APPENDIX A
REFERENCES

APPENDIX A

REFERENCES

NOTE:

THE DESIGN AND CONSTRUCTION OF THIS FACILITY MUST BE IN ACCORDANCE WITH THE UFC 1-200-01, 3-600-01, 4-010-01, THE LATEST VERSION OF THE INTERNATIONAL BUILDING CODE AND INTERNATIONAL PLUMBING CODE AND THE STATE OF KENTUCKY TEN STATES STANDARDS, THE MOST STRINGENT TAKING PRECEDENCE.

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CODE OF FEDERAL REGULATIONS
Government Printing Office
Washington, DC 20402

49 CFR 192	Transportation of Natural and other Gas by Pipeline: Minimum Federal Safety Standards
40 CFR 280	Owners and Operators of Underground Storage Tanks
49 CFR 195	Transportation of Hazardous Liquids by Pipeline
10 CFR 430	Energy Conservation Program for Consumer Products
29 CFR	Occupational Safety and Health Standards Part 1910
10 CFR 435B	Energy Conservation Performance Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 260	Hazardous Waste Management System General
40 CFR 261	Identification and Listing of Hazardous Waste

AMERICANS WITH DISABILITIES ACT (ADA)

Accessibility Guidelines for Buildings and Facilities

Available from US Architectural and Transportation Barriers Compliance Board, 1111 18th Street, N.W., Suite 501, Washington, DC 20036-3894, (202) 653-7834 v/TDD or (202) 653-7863 FAX

Manual on Uniform Traffic Control Devices- U.S. Department of Transportation, Federal Highway Administration

DEPARTMENT OF THE ARMY
Assistant Chief of Staff for Installation Management (ACSIM)

(28 April 2003) Army Installation Design Standards

ARMY REG 190-11 (12 February 1998) Physical Security of Arms, Ammunition and Explosives

ARMY/COE MILITARY HANDBOOKS
Internet: http://www.hnd.usace.army.mil/techinfo/engpubs.htm

ENGINEER TECHNICAL LETTER (ETL), MANUAL (EM) AND REGULATIONS (ER)

EM 1110-2-1906	Laboratory Soils Testing
EM1110-2-1909	Calibration of Laboratory Soils Testing Equipment
EM 1110-2-3102	General Principals of Pumping Station Design and Layout
ETL 91-6	Cathodic Protection
ETL 1110-3-466	Selection and Design of Oil/Water Separators at Army Facilities
ETL 1110-3-474	Cathodic Protection
ETL 1110-3-491	Sustainable Design for Military Facilities
ETL 1110-9-10	Cathodic Protection System Using Ceramic Anodes
ER 1110-3-110	Information Systems Design in Support of Military Construction

ARMY TECHNICAL INSTRUCTIONS (TI)

Internet: http://www.hnd.usace.army.mil/techinfo/engpubs.htm

TI 800-01	Design Criteria
TI 804-01	Area Planning, Site Planning and Design
TI 804-11	POV Site Circulation and Parking
TI 809-02	Structural Design Criteria for Buildings
TI 809-04	Seismic Design for Buildings
TI 809-07	Design of Cold-Formed Load Bearing Steel Systems
TI 809-29	Structural Considerations For Metal Roofing
TI 809-30	Metal Building Systems
TI 810-10	Mechanical Design Heating, Ventilating, and Air Conditioning
TI 810-11	Heating, Ventilating and Air Conditioning (HVAC) Control System
TI 814-01	Water Supply

TI 814-03	Water Distribution
TI 814-10	Wastewater Collection
TI 822-20	Surface Drainage Quad-Service Antiterrorism/Force Protection Construction Standard

ARMY/AIR FORCE TECHNICAL MANUAL ™
Internet: http://www.hnd.usace.army.mil/techinfo/engpubs.htm

TM 5-803-5	Installation Design
TM 5-803-13	Landscape Design and Planting Criteria
TM 5-803-13	Site Planning and Design
TM 5-807-10	Signage
TM 5-809-12	Concrete Floor Slabs on Grade Subjected to Heavy Loads
TM 5-813-4	Water Supply, Water Storage
TM 5-820-4	Drainage Areas Other Than Airfields
TM 5-822-2	General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas
TM 5-822-5	Pavement Design for Roads, Streets, Walks, and Open Storage Areas
TM 5-822-7	Standard Practice for Concrete Pavements
TM 5-822-8	Bituminous Pavements Standard Practice
TM 5-822-13	Pavement Design for Roads, Streets, and Open Storage Areas, Elastic Layered Method
TM 5-811-7	Electrical Design, Cathodic Protection

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Standardization Documents Order Desk
700 Robbins Avenue, Bldg. 4D
Philadelphia, PA 19111-5094

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U.S. Government Printing Office
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

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No. FD-4 Design of Wastewater and Stormwater Pumping Stations

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30 W. University Drive
Arlington Heights, IL 60004-1893

AMCA 210	(1999) Laboratory Methods of Testing Fans for Rating

AIR CONDITIONING AND REFRIGERATION INSTITUTE
4301 North Fairfax Drive
Arlington, VA 22203

ARI 310/380	(1993) Packaged Terminal Air-Conditioners and Heat Pumps
ARI 440	(1998) Room Fan-Coil and Unit Ventilator
ARI 445	(1987; R 1993) Room Air-Induction Units
ARI 880	(1998) Air Terminals

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square, Suite 104
Schaumburg, IL 60173-4268

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AAMA 605	Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
AAMA 607.1	Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum
AAMA 1503	Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 N. Capital St., NW, Suite 249
Washington, DC 20001
Ph: 800-231-3475
Fax: 800-525-5562
Internet: www.aashto.org

AMERICAN BEARING MANUFACTURERS ASSOCIATION
1200 19th Street, NW
Washington, DC 20036-4303

AFBMA Std 9	(1990) Load Ratings and Fatigue Life for Ball Bearings
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AMERICAN BOILER MANUFACTURERS ASSOCIATION (ABMA)
950 N. Glebe Rd, Suite 160
Arlington, VA 22203-1824

ABMA ISEI	Industry Standards and Engineering Information

ACI INTERNATIONAL (ACI)
P.O. Box 9094 Farmington Hills, MI 48333-9094
Ph: 248-848-3800
Fax: 248-848-3801
Internet: http://www.aci-int.org

ACI 318	Building Code Requirements for Reinforced Concrete
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ACGIH®
1330 Kemper Meadow Drive
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AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20190-4400
Ph: 800-548-2723
Fax: 703-295-6333
Internet: www.pubs.asce.org
e-mail: marketing@asce.org

ASCE 7	(1995) Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Bar Harbor Drive
West Conshohocken, PA 19428-2959

ASTM A 53	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
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ASTM B 88	(2003) Seamless Copper Water Tube
ASTM A 134	(1996) Pipe, Steel, Electric-Fusion (Arc)-Welded (Sizes NPS 16 and Over)
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ASTM A 36/A 36M	(2003) Carbon Structural Steel
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ASTM C 518	(2002) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
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ASTM D 1140	(2000) Standard Test Methods For Amount of Materials in Soils Finer Than the N. 200 Sieve
ASTM D 1248	(2002) Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1556	(2000) Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2000) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

ASTM D 1784	(2003) Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D 2216	(1998), Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 2241	(2004) Poly (Vinyl Chloride) (PVC) Pressure-Rated-Pipe (SDR Series)
ASTM D 2310	(2001) Machine-Made "Fiberglass" (Glass-Fiber-Reinforced) Thermosetting-Resin) Pipe
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes
ASTM D 2513	(2004); Rev. A) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
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ASTM D 2846/D 2846M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D 2996	(2000; Rev. A) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe
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ASTM D 5686	(1995) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Pipe Fittings, Adhesive Bonded Joint Type Epoxy Resin, for Condensate Return Lines
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials
ASTM E 119	(2000) Standard Test Methods and Fire Tests of Building Construction and Materials
ASTM E 779	(2003) Standard Test Method for Determining Air Leakage Rate by Fan Pressurization

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1791 Tully Circle. NE
Atlanta, GA 30329-2305

ASHRAE 15	(2001) Safety Standard for Refrigeration Systems
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ASHRAE 90.1	(2001) Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings
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ASHRAE 137	(1995) Method of Testing for Efficiency of Space-Conditioning/Water-Heating Appliances that Include a Desuperheater Water Heater
ASHRAE Hdbk-IP	(2001) Handbook, Fundamentals I-P Edition

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Three Park Place
New York, NY 10016-5990

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ASME	(1996) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24

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AMERICAN WELDING SOCIETY (AWS)

ARCHITECTURAL WOODWORK INSTITUTE
1952 Isaac Newton Square W.
Reston, VA 20190

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ASSOCIATED AIR BALANCE COUNCIL
1518 K Street NW, Suite 708
Washington, DC 20005

AABC MN-1 (2002) National Standards for Total System Balance

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BHMA A156.1	(1997) Butts and Hinges
BHMA A156.10	(1991) Power Operated Pedestrian Doors
BHMA A156.11	(1991) Cabinet Locks
BHMA A156.12	(1992) Interconnected Locks/Latches
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BHMA A156.14	(1997) Sliding and Folding Door Hardware
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BHMA A156.3	(1994) Exit Devices
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BHMA	Directory of Certified Door Closers
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BHMA	Directory of Certified Locks & Latches

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COUNCIL OF AMERICAN BUILDING OFFICIALS
5203 Leesburg Pike, Suite 708
Falls Church, VA 22041

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ELECTRONIC INDUSTRIES ASSOCIATION (EIA)
2500 Wilson Blvd
Arlington, VA 22201-3834

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120 Wall Street, 17th Floor
New York, NY 10005-4001

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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS INC. (IEEE)
445 Hoes Lane, P.O. Box 1331
Piscataway, NJ 08855-1331

Standard for Use of the International System of Units (SI):
the Modern Metric System

International Approval Services (IAS)
8501 E. Pleasant Valley Rd
Cleveland, OH 44131

IAS Directory (1999) IAS Directory of AGA & CGA Certified Appliances and Accessories

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS
20001 Walnut Drive South
Walnut, CA 91789-2825

IAPMO Z124.1 (1995) Plastic Bathtub Units

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IAPMO Z124.9 (1994) Plastic Urinal Fixtures

INTERNATIONAL CODE COUNCIL
5203 Leesburg Pike, Suite 600
Falls Church, VA 22041-3401

IBC (2003) International Building Code
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NATIONAL ASSOCIATION OF CORROSION ENGINEERS INTERNATIONAL
1440 South Creek Drive
Houston, TX 77084-4906

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Specifications for the Design and Construction of Load Bearing Concrete Masonry

Building Code Requirements for Concrete Masonry (ACI-ASCE 530 Building Code for Masonry; ACI-ASCE 530.1 Masonry Specifications)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
1300 N 17th Street, Suite 1847
Rosslyn, VA 22209

NEMA C12.1 (1995) Code for Electricity Metering

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8575 Grovemont Circle
Gaithersburg, MD 20877-4121

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NATIONAL FIRE PROTECTION ASSOCIATION
One Batterymarch Park
Quincy, MA 02269-9101

NFPA 10 (2002) Standard for Portable Fire Extinguishers

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PLUMBING AND DRAINAGE INSTITUTE
45 Bristol Drive, Suite 101

South Easton, MA 02375

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PO Box 221230
Chantilly, VA 20153-1230

SMACNA (1995; Addenda Nov 1997)) HVAC Duct Construction Standards - Metal and Flexible

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STEEL DECK INSTITUTE (SDI)

Steel Deck Institute Diaphragm Design Manual (Latest Edition)

STEEL DOOR INSTITUTE (SDI)
30200 Detroit Road
Cleveland, OH 44145-1967

ANSI A250.8/SDI 100 Standard Steel Doors and Frames

STEEL JOIST INSTITUTE

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UNDERWRITERS LABORATORIES STANDARDS (UL)

UL 430 (1994; Rev thru Nov 1996) Waste Disposers

UL 567 (1996; Rev thru Oct 1997) Pipe Connectors for Petroleum Products and LP-Gas

UL 1995 (1995; Rev thru Aug 1999) Heating and Cooling Equipment

UL 507 (1999) Electric Fans

UL 608 Modular Vault Panels

UL 746C (1995; Rev thru Jul 1999) Polymeric Materials – Use in electric Equipment Evaluations

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UNIFORM FEDERAL ACCESSIBILITY STANDARD (UFAS)

APPENDIX B1
FUNCTIONAL REQUIREMENTS – GENERAL

APPENDIX B1

FUNCTIONAL REQUIREMENTS – GENERAL

General Information:

60 soldiers make up a platoon. Each platoon has it's own housing, classroom and support spaces. These spaces are secure for the use of platoon members only.

Four platoons make up a company. Each barracks building serves one company (240 recruits) and is called a company building.

Five Companies comprise a Battalion (1200 recruits). Each battalion has a self-contained complex with Dining Facility, Battalion Headquarters and five Company Buildings as well as the following onsite training facilities:

1 400 meter track per Battalion
2 each covered training areas per Company (10 total)
1 each (Physical Training) PT area per Company (5 total)
15 each 4-station - 60 pull-up bars per Company
4 ea BRM Pits per Company (20 total)

Additional functional requirements for all buildings and site features are in Appendices B2 and B3.

This complex supports the housing and activities of one Battalion of new recruits in Basic Training. Basic training occurs on a ten-week cycle with a new group of recruits every ten weeks. Basic training is strongly characterized by a very rigid, regimented schedule of activities followed by all of the trainees in the complex. This creates unique building usage patterns and severe spikes in utility support requirements. Following is a generalized outline of the general use pattern of this complex, which applies to all 1200 recruits in a training cycle.

Wake up at 4:00AM.
PT outside in company's assigned PT area
20 minutes to return to platoon sleeping bay and shower and dress (each recruit gets five minutes to shower)
March to Dining Hall for breakfast
Return to Company Building
Queue and Covered Training area for platoon-level morning instruction
OR
Queue and march or be bussed to remote training area for platoon-level morning instruction
OR
Queue and Platoon classroom for platoon-level morning instruction.
OR
In first and last weeks of cycle go to large classroom at Battalion
Headquarters for company-level general orientation, training and graduation
March to Dining Hall for lunch (if coming from remote training area arrive by bus)
Return to Company Building
Training activities similar to morning training
March to Dining Hall for Dinner (if coming from remote training area arrive by bus)
Return to Company Building
Platoon classroom training 7:00 to 9:00 PM
Platoon sleeping bay to sleep at 9:00 PM

Because of the severe time restraints in the schedule the minimization of travel time and the maximum efficiency of activity flow is paramount to the successful functioning of this complex.

APPENDIX B2
FUNCTIONAL REQUIREMENTS
SITE AMENITIES

APPENDIX B2

FUNCTIONAL REQUIREMENTS – SITE AMENITIES/STRUCTURES

GENERAL INFORMATION

Required changes and allowable variations that apply to Site Amenities/Structures are stated in Section 01020 and are not repeated here.

Visibility and Vandal-resistance: Although recruits are supervised most of the time, teenagers are prone to mischief. In recruit use areas hiding spaces and opportunities for concealment must be minimized.

DINING FACILITY DUMPSTER ENCLOSURE

DESCRIPTION: Concrete pad for trash and recycling receptacles. Also includes a screened pad adjacent to it for recycled grease storage. This area is sized for two 55-gallon drums and has wash-down facilities.
REQUIRED CHANGES FROM DATA PROVIDED: Dumpster enclosures shall have brick exterior wall Dumpster enclosure shall have chain link gates with vinyl slats.
ALLOWABLE VARIATIONS FROM DATA PROVIDED: May be modified to include recycling containers.

BIKE RACK

DESCRIPTION: 1 station bike rack
ADJACENCY REQUIREMENTS:
Preferred location is adjacent to DFAC service entrance.
REQUIRED CHANGES FROM DATA PROVIDED: None
ALLOWABLE VARIATIONS FROM DATA PROVIDED: None

APPENDIX B3
FUNCTIONAL ROOM REQUIREMENTS
DINING FACILITY

APPENDIX B3

FUNCTIONAL ROOM REQUIREMENTS – DINING FACILITY

GENERAL INFORMATION
Required changes and allowable variations that apply to this building are stated in Section 01020 and are not repeated here.

The Dining Facility serves one battalion. The layout, which features four serving lines and two dining rooms, allows for efficient troop dining within training schedule constraints. The hours of operation for this entire facility is normal business day. The loading docks receive semi tractor trailer deliveries daily.
Insect Infestation: All wall cavities must be thoroughly cleaned prior to sealing to remove any debris that could contribute to insect infestation. Pretreatment of wall cavities with borax or silica gel is optional, preferred.
Kitchen walls shall not be white. White induces fatigue more quickly than other colors. Kitchen walls shall be soft colors.

Refer to Section 29.10.9 for Lighting Fixture Type description for the following areas.

SPACE: COVERED WAITING (2ea per Dining Facility)
DESCRIPTION: Covered exterior waiting area for platoons to wait until their turn to enter dining facility and to regroup after eating. Covered connecting walkway to entrance vestibule and to troop restrooms.
REQUIRED CHANGES FROM DATA PROVIDED: Provide 2ea 1200x1200 (4'x4') prefinished aluminum wall-mounted bulletin boards (locking) with scratch resistant clear sliding doors. Locate at columns near building entrance.
ALLOWABLE VARIATIONS FROM DATA PROVIDED:
Removable bollards for vehicle barriers optional, preferred.

Fixture Type – F10

SPACE: CRAWLSPACE
DESCRIPTION: Utility access crawlspace under kitchen, serving and dishwashing areas with unreinforced floor slab and minimum 48 inches clear height to facilitate repairs.
REQUIRED CHANGES FROM DATA PROVIDED: This space is not a bid option. It is required as part of base bid.

Fixture Type -

SPACE: DINING
DESCRIPTION: self-explanatory.
ALLOWABLE VARIATIONS FROM DATA PROVIDED: Column-free dining areas are preferred.

Fixture Type - Ca

SPACE: LOADING DOCK
DESCRIPTION: self-explanatory.
REQUIRED CHANGES FROM DATA PROVIDED: Delete dock leveler. Revise stair so that handrail extension at bottom of stair complies with ADAAG 4.9.4 with wall return. Provide physical protection of CO2 tank if located on the loading dock or anywhere else where susceptible to damage.

Fixture Type – H1
1-Telehpone/Data outlet

SPACE: OFFICE 142 and STORAGE 141
DESCRIPTION: self-explanatory.
REQUIRED CHANGES FROM DATA PROVIDED: Rearrange floor plan to place office 142 below office 140 and storage 141 to left of both offices. Keep both vision panels into kitchen (at office 140 and relocated office 142). Delete vision panels to corridor 150 and to storage 141 from office. See the Fort Jackson drawings for graphic description.

Office – Fixture Type – A; Storage – Fixture Type – Ca
1-Telehpone/Data outlet

SPACE: WASTE PULP 136
DESCRIPTION: Room for waste pulp extractor. Requires heavy waste to be taken by handcart to dumpster area. Room floor elevation shall be at the height of the finish grade at door.
ALLOWABLE VARIATIONS FROM DATA PROVIDED: None

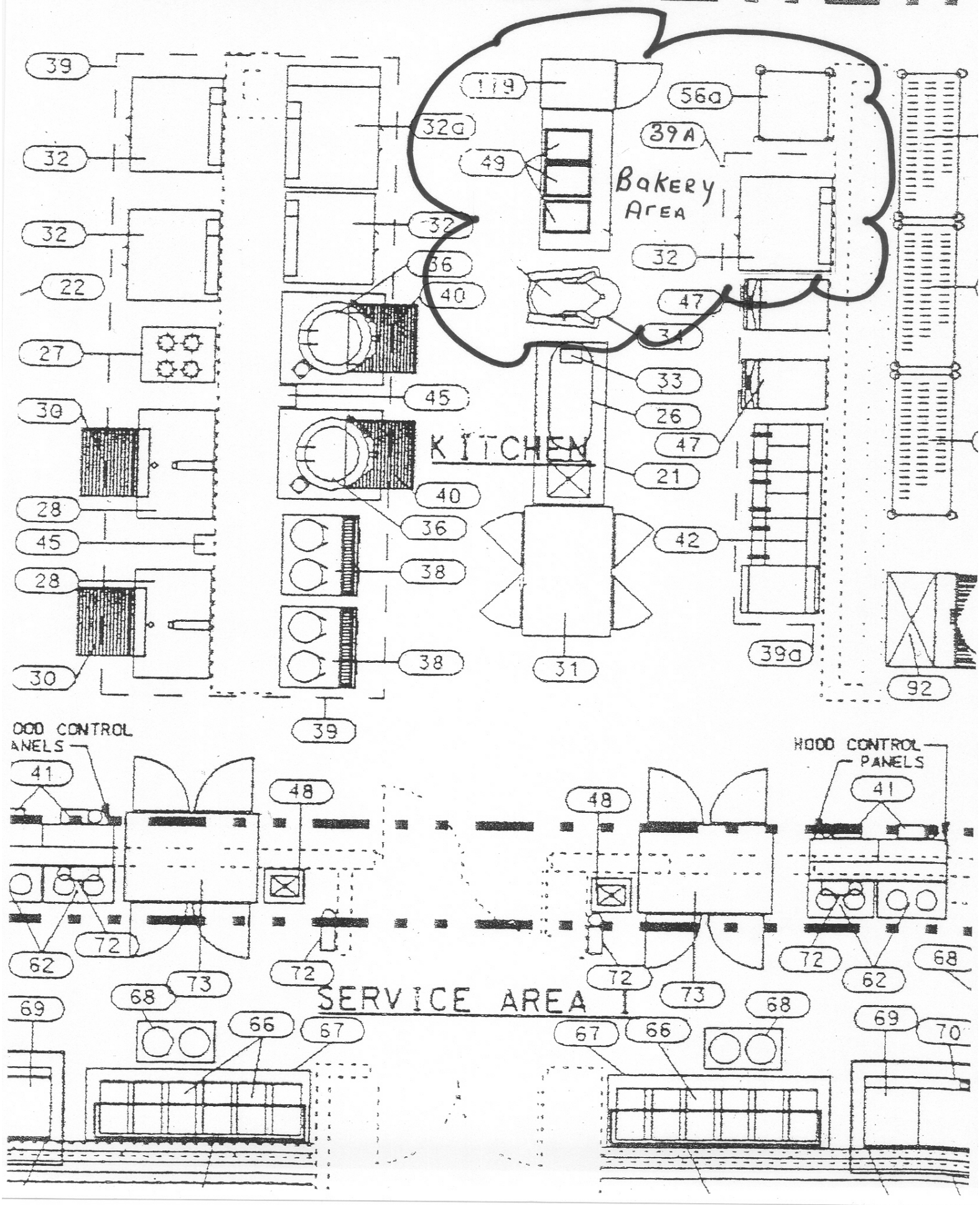
Fixture Type – E5

SPACE: POT/PAN AREA 123
DESCRIPTION: self explanatory
REQUIRED CHANGES FROM DATA PROVIDED: Increase the size of the back splash on the soiled and clean drain board on the power soak to 18” minimum in order to protect the walls in this area.

Fixture Type – E5

SPACE: VEGETABLE PREP AREA, POT/PAN SCRUB AREA AND BAKERY AREA
DESCRIPTION: self explanatory
REQUIRED CHANGES FROM DATA PROVIDED: Modifications to equipment layout per sketches attached hereto.

ALL OTHER SPACES:
REQUIRED CHANGES FROM DATA PROVIDED: None
ALLOWABLE VARIATIONS FROM DATA PROVIDED: None


Bakery Area
KITCHEN
SERVICE AREA
HOOD CONTROL PANELS
HOOD CONTROL PANELS
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32a
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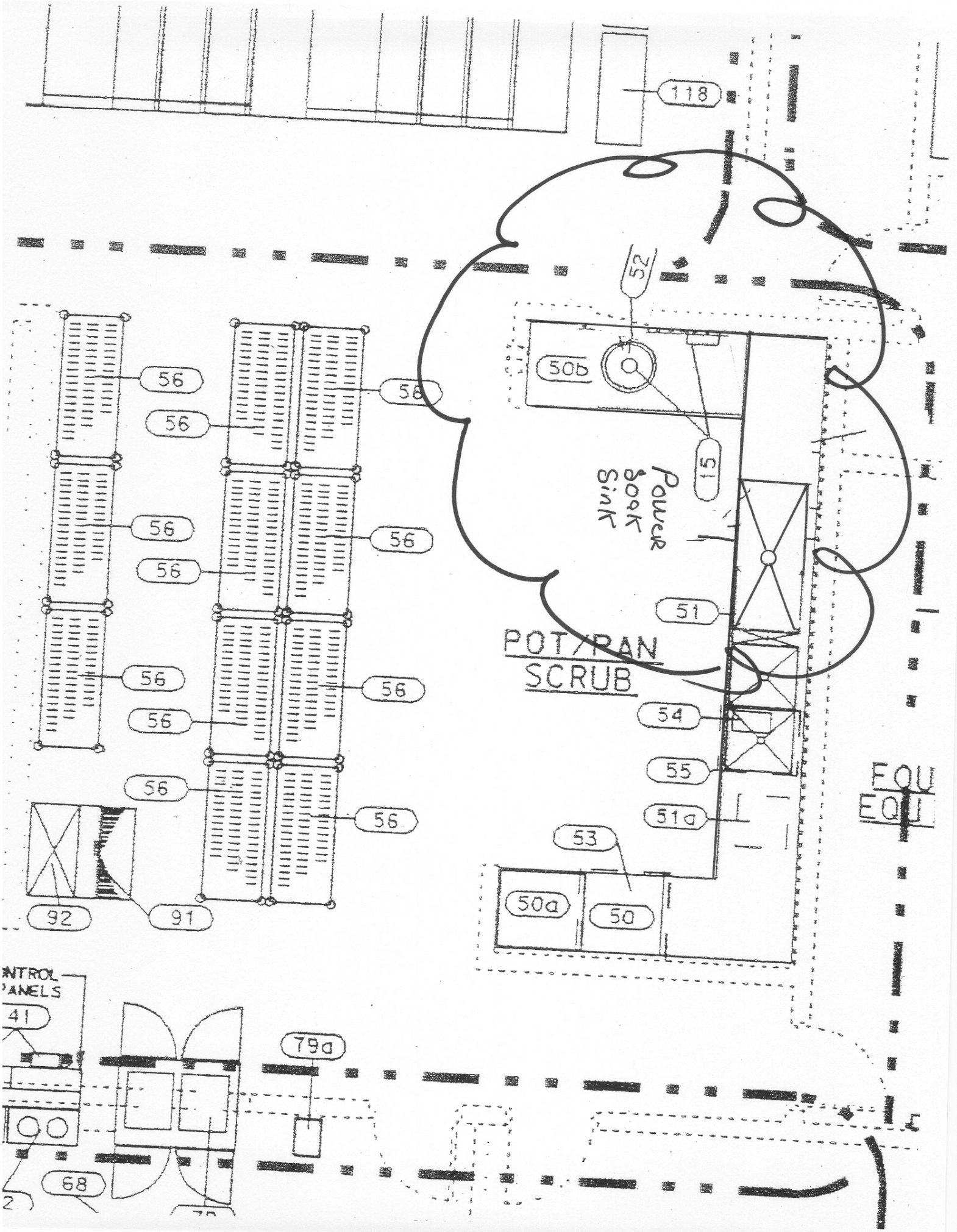
118
52
50b
15
Power
Soak
Sink
POT/PAN
SCRUB
51
54
55
51a
53
50a
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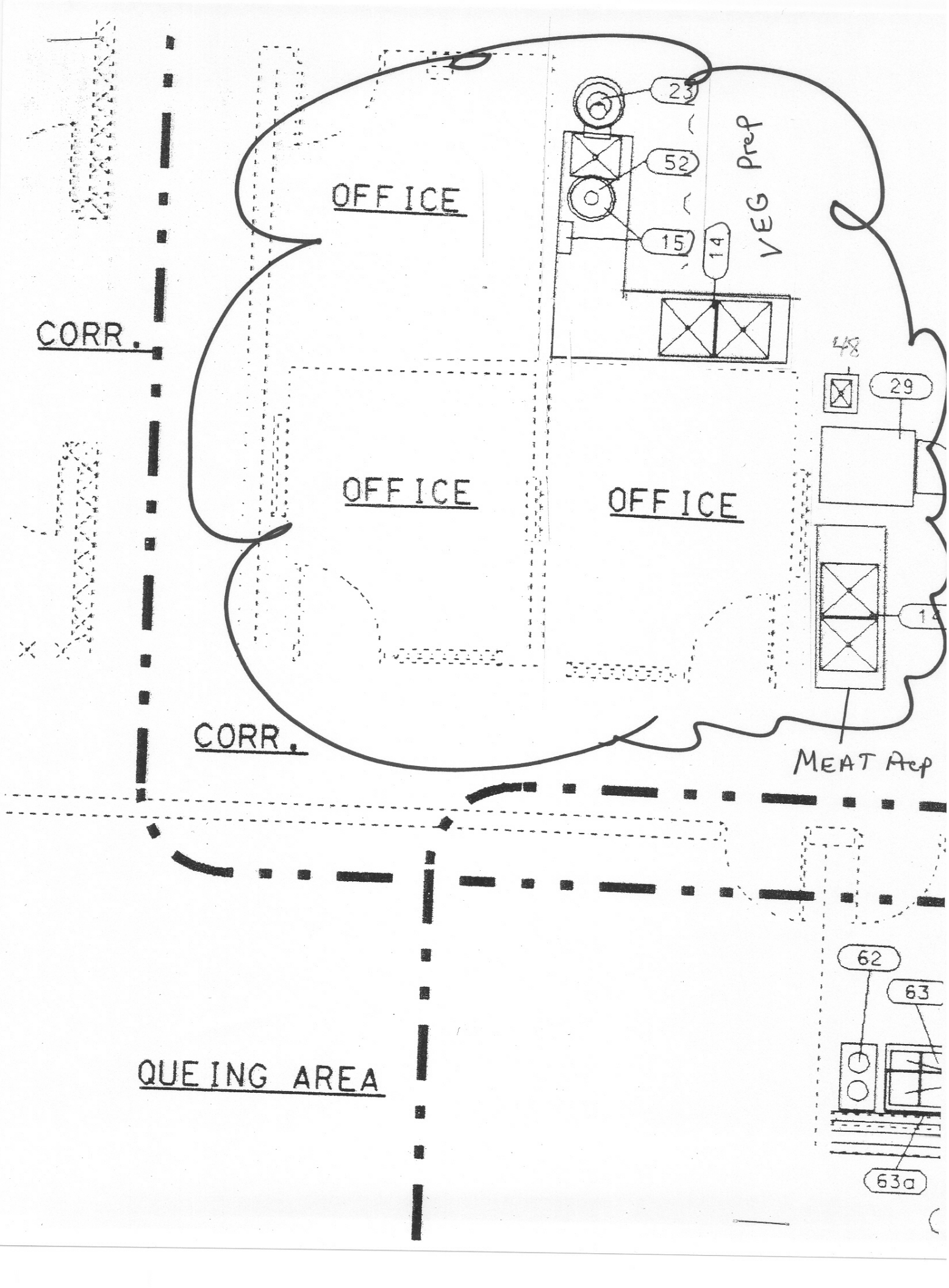
56
92
91
NTROL
ANELS
41
79a
68


OFFICE
OFFICE
OFFICE
CORR.
CORR.
QUEING AREA
VEG Prep
MEAT Prep
23
52
15
14
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63
63a

APPENDIX C
FIRE PROTECTION ANALYSIS / LIFE SAFETY CODE ANALYSIS OF BUILDINGS IN THIS PROJECT

APPENDIX C

FIRE PROTECTION ANALYSIS
DINING FACILITY

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NOTE TO DESIGNER: This document is a preliminary analysis used for concept development. It does not contain all requirements and does not relieve the designer of complete code and criteria review, compliance and documentation responsibilities during proposal preparation and final design development.

REFERENCES:
IBC – International Building Code, 2003
UFC 3-600-01, Design: Fire Protection Engineering for Facilities
NFPA 101, Life Safety Code, 2003
NFPA 10, Standard for Portable Fire Extinguishers, 2002
NFPA 13, Installation of Sprinkler Systems, 2002

BUILDING DESCRIPTION:
One Story Building, Approximately 40,900 Square Feet (including canopy areas)

1. IBC Occupancy Classification:
Dining Area with full Kitchen – Group A-2
Occupancy Separation - single use, no separation required.

302.1.1 Incidental Uses (Table 302.1.1)

- Mechanical Room where largest piece of equipment is over 400k Btu/hour input (if used in lieu of a geothermal system)	1 hour or fire extinguishing system
- Refrigerant Machinery Rooms (if used in lieu of a geothermal system)	1 hour or fire extinguishing system
- Storage Rooms over 100 square feet (standard BCT Barracks drawings require any storage room adjacent to exit-ways must be one-hour rated construction).	1 hour

302.3.2 Nonseparated Uses
The required type of construction for the building is determined by applying the height and area limitations for each of the applicable occupancies to the entire building. The most restrictive type of construction determined is required to apply to the entire building.

NFPA 101 Occupancy,:
Dining Area: New Assembly – Chapter 12
Kitchen: Incidental Industrial (Para 6.1.14.2).

2. IBC General Building Limitations:
Table 503 Height and Area Limitations.

Construction Type VA	Use Group A-2
Height	50
Stories	2
Area per Floor	11,500

Actual Building Height: Approximately 20' (per Standard BCT Barracks drawings)
Actual No. of Stories: 3
Actual Area per Floor: 40,900 square feet.

504 - Height Modification
Automatic sprinkler increase (504.2)
- Height increase: (20') - 70' total allowable height
- Stories increase: (1 story) - 3 total allowable stories.

506 - Area Modification - Type VA

Aa = 11,500 + [11,500 x 75 / 100] + [11,500 x 300 / 100]
Aa = 11,500 + 8,625 + 34,500
Aa = 54,625 total allowable area per floor

Comparison:

	Actual	Allowable
Height	Approx. 20'	70'
No. of Stories	3	3
Area per Floor	40,900 sf	54,125 sf

Note: Maximum allowable area with area modifications for Construction Type VB is 32,500 sq. ft.

3. IBC Construction Type
Table 601 Fire-Resistance Rating Requirements for Building Elements (hours)

Building Element	Classification VA
Structural Frame	1
Bearing Walls - Interior	1
Bearing Walls - Exterior ≥30'	0
Floor Construction	1
Roof Construction	1
Nonbearing Walls – Interior	0
Nonbearing Walls – Exterior ≥ 30'	0

Note: Although Type VA construction allows combustible construction, wood framing shall not be used. All other more restrictive construction types (except IV) may be used provided all other criteria is met.

4. IBC Fire Resistance - Rated Construction
Table 704.8 Maximum Area of Exterior Wall Openings.

Classification of Opening	Fire Separation Distance >30'
Unprotected	No Limit
Protected	No Limit

5. IBC Interior Finishes
Table 803.4 - Sprinklered

Group	Vertical Exits & Exit Passage	Exit Access Corr.	Rooms & Enclosed Spaces
A-2	B	B	C

6. Automatic sprinkler system. (UFC 3-600-01, 4-2.2, 6-1.1, NFPA 101 Paragraph 8.3.5.1, 28.3.5.1, 28.3.5.2, IBC 903.2.1.2)
The entire facility must have automatic sprinkler system protection meeting the requirements of NFPA 13.

7. Number of Exits Required,
Assembly – Exits Required (NFPA 101, Para. 7.4.1.2(1): 3
Exits Furnished: 4

8. Maximum Common Path of Travel,
Assembly – 20 feet (NFPA 101, 12-2.5.1 exception)

9. Maximum Dead End Corridor
Assembly – None permitted (NFPA 101, 7.5.1.6)

10. Maximum Travel Distance to Exit
Travel Distance to Exit (NFPA 101, Para. 12.2.6 exception 1):
Maximum allowable: 200 feet.

11. Distance to Fire Extinguisher:
NFPA 10 - Maximum 75 feet. The facility shall be provided with cabinets for portable fire extinguishers in accordance with NFPA 10.

12. Fire Alarm System:
The fire alarm system is designed in accordance with the applicable publications of NFPA. The system shall include a fire alarm control panel with battery back up, manual pull stations, automatic smoke/thermal detectors and audio/visual indicating devices. The system shall include local alarms as well as annunciation to the existing central fire alarm system.

13. Emergency Lighting and Exit Signs
Emergency Lighting and exit signs are provided by self-contained battery units in accordance with NFPA 101 to provide a reasonable degree of public safety within the building and for safe evacuation of the building.

14. Kitchen Hoods
Kitchen Hoods provided for the removal of smoke and grease-laden vapors shall be protected with pre-engineered fire suppression systems in accordance with NFPA 96.

APPENDIX D
SPIRIT REQUIREMENTS AND SUMMARY TABLE

SUSTAINABLE PROJECT RATING TOOL - FT. KNOX BCT BARRACKS & DINING HALL

23-Jan-04

FACILITY SUMMARY POINTS		Max. Points	Possible / Acceptable	Comments
1.0	**Sustainable Sites (S)**	**20**	**13**	
1.R1	Erosion, Sedimentation and Water Quality Control	**Req'd.**	**-**	
	Design a site sediment and erosion control plan and a pollution prevention plan that conforms to best management practices in the EPA's Storm Water Management for Construction Activities, EPA Document No. EPA-833-R-92-00(1), Chapter 3, OR local Erosion and Sedimentation Control standards and codes, whichever is more stringent. The plan shall meet the following objectives:			
	Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.			
	Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter			
	Prevent hazardous material discharge into storm water systems.			
	Prevent petroleum oils and lubricants (POL) discharge into storm water systems.			
1.C1	Site Selection	**2**	**2**	
	Do not develop buildings on portions of sites that meet any one of the following criteria: (1)		**1**	
	Prime training or maneuver land.			
	Land whose elevation is lower than 5 ft. above the 100-year flood elevation as defined by FEMA.			
	Land that provides habitat for any species on the Federal or State threatened or endangered list.			
	Within 100 feet of any wetland as defined by 40 CFR, Parts 230-233 and Part 22, OR as defined by local or state rule or law, whichever is more stringent.			
	Select site based on functional adjacencies/relationships and land use compatibility. (1)		**1**	
	Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure.			
	Select site in area of high density			
	Site facilities based on the strength of their relationships to other facilities/land-uses to limit travel distances. The stronger the relationship/functional interaction, the closer the distance between two facilities.			
	Select for distance to installation/base transit systems and access to pedestrian ways and bike paths.			
	Select for development previously used or developed suitable and available sites.			
1.C2	Installation/Base Urban Redevelopment	**2**	**2**	
	Increase localized density to conform to existing or desired density goals by utilizing sites that are located within existing cantonment areas of high development density. (1)		**1**	
	Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure. (1)		**1**	
1.C3	Brownfield Redevelopment	**1**	**0**	
	Develop on a site classified as a brownfield and provide remediation as required by EPA's Brownfield Redevelopment program requirements OR Develop a brownfield site (a site that has been contaminated by previous uses). (1)		**0**	
1.C4	Alternative Transportation	**4**	**1**	
	Locate building within ½ mile of installation/base transit systems. (1)		**0**	
	Provide suitable means for securing bicycles, with convenient changing/shower facilities for use by cyclists, for 5% or more of building occupants. (1)		**1**	

SUSTAINABLE PROJECT RATING TOOL - FT. KNOX BCT BARRACKS & DINING HALL

23-Jan-04

FACILITY SUMMARY POINTS	Max. Points	Possible / Acceptable	Comments
Locate building within 2 miles of alternative-fuel refueling station(s). (1)		**0**	
Size parking capacity not to exceed minimum installation/base cantonment requirements AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants, OR, add no new parking for rehabilitation projects AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants. (1)		**0**	
1.C5 Reduced Site Disturbance	**2**	**1**	
On greenfield sites, limit site disturbance including earthwork and clearing of vegetation to 40 feet beyond the building perimeter, 5 feet beyond primary roadway curbs, walkways, and main utility branch trenches, and 25 feet beyond pervious paving areas that require additional staging areas in order to limit compaction in the paved area; OR, on previously developed sites, restore a minimum of 50% of the remaining open area by planting native or adapted vegetation. (1)		**0**	
Reduce the development footprint (including building, access roads and parking) to exceed the installation/base's/base's master plan local zoning's open space requirement for the site by 25% or in accordance with installation/base policy on open space set asides, whichever is greater. (1)		**1**	
1.C6 Storm water Management	**2**	**1**	
Implement a stormwater management plan that results in:			
No net increase in the rate or quantity of stormwater runoff from undeveloped to developed conditions; OR, if existing imperviousness is greater than 50%, implement a stormwater management plan that results in a 25% decrease in the rate and quantity of stormwater runoff. (1)		**1**	
Treatment systems designed to remove 80% of the average annual post development total suspended solids (TSS), and 40% of the average annual post development total phosphorous (TP), by implementing Best Management Practices (BMPs) outlined in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (EPA-840-B-92-002 1/93). (1)		**0**	
1.C7 Landscape and Exterior Design to Reduce Heat Islands	**2**	**1**	
Provide shade (within 5 years) on at least 30% of non-roof impervious surface on the site, including parking lots, walkways, plazas, etc., OR, use light-colored/ high-albedo materials (reflectance of at least 0.3) for 30% of the site's non-roof impervious surfaces, OR place a minimum of 50% of parking space under-ground OR use open-grid pavement system (net impervious area of LESS than 50%) for a minimum of 50% of the parking lot area. (1)		**1**	
Use ENERGY STAR Roof compliant, high-reflectance AND low emissivity roofing (initial reflectance of at least .65 and three-year-aged reflectance of at least .5 when tested in accordance with ASTM E408) for a minimum of 75% of the roof surface; OR, install a "green" (vegetated) roof for at least 50% of the roof area. (1)		**0**	
1.C8 Light Pollution Reduction	**1**	**1**	

SUSTAINABLE PROJECT RATING TOOL - FT. KNOX BCT BARRACKS & DINING HALL

23-Jan-04

FACILITY SUMMARY POINTS	Max. Points	Possible / Acceptable	Comments
Do not exceed Illuminating Engineering Society of North America (IESNA) foot-candle level requirements as stated in the Recommended Practice Manual: Lighting for Exterior Environments, AND design interior and exterior lighting such that zero direct-beam illumination leaves the building site. (1)		1	
1.C9 Optimize Site Features	1	1	
Perform both of the following: (1)		1	
Maximize the use of free site energy.			
Plan facility, parking and roadways to "fit" existing site contours and limit cut and fill.			
1.C10 Facility Impact	2	2	
Cluster facilities to reduce impact, access distance to utilities and sufficient occupant density to support mass transit. (1)		1	
Collaborate with installation/base and community planners to identify and mitigate potential impacts of the project beyond site boundaries, and transportation planners to insure efficient public transport. (1)		1	
1.C11 Site Ecology	1	1	
Develop site environmental management and mitigation plan. (1)		1	
2.0 Water Efficiency (W)	5	1	
2.C1 Water Efficient Landscaping	2	1	
Use high efficiency irrigation technology, OR, use captured rain or recycled site water to reduce potable water consumption for irrigation by 50% over conventional means. (1)		0	
Use only captured rain or recycled site water for an additional 50% reduction (100% total reduction) of potable water for site irrigation needs, OR, do not install permanent landscape irrigation systems. (1)		1	
2.C2 Innovative Wastewater Technologies	1	0	
Reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 50%, OR, treat 100% of wastewater on site to tertiary standards. (1)		0	
2.C3 Water Use Reduction	2	0	
Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting Energy Policy Act (EPACT) of 1992 fixture performance requirements. (1)		0	
Exceed the potable water use reduction by an additional 10% (30% total efficiency increase). (1)		0	
3.0 Energy and Atmosphere (E)	28	13	
3.R1 Fundamental Building Systems Commissioning	Req'd.		
Implement all of the following fundamental best practice commissioning procedures.			
Engage a commissioning authority.			
Develop design intent and basis of design documentation.			
Include commissioning requirements in the construction documents.			
Develop and utilize a commissioning plan.			
Verify installation, functional performance, training and documentation.			
Complete a commissioning report.			
3.R2 Minimum Energy Performance	Req'd.		
Design to meet building energy efficiency and performance as required by TI 800-01 (Design Criteria).			
3.R3 CFC Reduction in HVAC&R Equipment	Req'd.		

SUSTAINABLE PROJECT RATING TOOL - FT. KNOX BCT BARRACKS & DINING HALL

23-Jan-04

FACILITY SUMMARY POINTS	Max. Points	Possible / Acceptable	Comments
Zero use of CFC-based refrigerants in new base building HVAC&R systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phaseout conversion.			
3.C1 Optimize Energy Performance	20	10	
Reduce design energy usage (DEU) compared to the energy use budget (EUB) in joules per square meter per year for regulated energy components as described in the requirements of Chapter 11 of the TI 800-01 (Design Criteria), as demonstrated by a whole building simulation.			
1 Point will be awarded for every reduction in design energy use of 2.5% for both new and existing facilities for a maximum score of 20 points. (20)		10	
Regulated energy components include HVAC systems, building envelope, service hot water systems, lighting and other regulated systems as defined by ASHRAE			
3.C2 Renewable Energy	4	1	
Supply a net fraction of the building's total energy use through the use of on-site renewable energy systems.			
% of Total Annual Energy Usage in Renewables			
5% = 1		1	
10% = 2		0	
15% = 3		0	
20% = 4		0	
3.C3 Additional Commissioning	1	1	
In addition to the Fundamental Building Commissioning prerequisite, implement the following additional commissioning tasks: (1)		1	
1. Conduct a focused review of the design prior to the construction documents phase.			
2. Conduct a focused review of the construction documents when close to completion.			
3. Conduct a selective review of contractor submittals of commissioned equipment.			
4. Develop a system and energy management manual.			
5. Have a contract in place for a near-warranty end or post occupancy review.			
Items 1, 2, and 3 must be performed by someone other than the designer.			
3.C4 Elimination of HCFC's and Halons (DELETED)			
3.C5 Measurement and Verification	1	1	
Comply with the installed equipment requirements for continuous metering as stated in selected Measurement and Verification Methods - Option B: Retrofit Isolation of the US DOE's International Performance Measurement and Verification Protocol (IPMVP) for the following: (1)		1	
Lighting systems and controls.			
Constant and variable motor loads.			
Variable frequency drive (VFD) operation.			
Chiller efficiency at variable loads (kW/ton).			
Cooling load.			
Air and water economizer and heat recovery cycles.			
Air distribution static pressures and ventilation air volumes.			
Boiler efficiencies.			
Building specific process energy efficiency systems and			
Indoor water risers and outdoor irrigation systems.			
3.C6 Green Power	1	0	
Engage in a two year contract to purchase the amount of power equal to projected building consumption generated from renewable sources that meet the Center for Resource Solutions (CRS) Green-E requirements. (1)		0	

SUSTAINABLE PROJECT RATING TOOL - FT. KNOX BCT BARRACKS & DINING HALL

23-Jan-04

FACILITY SUMMARY POINTS		Max. Points	Possible / Acceptable	Comments
3.C7	Distributed Generation	1	0	
	Reduce total energy usage and emissions by considering source energy implications and local cogeneration and direct energy conversion. Generate at least 50% of the building's projected annual consumption by on-site distributed generation sources. (1)		0	
4.0	**Materials and Resources (M)**	**13**	**4**	
4.R1	Storage & Collection of Recyclable	**Req'd.**		
	Provide an easily accessible area that serves the entire building that is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, glass, plastics, and metals.			
4.C1	Building Reuse	3	0	
	Reuse large portions of existing structures during renovation or redevelopment projects.			
	Maintain at least 75% of existing building structure and shell (exterior skin and framing excluding window assemblies). (1)		0	
	Maintain an additional 25% (100% total) of existing building structure and shell (exterior skin and framing excluding window assemblies). (1)		0	
	Maintain 100% of existing building structure and shell AND 50% non-shell (walls, floor coverings, and ceiling systems). (1)		0	
4.C2	Construction Waste Management	2	1	
	Develop and implement a waste management plan, quantifying material diversion by weight:			
	Recycle and/or salvage at least 50% (by weight) of construction, demolition, and land clearing waste. (1)		1	
	Recycle and/or salvage an additional 25% (75% total by weight) of the construction, demolition, and land clearing debris. (1)		0	
4.C3	Resource Reuse	2	0	
	Specify salvaged or refurbished materials for 5% of building materials. (1)		0	
	Specify salvaged or refurbished materials for 10% of building materials. (1)		0	
4.C4	Recycled Content	2	1	
	Specify a minimum of 25% of building materials that contain in aggregate a minimum weighted average of 20% post-consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. (1)		1	
	Specify an additional 25% (50% total) of building materials that contain in aggregate, a minimum weighted average of 20% post consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. (1)		0	
4.C5	Local/Regional Materials	2	2	
	Specify a minimum of 20% of building materials that are manufactured regionally within a radius of 500 miles. (1)		1	
	Of these regionally manufactured materials, specify a minimum of 50% that are extracted, harvested, or recovered within 500 miles. (1)		1	
4.C6	Rapidly Renewable Materials	1	0	
	Specify rapidly renewable building materials for 5% of total building materials.(1)		0	
4.C7	Certified Wood	1	0	

SUSTAINABLE PROJECT RATING TOOL - FT. KNOX BCT BARRACKS & DINING HALL

23-Jan-04

FACILITY SUMMARY POINTS	Max. Points	Possible / Acceptable	Comments
Use a minimum of 50% of wood-based materials certified in accordance with the Forest Stewardship Council guidelines for wood building components including but not limited to framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.(1)		**0**	
5.0 Indoor Environmental Quality (IEQ) (Q)	**17**	**16**	
5.R1. Minimum IAQ Performance	**Req'd.**		
Meet the minimum requirements of voluntary consensus standard ASHRAE 62-1999, Ventilation for Acceptable Indoor Air Quality and approved Addenda			
5.R2 Environmental Tobacco Control (ETS) Control	**Req'd.**		
Zero exposure of nonsmokers to ETS by prohibition of smoking in the building, OR, by providing a designated smoking room designed to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room shall be directly exhausted to the outdoors with no recirculation of ETS-containing air to the non-smoking area of the building, enclosed with impermeable structural deck-to-deck partitions and operated at a negative pressure compared with the surrounding spaces of at least 7 Pa (0.03 inches of water gauge). Performance of smoking rooms shall be verified using tracer gas testing methods as described in ASHRAE Standard 129-1997. Acceptable exposure in non-smoking areas is defined as less than 1% of the tracer gas concentration in the smoking room detectable in the adjoining non-smoking areas. Smoking room testing as described in the ASHRAE Standard 129-1997 is required in the contract documents and critical smoking facility systems testing results must be included in the building commissioning plan and report or as a separate document.			
5.C1 IAQ Carbon Dioxide (CO2) Monitoring	**1**	**1**	
Install a permanent carbon dioxide (CO2) monitoring system that provides feedback on space ventilation performance in a form that affords operational adjustments, AND specify initial operational set point parameters that maintain indoor carbon dioxide levels no higher than outdoor levels by more than 530 parts per million at any time. (1)		**1**	
5.C2 Increase Ventilation Effectiveness	**1**	**1**	
For mechanically ventilated buildings, design ventilation systems that result in an air change effectiveness (E) greater than or equal to 0.9 as determined by ASHRAE(1)29-1997. For naturally ventilated spaces demonstrate a distribution and laminar flow pattern that involves not less than 90% of the room or zone area in the direction of air flow for at least 95% of hours of occupancy. (1)		**1**	
5.C3 Construction IAQ Management Plan	**2**	**2**	
Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:			
During construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, AND protect stored on-site or installed absorptive materials from moisture damage, AND replace all filtration media immediately prior to occupancy (Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999). (1)		**1**	

SUSTAINABLE PROJECT RATING TOOL - FT. KNOX BCT BARRACKS & DINING HALL

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FACILITY SUMMARY POINTS		Max. Points	Possible / Acceptable	Comments
	Conduct a minimum two-week building flushout with new filtration media at 100% outside air after construction ends and prior to occupancy, OR, conduct a baseline indoor air quality testing procedure consistent with current EPA protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445. (1)		1	
5.C4	Low-Emitting Materials	4	4	
	Meet or exceed VOC limits for adhesives, sealants, paints, composite wood products, and carpet systems as follows:			
	Adhesives must meet or exceed the VOC limits of South Coast Air Quality Management District Rule #1168 by, AND all sealants used as a filler must meet or exceed Bay Area Air Resources Board Reg. 8, Rule 51. (1)		1	
	Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements. (1)		1	
	Carpet systems must meet or exceed the Carpet and Rug Institute Green Label Indoor Air Quality Test Program. (1)		1	
	Composite wood or agrifiber products must contain no added urea-formaldehyde resins. (1)		1	
5.C5	Indoor Chemical and Pollutant Source Control	1	1	
	Design to minimize cross-contamination of regularly occupied areas by chemical pollutants: (1)		1	
	Employ permanent entryway systems (grills, grates, etc.) to capture dirt, particulates, etc. from entering the building at all high volume entryways, AND provide areas with structural deck to deck partitions with separate outside exhausting, no air recirculation and negative pressure where chemical use occurs (including housekeeping areas and copying/print rooms), AND provide drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs			
5.C6	Controllability of Systems	2	1	
	Provide a minimum of one operable window and one lighting control zone per 200 s.f. for all occupied areas within 15 feet of the perimeter wall. (1)		0	
	Provide controls for each individual for airflow, temperature, and lighting for 50% of the non perimeter, regularly occupied areas. (1)		1	
5.C7	Thermal Comfort	2	2	
	Comply with ASHRAE Standard 55-1992, Addenda 1995 for thermal comfort standards including humidity control within established ranges per climate zone. (1)		1	
	Install a permanent temperature and humidity monitoring system configured to provide operators control over thermal comfort performance and effectiveness of humidification and/or dehumidification systems in the building.(1)		1	
5.C8	Daylight and Views	2	2	
	Achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. Exceptions include those spaces where tasks would be hindered by the use of daylight or where accomplishing the specific tasks within a space would be enhanced by the direct penetration of sunlight. (1)		1	

SUSTAINABLE PROJECT RATING TOOL - FT. KNOX BCT BARRACKS & DINING HALL

23-Jan-04

FACILITY SUMMARY POINTS		Max. Points	Possible / Acceptable	Comments
	Direct line of sight to vision glazing from 90% of all regularly occupied spaces, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. (1)		1	
5.C9	Acoustic Environmental/Noise Control	1	1	
	Minimize environmental noise through appropriate use of insulation, sound-absorbing materials and noise source isolation. (1)		1	**Provide sound attenuation within walls of mechanical rooms, toilet rooms and corridor walls**
5.C10	Facility In-Use IAQ Management Plan	1	1	
	Perform all of the following: (1)		1	
	Develop an air quality action plan to include scheduled HVAC system cleaning.			
	Develop an air quality action plan to include education of occupants and facility managers on indoor pollutants and their roles in preventing them.			
	Develop an air quality action plan to include permanent monitoring of supply and return air, and ambient air at the fresh air intake, for carbon monoxide (CO), carbon dioxide (CO 2), total volatile organic compounds (TVOCs), and particulates (including PM10).			
6.0	**Facility Delivery Process (P)**	7	7	
6.C1	Holistic Delivery of Facility	7	7	
	Choose team leaders that are experienced in holistic delivery of facilities. (1)		1	
	Train the entire team in the holistic delivery process. The team must include all stakeholders in the facility delivery, including the users, the contracting staff, the construction representatives, project manager, and design/engineering team members. (1)		1	
	Identify project goals and metrics. (1)		1	
	Plan and execute charrettes with team members at critical phases of the facility delivery. (1)		1	
	Identify and resolve tradeoffs among sustainability, first costs, life cycle costs and mission requirements through charrettes and other collaborative processes. (2)		2	
	Document required results for each phase of project deliverables that achieve the project goals and are measurable throughout the facility life span. (1)		1	
7.0	**Current Mission**	6	4	
7.C1	Operation and Maintenance	3	1	
	Develop a facility operations and maintenance program to include: (2)		0	
	Commissioning instructions for all facility systems.			
	Comprehensive facility operations and maintenance instructions for system operation, performance verification procedures and results, an equipment inventory, warrantee information, and recommended maintenance schedule. The instructions should include a comprehensive, preventive maintenance program to keep all facility systems functioning as designed.			
	A periodic training program for occupants, facilities managers, and maintenance staff in all facility operations and maintenance activities.			
	Instructions on sustainable cleaning and pest control practices.			
	Develop a comprehensive site/facility recycling/waste management plan.			
	Provide surfaces, furnishings, and equipment that are appropriately durable, according to life cycle cost analysis. (1)		1	
7.C2	Design for Soldier and Workforce Productivity and Retention	3	3	

SUSTAINABLE PROJECT RATING TOOL - FT. KNOX BCT BARRACKS & DINING HALL

23-Jan-04

FACILITY SUMMARY POINTS	Max. Points	Possible / Acceptable	Comments
Provide a high quality indoor environment to enhance user/occupant quality of life (QOL). (1)		1	
Provide a highly functional work environment to promote user/occupant work productivity. (1)		1	
Provide a healthy and safe work environment to sustain QOL and productivity. (1)		1	
8.0 Future Missions	4	4	
8.C1 Assess the Life Span of the Designed Use and Supporting Systems	2	2	
Identify how long the designed function is likely to occupy the current facility. (1)		1	
Identify how long the envelope, structure, HVAC, plumbing, communications, electrical, and other systems are likely to last before requiring replacement or upgrade. Consider economic, functional and physical obsolescence. (1)		1	
8.C2 Design for Adaption, Renewal and Future Uses	2	2	
Identify possible future uses for the facility; consider alternatives that expand the list of possible future uses. AND Design the building to accommodate as wide a range of future uses, as practical. AND Design the installation of building systems to accommodate foreseeable change with a minimum amount of disruption, cost, and additional materials. (1)		1	
Build the smallest facility necessary to meet current mission functional requirements, using the most efficient shape and form, while taking into consideration expansion capabilities and potential future mission requirements. AND Design the facility for recycling of materials and systems. (1)		1	
TOTALS	**100**	**62**	

APPENDIX E
GEOTECHNICAL INFORMATION

April 19, 2004

Mr. Alan Hautman, P.E.
KZF Design, Inc.
655 Eden Park Drive
Cincinnati, Ohio 45202-6000

Reference: Subsurface Investigation Report for the Proposed Fort Knox Barracks
Fort Knox United States Army Base, Kentucky
PRIME Project No.: 04019G

Dear Mr. Hautman:

Enclosed please find the Subsurface Investigation Report for the above referenced project. Our services included a field investigation, laboratory testing, engineering analysis, and general design and construction recommendations. These services have been provided in accordance with our proposal dated January 26, 2004. It is important that the items under "Limitations" be precisely followed and complied with.

We appreciate the opportunity of working with you on this project and we invite you to contact us at (330) 666-5432 when we can be of further assistance.

Respectfully,

PRIME ENGINEERING
& ARCHITECTURE, INC.

Stephen E. Mileski
Project Manager

Walid I. Najjar, P.E.
Principal

Enclosure:
04019Grpt/SEM:4/19/04

SUBSURFACE INVESIGATION REPORT
FOR
THE PROPOSED FORT KNOX BARRACKS
FORT KNOX U.S. ARMY BASE, KENTUCKY
PRIME PROJECT NO. 04019G

PREPARED FOR

KZF DESIGN, INC.

PREPARED BY

PRIME ENGINEERING & ARCHITECTURE, INC.

APRIL 19, 2004

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APPENDIX

1.0 INTRODUCTION

This report has been prepared for the design of a proposed barracks complex at Fort Knox, Kentucky at one or two potential sites presented as Phase 1 and Phase 2. This report represents the intent of KZF Design, Inc. (KZF), the Design Engineer, and The Fort Knox Army Base, the owner of the project, to secure subsurface information at pre-selected locations in accordance with accepted ASTM standards, and to provide recommendations based on the subsurface conditions encountered at the test boring locations. Based on this request, PRIME performed a site geotechnical investigation of the generalized area(s), not necessarily for a specific structure, to determine the general subsurface conditions across the site.

This report has been developed based on the field investigation program, laboratory testing, and information secured for site-specific studies. It must be noted that, as with any geotechnical investigation program, the site exploration identifies actual subsurface conditions only at those locations where samples were obtained. The data derived through sampling, and subsequent laboratory testing is reduced by geotechnical engineers and geologists who then render an opinion regarding the overall subsurface conditions, and their likely reaction on the site. The actual overall site conditions may differ from those inferred to exist. Therefore, although a fair amount of subsurface data has been assembled during this investigation, this report may not provide all of the geotechnical data needed for construction of this project. This report was prepared using English units.

1.1 Project Description

The proposed barracks complex, including both Phase 1 and Phase 2, is located in the eastern portion of the Fort Knox Army Base east of North Huron Street, south of Eisenhower Avenue, west of Ninth Cavalry Regiment Avenue, and north of Spearhead Division Avenue. Preliminary information provided by KZF indicates that the proposed barracks complex will consist of multiple structures consisting of five 60,000 square foot Barracks buildings, one 23,000 square foot Battalion Headquarters, and one 30,000 square foot Dining Facility with each individual building anticipated to have their own geothermal system.

The site topography of the existing landscape is fairly level to gently rolling in character. The existing surface conditions consist of asphalt roads, asphalt parking lots, unmaintained fields, and maintained lawns. The location of the project site with test boring locations is indicated in Figure 1.

1.2 Scope of Services

In accordance with PRIME Proposal No. P04011, the scope of services to be provided by PRIME was limited to the following tasks:

Task 1 - Reconnaissance and Planning, which primarily consisted of reviewing the site geology, performing a site reconnaissance and staking/marking the test boring locations based on locations provided by KZF on a drawing, and notifying and meeting on-base personnel for underground utility clearance before commencing drilling operations.

Task 2 – Field Investigation, which consisted of advancing the test borings, conducting field tests, sampling the subsurface materials, and preparing field drilling logs.

Our scope of services included advancing a total of four (4) test borings. Two (2) of these test borings were to each be advanced to an approximate depth of 25 feet or to bedrock and then terminated. The other two (2) test borings were to be advanced to bedrock and then 5.0 feet of rock was to be core sampled from each. To account for unknown subsurface conditions, PRIME's cost proposal allowed for 125 linear feet of drilling and sampling soil and for 10 linear feet of rock coring. Based on these totals and based on the objective to derive as much general subsurface information from the site as within the project budget, PRIME in coordination with KZF, transferred proposed monies from obtaining soil to obtaining additional rock core samples. The test borings were advanced in accordance with ASTM procedures. Groundwater was monitored during and upon completion of the drilling operations.

Task 3 – Laboratory Testing, which consisted of performing soil classification and engineering properties tests on selected soil samples, and classifying the soils in accordance with the Unified Soil Classification System (USCS).

Task 4 - Geotechnical Report, which included the following:

- Description of the investigation methods and procedures
- Description of the geologic, soil, bedrock, and groundwater conditions, depth to bedrock, and bedrock classification
- Boring logs showing soil stratigraphy, depths of samples taken, SPT "N" values, existing groundwater conditions, and laboratory test results
- Soil bearing capacity, recommendations on the foundation and roadway compositions, CBR ratings, seismic site classification, earthwork considerations, unconfined compressive strength of the upper 5.0 feet of the bedrock, and any additional subsurface parameters for the installation of geothermal systems

The scope of the geotechnical services did not include any environmental assessment for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site. Any statement in this report or on the boring logs regarding odors, colors or unusual or suspicious items or conditions are strictly for the information of the client.

2.0 GEOLOGIC SETTING

The project site lies on the eastern portion of the Mississippian Plateau or Pennyrile Physiographic Region of Kentucky. This physiographic region consists of a limestone plain characterized by karst topography with tens of thousands of sink holes, sinking streams, streamless valleys, springs, and caverns. The karst terrain of this physiographic region occurs because the bedrock is dominated by thick deposits of Mississippian-age limestones. These limestones are slowly dissolved away by weak acids found naturally in rain and groundwater.

Based on information obtained from the Kentucky Geological Survey, bedrock in the vicinity of the project site consists of the St. Louis Limestone. The St. Louis Limestone consists of very fine to medium grained limestone with typical bedding thickness ranging from 0.1 foot to 3.0 feet, but more commonly less than 1.0 foot in thickness. The unit thickness of the St. Louis Limestone can be more than 230 feet.

The St. Louis Limestone weathers to silty and cherty, reddish-orange clay residuum typically measuring 30 to 40 feet thick. Soils encountered across the site ranged in thickness from 17.5 to 25.5 feet.

The hydrology of the St. Louis Limestone is typically determined by the number and/or size of solution openings in karst areas or by the presence of major spring horizons. Where major spring horizons are present, the St. Louis can yield several hundred to several thousand gallons per minute (gal/min). Where large solution openings are present in karst areas, the St. Louis can yield more than 50 gal/min. And where there are no solution voids or major spring horizons, wells in the St. Louis are inadequate for domestic supply with a power pump.

This soil, bedrock, and groundwater information has been obtained on-line from the Kentucky Geological Survey.

3.0 SUBSURFACE INVESTIGATION

3.1 Exploratory Test Borings

In order to explore the subsurface conditions in the area of the proposed project site, test boring drilling, soil sampling, and field testing operations were performed on April 1 and 2, 2004. A total of four (4) test borings identified as B-1 through B-4 were advanced to approximate depths ranging from 17.6 feet to 41.3 feet below the existing ground surface. In order to determine the depth to bedrock across the site and to determine the amount of monies to be transferred from linear feet of soil to linear feet of bedrock, all of the test borings were first advanced down to bedrock before starting bedrock coring operations. As requested by KZF personnel, bedrock core samples were obtained from test borings B-2 and B-4 with the additional bedrock coring occurring in test boring B-4. As stated earlier, the four test borings were advanced not at specific structure locations for specific foundation recommendations, but to provide general recommendations based on soil and bedrock parameters encountered within each test boring. All test borings were advanced in accordance with accepted ASTM procedures.

The test boring locations were marked in the field by PRIME personnel in accordance with plans provided by KZF personnel. The test borings were cleared for underground utilities by Fort Knox personnel. A Mobile B47 track-mounted all terrain drill rig was mobilized to advance the test borings using 3.25-inch inside diameter continuous flight hollow stem augers (HSA). Representative disturbed samples of the soils were collected using a standard 2.0-inch outside diameter and 1.4-inch inside diameter split-barrel sampler driven into the soil by means of a 140-pound hammer falling freely through a distance of 30 inches in accordance with the Penetration Test and Split-Barrel Sampling of Soils (ASTM D 1586). Undisturbed samples were obtained using thin-walled sampling tubes (Shelby Tubes) that were pressed into the soil. The test borings were monitored for the presence of groundwater during drilling operations, before bedrock coring operations, and before backfilling the bore holes.

The test boring location map is included in Figure 1. The typed drilling logs and soil boring profiles are included in the Appendix. The typed drilling logs also show the SPT resistance values (N-values) for each soil sample that was obtained from each of the test borings. The logs also present the classification and description of all soils encountered at various depths within the test borings. The sample depths shown on the typed drilling logs and laboratory test results indicate the top of each sampling and/or testing interval.

INSERT: FIGURE 1 – SITE/BORING LOCATION MAP

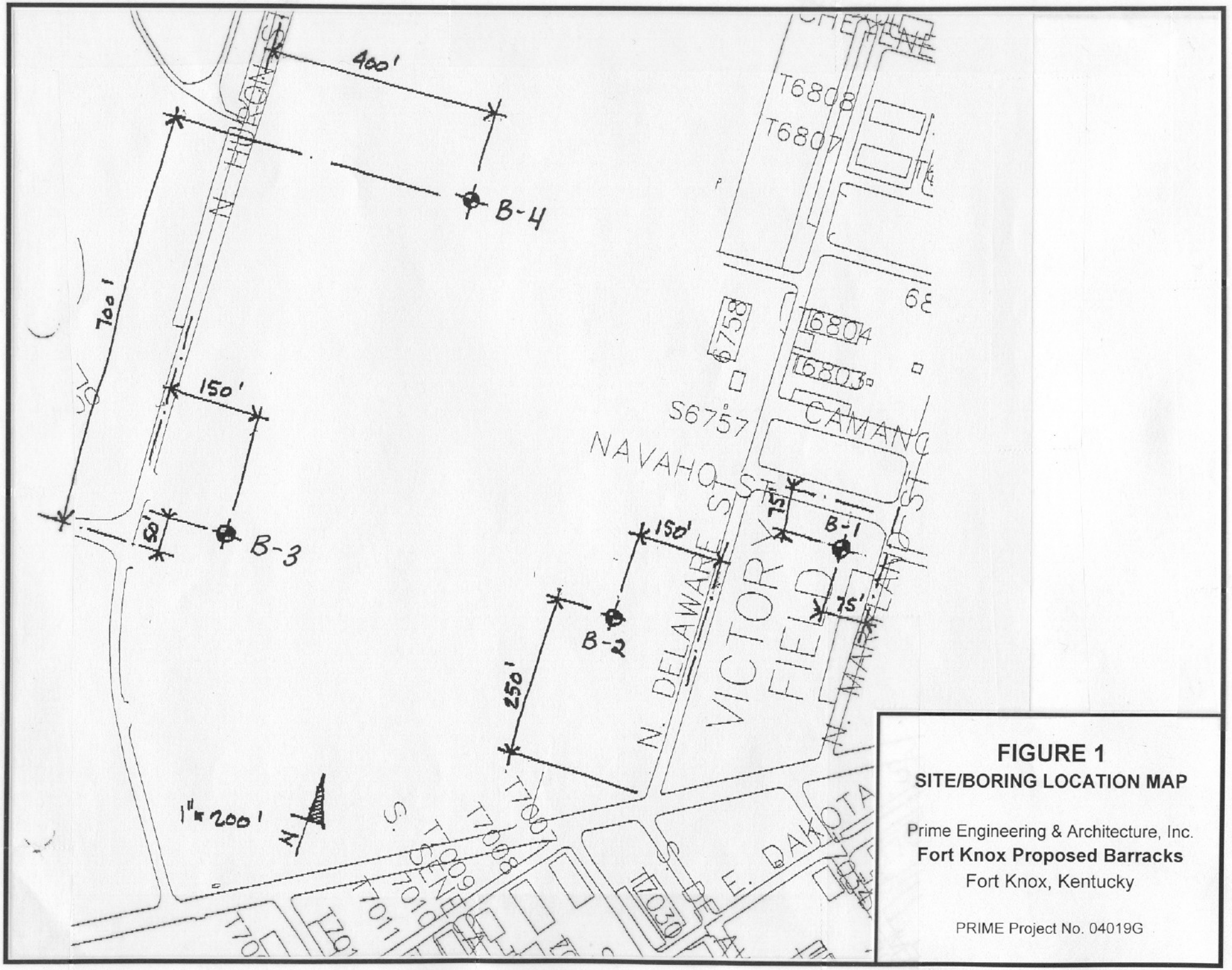


FIGURE 1

SITE/BORING LOCATION MAP

Prime Engineering & Architecture, Inc.

Fort Knox Proposed Barracks

Fort Knox, Kentucky

PRIME Project No. 04019G

3.2 Sample Analysis

All soil samples obtained during the field exploration were transported to PRIME's soils and materials testing facility in Akron, Ohio where they were visually examined by a geotechnical engineer and a geologist. The engineer selected representative soil samples to be tested in the laboratory for assistance in soil classification and determination of engineering properties of the soils. The tests consisted of Moisture Content Determination, Particle-Size Analysis, Atterberg Limits, Unconfined Compressive Strength of Soil and of Bedrock Samples, Shrinkage Limits, and Unit Weight/Bulk Density Determination. All laboratory tests were performed in accordance with the accepted ASTM or other standards listed in a table located in the Appendix. The results of the laboratory tests are also included in the Appendix. The soils were classified in accordance with the Unified Soil Classification System (USCS), a description of which is included in the Appendix.

Upon completion of the laboratory testing, all samples obtained for this project were placed in unheated storage at PRIME's Akron facility. Unless otherwise requested in writing, the samples will be discarded 45 days after submission of this report.

4.0 SURFICIAL AND SUBSURFACE CONDITIONS

4.1 Subsurface Soil Conditions

All of the test borings were advanced through topsoil that ranged in thickness from approximately 4.0-inches to approximately 7.5-inches, and averaged 5.75-inches in thickness. All of the test borings were also advanced through fill soils or possible fill soils. These fill soils (including the topsoil) ranged in thickness from approximately 3.0 feet to 6.0 feet, and averaged 4.4 feet. These fill soils are cohesive in nature and were classified both visually and through testing as LEAN CLAY (CL), FAT CLAY (CH), and SANDY LEAN CLAY (CL).

Natural soils encountered below the fill soils and above bedrock ranged in thickness from 12.5 feet in test boring B-3 to 22.0 feet in test boring B-1, and averaged 16.4 feet in thickness. The natural soils are cohesive in nature and were classified both visually and through testing as LEAN CLAY (CL), FAT CLAY (CH), SANDY LEAN CLAY (CL), and SILT with SAND (ML).

The consistency of the cohesive fill soils was found to range from "soft" to "very stiff" but was primarily "medium stiff". The consistency of the cohesive natural soils was found to range from "soft" to "very stiff" but was primarily "stiff". The laboratory test results indicated that the moisture contents of the tested cohesive fill soil samples ranged from 17 to 24% and averaged 21% while the tested cohesive natural soil samples ranged from 18 to 42% and averaged 26%.

Six (6) cohesive soil samples were tested for Atterberg limits with five samples containing natural moisture contents greater than their plastic limits and one sample containing a natural moisture content equal to its plastic limit. Normally, if the moisture content of a soil is above its liquid limit, the soil is in a liquid state and has no shear strength, and if the moisture content of a soil is less than its liquid limit and greater than or equal to its plastic limit, the soil is in a plastic state and deformation may occur under certain surcharge loading. The moisture contents and Atterberg limit results of the tested soil samples are included in the typed drilling logs in the Appendix.

4.2 Bedrock Conditions

Mississippian-age limestone bedrock of the St. Louis formation was encountered in all of the test borings at depths ranging from 17.5 to 25.5 feet and elevations ranging from 645.4 to 655.6 feet. The bedrock consisted of hard to very hard, gray to buff colored, fine to medium grained limestone of excellent quality as determined by the Rock Quality Designation (RQD). The limestone bedrock was primarily fresh but had few small portions with small solution voids that may be considered slightly weathered. Bedding ranged from moderate (4" to 1') to thick (1' to 3') but was primarily thick. Natural fractures were few and nearly horizontal. The RQD of the rock core samples ranged from 94 to 100%, which is considered "excellent". The recovery of the rock core samples ranged from 94% to 100%.

Generally, coring was attempted when the split-spoon sampler indicated very little penetration and recovery. The coring operations were performed in accordance with the procedure for "Diamond Core Drilling for Site Investigations" (ASTM D 2113). Refer to the typed drilling logs and to "Bedrock Descriptions" for complete bedrock information, both located in the Appendix.

Unconfined compressive strength tests (ASTM D 2938) were performed on selected bedrock core samples. The unconfined compressive strengths of the tested core samples were found to range from 8,834 to 12,634 psi. At these unconfined compressive strengths, the bedrock is considered to be of "high" strength. For complete unconfined compressive strength test results refer to "Unconfined Compressive Strength of Rock Core Specimens" in the Appendix.

4.3 Groundwater Conditions

The test borings were monitored for presence of groundwater during drilling, before bedrock coring operations, and upon completion of drilling operations. Groundwater or very moist soil was encountered near or at the interface of the soil and bedrock in test borings B-1 and B-4. However, no standing water was measured in either test boring upon completion of drilling operations or before beginning bedrock coring operations. Groundwater was not encountered in test borings B-2 or B-3 during drilling, before starting bedrock coring operations, or upon completion of drilling. It should be noted that groundwater elevations are subject to seasonal fluctuations and may be encountered where previously not recorded. Groundwater monitoring wells are essential to accurately define the position of the groundwater table but were not a part of our scope of services.

5.0 CONCLUSIONS AND GENERAL RECOMMENDATIONS

Based upon the findings of the field investigation, laboratory testing, and subsequent engineering analysis, the following sections have been prepared to address the general geotechnical aspects related to the design and construction of this project. Preliminary information provided by KZF indicates that there will be a proposed barracks complex constructed at this site with each building utilizing vertical geothermal systems for heating and cooling purposes. Building locations, foundation elevations, or detailed structural loading information for the proposed barracks complex were not provided to PRIME for the preparation of this report. The structural loading is assumed to be moderate in magnitude (2000 to 3500 psf) for the purposes of making the general recommendations presented herein.

5.1 Shallow Foundations

Assuming shallow foundations can be used to support the proposed structure loads and assuming minimal cut and fill operations across the project site, the maximum allowable bearing capacity of the natural soils at each test boring location are provided in Table 5.1.1 – "Maximum Allowable Soil Bearing Capacities". These values are provided for the natural soils below the fill at a depth of 3.5 feet in test borings B-1 and B-4 and below the fill at a depth of 6.0 feet in test borings B-2 and B-3.

A shrinkage limit was performed on a FAT CLAY sample to determine the potential for volume change. Based on the shrinkage limit, the potential for volume change is "probably low" and based on the plasticity index, the potential for volume change is "probably moderate".

Table 5.1.1 – Maximum Allowable Soil Bearing Capacities

Test Boring	Sample Depth	Soil Classification	N-value	Maximum Allowable Bearing Capacity
B-1	3.5 ft	FAT CLAY	17	3500 psf
B-2	6.0 ft	FAT CLAY	10	2500 psf
B-3	6.0 ft	LEAN CLAY	15	3250 psf
B-4	3.5 ft	LEAN CLAY	11	3000 psf

Settlement calculations were performed at test boring B-1 using assumed structure loads of 3000 psf, 2000 psf, and 1000 psf each placed at a depth of 3.0 feet below the existing ground surface to determine the total consolidation settlement. **Total consolidation settlement at test boring B-1 was calculated to be on the order of 6.1-inches using 3000 psf, on the order of 5.6-inches using 20500 psf, and on the order of 4.6-inches using 1000 psf.** Test boring B-1 was selected for settlement calculations based on the average lower "N" values, the average higher moisture contents, and the greater depth to bedrock for a "higher" compressible soil column.

It should be noted that these total settlement values are conservative due to the fact that the settlement was determined based on a formula for normally consolidated soils. Based on the liquidity index of the soils in test boring B-1, the soils are assumed to be preconsolidated because their liquidity indices are less than 0.7. This being the case, PRIME recommends performing one-dimensional consolidation tests once exact structure locations are determined. The best method for determining the preconsolidation pressure of a particular soil is to perform a one-dimensional consolidation test. Once testing is performed, more accurate settlement values can be achieved.

If the above maximum allowable bearing capacities are adequate to support the proposed structure loads and if total settlement and differential settlement are determined to be within tolerable limits (on the order of 1.0-inch and 0.5-inches, respectively), then the proposed building loads transmitted through columns and/or walls may be supported by means of spread and strip footings, respectively. If, one-dimensional consolidation testing indicates that total and differential settlement remain in the intolerable range, then deep foundations to support the structure loads, may need to be considered.

If shallow foundations are used, the proposed building footers must be constructed on natural, undisturbed soils that must be inspected using a proving ring penetrometer to determine the allowable bearing capacity at the bottom of the footer excavations, or on compacted engineered-fill.

Prior to footing construction, the subgrade soil should be examined by a competent geotechnical engineer to ensure that the maximum allowable soil bearing capacity is being complied with. Unsuitable (organic or highly compressible) materials and/or areas of low bearing capacity with excessive moisture (soft pockets) may be encountered during footing excavations. If encountered, they should be removed as directed by an on-site geotechnical engineer and replaced with compacted engineered fill in accordance with the earthwork specifications discussed in Section 5.6. Perimeter footers must be placed at least 3.0 feet below the proposed finished outside grade elevation to be protected against frost penetration and heave. Where stepping of footers is required, angles must not exceed 1 vertical to 2 horizontal and no individual step should be more than 1.5 feet deep. In order to minimize the effects of any slight differential movement that may occur due to variations in the character of the supporting soils and any variations in seasonal moisture contents, it is recommended that all continuous footings be suitably reinforced to make them as rigid as possible. If shallow foundations are constructed, PRIME recommends additional Atterberg limit and shrinkage limit testing to verify whether subgrade soils are, or are not, subject to potential volume change.

5.2 Slab on Grade Construction

In order to support building slabs, the project site soils must be prepared according to the earthwork specifications discussed in Section 5.6. The slab must be placed on free draining granular base material of adequate thickness in order to have a positive drainage outlet. An impervious membrane must be provided as a vapor barrier beneath all slabs. Steel reinforcement must be included in all slabs. If slab on grade construction is performed, PRIME recommends additional Atterberg limit and shrinkage limit testing to verify whether subgrade soils are, or are not, subject to potential volume change.

5.3 Seismic Site Class

Based on the soil information obtained from our subsurface investigation, Site Class “E” (Soft soil profile) may be assumed due to more of the average soil properties at the project site being found in Site Class “E” than in other Site Classes. For example, the average N-value of the site soils was 11, which meets the Site Class “E” criteria for Standard Penetration Resistance (N-value < 15). In addition, the average Plasticity Index (PI) of the site soils was 26 which meets the Site Class “E” criteria for PI > 20 for a soil profile more than 10 feet thick. However, the undrained shear strength of two samples tested for unconfined compressive strength meet the criteria for Site Class “D” for which the undrained shear strength is between 1000 and 2000 psf. These assumptions are based on the soil properties as indicated in Table 1615.1.1 – “Site Class Definitions” of the International Building Code (2000 Edition).

5.4 Pavement Design Parameters (Parking Lots or Roadways)

During construction of the project, the proposed pavement will be constructed either on the existing subgrade soils or on engineered fill materials. The following general alternatives have been prepared for your consideration.

Pavement on the Existing Subgrade Soils: If the pavement is constructed on the existing soils, it is anticipated that the upper 18 inches of the subgrade will consist of FAT CLAY (CH) or LEAN CLAY (CL) soils. Based on the N-values of the split-spoon samples obtained from a depth of 1.0 foot in each test boring, the FAT CLAY (CH) sample from test boring B-2 is the soil which 75% of the recorded soil strength readings (N-values) are higher than. Based on the correlation between N-value and undrained shear strength, this sample will be used to determine the California Bearing Ratio (CBR) for pavement design across the project site. **Specifications from the United States Army Corps of Engineer (USACE) technical letter TL1110-1-189 dated February 2003 were used to determine the subgrade CBR value to be approximately 1.0.**

Pavement Sections utilizing Geosynthetic Materials: Where subgrade soils have a CBR value less than or equal to 2 but greater than or equal to 0.5, the USACE recommends the use of both a nonwoven geotextile along with a biaxial geogrid to be incorporated into the pavement section in accordance with the USACE technical letter TL1110-1-189 dated February 2003.

The proposed pavement subgrade should be prepared and constructed as described in Section 5.6. Appropriate drainage systems, such as edge drains or underdrains are strongly recommended within poor drainage areas to minimize subgrade weakening resulting from excessive moisture penetration.

5.5 Groundwater Management

Based on the groundwater conditions described in Section 4.3 - "Groundwater Conditions", no unusual groundwater problems are anticipated for excavations extending as deep as bedrock. If ground water is encountered during excavation, it can be readily controlled by use of sump pumps. However, based on PRIME's experience, low to moderate volume pumping or dewatering may be required if an existing utility trench or old foundation trench contains trapped water. Such trenches may be intercepted during excavation. Please note that the groundwater levels during construction may vary due to seasonal fluctuations and groundwater may appear where it was not previously encountered.

5.6 Earthwork and Construction Monitoring

Prior to construction, all existing topsoil must be stripped from within the proposed building and/or pavement areas. There may be many existing utility trenches and old foundation trenches across the proposed site. Some of these trenches may cross beneath proposed building footers. If old foundation trenches cross beneath building footers, the backfill material in the old foundation trench must be removed at the new footer location(s) and replaced with engineered fill and compacted to the specifications provided below. The use of non-expansive, well-graded granular material (ODOT 304 limestone or the USACE equivalent) is recommended for engineered fill for footer construction. If an existing utility trench crosses beneath the new building footers, PRIME recommends that the backfill material in the utility trench at the footer location(s) be removed and replaced with low strength grout.

Prior to granular base material placement for pavement or building slabs, all subgrade areas must be subjected to proof rolling under the direction of a geotechnical engineer or qualified inspector. Any areas that exhibit an unacceptable subgrade reaction, local soft/loose soil zones, and areas of unacceptable material must be undercut to a minimum depth of two (2) feet below proposed pavement subgrade and to a minimum depth of three (3) feet below building slab subgrade. All removed soils should be replaced with engineered fill materials and compacted to the specification provided below.

Based on the subsurface soil conditions encountered in test boring B-2 at a depth of 1.0 foot and at other locations across the site, the subgrade FAT CLAY (CH) soils are expected to contain moisture contents approximately +/-3% above the optimum moisture of these soils. Thus, the subgrade will likely show some yielding during the proof rolling. Refer to Section 5.4 – "Pavement Design Parameters" for subgrade modification or design options.

Re-compaction of the existing subgrade soils or borrow fill should be in accordance with the specifications provided below. During preparation/construction, the subgrade should be cambered or adequately shaped to promote rapid drainage towards catch basins or underdrains where any collected water can be intercepted and removed. Silt (A-4b) or organic soils other than topsoil were not encountered in any of the test borings. However, these soils may be encountered beyond the test borings. If encountered, due to the susceptibility of silt soils to frost penetration and heave and due to the compressible nature of organic rich soils, we recommend the removal of the silt and/or organic rich soils to an approximate depth of three (3) feet below the bottom of the proposed pavement and building slab subgrades.

All removed soils should be replaced with compacted, engineered fill materials. All fill materials must be approved by a qualified geotechnical engineer prior to placement. All of the on-site soils free of organics, boulders, and man made inclusions can be considered for use as fill-borrow for earthwork. The lean clay (CL) and fat clay (CH) soils may have higher than optimum moisture contents. These soils may have to be dried to bring the moisture contents close to optimum moisture before use as fill. The fill materials should be placed in lifts of eight inches in thickness and be compacted to an unyielding condition with the following specifications.

1. For building footer areas, each lift must be compacted to a minimum of 100 percent of the maximum dry density of the material as determined by the Standard Proctor Test (ASTM D 698). The moisture content of the material should be within ±2.0 percent of the optimum moisture content as determined by the Standard Proctor Test.
2. For pavement and building slab areas, each lift must be compacted to a minimum of 98 percent of the maximum dry density of the fill as determined by the Standard Proctor Test (ASTM D 698). The moisture content of the material should be within ±1.5 percent of the optimum moisture content as determined by the Standard Proctor Test.

A sufficient number of in-place density tests should be performed on each lift of all fill placed during construction. The tests should be performed by a qualified soil technician under the supervision of PRIME or another geotechnical engineering firm and in accordance with the appropriate ASTM procedures.

5.7 Geothermal System Information

Based on information provided to PRIME by KZF and others regarding proposed geothermal systems, each of the buildings in the proposed barracks complex will utilize a vertical geothermal system. A depth of about 300 feet is standard for a vertical geothermal boring containing a single loop.

The five barracks buildings are each proposed to be 60,000 square feet. A 60,000 square foot building requires approximately 140 tons of cooling, with each loop or boring providing approximately 2.0 tons of cooling. Based on these values, each of the barracks buildings will require a boring field containing about 70 holes. Note that 1.0 ton of cooling is approximately equal to 12,000 Btu/Hr.

The battalion headquarters is proposed to be 23,000 square feet, which will require approximately 54 tons of cooling. Thus, the battalion headquarters will require a boring field containing about 27 holes.

And the dining facility is proposed to be 30,000 square feet, which will require approximately 70 tons of cooling. Thus, the dining facility will require a boring field containing about 35 holes.

Installing the loops into bedrock is preferred over soil because rock has a conductivity of 1.0, which is considered ideal, whereas soil can be <1.0. The presence of groundwater is also an important factor because water conducts hot/cold better than dry soil or bedrock. Because the St. Louis limestone bedrock was in excellent condition as per the RQD and with few horizontal natural fractures and no vertical or angular fractures encountered, the bedrock was relatively easy to core. Based on the St. Louis formation having a maximum thickness of more than 230 feet, more than half of each geothermal boring may be drilled into and installed within this limestone.

It should be noted that the above geothermal information is approximate and is based on general information regarding geothermal systems.

6.0 LIMITATIONS

This report is subject to the following conditions and limitations:

6.1 The subsurface conditions described are based on an examination of the soil and/or bedrock samples at the sampling intervals. Varying soil deposits or rock formations, including fill material, may exist between the sampling intervals and between the test boring locations. Variations in subsurface conditions from those indicated in this report may become apparent during the earthwork and/or installation of the foundations. Such variations may require changes and/or modifications in our recommendations. Such changes may cause time delays and/or additional costs. Owners must be made aware of these limitations and must incorporate them in the design budget and scheduling of the project.

6.2 The design of the proposed project does not depend entirely on this report due to the general nature of the investigation locations and methods. All changes in site design that are based on this report, must be reviewed by our geotechnical engineers. PRIME cannot assume any responsibility for interpretations made by others of the subsurface conditions and their behavior based on this report.

6.3 All foundation recommendations were general in nature and were not specific to any given location or elevation.

6.4 The subsurface investigation for this project is strictly from a geotechnical standpoint. An environmental site assessment was not included in the scope of this geotechnical services.

6.5 All sheeting, shoring, and bracing of trenches, pits and excavations should be made the responsibility of the contractor and should comply with all current and applicable local, state and federal safety codes, regulations and practices, including the Occupational Safety and Health Administration (OSHA).

APPENDIX

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING NO.: B-1

LOCATION:

ELEVATION: 675.37ft

CLIENT: KZF Design, Inc.

PROJECT: Fort Knox Proposed Barracks PROJECT No.: 04019G

LOCATION: Fort Knox, Kentucky

DATE STARTED: 4/1/04 DATE COMPLETED: 4/1/04

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER:

DRILLING INFORMATION:

American Drilling Services using an ATV Track-Mounted Mobile B47 Drill Rig

GROUNDWATER INFORMATION:

The outside of the split spoon sampler was wet at a depth of 23.8 feet and contained very thin (<1/8") sand seams. However, bore hole was dry upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	CO., MED., & FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			FIELD DATA						LABORATORY DATA							
675.0	0.4		TOPSOIL (5 inches thick with grass roots to a depth of 1.3 feet)													
			Stiff, light brown with gray mottling SANDY LEAN CLAY (CL), little rock fragments, moist. (possible fill)	SS 1	1.0	3 4 5	9	1.0	23	--	--		--	--		VISUAL
671.9	3.5		Very stiff to medium stiff, reddish-orange with yellow and light gray mottling FAT CLAY (CH) with high to low toughness, trace sand, trace very soft to hard white stone fragments with slight to no effervescence using HCl, moist.	SS 2	3.5	3 7 10	17	4.25	26	--	--		--	--		VISUAL
				SS 3	6.0	5 9 13	22	2.5	30	--	--		--	--		VISUAL
			Note: Few, very thin (<1/16") sand lenses throughout stratum.	SS 4	8.5	3 4 5	9	2.0	35	--	--		--	--		VISUAL
				SS 5	13.5	3 4 5	9	2.25	32	--	--		--	--		VISUAL
			Note: U.C. Strength of CLAY at 17.0 feet = 2,867 psf with a Unit Weight = 120.6 pcf	ST 6	16.0			1.5	32	64	26	38	0	7	27/66	CH
			Note: Clay has low toughness in 18.5 foot sample.	SS 7	18.5	3 3 3	6	1.0	35	--	--		--	--		VISUAL
651.6	23.8		Very soft to soft (higher N-value due to limestone fragments), reddish-orange SANDY LEAN CLAY (CL), little gray limestone fragments, wet.	SS 8	23.5	3 5 7	12	0.0	21	--	--		--	--		VISUAL
649.9	25.5		Note: Encountered auger refusal at 25.5 feet. Drove split spoon to verify bedrock.	SS 9	25.5	8 50/0.3	50+	--	10	--	--		--	--		VISUAL
649.1	26.3		Hard, gray, weathered LIMESTONE, wet. Note: Encountered spoon refusal at 26.3 feet and terminated test boring. TERMINATION DEPTH = 26.3 FEET													

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger, ST = Shelby Tube, HCl = Hydrochloric Acid

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING NO.: B-2

LOCATION: _____

ELEVATION: 664.93ft

CLIENT: KZF Design, Inc.

PROJECT: Fort Knox Proposed Barracks PROJECT No.: 04019G

LOCATION: Fort Knox, Kentucky

DATE STARTED: 4/1/04 DATE COMPLETED: 4/2/04

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER: _____

DRILLING INFORMATION:

American Drilling Services using an ATV Track-Mounted Mobile B47 Drill Rig

GROUNDWATER INFORMATION:

Groundwater was not encountered during drilling or 23 hours later before starting rock coring operations.

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	CO., MED., & FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			FIELD DATA					**LABORATORY DATA**							
664.3	0.6		TOPSOIL (7.5 inches thick)												
			Medium stiff, reddish-orange and mottled brown FAT CLAY with SAND (CH) with high toughness, trace to little white stone fragments that don't effervesce w/ dilute HCl, moist. (possible fill)	SS 1	1.0	3 3 3 — 6	1.5	24	51	24	27	1	15	84	CH
				SS 2	3.5	3 3 3 — 6	0.5	18	--	--		--	--		VISUAL
			Note: The 6.0' sample has the texture of fill and contains limestone fragments that effervesce w/ HCl.												
658.9	6.0		Stiff, reddish-orange and mottled yellow to brown LEAN CLAY (CL) with low toughness, trace to little sand, no to little white stone fragments that don't effervesce w/ dilute HCl, moist.	SS 3	6.0	3 5 5 — 10	2.5	22	44	20	24	0	10	90	CL
				SS 4	8.5	4 5 6 — 11	1.25	18	--	--		--	--		VISUAL
				SS 5	13.5	4 6 8 — 14	2.0	18	--	--		--	--		VISUAL
647.9	17.0		Medium stiff, light gray and yellow FAT CLAY (CH) with high toughness, trace sand, trace stone fragments, moist. (possible fill)	SS 6A	18.5	3 3 50/0.2 — 50+	1.25	33	--	--		--	--		VISUAL
			Note: Encountered limestone bedrock (effervesces) at 19.5 feet, augered to 20 feet and started coring operations.	SS 6B	19.5	50/0.2 — --			--	--		--	--		VISUAL
645.4	19.5		Hard to very hard, gray with few buff colored portions, fresh, fine to medium grained LIMESTONE with few to some dark gray shaley laminations. Effervesces freely w/ dilute HCl. Bedrock in excellent condition as per RQD.	CORE RUN 1	20.0	95% (95%)									
			Note: U.C. Strength of Rock at 21.6 feet = 12,634 psi												
			Note: Natural fractures at 20.8, 21.5 and 22.3'. The natural fracture at 21.5' was along a 1/4" thick dark gray shaley seam. Bedding is moderate to thick.												
639.9	25.0		Note: Medium grained with many small (<1/4") solution voids from 20.0' to 20.3' and from 22.0' to 22.4'.		25.0										
			TERMINATION DEPTH = 25.0 FEET												

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger, ST = Shelby Tube, HCl = Hydrochloric Acid

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING NO.: B-3

LOCATION: _____

ELEVATION: 664.62ft

CLIENT: KZF Design, Inc.

PROJECT: Fort Knox Proposed Barracks PROJECT No.: 04019G

LOCATION: Fort Knox, Kentucky

DATE STARTED: 4/1/04 DATE COMPLETED: 4/1/04

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER: _____

DRILLING INFORMATION:

American Drilling Services using an ATV Track-Mounted Mobile B47 Drill Rig

GROUNDWATER INFORMATION:

Groundwater was not encountered during drilling or 1.5 hours after completion of drilling operations.

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	CO., MED., & FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			FIELD DATA						LABORATORY DATA							
664.3	0.3		TOPSOIL (4 inches thick)													
			Soft to very stiff, light brown to buff colored LEAN CLAY (CL) with low toughness, little fine sand, no to some rock fragments, moist. (possible fill)	SS 1	1.0	2 2 2	4	0.0	21	--	--		--	--		VISUAL
			Note: Some white rock fragments that don't effervesce w/ dilute HCl were encountered in 3.5' sample. Sample also has the texture of fill.	SS 2	3.5	9 13 9	22	--	17	--	--		--	--		VISUAL
659.6	5.0		Stiff, reddish-orange and mottled brown, gray and white FAT CLAY (CH) with high toughness, little stone fragments, trace sand, moist.	SS 3	6.0	5 6 9	15	4.5	24	--	--		--	--		VISUAL
				SS 4	8.5	3 5 7	12	2.75	21	--	--		--	--		VISUAL
651.6	13.0		Stiff, brownish-yellow SILT with SAND (ML) with low toughness, some clay, moist.	SS 5A	13.5	3 4 7	11	0.75	38	48	28	20	0	16	84	ML
650.6	14.0		Stiff, reddish-orange and mottled brown, gray and white FAT CLAY (CH) with high toughness, little stone fragments, trace sand, moist.	5B	14.0			2.75	22	--	--		--	--		VISUAL
			Note: Encountered auger refusal on bedrock at 17.5 feet. Drove split spoon to verify bedrock.													
647.1	17.5		Hard, gray, fine grained LIMESTONE that effervesces freely w/ dilute HCl.	SS 6	17.5	50+ 50/0.1	--			--	--		--	--		VISUAL
647.0	17.6		TERMINATION DEPTH = 17.6 FEET													

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger, ST = Shelby Tube, HCl = Hydrochloric Acid

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING NO.: B-4

LOCATION: _____

ELEVATION: 676.12ft

CLIENT: KZF Design, Inc.

PROJECT: Fort Knox Proposed Barracks — PROJECT No.: 04019G

LOCATION: Fort Knox, Kentucky

DATE STARTED: 4/1/04 — DATE COMPLETED: 4/2/04

SAMPLER DIAM: 2.0" — TYPE: SS — HAMMER WT.: 140lb — FALL: 30"

CASING DIAM: 3.25" — TYPE: HSA — OTHER: _____

DRILLING INFORMATION:

American Drilling Services using an ATV Track-Mounted Mobile B47 Drill Rig

GROUNDWATER INFORMATION:

Groundwater was not encountered during drilling, however the soil/bedrock interface at a depth of 20.5 feet was very moist. Bore hole was dry upon completion of drilling operations.

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	AGGREGATE (%)	CO., MED., & FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
675.6	0.5		TOPSOIL (6.5 inches thick)													
			Medium stiff, light brown LEAN CLAY (CL) with medium toughness, trace sand, moist. (possible fill)	SS 1	1.0	3 4 3	7	0.75	23	--	--		--	--		VISUAL
673.1	3.0		Note: Small roots encountered to a depth of 2.0 feet.													
			Stiff to very stiff, light brown LEAN CLAY (CL) with medium to low toughness, trace sand, moist. (possible fill)	SS 2	3.5	4 5 6	11	2.5	21				0	10	90	
				ST 3	4.0				19	38	19	19	--	--		VISUAL
			Note: Upon completion of drilling B-4, moved rig 4 feet to east and pushed a Shelby Tube from 3.5 to 5.5 feet.													
			Note: U.C. Strength of LEAN CLAY at 4.8 feet = 3,587 psf with a Unit Weight = 131.2 pcf	SS 4	6.0	4 5 6	11	3.0	22				--	--		VISUAL
				SS 5	8.5	7 8 10	18	1.25	25				--	--		VISUAL
			Note: Lean clay between 13.5' to 14.6' is sandy with low toughness.	SS 6	13.5	3 4 5	9	0.75	20				--	--		VISUAL
657.6	18.5		Soft, yellowish-brown FAT CLAY (CH) with low toughness, trace sand, trace rock fragments, moist to very moist..	SS 7	18.5	1 2 2	4	0.25	42	53	26	27	3	9	89	CH
			Note: Encountered initial auger refusal on bedrock at 20.5'.													
655.6	20.5		Drove split spoon to verify bedrock.	SS 8	20.5	50+ 50/0.1	--	--					--	--		VISUAL
			Hard to very hard, gray with small portion buff colored, fresh, fine to medium grained LIMESTONE with few dark gray shaley laminations. Effervesces freely w/ dilute HCl. Bedrock in excellent condition as per RQD.	CORE RUN 1	21.7	94% (94%)										
			Note: U.C. Strength of Rock at 22.1 feet = 10,249 psi													
			Note: Moderate to thick bedding throughout core samples.													
			Note: Many small to medium (1/16" to 1/2") solution voids from 25.8' to 26.3'.	CORE RUN 2	26.2	100% (100%)										
			Note: Dark gray shaley natural fractures at 27.0', 28.5', 29.5', 30.1' and 30.9'.													

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger, ST = Shelby Tube, HCl = Hydrochloric Acid

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING NO.: B-4

LOCATION: _____

ELEVATION: 676.12ft

PROJECT: Fort Knox Proposed Barracks

PROJECT No.: 04019G

DRILLING INFORMATION:

American Drilling Services using an ATV Track-Mounted Mobile B47 Drill Rig

GROUNDWATER INFORMATION:

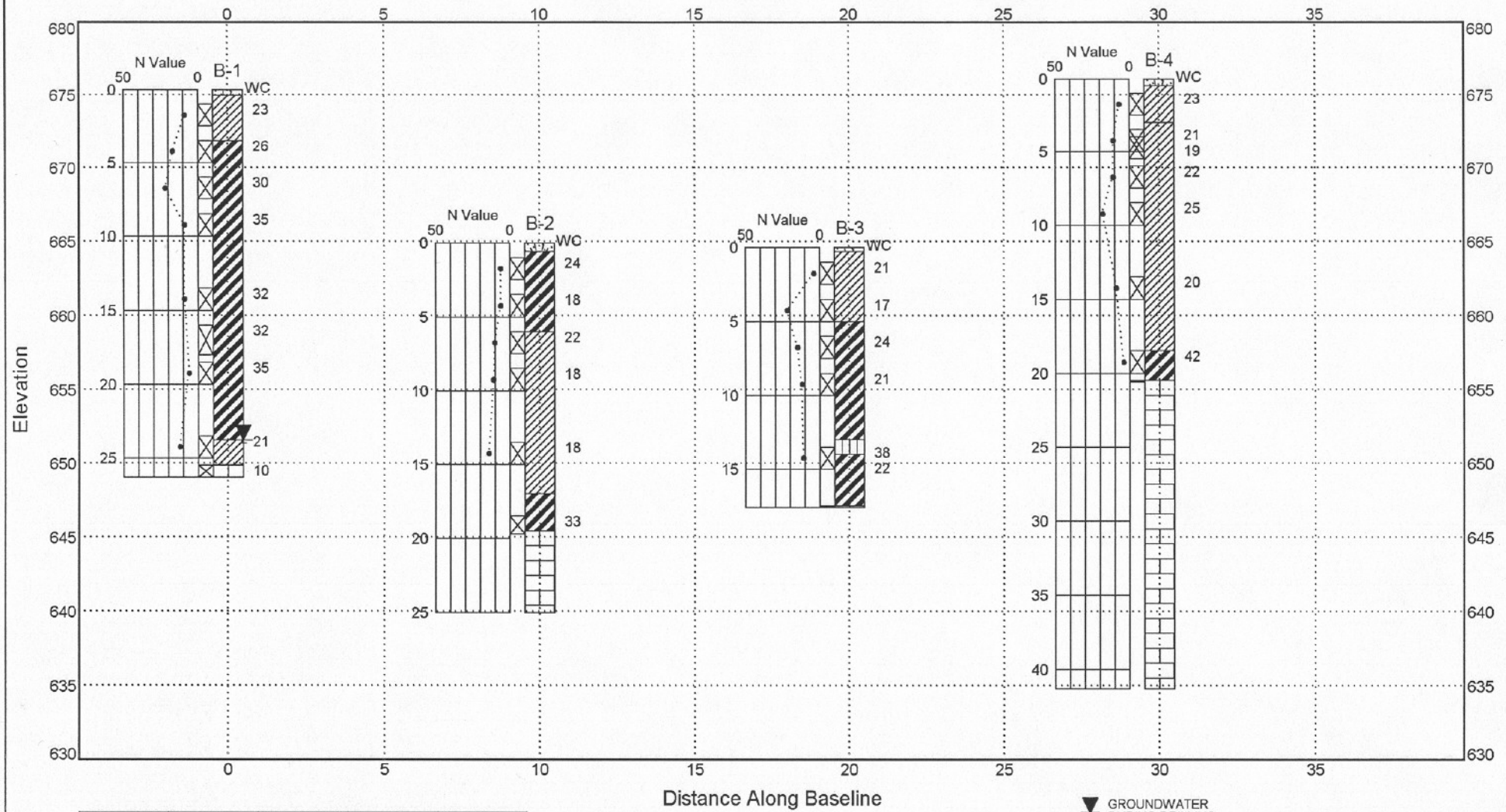
Groundwater was not encountered during drilling, however the soil/bedrock interface at a depth of 20.5 feet was very moist. Bore hole was dry upon completion of drilling operations.

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)
			Hard to very hard, gray with small portion buff colored, fresh, fine to medium grained LIMESTONE with few dark gray shaley laminations. Effervesces freely w/ dilute HCl. Bedrock in excellent condition as per RQD. *(continued)*	CORE RUN 3	31.3			
			Note: 1" thick dark gray shaley limestone from 31.3' to 31.4' then the limestone is all medium gray and fine grained to termination at 41.3'.				100% (100%)	
			Note: Driller used about 400 lbs of down pressure to core bedrock in both this test boring and B-2.	CORE RUN 4	36.3			
			Note: U.C. Strength of Rock at 39.3 feet = 8,834 psi				100% (100%)	
634.8	41.3		TERMINATION DEPTH = 41.3 FEET		41.3			

LABORATORY DATA

MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	CO., MED., & FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger, ST = Shelby Tube, HCl = Hydrochloric Acid



Borehole	North	East	Elev.	Depth
B-1			675.4	26.3
B-2			664.9	25.0
B-3			664.6	17.6
B-4			676.1	41.3

DISTANCES:

Beginning	0
Ending	35

VIEWING ANGLES (degrees):

Horizontal	0.0
Vertical	0.0

Position	North	East
Left, Front	0	10
Right, Front	0	45
Left, Back	0	10
Right, Back	0	45

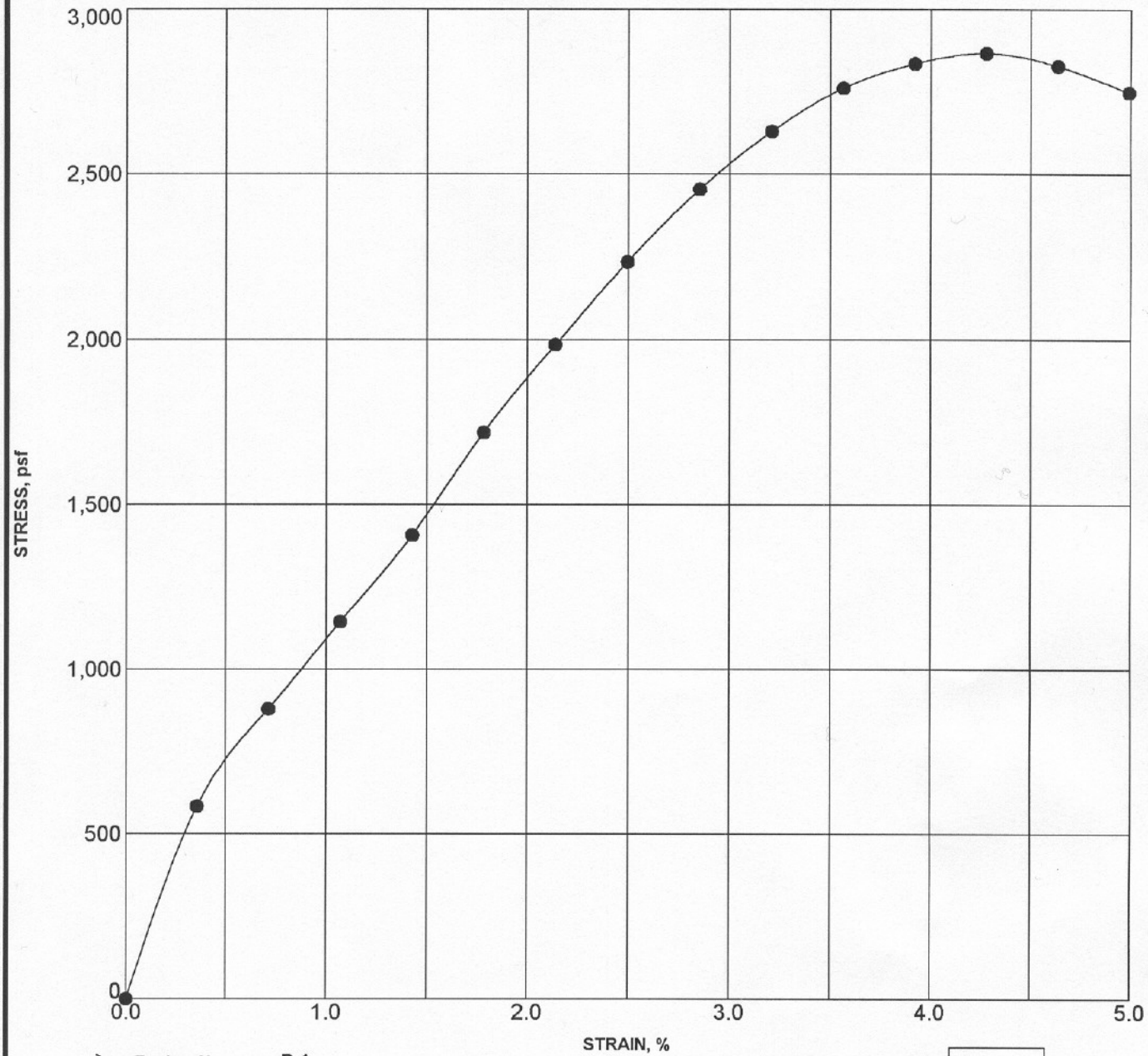
SOIL BORINGS PROFILE

Fort Knox Proposed Barracks

Fort Knox, Kentucky

PROJECT #	DATE	PLATE
04019G	Apr 04	1

PROFILE1 04019GA.GPJ PRIMENG.GDT 4/19/04



Boring No: B-1

Sample Depth : 16.0 ft.

Sample No.: 6

Failure Sketch:

Test Result Summary:

Average Diameter: 2.86 in. Average Height: 5.61 in. Height to Diameter Ratio: 1.96

Wet Density: 121 pcf Moisture Content: 31 % Dry Density: 92 pcf

Liquid Limit: 64 % Plastic Limit: 26 % Plasticity Index: 38 %

Classification: Reddish-orange FAT CLAY (CH), trace sand Average Rate of Strain: 1.430 %/Min.

Unconfined Compressive Strength: 2867 psf Strain at Failure: 4.28 %

PRIME ENGINEERING & ARCHITECTURE INC.

UNCONFINED COMPRESSION TEST

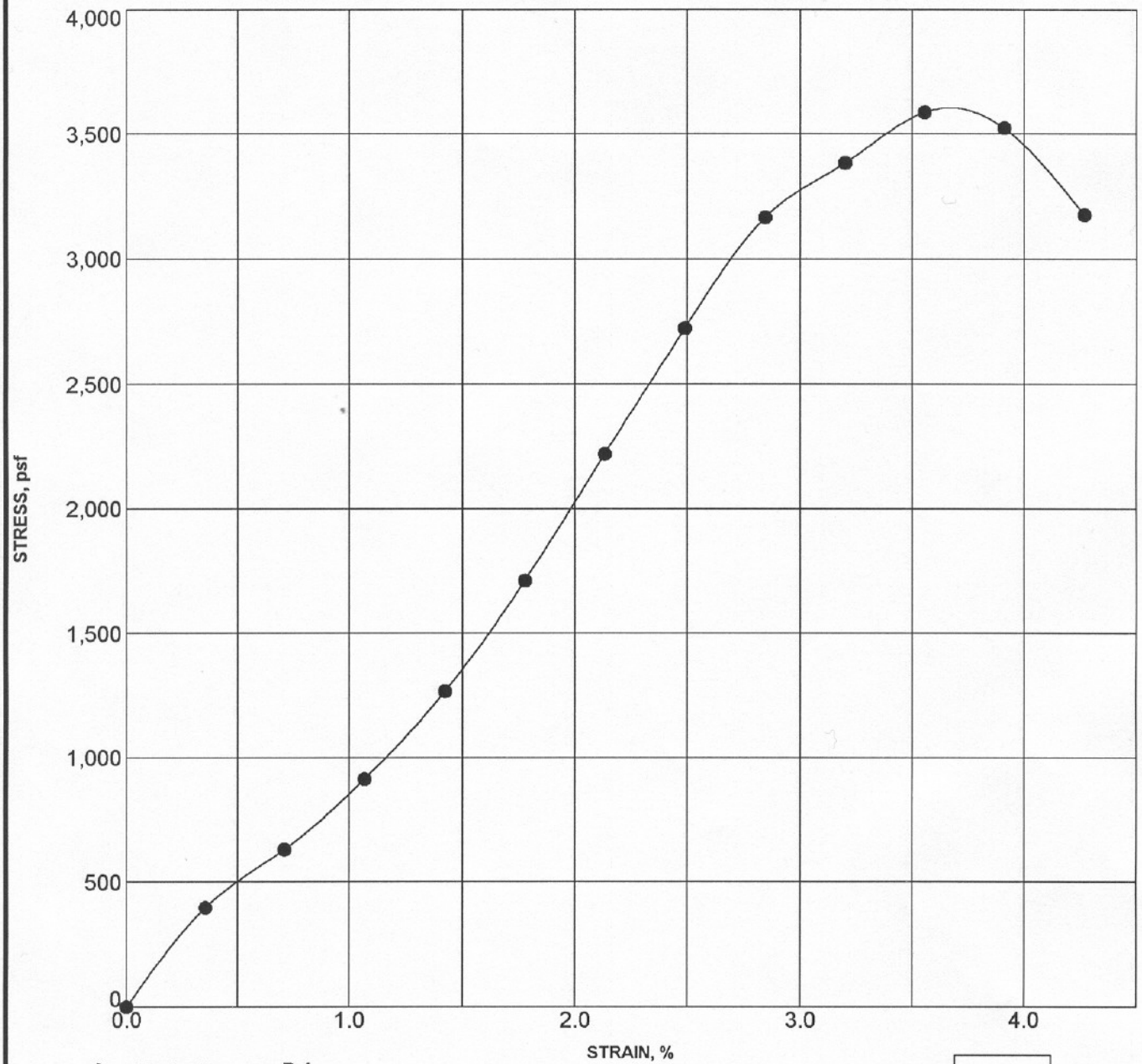
Client: KZF Design, Inc.

Project: Fort Knox Proposed Barracks

Location: Fort Knox, Kentucky

Number: 04019G

US_UNCONFINED2 04019GA.GPJ PRIMENG.GDT 4/18/04



Boring No: B-4

Sample Depth : 4.0 ft.

Sample No.: 3

Failure Sketch:

Test Result Summary:

Average Diameter: 2.85 in. Average Height: 5.62 in. Height to Diameter Ratio: 1.98

Wet Density: 131 pcf Moisture Content: 19 % Dry Density: 110 pcf

Liquid Limit: 38 % Plastic Limit: 19 % Plasticity Index: 19 %

Classification: Light brown LEAN CLAY (CL), trace sand Average Rate of Strain: 0.930 %/Min.

Unconfined Compressive Strength: 3587 psf Strain at Failure: 3.56 %

PRIME ENGINEERING & ARCHITECTURE INC.

UNCONFINED COMPRESSION TEST

Client: KZF Design, Inc.

Project: Fort Knox Proposed Barracks

Location: Fort Knox, Kentucky

Number: 04019G

US_UNCONFINED2 04019GA.GPJ PRIMENG.GDT 4/16/04

PROJECT No.: 04019G

PROJECT: Fort Knox Proposed Barracks

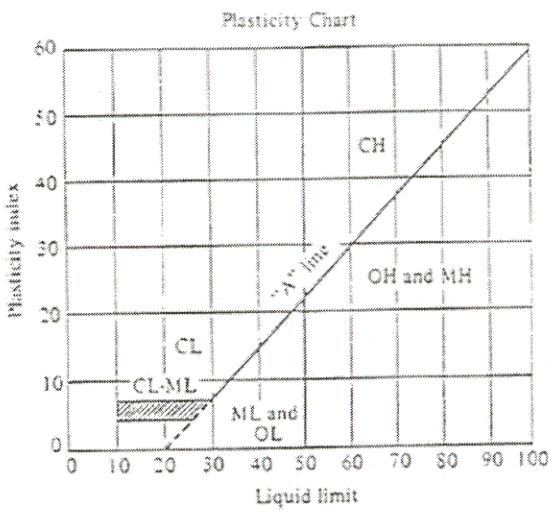
UNCONFINED COMPRESSIVE STRENGTH OF ROCK CORE SPECIMENS (ASTM D-2938)

CORE NUMBER	SAMPLE DEPTH (ft)	SAMPLE DEPTH (m)	LENGTH OF ROCK CORE (in)	LENGTH OF ROCK CORE (mm)	DIAMETER OF ROCK CORE (in)	DIAMETER OF ROCK CORE (mm)	DENSITY OF ROCK CORE (pcf)	DENSITY OF ROCK CORE (tons/cu.m)	ROCK TYPE	CORRECTION FACTOR	COMPRESSIVE STRENGTH (psi)	COMPRESSIVE STRENGTH (MPa)
B-2	21.6	6.58	4.02	102	1.98	50	164.8	2.640	Fresh LIMESTONE	1.00	12634	87.111
B-4	22.1	6.74	4.01	102	1.99	50	144.3	2.312	Fresh LIMESTONE	1.00	10249	70.665
B-4	39.3	11.98	4.08	104	1.99	50	157.3	2.520	Fresh LIMESTONE	1.00	8834	60.909

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2478)

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria	
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a] d	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GM[a] u		Atterberg limits below "A" line with P.I. greater than 7	
			GC	Clayey gravels, gravel-sand-clay mixtures		
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a] d	Silty sands, sand-silt mixtures	Atterberg limits above "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			SM[a] u		Atterberg limits above "A" line with P.I. greater than 7	
			SC	Clayey sands, sand-clay mixtures		
Fine-grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt	Peat and other highly organic soils		

Determining percentages of sand and gravel from grain-size curve.
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse grained soils are classified as follows:
Less than 5 per cent — GW, GP, SW, SP
More than 12 per cent — GM, GC, SM, SC
5 to 12 per cent — *Borderline* cases requiring dual symbols[b]



[a]Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.
[b]Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

DESCRIPTION OF SOIL AND ROCK

A. SOIL DECRIPTION ORDER

1. Consistency (cohesive soils) or density (non-cohesive soils)
2. Color
3. Major component (capitalized and underlined)
4. Minor component(s)
5. Relative moisture
6. Other characteristics such as "possible fill" or "road base"

B. CONSISTENCY OR RELATIVE DENSITY

1. Consistency (cohesive soils)

Consistency	SPT Blow Count, "N"	Description
Very Soft	< 2	Extruded between fingers when squeezed
Soft	2 – 4	Molded by light finger pressure
Medium Stiff	5 – 8	Molded by strong finger pressure
Stiff	9 – 15	Indented by thumb
Very Stiff	16 – 30	Indented by thumb nail
Hard	> 30	Difficult to indent by thumb nail

2. Relative Density (sand, gravel and non-plastic/non-cohesive silt)

Relative Density	SPT Blow Count. "N" Value
Very Loose	4 or less
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

C. COLOR

When the color of the soil is uniform throughout, the color recorded will be such as "brown", "gray", and "black", and may by modified by adjectives such as "light" and "dark". If the soil's predominant color is shaded by a secondary color, the secondary color precedes the primary color such as "gray-brown", "yellow-brown". If the two major and distinct colors are swirled throughout the soil, the colors will be modified by the term "mottled", such as "mottled brown and gray".

D. SOIL MAJOR COMPONENT TERMS

BOULDERS:	Larger than 300 mm (12")
COBBELS:	75 mm to 300 mm (3" to 12")
GRAVEL / ROCK FRAGMENTS **(ODOT)**:	
COARSE:	25 mm to 75 mm (1" to 3")
MEDIUM:	9.5 mm to 25 mm (3/8" to 1")
FINE:	2.0 mm to 9.5 mm (#10 sieve to 3/8")
GRAVEL / ROCK FRAGMENTS **(USCS)**:	
COARSE:	19 mm to 75 mm (3/4" to 3")
FINE:	4.75 mm to 19 mm (#4 sieve to 3/4")
SAND:	
COARSE:	0.42 mm to 2.0 mm (ODOT) / 2.0 mm to 4.75 mm (USCS)
MEDIUM:	0.42 mm to 2.0 mm (USCS) / No Medium Sand for ODOT
FINE:	0.075 mm to 0.42 mm (ODOT and USCS)
SILT:	0.005 mm to 0.075 mm (ODOT) / <0.075 mm (USCS)
CLAY:	Smaller than 0.005 mm (ODOT) / <0.075 mm (USCS)

E. SOIL MINOR COMPONENT TERMS

and:	36 – 50%
some:	21 – 35%
little	11 – 20%
trace:	1 – 10%

Note: Sand and silt may also be described as "silty sand", including that sand is the major component and silt is a minor component (35 – 50%). This can be done with other combinations, e.g., "sandy clay", "silty clay", "clayey gravel" etc.

F. MOISTURE CONTENT

1. Gravel, Sand, and Non-plastic Silt

dry:	Dry to tough
moist:	Moist to tough
wet:	Pore spaces partially water filled
saturated:	Pore spaces completely water filled

2. Clay and Plastic Silt

dry:	Powdery
damp:	Soil breaks up when worked between fingers
moist:	Soil can be molded or formed between fingers
wet:	Soil flows like a very thick liquid

G. ROCK DESCRIPTION

1. Rocks are generally described by their hardness, degree of weathering, color, and major rock type Example: "Hard, slightly weathered, brown SANDSTONE"
2. If the sample has been altered or decomposed as compared to the "fresh" rock, the term "weathered" may be added. Example: "weathered, gray SHALE"
3. If severely decomposed (rock core can be broken across grain with hand), the term "highly weathered" or "decomposed" should be used.

BEDROCK DESCRIPTIONS

Hardness

Very Soft -	(V. Soft) Easily gouged by knife, easily scratched by fingernail, easily broken by hand.
Soft -	Gouged by knife, scratched by fingernail, difficult to break by hand, powders with hammer.
Medium Hard -	(M. Hard) Easily scratched by knife, easily broken with hammer.
Hard -	Difficult to scratch, breaks with hammer.
Very Hard -	(V. Hard) Difficult to break, rings when struck.

Weathering

Decomposed -	(Dec.), bedding and fractures indistinct, no cementation.
Highly Weathered -	Hi. Wthd.) relict rock fragments; little to moderate cementation. Vugs, openings in bedding and fractures (may be filled).
Weathered -	(Wthd.) Good cementation, bedding and fractures are pronounced. Uniformly stained.
Slightly Weathered -	(Sl. Wthd.) Fractures pronounced, non-uniform staining, bedding distinct.
Fresh -	No staining. Fractures may be present. Bedding may or may not be indistinct.

BEDDING AND FRACTURES:

SPACING	BEDDING	FRACTURES
	(Bed.)	(Frac.)
	Indistinct	Broken
Less Than 1/2" (1cm)	Laminated (Lam.)	Fissile
1/2" TO 1" (1cm-3cm)	Very Thin	Very Close
1" TO 4" (3cm-10cm)	Thin	Close
4" TO 1' (10cm-30cm)	Moderate (Mod.)	Moderate
1' TO 3' (30cm-1m)	Thick	Wide
3' TO 10' (1m-3m)	Massive	Very Wide

RQD (ROCK QUALITY DESIGNATION)	DESCRIPTION OF ROCK QUALITY
0-25	very poor
25-50	poor
50-75	fair
75-90	good
90-100	excellent

A general description of the rock quality can be made from the RQD Value.

Classification of Rock with Respect to Strength	Unconfined Compressive Strength - PSI (MPa)
very high strength	greater than 32,000 (greater than 220.6)
high strength	8,000 to 32,000 (55.2 to 220.6)
medium strength	2,000 to 8,000 (13.8 to 55.2)
low strength	500 to 2,000 (3.5 to 13.8)
very low strength	125 to 500 (0.9 to 3.5)

Note: Rocks with compressive strengths lower than 125 lb/sq in. should be treated as soils.

LABORATORY TEST STANDARDS

STANDARDS	REFERENCE NUMBER

I. Soil/Rock Testing

Description and Identification of Soils (Visual-Manual Procedures)	ASTM D 2488-93
Classification of Soils for Engineering Purposes (U.S.C.S.)	ASTM D 2487-93
Laboratory Determination of Water (Moisture) Content of Soil and Rock	ASTM D 2216-92
Classification for Sizes of Aggregate for Road and Bridge Construction	ASTM D 488-86
Liquid Limit, Plastic Limit, and Plasticity Index of Soils	ASTM D 4318-95a
Shrinkage Factors of Soils by Mercury Method	ASTM D 427-93
Moisture, Ash, and Organic Matter of Peat and Other Organic Soils	ASTM D 2974-87
Specific Gravity of Soils	ASTM D 854-92
Direct Shear Test of Soils under Consolidated Drained Conditions	ASTM D 3080-90
Particle-Size Analysis of Soils	ASTM D 422-63
Unconfined Compressive Strength of Cohesive Soils	ASTM D 2166-91
Unconfined Compressive Strength of Intact Rock Core Specimens	ASTM D 2938-95
Slake Durability Index of Shale and Similar Weak Rock Test	ASTM D 4644-87
Point Load Test of Rock Core Specimens	ISRM*/ASTM D 5731
CBR (California Bearing Ratio) of Laboratory-Compacted Soils	ASTM D 1883-94
Laboratory Compaction Characteristics of Soil using Standard Effort	ASTM D 698-91
Laboratory Compaction Characteristics of Soil using Modified Effort	ASTM D 1557-91
One-Dimensional Consolidation Properties of Soils	ASTM D 2435-96
One-Dimensional Swell or Settlement Potential of Cohesive Soils	ASTM D 4546-96
pH of Soils	ASTM D 4972-95a

* ISRM – International Society of Rock Mechanics

II. Concrete Testing

Compressive Strength of Cylindrical Concrete Specimens	ASTM C 39-96
Acid-Soluble Chloride in Mortar and Concrete	ASTM C 1152-97

APPENDIX F
PERMITS MATRIX

ENVIRONMENTAL PERMITS MATRIX

US Army Corps of Engineers
Louisville District

PROJECT: **BASIC COMBAT TRAINING DINING FACILITY**

INSTALLATION: **FT. KNOX, KENTUCKY**

COMPLETED AT _____ **30%** _____ **60%** **X** **100% RFP**

TYPE OF PERMIT	PERMITTING ACTION				PIECE OF EQUIPMENT OR OPERATION	PERMITTING AUTHORITY CONTACTED AND DATE	PERMIT FEE	COMMENTS
	REQ'D Y/N	NO. OF PERMITS	TIME REQ'D FOR PERMIT (DAYS) PREP	TIME REQ'D FOR PERMIT (DAYS) APP				
AIR QUALITY	Y	1	~7	30-60	Construction	Ft. Knox Environmental Management Div., Eric Brown (502-624-3692)	None	Contractor submits to Ft. Knox EMD who approves and forwards to KY DAQ and EPA. **This permit is required prior to the installation of footings and foundations.**
	Y	1	~7	30-60	Cooling Towers	Ft. Knox Environmental Management Div., Eric Brown (502-624-3692)	None	Contractor submits to Ft. Knox EMD who approves and forwards to KY DAQ and EPA. Information such as manufacturer, size, and all technical data for each unit is required.
	Y	1	~7	30-60	Boilers	Ft. Knox Environmental Management Div., Eric Brown (502-624-3692)	None	Contractor submits to Ft. Knox EMD who approves and forwards to KY DAQ and EPA. Information such as manufacturer, size, and all technical data for each unit is required.
	Y	1	~7	30-60	Domestic Water Heaters	Ft. Knox Environmental Management Div., Eric Brown (502-624-3692)	None	Contractor submits to Ft. Knox EMD who approves and forwards to KY DAQ and EPA. Information such as manufacturer, size, and all technical data for each unit is required.

	Y	1	~7	30-60	Refrigerant Systems (Refrigerators, AC units, heat pumps, etc.)	Ft. Knox Environmental Management Div., Eric Brown (502-624-3692)	None	Contractor submits to Ft. Knox EMD who approves and forwards to KY DAQ and EPA. Information such as manufacturer, size, and all technical data for each unit is required.
WATER QUALITY	N				Water Plans, Specifications, Engineering Calculations	KY Div. of Water, Distribution Section, Shatig Amawi (502-564-2225, x-542)		Service lateral only – no permit required.
	N				Wastewater Plans, Specifications, Engineering Calculations	KY Div. of Water, Facilities Construction Branch, John Shupp (502-564-3410, x-435)		Service lateral and minor relocation only – no permit required.
	Y	1	~7	7	Stormwater Pollution Prevention Control	Ft. Knox Environmental Management Div., Donnie McGar (502-624-3629)	None	Contractor submits SWPP Plan to Ft. Knox EMD.
SOLID WASTE								
HAZARDOUS WASTE 1.	Y	1	~7	~30	Environmental Protection Plan	Fort Campbell, Environmental Division (various; 270/798-9597)		Contractor Submit Required 10 days after Notice to Proceed. Must include: 1. Hazmat Inventory Form for any hazardous material to be brought on Post. 2. MSDS Package including MSDS for all hazardous materials. 3. Hazardous Materials Generated List 4. Storage of Hazardous Materials; provision for. 5. Employee Training Documentation 6. Site Specific Spill Contingency Plan (SSSCP)
OTHER 2.	N							

1. Includes Underground Tank Permits for Fuels an Other Hazardous Materials.
2. Other Requirements Might Include Archaeological/Cultural Resource Clearance, State Historical Preservation Office (SHPO) coordination, Federal Aviation Administration (FAA) Coordination, and etc.

APPENDIX G
SUSTAINABLE RATING TOOL (SPiRiT)

SEE SEPARATE FILE

APPENDIX H
STANDARD DESIGN DOCUMENTS
BCT DINING FACILITY

SEE SEPARATE FILE

APPENDIX I
FORT KNOX BCT BARRACKS COMPLEX
CONCEPT SITE DRAWINGS

SEE SEPARATE FILE

APPENDIX J
PHOTOS OF BUILDINGS 1109 AND 1110 AT FORT KNOX

APPENDIX J

PHOTOGRAPHS OF FORT KNOX HISTORICAL STRUCTURES

Building 1109 from Spearhead Division Avenue

Building 1109 and 1110 from Brooks Field

APPENDIX K
FORT JACKSON
DESIGN DRAWINGS

SEE SEPARATE FILE

APPENDIX L
LOUISVILLE DISTRICT CORPS OF ENGINEERS
INTERIOR DESIGN GUIDE

Louisville District, Corps of Engineers

Interior Design Guide

Part 1 General

1.1 Overview of Military Interior Design

Military Interior Design projects are typically classified into two categories: Structural Interior Design (SID) and Comprehensive Interior Design (CID). The two types of projects cover different aspects of the interior environment and are funded through different sources. SID projects are funded with Military construction funds appropriated by Congress known as MCA, MCP or MILCON. CID projects are typically funded by the Major Command or the Installation. This type of funding is called O&M, OMA, RPM or NAF (Non-Appropriated Funds).

1.2 Structural Interior Design (SID)

Completion of a SID involves the selection and sampling of all applied finishes including material, color, texture and patterns necessary to complete the building's interior architectural features. Items include, but are not limited to; wall and floor finish materials, window and door finishes, glazing and trim materials, ceiling materials and finishes, millwork materials and finishes, as well as paint and stain samples. Since exterior colors, materials and finishes influence interior selections, include exterior materials as a separate section of the SID. Items include, but are not limited to, roofing materials and finishes, gutter and downspout, soffit and fascia panels, brick and mortar, exterior insulation and finish system samples, window and door frame, window glazing, as well as specialty items. If the Statement of Work and the DD 1391 includes Prewired Workstations, the SID will include all contract documents and finish samples relating to the prewired workstations. SID also includes signage details, plans and schedule. This information shall be submitted in 3" D-ring binders, 8-1/2" x 11" format.

1.3 Comprehensive Interior Design (CID)

The Comprehensive Interior Design (CID) includes selecting and developing interior building furnishings for an integrated visual design theme which reflects the interior atmosphere desired by the MACOM / MAJCOM and the using activity. The CID package must be developed concurrently with the design of the facility and submitted for review with the Preliminary and Final submittal. Furnishings selected in the CID generally include, but are not limited to, artwork and wall hangings, drapery and upholstery, furniture and systems furniture, files and other similar items. The use of prewired workstations (systems furniture) is mandatory for all Air Force administrative facilities and areas of 100 square meters or more per AF ETL 86-12. The CID package will include composite furniture floor plans, artwork illustration sheets, furniture and artwork cost estimates, order forms and justifications for waiver requests. The products and materials listed are purchased by the Government.

1.4 Design Recommendations

Experience proves that a “common sense” approach to all projects produce the most customer satisfaction. Neutral interior color schemes with the appropriate selection and placement of hues and patterns for carpet and upholstery achieve the most customer satisfaction. Cost constraints can limit costly design materials and finishes from being used throughout the facility. However, the lack of funds should not eliminate designs that create a professional image. When cost constraints exist, there are areas that rank in importance with regards to applied finishes. They are as follows: (1) Entries and Main Conference rooms, (2) Command Areas, (3) Employee Break Room, (4) Toilet Rooms and (5) General Office areas.

1.5 Contract Documents

Designers are not to reference the SID/CID binders in the Contract Drawings and Specifications. The SID/CID binders are only presentation tools used during the design process to illustrate color, texture and pattern. The General Contractor will only see the SID/CID binders after the project has been awarded.

1.5.1 If a client is purchasing and installing systems furniture, all systems furniture should be indicated in the contract drawings with the note “FOR INFORMATION ONLY”.

1.5 Disclaimer

Guide Specification 09915 Exterior/Interior Finish Schedule indicates that all product trade names and colors used for the project are nonproprietary. When this guide specification is used it is not necessary to place the disclaimer on the contract drawings.

Part 2 Applicable Publications

2.1 Government Publications

Federal Acquisition Regulations (FAR)

Part 8	Required Sources of Supplies and Services
Part 10	Specifications, Standards and Other Purchase Descriptions
Part 11	Describing agency needs

Department of the Army

AR 415-15	Military Construction, Army (MCA) Program Development
AR 415-17	Cost Estimating for Military Programming
DFARS	Defense FAR Supplement
AR 405-70	Utilization of Real Property

US Army Corps of Engineers

ER 1110-345-122	Engineering and Design, Interior Design
DG 1110-3-122	Design Guide for Interiors
	Guide to Enlisted Quarters, DIAM-FDH

Air Force and Air Force Reserves

Refer to the Air Force Center for Environmental Excellence http://www.afcee.brooks.af.mil/afceehome.asp
Interior Design Presentation Format

Army Reserves

DG-1110-3-107 Design Guide for Army Reserve Facilities
Modular Design System (MDS) Submittal Requirements http://bc.cecer.army.mil/mds/

Department of Defense

Interior Design Resources http://tsc.wes.army.mil/ID_Resources_DoD/index.htm

2.2 Referenced Standards

Accessibility

ASTM A 117.1	American Disabilities Act
UFAS	Uniform Federal Accessibility Standards

Acoustics

ASTM C 423	Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
SPP	Speech Privacy Potential

Fire Protection /Life Safety

UFC 1-200-01	Unified Facilities Criteria, Design: General Building Requirements
NFPA 101	Life Safety Code (most current year)
MIL Hankbook-1008C	Fire Protection for Facilities Engineering, Design, and Construction

Falls

ASTM D 2047	Standard Test Method for Static Coefficient of Friction of Polished-Coated Surfaces as Measured by the James Machine

Fire and Flame Spread

ASTM-E-84	Steiner Tunnel Test
NFPA-701	Standard Methods of Fire Tests for Flame Propagation of Textile and Films
NFPA-705	Recommended Practice for a Field Flame Test for Textiles and Films
FF 1-70	Standard for the Surface Flammability of Carpet and Rugs (Methenamine Pill Test)
NFPA 80	Standard for Fire Door and Fire Windows
NFPA-220	Standard on Types of Building Construction
NFPA 253	Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
NFPA-255	Standard Method of Test of Surface Burning Characteristics of Building Materials
NFPA 258	Recommended Practice for Determining Smoke Generation of Solid Materials
NFPA 259	Standard Test Method for Potential Heat of Building Materials
NFPA 260	Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture
NFPA 261	Standard Method of Test for Determining Resistance of Mock-up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes
NFPA 265	Standard Methods of Fire Test for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls
NFPA 267	Standard Method of Test for Fire Characteristics of Mattresses and Bedding Assemblies Exposed to Flaming Ignition Source
NFPA 272	Standard Method of Test for Heat and Visible Smoke Release Rates for Upholstered Furniture Components or Composites and Mattresses Using Oxygen Consumption Calorimeter
NFPA 701	Standard Methods of Fire Tests for Flame Propagation of Textures and Films
NFPA 703	Standard for Fire Retardant Impregnated Wood and Fire Retardant Coatings for Building Materials
UL-1056	Fire Test of Upholstered Furniture

Fire and Flame Spread

CAL TB-133	Flammability Test Procedure For Seating Furniture for Use in Public Occupancies. State of California Bureau Home Furnishings
CAL-TB 117	(Section A through E) Test Procedures for Testing the Flame Retardance of Resilient Filling Materials used in Upholstered Furniture.

Furnishings

ANSI/ BIFMA X5	American National Standard for Office Furnishings

Lighting

ASTM E 1347	Standard Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry http://www.astm.org

Part 3 Project Engineering / Concept Design

3.1 Structural Interior Design: Provide a narrative section WITHIN the Design Analysis write-up that discusses the basic design objectives for the facility. Discuss the building's materials, finishes and colors with regards to aesthetics, maintenance, durability, life safety, image and cost. State any specific materials, finishes and colors that are required by the Installation's Design Guide. Present architectural finish samples in an orderly arrangement according to like rooms/areas receiving like finishes. Each like room receiving like finishes will be noted as a Color Scheme or Color Placement Zones. Each Color Scheme shall have a written description of material used. This written description shall use the same material abbreviations and notes that appear on the

Room Finish Schedule and Legend in the contract drawings and in Guide Specification 09915 Color Schedule. Submit the SID binders concurrently with the architectural design submittals.

3.1.1 **SID Submittals:** Interior Design submittals run concurrent with the project milestone submittals.

3.1.1.1 **SID Preliminary Submittal:** Submit a minimum of three (3) complete sets of the initial SID package. Additional sets of the SID package may be required depending on the project. All SID proposals shall be reviewed and approved by the Government. The Interior Designer shall revise the SID binders after each review and update the SID to satisfy review comments. Each scheduled milestone submittal will follow this method of review until the Government approves the completed SID package.

3.1.1.2 **SID Final Submittal:** After approval of the Preliminary Submittal, submit three (3) complete sets of the approved and final Structural Interior Design package. Additional sets of the SID package may be required depending on the project. Once the SID has been submitted and approved by the Government, all materials, finishes, colors, textures and pattern submitted and approved for this project are then considered as part of the contract. **No deviations will be considered**.

3.1.1.3 The SID Submittal Matrix tells what information must be included in each submittal if that work is part of the design contract:

SID Submittal Matrix		
Description	**Preliminary**	**Final**
Title Page / Return Address of Designer	X	X
Table of Contents	X	X
Narrative of SID Design Objectives	X	X
Interior Color Zone Plan	X	X
Interior Finish Sample Boards	X	X
Interior Signage Samples	X	X
Furniture Systems Color Boards	X	X
Room Finish Schedule and Color Legend		X
09915 Color Schedule		X
Signage Plan / Schedule / Details		X
Composite Floor Plan	X	X
Furniture Systems Composite Floor Plans	X	X
Furniture Systems Panel Plans		X
Furniture Systems Electrical/ Voice / Data Plans	X	X
Furniture Systems Isometric and Inventory Drawings		X
Furniture Systems Cost Estimate	X	X
CD of all Drawings / Plans / Schedules		X

3.1.2 **Signage:** Signage is critical to “pathway finding” and is to meet the requirements indicated in the American With Disabilities Act unless directed in writing by the client to do otherwise. Signage may include emblems, striping, letters, numbers and logos. The interior designer shall consider visual appearance, organization, location, structural supports (if required) and relation to other Military Base / Post Design Guides (Installation Design Guide). Indicate on a separate signage sheet the location and message for all signage. Submit a sample of the signage material finish and color with the structural finishes. For signage requirements specific to the U.S. Army Reserve, refer to DG 1110-3-107, 2.1 Signage.

3.1.3 **Furniture Systems (Prewired Workstations):** Furniture systems are part of a SID project if they are specifically identified on the DD Form 1391. If so identified, they are O&M funded and can be an integral part of the construction project.

3.1.4 **Format:** Submit all SID information and samples on 8 1/2"x 11" modules with only one foldout. The maximum foldout width shall be approximately 25 inches. No foldouts on the top or bottom of the pages. Place the project title, project location, architectural firm, page number and date on each page or module.

3.1.4.1 Each binder shall be labeled on the outside spine and front cover with the following information: Project title, date, project location, and design firm.

3.1.4.2 The module shall support and anchor all samples. Anchor large or heavy samples with mechanical fasteners, velcro or double-sided foam tape. Rubber cement or glue will not be acceptable.

3.1.4.3 Assemble the 8 1/2" x 11" pages and modules in a 3" D-ring binder. Holes for placement of the modules in the binder shall be 3/8" in diameter. Each binder shall be identified on the outside spine and front cover by title, project number, percentage phase and date.

3.1.4.4 Material and finish samples shall indicate true pattern, color and texture. Carpet samples shall be large enough to indicate a complete pattern or design.

3.1.4.5 Where paint manufacturers color names and numbers are used indicated the finish of the paint such as gloss, semi-gloss, flat etc.

3.1.4.6 Each sample board is to be inserted into a clear page protector that is sturdy enough to keep the pages from tearing out.

3.1.4.7 No photographs or colored photocopies of materials will be accepted or approved.

3.1.4.8 Renderings and black & white sketches may be required for some interior design projects. Verify that renderings and/or sketches are a contract requirement before proceeding. All renderings and sketches are to be professional in appearance. The Designer is to submit a sample of the proposed artistic style to be used for Government approval. Some installations have standard framing and matting requirements and the Designer must comply with these standards. The rendering and sketches are to emphasize spatial relationship, furnishings, patterns and texture. The Government shall select the areas that a final rendering(s) will illustrate.

3.1.4.9 For U.S. Army Reserve projects refer to the "Modular Design System (MDS) Submittal Requirements". See website http://bc.cecer.army.mil/mds/

3.1.4.10 The SID Binder shall include the following information at each design submittal in this order:

SEQUENCE OF SID BROCHURE

A. Title page **-** Include any notes to the reviewer and a return address of the designer.

B. Table of contents

C. Narrative of Design Objectives - A statement of design objectives explaining the interior design philosophy of the facility shall be provided. Design objectives and the proposed method of accomplishing the objectives. Shall cover, when applicable, energy efficiency, safety, health, maintenance, image, personal performance of occupants and functional flexibility.

D. Interior Color Zone Plan - 1/8"=1'-0" scale or 8 1/2x11 size

E. Interior Finish Sample Boards - SID finish samples should be grouped into color schemes organized by Color Placement Zones. A color placement zone is all spaces or areas within a building that have like finishes. The finish board shall depict all SID materials and finishes. Pattern samples shall be large enough to show full pattern, color and texture. Label the material and finish samples with the material codes used in the contract documents. Include a written description for each color scheme indicating the specific manufacturer color names and numbers of each sample. Finish sample boards should include samples of signage and furniture systems (if required).

F. Room Finish Schedule / Color Legend

G. Signage Plan / Schedule / Details – Required for all Air Force Projects.

H. Composite Floor Plan – The composite floor plan(s) are full size contract drawings and indicate all the furniture, including the systems furniture, to illustrate its relationship to the building and the building's systems. Plan room numbers are to appear on the drawings. Plan must show suitability of proposed space to suit the furniture to be provided. If furniture systems are required, include workstation composite floor plans, panel plans, Electrical/Voice/Data Plans, Workstations Isometrics, Inventory Drawings and Cost Estimates.

I. CD of all drawings / Plans / Schedules

3.2 **Comprehensive Interior Design (CID):** Provide a narrative section WITHIN the Design Analysis write-up that discusses the basic design objectives for the furnishings being considered for the facility. State specific requirements for materials, finishes and colors. Discuss the furnishing selection with regards to the SID. The narrative is to include but is not limited to CID aesthetics, form, function, maintenance, durability, life safety and cost. Indicate that Government procurement regulations are being considered in the design development process. Present finish samples in an orderly arrangement according to like rooms/areas receiving like furnishings. Each like room receiving like furnishings will be noted as a Color Scheme. Each Color Scheme shall have a written description of material used. This written description shall use the same material abbreviations and notes that appear on the Room Finish Schedule and Legend in the contract drawings. Submit the CID binders concurrently with the architectural design submittals.

3.2.1 **CID Furniture Resource:** Every effort should be made to use UNICOR, GSA Stock or Federal Supply Schedule items. However, when the Interior Designer determines CID items available on FSS/GSA contract or from UNICOR do not meet the functional requirements, or there is no current FSS/GSA/UNICOR resource for a furniture requirement, a justification to use an Open Market source is required. The Designer shall write a justification letter (refer to Appendix 1). This letter shall be included in the CID Binder attached to the required order form.

3.2.2 **CID Submittals:** Note that the Interior Design Submittals run concurrent with the Architectural Submittals.

3.2.2.1 **CID Preliminary Submittal:** The Contractor shall submit three complete sets of the initial CID package. Additional sets of the SID package may be required depending on the project. All CID proposals shall be reviewed and approved by the Government. The Interior Designer shall revise the CID binders after each review and update the CID to satisfy review comments. Each submittal will follow this method of review until the Government approves the completed CID package.

3.2.2.2 **CID Final Submittal:** After approval of the Preliminary Submittal, the Contractor shall submit three (3) complete sets of the approved and final Comprehensive Interior Design package. Additional sets of the SID package may be required depending on the project. Once the Contractor has submitted the CID and the Government has approved the submittal, all materials, finishes, colors, textures and pattern submitted and approved for this project are then considered as part of the contract and the Contractor shall furnish all approved CID finishes. **No deviations will be considered.**

3.2.2.3 The CID Submittal Matrix tells what information must be included in each submittal if that work is part of the design contract:

CID Submittal Matrix		
Description	**Preliminary**	**Final**
Title Page / Return Address of Designer	X	X
Table of Contents	X	X
Narrative of CID Design Objectives	X	X
Proposed Rendering Technique	X	
Interior Renderings / Sketches		X
Composite Floor Plans with Conventional and Furniture Systems	X	X
Furniture Systems Panel Plans		X
Furniture Systems Electrical/ Voice / Data Plans	X	X
Furniture Systems Elevations / Isometric and Inventory Drawings	X	X
Manufacturers Summery List		X
Conventional Furniture Placement Plans		X
Conventional Furniture Illustration Sheets	X	X
Artwork Placement Plans	X	X
Artwork Specification Sheets		X
Order Data Sheets	X	X
Itemized Furniture Cost Estimate	X	X
Letters of Justification for Waivers (if required)	X	X
Finished Sample Boards	X	X
CD of all Drawings / Plans / Schedules		X

3.2.4 **Format:** Submit all CID information and samples on 8 1/2"x 11" modules with only one foldout. The maximum foldout width shall be approximately 25 inches. No foldouts on the top or bottom of the pages. Place the project title, base, architectural firm, page number and date on each page or module.

3.2.4.1 The module shall support and anchor all samples. Anchor large or heavy samples with mechanical fasteners, velcro or double-sided foam tape. Rubber cement or glue will not be acceptable.

3.2.4.2 Assemble the 8 1/2" x 11" pages and modules in a 3" D-ring binder. Holes for placement of the modules in the binder shall be 3/8" in diameter. Each binder shall be identified on the outside spine and front cover by title, date, project location, and design firm.

3.2.4.3 Material and finish samples shall indicate true pattern, color and texture. Carpet samples shall be large enough to indicate a complete pattern or design.

3.2.4.4 No photographs or colored photocopies of materials will be accepted or approved.

3.2.4.5 The CID Binder shall include the following information at each design submittal in this order:

SEQUENCE OF CID SUBMITTAL

A. **Title Page:** Include any notes to the reviewer and a return address of the designer.
B. Table of contents

C. **Narrative of Interior Design Objectives:** A statement of design objectives explaining the interior design philosophy of the facility shall be provided in the CID. Where applicable, include the psychological impact of the interior environment on its inhabitants and proposed method of accomplishing same space planning, shapes, forms, color, patterns, textures, fabrics and furnishings. Discuss plans to integrate the visual design disciplines such as architecture, graphic design and interior design.

D. **Rendering:** Photo of proposed rendering technique (if required by contract).

E. **Composite Floor Plans with Conventional and Furniture Systems** (on full size sheet): The Composite Floor Plan should show all panels, components and freestanding furniture in relationship to the building systems. This includes information on the location of light switches, fire pull boxes, mechanical devices, and other wall-mounted items. It should be a full size contract drawing showing furnishing item numbers.

F. **Furniture Systems Panel Plans** (Only required when systems furniture is used): The Panel Plan is to include a panel symbol legend, panel placements, critical dimensions of aisle widths, and critical dimensions tying the panels to the building's structure and electrical / mechanical systems. Panels must not block access to mechanical, electrical or fire controls. Each panel should labeled with the width, height and powered or non-powered.

G. **Furniture Systems Electrical / Voice / Data Plans** (Only required when systems furniture is used): Voice and Data Plans show any panel placements, all receptacles used in each workstation, height and location of all light switches and mechanical control devices, and a symbol legend. The workstation designer must coordinate the Electrical Voice and Data Plans with the building's communication and mechanical engineering drawings.

H. **Furniture Systems Elevation / Isometric and Inventory Drawings** (Only required when systems furniture is used): This drawing is either an elevation or isometric of each type of workstation with a related inventory list of all the panels and components used, and the method of attachment (floor mounted or wall hung). The inventory list is to describe components generally rather than using specific part numbers.

I. **Manufacturer's Summery List:** The Manufacturer's Summary List is a list of all the manufacturers whose products are used in the CID package. For each manufacturer provide, name, address, phone number, fax number and a point of contact.

J. **Conventional Furniture Placement Plans:** Required for all areas, include the furniture item codes. A Conventional Furniture Placement Plan is of one room showing each furniture component in the room. There will be one Conventional Furniture Placement Plan for each room on the Composite Floor Plan that contains furniture. Placement plans are to be drawn at 1:50 (1/4"=1'-0") if possible, or at 1:100 (1/8"=1'-0") if the room or area illustrated is very large. Each plan will include job name, job location, date, footprint of room, furnishings with item number on each piece, room name and number, quantity of each product specified.

K. **Conventional Furniture Illustration Sheets with number codes:** Provide one Furniture Illustration Sheet for each item of furniture in the CID. Each Furniture Illustration Sheet will include job name, job location, date, picture or line drawing of the item specified, furnishings with item number which keys the item to the Composite and Conventional Furniture Placement Plans, options specified, finish / fabric specification, comprehensive list of quantity per each room. Furniture Illustration Sheets are to be arranged in numerical order by furnishing item code number.

L. **Artwork Illustration Sheets / Artwork Placement Plans:** This plan shows the spatial relationship between the furniture and the artwork in a room. There will be one Artwork Placement Plan for each room in the Composite Floor Plan that contains artwork. Assign a furnishings item number to each piece of artwork. The Artwork Placement plan will include the furnishings item number for the artwork and will also show the furniture without the item numbers. These plans are to drawn at 1:50 (1/4"=1'-0") if possible, or at 1:100 (1/8"=1'-0") if the room or area illustrated is very large. Each plan will include job name, job location, date, plan of the room locating artwork, item number for each artwork item, room name and number, quantity of each product specified, and an elevation of each wall containing artwork showing mounting height.

M. **Order Data Sheets:** The Order Data Sheet provides all information necessary to order the furnishings specified in the CID. Only one item should be listed per data sheet. The sheets should be in numerical order. The Order

Data Sheet will include job name, job location, date, GSA number, Special Item Number (SIN) and contract expiration date, Source and manufacturers name (including address, telephone number and fax number), product name, product model number, description, finish name and number, fabric name and number, dimensions, weight, justification, item location by room number, quantity per room, total quantity, unit price, total price, estimated freight charges and any special instructions.

N. **Itemized Furniture Cost Estimate:** List all furnishings and indicate quantities, unit cost and totals. The cost estimate is also to include a 10% general contingency and 7% installation listed as separate line items. Estimated freight charges that are not included in furniture cost should be a separate line item.

O. **Letter of Justification for Waiver** (if required)

P. **Finish Sample Boards:** Samples of all finishes and fabrics are to be represented in a Finish Board. Label all samples with the furniture item number that corresponds to the Order Data Sheet and Composite and Conventional Furniture Placement Plans. The material / color samples provided must be large enough to indicate true patterns, colors, and textures.

Q. CD of all drawings / Plans / Schedules

3.3 Reviews and Revisions

3.3.1 All SID and CID packages will be reviewed by the Government during each design phase of the project. Written annotated comments will be provided to the designer using Dr. Checks. These annotated comments with the Designer's written responses should be incorporated into the next SID or CID binder submittal, placed in the front inside pocket of the first volume.

3.3.2 The Designer should revise the binder after each review to respond to the review comments. If the binders are not returned to the Designer after the design review, the Designer may simply provide updated inserts to the Government and the Government will be responsible for the update.

Part 4 Terms, Definitions and Resources

This section provides a glossary of Government Terms, Definitions and Resources which are useful in understanding and developing ideas and concepts discussed in this document. Within the Department of Defense there are consistent contracting definitions, processed and actions. This Glossary will provide the Department of the Army and Air Force specific acronyms as they relate to the SID/CID packages and contracting actions.

CID - COMPREHENSIVE INTERIOR DESIGN: The selection and illustration of all furniture necessary to complete the interior environment; the submittal is funded with OMA or O&M dollars; includes furniture illustrations, fabric and finish samples, plans, and ordering information. For projects other than barracks or the U.S. Army Reserve, the CID is purchased and installed by the installation; not the construction contractor. See also **SID**

DD 1391 - DEPARTMENT OF DEFENSE FORM 1391: A programming document initiated by the installation; submitted through the Major Command to Congress for funding. It includes an outline of basic needs for a proposed facility and an estimated cost to fulfill them. Prewired workstations to be included as part of a MILCON construction contract must also be included as a line-item on the DD 1391.

DESIGN BUILD: A method of contracting in which a single entity takes responsibility for both design and construction of a facility. Performance requirements are outlined using the Request for Proposal (RFP) format.

DFARS – DEFENCE FAR SUPPLEMENT: Department of Defense supplemental regulations to the FAR. DFARS 208.6 addresses a mandatory source status of UNICOR / FPI products.
http://www.acq.osd.mil/dp/dars/dfars.html

DPW - DIRECTORATE OF PUBLIC WORKS: The Army term for the centralized engineering management staff. The DPW is responsible for the coordination of all MILCON and O&M design and construction projects. DPW is the principle coordinator between the design agent, users and Major Commands.

ENVIRONMENTAL PRODUCTS GUIDE: for GSA CATALOG SUPPLY ITEMS. This Guide can be obtained by contacting:

GSA CENTRALIZED MAILING LIST SERVICE (7CAFL)
P.O. BOX 6477
FT. WORTH, TX 76115
(817)334-5215
1-800-488-3111

http://www.gsa.gov/Portal/content/offerings_content.jsp?contentOID=120597&contentType=1004&cid=null

FAR-FEDERAL ACQUISITION REGULATIONS: The laws governing how the government buys products and services. (FAR) 8.4 indicates the process for ordering from Federal Supply Schedules (http://www.arnet.gov/far/current/html/Subpart_8_4.html#1046478). Title 18 of the U.S. Code allows for direct purchase from UNICOR without competitive bids. (FAR) 8.6 identifies UNICOR as a mandatory procurement source to all federal agencies for products that meet the requirements of the ordering office (http://www.arnet.gov/far/current/html/Subpart_8_6.html). See also **UNICOR.**

FED BIZ OPPS: This website is where the Federal Government advertises notices of contracting actions for all projects over $25,000.00 and for request for Architectural – Engineering (A & E) Services.
http://www.fedbizopps.gov/

FSN 595B - FEDERAL STANDARD NUMBER 595B: A collection of standard colors used by the various departments or agencies. The first number in the five digit series indicates a specific finish: (1) full gloss, (2) semi-gloss and (3) flat. The remaining four digits indicate a specific hue and tint/shade range.

FSN 595B FAN DECK: Federal standard colors are available in a booklet for under $10.00.
Use order number # NSN 7690-01-162-2210 and your request to:

GSA
Specifications Unit (3F-BP-W)
Seventh and D Sts SW
Washington, DC 20407

FSS- FEDERAL SUPPLY SCHEDULES: provides indefinite quantity contracts for commercial items at established prices for direct ordering use by government agencies. Address:

GSA NCSC
Building 4, 1500 East Bannister Road
Kansas City, MO 64131
1-800-488-3111
(861) 823-3060

FURNITURE SYSTEMS: Furniture systems refer to workstations which are assembled to create custom designs by arrangements of miscellaneous components such as work surfaces, shelving, drawers, etc. Furniture systems may be panel-supported system, a floor-supported system, a desk-based system, it any be available in cluster configurations, or any of a number of methods to arrange various components. Usually it requires professional installation service. The CID designer needs to coordinate the furniture systems with the building systems and provide plans and specifications in the contract documents.

FY – FISCAL YEAR: (A) October 1 through September 30 of the calendar year. (B) "FY…." at the beginning of a project title identifies the year Congress will fund the Construction Contract Award.

GSA FSC – GENERAL SERVICES ADMINISTRATION FEDERAL SUPPLY CLASSES
FEDERAL SUPPLY GROUPS: Government contracts with private manufacturers that have a fixed price, MOL and fixed expiration date. This publication can be ordered from the GSA CENTRALIZED MAILING LIST SERVICE listed above.

IFB - INVITATION FOR BID: One of the ways Government solicits A&E Services. The IFB is a standard contract with clearly defined requirements, specifications and terms that are not negotiated. Any proposal prepared

in response to an IFB must strictly adhered to the terms. The award is based on the lowest bid meeting the requirements and specifications. See also RFP.

JOC - JOB ORDER CONTRACT: The JOC contract offers a simplified method for the installation to contract for repair work. The Contracting Officer and the Contractor agreed upon unit prices for work, then individual job orders are negotiated for specific scopes of repair work.

MCA – MCP – MILCON - MILITARY CONSTRUCTION: Funds appropriated by Congress for new construction–fixed price contracts.

OMA - O & M - OPERATION AND MAINTENANCE: Funds provided to each installation by the Major Command and used for the day to day operations of the installation. These funds may be used for the renovation of existing buildings or for the purchase of furniture. Funds not spent to award a contract expire at the end of the FY and cannot be recovered.

OPEN MARKET: Designation for products that are not on a GSA contract or provides by UNICOR / FPI.

PD- PROJECT DEFINITION PD: A conceptual design of the proposed project (floor plans, elevations, cost estimate).

PREWIRED WORKSTATIONS (PW): Systems furniture purchased with OMA or O&M funds. The Designers will coordinate the composite furniture plans with the building systems and provide the plans and specifications in the contract documents. The General Contractor purchases and installs these items as part of the facility construction contract.

RFP - REQUEST FOR PROPOSAL: One of the ways the Government solicits A&E Services. An RFP usually defines a design problem and allows those who respond to the RFP to suggest a solution. The RFP is much more flexible than the IFB.

RFQ - REQUEST FOR QUOTES: Ann informal request for a price for a standard item.

SF 254 & 255 - STANDARD FORMS: Resume forms that state the qualifications of the A-E firms responding to a FED BIZ OPPS announcement. See also FED BIZ OPPS.

SID - STRUCTURAL INTERIOR DESIGN: (a) the selection and sampling of building related finishes; (b) A submittal with samples of proposed building materials for a particular project. Materials and finishes purchased and installed by the General Contractor. (d) Projects that are funded with the MCA or MILCON funds.

SCOPE OF SERVICVES - APPENDIX A-SECTION C: The contractual scope of work for A-E contracts which outlines basic requirements including specific deliverables and the schedule of design submittals.

SYSTEMS FURNITURE: Systems furniture purchased with OMA or O & M funds. The designer coordinates the footprint plans with the building systems and provides the plans in the contract documents for “information only”. Procurement information will appear in the CID and will be purchased by the installation.

UNICOR: The trade name for the Federal Prison Industries Inc (FPI), a wholly owned government corporation established in 1934. UNICOR provides a variety of products and services to the Federal Government. Information can be found at: www.UNICOR.gov