

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>			1. CONTRACT ID CODE J	PAGE OF PAGES 1 2
2. AMENDMENT/MODIFICATION NO. 0003	3. EFFECTIVE DATE 10/08/2021	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)	
6. ISSUED BY U.S. ARMY ENGINEER DISTRICT, ALBUQUERQUE CORPS OF ENGINEERS 4101 JEFFERSON PLAZA, N.E. ALBUQUERQUE, NEW MEXICO 87109-3435	CODE W912PP	7. ADMINISTERED BY (If other than Item 6) See Item 6		
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)		(X)	9A. AMENDMENT OF SOLICITATION NO. W912PP21R0021	
		(X)	9B. DATED (SEE ITEM 11) 07/27/2021	
			10A. MODIFICATION OF CONTRACT/ORDER NO.	
			10B. DATED (SEE ITEM 13)	
CODE	FACILITY CODE			

**11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS**

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers  is extended,  is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

**13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS.  
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
<input type="checkbox"/>	
<input type="checkbox"/>	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
<input type="checkbox"/>	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
<input type="checkbox"/>	D. OTHER (Specify type of modification and authority)

**E. IMPORTANT:** Contractor  is not,  is required to sign this document and return 1 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

FY19 DANGEROUS CARGO PAD AND COMBAT ARMS TRAINING MAINTENANCE (CATM) FACILITY, CANNON AIR FORCE BASE, CURRY COUNTY, NM

1. This is Amendment No. 0003 to Solicitation No. W912PP21R0021. The following revisions shall be incorporated into the specifications. All other provisions shall remain unchanged.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR		16B. UNITED STATES OF AMERICA	
15C. DATE SIGNED		16C. DATE SIGNED	
<hr/> <i>(Signature of person authorized to sign)</i>		<hr/> <i>(Signature of Contracting Officer)</i>	

2. SPECIFICATIONS: Delete the following listed pages and substitute the pages attached hereto. On the revised pages, for convenience, changes are emphasized by ~~STRIKETHROUGH~~ for deletions and UNDERLINE for additions from the previous issue. All portions of the revised (or new) pages shall apply whether or not changes have been indicated.

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08 33 23, OVERHEAD COILING DOORS, ENTIRETY	08 33 23, OVERHEAD COILING DOORS, ENTIRETY
NA	12 48 13, ENTRANCE FLOOR MATS AND FRAMES
13 34 19, METAL BUILDING SYSTEMS, ENTIRETY	13 34 19, METAL BUILDING SYSTEMS, ENTIRETY
32 11 23, AGGREGATE BASE COURSES, ENTIRETY	32 11 23, AGGREGATE BASE COURSES, ENTIRETY
NA	APPENDIX D- GEOTECHNICAL BORING LOGS

3. DRAWING CHANGES: The following drawings have been revised and the sequence number changed to indicate such revision:

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**SUBMITTAL REGISTER**

CONTRACT NO.

TITLE AND LOCATION  
FY19 Dangerous Cargo Pad and Relocate CATM

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		MAILED TO CONTR/ DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

- ACI 117 (2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
- ACI 121R (2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
- ACI 301 (2016) Specifications for Structural Concrete
- ACI 302.1R (2015) Guide for Concrete Floor and Slab Construction
- ACI 304.2R (2017) Guide to Placing Concrete by Pumping Methods
- ACI 304R (2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
- ACI 305R (2010) Guide to Hot Weather Concreting
- ACI 306R (2016) Guide to Cold Weather Concreting
- ACI 308.1 (2011) Specification for Curing Concrete
- ACI SP-2 (2007; Abstract: 10th Edition) ACI Manual of Concrete Inspection
- ACI SP-15 (2011) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-05 with Selected ACI References

AMERICAN HARDBOARD ASSOCIATION (AHA)

- AHA A135.4 (1995; R 2004) Basic Hardboard

AMERICAN WELDING SOCIETY (AWS)

- AWS D1.4/D1.4M (2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706/A706M	(2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A934/A934M	(2016) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A970/A970M	(2018) Standard Specification for Headed Steel Bars for Concrete Reinforcement
ASTM A996/A996M	(2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2019) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2018) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2018a) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C78/C78M	(2018) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C94/C94M	(2018) Standard Specification for Ready-Mixed Concrete
ASTM C138/C138M	(2017a) Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143/C143M	(2015) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2018) Standard Specification for Portland

Cement

ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C311/C311M	(2018) Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C330/C330M	(2017a) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C494/C494M	(2017) Standard Specification for Chemical Admixtures for Concrete
ASTM C552	(2017; E 2018) Standard Specification for Cellular Glass Thermal Insulation
ASTM C567/C567M	(2014) Determining Density of Structural Lightweight Concrete
ASTM C578	(2018) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2017/2019) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C595/C595M	(2018) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C803/C803M	(2018) Standard Test Method for Penetration Resistance of Hardened Concrete
ASTM C873/C873M	(2015) Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds
ASTM C900	(2015) Standard Test Method for Pullout Strength of Hardened Concrete
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants

ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1012/C1012M	(2018b) Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1074	(2011) Standard Practice for Estimating Concrete Strength by the Maturity Method
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1107/C1107M	(2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1157/C1157M	(2017) Standard Performance Specification for Hydraulic Cement
ASTM C1218/C1218M	(2017) Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1293	(2008; R 2015) Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C1567	(2013) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C1778	(2016) Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled

PVC Expansion Joint Fillers for Concrete  
Paving and Structural Construction

- ASTM D2628 (1991; R 2016) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- ASTM D2835 (1989; R 2017) Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
- ASTM D5759 (2012) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
- ASTM D6690 (2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
- ASTM E96/E96M (2016) Standard Test Methods for Water Vapor Transmission of Materials
- ASTM E329 (2018) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
- ASTM E1155 (2014) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers
- ASTM E1643 (2018a) Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
- ASTM E1745 (2017) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- ASTM E1993/E1993M (1998; R 2013; E 2013) Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

- CRSI 10MSP (2009; 28th Ed; Errata) Manual of Standard Practice
- CRSI RB4.1 (2016) Supports for Reinforcement Used in Concrete

FOREST STEWARDSHIP COUNCIL (FSC)

- FSC STD 01 001 (2015) Principles and Criteria for Forest Stewardship

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1

(2009) DOC Voluntary Product Standard PS  
1-07, Structural Plywood

1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all portland cement, pozzolan, fly ash, and slag cement.
- b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.
- c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.
- d. "Supplementary cementing materials" (SCM) include coal fly ash, slag cement, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in improvement to sustainability and durability and reduced cost.
- e. "Design strength" ( $f'_c$ ) is the specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.
- f. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project while minimizing the initial and life-cycle cost.
- g. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic meter or cubic yard) of concrete.
- h. "Pozzolan" is a siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.
- i. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

1.3 SUBMITTALS

Submittals shall be made to U.S. Army Corps of Engineers. U.S. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation shall be submitted to the U.S. Government for information only. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Plan; G

Quality Control Personnel Certifications; G

Quality Control Organizational Chart

Laboratory Accreditation; G

Maturity Method Data

SD-02 Shop Drawings

Reinforcing Steel; G

SD-03 Product Data

Joint Sealants

Joint Filler

Formwork Materials

Recycled Aggregate Materials;  
Cementitious Materials

Vapor Barrier

Concrete Curing Materials

Reinforcement

Liquid Chemical Floor Sealers

Admixtures

Mechanical Reinforcing Bar Connectors

Local/Regional Materials

Biodegradable Form Release Agent

Finishing Plan to include slab joint details in the firing range; G

Nonshrink Grout

SD-05 Design Data

Concrete Mix Design; G

SD-06 Test Reports

Concrete Mix Design; G

Fly Ash

Pozzolan



Slag Cement

Aggregates

Tolerance Report

Compressive Strength Tests; G

Unit Weight of Structural Concrete

Chloride Ion Concentration

Air Content

Slump Tests

Water

SD-07 Certificates

Reinforcing Bars

Welder Qualifications

Forest Stewardship Council (FSC) Certification

Field Testing Technician and Testing Agency

SD-08 Manufacturer's Instructions

Liquid Chemical Floor Sealers

Joint Sealants

Curing Compound

#### 1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Follow [ACI 301](#), [ACI 304R](#) and [ASTM A934/A934M](#) requirements and recommendations. Do not deliver concrete until vapor retarder, vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

##### 1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Design Data

#### 1.6.1.1 Concrete Mix Design

Sixty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, supplementary cementitious materials, and admixtures; and applicable reference specifications. Submit mill test and all other test for cement, supplementary cementitious materials, aggregates, and admixtures. Provide documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes. For previously approved concrete mix designs used within the past twelve months, the previous mix design may be re-submitted without further trial batch testing if accompanied by material test data conducted within the last six months. Obtain mix design approval from the contracting officer prior to concrete placement.

### 1.6.2 Shop Drawings

#### 1.6.2.1 Reinforcing Steel

Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

### 1.6.3 Control Submittals

#### 1.6.3.1 Finishing Plan

Submit proposed material and procedures to be used in obtaining the finish for the firing range floors. No protrusions from the floor that could be struck by bullets are permissible.

### 1.6.4 Test Reports

#### 1.6.4.1 Fly Ash and Pozzolan

Submit test results in accordance with [ASTM C618](#) for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

#### 1.6.4.2 Slag Cement

Submit test results in accordance with [ASTM C989/C989M](#) for slag cement.

Submit test results performed within 6 months of submittal date.

#### 1.6.4.3 [Aggregates](#)

Submit test results in accordance with [ASTM C33/C33M](#), or [ASTM C330/C330M](#) for lightweight aggregate, and [ASTM C1293](#) or [ASTM C1567](#) as required in the paragraph titled ALKALI-AGGREGATE REACTION.

#### 1.6.5 [Quality Control Plan](#)

Develop and submit for approval a concrete quality control program in accordance with the guidelines of [ACI 121R](#) and as specified herein. The plan must include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. All quality control reports must be provided to the Contracting Officer, Quality Manager and Concrete Supplier. Maintain a copy of [ACI SP-15](#) and [CRSI 10MSP](#) at project site.

#### 1.6.6 [Quality Control Personnel Certifications](#)

The Contractor must submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a [quality control organizational chart](#) defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor.

Submit American Concrete Institute certification for the following:

- a. CQC personnel responsible for inspection of concrete operations.
- b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.
- c. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

#### 1.6.6.1 [Quality Manager Qualifications](#)

The quality manager must hold a current license as a professional engineer in a U.S. state or territory with experience on at least five similar projects. Evidence of extraordinary proven experience may be considered by the Contracting Officer as sufficient to act as the Quality Manager.

#### 1.6.6.2 [Field Testing Technician and Testing Agency](#)

Submit data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete.

- a. Work on concrete under this contract must be performed by an ACI Concrete Field Testing Technician Grade 1 qualified in accordance with [ACI SP-2](#) or equivalent. Equivalent certification programs must include requirements for written and performance examinations as stipulated in [ACI SP-2](#).
- b. Testing agencies that perform testing services on reinforcing steel must meet the requirements of [ASTM E329](#).

- c. Testing agencies that perform testing services on concrete materials must meet the requirements of [ASTM C1077](#).

#### 1.6.7 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and experience to accomplish required testing. The laboratory must meet the requirements of [ASTM C1077](#) and be Cement and Concrete Reference Laboratory (CCRL) inspected.

#### 1.6.8 Laboratory Accreditation

Laboratory and testing facilities must be provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with [ASTM C1077](#), including [ASTM C78/C78M](#) and [ASTM C1260](#). The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

- a. Aggregate Testing and Mix Proportioning: Aggregate testing and mixture proportioning studies must be performed by an accredited laboratory and under the direction of a registered professional engineer in a U.S. state or territory competent in concrete materials and must sign all reports and designs.
- b. Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by [ASTM C31/C31M](#).
- c. Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

#### 1.7 ENVIRONMENTAL REQUIREMENTS

Provide space ventilation according to material manufacturer recommendations, at a minimum, during and following installation of concrete curing compound and sealer. Maintain one of the following ventilation conditions during the curing period or for 72 hours after installation:

- a. Supply 100 percent outside air 24 hours a day.
- b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between [55 degrees F](#) and [84 degrees F](#) and humidity is between 30 percent and 60 percent.
- c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

##### 1.7.1 Submittals for Environmental Performance

- a. Provide data indication the percentage of post-industrial pozzolan (fly ash, slag cement) cement substitution as a percentage of the full product composite by weight.
- b. Provide data indicating the percentage of post-industrial and

post-consumer recycled content aggregate.

- c. Provide product data indicating the percentage of post-consumer recycled steel content in each type of steel reinforcement as a percentage of the full product composite by weight.
- d. Provide product data stating the location where all products were manufactured
- e. For projects using FSC certified formwork, provide chain-of-custody documentation for all certified wood products.
- f. For projects using reusable formwork, provide data showing how formwork is reused.
- g. Provide SDS product information data showing that form release agents meet any environmental performance goals such as using vegetable and soy based products.
- h. Provide SDS product information data showing that concrete adhesives meet any environmental performance goals including low emitting, low volatile organic compound products.

#### 1.8 SUSTAINABLE DESIGN REQUIREMENTS

##### 1.8.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources. See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total local material requirements. Concrete materials may be locally available.

##### 1.8.2 Forest Stewardship Council (FSC) Certification

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC STD 01 001 and identify certifying organization. Submit FSC certification numbers; identify each certified product on a line-item basis. Submit copies of invoices bearing the FSC certification numbers.

#### 1.9 QUALIFICATIONS FOR WELDING WORK

Welding procedures must be in accordance with AWS D1.4/D1.4M.

Verify that Welder qualifications are in accordance with AWS D1.4/D1.4M for welding of reinforcement or under an equivalent qualification test approved in advance. Welders are permitted to do only the type of welding for which each is specifically qualified.

## PART 2 PRODUCTS

### 2.1 FORMWORK MATERIALS

- a. Form-facing material in contact with concrete must be lumber, plywood, tempered concrete-form-grade hardboard, metal, or plastic. Submit product information on proposed form-facing materials if different from that specified herein.

- b. Design formwork, shores, reshores, and backshores to support loads transmitted to them and to comply with applicable building code requirements.
- c. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.
- d. Provide temporary openings in formwork if needed to facilitate cleaning and inspection.
- e. Design formwork joints to inhibit leakage of mortar.
- f. Limit deflection of facing materials for concrete surfaces exposed to view to 1/240 of center-to-center spacing of facing supports.
- g. Submit manufacturer's product data on form liner proposed for use with each formed surface.

#### 2.1.1.1 Wood Forms

Use lumber as specified in Section 06 10 00 ROUGH CARPENTRY and as follows. Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with NIST PS 1, B-B concrete form panels or better or AHA A135.4, hardboard for smooth form lining.

##### 2.1.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to NIST PS 1, B-B, concrete form, not less than 5/8-inch thick.

##### 2.1.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to NIST PS 1, B-B, high density form overlay, not less than 5/8-inch thick.

#### 2.1.2 Plastic Forms

Plastic lumber as specified in Section 06 10 00 ROUGH CARPENTRY.

#### 2.1.3 Carton Forms

Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete until initial set.

#### 2.1.4 Steel Forms

Provide steel form surfaces that do not contain irregularities, dents, or sags.

### 2.2 FORMWORK ACCESSORIES

- a. Use commercially manufactured formwork accessories, including ties and hangers.
- b. Form ties and accessories must not reduce the effective cover of the reinforcement.

2.2.1 Form Ties

- a. Use form ties with ends or end fasteners that can be removed without damage to concrete.
- b. Where indicated in Contract Documents, use form ties with integral water barrier plates or other acceptable positive water barriers in walls.
- c. The breakback distance for ferrous ties must be at least 2 in. for Surface Finish-2.0 or Surface Finish-3.0, as defined in [ACI 301](#).

2.2.2 [Biodegradable Form Release Agent](#)

- a. Provide form release agent that is colorless, biodegradable, and with a low (maximum of 55 grams/liter (g/l)) VOC content.
- b. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
- c. Provide form release agent that reduces formwork moisture absorption, and does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene. Submit documentation indicating type of biobased material in product and biobased content.
- d. Submit manufacturer's product data on formwork release agent for use on each form-facing material.

2.2.3 Chamfer Materials

Use lumber materials to form chamfer with dimensions of [3/4 x 3/4 in.](#) Chamfered construction joints are not permitted in the firing range.

2.2.4 Construction and movement joints

- a. Submit details and locations of construction joints in accordance with the requirements herein.
- b. Construction joints in the firing range slab shall consist of longitudinal sawed control joint no more than 1/4 inch in width. Locate longitudinal floor joints between firing lanes. Failure to comply will result in removal and re-installation at Contractor's expense.
- c. Make construction joints perpendicular to main reinforcement. Do not deviate from the control joint plan shown in the Contract Documents for the firing range area.
- d. Provide movement joints where indicated in Contract Documents or in accepted alternate locations.
- e. Submit location and detail of movement joints if different from those indicated in Contract Documents.
- f. Submit manufacturer's data sheet on expansion joint materials.
- g. Provide keyways where indicated in Contract Documents.

#### 2.2.5 Perimeter Insulation

Perimeter insulation must be polystyrene conforming to ASTM C578, Type II; polyurethane conforming to ASTM C591, Type II; or cellular glass conforming to ASTM C552, Type I or IV. Comply with EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

#### 2.2.6 Other Embedded items

Use sleeves, inserts, anchors, and other embedded items of material and design indicated in Contract Documents.

### 2.3 CONCRETE MATERIALS

#### 2.3.1 Cementitious Materials

##### 2.3.1.1 Portland Cement

- a. Unless otherwise specified, provide cement that conforms to ASTM C150/C150M Type I.
- b. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.
- c. Submit information along with evidence demonstrating compliance with referenced standards. Submittals must include types of cementitious materials, manufacturing locations, shipping locations, and certificates showing compliance.
- d. Cementitious materials must be stored and kept dry and free from contaminants.

##### 2.3.1.2 Blended Cements

- a. Blended cements must conform to ASTM C595/C595M Type IP or IS or ASTM C1157/C1157M Type GU.
- b. Slag cement added to the Type IS blend must meet ASTM C989/C989M.
- c. The pozzolan added to the Type IP blend must be ASTM C618 Class F fly ash and must be interground with the cement clinker. The manufacturer must state in writing that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. The percentage and type of pozzolan used in the blend must not change from that submitted for the aggregate evaluation and mixture proportioning.

##### 2.3.1.3 Fly Ash

- a. ASTM C618, Class F, except that the maximum allowable loss on ignition must not exceed 6 percent.
- b. Fly ash content must be a minimum of 20 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, provide the maximum amount of fly ash permissible that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with ASTM C311/C311M. Evaluate and classify



fly ash in accordance with [ASTM D5759](#).

#### 2.3.1.4 Slag cement

[ASTM C989/C989M](#), Grade 100. Slag content must be a minimum of 25 percent by weight of cementitious material.

#### 2.3.1.5 Other Supplementary Cementitious Materials

Natural pozzolan must be raw or calcined and conform to [ASTM C618](#), Class N, including the optional requirements for uniformity and effectiveness in controlling ASR and must have an ignition loss not exceeding 3 percent. Class N pozzolan for use in mitigating ASR must have a Calcium Oxide (CaO) content of less than 13 percent and total equivalent alkali content less than 3 percent.

Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) must conform to [ASTM C618](#), Class F or N, and the following additional requirements:

- a. The strength activity index at 28 days of age must be at least 95 percent of the control specimens.
- b. The average particle size must not exceed 6 microns.
- c. The sum of SiO<sub>2</sub> + Al<sub>2</sub>O<sub>3</sub> + Fe<sub>2</sub>O<sub>3</sub> must be greater than 77 percent.

#### 2.3.2 Water

- a. Water or ice must comply with the requirements of [ASTM C1602/C1602M](#).
- b. Minimize the amount of water in the mix. Improve workability by adjusting the grading of the aggregate and using admixture rather than by adding water.
- c. Water must be potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.
- d. Protect mixing water and ice from contamination during storage and delivery.
- e. Submit test report showing water complies with [ASTM C1602/C1602M](#).

#### 2.3.3 Aggregate

##### 2.3.3.1 Normal-Weight Aggregate

- a. Aggregates must conform to [ASTM C33/C33M](#).
- b. Aggregates used in concrete must be obtained from the same sources and have the same size range as aggregates used in concrete represented by submitted field test records or used in trial mixtures.
- c. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely. Do not use aggregates that contain frozen lumps.
- d. Submit types, pit or quarry locations, producers' names, aggregate

supplier statement of compliance with ASTM C33/C33M, and ASTM C1293 expansion data not more than 18 months old.

#### 2.3.3.2 Recycled Aggregate Materials

Use a minimum of 25 percent recycled aggregate, depending on local availability and conforming to requirements of the mix design. Recycled aggregate to include: recovered concrete that meets the aggregate requirements specified. Submit recycled material request with the aggregate certification submittals and do not use until approved by the Contracting Officer.

#### 2.3.4 Admixtures

- a. Chemical admixtures must conform to ASTM C494/C494M.
- b. Air-entraining admixtures must conform to ASTM C260/C260M.
- c. Chemical admixtures for use in producing flowing concrete must conform to ASTM C1017/C1017M.
- d. Do not use calcium chloride admixtures.
- e. Use an ASR-inhibiting admixture for concrete containing aggregate susceptible to ASR.
- f. Admixtures used in concrete must be the same as those used in the concrete represented by submitted field test records or used in trial mixtures.
- g. Protect stored admixtures against contamination, evaporation, or damage.
- h. To ensure uniform distribution of constituents, provide agitating equipment for admixtures used in the form of suspensions or unstable solutions. Protect liquid admixtures from freezing and from temperature changes that would adversely affect their characteristics.
- i. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.

#### 2.4 MISCELLANEOUS MATERIALS

##### 2.4.1 Concrete Curing Materials

Provide concrete curing material in accordance with ACI 301 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds. Submit manufactures instructions for placement of curing compound.

##### 2.4.2 Nonshrink Grout

Nonshrink grout in accordance with ASTM C1107/C1107M.

##### 2.4.3 Floor Finish Materials

###### 2.4.3.1 Liquid Chemical Floor Sealers

- a. Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content. Submit

manufacturer's instructions for placement of sealers.

- b. Firing range floor slab requires a waterproof sealant.

#### 2.4.4 Expansion/Contraction Joint Filler

ASTM D1751 or ASTM D1752 Type I or Type II. Material must be 1/2 inch thick. Not permitted in the firing range slab and walls.

#### 2.4.5 Joint Sealants

Submit manufacturer's product data, indicating VOC content.

##### 2.4.5.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T.

##### 2.4.5.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C920, Type M, Grade NS, Class 25, Use T.

##### 2.4.5.3 Preformed Polychloroprene Elastomeric Type

ASTM D2628.

##### 2.4.5.4 Lubricant for Preformed Compression Seals

ASTM D2835.

#### 2.4.6 Vapor Barrier

ASTM E1745 Class C polyethylene sheeting, minimum 15 mil thickness or ASTM E1993/E1993M bituminous membrane or other equivalent material with a maximum permeance rating of 0.01 perms per ASTM E96/E96M.

### 2.5 CONCRETE MIX DESIGN

#### 2.5.1 Properties and Requirements

- a. Use materials and material combinations listed in this section and the contract documents.
- b. Cementitious material content must be adequate for concrete to satisfy the specified requirements for strength, w/cm, durability, and finishability described in this section and the contract documents.

The minimum cementitious material content for concrete used in floors must meet the following requirements:

Nominal maximum size of aggregate, in.	Minimum cementitious material content, pounds per cubic yard
1-1/2	470
1	520
3/4	540

Nominal maximum size of aggregate, in.	Minimum cementitious material content, pounds per cubic yard
3/8	610

- c. Selected target slump must meet the requirements this section, the contract documents, and must not exceed 9 in. Concrete must not show visible signs of segregation.
- d. The target slump must be enforced for the duration of the project. Determine the slump by ASTM C143/C143M. Slump tolerances must meet the requirements of ACI 117.
- e. The nominal maximum size of coarse aggregate for a mixture must not exceed three-fourths of the minimum clear spacing between reinforcement, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.
- f. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must be in accordance with the requirements of the paragraph titled DURABILITY.
- g. Measure air content at the point of delivery in accordance with ASTM C173/C173M or ASTM C231/C231M.
- h. Concrete for slabs to receive a hard-troweled finish must not contain an air-entraining admixture or have a total air content greater than 3 percent.
- i. Concrete properties and requirements for each portion of the structure are specified in the table below. Refer to the paragraph titled DURABILITY for more details on exposure categories and their requirements.

	Minimum $f'c$ psi	Exposure Categories <sup>^</sup>	Miscellaneous Requirements
Footings	4500 at 28 days	S1; C1; W0; F1	Max. slump: 6 in.  Nominal maximum aggregate size must be 3/4 in.

	Minimum <i>f'c</i> psi	Exposure Categories <sup>^</sup>	Miscellaneous Requirements
Walls	4500 at 28 days	S0; C0; W0; F0	Nominal maximum aggregate size must be 1/2 in.
Slabs-on-ground	4500 at 28 days	S1; C0; W0; F0	
All other concrete	4000 at 28 days	S1 C0 W0 F1	

## 2.5.2 Durability

### 2.5.2.1 Alkali-Aggregate Reaction

Do not use any aggregate susceptible to alkali-carbonate reaction (ACR). Use one of the three options below for qualifying concrete mixtures to reduce the potential of alkali-silica reaction (ASR):

- a. For each aggregate used in concrete, the expansion result determined in accordance with **ASTM C1293** must not exceed 0.04 percent at one year.
- b. For each aggregate used in concrete, the expansion result of the aggregate and cementitious materials combination determined in accordance with **ASTM C1567** must not exceed 0.10 percent at an age of 16 days.
- c. Alkali content in concrete (LBA) must not exceed 4 pounds per cubic yard for moderately reactive aggregate or 3 pounds per cubic yard for highly reactive aggregate. Reactivity must be determined by testing in accordance with **ASTM C1293** and categorized in accordance with **ASTM C1778**. Alkali content is calculated as follows:  

$$\text{LBA} = (\text{cement content, pounds per cubic yard}) \times (\text{equivalent alkali content of portland cement in percent}/100 \text{ percent})$$

### 2.5.2.2 Freezing and Thawing Resistance

- a. Provide concrete meeting the following requirements based on exposure class assigned to members for freezing-and-thawing exposure in Contract Documents:

Exposure class	Maximum $w/cm^*$	Minimum $f'c$ , psi	Air content	Additional Requirements
F0	N/A	2500		N/A
F1	0.55	3500	Depends on aggregate size	N/A
F2	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by mass
F3	0.40	5000	Depends on aggregate size	See limits on maximum cementitious material by mass
F3 plain concrete	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by mass

\*The maximum  $w/cm$  limits do not apply to lightweight concrete.

- b. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must meet the requirements of the following table:

Nominal maximum aggregate size, in.	Total air content, percent* <sup>^</sup>	
	Exposure Class F2 and F3	Exposure Class F1
3/8	7.5	6.0
1/2	7.0	5.5
3/4	6.0	5.0
1	6.0	4.5
1-1/2	5.5	4.5

Nominal maximum aggregate size, in.	Total air content, percent*^	
	Exposure Class F2 and F3	Exposure Class F1
2	5.0	4.0
3	5.5	3.5

\*Tolerance on air content as delivered must be plus/minus 1.5 percent.  
 ^For f'c greater than 5000 psi, reducing air content by 1.0 percentage point is acceptable.

- c. Submit documentation verifying compliance with specified requirements.

2.5.2.3 Corrosion and Chloride Content

- a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members requiring protection against reinforcement corrosion in Contract Documents.
- b. Submit documentation verifying compliance with specified requirements.
- c. Water-soluble chloride ion content contributed from constituents including water, aggregates, cementitious materials, and admixtures must be determined for the concrete mixture by [ASTM C1218/C1218M](#) at age between 28 and 42 days.
- d. The maximum water-soluble chloride ion (Cl-) content in concrete, percent by mass of cement is as follows:

Exposure class	Maximum w/cm*	Minimum f'c, psi	Maximum water-soluble chloride ion (CL-) content in concrete, percent by mass of cement
Reinforced concrete			
C0	N/A	2500	1.00
C1	N/A	2500	0.30
C2	0.4	5000	0.15

\*The maximum w/cm limits do not apply to lightweight concrete.

2.5.2.4 Sulfate Resistance

- a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members for sulfate exposure.

Exposure class	Maximum w/cm	Minimum f'c, psi	Required cementitious materials-types			Calcium chloride admixture
			ASTM C150/C150M	ASTM C595/C595M	ASTM C1157/C1157M	
S0	N/A	2500	N/A	N/A	N/A	No restrictions
S1	0.50	4000	II*^	IP (MS); IS (<70) (MS); IT (MS)	MS	No restrictions
S2	0.45	4500	IV^	IP (HS); IS (<70) (HS); IT (HS)	HS	Not permitted
S3	0.45	4500	V + pozzolan or slag cement**	IP (HS) + pozzolan or slag cement^; IS (<70) (HS) + pozzolan or slag cement^; IT (HS) + pozzolan or slag cement**	HS + pozzolan or slag cement**	Not permitted

\* For seawater exposure, other types of portland cements with tricalcium aluminate (C3A) contents up to 10 percent are acceptable if the w/cm does not exceed 0.40.

\*\* The amount of the specific source of the pozzolan or slag cement to be used shall be at least the amount determined by test or service record to improve sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the pozzolan or slag used shall not be less than the amount tested in accordance with ASTM C1012/C1012M and meeting the requirements maximum expansion requirements listed herein.

^ Other available types of cement, such as Type III or Type I, are acceptable in exposure classes S1 or S2 if the C3A contents are less than 8 or 5 percent, respectively.

- b. Alternative combinations of cementitious materials of those listed in this paragraph are acceptable if they meet the maximum expansion requirements listed in the following table:

Exposure class	Maximum expansion when tested using ASTM C1012/C1012M		
	At 6 months	At 6 months	At 18 months
S1	0.10 percent	N/A	N/A
S2	0.05 percent	0.10 percent^	N/A



Exposure class	Maximum expansion when tested using ASTM C1012/C1012M		
	At 6 months	At 6 months	At 18 months
S3	N/A	N/A	0.10 percent

^The 12-month expansion limit applies only when the measured expansion exceeds the 6-month maximum expansion limit.

2.5.2.5 Concrete Temperature

The temperature of concrete as delivered must not exceed 95°F.

2.5.2.6 Concrete permeability

- a. Provide concrete meeting the requirements of the following table based on exposure class assigned to members requiring low permeability in the Contract Documents.

Exposure class	Maximum w/cm*	Minimum f'c, psi	Additional minimum requirements
W0	N/A	2500	None
W1	0.5	4000	None

\*The maximum w/cm limits do not apply to lightweight concrete.

- b. Submit documentation verifying compliance with specified requirements.

2.5.3 Trial Mixtures

Trial mixtures must be in accordance to ACI 301.

2.5.4 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C94/C94M.

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C94/C94M:

- a. Type and brand cement
- b. Cement and supplementary cementitious materials content in 94-pound bags per cubic yard of concrete
- c. Maximum size of aggregate
- d. Amount and brand name of admixtures
- e. Total water content expressed by water cementitious material ratio

## 2.6 REINFORCEMENT

- a. Bend reinforcement cold. Fabricate reinforcement in accordance with fabricating tolerances of [ACI 117](#).
- b. Submit manufacturer's certified test report for reinforcement.
- c. Submit placing drawings showing fabrication dimensions and placement locations of reinforcement and reinforcement supports. Placing drawings must indicate locations of splices, lengths of lap splices, and details of mechanical and welded splices.
- d. Submit request with locations and details of splices not indicated in Contract Documents.
- e. Submit request for field cutting, including location and type of bar to be cut and reason field cutting is required.

### 2.6.1 Reinforcing Bars

- a. Reinforcing bars must be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.
- b. [ASTM A615/A615M](#) with the bars marked A, Grade 60; or [ASTM A996/A996M](#) with the bars marked R, Grade 60, or marked A, Grade 60. See Section [01 33 29 SUSTAINABILITY REPORTING](#) for cumulative total recycled content requirements.
- c. Reinforcing bars may contain post-consumer or post-industrial recycled content. Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.
- d. Submit mill certificates for reinforcing bars.

#### 2.6.1.1 Headed Reinforcing Bars

Headed reinforcing bars must conform to [ASTM A970/A970M](#) including Annex A1, and other specified requirements.

### 2.6.2 Mechanical Reinforcing Bar Connectors

- a. Provide 125 percent minimum yield strength of the reinforcement bar.
- b. Submit data on mechanical splices demonstrating compliance with this paragraph.

### 2.6.3 Wire

- a. See Section [01 33 29 SUSTAINABILITY REPORTING](#) for cumulative total recycled content requirements. Wire reinforcement may contain post-consumer or post-industrial recycled content. Provide flat sheets of welded wire reinforcement for slabs and toppings.
- b. Plain or deformed steel wire must conform to [ASTM A1064/A1064M](#).

#### 2.6.4 Welded wire reinforcement

- a. Use welded wire reinforcement specified in Contract Documents and conforming to one or more of the specifications given herein.
- b. Plain welded wire reinforcement must conform to [ASTM A1064/A1064M](#), with welded intersections spaced no greater than 12 in. apart in direction of principal reinforcement.
- c. Deformed welded wire reinforcement must conform to [ASTM A1064/A1064M](#), with welded intersections spaced no greater than 16 in. apart in direction of principal reinforcement.

#### 2.6.5 Reinforcing Bar Supports

- a. Provide reinforcement support types within structure as required by Contract Documents. Reinforcement supports must conform to [CRSI RB4.1](#). Submit description of reinforcement supports and materials.
- b. Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.
- d. See Section [01 33 29 SUSTAINABILITY REPORTING](#) for cumulative total recycled content requirements. Plastic and steel may contain post-consumer or post-industrial recycled content.

#### 2.6.6 Dowels for Load Transfer in Floors

Provide greased dowels for load transfer in floors of the type, design, weight, and dimensions indicated. Provide dowel bars that are plain-billet steel conforming to [ASTM A615/A615M](#), Grade 40. Provide dowel pipe that is steel conforming to [ASTM A53/A53M](#).

#### 2.6.7 Welding

- a. Provide weldable reinforcing bars that conform to [ASTM A706/A706M](#) and [ASTM A615/A615M](#) and Supplement S1, Grade 60, except that the maximum carbon content must be 0.55 percent.
- b. Comply with [AWS D1.4/D1.4M](#) unless otherwise specified. Do not tack weld reinforcing bars.
- c. Welded assemblies of steel reinforcement produced under factory conditions, such as welded wire reinforcement, bar mats, and deformed bar anchors, are allowed.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- a. Do not begin installation until substrates have been properly constructed; verify that substrates are level.
- b. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before processing.
- c. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify

Contracting Officer and wait for instructions before beginning installation.

### 3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

#### 3.2.1 General

- a. Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.
- b. Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

#### 3.2.2 Subgrade Under Foundations and Footings

- a. When subgrade material is semi-porous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor barrier.
- b. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor barrier.

#### 3.2.3 Subgrade Under Slabs on Ground

- a. Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.
- b. Previously constructed subgrade or fill must be cleaned of foreign materials
- c. Finish surface of capillary water barrier under interior slabs on ground must not show deviation in excess of  $1/4$  inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.
- d. Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

#### 3.2.4 Edge Forms and Screed Strips for Slabs

- a. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment.
- b. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

#### 3.2.5 Reinforcement and Other Embedded Items

- a. Secure reinforcement, joint materials, and other embedded materials in

position, inspected, and approved before start of concrete placing.

- b. When concrete is placed, reinforcement must be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided minimum nominal dimensions, nominal weight, and minimum average height of deformations of a hand-wire-brushed test specimen are not less than applicable ASTM specification requirements.

### 3.3 FORMS

- a. Provide forms, shoring, and scaffolding for concrete placement. Set forms mortar-tight and true to line and grade.
- b. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch. Place chamfer strips in corners of formwork to produce beveled edges on permanently exposed surfaces. Do not bevel reentrant corners or edges of formed joints of concrete. For exposed areas within the firing range, no chamfer strips shall be used. Joints where required shall be a maximum of 0.25 in.
- c. Provide formwork with clean-out openings to permit inspection and removal of debris.
- d. Inspect formwork and remove foreign material before concrete is placed.
- e. At construction joints, lap form-facing materials over the concrete of previous placement. Ensure formwork is placed against hardened concrete so offsets at construction joints conform to specified tolerances.
- f. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in formwork after concrete has reached initial setting. Brace formwork to resist lateral deflection and lateral instability.
- g. Fasten form wedges in place after final adjustment of forms and before concrete placement.
- h. Provide anchoring and bracing to control upward and lateral movement of formwork system.
- i. Construct formwork for openings to facilitate removal and to produce opening dimensions as specified and within tolerances.
- j. Provide runways for moving equipment. Support runways directly on formwork or structural members. Do not support runways on reinforcement. Loading applied by runways must not exceed capacity of formwork or structural members.
- k. Position and support expansion joint materials and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with removable material to prevent concrete entry into voids.
- l. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete placement.

### 3.3.1 Coating

- a. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.
- b. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to concrete placement.
- c. Do not allow formwork release agent to contact reinforcement or hardened concrete against which fresh concrete is to be placed.

### 3.3.2 Reshoring

- a. Do not allow structural members to be loaded with combined dead and construction loads in excess of loads indicated in the accepted procedure.
- b. Install and remove reshores or backshores in accordance with accepted procedure.

### 3.3.3 Reuse

- a. Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.
- b. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.
- c. Remove leaked mortar from formwork joints before reuse.

### 3.3.4 Forms for Standard Rough Form Finish

Provide formwork in accordance with [ACI 301](#) Section 5 with a surface finish, SF-1.0, for formed surfaces that are to be concealed by other construction.

### 3.3.5 Forms for Standard Smooth Form Finish

Provide formwork in accordance with [ACI 301](#) Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view. Do not provide mockup of concrete surface appearance and texture.

### 3.3.6 Form Ties

- a. After ends or end fasteners of form ties have been removed, repair tie holes in accordance with [ACI 301](#) Section 5 requirements.

### 3.3.7 Tolerances for Form Construction

- a. Construct formwork so concrete surfaces conform to tolerances in [ACI 117](#).
- b. Position and secure sleeves, inserts, anchors, and other embedded items such that embedded items are positioned within [ACI 117](#) tolerances.
- c. To maintain specified elevation and thickness within tolerances, install formwork to compensate for deflection and anticipated settlement in formwork during concrete placement. Set formwork and

intermediate screed strips for slabs to produce designated elevation, camber, and contour of finished surface before formwork removal. If specified finish requires use of vibrating screeds or roller pipe screeds, ensure that edge forms and screed strips are strong enough to support such equipment.

### 3.3.8 Removal of Forms and Supports

- a. If vertical formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete.
- b. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform repairs and finishing operations required. If forms are removed before end of specified curing period, provide curing and protection.
- c. Do not damage concrete during removal of vertical formwork for columns, walls, and sides of beams. Perform needed repair and finishing operations required on vertical surfaces. If forms are removed before end of specified curing period, provide curing and protection.
- d. Form-facing material and horizontal facing support members may be removed before in-place concrete reaches specified compressive strength if shores and other supports are designed to allow facing removal without deflection of supported slab or member.

### 3.3.9 Strength of Concrete Required for Removal of Formwork

If removal of formwork, reshoring, or backshoring is based on concrete reaching a specified in-place strength, mold and field-cure cylinders in accordance with [ASTM C31/C31M](#). Test cylinders in accordance with [ASTM C39/C39M](#). Alternatively, use one or more of the methods listed herein to evaluate in-place concrete strength for formwork removal.

- a. Tests of cast-in-place cylinders in accordance with [ASTM C873/C873M](#). This option is limited to slabs with concrete depths from 5 to 12 in.
- b. Penetration resistance in accordance with [ASTM C803/C803M](#).
- c. Pullout strength in accordance with [ASTM C900](#).
- d. Maturity method in accordance with [ASTM C1074](#). Submit [maturity method data](#) using project materials and concrete mix proportions used on the project to demonstrate the correlation between maturity and compressive strength of laboratory cured test specimens to the Contracting Officer.

### 3.4 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

- a. Unless otherwise specified, placing reinforcement and miscellaneous materials must be in accordance to [ACI 301](#). Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.
- b. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

- c. Nonprestressed cast-in-place concrete members must have concrete cover for reinforcement given in the following table:

Concrete Exposure	Member	Reinforcement	Specified cover, in.
Cast against and permanently in contact with ground	All	All	3
Exposed to weather or in contact with ground	All	No. 6 through No. 18 bars	2
		No. 5 bar, W31 or D31 wire, and smaller	1-1/2
Not exposed to weather or in contact with ground	Slabs, joists, and walls	No. 14 and No. 18 bars	1-1/2
		No. 11 bar and smaller	3/4
	Beams, columns, pedestals, and tension ties	Primary reinforcement, stirrups, ties, spirals, and hoops	1-1/2

3.4.1 General

Provide details of reinforcement that are in accordance with the Contract Documents.

3.4.2 Vapor Barrier

- a. Install in accordance with [ASTM E1643](#). Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of [12 inches](#) and tape.
- b. Remove torn, punctured, or damaged vapor barrier material and provide with new vapor barrier prior to placing concrete. Concrete placement must not damage vapor barrier material.

3.4.3 Perimeter Insulation

Install perimeter insulation at locations indicated. Adhesive must be used where insulation is applied to the interior surface of foundation walls and



may be used for exterior application.

#### 3.4.4 Reinforcement Supports

Provide reinforcement support in accordance with [CRSI RB4.1](#) and [ACI 301](#) Section 3 requirements.

#### 3.4.5 Splicing

As indicated in the Contract Documents. For splices not indicated follow [ACI 301](#). Do not splice at points of maximum stress. Overlap welded wire reinforcement the spacing of the cross wires, plus 2 inches.

#### 3.4.6 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

#### 3.4.7 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

#### 3.4.8 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

- a. Provide fabrication tolerances that are in accordance with [ACI 117](#).
- b. Provide hooks and bends that are in accordance with the Contract Documents.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

- a. Bar lengths, depths, and bends beyond specified fabrication tolerances
- b. Bends or kinks not indicated on drawings or approved shop drawings
- c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

#### 3.4.9 Placing Reinforcement

Place reinforcement in accordance with [ACI 301](#).

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

For slabs other than on grade, supports for which any portion is less than [1 inch](#) from concrete surfaces that are exposed to view or to be painted must be of precast concrete units, plastic-coated steel, or stainless steel protected bar supports. Precast concrete units must be wedge shaped, not larger than [3-1/2 by 3-1/2 inches](#), and of thickness equal to that indicated for concrete protection of reinforcement. Provide precast units that have cast-in galvanized tie wire hooked for anchorage and blend with concrete surfaces after finishing is completed.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

- a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with [ACI 301](#) and [CRSI 10MSP](#). Do not use supports to support runways for concrete conveying equipment and similar construction loads.
- b. Equip supports on ground and similar surfaces with sand-plates.
- c. Support welded wire reinforcement as required for reinforcing bars.
- d. Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than [16 gage](#).
- e. Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to the Contract Documents.
- f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in the Contract Documents.

#### 3.4.10 Spacing of Reinforcing Bars

- a. Spacing must be as indicated in the Contract Documents.
- b. Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

#### 3.4.11 Concrete Protection for Reinforcement

Additional concrete protection must be in accordance with the Contract Documents.

#### 3.4.12 Welding

Welding must be in accordance with [AWS D1.4/D1.4M](#).

#### 3.5 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

In accordance with [ASTM C94/C94M](#), [ACI 301](#), [ACI 302.1R](#) and [ACI 304R](#), except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

##### 3.5.1 Measuring

Make measurements at intervals as specified in paragraphs SAMPLING and TESTING.

##### 3.5.2 Mixing

- a. Mix concrete in accordance with [ASTM C94/C94M](#), [ACI 301](#) and [ACI 304R](#).
- b. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than [84 degrees F](#).
- c. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than [84 degrees F](#) except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and submitted water-cementitious material ratio are not exceeded and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required.
- d. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.

##### 3.5.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

#### 3.6 PLACING CONCRETE

Place concrete in accordance with [ACI 301](#) Section 5.

##### 3.6.1 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of [4 inches](#) greater than indicated.

### 3.6.2 Pumping

ACI 304R and ACI 304.2R. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well-rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

### 3.6.3 Cold Weather

Cold weather concrete must meet the requirements of ACI 301 unless otherwise specified. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 37 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

### 3.6.4 Hot Weather

Hot weather concrete must meet the requirements of ACI 301 unless otherwise specified. Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

### 3.6.5 Bonding

Surfaces of set concrete at joints, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

- a. At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.

- b. At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; the roughened and cleaned surface of set concrete must be dampened but not saturated and covered with a cement grout coating.
- c. Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

### 3.7 WASTE MANAGEMENT

Provide as specified in the Waste Management Plan and as follows.

#### 3.7.1 Mixing Equipment

Before concrete pours, designate Contractor-owned site meeting environmental standards or on-site area to be paved later in project for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

#### 3.7.2 Hardened, Cured Waste Concrete

Crush and reuse hardened, cured waste concrete as fill or as a base course for pavement.

#### 3.7.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

#### 3.7.4 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material.

### 3.8 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

#### 3.8.1 Defects

Repair surface defects in accordance with ACI 301 Section 5.

#### 3.8.2 Not Against Forms (Top of Walls)

Surfaces not otherwise specified must be finished with wood floats to even surfaces. Finish must match adjacent finishes.

#### 3.8.3 Formed Surfaces

##### 3.8.3.1 Tolerances

Tolerances in accordance with ACI 117 and as indicated.

##### 3.8.3.2 As-Cast Rough Form

Provide for surfaces not exposed to public view a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301.

### 3.8.3.3 Standard Smooth Finish

Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with [ACI 301](#).

## 3.9 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

In accordance with [ACI 301](#) and [ACI 302.1R](#), unless otherwise specified. Slope floors uniformly to drains where drains are provided. Depress the concrete base slab where quarry tile, or ceramic tile are indicated. Steel trowel and fine-broom finish concrete slabs that are to receive quarry tile, ceramic tile, or paver tile. Where straightedge measurements are specified, Contractor must provide straightedge.

### 3.9.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

#### 3.9.1.1 Floated

Use for exterior slabs where not otherwise specified. Finish concrete in accordance with [ACI 301](#) Section 5 for a floated finish.

#### 3.9.1.2 Steel Troweled

Use for floors intended as walking surfaces, for reception of floor coverings, and for firing range floor slab. Finish concrete in accordance with [ACI 301](#) Section 5 for a steel troweled finish.

#### 3.9.1.3 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Finish concrete in accordance with [ACI 301](#) Section 5 for a broomed finish.

### 3.9.2 Flat Floor Finishes

[ACI 302.1R](#). Construct in accordance with one of the methods recommended in Table 7.15.3, "Typical Composite Ff/FL Values for Various Construction Methods." [ACI 117](#) for tolerance tested by [ASTM E1155](#). Only required for the firing range. No local anomalies that could cause ricochets will be accepted.

#### a. Floor tolerances for firing range:

Floor Flatness (Ff) 20 minimum  
Floor Levelness (FL) 15 minimum

#### 3.9.2.1 Measurement of Floor Tolerances

Test slab within 24 hours of the final troweling. Provide tests to Contracting Officer within 12 hours after collecting the data. Floor flatness inspector is required to provide a [tolerance report](#) which must include:

- a. Key plan showing location of data collected.
- b. Results required by **ASTM E1155**.

#### 3.9.2.2 Remedies for Out of Tolerance Work

Contractor is required to repair and retest any floors not meeting specified tolerances. Prior to repair, Contractor must submit and receive approval for the proposed repair, including product data from any materials proposed. Repairs must not result in damage to structural integrity of the floor. For floors exposed to public view, repairs must prevent any uneven or unusual coloring of the surface.

#### 3.9.3 Concrete Walks

Provide **4 inches** thick minimum. Provide contraction joints spaced every **5 linear feet** unless otherwise indicated. Cut contraction joints **1 inch** deep, or one fourth the slab thickness whichever is deeper, with a jointing tool after the surface has been finished. Provide **0.5 inch** thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every **50 feet** maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to **1/4 inch in 5 feet**.

#### 3.9.4 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be precast concrete, and must be **24 inches long, 12 inches wide and 4 inches thick**, unless otherwise indicated, with smooth-finished countersunk dishes sloped to drain away from the building.

### 3.10 JOINTS

#### 3.10.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

##### 3.10.1.1 Maximum Allowable Construction Joint Spacing

- a. In walls at not more than **60 feet** in any horizontal direction.
- b. In slabs on ground, so as to divide slab into areas not in excess of **1,200 square feet**.

##### 3.10.1.2 Construction Joints for Constructability Purposes

- a. In walls, at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall.
- b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier.

Provide keyways at least 1-1/2-inches deep, or concrete roughened to produce a surface texture of plus or minus 1/4 inch in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

### 3.10.2 Isolation Joints in Slabs on Ground

- a. Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
- b. Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.
- c. No isolation joints shall be located in firing range.

### 3.10.3 Contraction/Control Joints in Slabs on Ground

- a. Provide joints to form panels as indicated.
- b. ~~Discontinue reinforcing 2 inches each side of joint. Under and on exact line of each control joint, cut 50 percent of welded wire reinforcement before placing concrete.~~
- c. Sawcut ~~contraction~~ joints into slab on ground in accordance with **ACI 301** Section 5. Maximum joint width within the firing range to be 1/4 inch.

### 3.10.4 Construction Joints in Slabs on Ground

- a. Provide joints to form panels as indicated.
- b. Discontinue reinforcing 2 inches each side of joint.
- c. Tool a 1/2 inch deep groove with 1/8 inch radius on each joint edge. Maximum groove width within the firing range shall be 1/4 inch.

### 3.10.5 Sealing Joints in Slabs on Ground

- a. ~~Contraction and control joints~~Joints which are to receive finish flooring material must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.
- b. Sealed groove must be left ready to receive filling material that is provided as part of finish floor covering work.

### 3.11 CURING AND PROTECTION

Curing and protection in accordance with **ACI 301** Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving,



movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

### 3.11.1 Curing Periods

ACI 301 Section 5, except 10 days for retaining walls, pavement or chimneys. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

### 3.11.2 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

### 3.11.3 Curing Unformed Surfaces

- a. Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.
- b. Accomplish final curing of unformed surfaces by any of curing methods specified, as applicable.
- c. Accomplish final curing of concrete surfaces to receive liquid floor hardener of finish flooring by moisture-retaining cover curing.

### 3.11.4 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete

during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any one hour nor 80 degrees F in any 24-hour period.

#### 3.11.5 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

#### 3.11.6 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

### 3.12 FIELD QUALITY CONTROL

#### 3.12.1 Sampling

ASTM C172/C172M. Collect samples of fresh concrete to perform tests specified. ASTM C31/C31M for making test specimens.

#### 3.12.2 Testing

##### 3.12.2.1 Slump Tests

ASTM C143/C143M. Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

##### 3.12.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

##### 3.12.2.3 Compressive Strength Tests

ASTM C39/C39M. Make six 6 inch by 12 inch test cylinders for each set of tests in accordance with ASTM C31/C31M, ASTM C172/C172M and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold two cylinder in reserve. Take samples for strength tests of each mix design and for concrete placed each day not less than once a day, nor less than once for each 100 cubic yards of concrete for the first 500 cubic yards, then every 500 cubic yards thereafter, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. Concrete compressive tests must meet the requirements of this section, the Contract Document, and ACI 301. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or

remediation plan for review and approval by the contracting officer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

#### 3.12.2.4 Air Content

ASTM C173/C173M or ASTM C231/C231M for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

#### 3.12.2.5 Unit Weight of Structural Concrete

ASTM C567/C567M and ASTM C138/C138M. Determine unit weight of lightweight and normal weight concrete. Perform test for every 20 cubic yards maximum.

#### 3.12.2.6 Chloride Ion Concentration

Chloride ion concentration must meet the requirements of the paragraph titled CORROSION AND CHLORIDE CONTENT. Determine water soluble ion concentration in accordance with ASTM C1218/C1218M. Perform test once for each mix design.

#### 3.12.2.7 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if any of the following conditions are identified:

- a. Failure to meet compressive strength tests as evaluated.
- b. Reinforcement not conforming to requirements specified.
- c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
- d. Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified.
- e. Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.
- f. Poor workmanship likely to result in deficient strength.

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the contracting officer.

#### 3.12.2.8 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate

or remediate the non-conforming material. The Contracting Officer may accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Government.

### 3.12.2.9 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements or there are non-conforming materials, make cores drilled from hardened concrete for compressive strength determination in accordance with [ASTM C42/C42M](#), and as follows:

- a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.
- b. Test cores after moisture conditioning in accordance with [ASTM C42/C42M](#) if concrete they represent is more than superficially wet under service.
- c. Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.
- d. Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

### 3.13 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the Contracting Officer for approval before any corrective work is accomplished.

#### 3.13.1 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than  $1/4$  inch thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than  $1/4$  inch thick must be removed and replaced or mitigated in a manner acceptable to the Contracting Officer.

#### 3.13.2 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Contracting Officer prior to proceeding.

-- End of Section --

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2017) Minimum Design Loads for Buildings and Other Structures

ASME INTERNATIONAL (ASME)

ASME B29.400 (2001; (R 2008) (R 2013) (R 2018))  
Combination, "H" Type Mill Chains, and Sprockets

ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M (2017) Standard Specification for Steel Castings, Carbon, for General Application

ASTM A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A48/A48M (2003; R 2012) Standard Specification for Gray Iron Castings

ASTM A53/A53M (2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A307 (2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A653/A653M (2018) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A666 (2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

ASTM A924/A924M (2018) Standard Specification for General Requirements for Steel Sheet,

Metallic-Coated by the Hot-Dip Process

ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM D2000	(2012; R 2017) Standard Classification System for Rubber Products in Automotive Applications
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E330/E330M	(2014) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM F568M	(2007) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

## 1.2 SUBMITTALS

Submittals shall be made to U.S. Army Corps of Engineers. U.S. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation shall be submitted to the U.S. Government for information only. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

- Overhead Coiling Doors; G
- Counterbalancing Mechanism; G
- Manual Door Operators; G
- Electric Door Operators; G
- Guides; G
- Mounting Brackets; G
- Overhead Drum; G
- Hood; G
- Installation Drawings; G

### SD-03 Product Data

- Overhead Coiling Doors; G
- Hardware; G
- Counterbalancing Mechanism; G

Manual Door Operators; G

Electric Door Operators; G

SD-05 Design Data

Overhead Coiling Doors; G

Hardware; G

Counterbalancing Mechanism; G

Manual Door Operators; G

Electric Door Operators; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

Materials; G

Devices; G

Procedures; G

Manufacture's Brochures; G

Parts Lists; G

SD-11 Closeout Submittals

Warranty; G

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store doors in an adequately ventilated dry location that is free from dirt and dust, water, or other contaminants. Store in a manner that permits easy access for inspection and handling.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Doors to be coiling type, with interlocking slats, complete with anchoring and door hardware, guides, hood, and operating mechanisms, and designed for use on openings as indicated. Use grease-sealed or self-lubricating bearings for rotating members.

2.1.1 Design Requirements

2.1.1.1 Overhead Coiling Door Detail Shop Drawings

Provide installation drawings for overhead coiling door assemblies which show: elevations of each door type, shape and thickness of materials, finishes, details of joints and connections, details of guides and

fittings, rough opening dimensions, location and description of hardware, anchorage locations, and counterbalancing mechanism and door operator details. Show locations of replaceable fusible links on wiring diagrams for power, signal and controls. Include a schedule showing the location of each door with the drawings.

## 2.1.2 Performance Requirements

### 2.1.2.1 Wind Loading

Design and fabricate door assembly to withstand the wind loading pressure of at least 24 pounds per square foot with a maximum deflection of 1/120 of the opening width. Provide test data showing compliance with ASTM E330/E330M. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested. Ensure complete assembly meets or exceeds the requirements of ASCE 7.

### 2.1.2.2 Operational Cycle Life

Design all portions of the door, hardware and operating mechanism that are subject to movement, wear, or stress fatigue to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the fully open position, and returns to the closed position.

## 2.2 COMPONENTS

### 2.2.1 Overhead Coiling Doors

#### 2.2.1.1 Curtain Materials and Construction

Provide curtain slats fabricated from Grade A steel sheets conforming to ASTM A653/A653M, with the additional requirement of a minimum yield point of 33,000 psi. Provide sheets, galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M.

~~Provide curtain slats fabricated from Type 304 stainless steel sheets conforming to ASTM A 666, sheet thickness of 0.025 inch as specified.~~

~~Provide curtain slats fabricated from aluminum sheets conforming to ASTM B209, or ASTM B221 extrusions, alloy and tempering standard from manufacturer for type of use and finish indicated, with a thickness of 0.050 inch as specified.~~

Fabricate doors from interlocking cold-rolled slats, with section profiles as specified, designed to withstand the specified wind loading. Ensure the provided slats are continuous without splices for the width of the door.

Provide slats filled with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84. Enclose insulation completely within slat faces on interior surface of slats.

#### 2.2.1.2 Locks

Provide end and/or wind locks of Grade B cast steel conforming to ASTM A27/A27M, galvanized in accordance with ASTM A653/A653M, ASTM A153/A153M and ASTM A924/A924M. Secure locks at every other curtain slat.



#### 2.2.1.3 Weather Stripping

Ensure weather-stripping at the door-head and jamb is 1/8-inch thick sheet of natural or neoprene rubber with air baffles. Secure weather stripping to the insides of hoods with galvanized-steel fasteners through continuous galvanized-steel pressure bars at least 5/8-inch wide and 1/8-inch thick.

Ensure threshold weather-stripping is 1/8-inch thick sheet natural or neoprene rubber secured to the bottom bars.

Provide weather-stripping of natural or neoprene rubber conforming to [ASTM D2000](#).

#### 2.2.1.4 Locking Devices

Ensure slide bolt engages through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

Provide a locking device assembly which includes cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

Provide chain lock keeper suitable for a standard padlock.

#### 2.2.1.5 Safety Interlock

Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

#### 2.2.1.6 Overhead Drum

Fabricate drums from nominal 0.028-inch thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with [ASTM A653/A653M](#).

Fabricate drums from nominal 0.025-inch thick stainless-steel sheet, Type 304, complying with [ASTM A666](#).

Fabricate drums from nominal 0.040-inch thick aluminum sheet complying with [ASTM B209](#). Aluminum of alloy and temper recommended by manufacturer. Select finish for type of use and finish indicated.

#### 2.2.1.7 Slats

No. 5F, 18 gauge, Grade 40 steel, [ASTM A653/A653M](#) galvanized steel zinc coating.

#### 2.2.2 Hardware

Ensure all hardware conforms to [ASTM A153/A153M](#), [ASTM A307](#), [ASTM F568M](#), and [ASTM A27/A27M](#).

##### 2.2.2.1 Guides

Fabricate curtain jamb guides from the manufacturer's standard angles or channels of same material and finish as curtain slats unless otherwise indicated. Provide guides with sufficient depth and strength to retain curtain, and to withstand loading. Ensure curtain operates smoothly. Slot bolt holes for track adjustment.

Ensure guides are roll-formed steel channel bolted to angle or structural grade, three angle assembly of steel to form a slot of sufficient depth to retain curtains in guides to achieve 20 psf windload standard. Guides may be provided with integral windlock bars and removable bottom bar stops.

Fabricate with structural steel angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Flare the top of inner and outer guide angles outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.

#### 2.2.2.2 Equipment Supports

Fabricate door-operating equipment supports from the manufacturer's standard steel shapes and plates conforming to ASTM A36/A36M, galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M. Size the shapes and plates in accordance with the industry standards for the size, weight, and type of door installation.

#### 2.2.2.3 Hood

Provide a hood with a minimum 24-gauge galvanized sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness. The hood encloses the curtain coil and counterbalance mechanism.

Provide a 24-gauge galvanized steel hood with reinforced top and bottom edges. Provide minimum 1/4-inch steel intermediate support brackets as required to prevent excessive sag.

#### 2.2.3 Counterbalancing Mechanism

Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted, around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members.

##### 2.2.3.1 Brackets

Provide the manufacturer's standard mounting brackets with one located at each end of the counterbalance barrel conforming to ASTM A48/A48M. Provide brackets of either cast iron or cold-rolled steel.

Brackets will be of 3/16-inch minimum thick steel plates, with permanently sealed ball bearings. Designed to enclose ends of coil and provide support of counterbalance pipe at each end.

Fabricate brackets from minimum 3/16-inch steel plate. Permanently lubricate ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.

##### 2.2.3.2 Counterbalance Barrels

Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, conforming to ASTM A53/A53M. Ensure the barrel is of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats. Limit barrel deflection to not more than 0.03 inch per foot of span under full

load.

Curtain to be coiled on a pipe of sufficient size to carry door load with deflection not to exceed 0.033 inches per foot of door span and to be correctly balanced by helical springs, oil tempered torsion type. Use cast iron barrel plugs to anchor springs to tension shaft and pipe.

a. Barrel

Provide steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.

b. Spring Balance

Provide an oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door. Ensure that effort to operate manually operated units does not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.

2.2.3.3 Spring Balance

Install one or more oil-tempered, heat-treated steel helical torsion springs within the barrel, capable of producing sufficient torque to assure easy operation of the door curtain. Provide and size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

2.2.3.4 Torsion Rod for Counter Balance

Fabricate rod from the manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

2.2.3.5 Counterbalance Shaft Assembly

a. Barrel

Provide steel pipe capable of supporting the curtain load with maximum deflection of 0.03 inches per foot of width.

b. Spring Balance

Provide an oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door. Ensure that maximum effort to operate does not exceed 25 pounds. Provide wheel for applying and adjusting spring torque.

2.2.4 Manual Door Operators

2.2.4.1 Manual Push-Up Door Operators

Equip door with manufacturer's recommended lifting handles, locks, and latches. Adjust counterbalance mechanisms so that the required lift or pull for operation does not exceed 25 pounds unless another type of door operator is indicated. Design operating mechanisms so that the curtain can be stopped at any point in its upward or downward travel and remains in that position until pushed to the fully open or closed position.

#### 2.2.4.2 Manual Chain-Hoist Door Operators

Provide door operators which consist of an endless steel hand chain, chain-pocket wheel, guard, and a geared reduction unit of at least a 3 to 1 ratio with a maximum lifting force of 25 lbf. Required pull for operation cannot exceed 35 pounds.

Provide chain hoists with a self-locking mechanism allowing the curtain to be stopped at any point in its upward or downward travel and to remain in that position until moved to the fully open or closed position. Provide hand chains of cadmium-plated alloy steel conforming to ASME B29.400. Ensure yield point of the chain is at least three times the required hand-chain pull.

Provide chain sprocket wheels of cast iron conforming to ASTM A48/A48M.

#### 2.2.4.3 Manual Crank-Hoist Door Operators

Provide door operators which consist of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit with a maximum 25 lbf force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device with a self-locking mechanism allowing the curtain to be stopped at any point in its upward or downward travel and remain in that position until moved to the fully open or closed position.

#### 2.2.5 Electric Door Operators

##### 2.2.5.1 Door-Operator Types

Provide an operator mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.

Provide an operator mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

Provide an operator mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

Provide a bench mounted operator mounted to the right or left door head plate and connected to the door drive shaft with drive chain and sprockets. Side room is required for this type of mounting.

Provide a through-wall operator which is mounted on other side of wall from coil side of door.

#### 2.2.6 Surface Finishing

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Noticeable variations in the same metal component are not acceptable. Variations in appearance of adjoining components are acceptable if they are

within the range of approved samples and are assembled or installed to minimize contrast.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install overhead coiling door assembly, anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories in accordance with approved detail drawings and manufacturer's written instructions. Upon completion of installation, ensure doors are free from all distortion.

Install overhead coiling doors, motors, hoods, and operators at the mounting locations as indicated for each door in the contract documents and as required by the manufacturer.

Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility and as required by the manufacturer.

##### 3.1.1 Field Painted Finish

Ensure field painted steel doors and frames are in accordance with Section 09 90 00 PAINTS AND COATINGS and manufacturer's written instructions. Protect weather stripping from paint. Ensure finishes are free of scratches or other blemishes.

#### 3.2 ADJUSTING AND CLEANING

##### 3.2.1 Acceptance Provisions

After installation, adjust hardware and moving parts. Lubricate bearings and sliding parts as recommended by manufacturer to provide smooth operating functions for ease movement, free of warping, twisting, or distortion of the door assembly.

Adjust seals to provide weather-tight fit around entire perimeter.

Engage a factory-authorized service representative to perform startup service and checks according to manufacturer's written instructions.

Test the door opening and closing operation when activated by controls or alarm-connected fire-release system. Adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Reset door-closing mechanism after successful test.

Test and make final adjustment of new doors at no additional cost to the Government.

##### 3.2.1.1 Maintenance and Adjustment

Not more than 90 calendar days after completion and acceptance of the project, examine, lubricate, test, and re-adjust doors as required for proper operation.

##### 3.2.1.2 Cleaning

Clean aluminum doors in accordance with manufacturer's approved instructions.

### 3.3 CLOSEOUT ACTIVITIES

#### 3.3.1 Warranty

Furnish a written guarantee that the helical spring and counterbalance mechanism are free from defects in material and workmanship for not less than two years after completion and acceptance of the project.

Warrant that upon notification by the Government, any defects in material, workmanship, and door operation are immediately correct within the same time period covered by the guarantee, at no cost to the Government.

#### 3.3.2 Operation And Maintenance

Submit 6 copies of the [Operation and Maintenance Manuals](#) 30 calendar days prior to testing the Overhead Coiling Door Assemblies. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies, including the following items:

##### [Materials](#)

##### [Devices](#)

Manual Door Operators

##### [Hood](#)

Counterbalancing Mechanism

Painting

##### [Procedures](#)

[Manufacture's Brochures](#)

##### [Parts Lists](#)

Provide operation and maintenance manuals which are consistent with manufacturer's standard brochures, schematics, printed instructions, operating procedures, and safety precautions. Provide test data that is legible and of good quality.

-- End of Section --

SECTION 12 48 13

ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

**ASTM B221** (2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

**ASTM D2047** (2017) Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine

**ASTM E648** (2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

**36 CFR 1191** Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

1.2 SUSTAINABILITY REPORTING

Materials in this technical specification may increase contract compliance with sustainability requirements.

1.2.1 EPA Comprehensive Procurement Guidelines

See Section **01 33 29** SUSTAINABILITY REPORTING for requirements associated with EPA-designated products.

1.2.2 USDA Biobased

See Section **01 33 29** SUSTAINABILITY REPORTING for requirements associated with USDA Biobased products.

1.3 SUBMITTALS

Submittals shall be made to U.S. Army Corps of Engineers. U.S. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation shall be submitted to the U.S. Government for information only. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section **01 33 29** SUSTAINABILITY REPORTING. Submit the following in accordance with Section

01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G

Detail Drawings; G

Custom Graphics Drawings; G

SD-03 Product Data

Entrance Floor Mats and Frames; G

SD-04 Samples

Entrance Floor Mats and Frames; G

Custom Graphics; G

SD-08 Manufacturer's Instructions

Manufacturer's Instructions

SD-10 Operation and Maintenance Data

Protection, Maintenance, and Repair Information

1.4 QUALITY CONTROL

Comply with 36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines for installed entrance floor mats and frames. Ensure that entrance floor mats and frames are slip-resistant in accordance with ASTM D2047, with a minimum 0.60 coefficient of friction, for accessible routes and are structurally capable of withstanding a uniform floor load of 300 lb/sq ft. Ensure that flammability is in accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45 watts/square meter.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in their original packages or containers bearing labels clearly identifying the manufacturer, brand name, and quality or grade.

Store materials in their original unbroken packages or containers in the area in which they will be installed. Unwrap, inspect, and place mats at indicated locations. Remove all excess packing materials.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

2.1.1 Entrance Floor Mats and Frames

Submit the manufacturer's catalog data. Submit samples of assembled sections of floor mats showing corners, intersections, and other details of construction. Submit samples of custom graphics, exposed floor mats,



frame finishes and accessories.

#### 2.1.1.1 Resilient-Link Mats

Provide vinyl resilient-link mats, [7/16 inch](#) thick with stainless steel wire link rods. Ensure that nosing is vulcanized and square for recess or mats butted one to another. Provide mats with steel-reinforced end trim that is open-weave with link openings of [1 1/2 inches](#) by [1/2 inch](#).

#### 2.1.1.2 Floor Grids

Provide a floor grid consisting of a series of aluminum tread rails spaced [1 1/2 inches](#) on center and running counter to the traffic flow. Ensure that floor grids allow debris to fall to the subfloor. Provide a drain pan [1 5/8 inches](#) deep. Rest grid assemblies on a continuous vinyl cushion. For a stainless-steel grid, provide satin-finished stainless-steel rails, electronically welded joints, and a stainless-steel frame [1 5/8 inches](#) deep. Provide all anchors, fasteners, accessories, and other parts required for a complete installation.

#### 2.1.1.3 Frames

Provide recessed frames in extruded aluminum Alloy 6061-T6 or Alloy 6063-T5 [ASTM B221](#). Ensure that the frame depth accommodates the mat and system specified. Frame color is mill finish. Ensure that edge-frame members are fabricated in single lengths or with the fewest pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins. Ensure that any concealed surfaces of aluminum frames that contact cementitious material are coated with the manufacturer's standard protective coating. Ensure that frames include accessories and devices required for a complete installation.

#### 2.1.1.4 Tread Insert Options

Provide tread inserts consisting of carpet composed of solution-dyed nylon or polypropylene carpet fibers fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths; carpet has antistatic and antistain treatments. Ensure that pile weight is a minimum 30 ounces per square yard carpet/bristle filament mix.

#### 2.1.2 Color

Color to be selected from full range of color and style by the government.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Comply with the manufacturer's requirements for substrates and floor conditions affecting installation of floor mats and frames. Ensure that all unsatisfactory conditions have been corrected before installation.

#### 3.2 INSTALLATION

Submit [detail drawings](#), and [custom graphics drawings](#) as required. Provide [installation drawings](#). Provide the manufacturer's [protection, maintenance, and repair information](#).

Install floor mats and frames according to [manufacturer's instructions](#).

Set mat tops at the height recommended by the manufacturer for the most effective cleaning action. Provide clearance between bottoms of doors and tops of mats. Coordinate recess frame installation with concrete construction to ensure that frame anchorage is correct and that the base is level and flat. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

-- End of Section --

SECTION 13 34 19

METAL BUILDING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

- AA ADM (2020) Aluminum Design Manual
- AA ASD1 (2017; Errata 2017) Aluminum Standards and Data

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- AISC 325 (2017) Steel Construction Manual
- AISC 341 (2016) Seismic Provisions for Structural Steel Buildings
- AISC 360 (2016) Specification for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

- AISC/AISI 121 (2007) Standard Definitions for Use in the Design of Steel Structures
- AISI SG03-3 (2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

- ASCE 7 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- ASCE 7-10 (2010; Errata 2011; Supp 1 2013) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

- AWS A5.1/A5.1M (2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
- AWS D1.1/D1.1M (2020) Structural Welding Code - Steel
- AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2020) Standard Specification for Steel, sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A1011/A1011M	(2018) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability and Ultra-High Strength
ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2014; E 2017) Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A463/A463M	(2015; R 2020; E 2020) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A475	(2003; R 2014) Standard Specification for Zinc-Coated Steel Wire Strand
ASTM A500/A500M	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A501/A501M	(2014) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A529/A529M	(2019) Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572/A572M	(2018) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

ASTM A606/A606M	(2018) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A755/A755M	(2018) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2010; R 2015) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A992/A992M	(2011) Standard Specification for Structural Steel Shapes
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C136/C136M	(2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C518	(2017) Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D1308	(2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences

	from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D2794	(1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3363	(2005; E 2011; R 2011; E 2012) Film Hardness by Pencil Test
ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D523	(2014) Standard Test Method for Specular Gloss
ASTM D714	(2002; R 2017) Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D822	(2001; R 2006) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D968	(2015) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM DEFONLINE	(2008) ASTM Online Dictionary of Engineering Science and Technology
ASTM E1592	(20175 R 2012) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E1646	(1995; R 2018) Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Air Pressure Difference
ASTM E84	(2015a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F436/F436M	(2019) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F844	(2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1554	(2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F1852	(2014) Standard Specification for "Twist Off" Type Tension Control Structural

Bolt/Nut/Washer Assemblies, Steel, Heat  
Treated, 120/105 ksi Minimum Tensile  
Strength

ASTM G152

(2013) Operating Open Flame Carbon Arc  
Light Apparatus for Exposure of  
Nonmetallic Materials

ASTM G153

(2013) Operating Enclosed Carbon Arc Light  
Apparatus for Exposure of Nonmetallic  
Materials

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA MBSM

(2018) Metal Building Systems Manual

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500

(2006) Metal Finishes Manual

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA RoofMan

(2020) The NRCA Roofing Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

SMACNA 1793

(2012) Architectural Sheet Metal Manual,  
7th Edition

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 15

(1999; E 2004) Steel Joist Shop  
Primer/Metal Building Primer

SSPC Painting Manual

(2002) Good Painting Practice, Steel  
Structures Painting Manual, Volume 1

SSPC SP 2

(2018) Hand Tool Cleaning

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Structural Performance

Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within the limits and conditions indicated.

#### 1.2.1.1 Engineering

Design metal building systems conforming to procedures described in [MBMA MBSM](#).

#### 1.2.1.2 Design Loads

Conform to the requirements of [MBMA MBSM](#), [ASCE 7](#) and the building code applicable to the project geographical location.

#### 1.2.1.3 Live Loads

Include all vertical loads induced by the building occupancy indicated on the drawings, as well as loads induced by maintenance workers, materials and equipment for roof live loads. Clear Span structure must also withstand a 2,000 lb load anywhere along all primary bent members.

#### 1.2.1.4 Wind Loads

Include horizontal loads induced by a basic wind speed Project site of 158 mph. All three structures are Open Buildings and consider both open and obstructed wind flow per ASCE 7-10.

#### 1.2.1.5 Collateral Loads

Include additional dead loads other than the weight of metal building system for permanent items such as sprinklers, mechanical systems, electrical systems, and ceilings.

#### 1.2.1.6 Load Combinations

Design metal building systems to withstand the most critical effects of load factors and load combinations as required by MBMA MBSM, ASCE 7, and the building code applicable to the project location.

#### 1.2.1.7 Deflection Limits

Engineer assemblies to withstand design loads no greater than the following:

- a. Purlins and Rafters; vertical deflection of 1/180 of the span.
- b. Girts; horizontal deflection of 1/180 of the span
- c. Metal Roof Panels; vertical deflection of 1/180 of the span.

Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings. Provide metal panel assemblies capable of withstanding the effects of loads and stresses indicated, based on testing according to ASTM E1592.

#### 1.2.2 Seismic Performance

Design and engineer metal building systems capable of withstanding the effects of earthquake motions determined according to ASCE 7, AISC 341, and the applicable portions of the building code in the geographic area where the construction will take place.

#### 1.2.3 Thermal Movements

Provide metal panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss as follows:

Temperature Change (Range); 120 degrees F, ambient; 180 degrees F, material surfaces



#### 1.2.4 Thermal Performance

Provide batt insulation with the following minimum R-values for opaque elements when tested according to [ASTM C136/C136M](#) or [ASTM C518](#).

##### 1.2.4.1 Roof Assemblies

~~a. R-Value: 30~~

~~ab.~~ R-Value: As indicated on plans<sup>19</sup>

##### 1.2.4.2 Metal Wall Panel Assemblies

~~a. U-Factor: 30~~

~~ab.~~ R-Value: As indicated on plans<sup>19</sup>

#### 1.2.5 Water Penetration for Metal Roof Panels

No water penetration when tested according to [ASTM E1646](#) at test-pressure difference of 2.86 lbf/sq.ft.

#### 1.2.6 Wind-Uplift Resistance

Provide metal roof panel assemblies that comply with [ASCE 7](#).

### 1.3 DEFINITIONS

[ASTM DEFONLINE](#) applies to this definition paragraph.

- a. Bay: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured normal to end wall (outside face of end-wall girt) for end bays.
- b. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).
- c. Building Width: dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).
- d. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame or knee).
- e. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).
- f. Clear Height Under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.
- g. Terminology Standard: Refer to MBMA "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

#### 1.4 SYSTEM DESCRIPTION

General: Provide a complete, integrated set of metal building system manufacturer's standard or mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, metal roof panels, and accessories complying with requirements indicated.

Provide metal building system of size and with spacing, slopes, and spans indicated.

##### 1.4.1 Primary Frame Type

- a. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

##### 1.4.2 Expandable End-Wall Framing for Clear span Structure

Provide engineered end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.

##### 1.4.3 Secondary Frame Type

Provide manufacturer's standard purlins or joists.

##### 1.4.4 Eave Height

Eave height must be manufacturer's standard height, as indicated by nominal height on Drawings. For Clear Span structure eave height must accommodate 14 feet for vehicle clearance

##### 1.4.5 Bay Spacing

Bay Spacing may be determined by manufacturer. However Clear Span structure must utilize existing foundations.

##### 1.4.6 Roof Slope

Roof slope must be 2 inch per 12 inches on the Warehouse Building, 4 inches per 12 inches on the Rod and Gun Club Building.

##### 1.4.7 Roof System

Provide manufacturer's standard standing-seam metal roof panels.

#### 1.5 SUBMITTALS

Submittals shall be made to U.S. Army Corps of Engineers. U.S. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation shall be submitted to the U.S. Government for information only. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Manufacturer's Qualifications; G

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Manufacturer's Catalog Data; G

SD-04 Samples

Coil Stock, 12 inches long by the actual panel width; G

Metal Closure Strips 10 inches long of each type; G

Manufacturer's Color Charts and Chips, 4 by 4 inches; G

SD-05 Design Data

Manufacturer's Descriptive and Technical Literature; G

Building Design Analysis; G

Installation of Roof Panels

SD-06 Test Reports

Test Reports; G

Coatings and Base Metals; G

Factory Color Finish Performance Requirements; G

SD-07 Certificates

System Components; G

Certificates for Coil Stock; G

Aluminized Steel Repair Paint; G

Galvanizing Repair Paint; G

Enamel Repair Paint; G

Qualification of Manufacturer; G

Qualification of Erector; G

SD-08 Manufacturer's Instructions

Shipping, Handling, and Storage; G

SD-11 Closeout Submittals

Manufacturer's Warranty; G

Contractor's Warranty for Installation; G

1.6 QUALITY ASSURANCE

1.6.1 Pre-Erection Conference

After submittals are received and approved but before metal building system work, including associated work, is performed, the Contracting Officer will hold a pre-erection conference to review the following:

- a. The [detail drawings](#), specifications, and [manufacturer's descriptive and technical literature](#).
- b. Finalize construction schedule and verify availability of materials, erector's personnel, equipment, and facilities needed to make progress and avoid delays.
- c. Methods and procedures related to metal building system erection, including, but not limited to: [qualification of manufacturer](#), [qualification of erector](#), [manufacturer's catalog data](#), [building design analysis](#), written instructions and [test reports](#).
- d. Support conditions for compliance with requirements, including alignment between and erection of structural members.
- e. Flashing, special roofing and siding details, roof and wall penetrations, openings, and condition of other construction that will affect the metal building system, including [coatings and base metals](#), [factory color finish performance requirements](#), [system components](#), and [certificates for coil stock](#).
- f. Governing regulations and requirements for, certificates, insurance, tests and inspections if applicable.
- g. Temporary protection requirements for metal panel assembly during and after installation.
- h. Samples of [aluminized steel repair paint](#), [galvanizing repair paint](#), and [enamel repair paint](#).

1.6.1.1 Pre-Roofing and Siding Installation Conference

After structural framing system erection and approval but before roofing work, including associated work, is performed; the Contracting Officer will hold a pre-roofing conference to review the following:

- a. Examine purlins, sub-girts and formed shapes conditions for compliance with requirements, including flatness and attachment to structural members.
- b. Review structural limitations of purlins, sub-girts and formed shapes during and after roofing and siding.
- c. Review flashings, special roof and wall details, roof drainage, roof and wall penetrations, roof equipment curbs, and condition of other construction that will affect the metal building system.
- d. Review temporary protection requirements for metal roof and wall panels' assembly during and after installation.

- e. Review roof and wall observation and repair procedures after metal building system erection.

#### 1.6.2 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products, erection of structural framing and [installation of roof panels](#) in the geographical area where construction will take place.

#### 1.6.3 [Manufacturer's Qualifications](#)

Metal building system manufacturer must have a minimum of five years experience as a qualified manufacturer and a member of MBMA of metal building systems and accessory products.

Provide engineering services by an authorized currently licensed engineer in the geographical area where construction will take place, having a minimum of four years experience as an engineer knowledgeable in building design analysis, protocols and procedures for the "Metal Building Systems Manual" ([MBMA MBSM](#)); [ASCE 7](#) the building code in the geographic area where the construction will take place and [ASTM E1592](#).

Provide certified engineering calculations using the products submitted for:

- a. Roof and Wall Wind Loads with basic wind speed, exposure category, co-efficient, importance factor, designate type of facility, negative pressures for each zone, methods and requirements of attachment.
- b. Roof Dead and Live Loads
- c. Collateral Loads
- d. Foundation Loads
- e. Roof Snow Load
- f. Seismic Loads

#### 1.6.4 Qualification of Erection Contractor

An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and must be approved and certified by the metal building system manufacturer.

#### 1.6.5 Single Source

Obtain primary and secondary components and structural framing members, each type of metal roof, wall and liner panel assemblies, clips, closures and other accessories from the standard products of the single source from a single manufacturer to operate as a complete system for the intended use.

#### 1.6.6 Welding

Qualify procedures and personnel according to [AWS A5.1/A5.1M](#), [AWS D1.1/D1.1M](#), and [AWS D1.3/D1.3M](#).

#### 1.6.7 Structural Steel

Comply with [AISC 325](#), [AISC 341](#) for seismic impacted designs, [AISC 360](#), for design requirements and allowable stresses.

#### 1.6.8 Cold-Formed Steel

Comply with [AISC/AISI 121](#) and [AISI SG03-3](#) for design requirements and allowable stresses.

#### 1.6.9 Surface-Burning Characteristics

Provide metal panels having material with the following surface-burning characteristics as determined by testing identical products according to [ASTM E84](#) by a qualified testing agency. Identify products with appropriate markings of applicable testing agency showing:

- a. Flame-Spread Index: 25 or less.
- b. Smoke-Developed Index: 450 or less.

#### 1.6.10 Fabrication

Fabricate and finish metal panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements.

Provide metal panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel. Aluminum and aluminum-alloy sheet and plate must conform to [ASTM B209](#).

Fabricate metal panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within panel assembly.

Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in [SMACNA 1793](#) that apply to the design, dimensions, metal, and other characteristics of item indicated:

- a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- b. End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- c. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- e. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA or by metal building system manufacturer for application, but not less than thickness of metal being secured.

#### 1.6.11 Finishes

Comply with **NAAMM AMP 500** for recommendations for applying and designating finishes.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

#### 1.7 SHIPPING, HANDLING AND STORAGE

##### 1.7.1 Delivery

Package and deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed and protected during transportation and handling.

Stack and store metal panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering to ensure dryness, with positive slope for drainage of water. Store in a manner to prevent bending, warping, twisting, and surface damage. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage. Retain strippable protective covering on metal panel for entire period up to metal panel installation.

Protect foam-plastic insulation as follows:

- a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
- b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to project site before installation time.

Complete installation and concealment of plastic materials as rapidly as possible in each area of construction to minimize ultraviolet exposure.

#### 1.8 PROJECT CONDITIONS

##### 1.8.1 Weather Limitations

Proceed with installation preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into existing panel system or building.

##### 1.8.2 Field Measurements

###### 1.8.2.1 Established Dimensions for Foundations

Comply with established dimensions on approved anchor-bolt plans, established foundation dimensions, and proceed with fabricating structural framing. Do not proceed without verifying field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.

###### 1.8.2.2 Established Dimensions for Metal Panels

Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal

panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

#### 1.8.2.3 Verification Record

Verify locations of all framing and opening dimensions by field measurements before metal panel fabrication and indicate measurements on Shop Drawings.

#### 1.9 COORDINATION

Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in section on CAST-IN-PLACE CONCRETE.

Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leak-proof, secure, and non-corrosive installation.

#### 1.10 WARRANTY

##### 1.10.1 Building System Warranty

Furnish manufacturer's no-dollar-limit warranty for the metal building system. The warranty period is to be no less than 20 years from the date of acceptance of the work and be issued directly to the Government. The warranty must provide that if within the warranty period, the metal building system shows evidence of deterioration resulting from defective materials and/or workmanship, correcting of any defects is the responsibility of the metal building system manufacturer. Repairs that become necessary because of defective materials and workmanship while metal building system is under warranty are to be performed within 32 hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within 32 hours of notification will constitute grounds for having emergency repairs performed by others and will not void the warranty.

##### 1.10.2 Roof System Weather-Tightness Warranty

Furnish manufacturer's no-dollar-limit warranty for the metal panel system. The warranty period is to be no less than 20 years from the date of acceptance of the work and be issued directly to the Government.

The warranty is to provide that if within the warranty period the roof panel system shows evidence of corrosion, perforation, rupture, lost of weather-tightness or excess weathering due to deterioration of the panel system resulting from defective materials and correction of the defective workmanship is to be the responsibility of the metal building system manufacturer.

Repairs that become necessary because of defective materials and workmanship while roof panel system is under warranty are to be performed within 24 hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform temporary repairs within 24 hours of notification will constitute grounds for having emergency repairs performed by others and not void the warranty. Immediate follow-up and



completion of permanent repairs must be performed within 7 days from date of notification.

#### 1.10.3 Roof and Wall Panel Finish Warranty

Furnish manufacturer's no-dollar-limit warranty for the metal panel system. The warranty period is to be no less than 20 years from the date of acceptance of the work and be issued directly to the Government.

The warranty is to provide that if within the warranty period the metal panel system shows evidence of checking, delaminating cracking, peeling, chalk in excess of a numerical rating of eight, as determined by [ASTM D4214](#) test procedures; or change colors in excess of five CIE or Hunter units in accordance with [ASTM D2244](#) or excess weathering due to deterioration of the panel system resulting from defective materials and finish or correction of the defective workmanship is to be the responsibility of the metal building system manufacturer.

Liability under this warranty is exclusively limited to replacing the defective coated materials.

### PART 2 PRODUCTS

#### 2.1 STRUCTURAL FRAMING MATERIALS

##### 2.1.1 W Shapes

[ASTM A992/A992M](#); [ASTM A572/A572M](#) or [ASTM A529/A529M](#).

##### 2.1.2 Channel, Angles, M-Shapes and S-Shapes

[ASTM A36/A36M](#), [ASTM A572/A572M](#) or [ASTM A529/A529M](#)

##### 2.1.3 Plate and Bar

[ASTM A36/A36M](#), [ASTM A572/A572M](#) or [ASTM A529/A529M](#)

##### 2.1.4 Steel Pipe

[ASTM A36/A36M](#), [ASTM A53/A53M](#), [ASTM A572/A572M](#) or [ASTM A529/A529M](#).

##### 2.1.5 Cold-Formed and Hot Formed Hollow Structural Sections

Cold formed: [ASTM A500/A500M](#) or [ASTM B221](#), [ASTM B221M](#). Hot-formed: [ASTM A501/A501M](#).

##### 2.1.6 Structural-Steel Sheet

Hot-rolled, [ASTM A1011/A1011M](#) or cold-rolled, [ASTM A1008/A1008M](#).

##### 2.1.7 Metallic-Coated Steel Sheet

[ASTM A653/A653M](#), [ASTM A606/A606M](#).

##### 2.1.8 Metallic-Coated Steel Sheet Pre-painted with [Coil Stock](#) Coating

Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with [ASTM A755/A755M](#).

- a. Zinc-Coated (Galvanized) Steel Sheet: [ASTM A653/A653M](#), and [ASTM A123/A123M](#).
- b. Aluminum-Zinc Alloy-Coated Steel Sheet: [ASTM A792/A792M](#), and [ASTM A463/A463M](#).

#### 2.1.9 High-Strength Bolts, Nuts, and Washers

[ASTM 325](#), heavy hex steel structural bolts; [ASTM A563](#) heavy hex carbon-steel nuts; and [ASTM F436/F436M](#) hardened carbon-steel washers.

Finish: Plain

Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: [ASTM F1852](#), heavy-hex-head steel structural bolts with spline.

Finish: Plain

#### 2.1.10 Non-High-Strength Bolts, Nuts, and Washers

[ASTM A307](#), [ASTM A563](#), and [ASTM F844](#).

Finish: Plain

#### 2.1.11 Anchor Rods

[ASTM F1554](#)

- a. Configuration: Straight.
- b. Nuts: [ASTM A563](#) heavy hex carbon steel.
- c. Plate Washers: [ASTM A36/A36M](#) carbon steel.
- d. Washers: [ASTM F436/F436M](#) hardened carbon steel.
- e. Finish: Hot-dip zinc coating, [ASTM A153/A153M](#).

#### 2.1.12 Primer

SSPC-Paint 15, Type I, red oxide.

### 2.2 FABRICATION

#### 2.2.1 General

Comply with [MBMA MBSM](#) - "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

### 2.3 STRUCTURAL FRAMING

#### 2.3.1 General

Clean all framing members to remove loose rust and mill scale. Provide 1 shop coat of primer to an average dry film thickness of 1 mil according to [SSPC SP 2](#). Balance of painting and coating procedures must conform to [SSPC Paint 15](#) and [SSPC Painting Manual](#).

Primary Framing

Manufacturer's standard structural primary framing system includes transverse and lean-to frames; rafter, rakes, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing designed to withstand required loads and specified requirements. Provide frames with attachment plates, bearing plates, and splice members. Provide frame span and spacing indicated.

Shop fabricate framing components by welding or by using high-strength bolts to the indicated size and section with base-plates, bearing plates, stiffeners, and other items required. Cut, form, punch, drill, and weld framing for bolted field erection.

- a. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
- b. Frame Configuration: One-directional sloped, hipped roof, or single gable as indicated.
- c. Exterior Column Type: Tapered.
- d. Rafter Type: Tapered.

#### 2.3.2 Secondary Framing

Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet pre-painted with coil coating, unless otherwise indicated.

Shop fabricate framing components by roll-forming or break-forming to the indicated size and section with base-plates, bearing plates, stiffeners, and other plates required for erection. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

- a. Purlins: C or Z-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes; minimum depth as required to comply with system performance requirements.
- b. Girts: C or Z-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange minimum depth as required to comply with system performance requirements.
- c. Eave Struts: Unequal-flange, C-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.
- d. Flange Bracing: Structural-steel angles or cold-formed structural tubing to stiffen primary frame flanges.
- e. Purlin and Girt Clips: Steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
- f. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel

plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

### 2.3.3 Secondary Framing for Rod and Gun Club Building

Manufacturer's standard secondary framing members apply for all except for vertical perimeter wall studs, which are designed by the engineer of record. However, an eave girt shall support the top track of the metal stud wall. This eave girt shall be as specified in 2.3.3 above. No such girt is required at the end walls. The suggested geometry of the girt is shown on the drawings. Also, the horizontal wind load to be used in the design of this eave girt is shown on the drawings.

### 2.3.4 Bracing

Provide adjustable wind bracing as follows:

- a. Rods: **ASTM A36/A36M**; **ASTM A572/A572M**; or **ASTM A529/A529M** threaded a minimum of **12 inches** at each end.
- b. Cable: **ASTM A475**, **0.25 inch** diameter, extra-high-strength grade, zinc-coated, 7-strand steel; with threaded end anchors.
- c. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
- d. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- e. Fixed-Base Columns: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- f. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
- g. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.

## 2.4 PANEL MATERIALS

### 2.4.1 Aluminum Sheet

Roll-form aluminum roof panels to the specified profile, with **.040 inch** thickness and depth. Aluminum sheets must contain a minimum recycled content of 20 percent. Material must be plumb and true, and within the tolerances listed:

- a. Aluminum Sheet conforming to **ASTM B209**, **AA ADM** and **AA ASD1**.
- b. Individual panels to have continuous length to cover the entire length of roof slope with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
- c. Provide panels with thermal expansion and contraction consistent with the type of system specified.

1. Profile and coverage to be a minimum height and width from manufacturer's standard for the indicated roof slope.
2. Profile to be a 3 inch high standing seam, 24 inch coverage, factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.

#### 2.4.2 Steel Sheet

Roll-form steel roof panels to the specified profile, with 26 gauge and depth as indicated. Material must be plumb and true, and within the tolerances listed:

- a. Aluminum-Zinc Alloy-coated Steel Sheet conforming to ASTM A792/A792M and AISI SG03.
- b. Individual panels to have continuous length to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
- c. Provide panels with thermal expansion and contraction consistent with the type of system specified;

profile and coverage to be a minimum height and width from manufacturer's standard for the indicated roof slope. profile to be a 3 inch high standing seam, 24 inch coverage, factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners. Smooth, flat Surface Texture.

#### 2.4.3 Finish

All panels are to receive a factory-applied polyvinylidene fluoride of Kynar 500/Hylar 5000 finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat conforming to the following:

- a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough drying.
- b. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 plus 0.05 mils. This prime coat must be oven cured prior to application of finish coat.
- c. Exterior Finish Coating: Apply the finish coating over the primer by roll coating to dry film thickness of 0.80 plus 5 mils (3.80 plus 0.50 mils for Vinyl Plastisol) for a total dry film thickness of 1.00 plus 0.10 mils (4.00 plus 0.10 mils for Vinyl Plastisol).. This finish coat must be oven-cured.
- d. Interior Finish Coating: Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.30 plus 0.05 mils for a total dry film thickness of 0.50 plus 0.10 mils. The wash-coat must be oven-cured.
- e. Color: The exterior finish chosen from the manufacturer's color charts

and chips.

- f. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

Chalking: ASTM DEFONLINE  
Color Change and Conformity: ASTM D2244  
Weatherometer: ASTM G152, ASTM G153 and ASTM D822  
Humidity: ASTM D2247 and ASTM D714  
Salt Spray: ASTM B117  
Chemical Pollution: ASTM D1308  
Gloss at 60 degrees: ASTM D523  
Pencil Hardness: ASTM D3363  
Reverse Impact: ASTM D2794  
Flexibility: ASTM D522/D522M  
Abrasion: ASTM D968  
Flame Spread: ASTM E84

#### 2.4.4 Repair Of Finish Protection

Repair paint for color finishenameled metal panel must be compatible paint of the same formula and color as the specified finish furnished by the metal panel manufacturer, conforming to ASTM A780/A780M.

### 2.5 FASTENERS

#### 2.5.1 General

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 1 inch with other properties required to fasten miscellaneous metal framing members to substrates in accordance with the metal panel manufacturer's and ASCE 7 requirements.

#### 2.5.2 Exposed Fasteners

Fasteners for metal panels to be corrosion resistant coated steel, aluminum, stainless steel, or nylon capped steel compatible with the sheet panel or flashing and of a type and size recommended by the manufacturer to meet the performance requirements and design loads. Fasteners for accessories to be the manufacturer's standard. Provide an integral metal washer matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick.

#### 2.5.3 Screws

Screws to be corrosion resistant coated steel, aluminum or stainless steel being the type and size recommended by the manufacturer to meet the performance requirements.

#### 2.5.4 Rivets

Rivets to be closed-end type, corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

#### 2.5.5 Attachment Clips

Fabricate clips from steel hot-dipped galvanized in accordance with ASTM A653/A653M or Series 300 stainless steel. Size, shape, thickness and

capacity as required meeting the insulation thickness and design load criteria specified.

## 2.6 ACCESSORIES

### 2.6.1 General

All accessories to be compatible with the metal panels; sheet metal flashing, trim, [metal closure strips](#), caps and similar metal accessories must not be less than the minimum thickness specified for the metal panels. Exposed metal accessories/finishes to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips to be non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match configuration of the panels.

### 2.6.2 2.6.6 Joint Sealants

#### 2.6.2.1 Sealants

Sealants are to be an approved gun type for use in hand or air-pressure caulking guns at temperatures above [40 degrees F](#) (or frost-free application at temperatures above [10 degrees F](#) with minimum solid content of 85 percent of the total volume. Sealant is to dry with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the metal panel manufacturer.

#### 2.6.2.2 Shop-Applied

Sealant for shop-applied caulking must be an approved gun grade, non-sag one component polysulfide or silicone conforming to [ASTM C920](#), Type II, and with a curing time to ensure the sealant's plasticity at the time of field erection.

#### 2.6.2.3 Field-Applied

Sealant for field-applied caulking must be an approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and conforming to [ASTM C920](#), Type II. Color to match panel colors.

#### 2.6.2.4 Tape Sealant

Pressure sensitive, 100 percent solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the metal panel manufacturer.

## 2.7 SHEET METAL FLASHING AND TRIM

### 2.7.1 Fabrication

Shop fabricate sheet metal flashing and trim where practicable to comply with recommendations in [SMACNA 1793](#) that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

## 2.8 FINISHES

### 2.8.1 General

Comply with **NAAMM AMP 500** for recommendations for applying and designating finishes.

### 2.8.2 Appearance of Finished Work

Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Before erection proceeds, examine with the erector present, the concrete foundation dimensions, concrete and/or masonry bearing surfaces, anchor bolt size and placement, survey slab elevation, locations of bearing plates, and other embedments to receive structural framing with the metal building manufacturer's templates and drawings before erecting any steel components for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Examine primary and secondary framing to verify that rafters, purlins, angles, channels, and other structural and metal panel support members and anchorages have been installed within alignment tolerances required by metal building manufacturer, UL, ASTM, **ASCE 7** and as required by the building code for the geographical area where construction will take place.

Examine roughing-in for components and systems penetrating metal roof or wall panels to verify actual locations of penetrations relative to seam locations of metal panels before metal roof or wall panel installation.

Submit to the Contracting Officer a written report, endorsed by Erector, listing conditions detrimental to performance of the Work.

Proceed with erection only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

Provide temporary shoring, guys, braces, and other supports during erection to keep the structural framing secure, plumb, and in alignment against temporary construction loading or loads equal in intensity of the building design loads. Remove temporary support systems when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment and performance.



Miscellaneous Framing: Install sub-purlins, girts, angles, furring, and other miscellaneous support members or anchorage for the metal roof or wall panels, doors, windows, roof curbs, ventilators and louvers according to metal building manufacturer's written instructions.

### 3.3 ERECTION OF STRUCTURAL FRAMING

Erect metal building system according to manufacturer's written erection instructions, approved shop drawings and other erection documents in accordance with [MBMA MBSM](#) - "Metal Building Systems Manual".

Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer and the Contracting Officer.

Set structural framing accurately in locations and to elevations indicated and according to [AISC 325](#) specifications. Maintain structural stability of frame during erection.

Clean and roughen concrete and masonry bearing surfaces prior to setting plates. Clean bottom surface of plates.

Align and adjust structural framing before permanent bolt-up and connections. Perform necessary adjustments and alignment to compensate for changes or discrepancies in elevations.

Maintain erection tolerances of structural framing in accordance with [AISC 360](#).

### 3.4 METAL WALL PANEL INSTALLATION

Provide metal wall panels of full length from sill to eave as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal wall panels and other components of the Work securely in place, in accordance with [MBMA MBSM](#).

Erect wall panel system in accordance with the approved erection drawings, the printed instructions and safety precautions of the metal building manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Do not install bent, chipped, or defective sheets.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated eave, and sill.

Work is to allow for thermal movement of the wall panel, movement of the building structure, and to provide permanent freedom from noise due to wind pressure.

Field cutting metal wall panels by torch is not permitted.

### 3.5 ROOF PANEL INSTALLATION

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place in accordance with [NRCA RoofMan](#) and [MBMA MBSM](#).

Erect roofing system in accordance with the approved erection drawings, the printed instructions and safety precautions of the metal building manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Do not install bent, chipped, or defective sheets.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated rake and eave overhang.

Work must allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.

Field cutting metal roof panels by torch is not permitted.

Roofing sheets must be laid with corrugations in the direction of the roof slope. End laps of exterior roofing must not be less than 8 inches; the side laps of standard exterior corrugated sheets must be not be less than 2-1/2 corrugations.

Do not permit storage, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of roof construction.

### 3.6 METAL PANEL FASTENER INSTALLATION

Anchor metal panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

### 3.7 FLASHING, TRIM AND CLOSURE INSTALLATION

- a. Comply with performance requirements, manufacturer's written installation instructions, and [SMACNA 1793](#). Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- b. Sheet metalwork is to be accomplished to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades is to be performed by sheet metal mechanics.

### 3.8 ACCESSORY INSTALLATION

#### 3.8.1 General

Install accessories with positive anchorage to building and weather-tight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

### 3.8.2 Dissimilar Metals

Where dissimilar metals contact one another or corrosive substrates are present, protect against galvanic action by painting dissimilar metal surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each surface, or by other permanent separation techniques as recommended by the metal building manufacturer.

### 3.8.3 Gutters and Downspouts

Comply with performance requirements, manufacturer's written installation instructions, and install sheet metal roof drainage items to produce complete roof drainage system according to [SMACNA 1793](#) recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

### 3.8.4 Roof and Wall Accessories and Specialties

Install roof and wall accessories and specialties complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports as specified in Division 07 - THERMAL AND MOISTURE PROTECTION, unless otherwise indicated.

## 3.9 CLEAN-UP AND PROTECTION

### 3.9.1 Structural Framing

Clean all exposed structural framing at completion of installation. Remove metal shavings, filings, bolts, and wires from work area. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces to be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

### 3.9.2 Metal Panels

Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from work area. Remove protective coverings/films, grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces to be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

### 3.9.3 Touch-Up Painting

After erection, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted structural framing and accessories. Clean and touch-up paint with manufacturer's touch-up paint.

## 3.10 WASTE MANAGEMENT

Separate waste in accordance with the Waste Management Plan, placing copper materials, ferrous materials, and galvanized sheet metal in designated areas for reuse. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperatures

Collect and place scrap/waste debris in containers. Promptly dispose of scrap/waste debris. Do not allow on-site; transport scrap/waste debris from government property and legally dispose of them.

3.11 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01 45 35 SPECIAL INSPECTIONS..

3.12 WARRANTY

3.12.1 MANUFACTURER'S WARRANTY

Submit all manufacturers' signed warranties to Contracting Officer prior to final commissioning and acceptance.

3.12.2 CONTRACTOR'S WARRANTY for INSTALLATION

Submit contractor's warranty for installation to the Contracting Officer prior to final commissioning and acceptance.

-- End of Section --

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

- AASHTO T 88 (2013) Standard Method of Test for Particle Size Analysis of Soils
- AASHTO T 180 (2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
- AASHTO T 224 (2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

- ASTM C117 (2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
- ASTM C127 (2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
- ASTM C128 (2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
- ASTM C131/C131M (2014) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM C136/C136M (2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D75/D75M (2014) Standard Practice for Sampling Aggregates
- ASTM D1556/D1556M (2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method

ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> ) (2700 kN-m/m <sup>3</sup> )
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2487	(2017) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM E11	(2016) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

## 1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

### 1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

### 1.2.2 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve will be expressed as a percentage of the laboratory maximum dry density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224.

## 1.3 SUBMITTALS

Submittals shall be made to U.S. Army Corps of Engineers. U.S. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation shall be submitted to the U.S. Government for information only. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools; G

SD-06 Test Reports

Initial Tests; G

In-Place Tests; G

1.4 EQUIPMENT, TOOLS, AND MACHINES

All plant, equipment, and tools used in the performance of the work will be subject to approval by the Contracting Officer before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Use equipment capable of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.5 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor. Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00.00 10 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.5.1 Sampling

Take samples for laboratory testing in conformance with ASTM D75/D75M. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

1.5.2.1 Sieve Analysis

Perform sieve analysis in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11. Perform particle-size analysis of the soils in conformance with AASHTO T 88.

1.5.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with ASTM D4318.

1.5.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture content in accordance with paragraph DEGREE OF COMPACTION.

1.5.2.4 Field Density Tests

Measure field density in accordance with ASTM D1556/D1556M, ASTM D2167 or

ASTM D6938. For the method presented in ASTM D1556/D1556M use the base plate as shown in the drawing. For the method presented in ASTM D6938 check the calibration curves and adjust them, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil and ASTM D6938 will be used to determine the moisture content of the soil. Also check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. Make the calibration checks of both the density and moisture gauges using the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

#### 1.5.2.5 Wear Test

Perform wear tests on ABC course material in conformance with ASTM C131/C131M.

#### ~~1.5.2.6 Weight of Slag~~

~~Determine weight per cubic foot of slag in accordance with ASTM C29/C29M on the ABC course material.~~

### 1.6 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

## PART 2 PRODUCTS

### 2.1 AGGREGATES

Provide ABC consisting of clean, sound, durable particles of crushed stone, ~~crushed slag, crushed gravel, crushed recycled asphalt pavement, crushed recycled concrete, or~~ angular sand, ~~or other approved material~~. Provide ABC that is free of lumps of clay, organic matter, and other objectionable materials or coatings. Provide GCA that is free of silt and clay as defined by ASTM D2487, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve is known as coarse aggregate; that portion passing the No. 4 sieve is known as fine aggregate. When the coarse and fine aggregate is supplied from more than one source, provide aggregate from each source that meets the specified requirements.

#### 2.1.1 Coarse Aggregate

Provide coarse aggregates with angular particles of uniform density. Separately stockpile coarse aggregate supplied from more than one source.

- a. Crushed Gravel: Provide crushed gravel that has been manufactured by crushing gravels and that meets all the requirements specified below.
- b. Crushed Stone: Provide crushed stone consisting of freshly mined quarry rock, meeting all the requirements specified below.



- ~~e. Crushed Recycled Concrete: Provide crushed recycled concrete consisting of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. Provide recycled concrete that is free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and that has been crushed and processed to meet the required gradations for coarse aggregate. Reject recycled concrete aggregate exceeding this value. Provide crushed recycled concrete that meets all other applicable requirements specified below. Crushed recycled concrete is not acceptable in ABC supporting airfield pavements or airfield shoulder pavements.~~
- ~~d. Crushed Slag: Provide crushed slag that is an air cooled blast furnace product having an air dry unit weight of not less than 70 pcf as determined by ASTM C29/C29M, and meets all the requirements specified below.~~
- ~~e. Crushed Recycled Asphalt Pavement (RAP): Provide crushed RAP consisting of previously hardened asphalt concrete or other concrete containing bituminous binder material. Provide recycled asphalt that is free of foreign material and that has been crushed and processed to meet the required gradations for coarse aggregate. Crushed RAP will be blended with other materials materials such that the RAP does not exceed 25 percent by weight of the overall blended material. Reject RAP exceeding this value. Provide crushed recycled concrete that meets all other applicable requirements specified below. Crushed RAP is not acceptable in ABC supporting airfield pavements or airfield shoulder pavements.~~

#### 2.1.1.1 Aggregate Base Course

The percentage of loss of ABC coarse aggregate must not exceed 50 percent when tested in accordance with [ASTM C131/C131M](#). Provide aggregate that contains no more than 30 percent flat and elongated particles. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates must contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces determined in accordance with [ASTM D5821](#). When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Manufacture crushed gravel from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

#### 2.1.2 Fine Aggregate

Provide fine aggregates consisting of angular particles of uniform density.

##### 2.1.2.1 Aggregate Base Course

Provide ABC fine aggregate that consists of ~~screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally~~ combined with the coarse aggregate.

#### 2.1.3 Gradation Requirements

Apply the specified gradation requirements to the completed base course. Provide aggregates that are continuously well graded within the limits specified in TABLE 1. Use sieves that conform to [ASTM E11](#).

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	
2 inch	----
1-1/2 inch	100
1 inch	60-100
1/2 inch	30-65
No. 4	20-50
No. 10	15-40
No. 40	5-25
No. 200	0-8

NOTE 1: Particles having diameters less than 0.02 mm must not be in excess of 3 percent by weight of the total sample tested as determined in accordance with [AASHTO T 88](#).

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, test the materials in accordance with [ASTM C127](#) and [ASTM C128](#) to determine their specific gravities. Correct the percentages passing the various sieves as directed by the Contracting Officer if the specific gravities vary by more than 10 percent.

## 2.2 LIQUID LIMIT AND PLASTICITY INDEX

Apply liquid limit and plasticity index requirements to the completed course and to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the [No. 40](#) sieve must be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

## 2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

### 2.3.1 Initial Tests

Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. Complete this testing for each source if materials from more than one source are proposed.

- a. Sieve Analysis including 0.02 mm material.
- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.
- d. Wear.

~~e. Weight per cubic foot of Slag.~~

~~f. Percentage of Recycled Asphalt Pavement.~~

Submit certified copies of test results for approval not less than 30 days before material is required for the work.

### 2.3.2 Approval of Material

Tentative approval of material will be based on initial test results.

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

When the GCA is constructed in more than one layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

### 3.2 OPERATION OF AGGREGATE SOURCES

Condition aggregate sources on private lands in accordance with local laws or authorities.

### 3.3 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Stockpile materials obtained from different sources separately.

### 3.4 PREPARATION OF UNDERLYING COURSE OR SUBGRADE

Clean the underlying course or subgrade of all foreign substances prior to constructing the base course(s). Do not construct base course(s) on underlying course or subgrade that is frozen. Construct the surface of the underlying course or subgrade to meet specified compaction and surface tolerances. Correct ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the specified requirements set forth herein by loosening and removing soft or unsatisfactory material and adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in [ASTM D2487](#), stabilize the surface prior to placement of the base course(s). Stabilize by mixing ABC into the underlying course and compacting by approved methods. Consider the stabilized material as part of the underlying course and meet all requirements of the underlying course. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a satisfactory condition until the base course is placed.

### 3.5 GRADE CONTROL

Provide a finished and completed base course conforming to the lines, grades, and cross sections shown. Place line and grade stakes as necessary for control.

### 3.6 MIXING AND PLACING MATERIALS

Mix the coarse and fine aggregates in a stationary plant. Make adjustments in mixing procedures or in equipment, as directed, to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification. Place the mixed material on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. Place the layers so that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, clean the previously constructed layers of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Make adjustments in placing procedures or equipment as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

### 3.7 LAYER THICKNESS

Compact the completed base course to the thickness indicated. No individual layer may be thicker than 6 inches nor be thinner than 3 inches in compacted thickness. Compact the base course(s) to a total thickness that is within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 1/4 inch of the thickness indicated. Measure the total thickness of the base course at intervals of one measurement for each 500 square yards of base course. Measure total thickness using 3 inch diameter test holes penetrating the base course.

### 3.8 COMPACTION

Compact each layer of the base course, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density. Make such adjustments in compacting or finishing procedures as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Remove any materials found to be unsatisfactory and replace with satisfactory material or rework, as directed, to meet the requirements of this specification.

### 3.9 EDGES OF BASE COURSE

Place the base course(s) so that the completed section will be a minimum of 2 feet wider, on all sides, than the next layer that will be placed above it. Place approved material along the outer edges of the base course in

sufficient quantity to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, simultaneously roll and compact at least a 2 foot width of this shoulder material with the rolling and compacting of each layer of the base course, as directed.

### 3.10 FINISHING

Finish the surface of the top layer of base course after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Do not add thin layers of material to the top layer of base course to meet grade. If the elevation of the top layer of base course is 1/2 inch or more below grade, scarify the top layer to a depth of at least 3 inches and blend new material in and compact to bring to grade. Make adjustments to rolling and finishing procedures as directed by the Contracting Officer to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, scarify the unsatisfactory portion and rework and recompact it or replace as directed.

### 3.11 SMOOTHNESS TEST

Construct the top layer so that the surface shows no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Also take measurements perpendicular to the centerline at 50 foot intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

### 3.12 FIELD QUALITY CONTROL

#### 3.12.1 In-Place Tests

Perform each of the following tests on samples taken from the placed and compacted ABC. Take samples and test at the rates indicated. ~~Perform sampling and testing of recycled concrete aggregate or recycled asphalt pavement at twice the specified frequency until the material uniformity is established.~~

- a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area.
- b. Perform sieve analysis including 0.02 mm size material on every lift of material placed and at a frequency of one sieve analysis for every 500 square yards, or portion thereof, of material placed.
- c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.
- d. Measure the thickness of the base course at intervals providing at least one measurement for each 500 square yards of base course or part thereof. Measure the thickness using test holes, at least 3 inch in diameter through the base course.

### 3.12.2 Approval of Material

Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and fully compacted course(s).

### 3.13 TRAFFIC

For airfield pavements, do not allow traffic on the completed base course. For roadway pavements, completed portions of the base course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Do not allow heavy equipment on the completed base course except when necessary for construction. When it is necessary for heavy equipment to travel on the completed base course, protect the area against marring or damage to the completed work.

### 3.14 MAINTENANCE

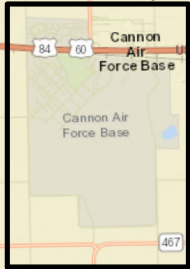
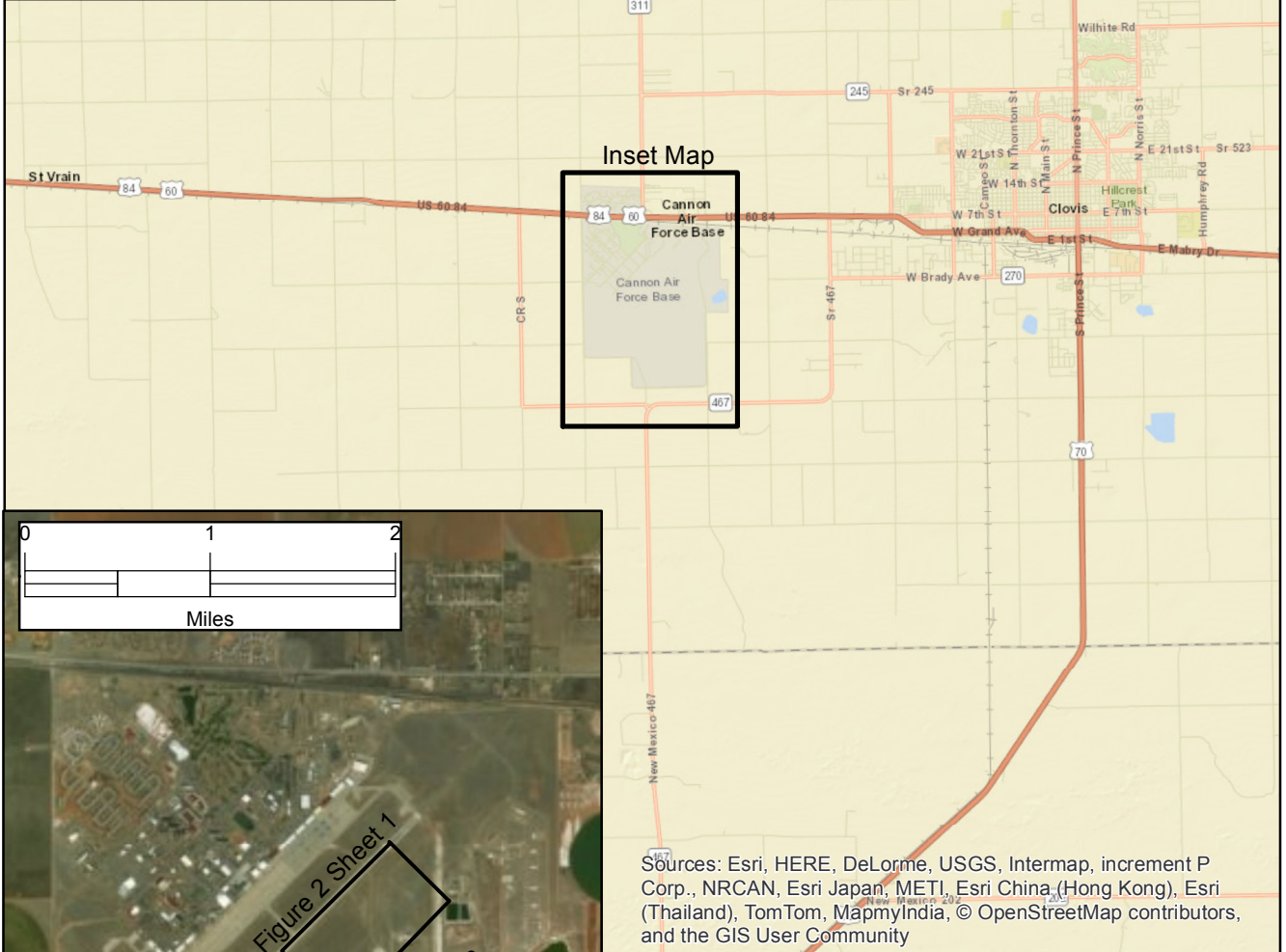
Maintain the base course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any base course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area of base course that is damaged as necessary to comply with this specification.

### 3.15 DISPOSAL OF UNSATISFACTORY MATERIALS

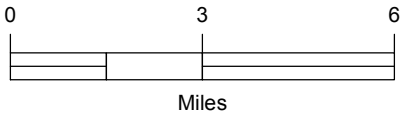
Dispose of any unsuitable materials that have been removed outside the limits of Government-controlled land. No additional payments will be made for materials that have to be replaced.

-- End of Section --

APPENDIX D  
GEOTECHNICAL BORING LOGS



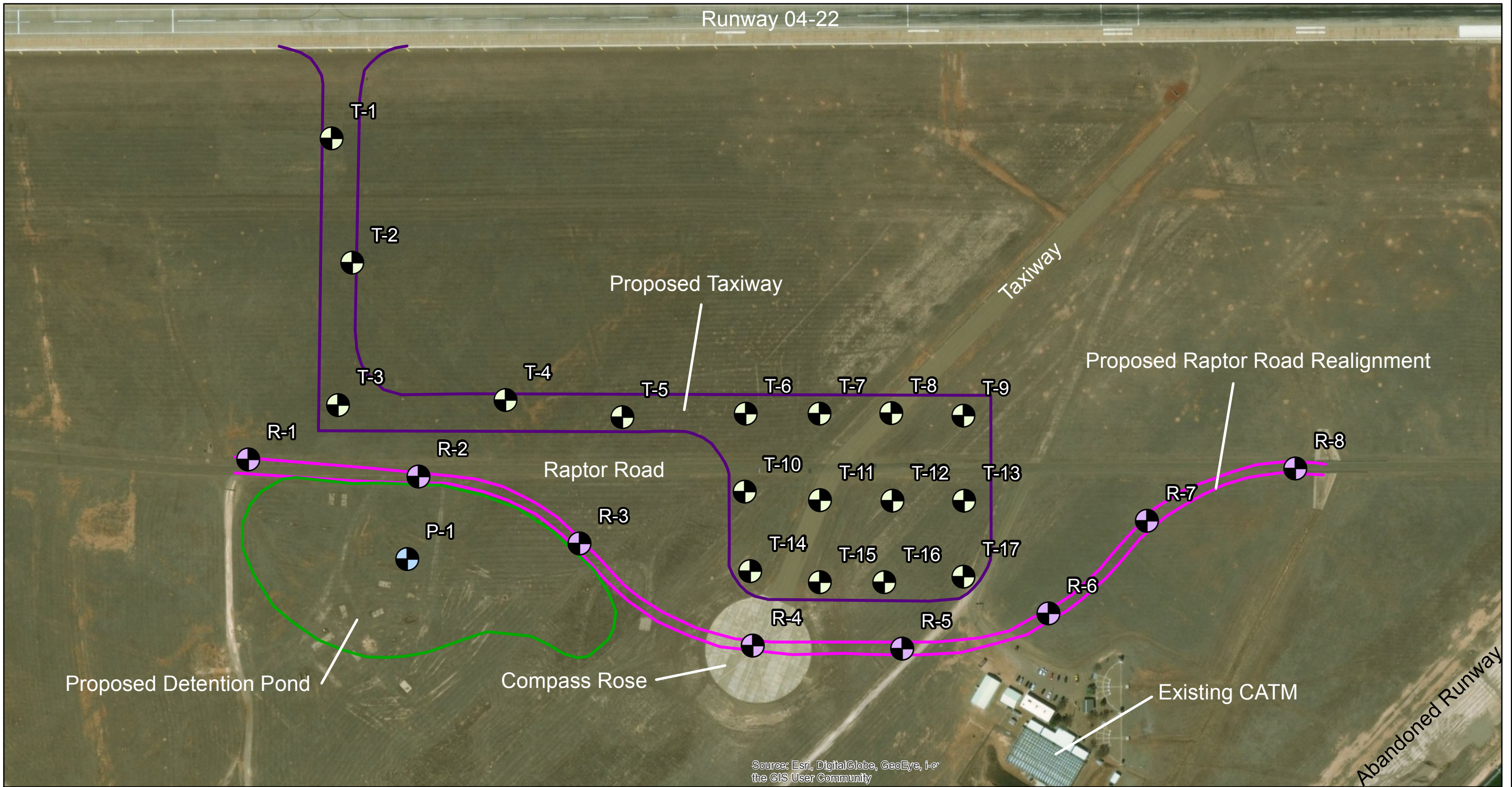
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



FY18 Construct DCP and Relocate CATM Cannon Air Force Base, New Mexico	
<b>VICINITY MAP</b>	
April 2018	23-1-01675-004
<b>SHANNON &amp; WILSON, INC.</b> Geotechnical and Environmental Consultants	
<b>FIG. 1</b>	

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community








Source: Esri, DigitalGlobe, GeoEye, i-c  
the GIS User Community

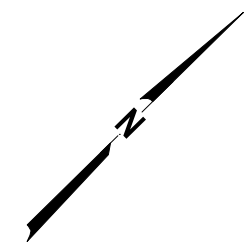
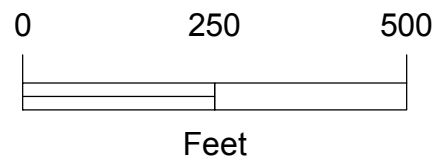
**Legend**

**Boring Designations**

-  T-2 Taxiway and DCP
-  R-4 Realignment of Raptor Road
-  P-1 Profile and Percolation

Note:

Locations of proposed features should be considered approximate.



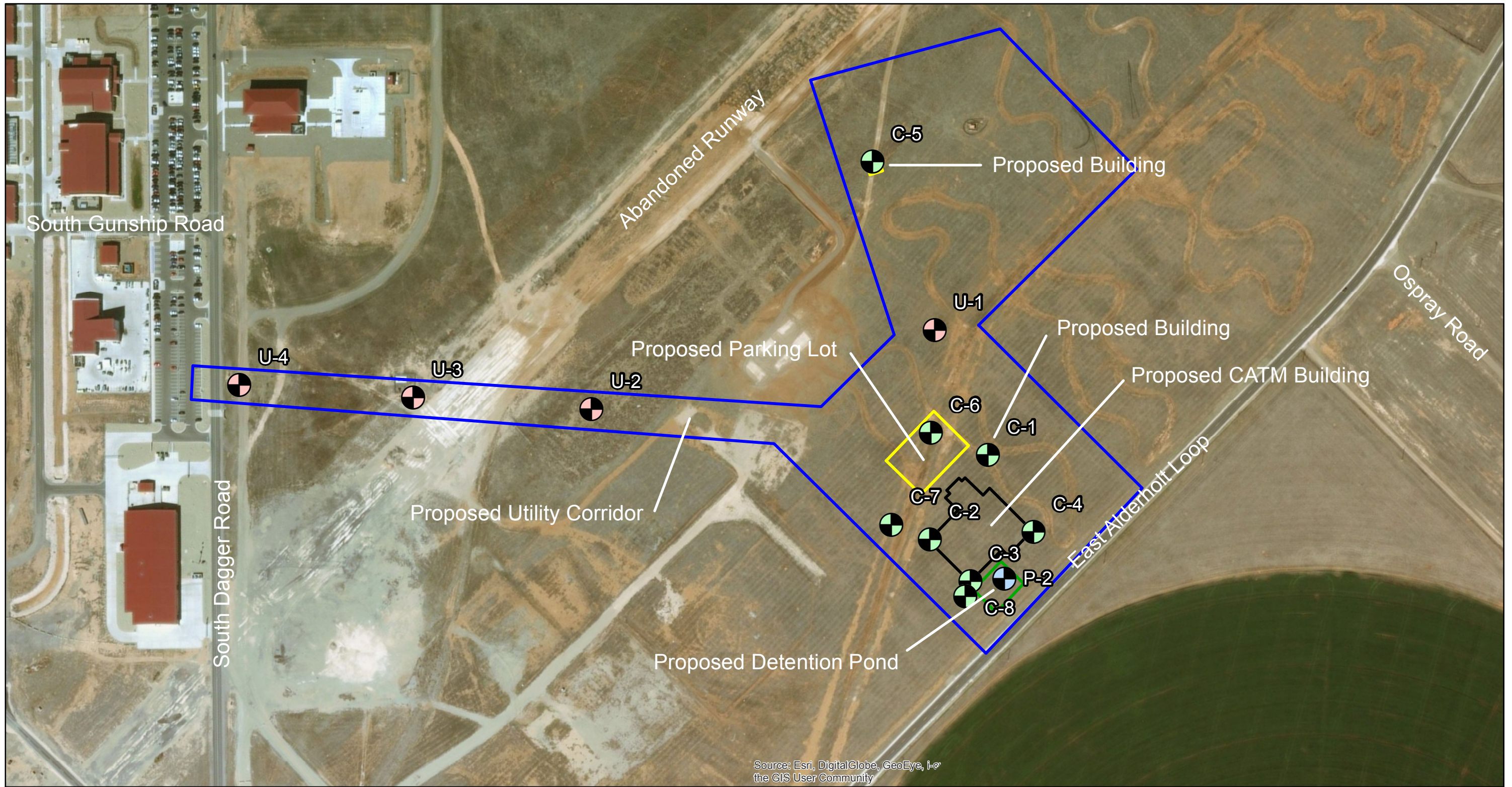
FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**SITE AND EXPLORATION PLAN**

April 2018 23-1-01675-004

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**FIG. 2**  
Sheet 1 of 2



Source: Esri, DigitalGlobe, GeoEye, i-c... the GIS User Community

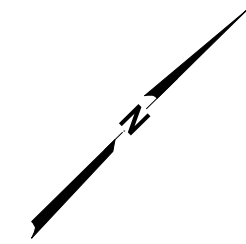
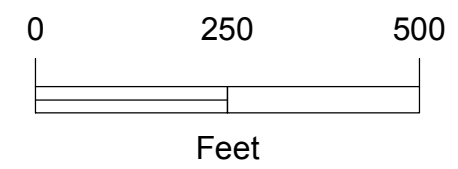
**Legend**

**Boring Designations**

-  P-1 Profile and Percolation
-  U-2 Utility Lines
-  C-5 CATM Structure

**Note:**

Locations of proposed features should be considered approximate.



FY18 Construct DCP and Relocate CATM Cannon Air Force Base, New Mexico

**SITE AND EXPLORATION PLAN**

April 2018 23-1-01675-004

**SHANNON & WILSON, INC.**  
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**FIG. 2**  
Sheet 2 of 2

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

**S&W INORGANIC SOIL CONSTITUENT DEFINITIONS**

CONSTITUENT <sup>2</sup>	FINE-GRAINED SOILS (50% or more fines) <sup>1</sup>	COARSE-GRAINED SOILS (less than 50% fines) <sup>1</sup>
<b>Major</b>	<b>Silt, Lean Clay, Elastic Silt, or Fat Clay<sup>3</sup></b>	<b>Sand or Gravel<sup>4</sup></b>
<b>Modifying (Secondary)</b> Precedes major constituent	30% or more coarse-grained: <b>Sandy or Gravelly<sup>4</sup></b>	More than 12% fine-grained: <b>Silty or Clayey<sup>3</sup></b>
<b>Minor</b> Follows major constituent	15% to 30% coarse-grained: <b>with Sand or with Gravel<sup>4</sup></b> 30% or more total coarse-grained and lesser coarse-grained constituent is 15% or more: <b>with Sand or with Gravel<sup>5</sup></b>	5% to 12% fine-grained: <b>with Silt or with Clay<sup>3</sup></b> 15% or more of a second coarse-grained constituent: <b>with Sand or with Gravel<sup>5</sup></b>

<sup>1</sup>All percentages are by weight of total specimen passing a 3-inch sieve.  
<sup>2</sup>The order of terms is: *Modifying Major with Minor*.  
<sup>3</sup>Determined based on behavior.  
<sup>4</sup>Determined based on which constituent comprises a larger percentage.  
<sup>5</sup>Whichever is the lesser constituent.

**MOISTURE CONTENT TERMS**

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

**STANDARD PENETRATION TEST (SPT) SPECIFICATIONS**

<b>Hammer:</b>	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm
	NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
<b>Sampler:</b>	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
<b>N-Value:</b>	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.
	NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

**PARTICLE SIZE DEFINITIONS**

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND Fine Medium Coarse	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.) #40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.) #10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL Fine Coarse	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.) 3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

**RELATIVE DENSITY / CONSISTENCY**

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

**WELL AND BACKFILL SYMBOLS**

	Bentonite		Surface Cement Seal
	Cement Grout		Asphalt or Cap
	Bentonite Grout		Slough
	Bentonite Chips		Inclinometer or Non-perforated Casing
	Silica Sand		Vibrating Wire Piezometer
	Perforated or Screened Casing		

**PERCENTAGES TERMS<sup>1,2</sup>**

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

<sup>1</sup>Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

<sup>2</sup>Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**SOIL DESCRIPTION AND LOG KEY**

April 2018

23-1-01675-004

**SHANNON & WILSON, INC.**  
Geotechnical and Environmental Consultants

**FIG. A-1**  
Sheet 1 of 3

**UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)**  
**(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)**

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL	TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Gravel (less than 5% fines)	GW	Well-Graded Gravel; Well-Graded Gravel with Sand
			GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel (more than 12% fines)	GM	Silty Gravel; Silty Gravel with Sand
			GC	Clayey Gravel; Clayey Gravel with Sand
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Sand (less than 5% fines)	SW	Well-Graded Sand; Well-Graded Sand with Gravel
			SP	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand (more than 12% fines)	SM	Silty Sand; Silty Sand with Gravel
			SC	Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS (50% or more passes the No. 200 sieve)	Silt and Clays (liquid limit less than 50)	Inorganic	ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silt and Clays (liquid limit 50 or more)	Inorganic	MH	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor	PT	Peat or other highly organic soils (see ASTM D4427)	

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

- Dual symbols (symbols separated by a hyphen, i.e., SP-SM, Sand with Silt) are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).
- Borderline symbols (symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand) indicate that the soil properties are close to the defining boundary between two groups.

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**SOIL DESCRIPTION  
AND LOG KEY**

April 2018

23-1-01675-004

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**FIG. A-1**  
Sheet 2 of 3

### GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

### CEMENTATION TERMS<sup>1</sup>

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

### PLASTICITY<sup>2</sup>

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASTICITY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20
High	It takes considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20

### ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

### PARTICLE ANGULARITY AND SHAPE TERMS<sup>1</sup>

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

### ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q <sub>u</sub>	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

### STRUCTURE TERMS<sup>1</sup>

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

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## SOIL DESCRIPTION AND LOG KEY

April 2018

23-1-01675-004

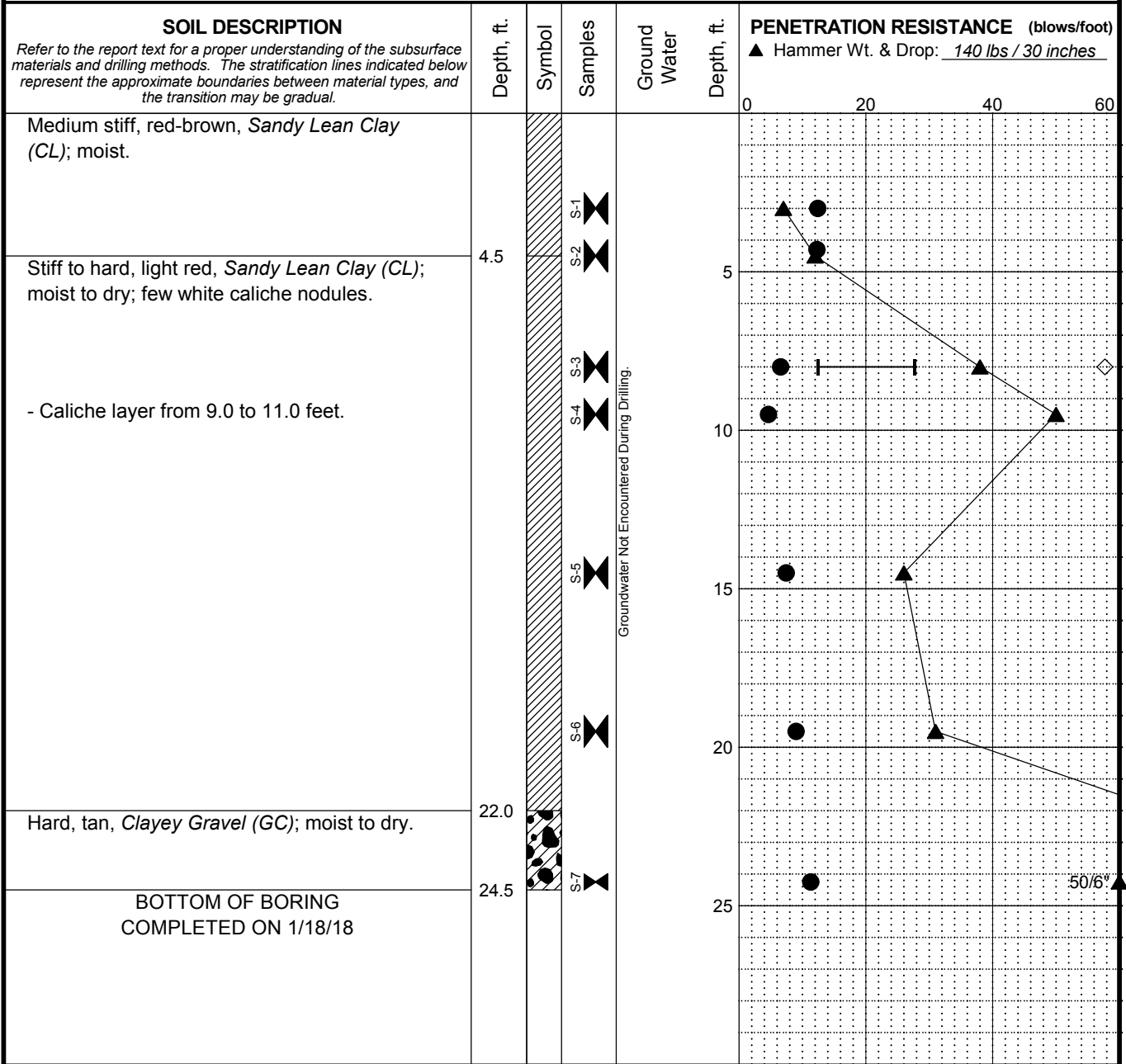
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**FIG. A-1**  
Sheet 3 of 3

<sup>1</sup>Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

<sup>2</sup>Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Total Depth: <u>24.5 ft.</u>	Northing: <u>1,231,929 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4273.8 ft.</u>	Easting: <u>852,254 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

\* Sample Not Recovered

✂ Modified California Sampler

◇ % Fines (<0.075mm)

● % Water Content

— Plastic Limit —●— Liquid Limit

○ Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING C-01**

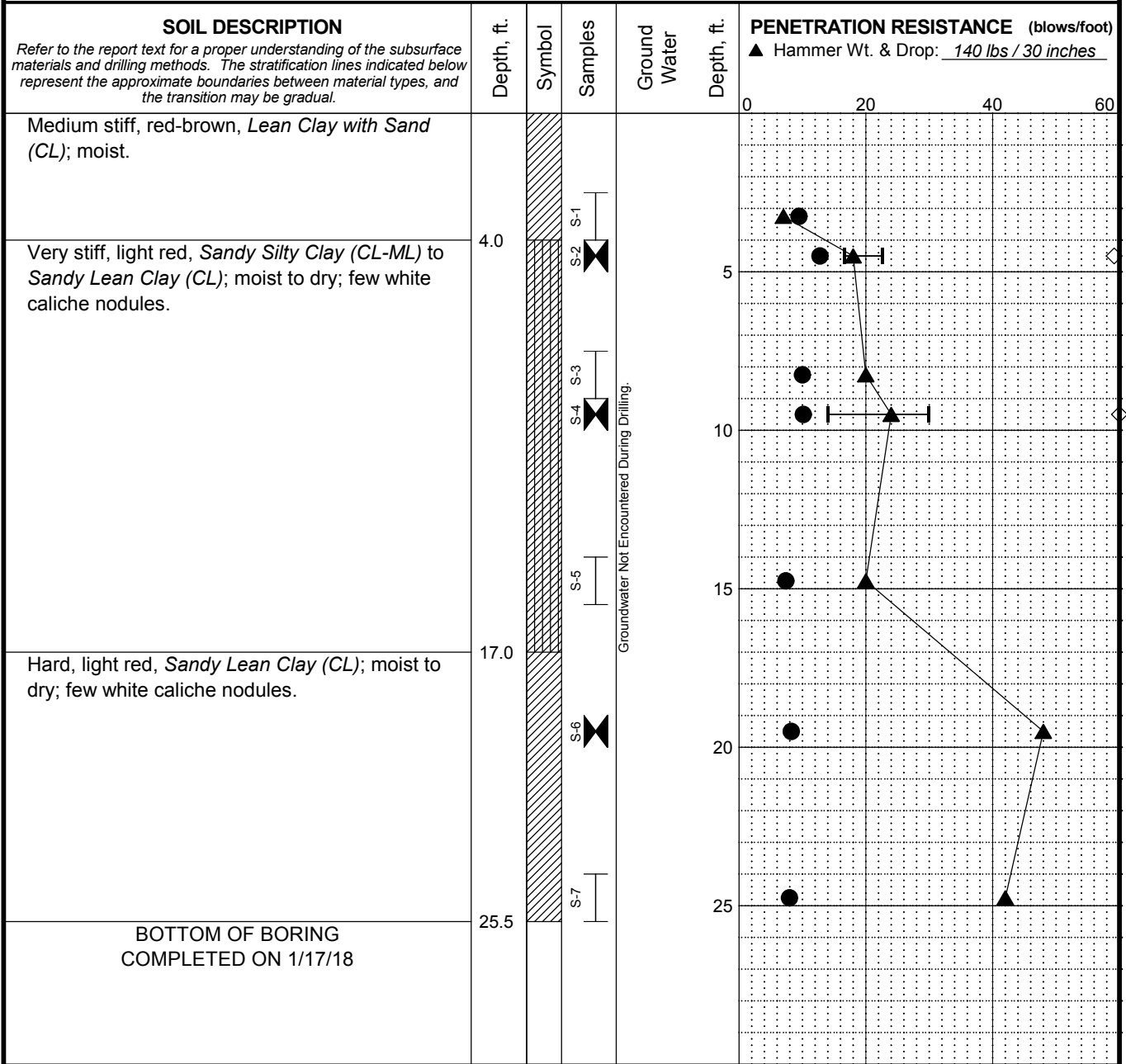
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**FIG. A-2**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>25.5 ft.</u>	Northing: <u>1,231,665 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4273.6 ft.</u>	Easting: <u>852,303 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- ⊥ Standard Penetration Test
- ⊕ Modified California Sampler

- ◇ % Fines (<0.075mm)
- % Water Content
- Plastic Limit —●— Liquid Limit
- Natural Water Content

**NOTES**

- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
- The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
- The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING C-02**

April 2018

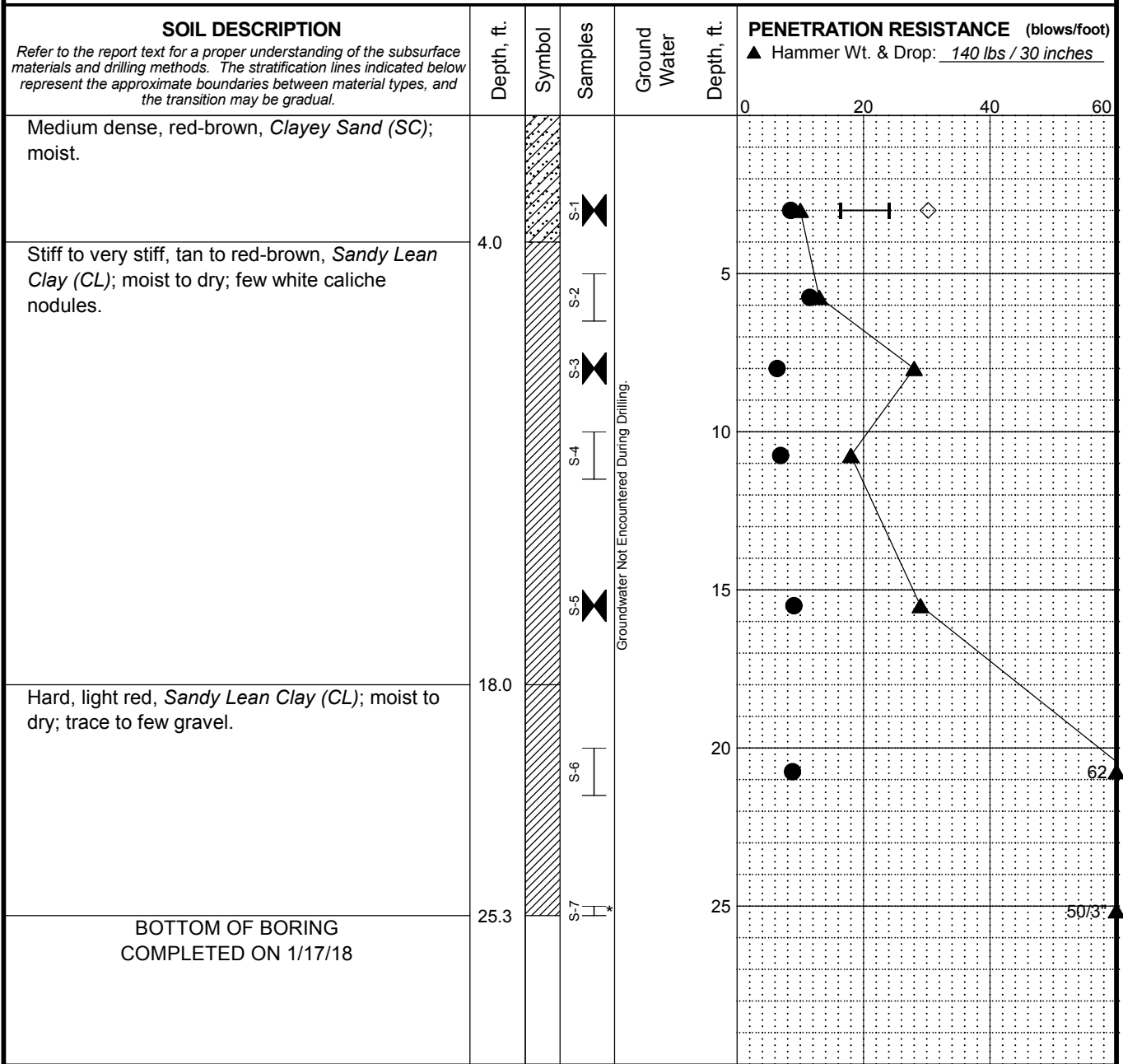
23-1-01675-004

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**FIG. A-3**

MASTER LOG E. POKKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 25.3 ft. Northing: 1,231,665 ft. Drilling Method: Hollow-Stem Auger Hole Diam.: 7 in.  
 Top Elevation: 4273.7 ft. Easting: 852,454 ft. Drilling Company: Vine Laboratories Rod Type: AWJ  
 Vert. Datum: \_\_\_\_\_ Station: \_\_\_\_\_ Drill Rig Equipment: CME-55 Truck Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_ Offset: - Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ☒ Modified California Sampler
- ⊥ Standard Penetration Test

- ◇ % Fines (<0.075mm)
- % Water Content
- Plastic Limit —●— Liquid Limit
- Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING C-03**

April 2018

23-1-01675-004

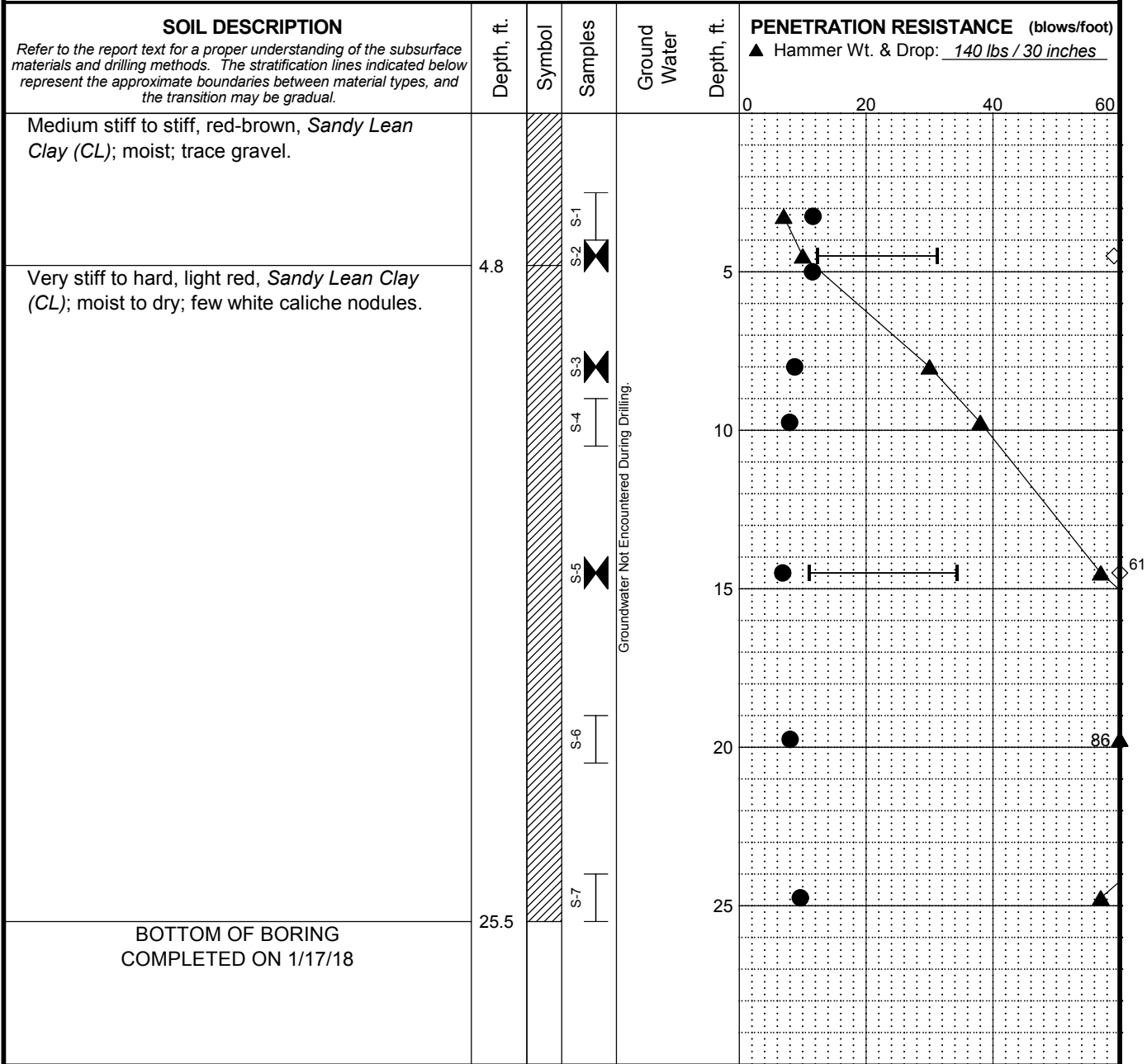
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**FIG. A-4**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18



Total Depth: <u>25.5 ft.</u>	Northing: <u>1,231,871 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4273.5 ft.</u>	Easting: <u>852,477 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- [I] Standard Penetration Test
- [X] Modified California Sampler

- ◇ % Fines (<0.075mm)
- % Water Content
- Plastic Limit [—●—] Liquid Limit
- Natural Water Content

- NOTES**
- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  - The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  - The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  - Groundwater level, if indicated above, is for the date specified and may vary.
  - USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING C-04**

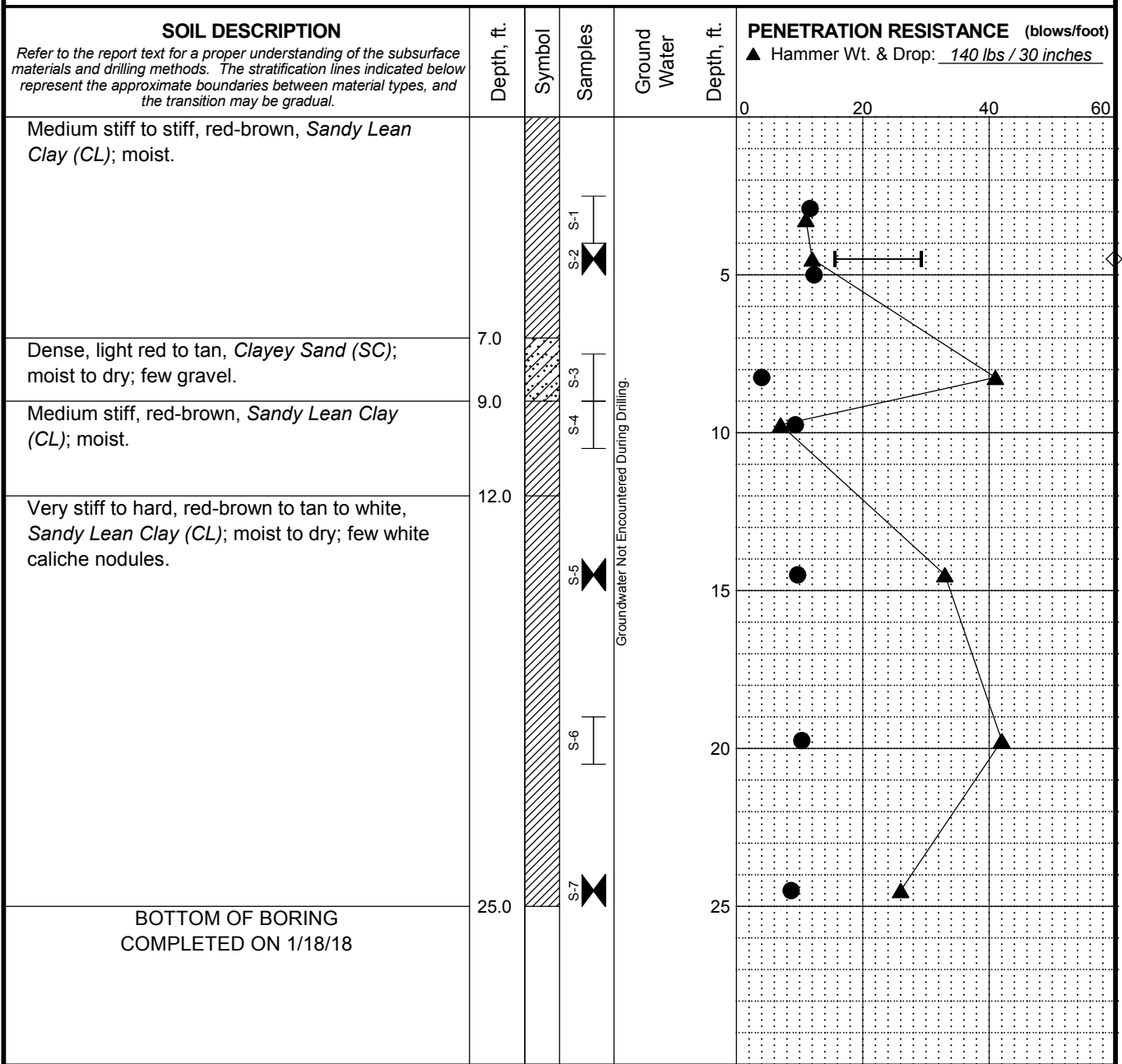
April 2018 23-1-01675-004

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**FIG. A-5**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 25 ft.    Northing: 1,232,236 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 4 in.  
 Top Elevation: 4272.8 ft.    Easting: 851,496 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- | Standard Penetration Test
- ⊠ Modified California Sampler

- ◇ % Fines (<0.075mm)
- % Water Content
- Plastic Limit
- Liquid Limit
- Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING C-05**

April 2018

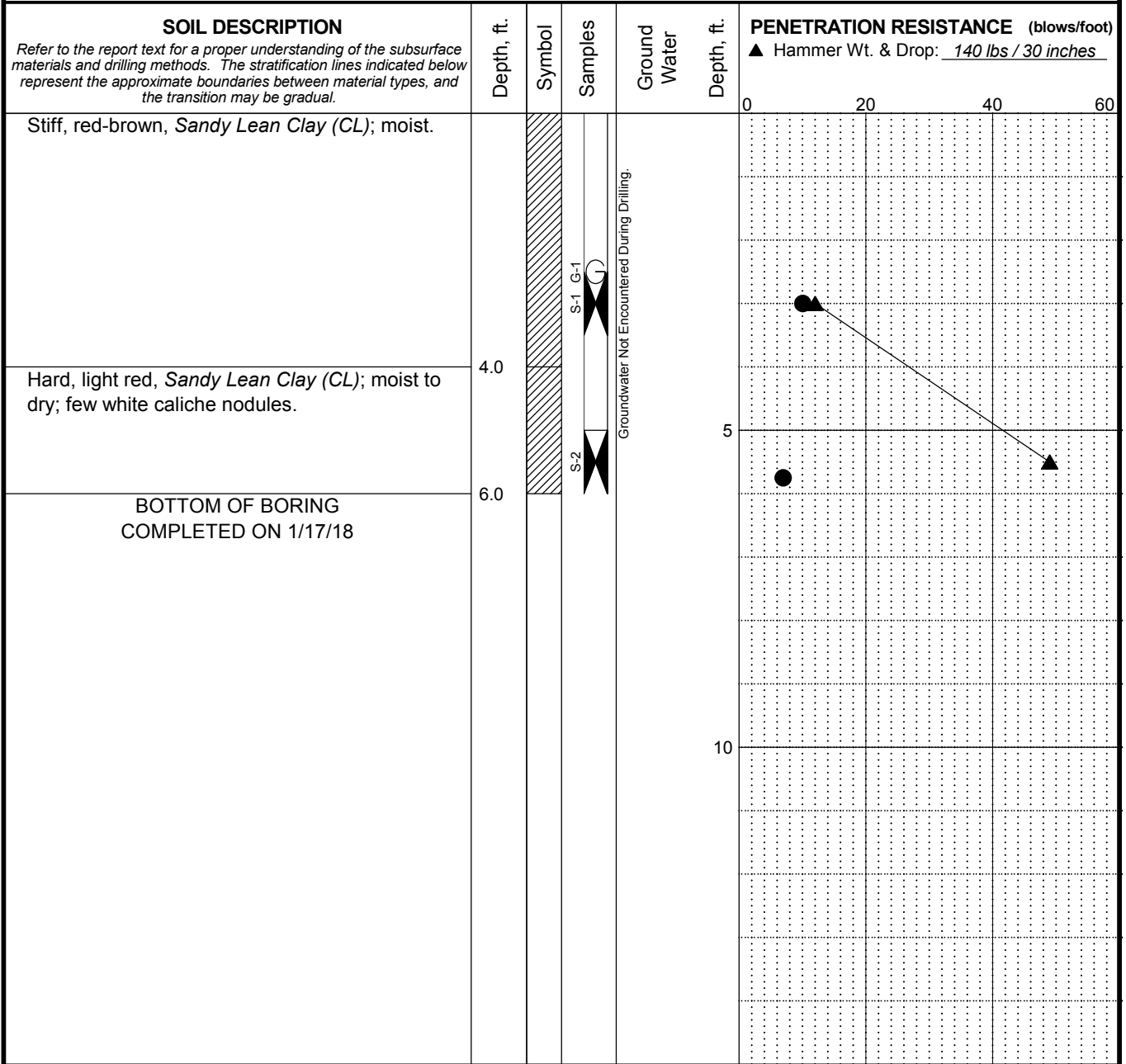
23-1-01675-004

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**FIG. A-6**

MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>6 ft.</u>	Northing: <u>1,231,862 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>6 in.</u>
Top Elevation: <u>4273.6 ft.</u>	Easting: <u>852,102 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- ☐ Grab Sample
- ⊠ Modified California Sampler

● % Water Content

**NOTES**

- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
- The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
- The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING C-06**

April 2018

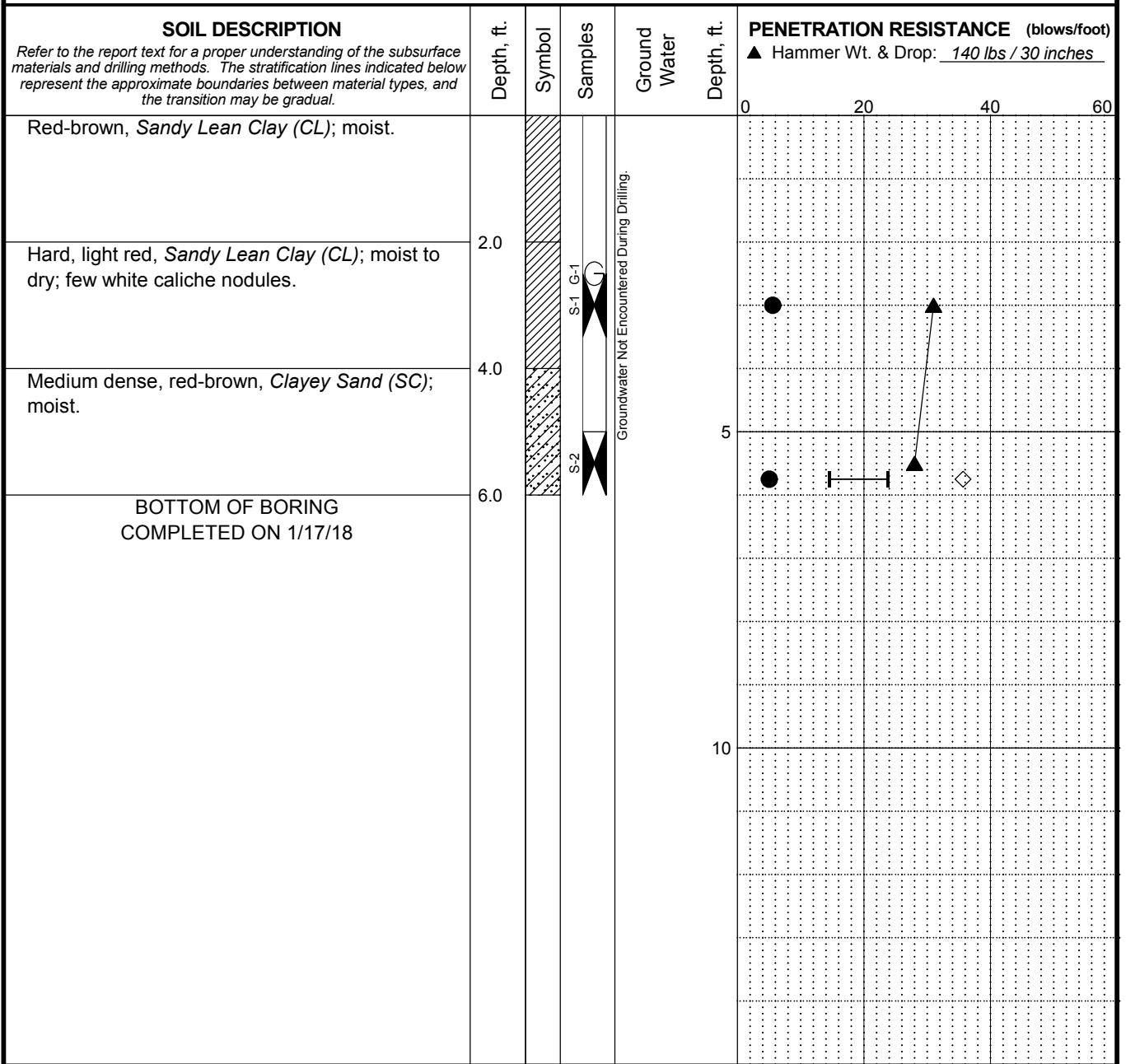
23-1-01675-004

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**FIG. A-7**

MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 6 ft.    Northing: 1,231,627 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 6 in.  
 Top Elevation: 4272.2 ft.    Easting: 852,201 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- [G] Grab Sample
- [MCS] Modified California Sampler

- ◇ % Fines (<0.075mm)
- % Water Content
- Liquid Limit
- Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
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**LOG OF BORING C-07**

April 2018

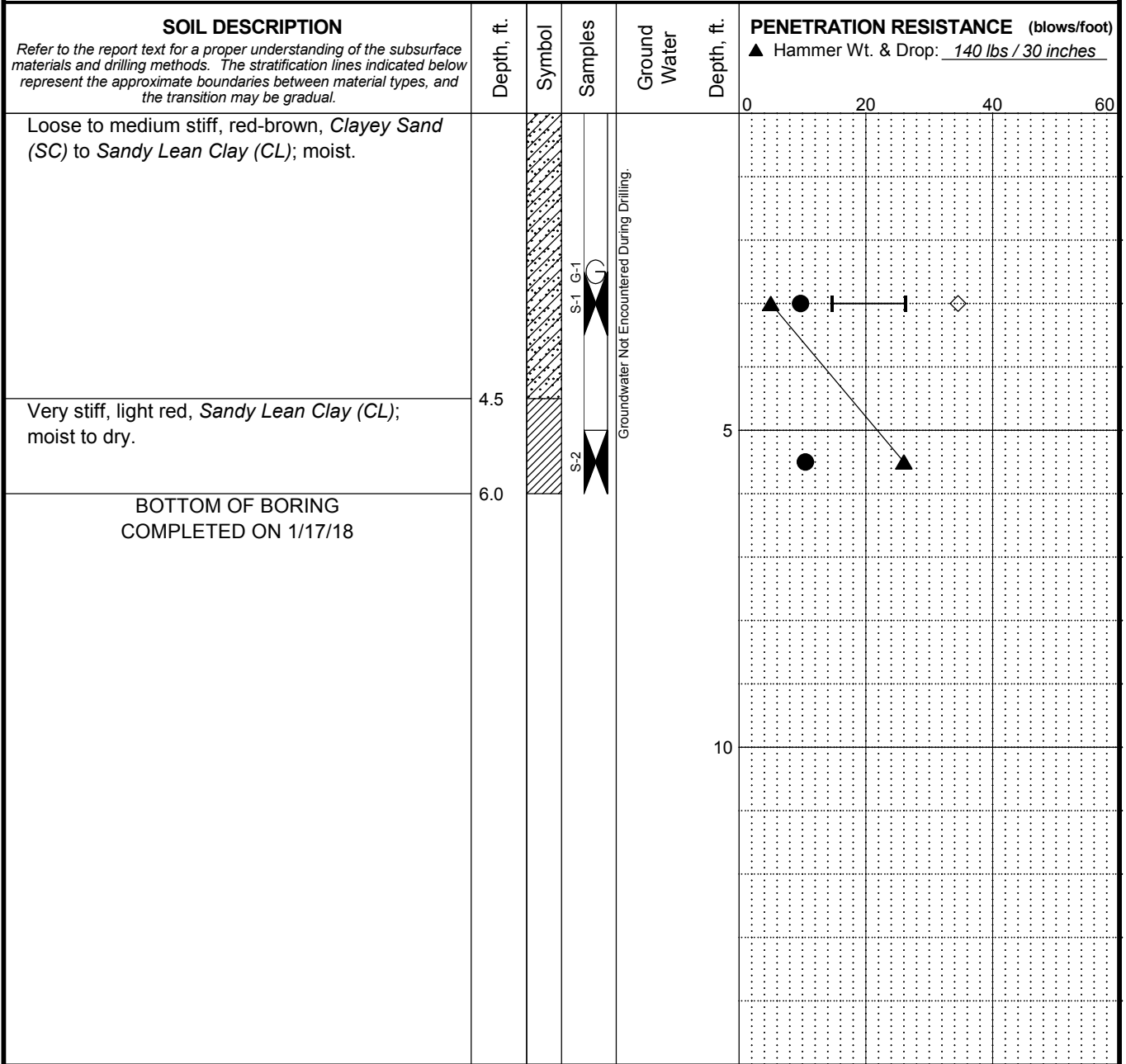
23-1-01675-004

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**FIG. A-8**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>6 ft.</u>	Northing: <u>1,231,627 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>6 in.</u>
Top Elevation: <u>4273.7 ft.</u>	Easting: <u>852,472 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

\* Sample Not Recovered  
 Grab Sample  
 Modified California Sampler

◇ % Fines (<0.075mm)  
● % Water Content  
Plastic Limit —●— Liquid Limit  
Natural Water Content

- NOTES**
1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  4. Groundwater level, if indicated above, is for the date specified and may vary.
  5. USCS designation is based on visual-manual classification and selected lab testing.

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Cannon Air Force Base, New Mexico

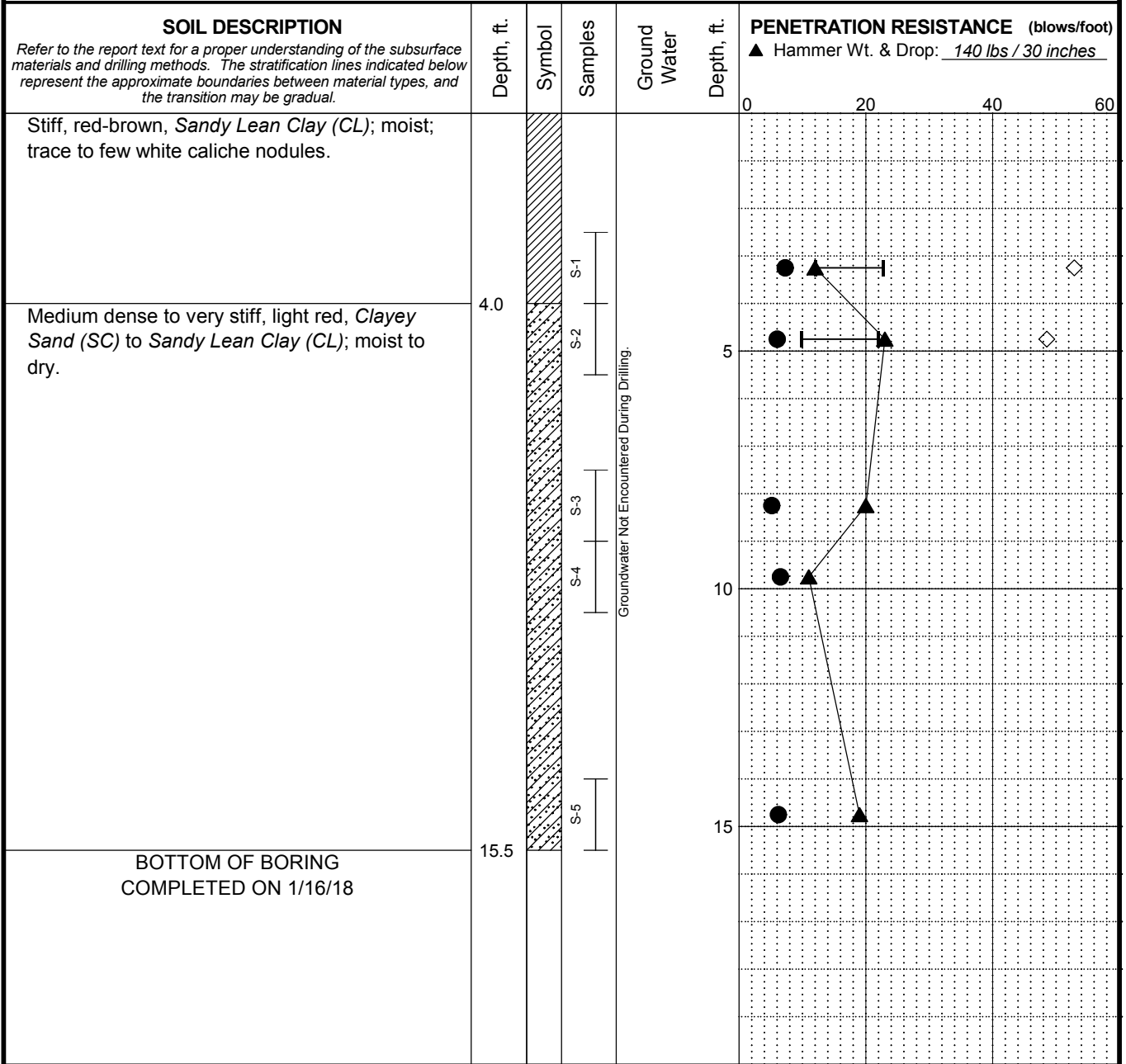
**LOG OF BORING C-08**

April 2018 23-1-01675-004

**SHANNON & WILSON, INC.**  
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MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 15.5 ft.    Northing: 1,233,553 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 4 in.  
 Top Elevation: 4278.3 ft.    Easting: 848,933 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**  
 \* Sample Not Recovered  
 I Standard Penetration Test

◇ % Fines (<0.075mm)  
 ● % Water Content  
 Plastic Limit —●— Liquid Limit  
 Natural Water Content

- NOTES**
1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  4. Groundwater level, if indicated above, is for the date specified and may vary.
  5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
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Cannon Air Force Base, New Mexico

**LOG OF BORING P-01**

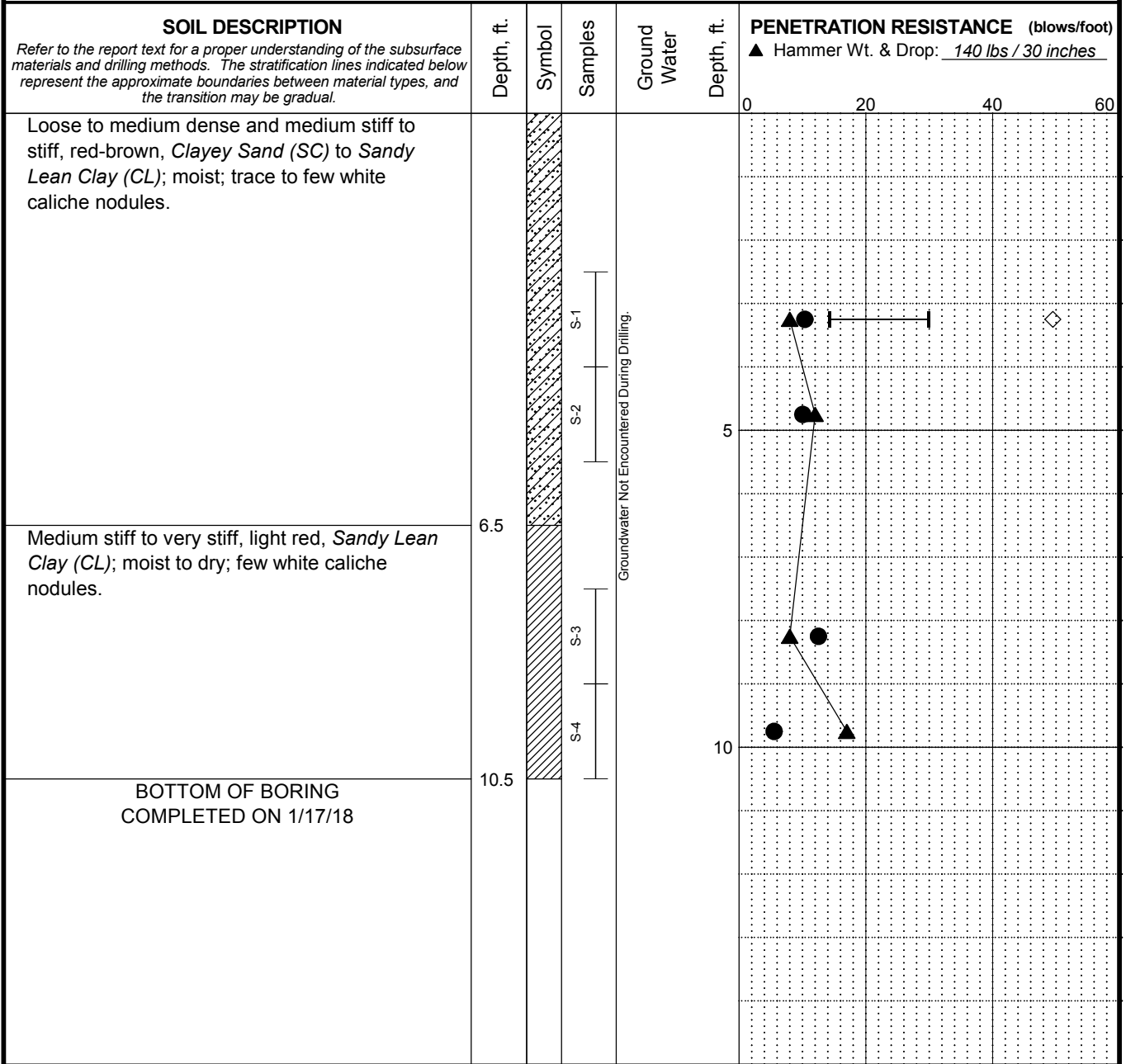
April 2018                      23-1-01675-004

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**FIG. A-10**

MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 10.5 ft.    Northing: 1,231,715 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 4 in.  
 Top Elevation: 4273.6 ft.    Easting: 852,516 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**  
 \* Sample Not Recovered  
 I Standard Penetration Test

◇ % Fines (<0.075mm)  
 ● % Water Content  
 Plastic Limit —●— Liquid Limit  
 Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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Cannon Air Force Base, New Mexico

**LOG OF BORING P-02**

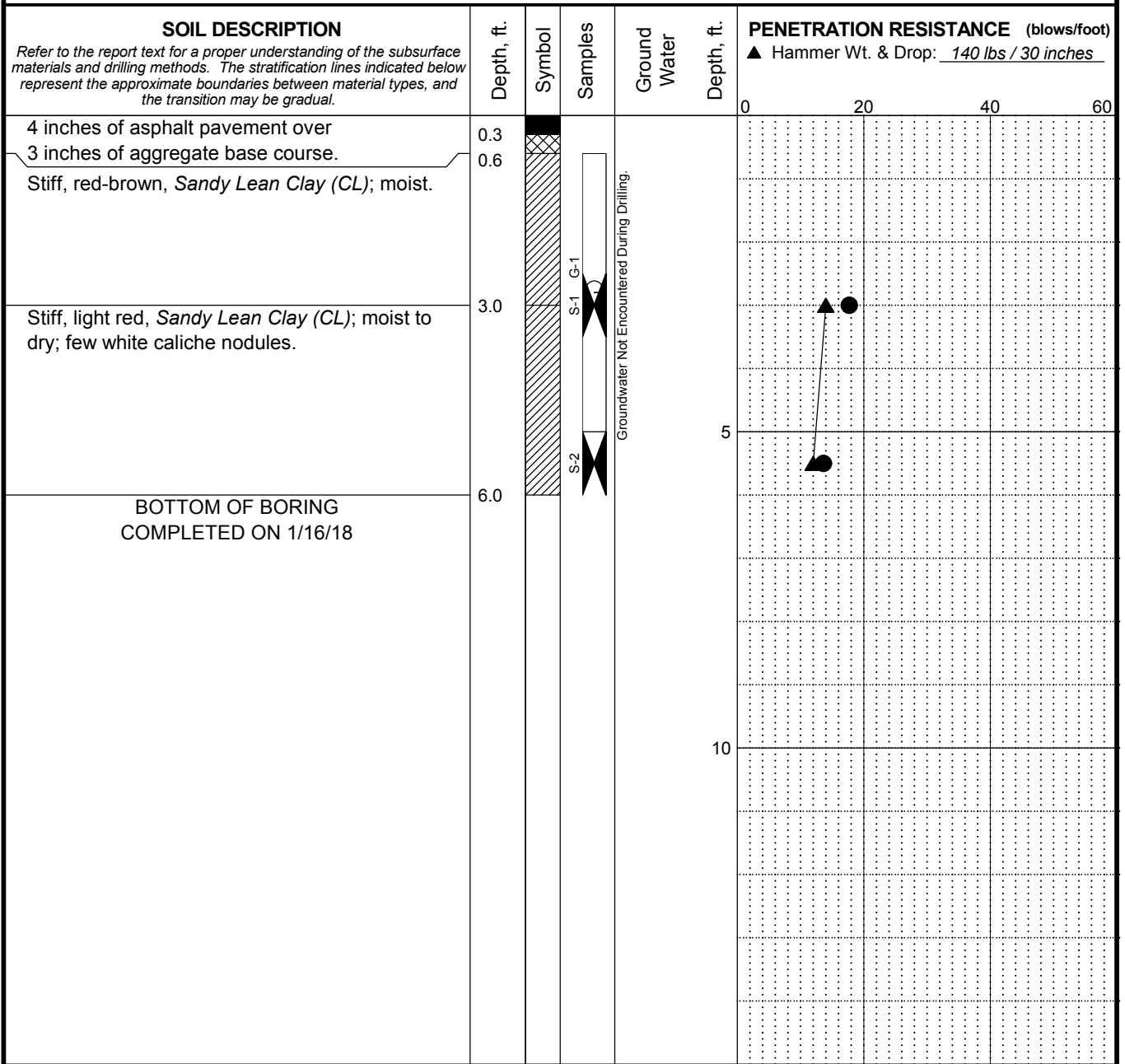
April 2018                      23-1-01675-004

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**FIG. A-11**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 6 ft.      Northing: 1,233,435 ft.      Drilling Method: Solid-Stem Auger      Hole Diam.: 6 in.  
 Top Elevation: 4280.3 ft.      Easting: 848,454 ft.      Drilling Company: Vine Laboratories      Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_      Station: \_\_\_\_\_      Drill Rig Equipment: CME-55 Truck      Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_      Offset: -      Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- [G] Grab Sample
- [MCS] Modified California Sampler

● % Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING R-01**

April 2018

23-1-01675-004

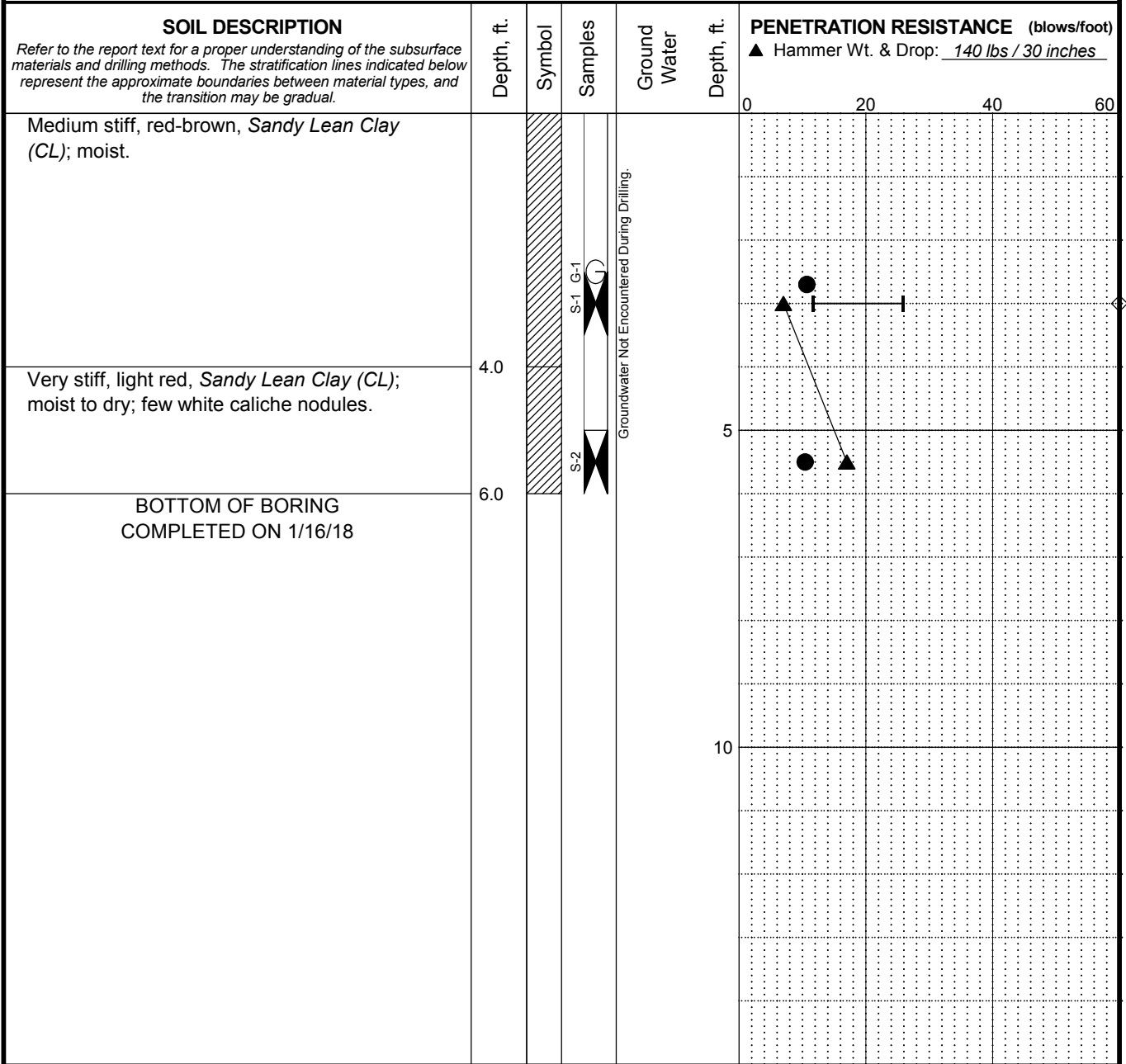
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**FIG. A-12**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18



Total Depth: 6 ft. Northing: 1,233,726 ft. Drilling Method: Solid-Stem Auger Hole Diam.: 6 in.  
 Top Elevation: 4280.1 ft. Easting: 848,797 ft. Drilling Company: Vine Laboratories Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_ Station: \_\_\_\_\_ Drill Rig Equipment: CME-55 Truck Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_ Offset: - Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ☐ Grab Sample
- ⊠ Modified California Sampler
- ◇ % Fines (<0.075mm)
- % Water Content
- Liquid Limit
- Natural Water Content

- NOTES**
1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  4. Groundwater level, if indicated above, is for the date specified and may vary.
  5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
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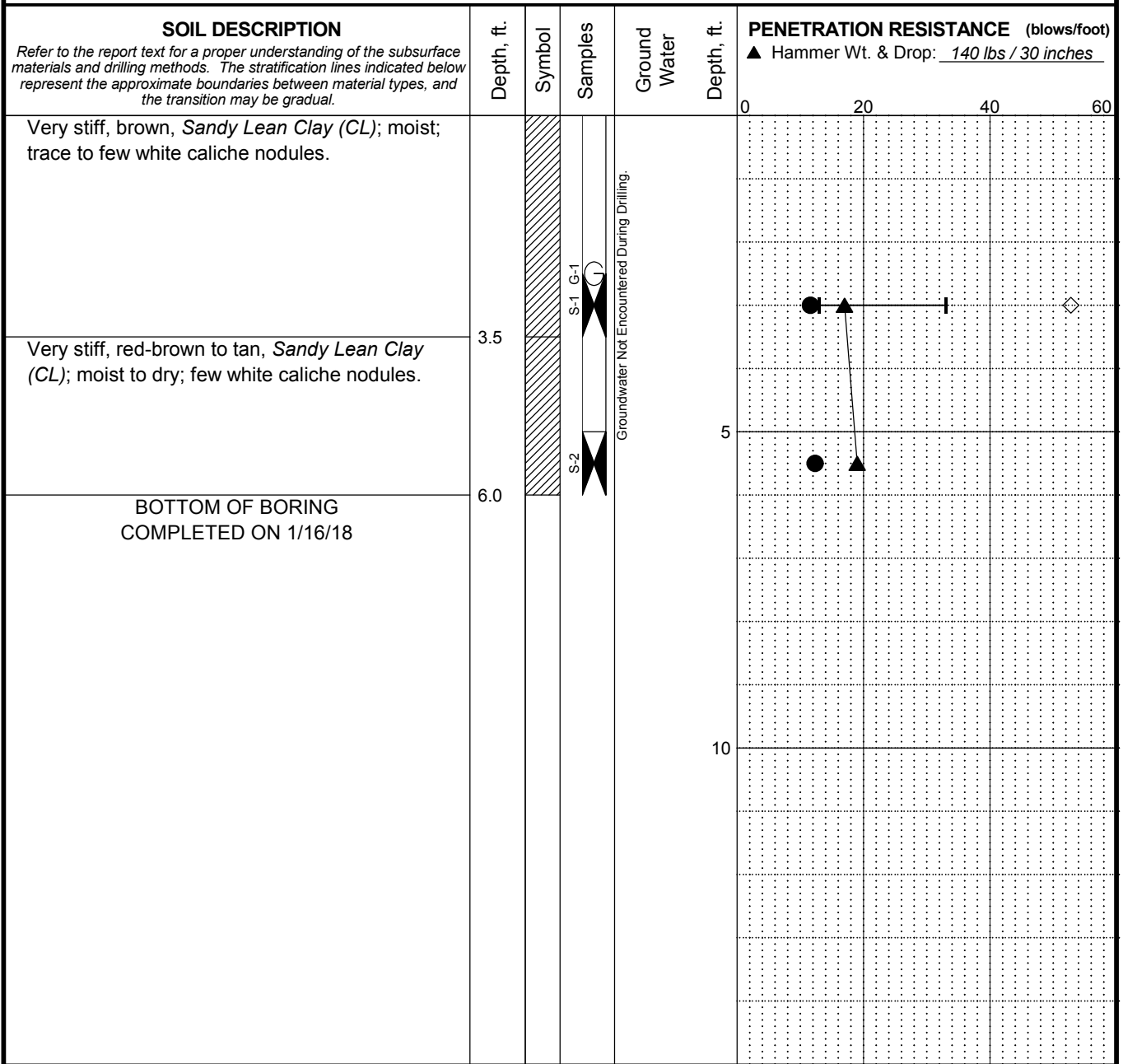
**LOG OF BORING R-02**

April 2018 23-1-01675-004

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MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 6 ft.    Northing: 1,233,904 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 6 in.  
 Top Elevation: 4280.5 ft.    Easting: 849,218 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- [G] Grab Sample
- [MCS] Modified California Sampler

◇ % Fines (<0.075mm)  
 ● % Water Content  
 Plastic Limit —●— Liquid Limit  
 Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING R-03**


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**FIG. A-14**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 0.8 ft. Northing: 1,234,044 ft. Drilling Method: Solid-Stem Auger Hole Diam.: 4 in.  
 Top Elevation: 4283.7 ft. Easting: 849,726 ft. Drilling Company: Vine Laboratories Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_ Station: \_\_\_\_\_ Drill Rig Equipment: CME-55 Truck Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_ Offset: - Other Comments: \_\_\_\_\_

<b>SOIL DESCRIPTION</b> <i>Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.</i>	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.
10 inches of concrete over brown, <i>Sandy Lean Clay (CL)</i> ; moist. Fill	0.8			Groundwater Not Encountered During Drilling	0 20 40 60
					5 10

**LEGEND**

\* Sample Not Recovered

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING R-04**

April 2018

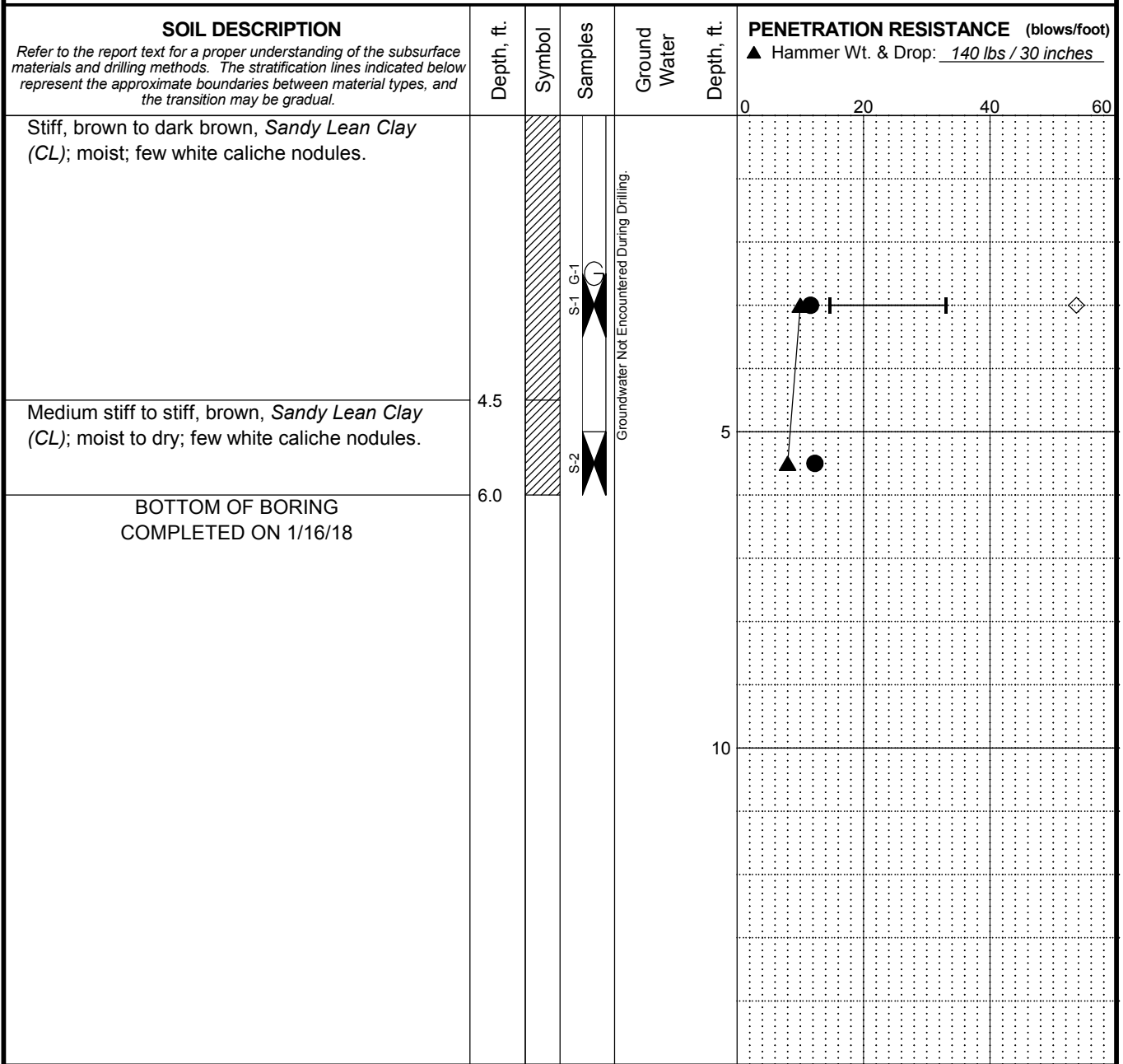
23-1-01675-004

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**FIG. A-15**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 6 ft. Northing: 1,234,319 ft. Drilling Method: Solid-Stem Auger Hole Diam.: 6 in.  
 Top Elevation: 4280.8 ft. Easting: 850,004 ft. Drilling Company: Vine Laboratories Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_ Station: \_\_\_\_\_ Drill Rig Equipment: CME-55 Truck Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_ Offset: - Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ☐ Grab Sample
- ⊠ Modified California Sampler

- ◇ % Fines (<0.075mm)
- % Water Content
- Liquid Limit
- Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING R-05**

April 2018

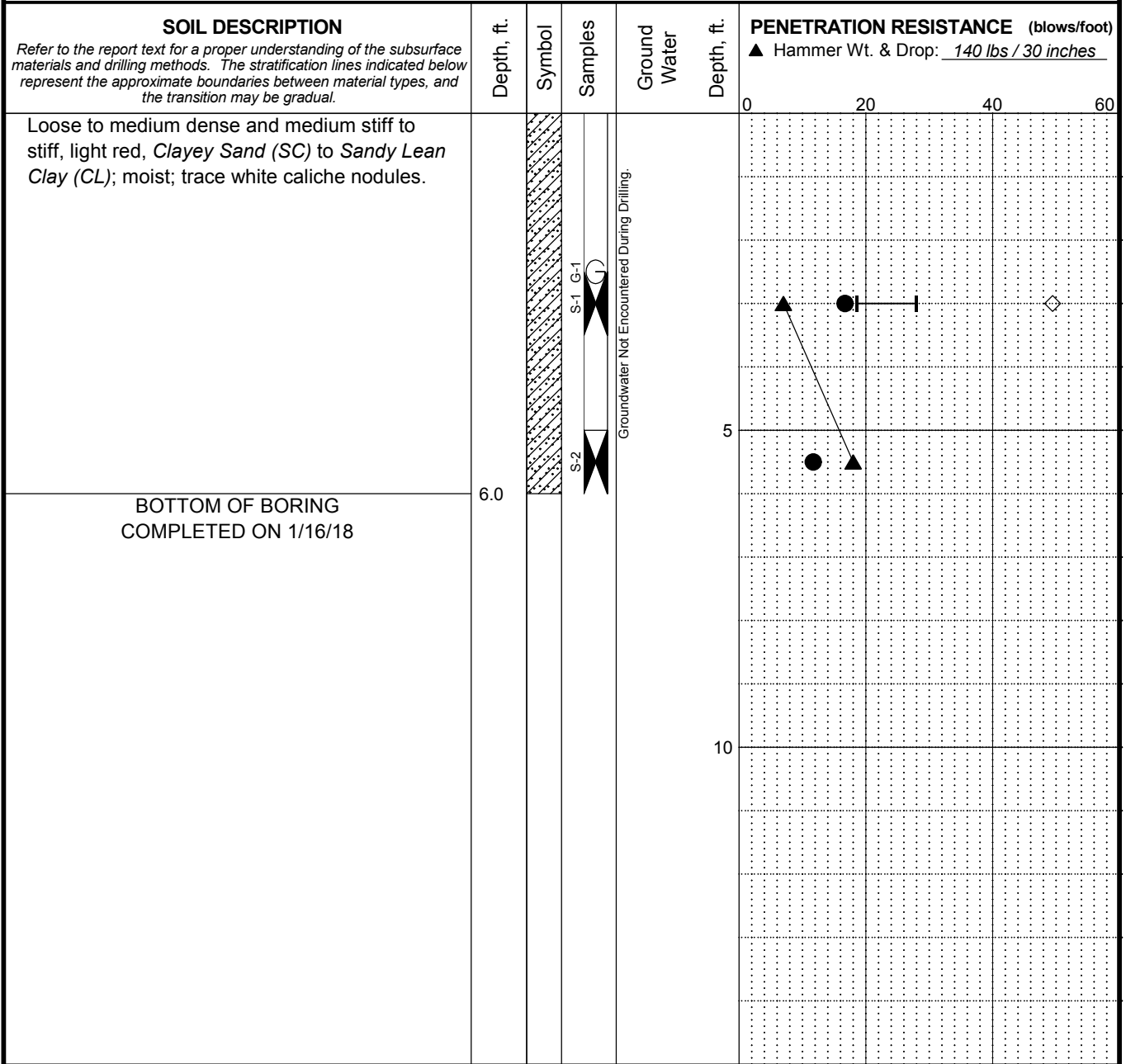
23-1-01675-004

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**FIG. A-16**

MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 6 ft. Northing: 1,234,656 ft. Drilling Method: Solid-Stem Auger Hole Diam.: 6 in.  
 Top Elevation: 4280.8 ft. Easting: 850,205 ft. Drilling Company: Vine Laboratories Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_ Station: \_\_\_\_\_ Drill Rig Equipment: CME-55 Truck Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_ Offset: - Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- Grab Sample
- Modified California Sampler

- % Fines (<0.075mm)
- % Water Content
- Plastic Limit Liquid Limit
- Natural Water Content

- NOTES**
- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  - The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  - The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  - Groundwater level, if indicated above, is for the date specified and may vary.
  - USCS designation is based on visual-manual classification and selected lab testing.

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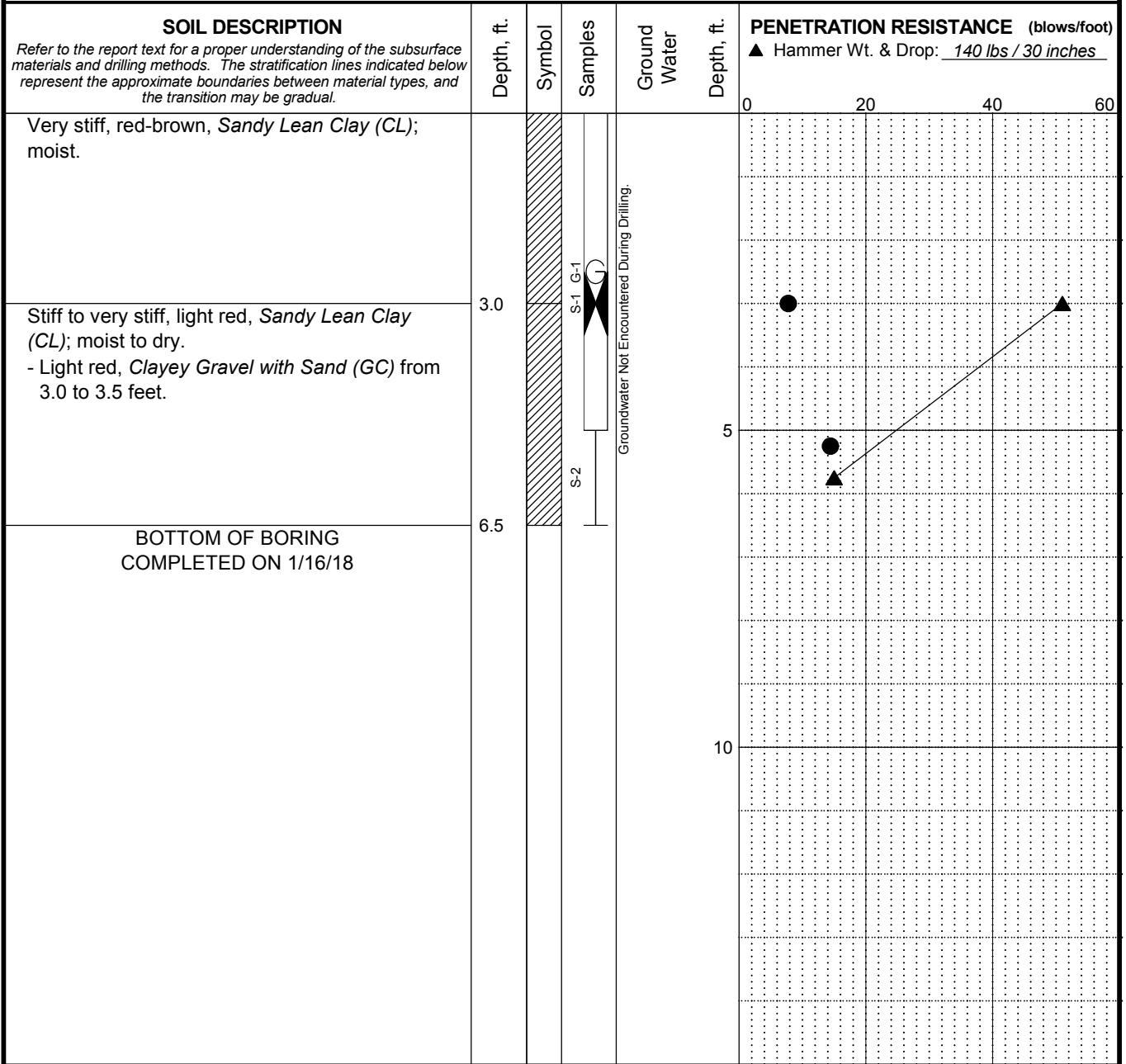
**LOG OF BORING R-06**

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**SHANNON & WILSON, INC.**  
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MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>6.5 ft.</u>	Northing: <u>1,235,009 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>6 in.</u>
Top Elevation: <u>4282.1 ft.</u>	Easting: <u>850,210 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



- LEGEND**
- \* Sample Not Recovered
  - ☐ Grab Sample
  - ⊠ Modified California Sampler
  - ⊥ Standard Penetration Test

● % Water Content

- NOTES**
- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  - The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  - The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  - Groundwater level, if indicated above, is for the date specified and may vary.
  - USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
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**LOG OF BORING R-07**

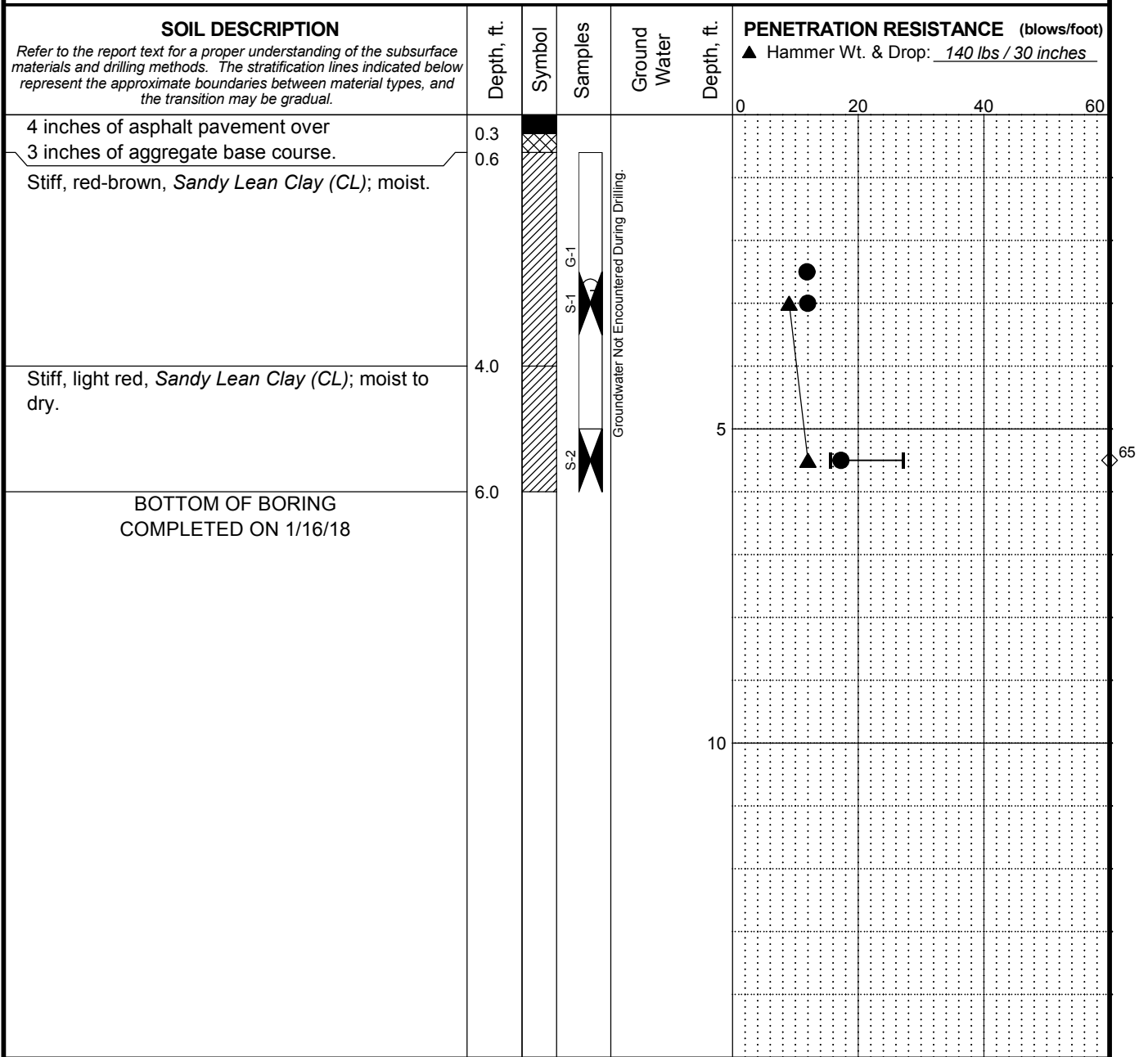
April 2018 23-1-01675-004

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**FIG. A-18**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 6 ft.    Northing: 1,235,384 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 6 in.  
 Top Elevation: 4283.4 ft.    Easting: 850,382 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ☐ Grab Sample
- ⊠ Modified California Sampler

◇ % Fines (<0.075mm)  
 ● % Water Content  
 Plastic Limit —●— Liquid Limit  
 Natural Water Content

**NOTES**

- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
- The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
- The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING R-08**

April 2018

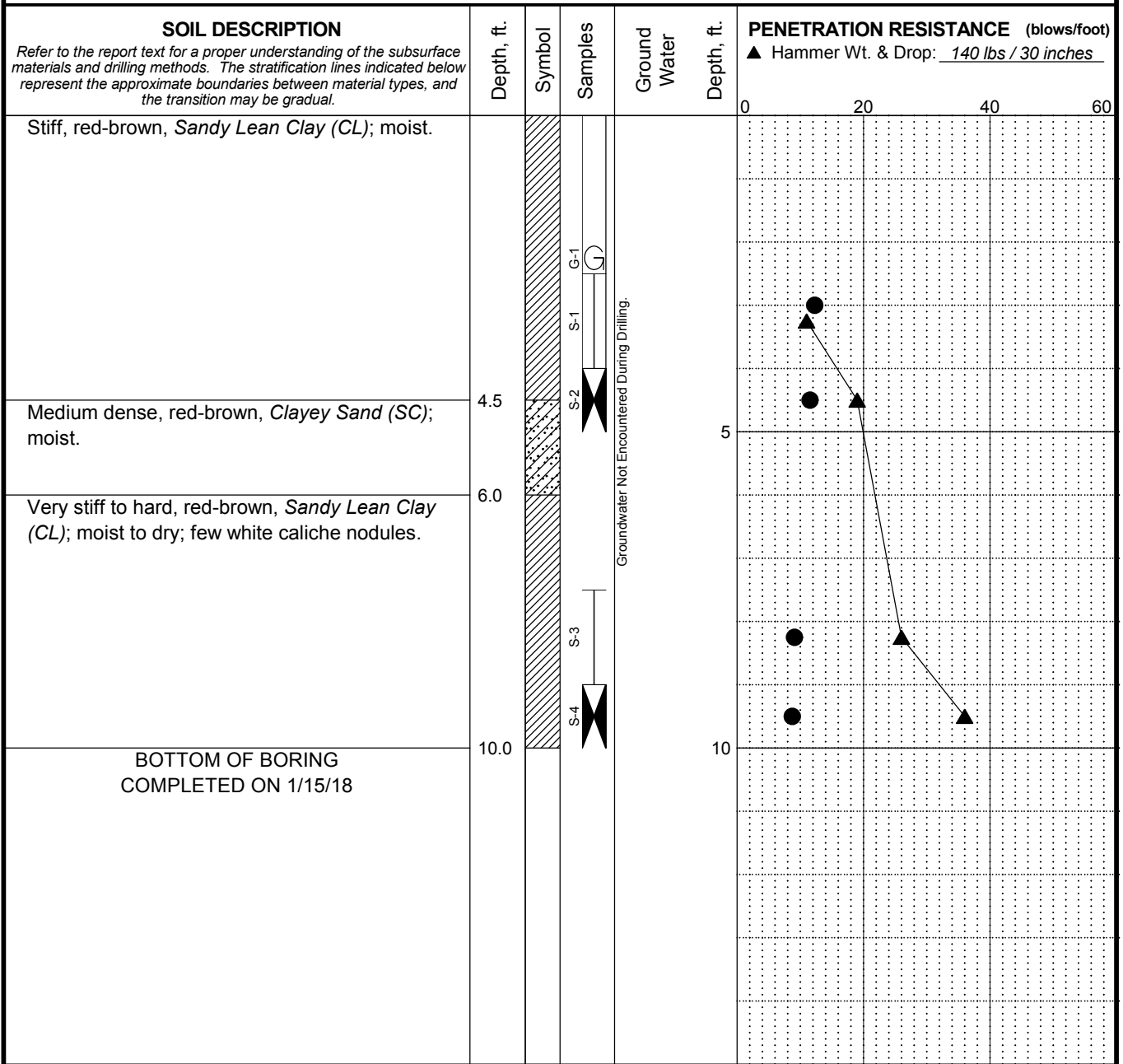
23-1-01675-004

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**FIG. A-19**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 10 ft. Northing: 1,234,174 ft. Drilling Method: Solid-Stem Auger Hole Diam.: 4 in.  
 Top Elevation: 4287.8 ft. Easting: 848,001 ft. Drilling Company: Vine Laboratories Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_ Station: \_\_\_\_\_ Drill Rig Equipment: CME-55 Truck Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_ Offset: - Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ☐ Grab Sample
- ⊥ Standard Penetration Test
- ⊕ Modified California Sampler

● % Water Content

**NOTES**

- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
- The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
- The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
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**LOG OF BORING T-01**

April 2018

23-1-01675-004

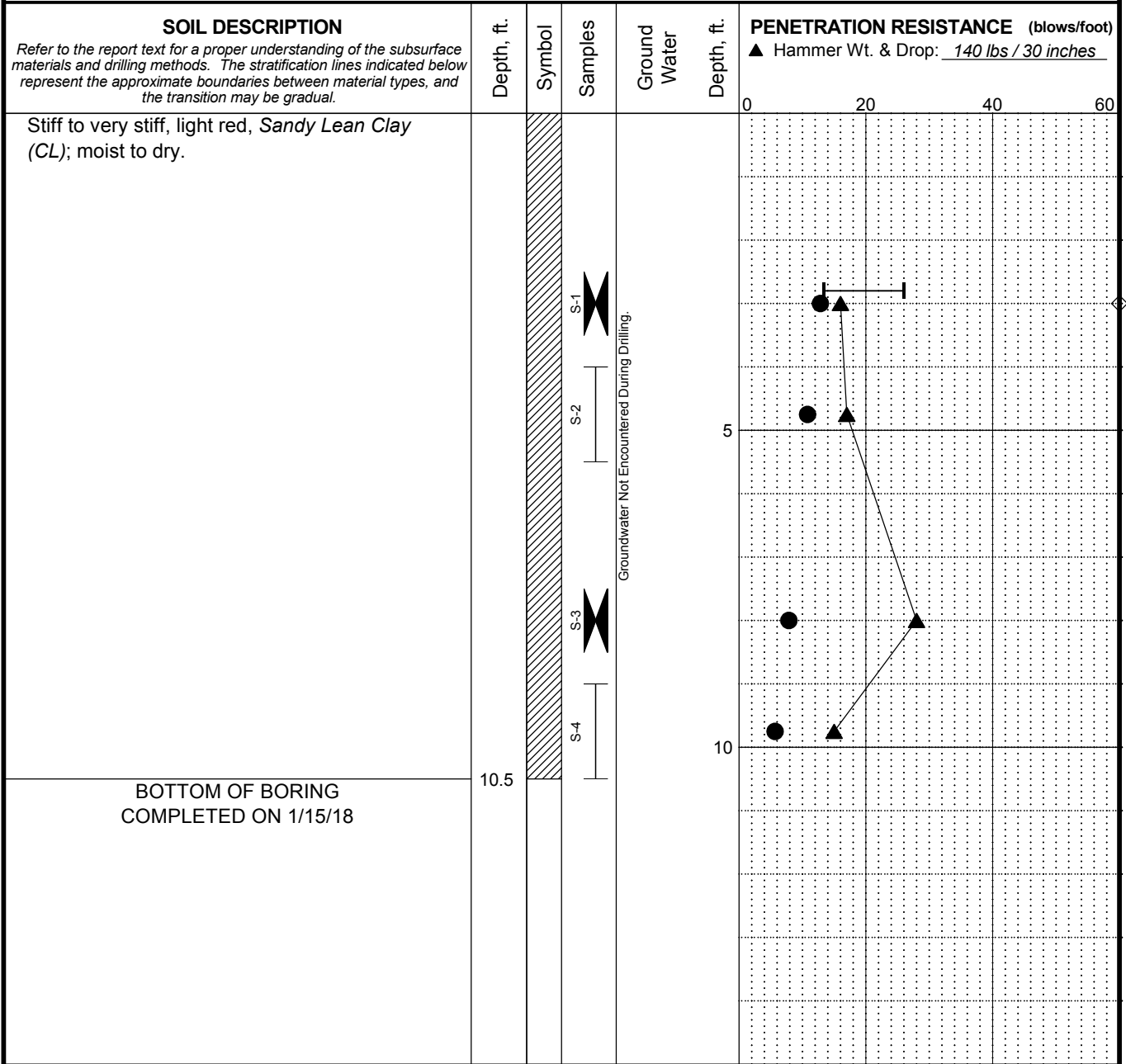
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**FIG. A-20**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18



Total Depth: 10.5 ft.    Northing: 1,233,987 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 4 in.  
 Top Elevation: 4284.8 ft.    Easting: 848,273 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ⊞ Modified California Sampler
- ⊞ Standard Penetration Test

- ◇ % Fines (<0.075mm)
- % Water Content
- Plastic Limit —●— Liquid Limit
- Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING T-02**

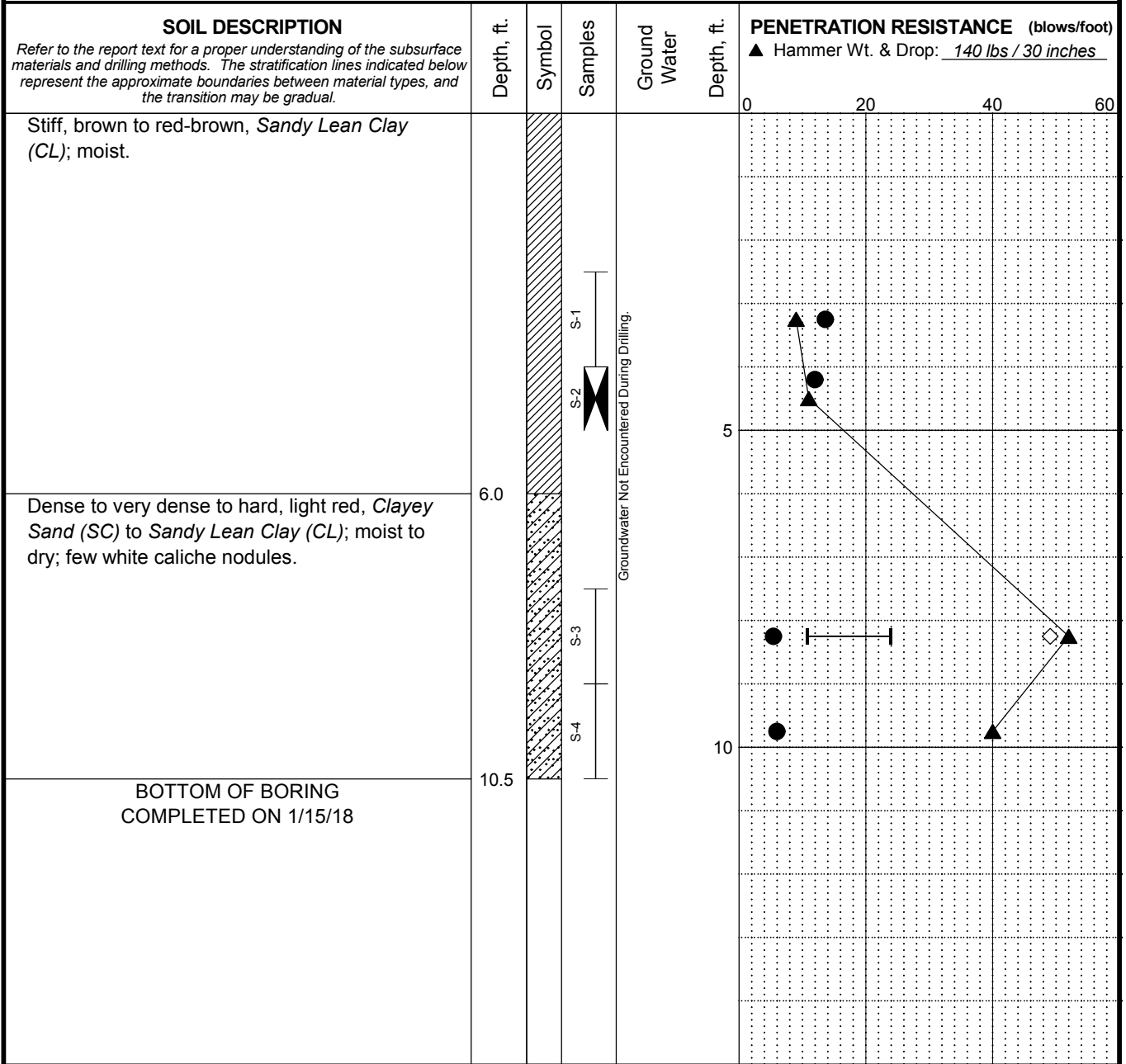
April 2018                      23-1-01675-004

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**FIG. A-21**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>10.5 ft.</u>	Northing: <u>1,233,703 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4281.3 ft.</u>	Easting: <u>848,516 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- ⊥ Standard Penetration Test
- ⊞ Modified California Sampler

- ◇ % Fines (<0.075mm)
- % Water Content
- Plastic Limit —●— Liquid Limit
- Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
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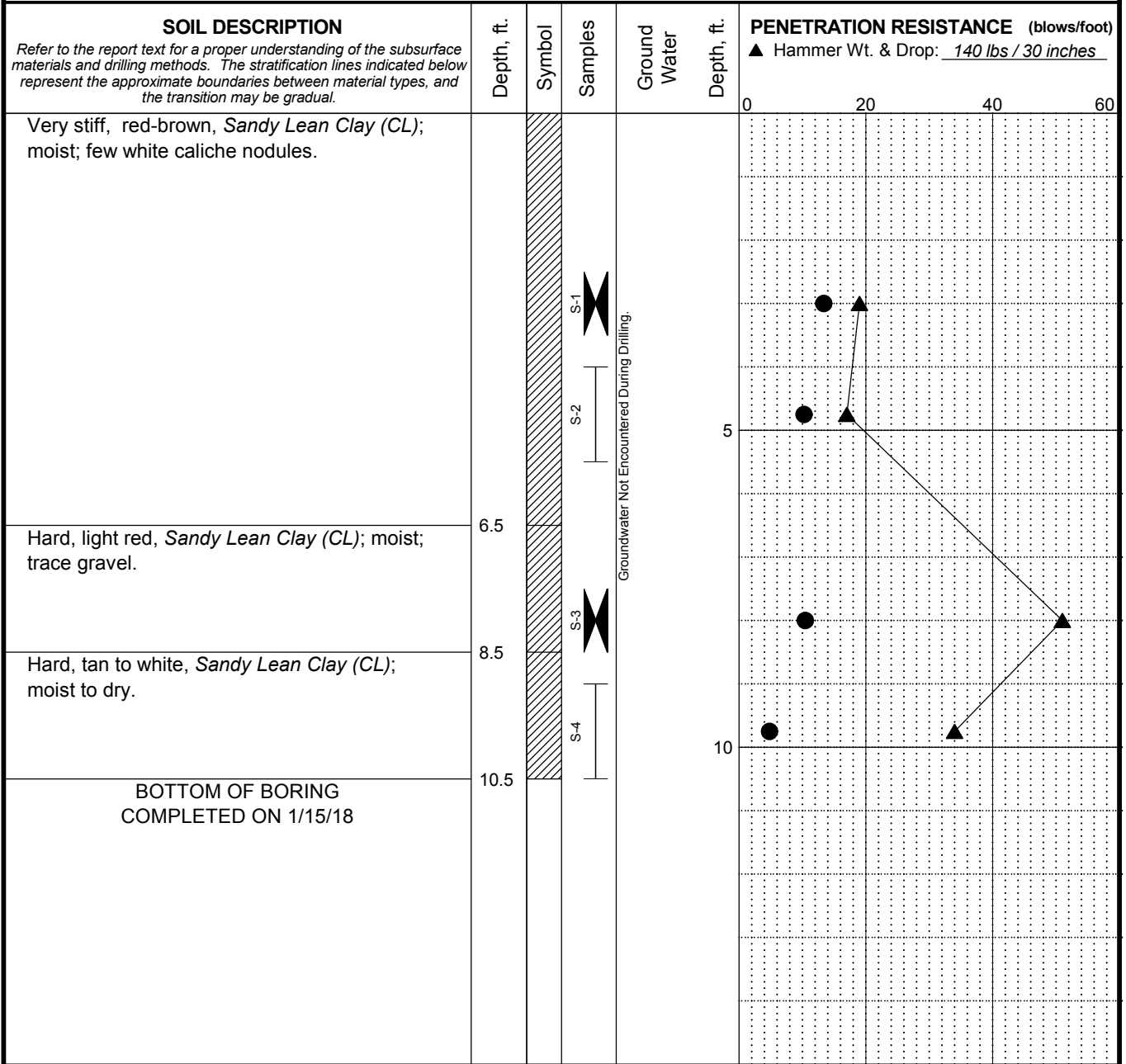
**LOG OF BORING T-03**

April 2018 23-1-01675-004

<b>SHANNON &amp; WILSON, INC.</b> Geotechnical and Environmental Consultants	<b>FIG. A-22</b>
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MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 10.5 ft.    Northing: 1,234,025 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 4 in.  
 Top Elevation: 4282.4 ft.    Easting: 848,812 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ⊞ Modified California Sampler
- ⊞ Standard Penetration Test

● % Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING T-04**

April 2018

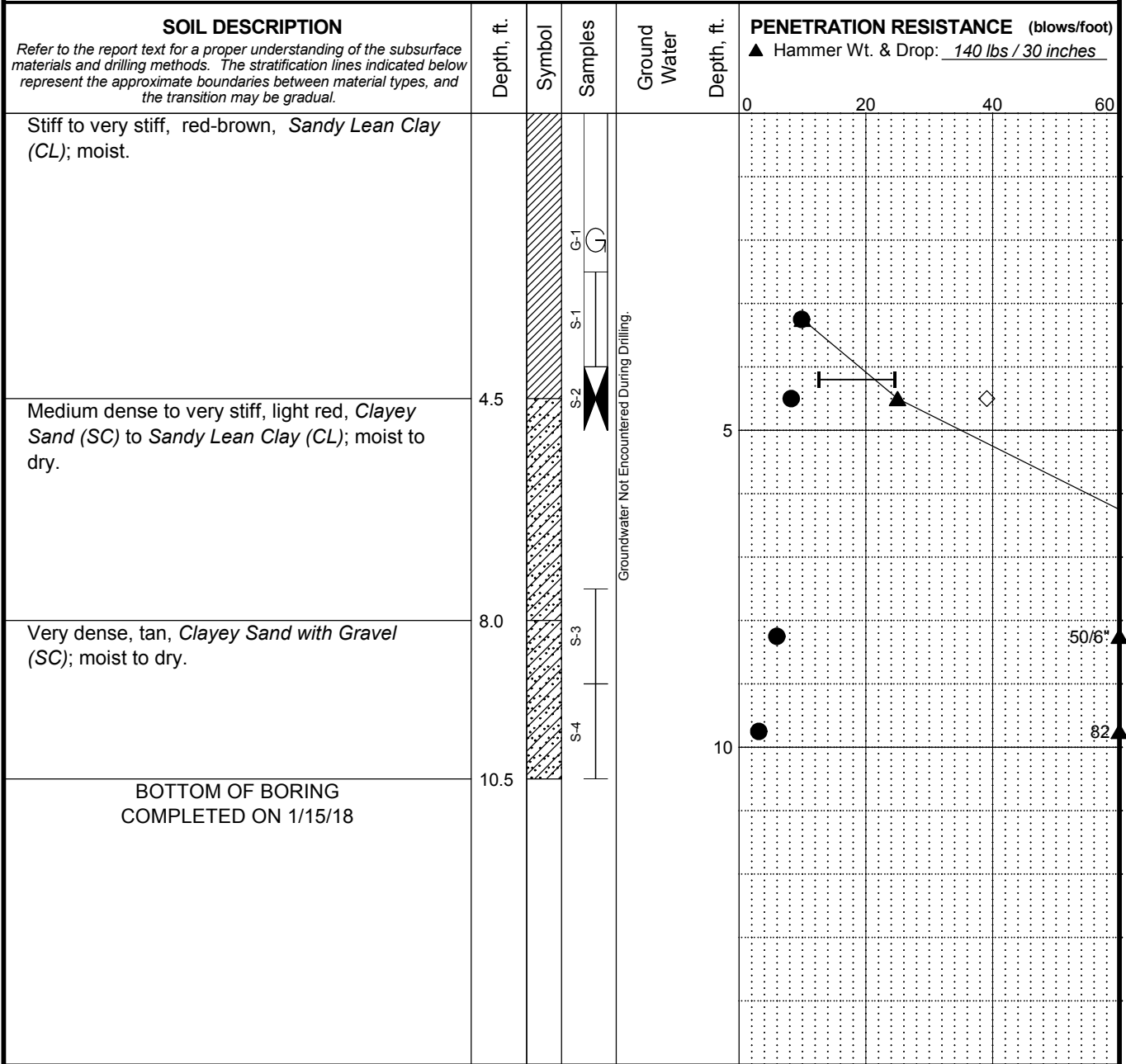
23-1-01675-004

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**FIG. A-23**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 10.5 ft.    Northing: 1,234,214 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 6 in.  
 Top Elevation: 4281.7 ft.    Easting: 849,058 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



- LEGEND**
- \* Sample Not Recovered
  - ☐ Grab Sample
  - ⊥ Standard Penetration Test
  - ⊕ Modified California Sampler

- ◇ % Fines (<0.075mm)
- % Water Content
- Plastic Limit —●— Liquid Limit
- Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING T-05**

April 2018

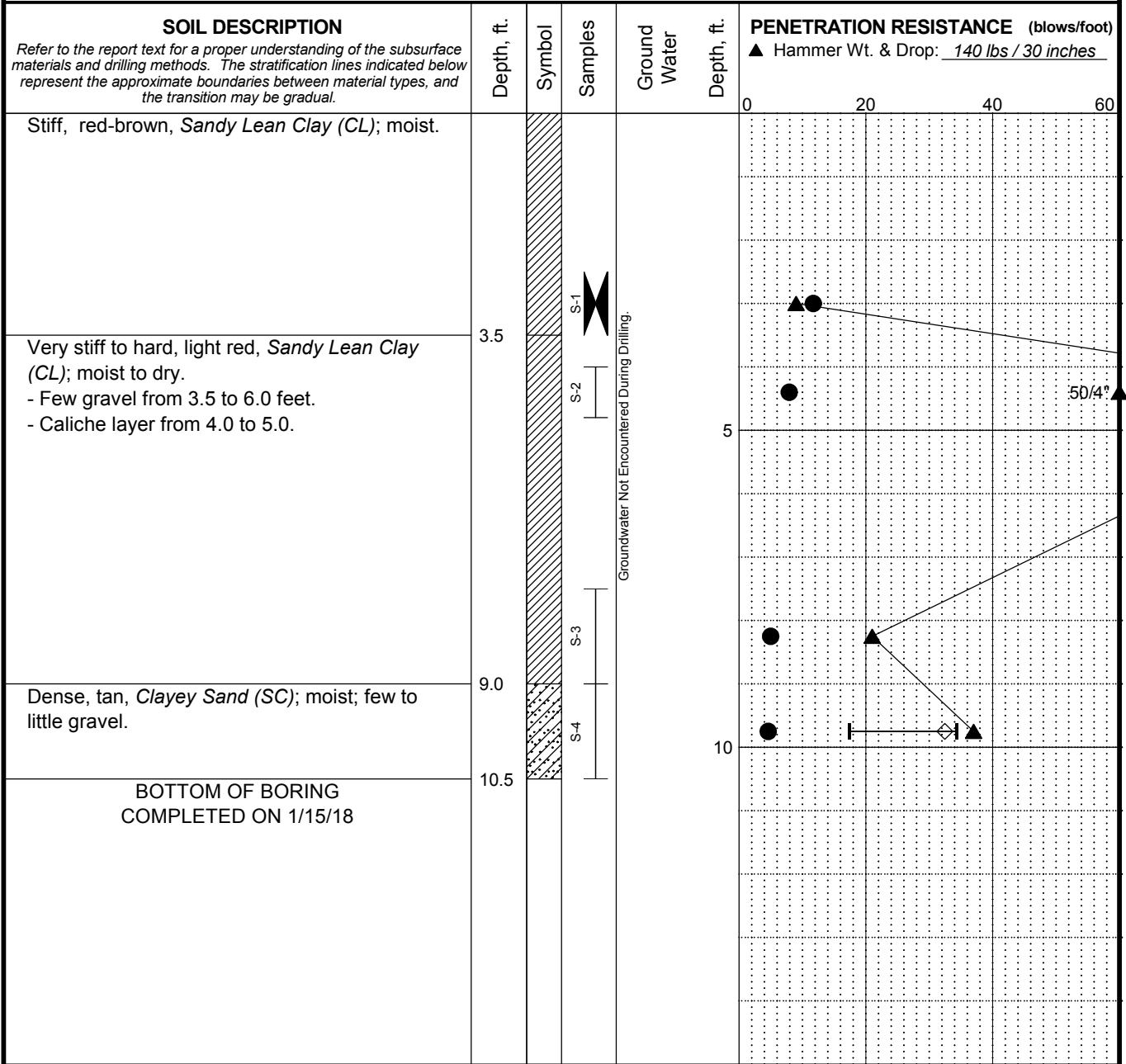
23-1-01675-004

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**FIG. A-24**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>10.5 ft.</u>	Northing: <u>1,234,451 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4283.3 ft.</u>	Easting: <u>849,276 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- [MC] Modified California Sampler
- [I] Standard Penetration Test
- ◇ % Fines (<0.075mm)
- % Water Content
- Plastic Limit [—●—] Liquid Limit
- Natural Water Content

- NOTES**
- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  - The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  - The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  - Groundwater level, if indicated above, is for the date specified and may vary.
  - USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING T-06**

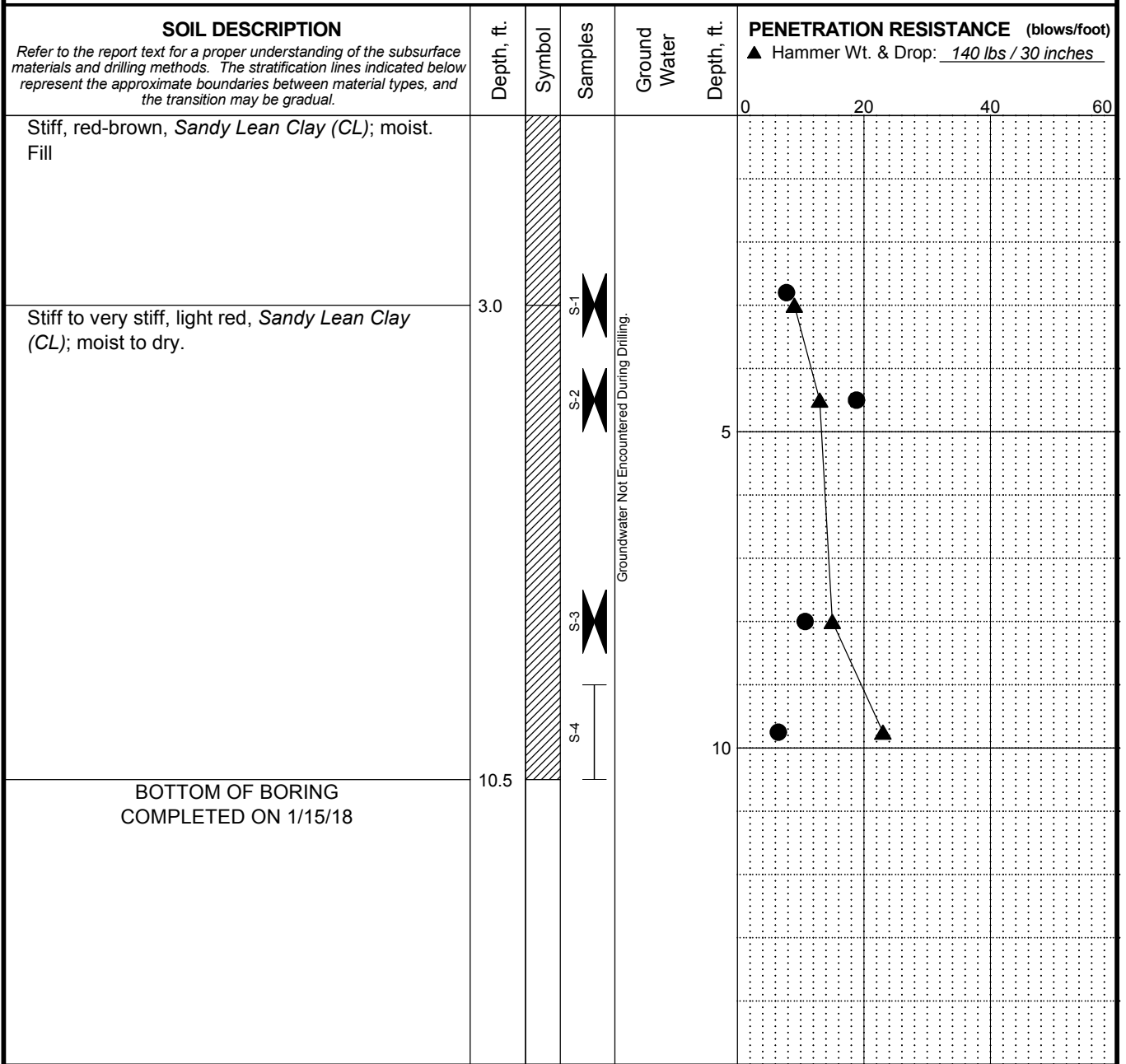
April 2018 23-1-01675-004

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**FIG. A-25**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 10.5 ft.    Northing: 1,234,590 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 4 in.  
 Top Elevation: 4284.1 ft.    Easting: 849,411 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ✂ Modified California Sampler
- ⊥ Standard Penetration Test

● % Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING T-07**

April 2018

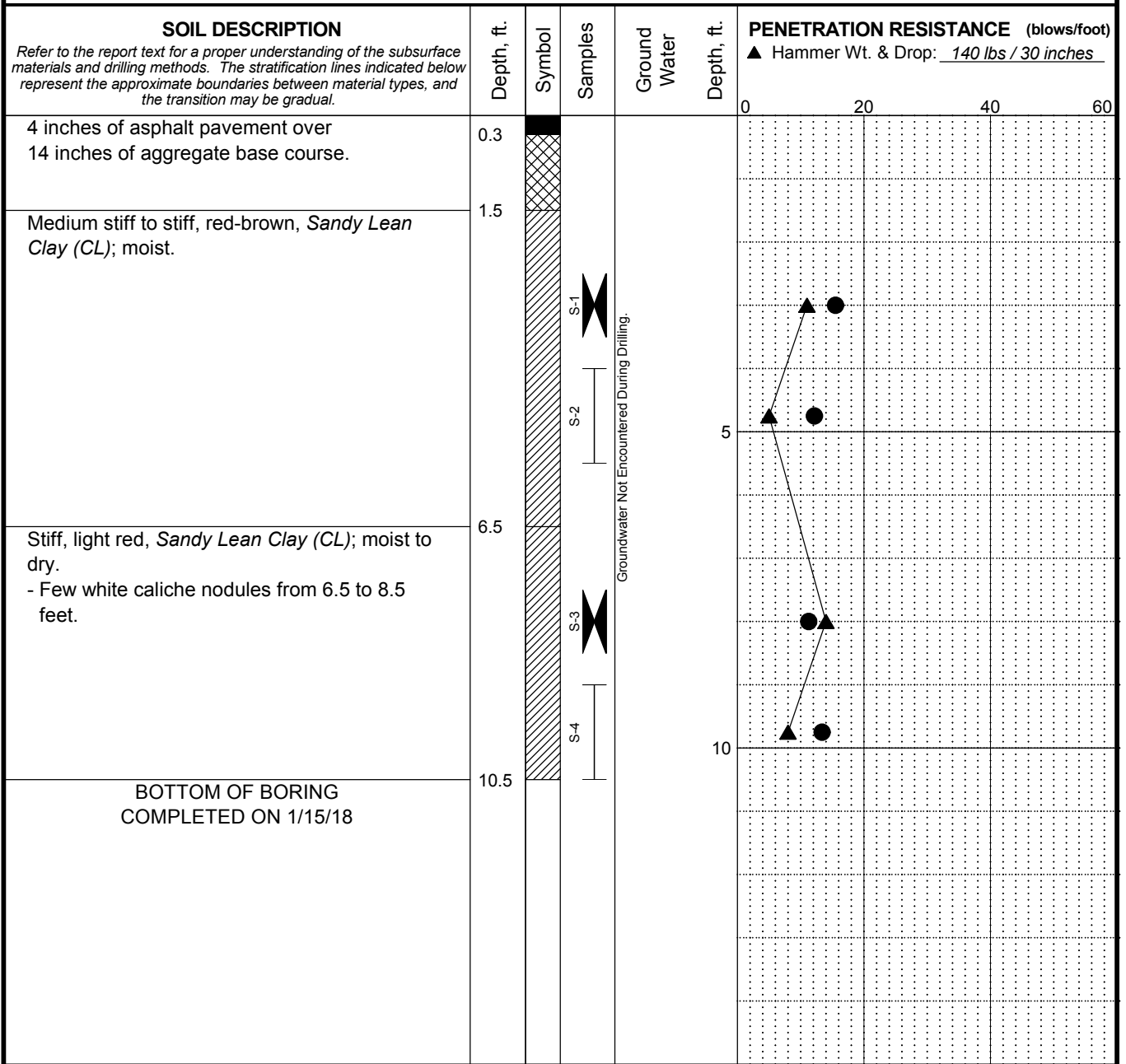
23-1-01675-004

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**FIG. A-26**

MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>10.5 ft.</u>	Northing: <u>1,234,725 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4285.4 ft.</u>	Easting: <u>849,541 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- ⊞ Modified California Sampler
- ⊞ Standard Penetration Test

● % Water Content

**NOTES**

- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
- The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
- The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

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**LOG OF BORING T-08**

April 2018

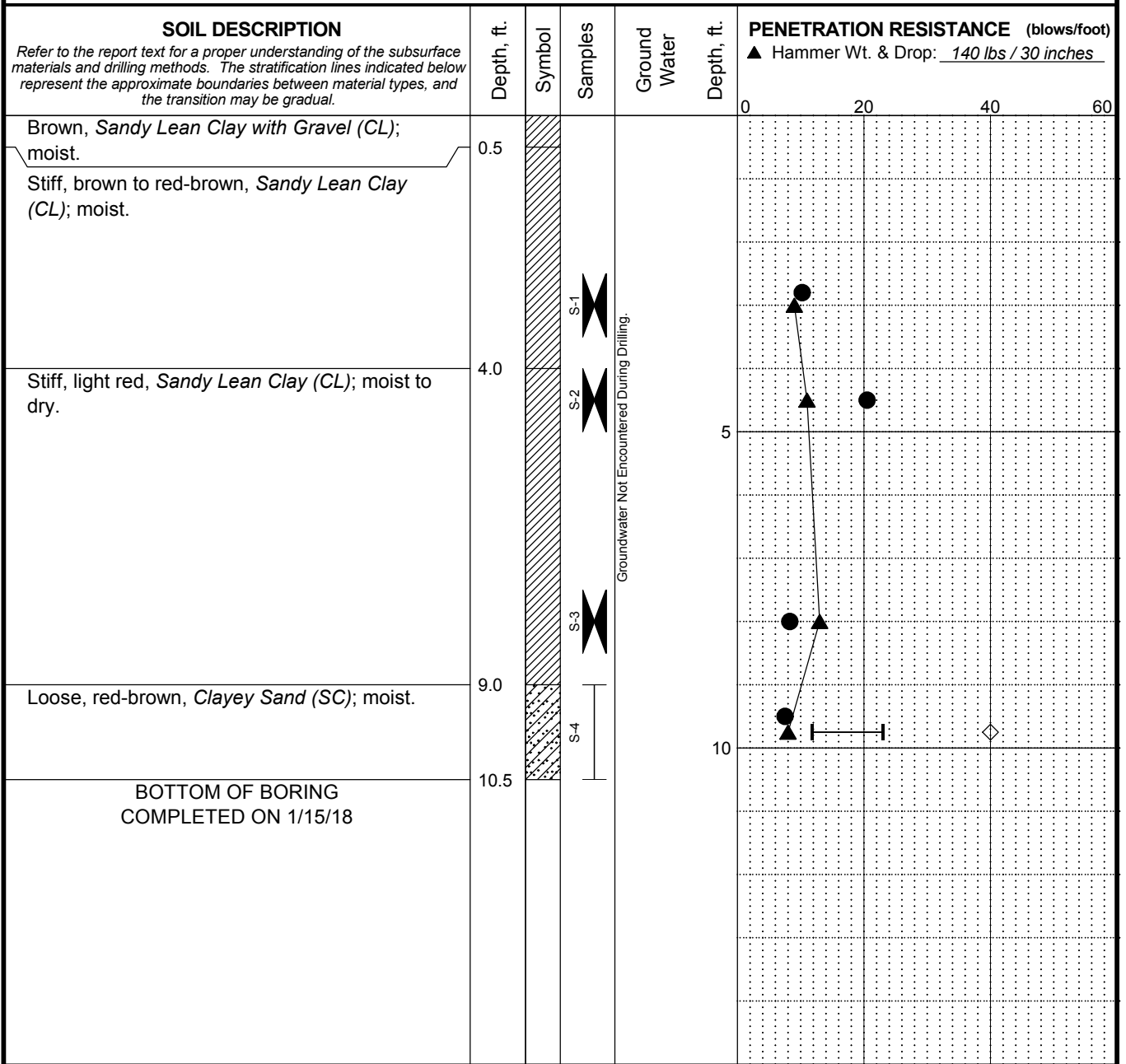
23-1-01675-004

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**FIG. A-27**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 10.5 ft. Northing: 1,234,855 ft. Drilling Method: Solid-Stem Auger Hole Diam.: 4 in.  
 Top Elevation: 4284.3 ft. Easting: 849,678 ft. Drilling Company: Vine Laboratories Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_ Station: \_\_\_\_\_ Drill Rig Equipment: CME-55 Truck Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_ Offset: - Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ⊞ Modified California Sampler
- ⊞ Standard Penetration Test

- ◇ % Fines (<0.075mm)
- % Water Content
- Liquid Limit
- Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
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**LOG OF BORING T-09**

April 2018

23-1-01675-004

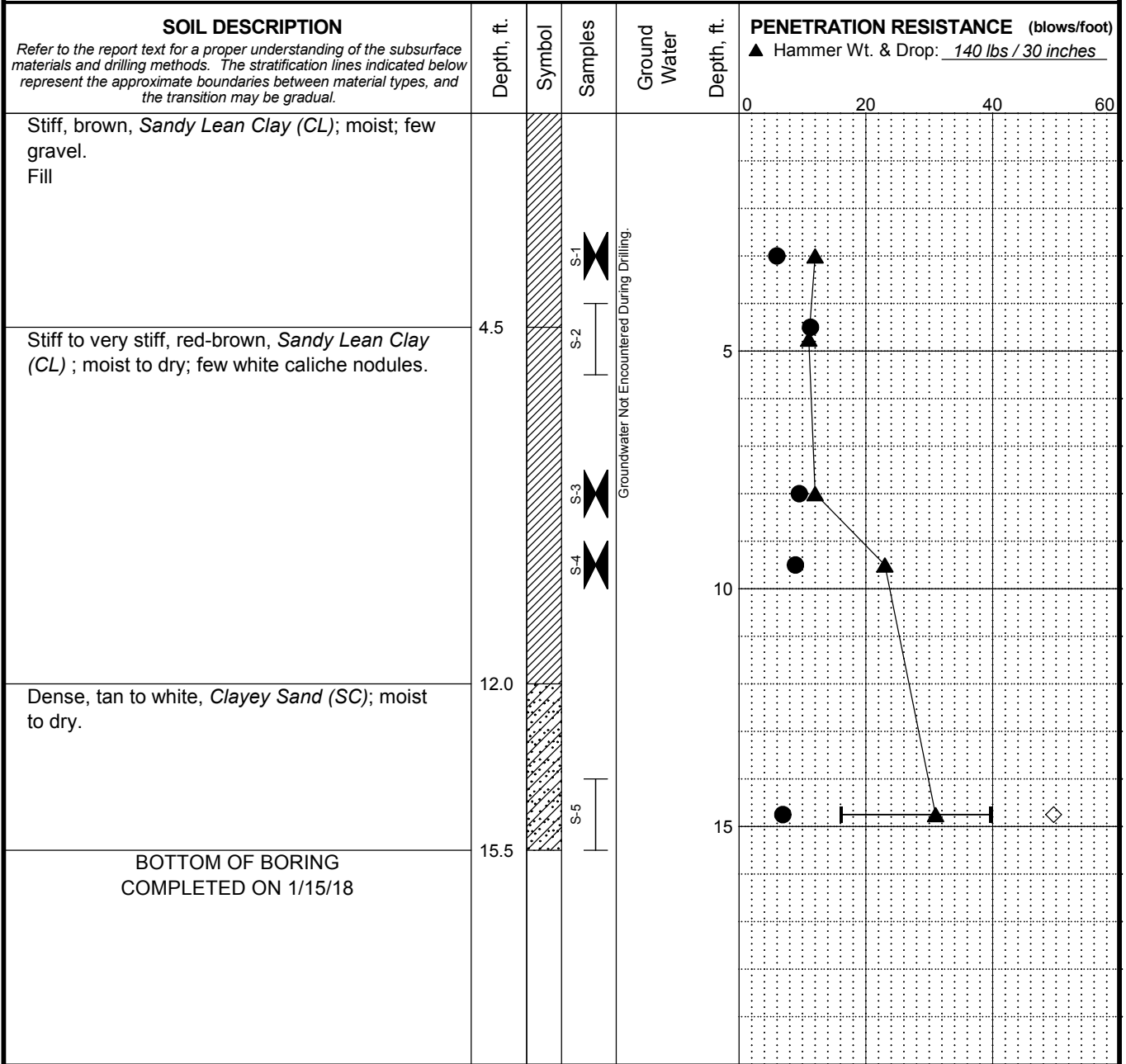
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**FIG. A-28**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18



Total Depth: 10.5 ft.    Northing: 1,234,308 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 4 in.  
 Top Elevation: 4283.2 ft.    Easting: 849,422 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ⊠ Modified California Sampler
- ⊥ Standard Penetration Test

- ◇ % Fines (<0.075mm)
- % Water Content
- Liquid Limit
- Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING T-10**

April 2018

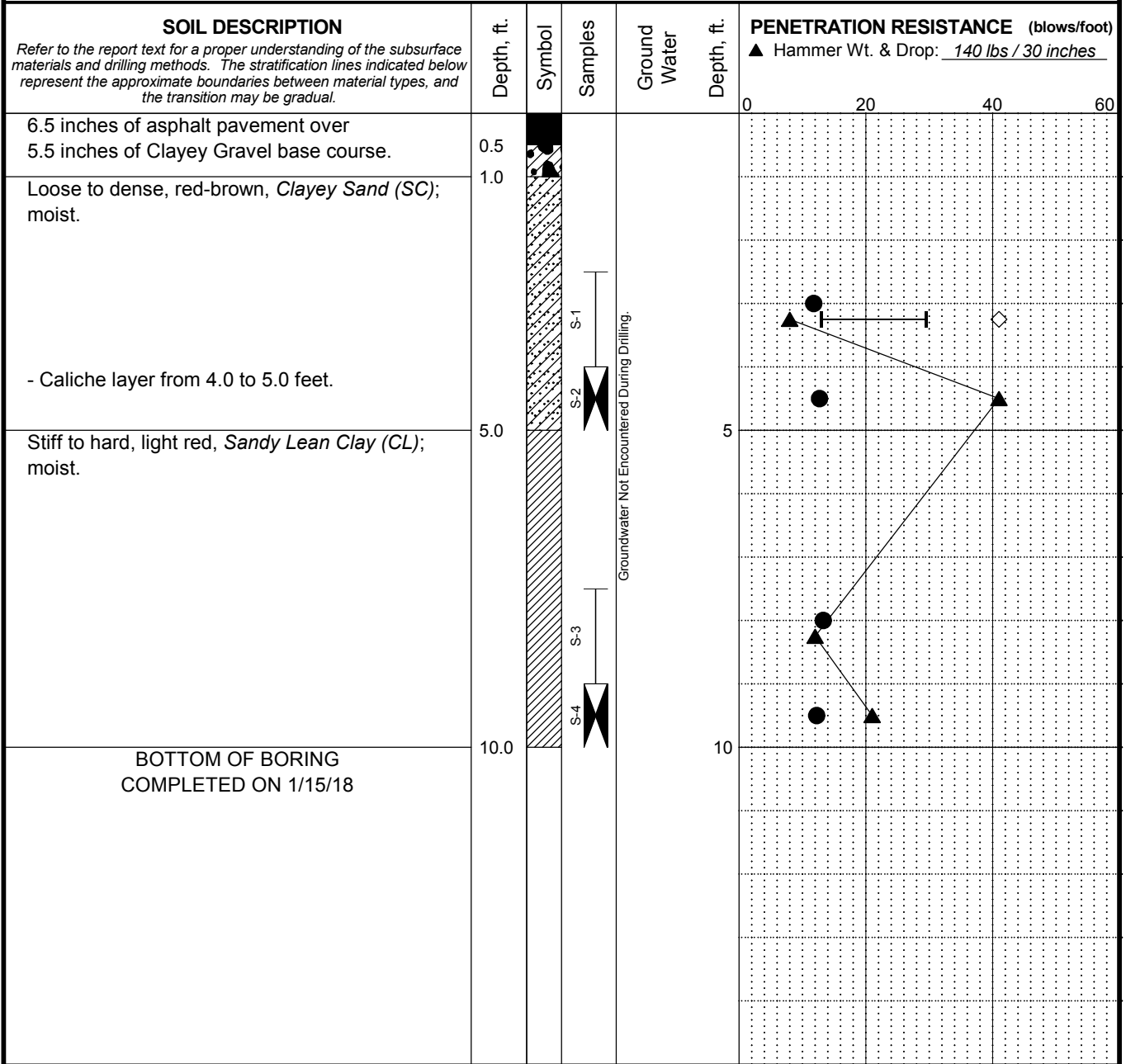
23-1-01675-004

**SHANNON & WILSON, INC.**  
Geotechnical and Environmental Consultants

**FIG. A-29**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 10.5 ft.    Northing: 1,234,433 ft.    Drilling Method: Solid-Stem Auger    Hole Diam.: 4 in.  
 Top Elevation: 4284.1 ft.    Easting: 849,575 ft.    Drilling Company: Vine Laboratories    Rod Type.: AWJ  
 Vert. Datum: \_\_\_\_\_    Station: \_\_\_\_\_    Drill Rig Equipment: CME-55 Truck    Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_    Offset: -    Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ⊥ Standard Penetration Test
- ⊕ Modified California Sampler

◇ % Fines (<0.075mm)  
 ● % Water Content  
 Plastic Limit —●— Liquid Limit  
 Natural Water Content

- NOTES**
- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  - The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  - The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  - Groundwater level, if indicated above, is for the date specified and may vary.
  - USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING T-11**

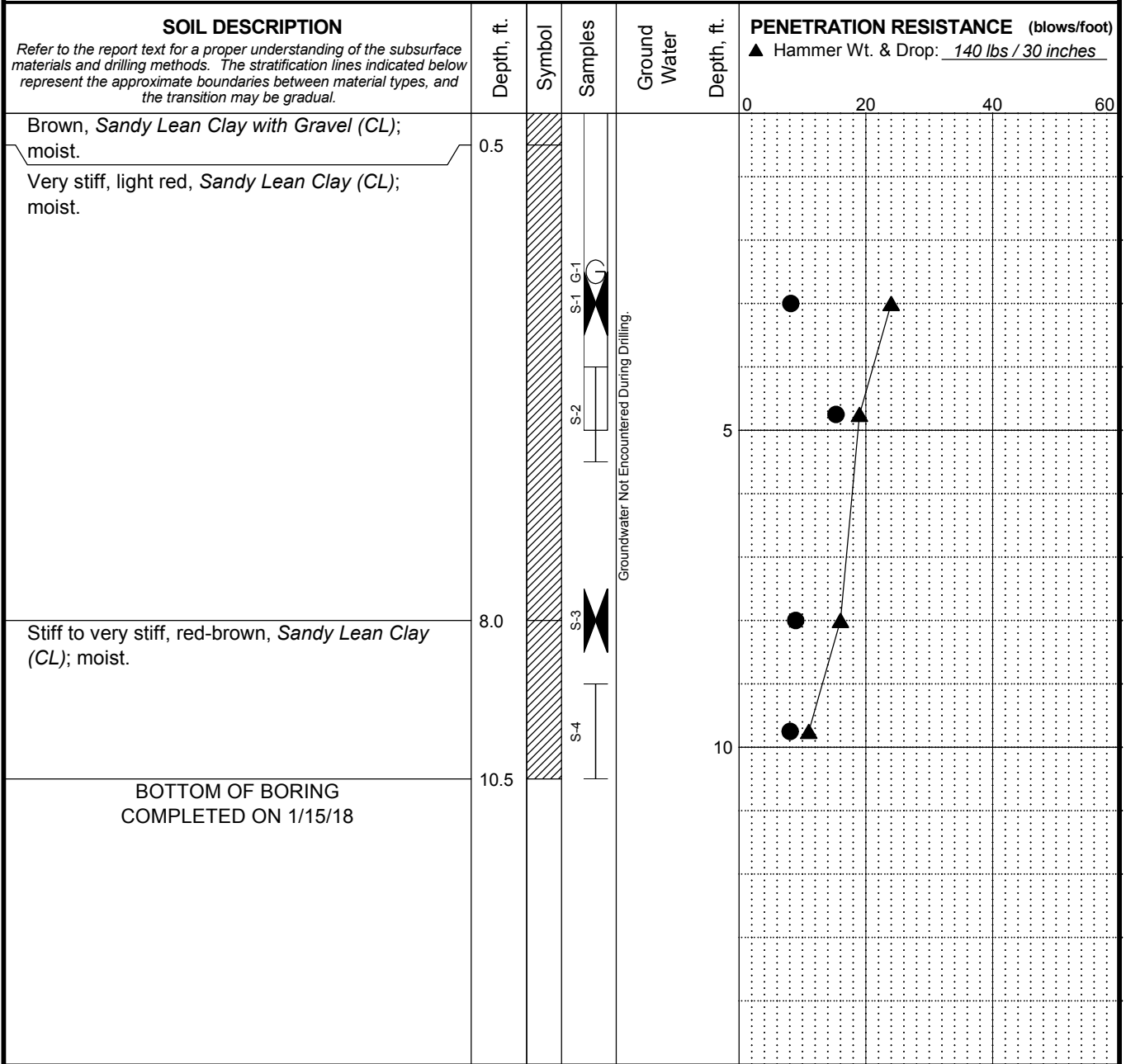
April 2018                      23-1-01675-004

**SHANNON & WILSON, INC.**  
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**FIG. A-30**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>10.5 ft.</u>	Northing: <u>1,234,569 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>6 in.</u>
Top Elevation: <u>4283.0 ft.</u>	Easting: <u>849,708 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



- LEGEND**
- \* Sample Not Recovered
  - ☐ Grab Sample
  - ⊕ Modified California Sampler
  - ⊥ Standard Penetration Test

● % Water Content

- NOTES**
- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  - The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  - The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  - Groundwater level, if indicated above, is for the date specified and may vary.
  - USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING T-12**

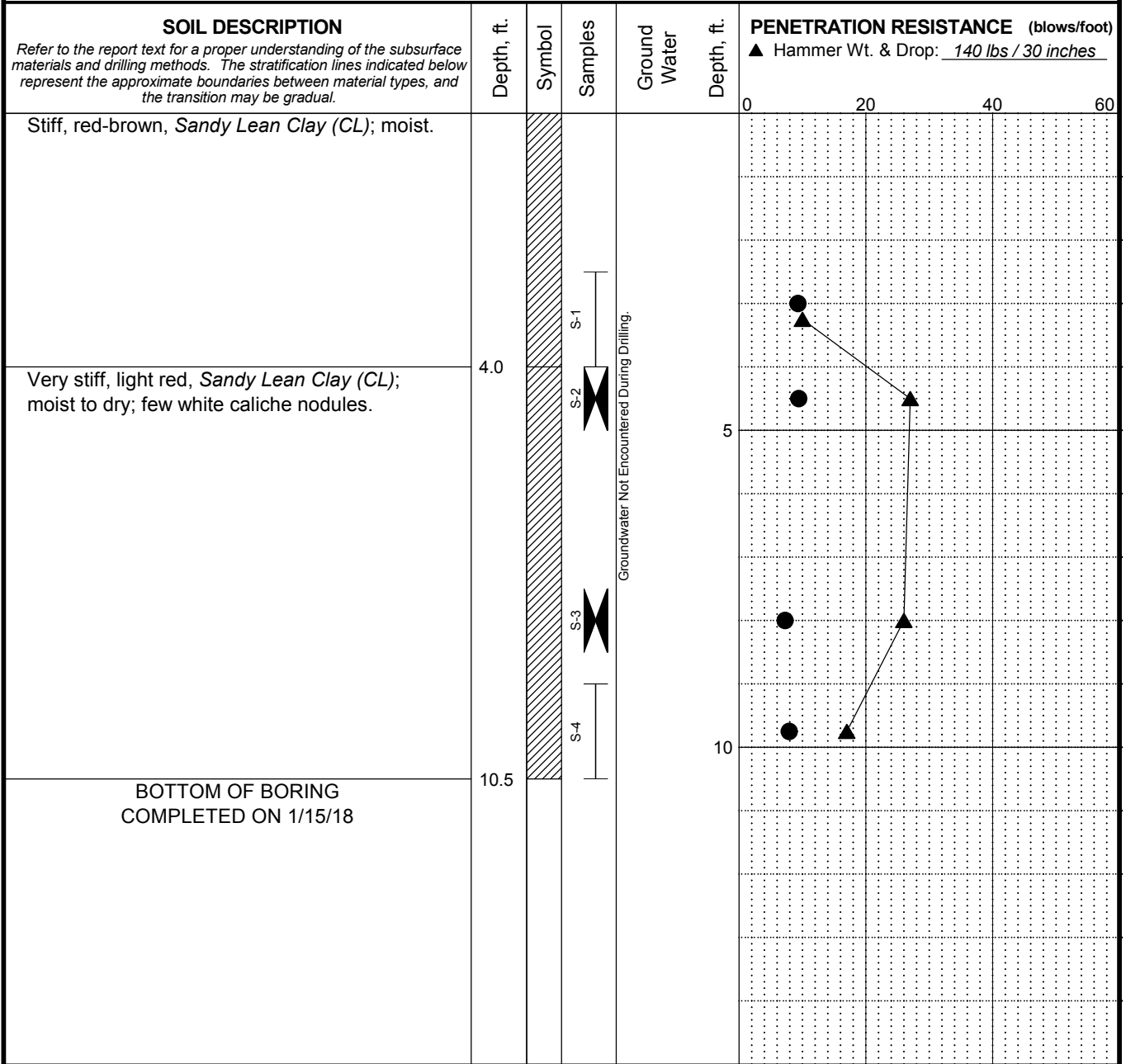
April 2018 23-1-01675-004

**SHANNON & WILSON, INC.**  
Geotechnical and Environmental Consultants

**FIG. A-31**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>10.5 ft.</u>	Northing: <u>1,234,700 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4283.0 ft.</u>	Easting: <u>849,839 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- ⊥ Standard Penetration Test
- ⊕ Modified California Sampler

● % Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING T-13**

April 2018

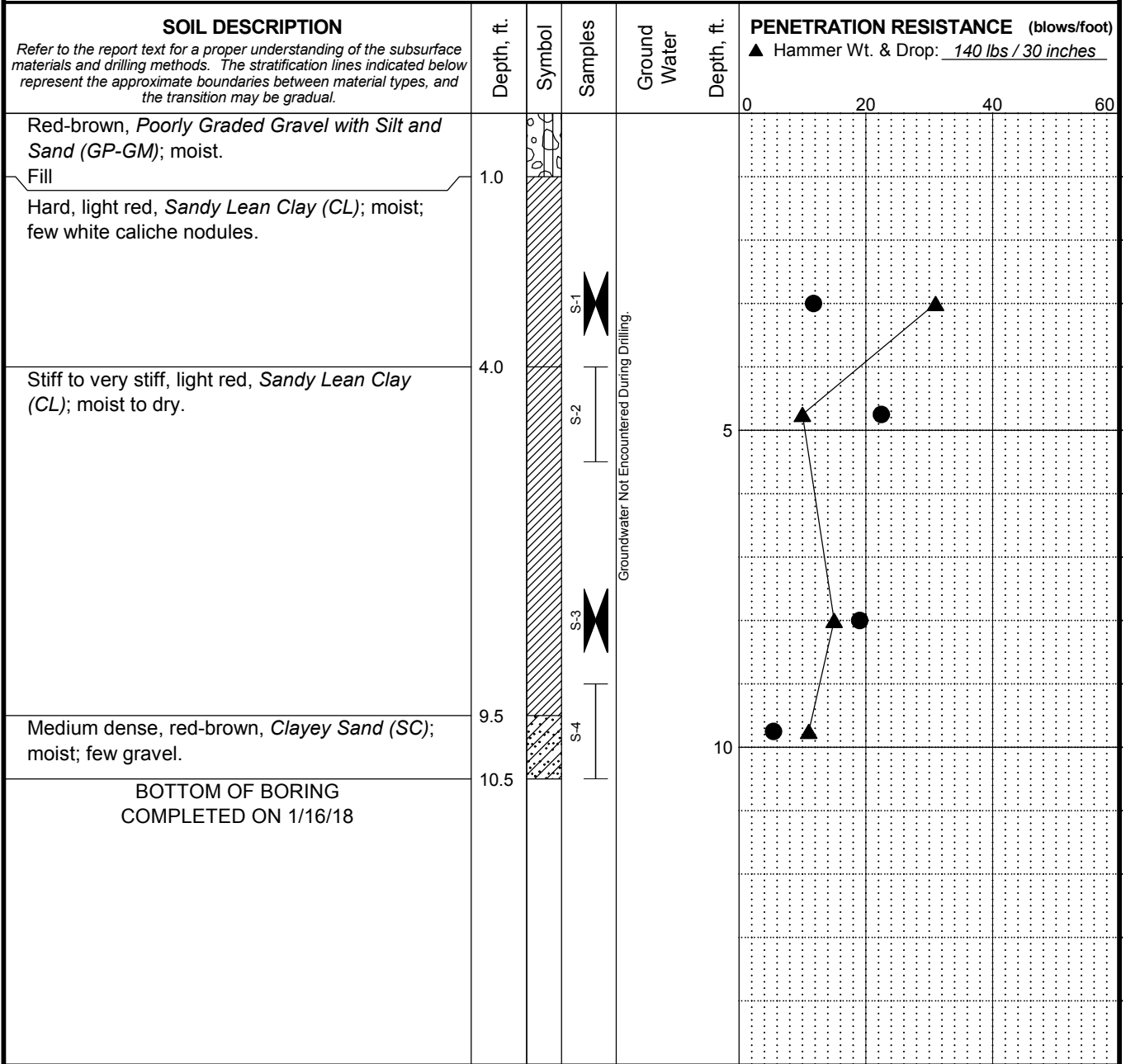
23-1-01675-004

**SHANNON & WILSON, INC.**  
Geotechnical and Environmental Consultants

**FIG. A-32**

MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>10.5 ft.</u>	Northing: <u>1,234,174 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4281.8 ft.</u>	Easting: <u>849,581 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- Modified California Sampler
- Standard Penetration Test

● % Water Content

**NOTES**

- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
- The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
- The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING T-14**

April 2018

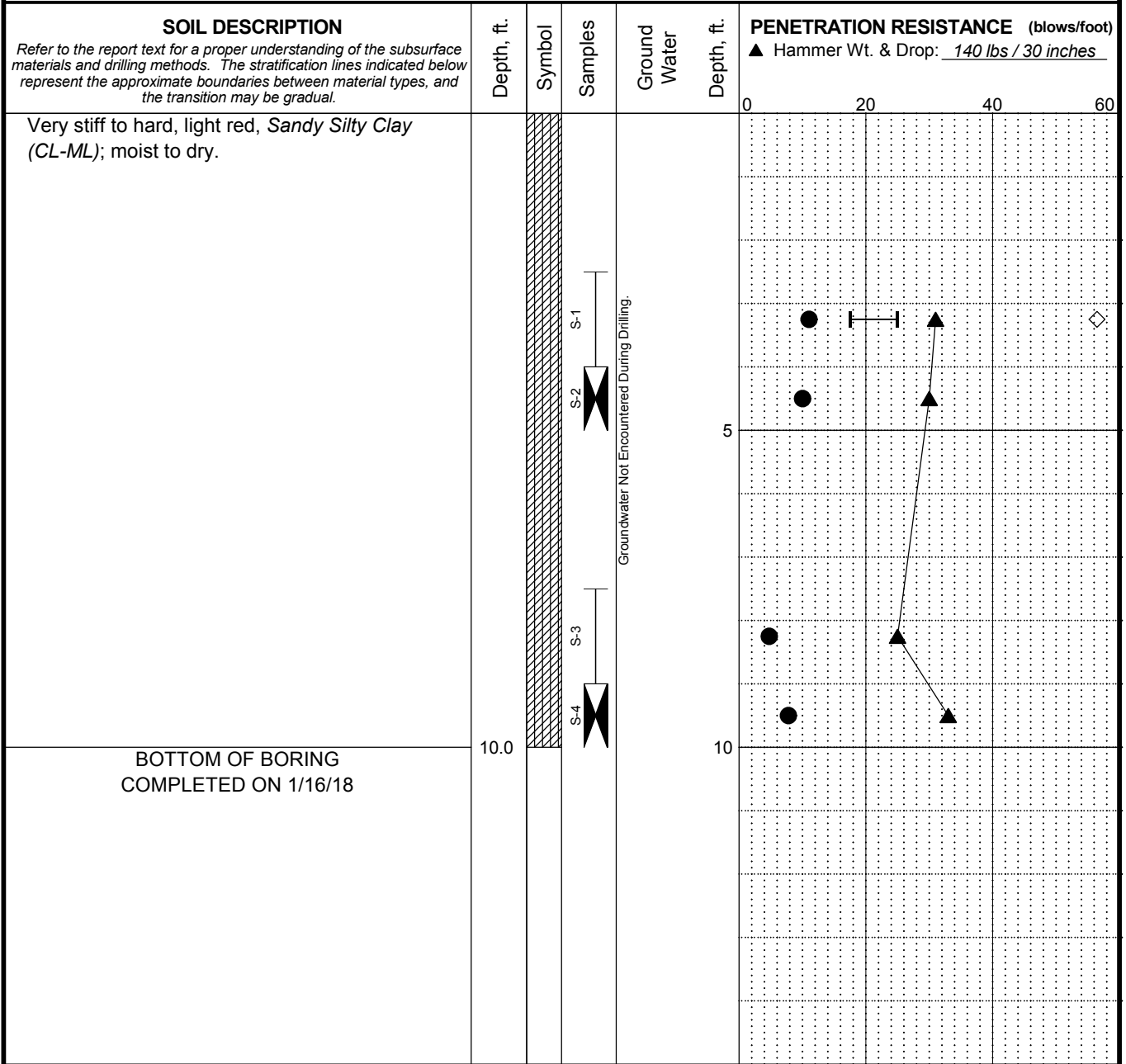
23-1-01675-004

**SHANNON & WILSON, INC.**  
Geotechnical and Environmental Consultants

**FIG. A-33**

MASTER LOG, E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: 10 ft. Northing: 1,234,285 ft. Drilling Method: Solid-Stem Auger Hole Diam.: 4 in.  
 Top Elevation: 4281.5 ft. Easting: 849,729 ft. Drilling Company: Vine Laboratories Rod Type: AWJ  
 Vert. Datum: \_\_\_\_\_ Station: \_\_\_\_\_ Drill Rig Equipment: CME-55 Truck Hammer Type: Automatic  
 Horiz. Datum: \_\_\_\_\_ Offset: - Other Comments: \_\_\_\_\_



**LEGEND**

- \* Sample Not Recovered
- ⊥ Standard Penetration Test
- ⊞ Modified California Sampler

- ◇ % Fines (<0.075mm)
- % Water Content
- Liquid Limit
- Natural Water Content

- NOTES**
- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  - The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  - The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  - Groundwater level, if indicated above, is for the date specified and may vary.
  - USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING T-15**

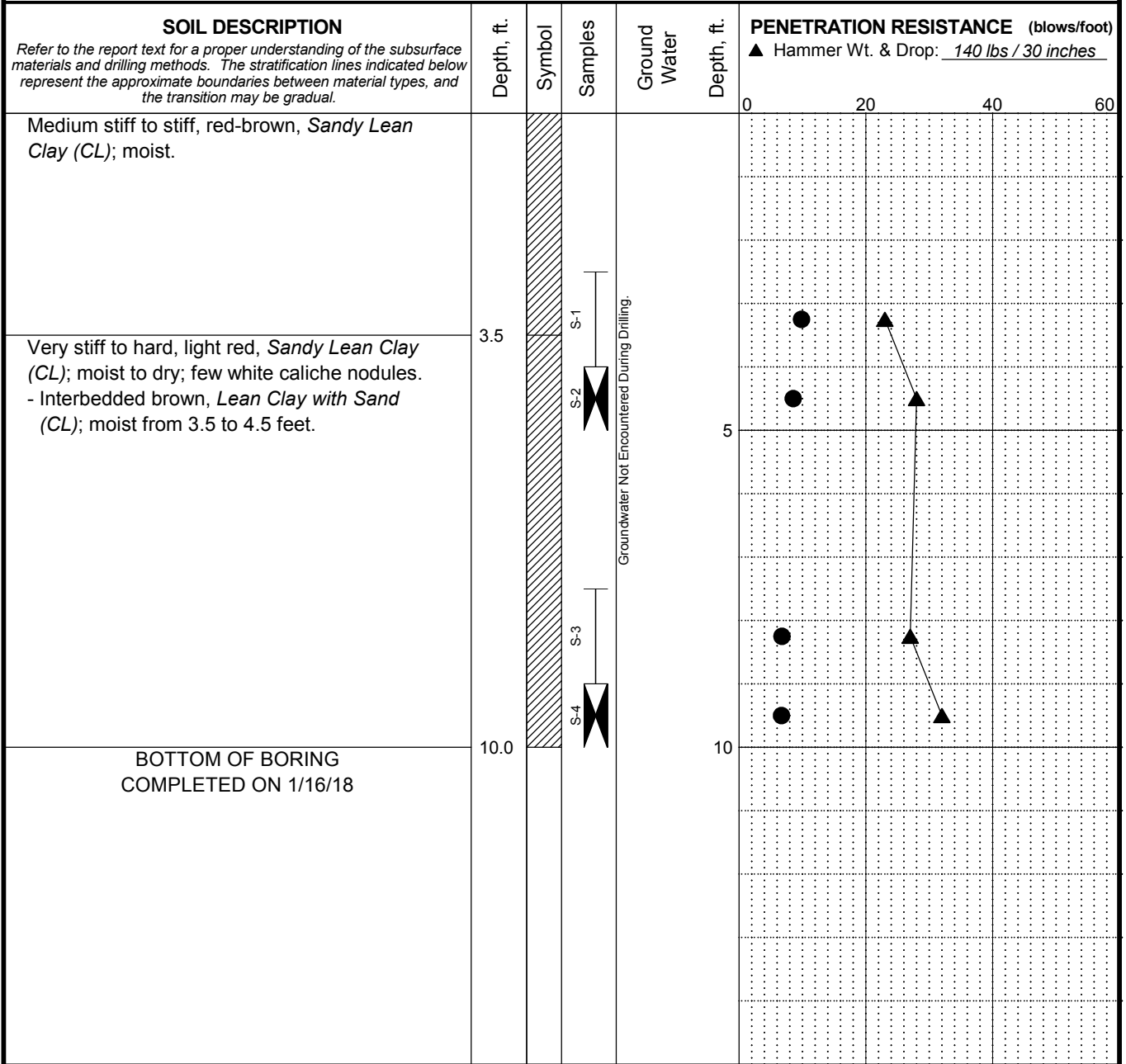
April 2018 23-1-01675-004

**SHANNON & WILSON, INC.**  
Geotechnical and Environmental Consultants

**FIG. A-34**

MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>10 ft.</u>	Northing: <u>1,234,405 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4281.9 ft.</u>	Easting: <u>849,846 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- ⊥ Standard Penetration Test
- ⊓ Modified California Sampler

● % Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING T-16**

April 2018

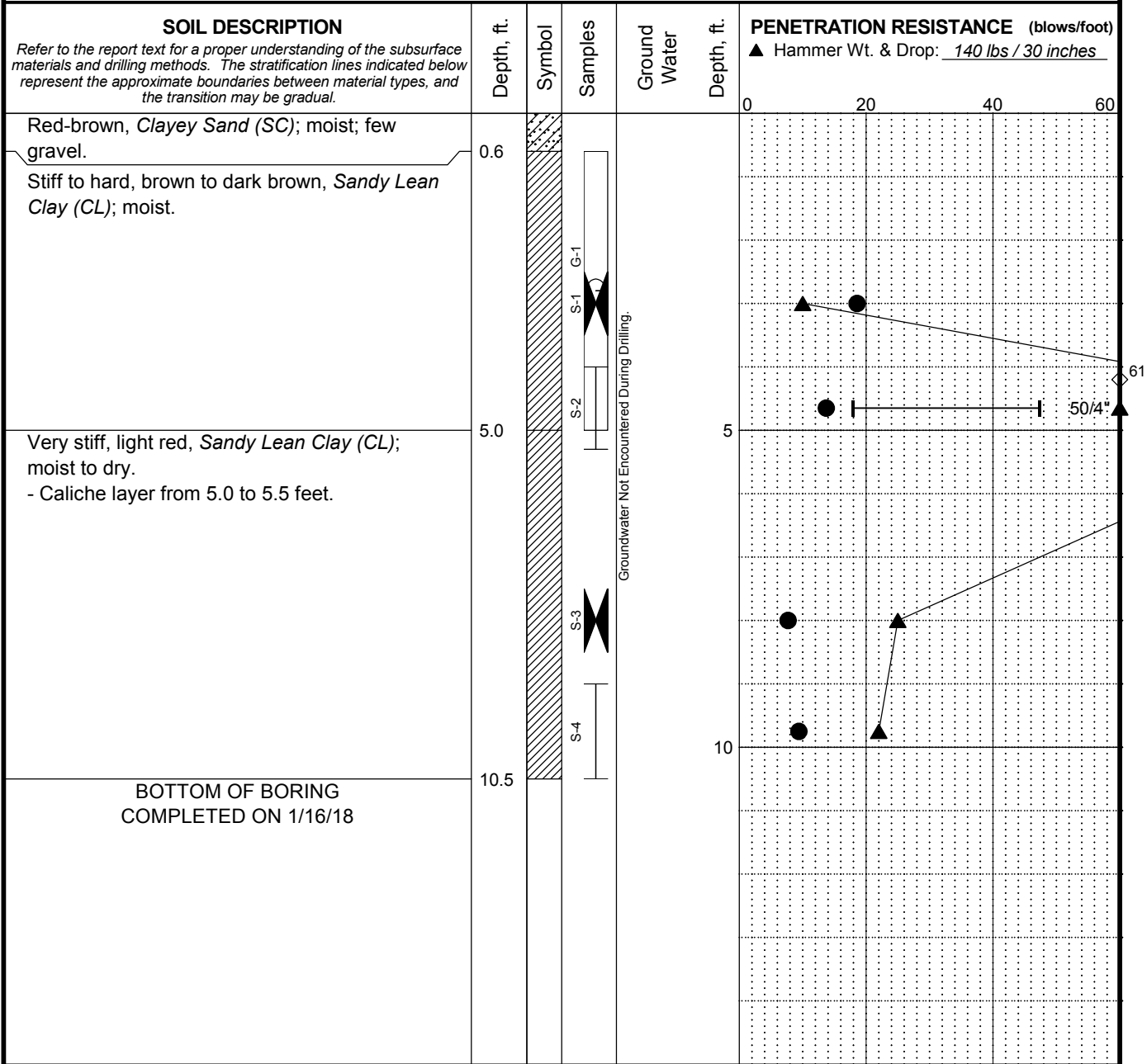
23-1-01675-004

**SHANNON & WILSON, INC.**  
Geotechnical and Environmental Consultants

**FIG. A-35**

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>10.5 ft.</u>	Northing: <u>1,234,564 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>6 in.</u>
Top Elevation: <u>4281.9 ft.</u>	Easting: <u>849,980 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- Grab Sample
- Modified California Sampler
- Standard Penetration Test

- % Fines (<0.075mm)
- % Water Content
- Plastic Limit Liquid Limit
- Natural Water Content

**NOTES**

- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
- The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
- The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING T-17**

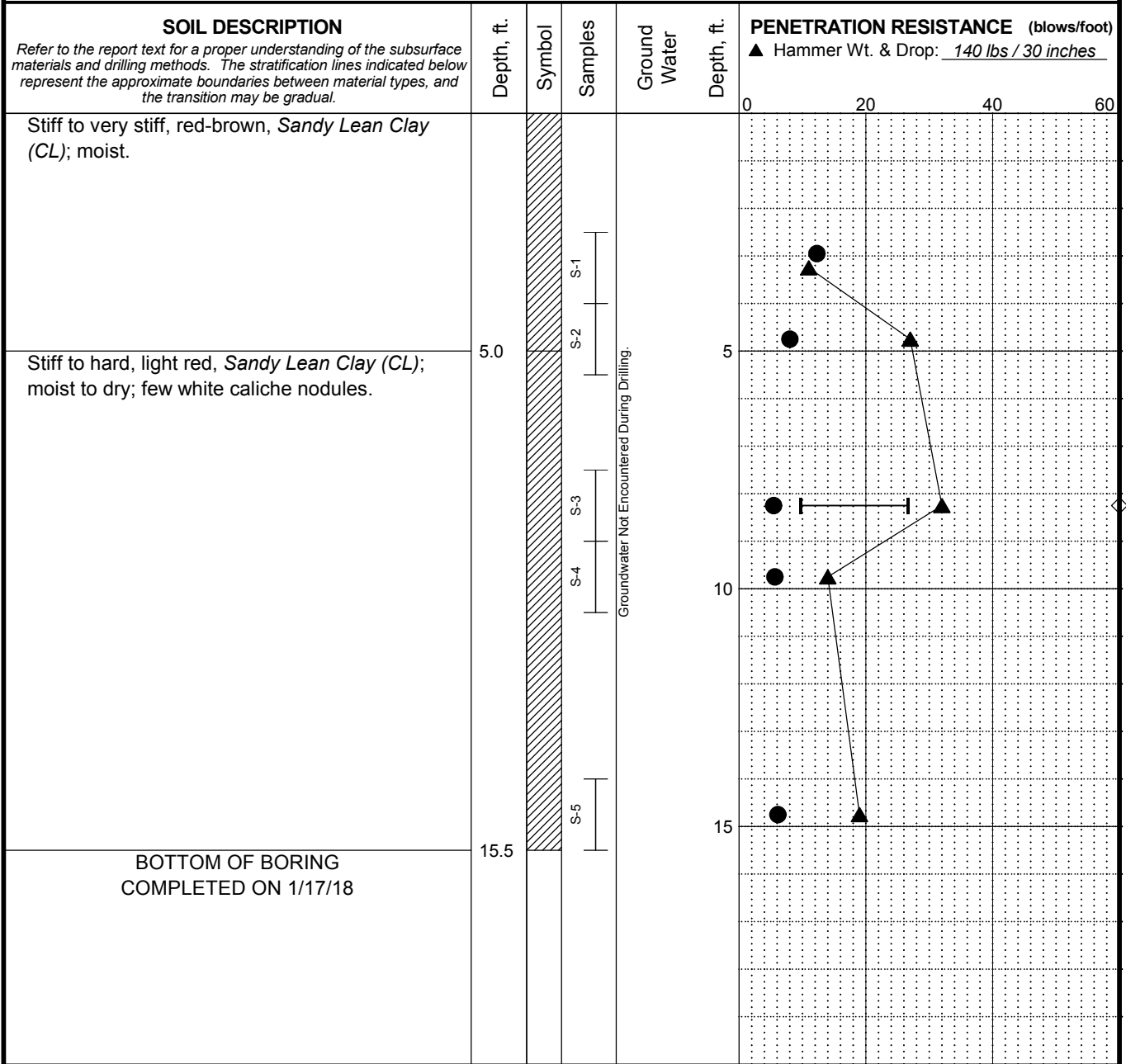
April 2018 23-1-01675-004

<b>SHANNON &amp; WILSON, INC.</b> Geotechnical and Environmental Consultants	<b>FIG. A-36</b>
---	------------------

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18



Total Depth: <u>15.5 ft.</u>	Northing: <u>1,232,007 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4274.7 ft.</u>	Easting: <u>851,890 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

\* Sample Not Recovered

┆ Standard Penetration Test

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit —●— Liquid Limit

Natural Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

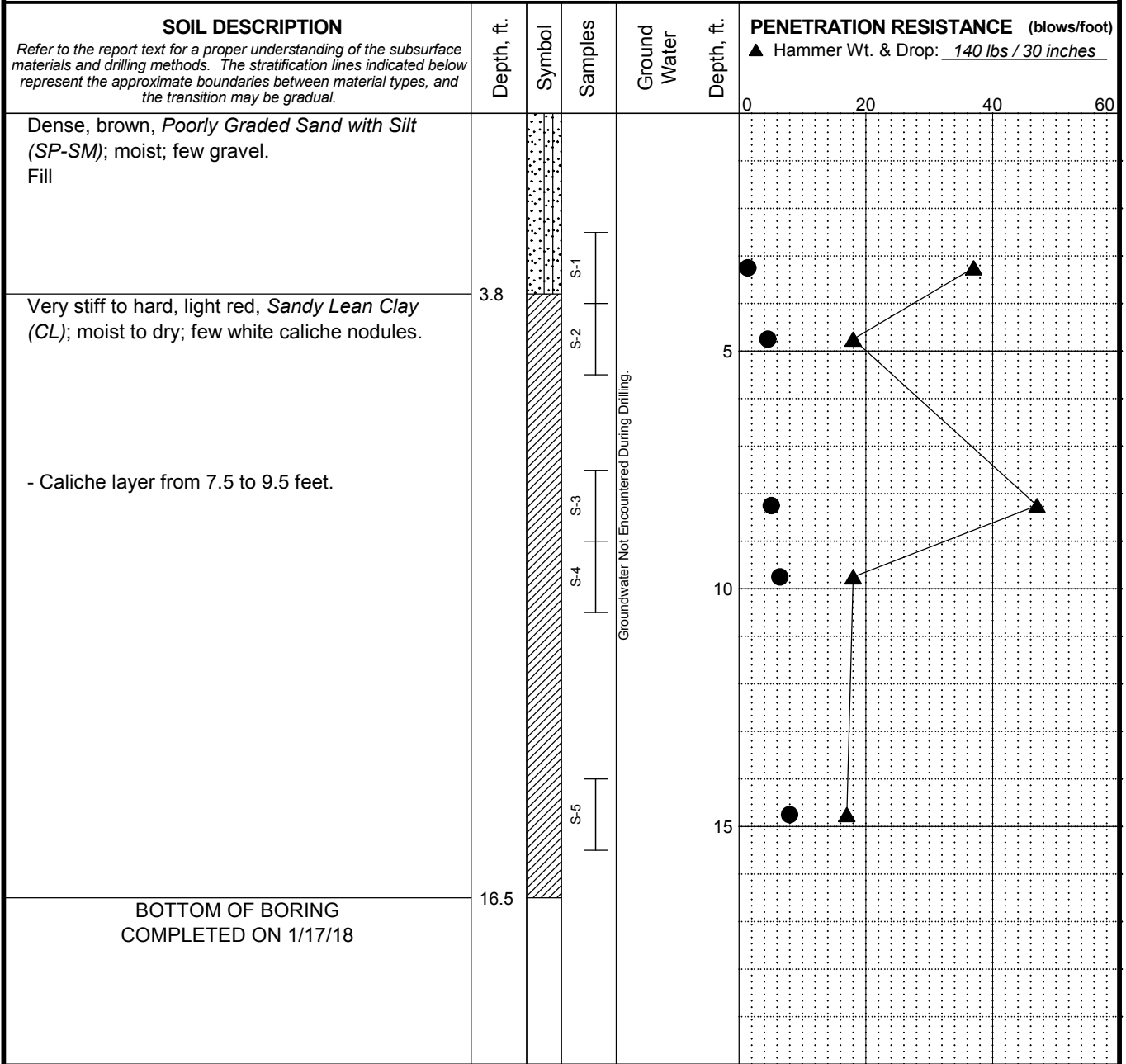
**LOG OF BORING U-01**

April 2018 23-1-01675-004

<b>SHANNON &amp; WILSON, INC.</b> Geotechnical and Environmental Consultants	<b>FIG. A-37</b>
---	------------------

MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>16.5 ft.</u>	Northing: <u>1,231,285 ft.</u>	Drilling Method: <u>Hollow-Stem Auger</u>	Hole Diam.: <u>7 in.</u>
Top Elevation: <u>4273.1 ft.</u>	Easting: <u>851,431 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- ⊥ Standard Penetration Test

● % Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING U-02**

April 2018

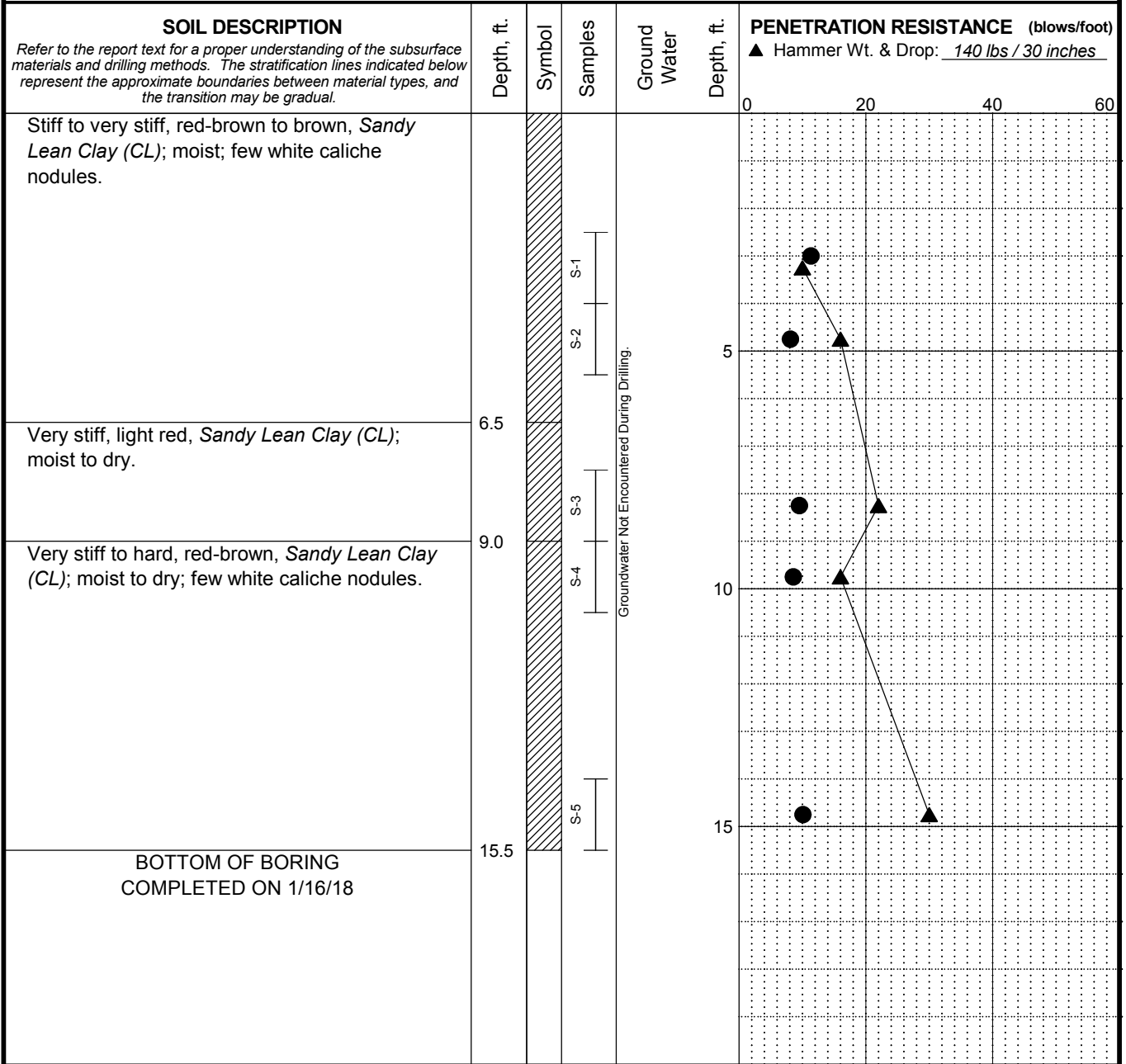
23-1-01675-004

**SHANNON & WILSON, INC.**  
Geotechnical and Environmental Consultants

**FIG. A-38**

MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>15.5 ft.</u>	Northing: <u>1,230,982 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4272.1 ft.</u>	Easting: <u>851,081 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

- \* Sample Not Recovered
- ⊥ Standard Penetration Test

● % Water Content

**NOTES**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING U-03**

April 2018

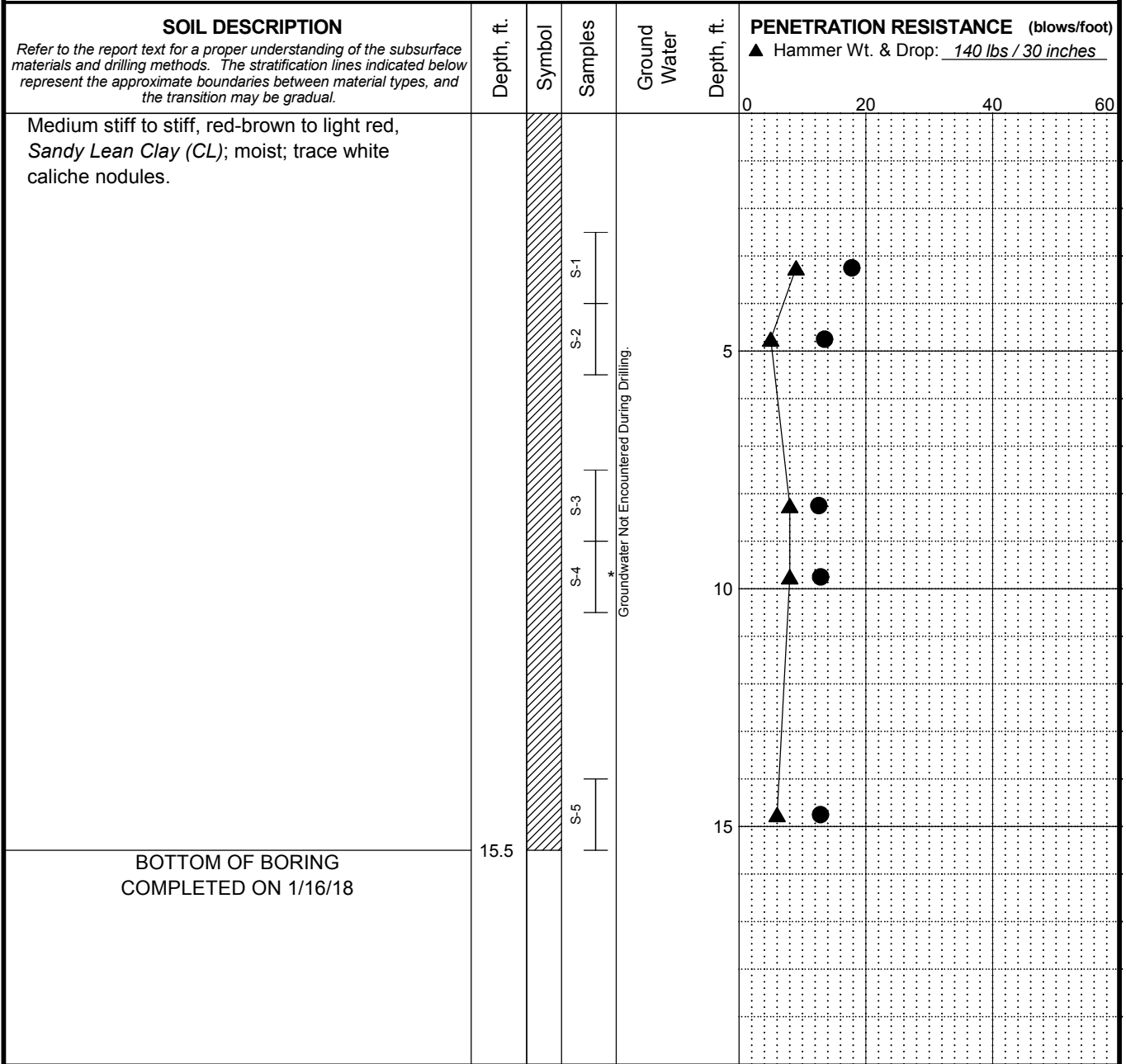
23-1-01675-004

**SHANNON & WILSON, INC.**  
Geotechnical and Environmental Consultants

**FIG. A-39**

MASTER LOG E. POCKET/PEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

Total Depth: <u>15.5 ft.</u>	Northing: <u>1,230,685 ft.</u>	Drilling Method: <u>Solid-Stem Auger</u>	Hole Diam.: <u>4 in.</u>
Top Elevation: <u>4267.6 ft.</u>	Easting: <u>850,736 ft.</u>	Drilling Company: <u>Vine Laboratories</u>	Rod Type.: <u>AWJ</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>CME-55 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: <u>-</u>	Other Comments: _____	



**LEGEND**

\* Sample Not Recovered

⊥ Standard Penetration Test

● % Water Content

- NOTES**
1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
  2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
  3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
  4. Groundwater level, if indicated above, is for the date specified and may vary.
  5. USCS designation is based on visual-manual classification and selected lab testing.

FY18 Construct DCP  
and Relocate CATM  
Cannon Air Force Base, New Mexico

**LOG OF BORING U-04**

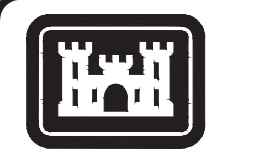
April 2018 23-1-01675-004

<b>SHANNON &amp; WILSON, INC.</b> Geotechnical and Environmental Consultants	<b>FIG. A-40</b>
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MASTER LOG E. POCKETPEN 23-1-01675-002 CANNON AFB.GPJ 3/20/18

DRAWING INDEX - VOLUME 2

Table with columns: SHT NO, TITLE, SHT NO, TITLE, SHT NO, TITLE, SHT NO, TITLE. Categories include GENERAL INFORMATION, CATM WINDOW TYPES, CATM ELECTRICAL, CATM ARCHITECTURAL, CATM MECHANICAL, CATM PLUMBING, CATM STRUCTURAL, CATM FIRE PROTECTION, CATM TELECOMMUNICATIONS, ROD AND GUN CLUB MECHANICAL, ROD AND GUN CLUB ELECTRICAL, ROD AND GUN CLUB ARCHITECTURAL, ROD AND GUN CLUB FOUNDATION PLAN, ROD AND GUN CLUB BUILDING ELEVATIONS, ROD AND GUN CLUB BUILDING SECTIONS, ROD AND GUN CLUB FINISH PLAN, ROD AND GUN CLUB ENLARGED PLANS AND ELEVATIONS, ROD AND GUN CLUB FIRE PROTECTION, ROD AND GUN CLUB PLUMBING, ROD AND GUN CLUB PLUMBING EQUIPMENT SCHEDULES, ROD AND GUN CLUB PLUMBING ISOMETRICS, SKEEHOUSE, TRAPHOUSE.



US Army Corps of Engineers

Table with columns: SHEET NO, DATE, REVISION NO, DESCRIPTION. Includes revision history for sheets 1A101.1, 1A101.2, 1A101.3, 1A101.4.

Table with columns: DESIGNED BY, DRAWN BY, CHECKED BY, SUBMITTED BY, SIZE, ANS I 'D'. Includes project details for Stanley Consultants.

Table with columns: CANNON AFB, NM; FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES; DRAWING INDEX - VOLUME 2.

SHEET ID  
GI005.2

DRAWING INDEX - VOLUME 1

SHT NO	TITLE	SHT NO	TITLE	SHT NO	TITLE
<b>GENERAL INFORMATION</b>					
GI001	COVER SHEET - VOLUME 1	<b>CIVIL GRADING (CONTINUED)</b>			
GI002	PROJECT DATA AND DESIGN TEAM - VOLUME 1	CG111.1	GRADING PLAN - CATM & TRAP - SKEET	CU501	CIVIL UTILITY DETAILS - CARGO PAD
<b>GI003.2</b>	<b>DRAWING INDEX - VOLUME 1</b>	<b>CG112.2</b>	<b>GRADING PLAN - CATM &amp; TRAP - SKEET</b>	CU502	CIVIL UTILITY DETAILS - CARGO PAD
GI006	GENERAL LEGEND	CG113.1	GRADING PLAN - CATM & TRAP - SKEET	CU503	CIVIL UTILITY DETAILS - CARGO PAD
GI007	ABBREVIATIONS	CG114.1	GRADING PLAN - CATM & TRAP - SKEET	CU504	CIVIL UTILITY DETAILS - CARGO PAD
		CG115.1	GRADING PLAN - CATM & TRAP - SKEET	CU505	CATM FIRE WATER STORAGE TANK DETAIL
<b>SURVEY DRAWINGS</b>					
V-100-146	EXISTING SITE DRAWINGS	CG201	DCP STORM AND CULVERT PROFILES	CU601.1	CIVIL UTILITY ALIGNMENT TABLES
		CG202	CATM STORM AND DITCH PROFILES	CU602	CIVIL UTILITY PIPE TABLES
<b>CIVIL GENERAL</b>					
C-001	CIVIL LEGEND, ABBREVIATIONS AND NOTES	<b>CG501.1</b>	<b>CIVIL DETAILS - CATM &amp; TRAP</b>	CU603	CIVIL UTILITY STRUCTURE AND APPURTENANCE TABLES
GC001	SITE LOCATION PLAN	<b>CG502.2</b>	<b>CIVIL DETAILS - SLOPED INLET STRUCTURES</b>	CU604	CIVIL SANITARY PIPE AND STRUCTURE TABLES
<b>GC100.1</b>	<b>AIRFIELD OPERATIONAL SAFETY NOTES</b>	CG503	CIVIL DETAILS - MEDIAN DROP INLET JUNCTION BOX, GRATES, NOTES, & QUANTITIES	<b>SITE ELECTRICAL</b>	
GC101	AIRFIELD PHASING & SAFETY PLAN	CG504	CIVIL DETAILS - AIRFIELD GUIDANCE SIGN GRADING	E-001	ELECTRICAL LEGEND - SHEET 1
GC102	CLOSURE & BARRICADE PLAN - PHASE 1			E-002	ELECTRICAL LEGEND - SHEET 2
GC501	PAVEMENT MARKING DETAILS	CG701	AIRFIELD GRADING CROSS SECTIONS	ED101	SITE DEMOLITION - CARGO PAD & AIRFIELD LIGHTING
		CG702	AIRFIELD GRADING CROSS SECTIONS	<b>ED103.1</b>	<b>SITE DEMOLITION - CATM &amp; TRAP-SKEET</b>
<b>CIVIL DEMOLITION</b>					
CD100	SITE DEMOLITION - KEYPLAN	CG703	AIRFIELD GRADING CROSS SECTIONS	ED104	SITE DEMOLITION - CATM & TRAP-SKEET
CD101	SITE DEMOLITION - CARGO PAD	CG704	AIRFIELD GRADING CROSS SECTIONS		
CD102	SITE DEMOLITION - CARGO PAD	CG705	AIRFIELD GRADING CROSS SECTIONS	<b>ES103.1</b>	<b>ELECTRICAL SITE PLAN</b>
CD103	SITE DEMOLITION - CATM & TRAP - SKEET	CG706	AIRFIELD GRADING CROSS SECTIONS	<b>ES104.1</b>	<b>ELECTRICAL SITE PLAN</b>
CD104	SITE DEMOLITION - CATM & TRAP - SKEET	CG707	AIRFIELD GRADING CROSS SECTIONS	<b>ES106.1</b>	<b>ELECTRICAL SITE PLAN</b>
CD105	SITE DEMOLITION - CATM & TRAP - SKEET	CG708	AIRFIELD GRADING CROSS SECTIONS	ES111	ELECTRICAL SITE PLAN
CD106	SITE DEMOLITION - CATM & TRAP - SKEET	CG709	AIRFIELD GRADING CROSS SECTIONS	ES112	ELECTRICAL SITE PLAN
		CG710	AIRFIELD GRADING CROSS SECTIONS	ES113	ELECTRICAL SITE PLAN
<b>CIVIL SITE AND PAVING</b>					
CS100	SITE LAYOUT - KEYPLAN	CG711	AIRFIELD GRADING CROSS SECTIONS	ES114	ELECTRICAL SITE PLAN
CS101	SITE LAYOUT - CARGO PAD	CG712	AIRFIELD GRADING CROSS SECTIONS	ES116	ELECTRICAL SITE PLAN
CS102	"NOT USED"	CG713	AIRFIELD GRADING CROSS SECTIONS	ES117	ELECTRICAL SITE PLAN
<b>CS103.1</b>	<b>SITE LAYOUT - CARGO PAD</b>	CG714	AIRFIELD GRADING CROSS SECTIONS	ES118	ELECTRICAL SITE PLAN
<b>CS104.1</b>	<b>SITE LAYOUT - CARGO PAD</b>			ES119	ELECTRICAL SITE PLAN
CS105	"NOT USED"	CP100	PCCP JOINT LAYOUT - KEYPLAN	ES501	ELECTRICAL SITE DETAILS CATHODIC PROTECTION
CS106	"NOT USED"	<b>CP101.1</b>	<b>PCCP JOINT LAYOUT - CARGO PAD</b>	ES502	ELECTRICAL SITE DETAILS
CS107	SITE LAYOUT - CARGO PAD	CP103	PCCP JOINT LAYOUT - CARGO PAD	ES503	ELECTRICAL SITE DETAILS
		CP104	PCCP JOINT LAYOUT - CARGO PAD		
		CP501	PCCP JOINT DETAILS - CARGO PAD	<b>SITE LIGHTING</b>	
		CP502	PCCP JOINT DETAILS - CARGO PAD	EA001	ELECTRICAL AIRFIELD LIGHTING LEGEND
				EA101	ELECTRICAL AIRFIELD LIGHTING PLAN
CS111	SITE LAYOUT - CATM & TRAP -SKEET			EA103	ELECTRICAL AIRFIELD LIGHTING PLAN
CS112	SITE LAYOUT - CATM & TRAP -SKEET	CX-101	PCCP ELEVATION PLAN - CARGO PAD	EA104	ELECTRICAL AIRFIELD LIGHTING PLAN
CS113	SITE LAYOUT - CATM & TRAP -SKEET	CX-103	PCCP ELEVATION PLAN - CARGO PAD	EA106	ELECTRICAL AIRFIELD LIGHTING PLAN
<b>CS114.1</b>	<b>SITE LAYOUT - CATM &amp; TRAP -SKEET</b>	CX-104	PCCP ELEVATION PLAN - CARGO PAD	EA501	ELECTRICAL AIRFIELD LIGHTING DETAILS GROUNDING AND DUCT BANKS
CS115	SITE LAYOUT - CATM & TRAP -SKEET			EA502	ELECTRICAL AIRFIELD LIGHTING DETAILS DUCT BANKS
		<b>CIVIL UTILITY</b>			
CS201	CARGO PAD PROFILES	CU100	SITE UTILITIES LAYOUT - KEYPLAN	EA503	ELECTRICAL AIRFIELD LIGHTING DETAILS RUNWAY AND TAXIWAY EDGE LIGHTS
CS202	RAPTOR ROAD PROFILES	CU101	"NOTUSED"	EA504	ELECTRICAL AIRFIELD LIGHTING DETAILS BASE CAN INSTALLATION
CS203	CATM PROFILES	CU102	"NOT USED"	EA505	ELECTRICAL AIRFIELD LIGHTING DETAILS MISCELLANEOUS
CS204	CATM PROFILES	CU103	SITE UTILITIES - CARGO PAD	EA506	ELECTRICAL AIRFIELD LIGHTING DETAILS RUNWAY GUARD LIGHTS
		CU104	SITE UTILITIES - CARGO PAD	EA507	ELECTRICAL AIRFIELD LIGHTING DETAILS GUIDANCE SIGNS
<b>CS301.1</b>	<b>AIRFIELD TYPICAL SECTIONS</b>	CU105	"NOT USED"	EA508	ELECTRICAL AIRFIELD LIGHTING DETAILS JUNCTION CAN PLAZA
CS302	ROADWAY & PARKING TYPICAL SECTIONS	CU106	SITE UTILITIES - CARGO PAD	EA601	AIRFIELD LIGHTING AND CCR SCHEDULE
				EA602	GUIDANCE SIGN SCHEDULE
CS401	TRAP AND SKEET ENLARGED PLAN	<b>CU111.2</b>	<b>SITE UTILITIES - CATM &amp; TRAP - SKEET</b>	<b>SITE TELECOMMUNICATION</b>	
<b>CS402.1</b>	<b>SKEET AND TRAP TWO COURSE LAYOUT</b>	<b>CU112.2</b>	<b>SITE UTILITIES - CATM &amp; TRAP - SKEET</b>	ET103	SITE LAYOUT - CARGO PAD
CS501	SITE DETAILS	<b>CU113.2</b>	<b>SITE UTILITIES - CATM &amp; TRAP - SKEET</b>	<b>ET104.1</b>	<b>SITE LAYOUT - CARGO PAD</b>
CS502	SITE DETAILS	CU114	SITE UTILITIES - CATM & TRAP - SKEET		
<b>CS503.1</b>	<b>SITE DETAILS</b>	CU115	"NOT USED"	ET111	TELECOMMUNICATIONS SITE PLAN
CS504	SITE DETAILS	CU116	SITE UTILITIES - CATM & TRAP - SKEET	ET112	TELECOMMUNICATIONS SITE PLAN
CS505	SITE DETAILS	CU117.1	SITE UTILITIES - CATM & TRAP - SKEET	ET113	TELECOMMUNICATIONS SITE PLAN
CS506	SITE DETAILS	CU118	SITE UTILITIES - CATM & TRAP - SKEET	ET114	TELECOMMUNICATIONS SITE PLAN
<b>CS507.1</b>	<b>SITE DETAILS</b>	CU119	SITE UTILITIES - CATM & TRAP - SKEET	ET116	TELECOMMUNICATIONS SITE PLAN
		CU120	SITE UTILITIES - CATM & TRAP - SKEET	ET117	TELECOMMUNICATIONS SITE PLAN
CS601	HORIZONTAL CONTROL DATA TABLES	CU121	SITE UTILITIES - CATM & TRAP - SKEET	ET118	TELECOMMUNICATIONS SITE PLAN
		CU122	SITE UTILITIES - CATM & TRAP - SKEET	ET119	TELECOMMUNICATIONS SITE PLAN
<b>CIVIL GRADING</b>					
CG100	GRADING-KEYPLAN	CU201	CIVIL UTILITIES SANITARY SEWER PROFILES		
CG101.1	GRADING PLAN - CARGO PAD	CU202	CIVIL UTILITIES SANITARY SEWER SERVICE PROFILES		
CG102	"NOT USED"	CU203	PRIMARY ELECTRIC PROFILES		
CG103.1	GRADING PLAN - CARGO PAD	CU204	PRIMARY ELECTRIC PROFILES		
CG104.1	GRADING PLAN - CARGO PAD	CU205	WATER MAIN WM1 PROFILES		
		CU206	WATER MAIN WM2 PROFILES		
		CU207	WATER MAIN WM2 PROFILES		
		CU208	WATER MAIN WM3 PROFILES		
		CU209	WATER MAIN WM3 PROFILES		
		CU210	FIRE WATER MAIN PROFILES		
		CU211	FIRE WATER MAIN PROFILES		



US Army Corps of Engineers

MARK	DESCRIPTION	DATE
A	SHEETS CG112, CG501, CG502, CP101, CS103, CS104, CS114, CS402, CS503, CS507, CU111, CU112, CU113, ED103, ES103, ES104, ES106, ET104, GC100, G1003 & G1005 - REVISED A002	10/01/2021
A	SHEETS CG101, CG103, CG104, CG111, CG112, CG113, CG114, CG115, CG502, CU111, CU112, CU113, CU117, & CU607 REVISED	09/21/2021

DESIGNED BY: P. JOHNSON  
 DRAWN BY: B. RILEY  
 CHECKED BY: L. MCULLOUGH  
 SUBMITTED BY: M. LOPEZ  
 SIZE: ANSI 'D'

ISSUE DATE: MAY 2021  
 SOLICITATION NO.: W912P2TR0021  
 CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS  
 ALBUQUERQUE DISTRICT  
 ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
 PHOENIX, AZ 85016

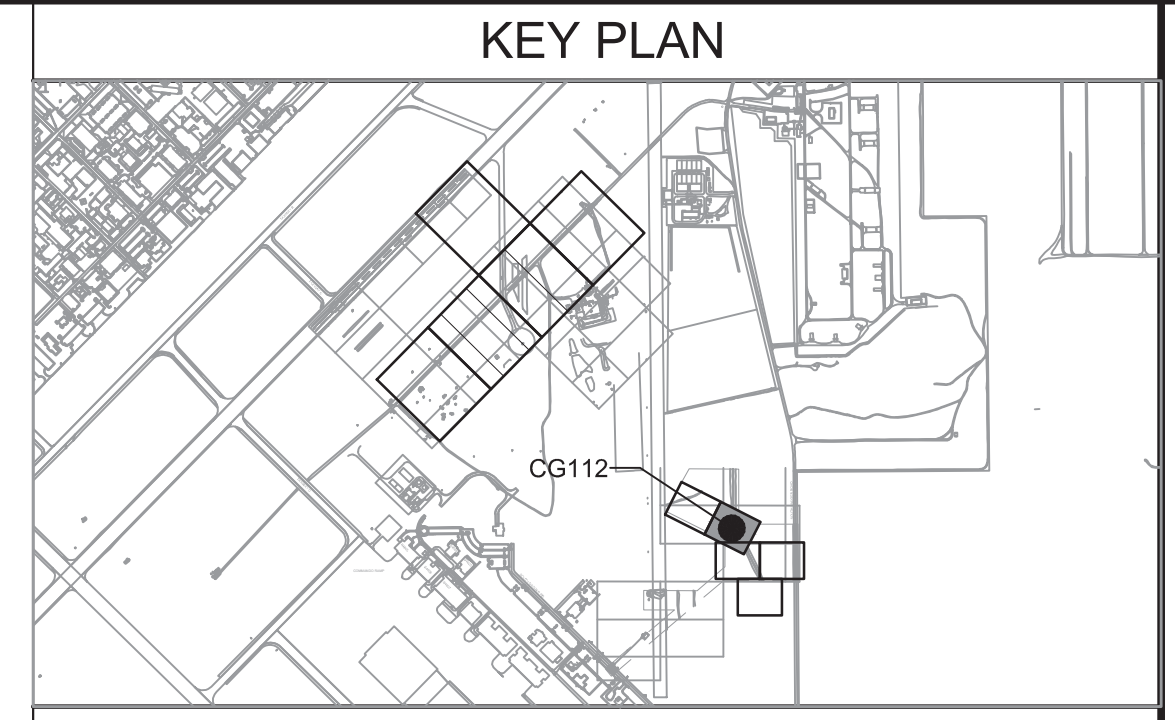
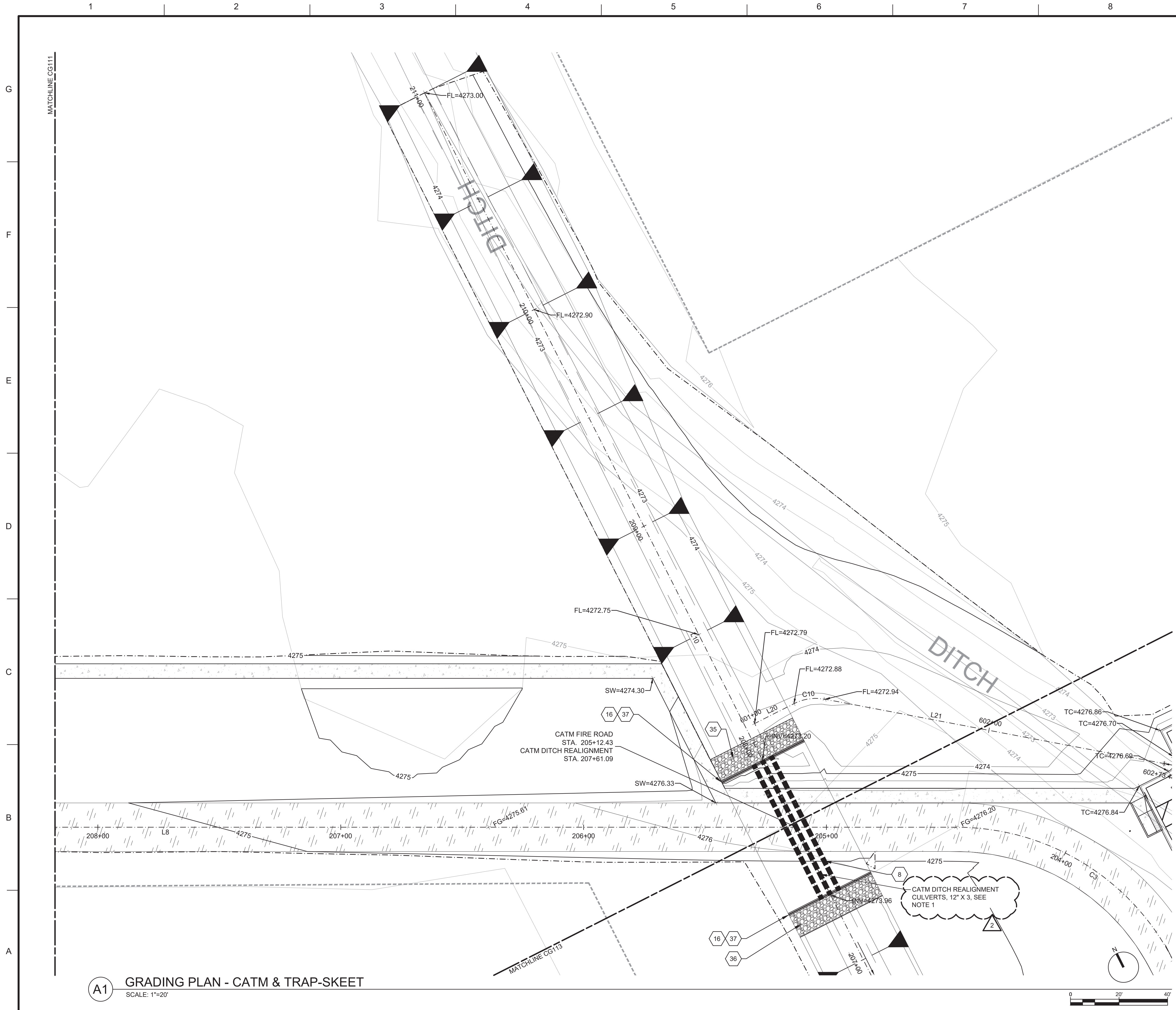
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CANNON AFB, NM  
 FY19 DANGEROUS CARGO PAD/ RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
 CZQC143001

DRAWING INDEX - VOLUME 1

SHEET ID  
**GI003.2**



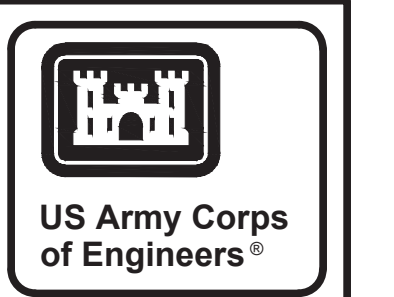


**GENERAL SHEET NOTES**

1. REFER TO CG202 FOR CULVERT PROFILES AND CS601 FOR CULVERT HORIZONTAL CONTROL.

**KEY NOTES**

- 8 CULVERT PIPE, CLASS IV CONCRETE
- 16 CULVERT HEADWALL, SHT CG501 DET D2
- 35 RIPRAP INLET APRON, SHT CG501 DET D6
- 36 RIPRAP OUTLET APRON, SHT CG501 DET D6
- 37 SAFETY RAIL, SHT CG501 DET A1



MARK	DESCRIPTION	DATE
A	(1 CHANGE) REVISED LABEL - A0002	10/1/21
	UPDATED SHEET TITLE & KEYNOTE 8	09/21/2021

DESIGNED BY:	ISSUE DATE:
DRAWN BY:	DATE:
CHECKED BY:	PROJECT NO.:
APPROVED BY:	CONTRACT NO.:
	ISSUE NO.:
	CONTRACT NO.:
	DATE:
	DESCRIPTION:

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

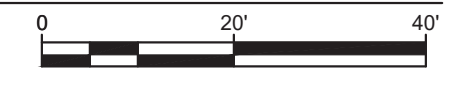
1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016

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FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS  
TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001

GRADING PLAN - CATM & TRAP-SKEET

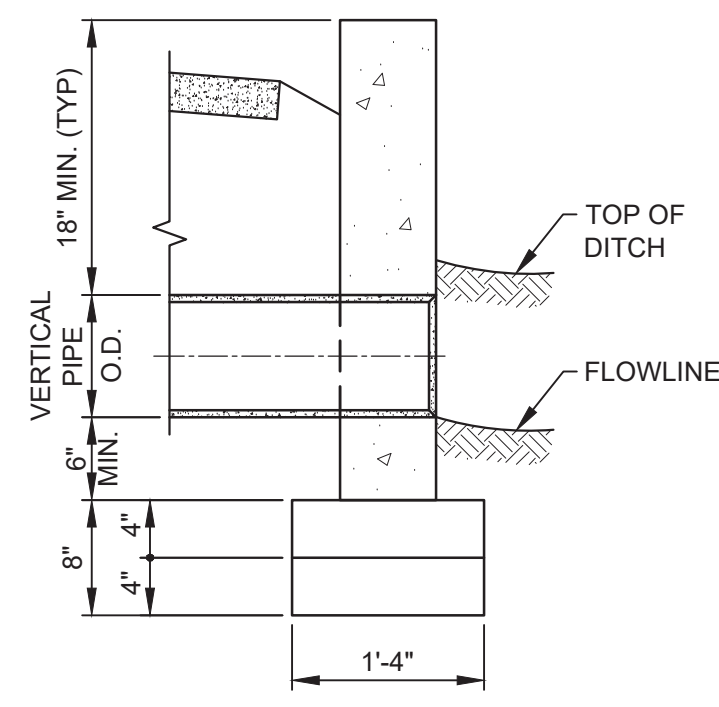
**A1 GRADING PLAN - CATM & TRAP-SKEET**  
SCALE: 1"=20'



SHEET ID  
**CG112.2**

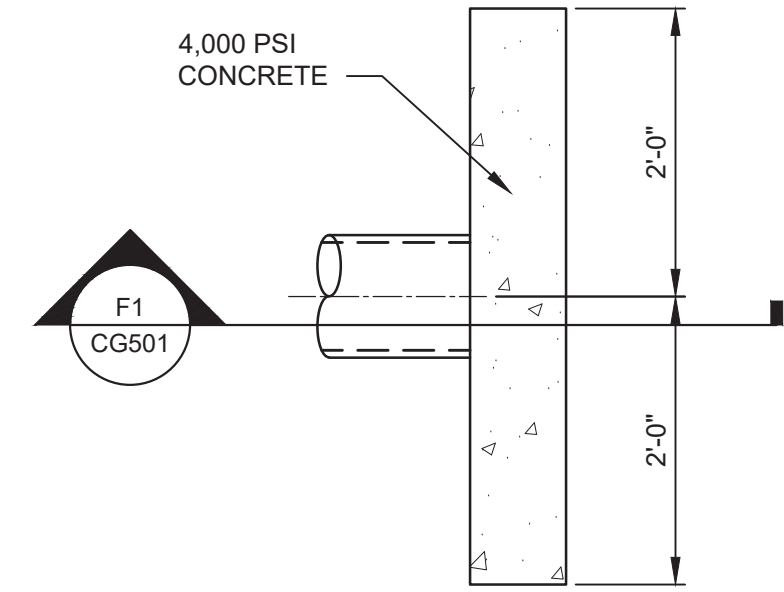
A0002



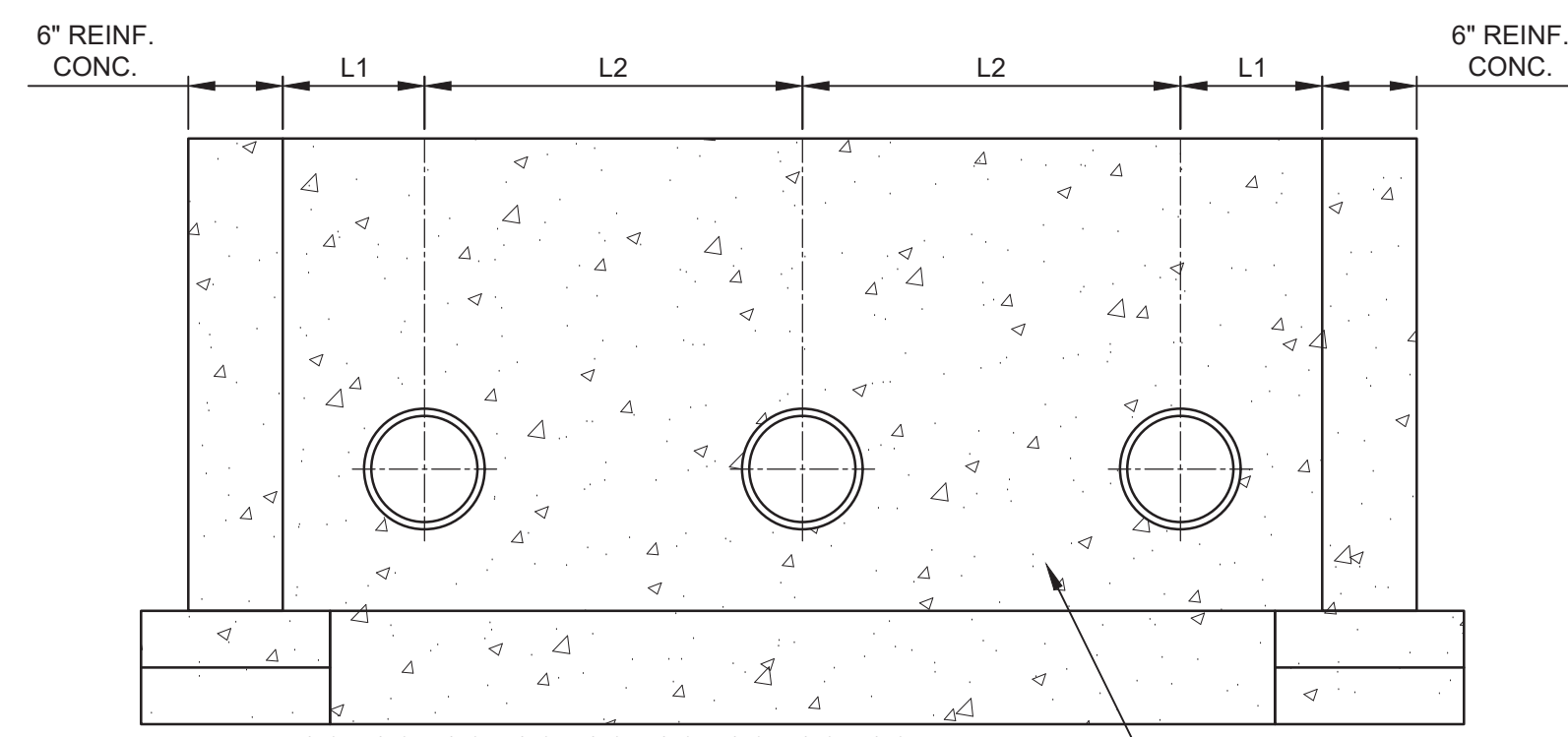


**F1** SECTION  
SCALE: NTS

PIPE SIZE	L1	L2
12" CIRCULAR	0'-10"	2'-10"
23"X14" HERCP	1'-6"	3'-11"



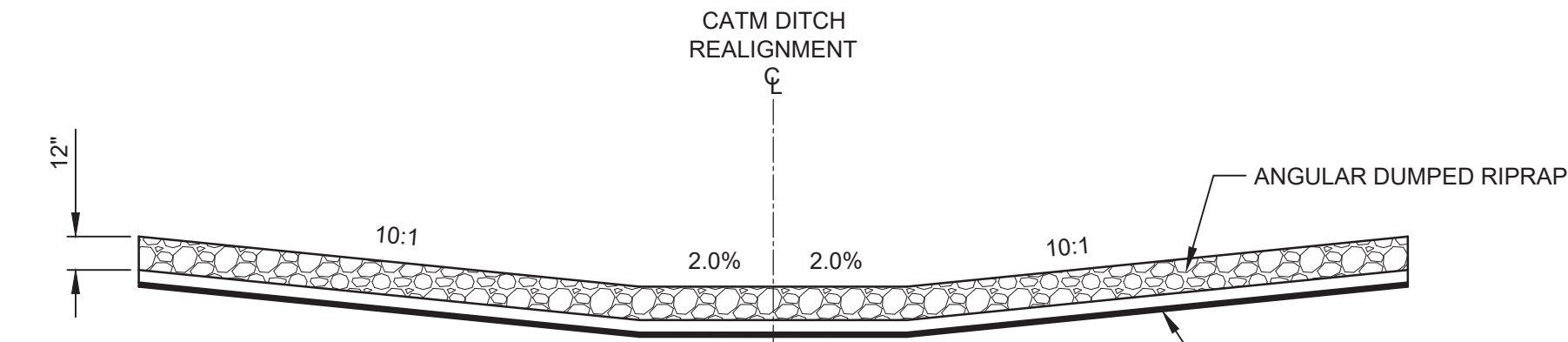
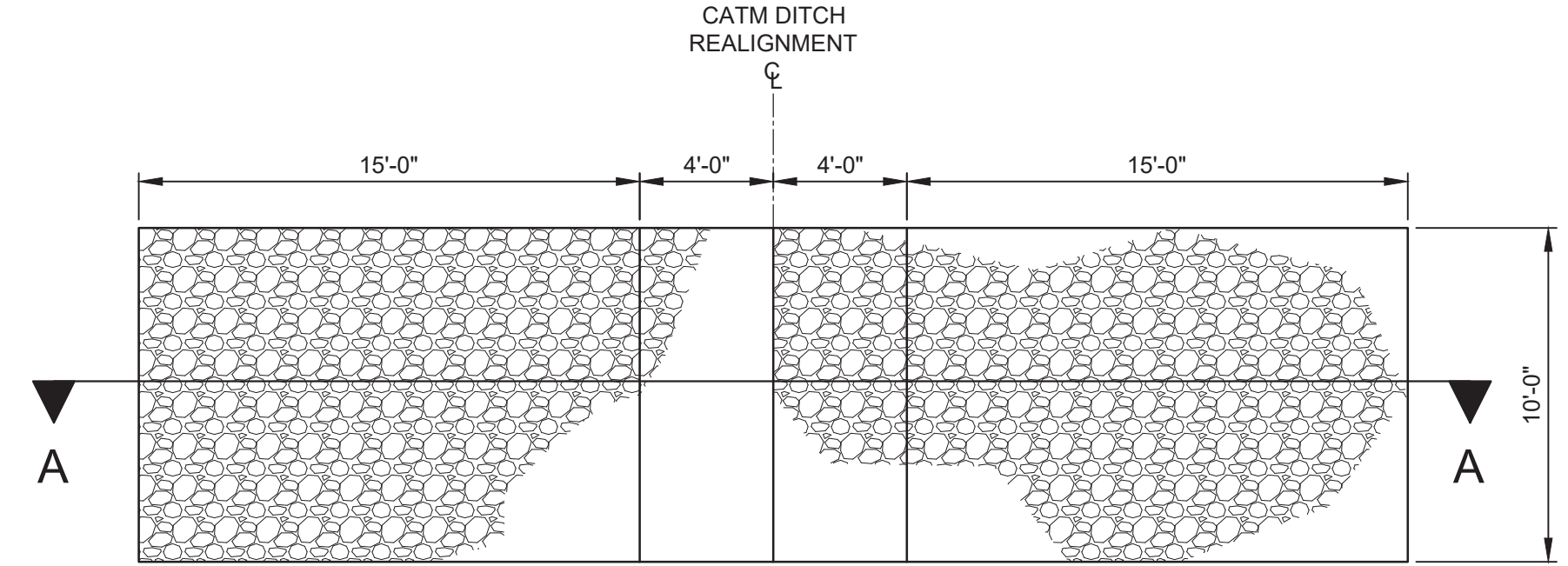
STRAIGHT TYPE



NOTE:  
CONCRETE REINFORCEMENT TO BE #4@12  
ON CENTER EACH WAY.

TRIPLE PIPE HEADWALL

**D2** STRAIGHT HEADWALL DETAIL  
SCALE: NTS

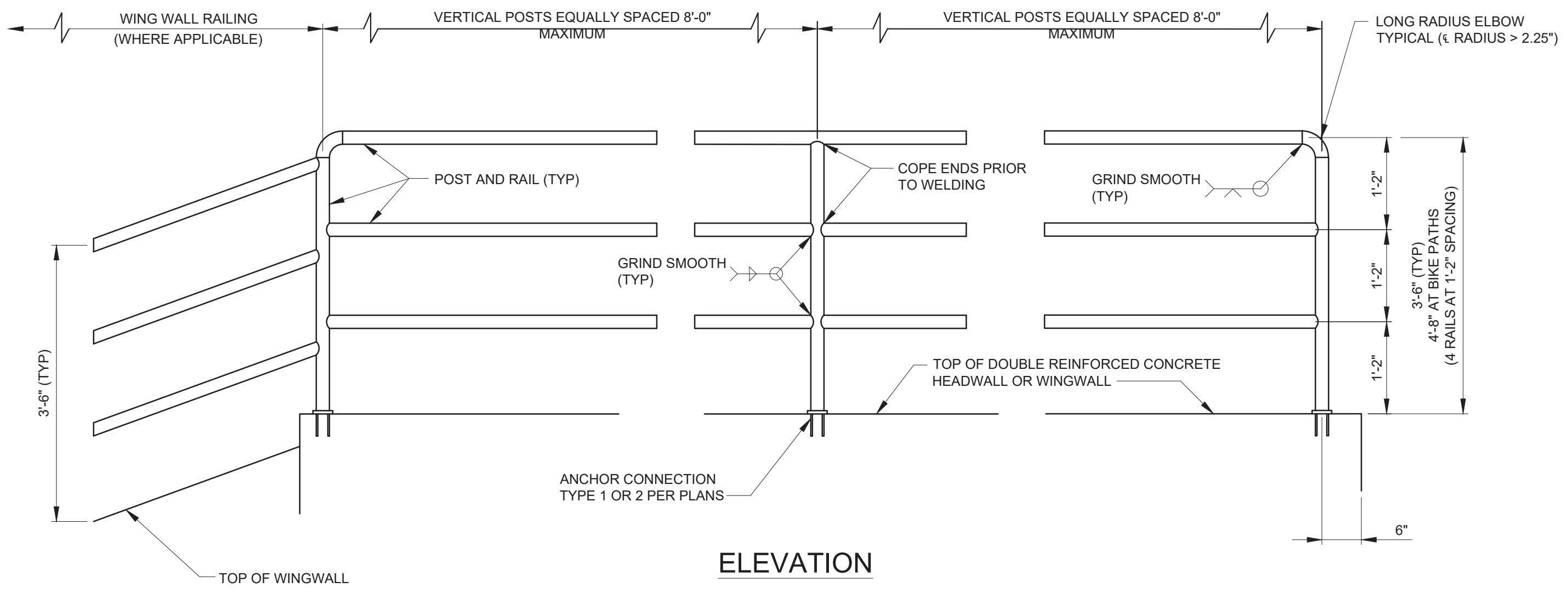


**D6** RIPRAP APRON  
SCALE: NTS

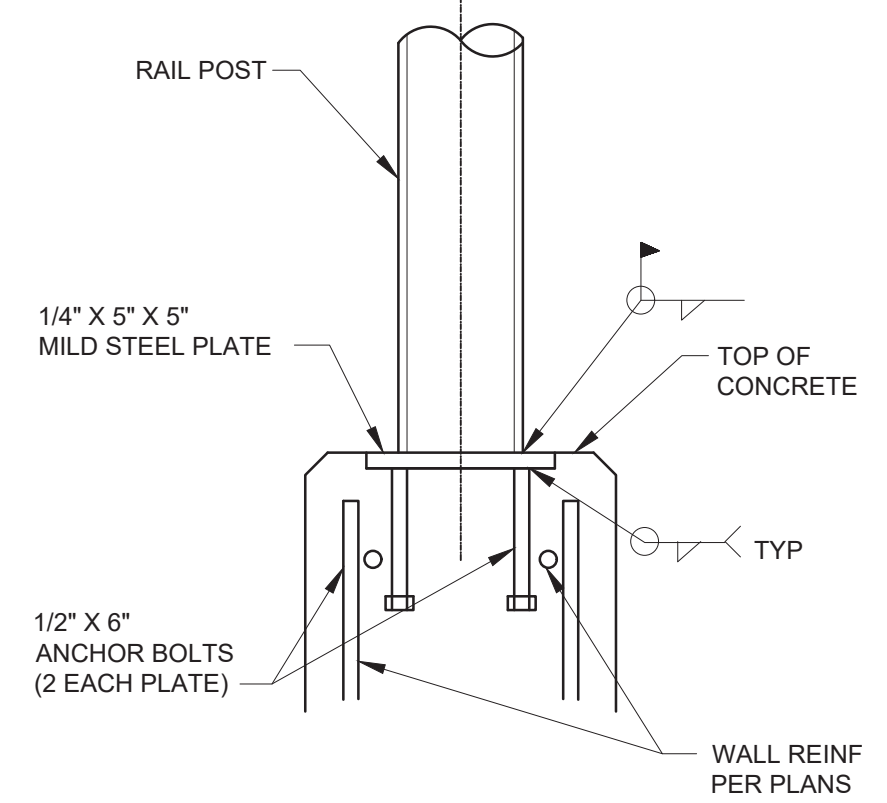
DESIGN GRADATION FOR DUMPED RIPRAP CLASSIFICATION D <sub>50</sub>		
GRADATION	SIZE	D <sub>50</sub> (IN)
% PASSING		6
100	1.7 D <sub>50</sub>	10.2
85	1.4 D <sub>50</sub>	8.4
50	1.15 D <sub>50</sub>	6.9
15	0.60 D <sub>50</sub>	3.6

ROCK RIPRAP GRADATION LIMITS (HEC II, 1989)

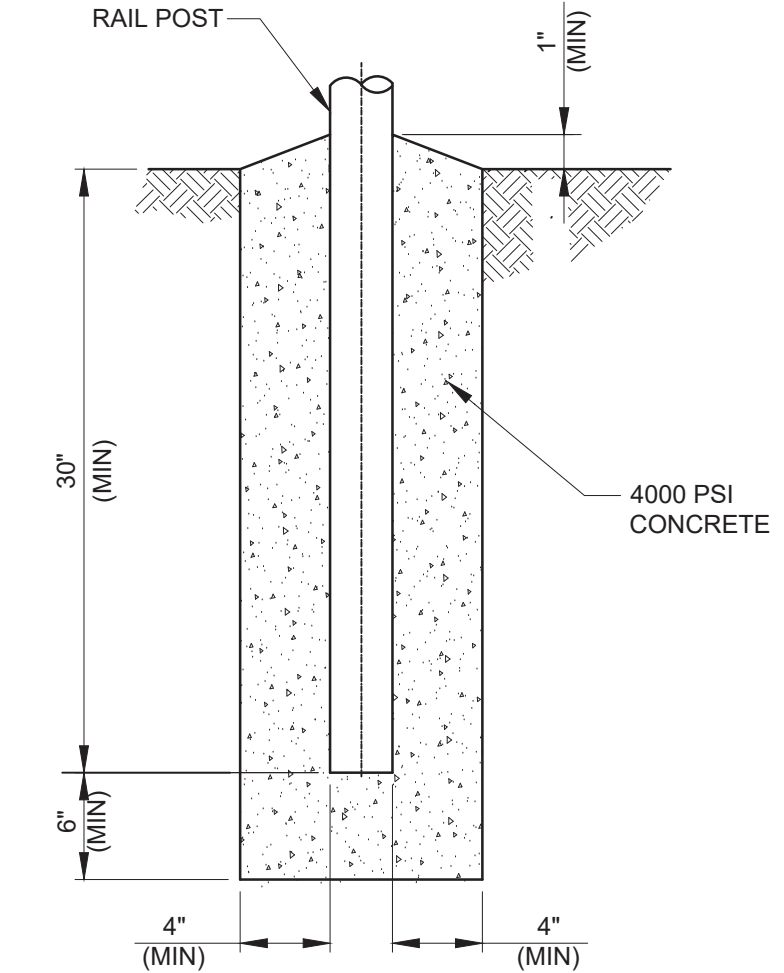
NOTE:  
RIPRAP DIMENSIONS SHOW REPRESENT THE MINIMUM INSTALLATION LIMITS. FIELD CONDITIONS VARY AND MAY REQUIRE ADJUSTMENTS TO DIMENSIONS AND SHAPE.



ELEVATION



**TYPE 1**  
ANCHOR PLATE DETAIL



**TYPE 2**  
GROUND INSTALLATION DETAIL

- NOTES:**
- POSTS AND RAILS SHALL BE 1.90 INCH OUTSIDE DIAMETER HIGH STRENGTH HEAVY INDUSTRIAL STEEL PIPE CONFORMING TO ASTM F1043 MATERIAL GROUP IA-2 (2.72 LB/FT, MINIMUM YIELD STRENGTH = 50 KSI) OR MATERIAL GROUP IC GALVANIZED AFTER FORMING (2.28 LB/FT, MINIMUM YIELD STRENGTH = 50 KSI).
  - PAINT RAIL PER SPECIFICATIONS. SHOP PRIME WITH RUST INHIBITING PRIMER (FIELD REPAIR PRIMER AS NEEDED).
  - VERTICAL POSTS TO BE EVENLY SPACED.
  - REMOVE ALL SHARP EDGES.
  - INSTALL SAFETY RAIL AS REQUIRED BY PLANS OR SPECIFICATIONS.
  - THE EMBEDMENT FOR ANCHOR TYPE SHALL BE LOCATED INSIDE THE WALL REINFORCEMENT CAGE.
  - SAFETY RAIL IS NOT TO BE USED AS A PEDESTRIAN BRIDGE RAIL.

**A1** SAFETY RAIL DETAILS  
SCALE: NTS



DATE	DESCRIPTION	MARK
10/12/11	(1 CHANGE) ADDED NOTE TO DETAIL D2 - A0002	

DESIGNED BY: L. WATZEL	ISSUE DATE: 10/12/11
DRAWN BY: P. MARKS	DATE: 10/12/11
CHECKED BY: I. McCULLOUGH	DESCRIPTION: RIPRAP APRON
SUBMITTED BY: M. LOPEZ	CONTRACT NO.:
SIZE: ANSI D	

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

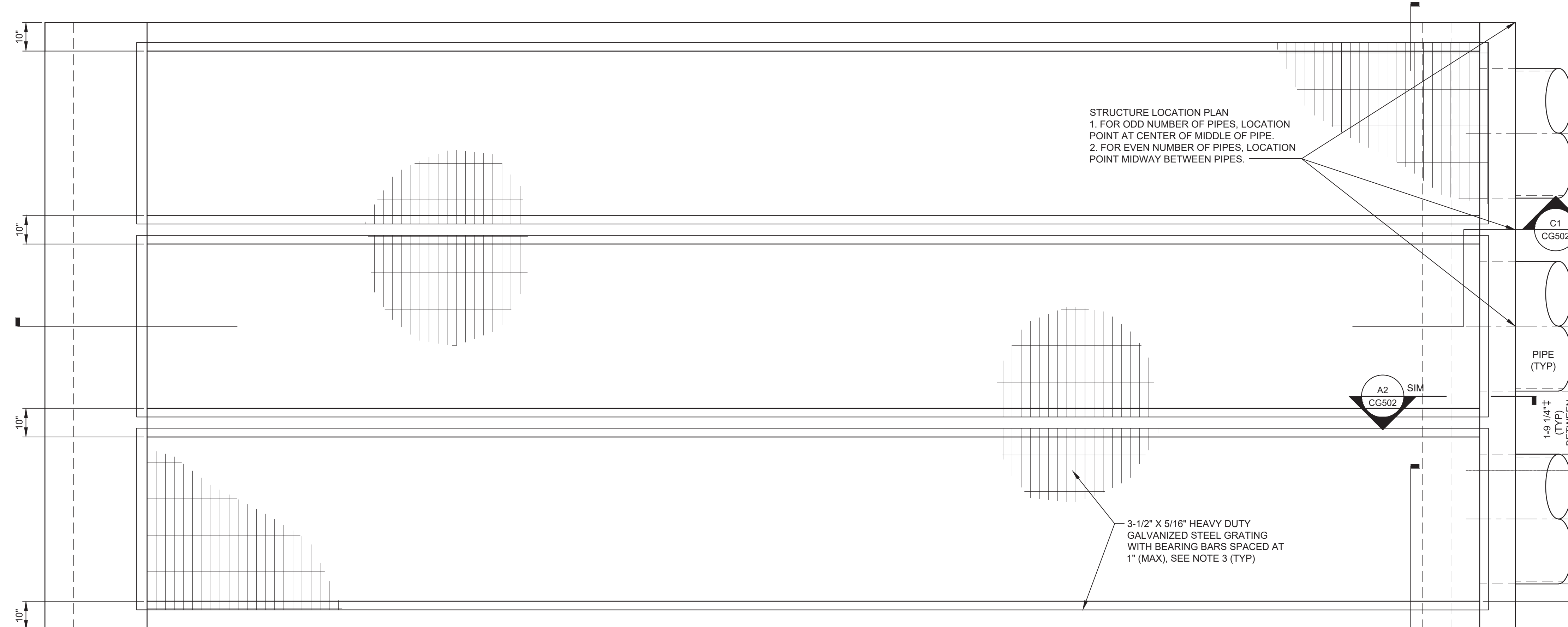
1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016

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CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001

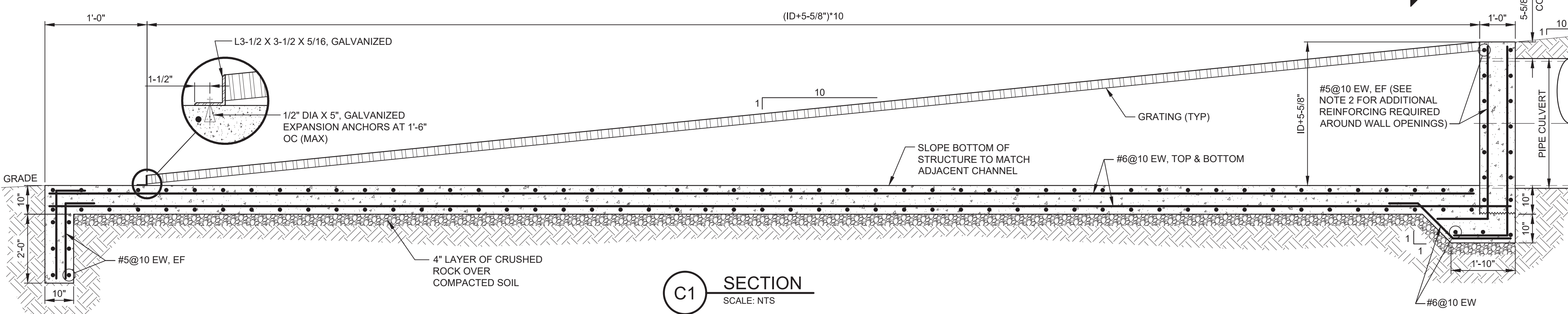
CIVIL DETAILS - CATM & TRAP

SHEET ID  
**CG501.1**

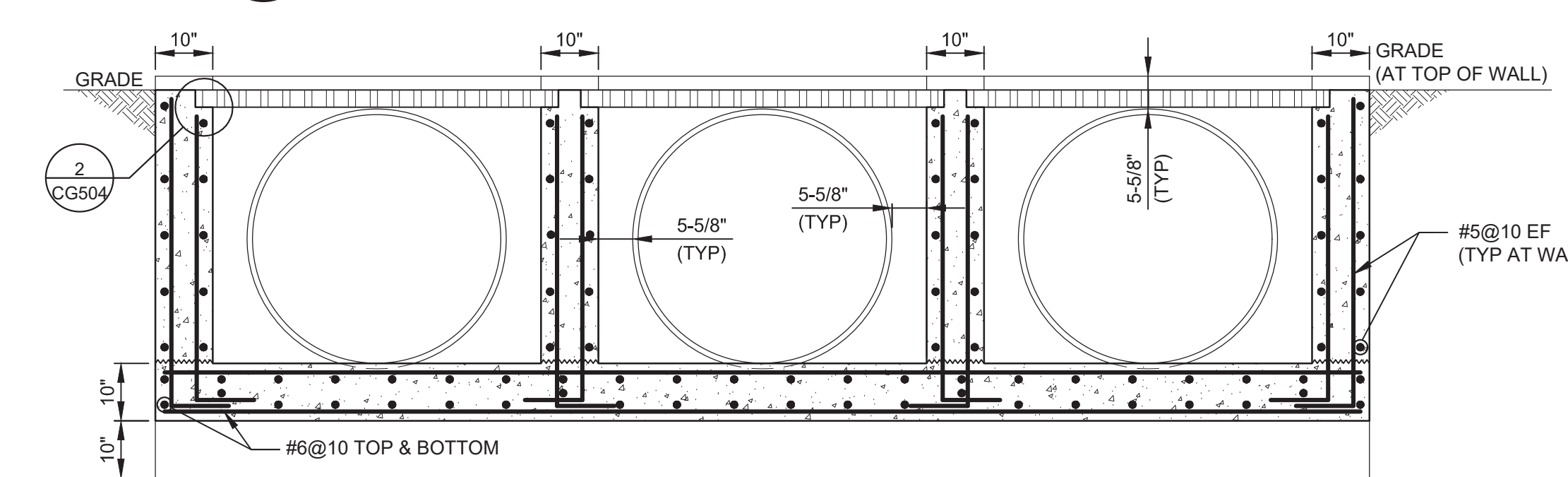


- NOTES:**
- DESIGN CRITERIA
    - A. REFER TO SHEET 1S001 FOR STRUCTURAL DESIGN CRITERIA.
    - B. SOIL SURCHARGE = 250 PSF
    - C. ADHESION AT BASE OF FOOTING = 750 PSF
    - D. PASSIVE EARTH PRESSURE = 360 PSF/FT
    - E. AT-REST EARTH PRESSURE = 60 PSF/FT
    - F. NET ALLOWABLE SOIL BEARING PRESSURE = 2100 PSF
    - G. REQUIRED CONCRETE COMPRESSIVE STRENGTH  $f'_c$  = 4500 PSI AT 28 DAYS
  - REFER TO SHEET 1S001 FOR REINFORCING DETAILS AND NOTES.
  - GRATING SHALL BE DESIGNED TO SUPPORT H25 WHEEL LOADING. USE HEAVY DUTY 15-W4 STEEL GRATING. GRATING SECTIONS SHALL BE REMOVABLE WITH MAXIMUM WEIGHT OF 300 LBS PER SECTION.

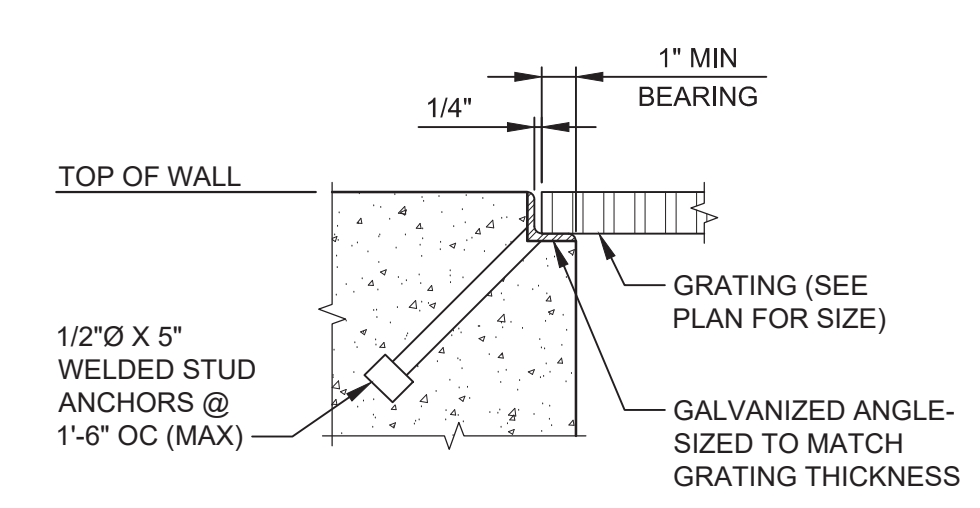
**RAMP INLET PLAN**  
SCALE: NTS



**C1 SECTION**  
SCALE: NTS



**A4 SECTION**  
SCALE: NTS



**A2 DETAIL**  
SCALE: NTS

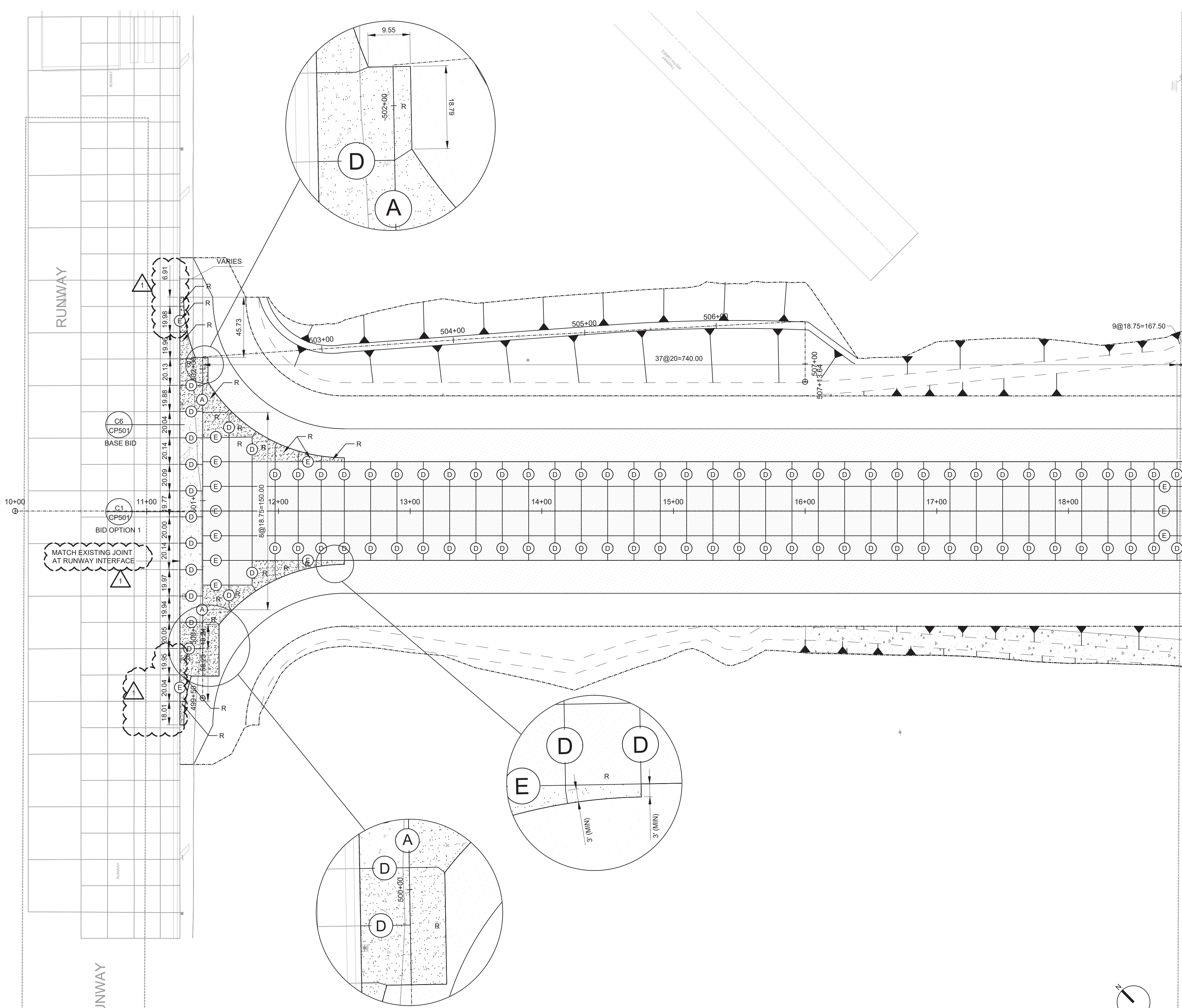


DESIGNED BY: P. JOHNSON	ISSUE DATE: MAY 2021
DRAWN BY: P. MARKS	SOLICITATION NO.: W912PP21R0021
CHECKED BY: L. MCCULLOUGH	CONTRACT NO.:
SUBMITTED BY: M. LOPEZ	
SIZE: ANSI 'D'	

U.S. ARMY CORPS OF ENGINEERS	1661 E CAMELBACK RD #400 PHOENIX, AZ 85016
ALBUQUERQUE DISTRICT ALBUQUERQUE, NM	<b>Stanley Consultants Inc.</b>

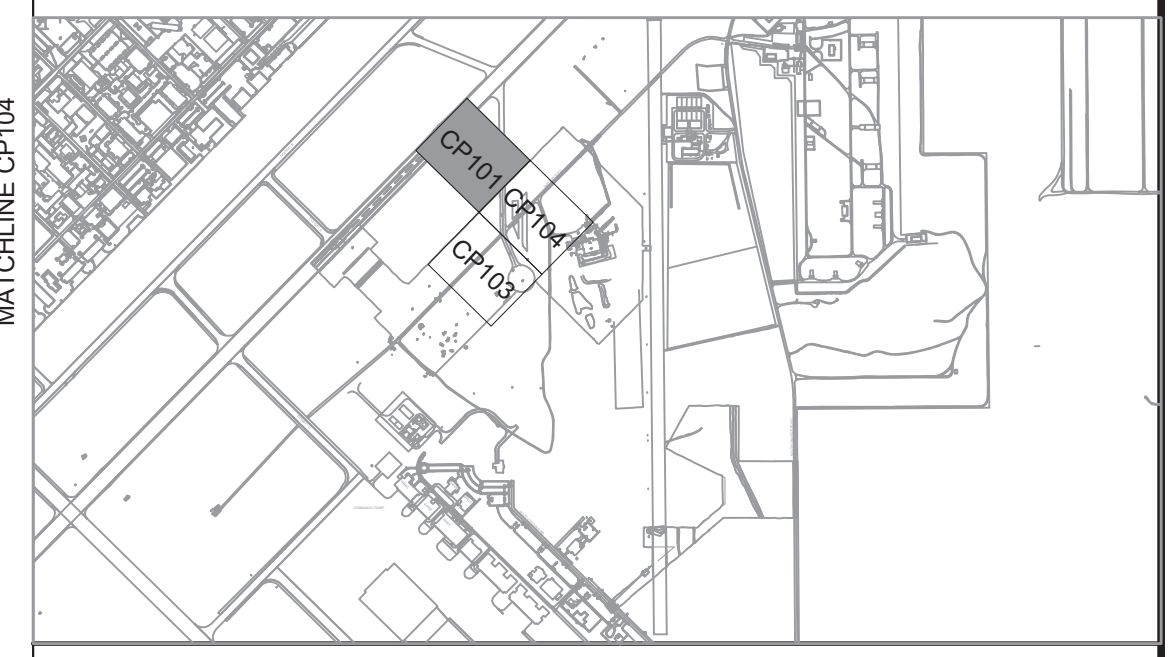
CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
CZCCH3001  
CIVIL DETAILS - SLOPED INLET STRUCTURES

SHEET ID  
**CG502.2**



**A1** PCCP JOINT LAYOUT - CARGO PAD  
SCALE: 1"=40'

MATCHLINE CP104

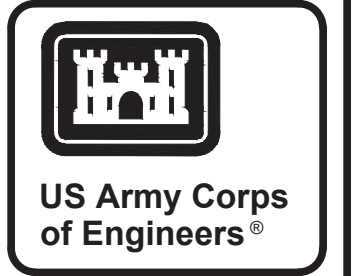


**JOINTING NOTES**

1. NO CHANGES IN THE JOINTING PATTERN SHALL BE MADE WITHOUT THE WRITTEN APPROVAL OF THE DESIGN ENGINEER.
2. NOT USED
3. INSTALL EDGE SEALANT AT ALL HMA & PCCP PAVEMENT INTERFACES, DET G4, SHEET CP501.
4. SEE SHEET CP502 FOR ADDITIONAL JOINT LAYOUT DETAILS.
5. PCCP JOINTING PLAN IS NOT APPLICABLE WHEN HMA TAXIWAY PAVEMENT IS USED.

**JOINT LEGEND**

- (A) THICKENED EDGE ISOLATION JOINT, DET A7, SHEET CP501
- (C) DOWELED CONTRACTION JOINT, DET A2, SHEET CP501
- (D) DUMMY CONTRACTION JOINT, DET G7, SHEET CP501
- (E) DOWELED CONSTRUCTION JOINT, DET G1, SHEET CP501
- R REINFORCED SLAB

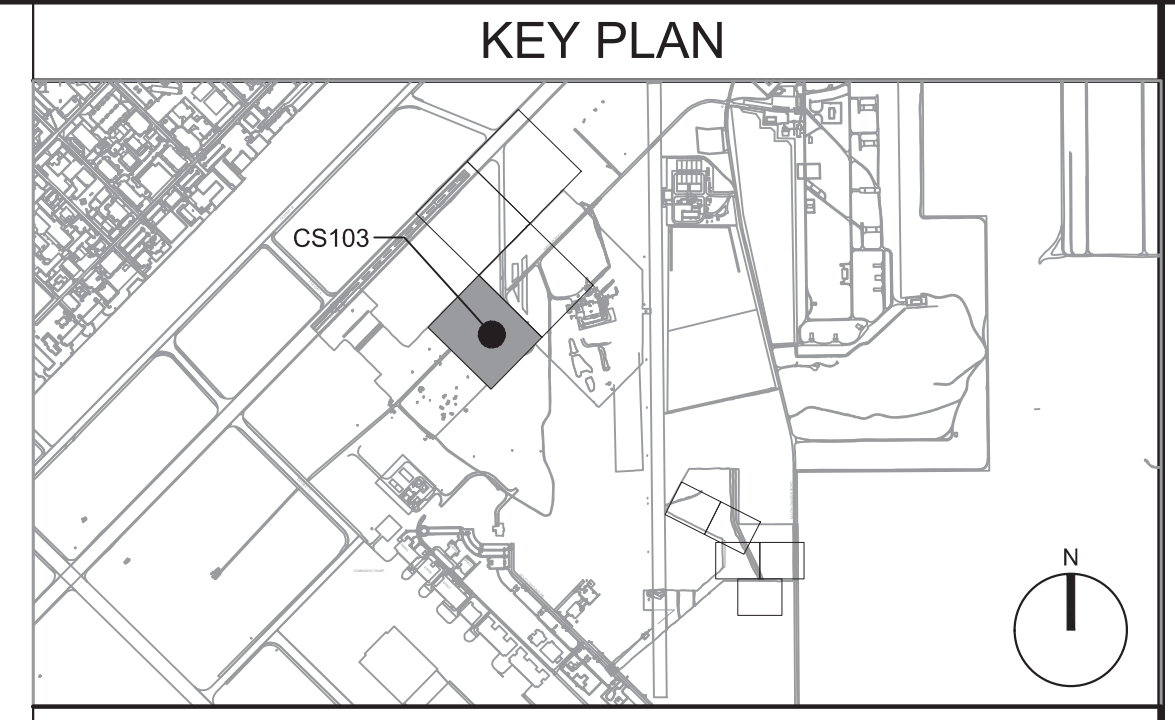
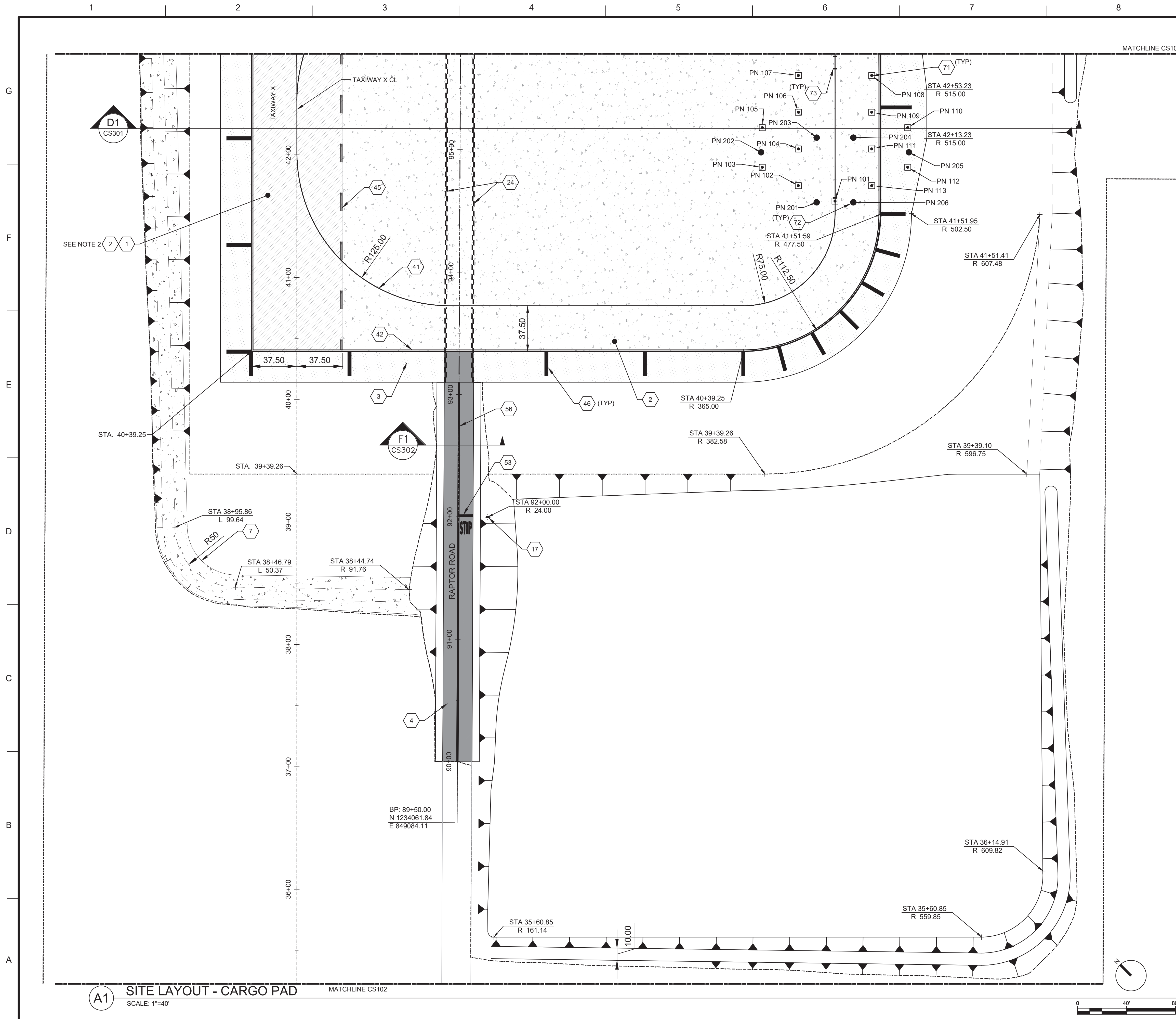


ISSUE DATE:	10/121	DATE
DESIGNED BY:		
CHECKED BY:		
DATE:		
CONTRACT NO.:		
DESCRIPTION:	(1) CHANGE REVISED ROADWAY INTERFACE DIMENSIONS - A0002	

DESIGNED BY:	U.S. ARMY CORPS OF ENGINEERS
CHECKED BY:	ALBUQUERQUE DISTRICT
DATE:	ALBUQUERQUE, NM
CONTRACT NO.:	1661 E CAMELBACK RD #400
DESCRIPTION:	PHOENIX, AZ 85016
DATE:	<b>Stanley Consultants inc.</b>

CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS  
TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001  
PCCP JOINT LAYOUT - CARGO PAD

SHEET ID  
**CP101.1**




### GENERAL SHEET NOTES

- REFER TO SHEETS CS201-CS203 FOR ROADWAY & TAXIWAY PROFILES.
- TAXIWAY AIRFIELD HMA PAVEMENT, SHT CS301, DET A3 (BASE BID) & AIRFIELD PCC PAVEMENT, SHT CS301, DET A1 (BID OPTION 1).

### KEY NOTES

- AIRFIELD HMA PAVEMENT, SHT CS301, DET A3
- AIRFIELD PCC PAVEMENT, SHT CS301, DET A1
- AIRFIELD HMA SHOULDER PAVEMENT, SHT CS301 DET A6
- ROADWAY HMA PAVEMENT, SHT CS302, DET A1
- PCC LINED DITCH, SHT CS302 DET B1
- STOP SIGN AND FOD SIGN ON SAME POST, SHT CS504
- VEHICLE ROADWAY ON AIRCRAFT APRON MARKING, SHT CS503 A1
- TAXIWAY CENTERLINE MARKING, DET D9, SHT CS502
- TAXIWAY EDGE MARKING, DET D7, SHT CS502
- DASHED TAXIWAY EDGE MARKING, DET D4, SHT CS502
- TAXIWAY SHOULDER MARKING, DET A9 & D2 SHT CS502
- 24" STOP BAR PAVEMENT MARKING, DET A1 SHT CS502
- SOLID DOUBLE YELLOW PAVEMENT MARKING, DET D7 SHT CS502
- AIRCRAFT TIE DOWN, SHT CS505, SEE SHT CS601 FOR LOCATION TABLE
- STATIC GROUNDING, SHT CS506, SEE SHT CS601 FOR LOCATION TABLE
- NOSE WHEEL STOP BARS, SHT CS502 DET E7




**US Army Corps of Engineers**

(1 CHANGE) EDITED KEY NOTE 17 - A0002	DATE 10/1/21
MARK	DESCRIPTION

DESIGNED BY: DRAWN BY: P. MARKS	ISSUE DATE: SAT. 12/1/21 W019P24R002
CHECKED BY: R. THEVENOT	CONTRACT NO.:
SUBMITTED BY: M. LOPEZ	SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016



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FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS  
TRAINING AND MAINTENANCE FACILITIES  
CZOC143001

SITE LAYOUT - CARGO PAD

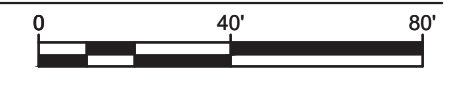
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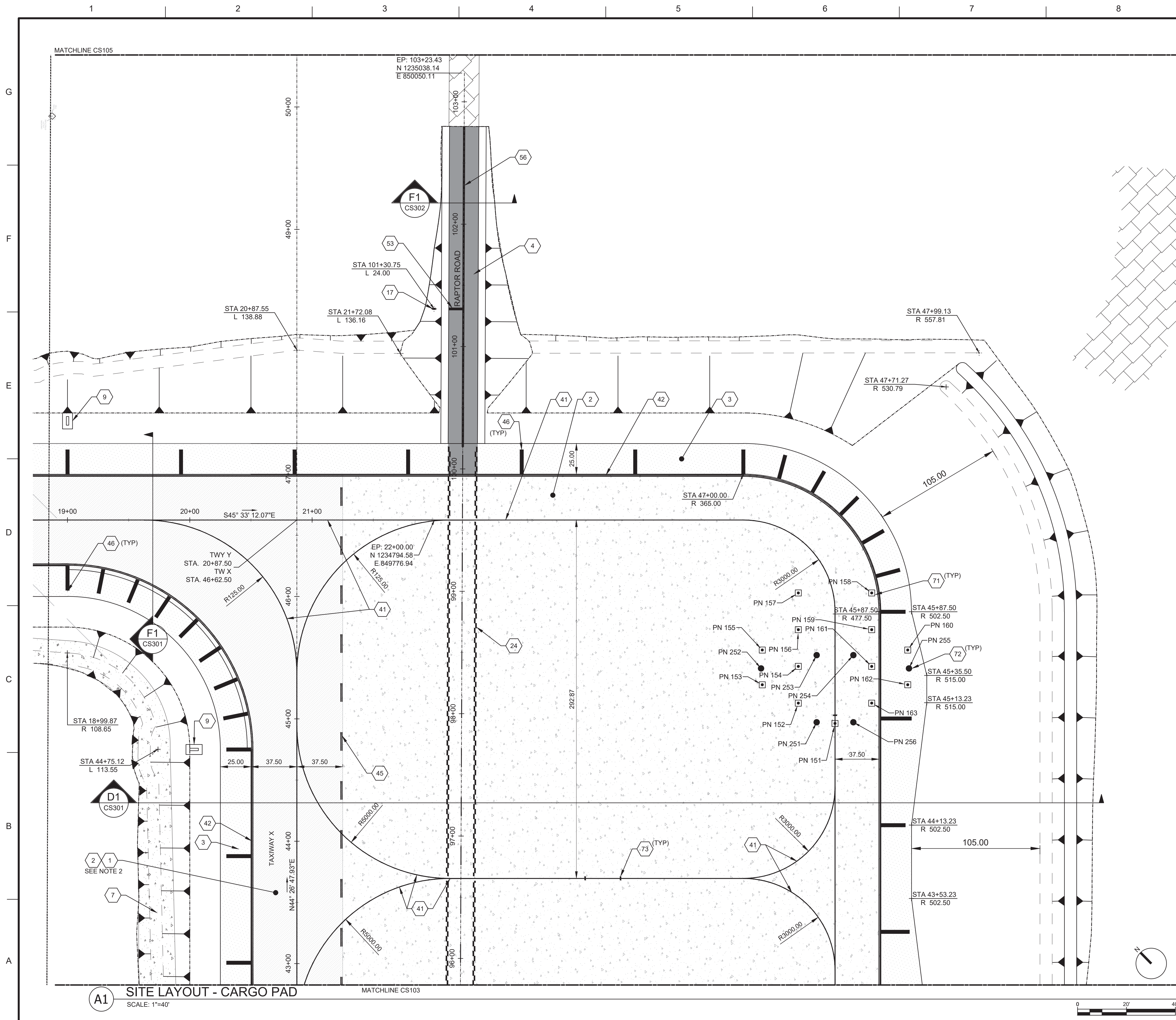
## CS103.1

**A1** SITE LAYOUT - CARGO PAD

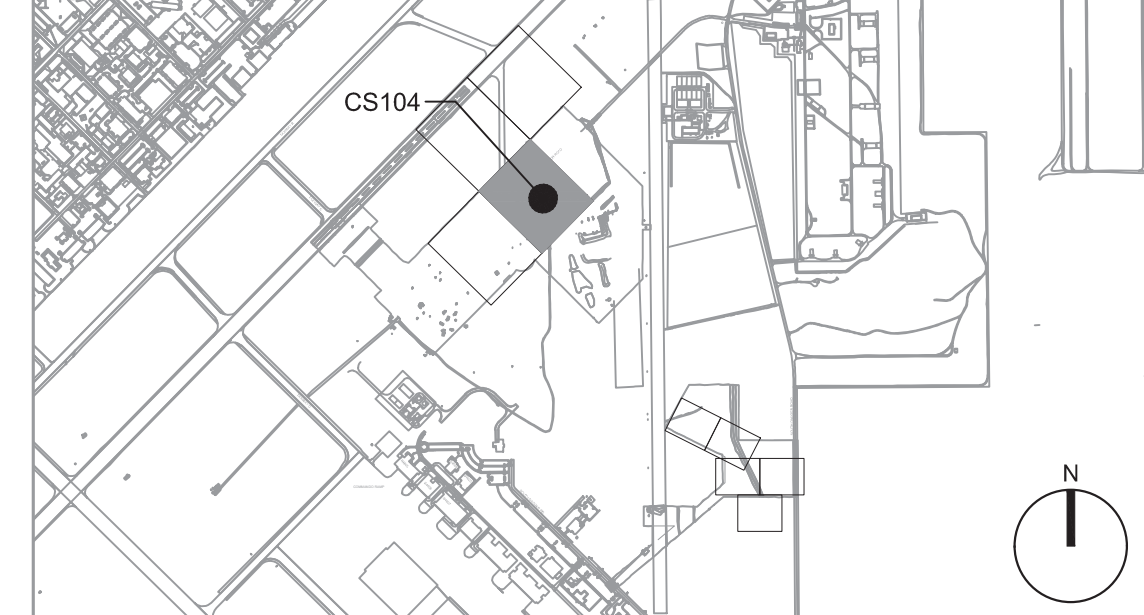
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MATCHLINE CS102





KEY PLAN



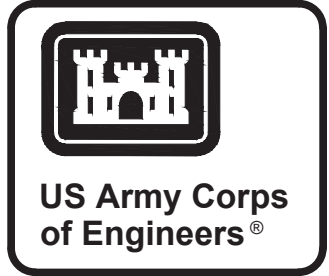
GENERAL SHEET NOTES

- REFER TO SHEETS CS201-CS203 FOR ROADWAY & TAXIWAY PROFILES.
- TAXIWAY AIRFIELD HMA PAVEMENT, SHT CS301, DET A3 (BASE BID) & AIRFIELD PCC PAVEMENT, SHT CS301, DET A1 (BID OPTION 1).
- SEE SHEETS EA101-EA104 FOR AIRFIELD GUIDANCE SIGN DETAILS.

KEY NOTES

- AIRFIELD HMA PAVEMENT, SHT CS301, DET A3
- AIRFIELD PCC PAVEMENT, SHT CS301, DET A1
- AIRFIELD HMA SHOULDER PAVEMENT, SHT CS301 DET A6
- ROADWAY HMA PAVEMENT, SHT CS302, DET A1
- PCC LINED DITCH, SHT CS302 DET B1
- AIRFIELD GUIDANCE SIGN, SHT CG504
- STOP SIGN AND FOD SIGN ON SAME POST, SHT CS504
- VEHICLE ROADWAY ON AIRCRAFT APRON MARKING, SHT CS503 A1
- TAXIWAY CENTERLINE MARKING, DET D9, SHT CS502
- TAXIWAY EDGE MARKING, DET D7, SHT CS502
- DASHED TAXIWAY EDGE MARKING, DET D4, SHT CS502
- TAXIWAY SHOULDER MARKING, DET A9 & D2 SHT CS502
- 24" STOP BAR PAVEMENT MARKING, DET A1 SHT CS502
- SOLID DOUBLE YELLOW PAVEMENT MARKING, DET D7 SHT CS502
- AIRCRAFT TIE DOWN, SHT CS505. SEE SHT CS601 FOR LOCATION TABLE
- STATIC GROUNDING, SHT CS506. SEE SHT CS601 FOR LOCATION TABLE
- NOSE WHEEL STOP BARS, SHT CS502 DET E7

A1 SITE LAYOUT - CARGO PAD  
SCALE: 1"=40'



DATE	10/1/21
DESCRIPTION	(1 CHANGE) EDITED KEY NOTE 17 - A0002
MARK	

ISSUE DATE:	
DESIGNED BY:	
CHECKED BY:	
DATE:	
PROJECT NO.:	
CONTRACT NO.:	
DESIGNED BY:	
CHECKED BY:	
DATE:	
PROJECT NO.:	
CONTRACT NO.:	
DESIGNED BY:	
CHECKED BY:	
DATE:	
PROJECT NO.:	
CONTRACT NO.:	

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

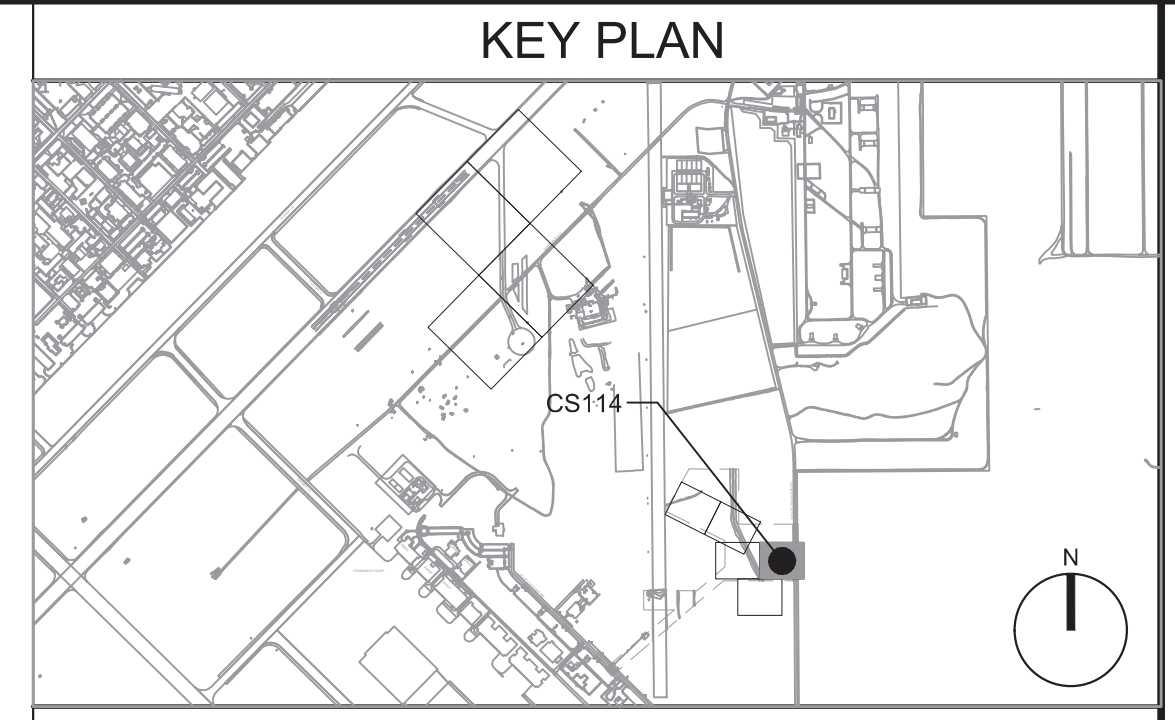
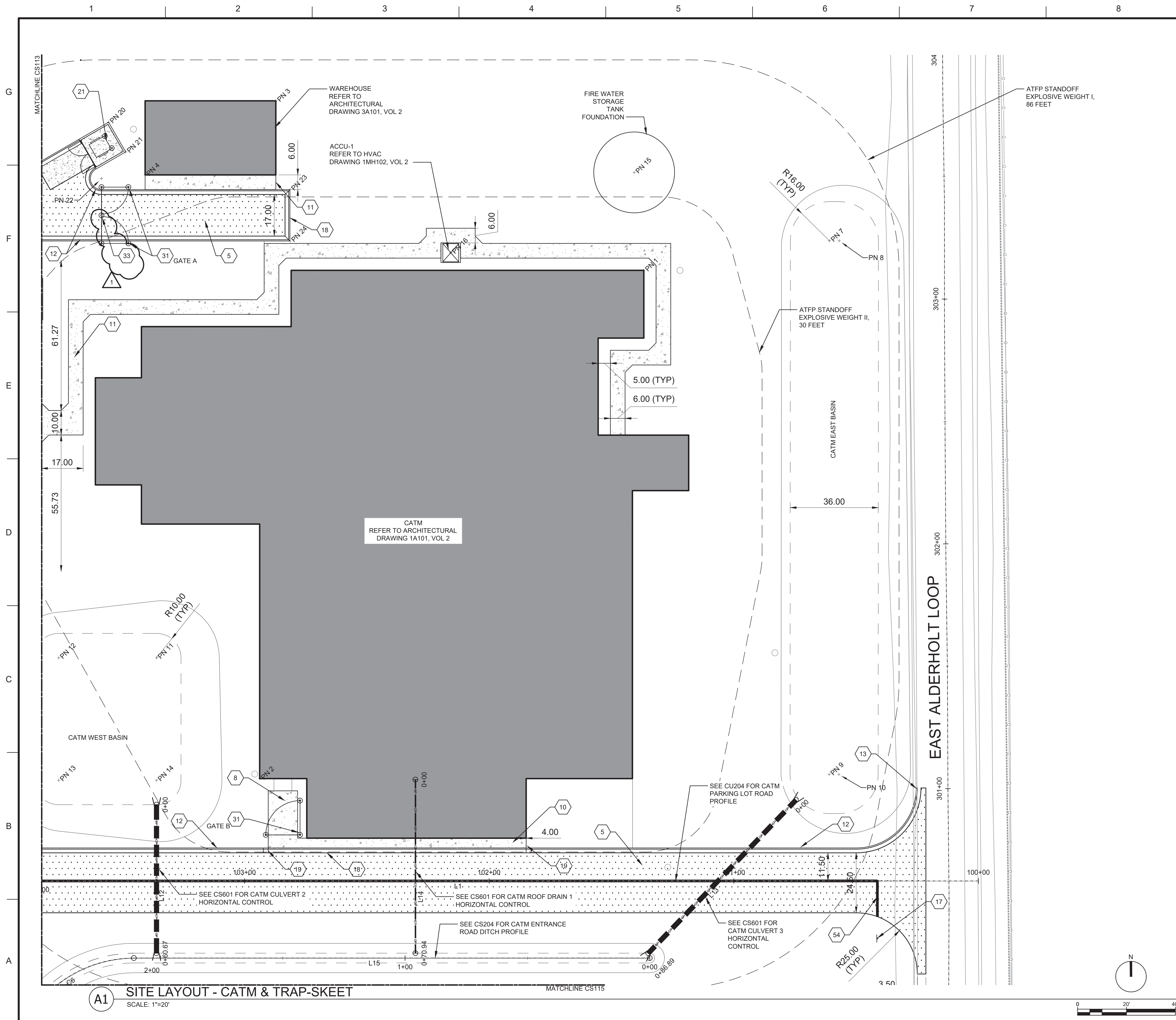
1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016

Stanley Consultants Inc.

CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS  
TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001

SITE LAYOUT - CARGO PAD

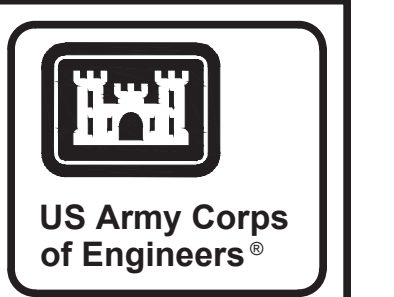
SHEET ID  
CS104.1



**GENERAL SHEET NOTES**

- REFER TO SHEET CS203-CS204 FOR ROADWAY AND DITCH PROFILES
- REFER TO SHEET CS601 FOR ALIGNMENT DATA TABLES

- KEY NOTES**
- 5 PARKING LOT HMA PAVEMENT, SHT CS302 DET A4
  - 8 6" REINFORCED PCCP ON 6" AGGREGATE BASE COURSE
  - 10 4' WIDE PCC SIDEWALK, SHT CS501
  - 11 6' WIDE PCC SIDEWALK, SHT CS501
  - 12 6" CURB AND GUTTER, SHT CS501 DET A4
  - 13 CURB TERMINATION, SHT CS504 DET A9
  - 17 STOP SIGN, SHT CS504
  - 18 6" MOUNTABLE CURB AND GUTTER, SHT CS504 DET F1
  - 19 MOUNTABLE TO VERTICAL CURB TRANSITION, SHT CS504 DET F4
  - 21 DUMPSTER PAD, SHT CS507
  - 31 SINGLE HSS GATE, SHT CS503
  - 33 REMOVABLE BOLLARD, SHT CS503 DET A9
  - 54 24" WHITE STOP BAR PAVEMENT MARKING, SHT CS504 DET



DATE	DESCRIPTION
10/12/11	(1 CHANGE) ADDED KEY NOTE 33 - A0002

DESIGNED BY: J. MCGILLICUDDY  
 DRAWN BY: M. LOPEZ  
 P. MARKS  
 CHECKED BY: J. MCGILLICUDDY  
 SUBMITTED BY: M. LOPEZ  
 SIZE: ANS I'D

ISSUE DATE: 10/12/11  
 DRAWING NO.: W912P24R002  
 CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS  
 ALBUQUERQUE DISTRICT  
 ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
 PHOENIX, AZ 85016

**Stanley Consultants inc.**

CANNON AFB, NM  
 FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS  
 TRAINING AND MAINTENANCE FACILITIES  
 CZ0C143001

**SITE LAYOUT - CATM & TRAP-SKEET**

SHEET ID  
**CS114.1**

**A1 SITE LAYOUT - CATM & TRAP-SKEET**  
 SCALE: 1"=20'

G

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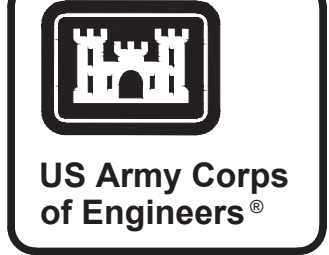
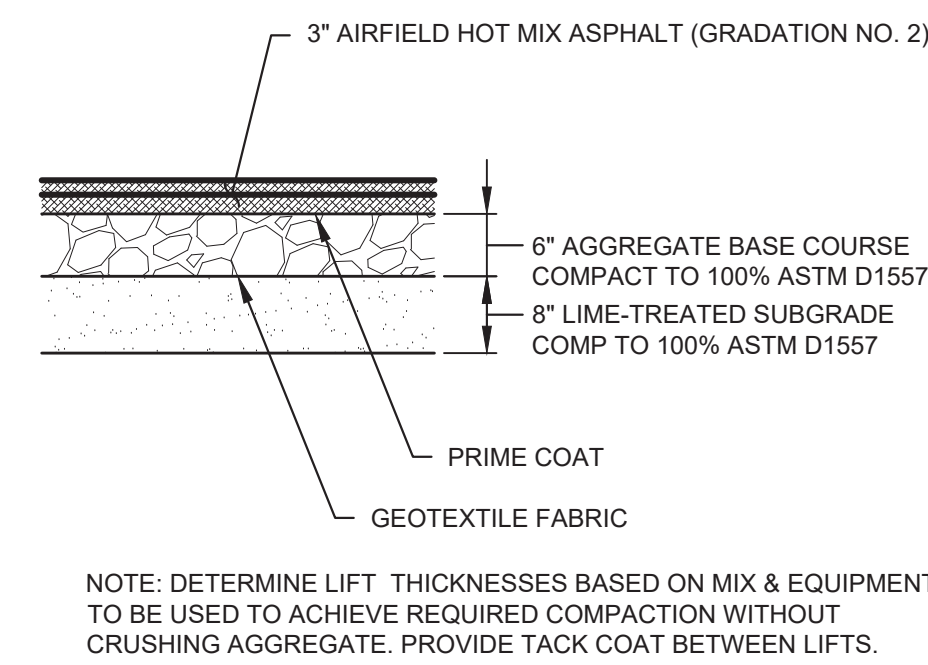
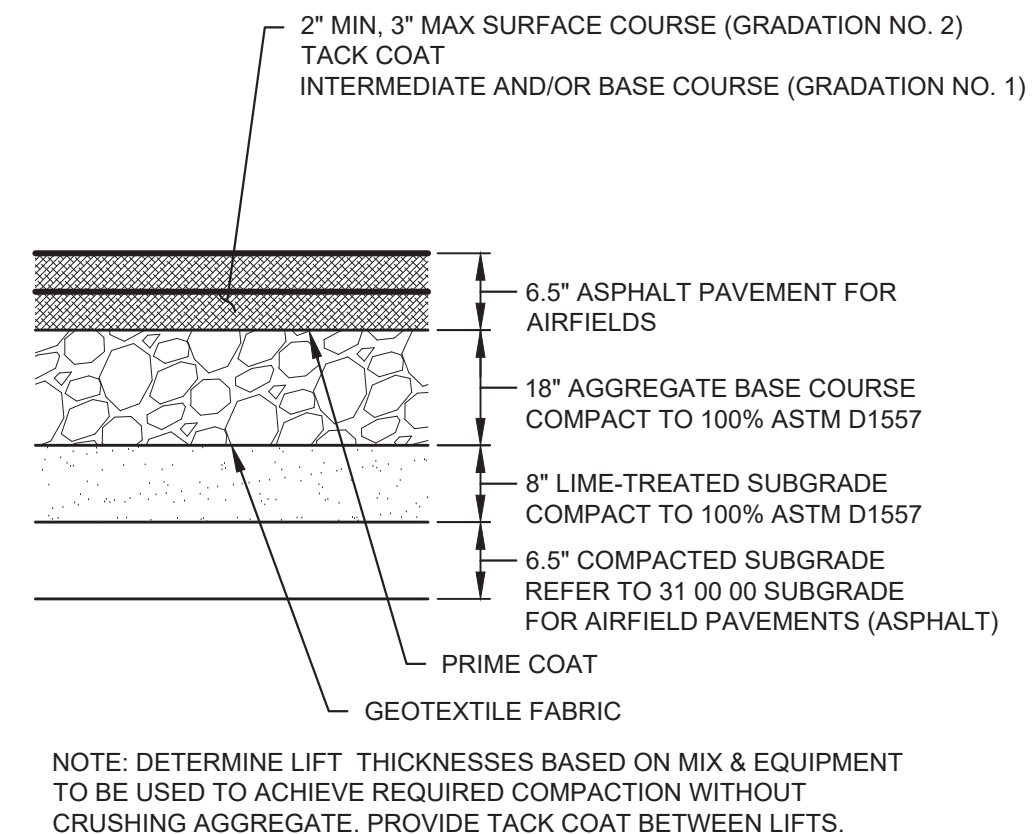
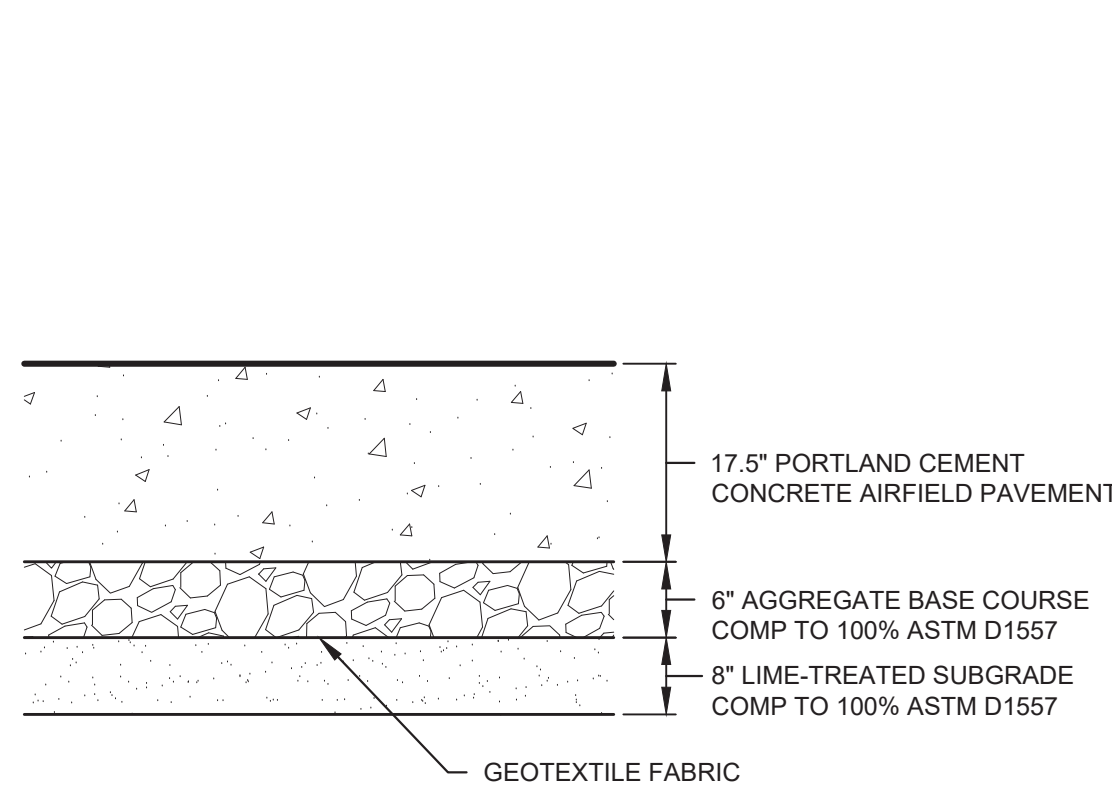
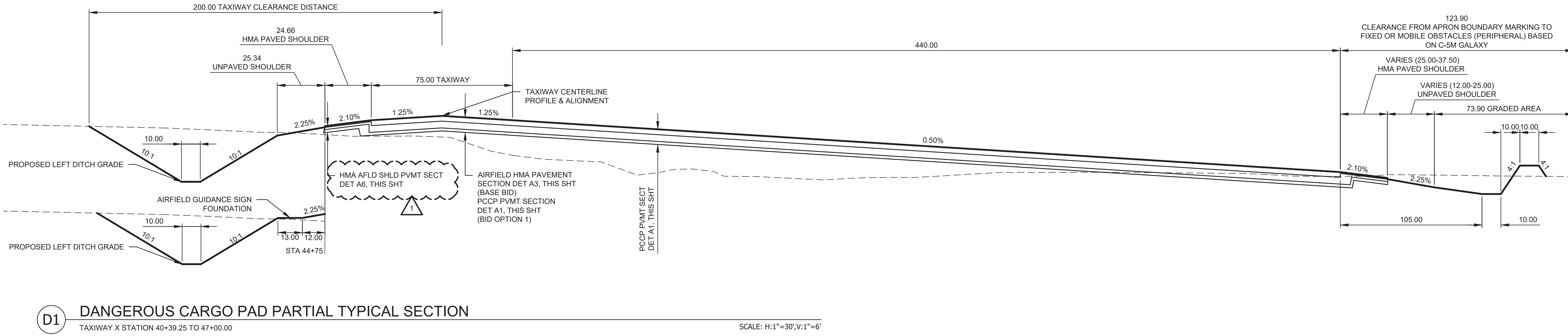
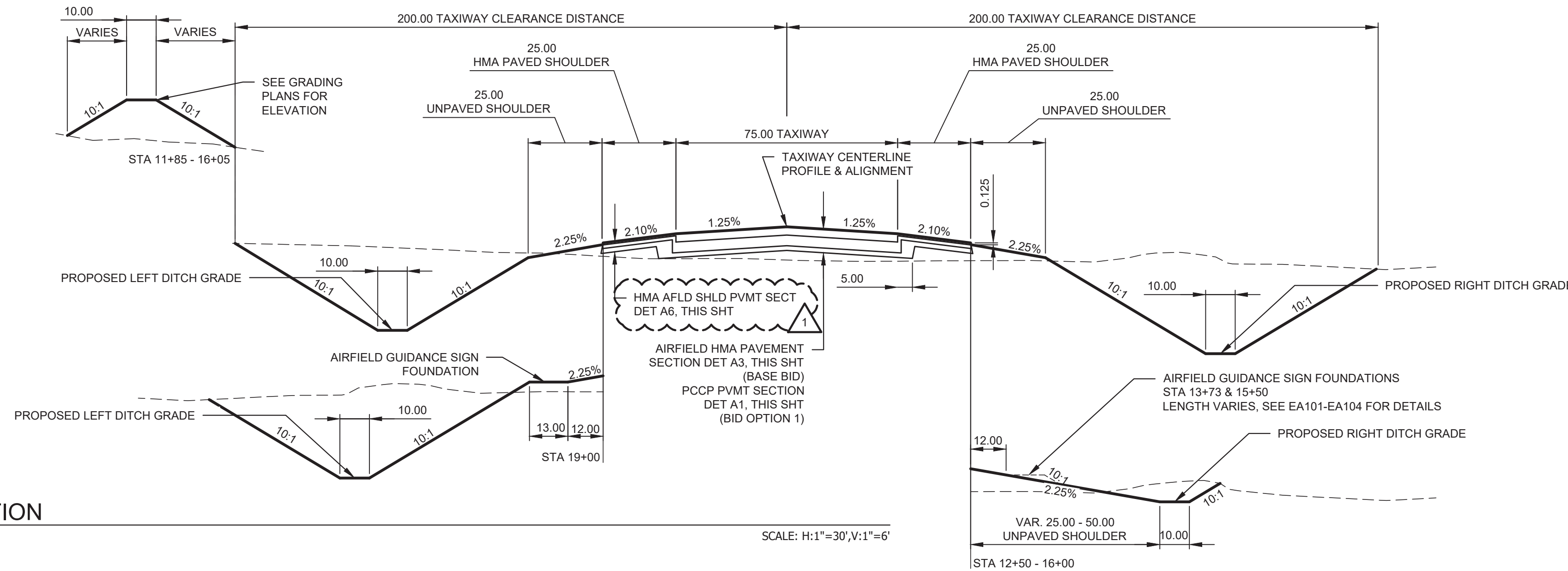
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DATE	DESCRIPTION
10/12/1	(1 CHANGE) CORRECTED HMA AFILD SHLD PVMT SECT CROSS REFERENCE CALLOUT

DESIGNED BY: R. THEVENOT	ISSUE DATE: 10/21/2011
CHECKED BY: M. LOPEZ	WATERSHED/SECTION NO.:
SUBMITTED BY: M. LOPEZ	CONTRACT NO.:
SIZE: ANSI D	PROJECT NO.:

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

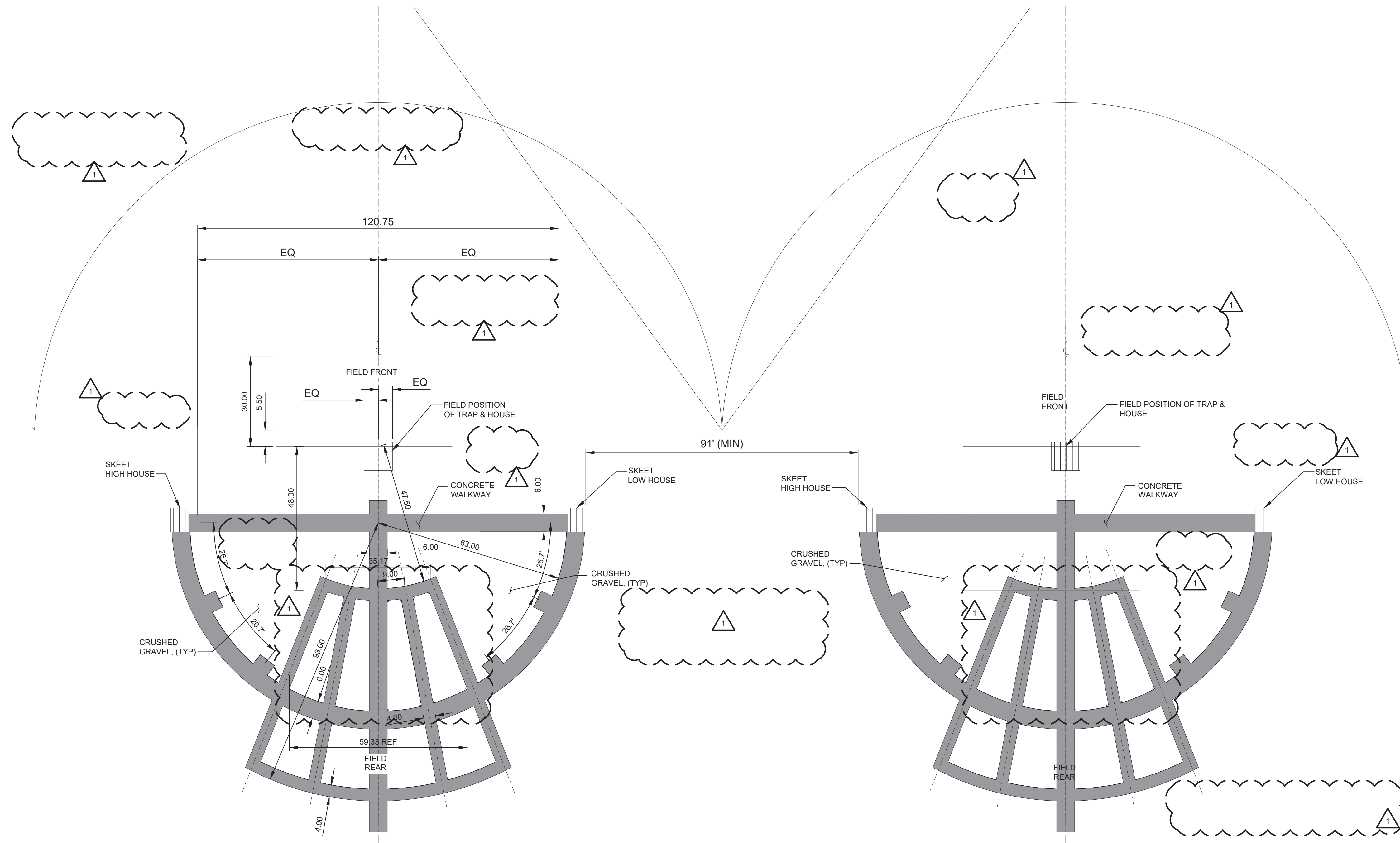
1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016

**Stanley Consultants inc.**

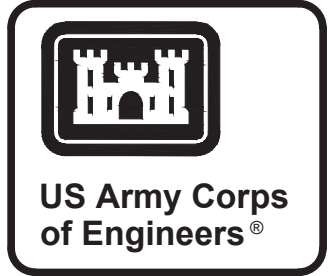
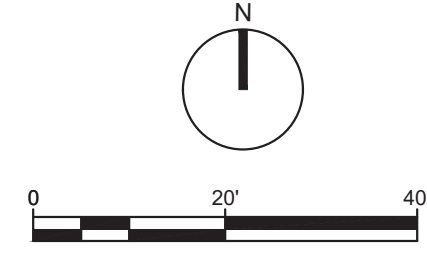
CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001

AIRFIELD TYPICAL SECTIONS

SHEET ID  
**CS301.1**



**C4** TYPICAL TRAP AND SKEET RANGE LAYOUT OF TWO RANGES  
SCALE: 1"=20'



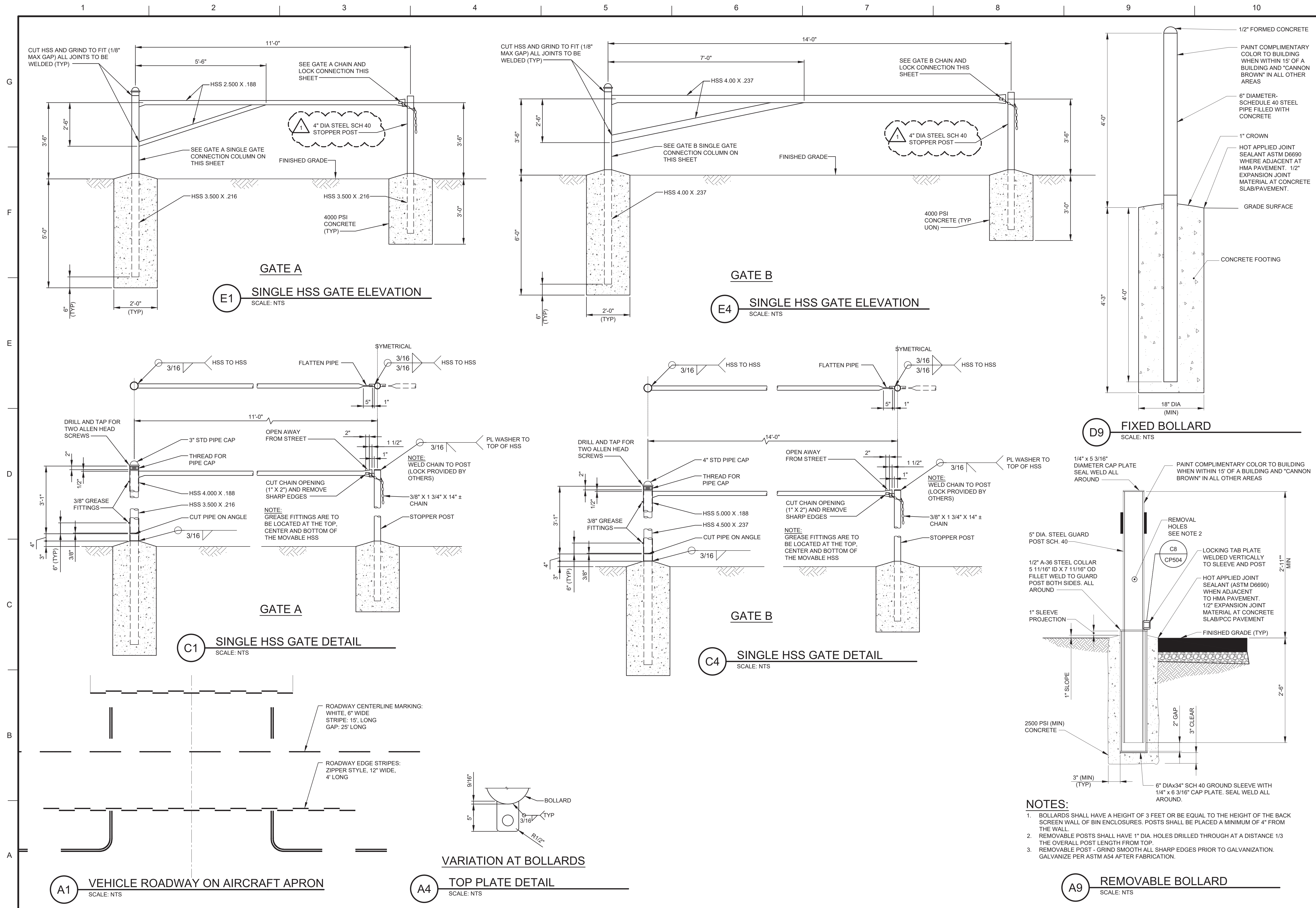
ISSUE DATE:	10/121
DATE:	
DESCRIPTION:	(1 CHANGE) REMOVED MARKINGS - A0002
MARK:	1

DESIGNED BY:	ISSUE DATE:
DRAWN BY:	DATE:
CHECKED BY:	CONTRACT NO.:
SUBMITTED BY:	
SIZE:	ANSI/D
U.S. ARMY CORPS OF ENGINEERS ALBUQUERQUE DISTRICT ALBUQUERQUE, NM 1661 E CAMELBACK RD #400 PHOENIX, AZ 85016 <b>Stanley Consultants Inc.</b>	

CANNON AFB, NM  
 FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS  
 TRAINING AND MAINTENANCE FACILITIES  
 CZ0C143001  
 SKEET AND TRAP TWO COURSE LAYOUT

SHEET ID  
**CS402.1**





**US Army Corps of Engineers**

ISSUE DATE: 10/1/21  
 DATE: 10/1/21  
 (2 CHANGES) EDITED STOPPER POST NOTE - A0002  
 DESCRIPTION: MARK

DESIGNED BY: WAT ZEL  
 CHECKED BY: WBP/2P/AR/03  
 CONTRACT NO.:  
 SUBMITTED BY: I. MCCULLOUGH  
 M. LOPEZ  
 SIZE: ANSI/D

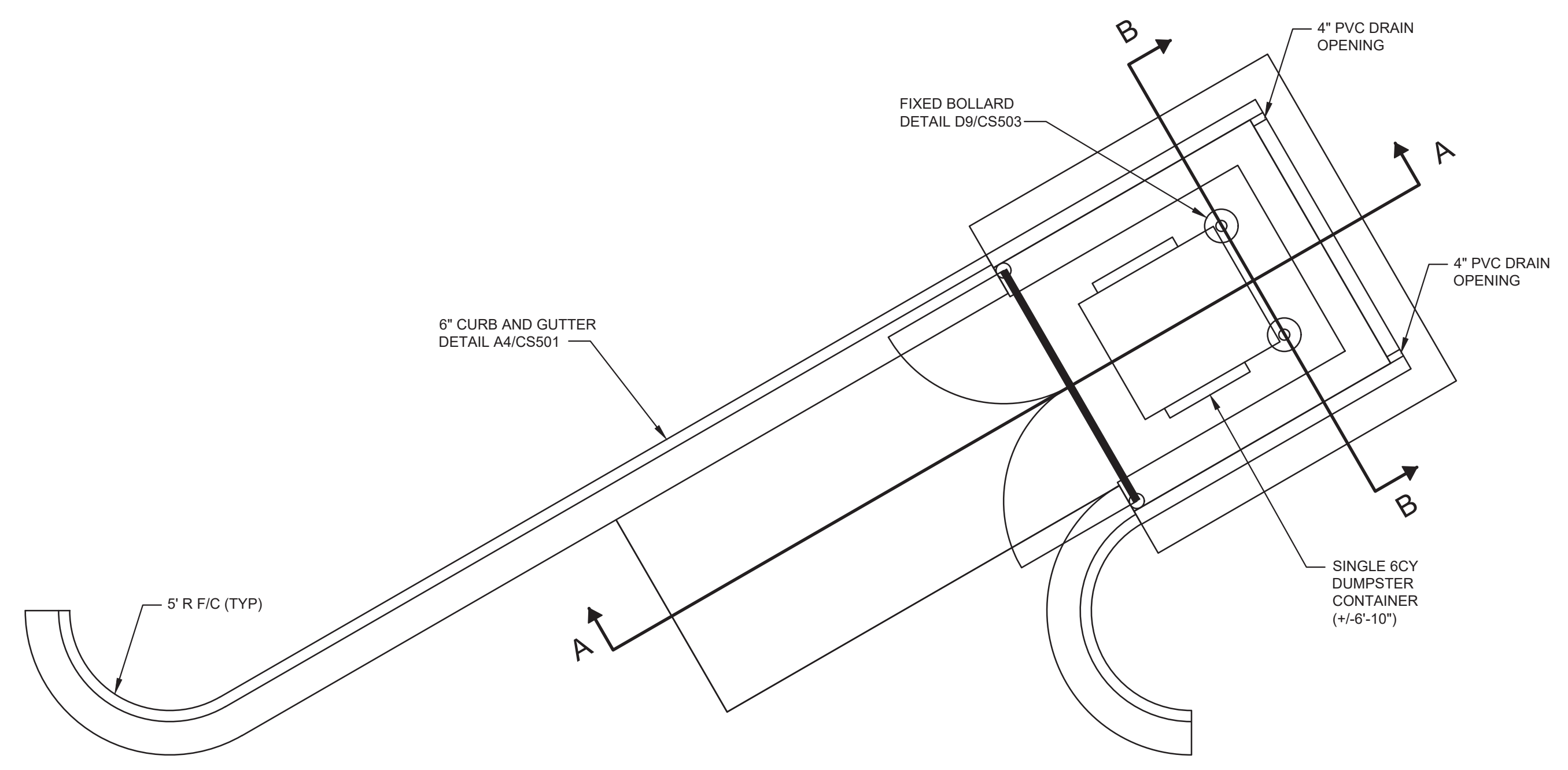
U.S. ARMY CORPS OF ENGINEERS  
 ALBUQUERQUE DISTRICT  
 ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
 PHOENIX, AZ 85016  
**Stanley Consultants inc.**

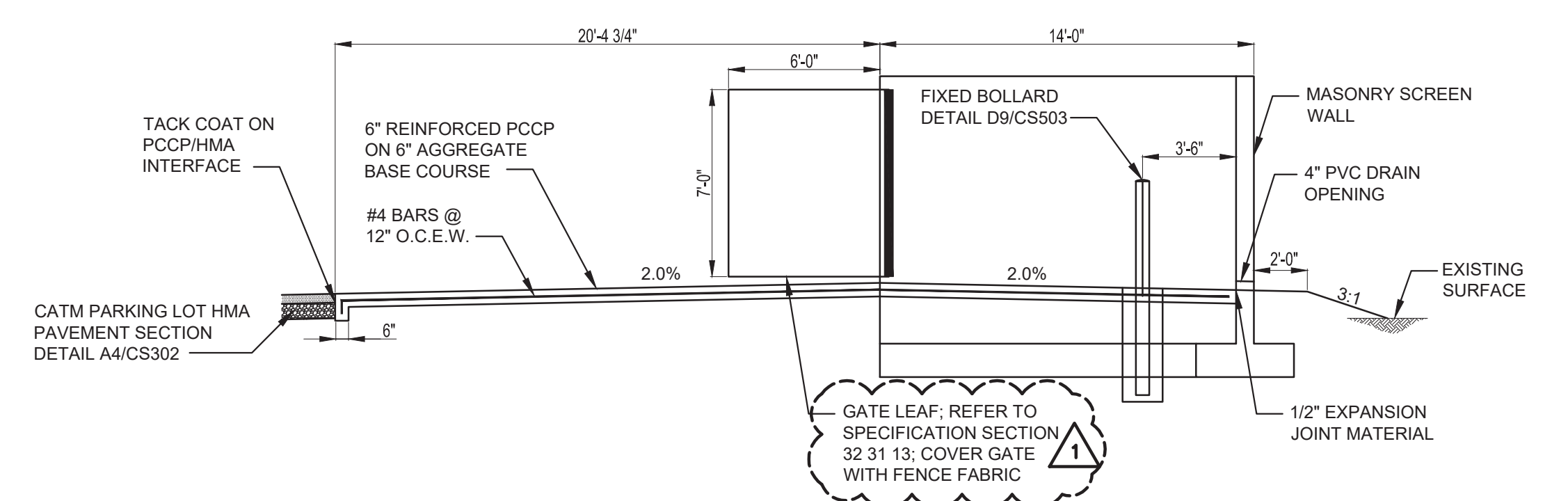
CANNON AFB, NM  
 FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS  
 TRAINING AND MAINTENANCE FACILITIES  
 CZ0C143001

**SITE DETAILS**

SHEET ID  
**CS503.1**

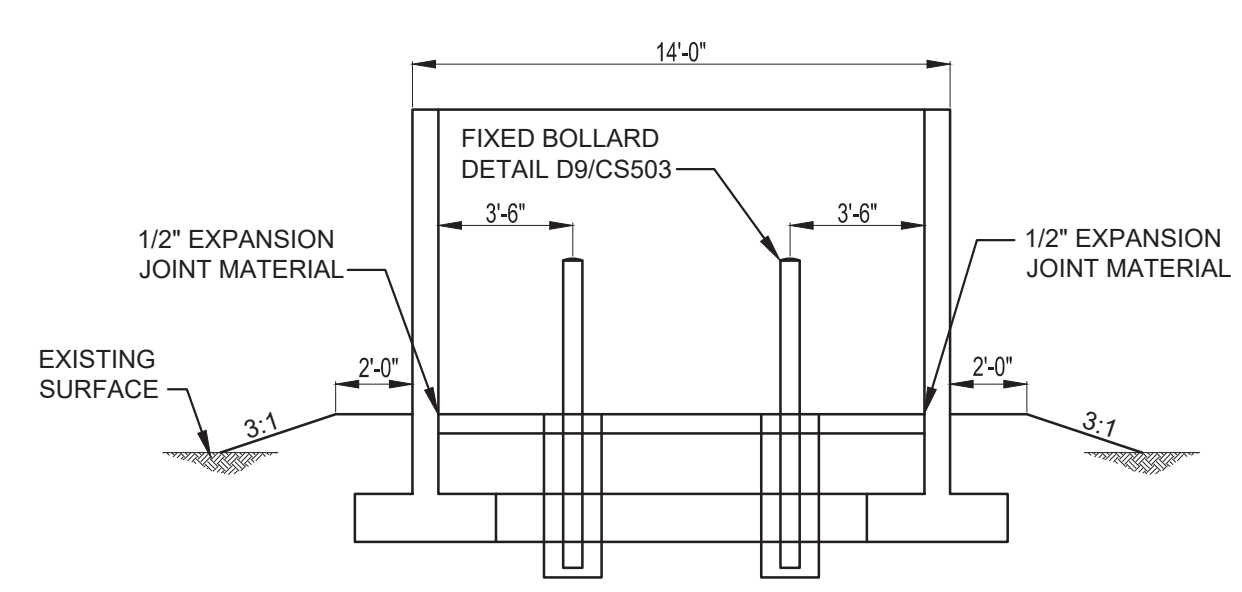


**D3** DUMPSTER PAD AND ENCLOSURE  
SCALE: NTS

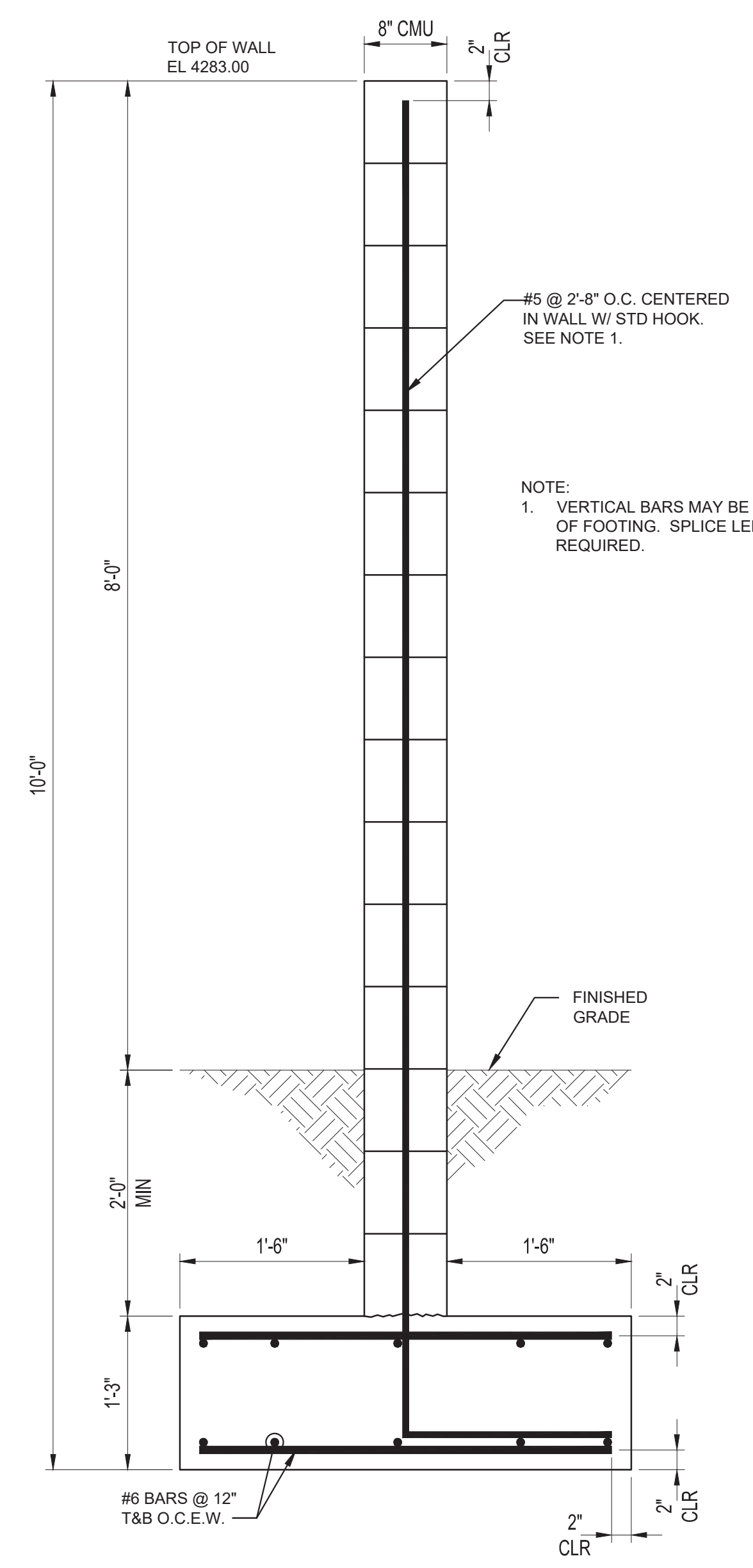


**B2** SECTION A-A  
SCALE: NTS

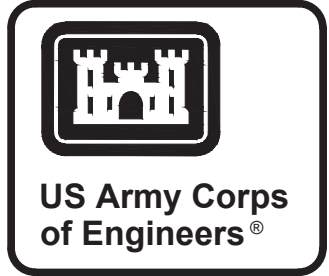
NOTE:  
FENCE FABRIC TO BE ZINC-COATED STEEL, NO. 9-GAGE WIRES WOVEN INTO A 2 INCH DIAMOND MESH CONFORMING TO ASTM A116 WITH 2.0 OUNCES PER SQUARE FOOT ZINC GALVANIZING. PROVIDE SELVAGE KNUCKLED AT BOTH ENDS.



**B5** SECTION B-B  
SCALE: NTS



**B8** MASONRY WALL SECTION  
SCALE: NTS



DATE	10/121
DESCRIPTION	(1 CHANGE) ADDED GATE NOTE - A0002
MARK	A

DESIGNED BY:	ISSUE DATE:
DRAWN BY:	DATE:
CHECKED BY:	PROJECT NO.:
DATE:	CONTRACT NO.:
SCALE:	
ANSI:	
U.S. ARMY CORPS OF ENGINEERS ALBUQUERQUE DISTRICT ALBUQUERQUE, NM 1661 E CAMELBACK RD #400 PHOENIX, AZ 85016 	

CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001  
SITE DETAILS

SHEET ID  
**CS507.1**

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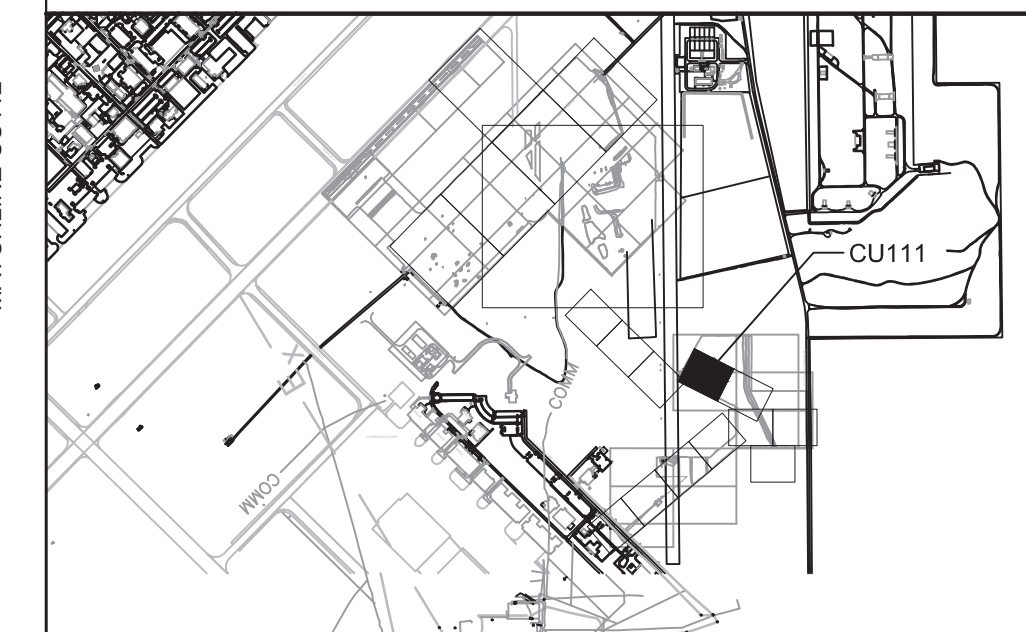
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### KEY PLAN

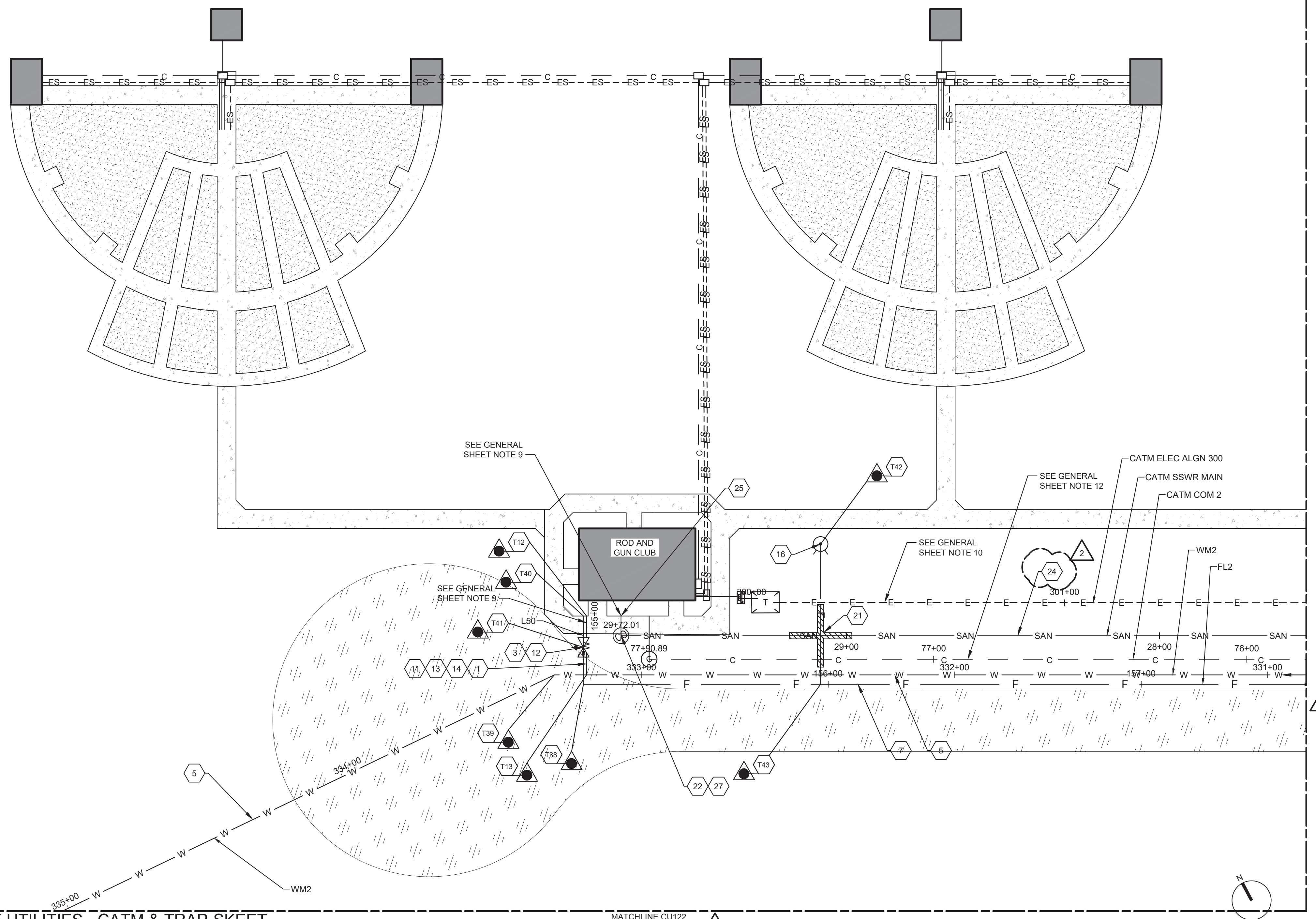


### GENERAL SHEET NOTES

1. LOCATION OF EXISTING UNDERGROUND UTILITY LINES INDICATED ON THIS PLAN ARE APPROXIMATE AND FOR INFORMATION ONLY. THE CONTRACTOR SHALL VERIFY THEIR EXACT LOCATION PRIOR TO COMMENCEMENT OF ANY TRENCHING OR EXCAVATION OPERATIONS.
2. REFER TO CU205-CU209 FOR WATER PROFILES.
3. REFER TO CU201, CU202 FOR SANITARY SEWER PROFILES.
4. FOR UTILITIES NOT PROFILED, REFER TO CROSSING UTILITY PROFILES FOR SEPARATION AT CROSSING.
5. VERTICAL AND HORIZONTAL BENDS OF WATER LINES SHALL HAVE THRUST BLOCKS. SEE DETAIL E6/CU502.
6. REFER TO C9/CU504 FOR PIPE BEDDING SECTION.
7. REFER TO CU602-603 FOR WATER PIPE AND APPURTENANCE SCHEDULES.
8. REFER TO CU604 FOR SANITARY SEWER PIPE AND STRUCTURE SCHEDULES.
9. REFER TO PLUMBING, MECHANICAL AND FIRE PROTECTION DRAWINGS FOR CONTINUATION.
10. REFER TO ES103-ES119 FOR ELECTRICAL SITE PLANS.
11. REFER TO CU203 - CU204 FOR ELECTRICAL DUCT BANK PROFILES.
12. REFER TO ET103 - ET119 FOR TELECOMMUNICATION SITE PLANS.
13. REFER TO ES501 FOR CATHODIC PROTECTION DETAILS.
14. CONTRACTOR TO VERIFY TO AVAILABLE NATURAL GAS LINE PRESSURE AND COORDINATE DESIGN WITH PROVIDER.
15. REFER TO C-001 FOR UTILITY LINE DESIGNATIONS.

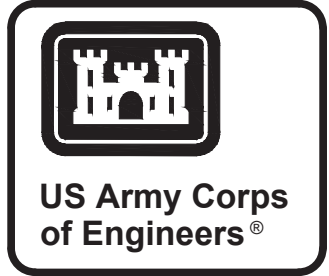
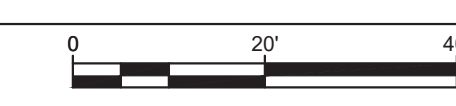
### KEY NOTES

- |     |  |
|-----|--|
| 1   | 2" PVC WATERLINE                             |
| 3   | 6" PVC WATERLINE                             |
| 5   | 12" PVC WATERLINE                            |
| 7   | 10" PVC WATERLINE                            |
| 11  | WATER VALVE, SHT CU504 DET A4                |
| 12  | WATER POST INDICATOR VALVE, SHT CU504 DET A1 |
| 13  | WATER METER, BOX AND COVER                   |
| 14  | WATER BACKFLOW PREVENTER                     |
| 16  | FIRE HYDRANT ASSEMBLY, SHT CU504 DET D1      |
| 21  | CONCRETE ENCASEMENT, SHT CU501 DET A1 & A3   |
| 22  | 4" SANITARY SEWER PIPE                       |
| 24  | 8" SANITARY SEWER PIPE                       |
| 25  | SINGLE CLEANOUT, SHT CU503 DET E1            |
| 27  | SANITARY SEWER MANHOLE, SHT CU503 DET A6     |
| TXX | CATHODIC PROTECTION TEST STATION, SHT ES501  |



**A1** SITE UTILITIES - CATM & TRAP-SKEET  
SCALE: 1"=20'

MATCHLINE CU122



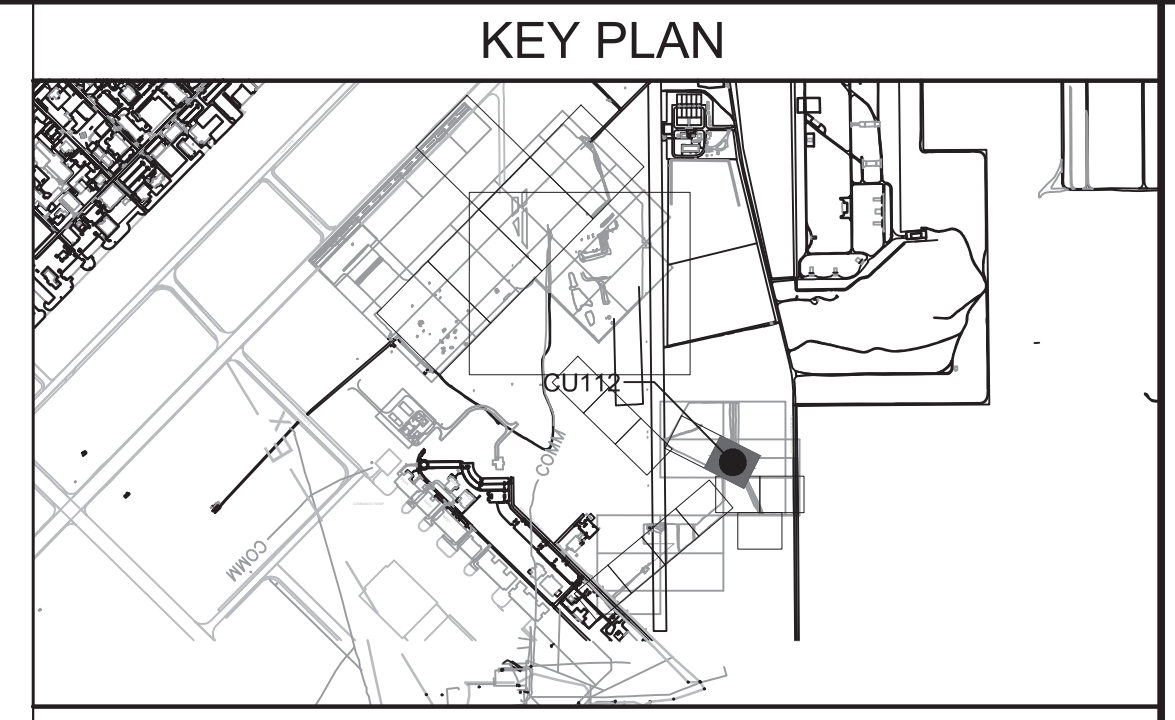
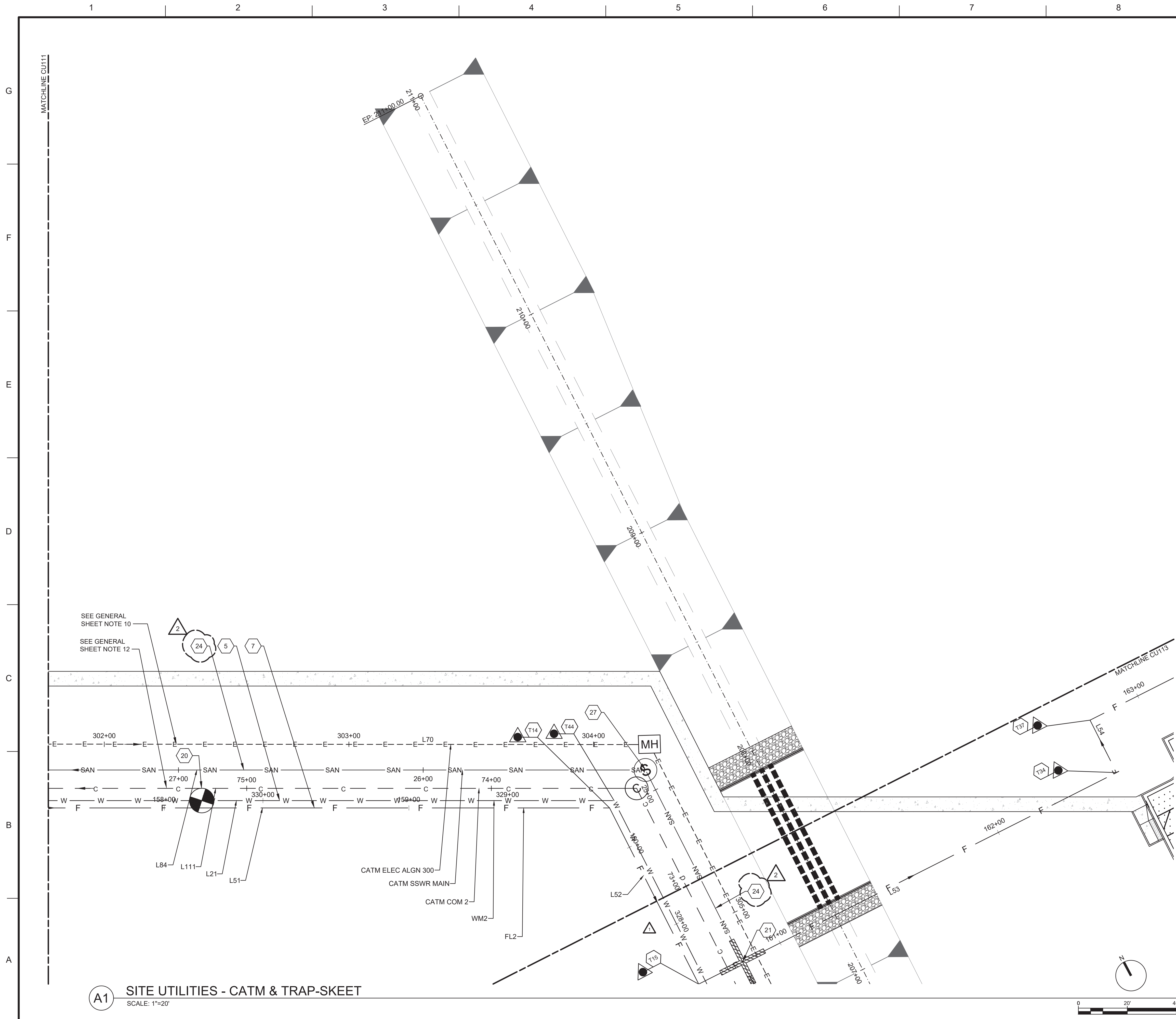
DESIGNED BY:	DATE:
DRAWN BY:	10/1/21
CHECKED BY:	09/21/2021
ISSUE DATE:	DATE
U.S. ARMY CORPS OF ENGINEERS	(1 CHANGE) REPLACED KEY NOTE 23 WITH 24 - A0002
ALBUQUERQUE DISTRICT	REMOVED CATM GAS LINE 2, ADDED MATCHLINE, & KEYNOTE
ALBUQUERQUE, NM	DESCRIPTION
1661 E CAMELBACK RD #400	MARK
PHOENIX, AZ 85016	
Stanley Consultants Inc.	

U.S. ARMY CORPS OF ENGINEERS	ALBUQUERQUE DISTRICT	ALBUQUERQUE, NM
CANNON AFB, NM	FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES	CZ0C143001
SITE UTILITIES - CATM & TRAP-SKEET		
SHEET ID		
<b>CU111.2</b>		

U.S. ARMY CORPS OF ENGINEERS	ALBUQUERQUE DISTRICT	ALBUQUERQUE, NM
CANNON AFB, NM	FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES	CZ0C143001
SITE UTILITIES - CATM & TRAP-SKEET		
SHEET ID		
<b>CU111.2</b>		


U.S. ARMY CORPS OF ENGINEERS	ALBUQUERQUE DISTRICT	ALBUQUERQUE, NM
CANNON AFB, NM	FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES	CZ0C143001
SITE UTILITIES - CATM & TRAP-SKEET		
SHEET ID		
<b>CU111.2</b>		

A0002



- ### GENERAL SHEET NOTES
1. LOCATION OF EXISTING UNDERGROUND UTILITY LINES INDICATED ON THIS PLAN ARE APPROXIMATE AND FOR INFORMATION ONLY. THE CONTRACTOR SHALL VERIFY THEIR EXACT LOCATION PRIOR TO COMMENCEMENT OF ANY TRENCHING OR EXCAVATION OPERATIONS.
  2. REFER TO CU205-CU209 FOR WATER PROFILES.
  3. REFER TO CU201, CU202 FOR SANITARY SEWER PROFILES.
  4. FOR UTILITIES NOT PROFILED, REFER TO CROSSING UTILITY PROFILES FOR SEPARATION AT CROSSING.
  5. VERTICAL AND HORIZONTAL BENDS OF WATER LINES SHALL HAVE THRUST BLOCKS. SEE DETAIL E6/CU502.
  6. REFER TO C9/CU504 FOR PIPE BEDDING SECTION.
  7. REFER TO CU602-603 FOR WATER PIPE AND APPURTENANCE SCHEDULES.
  8. REFER TO CU604 FOR SANITARY SEWER PIPE AND STRUCTURE SCHEDULES.
  9. REFER TO PLUMBING, MECHANICAL AND FIRE PROTECTION DRAWINGS FOR CONTINUATION.
  10. REFER TO ES103-ES119 FOR ELECTRICAL SITE PLANS.
  11. REFER TO CU203 - CU204 FOR ELECTRICAL DUCT BANK PROFILES.
  12. REFER TO ET103 - ET119 FOR TELECOMMUNICATION SITE PLANS.
  13. REFER TO ES501 FOR CATHODIC PROTECTION DETAILS.
  14. REFER TO C-001 FOR UTILITY LINE DESIGNATIONS.

- ### KEY NOTES
- 5 12" PVC WATERLINE
  - 7 10" PVC WATERLINE
  - 20 WATER MAIN AIR RELEASE VACUUM RELIEF VALVE, SHT CU501 DET E6
  - 21 CONCRETE ENCASMENT, SHT CU501 DET A1 & A3
  - 24 8" SANITARY SEWER PIPE
  - 27 SANITARY SEWER MANHOLE, SHT CU503 DET A6
  - TXX CATHODIC PROTECTION TEST STATION, SHT ES501




**US Army Corps of Engineers**

(1) CHANGE) REPLACED KEY NOTE 23 WITH 24 - A0002	DATE
REMOVED CATM GAS LINE 2 AND ADDED KEYNOTE	10/1/21
DESCRIPTION	09/21/2021

DESIGNED BY: J. MCULLOUGH	ISSUE DATE: 10/1/21
DRAWN BY: M. LOPEZ	DATE: 09/21/2021
CHECKED BY: M. LOPEZ	CONTRACT NO.:
SUBMITTED BY: M. LOPEZ	SCALE: ANS I'D

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016



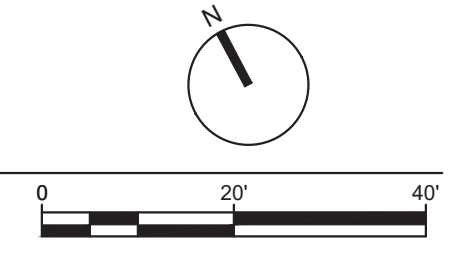
**Stanley Consultants**

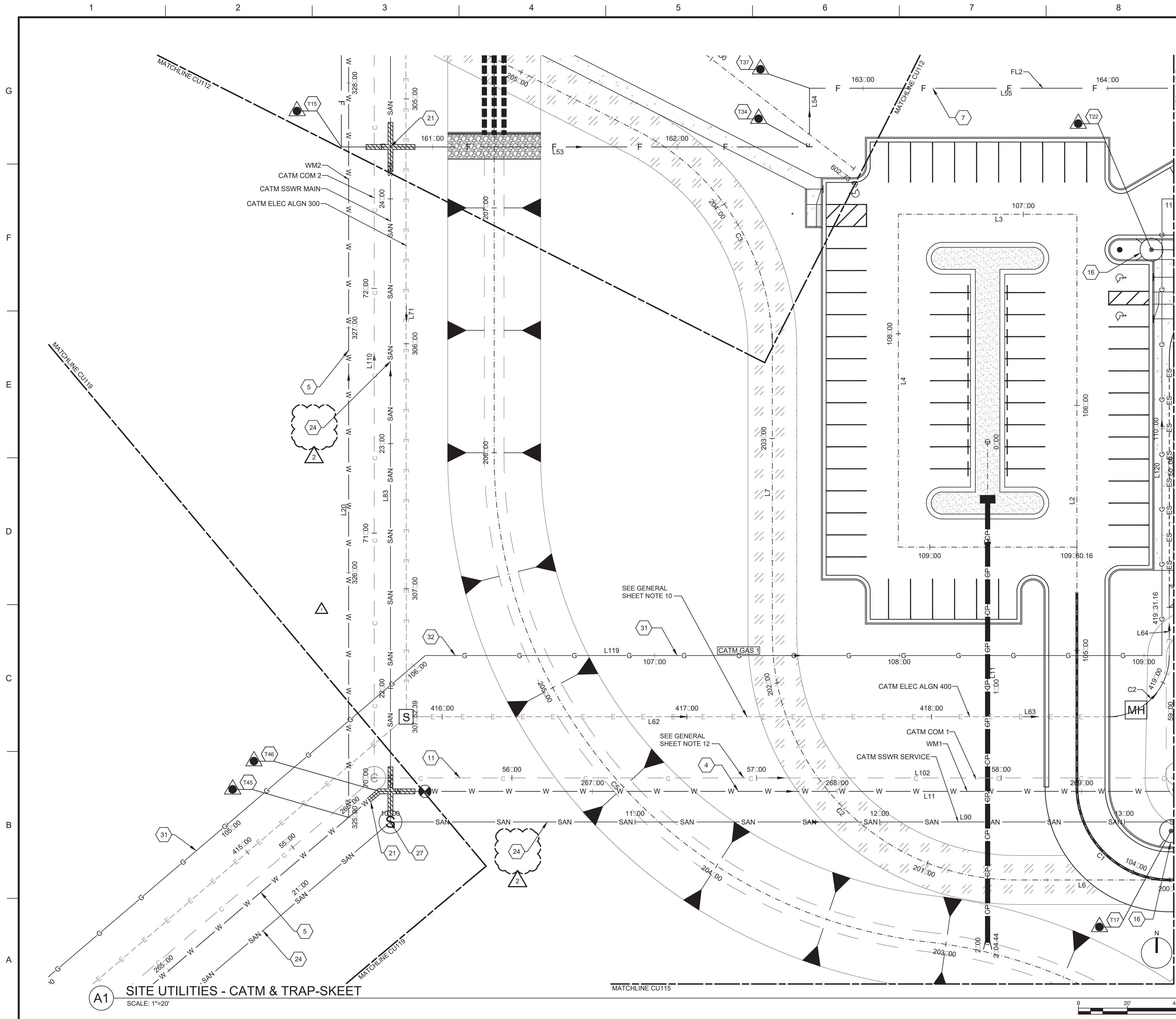
CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/ RELOCATE COMBAT ARMS  
TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001

SITE UTILITIES - CATM & TRAP-SKEET

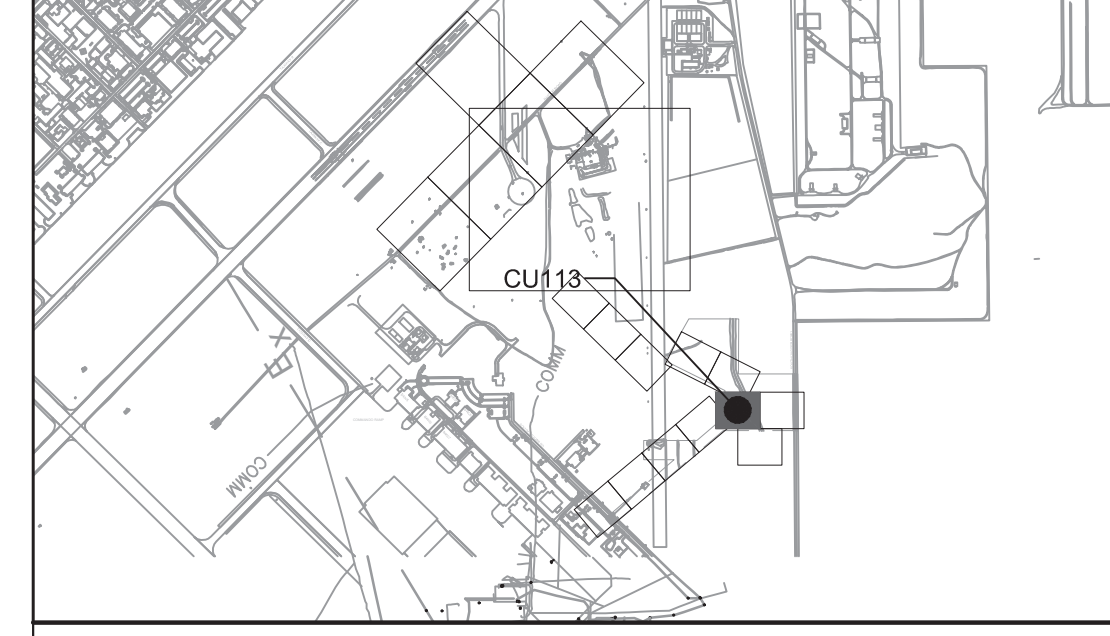
SHEET ID  
**CU112.2**

**A1 SITE UTILITIES - CATM & TRAP-SKEET**  
SCALE: 1"=20'





**KEY PLAN**



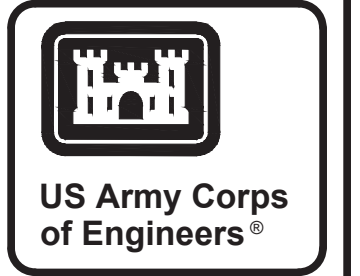
**GENERAL SHEET NOTES**

1. LOCATION OF EXISTING UNDERGROUND UTILITY LINES INDICATED ON THIS PLAN ARE APPROXIMATE AND FOR INFORMATION ONLY. THE CONTRACTOR SHALL VERIFY THEIR EXACT LOCATION PRIOR TO COMMENCEMENT OF ANY TRENCHING OR EXCAVATION OPERATIONS.
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3. REFER TO CU201, CU202 FOR SANITARY SEWER PROFILES.
4. FOR UTILITIES NOT PROFILED, REFER TO CROSSING UTILITY PROFILES FOR SEPARATION AT CROSSING.
5. VERTICAL AND HORIZONTAL BENDS OF WATER LINES SHALL HAVE THRUST BLOCKS. SEE DETAIL E6/CU502.
6. REFER TO C9/CU504 FOR PIPE BEDDING SECTION.
7. REFER TO CU602-603 FOR WATER PIPE AND APPURTENANCE SCHEDULES.
8. REFER TO CU604 FOR SANITARY SEWER PIPE AND STRUCTURE SCHEDULES.
9. REFER TO PLUMBING, MECHANICAL AND FIRE PROTECTION DRAWINGS FOR CONTINUATION.
10. REFER TO ES103-ES119 FOR ELECTRICAL SITE PLANS.
11. REFER TO CU203 - CU204 FOR ELECTRICAL DUCT BANK PROFILES.
12. REFER TO ET103 - ET119 FOR TELECOMMUNICATION SITE PLANS.
13. REFER TO ES501 FOR CATHODIC PROTECTION DETAILS.
14. REFER TO C-001 FOR UTILITY LINE DESIGNATIONS.

**KEY NOTES**

- 4 8" PVC WATERLINE
- 5 12" PVC WATERLINE
- 7 10" PVC WATERLINE
- 11 WATER VALVE, SHT CU504 DET A4
- 16 FIRE HYDRANT ASSEMBLY, SHT CU504 DET D1
- 21 CONCRETE ENCASMENT, SHT CU501 DET A1 & A3
- 22 4" SANITARY SEWER PIPE
- 24 8" SANITARY SEWER PIPE
- 27 SANITARY SEWER MANHOLE, SHT CU503 DET A6
- 31 NATURAL GAS LINE
- 32 NATURAL GAS VALVE
- TXX CATHODIC PROTECTION TEST STATION, SHT ES501

**A1 SITE UTILITIES - CATM & TRAP-SKEET**  
SCALE: 1"=20'

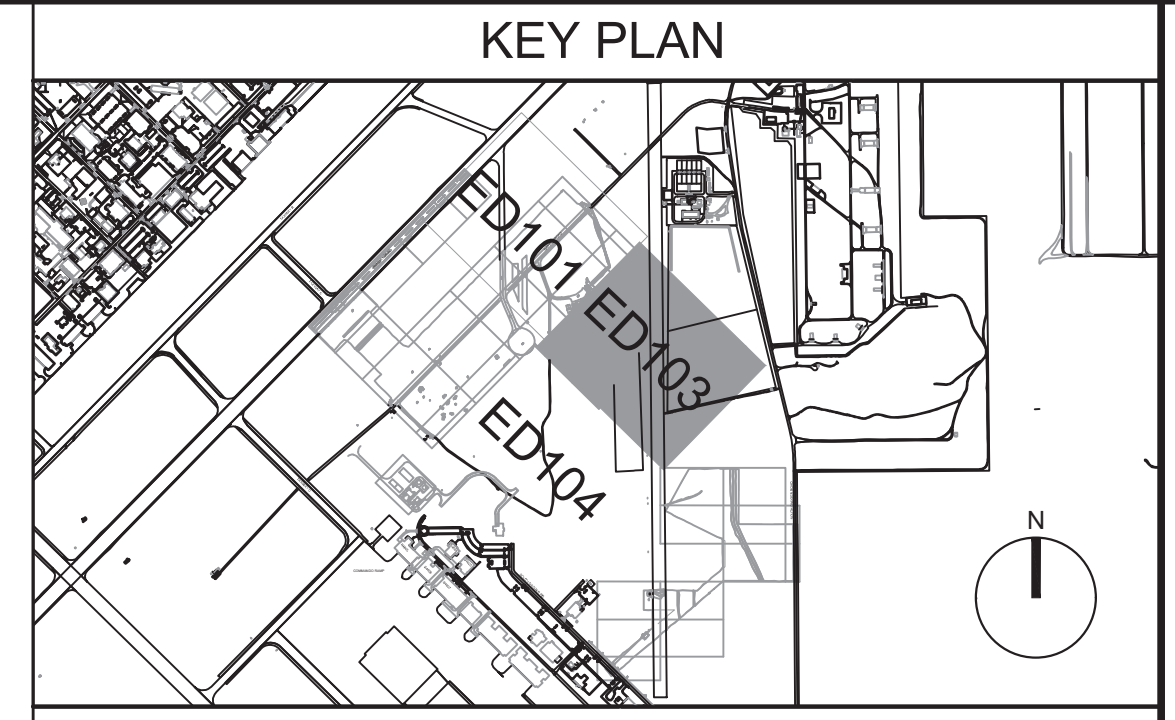
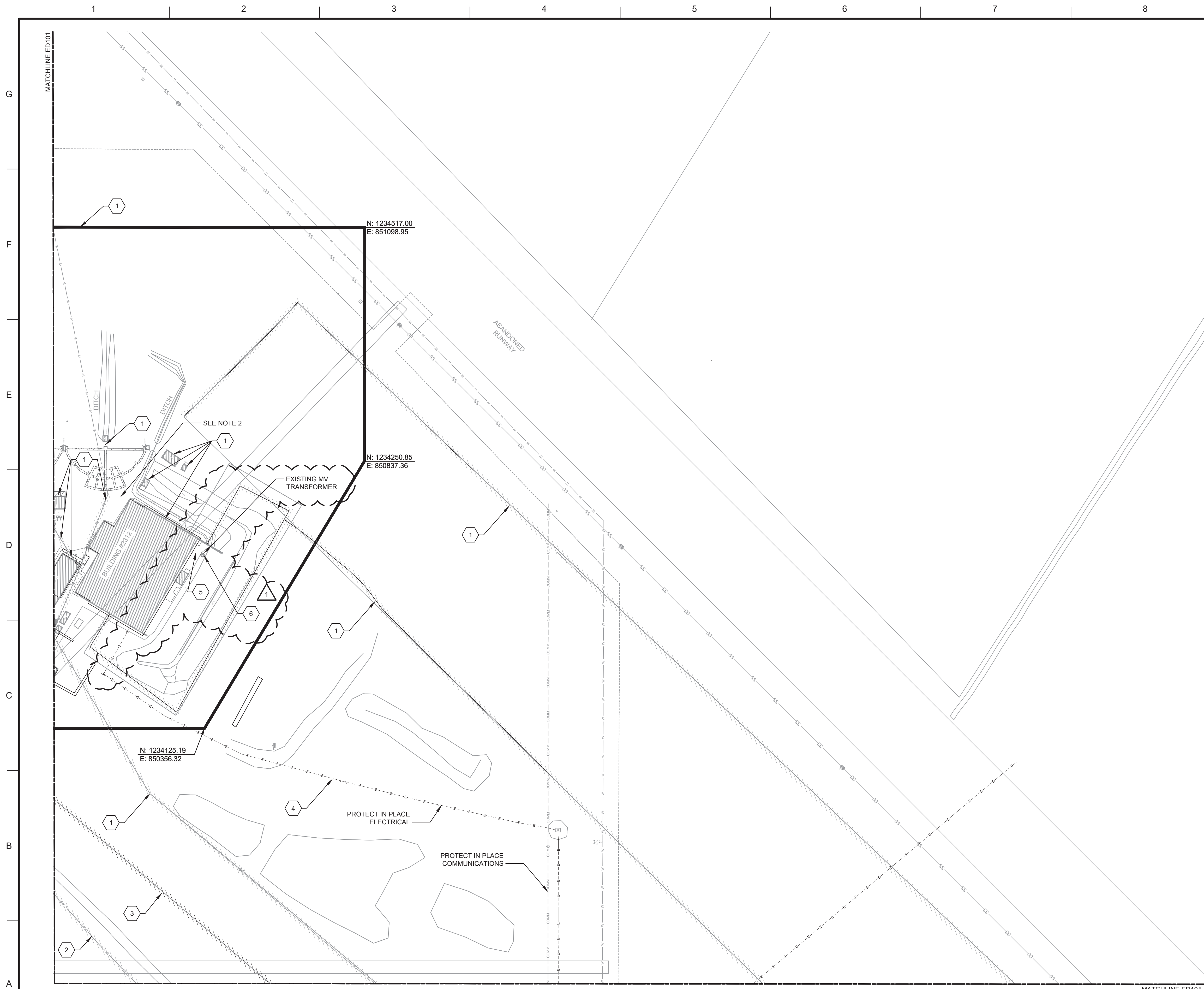


DESIGNED BY: M. LOPEZ	CHECKED BY: I. M. CULLOUGH	ISSUE DATE: 09/21/2021
DRAWN BY: P. MARKS	SUBMITTED BY: M. LOPEZ	DATE: 10/12/21
PROJECT NO.:W81P2P4R003	CONTRACT NO.:	DESCRIPTION: REMOVED CATM GAS LINE 2
(1 CHANGE) REMOVED KEY NOTE 23, EDITED KEY NOTE 22 & 23 TO KEY NOTE 24 REMOVED CATM GAS LINE 2		MARK

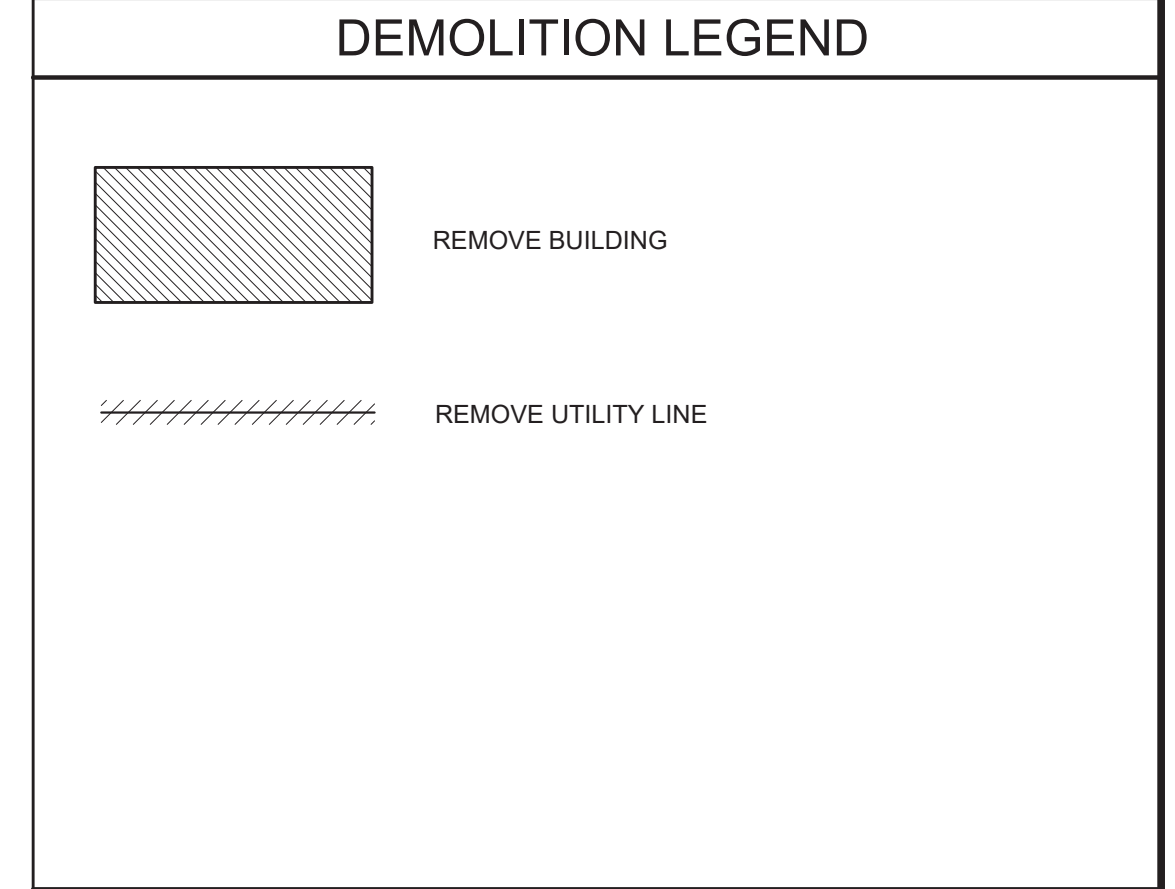
U.S. ARMY CORPS OF ENGINEERS ALBUQUERQUE DISTRICT ALBUQUERQUE, NM	1661 E CAMELBACK RD #400 PHOENIX, AZ 85016 
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CANNON AFB, NM  
 FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
 CZ0C143001  
**SITE UTILITIES - CATM & TRAP-SKEET**

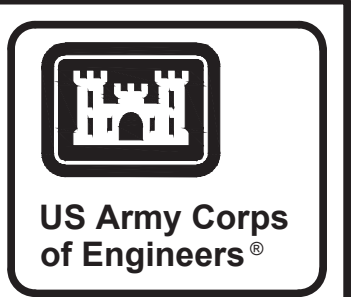
SHEET ID  
**CU113.2**



- ### GENERAL SHEET NOTES
- CLEAR AND GRUB AS REQUIRED.
  - SOILS WITH LEAD AND POLYNUCLEAR AROMATIC HYDROCARBONS HAVE BEEN IDENTIFIED IN THE PROJECT AREA. ALL SOILS REMOVED FROM THE AREA BY CONTRACTOR MUST BE TESTED IN ACCORDANCE WITH NMED AND USEPS REQUIREMENTS TO DETERMINE PROPER MANAGEMENT PROCEDURES. REFER TO LIMITED SITE INVESTIGATION TERRACON PROJECT NO. 65177490.
  - REFER TO SHEET C-001 FOR UTILITY LEGEND.



- ### KEY NOTES
- REFER TO CD SHEETS FOR CIVIL DEMOLITION.
  - REFER TO ET SHEETS FOR ANY COMMUNICATION DEMOLITION.
  - REMOVE CABLE, ABANDON CONDUIT FROM ELECTRICAL MANHOLE SHOWN ON DRAWING ED104.
  - PROTECT IN PLACE MEDIUM VOLTAGE CIRCUIT. ACTUAL ROUTING TO EXISTING TRANSFORMER UNKNOWN. CONTRACTOR SHALL CONFIRM IN FIELD.
  - REMOVE SECONDARY SERVICE CABLES FROM BUILDING 2312 TO EXISTING TRANSFORMER.
  - SALVAGE TRANSFORMER FOR RELOCATION FOR SERVICE TO HIGH MAST LIGHTING. ABANDON IN PLACE CONCRETE PAD. SEE SHEET ES106.



ISSUE DATE:	10/121	DATE
DESIGNED BY:		
DRAWN BY:		
CHECKED BY:		
SUBMITTED BY:		
SIZE:		
ANSI 'D'		

(2 CHANGES/ADDED / MODIFIED KEYNOTES 4 THRU 6 - A0002)

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016

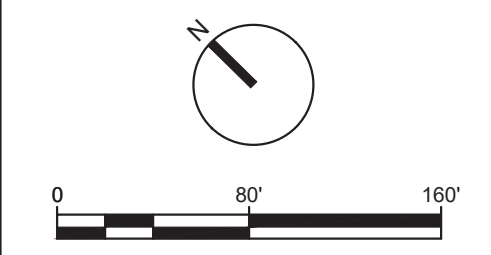
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CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/ RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001

SITE DEMOLITION - CATM & TRAP-SKEET

SHEET ID  
**ED103.1**

**A1 SITE DEMOLITION - CATM & TRAP-SKEET**  
SCALE: 1"=80'



AIRFIELD OPERATIONAL SAFETY NOTES:

1. RUNWAYS: CONSTRUCTION ACTIVITIES MUST NOT BE CONDUCTED WITHIN A DISTANCE EQUAL TO THE NORMAL VISUAL FLIGHT RULES (VFR) HOLDING POSITION DISTANCE FROM THE NEAR EDGE OF ANY ACTIVE SEGMENT OF A RUNWAY.
2. CONTRACTOR IS SOLELY RESPONSIBLE FOR PROTECTING WORK, MATERIALS, PERSONNEL AND BARRICADES FROM JET BLAST AND/OR PROPWASH. IN EXTREME CASES, THIS MAY REQUIRE THE USE OF TEMPORARY JET BLAST DEFLECTORS.
3. MARKING AND LIGHTING. CLOSED TAXIWAYS OR TAXILANES ON APRONS MUST BE MARKED OR BARRICADED AND NORMAL LIGHTING CIRCUITS DISABLED. TEMPORARY OBSTRUCTIONS, SUCH AS CRANES, MUST BE MARKED AND LIGHTED IN ACCORDANCE WITH FAA AC 70/7460-1. ALL HAZARDOUS AREAS (SUCH AS EXCAVATIONS OR STOCKPILED MATERIALS) ON THE AIRFIELD MUST BE DELINEATED WITH LIGHTED BARRICADES ON ALL EXPOSED (VISIBLE OR ACCESSIBLE) SIDES.
4. SUBMIT FORMAL NOTIFICATION OF CONSTRUCTION ACTIVITIES TO THE FAA AS DEFINED IN FAR PART 77, (FORMERLY FAA FORMS 7460-1 & 7460-2), USING THE FAA OBSTRUCTION EVALUATION/AIRPORT AIRSPACE ANALYSIS WEBSITE.
5. SAFETY CONSIDERATIONS:
  - KEEP ROUTES FROM FIREFIGHTING AND RESCUE STATIONS TO ACTIVE AIRPORT OPERATIONS AREAS CLEAR AT ALL TIMES. COORDINATE ALL RUNWAY, ROAD, & TAXIWAY CLOSURES WITH THE BASE FIRE DEPARTMENT (THROUGH THE CONTRACTING OFFICER).
  - INSTALL AND MAINTAIN TEMPORARY LIGHTING AND MARKING FOR CLOSED OR DIVERTED AIRCRAFT ROUTES AND DISABLE THE NORMAL LIGHTING CIRCUITS FOR CLOSED RUNWAYS. RUNWAY LIGHTS CAN BE FULLY COVERED IN LIEU OF DISABLING THE CIRCUIT. COORDINATE WITH AIRFIELD ELECTRICIANS TO DETERMINE THE ROUTING AND CONFIGURATION OF ANY REQUIRED CIRCUIT JUMPERS AND FOR THE LOCK-OUT OF CIRCUITS.
  - COVER AIRFIELD GUIDANCE SIGNAGE LEADING TO A CLOSED AREA . SECURE COVERS TO THE SIGNAGE IN A MANNER ACCEPTABLE TO THE AIRFIELD ELECTRICAL STAFF.
  - ALL DRIVERS AND EQUIPMENT OPERATORS SHALL ATTEND THE AIRFIELD DRIVING SAFETY TRAINING.
  - MARK AND/OR FLAG VEHICLES THAT ROUTINELY OPERATE ON THE AIRFIELD AREAS FOR HIGH DAYTIME VISIBILITY AND, IF APPROPRIATE, LIGHT FOR NIGHTTIME OPERATIONS. VEHICLES THAT ARE NOT MARKED AND LIGHTED REQUIRE ESCORT BY A VEHICLE THAT IS EQUIPPED WITH MARKING AND/OR LIGHTING DEVICES.
  - PARKING FOR CONSTRUCTION PERSONNEL WILL ONLY BE ALLOWED WITHIN THE CONTRACTOR STAGING AND STORAGE AREA OR IMMEDIATELY ADJACENT TO ACTIVE WORK AREAS.
  - DELINEATE ALL CONSTRUCTION AREAS WITH BARRICADES SPACED NO MORE THAN 100-FT APART. PROTECT BARRICADES FROM JET BLAST/PROP WASH. WITHIN THE PRIMARY SURFACE OF AN OPERATING RUNWAY, ONLY LOW PROFILE BARRICADES ARE ACCEPTABLE.
  - KEEP THE CONSTRUCTION SITE FREE OF DEBRIS THAT COULD CAUSE FOREIGN OBJECT DAMAGE AND PERFORM REGULARLY SCHEDULED SITE CLEAN UPS ON A SCHEDULE AS DIRECTED BY THE CONTRACTING OFFICER.
  - CLEARLY DISPLAY THE NAME OF THE COMPANY ON THE HIGH VISIBILITY VEST OF ALL PERSONNEL. DISPLAY THE NAME OF THE COMPANY ON A SIGN READABLE FROM 100 FT AWAY ON ALL VEHICLES & EQUIPMENT.
  - USE ONLY THOSE HAUL ROUTES IDENTIFIED ON THE DRAWINGS UNLESS ALTERNATE ROUTES ARE APPROVED BY THE CONTRACTING OFFICER, BASE CIVIL ENGINEERING, AND BASE OPERATIONS.
  - MAINTAIN A SUPPLY OF TYPICAL UTILITY MATERIALS ON-HAND TO PERFORM IMMEDIATE REPAIRS IN THE EVENT A UTILITY IS SEVERED.
  - PROVIDE ALL BARRICADING, SIGNAGE, AND LIGHTED X'S FOR AIRFIELD CLOSURES IN ACCORDANCE WITH UFC 3-260-01, APPENDIX B14, UFC 3-260-04, AND FAA ADVISORY CIRCULAR 150/5370-2G ; OPERATIONAL SAFETY ON AIRPORTS DURING CONSTRUCTION.
6. EXCAVATIONS AND OPEN TRENCHES MAY BE PERMITTED ALONG RUNWAYS 100 FEET FROM THE EDGE OF AN ACTIVE RUNWAY, PROVIDED THEY ARE ADEQUATELY SIGNED, LIGHTED AND MARKED. IN ADDITION, EXCAVATION AND OPEN TRENCHES MAY BE PERMITTED WITHIN 100 FEET OF THE RUNWAY EDGE ON A CASE-BY-CASE BASIS THAT IS, CABLE TRENCHES, PAVEMENT TIE-INS, ETC., WITH THE APPROVAL OF THE INSTALLATION COMMANDER. ALONG TAXIWAYS AND APRONS, EXCAVATION AND OPEN TRENCHES MAY BE PERMITTED UP TO THE EDGE OF STRUCTURAL TAXIWAY AND APRON PAVEMENTS, PROVIDED THE DROP-OFF IS ADEQUATELY SIGNED, LIGHTED AND MARKED.
7. STOCKPILING OF MATERIALS WITHIN THE PRIMARY SURFACE OF AN ACTIVE RUNWAY IS PROHIBITED.
8. REMOVE ALL VEHICLES FROM THE AIRFIELD AND STORE IN THE STAGING/STORAGE AREA AT THE END OF EACH SHIFT EXCEPT SLOW MOVING EQUIPMENT APPROVED ON A CASE-BY-CASE BASIS.
9. WORK OUTSIDE THE SCHEDULE RESTRICTED PHASES CAN BE COMPLETED AT ANY TIME WITHIN PERIOD OF PERFORMANCE OTHER THAN THE FOLLOWING EXCEPTIONS:
  - ANY WORK REQUIRING EQUIPMENT (I.E. CRANES) THAT WILL PENETRATE THE AIRSPACE CONTOURS SHOWN SHALL BE COORDINATED W/ BASE OPERATIONS 30 CALENDAR DAYS IN ADVANCE THROUGH THE CONTRACTING OFFICER.
  - ANY WORK THAT REQUIRES UTILITY SHUTDOWNS SHALL BE COORDINATED W/ BASE OPERATIONS & THE UTILITY OPERATOR AT LEAST 30 CALENDAR DAYS IN ADVANCE THROUGH THE CONTRACTING OFFICER.
10. SCHEDULE RESTRICTED WORK
  - ALL WORK WITHIN THESE AREAS SHALL BE COMPLETED DURING THE CLOSURES INCLUDING UTILITY INFRASTRUCTURE, FINISH GRADING, EROSION CONTROL, AND PAVEMENT MARKING. ALL AIRFIELD LIGHTING SHALL BE OPERATIONAL AT THE END OF THE CLOSURE.
11. COMPLY WITH ALL PROVISIONS OF THE PROJECT'S AIR FORCE TEMPORARY AIR FIELD CONSTRUCTION WAIVER.

# PHASING CONCURRENCE OPPORTUNITY/CONSTRAINT TABLE

	PHASE 1	PHASE 2	PHASE 3	PHASE 4
PHASE 1	-	o	o	o
PHASE 2	o	-	o	o
PHASE 3	o	o	-	o
PHASE 4	o	o	o	-

- o PHASES MAY BE CONSTRUCTED CONCURRENTLY
- MUST BE CONSTRUCTED CONCURRENTLY (NOT USED)
- x CANNOT BE CONSTRUCTED CONCURRENTLY (NOT USED)
- SAME PHASE

- PHASING NOTES:
1. PHASES DO NOT NEED TO BE CONSTRUCTED IN SEQUENTIAL ORDER AND MAY BE PERFORMED CONCURRENTLY, EXCEPT AS RESTRICTED BY OTHER PROVISIONS (I.E. MAINTAINING CATM COMPLEX OPERATIONS).
  2. INCLUDE THE PLANNED START/END DATE OF EACH PHASE IN ALL PROJECT SCHEDULES.
  3. NOTIFY BASE OPERATIONS IN WRITING BY SERIAL LETTER (THROUGH THE CONTRACTING OFFICER) AT LEAST 90 CALENDAR DAYS IN ADVANCE OF STARTING A PHASE.
  4. PHASE 1: DANGEROUS CARGO PAD OUTSIDE OF AIRFIELD CLEARANCES.
    - EXISTING CATM COMPLEX MUST REMAIN OPERATIONAL UNTIL USER HAS TAKEN OCCUPANCY OF THE NEW CATM FACILITY CONSTRUCTED UNDER THIS PROJECT.
    - EQUIPMENT HEIGHT RESTRICTED TO 15 FT. SUBMIT REQUESTS TO UTILIZE EQUIPMENT TALLER THAN 15 FT AT LEAST 60 DAYS IN ADVANCE. CONTRACTOR SHALL ALLOW 16 DAYS AFTER COMPLETION AND ACCEPTANCE OF NEW CATM FACILITY FOR THE EXISTING CATM FACILITY TO BE VACATED BY THE USER.
  5. PHASE 2: TAXIWAY WITHIN THE RUNWAY 04/22 PRIMARY & TRANSITIONAL SURFACES.
    - NOTIFY BASE OPERATIONS THROUGH THE CONTRACTING OFFICER 90 CALENDAR DAYS IN ADVANCE TO ALLOW FOR NECESSARY INTERGOVERNMENTAL NOTIFICATIONS AND NOTAMS.
  6. PHASE 3: TAXIWAY ADJACENT TO RUNWAY 04/22, WITHIN THE MANDATORY FRANGIBILITY ZONE. NOTIFY BASE OPERATIONS THROUGH THE CONTRACTING OFFICER 90 CALENDAR DAYS IN ADVANCE TO ALLOW FOR NECESSARY INTERGOVERNMENTAL NOTIFICATIONS AND NOTAMS. HOURS FOR CONSTRUCTION MAY BE RESTRICTED/ADJUSTED IN THIS AREA AT TIMES DUE TO REQUIRED BASE FLYING OPERATIONS.
  7. PHASE 4: NEW CATM.
    - EQUIPMENT HEIGHT RESTRICTED TO 100 FT. SUBMIT REQUESTS TO UTILIZE EQUIPMENT TALLER THAN 15 FT AT LEAST 60 DAYS IN ADVANCE.
  8. MAINTAIN TWO-LANE, ALL-WEATHER ACCESS TO EXISTING CATM OUTSIDE OF THE RESTRICTED 'NO DIG AREA' (NOTE 7, CD100) UNTIL IT IS VACATED. COORDINATE TEMPORARY ACCESS DRIVES AND/OR DRAINAGE WITH THE USACE COR & 27 SOCES AS REQUIRED TO FACILITATE PCCP PAVING & SUPPORTING GRADING FOR THE DANGEROUS CARGO PAD. ALL TEMPORARY DRIVES & GRADING WILL BE COMPLETED BY THE CONTRACTOR & RESTORED TO THE ORIGINAL CONDITION AT THE END OF THE PROJECT.

AIRFIELD MANAGER NOTES:

1. NOTIFY THE AIRFIELD MANAGER AND THE USACE COR IN WRITING VIA EMAIL 90 DAYS PRIOR TO RUNWAY CLOSURE.
2. NOTIFY THE AIRFIELD MANAGER AND THE USACE COR IN WRITING VIA EMAIL 60 DAYS PRIOR TO RUNWAY CLOSURE.
3. NOTIFY THE AIRFIELD MANAGER AND THE USACE COR IN WRITING VIA EMAIL 1 DAY PRIOR TO RUNWAY CLOSURE.

**A1** AIRFIELD OPERATIONAL SAFETY NOTES



US Army Corps of Engineers®

DATE	10/12/11
DESCRIPTION	ADDED PHASE DURATIONS & TEMP ACCESS DRIVE FOR A0002
MARK	

<b>DESIGNED BY:</b> P. MARKS	<b>ISSUE DATE:</b> 04/22/11
<b>CHECKED BY:</b> R. THEVENOT	<b>CONTRACT NO.:</b>
<b>SUBMITTED BY:</b> M. LOPEZ	
<b>SIZE:</b> ANSI D	

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016

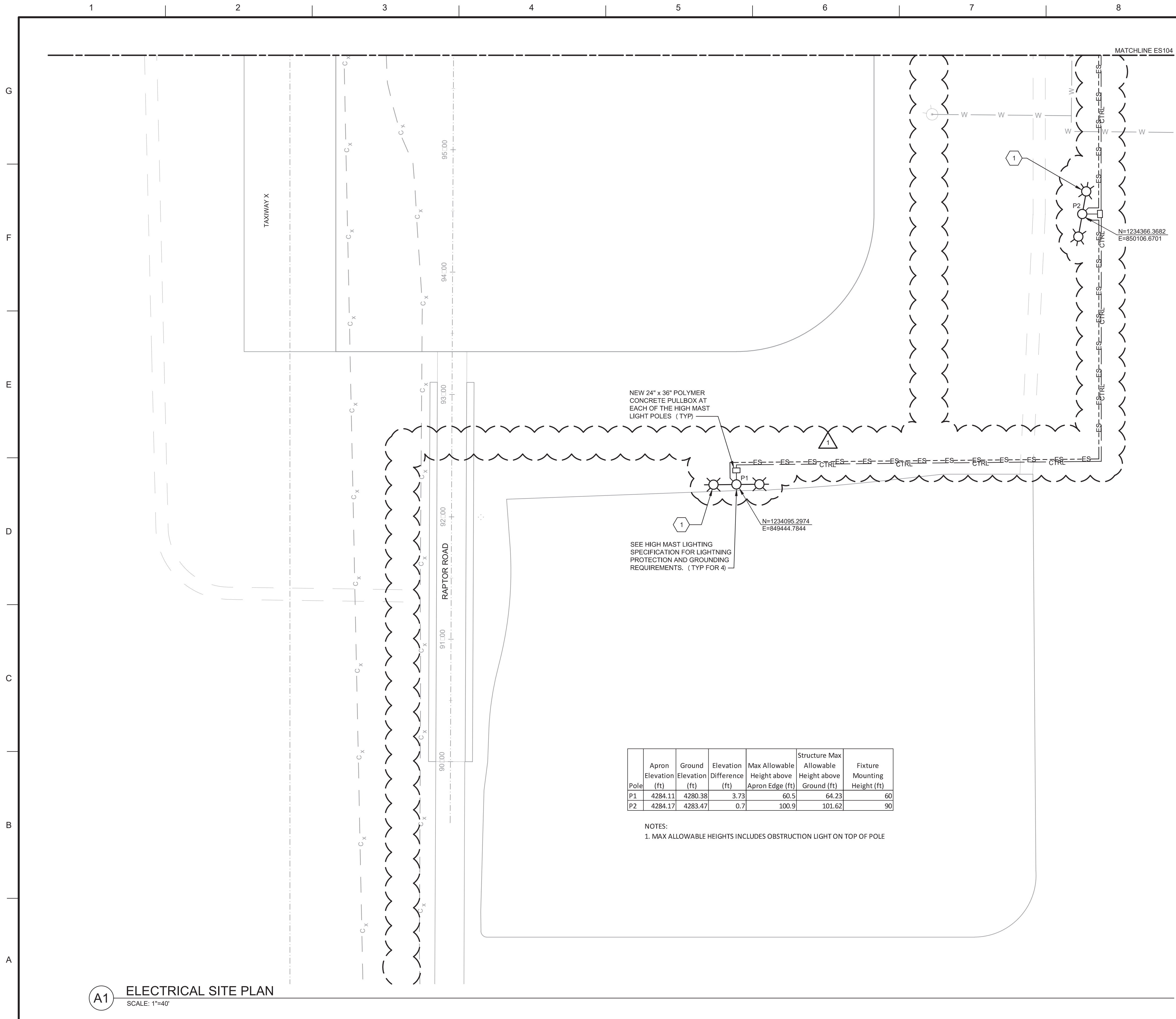
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CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001

AIRFIELD OPERATIONAL SAFETY NOTES

SHEET ID

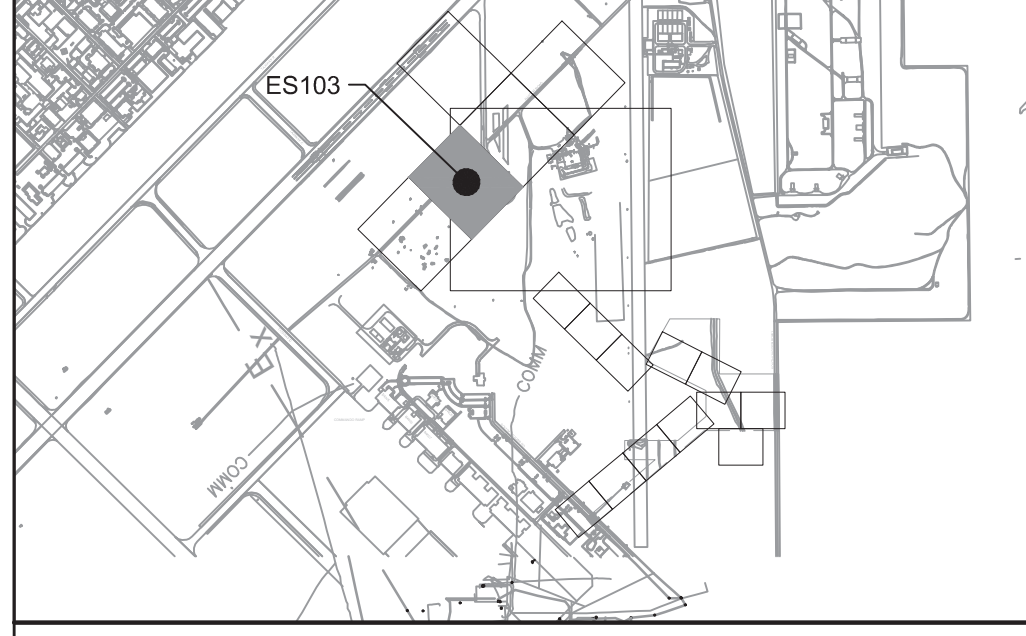
**GC100.1**



Pole	Apron Elevation (ft)	Ground Elevation (ft)	Elevation Difference (ft)	Max Allowable Height above Apron Edge (ft)	Structure Max Allowable Height above Ground (ft)	Fixture Mounting Height (ft)
P1	4284.11	4280.38	3.73	60.5	64.23	60
P2	4284.17	4283.47	0.7	100.9	101.62	90

NOTES:  
1. MAX ALLOWABLE HEIGHTS INCLUDES OBSTRUCTION LIGHT ON TOP OF POLE

KEY PLAN



GENERAL SHEET NOTES

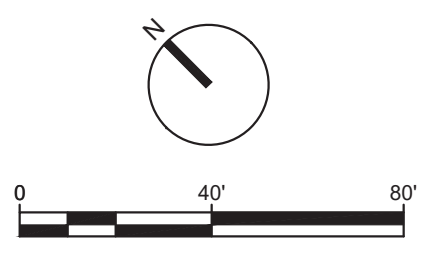
- FOR ELECTRICAL LEGEND SEE SHEET E-001.
- FOR ELECTRICAL DETAILS SEE E-500 SERIES SHEETS.
- FOR ONE-LINE DIAGRAMS SEE SHEETS E-601 AND E-602.
- LOCATION OF EXISTING UNDERGROUND UTILITY LINES INDICATED ON THIS PLAN ARE APPROXIMATE AND FOR INFORMATION ONLY. THE CONTRACTOR SHALL VERIFY THEIR EXACT LOCATION PRIOR TO COMMENCEMENT OF ANY TRENCHING OR EXCAVATION OPERATIONS.
- SEE CU200 SERIES SHEETS FOR UTILITY PROFILES.
- FOR UTILITIES NOT PROFILED, REFER TO CROSSING UTILITY PROFILES FOR SEPARATION AT CROSSING.
- SEE EA100 SERIES SHEETS FOR AIRFIELD ELECTRICAL PLANS FOR EDGE AND AIRFIELD LIGHTING.
- SEE ET110 SERIES SHEETS FOR TELECOMMUNICATION SITE PLANS.
- SEE SHEET C-001 FOR UTILITY LINE LEGEND.
- SEE SHEET E-601 FOR LIGHT FIXTURE SCHEDULE.
- SEE SHEET E-517 FOR HIGH MAST LIGHTING DETAILS, INCLUDING CONTROLS. SEE PANEL HML PANEL SCHEDULE ON SHEET 1EP607 FOR HIGH MAST LIGHTING CONDUIT AND CABLING REQUIREMENTS. FIXTURE AIMING POINTS PROVIDED IN LIGHTING COMPUTATIONS.
- OBSTRUCTION LIGHTS REQUIRED AT TOP OF EACH HIGH MAST LIGHTING POLE. PROVIDE LIGHTS AND CONTROLS PER HIGH MAST LIGHTING DETAILS.

KEY NOTES

- NEW HIGH MAST LIGHTING

A1 ELECTRICAL SITE PLAN

SCALE: 1"=40'



DESIGNED BY: D. JOHNSON	ISSUE DATE:	DATE
DRAWN BY: B. RILEY	DATE:	10/121
CHECKED BY: L. INGRAM	CONTRACT NO.:	
SUBMITTED BY: M. LOPEZ	(1 CHANGE) REMOVED COMM LINE, ADJUSTED ES AND CTRL LINES - A0002	DESCRIPTION
SIZE: ANSI 'D'	MARK	

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016

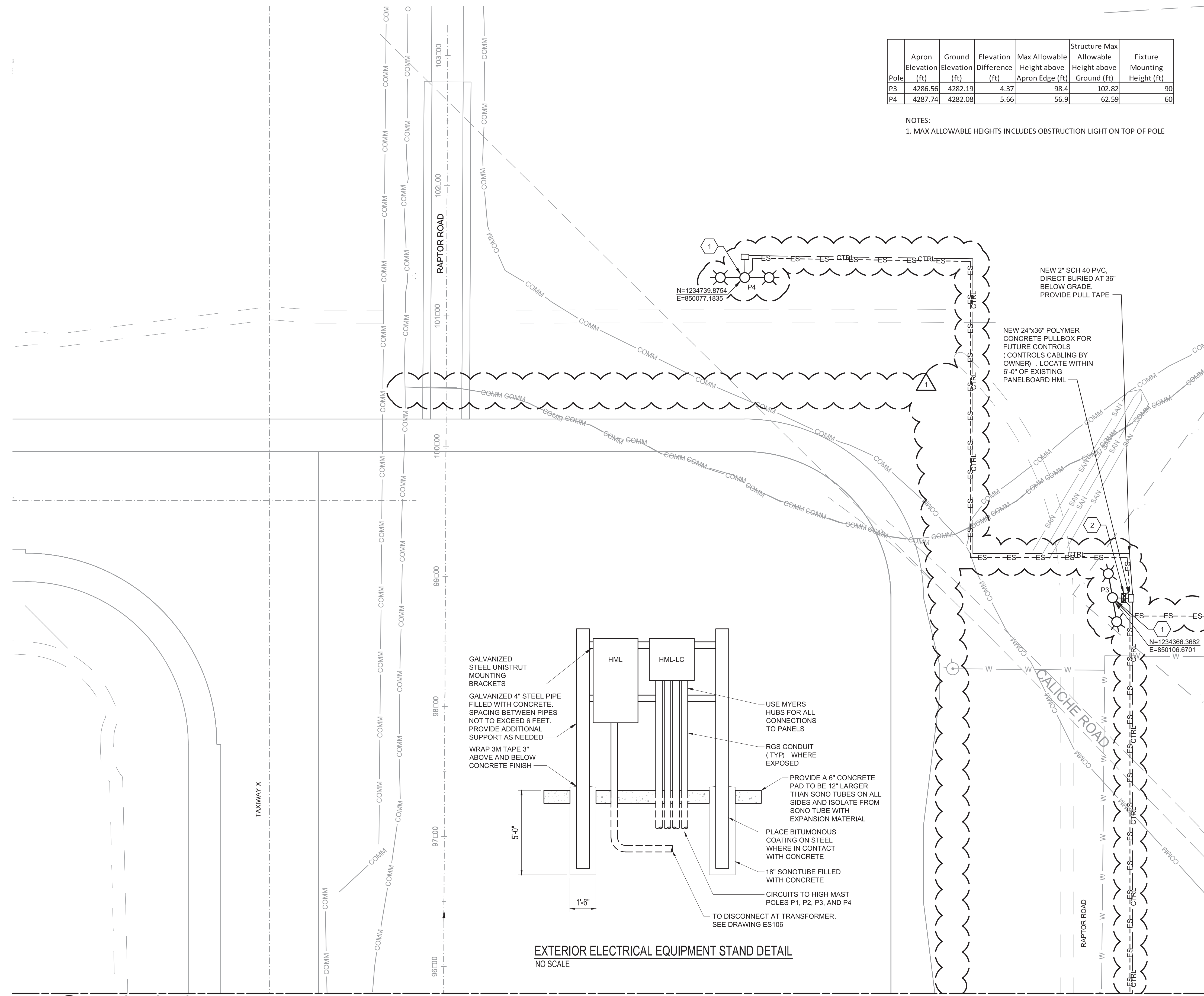
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FY19 DANGEROUS CARGO PAD/ RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
CZOC143001

ELECTRICAL SITE PLAN

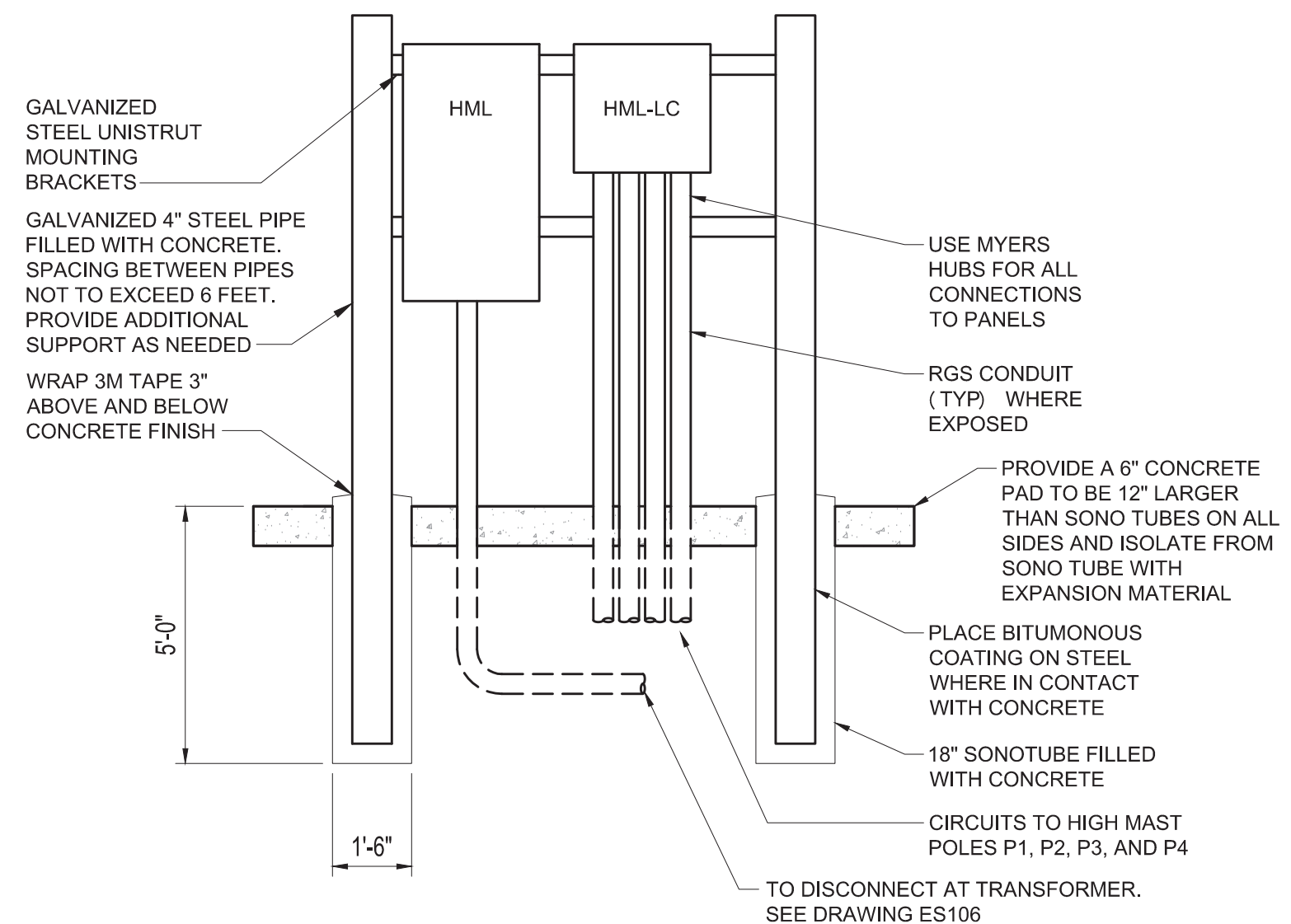
SHEET ID  
**ES103.1**



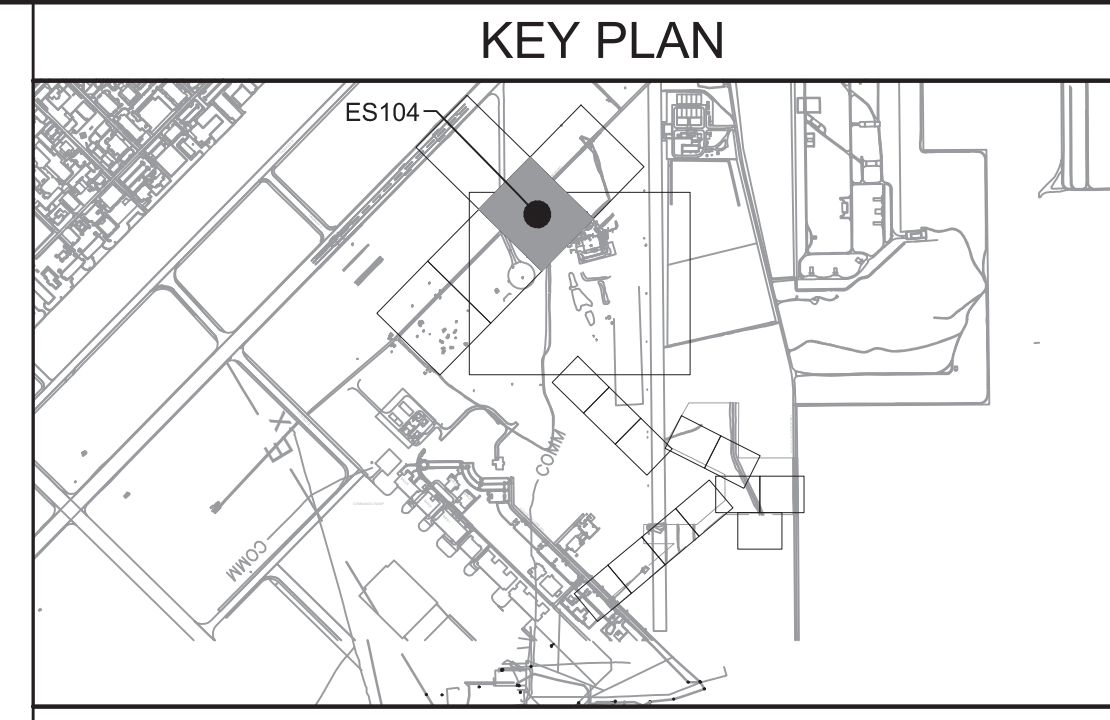


Pole	Apron Elevation (ft)	Ground Elevation (ft)	Elevation Difference (ft)	Max Allowable Height above Apron Edge (ft)	Structure Max Allowable Height above Ground (ft)	Fixture Mounting Height (ft)
P3	4286.56	4282.19	4.37	98.4	102.82	90
P4	4287.74	4282.08	5.66	56.9	62.59	60

NOTES:  
 1. MAX ALLOWABLE HEIGHTS INCLUDES OBSTRUCTION LIGHT ON TOP OF POLE



**EXTERIOR ELECTRICAL EQUIPMENT STAND DETAIL**  
NO SCALE

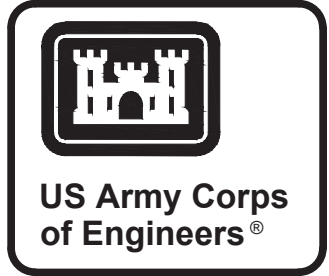


**GENERAL SHEET NOTES**

- FOR GENERAL SITE ELECTRICAL NOTES SEE SHEET ES103
- FOR HML PANEL SCHEDULE AND WIRING REQUIREMENTS SEE SHEET 1EP607. CONDUIT TO POLES IS DIRECT BURIED AT 36" BELOW GRADE.
- MOUNT 12-POLE LIGHTING CONTACTOR 'LC-HML' AT BASE OF POLE P3 ONLY FOR CONTROL OF ALL HIGH MAST LIGHTS. LIGHTING CONTACTOR SHALL HAVE HOA SWITCH FOR MANUAL OR AUTOMATIC OPERATION. MOUNT 7-PIN TYPE PHOTOCELL FACING NORTH, PER MANUFACTURER RECOMMENDATIONS FOR AUTOMATIC CONTROL.

**KEY NOTES**

- NEW HIGH MAST LIGHTING.
- NEW PANELBOARD HML AND HML-LC.



DATE	DESCRIPTION
10/121	(1 CHANGE) REMOVED COMM LINE, ADJUSTED ES AND CTRL LINES - A0002

DESIGNED BY: D. SON	ISSUE DATE: MAY 2011
DRAWN BY: P. MARKS	SCALE: AS SHOWN
CHECKED BY: L. INGRAM	CONTRACT NO.:
SUBMITTED BY: M. LOPEZ	CONTRACT NO.:
SIZE: ANSI D	

U.S. ARMY CORPS OF ENGINEERS  
 ALBUQUERQUE DISTRICT  
 ALBUQUERQUE, NM

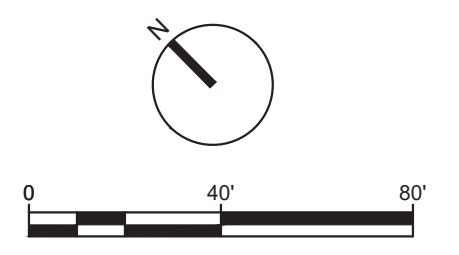
1661 E CAMELBACK RD #400  
 PHOENIX, AZ 85016  
**Stanley Consultants Inc.**

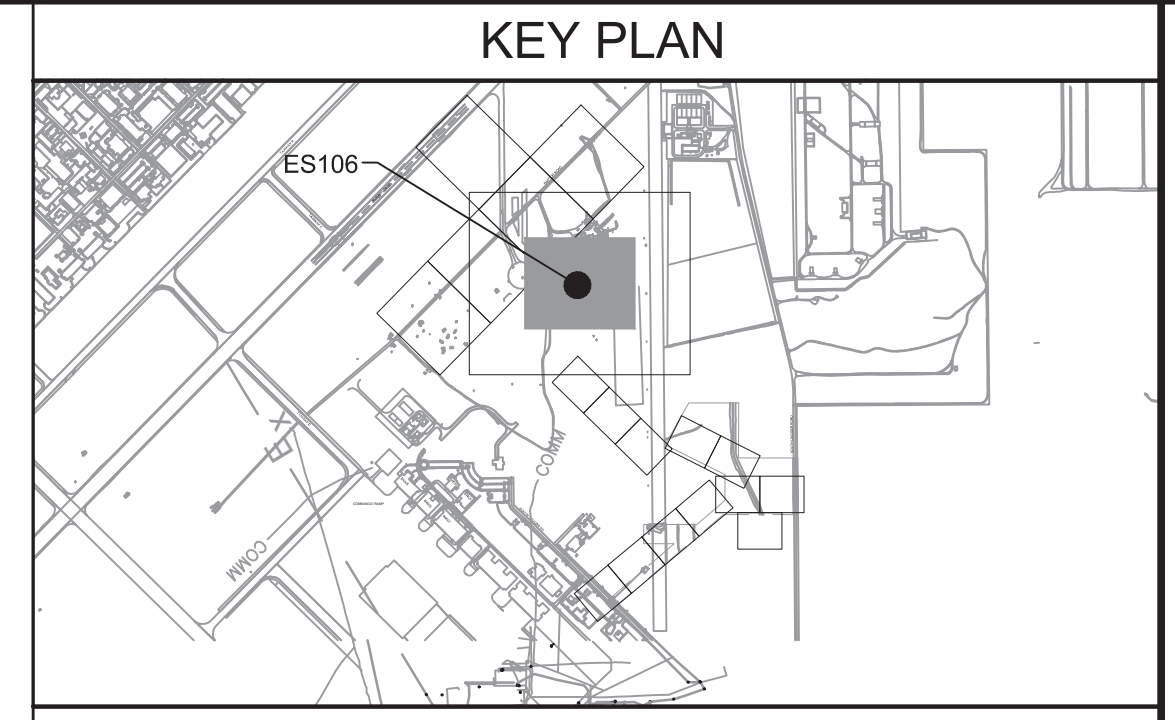
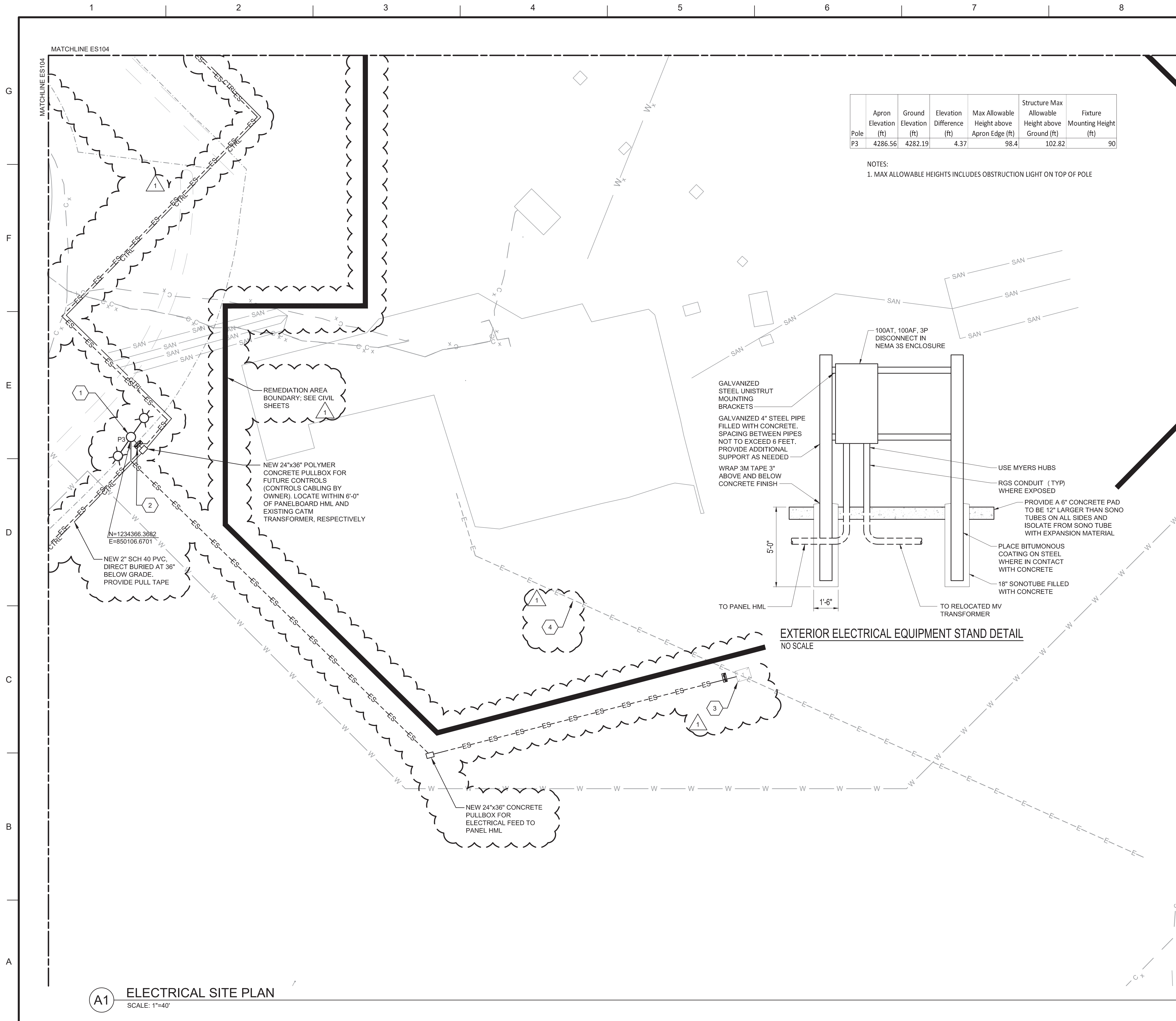
CANNON AFB, NM  
 FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
 CZ0C143001

**ELECTRICAL SITE PLAN**

SHEET ID  
**ES104.1**

**A1 ELECTRICAL SITE PLAN**  
SCALE: 1"=40'





- GENERAL SHEET NOTES**
- FOR GENERAL SITE ELECTRICAL NOTES SEE SHEET ES103.
  - FOR HML PANEL SCHEDULE AND WIRING REQUIREMENTS SEE SHEET 1EP607. CONDUIT TO POLES IS DIRECT BURIED AT 30" BELOW GRADE.
  - POWER CABLES FROM TRANSFORMER SECONDARY TO DISCONNECT AND ON TO PANELBOARD HML IS 4-#1, 1-#8 GND IN 2" DIRECT BURIED CONDUIT AT 30" BELOW GRADE. BURIED CONDUIT AND NEW ELECTRICAL PULLBOX SHALL BE LOCATED OUTSIDE THE REMEDIATION AREA BOUNDARY.
  - MOUNT 12-POLE LIGHTING CONTACTOR 'LC-HML' AT BASE OF POLE P3 ONLY FOR CONTROL OF ALL HIGH MAST LIGHTS. LIGHTING CONTACTOR SHALL HAVE HOA SWITCH FOR MANUAL OR AUTOMATIC OPERATION. MOUNT 7-PIN TYPE PHOTOCELL FACING NORTH, PER MANUFACTURER RECOMMENDATIONS FOR AUTOMATIC CONTROL.

- KEY NOTES**
- NEW HIGH MAST LIGHTING.
  - NEW PANELBOARD HML AND HML-LC.
  - SPLICE IN AND INSTALL RELOCATED MV TRANSFORMER (SEE SHEET ED103) ON A NEW CONCRETE PAD IN LINE WITH EXISTING MV CIRCUIT OUTSIDE THE REMEDIATION AREA BOUNDARY. CONNECT SECONDARY OF TRANSFORMER TO NEW DISCONNECT ON EQUIPMENT STAND FOR SERVICE TO PANELBOARD HML ON POLE P3. SEE DETAIL THIS SHEET.
  - DEMOLISH SPLICED EXISTING MV CABLES DURING NEW INSTALLATION OF RELOCATED TRANSFORMER. ABANDON EXISTING CONDUIT IN PLACE. ROUTING TO ORIGINAL EXISTING MV TRANSFORMER UNKNOWN. CONTRACTOR SHALL CONFIRM IN FIELD.

**US Army Corps of Engineers**

ISSUE DATE: 10/12/11

DESIGNED BY: WATZEL

DRAWN BY: B. RILEY

CHECKED BY: L. INGRAM

SUBMITTED BY: M. LOPEZ

U.S. ARMY CORPS OF ENGINEERS  
ALBUQUERQUE DISTRICT  
ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
PHOENIX, AZ 85016

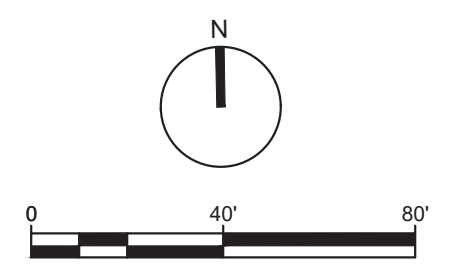
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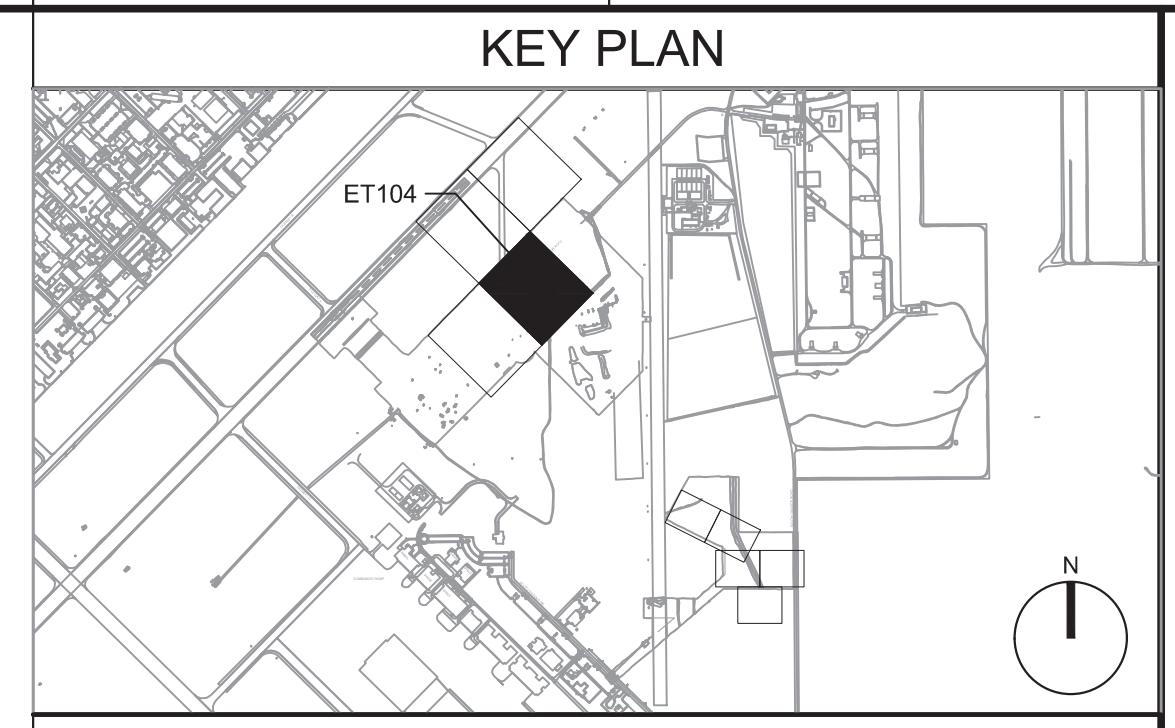
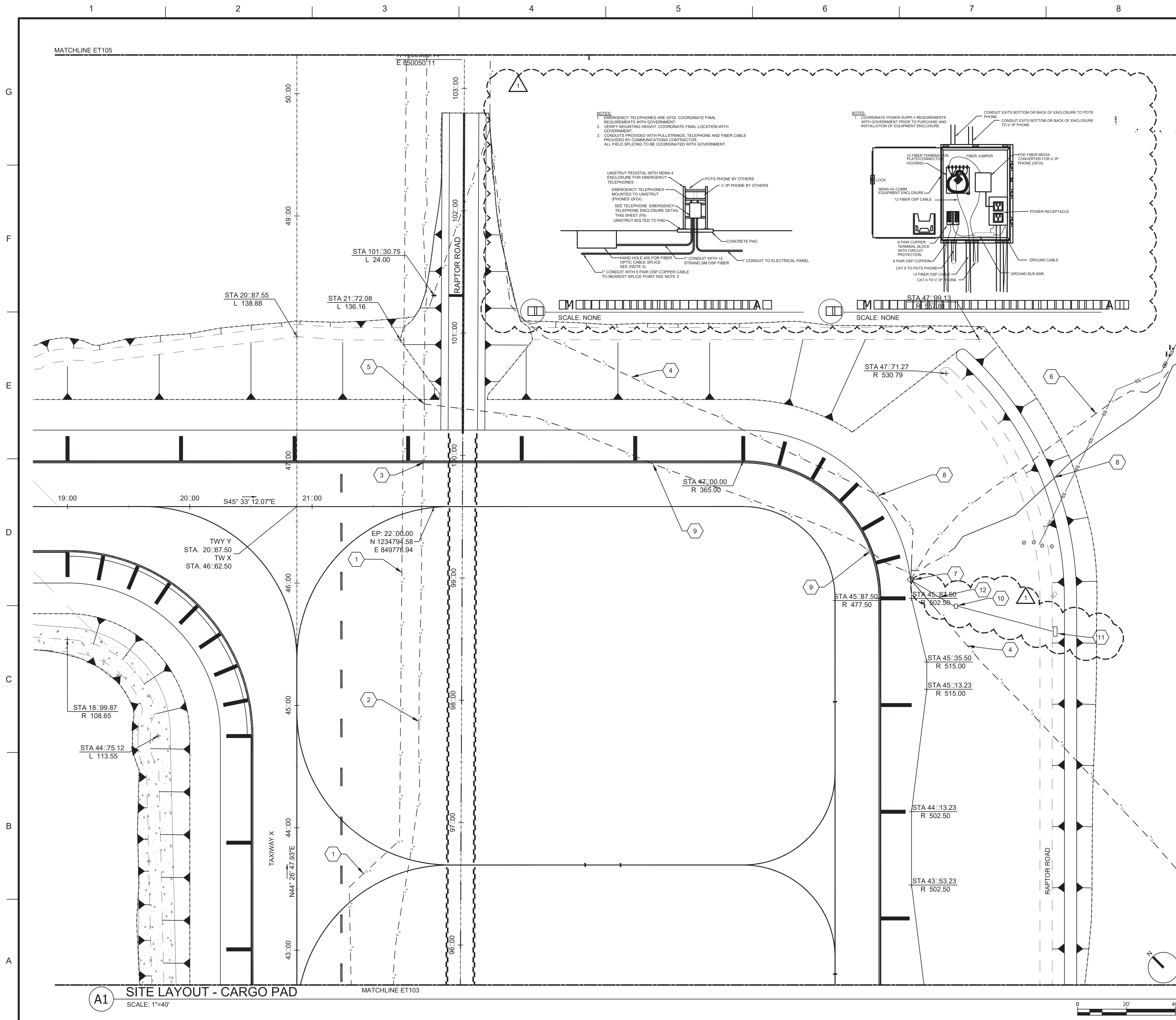
CANNON AFB, NM  
FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
CZ0C143001

ELECTRICAL SITE PLAN

SHEET ID  
**ES106.1**

**A1 ELECTRICAL SITE PLAN**  
SCALE: 1"=40'





**GENERAL SHEET NOTES**

- KEY NOTES**
- COAX-FF GMO-32 ABANDON IN PLACE OR REMOVE WHERE GRADING EXPOSES CABLE.
  - 1,200 PAIR COPPER CABLE CA 04x1-1200 TO REMAIN IN SERVICE DURING CONSTRUCTION. TO BE INTERCEPTED AND ENCASED IN CONCRETE UNDER NEW CARGO PAD. SEE NOTE 3.
  - SOUTH OF OF THIS POINT EXPOSE AND ENCASE EXISTING COMMUNICATIONS COPPER AND FIBER IN CONCRETE. TO REMAIN IN SERVICE.
  - EXISTING ACTIVE 72 STRAND FIBER CABLE FOC 72L8.3F TO REMAIN IN SERVICE DURING CONSTRUCTION.
  - EXISTING COPPER SPLICE 16-9 (CA 04X 801-900, 1101-1175) TO REMAIN IN SERVICE DURING CONSTRUCTION.
  - EXISTING FOC, TO REMAIN IN PLACE DURING CONSTRUCTION.
  - HAND HOLE 405, LIVE FOC TO REMAIN IN PLACE DURING CONSTRUCTION.
  - EXISTING COMMUNICATIONS CABLE TO REMAIN DURING CONSTRUCTION. LOCATE AND EXPOSE CABLE. COVER WITH PVC40 SPLIT CONDUIT (CLAMSHELL) AND ENCASE CABLE AND PVC40 IN CONCRETE UNDER PAD.
  - EXISTING 100 PAIR AND 75 PAIR COPPER CABLE (NOTE 5) TO REMAIN IN PLACE DURING CONSTRUCTION. LOCATE AND EXPOSE CABLE. COVER WITH PVC40 SPLIT CONDUIT (CLAMSHELL) AND ENCASE CABLE AND PVC40 IN CONCRETE UNDER PAD.
  - EMERGENCY TELEPHONE PEDSTAL SEE DETAILS F4 AND F6 ON THIS DRAWING.
  - NEW ELECTRICAL PANELBOARD HML AND HML-LC. (SEE ES104)
  - NEW 12 STRAND SM FIBER AND 6 PAIR COPPER CABLE TO ENCLOSURE.

**U.S. ARMY CORPS OF ENGINEERS**

DESIGNED BY: U.S. ARMY CORPS OF ENGINEERS  
 DRAWN BY: ALBUQUERQUE DISTRICT  
 CHECKED BY: T. PAKONEN  
 SUBMITTED BY: M. LOPEZ

ISSUE DATE: 10/12/11  
 DATE: 10/12/11

U.S. ARMY CORPS OF ENGINEERS  
 ALBUQUERQUE DISTRICT  
 ALBUQUERQUE, NM

1661 E CAMELBACK RD #400  
 PHOENIX, AZ 85016

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CANNON AFB, NM  
 FY19 DANGEROUS CARGO PAD/RELOCATE COMBAT ARMS TRAINING AND MAINTENANCE FACILITIES  
 CZOC143001

SITE LAYOUT - CARGO PAD

SHEET ID  
**ET104.1**

**US Army Corps of Engineers**

(3 CHANGES) ADDED DETAILS F4 AND F6, ADDED KEY NOTES 10 AND 11 FOR A0002.

MARK

DESCRIPTION

DATE

10/12/11

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**A1 SITE LAYOUT - CARGO PAD**  
 SCALE: 1"=40'

