1		
	ST-9			SANDY CLAY, stiff, moist, reddish brown and gray (CL)							2.5		
420 10													
	ST-10										2.2		
415 15													
				GRAVELLY SAND (SW)									
	SS-11												
410 20													
				WEATHERED LIMESTONE, moderately hard to hard, tan and gray, fractured									
405 25	RC 1			LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures	15					119.0		349.1	2.1
400 30	RC 2			-(29') 12" shaley limestone layer									
395 35	RC 3												

Notes: ***slickensided along failure plane**

LOG OF BORING T-11

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972510 E 2489570

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.66

Advancement Method: HSA / Wet Rotary
Date Started: 05/16/2016 Completed: 05/18/2016
Abandonment Method: Piezometer Installed
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures	15					118.6		285.9	1.7
390 40	RC 4			-shaley limestone layers									
			REC 100% RQD 100%	-w/ occasional shaley limestone layers below 45'									
385 45	RC 5												
			REC 100% RQD 97%		15					117.9		294.1	1.5
380 50	RC 6												
			REC 90% RQD 90%										
				SHALE, moderately hard, dark gray, unweathered, dry, with occasional joints and fractures									
375 55	RC 7			-hard, sandy, shaley, limestone at 55' to 56.8'									
			REC 100% RQD 90%		18					114.8		21.7	2.2
370 60	RC 8			-thin limestone seams									
			REC 100% RQD 100%										
365 65	RC 9												
			REC 100% RQD 100%	-pyrite infilling	20					110.3		24.0	1.6
360 70	RC 10												
			REC 100% RQD 100%	-pyrite infilling									
355													

Notes: ***slickensided along failure plane**

LOG OF BORING T-11

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972510 E 2489570

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.66

Advancement Method: HSA / Wet Rotary
Date Started: 05/16/2016 Completed: 05/18/2016
Abandonment Method: Piezometer Installed
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC 11		REC 97% RQD 93%	SHALE, moderately hard, dark gray, unweathered, dry, with occasional joints and fractures	17					114.8		24.1	1.1
350 80	RC 12		REC 67% RQD 67%	-pyrite infilling									
345 85	RC 13		REC 90% RQD 87%		19					113.1		18.0*	1.2
340 90	RC 14		REC 95% RQD 95%	-(91.5) 15" hard sandy, shaley, limestone layer									
335 95	RC 15		REC 100% RQD 97%		19					110.1		2.3*	2.1
330 100	RC 16		REC 100% RQD 100%										
325 105	RC 17		REC 100% RQD 100%	LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures	11					124.6		30.1	1.6
320 110	RC 18			SHALE, moderately hard, dark gray, unweathered, slightly fractured, moist, with occasional joints and fractures -pyrite infilling SHALE, moderately hard, dark gray, unweathered,									

Notes: ***slickensided along failure plane**

LOG OF BORING T-11

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972510 E 2489570

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.66

Advancement Method: HSA / Wet Rotary
Date Started: 05/16/2016 Completed: 05/18/2016
Abandonment Method: Piezometer Installed
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
315 – 115	RC 19		REC 90% RQD 90%	slightly fractured, moist, with occasional joints and fractures									
			REC 100% RQD 93%		20					104.6		2.7*	4.1
310 – 120				Boring terminated at 120'									
305 – 125													
300 – 130													
295 – 135													
290 – 140													
285 – 145													

Notes: ***slickensided along failure plane**

LOG OF BORING TS-13

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972431.078E 2489808.57

Drilling Contractor: Txplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.31

Advancement Method: HSA / Wet Rotary
Date Started: 05/11/2016 Completed: 05/13/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
430 / 0				5" CONCRETE									
	ST-1			SANDY CLAY and CLAY, very stiff, moist, reddish brown, yellowish brown and brown (CH-CL) (FILL)							3.7		
	ST-2			SAND and SILTY SAND, medium stiff, wet, gray and brown (SP) (FILL)									
	ST-3			SAND, stiff, moist, gray and reddish brown (SP)									
	ST-4			SANDY CLAY, stiff to very stiff, moist, gray and reddish brown									
425 / 5	ST-5												
	ST-6												
	ST-7			-with iron deposits below 7'									
	ST-8												
	ST-9												
420 / 10													
				SAND, stiff, moist, gray and yellowish brown, fine grained, with occasional clayey sand layers (SP)									
	ST-10												
415 / 15													
				SAND, stiff, wet, brown, fine to medium grained, with trace gravel (SW)									
	SS-11		2/6" 3/6" 5/6"										
410 / 20													
				WEATHERED LIMESTONE, moderately hard to hard, tan and gray, fractured									
405 / 25	RC 1		REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, sound, with occasional joints and fractures	13					124.0		260.1	1.3
				-calcite infilling									
400 / 30	RC 2		REC 100% RQD 100%	-burrows									
395 / 35	RC 3												

Notes: ***slickensided along failure plane**

LOG OF BORING TS-13

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972431.078E 2489808.57

Drilling Contractor: Txplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.31

Advancement Method: HSA / Wet Rotary
Date Started: 05/11/2016 Completed: 05/13/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures, and occasional shaley limestone layers	14					121.5		197.2	1.7
390 40	RC 4												
			REC 100% RQD 100%	-calcite infilling									
385 45	RC 5												
			REC 100% RQD 100%		14					121.0		170.3	1.2
				SHALEY LIMESTONE, hard, dark gray, unweathered, slightly fractured, with occasional joints and fractures									
380 50	RC 6												
			REC 100% RQD 100%	-calcite infilling									
				-pyrite infilling									
375 55	RC 7			LIMESTONE, hard, gray, slightly fractured									
			REC 87% RQD 87%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures	14					119.5		30.2	2.3
370 60	RC 8												
				-thin limestone seams									
			REC 100% RQD 100%										
365 65	RC 9												
			REC 100% RQD 100%	-fossils	22					106.3		22.5	1.0
360 70	RC 10												
				-(70.7') 12" limestone layer									
			REC 87% RQD 87%										

Notes: ***slickensided along failure plane**

LOG OF BORING TS-13

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972431.078 E 2489808.57

Drilling Contractor: Txplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.31

Advancement Method: HSA / Wet Rotary
Date Started: 05/11/2016 Completed: 05/13/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
355 – 75	RC 11		REC 100% RQD 97%	SHALE, moderately hard, dark gray, unweathered, slightly fractured, with occasional joints and fractures -thin limestone seams	15					119.4		21.7	2.4
350 – 80	RC 12		REC 100% RQD 100%	-pyrite infilling									
345 – 85	RC 13		REC 68% RQD 65%	SHALE, moderately hard, dry, moist, dark gray, unweathered, slightly fractured, with occasional joints and fractures	19					111.1		18.0	0.8
340 – 90	RC 14		REC 100% RQD 100%	-pyrite infilling -(93.6'-95.0') hard sandy, shaley, limestone layer									
335 – 95	RC 15		REC 100% RQD 100%		19					112.3		3.8*	1.1
330 – 100	RC 16		REC 100% RQD 100%										
325 – 105	RC 17		REC 100% RQD 100%	LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures	11					126.2		48.1	1.1
320 – 110	RC 18												

Notes: ***slickensided along failure plane**

LOG OF BORING TS-13

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972431.078 E 2489808.57

Drilling Contractor: Txplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.31

Advancement Method: HSA / Wet Rotary
Date Started: 05/11/2016 Completed: 05/13/2016
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
315 – 115	RC 19		REC 92% RQD 92%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
				-pyrite infilling	16					112.9		11.5*	2.1
			REC 100% RQD 100%										
310 – 120				Boring terminated at 120'									
305 – 125													
300 – 130													
295 – 135													
290 – 140													
285 – 145													

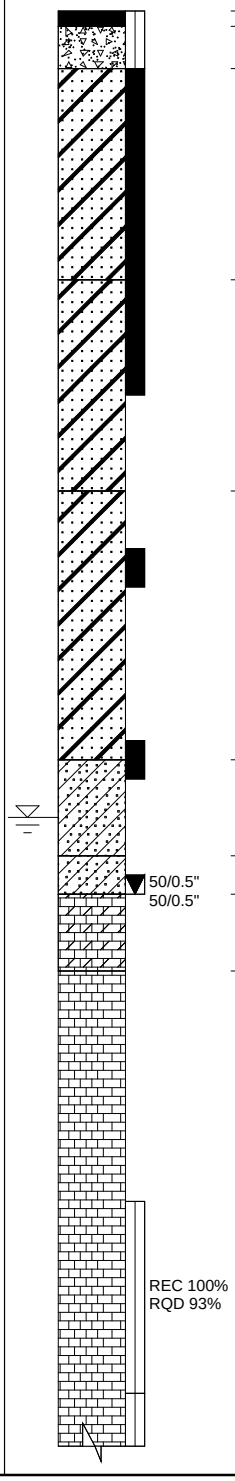
Notes: ***slickensided along failure plane**

LOG OF BORING TS-15

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972182.35E 2489830.945

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.29

Advancement Method: HSA / Wet Rotary
Date Started: 04/05/2016 Completed: 04/08/2016
Abandonment Method: Grouted
Groundwater During Drilling: 21'
Field Representative: Hassan Shah



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0			3" ASPHALT 15" CONCRETE									
	ST1 ST2 ST3 ST4		SANDY CLAY and CLAY (FILL), soft to stiff, moist, yellowish brown, brown, reddish brown and gray, with trace of asphalt and gravel (CL) - 3" fine grained sand layer at 3.5 feet							3.0 2.7 4.2 1.5 1.5		
425 / 5	ST5 ST6									0.5 1.2 0.7		
	ST7 ST8 ST9		SANDY CLAY (FILL), stiff, moist, dark brown and yellowish brown, with trace of gravel (CL)	14	30	11	19		120.8	3.0 2.4 3.2 2.0 3.2	3.3	6.3
420 / 10												
	ST10		CLAYEY SAND, medium stiff to stiff, moist, yellowish brown and gray (SC)	12	25	13	12		119.3	2.2 3.4	2.6	6.0
415 / 15												
	ST11									1.2		
410 / 20			CLAYEY SAND, wet, yellowish brown (SC) - seepage at 21'									
	TCP12		SAND, wet, yellowish brown (SP)									
			WEATHERED LIMESTONE, moderately hard to hard, tan and gray, fractured									
405 / 25			LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
	**		** Drillers were not able to perform core run. Hollow stem augers were advanced to 31'.									
400 / 30			- occasional shaley limestone layers below 31'	15					119.7		288.6	1.7
	RC 1											
395 / 35			- 5" shaley limestone layer at 34' - core diameter thin from 36' to 39'									

Notes: *** slickensided along failure plane**

LOG OF BORING TS-15

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972182.35E 2489830.945

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.29

Advancement Method: HSA / Wet Rotary
Date Started: 04/05/2016 Completed: 04/08/2016
Abandonment Method: Grouted
Groundwater During Drilling: 21'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
	RC 2		REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
390 40													
	RC 3		REC 100% RQD 100%		16					115.5		155.2	1.3
385 45													
	RC 4 RC 4		REC 100% RQD 100% REC 100% RQD 100%	- (48') 2" zone with calcite infilling - (49') pyrite infilling - (49.5') calcite infilling zone									
380 50					12					120.8		398.1	2.0
	RC 5		REC 100% RQD 100%	- (53') calcite infilling									
375 55				- (55') calcite infilling									
	RC 6		REC 87% RQD 87%	SHALE, moderately hard,dark gray, unweathered, with occasional joints and fractures	16					116.5		22.6	1.5
370 60				-(60.9') calcite infilling - (61'- 62') numerous mechanical breaks in top 1' of core run									
	RC 7		REC 77% RQD 70%	- thin shaley limestone seams at 63' to 63.5'									
365 65													
	RC 8		REC 100% RQD 100%	- (67'2" - 72') numerous mechanical breaks	20					109.4		20.2	1.4
360 70													
	RC 9		REC 100% RQD 100%										
355													

Notes: *** slickensided along failure plane**

LOG OF BORING TS-15

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972182.35E 2489830.945

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.29

Advancement Method: HSA / Wet Rotary
Date Started: 04/05/2016 Completed: 04/08/2016
Abandonment Method: Grouted
Groundwater During Drilling: 21'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				SHALE, moderately hard, dark gray, unweathered , with occasional joints and fractures									
	RC 10		REC 97% RQD 93%	- (77'9") calcite infilling	14					120.5		35.2	1.8
350 / 80				- core diameter thin from 79'3" to 79'10" - (80'6") 1 inch thick limestone seam - core diameter thin at 81'2" to 83'3.5"									
	RC 11		REC 67% RQD 60%										
345 / 85													
	RC 12		REC 87% RQD 77%										
340 / 90					18					118.2		24.5	1.6
	RC 13		REC 87% RQD 87%										
335 / 95					9					128.9		50.0	1.6
				** Core slipped. Drillers were only able to recover 3'3". Numerous mechanical breaks									
	RC 14		REC 67% RQD 63%										
330 / 100				- broken core; recovery only 4'4" - 5" soft layer 101'10"									
	RC 15		REC 87% RQD 77%										
325 / 105													
	RC 16		REC 93% RQD 93%	LIMESTONE, hard to very hard, dark gray, unweathered, shaley, silty, with occasional joints and fractures -with limestone seams from 108'4" to 110'8"	11					127.9		36.6	1.7
320 / 110				LIMESTONE (continued)									

Notes: *** slickensided along failure plane**

LOG OF BORING TS-15

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972182.35E 2489830.945

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.29

Advancement Method: HSA / Wet Rotary
Date Started: 04/05/2016 Completed: 04/08/2016
Abandonment Method: Grouted
Groundwater During Drilling: 21'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
315 / 115	RC 17		REC 87% RQD 87%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
310 / 120	RC 18		REC 73% RQD 73%		20					105.9		5.1*	3.5
				Boring terminated at 121'									
305 / 125													
300 / 130													
295 / 135													
290 / 140													
285 / 145													
280													

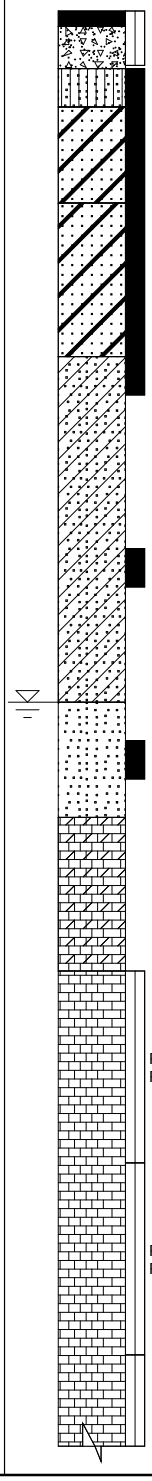
Notes: *** slickensided along failure plane**

LOG OF BORING TS-16

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972064.405 E 2489860.039

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.18

Advancement Method: HSA / Wet Rotary
Date Started: 04/13/2016 Completed: 04/15/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
430 – 0				3" ASPHALT									
				14" CONCRETE									
	ST1			SILTY SAND (FILL), stiff, brown (SM)									
	ST2			SANDY CLAY, very stiff to hard, moist to dry, reddish brown (CL)							2.6		
	ST3										3.0 3.5 4.5 4.5		
425 – 5	ST4			SANDY CLAY, very stiff to hard, moist to dry, reddish brown to yellowish brown (CL)							4.5		
	ST5										4.5+		
	ST6										4.5+		
	ST7										4.5+		
	ST8			CLAYEY SAND, hard, dry, yellowish brown, with sandy clay layers (SC)							4.5+		
420 – 10													
	ST9				12						4.5	118.1	
415 – 15				-seepage at 18'									
				SAND, medium to coarse, with trace gravel (SP)									
	SS-10												
410 – 20				WEATHERED LIMESTONE, moderately hard to hard, tan and gray, fractured									
405 – 25	RC 1			LIMESTONE, hard to very hard, gray, slightly fractured, massive bedding, unweathered	12					127.3		220.5	2.2
400 – 30	RC 2			- (31') calcite infilling									
395 – 35	RC 3												

Notes:

LOG OF BORING TS-16

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972064.405 E 2489860.039

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.18

Advancement Method: HSA / Wet Rotary
Date Started: 04/13/2016 Completed: 04/15/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 100% RQD 95%	LIMESTONE, hard to very hard, gray, slightly fractured, massive bedding, unweathered	14					121.9		293.3	1.4
390 — 40	RC 4			- (37-38') calcite infilling - (38') fossils, burrows - (40'-43') fossils									
			REC 93% RQD 93%	(42'-43.5') calcite infilling									
385 — 45	RC 5			LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
			REC 100% RQD 100%										
380 — 50	RC 6				13					123.1		358.8	1.7
			REC 100% RQD 98%	- (52-53') calcite infilling - (52.5') pyrite infilling									
375 — 55	RC 7												
			REC 100% RQD 97%	SHALE, soft to moderately hard, dark gray, unweathered, with occasional joints and fractures	18					107.7		9.2	5.2
370 — 60	RC 8			-(59'-60') thin diameter core, fossils - (61'- 62') 1" limestone seam									
			REC 75% RQD 72%	- (62') calcite infilling									
365 — 65	RC 9			SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
			REC 67% RQD 67%										
360 — 70	RC 10												
			REC 83% RQD 82%		17					113.9		20.4	1.7

Notes:

LOG OF BORING TS-16

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972064.405 E 2489860.039

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.18

Advancement Method: HSA / Wet Rotary
Date Started: 04/13/2016 Completed: 04/15/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
355 – 75	RC 11		REC 95% RQD 85%	SHALE, moderately hard, dark gray, unweathered , with occasional joints and fractures									
				- (77'9") calcite infilling	17					115.2		11.8	2.1
350 – 80	RC 12		REC 93% RQD 87%	- core diameter thin from 79'3" to 79'10"	18					115.6		20.1	1.0
345 – 85	RC 13		REC 75% RQD 72%	-numerous mechanical breaks at 85' to 105'									
340 – 90	RC 14		REC 52% RQD 47%	- (91'-92') hard limestone layer									
335 – 95	RC 15		REC 48% RQD 40%										
330 – 100	RC 16		REC 65% RQD 55%	- (101') pyrite infilling									
325 – 105	RC 17		REC 83% RQD 78%	- (105.4') pyrite infilling									
				LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures	13					120.3		18.5	2.0
320 – 110	RC 18												

Notes:

LOG OF BORING TS-16

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N6972064.405 E 2489860.039

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 430.18

Advancement Method: HSA / Wet Rotary
Date Started: 04/13/2016 Completed: 04/15/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
315 — 115	RC 19		REC 77% RQD 72%	SHALE, moderately hard, dark gray, unweathered									
			REC 100% RQD 100%		16					115.2		25.1	1.6
310 — 120				Boring terminated at 120'									
305 — 125													
300 — 130													
295 — 135													
290 — 140													
285 — 145													

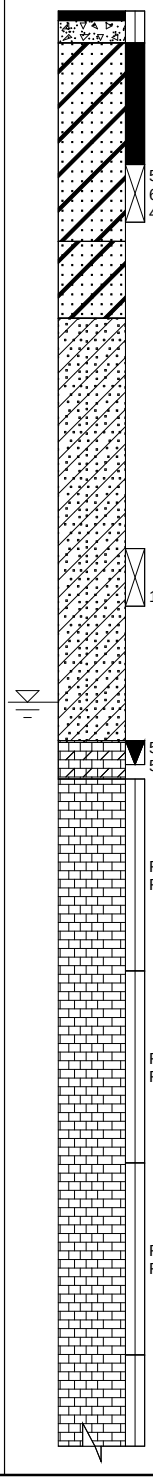
Notes:

LOG OF BORING T-24

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971220 E 2490458

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.86

Advancement Method: HSA / Wet Rotary
Date Started: 04/20/2016 Completed: 04/25/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				2.5" ASPHALT									
				7" CONCRETE									
	ST1			SANDY CLAY, stiff, moist to dry, dark brown, brown, dark gray and gray with some gravel and brick fragments (FILL) (CL)							3.5		
	ST2										4.5+		
420	ST3										1.5		
	SS4										2.5		
5											4.0		
	ST5			SANDY CLAY, stiff to very stiff, moist, reddish brown and yellowish brown (CL)	14	28	14	14		107.7	3.2	1.6	4.7
	ST6										4.2		
415	ST7			CLAYEY SAND, medium dense, dry, fine grained, with occasional clayey sand layers (SC)									
	ST8												
10													
410													
	SS9				15								
15				- moist below 15'									
405				-seepage at 18'									
				WEATHERED LIMESTONE, moderately hard to hard, tan and gray, fractured									
20	RC 1			LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures - (20.6'-21.5) calcite infilling	15					119.9		187.4	1.1
400													
25	RC 2			- (26') calcite infilling									
395				- (27') fossils burrows									
30	RC 3			(31'-32.2') calcite infilling									
390													
35	RC 4				12					127.2		200.2	1.8

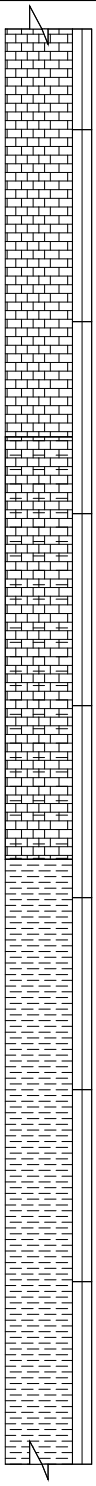
Notes: *** slickensided along failure plane**

LOG OF BORING T-24

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971220 E 2490458

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.86

Advancement Method: HSA / Wet Rotary
Date Started: 04/20/2016 Completed: 04/25/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
385				LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures - (38') calcite infilling									
40	RC 5												
				-shaley, dark gray, between 41.11' and 42.1' - (43') calcite infilling									
380				- (42') fossils									
45	RC 6												
375				SHALEY LIMESTONE, hard to very hard, dark gray, unweathered, with occasional joints and fractures	11					129.0		232.4	1.7
50	RC 7												
370													
55	RC 8												
365													
60	RC 9			SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures - (60.8') limestone seam - (61.10') calcite infilling	17					117.3		1.7*	0.5
360													
65	RC 10			* damaged core, only 12" recovery									
355													
70	RC 11												
350					18					111.5		28.7	1.8

Notes: *** slickensided along failure plane**

LOG OF BORING T-24

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971220 E 2490458

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.86

Advancement Method: HSA / Wet Rotary
Date Started: 04/20/2016 Completed: 04/25/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC 12		REC 87% RQD 78%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
345													
80	RC 13		REC 85% RQD 83%	-(80.1') limestone seam									
340					19					109.3		17.6	1.6
85	RC 14		REC 65% RQD 60%	- (85.4') pyrite infilling									
335													
90	RC 15		REC 93% RQD 92%										
330					18					111.3		15.4	1.4
95	RC 16		REC 70% RQD 67%	- (96.7'-96.9') hard limestone layer - (97' to 97.11') hard, sandy, shaley, limestone layer									
325													
100	RC 17		REC 83% RQD 83%		18					111.1		20.1	1.2
320													
105	RC 18		REC 98% RQD 98%										
315													
110	RC 19			LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures LIMESTONE (continued)									

Notes: *** slickensided along failure plane**

LOG OF BORING T-24

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971220 E 2490458

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.86

Advancement Method: HSA / Wet Rotary
Date Started: 04/20/2016 Completed: 04/25/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
310			REC 87% RQD 84%		13					122.7		25.2	2.2
115	RC 20			SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
					17					115.9		27.3	1.6
305			REC 100% RQD 100%										
120				Boring terminated at 120'									
300													
125													
295													
130													
290													
135													
285													
140													
280													
145													
275													

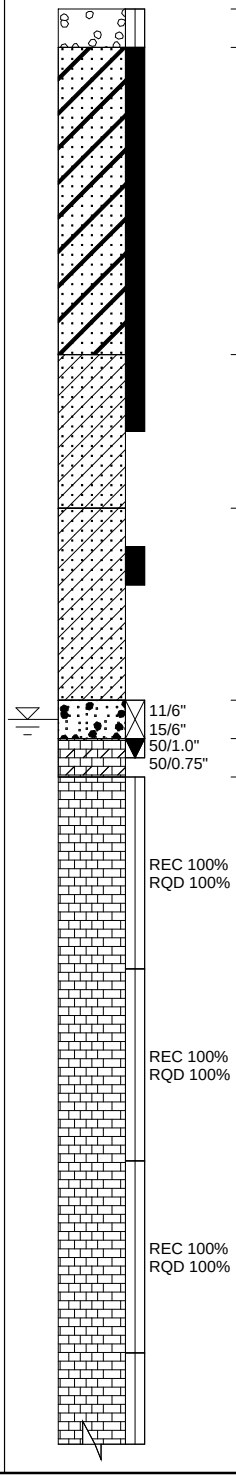
Notes: *** slickensided along failure plane**

LOG OF BORING T-25

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971246 E 2490552

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 423.6

Advancement Method: HSA / Wet Rotary
Date Started: 05/23/2016 Completed: 05/25/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18.5'
Field Representative: Hassan Shah



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				3.5" ASPHALT over 8" FLEX BASE									
	ST-1			SANDY CLAY and CLAY, medium stiff to very stiff, moist to very moist, reddish brown, with some brick, gravel and broken rock (CL) (FILL)							2.3		
	ST-2										2.0		
	ST-3										-		
420	ST-4										-		
5	ST-5				14						-		
	ST-6										1.0		
	ST-7										2.0		
	ST-8										4.5+		
415	ST-9										1.3		
10				CLAYEY SAND, medium stiff, very moist, dark grayish brown (SC)	19	28	12	16		107.7	1.2	1.9	10.8
410	ST-10			CLAYEY SAND, very stiff, very moist, gray and yellowish brown (SC))	13	25	13	12		120.5	4.5+	2.9	3.1
15													
405	SS-11			GRAVELLY SAND, medium dense, wet									
	TCP			-seepage at 18.5'									
20	RC 1			WEATHERED LIMESTONE, hard, tan and gray, fractured									
				LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
				-2.5" shaley limestone layer at 20.5'	14					122.1		252.2	1.3
400													
25	RC 2			-6" shaley limestone layer at 24.2'									
395				-8" shaley limestone layer at 28.8'									
30	RC 3												
				-calcite infilling	11					128.5		261.3	2.0
390													
35	RC 4												

Notes: *** slickensided along failure plane**

LOG OF BORING T-25

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971246 E 2490552

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 423.6

Advancement Method: HSA / Wet Rotary
Date Started: 05/23/2016 Completed: 05/25/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18.5'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
385			REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures -17" shaley limestone layer at 38'									
40	RC 5												
			REC 100% RQD 100%	-calcite infilling	13					123.1		240.7	1.3
380				-burrows -2.5" shaley limestone layer at 44.7'									
45	RC 6												
			REC 100% RQD 100%	-5" shaley limestone layer at 46.9' -calcite infilling									
375													
50	RC 7												
			REC 100% RQD 98%		11					130.2		286.8	1.8
370				-18" shaley limestone layer at 53.5'									
55	RC 8												
			REC 98% RQD 98%	-calcite infilling -23" shaley limestone layer at 58'									
365													
60	RC 9												
			REC 100% RQD 100%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures	17					114.5		8.4*	1.3
360													
65	RC 10												
			REC 95% RQD 95%	-thin limestone seams									
355													
70	RC 11												
			REC 100% RQD 100%		20					111.0		23.7	1.0
350													

Notes: *** slickensided along failure plane**

LOG OF BORING T-25

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971246 E 2490552

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 423.6

Advancement Method: HSA / Wet Rotary
Date Started: 05/23/2016 Completed: 05/25/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18.5'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC 12		REC 100% RQD 100%	SHALE, moderately hard, dark gray, unweathered with occasional joints and fractures									
345				-thin limestone seams									
80	RC 13		REC 97% RQD 97%		16					118.1		36.4	2.2
340				-thin limestone seams									
85	RC 14		REC 97% RQD 97%										
335													
90	RC 15		REC 100% RQD 100%	-pyrite infilling	19					113.5		23.8	1.2
330													
95	RC 16		REC 100% RQD 90%	-thin limestone seams -6" shaley limestone layer at 97.75' -9" limestone layer at 98.25'									
325													
100	RC 17		REC 93% RQD 93%		19					110.7		4.4*	3.1
320													
105	RC 18		REC 85% RQD 85%	-thin limestone seams									
315													
110	RC 19												

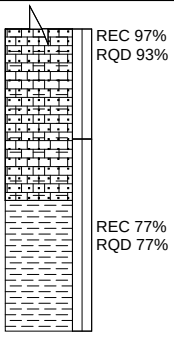
Notes: *** slickensided along failure plane**

LOG OF BORING T-25

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971246 E 2490552

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 423.6

Advancement Method: HSA / Wet Rotary
Date Started: 05/23/2016 Completed: 05/25/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18.5'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
310				LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures	10					130.0		56.3	1.9
115	RC 20												
305				SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
120				Boring terminated at 120'									
300													
125													
295													
130													
290													
135													
285													
140													
280													
145													
275													

Notes: *** slickensided along failure plane**

LOG OF BORING T-26

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971165 E 2490673

Drilling Contractor:
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 424.36

Advancement Method: HSA / Wet Rotary
Date Started: 05/31/2016 Completed: 06/01/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				1" ASPHALT over 4" CONCRETE									
	ST-1			Stabilized SANDY CLAY, medium stiff, moist, brown and dark brown (CL) (FILL)							-		
	ST-2			CLAY mixed with SANDY CLAY, medium stiff to stiff, moist, brown, grayish brown, and reddish brown (CH-CL) (FILL)							1.2		
	ST-3										1.3		
	ST-4										2.4		
420 / 5				CLAY, stiff, moist, gray and reddish brown with numerous thin sand lenses (CH)							1.6		
	ST-5										1.8		
	ST-6										1.7		
	ST-7										2.0		
	ST-8			CLAYEY SAND, loose, moist, reddish brown (SC)							-		
415 / 10	ST-9				10						-		
				SANDY CLAY, medium stiff, moist, reddish brown and grayish brown (CL)							1.0		
410 / 15	ST-10				16	32	14	18		111.6	1.7	1.8	7.3
				-seepage at 18'									
				CLAYEY SAND, medium stiff, moist, brownish gray, with trace of gravel (SC)									
405 / 20	ST-11				25					95.2	1.0		
400 / 25	RC 1			WEATHERED LIMESTONE, moderately hard to hard, tan, fractured									
			REC 92% RQD 92%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures	15					120.2		341.8	1.5
395 / 30	RC 2			-burrows									
				-calcite infilling									
			REC 100% RQD 100%										
390 / 35	RC 3												

Notes: ***slickensided along failure plane**

LOG OF BORING T-26

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971165 E 2490673

Drilling Contractor:
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 424.36

Advancement Method: HSA / Wet Rotary
Date Started: 05/31/2016 Completed: 06/01/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures	16					118.6		332.6	1.4
385 / 40	RC 4												
			REC 100% RQD 98%	-calcite infilling -burrows									
380 / 45	RC 5												
			REC 100% RQD 100%		15					118.8		263.7	1.3
375 / 50	RC 6												
			REC 100% RQD 95%										
370 / 55	RC 7												
			REC 100% RQD 100%	-calcite infilling	14					120.5		449.3	1.9
365 / 60	RC 8												
			REC 88% RQD 83%										
360 / 65	RC 9			SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
			REC 100% RQD 100%	-thin limestone seams	14					123		24.6	1.4
355 / 70	RC 10												
			REC 87% RQD 87%										
350													

Notes: ***slickensided along failure plane**

LOG OF BORING T-26

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971165 E 2490673

Drilling Contractor:
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 424.36

Advancement Method: HSA / Wet Rotary
Date Started: 05/31/2016 Completed: 06/01/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC 11		REC 100% RQD 100%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures	18					110.8		31.4	1.5
345 80	RC 12		REC 100% RQD 100%										
340 85	RC 13		REC 87% RQD 87%	-thin limestone seams	17					116.2		24.6	1.9
335 90	RC 14		REC 80% RQD 80%										
330 95	RC 15		REC 100% RQD 100%		17					114.8		27.3	2.1
325 100	RC 16		REC 73% RQD 73%	-12" shaley limestone layer at 99.6' -calcite infilling									
320 105	RC 17		REC 93% RQD 90%	-1.5" Bentonite seam at 106.9'	18					112.8		14.4*	1.4
315 110	RC 18			SHALE, moderately hard, dark gray, unweathered									

Notes: ***slickensided along failure plane**

LOG OF BORING T-26

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971165 E 2490673

Drilling Contractor:
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 424.36

Advancement Method: HSA / Wet Rotary
Date Started: 05/31/2016 Completed: 06/01/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 100% RQD 98%	with occasional joints and fractures									
310 115	RC 19		REC 88% RQD 85%	LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures	11					126.2		33.8	1.2
305 120				SHALE, moderately hard, dark gray, unweathered with occasional joints and fractures									
				Boring terminated at 120'									
300 125													
295 130													
290 135													
285 140													
280 145													
275													

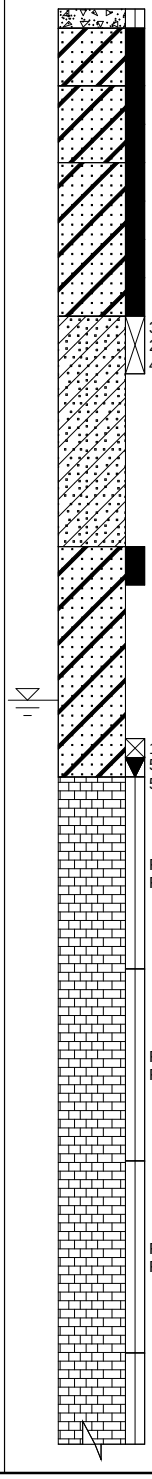
Notes: ***slickensided along failure plane**

LOG OF BORING T-27

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971149 E 2490768

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 425.12

Advancement Method: HSA / Wet Rotary
Date Started: 06/06/2016 Completed: 06/07/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
425 – 0			3" ASPHALT									
	ST-1		SANDY CLAY, loose, moist, brown and gray, with few rock pieces (CL)							-		
	ST-2		CLAY mixed with SANDY CLAY, stiff, moist, reddish brown (CL-CH)							1.5		
	ST-3									2.5		
	ST-4		SANDY CLAY, loose, moist, reddish brown (CL)									
420 – 5	ST-5											
	ST-6											
	ST-7									1.0 1.5		
	SS-8		CLAYEY SAND, medium stiff, dry, reddish brown (SC)									
415 – 10												
	ST-9		SANDY CLAY, very stiff to soft, dry, yellowish brown (CL)							2.5 3.5		
410 – 15												
	SS-10											
	TCP											
405 – 20	RC 1		LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
				12					126.6		316.4	1.9
400 – 25	RC 2											
			-burrows -calcite infilling									
395 – 30	RC 3											
			-calcite infilling -burrows	13					124.1		301.1	1.6
390 – 35	RC 4											

Notes: ***slickensided along failure plane**

LOG OF BORING T-27

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971149 E 2490768

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 425.12

Advancement Method: HSA / Wet Rotary
Date Started: 06/06/2016 Completed: 06/07/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			REC 100% RQD 100%	LIMESTONE, hard to very hard, gray, unweathered, with occasional joints and fractures									
385 — 40	RC 5												
			REC 100% RQD 100%	-few burrows	10					132.4		206.0	2.4
380 — 45	RC 6												
			REC 100% RQD 98%										
375 — 50	RC 7			-core damaged no recovery RC-7	14					119.3		238.4	1.2
			REC 0% RQD 0%										
370 — 55	RC 8												
			REC 95% RQD 95%	-calcite infilling									
365 — 60	RC 9												
			REC 100% RQD 100%		10					127.3		254.7	1.6
360 — 65	RC 10												
			REC 98% RQD 98%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
355 — 70	RC 11				15					118.6		15.1*	2.7
			REC 55% RQD 55%	-thin limestone seams									

Notes: ***slickensided along failure plane**

LOG OF BORING T-27

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971149 E 2490768

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 425.12

Advancement Method: HSA / Wet Rotary
Date Started: 06/06/2016 Completed: 06/07/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
350 — 75	RC 12		REC 95% RQD 95%	SHALE, moderately hard, dark gray, unweathered, with occasional joints and fractures									
345 — 80	RC 13		REC 55% RQD 55%		19					112.4		27.9	2.2
340 — 85	RC 14		REC 92% RQD 92%										
335 — 90	RC 15		REC 100% RQD 98%		17					115.2		19.7*	1.2
330 — 95	RC 16		REC 100% RQD 100%										
325 — 100	RC 17		REC 87% RQD 85%	16" hard sandy shaley limestone layer	15					118.9		30.2	1.9
320 — 105	RC 18		REC 100% RQD 97%										
315 — 110	RC 19			SHALE, moderately hard, dark gray, unweathered	17					112.9		20.0	0.8

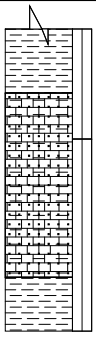
Notes: ***slickensided along failure plane**

LOG OF BORING T-27

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971149 E 2490768

Drilling Contractor: Texplor
Driller: Brent Thomason
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 425.12

Advancement Method: HSA / Wet Rotary
Date Started: 06/06/2016 Completed: 06/07/2016
Abandonment Method: Grouted
Groundwater During Drilling: 18'
Field Representative: Hassan Shah

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			 REC 88% RQD 88%	with occasional joints and fractures									
310 — 115	RC 20		REC 100% RQD 100%	LIMESTONE, hard to very hard, dark gray, unweathered, shaley, sandy, with occasional joints and fractures									
305 — 120				SHALE, moderately hard, dark gray, unweathered with occasional joints and fractures									
				Boring terminated at 120'									
300 — 125													
295 — 130													
290 — 135													
285 — 140													
280 — 145													

Notes: ***slickensided along failure plane**

APPENDIX B-2

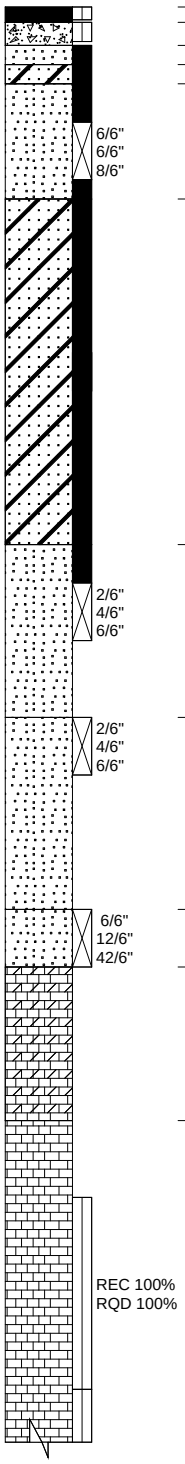
GRIFFIN-ELM-COMMERCE ALIGNMENT PRELIMINARY BORING LOGS (2017)

LOG OF BORING B-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972438 E 2490220

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 428.44

Advancement Method: HSA / Wet Rotary
Date Started: 04/04/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				2" ASPHALT									
				8" CONCRETE									
	ST-1			SAND, BASE, very loose, moist, brown & tan (SP)									
	ST-2			SANDY CLAY, loose, moist, dark brown & tan (CL)									
	ST-3			SAND, very loose, moist, gray and tan to tan (SP)	9								
425	SS-4				4								
5	ST-5			SANDY CLAY, very hard, moist, reddish brown (CL)	10	32	16	16		123	4.5		
	ST-6										4.5+		
	ST-7										4.5++		
420	ST-8										4.5++		
	ST-9										4.5++		
10													
415													
	ST-10			SAND, very loose, moist, reddish tan and brown (SP)	1		NP						
15	SS-11				6					107			
410	SS-12			SAND, very loose, wet, reddish tan and brown (SP)									
20				-water seepage at 20'									
405	SS-13			SAND, very loose, wet, tan (SP)									
25				WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan, w/ calcareous clay seams & layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
400													
30				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
	RC-1												
395													
35													
	RC-2												

Notes:

LOG OF BORING B-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972438 E 2490220

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 428.44

Advancement Method: HSA / Wet Rotary
Date Started: 04/04/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
390				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
40			REC 100% RQD 100%	-shaley from 41.5' to 43.2'									
385													
45	RC-3												
380				-shaley from 48.3' to 49'									
50			REC 98% RQD 98%	-slightly shaley at 50.3' to 51.4'									
375													
55	RC-4			-w/ occasional fossils, pyrite and calcite below 55' -slightly shaley at 55.5' to 56'									
370													
60			REC 100% RQD 100%										
365													
65	RC-5			SHALE (Eagle-Ford) - moderately fractured to sound, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous limestone layers									
360			REC 80% RQD 73%	-1.5" limestone seam at 68.8'									
70	RC-6			-1" limestone seam at 71.3' -1.5" limestone seam at 72.1									
355			REC 100% RQD 93%										

Notes:

LOG OF BORING B-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972438 E 2490220

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 428.44

Advancement Method: HSA / Wet Rotary
Date Started: 04/04/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				SHALE (Eagle-Ford) - moderately fractured to sound, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous limestone layers									
	RC-7		REC 97% RQD 93%	- soft shale from 75.5' to 81.6'									
350													
80													
	RC-8			-1.5" dark gray limestone layer at 81.6'									
345			REC 98% RQD 93%										
85													
	RC-9												
340			REC 100% RQD 100%										
90													
	RC-10			-0.25" limestone seam at 90.7'									
335			REC 100% RQD 100%	-0.5" limestone seam at 93.3'									
95				-0.75" limestone seam at 94.6'									
	RC-11												
330			REC 88% RQD 85%										
100													
	RC-12												
325			REC 88% RQD 88%	-12" hard shaley limestone layer at 102.2' w/ calcite infilling									
105													
	RC-13												
320			REC 85% RQD 78%										
110													
	RC-14												

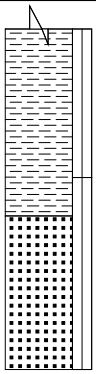
Notes:

LOG OF BORING B-1

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972438 E 2490220

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 428.44

Advancement Method: HSA / Wet Rotary
Date Started: 04/04/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
315 / 115	RC-15		 REC 0% RQD 0%	SHALE (Eagle-Ford) - moderately fractured to sound, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous limestone layers - No Recovery - Drillers slipped core at 111' to 116'									
310 / 120			REC 95% RQD 92%	SANDSTONE (Eagle-Ford) - slightly fractured to sound, medium hard to very hard, fresh, gray, fine grained, thick bedding, moderately close to wide joint spacing, w/ very hard calcareous stringers and nodules									
				Boring terminated at 121'									
305 / 125													
300 / 130													
295 / 135													
290 / 140													
285 / 145													
280													

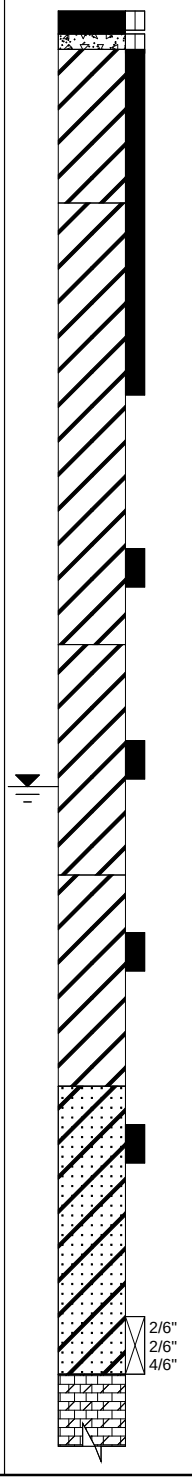
Notes:

LOG OF BORING B-2

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972894 E 2493220

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 465.52

Advancement Method: HSA / Wet Rotary
Date Started: 04/06/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling: 20.2'
Field Representative: William Cappell



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
465 / 0				6" ASPHALT									
				6" CONCRETE									
	ST-1			CLAY, medium stiff to stiff, moist, dark brown, w/ trace sand (FILL) (CH)	17	48	19	29			1.5		
	ST-2										1.0		
	NR												
	ST-3										1.5		
460 / 5	ST-4			CLAY, very stiff, dry, yellowish brown and dark brown, w/ trace calcareous deposits (CH)	17	50	18	32		113	4.5		
	ST-5										4.5		
	ST-6												
	ST-7										3.5		
	ST-8										3.0		
455 / 10													
	ST-9			-some calcareous nodules, sand and gravel at 14.5' to 15'	19	52	17	35			3.75		
450 / 15				CLAY, medium stiff to stiff, dry, yellowish brown w/ gravelly sand layers (CH)									
	ST-10				13	39	17	22			2.0		
445 / 20													
				CLAY, medium stiff, dry, yellowish brown and gray, silty, w/ trace sand (CL-CH)									
	ST-11				18	44	18	26		111	2.5		
440 / 25				-w/ sandy clay layers below 27'									
				-water seepage at 27.8' during drilling									
				SANDY CLAY, medium stiff, moist, yellowish brown and gray, w/ sand layers									
	ST-12				20	41	19	22		109	1.8	4.8	3.6
435 / 30													
	SS-13				15	35	17	18			1.3		
430 / 35				WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to soft, severely to moderately weathered, tan, w/									

Notes:

LOG OF BORING B-2

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972894 E 2493220

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 465.52

Advancement Method: HSA / Wet Rotary
Date Started: 04/06/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling: 20.2'
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
	SS-14		30/6" 50/1"	calcareous clay seams & layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
40, 425	RC-1		REC 95% RQD 95%	LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
45, 420	RC-2			-4" argillaceous limestone layer at 47.7'									
50, 415			REC 100% RQD 100%	-argillaceous limestone below 50.3'									
55, 410	RC-3												
60, 405			REC 98% RQD 98%										
				-2" shale layer at 63'									
65, 400	RC-4			-argillaceous limestone below 64.5'									
70, 395			REC 100% RQD 100%	-4" shale layer at 69.4'									

Notes:

LOG OF BORING B-2

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972894 E 2493220

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 465.52

Advancement Method: HSA / Wet Rotary
Date Started: 04/06/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling: 20.2'
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
390	RC-5												
80			REC 100% RQD 100%										
385													
85													
380	RC-6			-numerous burrows from 86' to 91' -3" argillaceous limestone layer at 86.7'									
				-4" argillaceous limestone layers at 88.4'									
90				-6" argillaceous limestone layer at 89.9'									
375			REC 98% RQD 98%										
				-2" shale layer at 92.8'									
95													
370	RC-7												
				-argillaceous limestone layer at 98' to 100'									
100													
365			REC 100% RQD 100%										
				-burrow -calcite at 102.8' to 103' -shale layer									
105													
360	RC-8												
110													
355			REC 98% RQD 98%	-argillaceous limestone layer and calcite at 111.5' to 112.4'									

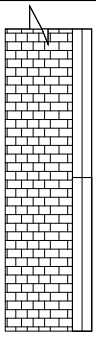
Notes:

LOG OF BORING B-2

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972894 E 2493220

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 465.52

Advancement Method: HSA / Wet Rotary
Date Started: 04/06/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling: 20.2'
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
350 115	RC-9 RC-9		 REC 100% RQD 100% REC 100% RQD 100%	LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses -argillaceous limestone layer and calcite at 113' to 113.5' -shale layer at 116' to 117.2' -argillaceous limestone layer and brown calcite at 118.5' to 119'									
345 120				Boring terminated at 120'									
340 125													
335 130													
330 135													
325 140													
320 145													

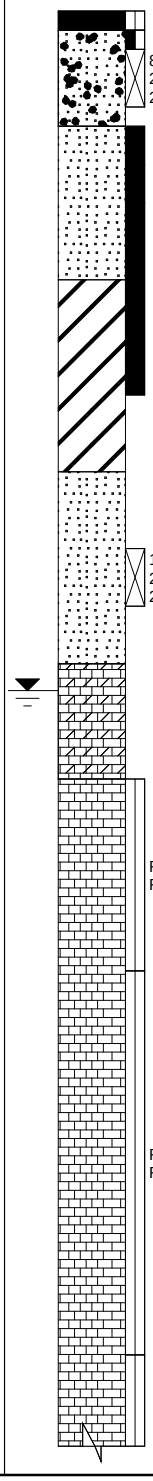
Notes:

LOG OF BORING B-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971805 E 2492044

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 435.23

Advancement Method: HSA / Wet Rotary
Date Started: 05/02/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
435 – 0				2" ASPHALT over 3" BRICK									
	SS-1			SAND, moist, brown, gravelly w/ concrete pieces (FILL) (SP)									
	ST-2			SAND, moist, brown and tan w/ clay and sandy clay layers and lenses (SP)	14								
	ST-3												
430 – 5	ST-4												
	ST-5												
	ST-6			CLAY, very stiff, moist, gray, w/ sand layers and lenses (CH)	20	53	18	35			3.2		
	ST-7										3.25		
	ST-8										3.25		
425 – 10													
				SAND, very loose, wet, tan, fine (SP)									
	SS-9			-water seepage at 14 feet	18								
420 – 15													
				WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan, w/ calcareous clay seams & layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
415 – 20	RC-1			LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
410 – 25	RC-2												
405 – 30													
400 – 35	RC-3												

Notes:

LOG OF BORING B-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971805 E 2492044

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 435.23

Advancement Method: HSA / Wet Rotary
Date Started: 05/02/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
395 — 40			REC 100% RQD 100%	LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
390 — 45	RC-4												
385 — 50			REC 100% RQD 100%										
380 — 55	RC-5												
375 — 60			REC 100% RQD 97%										
370 — 65	RC-6												
365 — 70			REC 100% RQD 100%										

Notes:

LOG OF BORING B-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971805 E 2492044

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 435.23

Advancement Method: HSA / Wet Rotary
Date Started: 05/02/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
360 – 75	RC-7			LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
355 – 80			REC 100% RQD 100%										
350 – 85	RC-8												
345 – 90			REC 100% RQD 99%										
340 – 95	RC-9			SANDY LIMESTONE (Austin Chalk) - sound, medium hard to very hard, fresh, gray, fine grained, medium bedding, moderately close joint spacing									
			REC 100% RQD 100%	SHALE (Eagle-Ford) - moderately fractured to sound, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous limestone layers									
335 – 100	RC-10			-w/ limestone seams from 100' to 105'									
330 – 105			REC 100% RQD 100%										
325 – 110	RC-11												

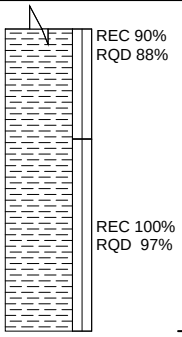
Notes:

LOG OF BORING B-3

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971805 E 2492044

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 435.23

Advancement Method: HSA / Wet Rotary
Date Started: 05/02/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
320 – 115	RC-12			SHALE (Eagle-Ford) - moderately fractured to sound, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous limestone layers -w/ argillaceous limestone layers from 110' to 120'									
315 – 120													
310 – 125													
305 – 130													
300 – 135													
295 – 140													
290 – 145													

Notes:

LOG OF BORING B-4

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972438 E 2491504

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation:

Advancement Method: HSA / Wet Rotary
Date Started: 05/12/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				3" ASPHALT, 3" CONCRETE, 3" BASE, 2" CONCRETE, 3" BASE									
	ST-1			Gray and yellowish brown calcareous CLAY w/ severely weathered limestone seams	12	42	20	22					
	SS-2		50/5"		1								
	ST-2			WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan, w/ calcareous clay seams & layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
	ST-4												
	ST-3												
5	ST-5												
	THD-1		50/0.75"										
	RC-1		50/0.25"										
			REC 98% RQD 97%	LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
10	RC-2												
			REC 100% RQD 100%										
15	RC-3												
			REC 99% RQD 99%										
20	RC-4												
			REC 100% RQD 98%										
25	RC-5												
			REC 98% RQD 98%										
30	RC-6												
			REC 100% RQD 100%										
35	RC-7												

Notes:

LOG OF BORING B-4

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972438 E 2491504

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation:

Advancement Method: HSA / Wet Rotary
Date Started: 05/12/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
40	RC-8		REC 98% RQD 98%	LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine g rained, massive bedding, moderately close to wide e joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
			REC 100% RQD 100%										
45	RC-9												
			REC 100% RQD 100%										
50	RC-10												
			REC 98% RQD 98%										
55	RC-11												
			REC 100% RQD 100%										
60	RC-12												
			REC 100% RQD 100%										
65	RC-13												
70			REC 100% RQD 100%										

Notes:

LOG OF BORING B-4

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972438 E 2491504

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation:

Advancement Method: HSA / Wet Rotary
Date Started: 05/12/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC-14		REC 98% RQD 98%	LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine g rained, massive bedding, moderately close to wide e joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
80	RC-15		REC 98% RQD 98%										
85	RC-16		REC 98% RQD 98%										
90	RC-17		REC 100% RQD 99%										
95	RC-18		REC 96% RQD 94%	SHALE (Eagle-Ford) - moderately fractured to sound nd, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous aqueous limestone layers									
100	RC-19		REC 90% RQD 89%										
105	RC-20		REC 98% RQD 98%										
110													

Notes:

LOG OF BORING B-4

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972438 E 2491504

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation:

Advancement Method: HSA / Wet Rotary
Date Started: 05/12/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling:
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
115				SHALE (Eagle-Ford) - moderately fractured to sound nd, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous aqueous limestone layers									
120				Boring terminated at 120'									
125													
130													
135													
140													
145													

Notes:

LOG OF BORING B-5

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972761 E 2490750

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 433.39

Advancement Method: HSA / Wet Rotary
Date Started: 07/17/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling: Dry before Coring
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				10" CONCRETE									
430				Dark brown to brown CLAY w/ calcareous nodules (FILL) (Blank drill to 10' within previous SUE pothole)									
5													
425													
10	ST-1			Brown CLAY w/ sand (FILL) -hit hard debris at 11'							0.75		
420													
15	SS-2		1/6" 2/6" 4/6"	Brown CLAY							1.8		
415													
20	ST-3			Gray and light brown CLAY w/ calcareous nodules	26	55	19	36			1.4		
410													
25	ST-4			Gray and light gray CLAY w/ sand -limestone fragments at 25' -weathered limestone at 27.5'	25	40	17	23			1.25		
405													
30	RC-1		REC 36% RQD 23%	WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan, w/ calcareous clay seams & layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
400													
35	RC-2			LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to									

Notes:

LOG OF BORING B-5

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972761 E 2490750

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 433.39

Advancement Method: HSA / Wet Rotary
Date Started: 07/17/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling: Dry before Coring
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
395			REC 100% RQD 97%	wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
40	RC-3			LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
390													
45			REC 98% RQD 93%										
385													
50	RC-4												
380			REC 100% RQD 85%										
55	RC-5												
375													
60			REC 99% RQD 98%										
370													
65	RC-6												
365													
70			REC 100% RQD 98%										
360													

Notes:

LOG OF BORING B-5

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972761 E 2490750

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 433.39

Advancement Method: HSA / Wet Rotary
Date Started: 07/17/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling: Dry before Coring
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC-7		REC 93% RQD 92%	SHALE (Eagle-Ford) - moderately fractured to sound, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous limestone layers									
355													
80	RC-8		REC 95% RQD 93%										
350													
85	RC-9		REC 90% RQD 90%										
345													
90	RC-10		REC 97% RQD 97%										
340													
95	RC-11		REC 95% RQD 95%										
335													
100	RC-12		REC 82% RQD 82%										
330													
105	RC-13		REC 100% RQD 98%										
325													
110	RC-14												

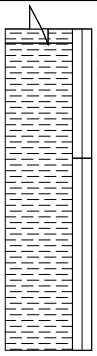
Notes:

LOG OF BORING B-5

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972761 E 2490750

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 433.39

Advancement Method: HSA / Wet Rotary
Date Started: 07/17/2017 Completed:
Abandonment Method: Grouted
Groundwater During Drilling: Dry before Coring
Field Representative: William Cappell

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
320 / 115	RC-15		 REC 100% RQD 95%	SHALE (Eagle-Ford) - moderately fractured to sound, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous limestone layers									
315 / 120			REC 73% RQD 70%										
				Boring terminated at 120.5'									
310 / 125													
305 / 130													
300 / 135													
295 / 140													
290 / 145													
285													

Notes:

APPENDIX B-3

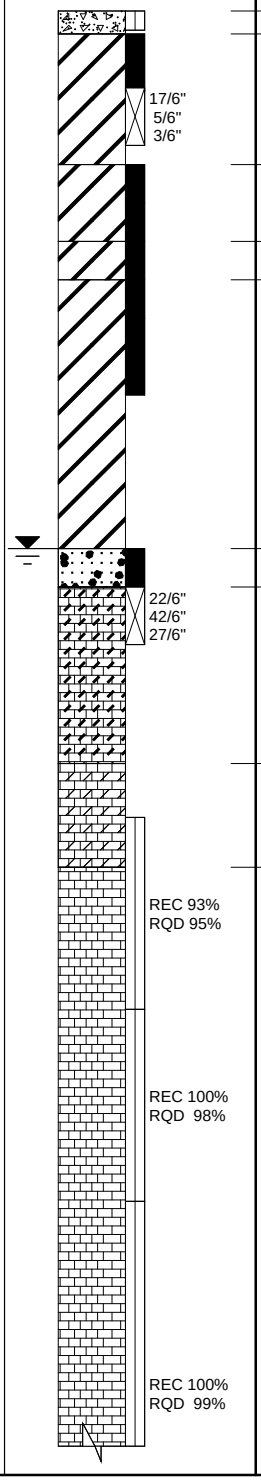
GRIFFIN-ELM-COMMERCE ALIGNMENT BORING LOGS (2017-2019)

LOG OF BORING P-102

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973575 E 2494136

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 469.61

Advancement Method: HSA / Wet Rotary
Date Started: 10/02/2017 Completed: 10/03/2017
Abandonment Method: Grouted
Groundwater During Drilling: 14'
Field Representative: Logan Tucker, E.I.T.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0			4" CONCRETE over 2" FLEX BASE									
	ST-1		CLAY, very stiff to hard, dark brown and tan, w/ gravel pieces, sand lenses and asphalt debris (FILL) (CH)							4.5+		
	SS-2									3.75		
	ST-3		CLAY, hard, dark brown, w/ calcareous nodules (CH)	16	55	21	34			4.5+		
465 / 5	ST-4									4.5+		
	ST-5		CLAY, hard, tan and brown, w/ calcareous nodules (CH)	15	57	21	36		114	4.5+		
	ST-6		CLAY, hard, tan and light gray w/ numerous calcareous deposits (CH)	11	52	19	33		119		28.7	3.0
	ST-7			11					120			
460 / 10										4.5		
			-seepage at 14' during drilling									
	ST-8		SANDY GRAVEL, medium coarse to coarse, tan, w/ sand seams (GP)	10								
455 / 15	SS-9		LIMESTONE (Austin Chalk)-extremely fractured, moderately hard, severely weathered, tan, decomposed, w/ clay seams									
450 / 20			LIMESTONE (Austin Chalk) moderately to slightly fractured, medium hard, moderately weathered, light tan to light gray, discolored									
	RC-1		-45° slickensided fracture at 21.4'									
			LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, w/ argillaceous limestone seams and layers	1.0					129		484.4	1.7
445 / 25	RC-2											
440 / 30			-45° slickensided fracture at 30.5'									
	RC-3											
			-very hard shell fossils at 33.4'									
435 / 35												

Notes:

LOG OF BORING P-102

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973575 E 2494136

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 469.61

Advancement Method: HSA / Wet Rotary
Date Started: 10/02/2017 Completed: 10/03/2017
Abandonment Method: Grouted
Groundwater During Drilling: 14'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
430 / 40	RC-4			LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, massive, w/ argillaceous limestone seams and layers -0.5" shale lense at 38.1'									
425 / 45			REC 98% RQD 97%	-3" shale layer at 44.5' -3" sandy calcareous mudstone at 44.8' -45° slickensided fracture at 45.4' and 45.6'									
420 / 50	RC-5			-45° slickensided fracture at 52.3'									
415 / 55			REC 100% RQD 98%										
410 / 60	RC-6			-1" calcareous shale lens at 63.3' -0.2" shale lens at 64.2'									
405 / 65			REC 100% RQD 100%	-2" calcareous shale seam at 67.2' -0.5" shale lens at 68' and 72'									
400 / 70	RC-7			-calcareous shale at 73.6'-73.9' -3" shale seam at 73.8'									
395													

Notes:

LOG OF BORING P-102

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973575 E 2494136

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 469.61

Advancement Method: HSA / Wet Rotary
Date Started: 10/02/2017 Completed: 10/03/2017
Abandonment Method: Grouted
Groundwater During Drilling: 14'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75			REC 99% RQD 99%	LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, massive, w/ argillaceous limestone seams and layers									
390 80	RC-8												
385 85			REC 98% RQD 95%	-2" calcareous shale layer at 86.2'									
380 90	RC-9			-2" shale at 93'									
375 95			REC 100% RQD 86%										
370 100	RC-10			-poor core recovery at 99.7 -101' due to fractured rock -1" calcareous shale at 103'									
365 105			REC 100% RQD 87%										
360 110	RC-11			-calcareous shale w/ linear fossils at 107.8' to 108.4'									

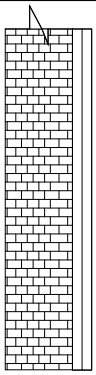
Notes:

LOG OF BORING P-102

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973575 E 2494136

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 469.61

Advancement Method: HSA / Wet Rotary
Date Started: 10/02/2017 Completed: 10/03/2017
Abandonment Method: Grouted
Groundwater During Drilling: 14'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
355 – 115			 REC 100% RQD 100%	LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, massive, w/ argillaceous limestone seams and layers -gray argillaceous limestone w/ linear fossils at 113.1'-113.6' and 114.5'-116' -very hard shell fossils at 114.5' -45° slickensided fracture at 114.7'									
350 – 120				Boring terminated at 121'									
345 – 125													
340 – 130													
335 – 135													
330 – 140													
325 – 145													

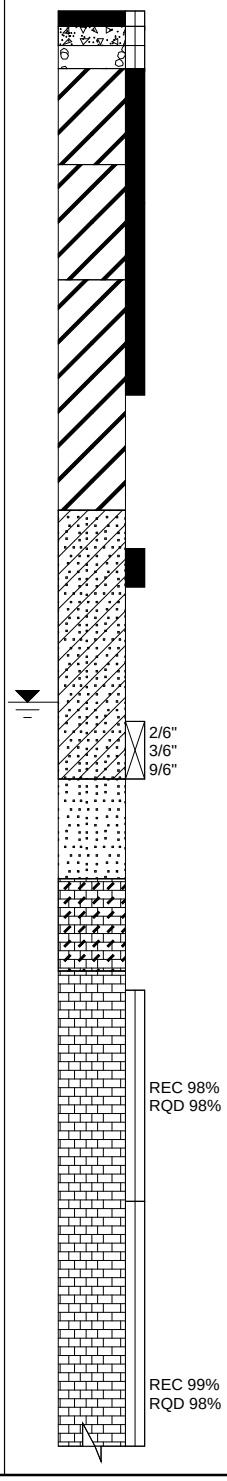
Notes:

LOG OF BORING T-102

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973346 E 2489997

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.65

Advancement Method: HSA / Wet Rotary
Date Started: 9/26/2017 Completed: 9/27/2017
Abandonment Method: Grouted
Groundwater During Drilling: -18'
Field Representative: Logan Tucker, E.I.T.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				2" ASPHALT									
				8" CONCRETE									
	ST-1			6" FLEX BASE	12	55	20	35			4.5++		
425	ST-2			CLAY, hard, dark gray to dark brown, w/ calcareous nodules (CH)							4.5++		
	ST-3			CLAY, hard, brown to light brown and gray, w/ calcareous deposits (CH)	11	48	20	28			4.5++		
5	ST-4										4.5++		
	ST-5										4.5++		
	ST-6			CLAY, hard, tan and light gray, w/ sand (CH)	10	44	19	25		128	4.5+	62.2	2.9
420	ST-7										4.5+		
	ST-8										4.5+		
10													
415													
	ST-9			CLAYEY SAND, medium dense, tan and light gray, w/ sandy clay seams (SC)	17					111			
15													
410				-seepage at 18' during drilling									
	SS-10				21								
20				SAND, coarse to fine, tan (SP)									
405				LIMESTONE (Austin Chalk) extremely fractured, medium hard, severely weathered, tan, decomposed, w/ clay seams									
25	RC-1			LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, massive bedding, wide joint spacing, w/ argillaceous limestone seams and layers	1					126		158.9	1.6
400													
30	RC-2												
395													
35													

Notes:

LOG OF BORING T-102

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973346 E 2489997

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.65

Advancement Method: HSA / Wet Rotary
Date Started: 9/26/2017 Completed: 9/27/2017
Abandonment Method: Grouted
Groundwater During Drilling: -18'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
390				LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, massive bedding, wide joint spacing, w/ argillaceous limestone seams and layers -35° slickensided fracture at 37.5'									
40													
	RC-3												
385													
45			REC 99% RQD 99%										
380													
50													
	RC-4			-mostly argillaceous limestone below 52'									
375													
55			REC 95% RQD 95%										
370				<u>SHALE</u> (Eagle Ford)-sound, medium hard, fresh, dark gray and gray, massive bedding, wide joint spacing, fine grained, w/ calcareous shale seams -numerous very hard calcareous nodules and stringers at 59.3'-59.7'									
60													
	RC-5			-very hard calcareous stringers at 61.1'-61.7'									
365				-2" very hard limestone at 62'									
			REC 97% RQD 96%										
65													
	RC-6												
360													
			REC 98% RQD 98%										
70													
	RC-7												
355				-35° fracture at 72.4'									
			REC 97% RQD 97%										

Notes:

LOG OF BORING T-102

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973346 E 2489997

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.65

Advancement Method: HSA / Wet Rotary
Date Started: 9/26/2017 Completed: 9/27/2017
Abandonment Method: Grouted
Groundwater During Drilling: -18'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				SHALE (Eagle Ford)-sound, medium hard, fresh, dark gray and gray, massive bedding, wide joint spacing, fine grained, w/ calcareous shale seams									
	RC-8		REC 93% RQD 91%										
350													
80				-1" tan band at 79.5'									
	RC-9			-0.3" ironstone at 79.8'									
345			REC 100% RQD 98%										
85				-30° slickensided fracture at 85.5'									
	RC-10												
340			REC 99% RQD 99%	-30° slickensided fracture at 87.5'									
				-20° fracture at 88.3'									
90													
	RC-11			-0.5" calcareous shale at 92.2'									
335			REC 80% RQD 68%	SANDY MUDSTONE (Eagle Ford) - sound, hard, fresh, dark gray, thin bedding, close joints, w/ very hard sandstone lens									
95													
	RC-12			SHALE (Eagle Ford)-sound, medium hard, fresh, dark gray, massive bedding, wide joint spacing, w/ occasional shell fossils									
330			REC 99% RQD 99%										
100													
	RC-13												
325			REC 80% RQD 72%										
105													
	RC-14			SANDY MUDSTONE (Eagle Ford)-sound, soft to medium hard, fresh, dark gray, medium bedding, moderately close joints, w/ very hard sandstone lens									
320			REC 95% RQD 92%	-numerous very hard calcareous nodules and stringers below 108'									
110													
	RC-15												

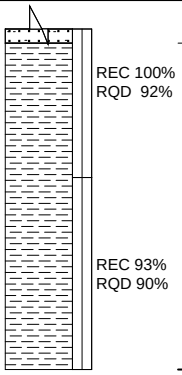
Notes:

LOG OF BORING T-102

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973346 E 2489997

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.65

Advancement Method: HSA / Wet Rotary
Date Started: 9/26/2017 Completed: 9/27/2017
Abandonment Method: Grouted
Groundwater During Drilling: -18'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
315													
115				SHALE (Eagle Ford)-sound, medium hard, fresh, dark gray, massive bedding, wide joint spacing, w/ occasional shell fossils									
	RC-16												
310													
120													
				Boring terminated at 121'									
305													
125													
300													
130													
295													
135													
290													
140													
285													
145													
280													

Notes:

LOG OF BORING T-103

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972807 E 2490090

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.39

Advancement Method: HSA / Wet Rotary
Date Started: 10/04/2017 Completed: 10/07/2017
Abandonment Method: Grouted
Groundwater During Drilling: -19'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				2" ASPHALT									
	ST-1			10" CONCRETE over layer of red brick									
				SAND, fine, reddish brown to gray, w/ clay seams (FILL) (SP)									
	ST-2			CLAY, hard, brown, tan and gray, w/ sand (CH)	12	42	18	24			4.5+		
425	ST-3										4.5+		
5	ST-4										4.5+		
	ST-5			CLAY, hard, tan and gray, slightly sandy to sandy (CL)	9	36	16	20		132	4.5++	67.9	3.0
	ST-6				9					129	4.5++		
	ST-7			-iron deposits from 8' to 10'							4.5++		
420											4.5++		
10													
415	ST-8			SAND, loose to medium dense, moist, tan, w/ clay and clayey sand seams (SP)									
15	SS-9		4/6" 5/6" 6/6"		5								
410				-seepage at 19' during drilling									
20	SS-10		4/6" 4/6" 4/6"		11								
				SAND, loose, tan and gray, w/ clay seams (SP)									
405				LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, wide joints, w/ gray argillaceous limestone seams and layers and occasional calcareous shale seams and layers									
25	RC-1			-calcareous shale at 26.3' to 26.8'									
			REC 100% RQD 98%										
400													
30	RC-2			-0.1" to 0.25" linear fossils at 32' to 32.1'									
395													
35			REC 99% RQD 99%		1					129		834.1	2.2

Notes:

LOG OF BORING T-103

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972807 E 2490090

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.39

Advancement Method: HSA / Wet Rotary
Date Started: 10/04/2017 Completed: 10/07/2017
Abandonment Method: Grouted
Groundwater During Drilling: -19'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
390 / 40	RC-3		REC 100% RQD 95%	LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, wide joints, w/ gray argillaceous limestone seams and layers and occasional calcareous shale seams and layers									
385 / 45				-thin calcareous shale seams at 44.7' & 46.9'									
380 / 50	RC-4												
375 / 55			REC 99% RQD 99%										
370 / 60	RC-5			-numerous very hard calcareous stringers & nodules at 61'-62.2'									
365 / 65			REC 94% RQD 93%	SHALE (Eagle Ford)-sound, soft, fresh, dark gray to gray, fine grained, wide joints, w/ occasional calcareous shale seams, limestone lenses, and very hard calcareous nodules and stringers									
360 / 70	RC-6			-1/2" limestone lens at 69.8'									
355			REC 92% RQD 92%										

Notes:

LOG OF BORING T-103

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972807 E 2490090

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.39

Advancement Method: HSA / Wet Rotary
Date Started: 10/04/2017 Completed: 10/07/2017
Abandonment Method: Grouted
Groundwater During Drilling: -19'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				SHALE (Eagle Ford)-sound, soft to medium hard, fresh, dark gray, fine grained, massive, wide joints, w/ occasional calcareous shale seams, limestone lenses, and very hard calcareous nodules and stringers									
	RC-7		REC 92% RQD 92%										
350 / 80													
	RC-8		REC 100% RQD 100%										
	RC-9		REC 94% RQD 94%										
345 / 85													
	RC-10		REC 60% RQD 59%	-1" tan band at 86.3' -2' of core slipped out during recovery of RC-10									
340 / 90													
	RC-11		REC 92% RQD 92%										
335 / 95													
	RC-12		REC 97% RQD 97%	-25° fracture at 96.8' -35° fracture at 97.5'									
330 / 100													
	RC-13		REC 97% RQD 96%	SANDY MUDSTONE (Eagle Ford)-sound, soft to medium hard, fresh, dark gray, w/ very hard sandstone lens SHALE (Eagle Ford)-sound, soft to medium hard, fresh, dark gray, fine grained, massive, wide joints, w/ occasional calcareous shale seams, limestone lenses, and very hard calcareous nodules and stringers									
325 / 105													
	RC-14		REC 82% RQD 73%	-40° fracture at 107.7' -50° fracture at 108.1' and 108.2'									
320 / 110													
	RC-15			SHALE (Eagle Ford)-sound, soft to medium hard,									

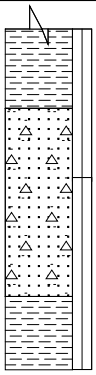
Notes:

LOG OF BORING T-103

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972807 E 2490090

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 429.39

Advancement Method: HSA / Wet Rotary
Date Started: 10/04/2017 Completed: 10/07/2017
Abandonment Method: Grouted
Groundwater During Drilling: -19'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
			 REC 98% RQD 97%	fresh, dark gray to gray, fine grained, wide joints, w/ occasional calcareous shale seams, limestone lenses, & very hard calcareous nodules & stringers									
315 / 115	RC-16		REC 97% RQD 95%	SANDY MUDSTONE (Eagle Ford)-sound, medium hard, fresh, gray, fine grained, thick, very sandy, w/ calcareous shale seams									
310 / 120				SHALE (Eagle Ford)-sound, soft to medium hard, fresh, dark gray to gray, fine grained, wide joints									
				Boring terminated at 121'									
305 / 125													
300 / 130													
295 / 135													
290 / 140													
285 / 145													
280													

Notes:

LOG OF BORING TS-104

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972204 E 2490204

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.71

Advancement Method: Wet Rotary
Date Started: 10/10/2018 Completed: 10/10/2018
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 19'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				2.5" ASPHALT									
				8.5" CONCRETE									
	ST-1			CLAY, very loose, dry, brown, w/ sand (CL)									
425	SS-1		N/A	CLAY, very loose, moist, brown, w/ sand (CL)									
5	SS-2		1/6" 2/6" 5/6"	CLAY, very loose, moist, tan and gray, very sandy, w/ sand seams (CL)	11								
	SS-3		3/6" 4/6" 5/6"	CLAYEY SAND, loose, moist, reddish brown (SC)	9								
420	SS-4		3/6" 3/6" 3/6"	SAND, loose, moist, reddish brown	4								
10													
415	SS-5		2/6" 4/6" 5/6"	SAND, loose, moist to wet, tan	7								
15													
410	SS-6		1/6" 4/6" 4/6"	-water seepage at 19' during drilling	18								
				SAND, loose, wet, tan, w/ gravel (SP)									
20													
405				LIMESTONE (Austin Chalk) - moderately to slightly fractured, severely to moderately weathered, tan and gray, fine grained, medium bedding, close joint spacing, (classification based on visual observation, soil cuttings and past experience in this formation)									
25	RC-1		REC 88% RQD 87%	LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to wide joint spacing, w/ calcareous lenses and seams, and occasional near horizontal shale seams and thin layers									
400													
30	RC-2		REC 97% RQD 93%	-calcareous stringers & nodules at 25.7' to 27' -shale seams at 29.2' to 29.4' -calcite seams at 29' - 29.4' -calcareous nodules at 30.2' and 33.5'									
395													
35	RC-3			-shale limestone layers at 30.2' to 31.5' -shale limestone layers at 32.3' to 33.1', and 33.5'	1					125		475	1.6

Notes:

LOG OF BORING TS-104

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972204 E 2490204

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.71

Advancement Method: Wet Rotary
Date Started: 10/10/2018 Completed: 10/10/2018
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 19'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
390				to 33.8'									
40			REC 99% RQD 94%	-calcareous nodules at 35.2' and 39.1' LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ calcareous lenses and seams, w/ occasional near horizontal shale seams and thin layers									
385													
45	RC-4			-calcite seams at 45.25', 45.33' & 49.58'									
380			REC 100% RQD 100%										
50	RC-5			LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray to dark gray, fine grained, massive bedding, wide joint spacing, w/ near horizontal argillaceous limestone layers and occasional shale seams and thin layers, w/ occasional very hard calcareous stringers and nodules	6					126		222.2	1.7
375			REC 100% RQD 97%										
55	RC-6			-calcite seams at 50.5', 51.1', 52', 52.8', 53' 53.8' and 54'- 54.3'									
370			REC 100% RQD 98%	-shale seams & layers at 50.7' to 52', & 52.6' to 55'									
60	RC-7			-various calcareous stringers & nodules at 50.4' to 54.3' & 55.1' to 59.6'									
365			REC 97% RQD 90%	SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ moderately hard near horizontal calcareous shale seams and layers, and occasional very hard calcareous stringers and nodules	13					120		38.4	3.5
65	RC-8			-calcite seams at 65.8', 66', 66.3', 66.7', 67.2'									
360			REC 98% RQD 97%										
70	RC-9												
355			REC 100% RQD 97%	-very soft shale at 72.3' to 73'									

Notes:

LOG OF BORING TS-104

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972204 E 2490204

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.71

Advancement Method: Wet Rotary
Date Started: 10/10/2018 Completed: 10/10/2018
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 19'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC-10		REC 98% RQD 97%	SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ moderately hard near horizontal calcareous shale seams and layers, and occasional very hard calcareous stringers and nodules									
350													
80	RC-11		REC 99% RQD 98%	-calcite seams at 81.8'									
345				-calcite seams at 83.2', 83.5', & 84.6'									
85	RC-12		REC 97% RQD 95%	-calcite seams at 85.4', 87', & 87.9' -calcite seams at 88.2' to 89.1'									
340													
90	RC-13		REC 95% RQD 92%	-calcite seam at 90.2'									
335													
95	RC-14		REC 98% RQD 90%										
330				-limestone seams at 98.5' to 98.7'									
100	RC-15		REC 87% RQD 83%										
325													
105	RC-16		REC 100% RQD 98%										
320													
110	RC-17												

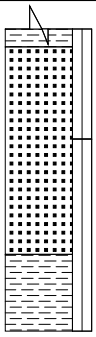
Notes:

LOG OF BORING TS-104

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972204 E 2490204

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 427.71

Advancement Method: Wet Rotary
Date Started: 10/10/2018 Completed: 10/10/2018
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 19'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
315			 REC 100% RQD 97%	SANDSTONE (Eagle Ford) - sound, medium hard, fresh, gray, fine grained, thick bedding, close to moderately close joint spacing, argillaceous, w/ very hard calcareous stringers and nodules									
115	RC-18												
			REC 97% RQD 93%	-calcite seam at 119.4'									
310				SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, close to moderately close joint spacing, w/ moderately hard near horizontal calcareous shale seams and layer, and occasional very hard calcareous stringers and nodules									
120				Boring terminated at 120'									
305													
125													
300													
130													
295													
135													
290													
140													
285													
145													
280													

Notes:

LOG OF BORING T-110

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972770 E 2492791

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 464.25

Advancement Method: HSA / Wet Rotary
Date Started: 04/09/2018 Completed: 4/10/2019
Abandonment Method: Grouted
Groundwater During Drilling: -19.5'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				3.5" ASPHALT									
				8.5" CONCRETE OVER 3" BASE									
	ST-1			SAND, tan, w/ asphalt pieces (FILL)							1.0		
	ST-2			CLAY, reddish brown							1.5		
460	ST-3			CLAY, stiff to hard, tan, w/ calcareous nodules							1.5		
5	ST-4										2.5		
	ST-5										2.25		
	ST-6										2.0		
	ST-7			-blocky at 8'							4.5		
455	ST-8										4.5+		
10													
450	ST-9			SAND, reddish brown, w/ clay seams							3.5		
15													
445	SS-10		4/6" 3/6" 2/6"	-seepage at 19.5' during drilling									
20													
440	SS-11		3/6" 4/6" 6/6"	SAND, loose, tan and gray, clayey							3.0		
25													
435				LIMESTONE (Austin Chalk)- moderately fractured, moderately hard to hard, weathered, tan, massive bedding, close to wide joint spacing									
30													
	RC-1		REC 100% RQD 100%	LIMESTONE (Austin Chalk) - sound, hard to very hard, fresh, light gray, massive bedding, close to wide joint spacing, w/ shaley limestone layers and calcite infillings									
430													
35													
	RC-2												

Notes: **Draft Log 12-4-18**

LOG OF BORING T-110

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972770 E 2492791

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 464.25

Advancement Method: HSA / Wet Rotary
Date Started: 04/09/2018 Completed: 4/10/2019
Abandonment Method: Grouted
Groundwater During Drilling: -19.5'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
425				LIMESTONE (Austin Chalk) - sound, hard to very hard, fresh, light gray, massive bedding, close to wide joint spacing, w/ shaley limestone layers and calcite infillings									
40			REC 100% RQD 98%										
420													
45	RC-3												
			REC 95% RQD 92%										
415				-pyrite at 49.1'									
50	RC-4												
				-2" shale layer at 53.2'									
410													
55			REC 100% RQD 97%										
				-calcite infilling w/ shale seam at 57.3'									
				-2" shale layer at 58.2'									
405													
60	RC-5												
400				-6" shale layer at 63.8'									
65			REC 97% RQD 96%										
				-5" shale layer at 67.3'									
395													
70	RC-6			-1" shale layer at 70.7'									
				-1.5" shale layer at 72.4'									
			REC 100% RQD 100%										
390													

Notes: **Draft Log 12-4-18**

LOG OF BORING T-110

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972770 E 2492791

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 464.25

Advancement Method: HSA / Wet Rotary
Date Started: 04/09/2018 Completed: 4/10/2019
Abandonment Method: Grouted
Groundwater During Drilling: -19.5'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				LIMESTONE (Austin Chalk) - sound, hard to very hard, fresh, light gray, massive bedding, close to wide joint spacing, w/ shaley limestone layers									
	RC-7												
				-6" shale at 77.8'									
385													
80			REC 100% RQD 100%										
				-2" shale at 81.3'									
				-4" shale at 82.9'									
380													
85				-3" shale at 84.6'									
	RC-8												
375				-3" shale at 89.2'									
90			REC 100% RQD 100%										
				-8.5" shale layer at 93.6'									
370													
95													
	RC-9												
				-shaley limestone at 97.5' to 99.1'									
365													
100			REC 100% RQD 96%										
				-calcite infilling at 101'									
				-0.25" shale at 103.6'									
360													
105				-calcite infilling at 103.9'									
	RC-10												
355													
110				-0.25" shale at 109.6'									
			REC 100% RQD 100%	-2" shale at 111' -calcite infilling at 111.3' LIMESTONE (Austin Chalk) - sound, hard to very									

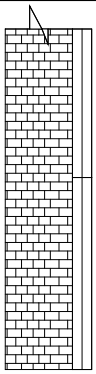
Notes: **Draft Log 12-4-18**

LOG OF BORING T-110

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972770 E 2492791

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 464.25

Advancement Method: HSA / Wet Rotary
Date Started: 04/09/2018 Completed: 4/10/2019
Abandonment Method: Grouted
Groundwater During Drilling: -19.5'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
350 – 115	RC-11		 REC 100% RQD 100%	hard, fresh, light gray, massive bedding, close to wide joint spacing, w/ shaley limestone layers and calcite infilling -0.25" shale at 116'									
345 – 120				-pyrite at 120.1'									
				Boring terminated at 121'									
340 – 125													
335 – 130													
330 – 135													
325 – 140													
320 – 145													
315													

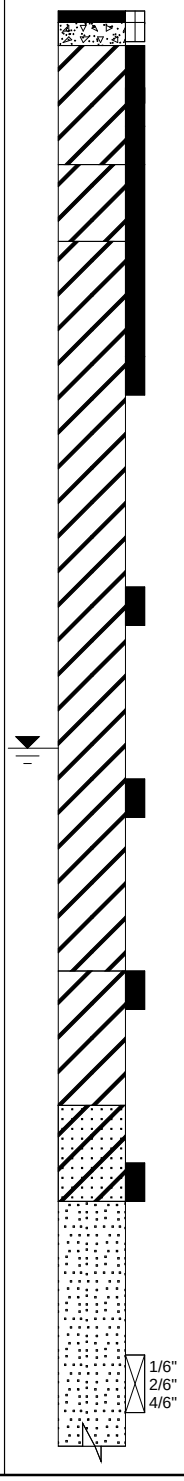
Notes: **Draft Log 12-4-18**

LOG OF BORING TS-111

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972970 E 2493291

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 464.79

Advancement Method: HSA / Wet Rotary
Date Started: 02/26/2018 Completed: 02/27/2018
Abandonment Method: Piezometer Installed
Groundwater During Drilling: -19.2'
Field Representative: D. Hnatyshyn / Logan Tucker, E.I.T.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0			3.25" ASPHALT									
	ST-1		3.25" CONCRETE over 3" FLEX BASE	18						2.6		
	ST-2		CLAY, very stiff to hard, brown and tan, w/ calcareous nodules (CH)		49	20	29			3.75		
	ST-3									4.25		
	ST-4		CLAY, hard, tan and dark brown, w/ calcareous nodules (CH)	17						4.5+		
460 5	ST-5				51	21	30		111	4.5+		
	ST-6		CLAY, very stiff to hard, tan and gray w/ calcareous nodules (CH)	16						4.0		
	ST-7									4.5+		
	ST-8				49	18	31		109	4.5+		
	ST-9									3.75		
455 10												
450 15	ST-10			17	41	17	24			2.8		
			-seepage at 19.2' during drilling									
445 20	ST-11			17	40	16	24			3.5		
440 25	ST-12		CLAY, very stiff, tan and dark brown, w/ sandy gravel lenses (CL)	17	37	16	21		104	3.5		
			CLAY, stiff, wet, tan, sandy, w/ sand lenses (CL)									
435 30	ST-13			18						1.75		
			SAND, loose to dense, wet, tan, fine, w/ gravel (SP)									
430 35	SS-14			15								

Notes:

LOG OF BORING TS-111

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972970 E 2493291

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 464.79

Advancement Method: HSA / Wet Rotary
Date Started: 02/26/2018 Completed: 02/27/2018
Abandonment Method: Piezometer Installed
Groundwater During Drilling: -19.2'
Field Representative: D. Hnatyshyn / Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
				SAND, loose to dense, wet, tan, fine, w/ gravel (SP)									
425 – 40	SS-15		5/6" 12/6" 21/6"		11								
				LIMESTONE (Austin Chalk) extremely to moderately fractured, moderately hard, severely to moderately weathered, light gray and tan									
420 – 45	RC-1		REC 92% RQD 92%	LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, massive bedding, wide joint spacing fine grained, w/ gray argillaceous limestone seams and layers and occasional linear fossils									
				-1" shale lens at 48.6'									
415 – 50	RC-2		REC 99% RQD 99%										
410 – 55	RC-3		REC 98% RQD 98%										
405 – 60	RC-4		REC 98% RQD 98%	-0.25" shale lens at 59.7'									
400 – 65	RC-5			-2.5" calcareous shale seam at 62.3'									
				-2" dark gray shale seam at 65.2'									
395 – 70			REC 99% RQD 97%										
				-9" shale layer at 71.2'									

Notes:

LOG OF BORING TS-111

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972970 E 2493291

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 464.79

Advancement Method: HSA / Wet Rotary
Date Started: 02/26/2018 Completed: 02/27/2018
Abandonment Method: Piezometer Installed
Groundwater During Drilling: -19.2'
Field Representative: D. Hnatyshyn / Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
390 – 75	RC-6			LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ gray argillaceous limestone seams and layers and occasional linear fossils									
				-3.5" calcareous shale seam at 78.1'									
385 – 80			REC 99% RQD 99%										
380 – 85	RC-7			-3" calcareous shale seam at 86.0'									
				-shale lens and thin seams at 87.5'-89.5'									
375 – 90			REC 99% RQD 99%										
				-6" calcareous shale seam at 92.5'									
370 – 95	RC-8			-4" shale layer at 95.5'									
			REC 100% RQD 60%	-poor core recovery at 97.9'-99.5' due to natural fractures									
				-55° slickensided fracture at 97.2'									
365 – 100				-45° slickensided fracture at 99.5'									
	RC-9			-poor core recovery at 100.5'-101.5' due to natural fractures									
			REC 95% RQD 95%										
360 – 105	RC-10												
355 – 110			REC 99% RQD 98%										

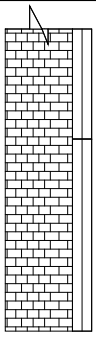
Notes:

LOG OF BORING TS-111

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972970 E 2493291

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 464.79

Advancement Method: HSA / Wet Rotary
Date Started: 02/26/2018 Completed: 02/27/2018
Abandonment Method: Piezometer Installed
Groundwater During Drilling: -19.2'
Field Representative: D. Hnatyshyn / Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
350 – 115	RC-11		 REC 97% RQD 94%	LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ gray argillaceous limestone seams and layers and occasional linear fossils -2" calcareous shale seams 115.7' -very calcareous shale at 118'-118.5'									
345 – 120				Boring terminated at 120'									
340 – 125													
335 – 130													
330 – 135													
325 – 140													
320 – 145													

Notes:

LOG OF BORING T-112

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973278 E 2493728

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 467.46

Advancement Method: HSA / Wet Rotary
Date Started: 03/21/2018 Completed: 03/22/2018
Abandonment Method: Grouted
Groundwater During Drilling: 19'
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0	ST-1			CLAY, stiff, brown, w/ sand seams, embedded gravel, and asphalt debris (FILL)							2.0		
465	ST-2				22	58	20	38	95	95	2.0		
	ST-3										1.5		
5				CONCRETE BOULDER at 4.5' to 8.5' (FILL)									
460	SS-4		1/6" 1/6" 1/6"	CLAY, stiff, light brown, w/ calcareous nodules (CH)							1.3		
10													
455	ST-5			CLAY, soft to stiff, light brown and light gray, w/ calcareous nodules (CH) -with bentonite seams & layers from 14'-24'	47	231	70	161	100	69	1.0	2.3	5.3
15													
450	ST-6			CLAY, wet, soft, light tan, w/ sand seams (CL)	102	240	75	165					
20													
445	SS-7		0/6" 0/6" 0/6"	CLAY wet, very soft, light tan, sandy, w/ sand seams and gravel pieces (CL) -minimal recovery within SPT									
25													
440	ST-8		21/6" 50/2"	LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan, w/ clay seams and layers (classification based on visual observation of soil cuttings and observations of drilling rate) -calcite lenses at 34.67'									
30													
435	RC-1			LIMESTONE (Austin Chalk) - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to moderately close joint spacing, w/ near horizontal argillaceous									
35													

Notes:

LOG OF BORING T-112

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973278 E 2493728

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 467.46

Advancement Method: HSA / Wet Rotary
Date Started: 03/21/2018 Completed: 03/22/2018
Abandonment Method: Grouted
Groundwater During Drilling: 19'
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
430			REC 83% RQD 70%	limestone layers and occasional near-horizontal shale seams and lenses									
40				LIMESTONE (Austin Chalk) - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to moderately close joint spacing, w/ near horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
	RC-2			-shale seams at 37.54' and 37.69'									
425				-shale seams at 38.19' and 38.5'									
			REC 92% RQD 88%	-shale seams at 39.13' and 39.7'									
45				-calcite lenses at 39.14'									
				-calcite lenses at 42.29' and 44.93'									
	RC-3			-shale seams at 46.17' and 47.14'									
420				-calcite lenses at 46.5'									
			REC 100% RQD 87%	-shale seams at 47.25' and 47.35'									
				-argillaceous limestone layer at 47.5'-47.75'									
50				-calcite lenses at 49.9'									
	RC-4			-3" argillaceous limestone layer at 51.4'									
415													
			REC 100% RQD 97%										
55				-3" argillaceous limestone layer at 54.6'									
	RC-5			LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
410													
			REC 100% RQD 98%										
60				-argillaceous limestone layer at 58.8'-59.2'									
	RC-6			-2" shale seam at 61.6'									
405													
			REC 97% RQD 90%										
				-1" shale seam at 64' and 64.9'									
65				-1.5" shale seam at 65.75'									
	RC-7			-0.5" shale seam at 66.1'									
400													
			REC 100% RQD 95%	-1.5" shale seam at 68.3'									
70													
	RC-8												
395				-2" shale seam at 72.6'									
				-mechanical break at 74.9'									

Notes:

LOG OF BORING T-112

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973278 E 2493728

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 467.46

Advancement Method: HSA / Wet Rotary
Date Started: 03/21/2018 Completed: 03/22/2018
Abandonment Method: Grouted
Groundwater During Drilling: 19'
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				-2.5" shale seam at 75.8'									
			REC 99% RQD 94%	LIMESTONE (Austin Chalk) - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses, w/ iron stains and fossil embeddment along fractures									
390													
80				-2" shale seam at 76.2'									
	RC-9			-mechanical break at 81.2'									
385				-argillaceous limestone layer at 82.4'-82.6'									
85													
			REC 99% RQD 93%	-2" shale seams at 85.8'									
380													
				-argillaceous limestone layer at 89.3'-89.8'									
90													
	RC-10												
375				-3.5" shale seam at 92.1'-92.4'									
95													
			REC 99% RQD 88%	-2" shale seam at 95.5'									
370				-argillaceous limestone layer at 97.9'-98.2' -0.5" shale seam at 98.1'									
100													
	RC-11												
365				-argillaceous limestone layer at 102.9'-103.4'									
105													
			REC 99% RQD 90%	-mechanical break at 105.6'									
360													
110													
	RC-12												

Notes:

LOG OF BORING T-112

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6973278 E 2493728

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 467.46

Advancement Method: HSA / Wet Rotary
Date Started: 03/21/2018 Completed: 03/22/2018
Abandonment Method: Grouted
Groundwater During Drilling: 19'
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
355				-argillaceous limestone layer at 112.9'-113.5'									
115			REC 100% RQD 95%	LIMESTONE (Austin Chalk) - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses, iron stains and fossil embeddment along fractures									
350				-argillaceous limestone layer at 114.6'-115'									
				-calcite seam at 118.25'									
120													
				Boring terminated at 121'									
345													
125													
340													
130													
335													
135													
330													
140													
325													
145													
320													

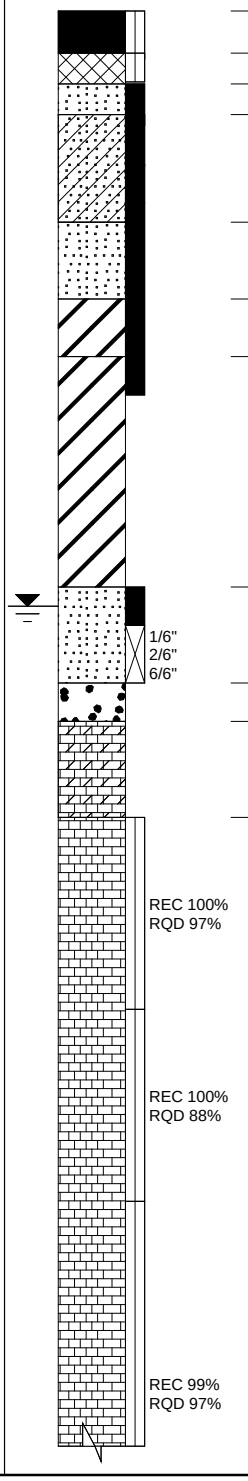
Notes:

LOG OF BORING T-201

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971605 E 2490642

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.6

Advancement Method: HSA / Wet Rotary
Date Started: 10/17/2017 Completed: 02/14/2018
Abandonment Method: Grouted
Groundwater During Drilling: 15.5'
Field Representative: Logan Tucker, E.I.T.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				6" HMAC over 9" CONCRETE									
				6" WOOD TIES (FILL)									
				SAND, brown, w/ clay and gravel (FILL) (SP)									
420	ST-1			CLAYEY SAND, reddish brown, w/ gravel pieces (SC)									
	ST-2												
5	ST-3												
	ST-4			SAND, tan, w/ clayey sand seams (SP)									
415	ST-5			CLAY, medium stiff, dark gray, w/ clayey sand seams (CH)							0.75		
	ST-6			CLAY, medium stiff to stiff, brown, w/ clayey sand seams (CH)							1.0		
10													
410													
15	ST-7			SAND, wet, loose, tan (SP)									
	SS-1		1/6" 2/6" 6/6"	-seepage at 15.5'									
405				GRAVEL, wet, tan (GP)									
20				LIMESTONE (Austin Chalk)-slightly fractured to moderately fractured, soft to medium hard, slightly weathered to moderately weathered, tan and gray (classification based on visual observation of soil & observation of drilling rate)									
	RC-1		REC 100% RQD 97%	LIMESTONE (Austin Chalk)-sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ argillaceous limestone layers and occasional shale seams and thin layers									
400													
25				-2" calcareous shale seam at 21.7'									
	RC-2			-0.125" iron stained linear fossils at 27.9' & 28'									
395			REC 100% RQD 88%	-calcareous shale at 28' to 28.5'									
30													
	RC-3			-0.125" to 0.25" iron stained linear fossils at 31.8, 32.1' & 32.5'									
390													
35			REC 99% RQD 97%	-hard thin shell fossil at 35.2'									

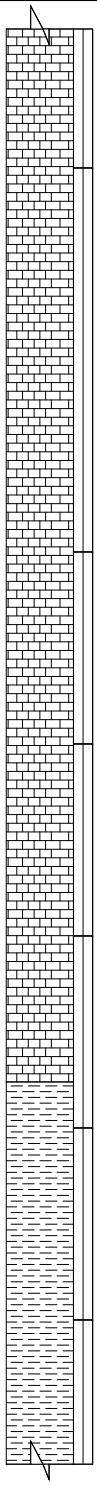
Notes: **This hole was on hold until 2-14-18 due to new permitting requirements by the City.**

LOG OF BORING T-201

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971605 E 2490642

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.6

Advancement Method: HSA / Wet Rotary
Date Started: 10/17/2017 Completed: 02/14/2018
Abandonment Method: Grouted
Groundwater During Drilling: 15.5'
Field Representative: Logan Tucker, E.I.T.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
385				LIMESTONE (Austin Chalk)-sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ argillaceous limestone layers and occasional shale seams and thin layers									
40	RC-4			-iron stained 20° fracture at 38.7' -iron stained 30° fracture at 41.7'									
380				-numerous black specks due to possibly fossilized microbes at 42.5' to 44'									
45			REC 100% RQD 66%										
375				-poor core recovery at 46.5' to 51' due to breakage of core catcher									
50	RC-5												
370			REC 98% RQD 97%										
55	RC-6												
365			REC 97% RQD 97%	-very hard calcareous stringers & nodules at 57.4' to 57.7'	1					121		606.2	1.8
60	RC-7												
360			REC 95% RQD 87%										
65	RC-8			SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, wide joint spacing, w/ moderately hard calcareous shale seams and layers, and occasional very hard calcareous stringers and nodules	4					132		367.6	2.8
355			REC 93% RQD 85%	-calcareous stringers & nodules at 66' to 66.5'									
70	RC-9												
350			REC 76% RQD 69%	-iron stained 25° fracture at 74.4' SHALE (Eagle Ford)-sound, soft, fresh, dark gray,									

Notes: **This hole was on hold until 2-14-18 due to new permitting requirements by the City.**

LOG OF BORING T-201

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971605 E 2490642

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.6

Advancement Method: HSA / Wet Rotary
Date Started: 10/17/2017 Completed: 02/14/2018
Abandonment Method: Grouted
Groundwater During Drilling: 15.5'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				fine grained, massive bedding, wide joint spacing, w/ moderately hard calcareous shale seams and layers, and occasional very hard calcareous stringers and nodules									
	RC-10												
345			REC 93% RQD 90%	-2" very soft shale layer at 78.5'									
80													
	RC-11												
340			REC 93% RQD 92%										
85													
	RC-12												
335			REC 88% RQD 82%										
90				-1" brownish gray discoloration at 89.5'									
	RC-13			-iron stained 15° fracture at 90'									
330			REC 87% RQD 83%	-2" tan discoloration at 92.5'									
95				-calcareous stringers and nodules at 94.3'									
	RC-14												
325			REC 85% RQD 67%										
100													
	RC-15												
320			REC 95% RQD 88%	-calcareous shale seams, hard limestone lenses and numerous calcareous stringers and nodules at 102'-103'									
105				-calcareous shale at 104.3' to 104.8'									
	RC-16			-iron stained 40° fracture at 106.8'									
315			REC 98% RQD 78%	-iron stained 30° fracture at 107.1', 107.3', 107.4' & 107.6' -poorly cemented sand w/ clay at 107.6' to 108.9'									
110				-poor core recovery from 110.1' to 111'									
	RC-17												

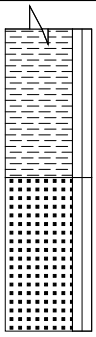
Notes: **This hole was on hold until 2-14-18 due to new permitting requirements by the City.**

LOG OF BORING T-201

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971605 E 2490642

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 422.6

Advancement Method: HSA / Wet Rotary
Date Started: 10/17/2017 Completed: 02/14/2018
Abandonment Method: Grouted
Groundwater During Drilling: 15.5'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
310				SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, wide joint spacing, w/ moderately hard calcareous shale seams and layers, and occasional very hard calcareous stringers and nodules									
115				-poor core recovery from 111' to 116' due to breaking of core catcher									
	RC-18			SANDSTONE (Eagle Ford) - sound, medium hard, fresh, gray, fine grained, thick bedding, wide joint spacing, argillaceous, w/ very hard calcareous stringers and nodules									
305													
120				Boring terminated at 120'									
300													
125													
295													
130													
290													
135													
285													
140													
280													
145													
275													

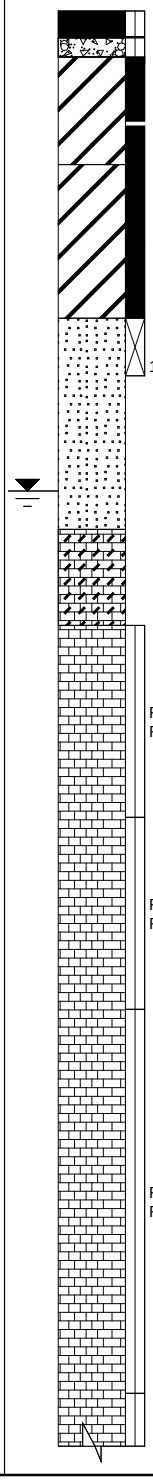
Notes: **This hole was on hold until 2-14-18 due to new permitting requirements by the City.**

LOG OF BORING TS-202

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971904 E 2491801

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 432.67

Advancement Method: HSA / Wet Rotary
Date Started: 10/09/2017 Completed: 10/12/2017
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 12.5'
Field Representative: Logan Tucker, E.I.T.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				2" ASPHALT over 5" RED BRICK									
	ST-1			2" Cement-Treated BASE over 4" Crushed CONCRETE	16	57	21	36			2.5		
430				CLAY, very stiff, tan and gray, w/ sand lenses (CH)									
	ST-2										2.6		
	ST-3			CLAY, very stiff, tan and gray, w/ sandy clay seams and lenses (CH)	16	46	17	29		109	2.25	6.2	5.5
5					11					116	2.5		
	ST-4				16					111	2.0		
											3.0		
425	SS-5			SAND, medium dense, fine, tan and gray, w/ sandy clay seams, and limestone fragments (SP)	9								
10													
420				-seepage at 12.5' during drilling									
15				LIMESTONE (Austin Chalk)-extremely fractured, moderately hard, severely weathered, light gray and tan, discolored and decomposed, w/ clay layers									
	RC-1			LIMESTONE (Austin Chalk)-sound, hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ argillaceous limestone seams and layers									
415													
20													
	RC-2			-1.5" shale seam at 21'									
410													
25													
	RC-3			-calcareous shale layer at 26.4'-26.8'									
405													
30				1" calcareous shale at 30'									
400				-dark gray shale at 32.8'-33.2'									
				-45° slickensided fracture at 33'									
35				-60° slickensided fracture at 35.1'									
	RC-4			-50° slickensided fracture at 35.7'	1					125		474.6	1.6

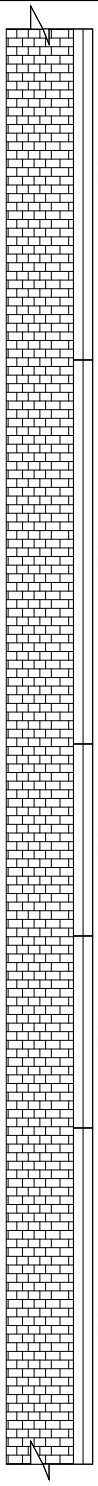
Notes:

LOG OF BORING TS-202

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971904 E 2491801

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 432.67

Advancement Method: HSA / Wet Rotary
Date Started: 10/09/2017 Completed: 10/12/2017
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 12.5'
Field Representative: Logan Tucker, E.I.T.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
395				LIMESTONE (Austin Chalk)-sound, hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ argillaceous limestone seams and layers									
40				-shale layer at 38.7'-39'									
390				-60° slickensided fracture at 42.3' -60° slickensided fracture at 43.2' -60° slickensided fracture at 43.4' -2" calcareous shale at 44.1'									
45	RC-5												
385				-shale layer at 47.4'-47.8'									
50				-calcareous shale layer at 50.3'-50.7' -0.3" ironstone at 51.4'									
380													
55	RC-6				1					124		614.9	1.5
375				-1" shale layer at 58.5' -shale layer at 59.4'-59.7'									
60	RC-7			-6" calcareous shale layer at 61'									
370				-2" shale layer at 64'									
65	RC-8												
365				-2" shale layer at 68.8									
70													
360													

Notes:

LOG OF BORING TS-202

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971904 E 2491801

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 432.67

Advancement Method: HSA / Wet Rotary
Date Started: 10/09/2017 Completed: 10/12/2017
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 12.5'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				LIMESTONE (Austin Chalk)-sound, hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ argillaceous limestone seams and layers									
	RC-9												
355													
80			REC 99% RQD 99%										
350													
85													
	RC-10			-broken core recovery at 86'-86.5' due to fractured rock -55° fracture at 86.1' -35° fracture at 86.4' -gray argillaceous limestone below 88'									
345													
90			REC 100% RQD 95%	-numerous very hard calcareous stringers and nodules at 88.6'-90'									
340				SHALE (Eagle Ford)-sound, medium hard, fresh, dark gray to gray, massive bedding, wide joint spacing, w/ occasional very hard calcareous stringers and calcareous shale seams									
95													
	RC-11												
335				-0.5" limestone lens at 97.4'									
			REC 99% RQD 98%										
100													
	RC-12												
330													
			REC 98% RQD 98%										
105													
	RC-13			-40° slickensided fracture at 105'									
325													
			REC 97% RQD 97%										
110													
	RC-14												

Notes:

LOG OF BORING TS-202

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6971904 E 2491801

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 432.67

Advancement Method: HSA / Wet Rotary
Date Started: 10/09/2017 Completed: 10/12/2017
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 12.5'
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
320													
115													
	RC-15		REC 99% RQD 99%	SHALE (Eagle Ford)-sound, medium hard, fresh, dark gray to gray, massive bedding, wide joint spacing, w/ occasional very hard calcareous stringers and calcareous shale seams -0.5" limestone lens at 115.1'									
315			REC 97% RQD 95%	-0.5" limestone lens at 118.8' -0.25" limestone lens at 120.7'									
120													
				Boring terminated at 121'									
310													
125													
305													
130													
300													
135													
295													
140													
290													
145													
285													

Notes:

LOG OF BORING T-203

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972035 E 2492315

Drilling Contractor: AGG
Driller: Emilio Luna
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 438.43

Advancement Method: HSA / Wet Rotary
Date Started: 08/18/2018 Completed: 08/19/2018
Abandonment Method: Grouted
Groundwater During Drilling: N/A
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				12" CONCRETE over 2" FLEX BASE									
	ST-1			CLAY, tan and brown, w/ gravel (FILL) (CH)	20					104	0.9		
435	ST-2												
5	ST-3			CLAY, tan and gray, sandy, w/ calcareous nodules (CL)							1.75		
	ST-4										4.5++		
	THD-1		21/2" 50/0.5"	WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan, w/ calcareous clay seams & layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
430	THD-2		50/0.25" 50/0.5"										
	RC-1		REC 98% RQD 83%										
10	RC-2			-mechanical fractures at 9' and 9.67'									
425				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
15			REC 93% RQD 91%	-calcareous stringer at 12.7' -argillaceous limestone seam at 14.4' -argillaceous limestone layer at 14.7-15.2'									
				-argillaceous limestone layer at 17-17.6' -sandy argillaceous limestone layer at 17.6-18.1'									
420				-argillaceous limestone layer at 18.6-19.3'									
20	RC-3												
415				-shale seam at 23' -various horizontal & vertical mechanical breaks from 23-25.7'									
25			REC 98% RQD 93%	-shale seam at 24.8' -pyrite trace at 25.5' -argillaceous limestone layer at 25.8-26.2'									
410				-shale seam at 28.3' -calcareous stringer at 28.25' & 28.4'									
30	RC-4												
			REC 100% RQD 95%	-pyrite at 31.35' -shale seam at 31.45'									
405				-argillaceous limestone seam at 33.3-33.4'									
35	RC-5												
				-calcareous stringer at 36.3' -shale layer w/ argillaceous limestone seam at									

Notes:

LOG OF BORING T-203

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972035 E 2492315

Drilling Contractor: AGG
Driller: Emilio Luna
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 438.43

Advancement Method: HSA / Wet Rotary
Date Started: 08/18/2018 Completed: 08/19/2018
Abandonment Method: Grouted
Groundwater During Drilling: N/A
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
400				36.3-37'									
40			REC 100% RQD 95%	LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
395				-argillaceous limestone seam at 38.9'									
				-argillaceous limestone layer w/ shale at 39.7-40.25'									
				-2" shale seam at 40'									
				-1.5" shale seam @ 43.05'									
45	RC-6			-argillaceous limestone seam at 44.1-44.2'									
				-argillaceous limestone layer at 48-49'									
390													
50			REC 99% RQD 96%	-shale seam at 50-50.4'									
385				-shale seam at 54-54.25'									
55	RC-7												
380													
60			REC 100% RQD 97%		3					124		359.4	1.3
375				-2" shale seam at 63.6'									
65	RC-8			-argillaceous limestone seam at 64.8-65'									
				-calcareous stringer at 66.1' & 66.2'									
370													
70			REC 97% RQD 92%	-3" shale seam at 69.75'									
				-argillaceous limestone layer w/ shale seams at 70-72.7'									
365													

Notes:

LOG OF BORING T-203

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972035 E 2492315

Drilling Contractor: AGG
Driller: Emilio Luna
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 438.43

Advancement Method: HSA / Wet Rotary
Date Started: 08/18/2018 Completed: 08/19/2018
Abandonment Method: Grouted
Groundwater During Drilling: N/A
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC-9												
				-argillaceous limestone seam at 75.3-75.4' -1" shale seam at 75.7' LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses -argillaceous limestone layer at 80-80.6'									
360													
80			REC 100% RQD 97%										
355				-calcareous stringer at 84.9'									
85	RC-10												
				-calcareous stringer at 85.95', 86.1' & 86.4' -argillaceous limestone seam at 86.2-86.3'									
			REC 100% RQD 98%										
350													
90	RC-11												
345													
95			REC 100% RQD 97%	-multiple calcareous stringer from 95-100' -very hard argillaceous limestone layer at 95-103.3'									
340													
100	RC-12												
335				SHALE (Eagle-Ford) - moderately fractured to sound, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous limestone layers									
105			REC 93% RQD 88%										
330													
110	RC-13			-multiple mechanical fractures from 110-115'									

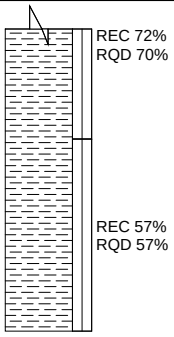
Notes:

LOG OF BORING T-203

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972035 E 2492315

Drilling Contractor: AGG
Driller: Emilio Luna
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 438.43

Advancement Method: HSA / Wet Rotary
Date Started: 08/18/2018 Completed: 08/19/2018
Abandonment Method: Grouted
Groundwater During Drilling: N/A
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
325 / 115	RC-14			<u>SHALE (Eagle-Ford)</u> - moderately fractured to sound, very soft to medium hard, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal argillaceous limestone layers -multiple mechanical fractures from 115-120'									
320 / 120				Boring terminated at 120'									
315 / 125													
310 / 130													
305 / 135													
300 / 140													
295 / 145													
290													

Notes:

LOG OF BORING T-204

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972147 E 2492712

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 448.77

Advancement Method: Wet Rotary
Date Started: 10/27/2018 Completed: 10/28/19
Abandonment Method: Grouted
Groundwater During Drilling: -9'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				4" ASPHALT									
				10" CONCRETE									
				6" FLEX BASE									
	ST-1			CLAY, soft, tan and gray, w/ calcareous nodules, iron stains (CH)	15	43	15	28		116	2.5		
445											4.0		
	ST-2										1.0		
5											2.5		
	ST-3										2.5		
				CLAY, moist, soft, reddish brown, w/ calcareous nodules (CH)							2.75		
	ST-4				20	29	13	16		109	2.0		
440	SS-1		40/6" 48/6" 36/6"	CLAY, moist, soft, reddish brown, sandy, w/ sand seams (CL)	20						4.5+		
10				LIMESTONE (Austin Chalk) extremely fractured, medium hard, severely weathered, light gray and tan, decomposed -seepage at 9' during drilling -12" clay layer, tan and gray									
435				LIMESTONE (Austin Chalk)- moderately fractured, very soft, weathered to moderately weathered, tan and gray, massive bedding									
15	RC-1		REC 100% RQD 97%	LIMESTONE (Austin Chalk) - slightly fractured, soft to moderately hard, fresh, gray, thin bedding, moderately close to close joint spacing, w/ occasional shale lenses and seams, and traces calcareous nodules -shale at 15'-15.8', 16'-16.3' -shale at 17.3'-18'									
430													
20	RC-2		REC 100% RQD 93%	-calcite at 17.9', 18', and 19' -shale at 18.6'-19.3', 20.3'-20.4' -soft shaley limestone layer at 20.8' - 20.9' -calcite at 20.3', 20.6', 21.8' -shale at 21.4'-22.7', 23.6'-24.4'									
425				-calcite at 23.7', 23.8', 24.1' and 24.7'									
25	RC-3		REC 100% RQD 98%	-shale at 24.7' -calcite at 27', 27.3', and 28.7' -shale at 25.5', 26.1'-27', 27.4'-28.2' and 28. 7'-29.4'									
420													
30	RC-4		REC 100% RQD 100%	-calcite at 30.8', 31.1', 33.1', 34.4' -shale at 30.4-32.3', 32.7', 32.8' -shale at 33.1'-33.2', 34.1', 34.6', 34.9' -pyrite at 33.1'									
415													
35	RC-5			-shale at 35.3'-35.6', 36.2', 37.2'-38.4'									

Notes:

LOG OF BORING T-204

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972147 E 2492712

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 448.77

Advancement Method: Wet Rotary
Date Started: 10/27/2018 Completed: 10/28/19
Abandonment Method: Grouted
Groundwater During Drilling: -9'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
410			REC 100% RQD 98%	LIMESTONE (Austin Chalk) - slightly fractured, soft to moderately hard, fresh, gray, thin bedding, moderately close to close joint spacing, w/ occasional shale lenses and seams, and traces calcareous nodules									
40	RC-6			-shale at 38.5', 38.6', 39'-39.2' 39.4'-39.7'									
			REC 98% RQD 97%	-calcite at 38.7' -shale at 39.8'-39.9', 40.8', 41', 41.3'									
405				-shale at 43.5'-43.7', 44.6'									
45	RC-7												
			REC 100% RQD 95%										
400				-calcite at 48.6'									
50	RC-8			-shale at 50.1'-50.3', 54.3'									
					7					123		313.8	1.3
			REC 100% RQD 98%										
395													
55	RC-9			-shale at 55.6'-55.9', 58.9'-59'									
			REC 98% RQD 93%										
390													
60	RC-10												
			REC 100% RQD 97%										
385				-calcite at 62', 63.1', 63.7', 64.1', 64.5'									
				-shale 62.1'-62.5', 63.3'-63.5'									
65	RC-11			-shale at 65'-65.2', 66.8'-67'									
			REC 98% RQD 88%										
380													
70	RC-12			-calcite: 70'-70.1', 70.6', 71.5', 71.8', 72.1'									
				-shale: 70.9'-71.1', 71.8'-72'									
			REC 100% RQD 80%										
375													

Notes:

LOG OF BORING T-204

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972147 E 2492712

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 448.77

Advancement Method: Wet Rotary
Date Started: 10/27/2018 Completed: 10/28/19
Abandonment Method: Grouted
Groundwater During Drilling: -9'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75	RC-13		REC 100% RQD 83%	LIMESTONE (Austin Chalk) - slightly fractured, soft to moderately hard, fresh, gray, thin bedding, moderately close to close joint spacing, w/ occasional shale lenses and seams, and traces calcareous nodules									
370													
80	RC-14		REC 100% RQD 90%	-shale: 75', 5.5', 75.6', 75.8', 76.9'-77.1' -calcite: 75.9', 77.8', 78.5', 79'-80' -calcite: 80.8', 81.5'-81.7', 82.7'-82.9' -shale: 80'-80.5'									
365													
85	RC-15		REC 100% RQD 67%	-calcite: 84.9'-85', 85.1',85.7',86.1'-86.4' -shale: 84'-85', 85'-86.1', 88.7'-90'									
360													
90	RC-16		REC 100% RQD 98%	-calcite: 90.6', 90.7', 94.3' -shale: 90'-91', 91.7'-91.8', 93.9'-95'									
355													
95	RC-17		REC 100% RQD 98%	-calcite: 96.7', 96.8', 99.1', 99.2' -shale: 96.2'-96.9', 97'-97.2',98.3'-99.6'									
350													
100	RC-18		REC 100% RQD 98%	-calcite: 102', 102.7', 103.5', 103.6', 103.9' -shale: 100.1'-101.3', 101.7'-102.1', 102.3' -calcite: 104.3', 104.6' -shale:103.3'-105'									
345													
105	RC-19		REC 100% RQD 97%	-calcite: 105.4', 105.8', 106', 106.1', 107.2' -shale: 105.9'-106.6', 106.8', 107.1'-110' LIMESTONE (Austin Chalk) - slightly fractured, medium hard, gray to dark gray, thin bedding, moderately close to wide joint spacing, very shaley w/ traces calcareous nodules									
340													
110	RC-20			-calcite: 107.3', 107.4', 107.7', 108.2' -calcite: 110.5', 110.9' -calcareous seams: 110.9'-112.1' LIMESTONE (Austin Chalk) - slightly fractured,									

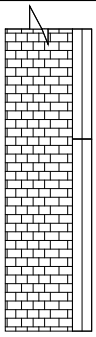
Notes:

LOG OF BORING T-204

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972147 E 2492712

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 448.77

Advancement Method: Wet Rotary
Date Started: 10/27/2018 Completed: 10/28/19
Abandonment Method: Grouted
Groundwater During Drilling: -9'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
335 / 115	RC-21		 REC 98% RQD 97%	medium hard, gray to dark gray, thin bedding, moderately close to wide joint spacing, very shaley w/ traces calcareous nodules -calcareous seams: 112.2'-112.6', 113', 113.3' -shale: 110.7'-112', 112'-112.8' -calcareous seams: 114.3'-114.4', 114.8' -shale: 114'-114.1', 114.7' -calcite: 115.8',116.7', 117.8', 118.9', 119' -pyrite: 117.1'									
330 / 120			REC 98% RQD 93%	Boring terminated at 120'									
325 / 125													
320 / 130													
315 / 135													
310 / 140													
305 / 145													
300													

Notes:

LOG OF BORING T-205

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972577 E 2493115

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 461.02

Advancement Method: HSA / Wet Rotary
Date Started: 08/15/2018 Completed: 08/17/2018
Abandonment Method: Grouted
Groundwater During Drilling: 21.4'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0	ST-1			SANDY CLAY, brown and tan, w/ occasional fine grained sand seams and layers, and trace calcareous nodules (CL)									
460													
5													
455													
10	ST-2												
450													
15													
445													
											4.25		
											4.5		
20	ST-3												
440				-water seepage at 21.4'									
											1.75		
											3.0		
25													
435													
				SAND, wet, tan & gray, w/ trace limestone fragments									
	SS-1		12/6" 33/6" 50/4"										
30				WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan, w/ calcareous clay seams & layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
430													
35	THD-1		21/6" 29/6"										
425													

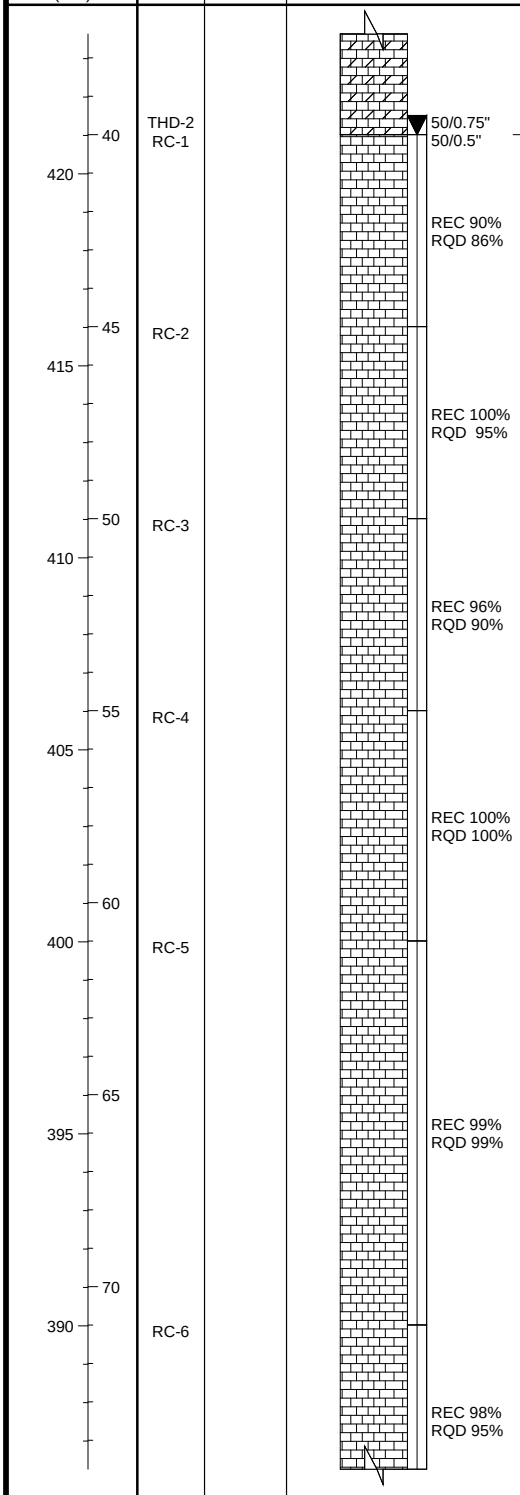
Notes:

LOG OF BORING T-205

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972577 E 2493115

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 461.02

Advancement Method: HSA / Wet Rotary
Date Started: 08/15/2018 Completed: 08/17/2018
Abandonment Method: Grouted
Groundwater During Drilling: 21.4'
Field Representative: Daniel Hnatyshyn



DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan, w/ calcareous clay seams & layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
RC-2	2					125		334.6	1.7
RC-4	2					120		396.8	1.4
RC-6	5					131		289.4	1.5

Notes:

LOG OF BORING T-205

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972577 E 2493115

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 461.02

Advancement Method: HSA / Wet Rotary
Date Started: 08/15/2018 Completed: 08/17/2018
Abandonment Method: Grouted
Groundwater During Drilling: 21.4'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75													
385	RC-7		REC 100% RQD 97%	LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
80													
380	RC-8			LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
85													
375			REC 100% RQD 99%										
90													
370	RC-9												
95													
365			REC 97% RQD 93%										
100													
360	RC-10												
			REC 98% RQD 88%										
105													
355	RC-11												
			REC 98% RQD 92%										
110													
350	RC-12												

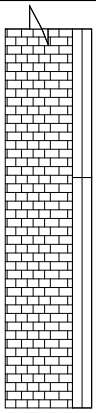
Notes:

LOG OF BORING T-205

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972577 E 2493115

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 461.02

Advancement Method: HSA / Wet Rotary
Date Started: 08/15/2018 Completed: 08/17/2018
Abandonment Method: Grouted
Groundwater During Drilling: 21.4'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
115 345 120 340	RC-13			LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
125 335 130 330 135 325 140 320 145 315				Boring terminated at 122'									

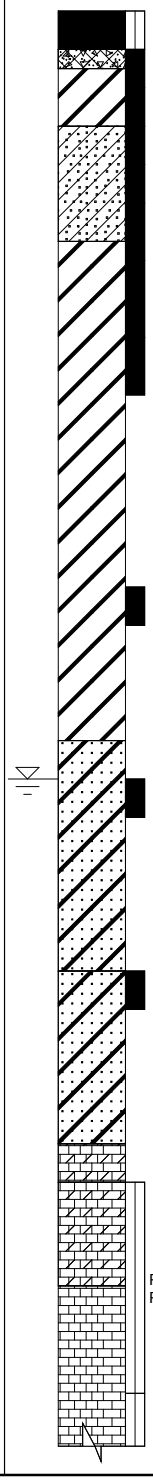
Notes:

LOG OF BORING TS-206

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972893 E 2493404

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 463.73

Advancement Method: HSA / Wet Rotary
Date Started: 03/05/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 20'
Field Representative: Daniel Hnatyshyn



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				11" ASPHALT									
	ST-1			4" Concrete BASE over 3" Lime-Treated BASE									
	ST-2			CLAY, very soft, reddish brown (FILL) (CH)									
	ST-3			CLAYEY SAND, soft to stiff, dark brown, w/ traces calcareous nodules (SC)									
460	ST-4										2.0		
5	ST-5										3.25		
	ST-6			CLAY, stiff to very stiff, light brown and tan, w/ calcareous nodules and sandy clay layers (CH)							3.5 4.0		
455	ST-7												
10													
450													
15	ST-8										4.0		
445				-water seepage at 18.4' before coring									
20	ST-9			SANDY CLAY, moist, soft to very soft, tan and light brown (CL)							1.5		
440													
25	ST-10			SANDY CLAY, moist, soft to stiff, tan and light brown, w/ limestone fragments and trace calcareous nodules (CL)									
435													
30	RC-1			WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan, w/ calcareous clay seams & layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
430				WEATHERED LIMESTONE (Austin Chalk) - moderately to slightly fractured, medium hard, moderately weathered, tan and gray, w/ calcareous clay seams									
35	RC-2			LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine									

Notes:

LOG OF BORING TS-206

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972893 E 2493404

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 463.73

Advancement Method: HSA / Wet Rotary
Date Started: 03/05/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 20'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
425			REC 98% RQD 98%	grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
40				-Bentonite at 36.6' to 37.8'									
	RC-3			LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near- horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
420			REC 100% RQD 100%	-no breaks of fractures at 41' to 46'									
45													
	RC-4			-shaley limestone from 46' to 49'									
415			REC 97% RQD 93%										
50													
	RC-5												
				-calcite infilling at 52.2'									
410			REC 98% RQD 98%	-2.5" shale layer at 54.7'									
55													
	RC-6												
405			REC 98% RQD 98%										
60				-2" Bentonitic shale layer at 59.5'									
	RC-7												
400			REC 100% RQD 100%	-2" shale layer at 63'									
65													
	RC-8												
395			REC 100% RQD 100%	-6" shaley limestone layer at 68.4' -4" shale layer at 68.9'									
70													
	RC-9												
				-5" shale layer at 71.3'									
390			REC 100% RQD 100%										

Notes:

LOG OF BORING TS-206

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972893 E 2493404

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 463.73

Advancement Method: HSA / Wet Rotary
Date Started: 03/05/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 20'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
	RC-10		REC 98% RQD 98%										
385													
80				-shale layer at 77.1' to 77.3'									
	RC-11			-shale layer at 78.7' to 78.9'									
				-4" shale layer at 81.7'									
			REC 100% RQD 100%										
380													
85													
	RC-12												
				-4" shale layer at 87.7'									
			REC 100% RQD 100%										
375													
90													
	RC-13			-traces of calcite at 91.9' and 95.5'									
				-4" shale layer at 94'									
			REC 98% RQD 98%										
370													
95													
	RC-14			-traces of calcite at 96.1' -8" shale layer at 97.3' -shale seam at 98.9'									
			REC 100% RQD 100%										
365													
100													
	RC-15												
			REC 98% RQD 98%										
360				-15" shale layer at 104' w/ occasional pits and calcite infilling -traces of fossils at 104'									
105													
	RC-16			-shale seams at 104.3' and 104.7'									
				-6" shale layer at 106.5' -3" shale layer at 107.9'									
			REC 100% RQD 100%										
355													
110				-2" shale layer at 109.7'									
	RC-17												

Notes:

LOG OF BORING TS-206

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972893 E 2493404

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 463.73

Advancement Method: HSA / Wet Rotary
Date Started: 03/05/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 20'
Field Representative: Daniel Hnatyshyn

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
350				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses									
115	RC-18		REC 100% RQD 100%										
				-7" shale layer at 113.0' w/ occasional pits and vugs and calcite infilling									
345			REC 100% RQD 100%										
120				-concretion seam at 113.3' -7" shale layer at 114.5' -traces of calcite at 115.1' and 115.6' -0.5" shale seams at 116.2', 120.1' 120.2' and 120.6' -calcite layer at 117.2', 117.6' and 117.7' -9" shaley limestone layer at 119.5'									
340				Boring terminated at 121'									
125													
335													
130													
330													
135													
325													
140													
320													
145													
315													

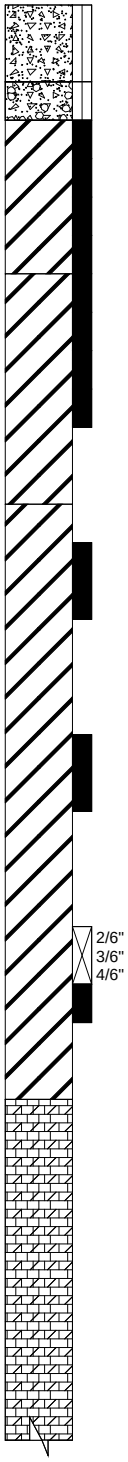
Notes:

LOG OF BORING TS-207

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972302 E 2493239

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 458.50

Advancement Method: HSA / Wet Rotary
Date Started: 02/04/2019 Completed:
Abandonment Method:
Groundwater During Drilling:
Field Representative: Samuel Tran, P.E.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				24" CONCRETE over brick Layer									
				12" Cement-Treated BASE									
455	ST-1			CLAY, very stiff to hard, light brown, w/ calcareous nodules and deposits (CH)							4.25		
	ST-2				16	44	15	29		114	4.0		
5	ST-3										3.25		
	ST-4										4.0		
	ST-5			CLAY, tan and light gray, w/ calcareous nodules (slightly blocky) (CH)							3.25		
450	ST-6				14	36	15	21	100	149	4.25		
	ST-7										4.5		
10	ST-8										4.25		
445				CLAY, tan, w/ sand lenses and seams (CH)									
	ST-9				19	64	24	40		111	3.75	4.8	10.1
15				-sand seams at 15'									
440	ST-10			-sand seams and lenses below 19'							3.0		
20											3.0		
435				CLAY, brown, w/ sand (CL/CH)							1.1		
	SS-11		2/6" 3/6" 4/6"		17								
25	ST-12										1.5		
430				WEATHERED LIMESTONE (Austin Chalk) - moderately fractured, very soft to soft, weathered, tan, w/ clay seams and layers (classification based on visual observation of soil cuttings and split spoon samples and observation of drilling rate)									
30													
425													
35													

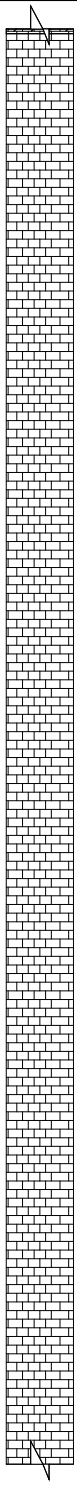
Notes:

LOG OF BORING TS-207

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972302 E 2493239

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 458.50

Advancement Method: HSA / Wet Rotary
Date Started: 02/04/2019 Completed:
Abandonment Method:
Groundwater During Drilling:
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
420, 40, 415, 45, 410, 50, 405, 55, 400, 60, 395, 65, 390, 70, 385				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near horizontal argillaceous limestone layers and occasional near-horizontal shale seams and layers, and occasional near-horizontal very hard calcareous stringers									

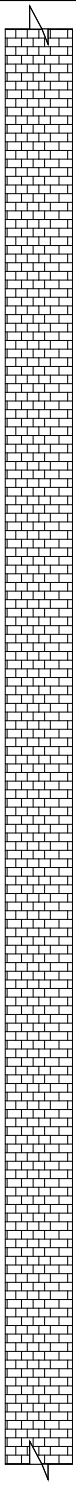
Notes:

LOG OF BORING TS-207

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972302 E 2493239

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 458.50

Advancement Method: HSA / Wet Rotary
Date Started: 02/04/2019 Completed:
Abandonment Method:
Groundwater During Drilling:
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near horizontal argillaceous limestone layers and occasional near-horizontal shale seams and layers, and occasional near-horizontal very hard calcareous stringers									
380													
80													
375													
85													
370													
90													
365													
95													
360													
100													
355													
105													
350													
110													

Notes:

LOG OF BORING TS-207

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972302 E 2493239

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 458.50

Advancement Method: HSA / Wet Rotary
Date Started: 02/04/2019 Completed:
Abandonment Method:
Groundwater During Drilling:
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
345 / 115				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near horizontal argillaceous limestone layers and occasional near-horizontal shale seams and layers, and occasional near-horizontal very hard calcareous stringers									
340 / 120				Boring terminated at 120'									
335 / 125													
330 / 130													
325 / 135													
320 / 140													
315 / 145													
310													

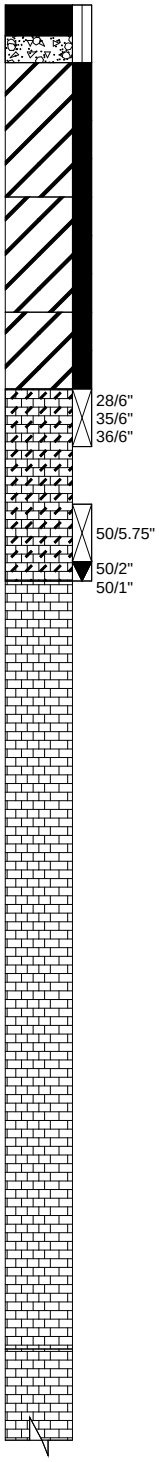
Notes:

LOG OF BORING TS-208

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972495 E 2493622

Drilling Contractor: AGG
Driller: Elilio Luna
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 456.99

Advancement Method: HSA / Wet Rotary
Date Started: 12/27/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: N/A
Field Representative: Logan Tucker, E.I.T.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				6.5" ASPHALT over 2.5" RED BRICK									
				8" Cement-Treated BASE over 1.5" CONCRETE									
455	ST-1			CLAY, very stiff to hard, brown and light brown, w/ sand and gravel pieces (FILL)							4.5+		
	ST-2				11					122	4.5+		
	ST-3										1.5		
5	ST-4			CLAY, very soft, wet, dark brown, w/ large gravel pieces, organics, and sand (FILL)	29				62	104	0.25		
	ST-5										0.25		
450	ST-6										1.25		
	ST-7			CLAY, wet, stiff, brown, w/ sand (native)	22	32	16	16		98	1.5		
	ST-8										2.25		
10	SS-9										4.5++		
				WEATHERED LIMESTONE (Austin Chalk) - extremely to moderately fractured, very soft to soft, severely to highly weathered, tan and gray, w/ clay seams and layers (classification based on visual observation of soil cuttings and split spoon samples and observation of drilling rate)									
445	SS-10												
	THD-1												
15				LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near horizontal argillaceous limestone layers and occasional near-horizontal shale seams and layers, and occasional near-horizontal very hard calcareous stringers									
440				-very hard calcareous stringer at 15.5', 15.6' and 15.8'									
20				-very hard calcareous stringer at 20.3', 21.55' and 21.8'									
435													
25													
430													
30				-shale layer (very soft) 30.5' to 31.2'									
425				-very hard calcareous stringer at 31.3', 31.8', and 32.3'									
35				LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/									
420													

Notes:

LOG OF BORING TS-208

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972495 E 2493622

Drilling Contractor: AGG
Driller: Elilio Luna
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 456.99

Advancement Method: HSA / Wet Rotary
Date Started: 12/27/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: N/A
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
				occasional near-horizontal very hard calcareous stringer and occasional near-horizontal shale seams -very hard calcareous stringer at 35.6' -very hard calcareous stringer at 39.3'									
40													
415				-very hard calcareous stringer at 42'									
45				-1" shale at 44.5'									
410													
50				-1" shale at 50.2'									
405													
55													
400				-1" shale at 57'									
60				-2.5" shale at 60.5'									
395													
65													
390				-4" shale at 66.5'									
70													
385				-1.5" shale at 73'									

Notes:

LOG OF BORING TS-208

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972495 E 2493622

Drilling Contractor: AGG
Driller: Elilio Luna
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 456.99

Advancement Method: HSA / Wet Rotary
Date Started: 12/27/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: N/A
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75				-mechanical breaks 75'-75.9'									
380													
				-very hard calcareous stringer at 78.3'									
80													
375													
				-very hard calcareous stringer at 83.5'									
85				LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal very hard calcareous stringer									
370													
90				-very hard calcareous stringer at 90.6'									
365													
95													
360													
100													
355													
105				-very hard calcareous stringer at 104.4'									
350													
				-very hard calcareous stringer at 108.3'									
110				-very hard calcareous stringer at 109.6'									
				-very hard calcareous stringer at 111' and 113'									
345													

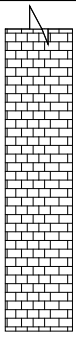
Notes:

LOG OF BORING TS-208

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972495 E 2493622

Drilling Contractor: AGG
Driller: Elilio Luna
Rig: CME-55
Boring Diameter: 4 inch
Ground Surface Elevation: 456.99

Advancement Method: HSA / Wet Rotary
Date Started: 12/27/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: N/A
Field Representative: Logan Tucker, E.I.T.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
115				LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal very hard calcareous stringer									
340				-very hard calcareous stringer at 117.2' and 117.5'									
120				Boring terminated at 120'									
335													
125													
330													
130													
325													
135													
320													
140													
315													
145													
310													

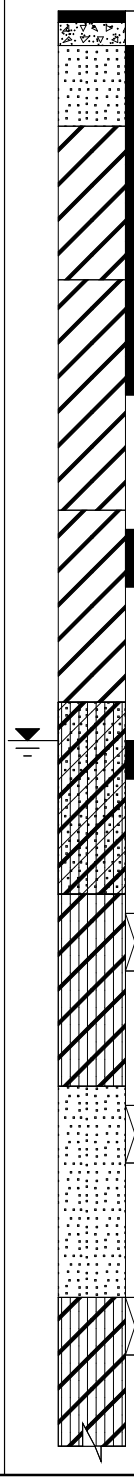
Notes:

LOG OF BORING TS-209

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972995 E 2493692

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 461.17

Advancement Method: HSA / Wet Rotary
Date Started: 12/27/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 19'
Field Representative: Samuel Tran, P.E.



ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
0				4" ASPHALT									
460	ST-1		11/35"REC	6.5" CONCRETE									
	ST-2		12/12"REC	SAND, moist, brown, w/ gravel and clay seams (FILL)	11						0.9		
	ST-3		8/12"REC	CLAY, soft, brown, w/ calcareous nodules (CH)									
	ST-4		6/12"REC		29	45	17	28		98	1.0		
5	ST-5		11/12"REC										
455	ST-6		10.5/12" Rec								2.75		
	ST-7		11/12"REC	CLAY, tan and light gray, blocky, w/ calcareous nodules (CH)	22	54	20	34		106	3.1	6.0	10.7
	ST-8		10.5/12" Rec										
	ST-9										2.25		
10													
450													
	ST-10		18/18"REC	CLAY, tan and light gray, calcareous, w/ calcareous nodules and sand lenses (CL)	17	41	17	24		103	1.6		
15													
445													
	ST-11		9/12" REC	CLAYEY SAND, to sandy silty CLAY, very soft, wet, brown (SC/CL) -water seepage at 19' during drilling							0.75		
20													
440													
	SS-12		18/18"REC 1/6" 2/6" 3/6"	CLAY, very soft, brown, silty, w/ sand lenses and seams (CL)	22	36	15	21			0.75		
25													
435													
	SS-13		14/18"REC 1/6" 1/6" 4/6"	SAND, wet, brown, w/ gravel (SP)	16								
30													
430													
	SS-14		18/18"REC 3/6" 3/6" 10/6"	CLAY, moist, brown, silty, w/ calcareous nodules, sand seams and layers, and gravel pieces (CL)	18	24	11	13			1.0		
35													
425													

Notes:

LOG OF BORING TS-209

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972995 E 2493692

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 461.17

Advancement Method: HSA / Wet Rotary
Date Started: 12/27/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 19'
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
				WEATHERED LIMESTONE (Austin Chalk) - extremely to slightly fractured, very soft to medium hard, severely to moderately weathered, tan and gray, fine grained, medium bedding, very close to moderately close joint spacing, w/ clay seams and layers (classification based on visual observation of soil cuttings and observation of drilling rate)									
40				LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal calcareous stringers, and w/ occasional near-horizontal argillaceous limestone seams, and occasional near-horizontal shale seams									
420				-numerous calcite seams at 40.5' -calcite at 41.95' and 43.13' -mechanical breaks at 43', 45.75' and 46.58' -argillaceous limestone at 47.3' - 47.67' -2" shale seam at 47.67'									
45													
415				-very hard calcareous stringer at 49.9' -1" argillaceous limestone at 52.5' -1" shale seam at 56.7' -very hard calcareous stringer at 53.83', 53.38' and 54.63'									
50													
410													
55				LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, gray, fine grained, massive bedding, wide to very wide joint spacing, w/ occasional near-horizontal calcareous stringers, w/ occasional near-horizontal argillaceous limestone seams and layers, and occasional near-horizontal shale seams									
405													
60													
400													
65													
395				-1.5" shale seam at 66.25'									
70													
390				-3" shale seam at at 71.79'									

Notes:

LOG OF BORING TS-209

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972995 E 2493692

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 461.17

Advancement Method: HSA / Wet Rotary
Date Started: 12/27/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 19'
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
75													
385				LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, gray, fine grained, massive bedding, wide to very wide joint spacing, w/ occasional near-horizontal calcareous stringers, w/ occasional near-horizontal argillaceous limestone seams and layers, and occasional near- horizontal shale seams									
80				-mechanical break at 77.92'									
380				-mechanical breaks at 81.25', 83' and 88.33'									
85													
375				-very hard calcareous stringer at 88.54'									
90													
370				-mechanical break at 92.2'' -1'' shale seam at 91.5'									
				-very hard calcareous stringer at 94.5' and 94.7'									
95													
365				-very hard calcareous stringer at 97.54' and 97.63									
100				LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, gray, fine grained, massive bedding, wide to very wide joint spacing, w/ occasional near-horizontal calcareous stringers, w/ occasional near-horizontal argillaceous limestone seams, and occasional near- horizontal shale seams -mechanical breaks at 101.8', 101.88' & 102.39'									
360													
105													
355													
110				-very hard calcareous stringer at 110.5' and 110.7'									
350													

Notes:

LOG OF BORING TS-209

Client: Dallas Area Rapid Transit
Project Name: DART - D2 - Dallas, Texas
Project Number: E17-0811
Location: See Appendix A
Boring Location: N 6972995 E 2493692

Drilling Contractor: AGG
Driller: Robert Cromeans
Rig: CME-75
Boring Diameter: 4 inch
Ground Surface Elevation: 461.17

Advancement Method: HSA / Wet Rotary
Date Started: 12/27/2018 Completed:
Abandonment Method: Piezometer Installed
Groundwater During Drilling: 19'
Field Representative: Samuel Tran, P.E.

ELEVATION/ DEPTH (feet)	Sample No.	Recovery (inch)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI %	-200 %	DD pcf	P.PEN tsf	UNCON ksf	Strain %
115				LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, gray, fine grained, massive bedding, wide to very wide joint spacing, w/ occasional near-horizontal calcareous stringers, w/ occasional near-horizontal argillaceous limestone seams, and occasional near- horizontal shale seams -very hard calcareous stringer at 113.58', 116.5', 117.08' 118.67' and 119'									
345													
120				Boring terminated at 120'									
340													
125													
335													
130													
330													
135													
325													
140													
320													
145													
315													

Notes:

KEY TO LOG TERMS & SYMBOLS

Symbol	Description
Strata symbols	
	Asphaltic Paving
	CONCRETE
	SAND
	CLAY, sandy
	LIMESTONE, weathered
	LIMESTONE
	SHALE
	SANDSTONE
	CLAY

Symbol	Description
	SAND, GRAVEL
	Sandy LIMESTONE
	CLAY, Calcareous
	GRAVEL, sandy
	LIMESTONE, severely weathered
	SAND, clayey
	Sandy CLAY, Clayey SAND
	Gravelly
	Sandy, Shaley, LIMESTONE
	FLEXABLE BASE

Notes:

1. Exploratory borings were drilled on dates indicated using truck mounted drilling equipment.

2. Water level observations are noted on boring logs.

3. Results of tests conducted on samples recovered are reported on the boring logs. Abbreviations used are:

DD = natural dry density (pcf)	LL = liquid limit (%)
MC = natural moisture content (%)	PL = plastic limit (%)
Uncon.= unconfined compression (tsf)	PI = plasticity index
P.Pen.= hand penetrometer (tsf)	-200 = percent passing #200

4. Rock Cores
   - REC = (Recovery) sum of core sample recovered divided by length of run, expressed as percentage.
   - RQD = (Rock Quality Designation) sum of core sample recovery 4" or greater in length divided by the run, expressed as percentage.

KEY TO LOG TERMS & SYMBOLS

Symbol	Description
Strata symbols	
	Shaley LIMESTONE
	Description not given for: "OS"
	Description not given for: "S\"
	FILL
	SAND, silty
	Description not given for: "1'Y"
	CONCRETE, LIME-TREATED SOIL
	Silty CLAY, Clayey SAND
	CLAY, silty
Misc. Symbols	
	Boring continues
	Water table when checked
	Water table at boring completion
Soil Samplers	
	Rock Core

Symbol	Description
	Thin Wall Shelby Tube
	Standard Penetration Test
	Auger
	THD Cone Penetration Test

APPENDIX C

DISCONTINUITY LOGS

Project: DART D-2 | Project Number: E16-0217 | Boring No. R-3

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 1

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
WEATHERED LIMESTONE	RC-1	1	60	100%	100%	16.3	X			0	X					X		X				X					
			60			17.4	X			0			X			X		X				X					
			60			18.5	X			0	X					X		X				X					
			60			19.1	X			0		X				X		X				X					
			60			19.7	X			0	X					X		X				X					
	RC-2	1	60	100%	100%	20.0	X			0	X					X		X				X					
			60			20.8	X			0	X					X		X				X					
			60			21.2	X			0	X					X		X			X						
			60			22.1	X			0	X					X		X				X					
			60			24.6	X			0	X					X		X				X					
	RC-3	1	60	100%	97%	25.0	X			0	X					X		X				X					
			60			25.2	X			0				X	X			X				X					
			60			25.6	X			0	X				X			X				X					
LIMESTONE			60			27.3	X			0	X					X		X			X						
	RC-4	1	60	100%	100%	30.0	X			0	X				X			X				X					
			60			35.0	X			0	X				X			X				X					
	RC-5	2	60	68%	68%	36.4	X			0	X				X			X				X					
			60			37.6	X			0	X				X			X				X					
SHALE	RC-6	2	60	93%	93%	40.9	X			0	X				X			X				X					
			60			42.5	X			0	X				X			X				X					
			60			44.5	X			0	X				X			X				X					
	RC-7	2	60	95%	92%	45.7	X			30	X					X		X			X						
			60			47.1	X			30	X					X		X			X						
			60			47.6	X			20			X			X		X			X						
			60			48.7		X		55		X				X		X				X					
			60			48.9	X			45		X				X		X				X					
			60			49.5	X			0	X					X		X				X					

Project: DART D-2 | Project Number: E16-0217 | Boring No. S-1

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 1

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	50%	50%	17.1	X			0	X					X		X				X					
	RC-2	1	60	100%	100%	20.0																					
	RC-3	1	60	100%	100%	25.4	X			0	X					X		X			X						
	RC-4	1	60	100%	100%	32.7	X			0	X					X		X			X						
			60			33.5	X			0	X					X		X			X						
	RC-5	2	60	100%	100%	37.7	X			0	X				X			X			X						
			60			38.3	X			0	X				X			X			X						
	RC-6	2	60	97%	97%	43.8	X			0	X				X			X			X						
SHALE	RC-7	2	60	90%	86%	47.0	X			0	X					X		X				X					
			60			47.2	X			0	X					X		X				X					
	RC-8	2	60	65%	65%	51.9	X			0	X					X		X				X					
			60			53.2	X			0	X					X		X				X					
	RC-9	3	60	80%	80%	57.8	X			0	X					X		X				X					
	RC-10	3	60	100%	100%	62.2	X			0	X				X			X				X					
	RC-11	3	60	100%	100%	67.2	X			0	X					X		X				X					
	RC-12	3	60	100%	100%	71.8	X			0	X					X		X				X					
			60			73.4	X			0	X					X		X				X					
	RC-13	4	60	70%	70%	75.5	X			0	X					X		X				X					
			60			78.4	X			0	X					X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. S-2

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 1

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	100%	23.0	X			0	X					X		X				X					
	RC-2	1	60	100%	100%	26.6	X			0	X					X		X				X					
			60			27.2	X			0	X					X		X			X						
			60			29.2	X			0	X					X		X			X						
	RC-3	1	60	95%	95%	30.0																					
	RC-4	1	60	100%	100%	39.0	X			0	X					X		X				X					
	RC-5	2	60	100%	100%	40.0	X			0				X	X			X				X					
	RC-6	2	60	88%	88%	46.1	X			0	X				X			X				X					
SHALE			60			48.2	X			0	X				X			X				X					
			60			49.4	X			0	X				X			X				X					
	RC-7	2	60	100%	100%	50.3	X			0	X					X		X				X					
			60			51.9	X			0	X					X		X				X					
			60			52.2	X			20	X					X		X				X					
			60			53.4	X			0	X					X		X				X					
	RC-8	2	60	100%	100%	57.3	X			0	X					X		X				X					
			60			58.0	X			0	X					X		X				X					
			60			58.8	X			0	X					X		X				X					
			60			59.8	X			0	X					X		X				X					
	RC-9	3	60	97%	97%	61.0	X			0	X					X		X				X					
			60			64.9	X			0	X					X		X				X					
	RC-10	3	60	100%	100%	65.0																					
	RC-11	3	60	100%	100%	71.3	X			30	X					X		X				X					
			60			73.5	X			0	X					X		X				X					
	RC-12	3	60	100%	100%	77.1	X			0	X					X		X			X						
			60			77.8	X			0	X					X		X				X					
			60			78.3	X			0	X					X		X				X					
			60			79.4	X			30	X					X		X				X					
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. S-3

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	100%	20.0	X			0	X					X		X				X					
			60			22.0	X			0	X					X		X				X					
			60			24.9	X			0	X					X		X				X					
	RC-2	1	60	100%	100%	25.0	X			20	X					X		X				X					
			60			26.6	X			0	X					X		X				X					
	RC-3	1	60	100%	100%	30.0	X			30	X					X		X				X					
			60			35.0	X			30		X				X		X				X					
	RC-4	1	60	100%	100%	36.9	X			50	X					X		X				X					
			60			39.7	X			0	X					X		X				X					
	RC-5	2	60	100%	100%	40.0	X			10	X				X			X				X					
			60			43.8	X			30			X		X			X				X					
			60			44.6	X			0	X				X			X				X					
	RC-6	2	60	100%	100%	46.9	X			0	X				X			X				X					
SHALE			60			47.0	X			30	X					X		X				X					
			60			48.9	X			0	X					X		X				X					
			60			49.9	X			0	X					X		X				X					
	RC-7	2	60	93%	93%	50.0	X			0	X				X			X				X					
			60			50.5	X			0	X				X			X				X					
			60			51.0	X			0	X				X			X				X					
			60			51.9	X			0	X				X			X				X					
			60			52.8				0		X															
			60			53.5	X			10	X					X		X				X					
			60			54.7	X			0		X				X		X				X					
	RC-8	2	60	62%	62%	56.0	X			30	X					X		X				X					
			60			56.7	X			30	X					X		X				X					
			60			57.4	X			0	X					X		X				X					
			60			57.8	X			40	X					X		X				X					
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. S-3

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-9	3	60	93%	93%	61.9	X			0	X					X		X				X					
			60			62.7	X			0	X					X		X				X					
			60			64.5	X			0	X					X		X				X					
	RC-10	3	60	100%	100%	65.2	X			0	X				X			X			X						
			60			68.9	X			30	X				X			X			X						
	RC-11	3	60	78%	78%	70.0	X			0		X				X		X				X					
			60			70.5	X			0		X				X		X				X					
			60			71.5	X			40		X				X		X			X						
			60			71.9	X			0	X					X		X				X					
			60			73.5	X			30		X				X		X			X						
	RC-12	3	60	100%	98%	75.3	X			0	X					X		X				X					
			60			75.7	X			0	X					X		X				X					
			60			76.0	X			0	X					X		X				X					
			60			76.8	X			0	X					X		X			X						
			60			77.5	X			50	X					X		X			X						
			60			78.8	X			30	X					X		X				X					
	RC-13	4	60	100%	100%	80.0	X			0	X					X		X				X					
			60			81.3	X			0	X					X		X				X					
			60			82.1	X			0	X				X			X				X					
			60			84.5	X			0		X			X			X				X					
			60			85.0	X			0	X				X			X				X					
	RC-14	4	60	80%	77%	85.5	X			0	X					X		X				X					
			60			85.8	X			50	X					X		X				X					
			60			87.9	X			20			X			X		X			X						
			60			88.1	X			30	X					X		X				X					
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. S-3

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-15	4	60	100%	100%	90.0	X			0	X					X		X				X					
			60			91.8	X			0	X					X		X				X					
			60			92.1	X			0	X					X		X				X					
			60			92.7	X			5	X					X		X				X					
LIMESTONE	RC-16	4	60	100%	100%	95.7																					
			60			96.7	X			0		X			X			X			X						
			60			97.8	X			0		X			X			X				X					
			60			98.6	X			0	X				X			X				X					
			60			99.3	X			0	X					X		X				X					
	RC-17	5	60	100%	100%	100.0	X			0		X			X			X				X					
			60			101.7	X			0		X			X			X				X					
			60			102.3	X			0	X				X			X				X					
SHALE			60			105.0	X			0	X					X		X				X					
	RC-18	5	60	100%	100%	105.3	X			0	X					X		X				X					
			60			106.0	X			0	X					X		X				X					
			60			107.0	X			0	X					X		X				X					
			60			110.0	X			0	X					X		X				X					
	RC-19	5	60	100%	100%	111.3	X			0	X					X		X				X					
			60			112.2	X			0	X					X		X				X					
			60			112.7	X			0	X					X		X				X					
			60			114.1	X			0	X					X		X				X					
			60			115.0	X			0		X				X		X				X					
	RC-20	5	60	63%	63%	116.6	X			0	X					X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-1

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			25.0	X			0	X					X		X				X					
	RC-1	1	60	95%	95%	27.5	X			10	X					X		X				X					
			60			28.2	X			0	X					X		X				X					
			60			31.0	X			0	X					X		X				X					
			60			32.2	X			10	X					X		X				X					
	RC-2	1	60	100%	98%	33.0	X			0	X					X		X				X					
			60			34.1	X			0	X					X		X				X					
			60			34.2	X			20	X					X		X				X					
			60			36.4	X			30			X			X		X				X					
			60			37.5	X			30		X				X		X			X						
	RC-3	1	60	90%	90%	38.0	X			0	X					X		X				X					
			60			38.4	X			0	X					X		X				X					
			60			38.7	X			0	X					X		X				X					
			60			39.1	X			0	X					X		X				X					
LIMESTONE			60			40.5	X			5	X					X		X				X					
			60			41.7	X			0	X					X		X									
			60			42.5	X			10	X					X		X			X						
	RC-4	1	60	100%	95%	42.6	X			0	X					X		X			X						
			60			43.7	X			0	X					X		X				X					
			60			44.1	X			0	X					X		X				X					
			60			44.5	X			30	X					X		X			X						
			60			45.0	X			0	X					X		X				X					
			60			45.5	X			0	X					X		X				X					
			60			45.9	X			0	X					X		X				X					
	RC-5	2	60	100%	98%	46.1	X			10		X				X		X			X						
			60			47.4	X			30	X					X		X			X						
			60			48.3	X			0	X					X		X				X					
			60			48.9	X			50	X					X		X			X						
			60			50.0	X			50	X					X		X			X						

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-1

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			50.8	X			0	X					X		X				X					
			60			52.7	X			30			X			X		X			X						
	RC-6	2	60	83%	82%	53.0	X			0	X					X		X				X					
LIMESTONE			60			53.7	X			0	X					X		X				X					
			60			54.2	X			0	X				X			X				X					
			60			56.3	X			50			X			X		X			X						
			60			56.8	X			0	X					X		X			X						
	RC-7	2	60	87%	83%	57.0	X			0	X				X			X				X					
			60			57.3	X			30	X				X			X			X						
			60			57.5	X			0	X				X			X				X					
			60			60.0	X			0	X				X			X				X					
			60			60.8	X			0	X				X			X				X					
			60			62.7	X			0	X				X			X				X					
	RC-8	2	60	85%	82%	63.1	X			0		X			X			X				X					
			60			63.3	X			0	X				X			X				X					
			60			63.4	X			0	X				X			X				X					
SHALE			60			63.8	X			0		X			X			X				X					
			60			65.1	X			0	X					X		X			X						
			60			65.5	X			0	X				X			X			X						
			60			66.0	X			0	X					X		X			X						
	RC-9	3	60	100%	97%	66.4	X			0	X					X		X			X						
			60			66.9	X			0	X					X		X			X						
			60			68.9	X			30	X					X		X			X						
			60			69.3	X			20	X					X		X			X						
	RC-10	3	60	100%	100%	72.1	X			0	X					X		X			X						
			60			75.0	X			0	X					X		X			X						
	RC-11	3	60	95%	95%	79.8	X			0	X				X			X			X						
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-1

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-12	3	60	80%	75%	80.2	X			10	X				X			X				X					
			60			80.4	X			30	X				X			X				X					
			60			80.9	X			0	X				X			X				X					
			60			82.4	X			0	X				X			X				X					
			60			82.6	X			30	X				X			X				X					
			60			82.9	X			20	X				X			X				X					
			60			83.7	X			0	X				X			X				X					
			60			83.9	X			0	X				X			X				X					
	RC-13	4	60	95%	90%	85.2	X			0	X				X			X				X					
			60			85.5	X			30	X				X			X				X					
			60			85.9	X			30	X				X			X				X					
			60			86.2	X			0	X				X			X				X					
			60			86.3	X			0	X				X			X				X					
			60			86.6	X			30	X				X			X				X					
			60			87.1	X			0	X				X			X				X					
			60			87.3	X			30	X				X			X				X					
			60			87.6	X			0	X				X			X				X					
			60			87.9	X			0	X				X			X				X					
	RC-14	4	60	100%	100%	90.0	X			0	X					X		X				X					
			60			91.6	X			0		X			X			X				X					
			60			92.7	X			0	X				X			X				X					
			60			93.1	X			0	X				X			X				X					
			60			94.0	X			0	X				X			X				X					
			60			94.5	X			0	X				X			X				X					
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-1

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 4 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	100	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			95.0	X			0	X					X		X				X					
			60			95.6	X			30	X					X		X			X						
			60			96.1		X		30	X					X		X			X						
			60			96.4	X			0	X					X		X				X					
			60			97.0	X			0	X					X		X				X					
	RC-15	4	60	100%	100%	97.3	X			0	X					X		X				X					
			60			97.5	X			20	X					X		X				X					
			60			97.8	X			0	X				X			X				X					
			60			98.3	X			0	X				X			X				X					
SHALE			60			98.9	X			0	X				X			X				X					
			60			100.0	X			0	X				X			X				X					
			60			100.8	X			40	X				X			X				X					
			60			101.3	X			0	X				X			X				X					
	RC-16	4	60	100%	100%	102.3	X			0	X				X			X				X					
			60			103.0	X			10	X				X			X				X					
			60			103.9	X			10	X				X			X				X					
			60			104.3	X			20	X				X			X				X					
			60			104.7	X			30	X				X			X				X					
			60			105.2		X				X			X			X			X						
LIMESTONE, SANDY, SHALEY	RC-17	5	60	100%	100%	106.8	X			30		X			X			X				X					
			60			110.0	X			0	X				X			X				X					
			60			112.0	X			20	X				X			X			X						
SHALE	RC-18	5	60	100%	100%	112.9	X			0		X			X			X			X						
			60			115.0	X			0	X				X			X				X					
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-1

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 5 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-19	5	60	100%	97%	115.4	X			0	X					X		X				X					
			60			115.5	X			0	X					X		X				X					
			60			116.7	X			0	X					X		X				X					
			60			117.4	X			0	X					X		X				X					
			60			117.7	X			0	X					X		X				X					
			60			118.4	X			0	X					X		X				X					
			60			118.8	X			0	X					X		X				X					
			60			119.8	X			0	X					X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-5

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	100%	28.0	X			35	X						X	X				X					
			60			30.0	X			50	X					X		X				X					
	RC-2	1	60	100%	100%	30.4	X			20	X					X		X				X					
			60			31.4	X			10	X					X		X				X					
			60			31.7	X			0	X					X		X				X					
			60			33.2	X			0	X					X		X				X					
			60			34.0	X			0	X					X		X				X					
			60			35.0	X			30	X					X		X				X					
	RC-3	1	60	100%	100%	40.0	X			0		X				X		X				X					
	RC-4	1	60	100%	100%	45.0	X			30	X					X		X				X					
	RC-5	2	60	100%	97%	47.4	X			0	X				X			X				X					
			60			47.6	X			0	X				X			X				X					
			60			48.0	X			0	X				X			X				X					
			60			50.0	X			0		X			X			X				X					
	RC-6	2	60	80%	80%	51.4	X			0	X				X			X				X					
SHALE			60			52.9	X			0	X				X			X				X					
			60			54.0	X			0	X				X			X				X					
	RC-7	2	60	95%	95%	55.0	X			0		X			X			X				X					
			60			56.6	X			0	X				X			X				X					
			60			57.0	X			0	X				X			X				X					
			60			57.4	X			0	X				X			X			X						
	RC-8	2	60	97%	97%	61.0	X			0	X				X			X				X					
			60			62.3	X			0	X				X			X				X					
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-5

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			66.5	X			20	X					X		X				X					
	RC-9	3	60	100%	100%	69.3	X			30	X					X		X				X					
			60			69.9	X			20	X					X		X				X					
			60			70.1	X			0	X					X		X				X					
	RC-10	3	60	85%	85%	71.8	X			0	X					X		X				X					
			60			73.8	X			30	X					X		X				X					
			60			74.3	X			0		X				X		X				X					
			60			75.8	X			0	X					X		X				X					
	RC-11	3	60	100%	100%	76.3	X			0	X					X		X				X					
			60			76.6	X			0	X					X		X				X					
			60			79.1	X			20	X					X		X				X					
			60			82.1	X			0		X				X		X				X					
SHALE	RC-12	3	60	100%	97%	84.2	X			0	X					X		X				X					
			60			84.4	X			0	X					X		X				X					
			60			84.7	X			0	X					X		X				X					
			60			85.8	X			0	X				X			X				X					
			60			86.9	X			0	X				X			X				X					
			60			87.1	X			0				X	X			X				X					
	RC-13	4	60	95%	92%	87.9	X			0	X				X			X				X					
			60			88.2	X			0	X				X			X				X					
			60			88.4	X			0	X				X			X				X					
			60			89.6	X			20	X					X		X				X					
			60			90.2	X			0	X				X			X				X					
	RC-14	4	60	87%	85%	90.8	X			0	X				X			X				X					
			60			92.5	X			0	X					X		X				X					
			60			92.8	X			10	X					X		X				X					
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-5

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-15	4	60	100%	98%	95.1	X			5	X					X		X				X					
			60			96.3	X			30	X					X		X				X					
			60			96.5	X			20	X					X		X				X					
			60			97.6	X			0	X					X		X				X					
	RC-16	4	60	100%	93%	100.3	X			30	X					X		X				X					
			60			101.1	X			0	X				X			X				X					
SHALEY LIMESTONE			60			102.1	X			0	X				X			X				X					
			60			102.3	X			30	X				X			X				X					
			60			102.5	X			0	X				X			X				X					
			60			103.8	X			0	X				X			X			X						
			60			105.0	X			0	X				X			X				X					
	RC-17	5	60	100%	100%	105.0	X			0	X				X			X				X					
			60			106.1	X			0	X				X			X				X					
SHALE			60			107.7	X			10	X				X			X				X					
			60			108.3	X			0				X	X			X				X					
			60			108.8	X			0	X				X			X				X					
	RC-18	5	60	100%	100%	110.0	X			0	X					X		X				X					
			60			110.7	X			0	X					X		X				X					
			60			115.0	X			0		X				X		X				X					
	RC-19	5	60	100%	100%	115.8	X			0	X					X		X				X					
			60			116.8	X			0	X					X		X				X					
			60			117.8	X			0	X					X		X				X					
			60			118.2	X			0	X					X		X				X					
			60			120.0	X			0	X					X		X				X					
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-6

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	100%	27.9	X			0	X					X		X				X					
			60			28.9	X			0	X					X		X				X					
			60			29.8	X			0	X					X		X				X					
	RC-2	1	60	100%	100%	32.9	X			0	X					X		X			X						
			60			35.0	X			20				X		X		X				X					
	RC-3	1	60	100%	100%	35.2	X			0	X					X		X				X					
			60			36.2	X			0	X					X		X				X					
			60			36.9	X			0	X					X		X			X						
			60			37.7	X			0	X					X		X				X					
			60			38.5	X			0	X					X		X				X					
			60			39.5	X			0				X		X		X				X					
	RC-4	1	60	100%	100%	40.2	X			0	X					X		X				X					
			60			40.8	X			0	X					X		X				X					
			60			43.1	X			0	X				X			X				X					
			60			44.2	X			0	X				X			X				X					
			60			44.6	X			0	X				X			X			X						
			60			45.0	X			0				X	X			X				X					
	RC-5	2	60	100%	100%	47.9	X			0	X				X			X				X					
SHALEY LIMESTONE			60			48.3	X			0	X				X			X				X					
			60			49.6	X			0	X				X			X				X					
SHALE	RC-6	2	60	97%	93%	51.7	X			0	X				X			X			X						
			60			52.2	X			0	X					X		X				X					
			60			52.4	X			0		X				X		X			X						
			60			53.4	X			0	X					X		X				X					
	RC-7	2	60	100%	100%	56.4	X			0	X					X		X				X					
			60			57.2	X			0	X					X		X				X					
			60			58.3	X			0	X					X		X				X					
			60			58.9	X			5	X					X		X				X					

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-6

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			61.2	X			5	X					X		X				X					
			60			63.0	X			30	X					X		X				X					
	RC-8	2	60	97%	90%	63.3	X			0	X					X		X				X					
			60			64.2	X			0	X					X		X				X					
			60			64.4	X			0	X					X		X				X					
			60			64.8	X			30	X					X		X				X					
			60			65.4	X			0	X					X		X				X					
			60			65.6	X			0	X					X		X				X					
	RC-9	3	60	100%	95%	66.0	X			0	X					X		X				X					
			60			66.4	X			0	X					X		X				X					
			60			66.7	X			0	X					X		X				X					
			60			71.8	X			0	X					X		X				X					
SHALE	RC-10	3	60	100%	100%	73.8	X			0	X					X		X				X					
			60			74.2	X			0	X					X		X				X					
			60			75.5	X			0	X					X		X				X					
			60			76.4	X			0	X					X		X				X					
	RC-11	3	60	100%	100%	77.6	X			0	X					X		X				X					
			60			78.0	X			25	X					X		X				X					
			60			78.6	X			0	X					X		X				X					
			60			80.6	X			0	X					X		X				X					
			60			81.8	X			0	X					X		X				X					
	RC-12	3	60	93%	90%	82.1	X			0	X					X		X				X					
			60			82.3	X			0	X					X		X				X					
			60			84.0	X			0	X					X		X				X					
			60			84.6	X			0				X		X		X				X					
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-6

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			85.4	X			30	X					X		X				X					
			60			85.7	X			20	X					X		X				X					
	RC-13	4	60	72%	70%	87.4	X			0	X				X			X				X					
			60			88.0	X			0	X				X			X				X					
			60			88.5	X			0	X				X			X				X					
			60			90.6	X			0	X					X		X				X					
SHALE	RC-14	4	60	100%	100%	92.3	X			30	X					X		X			X						
			60			92.7	X			30	X					X		X			X						
			60			93.8	X			10	X					X		X				X					
	RC-15	4	60	100%	100%	95.0																					
			60			100.7	X			0	X					X		X				X					
			60			101.2	X			0	X					X		X				X					
			60			102.3	X			0	X				X			X				X					
	RC-16	4	60	100%	98%	102.7	X			0	X				X			X				X					
LIMESTONE			60			103.1	X			0	X				X			X				X					
			60			104.3	X			0	X				X			X				X					
			60			104.5	X			0	X				X			X				X					
	RC-17	5	60	100%	100%	108.5	X			0	X					X		X				X					
			60			109.7	X			0	X					X		X				X					
SHALE	RC-18	5	60	98%	98%	113.2	X			0	X					X		X				X					
	RC-19	5	60	100%	100%	116.0	X			0	X					X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-11

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 4

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	100%	25.0	X			0	X					X		X				X					
			60			30.0	X			0	X					X		X				X					
	RC-2	1	60	100%	97%	31.3	X			0	X					X		X				X					
			60			33.4	X			0	X					X		X				X					
			60			34.2	X			0	X					X		X				X					
			60			34.5	X			0	X					X		X				X					
			60			34.7	X			0	X					X		X				X					
	RC-3	1	60	100%	100%	35.7	X			0	X					X		X				X					
			60			36.0	X			0	X					X		X				X					
			60			36.8	X			0	X					X		X				X					
			60			37.9	X			0	X				X			X				X					
			60			40.0	X			40	X					X		X				X					
	RC-4	1	60	100%	100%	41.4	X			0	X					X		X				X					
			60			41.7	X			0	X					X		X				X					
			60			42.0	X			0	X					X		X				X					
			60			42.8	X			0	X					X		X				X					
			60			44.2	X			0	X					X		X				X					
			60			44.8	X			0	X					X		X				X					
	RC-5	2	60	100%	97%	45.2	X			0	X					X		X				X					
			60			46.2	X			0	X					X		X				X					
			60			47.2	X			0	X					X		X			X						
			60			48.3	X			0	X					X		X				X					
			60			48.4	X			0	X					X		X			X						
			60			49.6	X			0	X					X		X				X					
	RC-6	2	60	90%	90%	50.3	X			0	X				X			X				X					
SHALE			60			54.2	X			0	X					X		X				X					
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-11

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 4

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-7	2	60	100%	90%	55.2	X			0		X			X			X				X					
			60			55.4	X			0		X			X			X				X					
			60			55.6	X			0		X			X			X				X					
			60			56.8	X			0	X				X			X			X						
			60			57.7	X			0	X					X		X				X					
			60			58.5	X			0	X					X		X				X					
			60			59.1	X			0	X					X		X				X					
			60			59.4	X			0	X					X		X				X					
	RC-8	2	60	100%	100%	64.1	X			5	X					X		X			X						
	RC-9	3	60	100%	100%	66.3	X			0	X					X		X				X					
			60			68.6	X			0	X				X			X				X					
	RC-10	3	60	100%	100%	67.2	X			0	X				X			X			X						
	RC-11	3	60	97%	93%	75.1	X			30	X				X			X			X						
			60			75.3	X			0	X					X		X				X					
			60			76.1	X			0	X					X		X				X					
			60			78.1	X			0	X					X		X			X						
			60			79.8	X			0	X					X		X				X					
	RC-12	3	60	67%	67%	80.4	X			0	X					X		X				X					
			60			81.3	X			0	X					X		X				X					
			60			81.7	X			30	X					X		X				X					
			60			82.2	X			0	X					X		X				X					
			60			82.5	X			40	X					X		X			X						
			60			83.3	X			0		X				X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-11

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 4

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			85.0	X			40	X					X		X				X					
			60			85.5	X			40	X					X		X				X					
			60			85.6	X			30	X					X		X				X					
	RC-13	4	60	90%	87%	86.2	X			0	X					X		X				X					
			60			86.9	X			40	X					X		X				X					
			60			87.2	X			0	X					X		X				X					
			60			87.7	X			20	X					X		X				X					
			60			88.8	X			0	X					X		X				X					
	RC-14	4	60	95%	95%	90.2	X			0	X				X			X				X					
			60			92.7	X			0	X				X			X				X					
			60			96.0	X			0	X				X			X				X					
			60			96.8	X			0	X				X			X				X					
			60			97.1	X			0	X				X			X			X						
	RC-15	4	60	100%	97%	97.3	X			0	X				X			X			X						
SHALE			60			98.0	X			0	X				X			X			X						
			60			98.7	X			0	X				X			X			X						
			60			99.4	X			0	X				X			X				X					
	RC-16	4	60	100%	100%	100.7	X			0	X				X			X				X					
			60			105.0	X			0	X				X			X				X					
			60			106.0	X			0	X				X			X				X					
			60			106.4	X			0	X				X			X				X					
	RC-17	5	60	100%	100%	107.9	X			0	X				X			X				X					
			60			108.3	X			0	X				X			X				X					
			60			108.7	X			0	X				X			X				X					
			60			109.4	X			0	X				X			X				X					
			60			110.8	X			20	X					X		X				X					
	RC-18	5	60	90%	90%	112.6	X			0	X					X		X				X					
			60			114.5	X			0	X					X		X				X					

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-11

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 4 of 4

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-19	5	60	100%	93%	115.5	X			20	X				X			X				X					
			60			115.7	X			0	X				X			X				X					
			60			116.5	X			0	X					X		X			X						
			60			117.3	X			0		X				X		X			X						
			60			117.6	X			0	X					X		X				X					
			60			118.4	X			0	X					X		X				X					
			60			118.5	X			0	X					X		X				X					
			60			118.8	X			0	X					X		X				X					
			60			119.1	X			0	X					X		X				X					
			60			119.6	X			0	X					X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-13

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	100%	25.0	X			0	X					X		X				X					
			60			28.0	X			0	X					X		X			X						
			60			30.0	X			0		X				X		X				X					
	RC-2	1	60	100%	100%	31.8	X			0		X				X		X				X					
			60			33.0	X			0	X					X		X			X						
			60			34.6	X			0	X					X		X				X					
	RC-3	1	60	100%	100%	36.5	X			0	X					X		X				X					
			60			38.1	X			0	X					X		X				X					
			60			39.1	X			0	X					X		X				X					
			60			40.0	X			30	X					X		X				X					
	RC-4	1	60	100%	100%	42.2	X			0	X					X		X				X					
			60			43.5	X			0	X					X		X				X					
			60			44.4	X			0	X					X		X				X					
	RC-5	2	60	100%	100%	45.2	X			0	X				X			X				X					
			60			46.6	X			0	X				X			X				X					
			60			47.6	X			0	X					X		X				X					
SHALEY LIMESTONE			60			48.0	X			0	X				X			X				X					
			60			48.9	X			0	X				X			X				X					
			60			50.0	X			0		X			X			X				X					
	RC-6	2	60	100%	100%	52.5	X			0	X					X		X				X					
			60			53.0	X			0	X				X			X				X					
			60			53.4	X			0	X				X			X				X					
			60			55.0	X			0		X			X			X				X					
LIMESTONE	RC-7	2	60	87%	87%	56.4																					
SHALE			60			57.9	X			0	X					X		X			X						
			60			59.3	X			0		X			X			X			X						
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-13

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
	RC-8	2	60	100%	100%	61.1	X			0		X				X		X			X						
			60			61.6	X			0	X					X		X				X					
			60			62.0	X			0	X				X			X				X					
			60			62.4	X			0	X				X			X				X					
	RC-9	3	60	100%	100%	65.0																					
	RC-10	3	60	87%	87%	70.0	X			0	X				X			X				X					
			60			70.3	X			0	X				X			X				X					
			60			70.9	X			0		X				X		X				X					
			60			72.5	X			0	X					X		X			X						
	RC-11	3	60	100%	100%	77.7	X			0	X					X		X				X					
			60			78.7	X			40	X					X		X				X					
			60			79.0	X			0	X					X		X				X					
			60			79.2	X			0	X					X		X				X					
SHALE	RC-12	3	60	100%	100%	80.6	X			0	X					X		X				X					
			60			82.4	X			20	X					X		X				X					
			60			84.6	X			0	X					X		X				X					
	RC-13	4	60	68%	65%	85.7	X			0	X					X		X				X					
			60			85.9	X			30	X					X		X				X					
			60			86.3	X			0			X				X	X			X						
			60			87.1	X			0	X					X		X				X					
	RC-14	4	60	100%	100%	90.6	X			0	X				X			X				X					
			60			91.4	X			0	X				X			X				X					
			60			93.3	X			0	X				X			X				X					
			60			94.9	X			0	X				X			X				X					
	RC-15	4	60	100%	100%	95.4	X			30	X					X		X				X					
			60			97.0	X			0	X					X		X				X					
			60			97.7	X			0	X					X		X				X					
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-13

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-16	4	60	100%	100%	100.9	X			0	X					X		X				X					
			60			103.2	X			0	X					X		X				X					
			60			104.3	X			0	X					X		X				X					
			60			104.8	X			30	X					X		X			X						
	RC-17		60	100%	100%	106.2	X			0	X				X			X			X						
			60			107.5	X			30	X				X			X			X						
			60			109.0	X			0		X			X			X			X						
			60			110.0	X			0	X				X			X				X					
	RC18		60	92%	92%	111.6	X			0	X				X			X				X					
			60			112.1	X			0	X				X			X				X					
			60			113.2	X			0	X					X		X			X						
	RC-19		60	100%	100%	115.4	X			0	X					X		X				X					
			60			119.2	X			0	X					X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-15

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 4

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	93%	31.9	X			0			X		X			X				X					
			60			32.1	X			0	X				X			X				X					
			60			33.5	X			0	X				X			X				X					
			60			33.7	X			0	X					X		X				X					
			60			34.0	X			0	X				X			X				X					
			60			35.3	X			0			X		X			X				X					
			60			35.6	X			0			X		X			X				X					
			60			35.8	X			0			X		X			X				X					
	RC-2	1	60	100%	100%	36.3	X			0	X					X		X				X					
			60			37.5	X			0		X			X			X				X					
			60			39.6	X			0	X				X			X				X					
			60			40.7	X			0	X				X			X				X					
	RC-3	1	60	100%	100%	41.7	X			0		X			X			X			X						
			60			43.3	X			0	X					X		X			X						
			60			43.8	X			0	X					X		X			X						
			60			44.5	X			5	X				X			X			X						
			60			45.8	X			0	X				X			X			X						
	RC-4	1	60	100%	100%	48.9	X			0	X				X			X			X						
			60			49.3	X			0	X				X			X				X					
	RC-5	2	60	100%	100%	53.9	X			0	X				X			X			X						
SHALE	RC-6	2	60	87%	87%	57.3	X			45		X					X		X			X					
			60			58.2	X			0	X				X			X			X						
			60			59.1	X			0	X				X			X			X						
			60			60.5	X			25		X			X			X				X					

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-15

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 4

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-7	2	60	77%	73%	61.2	X			0	X				X			X				X					
			60			61.8	X			0	X				X			X				X					
			60			61.9	X			0	X				X			X			X						
			60			62.3	X			0	X				X			X			X						
			60			62.9	X			0	X				X			X				X					
			60			63.4		X		5			X		X			X				X					
			60			63.8		X		5			X		X			X				X					
			60			64.6	X			0	X				X			X				X					
	RC-8	2	60	100%	100%	66.5	X			0	X				X			X			X						
			60			67.2	X			0	X				X			X				X					
			60			69.2	X			0	X				X			X				X					
			60			70.1	X			0	X				X			X				X					
	RC-9	3	60	100%	100%	72.5	X			0	X				X			X				X					
			60			73.0	X			0	X				X			X				X					
			60			73.9	X			0			X		X			X				X					
			60			74.3	X			15			X		X			X				X					
			60			75.1	X			0	X				X			X				X					
			60			75.4	X			0	X				X			X				X					
	RC-10	3	60	97%	93%	76.2	X			0	X				X			X				X					
			60			77.1	X			0		X			X			X				X					
			60			77.4	X			0	X				X			X				X					
			60			78.0		X		5	X				X			X				X					
			60			78.4			x	65	X				X			X				X					
			60			78.6	X			0	X				X			X				X					
			60			79.2	X			0	X				X			X				X					
			60			79.9	X			0	X				X			X				X					
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-15

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 4

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-11	3	60	67%	60%	81.8	X			0	X				X			X				X					
			60			82.0	X			0	X				X			X				X					
			60			82.5	X			30		X				X		X				X					
			60			83.0	X			35	X					X		X				X					
			60			83.7	X			5		X				X		X				X					
			60			84.1	X			0	X				X			X				X					
	RC-12	3	60	87%	77%	86.9	X			0	X				X			X				X					
			60			87.2	X			0	X				X			X				X					
			60			88.4	X			0	X				X			X				X					
			60			88.8	X			0	X				X			X				X					
			60			89.0	X			0	X				X			X			X						
			60			89.3	X			0	X				X			X			X						
			60			89.9	X			0	X				X			X				X					
			60			90.3	X			0	X				X			X				X					
	RC-13	4	60	87%	87%	91.9	X			0	X						X	X				X					
			60			93.3	X			0	X				X			X				X					
			60			94.0	X			0	X				X			X				X					
			60			94.4	X			0	X				X			X				X					
			60			95.2	X			0	X				X			X				X					
	RC-14	4	60	67%	63%	98.1	X			0	X				X			X				X					
			60			98.3	X			0		X			X			X				X					
			60			98.5	X			0	X				X			X				X					
	RC-15	4	60	87%	77%	102.3	X			0	X				X			X				X					
			60			102.8	X			0	X				X			X				X					
			60			103.0	X			0	X				X			X				X					
			60			104.0	X			30	X						X	X				X					
			60			104.3	X			45		X					X	X				X					
			60			104.9	X			0	X				X			X				X					
			60			105.3	X			0	X				X			X				X					

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-15

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 4 of 4

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE, Shaley, Silty	RC-16	4	60	93%	93%	107.1	X			0	X				X			X				X					
			60			108.6	X			0	X				X			X			X						
			60			109.1	X			5	X				X			X				X					
			60			109.5	X			10	X				X			X				X					
			60			110.3	X			5	X				X			X			X						
			60			110.7	X			0	X				X			X				X					
	RC-17	5	60	87%	87%	111.0	X			0	X				X			X				X					
			60			111.3	X			0	X				X			X			X						
			60			112.0	X			10			X		X			X			X						
SHALE			60			112.4	X			20			X		X			X			X						
			60			113.3	X			0	X				X			X				X					X
			60			115.3	X			0	X				X			X				X					
	RC-18	5	60	73%	73%	116.3	X			0	X					X		X				X					
			60			117.9		X		20			X			X		X			X						
			60			118.3		X		30			X			X		X				X					
			60			119.7		X		10			X			X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-16

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	100%	25.7	X			0	X				X			X				X					
						26.8	X			0	X				X			X				X					
						27.1	X			0	X				X			X				X					
						27.5	X			0	X				X			X				X					
	RC-2	1	60	100%	100%	30.3	X			0	X				X			X				X					
			60			31.2	X			5	X				X			X			X						
			60			31.6	X			0	X				X			X				X					
			60			32.1	X			0	X				X			X				X					
			60			33.0	X			0	X				X			X			X						
	RC-3	1	60	100%	95%	35.8	X			0	X				X			X				X					
			60			36.8	X			0			X		X			X			X						
			60			37.0	X			20	X				X			X				X					
			60			37.1	X			0	X				X			X				X					
			60			38.2	X			0	X				X			X				X					
			60			38.9	X			0	X				X			X				X					
	RC-4	1	60	93%	93%	42.0	X			20			X		X			X				X					
			60			42.3	X			0	X				X			X				X					
			60			43.5	X			0	X				X			X				X					
			60			44.8	X			0	X				X			X				X					
	RC-5	2	60	100%	100%	47.8	X			20			X		X			X				X					
			60			50.0	X			0	X				X			X				X					
	RC-6	2	60	100%	98%	52.3	X			5	X				X			X				X					
			60			52.5	X			0	X				X			X				X					
			60			52.6	X			0	X				X			X			X						
			60			52.8	X			0	X				X			X				X					
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-16

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-7	2	60	100%	97%	55.1	X			0	X				X			X				X					
			60			55.7	X			0	X					X		X				X					
SHALE			60			56.2	X			0	X					X		X				X					
			60			56.4	X			0	X					X		X				X					
			60			56.9	X			0	X					X		X				X					
			60			59.1	X			0	X					X		X				X					
			60			59.5	X			0	X					X		X				X					
	RC-8	2	60	75%	72%	60.1	X			0	X					X		X				X					
			60			60.6	X			0	X					X		X				X					
			60			61.2	X			0	X					X		X				X					
			60			61.8	X			0	X					X		X				X					
			60			62.0	X			0	X				X			X				X					
			60			62.3	X			0	X				X			X				X					
			60			62.8	X			0	X					X		X				X					
			60			63.0	X			0	X					X		X				X					
	RC-9	3	60	67%	67%	65.8	X			0	X					X		X				X					
			60			66.3	X			0		X				X		X				X					
			60			67.9	X			0	X					X		X				X					
			60			67.2	X			10	X					X		X				X					
	RC-10	3	60	83%	82%	70.3	X			0	X					X		X				X					
			60			70.8	X			0	X					X		X				X					
			60			71.2	X			0	X					X		X				X					
			60			72.3	X			50	X					X		X				X					
			60			72.7	X			0	X					X		X				X					
			60			73.5	X			0	X					X		X				X					
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-16

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			75.4	X			0	X					X		X				X					
			60			76.0	X			0	X					X		X				X					
			60			76.2	X			0	X					X		X				X					
			60			77.3	X			0	X					X		X				X					
	RC-11	3	60	95%	85%	77.4	X			30		X			X			X				X					
			60			77.6	X			0	X					X		X				X					
			60			78.0	X			5	X					X		X				X					
			60			78.6	X			0	X					X		X				X					
			60			79.5	X			0	X					X		X				X					
			60			80.3	X			5	X						X	X				X					
			60			80.9	X			0	X					X		X				X					
			60			81.0	X			0	X					X		X				X					
			60			81.9	X			0	X					X		X				X					
SHALE	RC-12	3	60	93%	87%	82.0	X			0	X					X		X				X					
			60			82.7	X			5	X					X		X				X					
			60			83.0	X			40	X					X		X				X					
			60			83.3	X			5	X					X		X				X					
			60			85.3	X			30			X		X			X				X					
			60			85.4	X			0	X				X			X				X					
	RC-13	4	60	75%	72%	85.8	X			0	X				X			X			X						
			60			86.3	X			5	X					X		X				X					
			60			87.8	X			20	X					X		X				X					
			60			88.3	X			5	X					X		X				X					
			60			90.8	X			0	X				X			X				X					
	RC-14	4	60	52%	47%	91.0	X			0	X				X			X				X					
			60			91.7	X			5	X				X			X				X					
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-16

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 4 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-15	4	60	48%	40%	95.5	X			5	X				X			X				X					
			60			95.7	X			35	X				X			X				X					
			60			96.0	X			0	X				X			X				X					
			60			96.3	X			0	X				X			X				X					
	RC-16	4	60	65%	55%	100.2	X			0	X				X			X				X					
			60			100.5	X			0	X				X			X				X					
			60			100.6	X			0	X				X			X				X					
			60			100.7	X			30	X				X			X				X					
			60			102.8	X			0	X				X			X				X					
			60			103.0	X			0	X				X			X				X					
			60			103.2	X			0	X				X			X				X					
SHALEY LIMESTONE	RC-17	5	60	83%	78%	105.2	X			0	X				X			X				X					
			60			106.2	X			0	X				X			X				X					
			60			106.8	X			5	X				X			X				X					
			60			107.4	X			0	X				X			X				X					
			60			108.5	X			0	X				X			X				X					
			60			108.8	X			0	X				X			X				X					
			60			109.3	X			0	X				X			X				X					
	RC-18	5	60	77%	72%	110.0	X			0	X				X			X				X					
			60			110.3	X			0	X				X			X				X					
			60			110.6	X			0	X				X			X				X					
			60			111.1	X			0	X				X			X				X					
SHALE			60			111.4	X			0	X				X			X				X					
			60			111.3	X			0	X					X		X				X					
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. TS-16

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 5 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			115.8	X			0	X				X			X				X					
			60			116.3	X			0	X				X			X				X					
SHALE	RC-19	5	60	100%	100%	116.7	X			5	X				X			X				X					
			60			117.9	X			5	X					X		X				X					
			60			118.6	X			5	X					X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-24

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	97%	20.0	X			0	X				X			X				X					
			60			22.2	X			0	X				X			X			X						
			60			23.1	X			0	X				X			X			X						
			60			23.8	X			0	X				X			X				X					
			60			24.4	X			0	X				X			X			X						
	RC-2	1	60	100%	100%																						
	RC-3	1	60	100%	100%	32.2	X			0	X				X			X			X						
	RC-4	1	60	100%	100%	39.0	X			5	X				X			X				X					
			60			39.7	X			30	X				X			X				X					
	RC-5	2	60	100%	100%	40.0	X			0	X				X			X				X					
			60			45.0	X			30	X				X			X				X					
	RC-6	2	60	90%	87%	46.0	X			5	X				X			X				X					
			60			46.5	X			20	X				X			X				X					
			60			46.7	X			0	X				X			X				X					
			60			47.0	X			0	X				X			X				X					
SHALEY LIMESTONE			60			47.4	X			0	X				X			X				X					
			60			49.2	X			5	X				X			X			X						
			60			49.5	X			10	X				X			X				X					
	RC-7	2	60	97%	93%	50.0	X			0	X				X			X				X					
			60			50.9	X			20	X				X			X				X					
			60			51.8	X			0	X				X			X				X					
			60			52.0	X			0	X				X			X				X					
			60			52.2	X			0	X				X			X				X					
			60			54.6	X			0	X				X			X				X					
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-24

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALEY LIMESTONE	RC-8	2	60	85%	82%	55.1	X			0	X				X			X				X					
			60			55.4	X			0	X				X			X				X					
			60			55.6	X			0	X				X			X				X					
			60			56.1	X			0	X				X			X				X					
SHALE			60			59.1	X			0	X				X			X				X					
	RC-9	3	60	77%	73%	60.7	X			0	X				X			X				X					
			60			61.3	X			0	X				X			X			X						
			60			61.8	X			0	X				X			X				X					
			60			62.4	X			0	X				X			X				X					
			60			62.8	X			5	X				X			X				X					
			60			63.0	X			0	X				X			X				X					
			60			63.7	X			0		X			X			X				X					
			60			63.8	X			0			X		X			X				X					
	RC-10	3	60	20%	20%																						
	RC-11	3	60	92%	92%	70.0	X			0	X				X			X				X					
			60			70.9	X			0	X				X			X				X					
			60			72.1	X			40	X				X			X				X					
			60			71.7	X			5		X			X			X				X					
			60			72.0	X			50			X		X			X				X					
			60			72.6	X			10	X				X			X				X					
			60			73.6	X			0		X			X			X				X					
			60			74.0	X			0	X				X			X				X					
			60			74.6	X			50			X		X			X				X					
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-24

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			75.3	X			0		X			X			X			X						
			60			76.2	X			0	X				X			X				X					
			60			76.4	X			25	X				X			X				X					
	RC-12	3	60	80%	78%	76.8	X			0	X				X			X			X						
			60			77.1	X			0	X				X			X									
			60			77.3	X			10	X				X			X			X						
			60			77.5	X			0	X				X			X			X						
			60			81.8	X			0	X				X			X				X					
	RC-13	4	60	85%	83%	82.0	X			0	X				X			X			X						
			60			82.3	X			40			X		X			X				X					
			60			89.3	X			0	X				X			X				X					
SHALE			60			85.2	X			0	X				X			X				X					
			60			85.5	X			0	X				X			X				X					
			60			86.0	X			30	X				X			X				X					
			60			86.4	X			30	X				X			X				X					
	RC-14	4	60	65%	60%	86.5	X			0	X				X			X				X					
			60			87.0	X			0	X				X			X				X					
			60			87.1	X			0	X				X			X				X					
			60			87.8	X			0	X				X			X				X					
			60			88.1	X			0	X				X			X				X					
			60			90.5	X			0	X				X			X				X					
	RC-15	4	60	93%	92%	91.5	X			0		X			X			X				X					
			60			94.7	X			0	X				X			X				X					
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-24

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 4 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-16	4	60	70%	67%	95.2	X			0	X				X			X				X					
			60			95.7	X			20	X					X		X				X					
			60			96.4	X			0	X					X		X				X					
			60			97.0	X			0	X				X			X				X					
			60			97.3	X			0	X				X			X				X					
			60			97.5	X			0	X				X			X			X						
			60			98.3	X			30	X				X			X				X					
	RC-17	5	60	83%	83%	100.7	X			0	X					X		X				X					
			60			101.1	X			0	X					X		X				X					
			60			101.4	X			30			X			X		X			X						
			60			102.0	X			0	X					X		X				X					
			60			104.0	X			30	X					X		X				X					
	RC-18	5	60	98%	98%	105.0	X			0	X					X		X				X					
			60			105.9	X			0	X					X		X				X					
			60			106.2	X			0	X					X		X				X					
			60			107.6	X			0	X					X		X				X					
			60			108.7	X			0	X				X			X			X						
SHALEY LIMESTONE			60			109.0	X			30	X				X			X				X					
			60			109.6	X			0	X				X			X				X					
	RC-19	5	60	87%	84%	110.3	X			0	X				X			X				X					
			60			111.2	X			5	X				X			X				X					
			60			111.5	X			0	X				X			X				X					
			60			112.5	X			5	X				X			X			X						
SHALE			60			113.3	X			0	X					X		X				X					
			60			113.7	X			0	X											X					
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-24

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 5 of 5

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-20	5	60	100%	100%	115.4	X			0	X					X		X				X					
			60			117.3	X			20	X					X		X			X						
			60			117.7	X			0	X					X		X				X					
			60			118.2	X			0	X					X		X				X					
			60			118.6	X			0	X					X		X				X					
			60			119.8	X			0	X					X		X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-25

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	100%	20.5	X			0	X					X		X				X					
			60			24.2	X			0		X				X		X				X					
	RC-2	1	60	100%	100%	26.5	X			0	X					X		X				X					
			60			28.2	X			0	X					X		X				X					
	RC-3	1	60	100%	100%	31.1	X			0	X					X		X				X					
			60			32.2	X			0	X					X		X			X						
			60			35.0	X			0	X					X		X				X					
	RC-4	1	60	100%	100%	36.4	X			0	X					X		X				X					
			60			37.0	X			0	X					X		X				X					
			60			39.4	X			0	X					X		X				X					
	RC-5	2	60	100%	100%	41.9	X			0	X					X		X				X					
			60			43.7	X			0	X					X		X			X						
	RC-6	2	60	100%	100%	46.1	X			0	X					X		X				X					
			60			46.9	X			0	X					X		X			X						
			60			47.4	X			10	X					X		X				X					
			60			48.5	X			0	X					X		X			X						
			60			49.1	X			0	X					X		X			X						
			60			49.6	X			25	X					X		X			X						
	RC-7	2	60	100%	98%	51.2	X			0	X					X		X				X					
			60			51.7	X			0	X					X		X				X					
			60			52.1	X			0	X				X			X				X					
			60			52.9	X			0	X				X			X				X					
			60			53.1	X			0	X				X			X				X					
			60			53.6	X			0	X				X			X				X					
			60			54.3	X			0	X				X			X				X					
			60			54.9	X			0	X				X			X				X					
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-25

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-8	2	60	98%	98%	56.7	X			0	X					X		X				X					
			60			57.3	X			0	X					X		X			X						
			60			58.5	X			0	X				X			X				X					
			60			58.8	X			0	X				X			X				X					
			60			59.2	X			0	X				X			X				X					
			60			59.9	X			0	X				X			X				X					
	RC-9	3	60	100%	100%	60.2	X			0	X				X			X				X					
			60			62.4	X			0	X				X			X			X						
SHALE			60			63.4	X			0	X					X		X				X					
			60			64.7	X			0	X					X		X				X					
	RC-10	3	60	95%	95%	65.5	X			0	X				X			X				X					
			60			66.9	X			0	X				X			X				X					
			60			67.8	X			0	X				X			X			X						
			60			68.3	X			0	X				X			X			X						
	RC-11	3	60	100%	100%	72.5	X			0	X					X		X			X						
	RC-12	3	60	100%	100%	75.3	X			0	X				X			X				X					
			60			77.3	X			0	X				X			X				X					
	RC-13	4	60	97%	97%	83.0	X			0	X					X		X			X						
			60			84.9	X			30	X					X		X				X					
	RC-14	4	60	97%	97%	88.2	X			0	X					X		X			X						
			60			89.0	X			0	X					X		X			X						
	RC-15	4	60	100%	100%	90.3	X			0	X				X			X				X					
			60			93.0	X			0	X				X			X				X					
			60			94.4	X			30	X					X		X			X						
			60			94.8	X			0	X					X		X				X					
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-25

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
			60			95.8	X			0	X					X		X				X					
			60			97.7	X			0	X				X			X				X					
	RC-16	4	60	100%	90%	98.2	X			0	X				X			X				X					
			60			98.7	X			0	X				X			X				X					
			60			99.0	X			0	X				X			X				X					
SHALE			60			99.3	X			0	X				X			X				X					
	RC-17	5	60	93%	93%	100.2	X			0	X					X		X				X					
			60			100.7	X			0	X					X		X				X					
	RC-18	5	60	85%	85%	109.2	X			40	X					X		X				X					
			60			110.4	X			0	X					X		X				X					
	RC-19	5	60	97%	93%	110.6	X			10	X					X		X				X					
SHALEY			60			113.2	X			0	X				X			X			X						
LIMESTONE	RC-20	5	60	77%	77%	115.6	X			0	X				X			X				X					
SHALE			60			117.2	X			30	X					X		X			X						
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-26

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	92%	92%	23.4	X			0				X		X		X				X					
			60			28.9	X			0	X					X		X				X					
			60			29.6	X			0	X					X		X				X					
	RC-2	1	60	100%	100%	34.0	X			0	X					X		X				X					
	RC-3	1	60	100%	100%	35.5	X			0	X					X		X				X					
	RC-4	1	60	100%	98%	41.5	X			0	X					X		X				X					
			60			41.7	X			0	X					X		X				X					
			60			42.7	X			0	X					X		X				X					
			60			44.3	X			0	X					X		X				X					
	RC-5	2	60	100%	100%	47.0	X			0	X					X		X				X					
	RC-6	2	60	100%	95%	50.3	X			0	X					X		X				X					
			60			51.6	X			0	X					X		X				X					
			60			52.1	X			0	X					X		X				X					
			60			54.0	X			0	X					X		X				X					
			60			54.2	X			0	X					X		X				X					
			60			54.5	X			0	X					X		X				X					
			60			54.8	X			0	X					X		X				X					
	RC-7	2	60	100%	100%	57.2	X			0	X					X		X			X						
			60			59.3	X			0	X					X		X			X						
	RC-8	2	60	88%	83%	60.3	X			0	X					X		X				X					
			60			60.7	X			0	X					X		X				X					
			60			63.9	X			0	X					X		X				X					
			60			64.2	X			0	X					X		X				X					
SHALE	RC-9	3	60	100%	100%	65.3	X			0	X				X			X				X					
			60			66.6	X			0	X				X			X				X					
			60			67.8	X			0	X				X			X				X					
			60			69.0	X			0	X				X			X				X					
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-26

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
	RC-10	3	60	87%	87%	70.0																					
	RC-11	3	60	100%	100%	76.2	X			10	X					X		X				X					
			60			78.6	X			0	X					X		X				X					
	RC-12	3	60	100%	100%	83.5	X			0	X					X		X				X					
	RC-13	4	60	87%	87%	86.8	X			0	X					X		X			X						
			60			87.9	X			0	X					X		X			X						
			60			88.6	X			0	X					X		X				X					
			60			89.2	X			0	X					X		X				X					
	RC-14	4	60	80%	80%	92.0	X			0	X					X		X				X					
			60			93.6	X			20	X					X		X				X					
	RC-15	4	60	100%	100%	96.7	X			30	X					X		X				X					
			60			98.2	X			0	X					X		X				X					
SHALE			60			99.6	X			0	X				X			X				X					
	RC-16	4	60	73%	73%	100.4	X			0	X				X			X				X					
			60			100.8	X			0	X				X			X				X					
			60			101.6	X			30	X					X		X			X						
			60			103.1	X			0	X					X		X				X					
	RC-17	5	60	93%	90%	106.1	X			0	X					X		X				X					
			60			107.9	X			30	X					X		X				X					
			60			108.1	X			20	X					X		X				X					
			60			109.0	X			20	X					X		X				X					
	RC-18	5	60	100%	98%	110.4	X			0	X					X		X				X					
			60			113.0	X			0	X					X		X				X					
			60			113.6	X			5	X					X		X				X					
			60			113.8	X			0	X				X			X				X					
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-26

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 3 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALEY LIMESTONE	RC-19	5	60	88%	85%	115.2	X			0	X				X			X				X					
			60			115.7	X			0	X				X			X				X					
			60			116.1	X			0				X	X			X				X					
			60			116.4	X			0				X	X			X				X					
			60			116.6	X			0				X	X			X				X					
			60			117.9	X			0				X	X			X				X					
			60			118.2	X			0				X	X			X				X					
SHALE			60			118.7	X			0	X				X			X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-27

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 2

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	98%	21.3	X			0	X					X		X				X					
			60			22.6	X			0	X					X		X				X					
			60			22.9	X			0	X					X		X				X					
			60			24.1	X			0	X					X		X				X					
	RC-2	1	60	100%	100%	27.5	X			0	X					X		X				X					
			60			28.5	X			0	X					X		X				X					
	RC-3	1	60	97%	97%	30.2	X			0	X					X		X				X					
	RC-4	1	60	100%	100%	36.1	X			0	X					X		X			X						
			60			38.7	X			0	X					X		X				X					
			60			39.3	X			0	X					X		X				X					
			60			39.7	X			0	X					X		X				X					
	RC-5	2	60	100%	100%	44.6	X			0	X				X			X				X					
	RC-6	2	60	100%	97%	45.7	X			0	X				X			X				X					
			60			46.1	X			0	X				X			X				X					
			60			47.6	X			0	X				X			X				X					
			60			48.5	X			0	X				X			X			X						
			60			48.6	X			0	X				X			X			X						
	RC-7	2	60	0%	0%	50.0																					
	RC-8	2	60	95%	95%	59.4	X			0	X				X			X				X					
	RC-9	3	60	100%	100%	60.0																					
	RC-10	3	60	98%	95%	66.0	X			0	X					X		X				X					
SHALE			60			68.0	X			0				X	X			X				X					
			60			68.5	X			0	X				X			X				X					
			60			69.1	X			30	X				X			X			X						
			60			69.2	X			0	X				X			X				X					
	RC-11	3	60	55%	55%	70.4	X			0				X	X			X				X					
			60			71.5	X			0	X				X			X				X					
	RC-12	3	60	95%	95%	79.7	X			30	X					X		X				X					

Project: DART D-2 | Project Number: E16-0217 | Boring No. T-27

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 2 of 2

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-13	4	60	55%	55%	82.5	X			0	X					X		X			X						
	RC-14	4	60	92%	92%	87.2	X			0	X				X			X			X						
			60			89.1	X			0	X				X			X			X						
			60			89.6	X			0	X				X			X				X					
	RC-15	4	60	100%	97%	90.7	X			0	X				X			X				X					
			60			91.0	X			0	X				X			X				X					
			60			91.6	X			0	X				X			X				X					
			60			92.3	X			0	X				X			X				X					
			60			94.1	X			30	X					X		X			X						
			60			94.6	X			0	X					X		X				X					
	RC-16	4	60	100%	100%	95.4	X			30	X					X		X				X					
			60			97.6	X			0	X					X		X				X					
	RC-17	5	60	87%	82%	102.0	X			0	X				X			X				X					
			60			102.6	X			0	X				X			X				X					
			60			103.3	X			0	X				X			X				X					
			60			103.5	X			0	X				X			X				X					
	RC-18	5	60	100%	90%	107.3	X			30	X					X		X			X						
			60			107.6	X			30	X					X		X			X						
			60			107.8	X			30	X					X		X			X						
	RC-19	5	60	88%	88%	110.9	X			0	X					X		X				X					
	RC-20	5	60	100%	100%	115.5	X			0	X				X			X				X					
			60			117.2	X			0	X				X			X				X					
			60			118.3	X			0	X				X			X				X					
			60			119.2	X			20	X				X			X				X					
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 | Project Number: E16-0217 | Boring No. R-8

Location: Dallas, Texas | Field Representative: Hassan Shah | Page 1 of 1

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
	RC-1	1	60	23%	23%	15.3	X			30	X				X							X					
	RC-2	1	60	60%	60%	23.2	X			0	X				X			X				X					
			60			23.9	X			0	X				X			X				X					
LIMESTONE	RC-3	1	60	95%	93%	25.3	X			0	X				X			X				X					
			60			25.6	X			0	X				X			X				X					
			60			26.9	X			0	X				X			X				X					
	RC-4	1	60	60%	60%	31.6	X			20	X						X	X				X					
			60			32.1	X			0	X				X			X				X					
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								
			60																								

Project: DART D-2 -TO #28 | Project Number: E17-0201 | Boring No. B-1

Location: Dallas, Texas | Field Representative: William Cappell | Page 1 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	100%	100%	31.7	X			0	X				X			X			X						
						33.3	X			0	X					X		X			X						
						34.1	X			0	X				X			X			X						
	RC-2	1	120	100%	100%	38.3	X			0	X				X			X			X						
						43.2	X			0	X				X			X			X						
	RC-3	1,2	120	98%	98%	49.0	X			0	X				X			X			X						
						53.0	X			0	X				X			X			X						
	RC-4	2	120	100%	100%	59.0	X			5			X		X			X			X						
						62.8	X			5	X				X			X			X						
						65.2	X			0	X				X			X			X						
SHALE	RC-5	2	60	80%	73%	66.1	X			0	X				X			X			X						
						67.6	X			0	X					X		X			X						
						67.8	X			0	X					X		X			X						
						67.9	X			0	X				X			X			X						
						68.0	X			0	X					X		X			X						
						69.1	X			5	X				X			X			X						
	RC-6	3	60	100%	93%	72.1	X			5	X				X			X				X					
						72.2	X			0	X				X			X				X					
						72.3	X			0	X					X		X			X						
						72.7	X			0	X				X			X				X					
						72.9	X			0	X				X			X			X						
						74.1	X			25	X				X			X			X						

Project: DART D-2 -TO #28 | Project Number: E17-0201 | Boring No. B-1

Location: Dallas, Texas | Field Representative: William Cappell | Page 2 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-7	3	60	97%	93%	76.2	X			0	X					X		X				X					
						77.0	X			0	X				X			X			X						
						77.5	X			0	X				X			X			X						
						78.0	X			0	X				X			X			X						
						78.7	X			0	X				X			X			X						
						79.1	X			0	X				X			X			X						
						79.4	X			0	X				X			X			X						
						80.2	X			0	X				X			X			X						
						80.4	X			0	X				X			X			X						
	RC-8	3	60	98%	93%	81.8	X			0	X				X			X				X					
						83.1		X		20	X						X	X			X						
	RC-9	3	60	100%	100%	86.5	X			0	X					X		X			X						
						86.6	X			5	X																
						87.9	X																				
						89.1	X			0	X					X		X			X						
						89.2	X			25																	
						90.8		X		45	X						X					X					
	RC-10	4	60	100%	100%	94.7	X			20																	
						94.8	X			10																	
						95.8		X		20	X						X	X			X						
	RC-11	4	60	88%	85%	97.2	X			0	X					X		X			X						
						97.4	X			15	X					X		X			X						
						98.8		X		50	X						X	X									
						100.0	X			5	X				X			X				X					

Project: DART D-2 -TO #28 | Project Number: E17-0201 | Boring No. B-1

Location: Dallas, Texas | Field Representative: William Cappell | Page 3 of 3

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-12	4	60	88%	88%	101.2	X			0	X				X			X				X					
						102.2	X			0	X				X			X				X					
						103.5	X			5	X				X			X			X						
						104.4	X			5	X					X		X			X						
						104.8	X			0	X					X		X			X						
						105.2	X			0	X				X			X			X						
	RC-13	4	60	85%	78%	107.6	X			0	X				X			X			X						
						108.2	X			0	X				X			X			X						
						108.4	X			0	X				X			X			X						
						109.2	X			0	X				X			X			X						
						109.4	X			0	X					X		X			X						
	RC-14	5	60	NR	NR	111-116																					
	RC-15	5	60	95%	92%	117.1	X			5	X				X			X				X					
SANDSTONE						118.1	X			0	X				X			X			X						
						118.9	X			10	X				X			X				X					
						119.2	X			5	X				X			X				X					
						119.3	X			5	X				X			X				X					
						120.8	X			0			X		X			X			X						

Project: DART D-2 | Project Number: E17-0201 | Boring No. B-2

Location: Dallas, Texas | Field Representative: Ellie Nezhad | Page 1 of 1

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
	RC-1	1	66	95%	95%	41.7	X			5	X				X			X			X						
						43.7	X			0	X				X			X			X						
	RC-2	1	120	100%	100%	49.0	X			0	X				X			X			X						
						53.3	X			5	X				X			X			X						
						54.2	X			5	X				X			X			X						
	RC-3	1,2	120	98%	98%	57.9	X			0	X				X			X			X						
						60.5	X			0	X				X			X			X						
						63.0	X			0	X				X			X				X					
						64.5	X			0	X				X			X			X						
	RC-4	2	120	100%	100%	69.5	X			60	X						X	X				X					
						73.0	X			5	X						X	X			X						
	RC-5	2,3	120	100%	100%	79.0	X			0	X						X	X			X						
						80.7	X			0	X						X	X			X						
						82.1	X			0	X				X			X			X						
LIMESTONE						84.2	X			0	X				X			X			X						
	RC-6	3	120	98%	98%	88.4	X			0	X				X			X			X						
						90.6	X			5	X				X			X			X						
						93.0	X			0	X				X			X			X						
	RC-7	3,4	120	100%	100%	97.7	X			5		X			X			X				X					
						98.5	X			0		X			X			X			X						
						103.0	X			5		X			X			X			X						
						103.7	X			0	X					X		X			X						
	RC-8	4	120	98%	98%	108.1	X			0		X			X			X			X						
						113.4	X			0	X					X		X			X						
						115.6	X			0	X					X		X			X						
	RC-9	4	60	100%	100%	116.1	X			5		X			X			X			X						
						118.0	X			0	X				X			X			X						
						119.0	X			0	X				X			X			X						
						120.0	X			0	X				X			X			X						

Project: DART D-2 | Project Number: E17-0201 | Boring No. B-3

Location: Dallas, Texas | Field Representative: Francis Mbogning | Page 1 of 2

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60"	93%	93%	21.8	X			0	X				X			X			X						
						25.0	X			0	X				X			X			X						
	RC-2	1	120"	100%	95%	27.3	X			0	X					X		X			X						
						30.2	X			0	X				X			X			X						
						30.7			X	10				X	X			X			X						
						33.2		X		55			X		X			X				X					
						35.0	X			20	X					X		X			X						
	RC-3	2	60"	100%	100%	40.0	X			0	X				X			X			X						
						44.8	X			0	X				X			X			X						
						45.0	X				X				X			X			X						
	RC-4	2	120"	100%	100%	46.8	X			0	X				X			X			X						
						48.5	X			0	X				X			X			X						
						50.3	X			0	X					X		X			X						
						53.3	X			0	X				X			X			X						
						55.0	X			0	X				X			X			X						
	RC-5	2 & 3	120"	100%	97%	55.9		X		60	X						X	X				X				X	
						58.9	X			0	X				X			X			X						
						61.3	X			0	X					X		X			X						
						65.0	X			0	X				X			X			X						
	RC-6	3	120"	100%	100%	70.0	X			0	X				X			X			X						
						75.0	X			0	X				X			X			X						
	RC-7	3 & 4	120"	100%	100%	75.9			X	35		X			X			X			X						
						80.0	X			0	X				X			X			X						
						85.0	X			0	X				X			X			X						
	RC-8	4	120"	100%	99%	90.1	X			0	X				X			X			X						
						95.0	X			0	X				X			X			X						

Project: DART D-2 | Project Number: E17-0201 | Boring No. B-3

Location: Dallas, Texas | Field Representative: Francis Mbogning | Page 2 of 2

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SANDY LIMESTONE						97.0																					
						97.2	X			0	X				X			X			X						
	RC-9	4	60"	100%	100%	98.0	X			0	X				X			X			X						
						99.3	X			0	X				X			X			X						
						100.0	X			0	X					X		X			X						
						100.5	X			0			X		X				X			X					
						103.5	X			0	X				X			X			X						
						103.8	X			0	X				X			X			X						
						105.0	X			0	X				X			X			X						
	RC-10	5	120"	90%	88%	105.7	X			0	X				X			X			X						
						108.0	X			0	X				X			X			X						
						109.0	X			0	X					X		X			X						
						109.9	X			0	X				X			X			X						
SHALE						110.0	X			0	X					X		X			X						
						110.3	X			0	X				X			X			X						
						111.6	X			0	X					X		X			X						
						112.8	X			0	X				X			X			X						
	RC-11	5	60"	100%	97%	112.8			X	20		X			X			X				X					
						112.9	X			0	X				X			X			X						
						114.8	X			0	X					X		X			X						
						115.0	X			0	X					X		X			X						
						117.5		X		20	X					X		X				X					
						119.0	X			0	X				X			X			X						
	RC-12	5	60"	100%	100%	119.7	X			0	X				X			X			X						
						119.8	X			0	X					X		X			X						
						120.0																					

Project: DART D-2 | Project Number: E17-0201 | Boring No. B-4

Location: Dallas, Texas | Field Representative: Elahe Nezhad | Page 1 of 2

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	98%	97%	6.9	X			15		X				X		X			X						
						7.6	X			5		X			X			X				X					
						8.5	X			5			X			X		X			X						
	RC-2	1	60	100%	100%	11.9	X			0	X					X		X			X						
	RC-3	1	60	99%	99%	18.3	X			5	X					X		X				X					
	RC-4	1	60	100%	98%	22.5	X			0		X				X		X				X					
	RC-5	2	60	98%	98%	26.5		X		5	X					X		X			X						
	RC-6	2	60	100%	100%	32.7		X				X			X			X				X					
	RC-7	2	60	98%	98%	37.9		X		5		X			X			X				X					
						40.5	X			0	X					X		X			X						
	RC-8	2	60	100%	100%	44.0	X			5	X					X		X			X						
	RC-9	3	60	100%	100%	50.0	X			0	X					X		X				X					
	RC-10	3	60	98%	98%																						
	RC-11	3	60	100%	100%																						
	RC-12	3	60	100%	100%	65.0	X			0	X					X		X			X						
	RC-13	4	60	100%	100%	74.7	X			0	X					X		X				X					
	RC-14	4	60	98%	98%	80.1	X			0	X					X		X			X						
	RC-15	4	60	98%	98%	82.3	X			0	X					X		X			X						
	RC-16	4	60	98%	98%																						
SHALE	RC-17	5	60	100%	99%	90.0	X			0	X					X		X			X						
	RC-18	5	60	96%	94%	92.2	X			0	X					X		X			X						
						93.5	X			0	X					X		X			X						
						95.1	X			0	X					X		X			X						
						95.6	X			0	X					X		X			X						
	RC-19	5	60	90%	89%	99.3	X			0	X					X		X			X						
	RC-20	5	60	98%	89%																						

Project: DART D-2 | Project Number: E17-0201 | Boring No. B-4

Location: Dallas, Texas | Field Representative: Elahe Nezhad | Page 2 of 2

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
SHALE	RC-21	6	60	98%	93%	108.9		X		10				X	X			X			X						
						109.3		X		15			X			X		X			X						
	RC-22	6	60	97%	88%	114.0		X		55	X				X			X			X						
						115.7	X			40		X			X			X			X						
	RC-23	6	60	98%	89%																						

Project: DART D-2 -TO #28 | Project Number: E17-0201 | Boring No. B-5

Location: Dallas, Texas | Field Representative: Logan Tucker | Page 1 of 1

							Type			Dip	Roughness							Weathering			Aperture			Infilling			
											Large				Small												
Rock Description	Core Run	Box No.	Run Length	REC %	RQD %	Depth	Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Shale	Silt	Calcite	Pyrite
LIMESTONE	RC-1	1	60	36%	23%	31.7		X			X					X		X					X				
						32.0		X			X					X		X				X					
	RC-2	1	60	100%	91%	36.2		X			X					X		X			X						
SHALEY LIMESTONE	RC-3	1	120	98%	93%	42.3		X			X						X	X			X						
						44.8		X			X					X		X			X						
						47.1		X			X						X	X			X						
	RC-4	2	60	100%	85%	53.0		X			X						X	X			X						
						53.6		X					X		X			X			X			X			
						54.0		X			X				X			X				X					
						55.2		X			X				X			X				X					X
	RC-5	2	120	99%	98%	55.5		X			X						X	X			X						
						59.5		X			X					X		X			X						
	RC-6	3	120	100%	98%	73.7	X					X			X			X			X						
SHALE	RC-7	3	60	93%	92%	75.6		X				X					X	X			X						
	RC-8	3	60	95%	93%	83.6		X					X			X		X			X						
	RC-9	3	60	90%	90%																						
	RC-10	4	60	97%	97%																						
	RC-11	4	60	95%	95%																						
	RC-12	4	60	82%	82%																						
	RC-13	4	60	100%	98%	106.9		X			X						X	X				X					
	RC-14	5	60	100%	95%	113.3		X			X					X		X			X						
						114.0		X			X						X	X			X						
	RC-15	5	60	73%	70%	116.0		X			X					X		X			X						

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker | Boring No. : P-102

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 10/2/2017 | Page: 1 of 1

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																							
							Depth (ft)	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Shale	Calcite	Pyrite	
WEATHERED LIMESTONE	1	RC-1	21'-26'	60	96%	92%	21.4		x		45	x					x			x		x							
							21.6	x			20	x					x			x		x							
LIMESTONE (below 22') w/ gray argillaceous limestone seams & layers		RC-2	26'-31'	60	99%	99%	30.5		x		45	x						x		x		x			x				
		RC-3	31'-41'	120	100%	98%	33.4	Shell fossil																					
	2	RC-4	41'-51'	120	98%	92%	44.4	x			20	x					x		x			x							
							44.5	3" shale																					
-shell fossils @ 33.4'							44.8	3" mudstone																					
-0.5" shale lens @38.1'							45.4		x		45	x						x		x		x			x				
-3" shale layer @ 44.5'							45.6		x		45	x						x		x		x			x				
		RC-5	51'-61'	120	99%	99%	52.3		x		45	x						x		x		x			x				
-3" sandy calcareous mudstone @ 44.8'	3	RC-6	61'-71'	120	100%	97%	63.3	0.8" calc shale																					
							64.2	0.2" calc. shale																					
-0.8" calcareous shale @ 63.3'							67.2	2" shale																					
-0.2" calcareous shale @64.2'							68.0	0.5" calc shale																					
-0.5" calcareous shale @68'		RC-7	71'-81'	120	99%	96%	71.9	0.2" calc shale																					
-calcareous shale @ 73.6'-73.9'							73.6-73.9	calc shale																					
-2" calc shale @ 86.2'	4	RC-8	81'-91'	120	98%	96%	none																						
-2" calc shale @ 93'		RC-9	91'-101'	120	85%	85%	none																						
-broken core recovery @ 99.7'-101' due to fractured rock	5	RC-10	101'-111'	120	98%	98%	none																						
		RC-11	111'-121'	120	99%	99%	114.7		x		45	x						x	x			x							
-1" very calcareous shale @ 103'																													
-very calcareous shale w/ linear fossils @ 107.8'-108.4'																													
-gray argillaceous limestone w/ linear fossils @ 113.1'-113.6' & 114.5'-116'																													
-hard shell fossils @ 114.5'																													

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker | Boring No. : T-102

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 9-26-17/9-27-17 | Page: 1 of 1

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																							
							Depth (ft)	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Shale	Calcite	Pyrite	
LIMESTONE	1	RC-1	25.5'-31'	66	98%	98%	none																						
		RC-2	31'-41'	120	99%	98%	37.5		x		35	x						x	x			x							
	2	RC-3	41'-51'	120	99%	99%	none																						
SHALE (below 56.5')		RC-4	51'-61'	120	95%	95%	none																						
	3	RC-5	61'-66'	60	97%	96%	62.0	LS seam																					
		RC-6	66'-71'	60	98%	98%	none																						
		RC-7	71'-76'	60	97%	97%	72.4	x			35	x					x		x			x							
		RC-8	76'-81'	60	93%	91%	79.8	ironstone seam																					
	4	RC-9	81'-86'	60	100%	98%	85.5		x		30	x						x	x			x							
		RC-10	86'-91'	60	99%	99%	87.5		x		30	x						x	x			x							
							88.3	x			20	x					x		x			x							
		RC-11	91'-96'	60	80%	68%	94.1	v hrd sandstone																					
SANDY MUDSTONE (93-95.5')							94.5	v hrd sandstone																					
SHALE (below 95.5'')							94.7	v hrd sandstone																					
		RC-12	96'-101'	60	100%	100%	96.3		x		30	x						x	x			x							
	5	RC-13	101'-106'	60	80%	72%	none																						
SANDY MUDSTONE (106.5-112.5')		RC-14	106'-111'	60	95%	92%	none																						
		RC-15	111'-116'	60	100%	92%	none																						
SHALE (below 112.5')		RC-16	116'-121'	60	93%	90%	none																						

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker | Boring No. : T-103

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 10/4/2018 | Page: 1 of 1

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	REC %	RQD %	Discontinuities: Depth (ft)	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Shale	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
LIMESTONE	1	RC-1	26'-31'	60	100%	98%	26.3 &26.8	shale seam																					
		RC-2	31'-41'	120	99%	99%	NA																						
	1&2	RC-3	41'-51'	120	100%	95%	44.7	shale seam																					
							46.9	shale seam																					
	2	RC-4	51'-61'	120	99%	99%	NA																						
SHALE (Below 65')	2&3	RC-5	61'-71'	120	94%	93%	69.8	LS seam																					
	3	RC-6	71'-76'	60	92%	92%	NA																						
		RC-7	76'-81'	60	92%	92%	NA																						
		RC-8	81'-83'	24	100%	100%	NA																						
	4	RC-9	83'-86'	36	94%	94%	NA																						
		RC-10	86'-91'	60	60%	59%	86.4																						
		RC-11	91'-96'	60	92%	92%	NA																						
		RC-12	96'-101'	60	97%	97%	96.8		x		25	x				x			x			x							
SANDY MUDSTONE (100-102')							97.5		x		35	x					x		x			x							
SHALE (Below 102')	5	RC-13	101'-106'	60	97%	96%	101.0	cem sand																					
							102.0	cem sand																					
							102.5		x		20	x					x		x			x							
		RC-14	106'-111'	60	82%	73%	107.7		x		40	x					x		x			x							
							108.1		x		45	x					x		x			x							
							108.2		x		45	x					x		x			x							
		RC-15	111'-116'	60	98%	97%	111.6	x			35	x					x		x			x							
SANDY MUDSTONE (114-119')							113.9	x			20	x					x		x			x							
SHALE (Below 119')		RC-16	116'-121'	60	97%	95%	117.5	x			30	x					x		x			x							
							120.8	x			25	x					x		x			x							

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Daniel Hnatyshyn | Boring No. : TS-104

Location: N Griffin St - Dallas, Texas | Driller: Robert Cromeans | Page: 1 of 5

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																						
							Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, very close joints, w/ calcareous lenses and seams and occasional shale seams and thin layers	1	RC-1	25'-30'	60	88%	87%	25.5	x			5	x				x			x			x							
							26.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							26.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							27.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							28.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							28.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-calcareous stringers & nodules at 25.7' to 27.0'							29.4	x			10	x				x			x				x						
-shale seams at 29.2' to 29.4'																													
-calcite lenses/seams @ 29.0-29.4'																													
-calcareous nodules at 30.2' & 33.5'		RC-2	30'-35'	60	97%	93%	30.2	x			5		x			x			x				x				x		
-shaley limestone layers: 30.2' to 31.5', 32.3' to 33.1', 33.5' to 33.8'							30.6	x			5		x				x		x				x						
							31.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							32.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							33.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-calcareous nodules at 35.2' & 39.1'		RC-3	35'-45'	120	99%	94%	37.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							38.8	x			5-10		x			x			x			x							
-multiple mechanical breaks from 39.5' to 45.0' due to dropped core							39.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							39.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							40.2		x		25-55				x	x			x				x						
							40.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							41.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							41.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							41.8	x			15				x			x	x			x							
							42.3	x			10	x				x			x				x						
							42.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							42.9		x		65	x						x	x				x						
							43.3	x			15		x			x			x			x							

Project Name & Project No: DART D-2 / E17-0811 Field Representative: Daniel Hnatyshyn Boring No. : TS-104

Location: N Griffin St - Dallas, Texas Driller: Robert Cromeans Page: 2 of 5

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	REC %	RQD %	Discontinuities: Depth ft	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Silt	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, very close joints, w/ calcareous lenses and seams and occasional shale seams and thin layers		RC-4	45'-50'	60	100%	100%	46.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							47.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-calcite seams at 45.25', 45.33' & 49.58'																													
AC LIMESTONE @ 50'																													
LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray to dark gray, fine grained, massive bedding, very close joints, w/ argillaceous limestone layers and occasional shale seams and thin layers, w/ occasional very hard calcareous stringers and nodules	2	RC-5	50'-55'	60	100%	97%	50.1	x			5	x				x			x			x							
							53.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							53.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							54.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-calcite seams at 50.5', 51.1', 52', 52.8', 53', 53.8, 54'-54.3'																													
-shale seams and layers at 50.7' to 52.0' & 52.6' to 55.0'		RC-6	55'-60'	60	100%	98%	57.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							58.2	x			5	x				x			x			x							
-various calcareous stringers & nodules at 50.4' to 54.3' & 55.1' to 59.6'							58.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
AC LIMESTONE @ 61.5 '																													
EF SHALE @ 61.5'		RC-7	60'-65'	60	97%	90%	61.5	x			10				x	x			x			x							
SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, very close joints, w/ moderately hard calcareous shale seams and later, and occasional very hard calcareous stringers and nodules							62.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							63.1	x			5-15	x						x	x			x							
							63.3	x			5	x				x			x				x						
							64.6	x			15				x	x			x			x					x		
							64.6	x			0-5	x					x		x			x							
							64.7	x			0-5	x					x		x			x							

Project Name & Project No: DART D-2 / E17-0811 Field Representative: Daniel Hnatyshyn Boring No. : TS-104

Location: N Griffin St - Dallas, Texas Driller: Robert Cromeans Page: 3 of 5

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																					
							Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
'SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, very close joints, w/ moderately hard calcareous shale seams and later, and occasional very hard calcareous stringers and nodules	3	RC-8	65'-70'	60	98%	97%	65.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							66.4	x			5	x				x			x			x					x		
							67.3	x			10	x				x			x				x				x		
							69.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							69.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-calcite seams at 65.8', 66', 66.3', 66.7', 67.2																													
	3	RC-9	70'-75'	60	100%	97%	71.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							71.7	x			25-55	x					x		x				x						
							-Various Mechanical Breaks from 72.6'-73.33' due to moisture loss															-	-	-	-	-	-	-	MB
							73.3	x			0	x					x		x			x					x		
							73.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							73.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-very soft shale at 72.3' to 73.0'							73.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
	3	RC-10	75'-80'	60	98%	97%	75.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							77.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							77.3		x		15	x				x			x				x						
							77.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							77.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-calcite seams at 81.8', 83.2', 83.5' & 84.6'							80.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							81.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
		RC-11	80'-85'	60	99%	98%	82.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							83.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							84.5	x			0	x					x		x			x							
-calcite seams at 85.4', 87.0', 87.9' & 88.2' to 89.1'	4	RC-12	85'-90'	60	97%	95%	85.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							85.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							86.4	x			0	x					x		x			x							
							88.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							88.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							89.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Daniel Hnatyshyn | Boring No. : TS-104

Location: N Griffin St - Dallas, Texas | Driller: Robert Cromeans | Page: 4 of 5

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																					
							Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, very close joints, w/ moderately hard calcareous shale seams and later, and occasional very hard calcareous stringers and nodules	4	RC-13	90'-95'	60	95%	92%	90.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							91.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							91.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							92.7		x		20	x						x	x			x						
							-Various Mechanical Breaks from 92.5' to 92.75' & 92.8' to 93.37' due to moisture loss																			-	-	MB
							94.4	x			0	x					x		x			x						
-calcite seams at 90.2'							94.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-Limestone seam at 98.5' to 98.7'		RC-14	95'-100'	60	98%	90%	97.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							98.5	x			10			x			x		x			x						
							98.7	x			5	x				x			x			x						
							99.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
		RC-15	100'-105'	60	87%	83%	100.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							100.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							101.3		x		15	x					x		x			x						
							102.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							103.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							103.6		x		35	x					x		x			x						
							103.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							104.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
	5	RC-16	105'-110'	60	100%	98%	105.3		x		35				x	x			x				x						
							106.2	x			0	x					x		x			x						
							107.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							109.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							109.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							109.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB

Project Name & Project No: DART D-2 / E17-0811 Field Representative: Daniel Hnatyshyn Boring No. : TS-104

Location: N Griffin St - Dallas, Texas Driller: Robert Cromeans Page: 5 of 5

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	REC %	RQD %	Depth ft	Discontinuities: Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness: Large: Planar	Roughness: Large: Step	Roughness: Large: Undul	Roughness: Large: Irreg	Roughness: Small: Rough	Roughness: Small: Smooth	Roughness: Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Silt	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, very close joints, w/ moderately hard calcareous shale	5	RC-17	110'-115'	60	100%	97%	-Various Mechanical Breaks from 110.0' to 110.2' due to moisture loss																				-	-	MB
							110.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							111.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							112.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
EF SHALE 112.6'							112.6	x			0-5	x					x		x			x							
SANDSTONE 112.6'							113.9	x			5			x		x			x			x							
SANDSTONE (Eagle Ford) - sound, medium hard, fresh, gray, fine grained, thick bedding, very close joints, argillaceous, w/ very hard calcareous							114.6	x			5			x		x			x			x							
		RC-18	115'-120'	60	97%	93%	117.1	x			5			x			x		x			x							
							117.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							117.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-calcite seams at 119.4'																													
SANDSTONE 118.0'																													
EF SHALE 118.0'							118.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							118.0	x			5	x					x		x			x							
							118.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
SHALE (Eagle Ford)-sound, soft, fresh, dark gray, fine grained, massive bedding, very close joints, w/ moderately hard calcareous shale seams and later, and occasional very hard calcareous stringers and nodules							119.5	x			5			x			x		x			x							

END OF BORING ----- TOTAL BORING DEPTH = 120'

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker | Boring No. : TS-111

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 10/4/2018 | Page: 1 of 1

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																							
							Depth (ft)	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Shale	Calcite	Pyrite	
LIMESTONE	1	RC-1	45'-50'	60	92%	92%	none																						
		RC-2	50'-55'	60	99%	99%	none																						
		RC-3	55'-60'	60	98%	98%	none																						
		RC-4	60'-65'	60	98%	98%	none																						
	2	RC-5	65'-75'	120	99%	97%	none																						
		RC-6	75'-85'	120	99%	99%	none																						
	3	RC-7	85'-95'	120	99%	99%	none																						
		RC-8	95'-101.5'	78	60%	60%	none																						
	4	RC-9	101.5'-105'	42	95%	95%	none																						
		RC-10	105'-115'	120	99%	98%	97.2		x		55	x						x	x			x			x				
		RC-11	115'-120'	60	94%	94%	99.5		x		45	x						x	x			x			x				

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker, E.I.T. | Boring No. : T-112

Location: Commerce St - Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 3-21-18/3-23-18 | Page: 1 of 4

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																						
							Depth (ft)	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Shale	Calcite	Pyrite	
LIMESTONE (Austin Chalk) - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to moderately close joint spacing, w/ near horizontal-argillaceous limestone layers and occasional near-horizontal shale seams and lenses	1	RC-1	34.5'-41'	78	83%	70%	35.70			X	25				X	X			X				X						
							35.80	X			15			X			X		X				X						
							36.30	X			20		X			X			X			X							
							36.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							36.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							37.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							37.54	X			25		X			X			X				X			X			
							36.69	X			5				X	X			X				X			X			
-Shale seams @ 37.54', 37.69', 38.19', 38.5', 39.7' & 39.13'							38.19	X			5	X					X		X			X				X			
							38.50			X	25				X	X			X				X			X			
							39.13			X	15				X	X			X				X			X			
-Calcite lenses @ 34.67' & 39.14'							39.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							39.70	X			5	X					X		X			X				X			
		RC-2	41'-46'	60	92	88%	41.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							41.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-Calcite lenses @ 42.29' & 44.93'							41.42	X			0	X					X		X				X			X			
							42.29	X			5		X														X		
							42.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							43.21		X		20	X					X		X			X							
							44.93			X	10				X	X			X				X				X		
		RC-3	46'-51'	60	100%	87%	46.17	X			5	X					X		X			X				X			
-Calcite lenses @ 46.5' & 49.9'							47.14	X			5	X					X		X			X				X			
							47.25	X			5	X					X		X			X				X			
-Shale seams @ 46.17', 47.14', 47.25', 47.35'							47.35	X			5			X			X		X			X				X			
							47.50	X			5		X			X			X				X			X			
-argillaceous limestone seam @ 47.5'-47.75'							48.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							49.90	X			10			X			X		X			X							

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Samuel Tran, P.E. | Boring No. : T-112

Location: Pacific Ave - Dallas, Texas | Driller: Robert Cromeans | Page: 2 of 4

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	REC %	RQD %	Discontinuities: Depth (ft)	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Shale	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
LIMESTONE (Austin Chalk) - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to moderately close joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses		RC-4	51'-56'	60	100%	97%	51.60	X			5			X		X			X			X							
							53.90	X			5	X				X			X			X							
							54.75	X			10			X			X		X			X							
-3" argillaceous limestone seam @ 51.4'																													
-3" argillaceous limestone seam @ 54.6'																													
LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses	2	RC-5	56'-61'	60	100%	98%	58.90	X			0	X					X		X			X							
-argillaceous limestone seam @ 58.8'-59.2'																													
-2" Shale seam @ 61.6"		RC-6	61'-66'	60	97%	90%	61.70	X			10	X				X			X			X							
-1" Shale seams @ 64.0' & 64.9'							64.00	X			5		X			X			X			X							
-1.5" Shale seam @ 65.75'							64.90	X			0	X				X			X			X							
-0.5" Shale seam @ 66.1'		RC-7	66'-71'	60	100%	95%	66.10	X			10	X				X			X			X							
-1.5" Shale seam @ 68.3'							68.30	X			5	X				X			X			X							
							70.00		X		15	X				X			X			X							

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Samuel Tran, P.E. | Boring No. : T-112

Location: Pacific Ave - Dallas, Texas | Driller: Robert Cromeans | Page: 3 of 4

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	REC %	RQD %	Depth (ft)	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Shale	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
LIMESTONE (Austin Chalk) - slightly fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses	3	RC-8	71'-81'	120	99%	94%	72.50		X		45	X					X		X				X						
							72.80	X			5		X			X			X			X							
							73.10	X			15	X					X		X			X							
							74.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-2" Shale seam @ 72.6'																													
-2.5" Shale seam @ 75.8'																													
-2" Shale seam @ 76.2'																													
LIMESTONE (Austin Chalk) @ 76' - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses, w/ iron stains and fossil embeddment along fractures							76.20	X			25				X		X		X				X						
							76.30	X			10				X		X		X			X							
							77.10			X	####			X		X			X				X						
		RC-9	81'-91'	120	99%	93%	81.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							82.00	X			10	X					X		X			X							
							82.50	X			5	X					X		X			X							
							83.80	X			10			X			X		X			X							
							85.80	X			10			X			X		X			X							
-2" Shale seam @ 85.8'																													
-argillaceous limestone seam @ 82.4'-82.6'																													
-argillaceous limestone seam @ 89.3'-89.8'																													
-iron stain and sulphur deposit @ 82'																													
-embedded fossil @ 83.8'							89.10	X			5		X			X			X			X							
							89.50	X			5		X			X			X			X							
							89.70	X			10	X				X			X			X							
							90.40		X		25	X						X	X			X							

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Samuel Tran, P.E. | Boring No. : T-112

Location: Pacific Ave - Dallas, Texas | Driller: Robert Cromeans | Page: 4 of 4

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																							
							Depth (ft)	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Shale	Calcite	Iron stain	
LIMESTONE (Austin Chalk) @ 76' - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and lenses, w/ iron stains and fossil embeddment along fractures	4	RC-10	91'-101'	120	99%	88%	92.10	X			0-5	X				X			X			X							
							92.40	X			0-5	X				X			X			X							
							94.20	X			5	X					X		X			X							
							95.60	X			5		X			X			X			X							
							97.40		X		55	X						X	X				X						
							97.70		X		60	X						X	X				X						
							98.00		X		0-30	X					X		X				X						
							98.40	X			15		X			X			X			X							
							98.10	X			0	X					X		X			X							
-3.5" Shale seam @92.1'-92.4' (various fractures due to moisture loss)							99.60		X		30		X			X			X			X					X		
-2" Shale seam @ 95.5'																													
-argillaceous limestone seam @ 97.9'-98.2'																													
-0.5" Shale seam @ 98.1'																													
-argillaceous limestone seam @ 102.9'-103.4'		RC-11	101'-111'	120	99%	90%	102.90	X			20		X			X			X			X							
							103.00	X			0	X					X		X			X						X	
							103.20	X			0	X					X		X			X						X	
							103.40		X		25	X					X		X			X						X	
							104.10		X		25	X					X		X			X							
							105.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							108.60	X			5	X					X		X			X						X	
							108.90		X		55	X						X	X			X						X	
							110.80	X			5	X					X		X			X						X	
-argillaceous limestone seam @ 112.9'-113.5'	5	RC-12	111'-121'	120	100%	95%	112.90	X			15			X		X			X			X					X	X	
							113.50	X			5		X			X			X			X					X		
-argillaceous limestone seam @ 114.6'-115'							114.90	X			5	X				X			X			X						X	
-Calcite seam @ 118.25'							118.20	X			5	X				X			X			X					X		
-Sulphur deposit at 120.6'							120.30	X			5-10				X	X			X			X					X		
							120.60	X			10	X					X		X			X						X	

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker, E.I.T. | Boring No. : T-201

Location: Commerce St - Dallas, Texas | Driller: Robert Cromeans | Page: 1 of 4

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	TCR %	SCR %	RQD %	Discontinuities																						
								Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
													Large				Small													
		No.	Depths						Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, very close joints, w/ argillaceous limestone layers and occasional shale seams and thin layers	1	RC-1	21'-26'	60	100%	99%	97%	21.7	x			0	x				x			x			x							
								21.8	x			5		x			x			x			x							
								23.3	x			5	x					x		x			x							
								25.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-2" calcareous shale seam @21.7'		RC-2	26'-31'	60	100%	100%	88%	26.5	x			10	x					x		x			x							
								27.9	x			0	x					x		x			x							
-1/8" iron stained linear fossil @ 27.9' & 28'								28.0	x			0-10	x					x		x			x							
								28.1	x			0-10	x					x		x			x							
-calcareous shale @ 28'-28.5'								28.4	x			0-10	x					x		x			x							
								28.5	x			0	x					x		x			x							
								28.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								29.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-1/4" to 1/8" iron stained linear fossil at 31.8', 32.2' & 32.5'		RC-3	31'-41'	120	99%	99%	97%	31.7	x			0	x					x		x			x							
								31.8	x			5		x			x			x			x							
								32.2	x			20	x					x		x			x							
								32.5	x			10	x					x		x			x							
								33.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								33.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								33.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								34.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-hard thin shell fossil @35.2'								35.2	x			10			x			x		x			x							
-1" calcareous shale @ 37'								37.0	x			0	x					x		x			x							
-iron stained fracture @38.7'								38.7	x			20	x				x			x			x							
								39.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								39.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								40.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker, E.I.T. | Boring No. : T-201

Location: Commerce St - Dallas, Texas | Driller: Robert Cromeans | Page: 2 of 4

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	TCR %	SCR %	RQD %	Discontinuities: Depth ft	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Silt	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
	2	RC-4	41'-51'	120	100%	81%	66%	41.3		x		25	x					x		x				x						
-iron stained fracture @ 41.7'								41.8		x		5	x						x	x				x			x			
-w/ numerous black specks due to possible fossilized microbes @ 42.5'-44'								42.8	x			0	x				x			x			x							
								43.6	x			5	x				x			x				x						
								43.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, very close joints, w/ argillaceous limestone layers and occasional shale seams and thin layers								44.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								44.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								-core broke severely into fragments during drilling @ 46.5'-51'														-	-	-	-	-	-	-	-	MB
		RC-5	51'-56'	60	98%	98%	97%	51.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								52.2	x			0	x					x		x			x							
								53.3	x			10	x					x		x			x							
								54.3	x			5	x					x		x			x							
								54.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
		RC-6	56'-61'	60	97%	97%	97%	56.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								57.4	x			0	x					x		x			x							
								58.1	x			0	x					x		x			x							
-calcareous stringers & nodules @ 57.4'-57.7'								58.7	x			0	x					x		x			x							
								59.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
	3	RC-7	61'-66'	60	95%	88%	87%	61.6	x			5	x					x		x			x							
								61.8	x			0	x				x			x			x							
								63.8	x			<5	x				x			x			x							
								64.7	x			0	x				x			x			x							
AC LIMESTONE @ 65'								Various Mechanical Breaks between 64.7'-65.1'											-	-	-	-	-	-	-	-	-	-	-	MB
EF SHALE @ 65'								65.1	x			0-5				x	x			x				x						
								65.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
-calcareous stringers & nodules @ 66' to 66.5'	3	RC-8	66'-71'	60	93%	85%	85%	66.5	x			0	x					x		x			x							
								67.3	x			10	x				x			x			x							
-fossil embeddment @ 67.7', 68.5', 69.3'								67.7	x			5-15		x			x			x				x						
								67.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								68.5	x			0	x				x			x				x						
SHALE (Eagle Ford) - sound, soft, fresh, dark gray, fine grained, massive bedding, very close joints, w/ moderately hard calcareous shale seams and layers, and occasional very hard calcareous stringers and nodules								68.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								69.3	x			0	x				x			x				x						
								69.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								69.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								70.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
								70.3	x			10	x				x			x				x						

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker, E.I.T. | Boring No. : T-201

Location: Commerce St - Dallas, Texas | Driller: Robert Cromeans | Page: 3 of 4

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	TCR %	SCR %	RQD %	Discontinuities: Depth ft	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Silt	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
SHALE (Eagle Ford) - sound, soft, fresh, dark gray, fine grained, massive bedding, very close joints, w/ moderately hard calcareous shale seams and layers, and occasional very hard calcareous stringers and nodules	4	RC-9	71'-76'	60	76%	76%	69%	71.2	x			10	x				x			x			x							
								72.0	x			5	x					x		x			x							
								73.1	x			5		x			x			x				x						
								74.0	x			20				x	x			x				x						
								74.4		x		25	x						x	x			x							
								74.7	x			5				x	x			x				x						
-iron stained fracture @ 74.4'								-Various Mechanical Breaks from 71'-76' due to moisture loss														-	-	-	-	-	-	-	-	MB
	4	RC-10	76'-81'	60	93%	93%	90%	76.7	x			0	x					x		x			x							
								78.3	x			0	x					x		x			x							
								79.2	x			0	x					x		x			x							
								-Various Mechanical Breaks from 76'-81' due to moisture loss														-	-	-	-	-	-	-	-	MB
		RC-11	81'-86'	60	93%	93%	92%	82.8	x			0	x					x		x			x							
		RC-12	86'-91'	60	88%	88%	82%	87.0	x			15-20		x			x				x		x							
								87.5	x			5	x				x			x				x						
-1" brownish gray discoloration @ 89.5'								88.7	x			15		x			x			x				x						
								89.3	x			5		x			x			x				x						
								89.7		x		0	x					x		x			x							
								-Various Mechanical Breaks from 86'-91' due to moisture loss														-	-	-	-	-	-	-	-	MB
-2" tan discoloration @ 92.5'	5	RC-13	91'-96'	60	87%	87%	83%	92.1	x			0	x				x			x				x						
								93.8		x		0	x					x		x			x							
-calcareous stringers & nodules @ 94.3'								94.1	x			0	x					x		x			x							
								94.7	x			10	x					x		x				x						
								-Various Mechanical Breaks from 91'-96' due to moisture loss														-	-	-	-	-	-	-	-	MB

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker, E.I.T. | Boring No. : T-201

Location: Commerce St - Dallas, Texas | Driller: Robert Cromeans | Page: 4 of 4

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	TCR %	SCR %	RQD %	Discontinuities: Depth ft	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Silt	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
SHALE (Eagle Ford) - sound, soft, fresh, dark gray, fine grained, massive bedding, very close joints, w/ moderately hard calcareous shale seams and layers, and occasional very hard calcareous stringers and nodules	5	RC-14	96'-101'	60	85%	74%	67%	96.1	x			0	x					x		x			x							
								96.9	x			0	x					x		x			x							
								97.4	x			0	x				x			x			x							
								99.1	x			5	x				x			x				x						
								99.6	x			0	x				x			x				x						
								-Various Mechanical Breaks from 96'-101' due to moisture loss															-	-	-	-	-	-	-	MB
-calc shale seams, hard calc stringers & nodules, & limestone lens @ 102'-103'		RC-15	101'-106'	60	95%	95%	88%	101.3	x			0	x					x		x			x							
								101.9	x			0	x					x		x			x							
								103.2	x			0	x					x		x			x							
								103.8	x			0	x				x			x			x							
-calc shale @104.3'-104.8'								105.4	x			0	x				x			x			x							
								-Various Mechanical Breaks from 101'-106' due to moisture loss															-	-	-	-	-	-	-	MB
-poorly cemented SAND w/ some clay @ 107.6'-108.9' (deformed recovery)		RC-16	106'-111'	60	98%	80%	78%	106.5	x			0	x					x		x			x							
								106.8		x		40	x						x		x		x							
								107.1		x		30	x					x			x		x							
								107.3		x		30	x					x			x		x							
-bottom 11" of RC-16 is broken, deformed & not testable								107.4		x		30	x					x			x		x							
								107.6		x		30	x					x			x		x							
								-Various Mechanical Breaks from 106'-111' due to moisture loss															-	-	-	-	-	-	-	MB
EF SHALE @ 116'	6	RC-17	111'-116'	60	65%	0%	0%	-RC-17 recovery is broken, deformed & not testable																						
EF SANDSTONE @ 116'																														
SANDSTONE (Eagle Ford) - sound, medium hard, fresh, gray, fine grained, thick bedding, very close joints, argillaceous, w/ very hard calcareous stingers and nodules		RC-18	116'-120'	48	67%	67%	63%	116.6	x			0	x					x		x			x							
								118.0	x			0	x				x			x			x							
								118.2	x			0	x				x			x			x							

Project: DART D-2 | Project Number: E17-0811 | Boring No. : T-202

Location: Dallas, Texas | Field Representative: Logan Tucker | Page: 1 of 1

Rock Description	Box No.	Core Run			Run Length (in.)	TCR %	SCR %	RQD %	Depth (ft)	Type			Dip	Roughness							Weathering			Aperture			Infilling			
														Large				Small												
		No.	From (ft)	To (ft)						Joint	Shear	Fault	Angle (deg)	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite
Lt gray LIMESTONE w/ gray arg LS seams & layers & occas linear fossil -1.5" calc shale seam @ 21'	1	RC-1	16	21	60	100%	100%	100%	none																					
-calc shale @ 26.5'-26.8'		RC-2	21	26	60	98%	98%	98%	none																					
-1" calc shale @ 30'		RC-3	26	36	120	99%	99%	98%	33.0		x		45	x						x	x			x						
-dark gray shale @ 29.9'-33.2'									35.1		x		60	x						x	x			x						
									35.7		x		50	x						x	x			x						
-dark gray shale @38.7'-39'	2	RC-4	36	46	120	100%	100%	95%	42.3		x		60	x						x	x			x						
-calc shale @ 40.4'-40.7'									43.2		x		60	x						x	x			x						
-calc shale @ 44'-44.2'									43.4		x		60	x						x	x			x						
-dark gray shale @ 47.4'-47.8'																														
-calc shale @ 50.3'-50.7' -0.3" ironstone @ 51.4'		RC-5	46	56	120	99%	99%	99%	none																					
-calc shale lens @ 51.4' -1" dark gray shale @ 58.5'	3	RC-6	56	61	60	100%	100%	98%	none																					
-dark gray shale @59.4'-59.7' -calc shale @ 59.7'-60.4'		RC-7	61	66	60	97%	97%	94%	none																					
-2" dark gray shale @ 64' -2" dark gray shale @ 68.8'		RC-8	66	76	120	98%	98%	97%	none																					
-1.5" dark gray shale @ 74.6'	4	RC-9	76	86	120	99%	99%	99%	none																					
-fractured rock caused core to break @ 86'-86.5'		RC-10	86	96	120	100%	95%	95%	86.1	x			55	x				x			x			x						
Dk gray CALC SHALE (bleow 88')									86.4	x			35	x				x			x			x						
-numerous hard calc stringers & nodules @ 88.7'-89.6'	5	RC-11	96	101	60	99%	98%	98%	none																					
Dk gray SHALE (below 92.5')		RC-12	101	106	60	98%	98%	98%	105.0		x		40	x						x	x			x						
-0.5" limestone lens @ 97.4'		RC-13	106	111	60	97%	97%	97%	none																					
-0.5" limestone lens @ 115.1'		RC-14	111	116	60	99%	99%	99%	none																					
-0.5" limestone lens @ 118.8' & 120.7'	6	RC-15	116	121	60	97%	97%	95%	none																					

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Samuel Tran, P.E. | Boring No. : TS-207

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 2-4-19/2-6-19 | Page: 1 of 3

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	REC %	RQD %	Discontinuities: Depth ft	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Silt	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
Severely Weathered Limestone to 31.75'	1	RC-1	31'-36'	60"	96%	83%	31.6	X			5	X				X					X		X		X				
LIMESTONE (Austin Chalk) @ 31.75' - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and layers, and occasional near-horizontal very hard calcareous stringers																													
		RC-2	36'-41'	60"	100%	99%																							
							40.4	X			0	X					X		X			X							
		RC-3	41'-46'	60"	100%	94%	41.08	X			5		X				X		X			X							
							41.13	X			5			X		X			X			X							
							42.71		X		10	X				X			X			X							
							45.17	X			10			X		X			X			X							
		RC-4	46'-51'	60"	99%	95%	46.13	X			5		X			X			X				X						
							48.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
LIMESTONE (Austin Chalk) @ 51' - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and layers, and occasional near-horizontal very hard calcareous stringers	2	RC-5	51'-56'	60"	100%	97%	54.54	X			5	X					X		X			X							
		RC-6	56'-61'	60"	100%	97%	57.7	X			0	X					X		X			X							
							59.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Samuel Tran, P.E. | Boring No. : TS-207

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 2-4-19/2-6-19 | Page: 2 of 3

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	REC %	RQD %	Discontinuities: Depth ft	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Silt	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and layers, and occasional near-horizontal very hard calcareous stringers	2	RC-7	61'-66'	60"	98%	98%	62.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
		RC-8	66'-71'	60"	100%	98%	66.71		X		20		X			X			X			X							
							70.33	X			5	X					X		X			X							
	3	RC-9	71'-76'	60"	99%	98%	72.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							73.60	X			5	X					X		X			X							
							74.83	X			5	X				X			X			X							
		RC-10	76'-81'	60"	100%	100%	78.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
		RC-11	81'-86'	60"	100%	100%																							
		RC-12	86'-91'	60"	98%	98%	88.17	X			0	X					X		X			X							

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Samuel Tran, P.E. | Boring No. : TS-207

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 2-4-19/2-6-19 | Page: 3 of 3

Rig Make: CME-75 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																						
							Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
LIMESTONE (Austin Chalk) @ 91' - moderately fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to wide joint spacing, w/ near-horizontal argillaceous limestone layers and occasional near-horizontal shale seams and layers, and occasional near-horizontal very hard calcareous stringers		RC-13	91'-96'	60"	100%	83%	91.08	X			5	X					X		X			X							
							91.37	X			5		X			X			X			X							
							91.25-91.5	X			55	Healed Fracture																	
							91.67	X			55	Healed Fracture																	
							93.5	X			10				X	X			X			X							
							93.6-94.6	X			85.0	Healed Fracture																	
		RC-14	96'-101'	60"	100%	97%	96.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
	4						100.15		X		20	X						X	X			X							
							100.33		X		30	X						X	X			X							
		RC-15	101'-106'	60"	99%	98%																							
							105.19	X			5			X		X			X			X							
							105.46	X			5			X		X			X			X							
		RC-16	106'-111'	60"	100%	98%																							
							108.42	X			15			X		X			X			X							
		RC-17	111'-116'	60"	100%	98%																							
							114.25	X			10	X				X			X			X							
	5																												
							117.38	X			25	X				X			X			X							
		RC-18	116'-121'	60"	100%	98%	118.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							119.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker, E.I.T. | Boring No. : TS-208

Location: Dallas, Texas | Driller: Emilio Luna | Date Started/Ended: 12-27-18/12-29-18 | Page: 1 of 4

Rig Make: CME-55 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																							
							Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
LIMESTONE (Austin Chalk) @ 15' - slightly fractured to sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near horizontal argillaceous limestone layers and occasional near-horizontal shale seams and layers, and occasional near-horizontal very hard calcareous stringers	1	RC-1	15'-20'	60"	100%	97%	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							16.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							17.3	X			25	X					X		X			X							
							19.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
		RC-2	20'-30'	120"	100%	98%																							
							21.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							23.8	X			0	X				X			X				X		X				
							25.7	X			0	X				X			X				X						
							29.3	X			5	X				X			X			X							
		RC-3	30'-35'	60"	98%	91%																							
							30.5	X			0	X				X			X				X		X				
							30.9	X			0	X				X			X				X		X				
							31.2	X			0	X				X			X				X		X				
							32.9	X			15	X					X		X			X							
LIMESTONE(Austin Chalk) @ 35' - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ occasional near-horizontal very hard calcareous stringer and occasional near-horizontal shale seams	2	RC-4	35'-45'	120"	98%	97%	35.5	X			0	X					X		X			X							
							44.5	X			10	X				X			X				X		X				

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker, E.I.T. | Boring No. : TS-208

Location: Dallas, Texas | Driller: Emilio Luna | Date Started/Ended: 12-27-18/12-29-18 | Page: 2 of 4

Rig Make: CME-55 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																						
							Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
LIMESTONE(Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ occasional near-horizontal very hard calcareous stringer and occasional near-horizontal shale seams	2	RC-5	45'-55'	120"	99%	98%	46.3	X			0	X				X			X				X						
							50.9	X			0	X					X		X			X							
							54.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							54.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
	3	RC-6	55'-65'	120"	95%	94%	57.0	X			0	X					X		X			X			X				
		RC-7	65'-75'	120"	98%	97%	66.5	X			0	X				X			X			X			X				
							70.7	X			5	X				X			X			X							

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker, E.I.T. | Boring No. : TS-208

Location: Dallas, Texas | Driller: Emilio Luna | Date Started/Ended: 12-27-18/12-29-18 | Page: 3 of 4

Rig Make: CME-55 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	REC %	RQD %	Discontinuities: Depth ft	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Silt	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
LIMESTONE(Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ occasional near-horizontal very hard calcareous stringer and occasional near-horizontal shale seams	4	RC-8	75'-80'	60"	100%	98%	75-75.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							75.9	X			0	X				X			X				X						
		RC-9	80'-85'	60"	100%	98%	81.7	X			0	X					X		X			X			X				
LIMESTONE (Austin Chalk) @ 85' - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal very hard calcareous stringer		RC-10	85'-95'	120"	100%	98%	85.3	X			5	X				X			X				X						
							85.6	X			0	X				X			X				X						
							92.0	X			0	X					X		X			X							
	5	RC-11	95'-105'	120"	100%	98%																							
							99.8			X	0	X				X			X				X						
							100.0	X			0	X					X		X			X							
							102.0	X			0	X					X		X			X							

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Logan Tucker, E.I.T. | Boring No. : TS-208

Location: Dallas, Texas | Driller: Emilio Luna | Date Started/Ended: 12-27-18/12-29-18 | Page: 4 of 4

Rig Make: CME-55 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																							
							Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, close to wide joint spacing, w/ occasional near-horizontal very hard calcareous stringer	**5**	RC-12	105'-115'	120"	100%	98%	105.8	X			5	X					X		X			X							
							111.6	X			5	X				X			X				X						
							112.8	X			5	X				X			X				X						
	6	RC-13	115'-120'	60"	100%	98%	119.7	X			25	X					X		X			X							
BORING TERMINATED @ 120'																													

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Samuel Tran, P.E. | Boring No. : TS-209

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 12-27-18/12-29-18 | Page: 1 of 3

Rig Make: CME-55 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run No.	Core Run Depths	Run Length (in.)	REC %	RQD %	Discontinuities: Depth ft	Type: Joint	Type: Shear	Type: Fault	Dip: Angle	Roughness Large: Planar	Roughness Large: Step	Roughness Large: Undul	Roughness Large: Irreg	Roughness Small: Rough	Roughness Small: Smooth	Roughness Small: Slick	Weathering: Fresh	Weathering: Disc.	Weathering: Decom.	Aperture: Tight	Aperture: Open	Aperture: Wide	Infilling: Clay	Infilling: Silt	Infilling: Calcite	Infilling: Pyrite	Mechanical Break (MB)
LIMESTONE (Austin Chalk) @ 40' - sound, medium hard to hard, fresh, gray, fine grained, massive bedding, moderately close to wide joint spacing, w/ near-horizontal calcareous stringers, and w/ occasional near-horizontal argillaceous limestone seams, and occasional near-horizontal shale seams	1	RC-1	40'-50'	120"	100%	98%	40.6	X			10		X			X			X			X					X		
							41.9	X			20	X					X		X			X					X		
							43.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							44.9	X			5			X		X			X				X						
							45.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							46.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							47.8	X			5	X					X		X			X							
							52.6	X			5	X					X		X			X							
LIMESTONE (Austin Chalk) @ 55' - sound, medium hard to hard, fresh, gray, fine grained, massive bedding, wide to very wide joint spacing, w/ occasional near-horizontal calcareous stringers, w/ occasional near-horizontal argillaceous limestone seams and layers, and occasional near-horizontal shale seams		RC-2	50'-60'	120"	99%	98%																							
	2	RC-3	60'-70'	120"	99%	98%	66.3	X			5	X				X			X			X						X	

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Samuel Tran, P.E. | Boring No. : TS-209

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 12-27-18/12-29-18 | Page: 2 of 3

Rig Make: CME-55 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																						
							Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
LIMESTONE (Austin Chalk) @ 55' - sound, medium hard to hard, fresh, gray, fine grained, massive bedding, wide to very wide joint spacing, w/ occasional near-horizontal calcareous stringers, w/ occasional near-horizontal argillaceous limestone seams and layers, and occasional near-horizontal shale seams	**2**	RC-4	70'-80'	120"	100%	98%	71.8		X		60	X						X	X			X			X				
							77.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
	3	RC-5	80'-90'	120"	100%	100%	81.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							83.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							88.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
		RC-6	90'-100'	120"	100%	99%	92.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							97.6	X			10		X			X			X			X					X		

Project Name & Project No: DART D-2 / E17-0811 | Field Representative: Samuel Tran, P.E. | Boring No. : TS-209

Location: Dallas, Texas | Driller: Robert Cromeans | Date Started/Ended: 12-27-18/12-29-18 | Page: 3 of 3

Rig Make: CME-55 | Rig Type: CME | Barrel Type/Length: NQ2 / 10 feet | Barrel Size: 3 1/8" OD / 2" ID | Bit Type: Geoset

Rock Description	Box No.	Core Run		Run Length (in.)	REC %	RQD %	Discontinuities																						
							Depth ft	Type			Dip	Roughness							Weathering			Aperture			Infilling				Mechanical Break (MB)
												Large				Small													
		No.	Depths					Joint	Shear	Fault	Angle	Planar	Step	Undul	Irreg	Rough	Smooth	Slick	Fresh	Disc.	Decom.	Tight	Open	Wide	Clay	Silt	Calcite	Pyrite	
LIMESTONE (Austin Chalk) @ 100' - sound, medium hard to hard, fresh, gray, fine grained, massive bedding, wide to very wide joint spacing, w/ occasional near-horizontal calcareous stringers, w/ occasional near-horizontal argillaceous limestone seams, and occasional near- horizontal shale seams	4	RC-7	100'-110'	120"	99%	98%	100.0		X		10	X					X		X			X							
							100.5		X		70			X			X		X			X							
							101.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							101.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
							102.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MB
		RC-8	110'-120'	120"	100%	99%	112.3	X			5	X					X		X			X							
BORING TERMINATED @ 120'																													

APPENDIX D

ROCK CORE PHOTOS

DART D-2 – ROCK CORE PHOTOS

Boring B-1 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring B-1 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring B-1 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring B-1 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring B-2 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring B-2 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring B-2 Box 3

DART D-2 – ROCK CORE PHOTOS

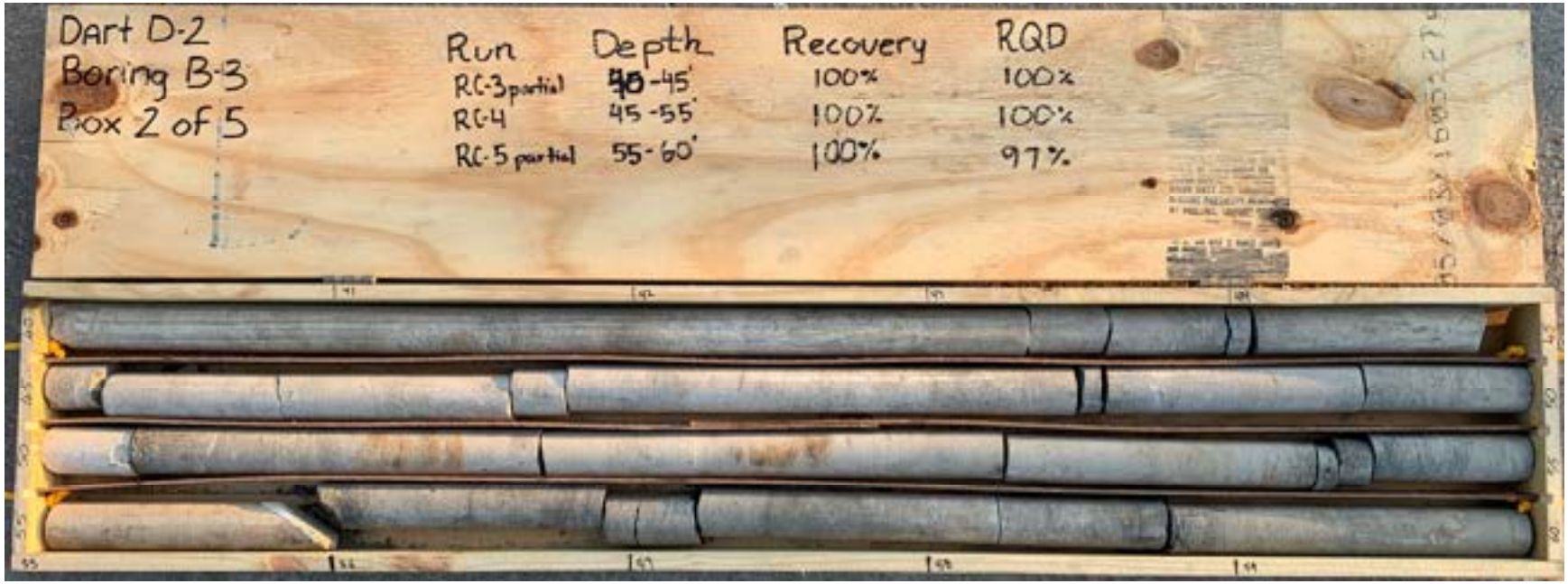
Boring B-2 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring B-3 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring B-3 Box 2



DART D-2 – ROCK CORE PHOTOS

Boring B-3 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring B-3 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring B-3 Box 5

DART D-2 – ROCK CORE PHOTOS

Boring B-4 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring B-4 Box 2

DART D-2 – ROCK CORE PHOTOS

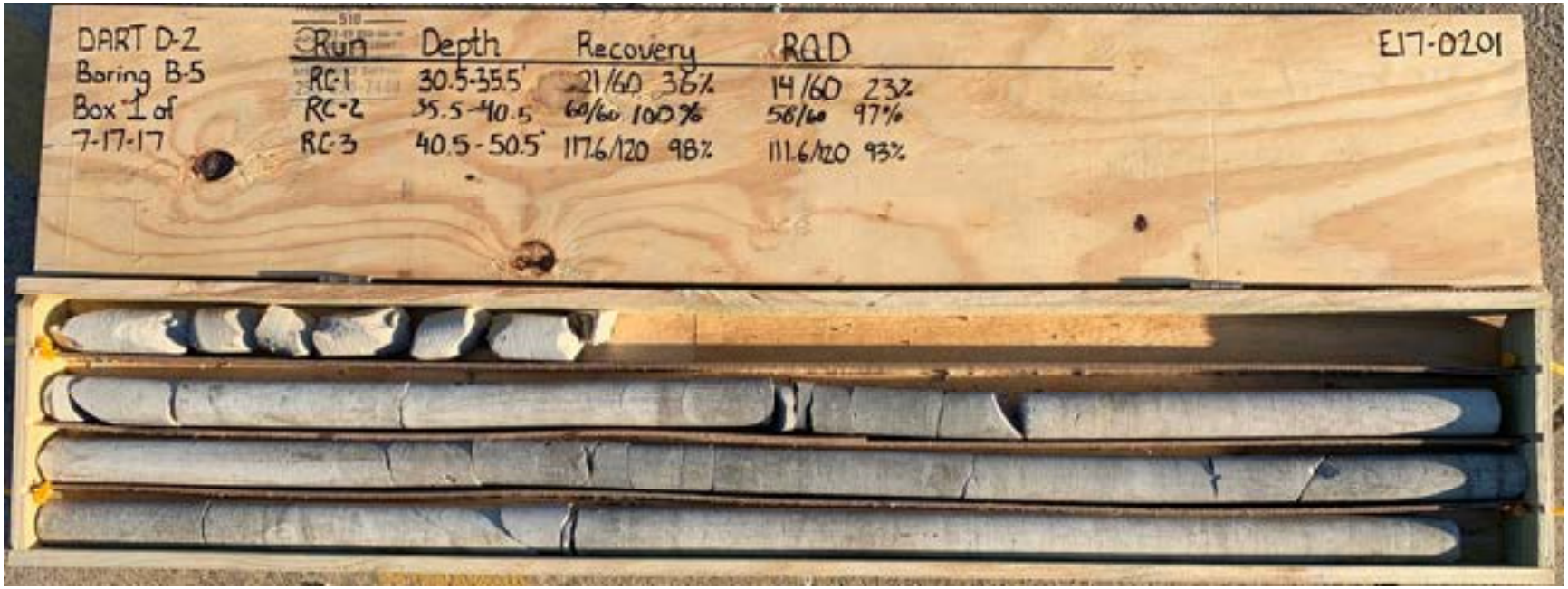
Boring B-4 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring B-4 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring B-5 Box 1



DART D-2 – ROCK CORE PHOTOS

Boring B-5 Box 2

DART D-2 – ROCK CORE PHOTOS

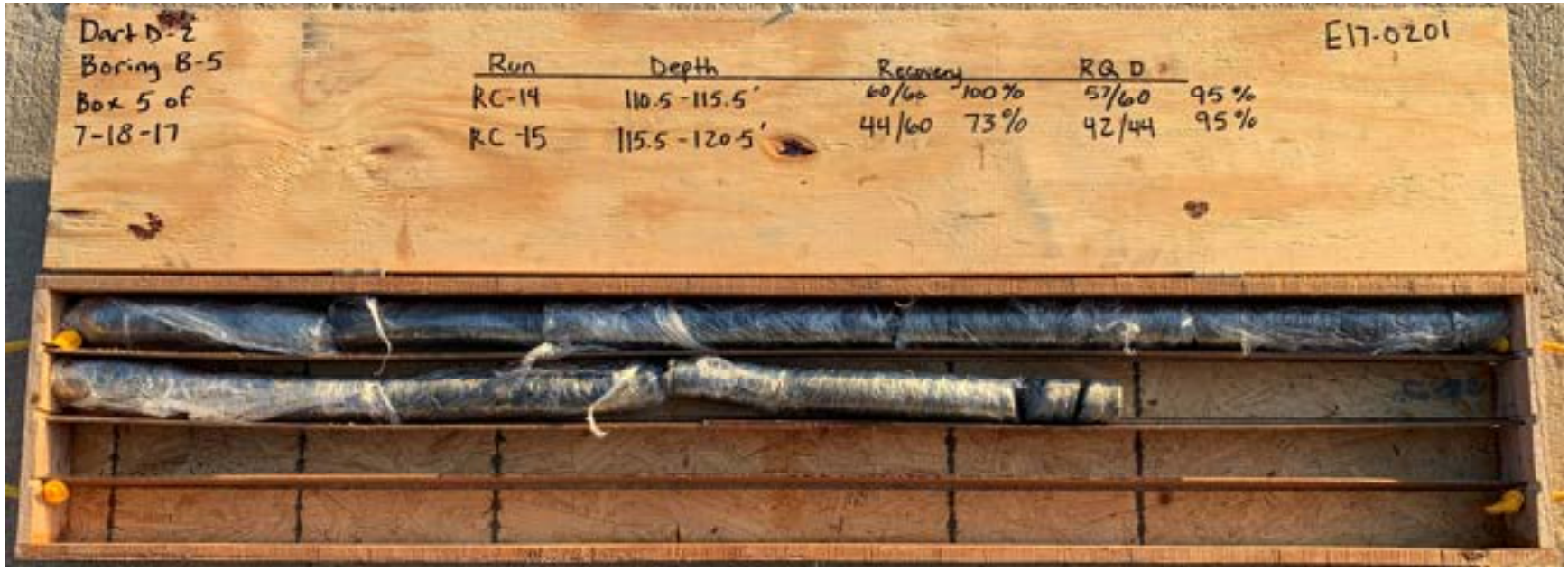
Boring B-5 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring B-5 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring B-5 Box 5



DART D-2 – ROCK CORE PHOTOS

Boring P-102 Box 1

RC-1: 21-26’
RC-2: 26-31’
RC-3: 31-41’

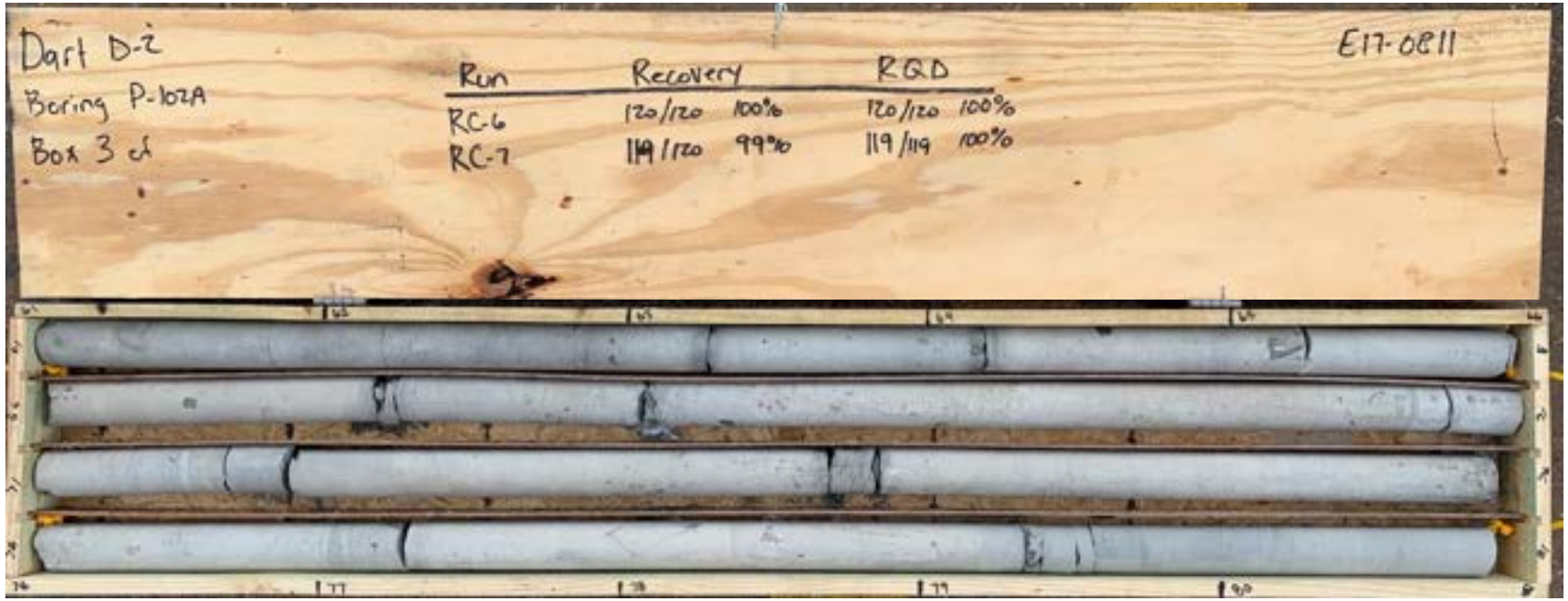
DART D-2 – ROCK CORE PHOTOS

Boring P-102 Box 2

RC-4: 41-51’
RC-5: 51-61’

DART D-2 – ROCK CORE PHOTOS

Boring P-102 Box 3



RC-6: 61-71’
RC-7: 71-81’

DART D-2 – ROCK CORE PHOTOS

Boring P-102 Box 4

RC-8: 81-91’
RC-9: 91-101’

DART D-2 – ROCK CORE PHOTOS

Boring P-102 Box 5

RC-10: 101-111’
RC-11: 111-121’

DART D-2 – ROCK CORE PHOTOS

Boring T-102 Box 1

RC-1: 25.5-31’
RC-2: 31-41’

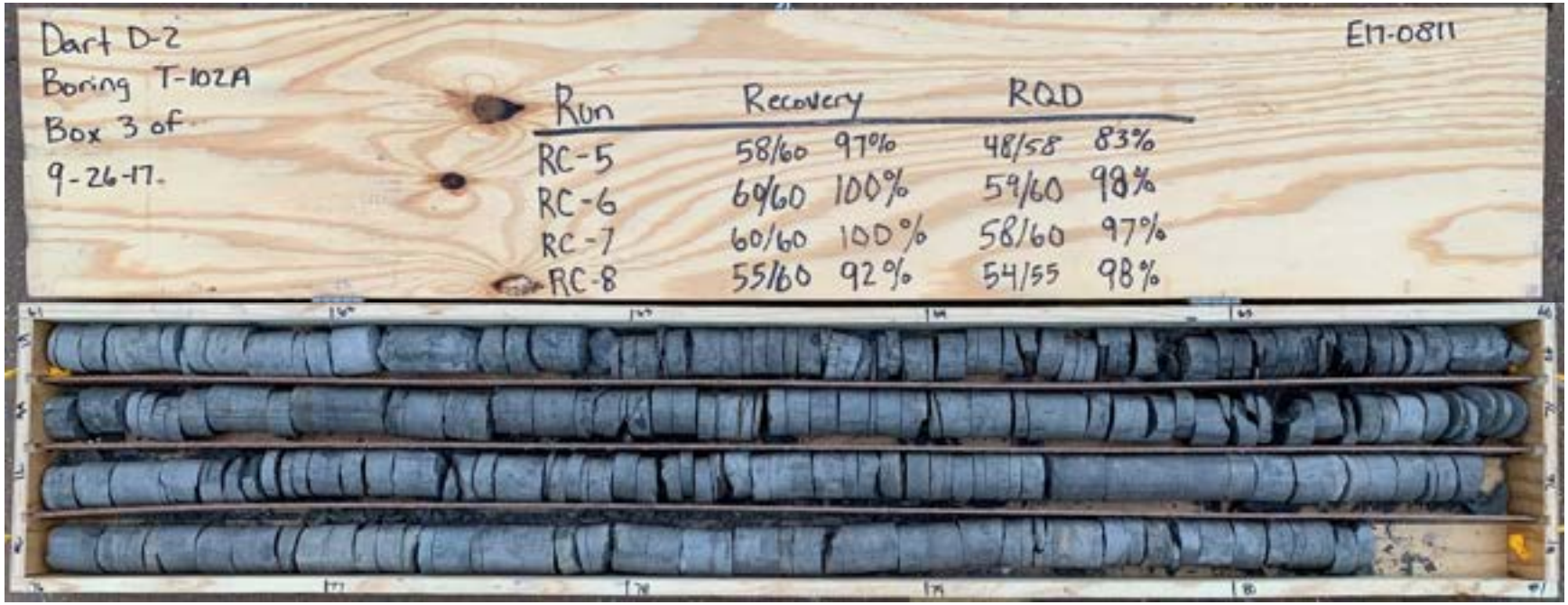
DART D-2 – ROCK CORE PHOTOS

Boring T-102 Box 2

RC-3: 41-51’
RC-4: 51-61’

DART D-2 – ROCK CORE PHOTOS

Boring T-102 Box 3



RC-5: 61-66’ RC-7: 71-76’
RC-6: 66-71’ RC-8: 76-81’

DART D-2 – ROCK CORE PHOTOS

Boring T-102 Box 4

RC-9: 81-86’ RC-11: 91-96’
RC-10: 86-91’ RC-12: 96-101’

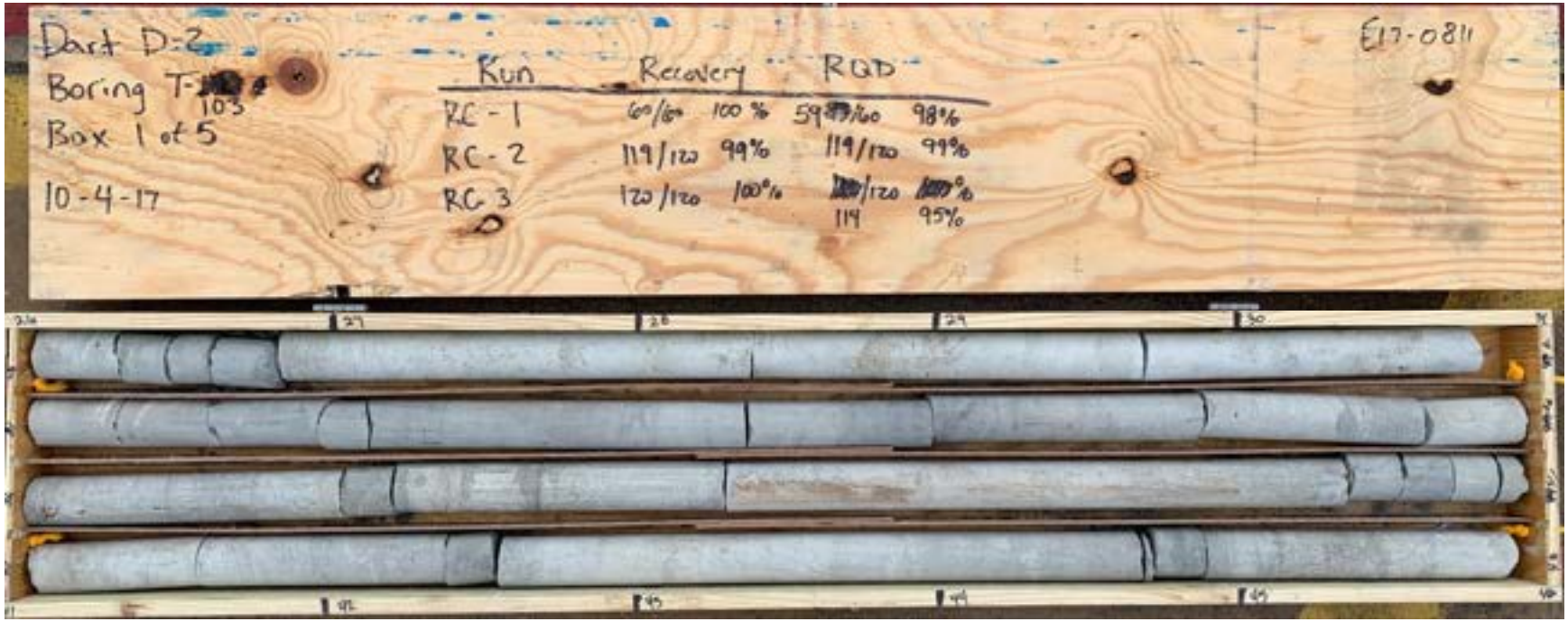
DART D-2 – ROCK CORE PHOTOS

Boring T-102 Box 5

RC-13: 101-106’ RC-15: 111-116’
RC-14: 106-111’ RC-16: 116-121’

DART D-2 – ROCK CORE PHOTOS

Boring T-103 Box 1



RC-1: 26-31’
RC-2: 31-41’
RC-3: 41-51’ (41-46’ in Box 1)

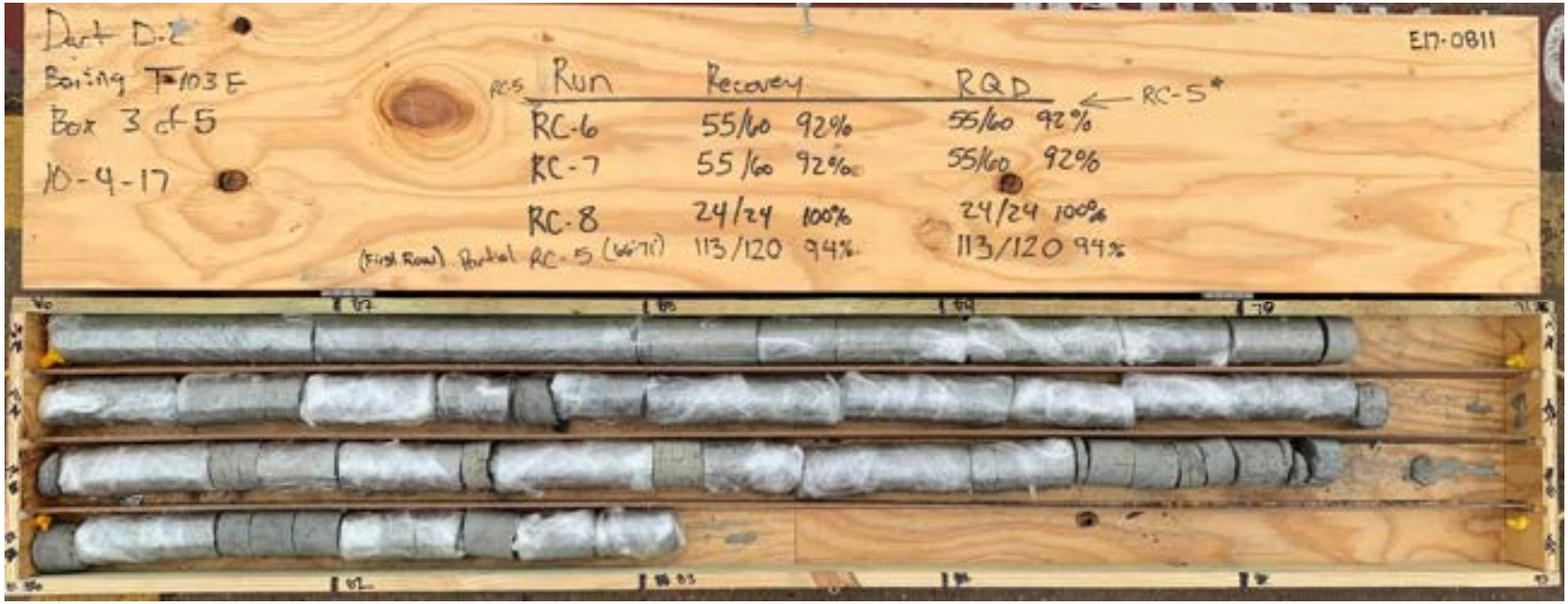
DART D-2 – ROCK CORE PHOTOS

Boring T-103 Box 2

RC-3: 41-51’ (46-51’ in Box 2)
RC-4: 51-61’
RC-5: 61-71’ (61-66’ in Box 2)

DART D-2 – ROCK CORE PHOTOS

Boring T-103 Box 3



RC-5: 61-71’ (66-71’ in Box 3)
RC-6: 71-76’
RC-7: 76-81’
RC-8: 81-83’

DART D-2 – ROCK CORE PHOTOS

Boring T-103 Box 4

RC-9: 83-86’
RC-10: 86-91’
RC-11: 91-91’
RC-12: 96-101’

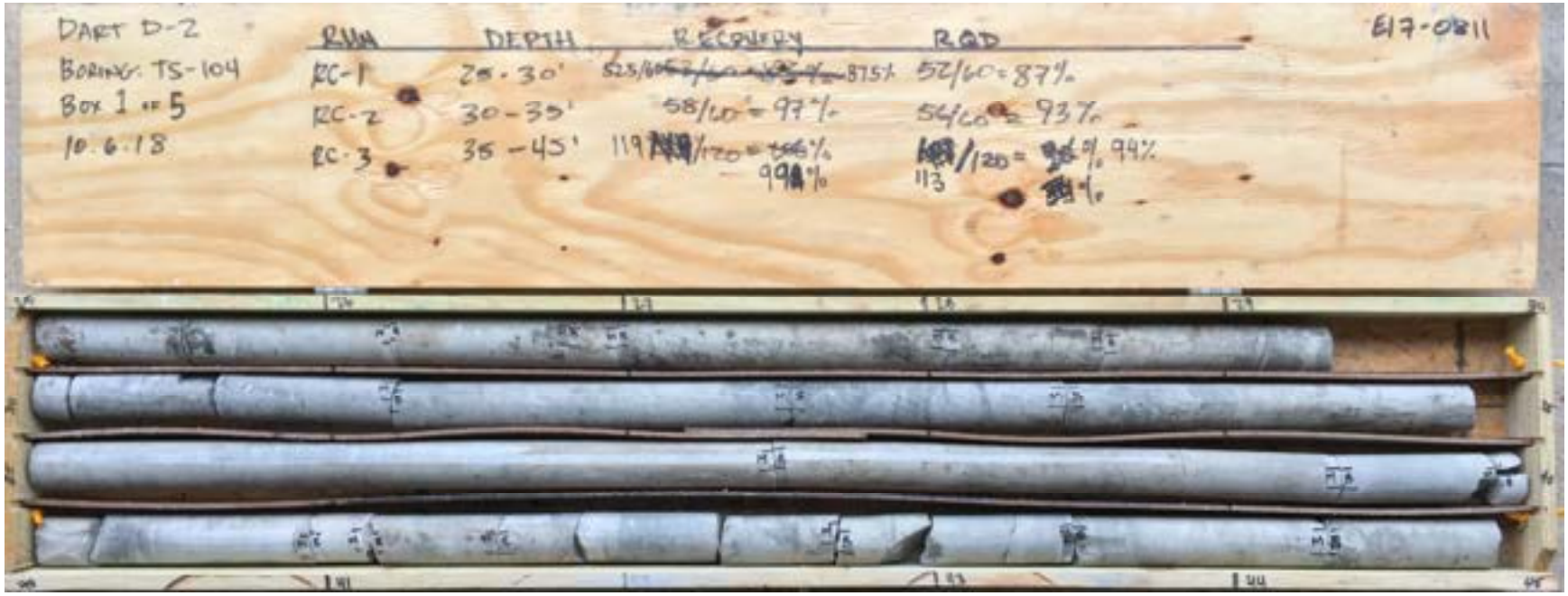
DART D-2 – ROCK CORE PHOTOS

Boring T-103 Box 5

RC-13: 101-106’
RC-14: 106-111’
RC-15: 111-116’
RC-16: 116-121’

DART D-2 – ROCK CORE PHOTOS

Boring TS-104 Box 1



DART D-2 – ROCK CORE PHOTOS

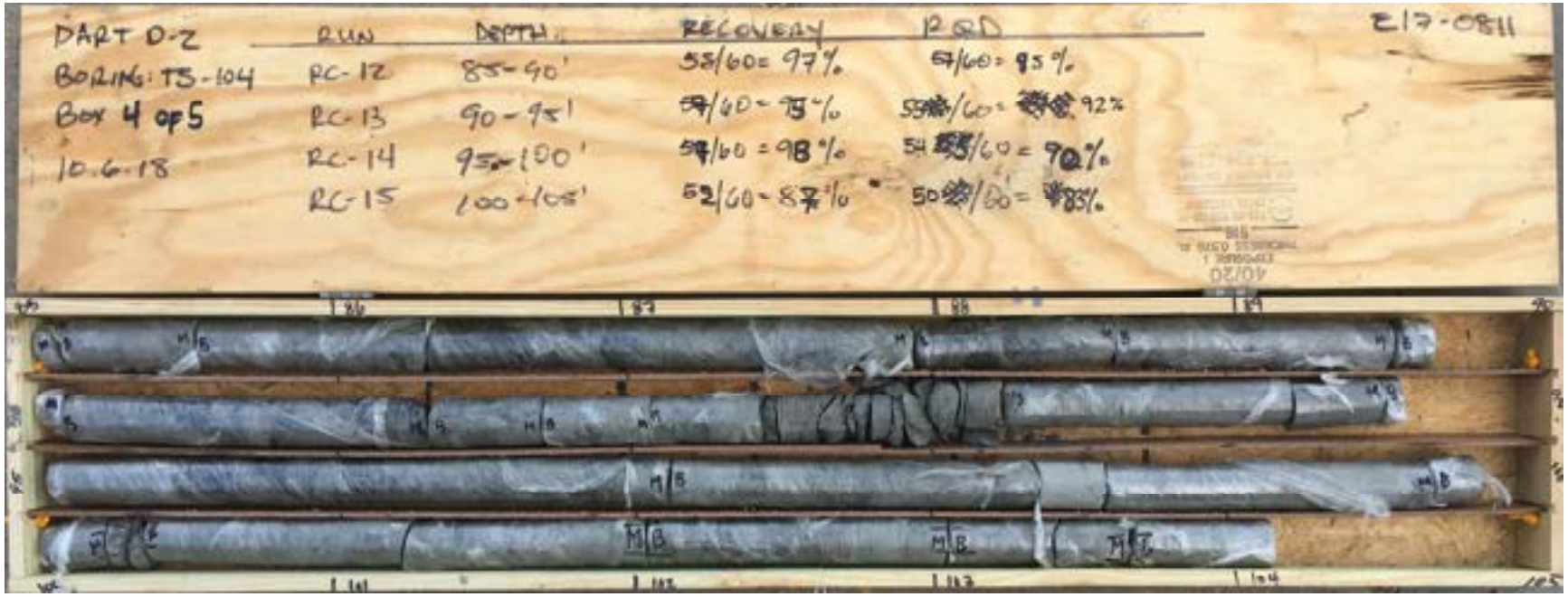
Boring TS-104 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring TS-104 Box 3

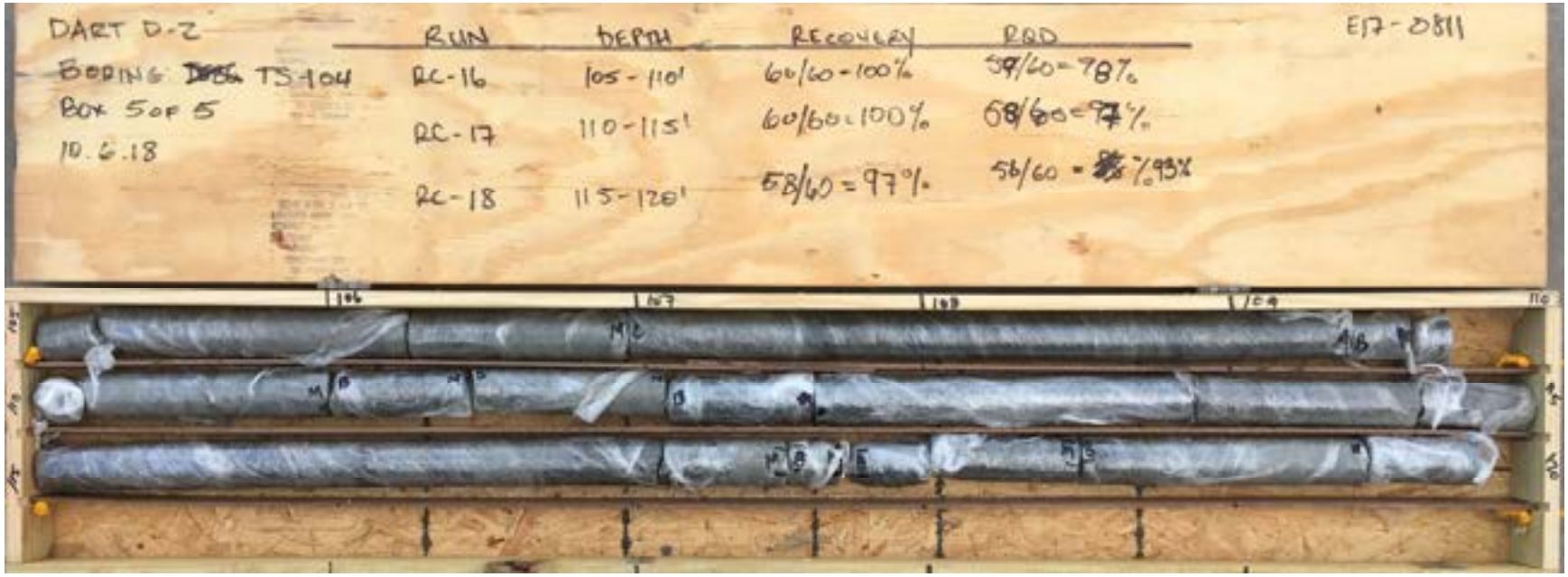
DART D-2 – ROCK CORE PHOTOS

Boring TS-104 Box 4



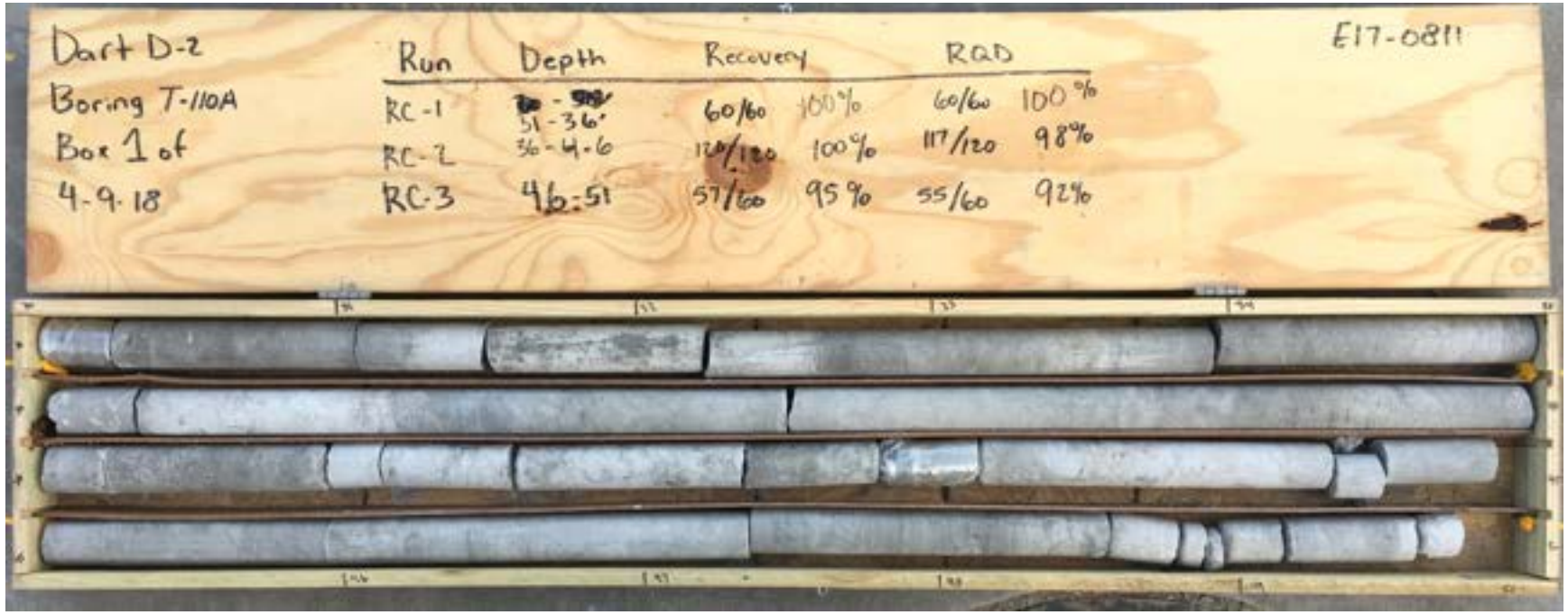
DART D-2 – ROCK CORE PHOTOS

Boring TS-104 Box 5



DART D-2 – ROCK CORE PHOTOS

Boring T-110 Box 1



DART D-2 – ROCK CORE PHOTOS

Boring T-110 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring T-110 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring T-110 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring T-110 Box 5

DART D-2 – ROCK CORE PHOTOS

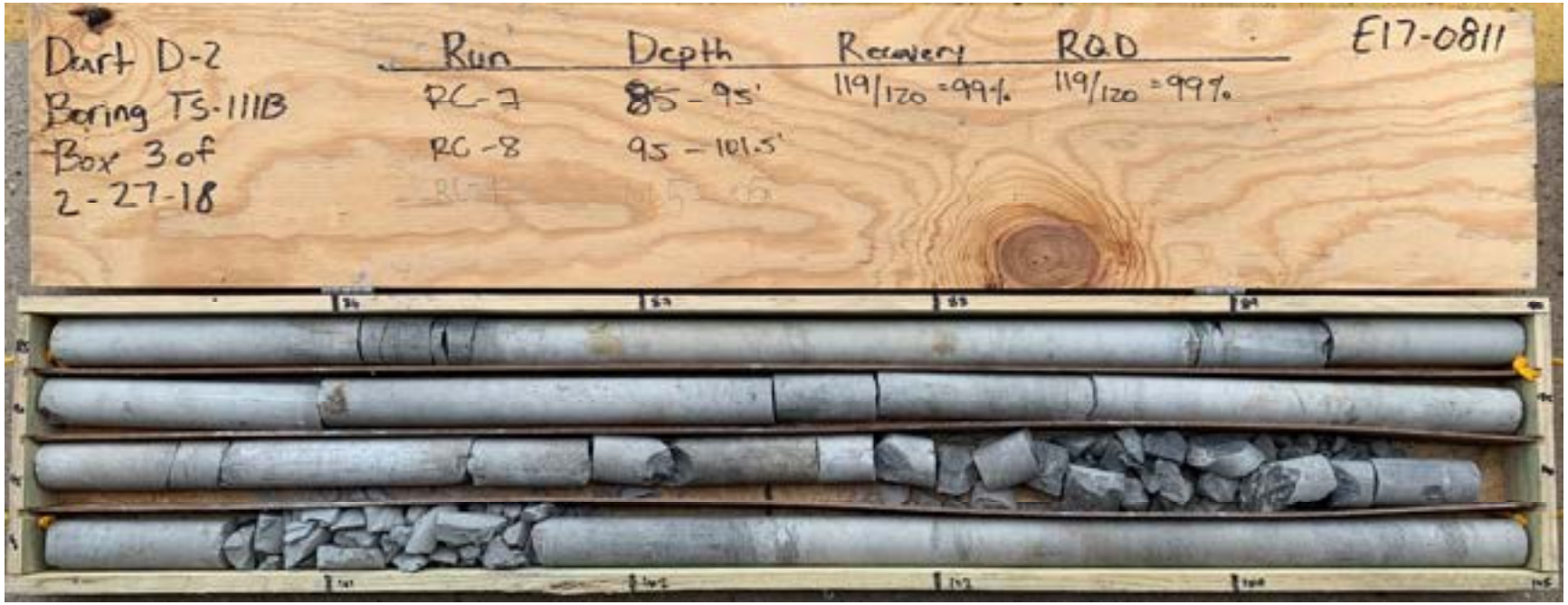
Boring TS-111 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring TS-111 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring TS-111 Box 3



RC-8:	95-101.5’	REC-100%	RQD-92%
RC-9	101.5-105’	REC-95%	RQD-95%

DART D-2 – ROCK CORE PHOTOS

Boring TS-111 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring T-112 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring T-112 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring T-112 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring T-112 Box 4

DART D-2 – ROCK CORE PHOTOS

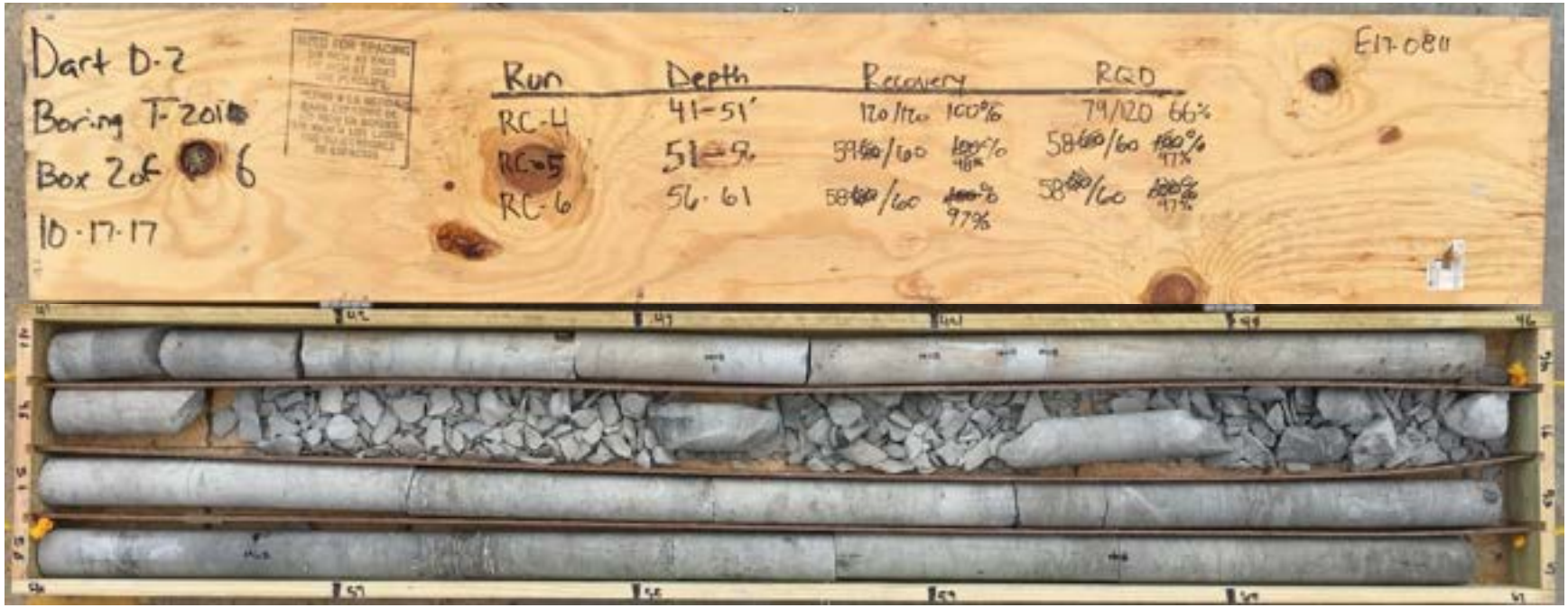
Boring T-112 Box 5

DART D-2 – ROCK CORE PHOTOS

Boring T-201 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring T-201 Box 2



DART D-2 – ROCK CORE PHOTOS

Boring T-201 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring T-201 Box 4

DART D-2 – ROCK CORE PHOTOS

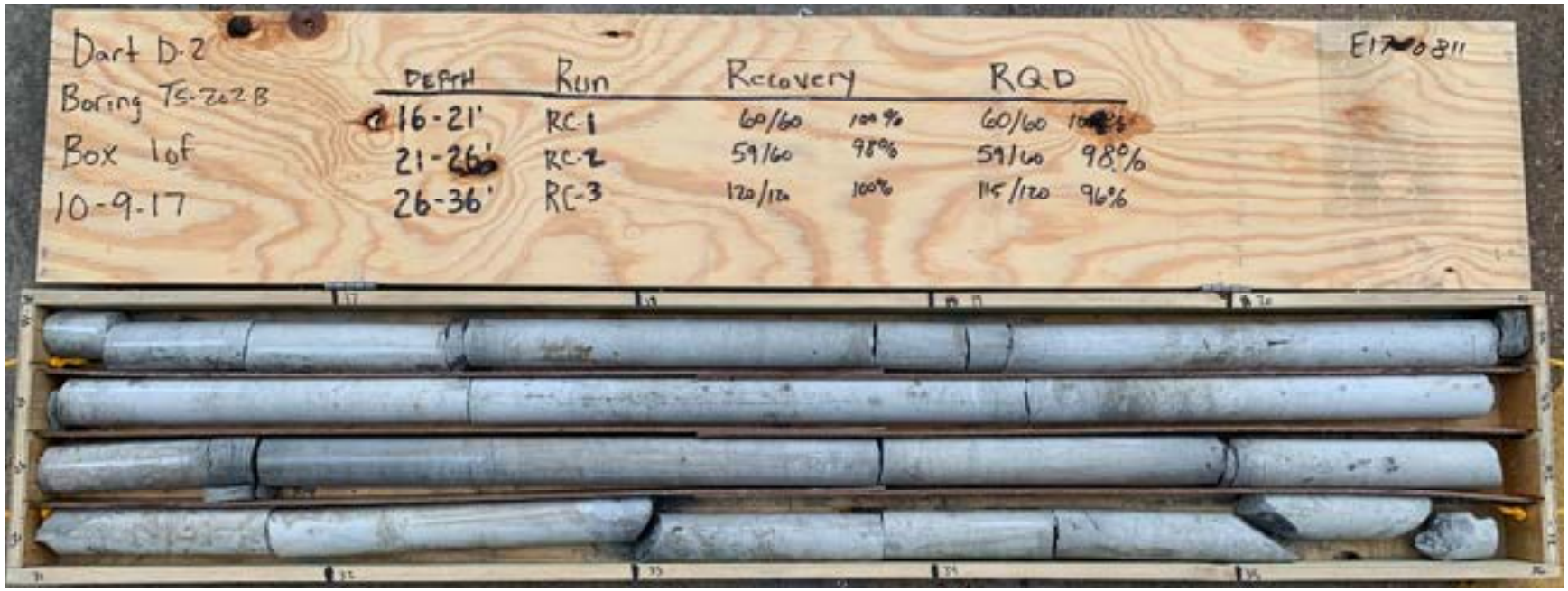
Boring T-201 Box 5

DART D-2 – ROCK CORE PHOTOS

Boring T-201 Box 6

DART D-2 – ROCK CORE PHOTOS

Boring TS-202 Box 1



DART D-2 – ROCK CORE PHOTOS

Boring TS-202 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring TS-202 Box 3

DART D-2 – ROCK CORE PHOTOS

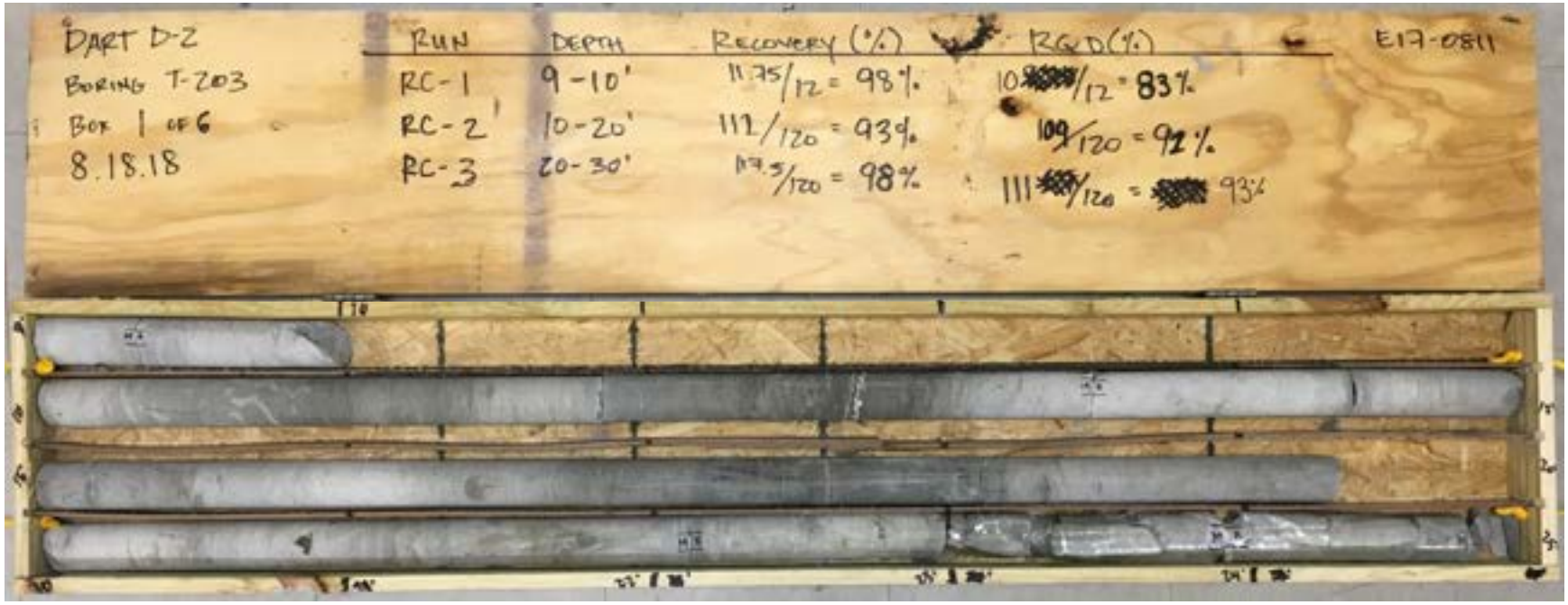
Boring TS-202 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring TS-202 Box 5

DART D-2 – ROCK CORE PHOTOS

Boring T-203 Box 1

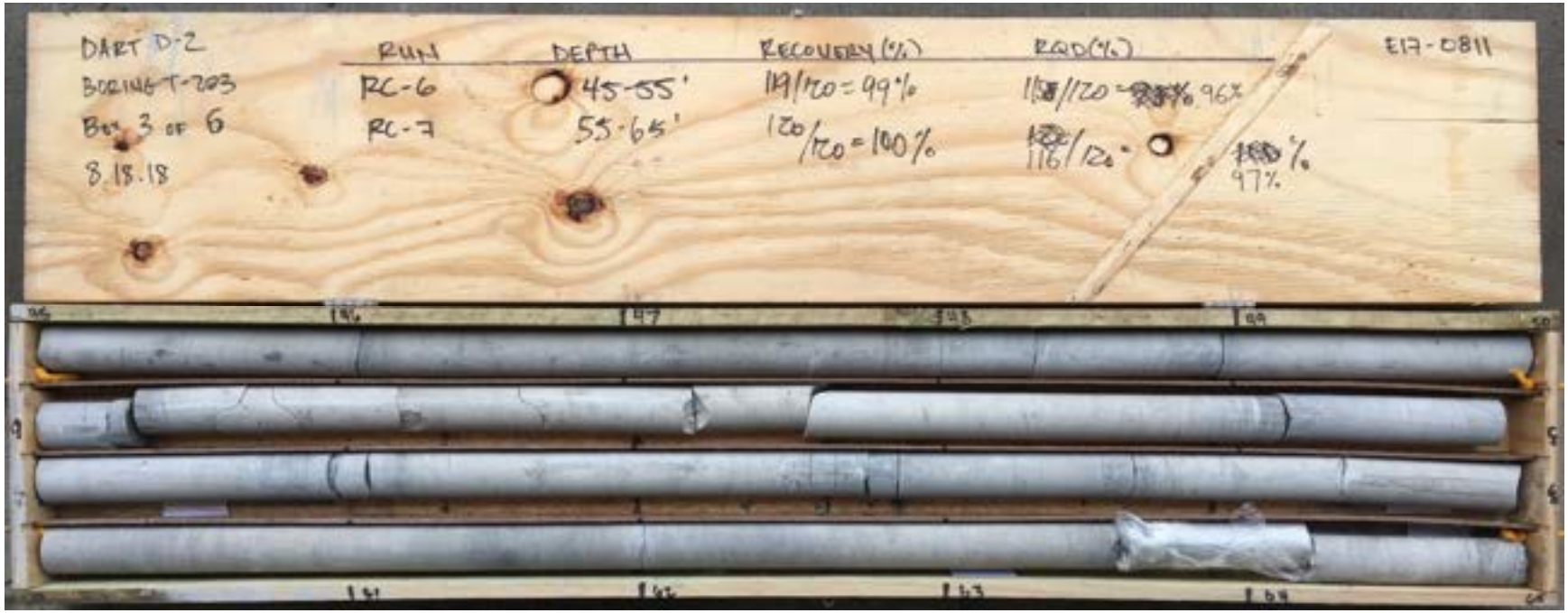


DART D-2 – ROCK CORE PHOTOS

Boring T-203 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring T-203 Box 3



DART D-2 – ROCK CORE PHOTOS

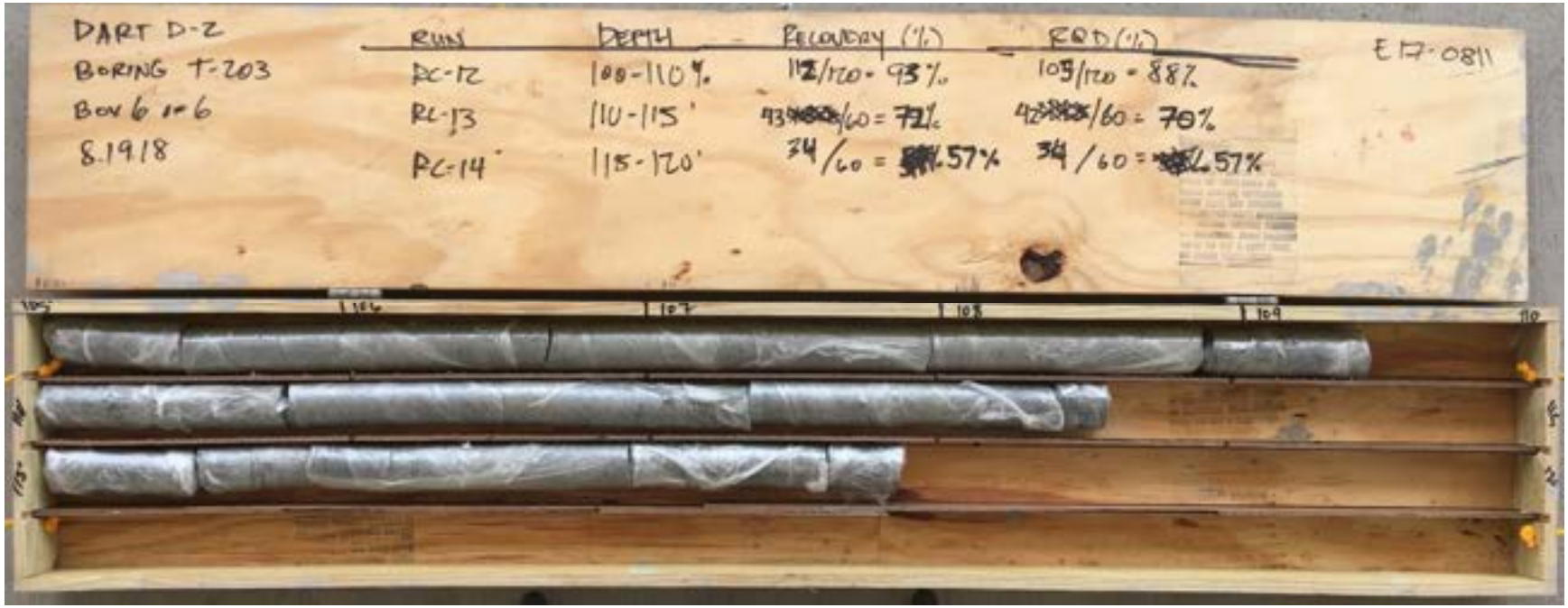
Boring T-203 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring T-203 Box 5

DART D-2 – ROCK CORE PHOTOS

Boring T-203 Box 6



DART D-2 – ROCK CORE PHOTOS

Boring T-204 Box 1

DART D-2 – ROCK CORE PHOTOS

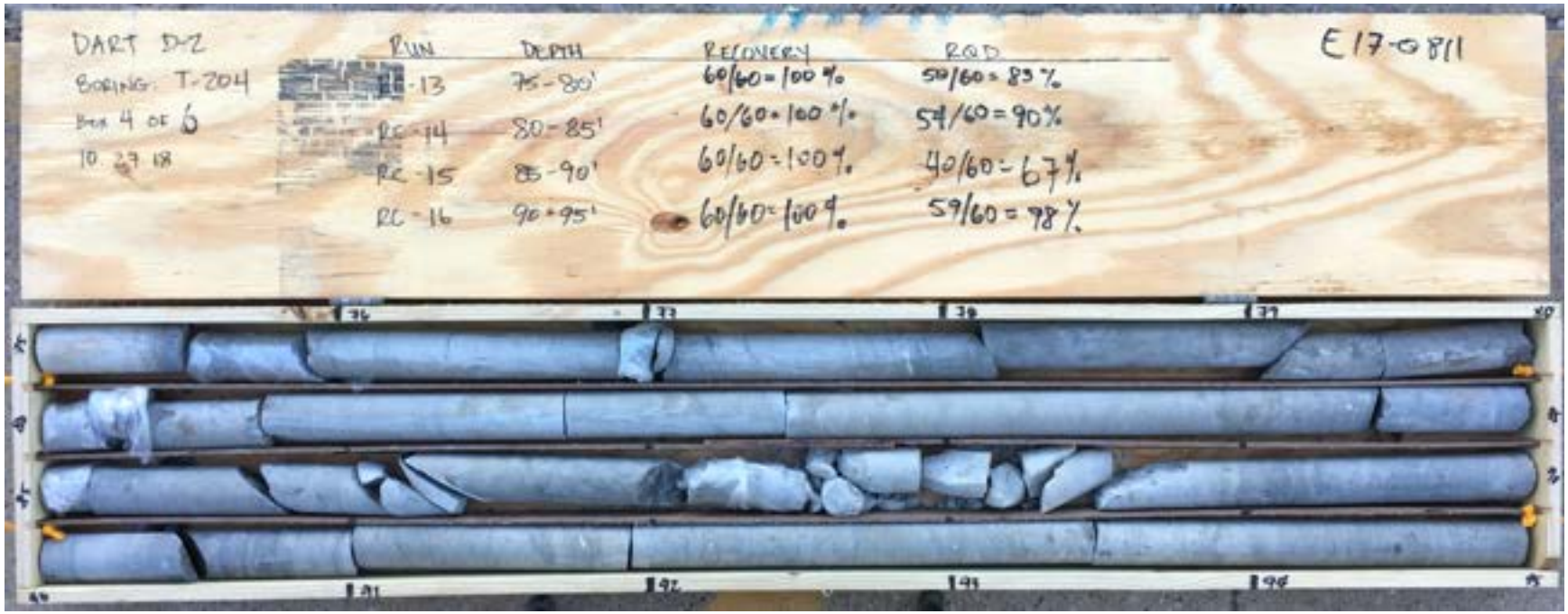
Boring T-204 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring T-204 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring T-204 Box 4

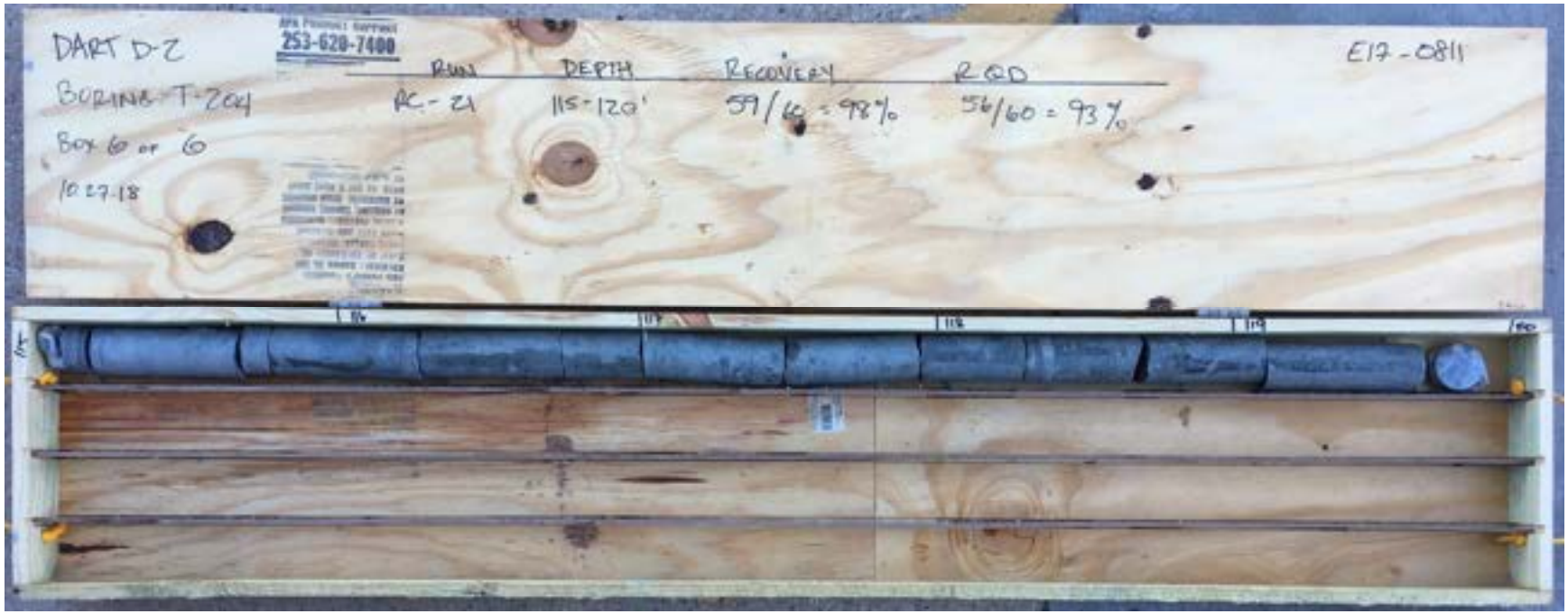


DART D-2 – ROCK CORE PHOTOS

Boring T-204 Box 5

DART D-2 – ROCK CORE PHOTOS

Boring T-204 Box 6



DART D-2 – ROCK CORE PHOTOS

Boring T-205 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring T-205 Box 2

DART D-2 – ROCK CORE PHOTOS

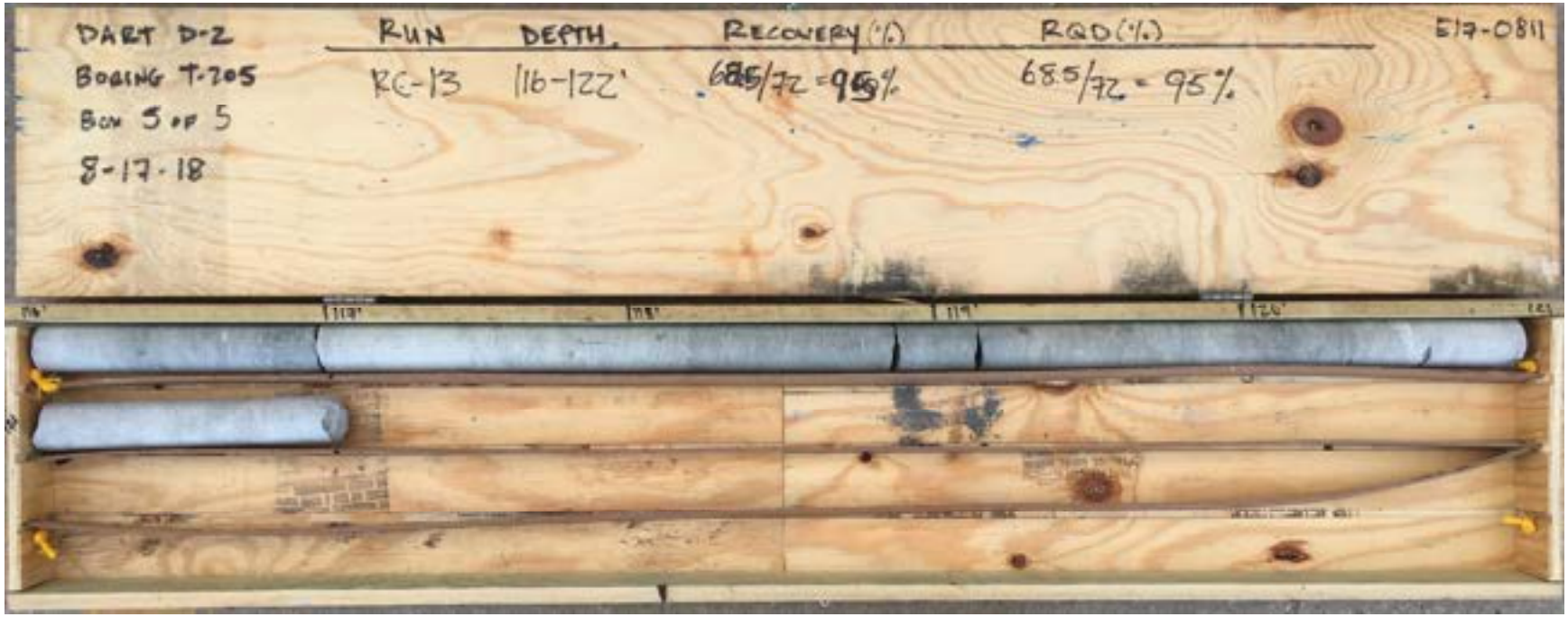
Boring T-205 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring T-205 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring T-205 Box 5



DART D-2 – ROCK CORE PHOTOS

Boring TS-206 Box 1

DART D-2 – ROCK CORE PHOTOS

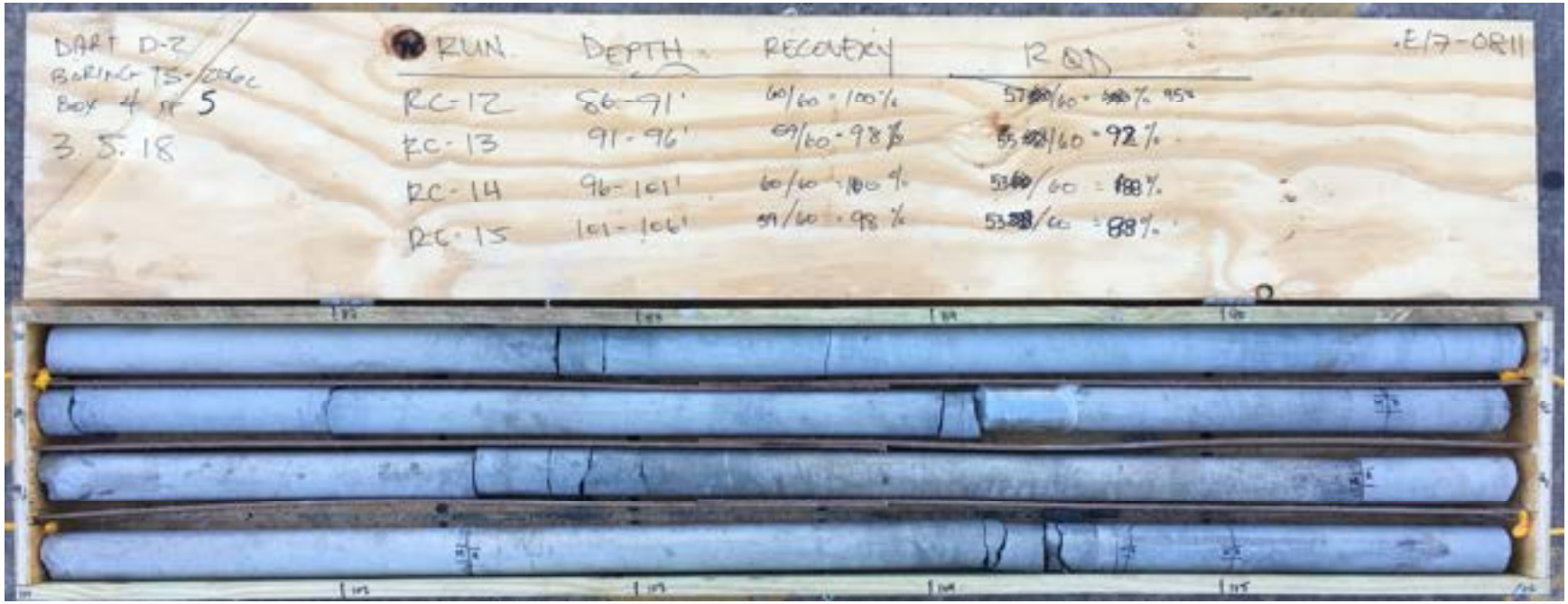
Boring TS-206 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring TS-206 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring TS-206 Box 4



DART D-2 – ROCK CORE PHOTOS

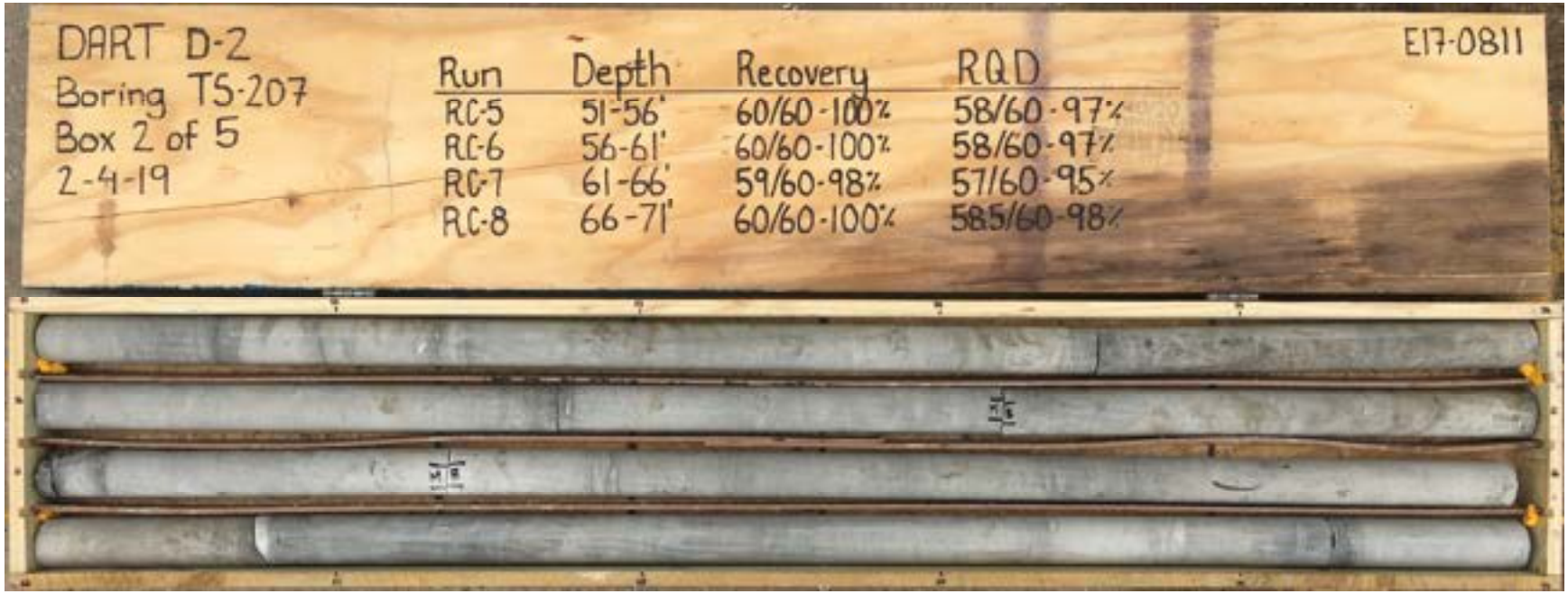
Boring TS-206 Box 5

DART D-2 – ROCK CORE PHOTOS

Boring TS-207 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring TS-207 Box 2



DART D-2 – ROCK CORE PHOTOS

Boring TS-207 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring TS-207 Box 4

DART D-2 – ROCK CORE PHOTOS

Boring TS-207 Box 5

DART D-2 – ROCK CORE PHOTOS

Boring TS-208 Box 1

DART D-2 – ROCK CORE PHOTOS

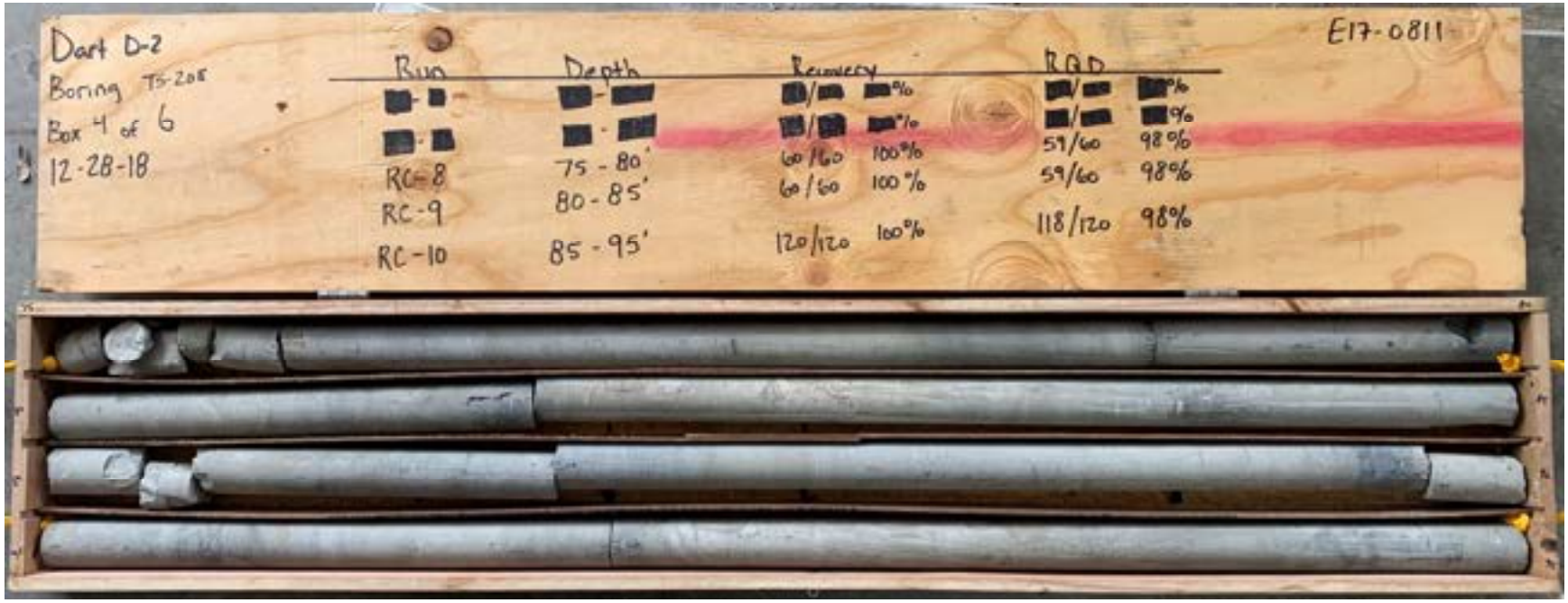
Boring TS-208 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring TS-208 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring TS-208 Box 4



DART D-2 – ROCK CORE PHOTOS

Boring TS-208 Box 5

DART D-2 – ROCK CORE PHOTOS

Boring TS-208 Box 6

DART D-2 – ROCK CORE PHOTOS

Boring TS-209 Box 1

DART D-2 – ROCK CORE PHOTOS

Boring TS-209 Box 2

DART D-2 – ROCK CORE PHOTOS

Boring TS-209 Box 3

DART D-2 – ROCK CORE PHOTOS

Boring TS-209 Box 4

APPENDIX E

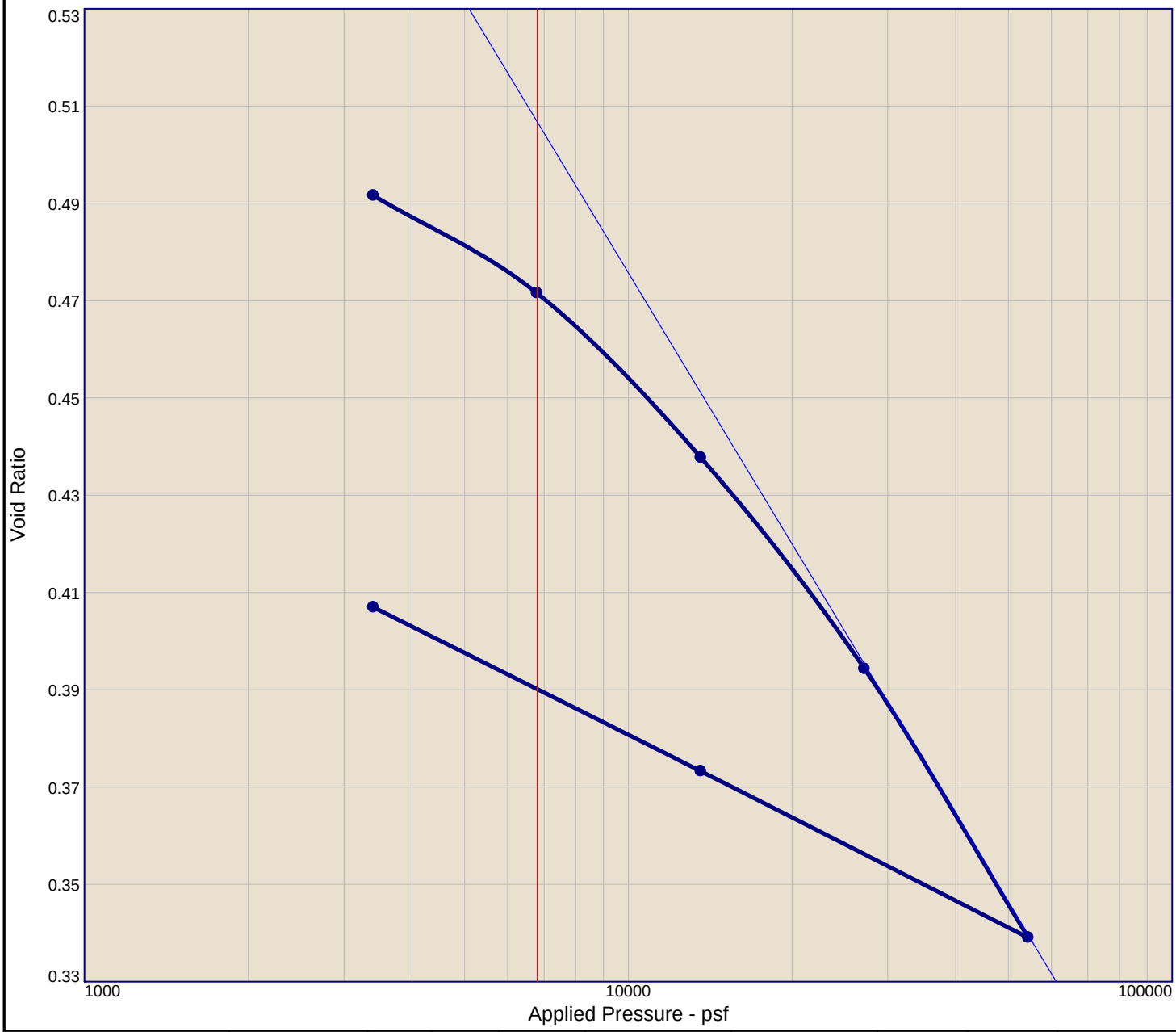
OVERBURDEN SOIL LAB TEST RESULTS

APPENDIX E-1

CONSOLIDATION

TEST RESULTS

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
54.3 %	9.9 %	113.0			2.70		12083	0.19	0.06	0.492

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY CLAY, very hard, moist, reddish brown	CL	

Project No. E17-0811
Project: DART D-2

Location: B-1 **Depth:** 5-10'

Remarks:
ASTM D2435

Alliance Geotechnical Group, Inc.

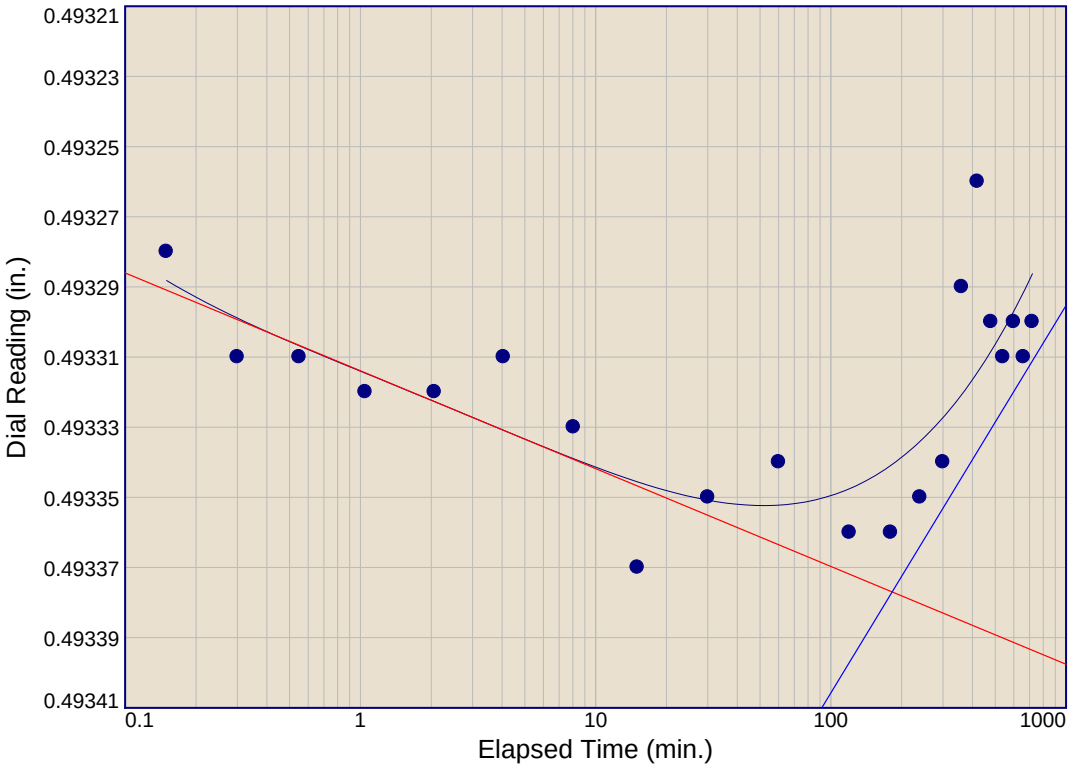
Dallas, TX

Checked By: HS

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: B-1 Depth: 5-10'



Load No.= 1

Load= 3400 psf

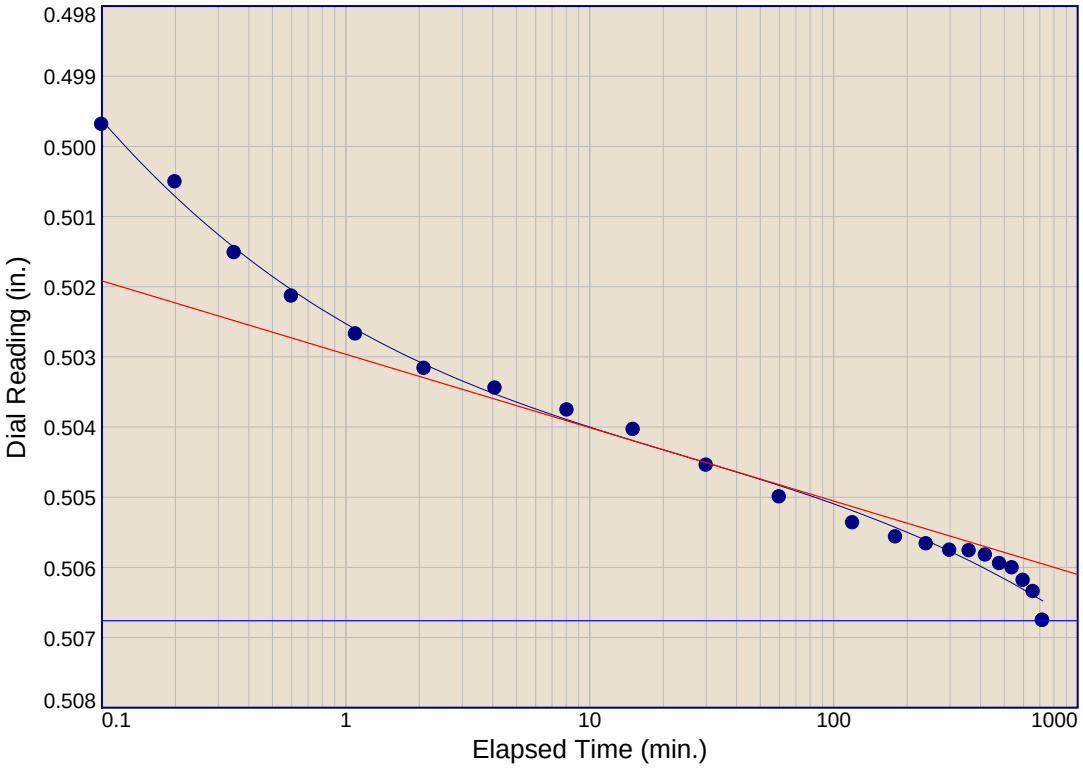
D_0 = 0.4932

D_{50} = 0.4933

D_{100} = 0.4934

T_{50} = 478.66 min.

C_v @ T_{50}
0.001 ft.^{2}/day



Load No.= 2

Load= 6800 psf

D_0 = 0.4933

D_{50} = 0.5000

D_{100} = 0.5068

T_{50} = 0.13 min.

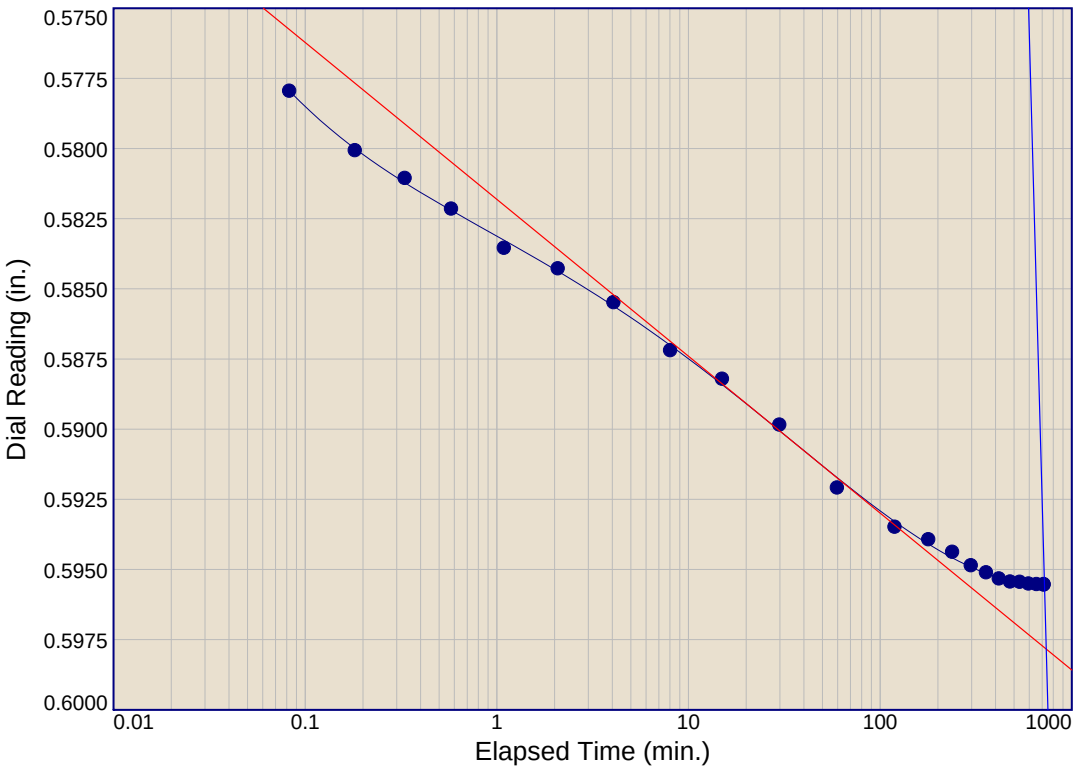
C_v @ T_{50}
3.834 ft.^{2}/day

C_α = 0.000

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: B-1 Depth: 5-10'



Load No.= 5

Load= 54400 psf

D_0 = 0.5585

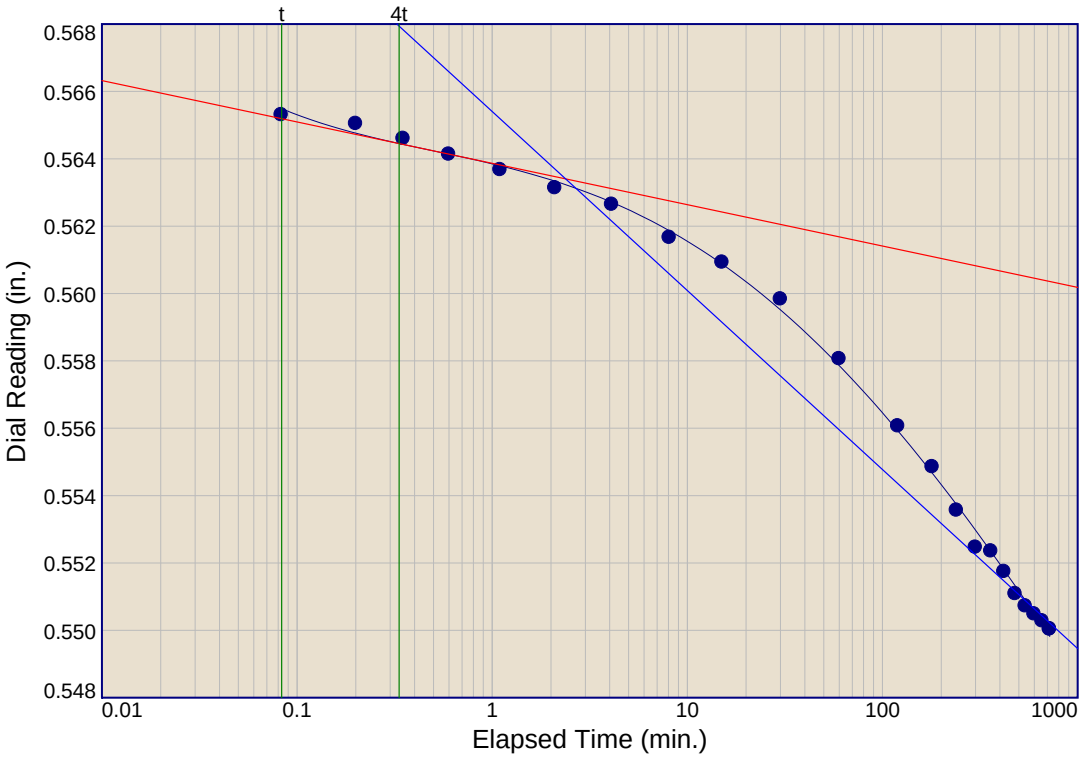
D_{50} = 0.5782

D_{100} = 0.5978

T_{50} = 0.09 min.

C_v @ T_{50}
4.629 ft.^{2}/day

C_α = 0.371



Load No.= 7

Load= 3400 psf

D_0 = 0.5665

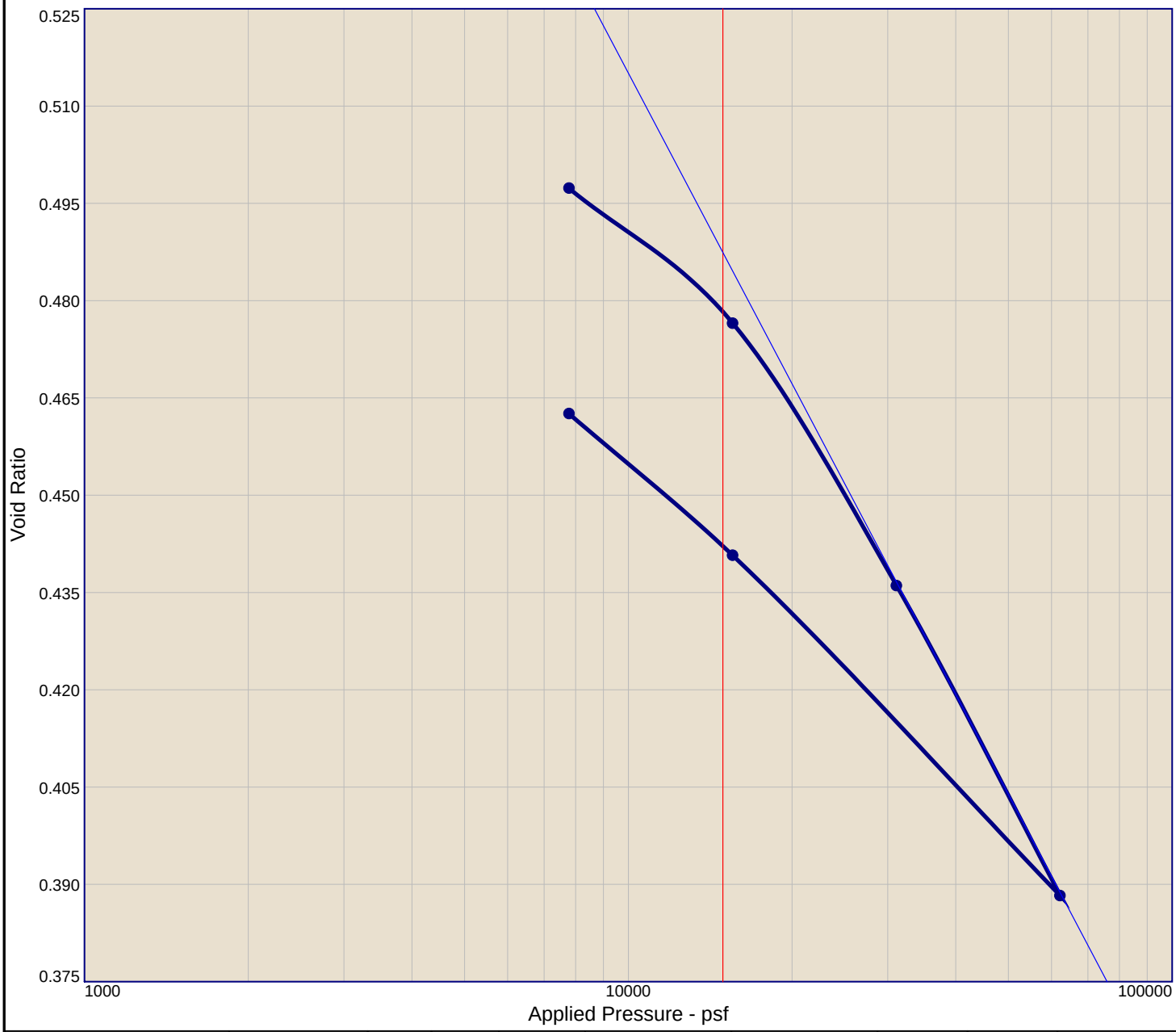
D_{50} = 0.5650

D_{100} = 0.5634

T_{50} = 0.15 min.

C_v @ T_{50}
2.856 ft.^{2}/day

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
83.4 %	15.2 %	113.6			2.72		18020	0.16	0.08	0.495

MATERIAL DESCRIPTION	USCS	AASHTO
CLAY, hard, tan and brown, w/ calcareous nodules (CH)	CH	

Project No. E17-0811 **Client:**

Project: DART D-2

Location: P-102 **Depth:** 6-7'

Remarks:
ASTM D2435

Alliance Geotechnical Group, Inc.

Dallas, TX

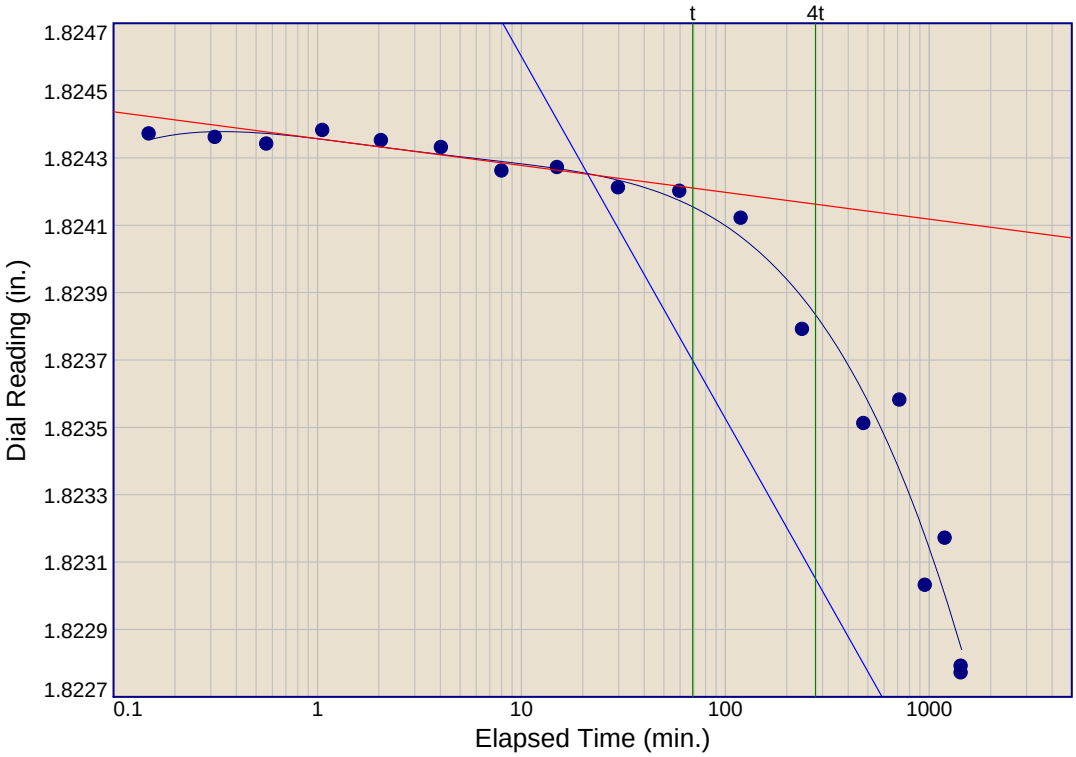
Figure

Checked By: HS

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: P-102 Depth: 6-7'



Load No.= 1

Load= 7800 psf

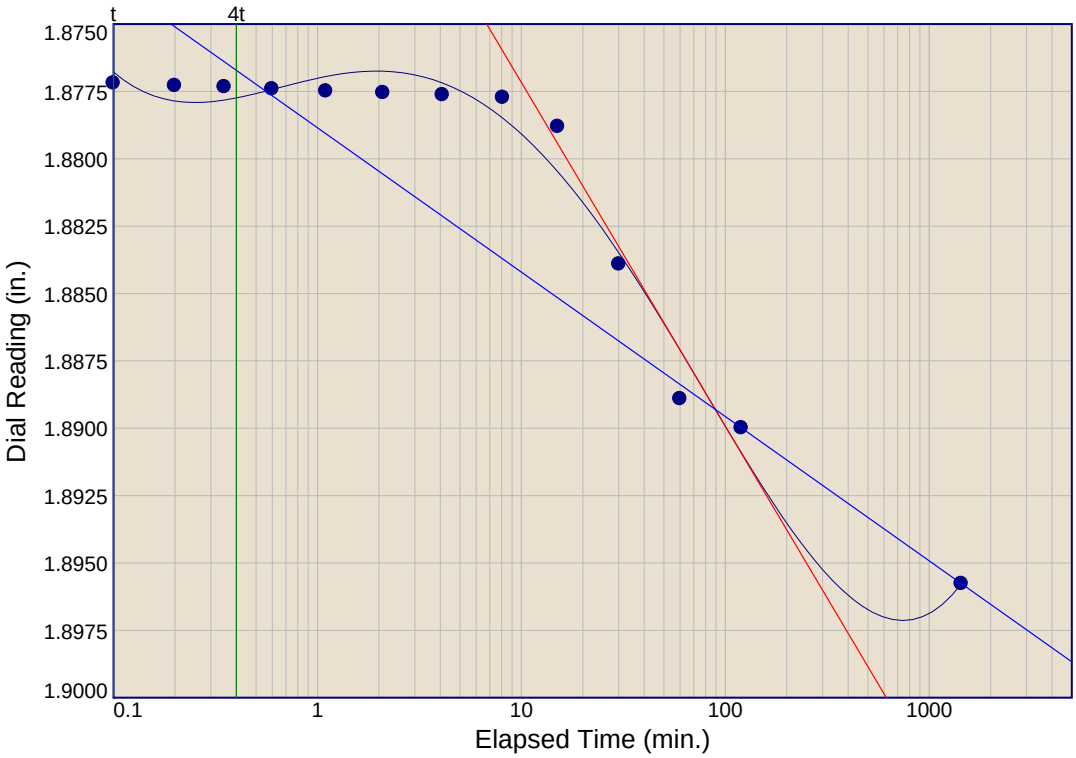
D_0 = 1.8245

D_{50} = 1.8244

D_{100} = 1.8243

T_{50} = 0.81 min.

C_v @ T_{50}
0.610 ft.^{2}/day



Load No.= 4

Load= 62400 psf

D_0 = 1.8758

D_{50} = 1.8826

D_{100} = 1.8893

T_{50} = 24.70 min.

C_v @ T_{50}
0.018 ft.^{2}/day

C_α = 0.008

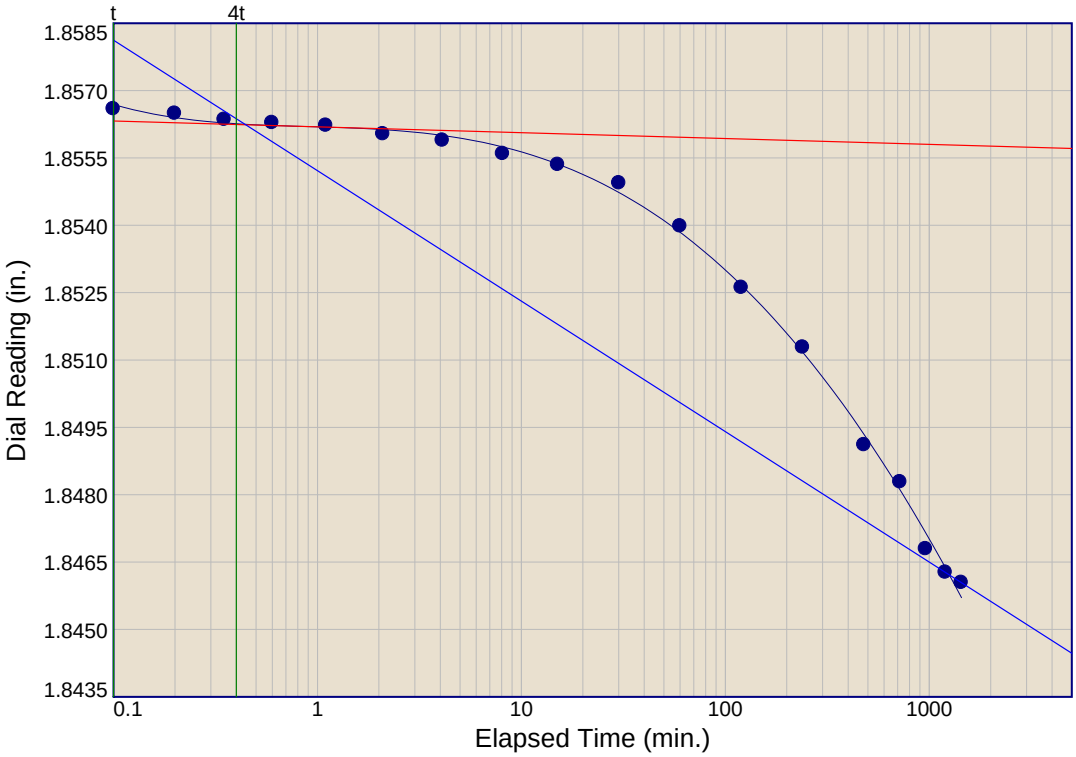
Figure

Alliance Geotechnical Group, Inc.

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: P-102 Depth: 6-7'



Load No.= 6

Load= 7800 psf

D_0 = 1.8571

D_{50} = 1.8567

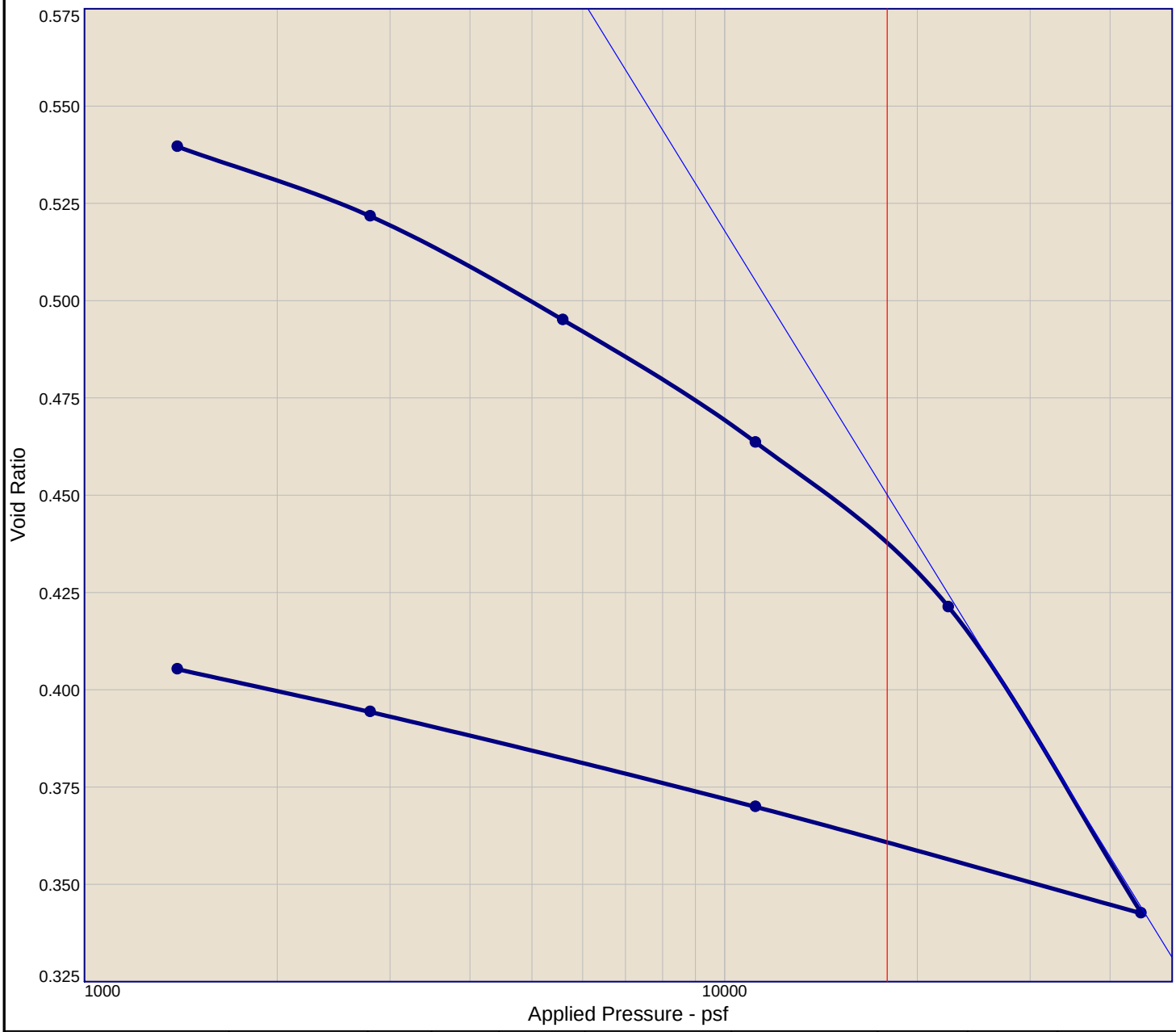
D_{100} = 1.8562

T_{50} = 0.10 min.

C_v @ T_{50}
4.552 ft.^{2}/day

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
40.1 %	8.0 %	109.9			2.71		20739	0.27	0.04	0.539

MATERIAL DESCRIPTION	USCS	AASHTO
CLAY, hard, tan and light gray, w/ sand	CH	

Project No. E17-0811
Project: DART D-2

Location: T-102 **Depth:** 7-10'

Alliance Geotechnical Group, Inc.

Dallas, TX

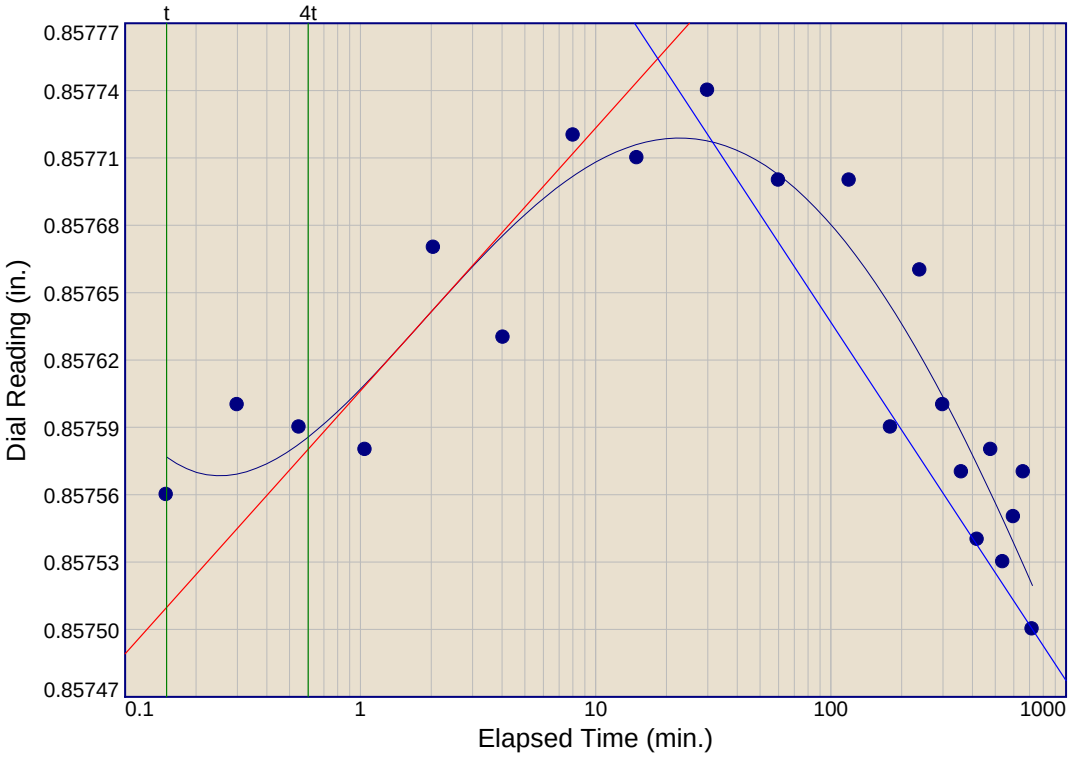
Remarks:
ASTM D2435

Checked By: HS

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: T-102 Depth: 7-10'



Load No.= 1

Load= 1400 psf

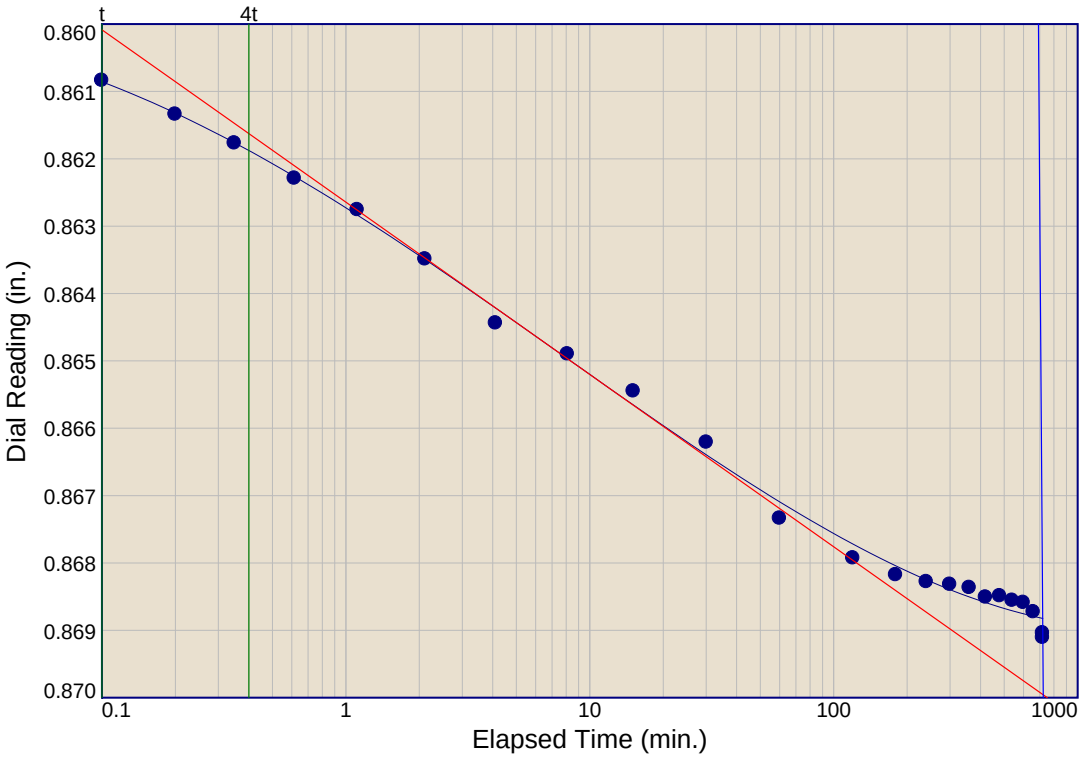
D_0 = 0.8576

D_{50} = 0.8577

D_{100} = 0.8578

T_{50} = 2.96 min.

C_v @ T_{50}
0.166 ft.^{2}/day



Load No.= 2

Load= 2800 psf

D_0 = 0.8598

D_{50} = 0.8649

D_{100} = 0.8700

T_{50} = 7.61 min.

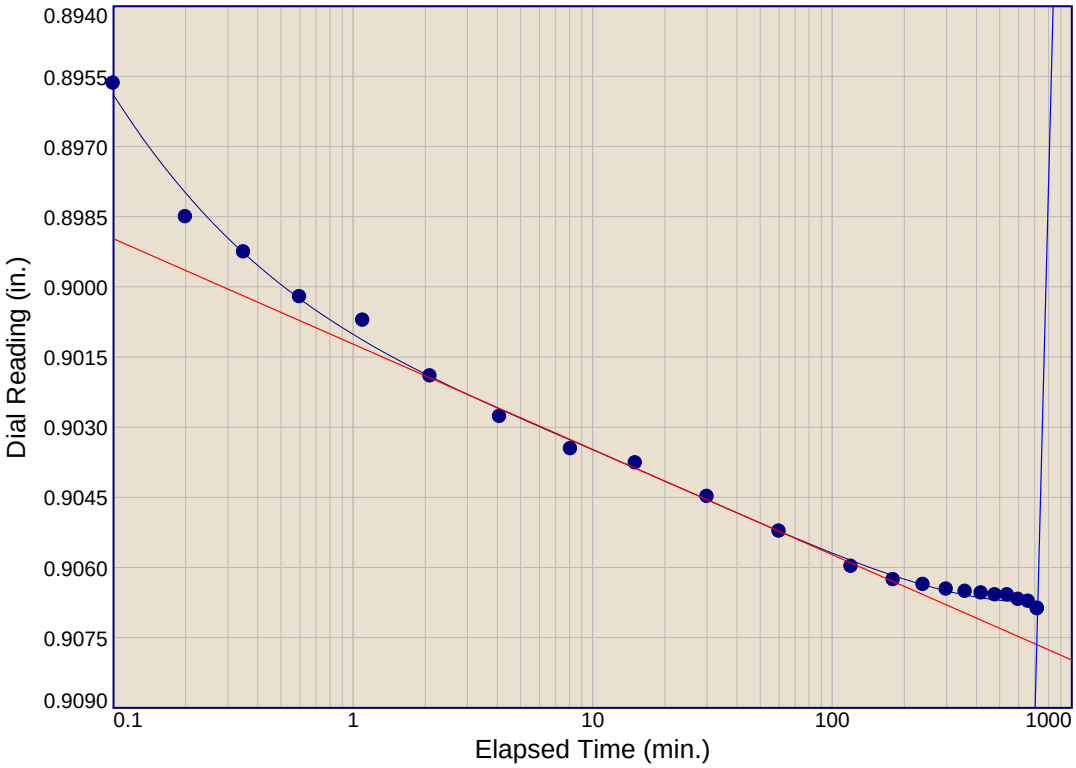
C_v @ T_{50}
0.064 ft.^{2}/day

C_α = 0.766

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: T-102 Depth: 7-10'



Load No.= 4

Load= 11200 psf

D_0 = 0.8864

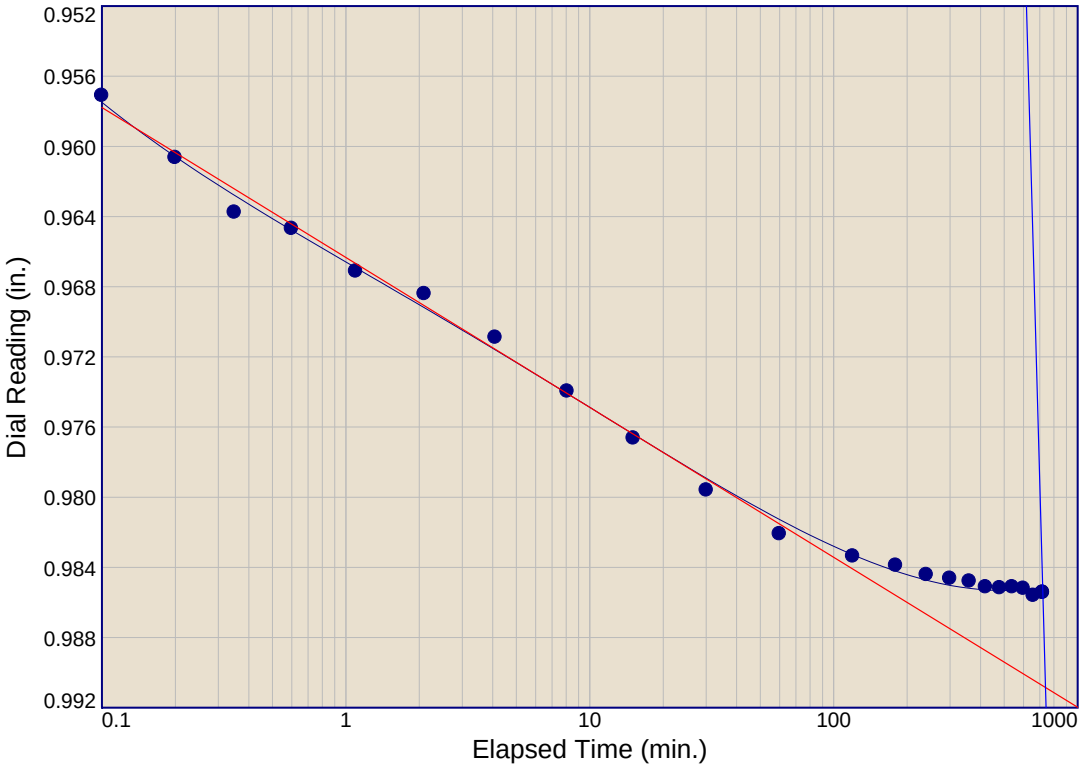
D_{50} = 0.8970

D_{100} = 0.9076

T_{50} = 0.14 min.

C_v @ T_{50}

3.197 ft.^{2}/day



Load No.= 6

Load= 44800 psf

D_0 = 0.9344

D_{50} = 0.9626

D_{100} = 0.9909

T_{50} = 0.33 min.

C_v @ T_{50}

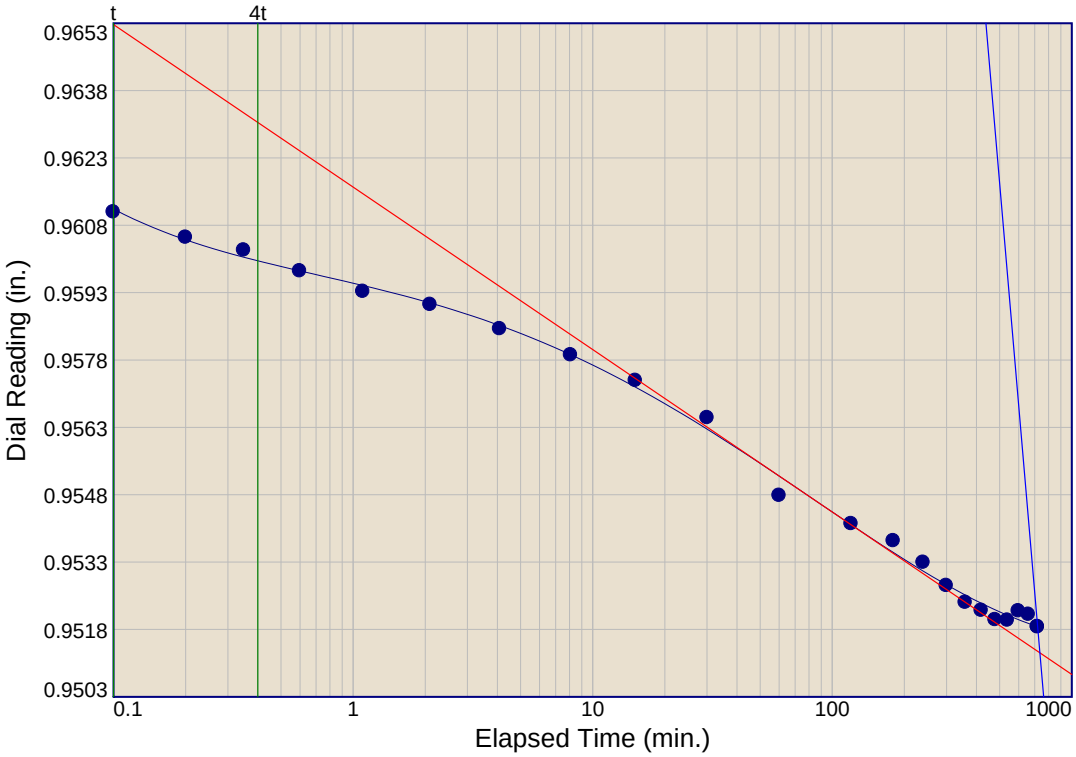
1.189 ft.^{2}/day

C_α = 0.767

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: T-102 Depth: 7-10'



Load No.= 8

Load= 2800 psf

D_0 = 0.9623

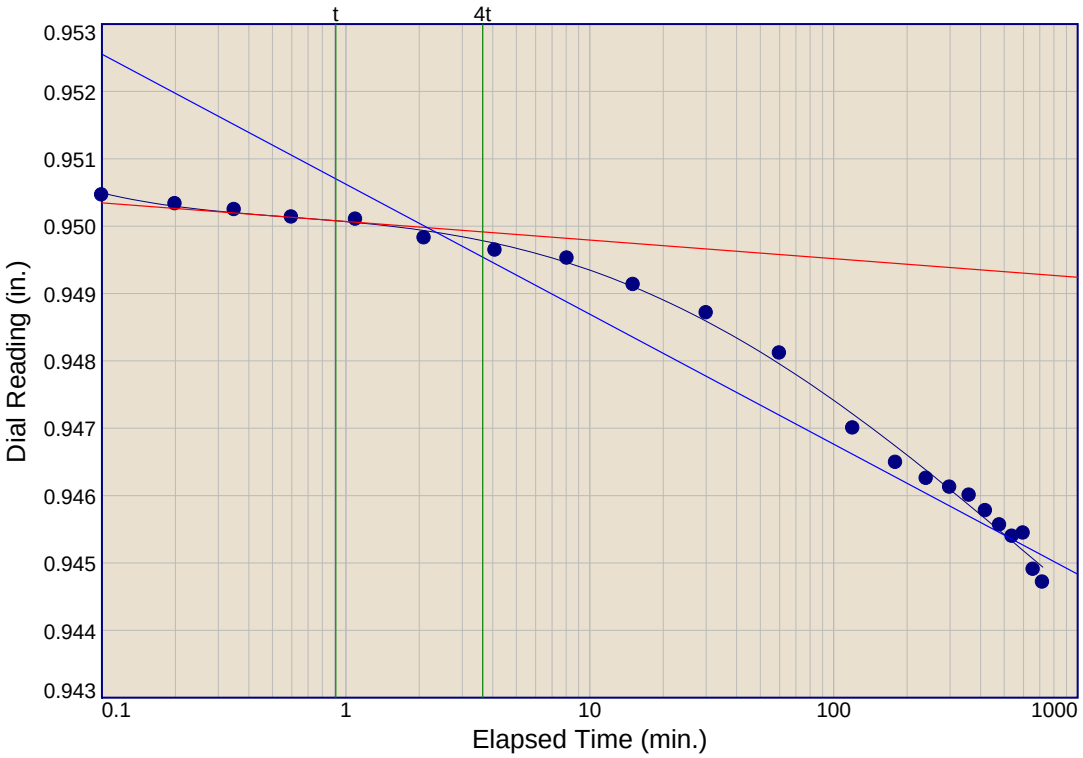
D_{50} = 0.9568

D_{100} = 0.9513

T_{50} = 20.46 min.

C_v @ T_{50}

0.019 ft.^{2}/day



Load No.= 9

Load= 1400 psf

D_0 = 0.9504

D_{50} = 0.9502

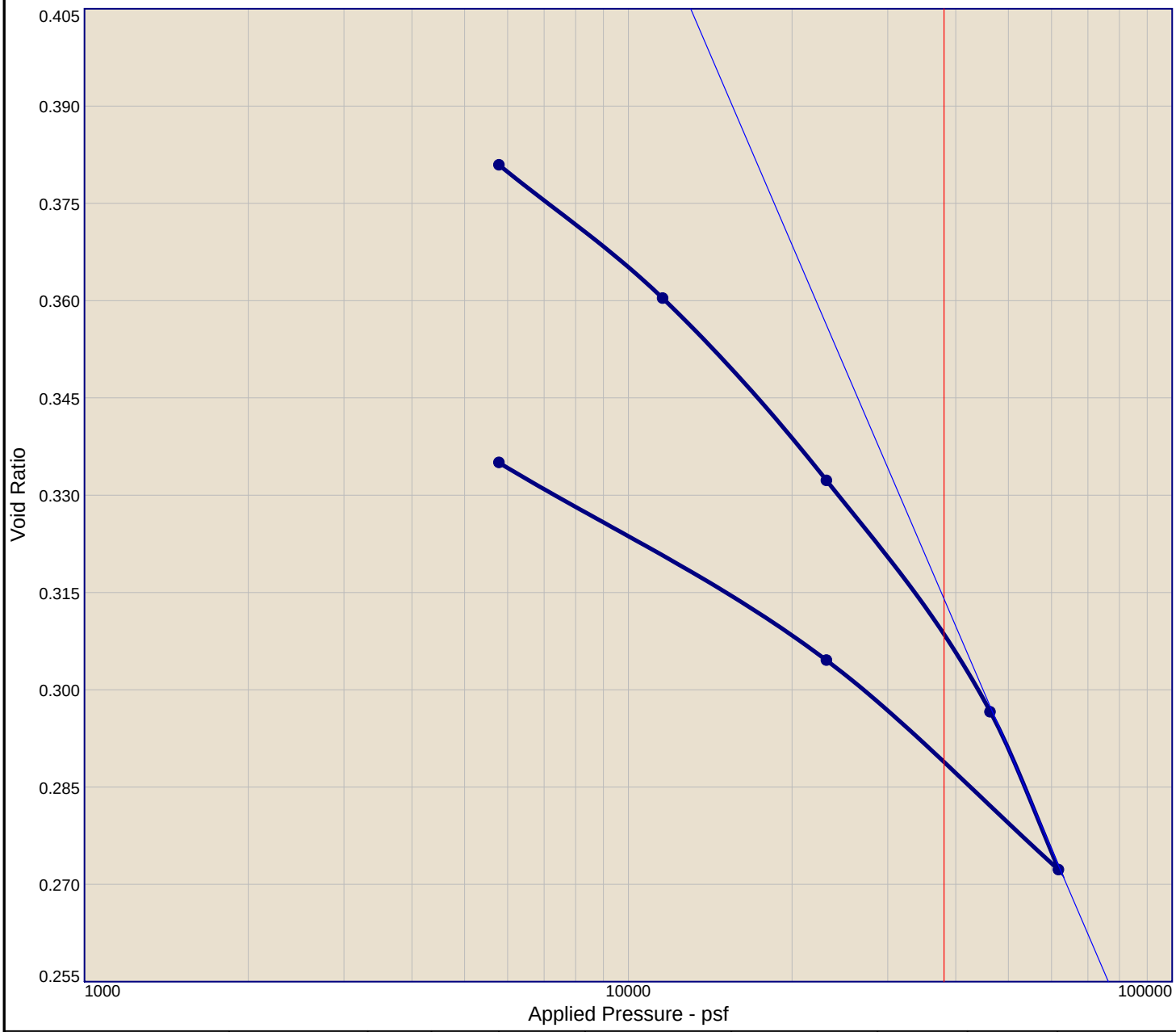
D_{100} = 0.9500

T_{50} = 0.42 min.

C_v @ T_{50}

0.978 ft.^{2}/day

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
64.9 %	9.2 %	122.1			2.70		41334	0.20	0.06	0.381

MATERIAL DESCRIPTION	USCS	AASHTO
CLAY, hard, tan and gray, slightly sandy to sandy (CL)		

Project No. E17-0811 **Client:**

Project: DART D-2

Location: T-103 **Depth:** 6-10'

Remarks:
ASTM D2435

Alliance Geotechnical Group, Inc.

Dallas, TX

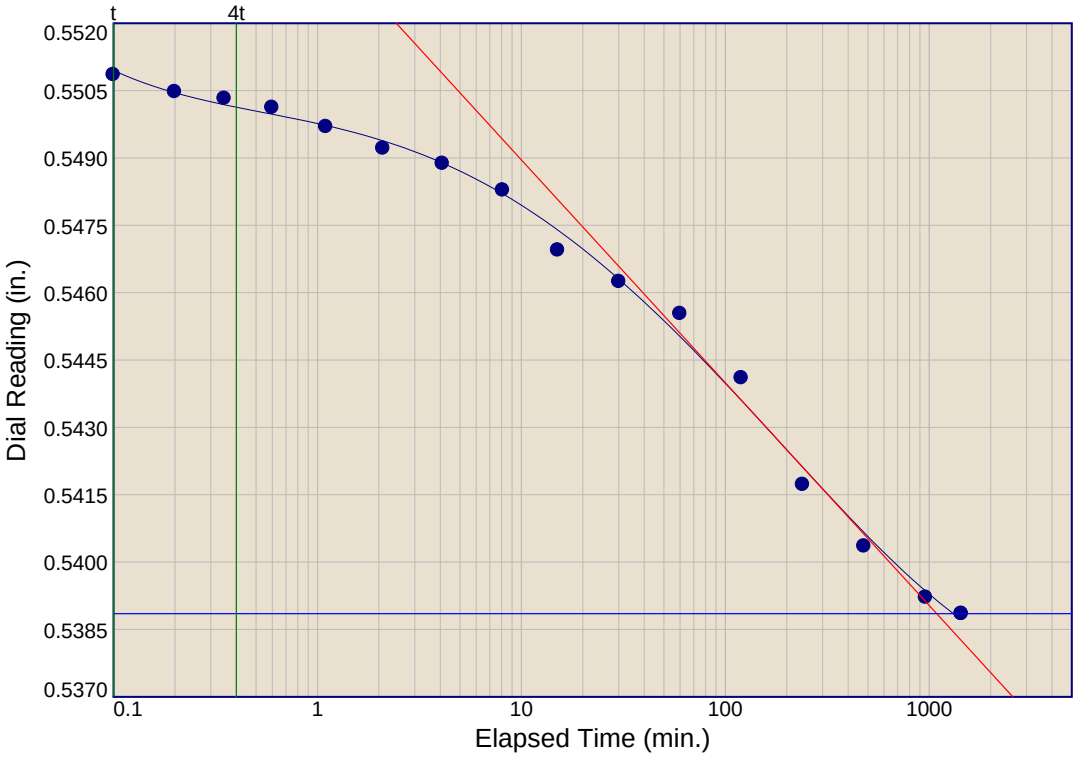
Figure

Checked By: HS

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: T-103 Depth: 6-10'



Load No.= 7

Load= 5800 psf

D_0 = 0.5518

D_{50} = 0.5453

D_{100} = 0.5389

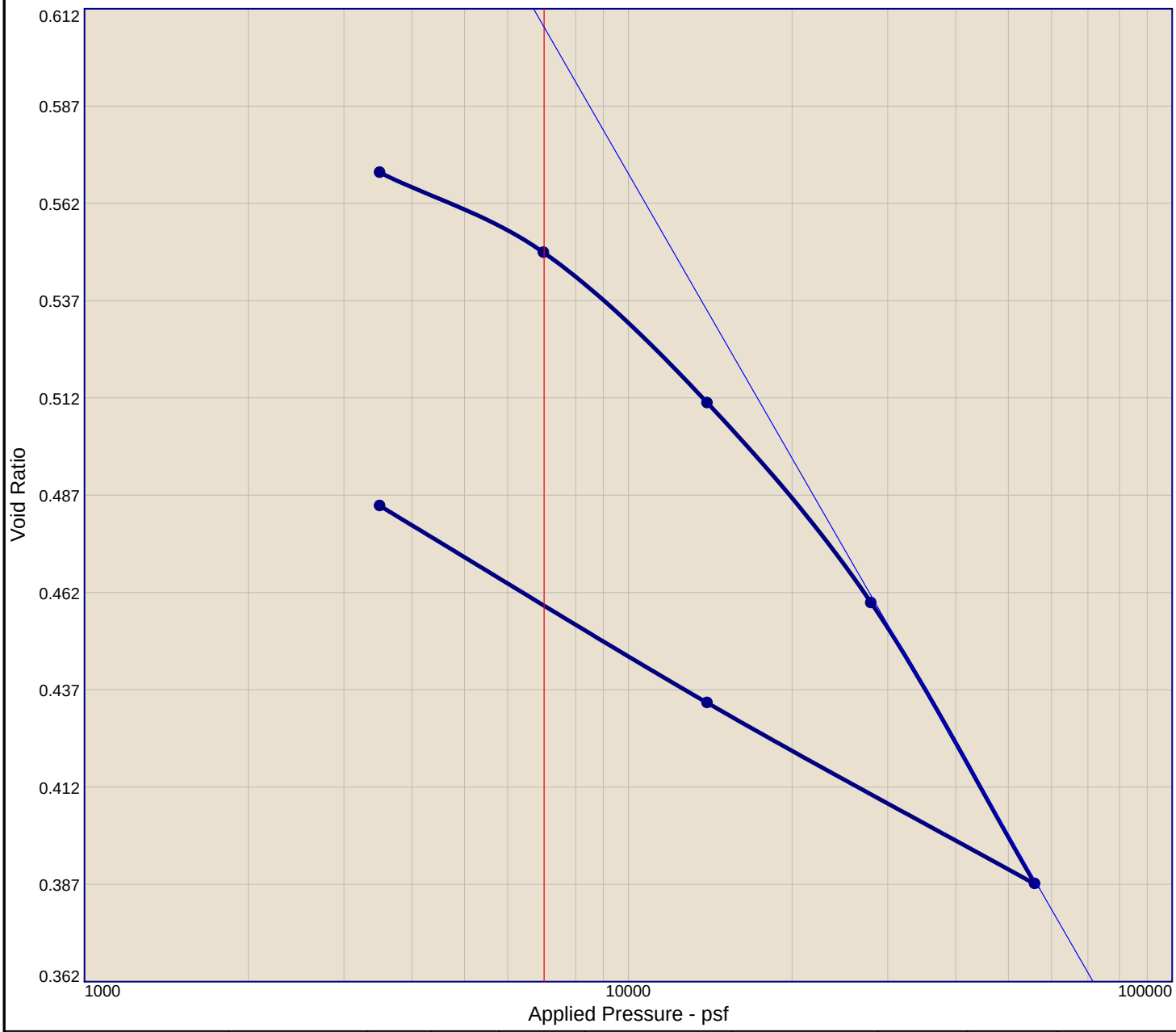
T_{50} = 51.73 min.

C_v @ T_{50}
0.009 ft.^{2}/day

C_α = 0.000

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
86.7 %	18.1 %	110.2			2.72		13914	0.24	0.08	0.570

MATERIAL DESCRIPTION	USCS	AASHTO
CLAY, very stiff, tan and gray, w/ sandy clay seams and lenses (CH)		

Project No. E17-0811 **Client:**

Project: DART D-2

Location: TS-202 **Depth:** 4-8'

Remarks:
ASTM D2435

Alliance Geotechnical Group, Inc.

Dallas, TX

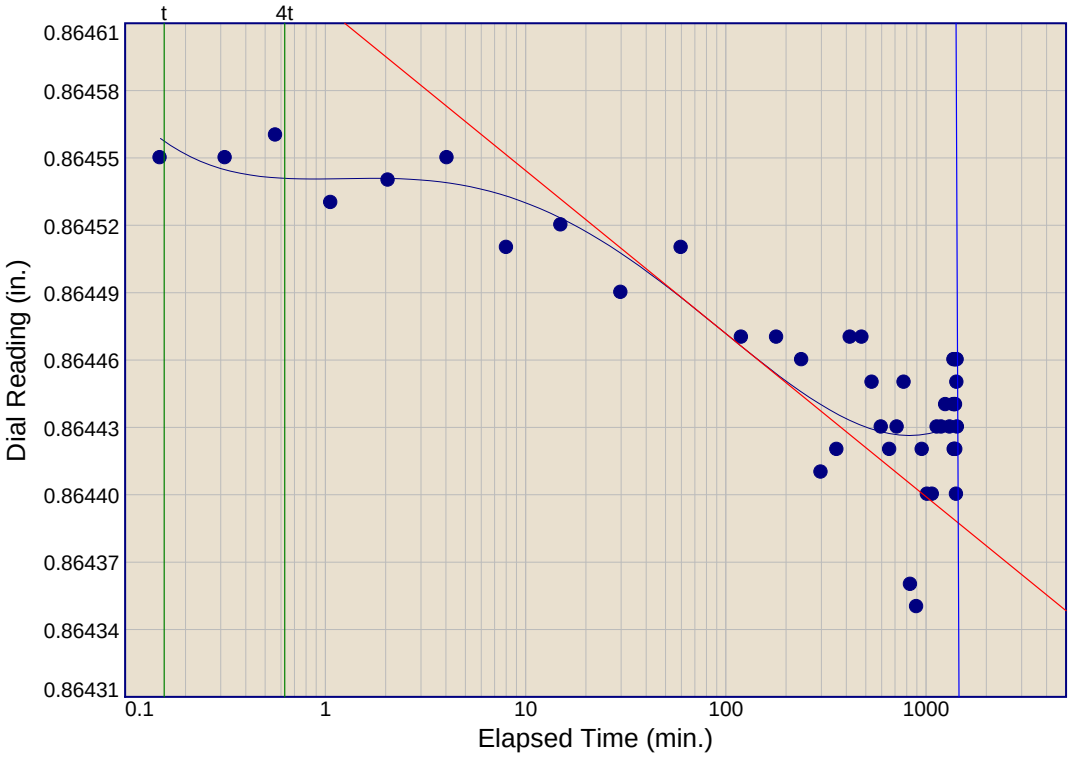
Figure

Checked By: HS

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: TS-202 Depth: 4-8'



Load No.= 1

Load= 3500 psf

D_0 = 0.8646

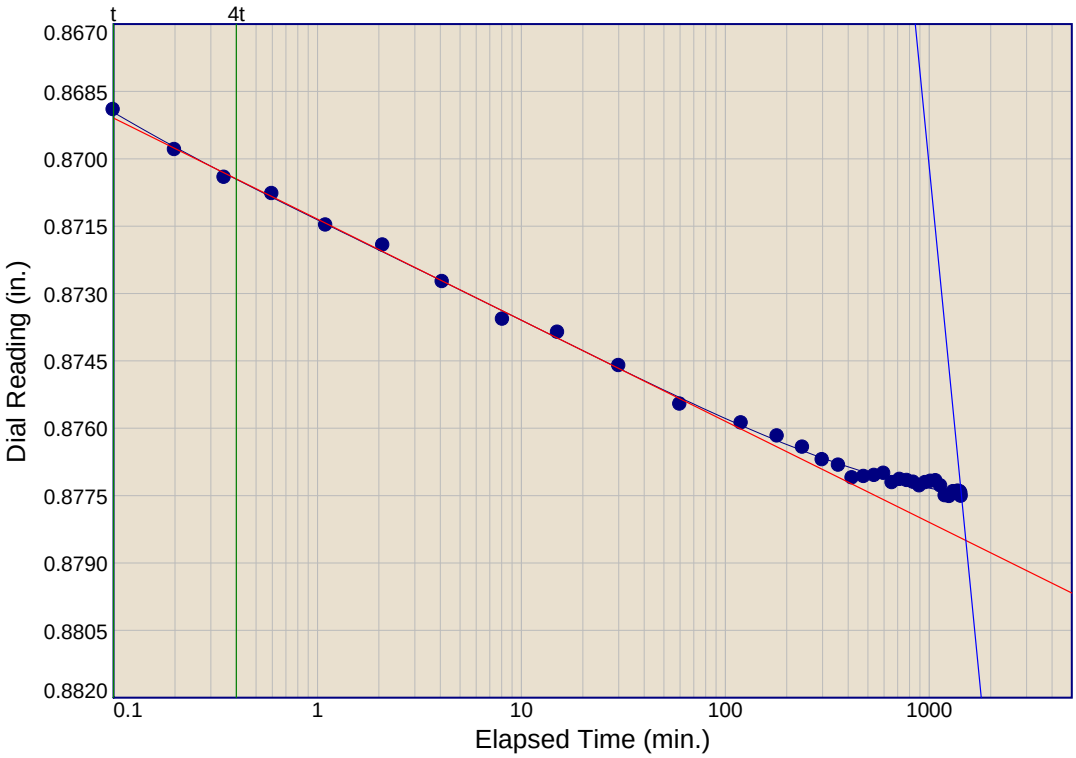
D_{50} = 0.8645

D_{100} = 0.8644

T_{50} = 75.07 min.

C_v @ T_{50}

0.007 ft.^{2}/day



Load No.= 2

Load= 7000 psf

D_0 = 0.8675

D_{50} = 0.8730

D_{100} = 0.8785

T_{50} = 5.36 min.

C_v @ T_{50}

0.091 ft.^{2}/day

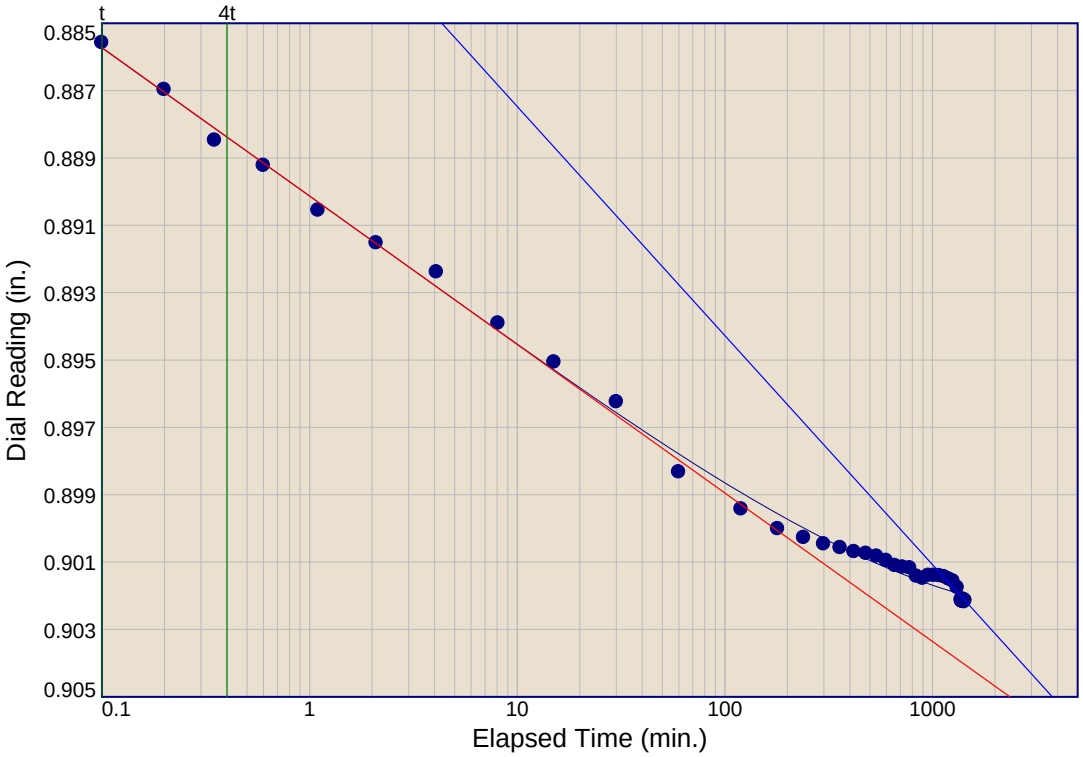
C_α = 0.073

Figure

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: TS-202 Depth: 4-8'



Load No.= 3

Load= 14000 psf

D_0 = 0.8831

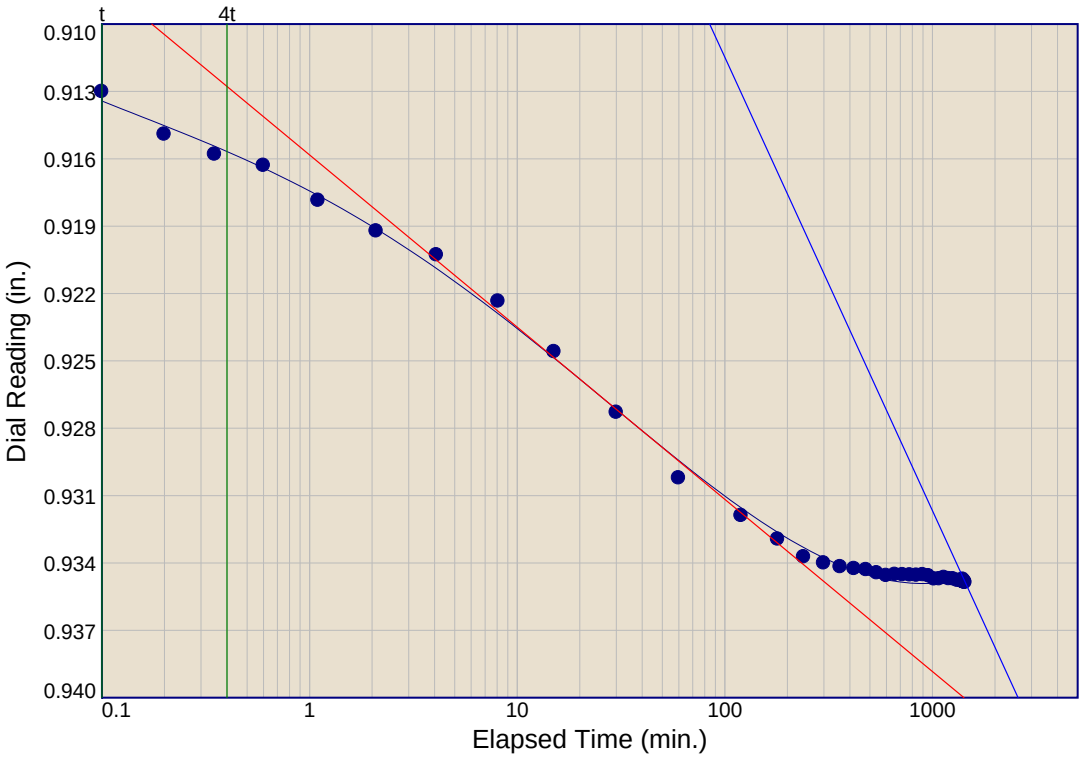
D_{50} = 0.8953

D_{100} = 0.9076

T_{50} = 15.26 min.

C_v @ T_{50}
0.031 ft.^{2}/day

C_α = 0.011



Load No.= 4

Load= 28000 psf

D_0 = 0.9112

D_{50} = 0.9272

D_{100} = 0.9432

T_{50} = 30.34 min.

C_v @ T_{50}
0.015 ft.^{2}/day

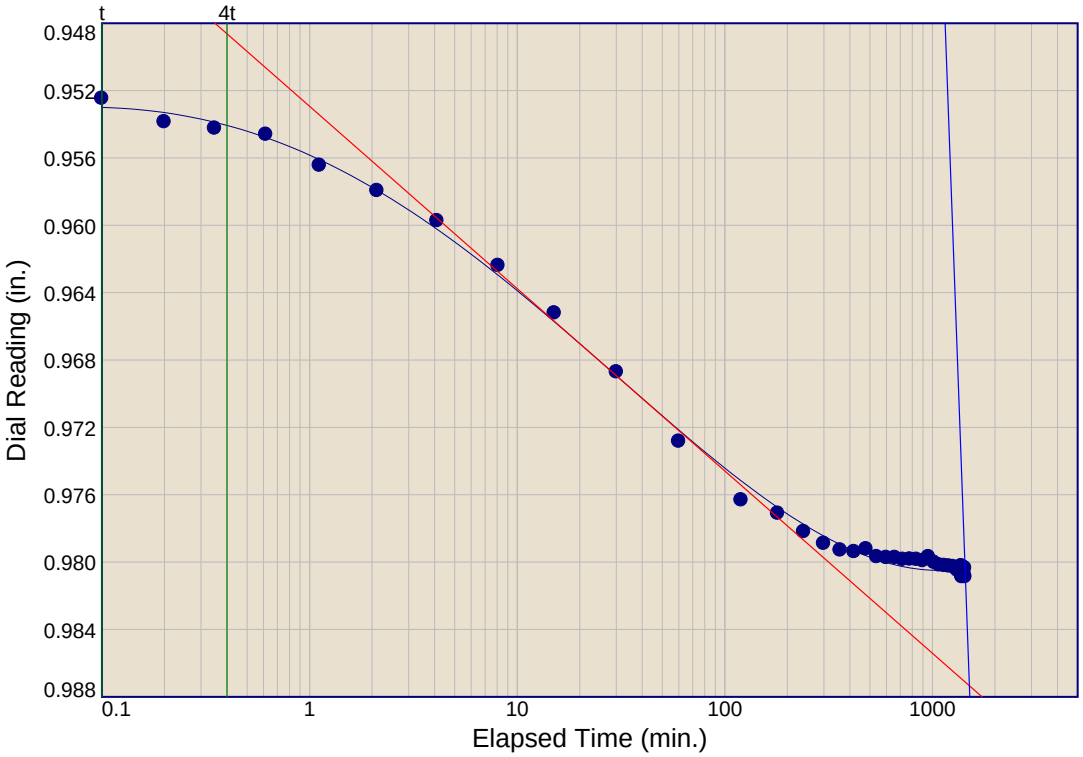
C_α = 0.032

Figure

Dial Reading vs. Time

Project No.: E17-0811
Project: DART D-2

Location: TS-202 Depth: 4-8'



Load No.= 5

Load= 56000 psf

D_0 = 0.9519

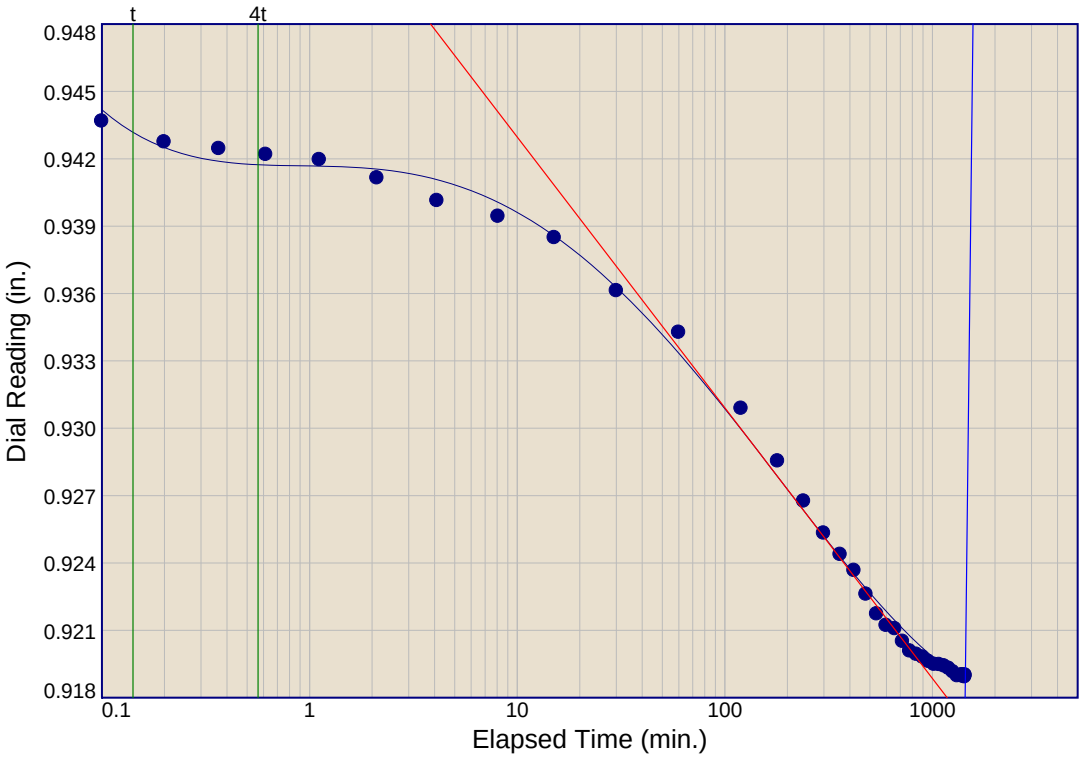
D_{50} = 0.9696

D_{100} = 0.9873

T_{50} = 34.87 min.

C_v @ T_{50}
0.012 ft.^{2}/day

C_α = 0.530



Load No.= 7

Load= 3500 psf

D_0 = 0.9446

D_{50} = 0.9308

D_{100} = 0.9170

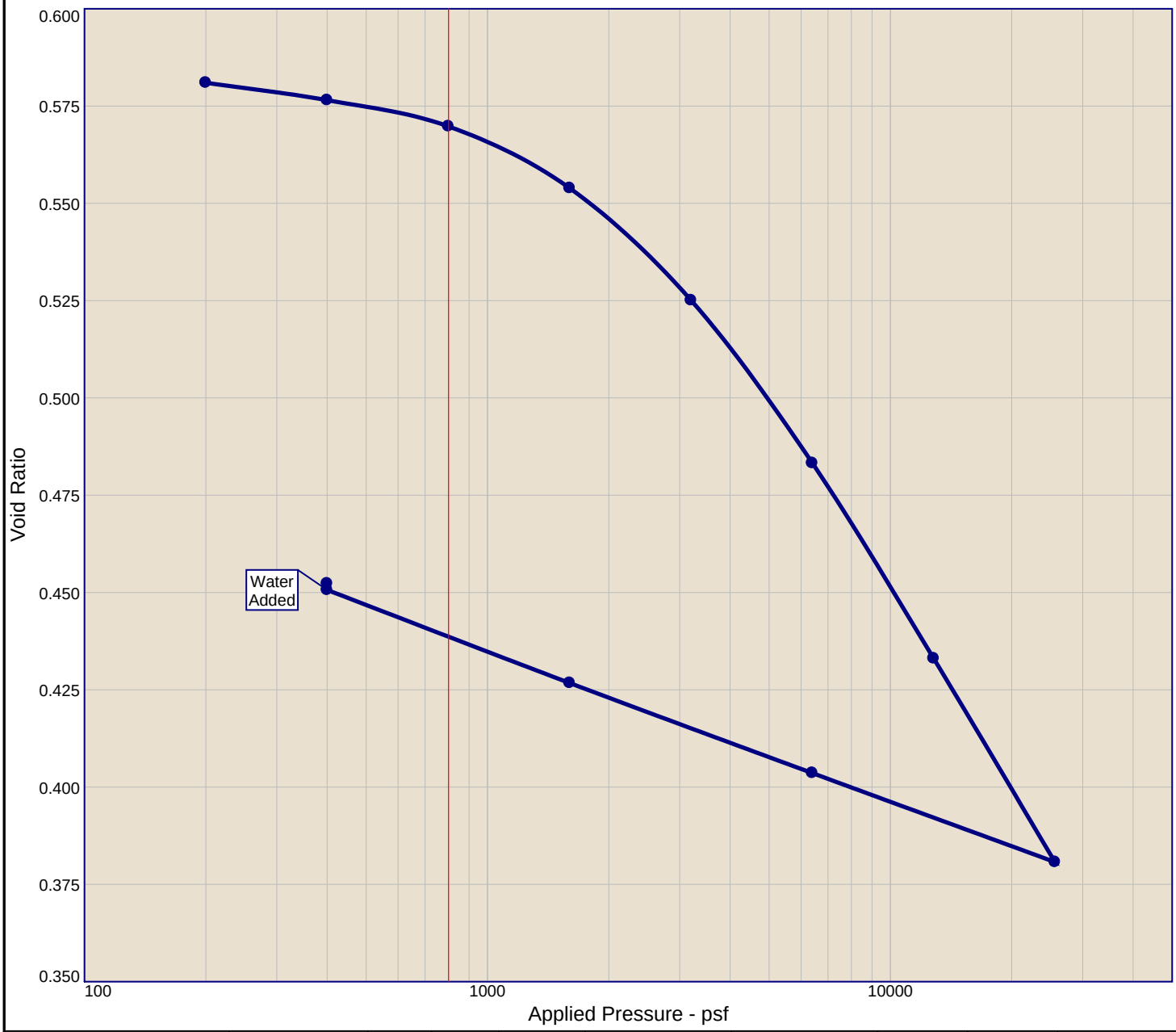
T_{50} = 101.36 min.

C_v @ T_{50}
0.004 ft.^{2}/day

C_α = 1.250

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
95.1 %	20.4 %	107.3			2.72				0.04	0.583

MATERIAL DESCRIPTION	USCS	AASHTO
CLAY, wet, stiff, brown, with sand (CL)	CL	

Project No. E17-0811 **Client:**

Project: DART D-2

Location: TS-208 **Depth:** 8-10'

Remarks:

Alliance Geotechnical Group, Inc.

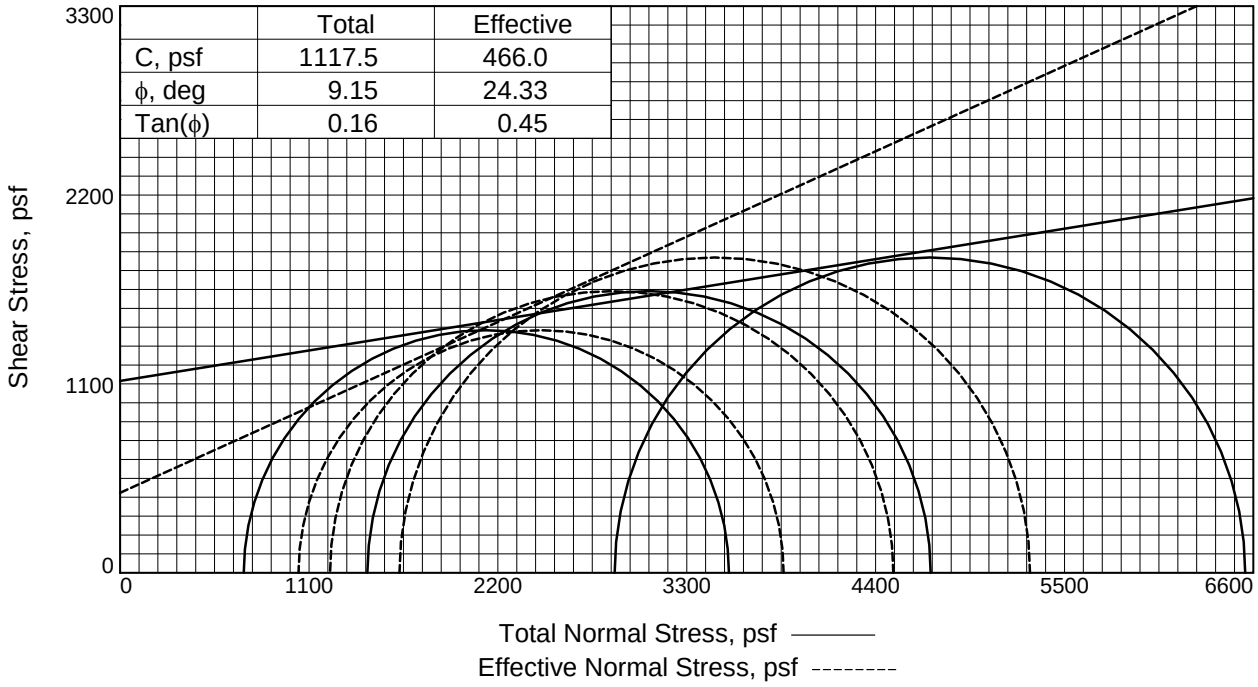
Dallas, TX

Figure

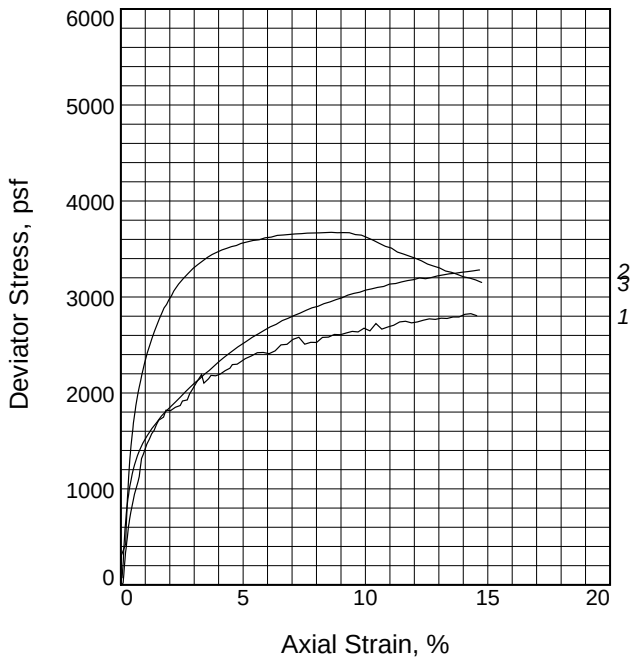
Checked By: HS

APPENDIX E-2

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS



	Total	Effective
C, psf	1117.5	466.0
ϕ, deg	9.15	24.33
Tan(ϕ)	0.16	0.45



Sample No.		1	2	3
Initial	Water Content, %	15.4	15.4	15.4
	Dry Density, pcf	111.6	110.9	109.1
	Saturation, %	80.1	78.7	75.2
	Void Ratio	0.5222	0.5317	0.5568
	Diameter, in.	2.686	2.697	2.689
	Height, in.	5.380	5.500	5.490
At Test	Water Content, %	24.5	23.7	23.4
	Dry Density, pcf	101.8	103.2	103.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6677	0.6446	0.6376
	Diameter, in.	2.769	2.761	2.735
	Height, in.	5.548	5.633	5.584
Strain rate, %/min.		0.01	0.01	0.01
Eff. Cell Pressure, psi		5.000	10.000	20.000
Fail. Stress, psf		2825.4	3280.7	3672.5
Excess Pore Pr., psf		-318.7	217.6	1253.2
Strain, %		14.3	14.7	8.6
Fail. Stress at Max Obliquity, psf		1573.7	2105.8	3489.9
Excess Pore Pr., psf		631.0	924.1	1465.1
Strain, %		1.3	3.0	4.1
$\bar{\sigma}_1$ Failure, psf		3864.2	4503.2	5299.3
$\bar{\sigma}_3$ Failure, psf		1038.7	1222.4	1626.8

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: CLAY, very stiff, dry, yellowish brown and dark brown, w/ trace calcareous deposits (CH)

Assumed Specific Gravity= 2.72

Remarks: ASTM D-4767
B Value: 0.98

Figure _____

Client:

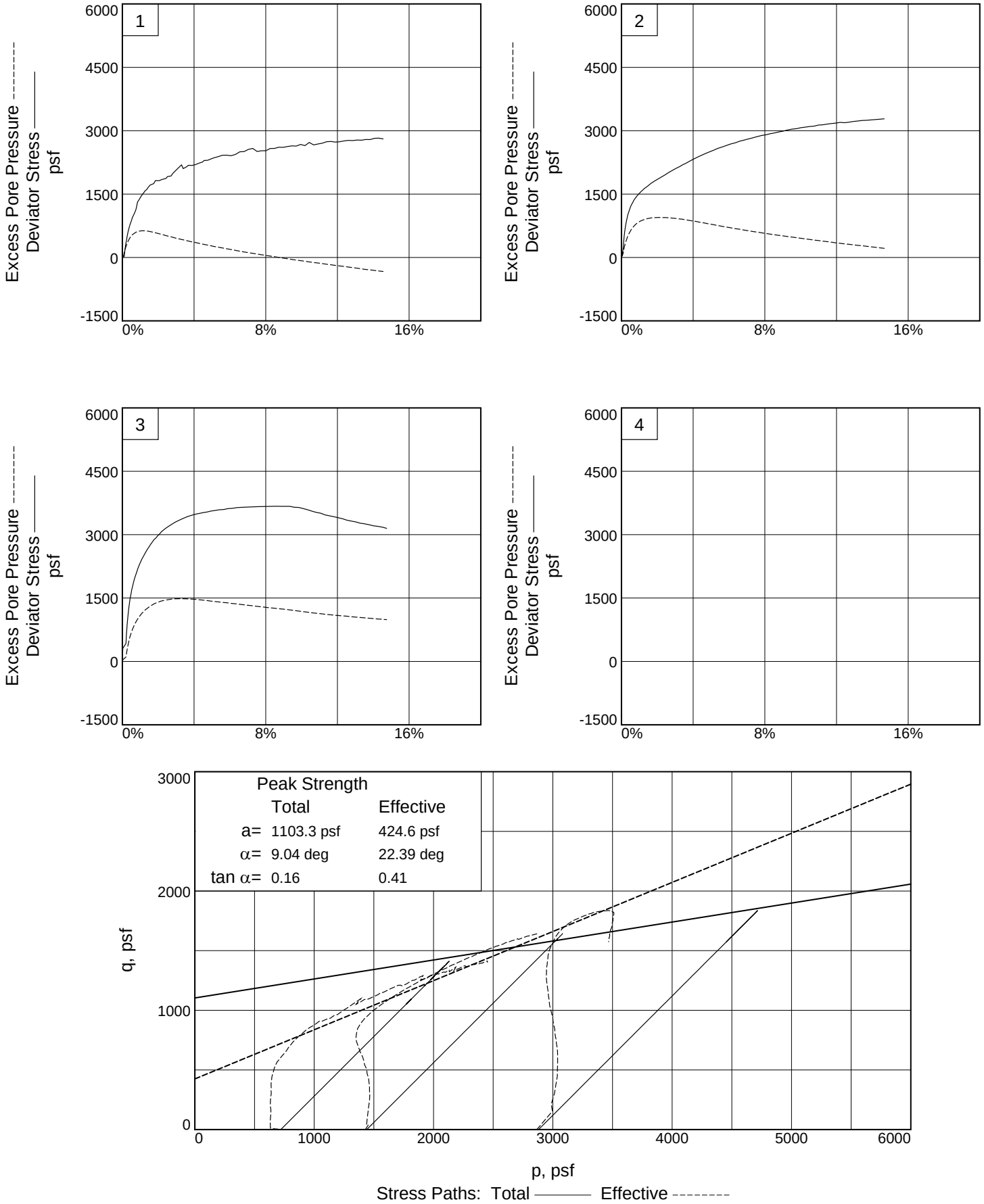
Project: DART D-2

Boring ID: B-2 **Depth:** 5'-10'

Proj. No.: E17-0811 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Alliance Geotechnical Group, Inc.
Dallas, TX

Checked By: HS



Project: DART D-2
Boring ID: B-2
Depth: 5'-10'
Project No.: E17-0811

Figure _____

Alliance Geotechnical Group, Inc.

Checked By: HS

APPENDIX E-3

COROSSIVITY

TEST RESULTS

SOIL CORROSIVITY SUMMARY
TEST RESULTS

BORING NO.	DEPTH (FT.)	SOIL RESISTIVITY (ohm-cm) (AASHTO T-288)	SOIL pH (TEX 128-E)	SOLUBLE SULFATES (PPM) (TEX 145-E)
B-1	5-10	1500.8	7.88	***See Attached Xenco Report
B-2	24-25	1200.6	8.39	*TNA
B-3	8-10	1400.7	8.07	**NES
P-102	6-7	*TNA	7.76	***See Attached Xenco Report
T-103	15-16.5	**NES	7.84	*TNA
TS-104	13.5-15	**NES	8.01	***See Attached Xenco Report
T-111	30-31	1767.6	7.19	***See Attached Xenco Report
T-112	14-15	170.0	7.92	***See Attached Xenco Report
T-201	16-17.5	**NES	**NES	**NES
TS-202	8-9.5	*TNA	8.42	*TNA
T-204	4-6	733.7	7.52	***See Attached Xenco Report
TS-208	5-8	850.0	6.96	***See Attached Xenco Report
	8-10	*TNA	7.41	*TNA
TS-209	4-6	*TNA	7.24	*TNA
	13.5-15	867.1	7.83	***See Attached Xenco Report

****TNA = Test Not Assigned***

*****NES = Test Assigned But Not Enough Sample for Testing***

******See Attached Xenco Report for Chloride Content & Soluble Sulfate Test Results***

ALLIANCE GEOTECHNICAL GROUP

CORROSIVITY TEST RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-3

Analytical Report 607590

for

Alliance Geotechnical Group

Project Manager: Juan Perez

DART D-2

E17-0811

10-DEC-18

Collected By: Client

9701 Harry Hines Blvd
Dallas, TX 75220

Xenco-Houston (EPA Lab Code: TX00122):
Texas (T104704215-18-28), Arizona (AZ0765), Florida (E871002-24), Louisiana (03054)
Oklahoma (2017-142)

Xenco-Dallas (EPA Lab Code: TX01468):
Texas (T104704295-18-17), Arizona (AZ0809), Arkansas (17-063-0)

Xenco-El Paso (EPA Lab Code: TX00127): Texas (T104704221-18-14)
Xenco-Lubbock (EPA Lab Code: TX00139): Texas (T104704219-18-18)
Xenco-Midland (EPA Lab Code: TX00158): Texas (T104704400-18-18)
Xenco-San Antonio (EPA Lab Code: TNI02385): Texas (T104704534-18-4)
Xenco Phoenix (EPA Lab Code: AZ00901): Arizona (AZ0757)
Xenco-Phoenix Mobile (EPA Lab Code: AZ00901): Arizona (AZM757)
Xenco-Atlanta (LELAP Lab ID #04176)
Xenco-Tampa: Florida (E87429)
Xenco-Lakeland: Florida (E84098)

Table of Contents

Cover Page	1
Cover Letter	3
Sample ID Cross Reference	4
Case Narrative	5
Certificate of Analysis (Detailed Report)	6
Explanation of Qualifiers (Flags)	10
LCS / LCSD Recoveries	11
MS / MSD Recoveries	12
Method Duplicate	13
Chain of Custody	14
Sample Receipt Conformance Report	15

10-DEC-18

Project Manager: **Juan Perez**
Alliance Geotechnical Group
3228 Halifax Suite A
Dallas, TX 75247

Reference: XENCO Report No(s): **607590**
DART D-2
Project Address: ---

Juan Perez:

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number(s) 607590. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. The uncertainty of measurement associated with the results of analysis reported is available upon request. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 607590 will be filed for 45 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Holly Taylor

Holly Taylor
Project Manager

Recipient of the Prestigious Small Business Administration Award of Excellence in 1994.
Certified and approved by numerous States and Agencies.
A Small Business and Minority Status Company that delivers SERVICE and QUALITY

Houston - Dallas - Midland - San Antonio - Phoenix - Oklahoma - Latin America

Sample Cross Reference 607590

Alliance Geotechnical Group, Dallas, TX

DART D-2

Sample Id	Matrix	Date Collected	Sample Depth	Lab Sample Id
P-102	S	11-21-18 00:00	6 - 7 ft	607590-001
TS-111	S	11-21-18 00:00	30 - 31 ft	607590-002
B-1	S	11-21-18 00:00	5 - 10 ft	607590-003

CASE NARRATIVE

Client Name: Alliance Geotechnical Group
Project Name: DART D-2

Project ID: *E17-0811*
Work Order Number(s): *607590*

Report Date: *10-DEC-18*
Date Received: *12/05/2018*

This laboratory is NELAC accredited under the Texas Laboratory Accreditation Program for all the methods, analytes, and matrices reported in this data package except as noted. The data have been reviewed and are technically compliant with the requirements of the methods used, except where noted by the laboratory.

Sample receipt non conformances and comments:

12/5/18 Per Juan Perez: Samples were taken on 11/21/18. Tests are Cl, SO4 and pH. Client was notified of holdtimes.

Sample receipt non conformances and comments per sample:

None

Certificate of Analytical Results
607590
Alliance Geotechnical Group, Dallas, TX
DART D-2

Sample Id: **P-102** Matrix: Soil Sample Depth: 6 - 7 ft

Lab Sample Id: 607590-001 Date Collected: 11.21.18 00.00 Date Received: 12.05.18 15.00

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3071882 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	<1.27	4.98	1.27	mg/kg	12.06.18 10:45	U	1

Analytical Method: Sulfate by SW-846 9038 Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3072034 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfate	14808-79-8	**27.3**	49.8	16.6	mg/kg	12.07.18 09:45	J	10

Analytical Method: Soil pH by EPA 9045C Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3071948 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
pH	12408-02-5	**8.20**			SU	12.06.18 15:45		
Temperature +	TEMP	**22.7**			Deg C	12.06.18 15:45		1

Certificate of Analytical Results
607590
Alliance Geotechnical Group, Dallas, TX
DART D-2

Sample Id: **TS-111** Matrix: Soil Sample Depth: 30 - 31 ft

Lab Sample Id: 607590-002 Date Collected: 11.21.18 00.00 Date Received: 12.05.18 15.00

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3071882 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	**4.93**	4.93	1.26	mg/kg	12.06.18 10:45	J	1

Analytical Method: Sulfate by SW-846 9038 Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3072034 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfate	14808-79-8	**35.4**	49.5	16.5	mg/kg	12.07.18 09:45	J	10

Analytical Method: Soil pH by EPA 9045C Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3071948 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
pH	12408-02-5	**8.39**			SU	12.06.18 15:45		
Temperature +	TEMP	**22.7**			Deg C	12.06.18 15:45		1

Certificate of Analytical Results
607590
Alliance Geotechnical Group, Dallas, TX
DART D-2

Sample Id: **B-1** Matrix: Soil Sample Depth: 5 - 10 ft

Lab Sample Id: 607590-003 Date Collected: 11.21.18 00.00 Date Received: 12.05.18 15.00

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3071882 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	**2.46**	4.92	1.26	mg/kg	12.06.18 10:45	J	1

Analytical Method: Sulfate by SW-846 9038 Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3072034 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfate	14808-79-8	<16.5	49.5	16.5	mg/kg	12.07.18 09:45	U	10

Analytical Method: Soil pH by EPA 9045C Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3071948 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
pH	12408-02-5	**8.16**			SU	12.06.18 15:45		
Temperature +	TEMP	**22.6**			Deg C	12.06.18 15:45		1

Certificate of Analytical Results
607590
Alliance Geotechnical Group, Dallas, TX
DART D-2

Sample Id: **3071882-1-BLK** Matrix: Solid Sample Depth:

Lab Sample Id: 3071882-1-BLK Date Collected: Date Received:

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3071882 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	<1.26	4.94	1.26	mg/kg	12.06.18 10:45	U	1

Sample Id: **3072034-1-BLK** Matrix: Solid Sample Depth:

Lab Sample Id: 3072034-1-BLK Date Collected: Date Received:

Analytical Method: Sulfate by SW-846 9038 Prep Method:

Analyst: SHT % Moist: Tech: SHT

Seq Number: 3072034 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfate	14808-79-8	<16.5	49.6	16.5	mg/kg	12.07.18 09:45	U	10

Flagging Criteria

X In our quality control review of the data a QC deficiency was observed and flagged as noted. MS/MSD recoveries were found to be outside of the laboratory control limits due to possible matrix /chemical interference, or a concentration of target analyte high enough to affect the recovery of the spike concentration. This condition could also affect the relative percent difference in the MS/MSD.

B A target analyte or common laboratory contaminant was identified in the method blank. Its presence indicates possible field or laboratory contamination.

D The sample(s) were diluted due to targets detected over the highest point of the calibration curve, or due to matrix interference. Dilution factors are included in the final results. The result is from a diluted sample.

E The data exceeds the upper calibration limit; therefore, the concentration is reported as estimated.

F RPD exceeded lab control limits.

J The target analyte was positively identified below the quantitation limit and above the detection limit.

U Analyte was not detected.

L The LCS data for this analytical batch was reported below the laboratory control limits for this analyte. The department supervisor and QA Director reviewed data. The samples were either reanalyzed or flagged as estimated concentrations.

H The LCS data for this analytical batch was reported above the laboratory control limits. Supporting QC Data were reviewed by the Department Supervisor and QA Director. Data were determined to be valid for reporting.

K Sample analyzed outside of recommended hold time.

JN A combination of the "N" and the "J" qualifier. The analysis indicates that the analyte is "tentatively identified" and the associated numerical value may not be consistent with the amount actually present in the environmental sample.

** Surrogate recovered outside laboratory control limit.

BRL Below Reporting Limit.

RL Reporting Limit

MDL Method Detection Limit **SDL** Sample Detection Limit **LOD** Limit of Detection

PQL Practical Quantitation Limit **MQL** Method Quantitation Limit **LOQ** Limit of Quantitation

DL Method Detection Limit

NC Non-Calculable

SMP Client Sample **BLK** Method Blank

BKS/LCS Blank Spike/Laboratory Control Sample **BKSD/LCSD** Blank Spike Duplicate/Laboratory Control Sample Duplicate

MD/SD Method Duplicate/Sample Duplicate **MS** Matrix Spike **MSD:** Matrix Spike Duplicate

+ NELAC certification not offered for this compound.

***** (Next to analyte name or method description) = Outside XENCO's scope of NELAC accreditation

BS / BSD Recoveries

Project Name: DART D-2

Work Order #: 607590 **Project ID:** E17-0811

Analyst: SHT **Date Prepared:** 12/06/2018 **Date Analyzed:** 12/06/2018

Lab Batch ID: 3071882 **Sample:** 3071882-1-BKS **Batch #:** 1 **Matrix:** Solid

Units: mg/kg

BLANK /BLANK SPIKE / BLANK SPIKE DUPLICATE RECOVERY STUDY

Chloride, Mercuric Nitrate Method by SM4500-CI- B Analytes	Blank Sample Result [A]	Spike Added [B]	Blank Spike Result [C]	Blank Spike %R [D]	Spike Added [E]	Blank Spike Duplicate Result [F]	Blk. Spk Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Chloride	<1.27	49.7	49.7	100	49.0	53.9	110	8	75-125	25	

Analyst: SHT **Date Prepared:** 12/07/2018 **Date Analyzed:** 12/07/2018

Lab Batch ID: 3072034 **Sample:** 3072034-1-BKS **Batch #:** 1 **Matrix:** Solid

Units: mg/kg

BLANK /BLANK SPIKE / BLANK SPIKE DUPLICATE RECOVERY STUDY

Sulfate by SW-846 9038 Analytes	Blank Sample Result [A]	Spike Added [B]	Blank Spike Result [C]	Blank Spike %R [D]	Spike Added [E]	Blank Spike Duplicate Result [F]	Blk. Spk Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Sulfate	<16.5	198	205	104	200	210	105	2	80-120	20	

Relative Percent Difference RPD = 200*|(C-F)/(C+F)|
Blank Spike Recovery [D] = 100*(C)/[B]
Blank Spike Duplicate Recovery [G] = 100*(F)/[E]
All results are based on MDL and Validated for QC Purposes

Form 3 - MS / MSD Recoveries

Project Name: DART D-2

Work Order # : 607590 **Project ID:** E17-0811

Lab Batch ID: 3071882 **QC- Sample ID:** 607030-001 S **Batch #:** 1 **Matrix:** Soil

Date Analyzed: 12/06/2018 **Date Prepared:** 12/06/2018 **Analyst:** SHT

Reporting Units: mg/kg

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY STUDY

Chloride, Mercuric Nitrate Method by SM4500-CI- B	Parent Sample Result [A]	Spike Added [B]	Spiked Sample Result [C]	Spiked Sample %R [D]	Spike Added [E]	Duplicate Spiked Sample Result [F]	Spiked Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Chloride	57.0	49.3	113	114	49.6	112	111	1	75-125	25	

Lab Batch ID: 3072034 **QC- Sample ID:** 607260-036 S **Batch #:** 1 **Matrix:** Soil

Date Analyzed: 12/07/2018 **Date Prepared:** 12/07/2018 **Analyst:** SHT

Reporting Units: mg/kg

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY STUDY

Sulfate by SW-846 9038 Analytes	Parent Sample Result [A]	Spike Added [B]	Spiked Sample Result [C]	Spiked Sample %R [D]	Spike Added [E]	Duplicate Spiked Sample Result [F]	Spiked Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Sulfate	324	198	511	94	197	499	89	2	75-125	20	

Matrix Spike Percent Recovery [D] = 100*(C-A)/B

Matrix Spike Duplicate Percent Recovery [G] = 100*(F-A)/E

Relative Percent Difference RPD = 200*|(C-F)/(C+F)|

ND = Not Detected, J = Present Below Reporting Limit, B = Present in Blank, NR = Not Requested, I = Interference, NA = Not Applicable

N = See Narrative, EQL = Estimated Quantitation Limit, NC = Non Calculable - Sample amount is > 4 times the amount spiked.

Sample Duplicate Recovery

Project Name: DART D-2

Work Order #: 607590

Lab Batch #: 3071948 **Project ID:** E17-0811
Date Analyzed: 12/06/2018 15:45 **Date Prepared:** 12/06/2018 **Analyst:** SHT
QC- Sample ID: 607282-001 D **Batch #:** 1 **Matrix:** Soil
Reporting Units: Deg C

Soil pH by EPA 9045C Analyte	SAMPLE / SAMPLE DUPLICATE RECOVERY Parent Sample Result [A]	Sample Duplicate Result [B]	%RPD	RPD Limit	Flag
Temperature	22.6	22.8	1	25	

Lab Batch #: 3071948
Date Analyzed: 12/06/2018 15:45 **Date Prepared:** 12/06/2018 **Analyst:** SHT
QC- Sample ID: 607282-001 D **Batch #:** 1 **Matrix:** Soil
Reporting Units: SU

Soil pH by EPA 9045C Analyte	SAMPLE / SAMPLE DUPLICATE RECOVERY Parent Sample Result [A]	Sample Duplicate Result [B]	%RPD	RPD Limit	Flag
pH	8.40	8.38	0	20	

Log Difference Log Diff. = Log(Sample Duplicate) - Log(Original Sample)
Spike Relative Difference RPD 200 * | (B-A)/(B+A) |
All Results are based on MDL and validated for QC purposes.

BRL - Below Reporting Limit

Chain of Custody

XENCO LABORATORIES

Work Order No 607590-D

Houston,TX (281) 240-4200 Dallas,TX (214) 902-0300 San Antonio,TX (210) 509-3334
Midland,TX (432-704-5440) EL Paso,TX (915)585-3443 Lubbock,TX (806)794-1296
Hobbs,NM (575-392-7550) Phoenix,AZ (480-355-0900) Atlanta,GA (770-449-8800) Tampa,FL (813-620-2000)

www.xenco.com Page _____ of _____

Project Manager:	Juan Perez	Bill to: (if different)	
Company Name:	Alliance Geotechnical Group	Company Name:	
Address:	3228 Halifax St	Address:	
City, State ZIP:	Dallas, Tx, [redacted] 75247	City, State ZIP:	
Phone:	972-444-8889	Email:	

Work Order Comments

Program: UST/PST ☐ PRP ☐ Brownfields ☐ RRC ☐ Superfund ☐
State of Project:
Reporting: Level II ☐ Level III ☐ PST/UST ☐ TRRP ☐ Level IV ☐
Deliverables: EDD ☐ ADaPT ☐ Other:

Project Name:	DART	Turn Around	
Project Number:	E17-0811	Routine	☐
P.O. Number:		Rush:	3-Day
Sampler's Name:		Due Date:	12/10

SAMPLE RECEIPT

Temp Blank:	Yes No	Wet Ice:	Yes No
Temperature (°C):		Thermometer ID	
Received Intact:	Yes No	Temp: 22.9 °C	ID: XDA
Cooler Custody Seals:	Yes No N/A	Correction Factor: +0.3°C	
Sample Custody Seals:	Yes No N/A	Corrected Temp: 23.2 °C	

ANALYSIS REQUEST

Sample Identification	Matrix	Date Sampled	Time Sampled	Depth	Number of Containers	Chem Analysis
[redacted] P-102				6'-7'		X
TS-111				30'-31'		X
B-1				5'-10'		X

Work Order Notes

TAT starts the day received by the lab, if received by 4:30pm

Sample Comments

Total 200.7 / 6010 200.8 / 6020: 8RCRA 13PPM Texas 11 Al Sb As Ba Be B Cd Ca Cr Co Cu Fe Pb Mg Mn Mo Ni K Se Ag SiO2 Na Sr Tl Sn U V Zn
Circle Method(s) and Metal(s) to be analyzed **TCLP / SPLP 6010:** 8RCRA Sb As Ba Be Cd Cr Co Cu Pb Mn Mo Ni Se Ag Tl U **1631 / 245.1 / 7470 / 7471 : Hg**

Notice: Signature of this document and relinquishment of samples constitutes a valid purchase order from client company to Xenco, its affiliates and subcontractors. It assigns standard terms and conditions of service. Xenco will be liable only for the cost of samples and shall not assume any responsibility for any losses or expenses incurred by the client if such losses are due to circumstances beyond the control of Xenco. A minimum charge of $75.00 will be applied to each project and a charge of $5 for each sample submitted to Xenco, but not analyzed. These terms will be enforced unless previously negotiated.

Relinquished by: (Signature)	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Received by: (Signature)	Date/Time
1 [signature]	[signature]	12/5/18 15:00	2		
3			4		
5			6		

Revised Date 05141B Rev. 2018.1

XENCO Laboratories
Prelogin/Nonconformance Report- Sample Log-In

Client: Alliance Geotechnical Group

Date/ Time Received: 12/05/2018 03:00:00 PM

Work Order #: 607590

Acceptable Temperature Range: 0 - 6 degC
Air and Metal samples Acceptable Range: Ambient

Temperature Measuring device used : XDA

Sample Receipt Checklist		Comments
#1 *Temperature of cooler(s)?	23.2	
#2 *Shipping container in good condition?	**Yes**	
#3 *Samples received on ice?	**No**	
#4 *Custody Seals intact on shipping container/ cooler?	**No**	
#5 Custody Seals intact on sample bottles?	**N/A**	
#6*Custody Seals Signed and dated?	**N/A**	
#7 *Chain of Custody present?	**Yes**	
#8 Any missing/extra samples?	**No**	
#9 Chain of Custody signed when relinquished/ received?	**Yes**	
#10 Chain of Custody agrees with sample labels/matrix?	**Yes**	
#11 Container label(s) legible and intact?	**Yes**	
#12 Samples in proper container/ bottle?	**Yes**	
#13 Samples properly preserved?	**Yes**	
#14 Sample container(s) intact?	**Yes**	
#15 Sufficient sample amount for indicated test(s)?	**Yes**	
#16 All samples received within hold time?	**Yes**	
#17 Subcontract of sample(s)?	**No**	
#18 Water VOC samples have zero headspace?	**N/A**	

*** Must be completed for after-hours delivery of samples prior to placing in the refrigerator**

Analyst: PH Device/Lot#:

Checklist completed by: Angelica Martinez Date: 12/05/2018

Checklist reviewed by: Holly Taylor Date: 12/07/2018

Analytical Report 621837

for

Alliance Geotechnical Group

Project Manager: Juan Perez

DART D2

E17-0811

30-APR-19

Collected By: Bryce V.

9701 Harry Hines Blvd
Dallas, TX 75220

Xenco-Houston (EPA Lab Code: TX00122):
Texas (T104704215-18-28), Arizona (AZ0765), Florida (E871002-24), Louisiana (03054)
Oklahoma (2017-142)

Xenco-Dallas (EPA Lab Code: TX01468):
Texas (T104704295-18-17), Arizona (AZ0809), Arkansas (17-063-0)

Xenco-El Paso (EPA Lab Code: TX00127): Texas (T104704221-18-14)
Xenco-Lubbock (EPA Lab Code: TX00139): Texas (T104704219-18-18)
Xenco-Midland (EPA Lab Code: TX00158): Texas (T104704400-18-18)
Xenco-San Antonio (EPA Lab Code: TNI02385): Texas (T104704534-18-4)
Xenco Phoenix (EPA Lab Code: AZ00901): Arizona (AZ0757)
Xenco-Phoenix Mobile (EPA Lab Code: AZ00901): Arizona (AZM757)
Xenco-Atlanta (LELAP Lab ID #04176)
Xenco-Tampa: Florida (E87429), North Carolina (483)
Xenco-Lakeland: Florida (E84098)

Table of Contents

Cover Page	1
Cover Letter	3
Sample ID Cross Reference	4
Case Narrative	5
Certificate of Analysis (Detailed Report)	6
Explanation of Qualifiers (Flags)	12
LCS / LCSD Recoveries	13
Matrix Spike Recoveries	14
MS / MSD Recoveries	15
Chain of Custody	16
IOS_COC_37512	17
IOS_Check_List_37512	18
Sample Receipt Conformance Report	19

30-APR-19

Project Manager: **Juan Perez**
Alliance Geotechnical Group
3228 Halifax Suite A
Dallas, TX 75247

Reference: XENCO Report No(s): **621837**
DART D2
Project Address: ---

Juan Perez:

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number(s) 621837. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. The uncertainty of measurement associated with the results of analysis reported is available upon request. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 621837 will be filed for 45 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Holly Taylor
Project Manager

Recipient of the Prestigious Small Business Administration Award of Excellence in 1994.
Certified and approved by numerous States and Agencies.
A Small Business and Minority Status Company that delivers SERVICE and QUALITY

Houston - Dallas - Midland - San Antonio - Phoenix - Oklahoma - Latin America

Sample Cross Reference 621837

Alliance Geotechnical Group, Dallas, TX

DART D2

Sample Id	Matrix	Date Collected	Sample Depth	Lab Sample Id
T-112	S	04-22-19 00:00	14 - 15 ft	621837-001
T-204	S	04-22-19 00:00	2 - 7 ft	621837-002
TS-104	S	04-22-19 00:00	13.5 - 15 ft	621837-003
TS-208	S	04-22-19 00:00	5 - 8 ft	621837-004
TS-209	S	04-22-19 00:00	13.5 - 15 ft	621837-005

CASE NARRATIVE

Client Name: Alliance Geotechnical Group
Project Name: DART D2

Project ID: *E17-0811*
Work Order Number(s): *621837*

Report Date: *30-APR-19*
Date Received: *04/22/2019*

This laboratory is NELAC accredited under the Texas Laboratory Accreditation Program for all the methods, analytes, and matrices reported in this data package except as noted. The data have been reviewed and are technically compliant with the requirements of the methods used, except where noted by the laboratory.

Sample receipt non conformances and comments:

None

Sample receipt non conformances and comments per sample:

None

Analytical non conformances and comments:

Batch: LBA-3086594 Chloride, Mercuric Nitrate Method by SM4500-CI- B
Lab Sample ID 621837-001 was randomly selected for Matrix Spike/Matrix Spike Duplicate (MS/MSD).
Chloride recovered above QC limits in the Matrix Spike. Outlier/s are due to possible matrix interference.
Samples in the analytical batch are: 621837-001, -002, -003, -004, -005.
The Laboratory Control Sample for Chloride is within laboratory Control Limits, therefore the data was accepted.

Certificate of Analytical Results
621837
Alliance Geotechnical Group, Dallas, TX
DART D2

Sample Id: **T-112** Matrix: Soil Sample Depth: 14 - 15 ft

Lab Sample Id: 621837-001 Date Collected: 04.22.19 00.00 Date Received: 04.22.19 13.15

Analytical Method: Soluble Sulfate Content in Soil by TEX-145-E Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3087287 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Soluble Sulfate Content	14808-79-8	**99.5**	99.8	39.9	mg/kg	04.29.19 13:45	J	20

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3086594 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	**942**	471	120	mg/kg	04.23.19 12:25	X	94

Analytical Method: Sulfide by SM4500-S-F-00 Prep Method:

Analyst: YAV % Moist: Tech: YAV

Seq Number: 3087452 Date Prep:

Subcontractor: SUB: T104704215-19-29 Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfide, total	18496-25-8	<6.72	20.0	6.72	mg/kg	04.30.19 17:22	U	10

Certificate of Analytical Results
621837
Alliance Geotechnical Group, Dallas, TX
DART D2

Sample Id: **T-204** Matrix: Soil Sample Depth: 2 - 7 ft

Lab Sample Id: 621837-002 Date Collected: 04.22.19 00.00 Date Received: 04.22.19 13.15

Analytical Method: Soluble Sulfate Content in Soil by TEX-145-E Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3087287 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Soluble Sulfate Content	14808-79-8	<39.4	98.5	39.4	mg/kg	04.29.19 13:45	U	20

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3086594 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	**1800**	449	115	mg/kg	04.23.19 12:25		90

Analytical Method: Sulfide by SM4500-S-F-00 Prep Method:

Analyst: YAV % Moist: Tech: YAV

Seq Number: 3087452 Date Prep:

Subcontractor: SUB: T104704215-19-29 Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfide, total	18496-25-8	<6.72	20.0	6.72	mg/kg	04.30.19 17:22	U	10

Certificate of Analytical Results
621837
Alliance Geotechnical Group, Dallas, TX
DART D2

Sample Id: **TS-104** Matrix: Soil Sample Depth: 13.5 - 15 ft

Lab Sample Id: 621837-003 Date Collected: 04.22.19 00.00 Date Received: 04.22.19 13.15

Analytical Method: Soluble Sulfate Content in Soil by TEX-145-E Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3087287 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Soluble Sulfate Content	14808-79-8	<39.2	97.9	39.2	mg/kg	04.29.19 13:45	U	20

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3086594 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	**484**	484	124	mg/kg	04.23.19 12:25	J	97

Analytical Method: Sulfide by SM4500-S-F-00 Prep Method:

Analyst: YAV % Moist: Tech: YAV

Seq Number: 3087452 Date Prep:

Subcontractor: SUB: T104704215-19-29 Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfide, total	18496-25-8	<6.72	20.0	6.72	mg/kg	04.30.19 17:22	U	10

Certificate of Analytical Results
621837
Alliance Geotechnical Group, Dallas, TX
DART D2

Sample Id: **TS-208** Matrix: Soil Sample Depth: 5 - 8 ft

Lab Sample Id: 621837-004 Date Collected: 04.22.19 00.00 Date Received: 04.22.19 13.15

Analytical Method: Soluble Sulfate Content in Soil by TEX-145-E Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3087287 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Soluble Sulfate Content	14808-79-8	<39.9	99.8	39.9	mg/kg	04.29.19 13:45	U	20

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3086594 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	**262**	4.86	1.24	mg/kg	04.23.19 12:25		1

Analytical Method: Sulfide by SM4500-S-F-00 Prep Method:

Analyst: YAV % Moist: Tech: YAV

Seq Number: 3087452 Date Prep:

Subcontractor: SUB: T104704215-19-29 Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfide, total	18496-25-8	<6.72	20.0	6.72	mg/kg	04.30.19 17:22	U	10

Certificate of Analytical Results
621837
Alliance Geotechnical Group, Dallas, TX
DART D2

Sample Id: **TS-209** Matrix: Soil Sample Depth: 13.5 - 15 ft

Lab Sample Id: 621837-005 Date Collected: 04.22.19 00.00 Date Received: 04.22.19 13.15

Analytical Method: Soluble Sulfate Content in Soil by TEX-145-E Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3087287 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Soluble Sulfate Content	14808-79-8	<39.1	97.7	39.1	mg/kg	04.29.19 13:45	U	20

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:

Analyst: REW % Moist: Tech: REW

Seq Number: 3086594 Date Prep:

Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	<125	489	125	mg/kg	04.23.19 12:25	U	98

Analytical Method: Sulfide by SM4500-S-F-00 Prep Method:

Analyst: YAV % Moist: Tech: YAV

Seq Number: 3087452 Date Prep:

Subcontractor: SUB: T104704215-19-29 Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfide, total	18496-25-8	<6.72	20.0	6.72	mg/kg	04.30.19 17:41	U	10

Certificate of Analytical Results
621837
Alliance Geotechnical Group, Dallas, TX
DART D2

Sample Id: **3086594-1-BLK** Matrix: Solid Sample Depth:
Lab Sample Id: 3086594-1-BLK Date Collected: Date Received:

Analytical Method: Chloride, Mercuric Nitrate Method by SM4500-CI- B Prep Method:
Analyst: REW % Moist: Tech: REW
Seq Number: 3086594 Date Prep:
Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Chloride	16887-00-6	<1.27	4.97	1.27	mg/kg	04.23.19 12:25	U	1

Sample Id: **3087287-1-BLK** Matrix: Solid Sample Depth:
Lab Sample Id: 3087287-1-BLK Date Collected: Date Received:

Analytical Method: Soluble Sulfate Content in Soil by TEX-145-E Prep Method:
Analyst: REW % Moist: Tech: REW
Seq Number: 3087287 Date Prep:
Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Soluble Sulfate Content	14808-79-8	<19.9	49.9	19.9	mg/kg	04.29.19 13:45	U	10

Sample Id: **3087452-1-BLK** Matrix: Solid Sample Depth:
Lab Sample Id: 3087452-1-BLK Date Collected: Date Received:

Analytical Method: Sulfide by SM4500-S-F-00 Prep Method:
Analyst: YAV % Moist: Tech: YAV
Seq Number: 3087452 Date Prep:
Subcontractor: SUB: T104704215-19-29 Prep seq:

Parameter	CAS Number	Result	MQL	SDL	Units	Analysis Date	Flag	Dil Factor
Sulfide, total	18496-25-8	<6.72	20.0	6.72	mg/kg	04.30.19 17:22	U	10

Flagging Criteria

X In our quality control review of the data a QC deficiency was observed and flagged as noted. MS/MSD recoveries were found to be outside of the laboratory control limits due to possible matrix /chemical interference, or a concentration of target analyte high enough to affect the recovery of the spike concentration. This condition could also affect the relative percent difference in the MS/MSD.

B A target analyte or common laboratory contaminant was identified in the method blank. Its presence indicates possible field or laboratory contamination.

D The sample(s) were diluted due to targets detected over the highest point of the calibration curve, or due to matrix interference. Dilution factors are included in the final results. The result is from a diluted sample.

E The data exceeds the upper calibration limit; therefore, the concentration is reported as estimated.

F RPD exceeded lab control limits.

J The target analyte was positively identified below the quantitation limit and above the detection limit.

U Analyte was not detected.

L The LCS data for this analytical batch was reported below the laboratory control limits for this analyte. The department supervisor and QA Director reviewed data. The samples were either reanalyzed or flagged as estimated concentrations.

H The LCS data for this analytical batch was reported above the laboratory control limits. Supporting QC Data were reviewed by the Department Supervisor and QA Director. Data were determined to be valid for reporting.

K Sample analyzed outside of recommended hold time.

JN A combination of the "N" and the "J" qualifier. The analysis indicates that the analyte is "tentatively identified" and the associated numerical value may not be consistent with the amount actually present in the environmental sample.

** Surrogate recovered outside laboratory control limit.

BRL Below Reporting Limit.

RL Reporting Limit

MDL Method Detection Limit **SDL** Sample Detection Limit **LOD** Limit of Detection

PQL Practical Quantitation Limit **MQL** Method Quantitation Limit **LOQ** Limit of Quantitation

DL Method Detection Limit

NC Non-Calculable

SMP Client Sample **BLK** Method Blank

BKS/LCS Blank Spike/Laboratory Control Sample **BKSD/LCSD** Blank Spike Duplicate/Laboratory Control Sample Duplicate

MD/SD Method Duplicate/Sample Duplicate **MS** Matrix Spike **MSD:** Matrix Spike Duplicate

+ NELAC certification not offered for this compound.

***** (Next to analyte name or method description) = Outside XENCO's scope of NELAC accreditation

BS / BSD Recoveries

Project Name: DART D2

Work Order #: 621837 **Project ID:** E17-0811

Analyst: REW **Date Prepared:** 04/23/2019 **Date Analyzed:** 04/23/2019

Lab Batch ID: 3086594 **Sample:** 3086594-1-BKS **Batch #:** 1 **Matrix:** Solid

Units: mg/kg

BLANK /BLANK SPIKE / BLANK SPIKE DUPLICATE RECOVERY STUDY

Chloride, Mercuric Nitrate Method by SM4500-CI- B Analytes	Blank Sample Result [A]	Spike Added [B]	Blank Spike Result [C]	Blank Spike %R [D]	Spike Added [E]	Blank Spike Duplicate Result [F]	Blk. Spk Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Chloride	<1.27	49.6	49.6	100	49.4	49.4	100	0	75-125	25	

Analyst: REW **Date Prepared:** 04/29/2019 **Date Analyzed:** 04/29/2019

Lab Batch ID: 3087287 **Sample:** 3087287-1-BKS **Batch #:** 1 **Matrix:** Solid

Units: mg/kg

BLANK /BLANK SPIKE / BLANK SPIKE DUPLICATE RECOVERY STUDY

Soluble Sulfate Content in Soil by TEX-145-E Analytes	Blank Sample Result [A]	Spike Added [B]	Blank Spike Result [C]	Blank Spike %R [D]	Spike Added [E]	Blank Spike Duplicate Result [F]	Blk. Spk Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Soluble Sulfate Content	<19.9	199	209	105	199	209	105	0	75-125	25	

Analyst: YAV **Date Prepared:** 04/30/2019 **Date Analyzed:** 04/30/2019

Lab Batch ID: 3087452 **Sample:** 3087452-1-BKS **Batch #:** 1 **Matrix:** Solid

Units: mg/kg

BLANK /BLANK SPIKE / BLANK SPIKE DUPLICATE RECOVERY STUDY

Sulfide by SM4500-S-F-00 Analytes	Blank Sample Result [A]	Spike Added [B]	Blank Spike Result [C]	Blank Spike %R [D]	Spike Added [E]	Blank Spike Duplicate Result [F]	Blk. Spk Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Sulfide, total	<6.72	500	476	95	500	476	95	0	75-120	20	

Relative Percent Difference RPD = 200*|(C-F)/(C+F)|
Blank Spike Recovery [D] = 100*(C)/[B]
Blank Spike Duplicate Recovery [G] = 100*(F)/[E]
All results are based on MDL and Validated for QC Purposes

Form 3 - MS Recoveries

Project Name: DART D2

Work Order #: 621837

Lab Batch #: 3086594 **Project ID:** E17-0811

Date Analyzed: 04/23/2019 **Date Prepared:** 04/23/2019 **Analyst:** REW

QC- Sample ID: 621837-001 S **Batch #:** 1 **Matrix:** Soil

Reporting Units: mg/kg

Chloride, Mercuric Nitrate Method by SM4500 Cl-C	MATRIX / MATRIX SPIKE RECOVERY STUDY					
Analytes	Parent Sample Result [A]	Spike Added [B]	Spiked Sample Result [C]	%R [D]	Control Limits %R	Flag
Chloride	942	4930	8380	151	75-125	X

Lab Batch #: 3087287

Date Analyzed: 04/29/2019 **Date Prepared:** 04/29/2019 **Analyst:** REW

QC- Sample ID: 621837-002 S **Batch #:** 1 **Matrix:** Soil

Reporting Units: mg/kg

Soluble Sulfate Content in Soil by TEX-145-E	MATRIX / MATRIX SPIKE RECOVERY STUDY					
Analytes	Parent Sample Result [A]	Spike Added [B]	Spiked Sample Result [C]	%R [D]	Control Limits %R	Flag
Soluble Sulfate Content	<38.8	388	399	103	75-125	

Matrix Spike Percent Recovery [D] = 100*(C-A)/B
Relative Percent Difference [E] = 200*(C-A)/(C+B)
All Results are based on MDL and Validated for QC Purposes

BRL - Below Reporting Limit

Form 3 - MS / MSD Recoveries

Project Name: DART D2

Work Order # : 621837 **Project ID:** E17-0811

Lab Batch ID: 3087452 **QC- Sample ID:** 621839-001 S **Batch #:** 1 **Matrix:** Soil

Date Analyzed: 04/30/2019 **Date Prepared:** 04/30/2019 **Analyst:** YAV

Reporting Units: mg/kg

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY STUDY

Sulfide by SM4500-S-F-00 Analytes	Parent Sample Result [A]	Spike Added [B]	Spiked Sample Result [C]	Spiked Sample %R [D]	Spike Added [E]	Duplicate Spiked Sample Result [F]	Spiked Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Sulfide, total	<6.72	500	488	98	500	484	97	1	75-120	20	

Matrix Spike Percent Recovery [D] = 100*(C-A)/B

Matrix Spike Duplicate Percent Recovery [G] = 100*(F-A)/E

Relative Percent Difference RPD = 200*|(C-F)/(C+F)|

ND = Not Detected, J = Present Below Reporting Limit, B = Present in Blank, NR = Not Requested, I = Interference, NA = Not Applicable
N = See Narrative, EQL = Estimated Quantitation Limit, NC = Non Calculable - Sample amount is > 4 times the amount spiked.

Chain of Custody

XENCO LABORATORIES

Houston,TX (281) 240-4200 Dallas,TX (214) 902-0300 San Antonio,TX (210) 509-3334
Midland,TX (432-704-5440) EL Paso,TX (915)585-3443 Lubbock,TX (806)794-1296
Hobbs,NM (575-392-7550) Phoenix,AZ (480-355-0900) Atlanta,GA (770-449-8800) Tampa,FL (813-620-2000)

Work Order No: 121837-D

www.xenco.com Page _____ of _____

Project Manager:	Juan Perez	Bill to: (if different)	
Company Name:	Alliance Geotechnical	Company Name:	
Address:	3228 Halifax St	Address:	
City, State ZIP:	Dallas, Tx 75247	City, State ZIP:	
Phone:	972-444-8889	Email:	

Work Order Comments

Program: UST/PST ☐ PRP ☐ Brownfields ☐ RRC ☐ Superfund ☐
State of Project:
Reporting: Level II ☐ Level III ☐ PST/UST ☐ TRRP ☐ Level IV ☐
Deliverables: EDD ☐ ADaPT ☐ Other:

Project Name:	DART D2	Turn Around	
Project Number:	E17-0811	Routine	☑
P.O. Number:		Rush:	
Sampler's Name:	Bryce V	Due Date:	

SAMPLE RECEIPT				
Temp Blank:	Yes No	Wet Ice:	Yes No	
Temperature (°C):		Thermometer ID:		
Received Intact:	Yes No			
Cooler Custody Seals:	Yes No N/A			
Sample Custody Seals:	Yes No N/A	Total Containers:		

Temp: 24.1 °C ID: XDA
Correction Factor: -0.1°C
Corrected Temp: 24.0 °C

ANALYSIS REQUEST

Sample Identification	Matrix	Date Sampled	Time Sampled	Depth	Number of Containers	Chloride Content	Sulfide Content	Water Soluble Sulfate Ion (AASHTO T290, T291)
T-112		4-22-19		14-15'		X	X	X
T-204		↓		2-7'		X	X	X
TS-104		↓		13.5-15'		X	X	X
TS-208		↓		5-8'		X	X	X
TS-209		↓		13.5-15'		X	X	X

Work Order Notes

TAT starts the day received by the lab, if received by 4:30pm

Sample Comments

Total 200.7 / 6010 200.8 / 6020: 8RCRA 13PPM Texas 11 Al Sb As Ba Be B Cd Ca Cr Co Cu Fe Pb Mg Mn Mo Ni K Se Ag SiO2 Na Sr Tl Sn U V Zn
Circle Method(s) and Metal(s) to be analyzed TCLP / SPLP 6010: 8RCRA Sb As Ba Be Cd Cr Co Cu Pb Mn Mo Ni Se Ag Tl U 1631 / 245.1 / 7470 / 7471 : Hg

Notice: Signature of this document and relinquishment of samples constitutes a valid purchase order from client company to Xenco, its affiliates and subcontractors. It assigns standard terms and conditions of service. Xenco will be liable only for the cost of samples and shall not assume any responsibility for any losses or expenses incurred by the client if such losses are due to circumstances beyond the control of Xenco. A minimum charge of $75.00 will be applied to each project and a charge of $5 for each sample submitted to Xenco, but not analyzed. These terms will be enforced unless previously negotiated.

Relinquished by: (Signature)	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Received by: (Signature)	Date/Time
1	Whitney Capps	4/22/19 13:15	2		
3			4		
5			6		

Revised Date 051416 Rev. 2016.1

Final 1.000

Inter-Office Shipment

IOS Number **37512**

Date/Time: 04/22/19 14:56
Lab# From: **Dallas**
Lab# To: **Houston**

Created by: Whitney Capps
Delivery Priority:
Air Bill No.: 775030752544

Please send report to: Holly Taylor
Address: 9701 Harry Hines Blvd
E-Mail: holly.taylor@xenco.com

Sample Id	Matrix	Client Sample Id	Sample Collection	Method	Method Name	Lab Due	HT Due	PM	Analytes	Sign
621837-001	S	T-112	04/22/19 00:00	SM4500SF00	Sulfide by SM4500-S-F-00	04/26/19	05/06/19	HTA	S	
621837-002	S	T-204	04/22/19 00:00	SM4500SF00	Sulfide by SM4500-S-F-00	04/26/19	05/06/19	HTA	S	
621837-003	S	TS-104	04/22/19 00:00	SM4500SF00	Sulfide by SM4500-S-F-00	04/26/19	05/06/19	HTA	S	
621837-004	S	TS-208	04/22/19 00:00	SM4500SF00	Sulfide by SM4500-S-F-00	04/26/19	05/06/19	HTA	S	
621837-005	S	TS-209	04/22/19 00:00	SM4500SF00	Sulfide by SM4500-S-F-00	04/26/19	05/06/19	HTA	S	

Inter Office Shipment or Sample Comments:

Relinquished By: Whitney Capps

Date Relinquished: 04/22/2019

Received By: Travis Simmons

Date Received: 04/23/2019 09:30

Cooler Temperature: 1.2

XENCO Laboratories

Inter Office Report- Sample Receipt Checklist

Sent To: Houston

IOS #: 37512

Acceptable Temperature Range: 0 - 6 degC
Air and Metal samples Acceptable Range: Ambient
Temperature Measuring device used : HOU-068

Sent By: Whitney Capps **Date Sent:** 04/22/2019 02:56 PM

Received By: Travis Simmons **Date Received:** 04/23/2019 09:30 AM

Sample Receipt Checklist		Comments
#1 *Temperature of cooler(s)?	1.2	
#2 *Shipping container in good condition?	**Yes**	
#3 *Samples received with appropriate temperature?	**Yes**	
#4 *Custody Seals intact on shipping container/ cooler?	**Yes**	
#5 *Custody Seals Signed and dated for Containers/coolers	**Yes**	
#6 *IOS present?	**Yes**	
#7 Any missing/extra samples?	**No**	
#8 IOS agrees with sample label(s)/matrix?	**Yes**	
#9 Sample matrix/ properties agree with IOS?	**Yes**	
#10 Samples in proper container/ bottle?	**Yes**	
#11 Samples properly preserved?	**Yes**	
#12 Sample container(s) intact?	**Yes**	
#13 Sufficient sample amount for indicated test(s)?	**Yes**	
#14 All samples received within hold time?	**Yes**	

*** Must be completed for after-hours delivery of samples prior to placing in the refrigerator**

NonConformance:

Corrective Action Taken:

Nonconformance Documentation

Contact: _____ **Contacted by :** _____ **Date:** _____

Checklist reviewed by: _____ Date: 04/23/2019
Travis Simmons

XENCO Laboratories
Prelogin/Nonconformance Report- Sample Log-In

Client: Alliance Geotechnical Group

Date/ Time Received: 04/22/2019 01:15:00 PM

Work Order #: 621837

Acceptable Temperature Range: 0 - 6 degC
Air and Metal samples Acceptable Range: Ambient

Temperature Measuring device used : XDA

Sample Receipt Checklist		Comments
#1 *Temperature of cooler(s)?	24	
#2 *Shipping container in good condition?	**Yes**	
#3 *Samples received on ice?	**No**	
#4 *Custody Seals intact on shipping container/ cooler?	**No**	
#5 Custody Seals intact on sample bottles?	**No**	
#6*Custody Seals Signed and dated?	**N/A**	
#7 *Chain of Custody present?	**Yes**	
#8 Any missing/extra samples?	**No**	
#9 Chain of Custody signed when relinquished/ received?	**Yes**	
#10 Chain of Custody agrees with sample labels/matrix?	**Yes**	
#11 Container label(s) legible and intact?	**Yes**	
#12 Samples in proper container/ bottle?	**Yes**	
#13 Samples properly preserved?	**Yes**	
#14 Sample container(s) intact?	**Yes**	
#15 Sufficient sample amount for indicated test(s)?	**Yes**	
#16 All samples received within hold time?	**Yes**	
#17 Subcontract of sample(s)?	**Yes**	Xenco Stafford: Sulfide
#18 Water VOC samples have zero headspace?	**N/A**	

*** Must be completed for after-hours delivery of samples prior to placing in the refrigerator**

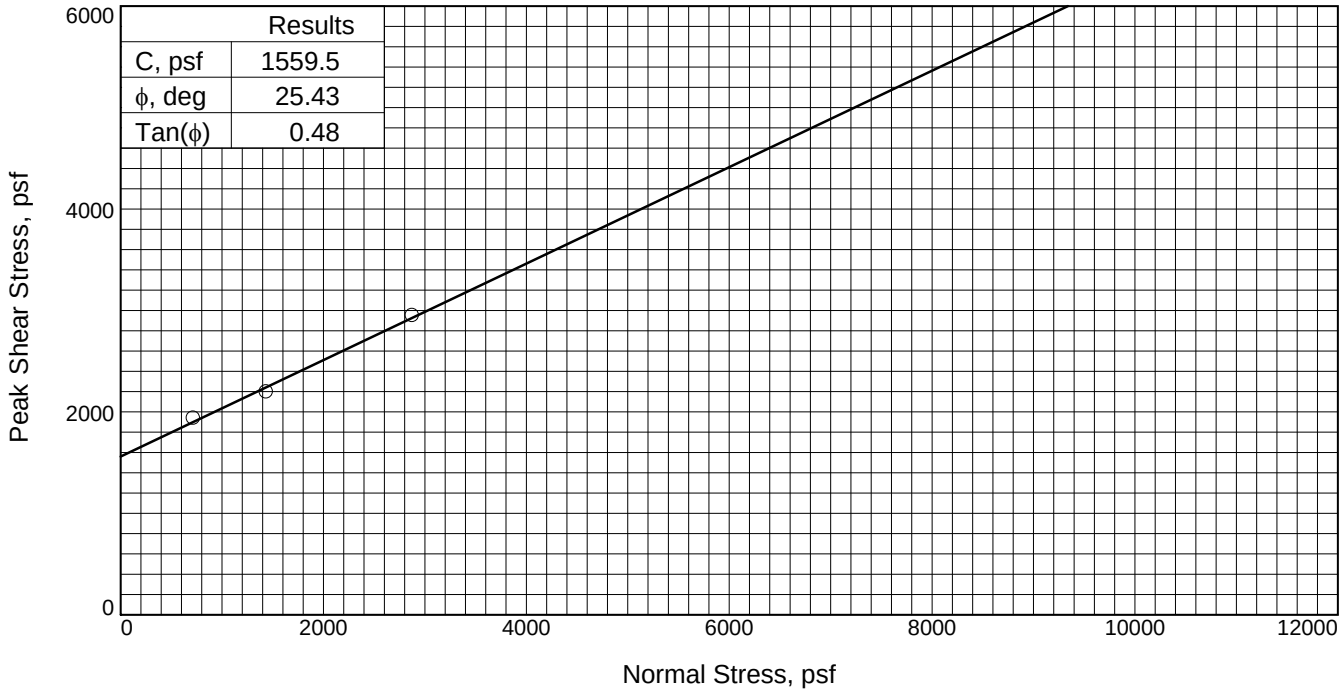
Analyst: PH Device/Lot#:

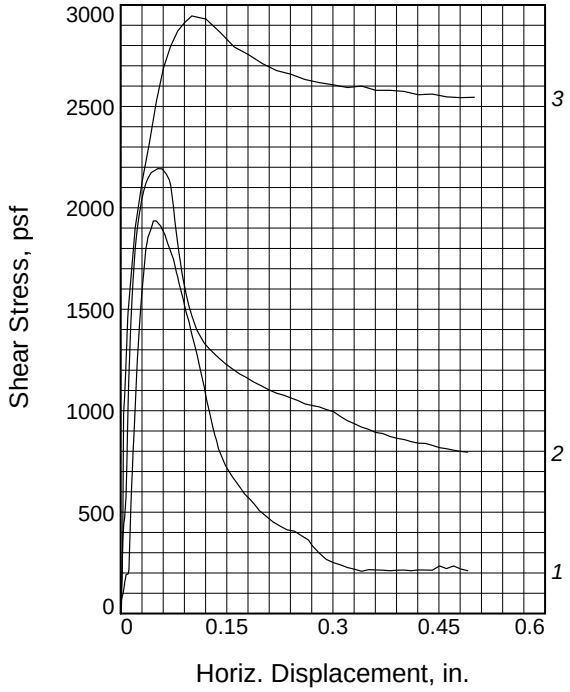
Checklist completed by: Whitney Capps Date: 04/22/2019

Checklist reviewed by: Holly Taylor Date: 04/24/2019

APPENDIX E-4

DIRECT SHEAR TEST RESULTS





Sample No.		1	2	3
Initial	Water Content, %	11.2	11.2	11.2
	Dry Density, pcf	117.9	117.8	117.9
	Saturation, %	70.2	70.1	70.2
	Void Ratio	0.4295	0.4303	0.4295
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	17.8	15.6	14.6
	Dry Density, pcf	113.8	116.3	117.8
	Saturation, %	99.8	93.9	91.7
	Void Ratio	0.4815	0.4498	0.4311
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.036	1.014	1.001
Normal Stress, psf		720.0	1440.0	2880.0
Peak Shear Stress, psf		1935.5	2193.8	2945.7
Displacement, in.		0.049	0.053	0.101
Residual Stress, psf				
Displacement, in.				
Strain rate, in./min.		0.050	0.050	0.050

Sample Type: Undisturbed
Description: SANDY CLAY, very hard, moist, reddish brown (CL)

Assumed Specific Gravity= 2.70
Remarks: ASTM D3080
Shear Rate, in./min. = 0.0005

Figure _____

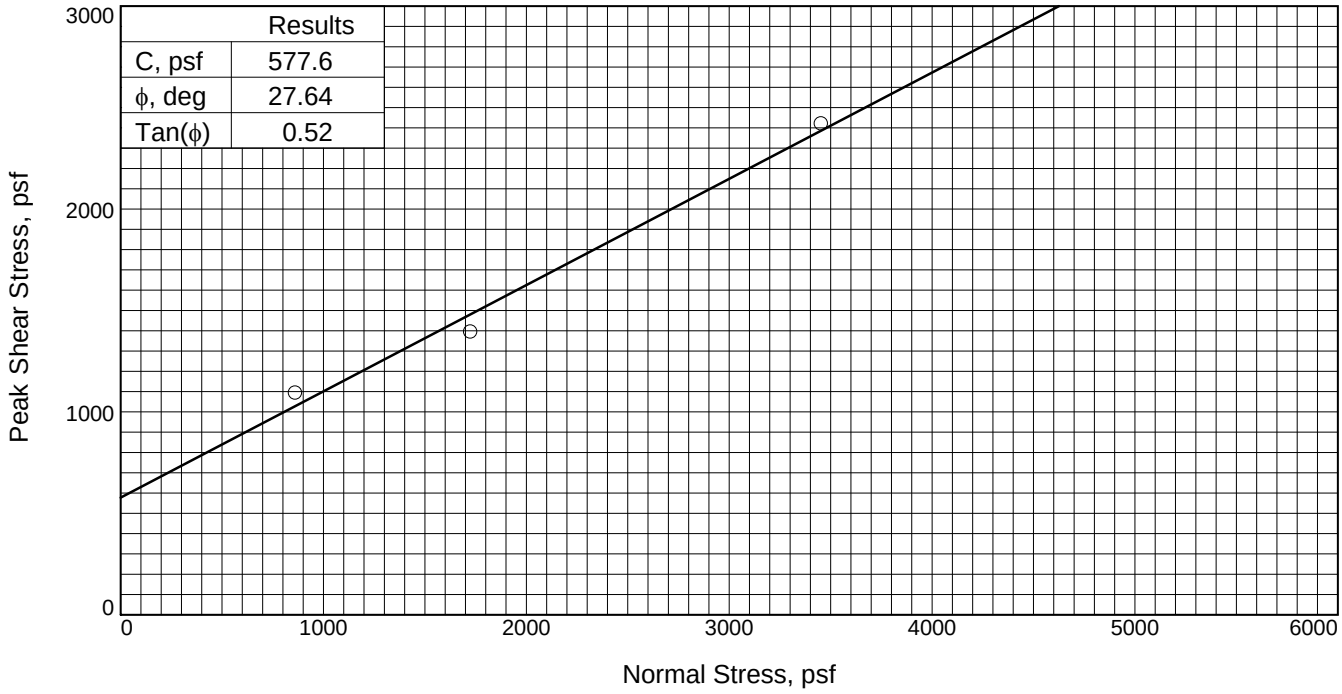
Client:

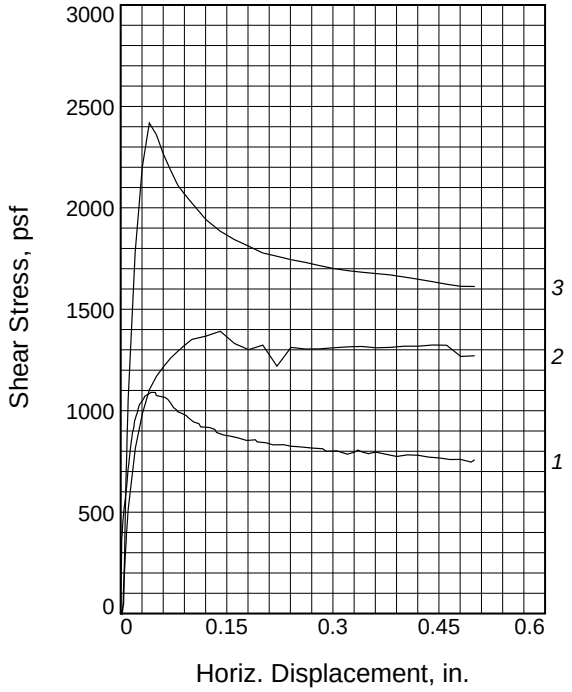
Project: DART D-2

Location: B-1
Depth: 5-10'
Proj. No.: E17-0811 **Date Sampled:**

DIRECT SHEAR TEST REPORT
Alliance Geotechnical Group, Inc.
Dallas, TX

Checked By: HS





Sample No.		1	2	3
Initial	Water Content, %	16.2	16.2	16.2
	Dry Density, pcf	112.2	112.8	112.9
	Saturation, %	85.9	87.3	87.2
	Void Ratio	0.5136	0.5055	0.5038
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	18.9	18.2	17.8
	Dry Density, pcf	111.9	113.4	114.0
	Saturation, %	99.5	99.4	98.7
	Void Ratio	0.5169	0.4975	0.4897
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.002	0.995	0.991
Normal Stress, psf		864.0	1728.0	3456.0
Peak Shear Stress, psf		1090.7	1391.7	2417.9
Displacement, in.		0.043	0.141	0.041
Residual Stress, psf				
Displacement, in.				
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Undisturbed
Description: CLAY, very stiff to hard, tan and gray w/ calcareous nodules (CH)

Assumed Specific Gravity= 2.72
Remarks: ASTM D3080
Shear Rate, in./min. = 0.001

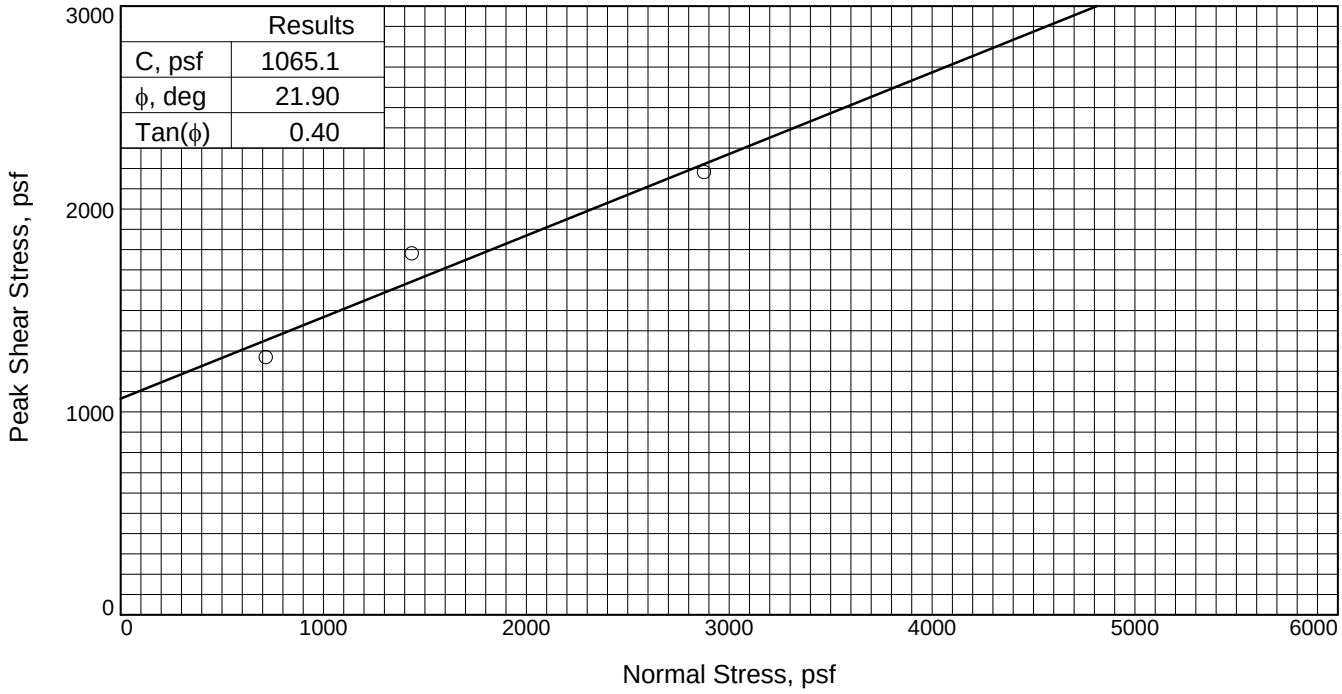
Client:

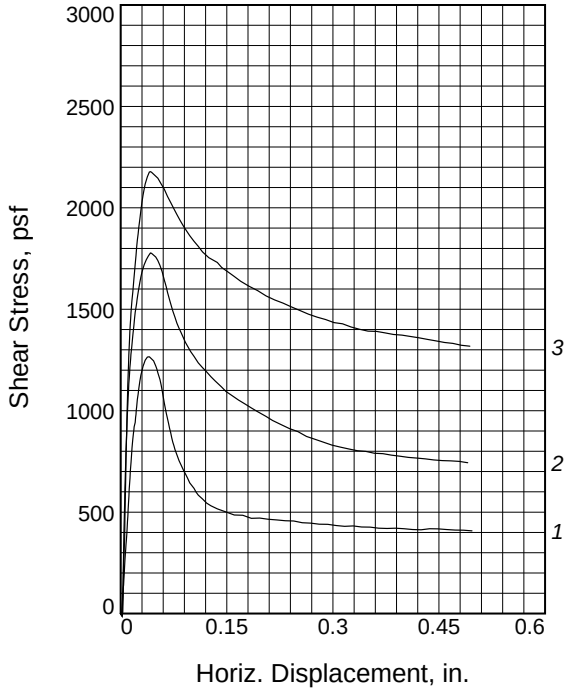
Project: DART D-2

Location: TS-111
Depth: 20-21'
Proj. No.: E17-0811

DIRECT SHEAR TEST REPORT
Alliance Geotechnical Group, Inc.
Dallas, TX

Checked By: HS





Sample No.		1	2	3
Initial	Water Content, %	24.5	24.5	24.5
	Dry Density, pcf	96.6	96.6	96.5
	Saturation, %	87.7	87.8	87.5
	Void Ratio	0.7646	0.7635	0.7657
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	27.9	25.7	24.4
	Dry Density, pcf	95.2	96.1	96.2
	Saturation, %	96.4	90.7	86.4
	Void Ratio	0.7909	0.7733	0.7712
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.015	1.006	1.003
Normal Stress, psf		720.0	1440.0	2880.0
Peak Shear Stress, psf		1265.6	1777.5	2178.5
Displacement, in.		0.039	0.042	0.042
Residual Stress, psf				
Displacement, in.				
Strain rate, in./min.		0.036	0.036	0.036

Sample Type: Undisturbed
Description: Dark brown clay

Assumed Specific Gravity= 2.73
Remarks: ASTM D3080
Shear Rate in./min. = 0.0009

Figure _____

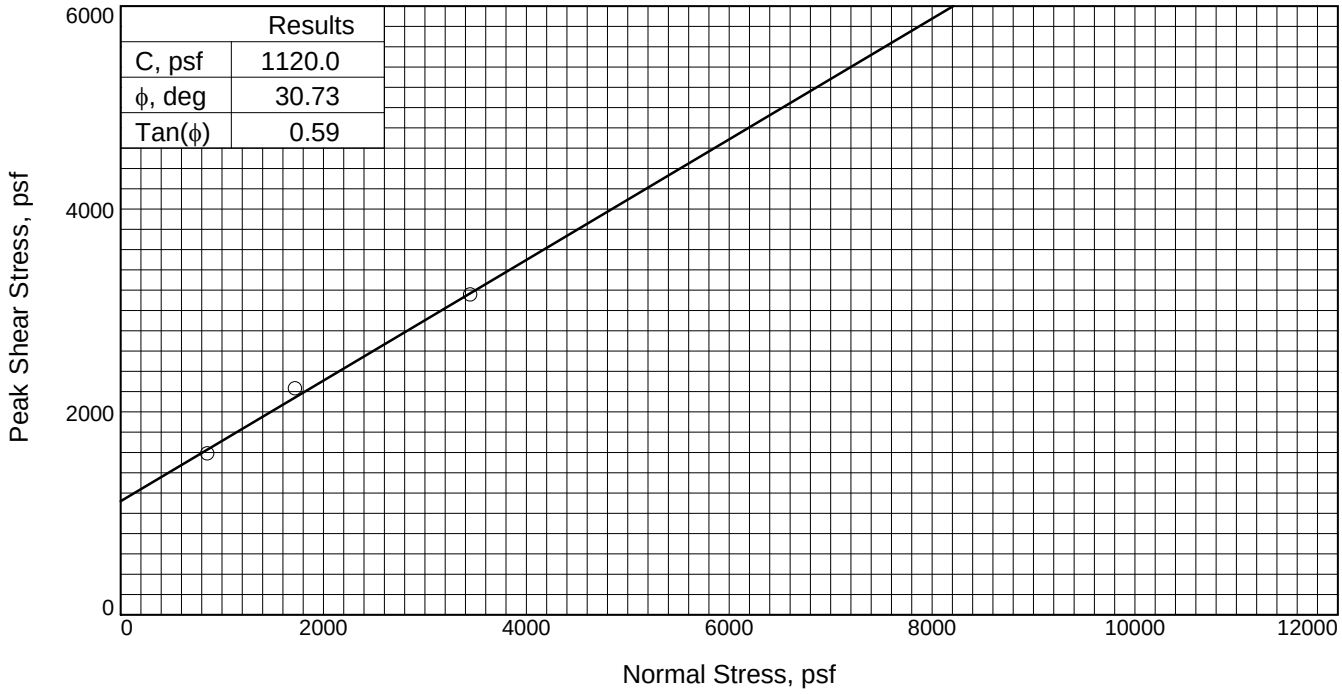
Client:

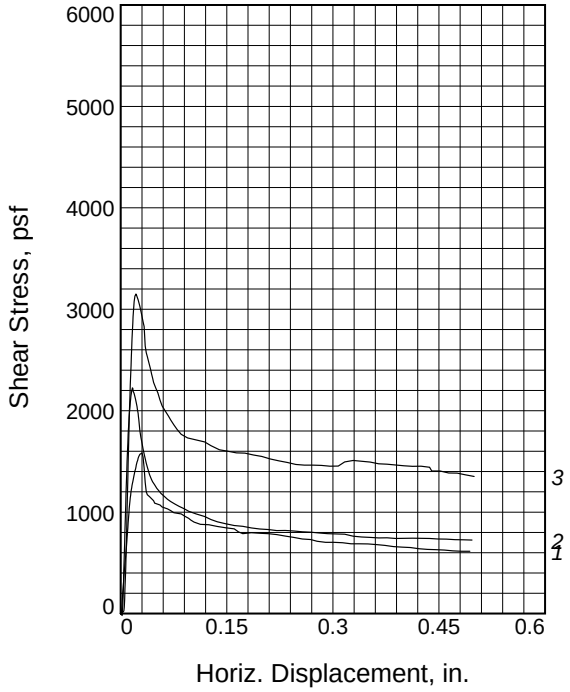
Project: DART D-2

Location: T-112
Depth: 2-4.5'
Proj. No.: E17-0811 **Date Sampled:**

DIRECT SHEAR TEST REPORT
Alliance Geotechnical Group, Inc.
Dallas, TX

Checked By: HS





Sample No.		1	2	3
Initial	Water Content, %	18.9	18.9	18.9
	Dry Density, pcf	110.3	110.3	110.3
	Saturation, %	95.3	95.3	95.3
	Void Ratio	0.5393	0.5393	0.5393
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	19.6	18.2	16.2
	Dry Density, pcf	109.1	109.6	110.1
	Saturation, %	95.6	89.9	81.3
	Void Ratio	0.5570	0.5498	0.5422
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.012	1.007	1.002
Normal Stress, psf		864.0	1728.0	3456.0
Peak Shear Stress, psf		1583.0	2223.3	3149.2
Displacement, in.		0.030	0.017	0.022
Residual Stress, psf				
Displacement, in.				
Strain rate, in./min.		0.036	0.036	0.036

Sample Type: Undisturbed
Description: CLAY, tan, with sand lenses and seams (CH)

Assumed Specific Gravity= 2.72
Remarks: ASTM D 3080

Figure _____

Client:

Project: DART D-2

Location: TS-207
Depth: 14-15'
Proj. No.: E17-0811 **Date Sampled:**

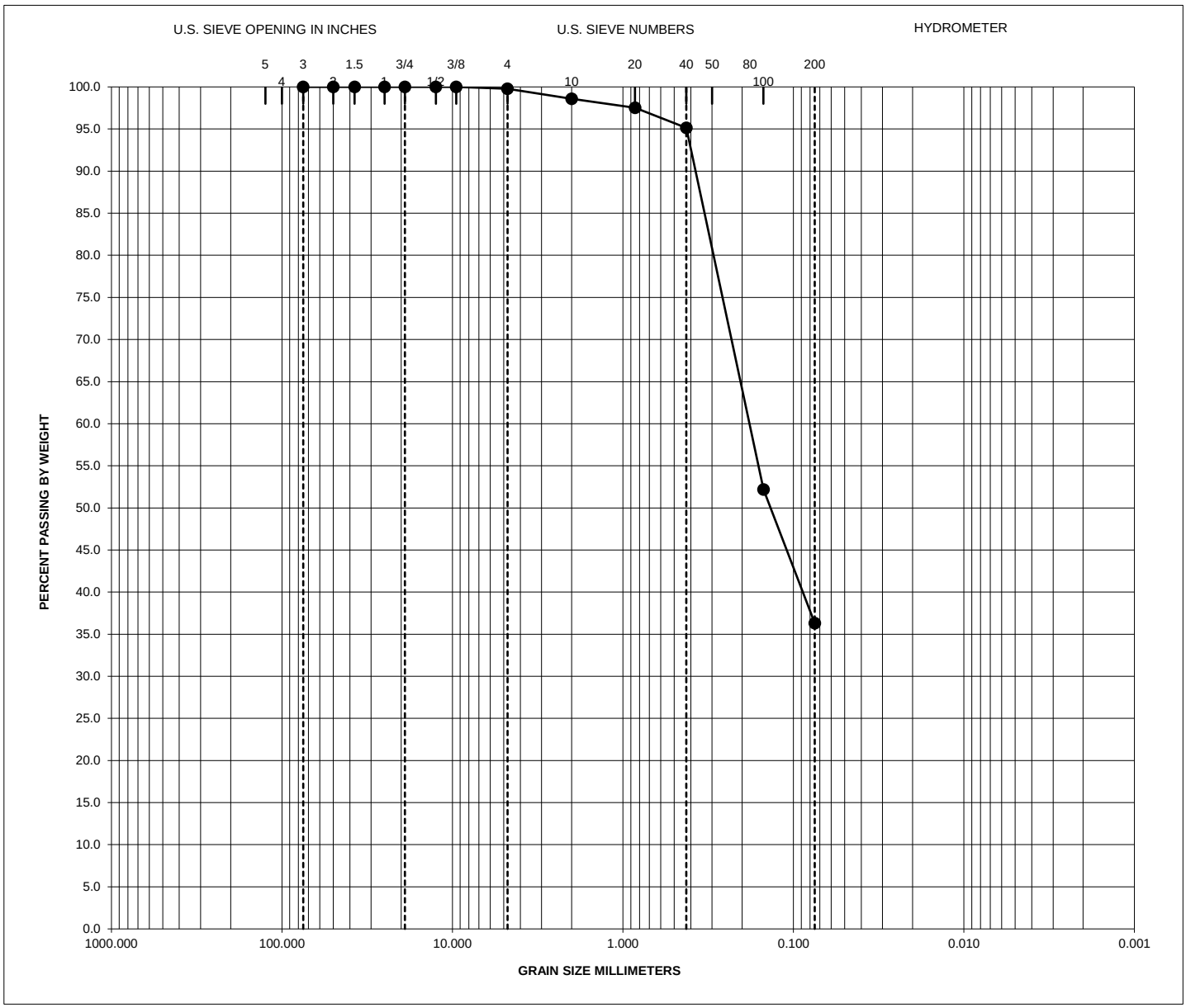
DIRECT SHEAR TEST REPORT
Alliance Geotechnical Group, Inc.
Dallas, TX

Checked By: HS

APPENDIX E-5

SIEVE & HYDROMETER

TEST RESULTS



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-1**	**2'-3'**	**SAND, very loose, moist, gray and tan to tan (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-1**	**2'-3'**					0.21	63.48	36.31

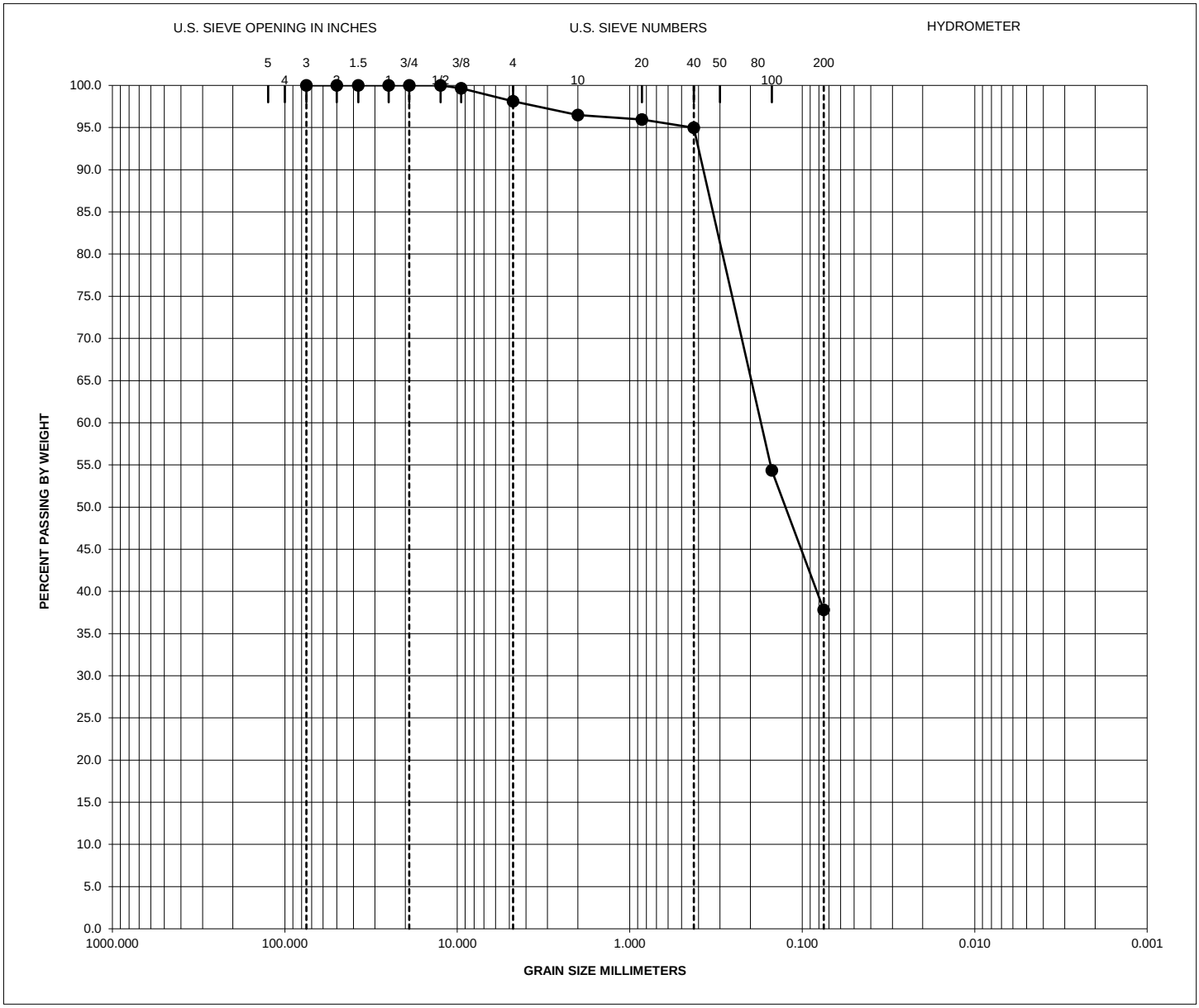
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**B-1** **3'-4.5'**	**SAND, very loose, moist, gray and tan to tan (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**B-1** **3'-4.5'**					1.87	60.33	37.80

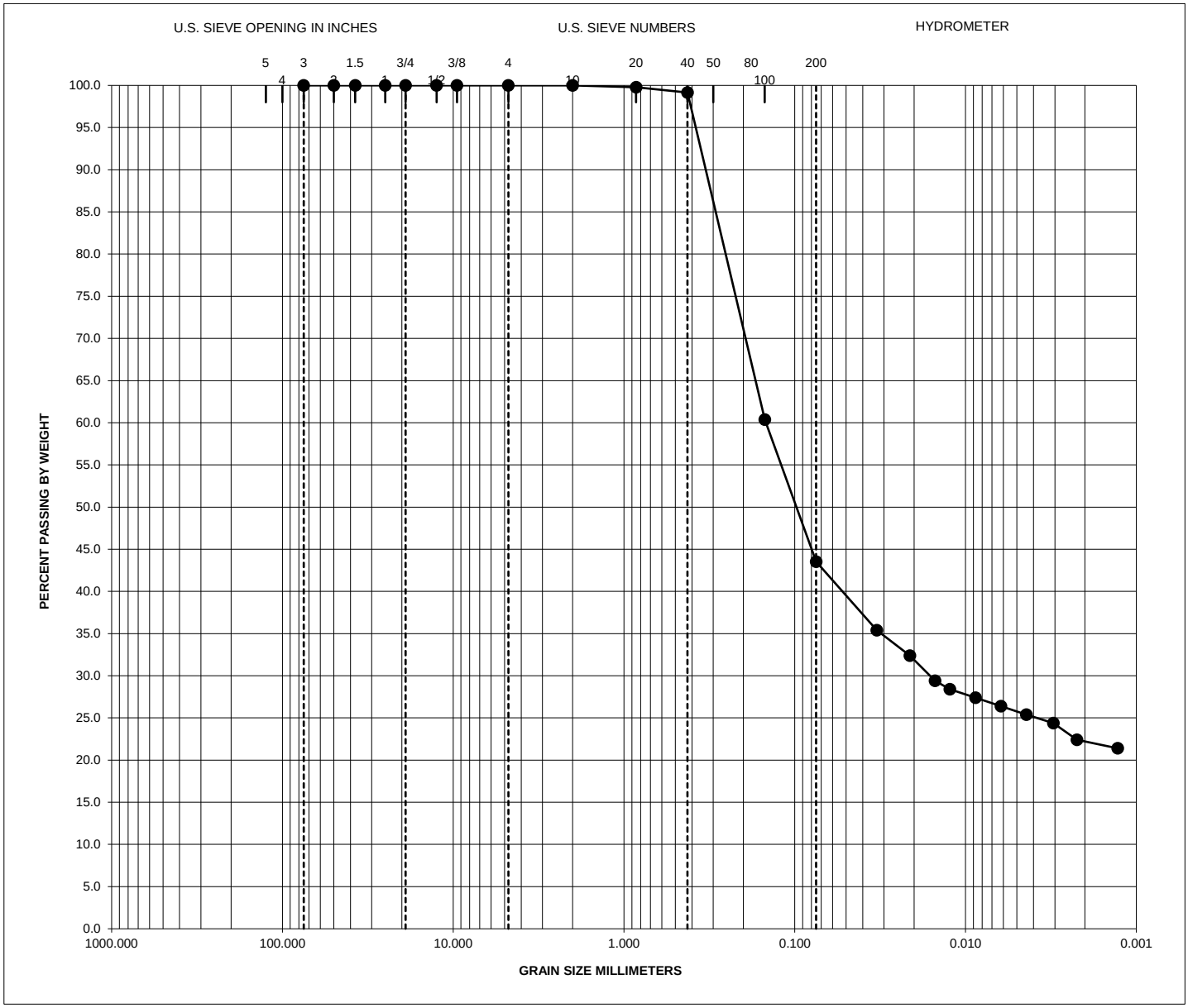
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-1**	**5'-10'**	**SANDY CLAY, very hard, moist, reddish brown (CL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-1**	**5'-10'**					0.00	56.46	43.54

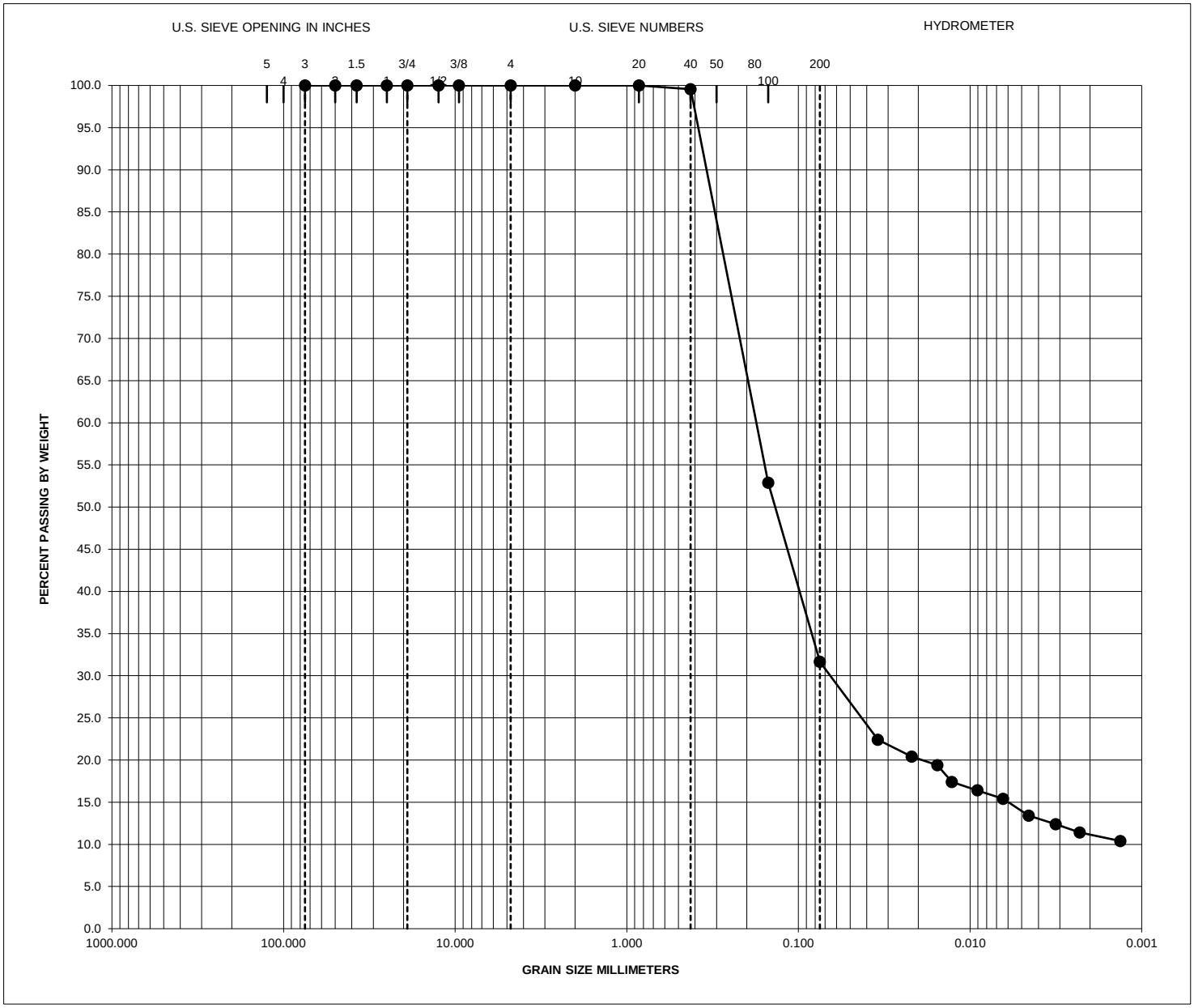
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**B-1 13'-14'**	**CLAYEY SAND, very loose, moist, reddish tan and brown (SC)**					

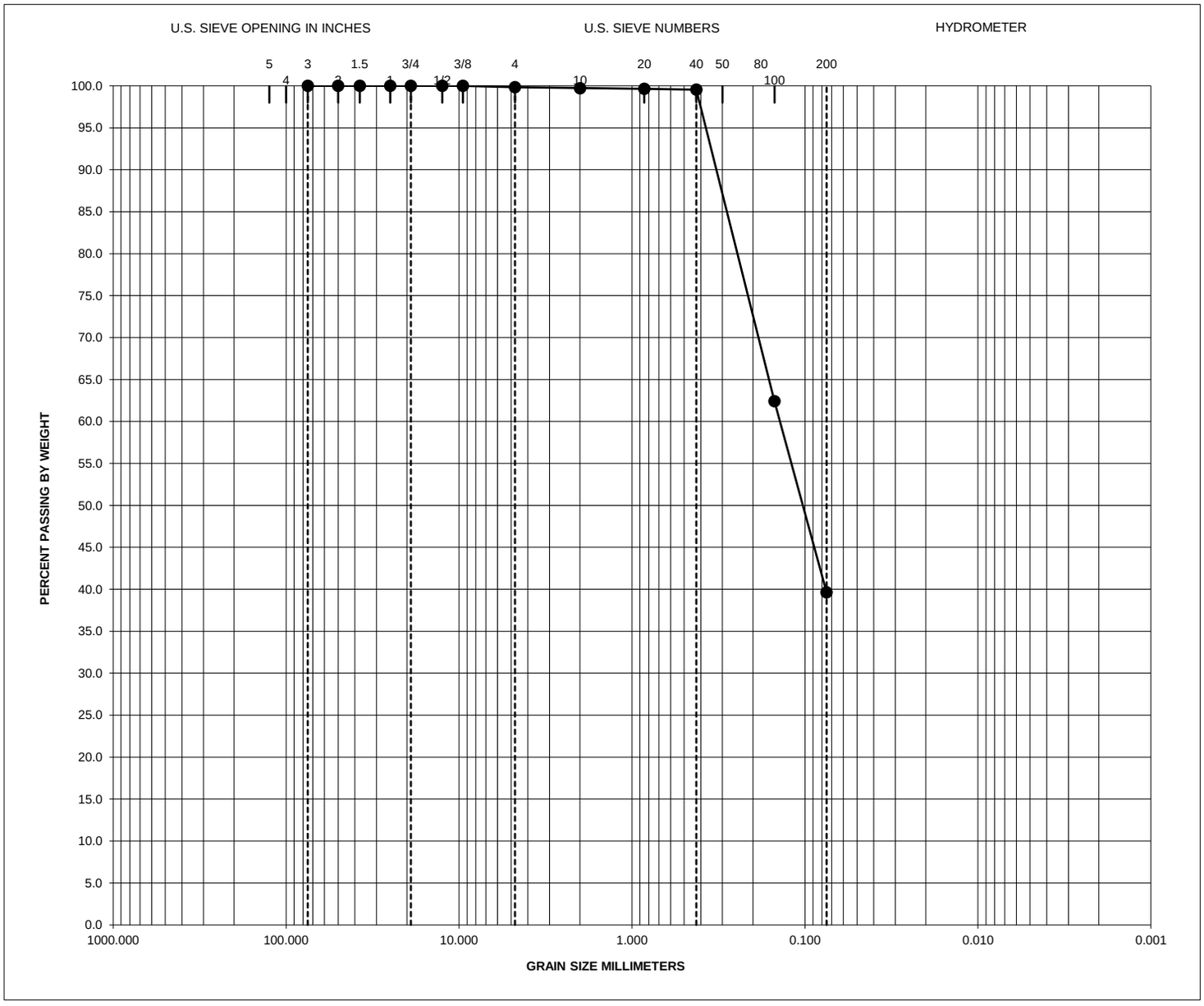
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**B-1 13'-14'**					0.00	68.36	31.64

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**B-1 14'-15.5'**	**SAND, moist, reddish brown, clayey (SC)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**B-1 14'-15.5'**					0.15	60.22	39.62

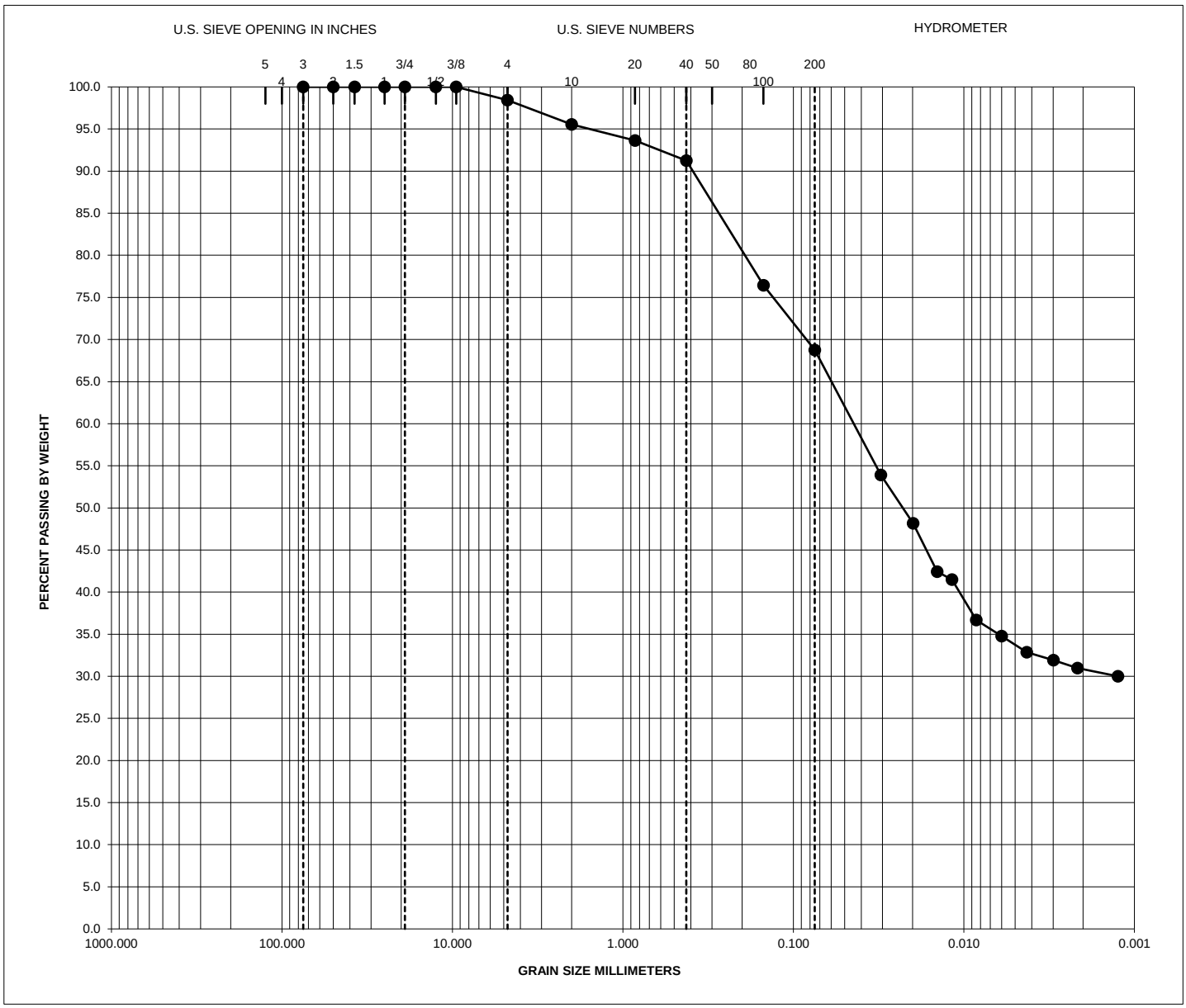
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-2**	**1'-5'**	**CLAY, medium stiff to stiff, moist, dark brown, w/ sand (FILL) (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-2**	**1'-5'**					1.57	29.69	68.74

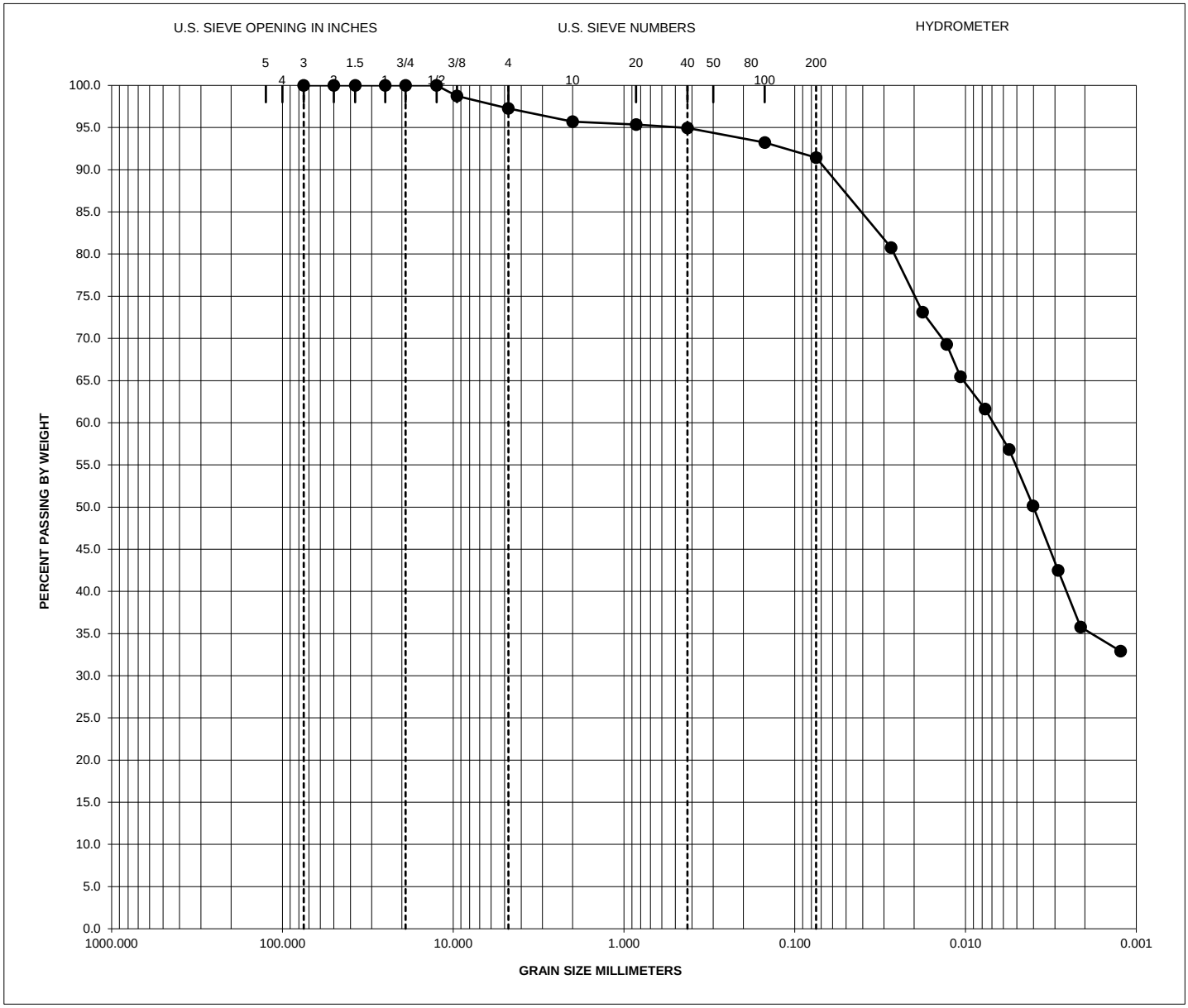
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-2**	**5'-10'**	**CLAY, very stiff, dry, yellowish brown and dark brown, w/ trace calcareous deposits (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-2**	**5'-10'**					2.74	5.84	91.42

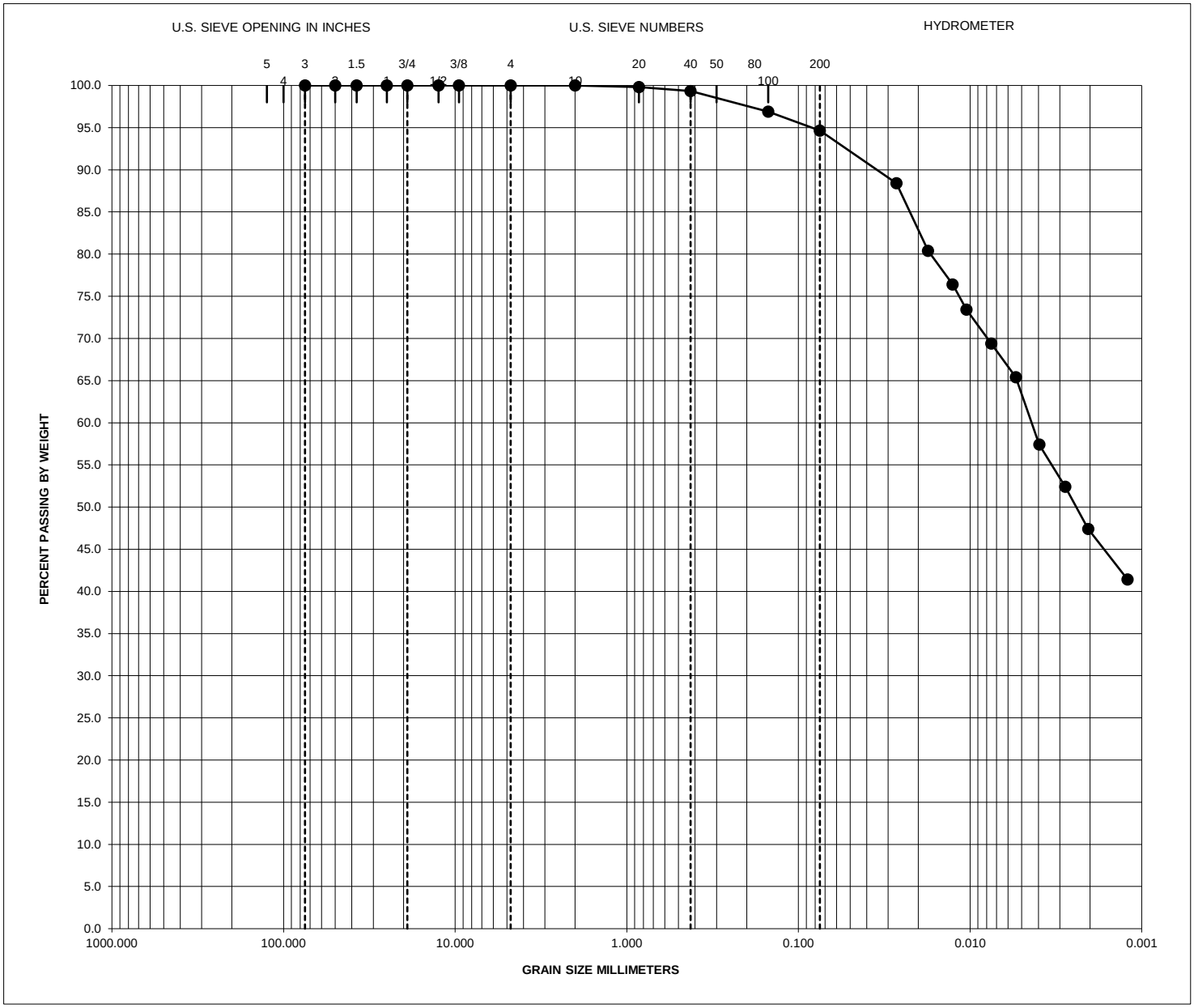
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-2**	**14'-15'**	**CLAY, very stiff, dry, yellowish brown and dark brown, w/ trace calcareous deposits (CH)**					

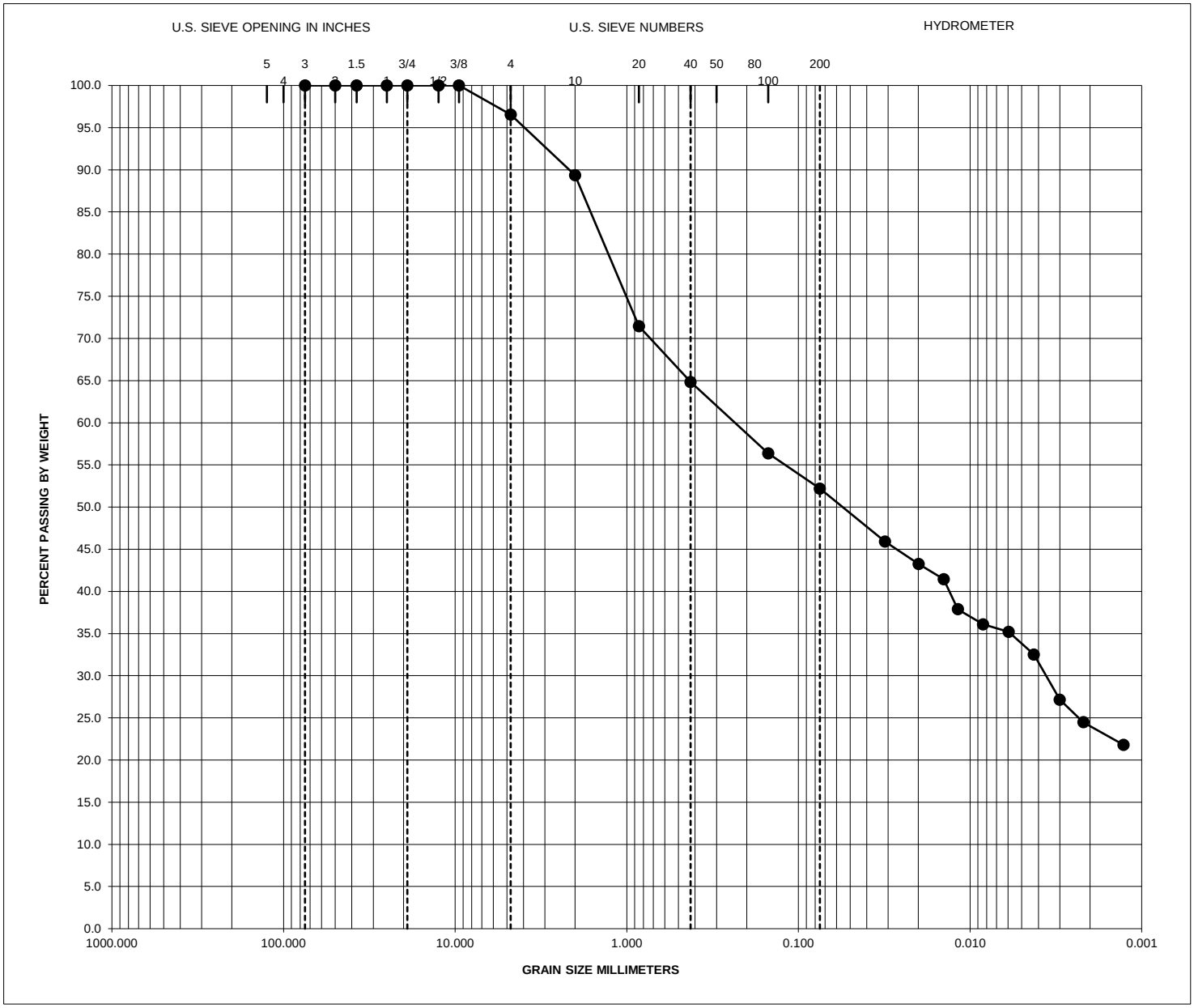
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-2**	**14'-15'**					0.00	5.36	94.64

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-2**	**19'-20'**	**SANDY CLAY, medium stiff to stiff, dry, yellowish brown w/ gravelly sand layers (CL)**					

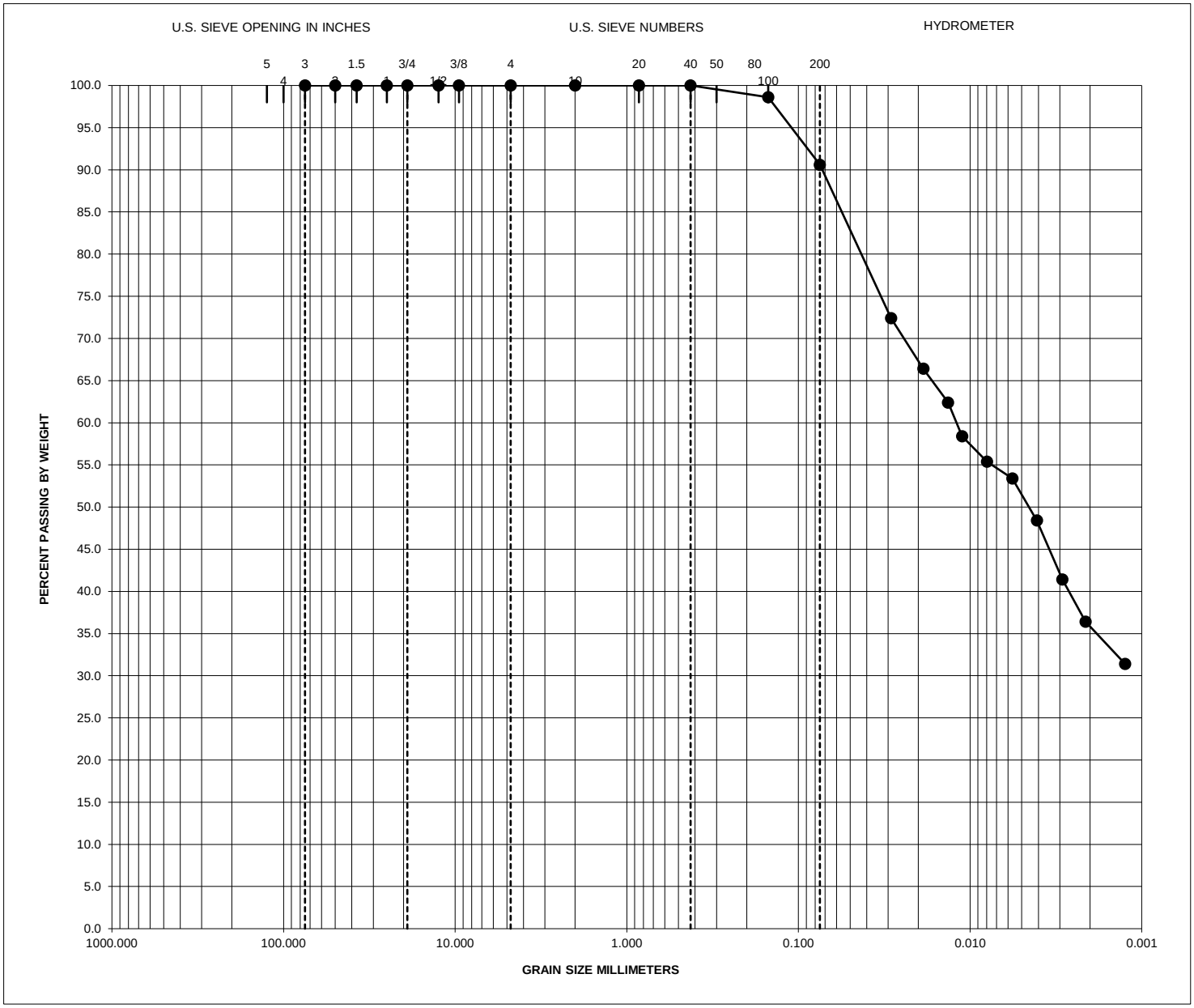
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-2**	**19'-20'**					3.45	44.36	52.18

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**B-2 24'-25'**	**CLAY, medium stiff, dry, yellowish brown and gray, w/ trace sand (CH)**					

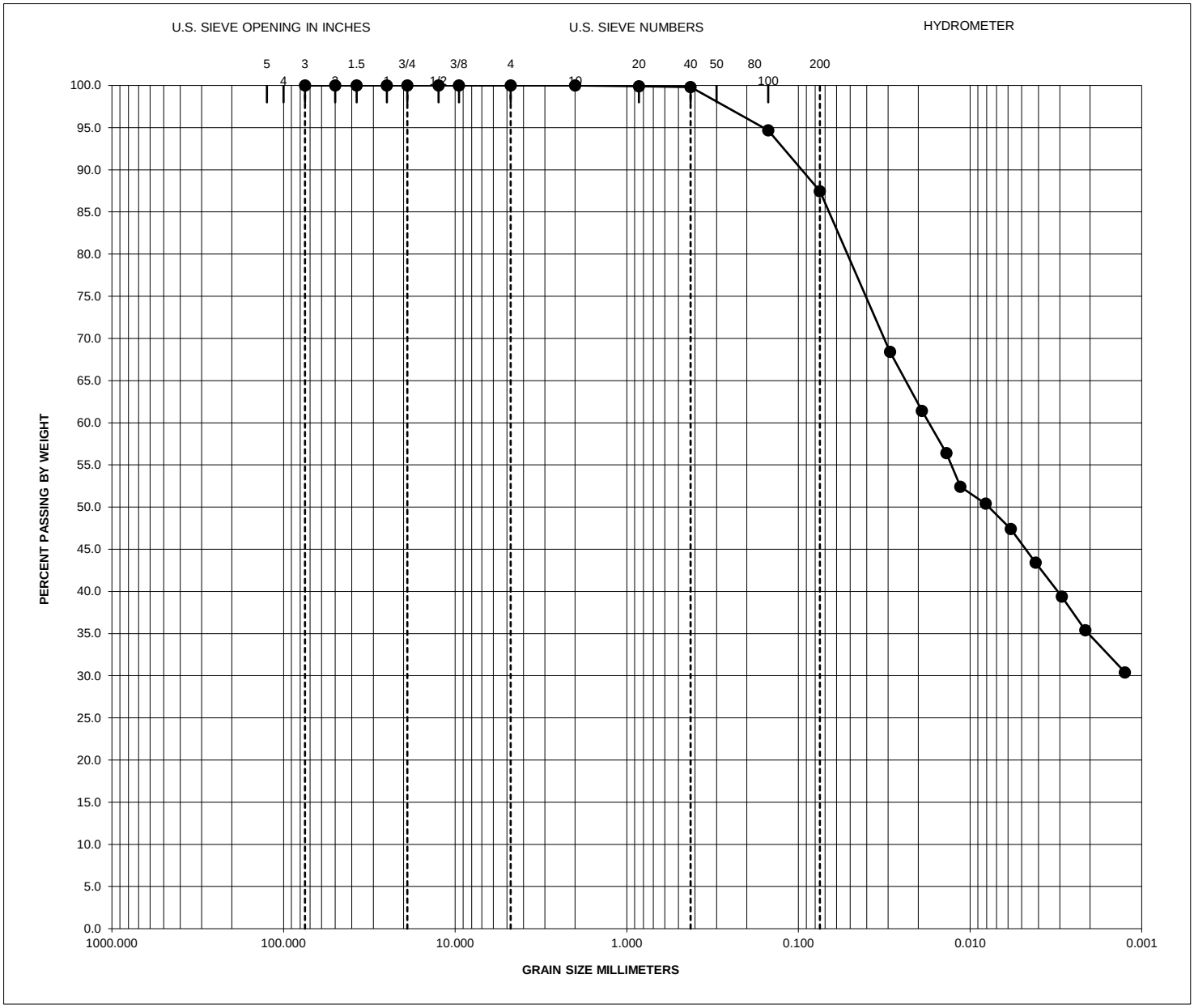
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**B-2 24'-25'**					0.00	9.42	90.58

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**B-2 29'-30'**	**CLAY, stiff, moist, yellowish brown and gray, w/ sand layers (CH)**					

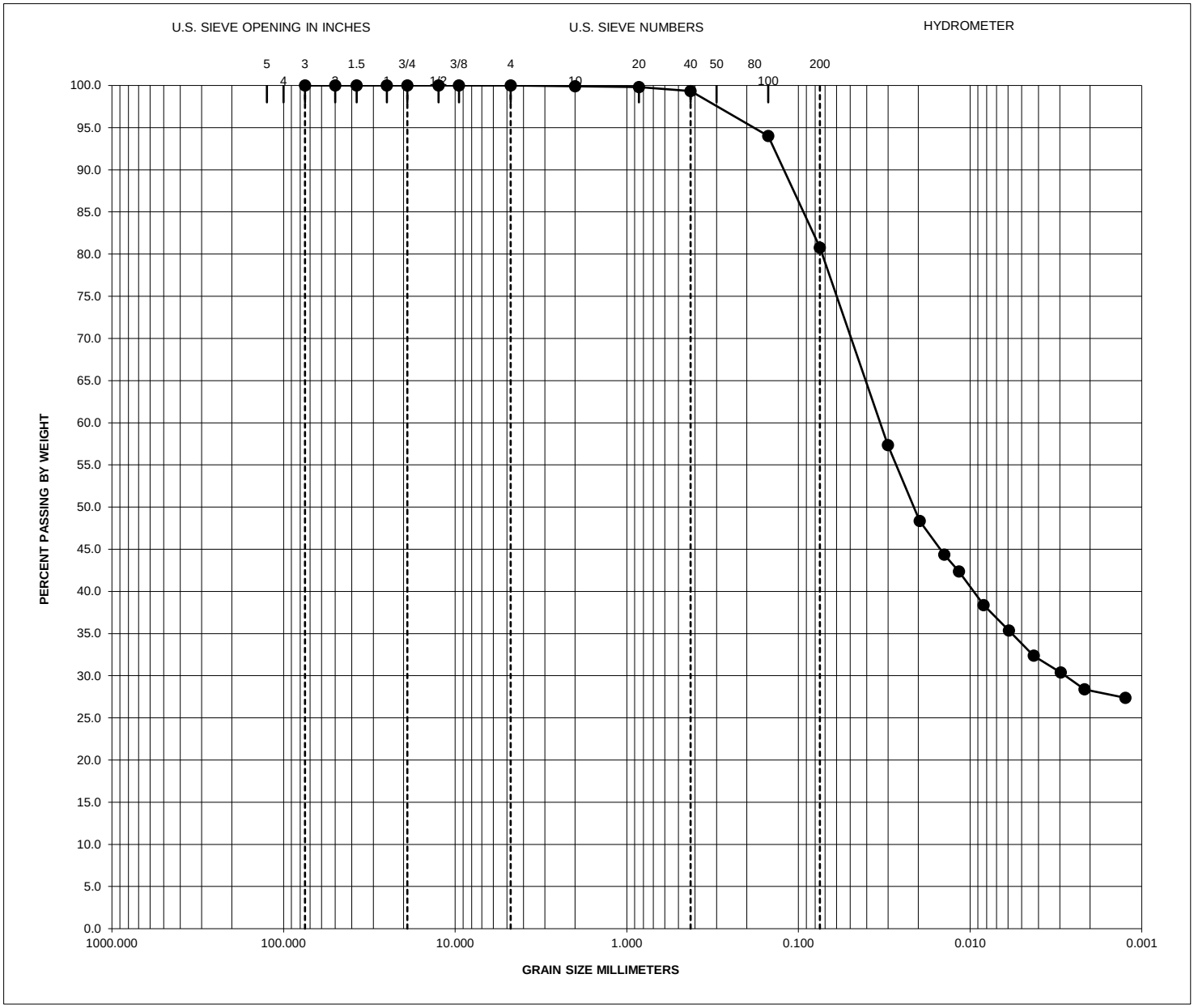
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**B-2 29'-30'**					0.00	12.54	87.46

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**B-2 34'-35'**	**CLAY, stiff, moist, yellowish brown and gray, w/ sand layers (CH)**					

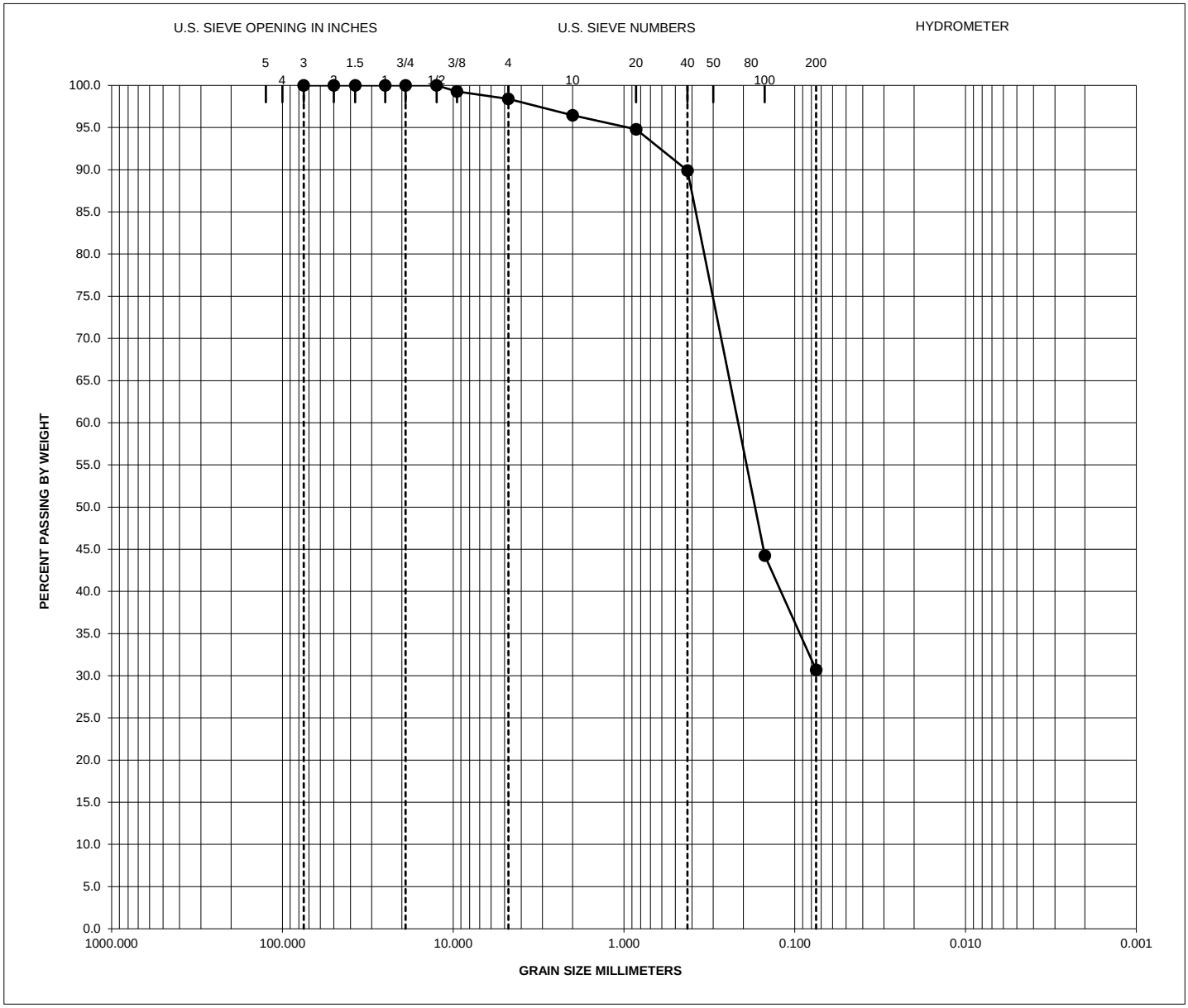
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**B-2 34'-35'**					0.00	19.25	80.75

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-3**	**3'-7'**	**SAND, moist, brown and tan w/ sandy clay layers and lenses (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-3**	**3'-7'**					1.61	67.70	30.70

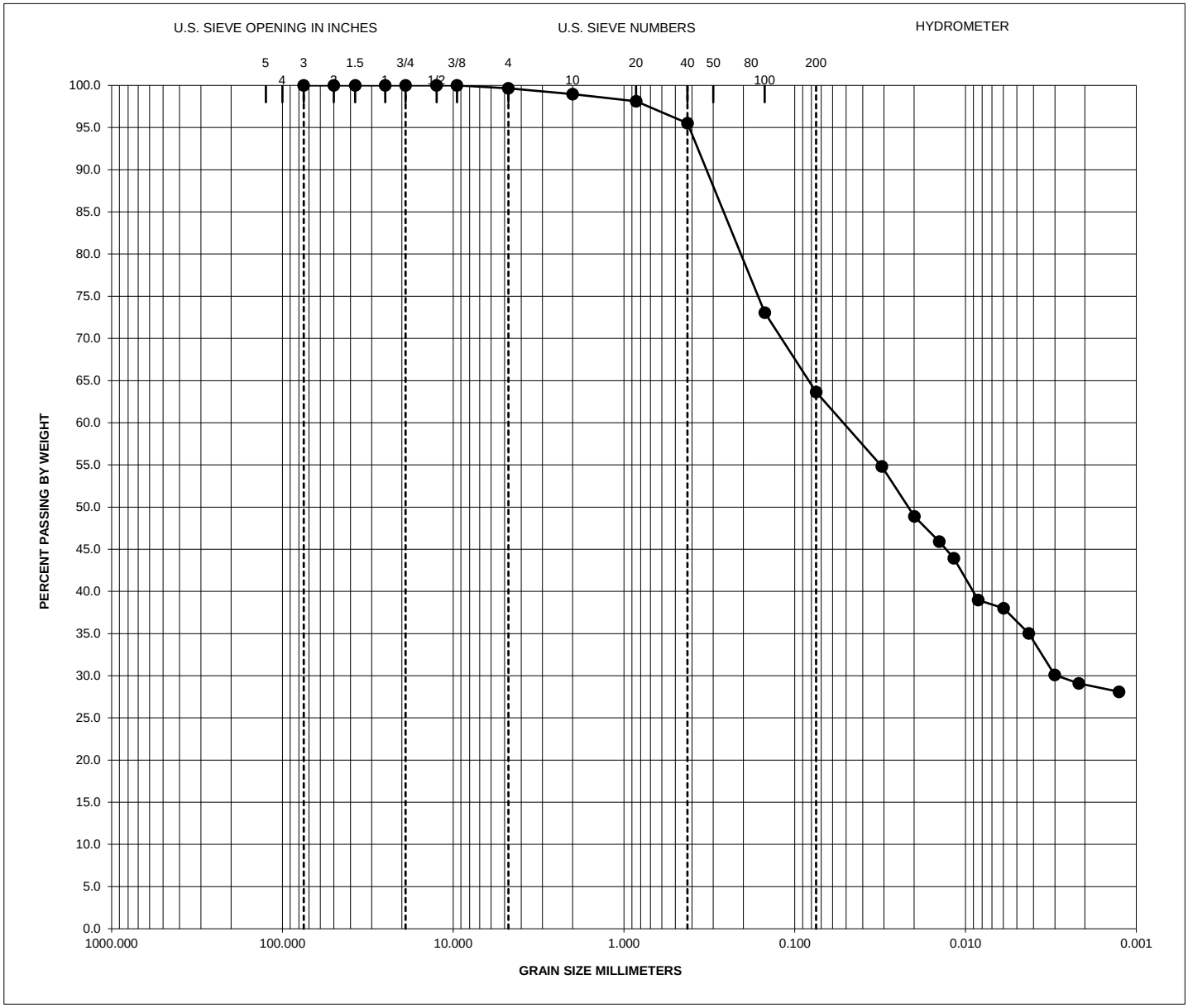
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-3**	**8'-10'**	**CLAY, very stiff, moist, gray, w/ sand layers and lenses (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-3**	**8'-10'**					0.33	36.04	63.63

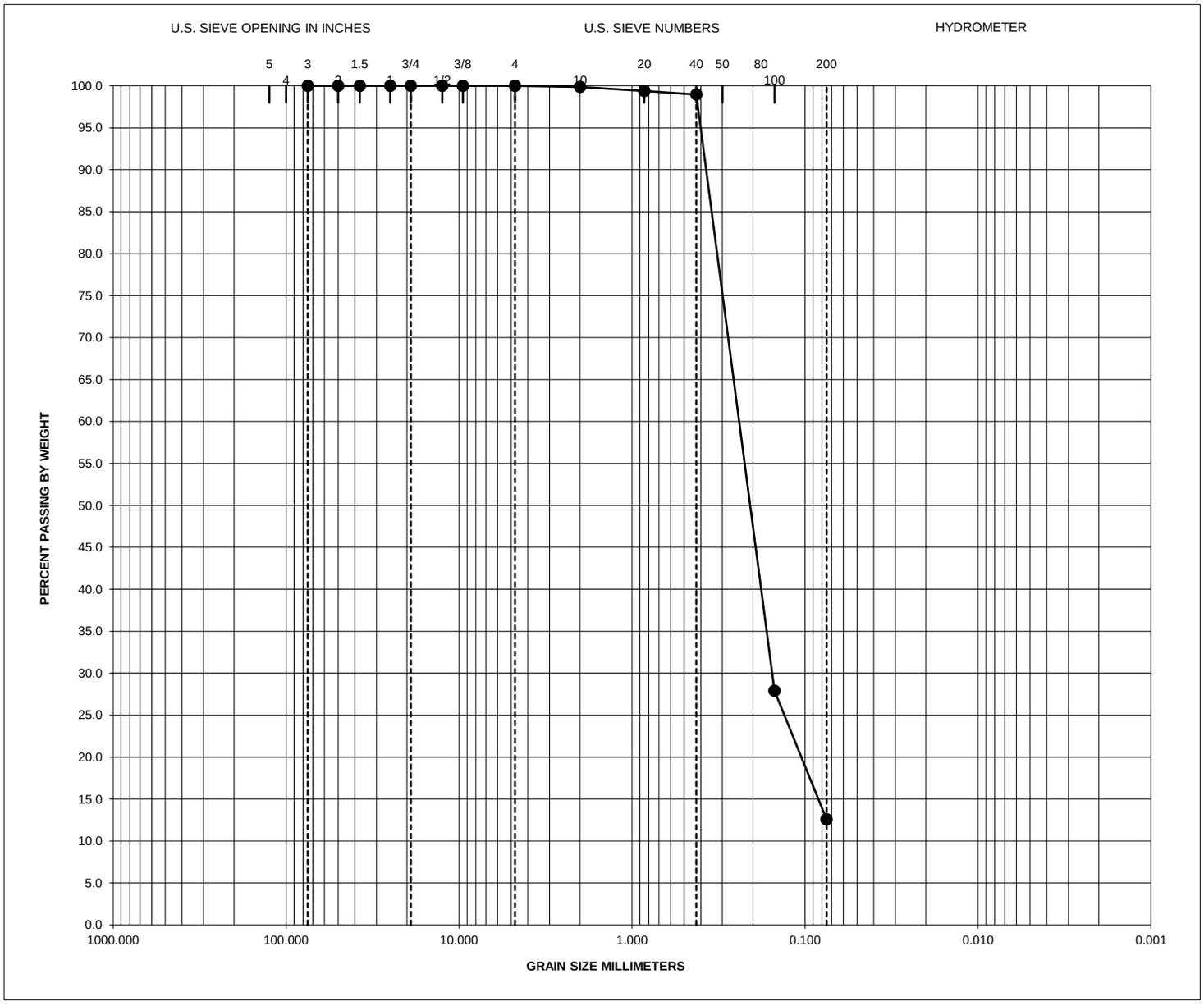
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**B-3 14'-15.5'**	**SAND, very loose, wet, tan, fine (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**B-3 14'-15.5'**					0.00	87.42	12.58

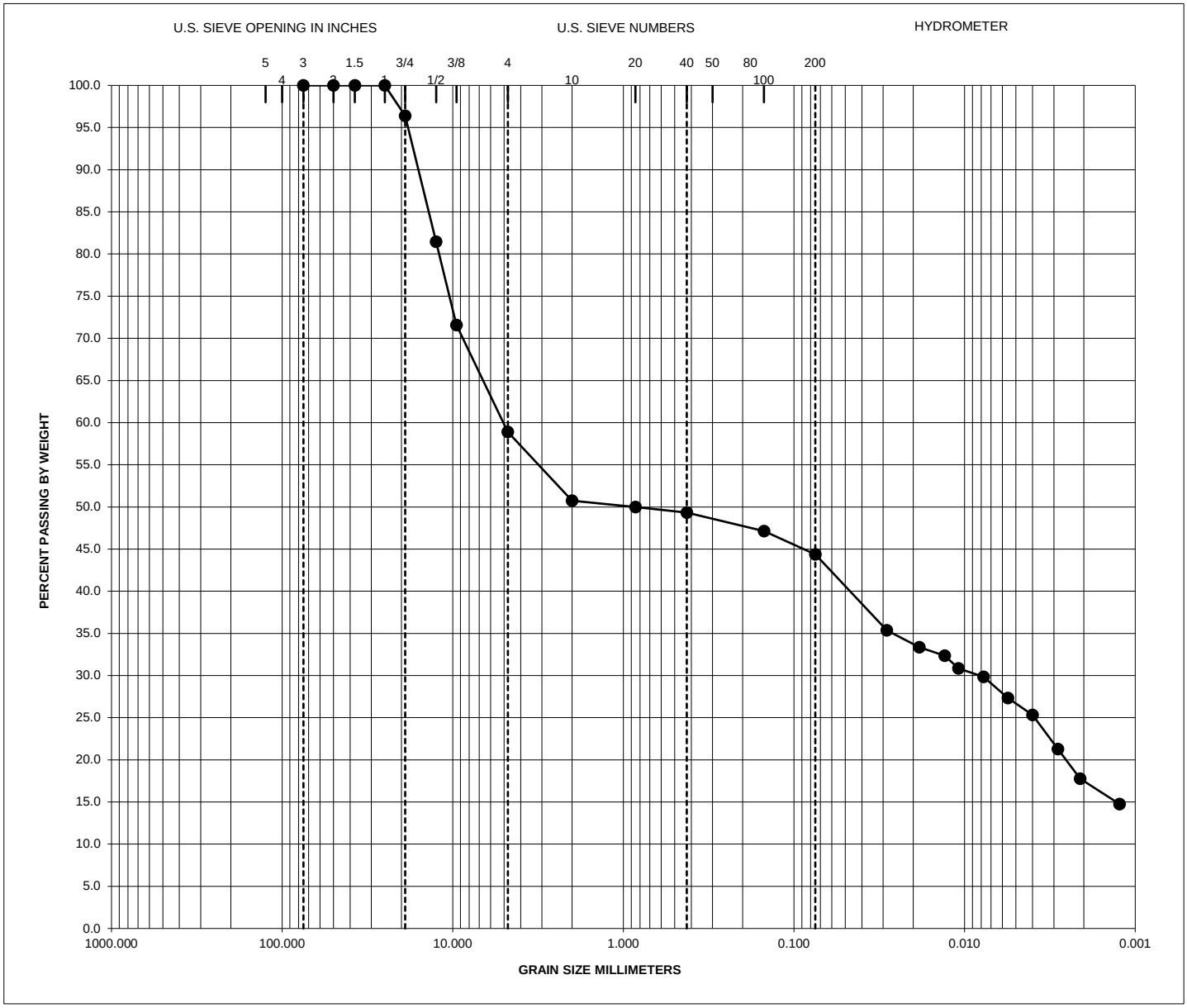
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-4**	**1'-2'**	**CLAY, gray and yellowish brown, calcareous, w/ severely weathered limestone seams**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-4**	**1'-2'**					41.11	14.51	44.38

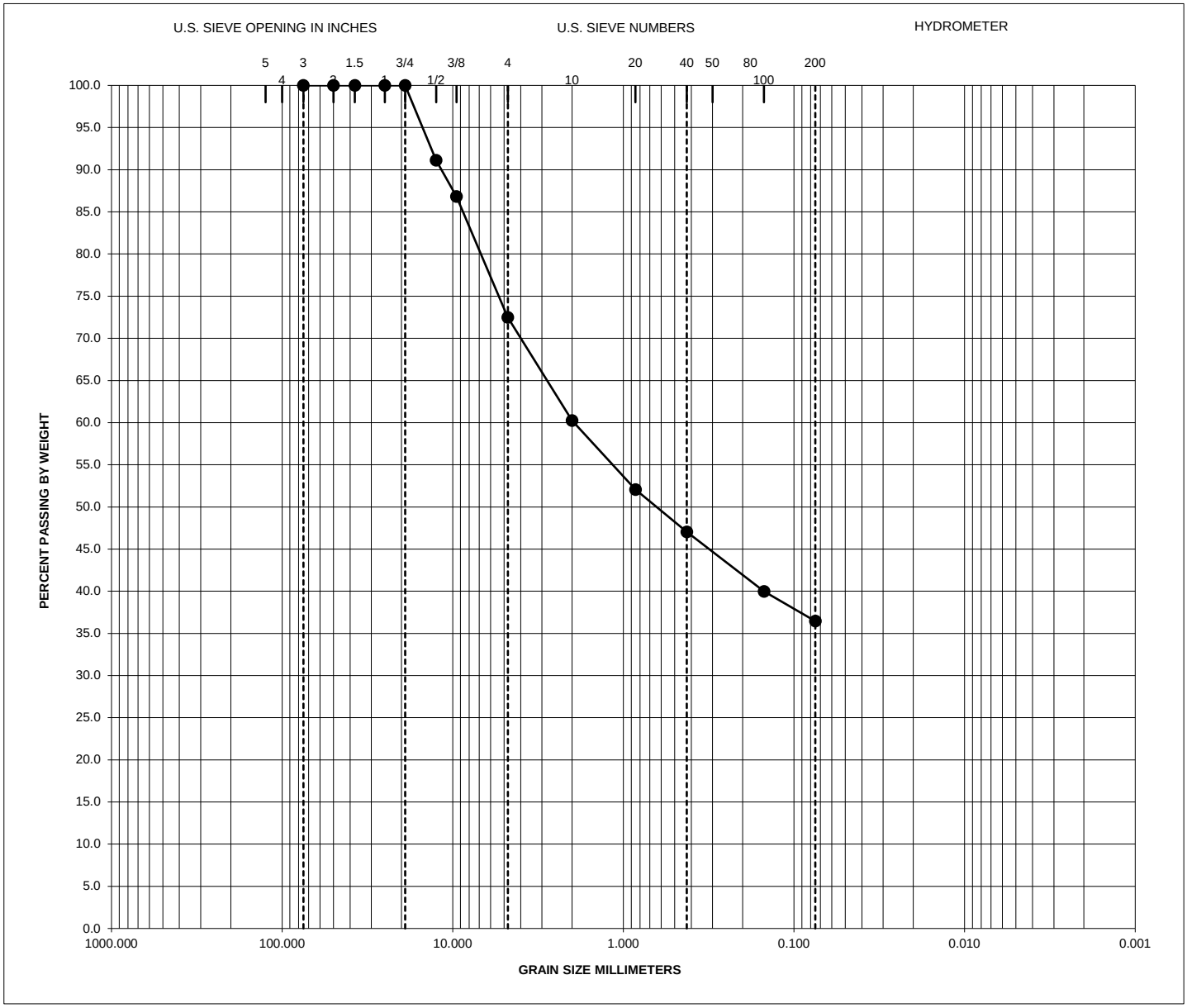
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
1/10/2019	BV	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **B-4**	**2'-2.5'**	**WEATHERED LIMESTONE, tan, w/ clay seams**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **B-4**	**2'-2.5'**					27.53	36.02	36.45

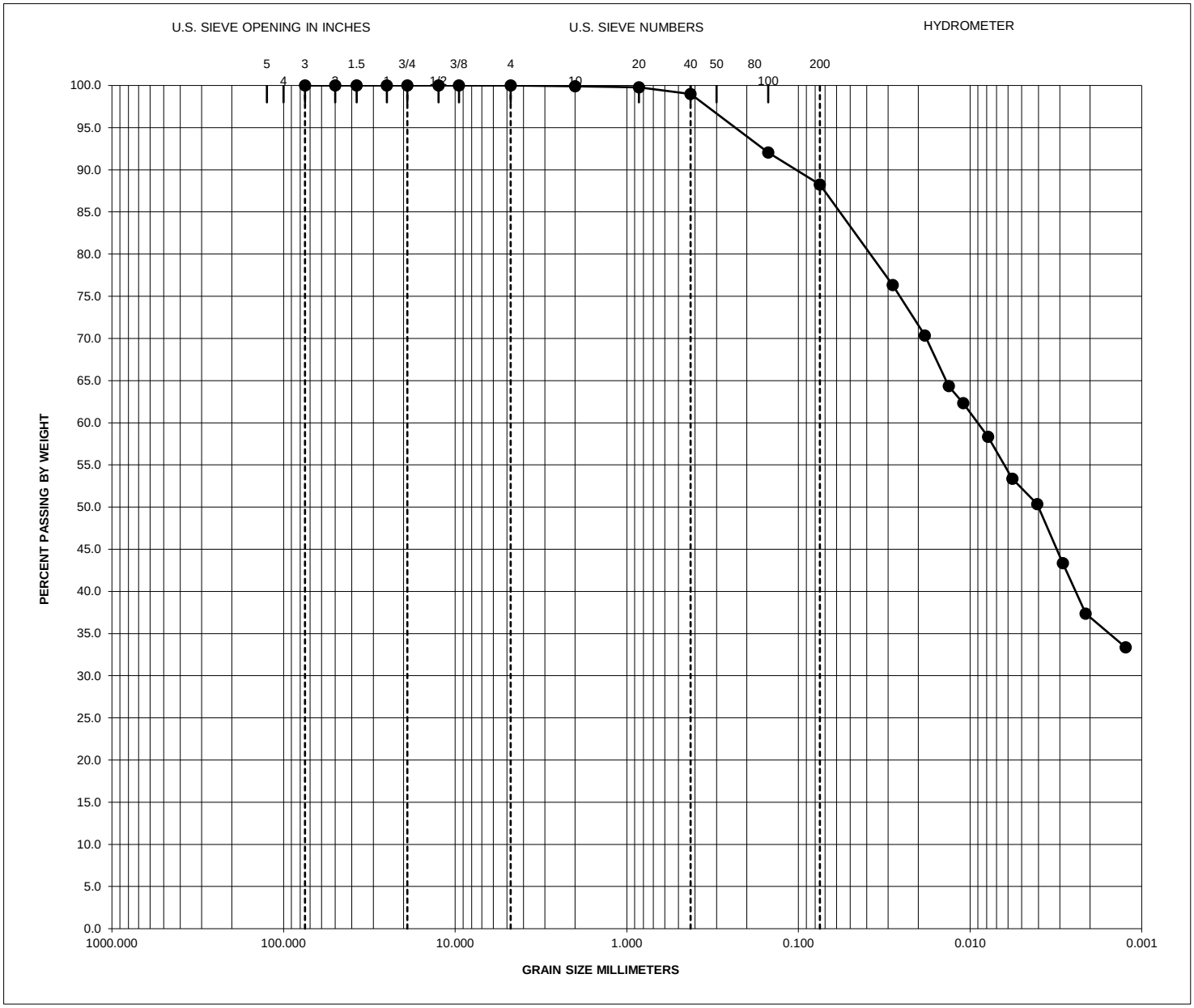
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	1/9/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**B-5 19'-20'**	**CLAY, moist, gray and light brown, w/ calcareous nodules (CH)**					

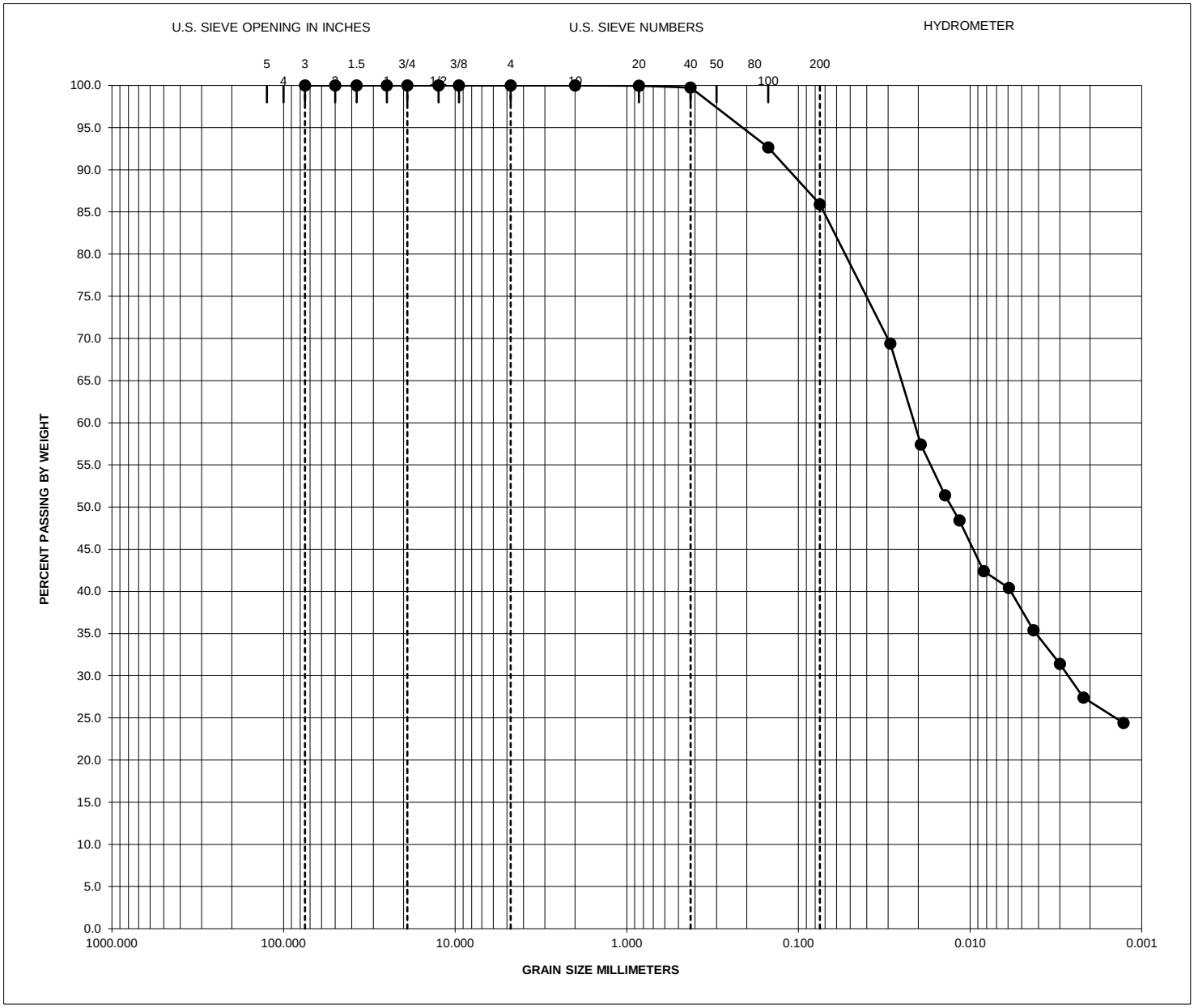
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**B-5 19'-20'**					0.00	11.76	88.24

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**B-5 24'-25'**	**CLAY, moist, gray and light gray, w/ sand (CH)**					

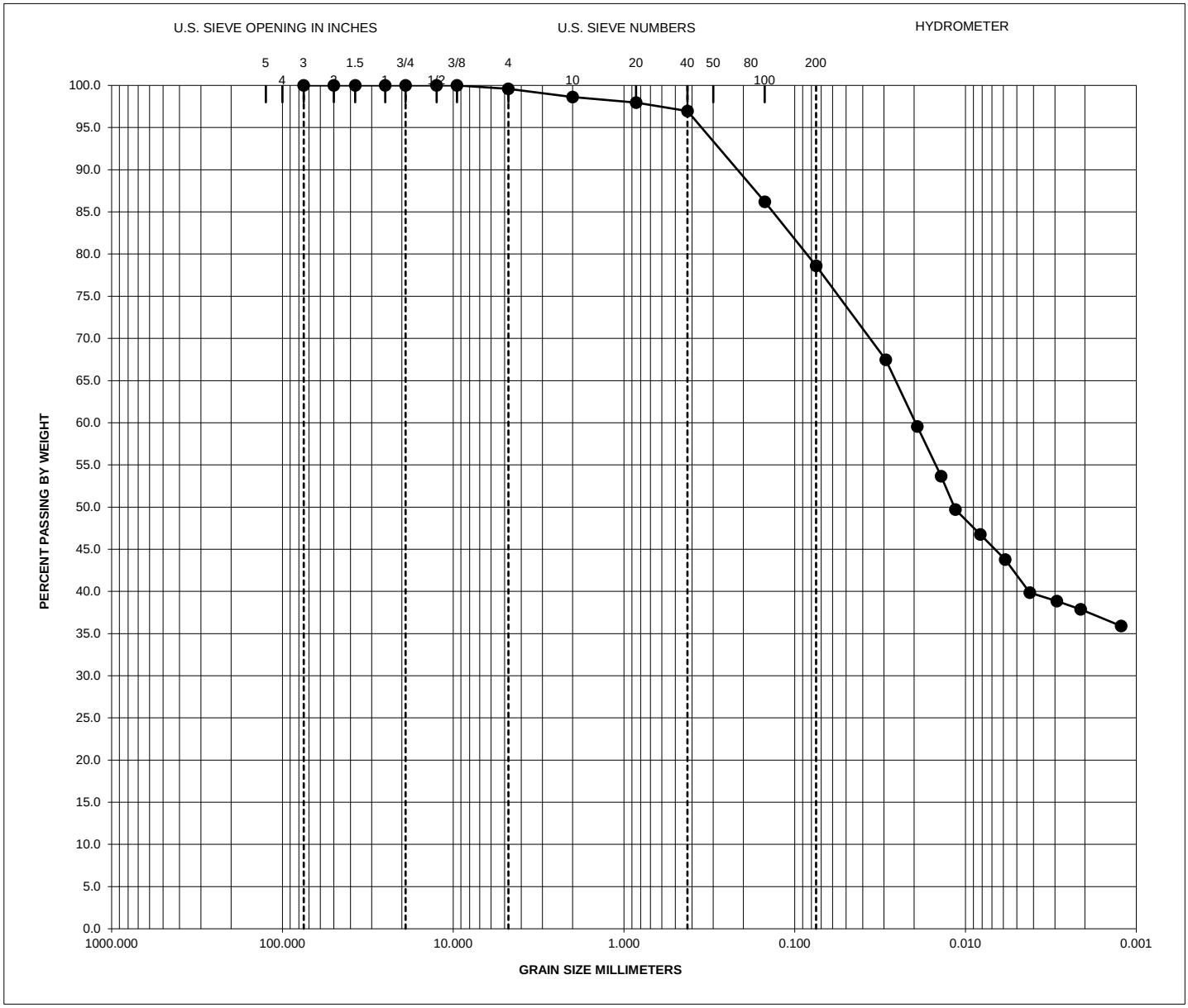
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**B-5 24'-25'**					0.00	14.10	85.90

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **P-102**	**4'-6'**	**CLAY, hard, dark brown, w/ calcareous nodules & sand (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **P-102**	**4'-6'**					0.40	21.00	78.60

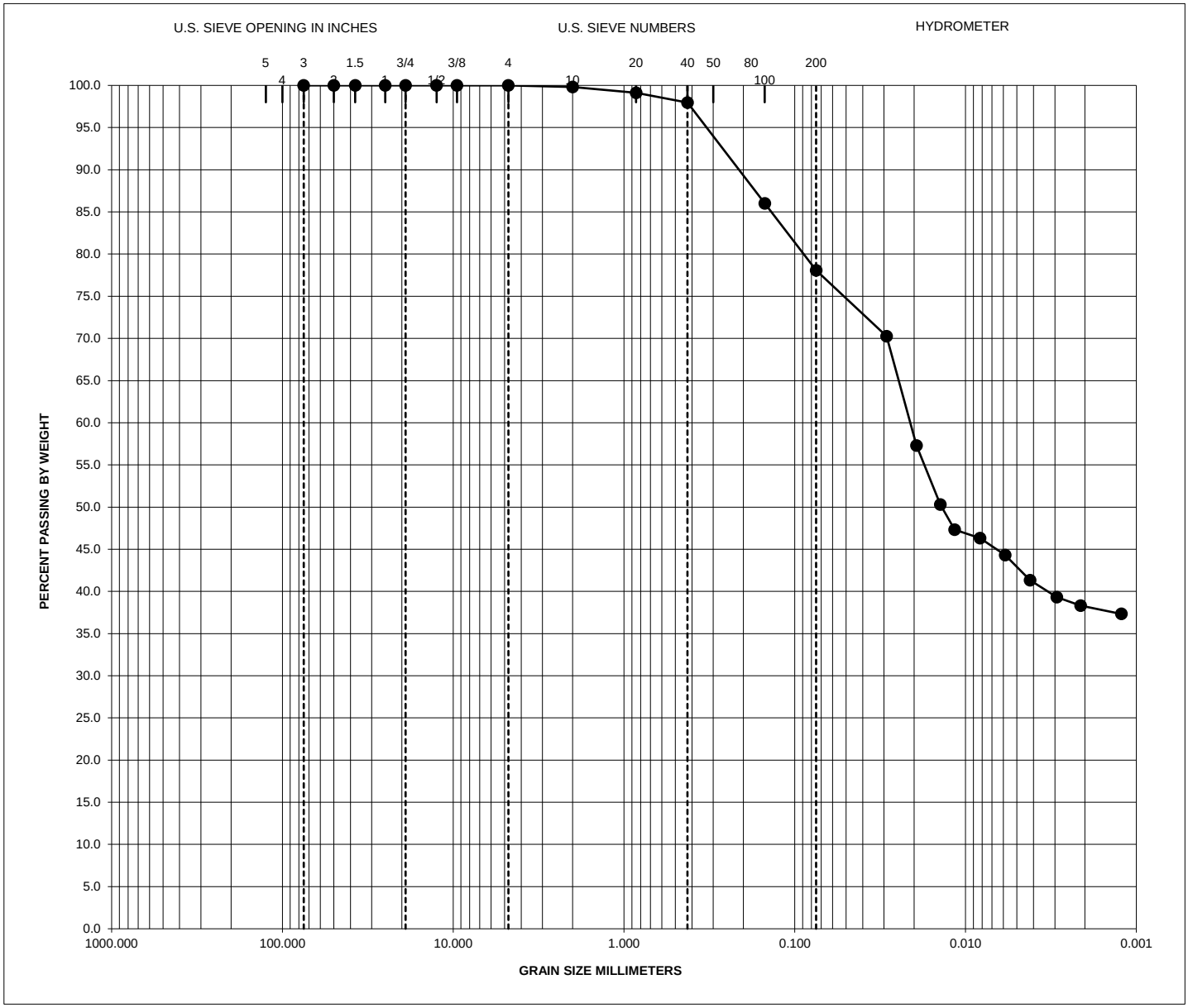
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **P-102**	**6'-7'**	**CLAY, hard, tan and light gray, w/ numerous calcareous deposits & sand (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **P-102**	**6'-7'**					0.00	21.93	78.07

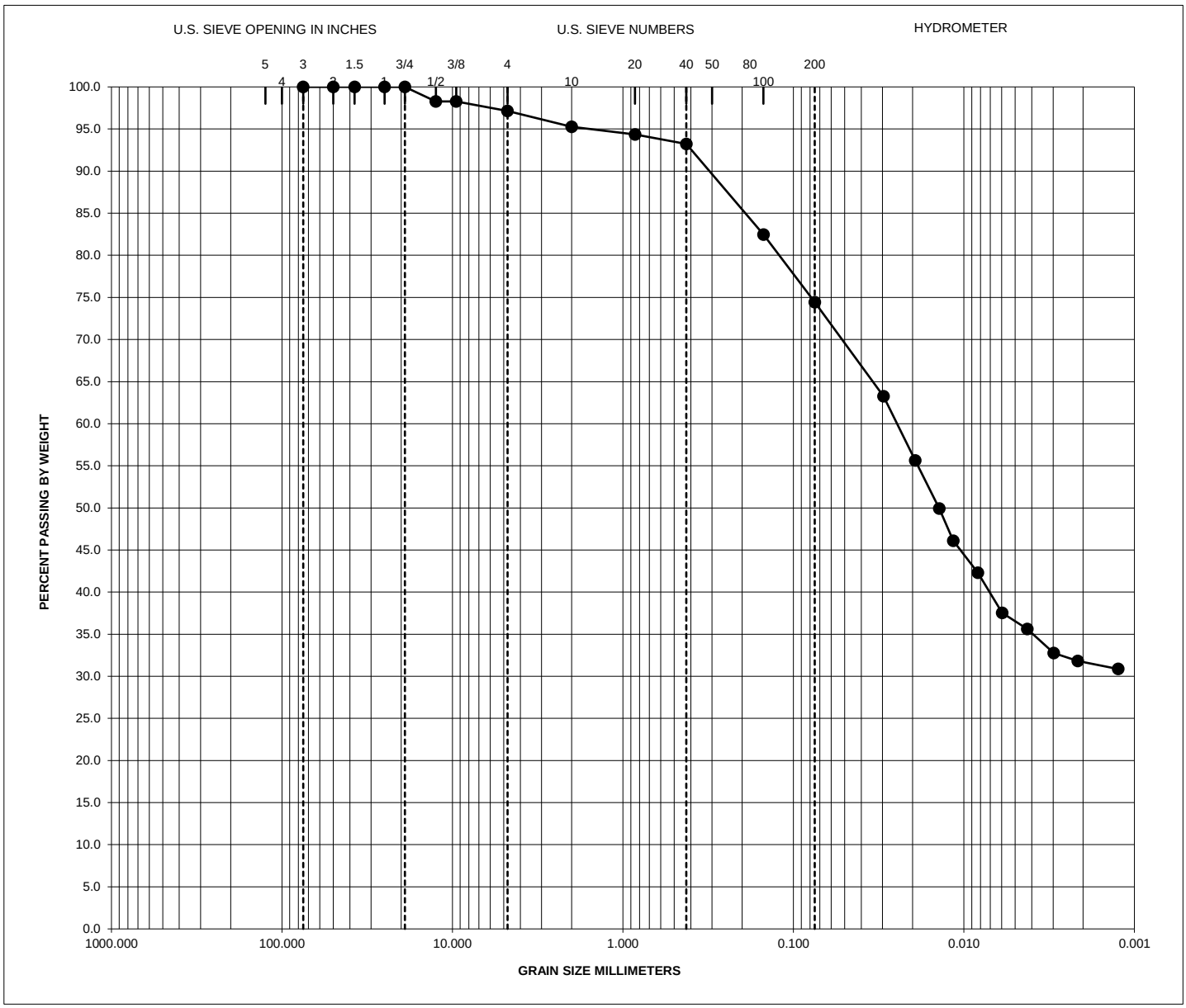
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **P-102**	**7'-10'**	**CLAY, hard, tan and light gray w/ numerous calcareous deposits & sand (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **P-102**	**7'-10'**					2.87	22.71	74.42

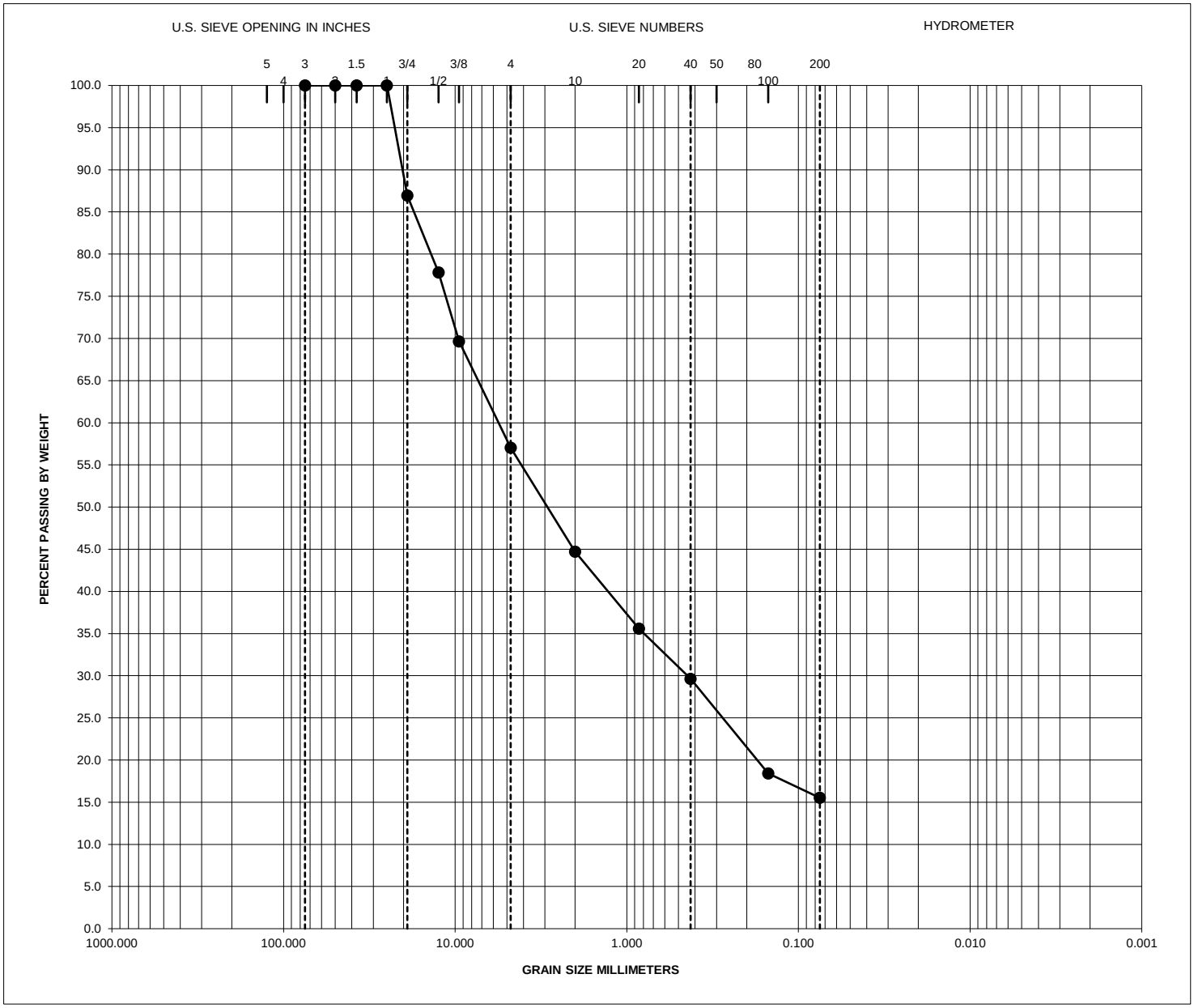
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**P-102 14'-16'**	**SANDY GRAVEL, medium coarse to coarse, tan, w/ sand seams (GP)**					

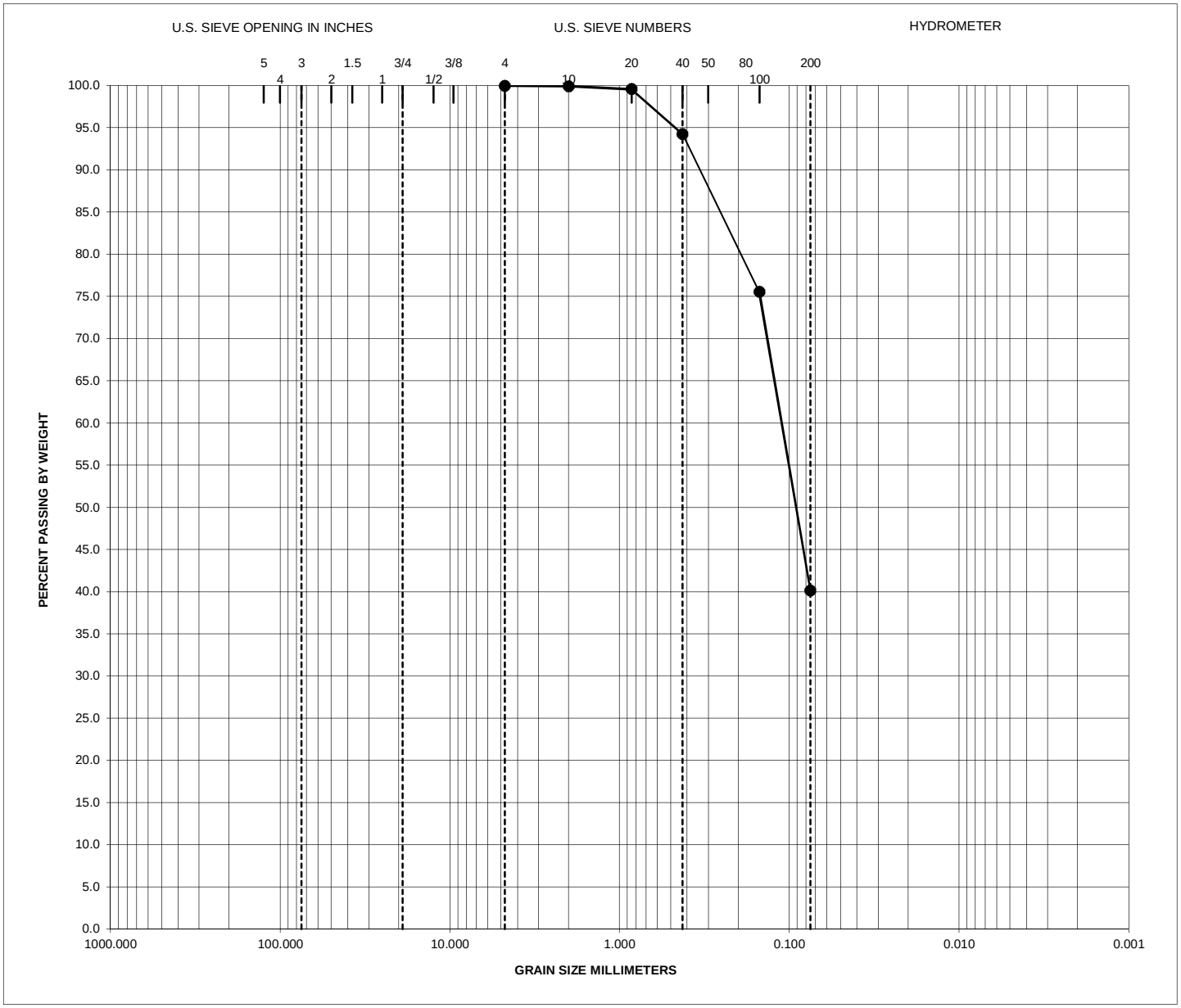
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**P-102 14'-16'**					42.96	41.52	15.52

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **S-3**	**6-7.5**	**CLAYEY SAND, reddish brown and yellowish brown (SC)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **S-3**	**6-7.5**					0.00	59.88	40.12

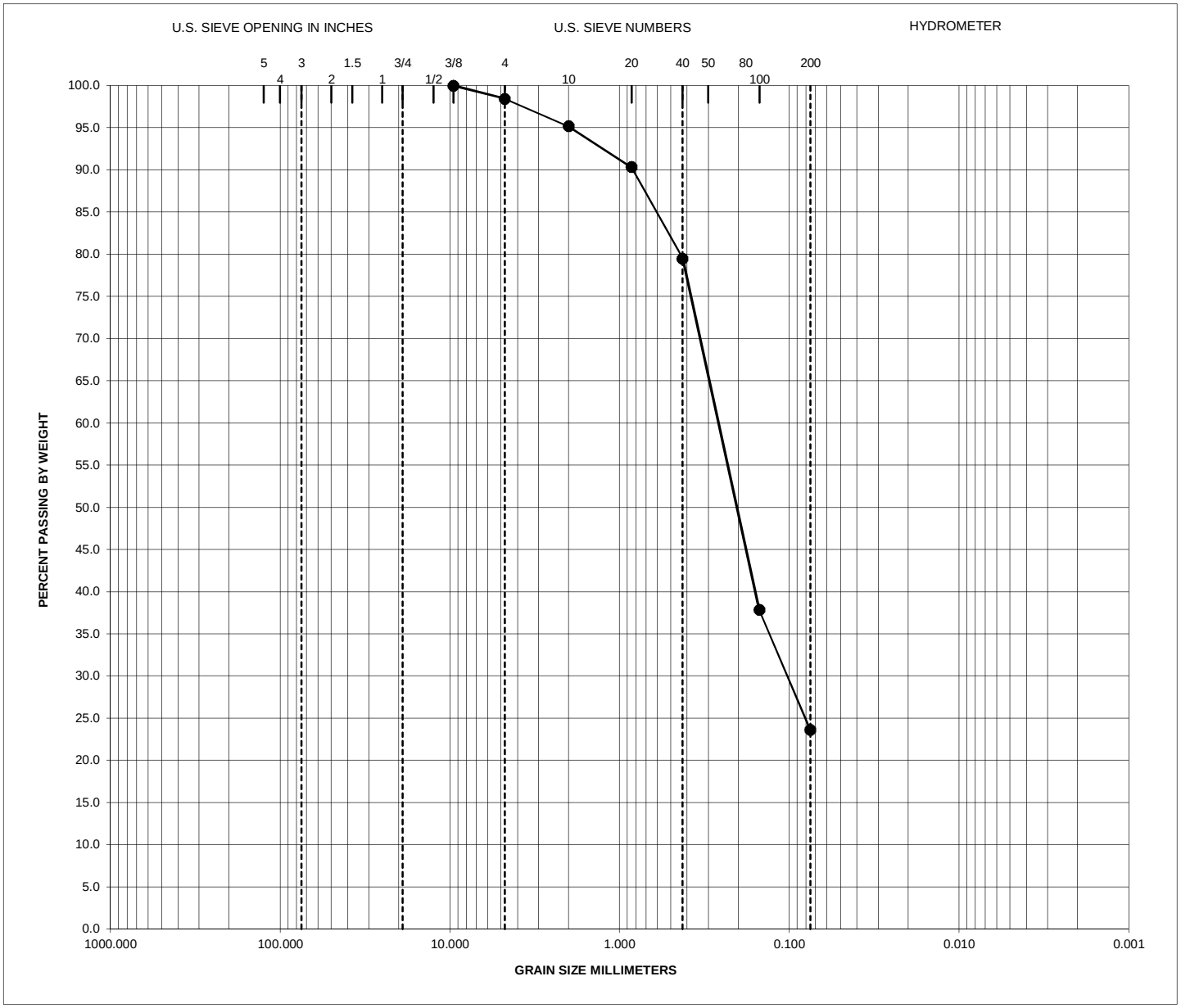
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E16-0217 / E17-0811**

Tested by:	Date Tested	Checked by:	
BV,JP	5/12/2016	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**S-3 13.5-15**	**CLAYEY SAND, reddish brown and yellowish brown (SC)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**S-3 13.5-15**					1.58	74.84	23.57

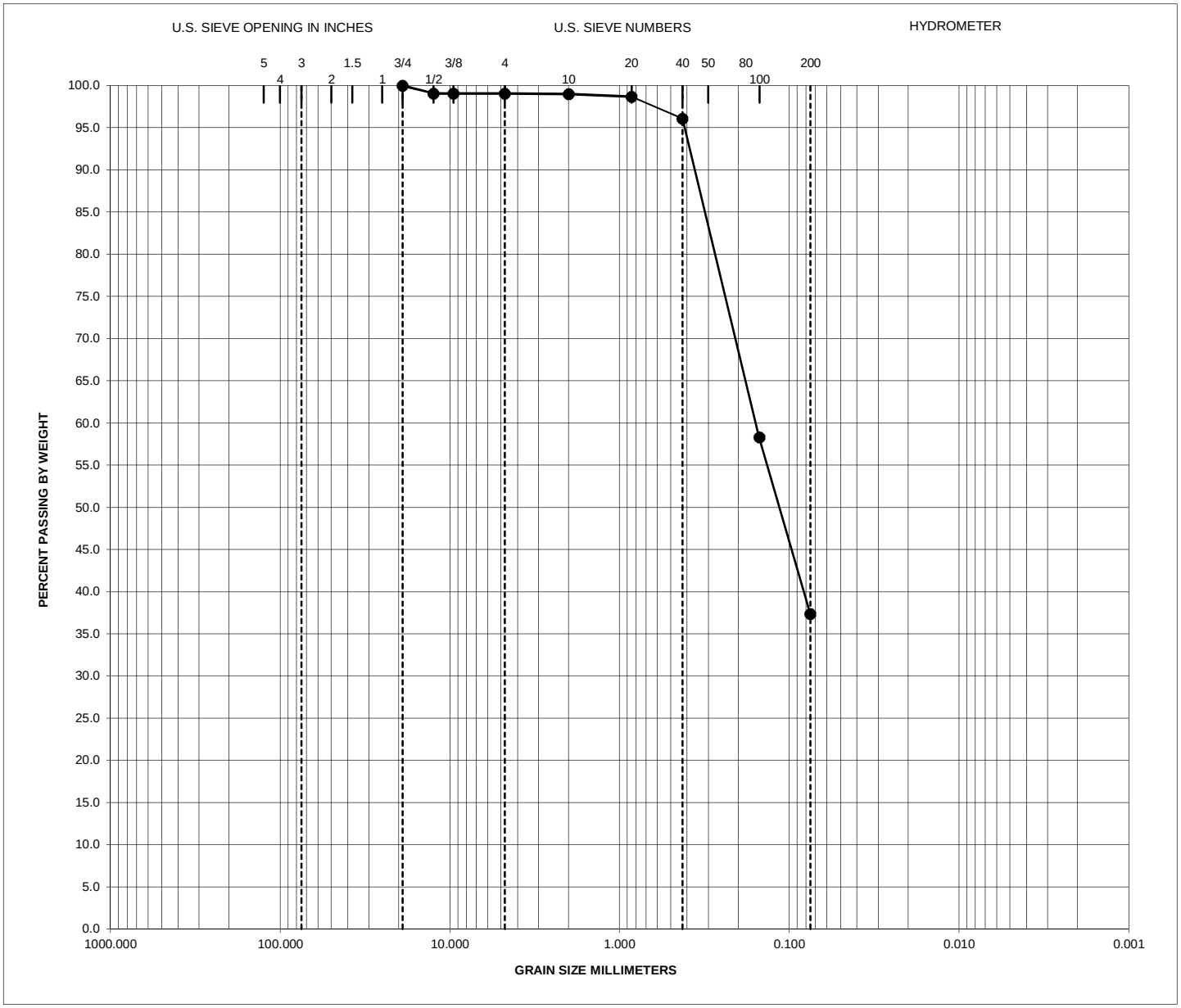
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E16-0217 / E17-0811**

Tested by:	Date Tested	Checked by:	
BV,JP	5/12/2016	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● T-1	14-15	**CLAYEY SAND, reddish brown and yellowish brown (SC)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● T-1	14-15					0.94	61.74	37.31

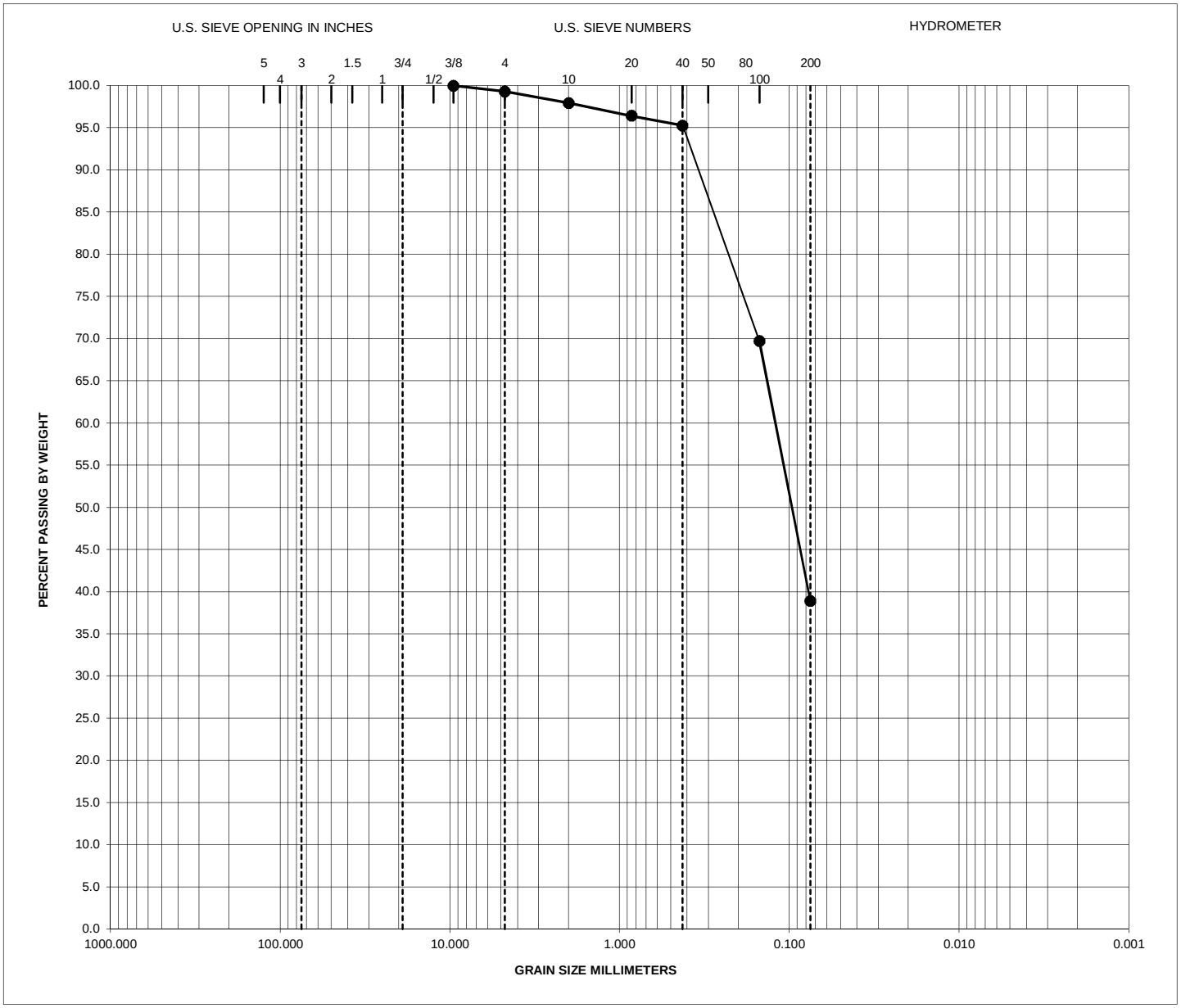
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E16-0217 / E17-0811**

Tested by:	Date Tested	Checked by:	**ALLIANCE GEOTECHNICAL GROUP**
BV,JP	5/12/2016		



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**T-24 14-15.5**	**CLAYEY SAND, grayish brown (SC)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**T-24 14-15.5**					0.70	60.45	38.86

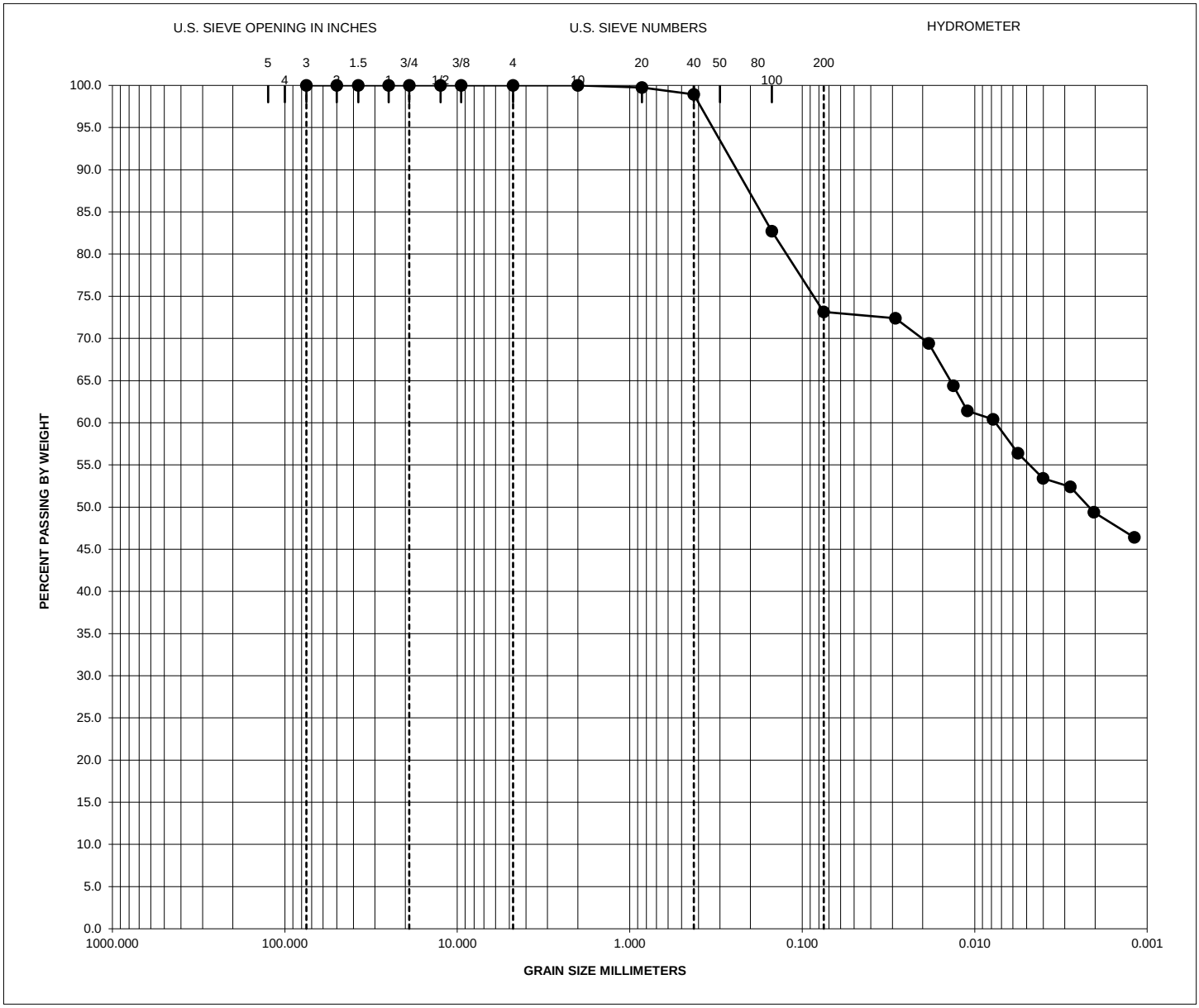
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E16-0217 / E17-0811**

Tested by:	Date Tested	Checked by:	
BV,JP	5/12/2016	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● T-102	1.5'-4'	CLAY, hard, dark gray to dark brown, w/ calcareous nodules & sand (CH)					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● T-102	1.5'-4'					0.00	26.86	73.14

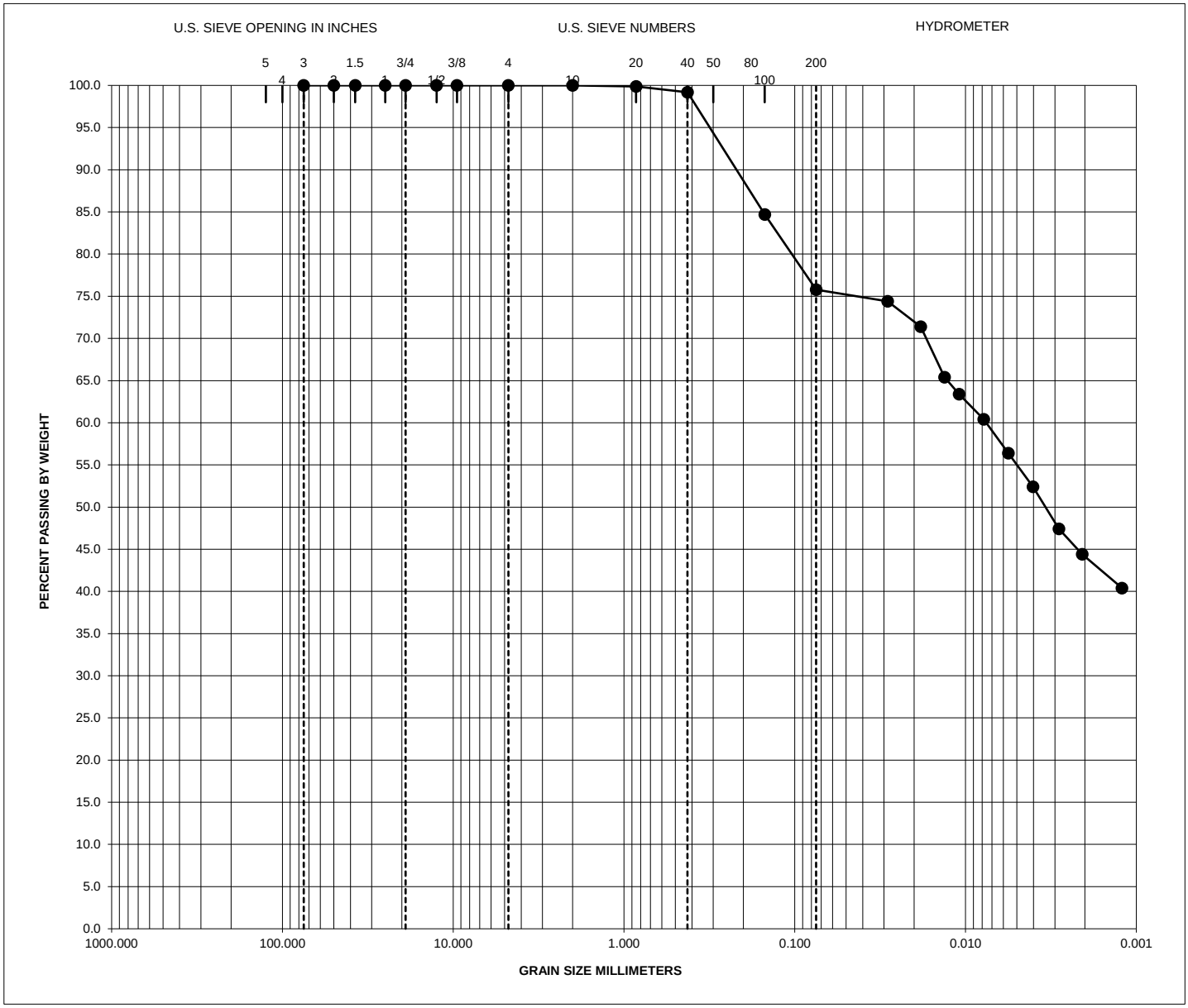
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: DART D-2

Project No: E17-0811

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-102**	**4'-7'**	**CLAY, hard, brown to light brown and gray, w/ calcareous deposits & sand (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-102**	**4'-7'**					0.00	24.22	75.78

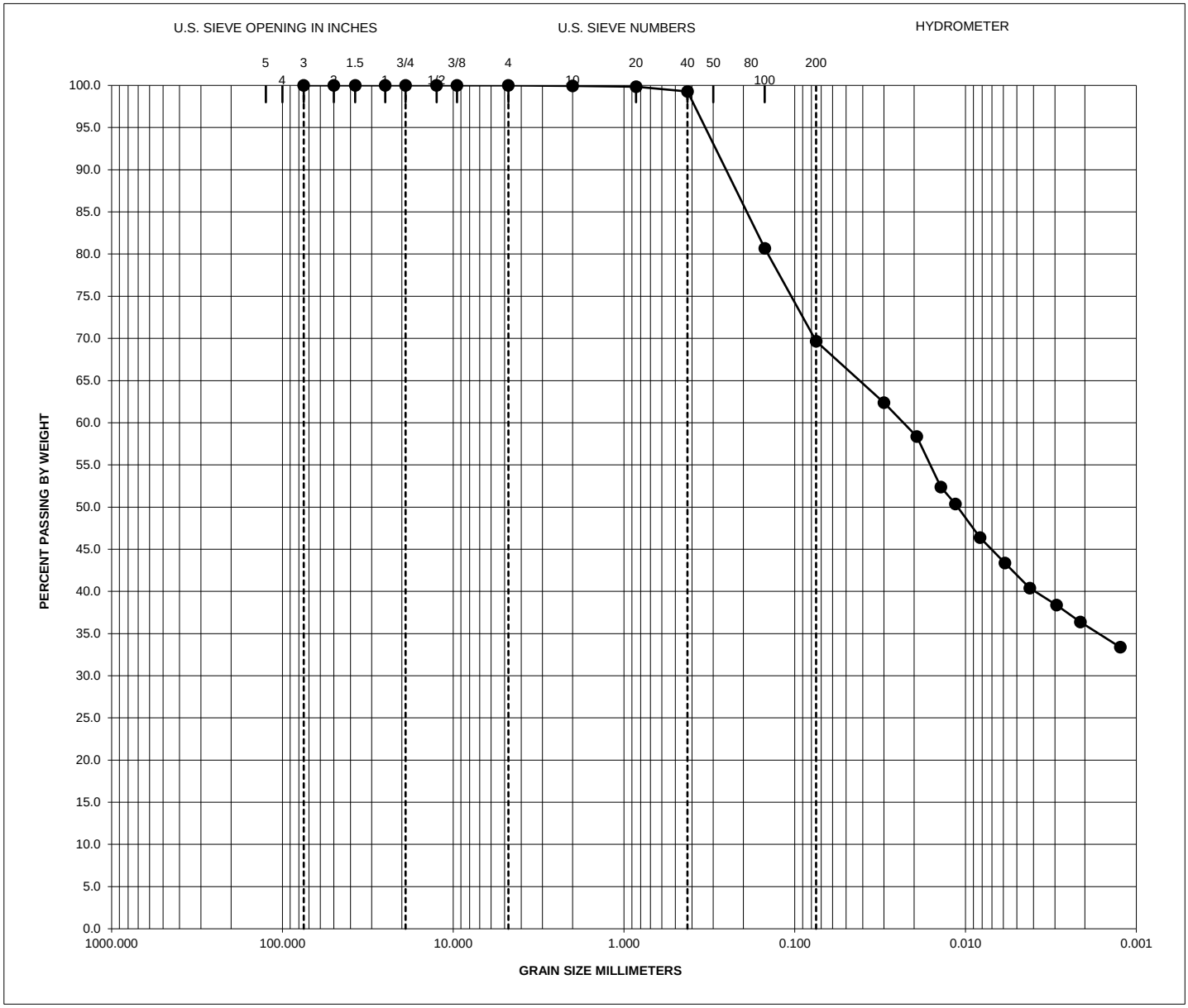
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-102**	**7'-10'**	**CLAY, hard, tan and light gray, w/ sand (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-102**	**7'-10'**					0.00	30.33	69.67

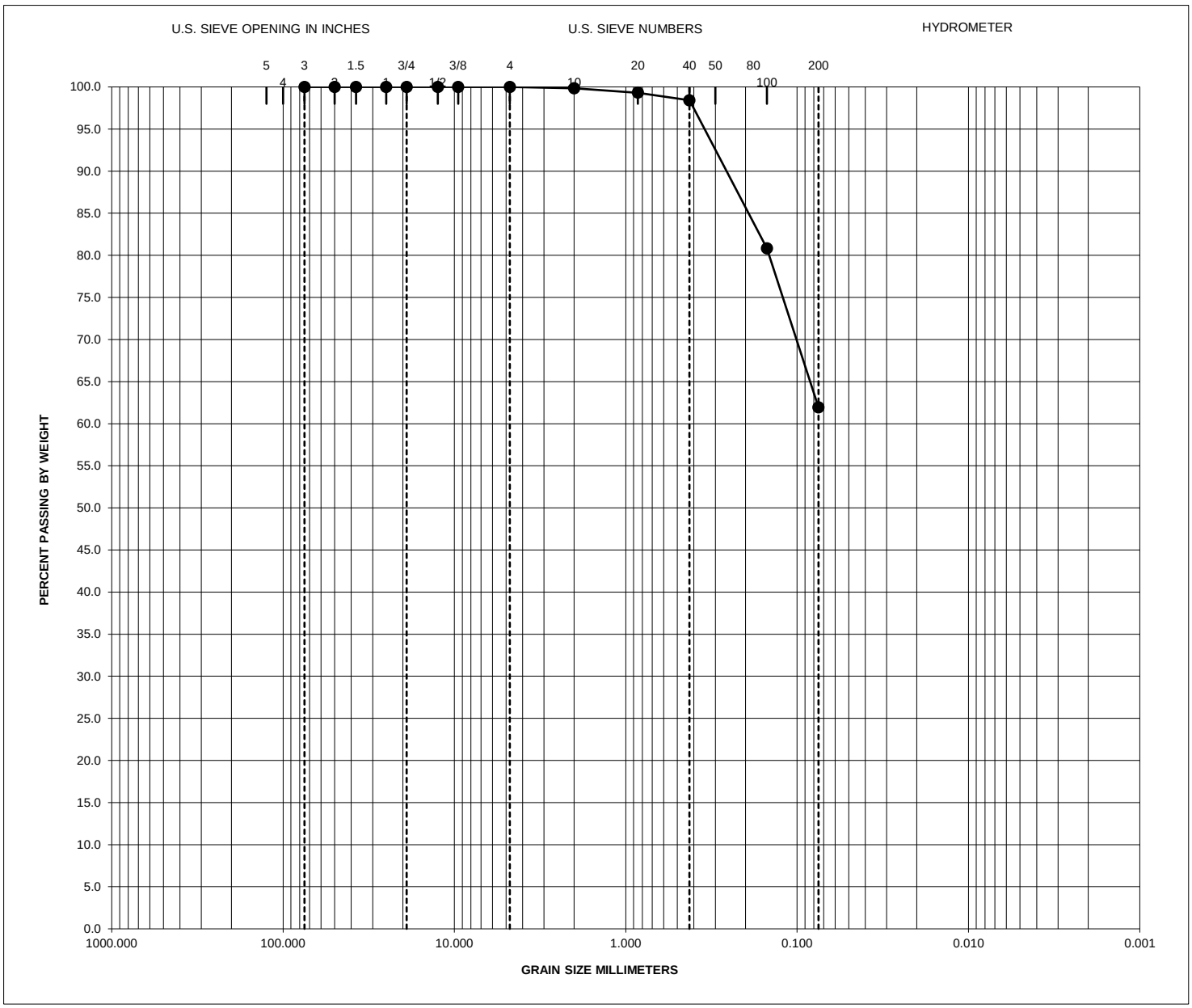
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**T-102 14'-15'**	**CLAY, tan & light gray, sandy, w/ clayey sand seams (CL)**					

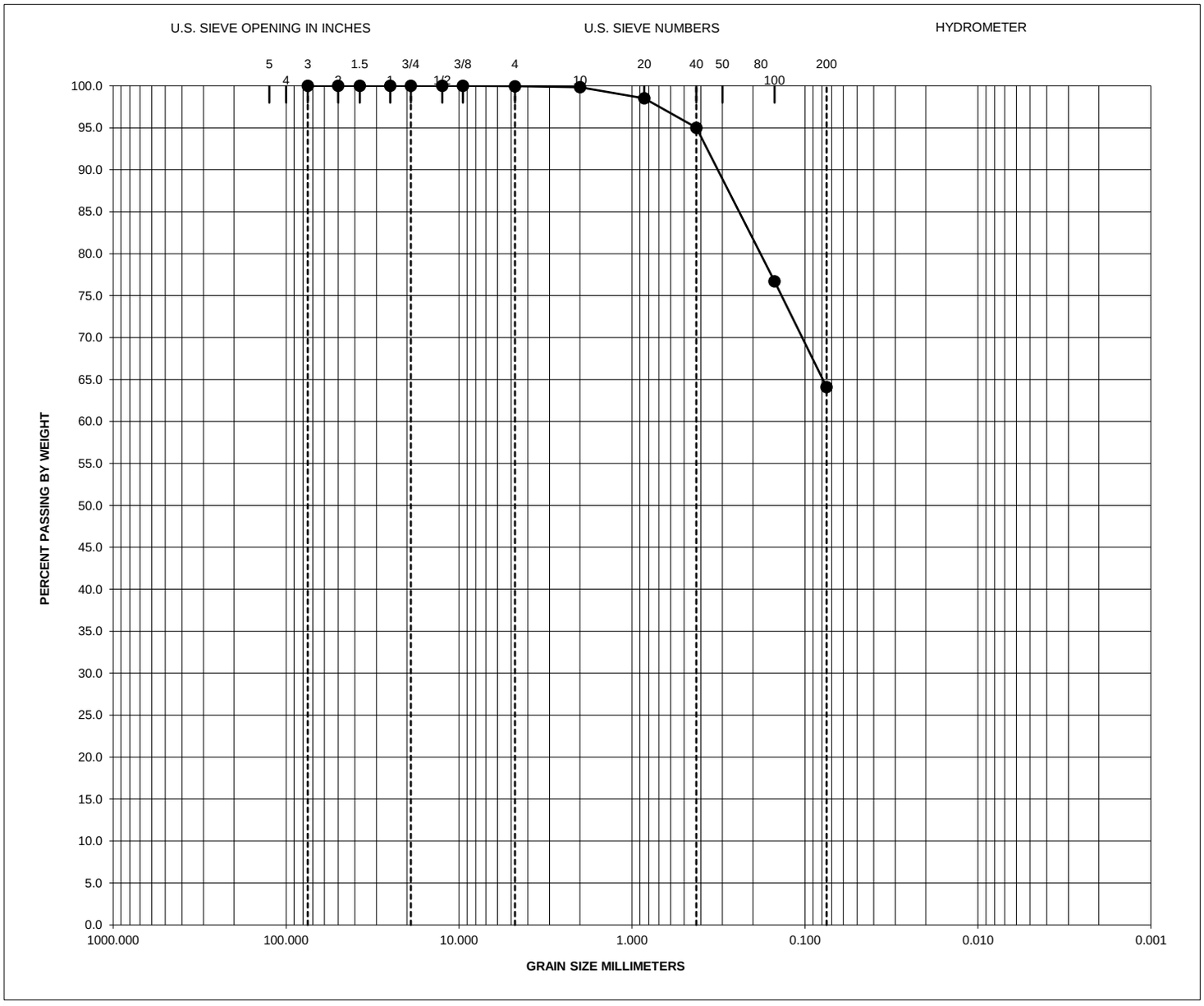
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**T-102 14'-15'**					0.00	38.06	61.94

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**T-102 18.5'-20'**	**Clay, moist, w/ coarse sand (CL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**T-102 18.5'-20'**					0.05	35.85	64.10

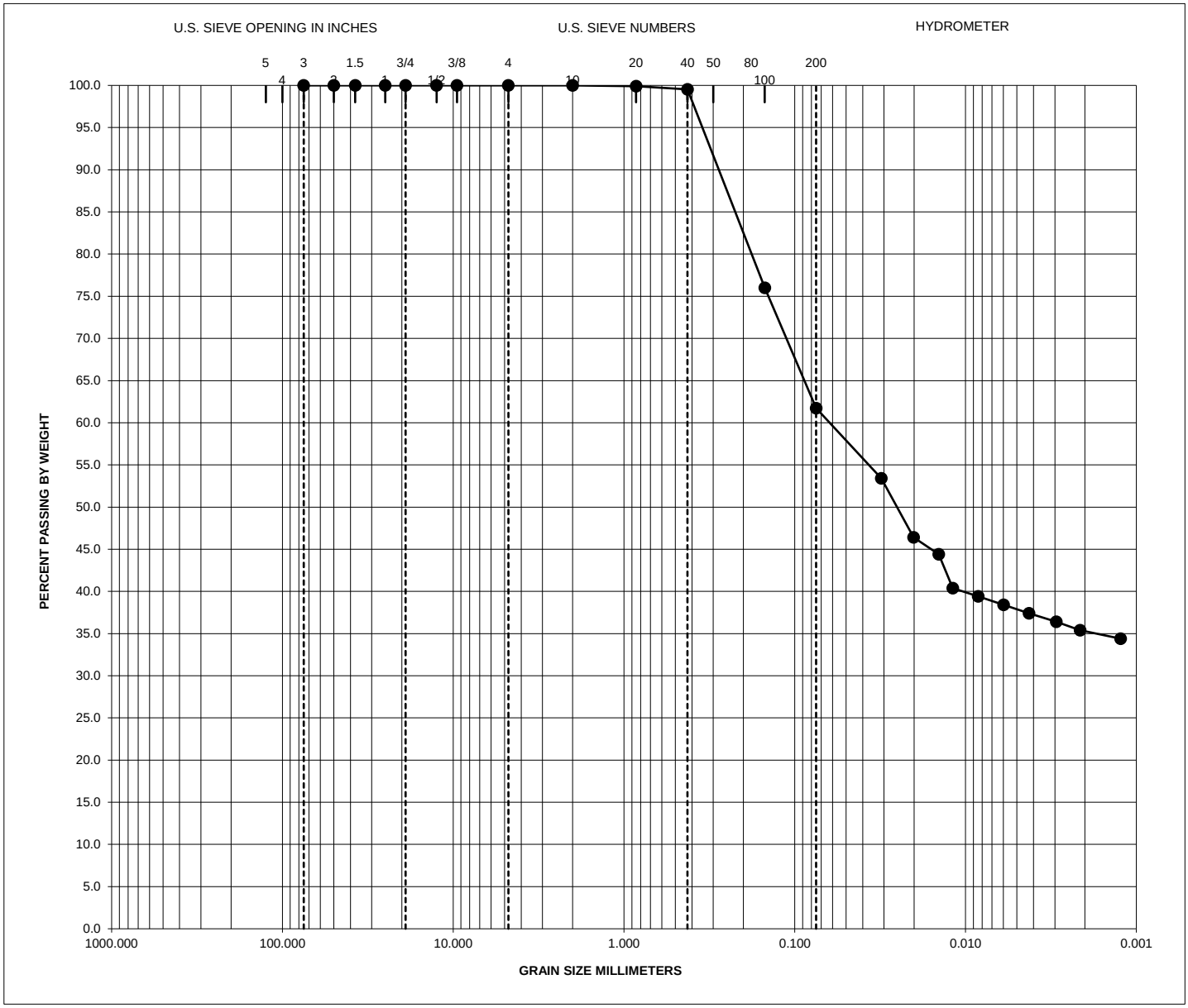
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**T-103 3'-6'**	**CLAY, hard, brown, tan and gray, w/ sand (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**T-103 3'-6'**					0.00	38.28	61.72

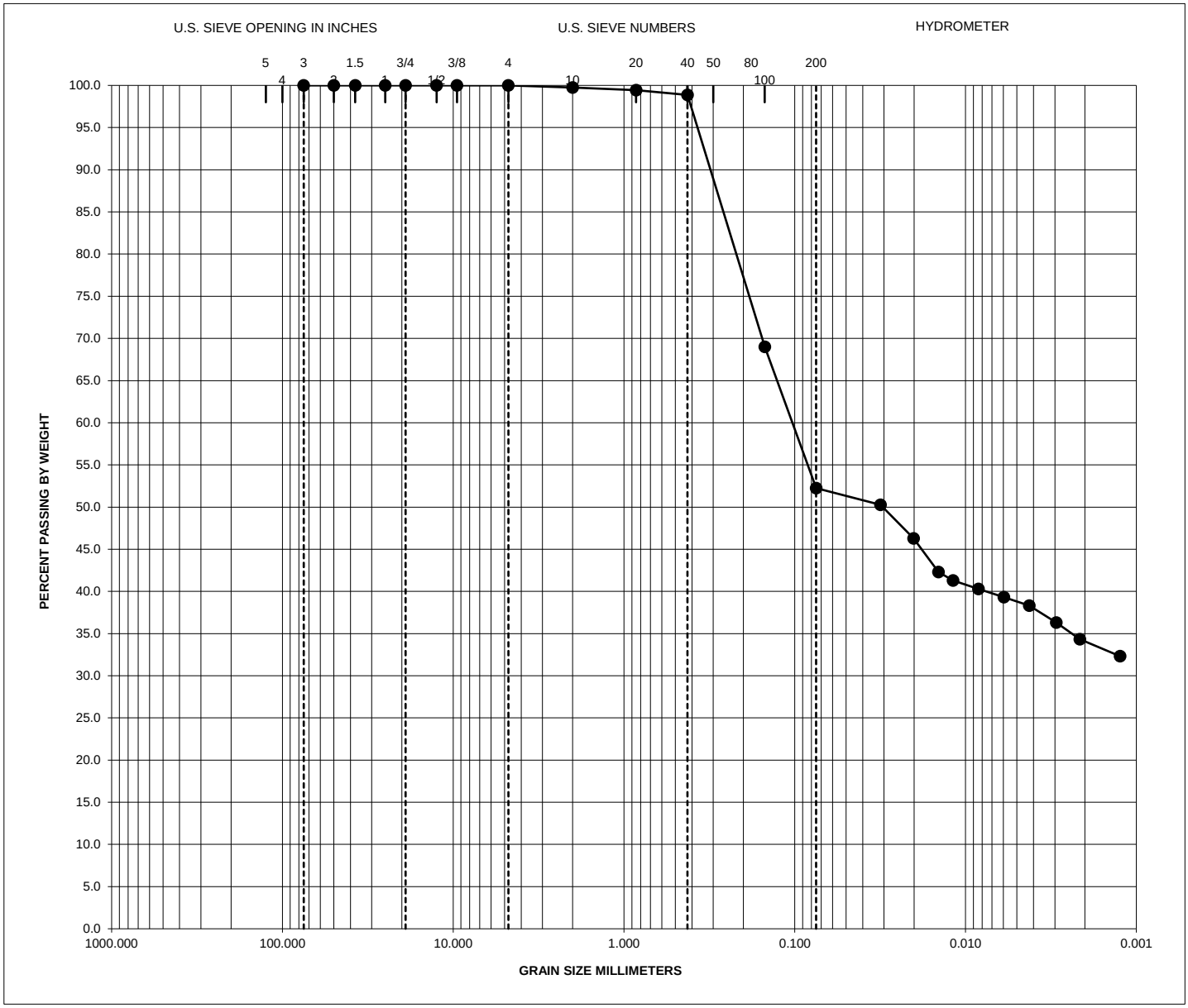
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**T-103 6'-10'**	**CLAY, hard, tan and gray, sandy (CL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**T-103 6'-10'**					0.00	47.75	52.25

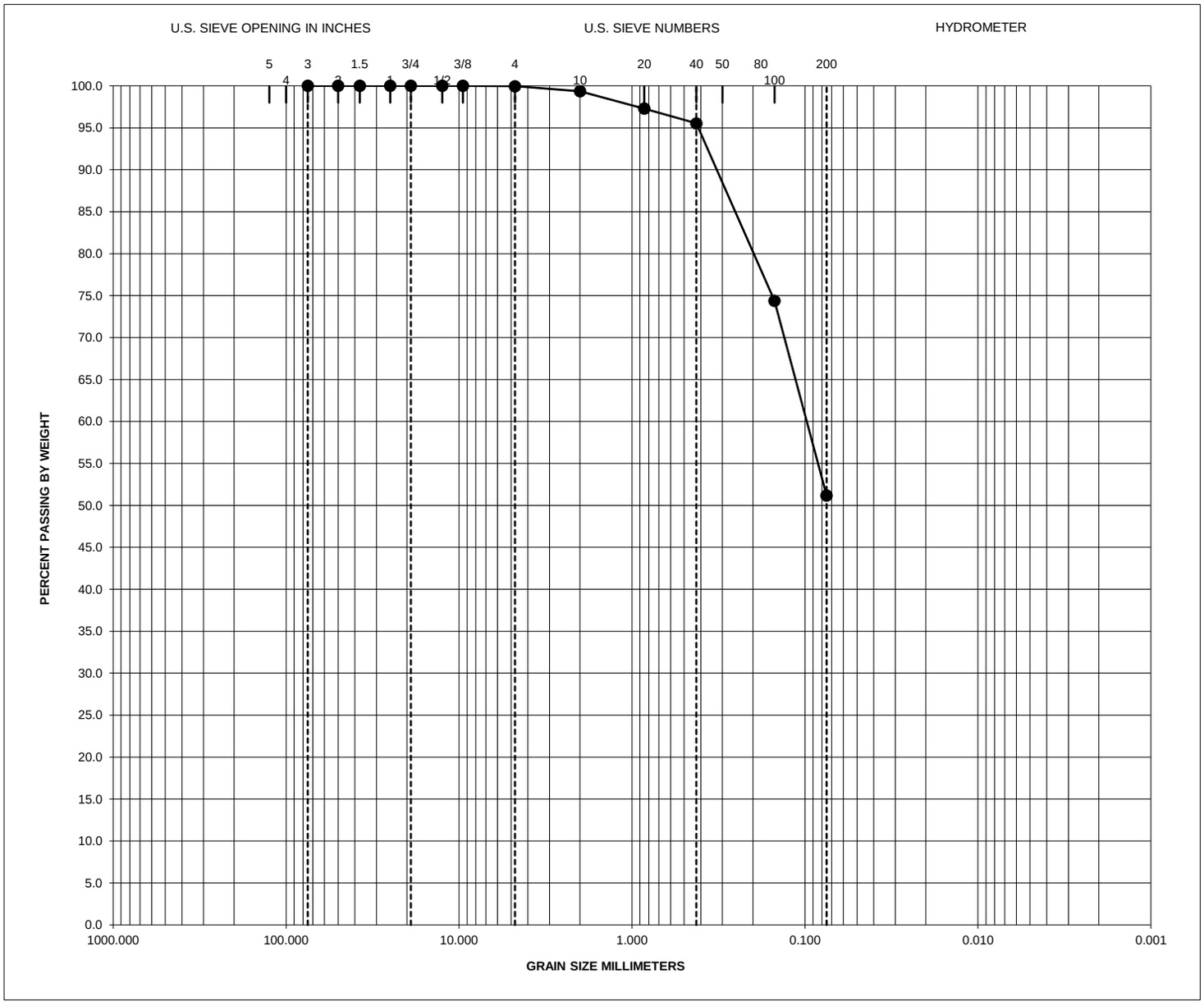
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-103**	**15'-16.5'**	**SAND, loose to medium dense, moist, tan, w/ clay and clayey sand seams (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-103**	**15'-16.5'**					0.05	48.77	51.19

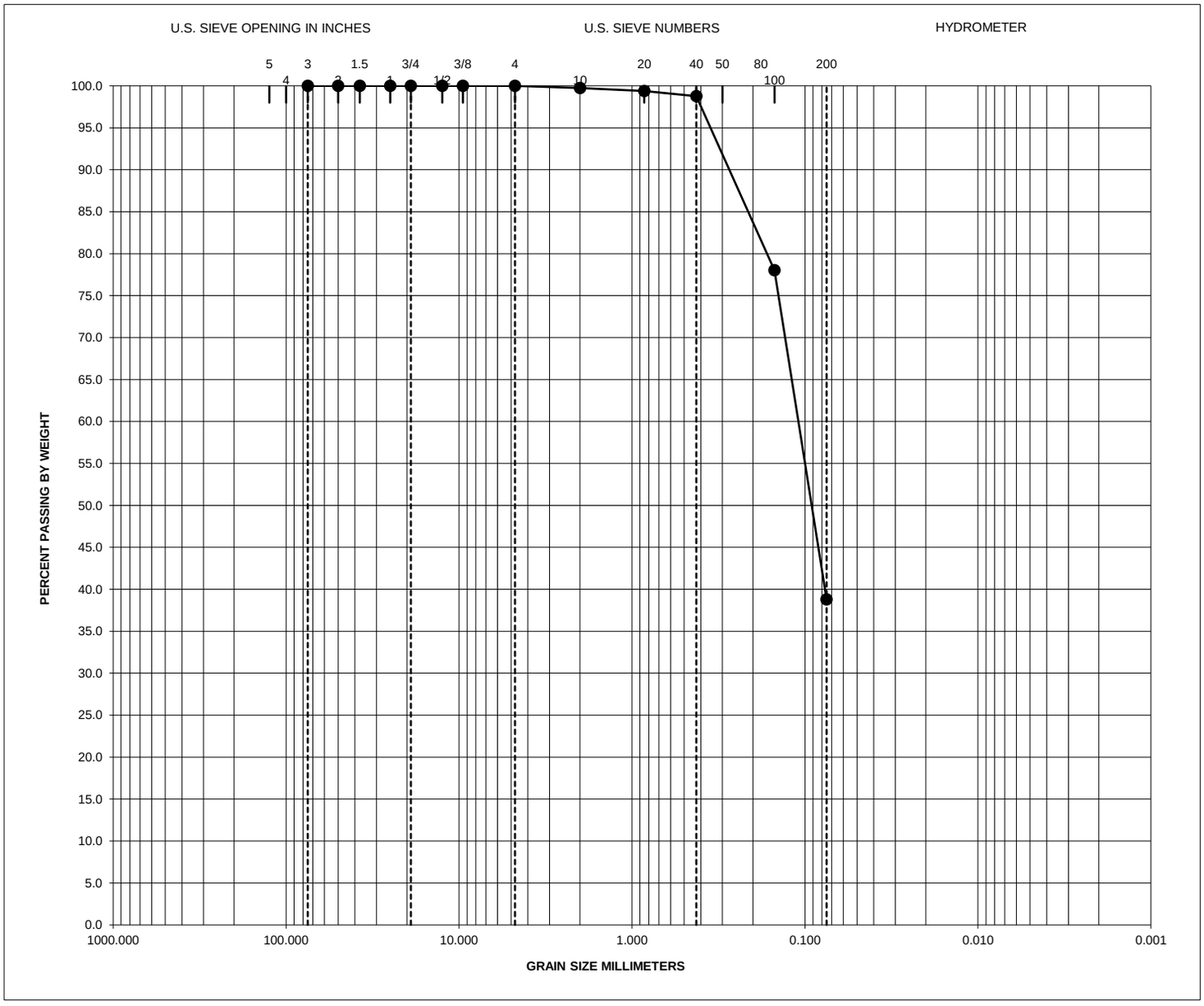
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-103**	**20'-21.5'**	**SAND, loose to medium dense, moist, tan, w/ clay and clayey sand seams (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-103**	**20'-21.5'**					0.00	61.20	38.80

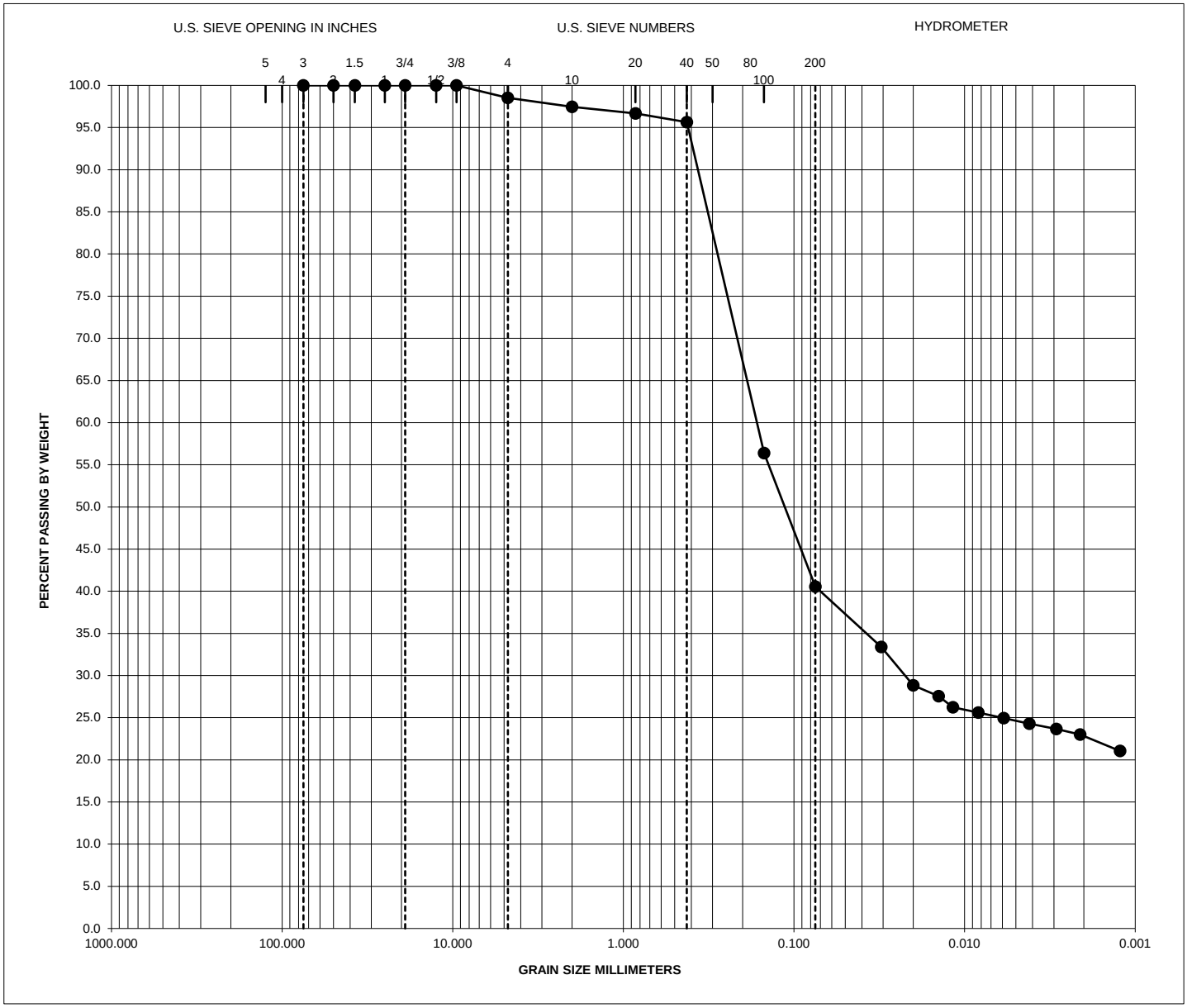
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-104**	**5-6**	**SAND, very loose, moist, tan and gray, clayey, w/ sand seams (SC)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-104**	**5-6**					1.46	57.99	40.55

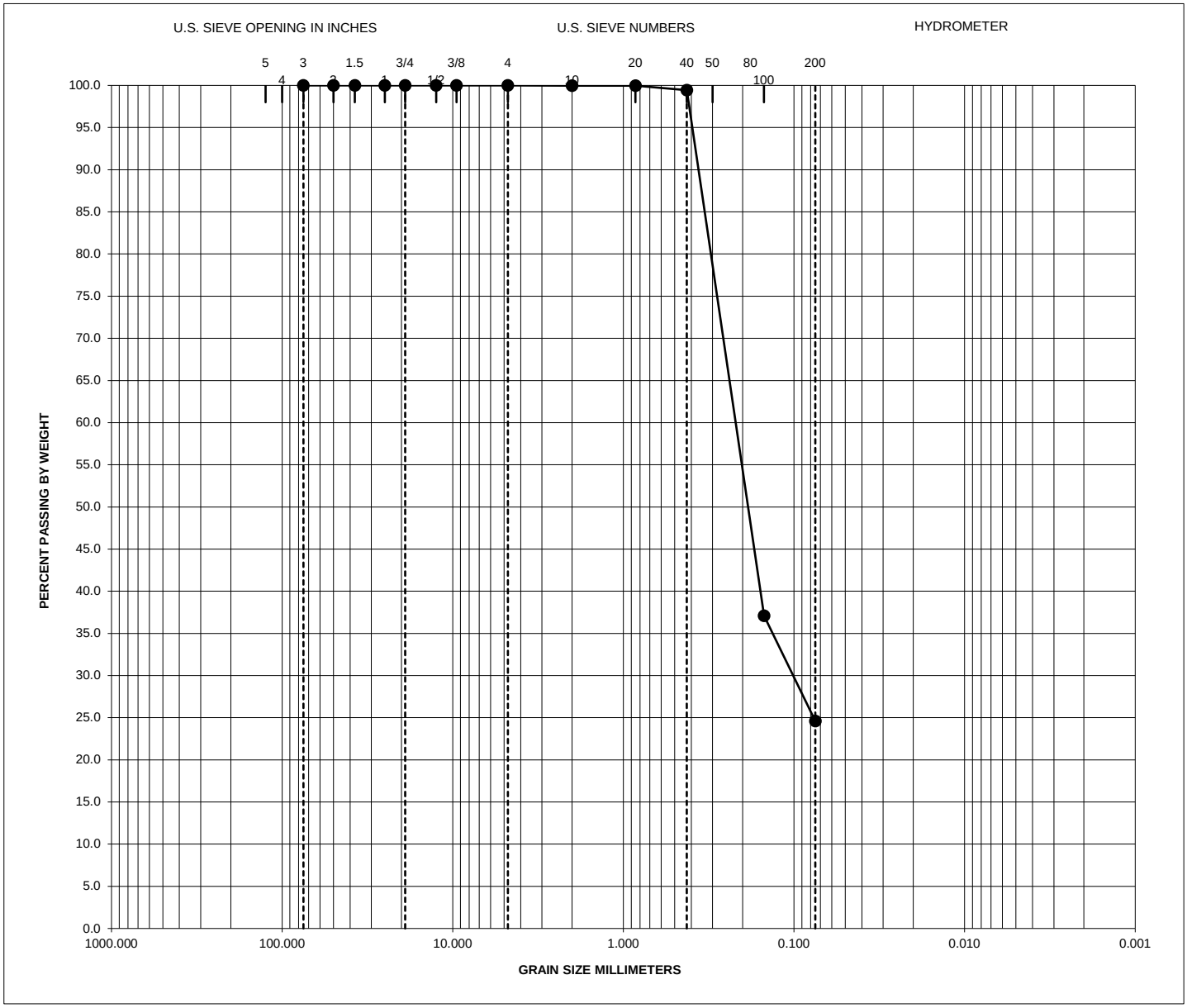
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-104**	**7-8.5**	**CLAYEY SAND, loose, moist, reddish brown (SC)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-104**	**7-8.5**					0.00	75.40	24.60

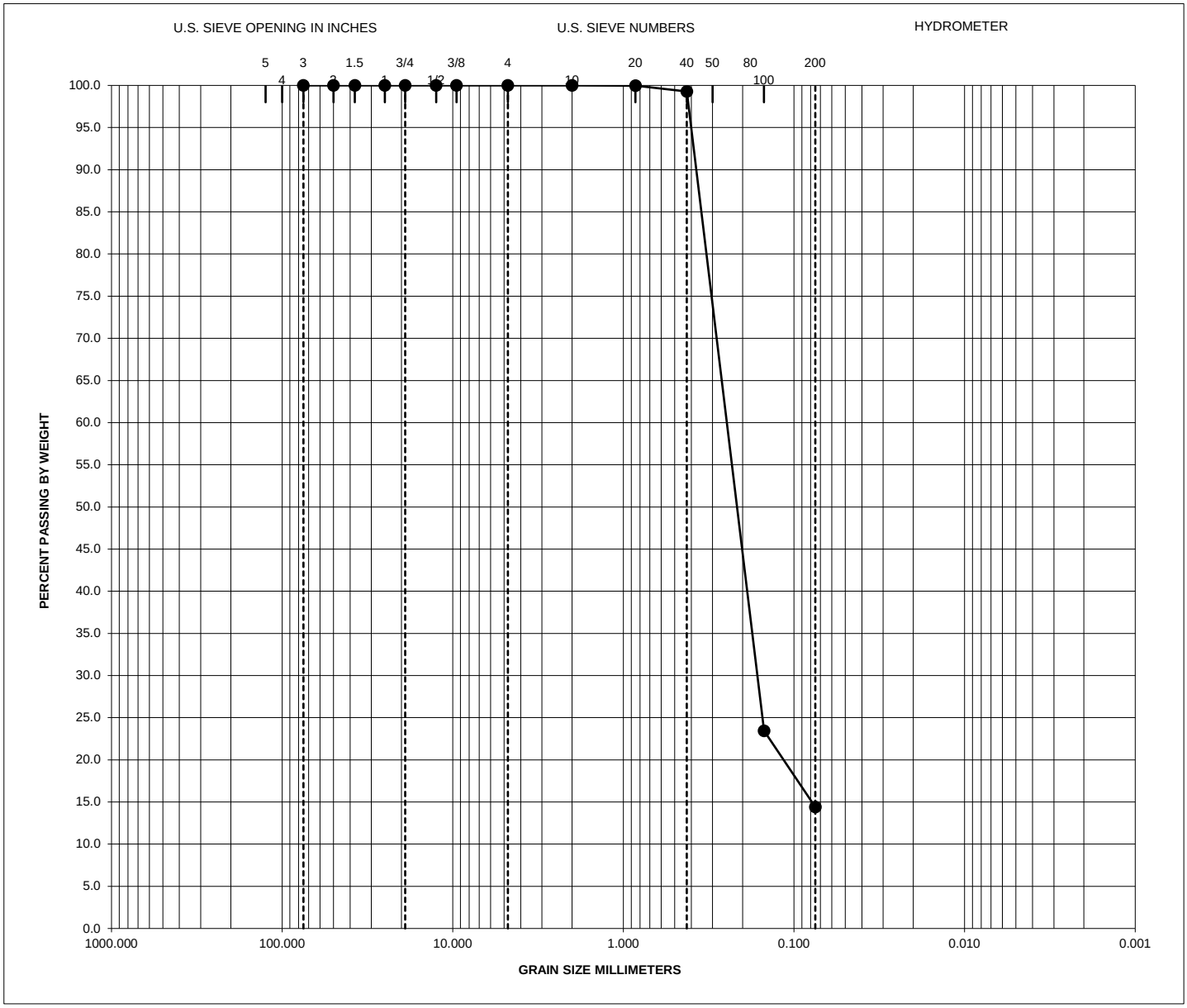
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/25/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-104**	**8.5-10**	**SAND, loose, moist, reddish brown (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-104**	**8.5-10**					0.00	85.59	14.41

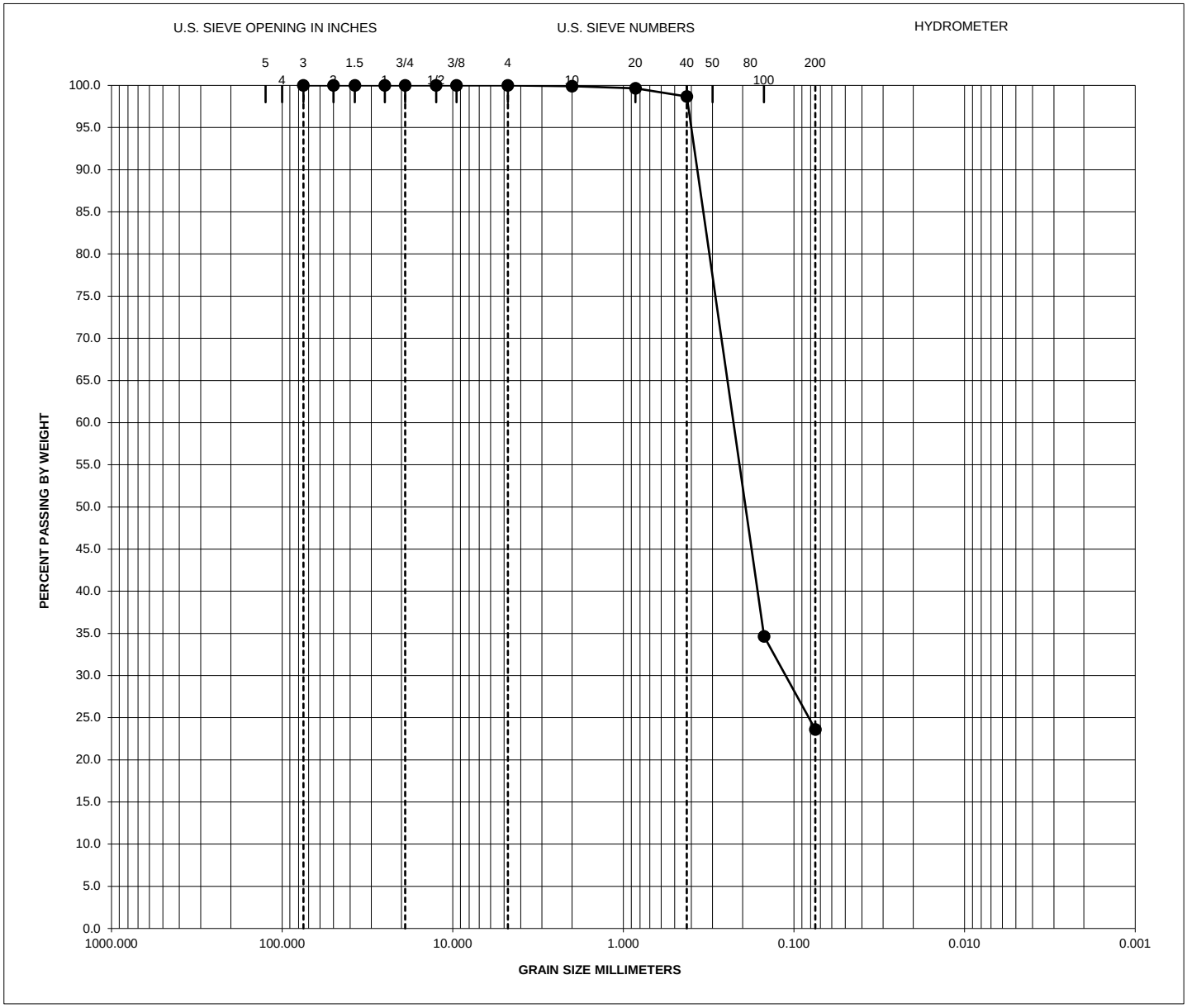
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/25/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification	Classification	LL	PL	PI	Cu	Cc
● **TS-104 13.5-15'**	**SAND, loose, moist to wet, tan (SP)**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-104 13.5-15'**					0.00	76.39	23.61

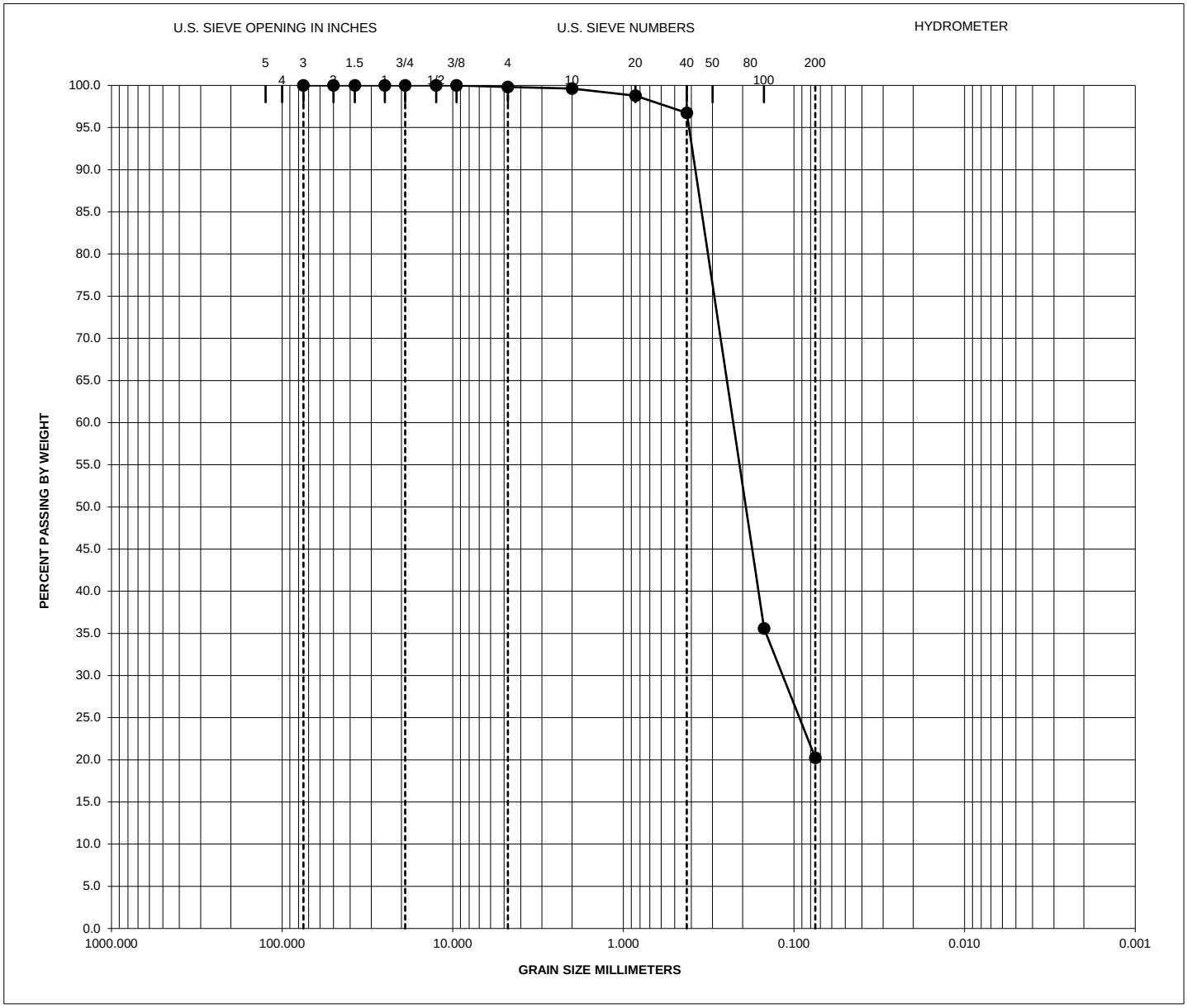
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/25/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification	Classification	LL	PL	PI	Cu	Cc
● TS-104 18.5-20'	SAND, loose, wet, tan, w/ gravel (SP)					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	% -#200
● TS-104 18.5-20'					0.19	79.57	20.24

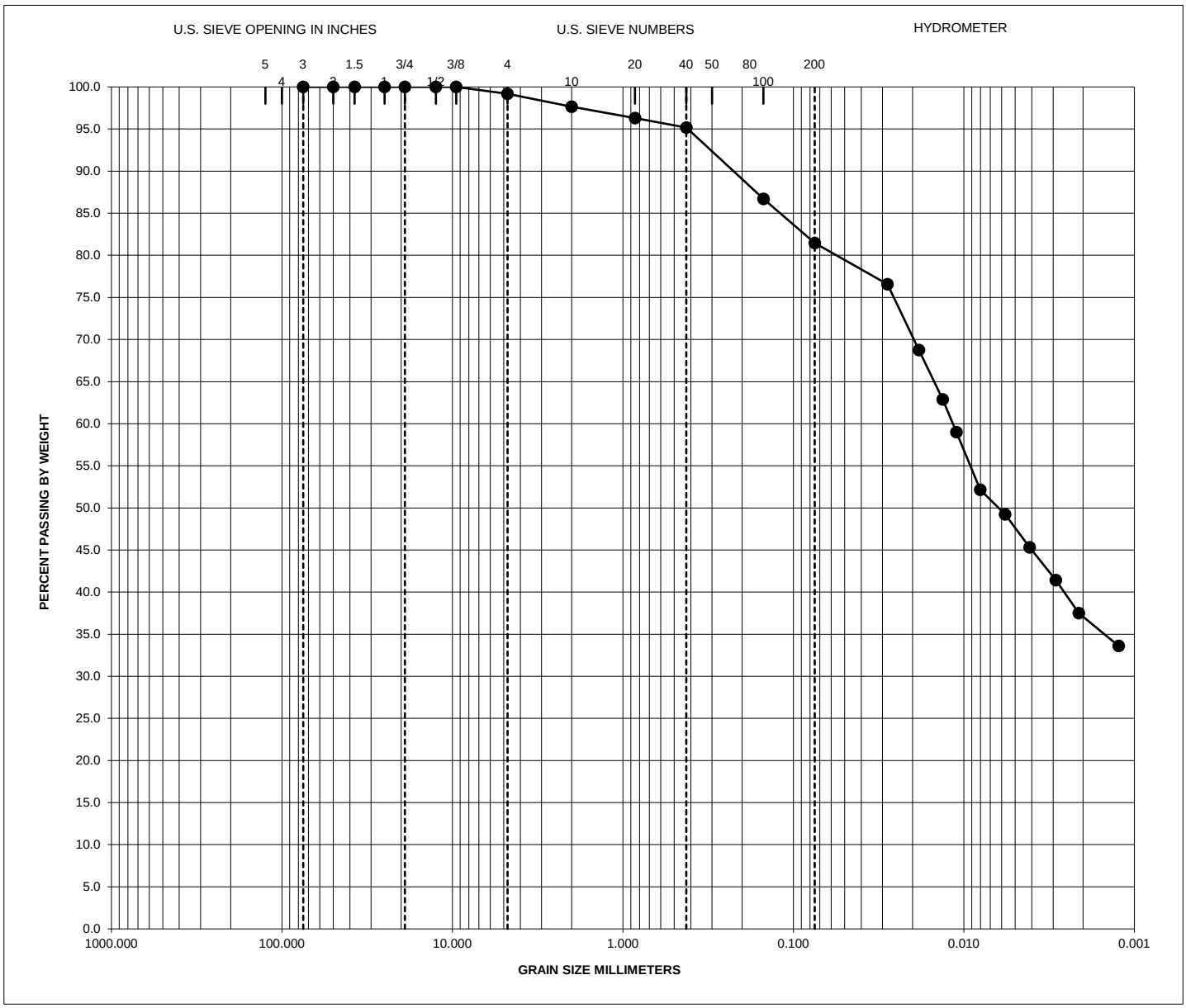
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: DART D-2

Project No: E17-0811

Tested by:	Date Tested	Checked by:	ALLIANCE GEOTECHNICAL GROUP
BV	5/25/2019	JP	



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-111 1'-4'**	**CLAY, very stiff to hard, brown and tan, w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-111 1'-4'**					0.80	17.73	81.47

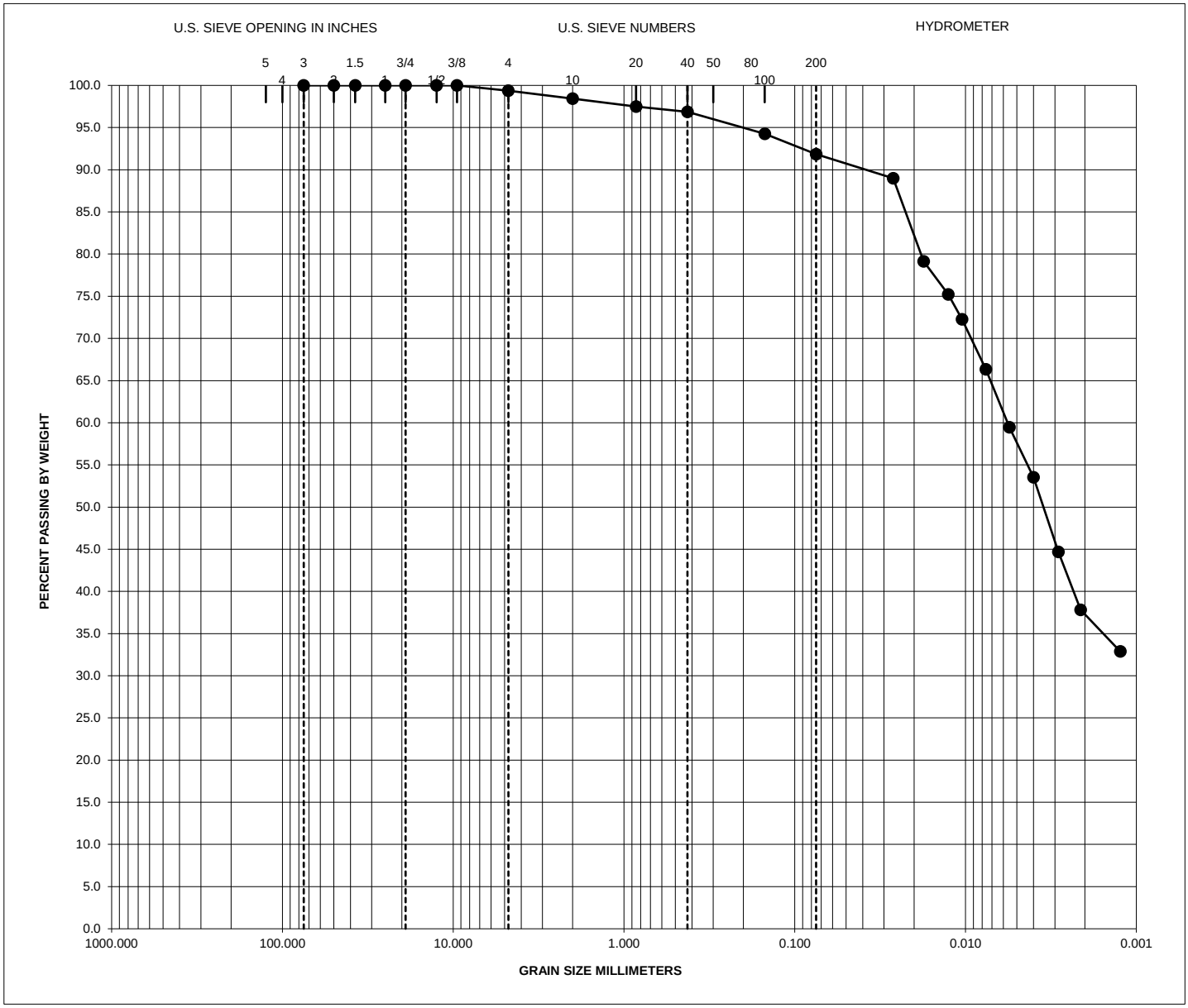
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-111 4'-6'**	**CLAY, hard, tan and dark brown, w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-111 4'-6'**					0.63	7.53	91.84

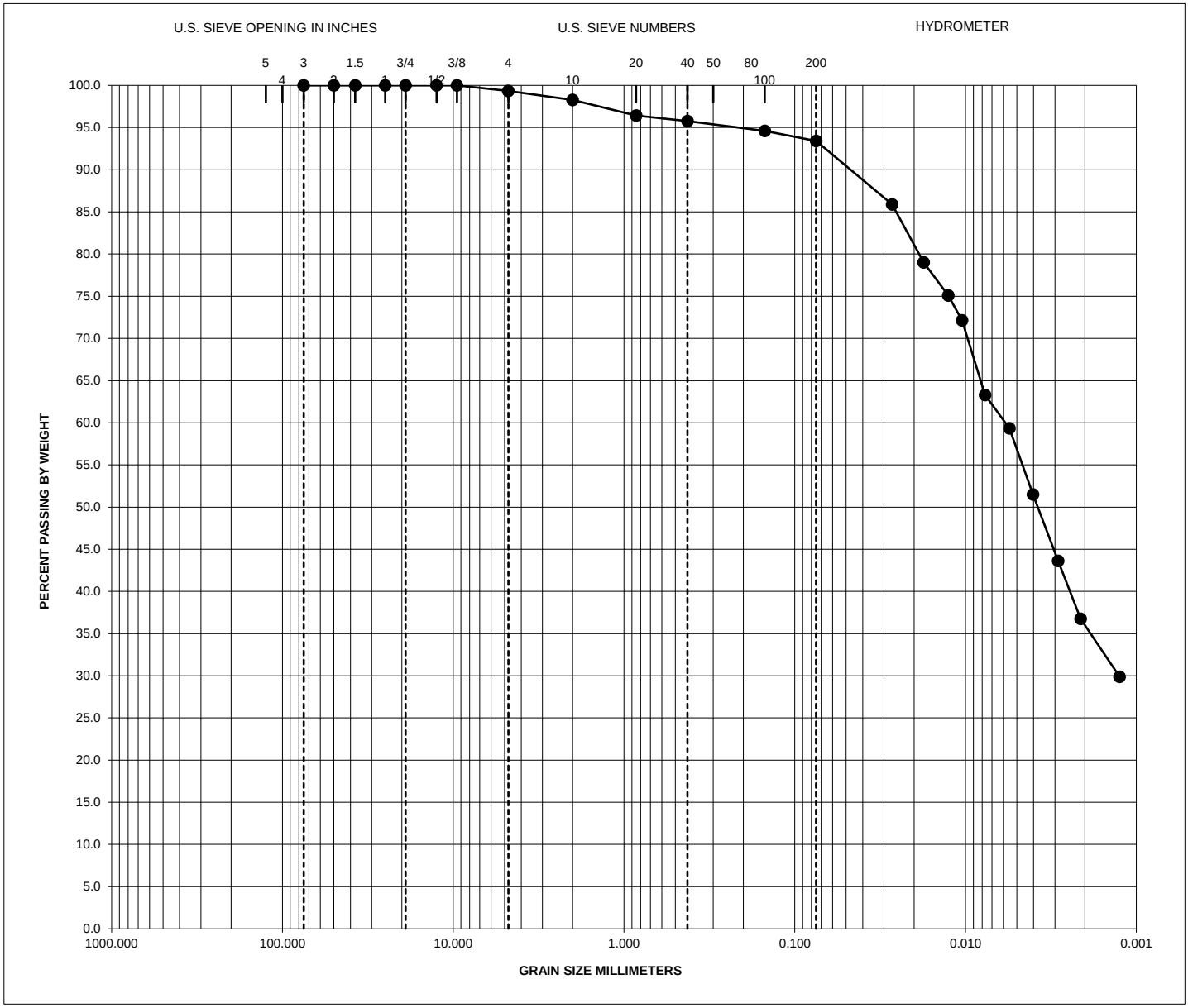
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-111 6'-10'**	**CLAY, very stiff to hard, tan and gray w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-111 6'-10'**					0.65	5.94	93.41

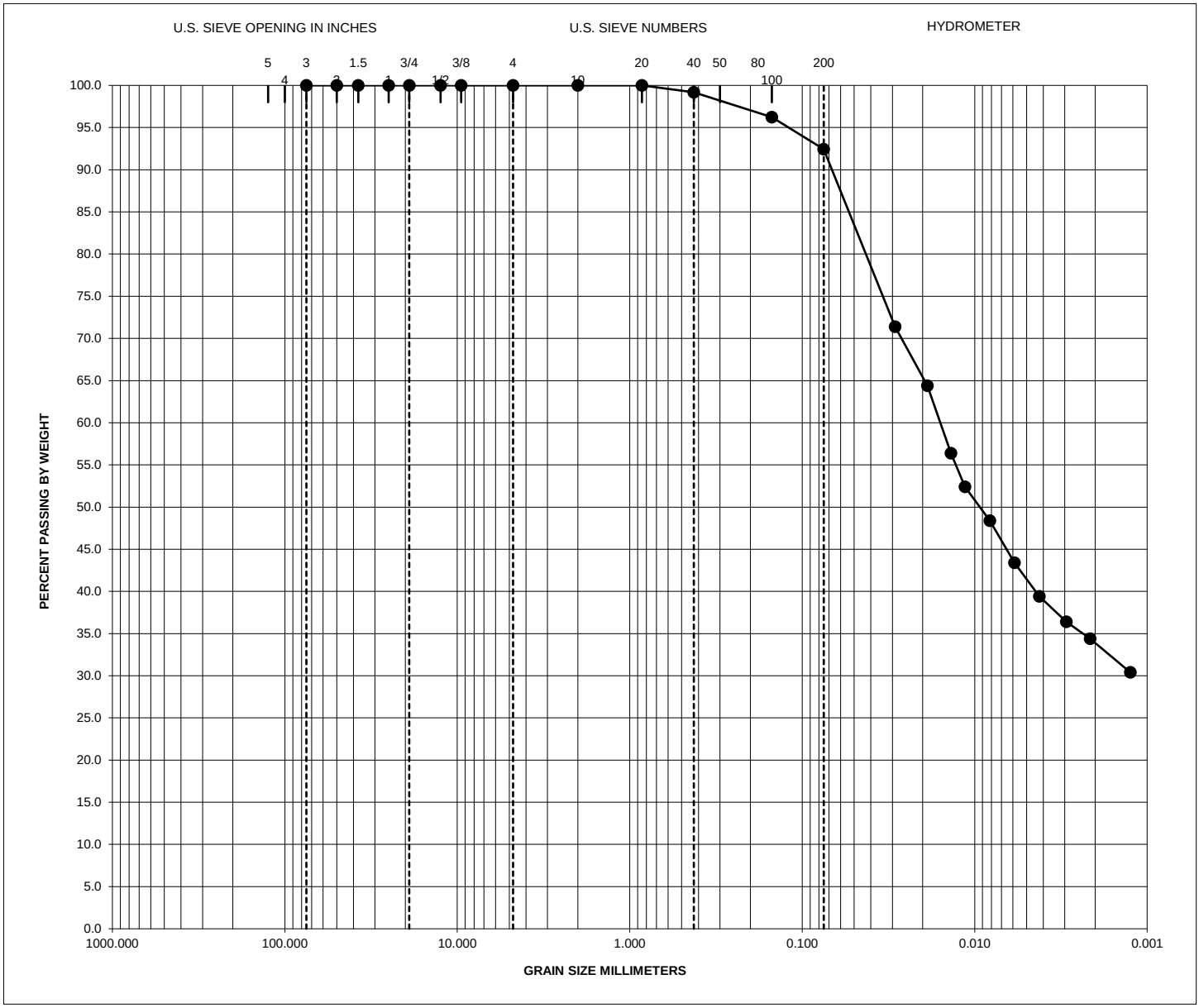
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-111 15'-16'**	**CLAY, very stiff to hard, tan and gray w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-111 15'-16'**					0.00	7.56	92.44

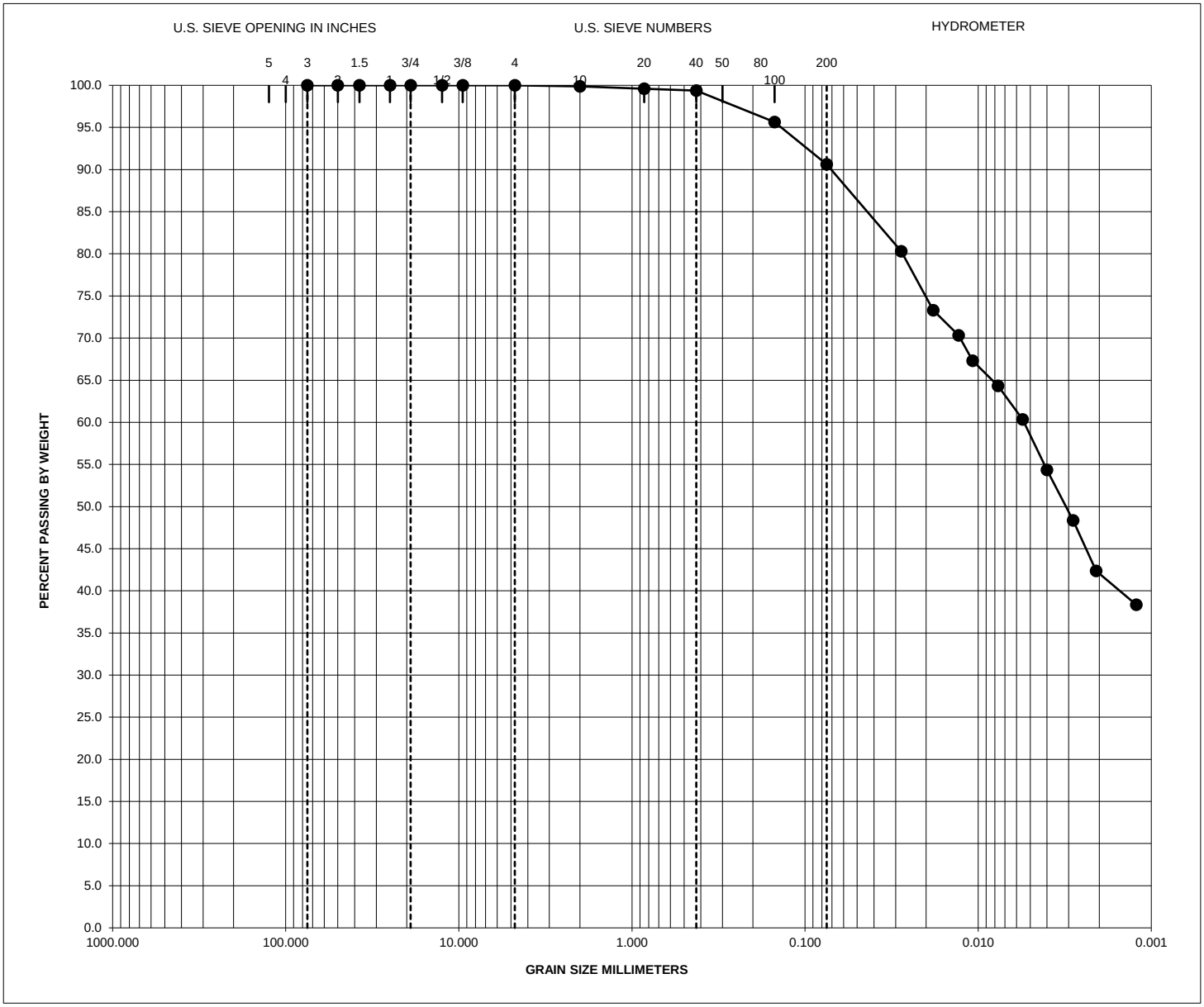
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-111 20'-21'**	**CLAY, very stiff to hard, tan and gray w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-111 20'-21'**					0.00	9.39	90.61

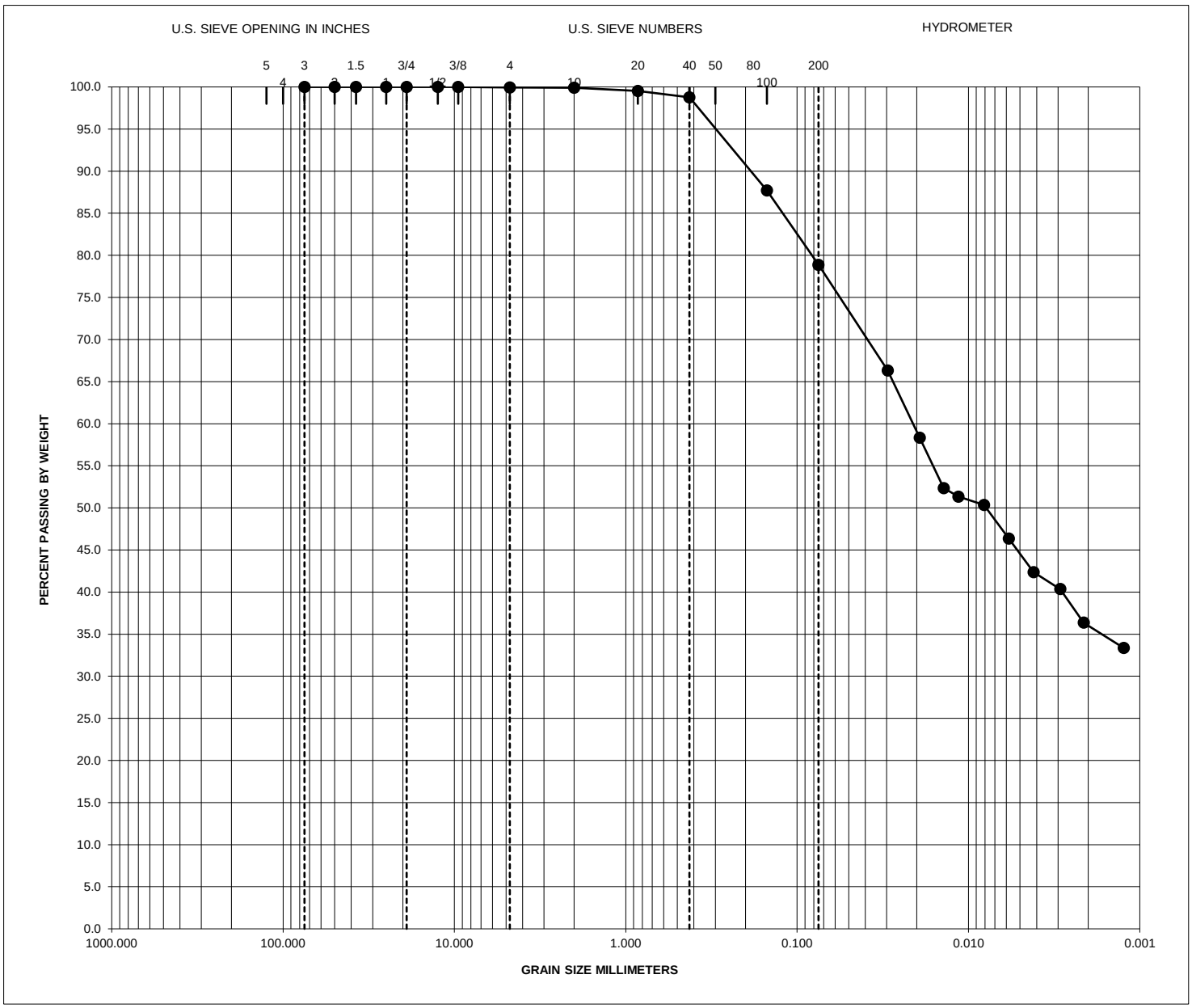
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-111 25'-26'**	**CLAY, very stiff, tan and dark brown, w/ sandy gravel lenses (CL)**					

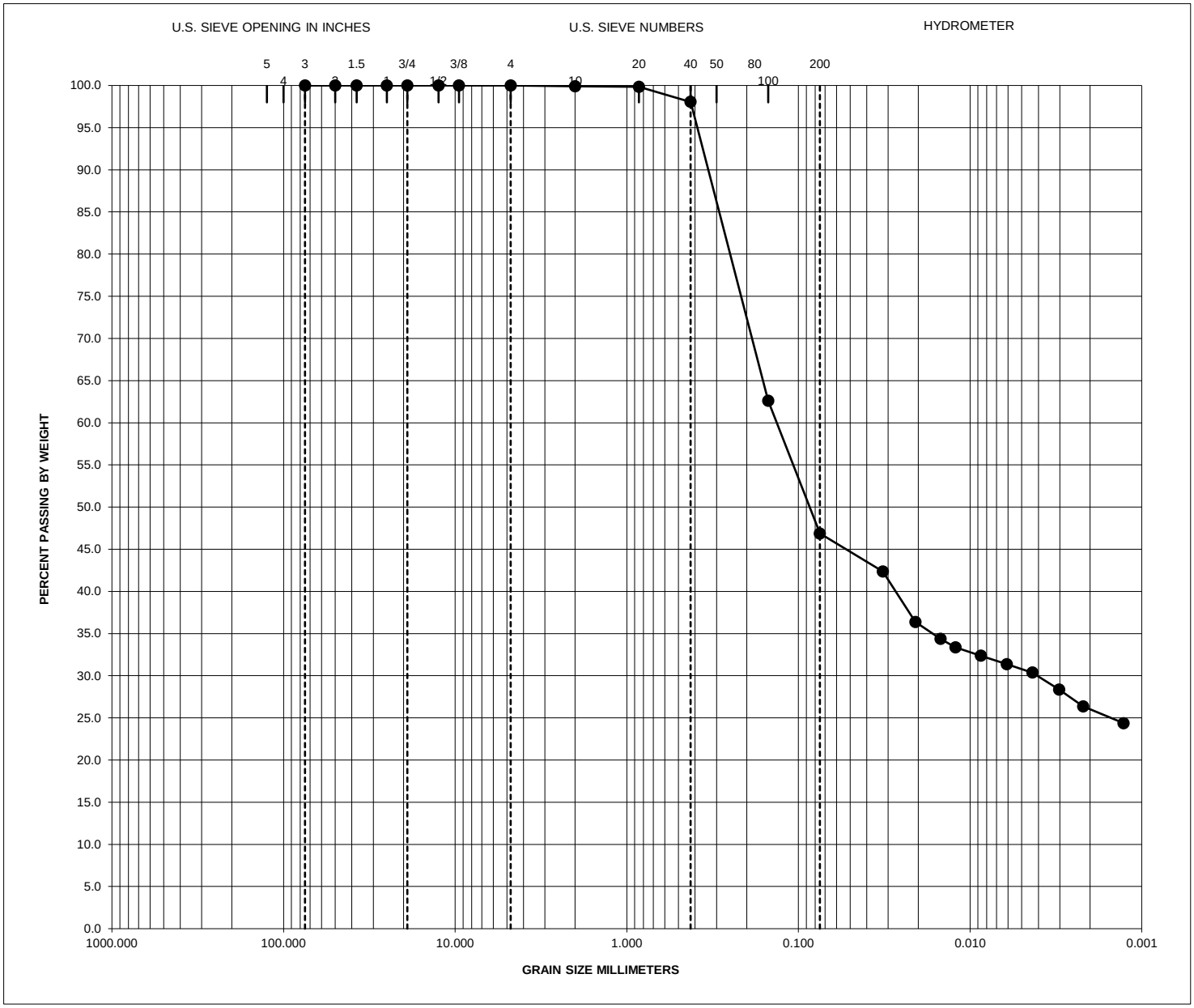
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-111 25'-26'**					0.07	21.07	78.85

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-111 30'-31'**	**SAND, wet, tan, clayey, w/ clay seams (SC)**					

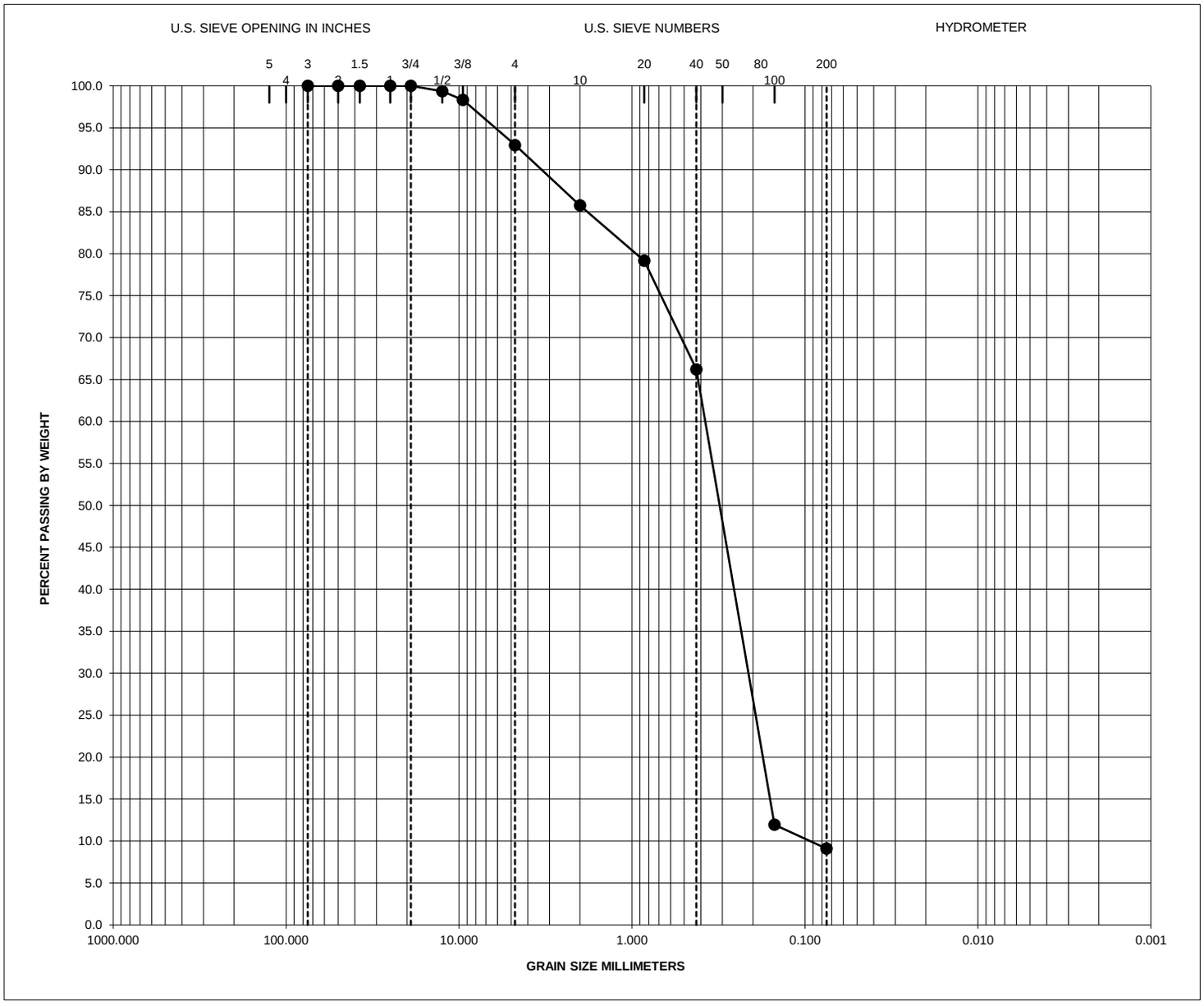
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-111 30'-31'**					0.00	53.14	46.86

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**
Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/13/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-111 35'-36.5'**	**SAND, loose to dense, wet, tan, fine, w/ gravel (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-111 35'-36.5'**					7.06	83.85	9.09

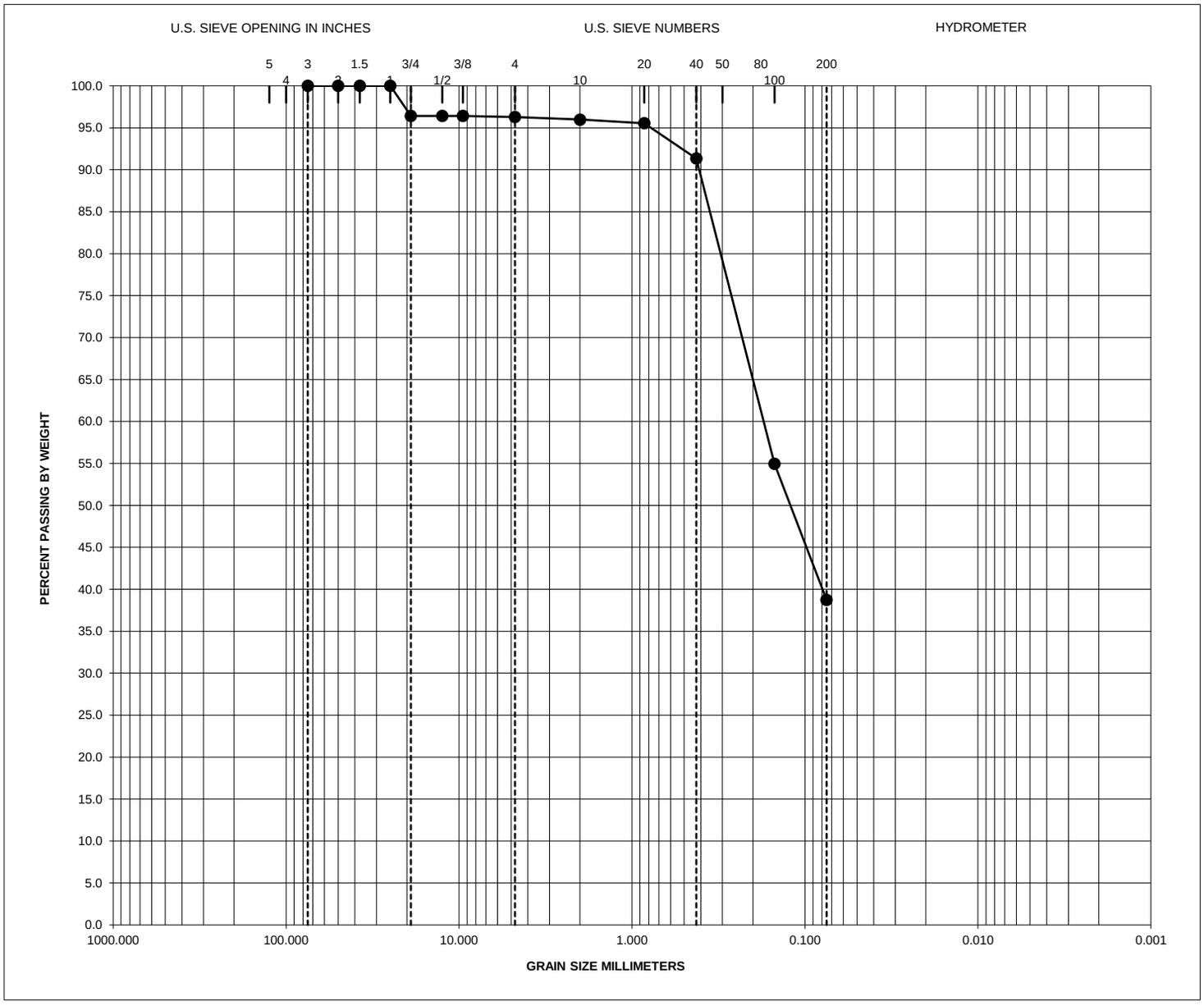
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-111 40'-41.5'**	**SAND, loose to dense, wet, tan, clayey, w/ gravel (SC)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-111 40'-41.5'**					3.71	57.55	38.74

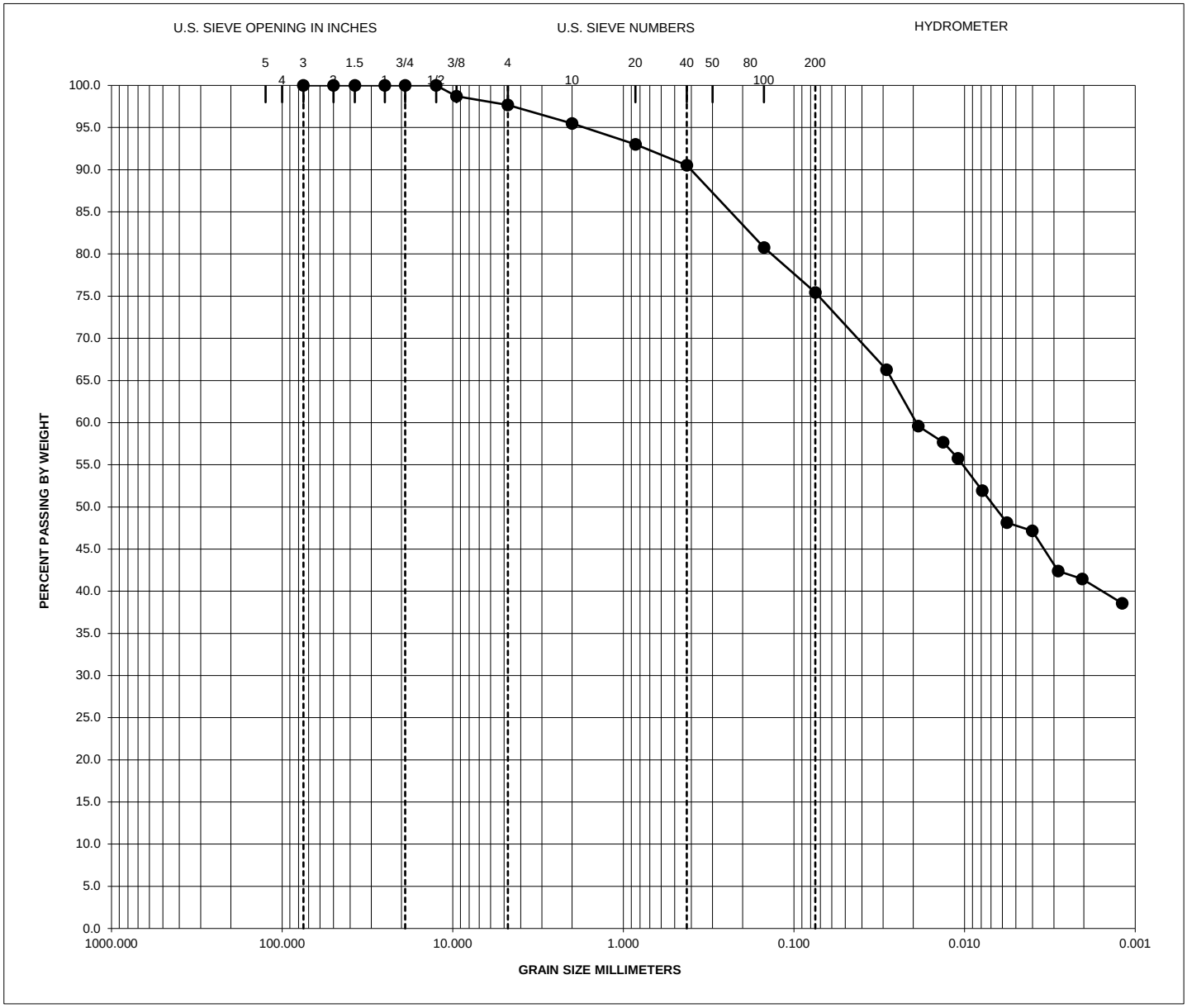
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-112**	**2-4**	**CLAY, stiff, brown, w/ sand seams, embedded gravel, and asphalt debris (FILL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-112**	**2-4**					2.31	22.26	75.43

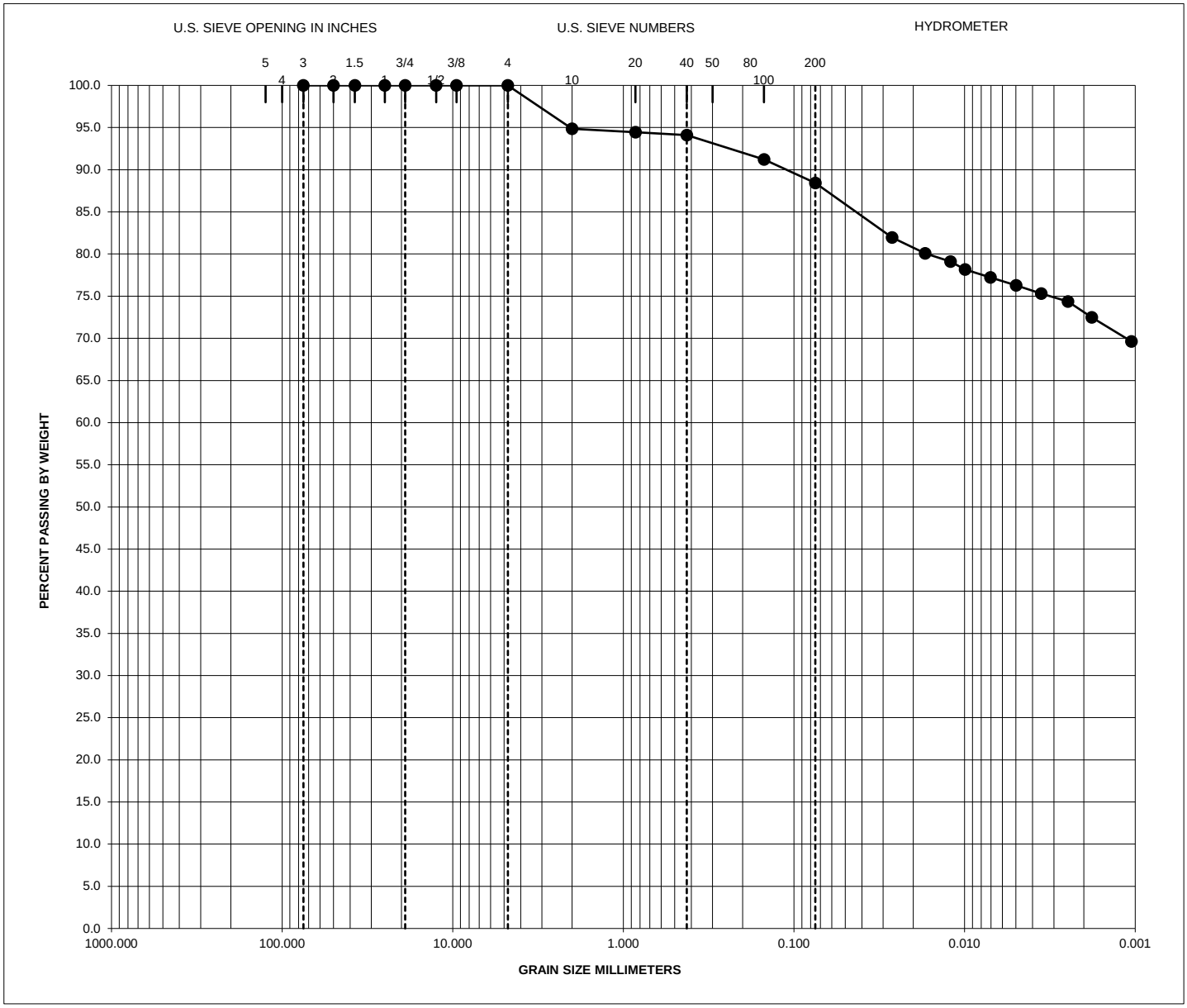
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-112**	**14-15**	**CLAY, soft to stiff, light brown and light gray, w/calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-112**	**14-15**					0.00	11.57	88.43

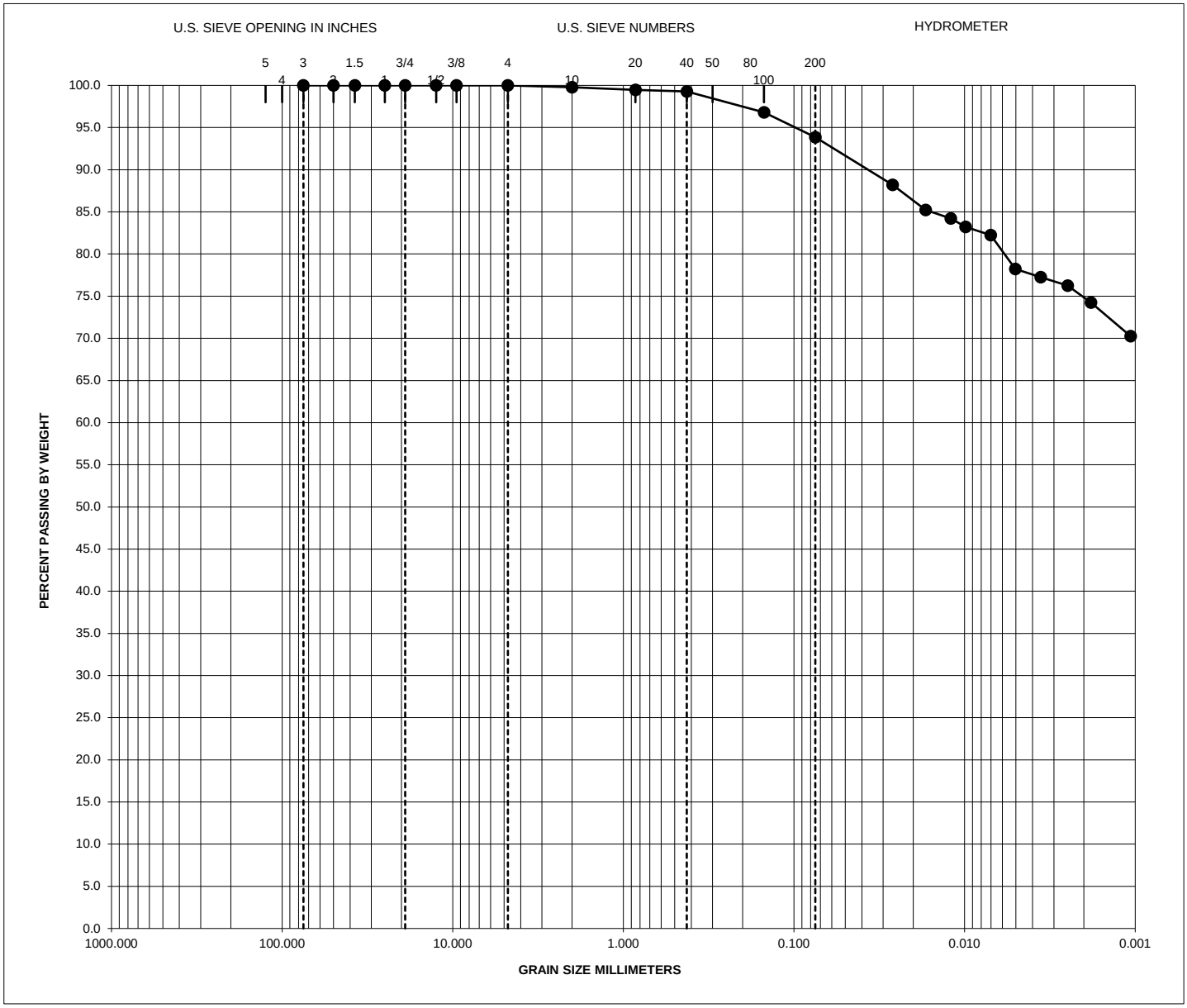
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-112**	**19-20**	**CLAY, wet, soft, light tan, w/ sand seams (CL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-112**	**19-20**					0.00	6.16	93.84

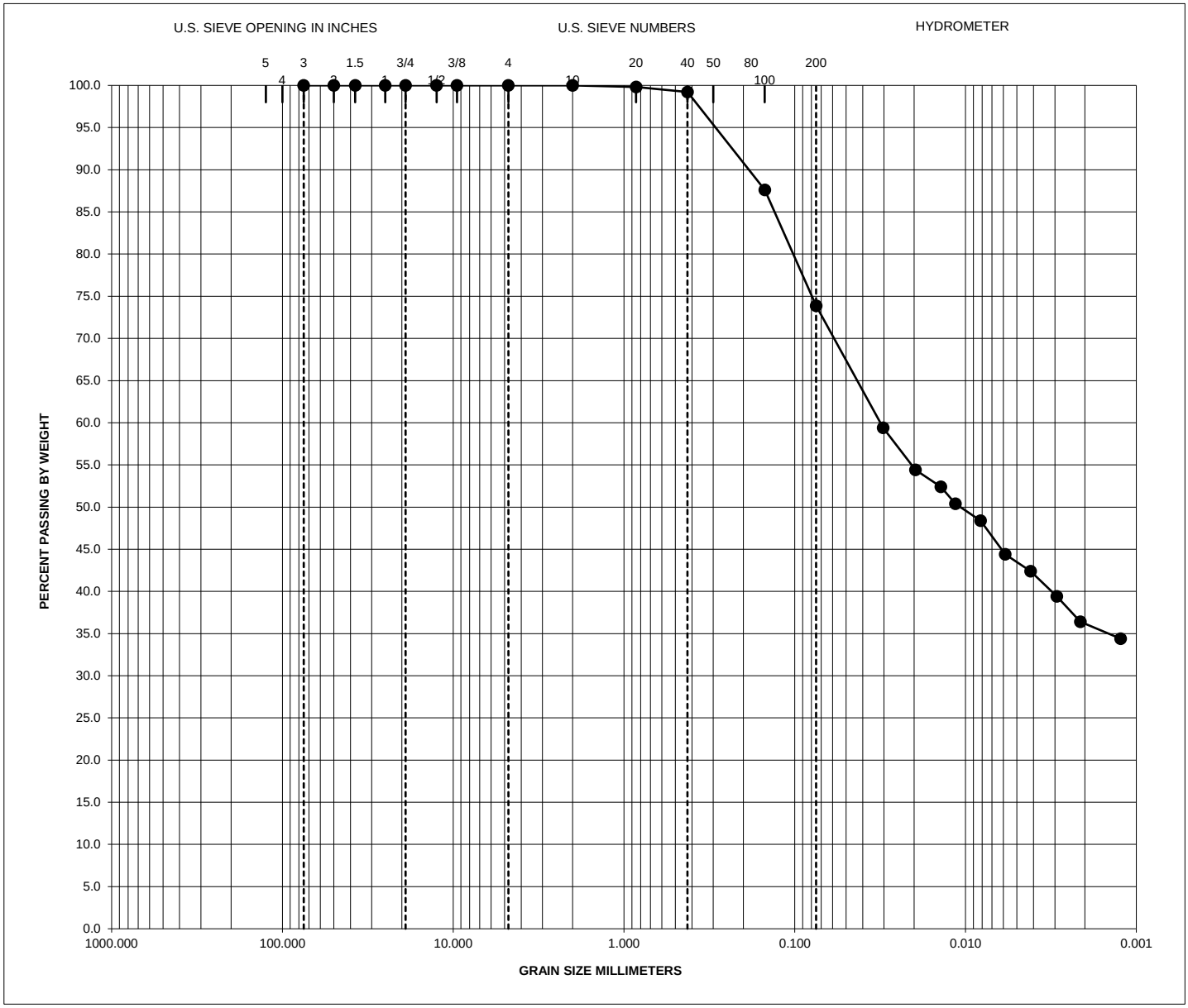
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-202 1'-4'**	**CLAY, stiff, tan and gray, w/ sand lenses (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-202 1'-4'**					0.00	26.12	73.88

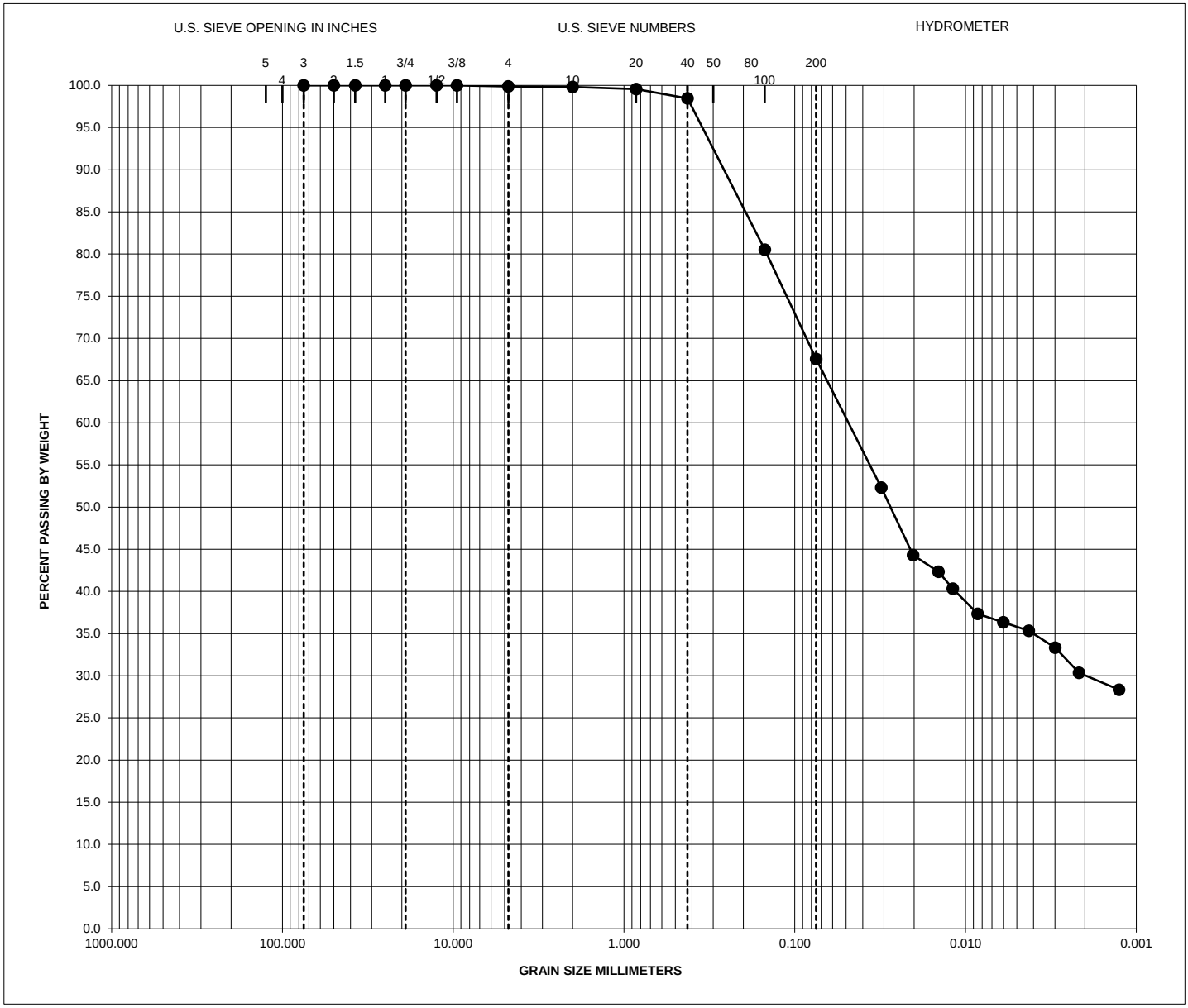
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-202 4'-8'**	**CLAY, very stiff, tan and gray, w/ sandy clay seams and lenses (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-202 4'-8'**					0.11	32.31	67.57

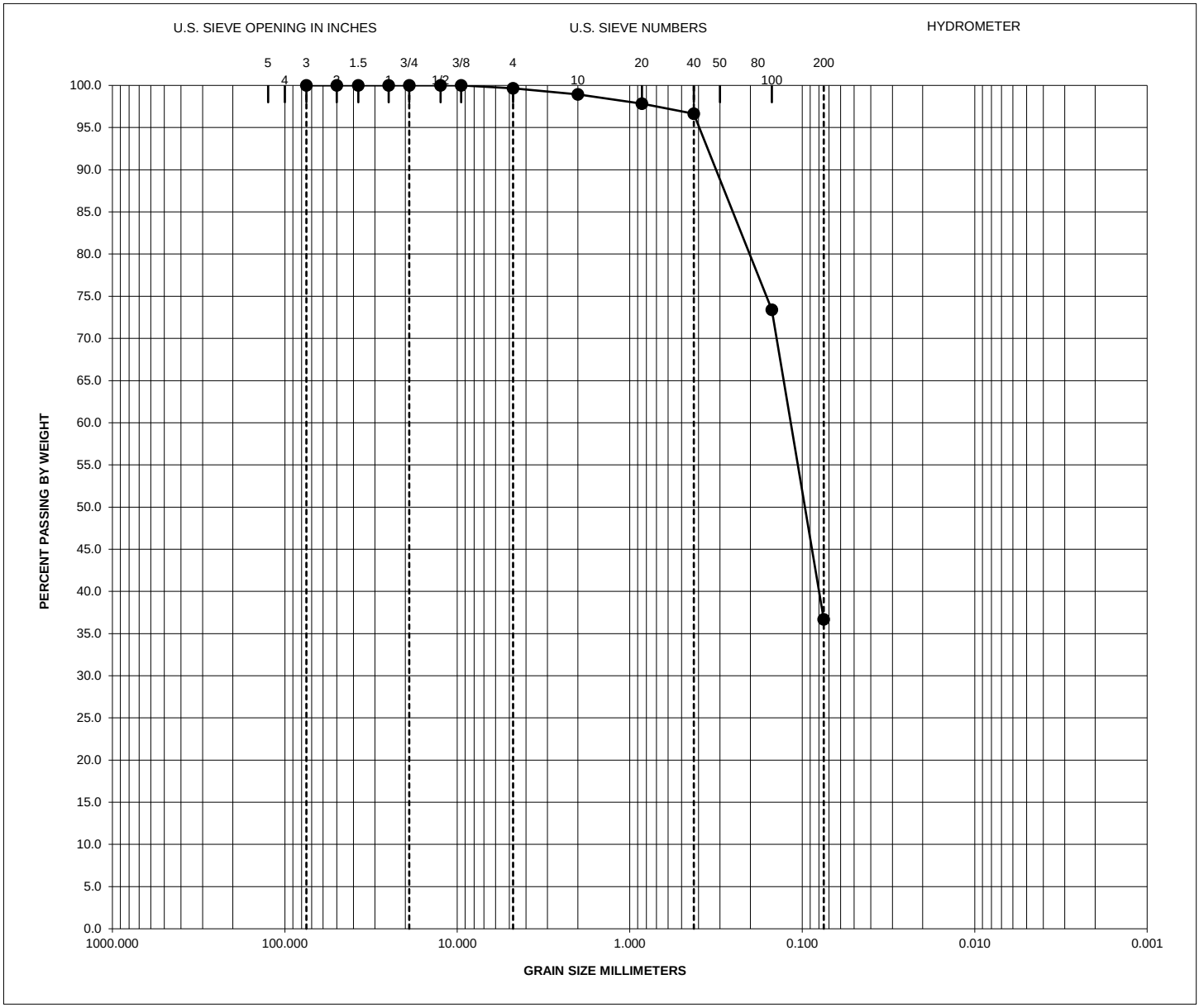
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/10/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-202**	**8'-9.5'**	**SAND, medium dense, tan and gray, fine, w/ sandy clay seams & limestone fragments (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-202**	**8'-9.5'**					0.35	62.98	36.68

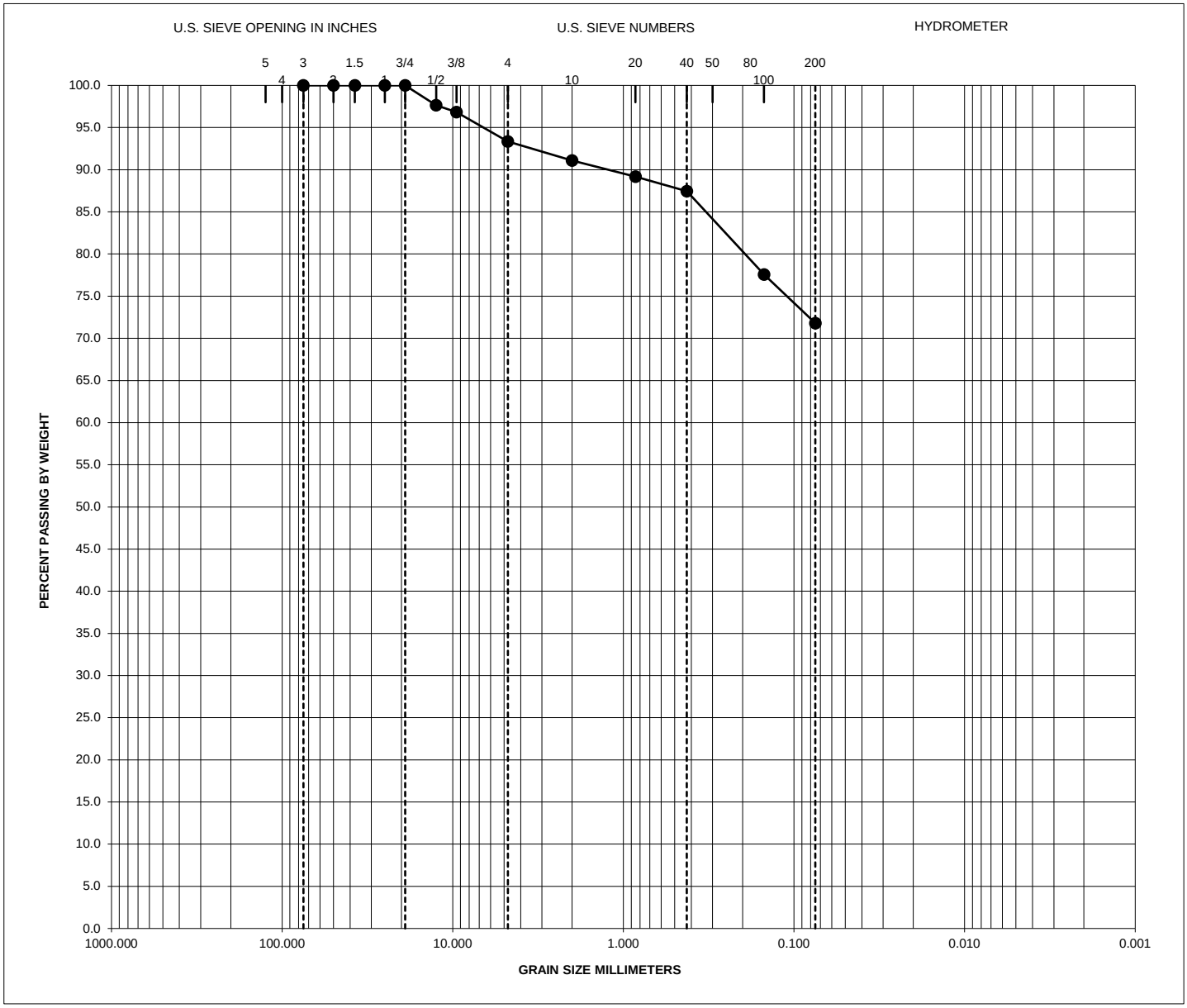
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	12/4/2018	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-203**	**1-3**	**CLAY, tan and brown, w/ gravel (FILL) (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-203**	**1-3**					6.66	21.54	71.80

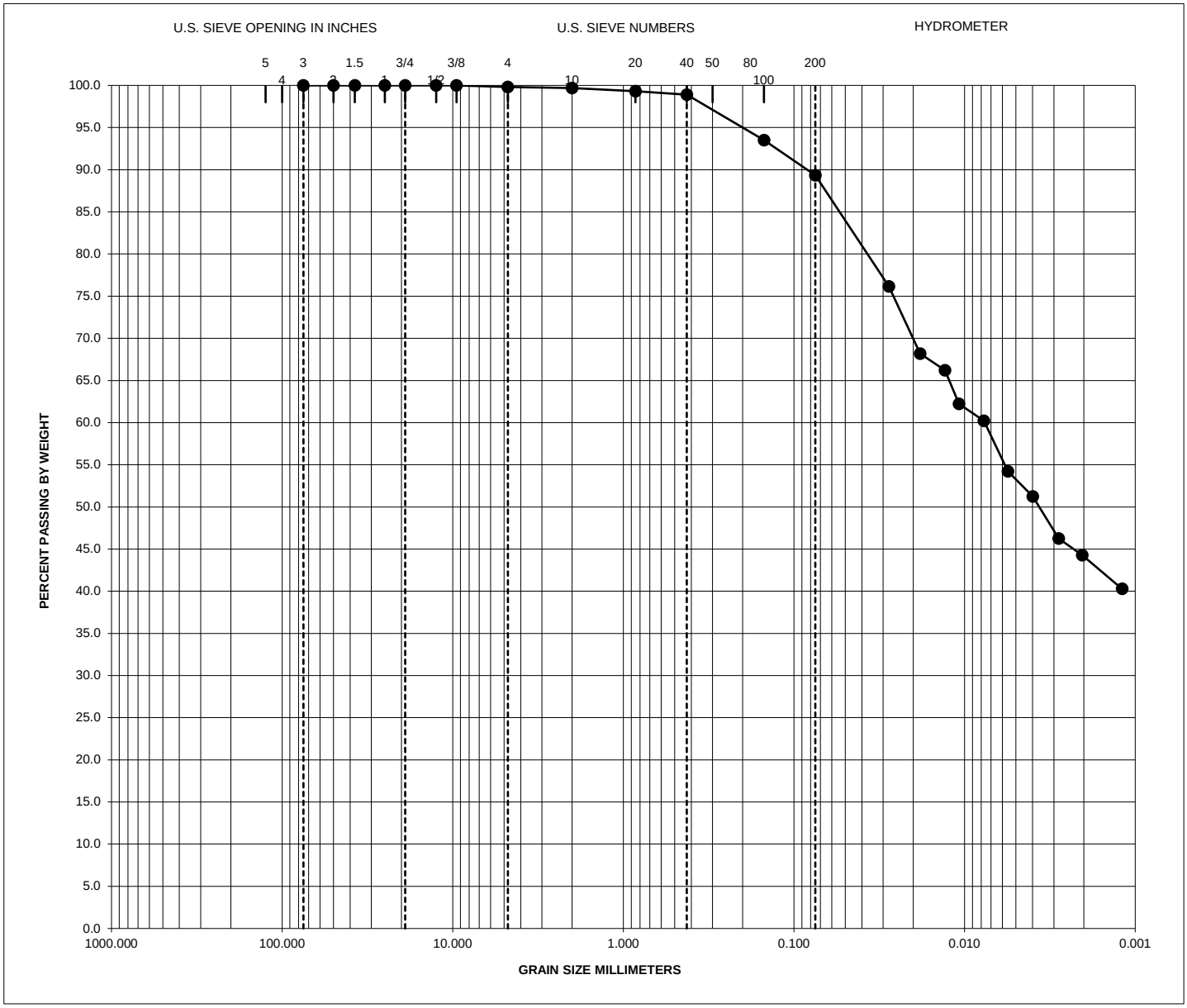
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/27/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-204**	**4-6**	**CLAY, soft, tan and gray, w/ calcareous nodules, iron stains (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-204**	**4-6**					0.18	10.49	89.33

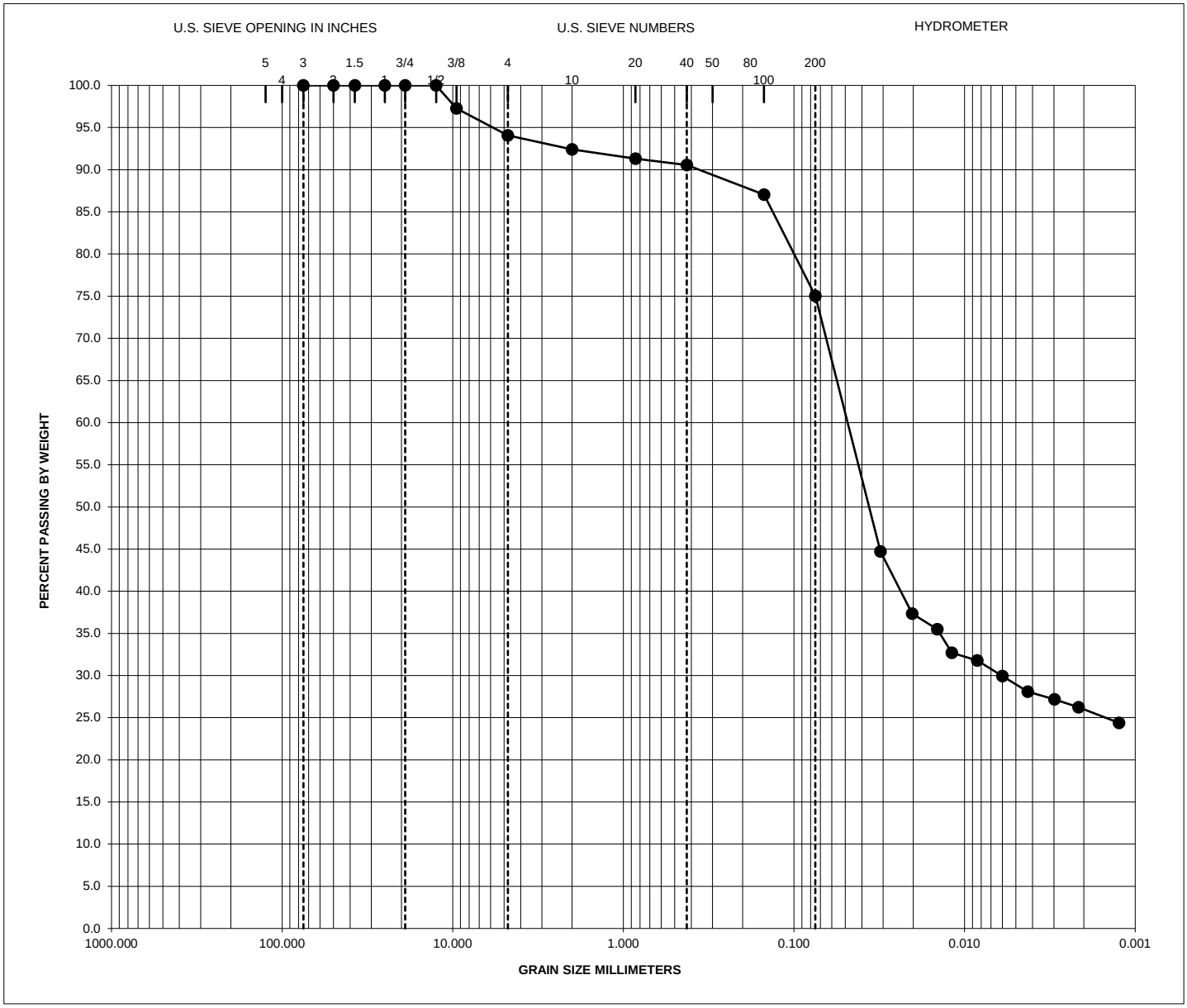
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-204**	**7-9'**	**CLAY, moist, soft, reddish brown, w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-204**	**7-9'**					5.93	19.04	75.03

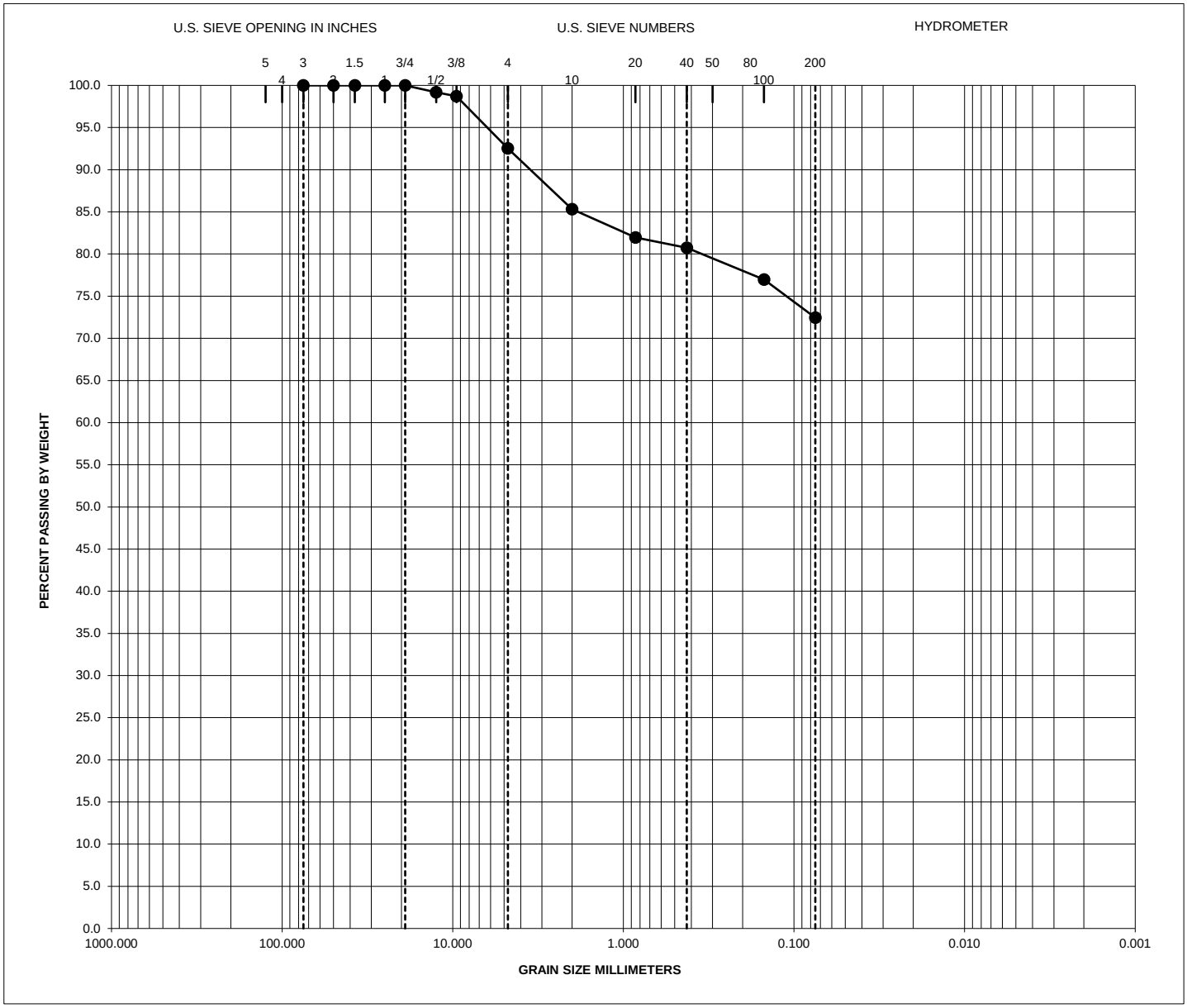
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **T-204**	**9-10.5**	**CLAY, moist, soft, reddish brown, w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **T-204**	**9-10.5**					7.47	20.08	72.45

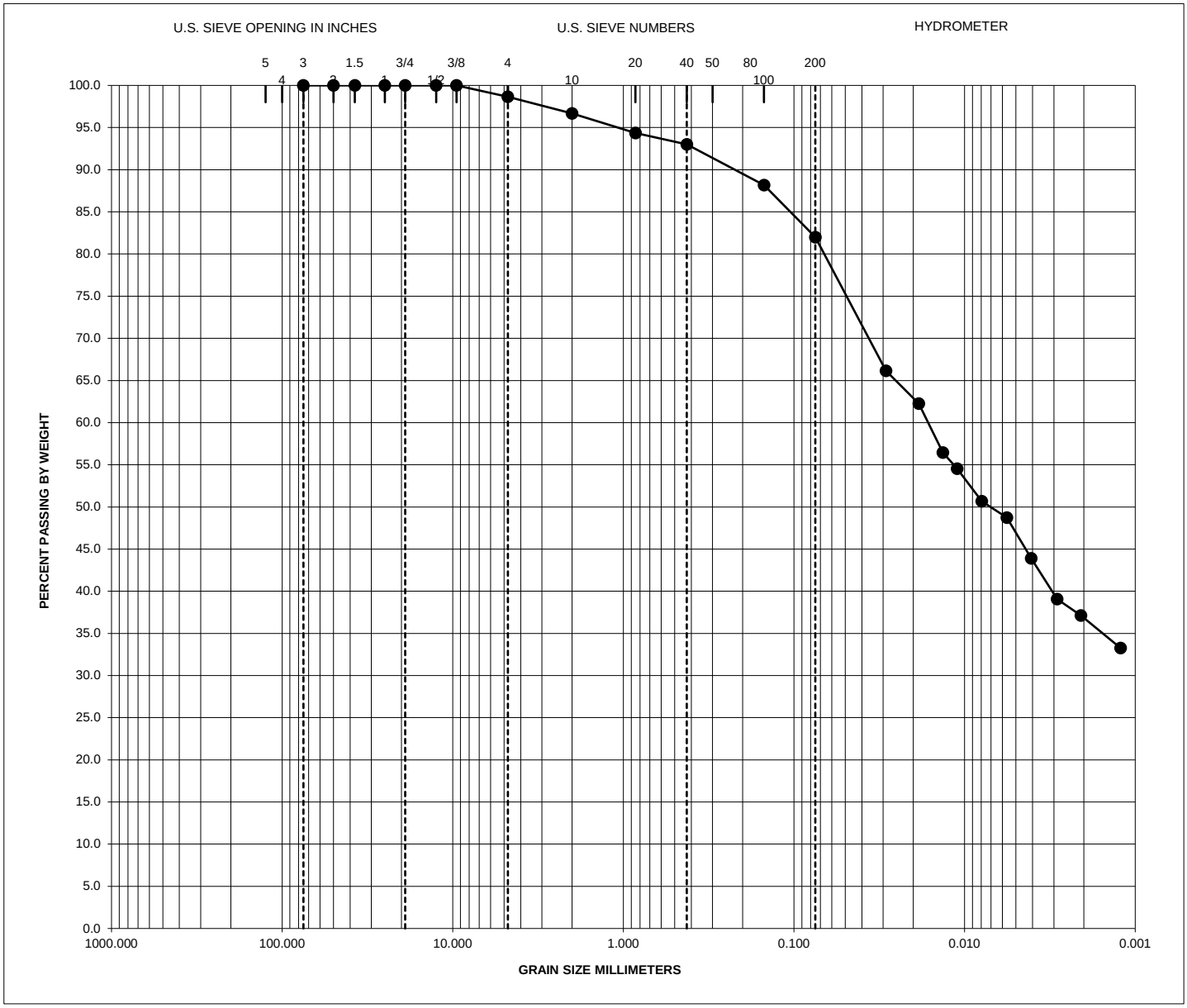
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/27/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-207**	**4-5**	**CLAY, very stiff to hard, light brown, w/ calcareous nodules and deposits (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-207**	**4-5**					1.34	16.67	81.99

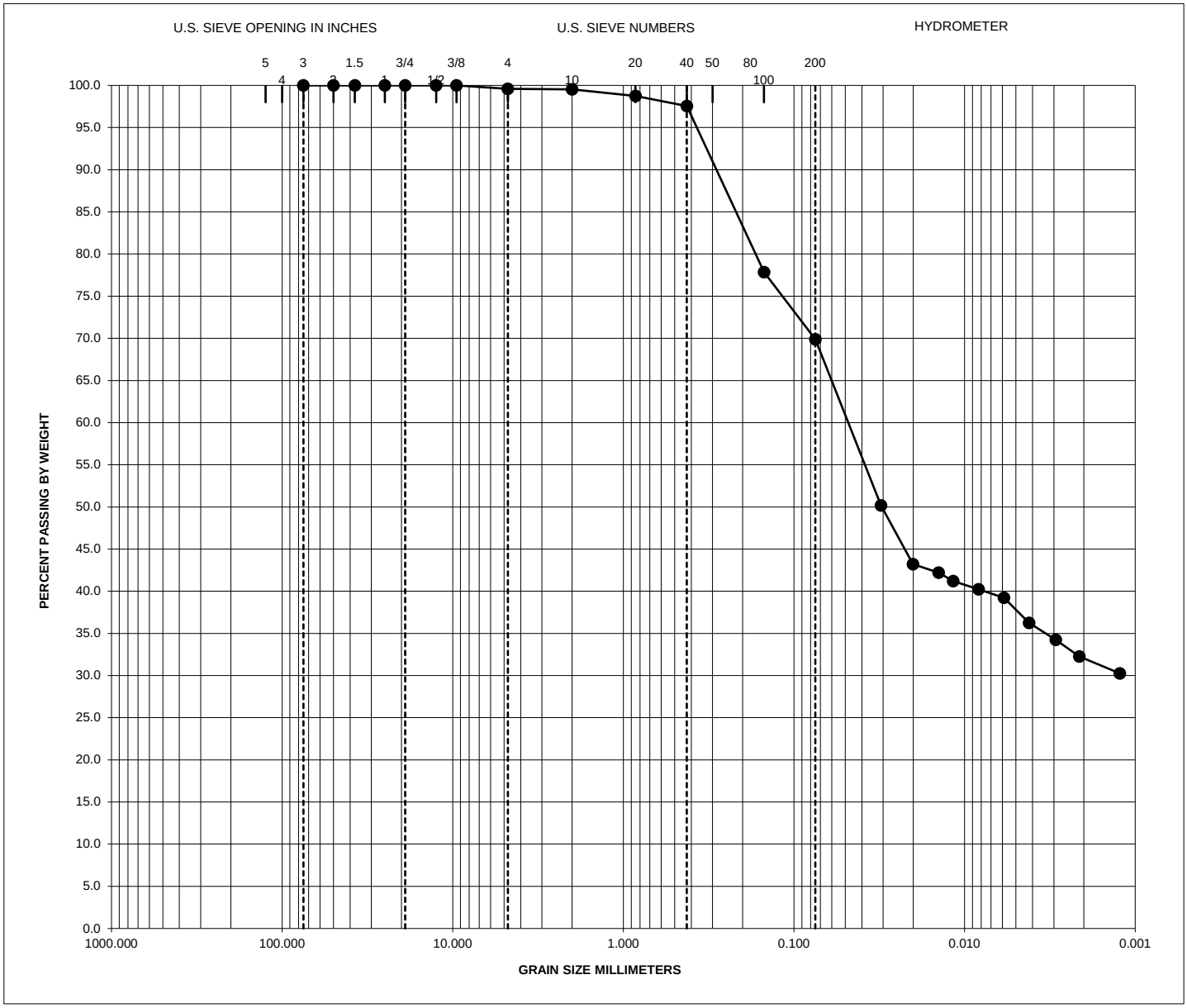
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-207**	**8-9**	**CLAY, tan and light gray, w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-207**	**8-9**					0.41	29.71	69.88

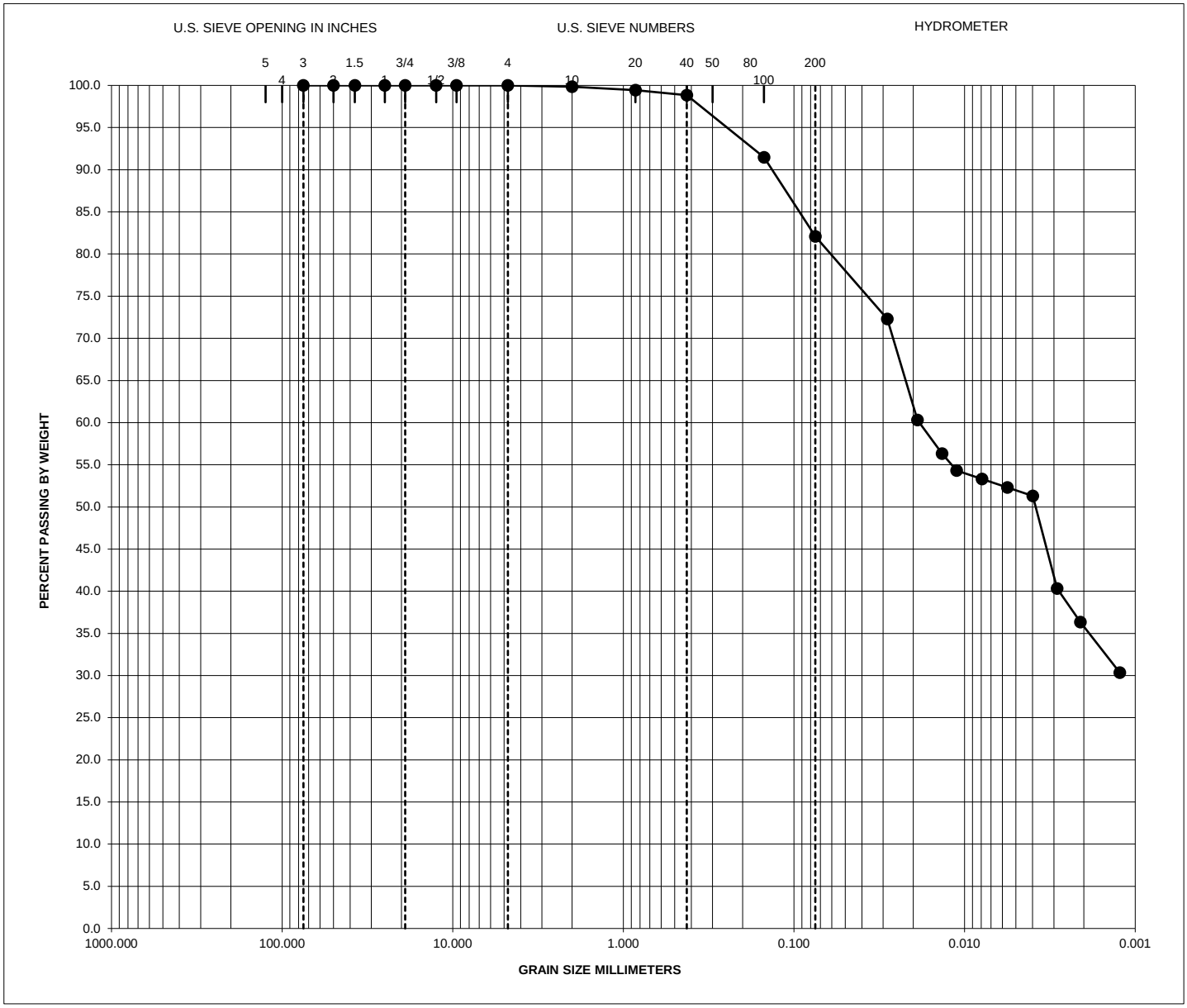
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-207 14-16**	**CLAY, tan, w/ sand lenses and seams (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-207 14-16**					0.00	17.93	82.07

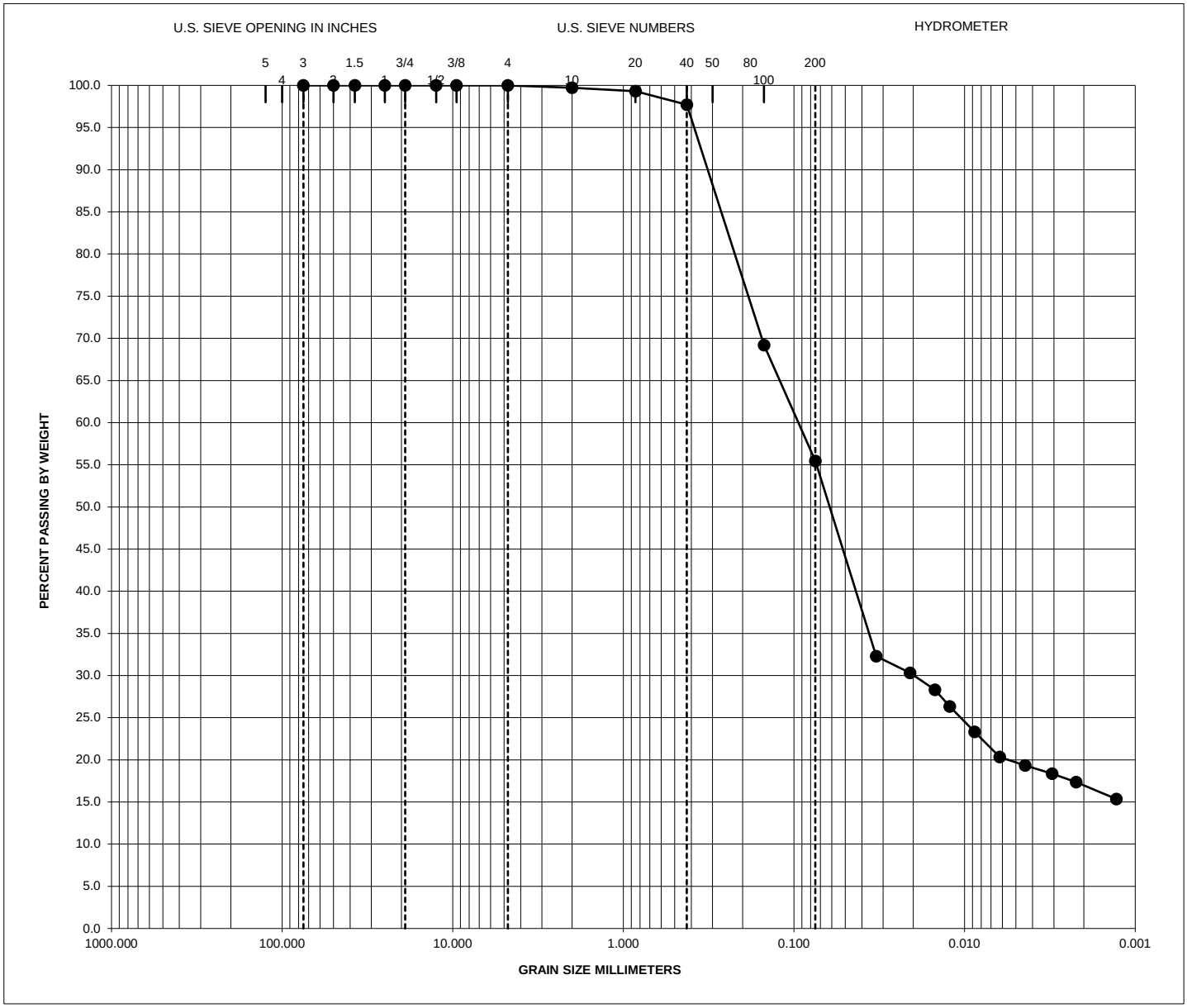
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification	Classification	LL	PL	PI	Cu	Cc
● TS-207 24-25.5	CLAY, brown, sandy (CL)					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	% -#200
● TS-207 24-25.5					0.00	44.56	55.44

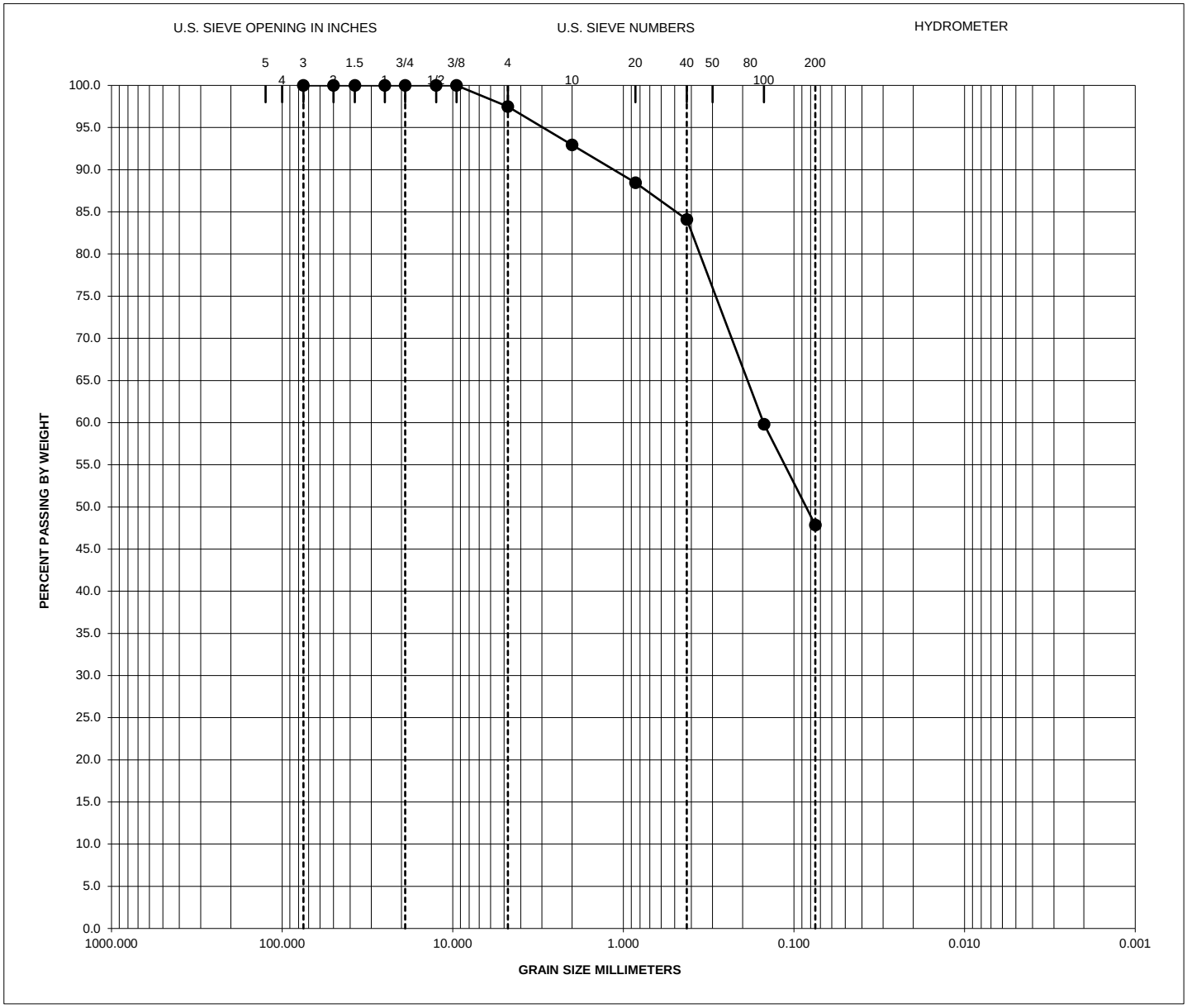
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: DART D-2

Project No: E17-0811

Tested by:	Date Tested	Checked by:	ALLIANCE GEOTECHNICAL GROUP
BV	5/21/2019	JP	



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-208**	**3-4**	**SAND, compact to dense, brown and light brown, clayey, w/ gravel pieces (FILL) (SC)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-208**	**3-4**					2.52	49.63	47.85

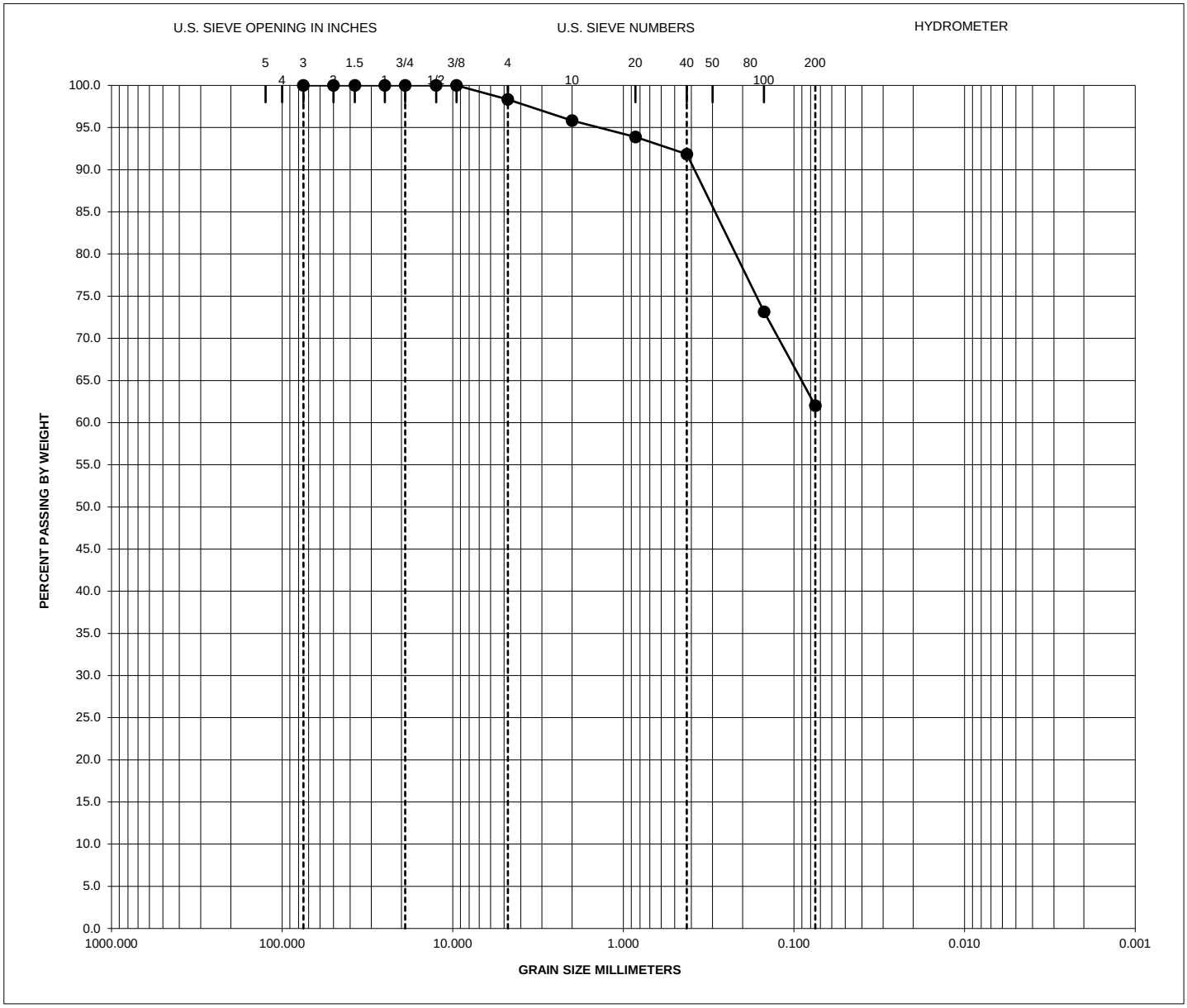
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/25/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-208**	**5-8**	**CLAY, very soft, wet, dark brown, sandy, w/ large gravel pieces, organics (FILL) (CL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-208**	**5-8**					1.66	36.32	62.02

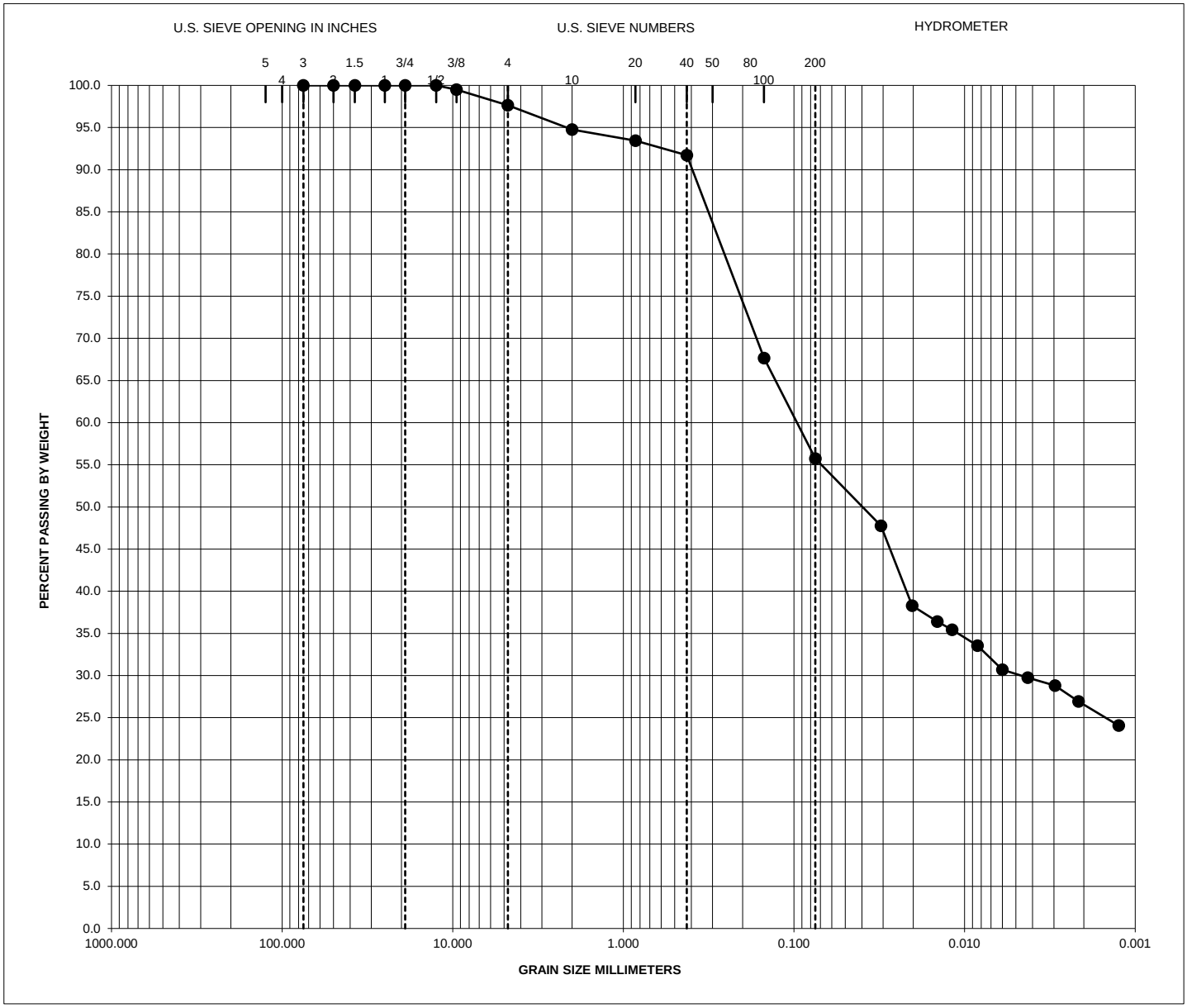
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/25/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-208**	**8-10**	**CLAY, wet, stiff, sandy, brown (CL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-208**	**8-10**					2.34	41.94	55.72

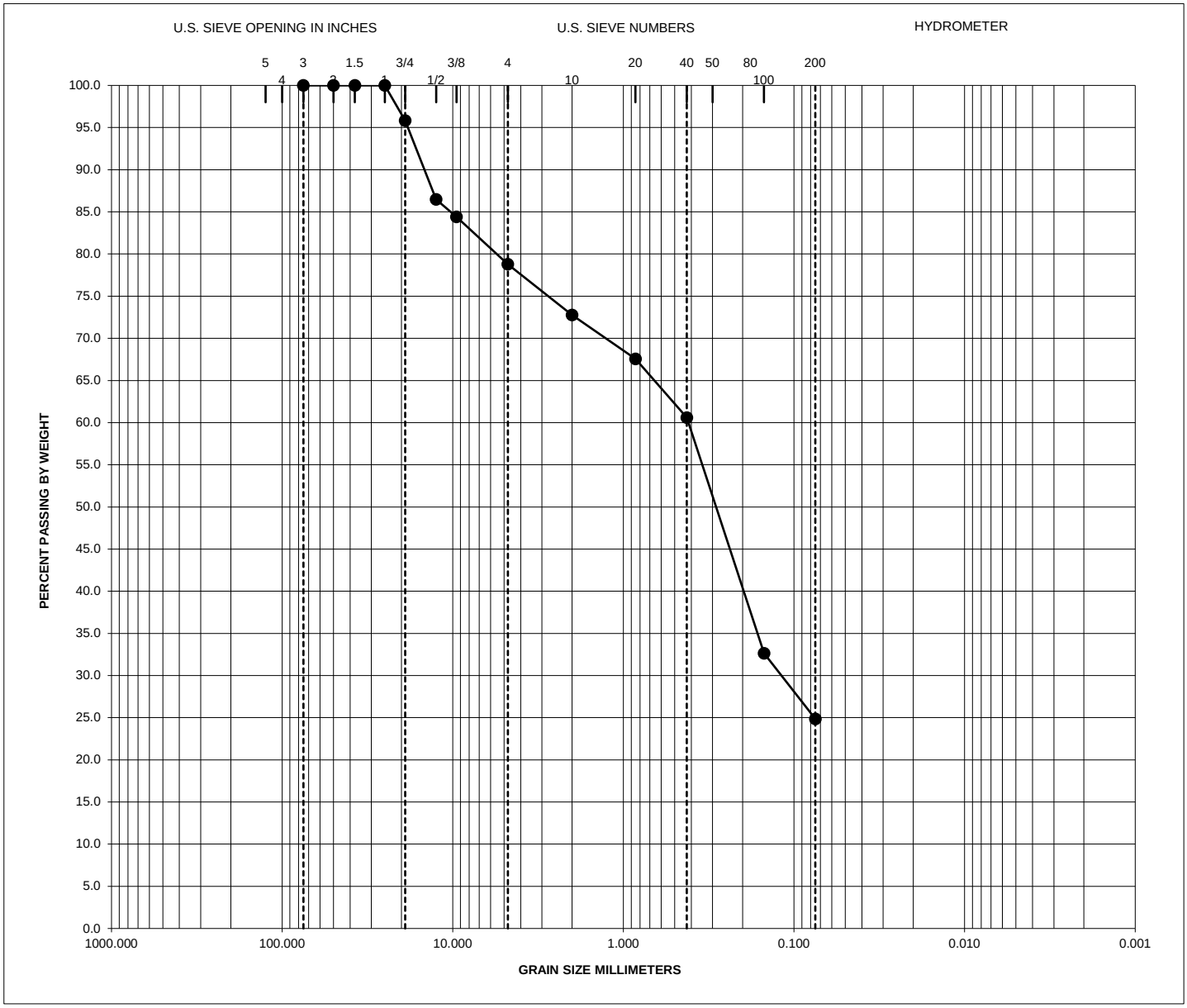
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-209**	**2-3**	**SAND, moist, brown, w/ gravel and clay seams (FILL) (SP)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-209**	**2-3**					21.20	53.93	24.87

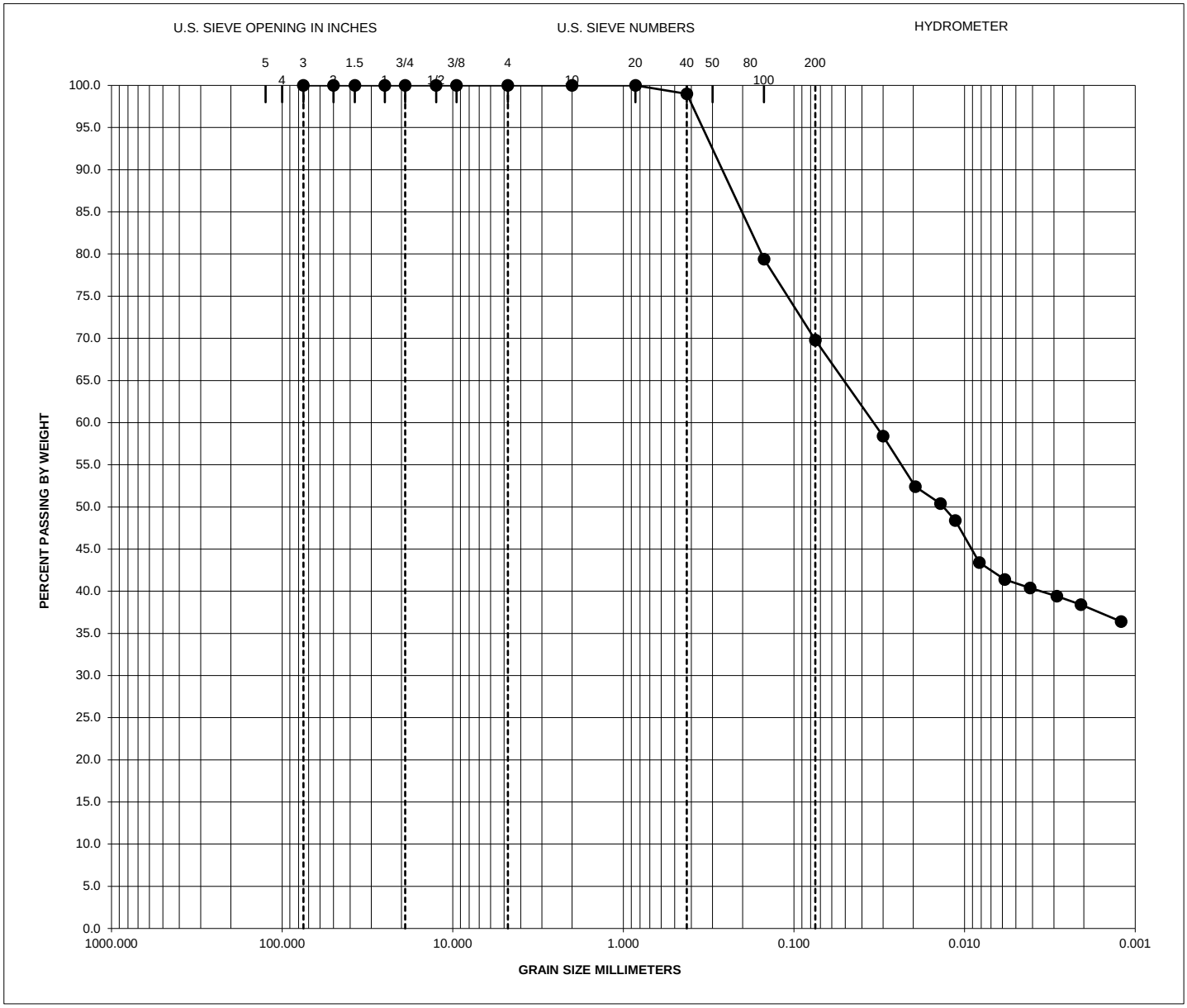
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/25/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-209**	**4-6**	**CLAY, soft, brown, w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-209**	**4-6**					0.00	30.20	69.80

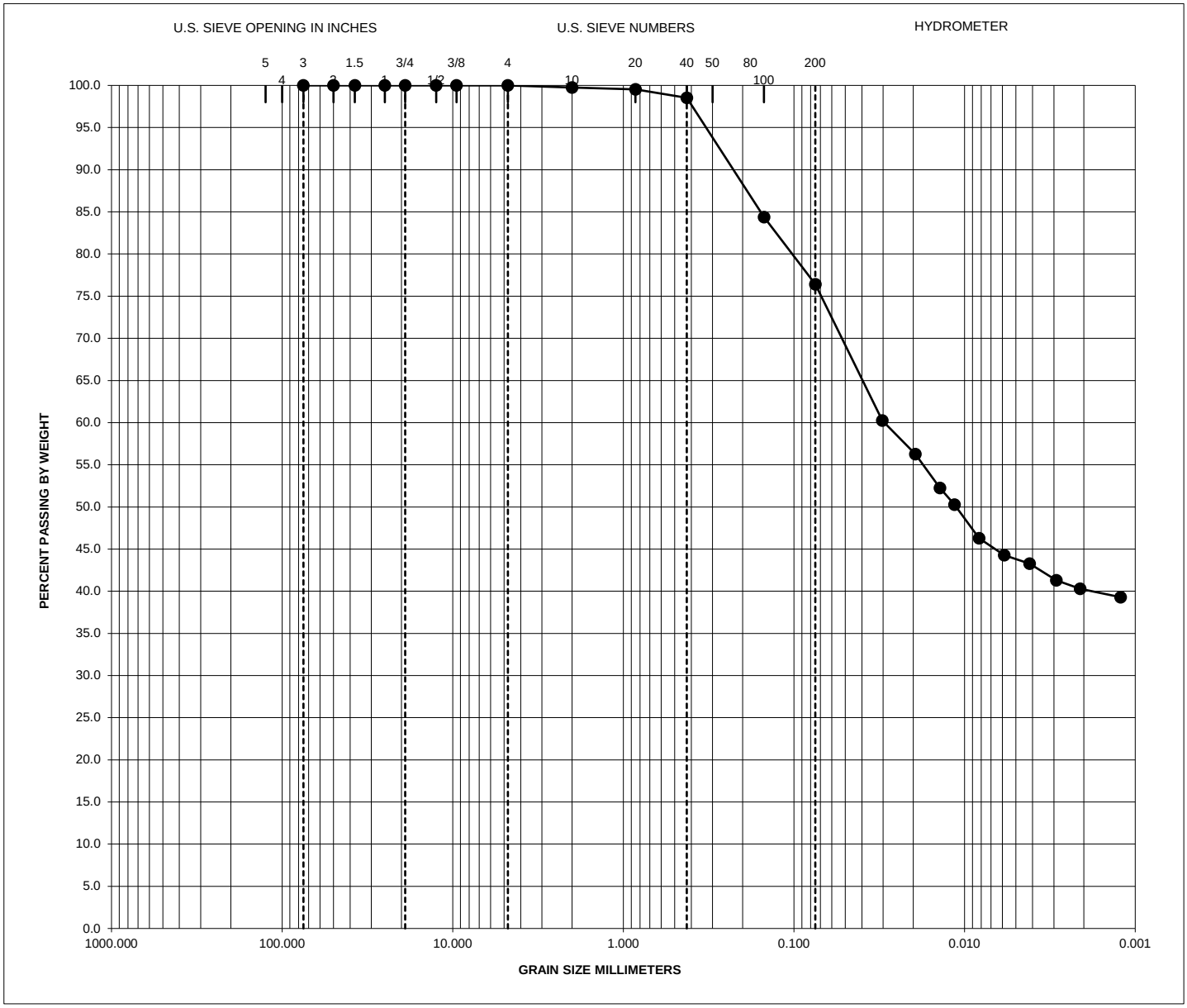
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/21/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
● **TS-209**	**7-10**	**CLAY, tan and light gray, blocky, w/ calcareous nodules (CH)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-209**	**7-10**					0.00	23.60	76.40

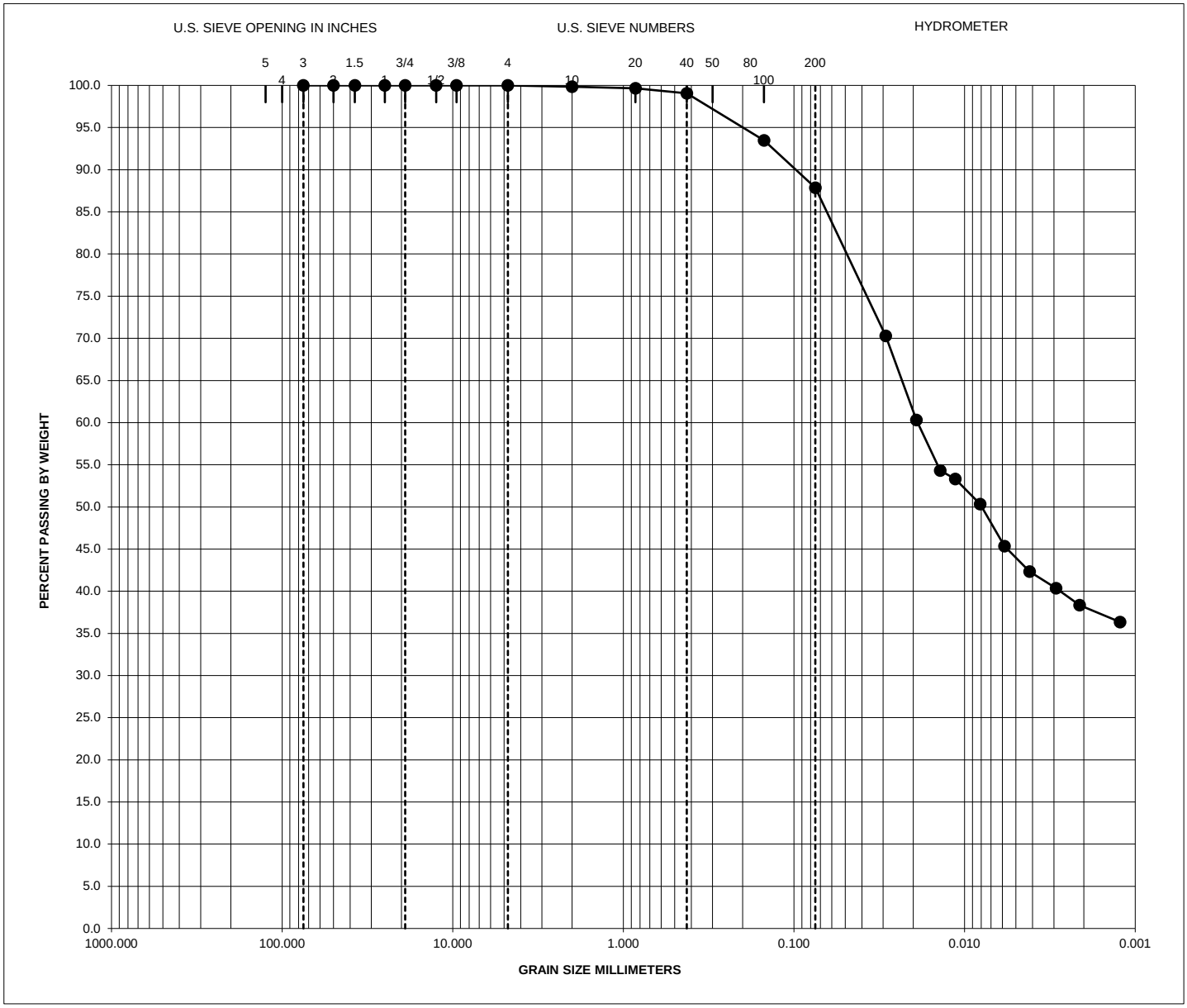
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/28/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-209 13.5-15'**	**CLAY, tan and light gray, calcareous, w/calcareous nodules and sand lenses (CL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-209 13.5-15'**					0.00	12.13	87.87

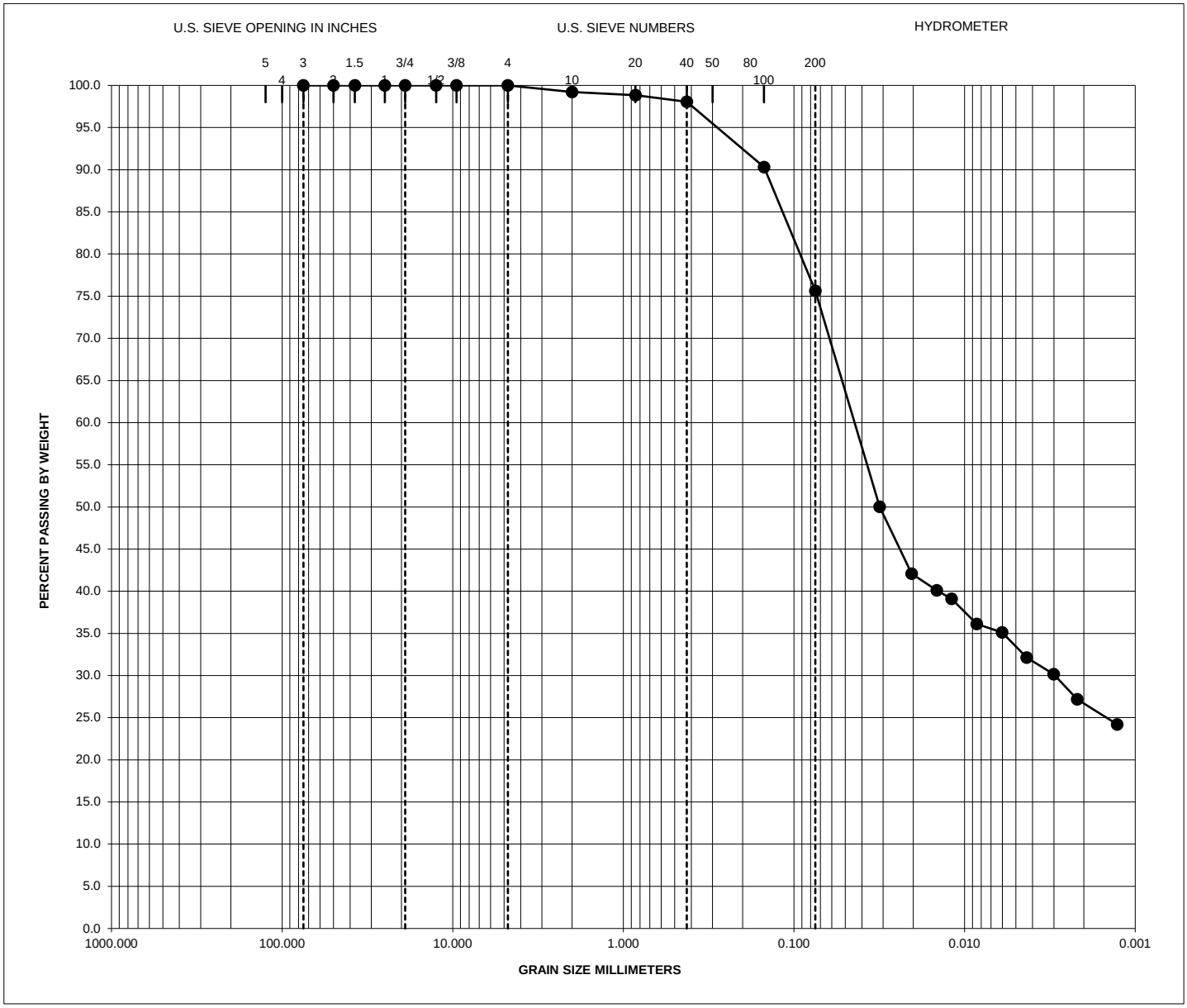
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/27/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-209 23.5-25'**	**CLAY, very soft, brown, silty, w/ sand lenses and seams (CL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-209 23.5-25'**					0.00	24.39	75.61

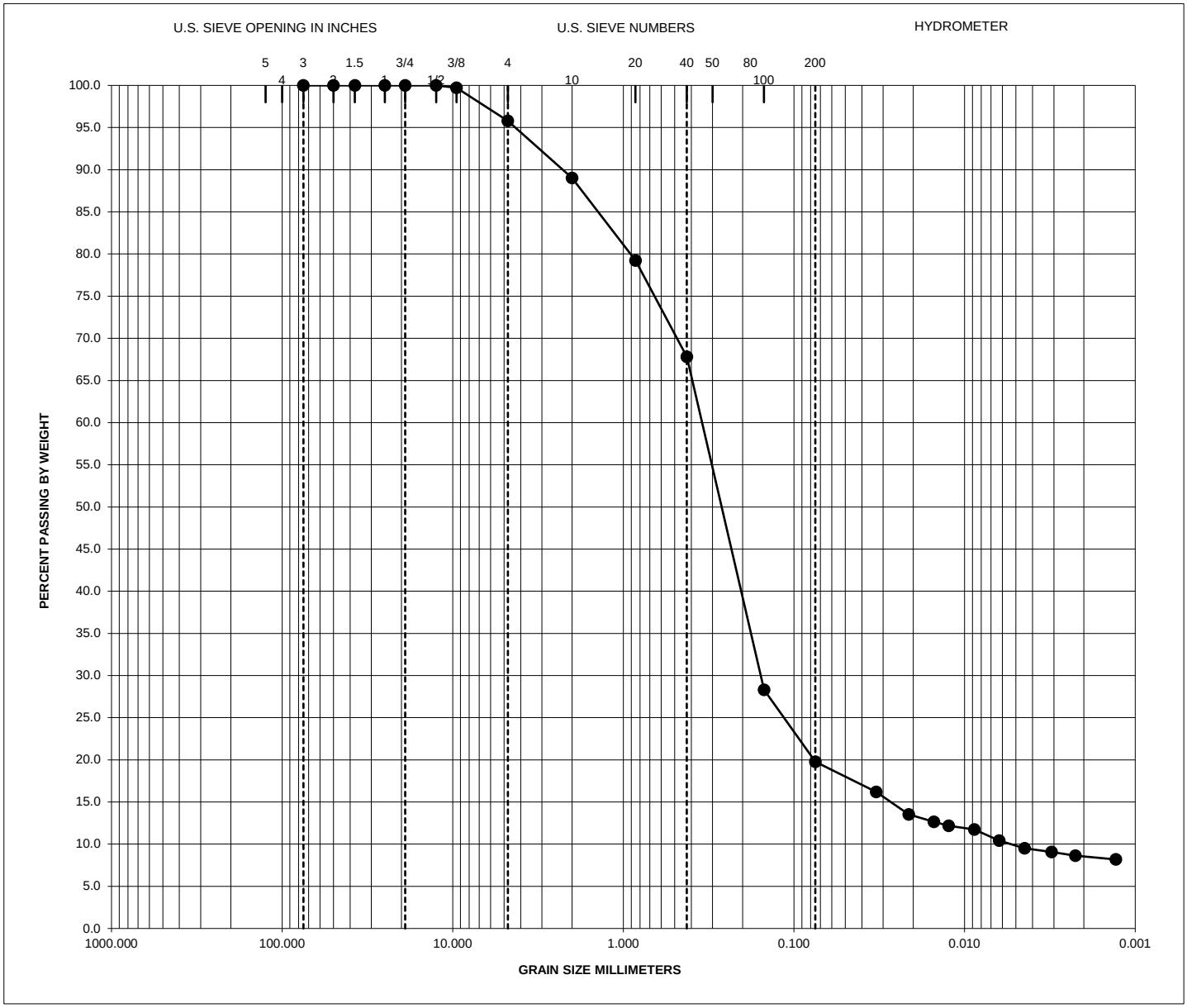
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/27/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification	Classification	LL	PL	PI	Cu	Cc
● **TS-209 28.5-30'**	**SAND, wet, brown, w/ gravel (SP)**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	% -#200
● **TS-209 28.5-30'**					4.20	76.04	19.76

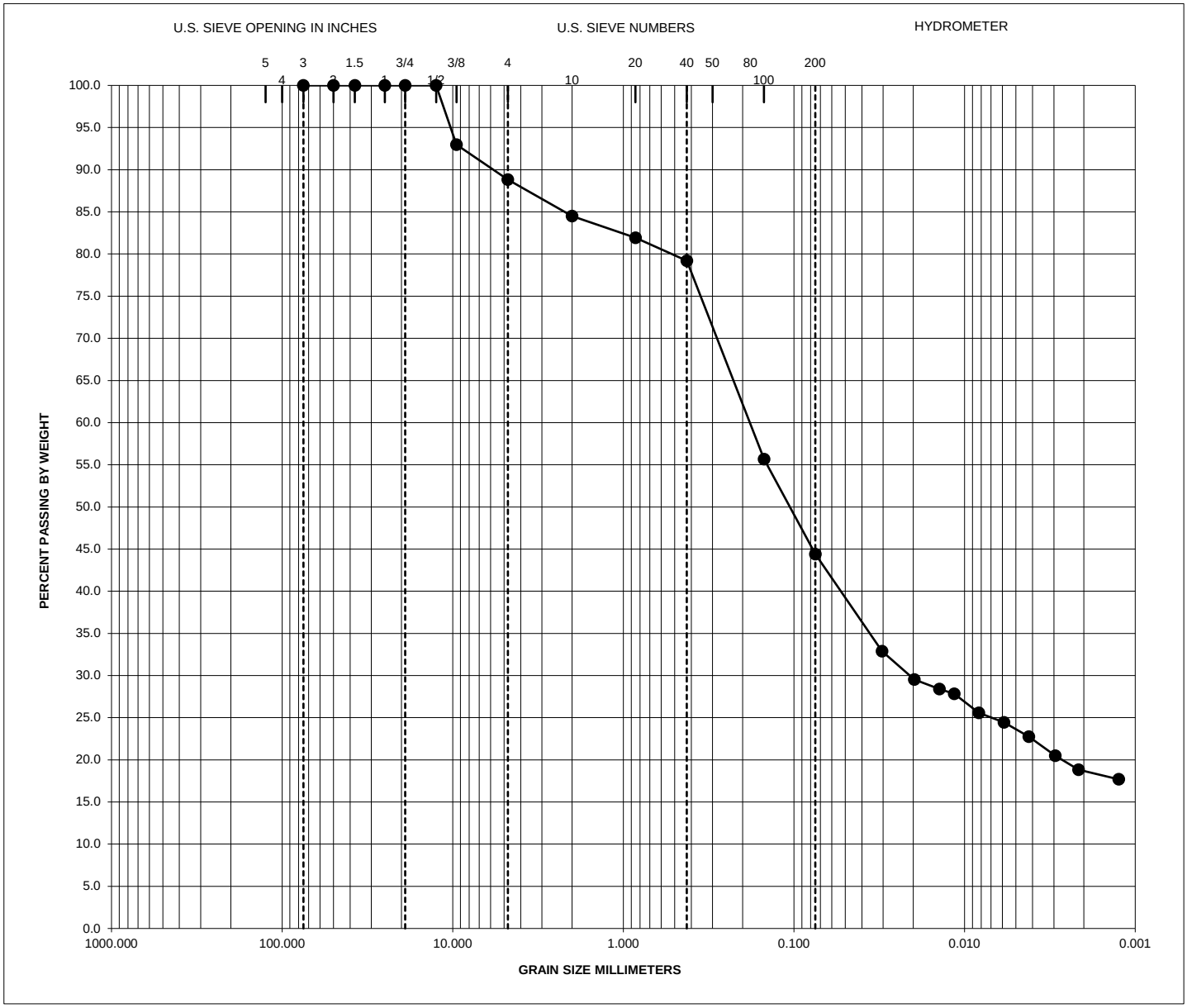
ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/27/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**



Specimen Identification		Classification	LL	PL	PI	Cu	Cc
●	**TS-209 33.5-35'**	**CLAY, moist, brown, silty, sandy, w/ calcareous nodules, sand seams and layers, and gravel pieces (CL)**					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% -#200
●	**TS-209 33.5-35'**					11.18	44.42	44.40

ALLIANCE GEOTECHNICAL GROUP

GRAIN SIZE DISTRIBUTION

Project Name: **DART D-2**

Project No: **E17-0811**

Tested by:	Date Tested	Checked by:	
BV	5/27/2019	JP	**ALLIANCE GEOTECHNICAL GROUP**

APPENDIX E-6

SPECIFIC GRAVITY TEST RESULTS

SPECIFIC GRAVITY RESULTS

BORING NO.	DEPTH (FEET)	SPECIFIC GRAVITY (ASTM D854)
B-1	14-15.5	2.681
B-3	8-10	2.719
P-102	6-7	2.721
T-102	7-10	2.696
T-103	6-10	2.684
	15-16.5	2.690
TS-104	8.5-10	2.592
	13.5-15	2.609
	18.5-20	2.746
TS-111	8-9	2.717
	25-26	2.685
TS-202	8-9.5	2.683
T-204	9-10.5	2.683
TS-207	24-25.5	2.771
TS-208	5-8	2.783
	8-10	2.722
TS-209	28.5-30	2.691

ALLIANCE GEOTECHNICAL GROUP

SPECIFIC GRAVITY RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-6

APPENDIX E-7

SWELL TEST RESULTS

METHOD A, B & C

SWELL TEST RESULTS
ASTM D4546-A

BORING NO.	DEPTH (FEET	UNIT WEIGHT (pcf)	IN-SITU MOISTURE CONTENT	FINAL MOISTURE CONTENT	SURCHARGE LOAD (psf)	% VERTICAL SWELL
B-1	5'-10'	116.4	9.4	14.2	1,200	2.6
		116.5	9.4	13.7	2,400	1.9
		116.9	9.2	13.4	3,600	1.2
		116.7	9.6	13.2	4,800	0.8

PROCEDURE:

1. Sample placed in confining ring, design load (including overburden) applied, free water with surfactant made available, and sample allowed to swell completely.
2. Load removed and final moisture content determined.

ALLIANCE GEOTECHNICAL GROUP

SWELL TEST METHOD-A RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-7

SWELL TEST RESULTS
ASTM D4546-A

BORING NO.	DEPTH (FEET	UNIT WEIGHT (pcf)	IN-SITU MOISTURE CONTENT	FINAL MOISTURE CONTENT	SURCHARGE LOAD (psf)	% VERTICAL SWELL
B-2	5'-10'	113.0	18.1	19.8	1,200	2.3
		113.7	18.1	19.3	2,400	1.9
		113.2	18.6	19.0	3,600	0.8
		113.6	18.2	18.6	4,800	0.6
	24'-25'	111.1	18.2	18.7	1,200	0.2
		111.6	18.3	18.7	2,400	0.2
		111.8	18.6	18.6	3,600	0.1
		111.7	18.5	18.3	4,800	0.0
	29'-30'	105.6	20.9	20.8	1,200	0.0
		105.2	21.0	20.7	2,400	0.0
		105.6	21.1	20.4	3,600	0.0
		105.3	21.0	19.7	4,800	0.0

PROCEDURE:

1. Sample placed in confining ring, design load (including overburden) applied, free water with surfactant made available, and sample allowed to swell completely.
2. Load removed and final moisture content determined.

ALLIANCE GEOTECHNICAL GROUP

SWELL TEST METHOD-A RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-7

SWELL TEST RESULTS
ASTM D4546-A

BORING NO.	DEPTH (FEET)	UNIT WEIGHT (pcf)	IN-SITU MOISTURE CONTENT	FINAL MOISTURE CONTENT	SURCHARGE LOAD (psf)	% VERTICAL SWELL
P-102	6'-7'	113.5	15.0	19.8	1,200	4.0
		113.4	15.1	19.2	2,400	3.3
		113.0	15.1	18.5	3,600	2.9
		113.3	15.1	18.1	4,800	2.1
	7'-10'	118.1	13.2	17.0	1,200	3.7
		118.6	13.2	16.5	2,400	3.0
		118.2	13.3	16.2	3,600	2.4
		118.6	13.3	15.8	4,800	1.9

PROCEDURE:

1. Sample placed in confining ring, design load (including overburden) applied, free water with surfactant made available, and sample allowed to swell completely.
2. Load removed and final moisture content determined.

ALLIANCE GEOTECHNICAL GROUP

SWELL TEST METHOD-A RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-7

SWELL TEST RESULTS
ASTM D4546-A

BORING NO.	DEPTH (FEET	UNIT WEIGHT (pcf)	IN-SITU MOISTURE CONTENT	FINAL MOISTURE CONTENT	SURCHARGE LOAD (psf)	% VERTICAL SWELL
TS-202	4'-8'	114.8	10.6	12.3	1,200	0.9
		114.6	10.4	12.1	2,400	0.7
		114.2	10.3	11.7	3,600	0.3
		114.2	10.4	11.5	4,800	0.1

PROCEDURE:

1. Sample placed in confining ring, design load (including overburden) applied, free water with surfactant made available, and sample allowed to swell completely.
2. Load removed and final moisture content determined.

ALLIANCE GEOTECHNICAL GROUP

SWELL TEST METHOD-A RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-7

SWELL TEST RESULTS
ASTM D4546-A

BORING NO.	DEPTH (FEET)	UNIT WEIGHT (pcf)	IN-SITU MOISTURE CONTENT	FINAL MOISTURE CONTENT	SURCHARGE LOAD (psf)	% VERTICAL SWELL
T-204	7'-9'	108.0	19.9%	19.8%	1,200	0.0
		106.7	20.1%	19.8%	2,400	0.0
		107.2	20.1%	19.6%	3,600	0.0
		104.9	20.0%	18.8%	4,800	0.0

PROCEDURE:

1. Sample placed in confining ring, design load (including overburden) applied, free water with surfactant made available, and sample allowed to swell completely.
2. Load removed and final moisture content determined.

ALLIANCE GEOTECHNICAL GROUP

SWELL TEST METHOD-A RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-7

SWELL TEST RESULTS
ASTM D4546-A

BORING NO.	DEPTH (FEET)	UNIT WEIGHT (pcf)	IN-SITU MOISTURE CONTENT	FINAL MOISTURE CONTENT	SURCHARGE LOAD (psf)	% VERTICAL SWELL
TS-207	4'-5'	115.3	14.9%	16.0%	1,200	1.0
		114.0	15.2%	15.8%	2,400	0.2
		112.9	15.1%	15.3%	3,600	0.1
		116.4	15.7%	15.6%	4,800	0.0
	8'-9'	116.0	16.3%	17.5%	1,200	0.8
		115.6	16.6%	17.6%	2,400	0.6
		115.0	16.0%	16.8%	3,600	0.4
		116.6	15.5%	15.6%	4,800	0

PROCEDURE:

1. Sample placed in confining ring, design load (including overburden) applied, free water with surfactant made available, and sample allowed to swell completely.
2. Load removed and final moisture content determined.

ALLIANCE GEOTECHNICAL GROUP

SWELL TEST METHOD-A RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-7

SWELL TEST RESULTS
ASTM D4546-A

BORING NO.	DEPTH (FEET)	UNIT WEIGHT (pcf)	IN-SITU MOISTURE CONTENT	FINAL MOISTURE CONTENT	SURCHARGE LOAD (psf)	% VERTICAL SWELL
TS-208	8'-10'	104.8	22.3%	22.3%	1,200	0.1
		104.0	22.2%	21.8%	2,400	0.0
		105.5	22.2%	21.5%	3,600	0.0
		104.9	22.0%	21.0%	4,800	0.0

PROCEDURE:

1. Sample placed in confining ring, design load (including overburden) applied, free water with surfactant made available, and sample allowed to swell completely.
2. Load removed and final moisture content determined.

ALLIANCE GEOTECHNICAL GROUP

SWELL TEST METHOD-A RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-7

SWELL TEST RESULTS
ASTM D4546-A

BORING NO.	DEPTH (FEET)	UNIT WEIGHT (pcf)	IN-SITU MOISTURE CONTENT	FINAL MOISTURE CONTENT	SURCHARGE LOAD (psf)	% VERTICAL SWELL
TS-209	3'-7'	95.5	27.6%	27.1%	1,200	0.0
		94.8	27.7%	25.7%	2,400	0.0
		95.7	27.2%	24.9%	3,600	0.0
		96.8	27.4%	24.7%	4,800	0.0
	7'-10'	108.1	20.0%	21.2%	1,200	0.9
		107.1	20.4%	21.1%	2,400	0.7
		108.1	20.3%	20.8%	3,600	0.4
		108.9	20.0%	20.3%	4,800	0.3

PROCEDURE:

1. Sample placed in confining ring, design load (including overburden) applied, free water with surfactant made available, and sample allowed to swell completely.
2. Load removed and final moisture content determined.

ALLIANCE GEOTECHNICAL GROUP

SWELL TEST METHOD-A RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-7

SWELL TEST RESULTS

ASTM D4546-B

BORING NO.	DEPTH (FEET)	DRY DENSITY (pcf)	IN-SITU MOISTURE CONTENT	FINAL MOISTURE CONTENT	LOAD (psf)	% VERTICAL SWELL
B-1	5-6	111.9	9.1	17.6	688	6.7
B-2	8-9	113.4	17.7	19.7	1,063	3.0
	24-25	110.3	18.5	19.0	3,063	0.2
P-102	6-7	114.7	15.0	20.0	813	5.5
	7-8	119.3	12.4	17.8	938	4.6
TS-202	5-6	115.9	10.8	14.6	688	4.0

PROCEDURE:

1. Sample placed in confining ring, design load (including overburden) applied, free water with surfactant made available, and sample allowed to swell completely.

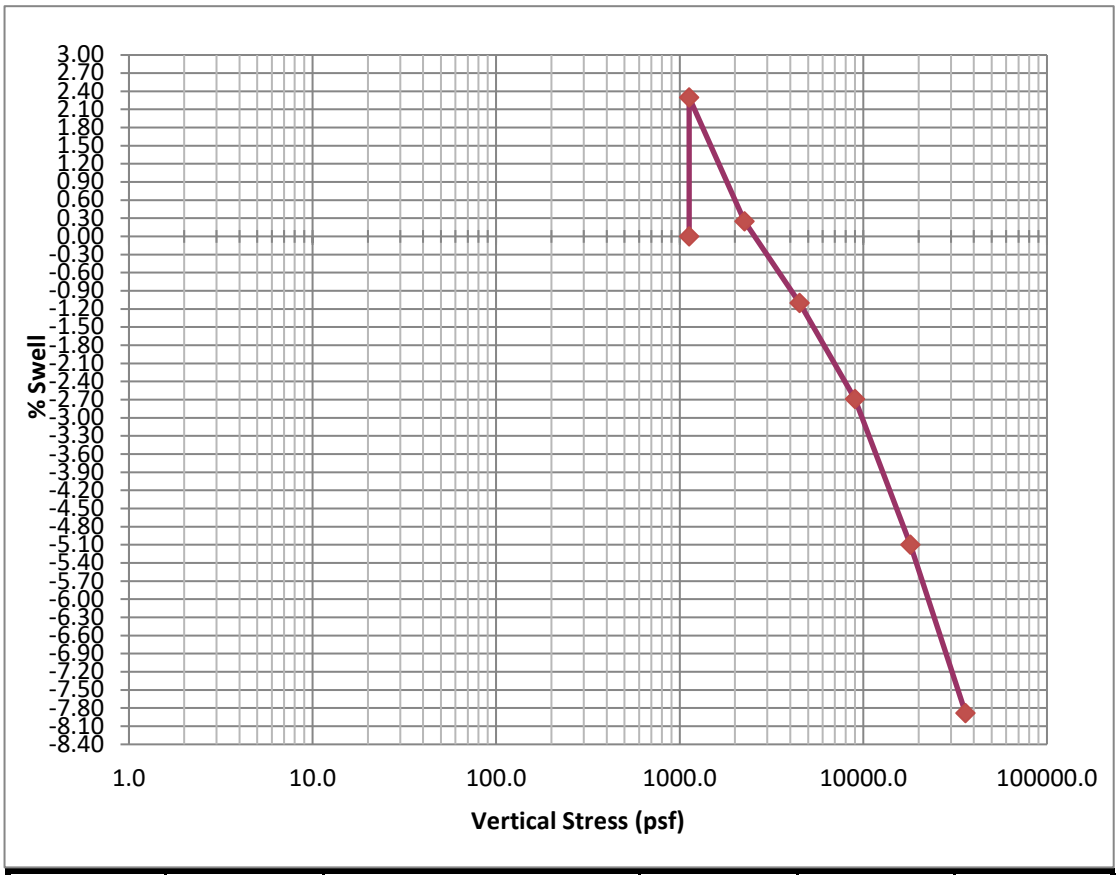
2. Load removed and final moisture content determined.

ALLIANCE GEOTECHNICAL GROUP

SWELL TEST METHOD-B RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-7

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name:	DART D-2	Date:	01/03/19
Project No:	E17-0811	Checked By:	HS
Material Description:	CLAY, very stiff, moist, gray, w/ sand layers and lenses	Figure No:	



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
B-3	8-10'	19.2	18.6	108.9	1125.0	0.00
					1125.0	2.30
					2250.0	0.25
					4500.0	-1.10
					9000.0	-2.69
					18000.0	-5.10
					36000.0	-7.88

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
4.50+	4.50+				2.70	CH

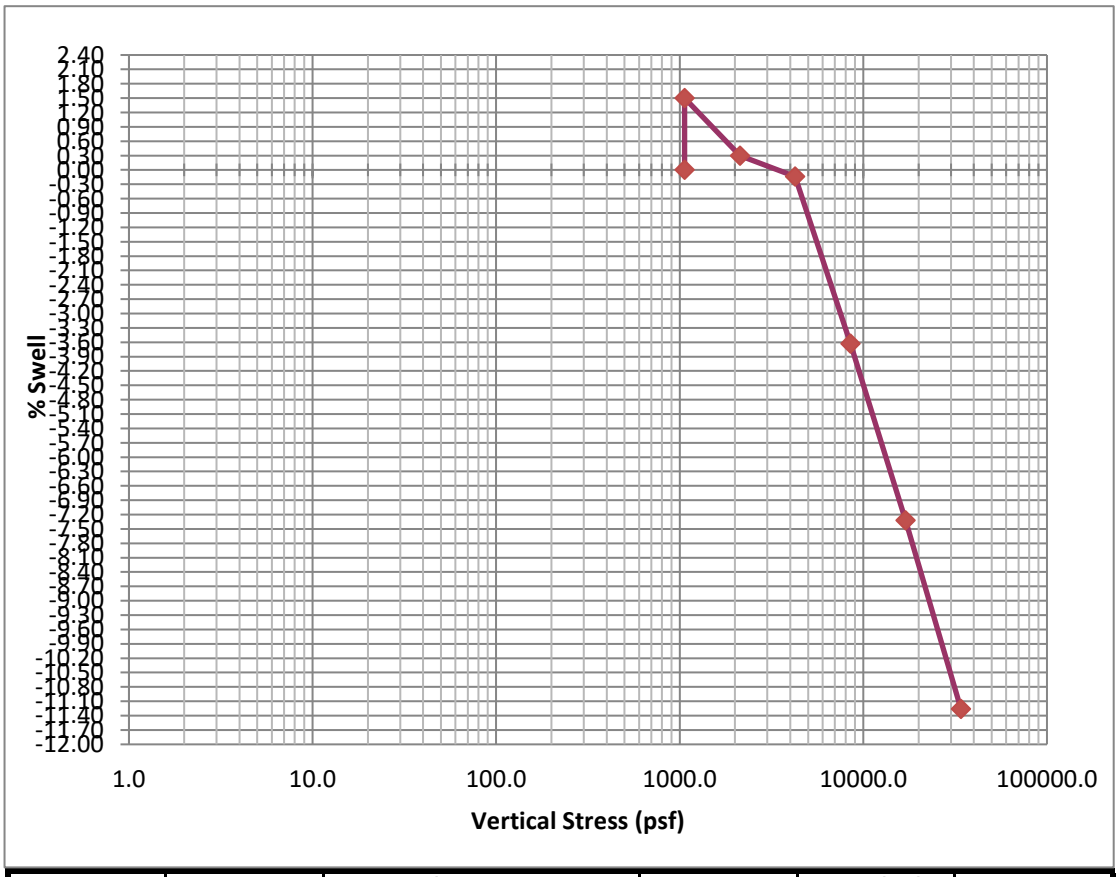
Alliance Geotechnical Group

3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name:	DART D-2	Date:	01/03/19
Project No:	E17-0811	Checked By:	HS
Material Description:	CLAY, hard, tan and light gray, w/ sand	Figure No:	



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
T-102	7-10'	11.4	11.6	105.6	1062.5	0.00
					1062.5	1.50
					2125.0	0.30
					4250.0	-0.14
					8500.0	-3.63
					17000.0	-7.32
					34000	-11.26

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
4.50++	4.50++				2.70	CH

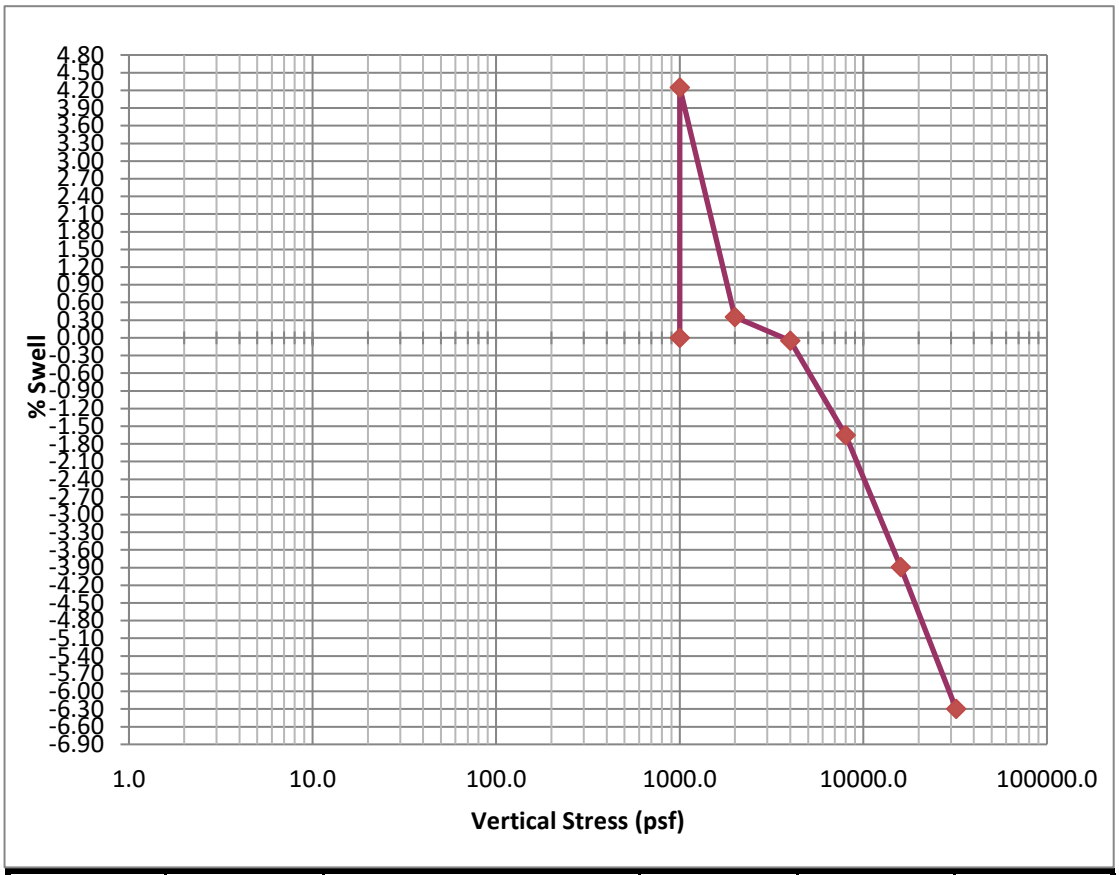
Alliance Geotechnical Group

3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name:	DART D-2	Date:	01/03/19
Project No:	E17-0811	Checked By:	HS
Material Description:	CLAY, hard, tan and gray, slightly sandy to sandy	Figure No:	



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
T-103	6-10'	10.9	12.5	120.9	1000.0	0.00
					1000.0	4.25
					2000.0	0.35
					4000.0	-0.05
					8000.0	-1.65
					16000.0	-3.89
					32000	-6.30

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
4.50++	4.50++				2.70	CL

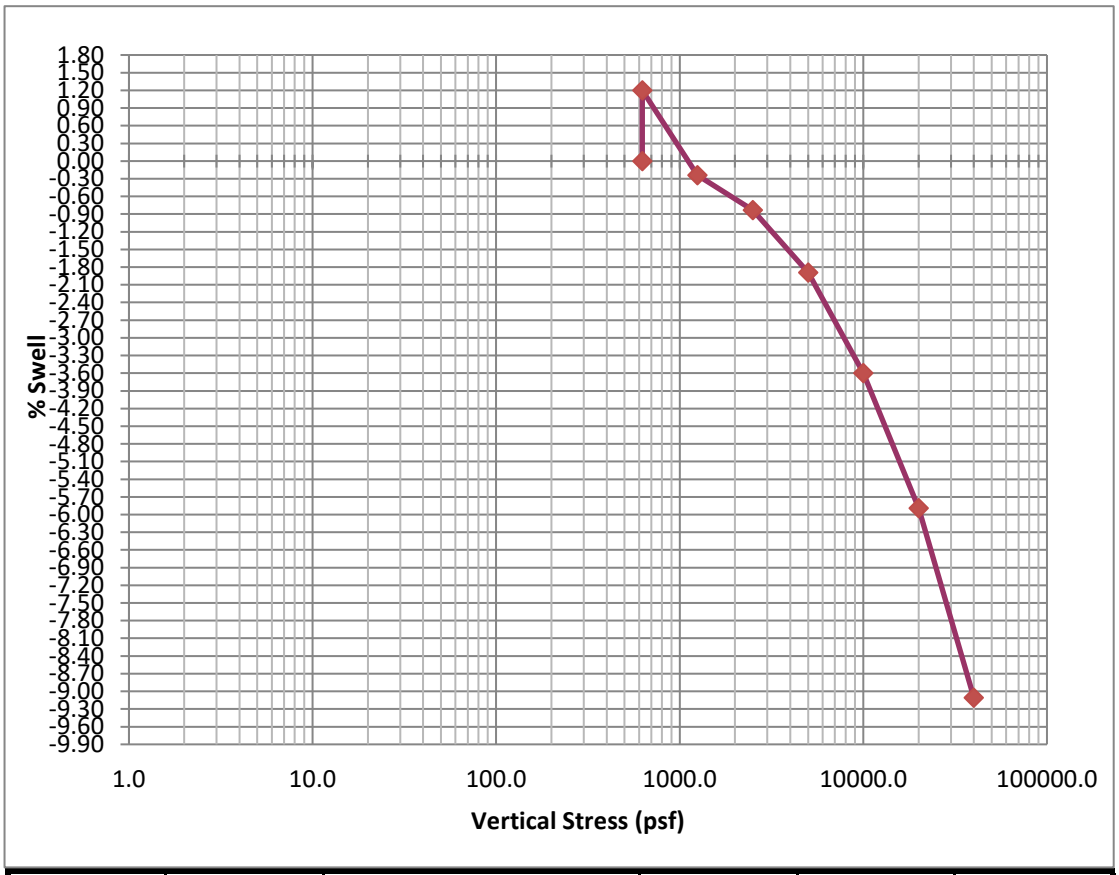
Alliance Geotechnical Group

3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name:	DART D-2	Date:	01/03/19
Project No:	E17-0811	Checked By:	HS
Material Description:	CLAY, hard, tan and dark brown, w/ calcareous nodules	Figure No:	



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
TS-111	4-6'	16.1	15.9	111.3	625.0	0.00
					625.0	1.20
					1250.0	-0.24
					2500.0	-0.83
					5000.0	-1.89
					10000.0	-3.60
					20000	-5.89
					40000	-9.11

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
4.50+	4.50+				2.70	CH

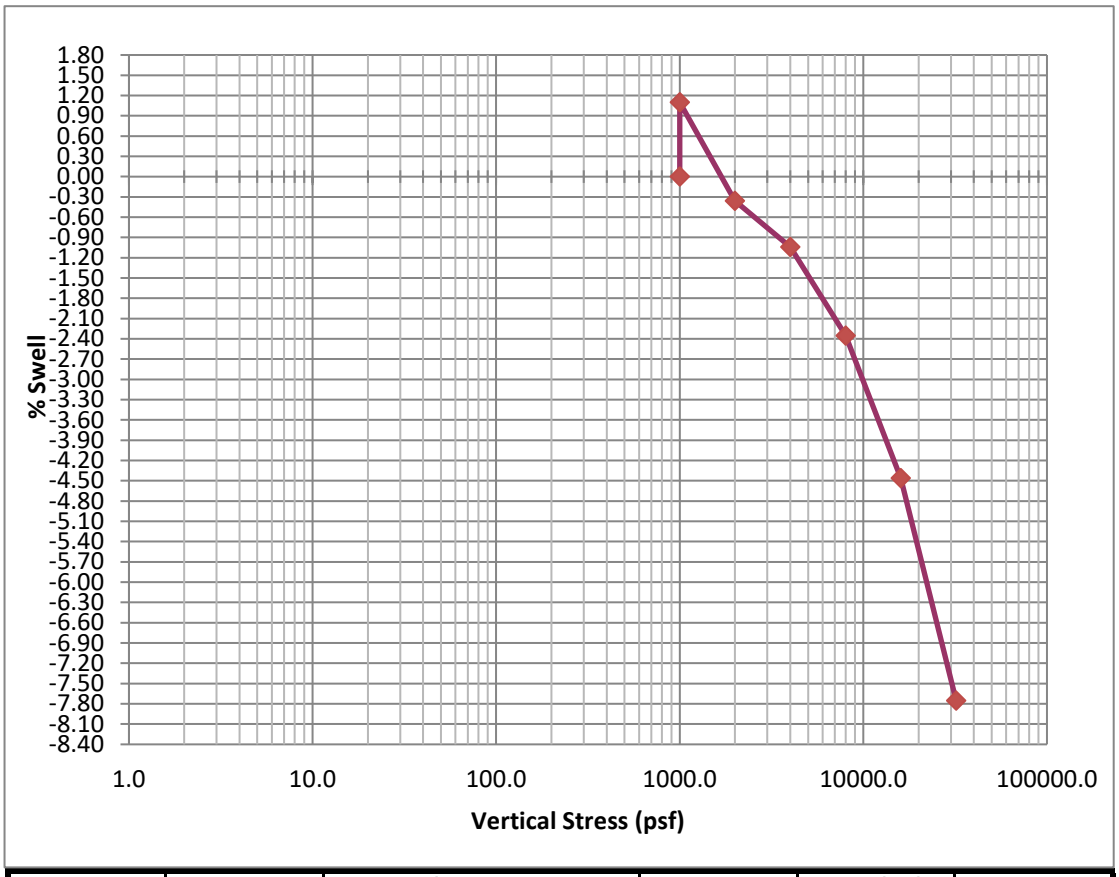
Alliance Geotechnical Group

3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name:	DART D-2	Date:	01/03/19
Project No:	E17-0811	Checked By:	HS
Material Description:	CLAY, very stiff to hard, tan and gray w/ calcareous nodules	Figure No:	



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
TS-111	6-10'	18.3	17.4	109.3	1000.0	0.00
					1000.0	1.10
					2000.0	-0.36
					4000.0	-1.04
					8000.0	-2.35
					16000.0	-4.46
					32000	-7.75

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
4.50+	4.50+				2.70	CH

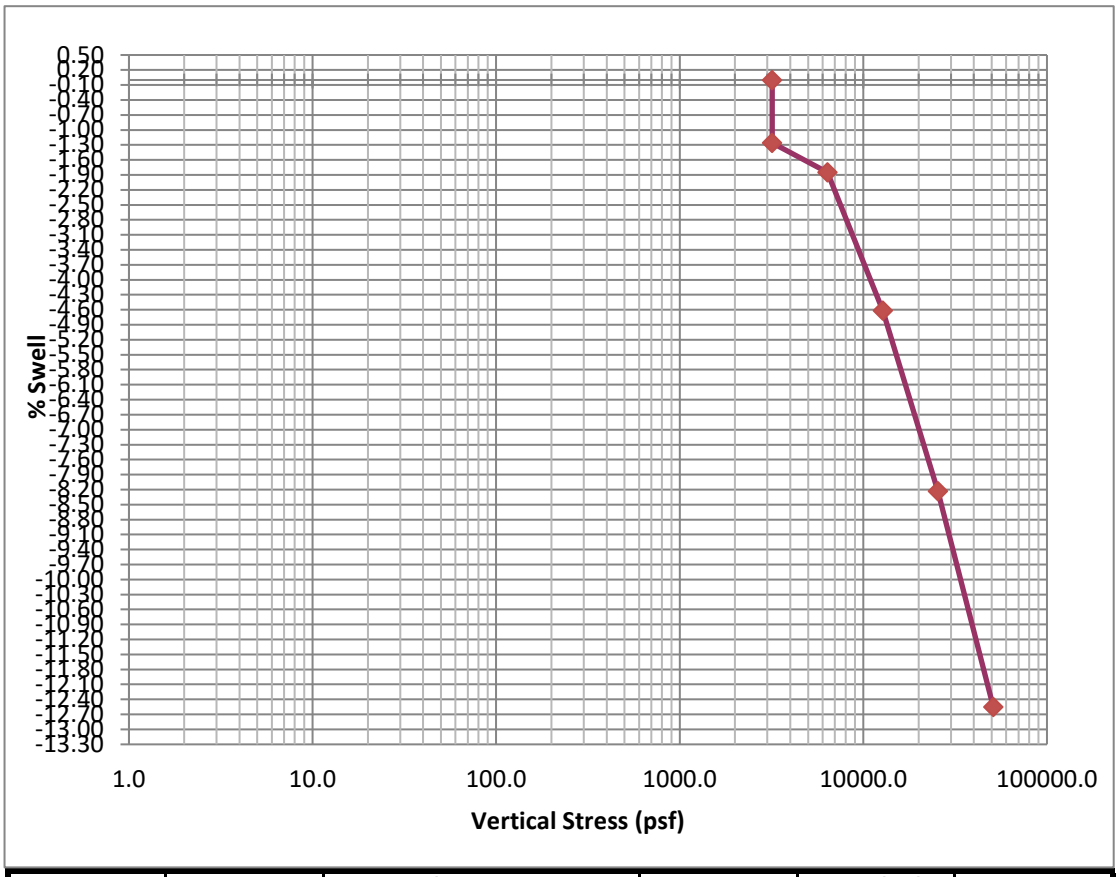
Alliance Geotechnical Group

3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name:	DART D-2	Date:	01/03/19
Project No:	E17-0811	Checked By:	HS
Material Description:	CLAY, very stiff, tan and dark brown, w/ sandy gravel	Figure No:	



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
TS-111	25-26'	20.0	17.2	104.1	3187.5	0.00
					3187.5	-1.26
					6375.0	-1.85
					12750.0	-4.62
					25500.0	-8.23
					51000.0	-12.55

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
3.5	4.50+				2.69	CL

Alliance Geotechnical Group

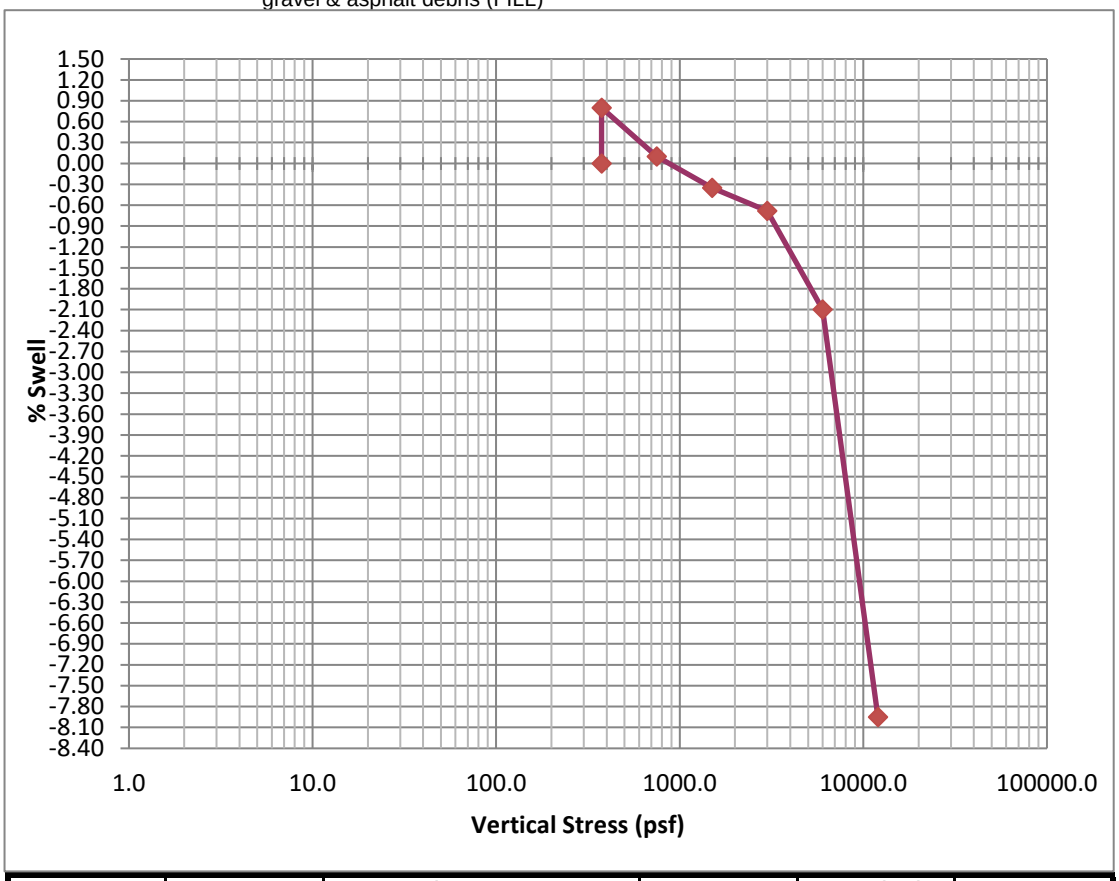
3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name: DART D-2
Project No: E17-0811
Material Description: CLAY, stiff, brown, w/ sand seams, embedded gravel & asphalt debris (FILL)

Date: 05/09/19
Checked By: HS
Figure No:



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
T-112	2-4.5'	26.0	23.7	94.7	375.0	0.00
					375.0	0.80
					750.0	0.10
					1500.0	-0.35
					3000.0	-0.68
					6000.0	-2.10
					12000	-7.95

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
2.75	4.00				2.72	CL

Alliance Geotechnical Group

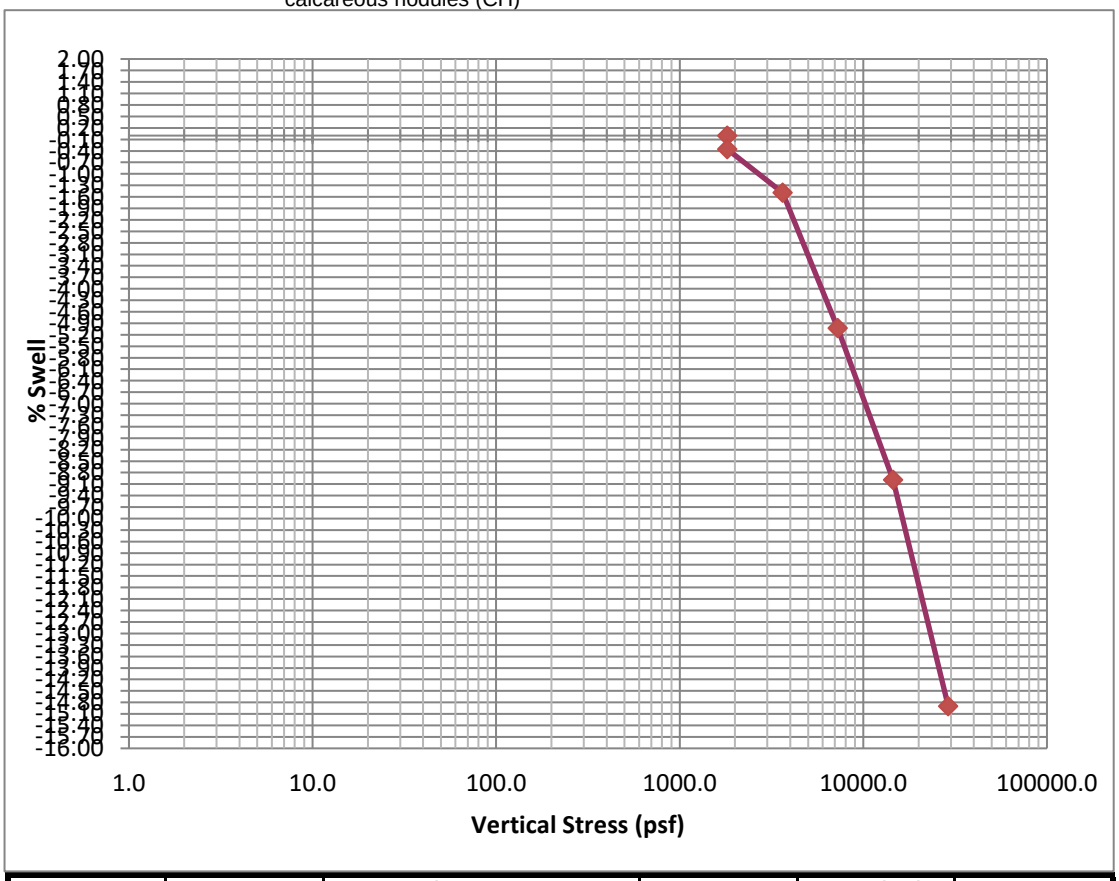
3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name: DART D-2
Project No: E17-0811
Material Description: CLAY, soft to stiff, light brown & light gray, w/ calcareous nodules (CH)

Date: 05/09/19
Checked By: HS
Figure No:



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
T-112	14-15'	52.3	46.5	66.7	1812.5	0.00
					1812.5	-0.35
					3625.0	-1.49
					7250.0	-5.03
					14500.0	-8.99
					29000.0	-14.90

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
1.6	3.00				2.70	

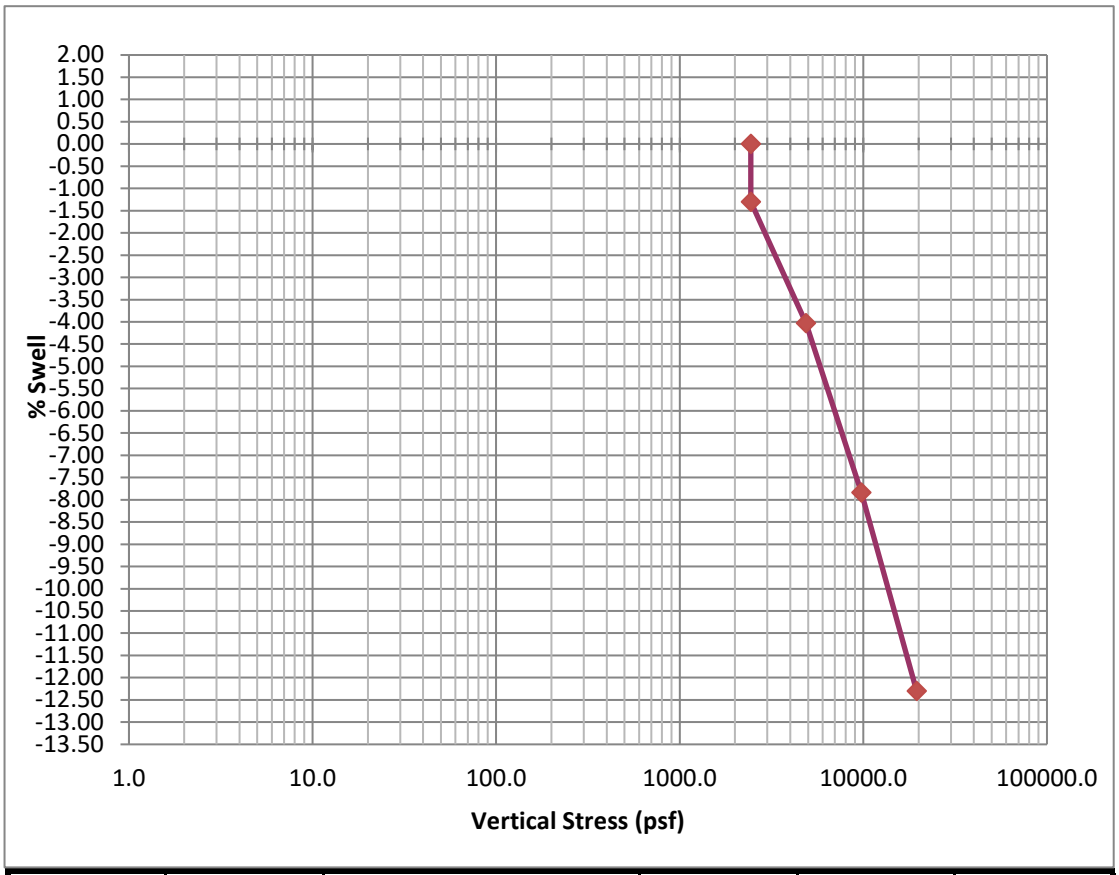
Alliance Geotechnical Group

3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name:	DART D-2	Date:	05/09/19
Project No:	E17-0811	Checked By:	HS
Material Description:	CLAY, wet, soft, light tan, w/ sand seams (CL)	Figure No:	



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
T-112	19-20'	82.6	75.7	56.1	2437.5	0.00
					2437.5	-1.30
					4875.0	-4.03
					9750.0	-7.84
					19500.0	-12.30

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
0.75	3.00				2.70	

Alliance Geotechnical Group

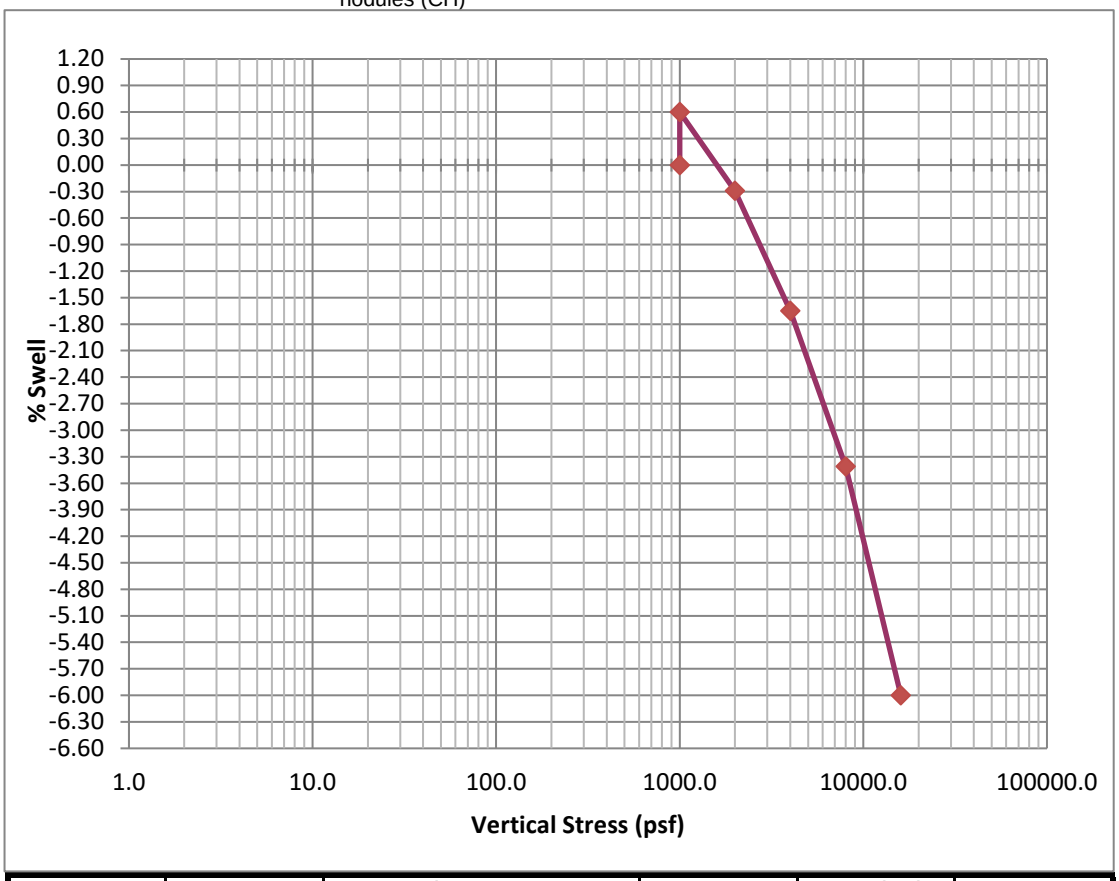
3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name: DART D-2
Project No: E17-0811
Material Description: CLAY, moist, soft, reddish brown, w/ calcareous nodules (CH)

Date: 05/09/19
Checked By: HS
Figure No:



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
T-204	7-9'	19.5	19.0	106.8	1000.0	0.00
					1000.0	0.60
					2000.0	-0.29
					4000.0	-1.65
					8000.0	-3.41
					16000.0	-6.00

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
2.5	3.75				2.70	CL

Alliance Geotechnical Group

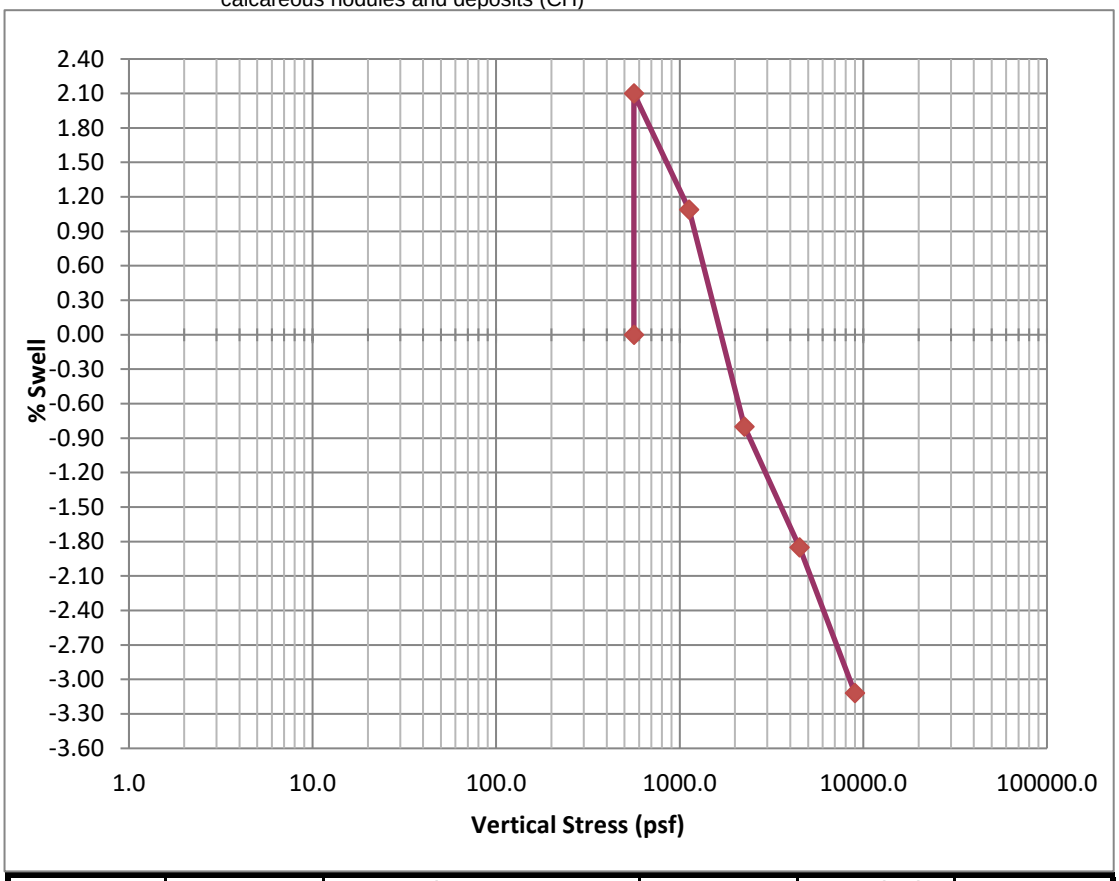
3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name: DART D-2
Project No: E17-0811
Material Description: CLAY, very stiff to hard, light brown, w/ calcareous nodules and deposits (CH)

Date: 05/09/19
Checked By: HS
Figure No:



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
TS-207	4-5'	15.2	15.6	109.4	562.5	0.00
					562.5	2.10
					1125.0	1.09
					2250.0	-0.80
					4500.0	-1.85
					9000.0	-3.12

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
4.50+	4.50				2.71	CL

Alliance Geotechnical Group

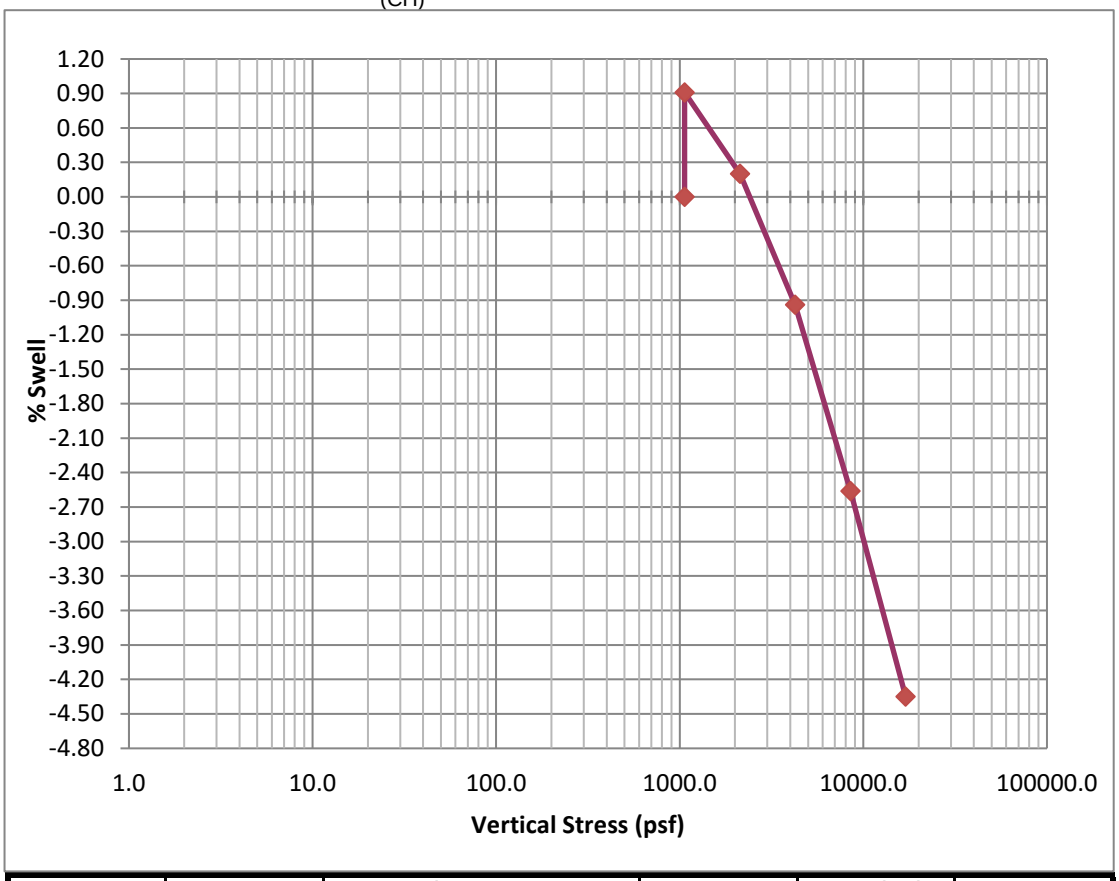
3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name: DART D-2
Project No: E17-0811
Material Description: CLAY, tan and light gray, w/ calcareous nodules (CH)

Date: 05/09/19
Checked By: HS
Figure No:



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
TS-207	8-9'	18.1	18.8	107.1	1062.5	0.00
					1062.5	0.91
					2125.0	0.20
					4250.0	-0.94
					8500.0	-2.56
					17000.0	-4.35

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
4.50+	4.50				2.71	CL

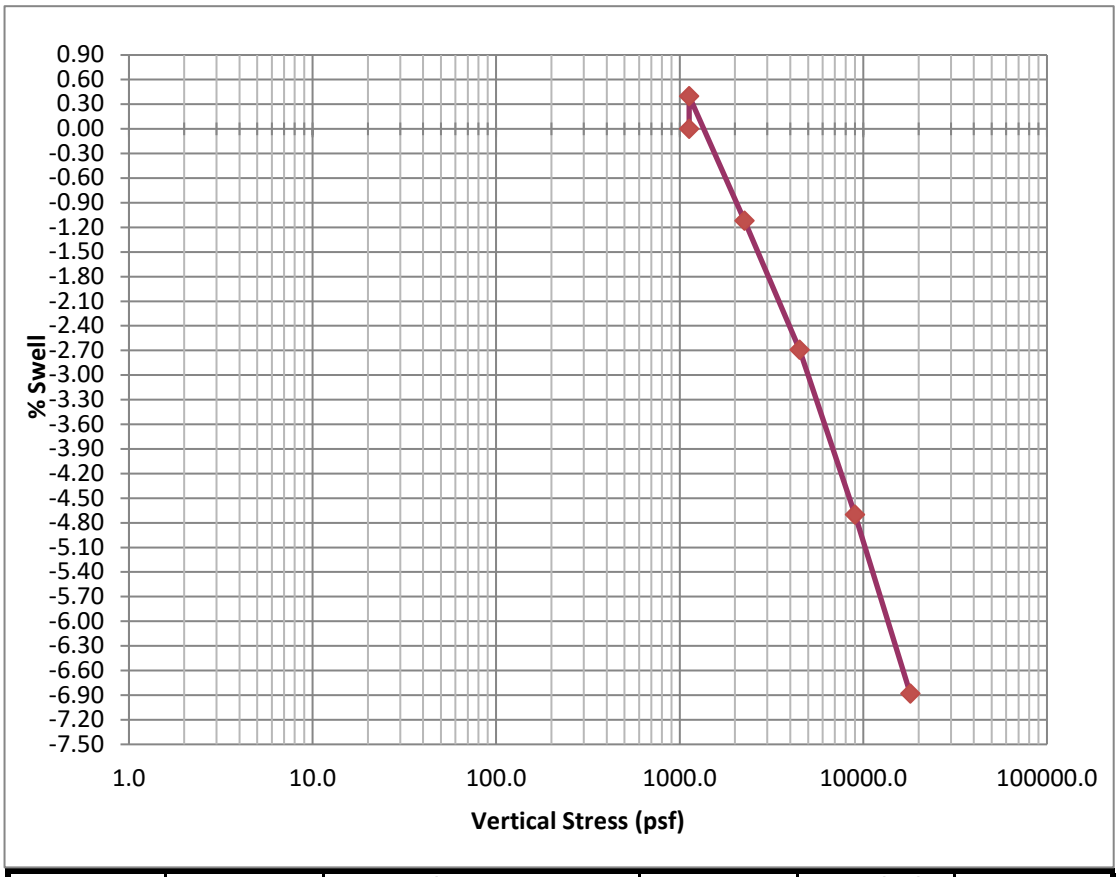
Alliance Geotechnical Group

3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name:	DART D-2	Date:	05/09/19
Project No:	E17-0811	Checked By:	HS
Material Description:	CLAY, wet, stiff, brown, w/ sand (CH)	Figure No:	



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
TS-208	8-10'	22.3	21.1	97.6	1125.0	0.00
					1125.0	0.40
					2250.0	-1.12
					4500.0	-2.69
					9000.0	-4.70
					18000.0	-6.88

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
1.9	3.75				2.71	CH

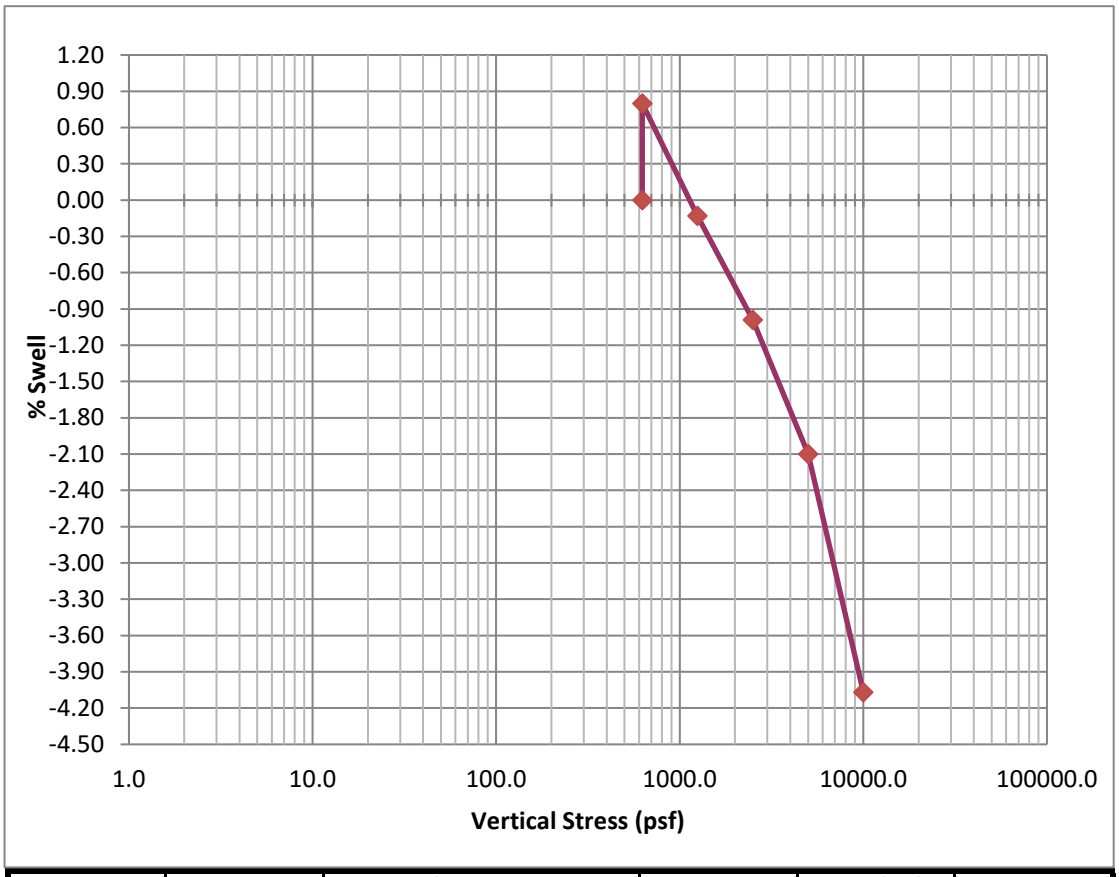
Alliance Geotechnical Group

3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name:	DART D-2	Date:	05/09/19
Project No:	E17-0811	Checked By:	HS
Material Description:	CLAY, soft, brown, w/ calcareous nodules (CH)	Figure No:	



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
TS-209	3-7'	29.6	27.0	79.0	625.0	0.00
					625.0	0.80
					1250.0	-0.13
					2500.0	-0.99
					5000.0	-2.10
					10000.0	-4.07

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
1.25	3.10				2.70	CH

Alliance Geotechnical Group

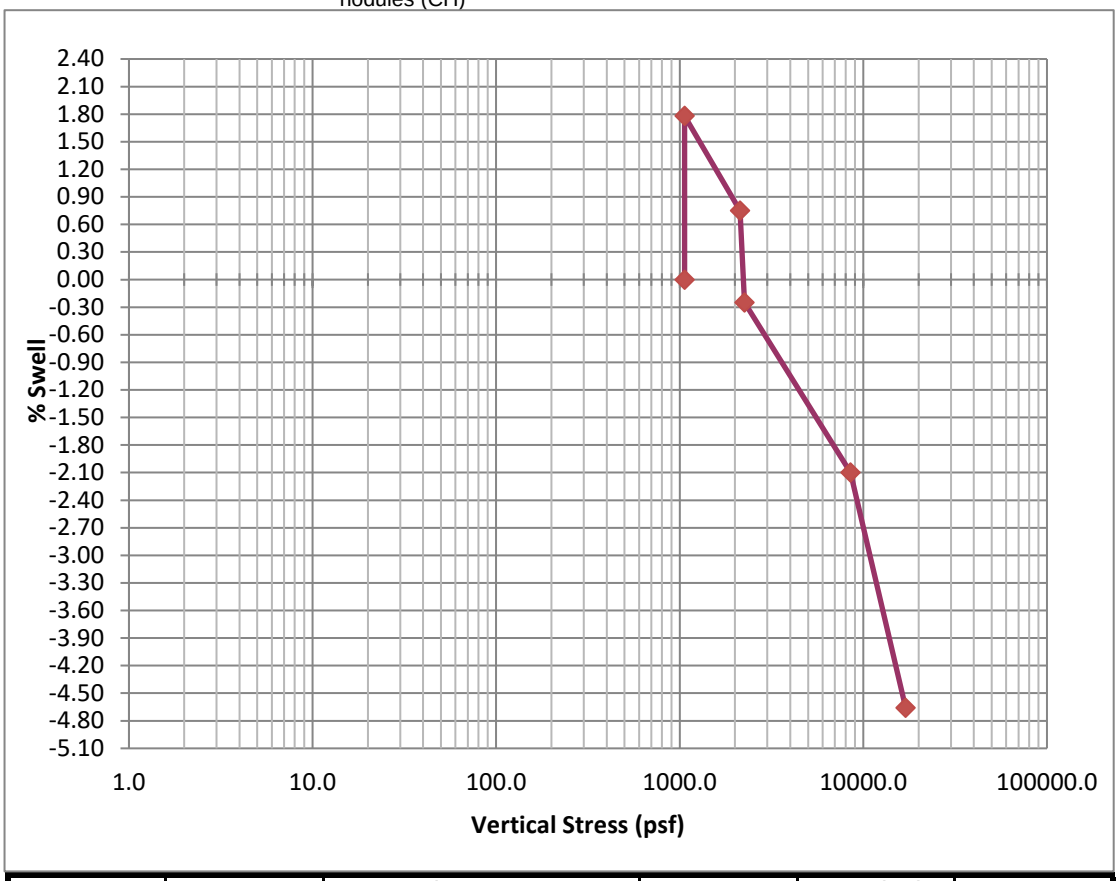
3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

ONE- DIMENSIONAL SWELL (ASTM D4546-C)

Project Name: DART D-2
Project No: E17-0811
Material Description: CLAY, tan and light gray, blocky, w/ calcareous nodules (CH)

Date: 05/09/19
Checked By: HS
Figure No:



Boring No.	Depth	% Moisture Content		Dry Density (pcf)	Vertical Stress (psf)	% Swell
		Initial	Final			
TS-209	7-10'	21.2	20.1	105.3	1062.5	0.00
					1062.5	1.78
					2125.0	0.75
					2250.0	-0.25
					8500.0	-2.10
					17000.0	-4.66

Pocket Penetrometer (tsf)		LL	PI	% Passing No.200	Sp. Gr. (assumed)	USCS
Initial	Final					
4.5	4.50+				2.72	CH

Alliance Geotechnical Group

3228 Halifax Street
Dallas, TX 75247
Tel: 972-444-8889, Fax: 972-444-8893

ALLIANCE GEOTECHNICAL GROUP

APPENDIX E-8

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

UNDRAINED UNCONSOLIDATED TRIAXIAL TEST RESULTS

BORING NO.	DEPTH (FT)	CONFINING PRESSURE (psi)	UU STRESS (ksf)	% STRAIN
B-1	5-6	5.6	33.26	3.3
B-2	24-25	21.3	9.04	7.1
P-102	8-9	7.8	36.76	3.8
T-102	14-15	12.6	1.65	3.6
T-103	7-8	7.0	47.50	2.0
TS-202	6-7	6.1	17.51	5.8
TS-208	5-6	5.7	1.46	14.1
TS-209	4-5	4.4	1.25	14.8

ALLIANCE GEOTECHNICAL GROUP

UNDRAINED UNCONSOLIDATED TRIAXIAL TEST RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-8

APPENDIX E-9

ORGANIC CONTENT TEST RESULTS

ORGANIC CONTENT TEST RESULTS

BORING NO.	DEPTH (FEET)	ORGANIC CONTENT (ASTM D2974)
TS-208	5-8	2.0%
	8-10	1.7%

ALLIANCE GEOTECHNICAL GROUP

ORGANIC CONTENT TEST RESULTS
DART D-2
DALLAS, TEXAS
PROJECT NO: E17-0811
APPENDIX E-9

APPENDIX F

ROCK CORE

TEST RESULTS

APPENDIX F-1

ABRASIVENESS OF ROCK USING CERCHAR METHOD TEST RESULTS

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	P-102	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-1/RC-2	Test Date:	05/14/19	Checked By:	jsc
Depth :	22.0-29.5 ft	Test Id:	501284		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
P-102	RC-1/RC-2	22.0-29.5	1	0.1	0.3	0.20	
			2	0.0	0.0	0.00	
			3	0.0	0.0	0.00	
			4	0.2	0.1	0.15	
			5	0.0	0.0	0.00	
			Average CAIs			0.07	
			Average CAI *			0.55	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

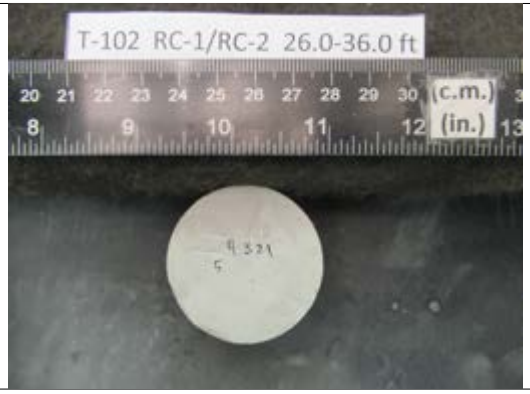
Client:	Alliance Geotechnical Group		
Project:	DART Project		
Location:	Dallas, TX	Project No:	GTX-309416
Boring ID: T-102	Sample Type: cylinder	Tested By:	tlm
Sample ID: RC-1/RC-2	Test Date: 05/14/19	Checked By:	jsc
Depth : 26.0-36.0 ft	Test Id: 501292		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
T-102	RC-1/RC-2	26.0-36.0	1	0.0	0.0	0.00	
			2	0.0	0.0	0.00	
			3	0.0	0.0	0.00	
			4	0.0	0.0	0.00	
			5	0.2	0.0	0.10	
			Average CAIs			0.02	
			Average CAI *			0.50	
					CERCHAR Abrasiveness Index Classification	**Very low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:



Client:	Alliance Geotechnical Group		
Project:	DART Project		
Location:	Dallas, TX	Project No:	GTX-309416
Boring ID: T-103	Sample Type: cylinder	Tested By:	tlm
Sample ID: RC-3	Test Date: 05/23/19	Checked By:	jsc
Depth : 41.0-46.0 ft	Test Id: 505078		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
T-103	RC-3	41.0-46.0 ft	1	0.0	0.0	0.00	
			2	0.0	0.0	0.00	
			3	0.1	0.1	0.10	
			4	0.1	0.1	0.10	
			5	0.0	0.0	0.00	
			Average CAIs			0.04	
			Average CAI *			0.52	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	TS-104	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-3	Test Date:	05/14/19	Checked By:	jsc
Depth :	35.0-40.0 ft	Test Id:	501304		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
TS-104	RC-3	35.0-40.0	1	0.1	0.3	0.20	
			2	0.1	0.4	0.25	
			3	0.2	0.0	0.10	
			4	0.0	0.0	0.00	
			5	0.0	0.0	0.00	
			Average CAIs			0.11	
			Average CAI *			0.59	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	TS-104	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-7/RC-8	Test Date:	05/14/19	Checked By:	jsc
Depth :	62.0-70.0 ft	Test Id:	501308		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
TS-104	RC-7/RC-8	62.0-70.0	1	0.0	0.2	0.10	
			2	0.2	0.2	0.20	
			3	0.0	0.0	0.00	
			4	0.0	0.0	0.00	
			5	0.0	0.0	0.00	
			Average CAIs			0.06	
			Average CAI *			0.54	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	T-201	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-7	Test Date:	05/23/19	Checked By:	jsc
Depth :	61.0-64.7 ft	Test Id:	505077		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
T-201	RC-7	61.0-64.7 ft	1	0.1	0.1	0.10	
			2	0.1	0.0	0.05	
			3	0.0	0.0	0.00	
			4	0.0	0.0	0.00	
			5	0.0	0.0	0.00	
			Average CAIs			0.03	
			Average CAI *			0.51	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	TS-202	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-4	Test Date:	05/23/19	Checked By:	jsc
Depth :	36.0-46.0 ft	Test Id:	505075		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
TS-202	RC-4	36.0-46.0 ft	1	0.0	0.0	0.00	
			2	0.0	0.0	0.00	
			3	0.1	0.0	0.05	
			4	0.1	0.1	0.10	
			5	0.0	0.0	0.00	
			Average CAIs			0.03	
			Average CAI *			0.51	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	TS-202	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-6/RC-7	Test Date:	05/14/19	Checked By:	jsc
Depth :	56.0-66.0 ft	Test Id:	501311		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
TS-202	RC-6/RC-7	56.0-66.0	1	0.0	0.0	0.00	
			2	0.0	0.0	0.00	
			3	0.0	0.0	0.00	
			4	0.0	0.0	0.00	
			5	0.1	0.2	0.15	
			Average CAIs			0.03	
			Average CAI *			0.51	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

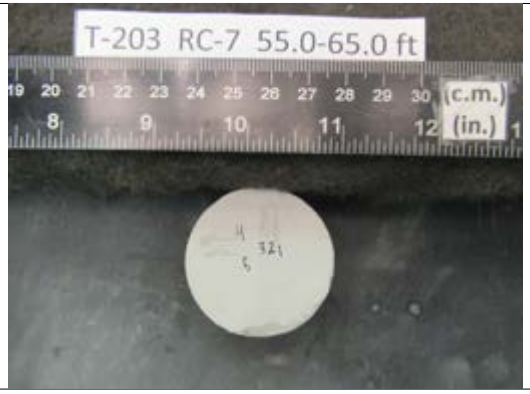
Client:	Alliance Geotechnical Group		
Project:	DART Project		
Location:	Dallas, TX	Project No:	GTX-309416
Boring ID: T-203	Sample Type: cylinder	Tested By:	tlm
Sample ID: RC-7	Test Date: 05/14/19	Checked By:	jsc
Depth : 55.0-65.0 ft	Test Id: 501295		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
T-203	RC-7	55.0-65.0	1	0.0	0.0	0.00	
			2	0.0	0.0	0.00	
			3	0.1	0.2	0.15	
			4	0.0	0.0	0.00	
			5	0.0	0.0	0.00	
			Average CAIs			0.03	
			Average CAI *			0.51	
				CERCHAR Abrasiveness Index Classification		**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:



Client:	Alliance Geotechnical Group		
Project:	DART Project		
Location:	Dallas, TX	Project No:	GTX-309416
Boring ID: T-204	Sample Type: cylinder	Tested By:	tlm
Sample ID: RC-8/RC-9	Test Date: 05/14/19	Checked By:	jsc
Depth : 50.0-60.0 ft	Test Id: 501298		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
T-204	RC-8/RC-9	50.0-60.0	1	0.0	0.1	0.05	
			2	0.4	0.2	0.30	
			3	0.0	0.0	0.00	
			4	0.2	0.2	0.20	
			5	0.0	0.0	0.00	
			Average CAIs			0.11	
			Average CAI *			0.59	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Alliance Geotechnical Group		
Project:	DART Project		
Location:	Dallas, TX	Project No:	GTX-309416
Boring ID: T-205	Sample Type: cylinder	Tested By:	tlm
Sample ID: RC-2	Test Date: 05/14/19	Checked By:	jsc
Depth : 45.0-50.0 ft	Test Id: 501299		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
T-205	RC-2	45.0-50.0	1	0.3	0.1	0.20	
			2	0.1	0.3	0.20	
			3	0.0	0.0	0.00	
			4	0.1	0.1	0.10	
			5	0.1	0.0	0.05	
			Average CAIs			0.11	
			Average CAI *			0.59	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	T-205	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-4	Test Date:	05/14/19	Checked By:	jsc
Depth :	55.0-61.0 ft	Test Id:	501300		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
T-205	RC-4	55.0-61.0	1	0.1	0.0	0.05	
			2	0.0	0.2	0.10	
			3	0.0	0.1	0.05	
			4	0.0	0.0	0.00	
			5	0.1	0.0	0.05	
			Average CAIs			0.05	
			Average CAI *			0.53	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Alliance Geotechnical Group		
Project:	DART Project		
Location:	Dallas, TX	Project No:	GTX-309416
Boring ID: T-205	Sample Type: cylinder	Tested By:	tlm
Sample ID: RC-5	Test Date: 05/14/19	Checked By:	jsc
Depth : 66.0-71.0 ft	Test Id: 501303		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
T-205	RC-5	66.0-71.0	1	0.1	0.0	0.05	
			2	0.0	0.0	0.00	
			3	0.0	0.0	0.00	
			4	0.0	0.1	0.05	
			5	0.0	0.1	0.05	
			Average CAIs			0.03	
			Average CAI *			0.51	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

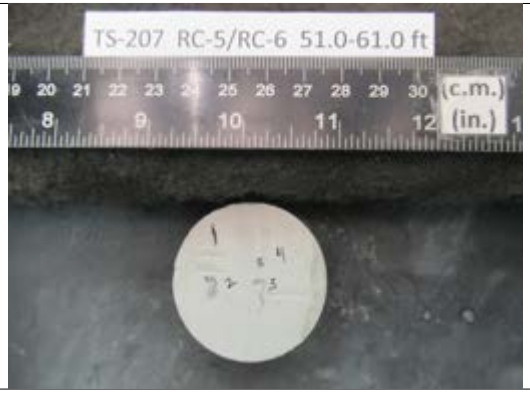
Client:	Alliance Geotechnical Group		
Project:	DART Project		
Location:	Dallas, TX	Project No:	GTX-309416
Boring ID: TS-207	Sample Type: cylinder	Tested By:	tlm
Sample ID: RC-5/RC-6	Test Date: 05/14/19	Checked By:	jsc
Depth : 51.0-61.0 ft	Test Id: 501466		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
TS-207	RC-5/RC-6	51.0-61.0	1	0.0	0.0	0.00	
			2	0.0	0.1	0.05	
			3	0.0	0.0	0.00	
			4	0.6	0.8	0.70	
			5	0.1	0.0	0.05	
			Average CAIs			0.16	
			Average CAI *			0.64	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:



Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	TS-208	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-4	Test Date:	05/14/19	Checked By:	jsc
Depth :	35.0-45.0 ft	Test Id:	501501		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
TS-208	RC-4	35.0-45.0	1	0.0	0.1	0.05	
			2	0.0	0.0	0.00	
			3	0.1	0.3	0.20	
			4	0.0	0.0	0.00	
			5	0.0	0.0	0.00	
			Average CAIs			0.05	
			Average CAI *			0.53	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	TS-209	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-1	Test Date:	05/14/19	Checked By:	jsc
Depth :	40.0-50.0 ft	Test Id:	501508		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
TS-209	RC-1	40.0-50.0	1	0.0	0.0	0.00	
			2	0.2	0.3	0.25	
			3	0.0	0.0	0.00	
			4	0.2	0.1	0.15	
			5	0.2	0.2	0.20	
			Average CAIs			0.12	
			Average CAI *			0.60	
					CERCHAR Abrasiveness Index Classification	**Low abrasiveness**	

Notes

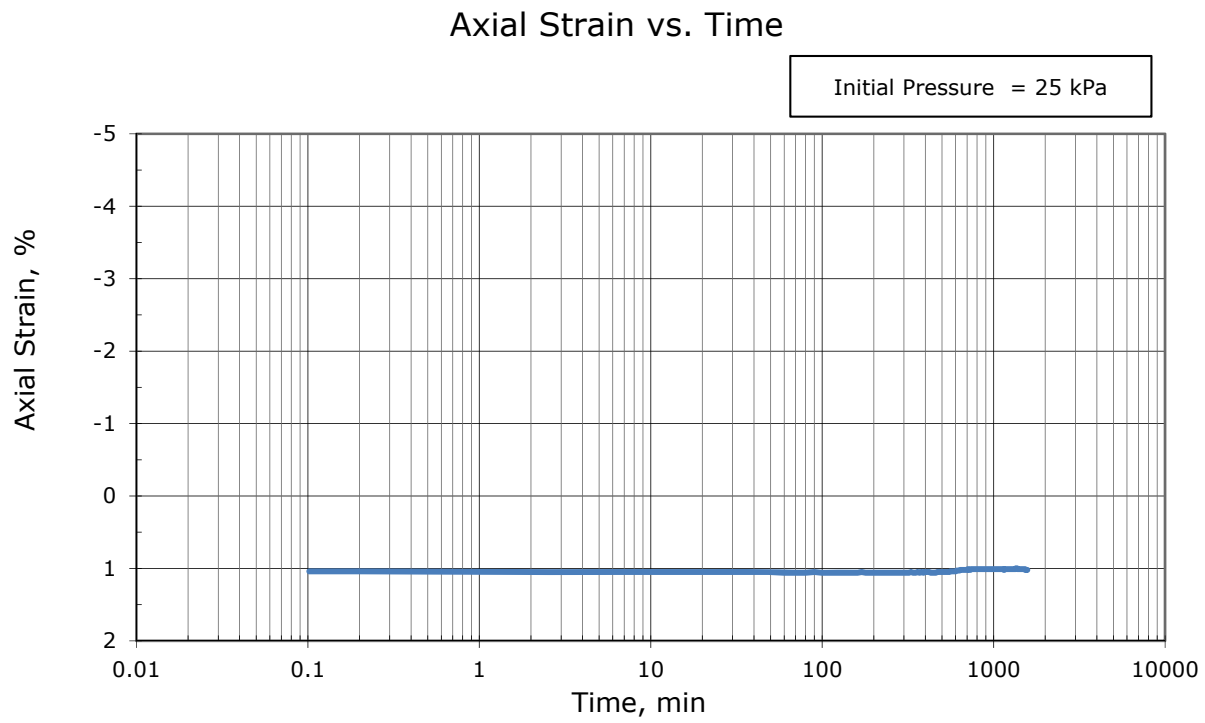
Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

APPENDIX F-2

AXIAL SWELLING TEST

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	trm
Test Date:	05/21/19	Checked By:	njh
Boring ID:	B-3	Test ID:	SW-20
Sample ID:	RC-6		
Depth, ft:	70-75		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



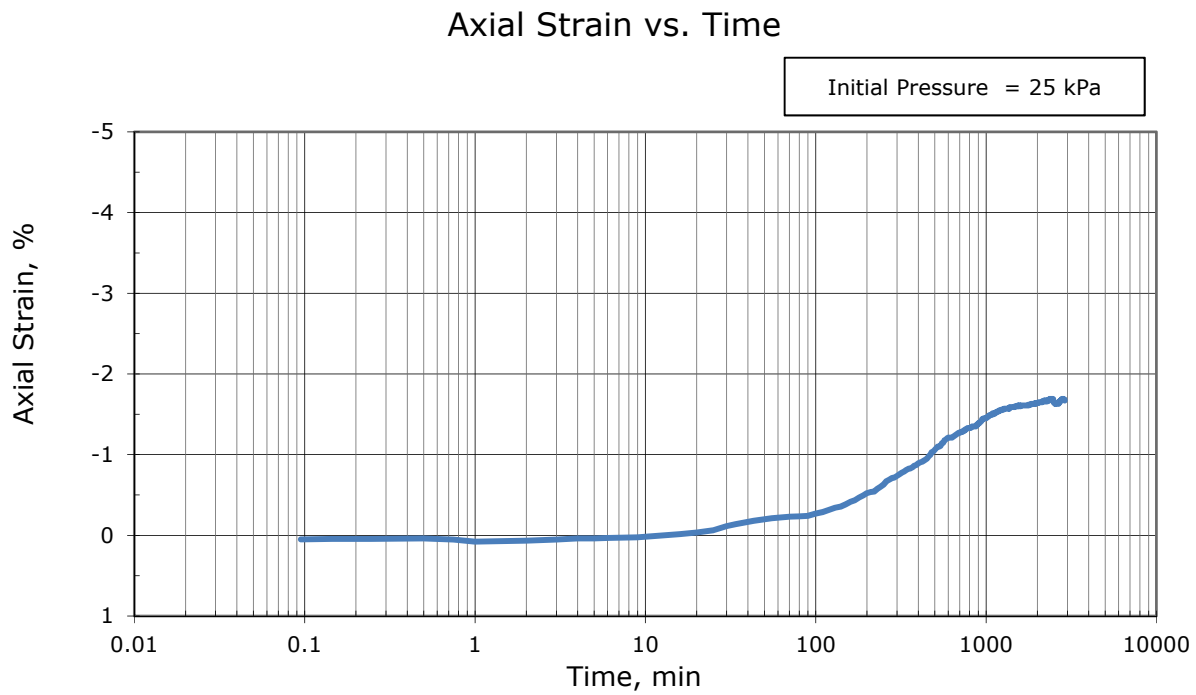
Initial diameter, in:	1.99	Final Moisture Content, %:	12.1
Initial height, in:	0.82	Final Dry Density, pcf:	128.5
Initial mass, g:	94.00	Final Bulk Density, pcf:	144.0
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	140.4		

***Final Axial Strain, %: 1.01**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/06/19	Checked By:	njh
Boring ID:	P-102	Test ID:	SW-1
Sample ID:	---		
Depth, ft:	26'-28' 4"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



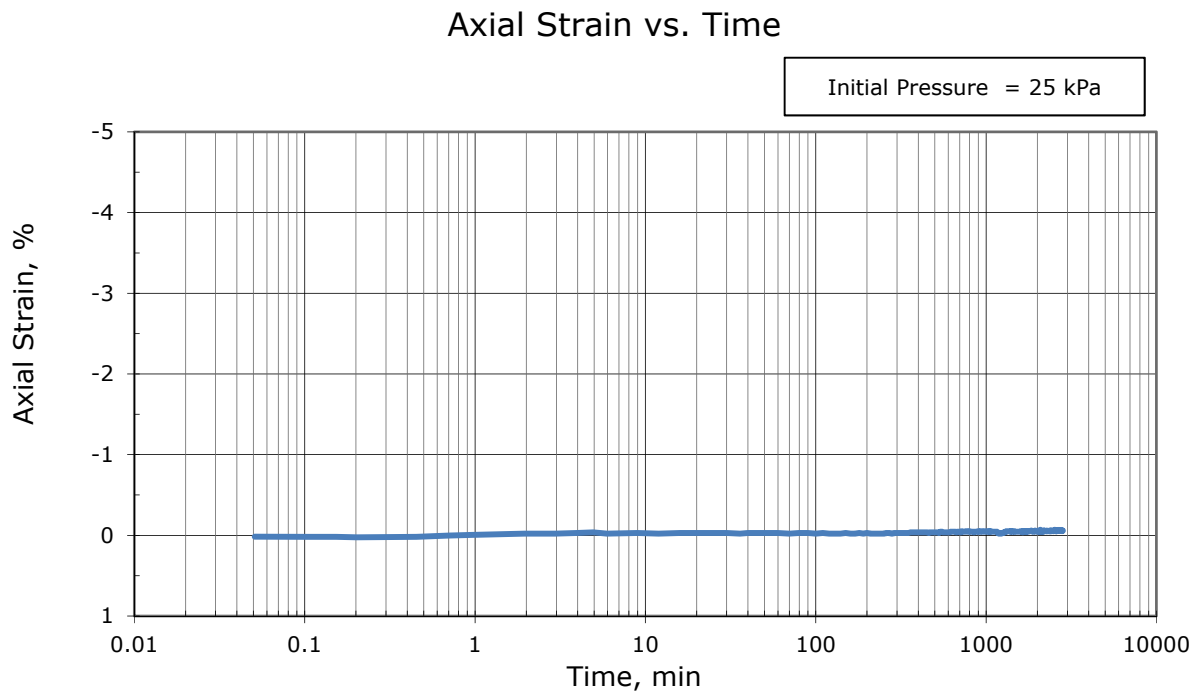
Initial diameter, in:	1.96	Final Moisture Content, %:	12.5
Initial height, in:	0.74	Final Dry Density, pcf:	123.7
Initial mass, g:	77.86	Final Bulk Density, pcf:	139.2
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	132.8		

***Final Axial Strain, %: -1.7**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/12/19	Checked By:	njh
Boring ID:	T-102	Test ID:	SW-4
Sample ID:	RC-1		
Depth, ft:	28' 3"-30' 4"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



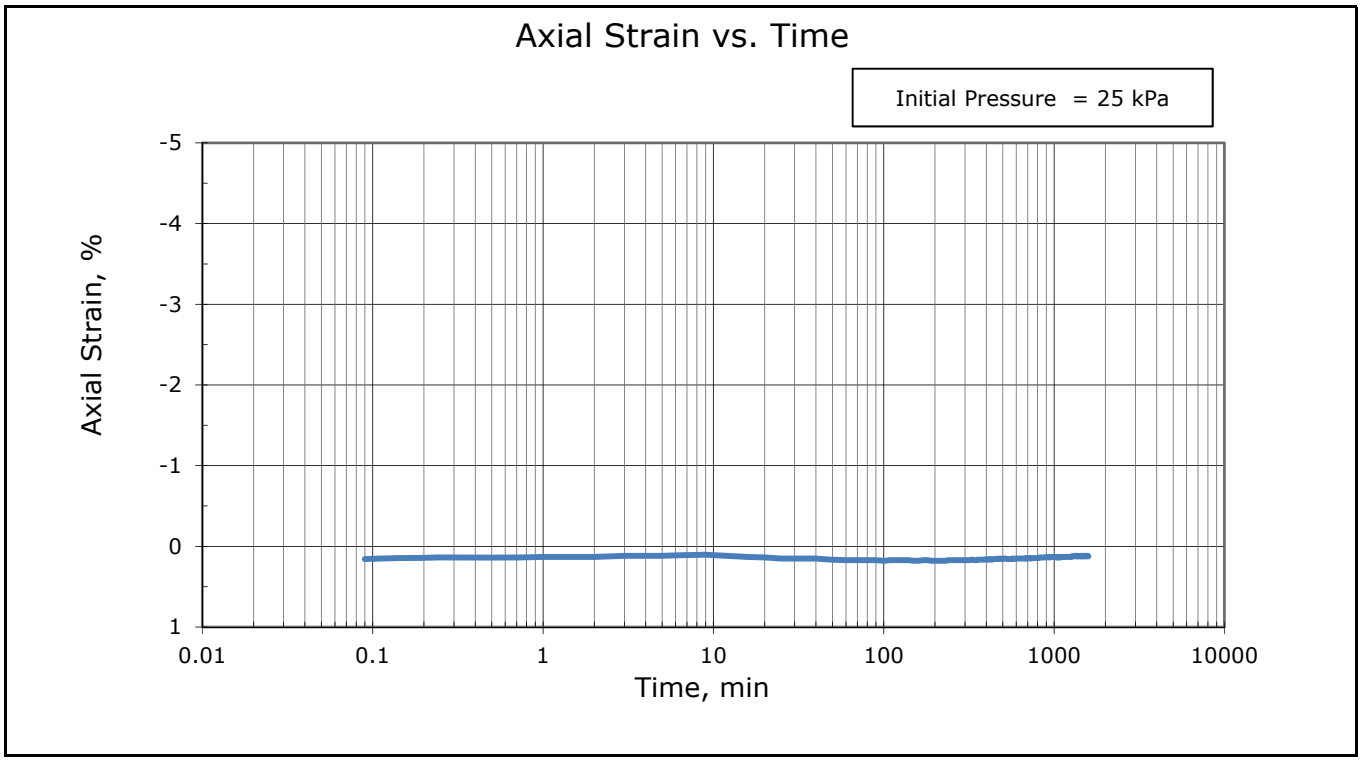
Initial diameter, in:	1.99	Final Moisture Content, %:	12.7
Initial height, in:	0.64	Final Dry Density, pcf:	122.5
Initial mass, g:	66.15	Final Bulk Density, pcf:	138.0
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	126.6		

***Final Axial Strain, %: -0.06**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/11/19	Checked By:	njh
Boring ID:	T-103	Test ID:	SW-3
Sample ID:	RC-2		
Depth, ft:	38' 4"-40' 5"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



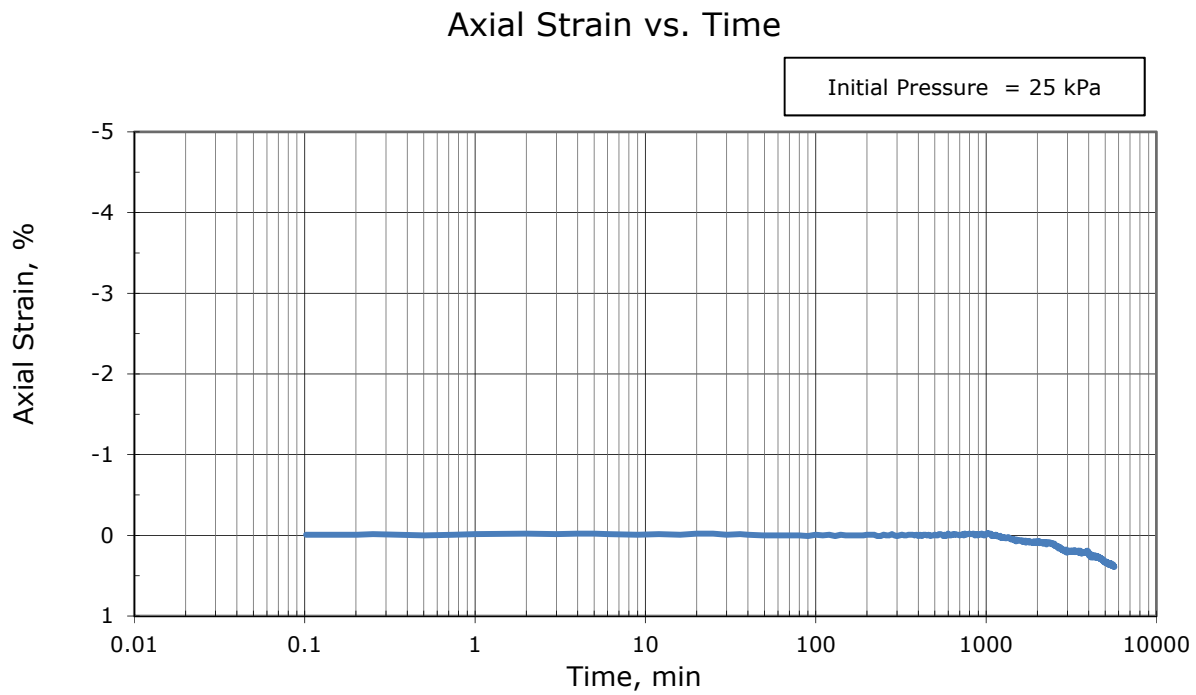
Initial diameter, in:	1.98	Final Moisture Content, %:	14.1
Initial height, in:	0.73	Final Dry Density, pcf:	119.8
Initial mass, g:	72.90	Final Bulk Density, pcf:	136.8
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	123.6		

***Final Axial Strain, %: 0.12**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/28/19	Checked By:	njh
Boring ID:	TS-104	Test ID:	SW-10
Sample ID:	RC-3A		
Depth, ft:	35'-37' 6"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



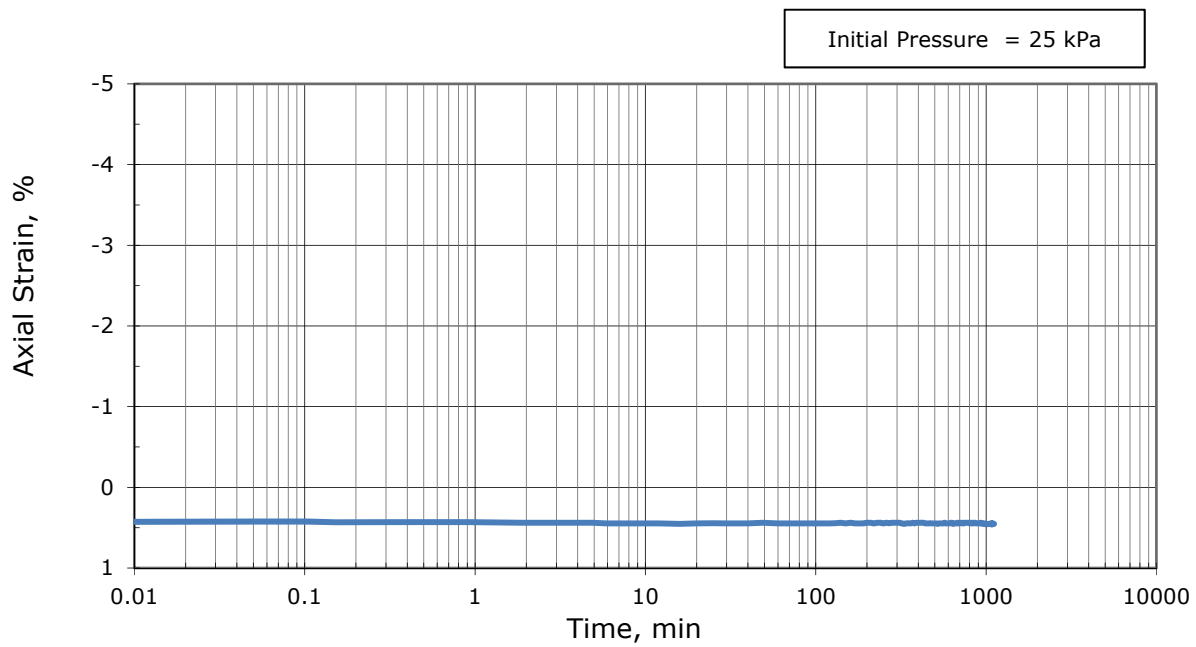
Initial diameter, in:	1.92	Final Moisture Content, %:	15.2
Initial height, in:	0.68	Final Dry Density, pcf:	119.7
Initial mass, g:	63.89	Final Bulk Density, pcf:	137.9
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	123.6		

***Final Axial Strain, %: 0.37**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	03/13/19	Checked By:	njh
Boring ID:	TS-104	Test ID:	SW-14
Sample ID:	RC-5		
Depth, ft:	53' 3"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



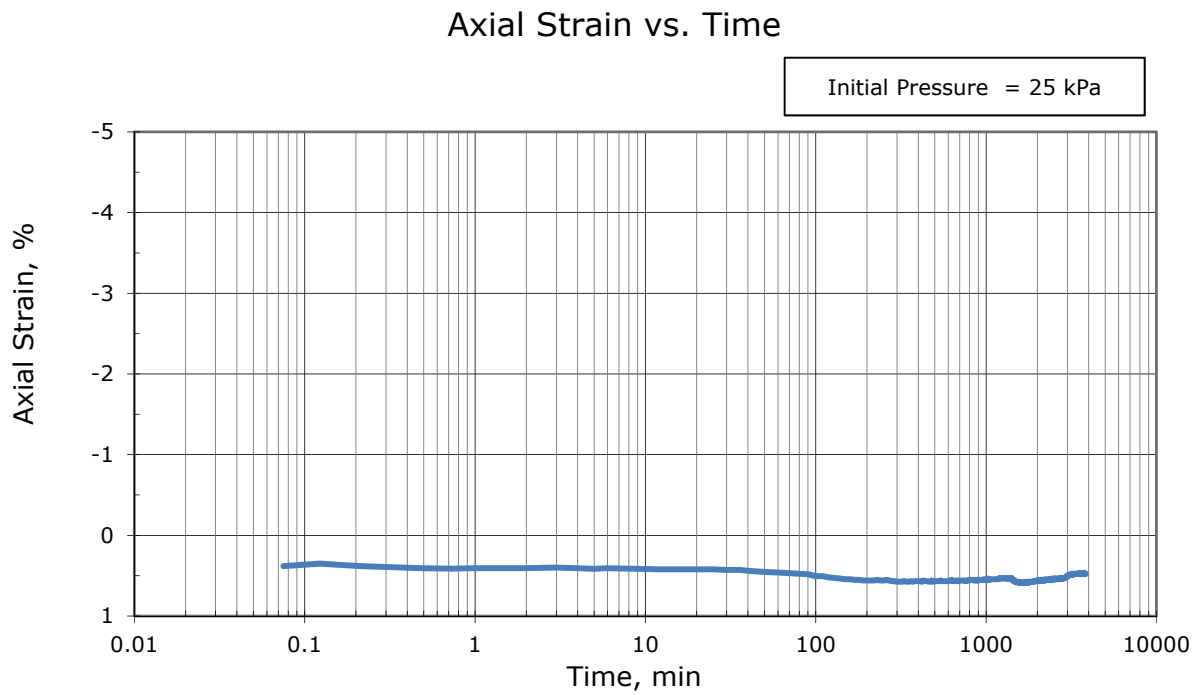
Initial diameter, in:	1.96	Final Moisture Content, %:	13.6
Initial height, in:	0.7	Final Dry Density, pcf:	119.7
Initial mass, g:	71.23	Final Bulk Density, pcf:	135.9
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	128.5		

***Final Axial Strain, %: 0.45**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/08/19	Checked By:	njh
Boring ID:	TS-104	Test ID:	SW-2
Sample ID:	RC-7		
Depth, ft:	60'-63' 5"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



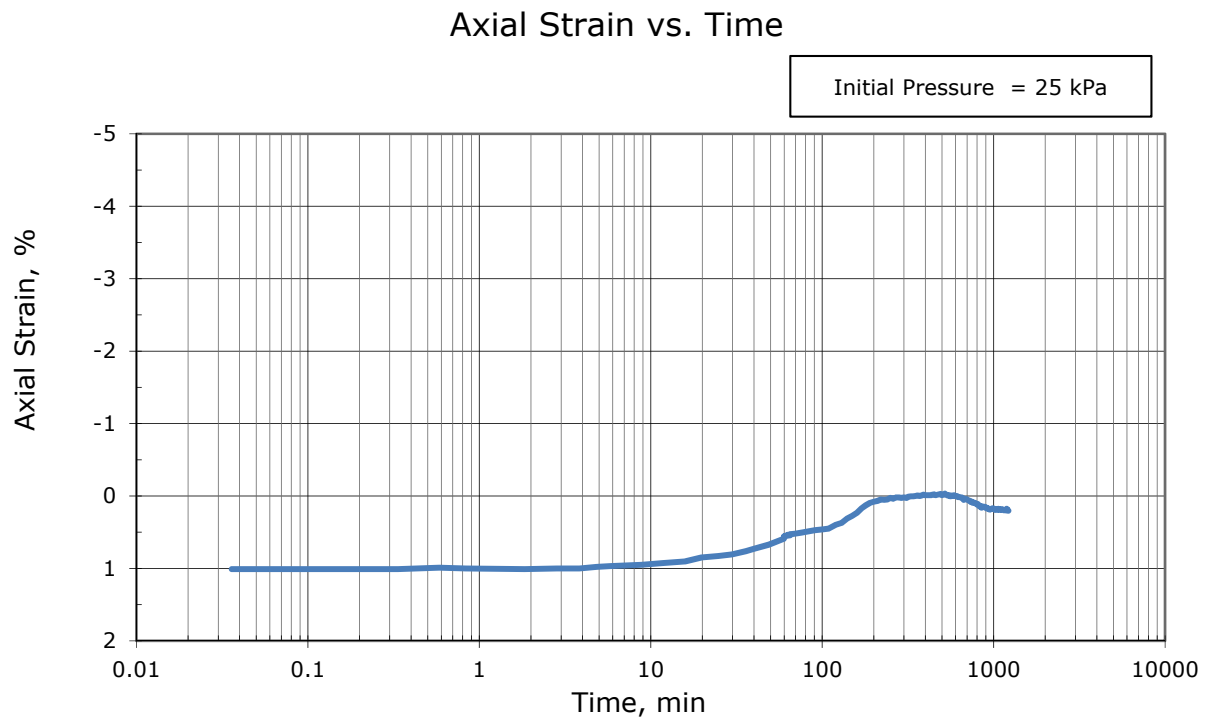
Initial diameter, in:	1.98	Final Moisture Content, %:	13.0
Initial height, in:	0.65	Final Dry Density, pcf:	122.2
Initial mass, g:	67.85	Final Bulk Density, pcf:	138.1
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	129.1		

***Final Axial Strain, %: 0.5**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	05/01/19	Checked By:	njh
Boring ID:	T-112	Test ID:	SW-16
Sample ID:	RC-2		
Depth, ft:	41-46		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



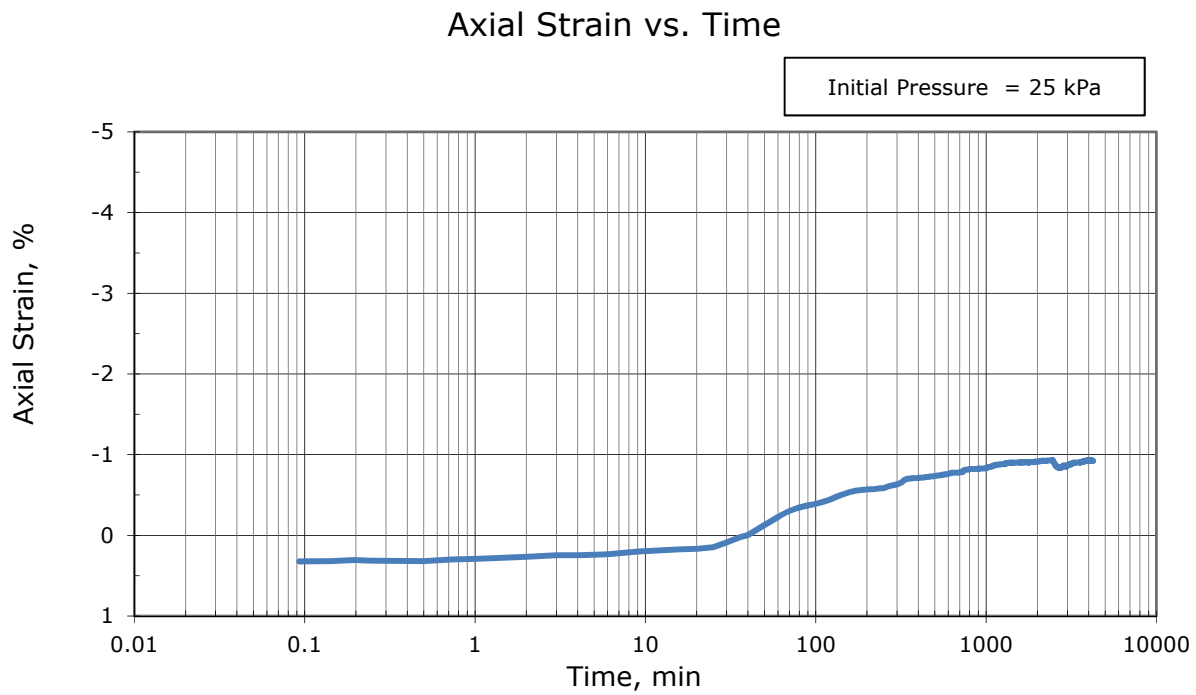
Initial diameter, in:	1.99	Final Moisture Content, %:	12.9
Initial height, in:	0.869	Final Dry Density, pcf:	123.9
Initial mass, g:	91.42	Final Bulk Density, pcf:	139.9
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	128.9		

***Final Axial Strain, %: 0.19**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/19/19	Checked By:	njh
Boring ID:	T-201	Test ID:	SW-6
Sample ID:	RC-7		
Depth, ft:	63' 10"-65'		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



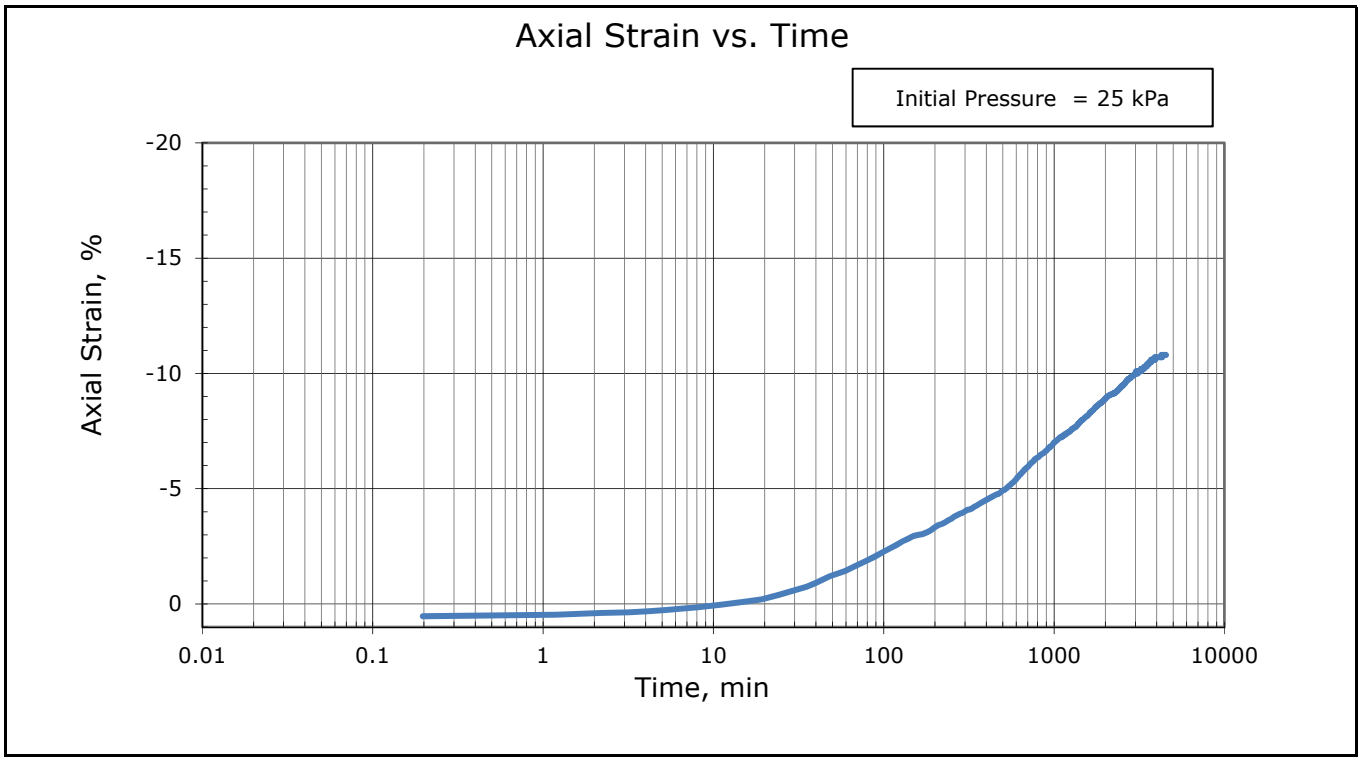
Initial diameter, in:	1.99	Final Moisture Content, %:	11.0
Initial height, in:	0.75	Final Dry Density, pcf:	132.3
Initial mass, g:	83.53	Final Bulk Density, pcf:	146.9
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	136.4		

***Final Axial Strain, %: -0.93**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	03/08/19	Checked By:	njh
Boring ID:	T-201	Test ID:	SW-12
Sample ID:	RC-8		
Depth, ft:	67' 5"-69' 6"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



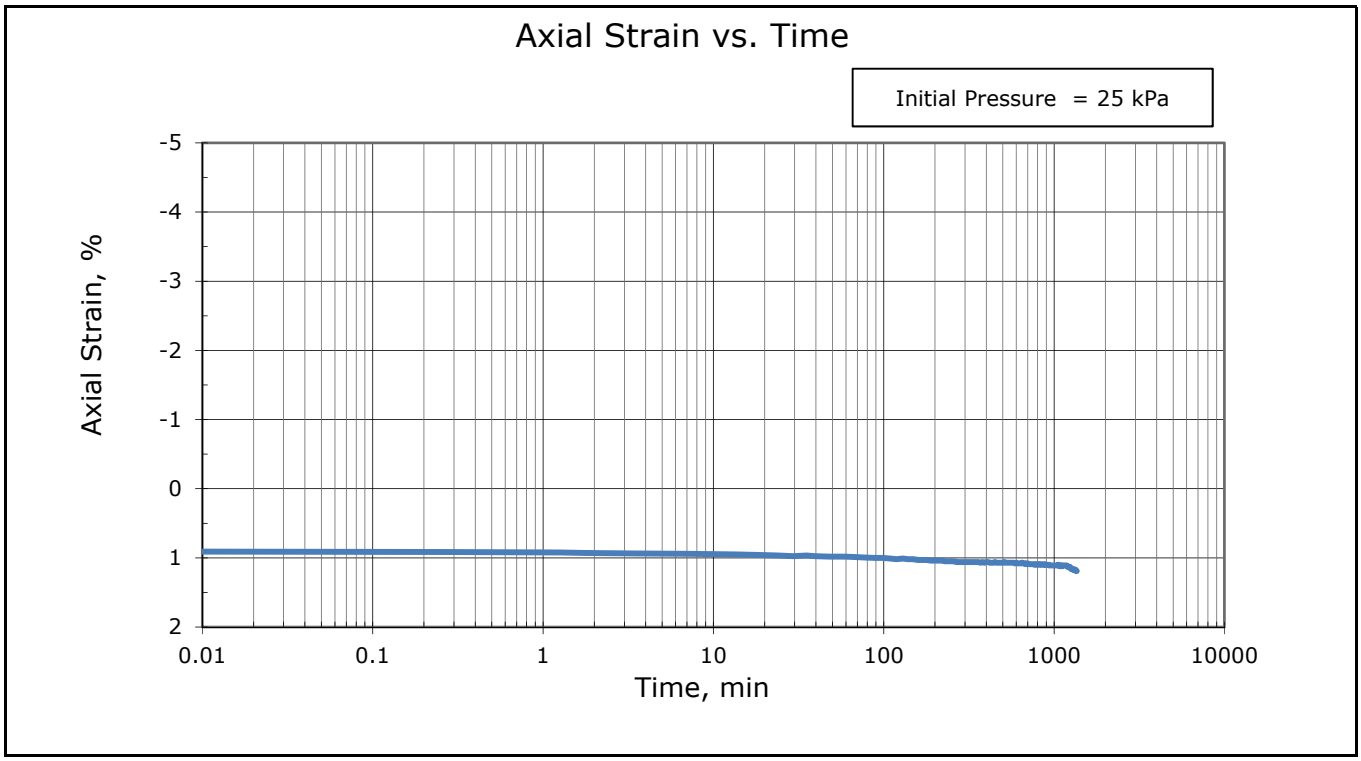
Initial diameter, in:	1.91	Final Moisture Content, %:	20.9
Initial height, in:	0.68	Final Dry Density, pcf:	114.2
Initial mass, g:	67.88	Final Bulk Density, pcf:	138.1
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	132.7		

***Final Axial Strain, %: -10.78**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	03/14/19	Checked By:	njh
Boring ID:	TS-202	Test ID:	SW-15
Sample ID:	RC-4		
Depth, ft:	36' 6"-38' 9"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



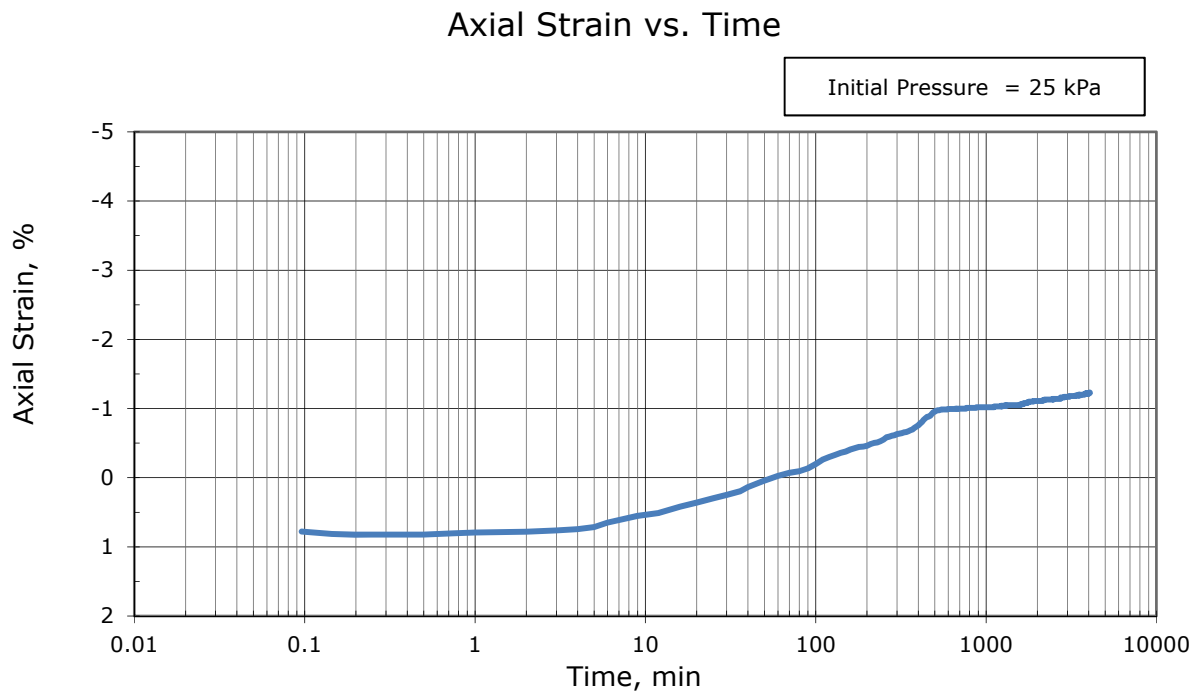
Initial diameter, in:	1.97	Final Moisture Content, %:	13.8
Initial height, in:	0.68	Final Dry Density, pcf:	120.8
Initial mass, g:	65.51	Final Bulk Density, pcf:	137.5
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	120.4		

***Final Axial Strain, %: 1.14**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/22/19	Checked By:	njh
Boring ID:	TS-202	Test ID:	SW-7
Sample ID:	RC-6/7		
Depth, ft:	60'-64' 1"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



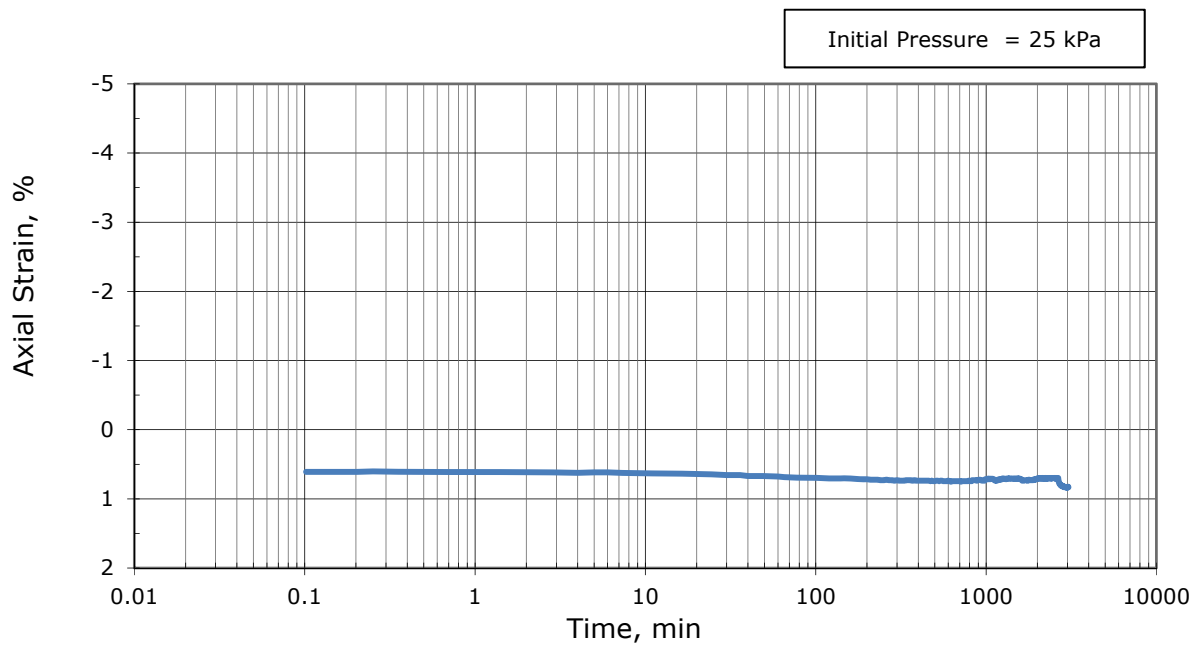
Initial diameter, in:	1.96	Final Moisture Content, %:	13.4
Initial height, in:	0.82	Final Dry Density, pcf:	120.8
Initial mass, g:	81.86	Final Bulk Density, pcf:	137.0
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	126.0		

***Final Axial Strain, %: -1.2**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/26/19	Checked By:	njh
Boring ID:	T-203	Test ID:	SW-9
Sample ID:	---		
Depth, ft:	60'-65'		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



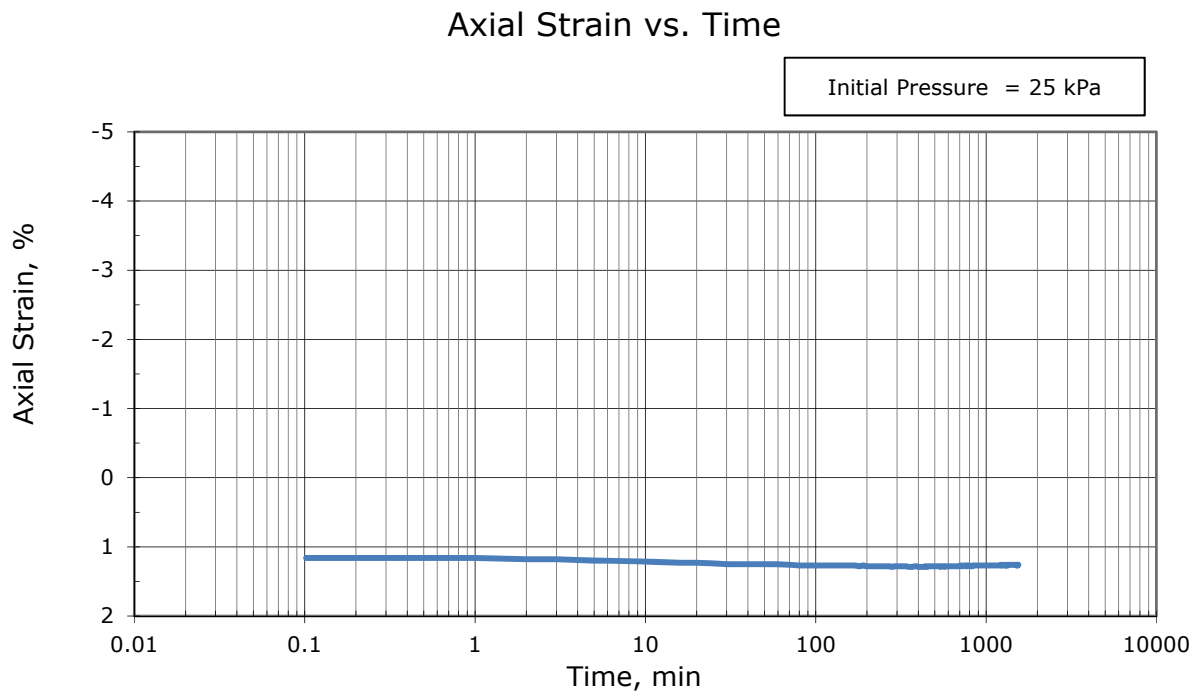
Initial diameter, in:	1.98	Final Moisture Content, %:	14.1
Initial height, in:	0.74	Final Dry Density, pcf:	121.8
Initial mass, g:	77.92	Final Bulk Density, pcf:	139.0
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	130.3		

***Final Axial Strain, %: 0.82**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/25/19	Checked By:	njh
Boring ID:	T-204	Test ID:	SW-8
Sample ID:	---		
Depth, ft:	52' 10"-55'		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



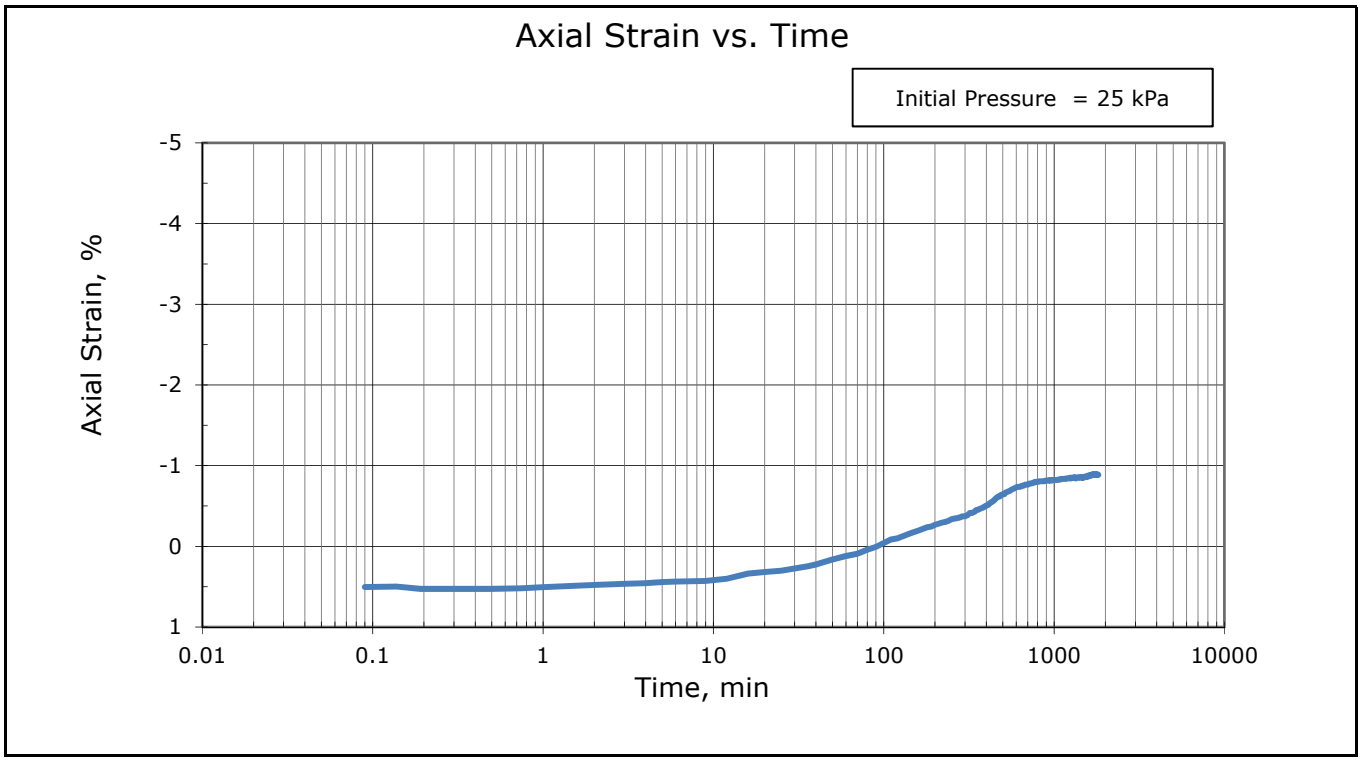
Initial diameter, in:	1.96	Final Moisture Content, %:	13.4
Initial height, in:	0.72	Final Dry Density, pcf:	125.1
Initial mass, g:	76.81	Final Bulk Density, pcf:	141.9
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	134.7		

***Final Axial Strain, %: 1.3**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	03/12/19	Checked By:	njh
Boring ID:	T-205	Test ID:	SW-13
Sample ID:	RC-2		
Depth, ft:	47' 5"-48' 11"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



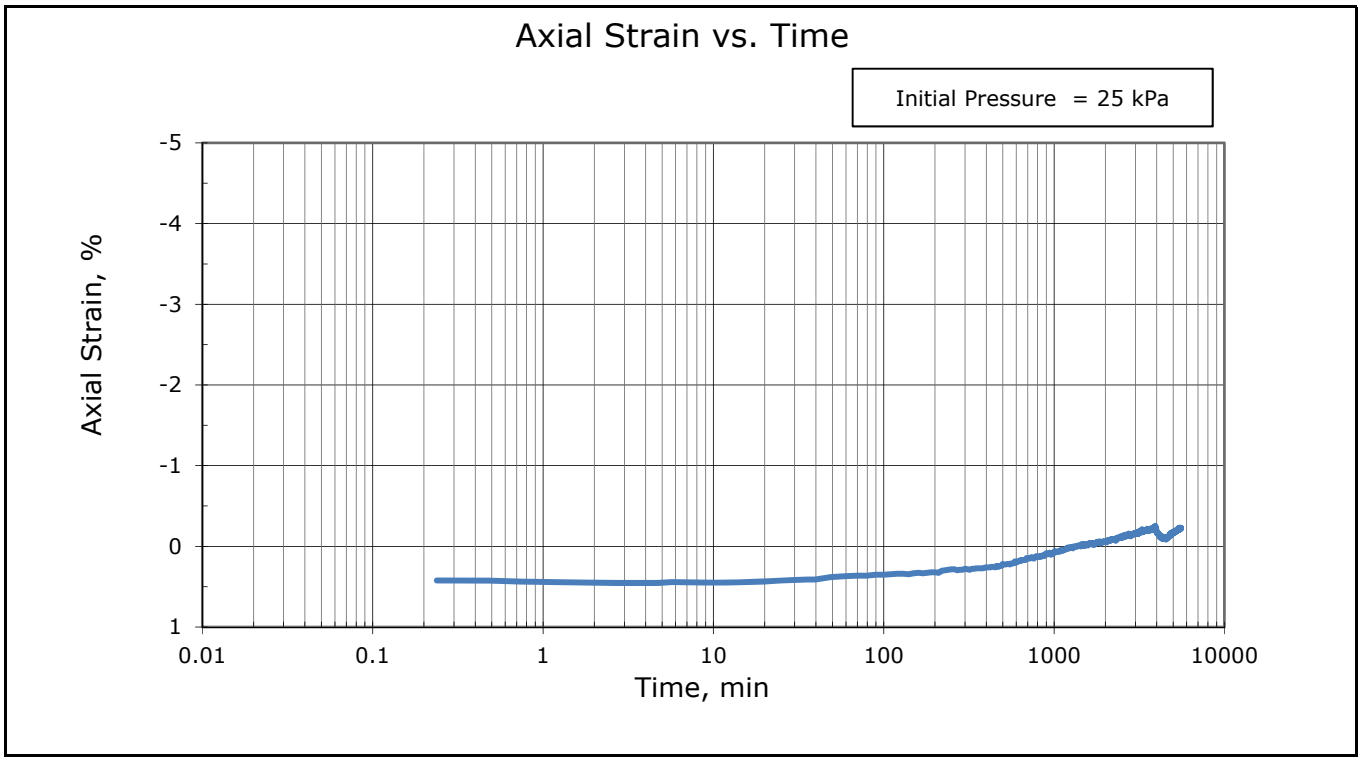
Initial diameter, in:	1.96	Final Moisture Content, %:	13.4
Initial height, in:	0.715	Final Dry Density, pcf:	122.1
Initial mass, g:	72.53	Final Bulk Density, pcf:	138.5
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	128.1		

***Final Axial Strain, %: -0.88**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	03/04/19	Checked By:	njh
Boring ID:	T-205	Test ID:	SW-11
Sample ID:	RC-4		
Depth, ft:	56' 10"-60'		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



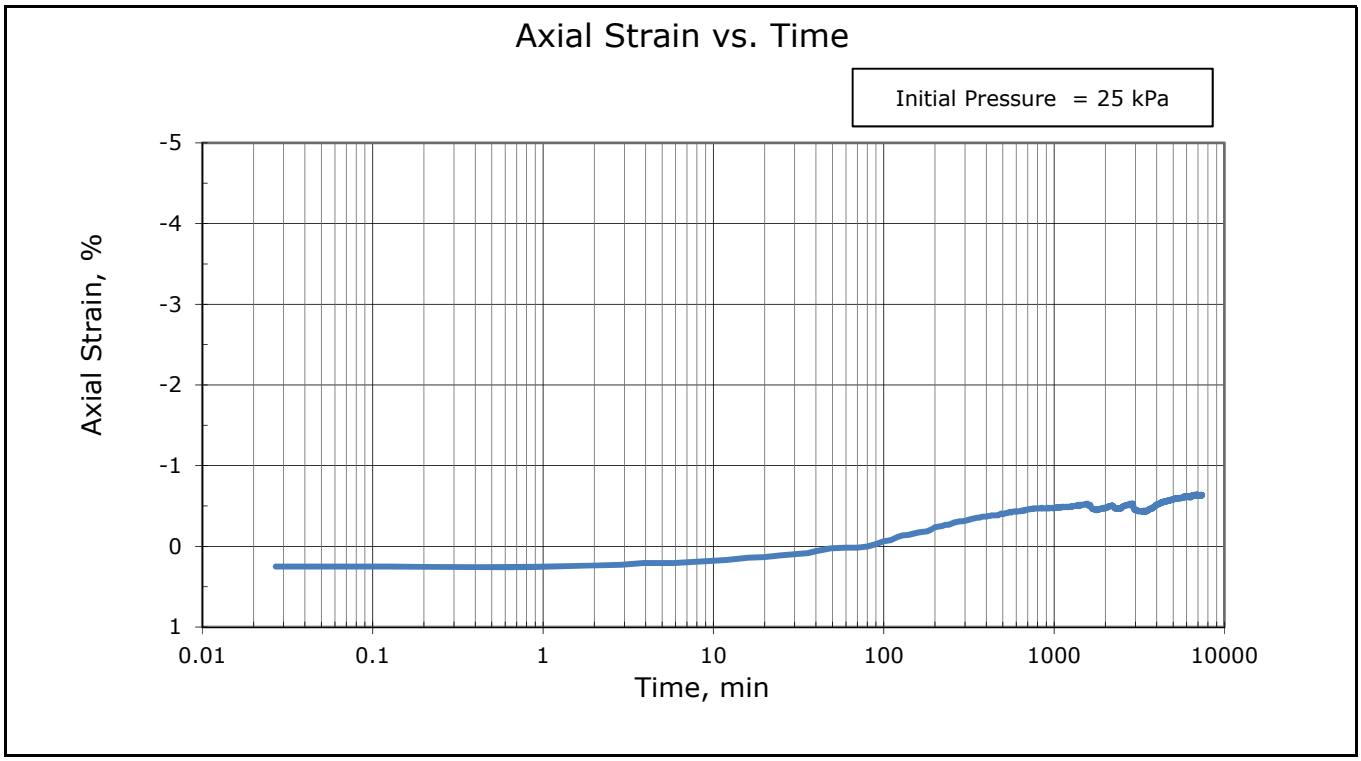
Initial diameter, in:	1.95	Final Moisture Content, %:	12.0
Initial height, in:	0.83	Final Dry Density, pcf:	120.3
Initial mass, g:	79.69	Final Bulk Density, pcf:	134.8
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	122.5		

***Final Axial Strain, %: -0.21**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	md
Test Date:	02/14/19	Checked By:	njh
Boring ID:	T-205	Test ID:	SW-5
Sample ID:	RC-5B		
Depth, ft:	66' 8"-68' 3"		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



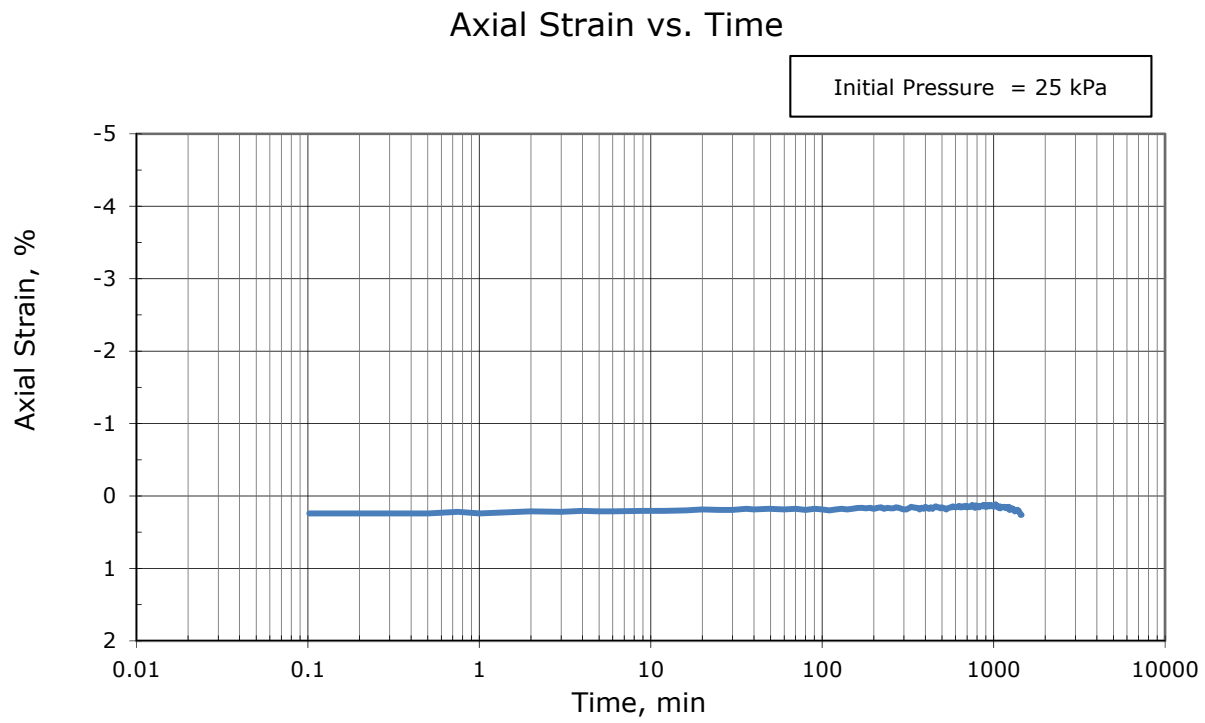
Initial diameter, in:	1.95	Final Moisture Content, %:	11.4
Initial height, in:	0.68	Final Dry Density, pcf:	131.2
Initial mass, g:	73.89	Final Bulk Density, pcf:	146.2
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	138.6		

***Final Axial Strain, %: -0.63**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	trm
Test Date:	05/02/19	Checked By:	njh
Boring ID:	TS-207	Test ID:	SW-17
Sample ID:	RC-5/RC-6		
Depth, ft:	51-61		
Description:	Dry, light gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



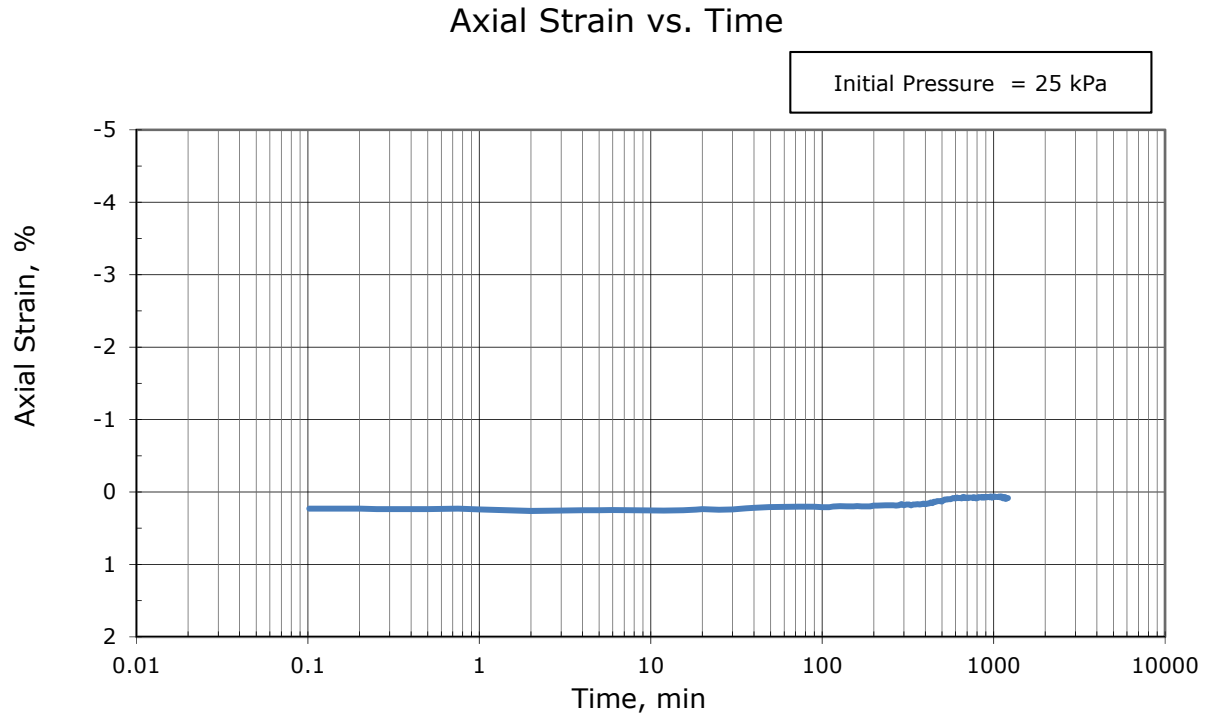
Initial diameter, in:	1.98	Final Moisture Content, %:	13.0
Initial height, in:	0.68	Final Dry Density, pcf:	123.4
Initial mass, g:	69.80	Final Bulk Density, pcf:	139.4
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	127.0		

***Final Axial Strain, %: 0.19**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	trm
Test Date:	05/06/19	Checked By:	njh
Boring ID:	TS-208	Test ID:	SW-19
Sample ID:	RC-4		
Depth, ft:	35-45		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



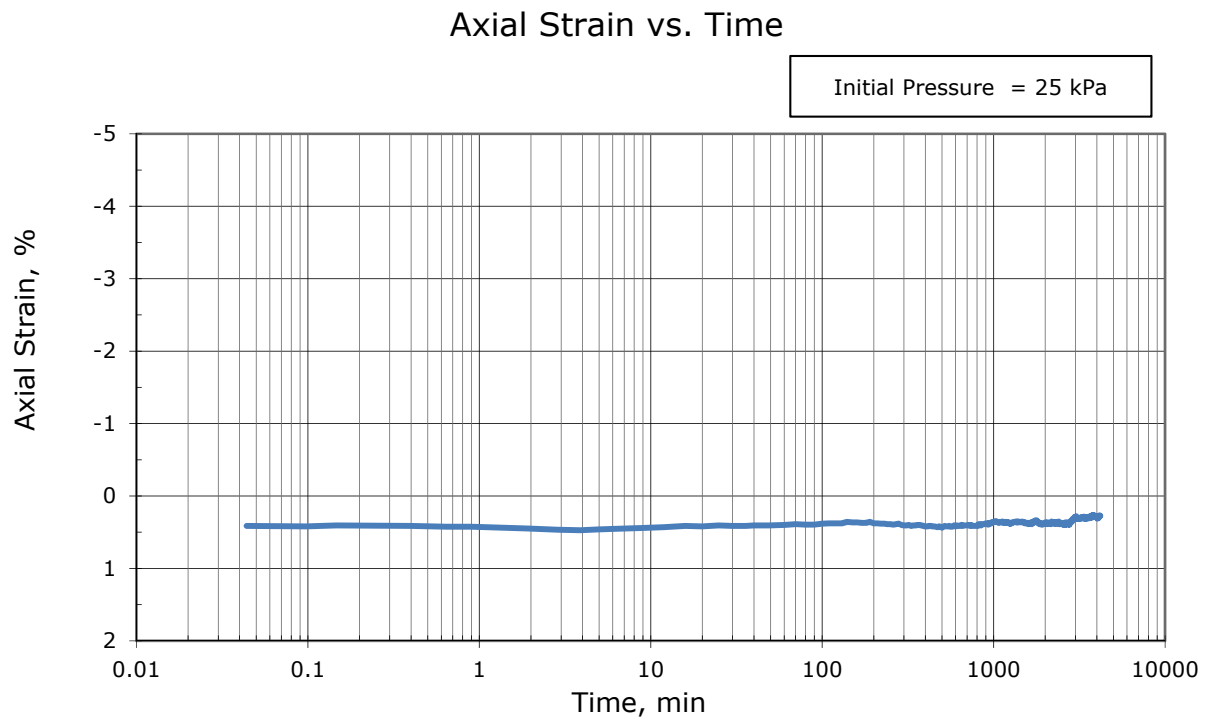
Initial diameter, in:	1.97	Final Moisture Content, %:	9.6
Initial height, in:	0.89	Final Dry Density, pcf:	131.4
Initial mass, g:	101.87	Final Bulk Density, pcf:	143.9
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	143.1		

***Final Axial Strain, %: 0.07**

Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

Client:	Alliance Geotechnical Group		
Project Name:	DART Project		
Project Location:	Dallas, TX		
GTX #:	309416	Tested By:	trm
Test Date:	05/03/19	Checked By:	njh
Boring ID:	TS-209	Test ID:	SW-18
Sample ID:	RC-1		
Depth, ft:	40-50		
Description:	Dry, gray rock core		
Preparation:	Core trimmed and tested at the as-received moisture and density. Load applied axially on core, as received.		

Axial Swelling of Rock by ISRM Part 3



Initial diameter, in:	1.98	Final Moisture Content, %:	11.4
Initial height, in:	0.78	Final Dry Density, pcf:	131.8
Initial mass, g:	89.66	Final Bulk Density, pcf:	146.9
Initial Moisture Content, %:	---		
Initial Bulk Density, pcf:	142.2		

***Final Axial Strain, %: 0.29**

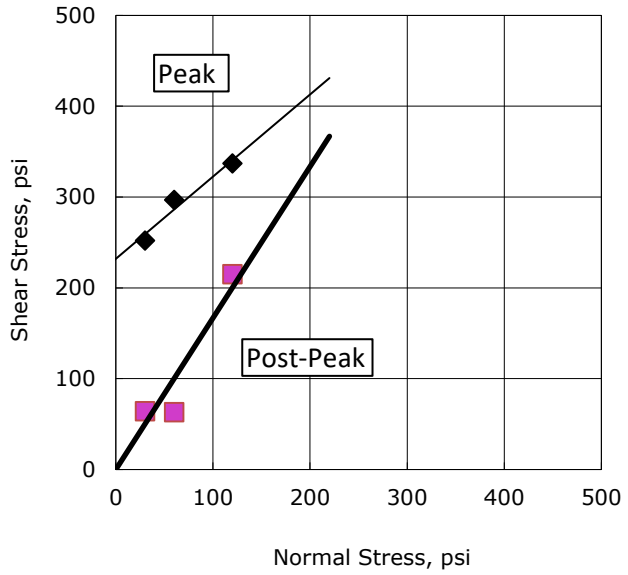
Notes: "---" indicates testing not performed.
Seating Load applied for 5 minutes
Specimen inundated at start of test, after seating load application.
*Negative value is indication of swelling, positive value is consolidation.

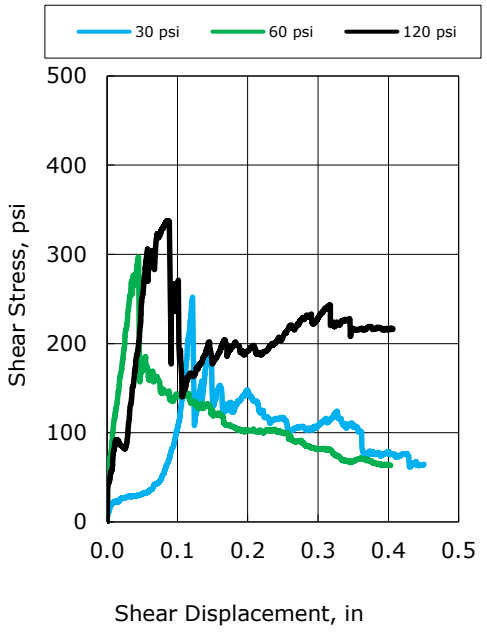
APPENDIX F-3

DIRECT SHEAR TEST

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Start Date:	2/7/2019
End Date:	2/8/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-202
Sample ID:	RC-4
Depth:	36'6"-38'9"
Visual Description:	Rock Core

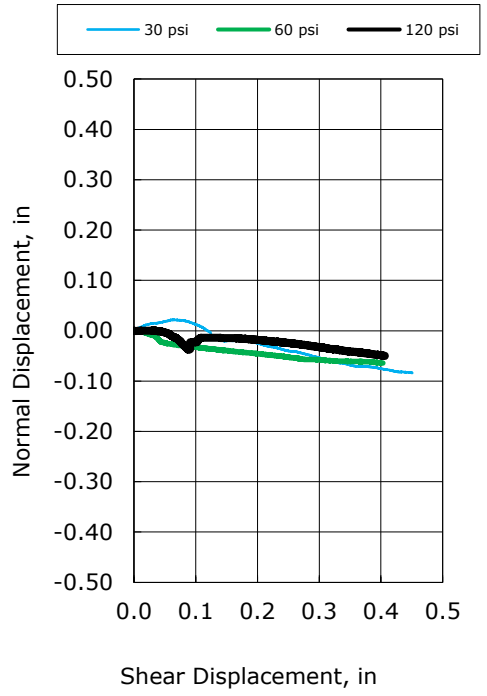
Direct Shear Test of Rock by ASTM D5607





Test No.:	DS-7	DS-8	DS-9
Specimen Diameter, in:	1.96	1.96	1.97
Specimen Length, in:	1.98	1.98	1.83
Specimen Mass, grams:	193	193	179
Specimen Area, in^2:	3.02	3.02	3.03
Specimen Bulk Density, pcf	123	123	123
Shear Plane Area, in^2	3.02	3.02	3.03
Normal Stress, psi:	30	60	120
Peak Shear Stress, psi:	252	297	337
Post Peak Shear Stress, psi:	64	63	215
Horiz. Displacement Rate, in/min:	0.005	0.005	0.005

Peak Friction Angle:		**42.1**	
Peak Cohesive Intercept, psi:		**232**	
Post-Peak Friction Angle:		**59.1**	
Post-Peak Cohesive Intercept, psi:		**0.0**	
JRC Roughness	10-12	14-16	14-16



Notes: Specimen cut to length using diamond tipped saw blade.
Tested at as-received moisture content and density.
'Hydro-Stone Super X' encapsulating compound used to mount specimen in test rings.
Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Start Date:	2/7/2019
End Date:	2/8/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-202
Sample ID:	RC-4
Depth, ft:	36'6"-38'9"
Visual Description:	Rock Core

Point 1
Normal Stress, psi:
30

Pre-Test

Post-Test

Point 2
Normal Stress, psi:
60

Pre-Test

Post-Test

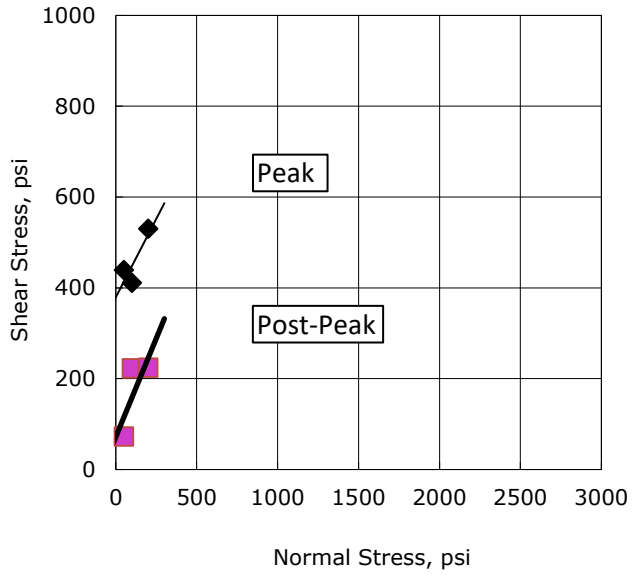
Point 3
Normal Stress, psi:
120

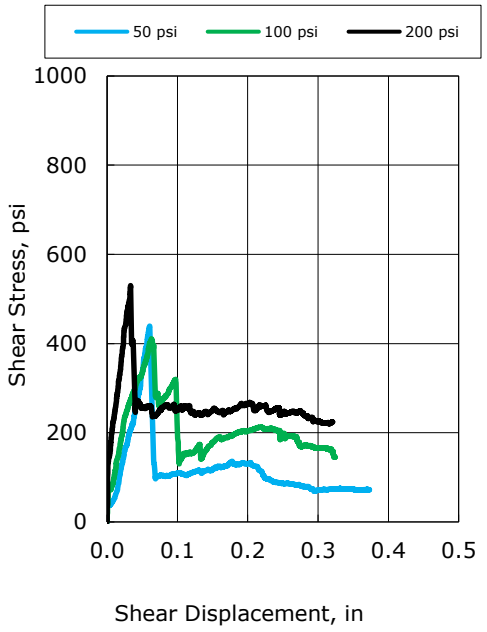
Pre-Test

Post-Test

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Start Date:	2/6/2019
End Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-203
Sample ID:	---
Depth, ft:	60'-65'
Visual Description:	Rock Core

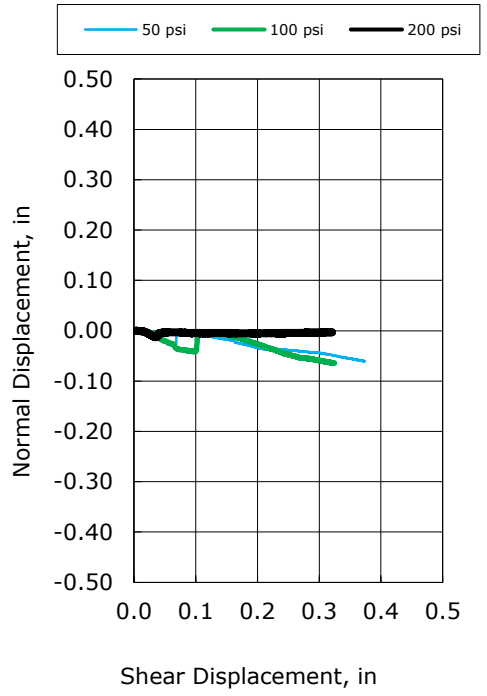
Direct Shear Test of Rock by ASTM D5607





Test No.:	DS-1	DS-2	DS-3
Specimen Diameter, in:	1.99	1.99	1.98
Specimen Length, in:	1.74	2.00	2.04
Specimen Mass, grams:	193	209	206
Specimen Area, in^2:	3.10	3.10	3.09
Specimen Bulk Density, pcf	137	129	125
Shear Plane Area, in^2	3.10	3.10	3.09
Normal Stress, psi:	50	100	200
Peak Shear Stress, psi:	439	411	530
Post Peak Shear Stress, psi:	73	223	224
Horiz. Displacement Rate, in/min:	0.005	0.005	0.005

Peak Friction Angle:	**34.6**		
Peak Cohesive Intercept, psi:	**380**		
Post-Peak Friction Angle:	**40.9**		
Post-Peak Cohesive Intercept, psi:	**72**		
JRC Roughness	10-12	14-16	14-16

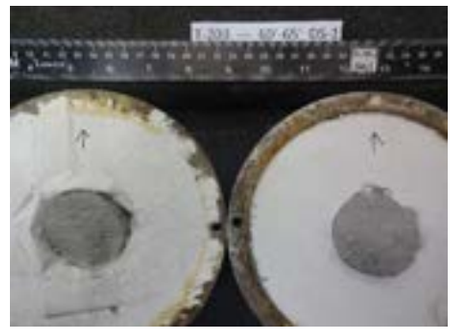


Notes: Specimen cut to length using diamond tipped saw blade.
Tested at as-received moisture content and density.
'Hydro-Stone Super X' encapsulating compound used to mount specimen in test rings.
Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Start Date:	2/6/2019
End Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-203
Sample ID:	---
Depth, ft:	60'-65'
Visual Description:	Rock Core

Point 1
Normal Stress, psi:
50

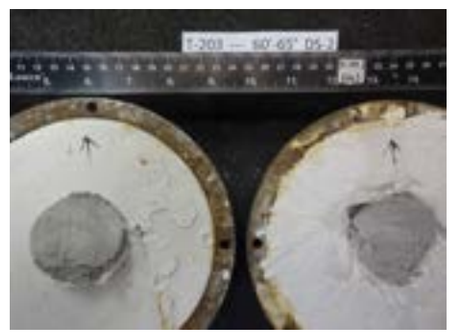
Pre-Test



Post-Test

Point 2
Normal Stress, psi:
100

Pre-Test



Post-Test

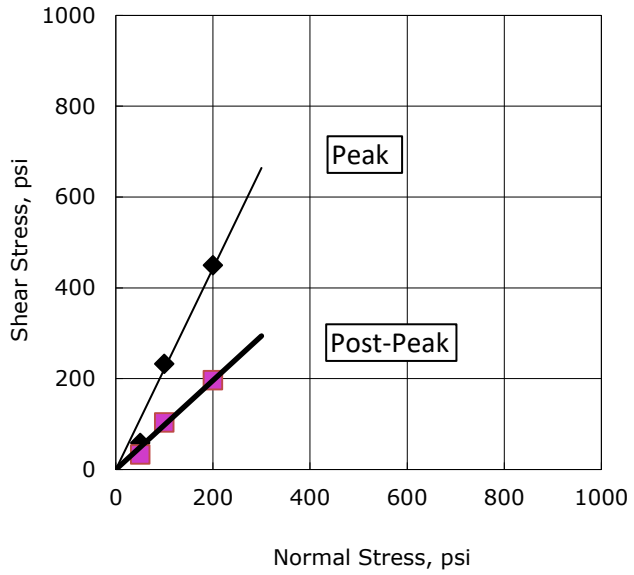
Point 3
Normal Stress, psi:
200

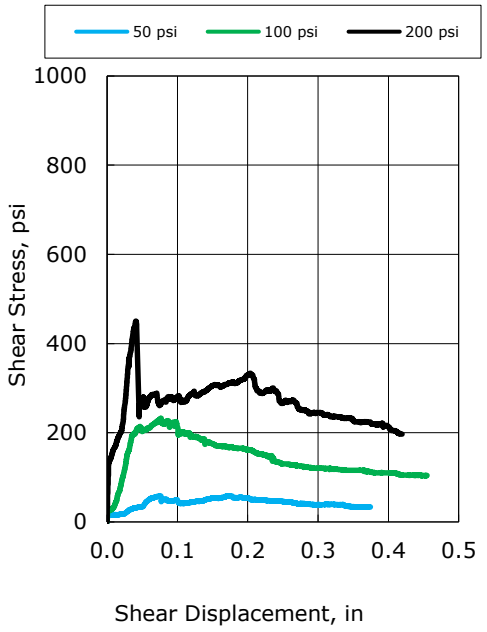
Pre-Test

Post-Test

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Start Date:	2/6/2019
End Date:	2/7/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-205
Sample ID:	RC-4
Depth, ft:	56'10"-60'
Visual Description:	Rock Core

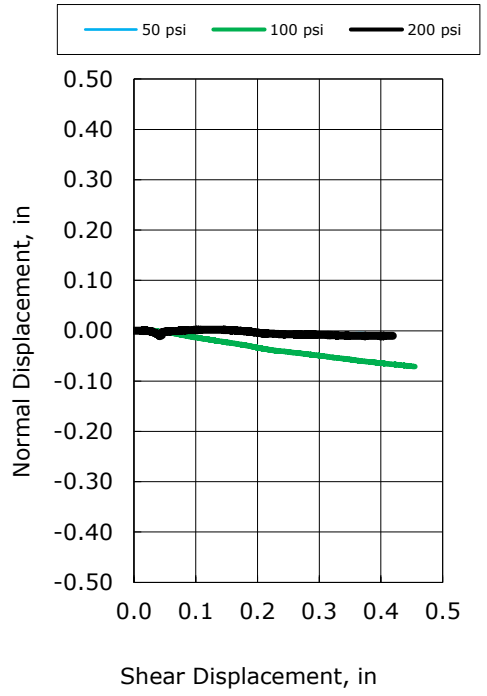
Direct Shear Test of Rock by ASTM D5607





Test No.:	DS-4	DS-5	DS-6
Specimen Diameter, in:	1.95	1.95	1.95
Specimen Length, in:	2.23	1.62	1.39
Specimen Mass, grams:	234	165	144
Specimen Area, in^2:	3.00	2.99	2.98
Specimen Bulk Density, pcf	134	129	132
Shear Plane Area, in^2	3.00	2.99	2.98
Normal Stress, psi:	50	100	200
Peak Shear Stress, psi:	59	233	450
Post Peak Shear Stress, psi:	34	104	197
Horiz. Displacement Rate, in/min:	0.005	0.005	0.005

Peak Friction Angle:	**65.7**		
Peak Cohesive Intercept, psi:	**0**		
Post-Peak Friction Angle:	**44.4**		
Post-Peak Cohesive Intercept, psi:	**0**		
JRC Roughness	6-8	8-10	14-16

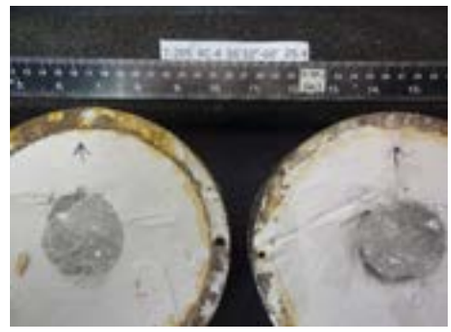


Notes: Specimen cut to length using diamond tipped saw blade.
Tested at as-received moisture content and density.
'Hydro-Stone Super X' encapsulating compound used to mount specimen in test rings.
Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Start Date:	2/6/2019
End Date:	2/7/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-205
Sample ID:	RC-4
Depth, ft:	56'10"-60'
Visual Description:	Rock Core

Point 1
Normal Stress, psi:
50

Pre-Test



Post-Test

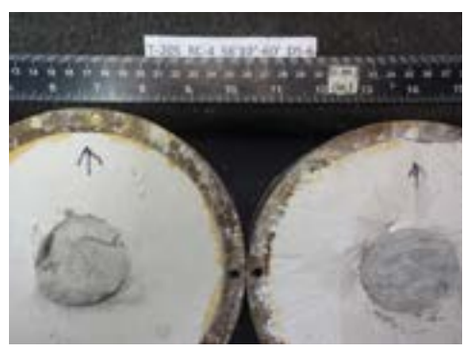
Point 2
Normal Stress, psi:
100

Pre-Test

Post-Test

Point 3
Normal Stress, psi:
200

Pre-Test



Post-Test

APPENDIX F-4

DRILLABILITY INDICES

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/25/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability Tests (1) (2)

Test Results:

Brittleness Value S_{20}, (%)	Flakiness, (f)	Compaction Index	Density, (g/cm^3)	Sievers J-Value, (0.1 mm)	Abrasion Value, (mg)	Abrasion Value Steel Cutters, (mg)
79.95	1.55	2	2.30	104.7	1.75	0.45
Extremely High	---	---	---	**Extremely Low**	**Very Low**	**Extremely Low**

Calculated Indices:

	Drilling Rate Index	Bit Wear Index	Cutter Life Index
Assessed value	88	8	112.6
Classification Category	**Extremely High**	**Extremely Low**	**Extremely High**

NTNU/SINTEF Rock Drillability Tests Classifications:

Classification of Indices according to "13A-98 Drillability Test Methods," Dept. of Civil and Transport Engineering, NTNU.

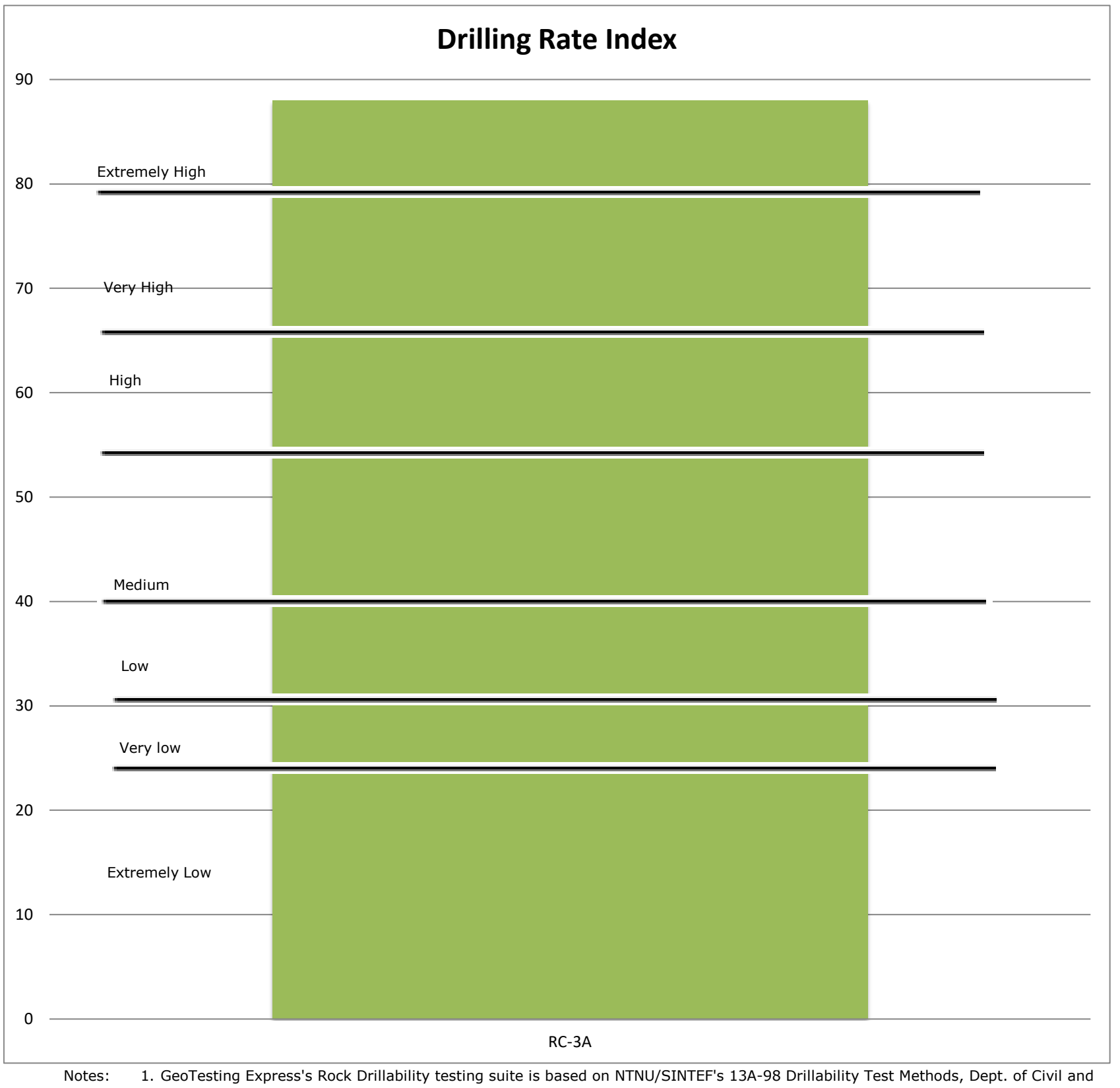
Category	Drilling Rate Index	Bit Wear Index	Cutter Life Index
Extremely Low Very Low	$\leq$ 25 26 - 32	$\leq$ 10 11-20	$\leq$ 5 5.0-5.9
Low	33 - 42	21 - 30	6.0 - 7.9
Medium	43 - 57	31 - 44	8.0 - 14.9
High	58 - 69	45 - 55	15 - 34
Very High Extremely High	70 - 82 $\geq$ 83	56 - 69 $\geq$ 70	35 - 74 $\geq$ 75

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. Samples were delivered to GTX by client.
4. Testing was done on best representative rock specimens from samples provided.
5. Samples were stored at 20° $\pm$ 5° C for a minimum of 48 hrs before testing.
6. Assessed values were measured by NTNU/SINTEF's Hard Rock Tunnel Boring Drillability Test Methods figures.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	43549
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability Tests

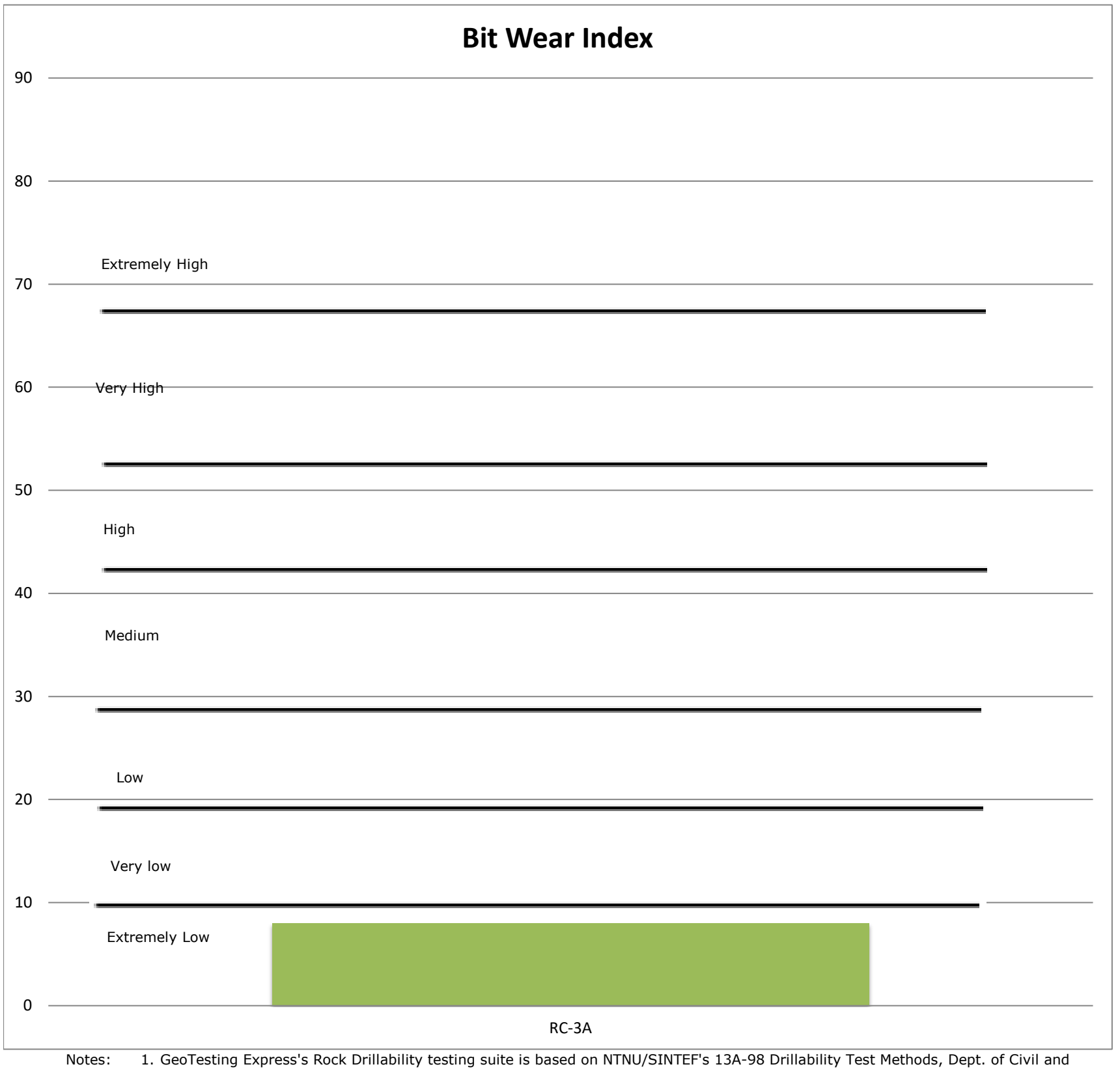


Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	43549
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability Tests

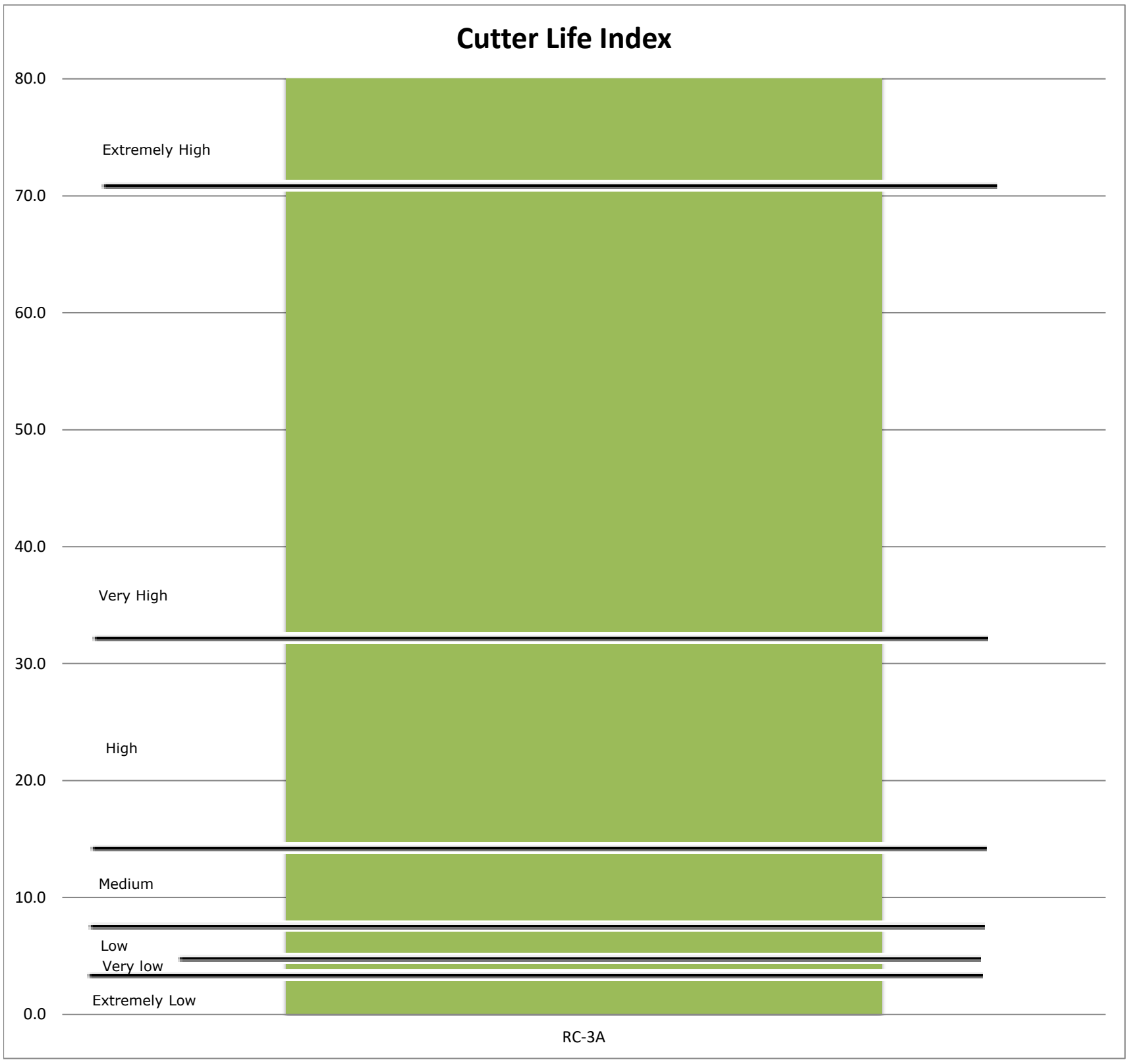


Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	43549
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability Tests



Notes:
1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability - Sample As-Received

(Red lines indicate location of Sievers' J-Value sampling)

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/25/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability - Brittleness Value

Individual Test Results

Test Number	Brittleness Value, S_{20} (%)
1	66.11
2	83.39
3	90.35
Average	79.95

Sample classification: Extremely High

Brittleness Value Reference Classification Chart

Category	Brittleness Value, S_{20} (%)
Extremely Low	$\leq$ 29.0
Very Low	29.1 - 34.9
Low	35.0 - 40.9
Medium	41.0 - 50.9
High	51.0 - 59.9
Very High	60.0 - 65.9
Extremely High	$\geq$ 66.0

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. The Brittleness Value test is performed on three extractions from one representative and homogenized sample of crushed and sieved rock material. When there is not enough material provided to perform the three tests, one or two tests may be performed.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/18/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability - Sievers' J-Value

Individual Test Results

Test Number	Sievers' J-Value SJ (1/10 mm)
1	108.10
2	112.15
3	101.25
4	104.40
5	92.00
Average	103.58

Sample Classification: Extremely Low

Sievers' J-Value Reference Classification Chart

Category	SJ-Value (1/10 mm)
Extremely High	≤ 2.0
Very High	2.1 - 3.9
High	4.0 - 6.9
Medium	7.0 - 18.9
Low	19.0 - 55.9
Very Low	56.0 - 85.9
Extremely Low	≥ 86.0

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. The standard number of Sievers' J drillings performed on each sample is 4 to 8, depending on the variation in the texture of the sample. Drilling locations were selected to be tested on 60% hard and 40% softer layers found in the sample. Soft/hard combinations at drill locations are avoided as best as possible to try to give a more accurate representation of the rock. This is however impossible in samples which have alternating soft and hard layered mineral composition. The average Sievers' J value is regarded as representative for the tested rock.
4. Test was performed at 197 RPM.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/18/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability - Sievers' J-Value Sample

Sample before testing (specimen would fail if more than one drill location was used)

After testing showing drill locations

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/25/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability - Abrasion Value (AV)

Individual Test Results

Test Number	Abrasion Value AV (mg)
1	1.20
2	2.30
Average	1.75

Sample Classification: Very Low

Abrasion Value Reference Classification Chart

Category	AV (mg)
Extremely Low	≤ 1.0
Very Low	1.1 - 3.9
Low	4.0 - 10.9
Medium	11.0 - 27.9
High	28.0 - 41.9
Very High	42.0 - 57.9
Extremely High	≥ 58.0

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. Abrasion test material was taken from the extractions used for the Brittleness Value test. The AV test pieces are comprised of tungsten carbide. Grain size, shape and binding are some factors that are believed to have substantial influence on the abrasiveness of the rock.
4. Test was performed at 20 RPM for 5 mins for a total of 100 revolutions

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/25/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

Rock Drillability - Abrasion Value Cutter Steel (AVS)

Individual Test Results

Test Number	Abrasion Value Cutter Steel AVS (mg)
1	0.50
2	0.40
Average	0.45

Sample Classification: Extremely Low

Abrasion Value Cutter Steel Reference Classification Chart

Category	AVS (mg)
Extremely Low	≤ 1.0
Very Low	1.1 - 3.9
Low	4.0 - 12.9
Medium	13.0 - 25.9
High	26.0 - 35.9
Very High	36.0 - 43.9
Extremely High	≥ 44.0

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. Abrasion test material was taken from the extractions used for the Brittleness Value test. The AVS test pieces are comprised of cutter ring steel. Grain size, shape and binding are some factors that are believed to have substantial influence on the abrasiveness of the rock.
4. Test was performed at 20 RPM for 1 minute for a total of 20 revolutions.

Rock Drillability Test Equipment

Brittleness test equipment

An example sample prior to impacts

An example sample after 20 impacts

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Rock Drillability Test Equipment

Sievers' J-Value Apparatus

Closeup of Sievers J-Value Apparatus with sample

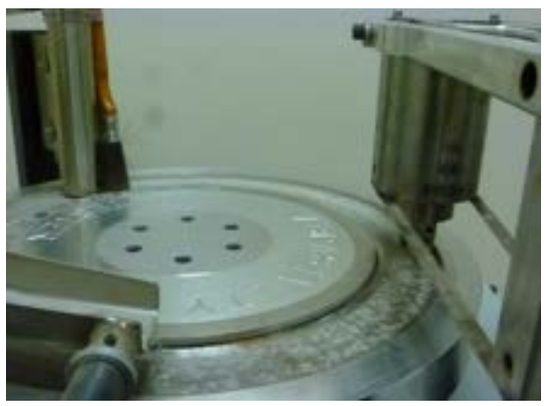
Sievers' J-Value untested drillbits

Notes:

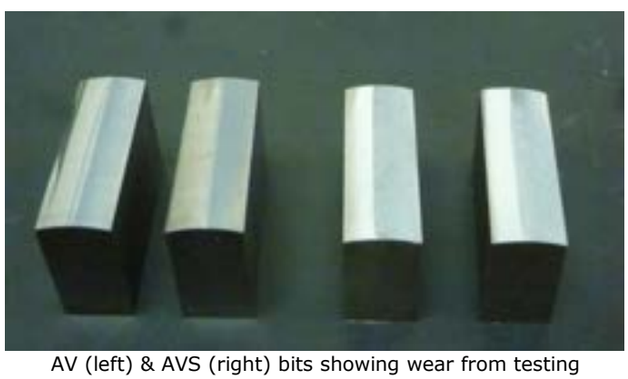
1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norwav.

Rock Drillability Test Equipment

Abrasivity machine



Closeup of Abrasivity machine with sample



AV (left) & AVS (right) bits showing wear from testing

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/25/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

Rock Drillability Tests (1) (2)

Test Results:

Brittleness Value S_{20}, (%)	Flakiness, (f)	Compaction Index	Density, (g/cm^3)	Sievers J-Value, (0.1 mm)	Abrasion Value, (mg)	Abrasion Value Steel Cutters, (mg)
78.56	1.62	2	2.30	111.5	1.35	0.45
Extremely High	---	---	---	**Extremely Low**	**Very Low**	**Extremely Low**

Calculated Indices:

	Drilling Rate Index	Bit Wear Index	Cutter Life Index
Assessed value	89	8	115.4
Classification Category	**Extremely High**	**Extremely Low**	**Extremely High**

NTNU/SINTEF Rock Drillability Tests Classifications:

Classification of Indices according to "13A-98 Drillability Test Methods," Dept. of Civil and Transport Engineering, NTNU.

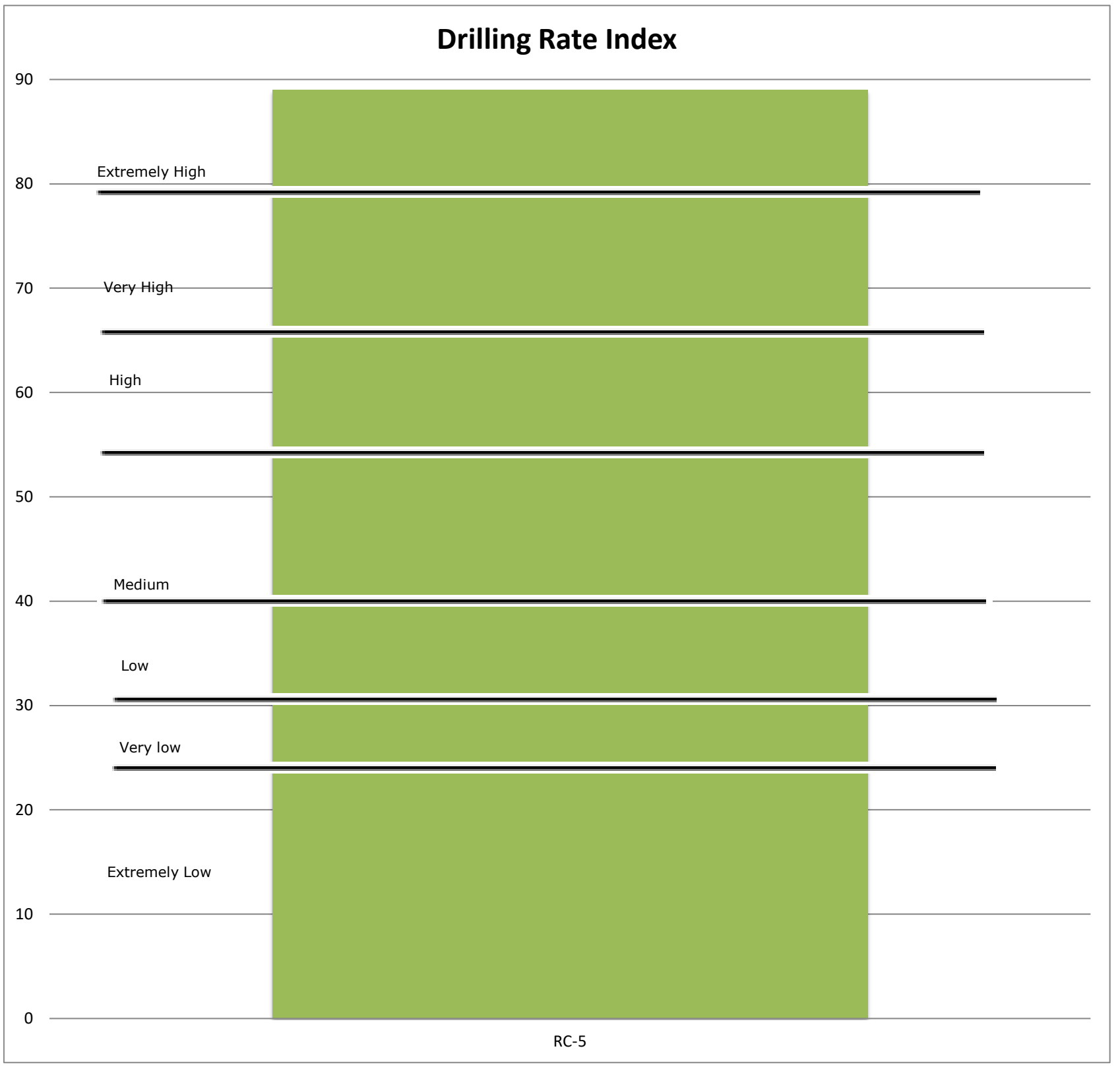
Category	Drilling Rate Index	Bit Wear Index	Cutter Life Index
Extremely Low Very Low	$\leq$ 25 26 - 32	$\leq$ 10 11-20	$\leq$ 5 5.0-5.9
Low	33 - 42	21 - 30	6.0 - 7.9
Medium	43 - 57	31 - 44	8.0 - 14.9
High	58 - 69	45 - 55	15 - 34
Very High Extremely High	70 - 82 $\geq$ 83	56 - 69 $\geq$ 70	35 - 74 $\geq$ 75

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. Samples were delivered to GTX by client.
4. Testing was done on best representative rock specimens from samples provided.
5. Samples were stored at 20° $\pm$ 5° C for a minimum of 48 hrs before testing.
6. Assessed values were measured by NTNU/SINTEF's Hard Rock Tunnel Boring Drillability Test Methods figures.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	43549
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

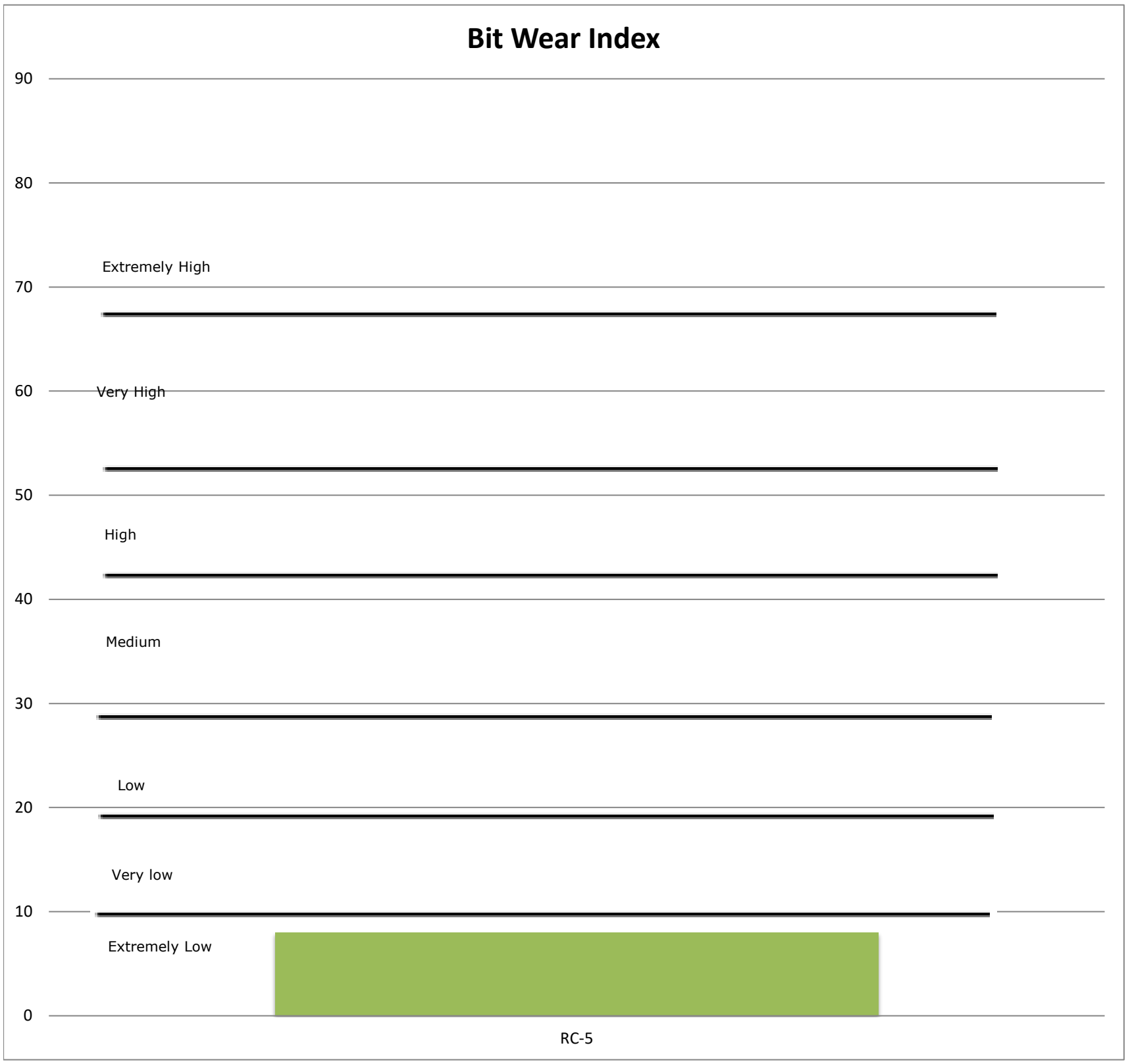
Rock Drillability Tests



Notes:
1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	43549
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

Rock Drillability Tests

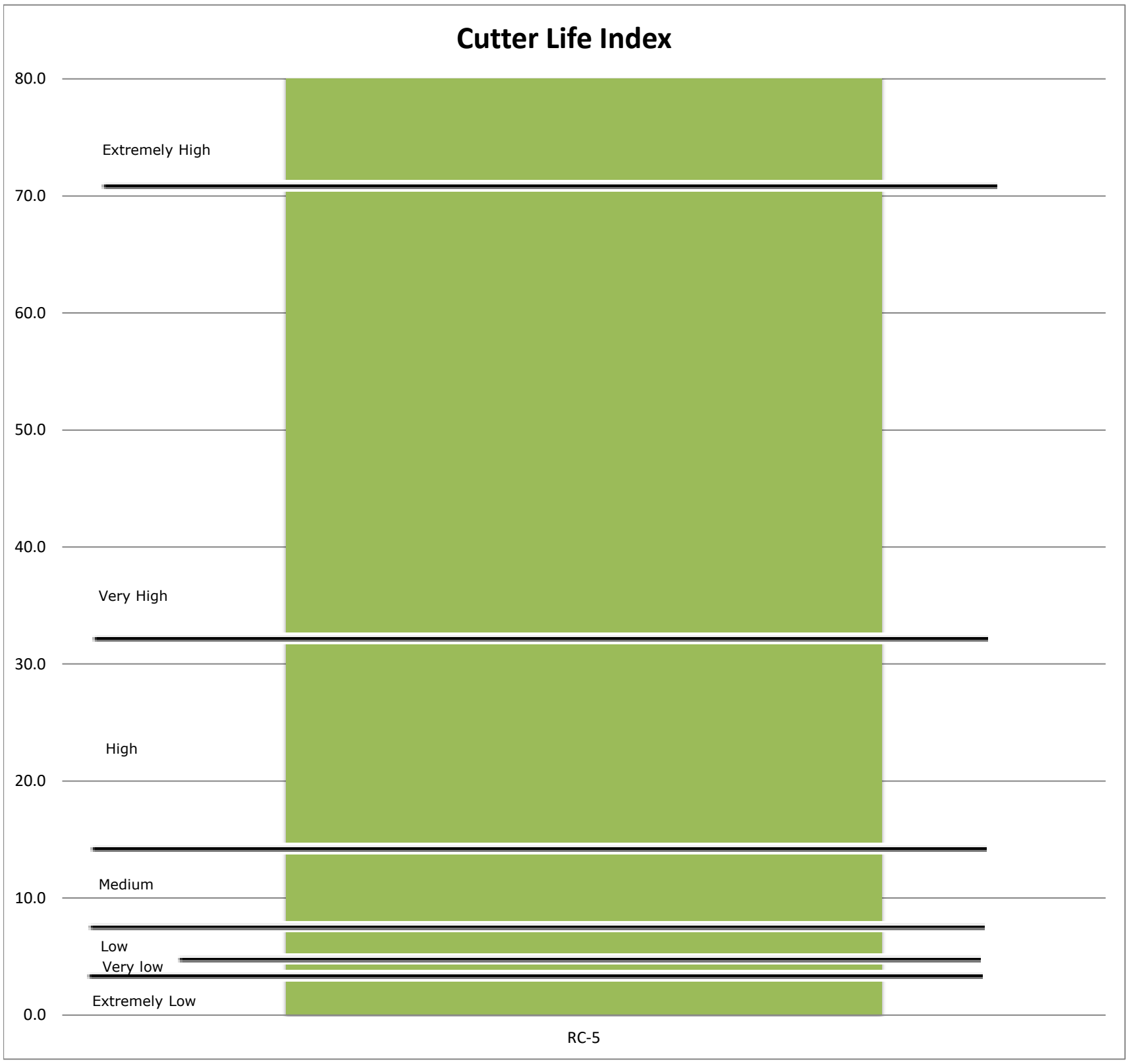


Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	43549
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

Rock Drillability Tests



Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

Rock Drillability - Sample As-Received

(Red lines indicate location of Sievers' J-Value sampling)

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/25/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

Rock Drillability - Brittleness Value

Individual Test Results

Test Number	Brittleness Value, S_{20} (%)
1	64.46
2	81.53
3	89.70
Average	78.56

Sample classification: Extremely High

Brittleness Value Reference Classification Chart

Category	Brittleness Value, S_{20} (%)
Extremely Low	$\leq$ 29.0
Very Low	29.1 - 34.9
Low	35.0 - 40.9
Medium	41.0 - 50.9
High	51.0 - 59.9
Very High	60.0 - 65.9
Extremely High	$\geq$ 66.0

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. The Brittleness Value test is performed on three extractions from one representative and homogenized sample of crushed and sieved rock material. When there is not enough material provided to perform the three tests, one or two tests may be performed.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/18/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

Rock Drillability - Sievers' J-Value

Individual Test Results

Test Number	Sievers' J-Value SJ (1/10 mm)
1	109.8
2	113.2
3	98.1
4	98.3
5	112.3
6	108.2
7	93.4
8	159.0
Average	111.5

Sample Classification: Extremely Low

Sievers' J-Value Reference Classification Chart

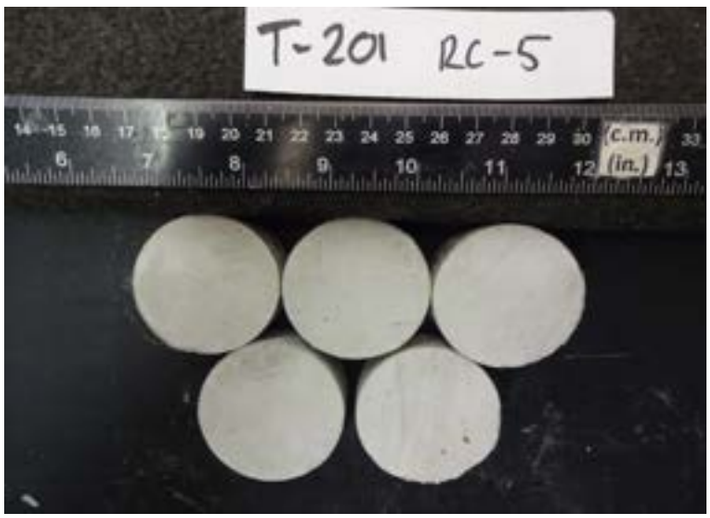
Category	SJ-Value (1/10 mm)
Extremely High	≤ 2.0
Very High	2.1 - 3.9
High	4.0 - 6.9
Medium	7.0 - 18.9
Low	19.0 - 55.9
Very Low	56.0 - 85.9
Extremely Low	≥ 86.0

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. The standard number of Sievers' J drillings performed on each sample is 4 to 8, depending on the variation in the texture of the sample. Drilling locations were selected to be tested on 60% hard and 40% softer layers found in the sample. Soft/hard combinations at drill locations are avoided as best as possible to try to give a more accurate representation of the rock. This is however impossible in samples which have alternating soft and hard layered mineral composition. The average Sievers' J value is regarded as representative for the tested rock.
4. Test was performed at 197 RPM.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/18/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

Rock Drillability - Sievers' J-Value Sample



Sample before testing (specimen would fail if more than one drill location was used)

After testing showing drill locations

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/25/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

Rock Drillability - Abrasion Value (AV)

Individual Test Results

Test Number	Abrasion Value AV (mg)
1	1.30
2	1.40
Average	1.35

Sample Classification: Very Low

Abrasion Value Reference Classification Chart

Category	AV (mg)
Extremely Low	≤ 1.0
Very Low	1.1 - 3.9
Low	4.0 - 10.9
Medium	11.0 - 27.9
High	28.0 - 41.9
Very High	42.0 - 57.9
Extremely High	≥ 58.0

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. Abrasion test material was taken from the extractions used for the Brittleness Value test. The AV test pieces are comprised of tungsten carbide. Grain size, shape and binding are some factors that are believed to have substantial influence on the abrasiveness of the rock.
4. Test was performed at 20 RPM for 5 mins for a total of 100 revolutions

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/25/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-5
Depth:	51'-52'3"

Rock Drillability - Abrasion Value Cutter Steel (AVS)

Individual Test Results

Test Number	Abrasion Value Cutter Steel AVS (mg)
1	0.40
2	0.50
Average	0.45

Sample Classification: Extremely Low

Abrasion Value Cutter Steel Reference Classification Chart

Category	AVS (mg)
Extremely Low	≤ 1.0
Very Low	1.1 - 3.9
Low	4.0 - 12.9
Medium	13.0 - 25.9
High	26.0 - 35.9
Very High	36.0 - 43.9
Extremely High	≥ 44.0

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.
3. Abrasion test material was taken from the extractions used for the Brittleness Value test. The AVS test pieces are comprised of cutter ring steel. Grain size, shape and binding are some factors that are believed to have substantial influence on the abrasiveness of the rock.
4. Test was performed at 20 RPM for 1 minute for a total of 20 revolutions.

Rock Drillability Test Equipment

Brittleness test equipment

An example sample prior to impacts

An example sample after 20 impacts

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

Rock Drillability Test Equipment

Sievers' J-Value Apparatus

Closeup of Sievers J-Value Apparatus with sample

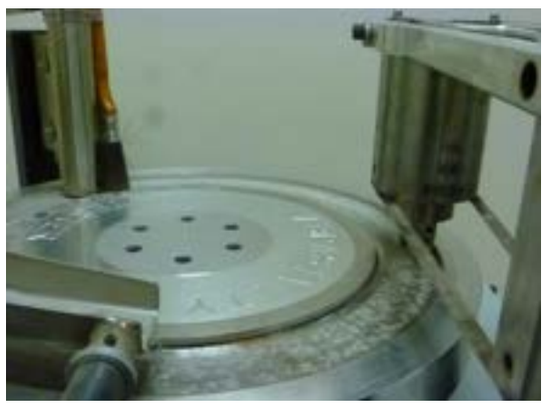
Sievers' J-Value untested drillbits

Notes:

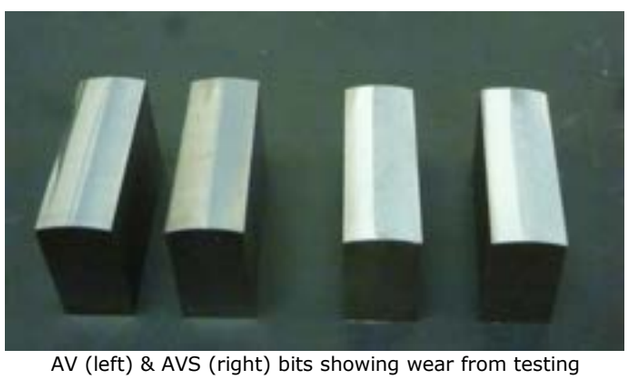
1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norwav.

Rock Drillability Test Equipment

Abrasivity machine



Closeup of Abrasivity machine with sample



AV (left) & AVS (right) bits showing wear from testing

Notes:

1. GeoTesting Express's Rock Drillability testing suite is based on NTNU/SINTEF's 13A-98 Drillability Test Methods, Dept. of Civil and Transportation Engineering and performed in accordance with Dahl, Filip, 2003, The Suggested DRI, BWI, CLI Standard.
2. The trademarked acronyms and terms DRI™, BWI™, CLI™ BWI™, SAT™, Bit Wear Index™, Cutter Life Index™ and Soil Abrasion Test™ are unique for test results and calculated indices originating from NTNU/SINTEF and can only be obtained by testing samples at their reference laboratory in Trondheim, Norway.

APPENDIX F-5

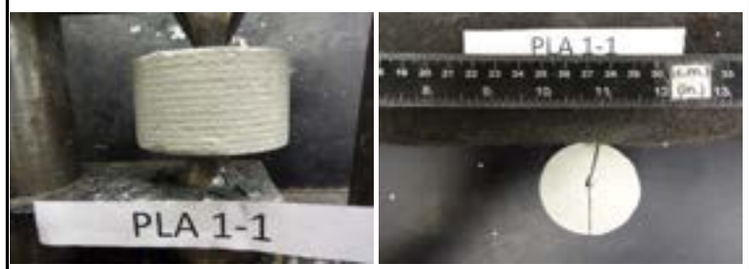
POINT LOAD STRENGTH INDEX OF ROCK

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

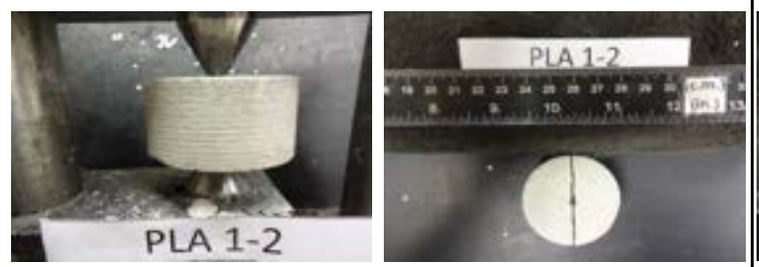
Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
P-102	RC-1/RC-2	22-29.5	PLA-1-1	Axial	1.97	1.13	645	2.84	1.69	227	0.933	212	235	19	4,470
		22-29.5	PLA-1-2	Axial	1.97	1.07	620	2.68	1.64	232	0.920	213			
		22-29.5	PLA-1-3	Axial	1.99	1.03	670	2.61	1.62	256	0.915	235			
		22-29.5	PLA-1-4	Axial	1.99	0.94	443	2.37	1.54	187	0.895	167			
		22-29.5	PLA-1-5	Axial	1.99	1.07	427	2.70	1.64	158	0.922	146			
		22-29.5	PLA-1-6	Axial	2.00	1.12	1007	2.86	1.69	352	0.934	329			

PLA-1-1



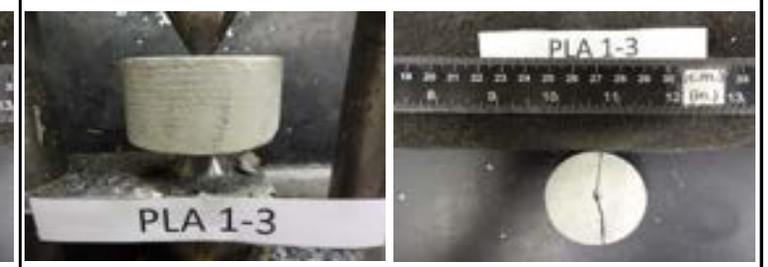
Intact Material Failure

PLA-1-2



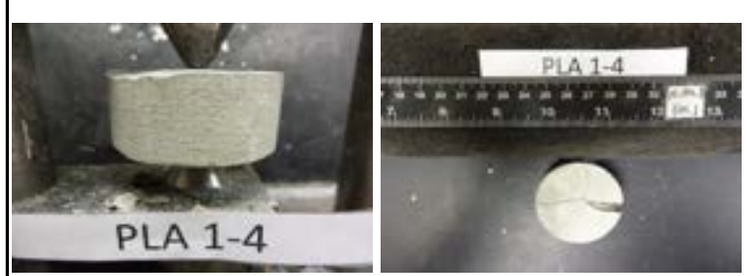
Intact Material Failure

PLA-1-3



Intact Material Failure

PLA-1-4

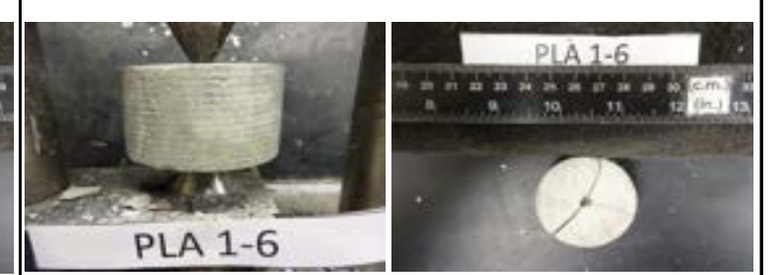


Intact Material Failure

PLA-1-5

Intact Material Failure

PLA-1-6



Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

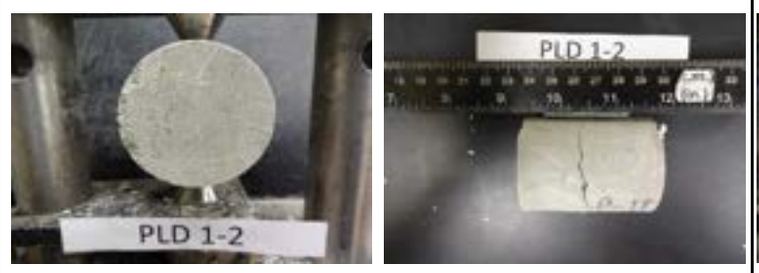
Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
P-102	RC-1/RC-2	22-29.5	PLD-1-1	Diametral	1.99	1.96	292	3.86	1.96	76	0.999	76	59	24.5	1,460
		22-29.5	PLD-1-2	Diametral	1.99	2.43	315	5.90	2.43	53	1.099	59			
		22-29.5	PLD-1-3	Diametral	1.99	2.93	456	8.56	2.93	53	1.195	64			
		22-29.5	PLD-1-4	Diametral	1.99	2.63	319	6.91	2.63	46	1.139	53			
		22-29.5	PLD-1-5	Diametral	1.99	3.15	121	9.92	3.15	12	1.235	15			
		22-29.5	PLD-1-6	Diametral	1.98	2.45	692	5.99	2.45	116	1.103	128			

PLD-1-1

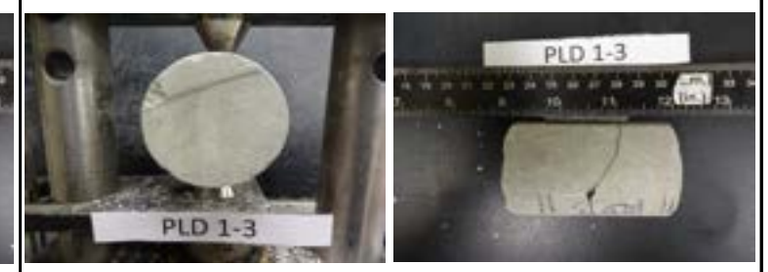
Intact Material Failure

PLD-1-2



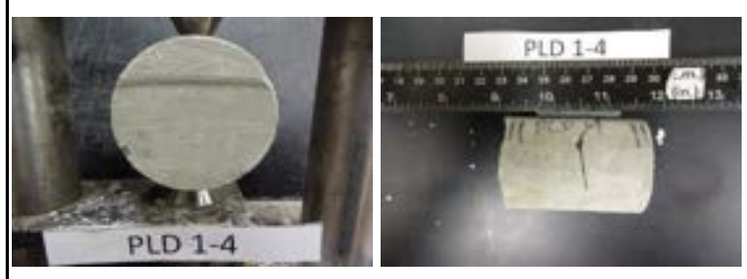
Intact Material Failure

PLD-1-3



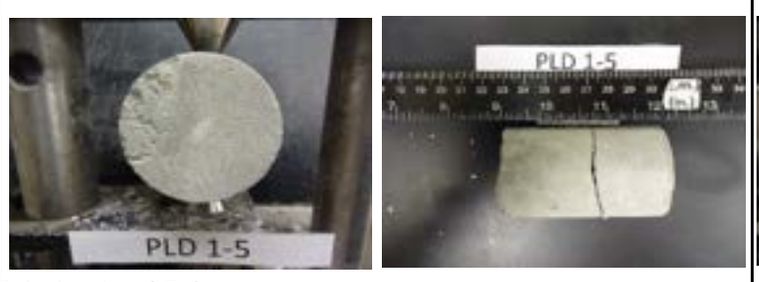
Intact Material Failure

PLD-1-4



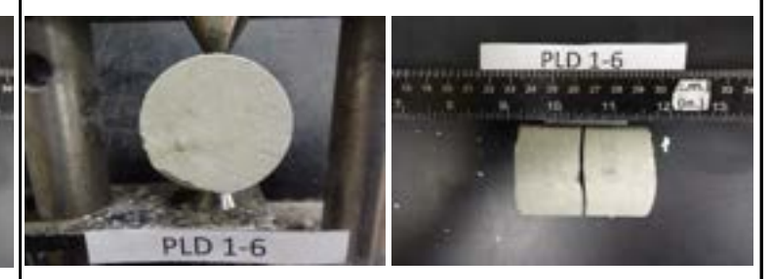
Intact Material Failure

PLD-1-5



Intact Material Failure

PLD-1-6



Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

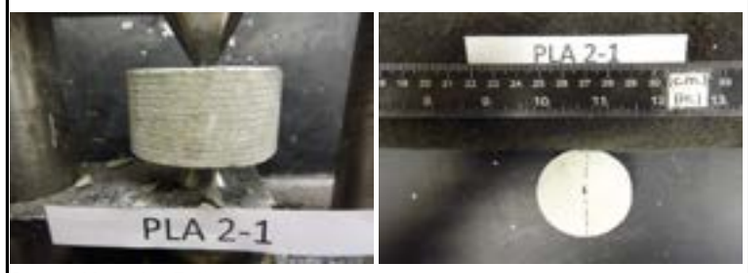
The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

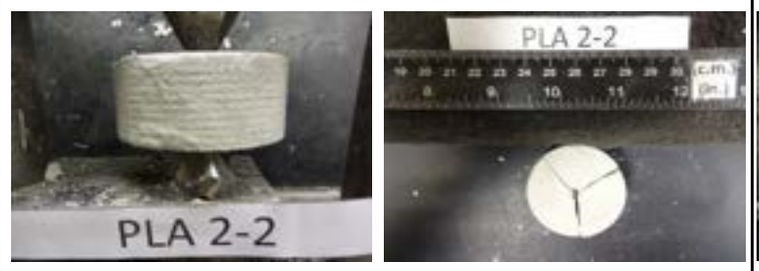
Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-102	RC-1/RC-2	26-36	PLA-2-1	Axial	1.98	1.13	600	2.86	1.69	210	0.934	196	247	19	4,690
		26-36	PLA-2-2	Axial	1.98	0.92	614	2.32	1.52	265	0.891	236			
		26-36	PLA-2-3	Axial	1.98	1.16	735	2.94	1.71	250	0.940	235			
		26-36	PLA-2-4	Axial	1.98	1.02	614	2.57	1.60	238	0.912	218			
		26-36	PLA-2-5	Axial	1.99	1.07	692	2.72	1.65	255	0.923	235			
		26-36	PLA-2-6	Axial	1.98	1.02	677	2.57	1.60	264	0.911	240			

PLA-2-1



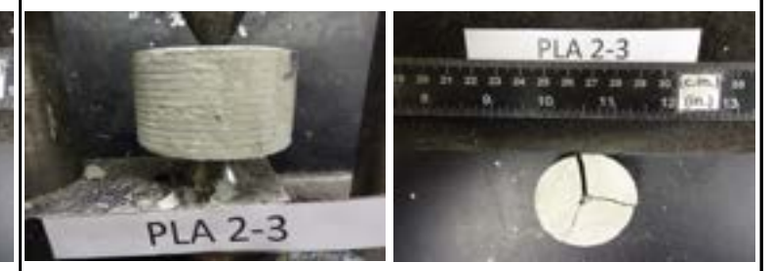
Intact Material Failure

PLA-2-2



Intact Material Failure

PLA-2-3

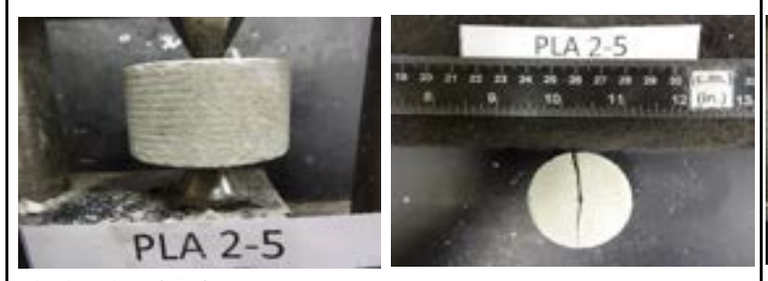


Intact Material Failure

PLA-2-4

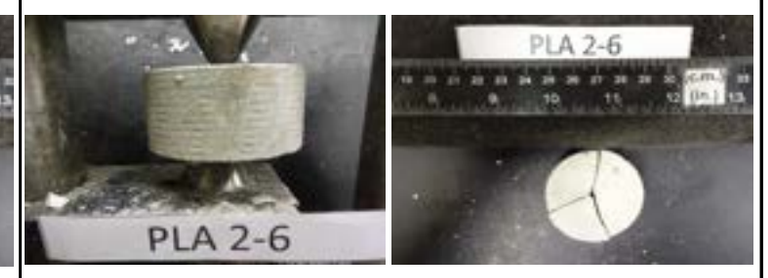
Intact Material Failure

PLA-2-5



Intact Material Failure

PLA-2-6



Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

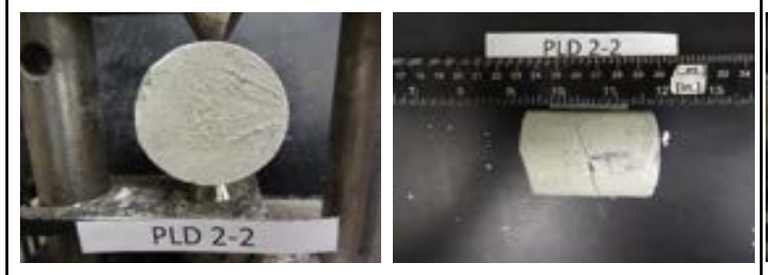
Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-102	RC-1/RC-2	26-36	PLD-2-1	Diametral	1.98	2.97	780	8.81	2.97	89	1.203	106	93	24.5	2,290
		26-36	PLD-2-2	Diametral	1.97	2.49	585	6.20	2.49	94	1.111	105			
		26-36	PLD-2-3	Diametral	1.98	3.05	654	9.31	3.05	70	1.218	86			
		26-36	PLD-2-4	Diametral	1.98	2.22	607	4.91	2.22	124	1.055	130			
		26-36	PLD-2-5	Diametral	1.98	2.62	578	6.89	2.62	84	1.138	95			
		26-36	PLD-2-6	Diametral	1.98	2.61	679	6.84	2.61	99	1.136	113			

PLD-2-1

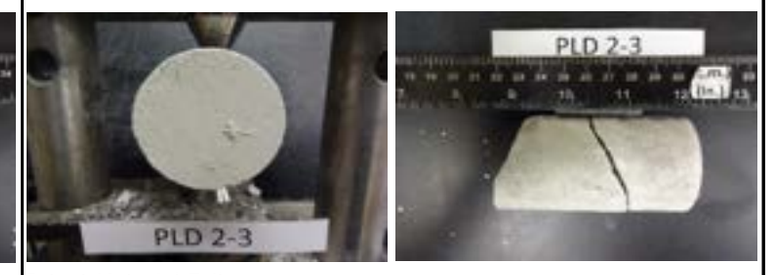
Intact Material Failure

PLD-2-2



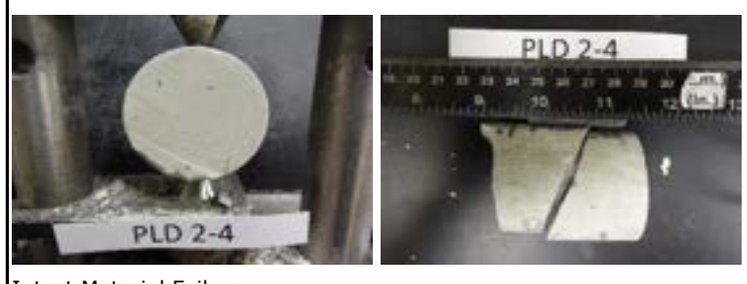
Intact Material Failure

PLD-2-3



Intact Material Failure

PLD-2-4



Intact Material Failure

PLD-2-5

Intact Material Failure

PLD-2-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

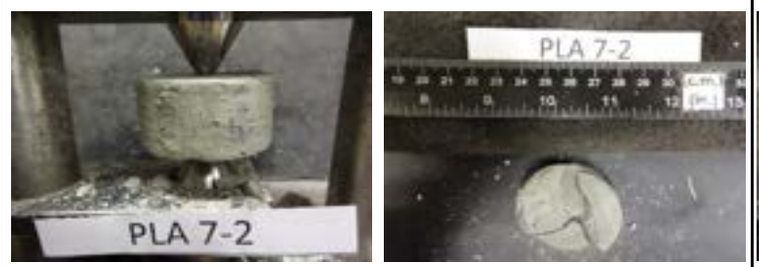
Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-104	RC-7/RC-8	62-70	PLA-7-1	Axial	1.93	0.93	232	2.29	1.51	101	0.888	90	94	18	1,690
		62-70	PLA-7-2	Axial	1.93	1.03	234	2.51	1.59	93	0.907	84			
		62-70	PLA-7-3	Axial	1.94	1.13	169	2.79	1.67	60	0.929	56			
		62-70	PLA-7-4	Axial	1.93	1.05	214	2.57	1.60	83	0.912	76			
		62-70	PLA-7-5	Axial	1.92	0.96	324	2.35	1.53	138	0.893	123			
		62-70	PLA-7-6	Axial	1.95	0.94	209	2.34	1.53	89	0.893	80			

PLA-7-1

Discontinuity Failure

PLA-7-2



Discontinuity Failure

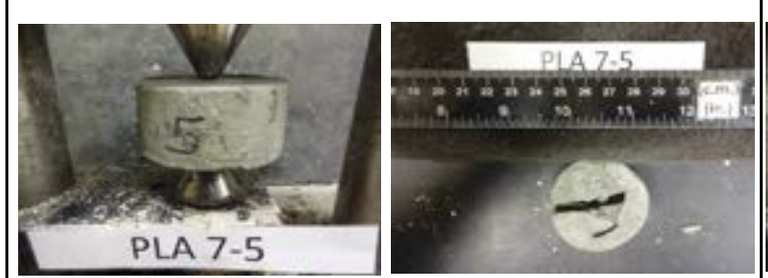
PLA-7-3

Discontinuity Failure

PLA-7-4

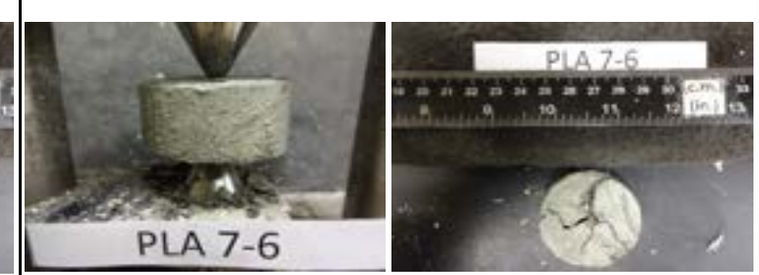
Discontinuity Failure

PLA-7-5



Discontinuity Failure

PLA-7-6



Discontinuity Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-104	RC-7/RC-8	62-70	PLD-7-1	Diametral	1.92	2.65	36	7.03	2.65	5	1.143	6	22	24.5	550
		62-70	PLD-7-2	Diametral	1.93	2.76	112	7.63	2.76	15	1.165	17			
		62-70	PLD-7-3	Diametral	1.96	2.86	164	8.15	2.86	20	1.182	24			
		62-70	PLD-7-4	Diametral	1.96	1.97	178	3.88	1.97	46	1.000	46			
		62-70	PLD-7-5	Diametral	1.95	2.14	142	4.56	2.14	31	1.038	32			
		62-70	PLD-7-6	Diametral	1.96	1.58	45	2.50	1.58	18	0.906	16			

PLD-7-1

Intact Material Failure

PLD-7-2

Intact Material Failure

PLD-7-3

Intact Material Failure

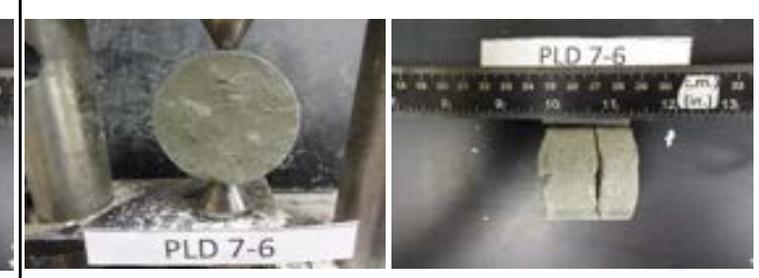
PLD-7-4

Intact Material Failure

PLD-7-5

Intact Material Failure

PLD-7-6



Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-112	RC-2	41-46	PLA-3-1	Axial	1.99	0.82	416	2.07	1.44	201	0.869	174	206	18	3,720
		41-46	PLA-3-2	Axial	1.98	0.98	636	2.46	1.57	259	0.903	233			
		41-46	PLA-3-3	Axial	1.97	0.90	582	2.26	1.50	258	0.886	228			
		41-46	PLA-3-4	Axial	1.97	1.00	335	2.52	1.59	133	0.908	121			
		41-46	PLA-3-5	Axial	1.98	1.01	396	2.53	1.59	156	0.909	142			
		41-46	PLA-3-6	Axial	1.97	0.90	526	2.26	1.50	233	0.886	206			

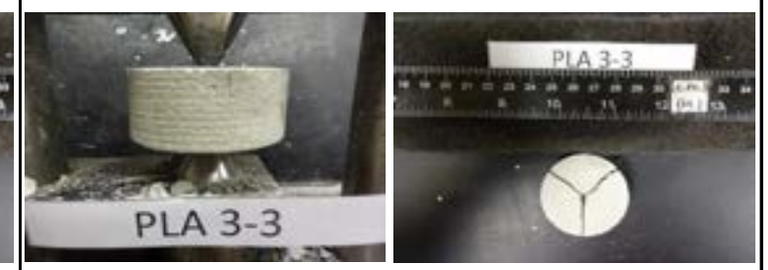
PLA-3-1

Intact Material Failure

PLA-3-2

Intact Material Failure

PLA-3-3



Intact Material Failure

PLA-3-4

Intact Material Failure

PLA-3-5

Intact Material Failure

PLA-3-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

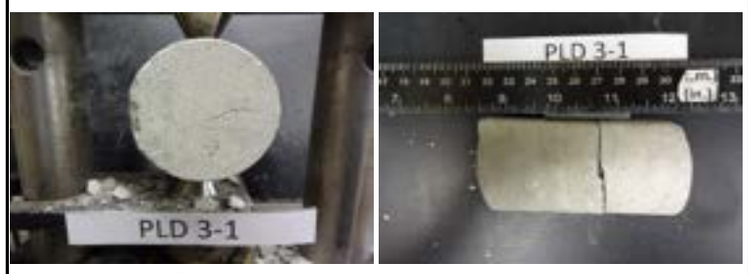
The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

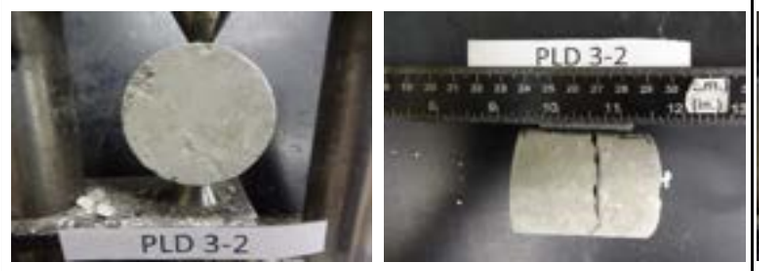
Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-112	RC-2	41-46	PLD-3-1	Diametral	1.96	3.56	719	12.70	3.56	57	1.306	74	51	24.5	1,240
		41-46	PLD-3-2	Diametral	1.98	2.13	272	4.55	2.13	60	1.037	62			
		41-46	PLD-3-3	Diametral	1.99	3.05	198	9.30	3.05	21	1.218	26			
		41-46	PLD-3-4	Diametral	1.99	2.36	108	5.57	2.36	19	1.085	21			
		41-46	PLD-3-5	Diametral	1.99	1.93	164	3.74	1.93	44	0.992	44			
		41-46	PLD-3-6	Diametral	1.99	2.08	445	4.31	2.08	103	1.024	106			

PLD-3-1



Intact Material Failure

PLD-3-2

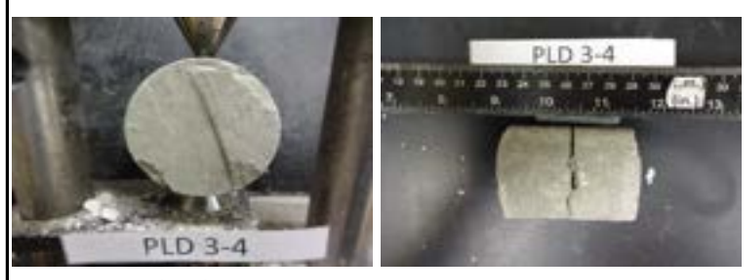


Intact Material Failure

PLD-3-3

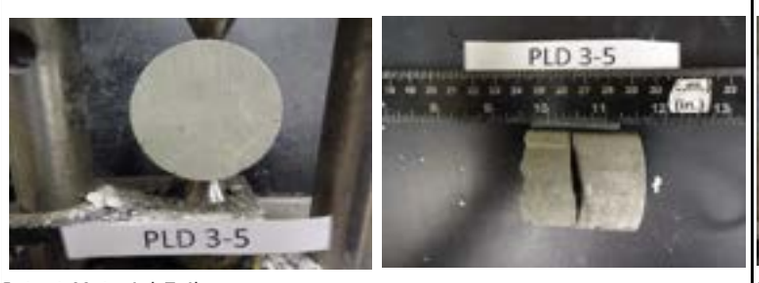
Intact Material Failure

PLD-3-4



Intact Material Failure

PLD-3-5



Intact Material Failure

PLD-3-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

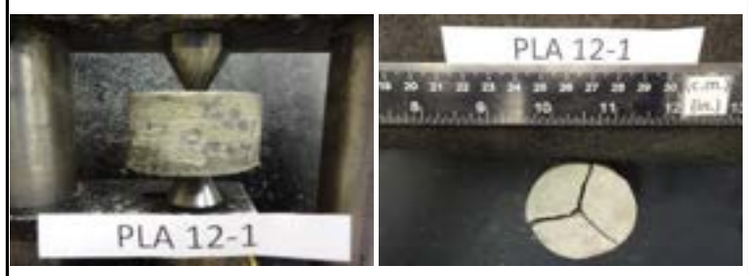
The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/24/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

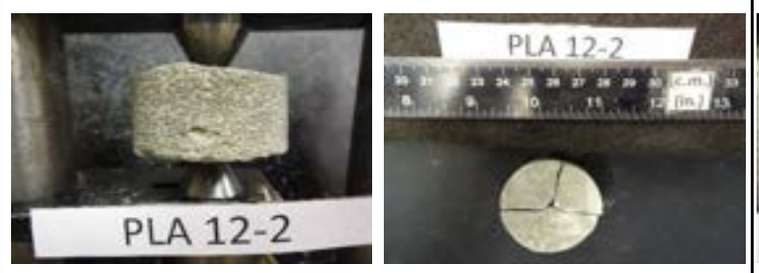
Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-201	RC-7	61.0-64.7	PLA-12-1	Axial	1.99	1.10	872	2.80	1.67	312	0.929	290	204	18	3,680
		61.0-64.7	PLA-12-2	Axial	2.00	1.01	225	2.56	1.60	88	0.911	80			
		61.0-64.7	PLA-12-3	Axial	1.99	0.89	497	2.26	1.50	220	0.886	195			
		61.0-64.7	PLA-12-4	Axial	2.00	0.88	486	2.23	1.49	217	0.883	192			
		61.0-64.7	PLA-12-5	Axial	1.99	1.01	360	2.55	1.60	141	0.910	128			
		61.0-64.7	PLA-12-6	Axial	1.98	0.88	553	2.23	1.49	248	0.883	219			

PLA-12-1



Intact Material Failure

PLA-12-2



Intact Material Failure

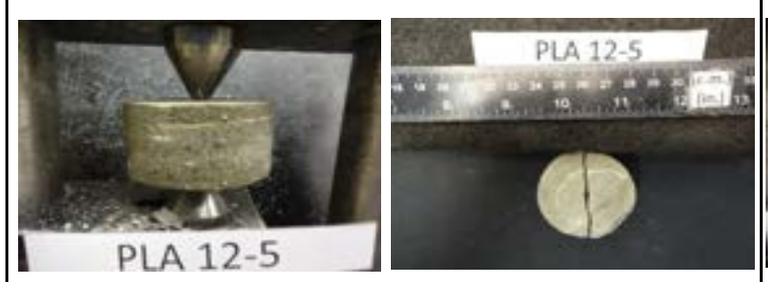
PLA-12-3

Intact Material Failure

PLA-12-4

Intact Material Failure

PLA-12-5



Intact Material Failure

PLA-12-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/24/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

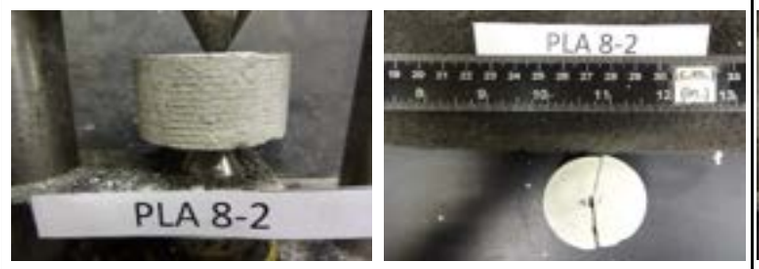
Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-202	RC-6/RC-7	56-66	PLA-8-1	Axial	1.98	1.17	643	2.96	1.72	217	0.941	204	195	19	3,710
		56-66	PLA-8-2	Axial	1.98	1.05	780	2.65	1.63	294	0.918	270			
		56-66	PLA-8-3	Axial	1.98	1.12	643	2.82	1.68	228	0.931	212			
		56-66	PLA-8-4	Axial	1.99	1.13	263	2.85	1.69	92	0.933	86			
		56-66	PLA-8-5	Axial	1.97	1.03	330	2.57	1.60	128	0.912	117			
		56-66	PLA-8-6	Axial	1.97	1.05	562	2.64	1.62	213	0.917	195			

PLA-8-1

Intact Material Failure

PLA-8-2



Intact Material Failure

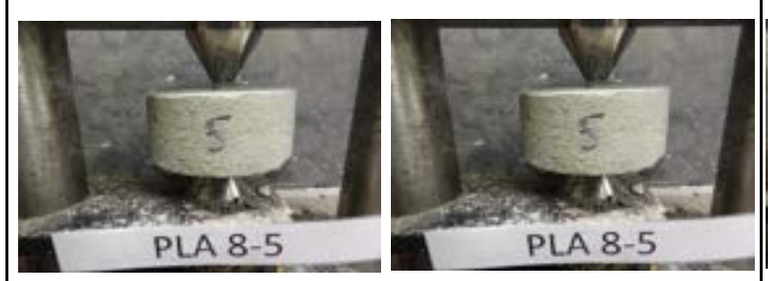
PLA-8-3

Intact Material Failure

PLA-8-4

Discontinuity Failure

PLA-8-5



Discontinuity Failure

PLA-8-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

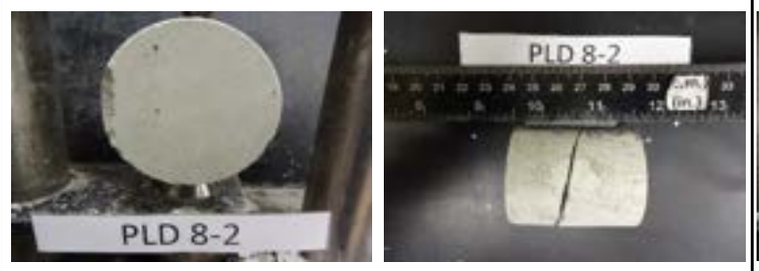
Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-202	RC-6/RC-7	56-66	PLD-8-1	Diametral	1.97	2.55	888	6.49	2.55	137	1.123	154	180	24	4,310
		56-66	PLD-8-2	Diametral	1.98	2.13	773	4.55	2.13	170	1.037	176			
		56-66	PLD-8-3	Diametral	1.97	2.11	839	4.46	2.11	188	1.032	194			
		56-66	PLD-8-4	Diametral	1.96	2.01	857	4.03	2.01	212	1.009	214			
		56-66	PLD-8-5	Diametral	1.97	2.06	753	4.25	2.06	177	1.021	181			
		56-66	PLD-8-6	Diametral	1.97	2.11	861	4.44	2.11	194	1.031	200			

PLD-8-1

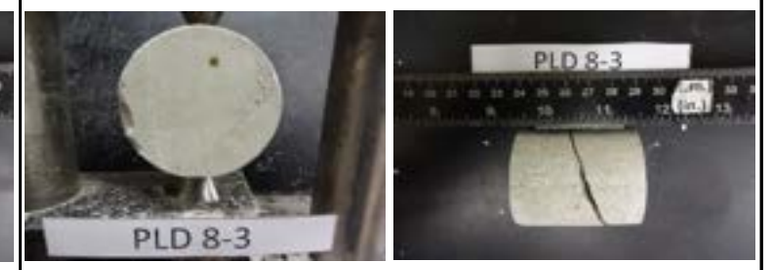
Intact Material Failure

PLD-8-2



Intact Material Failure

PLD-8-3

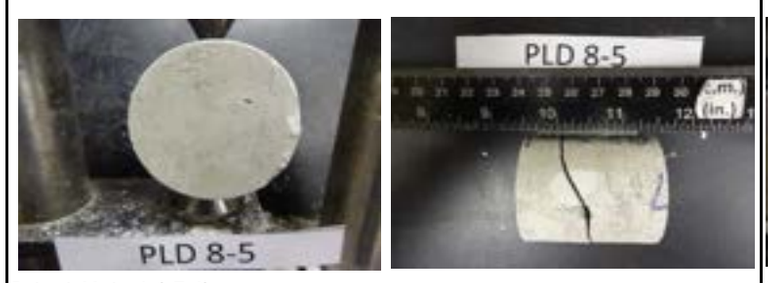


Intact Material Failure

PLD-8-4

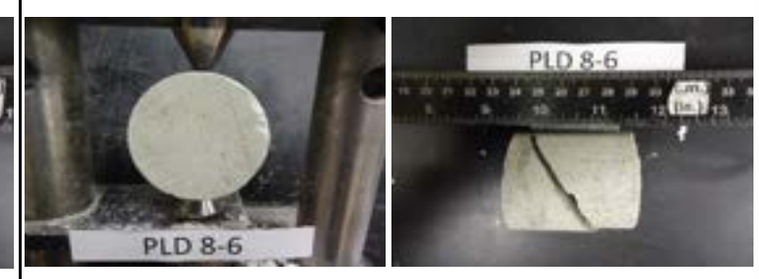
Intact Material Failure

PLD-8-5



Intact Material Failure

PLD-8-6



Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

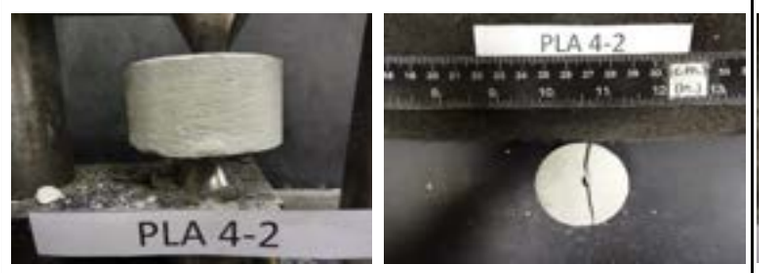
Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-203	RC-7	55-65	PLA-4-1	Axial	1.95	1.06	883	2.63	1.62	335	0.917	307	270	19	5,130
		55-65	PLA-4-2	Axial	1.95	1.06	785	2.64	1.63	297	0.918	272			
		55-65	PLA-4-3	Axial	1.96	1.11	746	2.76	1.66	270	0.927	250			
		55-65	PLA-4-4	Axial	1.97	0.85	283	2.14	1.46	133	0.875	116			
		55-65	PLA-4-5	Axial	1.95	1.13	771	2.81	1.68	275	0.930	256			
		55-65	PLA-4-6	Axial	1.95	1.11	850	2.74	1.66	310	0.925	287			

PLA-4-1

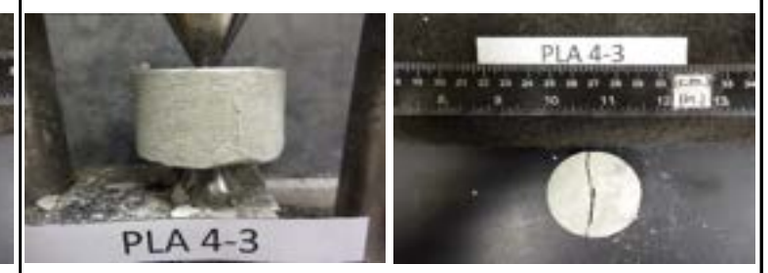
Intact Material Failure

PLA-4-2



Intact Material Failure

PLA-4-3



Intact Material Failure

PLA-4-4

Discontinuity Failure

PLA-4-5

Intact Material Failure

PLA-4-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

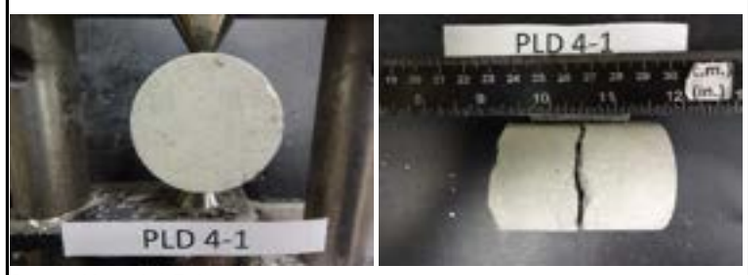
The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-203	RC-7	55-65	PLD-4-1	Diametral	1.96	2.53	92	6.39	2.53	14	1.119	16	186	24	4,450
		55-65	PLD-4-2	Diametral	1.96	2.02	937	4.10	2.02	229	1.013	232			
		55-65	PLD-4-3	Diametral	1.94	1.93	919	3.73	1.93	247	0.991	245			
		55-65	PLD-4-4	Diametral	1.95	1.94	908	3.78	1.94	241	0.994	239			
		55-65	PLD-4-5	Diametral	1.95	2.07	895	4.28	2.07	209	1.023	214			
		55-65	PLD-4-6	Diametral	1.95	2.00	697	4.01	2.00	174	1.008	175			

PLD-4-1



Intact Material Failure

PLD-4-2

Intact Material Failure

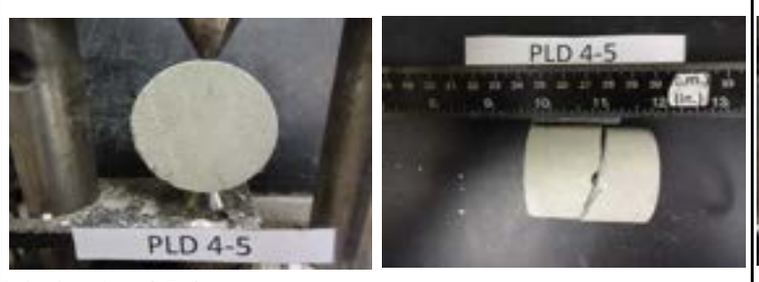
PLD-4-3

Intact Material Failure

PLD-4-4

Intact Material Failure

PLD-4-5



Intact Material Failure

PLD-4-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

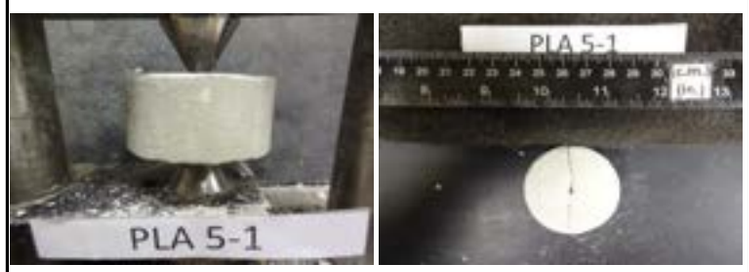
The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

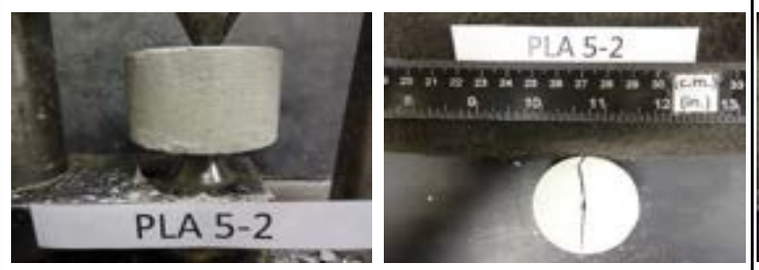
Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-204	RC-8/RC-9	50-60	PLA-5-1	Axial	1.99	1.03	812	2.61	1.61	311	0.915	285	277	18	4,990
		50-60	PLA-5-2	Axial	1.98	1.15	901	2.91	1.71	310	0.938	290			
		50-60	PLA-5-3	Axial	1.98	1.02	742	2.56	1.60	289	0.911	264			
		50-60	PLA-5-4	Axial	1.98	0.91	641	2.29	1.51	280	0.888	249			
		50-60	PLA-5-5	Axial	1.98	0.92	593	2.32	1.52	256	0.891	228			
		50-60	PLA-5-6	Axial	1.97	0.90	488	2.26	1.50	216	0.885	191			

PLA-5-1



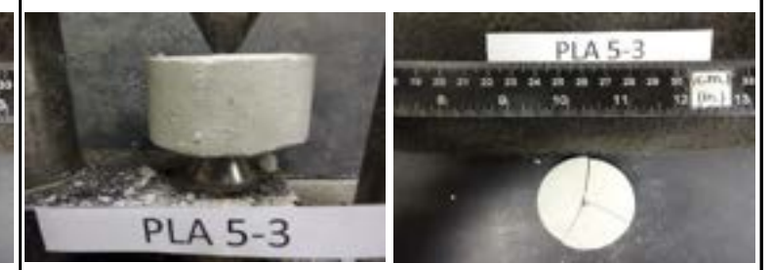
Intact Material Failure

PLA-5-2



Intact Material Failure

PLA-5-3



Intact Material Failure

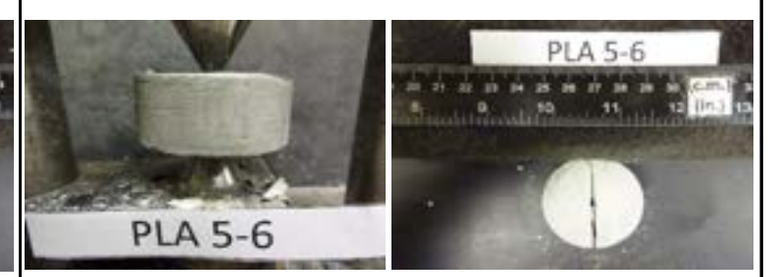
PLA-5-4

Intact Material Failure

PLA-5-5

Intact Material Failure

PLA-5-6



Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

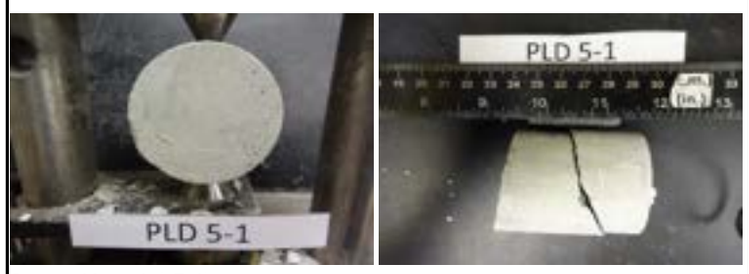
The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-204	RC-8/RC-9	50-60	PLD-5-1	Diametral	1.98	2.35	857	5.54	2.35	155	1.084	168	118	24	2,840
		50-60	PLD-5-2	Diametral	1.98	2.20	263	4.86	2.20	54	1.052	57			
		50-60	PLD-5-3	Diametral	1.98	2.39	697	5.73	2.39	122	1.092	133			
		50-60	PLD-5-4	Diametral	1.98	2.07	731	4.29	2.07	170	1.023	174			
		50-60	PLD-5-5	Diametral	1.98	2.21	187	4.89	2.21	38	1.054	40			
		50-60	PLD-5-6	Diametral	1.98	2.10	751	4.39	2.10	171	1.028	176			

PLD-5-1

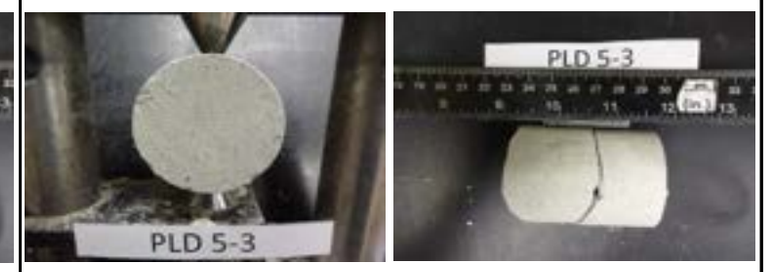


Intact Material Failure

PLD-5-2

Intact Material Failure

PLD-5-3

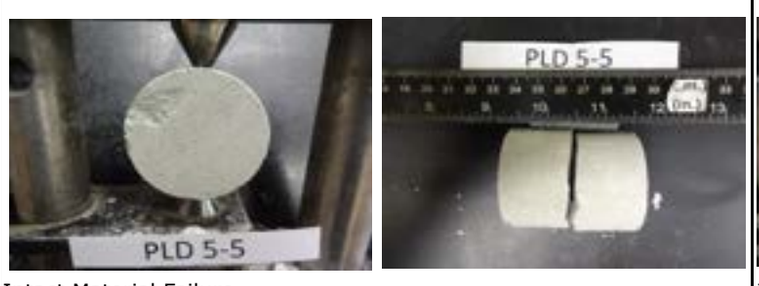


Intact Material Failure

PLD-5-4

Intact Material Failure

PLD-5-5



Intact Material Failure

PLD-5-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

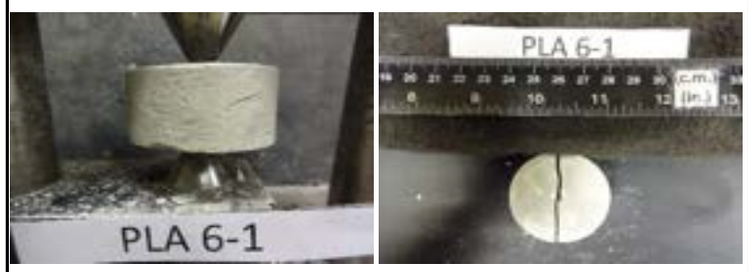
The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

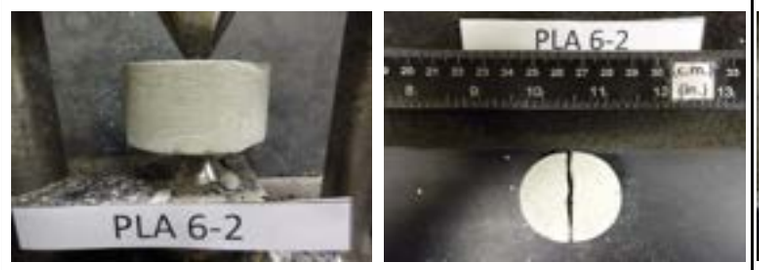
Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-205	RC-5	66-71	PLA-6-1	Axial	1.92	0.98	697	2.38	1.54	292	0.896	262	284	19	5,410
		66-71	PLA-6-2	Axial	1.91	1.07	731	2.60	1.61	281	0.914	257			
		66-71	PLA-6-3	Axial	1.94	1.07	809	2.64	1.62	307	0.917	281			
		66-71	PLA-6-4	Axial	1.94	1.01	737	2.50	1.58	295	0.906	267			
		66-71	PLA-6-5	Axial	1.95	0.99	596	2.46	1.57	242	0.903	218			
		66-71	PLA-6-6	Axial	1.94	1.04	746	2.57	1.60	290	0.912	265			

PLA-6-1



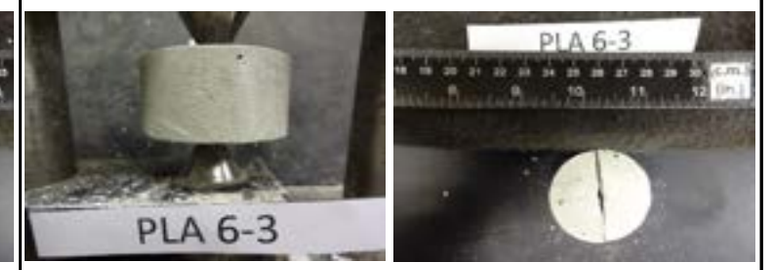
Intact Material Failure

PLA-6-2



Intact Material Failure

PLA-6-3



Intact Material Failure

PLA-6-4

Intact Material Failure

PLA-6-5

Intact Material Failure

PLA-6-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
T-205	RC-5	66-71	PLD-6-1	Diametral	1.93	2.39	892	5.73	2.39	156	1.092	170	165	24	3,950
		66-71	PLD-6-2	Diametral	1.95	2.08	787	4.34	2.08	181	1.026	186			
		66-71	PLD-6-3	Diametral	1.92	2.10	850	4.43	2.10	192	1.030	198			
		66-71	PLD-6-4	Diametral	1.92	2.18	755	4.76	2.18	159	1.047	166			
		66-71	PLD-6-5	Diametral	1.92	2.45	816	5.99	2.45	136	1.103	150			
		66-71	PLD-6-6	Diametral	1.92	2.15	760	4.64	2.15	164	1.041	171			

PLD-6-1

Intact Material Failure

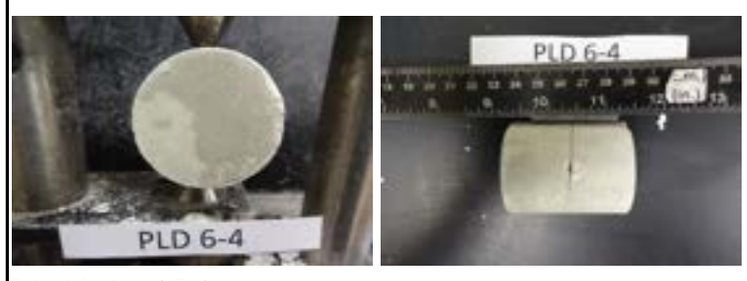
PLD-6-2

Intact Material Failure

PLD-6-3

Intact Material Failure

PLD-6-4



Intact Material Failure

PLD-6-5

Intact Material Failure

PLD-6-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-207	RC-5/RC-6	51.0-61.0	PLA-9-1	Axial	1.98	0.90	602	2.28	1.51	264	0.888	234	259	18	4,670
		51.0-61.0	PLA-9-2	Axial	1.98	0.99	638	2.49	1.58	256	0.905	232			
		51.0-61.0	PLA-9-3	Axial	1.99	0.97	589	2.45	1.56	241	0.902	217			
		51.0-61.0	PLA-9-4	Axial	1.98	0.96	629	2.43	1.56	259	0.901	233			
		51.0-61.0	PLA-9-5	Axial	1.99	0.97	654	2.44	1.56	268	0.901	241			
		51.0-61.0	PLA-9-6	Axial	1.99	1.02	692	2.58	1.61	268	0.913	245			

PLA-9-1

Intact Material Failure

PLA-9-2

Intact Material Failure

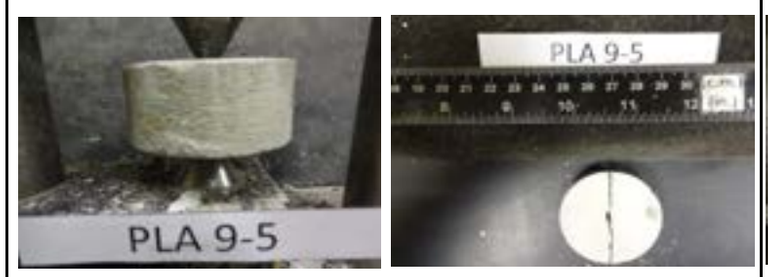
PLA-9-3

Intact Material Failure

PLA-9-4

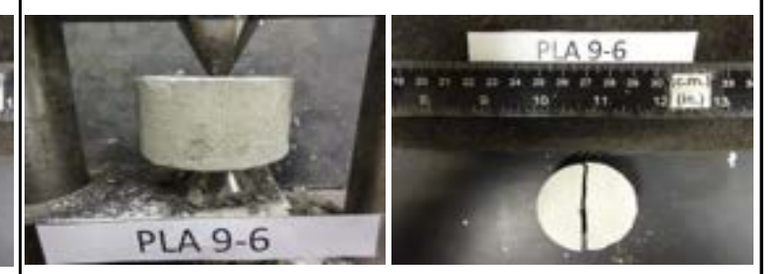
Intact Material Failure

PLA-9-5



Intact Material Failure

PLA-9-6



Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-207	RC-5/RC-6	51-61	PLD-9-1	Diametral	1.98	2.22	274	4.92	2.22	56	1.055	59	132	24.5	3,220
		51-61	PLD-9-2	Diametral	1.98	2.18	980	4.74	2.18	207	1.046	216			
		51-61	PLD-9-3	Diametral	1.98	2.49	441	6.19	2.49	71	1.111	79			
		51-61	PLD-9-4	Diametral	1.99	2.04	1050	4.17	2.04	252	1.017	256			
		51-61	PLD-9-5	Diametral	1.98	2.44	247	5.93	2.44	42	1.101	46			
		51-61	PLD-9-6	Diametral	1.97	2.17	762	4.70	2.17	162	1.045	169			

PLD-9-1

Intact Material Failure

PLD-9-2

Intact Material Failure

PLD-9-3

Intact Material Failure

PLD-9-4

Intact Material Failure

PLD-9-5

Intact Material Failure

PLD-9-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

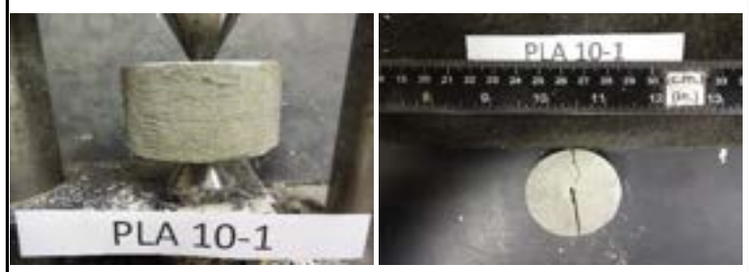
The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

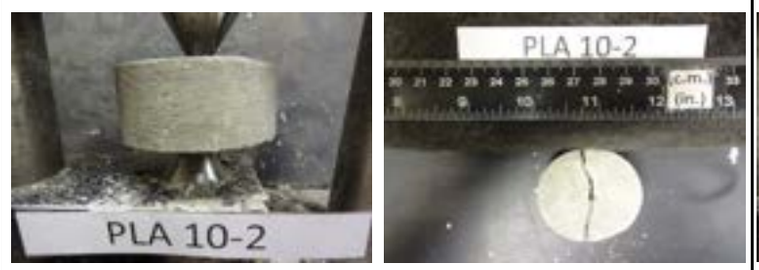
Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-208	RC-4	35-45	PLA-10-1	Axial	1.96	1.07	602	2.68	1.64	225	0.920	207	245	19	4,650
		35-45	PLA-10-2	Axial	1.97	0.97	670	2.43	1.56	275	0.900	248			
		35-45	PLA-10-3	Axial	1.96	0.99	668	2.49	1.58	268	0.905	243			
		35-45	PLA-10-4	Axial	1.96	1.07	634	2.68	1.64	236	0.921	217			
		35-45	PLA-10-5	Axial	1.96	0.99	618	2.48	1.57	250	0.904	226			
		35-45	PLA-10-6	Axial	1.97	1.01	542	2.53	1.59	214	0.909	194			

PLA-10-1



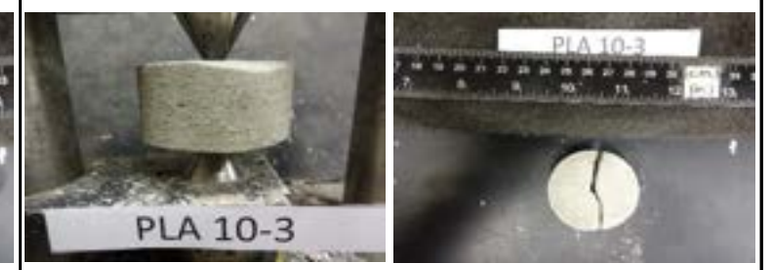
Intact Material Failure

PLA-10-2



Intact Material Failure

PLA-10-3

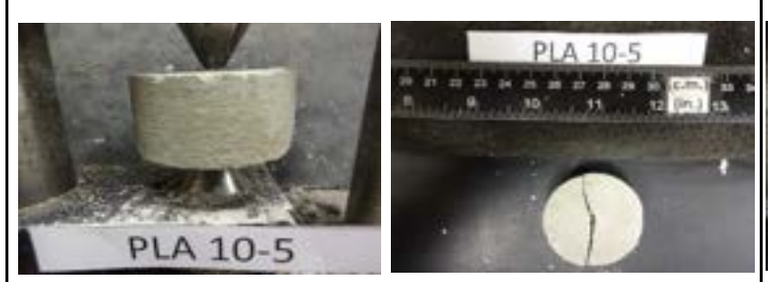


Intact Material Failure

PLA-10-4

Intact Material Failure

PLA-10-5



Intact Material Failure

PLA-10-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-208	RC-4	35-45	PLD-10-1	Diametral	1.98	2.06	544	4.22	2.06	129	1.020	131	110	24	2,630
		35-45	PLD-10-2	Diametral	1.98	2.16	522	4.66	2.16	112	1.042	117			
		35-45	PLD-10-3	Diametral	1.98	2.05	526	4.21	2.05	125	1.019	127			
		35-45	PLD-10-4	Diametral	1.98	2.09	432	4.37	2.09	99	1.027	102			
		35-45	PLD-10-5	Diametral	1.98	2.06	663	4.23	2.06	157	1.020	160			
		35-45	PLD-10-6	Diametral	1.98	2.25	184	5.05	2.25	36	1.061	39			

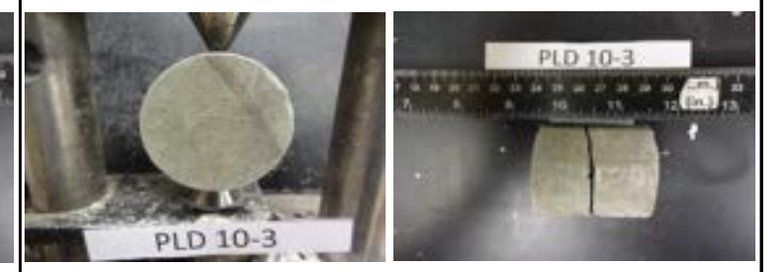
PLD-10-1

Intact Material Failure

PLD-10-2

Intact Material Failure

PLD-10-3

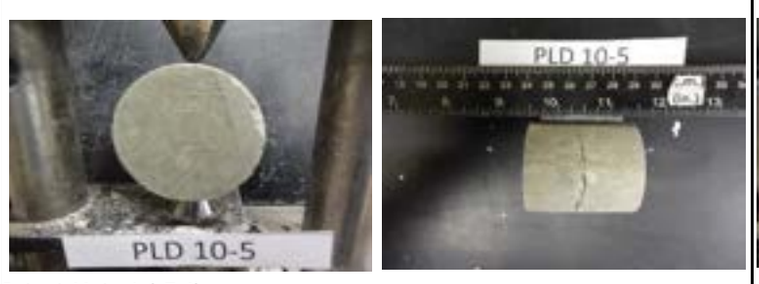


Intact Material Failure

PLD-10-4

Intact Material Failure

PLD-10-5



Intact Material Failure

PLD-10-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were run at their as-received moisture content.

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-209	RC-1	40-50	PLA-11-1	Axial	1.98	1.16	650	2.92	1.71	222	0.938	209	231	19	4,380
		40-50	PLA-11-2	Axial	1.98	1.13	708	2.84	1.68	250	0.932	233			
		40-50	PLA-11-3	Axial	1.98	0.99	589	2.49	1.58	237	0.905	214			
		40-50	PLA-11-4	Axial	1.98	1.00	528	2.51	1.58	211	0.907	191			
		40-50	PLA-11-5	Axial	1.98	0.96	589	2.42	1.55	244	0.899	219			
		40-50	PLA-11-6	Axial	1.98	1.06	589	2.67	1.63	221	0.920	203			

PLA-11-1

Intact Material Failure

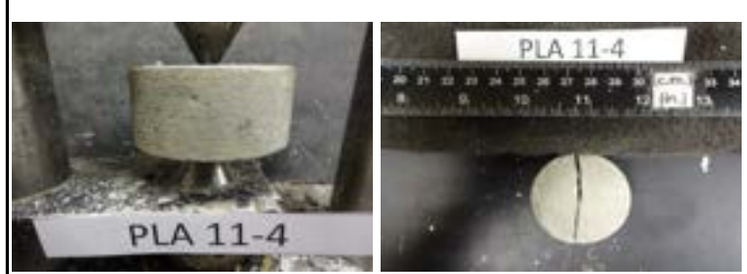
PLA-11-2

Intact Material Failure

PLA-11-3

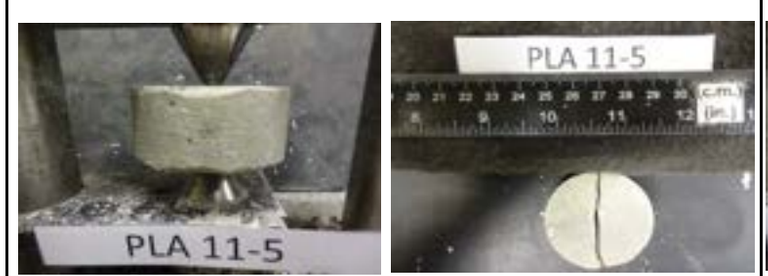
Intact Material Failure

PLA-11-4



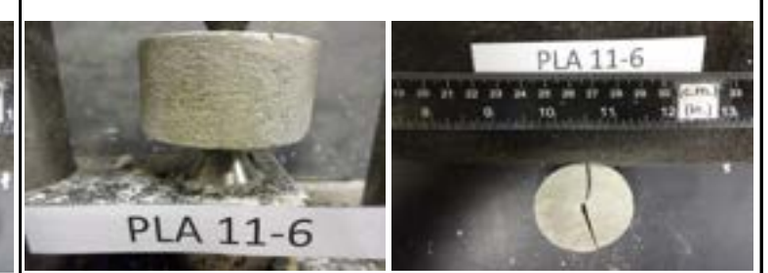
Intact Material Failure

PLA-11-5



Intact Material Failure

PLA-11-6



Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/10/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were soaked in water overnight to saturate and then surfaced dried before testing.

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
TS-209	RC-1	40-50	PLD-11-1	Diametral	1.99	2.40	827	5.76	2.40	144	1.093	157	162	24.5	3,980
		40-50	PLD-11-2	Diametral	1.99	2.11	998	4.44	2.11	225	1.031	232			
		40-50	PLD-11-3	Diametral	1.99	1.99	982	3.96	1.99	248	1.005	249			
		40-50	PLD-11-4	Diametral	1.99	2.39	636	5.72	2.39	111	1.091	121			
		40-50	PLD-11-5	Diametral	1.99	2.04	845	4.15	2.04	204	1.016	207			
		40-50	PLD-11-6	Diametral	1.99	2.83	342	8.03	2.83	43	1.178	50			

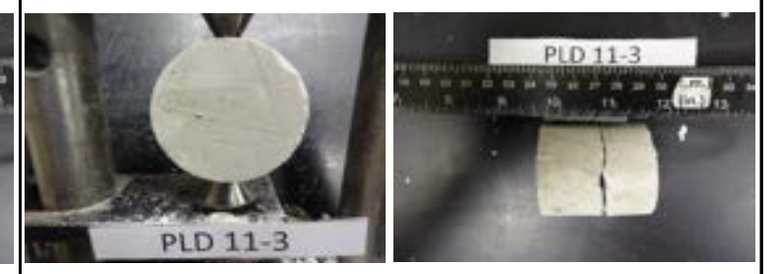
PLD-11-1

Intact Material Failure

PLD-11-2

Intact Material Failure

PLD-11-3

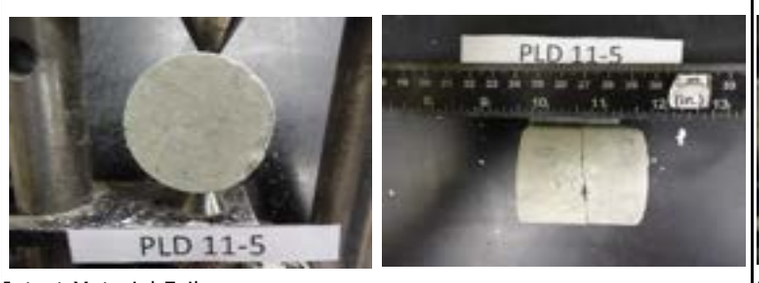


Intact Material Failure

PLD-11-4

Intact Material Failure

PLD-11-5



Intact Material Failure

PLD-11-6

Intact Material Failure

Notes:

D_e = the equivalent core diameter
I_s = the uncorrected point load strength
F = the size correction factor
$I_{s(50)}$ = the size corrected point load strength index
Average I_s calculated by averaging the I_s values.
Estimated Compressive Strength = Average I_S x K

Client:	Alliance Geotechnical Group	Test Date:	5/13/2019
Project Name:	DART Project	Tested By:	tlm
Project Location	Dallas, TX	Checked By:	jsc
GTX #:	309416	Sample Description:	rock core

Point Load Strength Index of Rock by ASTM D5731

Boring ID	Sample ID	Depth, ft	Test No.	Test Type	Width (W), in	Depth (D), in	Failure Load(P), lb	D_e^2, in^2	D_e, in	I_s, psi	F	$I_{s(50)}$, psi	Average I_s, psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi

The specimens were run at their as-received moisture content.

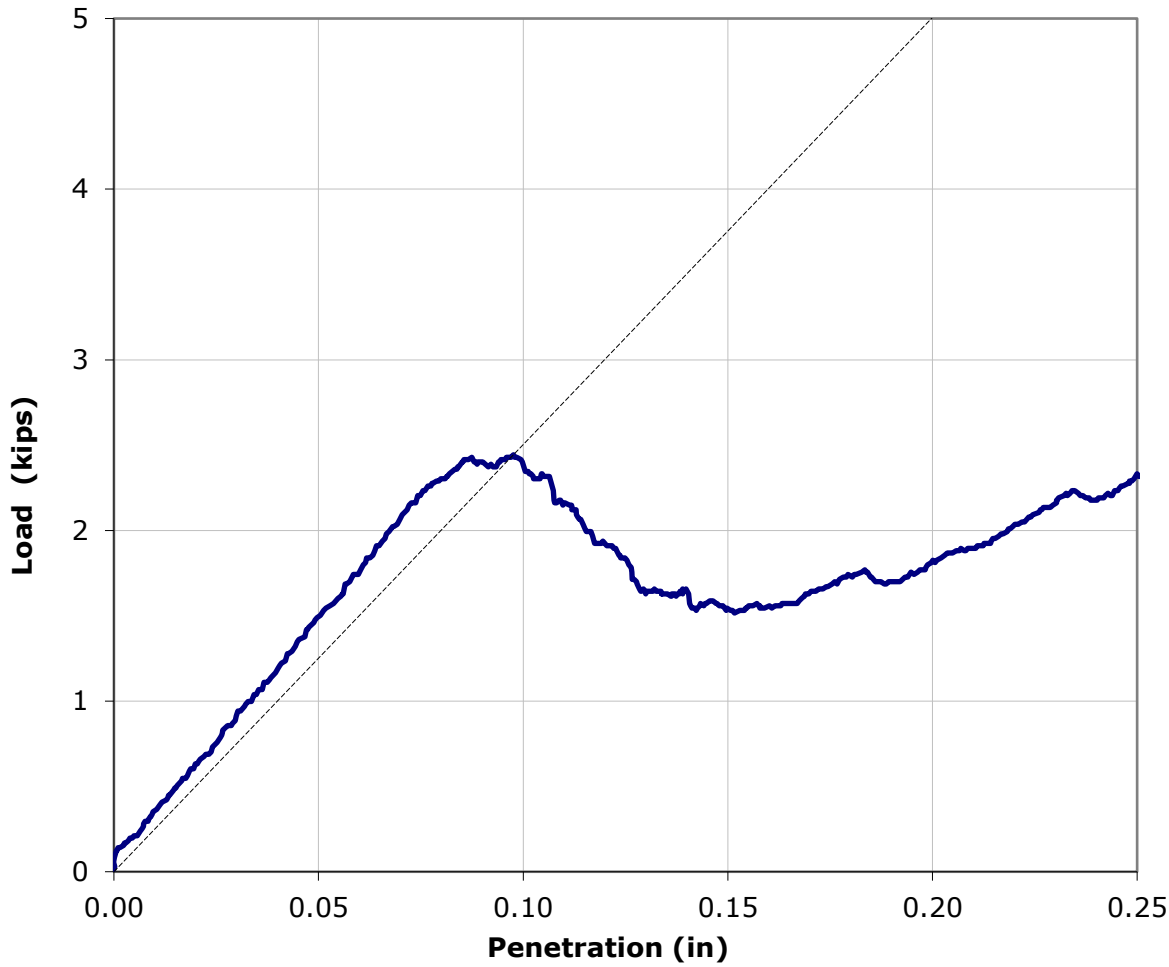
APPENDIX F-6

PUNCH PENETRATION TEST

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/5/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-102
Sample ID:	RC-1
Depth:	28'3"-30'4"
Visual Description:	---

Punch Penetration Index Test

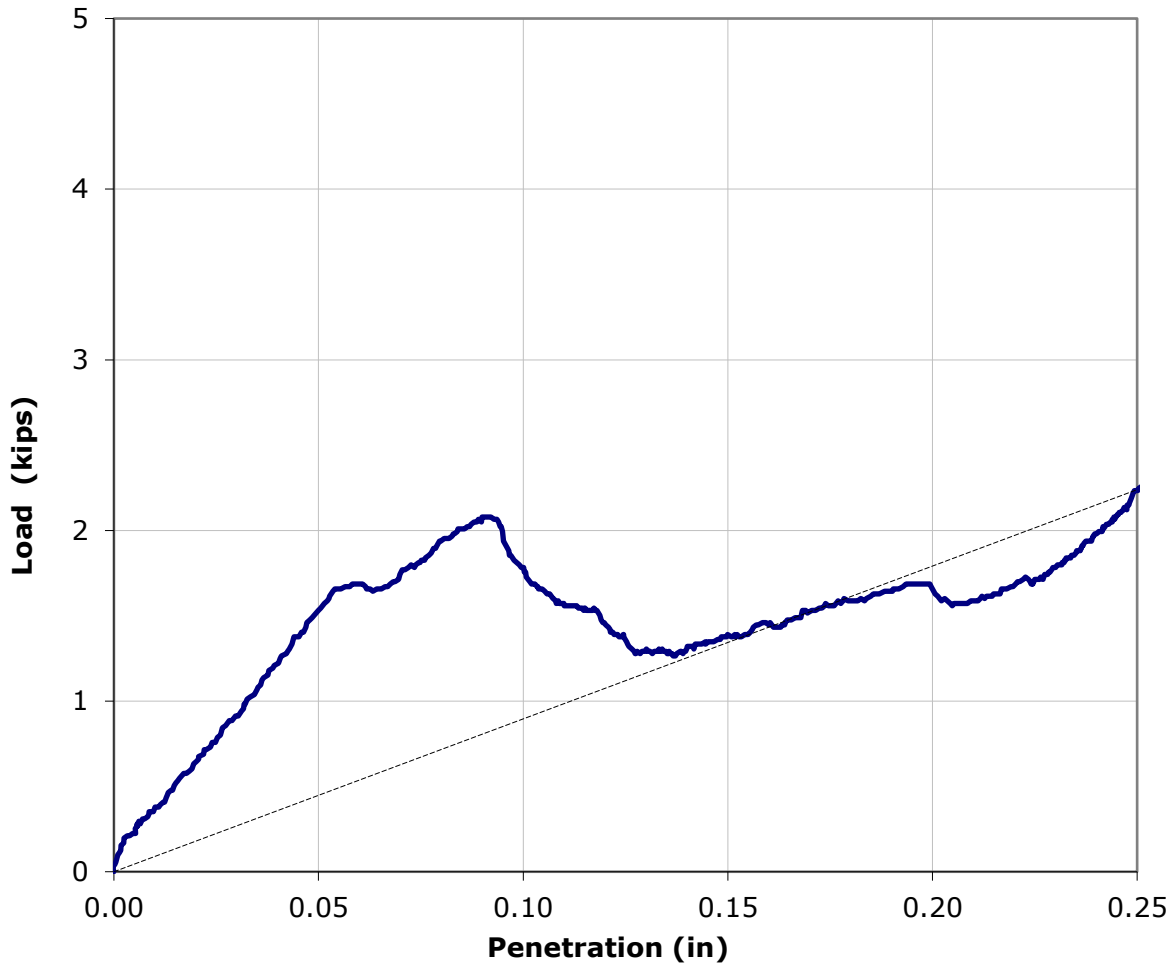
Moisture Condition:	as-received	Maximum Load, lbs:	2739
Penetration Rate, in/sec:	0.001	Peak Slope Index, kips/in:	25.0



Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"
Visual Description:	---

Punch Penetration Index Test

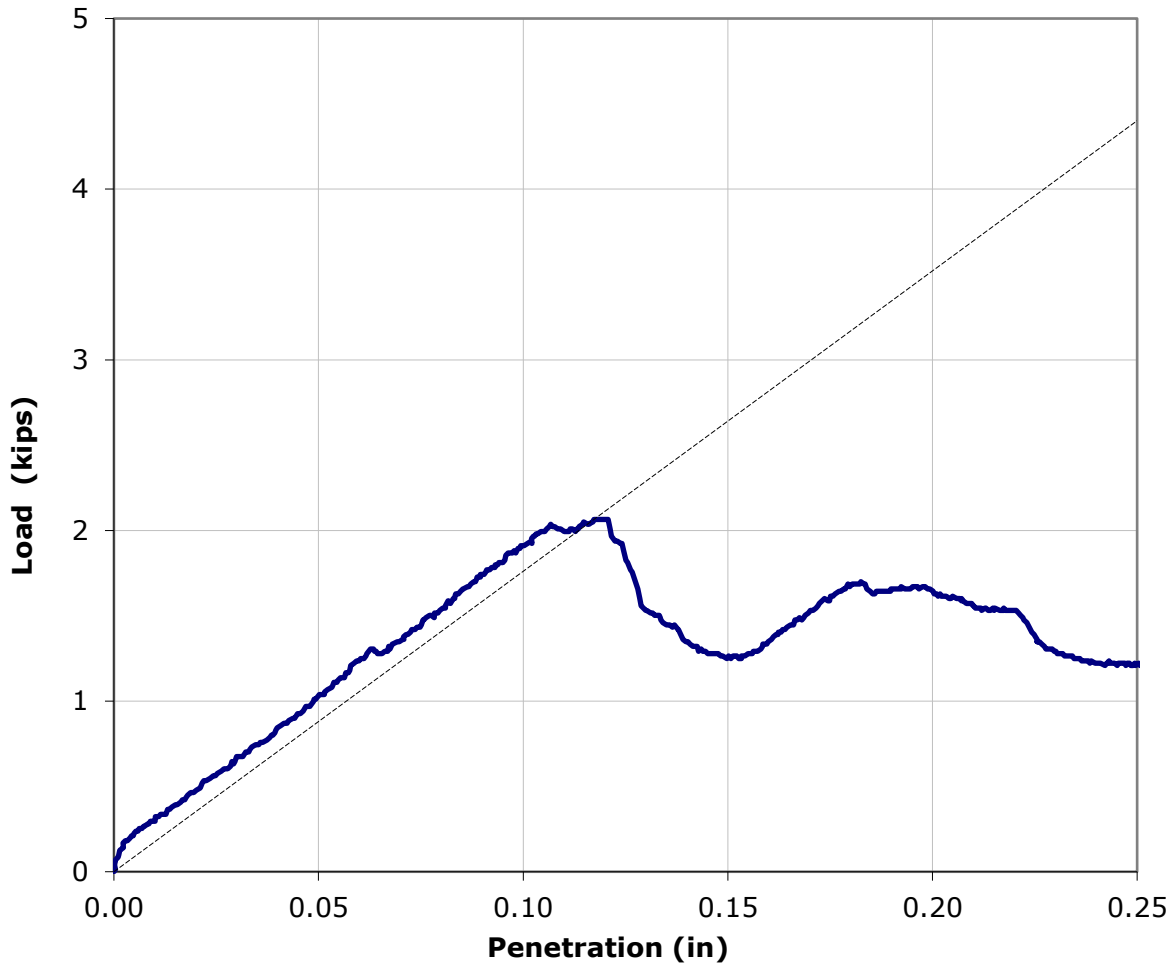
Moisture Condition:	as-received	Maximum Load, lbs:	3399
Penetration Rate, in/sec:	0.001	Peak Slope Index, kips/in:	8.96



Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-7
Depth:	60'-63'5"
Visual Description:	---

Punch Penetration Index Test

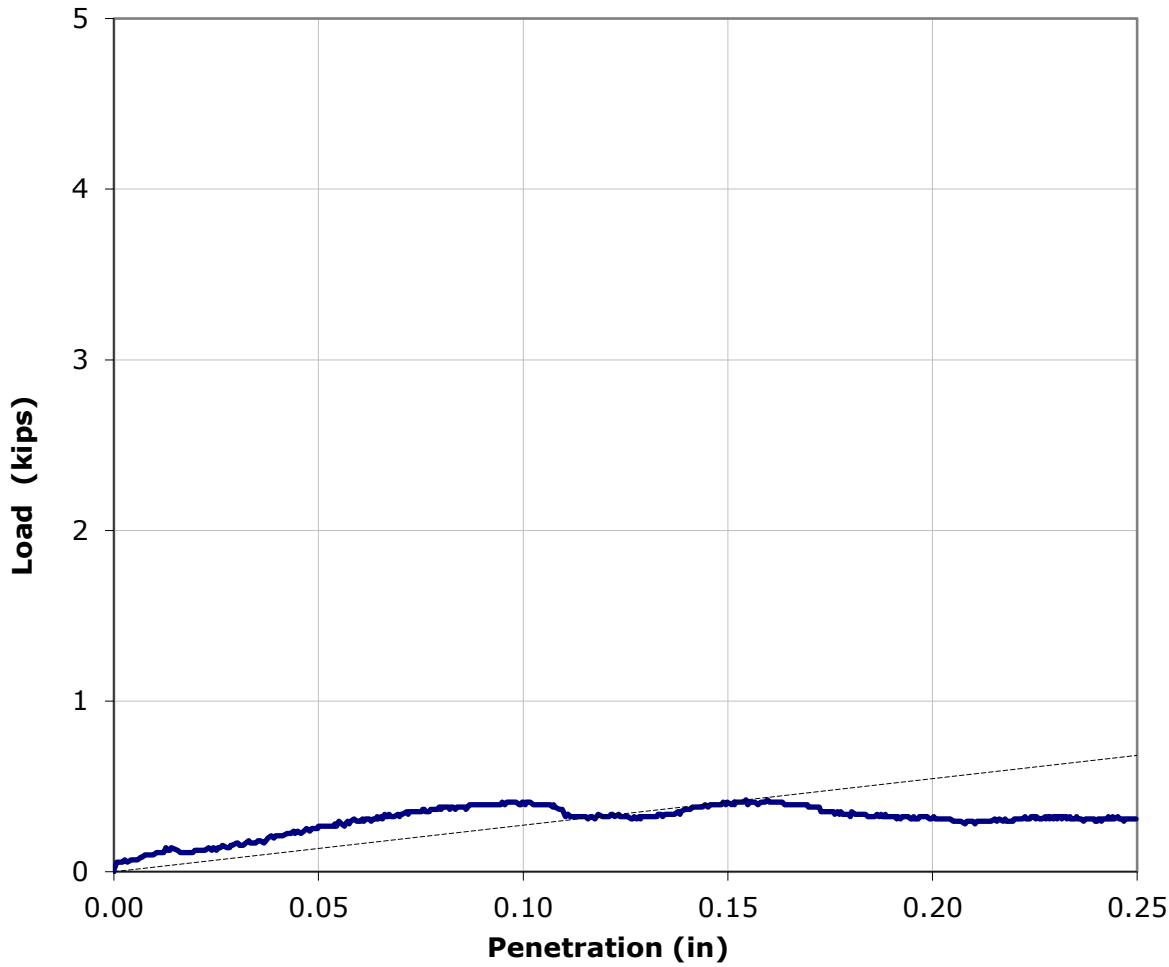
Moisture Condition:	as-received	Maximum Load, lbs:	2079
Penetration Rate, in/sec:	0.001	Peak Slope Index, kips/in:	17.6



Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-8
Depth, ft.:	67'5"-69'6"
Visual Description:	---

Punch Penetration Index Test

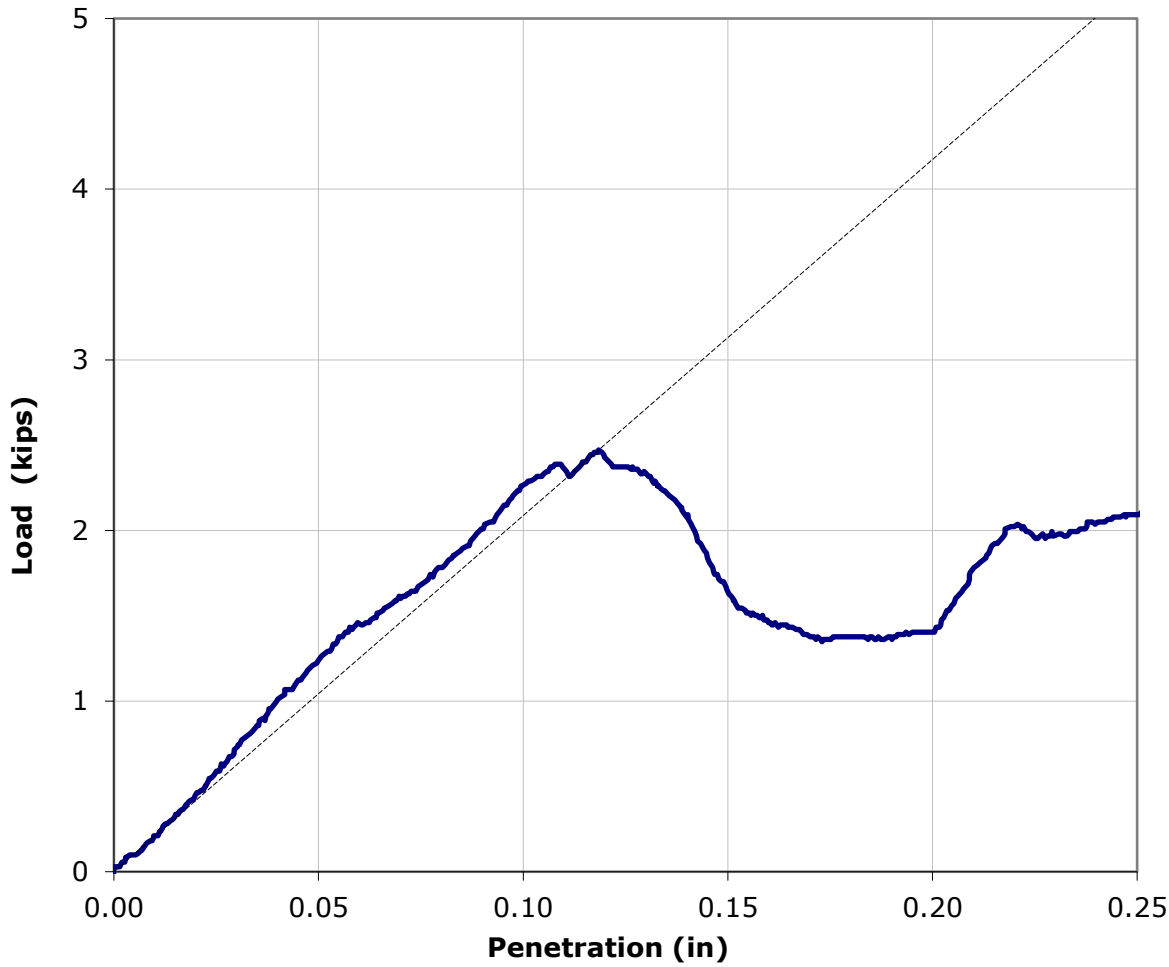
Moisture Condition:	as-received	Maximum Load, lbs:	421
Penetration Rate, in/sec:	0.001	Peak Slope Index, kips/in:	2.73



Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-202
Sample ID:	RC-6/7
Depth:	60'-64'1"
Visual Description:	---

Punch Penetration Index Test

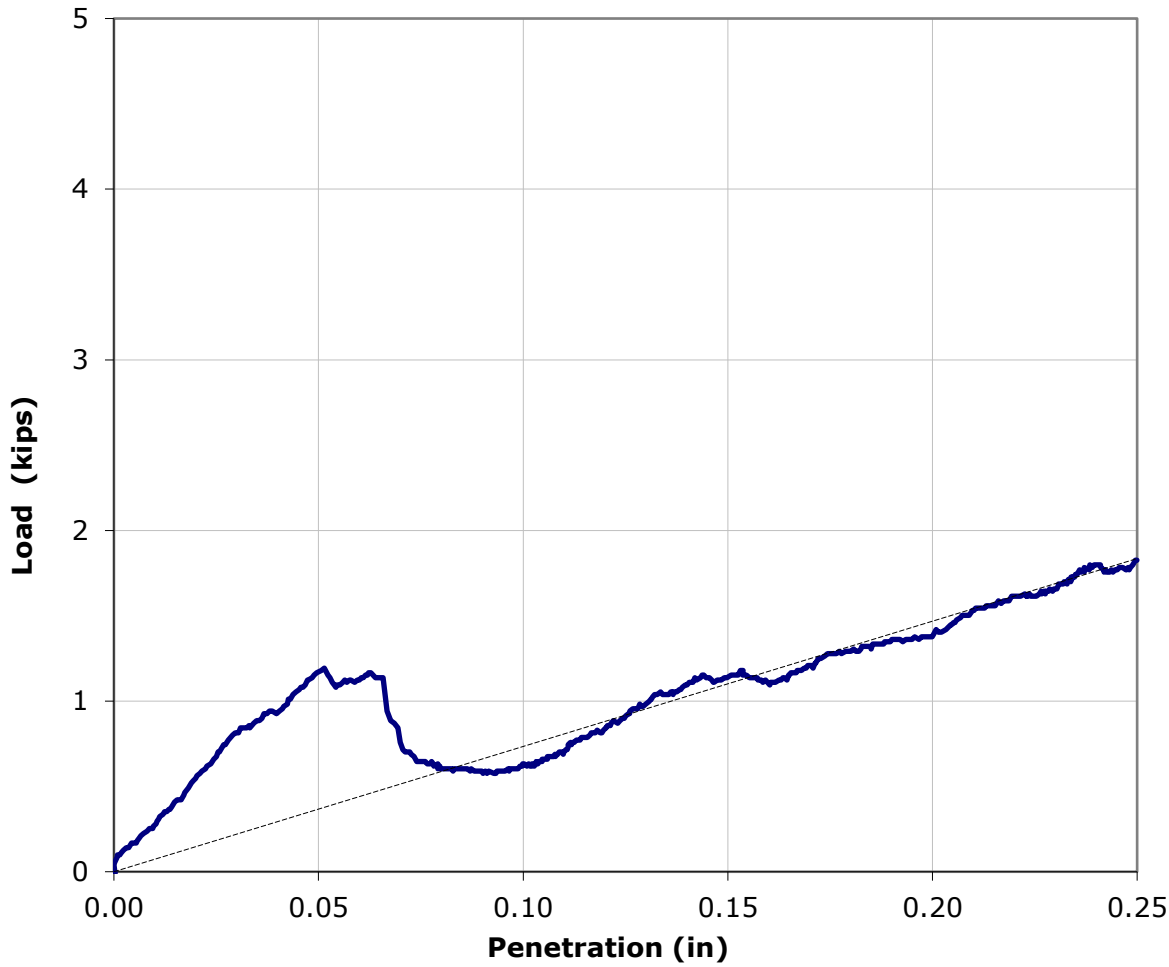
Moisture Condition:	as-received	Maximum Load, lbs:	2472
Penetration Rate, in/sec:	0.001	Peak Slope Index, kips/in:	20.8



Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-203
Sample ID:	---
Depth:	60'-65'
Visual Description:	---

Punch Penetration Index Test

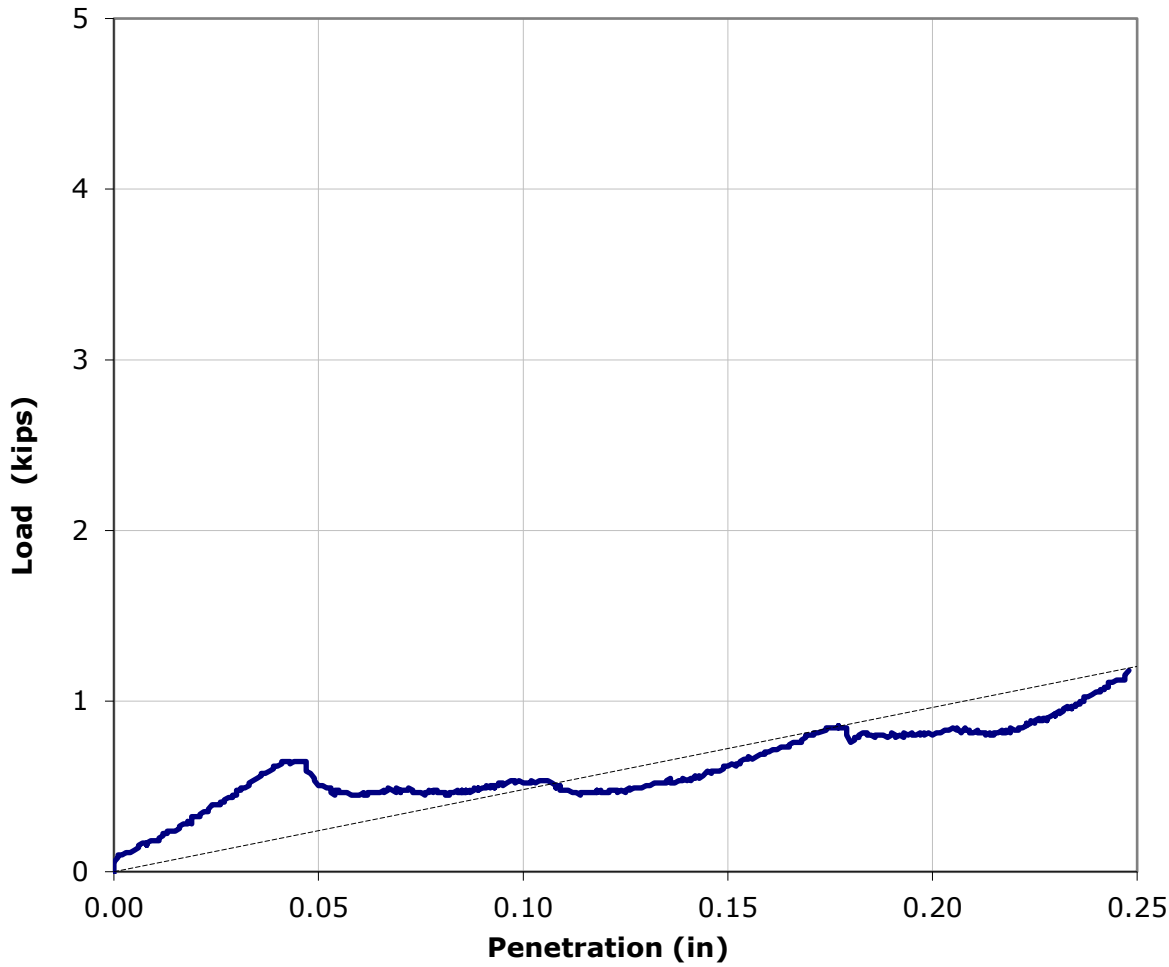
Moisture Condition:	as-received	Maximum Load, lbs:	2500
Penetration Rate, in/sec:	0.001	Peak Slope Index, kips/in:	7.34



Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/10/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-207
Sample ID:	RC-5/6
Depth:	51.0-61.0
Visual Description:	---

Punch Penetration Index Test

Moisture Condition:	as-received	Maximum Load, lbs:	1587
Penetration Rate, in/sec:	0.001	Peak Slope Index, kips/in:	4.80



APPENDIX F-7

PULSE VELOCITY AND DYNAMIC ELASTIC CONSTANTS

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	11/25/13
Tested By:	cmh
Checked By:	jsc

Pulse Velocities and Ultrasonic Elastic Constants of Rock by ASTM D2845 - Summary Table

Boring ID	Sample ID	Depth, ft	Bulk Density, lbs/ft^3	P-Wave Velocity, (ft/sec) (Axial)	S-Wave Velocity, (ft/sec) (Axial)	Young's Modulus, (psi) 10^6	Poisson's Ratio
B-3	RC-6	70.0-70.35	127	5,366	4,337	0.58	0.44

Notes: Density determined on rock core samples by measuring dimensions and weight and then calculating.
All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.
No coupling medium was used.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/19
Tested By:	smd/cmh
Checked By:	jsc

Pulse Velocities and Ultrasonic Elastic Constants of Rock by ASTM D2845 - Summary Table

Boring ID	Sample ID	Depth	Bulk Density, lbs/ft^3	P-Wave Velocity, (ft/sec) (Axial)	S-Wave Velocity, (ft/sec) (Axial)	Young's Modulus, (psi) 10^6	Poisson's Ratio
P-102	---	26'-28'4"	132	4,035	3,234	0.36	0.40
T-102	RC-1	28'3"-30'4"	125	6,008	4,510	0.93	0.15
T-103	RC-2	38'4"-40'5"	126	6,676	5,061	1.15	0.18
T-201	RC-7	63'10"-65'	132	3,963	3,097	0.39	0.28
T-201	RC-8	67'5"-69'6"	128	2,187	1,657	0.12	0.18
T-203	---	60'-65'	133	5,267	4,277	0.56	0.47
T-204	---	52'10"-55'	133	4,605	3,627	0.51	0.32
T-205	RC-2	47'5"-48'11"	129	3,995	3,204	0.34	0.40
T-205	RC-5B	66'8"-68'3"	136	3,676	2,955	0.30	0.41
T-205	RC-4	56'10"-60'	132	11,175	6,416	2.94	0.25
TS-104	RC-3A	35'-37'6"	133	3,968	2,981	0.44	0.15
TS-104	RC-5	53'3"	135	3,348	2,689	0.25	0.41
TS-202	RC-4	36'6"-38'9"	129	4,695	3,830	0.41	0.49
TS-202	RC-6/7	60'-64'1"	127	4,009	3,200	0.35	0.38

Notes: Density determined on rock core samples by measuring dimensions and weight and then calculating.
All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.
No coupling medium was used.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416

Pulse Velocities and Ultrasonic Elastic Constants of Rock by ASTM D2845

P-102

26'-28'4"

T-102
RC-1
28'3"-30'4"

T-103
RC-2
38'4"-40'5"

T-201
RC-7
63'10"-65'

T-201
RC-8
67'5"-69'6"

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416

Pulse Velocities and Ultrasonic Elastic Constants of Rock by ASTM D2845

T-203

60'-65'

T-204

52'10"-55'

T-205
RC-2
47'5"-48'11"

T-205
RC-5B
66'8"-68'3"

T-205
RC-4
56'10"-60'

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416

Pulse Velocities and Ultrasonic Elastic Constants of Rock by ASTM D2845

TS-104
RC-3A
35'-37'6"

TS-104
RC-5
53'3"

TS-202
RC-4
36'6"-38'9"

TS-202
RC-6/7
60'-64'1"

APPENDIX F-8

SCHMIDT HAMMER REBOUND HARDNESS

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	P-102
Sample ID:	---
Depth:	26'-28'4"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
7.9	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	21.0*	Value not used. Specimen broke	6.	14.0	Specimen < 6"
2.	23.0	Specimen < 6"	7.	13.0	Specimen < 6"
3.	21.0	Specimen < 6"	8.	19.0	Specimen < 6"
4.	21.0	Specimen < 6"	9.	11.0*	Value not used. Specimen broke
5.	17.0	Specimen < 6"	10.	16.0	Specimen < 6"

Average: 18.0

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 18.3* **Test specimen < 6 inches**

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-102
Sample ID:	RC-1
Depth:	28'3"-30'4"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
6.1	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	12.0		6.	18.0	Specimen < 6"
2.	16.0		7.	26.0	Specimen < 6"
3.	10.0*	Value not used. Specimen broke	8.	10.0	Specimen < 6"
4.	26.0	Specimen < 6"	9.	11.0	Specimen < 6"
5.	10.0	Specimen < 6"	10.	12.0	Specimen < 6"

Average: Recalculate Average

Correction Factor: 1.016

Schmidt Hardness Number, H_R: **12.6*** **Test specimen < 6 inches**

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-103
Sample ID:	RC-2
Depth:	38'4"-40'5"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
6.9	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	10.0*	Value not used. Specimen broke	6.	14.0
2.	22.0		7.	17.0
3.	22.0		8.	15.0
4.	19.0		9.	16.0
5.	12.0		10.	17.0

Average: 17.1

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 17.4

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
7.0	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	23.0		6.	11.0	Value not used. Specimen broke
2.	20.0		7.	30.0	Specimen < 6"
3.	17.0	Value not used. Specimen broke	8.	28.0	Specimen < 6"
4.	26.0	Specimen < 6"	9.	22.0	Specimen < 6"
5.	19.0	Specimen < 6"	10.	26.0	Specimen < 6"

Average: 24.3

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 24.6* **Test specimen < 6 inches**

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-5
Depth, ft:	53'3"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
11.7	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	20.0	6.	26.0
2.	24.0	7.	22.0
3.	12.0	8.	18.0
4.	16.0	9.	22.0
5.	25.0	10.	19.0

Average: 21.3

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 21.7

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-7
Depth:	60'63'5"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
9.7	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	10.0	Value not used to determine average.	6.	10.0*	Value not used. Specimen broke
2.	14.0		7.	10.0*	Value not used. Specimen broke
3.	20.0		8.	10.0*	Value not used. Specimen broke
4.	10.0		9.	10.0	
5.	10.0		10.	17.0	

Average: 11.8

Correction Factor: 1.016

Schmidt Hardness Number, H_R: **12.0*** **Test specimen < 6 inches**

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	43502
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-7
Depth:	63'10"-65'
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
5.9	2.0	As-Received	Fresh	---

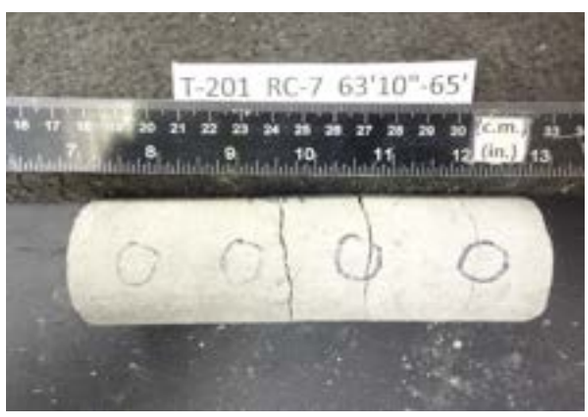
Schmidt Hammer Readings

1.	20.0*	Value not used. Specimen broke	6.	14.0	Specimen < 6"
2.	14.0	Specimen < 6"	7.	21.0	Specimen < 6"
3.	16.0	Specimen < 6"	8.	19.0	Specimen < 6"
4.	17.0	Specimen < 6"	9.	10.0*	Value not used. Specimen broke
5.	22.0	Specimen < 6"	10.	12.0	Specimen < 6"

Average: 16.9

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 17.2* **Test specimen < 6 inches**



Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-201
Sample ID:	RC-8
Depth:	67'5"-69'6"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
6.6	2.0	As-Received	Fresh	---

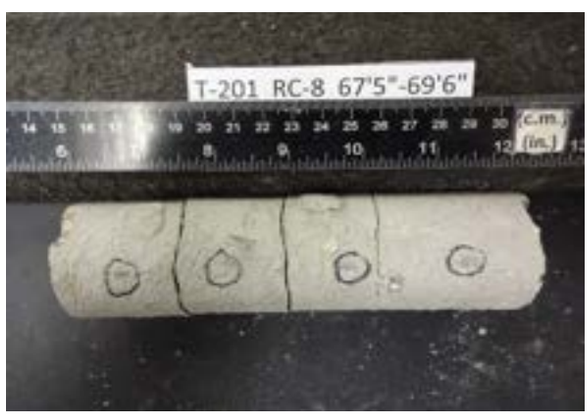
Schmidt Hammer Readings

1.	10.0		6.	10.0	Specimen < 6"
2.	10.0		7.	8.0	Specimen < 6"
3.	8.0*	Value not used. Specimen broke	8.	16.0	Specimen < 6"
4.	10.0	Specimen < 6"	9.	10.0	Specimen < 6"
5.	14.0	Specimen < 6"	10.	10.0	Specimen < 6"

Average: 10.9

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 10.9* **Test specimen < 6 inches**



Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-202
Sample ID:	RC-4
Depth:	36'6"-38'9"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
7.6	2.0	As-Received	Fresh	---

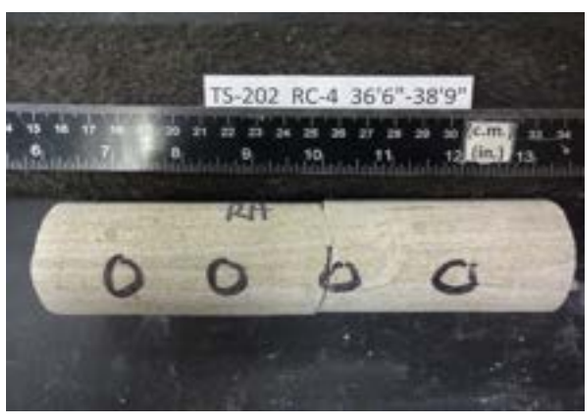
Schmidt Hammer Readings

1.	12.0*	Value not used. Specimen broke	6.	18.0	Specimen < 6"
2.	22.0	Specimen < 6"	7.	13.0	Specimen < 6"
3.	18.0	Specimen < 6"	8.	20.0	Specimen < 6"
4.	20.0	Specimen < 6"	9.	15.0	Specimen < 6"
5.	16.0	Specimen < 6"	10.	16.0	Specimen < 6"

Average: 17.6

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 17.8* **Test specimen < 6 inches**



Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-202
Sample ID:	RC-6/7
Depth:	60'-64'1"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
6.3	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	14.0*	Value not used. Specimen broke	6.	19.0	Specimen < 6"
2.	19.0	Specimen < 6"	7.	23.0	Specimen < 6"
3.	21.0	Specimen < 6"	8.	22.0	Specimen < 6"
4.	22.0	Specimen < 6"	9.	18.0	Specimen < 6"
5.	22.0	Specimen < 6"	10.	14.0	Specimen < 6"

Average: 20.0

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 20.3* **Test specimen < 6 inches**

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-203
Sample ID:	---
Depth:	60'-65'
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
8.4	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	16.0		6.	24.0	Specimen < 6"
2.	12.0		7.	22.0	Specimen < 6"
3.	16.0*	Value not used. Specimen broke	8.	30.0	Value not used to calculate average.
4.	18.0	Specimen < 6"	9.	24.0	Specimen < 6"
5.	12.0	Specimen < 6"	10.	14.0	Specimen < 6"

Average: 17.8

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 18.0

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-204
Sample ID:	---
Depth:	52'10"-55'
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
7.2	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	18.0	6.	24.0
2.	12.0	7.	27.0
3.	26.0	8.	18.0
4.	29.0	9.	15.0
5.	18.0	10.	20.0

Average: 20.8

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 21.1

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-205
Sample ID:	RC-2
Depth, ft:	47'5"-48'11"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
6.2	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	18.0	6.	20.0
2.	12.0	7.	19.0
3.	22.0	8.	20.0
4.	19.0	9.	12.0
5.	13.0	10.	13.0

Average: 16.8

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 17.1

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-205
Sample ID:	RC-4
Depth:	56'10"-60'
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
6.3	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	18.0	6.	23.0	
2.	20.0	7.	21.0	
3.	24.0	8.	21.0	
4.	23.0	9.	16.0	
5.	14.0	10.	12.0	Value not used to calculate average

Average: 20.0

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 20.3

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	T-205
Sample ID:	RC-5B
Depth:	66'8"-68'3"
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
6.4	2.0	As-Received	Fresh	---

Schmidt Hammer Readings

1.	15.0		6.	24.0	Specimen < 6"
2.	11.0	Value not used. Specimen broke	7.	21.0	Value not used. Specimen broke
3.	24.0	Specimen < 6"	8.	26.0	Specimen < 6"
4.	22.0	Specimen < 6"	9.	18.0	Specimen < 6"
5.	15.0	Specimen < 6"	10.	26.0	Specimen < 6"

Average: 21.3

Correction Factor: 1.016

Schmidt Hardness Number, H_R: 21.6* **Test specimen < 6 inches**

Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/2/2019
Tested By:	tlm
Checked By:	jsc
Boring ID:	TS-207
Sample ID:	RC-5/RC-6
Depth, ft:	51.0-61.0
Sample Type:	rock core
Sample Description:	core

Determination of Rock Hardness by Rebound Hammer Method (Schmidt Hammer) by ASTM D5873

Length, in	Diameter, in	Specimen Moisture Condition	Weathering and Alteration Condition of Sample	Remarks
6.5	2.0	As-Received	Fresh	---

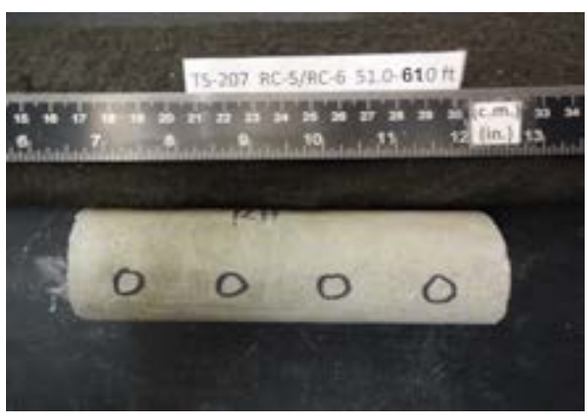
Schmidt Hammer Readings

1.	24.0	6.	28.0	
2.	22.0	7.	34.0*	Reading not used to calculate average
3.	20.0	8.	32.0	
4.	26.0	9.	30.0	
5.	23.0	10.	30.0	

Average: 26.1

Correction Factor: 0.993

Schmidt Hardness Number, H_R: 23.3



Notes: Test performed using an Type L Schmidt Hammer
Test specimen was clamped into a steel cradle
Test was performed with the Schmidt hammer plunger axis near vertical
Specimen stored and tested at standard laboratory temperature.

APPENDIX F-9

SLAKE DURABILITY

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	B-3	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-6	Test Date:	05/29/19	Checked By:	smd
Depth :	70.0-75.0 ft	Test Id:	505082		
Test Comment:	---				
Visual Description:	See photograph(s)				
Sample Comment:	---				

Slake Durability of Shales and Similar Weak Rocks by ASTM D4644

Boring ID	Sample ID	Depth	Visual Description	Slake Durability Index %	Average water temperature, degrees C	As-Received Water Content %	Description of Fragments
B-3	RC-6	70.0 - 75.0 ft	See photograph(s)	96.0	20	9.5	Type I

Comments: Description of the appearance of the fragments retained in the drum:

Type I - Retained pieces remain virtually unchanged

Type II - Retained materials consist of large and small fragments

Type III - Retained material is exclusively small fragments

Before Test:

After Test:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	T-112	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-2	Test Date:	05/06/19	Checked By:	jsc
Depth :	41.0-46.0 ft	Test Id:	501446		
Test Comment:	---				
Visual Description:	See photograph(s)				
Sample Comment:	---				

Slake Durability of Shales and Similar Weak Rocks by ASTM D4644

Boring ID	Sample ID	Depth	Visual Description	Slake Durability Index %	Average water temperature, degrees C	As-Received Water Content %	Description of Fragments
T-112	RC-2	41 - 46 ft	See photograph(s)	86.1	20	0.9	Type I

Comments: Description of the appearance of the fragments retained in the drum:

Type I - Retained pieces remain virtually unchanged

Type II - Retained materials consist of large and small fragments

Type III - Retained material is exclusively small fragments

Before Test:

After Test:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	TS-207	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-5/RC-6	Test Date:	05/06/19	Checked By:	jsc
Depth :	51.0-61.0 ft	Test Id:	501467		
Test Comment:	---				
Visual Description:	See photograph(s)				
Sample Comment:	---				

Slake Durability of Shales and Similar Weak Rocks by ASTM D4644

Boring ID	Sample ID	Depth	Visual Description	Slake Durability Index %	Average water temperature, degrees C	As-Received Water Content %	Description of Fragments
TS-207	RC-5/RC-6	51 - 61 ft	See photograph(s)	95.6	20	3.6	Type I

Comments: Description of the appearance of the fragments retained in the drum:

Type I - Retained pieces remain virtually unchanged

Type II - Retained materials consist of large and small fragments

Type III - Retained material is exclusively small fragments

Before Test:

After Test:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	TS-208	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-4	Test Date:	05/06/19	Checked By:	jsc
Depth :	35.0-45.0 ft	Test Id:	501502		
Test Comment:	---				
Visual Description:	See photograph(s)				
Sample Comment:	---				

Slake Durability of Shales and Similar Weak Rocks by ASTM D4644

Boring ID	Sample ID	Depth	Visual Description	Slake Durability Index %	Average water temperature, degrees C	As-Received Water Content %	Description of Fragments
TS-208	RC-4	35 - 45 ft	See photograph(s)	97.0	20	6.9	Type I

Comments: Description of the appearance of the fragments retained in the drum:

Type I - Retained pieces remain virtually unchanged

Type II - Retained materials consist of large and small fragments

Type III - Retained material is exclusively small fragments

Before Test:

After Test:

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	TS-209	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	RC-1	Test Date:	05/06/19	Checked By:	jsc
Depth :	40.0-50.0 ft	Test Id:	501509		
Test Comment:	---				
Visual Description:	See photograph(s)				
Sample Comment:	---				

Slake Durability of Shales and Similar Weak Rocks by ASTM D4644

Boring ID	Sample ID	Depth	Visual Description	Slake Durability Index %	Average water temperature, degrees C	As-Received Water Content %	Description of Fragments
TS-209	RC-1	40 - 50 ft	See photograph(s)	97.0	19	1.8	Type I

Comments: Description of the appearance of the fragments retained in the drum:

Type I - Retained pieces remain virtually unchanged

Type II - Retained materials consist of large and small fragments

Type III - Retained material is exclusively small fragments

Before Test:

After Test:

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	P-102	Sample Number:	RC-1	Depth ft:	23'2"-24'5"

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, w/ argillaceous limestone seams and layers	Slake Durability 98.5% Slake Durability Classification(1) TYPE 1	Slake Durability 97.7% Slake Durability Classification(1) TYPE 1 A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/28/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	T-102	Sample Number:	RC-1	Depth ft:	26'-27'3"

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - sound, hard, fresh, light gray, massive bedding, wide joint spacing, w/ argillaceous limestone seams and layers	Slake Durability 97.9% Slake Durability Classification(1) TYPE 1	Slake Durability 96.5% Slake Durability Classification(1) TYPE 1 A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	T-103	Sample Number:	RC-2	Depth ft:	37-38'

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - sound, medium hard to hard, fresh, light gray, fine grained, wide joints, w/ argillaceous limestone seams and layers	Slake Durability 98.3% Slake Durability Classification(1) TYPE 1	Slake Durability 96.9% Slake Durability Classification(1) TYPE 1 A.S.T.M. Classification

Boring Number:		Sample Number:		Depth ft:	

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	TS-104	Sample Number:	RC-3	Depth ft:	37'6''-38'5''

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - sound, med. hard to hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ calcareous lenses and seams, w/ occasional near-horiz. shale seams	Slake Durability 97.8% Slake Durability Classification(1) TYPE I	Slake Durability 96.3% Slake Durability Classification(1) TYPE I A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	TS-104	Sample Number:	RC-5	Depth ft:	54'-55'

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - sound, med. hard to hard, fresh, lt gray to dk gray, fine grained, massive bedding, wide joint spacing, w/ near-horiz. argillaceous limestone layers and occasional shale seams	Slake Durability 98.5% Slake Durability Classification(1) TYPE I	Slake Durability 97.3% Slake Durability Classification(1) TYPE I A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/28/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	TS-104	Sample Number:	RC-7	Depth ft:	62-63'

Initial Sample	Cycle 1	Cycle 2
Description: SHALE (Eagle Ford)- sound, soft, fresh, dark gray, fine grained, massive bedding, close to wide joint spacing, w/ moderately hard near-horizontal calcareous shale seams & layers	Slake Durability 71.1% Slake Durability Classification(1) TYPE I	Slake Durability 40.6% Slake Durability Classification(1) TYPE I,II A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/28/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	T-201	Sample Number:	RC-6	Depth ft:	58'7"-59'7"

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk)-sound, medium hard to hard, fresh, light gray, fine grained, massive bedding, very close joints,w/ argillaceous limestone layers & occas. shale seams	Slake Durability 98.6% Slake Durability Classification(1) TYPE 1	Slake Durability 97.5% Slake Durability Classification(1) TYPE 1 A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	T-201	Sample Number:	RC-8	Depth ft:	66'5''-67'5''

Initial Sample	Cycle 1	Cycle 2
Description: SHALE (Eagle Ford)- sound, soft, fresh, dk gray, fine, grained, massive bedding, very close joints, w/ mod. hard calcareous shale seams & layers and occas. very hard calcareous stringers	Slake Durability 74.2% Slake Durability Classification(1) TYPE I	Slake Durability 44.2% Slake Durability Classification(1) TYPE I, II A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	TS-202	Sample Number:	RC-4	Depth ft:	39-40'

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk)- sound, hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ argillaceous limestone seams and layers	Slake Durability 98.0% Slake Durability Classification(1) TYPE -I	Slake Durability 96.6% Slake Durability Classification(1) TYPE-I A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/28/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	TS-202	Sample Number:	RC-6	Depth ft:	56'5"-57'5"

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk)- sound, hard, fresh, light gray, fine grained, massive bedding, wide joint spacing, w/ argillaceous limestone seams and layers	Slake Durability 98.5% Slake Durability Classification(1) TYPE I	Slake Durability 97.7% Slake Durability Classification(1) TYPE I A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/27/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	T-203	Sample Number:		Depth ft:	55'-56'

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - slightly fractured to sound, med. hard to hard, fresh, gray, fine grained, massive bedding, mod. close to wide joint spacing, w/ near-horiz. argillaceous limestone layers	Slake Durability 98.6% Slake Durability Classification(1) TYPE I	Slake Durability 97.7% Slake Durability Classification(1) TYPE I A.S.T.M. Classification

Boring Number:		Sample Number:		Depth ft:	

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	T-204	Sample Number:		Depth ft:	51'9''-52'10''

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - slightly fractured, soft to moderately hard, fresh, gray, thin bedding, mod. close to close joint spacing, w/ occasional shale lenses and seams	Slake Durability 97.9% Slake Durability Classification(1) TYPE I	Slake Durability 96.5% Slake Durability Classification(1) TYPE I A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	T-205	Sample Number:	RC-2	Depth ft:	45'6''-46'5''

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - slightly fractured to sound, med. hard to hard, fresh, gray, fine grained, massive bedding, mod. close to wide joint spacing, w/ near-horiz. argillaceous limestone layers	Slake Durability 97.6% Slake Durability Classification(1) TYPE I	Slake Durability 95.4% Slake Durability Classification(1) TYPE I A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	T-205	Sample Number:	RC-4	Depth ft:	55'5''-56'9''

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - slightly fractured to sound, med. hard to hard, fresh, gray, fine grained, massive bedding, mod. close to wide joint spacing, w/ near-horiz. argillaceous limestone layers	Slake Durability 98.6% Slake Durability Classification(1) TYPE I	Slake Durability 97.7% Slake Durability Classification(1) TYPE I A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

Alliance Geotechnical Group

Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

ASTM D 4644-16

Project Name:	DART D-2			Date Tested:	1/23/2019
Project Number:	E17-0811				
Boring Number:	T-205	Sample Number:	RC-5B	Depth ft:	68'8''-69'6''

Initial Sample	Cycle 1	Cycle 2
Description: LIMESTONE (Austin Chalk) - slightly fractured to sound, med. hard to hard, fresh, gray, fine grained, massive bedding, mod. close to wide joint spacing, w/ near-horiz. argillaceous limestone layers	Slake Durability 98.6% Slake Durability Classification(1) TYPE I	Slake Durability 97.8% Slake Durability Classification(1) TYPE I A.S.T.M. Classification

Boring Number:	Sample Number:	Depth ft:

Initial Sample	Cycle 1	Cycle 2
Description:	Slake Durability Slake Durability Classification(1)	Slake Durability Slake Durability Classification(1) A.S.T.M. Classification

Tested By:	BV	Reviewed By:	JP	Date Reviewed:	1/29/2019

APPENDIX F-10

SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE

Client:	Aliiance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	05/24/19
Tested By:	tlm
Checked By:	jsc
Sample Type:	Core
Sample Description:	---
Strain Rate:	2.5%/min.

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Boring ID	Sample ID	Depth	Test No.	Thickness (L), in.			Diameter (D), in.	Failure Load (P), lb.	Splitting Tensile Strength, psi
B-3	RC-6	70.0-75.0	ST-3-1	1.07	1.08	1.07	1.99	756	225
B-3	RC-6	70.0-75.0	ST-3-2	1.05	1.05	1.05	1.99	791	241
B-3	RC-6	70.0-75.0	ST-3-3	1.03	1.04	1.04	2.00	325	100

ST-3-1

Intact material failure

L/D: 0.5

ST-3-2

Intact material failure

L/D: 0.5

ST-3-3

Intact material failure

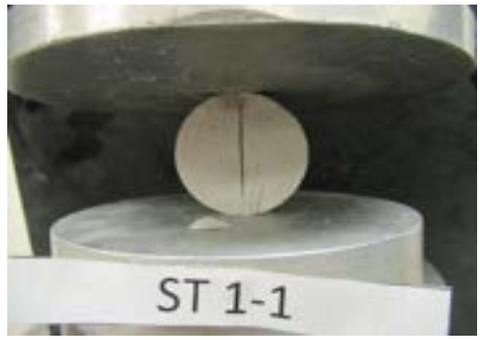
L/D: 0.5

Client:	Aliiance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	05/10/19
Tested By:	tlm/trm
Checked By:	jsc
Sample Type:	Core
Sample Description:	---
Strain Rate:	2.5%/min.

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Boring ID	Sample ID	Depth	Test No.	Thickness (L), in.			Diameter (D), in.	Failure Load (P), lb.	Splitting Tensile Strength, psi
TS-207	RC-5/RC-6	51.0-61.0	ST-1-1	0.98	0.98	0.97	1.99	729	239
TS-207	RC-5/RC-6	51.0-61.1	ST-1-2	1.07	1.06	1.06	1.99	1030	309
TS-207	RC-5/RC-6	51.0-61.2	ST-1-3	1.08	1.07	1.08	1.99	1035	307

ST-1-1



Intact material failure

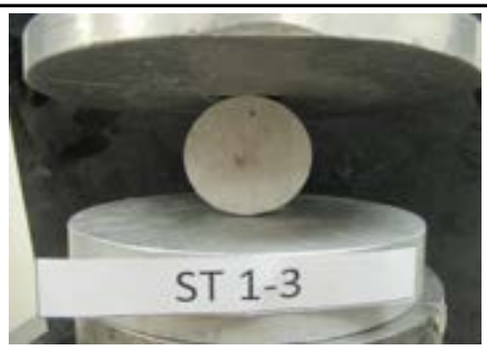
L/D: 0.5

ST-1-2

Intact material failure

L/D: 0.5

ST-1-3



Intact material failure

L/D: 0.5

Client:	Aliiance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	05/10/19
Tested By:	tlm/trm
Checked By:	jsc
Sample Type:	Core
Sample Description:	---
Strain Rate:	2.5%/min.

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Boring ID	Sample ID	Depth	Test No.	Thickness (L), in.			Diameter (D), in.	Failure Load (P), lb.	Splitting Tensile Strength, psi
TS-209	RC-1	40.0-50.0	ST-2-1	1.04	1.04	1.04	1.98	822	254
TS-209	RC-1	40.0-50.0	ST-2-2	1.04	1.04	1.04	1.98	792	245
TS-209	RC-1	40.0-50.0	ST-2-3	1.01	1.01	1.02	1.98	703	223

ST-2-1

Intact material failure

L/D: 0.5

ST-2-2

Intact material failure

L/D: 0.5

ST-2-3

Intact material failure

L/D: 0.5

APPENDIX F-11

THIN SECTION PETROGRAPHIC ANALYSIS

DART Project

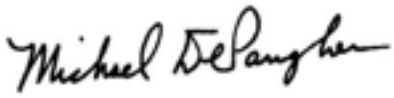
Petrographic Report #E3M

March 22, 2019

for

Mark P. Dobday
GeoTesting Express, Inc.
125 Nagog Park
Acton, MA 01720

by



Michael DePangher, Ph.D.
Spectrum Petrographics, Inc.

Key to Petrographic and Photomicrographic Descriptions - v. 170118

Clay minerals common in altered rocks must often be identified by X-ray diffraction either because their optic properties are not diagnostic or because they are too fine grained to be reliably identified by optical methods. The term "clay" is used herein to denote fine grained phyllosilicates in general. Under ideal conditions, it is often possible to optically discriminate between 4 major groups: kaolinite, smectite, mica (including illite), and chlorite. This is done whenever conditions permit.

The term "sericite" is applied to fine grained colorless phyllosilicates that show upper 2nd order maximum interference colors. These could include muscovite, illite, paragonite, lepidolite, margarite, clintonite, pyrophyllite, and talc. The term "intermediate clay" is applied to fine grained very pale or colorless phyllosilicates that show upper 1st order maximum interference colors. These are probably dominated by chlorite, smectite, and mixed-layer illite/smectite.

The term "opaques" is used to refer to all materials opaque (and sometimes semi-opaque) to transmitted light. The term "FEOH" is herein used to indicate fine grained, yellowish to reddish brown, earthy materials of varying opacity in transmitted light. FEOH is probably mostly Fe oxy-hydroxides but may sometimes include sphalerite, realgar, orpiment, jarosite, a number of Mn oxy-hydroxides, and organic matter.

A question mark after a rock or mineral name in a petrographic description means that there is uncertainty about the identification of that rock or mineral.

Particle size distributions are given as (A-B µm), where A and B are the median and largest particle sizes, respectively, in microns. A question mark (?) in the position of A or B indicates that the value of A or B was indeterminate, probably because of excessively large or small particle size or statistically insignificant numbers of particles.

Mineral abundances are visual estimates for an entire slide. For multi-lithologic materials (cuttings, etc...), mineralogy, textures, and alteration are described only for the dominant lithology.

Section preparation codes are as follows: (1) Format: 27 x 46 mm; 51 x 76 mm; or 1" round; (2) Finish: standard lapping (STD); or polished (POL); (3) Stains: sodium cobaltinitrite (SCN); alizarin red S + potassium ferricyanide (ARSPF); and barium chloride + potassium rhodizonate (BCPR); and (4) Cover: none; or permanent Loctite acrylic (PLA).

Photomicrograph captions contain the following items of information in consecutive order separated by forward slashes: (1) sample identifier; (2) JPG image file name composed of concatenated [job identification code + sequence number]; (3) illumination type; and (4) field of view (FOV). For illumination types: "PPL" indicates plane-polarized light; "XPL indicates cross-polarized light; "R" indicates reflected light. "550" means that a 550 nanometer wavelength plate was inserted in the light path. "C" indicates that the substage condenser was <u>in</u> (sometimes used for Fe-oxides). "O" indicates oblique incident illumination. These various illuminations can be combined. "CON" indicates conoscopic illumination. POL means that a polarizing filter was used with the lens, and DAY means the sample was photographed in diffused daylight. Unless otherwise noted, sequential images are taken in XPL and PPL of a single field of view.

Features on photomicrographs are indicated by the number of the feature in the ALTERATION section of the text or by a mineral name abbreviation, e.g., **Q**uartz, **P**lagioclase, **K**-feldspar, **ser**icite, **b**io**t**ite, **fe**rroan **c**al**c**ite, **act**inolite.

Igneous rock classifications are according to IUGS (1973; 1979); sandstones are classified according to McBride (1963); mudrocks are classified according to Picard (1971); carbonates are classified according to Folk (1959); and metamorphic rocks classified according to IUGS (Fettes and Desmons, 2011).

The term “protolith” is used for the interpreted primary lithology. The term “precursor” is used for a secondary lithology from which the current rock was derived.

SAMPLE # **P-102 26'-28'4"** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (90%) + smectite (5%) + opaques (5%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (40%)

Coiled Microfossil fragments (40%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

Matrix (60%) is composed of micrite calcite + smectite + opaques.

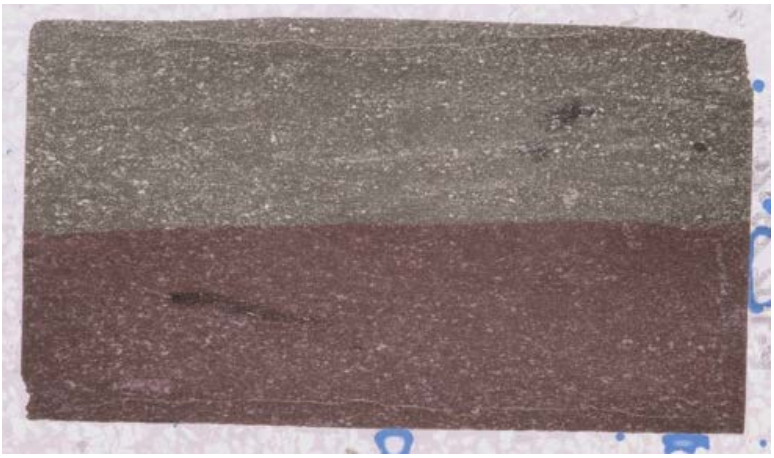
Cement (0%) was not observed.

ALTERATION No other alteration features were observed.

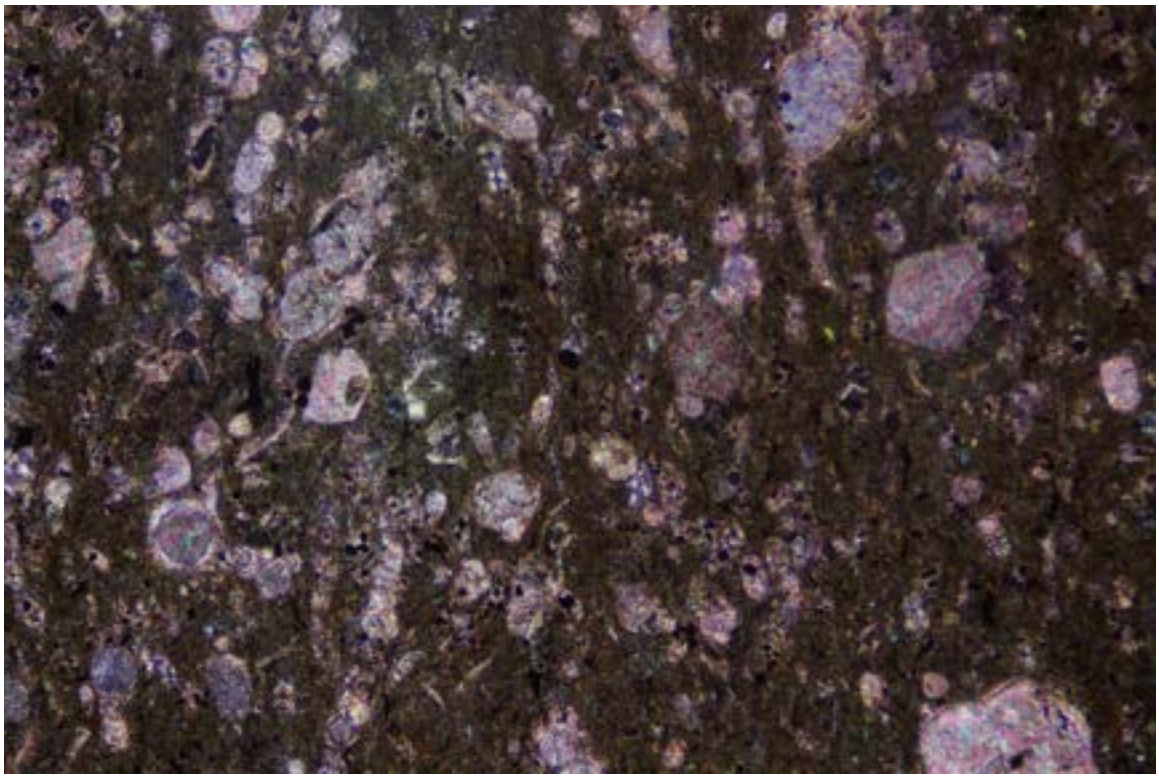
SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

IMAGES

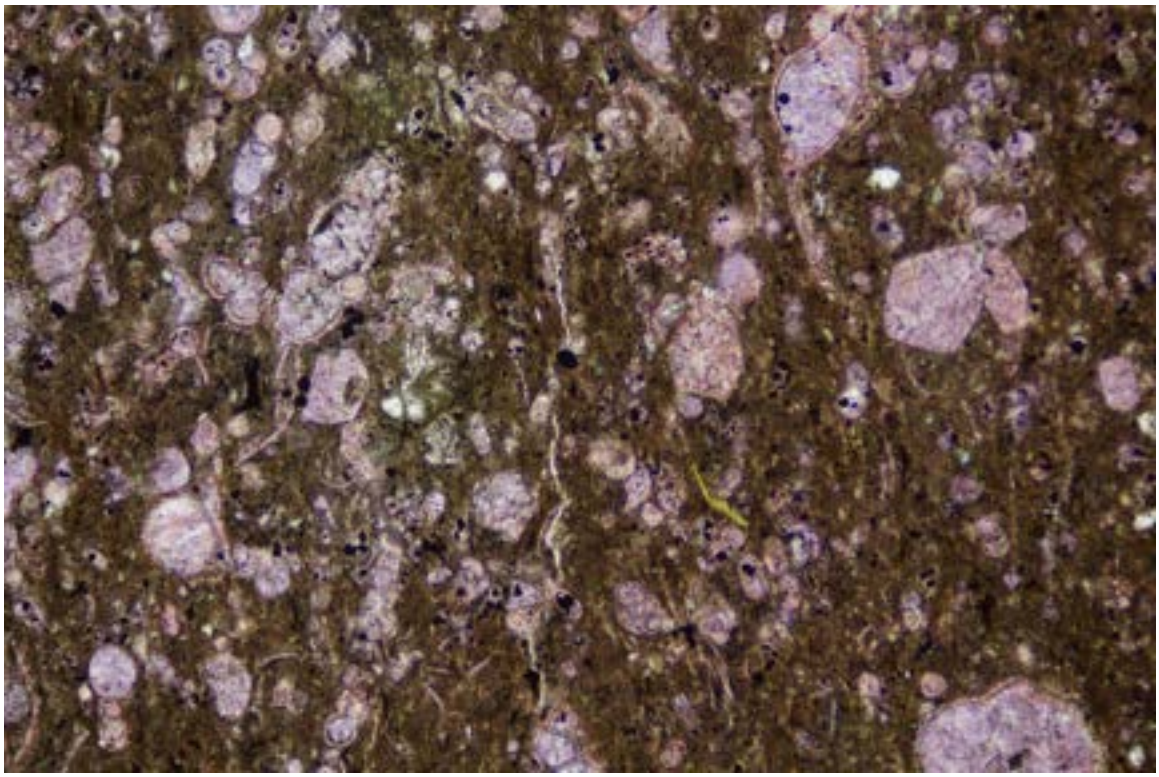
P-102 26'-28'4" E3M-001.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



P-102 26'-28'4" E3M-002.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



P-102 26'-28'4" E3M-033.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



P-102 26'-28'4" E3M-034.jpg/PPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.

SAMPLE # **T-102 RC-1 28'3"-30'4"** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (87%) + smectite (10%) + opaques (2%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (15%)

Coiled Microfossil fragments (15%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

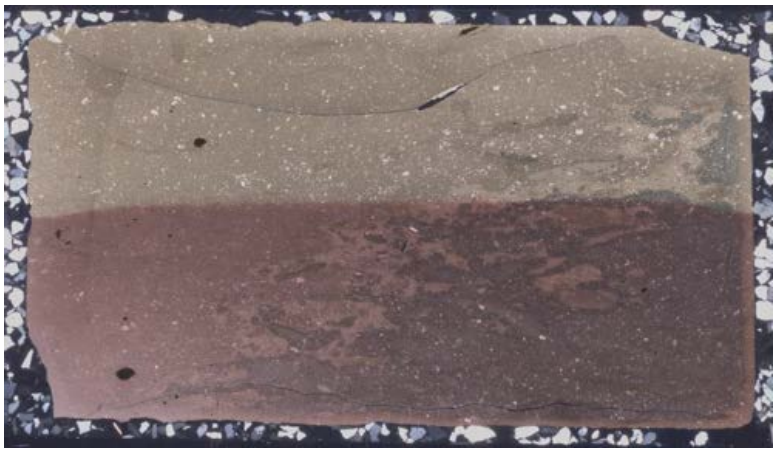
Matrix (85%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

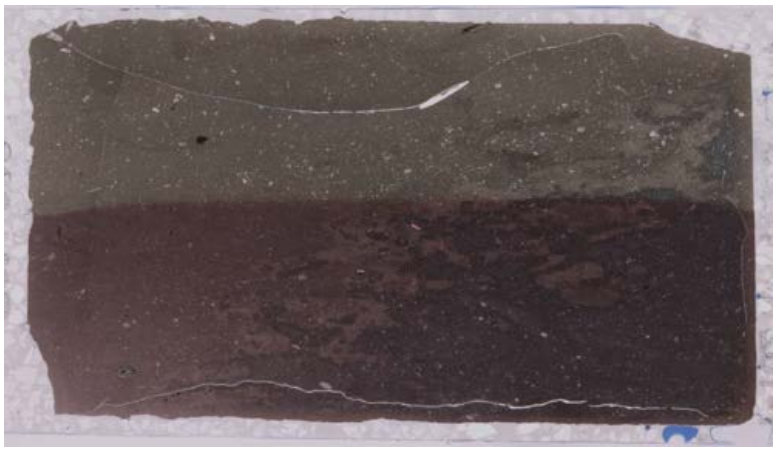
ALTERATION Alteration features in relative chronological order from oldest to youngest are: (1) vuggy veinlets of weakly ferroan calcite ± opaques.

SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

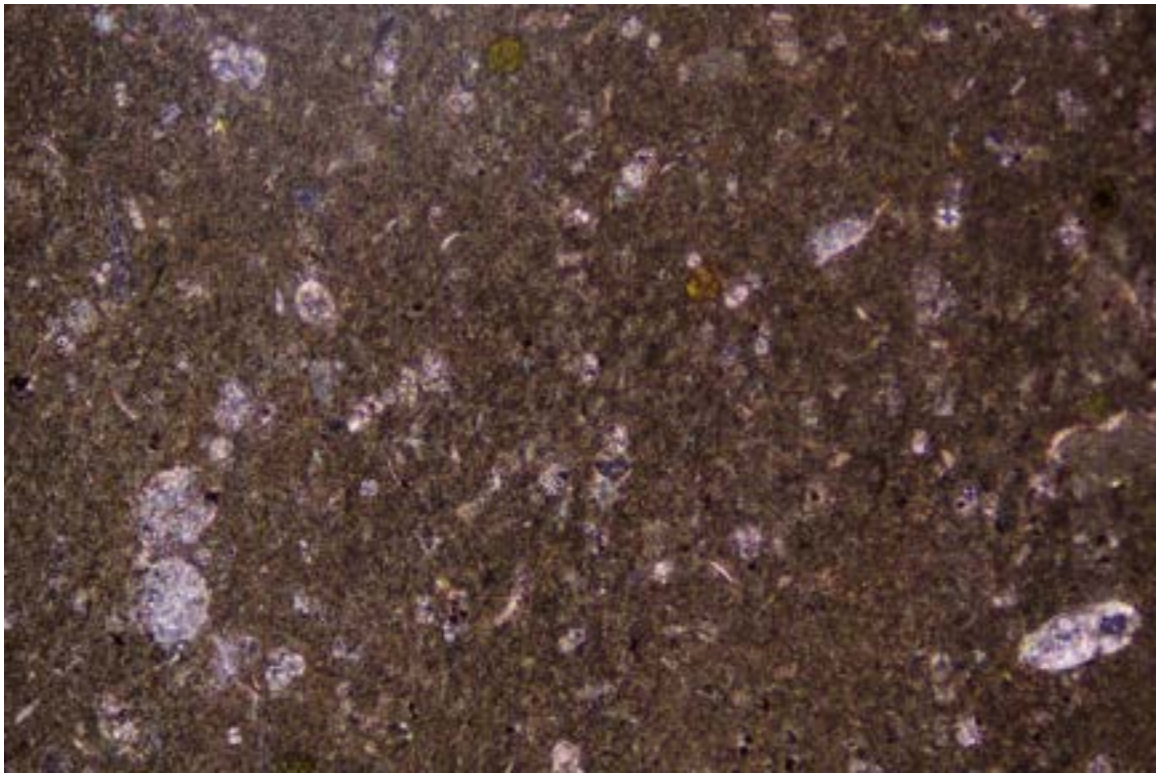
IMAGES



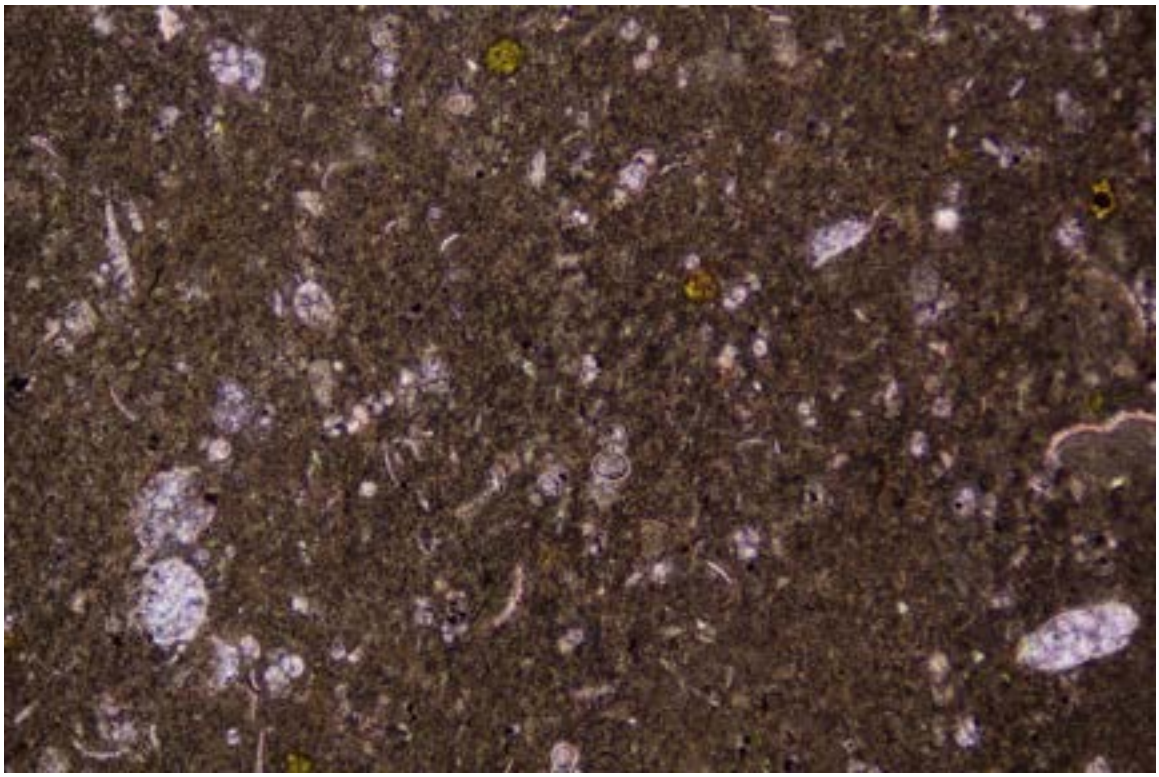
T-102 RC-1 28'3"-30'4" E3M-003.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-102 RC-1 28'3"-30'4" E3M-004.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-102 RC-1 28'3"-30'4" E3M-035.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



T-102 RC-1 28'3"-30'4" E3M-036.jpg/PPL/FOV = 0.96 x 1.40 mm
LIMESTONE showing typical appearance.

SAMPLE # **T-103 RC-2 38'4"-40'5"** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (86%) + smectite (10%) + opaques (3%) + collophane (1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (25%)

Coiled Microfossil fragments (24%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (1%) composed of collophane.

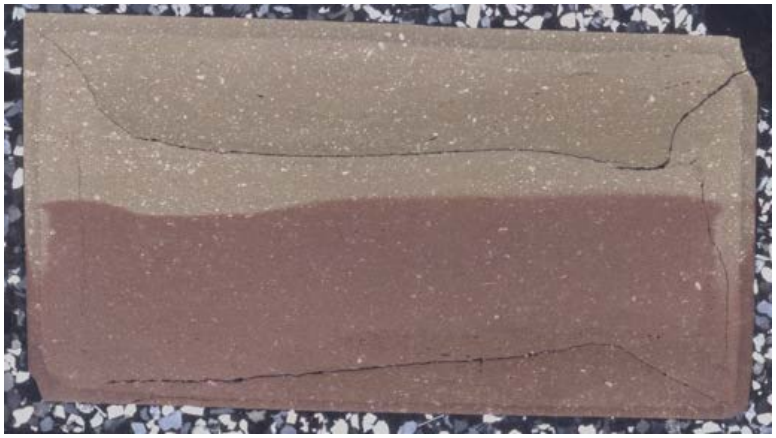
Matrix (75%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

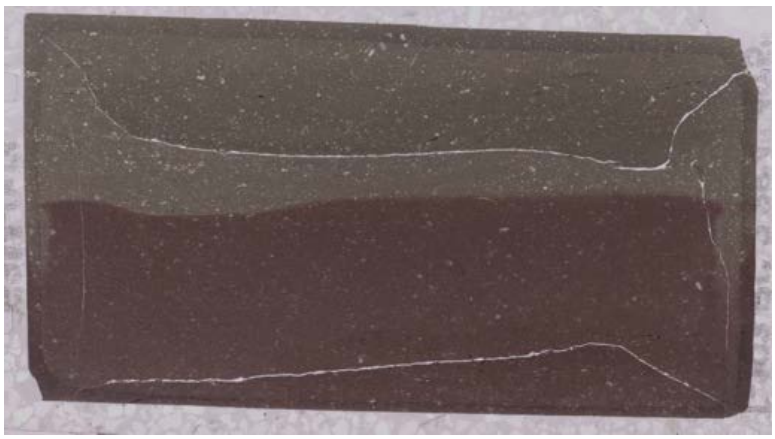
ALTERATION No other alteration features were observed.

SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

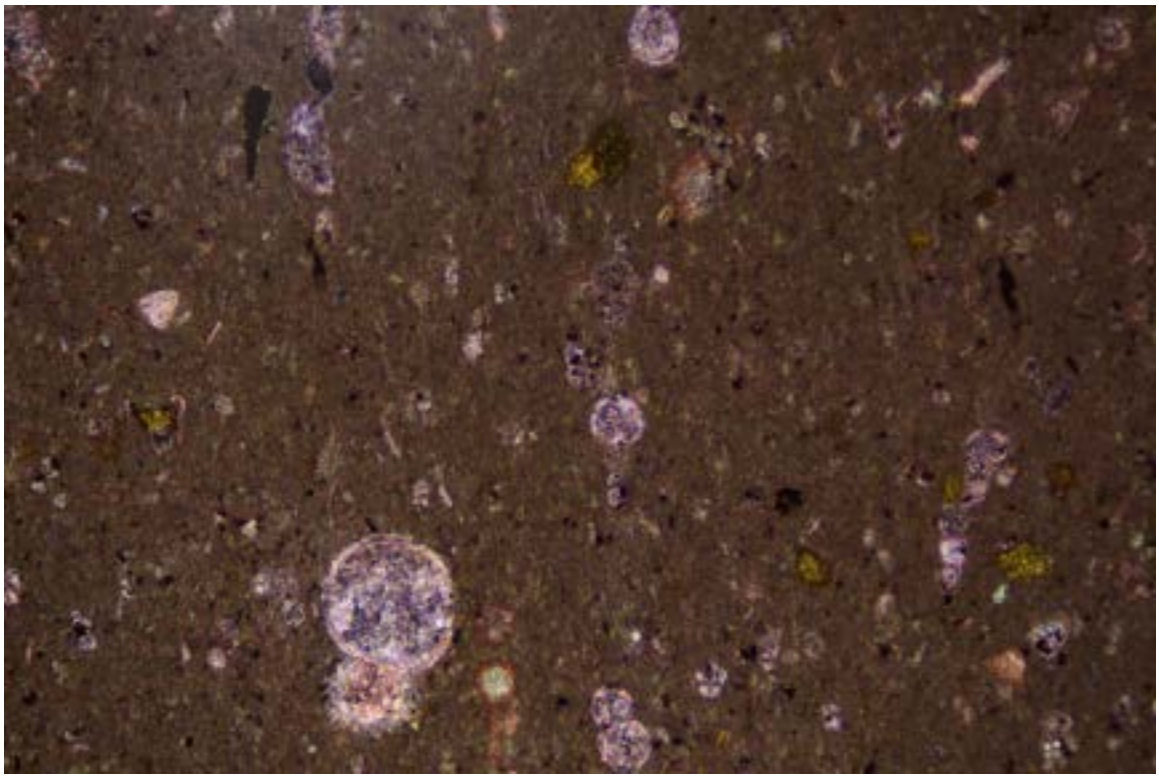
IMAGES



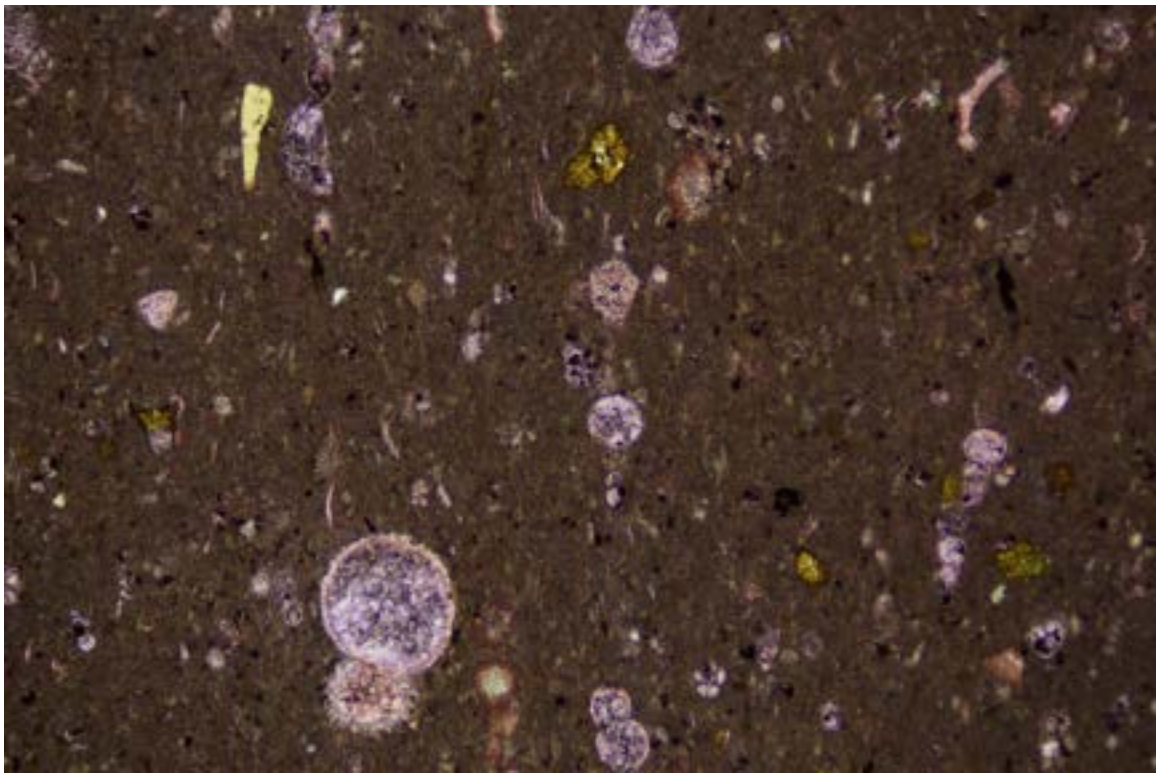
T-103 RC-2 38'4"-40'5" E3M-005.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-103 RC-2 38'4"-40'5" E3M-006.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-103 RC-2 38'4"-40'5" E3M-037.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



T-103 RC-2 38'4"-40'5" E3M-038.jpg/PPL/FOV = 0.96 x 1.40 mm
LIMESTONE showing typical appearance.

SAMPLE # **T-201 RC-5 51'-52'3"** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (92%) + smectite (5%) + opaques (3%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (30%)

Coiled Microfossil fragments (30%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

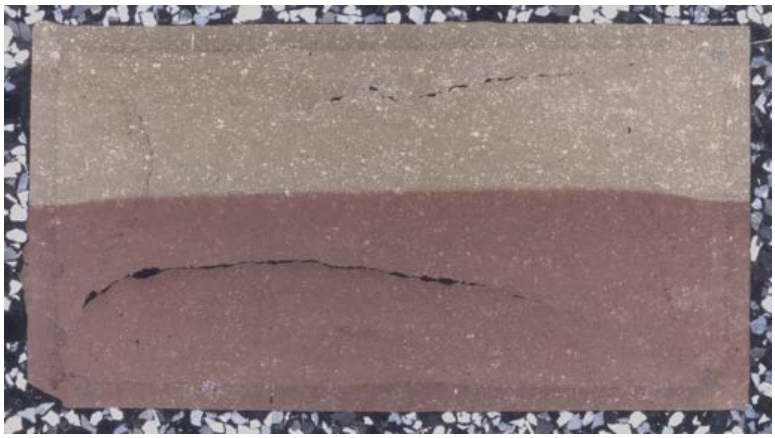
Matrix (70%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

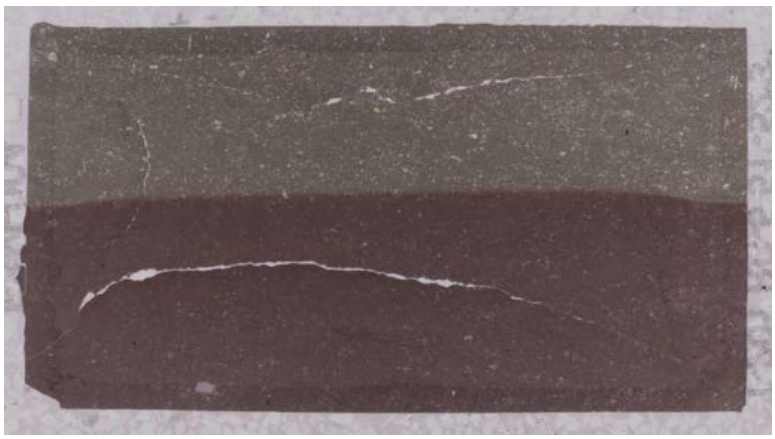
ALTERATION Alteration features in relative chronological order from oldest to youngest are: (1) vuggy veinlets of weakly ferroan calcite ± opaques.

SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

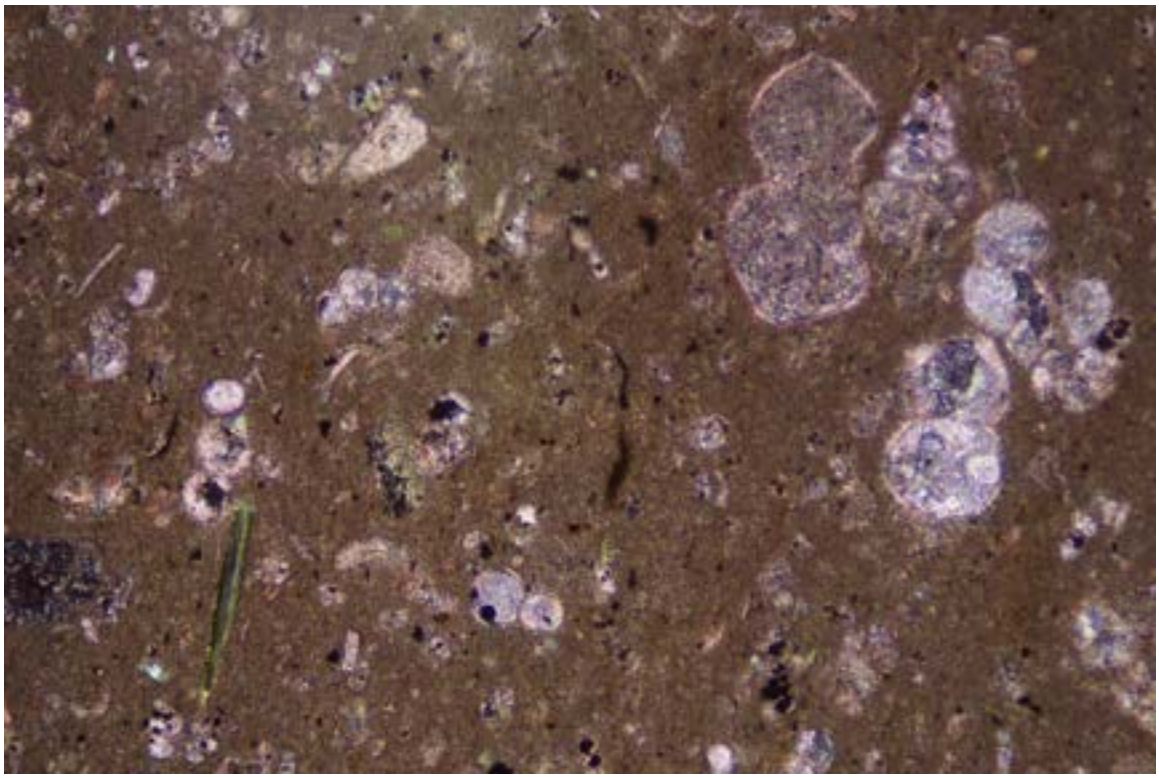
IMAGES



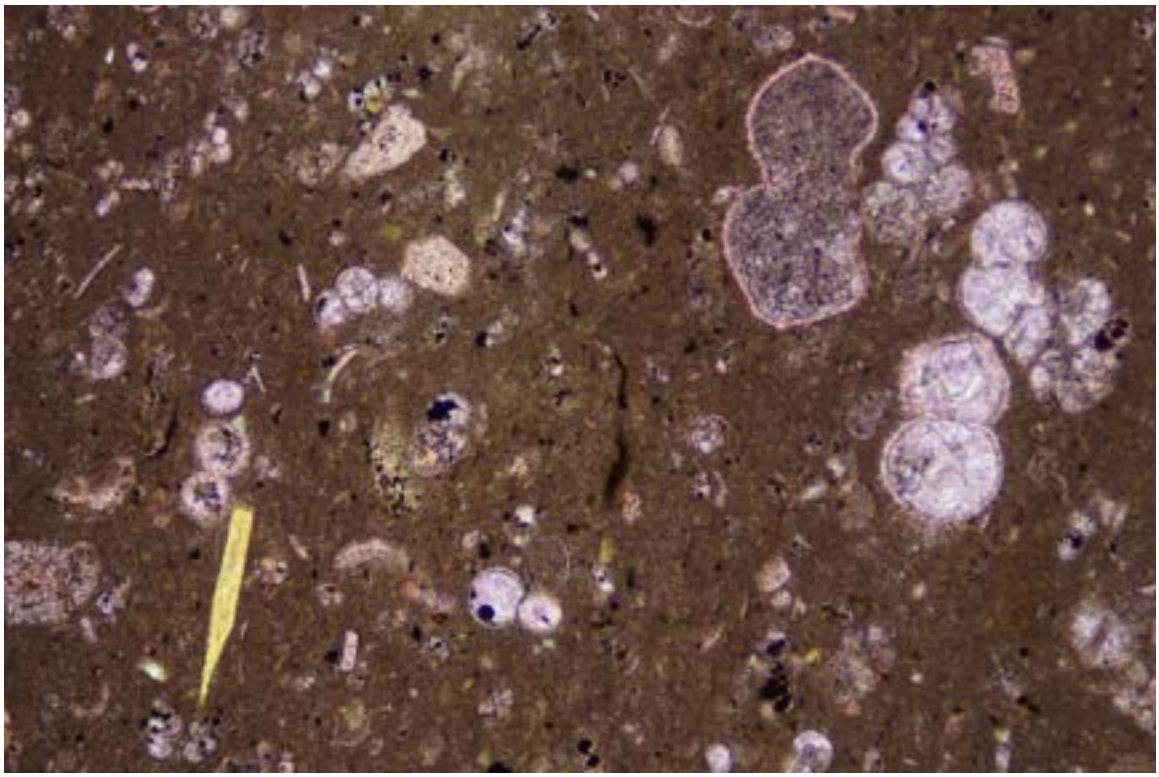
T-201 RC-5 51'-52'3" E3M-007.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-201 RC-5 51'-52'3" E3M-008.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-201 RC-5 51'-52'3" E3M-039.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



T-201 RC-5 51'-52'3" E3M-040.jpg/PPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.

SAMPLE # **T-201 RC-7 63'10"-65'** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a silty to very fine sandy biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (60%) + quartz (10%) + collophane (10%) + glauconite (10%) + smectite (5%) + opaques (5%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments + detrital quartz + glauconite + fish skeletal fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (70%)

Coiled Microfossil fragments (30%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Quartz (10%) silt to very fine sand

Fish Bone and Scale fragments (10%) composed of collophane.

Glauconite (10%)

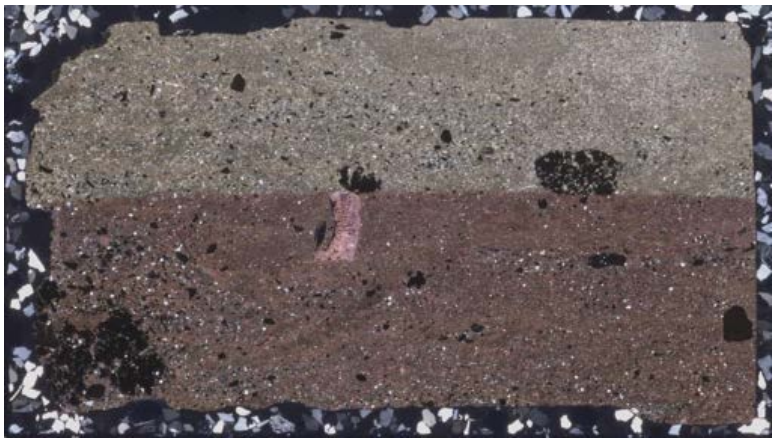
Matrix (30%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

ALTERATION No other alteration features were observed.

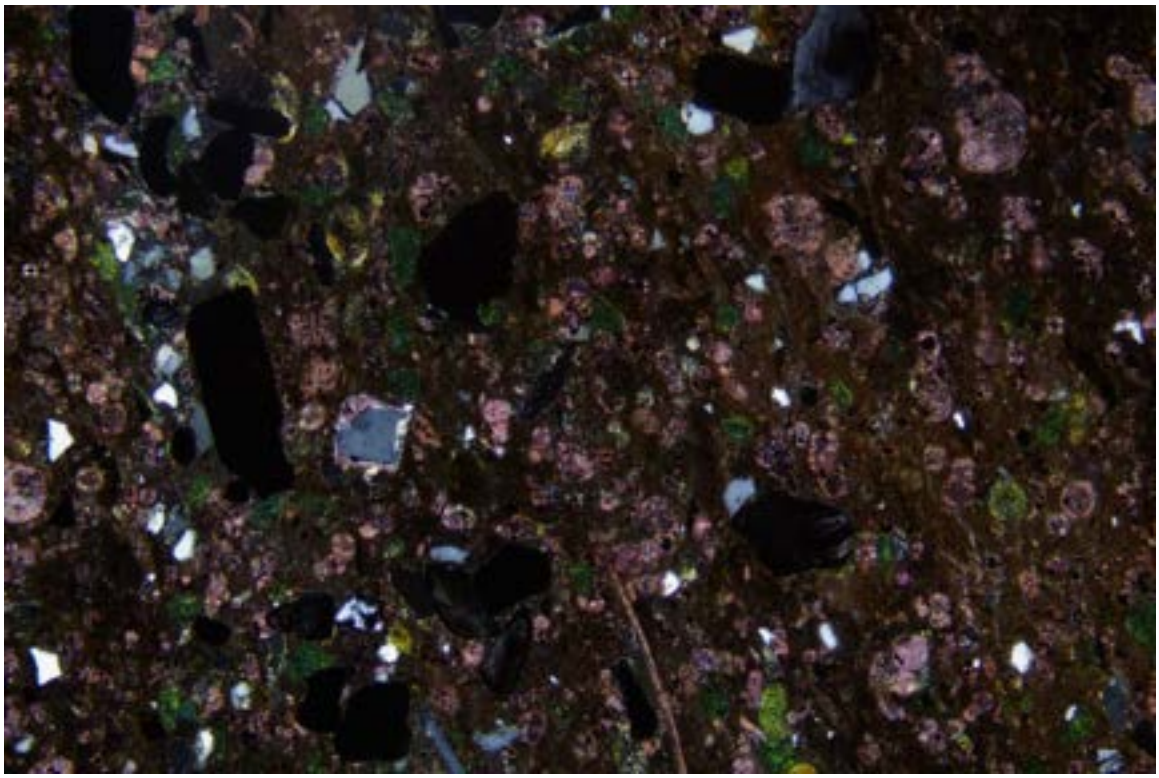
SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

IMAGES

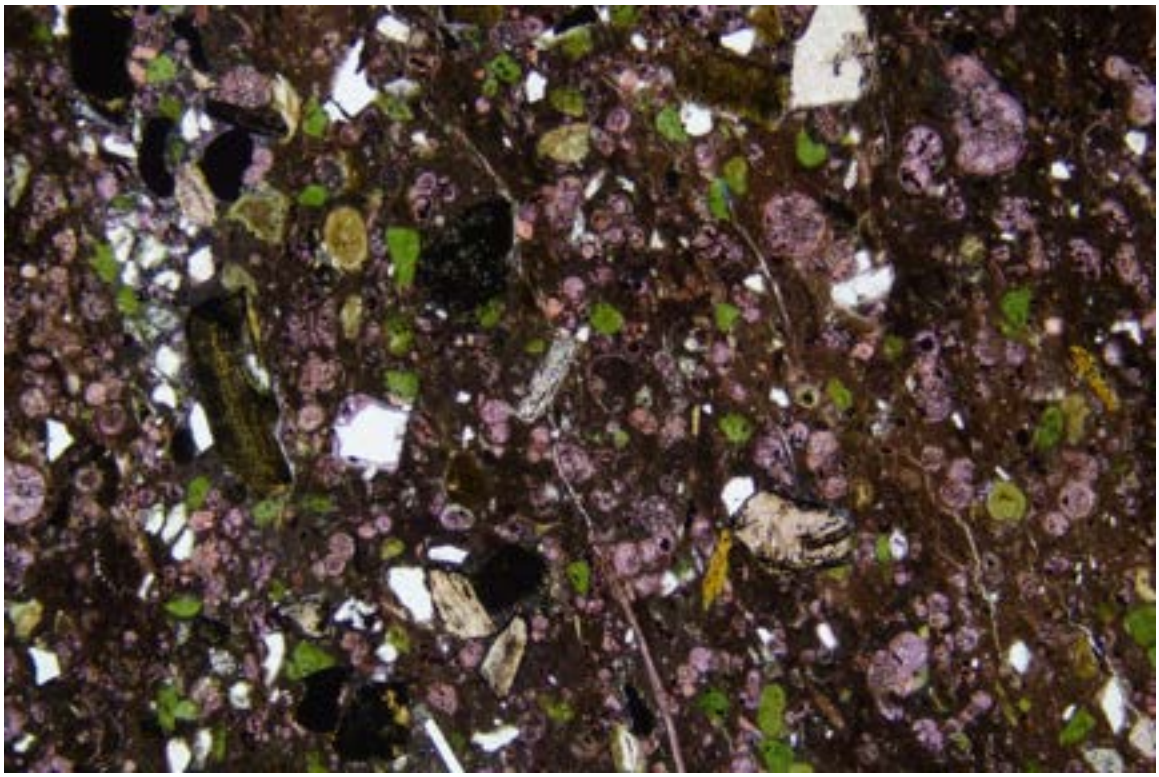


T-201 RC-7 63'10"-65' E3M-009.jpg/XPL/FOV = 27 x 46 mm CLAYSTONE showing typical appearance.

T-201 RC-7 63'10"-65' E3M-010.jpg/PPL/FOV = 27 x 46 mm CLAYSTONE showing typical appearance.



T-201 RC-7 63'10"-65' E3M-041.jpg/XPL/FOV = 1.85 x 2.69 mm CLAYSTONE showing typical appearance.



T-201 RC-7 63'10"-65' E3M-042.jpg/PPL/FOV = 1.85 x 2.69 mm CLAYSTONE showing typical appearance.

SAMPLE # **T-201 RC-8 67'5"-69'6"** March 22, 2019

ROCK NAME CLAYSTONE -- probably formed as a silty to very fine sandy claystone.

MINERALS Smectite (84%) + quartz (12%) + opaques (4%) + calcite (<1) + collophane (<1%) + illite (<1%).

TEXTURES The sample is a claystone composed of smectite + quartz silt to very fine sand. Preferential orientation of clay defines a weakly directed fabric.

Clasts (12%)

Quartz (12%) silt to very fine sand

Illite (<1%)

Fish Bone and Scale fragments (<1%) composed of collophane.

Matrix (88%) is composed of smectite + opaques.

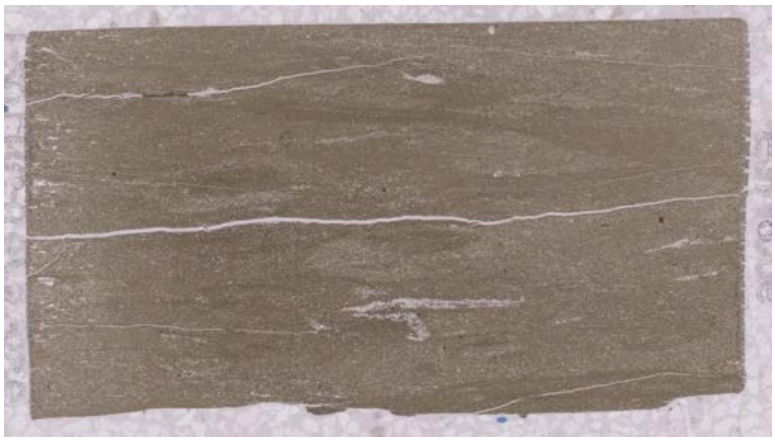
Cement (0%) was not observed.

ALTERATION No other alteration features were observed.

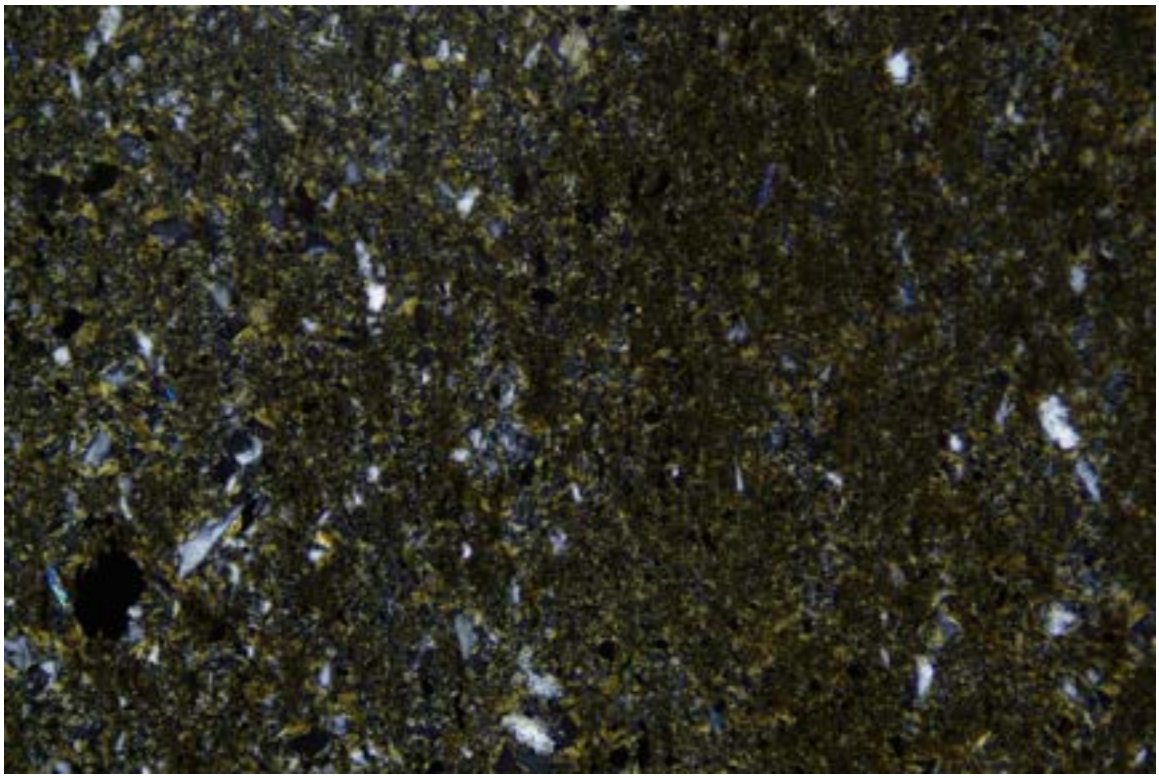
SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

IMAGES

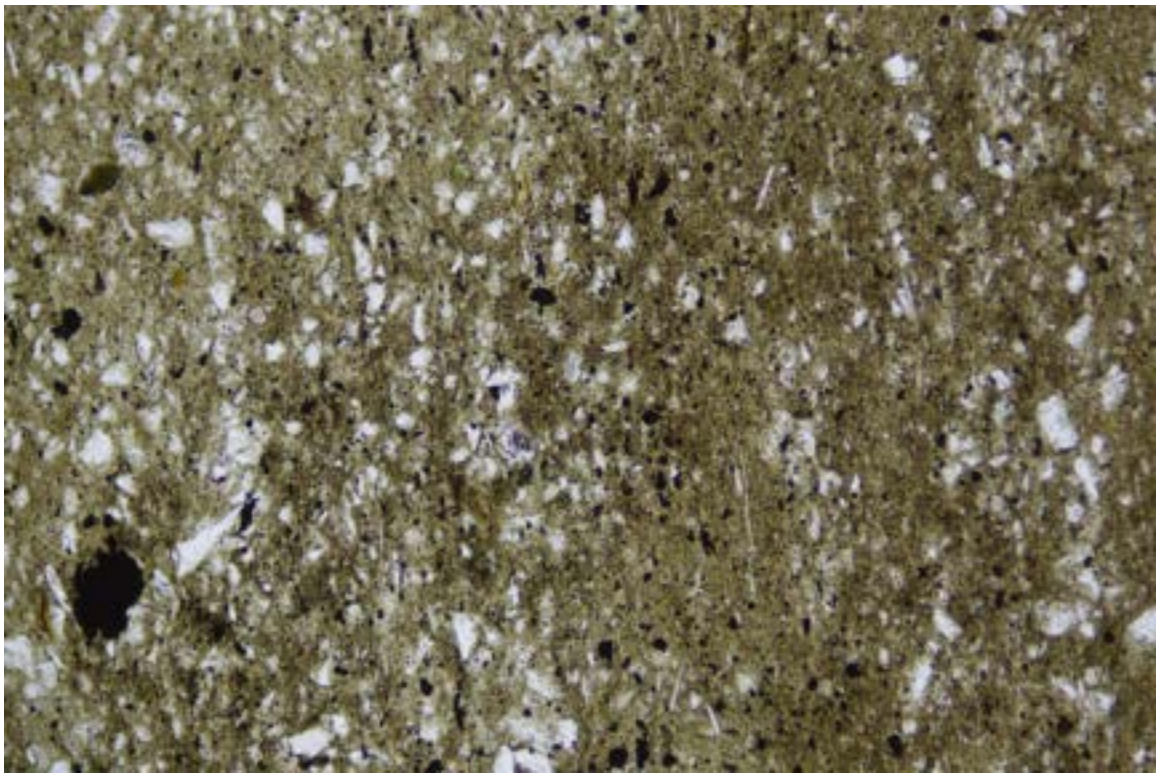
T-201 RC-8 67'5"-69'6" E3M-011.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-201 RC-8 67'5"-69'6" E3M-012.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-201 RC-8 67'5"-69'6" E3M-043.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



T-201 RC-8 67'5"-69'6" E3M-044.jpg/PPL/FOV = 0.96 x 1.40 mm
LIMESTONE showing typical appearance.

SAMPLE # **T-203 60'-65'** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (86%) + smectite (10%) + opaques (2%) + collophane (2%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (14%)

Coiled Microfossil fragments (12%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (2%) composed of collophane.

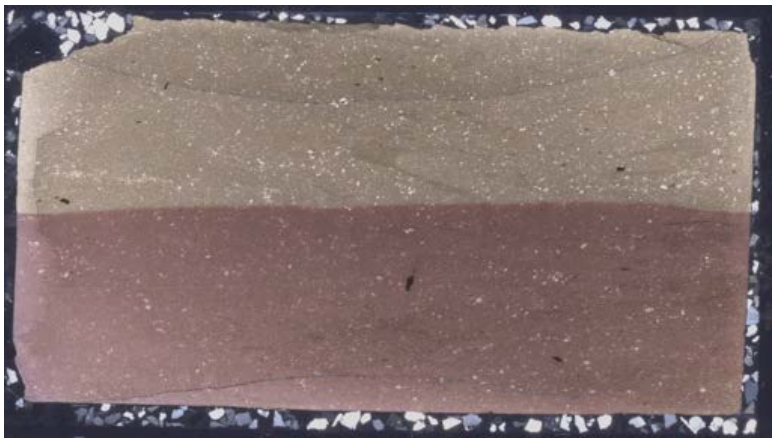
Matrix (86%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

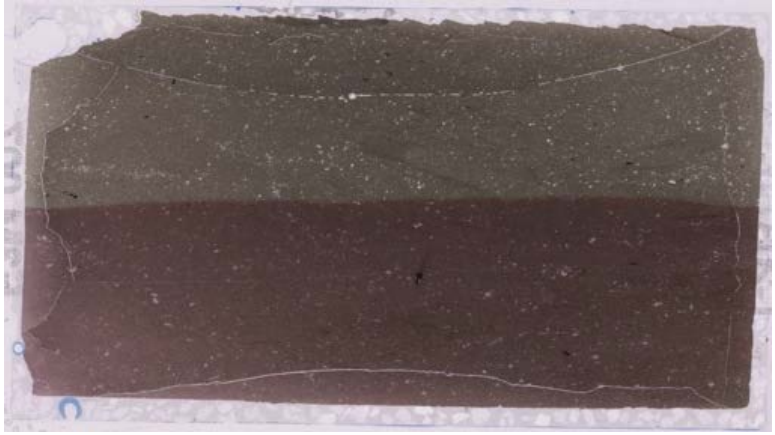
ALTERATION No other alteration features were observed.

SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

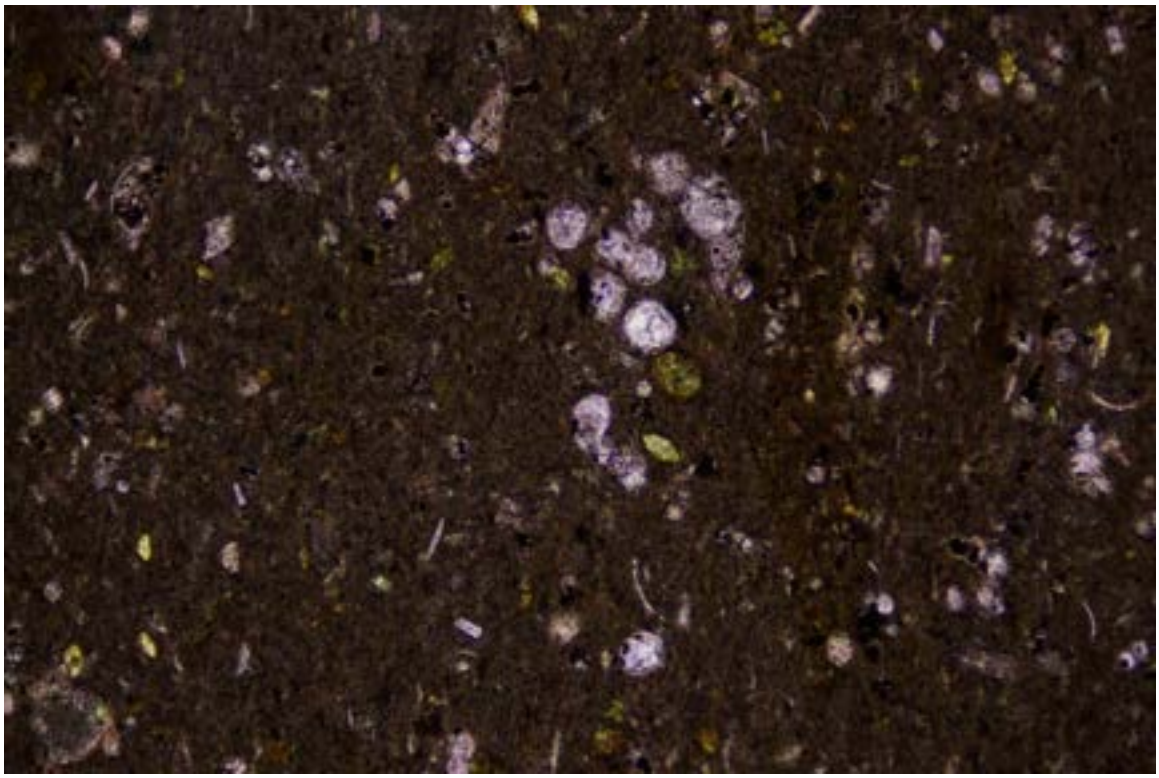
IMAGES



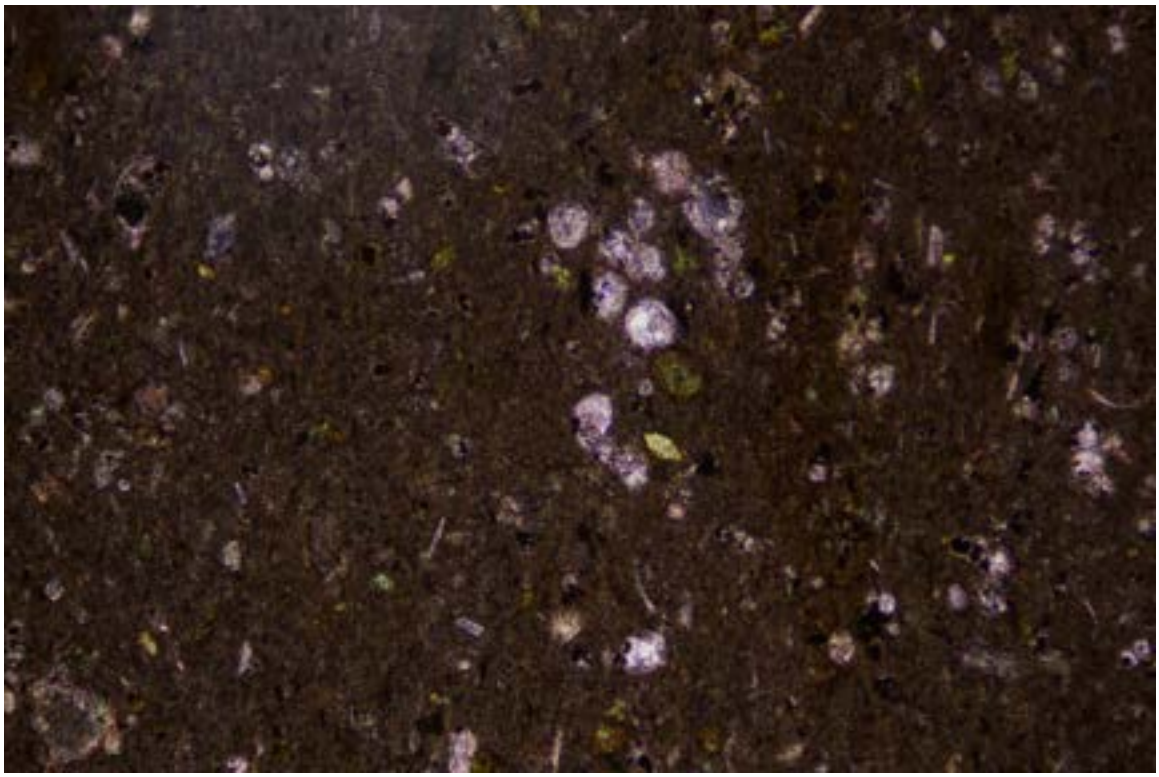
T-203 60'-65' E3M-013.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-203 60'-65' E3M-014.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-203 60'-65' E3M-045.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



T-203 60'-65' E3M-046.jpg/PPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.

SAMPLE # **T-204 52'10"-55'** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (88%) + smectite (10%) + opaques (2%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (10%)

Coiled Microfossil fragments (10%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

Matrix (90%) is composed of micrite calcite + smectite + opaques.

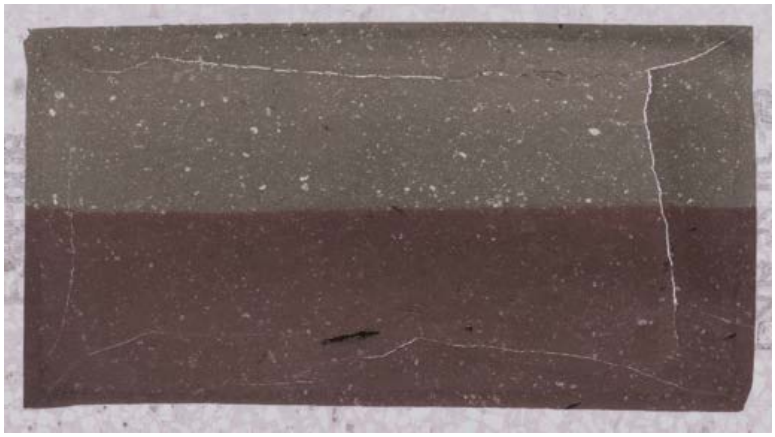
Cement (0%) was not observed.

ALTERATION No other alteration features were observed.

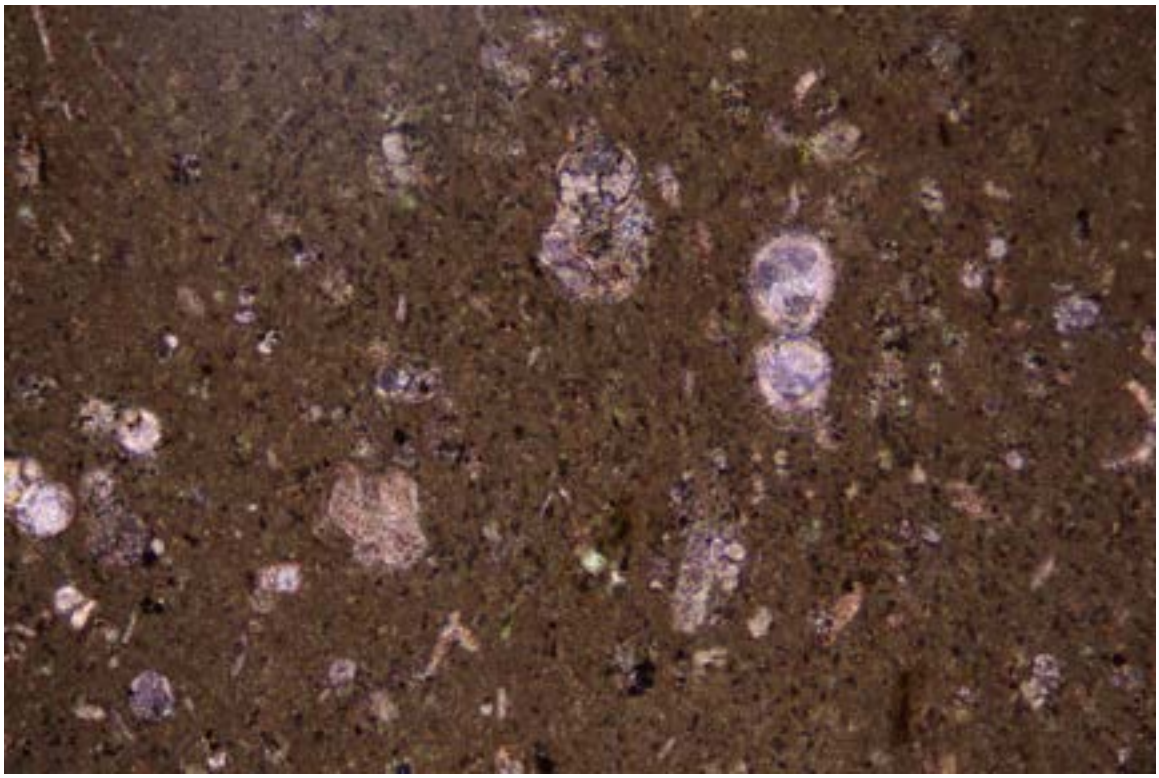
SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

IMAGES

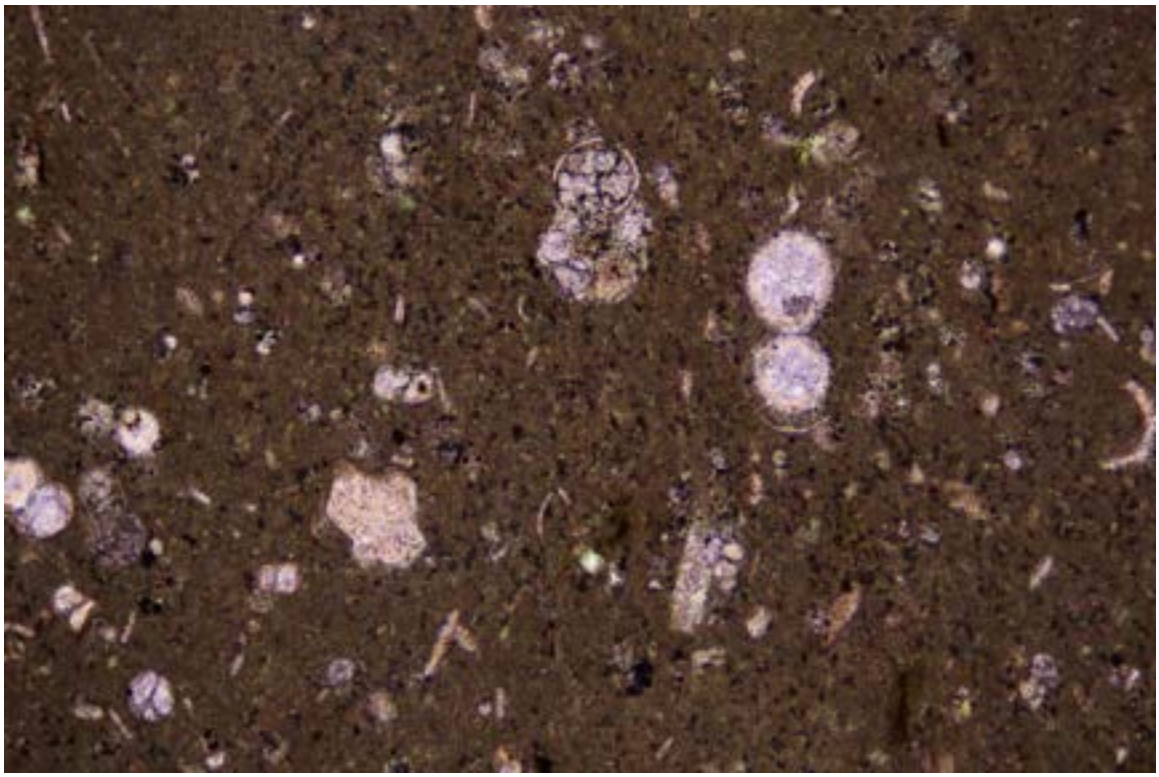
T-204 52'10"-55' E3M-015.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-204 52'10"-55' E3M-016.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-204 52'10"-55' E3M-047.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



T-204 52'10"-55' E3M-048.jpg/PPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.

SAMPLE # **T-205 RC-2 47'5"-48'11"** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (91%) + smectite (5%) + opaques (4%) + quartz (<1%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (20%)

Coiled Microfossil fragments (20%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

Quartz (<1%)

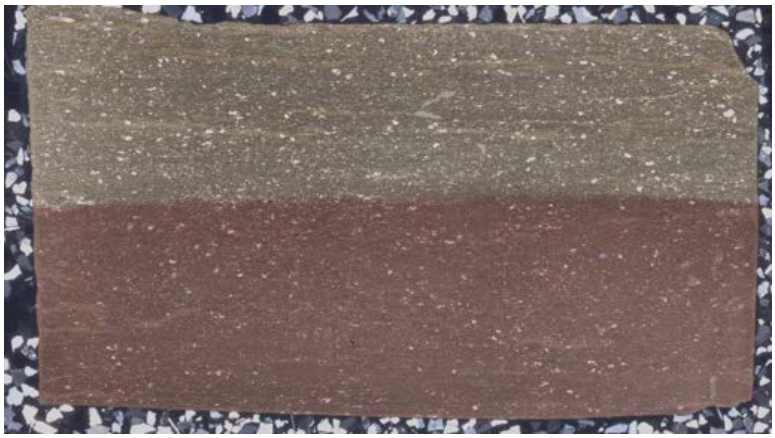
Matrix (80%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

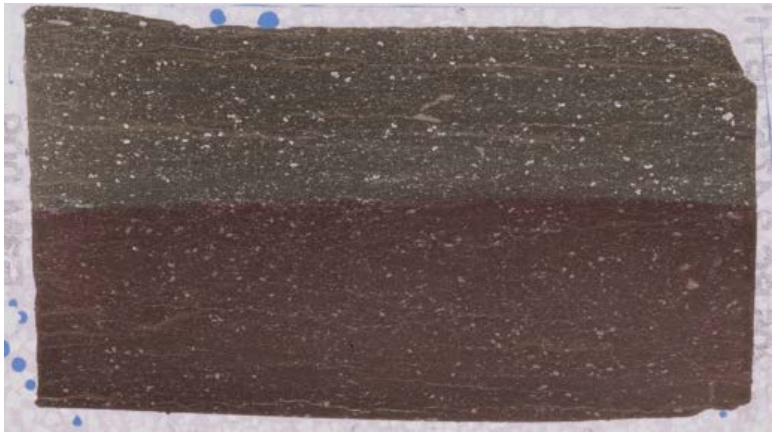
ALTERATION No other alteration features were observed.

SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

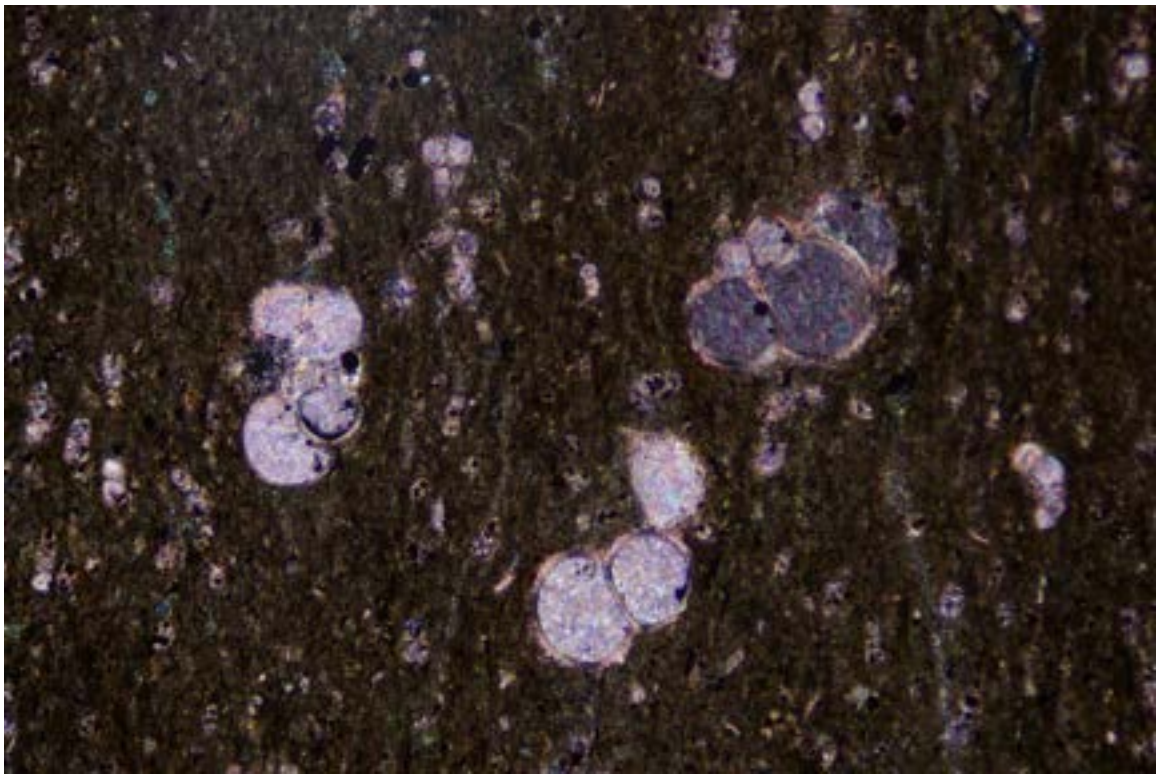
IMAGES



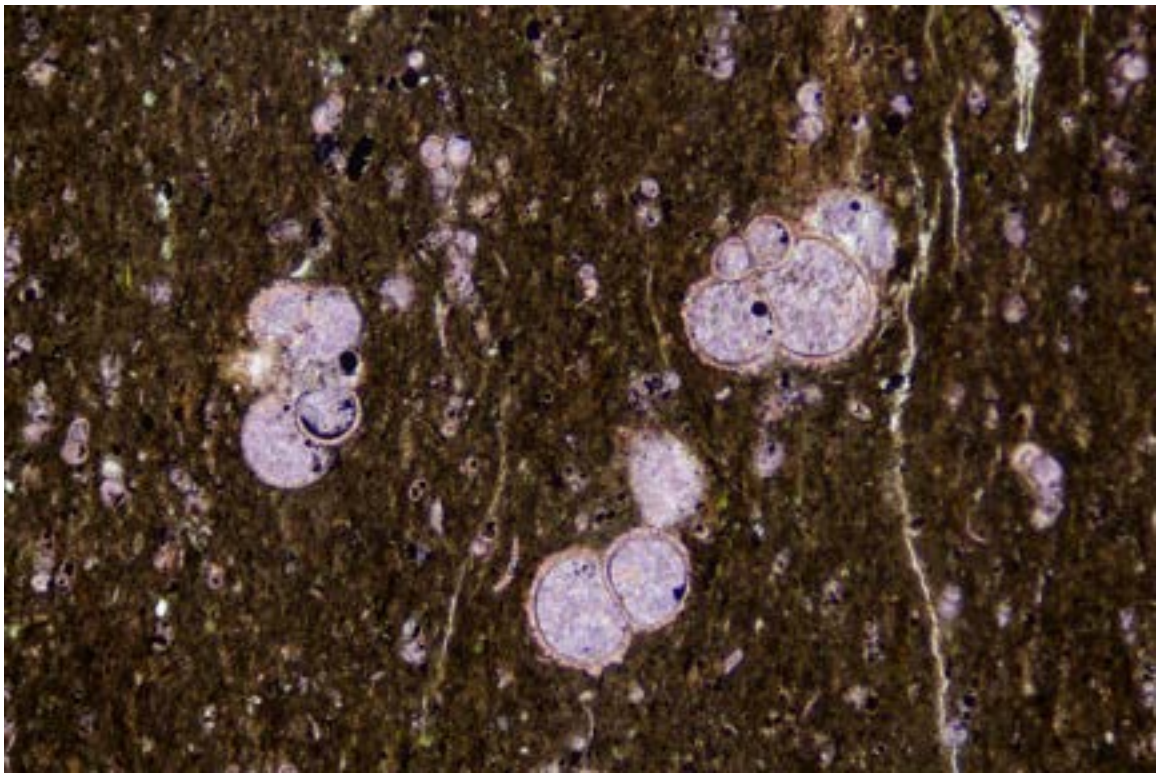
T-205 RC-2 47'5"-48'11" E3M-017.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-205 RC-2 47'5"-48'11" E3M-018.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-205 RC-2 47'5"-48'11" E3M-049.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



T-205 RC-2 47'5"-48'11" E3M-050.jpg/PPL/FOV = 0.96 x 1.40 mm
LIMESTONE showing typical appearance.

SAMPLE # **T-205 RC-4 56'10"-60'** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (94%) + smectite (5%) + opaques (1%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (10%)

Microfossil (coiled and uncoiled) fragments (10%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

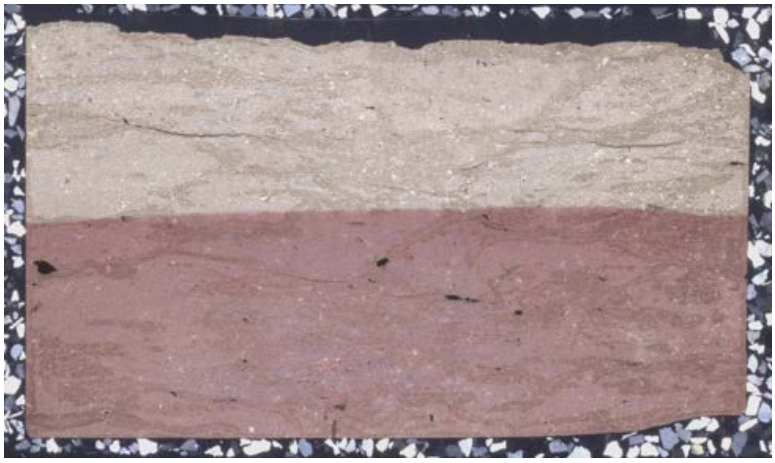
Matrix (90%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

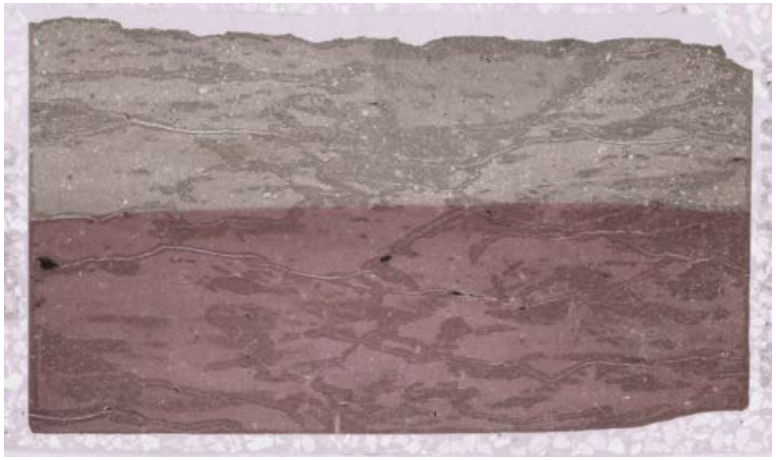
ALTERATION No other alteration features were observed.

SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

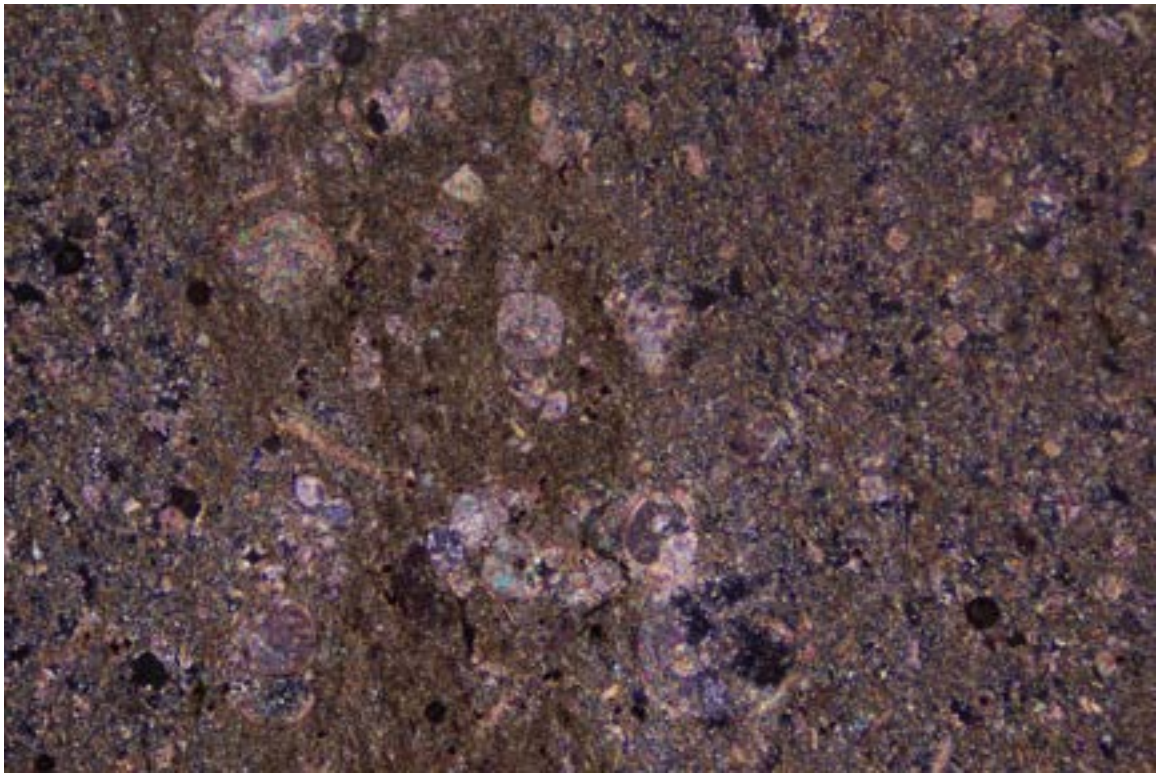
IMAGES



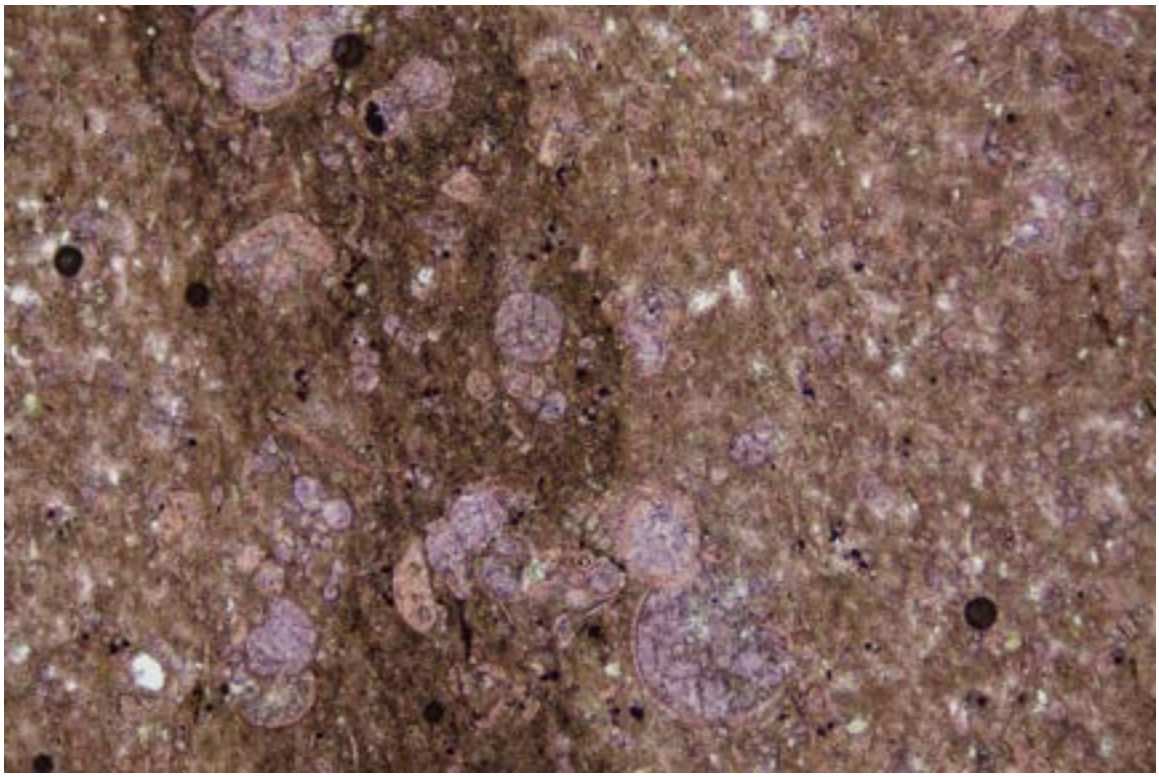
T-205 RC-4 56'10"-60' E3M-019.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-205 RC-4 56'10"-60' E3M-020.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-205 RC-4 56'10"-60' E3M-051.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



T-205 RC-4 56'10"-60' E3M-052.jpg/PPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.

SAMPLE # **T-205 RC-5B 66’8”-68’3”** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (92%) + smectite (5%) + opaques (3%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (20%)

Microfossil (coiled and uncoiled) fragments (20%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

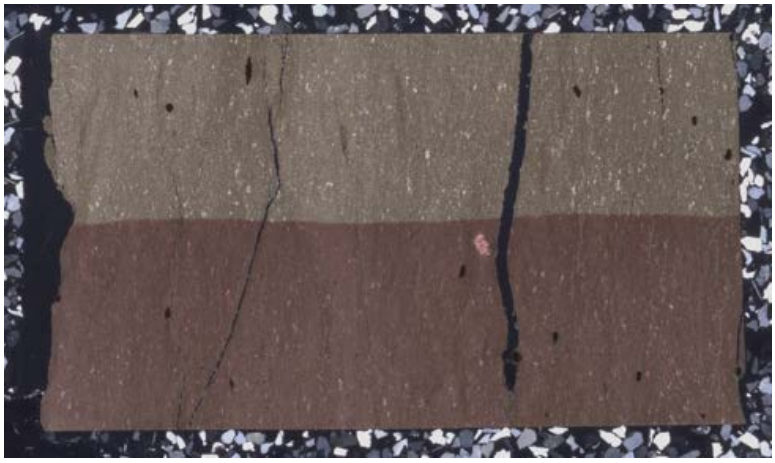
Matrix (80%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

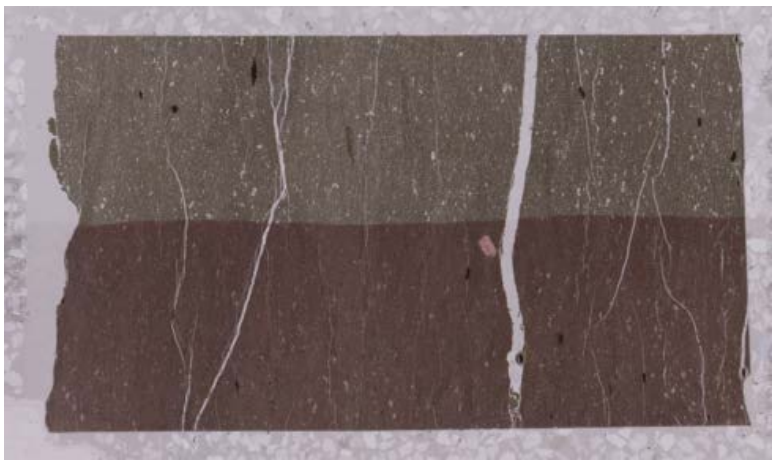
ALTERATION No other alteration features were observed.

SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

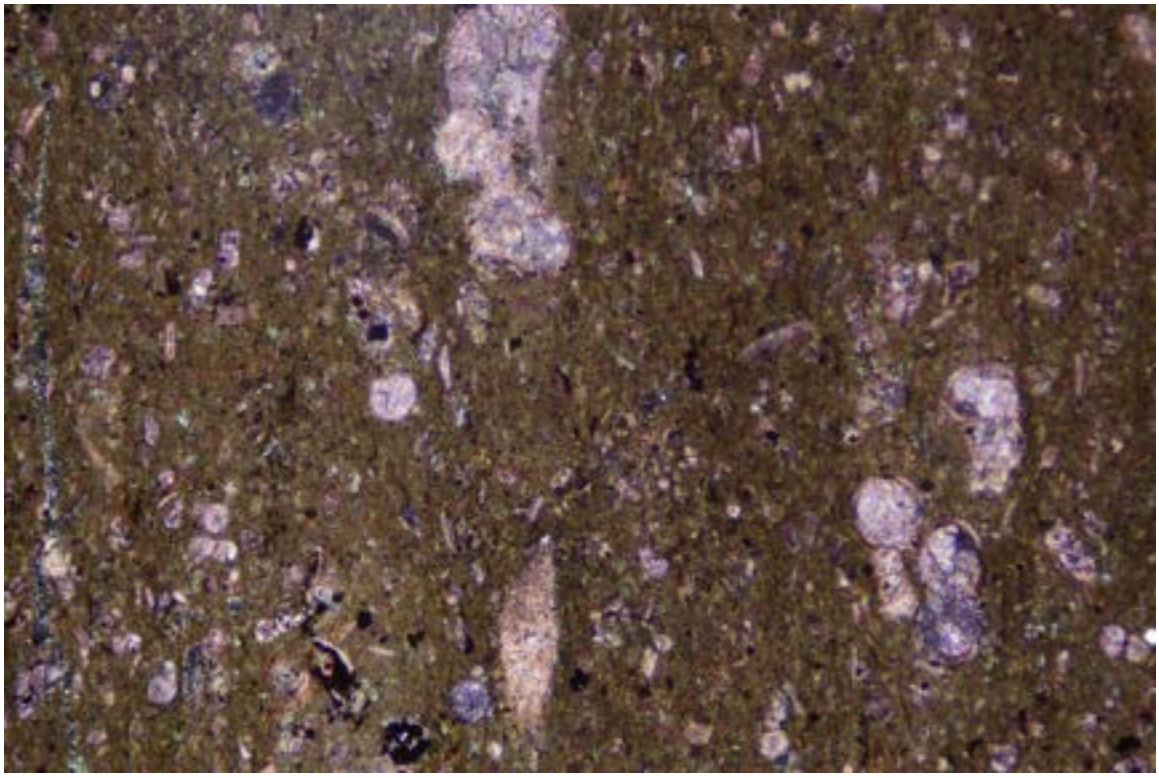
IMAGES



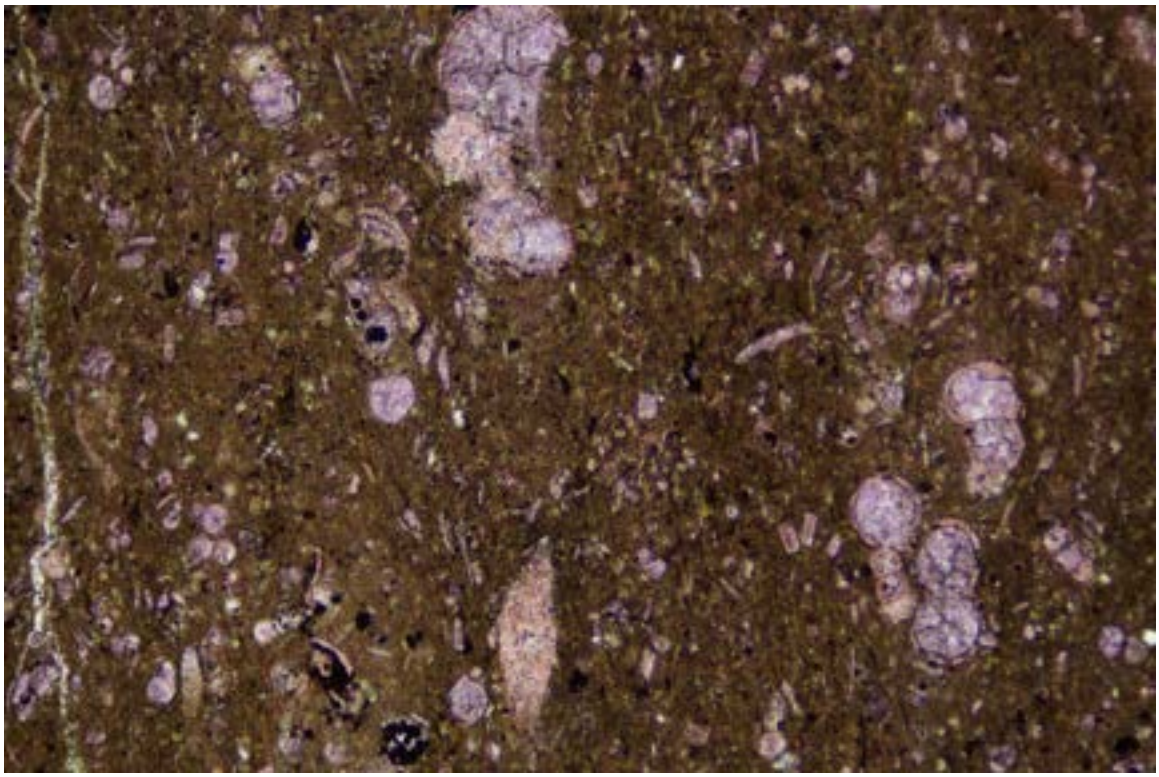
T-205 RC-5B 66'8"-68'3" E3M-021.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-205 RC-5B 66'8"-68'3" E3M-022.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



T-205 RC-5B 66'8"-68'3" E3M-053.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



T-205 RC-5B 66'8"-68'3" E3M-054.jpg/PPL/FOV = 0.96 x 1.40 mm
LIMESTONE showing typical appearance.

SAMPLE # **TS-104 RC-3A 35'-37'6"** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (88%) + smectite (10%) + opaques (1%) + collophane (1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (16%)

Microfossil (coiled and uncoiled) fragments (15%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (1%) composed of collophane.

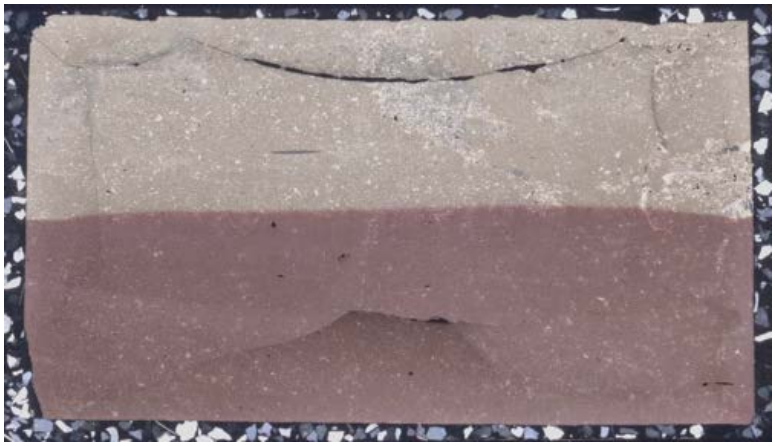
Matrix (84%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

ALTERATION No other alteration features were observed.

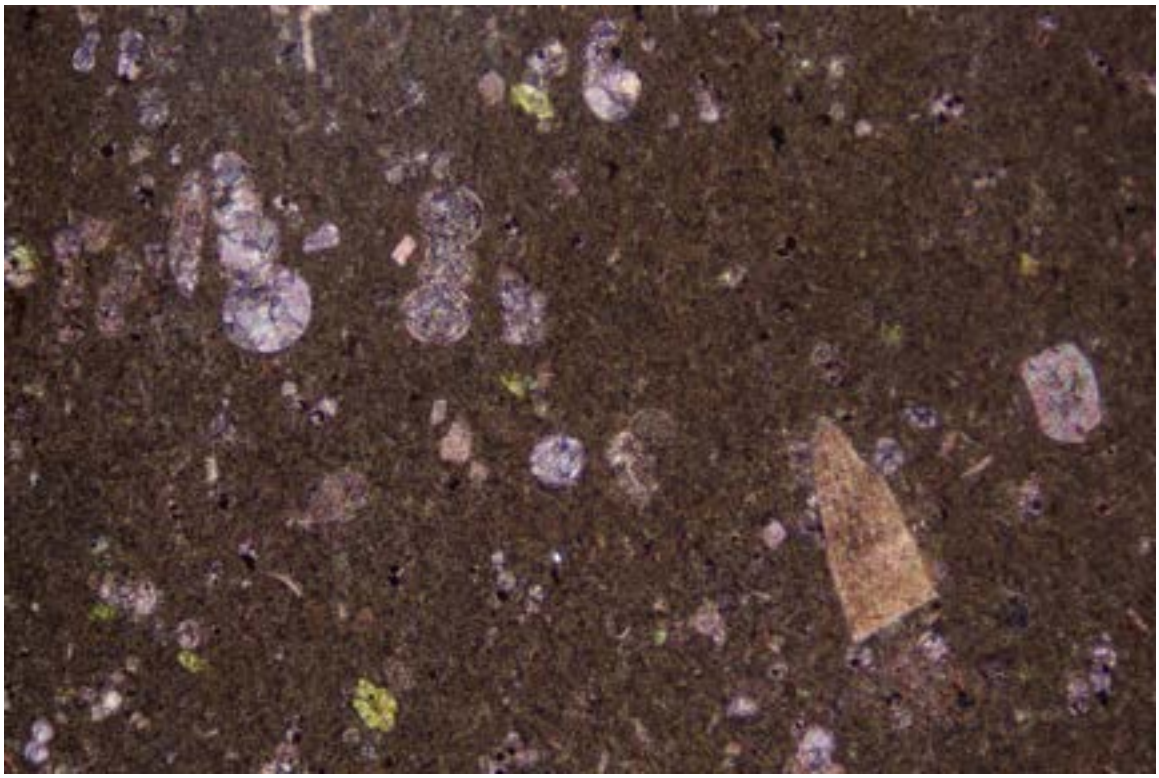
SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

IMAGES

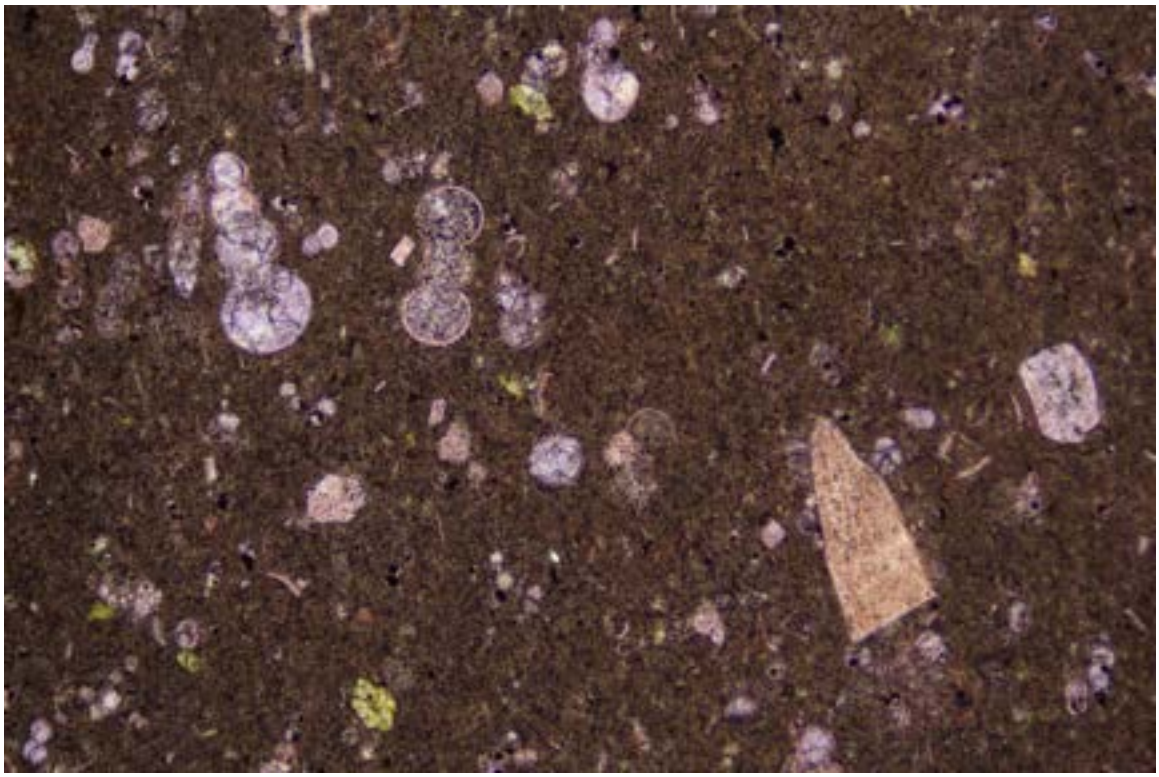


TS-104 RC-3A 35'-37'6" E3M-023.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.

TS-104 RC-3A 35'-37'6" E3M-024.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



TS-104 RC-3A 35'-37'6" E3M-055.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



TS-104 RC-3A 35'-37'6" E3M-056.jpg/PPL/FOV = 0.96 x 1.40 mm
LIMESTONE showing typical appearance.

SAMPLE # **TS-104 RC-5 53’3”** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (91%) + smectite (5%) + opaques (4%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (20%)

Microfossil (coiled and uncoiled) fragments (20%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

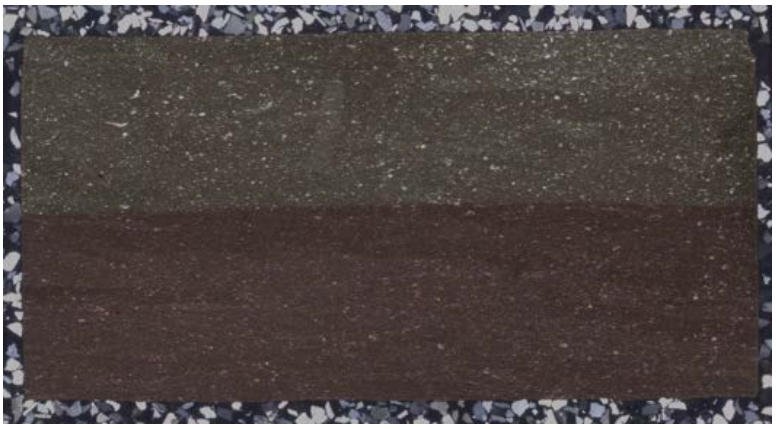
Matrix (80%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

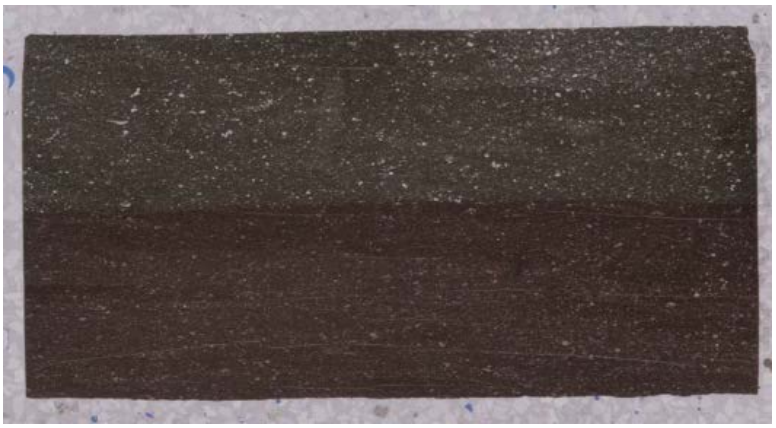
ALTERATION No other alteration features were observed.

SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

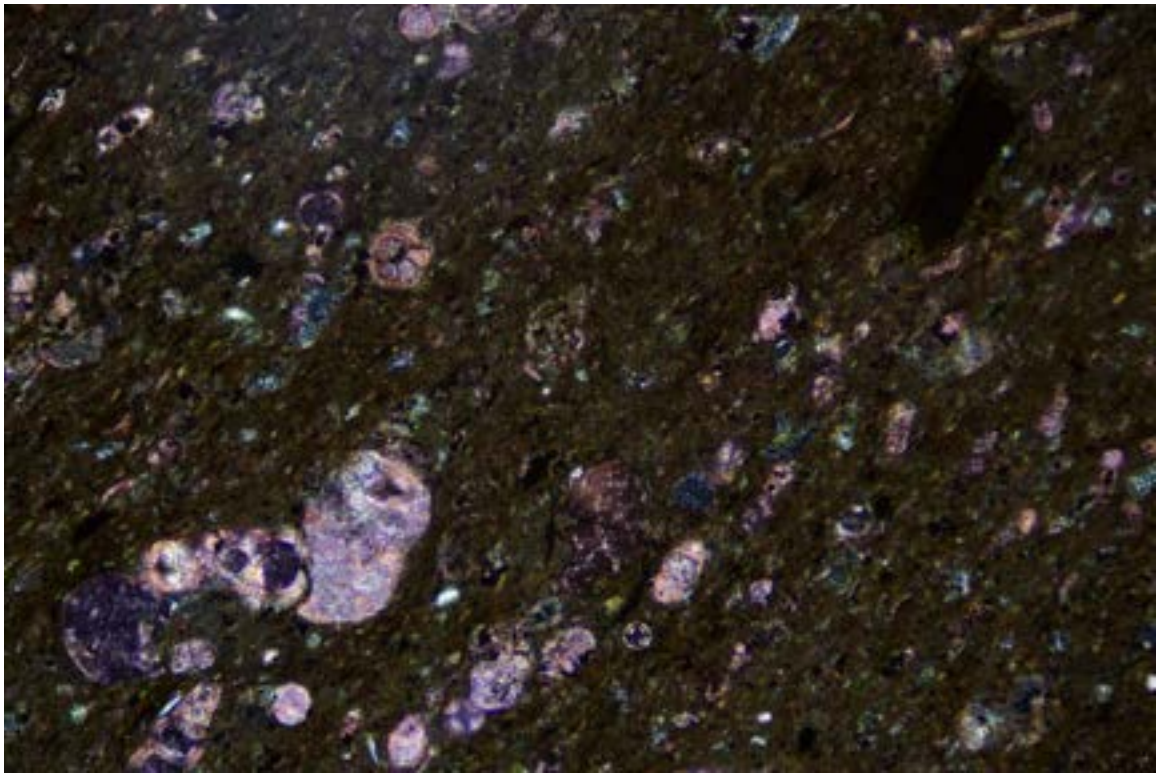
IMAGES



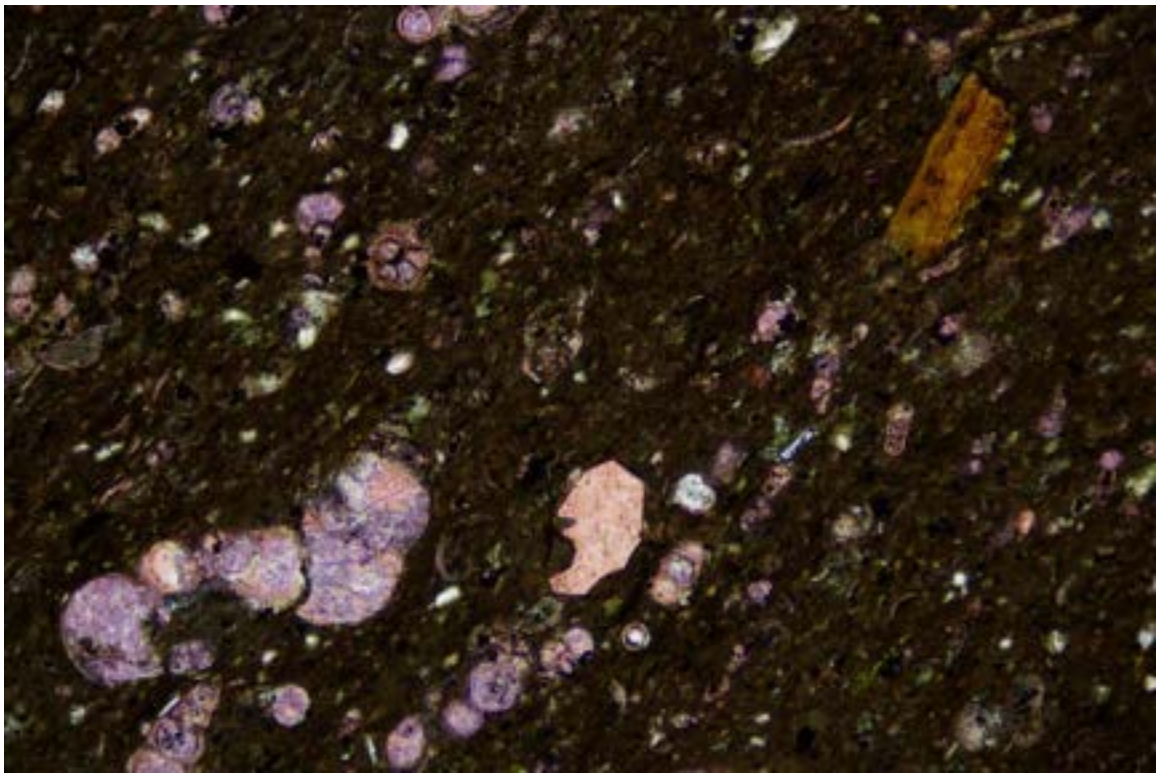
TS-104 RC-5 53'3" E3M-025.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



TS-104 RC-5 53'3" E3M-026.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



TS-104 RC-5 53'3" E3M-058.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



TS-104 RC-5 53'3" E3M-057.jpg/PPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.

SAMPLE # **TS-104 RC-7 60'-63'5"** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (86%) + smectite (5%) + collophane (5%) + opaques (4%) + glauconite (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (50%)

Microfossil (coiled and uncoiled) fragments (44%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (5%) composed of collophane.

Quartz (1%)

Glauconite (<1%)

Matrix (50%) is composed of micrite calcite + smectite + opaques.

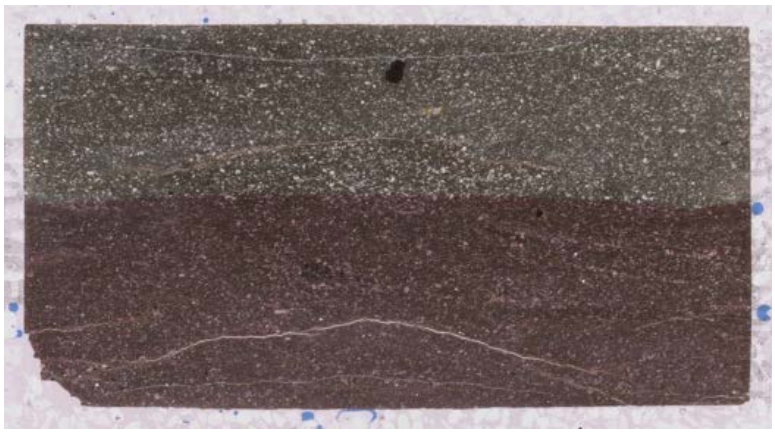
Cement (0%) was not observed.

ALTERATION No other alteration features were observed.

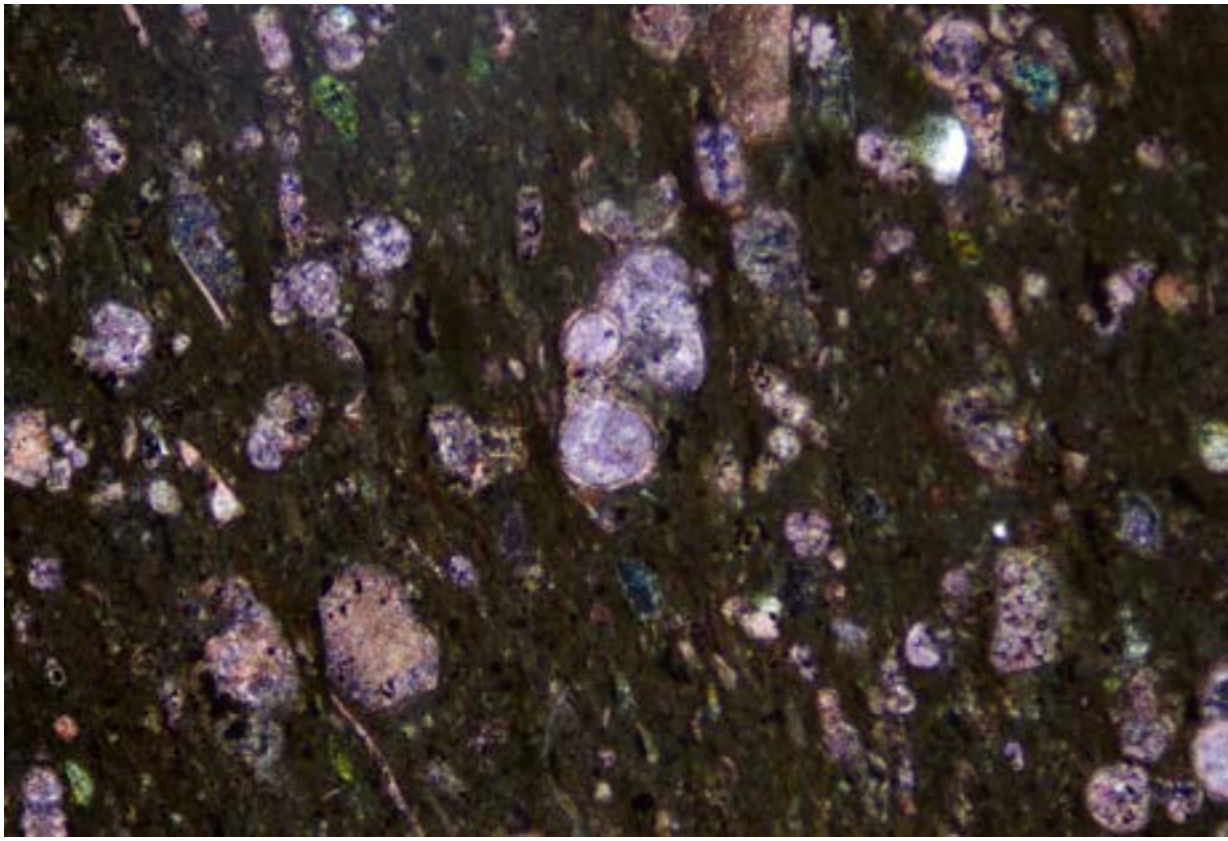
SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

IMAGES

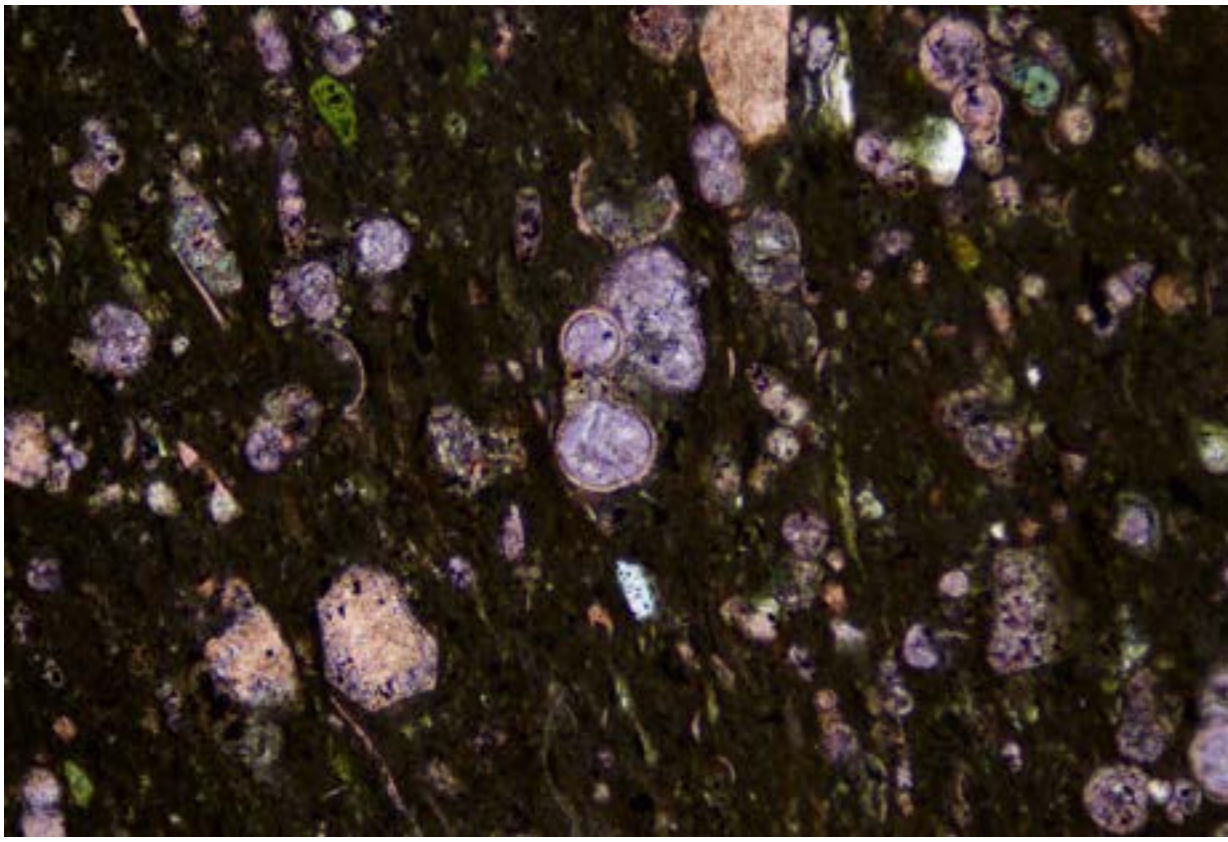
TS-104 RC-7 60'-63'5" E3M-027.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



TS-104 RC-7 60'-63'5" E3M-028.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



TS-104 RC-7 60'-63'5" E3M-059.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



TS-104 RC-7 60'-63'5" E3M-060.jpg/PPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.

SAMPLE # **TS-202 RC-4 36'6"-38'9"** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (88%) + smectite (10%) + opaques (2%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (15%)

Microfossil (coiled) fragments (15%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

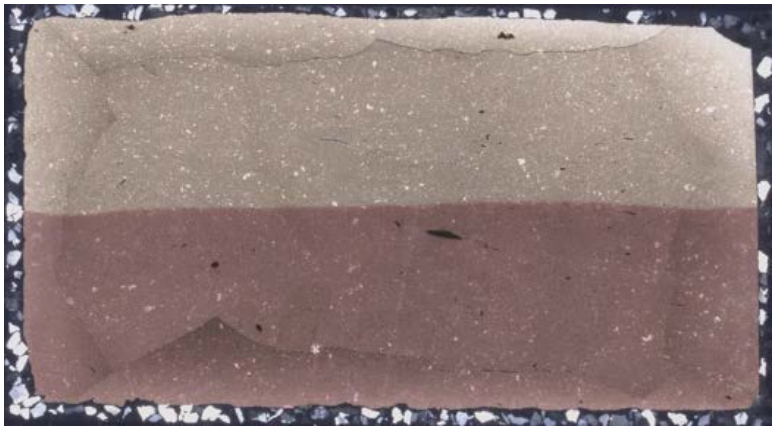
Matrix (85%) is composed of micrite calcite + smectite + opaques.

Cement (0%) was not observed.

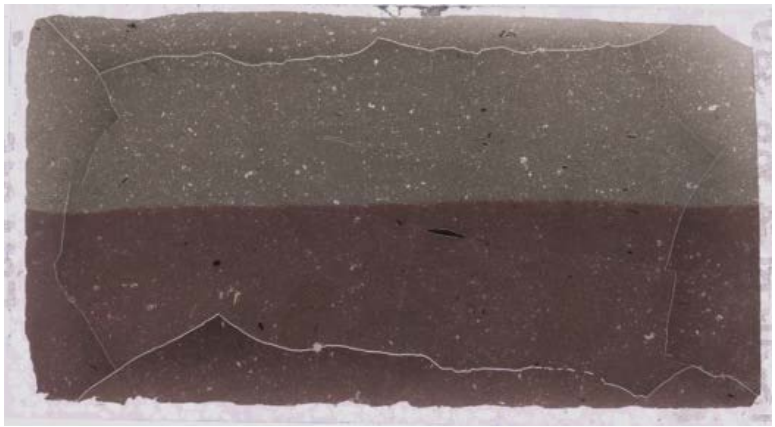
ALTERATION No other alteration features were observed.

SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

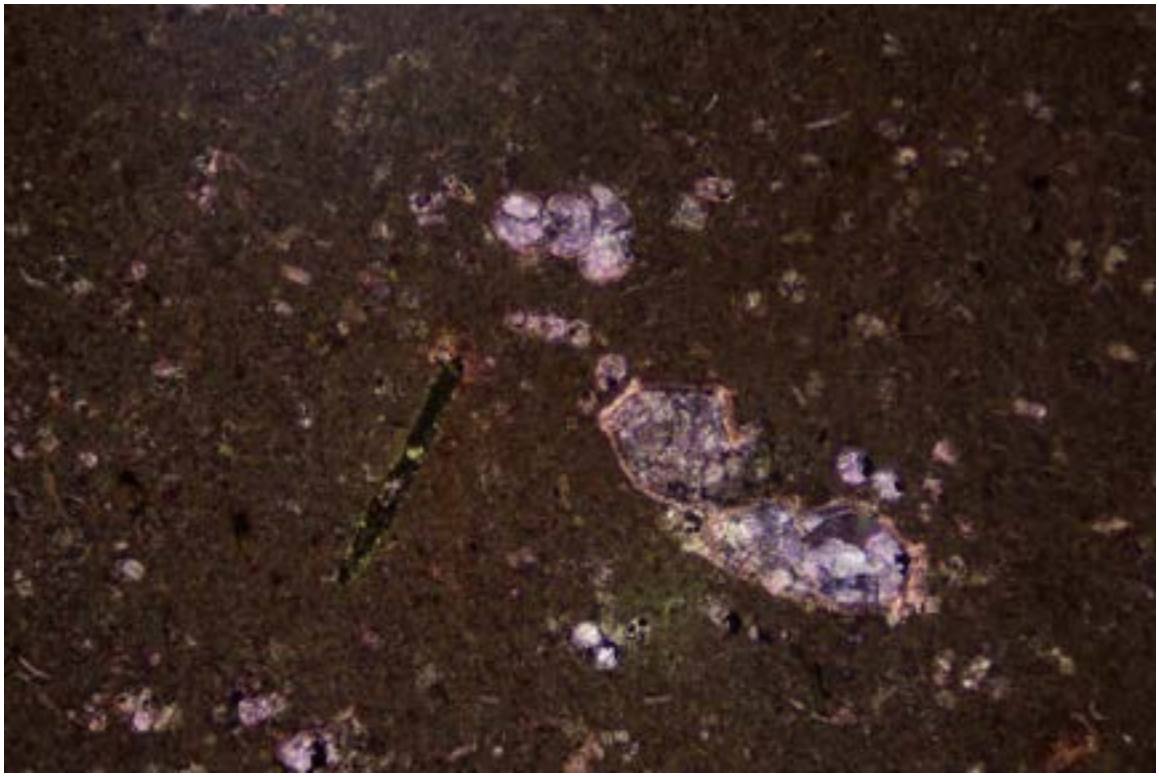
IMAGES



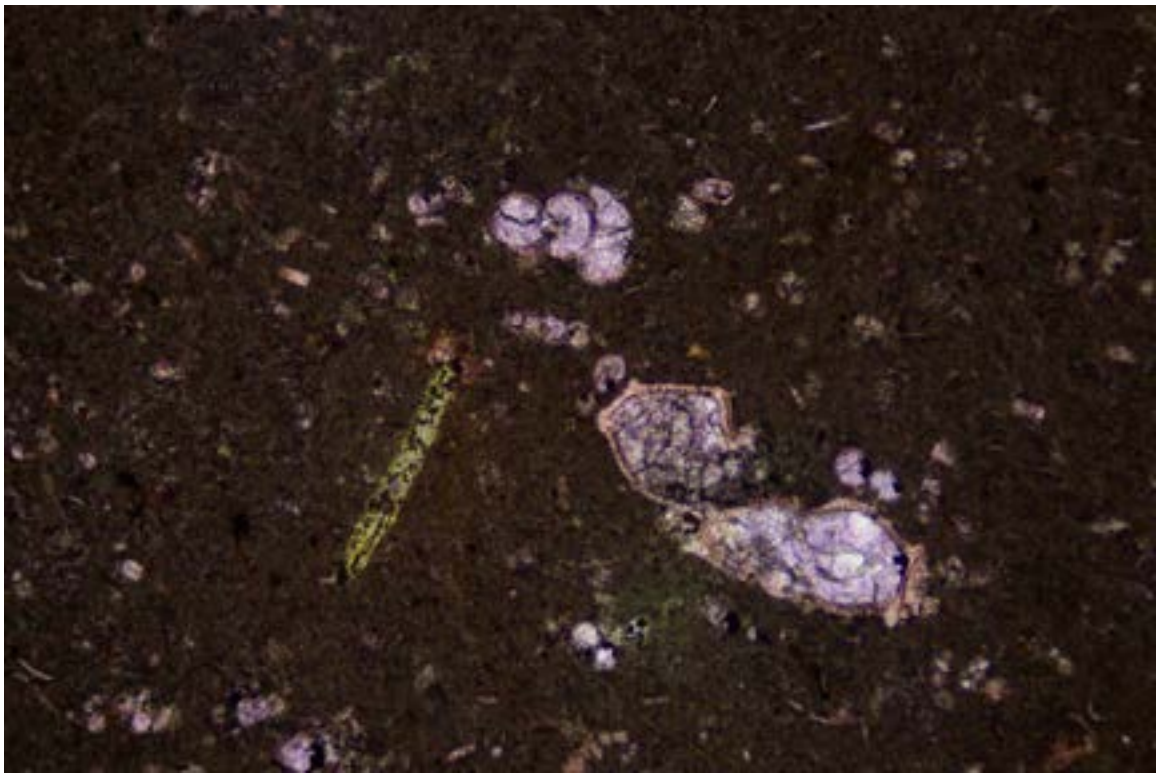
TS-202 RC-4 36'6"-38'9" E3M-029.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



TS-202 RC-4 36'6"-38'9" E3M-030.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



TS-202 RC-4 36'6"-38'9" E3M-061.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



TS-202 RC-4 36'6"-38'9" E3M-062.jpg/PPL/FOV = 0.96 x 1.40 mm
LIMESTONE showing typical appearance.

SAMPLE # **TS-202 RC-6/7 60'-64'1"** March 22, 2019

ROCK NAME LIMESTONE -- probably formed as a biomicrite limestone.

MINERALS [Calcite + weakly ferroan calcite] (88%) + smectite (10%) + opaques (2%) + collophane (<1%).

TEXTURES The sample is a fine grained limestone composed of microfossil fragments in a micrite matrix. Preferential orientation of elongate fossil fragments defines a weakly directed fabric.

Clasts (20%)

Microfossil (coiled and uncoiled) fragments (20%) composed of [calcite moderately altered to weakly ferroan calcite ± opaques].

Fish Bone and Scale fragments (<1%) composed of collophane.

Matrix (80%) is composed of micrite calcite + smectite + opaques.

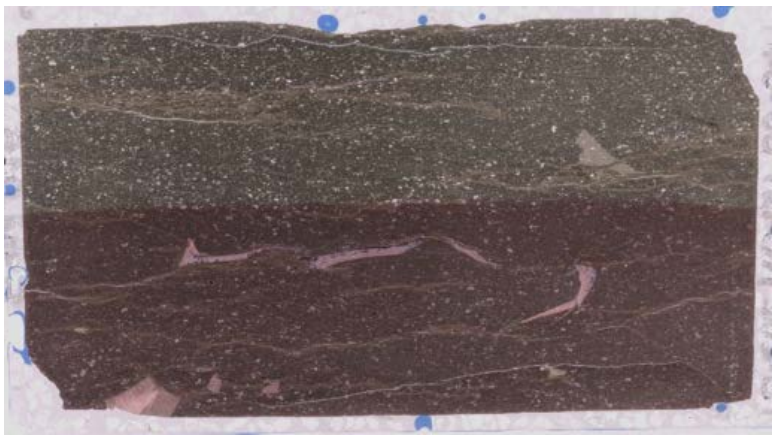
Cement (0%) was not observed.

ALTERATION No other alteration features were observed.

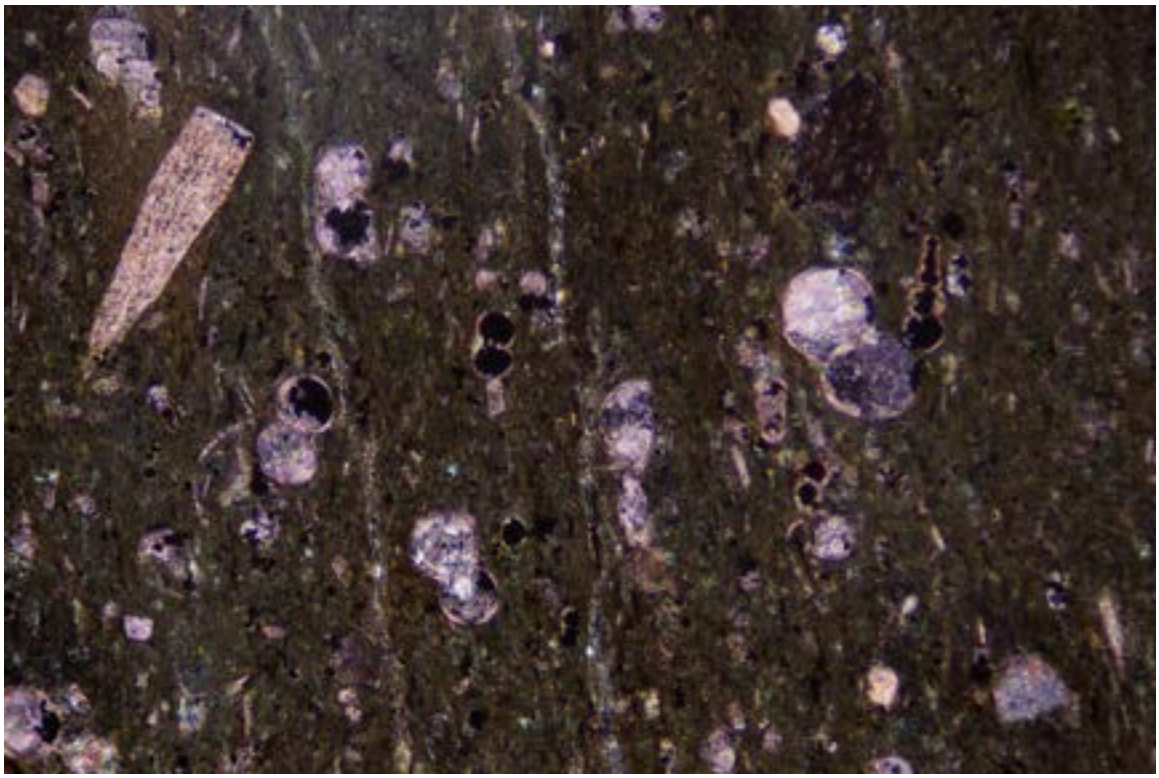
SECTIONING Format: 27 x 46 mm Finish: STD Stains: SCN (none) + ARSPF (right 1/2) Cover: PLA

IMAGES

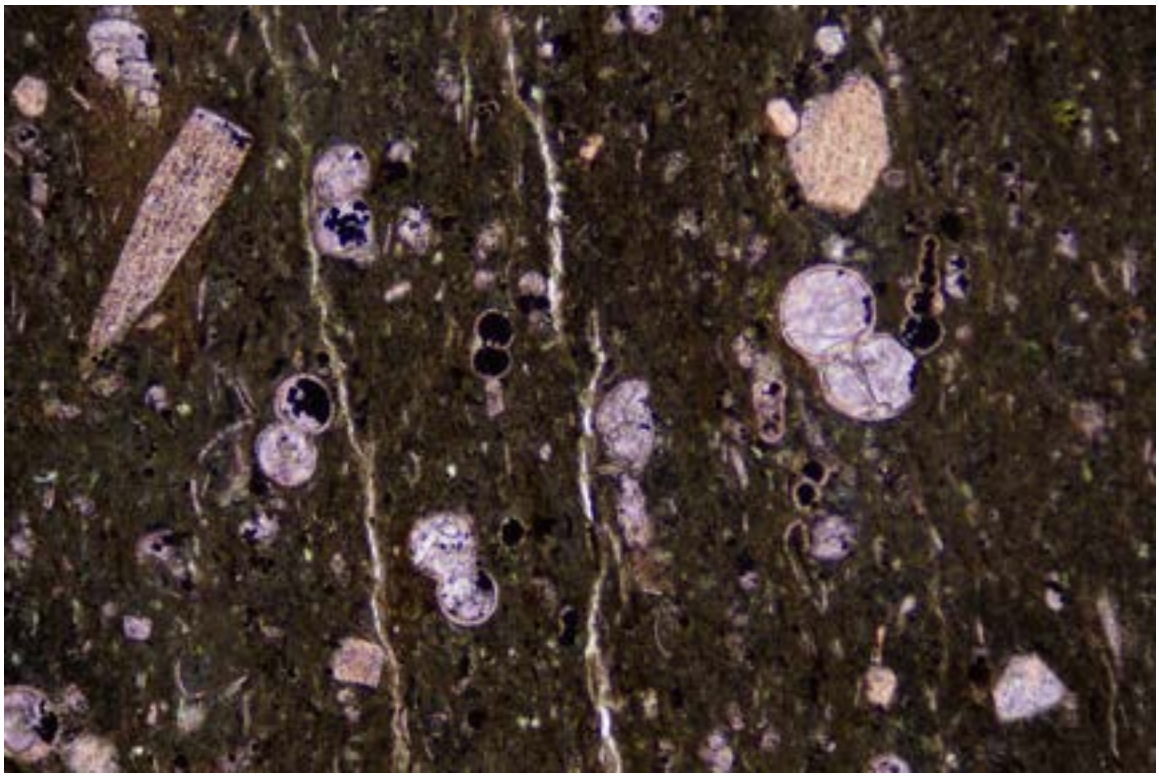
TS-202 RC-6/7 60'-64'1" E3M-031.jpg/XPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



TS-202 RC-6/7 60'-64'1" E3M-032.jpg/PPL/FOV = 27 x 46 mm LIMESTONE showing typical appearance.



TS-202 RC-6/7 60'-64'1" E3M-063.jpg/XPL/FOV = 0.96 x 1.40 mm LIMESTONE showing typical appearance.



TS-202 RC-6/7 60'-64'1" E3M-064.jpg/PPL/FOV = 0.96 x 1.40 mm
LIMESTONE showing typical appearance.

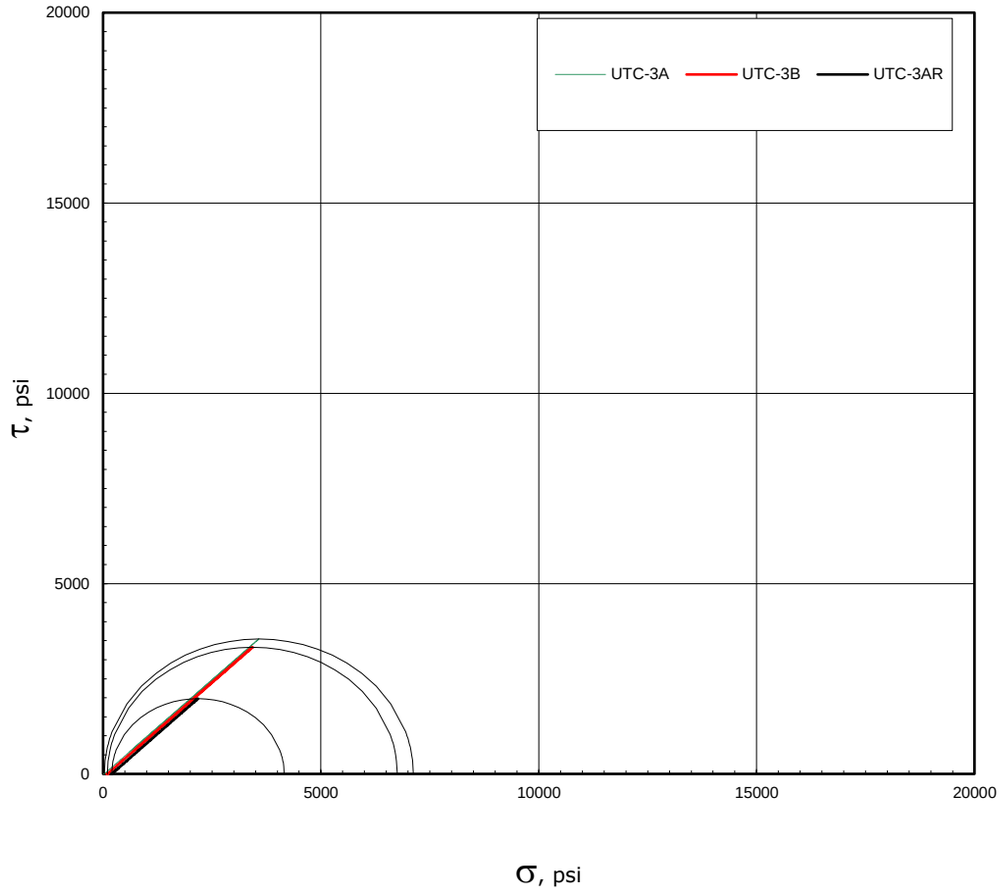
APPENDIX F-12

TRIAXIAL COMPRESSIVE STRENGTH TEST

METHOD-A

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019-3/8/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-1A, 3A
Depth:	31'-37'6"
Test No.:	UTC-1, 2 and 3
Sample Type:	rock core
Sample Description:	See Photographs

Triaxial Compressive Strength of Undrained Rock Core Specimens by ASTM D7012 - Method A



	UTC-3A	UTC-3B	UTC-3AR
Confining Stress, σ_3, psi	30	100	200
Maximum Total Stress, σ_1, psi	7,121	6,753	4,156
Peak Deviator Stress, σ, psi	7,091	6,653	3,956
Failure Type	Intact material failure	Intact material failure	Intact material failure

Notes: All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Client:	Alliance Geotechnical Group	Test Date:	3/8/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-104		
Sample ID:	RC-1A		
Depth:	31.00-31.36 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.21	4.20	4.21
Specimen Diameter, in:	2.00	1.99	2.00
Specimen Mass, g:	436.89		
Bulk Density, lb/ft^3	126	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.1	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00090	-0.00090	-0.00080	-0.00080	-0.00080	-0.00080	-0.00080	0.00000	-0.00030	-0.00030	-0.00030	-0.00030	-0.00010	-0.00010	-0.00010
Diameter 2, in (rotated 90°)	-0.00150	-0.00140	-0.00130	-0.00110	-0.00110	-0.00100	-0.00080	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00020	0.00040

Difference between max and min readings, in:

0° = 0.00090 90° = 0.00190

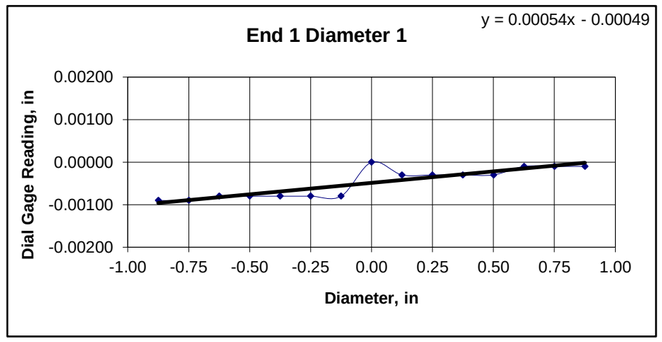
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00120	-0.00110	-0.00100	-0.00090	-0.00090	-0.00080	-0.00070	0.00000	-0.00030	-0.00040	-0.00040	-0.00020	-0.00020	-0.00020	-0.00040
Diameter 2, in (rotated 90°)	-0.00100	-0.00120	-0.00100	-0.00090	-0.00070	-0.00070	-0.00070	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00040	0.00060

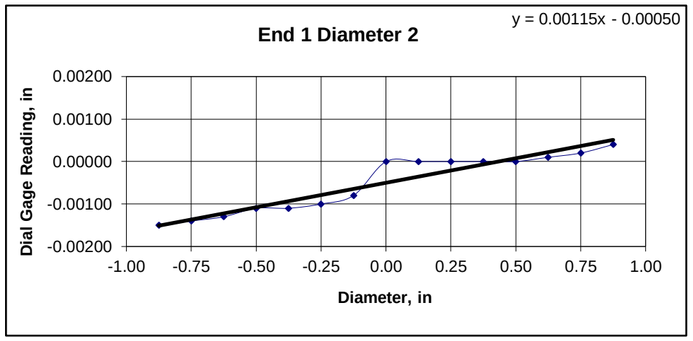
Difference between max and min readings, in:

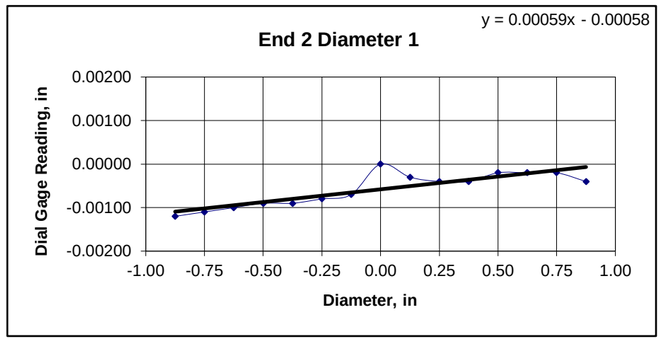
0° = 0.0012 90° = 0.0018

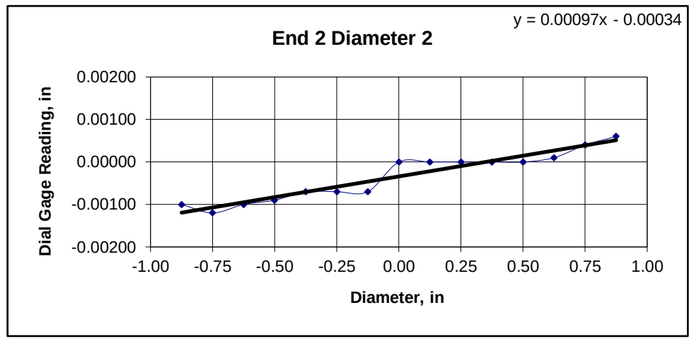
Maximum difference must be < 0.0020 in. Difference = ± 0.00095

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00054
Angle of Best Fit Line:	0.03094

End 2:

Slope of Best Fit Line	0.00059
Angle of Best Fit Line:	0.03356

Maximum Angular Difference: 0.00262

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00115
Angle of Best Fit Line:	0.06614

End 2:

Slope of Best Fit Line	0.00097
Angle of Best Fit Line:	0.05582

Maximum Angular Difference: 0.01031

Parallelism Tolerance Met? **NO**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00090	1.995	0.00045	0.026	YES
Diameter 2, in (rotated 90°)	0.00190	1.995	0.00095	0.055	YES
END 2					
Diameter 1, in	0.00120	1.995	0.00060	0.034	YES
Diameter 2, in (rotated 90°)	0.00180	1.995	0.00090	0.052	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/11/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-1A
Depth:	31.00-31.36

After cutting and grinding

After break

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-104		
Sample ID:	RC-3A		
Depth:	35'-37'6"		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.20	4.21	4.21
Specimen Diameter, in:	1.98	1.96	1.97
Specimen Mass, g:	444.91		
Bulk Density, lb/ft^3	132	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.1	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00140	-0.00120	-0.00120	-0.00120	-0.00060	-0.00020	0.00000	0.00000	0.00010	-0.00030	-0.00010	0.00040	0.00080	0.00050	0.00020
Diameter 2, in (rotated 90°)	0.00100	0.00050	0.00080	0.00050	0.00040	0.00030	0.00020	0.00000	-0.00020	-0.00050	-0.00070	-0.00080	-0.00110	-0.00180	-0.00200

Difference between max and min readings, in:

0° = 0.00220 90° = 0.00300

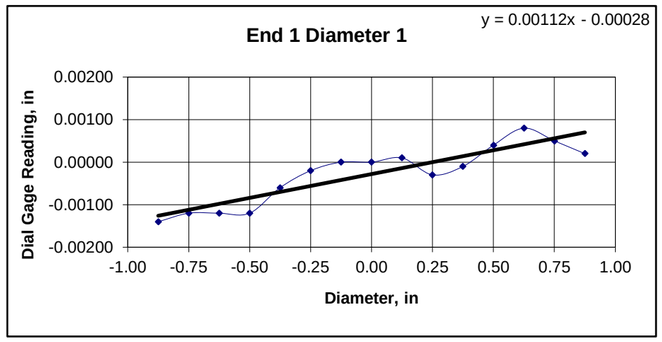
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00080	-0.00060	-0.00040	-0.00040	-0.00030	0.00000	-0.00010	0.00000	0.00050	0.00050	0.00060	0.00080	0.00130	0.00100	0.00080
Diameter 2, in (rotated 90°)	0.00140	0.00140	0.00120	0.00100	0.00080	0.00060	0.00040	0.00000	-0.00020	-0.00030	-0.00060	-0.00070	-0.00100	-0.00110	-0.00130

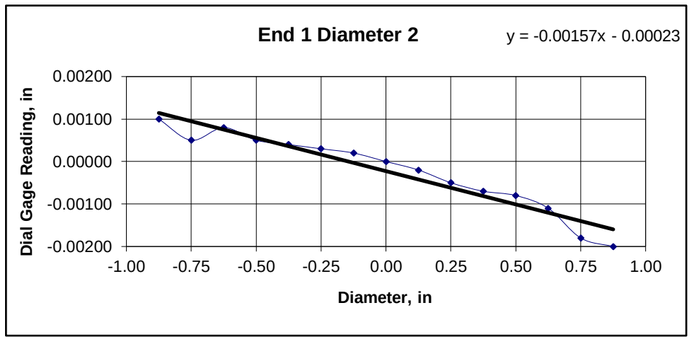
Difference between max and min readings, in:

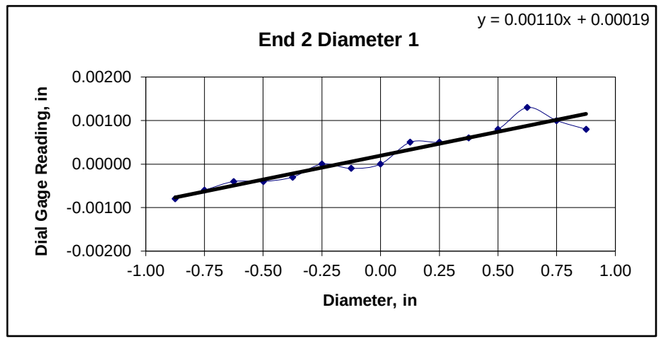
0° = 0.0021 90° = 0.0027

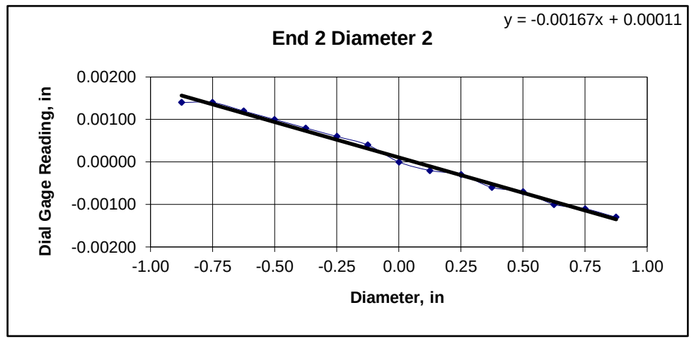
Maximum difference must be < 0.0020 in. Difference = ± 0.00150

Flatness Tolerance Met? **NO**









DIAMETER 1

End 1:

Slope of Best Fit Line 0.00112

Angle of Best Fit Line: 0.06417

End 2:

Slope of Best Fit Line 0.00110

Angle of Best Fit Line: 0.06286

Maximum Angular Difference: 0.00131

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line 0.00157

Angle of Best Fit Line: 0.08971

End 2:

Slope of Best Fit Line 0.00167

Angle of Best Fit Line: 0.09544

Maximum Angular Difference: 0.00573

Parallelism Tolerance Met? **NO**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

Maximum angle of departure must be ≤ 0.25°

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00220	1.970	0.00112	0.064	YES
Diameter 2, in (rotated 90°)	0.00300	1.970	0.00152	0.087	YES
END 2					
Diameter 1, in	0.00210	1.970	0.00107	0.061	YES
Diameter 2, in (rotated 90°)	0.00270	1.970	0.00137	0.079	YES

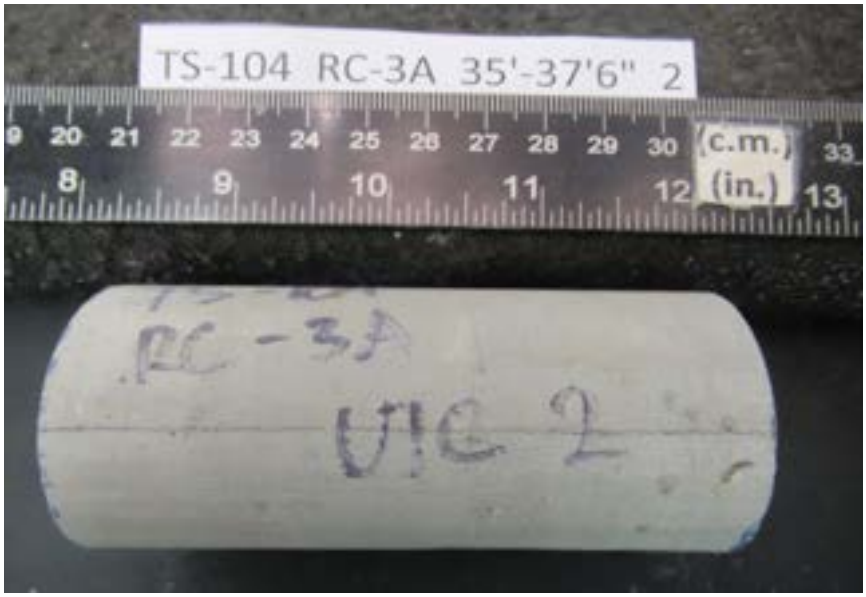
Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-194	Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	RC-3A		
Depth (ft):	35'-37'6"		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
	End Flatness Tolerance Met?	**YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/11/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"



After cutting and grinding

After break

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-104		
Sample ID:	RC-3A		
Depth:	35'-37'6"		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.16	4.16	4.16
Specimen Diameter, in:	1.97	1.97	1.97
Specimen Mass, g:	437.04		
Bulk Density, lb/ft^3	131	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.1	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	-0.00060	-0.00050	-0.00040	-0.00010	0.00020	0.00020	0.00000	0.00000	0.00020	0.00060	0.00060	0.00050	0.00030	0.00030
Diameter 2, in (rotated 90°)	0.00030	0.00000	-0.00010	-0.00020	-0.00010	0.00020	0.00040	0.00000	-0.00020	-0.00030	-0.00030	-0.00040	-0.00040	-0.00030	-0.00030

Difference between max and min readings, in:

0° = 0.00120 90° = 0.00080

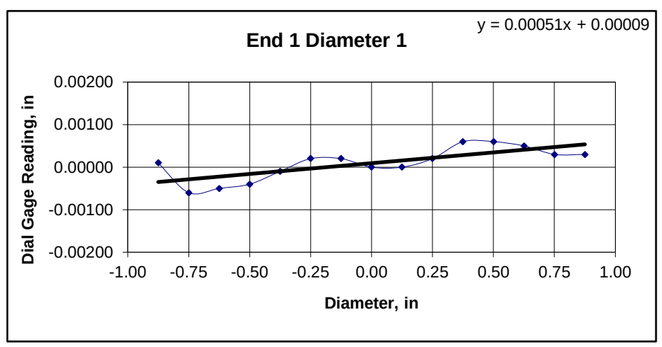
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00070	-0.00020	-0.00040	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00020	0.00020	0.00080	0.00150	0.00130	0.00070
Diameter 2, in (rotated 90°)	-0.00060	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00020	0.00020	0.00030	0.00050	0.00050	0.00050	0.00070

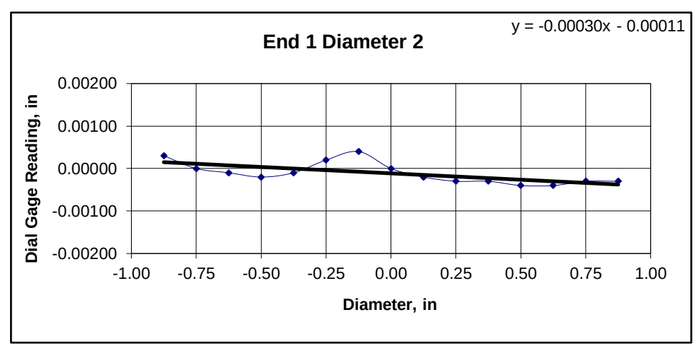
Difference between max and min readings, in:

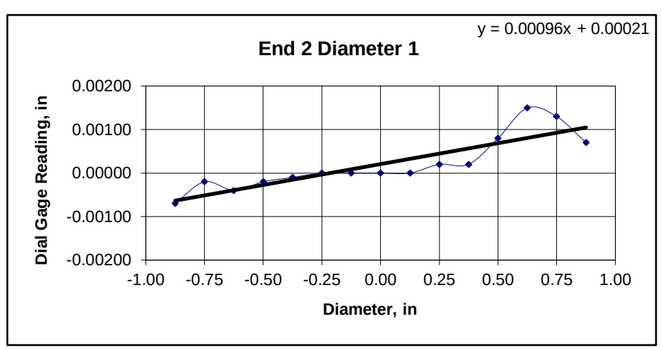
0° = 0.0022 90° = 0.0013

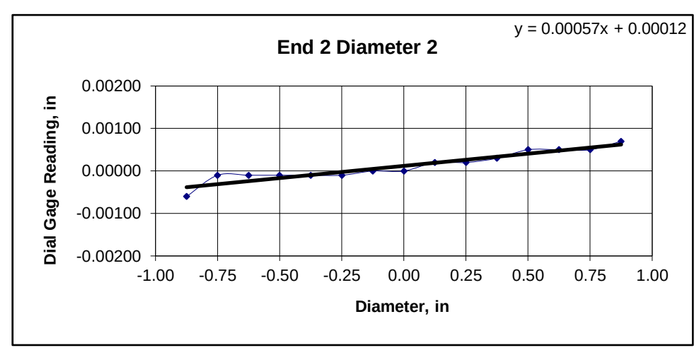
Maximum difference must be < 0.0020 in. Difference = ± 0.00110

Flatness Tolerance Met? **NO**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00051
Angle of Best Fit Line:	0.02898

End 2:

Slope of Best Fit Line	0.00096
Angle of Best Fit Line:	0.05500

Maximum Angular Difference: 0.02603

Parallelism Tolerance Met? **NO**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00030
Angle of Best Fit Line:	0.01719

End 2:

Slope of Best Fit Line	0.00057
Angle of Best Fit Line:	0.03290

Maximum Angular Difference: 0.01572

Parallelism Tolerance Met? **NO**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00120	1.970	0.00061	0.035	YES
Diameter 2, in (rotated 90°)	0.00080	1.970	0.00041	0.023	YES
END 2					
Diameter 1, in	0.00220	1.970	0.00112	0.064	YES
Diameter 2, in (rotated 90°)	0.00130	1.970	0.00066	0.038	YES

Maximum angle of departure must be ≤ 0.25°

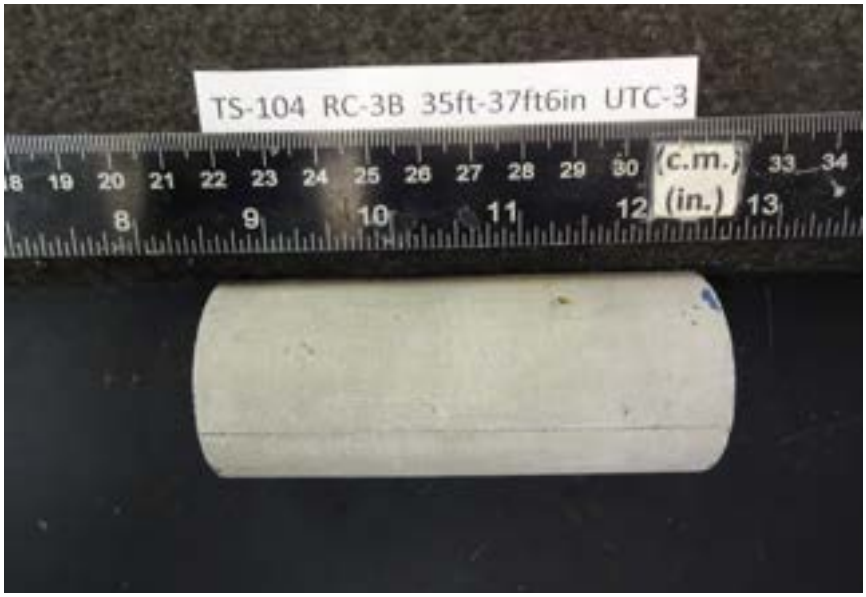
Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-104	Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	RC-3A		
Depth (ft):	35'-37'6"		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
	End Flatness Tolerance Met?	**YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/11/2019
Tested By:	JCK
Checked By:	jsc
Boring ID:	TS-104
Sample ID:	RC-3A
Depth:	35'-37'6"

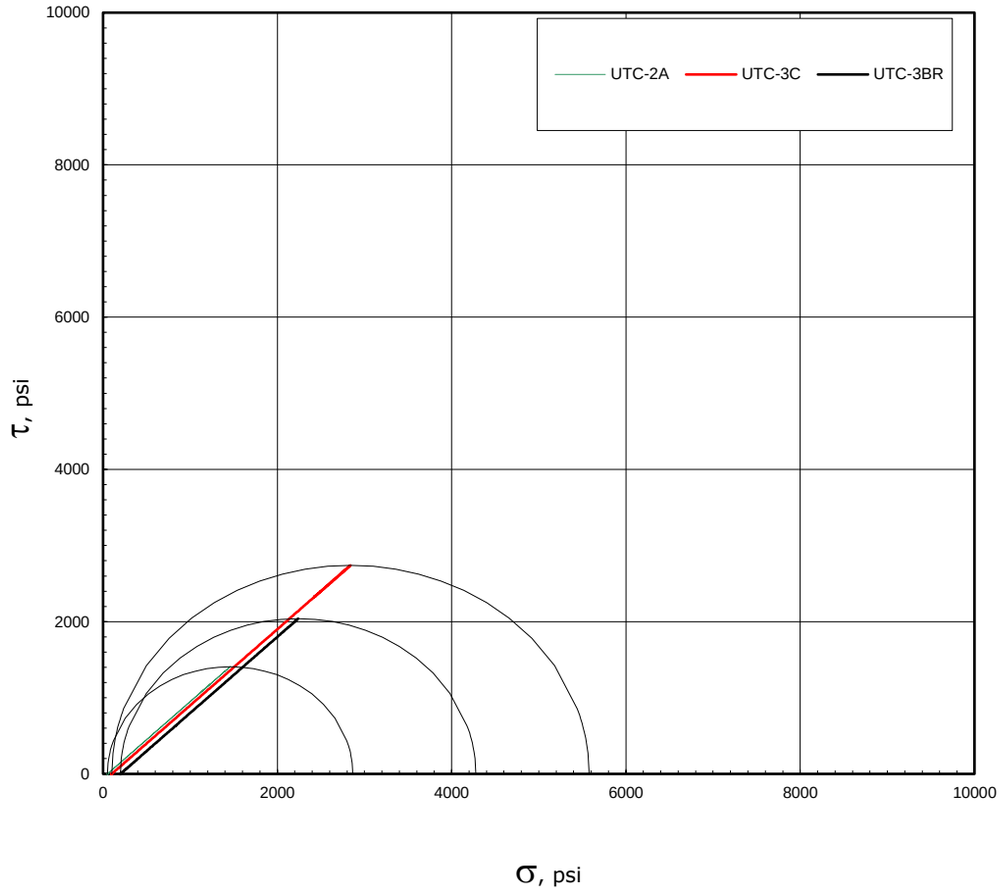


After cutting and grinding

After break

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/7/2019-3/8/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-202
Sample ID:	RC-1A, 3A
Depth:	60'-64'1"
Test No.:	UTC-1, 2 and 3
Sample Type:	rock core
Sample Description:	See Photographs

Triaxial Compressive Strength of Undrained Rock Core Specimens by ASTM D7012 - Method A



	UTC-2A	UTC-3C	UTC-3BR
Confining Stress, σ_3, psi	50	100	200
Maximum Total Stress, σ_1, psi	2,866	5,578	4,278
Peak Deviator Stress, σ, psi	2,816	5,478	4,078
Failure Type	Intact material failure	Intact material failure	Intact material failure

Notes: All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-202		
Sample ID:	RC-6/7		
Depth:	60'-64'1"		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.57	4.60	4.59
Specimen Diameter, in:	1.96	1.96	1.96
Specimen Mass, g:	457.52		
Bulk Density, lb/ft^3	126	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00210	-0.00160	-0.00150	-0.00150	-0.00160	-0.00080	-0.00040	0.00000	0.00010	0.00000	0.00000	-0.00080	-0.00080	-0.00080	-0.00080
Diameter 2, in (rotated 90°)	0.00010	-0.00020	-0.00060	-0.00080	-0.00080	-0.00080	-0.00040	0.00000	-0.00010	-0.00130	-0.00140	-0.00140	-0.00130	-0.00150	-0.00140

Difference between max and min readings, in:

0° = 0.00220 90° = 0.00160

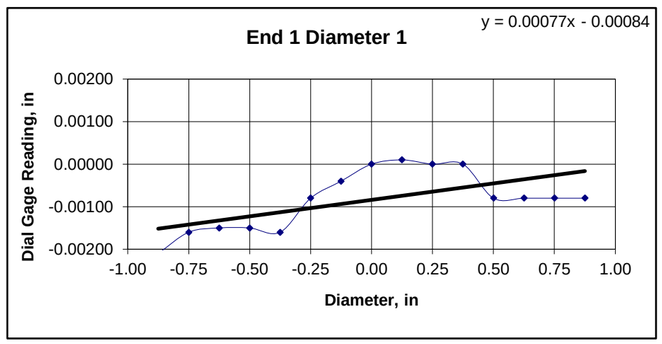
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00040	-0.00050	-0.00030	-0.00030	-0.00040	-0.00040	-0.00040	0.00000	0.00000	0.00000	0.00010	0.00020	0.00040	0.00050	0.00050
Diameter 2, in (rotated 90°)	0.00040	0.00040	0.00060	0.00060	0.00030	0.00020	0.00000	0.00000	-0.00010	-0.00040	-0.00030	-0.00010	-0.00020	-0.00010	-0.00010

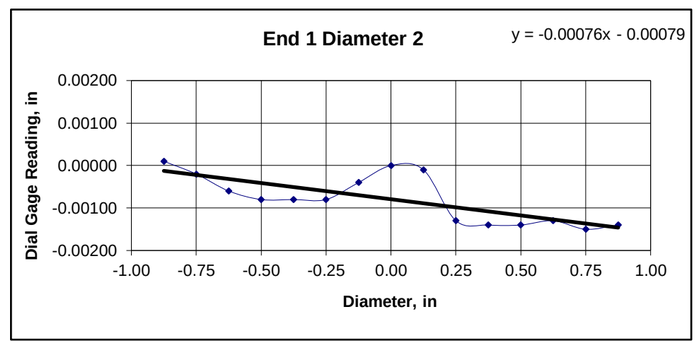
Difference between max and min readings, in:

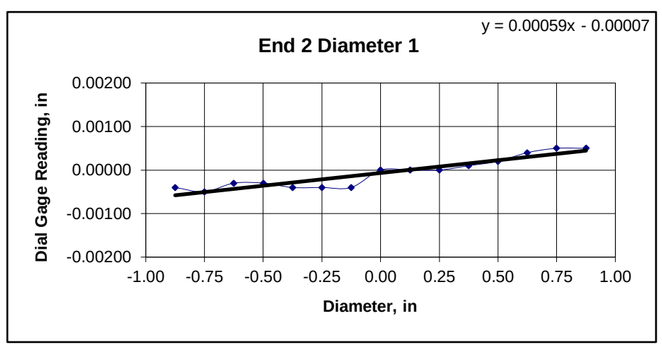
0° = 0.001 90° = 0.001

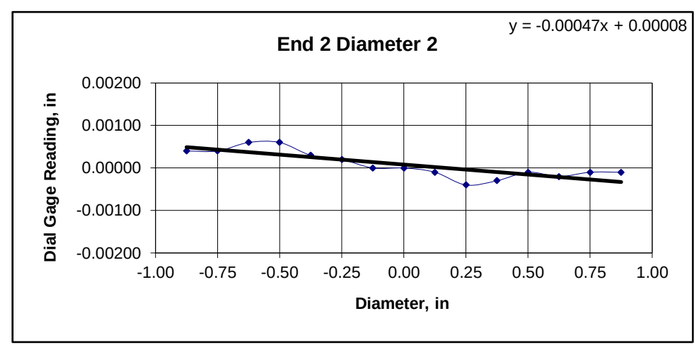
Maximum difference must be < 0.0020 in. Difference = ± 0.00110

Flatness Tolerance Met? **NO**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00077
Angle of Best Fit Line:	0.04436

End 2:

Slope of Best Fit Line	0.00059
Angle of Best Fit Line:	0.03356

Maximum Angular Difference: 0.01080

Parallelism Tolerance Met? **NO**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00076
Angle of Best Fit Line:	0.04371

End 2:

Slope of Best Fit Line	0.00047
Angle of Best Fit Line:	0.02685

Maximum Angular Difference: 0.01686

Parallelism Tolerance Met? **NO**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00220	1.960	0.00112	0.064	YES
Diameter 2, in (rotated 90°)	0.00160	1.960	0.00082	0.047	YES
END 2					
Diameter 1, in	0.00100	1.960	0.00051	0.029	YES
Diameter 2, in (rotated 90°)	0.00100	1.960	0.00051	0.029	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-202	Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	RC-6/7		
Depth (ft):	60'-64'1"		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
	End Flatness Tolerance Met?	**YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/7/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-202
Sample ID:	RC-6/7
Depth:	60'-64'1"

After cutting and grinding

After break

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-202		
Sample ID:	RC-6/7		
Depth:	60'-64'1"		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.31	4.31	4.31
Specimen Diameter, in:	1.95	1.95	1.95
Specimen Mass, g:	428.36		
Bulk Density, lb/ft^3	127	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00020	0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00030	0.00010	0.00110	0.00100	0.00080
Diameter 2, in (rotated 90°)	0.00030	0.00030	0.00010	0.00000	-0.00010	-0.00010	-0.00010	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00030	-0.00030	-0.00030

Difference between max and min readings, in:

0° = 0.00140 90° = 0.00060

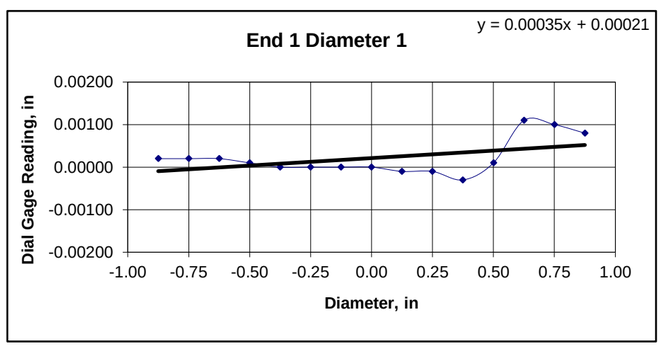
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00040	0.00000	-0.00010	-0.00010	-0.00040	-0.00050	-0.00050	0.00000	0.00010	0.00010	0.00010	0.00040	0.00130	0.00130	0.00130
Diameter 2, in (rotated 90°)	-0.00010	0.00000	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00020	0.00000	-0.00010	-0.00010	-0.00010	0.00000	0.00050

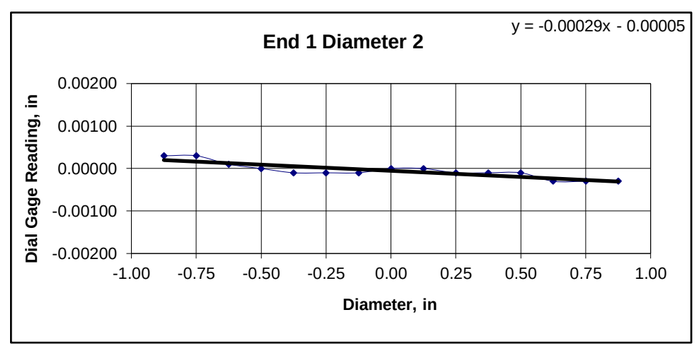
Difference between max and min readings, in:

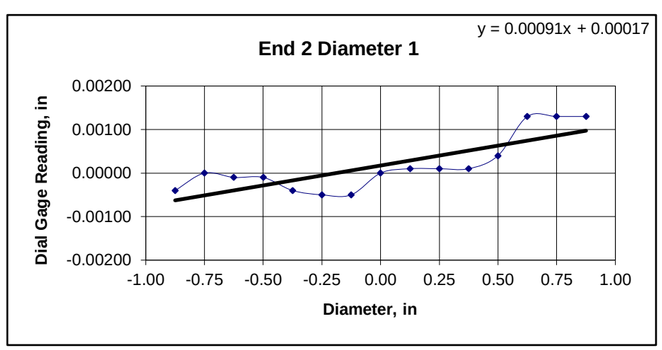
0° = 0.0018 90° = 0.0006

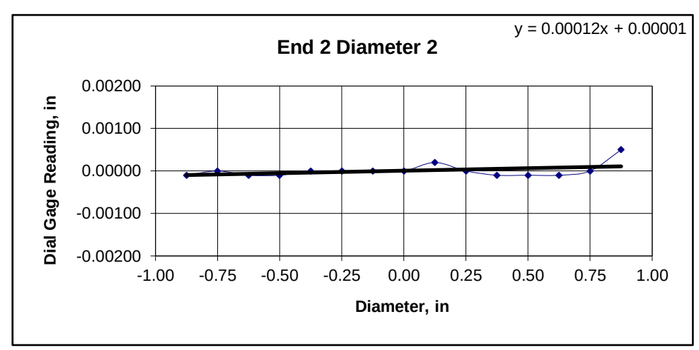
Maximum difference must be < 0.0020 in. Difference = ± 0.00090

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00035
Angle of Best Fit Line:	0.02014

End 2:

Slope of Best Fit Line	0.00091
Angle of Best Fit Line:	0.05238

Maximum Angular Difference: 0.03225

Parallelism Tolerance Met? **NO**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00029
Angle of Best Fit Line:	0.01653

End 2:

Slope of Best Fit Line	0.00012
Angle of Best Fit Line:	0.00671

Maximum Angular Difference: 0.00982

Parallelism Tolerance Met? **NO**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00140	1.950	0.00072	0.041	YES
Diameter 2, in (rotated 90°)	0.00060	1.950	0.00031	0.018	YES
END 2					
Diameter 1, in	0.00180	1.950	0.00092	0.053	YES
Diameter 2, in (rotated 90°)	0.00060	1.950	0.00031	0.018	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-202	Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	RC-6/7		
Depth (ft):	60'-64'1"		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	NO
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	NO
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	NO
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
	End Flatness Tolerance Met?	**NO**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/8/2019
Tested By:	JCK
Checked By:	jsc
Boring ID:	TS-202
Sample ID:	RC-6/7
Depth:	60'-64'1"

After cutting and grinding

After break

Client:	Alliance Geotechnical Group	Test Date:	2/26/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-202		
Sample ID:	RC-6/7		
Depth:	60'-64'1"		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.14	4.13	4.14
Specimen Diameter, in:	1.97	1.97	1.97
Specimen Mass, g:	447.48		
Bulk Density, lb/ft^3	135	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.1	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00020	-0.00030	-0.00030	-0.00040
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	-0.00010	-0.00010	-0.00010	0.00010	0.00000	0.00010	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020

Difference between max and min readings, in:

0° = 0.00050 90° = 0.00050

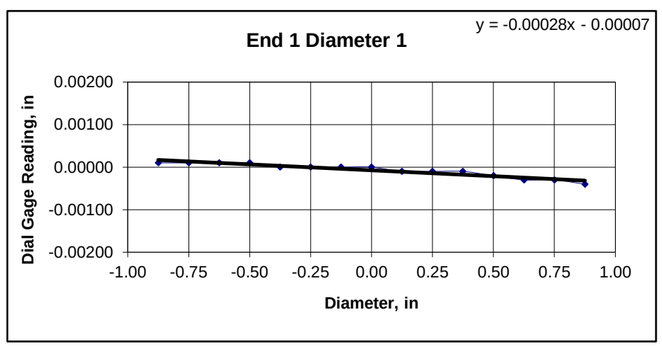
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00020	0.00020	0.00020	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030
Diameter 2, in (rotated 90°)	-0.00040	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	0.00000	0.00010	0.00020	0.00020	0.00020	0.00020

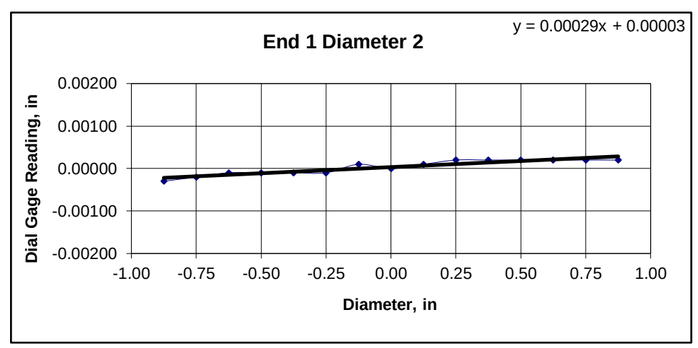
Difference between max and min readings, in:

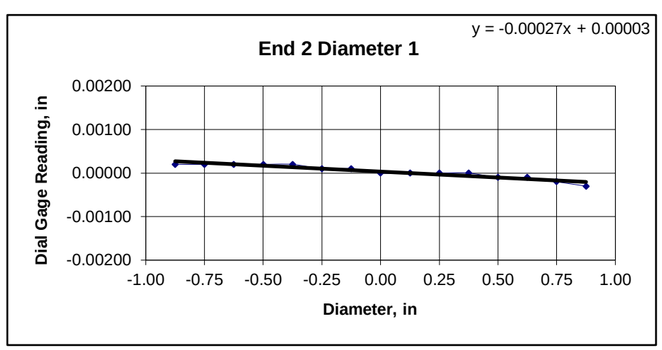
0° = 0.0005 90° = 0.0006

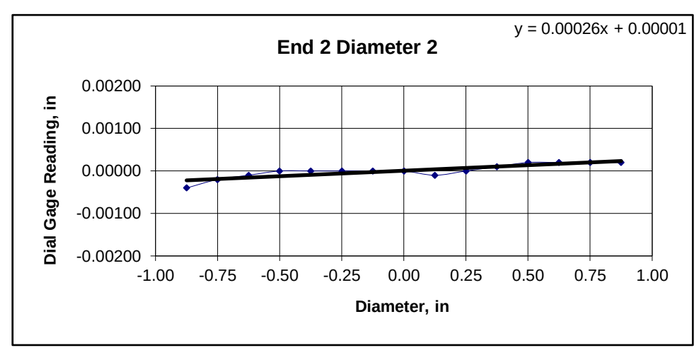
Maximum difference must be < 0.0020 in. Difference = ± 0.00030

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00028
Angle of Best Fit Line:	0.01588

End 2:

Slope of Best Fit Line	0.00027
Angle of Best Fit Line:	0.01555

Maximum Angular Difference: 0.00033

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00029
Angle of Best Fit Line:	0.01653

End 2:

Slope of Best Fit Line	0.00026
Angle of Best Fit Line:	0.01490

Maximum Angular Difference: 0.00164

Parallelism Tolerance Met? **YES**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00050	1.970	0.00025	0.015	YES
Diameter 2, in (rotated 90°)	0.00050	1.970	0.00025	0.015	YES
END 2					
Diameter 1, in	0.00050	1.970	0.00025	0.015	YES
Diameter 2, in (rotated 90°)	0.00060	1.970	0.00030	0.017	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

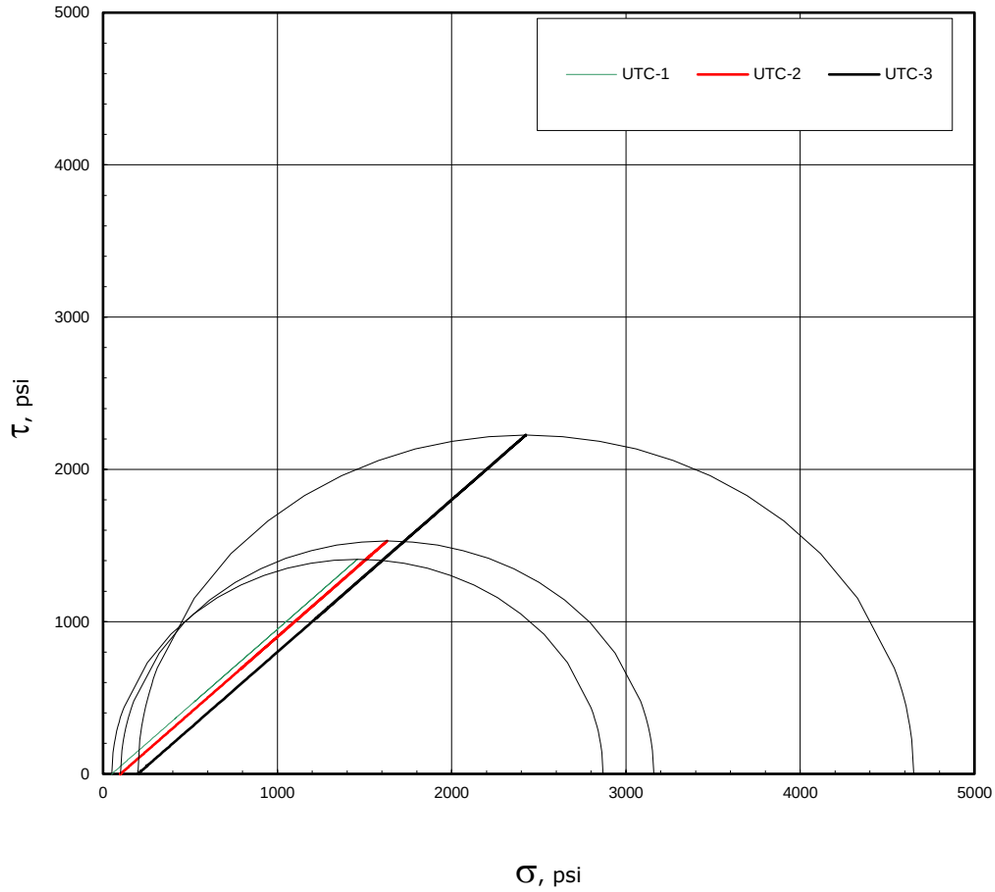
Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	3/8/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-202
Sample ID:	RC-6/7
Depth:	60'-64'1"

After cutting and grinding

After break

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/7/2019
Tested By:	trm
Checked By:	jsc
Boring ID:	T-203
Sample ID:	---
Depth:	60'-65'
Test No.:	UTC-1, 2 and 3
Sample Type:	rock core
Sample Description:	See Photographs

Triaxial Compressive Strength of Undrained Rock Core Specimens by ASTM D7012 - Method A



	UTC-1	UTC-2	UTC-3
Confining Stress, σ_3, psi	50	100	200
Maximum Total Stress, σ_1, psi	2,869	3,160	4,652
Peak Deviator Stress, σ, psi	2,819	3,060	4,452
Failure Type	Intact material failure	Intact material failure	Intact material failure

Notes: All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	T-203		
Sample ID:	---		
Depth:	60'-65'		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.26	4.27	4.27
Specimen Diameter, in:	1.98	1.98	1.98
Specimen Mass, g:	439.12		
Bulk Density, lb/ft^3	127	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00100	-0.00100	-0.00070	-0.00060	-0.00010	0.00000	0.00000	0.00000	0.00000	-0.00060	-0.00060	-0.00030	-0.00020	0.00010	0.00020
Diameter 2, in (rotated 90°)	0.00010	-0.00010	0.00010	0.00000	0.00000	0.00010	0.00000	0.00000	0.00000	0.00020	0.00020	0.00040	0.00070	0.00060	0.00030

Difference between max and min readings, in:

0° = 0.00120 90° = 0.00080

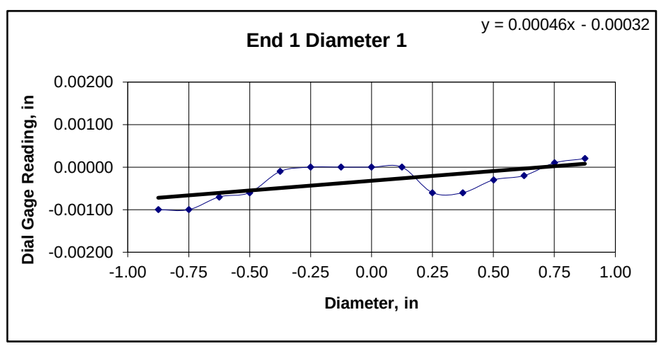
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00020	0.00050	0.00010	0.00030	0.00040	0.00020	0.00000	0.00030	0.00090	0.00110	0.00030	0.00050	0.00060	0.00030
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	-0.00010	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020

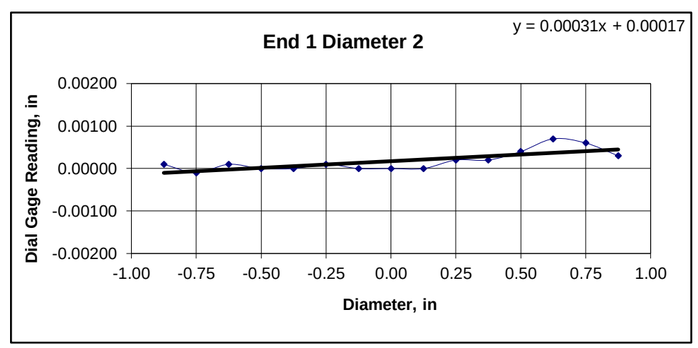
Difference between max and min readings, in:

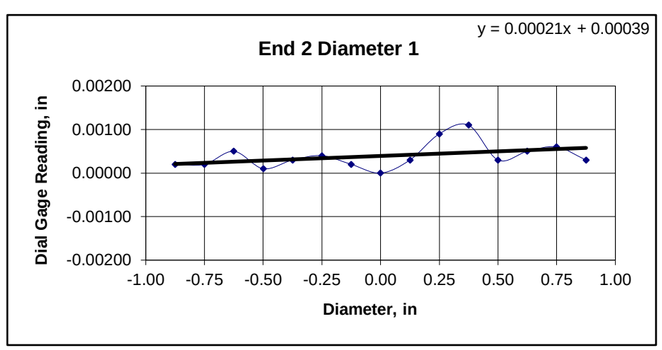
0° = 0.0011 90° = 0.0002

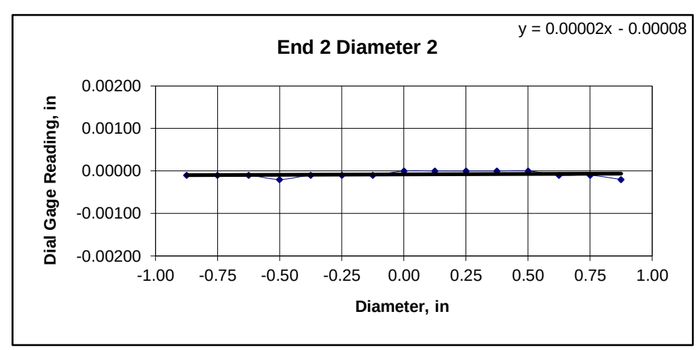
Maximum difference must be < 0.0020 in. Difference = ± 0.00060

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00046
Angle of Best Fit Line:	0.02619

End 2:

Slope of Best Fit Line	0.00021
Angle of Best Fit Line:	0.01211

Maximum Angular Difference: 0.01408

Parallelism Tolerance Met? **NO**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00031
Angle of Best Fit Line:	0.01801

End 2:

Slope of Best Fit Line	0.00002
Angle of Best Fit Line:	0.00115

Maximum Angular Difference: 0.01686

Parallelism Tolerance Met? **NO**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00120	1.980	0.00061	0.035	YES
Diameter 2, in (rotated 90°)	0.00080	1.980	0.00040	0.023	YES
END 2					
Diameter 1, in	0.00110	1.980	0.00056	0.032	YES
Diameter 2, in (rotated 90°)	0.00020	1.980	0.00010	0.006	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	T-203	Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	---		
Depth:	60'-65'		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
	End Flatness Tolerance Met?	**YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/7/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	T-203
Sample ID:	---
Depth:	60'-65'

After cutting and grinding

After break

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	T-203		
Sample ID:	---		
Depth:	60'-65'		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.50	4.50	4.50
Specimen Diameter, in:	1.98	1.98	1.98
Specimen Mass, g:	480.46		
Bulk Density, lb/ft^3	132	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00070	0.00070	0.00050	0.00040	0.00030	0.00000	0.00000	0.00000	-0.00040	-0.00050	-0.00070	-0.00080	-0.00090	-0.00110	-0.00120
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010

Difference between max and min readings, in:

0° = 0.00190 90° = 0.00010

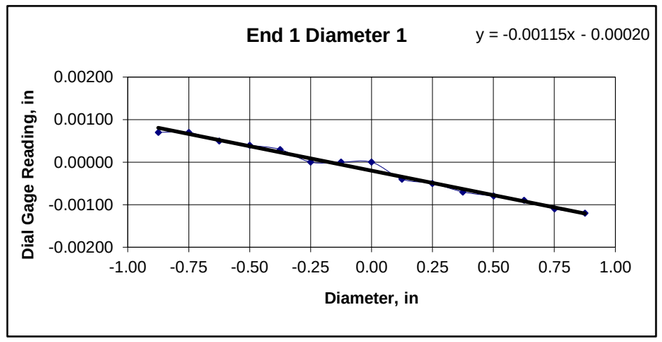
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00060	0.00000	0.00010	0.00010	0.00010	-0.00020	-0.00020	0.00000	0.00000	0.00000	0.00000	-0.00020	-0.00030	-0.00060	-0.00060
Diameter 2, in (rotated 90°)	-0.00020	-0.00020	-0.00020	-0.00010	0.00010	0.00020	0.00030	0.00000	0.00040	0.00040	0.00040	0.00050	0.00070	0.00070	0.00050

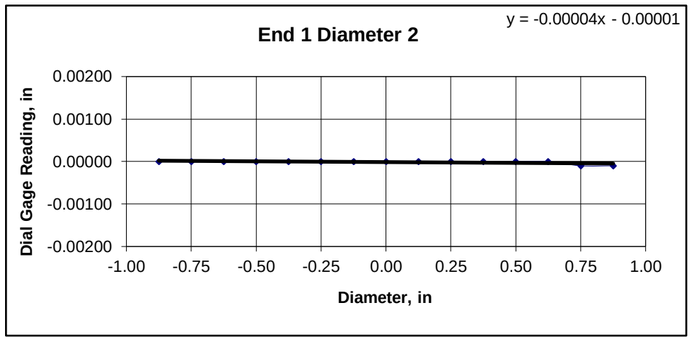
Difference between max and min readings, in:

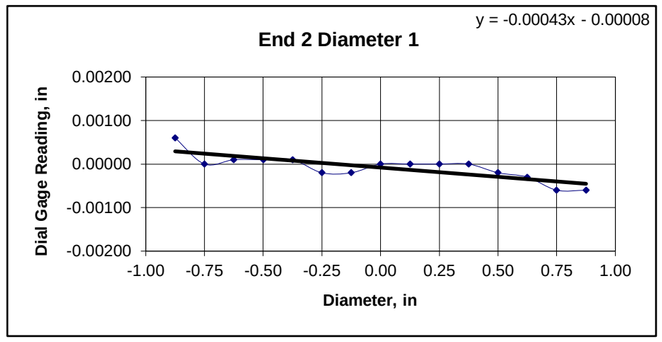
0° = 0.0012 90° = 0.0009

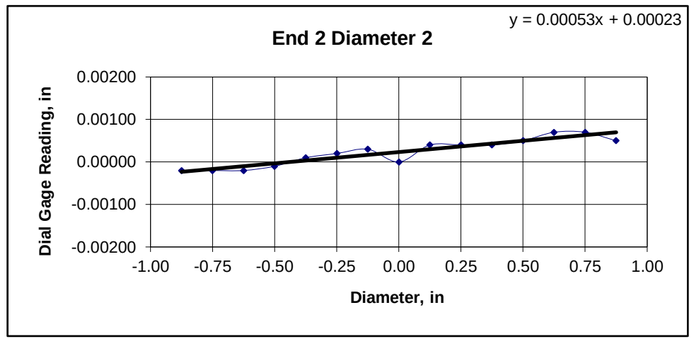
Maximum difference must be < 0.0020 in. Difference = ± 0.00095

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00115
Angle of Best Fit Line:	0.06597

End 2:

Slope of Best Fit Line	0.00043
Angle of Best Fit Line:	0.02439

Maximum Angular Difference: 0.04158

Parallelism Tolerance Met? **NO**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00004
Angle of Best Fit Line:	0.00213

End 2:

Slope of Best Fit Line	0.00053
Angle of Best Fit Line:	0.03045

Maximum Angular Difference: 0.02832

Parallelism Tolerance Met? **NO**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00190	1.980	0.00096	0.055	YES
Diameter 2, in (rotated 90°)	0.00010	1.980	0.00005	0.003	YES
END 2					
Diameter 1, in	0.00120	1.980	0.00061	0.035	YES
Diameter 2, in (rotated 90°)	0.00090	1.980	0.00045	0.026	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

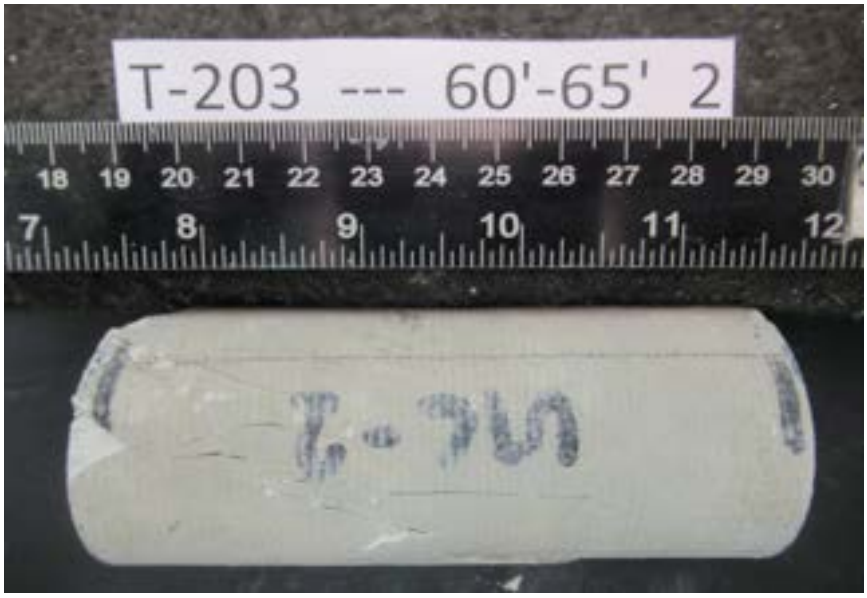
Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	T-203	Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	---		
Depth:	60'-65'		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
	End Flatness Tolerance Met?	**YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/7/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	T-203
Sample ID:	---
Depth:	60'-65'

After cutting and grinding



After break

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	T-203		
Sample ID:	---		
Depth:	60'-65'		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.31	4.31	4.31
Specimen Diameter, in:	1.98	1.98	1.98
Specimen Mass, g:	461.99		
Bulk Density, lb/ft^3	132	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00110	0.00100	0.00100	0.00140	0.00130	0.00100	0.00060	0.00000	-0.00020	-0.00050	-0.00070	-0.00070	-0.00060	-0.00070	-0.00090
Diameter 2, in (rotated 90°)	-0.00120	-0.00090	-0.00110	-0.00110	-0.00090	-0.00010	0.00030	0.00000	-0.00040	-0.00050	-0.00050	-0.00010	0.00040	0.00040	0.00010

Difference between max and min readings, in:

0° = 0.00230 90° = 0.00160

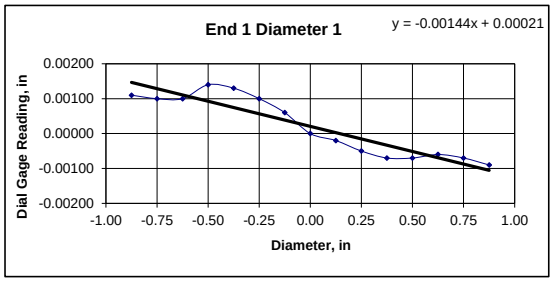
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00160	0.00170	0.00150	0.00120	0.00100	0.00070	0.00030	0.00000	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00090	-0.00070	-0.00040	0.00020	0.00010	0.00020	0.00010	0.00000	0.00060	0.00090	0.00080	0.00120	0.00130	0.00170	0.00190

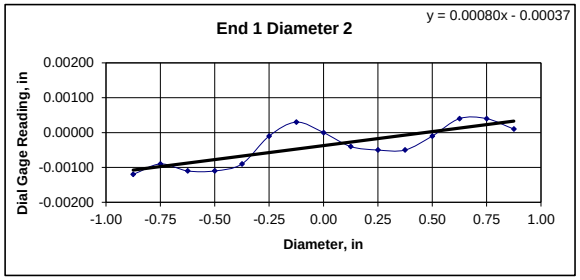
Difference between max and min readings, in:

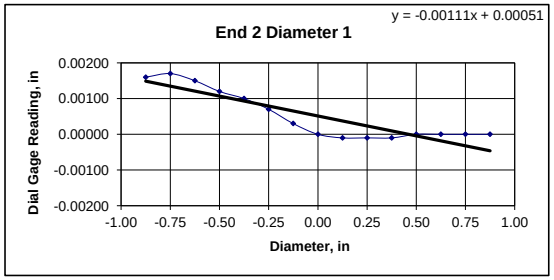
0° = 0.0018 90° = 0.0028

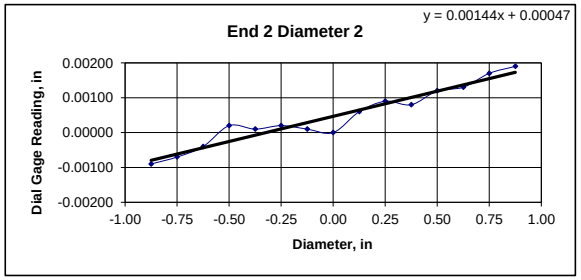
Maximum difference must be < 0.0020 in. Difference = ± 0.00140

Flatness Tolerance Met? **NO**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00144
Angle of Best Fit Line:	0.08251

End 2:

Slope of Best Fit Line	0.00111
Angle of Best Fit Line:	0.06384

Maximum Angular Difference: 0.01866

Parallelism Tolerance Met? **NO**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00080
Angle of Best Fit Line:	0.04600

End 2:

Slope of Best Fit Line	0.00144
Angle of Best Fit Line:	0.08267

Maximum Angular Difference: 0.03667

Parallelism Tolerance Met? **NO**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00230	1.980	0.00116	0.067	YES
Diameter 2, in (rotated 90°)	0.00160	1.980	0.00081	0.046	YES
END 2					
Diameter 1, in	0.00180	1.980	0.00091	0.052	YES
Diameter 2, in (rotated 90°)	0.00280	1.980	0.00141	0.081	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group	Test Date:	2/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	T-203	Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	---		
Depth:	60'-65'		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
	End Flatness Tolerance Met?	**YES**

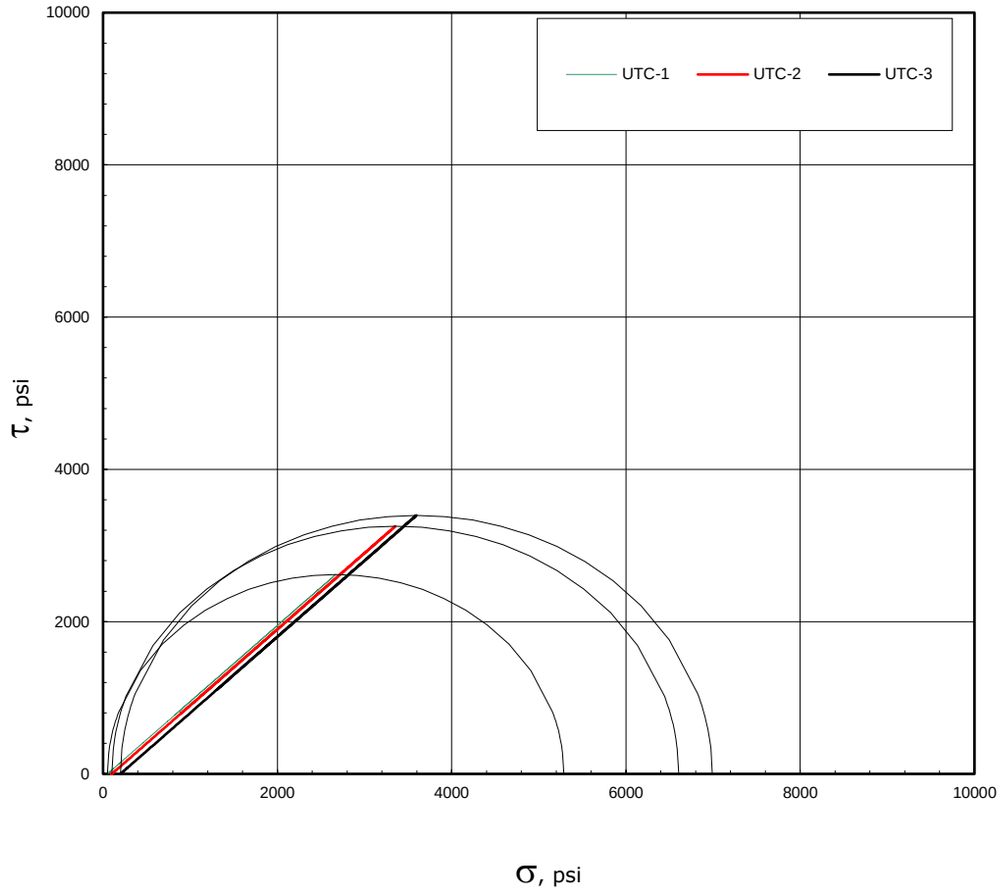
Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/7/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	T-203
Sample ID:	---
Depth:	60'-65'

After cutting and grinding

After break

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/9/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-207
Sample ID:	RC-5/RC-6
Depth, ft:	51.0-61.0
Test No.:	UTC-1, 2 and 3
Sample Type:	rock core
Sample Description:	See Photographs

Triaxial Compressive Strength of Undrained Rock Core Specimens by ASTM D7012 - Method A



	UTC-1	UTC-2	UTC-3
Confining Stress, σ_3, psi	50	100	200
Maximum Total Stress, σ_1, psi	5,288	6,607	6,991
Peak Deviator Stress, σ, psi	5,238	6,507	6,791
Failure Type	Intact material failure	Intact material failure	Intact material failure

Notes: All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Client:	Alliance Geotechnical Group	Test Date:	5/2/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-207		
Sample ID:	RC-5/RC-6		
Depth:	51.0-61.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.38	4.38	4.38
Specimen Diameter, in:	1.98	1.99	1.99
Specimen Mass, g:	438.33		
Bulk Density, lb/ft^3	123	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00060	0.00050	0.00040	0.00030	0.00030	0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00030	-0.00030	-0.00040
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00000	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00020	-0.00010	-0.00030	-0.00030

Difference between max and min readings, in:

0° = 0.00100 90° = 0.00040

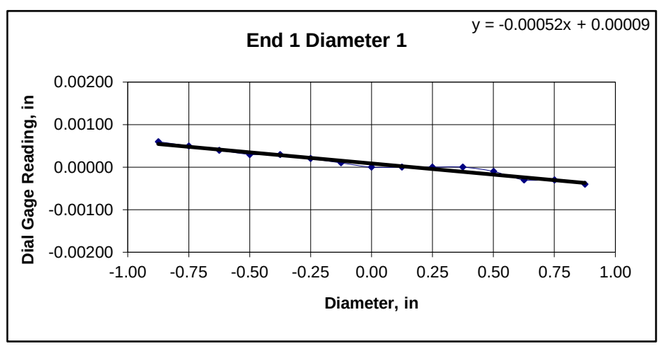
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00040	0.00030	0.00030	0.00020	0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00020	-0.00030	-0.00040	-0.00050	-0.00050
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010

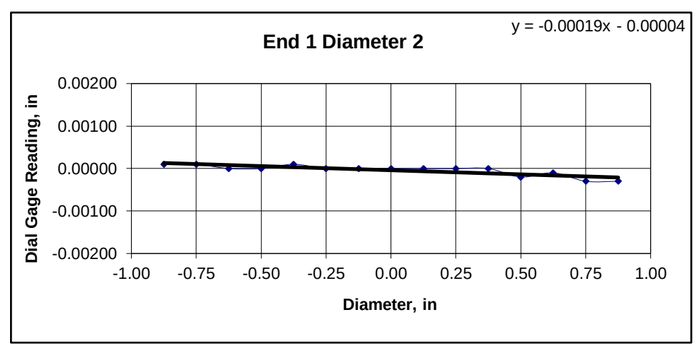
Difference between max and min readings, in:

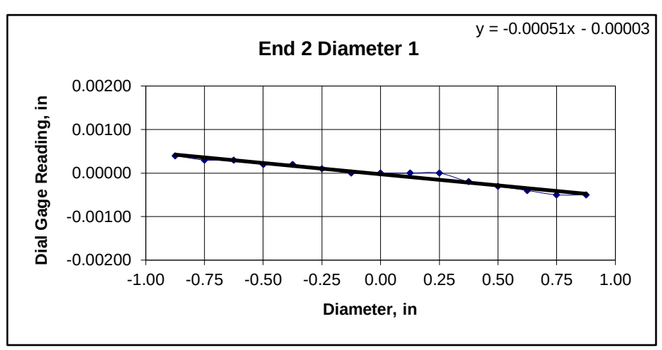
0° = 0.0009 90° = 0.0002

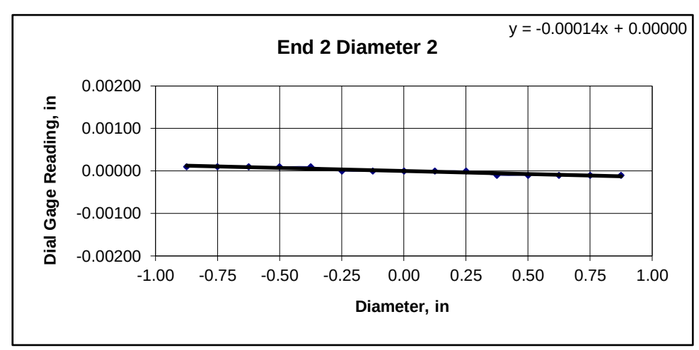
Maximum difference must be < 0.0020 in. Difference = ± 0.00050

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00052
Angle of Best Fit Line:	0.02996

End 2:

Slope of Best Fit Line	0.00051
Angle of Best Fit Line:	0.02947

Maximum Angular Difference: 0.00049

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00019
Angle of Best Fit Line:	0.01113

End 2:

Slope of Best Fit Line	0.00014
Angle of Best Fit Line:	0.00819

Maximum Angular Difference: 0.00295

Parallelism Tolerance Met? **YES**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

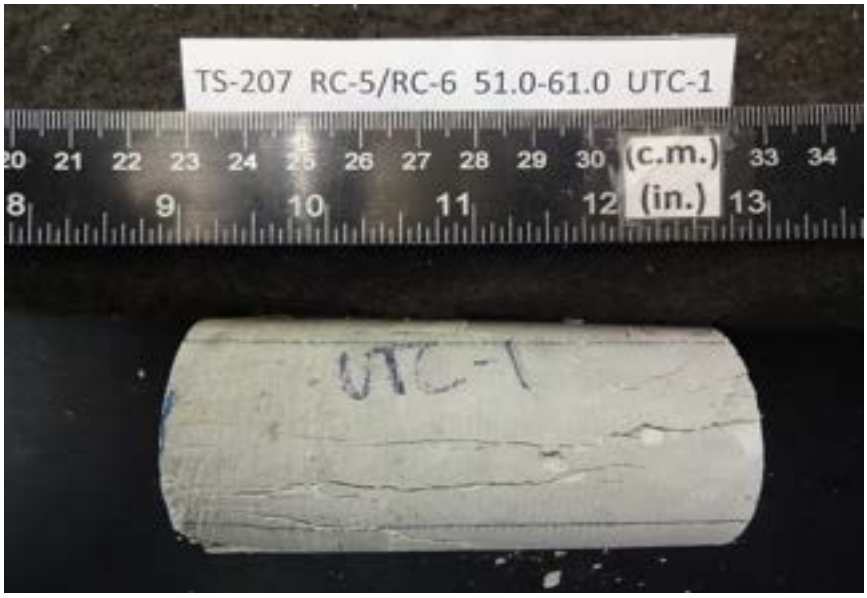
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00100	1.985	0.00050	0.029	YES
Diameter 2, in (rotated 90°)	0.00040	1.985	0.00020	0.012	YES
END 2					
Diameter 1, in	0.00090	1.985	0.00045	0.026	YES
Diameter 2, in (rotated 90°)	0.00020	1.985	0.00010	0.006	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/9/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-207
Sample ID:	RC-5/RC-6
Depth:	51.0-61.0

After cutting and grinding



After break

Client:	Alliance Geotechnical Group	Test Date:	5/2/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-207		
Sample ID:	RC-5/RC-6		
Depth:	51.0-61.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.38	4.37	4.38
Specimen Diameter, in:	1.99	1.98	1.99
Specimen Mass, g:	441.02		
Bulk Density, lb/ft^3	124	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00040	0.00040	0.00030	0.00030	0.00030	0.00020	0.00010	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030	-0.00040	-0.00040
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00010	0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010

Difference between max and min readings, in:

0° = 0.00080 90° = 0.00030

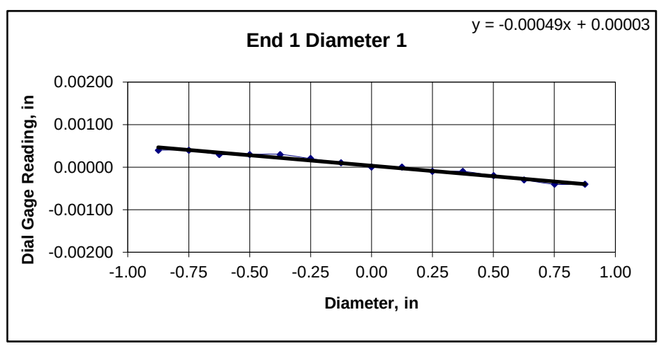
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00030	0.00030	0.00020	0.00020	0.00020	0.00010	0.00000	0.00000	0.00000	-0.00020	-0.00030	-0.00040	-0.00040	-0.00050	-0.00050
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	0.00000	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00020	-0.00020	-0.00020	-0.00020	-0.00020

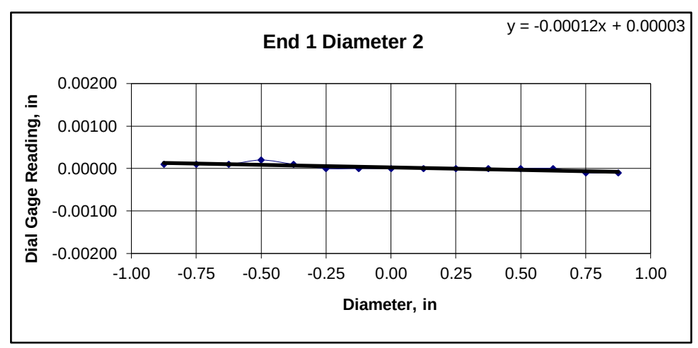
Difference between max and min readings, in:

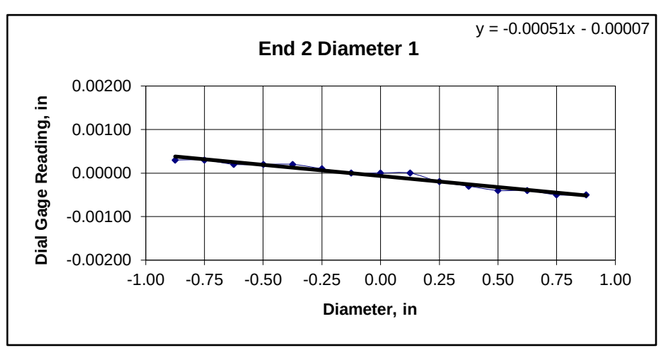
0° = 0.0008 90° = 0.0003

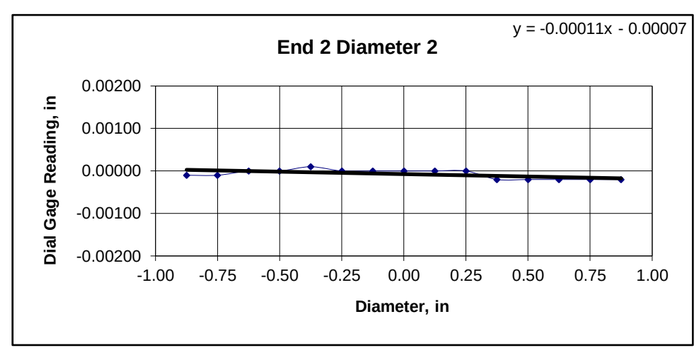
Maximum difference must be < 0.0020 in. Difference = ± 0.00040

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00049
Angle of Best Fit Line:	0.02832

End 2:

Slope of Best Fit Line	0.00051
Angle of Best Fit Line:	0.02930

Maximum Angular Difference: 0.00098

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00012
Angle of Best Fit Line:	0.00688

End 2:

Slope of Best Fit Line	0.00011
Angle of Best Fit Line:	0.00655

Maximum Angular Difference: 0.00033

Parallelism Tolerance Met? **YES**

Spherically Seated

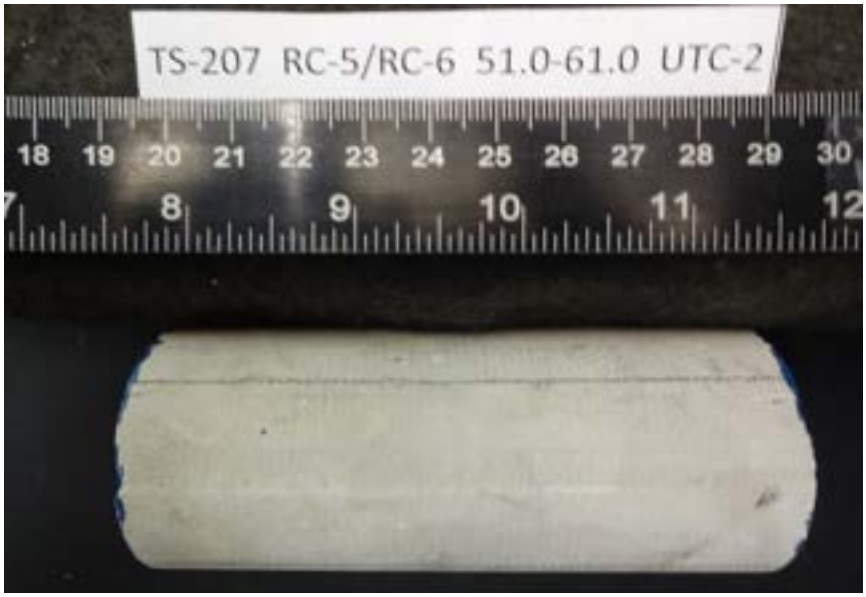
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00080	1.985	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00030	1.985	0.00015	0.009	YES
END 2					
Diameter 1, in	0.00080	1.985	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00030	1.985	0.00015	0.009	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/9/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-207
Sample ID:	RC-5/RC-6
Depth:	51.0-61.0



After cutting and grinding

After break

Client:	Alliance Geotechnical Group	Test Date:	5/2/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-207		
Sample ID:	RC-5/RC-6		
Depth:	51.0-61.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.40	4.40	4.40
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	463.32		
Bulk Density, lb/ft^3	129	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030	-0.00050

Difference between max and min readings, in:

0° = 0.00040 90° = 0.00050

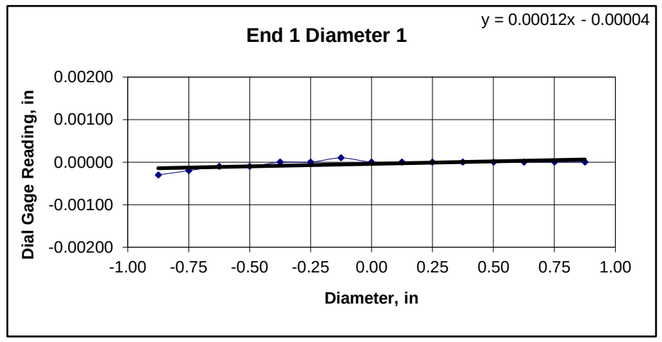
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00020	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00030	-0.00040

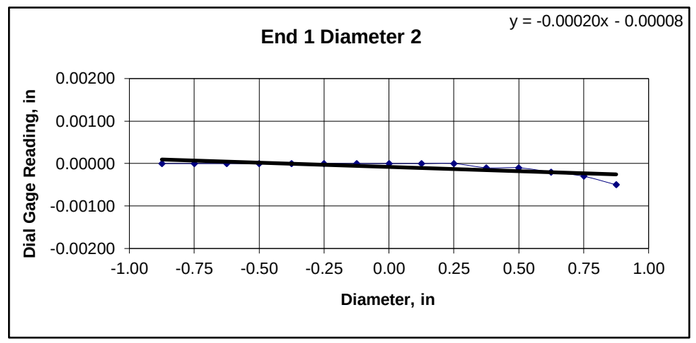
Difference between max and min readings, in:

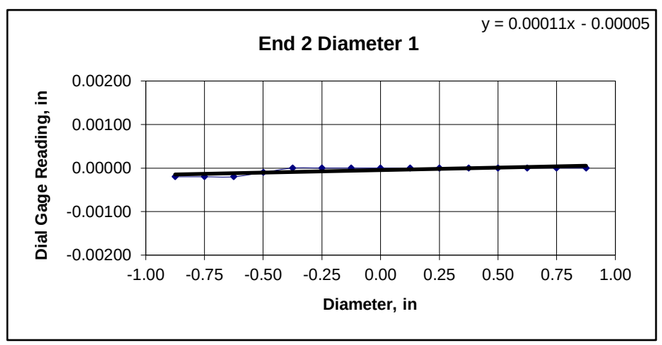
0° = 0.0002 90° = 0.0004

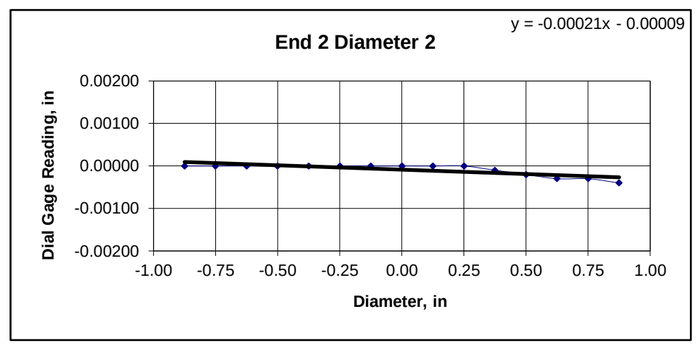
Maximum difference must be < 0.0020 in. Difference = ± 0.00025

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00012
Angle of Best Fit Line:	0.00671

End 2:

Slope of Best Fit Line	0.00011
Angle of Best Fit Line:	0.00655

Maximum Angular Difference: 0.00016

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00020
Angle of Best Fit Line:	0.01146

End 2:

Slope of Best Fit Line	0.00021
Angle of Best Fit Line:	0.01179

Maximum Angular Difference: 0.00033

Parallelism Tolerance Met? **YES**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

Maximum angle of departure must be ≤ 0.25°

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00040	1.990	0.00020	0.012	YES
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES
END 2					
Diameter 1, in	0.00020	1.990	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00040	1.990	0.00020	0.012	YES

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/9/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-207
Sample ID:	RC-5/RC-6
Depth:	51.0-61.0

After cutting and grinding

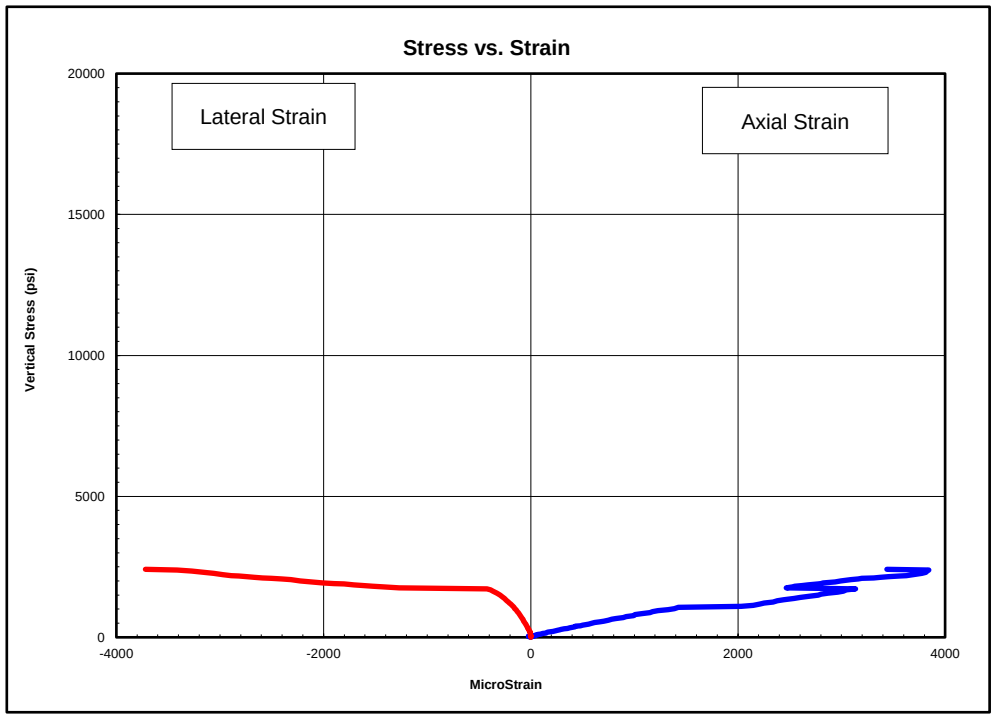
After break

APPENDIX F-13

UNCONFINED COMPRESSSIVE STRENGTH WITH MODULI METHOD-D

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/30/2019
Tested By:	cmh
Checked By:	jsc
Boring ID:	B-3
Sample ID:	RC-6
Depth, ft:	70.0-70.35
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 2,412 psi

The strain gauges picked up an initial failure within the specimen and then continued reading until total failure occured.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
200-900	721,000	0.12
900-1500	323,000	---
1500-2200	402,000	---

Notes:
Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Alliance Geotechnical Group	Test Date:	5/30/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	B-3		
Sample ID:	RC-6		
Depth:	70.0-70.35 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.34	4.34	4.34
Specimen Diameter, in:	1.97	1.97	1.97
Specimen Mass, g:	441.68		
Bulk Density, lb/ft^3	127	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.01840	-0.01560	-0.01260	-0.00860	-0.00610	-0.00380	-0.00210	0.00000	0.00050	0.00110	0.00130	0.00180	0.00210	0.00220	0.00260
Diameter 2, in (rotated 90°)	-0.01610	-0.01340	-0.01080	-0.00810	-0.00670	-0.00510	-0.00400	0.00000	0.00180	0.00290	0.00290	0.00470	0.00550	0.00650	0.00770

Difference between max and min readings, in:

0° = 0.02100 90° = 0.02380

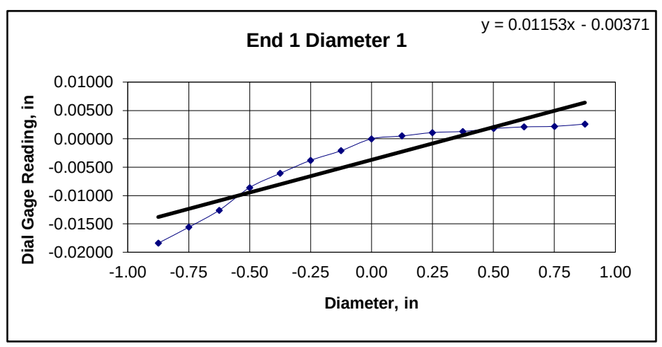
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.01370	-0.00980	-0.00950	-0.00480	-0.00180	-0.00010	0.00050	0.00000	0.00150	0.00590	0.00590	0.00980	0.01160	0.01180	0.00770
Diameter 2, in (rotated 90°)	-0.01530	-0.01210	-0.00880	-0.00730	-0.00500	-0.00360	-0.00090	0.00000	0.00280	0.00540	0.00590	0.00590	0.00880	0.01040	0.01180

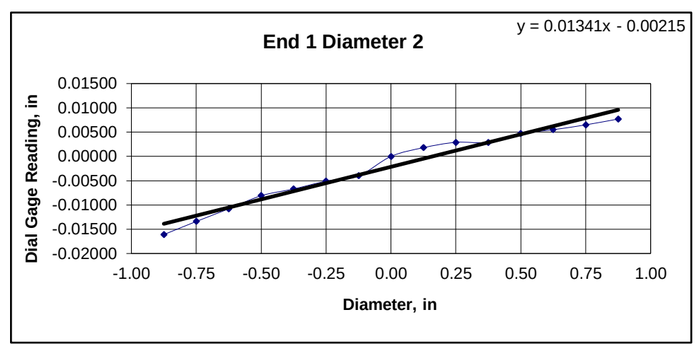
Difference between max and min readings, in:

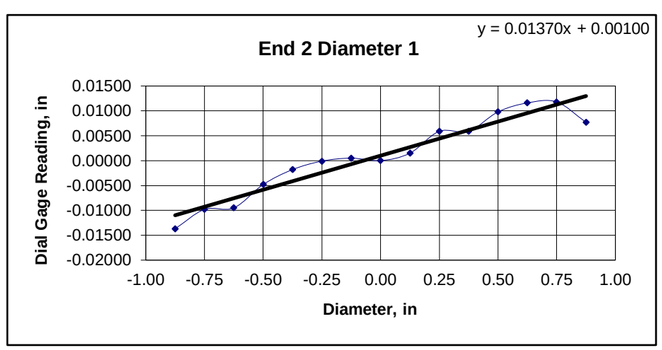
0° = 0.0255 90° = 0.0271

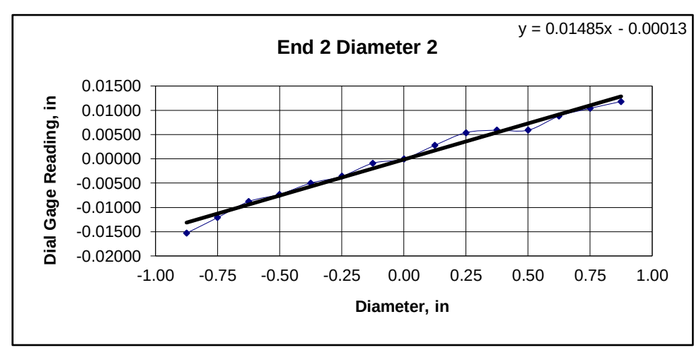
Maximum difference must be < 0.0020 in. Difference = ± 0.01355

Flatness Tolerance Met? **NO**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.01153
Angle of Best Fit Line:	0.66051

End 2:

Slope of Best Fit Line	0.01370
Angle of Best Fit Line:	0.78474

Maximum Angular Difference: 0.12423

Parallelism Tolerance Met? **NO**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.01341
Angle of Best Fit Line:	0.76821

End 2:

Slope of Best Fit Line	0.01485
Angle of Best Fit Line:	0.85103

Maximum Angular Difference: 0.08282

Parallelism Tolerance Met? **NO**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.02100	1.970	0.01066	0.611	NO
Diameter 2, in (rotated 90°)	0.02380	1.970	0.01208	0.692	NO
END 2					
Diameter 1, in	0.02550	1.970	0.01294	0.742	NO
Diameter 2, in (rotated 90°)	0.02710	1.970	0.01376	0.788	NO

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **NO**

Client:	Alliance Geotechnical Group	Test Date:	5/30/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	B-3	Reliable dial gauge measurements could not be performed on this rock type. Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	RC-6		
Depth (ft):	70.0-70.35 ft		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
	End Flatness Tolerance Met?	**YES**

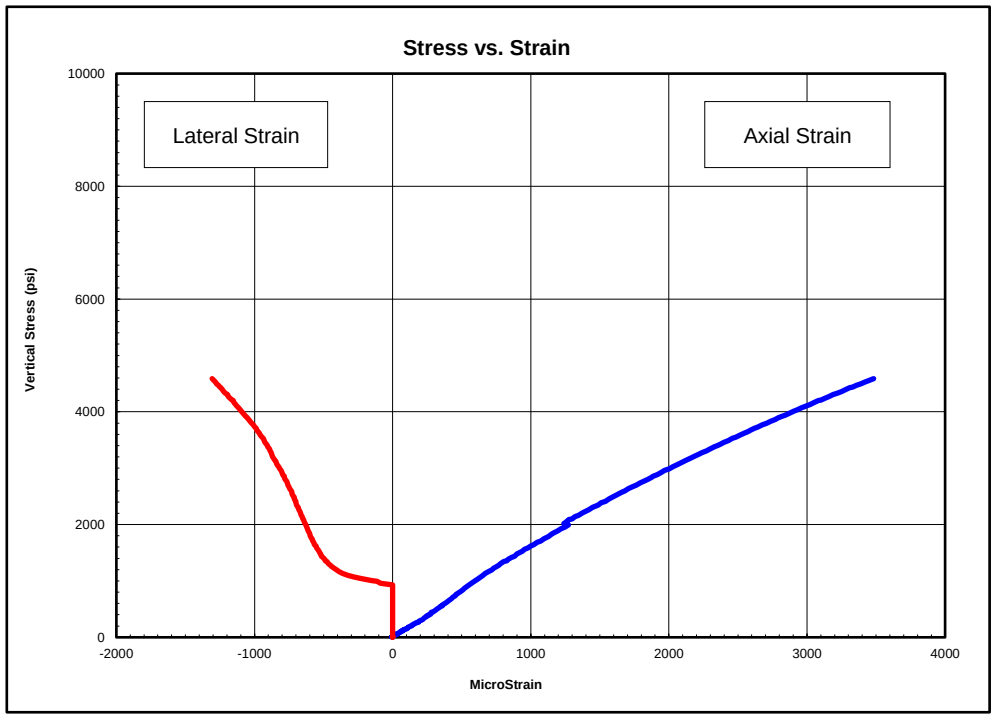
Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/30/2019
Tested By:	cmh
Checked By:	jsc
Boring ID:	B-3
Sample ID:	RC-6
Depth:	70.0-70.35

After cutting and grinding

After break

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/9/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-207
Sample ID:	RC-5/RC-6
Depth, ft:	51.0-61.0
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 4,999 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
500-1800	1,610,000	---
1800-3200	1,310,000	0.25
3200-4500	1,070,000	0.35

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Alliance Geotechnical Group	Test Date:	5/2/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-207		
Sample ID:	RC-5/RC-6		
Depth:	51.0-61.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.39	4.39	4.39
Specimen Diameter, in:	1.98	1.97	1.98
Specimen Mass, g:	456.33		
Bulk Density, lb/ft^3	129	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00020	0.00020	0.00030	0.00030	0.00030	0.00040
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00020	0.00020	0.00020

Difference between max and min readings, in:

0° = 0.00060 90° = 0.00020

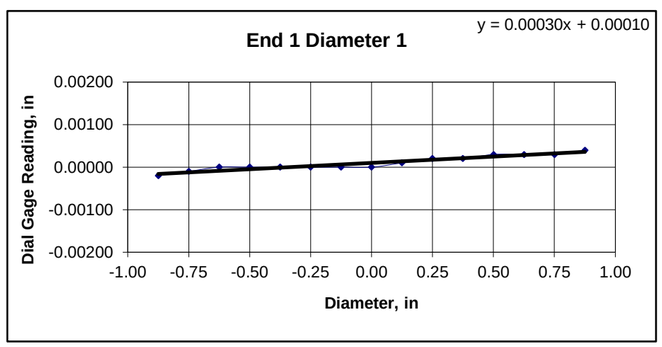
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	-0.00010	-0.00010	0.00000	0.00000	0.00010	0.00000	-0.00010	0.00000	0.00010	0.00020	0.00030	0.00040	0.00030
Diameter 2, in (rotated 90°)	-0.00040	-0.00030	-0.00010	-0.00010	-0.00020	-0.00020	-0.00010	0.00000	-0.00030	-0.00030	-0.00030	-0.00020	-0.00010	-0.00010	-0.00010

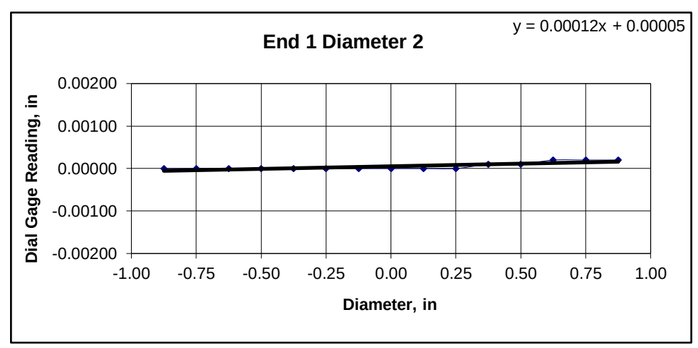
Difference between max and min readings, in:

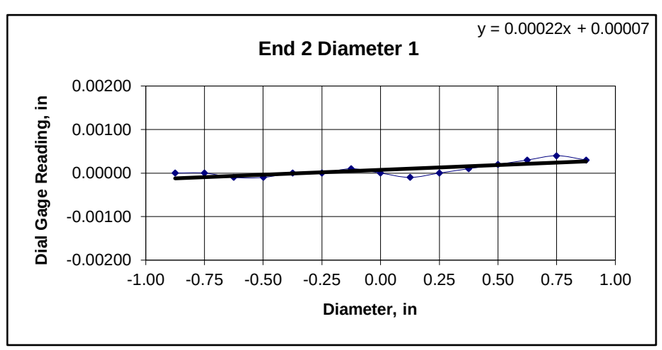
0° = 0.0005 90° = 0.0004

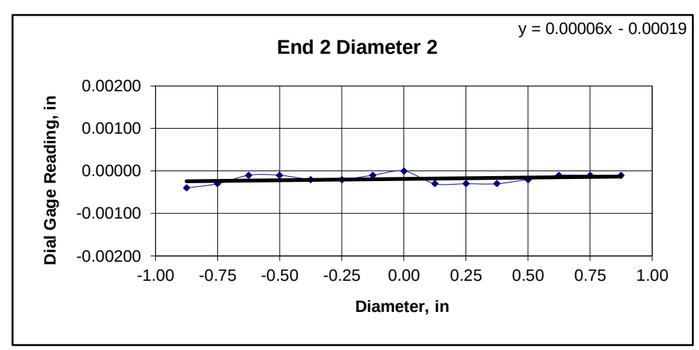
Maximum difference must be < 0.0020 in. Difference = ± 0.00030

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00030
Angle of Best Fit Line:	0.01703

End 2:

Slope of Best Fit Line	0.00022
Angle of Best Fit Line:	0.01277

Maximum Angular Difference: 0.00426

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00012
Angle of Best Fit Line:	0.00704

End 2:

Slope of Best Fit Line	0.00006
Angle of Best Fit Line:	0.00360

Maximum Angular Difference: 0.00344

Parallelism Tolerance Met? **YES**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00060	1.975	0.00030	0.017	YES
Diameter 2, in (rotated 90°)	0.00020	1.975	0.00010	0.006	YES
END 2					
Diameter 1, in	0.00050	1.975	0.00025	0.015	YES
Diameter 2, in (rotated 90°)	0.00040	1.975	0.00020	0.012	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

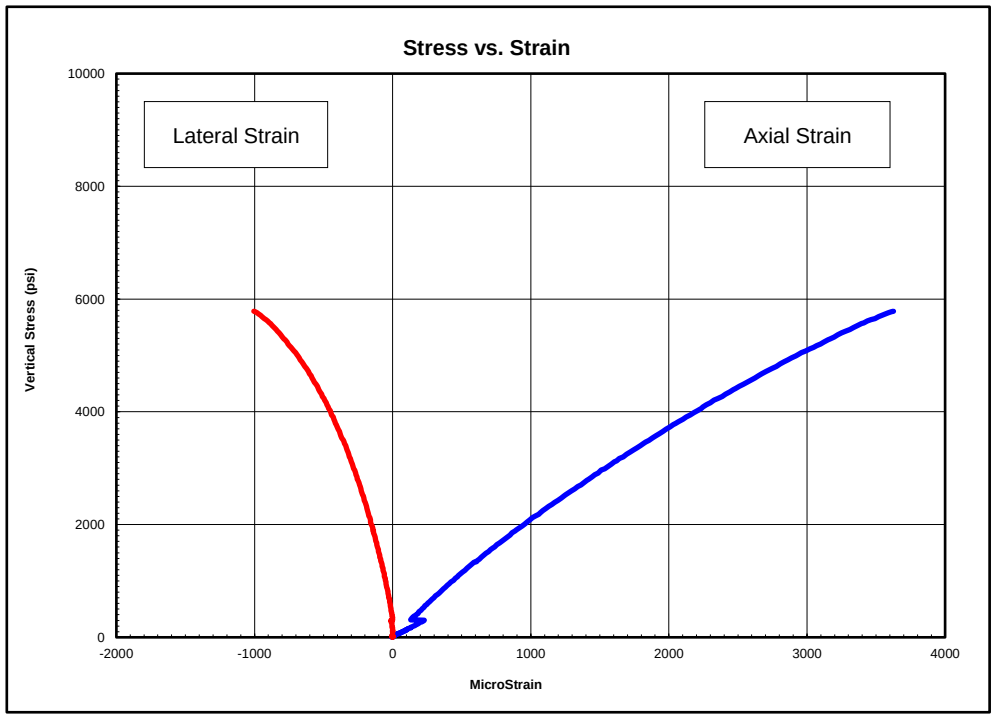
Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/9/2019
Tested By:	cmh
Checked By:	jsc
Boring ID:	TS-207
Sample ID:	RC-5/RC-6
Depth:	51.0-61.0

After cutting and grinding

After break

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/9/2019
Tested By:	jck
Checked By:	jsc
Boring ID:	TS-209
Sample ID:	RC-1
Depth, ft:	40.0-50.0
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 5,783 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
600-2100	2,000,000	0.19
2100-3700	1,630,000	0.23
3700-5200	1,360,000	0.32

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Alliance Geotechnical Group	Test Date:	5/2/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-209		
Sample ID:	RC-1		
Depth:	40.0-50.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.37	4.38	4.38
Specimen Diameter, in:	1.98	1.98	1.98
Specimen Mass, g:	462.88		
Bulk Density, lb/ft^3	131	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030	-0.00030	-0.00030	-0.00030
Diameter 2, in (rotated 90°)	0.00030	0.00030	0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030	-0.00030

Difference between max and min readings, in:

0° = 0.00040 90° = 0.00060

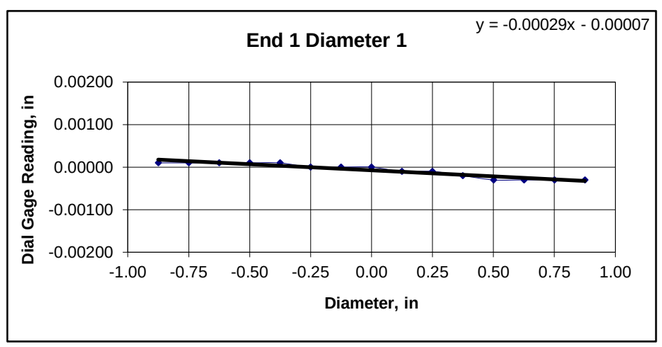
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00040
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00030	-0.00030	-0.00030	-0.00020	-0.00040	-0.00050	-0.00050

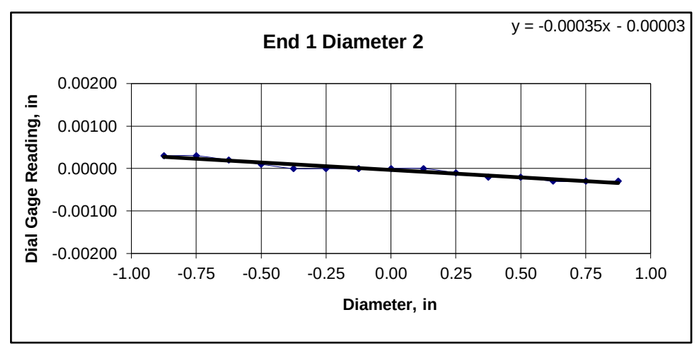
Difference between max and min readings, in:

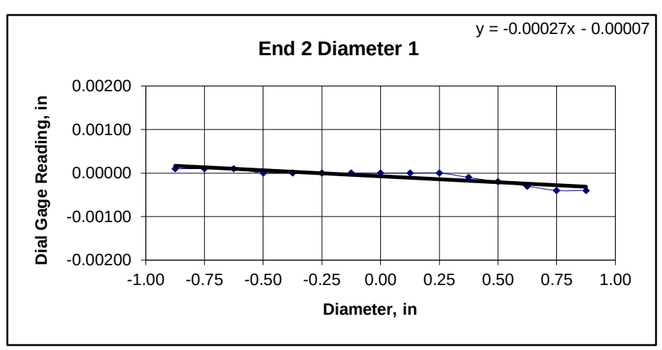
0° = 0.0005 90° = 0.0005

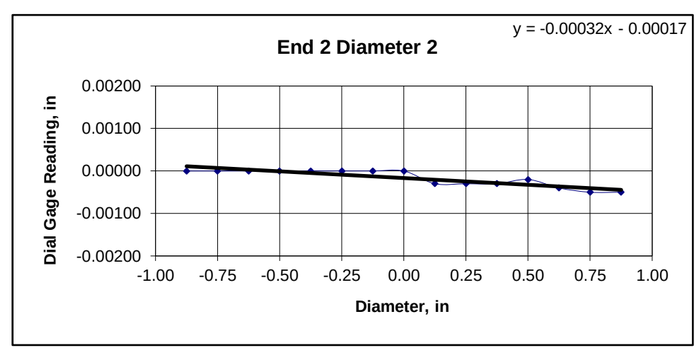
Maximum difference must be < 0.0020 in. Difference = ± 0.00030

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00029
Angle of Best Fit Line:	0.01637

End 2:

Slope of Best Fit Line	0.00027
Angle of Best Fit Line:	0.01572

Maximum Angular Difference: 0.00065

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00035
Angle of Best Fit Line:	0.02014

End 2:

Slope of Best Fit Line	0.00032
Angle of Best Fit Line:	0.01817

Maximum Angular Difference: 0.00196

Parallelism Tolerance Met? **YES**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00040	1.980	0.00020	0.012	YES
Diameter 2, in (rotated 90°)	0.00060	1.980	0.00030	0.017	YES
END 2					
Diameter 1, in	0.00050	1.980	0.00025	0.014	YES
Diameter 2, in (rotated 90°)	0.00050	1.980	0.00025	0.014	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/9/2019
Tested By:	cmh
Checked By:	jsc
Boring ID:	TS-209
Sample ID:	RC-1
Depth:	40.0-50.0

After cutting and grinding

After break

ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

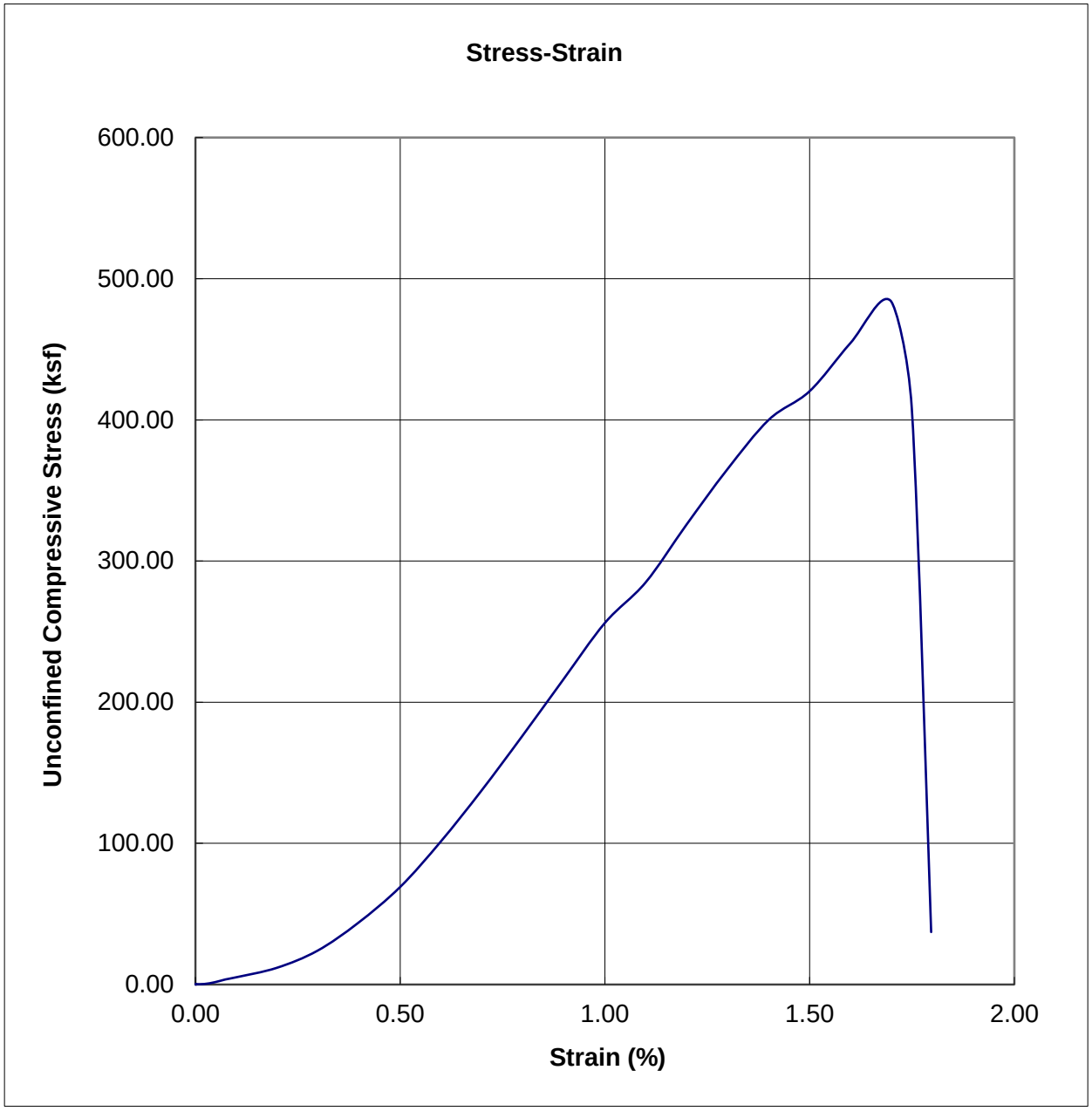
Project No.: E17-0811

Unc. Stress(ksf): 484.33

Boring No.: P-102

Depth,ft.: 23

%Strain: 1.7



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

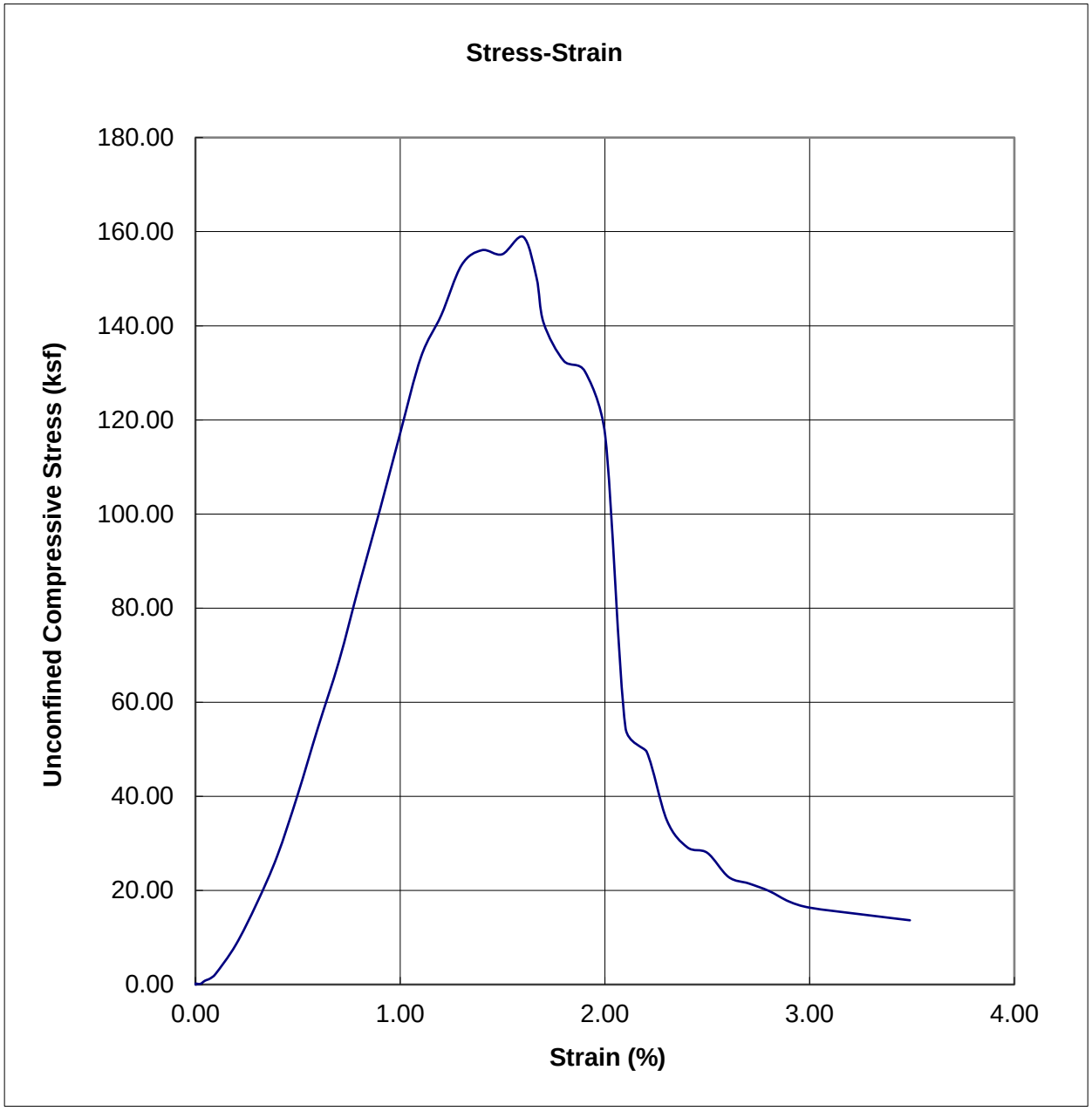
Project No.: E17-0811

Unc. Stress(ksf): 158.88

Boring No.: T-102

Depth,ft.: 25.75

%Strain: 1.6



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

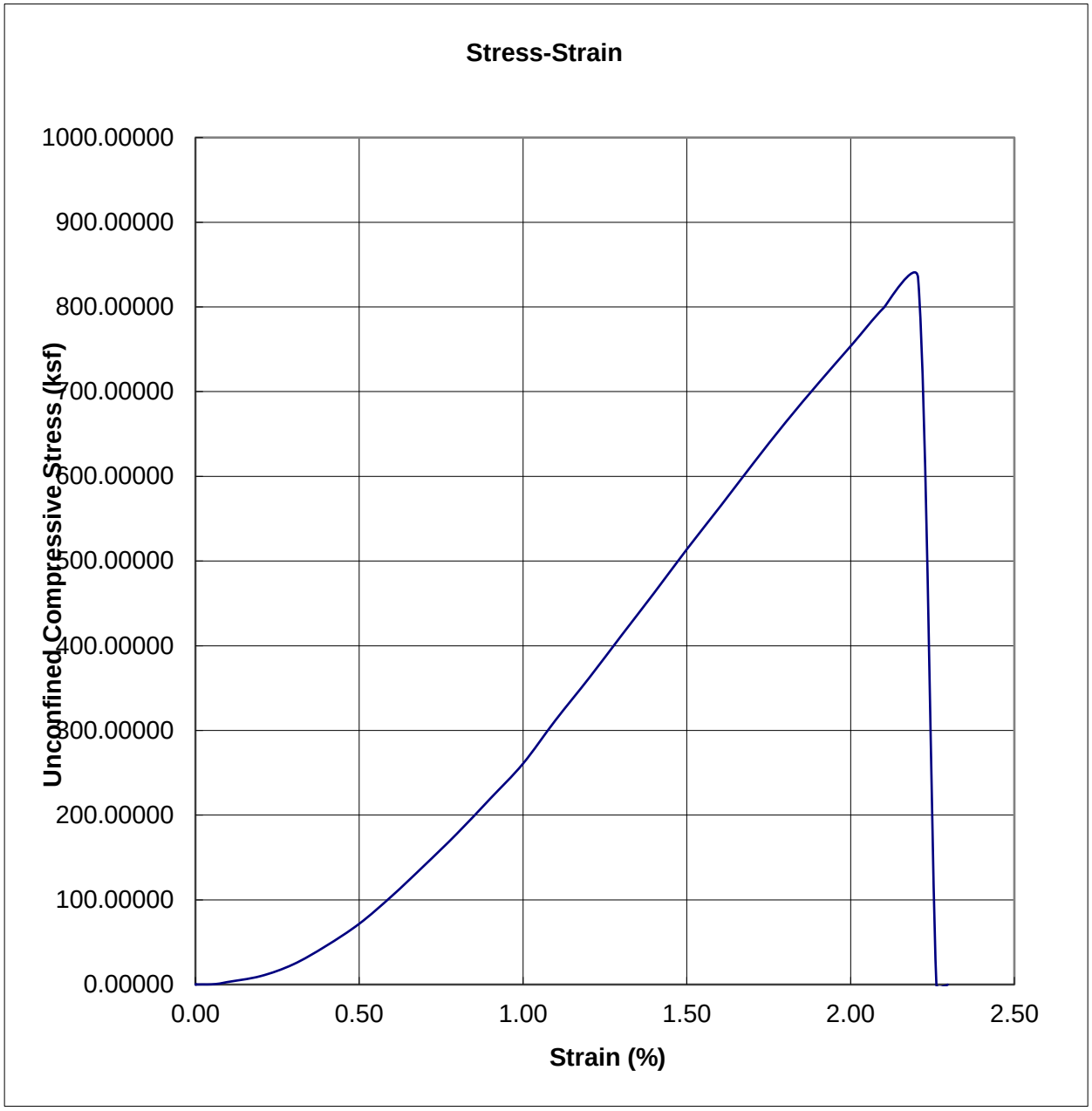
Project No.: E17-0811

Unc. Stress(ksf): 834.08

Boring No.: T-103

Depth,ft.: 36.25

%Strain: 2.2



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

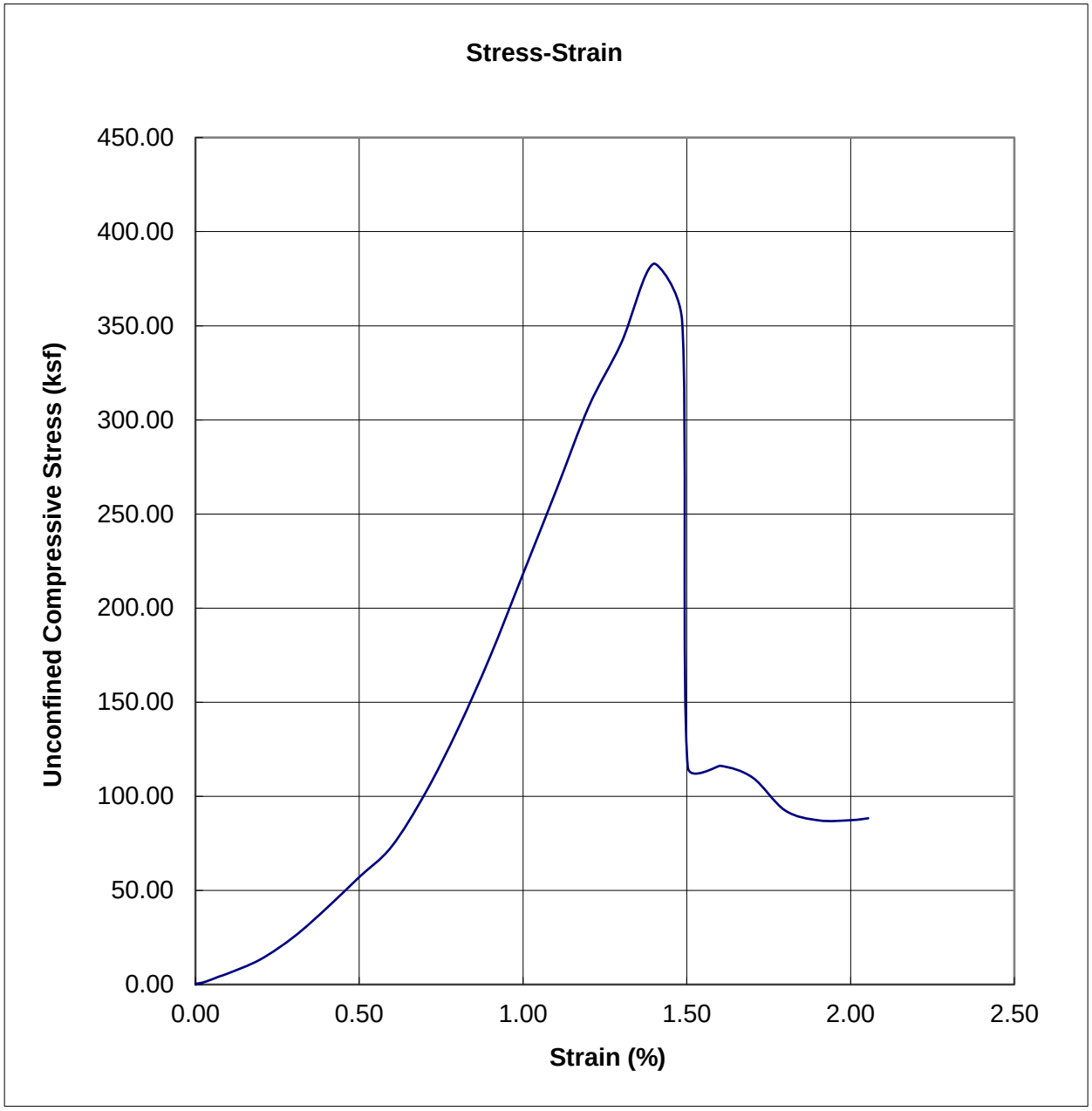
Project No.: E17-0811

Unc. Stress(ksf): 383.02

Boring No.: TS-104

Depth,ft.: 38.75

%Strain: 1.4



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

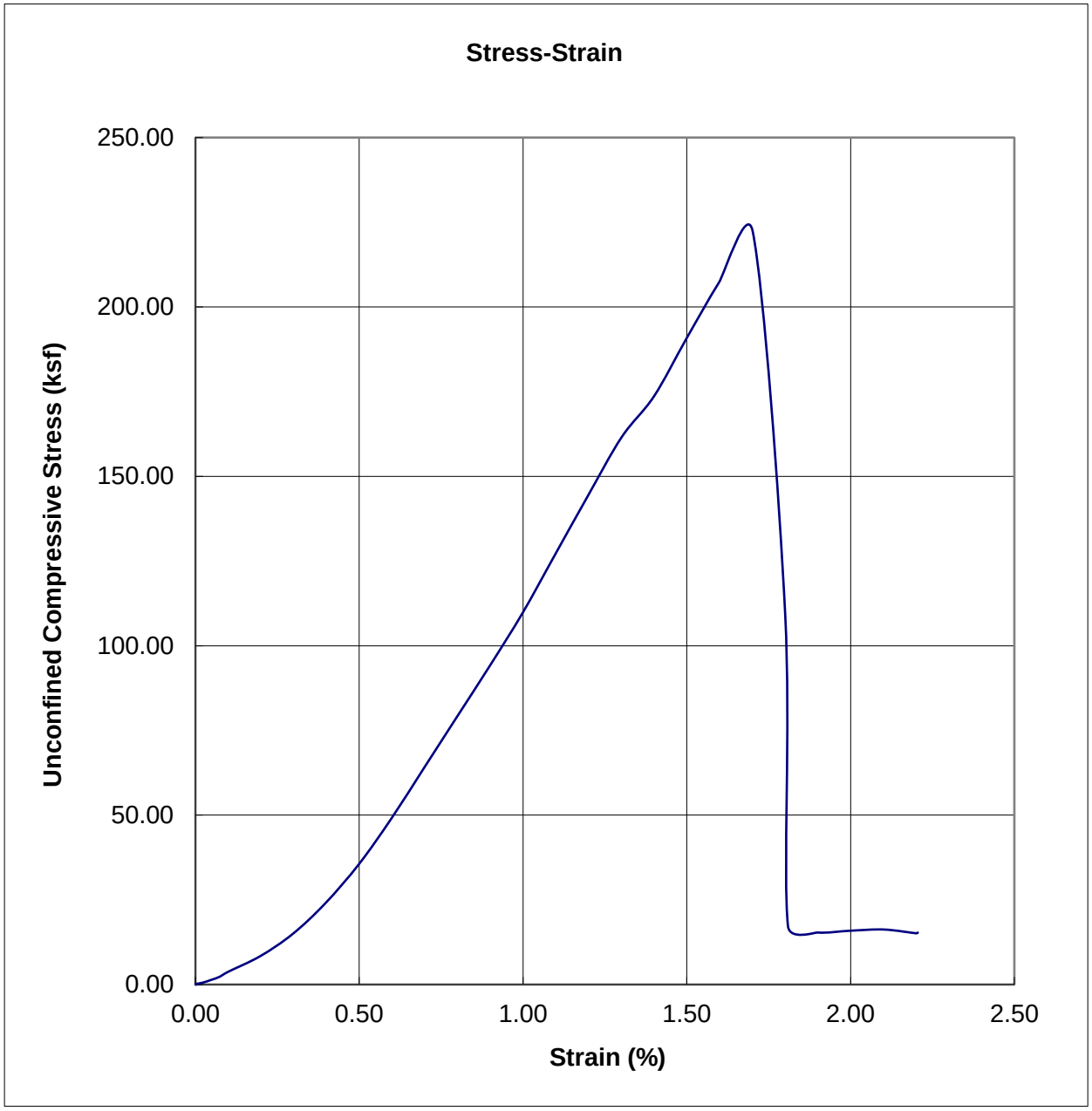
Project No.: E17-0811

Unc. Stress(ksf): 222.21

Boring No.: TS-104

Depth,ft.: 53.5

%Strain: 1.7



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

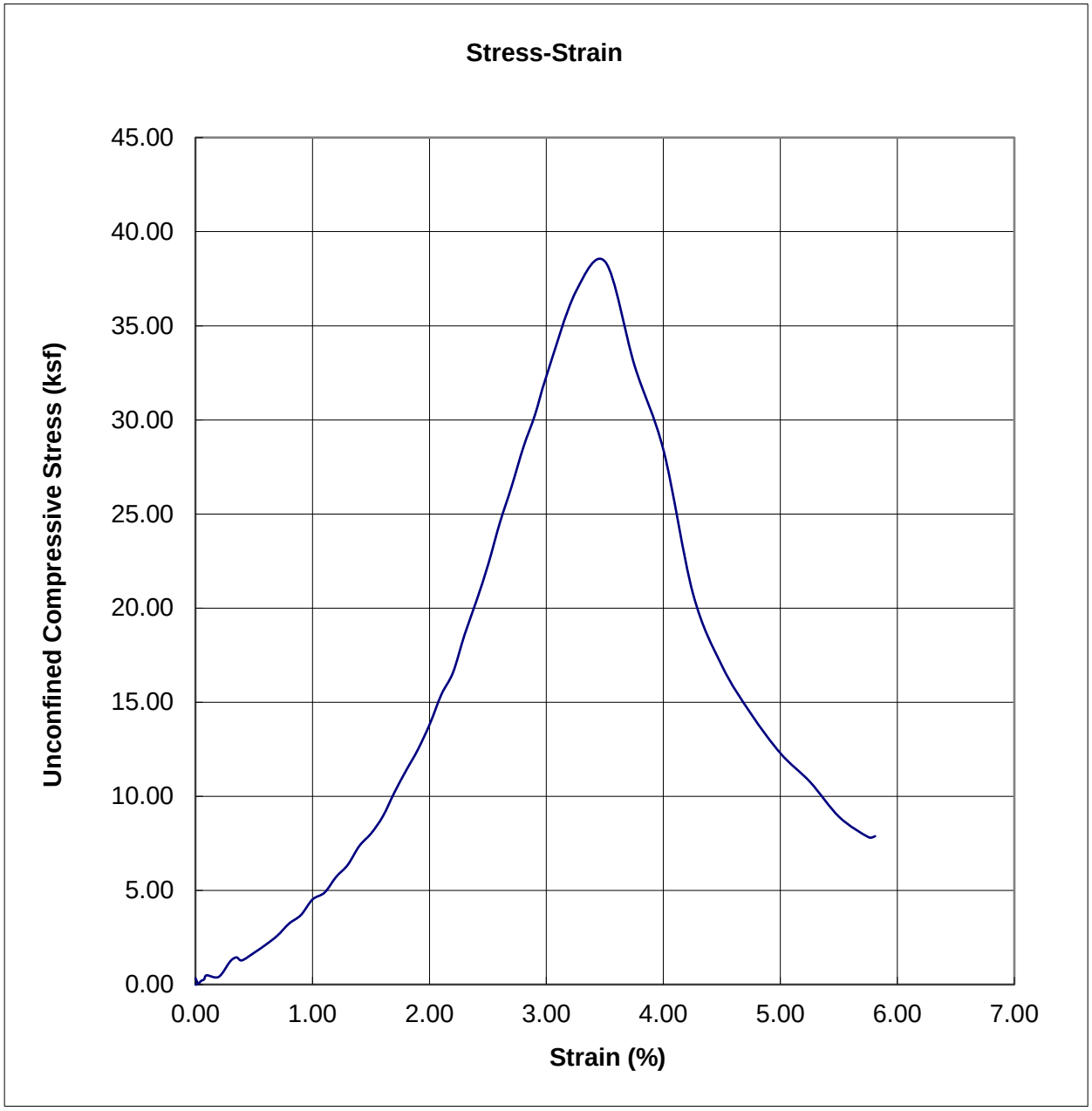
Project No.: E17-0811

Unc. Stress(ksf): 38.38

Boring No.: TS-104

Depth,ft.: 61.75

%Strain: 3.5



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

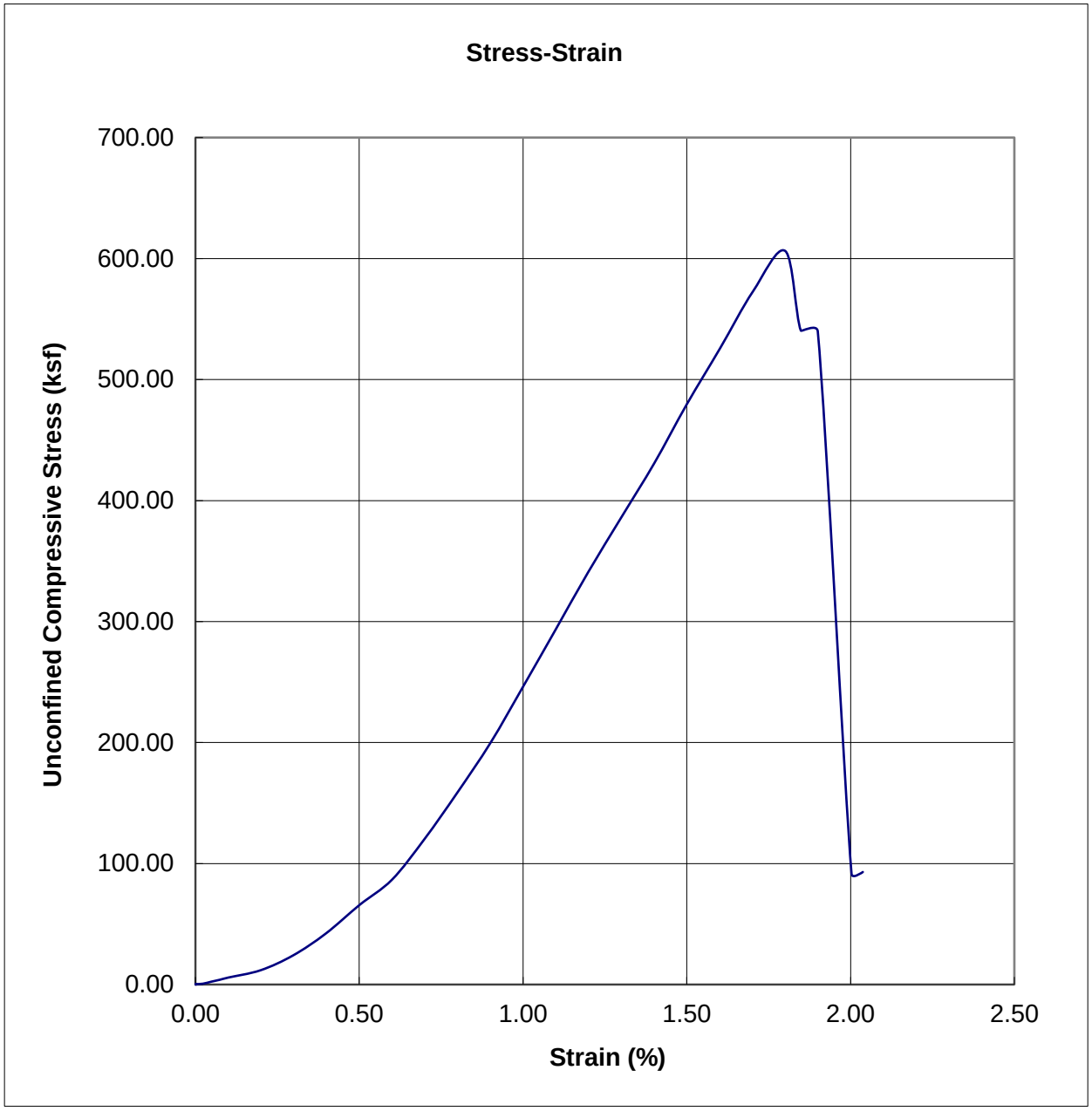
Project No.: E17-0811

Unc. Stress(ksf): 606.18

Boring No.: T-201

Depth,ft.: 58.5

%Strain: 1.8



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

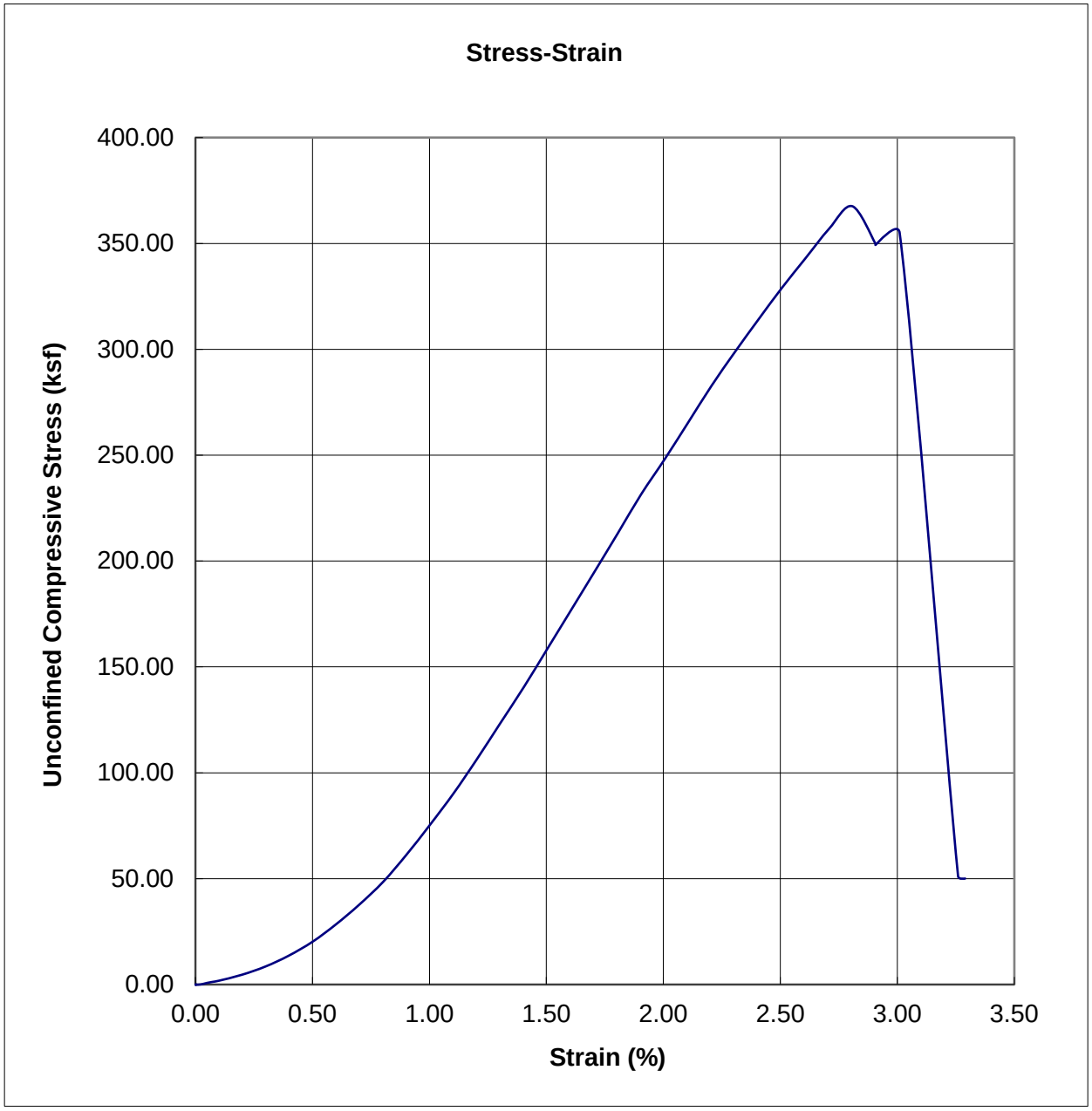
Project No.: E17-0811

Unc. Stress(ksf): 367.57

Boring No.: T-201

Depth,ft.: 66.25

%Strain: 2.8



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

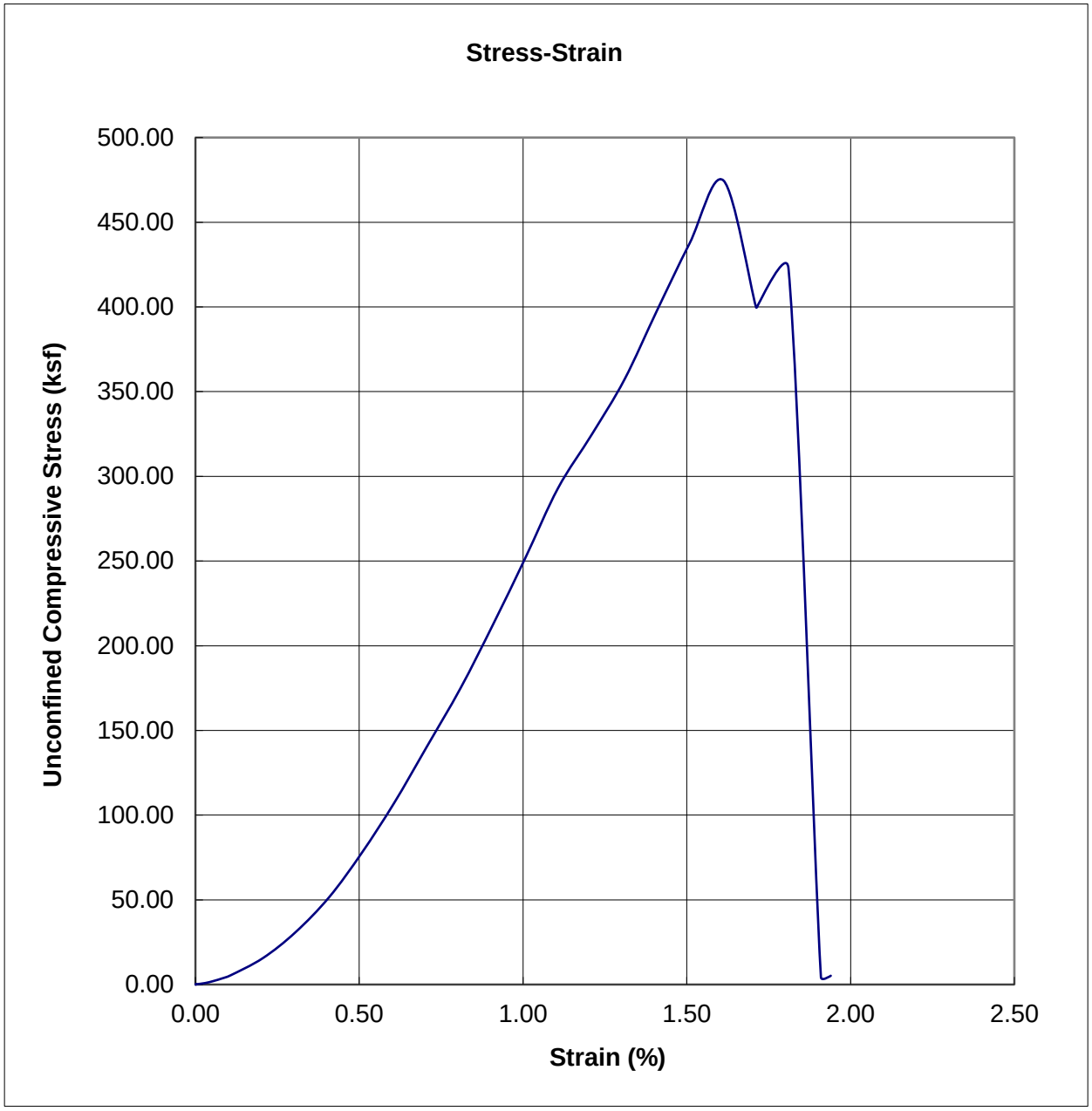
Project No.: E17-0811

Unc. Stress(ksf): 474.61

Boring No.: TS-202

Depth,ft.: 36.25

%Strain: 1.6



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

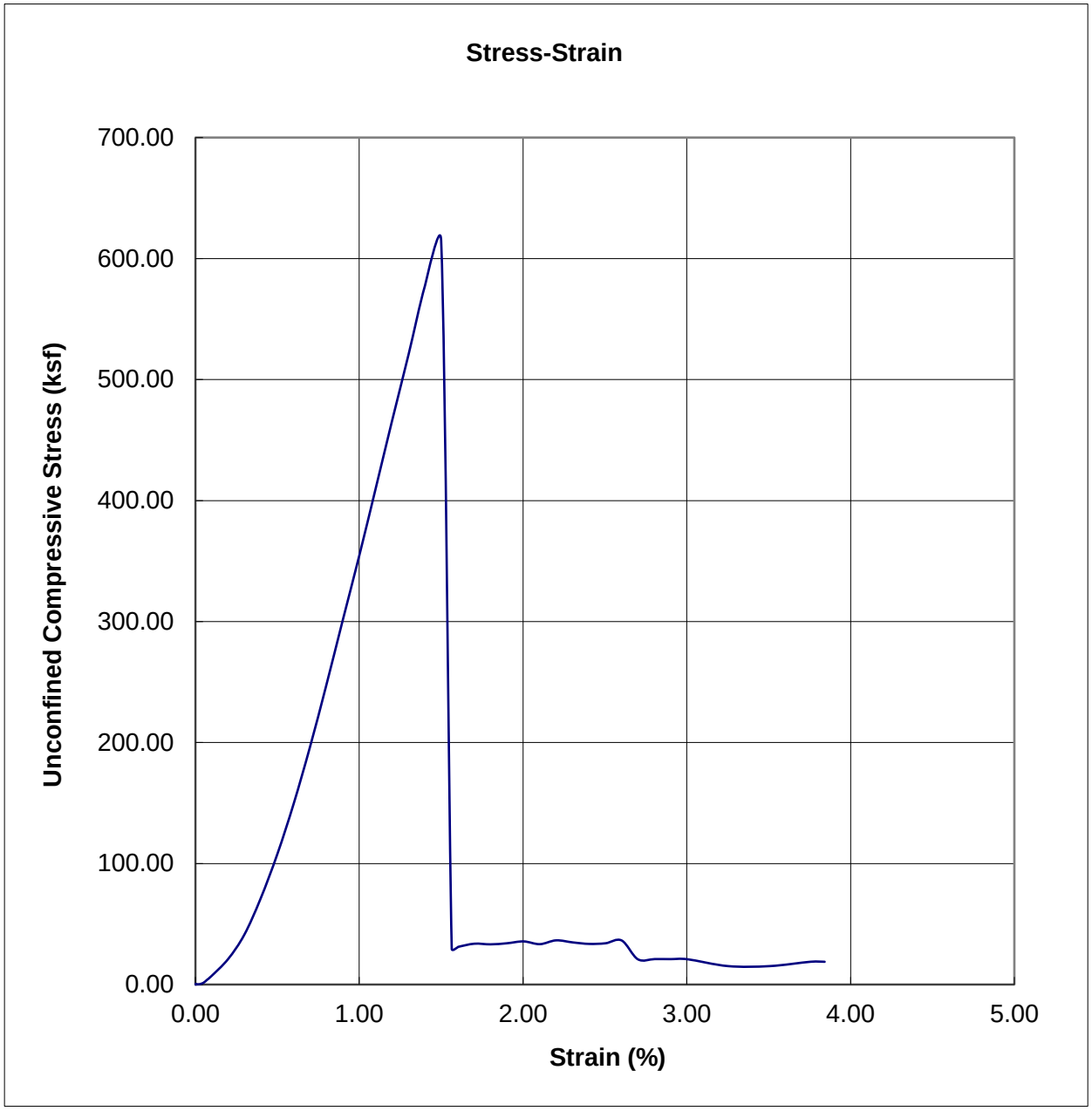
Project No.: E17-0811

Unc. Stress(ksf): 614.86

Boring No.: TS-202

Depth,ft.: 56.25

%Strain: 1.5



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

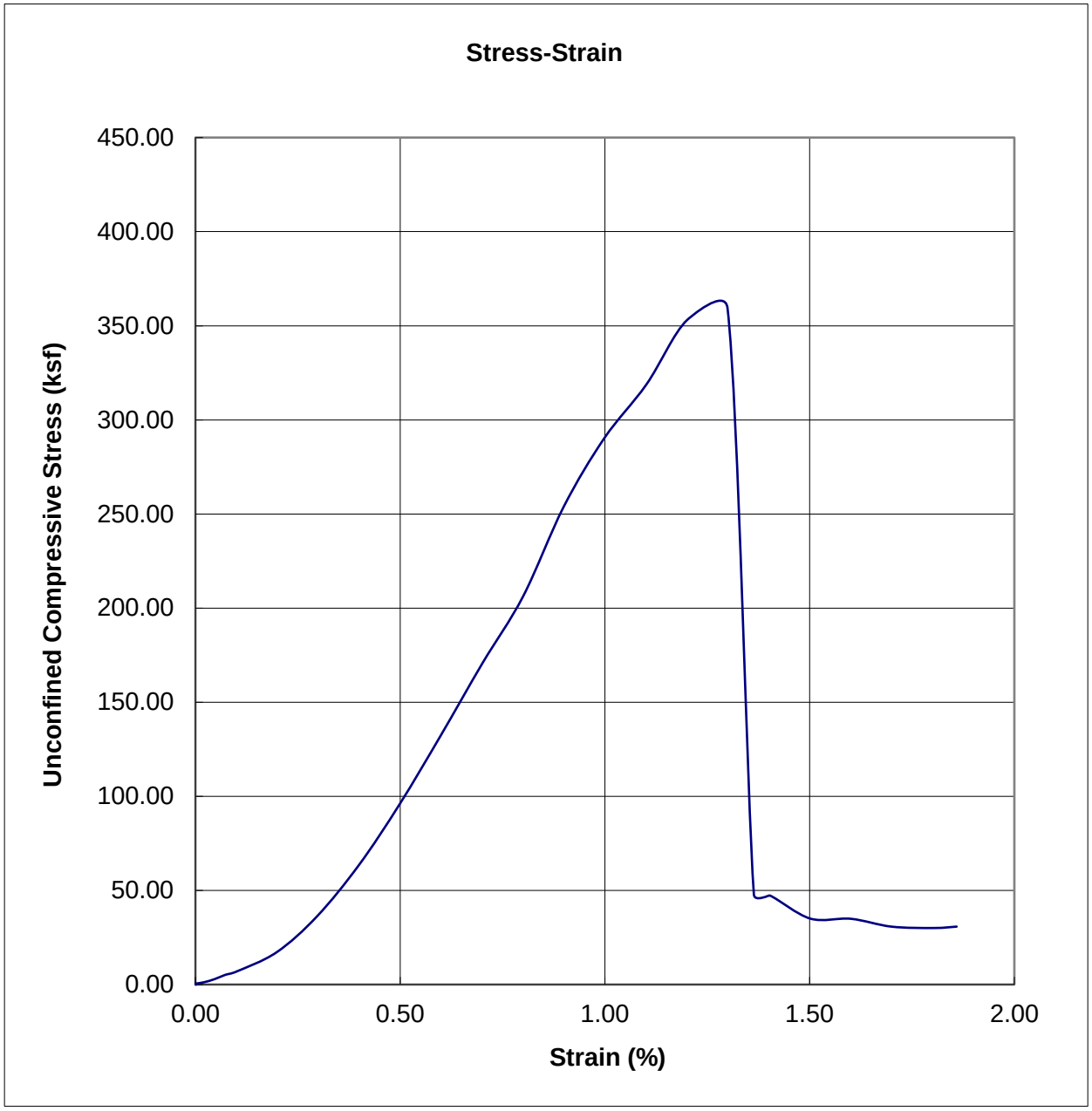
Project No.: E17-0811

Unc. Stress(ksf): 359.42

Boring No.: T-203

Depth,ft.: 59.75

%Strain: 1.3



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

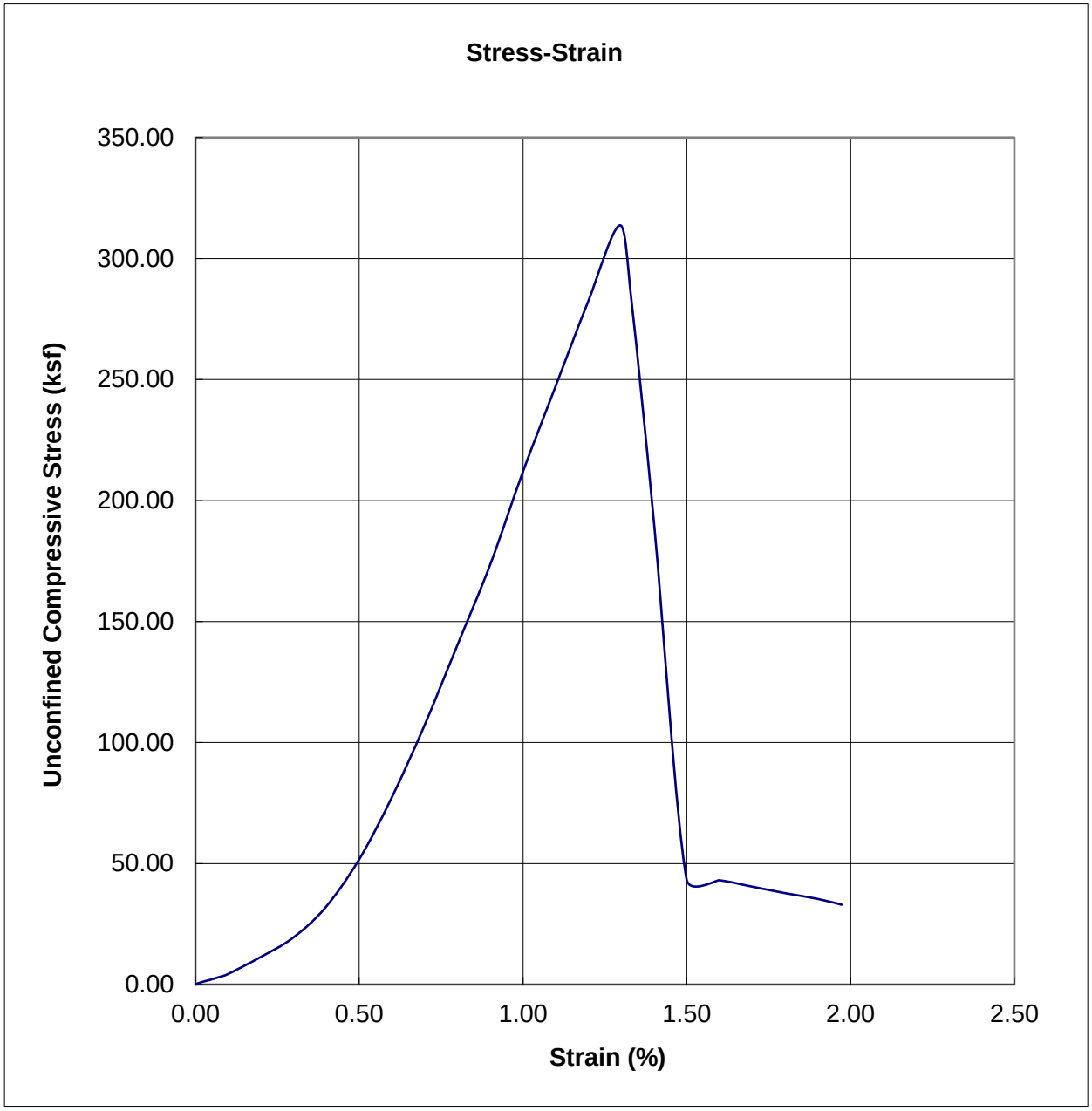
Project No.: E17-0811

Unc. Stress(ksf): 313.76

Boring No.: T-204

Depth,ft.: 51.75

%Strain: 1.3



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

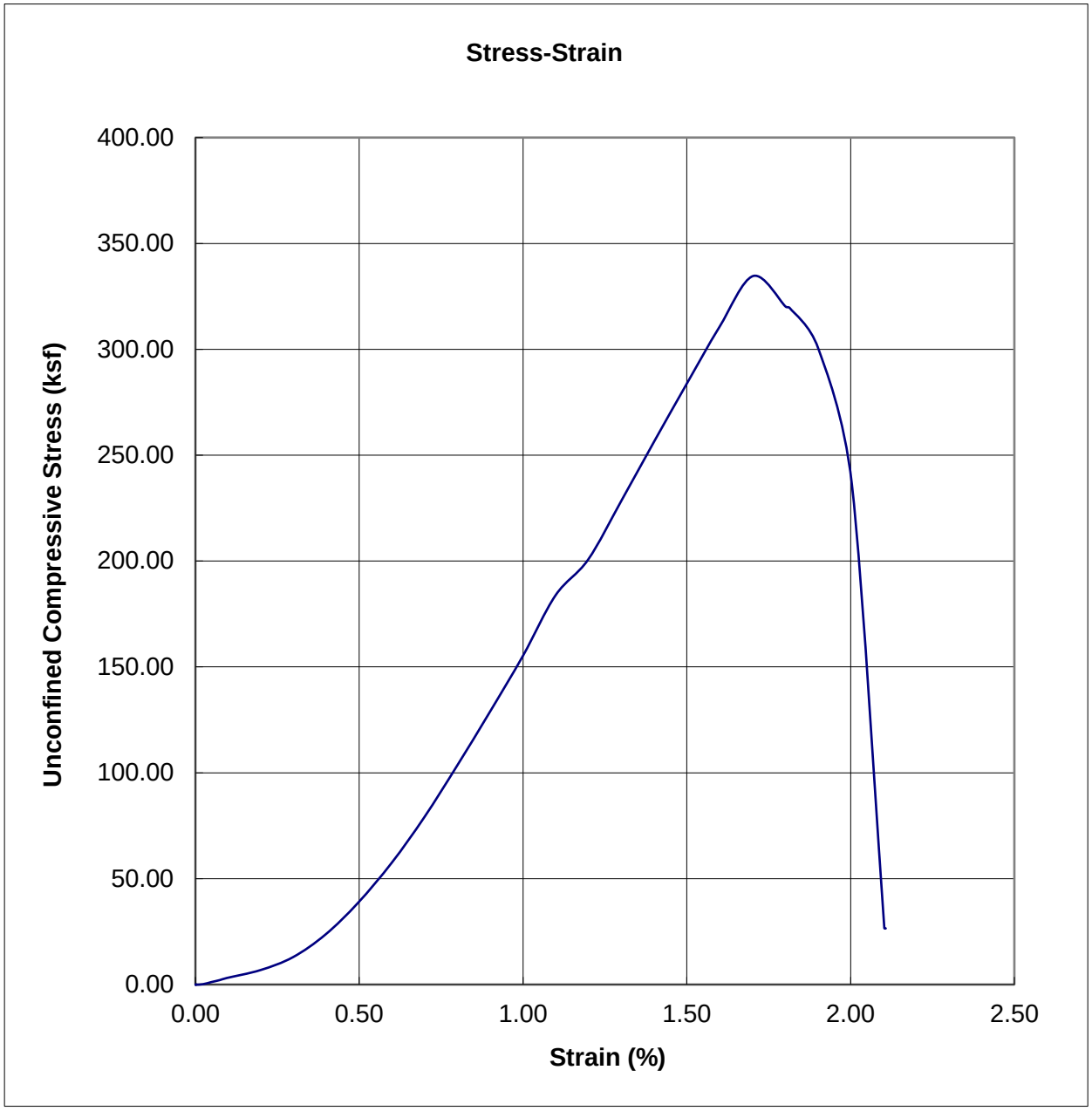
Project No.: E17-0811

Unc. Stress(ksf): 334.63

Boring No.: T-205

Depth,ft.: 45.25

%Strain: 1.7



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

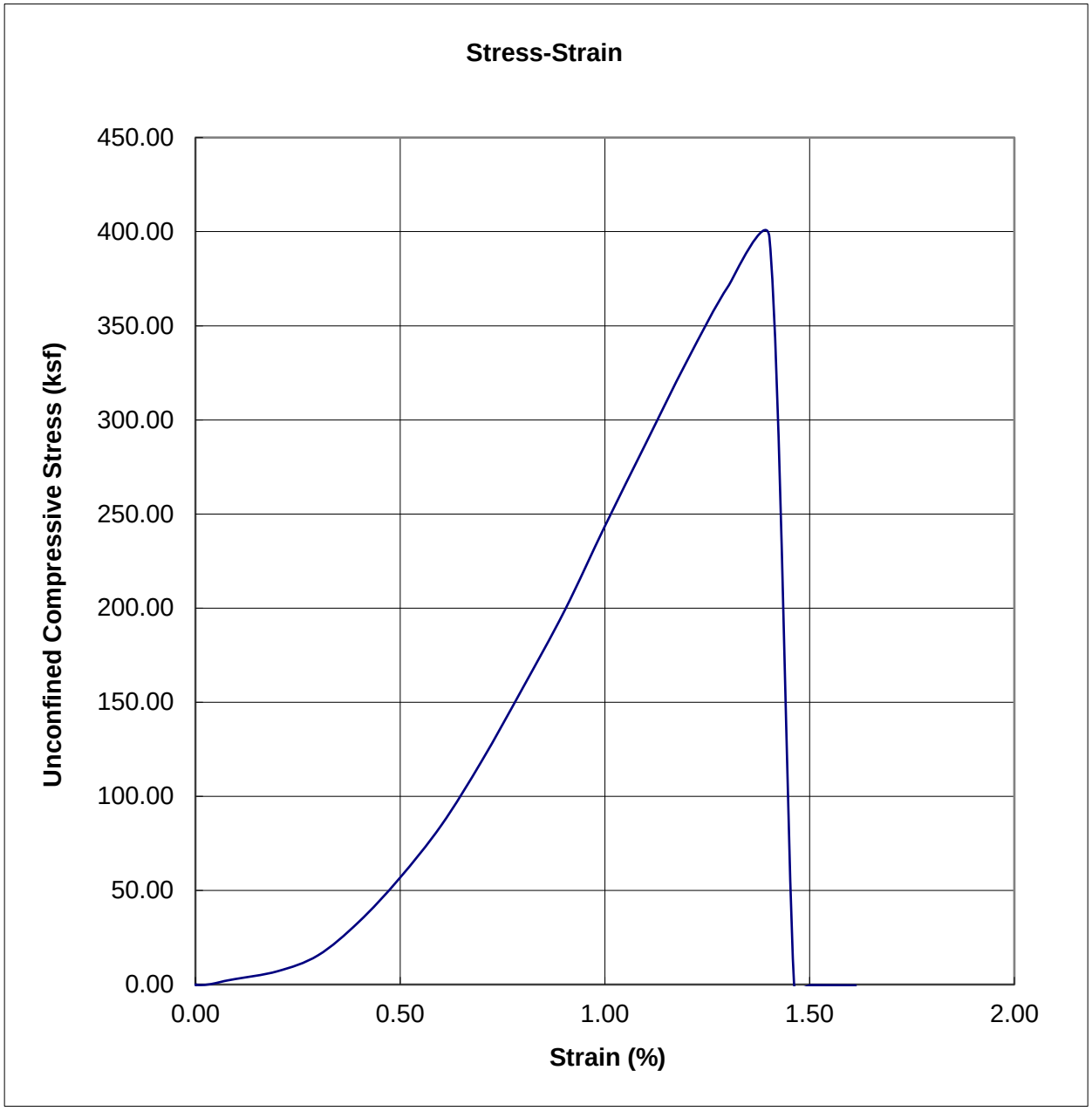
Project No.: E17-0811

Unc. Stress(ksf): 396.82

Boring No.: T-205

Depth,ft.: 55.25

%Strain: 1.4



ALLIANCE GEOTECHNICAL GROUP

GEOTECHNICAL AND CONSTRUCTION MATERIALS ENGINEERING AND TESTING

3228 Halifax St. Suite A, Dallas, TX 75247 Phone: 972-444-8889 Fax: 972- 444-8893

Unconfined Compressive Stress Graph

Project: DART D-2

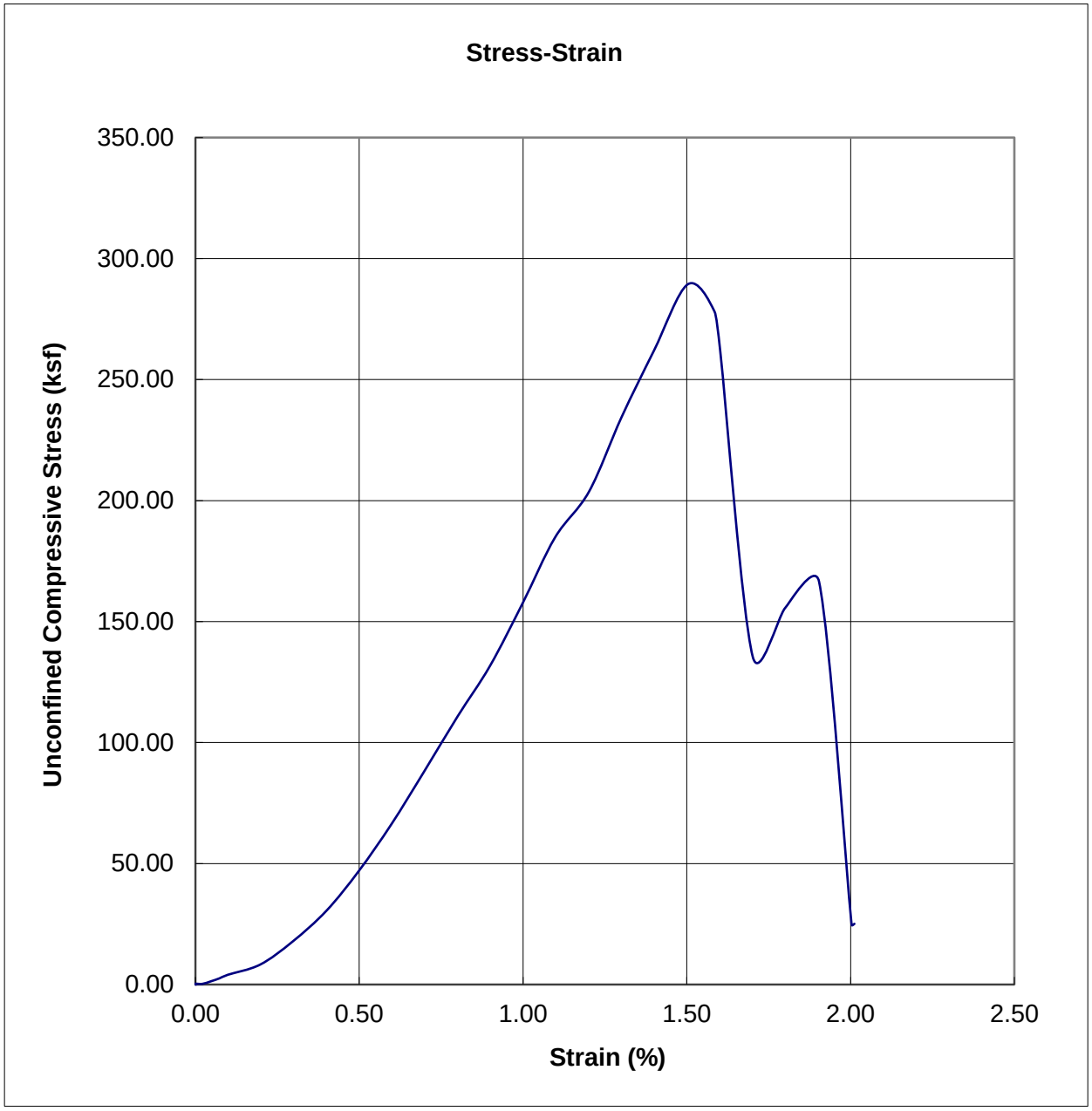
Project No.: E17-0811

Unc. Stress(ksf): 289.37

Boring No.: T-205

Depth,ft.: 68.5

%Strain: 1.5



APPENDIX F-14

UNCONFINED COMPRESSIVE STRENGTH WITHOUT MODULI METHOD-C

Client:	Alliance Geotechnical Group				
Project:	DART Project				
Location:	Dallas, TX			Project No:	GTX-309416
Boring ID:	---	Sample Type:	---	Tested By:	tlm
Sample ID:	---	Test Date:	05/06/19	Checked By:	jsc
Depth :	---	Test Id:	501443		

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
TS-207	RC-5/RC-6	51.0 - 61.0 ft	127	5105	1	Yes	---
TS-208	RC-4	35.0 - 45.0 ft	134	4656	1	Yes	---
T-112	RC-2	41.0 - 46.0 ft	128	3903	1	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

UNCONFINED COMPRESSIVE STRENGTH TEST RESULTS

ASTM D7012-C

BORING NO.	DEPTH (FEET)	MOISTURE (%)	DRY DENSITY (PCF)	UNCONFINED STRESS (KSF)	% STRAIN
P-102	22.9’-23.2’	1.0	128.7	484.33	1.7
T-102	25.6’-26’	1.4	125.6	158.88	1.6
T-103	36.1’-36.6’	0.9	128.8	834.08	2.2
TS-104	38.5’-38.1’	0.7	119.7	383.02	1.4
	53.3’-53.8’	6.1	125.9	222.21	1.7
	61.6’-62’	13.0	120.1	38.38	3.5
T-201	58.2’-58.7’	0.6	120.7	606.18	1.8
	66’-66.5’	3.7	132.4	367.57	2.8
TS-202	36’-36.6’	0.7	124.9	474.61	1.6
	56’-56.5’	0.6	123.6	614.86	1.5
T-203	59.4’-60’	3.1	123.7	359.42	1.3
T-204	51.4’-51.9’	6.7	123.4	313.76	1.3
T-205	45’-45.6’	2.0	125.2	334.63	1.7
	55’-55.5’	1.6	120.3	396.82	1.4
	68.3’-68.8’	4.5	130.5	289.37	1.5

ALLIANCE GEOTECHNICAL GROUP

UNCONFINED COMPRESSIVE STRENGTH TEST RESULTS

DART D-2

DALLAS, TEXAS

PROJECT NO: E17-0811

APPENDIX F-14

APPENDIX F-15

UNIT WEIGHT & DIMENSIONAL /SHAPE TOLERANCES OF SPECIMENS

Client:	Alliance Geotechnical Group	Test Date:	5/2/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-112		
Sample ID:	RC-2		
Depth:	41.0-46.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	3.94	3.93	3.94
Specimen Diameter, in:	1.97	1.98	1.98
Specimen Mass, g:	404.34		
Bulk Density, lb/ft^3	128	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.0	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90°)	0.00010	0.00000	0.00000	0.00000	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00040	-0.00050	-0.00060	-0.00060

Difference between max and min readings, in:

0° = 0.00020 90° = 0.00070

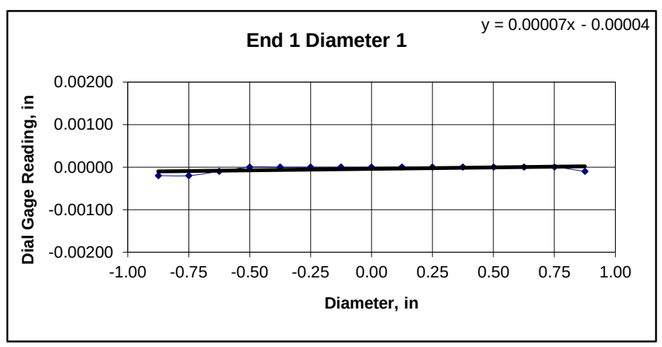
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00040	-0.00030	-0.00020	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030	-0.00040
Diameter 2, in (rotated 90°)	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00020	0.00020	0.00000	0.00000	-0.00010	-0.00030	-0.00040	-0.00060	-0.00070	-0.00070

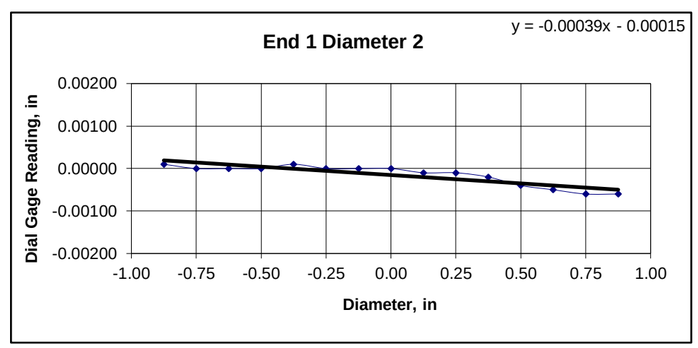
Difference between max and min readings, in:

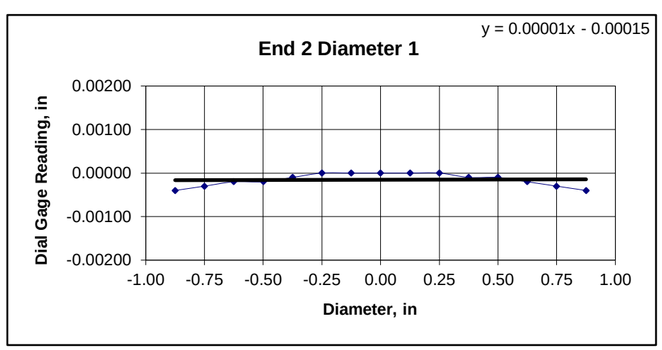
0° = 0.0004 90° = 0.0009

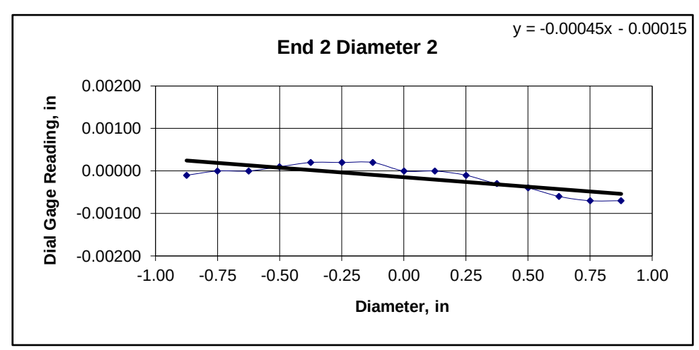
Maximum difference must be < 0.0020 in. Difference = ± 0.00045

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00007
Angle of Best Fit Line:	0.00393

End 2:

Slope of Best Fit Line	0.00001
Angle of Best Fit Line:	0.00065

Maximum Angular Difference: 0.00327

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00039
Angle of Best Fit Line:	0.02259

End 2:

Slope of Best Fit Line	0.00045
Angle of Best Fit Line:	0.02570

Maximum Angular Difference: 0.00311

Parallelism Tolerance Met? **YES**

Spherically Seated

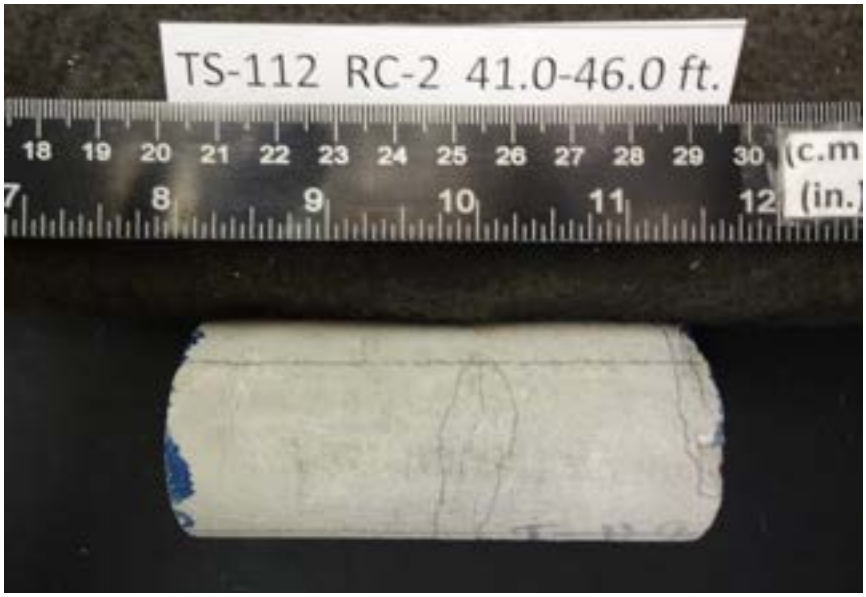
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	1.975	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00070	1.975	0.00035	0.020	YES
END 2					
Diameter 1, in	0.00040	1.975	0.00020	0.012	YES
Diameter 2, in (rotated 90°)	0.00090	1.975	0.00046	0.026	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/6/2019
Tested By:	cmh
Checked By:	jsc
Boring ID:	TS-112
Sample ID:	RC-2
Depth, ft:	41.0-46.0



After cutting and grinding

After break

Client:	Alliance Geotechnical Group	Test Date:	5/6/2019
Project Name:	DART Project	Tested By:	cmh
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-207		
Sample ID:	RC-5/RC-6		
Depth:	51.0-61.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.27	4.27	4.27
Specimen Diameter, in:	1.98	1.97	1.98
Specimen Mass, g:	436.23		
Bulk Density, lb/ft^3	127	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
END 1															
Diameter 1, in	0.00040	0.00040	0.00040	0.00040	0.00030	0.00020	0.00010	0.00000	-0.00010	-0.00020	-0.00020	-0.00020	-0.00020	-0.00020	-0.00030
Diameter 2, in (rotated 90°)	0.00020	0.00010	0.00010	0.00030	0.00020	0.00020	0.00020	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010

Difference between max and min readings, in:

0° = 0.00070 90° = 0.00030

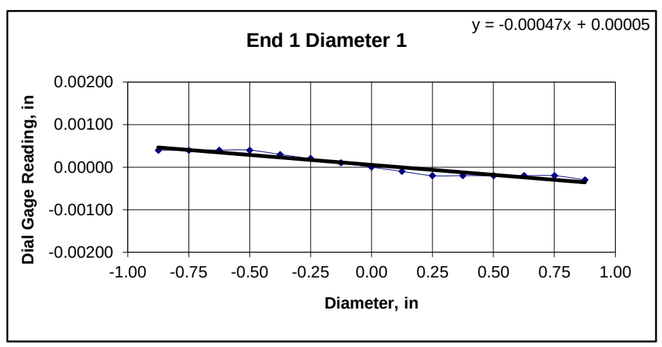
	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
END 2															
Diameter 1, in	0.00030	0.00030	0.00030	0.00020	0.00020	0.00020	0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00020	-0.00030	-0.00040
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00020

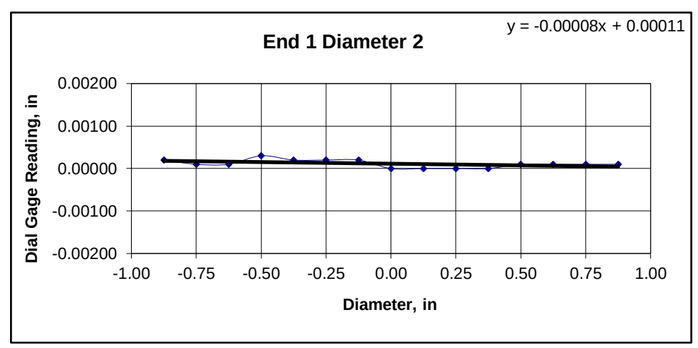
Difference between max and min readings, in:

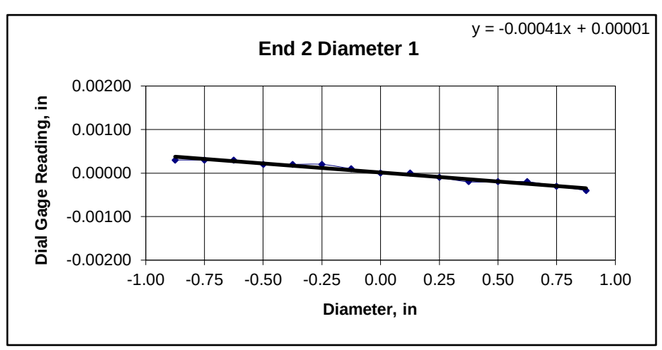
0° = 0.0007 90° = 0.0002

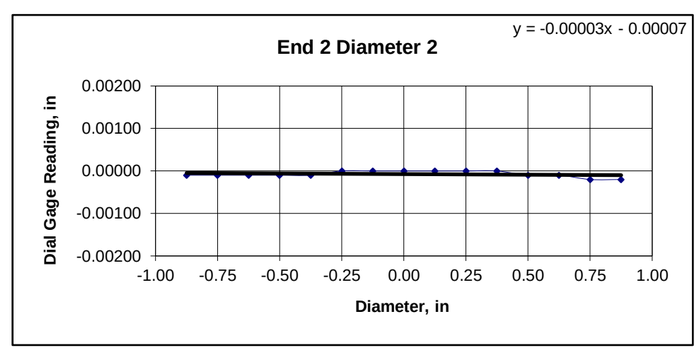
Maximum difference must be < 0.0020 in. Difference = ± 0.00035

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00047
Angle of Best Fit Line:	0.02685

End 2:

Slope of Best Fit Line	0.00041
Angle of Best Fit Line:	0.02374

Maximum Angular Difference: 0.00311

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00008
Angle of Best Fit Line:	0.00442

End 2:

Slope of Best Fit Line	0.00003
Angle of Best Fit Line:	0.00164

Maximum Angular Difference: 0.00278

Parallelism Tolerance Met? **YES**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00070	1.975	0.00035	0.020	YES
Diameter 2, in (rotated 90°)	0.00030	1.975	0.00015	0.009	YES
END 2					
Diameter 1, in	0.00070	1.975	0.00035	0.020	YES
Diameter 2, in (rotated 90°)	0.00020	1.975	0.00010	0.006	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/6/2019
Tested By:	cmh
Checked By:	jsc
Boring ID:	TS-207
Sample ID:	RC-5/RC-6
Depth, ft:	51.0-61.0

After cutting and grinding

After break

Client:	Alliance Geotechnical Group	Test Date:	5/2/2019
Project Name:	DART Project	Tested By:	jck
Project Location:	Dallas, TX	Checked By:	jsc
GTX #:	309416		
Boring ID:	TS-208		
Sample ID:	RC-4		
Depth:	35.0-45.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.38	4.38	4.38
Specimen Diameter, in:	1.97	1.98	1.98
Specimen Mass, g:	471.45		
Bulk Density, lb/ft^3	134	**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030	-0.00030	-0.00030
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010

Difference between max and min readings, in:

0° = 0.00050 90° = 0.00020

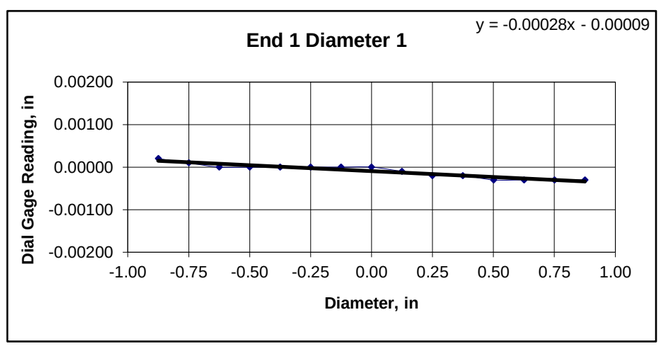
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00030	0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00020	-0.00020	-0.00020	-0.00020	-0.00020	-0.00040
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00010

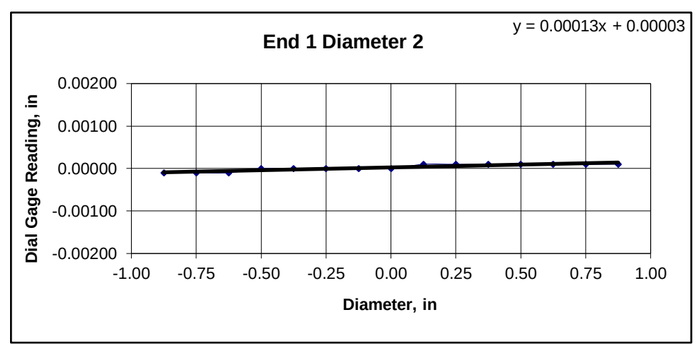
Difference between max and min readings, in:

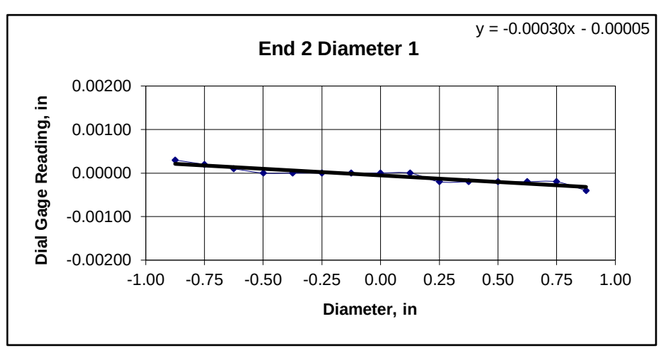
0° = 0.0007 90° = 0.0001

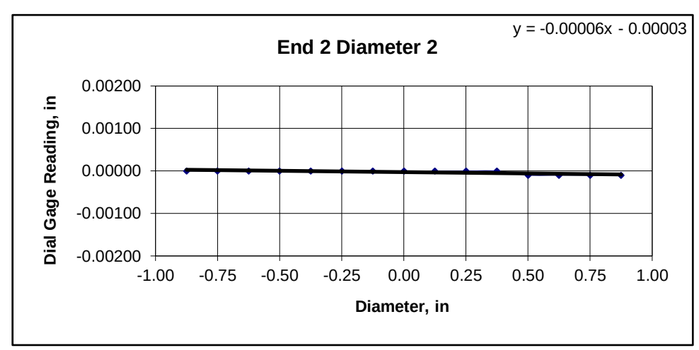
Maximum difference must be < 0.0020 in. Difference = ± 0.00035

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:

Slope of Best Fit Line	0.00028
Angle of Best Fit Line:	0.01588

End 2:

Slope of Best Fit Line	0.00030
Angle of Best Fit Line:	0.01735

Maximum Angular Difference: 0.00147

Parallelism Tolerance Met? **YES**

Spherically Seated

DIAMETER 2

End 1:

Slope of Best Fit Line	0.00013
Angle of Best Fit Line:	0.00753

End 2:

Slope of Best Fit Line	0.00006
Angle of Best Fit Line:	0.00360

Maximum Angular Difference: 0.00393

Parallelism Tolerance Met? **YES**

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00050	1.975	0.00025	0.015	YES
Diameter 2, in (rotated 90°)	0.00020	1.975	0.00010	0.006	YES
END 2					
Diameter 1, in	0.00070	1.975	0.00035	0.020	YES
Diameter 2, in (rotated 90°)	0.00010	1.975	0.00005	0.003	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/6/2019
Tested By:	cmh
Checked By:	jsc
Boring ID:	TS-208
Sample ID:	RC-4
Depth, ft:	35.0-45.0

After cutting and grinding

After break

APPENDIX F-16

UNIT WEIGHT, POROSITY, AND SPECIFIC GRAVITY

Client:	Aliiance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc

Unit Weight, Porosity & Specific Gravity of Rock - ISRM Method 2

Boring ID	Sample ID	Depth, ft.	Average Moisture Content, %	Average Dry Unit Weight, pcf	Average Bulk Specific Gravity	Average Porosity
T-102	RC-1	28'3"-30'4"	3.50	119	1.98	0.21

Notes: Results are based on the average of three saw-cut test specimens.
Unit weight obtained by digital caliper measurement.
Pore Volume obtained by water saturation.
Bulk Specific Gravity obtained by buoyancy technique.

Client:	Aliiance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc

Unit Weight, Porosity & Specific Gravity of Rock - ISRM Method 2

Boring ID	Sample ID	Depth, ft.	Average Moisture Content, %	Average Dry Unit Weight, pcf	Average Bulk Specific Gravity	Average Porosity
TS-104	RC-3A	35'-37'6"	3.56	117	1.95	0.23

Notes: Results are based on the average of three saw-cut test specimens.
Unit weight obtained by digital caliper measurement.
Pore Volume obtained by water saturation.
Bulk Specific Gravity obtained by buoyancy technique.

Client:	Aliiance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc

Unit Weight, Porosity & Specific Gravity of Rock - ISRM Method 2

Boring ID	Sample ID	Depth, ft.	Average Moisture Content, %	Average Dry Unit Weight, pcf	Average Bulk Specific Gravity	Average Porosity
TS-202	RC-6/7	60'64'1"	3.43	129	2.02	0.24

Notes: Results are based on the average of three saw-cut test specimens.
Unit weight obtained by digital caliper measurement.
Pore Volume obtained by water saturation.
Bulk Specific Gravity obtained by buoyancy technique.

Client:	Aliiance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	2/6/2019
Tested By:	tlm
Checked By:	jsc

Unit Weight, Porosity & Specific Gravity of Rock - ISRM Method 2

Boring ID	Sample ID	Depth, ft.	Average Moisture Content, %	Average Dry Unit Weight, pcf	Average Bulk Specific Gravity	Average Porosity
T-203	---	60'65'	8.57	123	2.04	0.18

Notes: Results are based on the average of three saw-cut test specimens.
Unit weight obtained by digital caliper measurement.
Pore Volume obtained by water saturation.
Bulk Specific Gravity obtained by buoyancy technique.

Client:	Alliance Geotechnical Group
Project Name:	DART Project
Project Location:	Dallas, TX
GTX #:	309416
Test Date:	5/3/2019
Tested By:	tlm
Checked By:	jsc

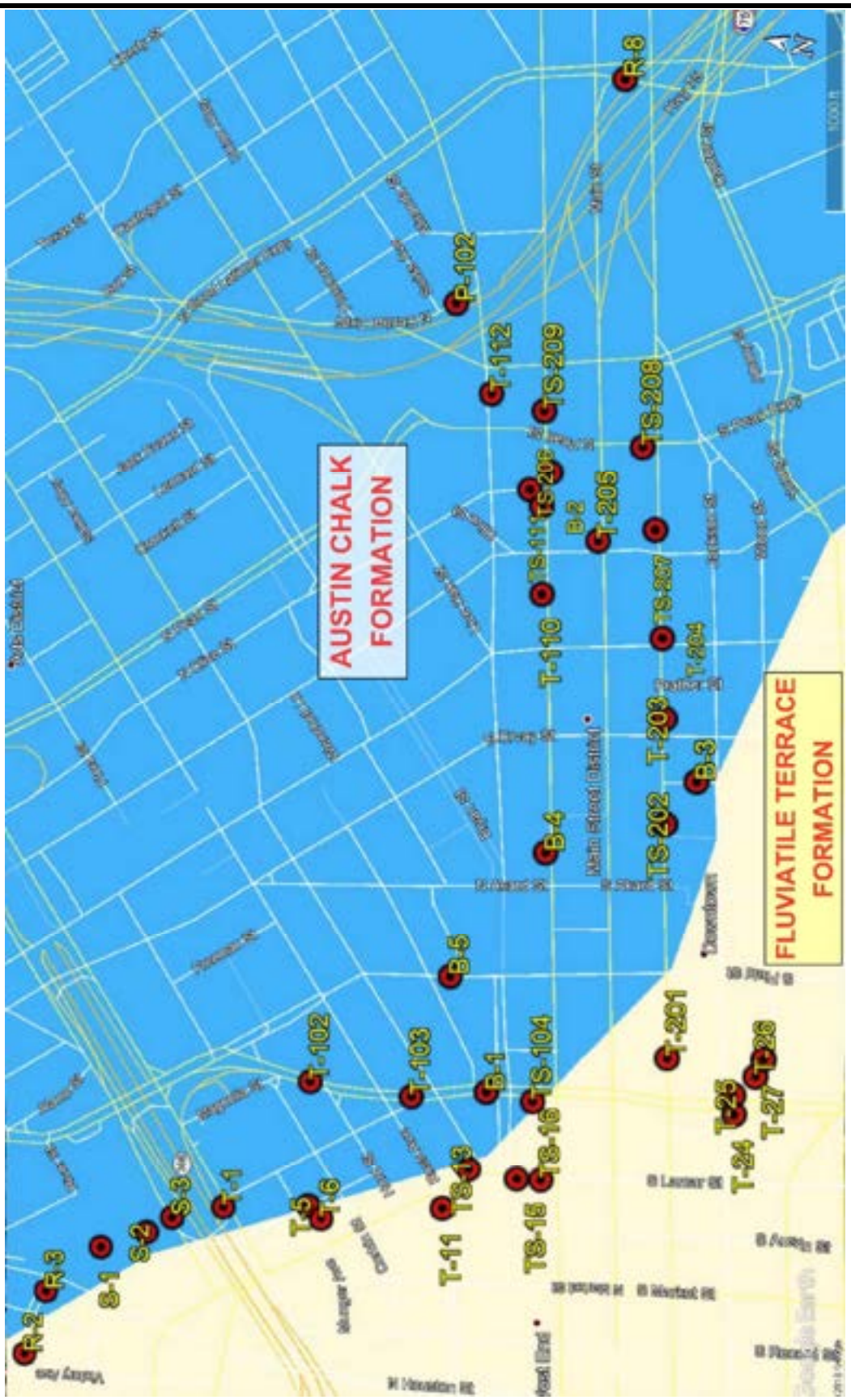
Unit Weight, Porosity & Specific Gravity of Rock - ISRM Method 2

Boring ID	Sample ID	Depth, ft.	Average Moisture Content, %	Average Dry Unit Weight, pcf	Average Bulk Specific Gravity	Average Porosity
TS-207	RC-5/RC-6	51.0-61.0	3.99	127	2.07	0.19

Notes: Results are based on the average of three saw-cut test specimens.
Unit weight obtained by digital caliper measurement.
Pore Volume obtained by water saturation.
Bulk Specific Gravity obtained by buoyancy technique.

APPENDIX G

GEOLOGICAL FORMATION LIMITS WITH BORING LAYOUT



ALLIANCE GEOTECHNICAL GROUP

Project No: E17-0811	GEOLOGICAL FORMATION AERIAL
DART D-2 DALLAS, TEXAS	APPENDIX G

APPENDIX H

WATER LEVEL READINGS

AND

PIEZOMETER REPORTS

ALLIANCE GEOTECHNICAL GROUP

E17-0811 - DART D-2 - Piezometer Readings										
Piezometer ID	**Date**	**Water Level**		**Piezometer ID**	**Date**	**Water Level**		**Piezometer ID**	**Date**	**Water Level**
T-1	7/29/2016	20'		**T-11**	7/29/2016	17.5'		**TS-104S**	12/31/2018	18.9'
	8/23/2016	20'			8/23/2016	17.15			1/8/2019	18.8'
	1/8/2019	19.9'			1/8/2019	17.84'			4/8/2019	19.6'
	2/21/2019	20.4'			2/21/2019	18'			4/24/2019	19.25'
	4/8/2019	20.5'			4/8/2019	18.6'			5/10/2019	18.9'
	5/10/2019	20.2'			5/10/2019	18'			6/17/2019	19.1'
	6/17/2019	20.4'			6/17/2019	18.2'			7/30/2019	19'
	7/30/2019	20.5'			7/30/2019	19'			8/20/2019	19.4'
	8/20/2019	20.5			8/20/2019	19.2				
								TS-104D	12/31/2018	16.9'
									1/8/2019	17.25'
									4/8/2019	20.8'
									4/24/2019	19.2'
									5/10/2019	19.9'
									6/17/2019	20.2'
									7/30/2019	20.6'
									8/20/2019	22.7

ALLIANCE GEOTECHNICAL GROUP

E17-0811 - DART D-2 - Piezometer Readings										
Piezometer ID	**Date**	**Water Level**		**Piezometer ID**	**Date**	**Water Level**		**Piezometer ID**	**Date**	**Water Level**
T-1	7/29/2016	20'		**T-11**	7/29/2016	17.5'		**TS-104S**	12/31/2018	18.9'
	8/23/2016	20'			8/23/2016	17.15			1/8/2019	18.8'
	1/8/2019	19.9'			1/8/2019	17.84'			4/8/2019	19.6'
	2/21/2019	20.4'			2/21/2019	18'			4/24/2019	19.25'
	4/8/2019	20.5'			4/8/2019	18.6'			5/10/2019	18.9'
	5/10/2019	20.2'			5/10/2019	18'			6/17/2019	19.1'
	6/17/2019	20.4'			6/17/2019	18.2'			7/30/2019	19'
	7/30/2019	20.5'			7/30/2019	19'			8/20/2019	19.4'
	8/20/2019	20.5			8/20/2019	19.2				
								TS-104D	12/31/2018	16.9'
									1/8/2019	17.25'
									4/8/2019	20.8'
									4/24/2019	19.2'
									5/10/2019	19.9'
									6/17/2019	20.2'
									7/30/2019	20.6'
									8/20/2019	22.7

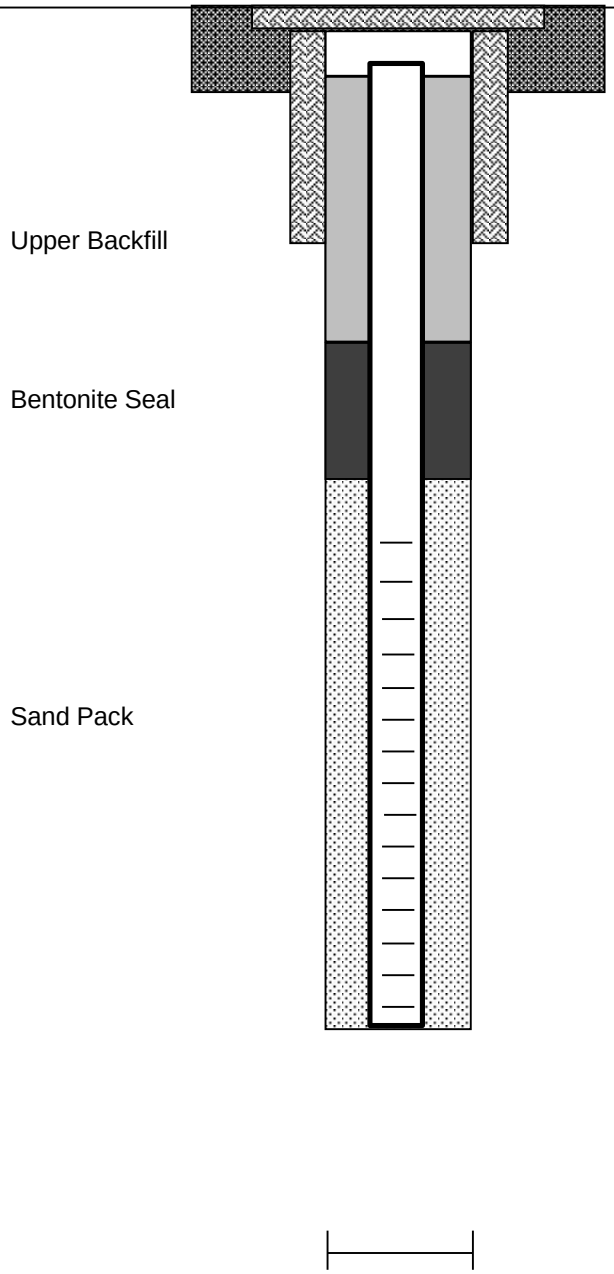
ALLIANCE GEOTECHNICAL GROUP

E17-0811 - DART D-2 - Piezometer Readings										
Piezometer ID	**Date**	**Water Level**		**Piezometer ID**	**Date**	**Water Level**		**Piezometer ID**	**Date**	**Water Level**
TS-207S	2/21/2019	23.7'		**TS-208S**	2/21/2019	4.8'		**TS-209S**	1/8/2019	9.6'
	4/8/2019	24.2'			4/24/2019	4.5'			2/21/2019	11.9'
	4/24/2019	23.1'			5/10/2019	4.55'			4/24/2019	11.6'
	5/10/2019	23'			6/17/2019	4.7'			5/10/2019	9.4'
	6/17/2019	23.1'			7/30/2019	5.2'			6/17/2019	9.1'
	7/30/2019	23.6'			8/20/2019	5.6'			7/30/2019	9'
	8/20/2019	24'							8/20/2019	9'
TS-207D	2/21/2019	24'		**TS-208D**	1/8/2019	22.05'		**TS-209D**	1/8/2019	9.25'
	4/8/2019	28.7'			2/21/2019	26.2'			2/21/2019	11.9'
	4/24/2019	28'			4/24/2019	26'			4/24/2019	9.4'
	5/10/2019	28.8'			5/10/2019	25.75'			5/10/2019	9'
	6/17/2019	29.1'			6/17/2019	25.8'			6/17/2019	9.3'
	7/30/2019	29.6'			7/30/2019	24'			7/30/2019	9.9'
	8/20/2019	30.9'			8/20/2019	22.3			8/20/2019	11.15'

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	T-1
Project Location:	McKinney Ave & N Griffin St (On McKinney Ave)	Driller:	Robert Cromeans	Date Installed:	April 28, 2016
Client:	DART	Ground El.:	431.15	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	430.85	Page:	1 of 1

Ground Surface 431.15 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips	
	Depth (ft)	Elev.
TOP OF SEAL:	1	430.15
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	16	415.2
TOP OF SCREEN:	18	413.2
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	28	403.2
BOTTOM OF SANDPACK:	28	403.2
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	28	403.2
BOREHOLE DIAMETER:	8"	

Remarks: Northing: 6973620.134 Easting: 2489240.069

Overburden & Limestone interface at 23' (EL. 408.15')

STATE OF TEXAS WELL REPORT for Tracking #507849

Owner:	**Dart**	Owner Well #:	**T1**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**McKinney Ave and N Griffin ST (on McKinney Ave) Dallas, TX**	Latitude:	**32° 47' 14" N**
		Longitude:	**096° 48' 19.33" W**
Well County:	**Dallas**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **3/1/2019** Drilling End Date: **3/1/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**28**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
16	**28**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
1	**16**	**Bentonite 3 Chips**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**0.85**	**10" concrete**
0.85	**5**	**reddish brown sandy clay**
5	**17**	**clayey sand reddish brown**
17	**22**	**sand w/a trace of gravel**
22	**24**	**gray weathered limestone**
28	**28**	**gray limestoe**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**18**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**18**	**28**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

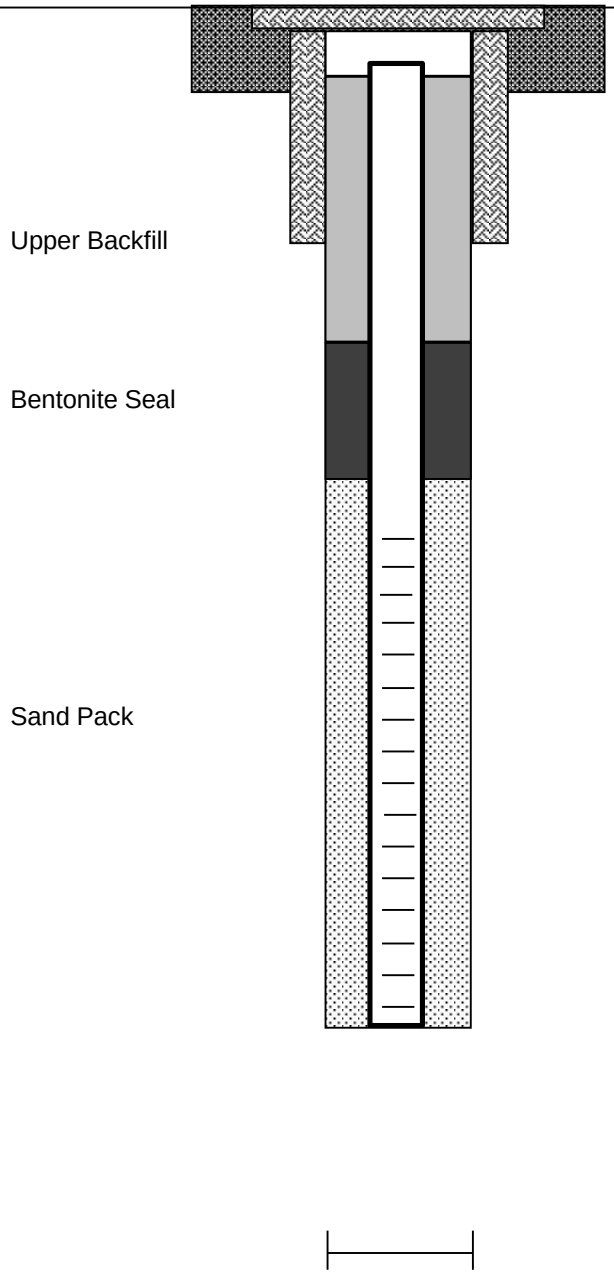
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	T-11
Project Location:	Ross Ave & Lamar St (On Ross Ave)	Driller:	Robert Cromeans	Date Installed:	May 16, 2016
Client:	DART	Ground El.:	429.66	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	429.32	Page:	1 of 1

Ground Surface 429.66 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips	
	Depth (ft)	Elev.
TOP OF SEAL:	1	428.66
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	14.5	415.2
TOP OF SCREEN:	16.5	413.2
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	26.5	403.2
BOTTOM OF SANDPACK:	26.5	403.2
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	26.5	403.2
BOREHOLE DIAMETER:	6"	

Remarks: Northing: 6972510.841 Easting: 2489570.535

Overburden & Limestone interface at 21' (EL. 408.66')

STATE OF TEXAS WELL REPORT for Tracking #507970

Owner:	**Dart**	Owner Well #:	**T11**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**Ross Ave and Lamar ST (on Ross Ave) Dallas, TX**	Latitude:	**32° 47' 03.79" N**
		Longitude:	**096° 48' 15.67" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/1/2019** Drilling End Date: **3/1/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6	**0**	**26.5**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
14.5	**26.5**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Concrete 1 Bags/Sacks**
1	**14.5**	**Bentonite 3 Chips**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1.2**	**1" asphalt 13" concrete**
1.2	**4**	**(fill) grayish brown clay**
4	**16**	**sandy clay grayish brown**
16	**21.5**	**gravelly sand**
21.5	**24**	**tan and gray weathered limestone**
24	**26.5**	**gray limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
1	**Blank**	**New Plastic (PVC)**	**40**	**0**	**16.5**
1	**Screen**	**New Plastic (PVC)**	**40**	**16.5**	**26.5**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

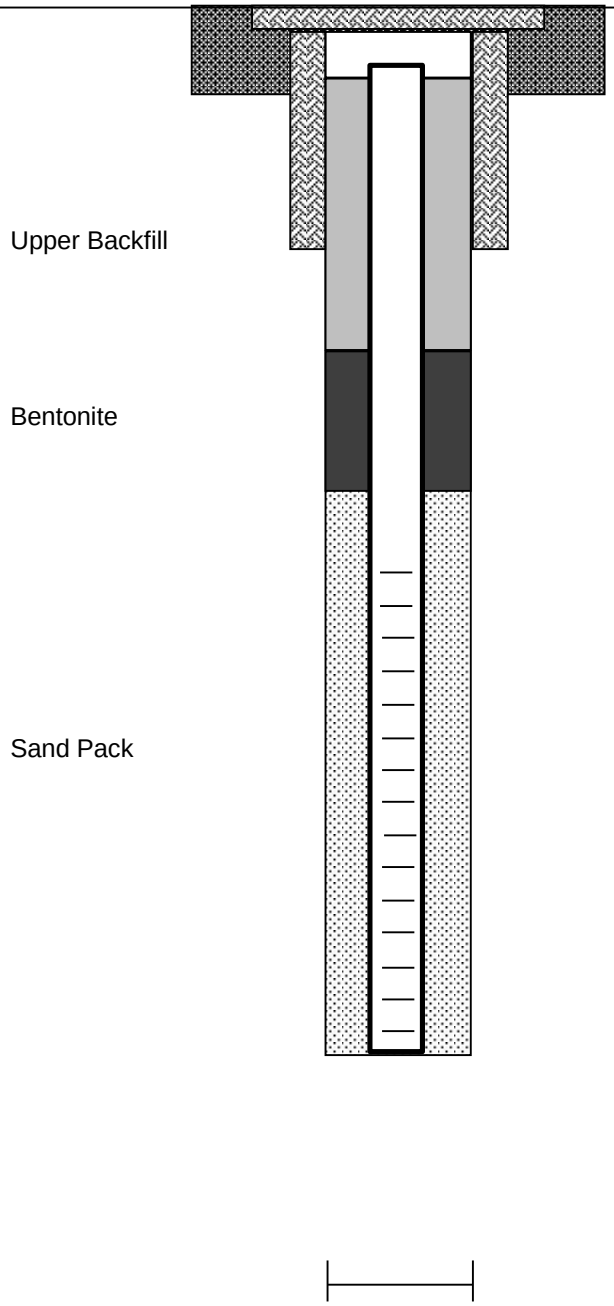
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-104D
Project Location:	N Griffin St & Pacific Ave (On Griffin St)	Driller:	Robert Cromeans	Date Installed:	October 10, 2018
Client:	DART	Ground El.:	427.71	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:		Page:	1 of 1

Ground Surface 427.71 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips (1'-5') & Grout (5'-45')	
	Depth (ft)	Elev.
TOP OF SEAL:	45	382.71
SEAL CONSTRUCTION:	Bentonite	
TOP OF SANDPACK:	51	376.7
TOP OF SCREEN:	56	371.7
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	66	361.7
BOTTOM OF SANDPACK:	66	361.7
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	66	361.7
BOREHOLE DIAMETER:	6"	

Remarks: Northing: 6972203.891 Easting: 2490240.123

Austin Chalk & Eagle Ford interface at 61.5' (EL. 366.21')

STATE OF TEXAS WELL REPORT for Tracking #507806

Owner:	**Dart**	Owner Well #:	**TS104D**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**N Griffin ST and Pacific AVE (on Griffin ST) Dallas, TX**	Latitude:	**32° 47' 00.65" N**
		Longitude:	**096° 48' 07.88" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/19/2019** Drilling End Date: **2/19/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6	**0**	**66**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
51	**66**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Concrete 1 Bags/Sacks**
1	**5**	**Bentonite 1 Chips**
5	**45**	**Grout 2 Bags/Sacks**
45	**51**	**Bentonite 2 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans** License Number: **2954**

Comments: **No Data**

Report Amended on 4/9/2019 by Request #27574

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**2.5" asphalt 8.5" concrete**
1	**5**	**brown clay w/sand**
5	**8**	**tan and gray sandy clay**
8	**22**	**tan clayey sand to sand**
22	**30**	**tan and gray limestone**
30	**61.5**	**gray limestone**
61.5	**66**	**gray shale**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**56**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**56**	**66**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

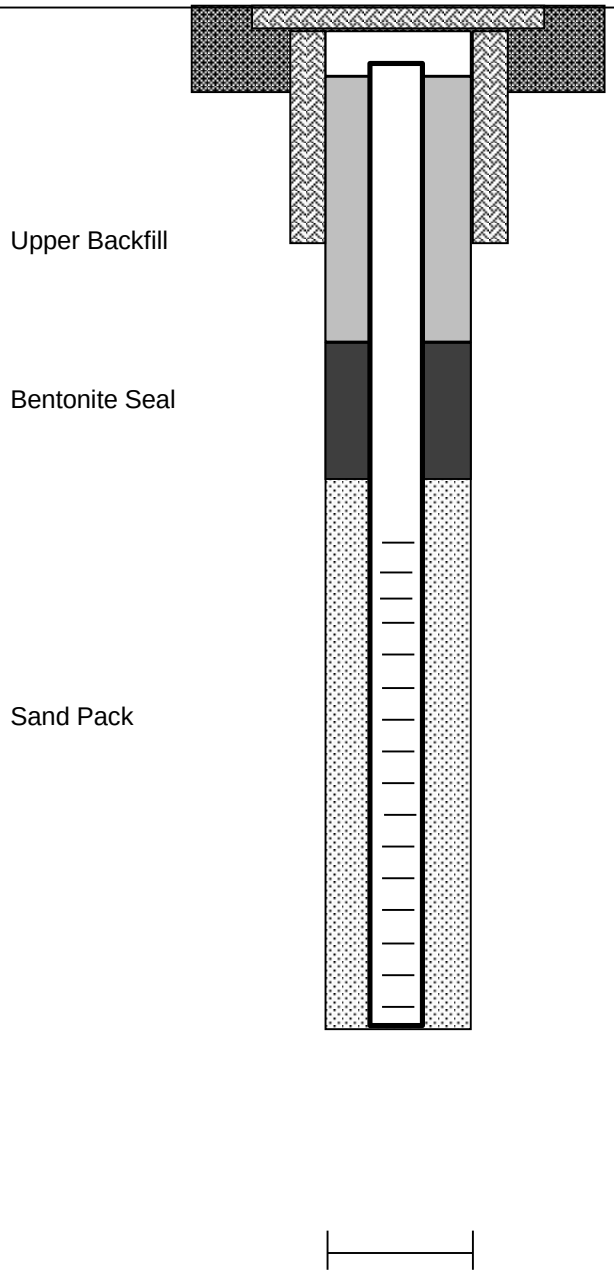
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-104S
Project Location:	N Griffin St & Pacific Ave (On Griffin St)	Driller:	Robert Cromeans	Date Installed:	October 10, 2018
Client:	DART	Ground El.:	427.76	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:		Page:	1 of 1

Ground Surface 427.76 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips	
	Depth (ft)	Elev.
TOP OF SEAL:	1	426.76
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	13	414.8
TOP OF SCREEN:	18	409.8
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	28	399.8
BOTTOM OF SANDPACK:	28	399.8
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	28	399.8
BOREHOLE DIAMETER:	8"	

Remarks: Northing: 6972201.533 Easting: 2490240.916

Overburden & Limestone interface at 22.5' (EL. 405.26')

STATE OF TEXAS WELL REPORT for Tracking #507812

Owner:	**Dart**	Owner Well #:	**TS104S**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**N Griffin ST and Pacific AVE (on Griffin ST) Dallas, TX**	Latitude:	**32° 47' 00.63" N**
		Longitude:	**096° 48' 07.88" W**
Well County:	**Dallas**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/19/2019** Drilling End Date: **2/19/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**28**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
13	**28**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Concrete 1 Bags/Sacks**
1	**13**	**Bentonite 5 Chips**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**2.5" asphalt 8.5" concrete**
1	**5**	**brown clay w/sand**
5	**8**	**tan and gray sandy clay**
8	**22**	**tan sand**
22	**28**	**tan and gray limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**18**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**18**	**28**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

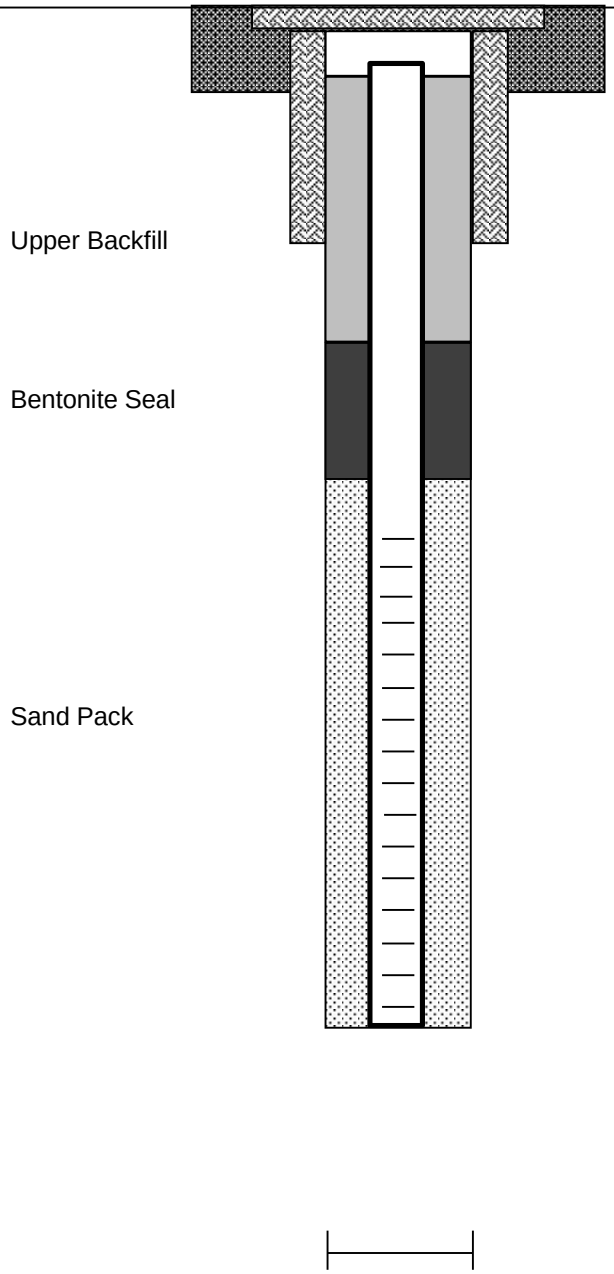
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-111D
Project Location:	Olive Street (65' North of Elm Street)	Driller:	Robert Cromeans	Date Installed:	March 1, 2019
Client:	DART	Ground El.:	464.79	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	464.38	Page:	1 of 1

Ground Surface 464.79 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Grout	
	Depth (ft)	Elev.
TOP OF SEAL:	87	377.79
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	100	364.8
TOP OF SCREEN:	110	354.8
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	120	344.8
BOTTOM OF SANDPACK:	120	344.8
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	120	344.8
BOREHOLE DIAMETER:	6"	

Remarks: Northing: 6972969.855 Easting: 2493291.225

Austin Chalk formation extended to the bottom of the borehole.

STATE OF TEXAS WELL REPORT for Tracking #473720

Owner:	**DART**	Owner Well #:	**TS-111D**
Address:	**1401 Pacific Ave Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**Olive Street 65' North of Elm Street 4.8' from crub Dallas, TX**	Latitude:	**32° 46' 58.43" N**
		Longitude:	**096° 47' 36.2" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/1/2018** Drilling End Date: **3/1/2018**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6	**0**	**120**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
100	**120**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1.5**	**Concrete 1 Bags/Sacks**
1.5	**87**	**Grout 3 Bags/Sacks**
87	**100**	**Bentonite 1 Chips**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Dale Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**0.75**	**asphalt concrete base**
0.75	**3**	**clay brown and tan w/ cal nods**
3	**5**	**clay dark brown w/ cal nods**
5	**25**	**clay tan and gray w/ cal nods**
25	**28**	**clay tan and dark brown w/sandy gravel lenses**
28	**31**	**clay tan sandy w/ sand lenses wet**
31	**41.5**	**sand wet tan w/ gravel**
41.5	**45**	**severely weathered to weathered limestone gray and tan**
45	**120**	**limestone unweathered dark gray w/occasional shale seams and shaley limestone layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**110**
2	**Screen**	**New Plastic (PVC)**	**40 10**	**110**	**120**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

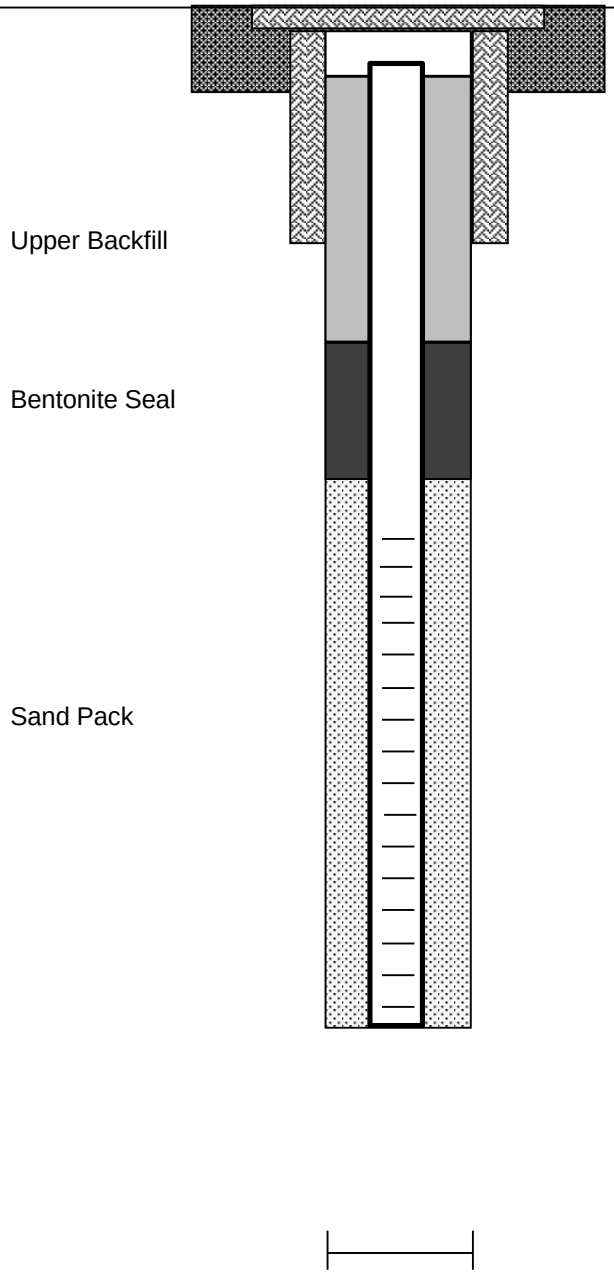
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-111S
Project Location:	Olive Street (68' North of Elm Street)	Driller:	Robert Cromeans	Date Installed:	March 2, 2019
Client:	DART	Ground El.:	464.77	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	464.40	Page:	1 of 1

Ground Surface 464.77 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Grout	
	Depth (ft)	Elev.
TOP OF SEAL:	26	438.77
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	31	433.8
TOP OF SCREEN:	36	428.8
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	46	418.8
BOTTOM OF SANDPACK:	46	418.8
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	46	418.8
BOREHOLE DIAMETER:	8"	

Remarks: Northing: 6972972.758 Easting: 2493290.307

Overburden & Limestone interface at 41.5' (EL. 423.27')

STATE OF TEXAS WELL REPORT for Tracking #473726

Owner:	**DART**	Owner Well #:	**TS-111S**
Address:	**1401 Pacific Ave Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**Olive Street 68' North of Elm Street 4.8' from curb Dallas, TX**	Latitude:	**32° 46' 58.46" N**
		Longitude:	**096° 47' 36.21" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/2/2018** Drilling End Date: **3/2/2018**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**46**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
31	**46**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1.5**	**Concrete 1 Bags/Sacks**
1.5	**26**	**Grout 2 Bags/Sacks**
26	**31**	**Bentonite 1 Chips**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Dale Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**0.75**	**asphalt concrete base**
0.75	**3**	**clay brown and tan w/ cal nods**
3	**5**	**clay dark brown w/ cal nods**
5	**25**	**clay tan and gray w/ cal nods**
25	**28**	**clay tan and dark brown w/ sandy gravel lenses**
28	**31**	**clay sandy w/sand lenses wet**
31	**41.5**	**sand wet tan w/ gravel**
41.5	**45**	**severely weathered to weathered limestone gray and tan**
45	**46**	**limestone unweathered dark gray**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**36**
2	**Screen**	**New Plastic (PVC)**	**40 10**	**36**	**46**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

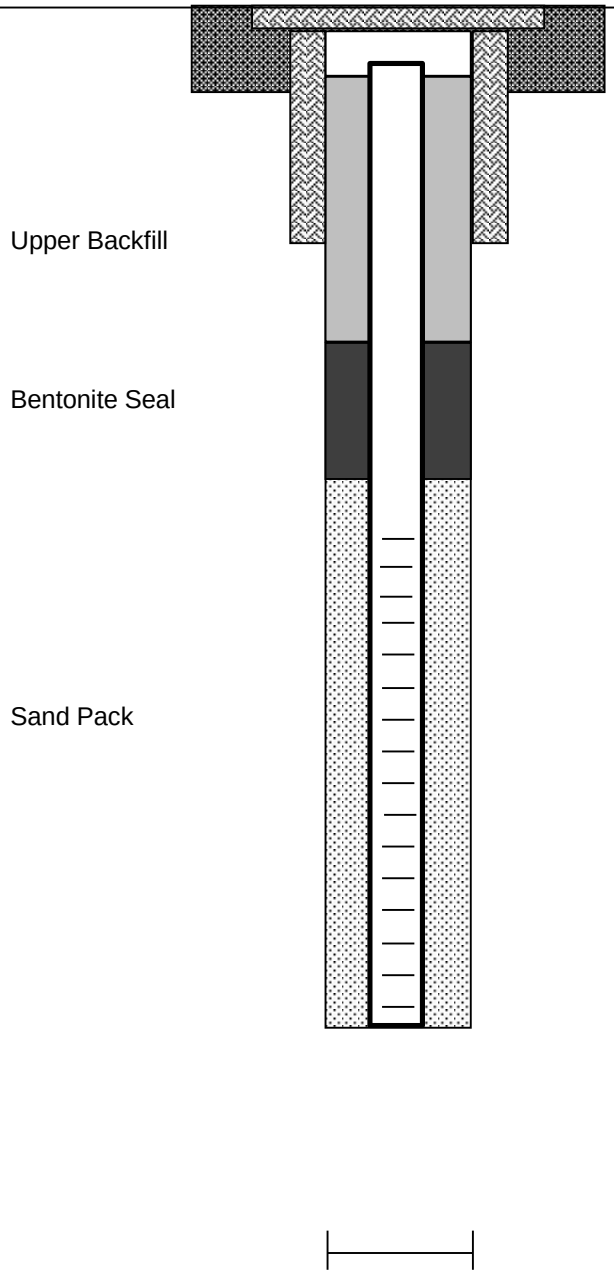
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-202D
Project Location:	Commerce St (110' East of Browder St & 13.5' from S. Curb)	Driller:	Robert Cromeans	Date Installed:	March 22, 2018
Client:	DART	Ground El.:	432.67	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	432.38	Page:	1 of 1

Ground Surface 432.67 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Grout	
	Depth (ft)	Elev.
TOP OF SEAL:	78	354.67
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	83	349.7
TOP OF SCREEN:	88	344.7
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	98	334.7
BOTTOM OF SANDPACK:	102	330.7
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	102	330.7
BOREHOLE DIAMETER:	6"	

Remarks: Northing: 6971904.308 Easting: 2491801.339
Austin Chalk & Eagle Ford interface at 92.5' (EL. 340.17')

STATE OF TEXAS WELL REPORT for Tracking #473807

Owner:	**DART**	Owner Well #:	**TS-202D**
Address:	**1401 Pacific Ave Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**Commerce Street 110' East of Bowder Street Dallas, TX**	Latitude:	**32° 46' 48.1" N**
		Longitude:	**096° 47' 53.9" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/22/2018** Drilling End Date: **3/22/2018**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6	**0**	**102**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
83	**102**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1.5**	**Concrete 1 Bags/Sacks**
1.5	**78**	**Grout 2 Bags/Sacks**
78	**83**	**Bentonite 1 Chips**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Dale Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**asphalt -red brick-base-crushed concrete**
1	**3**	**clay tan and gray w/ sand lenses**
3	**8**	**clay tan and gray w/sandy clay seams and lense**
8	**13.5**	**sand tan and gray w/ sandy clay seams and limestone fragments**
13.5	**16**	**severely wearthered to wearthered limestone gray and tan**
16	**90**	**limestone unwearthered gray w/ shale seams**
90	**92.5**	**sandy limestone unweathered dark gray**
92.5	**102**	**shale unweathered dark gray**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**88**
2	**Screen**	**New Plastic (PVC)**	**40 10**	**88**	**98**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

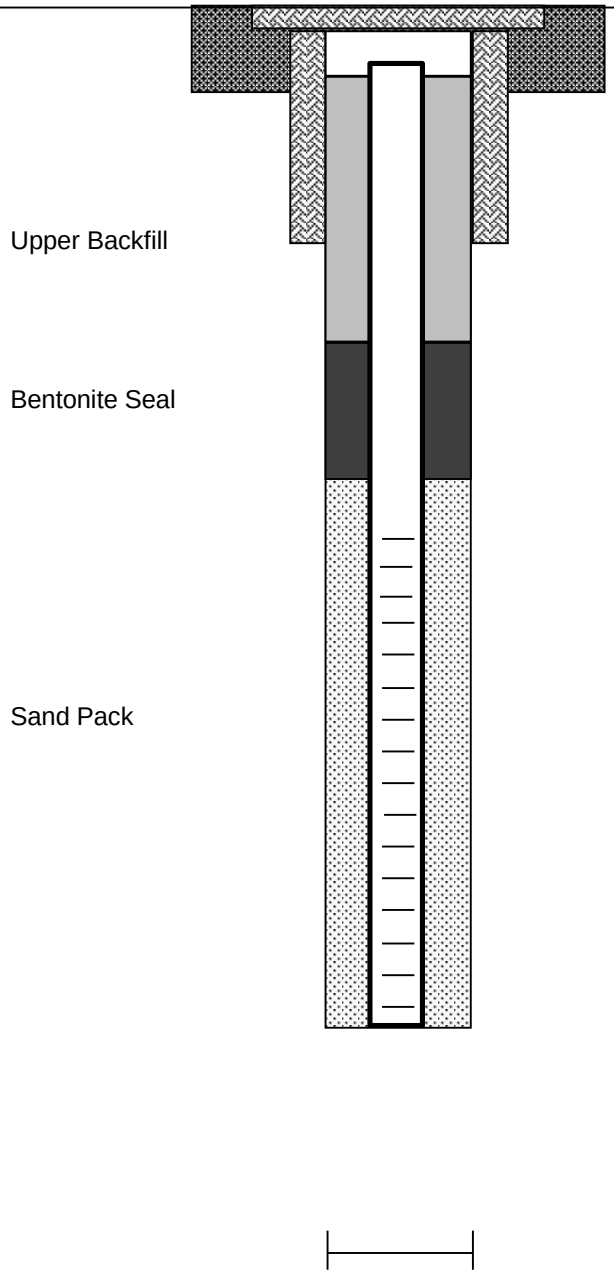
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-202S
Project Location:	Commerce St (113' East of Browder St & 13.5' from S. Curb)	Driller:	Robert Cromeans	Date Installed:	March 23, 2018
Client:	DART	Ground El.:	432.64	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	432.31	Page:	1 of 1

Ground Surface 432.64 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips	
	Depth (ft)	Elev.
TOP OF SEAL:	1.5	431.14
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	5	427.6
TOP OF SCREEN:	9	423.6
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	19	413.6
BOTTOM OF SANDPACK:	20	412.6
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	20	412.6
BOREHOLE DIAMETER:	8"	

Remarks: Northing: 6971903.059 Easting: 2491797.328

Overburden & Limestone interface at 13.5' (EL. 419.14')

STATE OF TEXAS WELL REPORT for Tracking #473810

Owner:	**DART**	Owner Well #:	**TS-202S**
Address:	**1401 Pacific Ave Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**Commerce 113 East of Bowder Street 13.5' from curb Dallas, TX**	Latitude:	**32° 46' 48.1" N**
		Longitude:	**096° 47' 53.85" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/23/2018** Drilling End Date: **3/23/2018**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**20**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
5	**20**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1.5**	**Concrete 1 Bags/Sacks**
1.5	**5**	**Bentonite 2 Chips**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Dale Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**asphalt-red brick-case-crushed concrete**
1	**4**	**clay tan and gray w/ sand lenses**
4	**8**	**clay tan and gray w/ sandy clay seams and lenses**
8	**13.5**	**sand tan and gray w/ sandy clay seams and limestone fragments**
13.5	**16**	**severely weathered to weathered limestone gray and tan**
16	**20**	**limestone unweathered gray w/ shale seams**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**9**
2	**Screen**	**New Plastic (PVC)**	**40 10**	**9**	**19**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

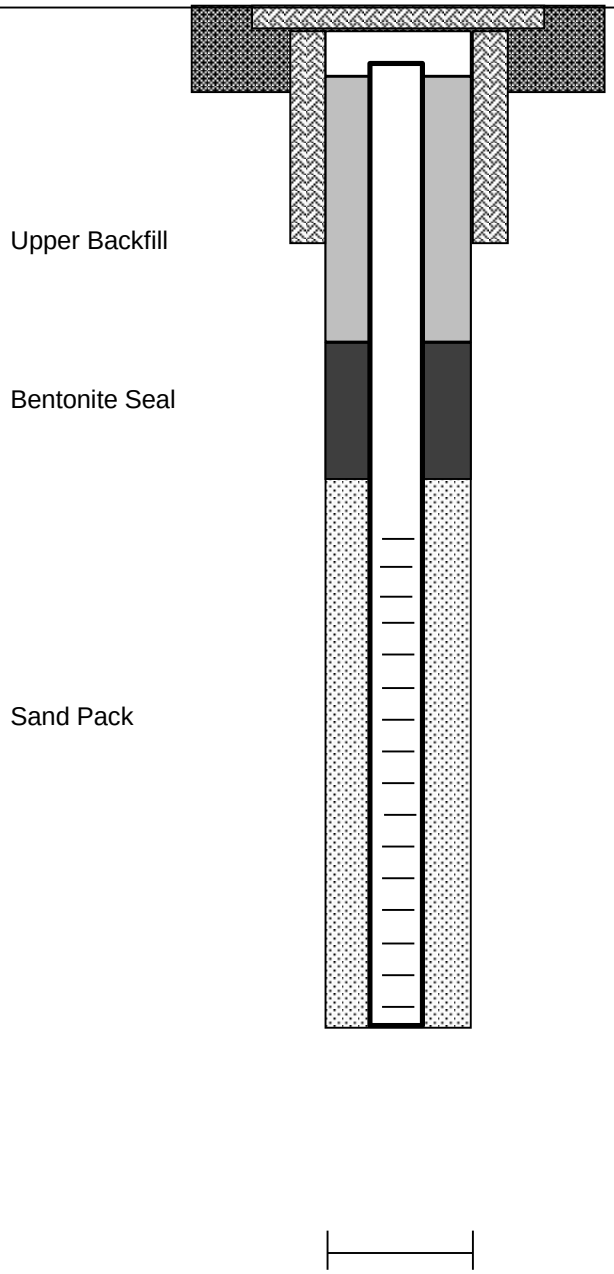
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-206D
Project Location:	Elm Street (135' West of Pearl Street & 4' from south curb)	Driller:	Robert Cromeans	Date Installed:	March 7, 2019
Client:	DART	Ground El.:	463.73	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	463.44	Page:	1 of 1

Ground Surface 463.73 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Grout	
	Depth (ft)	Elev.
TOP OF SEAL:	90	373.73
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	105	358.7
TOP OF SCREEN:	110	353.7
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	120	343.7
BOTTOM OF SANDPACK:	120	343.7
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	120	343.7
BOREHOLE DIAMETER:	6"	

Remarks: Northing: 6972893.008 Easting: 2493404.124
Austin Chalk formation extended to the bottom of the borehole.

STATE OF TEXAS WELL REPORT for Tracking #473729

Owner:	**Dart**	Owner Well #:	**TS-206D**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**Elm Street 135' west of Pearl Street 4' from curb Dallas, TX**	Latitude:	**32° 46' 57.63" N**
		Longitude:	**096° 47' 34.83" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/7/2018** Drilling End Date: **3/7/2018**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6	**0**	**120**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
105	**120**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1.5**	**Concrete 1 Bags/Sacks**
1.5	**90**	**Grout 3 Bags/Sacks**
90	**105**	**Bentonite 1 Chips**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Dale Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1.5**	**asphalt- concrete- base**
1.5	**3**	**clay reddish brown fill**
3	**6**	**clayey sand dark brown w/cal nods**
6	**19**	**clay light brown and tan w/ cal nods and sandy clay layers**
19	**25**	**sandy clay tan and light brown**
25	**29.5**	**sandy clay tan and light brown w/ limestone fragments and cal nods**
29.5	**30.5**	**weathered limestone tan**
30.5	**33**	**weathered limestone tan w/gray to dark gray w/shale layers**
33	**120**	**limestone unweathered gray w shale layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**110**
2	**Screen**	**New Plastic (PVC)**	**40 10**	**110**	**120**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

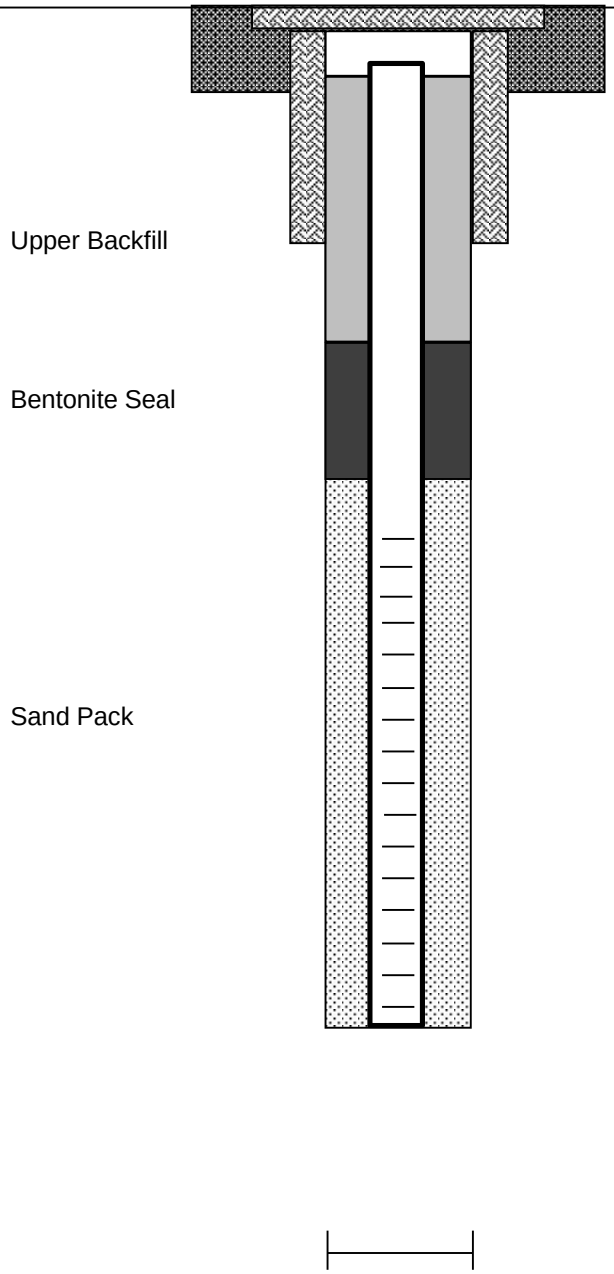
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-206S
Project Location:	Elm Street (138' West of Pearl Street & 4' from south curb)	Driller:	Robert Cromeans	Date Installed:	March 7, 2019
Client:	DART	Ground El.:	463.75	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	463.44	Page:	1 of 1

Ground Surface 463.75 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Grout	
	Depth (ft)	Elev.
TOP OF SEAL:	13	450.75
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	18	445.8
TOP OF SCREEN:	23	440.8
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	33	430.8
BOTTOM OF SANDPACK:	33	430.8
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	33	430.8
BOREHOLE DIAMETER:	8"	

Remarks: Northing: 6972892.073 Easting: 2493400.792

Overburden & Limestone interface at 29.5' (EL. 434.25')

STATE OF TEXAS WELL REPORT for Tracking #473799

Owner:	**DART**	Owner Well #:	**TS-206S**
Address:	**1401 Pacific Ave Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**Elm Street 138' West of Pearl Street 4' from curb Dallas, TX**	Latitude:	**32° 46' 57.62" N**
		Longitude:	**096° 47' 34.86" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/7/2018** Drilling End Date: **3/7/2018**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**33**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
18	**33**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1.5**	**Concrete 1 Bags/Sacks**
1.5	**13**	**Grout 1 Bags/Sacks**
13	**18**	**Bentonite 1 Chips**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Dale Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1.5**	**asphalt-concrete-base**
1.5	**3**	**clay reddish brown fill**
3	**6**	**clayey sand dark brown w/ cal nods**
6	**19**	**clay light brown and tan w/ cal nods and sandy clay layers**
19	**25**	**sandy clay tan and light brown**
25	**29.5**	**sandy clay tan and light brown w/ limestone fragmemts and cal nods**
29.5	**30.5**	**weathered limestone tan**
30.5	**33**	**weathered limestone tan w/ gray to dark gray w/ shale layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Screen**	**New Plastic (PVC)**	**40 10**	**0**	**23**
2	**Blank**	**New Plastic (PVC)**	**40**	**23**	**33**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

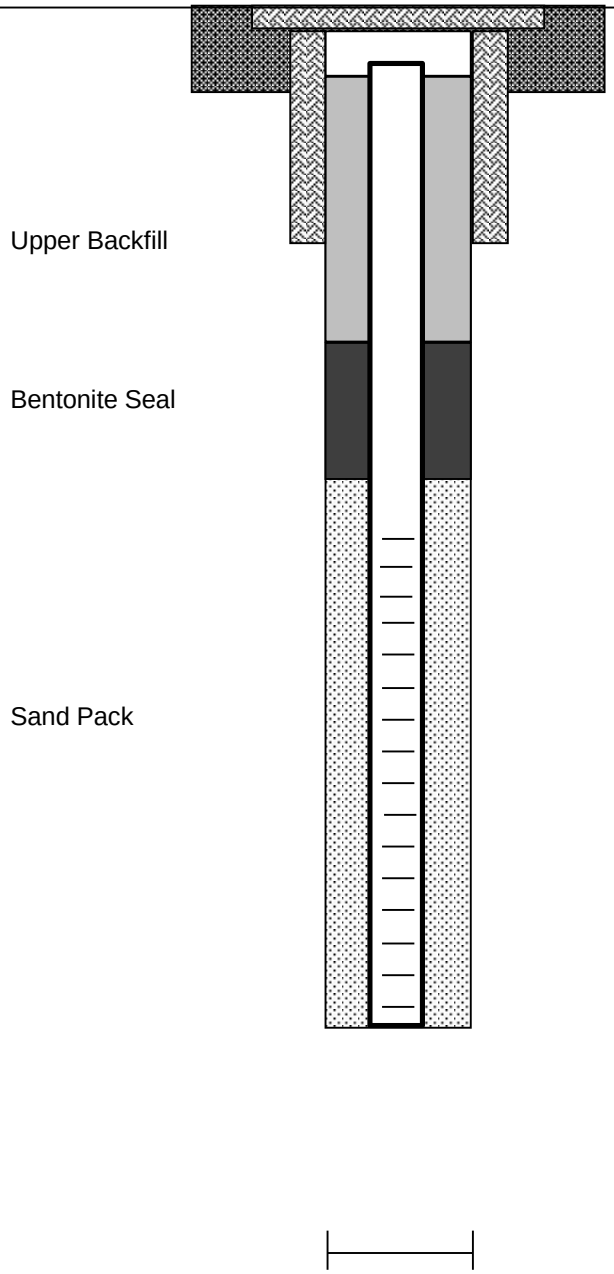
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-207D
Project Location:	Commerce St (63' East of S. Harwood St in the center lane)	Driller:	Robert Cromeans	Date Installed:	March 4, 2019
Client:	DART	Ground El.:	458.50	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	458.23	Page:	1 of 1

Ground Surface 458.496 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Grout	
	Depth (ft)	Elev.
TOP OF SEAL:	85	373.50
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	105	353.5
TOP OF SCREEN:	110	348.5
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	120	338.5
BOTTOM OF SANDPACK:	120	338.5
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	120	338.5
BOREHOLE DIAMETER:	6"	

Remarks: Northing: 6972301.989 Easting: 2493238.884

Austin Chalk formation extended to the bottom of the borehole.

STATE OF TEXAS WELL REPORT for Tracking #507851

Owner:	**Dart**	Owner Well #:	**TS207D**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**S Hardwood ST and Commerce ST (on Commerce ST) Dallas, TX**	Latitude:	**32° 47' 01.14" N**
		Longitude:	**096° 47' 32.74" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/4/2019** Drilling End Date: **3/4/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6	**0**	**120**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
105	**120**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
1	**85**	**Grout 2 Bags/Sacks**
85	**105**	**Bentonite 2 Chips**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**concrete**
2	**3**	**base**
3	**5**	**brown clay**
5	**12**	**tan and gray clay w/cal nods**
12	**22**	**tan clay w/sand seams**
22	**29**	**brown clay w/ sand**
29	**38**	**tan weathered limestone**
38	**120**	**gray limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**110**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**110**	**120**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

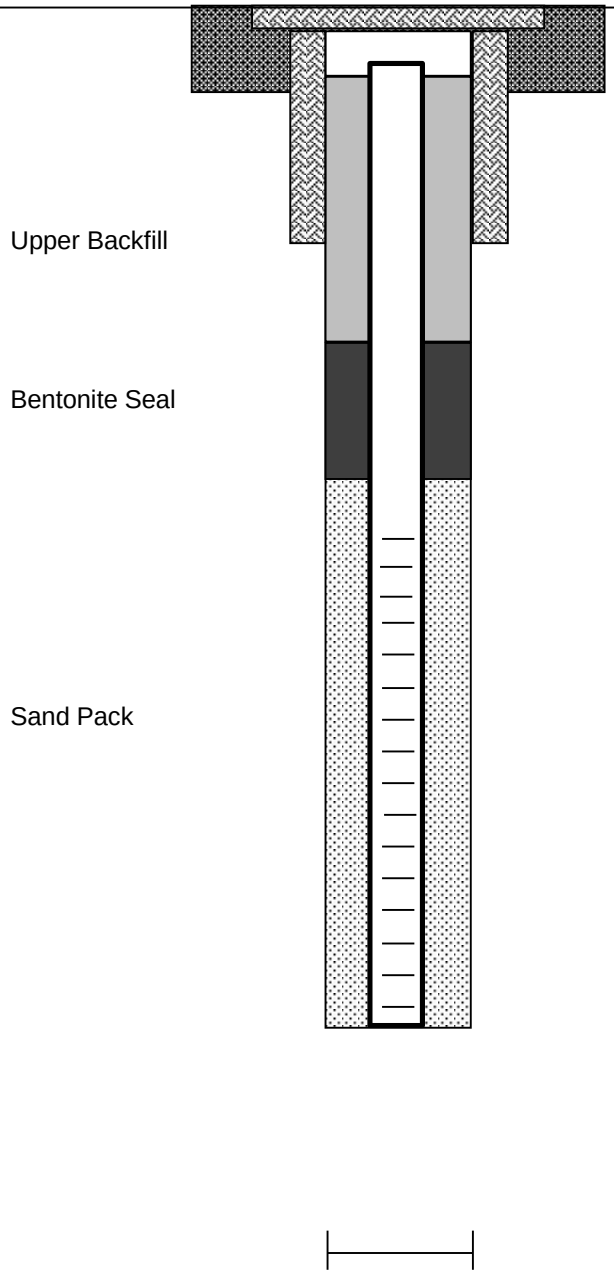
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-207S
Project Location:	Commerce St (60' East of S. Harwood St in the center lane)	Driller:	Robert Cromeans	Date Installed:	March 4, 2019
Client:	DART	Ground El.:	458.50	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	458.29	Page:	1 of 1

Ground Surface 458.501 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips	
	Depth (ft)	Elev.
TOP OF SEAL:	1	457.50
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	17	441.5
TOP OF SCREEN:	23.5	435.0
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	33.5	425.0
BOTTOM OF SANDPACK:	33.5	425.0
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	33.5	425.0
BOREHOLE DIAMETER:	8"	

Remarks: Northing: 6972300.541 Easting: 2493236.763

Overburden & Limestone interface at 28.5' (EL. 430.00')

STATE OF TEXAS WELL REPORT for Tracking #507854

Owner:	**Dart**	Owner Well #:	**TS207S**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-8**
Well Location:	**S Hardwood and Commerce ST (on Commerce ST) Dallas, TX**	Latitude:	**32° 47' 01.12" N**
		Longitude:	**096° 47' 32.77" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/4/2019** Drilling End Date: **3/4/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**33.5**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
17	**33.5**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Concrete 1 Bags/Sacks**
1	**17**	**Bentonite 3 Chips**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**concrete**
2	**3**	**base**
3	**5**	**brown clay**
5	**12**	**tan clay**
12	**22**	**tan clay w/ sand seams**
22	**28.5**	**brown clay w/ sand**
28.5	**33.5**	**tan weathered limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**23.5**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**23.5**	**33.5**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

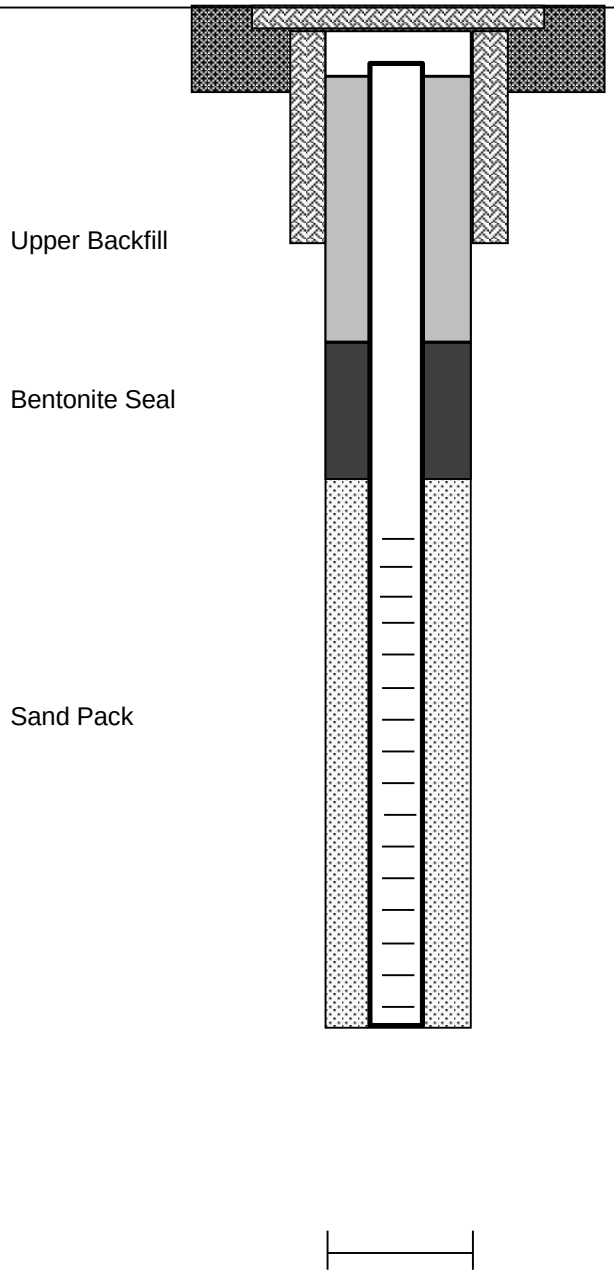
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-208D
Project Location:	Pearl St (42' N. of Commerce St & 16' East of West Curb)	Driller:	Robert Cromeans	Date Installed:	February 25, 2019
Client:	DART	Ground El.:	456.99	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	456.74	Page:	1 of 1

Ground Surface 456.985 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips (1'-5') & Grout (5'-100')	
	Depth (ft)	Elev.
TOP OF SEAL:	100	356.99
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	105	352.0
TOP OF SCREEN:	110	347.0
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	120	337.0
BOTTOM OF SANDPACK:	120	337.0
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	120	337.0
BOREHOLE DIAMETER:	6"	

Remarks: Northing: 6972495.214 Easting: 2493622.074

Austin Chalk formation extended to the bottom of the borehole.

STATE OF TEXAS WELL REPORT for Tracking #507760

Owner:	**Dart**	Owner Well #:	**TS208D**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-9**
Well Location:	**Intersection of Commerce and Pearl (on Pearl) Dallas, TX**	Latitude:	**32° 47' 02.99" N**
		Longitude:	**096° 47' 28.22" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/25/2019** Drilling End Date: **2/25/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6	**0**	**120**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
105	**120**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Concrete 1 Bags/Sacks**
1	**5**	**Bentonite 1 Chips**
5	**100**	**Grout 1 Bags/Sacks**
100	**105**	**Bentonite 1 Chips**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans** License Number: **2954**

Comments: **No Data**

Report Amended on 4/9/2019 by Request #27567

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1.5**	**6.5" asphalt 2.5 Brick 8" base**
1.5	**9**	**brown clay (fill)**
9	**10**	**brown clay w/ sand wet**
10	**18**	**tan and gray weathered limestone**
18	**120**	**gray limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**110**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**110**	**120**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

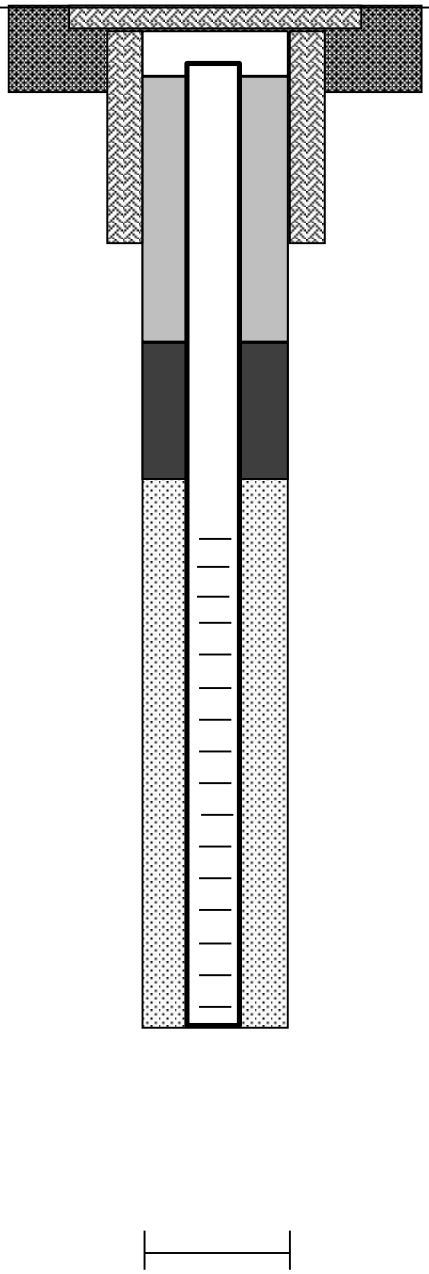
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-208S
Project Location:	Pearl St (45' N. of Commerce St & 16' East of West Curb)	Driller:	Robert Cromeans	Date Installed:	February 25, 2019
Client:	DART	Ground El.:	457.18	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	456.94	Page:	1 of 1

Ground Surface 457.177 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips	
	Depth (ft)	Elev.
TOP OF SEAL:	1	456.18
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	3	454.2
TOP OF SCREEN:	5	452.2
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	15	442.2
BOTTOM OF SANDPACK:	15	442.2
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	15	442.2
BOREHOLE DIAMETER:	8"	

Remarks: Northing: 6972498.084 Easting: 2493623.393

Overburden & Limestone interface at 10' (EL. 447.18')

STATE OF TEXAS WELL REPORT for Tracking #507771

Owner:	**Dart**	Owner Well #:	**TS208S**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-9**
Well Location:	**Intersection of Commerce and Pearl (on Pearl Dallas, TX**	Latitude:	**32° 47' 03.02" N**
		Longitude:	**096° 47' 28.2" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/25/2019** Drilling End Date: **2/25/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**15**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
3	**15**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Concrete 1 Bags/Sacks**
1	**3**	**Bentonite 1 Chips**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1.5**	**6.5"asphalt 2.5" brick 8"base**
1.5	**9**	**(fill) brown clay**
9	**10**	**brown clay w/sand (wet)**
10	**15**	**tan and gray weathered limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**5**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**5**	**15**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

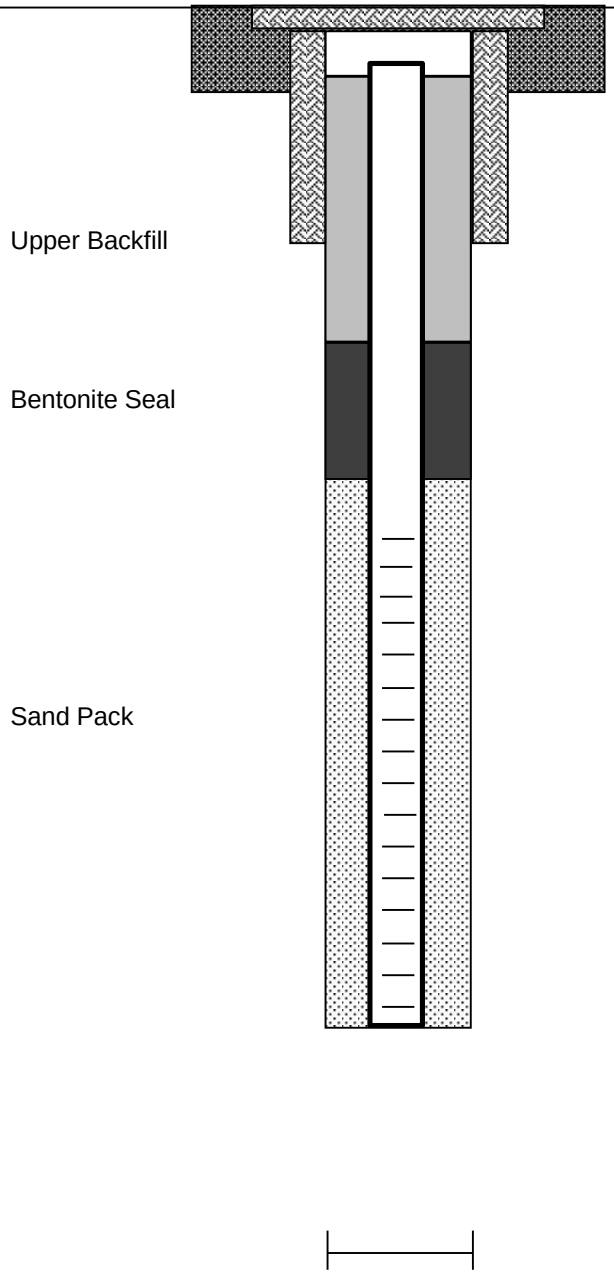
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-209D
Project Location:	Elm St (93' East of Pearl St & 25' North of South Curb)	Driller:	Robert Cromeans	Date Installed:	February 26, 2019
Client:	DART	Ground El.:	461.17	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	460.92	Page:	1 of 1

Ground Surface 461.167 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips (1'-12') & Grout (12'-100')	
	Depth (ft)	Elev.
TOP OF SEAL:	100	361.17
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	105	356.2
TOP OF SCREEN:	110	351.2
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	120	341.2
BOTTOM OF SANDPACK:	120	341.2
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	120	341.2
BOREHOLE DIAMETER:	6"	

Remarks: Northing: 6972995.259 Easting: 2493692.064
Austin Chalk formation extended to the bottom of the borehole.

STATE OF TEXAS WELL REPORT for Tracking #507784

Owner:	**Dart**	Owner Well #:	**TS209D**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-9**
Well Location:	**Inter section of South Pearl and Elm ST (on Elm ST) Dallas, TX**	Latitude:	**32° 47' 07.92" N**
		Longitude:	**096° 47' 27.3" W**
Well County:	**Dallas**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/26/2019** Drilling End Date: **2/26/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6	**0**	**120**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
105	**120**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Concrete 1 Bags/Sacks**
1	**12**	**Bentonite 3 Chips**
12	**100**	**Grout 2 Bags/Sacks**
100	**105**	**Bentonite 1 Chips**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans**

License Number: **2954**

Comments: **No Data**

Report Amended on 4/9/2019 by Request #27572

Report Amended on 4/10/2019 by Request #27592

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**0.85**	**4" asphalt 6.5" concrete**
0.85	**5**	**brown sand w/gravel (fill)**
5	**7**	**brown clay w/calcareous nodules**
7	**18**	**tan and light gray clay w/calcareous nodules**
18	**23**	**clayey sand brown**
23	**28**	**brown clay w/sang seams**
28	**32**	**brown sand and gravl**
32	**39**	**brown clay silty**
39	**45**	**tan and gray limestone**
45	**120**	**gray limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**110**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**110**	**120**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

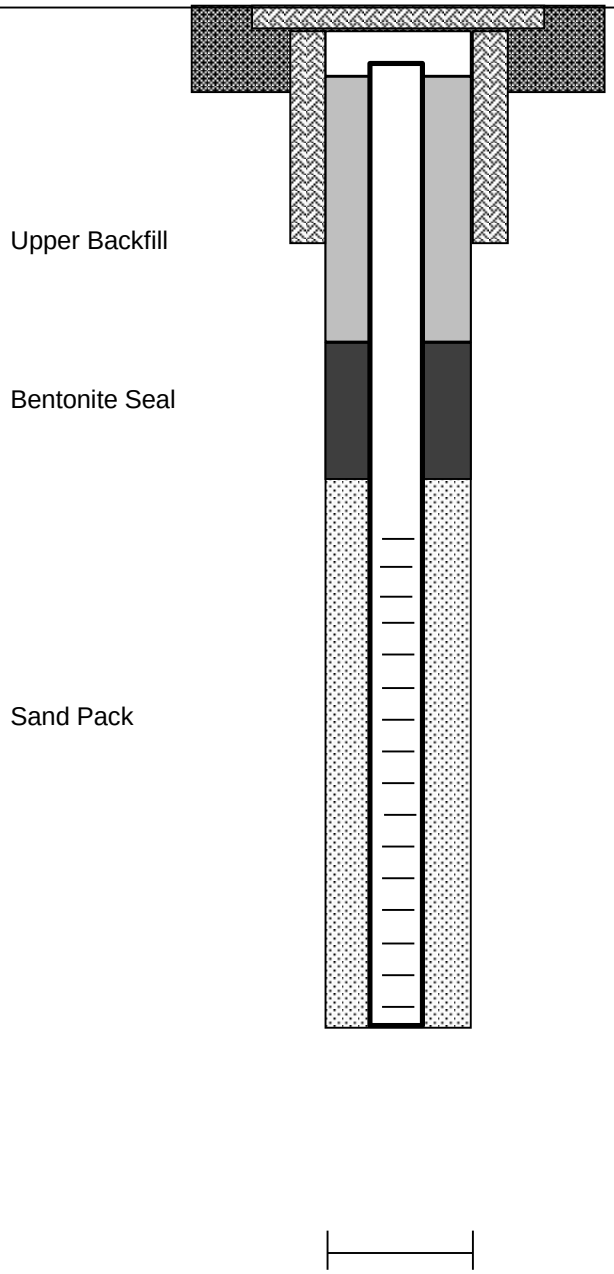
Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Installation Log

Project Name:	DART D-2	Contractor:	Alliance Geotechnical Group	Boring/Well No.:	TS-209S
Project Location:	Elm St (90' East of Pearl St & 25' North of South Curb)	Driller:	Robert Cromeans	Date Installed:	February 26, 2019
Client:	DART	Ground El.:	461.21	Logged By:	Robert Cromeans
Project Number:	E17-0811	Riser El.:	460.89	Page:	1 of 1

Ground Surface 461.209 ft



SURFACE SEAL: (Thickness and Type)	Concrete	
BACKFILL MATERIAL:	Bentonite Chips	
	Depth (ft)	Elev.
TOP OF SEAL:	1	460.21
SEAL CONSTRUCTION:	Bentonite Chips	
TOP OF SANDPACK:	32	429.2
TOP OF SCREEN:	34	427.2
SANDPACK TYPE:	No. 1 Sand	
SCREEN MATERIAL: (Type, Slot, Diameter)	PVC, 10 mil, 2 in	
BOTTOM OF SCREEN:	44	417.2
BOTTOM OF SANDPACK:	44	417.2
TOP OF SEAL:	N/A	
SEAL THICKNESS & CONSTRUCTION:	N/A	
BACKFILL BELOW SEAL:	N/A	
BOTTOM OF BOREHOLE:	44	417.2
BOREHOLE DIAMETER:	8"	

Remarks: Northing: 6972994.298 Easting: 2493689.769

Overburden & Limestone interface at 38' (EL. 423.21')

STATE OF TEXAS WELL REPORT for Tracking #507799

Owner:	**Dart**	Owner Well #:	**TS209S**
Address:	**1401 Pacific Dallas, TX 75202**	Grid #:	**33-10-9**
Well Location:	**Intersection of South Pearl ST and Elm ST (on Elm ST) Dallas, TX**	Latitude:	**32° 47' 07.92" N**
		Longitude:	**096° 47' 27.33" W**
Well County:	**Dallas**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/26/2019** Drilling End Date: **2/26/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**44**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
32	**44**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Concrete 1 Bags/Sacks**
1	**32**	**Bentonite 3 Chips**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alliance Geotechnical Group**

3228 Halifax
Dallas, TX 75247

Driller Name: **Robert Cromeans** License Number: **2954**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**0.85**	**4" asphalt 6.5" concrete**
0.85	**5**	**(fill) brown sand w/gravel**
5	**7**	**brown clay w/cal nods**
7	**18**	**tan and light gray clay w/cal nods**
18	**23**	**clayey sand brown**
23	**28**	**brown silty sandy clay**
28	**32**	**brown sand and gravel**
32	**39**	**brown silty clay**
39	**44**	**tan and gray limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Blank**	**New Plastic (PVC)**	**40**	**0**	**34**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**34**	**44**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540