Northern Agency Tronox Mines

FINAL
Appendix E
Geotechnical Evaluation Report

Response, Assessment, and Evaluation Services (RAES)

Contract No. EP-S9-17-03

Task Order 0001

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Submitted by

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ACRONYMS AND ABBREVIATIONS

AUM	Abandoned uranium mine
ASTM	ASTM International
cm/s	Centimeter per second
DQO	Data quality objective
Kerr-McGee	Kerr-McGee Oil Industries, Inc.
NAUM	Northern Agency abandoned uranium mine
NAVFAC	Naval Facilities Engineering Command
pcf	Pounds per cubic foot
RAES	Response, Assessment, and Evaluation Services
RCRA	Resource Conservation and Recovery Act
RSE	Removal site evaluation
RSE Report	Northern Agency Tronox Mines Removal Site Evaluation Report
RSE Work Plan	Northern Agency Tronox Mines Removal Site Evaluation Work Plan
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
SC	Clayey sand
SC-SM	Clayey silty sand
SM	Silty sand
SP	Poorly graded sand
SP-SC	Poorly graded clayey sand
SP-SM	Poorly graded silty sand
Tetra Tech	Tetra Tech, Inc.
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency

EXECUTIVE SUMMARY

This appendix summarizes the findings of the geotechnical investigation undertaken at the Northern Agency Tronox Mines as part of the 2018 removal site evaluation (RSE) investigation within the Navajo Nation. The abandoned uranium mine (AUM) sites and Targets within the Northern Agency have the potential for mine-related contamination. Removal actions to address mine-related contamination will require the use of geotechnical data to design repositories, understand the properties of materials to be placed in repositories after removal from the sites, and assess the mobility of contamination originating from and potentially migrating through soils at design locations. Soil samples had been collected at very few of the AUM sites and Targets prior to the 2018 RSE investigation, as discussed in the Data Gap Analysis Report in the Northern Agency Tronox Mines Removal Site Evaluation Work Plan (RSE Work Plan) (Tetra Tech, Inc. [Tetra Tech] 2018), and the analyses did not address the geotechnical data needs of future removal action designs.

Sixty-six (66) samples were collected for geotechnical laboratory testing from 34 AUM and Target sites. A total of 74 borings were drilled at 9 AUM and Target sites , and 10 of the geotechnical samples were obtained from the mechanically drilled borings; the remaining geotechnical samples were obtained using hand tools. Sampling corresponded with locations that exhibited relatively high radioactivity or where evidence of mining activities was present.

Generally, the borings were logged as silty sand (SM) and clayey sand (SC) with gravel prior to bedrock or practical refusal being reached at varying depths between 1.5 to 15 feet. No groundwater was encountered during drilling, and the subsurface soil moisture content was mostly considered dry.

Geotechnical laboratory testing indicated that the site soils are sands with varying amounts of fines content (percent passing #200 sieve) and no to low plasticity. Of 66 samples tested, 34 (52 percent) were silty sand (SM), 12 (18 percent) were poorly graded silty sand (SP-SM), 11 (17 percent) were clayey sand (SC), 5 (8 percent) were clayey silty sand (SC-SM), 3 (5 percent) were poorly graded clayey sand (SP-SC), and 1 (2 percent) was poorly graded sand (SP). Geotechnical testing included particle-size distribution (ASTM International [ASTM] D6913) and Atterberg limits (ASTM D4318).

Remaining geotechnical data gaps include laboratory testing for in situ moisture content (ASTM D2216) and density (ASTM D7263), specific gravity (ASTM C127), moisture-density relationships (standard Proctor test, ASTM D698), shear strength (direct shear, ASTM D3080), and permeability (ASTM D5084 or ASTM D5856). These data will be required for repository design and to determine properties of waste placed in repositories. In the absence of these test data, empirical correlations by soil classification are presented in this report for preliminary design and cost estimating.

Not all AUM sites and Targets were investigated, so an understanding of the site-specific conditions in some areas is also a geotechnical data gap. Subsurface investigations can be used to determine waste and borrow volumes. Alternative surficial methods, such as geophysics, visual observations, or analyzing topography, can potentially be used to assist in providing estimates of material quantities.

Borrow source investigations will be necessary to determine the feasibility of using on-site soils, gravel, and cobbles in remediation design. Geotechnical data including in-situ moisture content and density, specific gravity, classification, moisture-density relationships, shear strength, and permeability of borrow materials will be used in remedial design.

1.0 INTRODUCTION

This appendix presents the methods and results of the geotechnical investigation performed by Tetra Tech, Inc. (Tetra Tech) within the Northern Agency Tronox Mines in support of the U.S. Environmental Protection Agency (USEPA) Task Order 0001 of the Response, Assessment, and Evaluation Services (RAES) contract (EP-S9-17-03). Under Task Order 0001, Tetra Tech conducted removal site evaluation (RSE) field investigations at 39 abandoned uranium mine (AUM) sites and 37 Targets previously operated by, or likely associated with, Kerr-McGee Oil Industries, Inc. (Kerr-McGee), or its successor, Tronox (both Kerr-McGee and Tronox referred to herein as Tronox) at the Northern Agency Tronox Mines. Targets are classified as either AUM-related sites or non-AUM targets (see Section 1.6.1 of the Northern Agency Tronox Mines Removal Site Evaluation Work Plan [RSE Work Plan] [Tetra Tech 2018]).

The AUM sites and Targets within the Northern Agency have the potential for mine-related contamination, which may consist of radionuclide and heavy metal soil and sediment concentrations above human health and ecological risk levels. Remediation strategies to reduce the threat to human health and ecological receptors will require the use of geotechnical data. The RSE Work Plan identified a need for a geotechnical investigation to collect subsurface geotechnical data at the AUM sites and Targets of the Northern Agency Tronox Mines to satisfy the project data quality objectives (DQO), which are further discussed in Section 2.0 and in the main Northern Agency Tronox Mines Removal Site Evaluation Report (RSE Report).

2.0 DATA QUALITY OBJECTIVES

2.1 IDENTIFIED DATA GAPS AND DATA NEEDS

Soil samples had been collected at very few of the AUM sites and Targets prior to the 2018 RSE investigation, and the analyses did not address the data needs of future remedial designs. No soil samples had been collected at the majority of the sites prior to the RSE investigation, with the exception of Mesa I 3/4 Incline (M25), Mesa II, Mine Number 1 &and 2, P-21 (M27), and the Cove Transfer Station (T9), as discussed in the Data Gap Analysis Report in the RSE Work Plan (Tetra Tech, 2018). The previous soil sampling results at M25, M27 and T9 did not include geotechnical data related to the physical properties of soil and waste. The conclusions of the Data Gap Analysis Report in the RSE Work Plan (Tetra Tech 2018) identified physical properties and dimensions of soil and waste as being necessary for future remedy evaluations.

2.2 STUDY QUESTIONS

Study questions to be answered by the geotechnical investigation as described in the Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) in the RSE Work Plan (Tetra Tech 2018) include the following.

- Baseline Study, Study Goal 3: “Is there potential for contaminants to migrate off site via surface water pathways at each site?”
- Baseline Study, Study Goal 4: “Is there potential for contaminants to migrate off site via the groundwater pathway?”
- Baseline Study, Study Goal 6: “Have the Tronox Northern Agency abandoned uranium mine (NAUM) risk prioritization factors been evaluated adequately (such as site accessibility, reclamation status, land use, and waste material characteristics)?”
- Site Characterization Study, Study Goal 3: “What is the lateral and vertical extent of mine-related subsurface radionuclides and metals in soils and waste at each site?”
- Site Characterization Study, Study Goal 7: “Have the physical characteristics of mine waste been adequately evaluated to support modeling, remedy evaluation, and evaluation of the Tronox NAUM risk prioritization factors?”

2.3 DATA USES

Geotechnical data will be used to design repositories, understand the properties of materials to be placed in repositories after removal from the sites, and assess the mobility of contamination originating from and potentially migrating through soils at design locations. Repository design and in situ conditions of the waste affect the risk to human health and ecological receptors. Risk can be quantified by determining the potential for complete exposure pathways to these receptors via dust, radon gas, surface water, groundwater, flora, and fauna. Once risk is quantified and mitigation is determined to be necessary, risk can be mitigated by repository design or removal actions. Repositories will be designed to provide a physical barrier limiting direct contact with the waste and lengthening radon exit flux pathways, as well as a chemical barrier reducing contact with water and air. Geotechnical data will be used to evaluate the suitability of on-site material for liners and covers, quantities of materials, permeability of the waste, mobility of the waste, and acceptable slope inclination (via slope stability and erosivity modeling) of the waste and on-site materials. Material quantities, repository geometry, and material properties will also provide data for construction cost estimating.

3.0 GEOTECHNICAL INVESTIGATION

3.1 FIELD INVESTIGATION

Geotechnical sampling consisted of both near-ground surface sampling by hand and mechanical drilling to deeper depths at accessible sites. Surficial geotechnical samples were collected using a shovel or hand auger. Composite geotechnical samples were collected from the existing ground surface to a depth of 18 inches or until practical refusal was encountered. Geotechnical samples were logged by visual classification before being deposited in gallon-sized bags, which were labeled and sealed.

Hollow stem auger and direct push mechanical drilling methods were used to collect geotechnical samples at greater depths. The sampler was advanced by mechanical methods until target depths or practical refusal occurred. In select instances, the boring was advanced using hollow stem augers beyond refusal by direct push drilling in the same boring. Geotechnical samples were obtained from downhole direct push probe rods with sample tubes or a split spoon sampler at target depths based on the interpretation of site features and downhole gamma measurements. Upon return to the surface, the samples were visually classified and logged before being deposited in gallon-sized bags, which were labeled and sealed. Borings were backfilled with drill cuttings.

The sampling locations, depths of the borings and geotechnical sample identification are shown on Figure E-1 through Figure E-37 and presented in Table E-1 and Table E-2. Sixty-six (66) samples were collected for geotechnical laboratory testing from 34 AUM and Target sites. A total of 74 borings were drilled at 9 AUM and Target sites, and 10 of the geotechnical samples tested in the laboratory for geotechnical properties were obtained from the mechanically drilled borings; the remaining geotechnical samples were obtained using hand tools. Sampling corresponded with locations that exhibited relatively high radioactivity or where evidence of mining activities was present. Most locations meeting these criteria were not accessible to drill rigs, resulting in sampling being limited to hand tools only.

3.2 ANALYTICAL METHODS

Laboratory testing of geotechnical samples generally followed ASTM International (ASTM) methods. Testing included particle-size distribution (ASTM D6913) and Atterberg limits (ASTM D4318). Particle size distribution testing with a hydrometer (ASTM D7928) as discussed in the SAP/QAPP was not conducted based on the coarse-grained nature of the soils.

Following the drilling of each boring, downhole measurements were made using a Ludlum 44-2 detector (1- by 1-inch sodium iodide scintillator) paired with a Ludlum 2221 scaler-ratemeter. Thirty second scaler counts were taken in 12-inch increments, starting from the ground surface. The reported count per minute values were obtained by doubling the 30-second scaler counts. The measurements taken are qualitative in nature. Quantitative information, such as soil concentration, cannot be accurately determined from downhole measurements because of the heterogenous and unique geometries of each boring. The count rates within borings are relative to each other; therefore, conclusions about relative activity and contamination can be drawn. For example, based on relative count rates within a boring, one can determine the magnitudes and extent of subsurface contamination. The relative nature of the measurements is sufficient to assist in the selection of soil samples to be used for quantitative analysis.

Table E-1. Geotechnical Sampling Locations

Boring	Sample Interval (feet)	Site Feature
M02-23	0 – 15 (D)	No site features
M03-51	0 – 1.5	Waste Pile M3
M04-81	0 – 1.5	Waste Pile M4
M05-149	0 – 1	Waste Pile M5A
M05-479	0 – 1	Footpath
M06-157	0 – 5 (D)	Waste Pile M6
M07-161	0 – 2.5	Waste Pile M7A
M07-204	0 – 2.5	Waste Pile M7B
M08-94	0 – 1.5	Waste Pile M8B
M08-106	0 – 1.5 (D)	Waste Pile M8A/Adjacent to a Vehicle Access Path
M09-19	0 – 0.5	Waste Pile M9/Adjacent Portal 26
M11-35	0 – 1	Waste Pile M11
M11-40	0 – 0.5	Waste Pile M11
M12-33	0 – 1	On the boundary of Waste Pile M12
M16-93	0 – 1.5	Waste Pile M16A/Adjacent to drainage
M17-04	0 – 1	Footpath
M17-35	0 – 1.5	Downgradient of Haul Shaft/Adjacent to Waste Pile M17
M17-38	0 – 1.5	Adjacent to footpath
M17-64	0 – 1.5	Waste Pile M17
M17-93	0 – 1.5	Adjacent to Waste Pile M17
M18-92	1.5 – 4 (D)	Vehicle Path
M20-147	0 – 0.83	Waste Pile M20
M20-244	0 – 1.5	Waste Pile M20
M20-59	0 – 1.5	Downstream of Waste Pile M20
M21-280	0 – 1	Waste Pile M21D
M21-405	0 – 1	Waste Pile M21F
M21-434	0 – 1.5	Waste Pile M21A
M21-528	0 – 1	Waste Pile M21B
M21-528	1 – 1.5	Waste Pile M21B
M22-104	0 – 1	Waste Pile M22
M23-54	0 – 1.5	Waste Pile M23
M23-132	0 – 1	Downgradient of Burial Cell 70b in drainage
M24-22	0 – 1	West of Waste Pile M24, no site features
M24-35	0 – 0.83	Adjacent to Waste Pile M24
M24-40	0 – 1	Adjacent to Waste Pile M24, same survey unit as Waste
M24-76	0 – 1.5	Waste Pile M24
M24-88	0 – 1.5	No site features
M24-127	0 – 1.5	Adjacent to Waste Pile M24
M25-50	0 – 1.5	Adjacent to Waste Pile M25
M27-51	0 – 1	Waste Pile M27
M28-30	0 – 1	Waste Pile M28
M28-104	0 – 1.3	No site features

Table E-1. Geotechnical Sampling Locations (Continued)

Boring	Sample Interval (feet)	Site Feature
M28-133	0 – 1	Adjacent to foot path. No site features
M29-05	0 – 0.5	Adjacent to Waste Pile 43
M29-13	0 – 1.5	Waste Pile 43/Burial Cell 43
M29-19	0 – 1.5	Waste Pile M29B
M29-45	0 – 1.5	Adjacent to Burial Cell 43
M29-48	0 – 0.5	Waste Pile M29A
M30-208	0 – 0.5	Burial Cell 48
M31-23	0 – 1	Adjacent to foot path. No site features
M31-37	0 – 1.5	Waste Pile M31
M32-89	0 – 0.5	Waste Pile M32
M32-96	0 – 1	Adjacent to Waste Pile M32
M33-97	0 – 1	Waste Pile M33
M34-97	0 – 0.5	Adjacent to Portal 213
M34-109	0 – 0.5	Waste Pile M34A
M37-44	0 – 1	Waste Pile M37A/ Portal 211
M38-02	0 – 1.5	No site features
M38-08	0 – 1.5	Adjacent to drainage and foot path
M38-20	0 – 1.5	Portal 207/Portal 280
T09-67	0 – 3 (D)	Waste Pile 344A-1
T09-109	0 – 5 (D)	Waste Pile 344A-1
T09-185	0 – 5 (D)	No site features
T17-141A	0 – 3 (D)	Burial Cell 310AB
T23-24	4 – 8.5 (D)	Burial Cell 344B-2
T37-86A	4 – 8 (D)	Waste Pile T37

Note:
D Sample collected during drilling

Table E-2. Geotechnical Drilling Locations

Boring	Total Depth Drilled (feet)	Site Feature
M02-05	15	Waste Pile 173d
M02-12	14.5	Waste Pile 173c
M02-23 (L)	15	North of burial cell, flat elevation
M02-37	15	Burial Cell 173
M02-40	13.5	Waste Pile 173a
M02-50	12	Waste Pile 173a
M02-51	15	Waste Pile 173a
M02-55	13.5	Burial Cell 173
M02-59	15	Waste Pile 173a
M02-63A	14	Burial Cell 173
M02-73	13.5	Burial Cell 173
M02-77	15	No site feature
M02-81	13.5	Burial Cell 173
M06-109	6	No site feature
M06-140	4.5	Waste Pile M6
M06-142	13	Waste Pile M6
M06-157 (L)	5	Waste Pile M6
M06-174	6	Waste Pile M6
M06-190	7	Waste Pile M6
M08-100	10	Burial Cell 6a
M08-103	8	No site feature
M08-104	16	No site feature
M08-106 (L)	4	Waste Pile M8A
M08-116	12	Burial Cell 6a
M08-120	5	Waste Pile M8A
M15-03	5	No site feature
M15-14	7	Waste Pile M15A
M15-23	6	Waste Pile M15A
M15-23A	1.5	Waste Pile M15A
M15-34	7	Waste Pile M15A
M18-73	2	Waste Pile 87b
M18-74	4.5	Waste Pile 87b
M18-76	4	Waste Pile 87a
M18-84	5	No site feature
M18-92 (L)	4	No site feature
T09-67 (L)	11	Waste Pile 344A-1
T09-109 (L)	10	Waste Pile 344A-1
T09-129	16	Waste Pile 344A-1
T09-144	13.5	Waste Pile 344A-1
T09-155	15	Waste Pile 344A-1
T09-176	10	Road
T09-185 (L)	13.5	No site feature

Table E-2. Geotechnical Drilling Locations (Continued)

Boring	Total Depth Drilled (feet)	Site Feature
T09-212	10	No site feature
T17-67	7	Burial Cell 310AB
T17-71	7	Burial Cell 310AB
T17-89	8	Burial Cell 310AB
T17-91	7	Burial Cell 310AB
T17-137	9	Burial Cell 310AB
T17-139	7	Burial Cell 310AB
T17-141	4	Burial Cell 310AB
T17-141A (L)	12	Burial Cell 310AB
T17-163	8	No site feature
T17-196	10.5	Burial Cell 310AB
T17-198	8.5	Burial Cell 310AB
T17-199	12	Burial Cell 310AB
T17-258	7.5	Burial Cell 310AB
T17-261	7	Burial Cell 310AB
T23-22	6	Adjacent to Burial Cell 344B-2
T23-24 (L)	4	Burial Cell 344B-2
T23-32	6	Burial Cell 344B-2
T23-33	9	Burial Cell 344B-2
T23-35	5	Burial Cell 344B-2
T23-41	5	Adjacent to Burial Cell 344B-2
T23-42	7	Burial Cell 344B-2
T23-44	6	Burial Cell 344B-2
T23-45	5	Burial Cell 344B-2
T23-52	4	Burial Cell 344B-2
T37-69	8	Downstream of Waste Pile T37
T37-77	6	Waste Pile T37
T37-86	10	Waste Pile T37
T37-86A (L)	10	Waste Pile T37
T37-87	10	Adjacent to Waste Pile T37
T37-94	10	Waste Pile T37
T37-103	10	Adjacent to Waste Pile T37

Note:
L Sample tested in geotechnical laboratory

4.0 INVESTIGATION RESULTS

Geotechnical investigation included drilling at five AUM sites and four Targets in addition to hand sampling of near surface soils at 29 AUM sites and four Targets (Figure E-1 through Figure E-37).

4.1 GEOTECHNICAL DRILLING

Boring logs are included in Attachment E1, and a summary of subsurface conditions at each site is presented in the subsections that follow. Field forms and photographic documentation are provided for each site in Appendix H of the RSE Report. Groundwater was not encountered in any of the borings at the time of drilling in September 2018. Borings were backfilled immediately with drill cuttings.

4.1.1 Block K Mine (M2)

Thirteen borings were drilled at the Block K mine (M2) using hollow stem auger methods. Six borings were drilled in Waste Pile 173, five borings were drilled in Burial Cell 173, and two borings were drilled outside of the site features (Figure E-4). Borings ranged in depth from 12 to 15 feet as noted in the boring logs. Subsurface profiles generally consisted of light brown to brown or red silty sand with little to no plasticity. Sandstone gravel within the silty sand was observed in some of the borings. Gray to tan sandstone bedrock was encountered at depths of 10.5 to 13.5 feet in Waste Pile 173, 10.5 to 15 feet in Burial Cell 173, and 12 and 13.5 feet in borings M2-12 and M2-77, located outside of the site features. Drilling terminated in the bedrock in each boring except in M2-73 (Burial Cell 173), where the silty sand continued to boring termination at 13.5 feet. The subsurface moisture was described as dry to damp throughout the profile.

4.1.2 Mesa I Mine 13 (M6)

Six borings were completed at Mesa I Mine 13 (M6) using direct push methods. Five borings were drilled in Waste Pile M6 and one boring (M6-109) was drilled outside of the site features (Figure E-8). Borings ranged in depth from 4.5 to 13 feet as noted in the boring logs. Subsurface profiles generally consisted of brown to reddish brown fine-grained silty sand with sandstone gravel and no plasticity. Borings were terminated upon practical refusal with sandstone noted at M6-109 and M6-157. Borings in Waste Pile M6 extended to depths of 4.5 to 13 feet. The subsurface moisture was described as dry to damp throughout the profile.

4.1.3 Mesa I Mine 15 (M8)

Six boreholes were completed at Mesa I Mine 15 (M8) using direct push and hollow stem auger methods. Borings M8-100 and M8-116 were drilled in Burial Cell 6a, M8-113 and M8-114 were drilled outside of the site features, and M8-106 and M8-120 were drilled in Waste Pile M8A (Figure E-10). Borings ranged in depth from 4 to 16 feet as noted in the boring logs. Subsurface profiles generally consisted of light brown to brown fine-grained silty sand with no plasticity. Sandstone gravel was observed within the silty sand in each boring except M8-116. The subsurface moisture was described as dry to damp until borings were terminated upon practical refusal.

4.1.4 Mesa V Incline (M15)

Five borings were completed at the Mesa V Incline (M15) using direct push methods. Four borings were drilled in Waste Pile 15A and one boring (M15-03) was drilled outside of the site features (Figure E-14). Borings ranged in depth from 1.5 to 7 feet as noted in the boring logs. Subsurface profiles generally consisted of light brown to brown fine-grained silty sand with sandstone gravel. Cohesive soils were encountered in borings M15-14, M15-23A, and M15-34 and were a relatively darker brown than the silty sand. Practical drill rig refusal occurred in boring M15-3 (outside of the site features) and M15-23A (Waste Pile 95b) at depths of 5 and 1.5 feet, respectively. The subsurface moisture was described as dry except for boring M15-3, which had dry to moist soil.

4.1.5 Mesa V Mine 508 (M18)

Five borings were completed at Mesa V Mine 508 (M18) using direct push methods. Two borings (M18-73 and M18-74) were drilled in Waste Pile 87b, one boring (M18-76) was drilled in Waste Pile 87a, and two borings (M18-84 and M18-92) were drilled outside of the site features (Figure E-17). Borings ranged in depth from 2 to 5 feet as noted in the boring logs. Subsurface profiles generally consisted of light brown to gray fine-grained silty sand with sandstone gravel. The subsurface moisture was described as dry throughout the profile. Practical refusal occurred in sandstone in borings M18-73, M18-76, and M18-92 at respective depths of 2, 4, and 4 feet.

4.1.6 Cove Transfer Station (M40/T09/T37)

Eight borings were drilled at the Cove Transfer Station (T9) and seven borings were drilled at the Cover Transfer Station South (T37). At T9, five borings were drilled in Waste Pile 344A-1, one boring (T9-176) was drilled at a road, and two borings (T9-185 and T9-212) were drilled outside of the site features (Figure E-34 and Figure E-37). At T37, four borings were drilled in Waste Pile T37 and three borings were drilled outside of the site features. Borings were advanced using hollow stem auger and direct push methods. Borings at T9 ranged in depth from 10 to 16 feet and borings at T37 ranged from 6 to 10 feet as noted in the boring logs. Subsurface profiles generally consisted of light brown to brown alternating layers of silty sand and clayey sand. The subsurface moisture was described as dry throughout the profile. Gravel and cobbles within the sand were observed in most of the borings. Surficial fill soils extended to depths of 4.5, 1, and 1 feet below existing ground surface in T9-155 (Waste Pile 344A-1), T37-69 (outside of the site features), and T37-77 (Waste Pile T37), respectively. Boring T9-67 (Waste Pile 344A-1) and T9-212 (outside of the site features) encountered a sandy lean clay layer at respective depths of 5 and 7 feet. Claystone bedrock was observed at depths of 8.5, 8, 13, and 13 feet in T9-67 (Waste Pile 344A-1), T9-109 (Waste Pile 344A-1), T9-129 (Waste Pile 344A-1), and T9-185 (outside of the site features). Bedrock was not encountered in the T37 borings.

4.1.7 Mesa I Camp (M41/T17)

Fourteen borings were drilled at Mesa I Camp using direct push and hollow stem auger methods. Thirteen borings were located in Burial Cell 310AB and one boring (T17-163) was outside of the site features (Figure E-35). Borings ranged in depth from 4 to 12 feet, where practical refusal occurred, as noted in the boring logs. Subsurface profiles generally consisted of brown fine-grained silty sand with little to no plasticity overlying sandstone. Sandstone gravel within the silty sand was observed in some borings. At borings T17-89 (Burial Cell 310AB) and T17-163 (outside of the site features), drilling was advanced through bedrock encountered at depths of 7.8 and 3 feet, respectively. The subsurface moisture was described as dry throughout the profile.

4.1.8 NA-0344B (M42/T23)

Ten borings were drilled at NA-0344B using direct push and hollow stem auger methods. Eight borings were drilled in Burial Cell 344B-2 and two borings were drilled outside of the site features (Figure E-36). Borings ranged in depth from 4 to 9 feet, where practical refusal occurred, as noted in the boring logs. Subsurface profiles generally consisted of light brown to brown silty sand with little to no plasticity until refusal into presumed gray sandstone. Sandstone gravel within the silty sand was observed in most of the borings. The subsurface moisture was described as dry throughout the profile.

4.2 GEOTECHNICAL LABORATORY TESTING

Sixty-six geotechnical samples were collected for geotechnical laboratory testing. The subsections below summarize the laboratory results and analyze the results by subarea group and geologic area.

4.2.1 Overview of Laboratory Test Results

Geotechnical laboratory test results are presented in Table E-3 and Attachment E2. Testing indicated that the soils are sands with varying amounts of fines contents (percent passing #200 sieve) and no to low plasticity. The geotechnical samples classify as silty sand (SM), clayey sand (SC), poorly graded sand (SP), or dual classifications of poorly graded silty sand (SP-SM), clayey silty sand (SC-SM), and poorly graded clayey sand (SP-SC) according to the Unified Soil Classification System (USCS) and ASTM D2487. Of the 66 samples tested, 34 (52 percent) were SM, 12 (18 percent) were SP-SM, 11 (17 percent) were SC, 5 (8 percent) were SC-SM, 3 (5 percent) were SP-SC, and 1 (2 percent) was SP.

Test results indicate the majority of the samples have a maximum particle size passing the #4 sieve that is defined by the USCS/ASTM D2487 as the boundary between gravel and sand sized particles. However, field forms (Appendix H) and boring logs (Attachment E1) indicate that gravel and cobbles were present in the field. This discrepancy is attributed to material breakdown during sampling, transporting, and washing; gravel and cobbles removed during sampling; or misidentification of gravel sized particles during field logging.

Table E-3. Geotechnical Laboratory Test Results

Boring	Sample Interval (feet)	Atterberg Limits (LL/PL/PI)	Fines Content (%)	Classification
M02-23	0 – 15	NP	17	SM
M03-51	0 – 1.5	22/20/2	17	SM
M04-81	0 – 1.5	NP	14	SM
M05-149	0 – 1	NP	10	SP-SM
M05-479	0 – 1	28/22/6	16	SC-SM
M06-157	0 – 5	22/21/1	17	SM
M07-161	0 – 2.5	21/20/1	20	SM
M07-204	0 – 2.5	24/21/3	22	SM
M08-94	0 – 1.5	NP	11	SP-SM
M08-106	0 – 1.5	NP	13	SM
M09-19	0 – 0.5	NP	19	SM
M11-35	0 – 1	22/20/2	16	SM
M11-40	0 – 0.5	21/19/2	14	SM
M12-33	0 – 1	20/19/1	8	SP-SM
M16-193	0 – 1.5	NP	12	SP-SM
M17-04	0 – 1	25/24/1	18	SM
M17-35	0 – 1.5	22/21/1	22	SM
M17-38	0 – 1.5	21/20/1	20	SM
M17-64	0 – 1.5	NP	13	SM
M17-93	0 – 1.5	NP	16	SM
M18-92	1.5 – 4	NP	22	SM
M20-147	0 – 0.83	NP	13	SM
M20-244	0 – 1.5	22/21/1	14	SM
M20-59	0 – 1.5	22/20/2	20	SM
M21-280	0 – 1	NP	12	SP-SM
M21-405	0 – 1	25/20/5	28	SC-SM
M21-434	0 – 1.5	NP	12	SM
M21-528	0 – 1	NP	18	SM
M21-528	1 – 1.5	22/21/1	16	SM
M22-104	0 – 1	24/21/3	28	SM
M23-54	0 – 1.5	26/20/6	11	SP-SC
M23-132	0 – 1	20/19/1	9	SP-SM
M24-22	0 – 1	NP	9	SP-SM
M24-35	0 – 0.83	25/23/2	14	SM
M24-40	0 – 1	24/20/4	10	SP-SC
M24-76	0 – 1.5	31/19/12	14	SC
M24-88	0 – 1.5	23/20/3	13	SM
M24-127	0 – 1.5	33/20/13	19	SC
M25-50	0 – 1.5	22/20/2	10	SP-SM
M27-51	0 – 1	NP	17	SM
M28-30	0 – 1	NP	9	SP-SM
M28-104	0 – 1.3	23/22/1	14	SM

Table E-3. Geotechnical Laboratory Test Results (Continued)

Boring	Sample Interval (feet)	Atterberg Limits (LL/PL/PI)	Fines Content (%)	Classification
M28-133	0 – 1	23/20/3	15	SM
M29-05	0 – 0.5	NP	5	SP-SM
M29-13	0 – 1.5	NP	5	SP
M29-19	0 – 1.5	26/15/11	21	SC
M29-45	0 – 1.5	NP	7	SP-SM
M29-48	0 – 0.5	NP	9	SP-SM
M30-208	0 – 0.5	26/17/9	17	SC
M31-23	0 – 1	28/21/7	20	SC-SM
M31-37	0 – 1.5	22/19/3	13	SM
M32-89	0 – 0.5	20/19/1	21	SM
M32-96	0 – 1	23/17/6	25	SC-SM
M33-97	0 – 1	22/21/1	17	SM
M34-97	0 – 0.5	23/16/7	17	SC-SM
M34-109	0 – 0.5	21/19/2	18	SM
M37-44	0 – 1	25/17/8	18	SC
M38-02	0 – 1.5	NP	14	SM
M38-08	0 – 1.5	23/18/5	9	SP-SC
M38-20	0 – 1.5	25/16/9	17	SC
T09-67	0 – 3	28/19/9	16	SC
T09-109	0 – 5	24/16/8	29	SC
T09-185	0 – 5	31/22/9	32	SC
T17-141A	0 – 3	22/20/2	19	SM
T23-24	4 – 8.5	31/19/12	30	SC
T37-86A	4 – 8	28/17/11	43	SC

Notes:
LL Liquid limit
NP Non-plastic
PI Plasticity index
PL Plastic limit
SC Clayey sand
SC-SM Clayey silty sand
SM Silty sand
SP Poorly graded sand
SP-SC Poorly graded clayey sand
SP-SM Poorly graded silty sand

4.2.2 Results by Subarea Group and Geologic Unit

Laboratory test results were organized by Subarea Group (Figure E-1 through Figure E-3) (Table E-4) and geologic unit (Table E-5) to determine if trends existed within these features.

Subarea Groups A through J have been assigned based on geographic proximity to AUM sites. Comparing the USCS classifications by subarea group indicates that SM was the most abundant soil classification in each subarea group except Subarea Group C, which was entirely SC. Subarea Group C had the highest average fines content and plasticity index amongst the subarea groups. SM was present at each subarea groups except Subarea C.

Table E-4. Geotechnical Laboratory Test Results by Subarea Group

Subarea (# of Samples Tested)	Silty Sand (SM)	Clayey Sand (SC)	Poorly Graded Sand (SP)	Poorly Graded Silty Sand (SP-SM)	Clayey Silty Sand (SC-SM)	Poorly Graded Clayey Sand (SP-SC)
A (0)						
B (1)	100%					
C (4)		100%				
D (10)	70%			20%	10%	
E (4)	75%			25%		
F (8)	75%	13%		13%		
G (17)	53%	12%		18%	6%	12%
H (15)	33%	13%	7%	33%	13%	
I (1)	100%					
J (6)	33%	33%			17%	17%

Geotechnical samples were collected from locations mapped as five different geologic units. Geotechnical samples were collected from surface soils and do not necessarily represent the underlying native geologic unit. The Morrison Formation and the Summerville Entrada Formation each represented nearly half of the geotechnical sample collection locations. The remaining geotechnical samples came from locations mapped as the Chinle Formation, Quaternary Alluvium, and Wingate Sandstone. The distribution of soil classifications within the Morrison Formation and Summerville Entrada Formation was similar. Geotechnical samples obtained from locations mapped as the Chinle Formation are all SC. Chinle Formation soil samples had a higher average higher plasticity and fines content than the rest of the geologic units.

Table E-5. Geotechnical Laboratory Test Results by Mapped Geologic Unit

Geologic Unit (# of samples tested)	Silty Sand (SM)	Clayey Sand (SC)	Poorly Graded Sand (SP)	Poorly Graded Silty Sand (SP-SM)	Clayey Silty Sand (SC-SM)	Poorly Graded Clayey Sand (SP-SC)
Morrison Formation (30)	53%	10%		20%	10%	7%
Summerville, Entrada Formation (29)	55%	10%	3%	21%	7%	3%
Chinle Formation (4)		100%				
Quaternary Alluvium (1)	100%					
Wingate Sandstone (1)	100%					

5.0 EVALUATION OF DATA QUALITY OBJECTIVES

5.1 ATTAINMENT OF DATA QUALITY OBJECTIVES

Subsurface profile and laboratory data obtained from this geotechnical investigation provide soil classification at the majority of the sites investigated in 2018, and can be used to address the study questions identified in Section 2.2 as follows:

- Site Characterization Study, Study Goal 3: Geotechnical drilling data provide the vertical extent of waste at the nine sites drilled. Geotechnical drilling information supplemented laboratory data at ten sites.
- Baseline Study, Study Goal 6: Laboratory data and boring logs indicated that site soils are coarse grained (with more than 50 percent of material larger than the #200 sieve size).
- Baseline Study, Study Goal 3: Coarse-grained soils have a relatively higher density and shear strength, which results in low mobility and the ability to remain stable at relatively steep slopes compared to fine-grained soils.
- Baseline Study, Study Goal 4: Coarse-grained soils are generally considered semi-pervious to pervious and will not present a hydraulic barrier to surface water, which can lead to groundwater contamination.
- Site Characterization Study, Study Goal 7: The coarse-grained soil characteristics described above are used to address this goal.

5.2 IDENTIFIED REMAINING DATA GAPS AND DATA NEEDS

Geotechnical data gaps include laboratory testing for in situ moisture content (ASTM D2216) and density (ASTM D7263), specific gravity (ASTM C127), moisture-density relationships (standard Proctor test, ASTM D698), shear strength (direct shear, ASTM D3080), and permeability (ASTM D5084 or ASTM D5856). These data will be required for repository design and to determine the properties of waste placed in repositories.

Not all AUM sites and Targets were investigated, so an understanding of the site-specific conditions in some areas is also a geotechnical data gap. Subsurface investigations can be used to determine waste and borrow volumes. Based on this investigation, the ability to sample by drilling is limited because most site are inaccessible to drill rigs and hand sampling is deterred by refusal because of gravel and cobbles. Alternative surficial methods such as geophysics, visual observations, or analyzing topography can potentially be used to assist in providing estimates of material quantities. Geophysics can provide a two-dimensional profile delineating soil and bedrock, as well as stark contrasts between soil layers if present. When evaluating borrow sources, geophysics is used to determine appropriate excavation methods of bedrock. Geophysics equipment is relatively small and lightweight, allowing for access to locations inaccessible to drill rigs.

Borrow source investigations will be necessary to determine the feasibility of using on-site soils, gravel, and cobbles in remedial design. Geotechnical data including in situ moisture content and density, specific gravity, classification, moisture-density relationships, shear strength, and permeability of borrow materials will be used in remedial design.

6.0 CONCLUSIONS

6.1 SUMMARY OF RESULTS

This geotechnical investigation included drilling at five AUM sites and four Targets and hand sampling surface soils at 29 AUM sites and four Targets. Borings were advanced via hollow stem auger and direct push methods or with hand augers where access was limited. Generally, the borings were logged as SM and SC with gravel prior to bedrock or practical refusal at depths from 1.5 to 15 feet. No groundwater was encountered during drilling, and the subsurface soil moisture content was mostly considered dry.

Geotechnical laboratory testing indicated that the site soils are sands with varying amounts of fines contents (percent passing #200 sieve) and no to low plasticity. Of 66 samples tested, 34 (52 percent) were SM, 12 (18 percent) were SP-SM, 11 (17 percent) were SC, 5 (8 percent) were SC-SM, 3 (5 percent) were SP-SC, and 1 (2 percent) was SP.

6.2 DATA USABILITY

Geotechnical data obtained during this investigation will be used for preliminary design and cost-estimating purposes. Contingencies should be included with cost estimates until material properties are better understood and design advances.

Moisture/density relationships are determined using standard Proctor (ASTM D698) test procedures, which provides a maximum dry density (pounds per cubic foot [pcf]) at an optimum moisture content percentage. The moisture density relationship curve is used for material placement as engineered fill. Typically, the fill is placed at a specified percentage of the maximum dry density and moisture content as determined by the laboratory testing. The values selected for both density and moisture content are based upon desired engineering criteria for the respective design feature. The density is used in slope stability and radon emanation modeling, as well as for cost-estimating purposes to assess material mass or volumes. In the absence of laboratory testing, empirical correlations for the maximum dry density by USCS classifications are presented in Table E-6. The wet density reported in this table includes weight of water. The samples tested as part of this investigation did not include material greater than 1 inch in diameter, but coarse gravel and cobbles were noted in the field logs. The presence of coarse gravel and cobbles would increase the density towards the upper end of the range in Table E-6 as demonstrated by the recommended maximum dry density column. Laboratory standard Proctor testing is recommended to determine site-specific density values for use in design.

Table E-6. Recommended Density of Compacted Soils

USCS Classification	Range of Maximum Dry Density (pcf)	Recommended Maximum Dry Density (pcf)	Recommended Maximum Wet Density (pcf)
SP	100-120[1]	115	125
SM	110-125[1]	120	133
SC	105-125[1]	120	135
SP-SM	110-125	120	133
SP-SC	110-130	120	135
SM-SC	110-130[1]	120	137

Notes:
1 See Naval Facilities Engineering Command (NAVFAC) (1986).
pcf Pounds per cubic foot
SC Clayey sand
SC-SM Clayey silty sand
SM Silty sand
SP Poorly graded sand
SP-SC Poorly graded clayey sand
SP-SM Poorly graded silty sand
USCS Unified Soil Classification System

Slope stability analyses are dependent on shear strength parameters of soil. Empirical correlations for the effective internal angle of friction (Φ') and effective cohesion by USCS classifications are presented in Table E-7. Based on the relatively low plasticity indices determined by Atterberg limits testing, the soils should be considered relatively cohesionless. Because of the coarse-grained nature of the soil, effective stresses should be used in design as opposed to total stresses. Laboratory shear strength (direct shear, ASTM D3080) testing is recommended to determine site-specific shear strength values for use in design. Constraints in finding a geotechnical laboratory with a radioactive material license may limit this testing availability.

Table E-7. Recommended Shear Strength Parameters of Compacted Soils

USCS Classification	Effective Internal Angle of Friction (Φ') (degrees)	Effective Cohesion (pounds per square foot)
SP	37[1]	0
SM	34[1]	0
SC	31[1]	50
SP-SM	35	0
SP-SC	34	0
SM-SC	33[1]	25

Notes:
[1] See Naval Facilities Engineering Command (NAVFAC) (1986).
SC Clayey sand
SC-SM Clayey silty sand
SM Silty sand
SP Poorly graded sand
SP-SC Poorly graded clayey sand
SP-SM Poorly graded silty sand
USCS Unified Soil Classification System

Permeability data are used to determine flow rates through waste, covers, and liners, which affects slope stability, contaminant transport, and cover and liner performance. Typical saturated hydraulic conductivities in the range of 1×10^{-5} to 1×10^{-2} centimeters per second (cm/s) can be

assumed for the soil classifications derived from this investigation. Solid waste regulations in the Resource Conservation and Recovery Act (RCRA) require a liner or cover with a saturated hydraulic conductivity of less than 1 x 10-5 cm/s. Laboratory permeability testing (ASTM D5084 or ASTM D5856) is recommended to determine site-specific permeability values. Constraints in finding a geotechnical laboratory with a radioactive material license may limit this testing availability.

Soil transport analyses will utilize the grain-size distribution plots in Attachment E2. The median grain size from laboratory results indicate a phi (Φ) of 3 using the Krumbein (1934) phi scale. Incorporating gravel observed in the field would increase the median grain size, resulting in a Φ potentially in the range of 1 to -4.

Subsurface data can be used to further delineate and calculate the volume of waste at the Block K mine (M2), Mesa I Mine 13 (M6), Mesa I Mine 15 (M8), Mesa V Incline (M15), Mesa V Mine 508 (M18), Cove Transfer Station (M40/T09/T37), Mesa I Camp (M41/T17), and NA-0344B (M42/T23), where subsurface investigations via mechanical drilling allowed for access to the bottom of the waste.

7.0 REFERENCES

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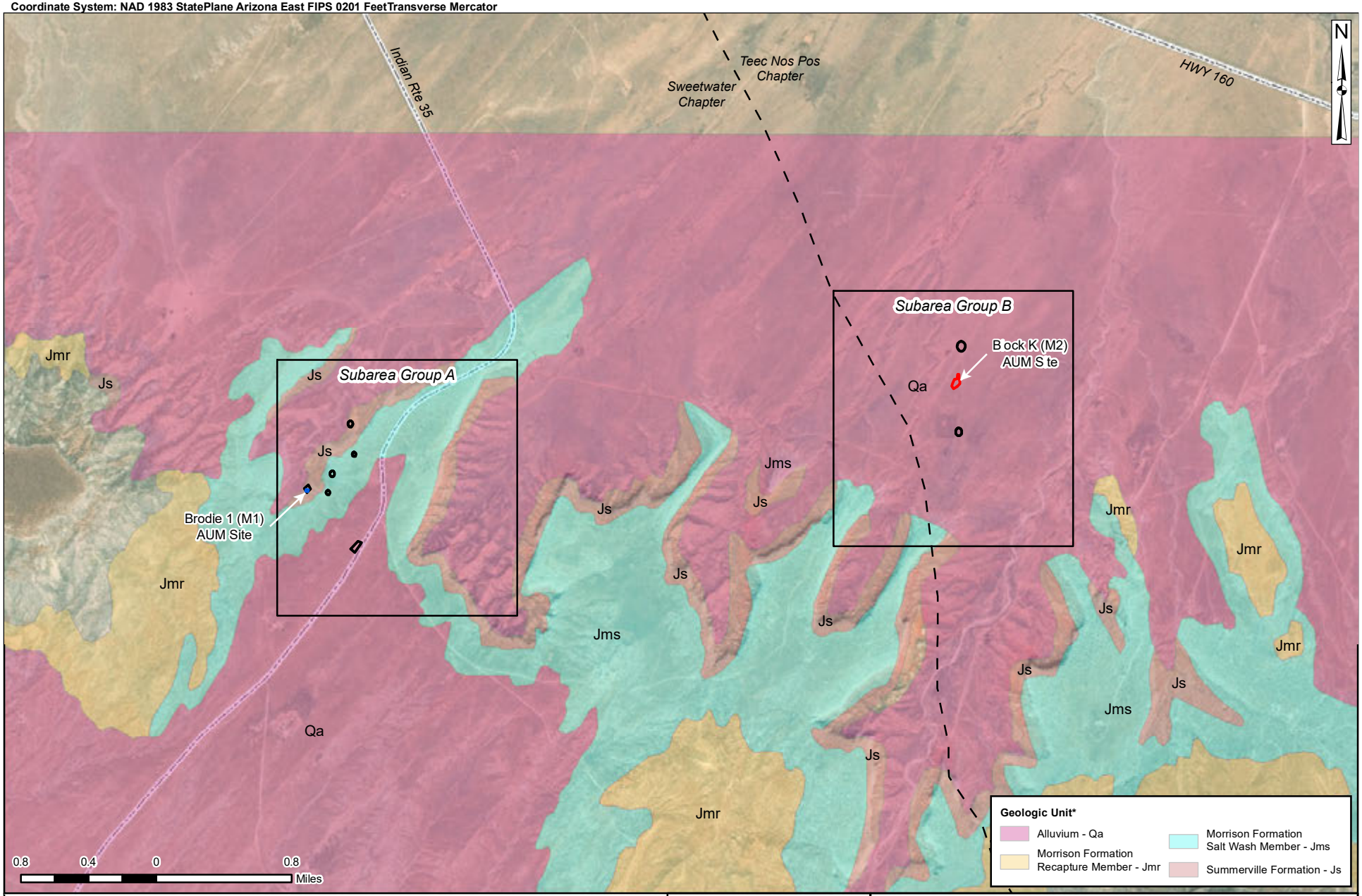
FIGURES

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



AUM Site Boundary *(Geotechnical Sampling and Drilling)*

AUM Site Boundary *(No Geotechnical Sampling or Drilling)*

Non-AUM Target Site Boundary

Subarea Group

Navajo Nation Chapter Boundary

Local Road

*O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Prepared for:

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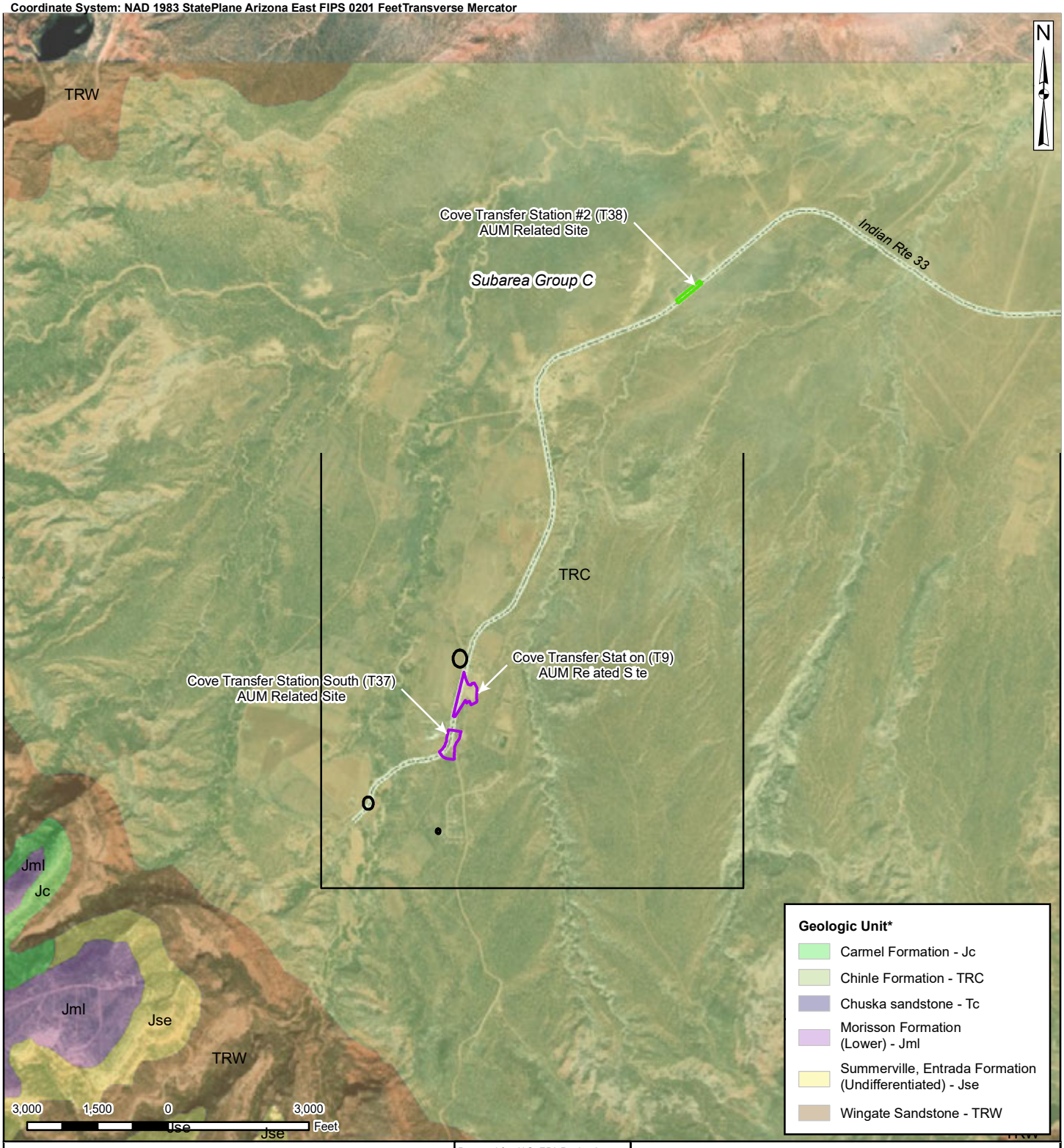
TSE TAH REGION SURFACE GEOLOGY MAP

Task Order No.:	Contract No.:	Figure No.:
TO0001	EP-S9-17-03	E-1
Location: NAVAJO NATION	Date: 7/2/2019	

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



AUM Related Site Boundary *(Geotechnical Sampling and Drilling)*

AUM Related Site Boundary *(No Geotechnical Sampling or Drilling)*

Non-AUM Target Site Boundary

Subarea Group

Local Road

*O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Prepared for: U.S. EPA Region 9

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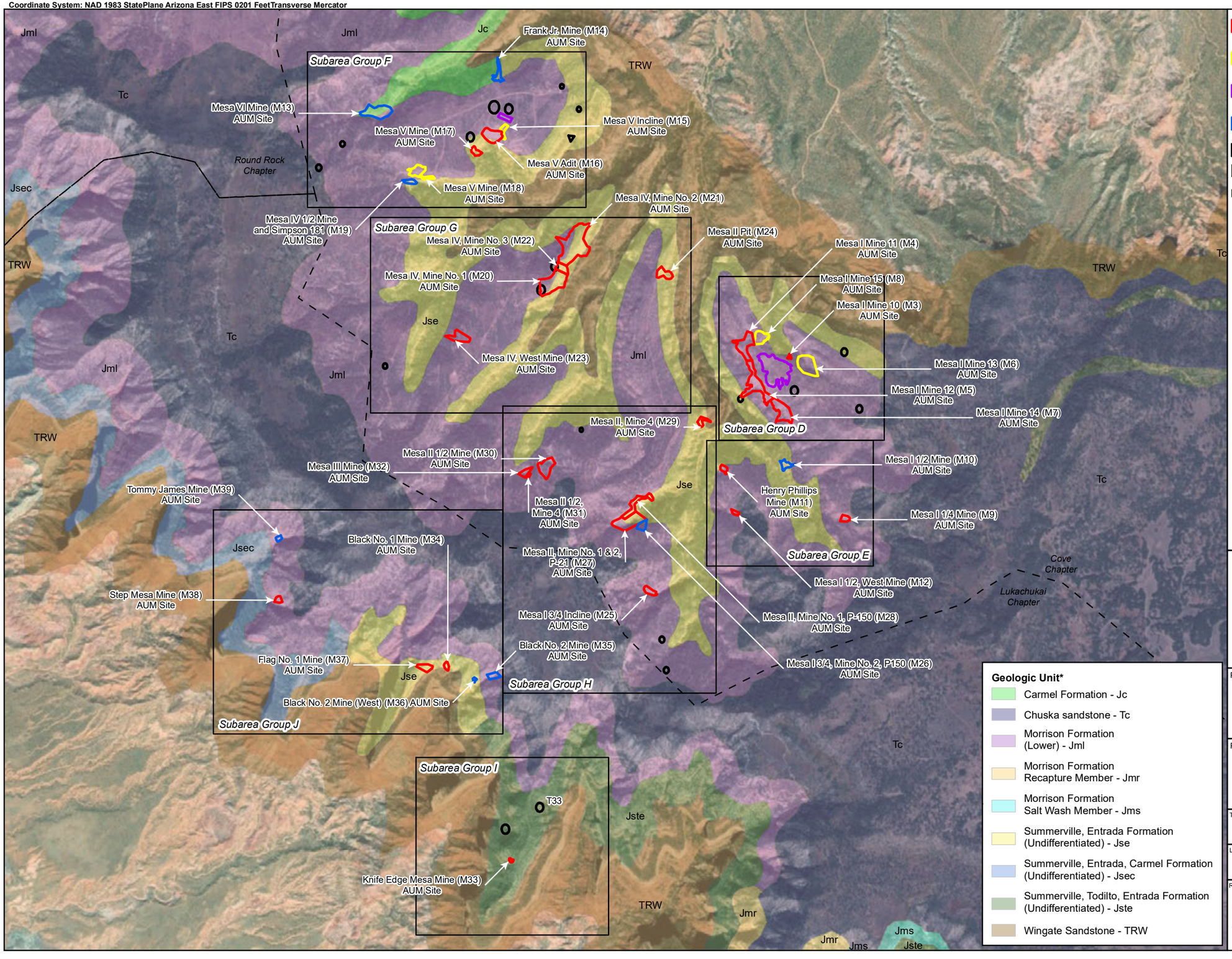
COVE VALLEY
SURFACE GEOLOGY MAP

Task Order No.:	Contract No.:	Figure No.:
TO0001	EP-S9-17-03	E-2
Location: COVE CHAPTER NAVAJO NATION	Date: 7/2/2019	

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- AUM Site Boundary *(Geotechnical Sampling)*
- AUM Site Boundary *(Geotechnical Sampling and Drilling)*
- AUM Related Site Boundary *(Geotechnical Sampling and Drilling)*
- AUM Site Boundary *(No Geotechnical Sampling or Drilling)*
- Non-AUM Target Site Boundary
- Subarea Group
- Navajo Nation Chapter Boundary

1 in = 2,640 ft

1:31,680

N W E S

0 1,320 2,640 5,280 Feet

Geologic Unit*

- Carmel Formation - Jc
- Chuska sandstone - Tc
- Morrison Formation (Lower) - Jml
- Morrison Formation Recapture Member - Jmr
- Morrison Formation Salt Wash Member - Jms
- Summerville, Entrada Formation (Undifferentiated) - Jse
- Summerville, Entrada, Carmel Formation (Undifferentiated) - Jsec
- Summerville, Todilto, Entrada Formation (Undifferentiated) - Jste
- Wingate Sandstone - TRW

LUKACHUKAI MOUNTAINS SURFACE GEOLOGY MAP

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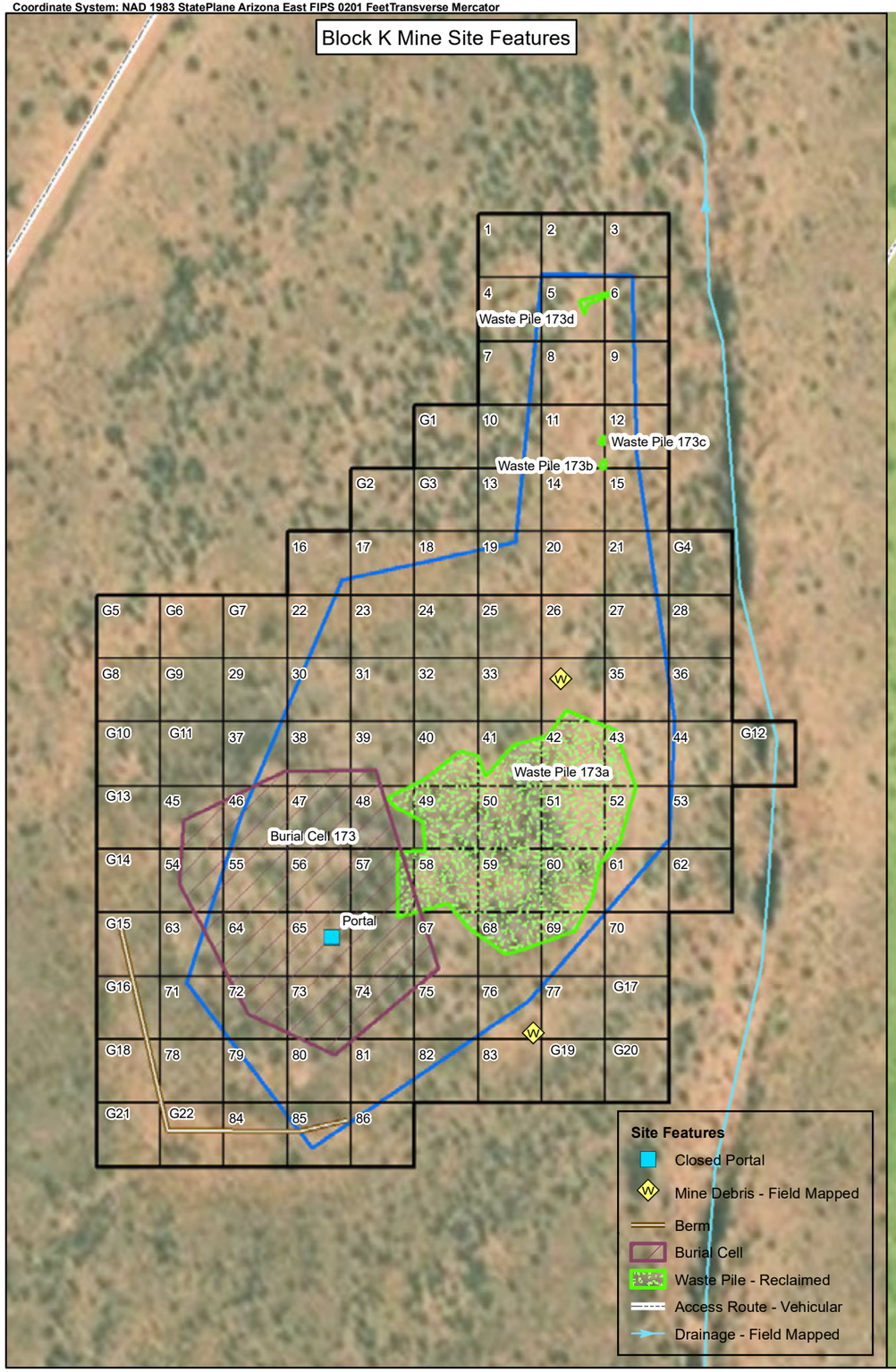
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location:	**Date:**
NAVAJO NATION	7/2/2019

Reference:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

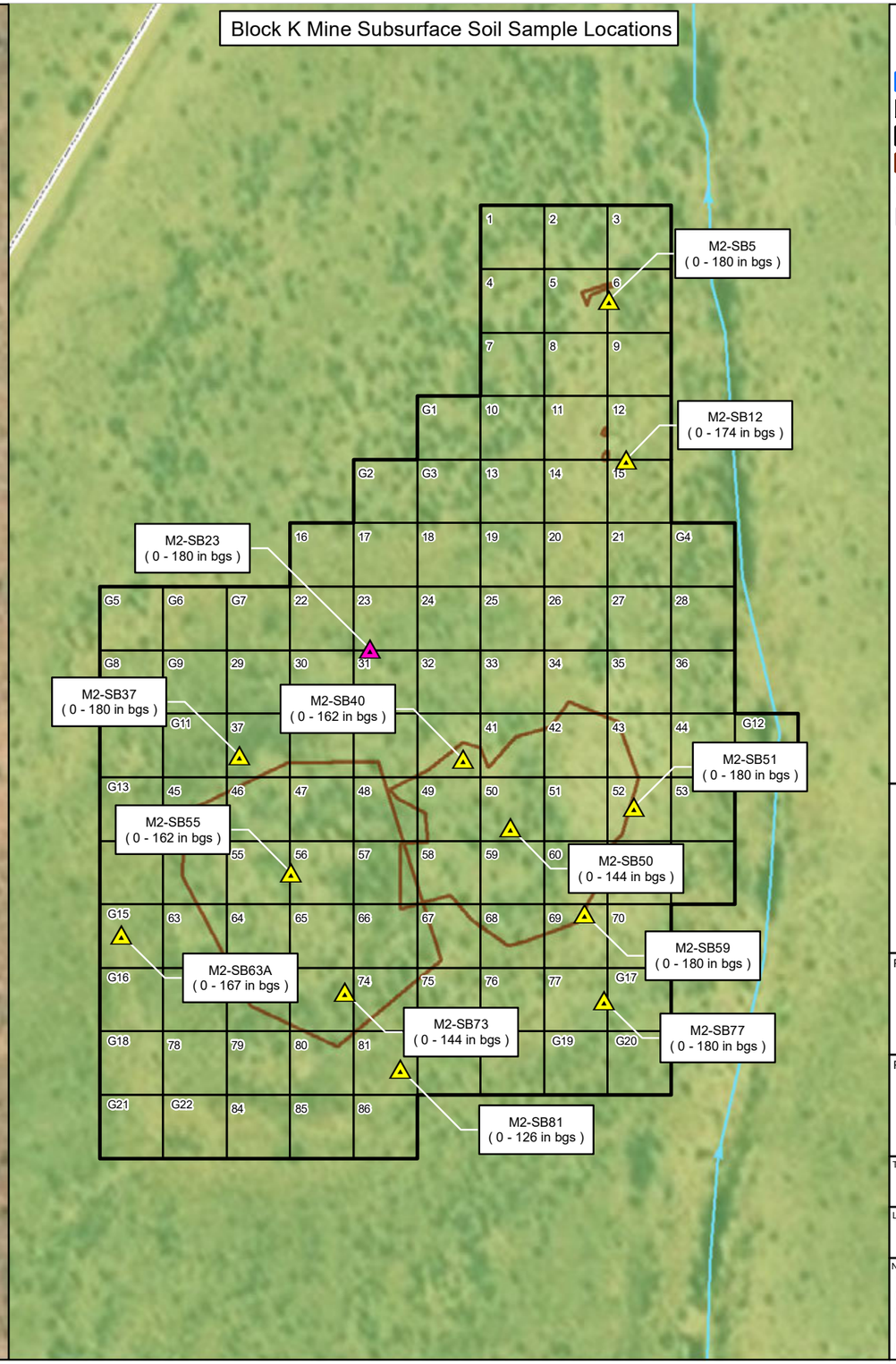
Figure No.: **E-3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Block K Mine Site Features



Block K Mine Subsurface Soil Sample Locations



- Geotechnical Sampling and Drilling Location*
- Geotechnical Drilling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary

Geologic Units**

- Alluvium - Qa

*M2-SB5 = site M2 soil boring collected at survey unit 5. 0 - 180 in bgs = 0 to 180 inches below ground surface.

1 in = 70 ft

1:840

N W E S

0 35 70 140 Feet

BLOCK K MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
Oakland, CA 94612

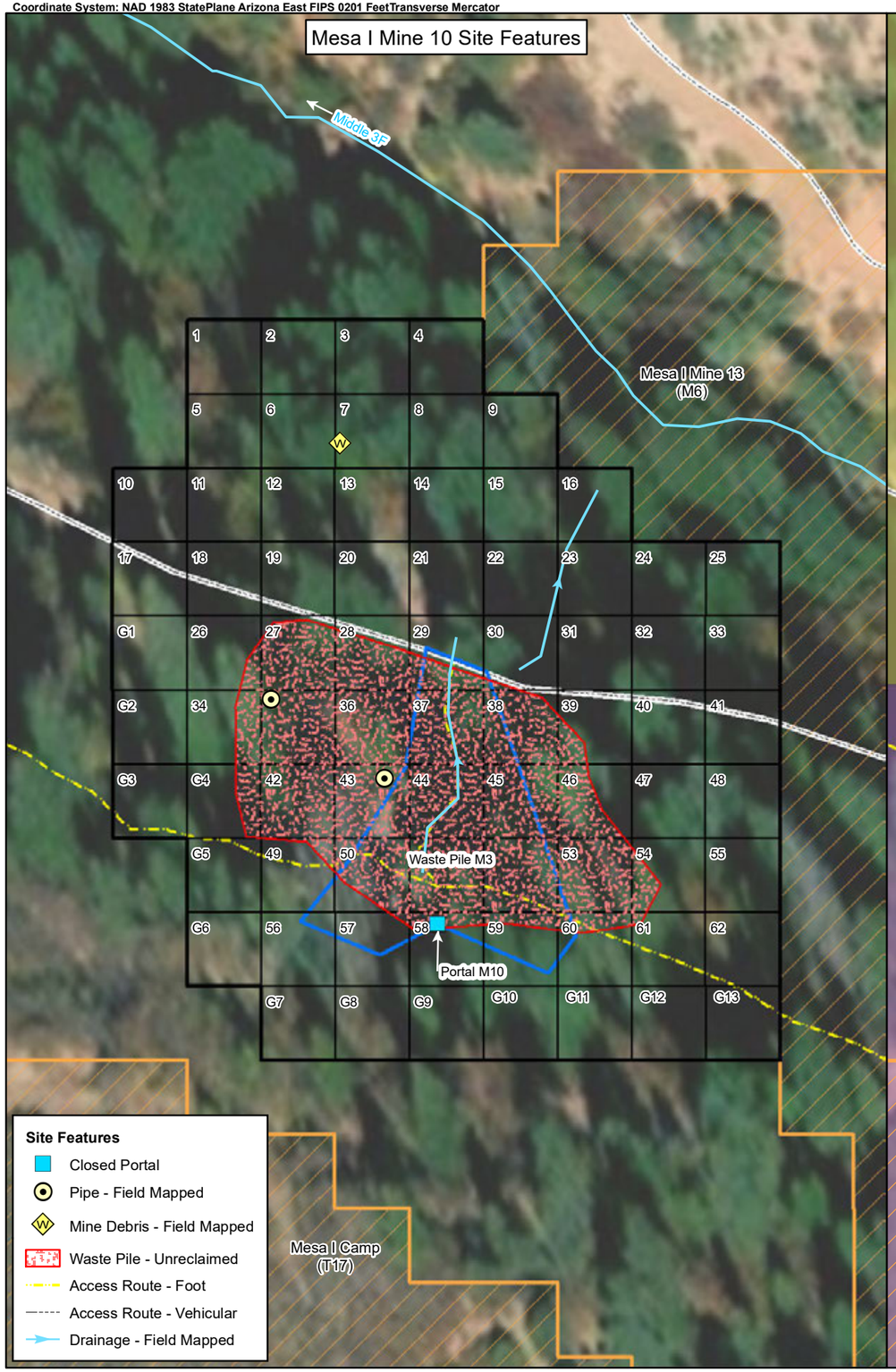
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: TEEC NOS POS CHAPTER NAVAJO NATION	Date: 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-4**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

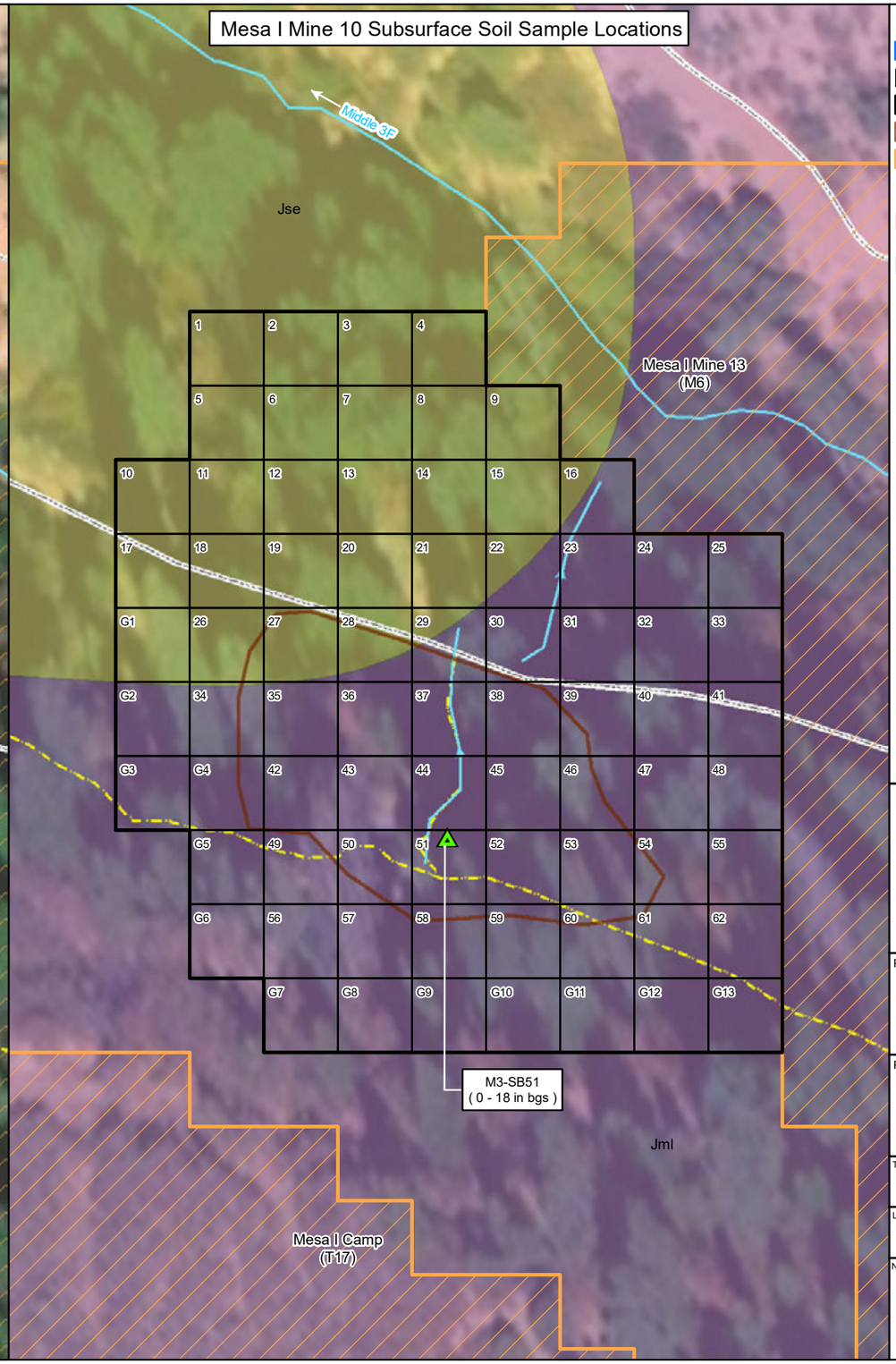
Mesa I Mine 10 Site Features



Site Features

- Closed Portal
- Pipe - Field Mapped
- Mine Debris - Field Mapped
- Waste Pile - Unreclaimed
- Access Route - Foot
- Access Route - Vehicular
- Drainage - Field Mapped

Mesa I Mine 10 Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M3-SB51 = site M3 soil boring collected at survey unit 51. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 60 ft

1:720

0 30 60 120 Feet

N W E S

MESA I MINE 10
GEOTECHNICAL INVESTIGATION MAP

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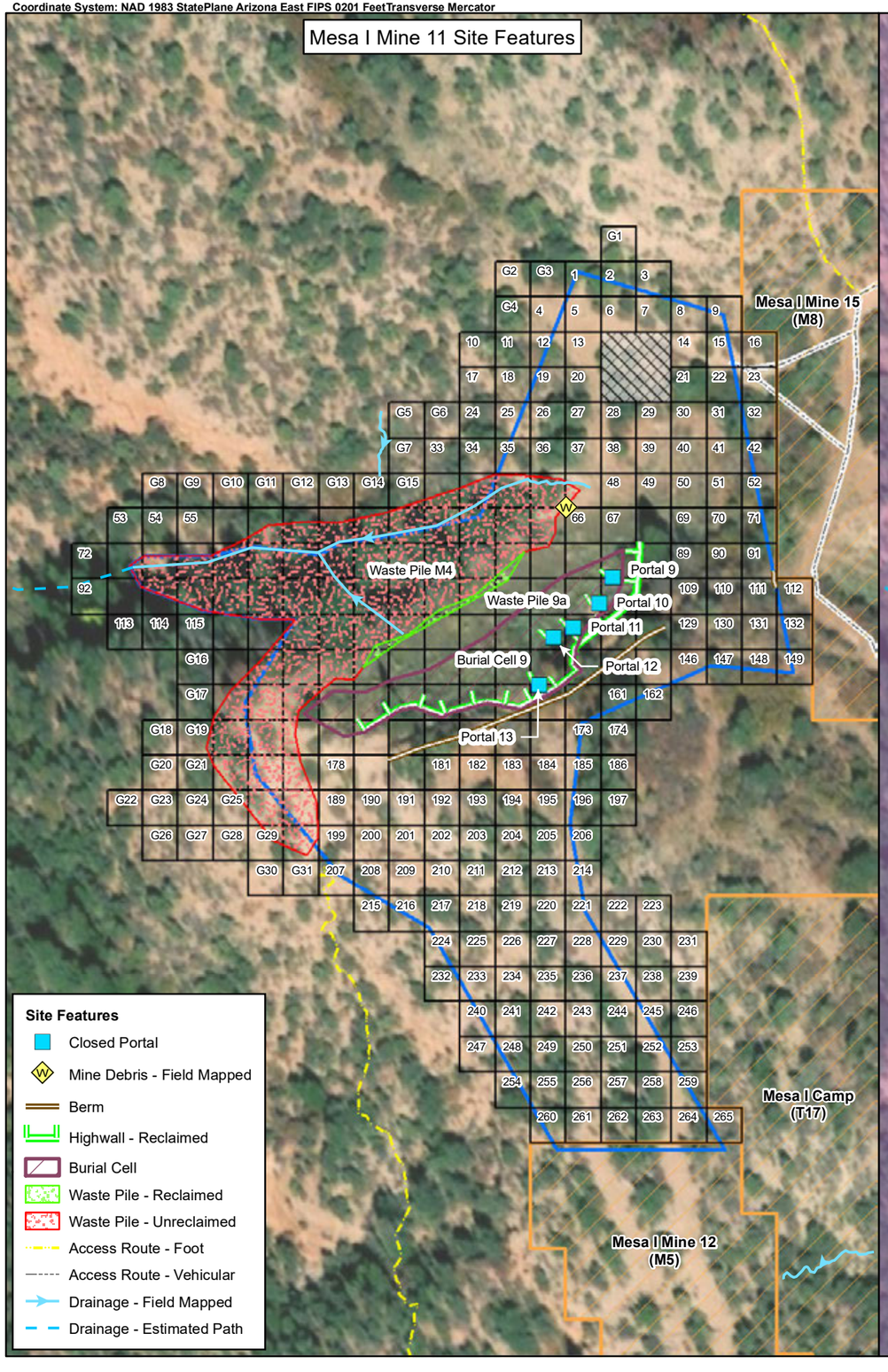
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

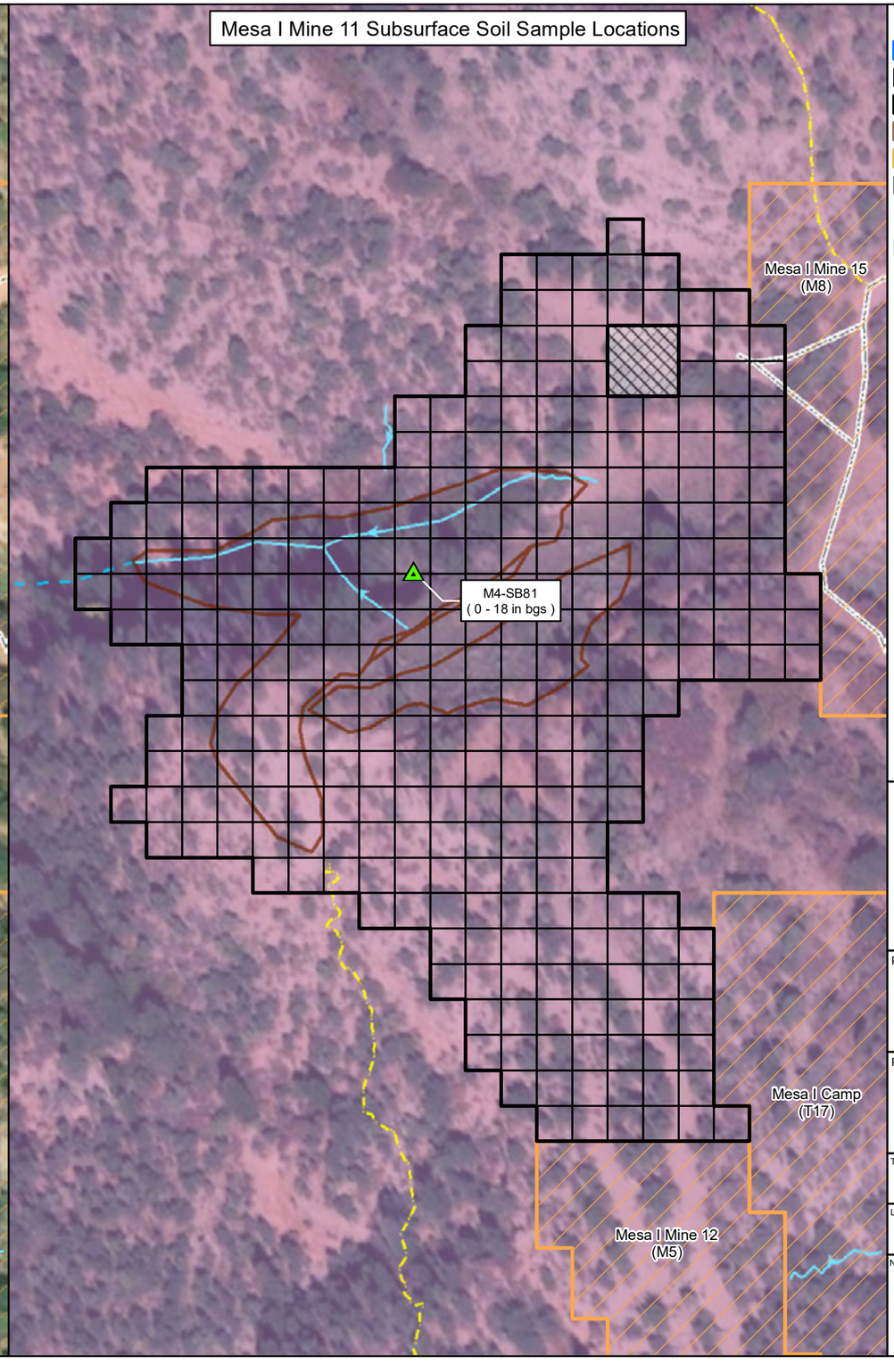
Figure No.: **E-5**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa I Mine 11 Site Features



Mesa I Mine 11 Subsurface Soil Sample Locations



Geotechnical Sampling Location*
AUM Site Boundary
Survey Unit (100 m²)
Survey Area Boundary
Burial Cell / Waste Pile Boundary
Other Survey Area
Restricted Area (Cultural)

Geologic Unit**

Morrison Formation (Lower) - Jml

*M4-SB81 = site M4 soil boring collected at survey unit 81. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

MESA I MINE 11
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-6**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa I Mine 12 Site Features

Mesa I Mine 11 (M4)

BSA-10 (B10)

Mesa I Camp (T17)

Portal 14

Portal 15

Portal 16

Portal 17a

Portal 17b

Portal 18

Portal 19

Portal 20\ Dangerous Highwall 20

Portal 21

Portal 22

Waste Pile M5A

Waste Pile M5B

Waste Pile M5C

Waste Pile M5D

M1-04 (T16) Non-AUM Target

Middle 3

Middle 3A

Middle 3E

Mesa I Mine 14 (M7)

M1-05 (T35)

Site Features

- Closed Portal
- Open Portal
- Mine Debris - Field Mapped
- NORM - Field Mapped
- Pipe - Field Mapped
- Highwall - Reclaimed
- Waste Pile (Unreclaimed)
- Access Route (Foot)
- Access Route (Vehicular)
- Drainage (Field Mapped)

Mesa I Mine 12 Subsurface Soil Sample Locations

BSA-10 (B10)

Jse

Jml

Mesa I Camp (T17)

M5-SB149 (0 - 12 in bgs)

M1-04 T(16)

M5-SB479 (0 - 12 in bgs)

Middle 3

Middle 3A

Middle 3E

Mesa I Mine 14 (M7)

M1-05 (T35)

TRW

Jse

- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area
- Non-AUM Target Site Boundary
- Background Location

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse
- Wingate Sandstone - TRW

*M5-SB149 = site M5 soil boring collected at survey unit 149. 0 - 12 in bgs = 0 to 12 inches below ground surface.

1 in = 200 ft

1:2,400

N W E S

0 100 200 400 Feet

MESA I MINE 12
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

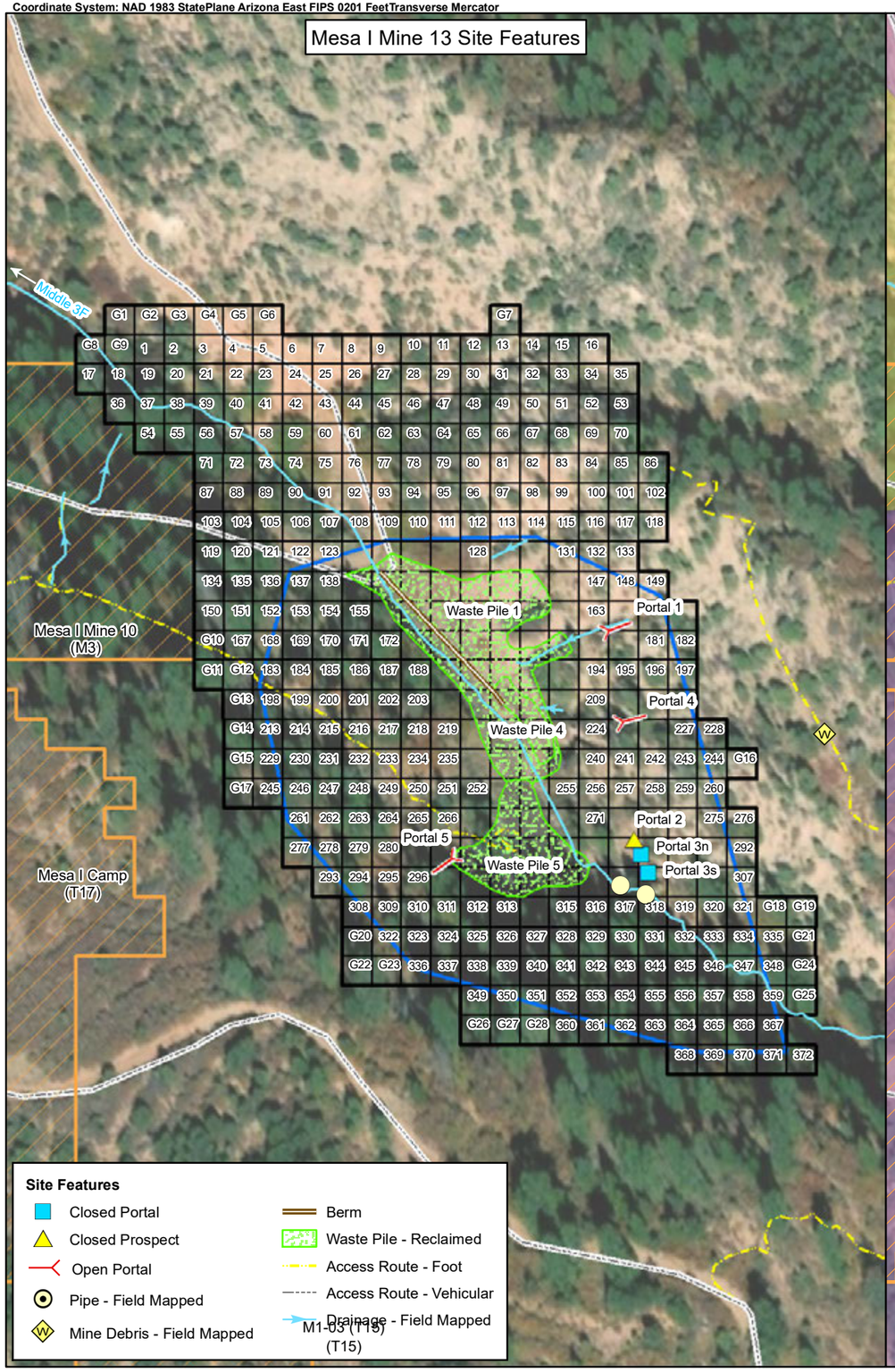
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-7**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

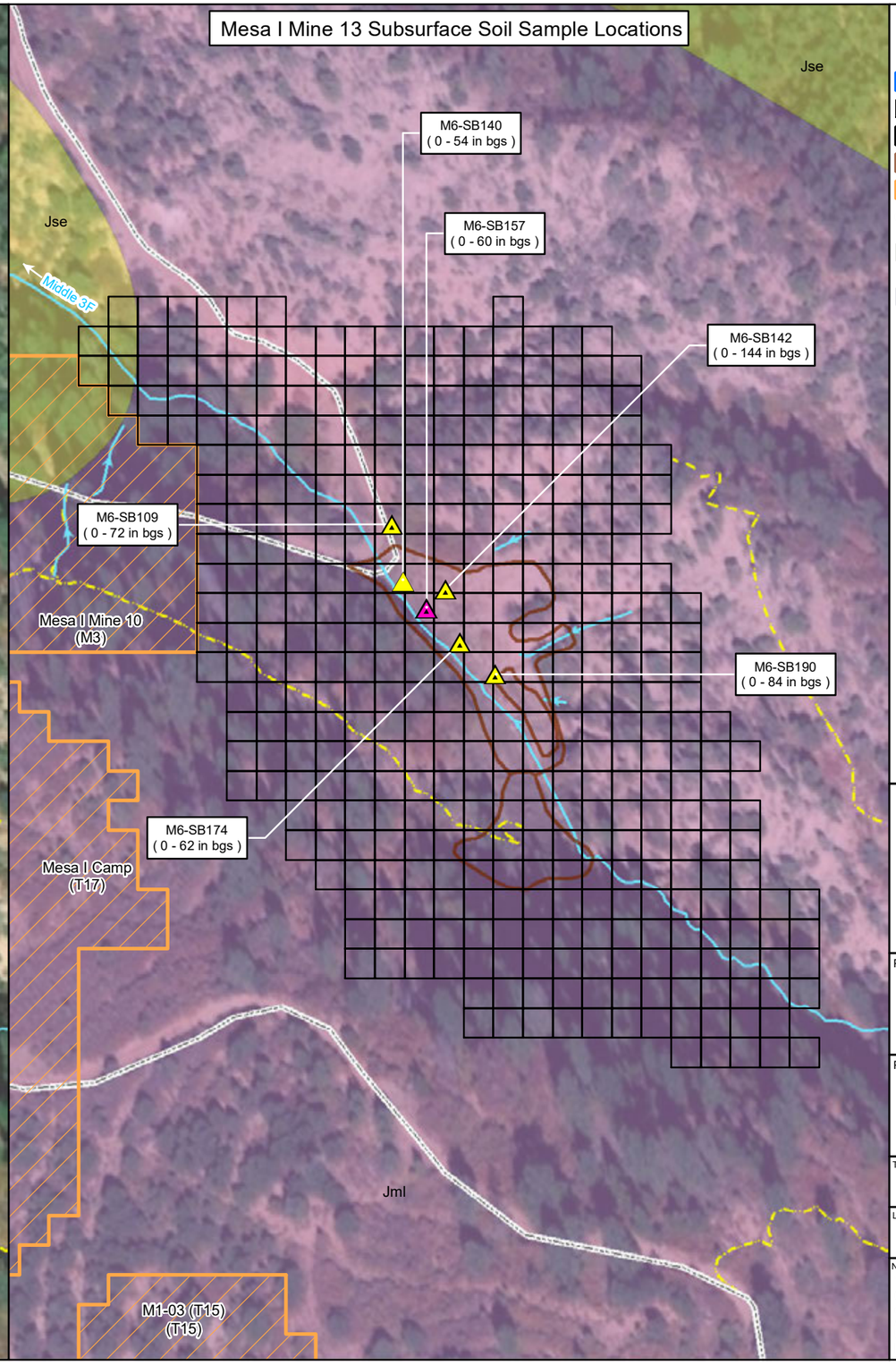
Mesa I Mine 13 Site Features



Site Features

- Closed Portal
- Closed Prospect
- Open Portal
- Pipe - Field Mapped
- Mine Debris - Field Mapped
- Berm
- Waste Pile - Reclaimed
- Access Route - Foot
- Access Route - Vehicular
- Drainage - Field Mapped

Mesa I Mine 13 Subsurface Soil Sample Locations



- Geotechnical Sampling and Drilling Location*
- Geotechnical Drilling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M6-SB142= site M6 soil boring collected at survey unit 142. 0 - 144 in bgs = 0 to 144 inches below ground surface.

1 in = 150 ft

1:1,800

N W E S

0 75 150 300 Feet

MESA I MINE 13
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-8**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa I Mine 14 Site Features

Mesa I Camp (T17)

M1-03 (T15)

Mesa I Mine 12 (M5)

Portal 24a

Portal 24

Portal 24b

Portal 25

Waste Pile M7A

Waste Pile M7B

Waste Pile M7C

Middle 3E

Poor GPS Signal

Site Features

- Closed Portal
- NORM - Field Mapped
- Waste Pile - Unreclaimed
- Access Route - Foot
- Drainage - Field Mapped
- Drainage - Estimated Path

Mesa I Mine 14 Subsurface Soil Sample Locations

Mesa I Camp (T17)

M1-03 (T15)

Mesa I Mine 12 (M5)

Jml

M7-SB161 (0 - 30 in bgs)

M7-SB204 (0 - 30 in bgs)

Jse

M1-06 (T36)

Middle 3E

Poor GPS Signal

- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area
- Non-AUM Target Site Boundary

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M7-SB161 = site M7 soil boring collected at survey unit 161. 0 - 30 in bgs = 0 to 30 inches below ground surface.

1 in = 140 ft

1:1,680

N W E S

0 70 140 280 Feet

MESA I MINE 14
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

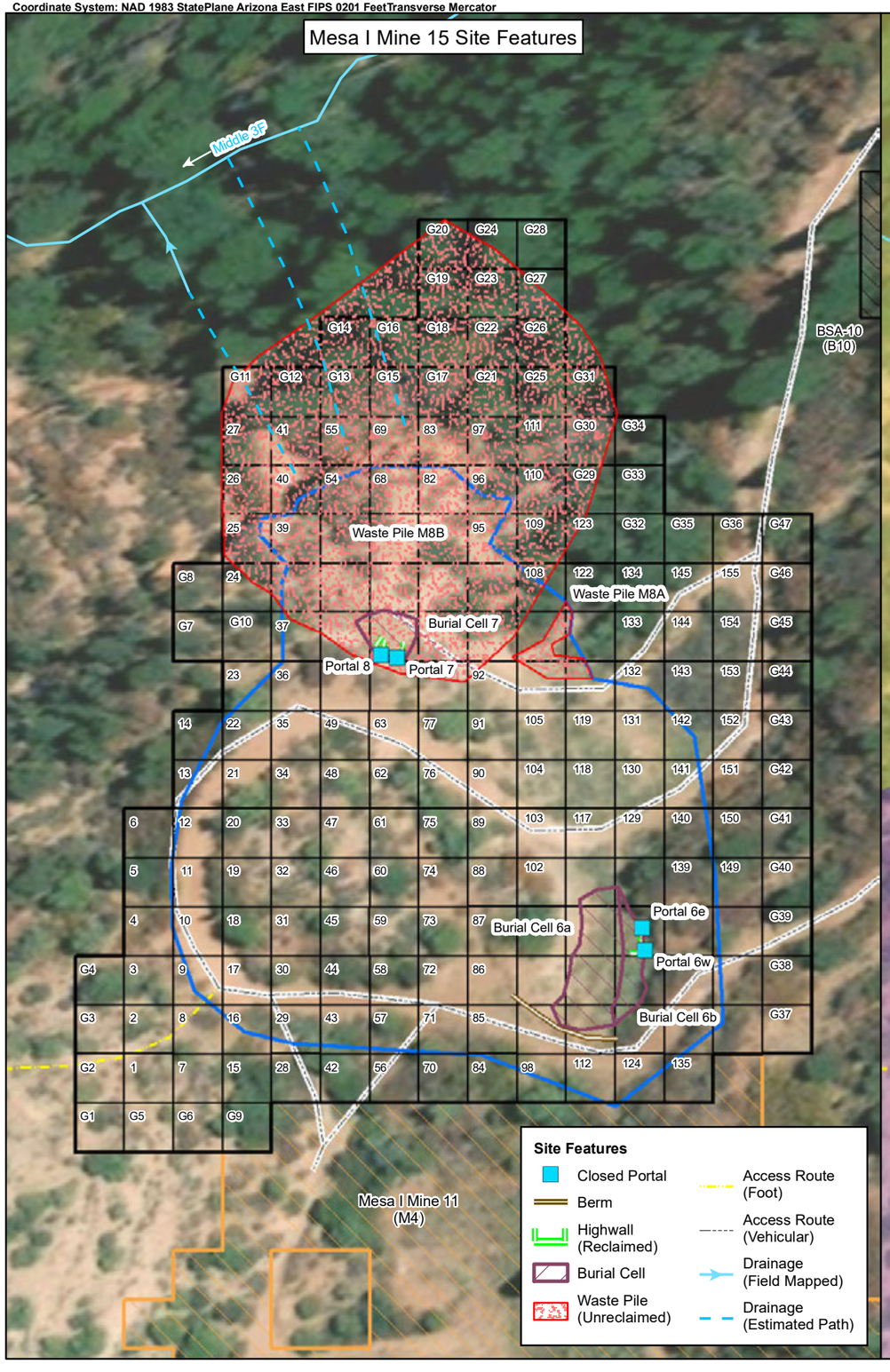
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

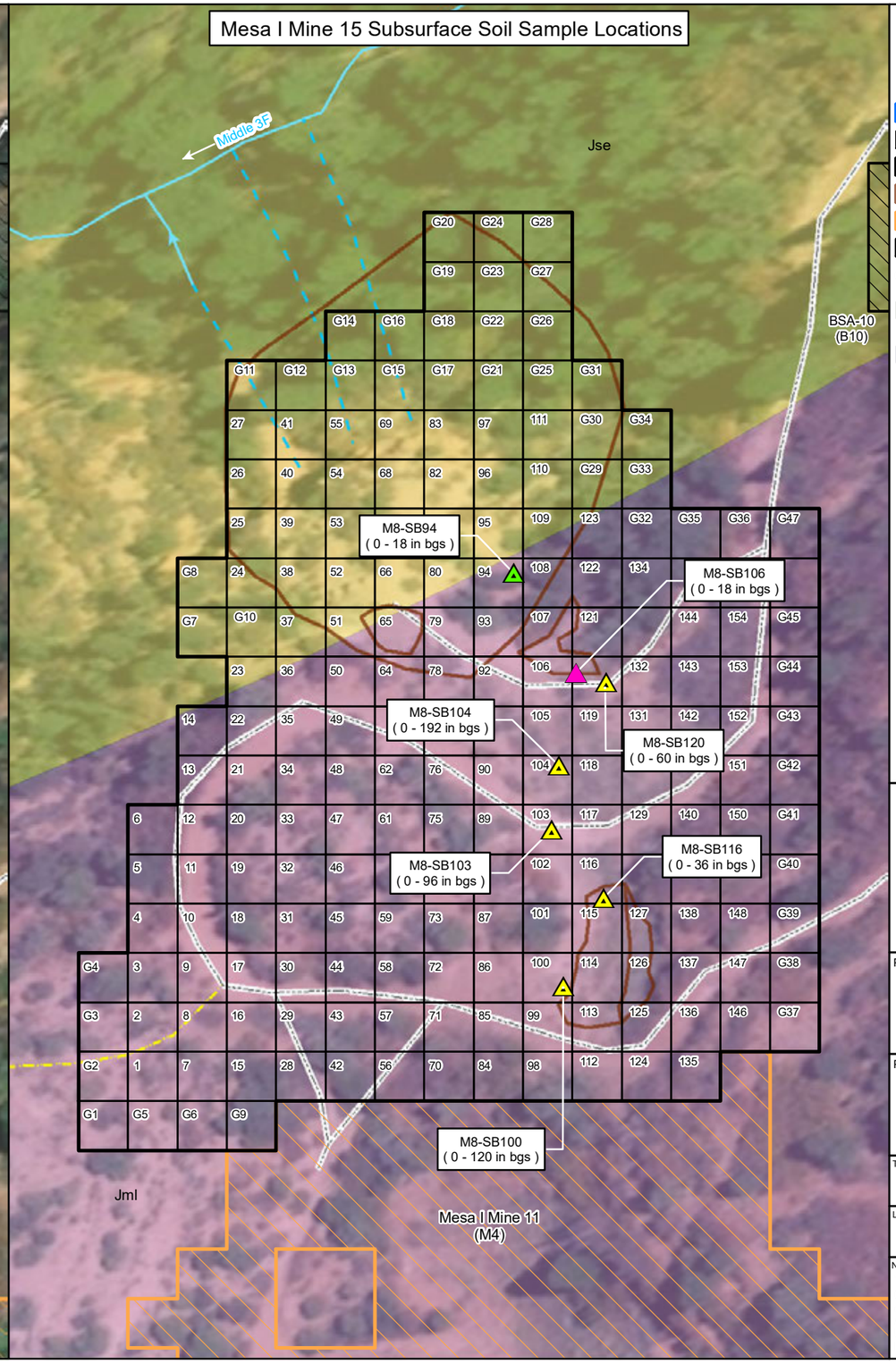
Figure No.: **E-9**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa I Mine 15 Site Features



Mesa I Mine 15 Subsurface Soil Sample Locations



- Geotechnical Sampling and Drilling Location*
- Geotechnical Drilling Location*
- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary
- Other Survey Area
- Background Location

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M8-SB104 = site M8 soil boring collected at survey unit 104. 0 - 192 in bgs = 0 to 192 inches below ground surface.

1 in = 90 ft

1:1,080

0 45 90 180 Feet

N W E S

MESA I MINE 15
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

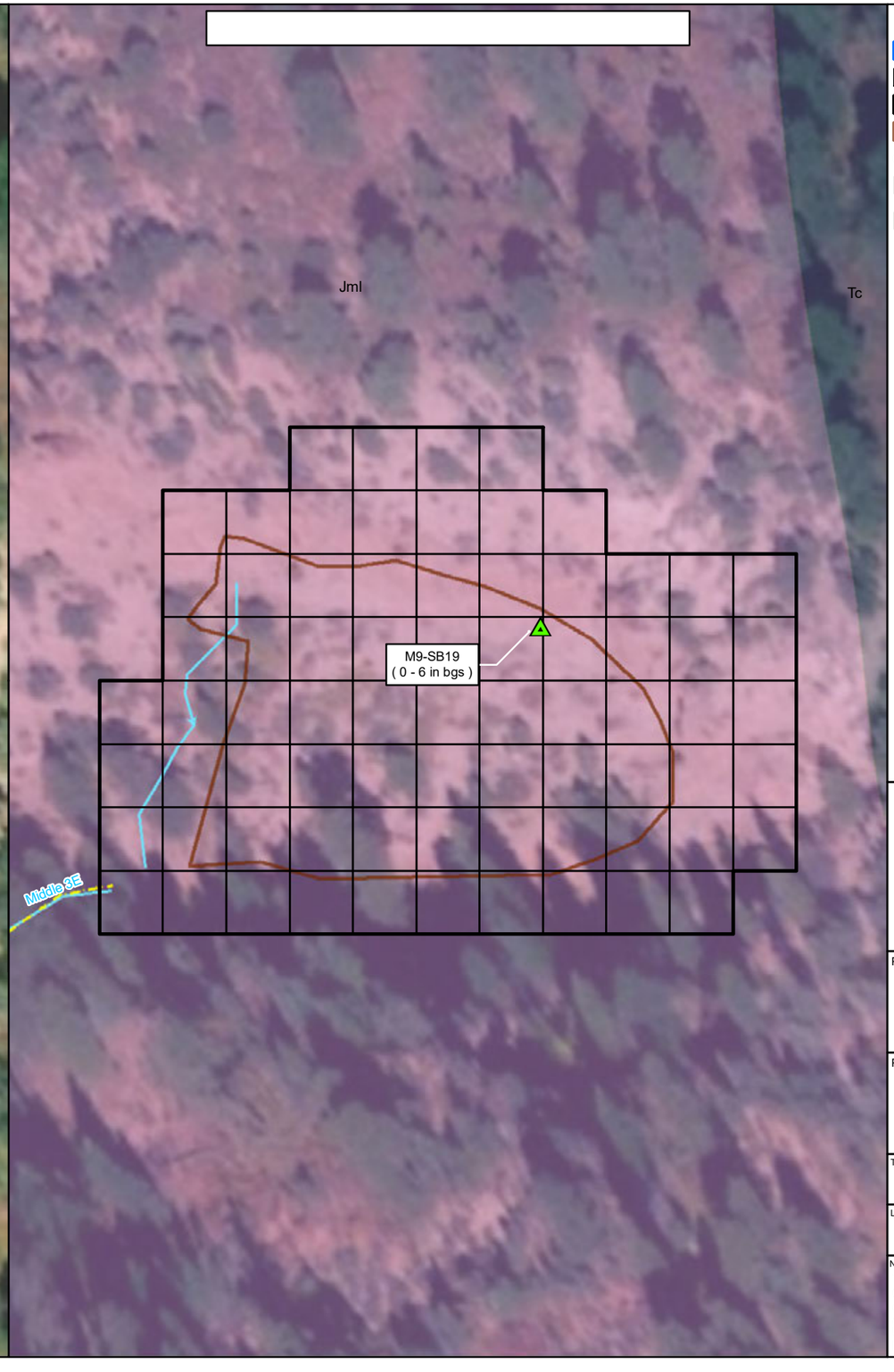
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-10**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary

Geologic Unit**

- Chuska sandstone - Tc
- Morrison Formation (Lower) - Jml

*M9-SB19 = site M9 soil boring collected at survey unit 19. 0 - 6 in bgs = 0 to 6 inches below ground surface.

1 in = 70 ft

1:840

N W E S

0 35 70 140 Feet

MESA I 1/4 MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

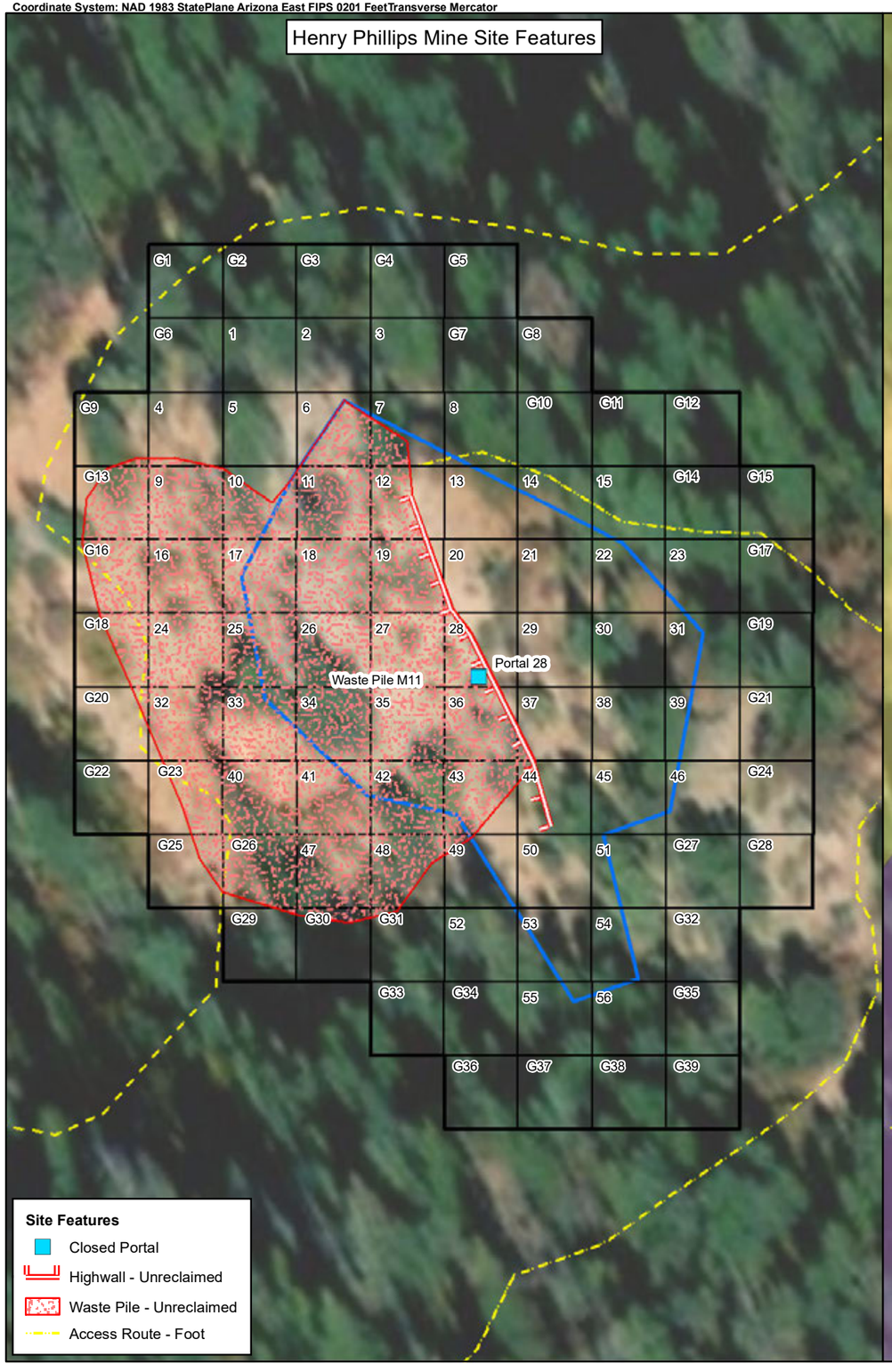
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-11**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

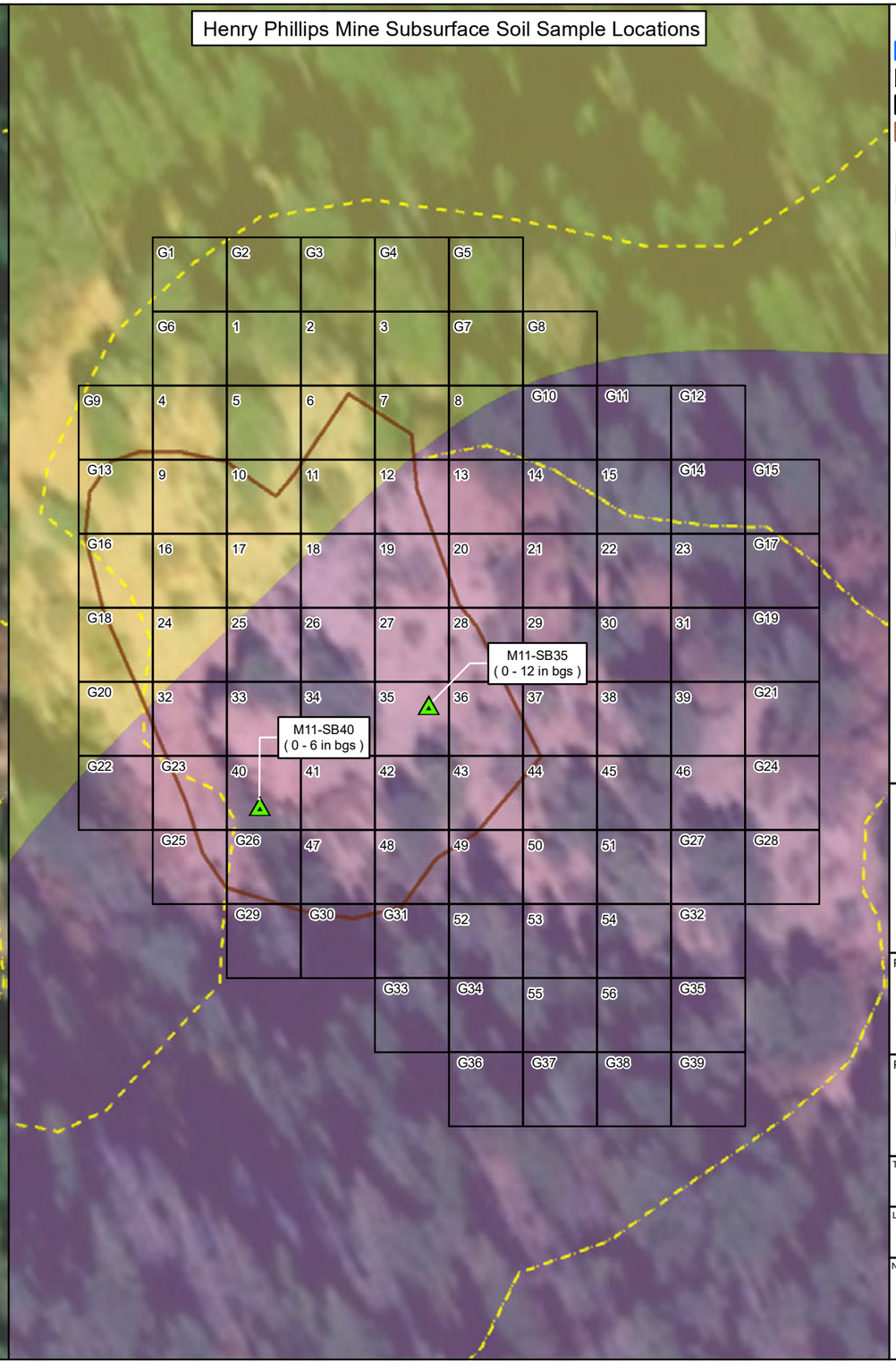
Henry Phillips Mine Site Features



Site Features

- Closed Portal
- Highwall - Unreclaimed
- Waste Pile - Unreclaimed
- Access Route - Foot

Henry Phillips Mine Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M11-SB35 = site M11 soil boring collected at survey unit 35. 0 - 12 in bgs = 0 to 12 inches below ground surface.

1 in = 60 ft

1:720

N W E S

0 30 60 120 Feet

HENRY PHILLIPS MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

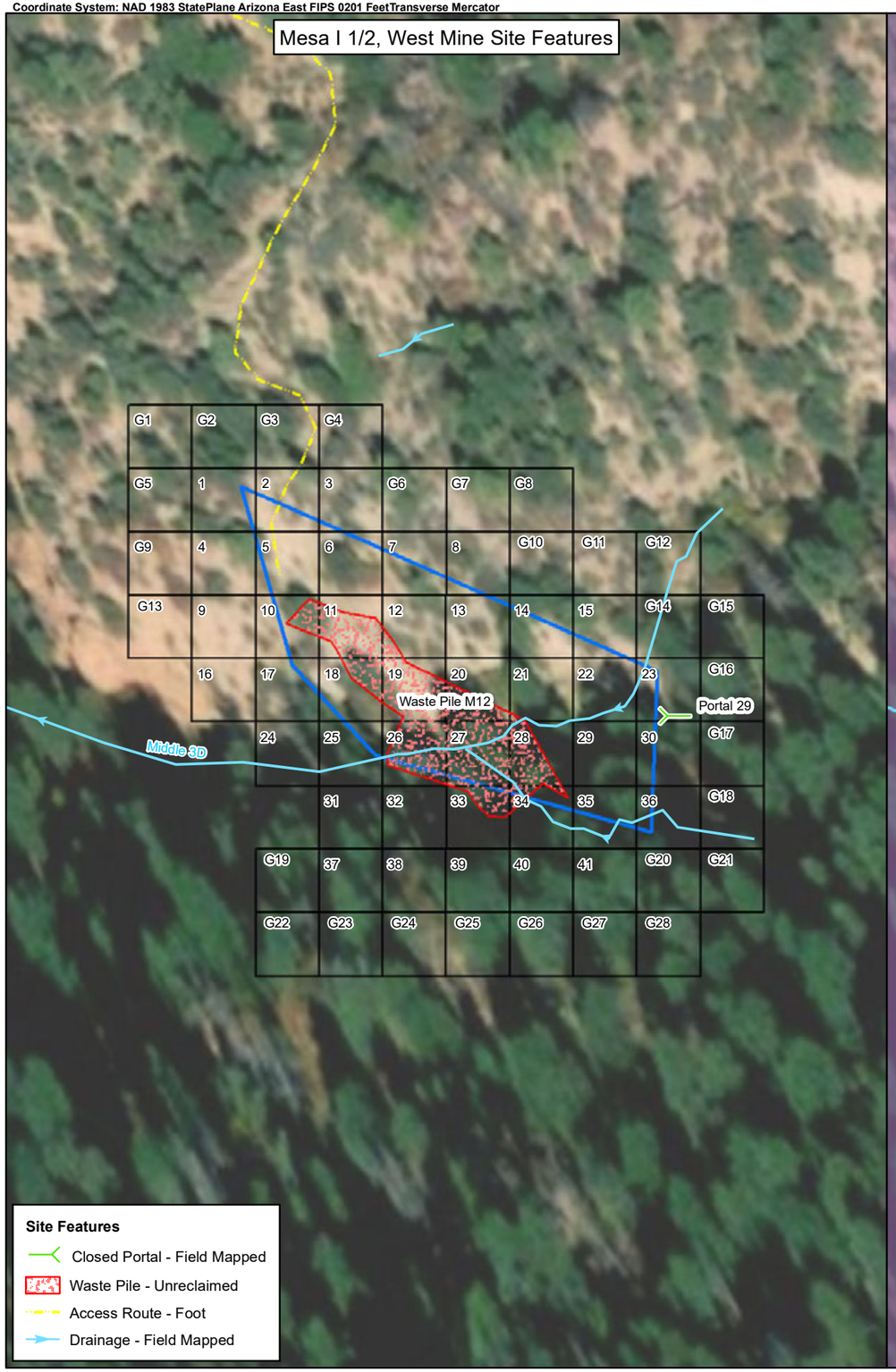
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-12**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

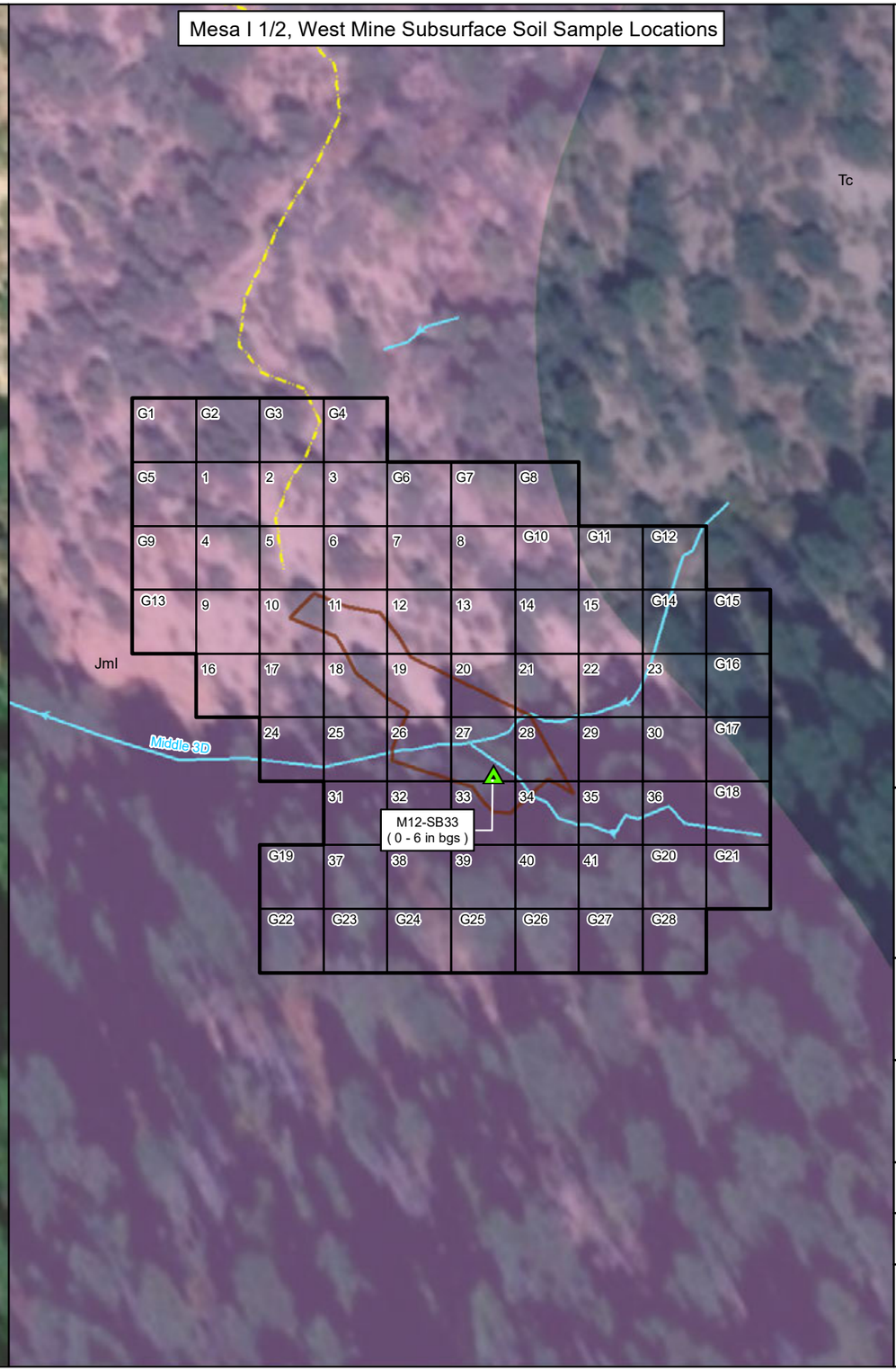
Mesa I 1/2, West Mine Site Features



Site Features

- Closed Portal - Field Mapped
- Waste Pile - Unreclaimed
- Access Route - Foot
- Drainage - Field Mapped

Mesa I 1/2, West Mine Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary

Geologic Unit**

- Chuska sandstone - Tc
- Morrison Formation (Lower) - Jml

*M12-SB33 = site M12 soil boring collected at survey unit 33. 0 - 6 in bgs = 0 to 6 inches below ground surface.

1 in = 70 ft

1:840

N W E S

0 35 70 140 Feet

MESA I 1/2, WEST MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

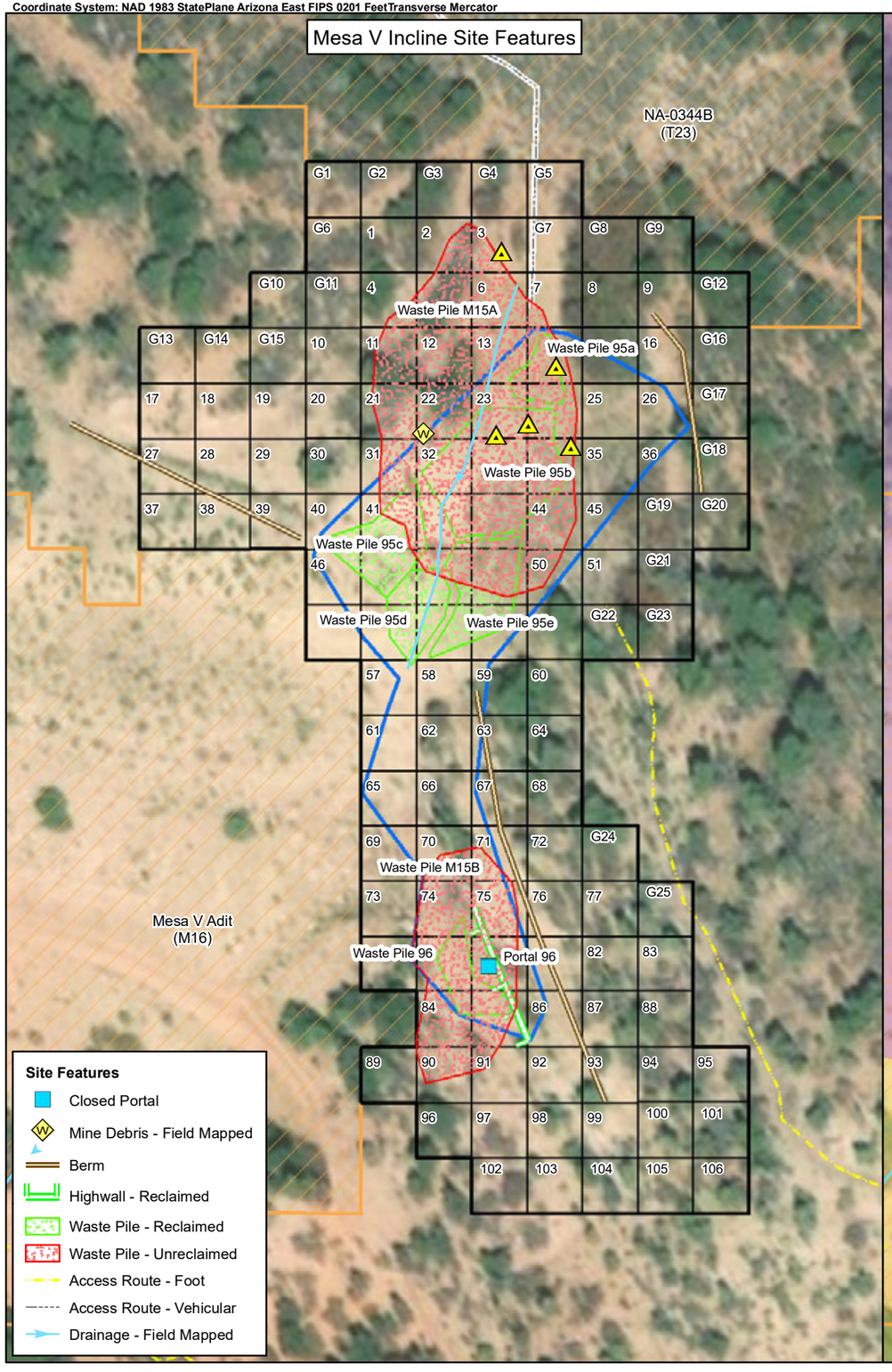
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/2/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-13**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

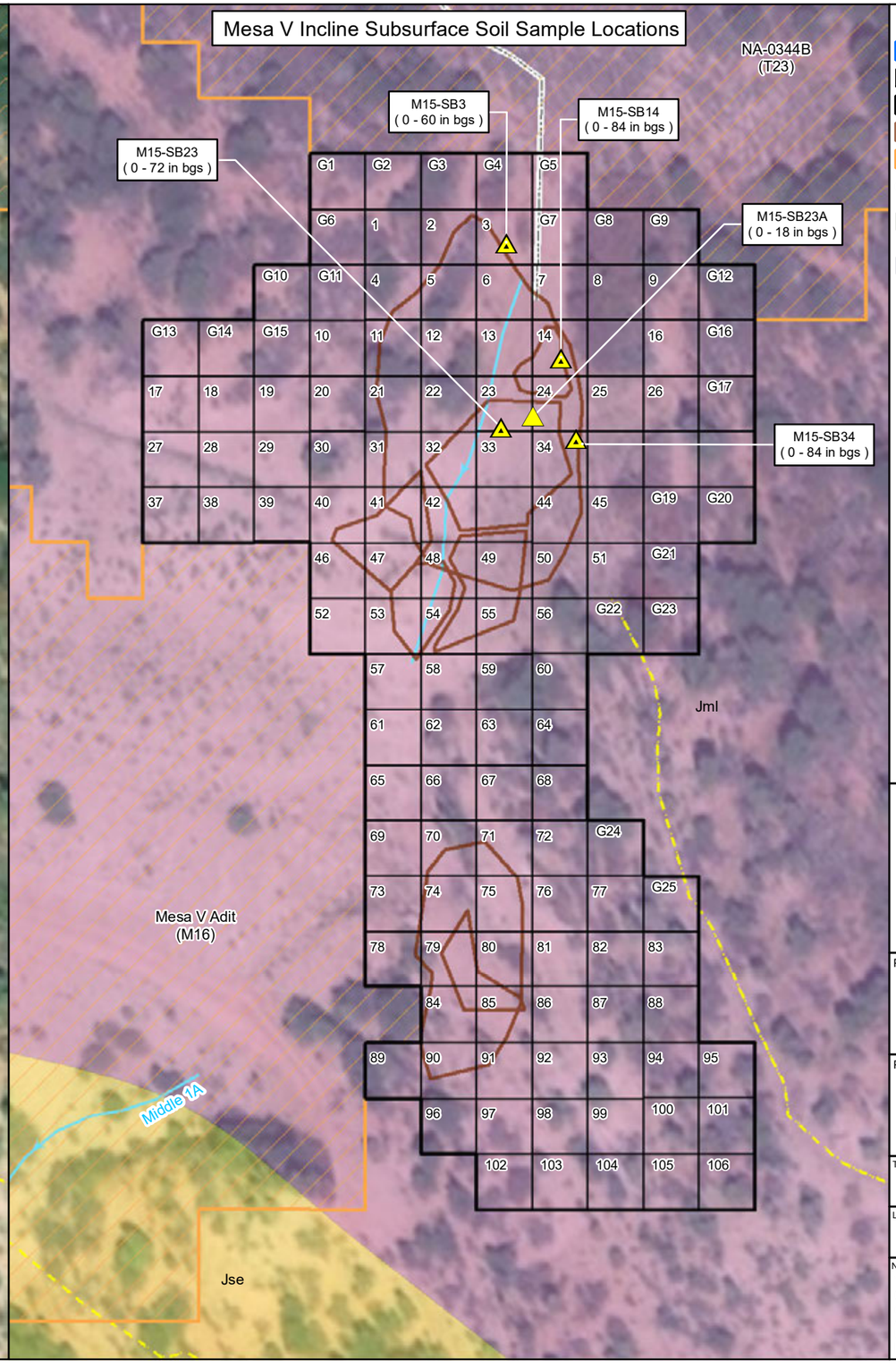
Mesa V Incline Site Features



Site Features

- Closed Portal
- Mine Debris - Field Mapped
- Berm
- Highwall - Reclaimed
- Waste Pile - Reclaimed
- Waste Pile - Unreclaimed
- Access Route - Foot
- Access Route - Vehicular
- Drainage - Field Mapped

Mesa V Incline Subsurface Soil Sample Locations



- Geotechnical Drilling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M15-SB3 = site M15 soil boring collected at survey unit 3. 0 - 60 in bgs = 0 to 60 inches below ground surface.

1 in = 80 ft

1:960

N W E S

0 40 80 160 Feet

MESA V INCLINE GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

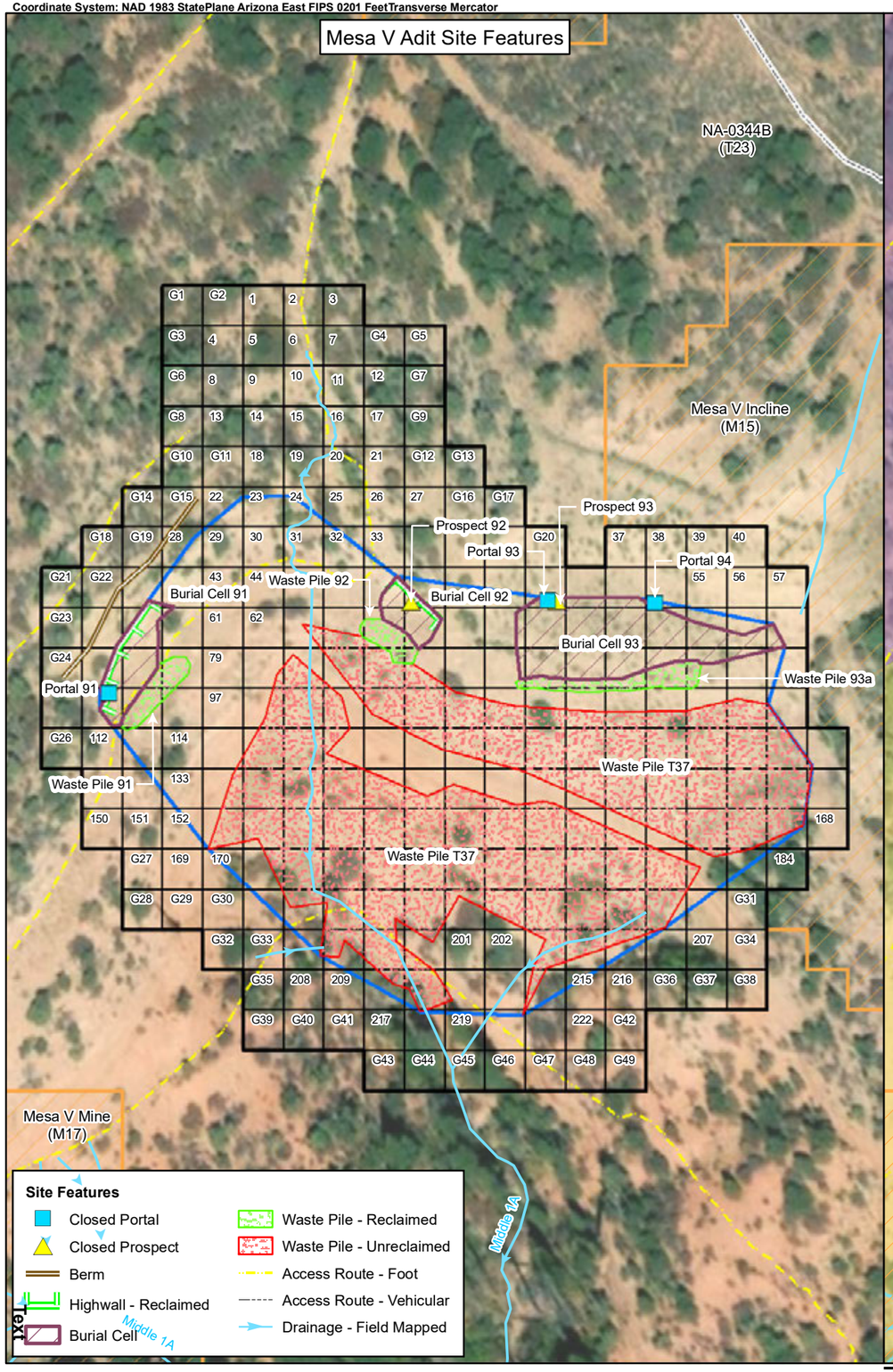
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

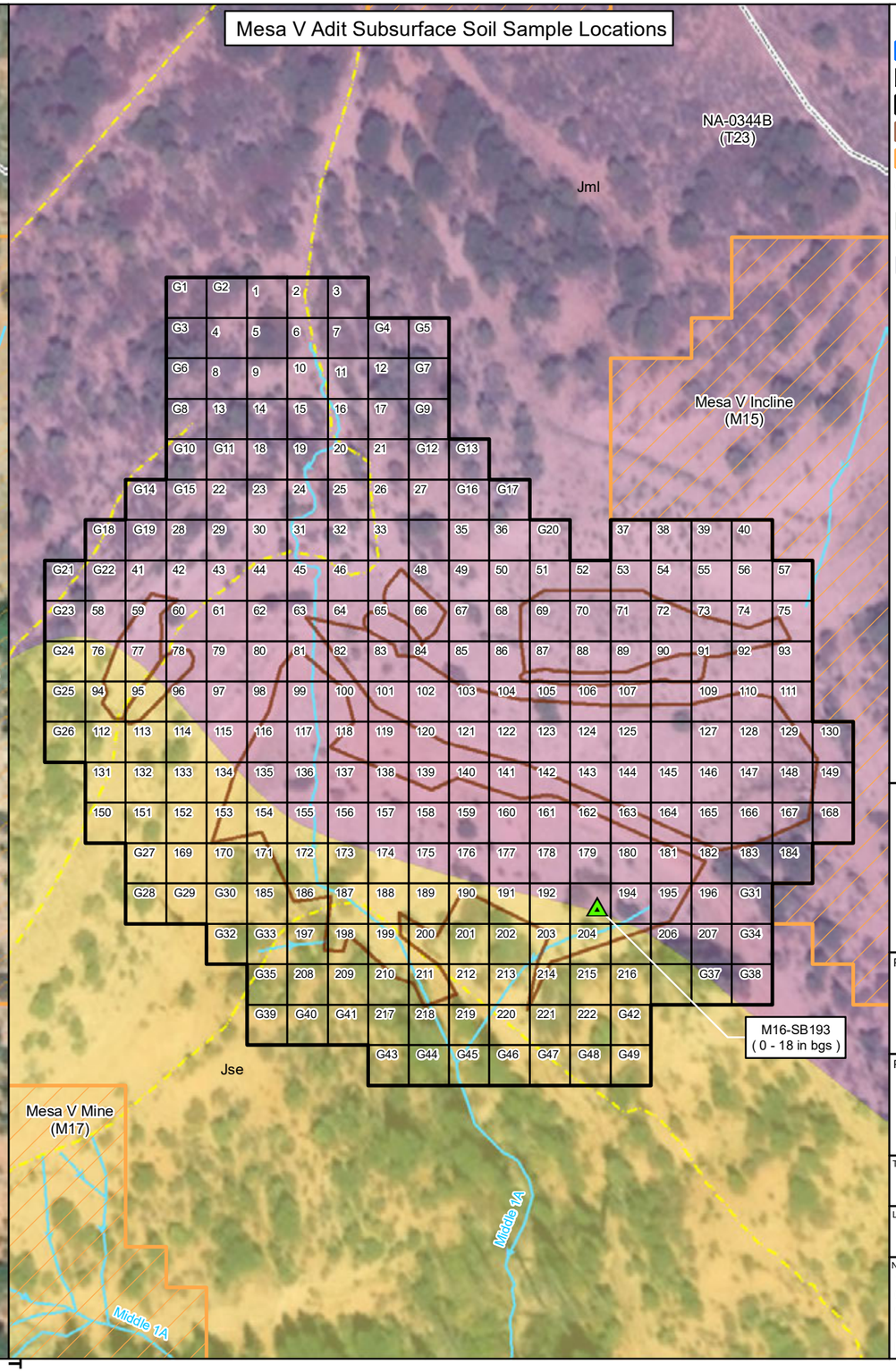
Figure No.: **E-14**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa V Adit Site Features



Mesa V Adit Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M16-SB193 = site M16 soil boring collected at survey unit 193. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 110 ft

1:1,320

N W E S

0 55 110 220 Feet

MESA V ADIT
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
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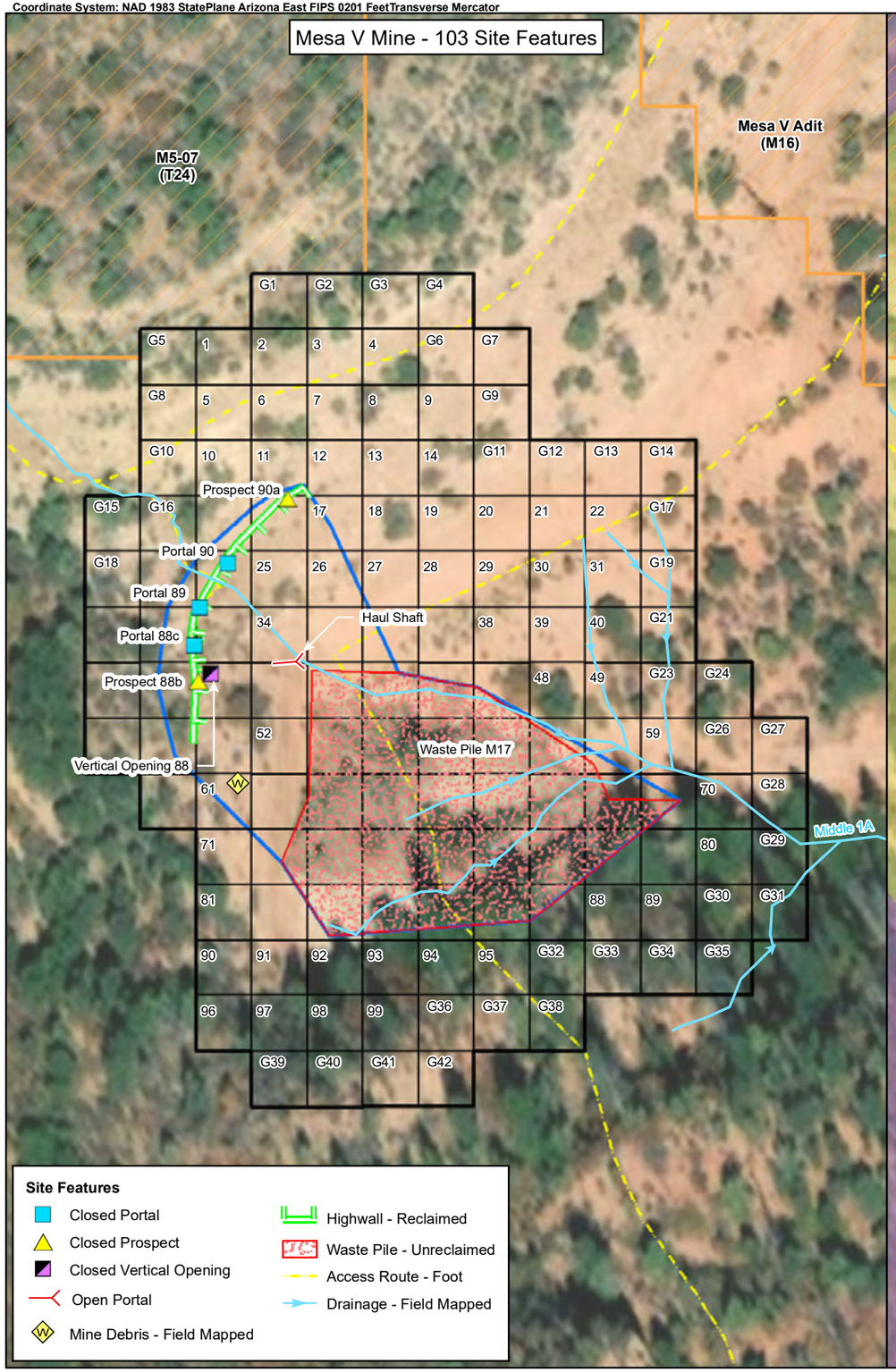
Figure No.: **E-15**

Text

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

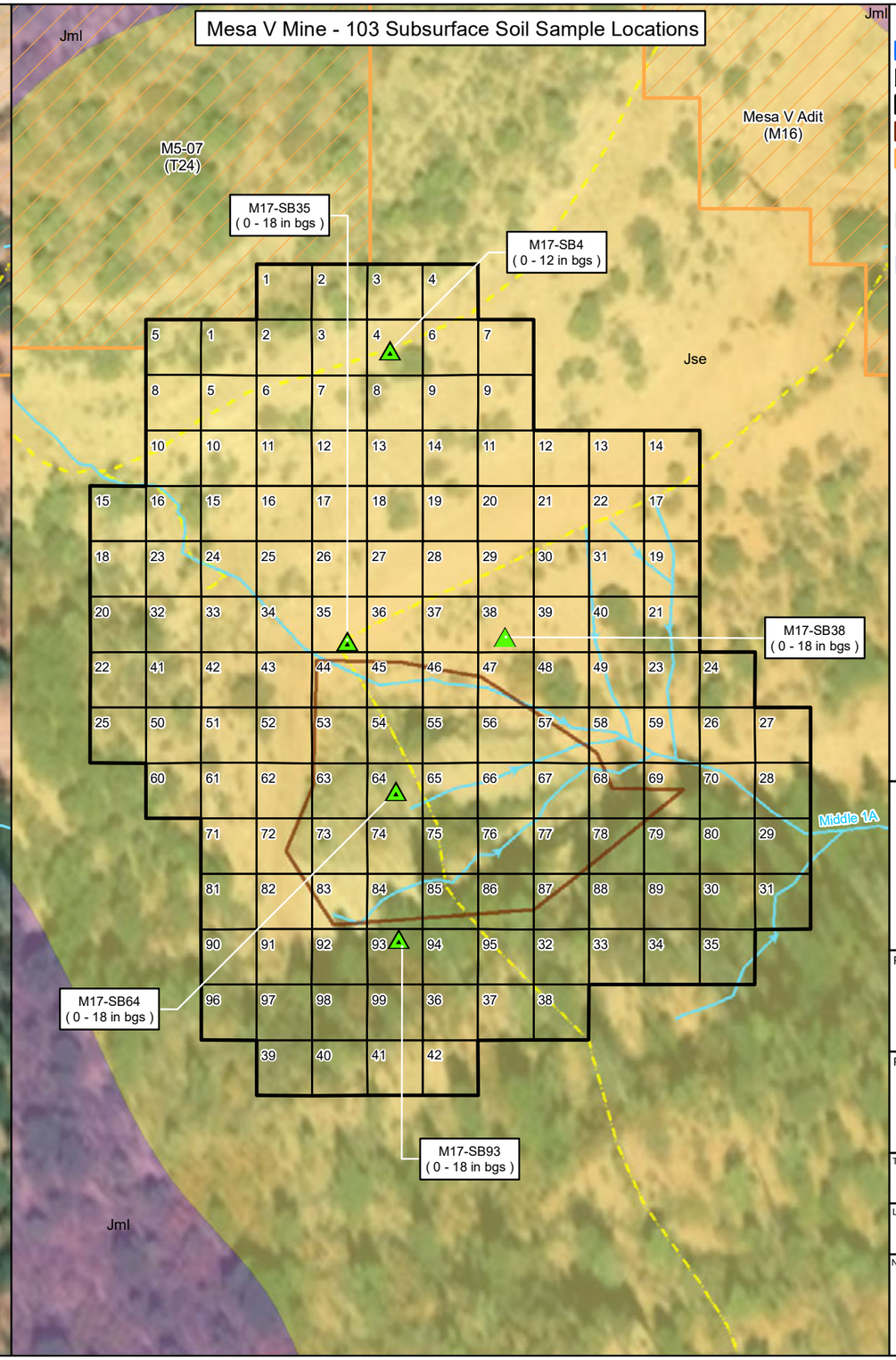
Mesa V Mine - 103 Site Features



Site Features

- Closed Portal
- Closed Prospect
- Closed Vertical Opening
- Open Portal
- Mine Debris - Field Mapped
- Highwall - Reclaimed
- Waste Pile - Unreclaimed
- Access Route - Foot
- Drainage - Field Mapped

Mesa V Mine - 103 Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M17-SB35 = site M17 soil boring collected at survey unit 35. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 80 ft

1:960

N W E S

0 40 80 160 Feet

MESA V MINE - 103
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

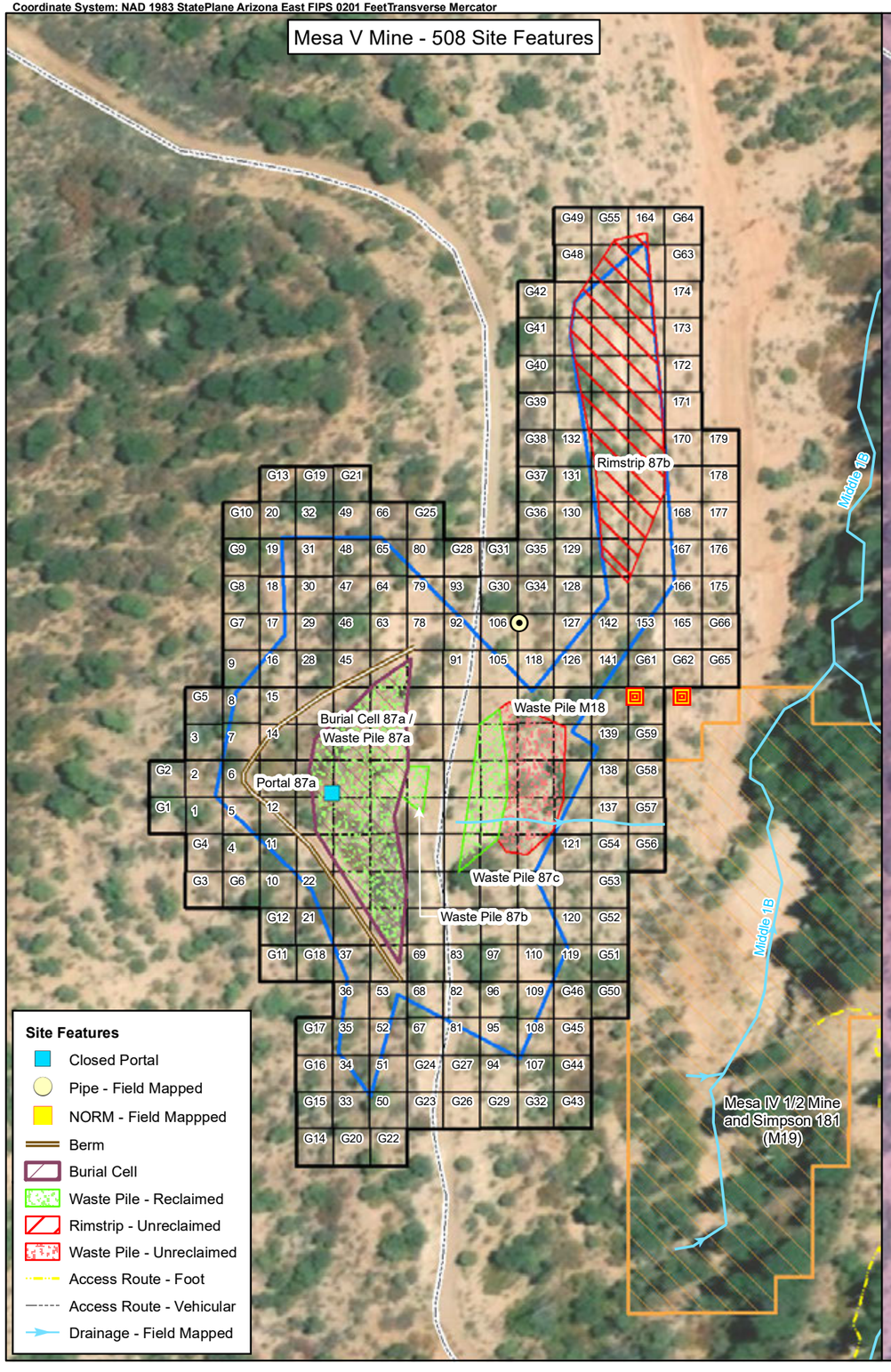
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-16**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

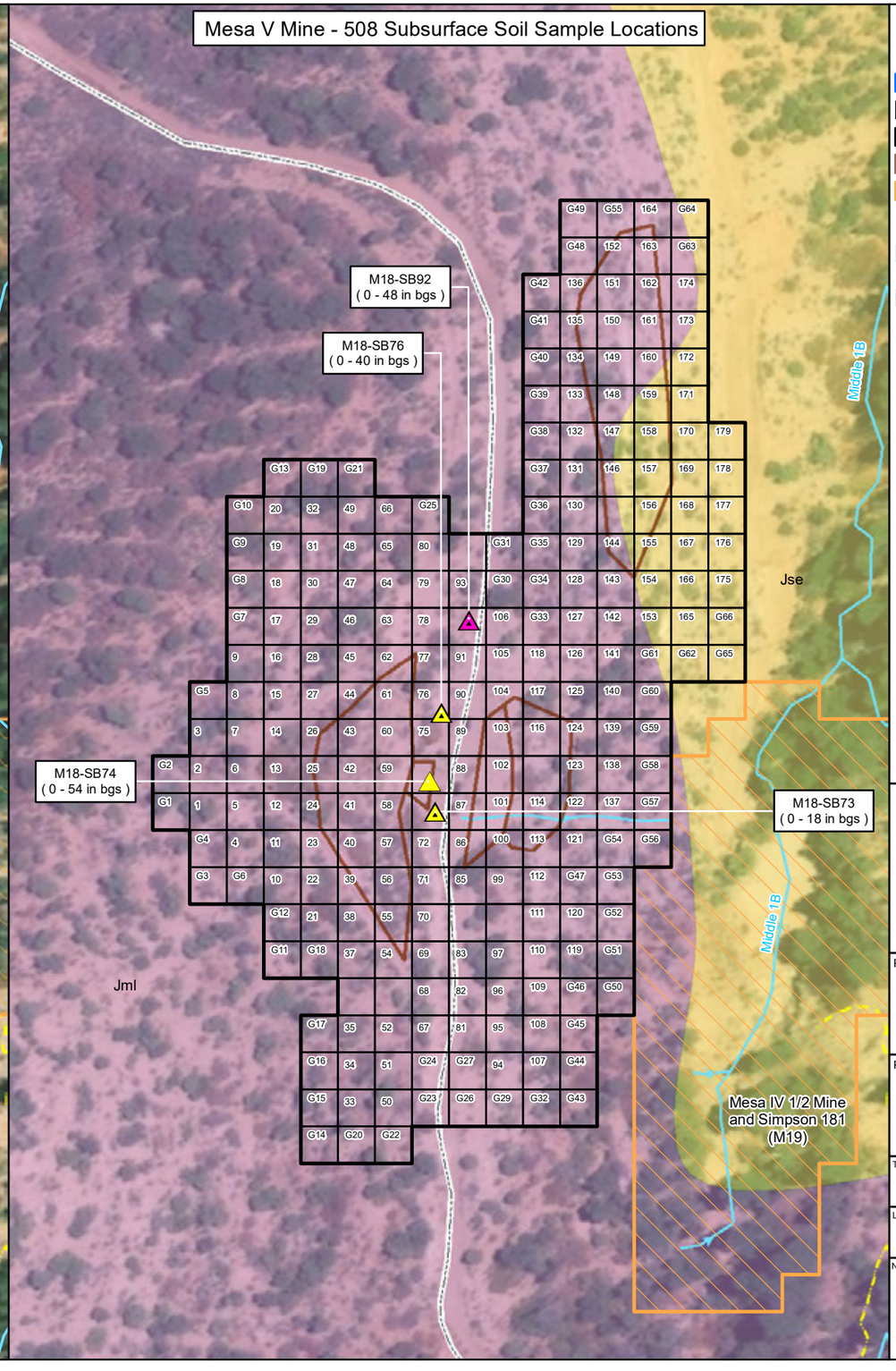
Mesa V Mine - 508 Site Features



Site Features

- Closed Portal
- Pipe - Field Mapped
- NORM - Field Mappped
- Berm
- Burial Cell
- Waste Pile - Reclaimed
- Rimstrip - Unreclaimed
- Waste Pile - Unreclaimed
- Access Route - Foot
- Access Route - Vehicular
- Drainage - Field Mapped

Mesa V Mine - 508 Subsurface Soil Sample Locations



- Geotechnical Sampling and Drilling Location*
- Geotechnical Drilling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Rimstrip / Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M18-SB92 = site M18 soil boring collected at survey unit 92. 0 - 48 in bgs = 0 to 48 inches below ground surface.

1 in = 120 ft

1:1,440

0 62.5 125 250 Feet

N E S W

MESA V MINE - 508
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

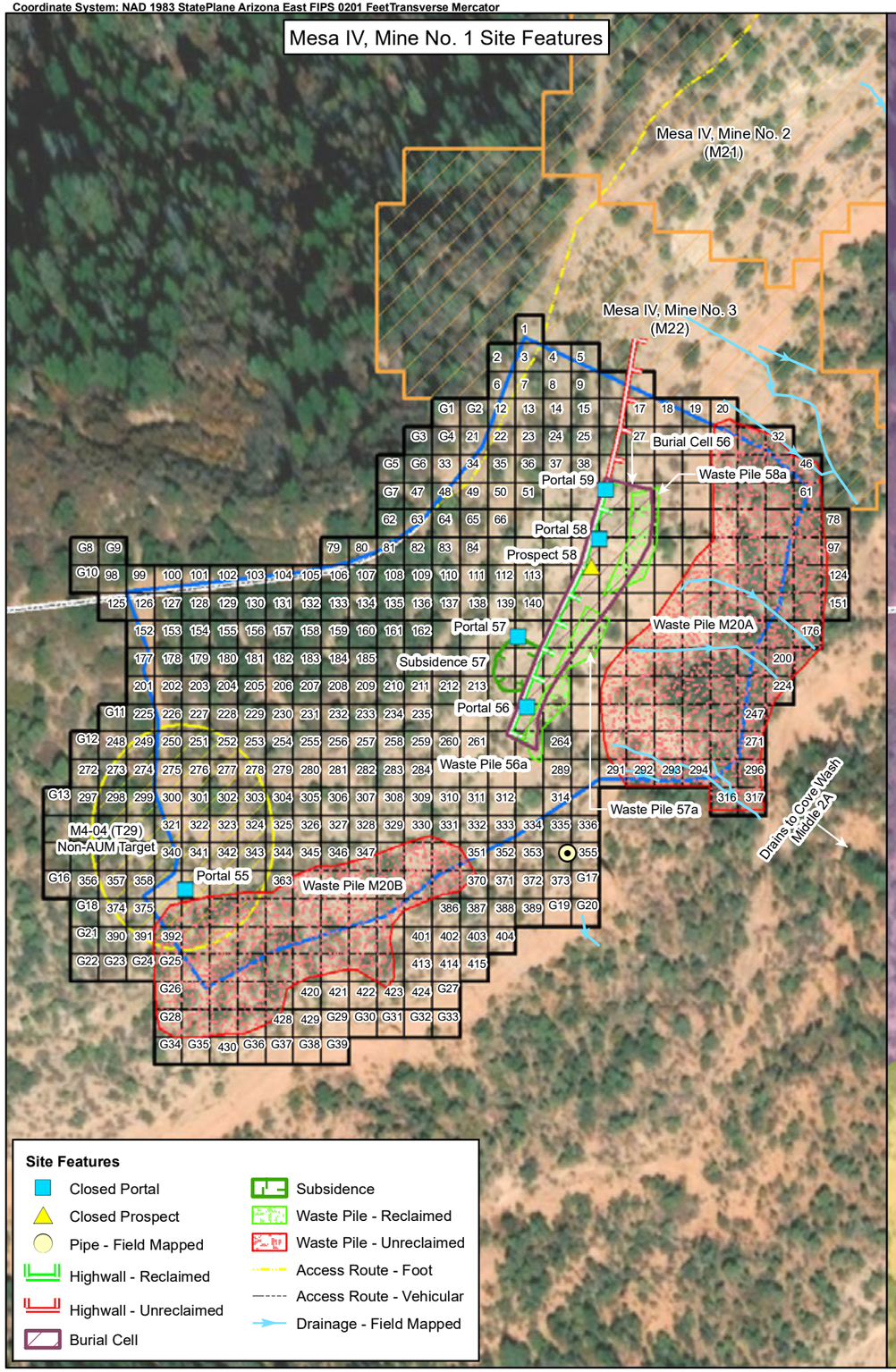
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-17**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

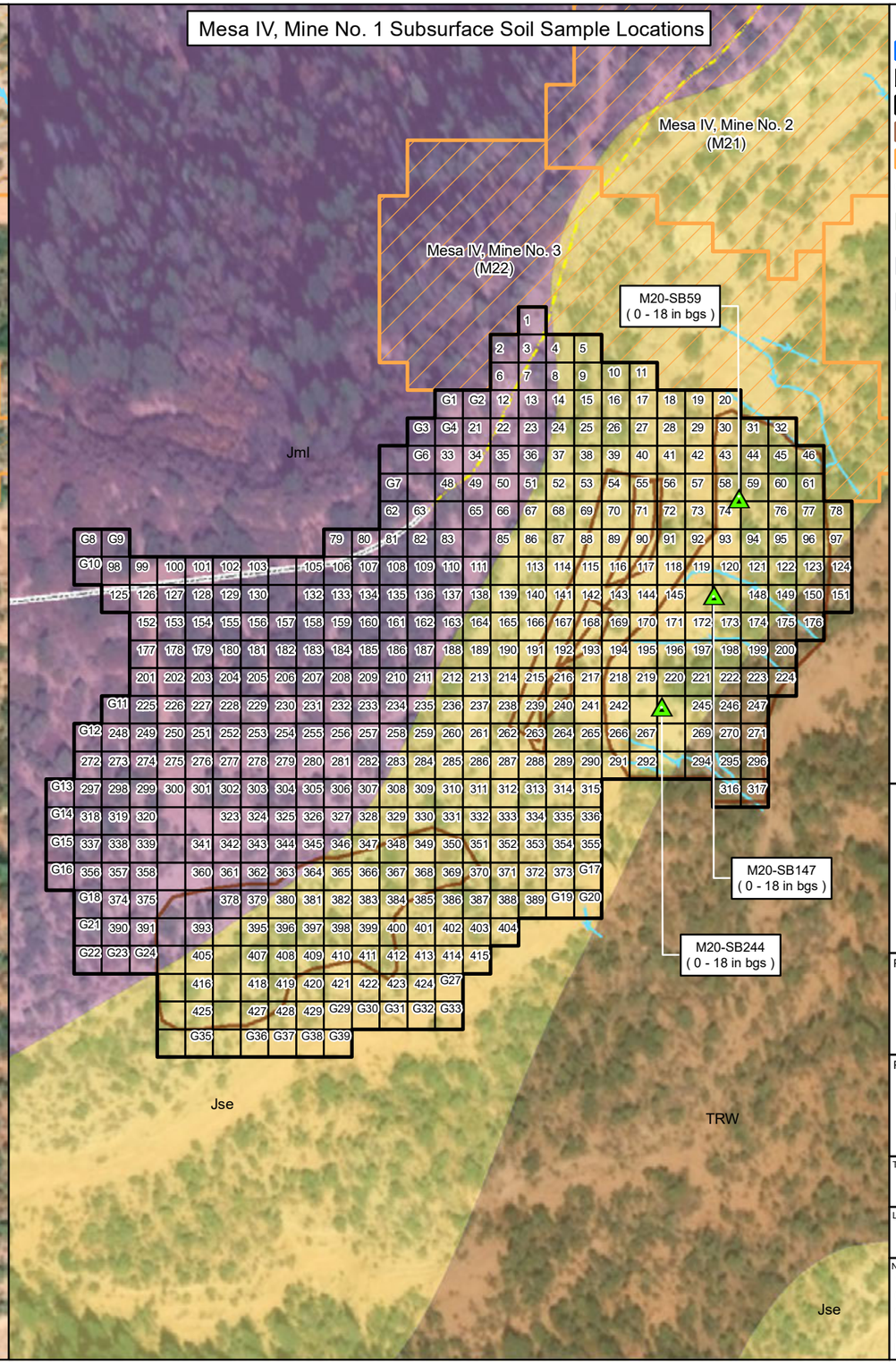
Mesa IV, Mine No. 1 Site Features



Site Features

- Closed Portal
- Closed Prospect
- Pipe - Field Mapped
- Highwall - Reclaimed
- Highwall - Unreclaimed
- Burial Cell
- Subsidence
- Waste Pile - Reclaimed
- Waste Pile - Unreclaimed
- Access Route - Foot
- Access Route - Vehicular
- Drainage - Field Mapped

Mesa IV, Mine No. 1 Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse
- Wingate Sandstone - TRW

*M20-SB59 = site M20 soil boring collected at survey unit 59. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 160 ft

1:1,920

N W E S

0 80 160 320 Feet

MESA IV, MINE NO. 1
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-18**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa IV, Mine No. 2 Site Features

Portal 65
Portal 66
Waste Pile M21E
Waste Pile M21D
Portal 67
Waste Pile M21C
Portal 64
Portal 63
Waste Pile M21F
Prospect 62
Waste Pile M21A
Waste Pile M21B
Burial Cell 63
Waste Pile 63a
Drains to Cove Wash Middle 2
Mesa IV, Mine No. 3 (M22)
Mesa IV, Mine No. 1 (M20)

Site Features

- Closed Portal
- Closed Prospect
- Pipe - Field Mapped
- Mine Debris - Field Mapped
- NORM - Field Mappped
- Berm
- Highwall - Reclaimed
- Highwall - Unreclaimed
- Burial Cell
- Waste Pile - Reclaimed
- Waste Pile - Unreclaimed
- Access Route - Foot
- Access Route - Vehicular
- Drainage - Field Mapped

Mesa IV, Mine No. 2 Subsurface Soil Sample Locations

TRW
Jse
Jml
M21-SB280 (0 - 12 in bgs)
M21-SB434 (0 - 18 in bgs)
M21-SB405 (0 - 12 in bgs)
M21-SB528 (0 - 18 in bgs)
Mesa IV, Mine No. 3 (M22)
Mesa IV, Mine No. 1 (M20)

- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse
- Wingate Sandstone - TRW

*M21-SB434 = site M21 soil boring collected at survey unit 434. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 190 ft

1:2,280

0 95 190 380 Feet

N W E S

MESA IV, MINE NO. 2
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

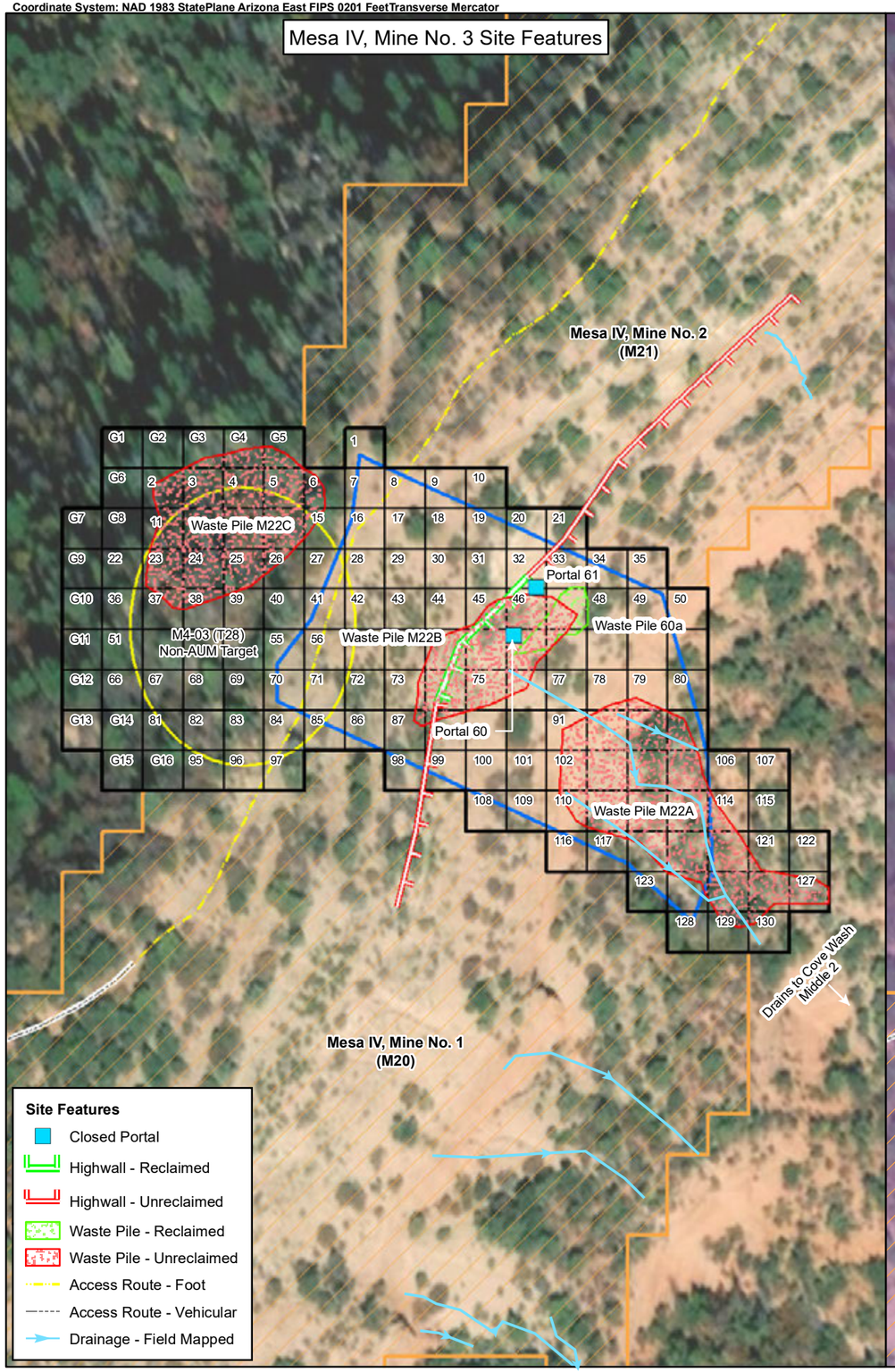
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-19**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

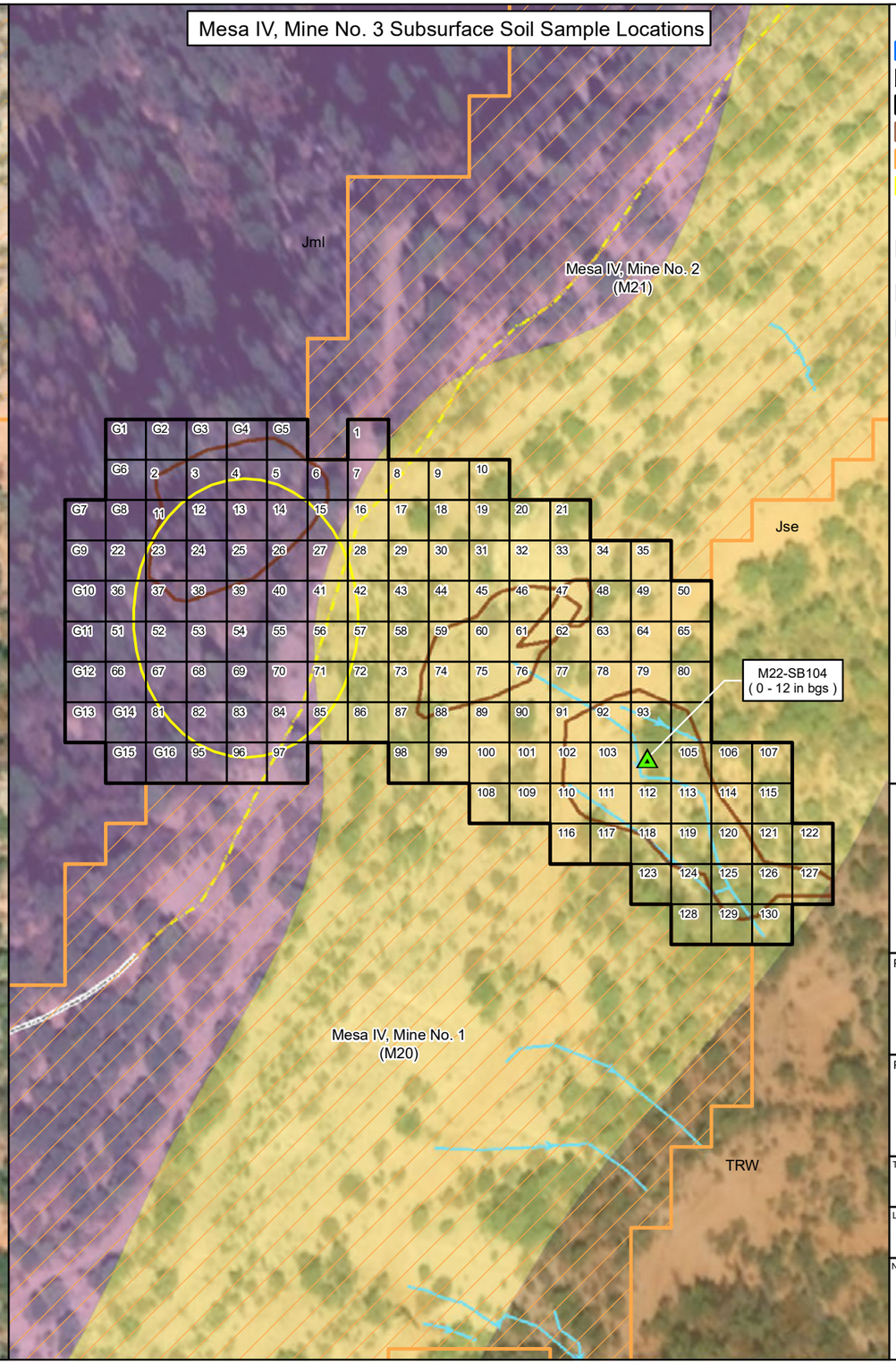
Mesa IV, Mine No. 3 Site Features



Site Features

- Closed Portal
- Highwall - Reclaimed
- Highwall - Unreclaimed
- Waste Pile - Reclaimed
- Waste Pile - Unreclaimed
- Access Route - Foot
- Access Route - Vehicular
- Drainage - Field Mapped

Mesa IV, Mine No. 3 Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area
- Non-AUM Target Site Boundary

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse
- Wingate Sandstone - TRW

*M22-SB104 = site M22 soil boring collected at survey unit 104. 0 - 12 in bgs = 0 to 12 inches below ground surface.

1 in = 110 ft

1:1,320

N W E S

0 55 110 220 Feet

MESA IV, MINE NO. 3
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

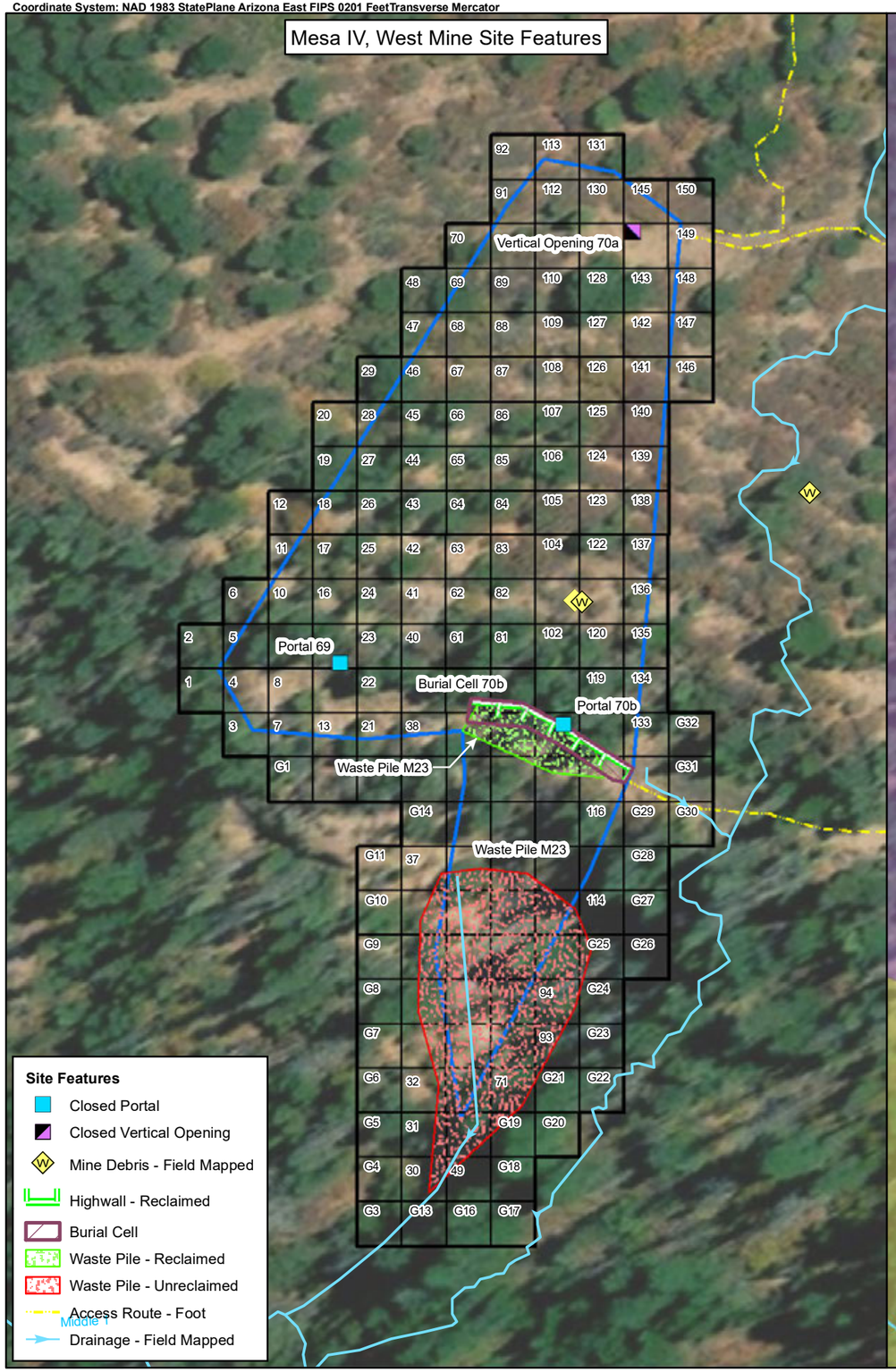
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-20**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

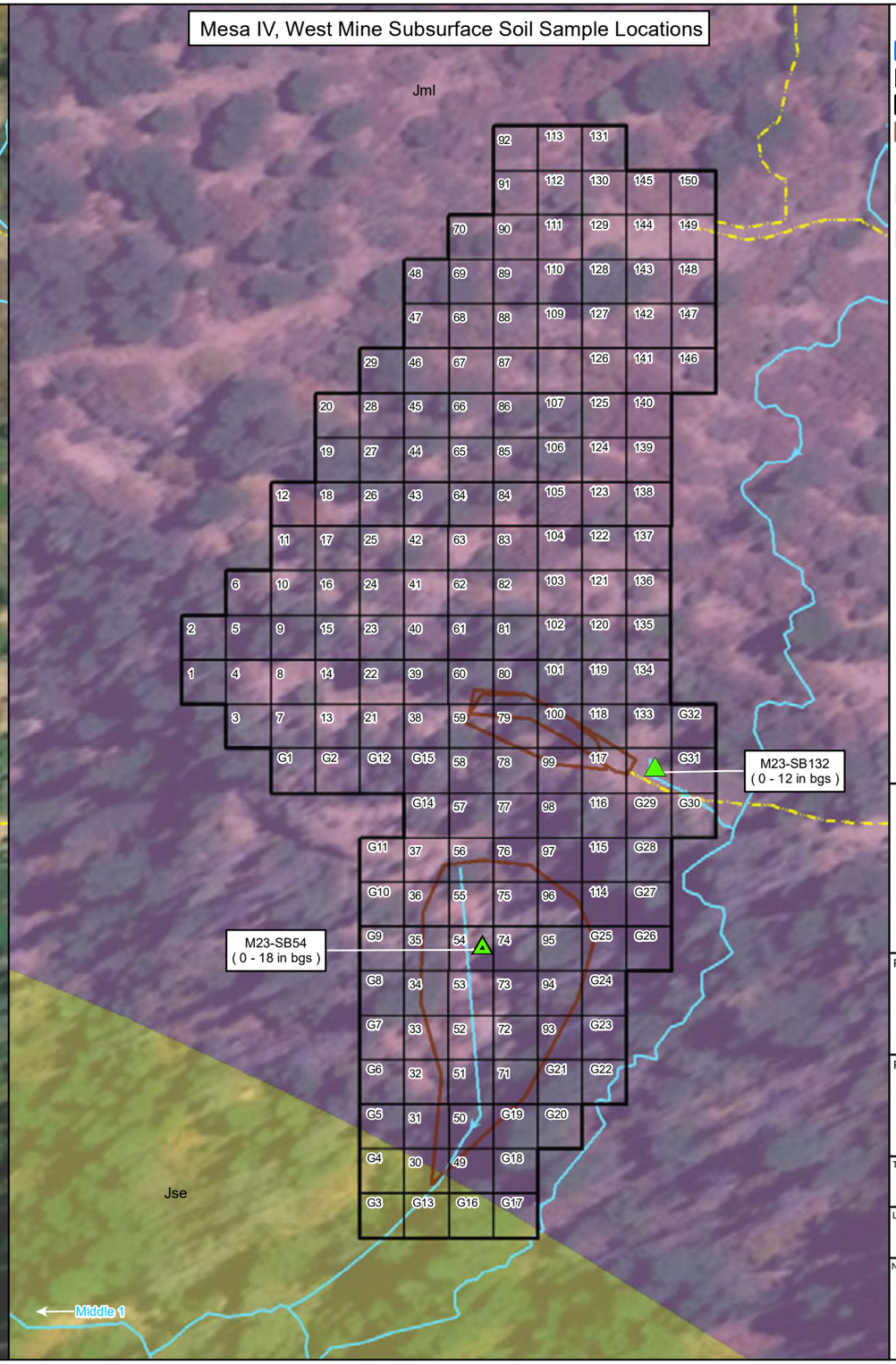
Mesa IV, West Mine Site Features



Site Features

- Closed Portal
- Closed Vertical Opening
- Mine Debris - Field Mapped
- Highwall - Reclaimed
- Burial Cell
- Waste Pile - Reclaimed
- Waste Pile - Unreclaimed
- Access Route - Foot
- Drainage - Field Mapped

Mesa IV, West Mine Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M23-SB54 = site M23 soil boring collected at survey unit 54. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 100 ft

1:1,200

0 50 100 200 Feet

N E S W

MESA IV, WEST MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

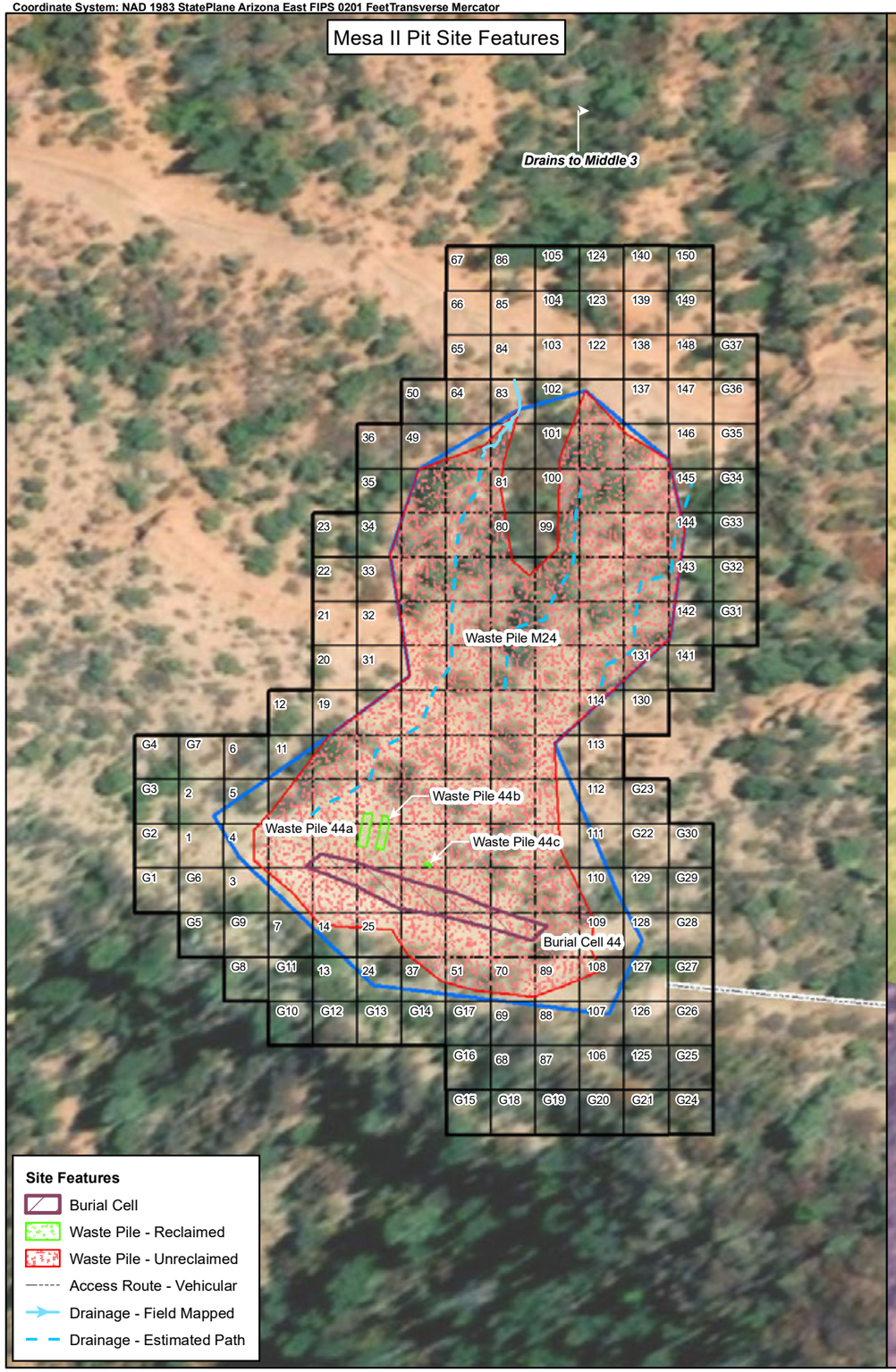
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-21**

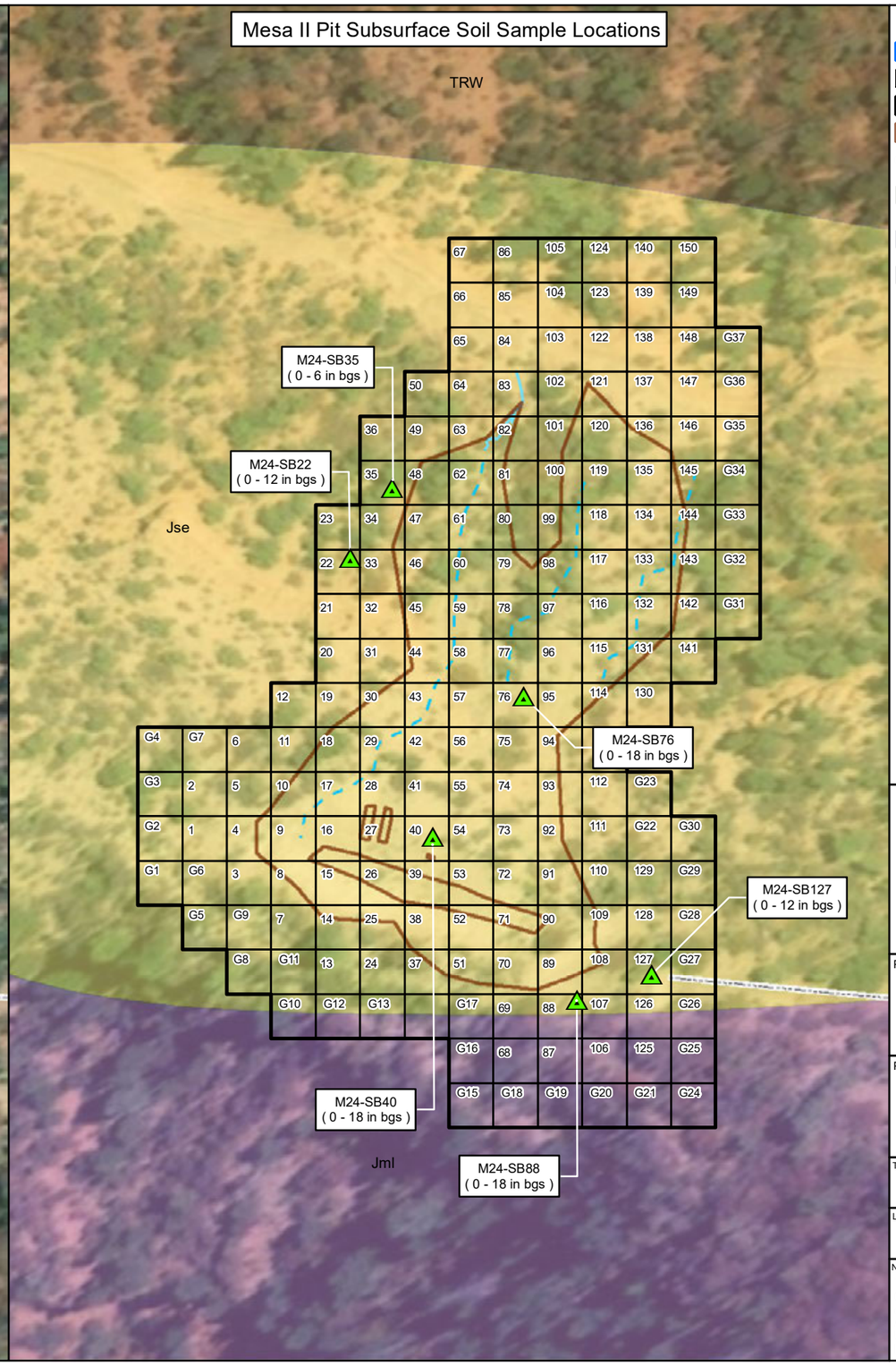
Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa II Pit Site Features



Site Features
- Burial Cell
- Waste Pile - Reclaimed
- Waste Pile - Unreclaimed
- Access Route - Vehicular
- Drainage - Field Mapped
- Drainage - Estimated Path

Mesa II Pit Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary

Geologic Unit**
- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse
- Wingate Sandstone - TRW

*M24-SB40 = site M24 soil boring collected at survey unit 40. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 100 ft

1:1,200

0 50 100 200 Feet

N E S W

MESA II PIT
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

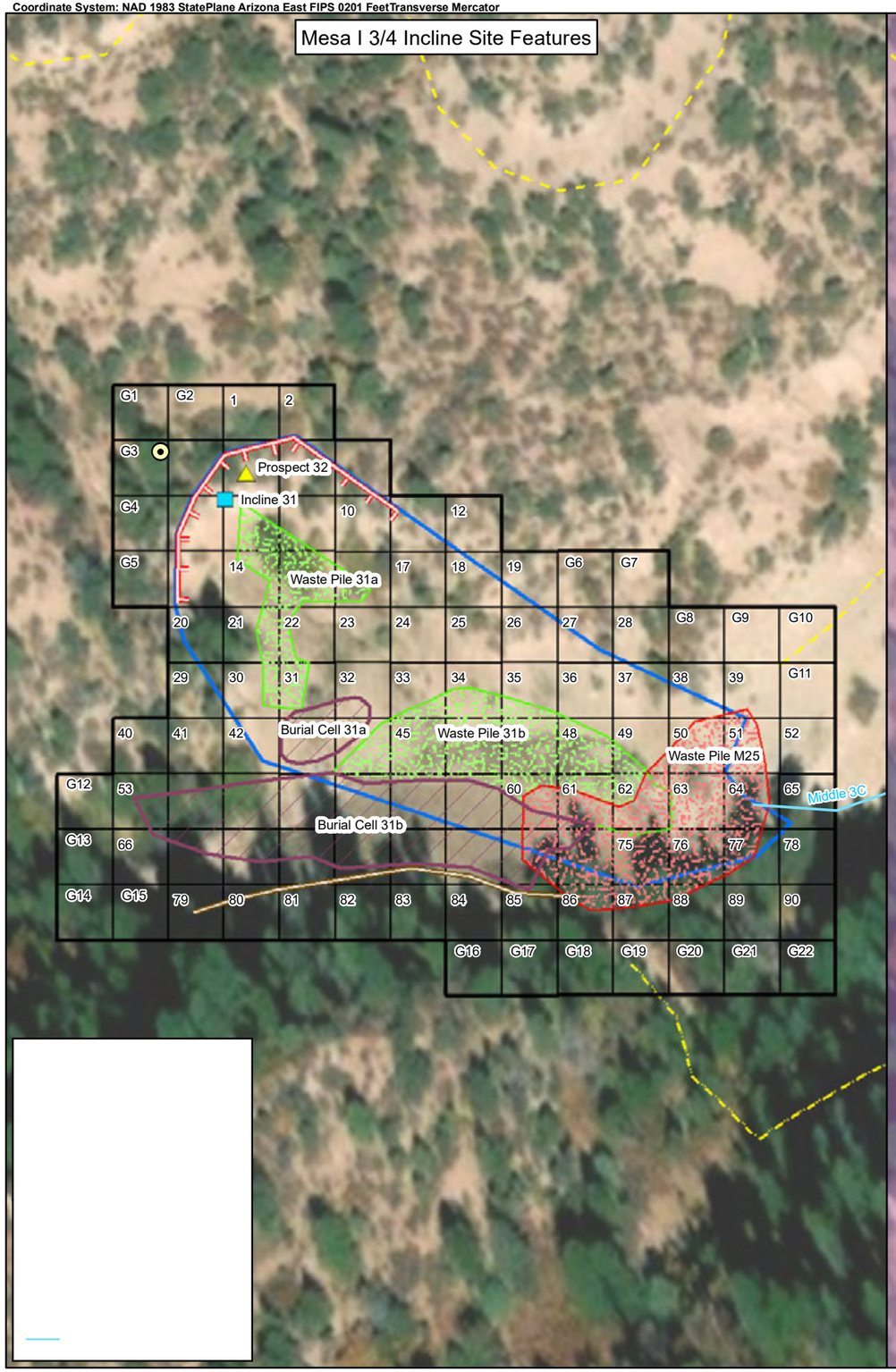
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

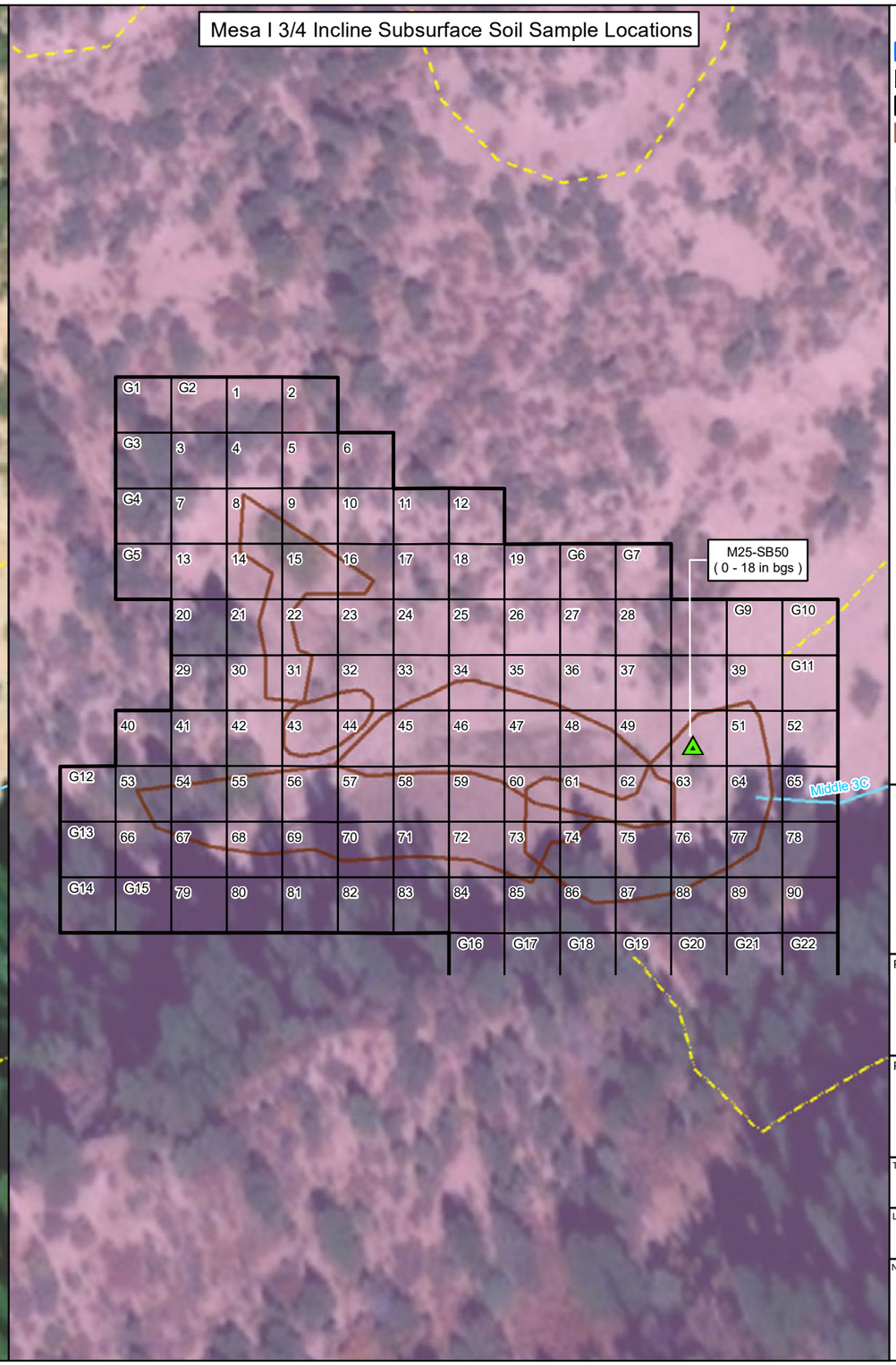
Figure No.: **E-22**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa I 3/4 Incline Site Features



Mesa I 3/4 Incline Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary

Geologic Unit**

- Morrison Formation (Lower) - Jml

*M25-SB50 = site M25 soil boring collected at survey unit 50. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 80 ft

1:960

N
W E
S

0 40 80 160 Feet

MESA I 3/4 INCLINE GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

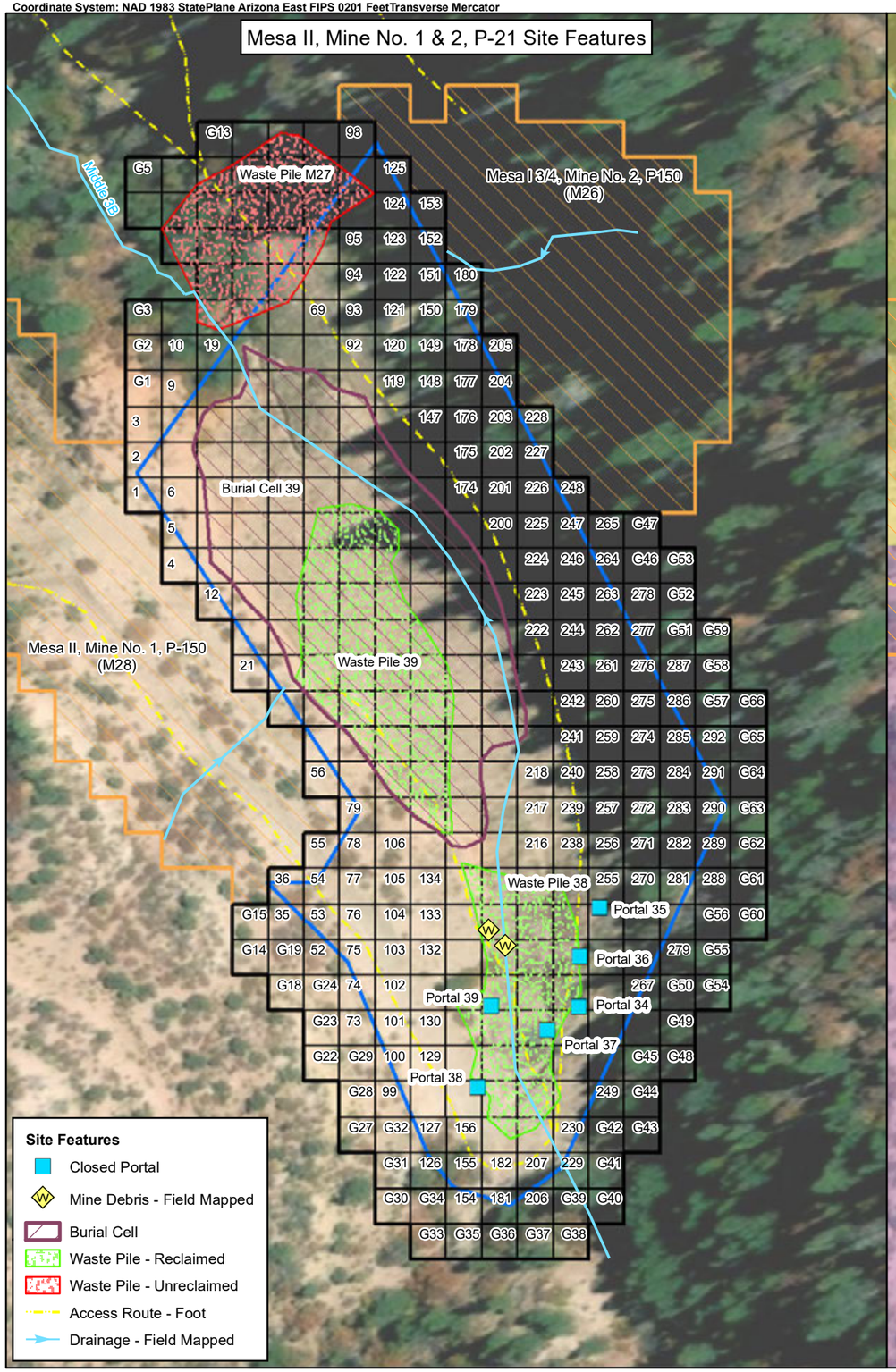
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

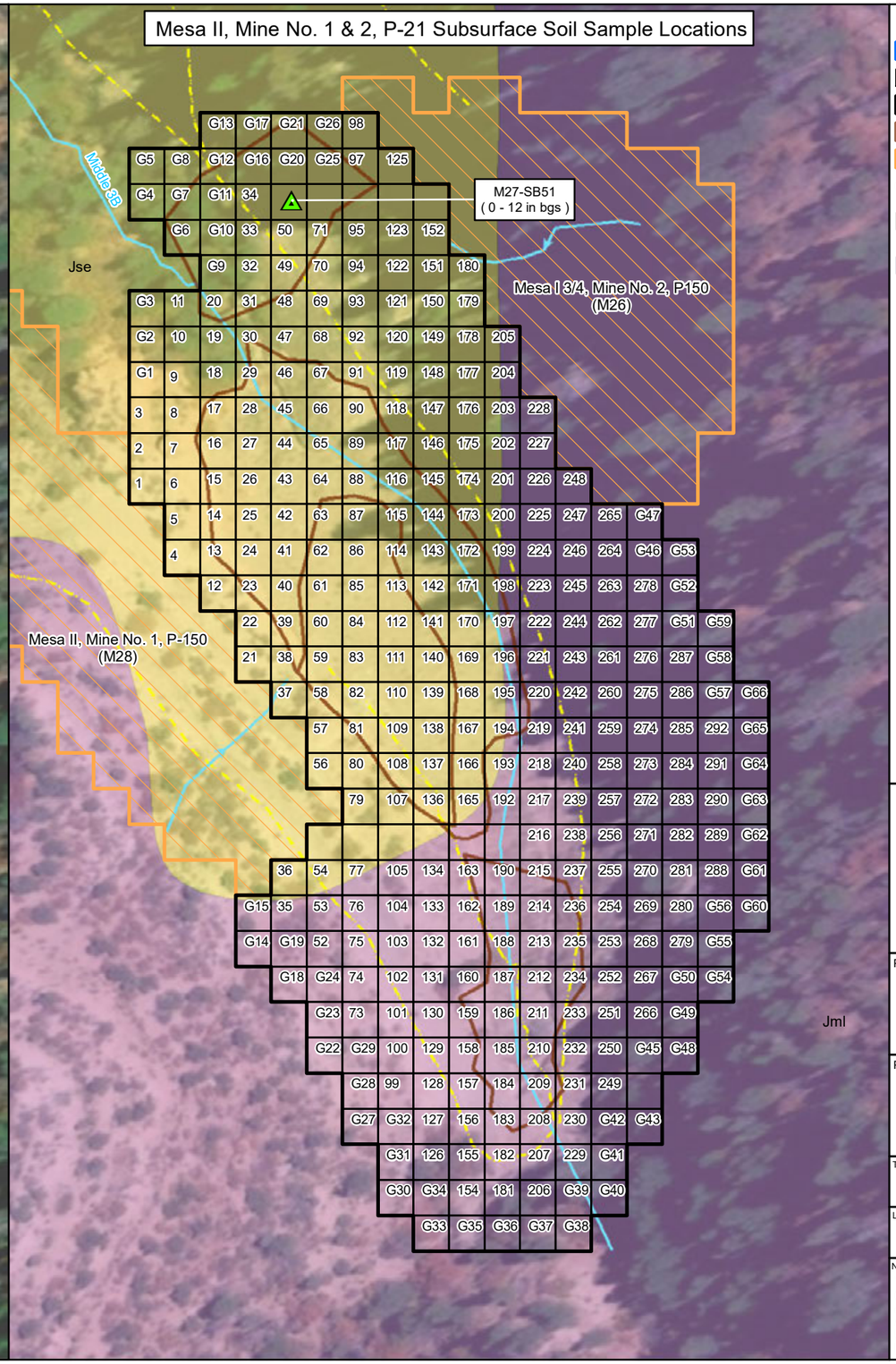
Figure No.: **E-23**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa II, Mine No. 1 & 2, P-21 Site Features



Mesa II, Mine No. 1 & 2, P-21 Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M27-SB51 = site M27 soil boring collected at survey unit 51. 0 - 12 in bgs = 0 to 12 inches below ground surface.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

MESA II, MINE NO. 1 & 2, P-21
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

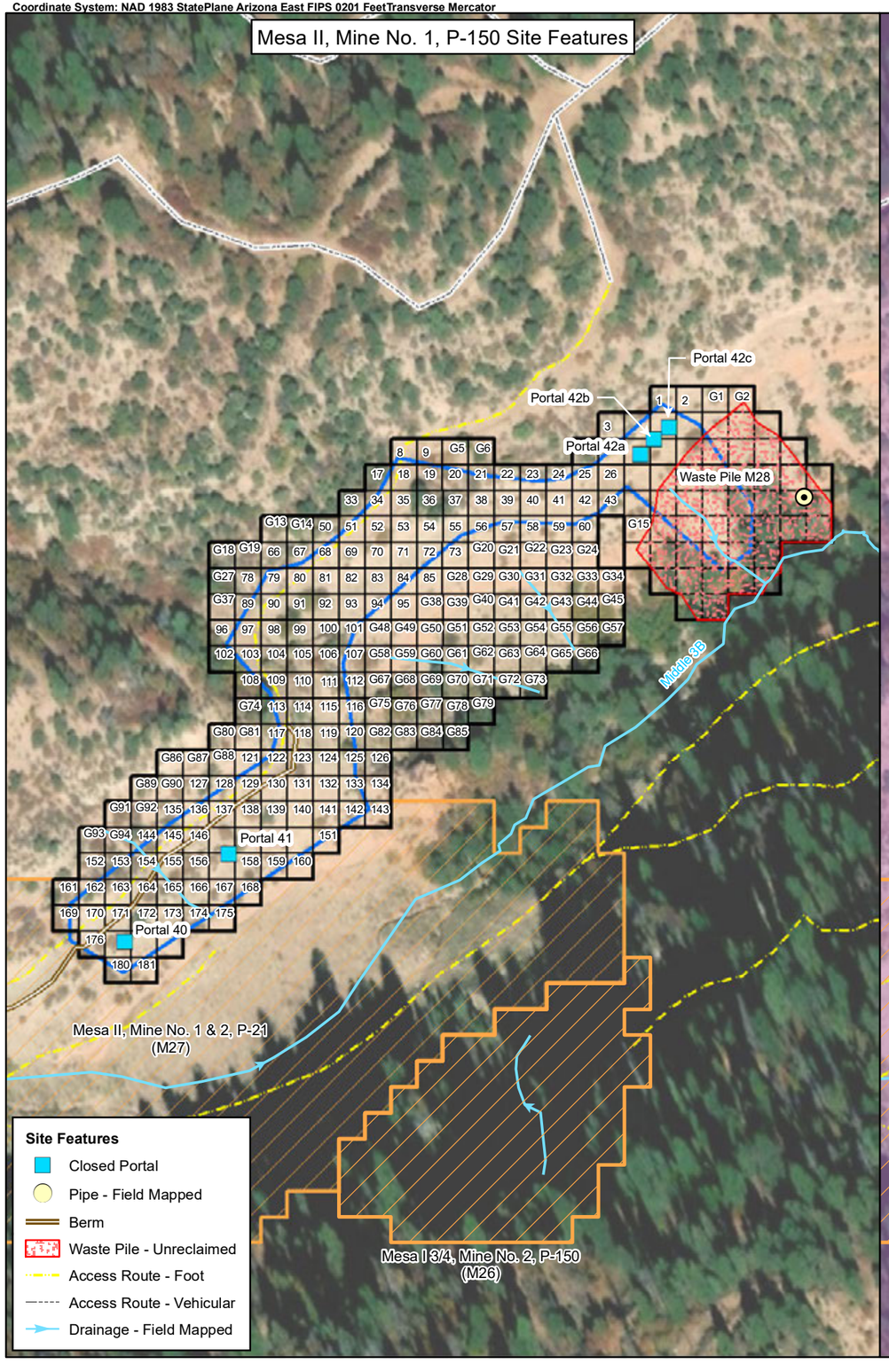
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-24**

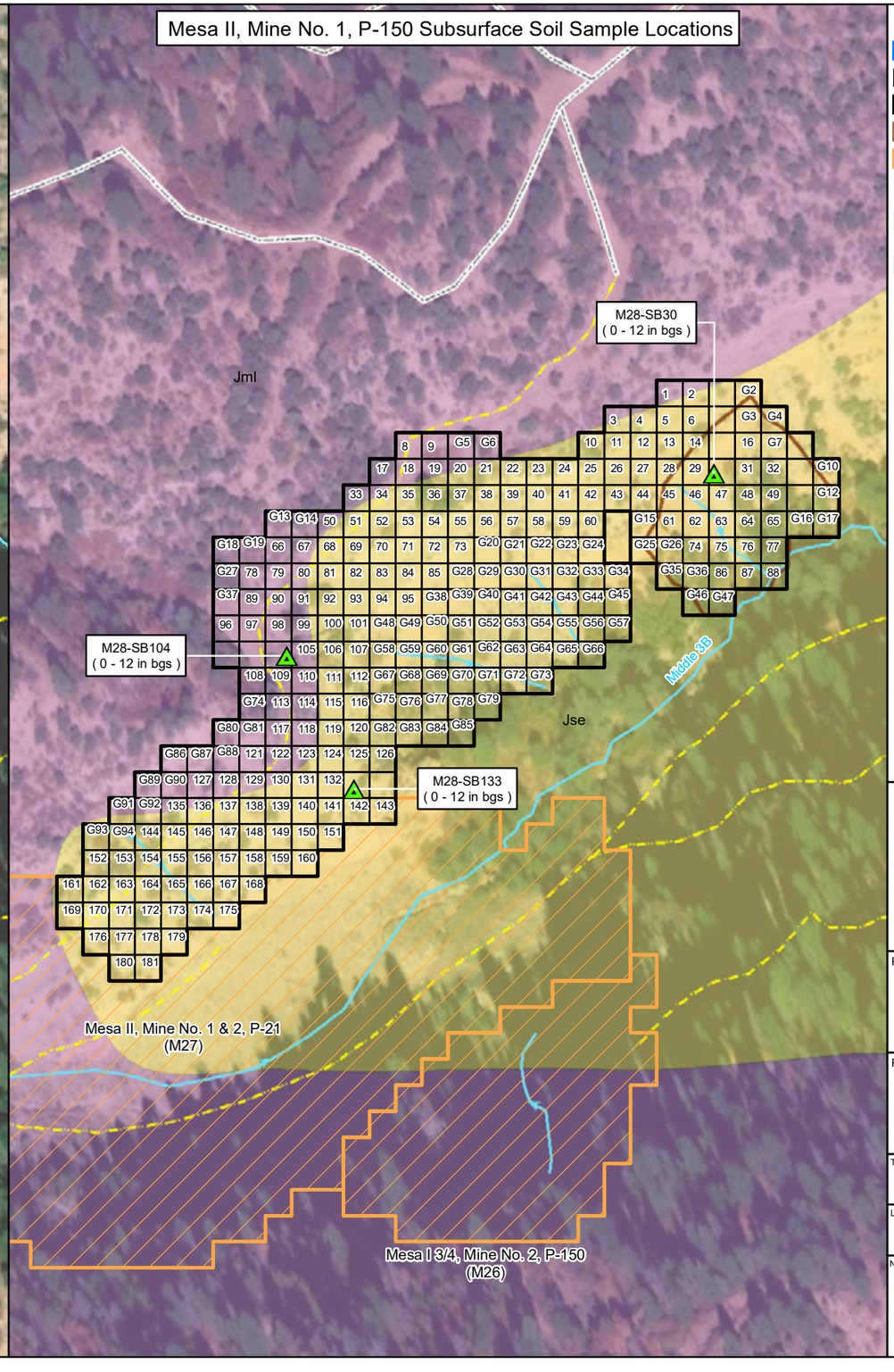
Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa II, Mine No. 1, P-150 Site Features



Site Features
- Closed Portal
- Pipe - Field Mapped
- Berm
- Waste Pile - Unreclaimed
- Access Route - Foot
- Access Route - Vehicular
- Drainage - Field Mapped

Mesa II, Mine No. 1, P-150 Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area

Geologic Unit**
- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M28-SB30 = site M28 soil boring collected at survey unit 30. 0 - 12 in bgs = 0 to 12 inches below ground surface.

1 in = 170 ft

1:2,040

N W E S

0 85 170 340 Feet

MESA II, MINE NO. 1, P-150
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

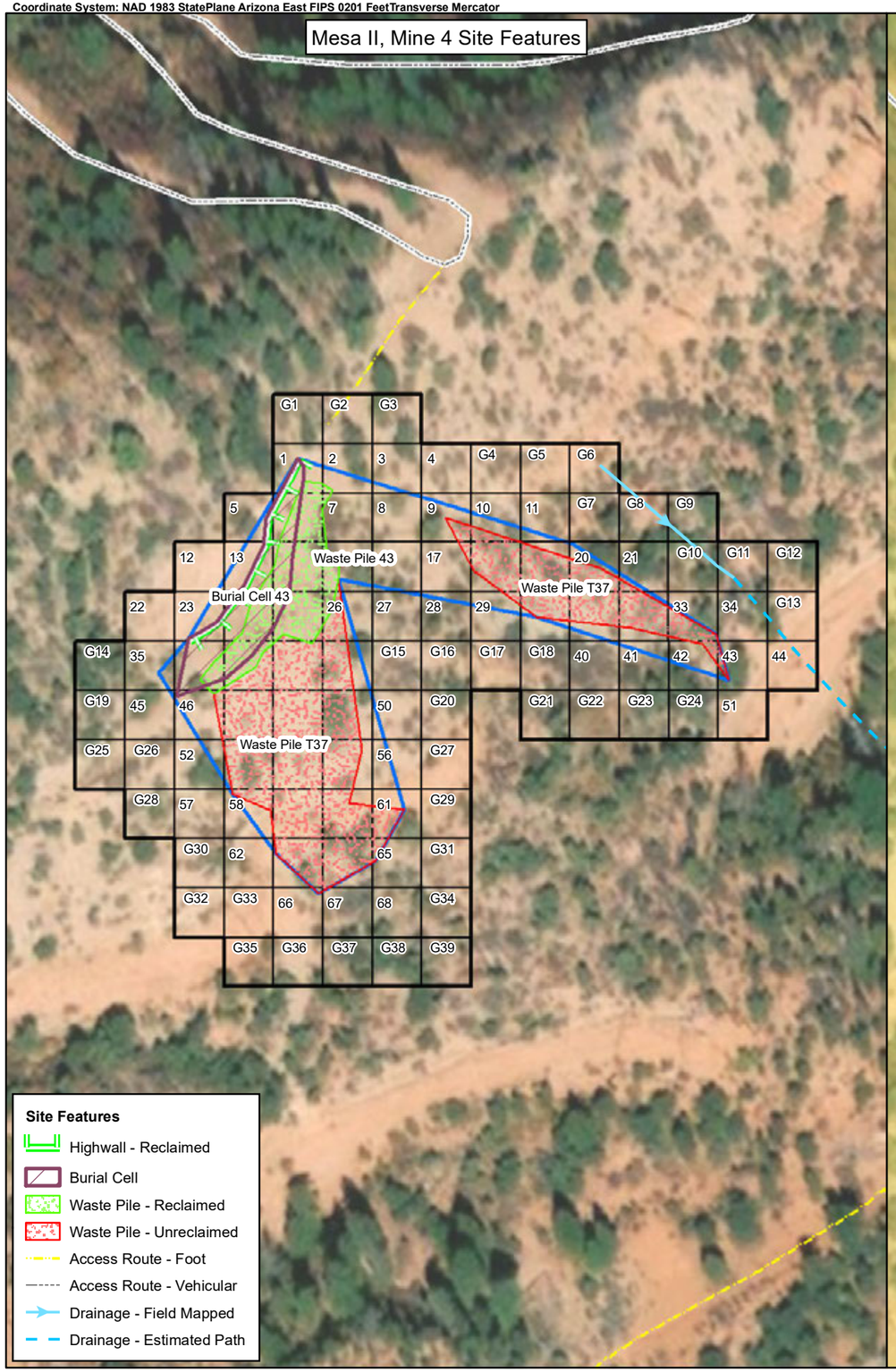
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

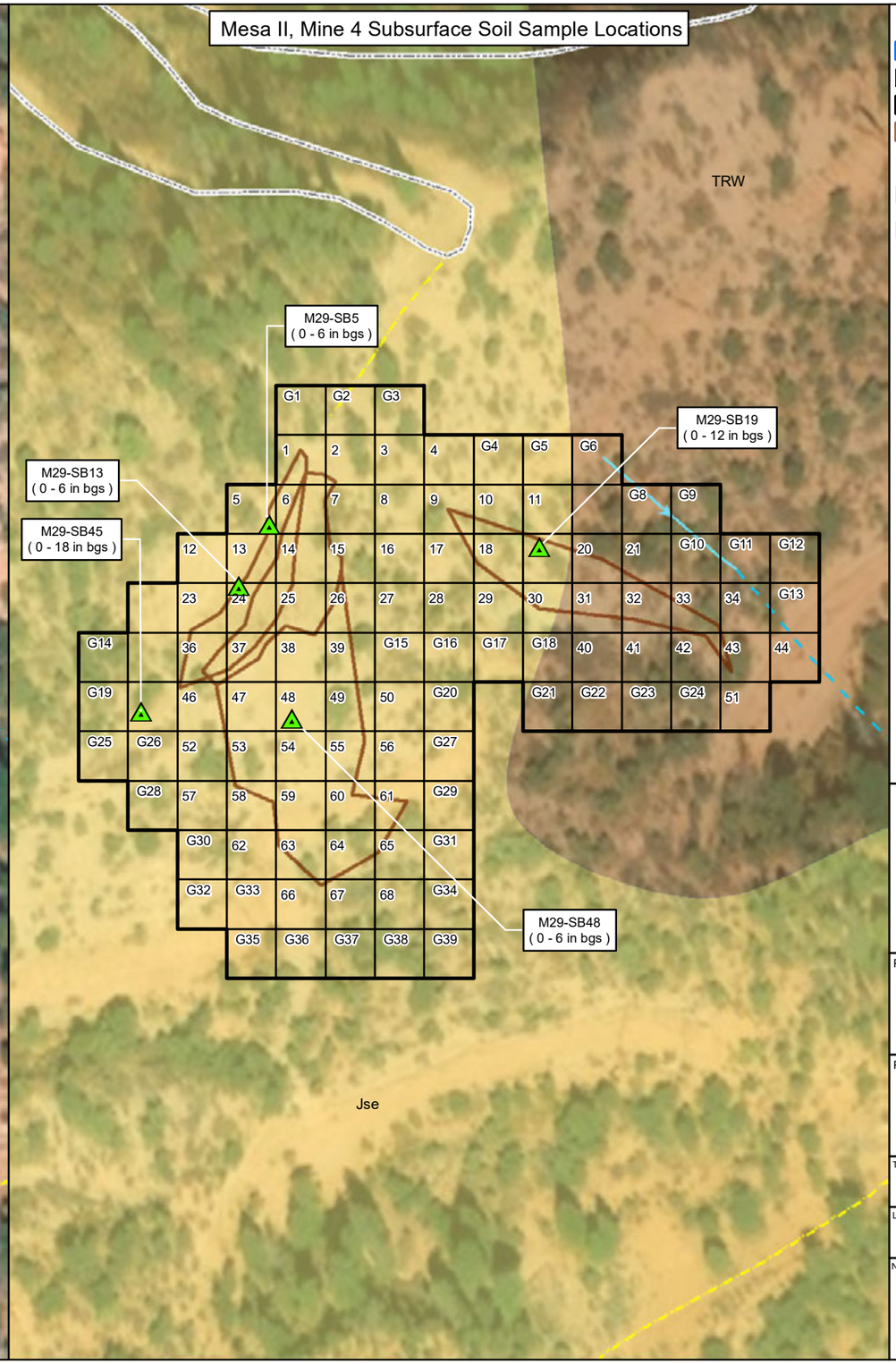
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-25**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator





Geotechnical Sampling Location*
AUM Site Boundary
Survey Unit (100 m²)
Survey Area Boundary
Burial Cell / Waste Pile Boundary

Geologic Unit**

Summerville, Entrada Formation (Undifferentiated) - Jse

Wingate Sandstone - TRW

*M29-SB45 = site M29 soil boring collected at survey unit 45. 0 - 18 in bgs = 0 to 18 inches below ground surface.

1 in = 90 ft

1:1,080

N W E S

0 45 90 180 Feet

MESA II, MINE 4
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/3/2019

Notes:
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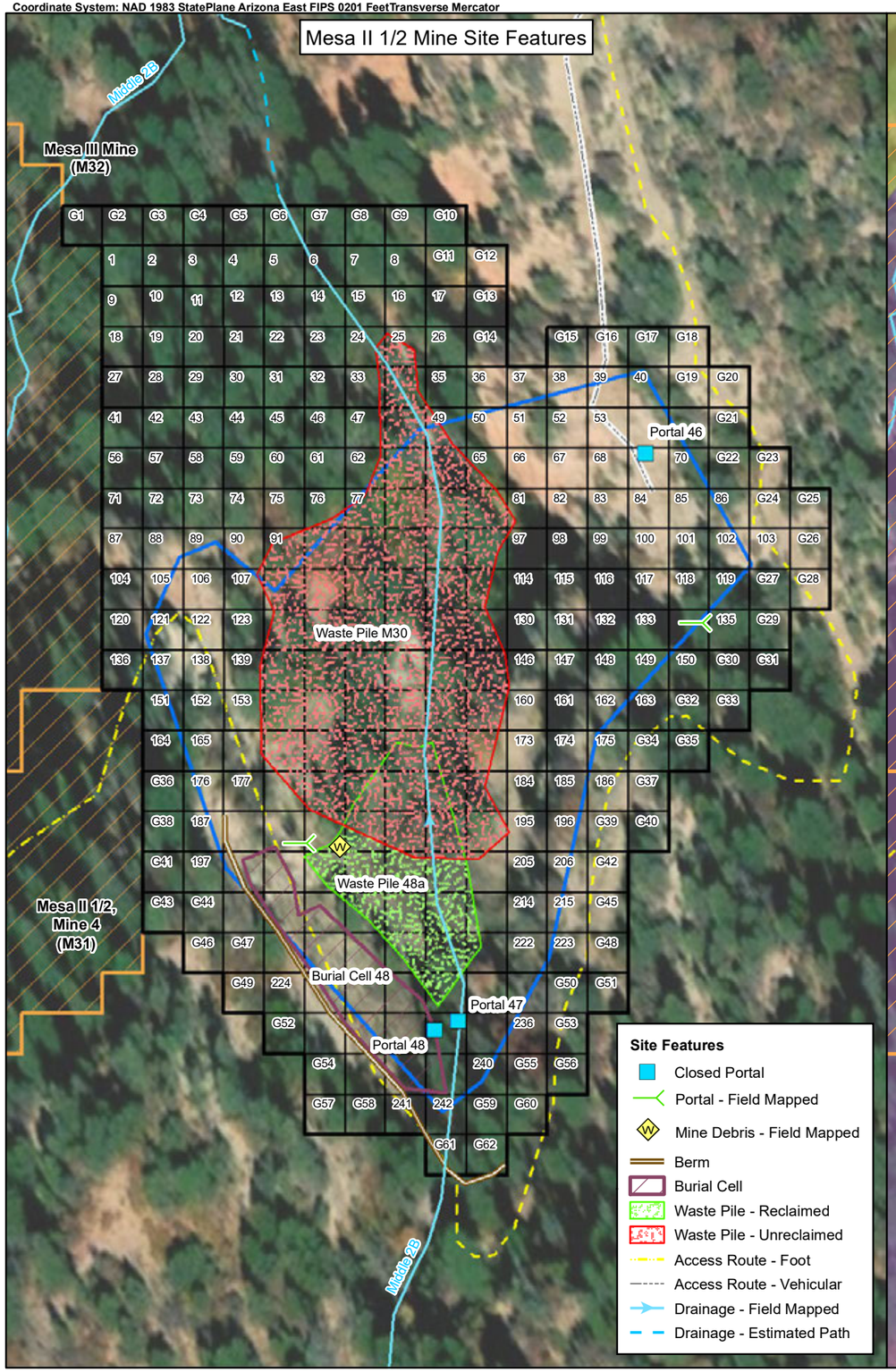
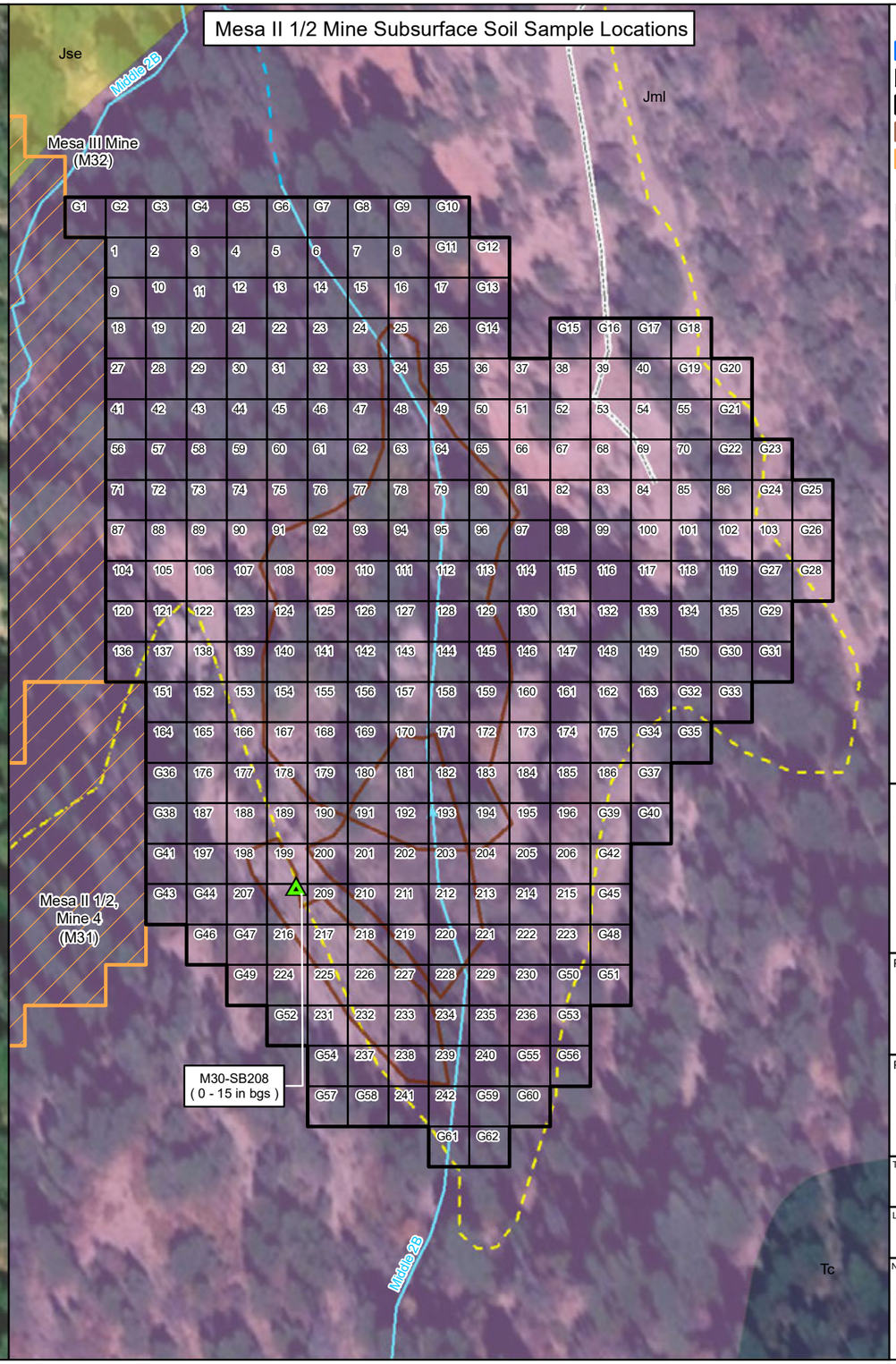
Figure No.: **E-26**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa II 1/2 Mine Site Features



Mesa II 1/2 Mine Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Chuska sandstone - Tc
- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M30-SB208 = site M30 soil boring collected at survey unit 208. 0 - 15 in bgs = 0 to 15 inches below ground surface.

1 in = 110 ft

1:1,320

0 55 110 220 Feet

N W E S

MESA II 1/2 MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

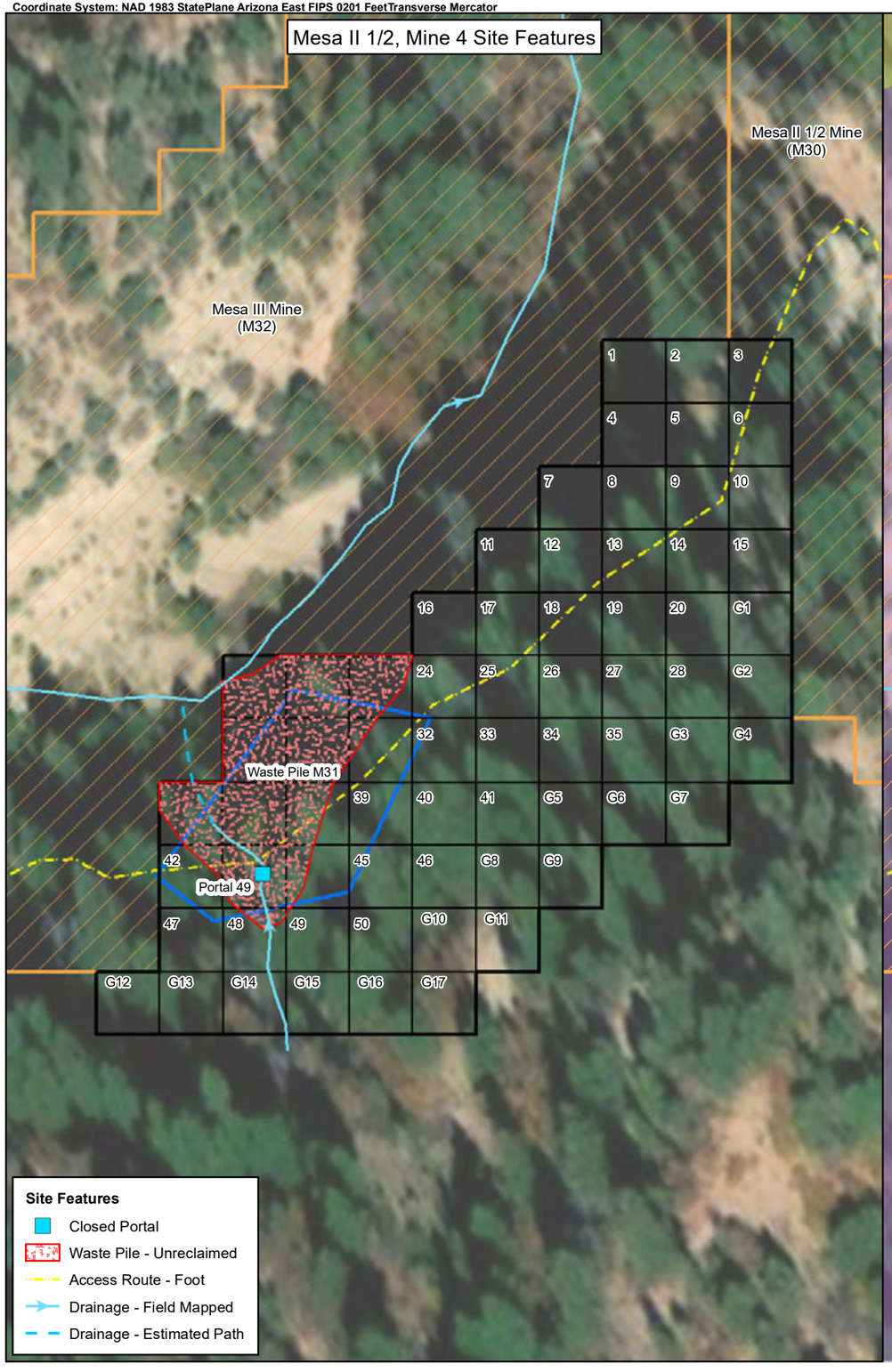
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

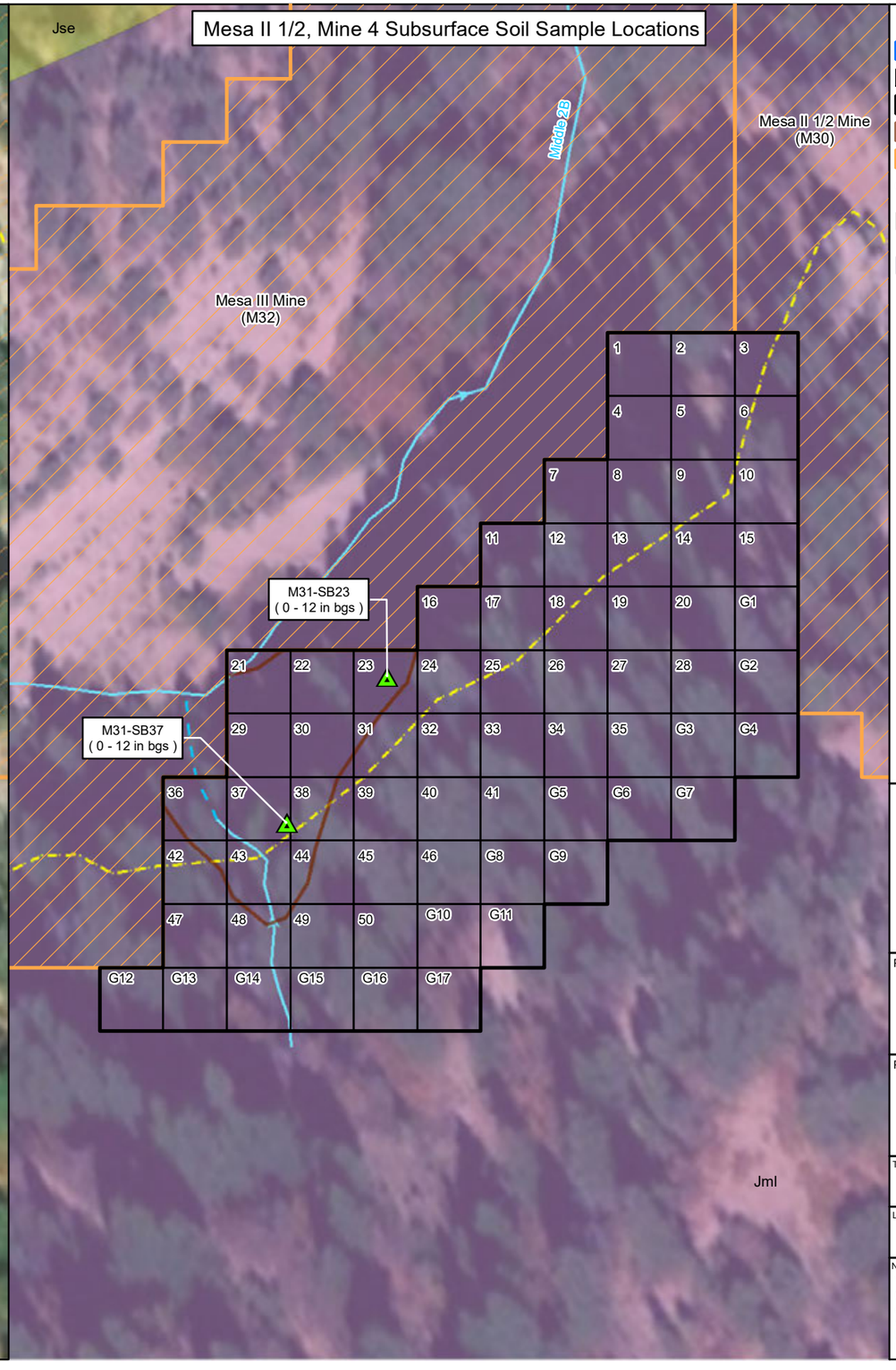
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-27**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator





- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M31-SB23 = site M31 soil boring collected at survey unit 23. 0 - 12 in bgs = 0 to 12 inches below ground surface.

1 in = 70 ft

1:840

N W E S

0 35 70 140 Feet

MESA II 1/2, MINE 4
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-28**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Mesa III Mine Site Features

Mesa III Mine Subsurface Soil Sample Locations

Middle 2B

Mesa II 1/2 Mine (M30)

Mesa II 1/2, Mine 4 (M31)

Waste Pile M32

Portal 51

Prospect 50

Jml

Jse

M32-SB96 (0 - 12 in bgs)

M32-SB89 (0 - 12 in bgs)

Site Features

- Closed Portal
- Closed Prospect
- Waste Pile - Unreclaimed
- Access Route - Foot
- Drainage - Field Mapped
- Drainage - Estimated Path

- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*M32-SB89 = site M32 soil boring collected at survey unit 89. 0 - 12 in bgs = 0 to 12 inches below ground surface.

1 in = 110 ft

1:1,320

N W E S

0 55 110 220 Feet

MESA III MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

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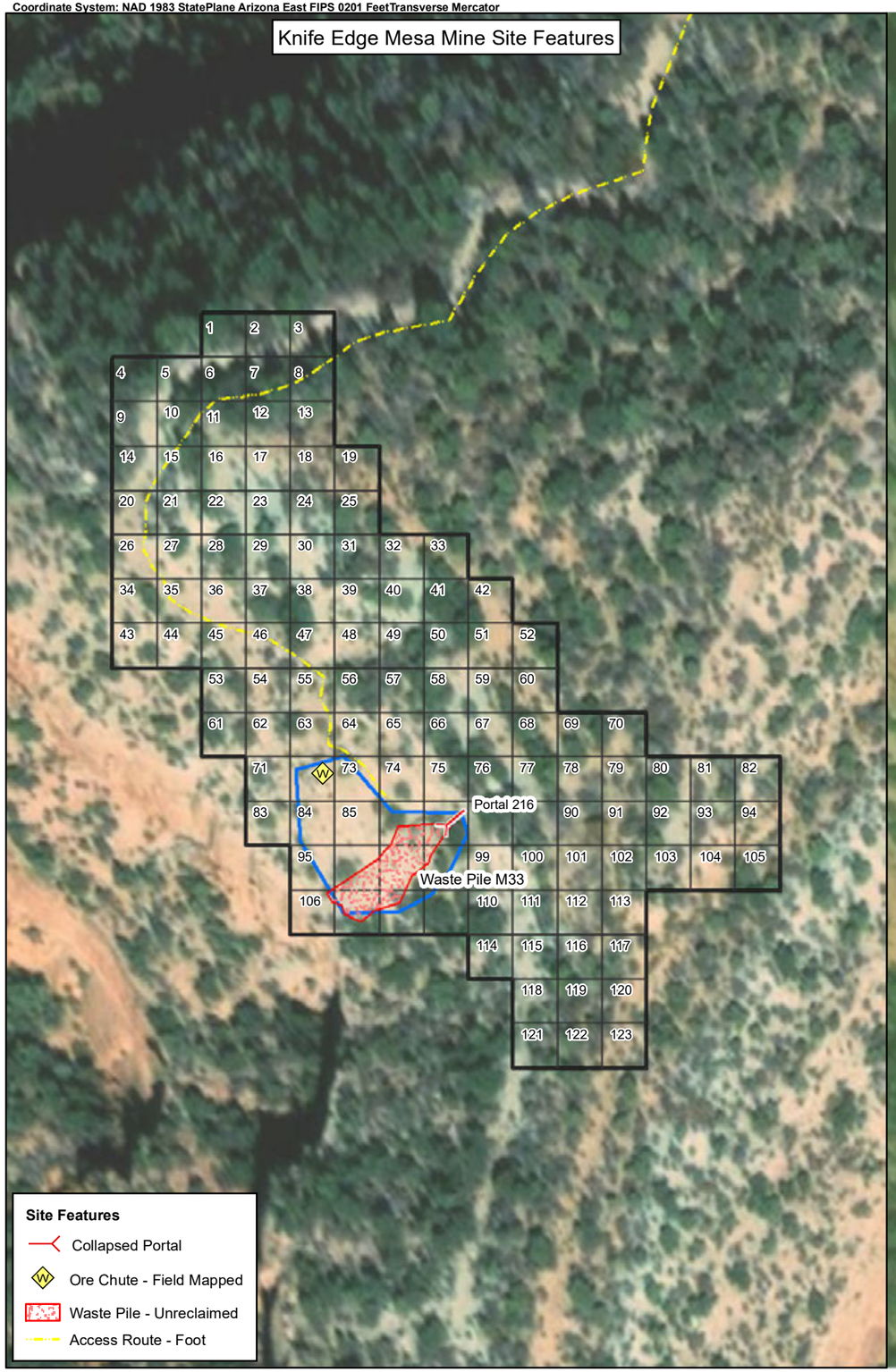
Figure No.: **E-29**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

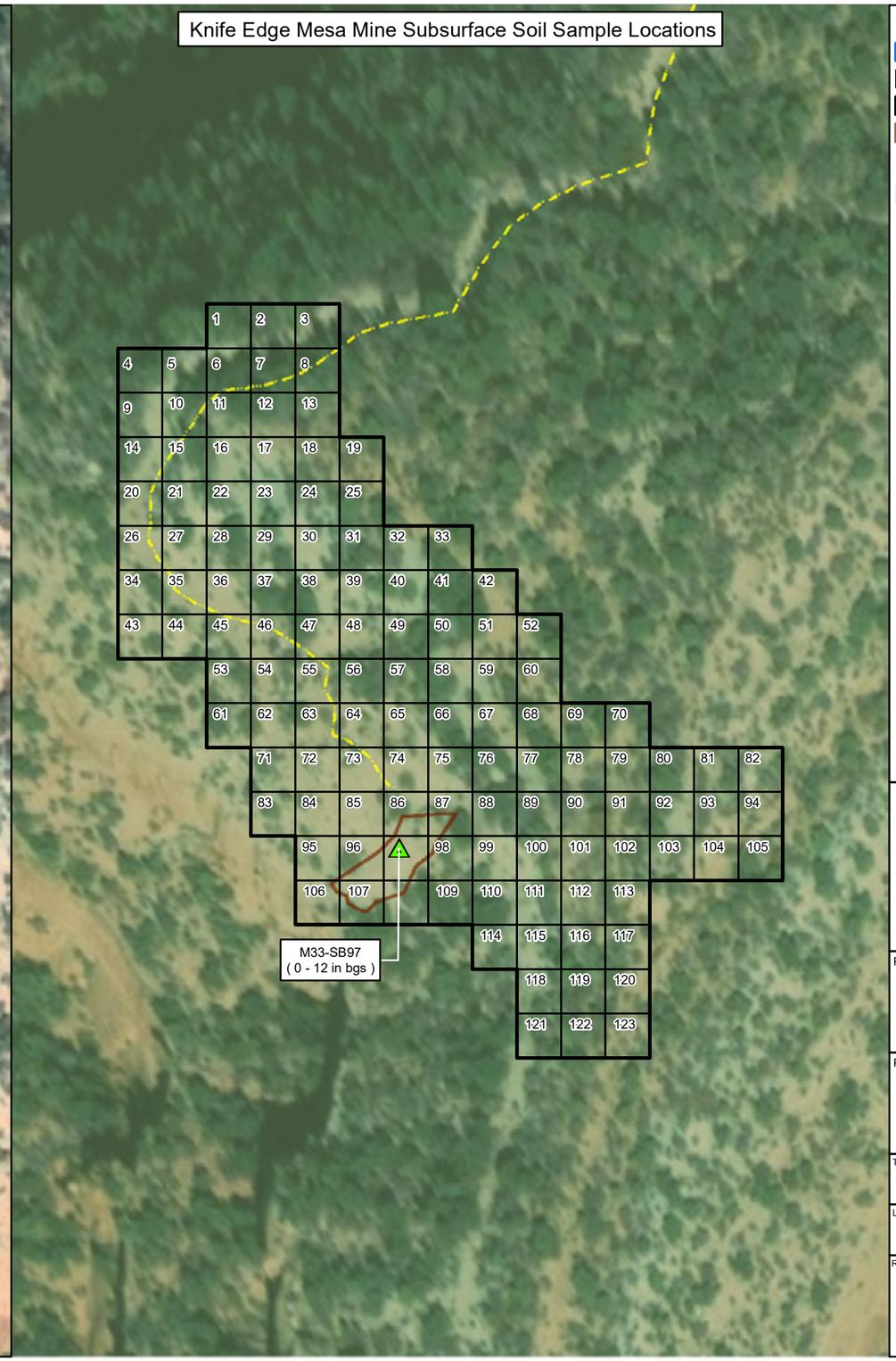
Knife Edge Mesa Mine Site Features



Site Features

- Collapsed Portal
- Ore Chute - Field Mapped
- Waste Pile - Unreclaimed
- Access Route - Foot

Knife Edge Mesa Mine Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary

Geologic Unit**

- Summerville, Todilto, Entrada Formation (Undifferentiated) - Jste

*M33-SB97 = site M33 soil boring collected at survey unit 97. 0 - 12 in bgs = 0 to 12 inches below ground surface.

1 in = 100 ft

1:1,200

N W E S

0 50 100 200 Feet

KNIFE EDGE MESA MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

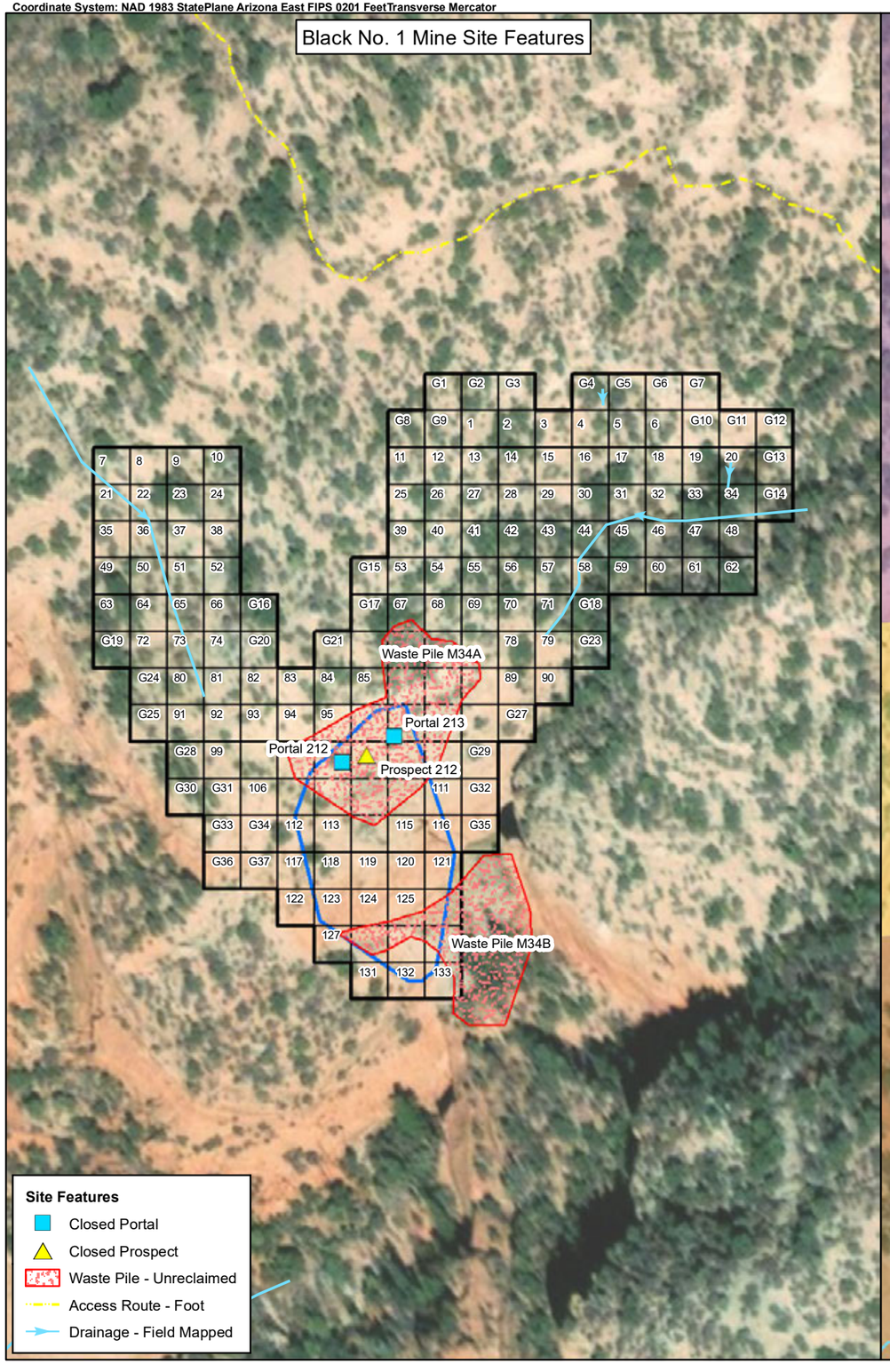
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 7/3/2019

Reference:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-30**

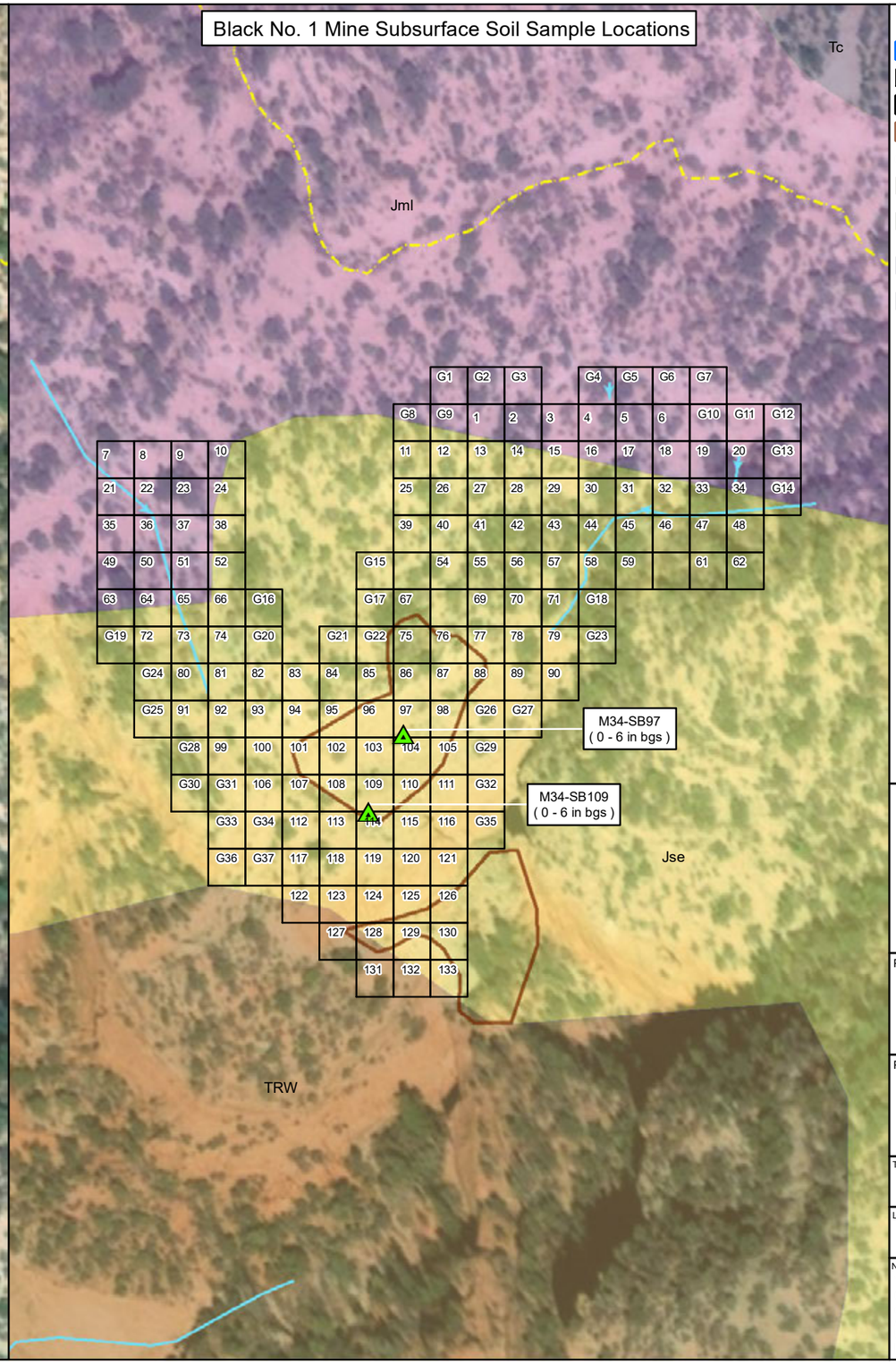
Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Black No. 1 Mine Site Features



Site Features
- Closed Portal
- Closed Prospect
- Waste Pile - Unreclaimed
- Access Route - Foot
- Drainage - Field Mapped

Black No. 1 Mine Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell/Waste Pile Boundary

Geologic Unit**
- Chuska sandstone - Tc
- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse
- Wingate Sandstone - TRW

*M34-SB109 = site M34 soil boring collected at survey unit 109. 0 - 6 in bgs = 0 to 6 inches below ground surface.

1 in = 120 ft

1:1,440

N W E S

0 60 120 240 Feet

BLACK NO. 1 MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

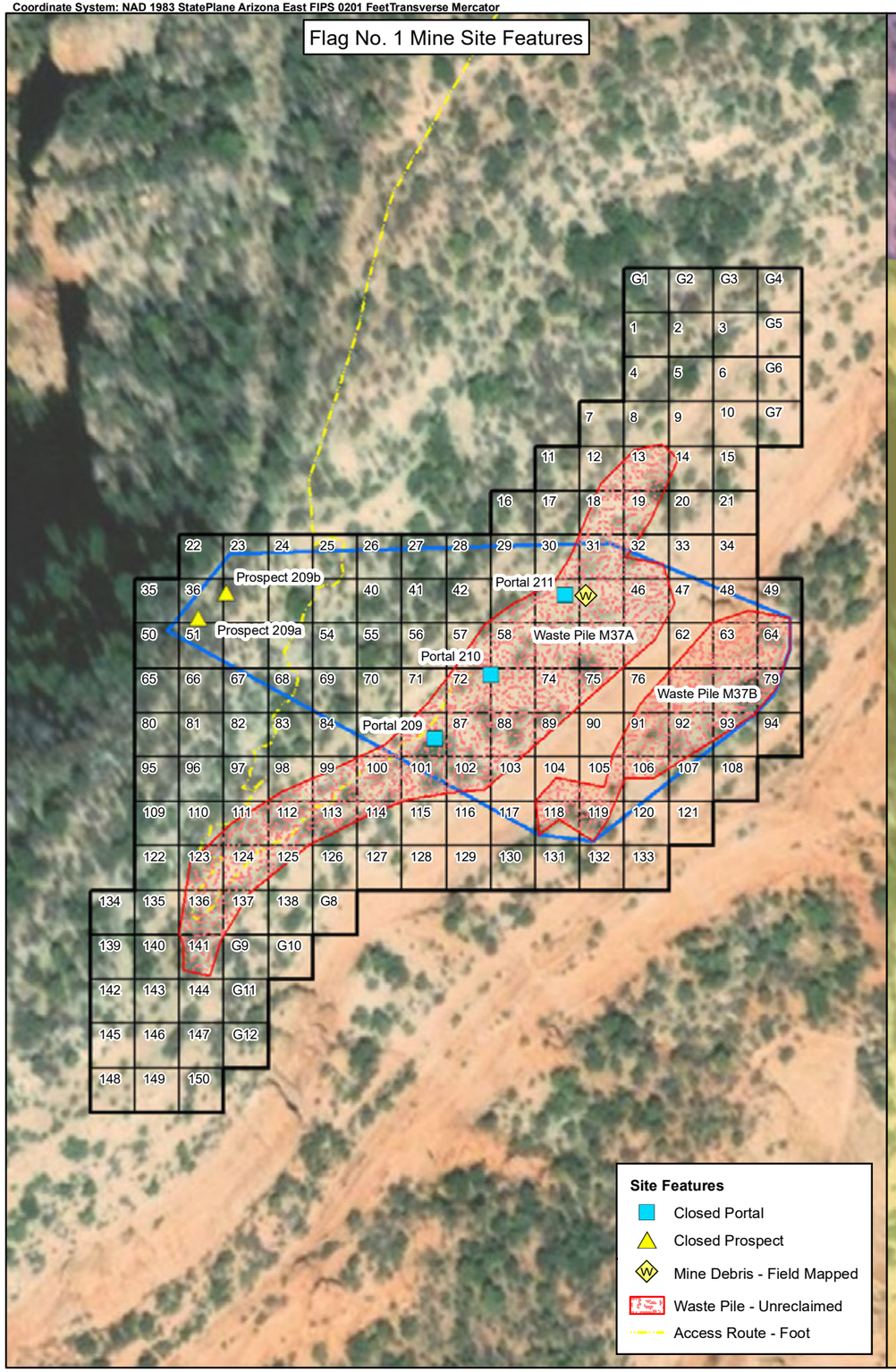
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-31**

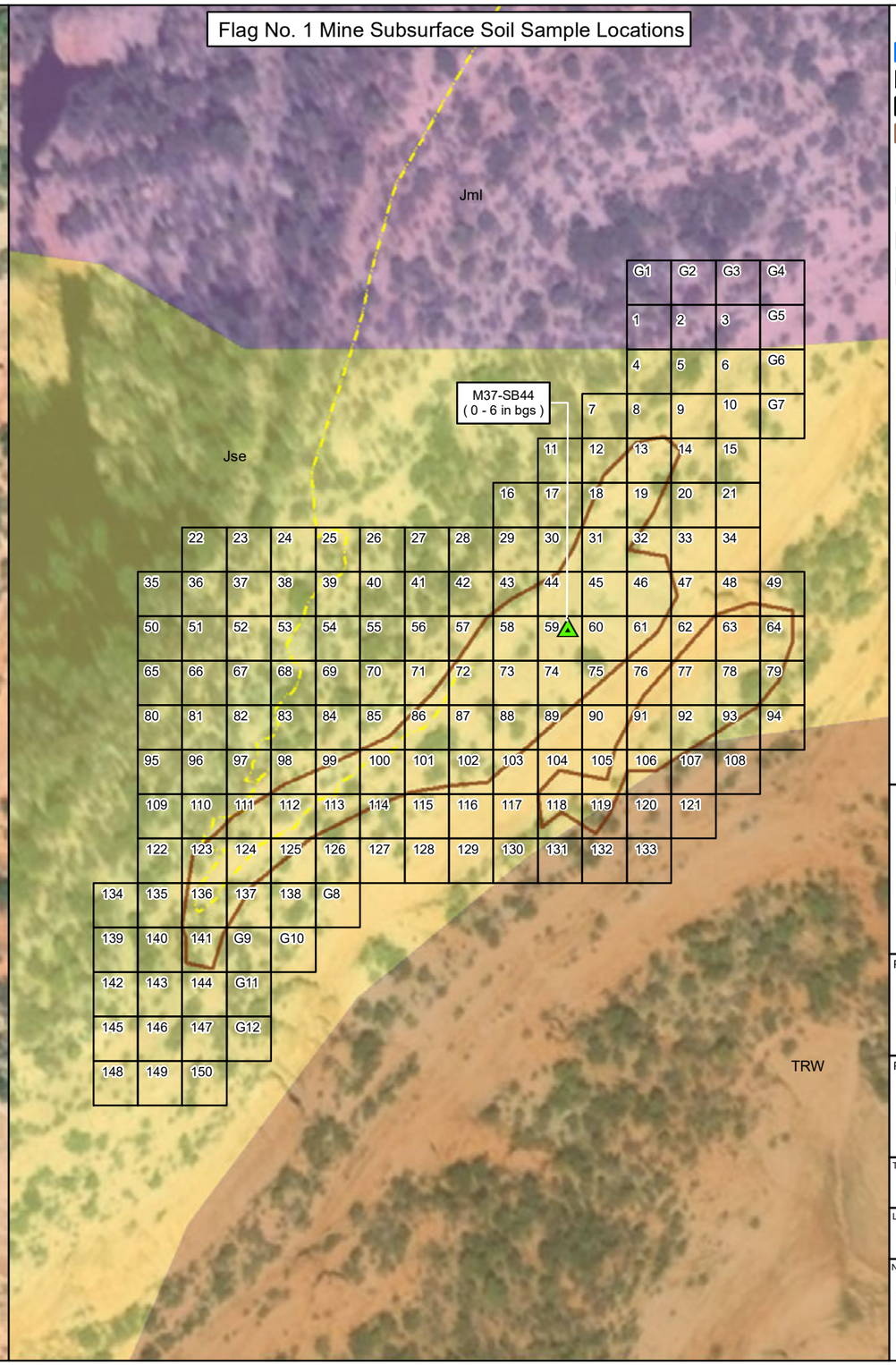
Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Flag No. 1 Mine Site Features



Site Features
- Closed Portal
- Closed Prospect
- Mine Debris - Field Mapped
- Waste Pile - Unreclaimed
- Access Route - Foot

Flag No. 1 Mine Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary

Geologic Unit**
- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse
- Wingate Sandstone - TRW

*M37-SB44 = site M37 soil boring collected at survey unit 44. 0 - 6 in bgs = 0 to 6 inches below ground surface.

1 in = 100 ft

1:1,200

N W E S

0 50 100 200 Feet

FLAG NO. 1 MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

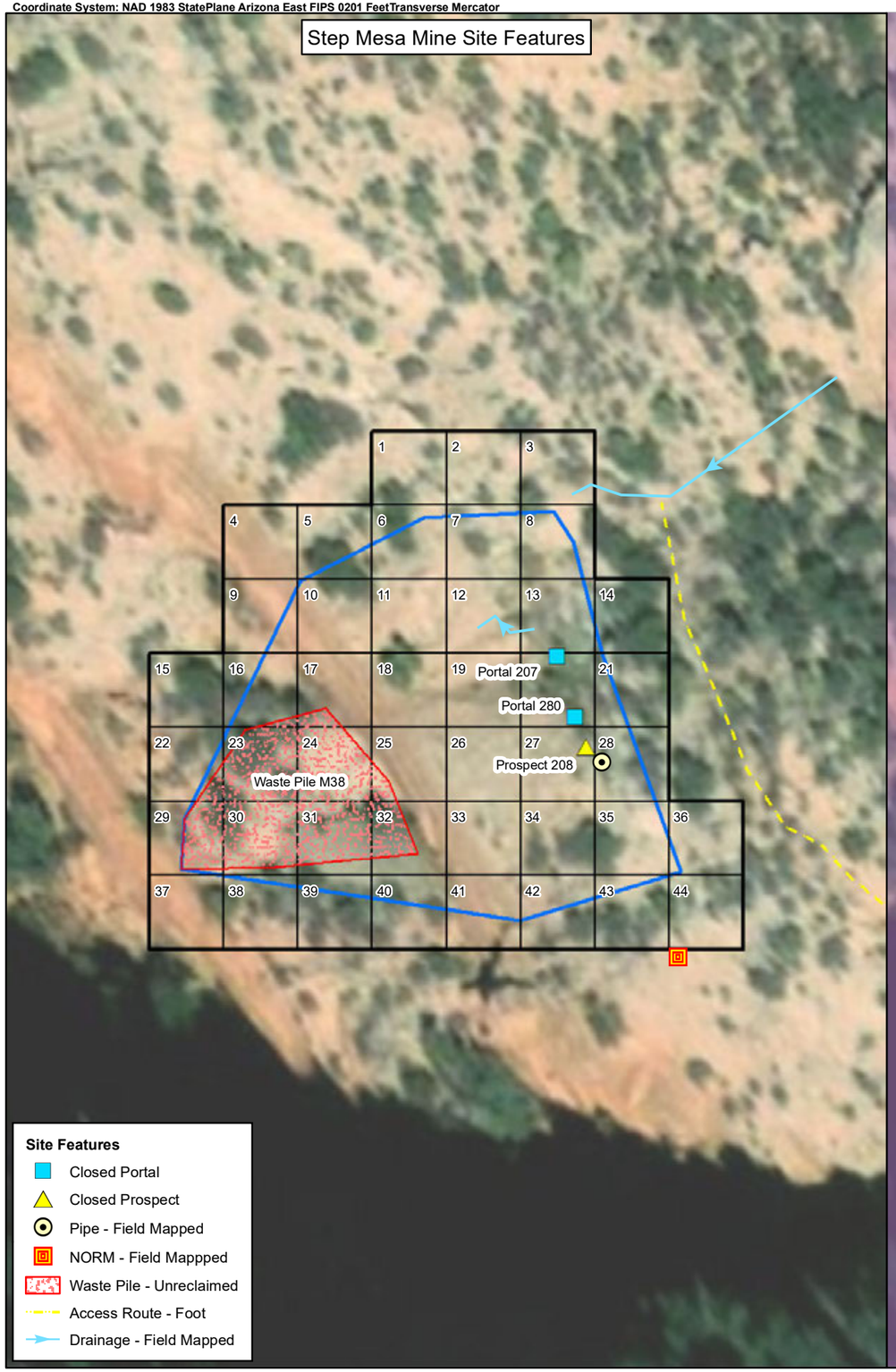
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-32**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

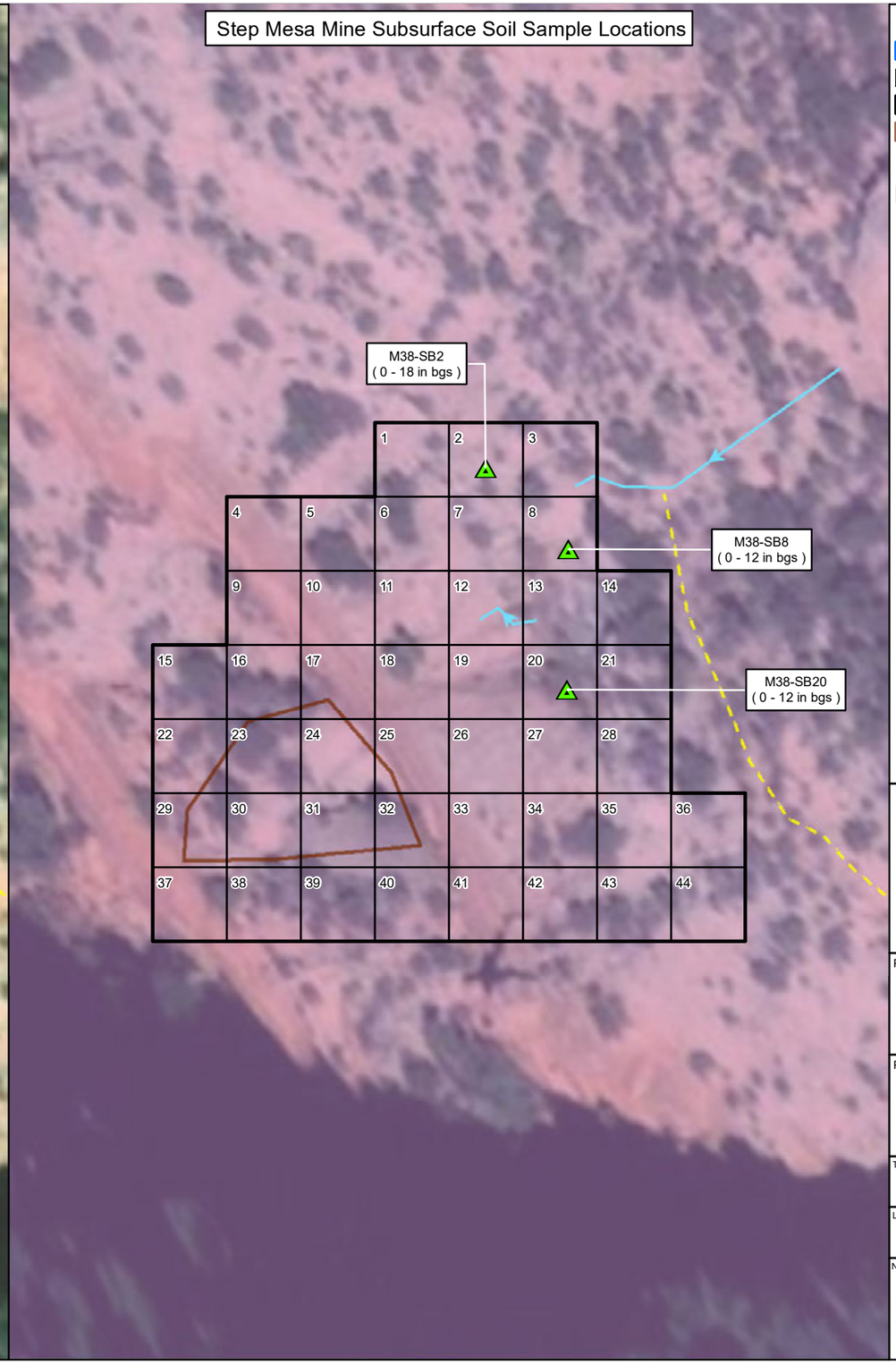
Step Mesa Mine Site Features



Site Features

- Closed Portal
- Closed Prospect
- Pipe - Field Mapped
- NORM - Field Mappped
- Waste Pile - Unreclaimed
- Access Route - Foot
- Drainage - Field Mapped

Step Mesa Mine Subsurface Soil Sample Locations



- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell/Waste Pile Boundary

Geologic Unit**

- Morrison Formation (Lower) - Jml

*M38-SB20 = site M38 soil boring collected at survey unit 20. 0 - 12 in bgs = 0 to 12 inches below ground surface.

1 in = 60 ft

1:720

N W E S

0 30 60 120 Feet

STEP MESA MINE
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

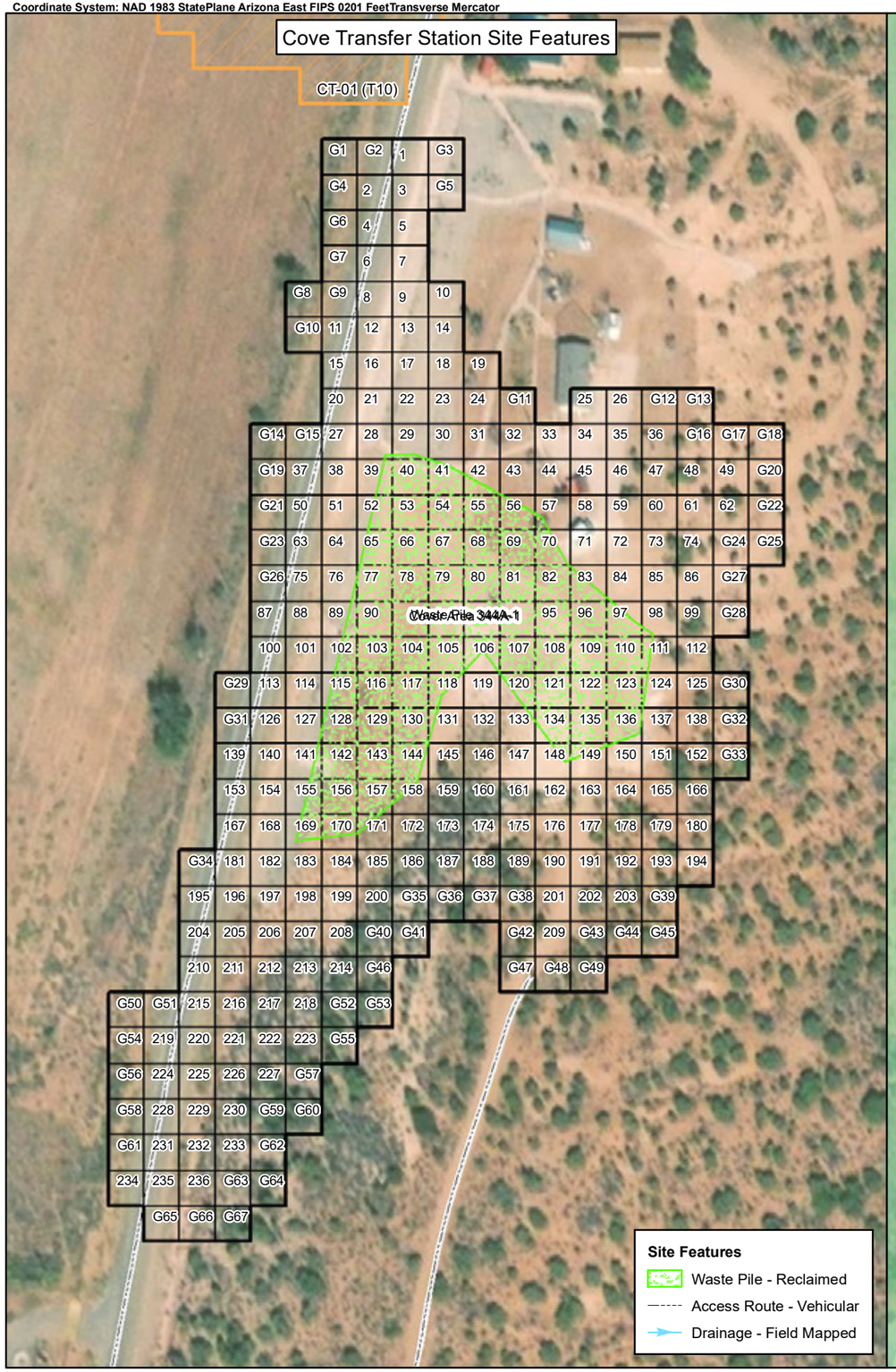
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

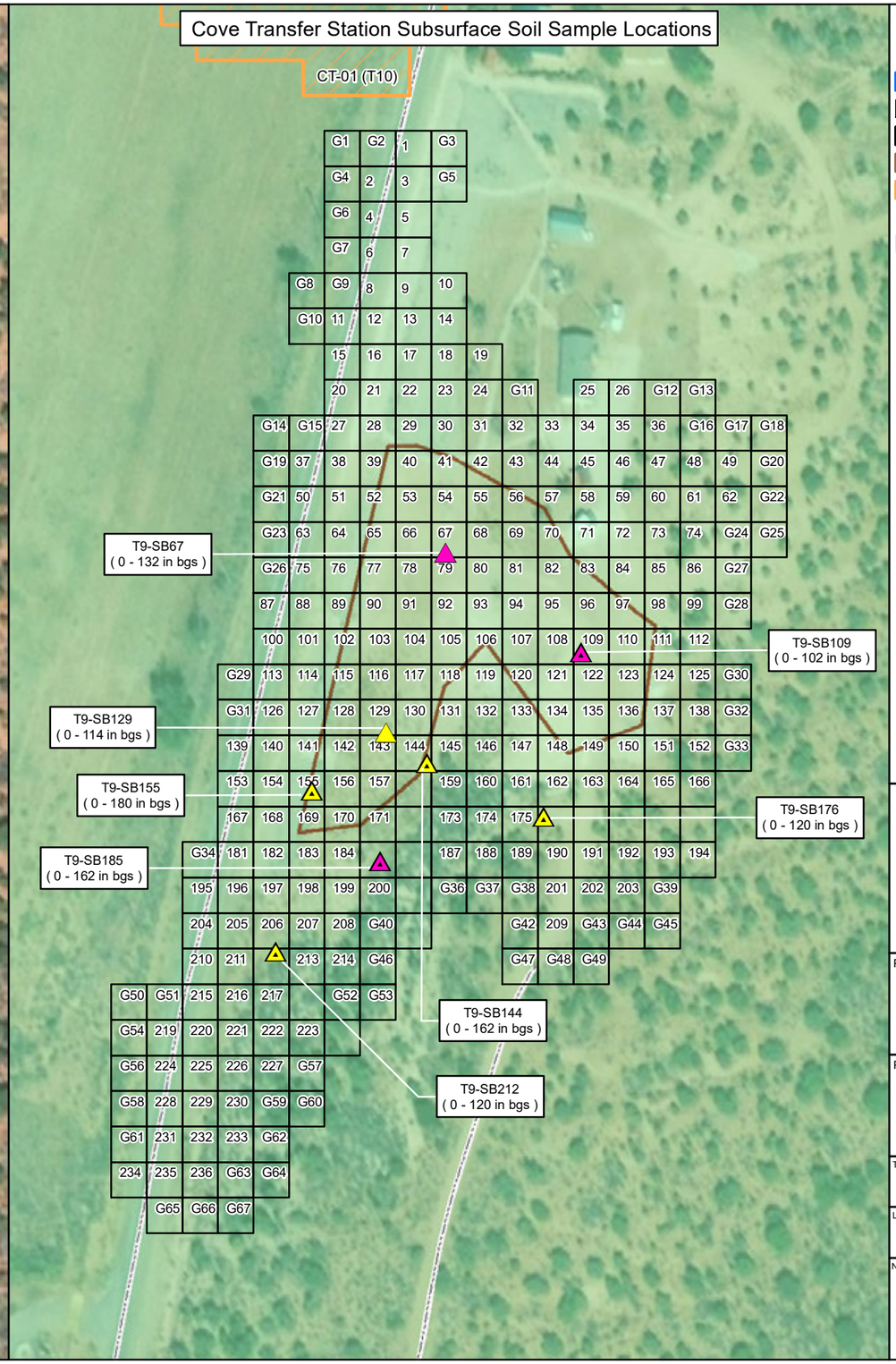
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-33**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator





- Geotechnical Sampling and Drilling Location*
- Geotechnical Drilling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary
- Other Survey Area

Geologic Unit**

- Chinle Formation - TRC

*T9-SB185 = site T9 soil boring collected at survey unit 185. 0 - 162 in bgs = 0 to 162 inches below ground surface.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE TRANSFER STATION GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

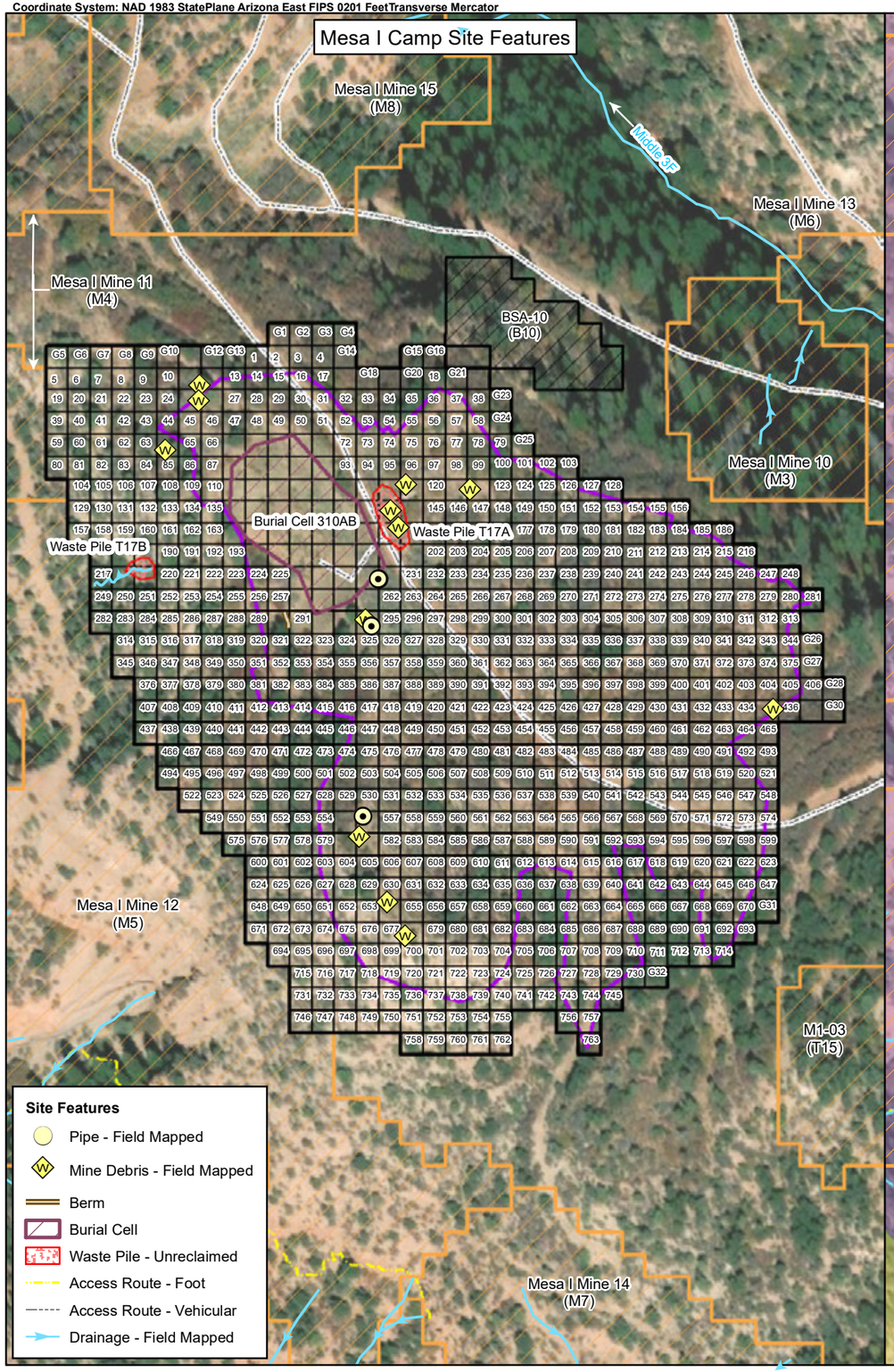
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-34**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

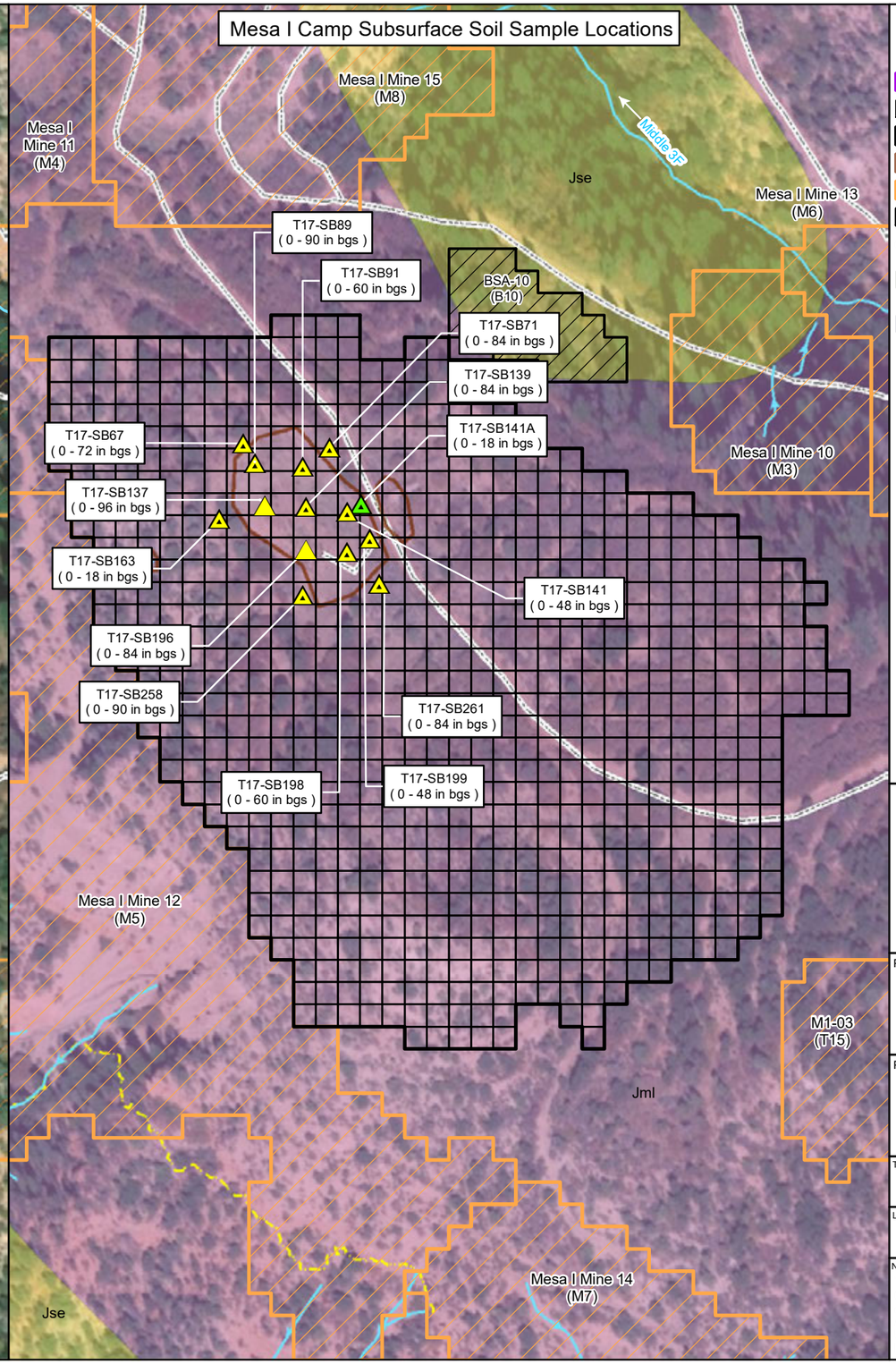
Mesa I Camp Site Features



Site Features

- Pipe - Field Mapped
- Mine Debris - Field Mapped
- Berm
- Burial Cell
- Waste Pile - Unreclaimed
- Access Route - Foot
- Access Route - Vehicular
- Drainage - Field Mapped

Mesa I Camp Subsurface Soil Sample Locations



- Geotechnical Sampling and Drilling Location*
- Geotechnical Drilling Location*
- AUM Related Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell / Waste Pile Boundary
- Other Survey Area
- Background Location

Geologic Unit**

- Morrison Formation (Lower) - Jml
- Summerville, Entrada Formation (Undifferentiated) - Jse

*T17-SB89 = site T17 soil boring collected at survey unit 89. 0 - 90 in bgs = 0 to 90 inches below ground surface.

1 in = 200 ft

1:2,400

N W E S

0 100 200 400 Feet

MESA I CAMP
GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

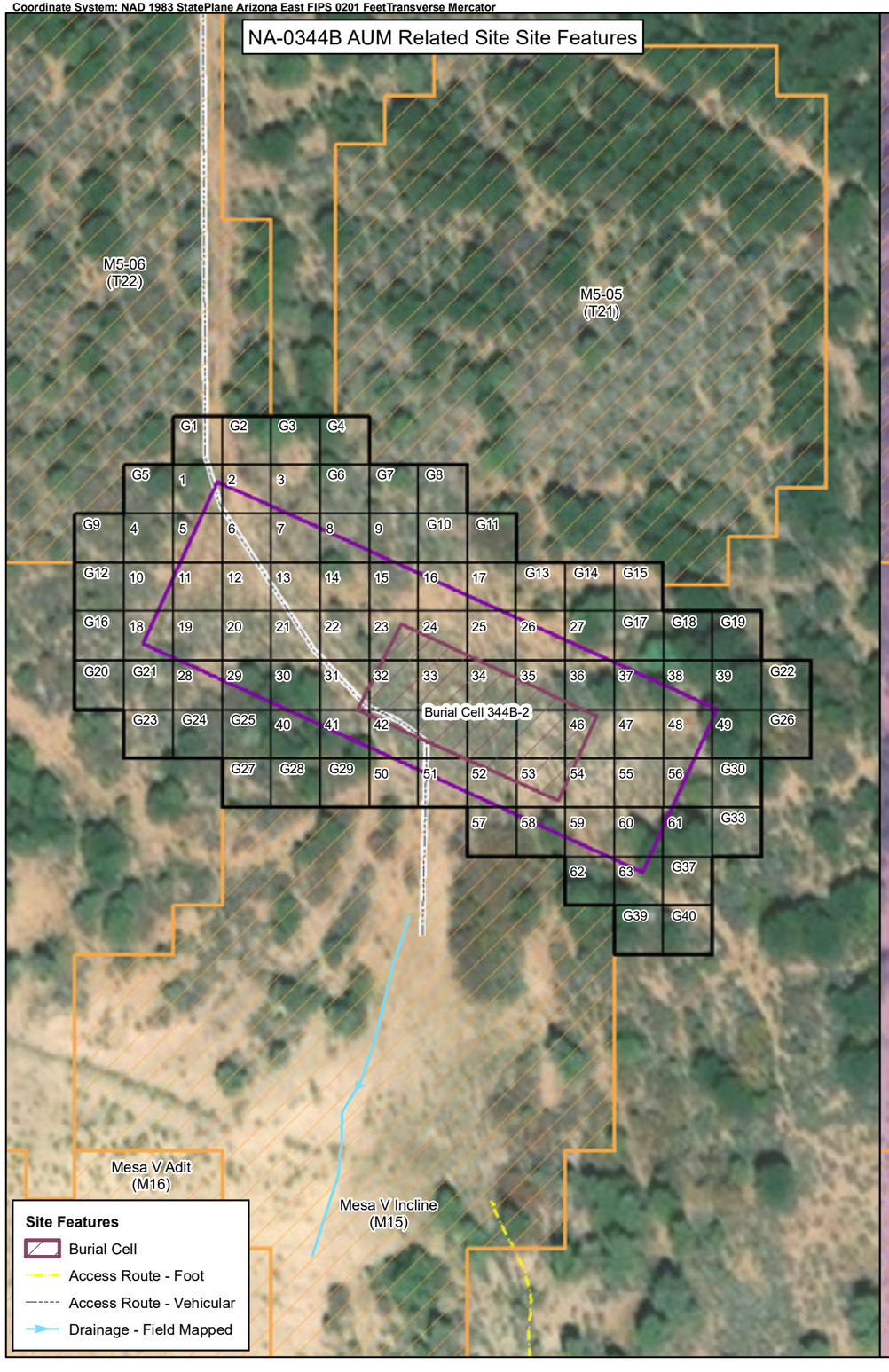
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

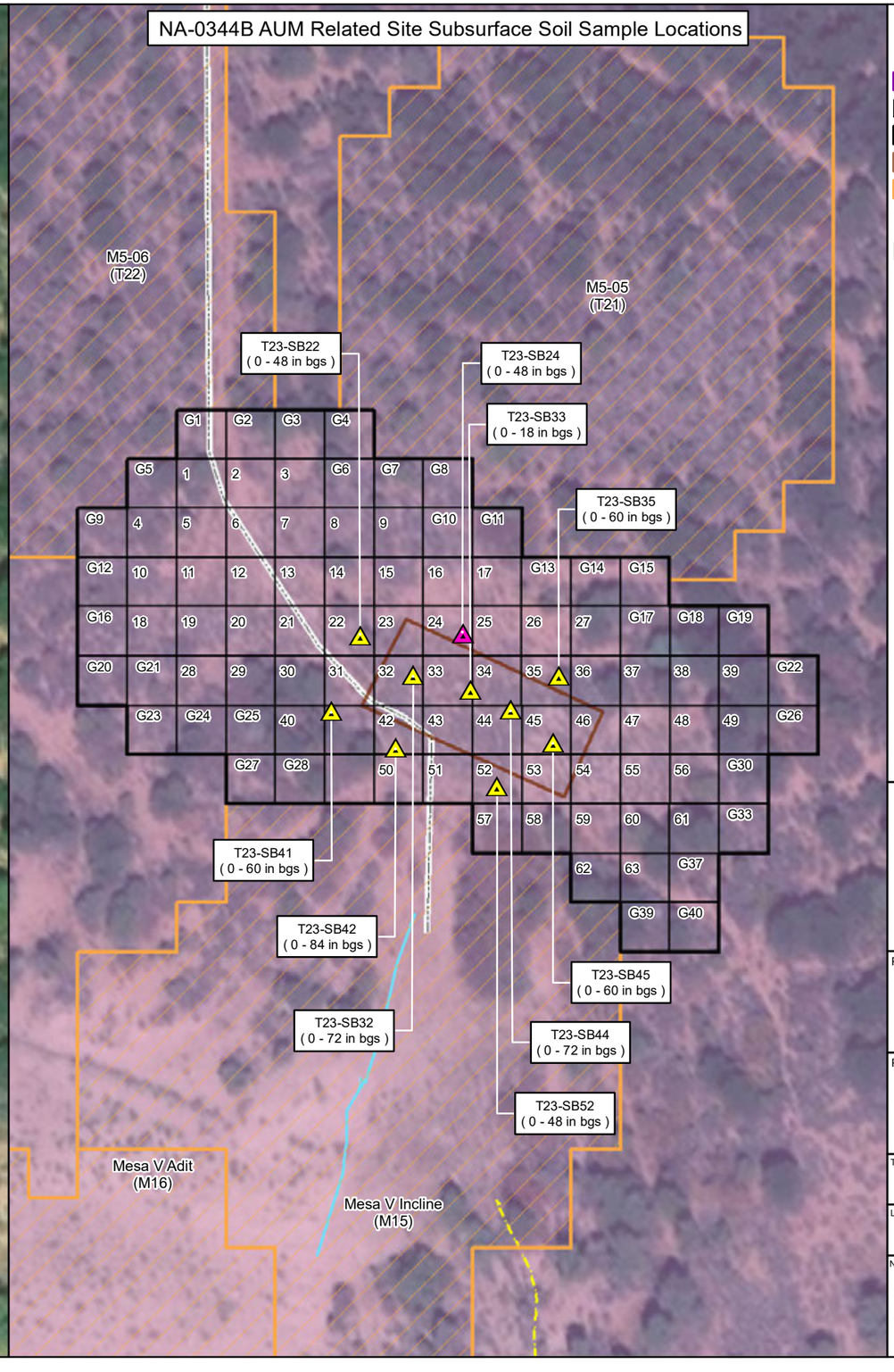
Figure No.: **E-35**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

NA-0344B AUM Related Site Site Features



NA-0344B AUM Related Site Subsurface Soil Sample Locations



- Geotechnical Sampling and Drilling Location*
- Geotechnical Drilling Location*
- AUM Related Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Burial Cell Boundary
- Other Survey Area

Geologic Unit**

- Morrison Formation (Lower) - Jml

*T23-SB44 = site T23 soil boring collected at survey unit 44. 0 - 72 in bgs = 0 to 72 inches below ground surface.

1 in = 90 ft

1:1,080

0 45 90 180 Feet

N W E S

NA-0344B AUM RELATED SITE GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

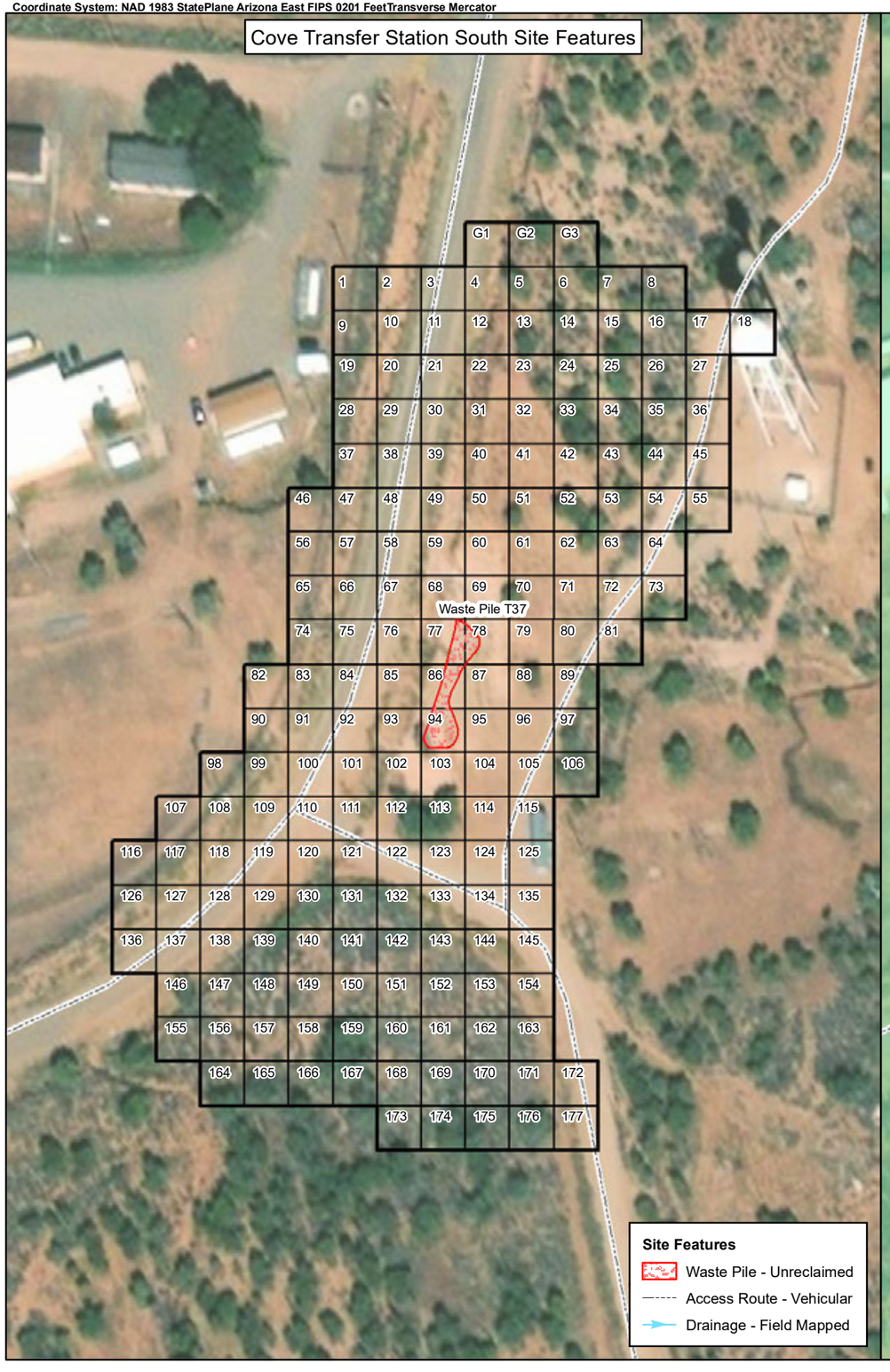
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-36**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

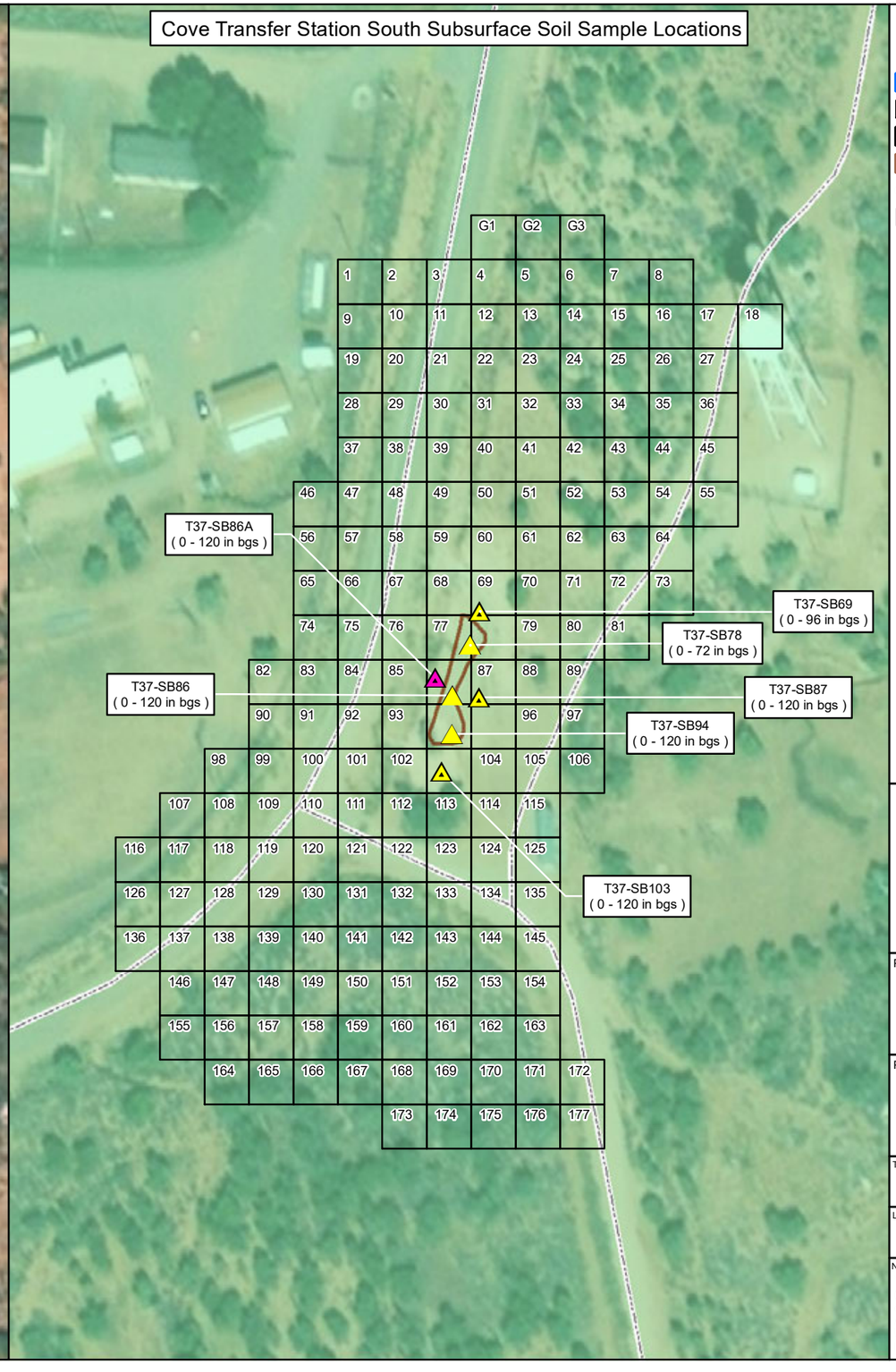
Cove Transfer Station South Site Features



Site Features

- Waste Pile - Unreclaimed
- Access Route - Vehicular
- Drainage - Field Mapped

Cove Transfer Station South Subsurface Soil Sample Locations



- Geotechnical Sampling and Drilling Location*
- Geotechnical Sampling Location*
- AUM Site Boundary
- Survey Unit (100 m²)
- Survey Area Boundary
- Waste Pile Boundary

Geologic Unit**

- Chinle Formation - TRC

*T37-SB86 = site T37 soil boring collected at survey unit 86. 0 - 120 in bgs = 0 to 120 inches below ground surface.

1 in = 100 ft

1:1,200

N W E S

0 50 100 200 Feet

COVE TRANSFER STATION SOUTH GEOTECHNICAL INVESTIGATION MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/3/2019

Notes:
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

Figure No.: **E-37**

ATTACHMENT E1

BORING LOGS

Tetra Tech EMI
1999 Harrison St, Suite 500
Oakland, CA 94612
Telephone: 510-302-6300

BOREHOLE ID: M02-05

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/17/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.915295 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.282974 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		460 1430		**SILTY SAND** brown to light brown, fine grained, dry
5		1398 920 1614		
		1350 1498	7.5	**SILTY SAND** brown, stratified layers, damp
10		1618 1056 1722 1838		
		1814 1918	13.5	**SANDSTONE** Gray to white, poorly sorted, dry, weathered top 12"
15		1198 3312	15.0	Borehole terminated at 15.0 ft.

BOREHOLE/TP/WELL - W/GAMMA RAES T01_MASTER.GPJ LAB SUMMARY.GDT 6/24/19

Tetra Tech EMI
1999 Harrison St, Suite 500
Oakland, CA 94612
Telephone: 510-302-6300

BOREHOLE ID: M02-12

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/17/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.915069 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.282947 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		1382		**SILTY SAND** light brown to red, very fine grained, non-plastic, dry
		1596		3.0 **SILTY SAND** light brown to tan, stratified lenses, fine to very fine grained
5		1292		4.5 **SILTY SAND** very fine, uniform, dense, damp
		1008		
		1480		
		1410		
		1478		Moist throughout sample
		1444		
10		980		10.5 Stratified layers, moist
		1718		**WEATHERED SANDSTONE**
		1752		12.0 tan to brown, well stratified
		1608		**SANDSTONE** gray to white, poorly sorted, non-plastic, dry
		1712		auger refusal at 14.5'
		1152		14.5
		2766		Borehole terminated at 14.5 ft.

Tetra Tech EMI
1999 Harrison St, Suite 500
Oakland, CA 94612
Telephone: 510-302-6300

BOREHOLE ID: M02-23

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/17/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914804 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.283402 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0		61113 91211	LL = NP PI = NP Fines = 17.3%		**SILTY SAND** Brown to red, fine grained, dry
5		121823			Moist
		51311			Uniform layers, dry
		587			
		7910			
10		81011			Stratified layers, damp
		71728			Weathered sandstone, dry
12.0					**WEATHERED SANDSTONE** Gray to tan cobbles, well sorted
		162124			
15				15.0	Borehole terminated at 15.0 ft.

Tetra Tech EMI
1999 Harrison St, Suite 500
Oakland, CA 94612
Telephone: 510-302-6300

BOREHOLE ID: M02-37

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/16/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914654 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.283635 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		747		**SILTY SAND** Light brown to red, fine grained, non-plastic, loose, dry
		1544		
		1682		
5		1220		Defined stratification
		1522		
		1686		
		1690		
		1624		
10		1122		
		1782		Well stratified, dry to damp
		1988		
		2012		Very well packed, damp
		1910		
15		1248	14.8 / 15.0	**WEATHERED SANDSTONE** Gray to light brown, poorly sorted cobbles
		3206		Borehole terminated at 15.0 ft.

Tetra Tech EMI
1999 Harrison St, Suite 500
Oakland, CA 94612
Telephone: 510-302-6300

BOREHOLE ID: M02-40

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/17/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914646 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.283240 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				**SILTY SAND**
		1332		fine grained, well sorted, non-plastic, dry
		1034		
5		1324		
		1424		
		1530		Sandstone seams present (small diameter)
		1536		
		1272		Stratified layers present
		1528		
10				
		1628		
		1670		12.0
		1568		**SANDSTONE**
		1462		gray to tan, poorly sorted gravel, low plasticity, dry, heavily weathered, well stratified upper 4"
		2860		13.5
				Borehole terminated at 13.5 ft.

Tetra Tech EMI
1999 Harrison St, Suite 500
Oakland, CA 94612
Telephone: 510-302-6300

BOREHOLE ID: M02-50

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/17/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914549 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.283157 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		908		**SILTY SAND** fine grained, non-plastic, dry
		1390		
5		1444		
		1424		Damp to moist
		1526		Dry
		966		
		1470		
		1480		
10				
		1610	10.5	Well stratified
		1702		**SANDSTONE**
		1218	12.0	
		3330		Borehole terminated at 12.0 ft.
		5634		

Tetra Tech EMI
1999 Harrison St, Suite 500
Oakland, CA 94612
Telephone: 510-302-6300

BOREHOLE ID: M02-51

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/17/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914576 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.282938 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			**SILTY SAND** fine grained, non-plastic, dry
5			Damp to moist Minor stratification
10			Evidence of weathered shale
10.5			**WEATHERED SANDSTONE** gray to white, fine to medium grained, non-plastic, dry Well stratified
15.0			Auger refusal at 14.5'
			Borehole terminated at 14.5 ft.

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BOREHOLE ID: M02-55

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/16/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914488 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.283546 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		6588		**SILTY SAND** light brown to red, very fine grained, non-plastic, dry
		4794		
		8290		
5		9852		
		11148		6.0
		23868		**POORLY GRADED SAND** gray to tan, non-plastic, mottled sandstone gravel-cobbles, dry
		17508		
		20232		Mottled pockets of native soil
10		24752		
		33694		
		32874		12.0
		21784		**SILTY SAND** red to brown, gray waste material, fine grained, non-plastic, dry
		17400		13.5
		13762		Borehole terminated at 13.5 ft.

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BOREHOLE ID: M02-59

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/17/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914425 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.283028 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				**SILTY SAND**
		1368		light brown to red, fine grained, non-plastic, dry
		1356		
5		1472		
		1014		Moist
		1406		
		1510		
		1374		Damp to moist
		1352		
10				
		1044		
		1730		Well stratified
		1680		Light gray to white weathered sandstone, poorly sorted, non-plastic, dry, weathered
		1734		13.5
		1856		**SANDSTONE**
15		1354		15.0
		3760		Borehole terminated at 15.0 ft.

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BOREHOLE ID: M02-63A

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/16/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914402 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.283847 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		1492		**SILTY SAND** red to light brown, fine grained, dry, non-plastic
		1310		
5		1452		Minor stratification
		1130		
		1438		Stratified, dry to moist
		1490		
		1506		
		1598		
10		1216		
		1752		
		1752		
				13.0
		1702		13.5 **WEATHERED SANDSTONE**
		1926		14.0 fractures, poorly sorted
		1436		**SANDSTONE** auger refusal in sandstone
				Borehole terminated at 14.0 ft.

BOREHOLE/TP/WELL - W/GAMMA RAES T01_MASTER.GPJ LAB SUMMARY.GDT 6/24/19

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BOREHOLE ID: M02-73

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/16/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914317 N** **LOGGED BY: J. Bekis**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.283452 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				0.5 **SILTY SAND** light brown, very fine grained sands and silt, organic debris, non-plastic, dry
		4698		
		7152		**SILTY SAND** light brown, very fine grained sands, non-plastic, dry
		4790		
		7868		
5		9734		Mottled light tan
		15322		6.0 Poorly graded sandstone gravel
				SILTY SAND
		18672		7.5 brown to reddish brown, mottled, light brown to gray last 4" (possible waste rock), dry
		22358		**GRAVEL** gray, white, poorly sorted gravel
		33706		
10		38160		Last 4" black to brown to red native formations
		31776		10.5
		12232		**SILTY SAND** red to brown, stratified layer, non-plastic, dry
		6314		
		8156		
		7366		13.5
				Borehole terminated at 13.5 ft.

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BOREHOLE ID: M02-77

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/16/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914302 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.282994 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				**SILTY SAND**
		2116		Light brown to red, fine graded, dry, root debris
				No root debris
		1478		
		1462		
5		920		Stratification present from 1.5' - 7.5'
		1444		
		1526		
		1470		Very fine grained
		1514		
10		1108		Very dense, damp
		1502		
		1698		
				Evidence of weathered sandstone
		1648		13.5
		1438		**WEATHERED SANDSTONE**
15		1180		Poorly graded, light brown to gray brown
		3341		15.0
				Borehole terminated at 15.0 ft.

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BOREHOLE ID: M02-81

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/16/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.914208 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.283356 W** **DRILLED BY: Resilient**

Notes: Block K

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		1398		**SILTY SAND** brown to red fine grained, non-plastic, well sorted, dry
		1418		
		1490		
5		1002		
		1460		
		1486		
		1510		
		1506		
10		1090		
		1948		10.5 **WEATHERED BEDROCK** light brown to gray, non-plastic, fine to medium grain, dry
		1928		
		1986		
		1958		13.5
		1442		Borehole terminated at 13.5 ft.

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BOREHOLE ID: M06-109

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/27/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523842 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.218134 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 13

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			**SILTY SAND**
			brown to reddish brown, fine grained, non-plastic, dry
			Poorly sorted sandstone cobbles
			No sandstone cobbles present
5			
		6.0	Trace white dry sandstone gravel
			DPT refusal at 6'
			Borehole terminated at 6.0 ft.

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BOREHOLE ID: M06-140

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/27/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523668 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.218094 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 13

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			**SILTY SAND** brown, fine grained, non-plastic, dry Poorly sorted sandstone gravel
4.5			Gravel throughout interval Gray to grayish brown; DPT refusal at 4.5' Borehole terminated at 4.5 ft.

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BOREHOLE ID: M06-142

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/27/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523643 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217933 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 13

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			**SILTY SAND**
			brown to reddish brown, fine grained, non-plastic, dry
			Poorly graded dark gray gravel
5			Gray to light gray, course
			Poorly graded sandstone gravel
			8.0
			SILTY SAND
10			brown to grayish brown, poorly sorted gray and grayish green gravel, fine grained, low plasticity, damp
			13.0
			DPT refusal at 13'
			Borehole terminated at 13.0 ft.

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BOREHOLE ID: M06-157

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/27/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523586 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.218006 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 13

DEPTH (ft)	SAMPLE TYPE	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0		LL = 22 PI = 1 Fines = 17.4%		**SILTY SAND** brown to reddish brown, fine grained, non-plastic, dry Poorly sorted dark gravel
5			5.0	Poorly sorted white sandstone pebbles Last 3" white finely grained sandstone; DPT refusal at 5' Borehole terminated at 5.0 ft.

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BOREHOLE ID: M06-174

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/27/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523480 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217881 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 13

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		4244		**SILTY SAND** brown to reddish brown, fine grained, non-plastic, dry Well stratified
5		5582 7205 5885 5107		Poorly sorted white sandstone gravel Damp
6.0				DPT refusal at 6' Borehole terminated at 6.0 ft.

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BOREHOLE ID: M06-190

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/27/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523384 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217749 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 13

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		0.5 **SILTY SAND** brown to reddish brown, fine grained, non-plastic, dry
		6494			1.5 **SILTY SAND** brown to grayish brown, fine grained, poorly sorted white sandstone cobbles, non-plastic, dry
		6324			**SILTY SAND** brown to light brown, fine grained, poorly graded dark gray cobbles, non-plastic, dry
		5452			
5		5156			
		6382			
		6004			7.0 DPT refusal at 7'
		6002			Borehole terminated at 7.0 ft.

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BOREHOLE ID: M08-100

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.525036 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.222499 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 15

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		7780	0.5	**SILTY SAND** light brown to brown, some pieces of gray gravel sized sandstone, non-plastic, dry
		11810	1.5	
		20450		**SILTY SAND** light brown to brown with mottled white and gray fines and gravel sized pieces, non-plastic, dry
		14740		
		9730		**SILTY SAND** light gray, fine grained, non-plastic, dry
		9082		
5				
		9206	8.0	
				SILTY SAND light gray to tan, fine grained, well sorted, non-plastic, dry
10			10.0	DPT refusal at 10'
				Borehole terminated at 10.0 ft.

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BOREHOLE ID: M08-103

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.525055 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.222145 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 15

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		4720 4874 4818 5350 5458		**SILTY SAND** light tan to gray, some white to gray sandstone gravel, non-plastic, dry
4.0				
5		6084		**SILTY SAND** light tan to gray with white sandstone fragments, non-plastic, slightly damp
8.0		5810		DPT refusal at 8' Borehole terminated at 8.0 ft.

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BOREHOLE ID: M08-104

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/27/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.525040 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.222000 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 15

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				**SILTY SAND**
		5106		Brown to reddish brown, fine grained, non-plastic, no cohesion, dry
				Brown to light brown, mottled gray, poorly sorted gravel
		4828		
		4596		
5				
		5292		
		5014		
		5748		Gray to brownish gray, fine grained, non-plastic, dry
10		5126		
		4582		
		4504		
		8950		Poorly sorted sandstone cobbles
		16508		
15		18740		Gray to dark gray, coarse graded
		17144	16.0	
		16788		DPT refusal at 16'
		16474		Borehole terminated at 16.0 ft.

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BOREHOLE ID: M08-106

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/27/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.525008 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221791 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 15

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0		8112	LL = NP PI = NP Fines = 13.2%		**SILTY SAND** brown to reddish brown, fine grained, non-plastic, no cohesion, dry Mottled sandstone gravel, poorly sorted
		6014 6232		4.0	Last 2" white fine to coarse grained sand, well sorted, non-plastic, dry Borehole terminated at 4.0 ft.

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BOREHOLE ID: M08-116

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.524961 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.222301 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 15

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		6318	0.5	**SILTY SAND** light brown to brown, fine grained, non-plastic, dry
		14054		
		21410		**SILTY SAND** light brown to brown with mottled white and gray, non-plastic, slightly damp
		29352		DPT refusal at 3'; auger refusal at 12'
		12588		
5		13628		
		25416		
		14456		
		11678		
10		11280		
		11186		
		12486	12.0	Borehole terminated at 12.0 ft.

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BOREHOLE ID: M08-120

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/27/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.524952 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221814 W** **DRILLED BY: Resilient**

Notes: Mesa I, Mine No. 15

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				**SILTY SAND**
		11710		brown to reddish brown, fine grained, non-plastic, no cohesion, dry
				Poorly graded sandstone cobbles
		7060		
5		5150		Gray to brownish gray
		4798	5.0	
		5024		DPT refusal at 5'
				Borehole terminated at 5.0 ft.

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BOREHOLE ID: M15-03

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.542000 N** **LOGGED BY: J. Bekis**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246388 W** **DRILLED BY: Resilient**

Notes: Mesa V Incline

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		4662 5528 8160 10238		**SILTY SAND** brown, fine grained with sandstone gravel and cobbles, dry
			4.0	
5			5.0	**SILTY SAND** brown to gray sand, fine grained with gravel, moist DPT refusal at 5' Borehole terminated at 5.0 ft.

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BOREHOLE ID: M15-14

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.541812 N** **LOGGED BY: J. Bekis**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246281 W** **DRILLED BY: Resilient**

Notes: Mesa V Incline

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		4792		**SILTY SAND** brown to light brown, fine grained, some sandstone gravel, dry
		5430		1.5 **CLAY** gray to yellow fine grained sand, gray to white sandstone gravels, dry
		8818		
		10976		
5		8866		
		7720		
				6.8
				7.0 **CLAY** dark gray, cohesive
				Borehole terminated at 7.0 ft.

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BOREHOLE ID: M15-23

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.541701 N** **LOGGED BY: J. Bekis**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246403 W** **DRILLED BY: Resilient**

Notes: Mesa V Incline

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		5966		**SILTY SAND** brown, fine grained, with sandstone gravel, dry
1.5				
		7930		**SILTY SAND** gray-yellow sand, fine grained, with poorly sorted sandstone gravel, dry
		6148		
		6112		
5				
6.0				Borehole terminated at 6.0 ft.

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BOREHOLE ID: M15-23A

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.541719 N** **LOGGED BY: J. Bekis**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246338 W** **DRILLED BY: Resilient**

Notes: Mesa V Incline

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		8480	0.5	**SILTY SAND** dark brown to gray, fine grained, dry
		5886	1.5	**CLAYEY SAND** dark brown to gray, fine grained, dry
				DPT refusal at 1.5'
				Borehole terminated at 1.5 ft.

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Telephone: 510-302-6300

BOREHOLE ID: M15-34

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.541682 N** **LOGGED BY: J. Bekis**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246252 W** **DRILLED BY: Resilient**

Notes: Mesa V Incline

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		8702		**SILTY SAND** brown to light brown, fine grained sand with sandstone gravel and fragments, non-plastic, dry
		8750		1.5 **CLAYEY SAND** interbedded gray clay and yellow to brown sand, fine grained, with yellow to brown sandstone gravel, dry
		5990		
		6852		
5		8490		
				7.0 Borehole terminated at 7.0 ft.

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BOREHOLE ID: M18-73

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/13/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.538294 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.254818 W** **DRILLED BY: Resilient**

Notes: Mesa V Mine - 508

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		7422 6746		**SILTY SAND** brown with gravel and cobbles, fine grained, non-plastic, dry
2.0				**SANDSTONE** Gray Borehole terminated at 2.0 ft.

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BOREHOLE ID: M18-74

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/14/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.538292 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.254719 W** **DRILLED BY: Resilient**

Notes: Mesa V Mine - 508

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		7648	0.5	**SILTY SAND** light brown to tan, fine grained, poorly sorted gravel, organic debris, non-plastic, dry
		8228		**SILTY SAND** brown to light brown, fine grained, poorly sorted fine gravel, non-plastic, damp
		6062		
		6166	4.5	
				Borehole terminated at 4.5 ft.

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BOREHOLE ID: M18-76

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/13/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.538288 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.254484 W** **DRILLED BY: Resilient**

Notes: Mesa V Mine - 508

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			**SILTY SAND** brown with gravel and cobbles, fine grained, non-plastic, dry
4.0			**SANDSTONE** tan, medium grained Borehole terminated at 4.0 ft.

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BOREHOLE ID: M18-84

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/14/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.538224 N** **LOGGED BY: M. Sears**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.255118 W** **DRILLED BY: Resilient**

Notes: Mesa V Mine - 508

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		6568 6028 5614 5246		**SILTY SAND** gray to light brown, fine grained, gravel and cobbles, non-plastic, dry
5				5.0 Borehole terminated at 5.0 ft.

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BOREHOLE ID: M18-92

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/13/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.538191 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.254250 W** **DRILLED BY: Resilient**

Notes: Mesa V Mine - 508

DEPTH (ft)	SAMPLE TYPE	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0		LL = NP PI = NP Fines = 22.0%		**SILTY SAND** tan to light brown with gravel, fine grained, non-plastic, dry
4.0				Refusal at 4' (boulder) Borehole terminated at 4.0 ft.

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BOREHOLE ID: T09-67

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/11/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.561384 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.216688 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station

DEPTH (ft)	SAMPLE TYPE	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0		LL = 28 PI = 9 Fines = 16.3%		**CLAYEY SAND** light reddish brown, medium to fine grained, low plasticity, slightly moist gravel
5				5.0 **SANDY LEAN CLAY** tan to light brown, occasional gravel, fine grained sand, plastic, moist
				8.5 **CLAYSTONE BEDROCK** gray, hard, fine grained, low plasticity, moist
10				11.0 Borehole terminated at 11.0 ft.

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Telephone: 510-302-6300

BOREHOLE ID: T09-109

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/11/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.561130 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.216267 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0			LL = 24 PI = 8 Fines = 29.0%		**CLAYEY SAND** tan, fine to medium grained, gravels, cobbles, non-plastic, slightly moist
		3960			1.0 **CLAYEY SAND** tan to light brown, gravel/cobbles, fine to medium grained, medium plasticity, slightly moist
		4396			
		4156			
5		3964			5.0 **SILTY SAND** light brown with gravel, fine to coarse grained, non-plastic, moist
		4372			
		4346			8.0 **CLAYSTONE BEDROCK** gray to greenish gray, firm to hard, minor iron oxide staining in fractures
10					10.0 Borehole terminated at 10.0 ft.

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BOREHOLE ID: T09-129

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/11/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.560930 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.216882 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			**SILTY CLAYEY SAND** reddish brown, fine grained, low plasticity, slightly moist
			4.0
5			**CLAYEY SAND** reddish brown to tan, fine grained, plastic, slightly moist
10			13.0 Gravel
			CLAYSTONE BEDROCK gray, low plasticity
15			16.0
			Borehole terminated at 16.0 ft.

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BOREHOLE ID: T09-144

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/12/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.560853 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.216753 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		4102	1.0	**SILTY SAND** light brown, fine grained, gravel, non-plastic, dry
		4380	2.5	**CLAYEY SILTY SAND** light brown to brown, low plasticity, slightly moist
		4350		**SILTY SAND** brown to light brown, fine grained, dry
		4182		
5		4524		
		4468		
		5290		
		4386		
		4738		
10				
			13.5	Borehole terminated at 13.5 ft.

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BOREHOLE ID: T09-155

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/11/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.560784 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217115 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		17408		0.1 **VEGETATION**
		36544		**FILL**
		19980		brown, clayey sand to silty sand, fine grained, slightly moist
		10106		4.5
5		5974		**CLAYEY SAND**
		4976		brown to light brown, fine grained, low plasticity, moist
		4434		
		4478		
		4150		
10		4248		
		4344		
		4332		
		4440		clay increases
15				15.0
				Borehole terminated at 15.0 ft.

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BOREHOLE ID: T09-176

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/12/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.560713 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.216389 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		3904		**SILTY SAND** light brown to tan, fine-medium grained, gravel, non-plastic, dry
		4684		
		4578	2.5	**SILTY SAND** brown to greenish brown, dense, medium coarse grained, less gravel, moist
		4768		
5		4350		Rig chatter at 5', cobbles
		4126	6.0	**SILTY SAND** brown with some tan, fine to coarse grained, gravel, cobbles, non-plastic, moist
		4240		
		4248		
10			10.0	Borehole terminated at 10.0 ft.

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Telephone: 510-302-6300

BOREHOLE ID: T09-185

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/12/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.560605 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.216905 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0		3586	LL = 31 PI = 8 Fines = 31.8%		**SILTY SAND** light brown, fine grained, occasional gravel
		3922		1.0	**CLAYEY SILTY SAND** light brown to brown, fine grained, calcite lenses, low plasticity, slightly moist
		4060		2.5	**SILTY SAND** light brown, fine grained, mixed sandy clay lenses, dry
5		4264			
		4218			
		4180		6.0	**CLAYEY SAND** light brown, calcite lenses, dense, slightly moist
		3544			
		2662			
		4560			
10		2910			
				13.0	
				13.5	**CLAYSTONE** gray, fine grained, hard, plastic
					Borehole terminated at 13.5 ft.

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Telephone: 510-302-6300

BOREHOLE ID: T09-212

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/12/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.560378 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217234 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		3880		**SILTY SAND** brown, fine grained, with occasional silty clay lenses, minor calcite lenses
		4078		
		3746		
		3604		
5		3740		
		4094		
		4042		7.0
		3996		**SANDY LEAN CLAY** mottled tan, fine grained sand, plastic, dry
10				10.0
				Borehole terminated at 10.0 ft.

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Telephone: 510-302-6300

BOREHOLE ID: T17-67

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.523685 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.222024 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		4012		**SILTY SAND** light brown to brown, some light gray sandstone gravel, dry
		4002		
		4056		
		3646		
5		3490		
		3232		
7.0				DPT refusal at 6'
				Auger refusal at 7'
				Borehole terminated at 7.0 ft.

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Telephone: 510-302-6300

BOREHOLE ID: T17-71

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523666 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221592 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		5594 5274 4686 5148		**SILTY SAND** brown to dark brown, some organic material, non-plastic, dry
4.0				
5		5490 5930		**SILTY SAND** light brown to brown, fine grained, non-plastic, dry
7.0				DPT refusal at 7' Borehole terminated at 7.0 ft.

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Telephone: 510-302-6300

BOREHOLE ID: T17-89

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/25/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523603 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221967 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			**SILTY SAND** brown to reddish brown, fine grained, non-plastic, dry
5			5.0 **SILTY SAND** light brown to tan, fine grained, non-plastic, dry
			7.8 8.0 **SANDSTONE** Refusal at 8' Borehole terminated at 8.0 ft.

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Telephone: 510-302-6300

BOREHOLE ID: T17-91

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.523588 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221726 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		3884		**SILTY SAND** light brown to brown, some organic material, non-plastic, dry
		4466	1.5	**SILTY SAND** light brown to brown, some pieces of light gray gravel, dry
		4902		
		5564		
5		5412		DPT refusal at 5'
		5156	7.0	Auger refusal at 7'
				Borehole terminated at 7.0 ft.

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BOREHOLE ID: T17-137

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/25/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523432 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221918 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		5044		**SILTY SAND**
		6046		brown to reddish brown, fine grained, non-plastic, dry
		6336		Well consolidated
		7236		4.0
5		8124		**SILTY SAND**
		8312		brown to grayish brown, fine grained, unconsolidated, dry
		11654		
		11248		
		17118		9.0
				DPT refusal at 9'
				Borehole terminated at 9.0 ft.

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Telephone: 510-302-6300

BOREHOLE ID: T17-139

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/25/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.523427 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221712 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				**SILTY SAND**
		24928		brown to reddish brown, fine grained, non-plastic, dry
		55190		poorly sorted sandstone cobbles
		59912		
		75540		4.0 mottled gray sediment
5		81496		**SILTY SAND**
		83126		gray to white, fine grained, non-plastic, dry
		108474		7.0 DPT and auger refusal at 7'
				Borehole terminated at 7.0 ft.

BOREHOLE/TP/WELL - W/GAMMA RAES T01_MASTER.GPJ LAB SUMMARY.GDT 6/24/19

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Telephone: 510-302-6300

BOREHOLE ID: T17-141

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523403 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221505 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		5524 4800 4764		**SILTY SAND** light brown to brown, fine grained, non-plastic, dry
4.0				DPT refusal at 4' Borehole terminated at 4.0 ft.

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Telephone: 510-302-6300

BOREHOLE ID: T17-141A

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.523434 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221436 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0		4920	LL = 22 PI = 2 Fines = 18.6%		**SILTY SAND** light brown to brown, non-plastic, dry
		4804			
		5022			DPT refusal at 3'
		5480			
5		5888			
		6342			
		8406			
		7764			
		8390			
10					
				12.0	Auger refusal at 12'
					Borehole terminated at 12.0 ft.

Tetra Tech EMI
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Oakland, CA 94612
Telephone: 510-302-6300

BOREHOLE ID: T17-163

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523378 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.222147 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		4746	0.5	**SILTY SAND** light brown to brown, some light gray gravel and organic material present, dry
		4490	1.5	**SILTY SAND** light brown to reddish brown, mottled white with some organic material, dry
		3856	3.0	**SILTY SAND** light brown and light gray, dry
		2470		**SANDSTONE** light brown to white, non-plastic, dry
5			8.0	Boring terminated at 8'
				Borehole terminated at 8.0 ft.

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BOREHOLE ID: T17-196

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/25/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.523249 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221715 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		12722		**SILTY SAND** brown to reddish brown, fine grained, non-plastic, dry
		47486		Rock pebbles throughout, well stratified
		68746		
		73162		4.0
5		64530		**SILTY SAND** gray to brownish gray, unconsolidated, non-plastic, dry
		73220		
		77454		DPT refusal at 7'
		75042		
		97802		
10		89494		10.5
		73436		Auger refusal at 10.5'
				Borehole terminated at 10.5 ft.

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BOREHOLE ID: T17-198

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/25/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.523241 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221508 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				**FILL** silty sand, brown to reddish brown, fine grained, non-plastic, dry Trace concrete debris
5		8664 10296 14374 46970 53132 10012 74050		Brown to brownish gray, some concrete debris Shallow DPT refusal at 5'
8.5				Auger refusal at 8.5' Borehole terminated at 8.5 ft.

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BOREHOLE ID: T17-199

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/26/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.523293 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221395 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		4218		**SILTY SAND** light brown to brown, fine grained silty sand, non-plastic, dry
		4652		
		4804		
		5096		DPT refusal at 4'
5		5164		
		5432		
		5670		
		6468		
		7490		
10		7220		
			12.0	Auger terminated at 12'
				Borehole terminated at 12.0 ft.

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BOREHOLE ID: T17-258

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/25/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523067 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221732 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				**SILTY SAND**
				brown to reddish brown, fine grained, non-plastic, dry
		4754		Well stratified
		4908		
5		4936		Slight plasticity
		5380		
		5782		
		6022		
		6668	7.5	
				Well stratified; DPT refusal at 7.5'
				Borehole terminated at 7.5 ft.

BOREHOLE/TP/WELL - W/GAMMA RAES T01_MASTER.GPJ LAB SUMMARY.GDT 6/24/19

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BOREHOLE ID: T17-261

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/25/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.523110 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.221348 W** **DRILLED BY: Resilient**

Notes: Mesa I Camp

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		4424		**SILTY SAND** brown to brownish red, fine grained, non-plastic, dry
		4570		Well stratified, cohesive
		4914		Very finely graded
5		5152		
		5130		
		5228		
		5206	7.0	Cohesive; DPT refusal at 7'
				Borehole terminated at 7.0 ft.

BOREHOLE/TP/WELL - W/GAMMA RAES T01_MASTER.GPJ LAB SUMMARY.GDT 6/24/19

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BOREHOLE ID: T23-22

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.542453 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246474 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		4262	0.5	**SILTY SAND** light brown to brown, fine grained, dry
		4742	1.5	**SILTY SAND** light brown with mottled gray, fine grained, dry
		4602		**SILTY SAND** light brown to brown, fine grained, dry to damp
		4252		
5		3982		DPT refusal at 4.5'
		3530	6.0	
				Auger refusal at 6'
				Borehole terminated at 6.0 ft.

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BOREHOLE ID: T23-24

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/14/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.542455 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246242 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
		6132 5982 5632 5592 5054 4128 4626	LL = 31 PI = 12 Fines = 30.3%		**SILTY SAND** brown, poorly sorted gravel, fine to medium grained, non-plastic, dry
1.5					**CLAYEY SAND** brown, poorly sorted gravel, non-plastic, dry
4.0					Shallow refusal at 4' Borehole terminated at 4.0 ft.

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BOREHOLE ID: T23-32

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/14/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.542380 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246355 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		6880		**SILTY SAND** brown, poorly sorted gravel, fine grained, non-plastic, dry
		10876		
		18230		
1.5				**SILTY SAND** light brown and gray, poorly sorted gravel, fine grained, non-plastic, dry
4.0				
5				**SILTY SAND** light brown with gray mottling, some gravel present, fine grained, non-plastic, dry to damp
6.0				DPT refusal at 6'
				Borehole terminated at 6.0 ft.

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BOREHOLE ID: T23-33

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/14/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.542351 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246225 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		8470		0.5 **SILTY SAND** light brown to brown, poorly sorted gravel, fine grained silts, non-plastic
		14496		1.5 **SILTY SAND** brown, poorly sorted gravel, fine grained silts, non-plastic, damp
		56050		**SILTY SAND** light brown, poorly sorted gravel, fine grained silts, non-plastic, dry
		60732		DPT refusal at 3'
5		6280		
		59840		
		52498		
				9.0 Auger refusal at 9'
				Borehole terminated at 9.0 ft.

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BOREHOLE ID: T23-35

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.542376 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246024 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		4642		**SILTY SAND** light brown to brown, fine grained, some consolidated red fine grained silt, gravel to cobble sized white to gray sandstone, some organic debris, dry
		4592	1.5	**CLAYEY SAND** light brown to brown, mottled gray, dry
		4604		
		4214	4.0	**CLAYEY SILTY SAND** light brown silty sand, gray to light gray mottled brown fine grained sand, gravel sized gray sandstone, dry
5		4106	5.0	DPT refusal at 5'
				Borehole terminated at 5.0 ft.

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BOREHOLE ID: T23-41

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.542316 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246541 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		4396		**SILTY SAND** light brown to brown, fine grained, dry, some organic debris
		4278	1.5	**SILTY SAND** light brown to gray, fine grained, dry
		5160		
		4214	4.0	**SILTY SAND** light brown to brown, fine grained, gray sandstone gravel at bottom of sample, dry
5		4108	5.0	DPT refual at 5'
				Borehole terminated at 5.0 ft.

BOREHOLE/TP/WELL - W/GAMMA RAES T01_MASTER.GPJ LAB SUMMARY.GDT 6/24/19

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BOREHOLE ID: T23-42

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.542248 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246396 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		6828	0.5	**SILTY SAND** light brown to brown, fine grained, some organic debris and gravel, dry
		18802		**SILTY SAND** light brown to gray, fine grained, gravel to cobble sized white to gray sandstone pieces, dry
		40162		
		52000	4.0	
5		57630		**SILTY SAND** light brown mottled gray-white, fine grained, gravel, dry
		55160		
		49314	7.0	DPT refusal at 7'
				Borehole terminated at 7.0 ft.

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BOREHOLE ID: T23-44

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/14/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push/HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.542315 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246135 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		6288	0.5	**SILTY SAND** light brown, poorly sorted gravel, fine grained, some vegetation present, non-plastic, dry
		15060	1.5	**SILTY SAND** gray to tan, large rock fragments (white-gray), medium grained, non-plastic, dry
		59206		**SILTY SAND** gray to light brown, some sandstone gravel present, fine grained, non-plastic, dry
		58076	4.0	**SILTY SAND** light brown, poorly sorted gravel, fine grained, non-plastic, dry
5		71776	6.0	DPT and auger refusal at 6'
				Borehole terminated at 6.0 ft.

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BOREHOLE ID: T23-45

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/14/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.542254 N** **LOGGED BY: J. Mellema**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246039 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		3782		**SILTY SAND** light brown, poorly sorted sandstone gravels, medium to fine grained, non-plastic, dry
		4126	1.5	**SILTY SAND** brown, trace gravel, fine grained, non-plastic, dry
		4480		
		4607	4.0	**SILTY SAND** brown, no gravel, very fine grained, low plasticity, dry
5		3938	5.0	DPT refusal at 5'
				Borehole terminated at 5.0 ft.

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BOREHOLE ID: T23-52

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/15/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.542175 N** **LOGGED BY: C. Allen**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.246168 W** **DRILLED BY: Resilient**

Notes: NA-0344B

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		4692	0.5	**SILTY SAND** light brown, fine grained, gravel to cobble sized light gray sandstone, some organic debris, dry
		3630		**SILTY SAND** light brown to brown, fine grained silt with some light gray to white gravel to cobble sized sandstone, dry
		3196	4.0	
				DPT refusal at 4'
				Borehole terminated at 4.0 ft.

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BOREHOLE ID: T37-69

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/12/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.558325 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217756 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station South

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		3736	1.0	**FILL** silty sand with gravel, brown to reddish brown, clay lenses (minor)
		3866		**SILTY, CLAYEY SAND** moist, brown, calcite stringers, fine grained
		3882		
		3880		
5		3720		
		3182	6.0	
		3428		**CLAYEY SAND** light brown, dry, dense
			8.0	
				Borehole terminated at 8.0 ft.

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BOREHOLE ID: T37-77

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/12/2018 **GROUND ELEVATION: NA** **METHOD: Direct Push**

CONSULTANT: Tetra Tech **LATITUDE: 36.558258 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217781 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station South

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			
			1.0 **FILL** brown to light brown, slightly moist, silty sand/clayey sand
			CLAYEY SAND brown, calcite/clay lenses, moist
5			
			6.0 Borehole terminated at 6.0 ft.

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BOREHOLE ID: T37-86

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/13/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.558156 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217825 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station South

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		3940		**FILL** silty sand with a little gravel, medium density, fine to medium grained, non-plastic, moist
		4370		2.0
		4156		**SILTY SAND** light brown, medium density, fine grained, calcite lenses, moist
		4034		
5		4062		
		3740		color changes to tan light brown
		3720		
		3706		
		3618		
10				10.0
				Borehole terminated at 10.0 ft.

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BOREHOLE ID: T37-86A

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/13/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.558191 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217869 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station South

DEPTH (ft)	SAMPLE TYPE	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
				1.0 **FILL** silty sand, light brown, fine grained, non-plastic, slightly moist
				CLAYEY SAND light brown, fine to medium grained, calcite lenses, slightly moist
		LL = 28 PI = 11 Fines = 42.9%		
5				
10				10.0
				Borehole terminated at 10.0 ft.

BOREHOLE/TP/WELL - W/GAMMA RAES T01_MASTER.GPJ LAB SUMMARY.GDT 7/2/19

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BOREHOLE ID: T37-87

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/13/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.558151 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217759 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station South

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0		4080 4058 3804		**SILTY SAND** light reddish brown, medium density, fine grained, non-plastic, moist
			3.0	
		3604 3604		**CLAYEY SAND** light reddish brown, medium density, fine grained, calcite lenses, non-plastic, moist
5			6.0	
		3052 3360 3798		**SILTY SAND** light reddish brown, medium density, fine grained, calcite lenses, non-plastic, moist (rig chatter)
10			10.0	
				Borehole terminated at 10.0 ft.

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BOREHOLE ID: T37-94

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/13/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.558078 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217828 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station South

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		3742		1.0 **FILL** silty sand with a little gravel, light brown, fine grained, dry
		3918		**SILTY SAND** light brown, medium dense to soft, fine grained with calcite lenses, slightly moist (softer drilling)
		4074		
		4214		
5		3970		
		3776		
		3634		
		3592		
10				10.0 Borehole terminated at 10.0 ft.

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BOREHOLE ID: T37-103

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM

DATE(S) OF DRILLING: 09/13/2018 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech **LATITUDE: 36.558001 N** **LOGGED BY: Jeff DeTienne**

DRILLING CONTRACTOR: Resilient Drilling **LONGITUDE: -109.217855 W** **DRILLED BY: Resilient**

Notes: Cove Transfer Station South

DEPTH (ft)	SAMPLE TYPE	GAMMA MEASUREMENT (CPM)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
		3772	1.0	**FILL** silty sand, reddish brown to light brown, fine to medium grained, dry
		4164		**CLAYEY SILTY SAND** reddish brown, very fine to fine grained, slightly moist
		4050		
		4316		
5		4168		
		4266		
		4476		
		4356		
		4492		
10			10.0	Borehole terminated at 10.0 ft.

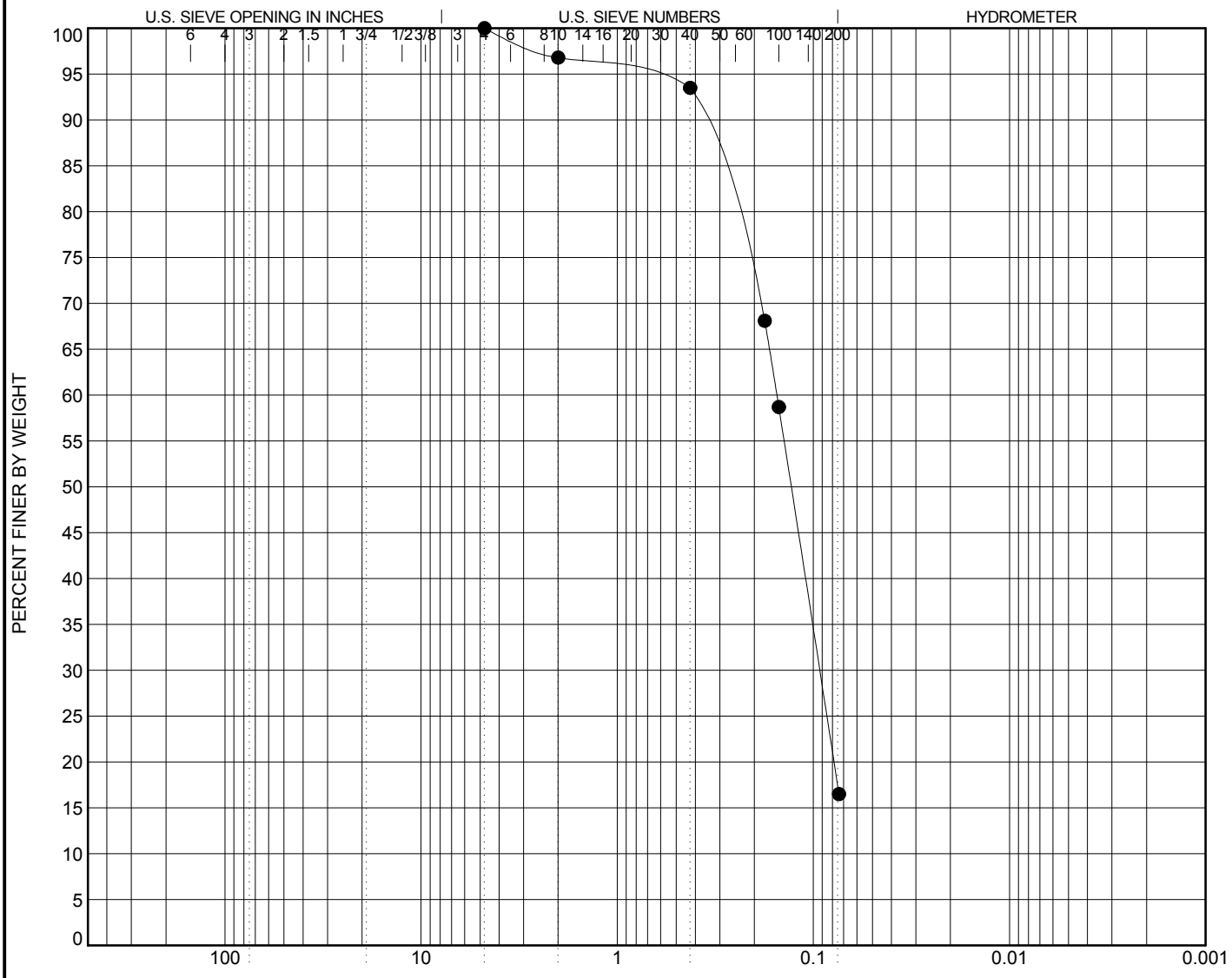
ATTACHMENT E2

GEOTECHNICAL LABORATORY TEST RESULTS

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

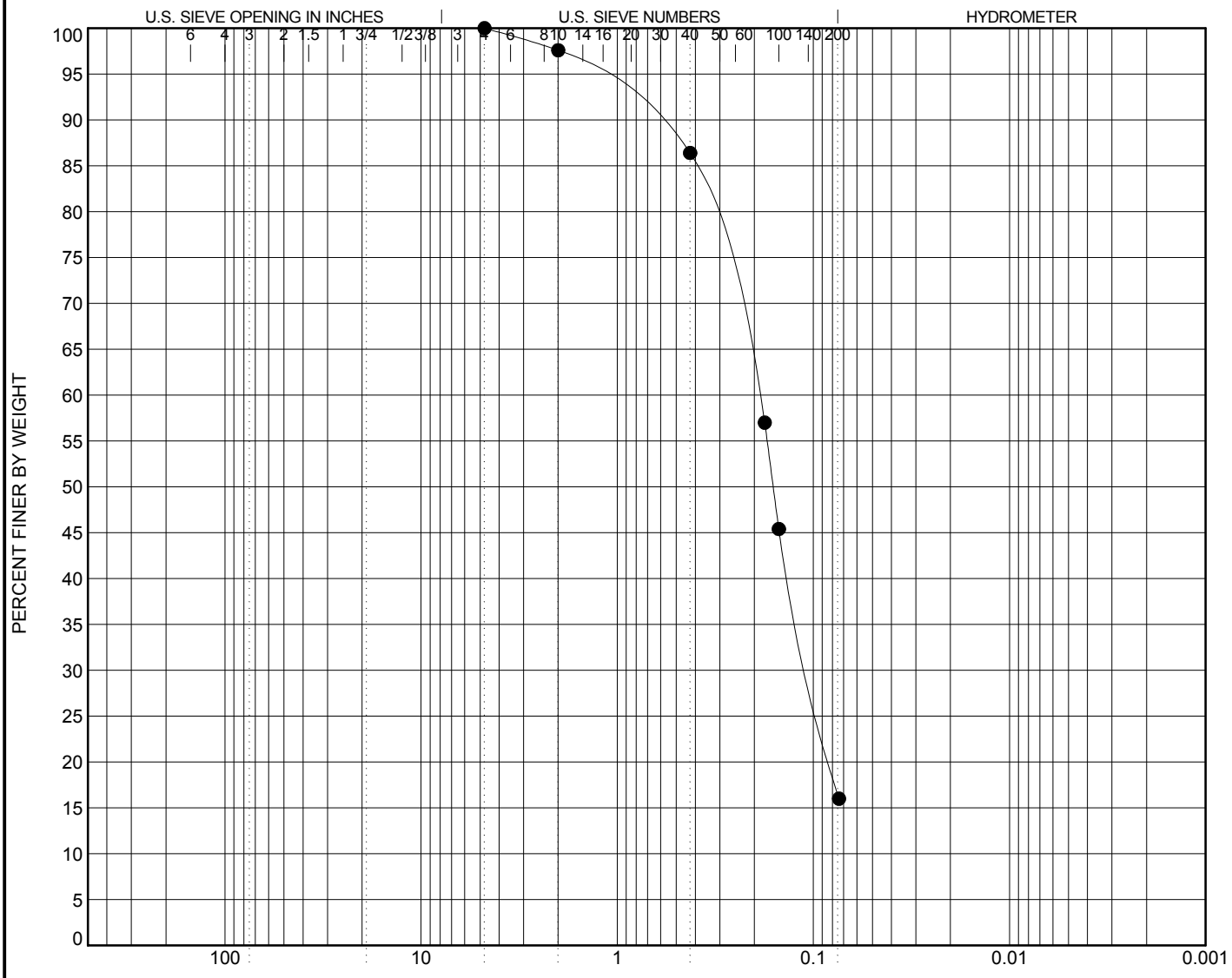
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M02-23**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M02-23**	**0.0**	**4.75**	**0.153**	**0.093**		**0.0**	**82.7**	**17.3**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

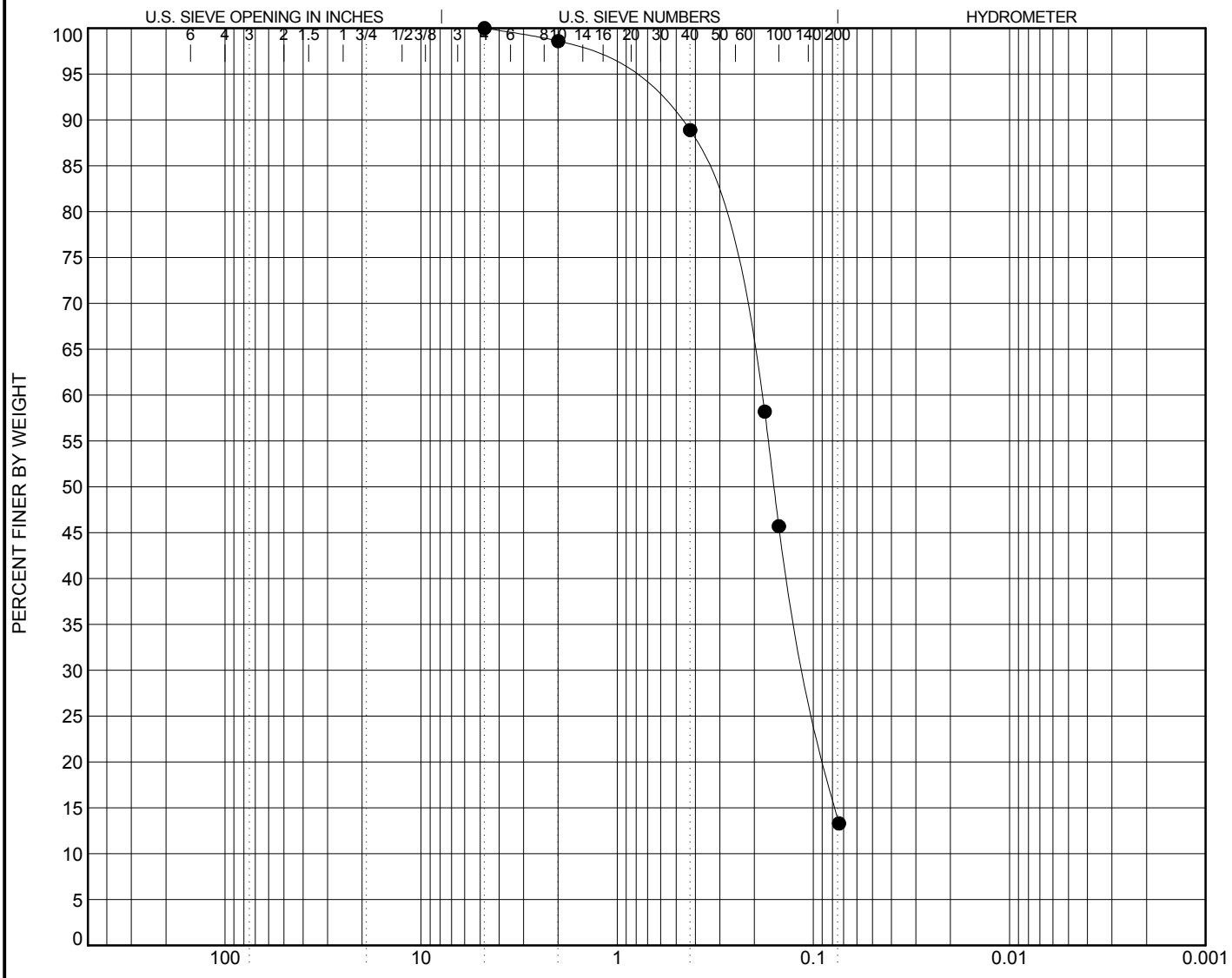
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M03-51**	**0.0**	**SILTY SAND (SM)**	**22**	**20**	**2**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M03-51**	**0.0**	**4.75**	**0.194**	**0.104**		**0.0**	**83.4**	**16.6**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

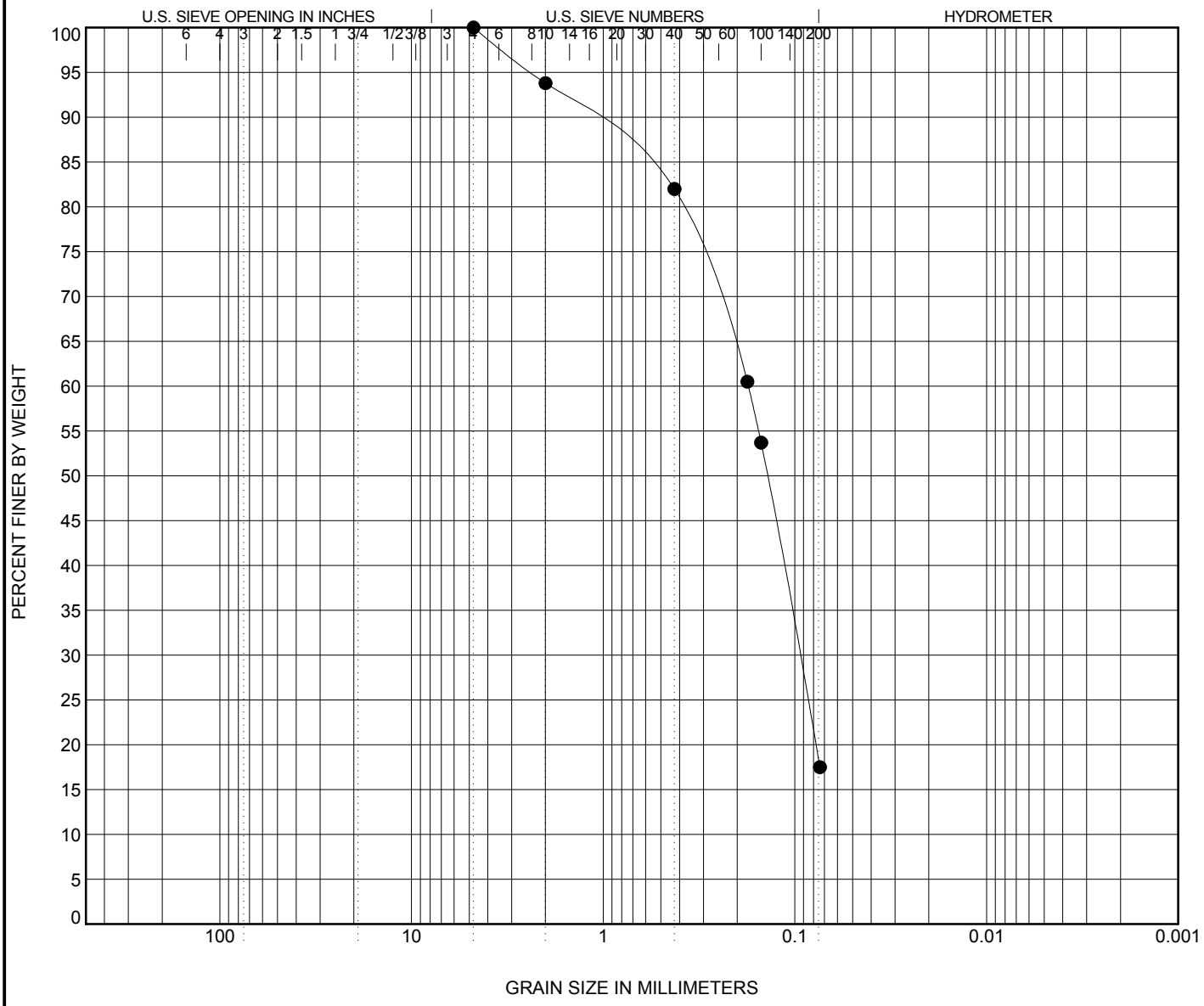
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M04-81**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M04-81**	**0.0**	**4.75**	**0.186**	**0.107**		**0.0**	**86.1**	**13.9**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

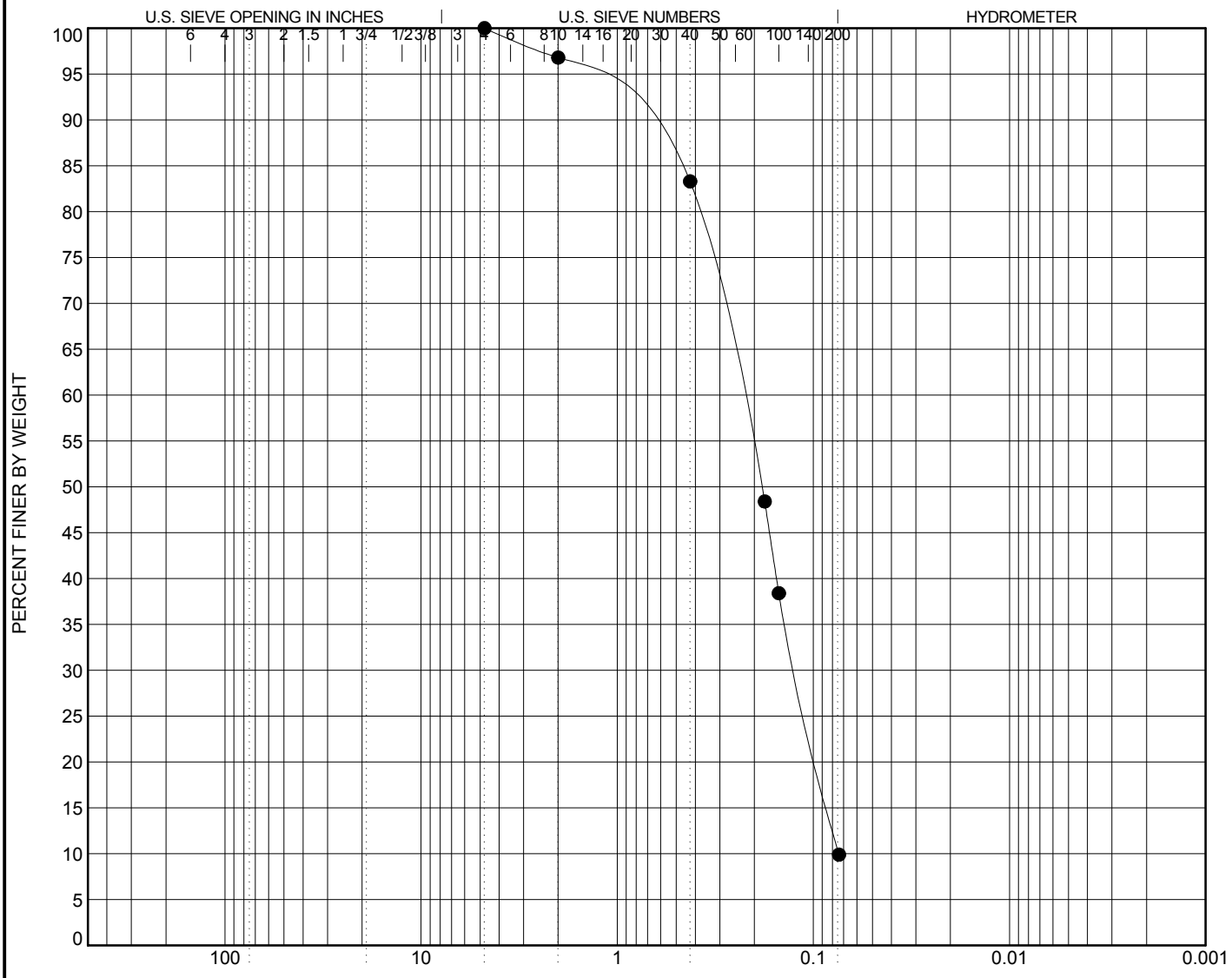
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M04-109**	**0.0**	**SILTY SAND (SM)**	**21**	**19**	**2**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M04-109**	**0.0**	**4.75**	**0.175**	**0.094**		**0.0**	**81.8**	**18.2**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

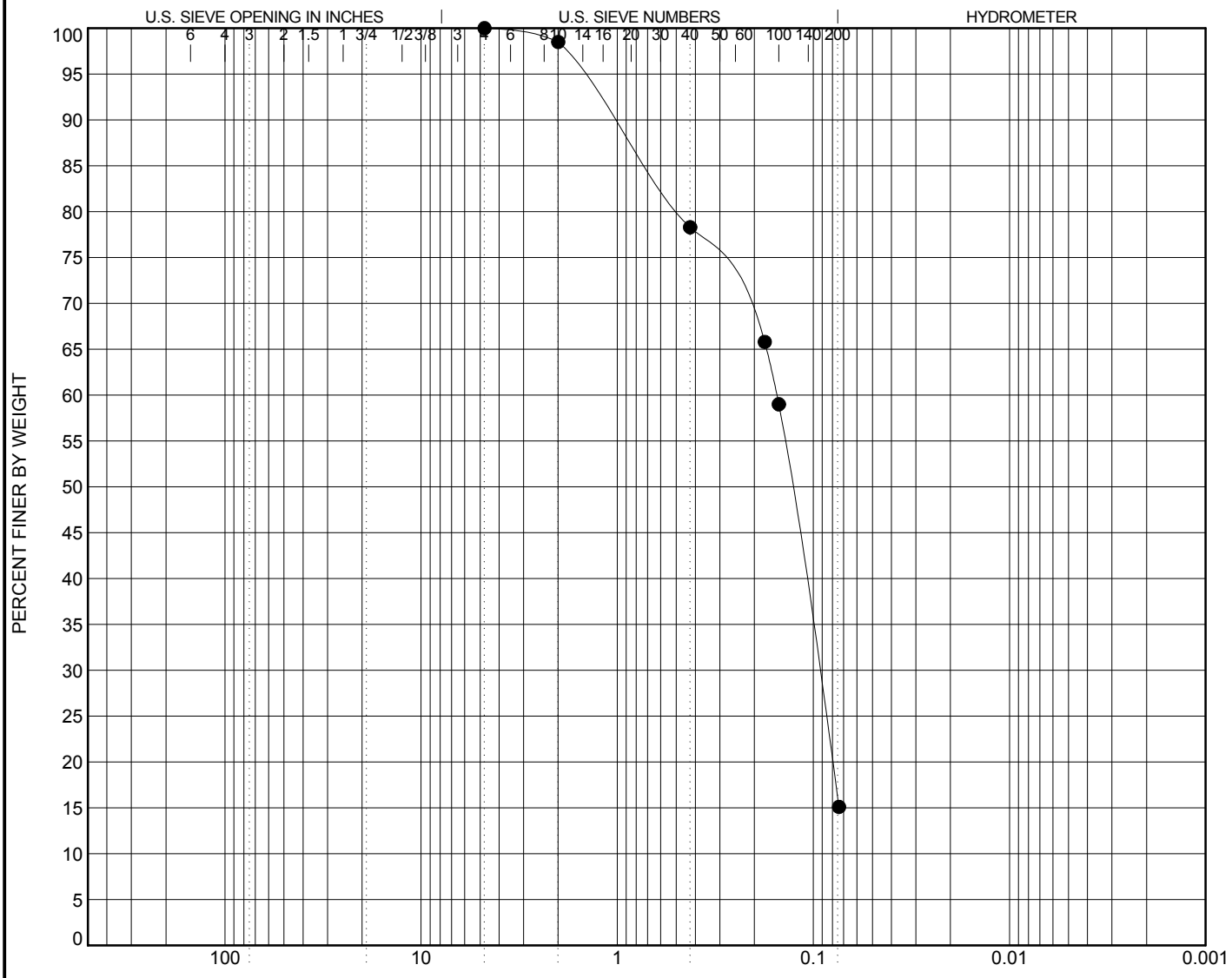
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M05-149**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**0.84**	**3.19**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M05-149**	**0.0**	**4.75**	**0.237**	**0.122**	**0.074**	**0.0**	**89.6**	**10.4**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

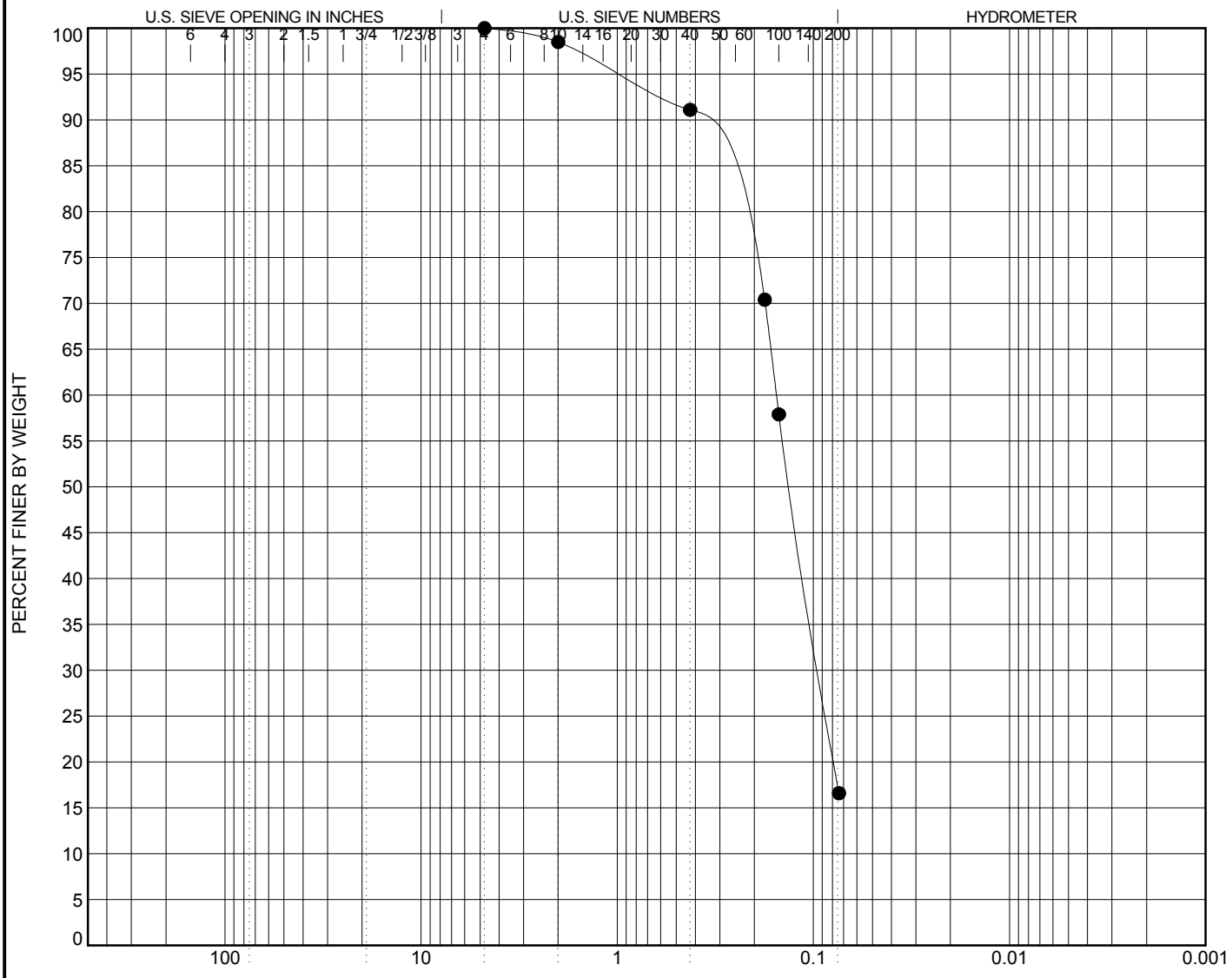
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M05-479**	**0.0**	**SILTY, CLAYEY SAND (SC-SM)**	**28**	**22**	**6**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M05-479**	**0.0**	**4.75**	**0.154**	**0.094**		**0.0**	**84.1**	**15.9**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

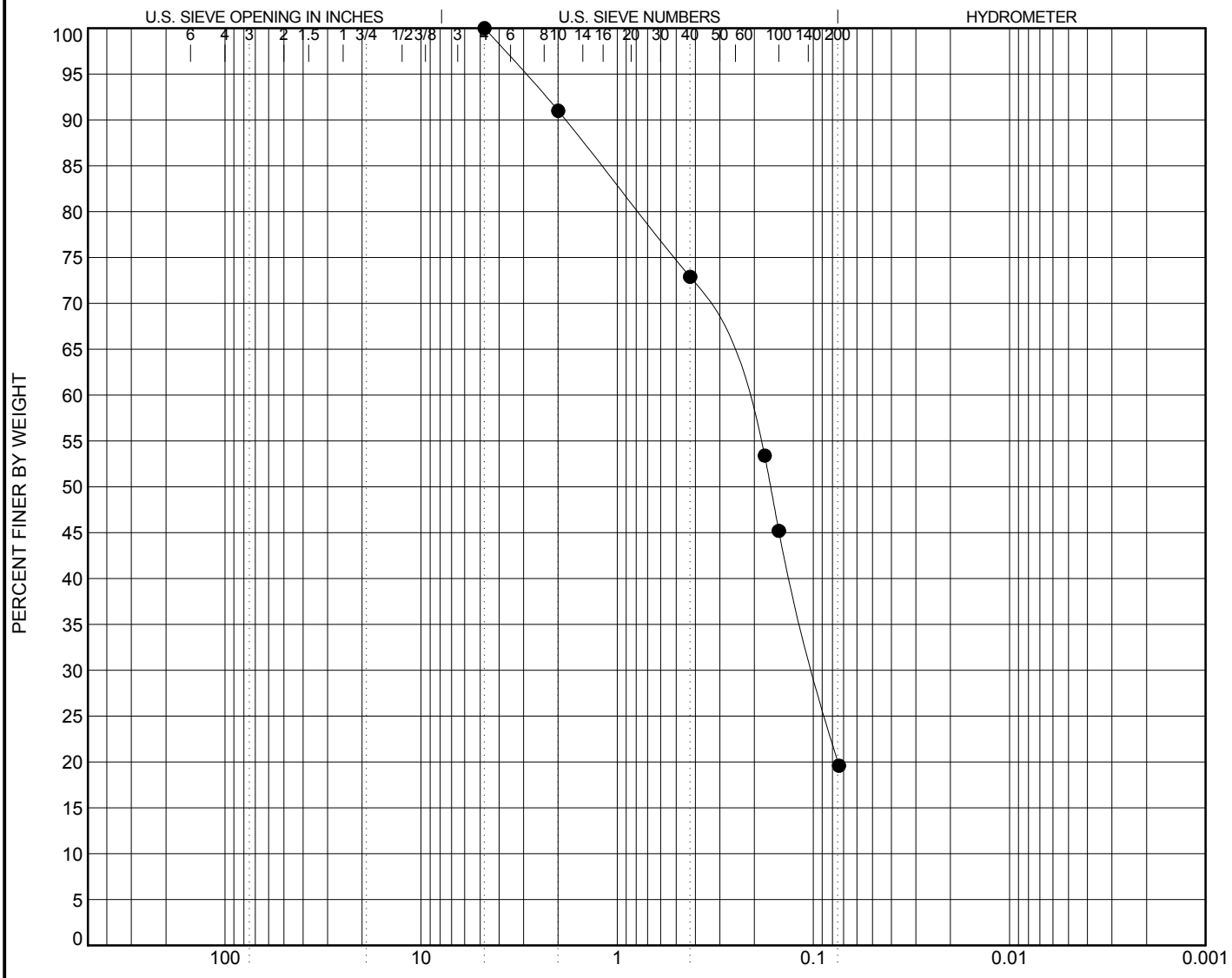
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M06-157**	**0.0**	**SILTY SAND (SM)**	**22**	**21**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M06-157**	**0.0**	**4.75**	**0.154**	**0.093**		**0.0**	**82.6**	**17.4**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

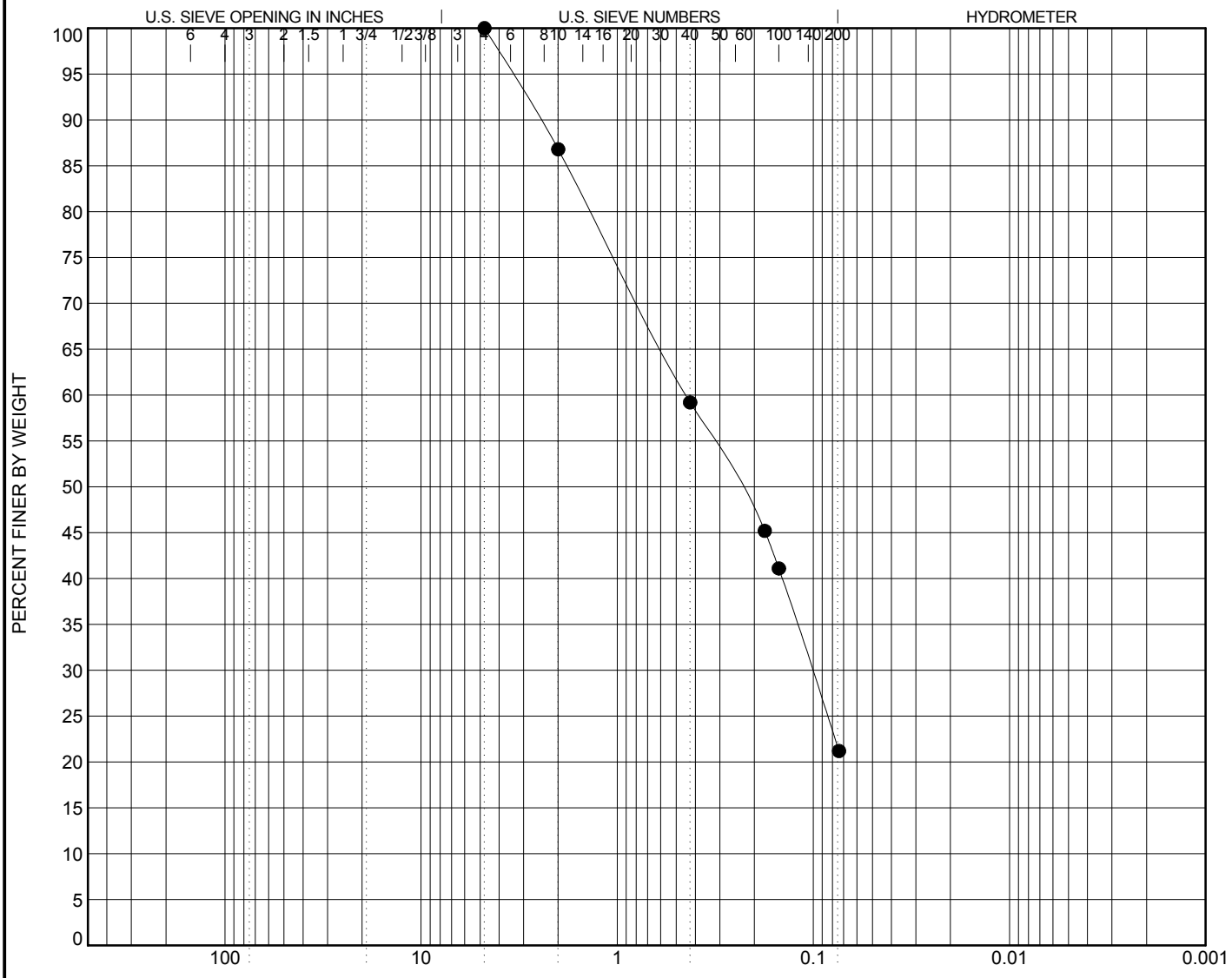
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M07-161**	**0.0**	**SILTY SAND (SM)**	**21**	**20**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M07-161**	**0.0**	**4.75**	**0.238**	**0.099**		**0.0**	**79.9**	**20.1**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

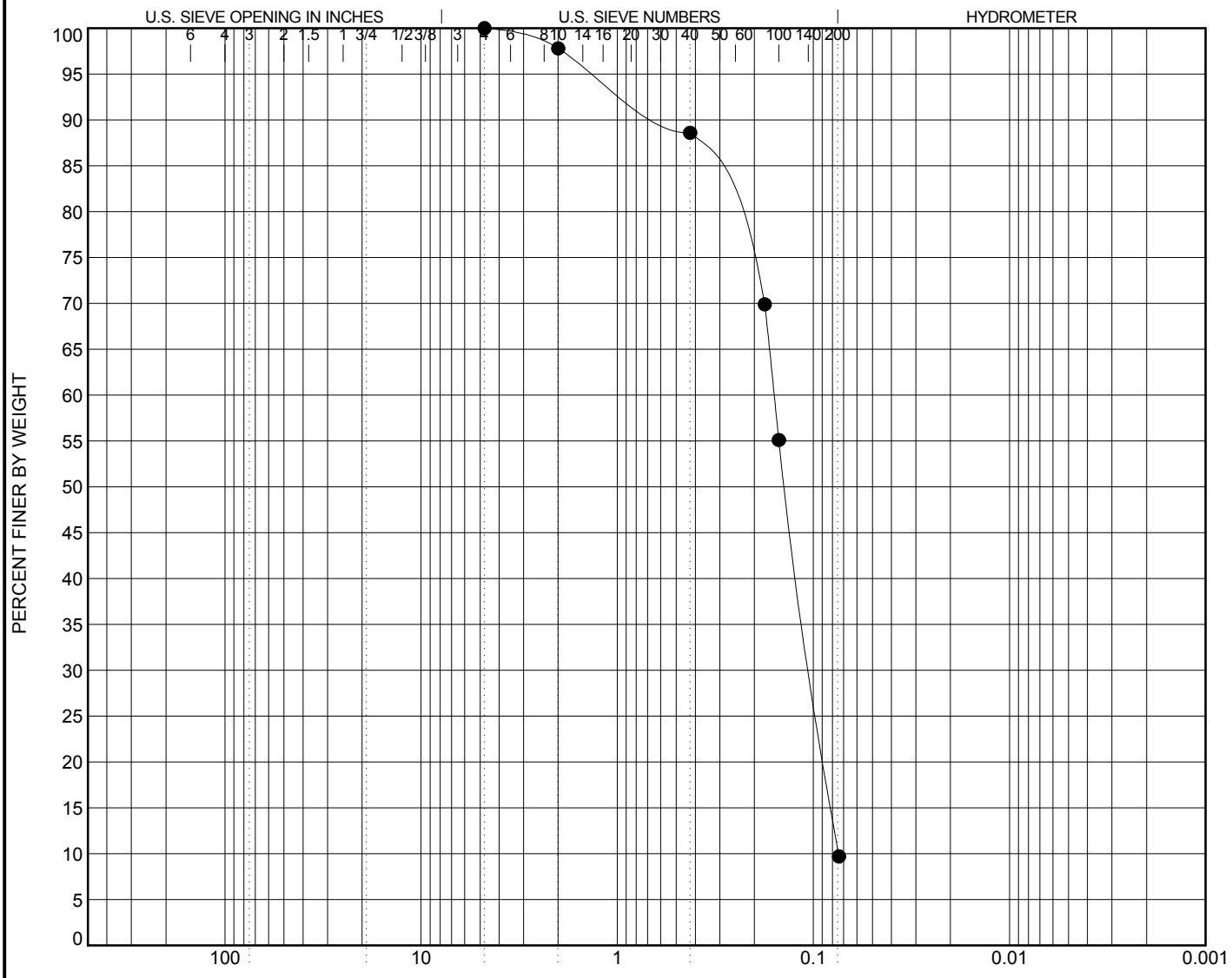
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M07-204**	**0.0**	**SILTY SAND (SM)**	**24**	**21**	**3**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M07-204**	**0.0**	**4.75**	**0.445**	**0.101**		**0.0**	**78.4**	**21.6**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

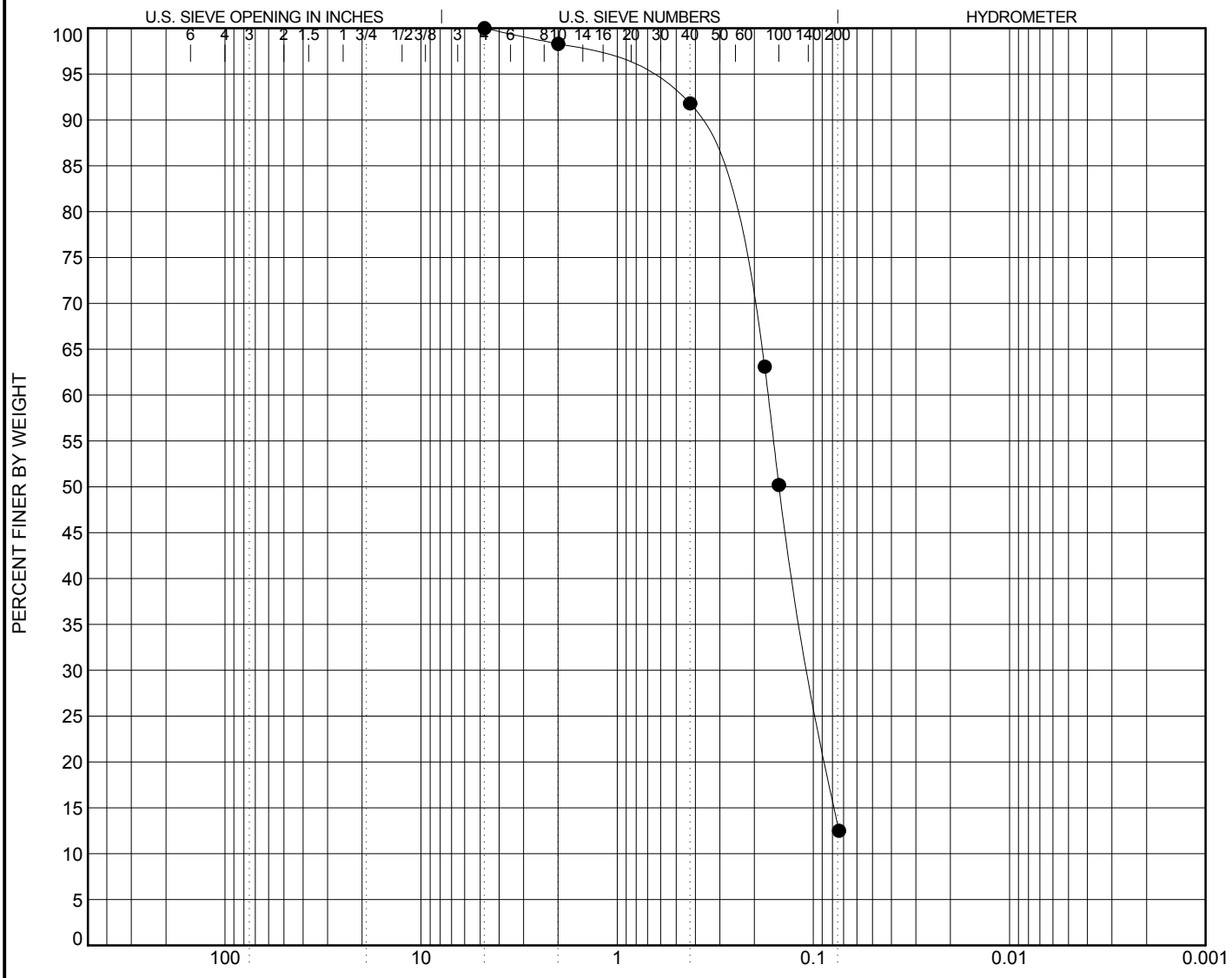
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M08-94**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**0.87**	**2.13**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M08-94**	**0.0**	**4.75**	**0.158**	**0.101**	**0.074**	**0.0**	**89.4**	**10.6**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

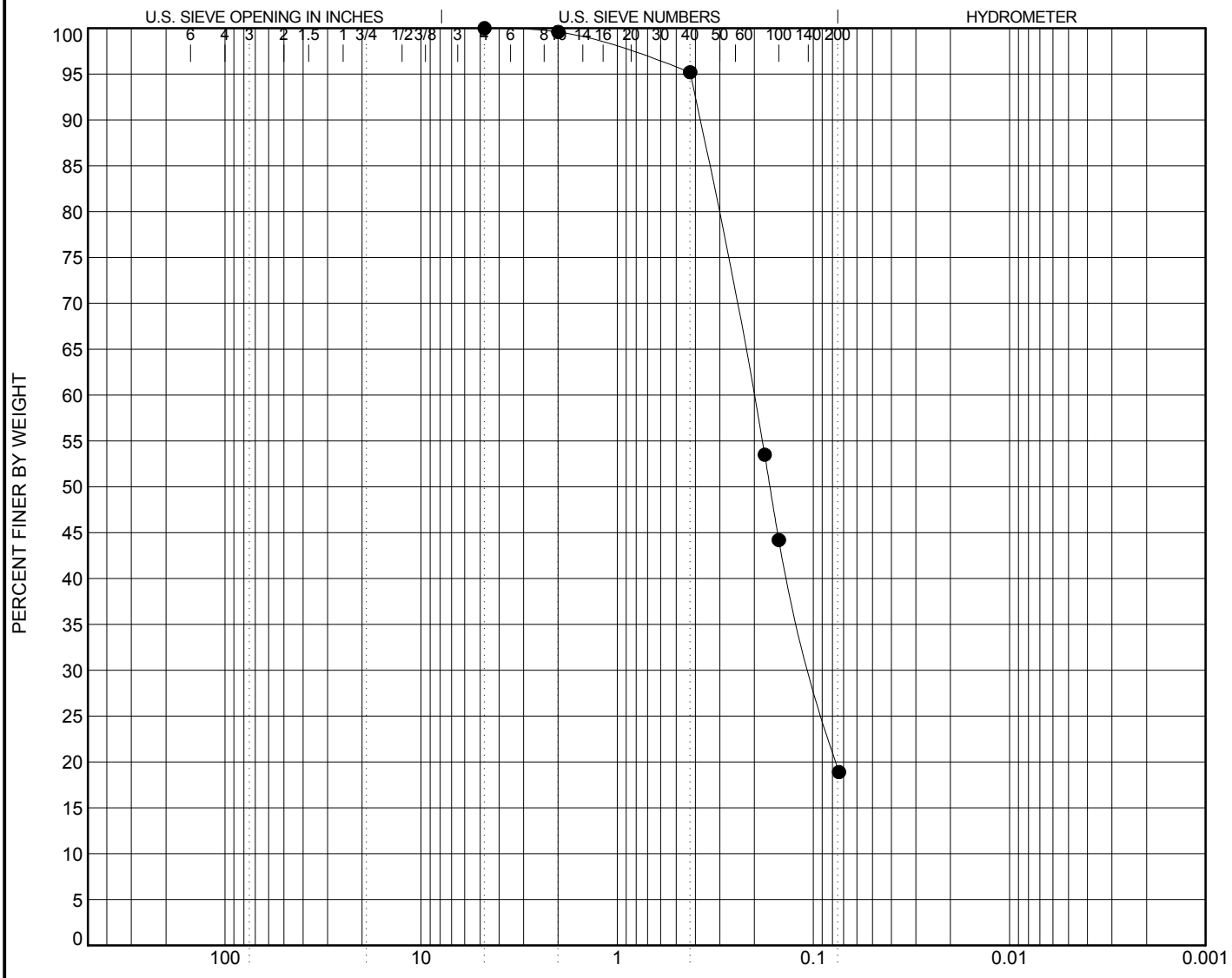
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M08-106**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M08-106**	**0.0**	**4.75**	**0.17**	**0.103**		**0.0**	**86.8**	**13.2**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

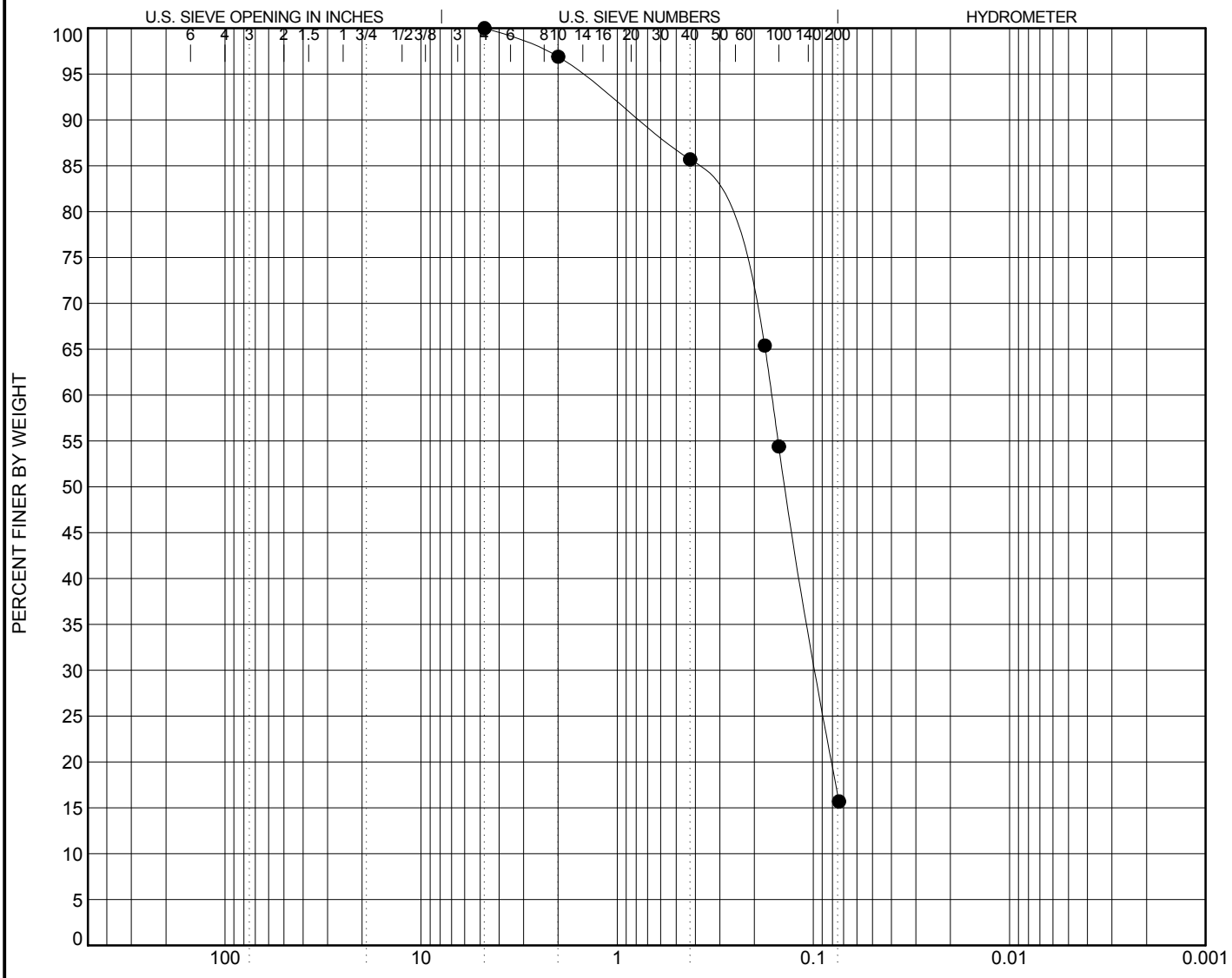
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M09-19**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M09-19**	**0.0**	**4.75**	**0.203**	**0.101**		**0.0**	**80.6**	**19.4**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M11-35**	**0.0**	**SILTY SAND (SM)**	**22**	**20**	**2**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M11-35**	**0.0**	**4.75**	**0.163**	**0.096**		**0.0**	**83.6**	**16.4**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

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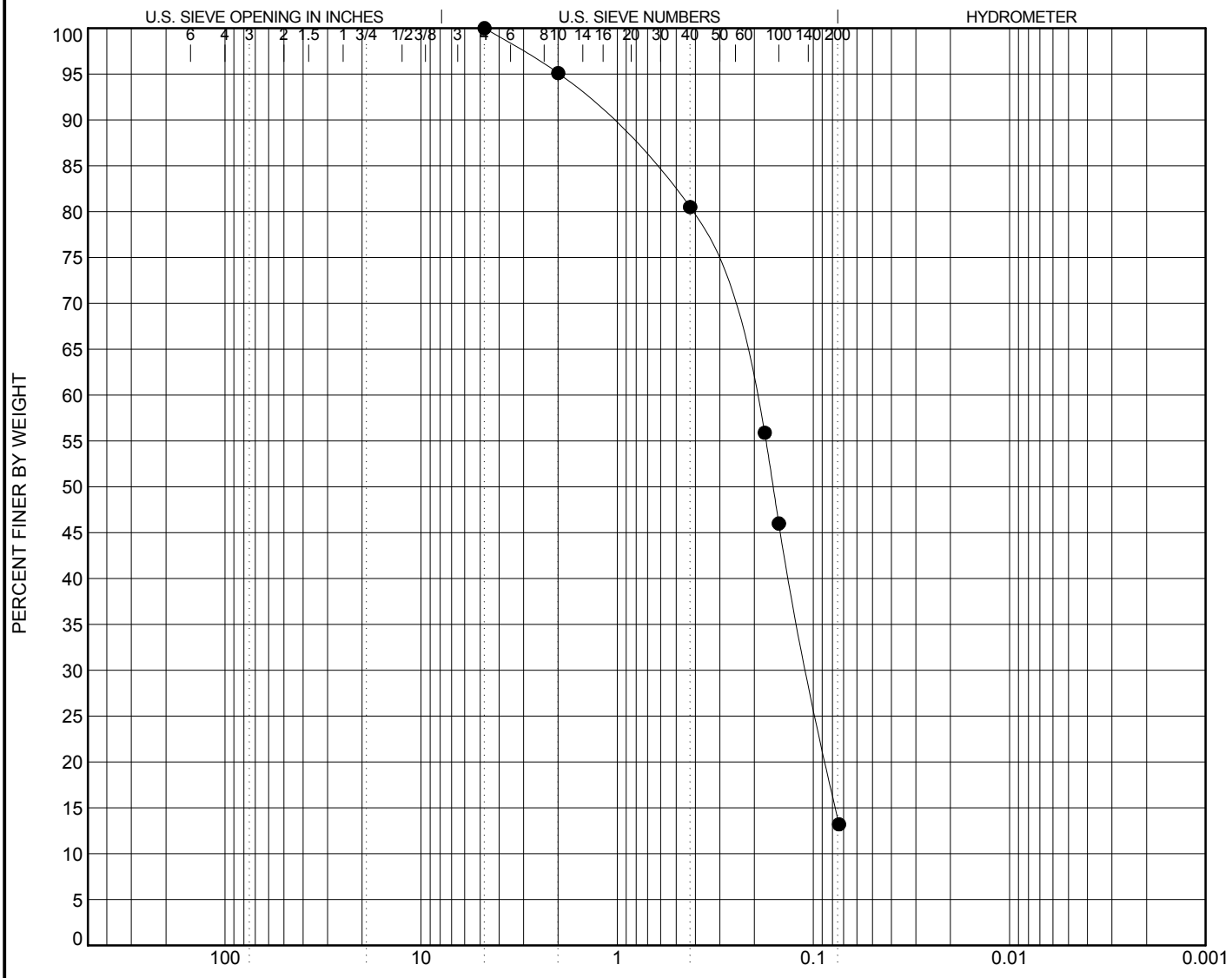

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M11-40**	**0.0**	**SILTY SAND (SM)**	**21**	**19**	**2**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M11-40**	**0.0**	**4.75**	**0.205**	**0.106**		**0.0**	**86.2**	**13.8**	

GRAIN SIZE DISTRIBUTION

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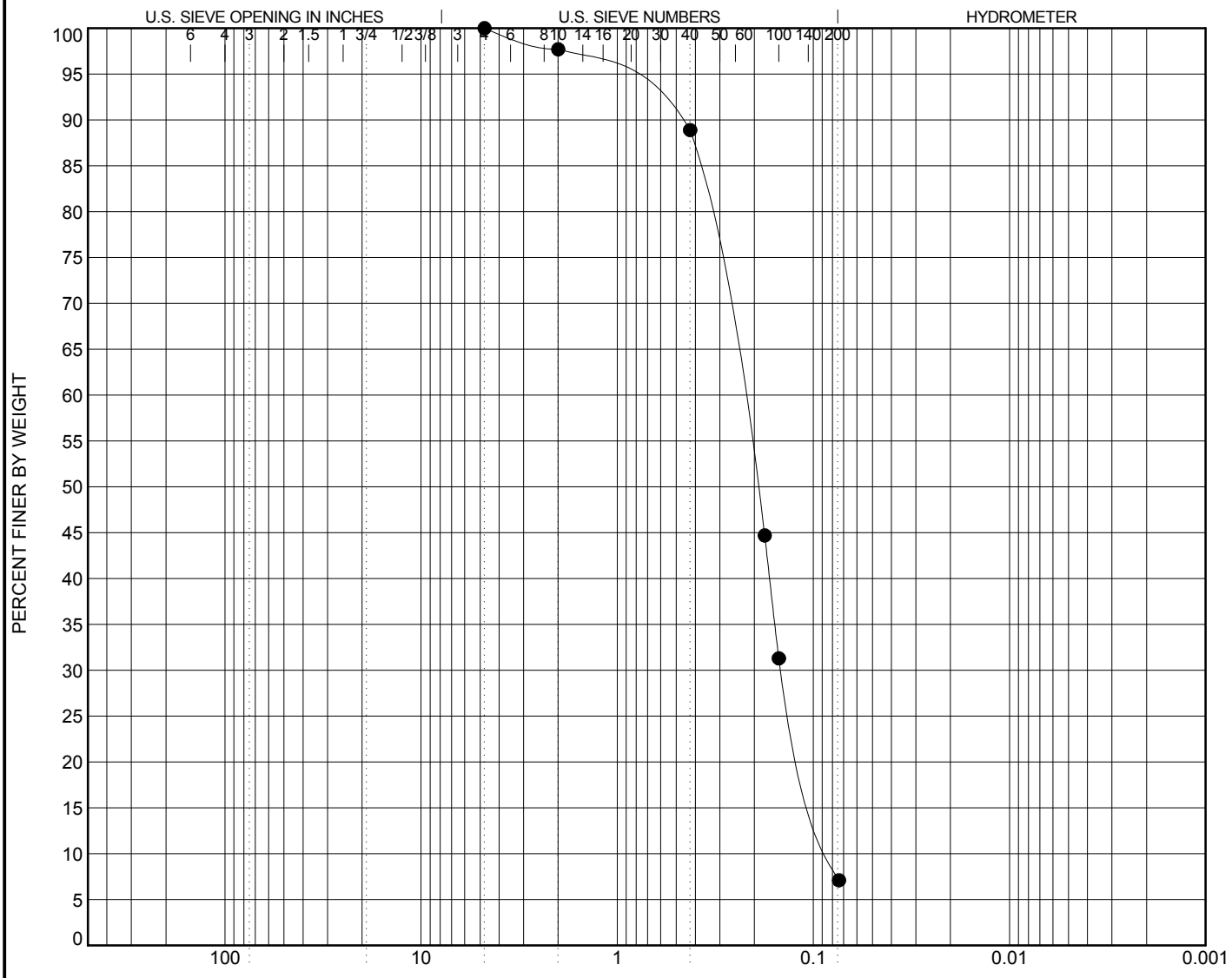
PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

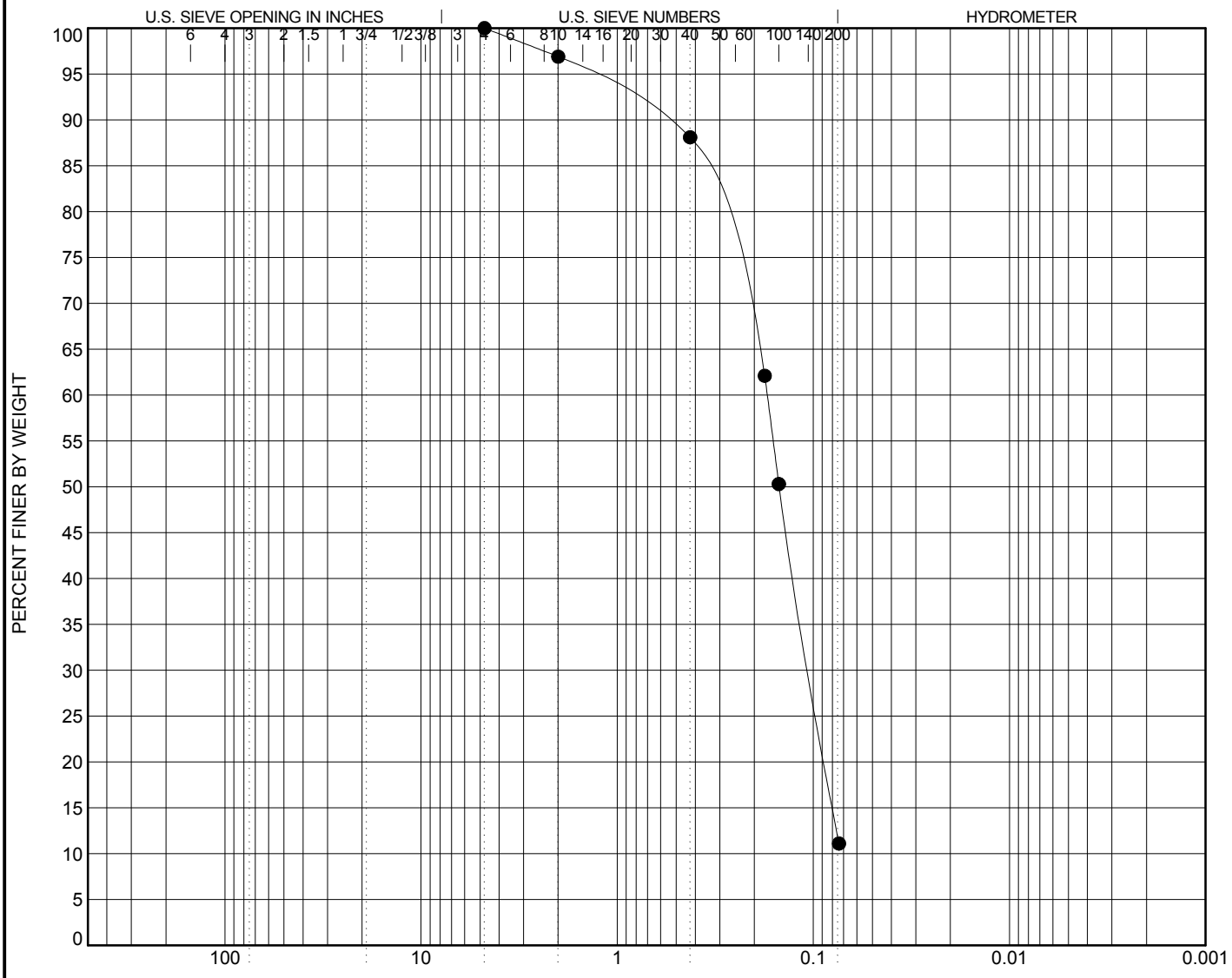
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M12-33**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**20**	**19**	**1**	**1.08**	**2.98**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M12-33**	**0.0**	**4.75**	**0.24**	**0.144**	**0.081**	**0.0**	**92.4**	**7.6**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

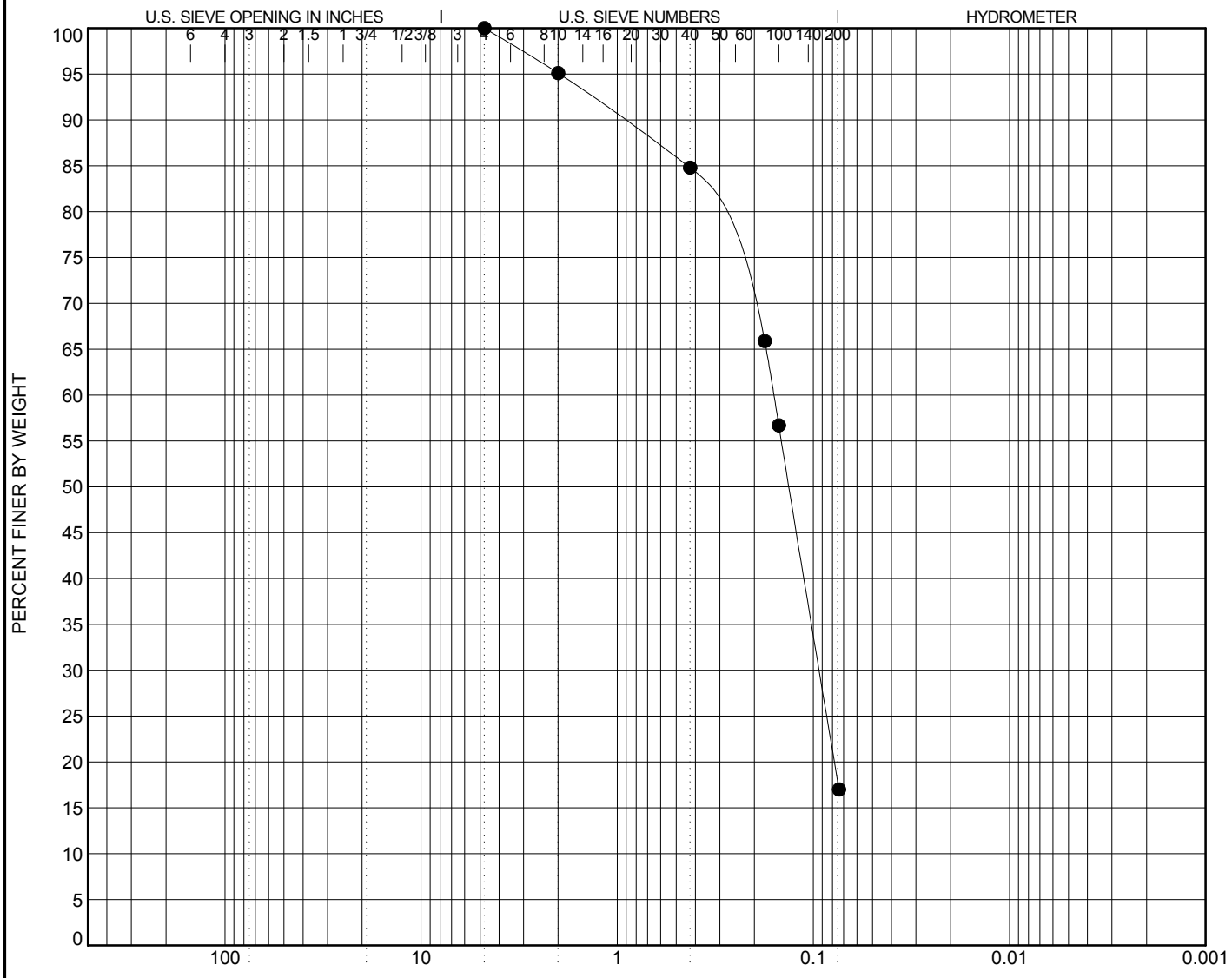
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M16-193**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**0.87**	**2.37**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M16-93**	**0.0**	**4.75**	**0.172**	**0.104**		**0.0**	**88.2**	**11.8**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

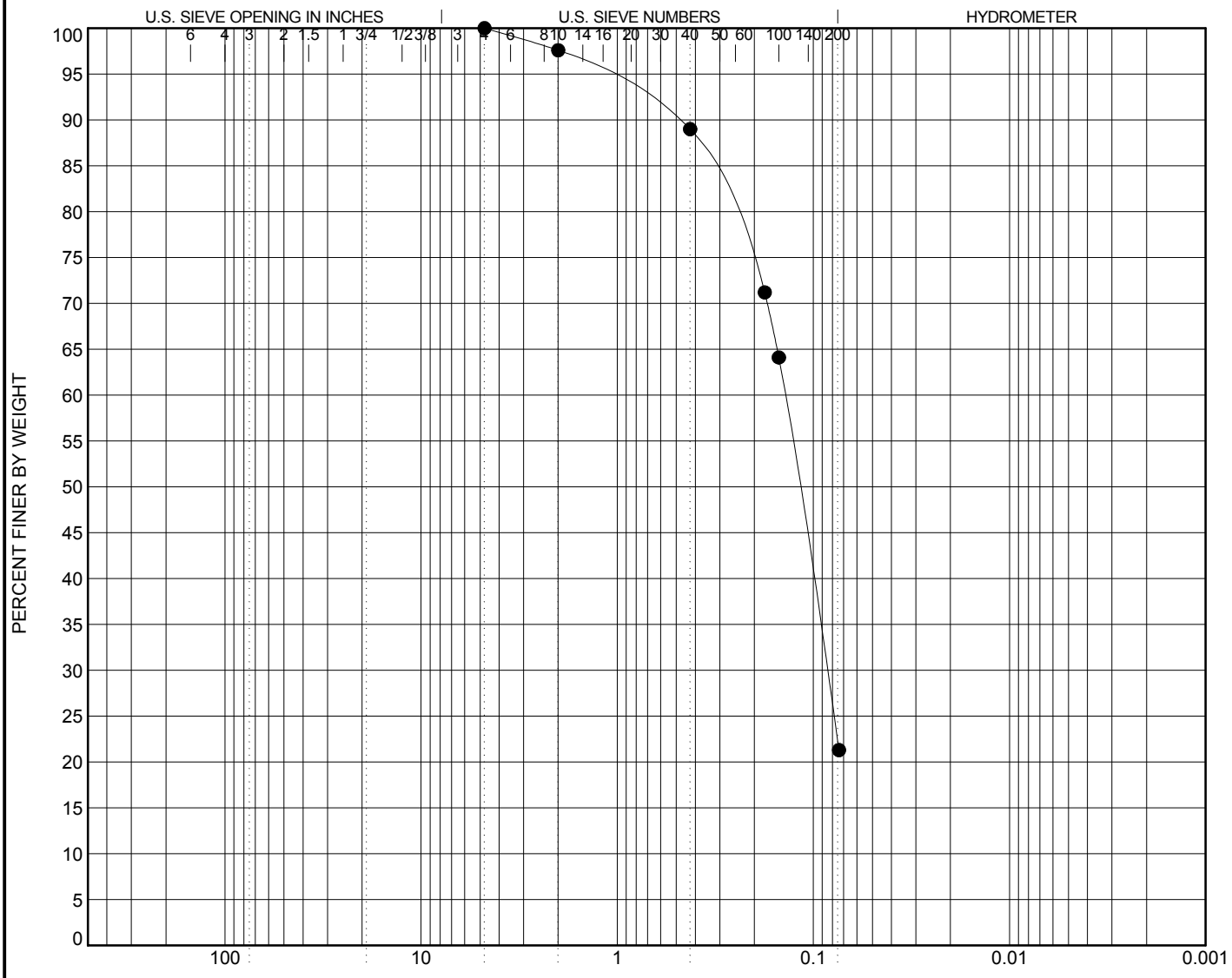
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M17-04**	**0.0**	**SILTY SAND (SM)**	**25**	**24**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M17-04**	**0.0**	**4.75**	**0.159**	**0.093**		**0.0**	**82.2**	**17.8**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

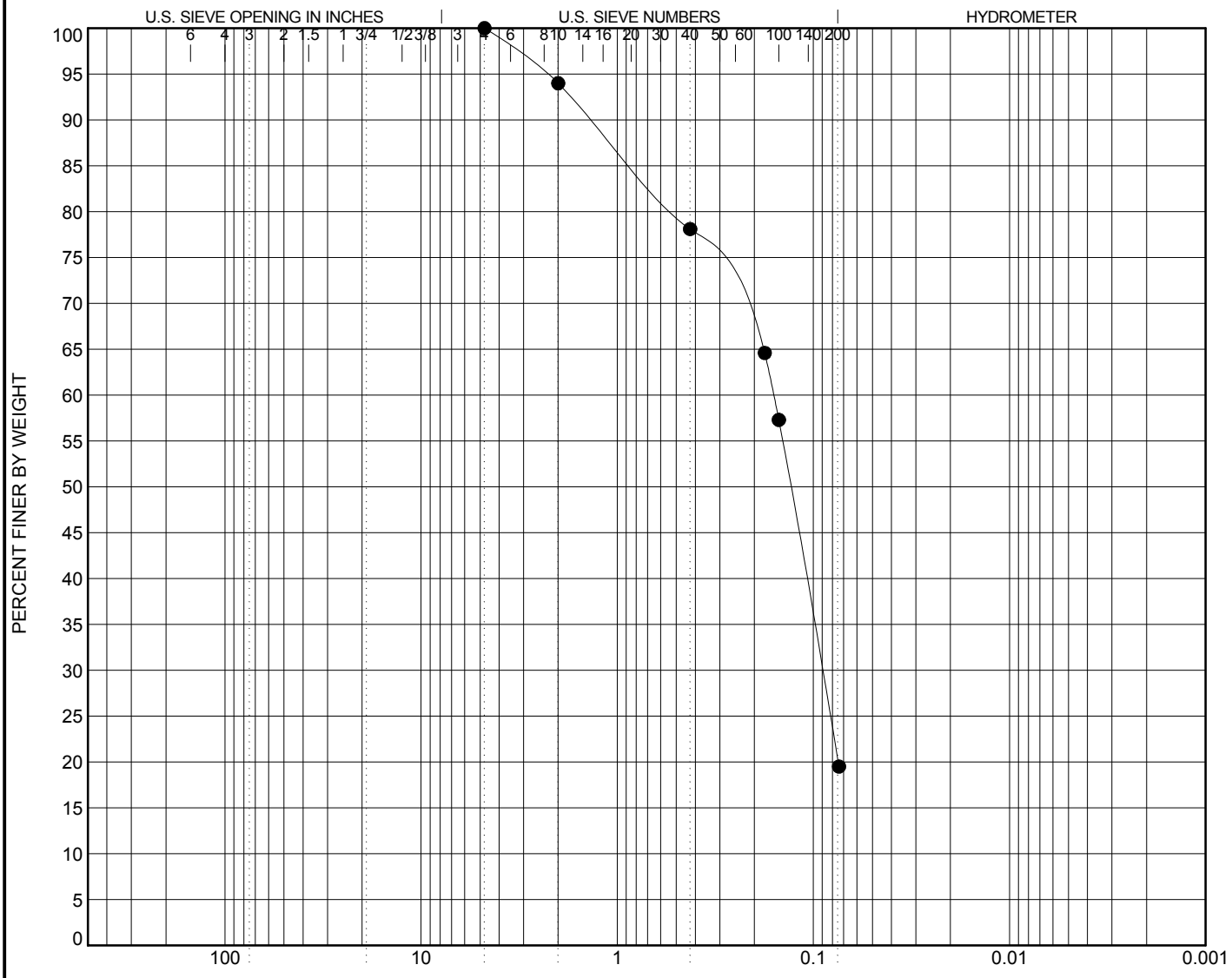
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M17-35**	**0.0**	**SILTY SAND (SM)**	**22**	**21**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M17-35**	**0.0**	**4.75**	**0.14**	**0.085**		**0.0**	**77.9**	**22.1**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

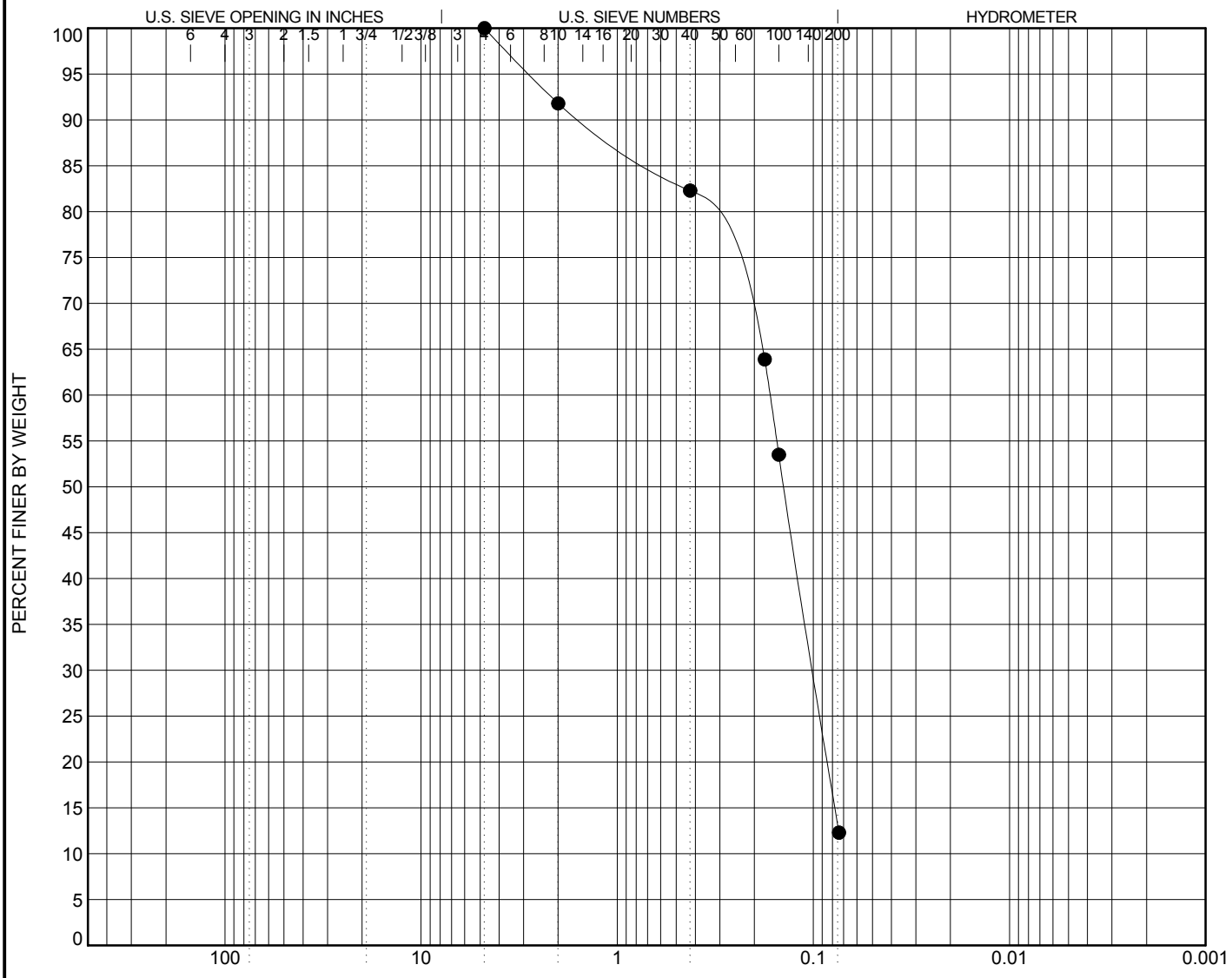
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M17-38**	**0.0**	**SILTY SAND (SM)**	**21**	**20**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M17-38**	**0.0**	**4.75**	**0.159**	**0.09**		**0.0**	**79.8**	**20.2**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

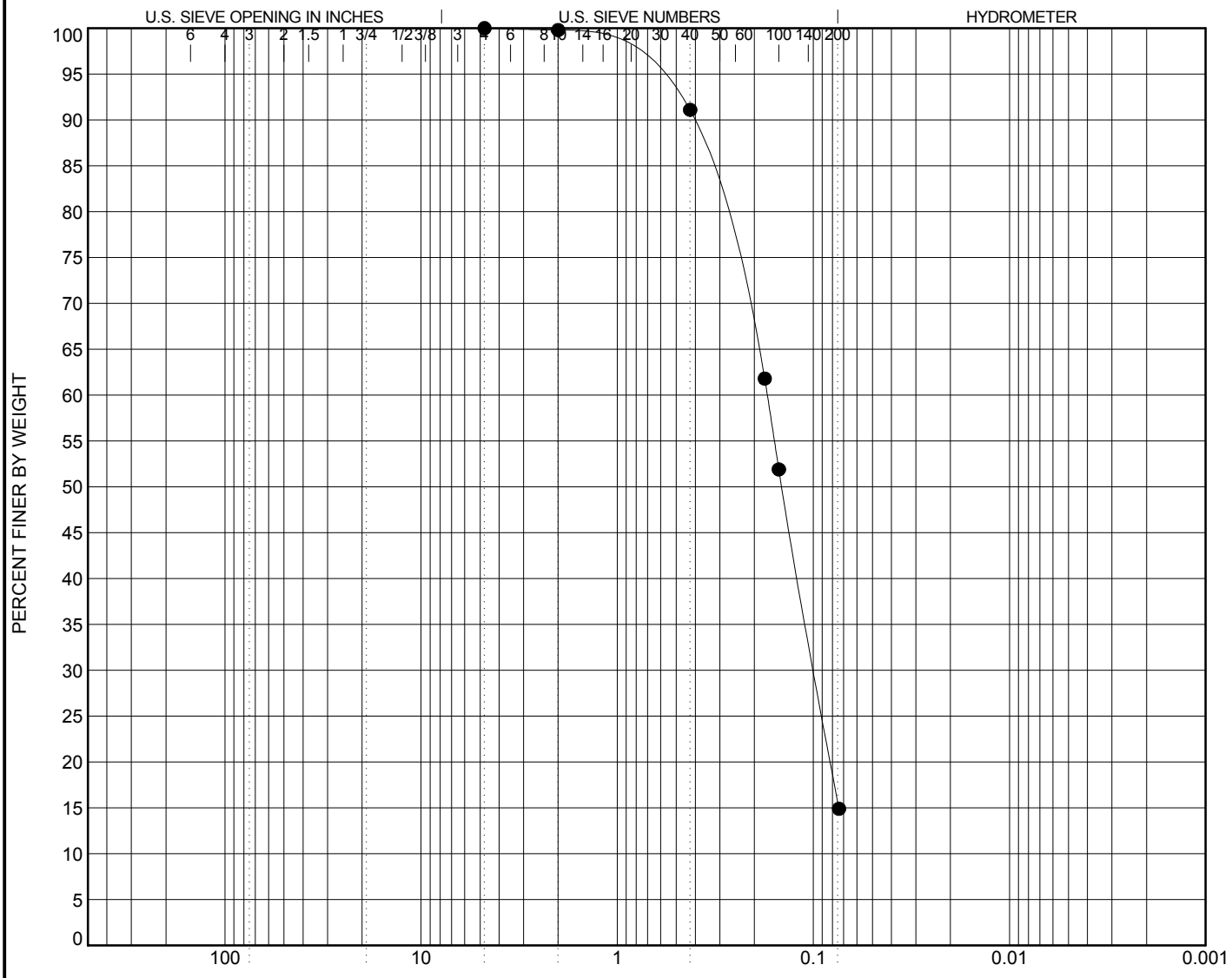
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M17-64**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**	**0.85**	**2.34**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M17-64**	**0.0**	**4.75**	**0.166**	**0.1**		**0.0**	**86.9**	**13.1**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

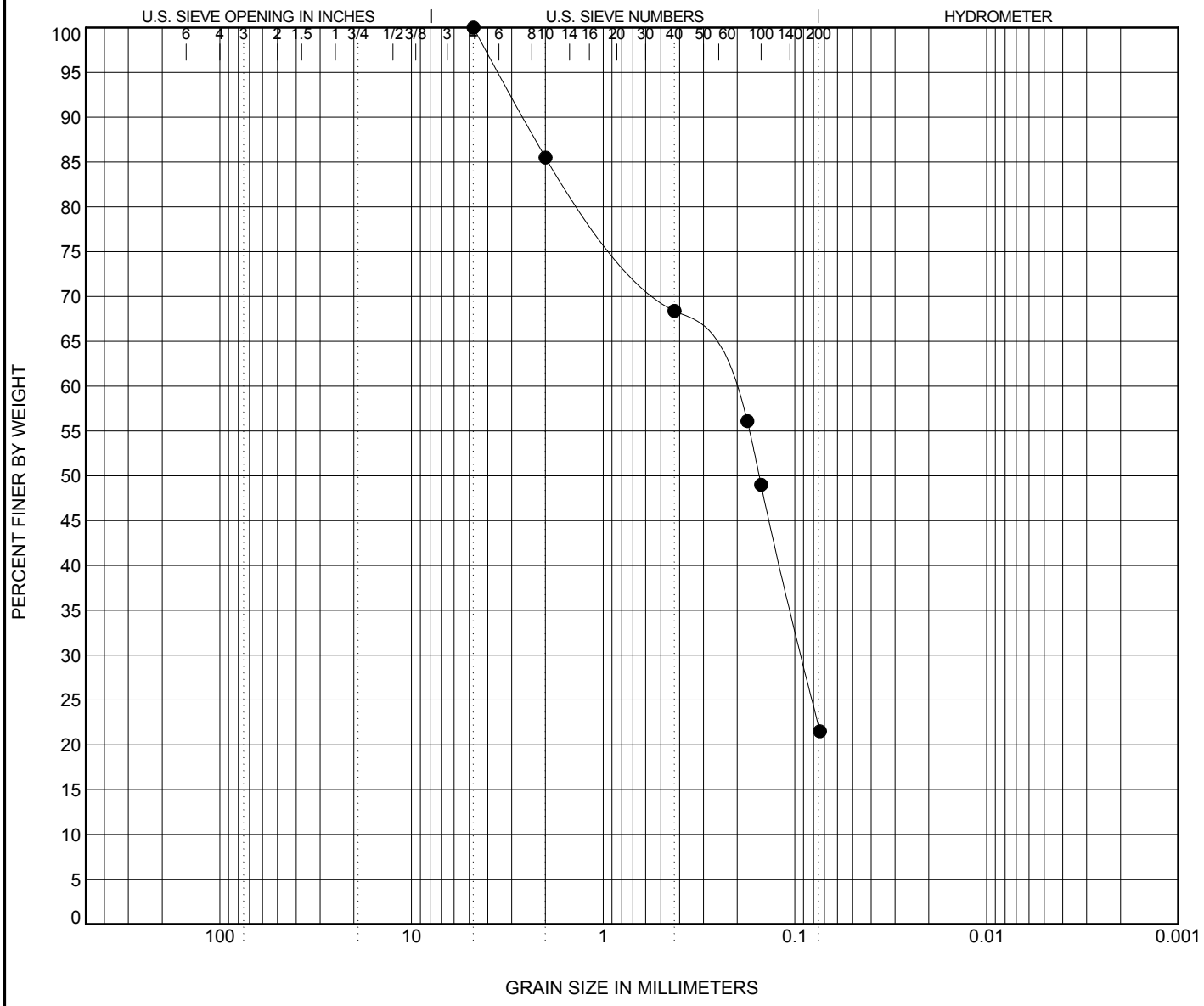
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M17-93**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M17-93**	**0.0**	**4.75**	**0.172**	**0.099**		**0.0**	**84.4**	**15.6**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

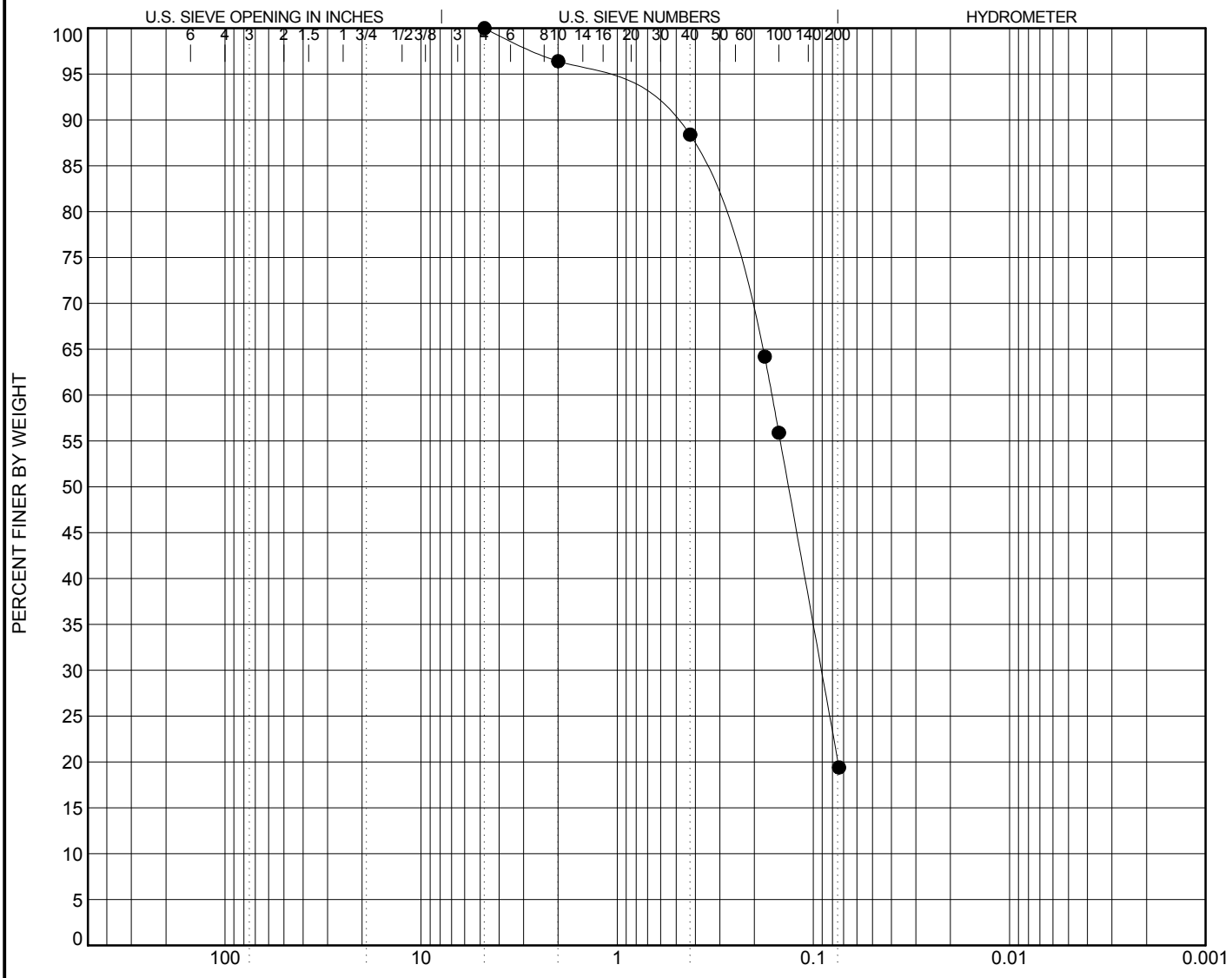
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M18-92**	**1.5**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M18-92**	**1.5**	**4.75**	**0.234**	**0.092**		**0.0**	**78.0**	**22.0**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

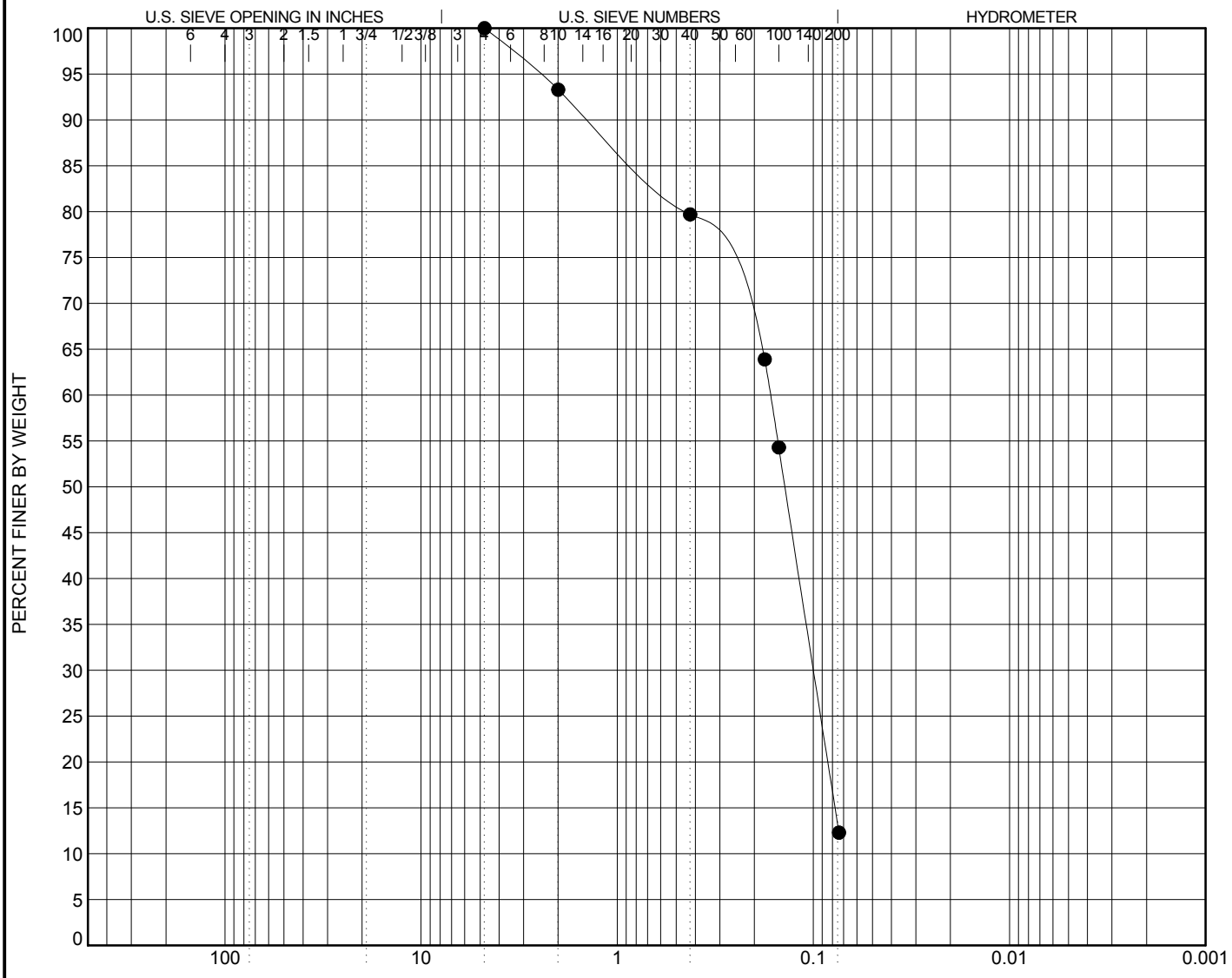
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M20-59**	**0.0**	**SILTY SAND (SM)**	**22**	**20**	**2**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M20-59**	**0.0**	**4.75**	**0.163**	**0.091**		**0.0**	**79.9**	**20.1**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

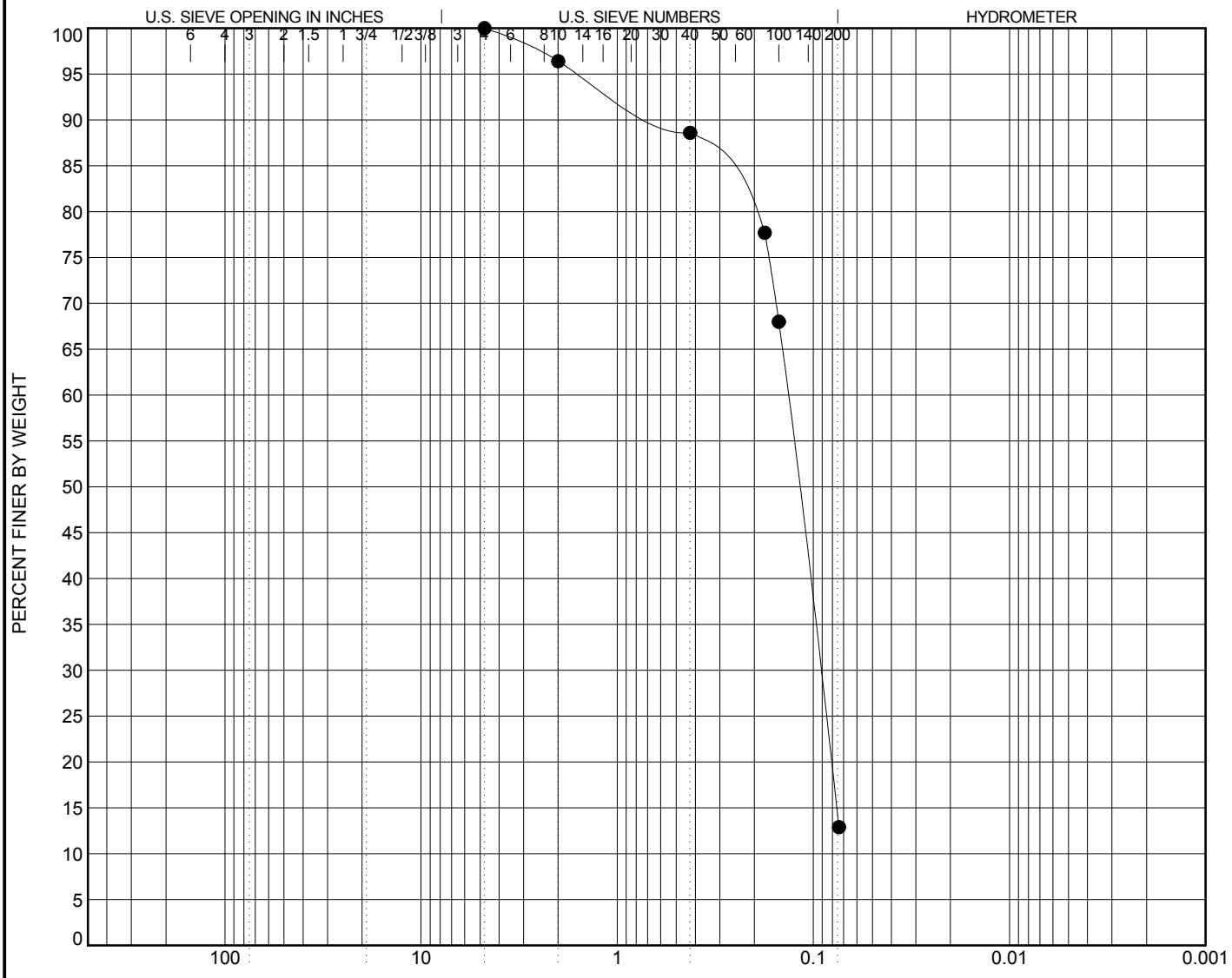
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M20-147**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**	**0.84**	**2.32**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M20-147**	**0.0**	**4.75**	**0.165**	**0.1**		**0.0**	**86.9**	**13.1**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

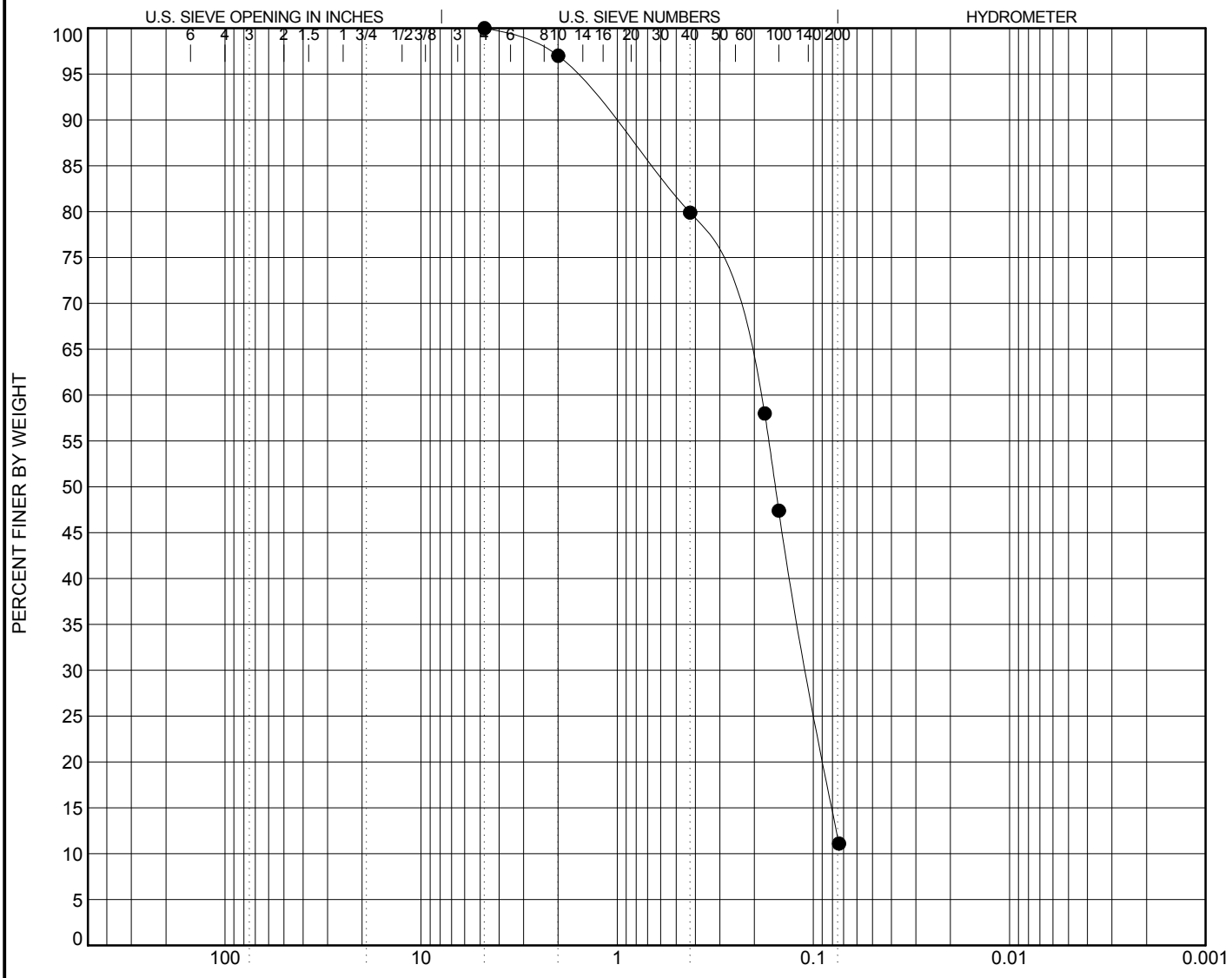
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M20-244**	**0.0**	**SILTY SAND (SM)**	**22**	**21**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M20-244**	**0.0**	**4.75**	**0.135**	**0.092**		**0.0**	**86.1**	**13.9**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

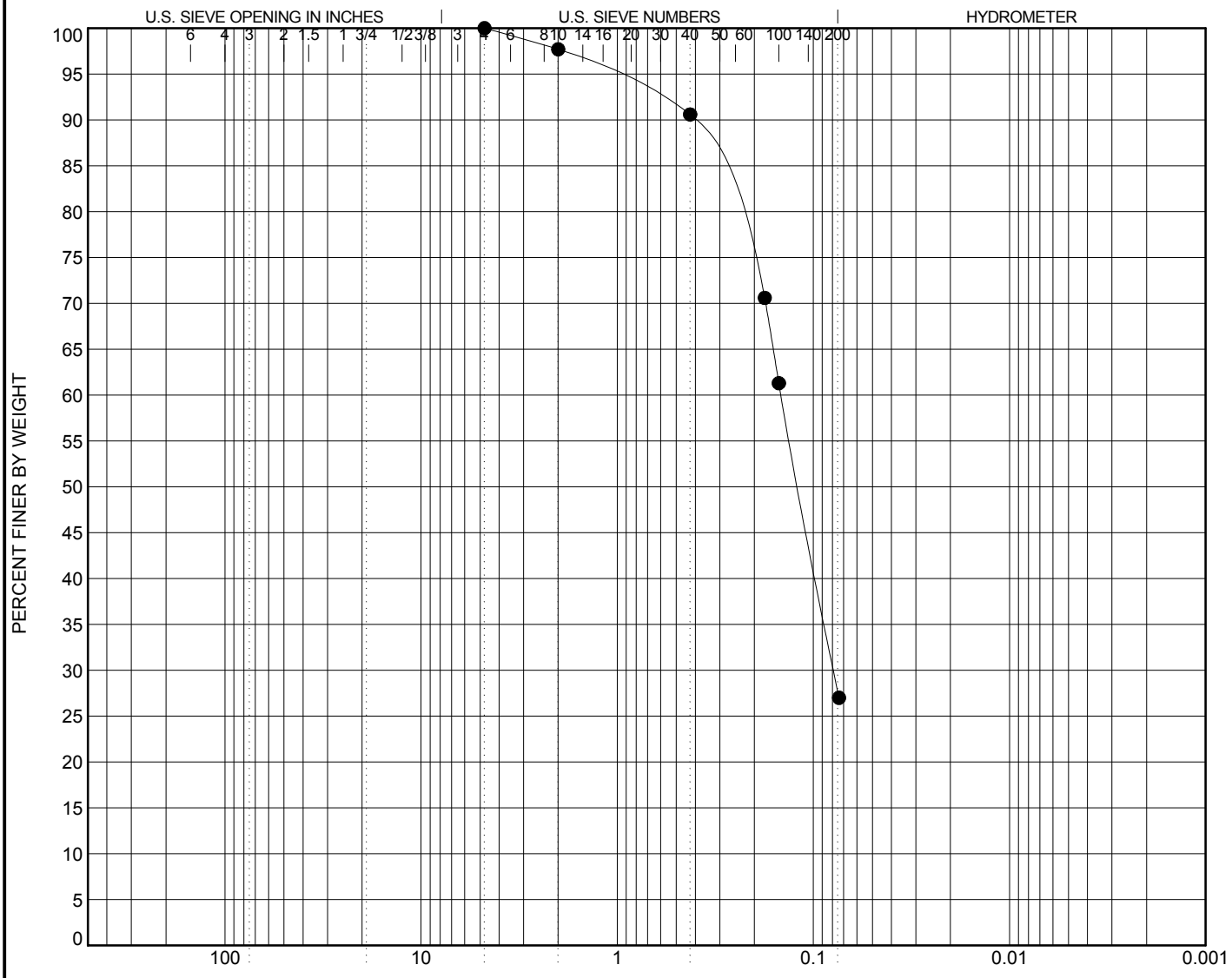
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M21-280**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**0.82**	**2.65**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M21-280**	**0.0**	**4.75**	**0.192**	**0.107**		**0.0**	**88.2**	**11.8**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

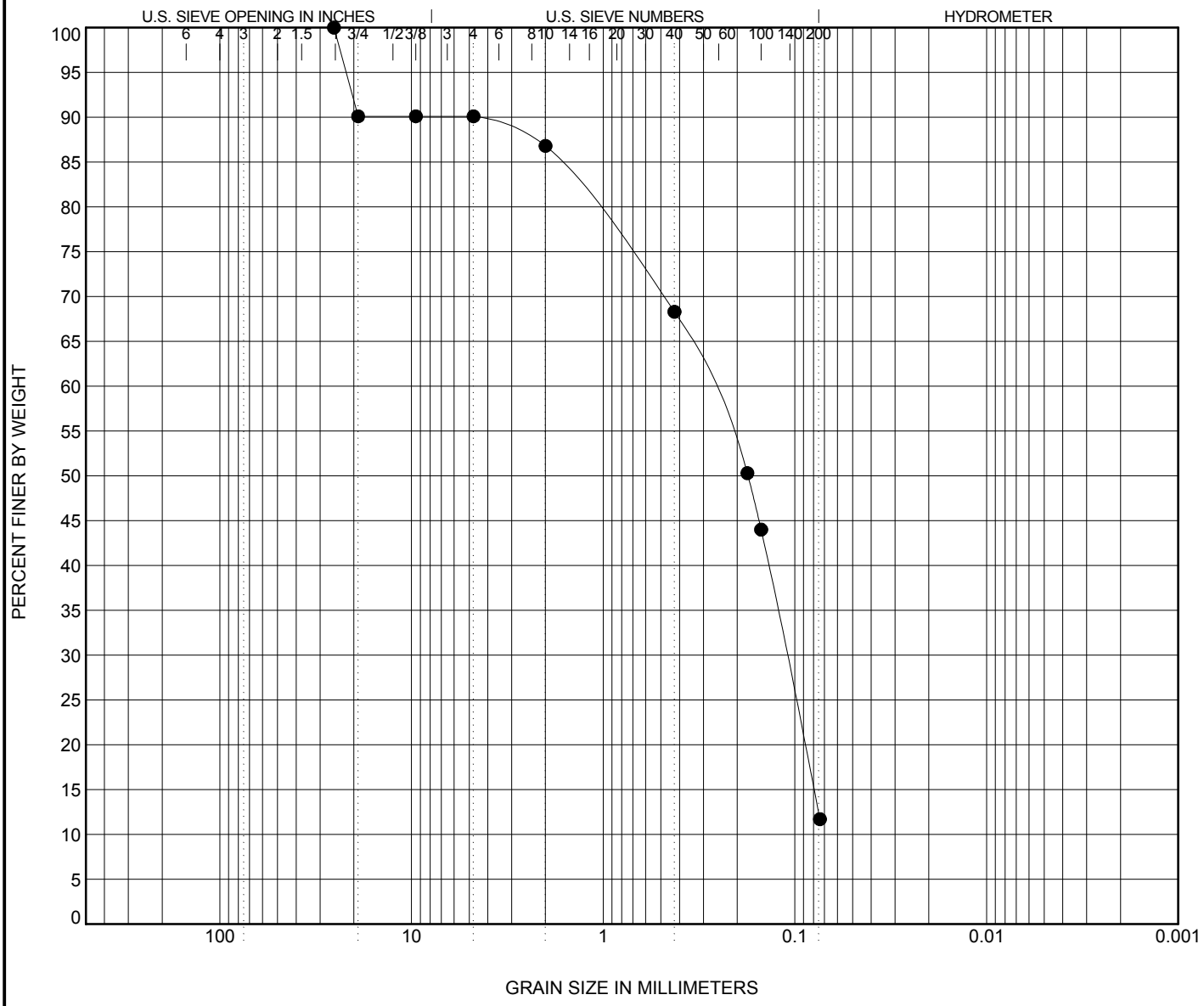
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M21-405**	**0.0**	**SILTY, CLAYEY SAND (SC-SM)**	**25**	**20**	**5**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M21-405**	**0.0**	**4.75**	**0.146**	**0.079**		**0.0**	**72.3**	**27.7**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

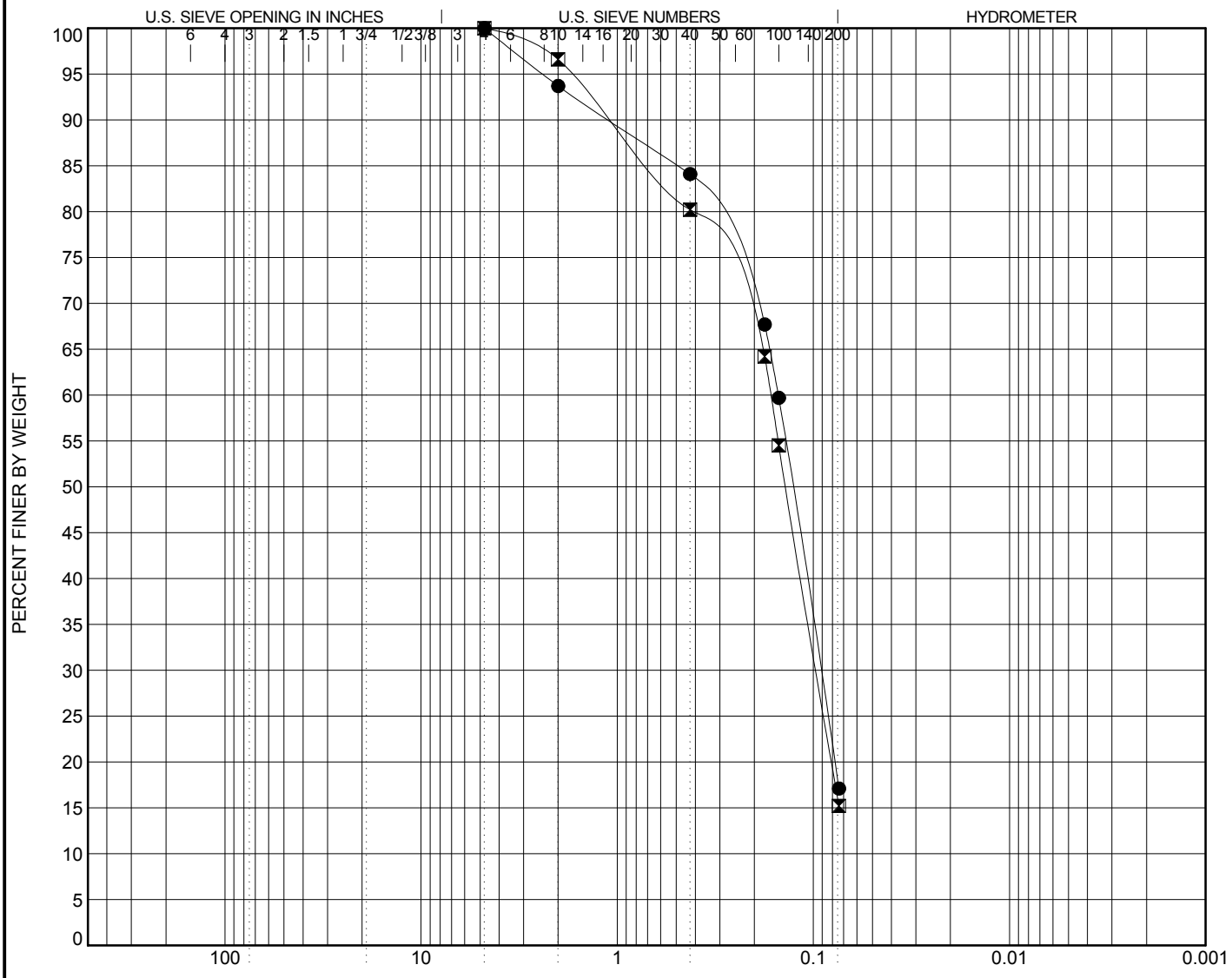
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M21-434**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**	**0.60**	**3.98**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M21-434**	**0.0**	**25.4**	**0.284**	**0.11**		**9.9**	**77.8**	**12.3**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

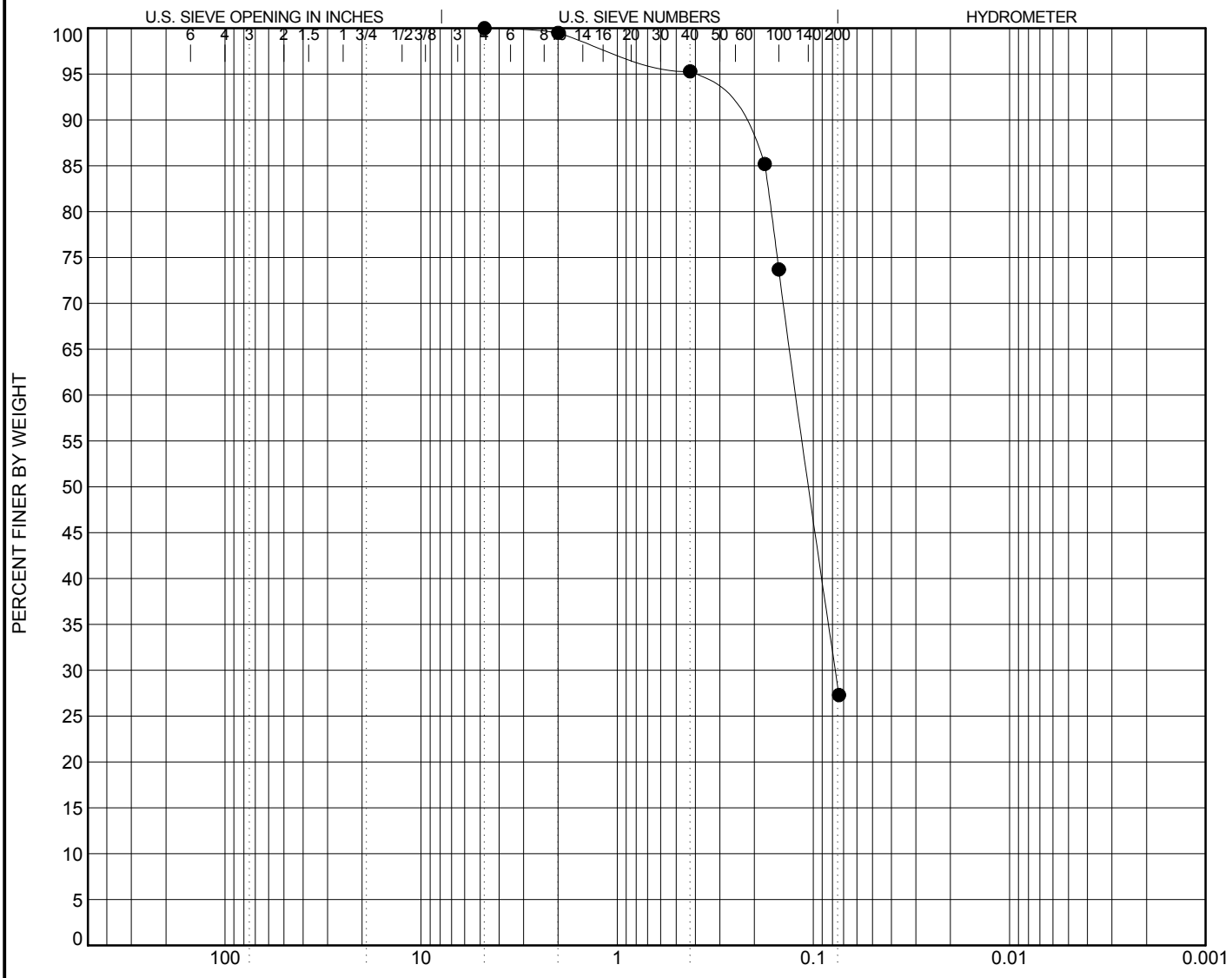
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M21-528**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**		
⧓	**M21-528**	**1.0**	**SILTY SAND (SM)**	**22**	**21**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M21-528**	**0.0**	**4.75**	**0.151**	**0.092**		**0.0**	**82.1**	**17.9**	
⧓	**M21-528**	**1.0**	**4.75**	**0.165**	**0.097**		**0.0**	**84.1**	**15.9**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

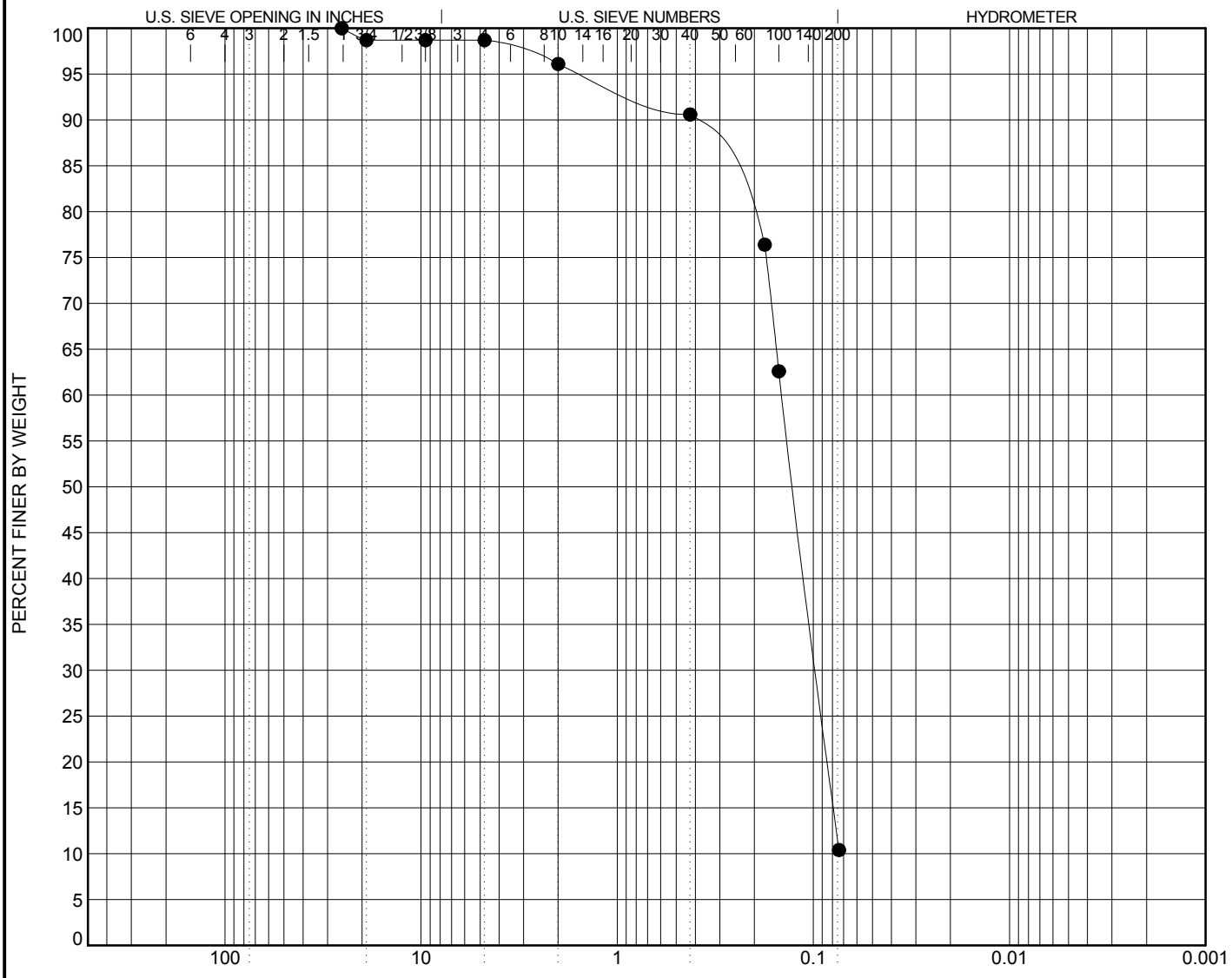
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M22-104**	**0.0**						

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M22-104**	**0.0**	**4.75**	**0.122**	**0.077**		**0.0**	**71.8**	**28.2**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

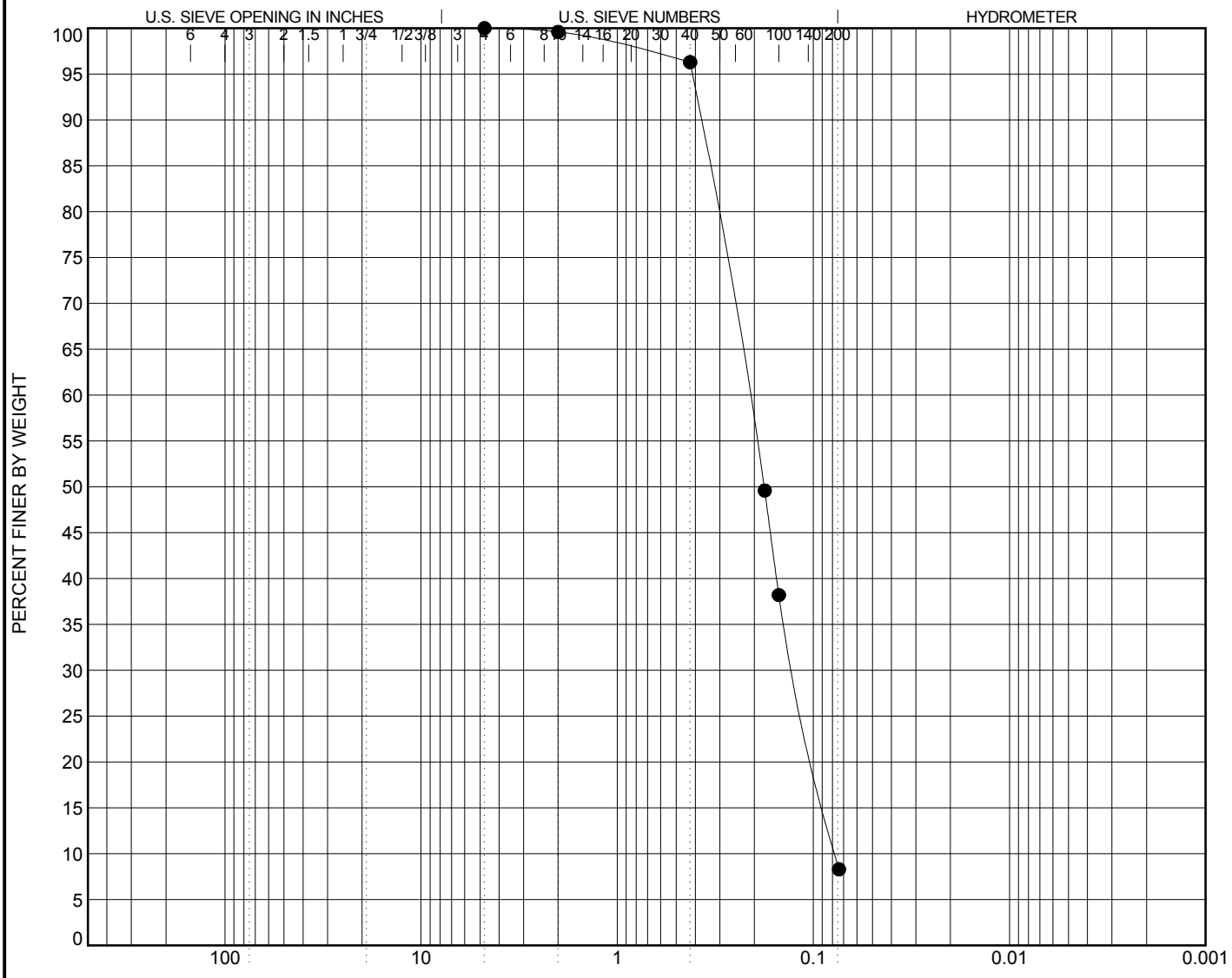
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M23-54**	**0.0**	**POORLY GRADED SAND with SILTY CLAY (SP-SC)**	**26**	**20**	**6**	**0.87**	**1.97**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M23-54**	**0.0**	**25.4**	**0.145**	**0.096**		**1.3**	**87.3**	**11.4**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

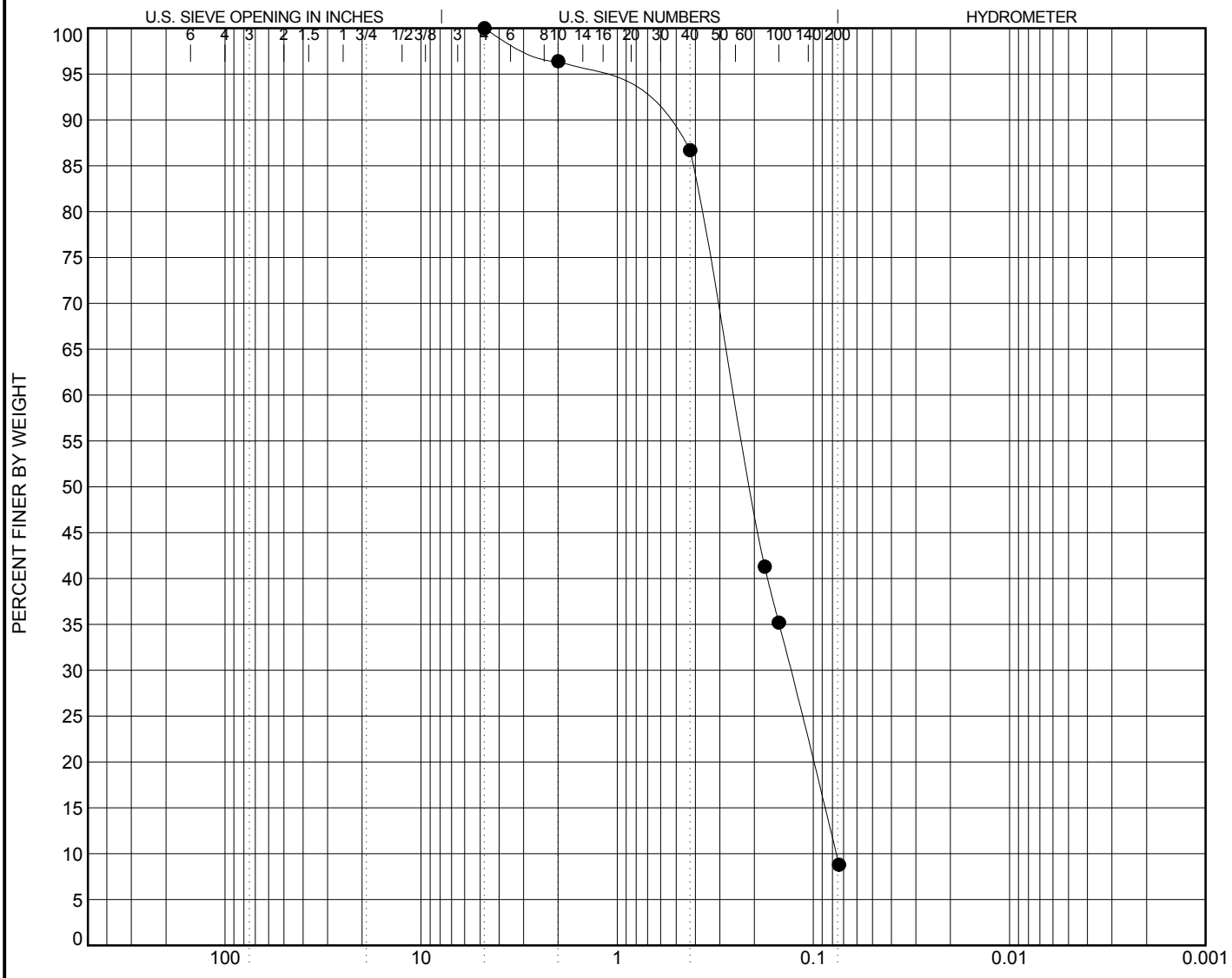
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M23-132**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**20**	**19**	**1**	**0.92**	**2.79**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M23-132**	**0.0**	**4.75**	**0.215**	**0.124**	**0.077**	**0.0**	**91.1**	**8.9**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

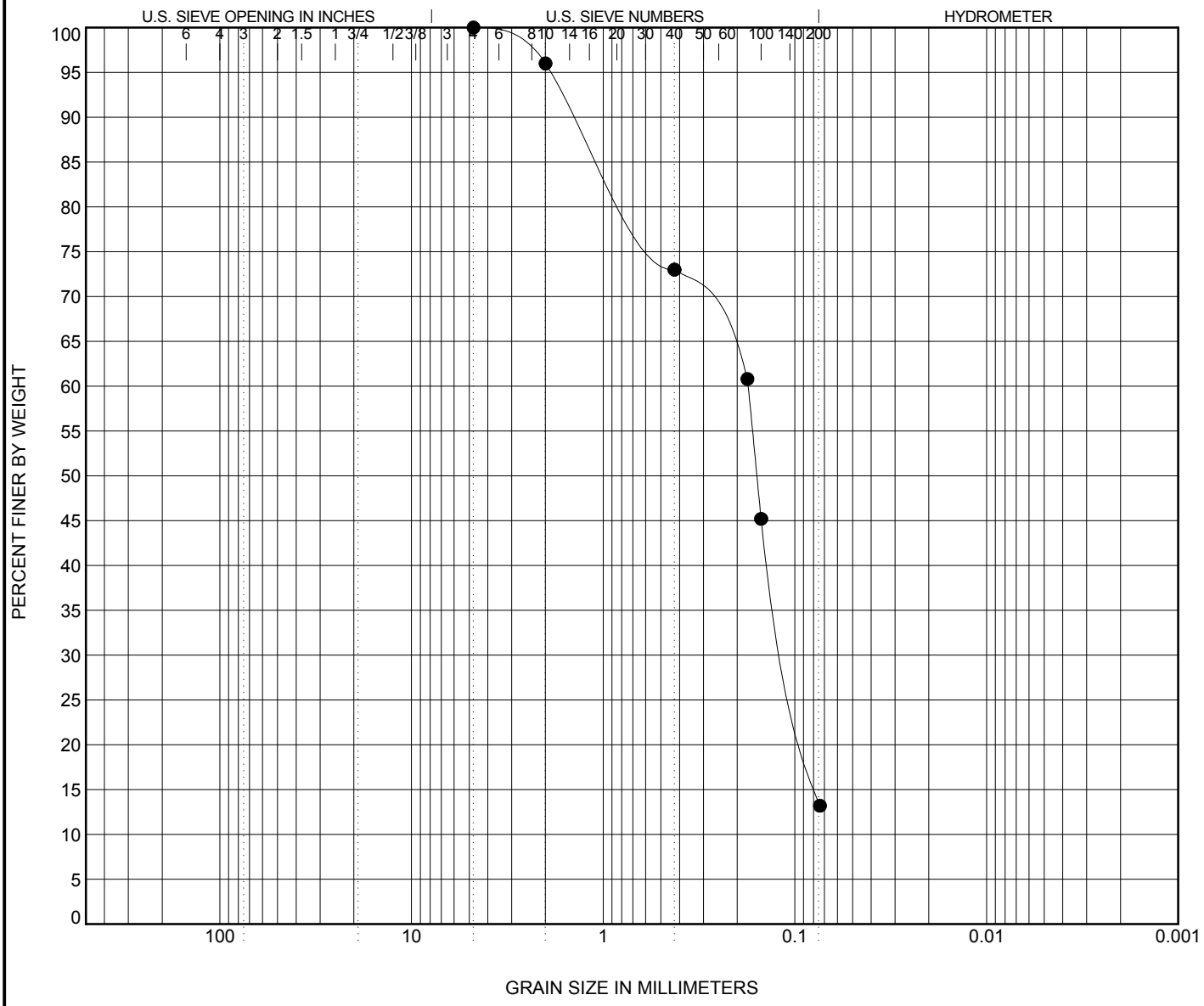
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M24-22**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**0.88**	**3.32**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M24-22**	**0.0**	**4.75**	**0.254**	**0.131**	**0.076**	**0.0**	**90.7**	**9.3**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

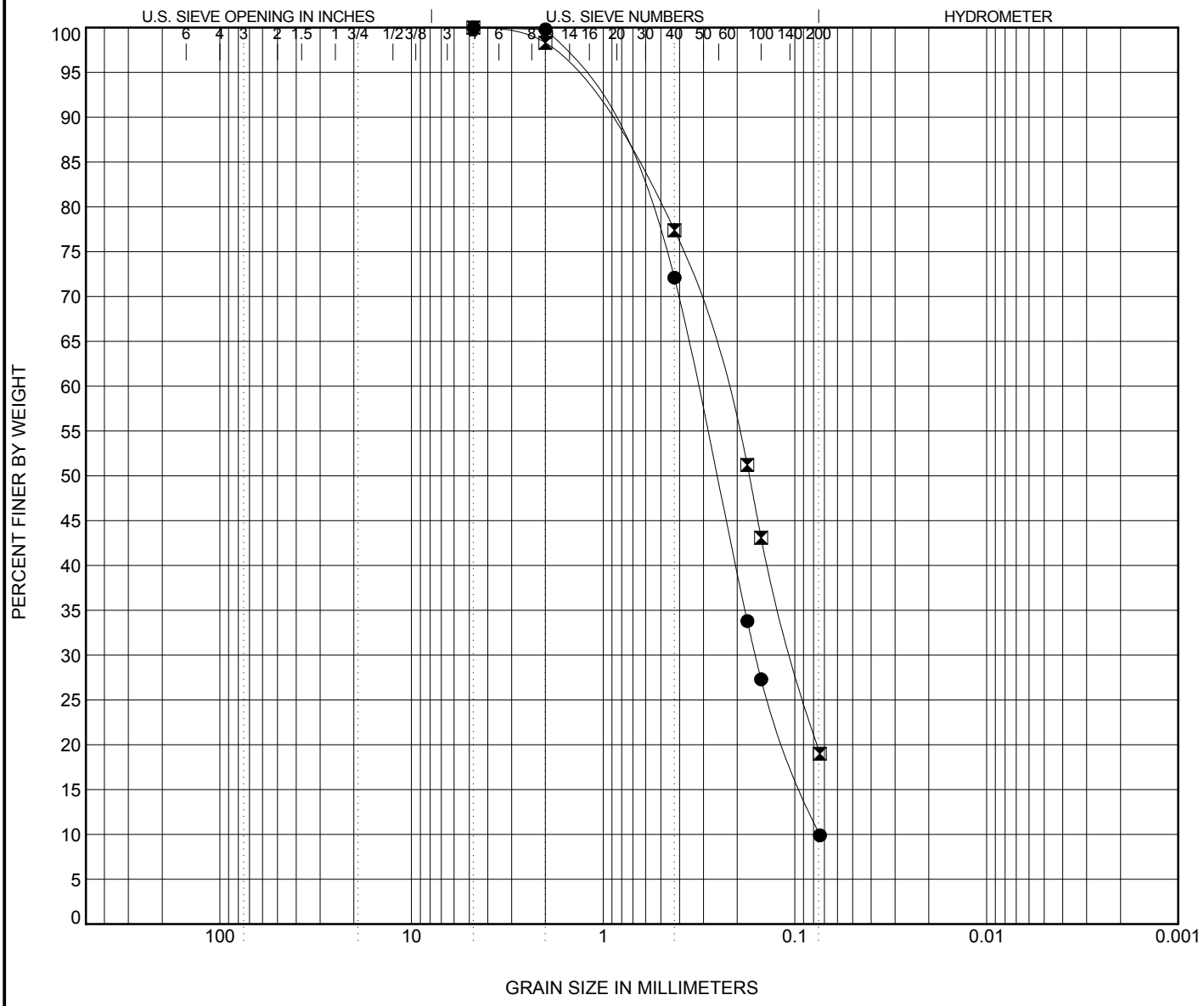
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M24-35**	**0.0**	**SILTY SAND (SM)**	**25**	**23**	**2**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M24-35**	**0.0**	**4.75**	**0.176**	**0.107**		**0.0**	**86.2**	**13.8**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

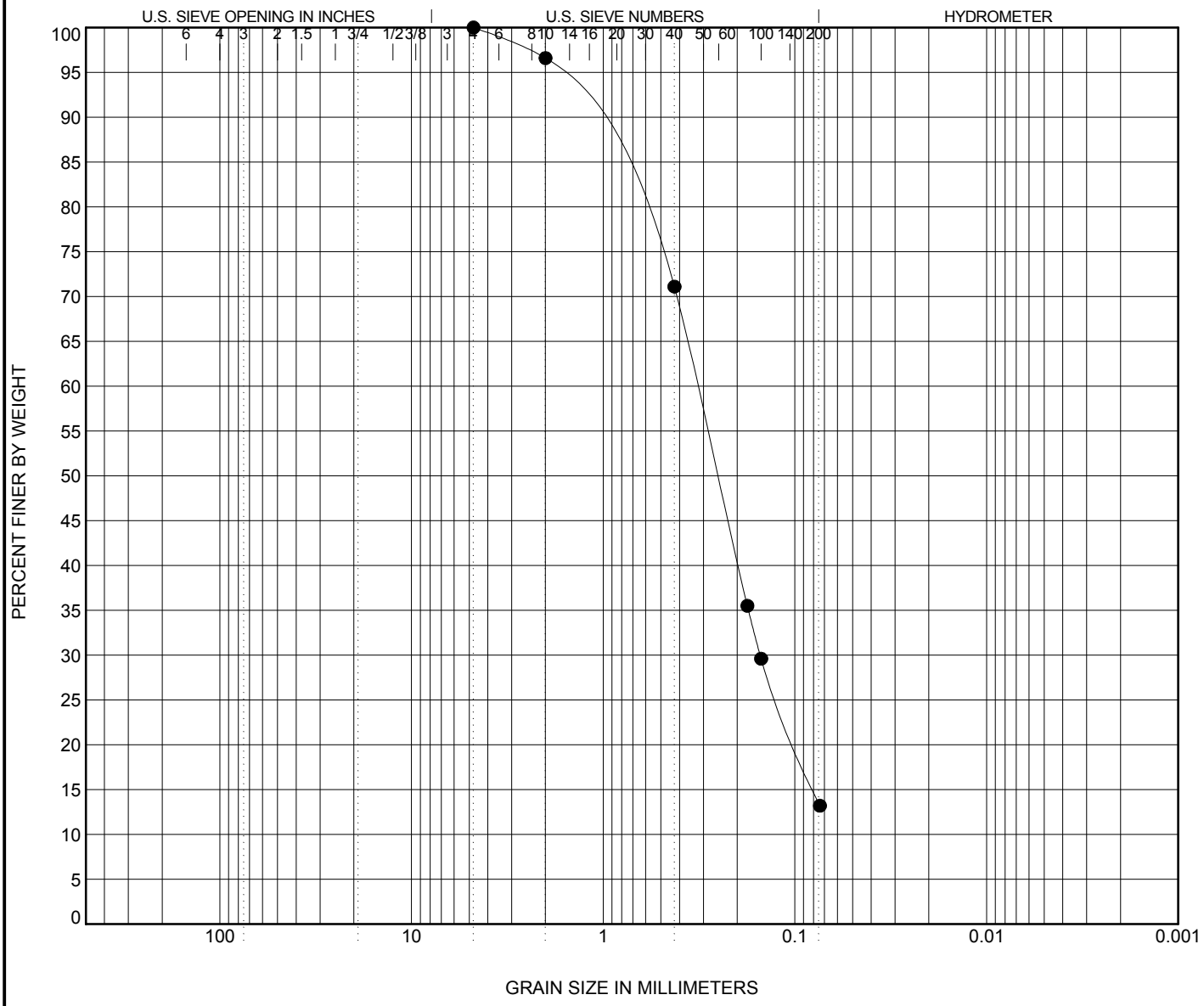
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M24-40**	**0.0**	**POORLY GRADED SAND with SILTY CLAY (SP-SC)**	**24**	**20**	**4**	**1.08**	**4.34**
⊠	**M24-40**	**0.1**	**CLAYEY SAND (SC)**	**33**	**20**	**13**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M24-40**	**0.0**	**4.75**	**0.322**	**0.161**	**0.074**	**0.0**	**89.8**	**10.2**	
⊠	**M24-40**	**0.1**	**4.75**	**0.238**	**0.102**		**0.0**	**80.5**	**19.5**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

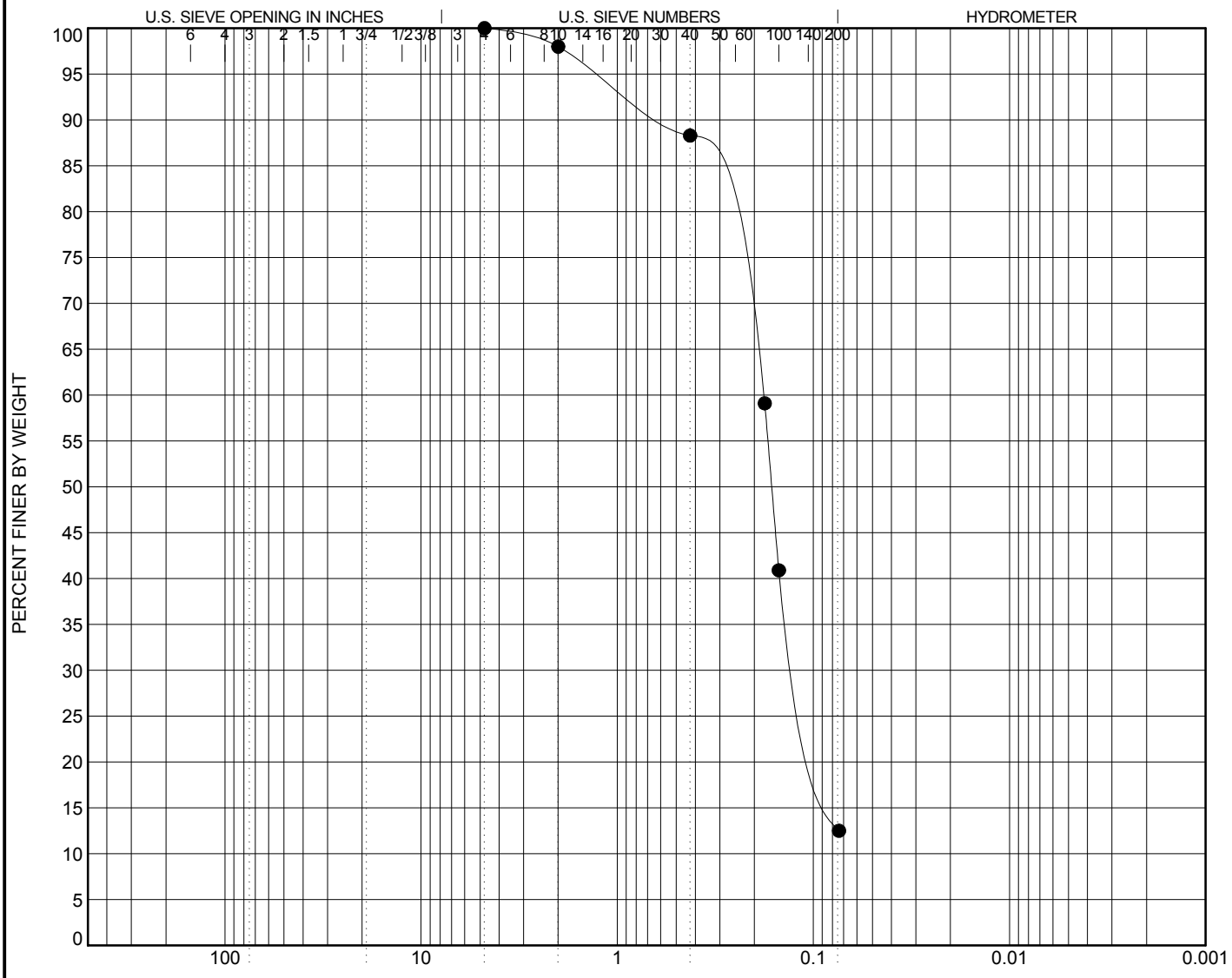
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M24-76**	**0.0**	**CLAYEY SAND (SC)**	**31**	**19**	**12**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M24-76**	**0.0**	**4.75**	**0.323**	**0.152**		**0.0**	**86.5**	**13.5**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

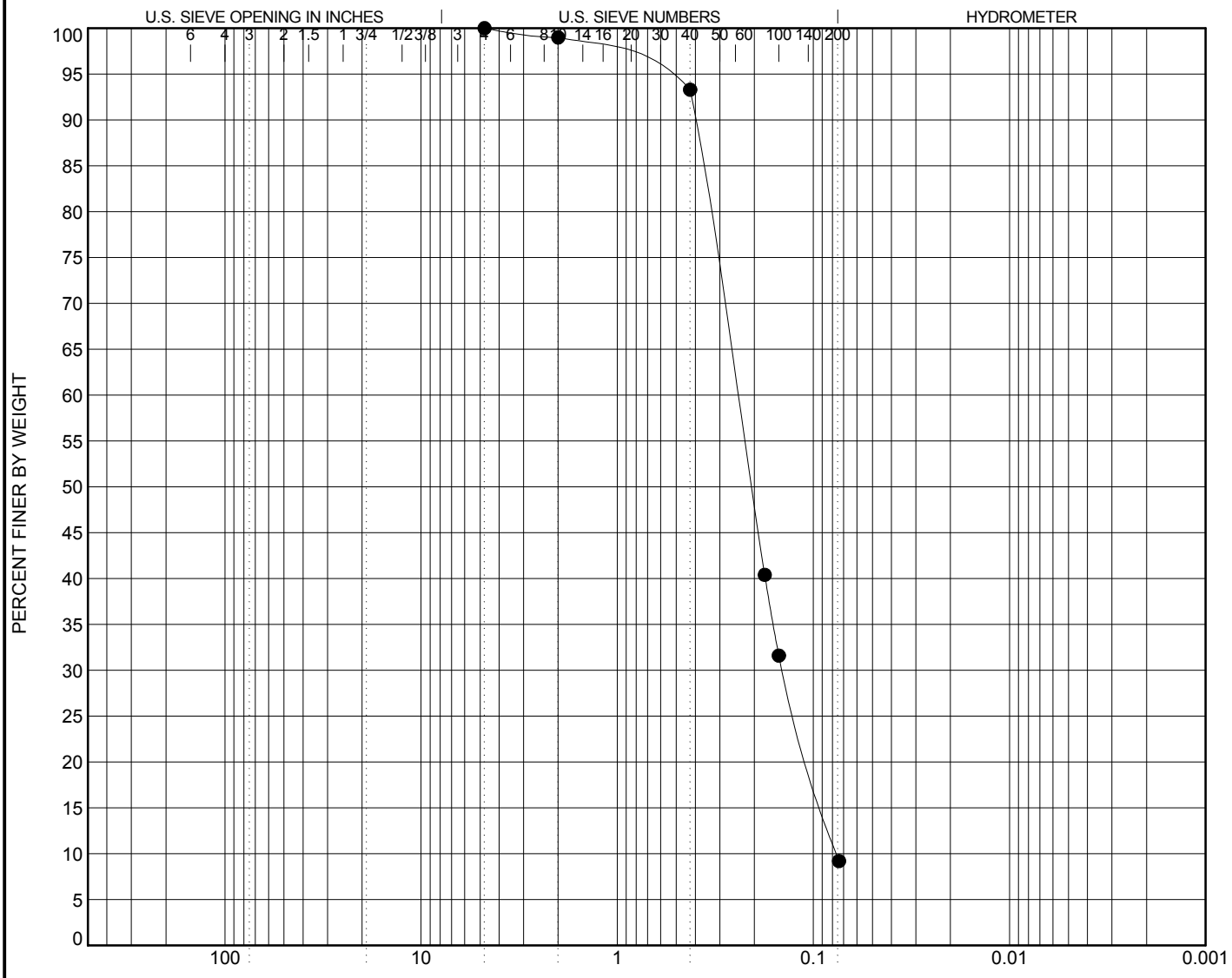
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M24-88**	**0.0**	**SILTY SAND (SM)**	**23**	**20**	**3**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M24-88**	**0.0**	**4.75**	**0.182**	**0.114**		**0.0**	**87.0**	**13.0**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

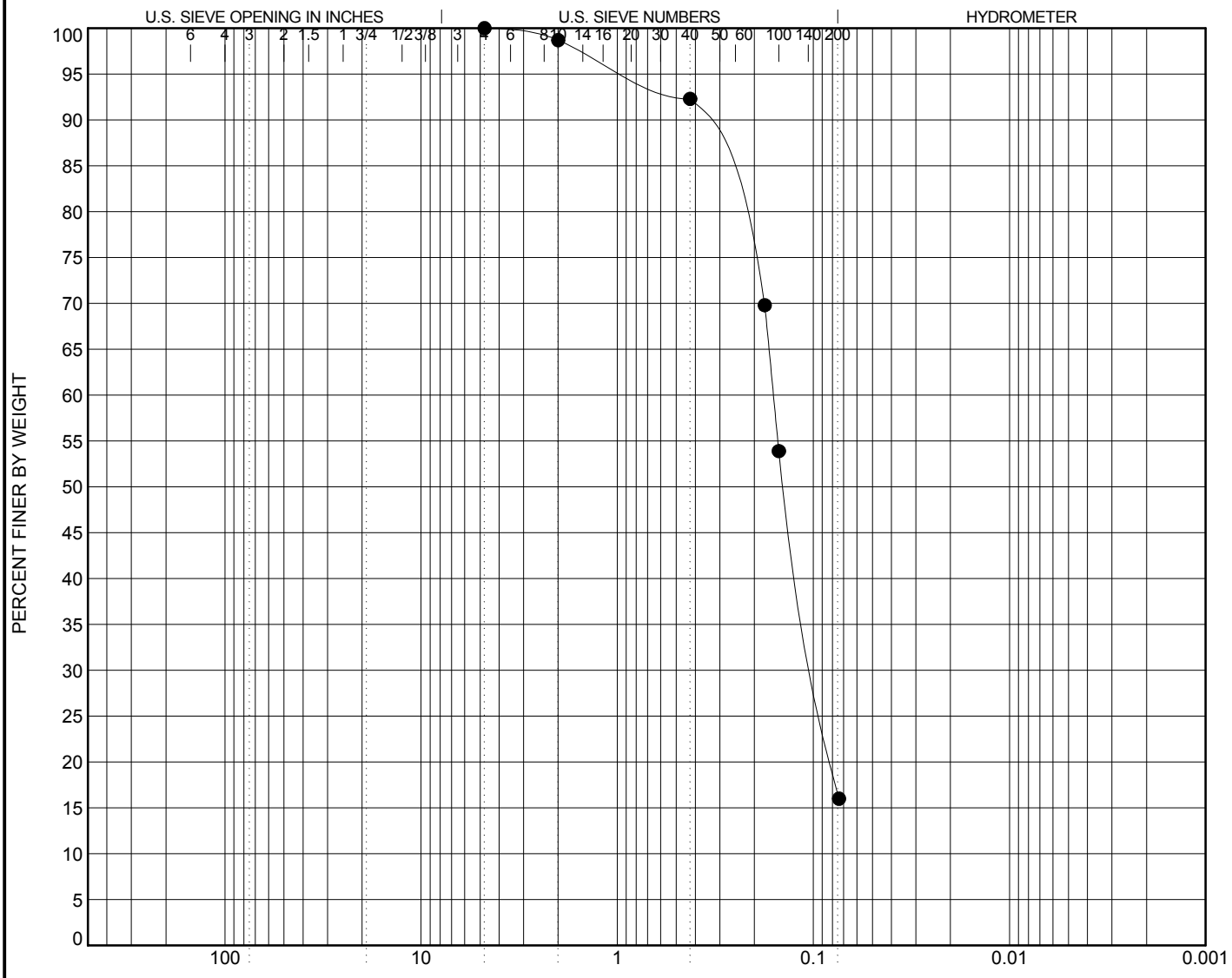
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M25-50**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**22**	**20**	**2**	**1.09**	**3.23**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M25-50**	**0.0**	**4.75**	**0.245**	**0.143**	**0.076**	**0.0**	**90.4**	**9.6**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

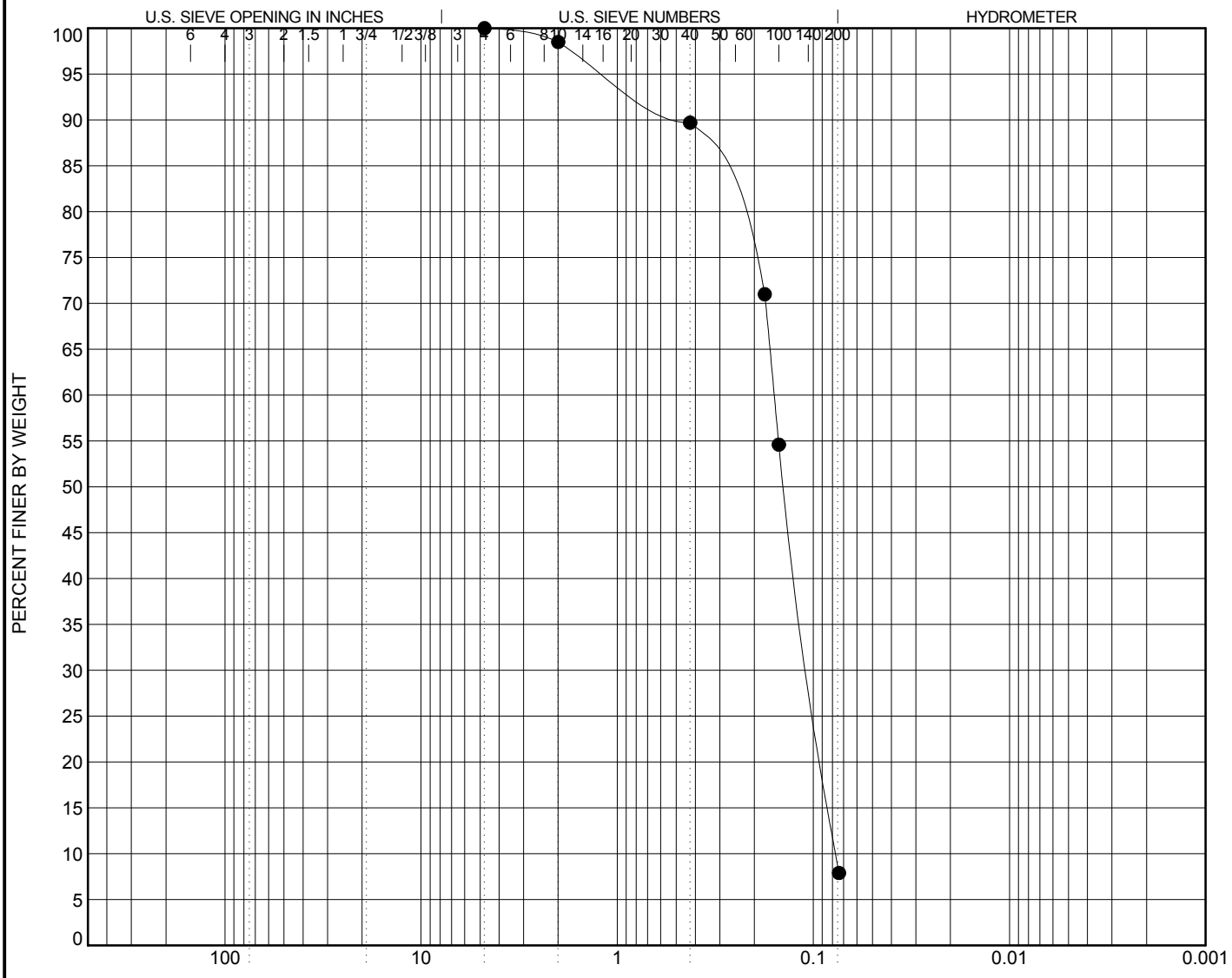
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M27-51**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M27-51**	**0.0**	**4.75**	**0.16**	**0.096**		**0.0**	**83.3**	**16.7**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

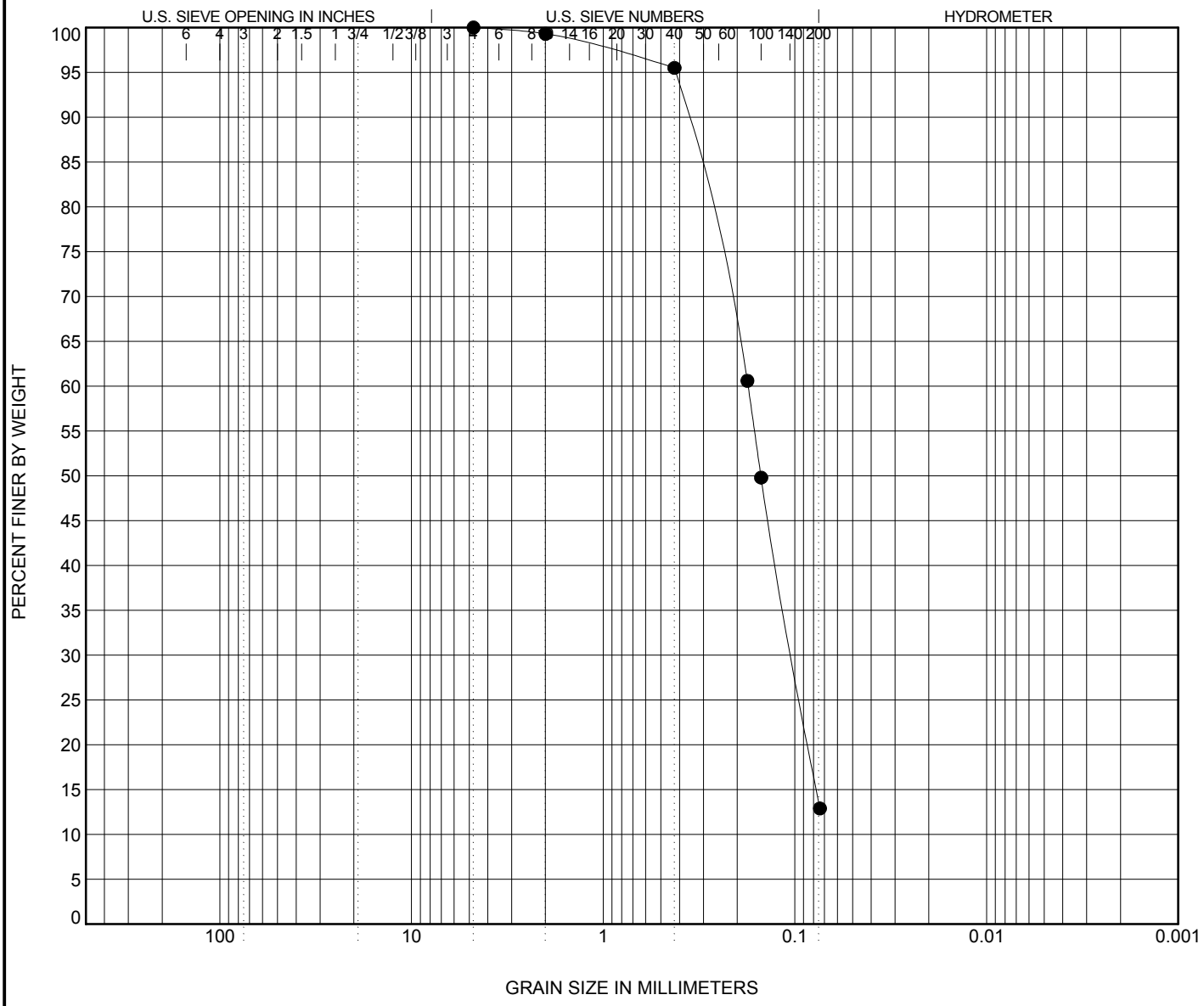
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M28-30**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**0.88**	**2.07**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M28-30**	**0.0**	**4.75**	**0.158**	**0.103**	**0.076**	**0.0**	**91.2**	**8.8**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

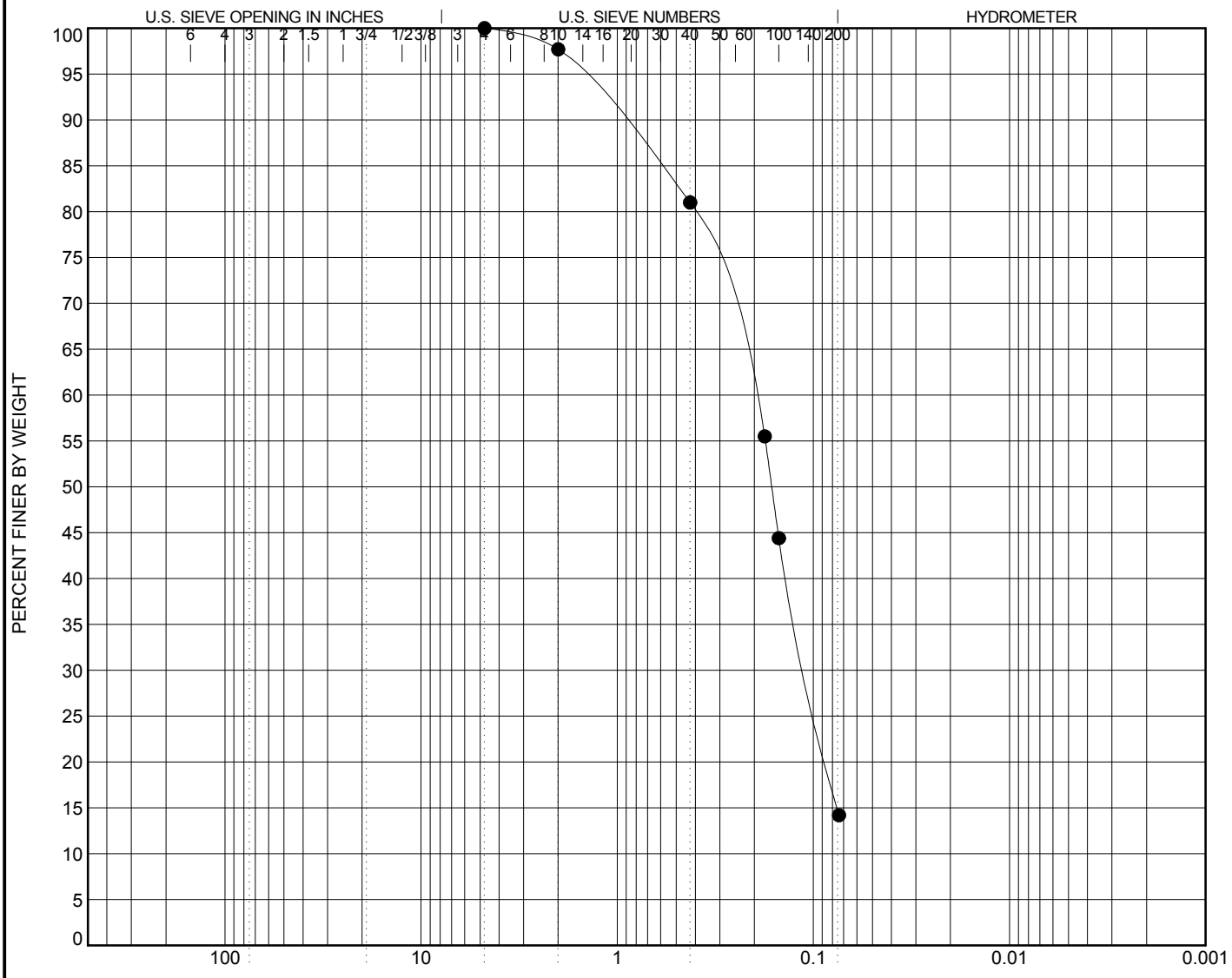
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M28-104**	**0.0**	**SILTY SAND (SM)**	**23**	**22**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M28-104**	**0.0**	**4.75**	**0.175**	**0.103**		**0.0**	**86.4**	**13.6**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

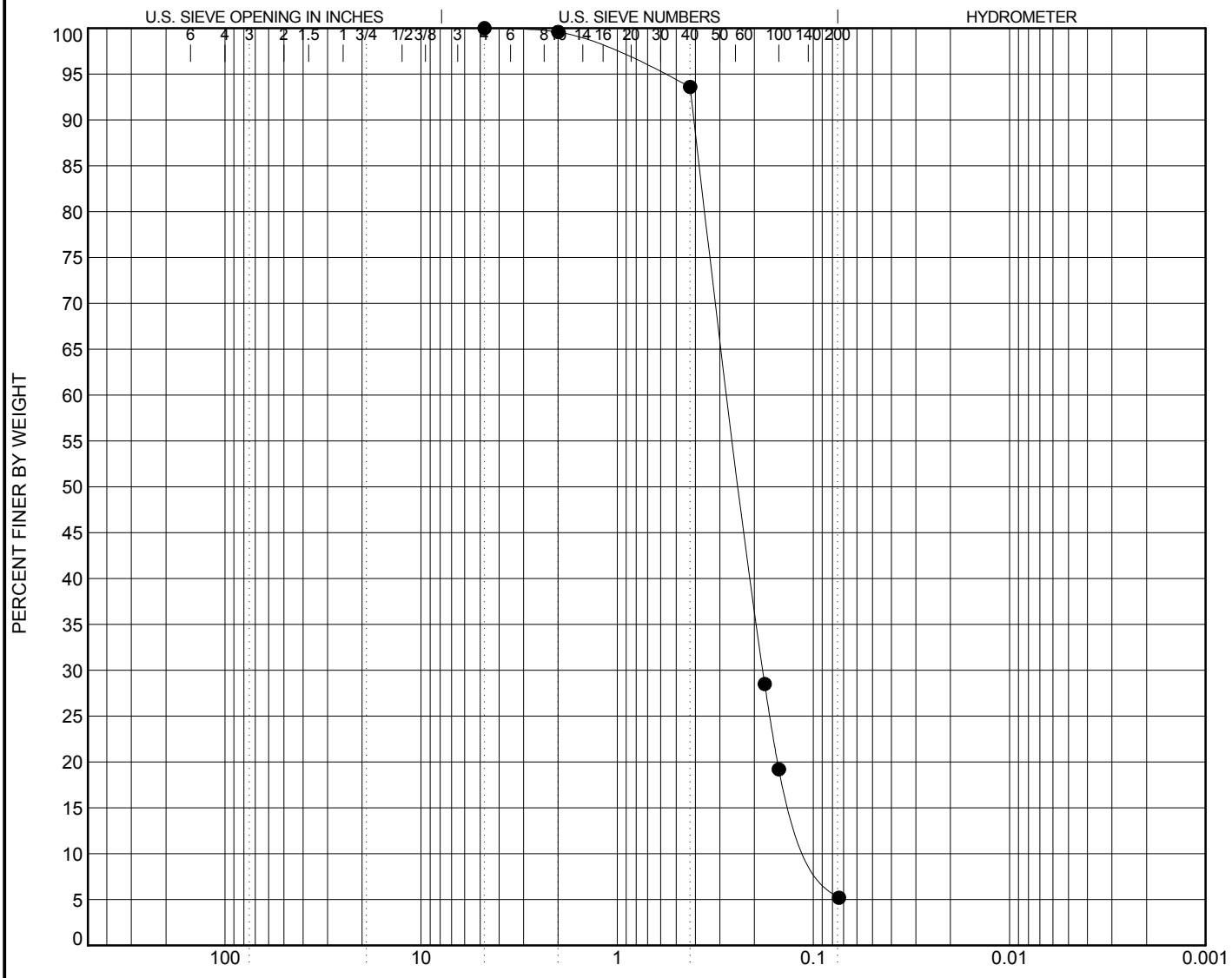
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M28-133**	**0.0**	**SILTY SAND (SM)**	**23**	**20**	**3**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M28-133**	**0.0**	**4.75**	**0.207**	**0.107**		**0.0**	**85.2**	**14.8**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

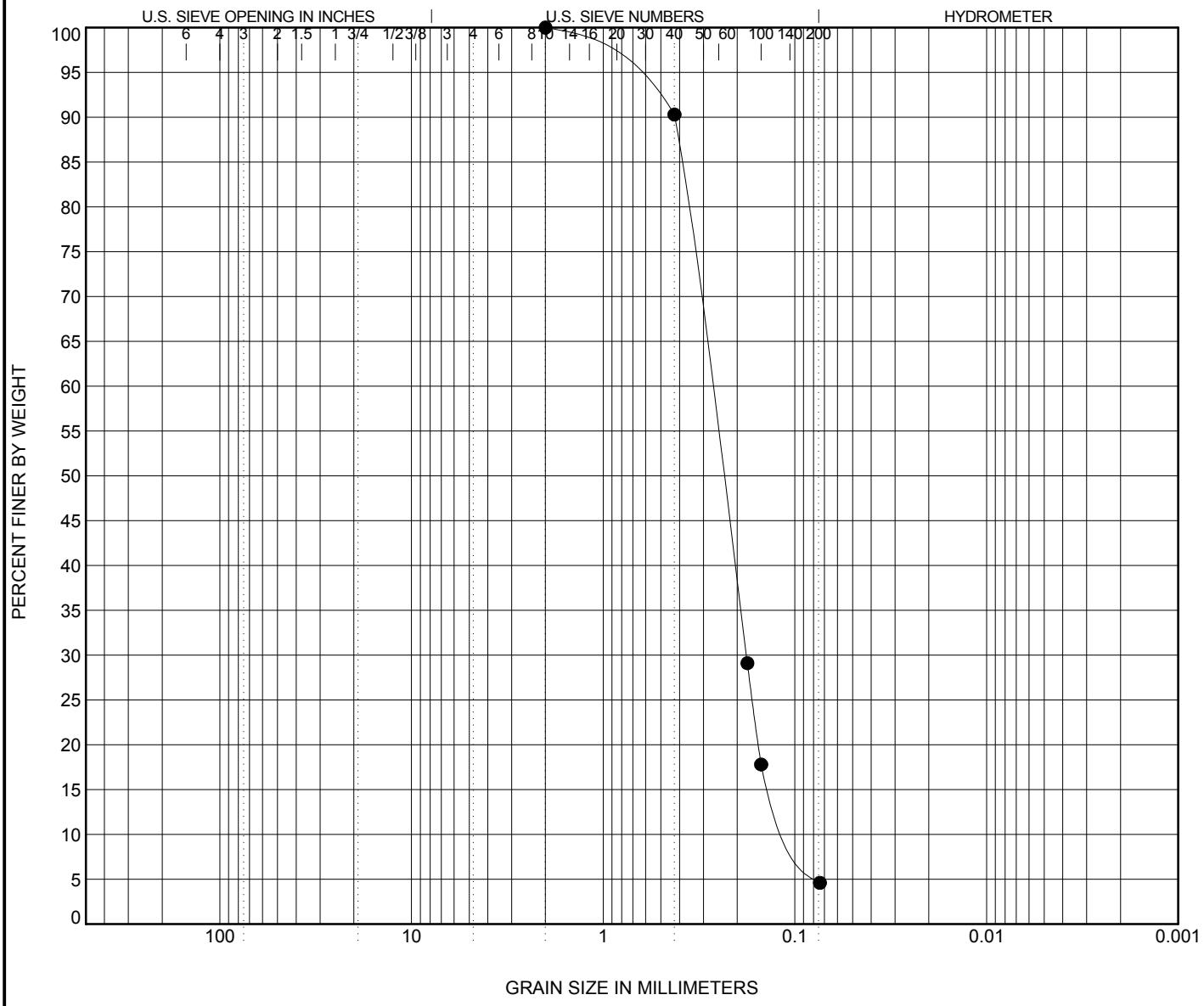
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M29-5**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**1.28**	**2.87**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M29-5**	**0.0**	**4.75**	**0.27**	**0.181**	**0.094**	**0.0**	**94.5**	**5.5**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

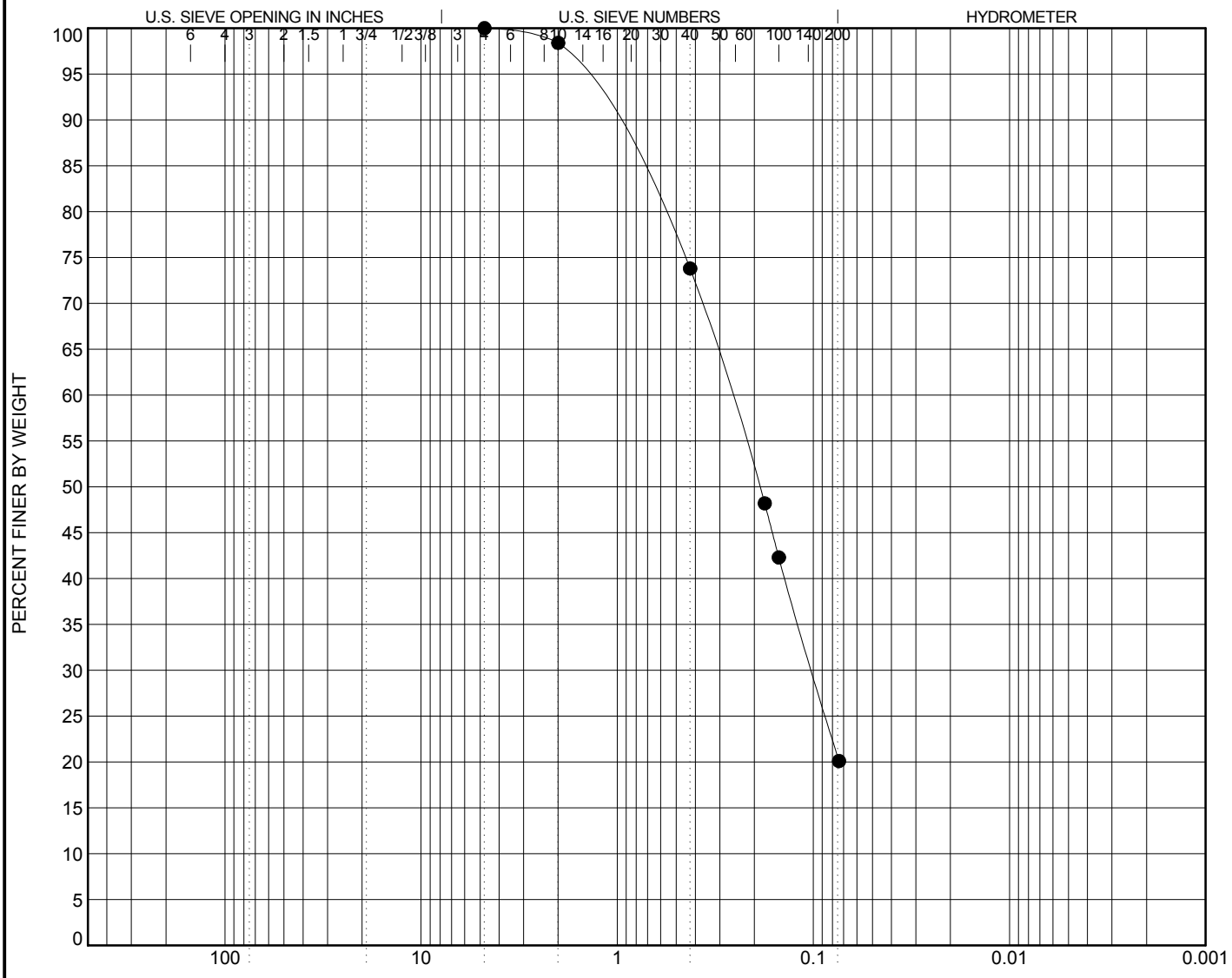
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M29-13**	**0.0**	**POORLY GRADED SAND (SP)**	**NP**	**NP**	**NP**	**1.18**	**2.79**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M29-13**	**0.0**	**2**	**0.275**	**0.179**	**0.099**	**0.0**	**95.1**	**4.9**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

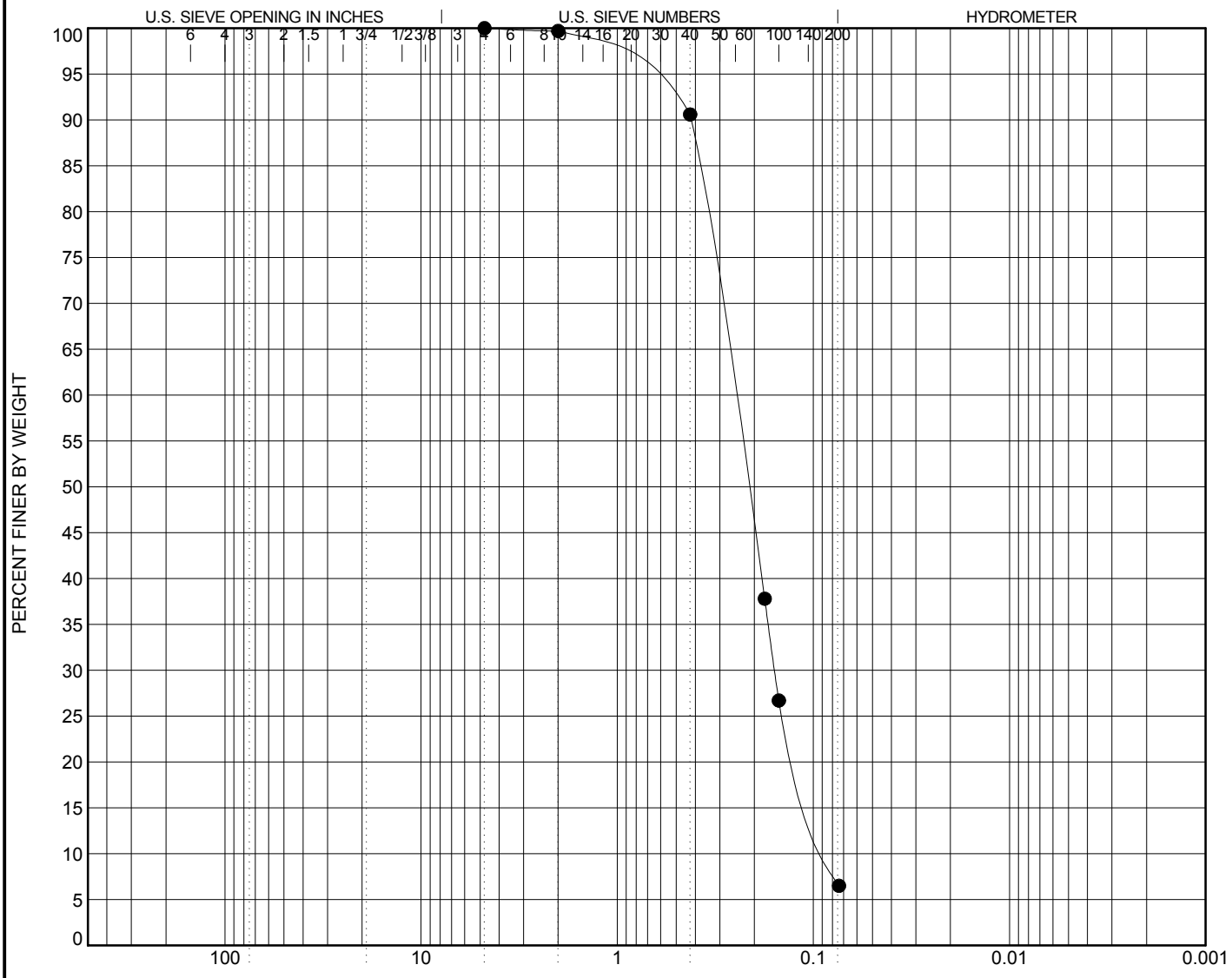
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M29-19**	**0.0**	**CLAYEY SAND (SC)**	**26**	**15**	**11**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M29-19**	**0.0**	**4.75**	**0.265**	**0.101**		**0.0**	**79.5**	**20.5**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

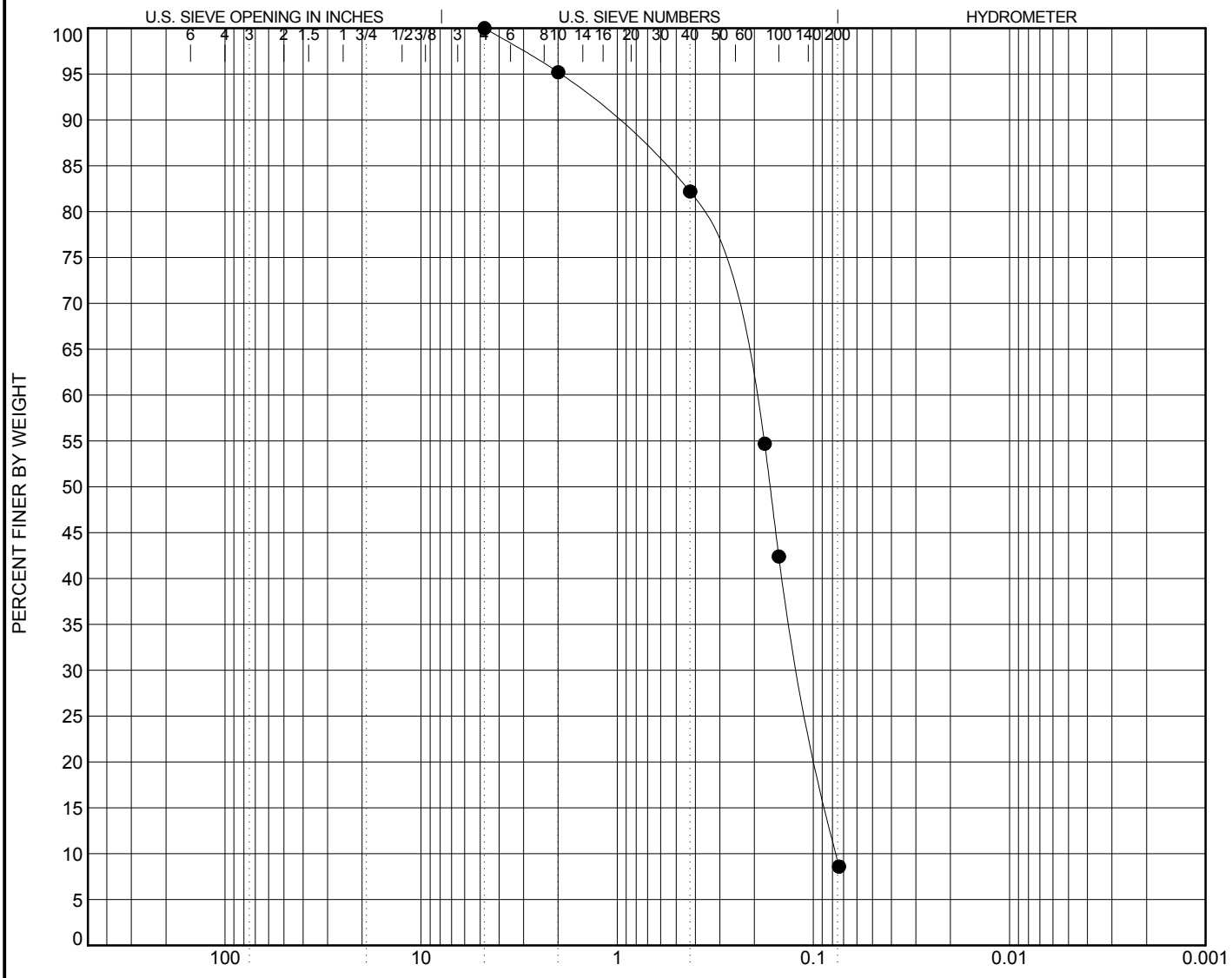
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M29-45**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**1.16**	**3.06**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M29-45**	**0.0**	**4.75**	**0.256**	**0.158**	**0.084**	**0.0**	**93.1**	**6.9**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

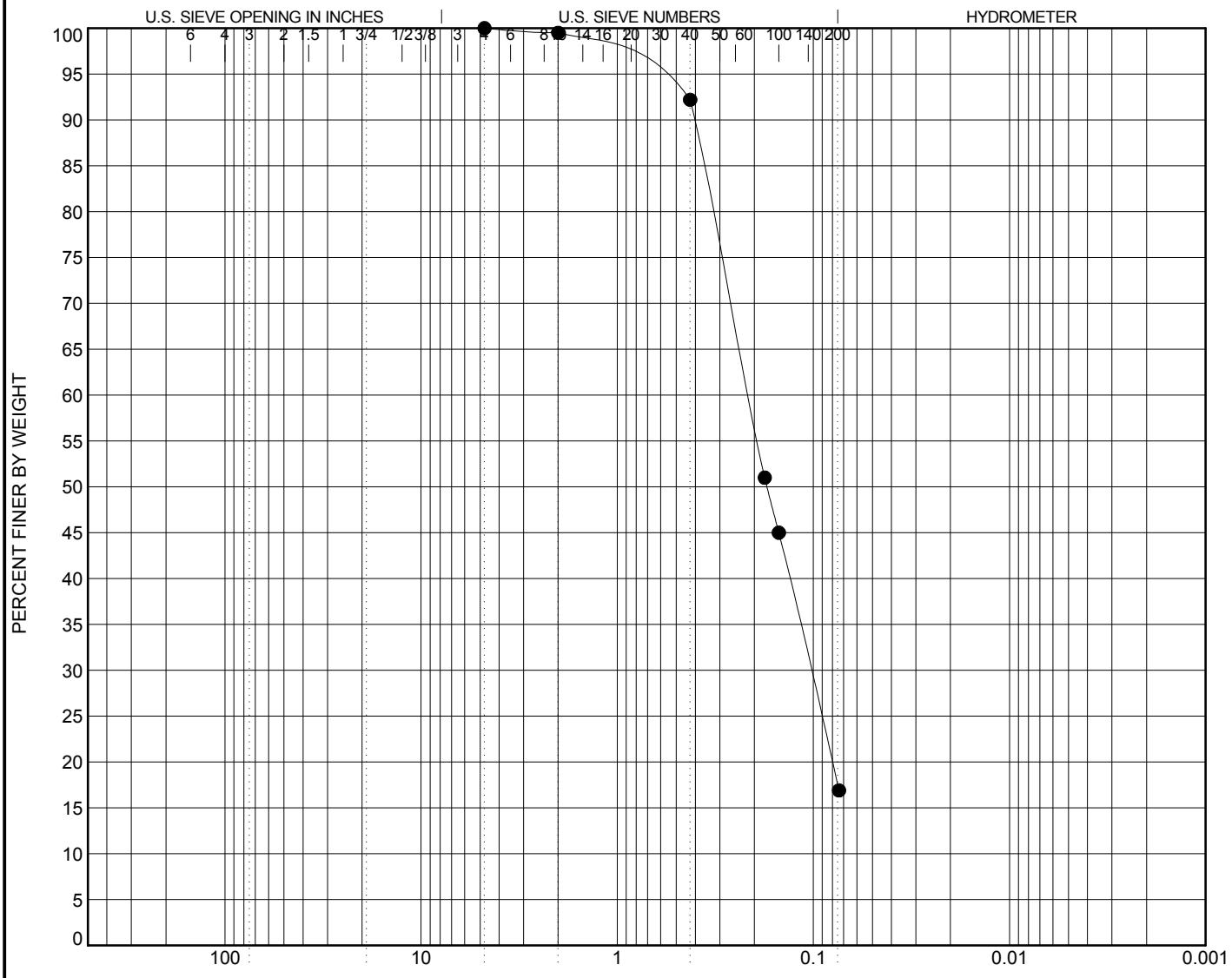
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M29-48**	**0.0**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**0.84**	**2.75**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M29-48**	**0.0**	**4.75**	**0.21**	**0.116**	**0.076**	**0.0**	**90.8**	**9.2**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

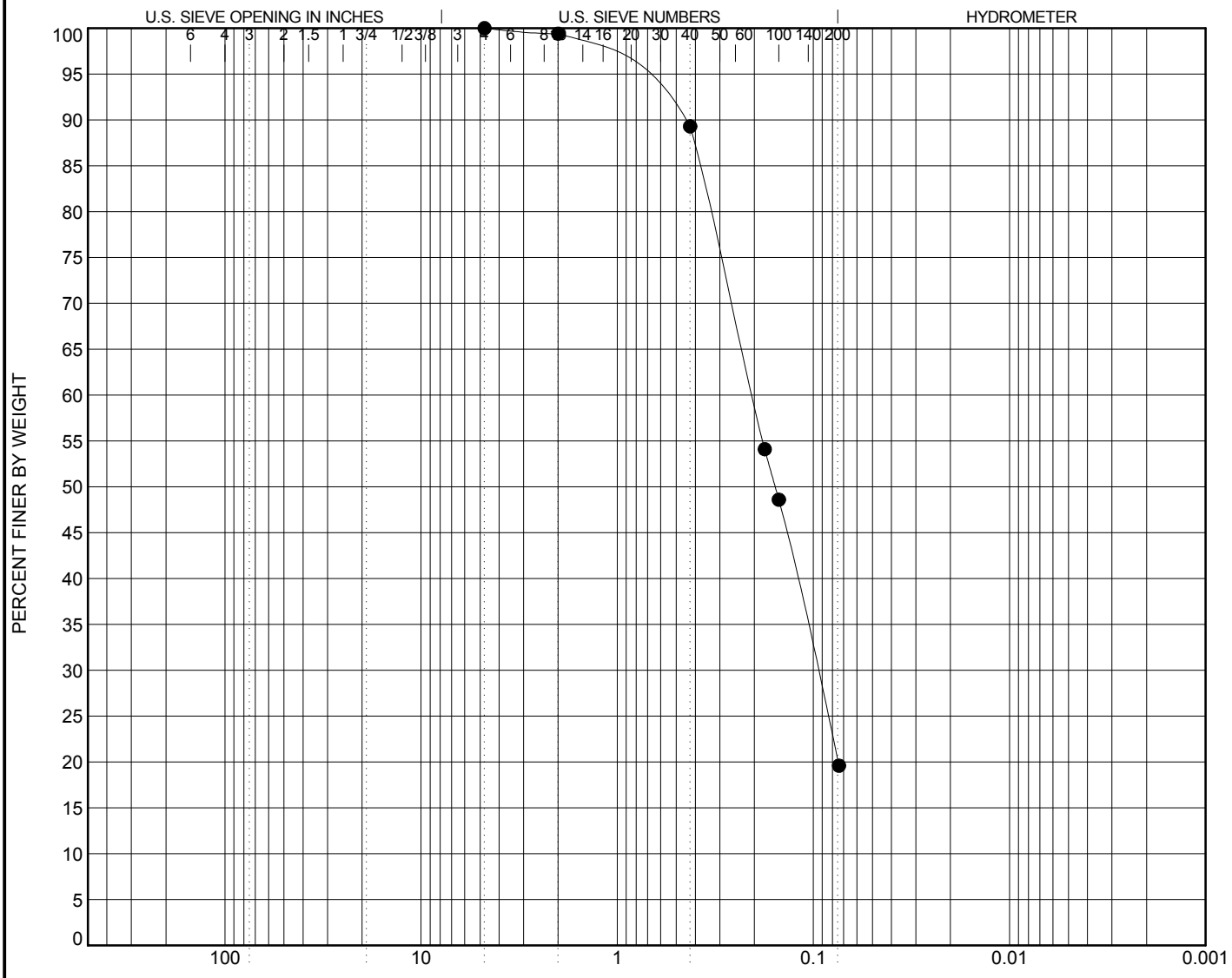
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M30-280**	**0.0**	**CLAYEY SAND (SC)**	**26**	**17**	**9**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M30-280**	**0.0**	**4.75**	**0.214**	**0.103**		**0.0**	**82.6**	**17.4**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

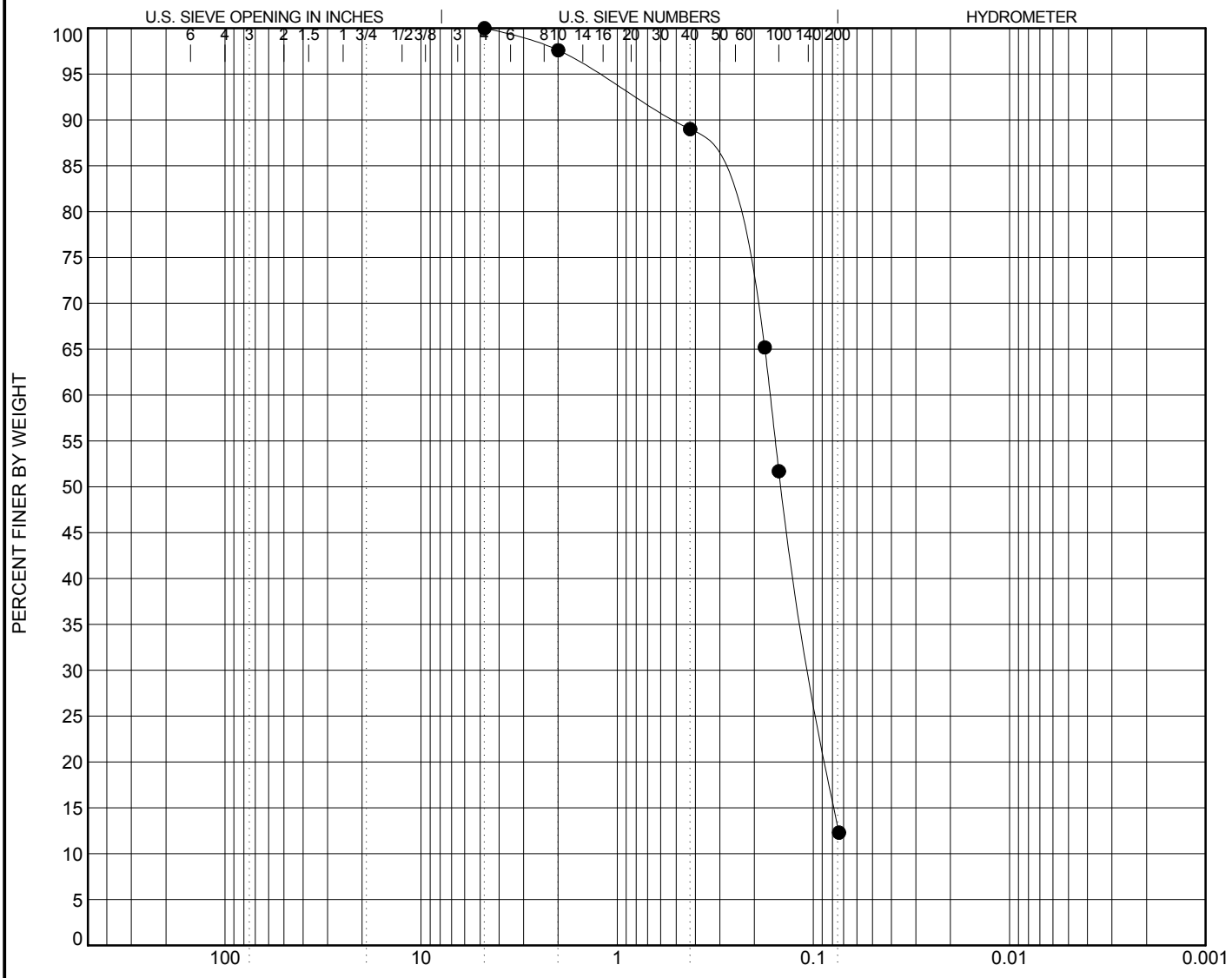
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M31-23**	**0.0**	**SILTY, CLAYEY SAND (SC-SM)**	**28**	**21**	**7**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M31-23**	**0.0**	**4.75**	**0.205**	**0.095**		**0.0**	**79.8**	**20.2**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

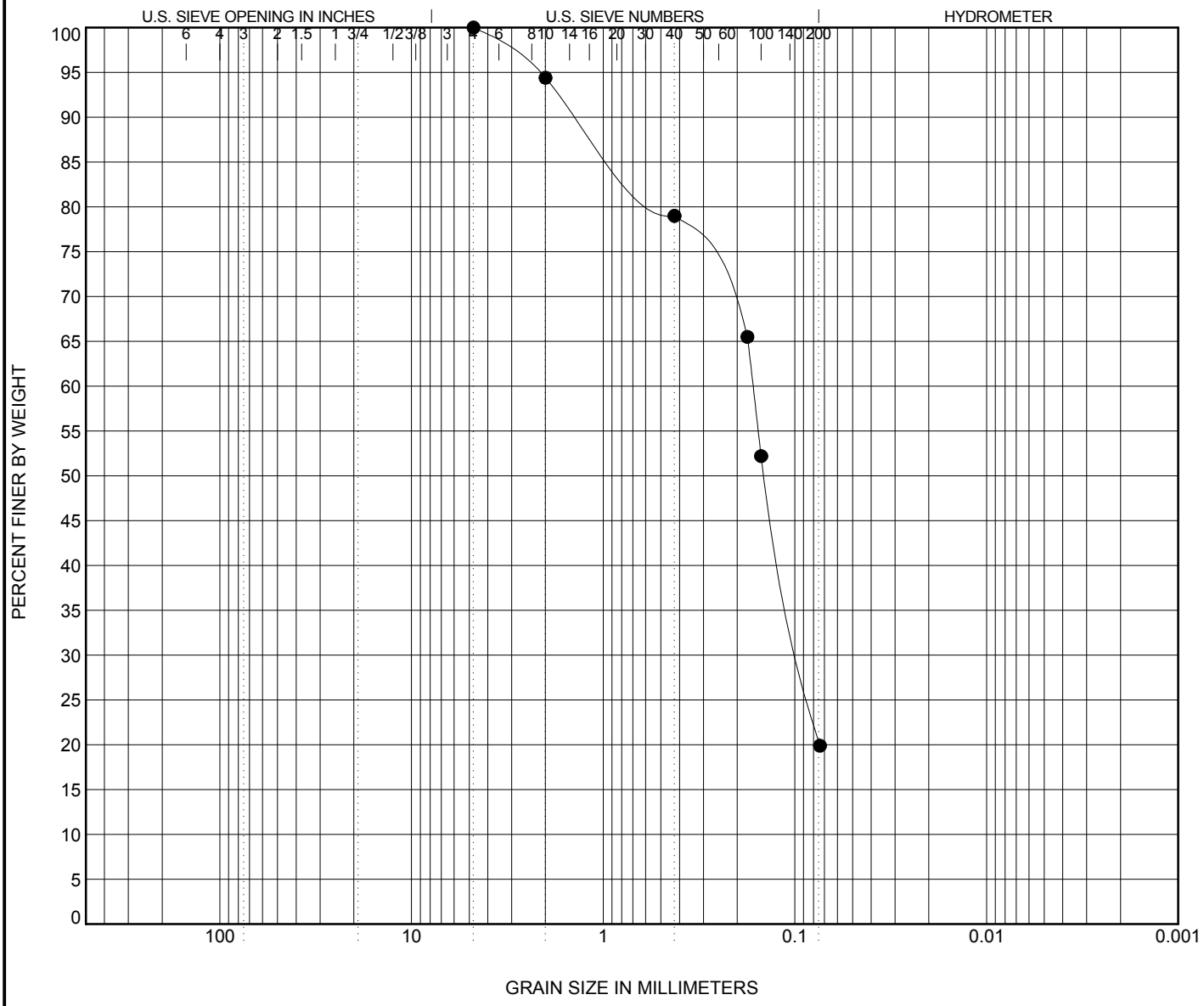
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M31-37**	**0.0**	**SILTY SAND (SM)**	**22**	**19**	**3**	**0.88**	**2.34**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M31-37**	**0.0**	**4.75**	**0.166**	**0.102**		**0.0**	**87.0**	**13.0**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

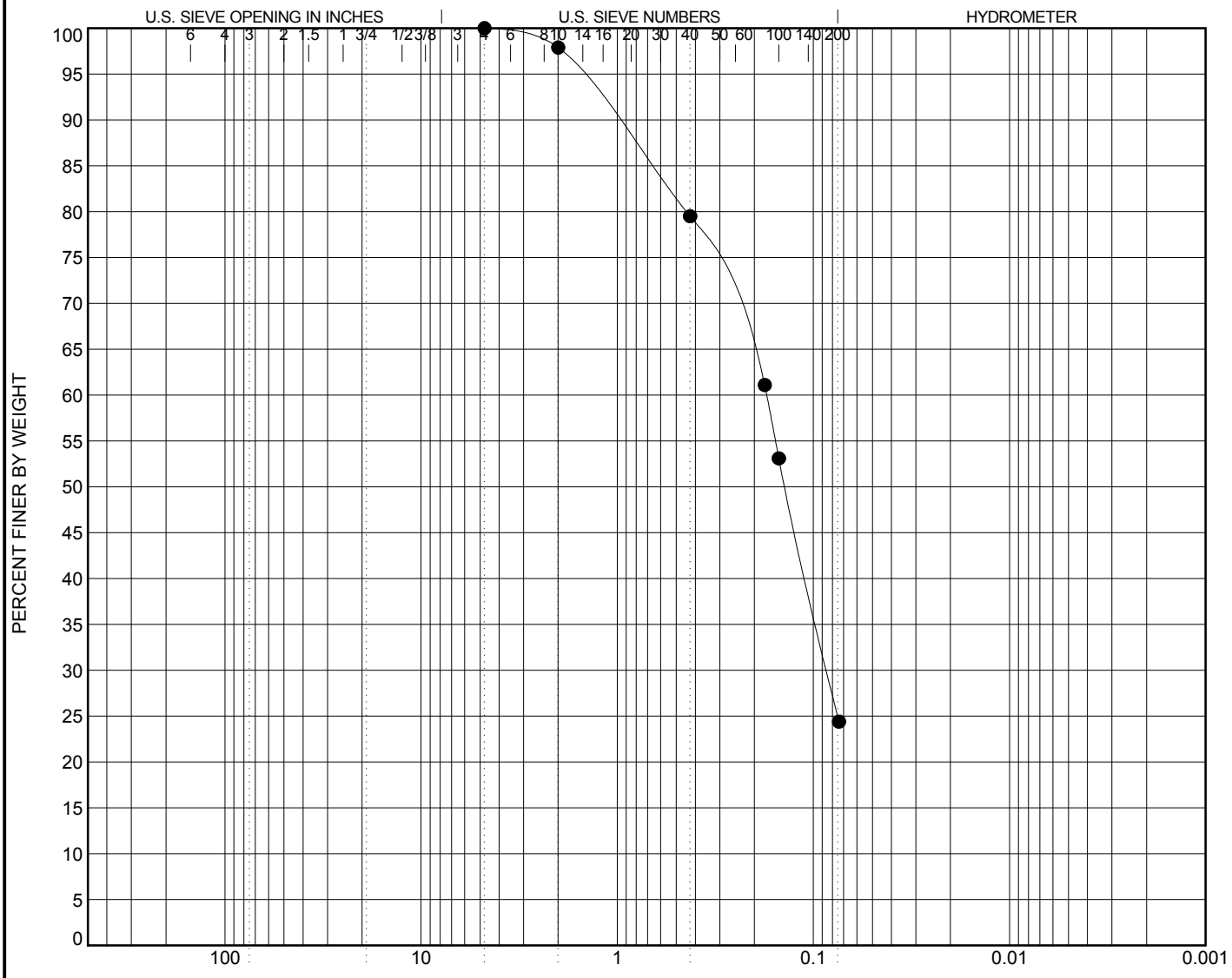
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M32-89**	**0.0**	**SILTY SAND (SM)**	**20**	**19**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M32-89**	**0.0**	**4.75**	**0.165**	**0.092**		**0.0**	**79.5**	**20.5**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

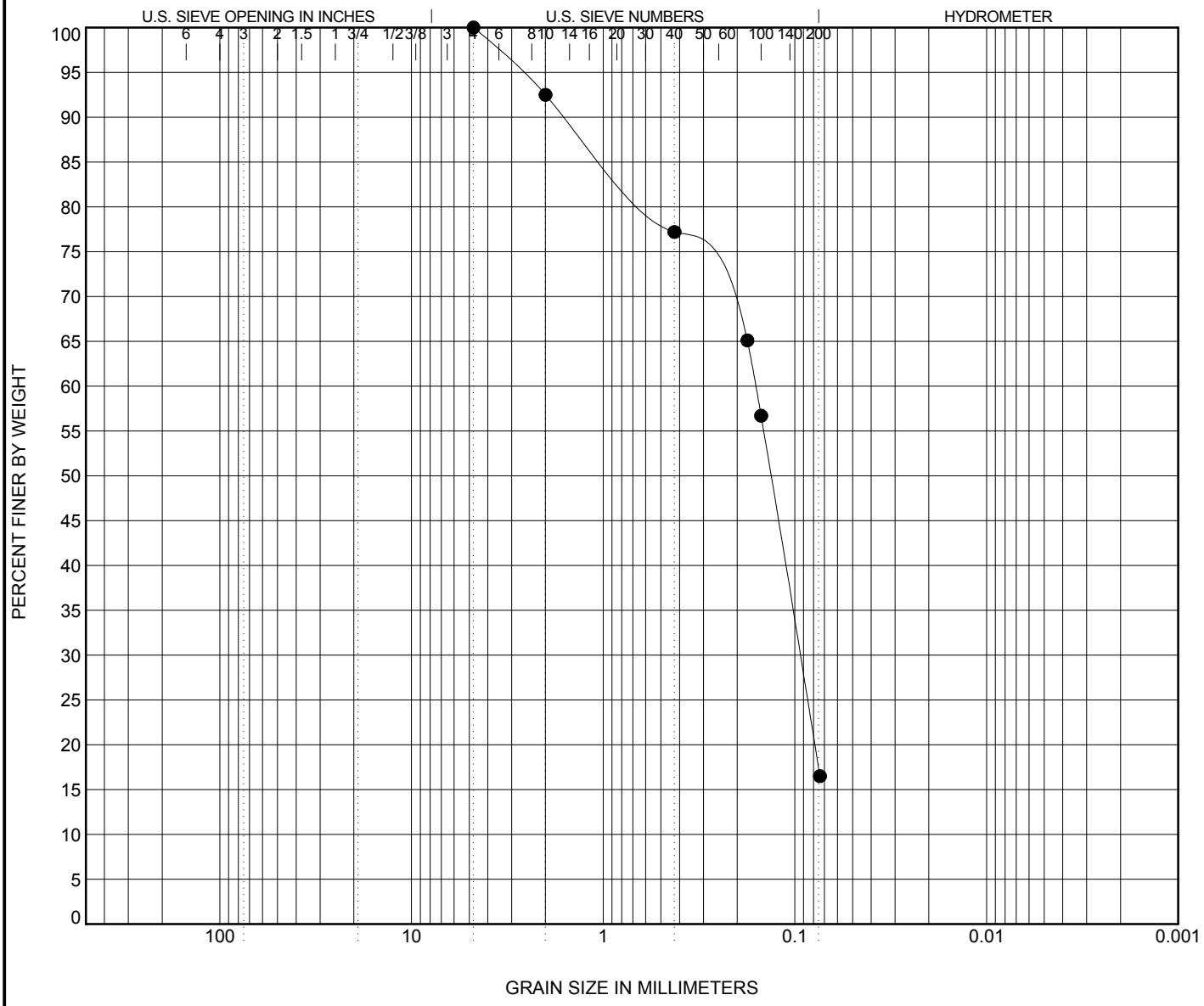
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M32-96**	**0.0**	**SILTY, CLAYEY SAND (SC-SM)**	**23**	**17**	**6**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M32-96**	**0.0**	**4.75**	**0.173**	**0.085**		**0.0**	**75.1**	**24.9**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

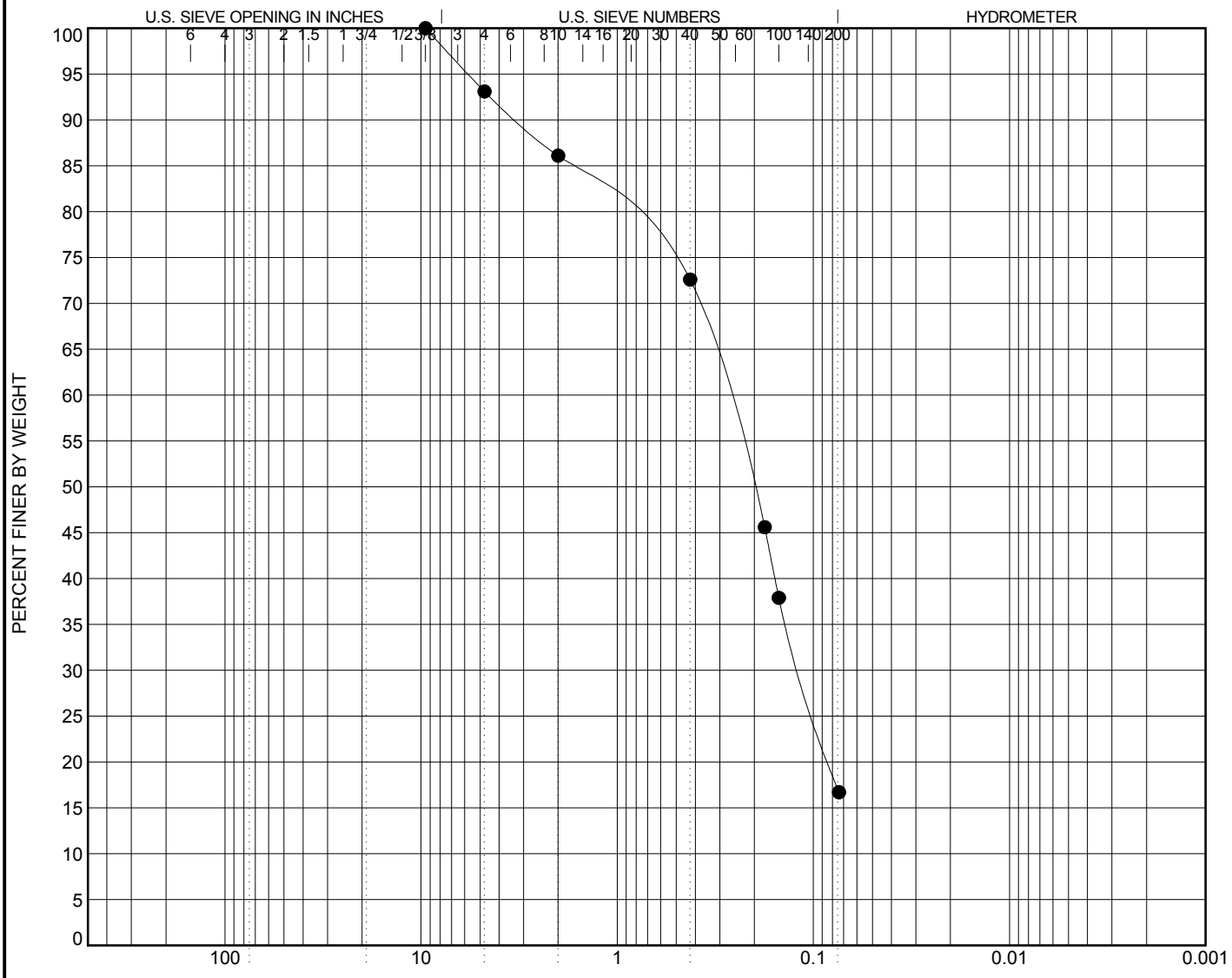
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M33-97**	**0.0**	**SILTY SAND (SM)**	**22**	**21**	**1**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M33-97**	**0.0**	**4.75**	**0.16**	**0.094**		**0.0**	**82.7**	**17.3**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

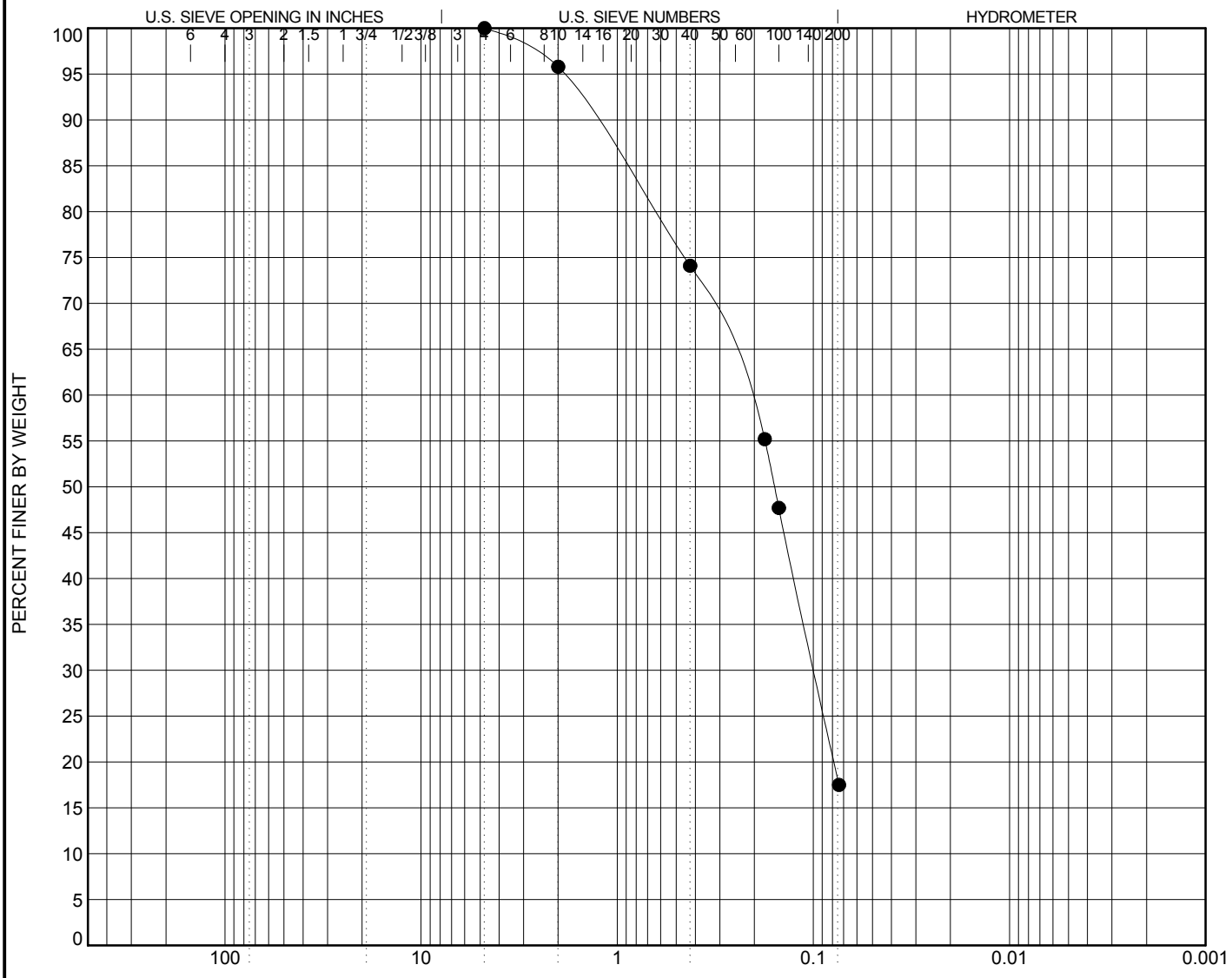
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M34-97**	**0.0**	**SILTY, CLAYEY SAND (SC-SM)**	**23**	**16**	**7**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M34-97**	**0.0**	**9.5**	**0.282**	**0.115**		**6.9**	**76.0**	**17.1**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

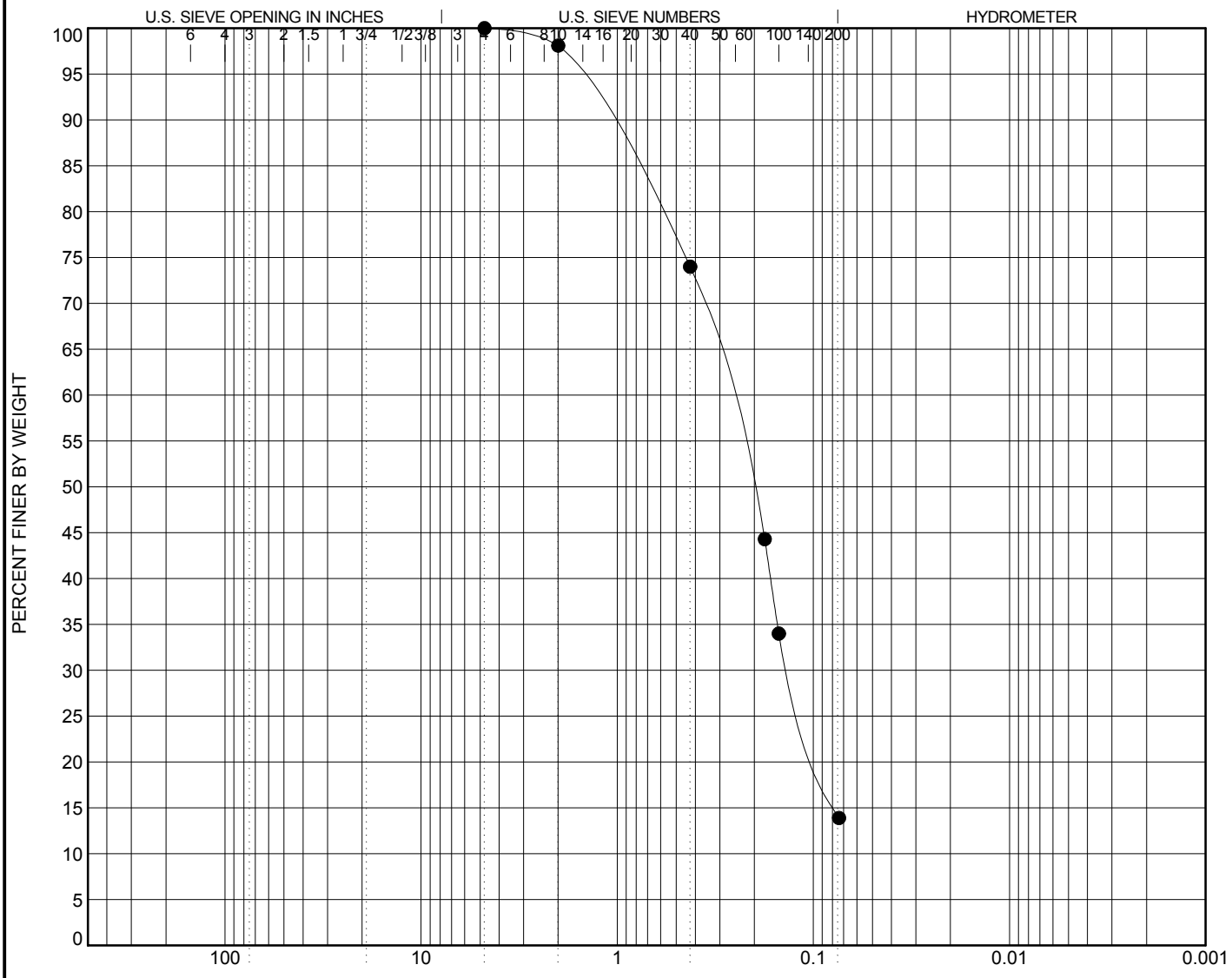
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M37-44**	**0.0**	**CLAYEY SAND (SC)**	**25**	**17**	**8**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M37-44**	**0.0**	**4.75**	**0.221**	**0.099**		**0.0**	**81.9**	**18.1**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

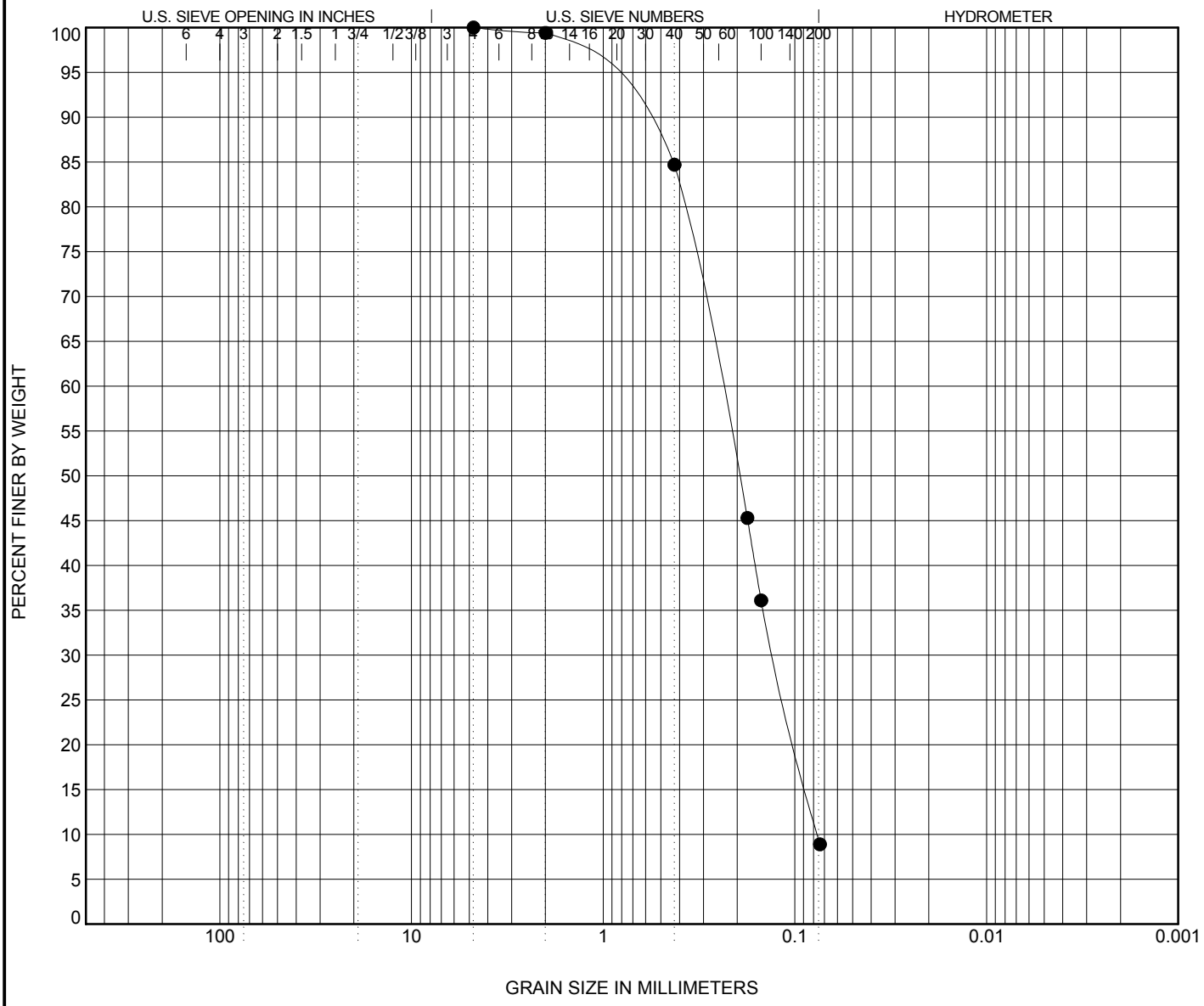
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M38-2**	**0.0**	**SILTY SAND (SM)**	**NP**	**NP**	**NP**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M38-2**	**0.0**	**4.75**	**0.281**	**0.13**		**0.0**	**85.7**	**14.3**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

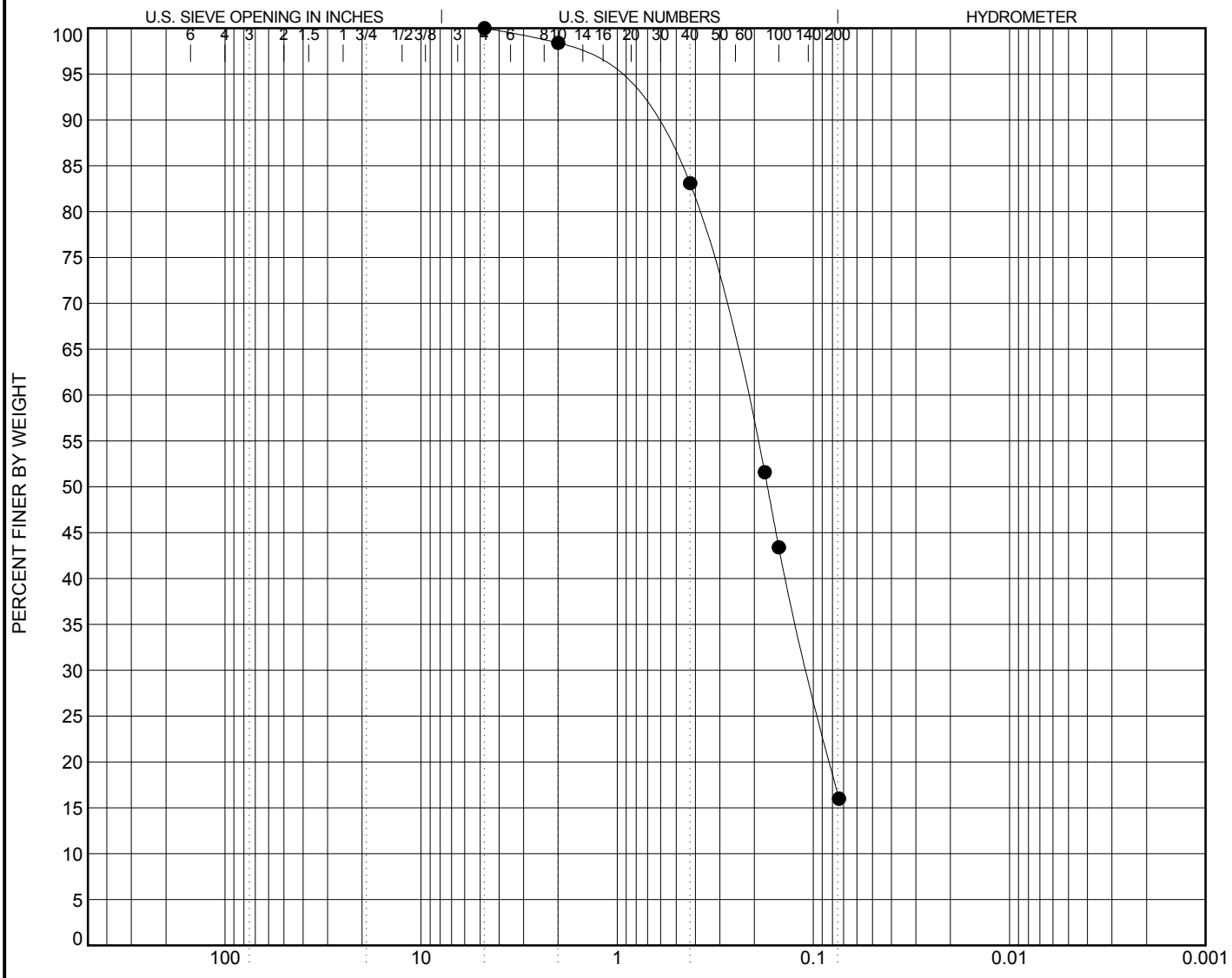
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M38-8**	**0.0**	**POORLY GRADED SAND with SILTY CLAY (SP-SC)**	**23**	**18**	**5**	**0.88**	**3.22**

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M38-8**	**0.0**	**4.75**	**0.245**	**0.128**	**0.076**	**0.0**	**90.6**	**9.4**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

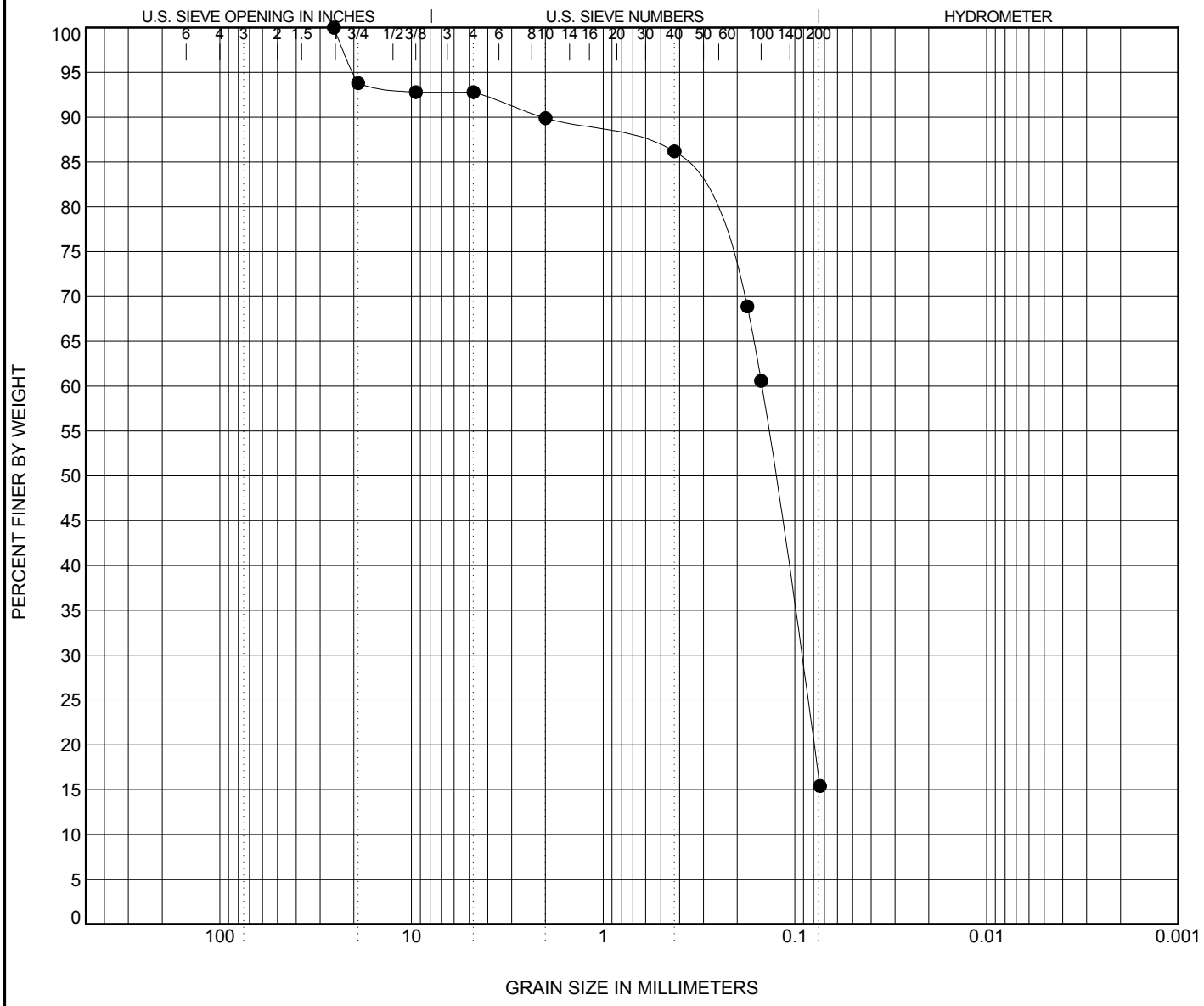
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**M38-20**	**0.0**	**CLAYEY SAND (SC)**	**25**	**16**	**9**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**M38-20**	**0.0**	**4.75**	**0.224**	**0.106**		**0.0**	**83.5**	**16.5**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

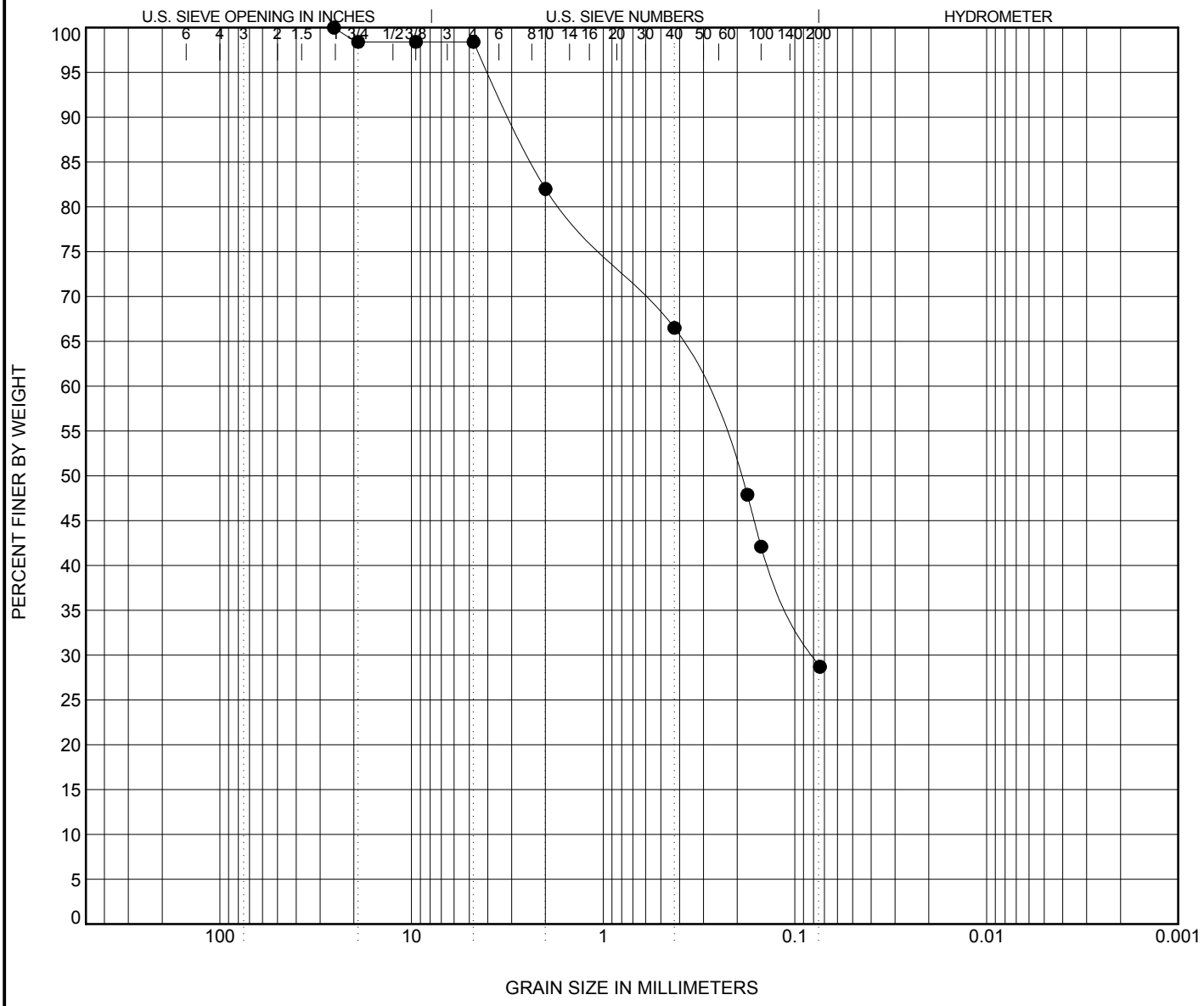
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**T09-67**	**0.0**	**CLAYEY SAND (SC)**	**28**	**19**	**9**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T09-67**	**0.0**	**25.4**	**0.149**	**0.093**		**7.2**	**76.5**	**16.3**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

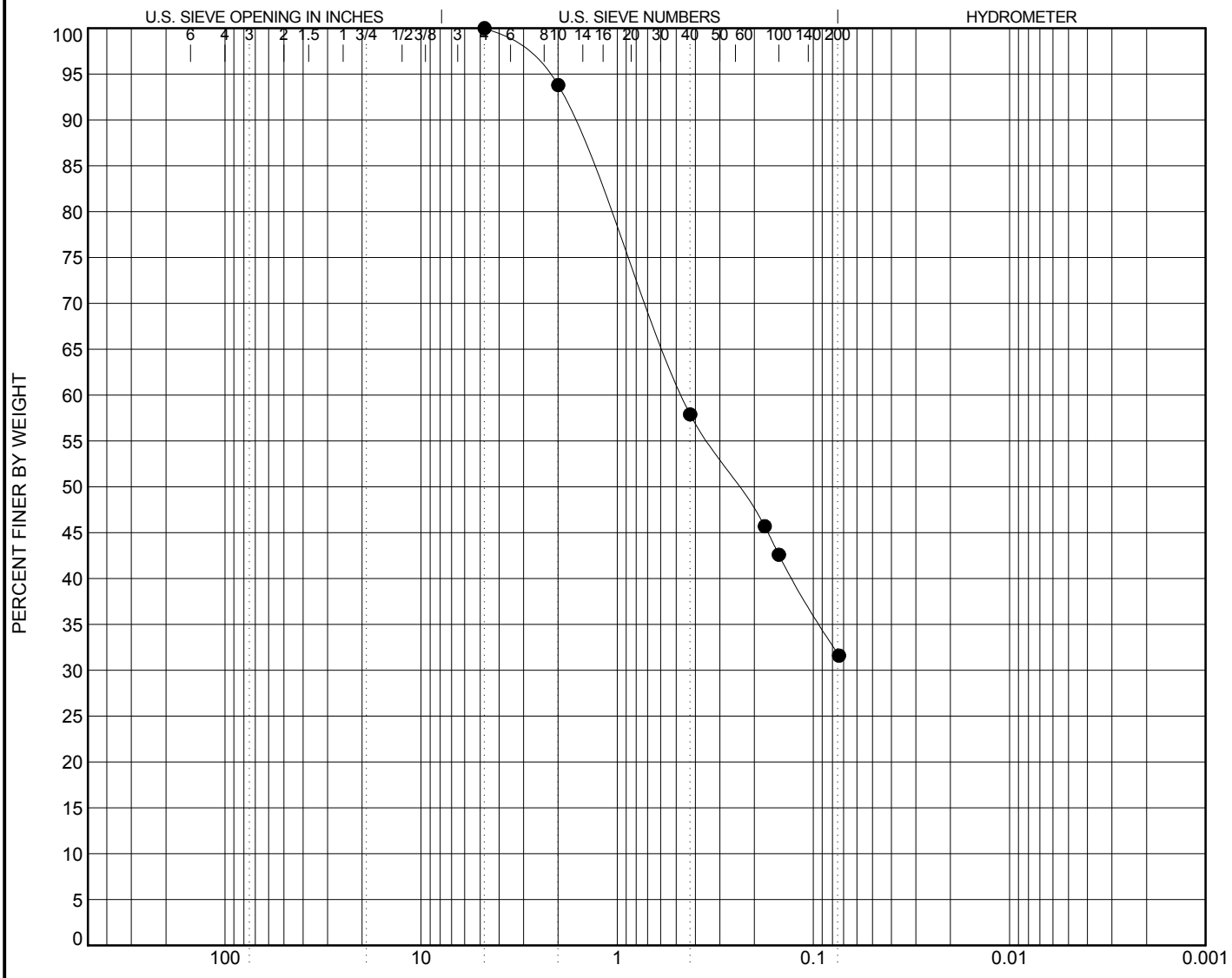
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**T09-109**	**0.0**	**CLAYEY SAND (SC)**	**24**	**16**	**8**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T09-109**	**0.0**	**25.4**	**0.313**	**0.079**		**1.6**	**69.4**	**29.0**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

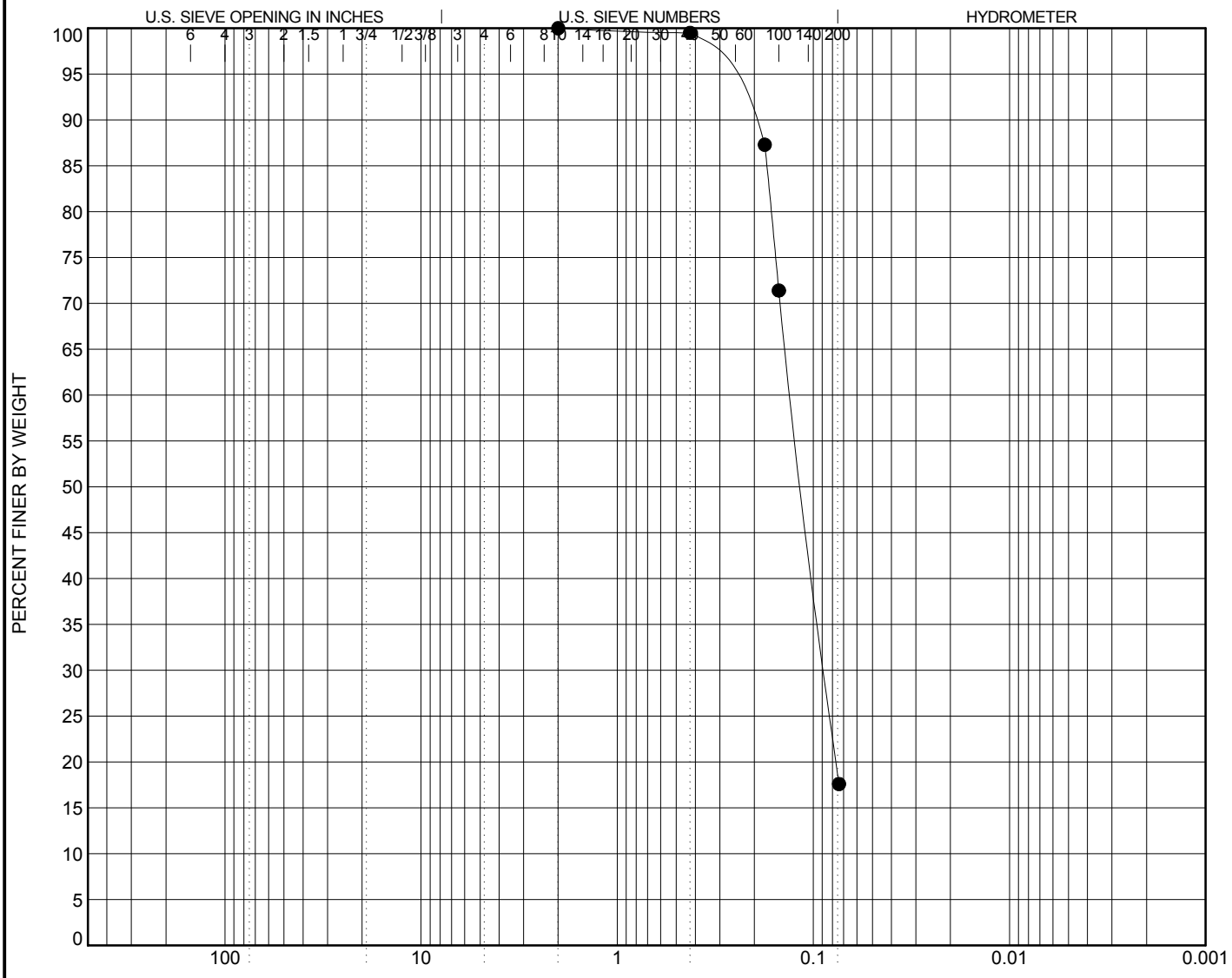
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**T09-185**	**0.0**	**CLAYEY SAND (SC)**	**31**	**22**	**9**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T09-185**	**0.0**	**4.75**	**0.465**			**0.0**	**68.2**	**31.8**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

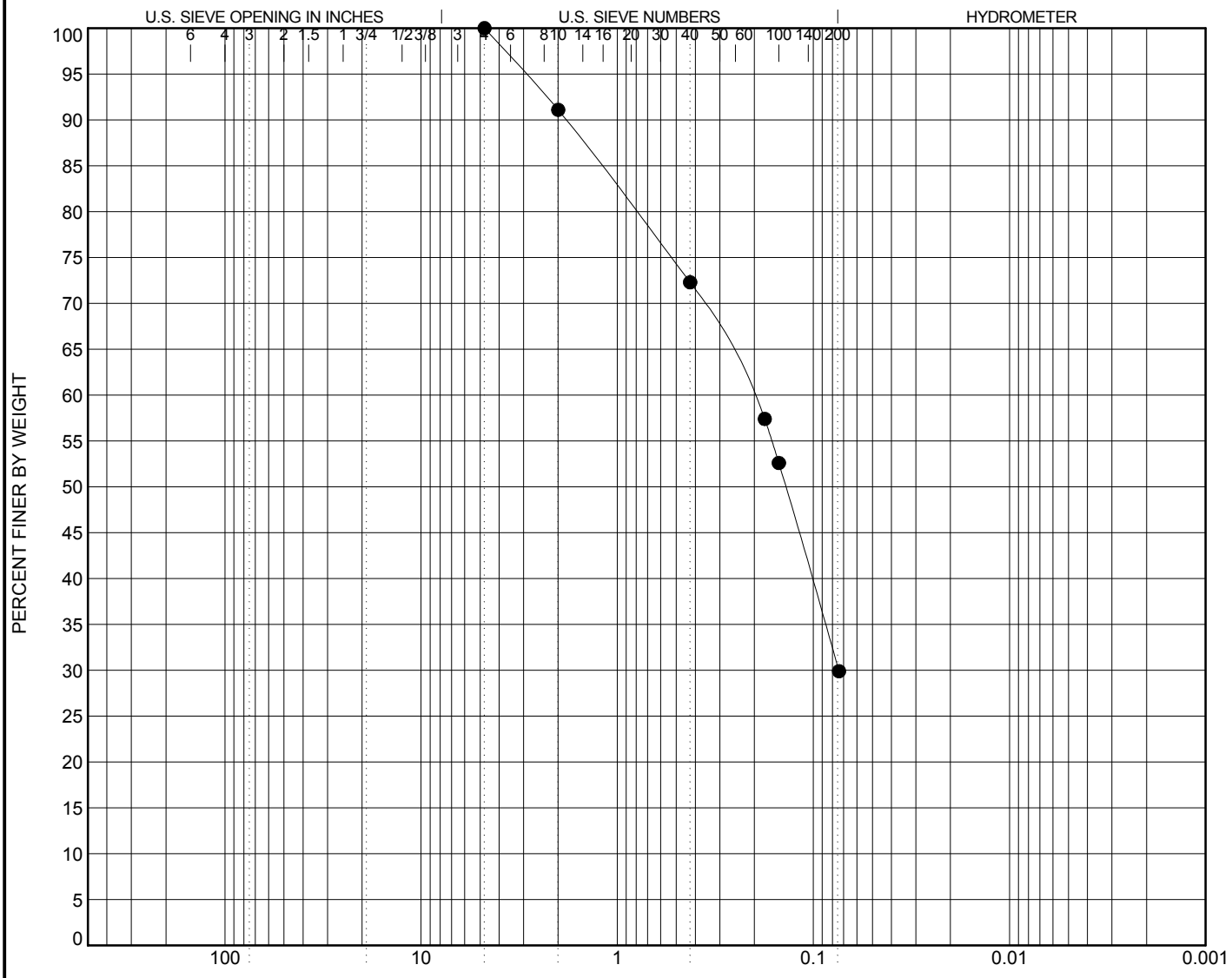
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**T17-141A**	**0.0**	**SILTY SAND (SM)**	**22**	**20**	**2**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T17-141A**	**0.0**	**2**	**0.129**	**0.087**		**0.0**	**81.4**	**18.6**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

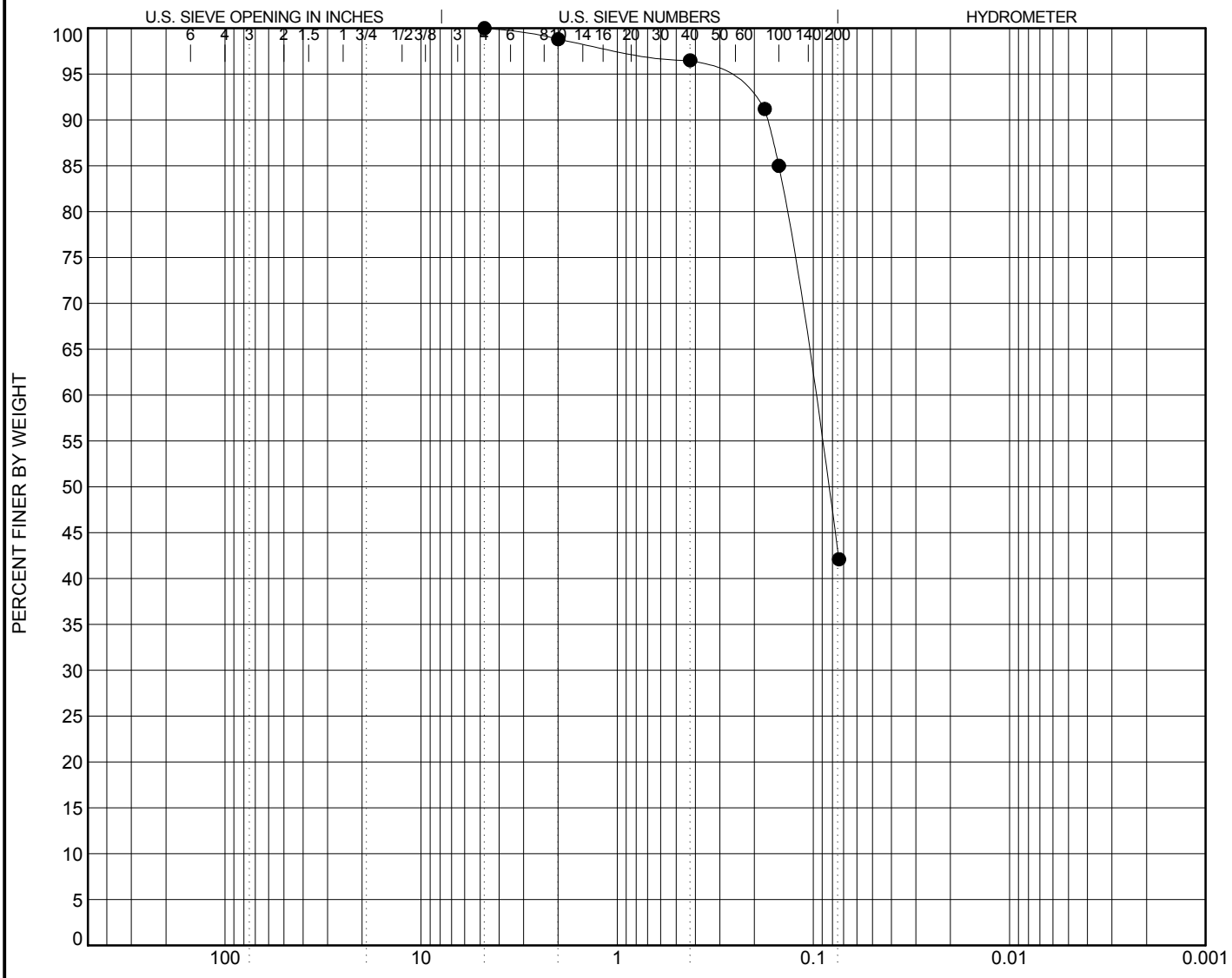
	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**T23-24**	**4.0**	**CLAYEY SAND (SC)**	**31**	**19**	**12**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T23-24**	**4.0**	**4.75**	**0.206**	**0.074**		**0.0**	**69.7**	**30.3**	

GRAIN SIZE DISTRIBUTION

CLIENT USEPA Region 9 **PROJECT NAME** RAES

PROJECT NUMBER 103G5440001 **PROJECT LOCATION** Tronox NAUM



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	**T37-86A**	**4.0**	**CLAYEY SAND (SC)**	**28**	**17**	**11**		

	ID	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T37-86A**	**4.0**	**4.75**	**0.099**			**0.0**	**57.1**	**42.9**	