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1.0 PROJECT OBJECTIVES

The project objective is to design and construct facilities for the military that are consistent with the design and construction practices used for civilian sector projects that perform similar functions to the military projects. For example, a Company Operations Facility has the similar function as an office/warehouse in the civilian sector; therefore the design and construction practices for a company operations facility should be consistent with the design and construction of an office/warehouse building.

Comparison of Military Facilities to Civilian Facilities

| Military Facility | Civilian Facility |
|---------------------------|-------------------|
| General Purpose Warehouse | Storage Facility |

It is the Army's objective that these buildings will have a 25-year useful design life before a possible re-use/re-purpose or renovation requirement, to include normal sustainment, restoration, modernization activities and a 50-year building replacement life. Therefore, the design and construction should provide an appropriate level of quality to ensure the continued use of the facility over that time period with the application of reasonable preventive maintenance and repairs that would be industry-acceptable to a major civilian sector project OWNER. The site infrastructure will have at least a 50-year life expectancy with industry-accepted maintenance and repair cycles.

The project site should be developed for efficiency and to convey a sense of unity or connectivity with the adjacent buildings and with the Installation as a whole.

Requirements stated in this contract are minimums. Innovative, creative, and life cycle cost effective solutions, which meet or exceed these requirements are encouraged. Further, the OFFEROR is encouraged to seek solutions that will expedite construction (panelization, pre-engineered, etc.) and shorten the schedule. **The intent of the Government is to emphasize the placement of funds into functional/operational requirements. Materials and methods should reflect this by choosing the lowest Type of Construction allowed by code for this occupancy/project allowing the funding to be reflected in the quality of interior/exterior finishes and systems selected.**

1.1 SECTION ORGANIZATION

This Section is organized under 6 major "paragraphs".

- (1) Paragraph 1 is intended to define the project objectives and to provide a comparison between the military facility(ies) and comparable "civilian" type buildings.
- (2) Paragraph 2 describes the scope of the project.
- (3) Paragraph 3 provides the functional, operational and facility specific design criteria for the specific facility type(s) included in this contract or task order.
- (4) Paragraph 4 lists applicable industry and government design criteria, generally applicable to all facility types, unless otherwise indicated in the Section. It is not intended to be all-inclusive. Other industry and government standards may also be used, where necessary to produce professional designs, unless they conflict with those listed.
- (5) Paragraph 5 contains Army Standard Design Criteria, generally applicable to all facility types, unless otherwise indicated in the Section.
- (6) Paragraph 6 contains installation and project specific criteria supplementing the other 5 paragraphs.

2.0 SCOPE

Design and Construct a General Purpose Warehouse (GPW) facility. This facility type is to accommodate logistic and administrative operations and to store combustible and non-combustible supplies.

2.1 GENERAL

This project is an Emergency Replacement Project to construct a new General Purpose Warehouse (GPW). The project site is located in the northeast portion of Fort Leonard Wood (FLW) in a light industrial warehouse area served by Ordnance Avenue. The proposed facility will be located on the Building 2563 site.

2.1.1. PRIMARY FACILITY

2.1.1.1. FACILITY DESCRIPTION: The GPW provides the central shipping and receiving point for the FLW Director of Material (DOM). The facility will include areas for loading docks, processing, general warehouse storage and administrative space. The maximum gross area for this facility is 18,280 square feet.

2.1.1.2. LOADING DOCKS/PROCESSING: An area will be designated for loading/unloading trucks and the processing of their associated contents.

2.1.1.3. WAREHOUSE: Movable, motorized storage racks will be integrated into the facility design to maximize the interior storage space. Storage must accommodate a combination of pallets, small parts and secured small arms parts storage. Small quantities of POL's will also require secure storage space. An area capable of charging four electric forklifts will be provided. One additional overhead door capable of accommodating a 6000 pound pneumatic tired forklift and step-vans should be provided at-grade and adjacent to the outdoor POL storage area and Building 2565. A minimum clear height space of 25'-0" (feet) is required in the warehouse area.

2.1.1.4. ADMINISTRATIVE: The GPW administrative area should be located where convenient access to Building 2562 is provided. An area capable of accommodating not more that 10 people will be provided. One private office is required with the balance of the offices to be configured in an open-office configuration. Male and female restrooms and a break room should also be provided for the building occupants.

2.2. SUPPORT FACILITIES

2.2.1. SITE IMPROVEMENTS: Warehouse site improvements include; POV parking 20-space to accommodate 10 administrative personnel as well as warehouse workers and visitors; utility line extension; and paving walks, curbs and gutters.

2.2.2. OTHER SITE RELATED IMPROVEMENTS; New water, sewer, gas, electric, and communications services; A 4-inch natural gas main extension (1,000' +/-); A 10-inch water main extension (4,800' +/-); An electric duct bank (replacing an existing overhead line); And a communication duct bank extension (3,800' – 4,200').

2.3 GOVERNMENT FURNISHED GOVERNMENT INSTALLED EQUIPMENT

Coordinate with Government on GFGI item requirements and provide suitable structural support, brackets for projectors/VCRs/TVs, all utility connections and space with required clearances for

all GFGL items. Include tables/cabinets/carts/etc. for GFGL equipment that is not freestanding in furniture design. All computers and related hardware, copiers, faxes, printers, video projectors, VCRs and TVs are GFGL.

The following are also GFGL items: No additional requirements beyond those described herein within the Statement of Work.

2.4 FURNITURE REQUIREMENTS

Provide furniture layout design for all spaces based on the furniture requirements listed. Provide rack system layout design for the warehouse. Include existing furniture and equipment to be re-used. See paragraph 3.4.5.4 CIF Furniture Chart. Furniture is GFGL. Rack system is GFGL.

2.2. SITE:

Provide all site improvements necessary to support the new building facilities. Refer to Paragraph 6.

Approximate area available 2.00 acres

2.3. GOVERNMENT-FURNISHED GOVERNMENT-INSTALLED EQUIPMENT (GFGI)

Coordinate with Government on GFGI item requirements and provide suitable structural support, brackets for projectors/VCRs/TVs, all utility connections and space with required clearances for all GFGI items. Fire extinguishers are GF/GI personal property, while fire extinguisher brackets and cabinets are Contractor furnished and installed CF/CI. All Computers and related hardware, copiers, faxes, printers, video projectors, VCRs and TVs are GFGI.

The following are also GFGI items: Vending machines (2), and dumpsters.

2.4. FURNITURE REQUIREMENTS

Provide furniture design for all spaces listed in Chapter 3 and including any existing furniture and equipment to be re-used. Coordinate with the user to define requirements for furniture systems, movable furniture, storage systems, equipment, any existing items to be reused, etc. Early coordination of furniture design is required for a complete and usable facility.

The procurement and installation of furniture is NOT included in this contract. Furniture will be provided and installed under a separate furniture vendor/installer contract. The general contractor shall accommodate that effort with allowance for entry of the furniture vendor/installer onto this project site at the appropriate time to permit completion of the furniture installation for a complete and usable facility to coincide with the Beneficial Occupancy Date (BOD) of this project. The furniture vendor/installer contract will include all electrical pre-wiring and the whips for final connection to the building electrical systems however; the general contractor shall make the final connections to the building electrical systems under this contract. Furthermore, the general contractor shall provide all Information/Technology (IT) wiring (i.e. LAN, phone, etc.) up to and including the face plate of all freestanding and/or systems furniture desk tops as applicable, the services to install the cable and face plates in the furniture, the coordination with the furniture vendor/installer to accomplish the installation at the appropriate time, and all the final IT connections to the building systems under this contract.

The Government reserves the right to change the method for procurement of and installation of furniture to Contractor Furnished/Contractor Installed (CF/CI). CF/CI furniture will require competitive open market procurement by the Contractor using the Furniture, Fixtures and Equipment (FF&E) package.

2.5. NOT USED

3.0 FUNCTIONAL / OPERATIONAL REQUIREMENTS

3.1 GENERAL

The General Purpose Warehouse is comprised of logistic, administration, shipping and receiving operations, and open storage areas.

3.2 FUNCTIONAL AND AREA REQUIREMENTS

Gross building area shall be calculated in accordance with Appendix Q. Net area is measured to the inside face of the room or space walls. Minimum dimension where stated shall be measured to the inside face of the defining enclosure. Net area requirements for programmed spaces are included in this paragraph. If net area requirements are not specified, the space shall be sized to accommodate the required function and to comply with code requirements, overall gross area limitations, and any other requirement of this RFP. Area requirements for corridors, stairs, mechanical, and electrical rooms will typically be left to the discretion of the Offeror.

3.2.1 Accessibility Requirements

GPW facilities shall comply with the ABA Accessibility Standard for DOD Facilities. Provide a handicapped accessible drinking fountain in the break room. Electronic exterior door push buttons are required at the main pedestrian entrance.

3.2.2 General Purpose Warehouse (GPW) A: 18,280 sf.

3.2.2.1 Functional Space Requirements (GPW): Warehouse Storage Area

(a) Guardrails. Guardrails shall protect all exterior walls with minimum 17" high single guard rails and all interior walls with minimum 44" high double guard rails adjacent to the defined warehouse storage area.

(b) Dock Areas:

- 1.) Provide covered exterior dock. Dock shall be 48" (nominal) above hardstand and have 4 vertical lift doors into warehouse.
- 2.) Provide high-capacity, low-maintenance, ergonomically-friendly dock levelers at each truck dock door. Dock height above the hardstand shall be 48". Truck/trailer heights may vary from 36" above the hardstand up to 60" above the hardstand. Provide dock levelers to accommodate this range (using electric lifts). Dock levelers need to be of sufficient width for safe and efficient fork lift operation and have features intended to prevent lifts from driving off the dock when a truck/trailer is not present. Provide features such as dock bumpers suitable to prevent building or truck/trailer damage. Also provide dock seals that will work effectively with standard truck /trailer sizes.

(c) Customer Pickup: Standard warehouse floor used for storage.

(d) Forklift Recharge Area: Provide an area for recharging (4) battery operated forklifts with a capacity of (6,000) lbs. Conventional and standup electrical lifts will be used. See Mechanical and Electrical requirements.

(e) Restroom: Provide toilet facilities to serve the public and administrative personnel.

(f) Janitor Closet: Provide a janitor's closet. Janitor's closet shall have a 10 inch deep floor mounted stainless steel mop sink, with hot and cold service faucet, a four holder mop rack and

two 18 inch deep by 48 inch long heavy duty stainless steel shelves for storage of cleaning supplies. Janitor's closet shall have space for storage of buckets and vacuum.

(g) Mechanical, Electrical, and Telecommunications Rooms: Mechanical rooms shall accommodate space for equipment maintenance/repair access without having to remove other equipment. Mechanical, electrical and telecommunications rooms shall be keyed separately for access by Installation maintenance personnel. Filter changes and preventative maintenance shall be performed without requiring access to the facility. Exterior access is required for centralized mechanical room. All telecommunications rooms shall be conditioned space. Telecommunications room will be provided on each floor in accordance with the latest Installation Information Infrastructure Architecture (I3A) guidance. Refer to paragraphs 3.6 MECHANICAL REQUIREMENTS and 3.7 ELECTRICAL AND TELECOMMUNICATIONS REQUIREMENTS for additional information.

(h) Vertical Lift doors: Provide 10'H X 9'W sectional or rollup doors at truck docks, openings to exterior dock and for ventilation purposes. For safety reasons provide eyebrows of sufficient width and depth to protect forklift drivers from the elements during inclement weather.

(i) Ramps with Vertical Lift doors: Provide (4) ramps with vertical lift doors.

(j) Corridors: Provide 6 feet minimum width corridors.

(k) Loading Dock (4) loading docks) - The facility shall have five dock wells must be truck-level height and shall have automatic dock leveling plates, one dock ramp for vans, cars and smaller trucks, (5) steel rollup doors, one pedestrian door, one stairwell, and a dock ramp for forklifts to enter and exit the facility. Vented electric forklift charging station inside dock. Provide safety rail along edge of dock, stopping to allow clearance at each truck door.

(l) Truck And Pedestrian Doors - The (4) large dock rollup doors shall be a minimum of 10'w x 12'h. The dock area must be separated from adjacent areas by a 2-hour rated fire. One 3'-0 x 6'-8" pedestrian door shall also be provided. All doors shall have nylon brush-style weather-stripping to prevent the entry of insects and to protect against external weather conditions.

(m) Dock Wells - Each dock well shall be designed to service a 53-foot long trailer plus tractor. Floors shall be reinforced concrete with a concrete sealed surface and level. Floor loading shall be adequate for maximum allowable truck/trailer loads. Sump pumps shall be provided. The wells shall be 4'-0" below the floor of the loading dock except for the well for vans, cars, and small trucks. Dock wells should run most of the full length of the building.

(n) Dock/Truck Guards - To avoid damage to the door jambs from trucking operations, suitable protective posts (bollards) or concrete truck wheel guards shall be provided at all truck entrances.

(o) Dock Levelers - (4) 5'd x 7' w automatic pit-type platform levelers are to be provided and installed by the Contractor. The levelers shall be adjustable 6" below and 6" above the platform, and incorporate forward and backward movement of the dockboards themselves. When at rest and in the level position, the levelers shall be supported by steel posts rather than totally dependent on hydraulics. Capacity of levelers shall be rated at 20,000 pounds or more. Also provide dock seals that will work effectively with standard truck /trailer sizes.

(p) Dock Bumpers And Chocks - Rubber bumpers, size 12"d x 24"w x 12"h, are to be installed on both sides of each truck bay per manufacturer's specifications. Truck wheel chocks 8" x 8" shall be provided and chained to the dock by the Contractor.

3.2.2.2 Space Allocation Table GPW – Warehouse Area

| GPW MINIMUM SQUARE FOOTAGE REQUIREMENTS NET SQUARE FEET (NSF) | |
|--|--------------------------|
| SPACE | TOTAL NSF |
| PRIMARY SPACES: | |
| POL SECURE STORAGE | 500 |
| SMALL ARMS PARTS SECURE STORAGE | 1500 |
| MOVABLE SMALL PARTS STORAGE | 2700 |
| MOVABLE GENERAL STORAGE | 6200 |
| ADMINISTRATIVE FUNCTION | 1600 |
| LOADING DOCK | 4 DOCKS- AS REQUIRED |
| | |
| | |
| SECONDARY SPACES: | |
| TOILET (MENS) | 1 - TOILET AS REQUIRED |
| TOILET (WOMENS) | 1 - TOILET AS REQUIRED |
| VESTIBULES | AS REQUIRED |
| HALLWAYS | AS REQUIRED |
| JANITOR CLOSET | 1- AS REQUIRED |
| EMPLOYEE BREAK ROOM | 1 – AS REQUIRED |
| FORKLIFT RECHARGING AREA | 4 – STATIONS AS REQUIRED |
| MECHANICAL ROOM | AS REQUIRED |
| ELECTRICAL ROOM(s) | AS REQUIRED |
| TELECOMMUNICATION ROOM(s) | AS REQUIRED per I3A |
| Note: Circulation: Circulation is not tabulated in space allocation table. Provide circulation space as needed. | |

3.2.3 Administrative Area: Functional and Area Requirements

3.2.3.1 Administrative Space 1600 sf

(a) Administrative Function - Area consists of carpet tile flooring, 4" rubber base, painted GWB walls, and 24" x 24" acoustical ceiling grid and tile (9'-0" AFF). Copier/scanning station in the Area shall be located along an interior circulation path and will be enclosed with walls extending to underside of deck above, and door equipped with closer. Area includes (1) private office (150 sf), and (9) Open Office workstations. Provide separate entrance to exterior and warehouse.

(b) Break Room - Area consists of vinyl composition tile with 4" covered Vinyl base. Wall covering shall be painted GWB. Contractor shall provide 6 linear feet of base cabinets, 24" deep, 34" high, with an integral 4" high back-splash. Except for the ADA cut-out under the sink, base cabinets shall include one drawer and one internal adjustable shelf, with door. The cabinet top, edges, and back-splash shall be high pressure plastic laminate finish. All other surfaces shall be

laminated. Matching wall-mounted cabinets will be provided by Contractor. Contractor to provide (1) sink, and space for the following GFGI equipment: (1) Microwave oven, (1) refrigerator, (1) 36" sq. tables, (4) chairs. Locate a vending area in the Common Break Room. Size vending area to accommodate two full size GFGI vending machines. Provide power outlets for the vending machines.

(c) Toilet Rooms ((1) Men, (1) Women) - Rooms to have non-slip unglazed ceramic with static coefficient of 0.6 or better. Walls extend to structural deck above with smooth ceramic wall tile finish to a height of 48" and with painted GWB on all remaining wall surfaces. Ceilings will be moisture-resistant plaster or pointed-and-taped gypsum board. Built-in lavatory counter will have a High Pressure Plastic Laminate Finish. Each toilet room will have sufficient water closets enclosed with floor mounted, overhead braced partitions. Each room to include ADA compliant mirror, soap dispenser for each lavatory, paper towel dispenser / trash receptacle, and toilet paper dispenser for each WC. At least one of each fixture type per restroom to be ADA compliant (includes required grab bars, mounting heights of fixtures, etc.). Provide following fixtures: Men: (2) WC, (2) Lavatory, Women: (2) WC, (2) Lavatories. Consider adding (1) unisex toilet room by loading docks if practical.

(d) Vestibule - Area consists of integral walk off mat, carpet tile flooring, 4" rubber base, painted GWB walls, and 24" x 24" acoustical ceiling grid and tile (9'-0" AFF). Provide separate entrance to exterior.

(e) Hallway - Area consists of carpet tile flooring, 4" rubber base, painted GWB walls, and 24" x 24" acoustical ceiling grid and tile (9'-0" AFF).

(f) Telecommunications Room(s) - The flooring shall be sealed concrete. Number and size of rooms shall be in accordance with I3A. Ceiling can be either GWB or exposed painted structure. If GWB is provided it shall be a minimum of 10'-0" AFF.

(g) Janitor Closet - located near the administrative area. Flooring shall be vinyl composition tile with 4" rubber base. Walls to be painted GWB with suspended grid and tile at 9'-0" AFF. Janitor closet shall have a 10-inch deep floor mounted stainless steel mop sink, with hot and cold service faucet, a four holder mop rack, and two 18 inch deep by 48 inch long heavy duty stainless steel shelves for storage of cleaning supplies. Janitor closet shall have space for storage of buckets and vacuum.

(h) Electrical Room - The flooring shall be sealed concrete. Walls to be painted GWB and ceiling to be exposed structure.

3.2.3.2 Storage Areas

All storage areas shall be provided with movable, motorized storage racks integrated into the facility design to maximize the interior storage space utilizing a combination of pallets, small parts and secured small arms parts storage. Specific storage area sizes are generically identified and indicated on the sketch. The actual size of these storage areas will be dependent on the amount and type of motorized storage racks purchased by the DPW.

(a) POL Secure Storage Area; 500 sf. This area shall meet AR 190-51, Appendix B for level 1 risk criteria for new construction and applicable modular storage systems.

(b) Small Arms Parts Secure Storage; 1,500 sf: This area shall meet AR 190-51, Appendix B for level 1 risk criteria for new construction and applicable modular storage systems.

(c) Movable Small Parts Storage; 2,700 sf

(d) Movable General Storage; 6,200 sf

3.3 SITE REQUIREMENTS

3.3.1 Walks

Provide pedestrian walks within the designated construction area and connect to existing sidewalks, where applicable. Sidewalks shall be a minimum of 6 feet wide. Pedestrian sidewalks shall be constructed of Portland Cement Concrete having a minimum nominal thickness of 4 inches. Design joint patterns uniformly, symmetrical, and in accordance with American Association of State Highway and Transportation Officials (AASHTO) standards. The length to width ratio shall not exceed 1.25 for non-reinforced pavements.

3.3.2 Site Structures and Amenities

Dumpster enclosure area(s) and screening shall be located, designed and constructed by the Contractor. The Contractor is responsible for locating the dumpster areas in accordance with UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings. The GFGI dumpsters shall be located outside of restricted areas to allow for servicing activities. Dumpster pads shall be sized to accommodate both trash and recycling dumpsters. Dumpster screening shall be aesthetically and architecturally compatible with the building it serves and shall be designed in accordance with the Installation's requirements.

3.3.3 Site Functional Requirements

3.3.3.1 External functional requirements include a separate shipping and receiving truck dock with ample concrete hardstand paving for marshalling and parking of supply trucks. See Section 01 10 00 Paragraph 3.2.2.1(b) for dock requirements.

3.3.3.2 Privately Owned Vehicle (POV) Parking: POV parking shall be designed and constructed by the Contractor. The location of the POV parking area(s) shall be designed based on the Installation's site constraints. The Contractor shall ensure that the location of parking complies with UFC 4-010-01. See paragraph 5.2.3 VEHICLE PAVEMENTS for additional requirements. POV parking shall be provided at the rate of 1 space for each 500 square feet gross office area, plus one space for every four persons assigned to the storage area, or as directed by the Installation. Parking for physically disabled personnel shall be in accordance with the current Americans with Disabilities Act (ADA) guidelines.

3.3.3.3 The Contractor shall provide service drives to each building. The drives shall be located in accordance with UFC 4-010-01. Where applicable, access to the drives shall be restricted as required by UFC 4-010-01. The pavement design shall be as required by paragraph 5.2.3 VEHICLE PAVEMENTS. The minimum access drive width shall be 10 feet. Provide curb and gutter only where needed for drainage. Minimum turning radius shall be designed as required for emergency vehicle access.

3.3.3.4 The Contractor shall provide fire access lanes in accordance with UFC 3-600-01, UFC 4-010-01, NFPA 1 and the Installation's requirements.

3.4 ARCHITECTURAL REQUIREMENTS

3.4.1 Hardware

3.4.1.1 Non Destructive Emergency Access System (NDEAS): Furnish and install a Knox-Vault 4400 Series (Single Lock Model) mounted on the exterior, adjacent to the Main Entry. Finish Hardware: All hardware shall be consistent and shall conform to ANSI/BMHA standards for Grade

1. All requirements for hardware keying shall be coordinated with the Contracting Officer. Extension of the existing Installation keying system shall be provided. The Installation's keying system is Best Access Systems B.A.S.I.S. V. with G software. Cores shall have not less than seven pins; cylinders shall have key-removable type cores. Disassembly of knob or lockset shall not be required to remove core from lockset. Locksets for mechanical, electrical and communications rooms only shall be keyed to the existing Installation Master Keying System. HVAC terminal units that are accessed from a central corridor shall have a deadbolt to minimize protrusion into corridor. Plastic cores are unacceptable. Provide closers for all exterior doors, all doors opening to corridors and as required by codes. Exit devices shall be installed all building egress doors.

3.4.1.2 Auxiliary Hardware

Provide wall or floor stops for all exterior doors that do not have overhead holder/stops. Provide other hardware as necessary for a complete installation.

3.4.1.3 Fire Door Hardware

Hardware for fire doors shall be installed in accordance with the requirements of applicable codes. Exit devices installed on fire doors shall have a visible label bearing the marking "Fire Exit Hardware". Other hardware installed on fire doors, such as locksets, closers, and hinges shall have a visible label or stamp indicating that the hardware items have been approved by an approved testing agency for installation on fire-rated doors. Hardware for smoke-control door assemblies shall be installed in accordance with applicable codes.

3.4.2 Special Acoustical Requirements

3.4.2.1 Exterior walls and roof/floor/ceiling assemblies, doors, windows and interior partitions shall be designed to provide for attenuation of external noise sources such as airfields in accordance with applicable criteria, but no less than the following:

(a) Interior partitions – STC 42

(b) Exterior walls – STC 29

(c) Doors and frames – STC 25

3.4.2.2 Due to the operation of mechanical and electrical systems and devices, sound conditions and levels for interior spaces shall not exceed levels as recommended by ASHRAE handbook criteria. Provide acoustical treatment for drain lines and other utilities to prevent noise transmission into the offices and other areas requiring noise suppression.

3.4.3 Exterior Design Objectives

Provide durable and easily maintainable materials. Do not use exterior materials that require periodic repainting or similar refinishing processes. Material exposed to weather shall be factory pre-finished, integrally colored or provided with intrinsic weathering finish.

3.4.3.1 Exterior Walls

There are numerous exterior wall systems appropriate and available for use on a utilitarian facility such as this General Purpose Warehouse. Considerations should be given to: Masonry, Panelized Metal, Precast or Tilt-Up Concrete, Pre-Engineered Metal Buildings and/or any combination thereof. However the appropriate finish shall reflect the Architectural theme noted in Appendix F.

3.4.3.2 Roof

Minimum roof slope for membrane roof systems shall be 1/4 inch per foot. Minimum roof slope for pitched roof systems shall be as recommended by roof system manufacturer. Membrane roof systems shall be fully adhered. Structural standing seam metal roofs shall comply with the requirements of ASTM E 1592. Roof system shall be Underwriters Laboratory (UL 580 Class 90) rated or Factory Mutual Global (FM) I-90 rated. Roof system shall comply with applicable criteria for fire rating.

(a) For roof mounted equipment, provide permanent access walkways and platforms to protect roof. Roof mounted equipment on membrane roof systems shall be screened by the roof parapet.

(b) Roof access from building exterior is prohibited.

3.4.3.3 Trim and Flashing

Gutters, downspouts, and fascias shall be factory pre-finished metal and shall comply with SMACNA Architectural Sheet Metal Manual.

3.4.3.4 Bird Habitat Mitigation

The Contractor shall provide details in the design necessary to eliminate the congregating and nesting of birds at, on, and in the facility.

3.4.3.5 Exterior Doors and Frames

(a) Main Entrance Doors: Provide aluminum storefront doors and frames with Architectural Class 1 anodized finish, fully glazed, with medium or wide stile for entry into lobbies or corridors. Provide doors complete with frames, framing members, sub frames, transoms, sidelights, trim, applied mountings, and accessories. Framing systems shall have thermal-break design. Storefront systems shall be capable of withstanding area wind loads, thermal and structural movement required by location and project requirements, and shall comply with applicable codes and criteria.

(b) Other Exterior Doors: Provide galvanized insulated hollow metal exterior doors for entry to all spaces other than corridors, lobbies, or reception/waiting rooms. Doors and frames shall comply with applicable codes and criteria. Doors shall be heavy duty (grade 2) insulated with 18-gage steel cladding; top edge closed flush; A60 galvanized. Frames shall be 12-gauge, with continuously welded mitered corners and seamless face joints. Doors and frames shall be constructed of hot dipped zinc coated steel sheet, complying with ASTM A653, Commercial Steel, Type B, minimum A40 coating weight; factory primed. Fire-rated openings shall comply with applicable codes, and the requirements of the labeling authority. Door and frame installation shall comply with applicable codes and criteria.

(c) Electrically Operated Sectional Overhead Doors: Doors shall be industrial class, high-lift sectional overhead doors, electrically operated, with auxiliary hand chain override. In the open position, the horizontal portion of the door shall be aligned with the angle of the roof structural elements; and shall be no more than 6 inches below the bottom of the roof structural elements. Doors shall consist of horizontal sections hinged together which operate in a system of tracks to completely close the door opening in the closed position and make the full width and height of the door opening available for use in the open position. Provide a permanent label on the door indicating the name and address of the manufacturer. Doors, components, and methods of installation shall be designed in accordance with DASMA 102. Minimum design wind load shall

be 20 psf. Maximum wind load deflection of the door shall not exceed the door height in inches divided by 120 and the door width in inches divided by 120. Doors shall be operable during design wind load when tested in accordance with ASTM E 330. Door sections shall be formed from hot-dipped galvanized steel not lighter than 16 gage with longitudinal integral reinforcing ribs. Meeting rails shall have interlocking joints to ensure a weather tight closure and alignment for full width of the door. Provide sections of the height indicated or the manufacturer's standard. Do not exceed 24 inch height for intermediate sections. Bottom sections may be varied to suit door height. Do not exceed 30 inch height for bottom section. Door sections shall be insulated and shall provide a "U" factor of 0.14 or less when tested in accordance with ASTM C 1363. Interior of door sections shall be covered with steel sheets of not lighter than 20 gage to completely enclose the insulating material. Provide galvanized steel tracks not lighter than 10 gage. Provide vertical tracks with continuous steel angle not lighter than 10 gage for installation to walls. Incline vertical track through use of adjustable brackets to obtain a weather tight closure at jambs. Reinforce horizontal track with galvanized steel angle; support from track ceiling construction with galvanized steel angle and cross bracing to provide a rigid installation. Provide hinges, brackets, rollers, locking devices, and other hardware required for complete installation. Counterbalance doors with an oil-tempered, helical-wound torsion spring mounted on a steel shaft. Provide adjustable spring tension; connect spring to doors with cable through cable drums. Provide cable safety factor of at least 7 to 1. Provide operators of the type recommended by the door manufacturer. Operators shall include electric motor, machine-cut reduction gears, steel chain and sprockets, magnetic brake, brackets, pushbutton controls, limit switches, magnetic reversing contactor, a manual operator as specified below for emergency use and other accessories necessary for operation. The electric operator shall be designed so that the motor may be removed without disturbing the limit switch timing and without affecting the manual operator. The manual operator shall be clutch controlled so that it may be engaged and disengaged from the floor; operation shall not affect limit switch timing. Provide an electrical or mechanical device that disconnects the motor from the operating mechanism when the manual operator is engaged. Provide a galvanized, endless chain operating over a sprocket. Extend chain to within 4 feet of the floor and mount on inside of building. Obtain reduction by use of roller chain and sprocket drive or gearing. Provide chain cleat and pin for securing operator chain. The force required to operate the door shall not exceed 35 pounds. Each door motor shall have an enclosed, across-the-line type, magnetic reversing contactor, thermal overload and under voltage protection, solenoid-operated brake, limit switches, and control switches. Locate control switches at least 5 feet above the floor so the operator will have complete visibility of the door at all times. Control equipment shall conform to NEMA ICS 1 and NEMA ICS 2. Control enclosures shall be NEMA ICS 6, Type 12 or Type 4, except that contactor enclosures may be Type 1. Each control switch station shall be of the three-button type; buttons shall be marked "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" buttons shall require only momentary pressure to operate. The "CLOSE" button shall require constant pressure to maintain the closing motion of the door. If the door is in motion and the "STOP" button is pressed or the "CLOSE" button released, the door shall stop instantly and remain in the stop position; from the stop position, the door may be operated in either direction by the "OPEN" or "CLOSE" buttons. Pushbuttons shall be full-guarded to prevent accidental operation. Provide limit switches to automatically stop doors at the fully open and closed positions. Limit switch positions shall be readily adjustable. Provide a safety device on the bottom edge of electrically operated doors. The device shall immediately stop and reverse the door in its closing travel upon contact with an obstruction in the door opening or upon failure of the device or any component of the control system and cause the door to return to the full open position. The door-closing circuit shall be automatically locked out and the door shall be operable manually until the failure or damage has been corrected. Do not use the safety device as a limit switch. Each sectional overhead door shall be furnished with a "headache bar" on the interior and exterior side of the facility. Set bottom of each "headache bar" 6-inches below bottom of door head height and 4-feet from face of door. Each interior "headache bar" shall be suspended from a pair of steel cables mounted on the roof structure. Each exterior "headache bar" shall be suspended from a pair of steel cables mounted on the roof structure or suspended from a pair of steel cables mounted on the upper arm of a structural steel tube "I" structure set in concrete on one side of the door. Use one structural steel tube "I" structure on

each side of doors wider than 10-feet. Length of "headache bar" shall be minimum 80% the width of the door and shall be centered on the door width.

3.4.3.6 Exterior Windows

Provide insulated, high efficiency (thermal and security) window systems, with thermally broken frames complying with applicable codes and criteria. Operable windows shall be furnished with locks, and fiberglass or aluminum insect screens removable from the inside. Curtain wall systems shall be capable of withstanding area wind loads, thermal and structural movement required by location and project requirements, and shall comply with applicable codes and criteria. Windows that are in the storage area spaces and are less than 12 feet above ground level must meet secure storage structure standards in accordance with AR 190-51, Appendix B for risk level 1. Window sills shall be designed to discourage bird nesting.

3.4.3.7 Exterior Glass and Glazing

Material and installation shall comply with applicable codes and criteria.

3.4.3.8 Thermal Insulation

Provide exterior wall, floor, and roof/ceiling assemblies with thermal transmittance (U-values) required to comply with the proposed energy calculations for the facilities. Insulation shall not be installed directly on top of suspended acoustical panel ceiling systems.

3.4.3.9 Exterior Louvers

Exterior louvers shall have bird screens and shall be designed to exclude wind-driven rain. Exterior louvers shall be made to withstand wind loads in accordance with the applicable codes. Wall louvers shall bear the Air Movement & Control Association (AMCA) International certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. Louver finish shall be factory applied.

3.4.4 Interior Design Objectives

3.4.4.1 General

Provide sustainable materials and furnishings that are easily maintained and replaced. Maximize use of day lighting. Provide interior surfaces that are easy to clean and light in color. Interior spaces should be structured to allow maximum flexibility for future modifications.

3.4.4.2 Signage

Provide interior signage as required by applicable codes and criteria.

3.4.4.3 Bulletin Boards

Provide one bulletin board at each entry vestibule. Bulletin board shall be 4'-0" high and 6'-0" wide. Bulletin boards shall have a header panel and shall have lockable, glazed doors.

3.4.4.4 Corner Guards

Provide surface mounted, high impact resistant, integral color, snap-on type resilient corner guards, extending from floor to ceiling for wall and column outside corners in high traffic areas such as corridors, waiting areas, lobbies, conference and multi-purpose rooms. Factory fabricated end closure caps shall be furnished for top and bottom of surface mounted corner guards.

3.4.4.5 Chair Rail

Chair rails shall be installed in areas prone to hi-impact use, such as corridors and waiting areas.

3.4.4.6 Casework

Provide cabinets complying with AWI Quality Standards. Countertops shall have waterfall front edge. Toilet countertops and all other countertops with sinks shall have integral covered backsplash. Toilet countertops shall be minimum ½-inch thick cast 100 percent acrylic polymer solid surfacing material with waterfall front edge and integral covered backsplash.

3.4.4.7 Fire Extinguisher Cabinets, Mounting Brackets and Fire Extinguishers

Furnish and install fire extinguisher cabinets and mounting brackets with fire extinguishers as required by applicable codes and criteria. Furnish a list of installed fire extinguisher cabinets and mounting brackets (including location, type and size) to the Contracting Officer's Representative.

3.4.4.8 Interior Doors and Frames

(a) Wood Doors: Provide flush solid core wood doors with Grade A hardwood face veneer for transparent finish. Stile edges shall be non-finger jointed hardwood compatible with face veneer. Provide wood doors at all interior locations except noted otherwise.

(b) Insulated Hollow Metal Doors: Comply with applicable codes and criteria. Doors shall be minimum Level 3, Physical Performance Level A, Model 2; factory primed. Provide insulated hollow metal doors at mechanical, electrical and telecommunications rooms, toilets, janitor closets and storage rooms.

(c) Hollow Metal Frames: Comply with ANSI A250.8/SDI 100. Frames shall be minimum Level 3, 16 gauge, with continuously welded mitered corners and seamless face joints; factory primed. All door frames shall be hollow metal frames.

(d) Fire-rated and Smoke Control Doors and Frames: Comply with applicable codes, criteria and requirements of labeling authority.

(e) STC ratings shall be of the sound classification required and shall include the entire door and frame assembly.

3.4.4.9 Window Treatment

Provide horizontal mini blinds at the administrative office exterior windows. Uniformity of window covering color and material shall be maintained to the maximum extent possible throughout the area. Window stools shall be minimum ½ inch thick cast 100 percent acrylic polymer solid surfacing material.

3.4.4.10 Mold Mitigation

The Designer of Record shall provide details in the design analysis and design showing steps taken to mitigate the potential growth of mold and mildew in the facility.

3.4.4.11 Toilet Accessories

Furnish and install the items listed below and all other toilet accessories necessary for a complete

and usable facility. All toilet accessories shall be Type 304 stainless steel with satin finish. Toilet accessories shall include the following:

- (a) Glass Mirror/Shelf – 18 inch by 24 inch glass mirror on stainless steel frame with shelf at each lavatory
- (b) Hands free liquid soap dispenser at each lavatory
- (c) Hands free paper towel dispenser
- (d) Waste receptacle- recess mounted at each lavatory/toilet area
- (e) Sanitary napkin disposal at each female toilet
- (f) Toilet paper dispenser – lockable multiple roll toilet paper dispenser at each toilet
- (g) Sanitary toilet seat cover dispenser – at each toilet stall
- (h) Grab bars – as required by ADA

3.4.5 Finishes

Designers are not limited to the minimum finishes listed in this paragraph and are encouraged to offer higher quality finishes.

3.4.5.1 Minimum Paint Finish Requirements

(a) All paints used shall be listed on the "Approved Product List" of the Master Painters Institute (MPI). Application criteria shall be as recommended by MPI guide specifications for the substrate to be painted and the environmental conditions existing at the project site.

(b) Exterior surfaces, except factory pre-finished material or exterior surfaces receiving other finishes shall be painted a minimum of one prime coat and two finish coats. Paints having a lead content over 0.06 percent by weight of nonvolatile content are unacceptable. Paints containing zinc-chromate, strontium-chromate, mercury or mercury compounds, confirmed or suspected human carcinogens shall not be used on this project. Exterior paints and coating products shall be classified as containing low volatile organic compounds (VOCs) in accordance with MPI criteria. Application criteria shall be as recommended by MPI guide specifications. Provide an MPI Gloss Level 5 Finish (semi-gloss), unless otherwise specified.

(c) Interior surfaces, except factory pre-finished material or interior surfaces receiving other finishes, shall be painted a minimum of one prime coat and two finish coats. Paints having a lead content over 0.06 percent by weight of nonvolatile content are unacceptable. Paints containing zinc-chromate, strontium-chromate, mercury or mercury compounds, confirmed or suspected human carcinogens shall not be used on this project. Interior paints and coating products shall contain a maximum level of 150 grams per liter (g/l) of VOCs for non-flat coatings and 50 g/l of VOCs for flat coatings. Provide an MPI Gloss Level 5 Finish (semi-gloss) in wet areas and a flat finish in all other areas.

3.4.5.2 Minimum Interior Finish Requirements

(a) Wall, ceiling and floor finishes and movable partitions shall conform to the requirements of the IBC, NFPA and UFC 3-600-01 Fire Protection Engineering for Facilities. Where code requirements conflict, the most stringent code requirement shall apply.

(b) Carpet shall be minimum of 2 yarn ply, modular tile conforming to ISO 2551, ASTM D 418, ASTM D 5793, ASTM D 5848, solution dyed, tufted, cut and loop pile, commercial 100% branded (federally registered trademark) nylon continuous filament. Vinyl composition tile (VCT) shall be minimum 1/8 inch thick, conforming to ASTM F 1066, Class 2, through pattern tile, Composition 1, asbestos free, with color and pattern uniformly distributed throughout the thickness of the tile.

(c) All wall finish shall be minimum 5/8" painted gypsum board, except where stated otherwise. All gypsum board shall achieve a score of 10, the highest level of performance for mold resistance under the ASTM D 3273 test method. All gypsum board shall be transported, handled, stored and installed in accordance with the GYPSUM ASSOCIATION – Guidelines For Prevention Of Mold Growth On Gypsum Board (GA-238-03). Use impact resistant gypsum board in corridors, storage rooms, stairwells and activity rooms and centralized laundries (if centralized laundries are required by RFP).

(d) All ceiling finishes shall be minimum 5/8" painted gypsum board, except where stated otherwise. All gypsum board shall achieve a score of 10, the highest level of performance for mold resistance under the ASTM D 3273 test method. All gypsum board shall be transported, handled, stored and installed in accordance with the GYPSUM ASSOCIATION – Guidelines For Prevention Of Mold Growth On Gypsum Board (GA-238-03).

3.4.5.3 Interior Finishes Table

| GPW INTERIOR FINISHES | | | | | | | | | | | | | | | | | |
|-----------------------------|------------------------|-------------|--------------|--------------------|-----------------|------------|-------------|--------------|-------------------------|---|--------------|--|-------------------------|-------------------------|-------------------|---------|--|
| | FLOORS | | | | | BASE | | | WALLS | | | | CEILING | | | REMARKS | |
| | VINYL COMPOSITION TILE | CARPET TILE | CERAMIC TILE | RECESSED ENTRY MAT | SEALED CONCRETE | VINYL BASE | RUBBER BASE | CERAMIC BASE | GYPSUM WALL BOARD-PAINT | FULLY GROUTED REINF. CMU OR REINF. CONCRETE | CERAMIC TILE | LAMINATED GLASS, INSUL. STORE FRONT SYSTEM | GYPSUM WALL BOARD PAINT | ACOUSTICAL CEILING TILE | PAINTED STRUCTURE | | MINIMUM HEIGHT 9'-0" UNLESS STATED OTHERWISE |
| ADMINISTRATIVE AREAS | | | | | | | | | | | | | | | | | |
| VESTIBULES | | • | | • | | | • | | • | | | • | | • | | 9' | |
| PRIVATE OFFICE | | • | | | | | • | | • | | | | | • | | | |
| OPEN OFFICE AREA | | • | | | | | • | | • | | | | | • | | | |
| BREAK ROOM | • | | | | | • | | | • | | | | | • | | | NOTE 2 |
| HALLWAY | | • | | | | | • | | • | | | | | • | | | |
| MALE TOILET | | | • | | | | | • | • | | | | • | | | | NOTE 1 |
| FEMALE TOILET | | | • | | | | | • | • | | | | • | | | | NOTE 1 |
| JANITOR'S CLOSET | • | | | | | | • | | • | | | | • | | | | |
| ELECTRICAL ROOMS | | | | | • | | | | • | | | | | • | | | |
| TELECOMMUNICATION RMS | | | | | • | | | | • | | | | | • | | | |

| GPW INTERIOR FINISHES | | | | | | | | | | | | | | | | | |
|--|------------------------|-------------|--------------|--------------------|-----------------|------------|-------------|--------------|-------------------------|---|--------------|--|-------------------------|-------------------------|-------------------|---------|--|
| | FLOORS | | | | | BASE | | | WALLS | | | | CEILING | | | REMARKS | |
| | VINYL COMPOSITION TILE | CARPET TILE | CERAMIC TILE | RECESSED ENTRY MAT | SEALED CONCRETE | VINYL BASE | RUBBER BASE | CERAMIC BASE | GYPSUM WALL BOARD-PAINT | FULLY GROUTED REINF. CMU OR REINF. CONCRETE | CERAMIC TILE | LAMINATED GLASS, INSUL. STORE FRONT SYSTEM | GYPSUM WALL BOARD PAINT | ACOUSTICAL CEILING TILE | PAINTED STRUCTURE | | MINIMUM HEIGHT 9'-0" UNLESS STATED OTHERWISE |
| | | | | | | | | | | | | | | | | | REFER TO NOTE. |
| STORAGE AREAS | | | | | | | | | | | | | | | | | |
| POL SECURE STORAGE | | | | | • | • | | | • | | | | • | | | 25' | NOTE 3,4 & 5 |
| SMALL ARMS PARTS STG | | | | | • | • | | | • | | | | • | | | 25' | NOTE 3, 4 & 5 |
| MOVABLE SMALL PARTS STG | | | | | • | • | | | • | | | | • | | | 25' | NOTE 3, 4 & 5 |
| MOVABLE GENERAL STG | | | | | • | • | | | • | | | | • | | | 25' | NOTE 3, 4 & 5 |
| <p>1. ALL WET WALLS IN TOILET ROOMS SHALL HAVE 4'-0" HIGH CERAMIC TILE WAINSCOT. VANITY TOPS SHALL BE CAST 100 PERCENT ACRYLIC POLYMER SOLID SURFACING MATERIAL WITH WATERFALL FRONT EDGE AND A MINIMUM 4" INTEGRAL COVERED BACKSPLASH.</p> <p>2. ALL COUNTER TOPS SHALL HAVE A WATERFALL FRONT EDGE. COUNTER TOP IN BREAK ROOM SHALL HAVE A MINIMUM 4" INTEGRAL COVERED BACKSPLASH.</p> <p>3. CEILING SHALL BE PAINTED STRUCTURE IF ALLOWED BY APPLICABLE CODE</p> <p>4. THE WAREHOUSE AREA SHALL BE CLEAR OF STRUCTURAL OBSTRUCTION TO A HEIGHT OF 25'-0" ABOVE FINISH FLOOR.</p> <p>5. THE WAREHOUSE SIDE OF ALL GYPSUM WALL BOARD PARTITIONS/FINISHES SHALL HAVE A MINIMUM 20 GAGE SHEET METAL FINISH UP TO A HEIGHT OF 8 FEET ABOVE THE FINISH FLOOR.</p> | | | | | | | | | | | | | | | | | |

3.4.5.4 GPW Furniture Chart

| Description | Comments | Furniture Required |
|-----------------------------|--------------------------|--|
| GPW | Private Office | L-shaped double pedestal modular desk, hutch, one 4-drawer lateral file, one bookcase, one guest chair, one managerial chair |
| GPW | 48 NSF Open Workstations | Nine modular workstations with work surfaces, file pedestals, and overhead storage, four task chairs |
| Employee Break Room | Break area | One rectangle table with seating for 4 |
| POL Secure Stg, Area | | Storage Racks |
| Small Arms Parts Secure Stg | Movable | Vertical Lift Module motorized |
| Movable Small Parts Stg | Movable | Movable Motorized Storage System |
| Movable General Stg. | Movable | Movable Motorized Storage System |

3.5 STRUCTURAL REQUIREMENTS

Design and construct as a complete system in accordance with APPLICABLE CRITERIA.

3.5.1 Live Loads

Design live loads shall be per the IBC but not lower than the following minimums.

(a) Primary roof members, exposed to work floor (in addition to the uniform load):

Single panel point on lower chord of roof trusses or any point along primary structural members supporting roofs.....2,000 pounds

(b) Floor slab:

(1) Warehouse: The most stringent loading of the following:

(a) Uniform load.....300 psi

(b) Fork lift with lifting capacity of6,000 lb

(c) Pallets with average weight of 1500 lb each will be stacked 5 high in pallets storage racks (Maximum pallet weight is 2500 lb). Slab shall be designed for all loads induced on slab by racking system.

(2) Administration.....80 psf

Column spacing shall not be less than 25 feet in the long direction of building and 60 feet (in warehouse) in the narrow direction. Columns are to be spaced in such a way as to allow standard industrial shelving for palletized loading. Shelving shall be constructed in a back-to-back double row configuration with no interspersed single rows. Preference is to have no freestanding columns in open warehouse space.

3.6 MECHANICAL REQUIREMENTS

3.6.1 Plumbing

3.6.1.1 Plumbing system shall be designed and installed in accordance with the International Plumbing Code (IPC). Fixtures shall be of the water saving type and approved for its use per the IPC. Hot water shall be provided for all lavatories. Refer to paragraph 5 for domestic water metering requirements.

3.6.1.2 Gas systems (if applicable) shall be designed and installed in accordance with NFPA 54. Gas fired appliances shall be of the energy saving type. Refer to paragraph 5 for gas metering requirements.

3.6.1.3 Locate emergency eye wash stations in accordance with OSHA standards 1910 and 1926. Water must be heated and a thermostatic tempering valve employed to provide water at the OSHA-required temperature. Provide a floor drain with a secondary waterless trap.

3.6.1.4 Provide floor drains in toilets to facilitate proper maintenance.

3.6.2 Heating, Ventilating and Air-Conditioning (HVAC)

3.6.2.1 All offices and public spaces shall be heated and air-conditioned. Offices and public spaces shall have user adjustable controls of +/- 2 degrees F with a set point of 75 degrees F for cooling and 70 degrees F for heating. Installation shall be in accordance with the International Mechanical Code (IMC). Restrooms, copy rooms, and janitor closets shall be continuously exhausted during occupied hours. Air conditioning for communications rooms shall remain active at all times. Air-conditioned office and public space zoning shall be based on exterior envelope exposures. Where VAV systems are used, limit individual zones to a maximum of 2,500 cfm. Air handling units shall run continuously during occupied hours. Outdoor ventilation air required by ASHRAE 62.1 shall be continuous during occupied hours.

3.6.2.2 All warehouse and storage areas shall be heated and ventilated separate from the office and public spaces. During cold weather warehouse and storage areas shall be maintained at a minimum of 55 degrees F when occupied. During non-occupied hours the temperature shall be maintained at a minimum of 40 degrees F for freeze protection. Air conditioning is not allowed in warehouse and storage areas. Installation shall be in accordance with the IMC. Only freeze protection is required in the fire riser room. Outdoor ventilation air required by ASHRAE 62.1 shall be continuous.

3.6.2.3 Refer to Paragraph 5 for temperature control information.

3.6.2.4 Split system air handling units shall be located in a mechanical room accessible only through an exterior door. Mechanical room shall be sized for ease of service, maintenance, and replacement of HVAC equipment. Design shall be such that equipment is not "trapped" in the space.

3.6.2.5 Equipment located outside (on the ground) shall be enclosed in a security-screened equipment yard. Sound/noise shall be a consideration in the selection of all equipment.

3.6.2.6 For hot weather provide a manually-controlled up-blast fan-powered warehouse ventilation system capable of exhausting stratified hot, stale air trapped below the roofline at a minimum rate of 4 cfm per square foot of under-roof-area open to the warehouse. Cfm rating shall be at no less than 0.125 inch of static pressure. Limit noise level (per exhaust ventilator) to 50 fan sones (measured at 5 feet per AMCA Standard 301, installation A, tested at zero static pressure). Fixed exhaust volume (per ventilator fan) shall fall between 23,000 cfm minimum and 45,000 cfm maximum at 0.125 inch of static pressure. Ventilators shall be curb-mounted and have a cfm to sone ratio of at least 800 (cfm/sones = 800+). Ventilator ratings, etc. shall come

from regularly published data provided by the equipment manufacturer. Locate ventilators near the long axis of the space to maximize the sweep of fresh air through the warehouse and prevent short-circuiting of air between intake and exhaust points. To minimize condensation, ventilator butterfly dampers shall be made from non-metallic material such as epoxy-fiberglass and have molded-on one-piece axles. Provide full size drip pans to catch any condensate. Provide separate on/off control for each ventilator at a convenient single location. For purposes of night cool down provide low-wall, rain-resistant, air intake, wall louvers with motorized dampers and insect/bird screens. Size louvers for 3 air changes per hour (based on warehouse under-roof volume only) to produce a net free area velocity of no more than 500 fpm. If excess airflow is necessary (because of fan sizing) to meet the minimum night (3 air change) airflow requirement then louvers must be sized so as to not exceed the 500 fpm maximum. Locate the louvers so as to promote balanced airflow and prevent short circuiting. Interlock fans/dampers so that operation of a single fan or any combination of fans will open all of the dampers. During daytime (with all fans operating and all dock doors and dampers open) the velocity through the free area of all louvers and dock doors shall not exceed 500 fpm. To prevent back-drafting of gas-fired appliances interlock ventilators to heating units so that they will not fire if ventilators are energized. Heating unit interlocks are not required for appliances whose combustion air supply does not communicate with the warehouse space.

3.6.2.7 Per 29 CFR 1910 and other applicable criteria provide for sufficient diffusion and ventilation of gases from forklift storage batteries to prevent the accumulation of explosive mixtures. To accomplish this a fork lift battery charging station ventilation system shall be provided as a part of this project. It shall be designed and constructed to work effectively with government-furnished, government-installed (GFGI) forklift charging equipment. (See section 6.5.4) THE FORKLIFT CHARGING EQUIPMENT (GFGI) IS NOT INCLUDED IN THIS PROJECT. Ventilation system design shall be based on all relevant factors including the number of lifts and their usage, and whether or not batteries will be charged "in place" or placed in a charging rack. Construction of a room, a hood, or some combination thereof to completely capture the fumes is acceptable so long as it does not negatively impact warehouse productivity. Components of the system such as the exhaust duct, fan, and hood material, etc. shall be of corrosion-resistant construction. Exhaust discharge shall be high enough above the roofline to be safe and effective and shall be accomplished so as to not result in exterior degradation of the structure. The chargers shall be interlocked with the exhaust system so that even a fan failure cannot create an unsafe condition. Spark-resistant fan construction (per AMCA) and necessary explosion-proof wiring and lighting shall be provided.

3.6.2.8 Rooftop-mounted exhaust fans shall be accessible by means of a fully caged roof ladder. An approved lockable roof hatch having an opening at least as large as the ladder shall be provided.

3.6.3 Fire Protection

3.6.3.1 Fire suppression systems shall be designed in accordance with the latest edition of UFC 3-600-01. Warehouse and storage areas shall be protected utilizing Early Suppression Fast Response (ESFR) type sprinklers. ESFR shall be designed and installed in accordance with NFPA 13. ESFR system shall be on a separate fire riser from the rest of the building. (Note: maximum roof slope for ESFR is 2/12 and maximum roof height is 45')

3.6.3.2 Fire pumps, if required, shall be installed in accordance with NFPA 20. Fire pumps shall be installed in a separate room with access from the exterior. Fire pump room shall have one-hour separation from the rest of the building.

3.6.3.3 Water storage tanks, if required, shall meet the requirements of UFC 3-600-01 and NFPA 22. Water tanks must be supervised by the building fire alarm system.

3.6.3.4 Fire Department Connection (FDC) shall be provided in accordance with NFPA

requirements.

3.6.3.5 Post Indicator Valve (PIV) shall be provided in accordance with NFPA requirements. PIV shall be supervised by the building fire alarm system.

3.7 ELECTRICAL AND TELECOMMUNICATIONS REQUIREMENTS

Select electrical characteristics of the power system to provide a safe, efficient, and economical distribution of power based upon the size and types of loads to be served. Use distribution and utilization voltages of the highest level that is practical for the load to be served. The effect of nonlinear loads such as computers, other electronic equipment and electronic ballasts shall be considered and accommodated as necessary. Voltage drop shall not exceed the maximum allowed per ASHRAE 90.1.

3.7.1 Power outlets

Power shall be provided for all installed equipment requiring power including Government Furnished Contractor Installed equipment and all GFGI equipment. Refer to paragraph 6.0 for power requirements of all special equipment such as motorized overhead doors, dock levelers and forklift battery chargers, etc. Power poles are not allowed. The following shall also be provided.

3.7.1.1 Duplex receptacles shall be provided per NFPA 70 and in conjunction with the proposed equipment and furniture layouts.

3.7.1.2 Each CATV outlet shall have a duplex receptacle mounted adjacent to it in accordance with I3A, para. 2.3.1.

3.7.1.3 In offices and open administration areas no point along the wall at 18 inches above finished floor (AFF) shall be more than 6' from an outlet.

3.7.1.4 For housekeeping purposes provide a minimum of one 125-volt, duplex receptacle per hallway. No point along hallway wall at 18 inches AAF shall be more than 25 feet from a receptacle.

3.7.1.5 Provide 125-volt duplex receptacles mounted adjacent to lavatories. Provide a minimum of one for every two adjacent lavatories. Each single lavatory shall also be provided a receptacle.

3.7.1.6 Provide 125-volt duplex receptacles along counter top in the break room in accordance with NFPA 70 spacing requirements for kitchens in dwelling units. In addition, provide a minimum of two convenience 125-volt duplex receptacles along walls.

3.7.1.7 A minimum of two 125-volt, duplex receptacles shall be provided in each mechanical room and one in each electrical room in addition to NFPA 70 requirements.

3.7.1.8 Provide 125-volt duplex receptacles on the building exterior walls near entrances.

3.7.1.9 Provide 125-volt duplex receptacles along loading docks and central receiving area walls mounted at 18 inches AAF. No point along walls at 18 inches AFF shall be more than 12 feet from a receptacle.

3.7.1.10 Provide 125-volt duplex receptacles along movable small parts and movable general storage area walls mounted 18" AFF. No point along walls at 18 inches AFF shall be more than 25 feet from a receptacle. If columns that are not part of the walls are placed within the areas each one shall be provided a duplex receptacle.

3.7.1.11 Provide a power circuit for each forklift battery charging station. It is the DOR's responsibility to obtain specific requirements for the circuit to include receptacle type.

3.7.2 Grounding

Grounding shall be provided in accordance with NFPA 70 and the Technical Criteria for the I3A.

3.7.3 Interior Lighting

Interior lighting controls shall be provided in accordance with ASHRAE 90.1. Compact fluorescent lamps of 12 watts or less shall not be used. Electronic ballast for linear fluorescent lamps shall be the high efficiency programmed start type. Lighting shall comply with the recommendations of the Illumination Engineering Society of North America unless specified otherwise below. Provided lighting levels shall be within +/- 10% of required lighting levels.

3.7.3.1 Mechanical rooms, electrical rooms, break room, fork lift charging area and central receiving station shall be illuminated to a level of 30 foot-candles.

3.7.3.2 POL secure storage room, small arms parts storage room, movable small parts storage racks area and movable general storage racks area shall be illuminated to a level of 15 foot-candles.

3.7.4 Exterior Lighting

3.7.4.1 Provide dock lighting fixture for each loading dock door. Arm shall be 60 inches minimum in length. Provide housing composed of die cast aluminum and hood with wire guard. Each fixture shall be switched individually.

3.7.4.2 Provide a wall mounted metal halide wall pack above or adjacent to all exterior doors to include personnel doors, utility room doors, loading dock doors (this is in addition to the requirement of paragraph 3.7.4.1) and truck doors.

3.7.5 Telecommunications System

Telecommunication outlets shall be provided per the applicable criteria based on functional purpose of the space within the building and in accordance with other provisions of this RFP

3.7.5.1 Provide voice and data connection capability to all workstations.

3.7.5.2 Provide a minimum of one dual (voice and data) 8-pin modular jack outlet in the break room and the central receiving station.

3.7.5.3 Provide a dual (voice and data) 8-pin modular jack outlet in the movable storage areas for every 5000 SF of floor space.

3.7.6 Intrusion Detection System (IDS) Infrastructure

IDS infrastructure shall include conduit and j-boxes for each exterior personnel door to accommodate GFGI bimetallic switches and wiring. Exact location of j-boxes at each door shall be coordinated with the Installation. Conduit shall be home run from each j-box back to the main telecommunications room above the location of the IDS panel.

3.7.7 Mass Notification

Mass notification system shall be provided in accordance with UFC 4-021-01.

3.8 FIRE ALARM REQUIREMENTS

3.8.1 All software, software locks, special tools and any other proprietary equipment required to maintain, add devices to or delete devices from the system, or test the Fire Alarm system shall become property of the Government and be furnished to the Contracting Officer's Representative prior to final inspection of the system.

3.8.2 The fire alarm system installation shall be supervised by a National Institute for Certification of Engineering Technologies (NICET) 3 (minimum) technician.

4.0 APPLICABLE CRITERIA

Unless a specific document version or date is indicated, use criteria from the most current references as of the date of issue of the contract or task order, including any applicable addenda, unless otherwise stated in the task order. In the event of conflict between References and/or Applicable Military Criteria, apply the most stringent requirement, unless otherwise specifically noted in the contract or task order.

4.1. INDUSTRY CRITERIA

Applicable design and construction criteria references are listed in Table 1 below. This list is not intended to include all criteria that may apply or to restrict design and construction to only those references listed. See also Paragraph 3 for additional facility-specific applicable criteria.

Table 1: Industry Criteria

| Air Conditioning and Refrigeration Institute (ARI) | |
|--|--|
| ARI 310/380 | Packaged Terminal Air-Conditioners and Heat Pumps |
| ARI 440 | Room Fan-Coil and Unit Ventilator |
| ANSI/ARI 430-99 | Central Station Air Handling Units |
| ARI 445 | Room Air-Induction Units |
| ARI 880 | Air Terminals |
| Air Movement and Control Association (AMCA) | |
| AMCA 210 | Laboratory Methods of Testing Fans for Rating |
| American Architectural Manufacturers Association (AAMA) | |
| 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) | |
| | Roadside Design Guide [guardrails, roadside safety devices] |
| | Standard Specifications for Transportation Materials and Methods of Sampling and Testing [Road Construction Materials] |

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| | Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals |
| | Guide for Design of Pavement Structures, Volumes 1 and 2 [pavement design guide] |
| | A Policy of Geometric Design of Highways and Streets |
| American Bearing Manufacturers Association (AFBMA) | |
| AFBMA Std. 9 | Load Ratings and Fatigue Life for Ball Bearings |
| AFBMA Std. 11 | Load Ratings and Fatigue Life for Roller Bearings |
| American Boiler Manufacturers Association (ABMA) | |
| ABMA ISEI | Industry Standards and Engineering Information |
| American Concrete Institute | |
| ACI 302.2R | Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials |
| ACI 318 | Building Code Requirements for Structural Concrete |
| ACI SP-66 | ACI Detailing Manual |
| ACI 530 | Building Code Requirements for Masonry Structures |
| ADA Standards for Accessible Design | |
| See US Access Board | ADA and ABA Accessibility Guidelines for Buildings and Facilities, Chapters 3-10. |
| American Institute of Steel Construction (AISC) | |
| | Manual of Steel Construction – 13 th Edition (or latest version) |
| American Iron and Steel Institute | |
| AISI S100 | North American Specification for the Design of Cold-Formed Steel Structural Members |
| American National Standards Institute 11 (ANSI) | |

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| ANSI Z21.10.1 | Gas Water Heaters Vol. 1, Storage water Heaters with Input Ratings of 75,000 Btu per Hour or less |
| ANSI Z124.3 | American National Standard for Plastic Lavatories |
| ANSI Z124.6 | Plastic Sinks |
| ANSI Z21.45 | Flexible Connectors of Other Than All-Metal Construction for Gas Appliances |
| ANSI/IEEE C2-2007 | National Electrical Safety Code |
| ANSI/AF&PA NDS-2001 | National Design Specification for Wood Construction |
| American Society of Civil Engineers (ASCE) | |
| ASCE 7 | Minimum Design Loads for Buildings and Other Structures |
| ASCE 37 | Design and Construction of Sanitary and Storm Sewers, Manuals and Reports on Engineering Practice [sanitary sewer and storm drain design criteria] |
| ASCE/SEI 31-03 | Seismic Evaluation of Existing Buildings [Existing Building Alteration/Renovation] |
| ASCE/SEI 41-06 | Seismic Rehabilitation of Existing Buildings [Existing Building Alteration/Renovation] |
| American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) | |
| ASHRAE 90.1 | ANSI/ASHRAE/IESNA 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings |
| ASHRAE Guideline 0 | The Commissioning Process |
| ASHRAE Guideline 1.1 | The HVAC Commissioning Process |
| ASHRAE Handbooks | Fundamentals, HVAC Applications, Systems and Equipment, Refrigeration (Applicable, except as otherwise specified) |
| ASHRAE Standard 15 | Safety Standard for Refrigeration Systems |
| ASHRAE Standard 62.1 | Ventilation for Acceptable Indoor Air Quality |
| ASHRAE Standard 55 | Thermal Environmental Conditions for Human Occupancy (Design portion is applicable) |

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| American Society of Mechanical Engineers International (ASME) | |
| ASME BPVC SEC VII | Boiler and Pressure Vessel Code: Section VII Recommended Guidelines for the Care of Power Boilers |
| ASME A17.1 | Safety Code for Elevators and Escalators |
| ASME B 31 (Series) | Piping Codes |
| American Water Works Association (AWWA) | |
| | Standards [standards for water line materials and construction] |
| American Welding Society | |
| | Welding Handbook |
| | Welding Codes and Specifications (as applicable to application, see International Building Code for example) |
| Architectural Woodwork Institute (AWI) | |
| Version 1.2 | AWI Quality Standards 7th Edition |
| Associated Air Balance Council (AABC) | |
| AABC MN-1 | National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems |
| | AABC Associated Air Balance Council Testing and Balance Procedures |
| ASTM International | |
| ASTM C1060-90(1997) | Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings |
| ASTM E 779 (2003) | Standard Test Method for Determining Air Leakage Rate by Fan Pressurization |
| ASTM E1827-96(2002) | Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door |
| Builders Hardware Manufacturers Association (BHMA) | |
| ANSI/BHMA | American National Standards for Builders Hardware |

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| Building Industry Consulting Service International | |
| | Telecommunications Distribution Methods Manual (TDMM) |
| | Customer-Owned Outside Plant Design Manual (CO-OSP) |
| Code of Federal Regulations (CFR) | |
| 49 CFR 192 | Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards |
| 10 CFR 430 | Energy Conservation Program for Consumer Products |
| Consumer Electronics Association | |
| CEA 709.1B | Control Network Protocol Specification |
| CEA 709.3 | Free-Topology Twisted-Pair Channel Specification |
| CEA 852 | Tunneling Component Network Protocols Over Internet Protocol Channels |
| Electronic Industries Association (EIA) | |
| ANSI/EIA/TIA 568 | Structured Cabling Series |
| ANSI/EIA/TIA 569 | Commercial Building Standard for Telecommunications Pathways and Spaces (includes ADDENDA) |
| ANSI/TIA/EIA-606 | Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings |
| J-STD EIA/TIA 607 | Commercial Building Grounding and Bonding Requirements for Telecommunications |
| Federal Highway Administration (FHWA) | |
| | Manual on Uniform Traffic Control Devices for Streets and Highways [signage and pavement markings for streets and highways] |
| FHWA-NHI-01-021 | Hydraulic Engineering Circular No. 22, Second Edition, URBAN DRAINAGE DESIGN MANUAL |
| Illuminating Engineering Society of North America (IESNA) | |
| IESNA RP-1 | Office Lighting |

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| IESNA RP-8 | Roadway Lighting |
| IESNA Lighting Handbook | Reference and Application |
| Institute of Electrical and Electronics Engineers Inc. (IEEE) | |
| | Standard for Use of the International System of Units (SI): the Modern Metric System |
| Standard 1100 | Recommended Practice for Powering and Grounding Sensitive Electronic Equipment |
| International Code Council (ICC) | |
| IBC | <p>International Building Code</p> <p>Note: All references in the International Building Code to the International Electrical Code shall be considered to be references to NFPA 70.</p> <p>All references in the International Building Code to the International Fuel Gas Code shall be considered to be references to NFPA 54 and NFPA 58.</p> <p>All references in the International Building Code to the International Fire Code and Chapter 9 shall be considered to be references to Unified Facilities Criteria (UFC) 3-600-01.</p> |
| IMC | <p>International Mechanical Code –</p> <p>Note: For all references to “HEATING AND COOLING LOAD CALCULATIONS”, follow ASHRAE 90.1</p> <p>Note: For all references to “VENTILATION”, follow ASHRAE 62.1</p> |
| IRC | International Residential Code |
| IPC | International Plumbing Code |
| IEC | Energy Conservation Code (IEC) –Applicable only to the extent specifically referenced herein. Refer to Paragraph 5, ENERGY CONSERVATION requirements. |
| IGC | International Gas Code - not applicable. Follow NFPA 54, National Fuel Gas Code and NFPA 58, Liquefied Petroleum Gas Code. |
| International Organization for Standardization (ISO) | |
| ISO 6781:1983 | Qualitative detection of thermal irregularities in building envelopes – |

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| | infrared method |
| LonMark International (LonMark) | |
| LonMark Interoperability Guidelines | (available at www.lonmark.org), including: Application Layer Guidelines, Layer 1-6 Guidelines, and External Interface File (XIF) Reference Guide |
| LonMark Resource Files | (available at www.lonmark.org), including Standard Network Variable Type (SNVT) definitions |
| Metal Building Manufacturers Association (MBMA) | |
| | Metal Building Systems Manual |
| Midwest Insulation Contractors Association (MICA) | |
| | National Commercial and Industrial Insulation Standards Manual |
| National Association of Corrosion Engineers International (NACE) | |
| NACE RP0169 | Control of External Corrosion on Underground or Submerged Metallic Piping Systems |
| NACE RP0185 | Extruded, Polyolefin Resin Coating Systems with Adhesives for Underground or Submerged Pipe |
| NACE RP0285 | Corrosion Control of Underground Storage Tank Systems by Cathodic Protection |
| NACE RP0286 | Electrical Isolation of Cathodically Protected Pipelines |
| National Electrical Manufacturers Association (NEMA) | |
| National Environmental Balancing Bureau (NEBB) | |
| | Procedural Standards Procedural Standards for Testing Adjusting Balancing of Environmental Systems |
| National Fire Protection Association (NFPA) | |
| NFPA 10 | Standard for Portable Fire Extinguishers |
| NFPA 13 | Installation of Sprinkler Systems |
| NFPA 13R | Residential Occupancies up to and Including Four Stories in Height Sprinkler Systems |

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| NFPA 14 | Standard for the Installation of Standpipes and Hose Systems |
| NFPA 20 | Installation of Centrifugal Fire Pumps |
| NFPA 24 NFPA 25 | Standard for the Installation of Private Fire Service Mains and Their Appurtenances [underground fire protection system design] Inspection, Testing And Maintenance Of Water-Based Fire Protection Systems |
| NFPA 30 | Flammable and Combustible Liquids Code |
| NFPA 30A | Motor Fuel Dispensing Facilities and Repair Garages |
| NFPA 31 | Installation of Oil Burning Equipment |
| NFPA 54 | National Fuel Gas Code |
| NFPA 58 | Liquefied Petroleum Gas Code |
| NFPA 70 | National Electrical Code |
| NFPA 72 | National Fire Alarm Code |
| NFPA 76 | Fire Protection of Telecommunications Facilities |
| NFPA 80 | Standard for Fire Doors and Fire Windows |
| NFPA 90a | Installation of Air Conditioning and Ventilating Systems |
| NFPA 96 | Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations |
| NFPA 101 | Life Safety Code |
| NFPA 780 | Standard for the Installation of Lightning Protection Systems |
| National Roofing Contractor's Association (NRCA) | |
| | Roofing and Waterproofing Manual |
| National Sanitation Foundation, International | |
| NSF/ANSI Std. 2, 3, 4, 5, 6, 7, 8, 12, 13, 18, 20, 21, 25, 29, 35, 36, 37, 51, 52, 59, | Food Equipment Standards |

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| 169 | |
| ANSI/UL Std. 73, 197, 471, 621, 763 | Food Equipment Standards |
| CSA Std. C22.2 No. 109, 120, 195 | Food Equipment Standards |
| Occupational Safety and Health Administration (OSHA) | |
| Title 29, Part 1926 | OSHA Construction Industry Standards, Title 29, Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction |
| Plumbing and Drainage Institute (PDI) | |
| PDI G 101 | Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data |
| PDI WH201 | Water Hammer Arrestors |
| Precast Concrete Institute | |
| PCI Design Handbook | Precast and Prestressed Concrete |
| Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) | |
| SMACNA HVAC Duct Construction Standards | HVAC Duct Construction Standards - Metal and Flexible |
| SMACNA Architectural Manual | Architectural Sheet Metal Manual |
| SMACNA HVAC TAB | HVAC Systems - Testing, Adjusting and Balancing |
| State/Local Regulations | |
| | State Department of Transportation Standard Specifications for Highway and Bridge Construction |
| | Sedimentation and Erosion Control Design Requirements |
| | Environmental Control Requirements |
| | Storm Water Management Requirements |
| Steel Door Institute (SDI) | |

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| ANSI A250.8/SDI 100 | Standard Steel Doors and Frames |
| Steel Deck Institute | |
| | SDI Diaphragm Design Manual |
| Steel Joist Institute | |
| | Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders |
| Underwriters Laboratories (UL) | |
| UL 96A | Installation Requirements for Lightning Protection Systems |
| UL 300 | Standard for Safety for Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas |
| UNITED STATES ACCESS BOARD: U.S. ARCHITECTURAL AND TRANSPORTATION BARRIERS COMPLIANCE BOARD | |
| ADA and ABA Accessibility Guidelines for Buildings and Facilities | <p>ABA Accessibility Standard for DoD Facilities</p> <p>Derived from the ADA and ABA Accessibility Guidelines: Specifically includes: ABA Chapters 1 and 2 and Chapters 3 through 10.</p> <p>Use this reference in lieu of IBC Chapter 11.</p> <p>Excluded are:</p> <p>(a) Facilities, or portions of facilities, on a military installation that are designed and constructed for use exclusively by able-bodied military personnel (See Paragraph 3 for any reference to this exclusion).</p> <p>(b) Reserve and National Guard facilities, or portions of such facilities, owned by or under the control of the Department of Defense, that are designed and constructed for use exclusively by able-bodied military personnel. (See paragraph 3 for any reference to this exclusion).</p> |
| U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES | |
| | FDA National Food Code |
| U.S. GREEN BUILDING COUNCIL (USGBC) | |
| LEED-NC | Green Building Rating System for New Construction & Major Renovations |
| | Application Guide for Multiple Buildings and On-Campus Building Projects |

4.2. MILITARY CRITERIA

The project shall conform to the following criteria. Certain design impacts and features due to these criteria are noted for the benefit of the offeror. However, all requirements of the referenced criteria will be applicable, whether noted or not, unless otherwise specified herein.

- 4.2.1. Energy Policy Act of 2005 (Public Law 109-58) (applies only to the extent specifically implemented in the contract, which may or may not directly cite or reference EPACT)
- 4.2.2. Executive Order 12770: Metric Usage In Federal Government
- (a) Metric design and construction is required except when it increases construction cost. Offeror to determine most cost efficient system of measurement to be used for the project.
- 4.2.3. TB MED 530: Occupational and Environmental Health Food Sanitation
- 4.2.4. Unified Facilities Criteria (UFC) 3-410-01FA: Heating, Ventilating, and Air Conditioning - applicable only to the extent specified in paragraph 5, herein.
- 4.2.5. Deleted.
- 4.2.6. UFC 3-600-01 Design: Fire Protection Engineering for Facilities. Use the latest edition of the IBC in coordination with this UFC. Use Chapters 3, 6, 7, 33 and UFC 3-600-01. If any conflict occurs between these Chapters and UFC 3-600-01, the requirements of UFC 3-600-01 take precedence. Use UFC 3-600-01 in lieu of IBC Chapters 4, 8,9,10.
- 4.2.7. UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings
- 4.2.8. UFC 4-023-03 Design of Buildings to Resist Progressive Collapse (Use most recent version, regardless of references thereto in other publications)
- (a) Note the option to use tie force method or alternate path design for Occupancy Category II.
- 4.2.9. UFC 4-021-01 Design and O&M: Mass Notification Systems
- 4.2.10. Technical Criteria for Installation Information Infrastructure Architecture (I3A)
- (a) Email: DetrickSECI3Aguide@conus.army.mil
- 4.2.11. U.S. Army Information Systems Engineering Command (USAISEC) TG for the Integration of SECRET Internet Protocol (IP) Router Network (SIPRNET). See Paragraph 3 for applicability to specific facility type. May not apply to every facility. This is mandatory criteria for those facilities with SIPRNET.

5.0 GENERAL TECHNICAL REQUIREMENTS

This paragraph contains general technical requirements. See also Paragraph 3 for facility-specific technical requirements. Residential or similar grade finishes and materials are not acceptable for inclusion in these buildings, unless otherwise specifically allowed.

5.1. SITE PLANNING AND DESIGN

5.1.1. STANDARDS AND CODES: The site planning and design shall conform to APPLICABLE CRITERIA and to paragraph 6, PROJECT SPECIFIC REQUIREMENTS.

5.1.2. SITE PLANNING OBJECTIVES: Group buildings in configurations that create a sense of community and promote pedestrian use. See paragraph 3 for additional site planning requirements relating to building functions.

5.1.2.1. Provide enclosures and or visual screening devices for Outdoor Utility such as dumpsters, emergency generators, transformers, heating, ventilation, and air conditioning units from streetscape and courtyard views to limit visual impact. Enclosures shall be compatible with the building they serve and accessible by vehicle. The location of dumpsters can have a significant visual impact and should be addressed as part of an overall building design and incorporated in site planning.

5.1.2.2. Where included in the project, dumpster pads shall be concrete (minimum of 8 inches thick on 4 inch base course, unless site conditions dictate more conservative requirements) and directly accessible by way of a paved service drive or parking lot with adequate overhead clearance for collection vehicles. Provide space at dumpster areas for recycling receptacles. Coordinate with Installation on recycling receptacle types, sizes and access requirements and provide space at dumpster areas to accommodate them.

5.1.2.3. Vehicular Circulation. Apply design vehicle templates provided by the American Association of State Highway and Transportation Officials (AASHTO) to the site design. The passenger car class includes passenger cars and light trucks, such as vans and pick-ups. The passenger car template is equivalent to the non-organizational – privately owned vehicle (POV). The truck class template includes single-unit trucks, recreation vehicles, buses, truck tractor-semi-trailer combinations, and trucks or truck tractors with semi-trailers in combination with full trailers. Provide vehicle clearances required to meet traffic safety for emergency vehicles, service vehicles, and moving vans. Provide required traffic control signage Site entrances and site drive aisles shall maximize spacing between drives, incorporate right-angle turns, and limit points of conflict between traffic. Design Services Drives to restrict access to unauthorized vehicles by removable bollards, gates, or other barriers to meet Anti-Terrorism/Force Protection (ATFP) requirements. Orient service drives to building entrances other than the primary pedestrian entry at the front of the building.

5.1.2.4. Provide Emergency Vehicle Access around the facility and shall be in accordance with AT/FP requirements. Maintain a 33-foot clear zone buffer for emergency vehicles, designed to prevent other vehicles from entering the AT/FP standoff to the building.

5.1.2.5. Clear and grub all trees and vegetation necessary for construction; but, save as many trees as possible. Protect trees to be saved during the construction process from equipment.

5.1.2.6. Stormwater Management. Employ design and construction strategies (Best Management Practices) that reduce stormwater runoff, reduce discharges of polluted water offsite and maintain or restore predevelopment hydrology with respect to temperature, rate, volume and duration of flow to the maximum extent practicable. See paragraph 6, PROJECT SPECIFIC requirements for additional information.

5.1.3. EXTERIOR SIGNAGE: Provide exterior signage in accordance with Appendix H, Exterior Signage. Provide exterior NO SMOKING signage that conveys building and grounds smoking policy.

5.1.4. EXISTING UTILITIES: Base utilities maps and capacities for this site are included as part of this RFP. See paragraph 6 for more detailed information.

5.2. SITE ENGINEERING

5.2.1. STANDARDS AND CODES: The site engineering shall conform to APPLICABLE CRITERIA.

5.2.2. SOILS:

5.2.2.1. A report has been prepared to characterize the subsurface conditions at the project site and is **appended to these specifications**. The report provides a general overview of the soil and geologic conditions with detailed descriptions at discrete boring locations. The Contractor's team shall include a licensed geotechnical engineer to interpret the report and develop earthwork and foundation recommendations and design parameters in which to base the contractor's design. If any additional subsurface investigation or laboratory analysis is required to better characterize the site or develop the final design, the Contractor shall perform it under the direction of a licensed geotechnical engineer. There will be no separate payment for the cost of additional tests. If differences between the Contractor's additional subsurface investigation and the government provided soils report or the reasonably expected conditions require material revisions in the design, an equitable adjustment may be made, in accordance with the provisions of the Differing Site Conditions clause. The basis for the adjustment would be the design and construction appropriate for the conditions described in the Government furnished report or the reasonably expected conditions, in comparison with any changes required by material differences in the actual conditions encountered, in accordance with the terms of contract clause Differing Site Conditions.

5.2.2.2. The contractor's licensed geotechnical engineer shall prepare a final geotechnical evaluation report, to be submitted along with the first foundation design submittal, as described in Section 01 33 16, *Design After Award*.

5.2.3. VEHICLE PAVEMENTS: (as applicable to the project)

5.2.3.1. Design procedures and materials shall conform to one of the following: 1) the USACE Pavement Transportation Computer Assisted Structural Engineering (PCASE) program, 2) American Association of State Highway and Transportation Officials (AASHTO) or, 3) the applicable state Department of Transportation standards in which the project is located. See paragraph 5.2.2.2 and Section 01 33 16 for required information for the Contractor's geotechnical evaluation report. The minimum flexible pavement section shall consist of 2 inches of asphalt and 6 inches of base or as required by the pavement design, whichever is greater, unless specifically identified by the Government to be a gravel road. Design roads and parking areas for a life expectancy of 25 years with normal maintenance. Parking area for tactical vehicles (as applicable to the project) shall be Portland Cement Concrete (PCC) rigid pavement design. For concrete pavements, submit joint layout plan for review and concurrence. Design pavements for military tracked vehicles (as applicable to the project) IAW USACE PCASE. Traffic estimates for each roadway area will be as shown on the drawings or listed in Section 01 10 00 Paragraph 6.4.4. Pavement markings and traffic signage shall comply with the Installation requirements and with the Manual on Uniform Traffic Control Devices.

5.2.3.2. Parking Requirements.

- (a) All handicap POV parking lots (where applicable in the facility specific requirements) shall meet the ADA and ABA Accessibility Guidelines for accessible parking spaces.
- (b) Design POV parking spaces for the type of vehicles anticipated, but shall be a minimum of 9 ft by 18 ft for POVs, except for two wheel vehicles.

5.2.3.3. Sidewalks. Design the network of walks throughout the complex (where applicable) to facilitate pedestrian traffic among facilities, and minimize the need to use vehicles. Incorporate sidewalks to enhance the appearance of the site development, while creating a sense of entry at the primary patron entrances to the buildings. Minimum sidewalk requirements are in Paragraph 3, where applicable.

5.2.4. CATHODIC PROTECTION: Provide cathodic protection systems for all underground metallic systems and metallic fittings/portions of non-metallic, underground systems, both inside and outside the building 5 foot line that are subject to corrosion. Coordinate final solutions with the installation to insure an approach that is consistent with installation cathodic protection programs.

5.2.5. UTILITIES: See paragraph 6.4.6 for specific information on ownership of utilities and utility requirements. Meter all utilities (gas, water, and electric, as applicable) to each facility. For Government owned utilities, install meters that are wireless data transmission capable as well as have a continuous manual reading option. All meters will be capable of at least hourly data logging and transmission and provide consumption data for gas, water, and electricity. Gas and electric meters will also provide demand readings based on consumption over a maximum of

any 15 minute period. Configure all meters to transmit at least daily even if no receiver for the data is currently available at the time of project acceptance. For privatized utilities, coordinate with the privatization utility(ies) for the proper meter base and meter installation.

5.2.6. PERMITS: The CONTRACTOR shall be responsible for obtaining all permits (local, state and federal) required for design and construction of all site features and utilities.

5.2.7. IRRIGATION. Landscape irrigation systems, if provided, shall comply with the following:

5.2.7.1. Irrigation Potable Water Use Reduction. Reduce irrigation potable water use by 100 percent using LEED credit WE1.1 baseline (no potable water used for irrigation), except where precluded by other project requirements.

5.2.8. EPA WaterSense Products and Contractors. Except where precluded by other project requirements, use EPA WaterSense labeled products and irrigation contractors that are certified through a WaterSense labeled program where available.

5.3. ARCHITECTURE AND INTERIOR DESIGN:

This element will be evaluated per APPLICABLE CRITERIA under the quality focus.

5.3.1. STANDARDS AND CODES: The architecture and interior design shall conform to APPLICABLE CRITERIA.

5.3.2. GENERAL: Overall architectural goal is to provide a functional, quality, visually appealing facility that is a source of pride for the installation and delivered within the available budget and schedule.

5.3.3. COMPUTATION OF AREAS: See APPENDIX Q for how to compute gross and net areas of the facility(ies).

5.3.4. BUILDING EXTERIOR: Design buildings to enhance or compliment the visual environment of the Installation. Where appropriate, reflect a human scale to the facility. Building entrance should be architecturally defined and easily seen. When practical, exterior materials, roof forms, and detailing shall be compatible with the surrounding development and adjacent buildings on the Installation and follow locally established architectural themes. Use durable materials that are easy to maintain. Exterior colors shall conform to the Installation requirements. See paragraph 6.

5.3.4.1. Building Numbers: Each building shall have exterior signage permanently attached on two faces of the building indicating the assigned building number or address. Building number signage details and locations shall conform to Appendix H, Exterior Signage.

5.3.5. BUILDING INTERIOR

5.3.5.1. Space Configuration: Arrange spaces in an efficient and functional manner in accordance with area adjacency matrices.

5.3.5.2. Surfaces: Appearance retention is the top priority for building and furniture related finishes. Provide low maintenance, easily cleaned room finishes that are commercially standard for the facility occupancy specified, unless noted otherwise.

5.3.5.3. Color: The color, texture and pattern selections for the finishes of the building shall provide an aesthetically pleasing, comfortable, easily maintainable and functional environment for the occupants. Coordination of the building colors and finishes is necessary for a cohesive design. Color selections shall be appropriate for the building type. The use of color, texture and pattern shall be used to path or way find through the building. Trendy colors that will become dated shall be limited to non-permanent finishes such as carpet and paint. Finishes should be selected with regards to aesthetics, maintenance, durability, life safety and image. Limit the number of similar colors for each material. Color of Ceramic and porcelain tile grout shall be medium range color to help hide soiling. Plastic laminate and solid surface materials shall have patterns that are mottled, flecked or speckled. Finish colors of fire extinguisher cabinets, receptacle bodies and plates, fire alarms / warning lights, emergency lighting, and other miscellaneous items shall be coordinated with the building interior. Color of equipment items on ceilings (speakers, smoke detectors, grills, etc.) shall match the ceiling color.

5.3.5.4. Circulation: Circulation schemes must support easy way finding within the building.

5.3.5.5. Signage: Provide interior signage for overall way finding and life safety requirements. A comprehensive interior plan shall be from one manufacturer. Include the following sign types: (1) Lobby Directory, (2) Directional Signs; (3) Room Identification Signs; (4) Building Service Signs; (5) Regulatory Signs; (6) Official and Unofficial Signs (7) Visual Communication Boards (8) NO SMOKING signage that conveys building smoking policy. Use of emblems or logos may also be incorporated into the signage plan.

5.3.5.6. Window Treatment: Interior window treatments with adjustable control shall be provided in all exterior window locations for control of day light coming in windows or privacy at night. Uniformity of treatment color and material shall be maintained to the maximum extent possible within a building.

5.3.6. COMPREHENSIVE INTERIOR DESIGN

5.3.6.1. Comprehensive Interior Design includes the integration of a Structural Interior Design (SID) and a Furniture, Fixtures and Equipment (FF&E) design and package. SID requires the design, selection and coordination of interior finish materials that are integral to or attached to the building structure. Completion of a SID involves the selection and specification of applied finishes for the building's interior features including, but not limited to, walls, floors, ceilings, trims, doors, windows, window treatments, built-in furnishings and installed equipment, lighting, and signage. The SID package includes finish schedules, finish samples and any supporting interior elevations, details or plans necessary to communicate the building finish design and build out. The SID also provides basic space planning for the anticipated FF&E requirements in conjunction with the functional layout of the building and design issues such as life safety, privacy, acoustics, lighting, ventilation, and accessibility. See Section 01 33 16 for SID design procedures.

The FF&E design and package includes the design, selection, color coordination and of the required furnishing items necessary to meet the functional, operational, sustainability, and aesthetic needs of the facility coordinated with the interior finish materials in the SID. The FF&E package includes the specification, procurement documentation, placement plans, ordering and finish information on all freestanding furnishings and accessories, and a cost estimate. Coordinate the selection of furniture style, function and configuration with the defined requirements. Examples of FF&E items include, but are not limited to workstations, seating, files, tables, beds, wardrobes, draperies and accessories as well as marker boards, tack boards, and presentation screens. Criteria for furniture selection include function and ergonomics, maintenance, durability, sustainability, comfort and cost. See Section 01 33 16 for FFE design procedures.

5.4. STRUCTURAL DESIGN

5.4.1. STANDARDS AND CODES: The structural design shall conform to APPLICABLE CRITERIA.

5.4.2. GENERAL: The structural system needs to be compatible with the intended functions and components that allows for future flexibility and reconfigurations of the interior space. Select an economical structural system based upon facility size, projected load requirements and local availability of materials and labor. Base the structural design on accurate, site specific geotechnical information and anticipated loads for the building types and geographical location. Consider climate conditions, high humidity, industrial atmosphere, saltwater exposure, or other adverse conditions when selecting the type of cement and admixtures used in concrete, the concrete cover on reinforcing steel, the coatings on structural members, expansion joints, the level of corrosion protection, and the structural systems. Analyze, design and detail each building as a complete structural system. Design structural elements to preclude damage to finishes, partitions and other frangible, non-structural elements to prevent impaired operability of moveable components; and to prevent cladding leakage and roof ponding. Limit deflections of structural members to the allowable of the applicable material standard, e.g., ACI, AISC, Brick Industry Association, etc. When modular units or other pre-fabricated construction is used or combined with stick-built construction, fully coordinate and integrate the overall structural design between the two different or interfacing construction types. If the state that the project is located in requires separate, specific licensing for structural engineers (for instance, such as in Florida, California and others), then the structural engineer designer of record must be registered in that state.

5.4.3. LOADS: See paragraph 3 for facility specific (if applicable) and paragraph 6 for site and project specific structural loading criteria. Unless otherwise specified in paragraph 6, use Exposure Category C for wind. If not specified, use Category C unless the Designer of Record can satisfactorily justify another Exposure Category in its

design analysis based on the facility Master Plan. Submit such exceptions for approval as early as possible and prior to the Interim Design Submittal in Section "Design After Award". In addition to gravity, seismic and lateral loads, design the ancillary building items, e.g. doors, window jambs and connections, overhead architectural features, equipment bracing, for the requirements of UFC 4-010-01, DOD Minimum Antiterrorism Standards for Buildings. Ensure and document that the design of glazed items includes, but is not limited to, the following items under the design loads prescribed in UFC 4-010-01:

- (a) Supporting members of glazed elements, e.g. window jamb, sill, header
- (b) Connections of glazed element to supporting members, e.g. window to header
- (c) Connections of supporting members to each other, e.g. header to jamb
- (d) Connections of supporting members to structural system, e.g. jamb to foundation.

5.4.4. TERMITE TREATMENT: (Except Alaska) Provide termite prevention treatment in accordance with Installation and local building code requirements, using licensed chemicals and licensed applicator firm.

5.5. THERMAL PERFORMANCE

5.5.1. STANDARDS AND CODES: Building construction and thermal insulation for mechanical systems shall conform to APPLICABLE CRITERIA.

5.5.2. BUILDING ENVELOPE SEALING PERFORMANCE REQUIREMENT. Design and construct the building envelope for office buildings, office portions of mixed office and open space (e.g., company operations facilities), dining, barracks and instructional/training facilities with a continuous air barrier to control air leakage into, or out of, the conditioned space. Clearly identify all air barrier components of each envelope assembly on construction documents and detail the joints, interconnections and penetrations of the air barrier components. Clearly identify the boundary limits of the building air barriers, and of the zone or zones to be tested for building air tightness on the drawings.

5.5.2.1. Trace a continuous plane of air-tightness throughout the building envelope and make flexible and seal all moving joints.

5.5.2.2. The air barrier material(s) must have an air permeance not to exceed 0.004 cfm / sf at 0.3" wg (0.02 L/s.m² @ 75 Pa) when tested in accordance with ASTM E 2178

5.5.2.3. Join and seal the air barrier material of each assembly in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of these assemblies and components.

5.5.2.4. Support the air barrier so as to withstand the maximum positive and negative air pressure to be placed on the building without displacement, or damage, and transfer the load to the structure.

5.5.2.5. Seal all penetrations of the air barrier. If any unavoidable penetrations of the air barrier by electrical boxes, plumbing fixture boxes, and other assemblies are not airtight, make them airtight by sealing the assembly and the interface between the assembly and the air barrier or by extending the air barrier over the assembly.

5.5.2.6. The air barrier must be durable to last the anticipated service life of the assembly.

5.5.2.7. Do not install lighting fixtures with ventilation holes through the air barrier

5.5.2.8. Provide a motorized damper in the closed position and connected to the fire alarm system to open on call and fail in the open position for any fixed open louvers such as at elevator shafts.

5.5.2.9. Damper and control to close all ventilation or make-up air intakes and exhausts, atrium smoke exhausts and intakes, etc when leakage can occur during inactive periods.

5.5.2.10. Compartmentalize garages under buildings by providing air-tight vestibules at building access points.

5.5.2.11. Compartmentalize spaces under negative pressure such as boiler rooms and provide make-up air for combustion.

5.5.2.12. Performance Criteria and Substantiation: Submit the qualifications and experience of the testing entity for approval. Demonstrate performance of the continuous air barrier for the opaque building envelope by the following tests:

(a) Test the completed building and demonstrate that the air leakage rate of the building envelope does not exceed 0.25cfm/ft² at a pressure differential of 0.3" w.g.(75 Pa) in accordance with ASTM's E 779 (2003) or E-1827-96 (2002). Accomplish tests using either pressurization or depressurization or both. Divide the volume of air leakage in cfm @ 0.3" w.g. (L/s @ 75 Pa) by the area of the pressure boundary of the building, including roof or ceiling, walls and floor to produce the air leakage rate in cfm/ft² @ 0.3" w.g. (L/s.m² @ 75 Pa). Do not test the building until verifying that the continuous air barrier is in place and installed without failures in accordance with installation instructions so that repairs to the continuous air barrier, if needed to comply with the required air leakage rate, can be done in a timely manner.

(b) Test the completed building using Infrared Thermography testing. Use infrared cameras with a resolution of 0.1deg C or better. Perform testing on the building envelope in accordance with ISO 6781:1983 and ASTM C1060-90(1997). Determine air leakage pathways using ASTM E 1186-03 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems, and perform corrective work as necessary to achieve the whole building air leakage rate specified in (a) above.

(c) Notify the Government at least three working days prior to the tests to provide the Government the opportunity to witness the tests. Provide the Government written test results confirming the results of all tests.

5.6. PLUMBING

5.6.1. STANDARDS AND CODES: The plumbing system shall conform to APPLICABLE CRITERIA.

5.6.2. PRECAUTIONS FOR EXPANSIVE SOILS: Where expansive soils are present, the design for underslab piping systems and underground piping serving chillers, cooling towers, etc, shall include features to control forces resulting from soil heave. Some possible solutions include, but are not necessarily limited to, features such as flexible expansion joints, slip joints, horizontal offsets with ball joints, or multiple bell and spigot gasketed fittings. For structurally supported slabs, piping should be suspended from the structure with adequate space provided below the pipe for the anticipated soil movement.

5.6.3. HOT WATER SYSTEMS: For Hot Water heating and supply, provide a minimum temp of 140 Deg F in the storage tank and a maximum of 110 Deg F at the fixture, unless specific appliances or equipment specifically require higher temperature water supply.

5.6.4. SIZING HOT WATER SYSTEMS: Unless otherwise specified or directed in paragraph 3, design in accordance with ASHRAE Handbook Series (appropriate Chapters), ASHRAE Standard 90.1, and the energy conservation requirements of the contract. Size and place equipment so that it is easily accessible and removable for repair or replacement.

5.6.5. JANITOR CLOSETS: In janitor spaces/room/closets, provide at minimum, a service sink with heavy duty shelf and wall hung mop and broom rack(s).

5.6.6. FLOOR DRAINS: As a minimum, provide floor drains in mechanical rooms and areas, janitor spaces/rooms/closets and any other area that requires drainage from fixtures or equipment, drain downs, condensate, as necessary.

5.6.7. URINALS: Urinals shall be vitreous china, wall-mounted, wall outlet, non-water using, with integral drain line connection, and with sealed replaceable cartridge or integral liquid seal trap. Either type shall use a biodegradable liquid to provide the seal and maintain a sanitary and odor-free environment. Install, test and maintain in accordance with manufacturer's recommendations. Slope the sanitary sewer branch line for non-water use urinals a minimum of 1/4 inch per foot. Do not use copper tube or pipe for drain lines that connect to the urinal. Manufacturer shall provide an operating manual and on-site training to installation operations personnel for the proper care and maintenance of the urinal. For complexes, non-water using urinals are not required for barracks type spaces.

5.6.8. BUILDING WATER USE REDUCTION. Reduce building potable water use in each building 30 percent using IPC fixture performance requirements baseline.

5.6.9. Do not use engineered vent or Sovent® type drainage systems.

5.6.10. Where the seasonal design temperature of the cold water entering a building is below the seasonal design dew point of the indoor ambient air, and where condensate drip will cause damage or create a hazard, insulate plumbing piping with a vapor barrier type of insulation to prevent condensation. Do not locate water or drainage piping over electrical wiring or equipment unless adequate protection against water (including condensation) damage is provided. Insulation alone is not adequate protection against condensation. Follow ASHRAE Fundamentals Chapter 23, Insulation for Mechanical Systems, IMC paragraph 1107 and International Energy Conservation Code for pipe insulation requirements.

5.7. ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

5.7.1. STANDARDS AND CODES: The electrical systems for all facilities shall conform to APPLICABLE CRITERIA.

5.7.2. MATERIALS AND EQUIPMENT: Materials, equipment and devices shall, as a minimum, meet the requirements of Underwriters Laboratories (UL) where UL standards are established for those items. Wiring for branch circuits shall be copper. Motors larger than one-half horsepower shall be three phase. All electrical systems shall be pre-wired and fully operational unless otherwise indicated. Wall mounted electrical devices (power receptacles, communication outlets and CATV outlets) shall have matching colors, mounting heights and faceplates.

5.7.3. POWER SERVICE: Primary service from the base electrical distribution system to the pad-mounted transformer and secondary service from the transformer to the building service electrical equipment room shall be underground. See paragraph 6 for additional site electrical requirements.

5.7.3.1. Spare Capacity: Provide 10% space for future circuit breakers in all panelboards serving residential areas of buildings and 15% spaces in all other panelboards.

5.7.4. TELECOMMUNICATION SERVICE: The project's facilities must connect to the Installation telecommunications (voice and data) system through the outside plant (OSP) telecommunications underground infrastructure cabling system per the I3A Criteria. Connect to the OSP cabling system from each facility main cross connect located in the telecommunications room.

5.7.5. LIGHTING: Comply with the recommendations of the Illumination Engineering Society of North America (IESNA), the National Energy Policy Act and Energy Star requirements for lighting products..

5.7.5.1. Interior Lighting:

(a) Reflective Surfaces: Coordinate interior architectural space surfaces and colors with the lighting systems to provide the most energy-efficient workable combinations.

(b) High Efficiency Fluorescent Lighting: Utilize NEMA premium electronic ballasts and energy efficient fluorescent lamps with a Correlated Color Temperature (CCT) of 4100K. Linear fluorescent and compact fluorescent fixtures shall have a Color Rendering Index of (CRI) of 87 or higher. Fluorescent lamps shall be the low mercury type qualifying as non-hazardous waste upon disposal. Do not use surface mounted fixtures on acoustical tile ceilings. Provide an un-switched fixture with emergency ballast shall be provided at each entrance to the building.

(c) Solid State Lighting: Fixtures shall provide lighting with a minimum Correlated Color Temperature (CCT) of 4100K and shall have a Color Rendering Index of (CRI) of 75 or higher. Verify performance of the light producing solid state components by a test report in compliance with the requirements of IESNA LM 80. Verify performance of the solid state light fixtures by a test report in compliance with the requirements of IESNA LM 79. Provide lab results by a NVLAP certified laboratory. The light producing solid state components and drivers shall have a life expectancy of 50,000 operating hours while maintaining at least 70% of original illumination level. Provide a complete five year warranty for fixtures.

(d) Metal Halide Lighting (where applicable): Metal Halide lamp fixtures in the range of 150-500 Watts shall be pulse start type and have a minimum efficiency rating of 88%.

(e) Lighting Controls: ANSI/ASHRAE/IESNA 90.1 has specific lighting controls requirements. Provide a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces (classrooms, conference rooms) to promote the productivity, comfort and well being of the building occupants. In office spaces, the preferred lighting should be a 30 FC ambient lighting level with occupancy sensor controlled task lighting in the work spaces to provide a composite lighting level of 50 FC on the working surfaces. Consider incorporating daylighting techniques for the benefit of reducing lighting energy requirements while improving the quality of the indoor spaces. If daylight strategies are used, additional coordination is required with the architect and mechanical engineer. Additionally, incorporate electric lighting controls to take advantage of the potential energy savings.

(f) Exterior Lighting: See paragraph 6.9 for site specific information, if any, on exterior lighting systems. Minimize light pollution and light trespass by not over lighting and use cutoff type exterior luminaires.

5.7.6. TELECOMMUNICATION SYSTEM: All building telecommunications cabling systems (BCS) and OSP telecommunications cabling system shall conform to APPLICABLE CRITERIA to include I3A Technical Criteria. An acceptable BCS encompasses, but is not limited to, copper and fiber optic (FO) entrance cable, termination equipment, copper and fiber backbone cable, copper and fiber horizontal distribution cable, workstation outlets, racks, cable management, patch panels, cable tray, cable ladder, conduits, grounding, and labeling.. Items included under OSP infrastructure encompass, but are not limited to, manhole and duct infrastructure, copper cable, fiber optic cable, cross connects, terminations, cable vaults, and copper and FO entrance cable.

5.7.6.1. Design, install, label and test all telecommunications systems in accordance with the I3A Criteria and ANSI/TIA/EIA 568, 569, and 606 standards. A Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) with at least 2 yrs related experience shall develop and stamp telecommunications design, and prepare the test plan. See paragraph 5.8.2.5 for design of environmental systems for Telecommunications Rooms.

5.7.6.2. The installers assigned to the installation of the telecommunications system or any of its components shall be regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. Key personnel; i.e., supervisors and lead installers assigned to the installation of this system or any of its components shall be BICSI Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel. In lieu of BICSI certification, supervisors and installers shall have a minimum of 5 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

5.7.6.3. Perform a comprehensive end to end test of all circuits to include all copper and fiber optic cables upon completion of the BCS and prior to acceptance of the facility. The BCS circuits include but are not limited to all copper and fiber optic(FO) entrance cables, termination equipment, copper and fiber backbone cable, copper and fiber horizontal distribution cable, and workstation outlets. Test in accordance with ANSI/EIA/TIA 568 standards. Use test instrumentation that meets or exceeds the standard. Submit the official test report to include test procedures, parameters tested, values, discrepancies and corrective actions in electronic format. Test and accomplish all necessary corrective actions to ensure that the government receives a fully operational, standards based, code compliant telecommunications system.

5.7.7. LIGHTNING PROTECTION SYSTEM: Provide a lightning protection system where recommended by the Lightning Risk Assessment of NFPA 780, Annex L.

5.8. HEATING, VENTILATING, AND AIR CONDITIONING

5.8.1. STANDARDS AND CODES: The HVAC system shall conform to APPLICABLE CRITERIA.

5.8.2. DESIGN CONDITIONS.

5.8.2.1. Outdoor and indoor design conditions shall be in accordance with UFC 3-410-01FA. Outdoor air and exhaust ventilation requirements for indoor air quality shall be in accordance with ASHRAE 62.1. All Buildings with minimum LEED Silver requirement (or better) will earn LEED Credit EQ 7.1, Thermal Comfort-Design.

5.8.2.2. Design systems in geographical areas that meet the definition for high humidity in UFC 3-410-01FA in accordance with the special criteria for humid areas therein.

5.8.2.3. Cooling equipment may be oversized by up to 15 percent to account for recovery from night setback. Heating equipment may be oversized by up to 30 percent to account for recovery from night setback. Design single zone systems and multi-zone systems to maintain an indoor design condition of 50% relative humidity for cooling only. For heating only where the indoor relative humidity is expected to fall below 20% for extended periods, add humidification to increase the indoor relative humidity to 30%. Provide ventilation air from a separate dedicated air handling unit (DOAU) for facilities using multiple single zone fan-coil type HVAC systems. Do not condition outside air through fan coil units. Avoid the use of direct expansion cooling coils in air handling units with constant running fans that handle outside air.

5.8.2.4. Locate all equipment so that service, adjustment and replacement of controls or internal components are readily accessible for easy maintenance.

5.8.2.5. Environmental Requirements for Telecommunications Rooms,(including SIPRNET ROOMS, where applicable for specific facility type). Comply with ANSI/EIA/TIA 569 and the I3A.

5.8.2.6. Fire dampers: dynamic type with a dynamic rating suitable for the maximum air velocity and pressure differential to which the damper is subjected. Test each fire damper with the air handling and distribution system running.

5.8.3. BUILDING AUTOMATION SYSTEM. Provide a Building Automation System consisting of a building control network , and integrate the building control network into the UMCS as specified.

The building control network shall be a single complete non-proprietary Direct Digital Control (DDC) system for control of the heating, ventilating and air conditioning (HVAC) systems as specified herein. The building control network shall be an Open implementation of LONWORKS® technology using ANSI/EIA 709.1B as the only communications protocol and use only LonMark Standard Network Variable Types (SNVTs), as defined in the LonMark® Resource Files, for communication between DDC Hardware devices to allow multi-vendor interoperability.

5.8.3.1. The building automation system shall be open in that it is designed and installed such that the Government or its agents are able to perform repair, replacement, upgrades, and expansions of the system without further dependence on the original Contractor. This includes, but is not limited to the following:

(a) Install hardware such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.

(b) Necessary documentation (including rights to documentation and data), configuration information, configuration tools, programs, drivers, and other software shall be licensed to and otherwise remain with the Government such that the Government or its agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

5.8.3.2. All DDC Hardware shall:

(a) Be connected to a TP/FT-10 ANSI/EIA 709.3 control network.

(b) Communicate over the control network via ANSI/EIA 709.1B exclusively.

(c) Communicate with other DDC hardware using only SNVTs

(d) Conform to the LonMark® Interoperability Guidelines.

(e) Be locally powered; link power (over the control network) is not acceptable.

(f) Be fully configurable via standard or user-defined configuration parameter types (SCPT or UCPT), standard network variable type (SNVT) network configuration inputs (*nci*), or hardware settings on the controller itself to support the application. All settings and parameters used by the application shall be configurable via standard or user-defined configuration parameter types (SCPT or UCPT), standard network variable type (SNVT) network configuration inputs (*nci*), or hardware settings on the controller itself

(g) Provide input and output SNVTs required to support monitoring and control (including but not limited to scheduling, alarming, trending and overrides) of the application. Required SNVTs include but are not limited to: SNVT outputs for all hardware I/O, SNVT outputs for all setpoints and SNVT inputs for override of setpoints.

(h) To the greatest extent practical, not rely on the control network to perform the application..

5.8.3.3. Controllers shall be Application Specific Controllers whenever an ASC suitable for the application exists. When an ASC suitable for the application does not exist use programmable controllers or multiple application specific controllers.

5.8.3.4. Application Specific Controllers shall be LonMark Certified whenever a LonMark Certified ASC suitable for the application exists. For example, VAV controllers must be LonMark certified.

5.8.3.5. Application Specific Controllers (ASCs) shall be configurable via an LNS plug-in whenever t an ASC with an LNS plug-in suitable for the application exists.

5.8.3.6. Each scheduled system shall accept a network variable of type SNVT_occupancy and shall use this network variable to determine the occupancy mode. If the system has not received a value to this network variable for more than 60 minutes it shall default to a configured occupancy schedule.

5.8.3.7. Gateways may be used provided that each gateway communicates with and performs protocol translation for control hardware controlling one and only one package unit.

5.8.3.8. Not Used

5.8.3.9. Perform all necessary actions needed to fully integrate the building control system. These actions include but are not limited to:

- Configure M&C Software functionality including: graphical pages for System Graphic Displays including overrides, alarm handling, scheduling, trends for critical values needing long-term or permanent monitoring via trends, and demand limiting.
- Install IP routers or ANSI/CEA-852 routers as needed to connect the building control network to the UMCS IP network. Routers shall be capable of configuration via DHCP and use of an ANSI/CEA-852 configuration server but shall not rely on these services for configuration. All communication between the UMCS and building networks shall be via the ANSI/CEA-709.1B protocol over the IP network in accordance with ANSI/CEA-852.

5.8.3.10. Provide the following to the Government for review prior to acceptance of the system:

- The latest version of all software and user manuals required to program, configure and operate the system.
- Points Schedule drawing that shows every DDC Hardware device. The Points Schedule shall contain the following information as a minimum:
 - Device address and NodeID.
 - Input and Output SNVTs including SNVT Name, Type and Description.
 - Hardware I/O, including Type (AI, AO, BI, BO) and Description.
 - Alarm information including alarm limits and SNVT information.
 - Supervisory control information including SNVTs for trending and overrides.
 - Configuration parameters (for devices without LNS plug-ins) Example Points Schedules are available at <https://eko.usace.army.mil/fa/besc/>
- Riser diagram of the network showing all network cabling and hardware. Label hardware with ANSI.CEA-709.1 addresses, IP addresses, and network names.
- Control System Schematic diagram and Sequence of Operation for each HVAC system.
- Operation and Maintenance Instructions including procedures for system start-up, operation and shut-down, a routine maintenance checklist, and a qualified service organization list.
- LONWORKS® Network Services (LNS®) database for the completed system.
- Quality Control (QC) checklist (below) completed by the Contractor's Chief Quality Control (QC)

Representative

Table 5-1: QC Checklist

| Instructions: Initial each item, sign and date verifying that the requirements have been met. | | |
|--|---|----------|
| # | Description | Initials |
| 1 | All DDC Hardware is installed on a TP/FT-10 local control bus. | |
| 2 | Communication between DDC Hardware is only via EIA 709.1B using SNVTs. Other protocols and network variables other than SNVTs have not been used. | |
| 3 | All sequences are performed using DDC Hardware. | |
| 4 | LNS Database is up-to-date and accurately represents the final installed system | |
| 5 | All software has been licensed to the Government | |
| 6 | M&C software monitoring displays have been created for all building systems, including all override and display points indicated on Points Schedule drawings. | |
| 7 | Final As-built Drawings accurately represent the final installed system. | |
| 8 | O&M Instructions have been completed and submitted. | |
| 9 | Connections between the UMCS IP network and ANSI/CEA-709.1B building networks are through ANSI/CEA-852 Routers. | |
| By signing below I verify that all requirements of the contract, including but not limited to the above, been met. | | |
| Signature: _____ Date: _____ | | |

5.8.3.11. Perform a Performance Verification Test (PVT) under Government supervision prior to system acceptance. During the PVT demonstrate that the system performs as specified, including but not limited to demonstrating that the system is Open and correctly performs the Sequences of Operation.

5.8.3.12. Provide a 1 year unconditional warranty on the installed system and on all service call work. The warranty shall include labor and material necessary to restore the equipment involved in the initial service call to a fully operable condition.

5.8.3.13. Provide training at the project site on the installed building system Upon completion of this training each student, using appropriate documentation, should be able to start the system, operate the system, recover the system after a failure, perform routine maintenance and describe the specific hardware, architecture and operation of the system.

5.8.4. TESTING, ADJUSTING AND BALANCING. Test and balance air and hydronic systems, using a firm certified for testing and balancing by the Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or the Testing Adjusting, and Balancing Bureau (TABB). The prime contractor shall hire the TAB firm directly, not through a subcontractor. Perform TAB in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB TABES, or SMACNA HVACTAB unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. Use the provisions of the TAB Standard, including checklists, report forms, etc., as nearly as practicable to satisfy the Contract requirements. Use the TAB Standard for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, adhere to the manufacturer's recommendations. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, the TAB Specialist shall develop TAB procedures. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements are mandatory.

5.8.5. COMMISSIONING: Commission all HVAC systems and equipment, including controls, and all systems requiring commissioning for LEED Enhanced commissioning, in accordance with ASHRAE Guideline 1.1, ASHRAE Guideline 0 and LEED. Do not use the sampling techniques discussed in ASHRAE Guideline 1.1 and in ASHRAE Guideline 0. Commission 100% of the HVAC controls and equipment. Hire the Commissioning Authority (CA), certified as a CA by AABC, NEBB, or TABB, as described in Guideline 1.1. The CA will be an independent

subcontractor and not an employee of the Contractor nor an employee or subcontractor of any other subcontractor on this project, including the design professionals (i.e., the DOR or their firm(s)). The CA will communicate and report directly to the Government in execution of commissioning activities. The Contracting Officer's Representative will act as the Owner's representative in performance of duties spelled out under OWNER in Annex F of ASHRAE Guideline 0. All buildings with Minimum LEED Silver (or better) requirement will earn LEED Credit EA3 Enhanced Commissioning.

5.9. ENERGY CONSERVATION

5.9.1. The building including the building envelope, HVAC systems, service water heating, power, and lighting systems shall meet the Mandatory Provisions and the Prescriptive Path requirements of ASHRAE 90.1. Substantiation requirements are defined in Section 01 33 16, Design After Award.

5.9.2. Design all building systems and elements to meet the minimum requirements of ANSI/ASHRAE/IESNA 90.1. Design the buildings, including the building envelope, HVAC systems, service water heating, power, and lighting systems to achieve an energy consumption that is at least 40% below the consumption of a baseline building meeting the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1. Energy calculation methodologies and substantiation requirements are defined in Section 01 33 16, Design After Award.

5.9.3. Purchase Energy Star products, except use FEMP designated products where FEMP is applicable to the type product. The term "Energy Star product" means a product that is rated for energy efficiency under an Energy Star program. The term "FEMP designated product" means a product that is designated under the Federal Energy Management Program of the Department of Energy as being among the highest 25 percent of equivalent products for energy efficiency. When selecting integral sized electric motors, choose NEMA PREMIUM type motors that conform to NEMA MG 1, minimum Class F insulation system. Motors with efficiencies lower than the NEMA PREMIUM standard may only be used in unique applications that require a high constant torque speed ratio (e.g., inverter duty or vector duty type motors that conform to NEMA MG 1, Part 30 or Part 31).

5.9.4. Solar Hot Water Heating. Provide at least 30% of the domestic hot water requirements through solar heating methodologies, unless the results of a Life Cycle Cost Analysis (LCCA) developed utilizing the Building Life Cycle Cost Program (BLCC) which demonstrates that the solar hot water system is not life cycle cost effective in comparison with other hot water heating systems. The type of system will be established during the contract or task order competition and award phase, including submission of an LCCA for government evaluation to justify non-selection of solar hot water heating. The LCCA uses a study period of 25 years and the Appendix K utility cost information. The LCCA shall include life cycle cost comparisons to a baseline system to provide domestic hot water without solar components, analyzing at least three different methodologies for providing solar hot water to compare against the baseline system.

5.9.5. Process Water Conservation. When potable water is used to improve a building's energy efficiency, employ lifecycle cost effective water conservation measures, except where precluded by other project requirements.

5.9.6. Renewable Energy Features. The Government's goal is to implement on-site renewable energy generation for Government use when lifecycle cost effective. See Paragraph 6, PROJECT SPECIFIC REQUIREMENTS for renewable energy requirements for this project.

5.10. FIRE PROTECTION

5.10.1. STANDARDS AND CODES Provide the fire protection system conforming to APPLICABLE CRITERIA.

5.10.2. Inspect and test all fire suppression equipment and systems, fire pumps, fire alarm and detection systems and mass notification systems in accordance with the applicable NFPA standards. The fire protection engineer of record shall witness final tests. The fire protection engineer of record shall certify that the equipment and systems are fully operational and meet the contract requirements. Two weeks prior to each final test, the contractor shall notify, in writing, the installation fire department and the installation public work representative of the test and invite them to witness the test.

5.10.3. Fire Extinguisher Cabinets: Provide fire extinguisher cabinets and locations for hanging portable fire extinguishers in accordance with NFPA 10 Standard for Portable Fire Extinguishers.

5.10.4. Fire alarm and detection system: Required fire alarm and detection systems shall be the addressable type. Fire alarm initiating devices, such as smoke detectors, heat detectors and manual pull stations shall be addressable. When the system is in alarm condition, the system shall annunciate the type and location of each alarm initiating device. Sprinkler water flow alarms shall be zoned by building and by floor. Supervisory alarm initiating devices, such as valve supervisory switches, fire pump running alarm, low-air pressure on dry sprinkler system, etc. shall be zoned by type and by room location.

5.10.5. Fire Protection Engineer Qualifications: In accordance with UFC 3-600-01, FIRE PROTECTION ENGINEERING FOR FACILITIES, the fire protection engineer of record shall be a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys (NCEES), or a registered P.E. in a related engineering discipline with a minimum of 5 years experience, dedicated to fire protection engineering that can be verified with documentation.

5.11. SUSTAINABLE DESIGN

5.11.1. STANDARDS AND CODES: Sustainable design shall conform to APPLICABLE CRITERIA. See paragraph 6, PROJECT-SPECIFIC REQUIREMENTS for which version of LEED applies to this project. The LEED-NC Application Guide for Multiple Buildings and On-Campus Building Projects (AGMBC) applies to all projects. Averaging may be used for LEED compliance as permitted by the AGMBC but is restricted to only those buildings included in this project. Each building must individually comply with the requirements of paragraphs ENERGY CONSERVATION and BUILDING WATER USE REDUCTION.

5.11.2. LEED RATING, REGISTRATION, VALIDATION AND CERTIFICATION: See Paragraph PROJECT-SPECIFIC REQUIREMENTS for project minimum LEED rating/achievement level, for facilities that are exempt from the minimum LEED rating, for LEED registration and LEED certification requirements and for other project-specific information and requirements.

5.11.2.1. Innovation and Design Credits. LEED Innovation and Design (ID) credits are acceptable only if they are supported by formal written approval by GBCI (either published in USGBC Innovation and Design Credit Catalog or accompanied by a formal ruling from GBCI). LEED ID credits that require any Owner actions or commitments are acceptable only when Owner commitment is indicated in paragraph PROJECT-SPECIFIC REQUIREMENTS or Appendix LEED Project Credit Guidance

5.11.3. OPTIMIZE ENERGY PERFORMANCE. : Project must earn, as a minimum, the points associated with compliance with paragraph ENERGY CONSERVATION. LEED documentation differs from documentation requirements for paragraph ENERGY CONSERVATION and both must be provided. For LEED-NC v2.2 projects you may substitute ASHRAE 90.1 2007 Appendix G in its entirety for ASHRAE 90.1 2004 in accordance with USGBC Credit Interpretation Ruling dated 4/23/2008.

5.11.4. COMMISSIONING. See paragraph 5.8.5 COMMISSIONING for commissioning requirements. USACE templates for the required Basis of Design document and Commissioning Plan documents are available at <http://en.sas.usace.army.mil> (click on Engineering Criteria) and may be used at Contractor's option.

5.11.5. DAYLIGHTING. Except where precluded by other project requirements, do the following in at least 75 percent of all spaces occupied for critical visual tasks: achieve a 2 percent glazing factor (calculated in accordance with LEED credit EQ8.1) OR earn LEED Daylighting credit, provide appropriate glare control and provide either automatic dimming controls or occupant-accessible manual lighting controls.

5.11.6. LOW-EMITTING MATERIALS. Except where precluded by other project requirements, use materials with low pollutant emissions, including but not limited to composite wood products, adhesives, sealants, interior paints and finishes, carpet systems and furnishings,

5.11.7. CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT. Except where precluded by other project requirements, earn LEED credit EQ 3.1 Construction IAQ Management Plan, During Construction and credit EQ 3.2 Construction IAQ Management Plan, Before Occupancy.

5.11.8. RECYCLED CONTENT. In addition to complying with section RECYCLED/RECOVERED MATERIALS, earn LEED credit MR4.1, Recycled Content, 10 percent except where precluded by other project requirements.

5.11.9. **BIOBASED AND ENVIRONMENTALLY PREFERABLE PRODUCTS.** Except where precluded by other project requirements, use materials with biobased content, materials with rapidly renewable content, FSC certified wood products and products that have a lesser or reduced effect on human health and the environment over their lifecycle to the maximum extent practicable.

5.11.10. **FEDERAL BIOBASED PRODUCTS PREFERRED PROCUREMENT PROGRAM (FB4P).** The Farm Security and Rural Investment Act (FSRIA) of 2002 required the U.S. Department of Agriculture (USDA) to create procurement preferences for biobased products that are applicable to all federal procurement (to designate products for biobased content). For all designated products that are used in this project, meet USDA biobased content rules for them except use of a designated product with USDA biobased content is not required if the biobased product (a) is not available within a reasonable time, (b) fails to meet performance standard or (c) is available only at an unreasonable price. For biobased content product designations, see <http://www.biopreferred.gov/ProposedAndFinalItemDesignations.aspx>.

5.12. **CONSTRUCTION AND DEMOLITION (C&D) WASTE MANAGEMENT:** Achievement of 50% diversion, by weight, of all non-hazardous C&D waste debris is required. Reuse of excess soils, recycling of vegetation, alternative daily cover, and wood to energy are not considered diversion in this context, however the Contractor must track and report it. A waste management plan and waste diversion reports are required, as detailed in Section 01 57 20.00 10, ENVIRONMENTAL PROTECTION.

5.13. **SECURITY (ANTI-TERRORISM STANDARDS):** Unless otherwise specified in Project Specific Requirements, only the minimum protective measures as specified by the current Department of Defense Minimum Antiterrorism Standards for Buildings, UFC 4-010-01, are required for this project. The element of those standards that has the most significant impact on project planning is providing protection against explosives effects. That protection can either be achieved using conventional construction (including specific window requirements) in conjunction with establishing relatively large standoff distances to parking, roadways, and installation perimeters or through building hardening, which will allow lesser standoff distances. Even with the latter, the minimum standoff distances cannot be encroached upon. These setbacks will establish the maximum buildable area. All standards in Appendix B of UFC 4-010-01 must be followed and as many of the recommendations in Appendix C that can reasonably be accommodated should be included. The facility requirements listed in these specifications assume that the minimum standoff distances can be met, permitting conventional construction. Lesser standoff distances (with specific minimums) are not desired, however can be provided, but will require structural hardening for the building. See Project Specific Requirements for project specific siting constraints. The following list highlights the major points but the detailed requirements as presented in Appendix B of UFC 4-010-01 must be followed.

- (a) Standoff distance from roads, parking and installation perimeter; and/or structural blast mitigation
- (b) Blast resistant windows and skylights, including glazing, frames, anchors, and supports
- (c) Progressive collapse resistance for all facilities 3 stories or higher
- (d) Mass notification system (shall also conform to UFC 4-021-01, Mass Notification Systems)
- (e) For facilities with mailrooms (see paragraph 3 for applicability) – mailrooms have separate HVAC systems and are sealed from rest of building

6.0 PROJECT SPECIFIC REQUIREMENTS

6.1. GENERAL

The requirements of this paragraph augment the requirements indicated in Paragraphs 3 through 5.

6.2. APPROVED DEVIATIONS

The following are approved deviations from the requirements stated in Paragraphs 3 through 5 that only apply to this project.

6.2.1 Reference Paragraph 3.6.2.2 The Warehouse Storage area will be heated and ventilated but not air-conditioned.

6.2.2 LEED version 2.2 has been replaced with LEED version 3.0. The contractor shall be required to use LEED 3.0 to meet all LEED requirements of this RFP. LEED version 3.0 shall be used as the replacement for all references to LEED version 2.2 within this RFP.

6.2.3 Reference Spec Section 01 10 00, Paragraph 5.8.4. Paragraph to include test and balance for Domestic Hot Water systems, Renewable Energy Systems, and other systems prescribed under LEED commissioning using a firm meeting the requirements listed in paragraph 5.8.4. Testing, Adjusting, and Balancing.

6.2.4 Energy Policy Act (2005) Requirement - The building, including the building envelope, HVAC systems, service water heating, power, and lighting systems shall be designed to achieve an energy consumption that is at least 30% below the consumption of a baseline building meeting the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1-2004.

6.3. SITE PLANNING AND DESIGN

6.3.1. General:

Coordinate access to the Installation with the Contracting Officer. The Contractor shall coordinate with Installation Security if access to the site is modified based on the FPCON level at the Installation.

6.3.1.1 Site Description: The project site is bounded on the north by a railroad spur serving the warehouse district, on the east by an adjacent warehouse, Building 2565, on the west by a steep wooded area, and on the south by Ordnance Avenue (Appendix J).

The project building site is approximately 1.9 acres and utility extensions are expected to impact an additional 2.1 acres. The site is currently developed with an 18,280 square foot warehouse, Building 2563, which will be demolished (superstructure only) under a separate contract. The existing site has a gravel parking area on the west side, a gravel access drive along the north side, and a paved area on the east side that abuts the Building 2565 improvements. This paved area serves as an access drive across the railroad spur, and also provides forklift access between the two warehouses. Work shall be completed in a manner that does not impact the use of the railroad spur or limits emergency access at the railroad crossing. Work in or near the railroad ROW shall be coordinated with the DPW, Ops (POC, Terry Collins (573) 596-6340 or Cell (573) 855-1961).

Access to the Building 2565 loading dock shall be provided in the project design.

6.3.1.2 Utility Coordination: Prior to the commencement of construction, the Contractor shall verify utility locations, utility extension requirements and conduct utility coordination meetings with the Contracting Officer, Fort Leonard Wood utility personnel, and private utility service providers. The Contractor shall identify all utility lines impacted by the project construction and coordinate the proposed work with the each utility. Utility coordination shall identify the proposed method of maintaining service to existing facilities during construction.

6.3.1.3 Utility Road Crossings: When utilities are required to cross streets, the Installation standard street cut detail shows 6" compacted subgrade under pavement. Street trenches shall be patched using compacted crushed rock overlaid with six inches of concrete. The concrete patch shall span the trench plus two feet of undisturbed soil/base

course on each side of the trench. Cuts in Ordnance Avenue, First Street, and Replacement Avenue are not allowed, utility crossings shall be bored or jacked. Coordinate utility road crossings and tie in points with the Contracting Officer.

6.3.1.4 Tree Removal: Mature trees shall be preserved to the greatest extent possible. Trees which will be disturbed or require removal shall be identified and submitted by the Contractor to the FLW Environmental for their review. Tree removal may occur between the dates of November 1st and March 31st. In the event that tree removal is required outside of the stated dates, the FLW Environmental will survey the potentially affected trees to determine if there is any active roosting of the Indiana Gray Bat.

6.3.2. Site Structures and Amenities

6.3.2.1 POV Parking: 20 POV parking spaces, including designated spaces for 1-handicap accessible and 1-alternative fuel vehicle, shall be included in the design. Parking lot surfaces shall not exceed 4% maximum grade.

6.3.2.2 POL Storage Area: Storage area requires secondary containment with a lockable drain valve that is sloped to drain by gravity. Storage area shall be secured by a structure that meets or exceeds FE-6 standard fence requirements.

6.3.2.3 Fire Water Pump: Fire pumps providing service to Building 2563 shall be located outside the building structure. Pumps shall be housed in a frost-free enclosure and provide access for maintenance, repair and replacement.

6.3.2.4 A bollard shall be placed at each side of the overhead entry doors at the ends of the building (not the loading docks). Bollards shall be painted nutmeg brown.

6.3.2.5 Door stops with latching devices that can keep the doors propped open shall be provided on each standard entry door. If a pole stop is utilized, it shall be painted nutmeg brown.

6.3.3. Site Functional Requirements:

6.3.3.1. Stormwater Management (SWM) Systems.

Storm drains and appurtenant structures shall be designed and constructed in accordance with TM 5-820-4 Drainage for Areas Other than Airfields. Stormwater management systems combining conventional collection and conveyance components, an infiltration bio-swale, an exfiltration discharge trench, and an engineered rain garden area may be required. Both the bio-swale and rain garden components include infiltration sub-drainage layers that may utilize concrete rubble from the demolition of the existing warehouse foundation. Stormwater management system shall be based on a 10 year 24 hour storm frequency, using the NRCS method. Erosion both on site and off site due to construction shall be addressed.

6.3.3.2. Erosion and Sediment Control

Construction site storm water runoff shall be controlled and erosion and sedimentation control Best Management Practices (BMPs) shall be designed in compliance with Missouri Department of Natural Resources (MDNR) and National Pollutant Discharge Elimination System (NPDES) requirements. All erosion and sediment measures and other protective measures shall be maintained by the Contractor, at the Contractor's expense, in effective operating condition. All temporary structural practices shall be removed once the corresponding disturbed drainage area has been permanently stabilized. The Contractor is required to obtain an NPDES permit in accordance with MDNR following approval of the application by DPW Environmental.

6.3.3.3. Vehicular Circulation.

a. Tracking of mud from the construction site onto adjacent roads and parking areas shall be kept to a minimum. A temporary, stabilized stone pad shall be constructed at points where vehicular traffic will be leaving the construction site and moving directly onto a paved road or street. The entrance shall be maintained in a condition which will prevent tracking or flow of mud onto adjacent roads or streets. If conditions on the site are such that the majority of the mud is not removed by the vehicles traveling over the stone, then the tires of the vehicles shall be washed

before entering the road or street. Any mud which is tracked onto roads or streets shall be removed at least once daily.

b. The Contractor shall identify proposed access and truck routes on the contract drawings.

c. The construction of an adjacent structure, located on the south side of Ordnance is anticipated during the same timeframe as the Warehouse Contract. The Contractor shall coordinate construction activities so as they do not adversely impact the adjacent construction, Installation activities, and/or traffic circulation.

6.4. SITE ENGINEERING

6.4.1. Existing Topographical Conditions

The site has a considerable amount of relief with approximately 30 feet of fall from a highpoint on the east side to a low point on the west side of the site. The eastern half of the site slopes approximately 2% from west to east in the area around the existing warehouse and then falls off at approximately 8% to 10% on the western half. Currently, site runoff is collected in a road side ditch along Ordnance Avenue and in a shallow swale adjacent to the railroad spur. Both channels flow through culverts under an adjacent service drive then discharge into a tributary of the Big Piney River. The existing building does not have positive drainage along the east side and stormwater has previously entered the building near the northeast corner.

A three dimensional digital topographic and utility survey for this site has been prepared by the Government and is included as a part of this contract. Any discrepancies which are found in the Government furnished survey shall be brought to the immediate attention of the Government for clarification.

6.4.2. Existing Geotechnical conditions: See Appendix A for a preliminary geotechnical report.

See Appendix A for the preliminary geotechnical report.

6.4.3. Fire Flow Tests See Appendix D for results of fire flow tests to use for basis of design for fire flow and domestic water supply requirements.

The water distribution system is operated by the FLW DPW. General fire protection criteria and requirements for the facility are provided in UFC 3-600-01, Fire Protection Engineering for Facilities. Hydrants shall be located per UFC, NFPA, and other applicable codes listed in paragraph 4.

The Contractor shall provide fire protection for the facility. Fire Hydrants shall be Mueller Super Centurion Fire Hydrants, or approved equal, with 5 ¼ inch main value opening three-way (two hose nozzles and one pumper nozzle). The contractor shall install fire hydrant meeting manufacturer/NFPA standards and provide a fire water flow test data in accordance of NFPA. Fire hydrants shall be painted Nutmeg Brown and the brim of bonnets shall have flow marking IAW NFPA 291 using reflective marine tape. Hydrants located adjacent to parking areas or other vehicle traffic areas, must be protected by bollards. The bollards must be located so they are not directly in front of an outlet.

6.4.4. Pavement Engineering and Traffic Estimates:

The Contractor shall be responsible for determining the specific traffic requirements for loading areas and parking lots required to support passenger vehicles, commercial trucks and service equipment such as forklifts. The Contractor shall be responsible for determining the specific vehicles, traffic loads, and traffic volumes for each street and parking lot, except as otherwise specified. The Contractor's geotechnical report shall contain both flexible and rigid pavement design(s) including design CBR, modulus of subgrade reaction and required subgrade compaction criteria.

6.4.4.1 Section Thicknesses: The pavement design section thickness shall conform to the specified requirements, except that the pavement design shall not be less than the following minimum requirements:

a. Hot Mix Asphalt: Regardless of the pavement design, a minimum flexible pavement section shall consist of at least 4-inches of asphalt concrete pavement, on 4-inches of aggregate base course, on 4-inches of aggregate subbase. The compacted thickness for each lift of asphalt concrete pavement shall be between 2 to 3-inches.

b. Portland Cement Concrete: Regardless of the pavement design, a minimum rigid concrete pavement section for areas required to support trucks and cargo trailers, tracked vehicles, and organizational vehicles and equipment traffic shall consist of at least 8-inches of rigid concrete pavement, on 4-inches of aggregate base course, on 4-inches of aggregate subbase. The minimum rigid concrete pavement design for areas required to support passenger automobile traffic shall consist of at least 6-inches of rigid concrete pavement, on 4-inches of aggregate base course, on 4-inches of aggregate subbase.

6.4.4.2 Traffic Type and Material: Pavements for areas required to support trucks and cargo trailers, tracked vehicles, and organizational vehicles and equipment traffic shall be Portland cement concrete (PCC), except as otherwise specified or directed. Pavements for areas required to support passenger automobile traffic may be hot mix asphalt concrete (HMA) or Portland cement concrete (PCC), except as otherwise specified or directed.

6.4.4.3 Underdrainage: Design and construct an underdrain system for rigid PCC pavement over cohesive soil subgrade and all pavements in areas with high water tables. A properly designed geotextile filter fabric shall serve as a separation layer under the underdrain system. The geotextile separation layer prevents pumping of soil fines into the underdrain system.

6.4.4.4 Subgrade: Pavement subgrades shall conform to the materials and pavement design recommendations for this project as outlined in the baseline geotechnical report and verified by the Contractor's final geotechnical report and design. The subgrade surface for aggregate and paved surfaces subject to vehicular traffic shall be prepared and compacted. The site may include a low permeable clay subgrade, and is in an area subject to frost design conditions. Provide adequate drainage of the subgrade surface and aggregate courses. Grade and slope subgrade surfaces to ensure drainage of the subgrade surface. For areas with cohesive subgrade soils, lime modify at least the top 8-inches of subgrade, except as otherwise specified. When lime-modifying subgrade soils, evaluate the soils for soluble sulfate content in accordance with AASHTO T 290. If the soil contains soluble sulfates greater than 300 mg/kg, do not perform lime-modification. When soluble sulfate concentrations exceed 300 mg/kg, replace the top 8-inches of the subgrade with aggregate subbase materials (partial subgrade replacement).

6.4.4.5 Aggregate Subbase and Aggregate Base Course: Design and construct pavements on an aggregate base course underlain by a separation layer. The separation layer may consist of a subbase course or properly designed geotextile fabric. The separation layer prevents pumping of soil fines into the aggregate base course. Historically at this installation, a graded aggregate subbase course has been used as the separation course on the lime-modified subgrade.

6.4.4.6 Portland Cement Concrete Design Requirements:

a. Joint Layout and Spacing: Provide a concrete joint layout plan for all rigid concrete pavements. Show joint spacing and joint types. Pavement joint plan and joint details for Portland cement concrete pavements shall conform to UFC 3-250-01FA, or to MoDOT State Specifications and MoDOT standard details. The maximum joint spacing shall not exceed 15 feet. Pavement slabs shall not exceed a length to width ratio of 1.25 for non-reinforced slabs.

b. Joints Between Separate Features: Joints between exterior slab on grade pavements and vertical surfaces of buildings and other vertical construction shall be a full depth expansion joint. Joints between exterior slab on grade pavements and vertical surfaces of buildings at vehicle entrances to the buildings shall be a thickened edge expansion joint conforming to Figure 15-5b from UFC 3-250-01FA. Edges of pavement slabs abutting other rigid pavement areas shall be thickened edge expansion or thickened edge slip joints. Edges of pavement slabs abutting HMA pavement, or edges subject to traffic shall be thickened edge.

c. Reinforcement: Reinforce odd shaped slabs, slabs that are not square or rectangular, and slabs where the length to width ratio of the slab is 1.25 or more, with crack control steel reinforcement in accordance with UFC 3-250-01FA.

6.4.4.7 Materials and Construction Requirements:

a. General: Materials and construction shall conform to MoDOT State Specifications, 2004 edition and MoDOT Standard Details. Paragraphs pertaining to measurement and payment in the State Specifications shall not be used. References to State or Engineer in the State Specifications shall be understood to be the Contracting Officer. The Contractor shall be responsible for all materials sampling and testing required.

- b. Subgrade Preparation and Modification: Prepare and compact the subgrade in accordance with the Contractor's geotechnical report and MoDOT State Specification requirements. Lime modification of the subgrade soil shall conform to State Specification Section 205 SUBGRADE STABILIZATION. The amount of lime required varies depending on the plasticity index and gradation of the native subgrade soils. The hydrated lime addition rate will be at least 8 percent by weight based on the dry weight of the soil, or at least 6 percent by dry weight of soil if quicklime is used. If the lime-modification does not provide a stable subgrade, the top 8-inches of the subgrade soils shall be replaced in accordance with the requirements for partial subgrade replacement.
- c. Partial Subgrade Replacement: In areas where lime modification is determined to be impractical the Contractor may use partial subgrade replacement, subject to Contracting Officer's approval. Partial subgrade replacement involves the over-excavation of cohesive soils and replacement with non-cohesive granular materials. Use MoDOT Specification Section 303 ROCK BASE, except over-excavate a minimum of 8 inches instead of 18 inches. The finished surface shall be the subgrade surface and shall conform to MoDOT State Specification Section 209 SUBGRADE PREPARATION, and Section 210 SUBGRADE COMPACTION.
- d. Offset Requirements: Extend each course of the pavement structure and the modified subgrade layer at least 12 inches beyond the edge of the next overlying course in the pavement section. Where curb and gutters are used, extend the layers shall at least 12 inches beyond the back of curb and gutters.
- e. Underdrain System: Construct the underdrain system to conform to MoDOT State Specification Section 302 STABILIZED PERMEABLE BASE, and MoDOT Standard Details for underdrain systems. MoDOT Standard Drawing number 605.10H shows details for underdrain systems. If a geotextile filter fabric is proposed for use, verify that the geotextile is compatible with highly alkaline soil conditions.
- f. Base Course and Subbase Course Aggregates: Aggregate base courses and subbase courses shall conform to MoDOT Specification Section 304 AGGREGATE BASE COURSE. Aggregate base course shall conform to State specification Section 1007 AGGREGATE FOR BASE, Type 1. Aggregate subbase course shall conform to State specification Section 1007 AGGREGATE FOR BASE, Type 5.
- g. Surface Course Aggregates: Aggregate surfaced areas shall conform to MoDOT State Specifications Section 310 AGGREGATE SURFACE.
- h. Portland Cement Concrete Pavement: Portland cement concrete pavements and related work shall conform to State specification Division 500. All joints shall be cleaned and sealed with an elastomeric joint sealant.
- i. Hot Mix Asphalt Pavement: Asphalt concrete pavements and related work shall conform to MoDOT State Specification Division 400.

6.4.4.8 Exterior Equipment Pads: Any exterior mechanical or electrical equipment shall be installed on concrete pads. The pads shall be a minimum of 8 inches thick and shall be reinforced to adequately support the equipment load. The pads shall be 6 inches larger than the equipment being supported with chamfered edges. Design of exterior pads shall be coordinated with the mechanical and electrical system designs.

6.4.4.9 Guardrails and Bollards: Due to the proximity of the building to the Ordnance Avenue and probable need for retaining wall(s) around the parking lot, protection from vehicular traffic shall be provided. Protective devices shall be integrated into the landscape design as practicable.

6.4.5. Traffic Signage and Pavement Markings

Traffic signage and striping shall be provided for all parking areas. Signage and striping shall be designed in accordance with Appendix H and the Installation IDG. Parking areas shall be striped with non-reflectorized paint. Roads and streets shall be striped with reflectorized paint. Parking stalls shall be delineated with 4-inch wide white stripes.

6.4.6. Base Utility Information

Utilities available on site include sanitary sewer, water and power. Utility service connections will be required for each. Gas will need to be extended from 1st Street, an electric duct bank will be required to replace all or a portion

of an overhead power distribution system, and a communications duct bank will need to be extended from an existing communications shelter, Building 2102, on Replacement Avenue (Appendix J).

All non-metallic utilities, sanitary sewer, and storm drain line shall have #12 AWG TW (thermal-weather resistant) insulated, solid copper wire, installed with and 6 inches above the utility for the reception of a located transmitter signal. Construct test station with cap and with 36 inches of coiled wire. Marking tape shall be placed in trench 6 inches below finish grade.

Survey of As-Built Utility Lines: All proposed underground utility lines shall be located by the Contractor during installation utilizing survey equipment and methods. The Contractor shall survey pipe invert of gas, water, sanitary sewer, storm sewer, roof drains and culverts and top of duct bank of electrical power and communications lines. Storm drains and sanitary sewer lines shall be surveyed where pipes enter manholes and inlets. The inverts of all cleanouts and tees shall be surveyed. Inverts at each end of culverts shall be surveyed. Electrical power, communications gas and water lines shall be surveyed at all manholes, tees, valves, corners and changes in direction and at intervals along the line which will accurately depict the location of the line both horizontally and vertically (50-foot maximum interval). Survey accuracy shall meet or exceed National Map Standards for 1"=50' mapping. Survey shall be in Missouri State Plane Coordinate System North Zone. The horizontal and vertical control reference datum's shall be NAD 83 and NAVD 88 respectively.

Utilities shall be capable of incorporating wireless technologies.

Primary power distribution at Fort Leonard Wood is privatized utility that is operated by Laclede Electric Cooperative, Inc. (Laclede) under contract with the DPW. The Contractor shall be responsible for providing temporary power at the construction site per Section 01500. A utility sales agreement shall be reached with the Department of Public Works for the cost of the energy. Contact Laclede Electric directly for the installation of the temporary power meter. The expense of the temporary power meter shall be the contractor's responsibility. See section 6.9 for further site electrical requirements.

The potable water distribution system is operated by the DPW and is available at the site (Appendix J). Design and construction of follow the domestic water service shall be in accordance with the most current version of the FLW-DPW Water Construction Requirements as applicable. The Contractor shall coordinate the design of the domestic water with DPW, Ops (POC, Mr. Keith Pendleton (573) 596-0946).

Although domestic water is available on site, water pressure and volume are not adequate to serve the fire protection needs of the building. Consequently, a looped water main extension shall be designed and constructed to serve the warehouse district. A booster pump system shall be designed and constructed to serve the building.

A single water service entrance shall be provided for each building with a water meter, isolation valve and a double check type backflow preventer. The service assembly shall be located in a conditioned space and/or protected from freezing with electric heat tape. Coordinate water service piping installation to maintain clearances above and in front of electric panels.

a. Water Metering: The Contractor shall provide and install a Turbine Type water meter conforming to AWWA Class I, installed with a strainer. The main casing shall be bronze with stainless steel external fasteners. Registers shall be straight-threading type, permanently sealed and read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Isolation valves shall be provided to allow maintenance to be performed without shutting water off to the facility. Register type shall be an encoder type remote register designed in accordance with AWWA C707. Meters shall comply with the accuracy and capacity requirements of AWWA C701. The meter shall be wireless data transmission capable as well as have a continuous manual reading option. Water meter will be capable of at least hourly data logging and transmission and provide consumption data. Water meter will be configured to transmit at least daily even if no receiver for the data is currently available at the time of project acceptance. Contractor shall provide and install the raceway and wiring between the water meter and the DDC/BPOC Panel Conduct and provide fire hydrant tests preconstruction (for design analysis) and post construction (to verify sufficiency). Provide flow data to include static pressures, residual pressures, flow rates, date, time tests were conducted, and name of personnel conducting the fire hydrant flow tests on final drawings. Flow test in accordance with AWWA M17. The Contractor shall be responsible for the fire flow test data used in his design and construction. See Appendix C for FLW advanced water meter specifications.

b. Disinfection: The Contractor shall disinfect all new water lines and any remaining lines which do not remain fully

pressurized during construction or connection. The Contractor shall notify the Contracting Officer prior to disinfection of the water lines. Disinfection shall be in accordance with the American Water Works Association Standard AWWA C652 & C651 (except Calcium Hypochlorite shall not be used as a disinfection chemical in potable water systems) and shall not be considered complete until two consecutive days of bacteriological samples show no contamination. All bacteriological, lead and copper tests shall be performed by Environmental Protection Agency (EPA) certified laboratories. Copies of results of the analyses shall be forwarded by the Contractor, upon receipt to the Contracting Officer. The Design Analysis shall address the residual chlorine levels, system flushing and provide calculations.

c. Cathodic Protection: Ferrous fittings shall be cathodically protected in addition to coatings or wrappings. A cathodic protection system shall be designed by a NACE certified professional and shall include test stations.

Cathodic Protection for metallic piping shall have test station spacing shall not exceed 500 feet and be constructed of 4 inch diameter, 36 inch minimum long, PVC pipe with a threaded cap with a flush female square drive. Test stations, cleanouts and valve boxes shall have a concrete collar (4"x18"x18"minimum) or be in pavement. Include CP summary in the design analysis.

Where there is a conflict between UFC 3-230-10A and the State criteria, the State criteria shall be followed. The Contractor shall be responsible for protection of existing waterlines. If any potable waterlines are damaged during construction, the successful Contractor must immediately notify the Contracting Officer.

d. Extensions of water and sewer systems require submission of stamped design to MoDNR. Contractor shall notify and schedule Acceptance Testing so they may be witnessed by the FLW Fire & Emergency Services Fire Protection Inspector (POC, FLW Fire Department (573) 596-0886).

Sanitary sewer collection and treatment system is operated by the FLW DPW. Sanitary sewer is available at the site and will be connected at manhole number 1218 (Appendix J). Sanitary sewer lines shall be PVC. Provide cleanouts with 18"x 18"x4" minimum PCC collar. Cleanouts are normally located within five feet outside buildings. Manholes shall be constructed at changes in slope and grade and not more than 400 feet apart. As part of the scope of work for the utility design the Contractor shall provide total load to the receiving sanitary sewer manhole. The sewer design analysis executive summary will include the capacity of the system at the receiving manhole before construction, after construction of this contract and final state including existing and all facilities identified in this paragraph. Flows exceeding capacity shall be brought to the attention of the CO. Extensions of system require submission of stamped design through DPW-Environmental to MoDNR. Design and construction of the sanitary sewer service shall be in accordance with the most current version of the FLW-DPW Sewer Construction Requirements as they apply to the Warehouse site. The Contractor shall coordinate the design of the sanitary sewer with DPW, Ops (POC, Mr. Keith Pendleton (573) 596-0946).

The natural gas distribution system is a privatized utility that is operated by Omega Pipeline Company, LLC (Omega). The Contractor shall coordinate with DPW, Mechanical (POC, Mr. Earl Bivens (573) 596-0214) and Omega for gas service location and design. Omega will provide natural gas distribution from the PRV. Omega will provide service lines to the meter for the warehouse. Omega is responsible for the design, routing, tie-in, and installation of the exterior gas distribution system (up to and including the gas meter/regulator assembly). The Contractor is responsible for performing the piping connection to the meter outlet and shall provide all required piping and appurtenances downstream of the gas/regulator assembly and within the facility. The Contractor is responsible for coordinating gas utility information and design features (i.e. meter/regulator assembly characteristics and location, with Omega policies, standards, and specification requirements. The Contractor shall provide calculated heating loads, gas flow rates, and meter outlet pressure requirements to DPW and Omega for distribution system design purposes. The Contractor is not responsible for costs incurred for services provided by Omega. Omega will provide a pressure of 2 psi at the regulator outlet on the gas riser located outside the building. Higher outlet pressures shall be coordinated with Omega. The Contractor shall provide the secondary pressure regulator(s) to accommodate pressure requirements for all gas-fired equipment located within the buildings that are to be constructed by the Contractor. The Contractor shall provide the raceway and wiring (18 gauge 2-pair twisted/shield cable) from the Direct Digital Controls (DDC)/Building Point of Connection (BPOC) Panel out to the gas meter for the connection to the pulse reader. Omega Gas Company will make the actual connection at the gas meter reader. Omega's gas meters are compatible with the base Lonworks DDC control system. The DDC shall program into the BPOC that one pulse from the gas meter equals 100 cubic feet of gas to allow the DPW ability to read gas meters via the LAN. Firm gas exists at Fort Leonard Wood (Appendix J). See Appendix C for FLW advanced gas meter specifications.

The local cable television (CATV) company shall provide and install service cabling at the project site, terminating the cabling in the main communications room of the facility. Coordinate the site work and site/facility interfaces with the local cable company.

Provide 4 feet by 4 feet handhole a minimum of 10 feet from facility for vendor interface and cable entry into the building. Provide a 4-inch conduit from the handhole to a wall mounted enclosure inside the facility. The local Cable TV Company shall install the service coaxial CATV cables from the handhole through the 4-inch conduit to the wall mounted enclosure in the building's main communications room. See Paragraph 6.10.4 for additional requirements.

6.4.7. Cut and Fill

6.4.7.1 Grading:

Positive site drainage shall be provided for all areas and existing drainage ways shall be maintained and utilized to the extent possible. Drainage shall be directed away the facility. New paving areas shall be constructed such that storm water is directed off to the sides and not down the center of the paved area unless otherwise shown in the drawings. Drainage along new entrance drives shall be directed to ditches or swales. Provide culverts as necessary to continue drainage. Stockpile topsoil onsite for reuse onsite. Place additional topsoil as required to obtain a minimum depth of 3 inches.

6.4.7.2 Grades Away from Building:

a. Minimum of 5 percent for 10 feet. Contractor consideration shall be given to the use of area inlets, trench drains, culvert pipes, etc., to provide adequate drainage. An exception to this is for paved areas adjacent to buildings.

b. Maximum of 10 percent for 10 feet.

c. All walks and parking areas shall meet all accessibility grade requirements.

6.4.7.3 Adjustment of Existing Structures: All manholes, valve boxes, handholes or inlets of any nature within the project that do not conform to the new finish grade in either surfaced or unsurfaced areas shall be adjusted to the new finish grade. Where inlets, manholes, valve boxes, or handholes fall within a surfaced or unpaved roadway or parking, the existing frame and cover shall be removed and replaced with a heavy-duty frame and cover (minimum 375 lb.). The structure shall be adjusted as needed to fit the new conditions.

6.4.8. Borrow Material

Borrow material shall be obtained from an offsite location. Borrow material shall be free of contaminants and other unsuitable materials. Contractor shall provide analytical results as proof that borrow material is suitable and free of contaminants to the Contracting Officer.

6.4.9. Haul Routes and Staging Areas

See site plan (Appendix J) for project location. Proposed haul routes shall be submitted in writing by the Contractor and approved by the Contracting Officer prior to use. No disposal area is available on the installation. A construction and demolition waste diversion rate of 50% minimum is required. Disposal fees shall be the responsibility of the Contractor.

6.4.10. Clearing and Grubbing:

All non-paved areas within the development footprint will be cleared, grubbed, and the topsoil stripped and stockpiled. Existing trees located on the far west side of the site shall be preserved to the fullest extent possible. Tree removal shall be coordinated with FLW Environmental. All non-paved areas will be cleared, grubbed, and the topsoil stripped and stockpiled for use on the project site. No disposal sites are currently available within the Installation. All organic debris shall be removed and disposed of at an approved location outside the Installation.

6.4.11. Landscaping:

The conceptual plan assumes that all non-paved areas will generally be planted with native vegetation, and the stormwater management areas will be planted with low maintenance moisture tolerant species. Plantings shall consist of low maintenance plantings contained in defined planter beds. The planting of individual trees in turfed areas is not permitted. Vehicle access to all service yards and at-grade mechanical rooms shall be provided. Additional trees and shrubs may be planted in accordance with Appendix I.

The Contractor shall provide a Landscape Plan and construction as part of the design package. The Landscape Plan shall be designed to visually enhance the new facility with color, form and screening, while providing shade and windbreak for the parking area and building in as much as possible. Xeriscape plantings shall consist of low maintenance, low water plants appropriate to the region/installation. The use of berms to accent the building and plant beds is encouraged. Existing trees shall be protected and retained in as much as possible. Fort Leonard Wood has identified the specific requirements for trees, seeds and grasses that are appropriate for the region with minimal maintenance (Appendix I). All plantings should be coordinated with the FLW DPW, Environmental Division. Any coniferous plantings selected shall be discussed in the design analysis with respect to diseases particular to the region such as the Diplodia twig blight or Pinewilt disease. Furnished plant material shall be guaranteed to be in a vigorous growing condition for a minimum period of 12 months regardless of contract time period. Plant establishment period shall continue until 12 months from the BOD of the building.

6.4.12. Turf:

All areas disturbed by construction shall be seeded. Turf seed shall contain 50% turf fescue and 50% winter rye. Weed seed shall not exceed 1% by weight of the total mixture. Wet, moldy or otherwise damaged seed will be rejected. Prior to seeding, all surface soils shall be loosened to a minimum depth of three inches and broken up to fine, working textures suitable for seeding. Place additional topsoil on all disturbed areas as required to obtain a minimum depth of 3 inches. All newly turfed areas shall have a "starter" fertilizer applied at the recommended rate of the product. A soil test shall be made to determine any significant nutrient deficiencies or pH extremes, particularly in the areas near building foundations or in soil fill areas (submit FIO the test results to the COR). Seed shall be applied at the rate of 7 pounds per 1,000 square feet. Seeded areas shall be overlain with loose straw to control erosion and loss of seeded surface. Maintain turf by watering, weeding, and fertilizing as required to establish healthy, viable plantings.

6.4.13 Termite Treatment

The Contractor shall provide termite treatment with a 5 year warranty. The Contractor shall comply with 7 USC Section 136 for requirements on contractor's licensing, certification, and record keeping. The Contractor shall maintain daily records using Pest Management Maintenance Record, DD Form 1532-1 and submit copies of records when requested by the Contracting Officer.

Upon completion of this work, the Contractor shall submit the Pest Management Report, DD Form 1532 identifying the targeted pest(s), type of operation, brand name and pesticide manufacturer (including formulation, concentration or rate of application utilized). The Contractor shall confirm that final grading and landscaping installation will not disturb the treatment of the soil on the exterior sides of the foundation walls, grade beams or similar structures.

6.5. ARCHITECTURE

6.5.1. General: To the maximum extent possible within the contract cost limitation, the buildings shall conform to the look and feel of the architectural style and shall use the same colors as adjacent facilities as expressed herein. The Government will evaluate the extent to which the proposal is compatible with the architectural theme expressed in the RFP during the contract or task order competition. The first priority in order of importance is that the design provides comparable building mass, size, height, and configuration compared to the architectural theme expressed herein. The second priority is that design is providing compatible exterior skin appearance based upon façade, architectural character (period or style), exterior detailing, matching nearby and installation material/color pallets, as described herein.

6.5.2. Design

6.5.2.1. Appendix F is provided "For Information Only", to establish the desired site and architectural themes for the area. Appendix F identifies the desired project look and feel based on Fort Leonard Wood's Installation

Architectural Theme from existing and proposed adjacent building forms; i.e. building exterior skin, roof lines, delineation of entrances, proportions of fenestration in relation to elevations, shade and shadow effects, materials, textures, exterior color schemes, and organizational layout.

6.5.2.2. The design should address Fort Leonard Wood's identified preferences. Implement these preferences considering the following:

- (a) Achievable within the Construction Contract Cost Limitation (CCL)
- (b) Meets Milestones within Maximum Performance Duration.
- (c) Achieves Full Scope indentified in this Solicitation
- (d) Best Life-Cycle Cost Design
- (e) Meets the Specified Sustainable Design and LEED requirements
- (f) Complies with Energy Conservation Requirements Specified in this RFP.

6.5.2.3. Priority #1. Visual Compatibility: Facility Massing (Size, Height, Spacing, Architectural Theme, etc.) Exterior Aesthetic Considerations: The buildings massing, exterior functional aesthetics, and character shall create a comprehensive and harmonious blend of design features that are sympathetic to the style and context of the Installation. The Installation's intent for this area is:

This is a utilitarian type facility that will be located in the industrial / warehousing area of Fort Leonard Wood. The facilities architectural theme should reflect the same visual characteristics, the "look and feel" of an area together with the dominant features of those facilities.

6.5.2.4. Priority #2. Architectural Compatibility: Exterior Design Elements (Materials, Style, Construction Details, etc.) Roofs, Exterior Skin, and Windows & Door Fenestrations should promote a visually appealing compatibility with the desired character while not sacrificing the integrity and technical competency of building systems.

6.5.2.5. See Appendix F for exterior colors that apply to Architectural character at Fort Leonard Wood. The manufacturers and materials referenced are intended to establish color only, and are not intended to limit manufacturers and material selections.

6.5.2.6. Additional architectural requirements:

- (a) Install fall protection anchor points on all roofs with a slope greater than 2:12

See Section 01 10 00 Paragraph 3.4.5.3.

6.5.3. Programmable Electronic Key Card Access Systems:

Programmable key card systems are not applicable to this facility type.

Finish Hardware: In addition to the requirements of Section 01 10 00 Paragraph 3.0., the following requirements shall also apply.

- (1) Provide ANSI 626 (Satin Chromium plated on Brass or Bronze) or 630 (Stainless Steel).
- (2) The Main entrance door is considered a high traffic door. Provide a high quality door closing mechanism complying with BHMA A 156.4 with adequate strength to ensure safe and easy operation in a high-wind environment.
- (3) Key all doors individually, even if the doors lead to the same room. The mechanical, electrical, and communication rooms may be keyed alike, but the Installation encourages that they be keyed to the DCF-1. The cores for the mechanical electrical and communications rooms, if not keyed to the DCF-1, shall have a cylinder that is capable of receiving a Best Lock core. Provide four (4) keys for each lock. Provide master keys.

6.5.4. INTERIOR DESIGN

Acquisition and installation of furnishings will be provided by the Government. The Contractor shall provide design of furnishings throughout facilities as required by code, as indicated in the Scope of Work, or as necessary for complete function of the room or space. Furnishings shall be designed for compliance with ADAAG. Furniture materials and finishes shall be coordinated as described in Section 01 33 16, Design After Award, Structural Interior Design (SID) and Furniture, Fixtures and Equipment (FF&E) design.

(a) Acoustic ceiling tiles shall be two foot by two-foot Omni-directional mildew/moisture resistant units. Interior paint shall be semi-gloss in wet areas and flat in all other areas.

(b) For finish schedule, see Spec 01 10 00, Para 3.4.5.3 (Interior Finishes Table).

(c) GPW Storage Systems

The General Purpose Warehouse (GPW) storage capacity is defined as utilizing the width dimension of a standard pallet (4'-0" plus or minus inches) X clear height of structure (25'-0") X 2,208 linear feet of storage systems. The GPW will utilize a combination of three different storage systems. Two of the storage systems will be movable motorized systems structurally integrated into the building design and secured to the structural slab. These systems are contractor furnished and contractor installed. The third system is a Government Furnished, Government Installed, standard pallet rack system. The amount and extent usage of each system will be dependent upon the availability of funds and the proposal's best storage solution utilizing a combination of the three systems (reference conceptual building layout drawing in Appendix J).

Vertical Lift Module System: The module is basically a tower, 9'-0" wide by 10'-0" deep by 24'-0" high. The tower houses three separate vertical modules. The center module is an elevator and retrieval tray extractor. The system houses 52 trays with a storage capacity of 1080 pounds per tray. Module unit weight capacity is 36 tons. Provide at least one of these modules. The system shall have the following salient features;

- Bar coded systems that make it easy to track stored parts and equipment; programmable features that make it possible for more than one person to use the system at the same time.
- Prevent theft with proven security features including lockable units, keypad entry systems and remote access control.

Movable Motorized Storage System: This system has been describe by a number of different terms such as: movable shelving, high density shelving, mobile storage system, and movable aisle. The system shall have the following salient features;

- Bar coded systems that make it easy to track stored parts and equipment; programmable features that make it possible for more than one person to use the system at the same time, while accessing aisles independently. Increase efficiency with end cap and rotary shelves for frequently needed items.
- Incorporate drawers, shelves, bins, and racks to efficiently store parts and equipment of virtually any size or shape.
- Prevent theft with proven security features including lockable units, keypad entry systems and remote access control.
- Utilize a motorized system to provide access to individual racks and meet fire protection criteria.
- Are easily reconfigured when needs change.

This system should also be mounted on recessed rails in the floor slab. Ultimately this may be a mixed match of different systems custom configured to meet the many needs of Fort Leonard Woods. Logistics' Supply Division.

Fixed Pallet System: Fixed racks should only be utilized at each end of the movable system (accessed from one side only). Fixed shelving may also be incorporated as supplemental storage in available spaces outside the parameters of the movable storage systems (may not include fork lift area). Warehouse Area: Provide area for storage of goods on pallet racks. The Pallet Rack Storage System is a GFGI item. Coordinate with Government to provide suitable space, lighting and structural support for the system and to define detailed requirements. Provide

the detailed design layout necessary to purchase and install a complete Pallet Rack System that utilizes industry standard components and dimensions. The rack system shall take full advantage of the clear height specified for the warehouse area. System design is to be based on 48" wide X 40" deep X 48" high pallets weighing no more than 2,500 pounds each. Where possible use a standard 9'-3" module (108" open) shelf length. Provide at least two heavy duty (non-waterfall type) pallet supports per pallet space plus wire shelf decking. Provide sufficient rack depth for pallets so that they may be placed flush with the aisle beam face without overhanging on the back side. Install top shelves below the top of 240" high standard width uprights so that pallets at the end of a row will not accidentally slip off to the side. Pallet rack system design shall include a 4-inch (minimum) clear space between adjacent pallets and a 4-inch (minimum) clear space between the top of each pallet and the bottom of the shelf beam above it. Pallet rack system design shall be such that the top of the load on the top shelves shall be a minimum of 20 inches below the clear unobstructed height required in the warehouse. Assume that a fork lift with a 240" mast will be used to place and retrieve pallets. See Appendix FF.

Interior building signage requirements:

Provide interior signage as required by paragraph 5.3.5.5, and applicable codes and criteria. Signage must be coordinated through the Contracting Officer and the DPW.

6.6. STRUCTURAL DESIGN

6.6.1 GENERAL

Consider mission effectiveness, the most economical system in the locality, life-cycle economics, and space adaptability in choosing the structural systems. Space adaptability includes future reorganization or reallocation of space.

Analyze, design, and detail the building as a complete structural system. Design structural elements to preclude damage to finishes, partitions, and other frangible, nonstructural elements; to prevent impaired operability of moveable components; and to prevent cladding leakage and roof ponding. Limit deflections of structural members to the allowable of the applicable material standard, e.g. ACI, AISC, Brick Industry Association (BIA).

Consider climate conditions, high humidity, industrial atmosphere, saltwater exposure, or other adverse conditions when selecting the type of cement and admixtures used in concrete, the concrete cover on reinforcing steel, the coatings on structural members, expansion joints, the level of corrosion protection, and the structural systems. All concrete shall be a minimum of 3,000 psi and shall be reinforced. Place floor mounted mechanical and electrical equipment on a 4" minimum concrete pad.

In addition to gravity, seismic, and lateral loads, design ancillary building items, e.g. doors, window jambs and connections, overhead architectural features, equipment bracing, for the requirements of UFC 4-010-01, DOD Minimum Antiterrorism Standards for Buildings. Ensure and document that the design of glazed items includes, but is not limited to, the following items under the design loads prescribed in UFC 4-010-01:

- (a) Supporting members of glazed elements, e.g. window jamb, sill, header
- (b) Connections of glazed element to supporting members, e.g. window to header
- (c) Connections of supporting members to each other, e.g. header to jamb
- (d) Connections of supporting members to structural system, e.g. jamb to foundation

6.6.2 Applicable Standards, Codes, and Criteria

The structural design shall fully comply with the following listed criteria in addition to the provisions provided in Section 01 10 00 paragraph 4.0 Applicable Criteria. Use the latest edition of the International Building Code (IBC) for design guidance, and coordinate design with UFC 4-010-01. For buildings three stories and taller, design for progressive collapse in accordance with UFC 4-023-03, Design of Buildings to Resist Progressive Collapse.

6.6.3 Project Specific Design Loads:

6.6.3.1. Live loads shall be per the IBC but not lower than the minimums in paragraph 3.5 Structural Requirements.

6.6.3.2 Ground Snow: 20 psf

6.6.3.3. Wind Speed: 90 mph

6.6.3.4. Frost Penetration: 36 inches

6.6.3.5. Seismic Design Data: The mapped maximum considered earthquake (MCE) spectral response accelerations for site class B are:

S_s (at short periods) = 30 % g

S₁ (at 1-second period) = 12 % g.

The acceleration values identified are for the general location of the facility. Verify and use site specific criteria based on the final site location of the facility. Adjust site class per IBC to match specific site information in geotechnical report.

6.6.3.6 Antiterrorism/Force Protection loads and minimum requirements are per UFC 4-010-01. For design of structural components subjected to dynamic loads, the U.S. Army Corps of Engineers Protective Design Center (PDC) developed SBEDS, Single-Degree-of-Freedom Blast Effects Design Spreadsheets (SBEDS). SBEDS is available at the software tab of the PDC website.

6.6.4. Foundation

The foundation is site specific and must be designed upon known geotechnical considerations by an engineer knowledgeable of the local conditions, e.g. highly expansive soils, groundwater levels. Coordinate the need for a vapor barrier with the architectural floor finishes and requirements of the geotechnical report. All slab-on-grade to receive a coating (e.g. epoxy) or to receive an overlaying finish (e.g. carpet or tile), shall be underlain by a vapor barrier system with a minimum 10-mil polyethylene membrane.

6.6.5 Site Features - Retaining Walls/Bridges/etc.

Design site features, e.g. retaining walls, culverts, bridges, in accordance with the appropriate American Association of State Highway and Transportation Officials (AASHTO) criteria including AASHTO LRFD Bridge Design Specifications, AASHTO Standard Specifications for Highway Bridges, and AASHTO Guide Specifications for Design of Pedestrian Bridges. Consider operation and maintenance requirements, e.g. painting, mowing, inspecting, routine maintenance. Design site features to drain properly in order to meet loading assumptions.

6.6.6 Design Analysis

Computer generated calculations must identify the program name, source, and version. Provide input data, including loads, loading diagrams, node diagrams, and adequate documentation to illustrate the design. The schematic models used for input must show, as a minimum, nodes/joints, element/members, materials/properties, and all loadings, induced settlements/deflections, etc., and a list of load combinations. Results must include an output listing for maximum/minimum stresses/forces and deflections for each element and the reactions for each loading case and combination.

6.7. THERMAL PERFORMANCE

Moisture protection shall be considered by the Contractor. Protection from damage to flooring and wall finishes shall be taken into consideration when designing floor slabs and walls. This could be as simple as placing a vapor barrier under the floor slab, building wrap, or vapor barrier on the walls.

6.8. PLUMBING

6.8.1 CROSS CONNECTION CONTROL: All local site specific requirements for cross connection control/backflow prevention shall be followed. All facilities will be provided with an inlet water backflow prevention device, located at the 5' line of the building; additionally, potable water systems shall be protected from contamination by hydronic water and other industrial and mechanical systems (see fire protection codes and this RFP for backflow prevention for those systems) via a reduced pressure zone backflow preventer.

6.8.2 NATURAL GAS SUPPLY: FLW utility company, Omega delivers the 2 PSIG gas at the outlet of the last device/fitting at meter/regulator set assembly. Interior gas piping should continue to be 2 PSIG and inline regulators provided to reduce down at the manufacturer's inlet pressure recommendations. All interior regulators shall be vented to the outside IAW NFPA 54.

6.8.3 Domestic Water Piping: Ft Leonard Wood pipes corrode due to water hardness and other factors. Piping leaks have developed in less than 10 years after occupancy. Domestic piping design and installation shall conform to the conservative side of the recommendations of the Copper Development Association, which can be found at HYPERLINK "www.copper.org"www.copper.org. Water pipe velocities shall not exceed 5 fps for domestic cold water, 4 fps for domestic hot water below 140 degrees F and 2 fps for any domestic hot water at or above 140 degrees F. Long radius fittings shall be provided. Protrusions into the flow stream shall be minimized. Tube ends shall be properly reamed. Domestic circulation/recirculation pumps shall be selected to both meet and not exceed the design flow, i.e. care, including test adjust and balance, shall be provided to ensure that the actual installation of these pumps due not exceed the velocity specified above. Balancing valves or auto flow control valves shall be provided on all domestic hot water recirculation piping. Any automatic flush or water/soap dispensers must be hard-wired to the building. No battery-operated auto systems will be accepted.

6.8.4 EXTERIOR WATER PIPING FREEZE PROTECTION: Seasonally (not used in winter) utilized water supply piping shall detailed and installed for complete drain down and shall be provided with an interior or below grade isolation valve. Exposed water piping that is utilized year round shall be insulated and heat traced and protected with pipe jacketing to ensure that the piping will not freeze.

6.8.5 A floor drain must be provided in the Janitor's Closet.

6.8.6 Energy Conservation measures that are to be evaluated include domestic solar water heating, etc.

6.8.6.1 Domestic Water heating - 30% of domestic hot water must be from Solar systems if there is a payback within a 40-year life cycle cost analysis. High efficiency point-of-use instantaneous domestic hot water heaters are preferred for small hot water demand areas such as small restrooms (small is considered two lavatories or less.

6.8.6.2 Reduce potable water use for building sewage conveyance by 50 percent through the use of water conserving or non-potable water fixtures. This can be accomplished through the implementation of high-efficiency and very high efficiency toilets/urinals, rainwater harvesting/use, sensing low flow and very-low flow faucets, and other appropriate technologies.

6.8.7 Piping Materials

6.8.7.1 Plastic pipe (Schedule 40 PVC) shall be used for drainage and venting including under concrete slabs or inside buildings.

6.8.7.2 No cellular foam core piping is allowed.

6.8.7.3 CPVC and Type L (or above) copper shall be used for water supply above slabs. 6.8.7.4 Type K (copper) for water supply under slabs.

6.8.8 Wall Hydrants. Provide non-freeze wall hydrants on all building faces at no more than 100-foot intervals.

6.9. SITE ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

6.9.1 Medium Voltage Service Distribution

6.9.1.1 The power distribution is Privatized and maintained by Laclede Electric through contract with FLW DPW. Contract administrator shall be contacted during design through the Contracting Officer. See Appendix C for FLW advanced electric meter specifications.

a. Laclede Electric shall provide:

1) Primary service including transformer and pad.

- 2) Secondary conduits from the secondary section to 1-2 feet from that pad. Size to match design provided.
 - 3) Final connection of service conductors to transformer.
 - 4) Metering and enclosure rated to meet the EPACT Regulations.
 - 5) Final cost, for project, to DPW once Contractor's design is solid.
- b. FLW DPW shall provide:
- 1) Approval for location of transformer and pad.
 - 2) Gas and Electric rates for determining HVAC design parameters. I.e. most cost effective operating system. See Appendices for information available at time of bid.
 - 3) All payments to Laclede Electric.
 - 4) Site design approval related to utilities.
 - 5) Final cost statement, for project, to COE once Contractor's design is solid.
- c. Contracting Officer shall provide:
- 1) All coordination between Contractor and DPW.
 - 2) Payment to DPW for Electrical Utility cost, for project from project funds.
- d. Contractor shall provide:
- 1) Utility breakdown of NFPA 70 connected loads for transformer sizing. I.e: Lighting, receptacle, general, cooling, heating, etc. This is required 1 year before delivery of the utility transformer to the site due to ordering lead times. See Appendix C, Utility Connections for form.
 - 2) Size of secondary conduits and conductors with load breakdown information.
 - 3) Secondary conduits from the utility provided conduits to the facility service panel.
 - 4) Secondary cables to transformer with 15 feet extra cable for termination by Laclede.
 - 5) Proposed location of transformer for approval by DPW.

6.9.2 Underground 600V Distribution System

6.9.2.1 Contractor shall furnish and install an underground 600V class distribution system to provide power to all new facilities constructed by the requirements of this scope of work. The distribution system shall include but not be limited to 600V cable, manholes, pull boxes, duct bank, conduit, warning tape, and all accessories commonly used in 600V underground distribution. All distribution shall be routed underground from the low voltage side of pad mounted transformers through a duct bank, or direct buried conduit raceway system as required.

6.9.2.2 Provide exterior power, data, and control circuits as required for sump pumps, irrigation pumps, electrical and mechanical equipment, etc for this Contract.

6.9.2.3 Provide a green, insulated safety ground wire for all non-service feeders and branch circuits.

6.9.3 Conduits and Fittings

6.9.3.1 All exterior power and communication service conduits shall be 4" or larger PVC. Conduits installed above grade shall be rigid galvanized steel (RGS). Fittings for steel conduit shall be steel threaded or compression type. Screw, clamp or other type fittings are not acceptable.

6.9.3.2 Provide horizontally drilled (bored) cables with rigid galvanized steel (RGS) sleeve under roads. Roads may not be cut for utility installation without specific acceptance of the COE.

6.9.3.3 Provide all buried conduits and cables a minimum of 36" below finished grade or 24" below bottom of pavement. All buried cable shall be marked with warning tape installed 18" immediately below grade. Provide metal tracer mounted at conduits for GPS depth finding equipped with signal stations. Underground connections or splices are prohibited, except in boxes or manholes. Splices shall be in a self-draining, rodent-resistant box with a cover. Provide cover with appropriate labeling. Refer to FACILITY ELECTRICAL SYSTEMS for additional requirements.

6.9.3.4 Underground Splices: Underground connections or splices are prohibited, except in boxes or manholes. Splices shall be in a self-draining, rodent-resistant box with a cover. Provide cover with appropriate labeling.

6.9.4 Grounding: Refer to FACILITY ELECTRICAL SYSTEMS for additional requirements.

6.9.5 Luminaries and Accessories

6.9.5.1 Provide exterior lighting for the Warehouse in compliance with the recommendations of the Illumination Engineering Society of North America (IESNA). Exterior site and area lighting shall be metal halide HID type to meet Base standards. Exterior lighting shall include the parking areas, roadways, facility, and walkways. Design of lighting shall include 0.72 LLF maximum and 0.5 footcandle minimum values. Calculations for parking lot lighting shall be to obtain an IESNA Figure 22-21 recommended footcandle and ratios. Provide calculations for NFPA 101 foot-candle requirements to public way for compliance review as well.

6.9.5.2 Provide exterior luminaries for the complete with lamps and ballasts. Ballasts for High-Intensity-Discharge (HID) shall be constant wattage autotransformers (CWA) or regulator, high power-factor type. Provide single-lamp ballasts, which shall have a minimum starting temperature of minus 20 degrees C. HID ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 10,000 hours at the intended ambient temperature. Igniter case temperature shall not exceed 90 deg. C. Fluorescent fixtures if used outside shall have a minimum starting temperature of minus 20 degrees C and footcandle shall be calculated using 0.36 LLF.

6.9.5.3 Provide poles designed for wind loading of 100 miles per hour determined in accordance with AASHTO LTS-4 while supporting luminaries and all other appurtenances indicated. The effective projected areas of luminaries' and appurtenances used in calculations shall be specific for the actual products provided on each pole.

a. Non-wooden poles shall have hand hole having a minimum clear opening of 2.5 by 5 inches. Stainless steel captive screws shall secure handhole cover.

b. Aluminum Poles manufactured of corrosion resistant aluminum alloys conforming to AASHTO LTS-4 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3, 5) for cast alloys. Poles shall be seamless extruded or spun seamless type with minimum 0.188 inch wall thickness. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Tops of shafts shall be fitted with a cover. Base shall be anchor bolt mounted, made of cast 356-T6 aluminum alloy in accordance with ASTM B 108 and shall be machined to receive the lower end of shaft. Joint between shaft and base shall be welded. Base cover shall be cast 356-T6 aluminum alloy in accordance with ASTM B 108. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel. Aluminum poles and brackets for lightings shall have a dark anodic bronze finish to match fixtures and shall not be field painted. Manufacturer's standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes. Brackets and Supports shall comply with IEEE C136.3, IEEE C136.13 and IEEE C136.21 as applicable. Pole brackets shall be not less than 1¼-inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaries' provided, and brackets for use with one type of luminary shall be identical. Brackets for pole-mounted parking lights shall correctly position luminary no lower than mounting height indicated. Pole Foundations Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized in accordance with ASTM A 153/A 153M.

c. Provide ground rod at each pole location and bond equipment ground conductor to all metal parts.

d. Ordinance Ave. will be illuminated under separate contract. Coordinate parking lot and loading dock access points through COR.

6.9.6 Telecommunication Distribution (OSP)

6.9.6.1 Services for outside plant cabling, telecommunications and data are being furnished to the site from manhole 112A. Telecommunication system tie-in locations (telecommunication manholes) are identified on the drawings in appendix J. The general purpose warehouse will be connected through a new hand-hole (provided under separate contract) near the proposed warehouse to the nearest communications shelter (Building 2102). The installation of new system of manholes and 4-way underground duct bank will be required from Building 2102 to the handhole nearest to the project site (MH 112A).

6.9.6.2 Provide the telephone and data communications services from the facility to include but not be limited to the installation of all exterior cables, splice kits, handholes, manholes, conduit, duct bank systems and connections.

6.9.6.3 Provide communication duct banks as a minimum of a four-way configuration with 4" conduits along the street. From the last manhole along the street to the Main Facility on the range provide a minimum of a two-way duct bank configuration with 4" conduits is required. One conduit shall be provided with four 1-1/4 inch MaxCell innerduct throughout. All conduits shall be installed in concrete encased ductbank. When new "handholes" are required to meet I3A or for constructability they shall be provide as 6'x4'x6' minimum. From the main facility to secondary facilities, provide as indicated in the building plans.

6.9.6.4 Design from the demarcation location to the facility is the responsibility of the Contractor. Coordination of communication system minimum standards as well as final design, connections, routing, existing conditions and construction requirements shall be coordinated with the Fort Leonard Wood Network Enterprise Technology Command (NETC) through The Corps of Engineers Field representative.

6.9.6.5 See paragraph 6.10.3 for additional requirements.

6.9.7 Cable TV (CATV) Distribution

6.9.7.1 The local cable television (CATV) company shall provide and install service cabling throughout the project site and terminating in the main communications room of each facility. Coordinate the site work and site/facility interfaces with the local cable company.

6.9.7.2 Provide 4 feet by 4 feet handhole a minimum of 10 feet from facility for vendor interface and cable entry into the building. Provide a 4-inch conduit from the handhole to a wall mounted enclosure inside the facility. The local Cable TV Company shall install the service coaxial CATV cables from the handhole through the 4-inch conduit to the wall mounted enclosure in the building's main communications room.

6.9.7.3 See Paragraph 6.10.4 for additional requirements.

6.10. FACILITY ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

6.10.1 Power

6.10.1.1 Provide service power factor at 95% or better.

6.10.1.2 Provide 20% capacity for future expansion in all distribution.

6.10.1.3 Provide all 600V secondary service wiring as copper insulated conductors. Wire connectors of insulating material or solder less pressure connectors properly taped shall be utilized for all splices. Secondary service conductors shall be sized for the facility service and panel distribution and adjusted for voltage drop as required to limit the voltage drop to not more than 2%. Branch circuit conductors shall be sized for the load and adjusted for voltage drop as required to limit voltage drop to not more than 5% from the service transformer to the end of the branch circuit. Power conductor wiring identification shall be made by permanently attached printed markers and by color. Hand lettering or marking is not acceptable. Marking shall include the phase (or neutral), panel number, and circuit number. The color of the insulation on phases A, B, and C respectively (for three phase power conductors) or Phases A and B respectively (for single-phase power conductors) as follows: 120/208 Volt,

Phase A, Black; 120/208 Volt, Phase B, Red; 120/208 Volt, Phase C, Blue; 277/480 Volt, Phase A, Brown; 277/480 Volt, Phase B, Orange; 277/480 Volt, Phase C, Yellow. Conductor identification by a particular color shall be maintained continuously for the length of the circuit including junction boxes and splices.

6.10.1.4 Provide power to receptacles for communications and other systems within the Communications rooms with dedicated neutrals for each circuit.

6.10.1.5 Power circuits feeding electrified workstations are limited to three workstations per circuit. Electrified Systems furniture is connected with junction boxes. Provide with 12 inch minimum coiled conductors for connection by systems furniture installation contract electrical sub-contractor. Furniture comes with male and female modular connectors shipped with furniture.

6.10.1.6 Power circuits feeding workstations that do not have integral power are limited to four workstations per circuit.

6.10.1.7 Provide a green insulated, safety ground wire for all non-service feeders and branch circuits.

6.10.1.8 Provide general purpose receptacles as NEMA 5-20 rated duplex receptacles minimum.

6.10.1.9 Provide offices that do not use electrified systems furniture with power and telecommunications outlets to serve more than one furniture layout.

6.10.1.10 Provide duplex receptacle at each SARSS wireless receiver location. See paragraph 6.10.4 for SARSS description.

6.10.1.11 Provide duplex receptacle (these are in addition to other receptacle requirements stated in the RFP) adjacent to each loading dock door for a SARSS wireless input station. See paragraph 6.10.4 for SARSS description. Coordinate with bench location.

6.10.1.12 Provide duplex receptacle (these are in addition to other receptacle requirements stated in the RFP) at each AMS entry terminal location. See paragraph 6.10.5 for AMS description.

6.10.2 Lighting and Controls

6.10.2.1 The exterior and possibly any interior automated lighting controls shall utilize the DDC system instead of a separate time clock device. This is to allow remote access and easy coordinated schedule adjustments based on occupancy changes.

6.10.2.2 Local manual lighting controls shall be provided as the main ON/OFF feature. Occupancy sensors in areas shall be set for functioning after the switch is in the ON position. Provide interior lighting controls in accordance with ASHRAE 90.1. Provide occupancy sensor controls in restrooms, classrooms, storage rooms, operations rooms, and similar spaces. Interior ambient illumination shall provide a generally glare free, high quality lighting environment and conform to IESNA RP-1-04.

6.10.2.3 Interior use of HID lighting shall not be considered.

6.10.2.4 Provide T-8 lamps if linear fluorescent fixtures are installed at 9'-0" AFF or lower. Provide T-5 lamps if linear fluorescent fixtures are installed higher than 9'-0" AFF.

6.10.2.5 Exit signs shall have red lettering.

6.10.2.6 Point to point calculations, with summary information, shall be required for review to verify performance and NFPA 101 compliance. This includes emergency illumination to the approved public way location(s).

6.10.3 Telecommunications Systems

6.10.3.1 Telecommunications design must be performed and stamped by a Registered Communications Distribution Designer (RCDD) with 2 yrs related experience or person with 5 yrs related experience. The

information systems designer must prepare the test plan, and witness and certify the testing of telecommunications cabling. In the I3A Technical Criteria, the word "shall" shall be substituted for the word "should" throughout the document. The I3A Technical Criteria shall be considered to be MANDATORY Criteria.

6.10.3.2 Multi-pair 24 gauge copper conductor telephone cable shall be furnished for voice communications and multi-strand single mode fiber optic cable shall be furnished for data communications. Coordination of communication system minimum standards shall be coordinated with the Fort Leonard Wood Network Enterprise Technology Command (NETC) through The Corps of Engineers Contract representative.

(1) Provide 100 pairs of 24 AWG conductors for facility. The facility's voice only communications cables shall terminate at a backboard, 110 type block after the protected entrance terminal. Another 110 type block adjacent to the incoming block shall be used for terminating facility wiring.

(2) Provide 24 strand SM fiber optic cables for facility. The facility service data fiber optic cables shall terminate on a patch panel, on 19" floor mounted standard rack. Rack shall be mounted in a front and back open 24" wide by 36" long enclosure. Mount enclosure with 30" side working access and 36" front and back working access. Terminate cables with 'ST' connectors at facility service entrance. The facility's data communication shall terminate at an RJ45 patch panel in this rack. Provide the patch cables (fiber and copper) and connect as required by NETC to meet I3A requirements.

6.10.3.3 For the DDC system provide dedicated telephone lines to copper OSP. Provide clearly labeled for Ft Leonard Wood NETC to terminate in Communication Room.

6.10.3.4 I3A telecommunications rooms shall be designed and plans shall include a clear room layout including all equipment, conduit stub-up locations, cable tray, and related working spaces. Revise chapter 3 floor plan as required meeting I3A requirements. Room layout shall require approval from Fort Leonard Wood NETC prior to construction.

6.10.3.5 Communications System Testing: Provide material and documentation for communications testing. Provide complete end to certification of all wire/cable (copper or fiber) installed. Testing shall be in accordance with EIA/TIA 568, EIA/TIA TSB 67 and as indicated herein. Provide 30 days notifications of testing. Testing results shall be furnished within 7 days after testing is performed. Testing should include but not be limited to the following:

(1) A submitted test plan shall be approved by Contracting Officer/NETC.

(2) Testing of all installation ground bus bars, wiring, and ground grids.

(3) All test documentation shall be presented to Contracting Officer/NETC.

(4) Test results shall include at a minimum, electrical resistance readings, continuity readings, insulations resistance, and DB loss readings. Test shall include graphical representation of results. Test data shall include: date, time tester, building number, room number, and panel member.

(5) All components shall be terminated prior to testing. Equipment and systems shall not be accepted until the required inspections and tests have been made and all documentation delivered to the Contracting Officer/NETC.

6.10.4 Standard Army Retail Supply System (SARSS)

The SARSS system consists of GFGI wireless input stations located adjacent to each loading dock door, GFGI ceiling mounted wireless receivers throughout the facility and two GFGI data entry terminals (see paragraph 6.10.5). The data entry terminals communicate with a GFGI server located remotely via CAT6 wiring to the telecommunications room. Wireless receivers will be located on 50 foot x 50 foot spacing in the ceiling throughout the entire warehouse. At each of these locations provide 4-pair, #24 AWG, CAT6 copper wiring in 1-inch conduit to an 8-pin modular jack outlet. Cabling shall be homerun back to the main telecommunications room and terminated on a CAT6 modular patch panel.

6.10.5 Automated Manifest System (AMS)

The AMS consists of two GFGI data entry terminals located in the open office area. These data entry terminals communicate with a server in another building via the warehouse's telecommunications system. Provide dedicated 8-pin modular jack at each terminal location. Coordinate exact location of terminals with the Installation thru the COR.

6.10.6 Other Special Systems

6.10.6.1 Provide rough-in, including power, for Intrusion, Camera, and other GFGI systems in this contract. The Fort Leonard Wood Security Forces Office and other stakeholders shall be included in design to identify the rough-in requirements including power loads.

6.11. HEATING, VENTILATING, AND AIR CONDITIONING

HVAC System Requirements.

6.11.1. Office and warehouse spaces shall be heated by natural gas.

6.11.2. Air handlers shall utilize MERV 8 filters and shall have sufficient airflow/pressure capability to do so.

6.11.3.

(a) Air-cooled DX condensing units shall use HCFC-22. Air-cooled package water chillers shall use HCFC-22 or HFC-134A. Centrifugal water chillers shall use HFC-134A or HCFC-123. Chillers shall have low ambient controls, LON card, compressors shall have phase monitor. DX condensing units shall have hot gas bypass and low ambient controls. McQuay Tandem Scroll type chillers or approved equal are preferred if size permits. When size exceeds the tonnage of the tandem scroll type machines, multi compressor type screw machines are acceptable. Equipment training shall be provided by the contractor on all new equipment.

Air filters for air handlers, energy reclamation devices, fan coil units, package units, VAV ad FTU boxes, etc. shall be minimum 30% efficient, pleated media variety.

All outside condensing units or package chillers shall have protective louver hail guards over coil fin sections and 4" wire mesh access guards for lower compressor section. Outside equipment shall be mounted a minimum of 6 inches above existing grade and shall be protected from vehicles.

Mechanical rooms with refrigeration equipment shall be equipped with refrigerant sensors with an audible alarm. The sensors shall be tied to the DDC control System or Base UMCS for reporting purposes. Requirement of the latest edition of ASHRAE Standard 15 shall be strictly adhered to.

Heat recovery units shall be included in all air handler unit designs if cost effective. Heat recovery wheels (if used) shall be constructed of aluminum.

Air-blending Devices. When stratification can occur, air handling units utilizing outside and return air damper mechanisms shall have air-blending devices installed. AHU temperature sensors shall be averaging type, not single point reading.

Vibration isolators shall be provided on all air handlers and chillers.

All mechanical equipment shall have electrical surge and phase reversal protection.

(b) Boilers shall be natural gas fired, modular, condensing or pulse combustion type

(c) Closed Heating or Cooling System Water Treatment Requirements using 35% Inhibited Propylene Glycol. After all piping is completed and closed system water can be circulated through all piping and coils, the following should be completed:

AC-6160 detergent should be added to the closed system at the rate of one gallon per 100 gallons of system volume.

AC 6160 detergent should circulate within the closed system for 48 hrs.

Closed system is to be flushed from multiple points throughout the system (including boilers, AHU Coils, Pumps, etc.) to remove the dirty water. Air bleeders shall be removed from system while flushing and the air bleeder isolation valves shall be operated to remove air from the system. Flushing rate shall match operating gpm and head characteristics of the system. Strainers are to be cleaned. Care should be exercised to prevent exceeding makeup water capability.

AC-530 is to be added at the rate of 1 gallon per 1000 gallons of system volume and circulated through all the closed system piping, bundles, etc. for a period of 72 hours. Failure to clean the entire closed system at the same time will result in the Contractor recleaning the system prior to acceptance.

Closed system is to be flushed from multiple points throughout the system to remove the AC-530 and strainers are to be cleaned. Care should be exercised to prevent exceeding makeup water capability.

Contractor shall employ a third party (ex. AquaComp, Inc. 314-705-1393) to check the cleanliness of the closed system water. Total Iron levels must be 0.25 ppm or less. Should makeup water iron levels exceed the 0.25 ppm level, the iron levels within the closed system should equal that of the makeup water. No iron levels exceeding 0.5 ppm will be accepted. Contractor shall have third party tester perform 6-month and 12-month test to verify system is treated properly on the closed systems following completion of the addition of the glycol.

(d) Any natural gas fired or propane devices shall produce no greater than 30 ppm nitrogen oxides (NOx) in flue gasses at 3% excess oxygen and combustion air temperature of 68 degrees F.

(e) Make-up air units, if used, shall be of the direct fired or hydronic type and shall produce no greater than 0.5 ppm NOx.

(f) Ceiling mounted radiant tube heaters will be allowed when manufacturer mounting instructions are strictly followed. Radiant heaters shall be gas fired.

(g) Restrooms shall have negative air pressure. Air relief shall be provided in the building to prevent excessive over pressurization of building.”

(h) No equipment shall be roof mounted unless coordinated with DPW and prior approval from Contracting Officer is obtained.

Integrate the control system to the installation's existing UMCS. The existing UMCS is BIM Enterprise Network utilizing LONworks

6.12. ENERGY CONSERVATION

6.12.1. General

No additional requirements.

6.12.2. Inclusion of Renewable Energy Features. The following renewable energy features have been determined lifecycle cost effective, are included in the project budget and shall be provided:

LEED credits that commit the installation to long term monitoring or programs cannot be sought at this time. Reference LEED Appendices; L and O.

6.13. FIRE PROTECTION

6.13.1 Design fire protection system, including fire suppression and fire alarm systems, per UFC 3-600-01, except as follows. Design mass notification per UFC 4-021-01. All design shall involve the Fort Leonard Wood Fire Department and require approval prior to construction. Provide compliance with the Fort Leonard Wood DESIGN SPECIFICATION FOR CONSTRUCTION OF FIRE DETECTION AND FIRE SUPPRESSION document attached in the appendix AA. For warehouse, UFC 3-600-01 paragraph 6-11 shall be followed for Class IV commodities.

6.13.2 General

6.13.2.1 Provide a Knox box that is keyed to the Ft. Leonard Wood fire and emergency services account, at the nearest exit that permits access to the electrical room. For building that need surface mounting, Knox Box #3266 Dark Bronze with tamper switches. FLW Fire & Emergency Services will furnish to contractor an approved application to order Knox Box. Knox Box shall be located at main entry to warehouse.

6.13.2.2 Fire department vehicle access roads shall be designed for a 105-foot ladder truck, weighing 62000 LBS, with a 100-foot turning radius.

6.13.2.3 If Gates or chains are used on access points, then a residential knox box shall be provided by the Contractor at each location keyed to the Fire Department Account. This knox box does not require connection to the building fire alarm system.

6.13.2.4 Provide Fire Extinguishers and fire extinguisher cabinets. Provide 10 lb. ABC in the office areas and 20 lb. ABC for shop/repair area. Shop/repair area should have a fire extinguisher sign above location that is visible marking the location.

6.13.2.5 Provide a temporary building sign at each entrance to each building under construction EMS & Fire response. The sign shall be Brown background with white letters. The sign shall be visible from the road. The building numbers can be obtained from DPW.

6.13.2.6 Contractor shall provide fire flow test and results for each hydrant installed for this project. Contractor shall mark the bonnet using reflective marine tape to match the results of the fire flow test in compliance with NFPA 291. Hydrant shall be painted Nutmeg Brown.

6.13.2.7 As required by UFC 3 600-01 a Fire Protection Engineer should be involved in the Life Safety Plans. As part of this process the Fire Protection Engineer shall coordinate and receive approval from the Fort Leonard Wood Fire Department for the Public Way location(s). This is required for NFPA 101 verification of emergency illumination compliance.

6.13.2.8 Riser Location: Fire risers shall be installed in dedicated space or mechanical room with external access for fire department.

6.13.3 Sprinkler system design, shop drawings, product data, and hydraulic calculations shall be submitted as one complete package for government approval prior to construction. This is expected at Plan Review and may delay construction permits if not provided during this time.

6.13.4 Fire Alarm

6.13.4.1 Provide an addressable intelligent fire alarm (FA) and mass notification (MN) system. Common speakers will be used for FA alarm and MN messages. Clear strobes are required in a red housing for FA, and amber strobes in a white housing for MN. Speaker and strobes combined in one unit is acceptable.

6.13.4.2 Provide all Fire Alarm notification annunciations with:

A. Steady tone for 5 seconds, (Male voice) Message to say: "May I have your attention please! A fire emergency has been reported in the building. While this is being verified, please leave the building by the nearest exit."

B. Standard Fire Alarm tone for 5 minutes.

C. Repeat.

6.13.4.3 Provide the FACP in the electrical room. Placement of the FACP in the communication room or mechanical room is not permitted.

6.13.4.4 Provide an 80 character display annunciator, with message buffer, at the FACP. Also, provide a graphic display annunciator at the main building entry. The graphic display should be an architectural display of the

building set (floor plan) properly orientated to the building layout. The graphic display shall have LED lights for each device that illuminate, representing the activated device in red, and a separate yellow LED for trouble alarms." The design of the graphic annunciator shall be reviewed and approved by the AHJ (Fort Leonard Wood Fire Department) in writing before it is manufactured.

6.13.4.5 All fire sprinkler valves, including the PIV, shall be supervised, at its location, by the fire alarm system. PIV circuit requires protector block at entry into the building.

6.13.4.6 Provide Fire Alarm notification with DRILL function for local user operation. Provide with interface to the Mass Notification (MN) Local Operator Controller.

6.13.4.7 Wall mounted appliances are discouraged and not required by ABA. Ceiling mounted appliances are preferred.

6.13.4.8 Provide manual pull stations at each exit in compliance with NFPA 72 installation requirements. Additional stations shall be provided so that the travel distance, to a station, will not be in excess of 200 feet, measured horizontally on the same floor.

6.13.4.9 Provide the Fire Alarm transceiver as a Monaco BT-XF. The transceiver shall have at least 30 zones reporting, Each zone is a relay in the fire alarm control panel with a pair of wires routed to the BT-XF. Thirty zones will have thirty sets of wires routed between the FACP and BT-XF, and 60 relay contactors in the FACP. Transmission will be to the Fort Leonard Wood Monaco D-21 system utilizing FSK protocol.

6.13.4.10 Duct smoke detectors and HVAC system shall be resettable from FACP upon fire alarm activation.

6.13.5 Mass Notification (MN)

6.13.5.1 Provide a, Wheelock ATI, UHF signal transceiver with FSK protocol to the Ft Leonard Wood master Wheelock Mass Notification system in building 3200. This unit may be located adjacent to the Fire Alarm transceiver. MN messages shall NOT be sent to the county 911 center. Separate MN and FA transceivers and antennas are required. This transceiver shall be fully interfaced with the Fire Alarm equipment to provide all the functions necessary for interface all local features. The automatic over-ride and return between buildings Fire Alarm System and MNS by the EOC shall not require action by the local user to reset the system. The EOC shall be able to transmit any message their equipment permits into the buildings through the system.

6.13.5.2 The Local Operator Console shall be provided adjacent to the graphic annunciator at the fire fighter entry point.

6.13.5.3 Local Operator Console (LOC) for the project shall be a Cooper Wheelock Safepath 4, or approved equal with the following features.

- A. Located near the Fire Alarm annunciator.
- B. Keyed access as directed by Ft Leonard Wood fire department.
- C. Remote Microphone with push button interrupting the FA signal until finger pressure is released.
- D. Eight individual mass notification pre-recorded messages selector push buttons and one separately located ON - OFF switch.
 - (1) Button 1. FIRE ALARM DRILL, See Fire Alarm description above.
 - (2) Button 2. BUILDING EMERGENCY, Steady tone for 5 seconds, (Male Voice) Message to say: "May I have your attention please! An emergency has been reported in the building. Emergency personnel are in route. While this is being verified, please leave the building by the nearest exit."
 - (3) Button 3. SHELTER-IN-PLACE, Alternating Steady tone for 5 seconds, (Male voice) Message to say: "Attention. Seek Shelter immediately. Close doors and windows. Shut off heating, ventilation and air-conditioning. Seek shelter immediately."

(4) Button 4. TEST, Steady tone for 5 seconds, (Female voice) Message to say: "This is a test of the Fort Leonard Wood Mass Notification System, repeat this is only a test."

(5) Buttons 5 thru 8 to be left blank for future use by EOC.

(6) ON - OFF switch - HVAC Emergency Cut-off switch wired for simulated Fire Alarm activation. Once turned ON again the HVAC system should go through standard ON start-up sequencing required by the DDC system. DDC Notification of the ON-OFF status is required. Switch may be a pushbutton style.

6.13.5.4 MNS is required inside and exterior of the facility. Exterior strobes are not required.

6.13.6 Submittals

6.13.6.1 Submittals during Plan review shall include code compliance information. Differing to later "shop drawings" as verification of compliance will only delay construction permits being released. The following information does not elevate the requirements of a complete submittal indicated elsewhere in this contract.

6.13.6.2 Life Safety/ Code Compliance sheets should be issued as F- series sheets and include all relevant information related to Building and Life Safety Codes.

6.13.6.3 Sprinkler design sheets should be issued as FX series sheets and include all relevant information related to installation. This includes sprinkler heads coordinated with the overall building reflected ceiling plan.

6.13.6.4 Fire Alarm sheets should be submitted as FA series sheets and need to show compliance with UFC 3 600-01 and UFC 4 021-01. Provide design in compliance with UFC 3 600-01 5-1 and UFC 4 021 2-6.2. This includes:

a. All Fire Alarm equipment placed and coordinated with other work.

b. All devices shown including connections to hoods and elevator requirements. Only provide devices that are required by code. UFC 3 600-01 specifically prohibits additional devices.

c. All appliances placed. Provide candela and decibel ratings for each appliance on the plans, not amp tap so calculated spacing can be verified properly. Avoid the use of wall mounted appliances. ADA does not prohibit ceiling mounted appliances, Fort Leonard Wood Fire Department prefers ceiling mounted appliances, and they provide better coverage. If wall mounted appliances are used provide furniture/equipment elevations with heights coordinated with the mounting of appliances. Do note, unlike NFPA, UFC 4 021-01 requires coverage everywhere in the building and immediately outside the building. The Main Corp of Engineers AHJ, local Corp of Engineers AHJ, and Ft Leonard Wood AHJ translates this to include MNS in private offices, storage space, mechanical spaces, etc.

d. Provide plans, diagrams, Matrix, etc. similar to examples given in NFPA. The MATRIX should include all Mass Notification features as well.

e. Strobes for MNS are required adjacent to each of the Fire Alarm Strobes. Same coverage, equivalent candela intensity after de-rating amber lens, except where fire alarm strobes are not in an area with a speaker, then only the MNS strobe is required. I.e. Small Offices.

6.13.7 Fire pumps, if required, shall meet the requirements of UFC 3-600-01 section 3.6.

6.14. SUSTAINABLE DESIGN

6.14.1. LEED Rating Tool Version. This project shall be executed using LEED-NC Version 3.

6.14.2. The minimum requirement for this project is to achieve LEED Silver level. Each non-exempt facility (building plus sitework) must achieve this level. In addition to any facilities indicated as exempt in paragraph 3, the following facilities are exempt from the minimum LEED achievement requirement: There are no exempt facilities..

6.14.3. Credit Validation: LEED registration, compiling of documentation at LEED OnLine and use of the LEED Letter Templates is required. Registration and payment of registration fees will be by the Contractor. Administration/team management of the online project will be by the Contractor. Validation of credits will be accomplished by the Government. LEED certification of the project by the Contractor is not required. The Government may choose to seek LEED certification of the project, in which case the Government will pay certification fees and coordinate with the GBCI and the Contractor will furnish audit data as requested at no additional cost.

6.14.4. Commissioning: See Appendix M for Owner's Project Requirements document(s).

6.14.5. LEED Credits Coordination. The following information is provided relative to Sustainable Sites and other credits.

SS Credit 1 Site Selection:

Project site IS NOT considered prime farmland.

Delineation of 100-year flood elevation is shown on site drawings provided in this CONTRACT.

Project site contains no habitat for threatened or endangered species.

No portion of project site lies within 100 feet of any water, wetlands or areas of special concern.

Project site WAS NOT previously used as public parkland.

SS Credit 2 Development Density & Community Connectivity.

Project site DOES NOT meets the criteria for this credit.

SS Credit 3 Brownfield Redevelopment.

Project site DOES NOT meets the criteria for this credit.

SS Credit 4.1 Public Transportation Access.

Project site DOES NOT meets the criteria for this credit.

EA Credit 6 Green Power.

35% of the project's electricity WILL NOT will be provided through an Installation renewable energy contract. Do not purchase Renewable Energy Credits (REC's) to earn this credit.

MR Credit 2 Construction Waste Management.

The Installation does not have an on-post recycling facility available for Contractor's use.

Regional Priority Credits (Version 3 only)

The project zip code is 65473.

6.14.6. LEED Credit Preferences, Guidance and Resources. See Appendix L LEED Project Credit Guidance for supplemental information relating to individual credits.

6.14.7. Not Used

6.14.8. Additional Information

LEED Silver requires that a minimum of 50 points be achieved by the project. The project scorecard identifies 50 points that can be achieved due to the projects location and assumed design/construction methods. The integration

of the principles of LEED early in the design and construction process will ensure that the credits are achieved most efficiently.

The nature and location of the project limits design flexibility and precludes several LEED strategies. As a result of these constraints, a comprehensive strategy is required to most efficiently achieve and document the credits required to attain an energy-efficient and functional facility for the Installation. The following LEED sections were evaluated for their appropriateness to this facility type and subsequent credits were identified for potential use in the GPW. Those credits identified have been incorporated into the design assumptions utilized to develop the cost estimate.

Some components referenced are required by Army Regulation while others can be attained through traditional construction technology. It is the role of the project designer to determine the most appropriate path forward for the project.

6.14.8.1 Sustainable Sites. The Sustainable Sites credit is influenced by the site selection of facilities. Due to the project's location and the inherent limitations of a military installation, a number of credits cannot be achieved by this project. The following topics are identified for suitable use in this project.

- The utilization of designated parking for low-emitting vehicle and fuel efficient vehicles should be included in the site design.
- Open space provisions, storm water quality and quantity are important components of site development. Storm water storage is necessary to address the storm water runoff from the developed site.
- Reduce heat island effect by using light reflective surfaces for parking area, roof and walkways.
- Site lighting should utilize fixtures which reduce light pollution.

6.14.8.2 Water Efficiency. Water efficiency calculations are influenced by both indoor and outdoor use and subsequent reduction. The following topics are identified for their suitable use in this project.

- Site landscaping should utilize water efficient landscape design. This should include the appropriate selection of plantings that eliminate irrigation requirements as well as other elements suitable to the climate typical of Fort Leonard Wood.
- Water reduction technologies should be implemented where appropriate.

6.14.8.3 Energy and Atmosphere. Optimizing energy performance can provide significant energy savings. The following topics are identified for their suitable use in this project.

- Increase insulation
- Decreased lighting power
- Efficient mechanical equipment
- Managing refrigerants to eliminate CFCS.
- Improved building schedules can provide significant energy savings.
- Commissioning, measurement and verification of the mechanical systems/facility for 1 year of post occupancy will also serve to ensure that the HVAC systems are operating as designed while potentially improving the final product.

6.14.8.4 Materials and Resources. Building operations generate significant waste. The integration of waste management into the facility construction and design process will decrease the amount of waste transported to landfills. The following topics are identified for their suitable use in this project.

- The diversion of construction waste is required by the installation while also being a valid component in LEED.
- Materials used in construction should be assessed to determine their recycled content as well as their origin relative to Fort Leonard Wood. Materials having recycled content and/or are produced regionally should be utilized as appropriate.

6.14.8.5 Indoor Environmental Quality. Indoor air quality directly impacts the occupants of a building. The protection of the indoor environment from contaminants is essential for maintaining a healthy indoor space.

- Managing air contaminants by eliminating tobacco smoke, better filtration and monitored ventilation air
- Attention should be paid to the quality of indoor air both during and after construction.
- Utilization of low-emitting materials are essential in providing a healthy indoor environment. Adhesives, sealants, paints, coatings, flooring, and composite woods should be low VOC. Controlling of pollutant sources with mechanical ventilation and better construction practices are essential in providing a healthy indoor environment.
- The design should take into account the thermal comfort of the building occupants. The thermal comfort of the occupants should also be verified after occupancy.
- Provide day lighting for the administrative and warehouse areas and views to the outdoors from the administrative area.

6.14.8.6 Innovation and Design Process. New technologies are continually being developed for building construction. These technologies may be included in the design of the GPW with the understanding that their function and maintainability are paramount to the success of the project. No technologies have been identified in this process which would qualify for Innovation and Design. The inclusion of a LEED Accredited Professional in the design and construction of the facility is anticipated.

6.14.8.7 Regional Priority Credits. The use of Regional Priority Credits are awarded for certain LEED credits which have been identified by the USGBC regional council as regional priorities. The following credits apply to this project.

- Sustainable Sites: Site Selection
- Sustainable Sites: Stormwater Design, Quality Control
- Materials and Resources: Construction Waste Management
- Materials and Resources: Regional Materials

6.15. ENVIRONMENTAL

6.15.1 The Indiana bat inhabits this area. Removal of trees will be required between 1 November and 31 March. Tree removal beyond these dates requires habitat surveys and government approval.

6.15.2 See Appendix E, Environmental Requirements.

6.16. PERMITS

Refer to Appendix E, Environmental Information.

6.17. DEMOLITION

Demolition associated with this contract includes the building foundation and slab, site utilities and all other elements which will require demolition as part of site preparation. A construction and demolition waste diversion rate of 50% minimum is required. The disposal of any type of waste is not permitted on the Installation. The disposal of all material shall be the responsibility of the Contractor.

6.18. ADDITIONAL FACILITIES

None.

End of Section 01 10 00

**SECTION 01 32 01.00 10
PROJECT SCHEDULE**

1.0 GENERAL

1.1. REFERENCES

1.2. QUALIFICATION

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION

3.1. GENERAL REQUIREMENTS

3.2. BASIS FOR PAYMENT AND COST LOADING

3.3. PROJECT SCHEDULE DETAILED REQUIREMENTS

3.4. PROJECT SCHEDULE SUBMISSIONS

3.5. SUBMISSION REQUIREMENTS

3.6. PERIODIC SCHEDULE UPDATE MEETINGS

3.7. REQUESTS FOR TIME EXTENSIONS

3.8. DIRECTED CHANGES

3.9. WEEKLY PROGRESS MEETINGS

3.10. OWNERSHIP OF FLOAT

3.11. TRANSFER OF SCHEDULE DATA INTO RMS/QCS

1.0 GENERAL

1.1. REFERENCES

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

- U.S. ARMY CORPS OF ENGINEERS (USACE) ER 1-1-11 (1995) Progress, Schedules, and Network Analysis Systems <http://www.usace.army.mil/publications/eng-regs/er1-1-11/entire.pdf>
- Army Corps of Engineers ECB No. 2005-10, (31 August 2005) Scheduling Requirements for Testing of Mechanical Systems in Construction http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2005_10.pdf

1.2. QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of the schedule and all required updating (statusing) and preparation of reports. The authorized representative shall be experienced in scheduling projects similar in nature to this project and shall be experienced in the use of the scheduling software that meets the requirements of this specification.

2.0 PRODUCTS (Not Applicable)

3.0 EXECUTION

3.1. GENERAL REQUIREMENTS

3.1.1. Submit a project schedule as specified herein for approval showing the sequence in which the Contractor proposes to perform the work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of the entire project, including the design and construction sequences is required. Contractor management personnel shall actively participate in its development. Designers, subcontractors and suppliers working on the project shall also contribute in developing an accurate project schedule. The schedule must be a forward planning as well as a project monitoring tool. The approved project schedule shall be used to measure the progress of the work and to aid in evaluating requests for excusable time extensions. The schedule shall be cost loaded and activity coded as specified herein. The schedule will provide the basis for all progress payments. If the Contractor fails to submit any schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule

3.1.2. Status the schedule on at least a monthly basis, as specified herein. If in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained. See paragraph 3.7.4.

3.1.3. Failure of the Contractor to comply with the requirements of the Contracting Officer shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of the contract.

3.2. BASIS FOR PAYMENT AND COST LOADING

The schedule shall be the basis for determining contract earnings during each update period and therefore the amount of each progress payment. Lack of an approved schedule update or qualified scheduling personnel will result in an inability of the Contracting Officer to evaluate contract earned value for the purposes of payment. Failure of the Contractor to provide all information, as specified herein will result in the disapproval of the preliminary, initial and subsequent schedule updates. In the event schedule revisions are directed by the Contracting Officer and those revisions have not been included in subsequent revisions or updates, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until such revisions to the

project schedule have been made. Activity cost loading shall be reasonable as determined by the Contracting Officer. The aggregate value of all activities coded to a contract CLIN as specified herein shall equal the value of the CLIN on the Schedule.

3.3. PROJECT SCHEDULE DETAILED REQUIREMENTS

The computer software system utilized to produce and update the project schedule shall be capable of meeting all requirements of this specification. Failure of the Contractor to meet the requirements of this specification will result in the disapproval of the schedule. Scheduling software that meets the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER-1-1-11(1995) referenced herein are Primavera Project Planner (P3) by Primavera, and Open Plan by Deltek.

3.3.1. Use of the Critical Path Method

Use the Critical Path Method (CPM) of network calculation to generate the project schedule. Prepare the project schedule using the Precedence Diagram Method (PDM).

3.3.2. Level of Detail Required

Develop the project schedule to an appropriate level of detail. Failure to develop the project schedule to an appropriate level of detail, as determined by the Contracting Officer, will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.3.2.1. Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have Original Durations (OD) greater than 20 work days or 30 calendar days. Procurement activities are defined herein.

3.3.2.2. Design and Permit Activities

Design and permit activities, including necessary conferences and follow-up actions and design package submission activities shall be included. The Contractor shall include the design schedule in the project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. This shall be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. The schedule shall include review and correction periods associated with each item.

3.3.2.3. Procurement Activities

The schedule must include activities associated with the submittal, approval, procurement, fabrication and delivery of long lead materials, equipment, fabricated assemblies and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days. A typical procurement sequence includes the string of activities: submit, approve, procure, fabricate, and deliver.

3.3.2.4. Mandatory Tasks

The following tasks must be included and properly scheduled:

- 3.3.2.4.1. Submission, review and acceptance of design packages
- 3.3.2.4.2. Submission of mechanical/electrical/information systems layout drawings
- 3.3.2.4.3. Submission and approval of O & M manuals
- 3.3.2.4.4. Submission and approval of as-built drawings
- 3.3.2.4.5. Submission and approval of 1354 data and installed equipment lists

- 3.3.2.4.6. Submission and approval of testing and air balance (TAB)
- 3.3.2.4.7. Submission of TAB specialist design review report
- 3.3.2.4.8. Submission and approval of fire protection specialist
- 3.3.2.4.9. Submission and approval of testing and balancing of HVAC plus commissioning plans and data. Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with Engineering and Construction Bulletin (ECB) No. 2005-10 dated 31 August 2005.
- 3.3.2.4.10. Air and water balancing
- 3.3.2.4.11. HVAC commissioning
- 3.3.2.4.12. Controls testing plan submission
- 3.3.2.4.13. Controls testing
- 3.3.2.4.14. Performance Verification testing
- 3.3.2.4.15. Other systems testing, if required
- 3.3.2.4.16. Contractor's pre-final inspection
- 3.3.2.4.17. Correction of punch list from Contractor's pre-final inspection
- 3.3.2.4.18. Government's pre-final inspection
- 3.3.2.4.19. Correction of punch list from Government's pre-final inspection
- 3.3.2.4.20. Final Inspection

3.3.2.5. Activity Responsibility Coding (RESP)

Assign Responsibility Code for all activities to the Prime Contractor, Subcontractor or Government agency responsible for performing the activity. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements. Code all activities not coded with a Government Responsibility Code to the Prime Contractor or Subcontractor responsible to perform the work. Activities shall not have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE). Unacceptable code values are abbreviations of the names of subcontractors.

3.3.2.6. Activity Work Area Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities shall not have more than one Work Area Code. Not all activities are required to be Work Area coded. A lack of Work Area coding will indicate the activity is not resource or space constrained.

3.3.2.7. Contract Changes/Requests for Equitable Adjustment (REA) Coding (MODF)

Assign Activity code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer, with a Contract Changes/REA Code. Key all Code values to the Government's modification numbering system.

Any activity or sequence of activities added to the schedule as a result of alleged constructive changes made by the Government may be added to a copy of the current schedule, subject to the approval of the Contracting Officer. Assign Activity codes for these activities with a Contract Changes/REA Code. Key the code values to the Contractor's numbering system. Approval to add these activities does not necessarily mean the Government accepts responsibility and therefore liability for such activities and any associated impacts to the schedule, but rather the Government recognizes such activities are appropriately added to the schedule for the purposes of maintaining a realistic and meaningful schedule. Such activities shall not be Responsibility Coded to the Government unless approved. An activity shall not have more than one Contract Changes/REA Code

3.3.2.8. Contract Line Item (CLIN) Coding (BIDI)

Code all activities to the CLIN on the Contract Line Item Schedule to which the activity belongs. An activity shall not contain more than one CLIN Item Code. CLIN Item code all activities, even when an activity is not cost loaded.

3.3.2.9. Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities, based upon the phase of work in which the activity occurs. Code activities to either a Design Phase or a Construction Phase. Code fast track design and construction phases proposed by the Contractor to allow filtering and organizing the schedule by fast track design and construction packages. If the contract specifies construction phasing with separately defined performance periods, identify a Construction Phase Code to allow filtering and organizing the schedule accordingly. Each activity shall have only one Phase of Work code.

3.3.2.10. Category of Work Coding (CATW)

Assign Category of Work code to all Activities based upon the category of work which the activity belongs. Category of Work Code must include, but is not limited to: Design, Design Submittal, Construction Submittal, Approval, Acceptance, Procurement, Fabrication, Delivery, Weather Sensitive Installation, Non-Weather Sensitive Installation, Start Up, Test, and Turnover. Assign a Category of Work code to each activity. Each activity shall have only one Category of Work Code.

3.3.2.11. Definable Features of Work Coding (FOW1, FOW2, FOW3)

Assign a Definable Feature of Work Code to appropriate activities based on the definable feature of work to which the activity belongs. Definable Feature of Work is defined in Specification Section 01 45 04.00 10, Contractor Quality Control. An activity shall not have more than one Definable Feature of Work Code. Not all activities are required to be Definable Feature of Work Coded.

3.3.3. Scheduled Project Completion and Activity Calendars

The schedule interval shall extend from NTP date to the required contract completion date. The contract completion activity (End Project) shall finish based on the required contract duration in the accepted contract proposal, as adjusted for any approved contract time extensions. The first scheduled work period shall be the day after NTP is acknowledged by the Contractor. Schedule activities on a calendar to which the activity logically belongs. Activities may be assigned to a 7 day calendar when the contract assigns calendar day durations for the activity such as a Government Acceptance activity. If the Contractor intends to perform physical work less than seven days per week, schedule the associated activities on a calendar with non-work periods identified including weekends and holidays. Assign the Category of Work Code - Weather Sensitive Installation to those activities that are weather sensitive. Original durations must account for anticipated normal adverse weather. The Government will interpret all work periods not identified as non-work periods on each calendar as meaning the Contractor intends to perform work during those periods.

3.3.3.1. Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. Include as the first activity in the project schedule an activity called "Start Project" or "NTP". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, with a zero day duration.

3.3.3.2. Schedule Constraints and Open Ended Logic

Constrain completion of the last activity in the schedule by the contract completion date. Schedule calculations shall result in negative float when the calculated early finish date of the last activity is later than the contract completion date. Include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the contract completion date for the project, and with a zero day duration or by using the "project must finish by" date in the scheduling software. The schedule shall have no constrained dates other than those specified in the contract. The use of artificial float constraints such as "zero fee float" or "zero total float" are typically prohibited. There shall only be 2 open ended activities: Start Project (or NTP) with no predecessor logic and End Project with no successor logic.

3.3.3.3. Early Project Completion

In the event the Preliminary or Initial project schedule calculates an early completion date of the last activity prior to the contract completion date, the Contractor shall identify those activities that it intends to accelerate and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. The last activity shall have a late finish constraint equal to the contract completion date and the schedule will calculate positive float. The Government will not approve an early completion schedule with zero float on the longest path. The Government is under no obligation to accelerate activities for which it is responsible to support a proposed early contract completion.

3.3.4. Interim Completion Dates

Constrain contractually specified interim completion dates to show negative float when the calculated early finish date of the last activity in that phase is later than the specified interim completion date.

3.3.4.1. Start Phase

Include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

3.3.4.2. End Phase

Include as the last activity for a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the specified completion date for that phase and a zero day duration.

3.3.4.3. Phase "X" Hammock

Include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" hammock activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5. Default Progress Data Disallowed

Do not automatically update Actual Start and Finish dates with default mechanisms that may be included in the scheduling software. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the AS and AF dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's updated schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Disable program features which calculate one of these parameters from the other.

3.3.6. Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Correct out of sequence progress that continues for more than two update cycles by logic revision, as approved by the Contracting Officer.

3.3.7. Negative Lags and Start to Finish Relationships

Lag durations contained in the project schedule shall not have a negative value. Do not use Start to Finish relationships (SF).

3.3.8. Calculation Mode

Schedule calculations shall retain the logic between predecessors and successors even when the successor activity starts and the predecessor activity has not finished. Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") will not be allowed.

3.3.9. Milestones

The schedule must include milestone activities for each significant project event including but not limited to: milestone activities for each fast track design package released for construction; design complete; foundation/substructure construction complete; superstructure construction complete; building dry-in or enclosure complete to allow the initiation of finish activities; permanent power complete; and building systems commissioning complete.

3.4. PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data CD, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1. Preliminary Project Schedule Submission

Submit the Preliminary Project Schedule, defining the Contractor's planned operations for the first 90 calendar days for approval within 15 calendar days after the NTP is acknowledged. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. Detail it for the first 90 calendar days. It may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as previously specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required Plan and Program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, the planned submissions of all early design packages, permitting activities, design review conference activities and other non-construction activities intended to occur within the first 90 calendar days. Schedule any construction activities planned for the first 90 calendar days after NTP. Constrain planned construction activities by Government acceptance of the associated design package(s) and all other specified Program and Plan approvals. Activity code any activities that are summary in nature after the first 90 calendar days with Responsibility Code (RESP) and Feature of Work code (FOW1, FOW2, FOW3)

3.4.2. Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after NTP. The schedule shall demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. The Initial Schedule shall be at a reasonable level of detail as determined by the Contracting Officer. The schedule shall include detailed design and permitting activities, including but not limited to identification of individual design packages, design submission, reviews and conferences; permit submissions and any required Government actions; and long lead procurement activities required prior to design completion. The Initial Project Schedule shall include the entire construction sequence and all fast track construction activities, with as much detail as is known at the time but, as a minimum, shall include all construction start and completion milestone activities, and detailed construction activities through the dry-in milestone, including all activity coding and cost loading. Include the remaining construction, including cost loading, but it may be scheduled summary in nature. As the design proceeds and design packages are developed, fully detail the remaining construction activities concurrent with the monthly schedule updating process. Constrain construction activities by Government acceptance of associated designs. When the design is complete, incorporate into the then approved schedule update all remaining detailed construction activities that are planned to occur after the dry-in milestone.

3.4.3. Design Package Schedule Submission:

With each design package submitted to the Government, submit a frag-net schedule extracted from the then current Preliminary, Initial or Updated schedule which covers the activities associated with that Design Package including construction, procurement and permitting activities.

3.4.4. Periodic Schedule Updates

Based on the result of the meeting specified in PERIODIC SCHEDULE UPDATE MEETINGS, submit periodic schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made. Update the schedule to include detailed procurement and construction activities as the design progresses, but not later than the submission of the final, un-reviewed design submission for each separate design package. The Contracting Officer may require submission of detailed schedule activities for any distinct construction that is started prior to submission of a final design submission, if such activity is authorized.

3.4.5. Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used. A template SDEF compatible schedule backup file (sdef.prx) is available on the QCS website: www.rmssupport.com. The SDEF format is as follows:

| Field | Activity Code | Length | Description |
|-------|---------------|--------|--|
| 1 | WRKP | 3 | Workers per Day |
| 2 | RESP | 4 | Responsible Party (e.g. GC, subcontractor, USACE) |
| 3 | AREA | 4 | Area of Work |
| 4 | MODF | 6 | Modification or REA number |
| 5 | BIDI | 6 | Bid Item (CLIN) |
| 6 | PHAS | 2 | Phase of Work |
| 7 | CATW | 1 | Category of Work |
| 8 | FOW1 | 10 | Feature of Work (used up to 10 characters in length) |
| 9 | FOW2 | 10 | Feature of Work (used up to 20 characters in length) |
| 10 | FOW3 | 10 | Feature of Work (used up to 30 characters in length) |

3.5. SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

3.5.1. Data CD's

Provide two sets of data CD's containing the project schedule in the backup format. Each CD shall also contain all previous update backup files. File medium shall be CD. Label each CD, indicating the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and file names. Each schedule shall have a unique file name as determined by the Contractor.

3.5.2. Narrative Report

Provide a Narrative Report with the Preliminary, Initial, and each Periodic Update of the project schedule, as the basis of the progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths where the total float is less than or equal to 20 work days, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to communicate to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through its analysis. Identify and explain why any activities that, based their calculated late dates, should have either started or finished during the update period but did not.

3.5.3. Approved Changes Verification

Include only those project schedule changes in the schedule submission that have been previously approved by the Contracting Officer. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4. Schedule Reports

The format, filtering, organizing and sorting for each schedule report shall be as directed by the Contracting Officer. Typically reports shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. The following lists typical reports that will be requested. One or all of these reports may be requested for each schedule submission.

3.5.4.1. Activity Report

A list of all activities sorted according to activity number.

3.5.4.2. Logic Report

A list of detailed predecessor and successor activities for every activity in ascending order sorted by activity number.

3.5.4.3. Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

3.5.4.4. Earnings Report by CLIN

A compilation of the Contractor's Total Earnings on the project from the NTP to the data date. This report shall reflect the earnings of specific activities based on the agreements made in the schedule update meeting defined herein. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining progress payments. Group activities by CLIN Item number and sort by activity number. This report shall: sum all activities coded to a particular CLIN and provide a CLIN Item percent earned value; and complete and sum CLIN items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.5. Network Diagram

The network diagram is required for the Preliminary, Initial and Periodic Updates. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished.

The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1. Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

3.5.5.2. Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3. Critical Path

Clearly show the critical path.

3.5.5.4. Banding

Organize activities as directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5. S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6. PERIODIC SCHEDULE UPDATE MEETINGS

Conduct periodic schedule update meetings for the purposes of reviewing the Contractor's proposed out of sequence corrections, determining causes for delay, correcting logic, maintaining schedule accuracy and determining earned value. Meetings shall occur at least monthly within five days of the proposed schedule date and after the Contractor has updated the schedule with Government concurrence respecting actual start dates, actual finish dates, remaining durations and percent complete for each activity it intend to status. Match the actual start and finish dates with the dates exported, as described in paragraph 3.3.5. Provide a computer with the scheduling software loaded and a projector during the meeting which allows all meeting participants to view the proposed schedule update during the meeting. The meeting and resultant approvable schedule update shall be a condition precedent to a formal submission of the update as described in SUBMISSION REQUIREMENTS and to the submission of an invoice for payment. The meeting will be a working interactive exchange which will allow the Government and the Contractor the opportunity review the updated schedule on a real time and interactive basis. The Contractor's authorized scheduling representative will organize, sort, filter and schedule the update as requested by the Government. The meeting will last no longer than 8 hours. A rough draft of the proposed activity logic corrections and narrative report shall be provided to the Government 48 hours in advance of the meeting. The Contractor's Project Manager and Authorized Scheduler shall attend the meeting with the Authorized Representative of the Contracting Officer.

3.6.1. Update Submission Following Progress Meeting

Submit a complete update of the project schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 working days after the periodic schedule update meeting, reflecting only those changes made during the previous update meeting.

3.6.2. Activity Stating

Statusing information, including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD) and Percent Complete shall be subject to the approval of the Government prior to the meeting. As a minimum, address the following items on an activity by activity basis during each progress meeting:

3.6.2.1. Actual Start and Finish Dates

Accurately status the AS and/or AF dates for each activity currently in-progress or completed since the last update. The Government may allow an AF date to be assigned with the percent complete less than 100% to account for the value of work remaining but not restraining successor activities. Only assign AS dates when actual progress occurs on an activity.

3.6.2.2. Remaining Duration

Update the estimated RD for all incomplete activities independent of Percent Complete. Remaining durations may exceed the activity OD or may exceed the activity's prior update RD if the Government considers the current OD or RD to be understated based on current progress, insufficient work crews actually manning the job, unrealistic OD or deficiencies that must be corrected that restrain successor activities.

3.6.2.3. Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be statused 100 percent complete. To allow for proper schedule management, cost load the correction of punch list from Government pre-final inspection activity(ies) not less than 1% of the total contract value, which activity(ies) may be statused 100 percent complete upon completion and correction of all punch list work identified during Government pre-final inspection(s).

3.6.2.4. Logic Changes

Specifically identify and discuss all logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, and other changes that have been made pursuant to contract provisions. The Government will only approve logic revisions for the purpose of keeping the schedule valid in terms of its usefulness in calculating a realistic completion date, correcting erroneous logic ties, and accurately sequencing the work.

3.6.2.5. Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary. 3) Changes required to correct a schedule that does not represent the actual or planned prosecution and progress of the work.

3.7. REQUESTS FOR TIME EXTENSIONS

In the event the Contractor believes it is entitled to an extension of the contract performance period, completion date, or any interim milestone date, furnish the following for a determination by the Contracting Officer: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of excusable delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is a condition precedent to any approvals by the Government. In response to each Request For Proposal issued by the Government, the Contractor shall submit a schedule impact analysis demonstrating whether or not the change contemplated by the Government impacts the critical path.

3.7.1. Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with its request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay, will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

3.7.2. Submission Requirements

Submit a justification for each request for a change in the contract completion date of less than 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

3.7.2.1. A list of affected activities, with their associated project schedule activity number.

3.7.2.2. A brief explanation of the causes of the change

3.7.2.3. An analysis of the overall impact of the changes proposed.

3.7.2.4. A sub-network of the affected area

Identify activities impacted in each justification for change by a unique activity code contained in the required data file.

3.7.3. Additional Submission Requirements

The Contracting Officer may request an interim update with revised activities for any requested time extension of over 2 weeks. Provide this disk within 4 days of the Contracting Officer's request.

3.7.4. If Progress Falls Behind the Approved Project Schedule

3.7.4.1. Should progress fall behind the approved schedule (more than 20 work days of negative float) due to Contractor generated problems, promptly provide a supplemental recovery or completion schedule that illustrates its efforts to regain time to assure a completion by the required contract completion date.

3.7.4.2. The supplemental recovery or completion schedule will not replace the original, approved schedule as the official contract schedule. Continue to update the original, approved schedule on at least a monthly basis. In addition, the Contractor and the Contracting Officer will monitor the supplemental recovery or completion schedule on at least a bi-weekly basis to determine its effect on regaining the rate of progress to assure project completion by the contractually required completion date.

3.7.4.3. Do not artificially improve progress by simply revising the schedule logic, modifying or adding constraints, or shortening future work activity durations. Resource and manpower load the supplemental recovery schedule or completion schedule with crew size and productivity for each remaining activity, indicating overtime, weekend work, and/or double shifts needed to regain the schedule, in accordance with FAR 52.236.15, without additional cost to the Government. Indicate assumptions made and the basis for any logic, constraint, or duration changes used in the creation of the supplemental recovery or completion schedule in a narrative submitted for the Contracting Officer's approval. Any additional resources or manpower must be evident at the work site. Do not modify the official contract schedule to include these assumptions.

3.7.4.4. Failure to perform work and maintain progress in accordance with the supplemental recovery or completion schedule may result in an interim and final unsatisfactory performance rating and/or may result in corrective action by the Contracting Officer in accordance with FAR 52.236-15.

3.8. DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The Contracting Officer will approve proposed revisions to the schedule prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the

Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9. WEEKLY PROGRESS MEETINGS

3.9.1. The Government and the Contractor shall meet weekly (or as otherwise mutually agreed to) between the meetings described in paragraph PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. The then current and approved schedule update shall be used for the purposes of this meeting and for the production and review of reports. The Contractor's Project Manager and the Authorized Representative of the Contracting Officer shall attend. The weekly progress meeting will address the status of RFI's, RFP's and Submittals.

3.9.2. Provide a bar chart produced by the scheduling software, organized by Total Float and Sorted by Early Start Date, and a two week "look-ahead" schedule by filtering all schedule activities to show only current ongoing activities and activities schedule to start during the upcoming two weeks, organized by Work Area Code (AREA) and sorted by Early Start Date.

3.9.3. The Government and the Contractor shall jointly review the reports. If it appears that activities on the longest path(s) which are currently driving the calculated completion date (driving activities), are not progressing satisfactorily and therefore could jeopardize timely project completion, corrective action must be taken immediately. Corrective action includes but is not limited to: increasing the number of work crews; increasing the number of work shifts; increasing the number of hours worked per shift; and determining if Government responsibility coded activities require Government corrective action.

3.10. OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

3.11. TRANSFER OF SCHEDULE DATA INTO RMS/QCS

The Contractor shall download and upload the schedule data into the Resident Management System (RMS) prior to RMS databases being transferred to the Government and is considered to be additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 - Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 - Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and electronic export from QCS of the application for progress payment.

End of Section 01 32 01.00 10

**SECTION 01 33 00
SUBMITTAL PROCEDURES**

1.0 GENERAL

- 1.1. DEFINITIONS
- 1.2. NOT USED
- 1.3. SUBMITTAL CLASSIFICATION
- 1.4. APPROVED OR CONCURRED WITH SUBMITTALS
- 1.5. DISAPPROVED SUBMITTALS
- 1.6. WITHHOLDING OF PAYMENT
- 1.7. GENERAL
- 1.8. SUBMITTAL REGISTER
- 1.9. SCHEDULING
- 1.10. TRANSMITTAL FORM (ENG FORM 4025)
- 1.11. SUBMITTAL PROCEDURES
- 1.12. CONTROL OF SUBMITTALS
- 1.13. GOVERNMENT APPROVED SUBMITTALS
- 1.14. INFORMATION ONLY SUBMITTALS
- 1.15. STAMPS

1.0 GENERAL

1.1. DEFINITIONS

1.1.1. Submittal

Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.1.2. Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by SD numbers and titles as follows.

SD-01 Preconstruction Submittals

- Certificates of insurance.
- Surety bonds.
- List of proposed subcontractors.
- List of proposed products.
- Construction Progress Schedule.
- Submittal register.
- Schedule of prices.
- Accident Prevention Plan.
- Work plan.
- Quality control plan.
- Environmental protection plan.

SD-02 Shop Drawings

- Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.
- Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.
- Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

- Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.
- Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

- Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.
- Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.
- Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

- Calculations, mix designs, analyses or other data pertaining to a part of work.
- Design submittals, design substantiation submittals and extensions of design submittals.

SD-06 Test Reports

- Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must

have been within three years of date of contract award for the project.)

- Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.
- Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
- Investigation reports.
- Daily checklists.
- Final acceptance test and operational test procedure.

SD-07 Certificates

- Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.
- Document required of Contractor, or of a supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.
- Confined space entry permits.
- Text of posted operating instructions.

SD-08 Manufacturer's Instructions

- Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

- Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- Factory test reports.

SD-10 Operation and Maintenance Data

- Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

SD-11 Closeout Submittals

- Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

1.1.3. Approving Authority

Office authorized to approve submittal.

1.1.4. Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2. NOT USED

1.3. SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1. Designer of Record Approved (DA)

1.3.1.1. Designer of Record (DOR) approval is required for all extensions of design, critical materials, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings". Provide the Government the number of copies designated hereinafter of all DOR approved submittals, after the DOR has taken appropriate action. The DOR shall ensure that submittals conform to the Solicitation, the Accepted Proposal and the completed design, however see below for those submittals proposing a deviation to the contract or a substitution of a material, system, or piece of equipment that was identified by manufacturer, brand name or model description in the accepted contract proposal.

1.3.1.2. The DOR shall ensure that the submittals comply with all applicable Buy American Act and Trade Agreement Act clauses in the contract. The DOR may confer with the Contracting Officer's Representative for advice and interpretation of those clauses, as necessary.

1.3.1.3. The Government may, but is not required to, review any or all DOR approved submittals for conformance to the solicitation, accepted proposal and the completed design. Except for submittals designated as deviating from the Solicitation, the Accepted Proposal or completed design, the Contractor may proceed with acquisition and installation upon DOR approval. Government Approved (GA)

1.3.2. Government Approved (GA)

Government approval is required for any item specifically designated as requiring Government approval in the Solicitation, for internal and external color finish selections and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.3.3. Government Conformance Review of Design (CR)

The Government will review all intermediate and final design submittals for conformance with the technical requirements of the solicitation. Section 01 33 16 **DESIGN AFTER AWARD** covers the design submittal and review process in detail. Review will be only for conformance with the applicable codes, standards and contract requirements. Design data includes the design documents described in Section 01 33 16 **DESIGN AFTER AWARD**. Generally, design submittals should be identified as SD-05 Design Data submittals.

1.3.4. Designer of Record Approved/Government Conformance Review (DA/CR)

1.3.4.1. Deviations to the Accepted Design. Designer of Record approval and the Government's concurrence are required for any proposed deviation from the accepted design which still complies with the contract (the Solicitation and Accepted Proposal) before the Contractor is authorized to proceed with material acquisition or installation. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings." If necessary to facilitate the project schedule, the Contractor and the DOR may discuss a submittal proposing a deviation with the Contracting Officer's Representative prior to officially submitting it to the Government. However, the Government reserves the right to review the submittal before providing an opinion, if it deems it necessary. In any case, the Government will not formally agree to or provide a preliminary opinion on any deviation without the DOR's approval or recommended approval. The Government reserves the right to non-concur with any deviation from the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and concurred design.

1.3.4.2. Substitutions. Unless prohibited or provided for otherwise elsewhere in the Contract, where the accepted contract proposal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, and the Contractor desires to substitute manufacturer or model after award, submit a requested substitution for Government concurrence. Include substantiation, identifying information and the DOR's approval, as meeting the contract requirements and that it is equal in function, performance, quality and salient features to that in the accepted contract proposal.

1.3.5. Designer of Record Approved/Government Approved (DA/GA)

Any proposed deviation to the solicitation and/or the accepted proposal constitutes a change to the contract. In addition to the above stated requirements for proposed deviations to the accepted design, both Designer of Record and Government Approval and, where applicable, a contract modification are required before the Contractor is

authorized to proceed with material acquisition or installation for any proposed deviation to the contract. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings". The Government reserves the right to accept or reject any such proposed deviation at its discretion.

1.3.6. Information Only

All submittals not requiring Designer of Record or Government approval will be for information only. Provide the Government "For Information Only" copies of all submittals not requiring Government approval or concurrence, after the Designer of Record has taken the appropriate action.

1.4. APPROVED OR CONCURRED WITH SUBMITTALS

Do not construe the Contracting Officer's approval of or concurrence with submittals as a complete check, but only that design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal. Approval or concurrence will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for design, dimensions, all design extensions, such as the design of adequate connections and details, etc., and the satisfactory construction of all work. The Government won't consider re-submittals for the purpose of substituting previously approved materials or equipment unless accompanied by an explanation of why a substitution is necessary.

1.5. DISAPPROVED SUBMITTALS

Make all corrections required by the Contracting Officer, obtain the Designer of Record's approval when applicable, and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. Resubmit any "information only" submittal found to contain errors or unapproved deviations from the Solicitation or Accepted Proposal as one requiring "approval" action, requiring both Designer of Record and Government approval. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, provide prompt notice in accordance with the Contract Clause "Changes" to the Contracting Officer.

1.6. WITHHOLDING OF PAYMENT

No payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

1.7. GENERAL

Make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, the Contractor's Quality Control (CQC) System Manager and the Designer of Record, if applicable, shall check, approve, sign, and stamp all items, indicating action taken. Clearly identify proposed deviations from the contract requirements. Include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Schedule and make submittals requiring Government approval prior to the acquisition of the material or equipment covered thereby. Pick up and dispose of samples remaining upon completion of the work in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

1.8. SUBMITTAL REGISTER (GA)

Develop a complete list of submittals, including each separate design package submittal. Submit the initial submittal register within 15 days after Notice to Proceed, including, as a minimum, the design packages and other initial submittals required elsewhere in the contract. The Designer of Record shall identify required submittals in the

specifications, and use the list to prepare the Submittal Register, utilizing the government-provided software, QCS (see Section 01 45 01.10), to create the ENG Form 4288. Appendix Ris a preliminary submittal register input form for use with the Quality Management System and the Resident Office Management System (QCS and RMS). The Government will provide the Contractor the actual Excel Spreadsheet version of this sample input form after award to modify and to use for input into QCS. The Excel Spreadsheet is not totally inputable into QCS, so additional keystroke input will be necessary. The sample input form is not all-inclusive. In addition, additional submittals may be required by other parts of the contract. After award, the parties will meet to discuss contract specific (or task order specific for a task order contract) distribution for the submittals all-inclusive and additional submittals may be required by other parts of the contract. Develop and complete the submittal register as the design is completed. Submit it to the Contracting Officer with the un-reviewed final design package submission or as soon as the design specifications are completed, if before the final design submission. When applicable, if the Contractor elects to fast track design and construction, using multiple design package submissions, update the submittal register to reflect the submittals associated with each design submission, clearly denoting all revisions to the previous submission. The submittal register serves as a scheduling document for submittals and for control of submittal actions throughout the contract period. Coordinate the submit dates and need dates used in the submittal register with dates in the Contractor prepared progress schedule. Submit monthly updates to the submittal register showing the Contractor action codes and actual dates with Government action codes and actual dates or until all submittals have been satisfactorily completed. Revise and submit the submittal register when revising the progress schedule.

1.9. SCHEDULING

Schedule submittals covering component items forming a system or items that are interrelated to be coordinated and submitted concurrently. Schedule certifications to be submitted with the pertinent drawings. Allow adequate time (a minimum of 15 calendar days exclusive of mailing time) and show on the register for those items requiring Government approval or concurrence. No delay damages or time extensions will be allowed for time lost in late submittals by the Contractor.

1.10. TRANSMITTAL FORM (ENG FORM 4025)

Use the transmittal form (ENG Form 4025) for submitting submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor or are included in the QCS software if the Contractor is required to use QCS for this contract. Use a separate transmittal form for each specification section. Complete this form by filling out all the heading blank spaces and identify each item submitted. Exercise special care to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

1.11. SUBMITTAL PROCEDURES

Make submittals as follows:

1.11.1. Procedures

The Government will further discuss detailed submittal procedures with the Contractor at the Post-Award Conference.

1.11.2. Deviations

For submittals which include proposed deviations requested by the Contractor, check the column "variation" of ENG Form 4025. Set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.12. CONTROL OF SUBMITTALS

Carefully control his procurement operations to ensure that each individual submittal is made on or before the scheduled submittal date shown on the approved "Submittal Register."

1.13. GOVERNMENT APPROVED OR CONCURRED WITH SUBMITTALS

Upon completion of review of submittals requiring Government approval or concurrence, the Government will stamp and date the submittals as approved or concurred.. The Government will retain three (3) copies of the submittal and return one (1) copy(ies) of the submittal.

1.14. INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe. The Government will retain two (2) copies of information only submittals.

1.15. STAMPS

Use stamps similar to the following on the submittal data to certify that the submittal meets contract requirements:

CONTRACTOR

(FIRM NAME)

Approved

Approved with corrections as noted on submittal data and/or attached sheet(s)

Signature:

Title:

Date:

For design-build construction, both the Contractor Quality Control System Manager and the Designer of Record shall stamp and sign to certify that the submittal meets contract requirements.

**SECTION 01 33 16
DESIGN AFTER AWARD**

1.0 GENERAL INFORMATION

1.1. INTRODUCTION

1.2. DESIGNER OF RECORD

2.0 PRODUCTS (Not Applicable)

3.0 EXECUTION

3.1. PRE-WORK ACTIVITIES & CONFERENCES

3.1.1. Design Quality Control Plan

3.1.2. Post Award Conference

3.1.3. Partnering & Project Progress Processes

3.1.4. Initial Design Conference

3.1.5. Pre-Construction Conference

3.2. STAGES OF DESIGN SUBMITTALS AND OVER THE SHOULDER PROGRESS REVIEWS

3.2.1. Site/Utilities

3.2.2. Interim Design Submittals

3.2.3. Over-the-Shoulder Progress Reviews

3.2.4. Final Design Submissions

3.2.5. Design Complete Submittals

3.2.6. Holiday Periods for Government Review or Actions

3.2.7. Late Submittals and Reviews

3.3. DESIGN CONFIGURATION MANAGEMENT

3.3.1. Procedures

3.3.2. Tracking Design Review Comments

3.3.3. Design and Code Checklists

3.4. INTERIM DESIGN REVIEWS AND CONFERENCES

3.4.1. General

3.4.2. Procedures

3.4.3. Conference Documentation

- 3.5. INTERIM DESIGN REQUIREMENTS
 - 3.5.1. Drawings
 - 3.5.2. Design Analyses
 - 3.5.3. Geotechnical Investigations and Reports
 - 3.5.4. LEED Documentation
 - 3.5.5. Energy Conservation
 - 3.5.6. Specifications
 - 3.5.7. Building Rendering
 - 3.5.8. Interim Building Design Contents
- 3.6. FINAL DESIGN REVIEWS AND CONFERENCES
- 3.7. FINAL DESIGN REQUIREMENTS
 - 3.7.1. Drawings
 - 3.7.2. Design Analysis
 - 3.7.3. Specifications
 - 3.7.4. Submittal Register
 - 3.7.5. Preparation of DD Form 1354 (Transfer of Real Property)
 - 3.7.6. Acceptance and Release for Construction
- 3.8. DESIGN COMPLETE CONSTRUCTION DOCUMENT REQUIREMENTS
- 3.9. SUBMITTAL DISTRIBUTION, MEDIA AND QUANTITIES
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1.0 GENERAL INFORMATION

1.1. INTRODUCTION

1.1.1. The information contained in this section applies to the design required after award. After award, the Contractor will develop the accepted proposal into the completed design, as described herein.

1.1.2. The Contractor may elect to fast track the design and construction that is, proceed with construction of parts of the sitework and facilities prior to completion of the overall design. To facilitate fast tracking, the Contractor may elect to divide the design into no more than ten (10) design packages per major facility type and no more than three (3) design packages for site and associated work. Designate how it will package the design, consistent with its overall plan for permitting (where applicable) and construction of the project. See Sections 01 33 00 SUBMITTAL PROCEDURES and 01 32 01.00 10 PROJECT SCHEDULE for requirements for identifying and scheduling the design packaging plan in the submittal register and project schedule. See also Sections 01 10 00 STATEMENT OF WORK and 01 57 20.00 10 ENVIRONMENTAL PROTECTION for any specified permit requirements. If early procurement of long-lead item construction materials or installed equipment, prior to completion of the associated design package, is necessary to facilitate the project schedule, also identify those long-lead items and how it will assure design integrity of the associated design package to meet the contract requirements (The Contract consists of the Solicitation requirements and the accepted proposal). Once the Government is satisfied that the long-lead items meet the contract requirements, the Contracting Officer will allow the Contractor to procure the items at its own risk.

1.1.3. The Contractor may proceed with the construction work included in a separate design package after the Government has reviewed the final (100%) design submission for that package, review comments have been addressed and resolved to the Government's satisfaction and the Contracting Officer (or the Administrative Contracting Officer) has agreed that the design package may be released for construction.

1.1.4. **INTEGRATED DESIGN.** To the maximum extent permitted for this project, use a collaborative, integrated design process for all stages of project delivery with comprehensive performance goals for siting, energy, water, materials and indoor environmental quality and ensures incorporation of these goals. Consider all stages of the building lifecycle, including deconstruction.

1.2. DESIGNER OF RECORD

Identify, for approval, the Designer of Record ("DOR") that will be responsible for each area of design. One DOR may be responsible for more than one area. Listed, Professional Registered, DOR(s) shall account for all areas of design disciplines shall be accounted for by a listed. The DOR's shall stamp, sign, and date each design drawing and other design deliverables under their responsible discipline at each design submittal stage (see contract clause Registration of Designers). If the deliverables are not ready for release for construction, identify them as "preliminary" or "not for release for construction" or by using some other appropriate designation. The DOR(s) shall also be responsible for maintaining the integrity of the design and for compliance with the contract requirements through construction and documentation of the as-built condition by coordination, review and approval of extensions of design, material, equipment and other construction submittals, review and approval or disapproval of requested deviations to the accepted design or to the contract, coordination with the Government of the above activities, and by performing other typical professional designer responsibilities.

2.0 PRODUCTS (Not Applicable)

3.0 EXECUTION

3.1. PRE-WORK ACTIVITIES & CONFERENCES

3.1.1. Design Quality Control Plan

Submit for Government acceptance, a Design Quality Control Plan in accordance with Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL before design may proceed.

3.1.2. Post Award Conference

3.1.2.1. The government will conduct a post award contract administration conference at the project site, as soon as possible after contract award. This will be coordinated with issuance of the contract notice to proceed (NTP). The Contractor and major sub-contractor representatives shall participate. All designers need not attend this first meeting. Government representatives will include COE project delivery team members, facility users, facility command representatives, and installation representatives. The Government will provide an agenda, meeting goals, meeting place, and meeting time to participants prior to the meeting.

3.1.2.2. The post award conference shall include determination and introduction of contact persons, their authorities, contract administration requirements, discussion of expected project progress processes, and coordination of subsequent meetings for quality control (see Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL), Partnering (see below and SCR: Partnering), and the initial design conference (see below).

3.1.2.3. The government will introduce COE project delivery team members, facility users, facility command representatives, and installation representatives. The DB Contractor shall introduce major subcontractors, and other needed staff. Expectations and duties of each person shall be defined for all participants. A meeting roster shall be developed and distributed by the government with complete contact information including name, office, project role, phone, mailing and physical address, and email address.

3.1.3. Partnering & Project Progress Processes

3.1.3.1. The initial Partnering conference may be scheduled and conducted at any time with or following the post award conference. The Government proposes to form a partnership with the DB Contractor to develop a cohesive building team. This partnership will involve the COE project delivery team members, facility users, facility command representatives, installation representatives, Designers of Record, major subcontractors, contractor quality control staff, and contractor construction management staff. This partnership will strive to develop a cooperative management team drawing on the strengths of each team member in an effort to achieve a quality project within budget and on schedule. This partnership will be bilateral in membership and participation will be totally voluntary. All costs, excluding labor and travel expenses, shall be shared equally between the Government and the Contractor. The Contractor and Government shall be responsible for their own labor and travel costs. Normally, partnering meetings will be held at or in the vicinity of the project installation.

3.1.3.2. As part of the partnering process, the Government and Contractor shall develop, establish, and agree to comprehensive design development processes including conduct of conferences, expectations of design development at conferences, fast-tracking, design acceptance, Structural Interior Design (SID)/ Furniture, Fixtures & Equipment (FF&E) design approval, project closeout, etc. The government will explain contract requirements and the DB Contractor shall review their proposed project schedule and suggest ways to streamline processes.

3.1.4. Initial Design Conference

The initial design conference may be scheduled and conducted at the project installation any time after the post award conference, although it is recommended that the partnering process be initiated with or before the initial design conference. Any design work conducted after award and prior to this conference should be limited to site and is discouraged for other items. All Designers of Record shall participate in the conference. The purpose of the meeting is to introduce everyone and to make sure any needs the contractor has are assigned and due dates established as well as who will get the information. See also Attachment F, BUILDING INFORMATION MODELING REQUIREMENTS for discussion concerning the BIM Implementation Plan demonstration at this meeting. The DB Contractor shall conduct the initial design conference.

3.1.5. Pre-Construction Conference

Before starting construction activities, the Contractor and Government will jointly conduct a pre-construction administrative conference to discuss any outstanding requirements and to review local installation requirements for start of construction. It is possible there will be multiple Pre-Construction Conferences based on the content of the design packages selected by the Contractor. The Government will provide minutes of this meeting to all participants.

3.2. STAGES OF DESIGN SUBMITTALS AND OVER THE SHOULDER PROGRESS REVIEWS

The stages of design submittals described below define Government expectations with respect to process and content. The Contractor shall determine how to best plan and execute the design and review process for this project, within the parameters listed below. As a minimum, the Government expects to see at least one interim design submittal, at least one final design submittal before construction of a design package may proceed and at least one Design Complete submittal that documents the accepted design. The Contractor may sub-divide the design into separate packages for each stage of design and may proceed with construction of a package after the Government accepts the final design for that package. See discussion on waivers to submission of one or more intermediate design packages where the parties partner during the design process. See also Attachment F, BUILDING INFORMATION MODELING REQUIREMENTS for discussion concerning BIM and the various stages of design submittals and over-the-shoulder progress reviews.

3.2.1. Site/Utilities

To facilitate fast-track design-construction activities the contractor may submit a final (100%) site and utility design as the first design submittal or it may elect to submit interim and final site and utility design submittals as explained below. Following review, resolution, and incorporation of all Government comments, and submittal of a satisfactory set of site/utility design documents, after completing all other pre-construction requirements in this contract and after the pre-construction meeting, the Government will allow the Contractor to proceed with site development activities, including demolition where applicable, within the parameters set forth in the accepted design submittal. For the first site and utility design submission, whether an interim or final, the submittal review, comment, and resolution times from this specification apply, except that the Contractor shall allow the Government a 14 calendar day review period, exclusive of mailing time. No on-site construction activities shall begin prior to written Government clearance to proceed.

3.2.2. Interim Design Submittals

The Contractor may submit either a single interim design for review, representing a complete package with all design disciplines, or split the interim design into smaller, individual design packages as it deems necessary for fast-track construction purposes. As required in Section 01 32 01.00 10 PROJECT SCHEDULE, the Contractor shall schedule its design and construction packaging plan to meet the contract completion period. This submission is the Government's primary opportunity to review the design for conformance to the solicitation and to the accepted contract proposal and to the Building Codes at a point where required revisions may be still made, while minimizing lost design effort to keep the design on track with the contract requirements. The requirements for the interim design review submittals and review conferences are described hereinafter. This is not necessarily a hold point for the design process; the Contractor may designate the interim design submittal(s) as a snapshot and proceed with design development at its own risk. See below for a waiver, where the parties establish an effective over-the-shoulder progress review procedure through the partnering process that would eliminate the need for or expedite a formal intermediate design review on one or more individual design packages.

3.2.3. Over-the-Shoulder Progress Reviews

To facilitate a streamlined design-build process, the Government and the Contractor may agree to one-on-one reviewer or small group reviews, electronically, on-line (if available within the Contractor's standard design practices) or at the Contractor's design offices or other agreed location, when practicable to the parties. The Government and Contractor will coordinate such reviews to minimize or eliminate disruptions to the design process. Any data required for these reviews shall normally be provided in electronic format, rather than in hard copy. If the Government and Contractor establish and implement an effective, mutually agreeable partnering procedure for regular (e.g., weekly) over-the-shoulder review procedures that allow the Government reviewers the opportunity to keep fully informed of the progress, contents, design intent, design documentation, etc. of the design package, the Government will agree to waive or to expedite the formal intermediate design review period for that package. The Contractor shall still be required to submit the required intermediate design documentation, however the parties may agree to how that material will be provided, in lieu of a formal consolidated submission of the package. It should be noted that Government funding is extremely limited for non-local travel by design reviewers, so the maximum use of virtual teaming methods must be used. Some possible examples include electronic file sharing, interactive software with on-line or telephonic conferencing, televideo conferencing, etc. The Government must still perform its Code and Contract conformance reviews, so the Contractor is encouraged to partner with the reviewers to find ways to facilitate this process and to facilitate meeting or bettering the design-build schedule. The Contractor shall maintain a fully functional configuration management system as described herein to track design revisions, regardless of whether or not there is a need for a formal intermediate design review. The formal intermediate

review procedures shall form the contractual basis for the official schedule, in the event that the partnering process determines that the formal intermediate review process to be best suited for efficient project execution. However, the Government pledges to support and promote the partnering process to work with the Contractor to find ways to better the design schedule.

3.2.4. Final Design Submissions

This submittal is required for each design package prior to Government acceptance of that design package for construction. The requirements for the final design submittal review conferences and the Government's acceptance for start of construction are described herein after.

3.2.5. Design Complete Submittals

After the final design submission and review conference for a design package, revise the design package to incorporate the comments generated and resolved in the final review conferences, perform and document a back-check review and submit the final, design complete documents, which shall represent released for construction documents. The requirements for the design complete submittals are described hereinafter.

3.2.6. Holiday Periods for Government Review or Actions

Do not schedule meetings, Government reviews or responses during the last two weeks of December or other designated Government Holidays (including Friday after Thanksgiving). Exclude such dates and periods from any durations specified herein for Government actions.

3.2.7. Late Submittals and Reviews

If the Contractor cannot meet its scheduled submittal date for a design package, it must revise the proposed submittal date and notify the government in writing, at least one (1) week prior to the submittal, in order to accommodate the Government reviewers' other scheduled activities. If a design submittal is over one (1) day late in accordance with the latest revised design schedule, or if notification of a proposed design schedule change is less than seven (7) days from the anticipated design submission receipt date, the Government review period may be extended up to seven (7) days due to reviewers' schedule conflicts. If the Government is late in meeting its review commitment and the delay increases the Contractor's cost or delays completion of the project, the Suspension of Work and Defaults clauses provide the respective remedy or relief for the delay.

3.3. DESIGN CONFIGURATION MANAGEMENT

3.3.1. Procedures

Develop and maintain effective, acceptable design configuration management (DCM) procedures to control and track all revisions to the design documents after the Interim Design Submission through submission of the As-Built documents. During the design process, this will facilitate and help streamline the design and review schedule. After the final design is accepted, this process provides control of and documents revisions to the accepted design (See Special Contract Requirement: Deviating From the Accepted Design). The system shall include appropriate authorities and concurrences to authorize revisions, including documentation as to why the revision must be made. The DCM data shall be available to the Government reviewers at all times. The Contractor may use its own internal system with interactive Government concurrences, where necessary or may use the Government's "DrChecks Design Review and Checking System" (see below and Attachment C).

3.3.2. Tracking Design Review Comments

Although the Contractor may use its own internal system for overall design configuration management, the Government and the Contractor shall use the DrChecks Design Review and Checking System to initiate, respond to, resolve and track Government design compliance review comments. This system may be useful for other data which needs to be interactive or otherwise available for shared use and retrieval. See Attachment C for details on how to establish an account and set-up the DrChecks system for use on the project.

3.3.3. Design and Code Checklists

Develop and complete various discipline-specific checklists to be used during the design and quality control of each submittal. Submit these completed checklists with each design submittal, as applicable, as part of the project documentation. See Section 01 45 04.00 10 Contractor Quality Control, Attachment D for a Sample Fire Protection and Life Safety Code review checklist and Attachment E for LEED SUBMITTALS.

3.4. INTERIM DESIGN REVIEWS AND CONFERENCES

3.4.1. General

At least one interim design submittal, review and review conference is required for each design package (except that, per paragraph 3.2.1, the Contractor may skip the interim design submission and proceed directly to final design on the sitework and utilities package). The DB Contractor may include additional interim design conferences or over-the-shoulder reviews, as needed, to assure continued government concurrence with the design work. Include the interim submittal review periods and conferences in the project schedule and indicate what part of the design work is at what percentage of completion. The required interim design conferences shall be held when interim design requirements are reached as described below. See also Paragraph: **Over-the-Shoulder Progress Reviews** for a waiver to the formal interim design review.

3.4.2. Procedures

After receipt of an Interim Design submission, allow the Government fourteen (14) calendar days after receipt of the submission to review and comment on the interim design submittal. For smaller design packages, especially those that involve only one or a few separate design disciplines, the parties may agree on a shorter review period or alternative review methods (e.g., over-the-shoulder or electronic file sharing), through the partnering process. For each interim design review submittal, the COR will furnish, to the Contractor, a single consolidated, validated listing of all comments from the various design sections and from other concerned agencies involved in the review process using the DrChecks Design Review and Checking System. The review will be for conformance with the technical requirements of the solicitation and the Contractor's RFP proposal. If the Contractor disagrees technically with any comment or comments and does not intend to comply with the comment, he/she must clearly outline, with ample justification, the reasons for noncompliance within five (5) days after receipt of these comments in order that the comment can be resolved. Furnish disposition of all comments, in writing, through DrChecks. The Contractor is cautioned that if it believes the action required by any comment exceeds the requirements of this contract, that it should take no action and notify the COR in writing immediately. The Interim Review conference will be held for each design submittal at the installation. Bring the personnel that developed the design submittal to the review conference. The conference will take place the week after the receipt of the comments by the Contractor. For smaller fast-track packages that involve only a few reviewers, the parties may agree to alternative conferencing methods, such as teleconferencing, or televideo, where available, as determined through Partnering.

3.4.3. Conference Documentation

3.4.3.1. In order to facilitate and accelerate the Government code and contract conformance reviews, identify, track resolution of and maintain all comments and action items generated during the design process and make this available to the designers and reviewers prior to the Interim and subsequent design reviews.

3.4.3.2. The DB Contractor shall prepare meeting minutes and enter final resolution of all comments into DrChecks. Copies of comments, annotated with comment action agreed on, will be made available to all parties before the conference adjourns. Unresolved problems will be resolved by immediate follow-on action at the end of conferences. Incorporate valid comments. The Government reserves the right to reject design document submittals if comments are significant. Participants shall determine if any comments are critical enough to require further design development prior to government concurrence. Participants shall also determine how to proceed in order to obtain government concurrence with the design work presented.

3.5. INTERIM DESIGN REQUIREMENTS

Interim design deliverables shall include drawings, specifications, and design analysis for the part of design that the Contractor considers ready for review.

3.5.1. Drawings

Include comments from any previous design conferences incorporated into the documents to provide an interim design for the "part" submitted.

3.5.2. Design Analyses

3.5.2.1. The designers of record shall prepare and present design analyses with calculations necessary to substantiate and support all design documents submitted. Address design substantiation required by the applicable codes and references and pay particular attention to the following listed items:

3.5.2.2. For parts including sitework, include site specific civil calculations.

3.5.2.3. For parts including structural work, include structural calculations.

(a) Identify all loads to be used for design.

(b) Describe the method of providing lateral stability for the structural system to meet seismic and wind load requirements. Include sufficient calculations to verify the adequacy of the method.

(c) Provide calculations for all principal roof, floor, and foundation members and bracing and secondary members.

(d) Provide complete seismic analyses for all building structural, mechanical, electrical, architectural, and building features as dictated by the seismic zone for which the facility is being constructed.

(e) Computer generated calculations must identify the program name, source, and version. Provide input data, including loads, loading diagrams, node diagrams, and adequate documentation to illustrate the design. The schematic models used for input must show, as a minimum, nodes/joints, element/members, materials/properties, and all loadings, induced settlements/deflections, etc., and a list of load combinations. Include an output listing for maximum/minimum stresses/forces and deflections for each element and the reactions for each loading case and combination.

(f) See also the Security (Anti-Terrorism) requirements below for members subject to Anti-Terrorist Force Protection (ATFP) and Progressive Collapse requirements.

(g) Fully coordinate and integrate the overall structural design between two different or interfacing construction types, such as modular and stick-built or multistory, stacked modular construction. Provide substantiation of structural, consolidation/settlement analysis, etc., as applicable, through the interfaces.

3.5.2.4. For Security (Anti-Terrorism): Provide a design narrative and calculations where applicable, demonstrating compliance with each of the 22 standards in UFC 4-010-01, which includes Design of Buildings to Resist Progressive Collapse (use the most recent version of UFC 4-023-03, regardless of references to any specific version in UFC 4-010-01). Where sufficient standoff distance is not being provided, show calculations for blast resistance of the structural system and building envelope. Show complete calculations for members subjected to ATFP loads, e.g., support members of glazed items (jamb, headers, sills) connections of windows to support members and connections of support members to the rest of the structure. For 3 story and higher buildings, provide calculations to demonstrate compliance with progressive collapse requirements.

3.5.2.5. For parts including architectural work, include building floor area analysis.

3.5.2.6. For parts including mechanical work, include HVAC analysis and calculations. Include complete design calculations for mechanical systems. Include computations for sizing equipment, compressed air systems, air duct design, and U-factors for ceilings, roofs and exterior walls and floors. Contractor shall employ commercially available energy analysis techniques to determine the energy performance of all passive systems and features. Use of hourly energy load computer simulation is required (see paragraph 3.5.5.2 for list of acceptable software). Based on the results of calculations, provide a complete list of the materials and equipment proposed with the manufacturer's published cataloged product installation specifications and roughing-in data.

3.5.2.7. For parts including life safety, include building code analysis and sprinkler and other suppression systems. Notwithstanding the requirements of the Codes, address the following:

(a) A registered fire protection engineer (FPE) must perform all fire protection analyses. Provide the fire protection engineer's qualifications. See Section 01 10 00, paragraph 5 for qualifications.

- (b) Provide all references used in the design including Government design documents and industry standards used to generate the fire protection analysis.
- (c) Provide classification of each building in accordance with fire zone, building floor areas and height and number of stories.
- (d) Provide discussion and description of required fire protection requirements including extinguishing equipment, detection equipment, alarm equipment and water supply. Alarm and detection equipment shall interface to requirements of Electronic Systems.
- (e) Provide hydraulic calculations based on water flow test for each sprinkler system to insure that flow and pressure requirements can be met with current water supply. Include copies of Contractor's water flow testing done to certify the available water source.

3.5.2.8. For parts including plumbing systems:

- (a) List all references used in the design.
- (b) Provide justification and brief description of the types of plumbing fixtures, piping materials and equipment proposed for use.
- (c) Detail calculations for systems such as sizing of domestic hot water heater and piping; natural gas piping; LP gas piping and tanks, fuel oil piping and tanks, etc., as applicable.
- (d) When the geotechnical report indicates expansive soils are present, indicate in the first piping design submittal how piping systems will be protected against damage or backfall/backflow due to soil heave (from penetration of slab to the 5 foot building line).

3.5.2.9. For elevator systems:

- (a) List all criteria codes, documents and design conditions used.
- (b) List any required permits and registrations for construction of items of special mechanical systems and equipment.

3.5.2.10. For parts including electrical work, include lighting calculations to determine maintained foot-candle levels, electrical load analysis and calculations, electrical short circuit and protective device coordination analysis and calculations and arc fault calculations.

3.5.2.11. For parts including telecommunications voice/data (including SIPRNET, where applicable), include analysis for determining the number and placement of outlets

3.5.2.12. For Cathodic Protection Systems, provide the following stamped report by the licensed corrosion engineer or NACE specialist with the first design submission. The designer must be qualified to engage in the practice of corrosion control of buried or submerged metallic surfaces. He/she must be accredited or certified by the National Association of Corrosion Engineers (NACE) as a NACE Accredited Corrosion Specialist or a NACE certified Cathodic Protection Specialist, or must be a registered professional engineer with a minimum of five years experience in corrosion control and cathodic protection. Clearly describe structures, systems or components in soil or water to be protected. Describe methods proposed for protection of each.

3.5.3. Geotechnical Investigations and Reports:

3.5.3.1. The contractor's licensed geotechnical engineer shall prepare a final geotechnical evaluation report, to be submitted along with the first foundation design submittal. Make this information available as early as possible during the over-the-shoulder progress review process. Summarize the subsurface conditions and provide recommendations for the design of appropriate utilities, foundations, floor slabs, retaining walls, embankments, and pavements. Include compaction requirements for fill and backfill under buildings, sidewalks, other structures and open areas. Recommend foundation systems to be used, allowable bearing pressures for footings, lateral load resistance capacities for foundation systems, elevations for footings, grade beams, slabs, etc. Provide an assessment of post-construction settlement potential including total and differential. Provide recommendations regarding lateral earth pressures (active, at-rest, passive) to be used in the design of retaining walls. Include the recommended spectral accelerations and Site Class for seismic design along with an evaluation of any seismic hazards and recommendations for mitigation, if required. Include calculations to support the recommendations for bearing capacity, settlement, and pavement sections. Include supporting documentation for all recommended

design parameters such as Site Class, shear strength, earth pressure coefficients, friction factors, subgrade modulus, California Bearing Ratio (CBR), etc. Provide earthwork recommendations, expected frost penetration, expected groundwater levels, recommendations for dewatering and groundwater control and the possible presence of any surface or subsurface features that may affect the construction of the project such as sinkholes, boulders, shallow rock, old fill, old structures, soft areas, or unusual soil conditions. Include pH tests, salinity tests, resistivity measurements, etc., required to design corrosion control and grounding systems. Include the raw field data. Arrange a meeting with the Government subsequent to completion and evaluation of the site specific geotechnical exploration to outline any differences encountered that are inconsistent with the Government provided preliminary soils information. Clearly outline differences which require changes in the foundation type, or pavement and earthwork requirements from that possible and contemplated using the Government furnished preliminary soils investigation, which result in a change to the design or construction. Any equitable adjustment is subject to the provisions of the contract's Differing Site Conditions Clause.

3.5.3.2. Vehicle Pavements: The Contractor's geotechnical report shall contain flexible and rigid pavement designs, as applicable for the project, including design CBR and modulus of subgrade reaction and the required compaction effort for subgrades and pavement layers. Provide Information on the types of base course materials available in the area and design strengths.

3.5.3.3. The Contractor and the professional geotechnical engineer consultant shall certify in writing that the design of the project has been developed consistent with the Contractor's final geotechnical report. The certification shall be stamped by the consulting professional geotechnical engineer and shall be submitted with the first design submission. If revisions are made to the initial design submission, a new certification shall be provided with the final design submission.

3.5.4. LEED Documentation:

Assign a LEED Accredited Professional, responsible to track LEED planning, performance and documentation for each LEED credit through construction closeout. Incorporate LEED credits in the plans, specifications and design analyses. Develop LEED supporting documentation as a separable portion of the Design Analysis and provide with each required design submittal. Include the LEED Project checklist for each non-exempt facility (one checklist may be provided for multiple facilities in accordance with the LEED-NC Application Guide for Multiple Buildings and On-Campus Building Projects and the LEED SUBMITTALS (Attachment E, herein) with each submittal. Final design submittal for each portion of the work must include all required design documentation relating to that portion of work (example - all site credit design documents with final site design). Submittal requirements are as indicated in Attachment E, LEED SUBMITTALS. Submit all documentation indicated on Attachment E as due at final design at final design submittal (for fast-track projects with multiple final design submittals, this shall be at the last scheduled final design submittal). All project documentation related to LEED shall conform to USGBC requirements for both content and format, including audit requirements and be separate from other design analyses. Maintain and update the LEED documentation throughout project progress to construction closeout and shall compile product data, receipts, calculations and other data necessary to substantiate and support all credits claimed. The Government may audit any or all individual credits. Audit documentation is not required to be submitted unless requested. These requirements apply to all projects. If the project requires the Contractor to obtain USGBC certification, the Contractor shall also be responsible for obtaining USGBC certification and shall provide written evidence of certification with the construction closeout LEED documentation submittal. Install the USGBC building plaque at the location indicated by the Government upon receipt. If Contractor obtains USGBC interim design review, submit the USGBC review to the Government within 30 days of receipt for information only.

3.5.4.1. LEED Documentation for Technology Solution Set. If the Solicitation provides a Prescriptive Technology Solution Set, use of the Technology Solution set has no effect on LEED documentation requirements. Provide all required LEED documentation, including energy analysis, in accordance with LEED requirements when using the Technology Solution Set.

3.5.5. Energy Conservation:

3.5.5.1. Refer to Section 01 10 00, Paragraph 5. Interim and Final Design submittals shall demonstrate that each building including the building envelope, HVAC systems, service water heating, power, and lighting systems meet the Mandatory Provisions and the Prescriptive Path requirements of ASHRAE 90.1. Use Compliance Documentation forms available from ASHRAE and included in the ASHRAE 90.1 User's Manual for this purpose. The Architectural Section of the Design Analysis shall include completed forms titled "Building Envelope

Compliance Documentation Parts I and II". The Heating Ventilating and Air Conditioning (HVAC) Section of the Design Analysis shall include a completed form titled "HVAC Simplified Approach Option - Part I" if this approach is allowed by the Standard. Otherwise, the HVAC Section of the Design Analysis shall include completed forms titled "HVAC Mandatory Provisions - Part II" and "HVAC Prescriptive Requirements - Part III". The Plumbing Section of the Design Analysis shall include a completed form titled "Service Water Heating Compliance Documentation". The Electrical Section of the Design Analysis shall include an explanatory statement on how the requirements of ASHRAE 90.1-2004 Chapter 8 Power were met. The Electrical Section of the Design Analysis shall also include a completed form titled "Lighting Compliance Documentation".

3.5.5.2. Interim and Final Design submittals which address energy consuming systems, (heating, cooling, service hot water, lighting, power, etc.) must also include calculations in a separate Energy Conservation Section of the Design Analysis which demonstrate and document (a) the baseline energy consumption for the facility or facilities under contract, that would meet the requirements of ANSI/ASHRAE/IESNA Standard 90.1 and (b) the energy consumption of the facility or facilities under contract utilizing the materials and methods required by this construction contract. Use the USGBC Energy and Atmosphere (EA) Credit 1 compliance template / form or an equivalently detailed form for documenting compliance with the energy reduction requirements. This template / form is titled PERFORMANCE RATING METHOD and is available when the project is registered for LEED. The calculation methodology used for this documentation and analysis shall follow the guidelines set forth in Appendix G of ASHRAE 90.1, with two exceptions: a) receptacle and process loads may be omitted from the calculation; and b) the definition of the terms in the formula for Percentage Improvement found in paragraph G1.2 are modified as follows: Baseline Building Performance shall mean the annual energy consumption calculated for a building design intended for use as a baseline for rating above standard design meeting the minimum requirements of the energy standard, and Proposed Building Performance shall mean annual energy consumption calculated for the proposed building design intended for construction. This calculation shall address all energy consuming systems in a single integrated methodology. Include laboratory fume hoods and kitchen ventilation loads in the energy calculation. They are not considered process loads. Individual calculations for heating, cooling, power, lighting, power, etc. systems will not be acceptable. The following building simulation software is acceptable for use in calculating building energy consumption: Hourly Analysis Program (HAP) by Carrier Corp., TRACE 700 by Trane Corp., DOE-2 by US Department of Energy, EnergyPlus by DOD/DOE.

3.5.6. Specifications

Specifications may be any one of the major, well known master guide specification sources (use only one source) such as MASTERSPEC from the American Institute of Architects, SPECTEXT from Construction Specification Institute or Unified Facility Guide Specifications (UFGS using MASTERFORMAT 2004 numbering system), etc. (including specifications from these sources). Manufacturers' product specifications, utilizing CSI's Manu-Spec, three part format may be used in conjunction with the selected specifications. The designers of record shall edit and expand the appropriate Specifications to insure that all project design requirements, current code requirements, and regulatory requirements are met. Specifications shall clearly identify, where appropriate, specific products chosen to meet the contract requirements (i.e., manufacturers' brand names and model numbers or similar product information).

3.5.7. Building Rendering

Present and provide a draft color computer, artist, or hand drawn rendering with the conceptual design submittal of the building exterior. Perspective renderings shall include a slightly overhead view of the entire building to encompass elevations and the roof configuration of the building. After Government review and acceptance, provide a final rendering, including the following:

Three (3) 18" x 24" color prints, framed and matted behind glass with project title underneath the print.

One (1) Image file (high resolution) in JPG format on CD for those in the submittal distribution list.

3.5.8. Interim Building Design Contents

The following list represents what the Government considers should be included in the overall completed design for a facility or project. It is not intended to limit the contractor from providing different or additional information as needed to support the design presented, including the require design analyses discussed above. As the Contractor develops individual design packages and submits them for Interim review, include as much of the applicable

information for an individual design package as is developed at the Interim design level for review purposes. These pieces shall be developed as the design progresses toward the design complete stage.

3.5.8.1. Lawn and Landscaping Irrigation System

3.5.8.2. Landscape, Planting and Turfing

3.5.8.3. Architectural

- (a) Design Narrative
- (b) Architectural Floor Plans, Typical Wall and Roof Sections, Elevations
- (c) Finish schedule
- (d) All required equipment
- (e) Special graphics requirements
- (f) Door and Window Schedules
- (g) Hardware sets using BHMA designations
- (h) Composite floor plan showing all pre-wired workstations
- (i) Structural Interior Design (SID) package: See ATTACHMENT A for specific requirements
- (j) Furniture, Fixtures & Equipment (FF&E) design package: See ATTACHMENT B for specific requirements

3.5.8.4. Structural Systems. Include:

- (a) Drawings showing principal members for roof and floor framing plans as applicable
- (b) Foundation plan showing main foundation elements where applicable
- (c) Typical sections for roof, floor, and foundation conditions

3.5.8.5. Plumbing Systems

- (a) Show locations and general arrangement of plumbing fixtures and major equipment
- (b) Plan and isometric riser diagrams of all areas including hot water, cold water, waste and vent piping. Include natural gas (and meter as required), (natural gas and meter as required), (LP gas), (fuel oil) and other specialty systems as applicable.
- (c) Include equipment and fixture connection schedules with descriptions, capacities, locations, connection sizes and other information as required

3.5.8.6. HVAC Systems

- (a) Mechanical Floor Plans: The floor plans shall show all principle architectural features of the building which will affect the mechanical design. The floor plans shall also show the following:
 - (1) Room designations.
 - (2) Mechanical legend and applicable notes.
 - (3) Location and size of all ductwork and piping.
 - (4) Location and capacity of all terminal units (i.e., registers, diffusers, grilles, hydronic baseboards).
 - (5) Pre-Fabricated Paint Spray Booth (where applicable to project scope)
 - (6) Paint Preparation Area (where applicable to project scope)
 - (7) Exhaust fans and specialized exhaust systems.
 - (8) Thermostat location.
 - (9) Location of heating/cooling plant (i.e., boiler, chiller, cooling tower, etc).
 - (10) Location of all air handling equipment.

- (11) Air balancing information.
- (12) Flue size and location.
- (13) Piping diagram for forced hot water system (if used).
- (b) Equipment Schedule: Provide complete equipment schedules. Include:
 - (1) Capacity
 - (2) Electrical characteristics
 - (3) Efficiency (if applicable)
 - (4) Manufacturer's name
 - (5) Optional features to be provided
 - (6) Physical size
 - (7) Minimum maintenance clearances
- (a) Details: Provide construction details, sections, elevations, etc., only where required for clarification of methods and materials of design.
- (b) HVAC Controls: Submit complete HVAC controls equipment schedules, sequences of operation, wiring and logic diagrams, Input/Output Tables, equipment schedules, and all associated information. See the Statement of Work for additional specific requirements.

3.5.8.7. Fire Protection and Life Safety.

- (a) Provide plan for each floor of each building that presents a compendium of the total fire protection features being incorporated into the design. Include the following types of information:
 - (1) The location and rating of any fire-resistive construction such as occupancy separations, area separations, exterior walls, shaft enclosures, corridors, stair enclosures, exit passageways, etc.
 - (2) The location and coverage of any fire detection systems
 - (3) The location and coverage of any fire suppression systems (sprinkler risers, standpipes, etc.)
 - (4) The location of any other major fire protection equipment
 - (5) Indicate any hazardous areas and their classification
 - (6) Schedule describing the internal systems with the following information: fire hazard and occupancy classifications, building construction type, GPM/square foot sprinkler density, area of operation and other as required
- (b) Working plans and all other materials submitted shall meet NFPA 13 requirements, with respect to required minimum level of detail.

3.5.8.8. Elevators. Provide:

- (a) Description of the proposed control system
- (b) Description, approximate capacity and location of any special mechanical equipment for elevators.

3.5.8.9. Electrical Systems.

- (a) Electrical Floor Plan(s): Show all principle architectural features of the building which will affect the electrical design. Show the following:
 - (1) Room designations.
 - (2) Electrical legend and applicable notes.
 - (3) Lighting fixtures, properly identified.
 - (4) Switches for control of lighting.
 - (5) Receptacles.

- (6) Location and designation of panelboards. Clearly indicate type of mounting required (flush or surface) and reflect accordingly in specifications.
- (7) Service entrance (conduit and main disconnect).
- (8) Location, designation and rating of motors and/or equipment which requires electrical service. Show method of termination and/or connection to motors and/or equipment. Show necessary junction boxes, disconnects, controllers (approximate only), conduit stubs, and receptacles required to serve the motor and/or equipment.
- (b) Building Riser Diagram(s) (from pad-mounted transformer to unit load center panelboard): Indicate the types and sizes of electrical equipment and wiring. Include grounding and metering requirements.
- (c) Load Center Panelboard Schedule(s): Indicate the following information:
 - (1) Panelboard Characteristics (Panel Designation, Voltage, Phase, Wires, Main Breaker Rating and Mounting.
 - (2) Branch Circuit Designations.
 - (3) Load Designations.
 - (4) Circuit Breaker Characteristics. (Number of Poles, Trip Rating, AIC Rating)
 - (5) Branch Circuit Connected Loads (AMPS).
 - (6) Special Features
- (d) Lighting Fixture Schedule(s): Indicate the following information:
 - (1) Fixture Designation.
 - (2) General Fixture Description.
 - (3) Number and Type of Lamp(s).
 - (4) Type of Mounting.
 - (5) Special Features.
- (e) Details: Provide construction details, sections, elevations, etc. only where required for clarification of methods and materials of design.

3.5.8.10. Electronic Systems including the following responsibilities:

- (a) Fire Detection and Alarm System. Design shall include layout drawings for all devices and a riser diagram showing the control panel, annunciator panel, all zones, radio transmitter and interfaces to other systems (HVAC, sprinkler, etc.)
- (b) Fire Suppression System Control. Specify all components of the Fire Suppression (FS) System in the FS section of the specifications. Clearly describe how the system will operate and interact with other systems such as the fire alarm system. Include a riser diagram on the drawings showing principal components and interconnections with other systems. Include FS system components on drawing legend. Designate all components shown on floor plans "FS system components" (as opposed to "Fire Alarm components"). Show location of FS control panels, HVAC control devices, sensors, and 120V power panel connections on floor plans. Indicate zoning of areas by numbers (1, 2, 3) and detectors sub-zoned for cross zoning by letter designations (A and B). Differentiate between ceiling mounted and under floor detectors with distinct symbols and indicate sub-zone of each.
- (c) Public Address System
- (d) Special Grounding Systems. Completely reflect all design requirements in the specifications and drawings. Specifications shall require field tests (in the construction phase), witnessed by the Government, to determine the effectiveness of the grounding system. Include drawings showing existing construction, if any.
- (e) Cathodic Protection.
- (f) Intrusion Detection, Card Access System
- (g) Central Control and Monitoring System
- (h) Mass Notification System
- (i) Electrical Power Distribution Systems

3.5.8.11. Separate detailed Telecommunications drawings for Information Systems including the following responsibilities:

(a) Telecommunications Cabling

(b) Supporting Infrastructure

(a) Outside Plant (OSP) Cabling - Campus or Site Plans - Exterior Pathways and Inter-Building Backbones

(a) Include a layout of the voice/data outlets (including voice only wall & pay phones) on telecommunication floor plan drawing, location of SIPRNET data outlets (where applicable), and a legend and symbol definition to indicate height above finished floor. Show size of conduit and cable type and size on Riser Diagram. Do not show conduit runs between backboard and outlets on the floor plans. Show underground distribution conduit and cable with sizing from point of presence to entrance facility of building.

(b) Layout of complete building per floor - Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways including Serving Zones Drawings - Drop Locations and Cable ID's

(c) Communication Equipment Rooms - Plan Views - Tech and AMEP/Elevations - Racks and Walls. Elevations with a detailed look at all telecomm rooms. Indicate technology layout (racks, ladder-racks, etc.), mechanical/electrical layout, rack elevation and backboard elevation. They may also be an enlargement of a congested area of T1 or T2 series drawing.

3.6. FINAL DESIGN REVIEWS AND CONFERENCES

A final design review and review conference will be held upon completion of final design at the project installation, or – where equipment is available - by video teleconference or a combination thereof, for any design package to receive Government acceptance to allow release of the design package for construction. For smaller separate design packages, the parties may agree on alternative reviews and conferences (e.g., conference calls and electronic file sharing, etc.) through the Partnering process. Include the final design conference in the project schedule and shall indicate what part of the design work is at 100% completion. The final design conference will be held after the Government has had seven (7) calendar days after receipt of the submission to review the final design package and supporting data. For smaller packages, especially those involving only one or a few design disciplines the parties may agree on a shorter period.

3.7. FINAL DESIGN REQUIREMENTS

Final design deliverables for a design package shall consist of 100% complete drawings, specifications, submittal register and design analyses for Government review and acceptance. The 100% design submission shall consist of drawings, specifications, updated design analyses and any permits required by the contract for each package submitted. In order to expedite the final design review, prior to the conference, ensure that the design configuration management data and all review comment resolutions are up-to-date. Include the 100% SID and 100% FF&E binders for government approval. The Contractor shall have performed independent technical reviews (ITR's) and back-checks of previous comment resolutions, as required by Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL, including providing documentation thereof.

3.7.1. Drawings

3.7.1.1. Submit drawings complete with all contract requirements incorporated into the documents to provide a 100% design for each package submitted.

3.7.1.2. Prepare all drawings with the Computer-Aided Design and Drafting (CADD)/Computer-Aided Design (CAD) system, organized and easily referenced electronically, presenting complete construction information.

3.7.1.3. Drawings shall be complete. The Contractor is encouraged to utilize graphics, views, notes, and details which make the drawings easier to review or to construct but is also encouraged to keep such materials to those that are necessary.

3.7.1.4. Provide detail drawings that illustrate conformance with the contract. Include room finish schedules, corresponding color/finish/special items schedules, and exterior finish schedules that agree with the submitted SID binders.

3.7.1.5. The design documents shall be in compliance with the latest version of the A/E/C CADD Standard, available at <https://caddim.usace.army.mil/CAD>. Use the approved vertical Corps of Engineers title blocks and borders on all drawings with the appropriate firm name included within the title block area.

3.7.1.6. CAD System and Building Information Modeling (BIM) (NOTE: If this is a Single Award or Multiple Award, Indefinite Delivery/Indefinite Quantity Contract, this information will be provided for each task order.)

All CAD files shall be fully compatible with MicroStation V8 or higher. Save all design CAD files as MicroStation V8 or higher files. All submitted BIM Models and associated Facility Data shall be fully compatible with Bentley BIM file format and the USACE Bentley BIM v8 Workspace.

(a) CAD Data Final File Format: During the design development capture geo-referenced coordinates of all changes made to the existing site (facility footprint, utility line installations and alterations, roads, parking areas, etc) as a result of this contract. There is no mandatory methodology for how the geo-referenced coordinates will be captured, however, Engineering and Construction Bulletin No. 2006-15, Subject: Standardizing Computer Aided Design (CAD) and Geographic Information Systems (GIS) Deliverables for all Military Design and Construction Projects identifies the format for final as-built drawings and data sets to be delivered to the government. Close-out requirements at the as-built stage; require final geo-referenced GIS Database of the new facility along with all exterior modifications. The Government will incorporate this data set into the Installation's GIS Masterplan or Enterprise GIS System. See also, Section 01 78 02.00 10 Closeout Submittals.

(b) Electronic Drawing Files: In addition to the native CAD design files, provide separate electronic drawing files (in editable CAD format and Adobe Acrobat PDF version 7.0 or higher) for each project drawing.

(c) Each file (both CAD and PDF) shall represent one complete drawing from the drawing set, including the date, submittal phase, and border. Each drawing file shall be completely independent of any data in any other file, including fonts and shapes not included with the basic CAD software program utilized. Drawing files with external references or special fonts are not acceptable. All displayed graphic elements on all levels of the drawing files shall be part of the project drawing image. The drawing files shall not contain any graphic element that is not part of the drawing image.

(d) Deliver BIM Model and associated Facility Data files in their native format. At a minimum, BIM files shall address major architecture design elements, major structural components, mechanical systems and electrical/communication distribution and elements as defined in Attachment F. See Attachment F for additional BIM requirements.

(e) Drawing Index: Provide an index of drawings sheet in CAD as part of the drawing set, and an electronic list in Microsoft Excel of all drawings on the CD. Include the electronic file name, the sheet reference number, the sheet number, and the sheet title, containing the data for each drawing.

(f) Hard Copies: Plot submitted hard copy drawings directly from the "electronic drawing files" and copy for quantities and sizes indicated in the distribution list at the end of this specification section. The Designers of Record shall stamp, sign and date original hard copy sheets as Released For Construction, and provide copies for distribution from this set.

3.7.2. Design Analyses

3.7.2.1. The designers of record shall update, finalize and present design analyses with calculations necessary to substantiate and support all design documents submitted.

3.7.2.2. The responsible DOR shall stamp, sign and date the design analysis. Identify the software used where, applicable (name, version, vendor). Generally, provide design analyses, individually, in an original (file copy) and one copy for the assigned government reviewer.

3.7.2.3. All disciplines review the LEED design analysis in conjunction with their discipline-specific design analysis; include a copy of the separable LEED design analysis in all design analysis submittals.

3.7.2.4. Do not combine multi-disciplined volumes of design-analysis, unless multiple copies are provided to facilitate multiple reviewers (one copy per each separate design analysis included in a volume).

3.7.3. Specifications

Specifications shall be 100% complete and in final form.

3.7.4. Submittal Register

Prepare and update the Submittal Register and submit it with the 100% design specifications (see Specification Section 01 33 00, SUBMITTAL PROCEDURES) with each design package. Include the required submittals for each specification section in a design package in the submittal register.

3.7.5. Preparation of DD Form 1354 (Transfer of Real Property)

This form itemizes the types, quantities and costs of various equipment and systems that comprise the project, for the purpose of transferring the new construction project from the Corps Construction Division to the Installation's inventory of real property. The Government will furnish the DB Contractor's design manager a DD Form 1354 checklist to use to produce a draft Form 1354. Submit the completed checklist and prepared draft Form DD 1354 with the 100% design in the Design Analysis. The Corps will use these documents to complete the final DD 1354 upon completion of construction.

3.7.6. Acceptance and Release for Construction

3.7.6.1. At the conclusion of the Final Design Review (after resolutions to the comments have been agreed upon between DOR and Government reviewers), the Contracting Officer or the ACO will accept the Final Design Submission for the design package in writing and allow construction to start for that design package. The Government may withhold acceptance until all major corrections have been made or if the final design submission requires so many corrections, even though minor, that it isn't considered acceptably complete.

3.7.6.2. Government review and acceptance of design submittals is for contract conformance only and shall not relieve the Contractor from responsibility to fully adhere to the requirements of the contract, including the Contractor's accepted contract proposal, or limit the Contractor's responsibility of design as prescribed under Special Contract Requirement: "Responsibility of the Contractor for Design" or limit the Government's rights under the terms of the contract. The Government reserves the right to rescind inadvertent acceptance of design submittals containing contract deviations not separately and expressly identified in the submittal for Government consideration and approval.

3.8. DESIGN COMPLETE CONSTRUCTION DOCUMENT REQUIREMENTS

After the Final Design Submission and Review Conference and after Government acceptance of the Final Design submission, revise the design documents for the design package to incorporate the comments generated and resolved in the final review conference, perform and document a back-check review and submit the final, design complete documents. Label the final design complete documents "FOR CONSTRUCTION" or use similar language. In addition to the final drawings and specifications, the following deliverables are required for distribution and field use. The deliverable includes all documentation and supporting design analysis in final form, as well as the final review comments, disposition and the back-check. As part of the quality assurance process, the Government may perform a back-check of the released for construction documentation. Promptly correct any errors or omissions found during the Government back-check. The Government may withhold retainage from progress payments for work or materials associated with a final design package until this submittal has been received and the Government determines that it is complete.

3.9. SUBMITTAL DISTRIBUTION, MEDIA AND QUANTITIES

3.9.1. Submittal Distribution and Quantities

General: The documents which the Contractor shall submit to the Government for each submittal are listed and generally described in preceding paragraphs in this Section. Provide copies of each design submittal and design substantiation as follows (NOTE: If this is a Single Award or Multiple Award, Indefinite Delivery/Indefinite Quantity Contract, this information will be provided for each task order):

| Activity and Address | Drawing Size (Full Size) 22 X 34 Full Sets/ *Partial Sets | Design Analyses & Specs Full Sets/ *Partial Sets | Drawing Size (Half Size) 11 X 17 Full Sets/ *Partial Sets | Non-BIM Data CD-ROM or DVD as Necessary (PDF & <u>.dgn</u>) | Furniture Submittal (FFE) | Structural Interior Design Submittal | BIM Data DVD (Per Attach F) |
|--|---|--|---|--|---------------------------|--------------------------------------|-----------------------------|
| Commander, U.S.Army Engineer District Kansas City District | 1/1 | 5/2 | 5/2 | 4 | 1 | 1 | 1 |
| Commander, U.S.Army Engineer District, Center of Standardization Fort Worth District | 1/0 | 5/2 | 5/2 | 6 | 1 | 1 | 1 |
| Installation | 10/0 | 100/0 | 10/0 | 2 | 2 | 2 | 1 |
| U.S.Army Corps of Engineers Construction Area Office | 3/2 | 3/2 | 3/2 | 3 | 3 | 3 | 1 |
| Information Systems Engineering Command (ISEC) | 0/0 | 0/1 | 0/0 | 1 | 1 (Electronic only) | N/A | 1 |
| Other Offices | 0/0 | 3/3 | 3/3 | 3 | 1 | 0 | 1 |

***NOTE: For partial sets of drawings, specifications and design analyses, see paragraph 3.9.3.3, below.**

****NOTE: When specified below in 3.9.2, furnish Installation copies of Drawings as paper copies, in lieu of the option to provide secure web-based submittals.**

3.9.2. Web based Design Submittals

Except for full or half-sized drawings for Installation personnel, as designated in the Table above, Web based design submittals will be acceptable as an alternative to the paper copies listed in the Table above, provided a single hard-copy PDF based record set is provided to the Contracting Officer for record purposes. Where the contract requires the Contractor to submit documents to permitting authorities, still provide those authorities paper copies (or in an alternate format where required by the authority). Web based design submittal information shall be provided with adequate security and availability to allow unlimited access those specifically authorized to Government reviewers while preventing unauthorized access or modification. File sizes must be of manageable size for reviewers to quickly download or open on their computers. As a minimum, drawings shall be full scale on American National Standards Institute (ANSI) D sheets (34" x 22"). In addition to the optional website, provide the BIM data submission on DVD to each activity and address noted above in paragraph 3.9.1 for each BIM submission required in Attachment F.

3.9.3. Mailing of Design Submittals

3.9.3.1. Mail all design submittals to the Government during design and construction, using an overnight mailing service. The Government will furnish the Contractor addresses where each copy shall be mailed to after award of the contract (or individual task order if this is an indefinite delivery/indefinite quantity, task order contract). Mail the submittals to four (4) different addresses. Assemble drawing sheets, specs, design analyses, etc. into individual sets; do not combine duplicate pages from individual sets so that the government has to assemble a set.

3.9.3.2. Each design submittal shall have a transmittal letter accompanying it indicating the date, design percentage, type of submittal, list of items submitted, transmittal number and point of contact with telephone number.

3.9.3.3. Provide partial sets of drawings, specifications, design analyses, etc., as designated in the Table in paragraph 3.9.1, to those reviewers who only need to review their applicable portions of the design, such as the various utilities. The details of which office receives what portion of the design documentation will be worked out after award.

3.10. AS-BUILT DOCUMENTS

Provide as-built drawings and specifications in accordance with Section 01 78 02.00 10, CLOSEOUT SUBMITTALS. Update LEED design phase documentation during construction as needed to reflect construction changes and advancing project completion status (example - Commissioning Plan updates during construction phase) and include updated LEED documentation in construction closeout submittal.

ATTACHMENT A STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS

1.0 GENERAL INFORMATION

Structural Interior Design includes all building related elements and components generally part of the building itself, such as wall finishes, ceilings finishes, floor coverings, marker/bulletin boards, blinds, signage and built in casework. Develop the SID in conjunction with the furniture footprint.

2.0 STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS FOR THE INTERIM AND FINAL DESIGN SUBMITTALS

2.1. FORMAT AND SCHEDULE

Prepare and submit for approval an interior and exterior building finishes scheme for an interim design submittal. The DOR shall meet with and discuss the finish schemes with the appropriate Government officials prior to preparation of the schemes to be presented. Present original sets of the schemes to reviewers at an interim design conference.

At the conclusion of the interim phase, after resolutions to the comments have been agreed upon between DOR and Government reviewers, the Contractor may proceed to final design with the interior finishes scheme presented.

The SID information and samples are to be submitted in 8 ½" x 11" format using three ring binders with pockets on the inside of the cover. When there are numerous pages with thick samples, use more than one binder. Large D-ring binders are preferred to O-ring binders. Use page protectors that are strong enough to keep pages from tearing out. Anchor large or heavy samples with mechanical fasteners, Velcro, or double-faced foam tape rather than rubber cement or glue. Fold out items must have a maximum spread of 25 ½". Provide cover and spine inserts sheets identifying the document as "Structural Interior Design" package. Include the project title and location, project number, Contractor/A/E name and phone number(s), submittal stage and date.

Design submittal requirements include, but are not limited to:

2.1.1. Narrative of the Structural Interior Design Objectives

The SID shall include a narrative that discusses the building related finishes. Include topics that relate to base standards, life safety, sustainable design issues, aesthetics, durability and maintainability, discuss the development and features as they relate to the occupants requirements and the building design.

2.1.2. Interior Color Boards

Identify and key each item on the color boards to the contract documents to provide a clear indication of how and where each item will be used. Arrange finish samples to the maximum extent possible by room type in order to illustrate room color coordination. Label all samples on the color boards with the manufacturer's name, patterns and colors name and number. Key or code samples to match key code system used on contract drawings.

Material and finish samples shall indicate true pattern, color and texture. Provide photographs or colored photocopies of materials or fabrics to show large overall patterns in conjunction with actual samples to show the actual colors. Finish samples must be large enough to show a complete pattern or design where practical.

Color boards shall include but not be limited to original color samples of the following:

All walls finishes and ceiling finishes, including corner guards, acrylic wainscoting and wall guards/chair rail finishes

All tile information, including tile grout color and tile patterns.

- All flooring finishes, including patterns.
- All door, door frame finishes and door hardware finishes
- All signage, wall base, toilet partitions, locker finishes and operable/folding partitions and trim

- All millwork materials and finishes (cabinets, counter tops, etc.)
- All window frame finishes and window treatments (sills, blinds, etc.)

Color board samples shall reflect all actual finish textures, patterns and colors required as specified. Patterned samples shall be of sufficient size to adequately show pattern and its repeat if a repeat occurs.

2.1.3. Exterior Color Boards

Prepare exterior finishes color boards in similar format as the interior finishes color boards, for presentation to the reviewers during an interim design conference. Provide original color samples of all exterior finishes including but not limited to the following:

- All Roof Finishes
- All Brick and Cast Stone Samples
- All Exterior Insulation and Finish Samples
- All Glass Color Samples
- All Exterior Metals Finishes
- All Window & Door Frame Finishes
- All Specialty Item Finishes, including trim

Identify each item on the exterior finishes color boards and key to the building elevations to provide a clear indication of how and where each item will be used.

2.2. STRUCTURAL INTERIOR DESIGN DOCUMENTS

2.2.1. General

Structural interior design related drawings must indicate the placement of extents of SID material, finishes and colors and must be sufficiently detailed to define all interior work. The following is a list of minimum requirements:

2.2.2. Finish Color Schedule

Provide finish color schedule(s) in the contract documents. Provide a finish code, material type, manufacturer, series, and color designations. Key the finish code to the color board samples and drawings.

2.2.3. Interior Finish Plans

Indicate wall and floor patterns and color placement, material transitions and extents of interior finishes.

2.2.4. Furniture Footprint Plans

Provide furniture footprint plans showing the outline of all freestanding and systems furniture for coordination of all other disciplines.

2.2.5. Interior Signage

Include interior signage plans or schedules showing location and quantities of all interior signage. Key each interior sign to a quantitative list indicating size, quantity of each type and signage text.

2.2.6. Interior Elevations, Sections and Details

Indicate material, color and finish placement.

**ATTACHMENT B
FURNITURE, FIXTURES & EQUIPMENT (FF&E) REQUIREMENTS**

1.0 FF&E REQUIREMENTS FOR THE INTERIM AND FINAL DESIGN SUBMITTALS

1.1. FORMAT AND SCHEDULE

Prepare and submit for approval a comprehensive FF&E scheme for an interim design submittal. The Contractor's interior designer, not a furniture dealer, shall develop the design. FF&E is the selection, layout, specification and documentation of furniture includes but is not limited to workstations, seating, tables, storage and shelving, filing, trash receptacles, clocks, framed artwork, artificial plants, and other accessories. Contract documentation is required to facilitate pricing, procurement and installation. The FF&E package is based on the furniture footprint developed in the Structural Interior Design (SID) portion of the interior design. Develop the FF&E package concurrently with the building design to ensure that there is coordination between the electrical outlets, switches, J-boxes, communication outlets and connections, and lighting as appropriate. In addition, coordinate layout with other building features such as architectural elements, thermostats, location of TV's, GF/GI equipment (for example computers, printers, copiers, shredders, faxes), etc. Locate furniture in front of windows only if the top of the item falls below the window and unless otherwise noted, do not attach furniture including furniture systems to the building. If project has SIPRNET and/or NIPRNET, coordinate furniture layout with SIPRNET and NIPRNET separation requirements. Verify that access required by DOIM for SIPRNET box and conduit is provided. The DOR shall interview appropriate Government personnel to determine FF&E requirements for furniture and furnishings prior to preparation of the scheme to be presented. Determine FFE items and quantities by, but not limited to: (1) the number of personnel to occupy the building, (2) job functions and related furniture/office equipment to support the job function, (3) room functions, (4) rank and grade. Present original sets of the scheme to reviewers at an interim design conference upon completion of the interim architectural submittal or three months prior to the submittal of the final FF&E package (whichever comes first).

Design may proceed to final with the FF&E scheme presented at the conclusion of the interim phase, after resolutions to the comments have been agreed upon between DOR and Government reviewers.

Provide six copies of the electronic versions of all documents upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first), to ensure adequate time for furniture acquisition. Provide unbound, electronic drawings in CAD and BIM. Provide all files needed to view complete drawings. Submit all text documents in Microsoft Word or Excel..

Submit three copies of the final and complete FF&E information and samples in 8 ½" x 11" format using three ring binders with pockets on the inside of the cover upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first). Use more than one binder when there are numerous pages with thick samples. Large D-ring binders are preferred to O-ring binders. Use page protectors that are strong enough to keep pages from tearing out for upholstery and finish boards. Anchor large or heavy samples with mechanical fasteners, Velcro, or double-faced foam tape rather than rubber cement or glue. Fold out items must have a maximum spread of 25 ½". Provide cover and spine inserts sheets identifying the document as "Furniture, Fixtures & Equipment" package and include the project title and location, project number, Contractor/A/E name and phone number(s), submittal stage and date.

Provide electronic copies of all documents upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first), to ensure adequate time for furniture acquisition. Provide six compact disks with all drawings files needed to view the complete drawings unbound and in the latest version AutoCAD. Provide six additional compact disks of all text documents in Microsoft Word or Excel.

Design submittal requirements include, but are not limited to:

1.1.1. Narrative of Interior Design Objectives

Provide a narrative description of the furniture, to include functional, safety and ergonomic considerations, durability, sustainability, aesthetics, and compatibility with the building design.

1.1.2. Furniture Order Form

Prepare one Furnishings Order Form for each item specified in the design. This form identifies all information required to order each individual item. In addition to the project name and location, project number, and submittal phase, the order form must include:

- (a) Furniture item illustration and code
- (b) Furniture item name
- (c) Job name, location, and date
- (d) General Services Administration (GSA) FSC Group, part, and section
- (e) Manufacturer, Product name and Product model number or National Stock Number (NSN)
- (f) Finish name and number (code to finish samples)
- (g) Fabric name and number, minimum Wyzenbeek Abrasion Test double rubs (code to fabric samples)
- (h) Dimensions
- (i) Item location by room number and room name
- (j) Quantity per room
- (k) Total quantity
- (l) Special instructions for procurement ordering and/or installation (if applicable)
- (m) Written Product Description: include a non-proprietary paragraph listing the salient features of the item to include but not limited to:
 - (1) required features and characteristics
 - (2) ergonomic requirements
 - (3) functional requirements
 - (4) testing requirements
 - (5) furniture style
 - (6) construction materials
 - (7) minimum warranty

The following is an example for "m" features and characteristics, ergonomic requirements and functional requirements:

Chair Description:

- (1) Mid-Back Ergonomic Task Chair
- (2) Pneumatic Gaslift; Five Star Base
- (3) Mesh Back; Upholstered Seat
- (4) Height and Width Adjustable Task Arms:
 - a. Arm Height: 6"- 11" (+-1/2")
 - b. Arm Width: 2"- 4" adjustment
- (5) Height Adjustable Lumbar Support
- (6) Adjustable Seat Height 16"-21" (+- 1")
- (7) Sliding Seat Depth Adjustment 15"-18" (+-1")
- (8) Standard Hard Casters (for carpeted areas)
- (9) Overall Measurements:
 - a. Overall width: 25" - 27"
 - b. Overall depth: 25"- 28"

- (10) Must have a minimum of the following adjustments (In addition to the above):
- a. 360 Degree Swivel
 - b. Knee-Tilt with Tilt Tension
 - c. Back angle
 - d. Forward Tilt
 - e. Forward Tilt and Upright Tilt Lock

For projects with systems furniture, also provide a written description of the following minimum requirements:

- (1) Type furniture systems (panel, stacking panels, spine wall, desk based system, or a combination)
- (2) Minimum noise reduction coefficient (NRC)
- (3) Minimum sound transfer coefficient (STC)
- (4) Minimum flame spread and smoke development
- (5) UL testing for task lighting and electrical system
- (6) Panel widths and heights and their locations (this may be done on the drawings) Worksurface types and sizes (this may be done on the drawings)
- (7) Worksurface edge type
- (8) Varying panel/cover finish materials and locations (locations may be shown on the drawings)
- (9) Storage requirements
- (10) Keyboard requirements
- (11) Lock and keying requirements
- (12) Accessory components (examples: tack boards, marker boards, paper management)
- (13) Electrical and communication raceway requirement; type, capacity and location (base, bellline, below and/or above bellline)
- (14) Locations of communication cables (base, bellline, below and/or above bellline, top channel)
- (15) Types of electrical outlets
- (16) Types of communication jacks; provided and installed by others
- (17) Locations of electrical outlets and communication jacks (this may be done on the drawings)
- (18) Type of cable (examples: Cat. 5, Cat. 6, fiber optic; UTP or STP, etc.) system needs to support; provided and installed by others

1.1.3. Alternate Manufacturer List

Provide a table consisting of major furniture items that lists the manufacturers products specified on the Order Form and two alternate manufacturers. Major furniture items include, but are not limited to, casegoods, furniture systems, seating, and tables. Organize matrix by item code and item name. Supply alternates that are available on GSA Schedule and meet the requirements of the Furniture Order Form. One of the two alternates must be from UNICOR if possible. Provide manufacturer name address, telephone number, product series and product name for each alternate manufacturer.

1.1.4. FF&E Procurement List

Provide a table that lists all FF&E furniture, mission unique equipment and building Contractor Furnished/Contractor Installed (CF/CI) items. Give each item a code and name and designate whether item will be procured as part of the FF&E furniture, mission unique equipment or the building construction contract. Use the item code to key all FF&E documents including location plans, color boards, data sheets, cost estimate, etc.

1.1.5. Points of Contact (POCs)

Provide a comprehensive list of POCs needed to implement the FF&E package. This would include but not be limited to appropriate project team members, using activity contacts, interior design representatives, construction contractors and installers involved in the project. In addition to name, address, phone, fax and email, include each contact's job function. Divide the FF&E package into different sections based on this listing, applies to order forms and cost estimates.

1.1.6. Color Boards

Provide color boards for all finishes and fabrics for all FF&E items. Finishes to be included but not limited to paint, laminate, wood finish, fabric, etc.

1.1.7. Itemized Furniture Cost Estimate

Provide an itemized cost estimate of furnishings keyed to the plans and specifications of products included in the package. This cost estimate should be based on GSA price schedules. The cost estimate must include separate line items for general contingency, installation, electrical hook-up for systems furniture or other furniture requiring hardwiring by a licensed electrician, freight charges and any other related costs. Installation and freight quotes from vendors should be use in lieu of a percentage allowance when available. Include a written statement that the pricing is based on GSA schedules. An estimate developed by a furniture dealership may be provided as support information for the estimate, but must be separate from the contractor provided estimate.

1.2. INTERIOR DESIGN DOCUMENTS

1.2.1. Overall Furniture and Area Plans

Provide floor Plans showing locations and quantities of all freestanding, and workstation furniture proposed for each floor of the building. Key each room to a large scale Furniture Placement Plan showing the furniture configuration, of all furniture. Provide enlarged area plans with a key plan identifying the area in which the building is located. Key all the items on the drawings by furniture item code. Do not provide manufacturer specific information such as product names and numbers on drawings, Drawings shall be non-proprietary. This is typical for FFE on all plans, including those mentioned below.

1.2.2. Workstation Plans

Show each typical workstation configuration in plan view, elevations or isometric view. Drawings shall illustrate panels and all major components for each typical workstation configuration. Identify workstations using the same numbering system as shown on the project drawings. Key components to a legend on each sheet which identifies and describes the components along with dimensions. Provide the plan, elevations and isometric of each typical workstation together on the same drawing sheet.

1.2.3. Panel Plans

Show panel locations and critical dimensions from finished face of walls, columns, panels including clearances and aisle widths. Key panel assemblies to a legend which shall include width, height, configuration of frames, panel fabric and finishes (if there are different selections existing within a project), powered or non-powered panel and wall mount locations.

1.2.4. Desk Plans

Provide typical free standing desk configurations in plan view, elevation or isometric view and identify components to clearly represent each desk configuration.

1.2.5. Reflected Ceiling Plans

Provide typical plans showing ceiling finishes and heights, lighting fixtures, heating ventilation and air conditioning supply and return, and sprinkler head placement for coordination of furniture.

1.2.6. Electrical and Telecommunication Plans

Show power provisions including type and locations of feeder components, activated outlets and other electrical components. Show locations and quantities of outlets for workstations. Clearly identify different outlets, i.e. electrical, LAN and telecommunication receptacles indicating each type proposed. Show wiring configuration, (circuiting, switching, internal and external connections) and provide as applicable.

1.2.7. Artwork Placement Plans

Provide an Artwork Placement Plan to show location of artwork, assign an artwork item code to each piece of artwork. As an alternative, artwork can be located on the Furniture Plans. Provide a schedule that identifies each piece by room name and number. Provide installation instructions; include mounting height.

1.2.8. Window Drapery Plans

Provide Interior Window Drapery Plans. Key each drapery treatment to a schedule showing color, pattern, material, drapery size and type, draw direction, location and quantities.

1.3. FURNITURE SELECTION

1.3.1. Select furniture from the GSA Schedules. Specify furniture available open market when an item is not available on the GSA Schedules. Provide justification for items not available on the GSA Schedules.

1.3.2. To the greatest extent possible when specifying furniture work within a manufacturer's family of furniture for selections, example: Steelcase, Turnstone, Brayton International, Metro, and Vecta are all Steelcase companies. Each alternate should also be specified from a manufacturer's family of furniture, example: first set of alternates would be specified from Knoll's family of furniture and the second from Herman Miller family of furniture. It may be necessary to make some selections from other than a manufacturer's family of furniture if costs are not reasonable for particular items, some items are not available or appropriate for the facility or the items are not on GSA Schedule. If this occurs, consider specifying product from an open line that is accessible by numerous dealerships. Select office furniture including case goods, tables, storage, seating, etc. that is compatible in style, finish and color. Select furniture that complies with ANSI/BIFMA and from manufacturer's standard product line as shown in the most recent published price list and/or amendment and not custom product.

1.4. CONSTRUCTION

1.4.1. Provide knee space at workstations and tables that is not obstructed by panels/legs that interfere with knee space of seated person and provide desks, storage and tables with leveling devices to compensate for uneven floors.

1.4.2. Provide worksurface tops constructed to prevent warpage. Provide user friendly features such as radius edges. Do not use sharp edges and exposed connections and ensure the underside of desks, tables and worksurfaces are completely and smoothly finished. Provide abutting worksurfaces that mate closely and are of equal heights when used in side-by-side configurations in order to provide a continuous and level worksurface.

1.4.3. Drawers shall stay securely closed when in the closed position and protect wires from damage during drawer operation. Include a safety catch to prevent accidental removal when fully open

1.4.4. Unless otherwise noted, specify lockable desks and workstations and storage of steel construction. Use tempered glass glazing when glazing is required.

1.5. FINISHES AND UPHOLSTERY

1.5.1. Specify neutral colors for casegoods, furniture systems, storage and tables. Specify desk worksurfaces and table tops that are not too light or too dark in color and have a pattern to help hide soiling. Accent colors are allowed in break and lounge areas. Keep placement of furniture systems panel fabric accent colors to a minimum. All finishes shall be cleanable with ordinary household cleaning solutions.

1.5.2. Use manufacturer's standard fabrics; including textile manufacturers fabrics that have been graded into the furniture manufacturers fabric grades and are available through their GSA Schedule. Customers Own Material

(COM) can be used in headquarter buildings in command suites with executive furniture. Coordinate specific locations with Corps of Engineers Interior Designer.

1.5.3. Specify seating upholstery that meets Wyzenbeek Abrasion Test, 55,000 minimum rubs. Specify a soil retardant finish for woven fabrics if Crypton or vinyl upholstery is not provided for seating in dining areas. Use manufacturer's standard fabrics. This includes textile manufacturers fabrics that have been graded into the furniture manufactures fabric grades and are available through their GSA Schedule. Specify upholstery and finish colors and patterns that help hide soiling. Specify finishes that can be cleaned with ordinary household cleaning solutions.

1.6. ACCESSORIES

1.6.1. Specify all accessories required for completely finished furniture installation. Provide filing cabinets and storage for office supplies. Provide tack surfaces at workstations with overhead storage. Provide tackable surfaces at workstations with overhead storage.

1.6.2. Not Used.

1.6.3. Workstations are to be equipped with stable keyboard trays that have height adjustability, tilting capability, including negative tilt, have a mouse pad at same height as the keyboard tray that can accommodate both left and right handed users, and retractable under worksurface.

1.7. MISSION UNIQUE EQUIPMENT

Funding for FF&E furniture items and mission unique equipment (MUE) items are from two different sources. Separate the designs and procurement documentation for FFE items and MUE. MUE includes, but is not limited to, items such as industrial shelving, workbenches, appliances, fitness equipment, IT equipment and supporting carts. The User will purchase and install mission unique equipment items, unless otherwise noted. Identify locations of known MUE items such as industrial shelving, workbenches, appliances, etc. for space planning purposes.

1.8. SUSTAINABILITY

1.8.1. For all designs provided regardless of facility type, make every effort to implement all aspects of sustainability to the greatest extent possible for all the selections made in the FF&E package. This includes but is not limited to the selection of products that consider: **Material Chemistry and Safety of Inputs** (What chemicals are used in the construction of the selections?); **Recyclability** (Do the selections contain recycled content?); **Disassembly** (Can the selections be disassembled at the end of their useful life to recycle their materials?).

1.8.2. Make selections to the greatest extent possible of products that possess current McDonough Braungart Design Chemistry ([MBDC](#)) certification or other "third-party" certified Cradle to Cradle program, Forest Stewardship Council (FSC) certification, GREENGAURD certification or similar "third-party" certified products consisting of low-emitting materials.

1.9. FURNITURE SYSTEMS

1.9.1. General.

Where appropriate, design furniture systems in open office areas. Coordinate style and color of furniture systems with other storage, seating, etc. in open office areas. Minimize the number of workstation typicals and the parts and pieces required for the design to assist in future reconfiguration and inventorying.

1.9.2. Connector Systems.

Specify a connector system that allows removal of a single panel or spine wall within a typical workstation configuration without requiring disassembly of the workstation or removal of adjacent panels. Specify connector system with tight connections and continuous visual seals. When Acoustical panels are used, provide connector system with continuous acoustical seals. Specify concealed clips, screws, and other construction elements, where possible.

1.9.3. Panels and Spine Walls

Specify panels and spine walls with hinged or removable covers that permit easy access to the raceway when required but are securely mounted and cannot be accidentally dislodged under normal conditions. Panels shall be capable of structurally supporting more than 1 fully loaded component per panel per side. Raceways are to be an integral part of the panel and must be able to support lay-in cabling and have a large capacity for electrical and IT. Do not thread cables through the frame.

1.9.4. Electrical And Information/Technology (IT)

Design furniture with electrical systems that meets requirements of UL 1286 when powered panels are required and UL approved task lights that meet requirements of NFPA 70. Dependent on user requirements and Section 01 10 00, paragraph 3 requirements, it is recommended that workstation electrical and IT wiring entry come from the building walls to eliminate the use of power poles and access at the floor. Design electrical and IT systems that are easily accessed in the spine wall and panels without having to move return panels and components. Electrical and IT management will be easily accessible by removable wall covers which can be removed while workstation components are still attached. Specify connector system that has continuation of electrical and IT wiring within workstations and workstation to workstation.

1.9.5. Pedestals

Specify pedestals that are interchangeable from left to right, and right to left, and retain pedestal locking system capability.

1.10. EXECUTIVE FURNITURE

1.10.1. Design for executive furniture in command areas, coordinate specific locations with Corps of Engineers Interior Designer. Use upgraded furniture, upholsteries and finishes in command suites. This includes but is not limited to wood casegoods, seating and tables. Select executive furniture casegoods from a single manufacturer and style line, to include workstations, credenzas, filing, and storage, etc.

1.10.2. Specify furniture with wood veneer finish (except worksurfaces) with mitered solid wood edge of same wood type. Provide worksurface plastic laminate that closely matches adjacent wood veneer. Other executive office furniture such as seating, tables, executive conference room furniture, etc. shall be compatible in style, finish and color with executive furniture casegoods.

1.11. SEATING

1.11.1. General

Specify appropriate chair casters and glides for the floor finish where the seating is located. Universal casters that are appropriate for both hard surface flooring and carpet are preferred. All seating shall support up to a minimum of 250 lbs.

1.11.2. Desk and Guest Seating

Select ergonomic desk chairs with casters, non-upholstered adjustable arms, waterfall front, swivel, tilt, variable back lock, adjustable back height or adjustable lumbar support, pneumatic seat height adjustment, and padded, contoured upholstered seat and back. Desk and guest chair backs may be other than upholstered such as mesh fabric if it is ergonomically designed, forms to back and is comfortable. Depending on scale of desk chair provide seat pan forward and back adjustment to increase or decrease depth of seat pan. All desk chairs shall have an adjustable seat height range of 4 1/2", range to include 16 1/2"-20". Select guest chairs that are compatible in style, finish and color with the desk chairs.

1.11.3. Conference Room Seating

At tables, select ergonomic conference seating with casters, non-upholstered arms, waterfall front, swivel, tilt, pneumatic seat height adjustment, and padded, contoured seat and back, unless otherwise noted. Select arm height and/or design that allows seating to be moved up closely to the table top. Conference chair backs may be other than upholstered such as mesh fabric if it is ergonomically designed, forms to back and is comfortable. Perimeter conference chairs shall be compatible in style, finish and color with conference seating at the tables.

1.11.4. Lounge, Waiting and Reception Area Seating

Select seating with arms and cushioned, upholstered seat and back. In heavy use areas, arms shall be easily cleaned such as non-upholstered arms or upholstered arms with wood arm caps unless otherwise noted.

1.11.5. Break Room Seating

Select stackable seating that is easily cleaned. Seating shall be appropriate for table and counter heights as applicable with non-upholstered arms if arms are required. Chairs shall have metal legs and composite materials for seats.

1.11.6. Lounge, Waiting and Reception Furniture.

Design for end and coffee tables with plastic laminate tops that are compatible in style finish and color with the seating.

1.12. FILING AND STORAGE.

Select storage and shelving units that meet customer's functional load requirements for stored items. Specify counterweights for filing cabinets when required by the manufacturer for stability. File drawers shall allow only one drawer to be opened at a time. Provide heavy duty storage and shelving if information is not available.

1.13. TRAINING TABLES.

Don't use plastic laminate self edge. Training tables shall be reconfigurable, moveable and storable; lighter weight folding with dollies or casters as necessary. Specify dollies if required.

1.14. FURNITURE WARRANTIES.

Specify manufacturer's performance guarantees or warranties that include parts, labor and transportation as follows:

Furniture System, unless otherwise noted – 10 year minimum
 Furniture System Task Lights – 2 year minimum, excluding bulbs
 Furniture System Fabric – 3 year minimum
 Desks - 10 year minimum
 Seating, unless otherwise noted - 10 year minimum
 Seating Mechanisms and Pneumatic Cylinders - 10 years
 Fabric - 3 years minimum
 Filing and Storage - 10 year minimum
 Tables, unless otherwise noted - 10 year minimum
 Table Mechanisms – 5 year
 Table Ganging Device - 1 year
 Items not listed above - 1 year minimum

ATTACHMENT C TRACKING COMMENTS IN DRCHECKS

1.0 General

The Government and DB Contractor shall set up the project in Dr Checks. Throughout the design process, the parties shall enter, track, and back-check comments using the DrChecks system. Government reviewers enter design review comments into DrChecks. Designers of Record shall annotate comments timely and specifically to indicate exactly what action will be taken or why the action is not required. Comments considered critical by the conference participants shall be flagged as such.

2.0 DrChecks Review Comments

The Contractor and the Government shall monitor DrChecks to assure all comments are annotated and agreed to by the designers and reviewers prior to the next submittal. The DrChecks comments and responses shall be printed and included in the design analysis for record.

2.1. Conference participants (reviewers) will expect coordination between Design Analysis calculations and the submitted design. Reviewers will also focus on the design submittal's satisfaction of the contract requirements.

2.2. The Designers of Record shall answer each comment in DrChecks with a formal response prior to the next submittal, clearly indicating what action will be taken and what drawing/spec will change. Designers of Record are encouraged to directly contact reviewers to discuss and agree to the formal comment responses rather than relying only on DrChecks and review meetings to discuss comments. With the next design conference, reviewers will back-check answers to the comments against the submittal, in addition to reviewing additional design work.

2.3. Comments that, in the DB Contractor's opinion, require effort outside the scope of the contract shall be clearly indicated as such in DrChecks. The DB Contractor shall not proceed with work outside the contract until a modification to the contract is properly executed, if one is necessary.

3.0 DrChecks Initial Account Set-Up

To initialize an office's use of DrChecks, choose a contact person within the office to call the DrChecks Help Desk at 800-428-HELP, M-F, 8AM-5PM, Central time. This POC will be given an office password to distribute to others in the office. Individuals can then go to the hyperlink at <http://www.projnet.org> and register as a first time user. Upon registration, each user will be given a personal password to the DrChecks system.

3.1. Once the office and individuals are registered, the COE's project manager or lead reviewer will assign the individuals and/or offices to the specific project for review. At this point, persons assigned can make comments, annotate comments, and close comments, depending on their particular assignment.

4.0 DrChecks Reviewer Role

The Contractor is the technical reviewer and the Government is the compliance reviewer of the DB designers design documents. Each reviewer enters their own comments into the Dr Checks system. To enter comments:

4.1. Log into DrChecks.

4.2. Click on the appropriate project.

4.3. Click on the appropriate review conference. An Add comment screen will appear.

4.4. Select or fill out the appropriate sections (particularly comment discipline and type of document for sorting) of the comment form and enter the comment in the space provided.

4.5. Click the Add Comment button. The comment will be added to the database and a fresh screen will appear for the next comment you have.

4.6. Once comments are all entered, exit DrChecks by choosing "My Account" and then Logout.

5.0 DrChecks Comment Evaluation

The role of the designers of record is to evaluate and respond to the comments entered by the Government reviewers and by the DB Contractor. To respond to comments:

5.1. Log into DrChecks.

5.2. Click on the appropriate project.

5.3. Under "Evaluate" click on the number under "Pending".

5.4. Locate the comments that require your evaluation. (Note: If you know the comment number you can use the Quick Pick window on your home page in DrChecks; enter the number and click on go.)

5.5. Select the appropriate evaluation (concur, non-concur, for information only, or check and resolve) and add the response.

5.6. Click on the Add button. The evaluation will be added to the database and a fresh screen will appear with the next comment.

5.7. Once evaluations are all entered, exit DrChecks by choosing "My Account" and then Logout.

6.0 DrChecks Back-check

At the following design conference, participants will back-check comment annotations against newly presented documents to verify that the designers' responses are acceptable and completed. The Contractor and Government reviewers shall either enter additional back-check comments, as necessary or close those that are resolved as a result of the design conferences:

6.1. Log into DrChecks.

6.2. Click on the appropriate project.

6.3. Under "My Backcheck" click on the number under "Pending".

6.4. If you agree with the designer's response select "Close Comment" and add a closing response if desired.

6.5. If you do not agree with the designer's response or the submittal does not reflect the response given, select "Issue Open", enter additional information.

6.6. Click on the Add button. The back-check will be added to the database and a fresh screen will appear with the next comment.

6.7. Once back-checks are all entered, exit DrChecks by choosing "My Account" and then Logout. The design is completed and final when there are no pending comments to be evaluated and there are no pending or open comments under back-check.

**ATTACHMENT D
SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW**

Instructions: Use the information outlined in this document to provide the minimum requirement for development of Fire Protection and Life Safety Code submittals for all building projects. Additional and supplemental information may be used to further develop the code review. Insert N/A after criteria, which may be "not applicable".

1.0 SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW

- 1.1. Project Name (insert name and location)
- 1.2. Applicable Codes and Standards
 - 1.2.1. Unified Facilities Criteria (UFC): 3-600-01, Design: Fire Protection Engineering For Facilities
 - 1.2.2. International Building Code (IBC) for fire resistance requirements, allowable floor area, building height limitations and building separation distance requirements, except as modified by UFC 3-600-01.
 - 1.2.3. National Fire Protection Association (NFPA) 101 Life Safety Code (latest edition), for building egress and life safety and applicable criteria in UFC 3-600-01.
 - 1.2.4. ADA and ABA Accessiblity Guidelines. For Buildings and Facilities See Section 01 10 00, Paragraph 3 for facility specific criteria.
- 1.3. Occupancy Classification
IBC chapters 3 and 4
- 1.4. Construction Type
IBC chapter 6
- 1.5. Area Limitations
IBC chapter 5, table 503
- 1.6. Allowable Floor Areas
IBC section 503, 505
- 1.7. Allowable area increases
IBC section 506, 507
- 1.8. Maximum Height of Buildings
IBC section 504
- 1.9. Fire-resistive substitution
- 1.10. Occupancy Separations
IBC table 302.3.2
- 1.11. Fire Resistive Requirements
 - 1.11.1. Exterior Walls - [] hour rating, IBC table 601, 602
 - 1.11.2. Interior Bearing walls - [] hour rating
 - 1.11.3. Structural frame - [] hour rating
 - 1.11.4. Permanent partitions - [] hour rating

- 1.11.5. Shaft enclosures - [] hour rating
- 1.11.6. Floors & Floor-Ceilings - [] hour rating
- 1.11.7. Roofs and Roof Ceilings - [] hour rating
- 1.12. Automatic Sprinklers and others used to determine the need for automatic Extinguishing Equipment, Extinguishing Systems, Foam Systems, Standpipe
 - 1.12.1. UFC 3-600-01, chapters 4 and 6 systems, wet chemical systems, etc. State which systems are required and to what criteria they will be designed.
 - 1.12.2. UFC 3-600-01, Appendix B Occupancy Classification. Note the classification for each room. This may be accomplished by classifying the entire building and noting exceptions for rooms that differ (E.g. The entire building is Light Hazard except boiler room and storage rooms which are [], etc.)
 - 1.12.3. UFC 3-600-01, Chapter 3 Sprinkler Design Density, Sprinkler Design Area, Water Demand for Hose Streams (supply pressure and source requirements).
 - 1.12.4. UFC 3-600-01, Chapter 4 Coverage per sprinkler head. Extended coverage sprinkler heads are not permitted.
 - 1.12.5. Available Water Supply. Provide the results of the water flow tests showing the available water supply static pressure and residual pressure at flow. Based on this data and the estimated flow and pressure required for the sprinkler system, determine the need for a fire pump.
 - 1.12.6. NFPA 13, Para. 8.16.4.6.1. Provide backflow preventer valves as required by the local municipality, authority, or water purveyor. Provide a test valve located downstream of the backflow preventer for flow testing the backflow preventer at full system demand flow. Route the discharge to an appropriate location outside the building.
- 1.13. Kitchen Cooking Exhaust Equipment
Describe when kitchen cooking exhaust equipment is provided for the project. Type of extinguishing systems for the equipment should be provided. per NFPA 96. Show all interlocks with manual release switches, fuel shutoff valves, electrical shunt trips, exhaust fans, and building alarms.
- 1.14. Portable Fire Extinguishers, fire classification and travel distance. per NFPA 10
- 1.15. Enclosure Protection and Penetration Requirements. - Opening Protectives and Through Penetrations
 - 1.15.1. IBC Section 712, 715 and Table 715.3. Mechanical rooms, exit stairways, storage rooms, janitor [] hour rating. IBC Table 302.1.1
 - 1.15.2. Fire Blocks, Draft Stops, Through Penetrations and Opening Protectives
- 1.16. Fire Dampers. Describe where fire dampers and smoke dampers are to be used (IBC Section 716 and NFPA 90A). State whether isolation smoke dampers are required at the air handler.
- 1.17. Detection Alarm and Communication. UFC 3-600-01, (Chapter 5); NFPA 101 para. 3.4 (chapters 12-42); NFPA 72
- 1.18. Mass Notification. Describe building/facility mass notification system (UFC 4-021-01) type and type of base-wide mass notification/communication system. State whether the visible notification appliances will be combined with the fire alarm system or kept separate. (Note: Navy has taken position to combine visible notification appliances with fire alarm).
- 1.19. Interior Finishes (classification). NFPA 101.10.2.3 and NFPA 101.7.1.4
- 1.20. Means of Egress

- 1.20.1. Separation of Means of Egress, NFPA 101 chapters 7 and 12-42; NFPA101.7.1.3
- 1.20.2. Occupant Load, NFPA101.7.3.1 and chapters 12-42.
- 1.20.3. Egress Capacity (stairs, corridors, ramps and doors) NFPA101.7.3.3
- 1.20.4. Number of Means of Egress, NFPA101.7.4 and chapters 12-42.
- 1.20.5. Dead end limits and Common Path of Travel, NFPA 101.7.5.1.6 and chapters 12-42.
- 1.20.6. Accessible Means of Egress (for accessible buildings), NFPA101.7.5.4
- 1.20.7. Measurement of Travel Distance to Exits, NFPA101.7.6 and chapters 12-42.
- 1.20.8. Discharge from Exits, NFPA101.7.7.2
- 1.20.9. Illumination of Means of Egress, NFPA101.7.8
- 1.20.10. Emergency Lighting, NFPA101.7.9
- 1.20.11. Marking of Means of Egress, NFPA101.7.10
- 1.21. Elevators, UFC 3-600-01, Chapter 6; IBC and ASME A17.1 - 2000,(Safety Code for Elevators and Escalators)
- 1.22. Accessibility Requirements, ADA and ABA Accessibility Guidelines for Buildings and Facilities
- 1.23. Certification of Fire Protection and Life Safety Code Requirements. (Note: Edit the Fire team membership if necessary). Preparers of this document certify the accuracy and completeness of the Fire Protection and Life Safety features for this project in accordance with the attached completed form(s).
- 1.24. Designer of Record. Certification of Fire protection and Life Safety Code Requirements. (Note: Edit the Fire team members if necessary). Preparers of this document certify the accuracy and completeness of the Fire Protection and Life Safety features of this project.

Fire Protection Engineer of Record:

Signature and Stamp

Date

OR

Architect of Record:

Signature and Stamp

Date

Mechanical Engineer of Record:

Signature and Stamp

Date

Electrical Engineer of Record:

Signature/Date

**ATTACHMENT E
LEED SUBMITTALS**

| LEED Credit Paragraph | Contractor Check Here if Credit is Claimed | LEED-NC v3 Submittals (OCT09) | Provide for Credit Audit Only | REQUIRED DOCUMENTATION | Date Submitted (to be filled in by Contractor) | Government Reviewer's Use |
|---------------------------------------|--|---|-------------------------------|---|--|---------------------------|
| PAR | | FEATURE | DUE AT | | DATE | REV |
| GENERAL | | | | | | |
| | | GENERAL - All calculations shall be in accordance with LEED 2009 Reference Guide. | | | | |
| | | GENERAL: Obtain excel version of this spreadsheet at http://en.sas.usace.army.mil/enWeb , "Engineering Criteria". | | | | |
| | | GENERAL - For all credits, narrative/comments may be added to describe special circumstances or considerations regarding the project's credit approach. | | | | |
| | | GENERAL - Include all required LEED drawings indicated below in contract drawings with applicable discipline drawings, labeled For Reference Only. | | | | |
| | | NOTE: Each submittal indicated with "****" differs from LEED certified project submittals by either having a different due date or being an added submittal not required by GBCI. | | | | |
| | | NOTE: Projects seeking LEED certification need only submit to GBCI whatever documentation is acceptable to GBCI (for example, licensed professional certifications). This checklist identifies what must be submitted to the Government for internal review purposes. Government review of LEED documentation in no way supercedes or modifies the requirements and rulings of GBCI for purposes of compliance with project requirement to obtain LEED certification. | | | | |
| | | GENERAL - Audit documentation may include but is not limited to what is indicated in this table. | | | | |
| | | | Closeout | List of all Final Design submittals revised after final design to reflect actual closeout conditions. Revised Final Design submittals. - OR - Statement confirming that no changes have been made since final design that effect final design submittal documents. | | Proj Engr (PE) |
| CATEGORY 1 - SUSTAINABLE SITES | | | | | | |
| SSPR1 | | Construction Activity Pollution Prevention (PREREQUISITE) | **Final Design | List of drawings and specifications that address the erosion control, particulate/dust control and sedimentation control measures to be implemented. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| | | | **Final Design | Narrative that indicates which compliance path was used (NPDES or Local standards) and describes the measures to be implemented on the project. If a local standard was followed, provide specific information to demonstrate that the local standard is equal to or more stringent than the NPDES program. | | CIV |
| SS1 | | Site Selection | Final Design | Statement confirming that project does not meet any of the prohibited criteria. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| | | | Final Design | LEED Site plan drawing that shows all proposed development, line depicting boundary of all bodies of water and/or wetlands within 100 feet of project boundary and a line depicting 5' elevation above 100 year flood line that falls within project boundary. Not required if neither condition applies. | | CIV |
| SS2 | | Development Density & Community Connectivity | Final Design | Option 1: LEED Site vicinity plan showing project site and surrounding development. Show density boundary or note drawing scale. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| | | | Final Design | Option 1: Table indicating, for project site and all surrounding sites within density radius (keyed to site vicinity plan), site area and building area. Project development density calculation. Density radius calculation. Development density calculation within density radius. | | CIV |
| | | | Final Design | Option 2: LEED Site vicinity plan showing project site, the 1/2 mile community radius, pedestrian walkways and the locations of the residential development(s) and Basic Services surrounding the project site. | | CIV |
| | | | Final Design | Option 2: List (including business name and type) of all Basic Services facilities within the 1/2 mile radius, keyed to site vicinity plan. | | CIV |
| SS3 | | Brownfield Redevelopment | Final Design | Narrative describing contamination and the remediation activities included in project. Include statement indicating how site was determined to be a brownfield. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| SS4.1 | | Alternative Transportation: Public Transportation Access | Final Design | Statement indicating which option for compliance applies. State whether public transportation is existing or proposed and, if proposed, cite source of this information. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| | | | Final Design | Option 1: LEED Site vicinity plan showing project site, mass transit stops and pedestrian path to them with path distance noted. | | CIV |
| | | | Final Design | Option 2: LEED Site vicinity plan showing project site, bus stops and pedestrian path to them with path distance noted. | | CIV |
| SS4.2 | | Alternative Transportation: Bicycle Storage & Changing Rooms | Final Design | FTE calculation. Bicycle storage spaces calculation. Shower/changing facilities calculation. | | CIV |
| | | | Final Design | List of drawings that show the location(s) of bicycle storage areas. Statement indicating distance from building entrance. | | CIV |
| | | | Final Design | List of drawings that show the location(s) of shower/changing facilities and, if located outside the building, statement indicating distance from building entrance. | | CIV |

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| PAR | | FEATURE | DUE AT | | DATE | REV |
| SS4.3 | | Alternative Transportation: Low Emitting & Fuel Efficient Vehicles | Final Design | Statement indicating which option for compliance applies. FTE calculation. Statement indicating total parking capacity of site. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| | | | Final Design | Option 1: Low-emission & fuel-efficient vehicle calculation. | | CIV |
| | | | Final Design | Option 1: List of drawings and specification references that show location and number of preferred parking spaces for low-emission & fuel-efficient vehicles and signage. | | CIV |
| | | | Final Design | Option 1: Statement indicating quantity, make, model and manufacturer of low-emission & fuel-efficient vehicles to be provided. Statement confirming vehicles are zero-emission or indicating ACEEE vehicle scores. | | CIV |
| | | | Final Design | Option 2: Low-emission & fuel-efficient vehicle parking calculation. | | CIV |
| | | | Final Design | Option 2: List of drawings and specification references that show location and number of preferred parking spaces and signage. | | CIV |
| | | | Final Design | Option 3: Low-emission & fuel-efficient vehicle refueling station calculation. | | CIV |
| | | | Final Design | Option 3: List of drawings and specifications indicating location and number of refueling stations, fuel type and fueling capacity for each station for an 8-hour period. | | CIV |
| | | | Closeout | X Option 3: Construction product submittals indicating what was provided and confirming compliance with respect to fuel type and fueling capacity for each station for an 8-hour period. | | CIV |
| SS4.4 | | Alternative Transportation: Parking Capacity | Final Design | Statement indicating which option for compliance applies. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| | | | Final Design | Option 1: Preferred parking calculation including number of spaces required, total provided, preferred spaces provided and percentage. | | CIV |
| | | | Final Design | Option 2: FTE calculation. Preferred parking calculation including number of spaces provided, preferred spaces provided and percentage. | | CIV |
| | | | Final Design | Options 1 and 2: List of drawings and specification references that show location and number of preferred parking spaces and signage. | | CIV |
| | | | Final Design | Option 3: Narrative indicating number of spaces required and provided and describing infrastructure and support programs with description of project features to support them. | | CIV |
| SS5.1 | | Site Development: Protect or Restore Habitat | **Final Design | Option 1: List of drawing and specification references that convey site disturbance limits. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| | | | **Final Design | Option 2: LEED site plan drawing that delineates boundaries of each preserved and restored habitat area with area (sf) noted for each. | | CIV |
| | | | **Final Design | Option 2: Percentage calculation of restored/preserved habitat to total site area. List of drawings and specification references that convey restoration planting requirements. | | CIV |
| SS5.2 | | Site Development: Maximize Open Space | Final Design | Option 2: LEED site plan drawing delineating boundary of vegetated open space adjacent to building with areas of building footprint and designated open space noted. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| SS6.1 | | Stormwater Design: Quantity Control | Final Design | Statement indicating which option for compliance applies. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| | | | Final Design | Option 1: Indicate pre-development and post-development runoff rate(cfs) and runoff quantity (cf) -OR - Narrative describing site conditions, measures and controls to be implemented to prevent excessive stream velocities and erosion. | | CIV |
| | | | Final Design | Option 2: Indicate pre-development and post-development runoff rate(cfs) and runoff quantity (cf). Indicate percent reduction in each. | | CIV |
| SS6.2 | | Stormwater Design: Quality Control | Final Design | For non-structural controls, list all BMPs used and, for each, describe the function of the BMP and indicate the percent annual rainfall treated. List all structural controls and, for each, describe the pollutant removal and indicate the percent annual rainfall treated. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| SS7.1 | | Heat Island Effect: Non-Roof | **Final Design | LEED site plan drawing indicating locations and quantities of each paving type, including areas of shaded pavement. Percentage calculation indicating percentage of reflective/shaded/open grid area. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |

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| SS7.2 | | Heat Island Effect: Roof | Final Design | Option 1: Percentage calculation indicating percentage of SRI compliant roof area. List of drawings and specification references that convey SRI requirements and roof slopes. | | ARC |
| | | | Final Design | Option 1: List of specified roof materials indicating, for each, type, manufacturer, product name and identification if known, SRI value and roof slope. | | ARC |
| | | | **Closeout | Option 1: List of installed roof materials indicating, for each, manufacturer, product name and identification, SRI value and roof slope. | | PE |
| | | | Closeout | X Option 1: Manufacturer published product data or certification confirming SRI | | PE |
| | | | Final Design | Option 2: Percentage calculation indicating percentage of vegetated roof area. | | ARC |
| | | | Final Design | Option 3: Combined reflective and green roof calculation. | | ARC |
| | | | Final Design | Option 3: List of specified roof materials indicating, for each, type, manufacturer, product name and identification if known, SRI value and roof slope. | | ARC |
| | | | **Closeout | Option 3: List of installed roof materials indicating, for each, manufacturer, product name and identification, SRI value and roof slope. | | PE |
| | | | Closeout | X Option 3: Manufacturer published product data or certification confirming SRI | | PE |
| SS8 | | Light Pollution Reduction | Final Design | Interior Lighting: List of drawings and specification references that convey interior lighting requirements (location and type of all installed interior lighting, location of non-opaque exterior envelope surfaces, allowing confirmation that maximum candela value from interior fixtures does not intersect non-opaque building envelope surfaces). - OR - List of drawings and specification references that show automatic lighting controls compliance with credit requirement. | | ELEC |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | ELEC |
| | | | Final Design | Exterior Lighting: List of drawings and specification references that convey exterior lighting requirements (location and type of all site lighting and building facade/landscape lighting). | | ELEC |
| | | | Final Design | Exterior Site Lighting Power Density (LPD): Tabulation for exterior site lighting indicating, for each location identification or description, units of measure, area or distance of the location, actual LPD using units consistent with ASHRAE 90.1, and the ASHRAE allowable LPD for that type of location. Percentage calculation of actual versus allowable LPD for all site lighting. | | ELEC |
| | | | Final Design | Exterior Building Facade/Landscape Lighting Power Density (LPD): Tabulation for exterior building facade/landscape lighting indicating, for each location identification or description, units of measure, area or distance of the location, actual LPD using units consistent with ASHRAE 90.1, and the ASHRAE allowable LPD for that type of location. Percentage calculation of actual versus allowable LPD for all building facade/landscape lighting. | | ELEC |
| | | | Final Design | Exterior Lighting IESNA Zone: Indicate which IESNA zone is applicable to the project. | | ELEC |
| | | | Final Design | Exterior Lighting Site Lumen table indicating, for each fixture type, quantity installed, initial lamp lumens per luminaire, initial lamp lumens above 90 degrees from Nadir, total lamp lumens and total lamp lumens above 90 degrees. Percentage of site lamp lumens above 90 degrees from nadir to total lamp lumens. | | ELEC |
| | | | Final Design | Exterior Lighting Narrative describing analysis used for addressing requirements for light trespass at site boundary and beyond. | | ELEC |
| CATEGORY 2 – WATER EFFICIENCY | | | | | | |
| WEPR1 | | Water Use Reduction: 20% Reduction | Final Design | Statement confirming which occupancy breakdown applies (default or special). For special occupancy breakdown, indicate source and explanation for ratio. | | MEC |
| | | | Final Design | Occupancy calculation including male/female numbers for FTEs, visitors, students, customers, residential and other type occupants/users | | MEC |
| | | | Final Design | Statement indicating percent of male restrooms with urinals. Statement indicating annual days of operation. | | MEC |

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|-----------------------|--|--|-------------------------------|---|------|-----|
| | | | | Baseline flush fixture calculation spreadsheet indicating, for each fixture type, gender, flush rate, daily uses per person for each occupant type identified in occupancy calculation and annual baseline flush fixture water usage. | | MEC |
| | | | | Design case flush fixture calculation spreadsheet indicating, for each fixture type, gender, fixture manufacturer, fixture model number, flush rate, percent of occupants using this fixture type, daily uses per person for each occupant type identified in occupancy calculation and annual design case flush fixture water usage. | | MEC |
| | | | Closeout | X Manufacturer published product data or certification confirming fixture water usage. | | PE |
| WE1.1 | | Water Efficient Landscaping: Reduce by 50% | Final Design | Statement indicating which option for compliance applies. | | CIV |
| | | | **Final Design | Delineation and labeling of "LEED Project site boundary" on site plan. | | CIV |
| | | | Final Design | Calculation indicating, for baseline and design case, total water applied, total potable water applied, total non-potable water applied. Design case percent potable water reduction. If nonpotable water is used, indicate source of nonpotable water. | | CIV |
| | | | Final Design | List of landscape plan drawings. | | CIV |
| | | | Final Design | Narrative describing landscaping and irrigation design strategies, including water use calculation methodology used to determine savings and, if non-potable water is used, specific information about source and available quantity. | | CIV |
| WE1.2 | | Water Efficient Landscaping: No Potable Water Use or No Irrigation | Same as WE1.1 | Same as WE1.1 | | CIV |
| WE2 | | Innovative Wastewater Technologies | Final Design | Statement confirming which option for compliance applies. | | MEC |
| | | | Final Design | Statement confirming which occupancy breakdown applies (default or special). For special occupancy breakdown, indicate source and explanation for ratio. | | MEC |
| | | | Final Design | Occupancy calculation including male/female numbers for FTEs, visitors, students, customers, residential and other type occupants/users | | MEC |
| | | | Final Design | Statement indicating percent of male restrooms with urinals. Statement indicating annual days of operation. | | MEC |
| | | | Final Design | Baseline flush fixture calculation spreadsheet indicating, for each fixture type, gender, flush rate, daily uses per person for each occupant type identified in occupancy calculation and annual baseline flush fixture water usage. | | MEC |
| | | | Final Design | Design case flush fixture calculation spreadsheet indicating, for each fixture type, gender, fixture manufacturer, fixture model number, flush rate, percent of occupants using this fixture type, daily uses per person for each occupant type identified in occupancy calculation and annual design case flush fixture water usage. | | MEC |
| | | | Final Design | Option 1: If onsite non-potable water is used, identify source(s), indicate annual quantity from each source and indicate total annual quantity from all onsite non-potable water sources. | | MEC |
| | | | Final Design | Option 1: Summary calculation indicating baseline annual water consumption, design case annual water consumption, non-potable annual water consumption and total percentage annual water savings. | | MEC |
| | | | Final Design | Option 2: Statement confirming on-site treatment of all generated wastewater to tertiary standards and all treated wastewater is either infiltrated or used on-site. | | MEC |
| | | | Final Design | Option 2: List of drawing and specification references that convey design of on-site wastewater treatment features. | | CIV |
| | | | Final Design | Option 2: On-site water treatment quantity calculation indicating all on-site wastewater source(s), annual quantity treated, annual quantity infiltrated and annual quantity re-used on site from each source and totals for annual quantity treated, annual quantity infiltrated and annual quantity re-used on site from all sources. | | CIV |
| | | | Final Design | Option 2: Wastewater summary calculation indicating design case annual flush fixture water usage, annual on-site water treatment and percentage sewage conveyance reduction. | | MEC |
| | | | Final Design | Narrative describing project strategy for reduction of potable water use for sewage conveyance, including specific information on reclaimed water usage and treated wastewater usage. | | MEC |
| WE3 | | Water Use Reduction: 30% - 40% Reduction | Same as WEPR1 | Same as WEPR1 | | MEC |

CATEGORY 3 – ENERGY AND ATMOSPHERE

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| PAR | | FEATURE | DUE AT | | | | | |
| EAPR1 | | Fundamental Commissioning of the Building Energy Systems (PREREQUISITE) | **Final Design | **Owner's Project Requirements document | | | | ALL MEC, ELEC |
| | | | **Final Design | **Basis of Design document for commissioned systems | | | | MEC, ELEC |
| | | | **Final Design | **Commissioning Plan | | | | MEC, ELEC |
| | | | Closeout | Statement confirming all commissioning requirements have been incorporated into construction documents. | | | | PE |
| | | | Closeout | Commissioning Report | | | | PE |
| EAPR2 | | Minimum Energy Performance (PREREQUISITE) | Final Design | Statement listing the mandatory provisions of ASHRAE 90.1 that project meets relative to compliance with this prerequisite and indicating which compliance path was used. | | | | MEC ELEC ARC |
| | | | Final Design | Statement indicating which compliance path option applies. | | | | MEC |
| | | | Final Design | Option 1: Statement confirming simulation software capabilities and confirming assumptions and methodology. | | | | MEC |
| | | | Final Design | Option 1: General information including simulation program, principal heating source, percent new construction and renovation, weather file, climate zone and Energy Star Target Finder score. | | | | MEC |
| | | | Final Design | Option 1: Space summary listing, for each building use, the conditioned area, unconditioned area and total area and include total area for each category | | | | MEC |
| | | | Final Design | Option 1: List of all simulation output advisory message data and show difference between baseline and proposed design | | | | MEC |
| | | | Final Design | Option 1: Comparison summary for energy model inputs including description of baseline and design case energy model inputs, showing both by element type | | | | MEC |
| | | | Final Design | Option 1: Energy type summary listing, for each energy type, utility rate description, units of energy and units of demand | | | | MEC |
| | | | Final Design | Option 1: Statement indicating whether project uses on-site renewable energy. If yes, list all sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost | | | | MEC |
| | | | Final Design | Option 1: If analysis includes exceptional calculation methods, statement describing how exceptional calculation measure cost savings is determined | | | | MEC |
| | | | Final Design | Option 1: If analysis includes exceptional calculation methods, for each exceptional calculation method indicate energy types and, for each energy type, annual energy savings, annual cost savings, and brief descriptive narrative | | | | MEC |
| | | | Final Design | Option 1: Baseline performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand for all four orientations. For each orientation indicate total annual energy use for each orientation and total annual process energy use. | | | | MEC |
| | | | Final Design | Option 1: Baseline energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost. | | | | MEC |
| | | | Final Design | Option 1: Proposed Design performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand, baseline annual and peak energy demand and percent savings. Indicate total annual energy use and total annual process energy use for both proposed design and baseline and percent savings. | | | | MEC |
| | | | Final Design | Option 1: Proposed Design energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost. | | | | MEC |
| | | | Final Design | Option 1: Energy cost and consumption by energy type report indicating, for each energy type, proposed design and baseline annual use and annual cost, percent savings annual use and annual cost. Indicate for renewable energy annual energy generated and annual cost. Indicate exceptional calculations annual energy savings and annual cost savings. Indicate building total annual energy use, annual energy cost for proposed design and baseline and indicate percent savings annual energy use and annual energy cost. | | | | MEC |

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| | | | Final Design | Option 1: Compliance summaries from energy simulation software. If software does not produce compliance summaries provide output summaries and example input summaries for baseline and proposed design supporting data in the tables. Output summaries must include simulated energy consumption by end use and total energy use and cost by energy type. Example input summaries should represent most common systems and must include occupancy, use pattern, assumed envelope component sizes and descriptive features and assumed mechanical equipment types and descriptive features | | MEC |
| | | | Final Design | Option 1: Energy rate tariff from project energy providers (only if not using LEED Reference Guide default rates) | | MEC |
| EAPR3 | | Fundamental Refrigerant Management (PREREQUISITE) | Final Design | Statement indicating which option for compliance applies. | | MEC |
| | | | Final Design | Option 2: Narrative describing phase out plan, including specific information on phase out dates and refrigerant quantities. | | MEC |
| EA1 | | Optimize Energy Performance | Final Design | Statement indicating which compliance path option applies. | | MEC |
| | | | Final Design | Option 1: Statement confirming simulation software capabilities and confirming assumptions and methodology. | | MEC |
| | | | Final Design | Option 1: General information including simulation program, principal heating source, percent new construction and renovation, weather file, climate zone and Energy Star Target Finder score. | | MEC |
| | | | Final Design | Option 1: Space summary listing, for each building use, the conditioned area, unconditioned area and total area and include total area for each category | | MEC |
| | | | Final Design | Option 1: List of all simulation output advisory message data and show difference between baseline and proposed design | | MEC |
| | | | Final Design | Option 1: Comparison summary for energy model inputs including description of baseline and design case energy model inputs, showing both by element type | | MEC |
| | | | Final Design | Option 1: Energy type summary listing, for each energy type, utility rate description, units of energy and units of demand | | MEC |
| | | | Final Design | Option 1: Statement indicating whether project uses on-site renewable energy. If yes, list all sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost | | MEC |
| | | | Final Design | Option 1: If analysis includes exceptional calculation methods, statement describing how exceptional calculation measure cost savings is determined | | MEC |
| | | | Final Design | Option 1: If analysis includes exceptional calculation methods, for each exceptional calculation method indicate energy types and, for each energy type, annual energy savings, annual cost savings, and brief descriptive narrative | | MEC |
| | | | Final Design | Option 1: Baseline performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand for all four orientations. For each orientation indicate total annual energy use for each orientation and total annual process energy use. | | MEC |
| | | | Final Design | Option 1: Baseline energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost. | | MEC |
| | | | Final Design | Option 1: Proposed Design performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand, baseline annual and peak energy demand and percent savings. Indicate total annual energy use and total annual process energy use for both proposed design and baseline and percent savings. | | MEC |
| | | | Final Design | Option 1: Proposed Design energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost. | | MEC |
| | | | Final Design | Option 1: Energy cost and consumption by energy type report indicating, for each energy type, proposed design and baseline annual use and annual cost, percent savings annual use and annual cost. Indicate for renewable energy annual energy generated and annual cost. Indicate exceptional calculations annual energy savings and annual cost savings. Indicate building total annual energy use, annual energy cost for proposed design and baseline and indicate percent savings annual energy use and annual energy cost. | | MEC |

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| PAR | | FEATURE | DUE AT | | DATE | REV |
| | | | Final Design | Option 1: Compliance summaries from energy simulation software. If software does not produce compliance summaries provide output summaries and example input summaries for baseline and proposed design supporting data in the tables. Output summaries must include simulated energy consumption by end use and total energy use and cost by energy type. Example input summaries should represent most common systems and must include occupancy, use pattern, assumed envelope component sizes and descriptive features and assumed mechanical equipment types and descriptive features | | MEC |
| | | | Final Design | Option 1: Energy rate tariff from project energy providers (only if not using LEED Reference Guide default rates) | | MEC |
| EA2.1 | | On-Site Renewable Energy | Final Design | Statement indicating which compliance path option applies. | | ELEC |
| | | | Final Design | List all on-site renewable energy sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost. Indicate total annual energy use (all sources), total annual energy cost (all sources) and percent renewable energy cost. | | ELEC MEC |
| | | | Final Design | Option 1: Indicate, for renewable energy, proposed design total annual energy generated and annual cost. | | ELEC MEC |
| | | | Final Design | Option 2: Indicate CBECS building type and building gross area. Provide the following CBECS data: median annual electrical intensity, median annual non-electrical fuel intensity, average electric energy cost, average non-electric fuel cost, annual electric energy use and cost, annual non-electric fuel use and cost. | | ELEC MEC |
| | | | Final Design | Option 2: Narrative describing renewable systems and explaining calculation method used to estimate annual energy generated, including factors influencing performance. | | ELEC MEC |
| EA2.2 | | On-Site Renewable Energy | Same as EA2.1 | Same as EA2.1 | | ELEC MEC |
| EA2.3 | | On-Site Renewable Energy | Same as EA2.1 | Same as EA2.1 | | ELEC MEC |
| EA3 | | Enhanced Commissioning | **Final Design | **Owner's Project Requirements document (OPR) | | ALL |
| | | | **Final Design | **Basis of Design document for commissioned systems (BOD) | | ELEC MEC |
| | | | **Final Design | **Commissioning Plan | | ELEC MEC |
| | | | Closeout | Statement confirming all commissioning requirements have been incorporated into construction documents. | | PE |
| | | | Closeout | **Commissioning Report | | PE |
| | | | **Final Design | Statement by CxA confirming Commissioning Design Review | | |
| | | | Closeout | Statement by CxA confirming review of Contractor submittals for compliance with OPR and BOD | | PE |
| | | | Closeout | **Systems Manual | | PE |
| | | | Closeout | Statement by CxA confirming completion of O&M staff and occupant training | | PE |
| | | | Closeout | **Scope of work for post-occupancy review of building operation, including plan for resolution of outstanding issues | | PE |
| | | | **Predesign | Statement confirming CxA qualifications and contractual relationships relative to work on this project, demonstrating that CxA is an independent third party. | | MEC |
| EA4 | | Enhanced Refrigerant Management | Final Design | Refrigerant impact calculation table with all building data and calculation values as shown in LEED 2009 Reference Guide Example Calculations | | MEC |
| | | | Final Design | Narrative describing any special circumstances or explanatory remarks | | |
| | | | Closeout | X Cut sheets highlighting refrigerant data for all HVAC components. | | PE |
| EA5 | | Measurement & Verification | Closeout | Statement indicating which compliance path option applies. | | PE |
| | | | Closeout | Measurement and Verification Plan including Corrective Action Plan | | PE |
| | | | Closeout | **Scope of work for post-occupancy implementation of M&V plan including corrective action plan. | | PE |
| EA6 | | Green Power | Closeout | Statement indicating which compliance path option applies. | | PE |
| | | | Closeout | Option 1: Indicate proposed design total annual electric energy usage | | PE |
| | | | Closeout | Option 2: Indicate actual total annual electric energy usage | | PE |
| | | | Closeout | Option 3: Calculation indicating building type, total gross area, median electrical intensity and annual electric energy use | | PE |

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| | | | Closeout | Green power provider summary table indicating, for each purchase type, provider name, annual quantity green power purchased and contract term. Indicate total annual green power use and indicate percent green power | | PE |
| | | | Closeout | Narrative describing how Green Power or Green Tags are purchased | | PE |
| CATEGORY 4 – MATERIALS AND RESOURCES | | | | | | |
| MRPR1 | | Storage & Collection of Recyclables (PREREQUISITE) | Final Design | Statement confirming that recycling area will accommodate recycling of plastic, metal, paper, cardboard and glass. Narrative indicating any other materials addressed and coordination with pickup. | | ARC |
| MR1.1 | | Building Reuse: Maintain 55% of Existing Walls, Floors & Roof | **Final Design | If project includes a building addition, confirm that area of building addition does not exceed 2x the area of the existing building. | | ARC |
| | | | **Final Design | Spreadsheet listing, for each building structural/envelope element, the existing area and reused area. Total percent reused. | | ARC |
| MR1.2 | | Building Reuse: Maintain 75% of Existing Walls, Floors & Roof | Same as MR1.1 | Same as MR1.1 | | ARC |
| MR1.3 | | Building Reuse: Maintain 95% of Existing Walls, Floors & Roof | Same as MR1.1 | Same as MR1.1 | | ARC |
| MR1.4 | | Building Reuse: Maintain 50% of Interior Non-Structural Elements | **Final Design | If project includes a building addition, confirm that area of building addition does not exceed 2x the area of the existing building. | | ARC |
| | | | **Final Design | Spreadsheet listing, for each building interior non-structural element, the existing area and reused area. Total percent reused. | | ARC |
| MR2.1 | | Construction Waste Management: Divert 50% From Disposal | **Preconstruction | Waste Management Plan | | PE |
| | | | **Construction Quarterly and Closeout | Spreadsheet calculations indicating material description, disposal/diversion location (or recycling hauler), weight, total waste generated, total waste diverted, diversion percentage | | PE |
| | | | **Construction Quarterly and Closeout | Receipts/tickets for all items on spreadsheet | | PE |
| MR2.2 | | Construction Waste Management: Divert 75% From Disposal | Same as MR2.1 | Same as MR2.1 | | PE |
| MR3.1 | | Materials Reuse: 5% | Closeout | Statement indicating total materials value and whether default or actual. | | PE |
| | | | Closeout | Spreadsheet calculations indicating, for each reused/salvaged material, material description, source or vendor, cost. Total reused/salvaged materials percentage. | | PE |
| MR3.2 | | Materials Reuse: 10% | Same as MR3.1 | Same as MR3.1 | | PE |
| MR4.1 | | Recycled Content: 10% (post-consumer + 1/2 pre-consumer) | Closeout | Statement indicating total materials value and whether default or actual. | | PE |
| | | | Closeout | Spreadsheet calculations indicating, for each recycled content material, material name/description, manufacturer, cost, post-consumer recycled content percent, pre-consumer recycled content percent, source of recycled content data. Total post-consumer content materials cost, total pre-consumer content materials cost, total combined recycled content materials cost, recycled content materials percentage. | | PE |
| | | | Final Design or NLT Preconstruction | **Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal. | | PE |
| | | | Closeout | X Manufacturer published product data or certification, confirming recycled content percentages in spreadsheet | | PE |
| MR4.2 | | Recycled Content: 20% (post-consumer + 1/2 pre-consumer) | Same as MR4.1 | Same as MR4.1 | | PE |
| MR5.1 | | Regional Materials: 10% Extracted, Processed & Manufactured Regionally | Closeout | Statement indicating total materials value and whether default or actual. | | PE |
| | | | Closeout | Spreadsheet calculations indicating, for each regional material, material name/description, manufacturer, cost, percent compliant, harvest distance, manufacture distance, source of manufacture and harvest location data. Total regional materials cost, regional materials percentage. | | PE |
| | | | Preconstruction | **Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal. | | PE |
| | | | Closeout | X Manufacturer published product data or certification confirming regional material percentages in spreadsheet | | PE |

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| MR5.2 | | Regional Materials:20% Extracted, Processed & Manufactured Regionally | Same as MR5.1 | Same as MR5.1 | | PE |
| MR6 | | Rapidly Renewable Materials | Closeout | Statement indicating total materials value and whether default or actual. | | PE |
| | | | Closeout | Spreadsheet calculations indicating, for each rapidly renewable material, material name/description, manufacturer, cost, rapidly renewable content percent, rapidly renewable product value. Total rapidly renewable product value, rapidly renewable materials percentage. | | PE |
| | | | Final Design | **Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal. | | ARC |
| | | | Closeout | X Manufacturer published product data or certification confirming rapidly renewable material percentages in spreadsheet | | PE |
| MR7 | | Certified Wood | Closeout | Statement indicating total materials value and whether default or actual. | | PE |
| | | | Closeout | Spreadsheet calculations indicating, for each certified wood material, material name/description, vendor, cost, wood component percent, certified wood percent of wood component, FSC chain of custody certificate number. Total certified wood product value, certified wood materials percentage. | | PE |
| | | | Final Design or NLT Preconstruction | **Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal. | | PE |
| | | | Closeout | X Vendor invoices, FSC chain of custody certificates and manufacturer published product data or certification confirming all certified wood materials percentages in spreadsheet. | | PE |
| INDOOR ENVIRONMENTAL QUALITY | | | | | | |
| EQPR1 | | Minimum IAQ Performance (PREREQUISITE) | Final Design | Statement indicating which option for compliance applies, stating applicable criteria/requirement, and confirming that project has been designed to meet the applicable requirements. | | MEC |
| | | | Final Design | Narrative describing the project's ventilation design, including specifics about fresh air intake volumes and special considerations. | | MEC |
| EQPR2 | | Environmental Tobacco Smoke (ETS) Control (PREREQUISITE) | Final Design | Statement indicating which option for compliance applies, stating applicable criteria/requirement, and confirming that project has been designed to meet the applicable requirements. | | ARC |
| | | | Final Design | List of drawing and specification references that convey conformance to applicable requirements (signage, exhaust system, room separation details, etc). | | ARC |
| EQ1 | | Outdoor Air Delivery Monitoring | Final Design | Statement indicating which option for compliance applies and confirming that project has been designed to meet the applicable requirements. | | MEC |
| | | | Final Design | List of drawing and specification references that convey conformance to applicable requirements. | | MEC |
| | | | Final Design | Narrative describing the project's ventilation design and CO2 monitoring system, including specifics about monitors, operational parameters and setpoints. | | MEC |
| | | | Closeout | X Cut sheets for CO2 monitoring system. | | PE |
| EQ2 | | Increased Ventilation | Final Design | Statement indicating which option for compliance applies and confirming that project has been designed to meet the applicable requirements. | | MEC |
| | | | Final Design | Narrative describing the project's ventilation design, including specifics about zone fresh air intake volumes and demonstrating compliance. | | MEC |
| | | | Final Design | Option 2: Narrative describing design method used for determining natural ventilation design, including calculation methodology/model results and demonstrating compliance. | | MEC |
| | | | Final Design | List of drawing and specification references that convey conformance to applicable requirements. | | MEC |
| EQ3.1 | | Construction IAQ Management Plan: During Construction | **Preconstruction | Construction IAQ Management Plan | | PE |
| | | | Closeout | Statement confirming whether air handling units were operated during construction | | PE |
| | | | Closeout | Dated jobsite photos showing examples of IAQ management plan practices being implemented. Label photos to indicate which practice they demonstrate. Minimum one photo of each practice at each building. | | PE |

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| | | | Closeout | Spreadsheet indicating, for each filter installed during construction, the manufacturer, model number, MERV rating, location installed, and if it was replaced immediately prior to occupancy. | | PE |
| EQ3.2 | | Construction IAQ Management Plan: Before Occupancy | **Preconstruction | Construction IAQ Management Plan | | PE |
| | | | Closeout | Statement indicating which option for compliance applies and confirming that required activities have occurred that meet the applicable requirements. | | PE |
| | | | Closeout | Option 1a: Narrative describing the project's flushout process, including specifics about temperature, airflow and duration, special considerations (if any) and demonstrating compliance. | | PE |
| | | | Closeout | Option 1b: Narrative describing the project's pre-occupancy and post-occupancy flushout processes, including specifics about temperature, airflow and duration, special considerations (if any) and demonstrating compliance. | | PE |
| | | | Closeout | Option 2: Narrative describing the project's IAQ testing process, including specifics about contaminants tested for, locations, remaining work at time of test, retest parameters and special considerations (if any). | | PE |
| | | | Closeout | Option 2: IAQ testing report demonstrating compliance. | | PE |
| EQ4.1 | | Low Emitting Materials: Adhesives & Sealants | Closeout | Spreadsheet indicating, for each applicable indoor adhesive, sealant and sealant primer used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data. | | PE |
| | | | Closeout | Spreadsheet indicating, for each applicable indoor aerosol adhesive, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data - OR - Statement confirming no indoor aerosol adhesives were used for the project. | | PE |
| | | | Closeout | Manufacturer published product data or certification confirming material VOCs in spreadsheet | X | PE |
| EQ4.2 | | Low Emitting Materials: Paints & Coatings | Closeout | Spreadsheet indicating, for each applicable indoor paint and coating used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data. | | PE |
| | | | Closeout | Spreadsheet indicating, for each applicable indoor anti-corrosive/anti-rust paint and coating used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data - OR - Statement confirming no indoor anti-corrosive/anti-rust paints were used for the project . | | PE |
| | | | Closeout | Manufacturer published product data or certification confirming material VOCs in spreadsheet | X | PE |
| EQ4.3 | | Low Emitting Materials: Flooring Systems | Closeout | Spreadsheet indicating, for each indoor flooring system used, the manufacturer, product name/model number, if it meets LEED requirement (yes/no) and source of LEED compliance data. | | PE |
| | | | Closeout | Spreadsheet indicating, for each indoor carpet cushion used, the manufacturer, product name/model number, if it meets LEED requirement (yes/no) and source of LEED compliance data - OR - Statement confirming no indoor carpet cushion was used for the project. | | PE |
| | | | Closeout | Manufacturer published product data or certification confirming material compliance label in spreadsheet | X | PE |
| EQ4.4 | | Low Emitting Materials: Composite Wood & Agrifiber Products | Closeout | Spreadsheet indicating, for each indoor composite wood and agrifiber product used, the manufacturer, product name/model number, if it contains added urea formaldehyde (yes/no) and source of LEED compliance data. | | PE |
| | | | Closeout | Manufacturer published product data or certification confirming material urea formaldehyde in spreadsheet | X | PE |
| EQ5 | | Indoor Chemical & Pollutant Source Control | Closeout | Spreadsheet indicating, for each permanent entryway system used, the manufacturer, product name/model number and description of system. | | PE |
| | | | Final Design | List of drawing and specification references that convey locations and installation methods for entryway systems. | | ARC |
| | | | Final Design | Spreadsheet indicating, for each chemical use area, the room number, room name, description of room separation features (walls, floor/ceilings, openings) and pressure differential from surrounding spaces with doors closed - OR - Statement confirming that project includes no chemical use areas and that no hazardous cleaning materials are needed for building maintenance. | | ARC MEC |
| | | | Final Design | If project includes chemical use areas: List of drawing and specification references that convey locations of chemical use areas, room separation features and exhaust system. | | ARC |

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| | | | Final Design | If project includes places where water and chemical concentrate mixing occurs: List of drawing and specification references that convey provisions for containment of hazardous liquid wastes OR - Statement confirming that project includes no places where water and chemical concentrate mixing occurs. | | ARC MEC |
| | | | Closeout | If project includes chemical use areas: Spreadsheet indicating, for AHUs/mechanical ventilation equipment serving occupied areas, the manufacturer, model number, MERV rating, location installed, and if it was replaced immediately prior to occupancy (yes/no) - OR - Statement confirming that project does not use mechanical equipment for ventilation of occupied areas. | | PE |
| EQ6.1 | | Controllability of Systems: Lighting | Final Design | Calculation indicating total number of individual workstations, number of workstations with individual lighting controls and the percentage of workstations with individual lighting controls. | | ELEC |
| | | | Final Design | For each shared multi-occupant space, provide a brief description of lighting controls. | | ELEC |
| | | | Final Design | Narrative describing lighting control strategy, including type and location of individual controls and type and location of controls in shared multi-occupant spaces. | | ELEC |
| EQ6.2 | | Controllability of Systems: Thermal Comfort | Final Design | Calculation indicating total number of individual workstations, number of workstations with individual thermal comfort controls and the percentage of workstations with individual thermal comfort controls. | | MEC |
| | | | Final Design | For each shared multi-occupant space, provide a brief description of thermal comfort controls. | | MEC |
| | | | Final Design | Narrative describing thermal comfort control strategy, including type and location of individual and shared multi-occupant controls. | | MEC |
| EQ7.1 | | Thermal Comfort: Design | Final Design | Design criteria spreadsheet indicating, for spring, summer, fall and winter, maximum indoor space design temperature, minimum indoor space design temperature and maximum indoor space design humidity. | | MEC |
| | | | Final Design | Narrative describing method used to establish thermal comfort control conditions and how systems design addresses the design criteria, including compliance with the referenced standard. | | MEC |
| EQ7.2 | | Thermal Comfort: Verification | Final Design | Narrative describing the scope of work for the thermal comfort survey, including corrective action plan development | | MEC |
| | | | Final Design | List of drawing and specification references that convey permanent monitoring system. | | MEC |
| EQ8.1 | | Daylight & Views: Daylight 75% of Spaces | Final Design | Option 2: Table indicating all regularly occupied spaces with space area and space area with compliant daylight zone. Sum of regularly occupied areas and regularly occupied areas with compliant daylight zone. Percentage calculation of areas with compliant daylight zone to total regularly occupied areas. | | ARC |
| | | | Final Design | Option 1: Simulation model method, software and output data | | ELEC |
| | | | Final Design | Option 1: Table indicating all regularly occupied spaces with space area, space area with minimum 25 footcandles daylighting illumination, and method of providing glare control. Sum of regularly occupied areas and regularly occupied areas with 25 fc daylighting. Percentage calculation of areas with 25 fc daylighting to total regularly occupied areas. | | ELEC |
| | | | Final Design | For all occupied spaces excluded from the calculation, provide narrative indicating reasons for excluding the space. | | ARC |
| | | | Final Design | List of drawing and specification references that convey exterior glazed opening head and sill heights, glazing performance properties and glare control/sunlight redirection devices. | | ARC |
| | | | Closeout | X Manufacturer published product data or certification confirming glazing Tvis in spreadsheet | | PE |
| EQ8.2 | | Daylight & Views: Views for 90% of Spaces | Final Design | Table indicating all regularly occupied spaces with space area and space area with access to views. Sum of regularly occupied areas and regularly occupied areas with access to views. Percentage calculation of areas with views to total regularly occupied areas. | | ARC |
| | | | Final Design | For all occupied spaces excluded from the calculation, provide narrative indicating reasons for excluding the space. | | ARC |
| | | | Final Design | LEED Floor plan drawings showing line of sight diagramming of views areas in each regularly occupied space. List of drawing/specification references that convey exterior glazed opening head and sill heights. | | ARC |

INNOVATION & DESIGN PROCESS

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| IDc1.1 | | Innovation in Design | Final Design | Narrative describing intent, requirement for credit, project approach to the credit. List of drawings and specification references that convey implementation of credit. All other documentation that validates claimed credit. | | |
| IDc1.2 | | Innovation in Design | Final Design | | | |
| IDc1.3 | | Innovation in Design | Final Design | | | |
| IDc1.4 | | Innovation in Design | Final Design | | | |
| IDc2 | | LEED Accredited Professional | Final Design | Narrative indicating name of LEED AP, company name of LEED AP, description of LEED AP's role and responsibilities in the project. | | ARC |

ATTACHMENT F
Version 02-03-2010

BUILDING INFORMATION MODELING REQUIREMENTS

1.0 Section 1 - Submittal Format

1.1. Design Deliverables. Develop all designs using Building Information Modeling (BIM) and Computer Aided Design (CAD) software. Design submittal drawings shall be 22 X 34 size, suitable for half-size scaled reproduction.

2.0 Section 2 – Design Requirements

2.1. BIM Model and Facility Data. Contractor shall use BIM application(s) and software(s) to develop project designs. "Facility Data" is defined as associated intelligent attribute data. The "Model" is defined as 3D graphics that includes Facility Data and output as described in the paragraph 'Output' below. Contractors will use the Model to produce accurate Construction Documents. For each Center of Standardization (CoS) facility type included in this project, all BIM Models and associated Facility Data shall be submitted in Bentley Systems BIM [Not Supplied - SubmittalReqCADDSystem : BENTLEY_VERSION] with associated USACE Bentley BIM Workspace (which includes specific standard BIM libraries and definitions). This Workspace can be downloaded from the CAD/BIM Technology Center. [Where available, the workspace will be specific to this CoS Facility Standard Design. The Contractor will be provided a baseline multi-discipline BIM Project Model for the CoS Facility Standard Design type, where such a model exists (for the purposes of site adaptation).] The USACE Bentley BIM Workspace is dependent on specific versions of the Bentley BIM suite of products and only the versions of the software that are listed in the Contractor instructions included with the USACE BIM Workspace are permitted to be used.

2.1.1. Reference. Refer to ERDC TR-06-10, "U.S. Army Corps of Engineers Building Information Modeling Road Map" from the CAD/BIM Technology Center website for more information on the USACE BIM implementation goals.

2.2. Drawings. Deliver CAD files used for the creation of the Construction Documents Drawings per requirements in Section 01 33 16, the criteria of the USACE Kansas City District District, and as noted herein. Specification of a CAD file format for these Drawings does not limit which BIM application(s) or software(s) may be used for project development and execution.

2.2.1. IFC Support. The Contractor's selected BIM application(s) and software(s) must support the IFC (Industry Foundation Class - see www.iai-tech.org). Submit any deviations from or additions to the IFC property sets for any new spaces, systems, and equipment for Government approval.

2.2.2. Submittal Requirements. BIM submittals shall be fully interoperable, compatible, and editable with the Bentley BIM tools. Use the specified version of the USACE Bentley BIM Workspace and conform to the requirements of **Sections 3 and 4 below**.

2.2.3. BIM Project Execution Plan.

2.2.3.1. Develop a BIM Project Execution Plan ("Plan" or "PxP") documenting the BIM and analysis technologies selected for the Project Model (integrated with the AEC CAD Standard) from concept development through As-Builts as a design, production, coordination, construction, and documentation tool and the collaborative process by which it shall be executed. See Section 7 for additional guidance on developing the Plan.

2.2.4. BIM Requirements..

2.2.4.1. Facility Data. Develop the Facility Data consisting of a set of intelligent elements for the Model (e.g., doors, air handlers, electrical panels). This Facility Data shall include all material definitions and attributes that are necessary for the Project facility design and construction. Additional data in support of Section 6 Contractor Electives is encouraged.

2.2.4.2. Model Content. The Model and Facility Data shall include, at a minimum, the requirements of Section 4 below.

2.2.4.3. Model Granularity. Models may vary in level of detail for individual elements within a model, but at a minimum must include all features that would be included on a quarter inch (1/4" = 1'0") scaled drawing (e.g. at least 1/16th, 1/8th and 1/4th), or appropriately scaled civil drawings.

2.2.4.4. Output. Submitted CAD drawings (e.g., plans, elevations, sections, schedules, details, etc.) shall be derived (commonly known as extractions, views or sheets) and maintained from the submitted Model and Facility Data.

2.3. Quality Control. Implement quality control (QC) parameters for the Model, including:

2.3.1. Model Standards Checks. QC validation used to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements. Report non-compliant elements and corrective action plan to correct non-compliant elements. Provide the government with detailed justification and request government approval for any non-compliant element which the contractor proposes to be allowed to remain in the Model.

2.3.2. CAD Standards Checks. QC checking performed to ensure that the fonts, dimensions, line styles, levels and other construction document formatting issues are followed per the A/E/C CADD Standard.

2.3.3. Other Parameters. Develop such other QC parameters as Contractor deems appropriate for the Project and provide to the Government for concurrence.

2.4. Design and Construction Reviews. Perform design and construction reviews at each submittal stage under Section 3 to test the Model, including:

2.4.1. Visual Checks. Checking to ensure the design intent has been followed and that there are no unintended elements in the Model.

2.4.2. Interference Management Checks. Locate conflicting spatial data in the Model where two elements are occupying the same space. Log hard interferences (e.g., mechanical vs. structural or mechanical vs. mechanical overlaps in the same location) and soft interferences, (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation) in a written report and resolve.

2.4.3. IFC Coordination View. Provide an IFC Coordination View in IFC Express format for all deliverables. Provide exported property set data for all IFC supported named building elements.

2.4.4. Other Parameters. Develop such other Review parameters as the Contractor deems appropriate for the Project and provide to the Government for concurrence..

3.0 Section 3 – Design Stage Submittal Requirements

3.1. General Submittal Requirements.

3.1.1. Provide submittals in compliance with BIM Project Execution Plan deliverables at stages as described hereinafter.

3.1.2. At each Stage in Paragraphs 3.3 through 3.6, provide a Contractor-certified written report confirming that consistency checks as identified in Paragraphs 2.3 and 2.4 have been completed. This report shall be discussed as part of the review process and shall address cross-discipline interferences, if any.

3.1.3. At each Stage in Paragraphs 3.3 through 3.6, provide the Government with:

- The Model, Facility Data, Workspace and CAD Data files in native Bentley BIM/CAD.

- A 3-D interactive review format of the Model in Bentley Navigator, Autodesk Navisworks, Adobe 3D PDF 7.0 (or later), Google Earth KMZ or other format per Plan requirements. The file format for reviews can change between submittals.

- A list of all submitted files. The list should include a description, directory, and file name for each file submitted. For all CAD sheets, include the sheet title and sheet number. Identify files that have been produced from the submitted Model and Facility Data.

3.2. Initial Design Conference Submittal.

3.2.1. Submit a digital copy of the Plan where, in addition to Paragraph 3.1.4, the USACE Geographic District BIM Manager will coordinate with the USACE CoS BIM Manager to confirm acceptability of the Plan or advise as to additional processes or activities necessary to be incorporated.

3.2.2. Within thirty (30) days after the approval of the Plan, conduct a demonstration to review the Plan for clarification, and to verify the functionality of Model technology workflow and processes. If modifications are required, the Contractor shall complete the modifications and resubmit the Plan and perform subsequent demonstration for Government acceptance. There will be no payment for design or construction until the Plan is acceptable to the Government. The Government may also withhold payment for design and construction for unacceptable performance in executing the approved Plan.

3.3. Interim Design Submittals.

3.3.1. BIM and CAD Data. The Model shall include the requirements identified in Paragraph 2.2.4 as applicable to the Interim Design package(s).

3.4. Final Design Submissions and Design Complete Submittals.

3.4.1. BIM and CAD Data. The Model shall include the requirements identified in Paragraph 2.2.4. Acceptance according to Paragraph 3.1.4 is required before commencement of construction, as described in Paragraph 3.7.6 of Section 01 33 16.

3.5. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model, including interference management and design change tracking information.

3.6. Final As-Built BIM and CAD Data Submittal. Submit the final Model, Facility Data, and CAD files reflecting as-built conditions for Government Approval, as specified in Section 01 78 02.00 10, PROJECT CLOSEOUT.

4.0 Section 4 – BIM Model Minimum Requirements and Output

4.1. General Provisions. The deliverable Model shall be developed to include the systems described below as they would be built and the processes of installing them, and to reflect final as-built conditions. The deliverable model at the interim design stage and at the final design stage (“released for construction”) shall be developed to include as many of the systems described below as are necessary and appropriate at that design stage.

4.2. Architectural/Interior Design. The Architectural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4”=1’0”) scaled drawing. Additional minimum Model requirements include:

4.2.1. Spaces. The Model shall include spaces defining accurate net square footage and net volume, and holding data for the room finish schedule for including room names and numbers. Include Programmatic Information provided by the Government or validated program to verify design space against programmed space, using this information to validate area quantities.

4.2.2. Walls and Curtain Walls. Each wall shall be depicted to the exact height, length, width and ratings (thermal, acoustic, fire) to properly reflect wall types. The Model shall include all walls, both interior and exterior, and the necessary intelligence to produce accurate plans, sections and elevations depicting these design elements.

4.2.3. Doors, Windows and Louvers. Doors, windows and louvers shall be depicted to represent their actual size, type and location. Doors and windows shall be modeled with the necessary intelligence to produce accurate window and door schedules.

- 4.2.4. Roof. The Model shall include the roof configuration, drainage system, penetrations, specialties, and the necessary intelligence to produce accurate plans, building sections and generic wall sections where roof design elements are depicted.
- 4.2.5. Floors. The floor slab shall be developed in the structural Model and then referenced by the architectural Model for each floor of the Project building.
- 4.2.6. Ceilings. All heights and other dimensions of ceilings, including soffits, ceiling materials, or other special conditions shall be depicted in the Model with the necessary intelligence to produce accurate plans, building sections and generic wall sections where ceiling design elements are depicted.
- 4.2.7. Vertical Circulation. All continuous vertical components (i.e., non-structural shafts, architectural stairs, handrails and guardrails) shall be accurately depicted and shall include the necessary intelligence to produce accurate plans, elevations and sections in which such design elements are referenced.
- 4.2.8. Architectural Specialties and Woodwork. All architectural specialties (i.e., toilet room accessories, toilet partitions, grab bars, lockers, and display cases) and woodwork (i.e., cabinetry and counters) shall be accurately depicted with the necessary intelligence to produce accurate plans, elevations and sections in which such design elements are referenced.
- 4.2.9. Signage. The Model shall include all signage and the necessary intelligence to produce accurate plans and schedules.
- 4.2.10. Schedules. Provide door, window, hardware sets using BHMA designations, flooring, wall finish, and signage schedules from the Model, indicating the type, materials and finishes used in the design.
- 4.3. Furniture. The furniture systems Model may vary in level of detail for individual elements within a Model, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing, and have necessary intelligence to produce accurate plans. Representation of furniture elements is to be 2D. Contractor may provide a minimal number of 3D representations as examples. Examples of furniture include, but are not limited to, desks, furniture systems, seating, tables, and office storage.
- 4.3.1. Furniture Coordination. Furniture that makes use of electrical, data or other features shall include the necessary intelligence to produce coordinated documents and data.
- 4.4. Equipment. The Model may vary in level of detail for individual elements within a Model. Equipment shall be depicted to meet layout requirements with the necessary intelligence to produce accurate plans and minimum schedules depicting their configuration. Examples of equipment include but are not limited to copiers, printers, refrigerators, ice machines and microwaves.
- 4.4.1. Schedules. Provide furniture and equipment schedules from the model indicating the materials, finishes, mechanical, and electrical requirements.
- 4.5. Structural. The structural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:
- 4.5.1. Foundations. All necessary foundation and/or footing elements, with necessary intelligence to produce accurate plans and elevations
- 4.5.2. Floor Slabs. Structural floor slabs shall be depicted, including all necessary recesses, curbs, pads, closure pours, and major penetrations accurately depicted.
- 4.5.3. Structural Steel. All steel columns, primary and secondary framing members, and steel bracing for the roof and floor systems (including decks), including all necessary intelligence to produce accurate structural steel framing plans and related building/wall sections.
- 4.5.4. Cast-in-Place Concrete. All walls, columns, and beams, including necessary intelligence to produce accurate plans and building/wall sections depicting cast-in-place concrete elements.

- 4.5.5. Expansion/Contraction Joints. Joints shall be accurately depicted.
- 4.5.6. Stairs. The structural Model shall include all necessary openings and framing members for stair systems, including necessary intelligence to produce accurate plans and building/wall sections depicting stair design elements.
- 4.5.7. Shafts and Pits. The structural Model shall include all necessary shafts, pits, and openings, including necessary intelligence to produce accurate plans and building/wall sections depicting these design elements.
- 4.6. Mechanical. The mechanical systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Small diameter (less than 1-1/2" NPS) field-routed piping is not required in the model. Additional minimum Model requirements include:
- 4.6.1. HVAC. All necessary heating, ventilating, air-conditioning and specialty equipment, including air distribution ducts for supply, return, and ventilation and exhaust ducts, including control system, registers, diffusers, grills and hydronic baseboards with necessary intelligence to produce accurate plans, elevations, building/wall sections and schedules.
- 4.6.1.1. Mechanical Piping. All necessary piping and fixture layouts, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, and schedules.
- 4.6.2. Plumbing. All necessary plumbing piping and fixture layouts, floor and area drains, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules.
- 4.6.3. Equipment Clearances. All HVAC and Plumbing equipment clearances shall be modeled for use in interference management and maintenance access requirements.
- 4.6.4. Elevator Equipment. The Model shall include the necessary equipment and control system, including necessary intelligence to produce accurate plans, sections and elevations depicting these design elements.
- 4.7. Electrical/Telecommunications. The electrical systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Small diameter (less than 1-1/2"Ø) field-routed conduit is not required in the model. Additional minimum Model requirements include:
- 4.7.1. Interior Electrical Power and Lighting. All necessary interior electrical components (i.e., lighting, receptacles, special and general purpose power receptacles, lighting fixtures, panelboards, cable trays and control systems), including necessary intelligence to produce accurate plans, details and schedules. Lighting and power built into furniture/equipment shall be modeled.
- 4.7.2. Special Electrical Systems. All necessary special electrical components (i.e., security, Mass Notification, Public Address, nurse call and other special occupancies, and control systems), including necessary intelligence to produce accurate plans, details and schedules.
- 4.7.3. Grounding Systems. Grounding Systems. All necessary grounding components (i.e., lightning protection systems, static grounding systems, communications grounding systems, bonding), including necessary intelligence to produce accurate plans, details and schedules.
- 4.7.4. Communications. All existing and new communications service controls and connections, both above ground and underground with necessary intelligence to produce accurate plans, details and schedules. Cable tray routing shall be modeled without detail of cable contents.
- 4.7.5. Exterior Building Lighting. All necessary exterior lighting with necessary intelligence to produce accurate plans, elevations and schedules. The exterior building lighting Model shall include all necessary lighting, relevant existing and proposed support utility lines and equipment required with necessary intelligence to produce accurate plans, details and schedules.

4.7.6. Equipment Clearances. The model shall incorporate and define all electrical and communications working spaces, clearances, and required access

4.8. Fire Protection. The fire protection system Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.8.1. Fire Protection System. All relevant fire protection components (i.e., branch piping, sprinkler heads, fittings, drains, pumps, tanks, sensors, control panels) with necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All fire protection piping shall be modeled.

4.8.2. Fire Alarms. Fire alarm/mass notification devices and detection system shall be indicated with necessary intelligence to produce accurate plans depicting them.

4.9. Civil. The civil Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a one inch (1"=100') scaled drawing. Additional minimum Model requirements include:

4.9.1. Terrain (DTM). All relevant site conditions and proposed grading, including necessary intelligence to produce accurate Project site topographical plans and cross sections.

4.9.2. Drainage. All existing and new drainage piping, including upgrades thereto, including necessary intelligence to produce accurate plans and profiles for the Project site.

4.9.3. Storm Water and Sanitary Sewers. All existing and new sewer structures and piping, including upgrades thereto, on the Project site with necessary connections to mains or other distribution points as appropriate, including necessary intelligence to produce accurate plans and profiles for the Project site.

4.9.4. Utilities. All necessary new utilities connections from the Project building(s) to the existing or newly-created utilities, and all existing above ground and underground utility conduits, including necessary intelligence to produce accurate plans and site-sections.

4.9.5. Roads and Parking. All necessary roadways and parking lots or parking structures, including necessary intelligence to produce accurate plans, profiles and cross-sections.

5.0 Section 5 - Ownership and Rights in Data

5.1. Ownership. The Government has ownership of and rights at the date of Closeout Submittal to all CAD files, BIM Model, and Facility Data developed for the Project in accordance with FAR Part 27, clauses incorporated in Section 00 72 00, Contract Clauses and Special Contract Requirement 1.14 GOVERNMENT RE-USE OF DESIGN (Section 00 73 00). The Government may make use of this data following any deliverable.

6.0 Section 6 – Contractor Electives

6.1. Applicable Criteria. If the Contractor elected to include one or more of the following features as an elective in its accepted contract proposal for additional credit during the source selection, as described in the proposal submission requirements and evaluation criteria, the following criteria are requirements, as applicable to those elective feature(s).

6.2. COBIE Compliance. The Model and Facility Data for the Project shall fulfill Construction Operations Building Information Exchange (COBIE) requirements as defined by the Whole Building Design Guide organization, including all requirements for the indexing and submission of Portable Document Format (PDF) and other appropriate file formats that would otherwise be printed and submitted in compliance with Project operations and maintenance handover requirements.

6.3. Project Scheduling using the Model. In the BIM Execution Plan and during the Preliminary BIM Execution Plan Review, provide an overview of the use of BIM in the development and support of the project construction schedule.

6.3.1. Submittal Requirements. During the Submittal stages, the Contractor shall deliver the construction schedule with information derived from the Model.

6.3.1.1. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model for project scheduling.

6.4. Cost Estimating. In the BIM Execution Plan and during the Preliminary BIM Execution Plan Review, provide an overview of the use of BIM in the development and support of cost estimating requirements, or other applications such as cost analysis and estimate validation.

6.4.1. Submittal Requirements. During the Submittal stages, the Contractor shall deliver cost estimating information derived from the Model.

6.4.2. Project completion. At project completion, the Contractor shall provide an MII (Micro Computer Aided Cost Estimating System Generation II) Cost Estimate which follows the USACE Cost Engineering Military Work Breakdown System (WBS), a modified Uniformat, to at least the sub-systems level and uses quantity information supplied directly from BIM output to the maximum extent possible, though other "Gap" quantity information will be included as necessary for a complete and accurate cost estimate.

6.4.2.1. Sub system level extracted quantities from the BIM for use within the estimate shall be provided according to how detailed line items or tasks should be installed/built so that accurate costs can be developed and/or reflected. Therefore, when developing a BIM, the designer shall be cognizant of what tasks need to be separated appropriately at the beginning stages of model development, such as tasks done on the first floor versus the same task on higher floors that will be more labor intensive and therefore need to have a separate quantity and be priced differently. Tasks and their extracted quantities from the BIM shall be broken down by their location (proximity in the structure) as well as the complexity of its installation.

6.4.2.2. At all design stages it shall be understood that BIM output as described in this document will not generate all quantities that are necessary in order to develop a complete and accurate cost estimate of the project based on the design. An example of this would be plumbing that is less than 1.5" diameter and therefore not expected to be modeled due to granularity; this information is commonly referred to as The Gap. Quantities from The Gap and their associated costs shall be included in the final project actual cost estimates as well.

6.5. Other Analyses and Reports. Structural, energy and efficiency, EPACT 2005 & EISA 2007, lighting design, daylighting, electrical power, psychrometric processing, shading, programming, LEED, fire protection, code compliance, Life Cycle Cost, acoustic, plumbing.

7.0 Section 7 – BIM Project Execution Plan Template

7.1. Contractors will utilize the latest version of the USACE BIM PROJECT EXECUTION PLAN (USACE PxP) Template to develop an acceptable Plan. The template can be downloaded from the CAD/BIM Technology Center website.

ATTACHMENT G**DESIGN SUBMITTAL DIRECTORY AND SUBDIRECTORY FILE ARRANGEMENT**

Organize electronic design submittal files in a subdirectory/file structure in accordance with the following table. The Contractor may suggest a slightly different structure, subject to the discretion of the government.

Design Submittal Directory and Subdirectory File Arrangement.

| Directory | Sub-Directory | Sub-Directory or Files | Files |
|------------------------|--------------------------------|--|--|
| Submittal/Package Name | Narratives | PDF file or files with updated design narrative for each applicable design discipline | |
| | Drawings | PDF (subdirectory) | Single PDF file with all applicable drawing sheets - bookmarked by sheet number and name |
| | | BIM (subdirectory) See Attachment F. | BIM project folder (with files) per the USACE Workspace. Include an Excel drawing index file with each drawing sheet listed by sheet #, name and corresponding dgn file name (Final Design & Design Complete only) |
| | Design Analysis & Calculations | Individual PDF files containing design analysis and calculations for each discipline applicable to the submittal | |
| | | PDF file with Fire Protection and Life Safety Code Review checklist | |
| | LEED | PDF file with updated Leed Check List | |
| | | PDF file or files with LEED Templates for each point with applicable documentation included in each file. | |
| | | LEED SUBMITTALS | |
| | Energy Analysis | PDF with baseline energy consumption analysis | |
| | | PDF with actual building energy consumption analysis | |
| | Specifications | Single PDF file with table of contents and all applicable specifications sections. | |
| | | Submittal Register (Final Design & Design Complete submittal only) | |
| | Design Quality Control | PDF file or files with DQC checklist(s) and/or statements | |
| | Building Rendering(s) | PDF file of rendering for each building type included in contract (Final Design & Design Complete). | |

**SECTION 01 45 01.10
QUALITY CONTROL SYSTEM (QCS)**

1.0 GENERAL

- 1.1. CORRESPONDENCE AND ELECTRONIC COMMUNICATIONS
- 1.2. QCS SOFTWARE
- 1.3. SYSTEM REQUIREMENTS
- 1.4. RELATED INFORMATION
- 1.5. CONTRACT DATABASE
- 1.6. DATABASE MAINTENANCE
- 1.7. IMPLEMENTATION
- 1.8. DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM
- 1.9. MONTHLY COORDINATION MEETING
- 1.10. NOTIFICATION OF NONCOMPLIANCE

1.0 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. The Contractor module, user manuals, updates, and training information can be downloaded from the RMS web site. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data
- Request for Information
- Accident Reporting
- Safety Exposure Manhours

1.1. CORRESPONDENCE AND ELECTRONIC COMMUNICATIONS

For ease and speed of communications, both Government and Contractor will exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.2. OTHER FACTORS

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01 32 01.00 10, PROJECT SCHEDULE, Section 01 33 00, SUBMITTAL PROCEDURES, and Section 01 45 04.00 10, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.3. QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.4. SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

- (a) Hardware
- IBM-compatible PC with 1000 MHz Pentium or higher processor
 - 256 MB RAM for workstation / 512+ MB RAM for server
 - 1 GB hard drive disk space for sole use by the QCS system
 - Compact disk (CD) Reader, 8x speed or higher
 - SVGA or higher resolution monitor (1024 x 768, 256 colors)
 - Mouse or other pointing device
 - Windows compatible printer (Laser printer must have 4+ MB of RAM)
 - Connection to the Internet, minimum 56K BPS

(b) Software

- MS Windows 2000 or higher
- MS Word 2000 or newer
- Latest version of : Netscape Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher
- Electronic mail (E-mail), MAPI compatible
- Virus protection software that is regularly upgraded with all issued manufacturer's updates

1.5. RELATED INFORMATION

1.5.1. QCS USER GUIDE

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

1.5.2. CONTRACTOR QUALITY CONTROL (CQC) TRAINING

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.6. CONTRACT DATABASE

Prior to the pre-construction conference, the Government will provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by using the government's SFTP repository built into QCS import/export function. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.7. DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government, e.g., daily reports, submittals, RFI's, schedule updates, payment requests, etc. shall be submitted using the government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, email or CD-ROM may be used instead (see Paragraph DATA SUBMISSION VIA CD-ROM). The QCS database typically shall include current data on the following items:

1.7.1. ADMINISTRATION

1.7.1.1. Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format.

1.7.1.2. Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format.

1.7.1.3. Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main)

office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

All Requests For Information (RFI) shall be exchanged using the Built-in RFI generator and tracker in QCS.

1.7.1.4. Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.7.1.5. Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

1.7.2. FINANCES

1.7.2.1. Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the design and construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

1.7.2.2. Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet prompt payment certification, and payment invoice in QCS. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment request, prompt payment certification, and payment invoice with supporting data by using the government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, E-mail or a CD-ROM may be used. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.7.3. Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01 45 04.00 10, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a QCS update reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.7.3.1. Daily Contractor Quality Control (CQC) Reports

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01 45 04.00 10, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government within 24 hours after the date covered by the report. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.7.3.2. Deficiency Tracking

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.7.3.3. QC Requirements

The Contractor shall develop and maintain a complete list of QC testing and required structural and life safety special inspections required by the International Code Council (ICC), transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

1.7.3.4. Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.7.3.5. Labor and Equipment Hours

The Contractor shall log labor and equipment exposure hours on a daily basis. This data will be rolled up into a monthly exposure report.

1.7.3.6. Accident/Safety Tracking Reporting

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This supplemental entry is not to be considered as a substitute for completion of mandatory notification and reports, e.g., ENG Form 3394 and OSHA Form 300.

1.7.3.7. Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.7.3.8. Hazard Analysis

The Contractor shall use QCS to develop a hazard analysis for each feature of work included in its CQC Plan. The hazard analysis shall address any hazards, or potential hazards, that may be associated with the work

1.7.4. Submittal Management

The Government will provide the submittal register form, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. The Contractor and Designer of Record (DOR) shall develop and maintain a complete list of all submittals, including completion of all data columns and shall manage all submittals. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. QCS and RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.7.5. Schedule

The Contractor shall develop a design and construction schedule consisting of pay activities, in accordance with Section 01 32 01.00 10, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01 32 01.00 10 PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

1.7.5.1. Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data from RMS, and schedule data using SDEF.

1.8. IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.9. DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of QCS data is by using the government's SFTP repository built into QCS export function.. Other data should be submitted using E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of CD-ROM for data transfer. Data on CDs shall be exported using the QCS built-in export function. If used, CD-ROMs will be submitted in accordance with the following:

1.9.1. File Medium

The Contractor shall submit required data on CD-ROMs. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.9.2. Disk Or Cd-Rom Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.9.3. File Names

The files will be automatically named by the QCS software. The naming convention established by the QCS software shall not be altered in any way by the Contractor.

1.10. MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions.

The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.11. NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

End of Section 01 45 01.10

**SECTION 01 45 04.00 10
CONTRACTOR QUALITY CONTROL**

1.0 GENERAL

1.1. REFERENCES

1.2. PAYMENT

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION

3.1. GENERAL REQUIREMENTS

3.2. QUALITY CONTROL PLAN

3.3. COORDINATION MEETING

3.4. QUALITY CONTROL ORGANIZATION

3.5. SUBMITTALS AND DELIVERABLES

3.6. CONTROL

3.7. TESTS

3.8. COMPLETION INSPECTION

3.9. DOCUMENTATION

3.10. NOTIFICATION OF NONCOMPLIANCE

1.0 GENERAL

1.1. REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Refer to the latest edition, as of the date of the contract solicitation.

- ASTM INTERNATIONAL (ASTM)
- ASTM D 3740 Minimum Requirements for Agencies
Engaged in the Testing and/or Inspection
of Soil and Rock as Used in Engineering
Design and Construction
- ASTM E 329 Agencies Engaged in the Testing
and/or Inspection of Materials Used in
Construction
- U.S. ARMY CORPS OF ENGINEERS (USACE)
ER 1110-1-12 Quality Management

1.2. PAYMENT

There will be no separate payment for providing and maintaining an effective Quality Control program. Include all costs associated therewith in the applicable unit prices or lump-sum prices contained in the Contract Line Item Schedule.

2.0 PRODUCTS (Not Applicable)

3.0 EXECUTION

3.1. GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product, which complies with the contract requirements. The system shall cover all design and construction operations, both onsite and offsite, and shall be keyed to the proposed design and construction sequence. The site project superintendent is responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.

3.2. QUALITY CONTROL PLAN

Furnish for Government review, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Design and construction may begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. The Government will not permit work outside of the features of work included in an accepted interim plan to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started. Where the applicable Code issued by the International Code Council calls for an inspection by the Building Official, the Contractor shall include the inspections in the Quality Control Plan and shall perform the inspections. The Designer of Record shall develop a program for any special inspections required by the applicable International Codes and the Contractor shall perform these inspections, using qualified inspectors. Include the special inspection plan in the QC Plan.

3.2.1. Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents subcontractors, designers of record, consultants, architect/engineers (AE), fabricators, suppliers, and purchasing agents:

3.2.1.1. A description of the quality control organization. Include a chart showing lines of authority and an acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. A CQC System Manager shall report to the project superintendent or someone higher in the contractor's organization.

3.2.1.2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function. Also include those responsible for performing and documenting the inspections required by the International Codes and the special inspection program developed by the designer of record.

3.2.1.3. A copy of the letter to the CQC System Manager, signed by an authorized official of the firm, which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Furnish copies of these letters.

3.2.1.4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents subcontractors, designers of record, consultants, architect engineers (AE), offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

3.2.1.5. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. Use only Government approved Laboratory facilities.

3.2.1.6. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

3.2.1.7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

3.2.1.8. Reporting procedures, including proposed reporting formats.

3.2.1.9. A list of the definable features of work. A definable feature of work is a task, which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

3.2.1.10. A list of all inspections required by the International Codes and the special inspection program required by the code and this contract.

3.2.2. Additional Requirements for Design Quality Control (DQC) Plan

The following additional requirements apply to the Design Quality Control (DQC) plan:

3.2.2.1. The Contractor's QCP Plan shall provide and maintain a Design Quality Control (DQC) Plan as an effective quality control program which will assure that all services required by this design-build contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, competent, independent reviewers identified in the DQC Plan shall review all documents. Use personnel who were not involved in the design effort to produce the design to perform the independent technical review (ITR). The ITR is intended as a quality control check of the design. Include, at least, but not necessarily limited to, a review of the contract requirements (the accepted contract or task order proposal and amended RFP), the basis of design, design calculations, the design configuration management documentation and check the design documents for

errors, omissions, and for coordination and design integration. The ITR team is not required to examine, compare or comment concerning alternate design solutions but should concentrate on ensuring that the design meets the contract requirements. Correct errors and deficiencies in the design documents prior to submitting them to the Government.

3.2.2.2. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit these completed checklists at each design phase as part of the project documentation.

3.2.2.3. A Design Quality Control Manager, who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated, shall implement the DQC Plan. This individual shall be a person who has verifiable engineering or architectural design experience and is a registered professional engineer or architect. Notify the Government, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

3.2.3. Acceptance of Plan

Government acceptance of the Contractor's plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4. Notification of Changes

After acceptance of the CQC Plan, notify the Government in writing of any proposed change. Proposed changes are subject to Government acceptance.

3.3. COORDINATION MEETING

After the Postaward Conference, before start of design or construction, and prior to acceptance by the Government of the CQC Plan, the Contractor and the Government shall meet and discuss the Contractor's quality control system. Submit the CQC Plan for review a minimum of 7 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, design activities, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. The Government will prepare minutes of the meeting for signature by both parties. The minutes shall become a part of the contract file. There may be occasions when either party will call for subsequent conferences to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4. QUALITY CONTROL ORGANIZATION

3.4.1. Personnel Requirements

The requirements for the CQC organization are a CQC System Manager, a Design Quality Manager, and sufficient number of additional qualified personnel to ensure contract compliance. The CQC organization shall also include personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly furnish complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2. CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System

Manager shall be a graduate engineer, graduate architect, or a BA/BS graduate of an ACCE accredited construction management college program. The CQC system Manager may alternately be an engineering technician with at least 2 years of college and an ICC certification as a Commercial Building Inspector (Residential Building Inspector certification will be required for Military Family Housing projects). In addition, the CQC system manager shall have a minimum of 5 years construction experience on construction similar to this contract. The CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. Assign the CQC System Manager no other duties (except may also serve as Safety and Health Officer, if qualified and if allowed by Section 00 73 00). Identify an alternate for the CQC System Manager in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager but the alternate may have other duties in addition to serving in a temporary capacity as the acting QC manager.

3.4.3. CQC Personnel

3.4.3.1. In addition to CQC personnel specified elsewhere in the contract provide specialized CQC personnel to assist the CQC System Manager in accordance with paragraph titled Area Qualifications.

3.4.3.2. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; **are not intended to be full time, but must be physically present at the construction site during work on their areas of responsibility**; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan. **One person may cover more than one area, provided that they are qualified to perform QC activities for the designated areas below and provided that they have adequate time to perform their duties:**

3.4.4. Experience Matrix

3.4.4.1. Area Qualifications

3.4.4.1.1. Civil - Graduate Civil Engineer or (BA/BS) graduate in construction management with 4 years experience in the type of work being performed on this project or engineering technician with 5 yrs related experience.

3.4.4.1.2. Mechanical - Graduate Mechanical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or engineering technician with an ICC certification as a Commercial Mechanical Inspector with 5 yrs related experience.

3.4.4.1.3. Electrical - Graduate Electrical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or engineering technician with an ICC certification as a Commercial Electrical Inspector with 5 yrs related experience.

3.4.4.1.4. Structural - Graduate Structural Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or person with an ICC certification as a Reinforced Concrete Special Inspector and Structural Steel and Bolting Special Inspector (as applicable to the type of construction involved) with 5 yrs related experience.

3.4.4.1.5. Plumbing - Graduate Mechanical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience, or person with an ICC certification as a Commercial Plumbing Inspector with 5 yrs related experience.

3.4.4.1.6. Concrete, Pavements and Soils Materials Technician (present while performing tests) with 2 yrs experience for the appropriate area

3.4.4.1.7. Testing, Adjusting and Balancing Specialist must be a member (TAB) Personnel of AABC or an experienced technician of the firm certified by the NEBB (present while testing, adjusting, balancing).

3.4.4.1.8. Design Quality Control Manager Registered Architect or Professional Engineer (not required on the construction site)

3.4.4.1.9. Registered Fire Protection Engineer with 4 years related experience or engineering technician with 5 yrs related experience (but see requirements for Fire Protection Engineer of Record to witness final testing in Section 01 10 00, paragraph 5.10, Fire Protection).

3.4.4.1.10. QC personnel assigned to the installation of the telecommunication system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification. In lieu of BICSI certification, QC personnel shall have a minimum of 5 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. QC personnel shall witness and certify the testing of telecommunications cabling and equipment.

3.4.5. Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management for Contractors". This course is periodically offered at Fort Leonard Wood, Missouri. Inquire of the District or Division sponsoring the course for fees and other expenses involved, if any, for attendance at this course.

3.4.6. Organizational Changes

When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5. SUBMITTALS AND DELIVERABLES

Make submittals as specified in Section 01 33 00 **SUBMITTAL PROCEDURES**. The CQC organization shall certify that all submittals and deliverables are in compliance with the contract requirements.

3.6. CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The CQC organization shall conduct at least three phases of control for each definable feature of the construction work as follows:

3.6.1. Preparatory Phase

Perform this phase prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

3.6.1.1. A review of each paragraph of applicable specifications, reference codes, and standards. Make a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field at the preparatory inspection. Maintain these copies in the field, available for use by Government personnel until final acceptance of the work.

3.6.1.2. A review of the contract drawings.

3.6.1.3. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

3.6.1.4. Review of provisions that have been made to provide required control inspection and testing.

3.6.1.5. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

3.6.1.6. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

3.6.1.7. A review of the appropriate activity hazard analysis to assure safety requirements are met.

3.6.1.8. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

3.6.1.9. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

3.6.1.10. Discussion of the initial control phase.

3.6.1.11. Notify the Government at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2. Initial Phase

Accomplish this phase at the beginning of a definable feature of work. Include the following actions:

3.6.2.1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

3.6.2.2. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

3.6.2.3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

3.6.2.4. Resolve all differences.

3.6.2.5. Check safety to include compliance with and upgrading of the Accident Prevention plan and activity hazard analysis. Review the activity analysis with each worker.

3.6.2.6. Notify the Government at least 24 hours in advance of beginning the initial phase. The CQC System Manager shall prepare and attach to the daily CQC report separate minutes of this phase. Indicate exact location of initial phase for future reference and comparison with follow-up phases.

3.6.2.7. Repeat the initial phase any time acceptable specified quality standards are not being met.

3.6.3. Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Conduct final follow-up checks and correct deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.

3.6.4. Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7. TESTS

3.7.1. Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements and project design documents. Upon request, furnish to the Government

duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory, or establish an approved testing laboratory at the project site. The Contractor may elect to use a laboratory certified and accredited by the Concrete and cement Reference Laboratory (CCRL) or by AASHTO Materials Reference Laboratory (AMRL) for testing procedures that those organizations certify. The Contractor shall perform the following activities and record and provide the following data:

3.7.1.1. Verify that testing procedures comply with contract requirements and project design documents.

3.7.1.2. Verify that facilities and testing equipment are available and comply with testing standards.

3.7.1.3. Check test instrument calibration data against certified standards.

3.7.1.4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

3.7.1.5. Include results of all tests taken, both passing and failing tests, recorded on the CQC report for the date taken. Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2. Testing Laboratories

3.7.2.1. Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2. Capability Recheck

If the selected laboratory fails the capability check, the Government will assess the Contractor a charge of \$1,375 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3. Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4. Furnishing or Transportation of Samples for Government Quality Assurance Testing

The Contractor is responsible for costs incidental to the transportation of samples or materials. Deliver samples of materials for test verification and acceptance testing by the Government to the Corps of Engineers Laboratory, f.o.b., at the following address:

- For delivery by mail:
 - TBD as required
 - N/A
 - N/A
 - N/A
- For other deliveries:
 - TBD as required

N/A

N/A

N/A

The area or resident office will coordinate, exact delivery location, and dates for each specific test.

3.8. COMPLETION INSPECTION

3.8.1. Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the SPECIAL CONTRACT REQUIREMENTS Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. Prepare a punch list of items which do not conform to the approved drawings and specifications and include in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2. Pre-Final Inspection

As soon as practicable after the notification above, the Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. Accomplish these inspections and any deficiency corrections required by this paragraph within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3. Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall attend the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups and major commands may also attend. The Government will formally schedule the final acceptance inspection based upon results of the Pre-Final inspection. Provide notice to the Government at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9. DOCUMENTATION

3.9.1. Maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers using government-provided software, QCS (see Section 01 45 01.10). The report includes, as a minimum, the following information:

3.9.1.1. Contractor/subcontractor and their area of responsibility.

3.9.1.2. Operating plant/equipment with hours worked, idle, or down for repair.

3.9.1.3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

- 3.9.1.4. Test and/or control activities performed with results and references to specifications/drawings requirements. Identify the applicable control phase (Preparatory, Initial, Follow-up). List deficiencies noted, along with corrective action.
- 3.9.1.5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- 3.9.1.6. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.
- 3.9.1.7. Offsite surveillance activities, including actions taken.
- 3.9.1.8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- 3.9.1.9. Instructions given/received and conflicts in plans and/or specifications.
- 3.9.1.10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identity of the ITR team, the ITR review comments, responses and the record of resolution of the comments.
- 3.9.2. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. Furnish the original and one copy of these records in report form to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, submit one report for every 7 days of no work and on the last day of a no work period. Account for all calendar days throughout the life of the contract. The first report following a day of no work shall be for that day only. The CQC System Manager shall sign and date reports. The report shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel. The Contractor may submit these forms electronically, in lieu of hard copy.

3.10. NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

End of Section 01 45 04.00 10

**SECTION 01 50 02
TEMPORARY CONSTRUCTION FACILITIES**

1.0 OVERVIEW

1.1. GENERAL REQUIREMENTS

1.2. AVAILABILITY AND USE OF UTILITY SERVICES

1.3. BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.4. PROTECTION AND MAINTENANCE OF TRAFFIC

1.5. MAINTENANCE OF CONSTRUCTION SITE

1.6. GOVERNMENT FIELD OFFICE

1.0 OVERVIEW

1.1. GENERAL REQUIREMENTS

1.1.1. Site Plan

Prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Also indicate if the use of a supplemental or other staging area is desired.

1.2. AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1. See Section 00 72 00, Contract Clauses and Section 00 73 00, Special Contract Requirements, for Utility Availability requirements.

1.2.2. Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.2.3. Telephone

Make arrangements and pay all costs for desired telephone facilities.

1.3. BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.3.1. Bulletin Board

Immediately upon beginning of onsite work, provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Display legible copies of the aforementioned data until work is completed. Remove the bulletin board from the site upon completion of the project.

1.3.2. Project and Safety Signs

Erect a project sign and a site safety sign with informational details as provided by the Government at the Post award conference, within 15 days prior to any work activity on project site. Update the safety sign data daily, with light colored metallic or non-metallic numerals. Remove the signs from the site upon completion of the project. Engineer Pamphlet EP 310-1-6a contains the standardized layout and construction details for the signs. It can be found through a GOOGLE Search or try <http://www.usace.army.mil/publications/eng-pamphlets/ep310-1-6a/s-16.pdf>.

1.4. PROTECTION AND MAINTENANCE OF TRAFFIC

Provide access and temporary relocated roads as necessary to maintain traffic. Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Take measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property.

The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. Investigate the adequacy of existing roads and the allowable load limit on these roads. Repair any damage to roads caused by construction operations.

1.4.1. Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Construct haul roads with suitable grades and widths. Avoid sharp curves, blind corners, and dangerous cross traffic. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Provide adequate lighting to assure full and clear visibility for full width of haul road and work areas during any night work operations. Remove haul roads designated by the Contracting Officer upon completion of the work and restore those areas.

1.4.2. Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.5. MAINTENANCE OF CONSTRUCTION SITE

Mow grass and vegetation located within the boundaries of the construction site for the duration of the project, from NTP to contract completion. Edge or neatly trim grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers from NTP to contract completion.

1.6. GOVERNMENT FIELD OFFICE

1.6.1. Resident Engineer's Office

Provide the Government Resident Engineer with an office, approximately 600 square feet in floor area, co-located on the project site with the Contractor's office and providing space heat, air conditioning, electric light and power, power and communications outlets and toilet facilities consisting of at least one lavatory and at least one water closet complete with connections to water and sewer mains. Provide a mail slot in the door or a lockable mail box mounted on the surface of the door. Provide outlets for 4 government phones and same number of LAN connections for Government computers. Coordinate with the Resident Engineer for locations. Provide a conference room with space large enough for 8 personnel to hold meetings. Provide a minimum of two outlets per government work station and at least one outlet per 10 feet of wall space for other government equipment. Provide at least twice weekly janitorial service. Remove the office facilities upon completion of the work and restore those areas. Connect and disconnect utilities in accordance with local codes and to the satisfaction of the Contracting Officer.

1.6.2. Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. Securely anchor the trailer to the ground at all four corners to guard against movement during high winds, per EM 385-1-1.

End of Section 01 50 02

**SECTION 01 57 20.00 10
ENVIRONMENTAL PROTECTION**

1.0 GENERAL REQUIREMENTS

- 1.1. SUBCONTRACTORS
- 1.2. ENVIRONMENTAL PROTECTION PLAN
- 1.3. PROTECTION FEATURES
- 1.4. ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS
- 1.5. NOTIFICATION

2.0 PRODUCTS (NOT USED)

3.0 EXECUTION

- 3.1. LAND RESOURCES
- 3.2. WATER RESOURCES
- 3.3. AIR RESOURCES
- 3.4. CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL
- 3.5. RECYCLING AND WASTE MINIMIZATION
- 3.6. HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES
- 3.7. BIOLOGICAL RESOURCES
- 3.8. INTEGRATED PEST MANAGEMENT
- 3.9. PREVIOUSLY USED EQUIPMENT
- 3.10. MILITARY MUNITIONS
- 3.11. TRAINING OF CONTRACTOR PERSONNEL
- 3.12. POST CONSTRUCTION CLEANUP

1.0 GENERAL REQUIREMENTS

Minimize environmental pollution and damage that may occur as the result of construction operations. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this contract. Comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations

1.1. SUBCONTRACTORS

Ensure compliance with this section by subcontractors.

1.2. ENVIRONMENTAL PROTECTION PLAN

1.2.1. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Define issues of concern within the Environmental Protection Plan as outlined in this section. Address each topic in the plan at a level of detail commensurate with the environmental issue and required construction task(s). Identify and discuss topics or issues which are not identified in this section, but which the Contractor considers necessary, after those items formally identified in this section. Prior to commencing construction activities or delivery of materials to the site, submit the Plan for review and Government approval. The Contractor shall meet with the Government prior to implementation of the Environmental Protection Plan, for the purpose of discussing the implementation of the initial plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. Maintain and keep the Environmental Protection Plan current onsite.

1.2.2. Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

1.2.3. Contents

The plan shall include, but shall not be limited to, the following:

1.2.3.1. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.

1.2.3.2. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable

1.2.3.3. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel

1.2.3.4. Description of the Contractor's environmental protection personnel training program

1.2.3.5. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. Include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan.

1.2.3.6. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site

1.2.3.7. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.

1.2.3.8. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

1.2.3.9. Drawing showing the location of on-installation borrow areas.

1.2.3.10. A spill control plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The spill control plan supplements the requirements of EM 385-1-1. This plan shall include as a minimum:

(a) The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Government and the local Fire Department in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers.

(b) The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup

(c) Training requirements for Contractor's personnel and methods of accomplishing the training

(d) A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

(e) The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency

(f) The methods and procedures to be used for expeditious contaminant cleanup

1.2.3.11. A solid waste management plan identifying waste minimization, collection, and disposals methods, waste streams (type and quantity), and locations for solid waste diversion/disposal including clearing debris and C&D waste that is diverted (salvaged, reused, or recycled). Detail the contractor's actions to comply with, and to participate in, Federal, state, regional, local government, and installation sponsored recycling programs to reduce the volume of solid waste at the source. Identify any subcontractors responsible for the transportation, salvage and disposal of solid waste. Submit licenses or permits for solid waste disposal sites that are not a commercial operating facility. Attach evidence of the facility's ability to accept the solid waste to this plan. A construction and demolition waste management plan, similar to the plan specified in the UFGS 01 74 19 (formerly 01572) may be used as the non-hazardous solid waste management plan. Provide a Non-Hazardous Solid Waste Diversion Report. Submit the report on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted and each quarter thereafter (e.g. the first working day of January, April, July, and October) until the end of the project. Additionally, a summary report, with all data fields, is required at the end of the project. The report shall indicate the total type and amount of waste generated, total type and amount of waste diverted, type and amount of waste sent to waste-to-energy facility and alternative daily cover, in tons along with the percent that was diverted. Maintain, track and report construction and demolition waste data in a manner such that the installation can enter the data into the Army SWAR database, which separates data by type of material. A cumulative report in LEED Letter Template format may be used but must be modified to include the date disposed of/diverted and include the above stated diversion data. NOTE: The Solid Waste Diversion Reports are separate documentation than the LEED documentation.

1.2.3.12. DELETED.

1.2.3.13. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

1.2.3.14. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of

these materials. In accordance with EM 385-1-1, include a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time in the contaminant prevention plan. Update the plan as new hazardous materials are brought on site or removed from the site. Reference this plan in the storm water pollution prevention plan, as applicable.

1.2.3.15. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented and any required permits. If surface discharge will be the method of disposal, include a copy of the permit and associated documents as an attachment prior to discharging the waste water. If disposal is to a sanitary sewer, include documentation that the waste water treatment plant Operator has approved the flow rate, volume, and type of discharge.

1.2.3.16. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. Include methods to assure the protection of known or discovered resources and shall identify lines of communication between Contractor personnel and the Government.

1.2.3.17. A pesticide treatment plan, updated, as information becomes available. Include: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. The Contractor is responsible for Federal, State, Regional and Local pest management record keeping and reporting requirements as well as any additional Installation specific requirements. Follow AR 200-1, Chapter 5, Pest Management, Section 5-4, "Program Requirements" for data required to be reported to the Installation.

1.3. PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Government shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. Both the Contractor and the Government will sign this survey, upon mutual agreement as to its accuracy and completeness. The Contractor develop a plan that depicts how it will protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

1.4. ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings, plans and specifications which may have an environmental impact will be subject to approval by the Government and may require an extended review, processing, and approval time. The Government reserves the right to disapprove alternate methods, even if they are more cost effective, if the Government determines that the proposed alternate method will have an adverse environmental impact.

1.5. NOTIFICATION

The Government will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Government of the proposed corrective action and take such action when approved by the Government. The Government may issue an order stopping all or part of the

work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Government may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

2.0 PRODUCTS (NOT USED)

3.0 EXECUTION

3.1. LAND RESOURCES

Confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. Do not attach or fasten any ropes, cables, or guys to any trees for anchorage unless specifically authorized. Provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Remove all stone, soil, or other materials displaced into uncleared areas..

3.1.1. Work Area Limits

Prior to commencing construction activities, mark the areas that need not be disturbed under this contract. Mark or fence isolated areas within the general work area which are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. Personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

3.1.2. Landscape

Clearly identify trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved by marking, fencing, or wrapping with boards, or any other approved techniques. Restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

3.1.3. Erosion and Sediment Controls

Provide erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. Coordinate with approving authorities (federal, state, etc.) for specific requirements to be included in the plan. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. Keep the area of bare soil exposed at any one time by construction operations to a minimum necessary. Construct or install temporary and permanent erosion and sediment control best management practices (BMPs). BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. Remove any temporary measures after the area has been stabilized.

3.1.4. Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Government. Make only approved temporary movement or relocation of Contractor facilities. Provide erosion and sediment controls for on-site borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant and/or work areas to protect adjacent areas.

3.2. WATER RESOURCES

Monitor construction activities to prevent pollution of surface and ground waters. Do not apply toxic or hazardous chemicals to soil or vegetation unless otherwise indicated. Monitor all water areas affected by construction activities. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by state or federally issued Clean Water Act permits.

3.2.1. Stream Crossings

Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State, and local governments or impede state-designated flows.

3.2.2. Wetlands

Do not enter, disturb, destroy, or allow discharge of contaminants into any wetlands.

3.3. AIR RESOURCES

Comply with all Federal and State air emission and performance laws and standards for equipment operation, activities, or processes.

3.3.1. Particulates

Control dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants, including weekends, holidays and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods are permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with all State and local visibility regulations.

3.3.2. Odors

Control odors from construction activities at all times. Odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

3.3.3. Sound Intrusions

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the state and Installation rules.

3.3.4. Burning

Burning is not allowed on the project site unless specified in other sections of the specifications or by written authorization. Specific times, locations, and manners of burning shall be subject to approval.

3.4. CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

3.4.1. Solid Wastes

Place solid wastes (excluding clearing debris) in containers which are emptied on a regular schedule. Conduct handling, storage, and disposal to prevent contamination. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with solid waste. Transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. The minimum acceptable off-site solid waste disposal option is a Subtitle D RCRA permitted landfill. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Comply with Federal, State, and local laws and regulations pertaining to the use of landfill areas.

3.4.2. Chemicals and Chemical Wastes

Dispense chemicals, ensuring no spillage to the ground or water. Perform and document periodic inspections of dispensing areas to identify leakage and initiate corrective action. The Government may periodically review this documentation. Collect chemical waste in corrosion resistant, compatible containers. Monitor and remove collection drums to a staging or storage area when contents are within 6 inches of the top. Classify, manage, store, and dispose of wastes in accordance with Federal, State, and local laws and regulations.

3.4.3. Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable state and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. At a minimum, manage and store hazardous waste in compliance with 40 CFR 262. Take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. Segregate hazardous waste from other materials and wastes; protect it from the weather by placing it in a safe covered location and take precautionary measures, such as berming or other appropriate measures, against accidental spillage. Store, describe, package, label, mark, and placard hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, state, and local laws and regulations. Transport Contractor generated hazardous waste off Government property in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. Dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Immediately report spills of hazardous or toxic materials to the Government and the Facility Environmental Office. Contractor will be responsible for cleanup and cleanup costs due to spills. Contractor is responsible for the disposition of Contractor generated hazardous waste and excess hazardous materials.

3.4.4. Fuel and Lubricants

Conduct storage, fueling and lubrication of equipment and motor vehicles in a manner that affords the maximum protection against spill and evaporation. Manage and store fuel, lubricants and oil in accordance with all Federal, State, Regional, and local laws and regulations.

3.5. RECYCLING AND WASTE MINIMIZATION

Participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project. Line and berm fueling areas and establish storm water control structures at discharge points for site run-off. Keep a liquid containment clean-up kit available at the fueling area.

3.6. HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area are shown on the drawings. Protect and preserve these resources during the life of the Contract. Temporarily suspend all activities that may damage or alter such resources, if any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found during excavation or other construction activities. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, notify the Government so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

3.7. BIOLOGICAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitat. Protect threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

3.8. INTEGRATED PEST MANAGEMENT

Coordinate, through the Government, with the Installation Pest Management Coordinator (IPMC) at the earliest possible time prior to pesticide application, in order to minimize impacts to existing fauna and flora. Discuss

integrated pest management strategies with the IPMC and receive concurrence from the IPMC, through the COR, prior to the application of any pesticide associated with these specifications. Give IMPC personnel the opportunity to be present at all meetings concerning treatment measures for pest or disease control and during application of the pesticide. The use and management of pesticides are regulated under 40 CFR 152 - 186.

3.8.1. Pesticide Delivery and Storage

Deliver pesticides, approved for use on the Installation, to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

3.8.2. Qualifications

Use the services of a subcontractor for pesticide application whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed.

3.8.3. Pesticide Handling Requirements

Formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions.

3.8.4. Application

A state certified pesticide applicator shall apply pesticides in accordance with EPA label restrictions and recommendations.

3.9. PREVIOUSLY USED EQUIPMENT

Clean all previously used construction equipment prior to bringing it onto the project site. Ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the USDA jurisdictional office for additional cleaning requirements.

3.10. MILITARY MUNITIONS

Immediately stop work in that area and immediately inform the Government, in the event military munitions, as defined in 40 CFR 260, are discovered or uncovered.

3.11. TRAINING OF CONTRACTOR PERSONNEL

Train personnel in all phases of environmental protection and pollution control. Conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. The training and meeting agenda shall include methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

3.12. POST CONSTRUCTION CLEANUP

Clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade, fill and seed the entire disturbed area, unless otherwise indicated.

**SECTION 01 62 35
RECYCLED/RECOVERED MATERIAL**

1.0 GENERAL

1.1. REFERENCES

1.2. OBJECTIVES

1.3. EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

1.4. EPA PROPOSED ITEMS INCORPORATED IN THE WORK

1.5. EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

1.0 GENERAL

1.1. REFERENCES

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

- U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
- 40 CFR 247 Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2. OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. The Contractor shall make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

1.3. EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials, when incorporated into the work under this contract, shall contain at least the minimum percentage of recycled or recovered materials indicated by EPA unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

1.4. EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

1.5. EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be use by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

End of Section 01 62 35

**SECTION 01 78 02.00 10
CLOSEOUT SUBMITTALS**

1.0 OVERVIEW

1.1. SUBMITTALS

1.2. PROJECT RECORD DOCUMENTS

1.3. EQUIPMENT DATA

1.4. CONSTRUCTION WARRANTY MANAGEMENT

1.5. MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

1.6. OPERATION AND MAINTENANCE MANUALS

1.7. FIELD TRAINING

1.8. PRICING OF CONTRACTOR-FURNISHED AND INSTALLED PROPERTY AND GOVERNMENT-FURNISHED CONTRACTOR-INSTALLED PROPERTY

1.9. LEED REVIEW MEETINGS

1.10. RED ZONE MEETING

1.11. FINAL CLEANING

1.12. INTERIM FORM DD1354 "TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY"

EXHIBIT 1 SAMPLE RED ZONE MEETING CHECKLIST

1.0 OVERVIEW

1.1. SUBMITTALS

Government approval is required for any submittals with a "G" designation; submittals not having a "G" designation are for Designer of Record approval or for information only. Submit the following in accordance with Section 01 33 00 submittals:

SD-02 Shop Drawings

- As-Built Drawings - G
 - Drawings showing final as-built conditions of the project. Provide electronic drawing files as specified in Section 01 33 16, 3 sets of blue-line prints and one set of the approved working as-built drawings.

SD-03 Product Data

- As-Built Record of Equipment and Materials
 - Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.
- Construction Warranty Management Plan
 - Three sets of the construction warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.
- Warranty Tags
 - Two record copies of the warranty tags showing the layout and design.
- Final Cleaning
 - Two copies of the listing of completed final clean-up items.

1.2. PROJECT RECORD DOCUMENTS

1.2.1. As-Built Drawings – G

An as-built drawing is a construction drawing revised to reflect the final as-built conditions of the project as a result of modifications and corrections to the project design required during construction. The final as-built drawings shall not have the appearance of marked up drawings, but that of professionally prepared drawings as if they were the "as designed" drawings.

1.2.2. Maintenance of As-Built Drawings

1.2.2.1. The Configuration Management Plan shall describe how the Contractor will maintain up-to-date drawings, how it will control and designate revisions to the drawings and specifications (In accordance with Special Contract Requirement: ***Deviating from the Accepted Design*** and Section 01 33 16: ***Design after Award***, the Designer of Record's approval is necessary for any revisions to the accepted design).

1.2.2.2. Make timely updates, carefully maintaining a record set of working as-built drawings at the job site, marked in red, of all changes and corrections from the construction drawings. Enter changes and corrections on drawings promptly to reflect "Current Construction". Perform this update no less frequently than weekly for the blue line drawings and update no less frequently than quarterly for the CADD/CAD and BIM files, which were prepared previously in accordance with Section 01 33 16. Include a confirmation that the as-builts are up to date with the submission of the monthly project schedule.

1.2.2.3. If the DB Contractor fails to maintain the as-built drawings as required herein, the Government will retain from the monthly progress payment, an amount representing the estimated monthly cost of maintaining the as-built drawings. Final payment with respect to separately priced facilities or the contract as a whole will be withheld until the Contractor submits acceptable as-built drawings and the Government approves them.

1.2.2.4. The marked-up set of drawings shall reflect any changes, alterations, adjustments or modifications. Changes must be reflected on all sheets affected by the change. Changes shall include marking the drawings to reflect structural details, foundation layouts, equipment sizes, and other extensions of design.

1.2.2.5. Typically, room numbers shown on the drawings are selected for design convenience and do not represent the actual numbers intended for use by the end user. Final as-built drawings shall reflect actual room numbers adopted by the end user.

1.2.2.6. If there is no separate contract line item (CLIN) for as-built drawings, the Government will withhold the amount of \$35,000, or 1% of the present construction value, whichever is the greater, until the final as-built drawing submittal has been approved by the Government.

1.2.3. Underground Utilities

The drawings shall indicate, in addition to all changes and corrections, the actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Locate Valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Record average elevation of the top of each run or underground structure..

1.2.4. Partial Occupancy

For projects where portions of construction are to be occupied or activated before overall project completion, including portions of utility systems, supply as-built drawings for those portions of the facility being occupied or activated at the time the facility is occupied or activated. Show this same as-built information previously furnished on the final set of as-built drawings.

1.2.5. As-Built Conditions That are Different From the construction Drawings

Accurately reflect all as-built conditions that are different, such as dimensions, road alignments and grades, and drainage and elevations, from the construction drawings on each drawing. If the as-built condition is accurately reflected on a shop drawing, then furnish that shop drawing in CADD format. Reference the final as-built construction drawing the shop drawing file that includes the as-built information. In turn, the shop drawing shall reference the applicable construction as-built drawing. Delete any options shown on drawings and not selected clearly reflect options selected on final as-built drawings.

1.2.6. Additional As-Built Information that Exceeds the Detail Shown on the construction Drawings:

These as-built conditions include those that reflect structural details, foundation layouts, equipment, sizes, mechanical and electrical room layouts and other extensions of design, that were not shown in the project design documents because the exact details were not known until after the time of approved shop drawings. It is recognized that these shop drawing submittals (revised showing as-built conditions) will serve as the as-built record without actual incorporation into the construction drawings, piping, and equipment drawings. Include locations of all explorations, logs of all explorations, and results of all laboratory testing, including those provided by the Government. Furnish all such shop drawings in CADD /CADformat. Include fire protection details, such as wiring, performed for the design of the project.

1.2.7. Final As-Built Drawings

Submit final as-built CADD/CAD and BIM Model(s) and Facility Data files at the time of Beneficial Occupancy of the project or at a designated phase of the project. In the event the Contractor accomplishes additional work after this submittal, which changes the as-built conditions, submit a new DVD with all drawing sheets and three blue-line copies of affected sheets which depict additional changes.

1.2.8. Title Blocks

In accordance with the configuration management plan, clearly mark title blocks to indicate final as-built drawings.

1.2.9. Other As-Built Documents

Provide scans of all other documents such as design analysis, catalog cuts, certification documents that are not available in native electronic format in an organized manner in Adobe.pdf format.

1.2.9.1. LEED Documentation

Update LEED documentation on at least a monthly basis and have it available for review by the Government on the jobsite at all times during construction. Submit the final LEED Project Checklist(s), final LEED submittals checklist and complete project documentation, verifying the final LEED score and establishing the final rating. Provide full support to the validation review process, including credit audits. See also the LEED documentation requirements in Section 01 33 16, DESIGN AFTER AWARD.

1.2.9.2. GIS Documentation

Provide final geo-referenced GIS database of the new building footprint along with any changes made to exterior of the building. The intent of capturing the final building footprint and exterior modifications in a GIS database is to provide the installation with a data set of the comprehensive changes made to the landscape as a result of the construction project. The Government will incorporate this data set into the installations existing GIS MasterPlan or Enterprise GIS system. The GIS database deliverable shall follow a standard template provided to the Contractor by the Government, adhere to detailed specifications outlined in ECB No 2006-15, and be documented using the Federal Geographic Data Committee (FGDC) metadata standard.

1.3. EQUIPMENT DATA

1.3.1. Real Property Equipment

Provide an Equipment-in-Place list of all installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. Include the cost of each piece of installed property F.O.B. construction site. For each of the items which is specified herein to be guaranteed for a specified period from the date of acceptance thereof, provide the following information: The name, serial and model number address of equipment supplier, or manufacturer originating the guaranteed item. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. Furnish the list as one (1) reproducible and three (3) copies thirty (30) calendar days before completion of any segment of the contract work which has an incremental completion date.

1.3.2. Maintenance and Parts Data

Furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication showing detailed parts data on all other equipment subject to repair and maintenance procedures not otherwise required in Operations and Maintenance Manuals specified elsewhere in this contract. Distribution of directives shall follow the same requirements as listed in paragraph above.

1.3.3. Construction Specifications

Furnish permanent electronic files of final as-built construction specifications, including modifications thereto, with the as-built drawings.

1.4. CONSTRUCTION WARRANTY MANAGEMENT

1.4.1. Prior to the end of the one year warranty, the Government may conduct an infrared roof survey on any project involving a membrane roofing system. This survey will be conducted in accordance with ASTM C1153-90, "Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging". The Contractor shall replace all damaged materials and locate and repair sources of moisture penetration.

1.4.2. Management

1.4.2.1. Warranty Management Plan

Develop a warranty management plan containing information relevant to the clause **Warranty of Construction** in FAR 52.246-21. Submit the warranty management plan for Government approval at least 30 days before the planned pre-warranty conference. In the event of phased turn-over of the contract, update the Warranty Management Plan as necessary to include latest information required. Include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Submit warranty information made available during the construction phase prior to each monthly pay estimate. Assemble information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. The Contractor, Government, including the Customer Representative shall jointly conduct warranty inspections, 4 months and 9 months, after acceptance. The warranty management plan shall include, but shall not be limited to, the following information:

- (1) Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the contractors, subcontractors, manufacturers or suppliers involved.
- (2) Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.
- (3) A list for each warranted equipment, item, feature of construction or system indicating:
 - (i) Name of item.
 - (ii) Model and serial numbers.
 - (iii) Location where installed.
 - (iv) Name and phone numbers of manufacturers or suppliers.
 - (v) Names, addresses and telephone numbers of sources of spare parts.
 - (vi) Warranties and terms of warranty. Include one-year overall warranty of construction. Indicate those items, which have extended warranties with separate warranty expiration dates.
 - (vii) Cross-reference to warranty certificates as applicable.
 - (viii) Starting point and duration of warranty period.
 - (ix) Summary of maintenance procedures required to continue the warranty in force.
 - (x) Cross-reference to specific pertinent Operation and Maintenance manuals.
 - (xi) Organization, names and phone numbers of persons to call for warranty service.
 - (xii) Typical response time and repair time expected for various warranted equipment.
- (4) The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- (5) Procedure and status of tagging of all equipment covered by extended warranties.
- (6) Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.4.3. Performance Bond

1.4.3.1. The Contractor's Performance Bond will remain effective throughout the construction warranty period.

1.4.3.2. In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required under this clause, and in a manner pursuant to the requirements thereof, the Government shall have

a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Government shall have the work performed by others, and after completion of the work, may make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

1.4.3.3. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Government will have the right to recoup expenses from the bonding company.

1.4.3.4. Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 1.4.5. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Government to proceed against the Contractor as outlined in the paragraph 1.4.5.5 and/or above.

1.4.4. Pre-Warranty Conference

Prior to contract completion, or completion of any phase or portion of contract to be turned over, and at a time designated by the Contracting Officer, the Contractor shall meet with the Government to develop a mutual understanding with respect to the requirements of this clause. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Government for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with other portions of this provision.

1.4.5. Contractor's Response to Warranty Service Requirements.

Following Government oral or written notification, which may include authorized installation maintenance personnel, the Contractor shall respond to warranty service requirements in accordance with the "Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and backcharge the construction warranty payment item established.

1.4.5.1. First Priority Code 1 Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

1.4.5.2. Second Priority Code 2 Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

1.4.5.3. Third Priority Code 3 All other work to be initiated within 3 work days and work continuously to completion or relief.

1.4.5.4. The "Warranty Service Priority List" is as follows:

- Code 1 - Air Conditioning System
 - (a) Buildings with computer equipment.
 - (b) Barracks, mess halls (entire building down).
- Code 2 - Air Conditioning Systems
 - (a) Recreational support.
 - (b) Air conditioning leak in part of building, if causing damage.
 - (c) Air conditioning system not cooling properly

- (d) Admin buildings with Automated Data Processing (ADP) equipment not on priority list.
 - Code 1 - Doors
- (a) Overhead doors not operational.
 - Code 1 - Electrical
- (a) Power failure (entire area or any building operational after 1600 hours).
- (b) Traffic control devices.
- (c) Security lights.
- (d) Smoke detectors and fire alarm systems
- (e) Power or lighting failure to an area, facility, portion of a facility, which may adversely impact health, safety, security, or the installation's mission requirement, or which may result in damage to property.
 - Code 2 - Electrical
- (a) Power failure (no power) for unoccupied buildings or portions thereof or branch circuits within occupied buildings, not listed as Code 1.
- (a) Receptacle and lights, not listed as code 1.
 - Code 3 - Electrical
- (a) Street, parking area lights
 - Code 1 - Gas
- (a) Leaks and breaks.
- (b) No gas to cantonment area.
 - Code 1 - Heat
- (a) Area power failure affecting heat.
- (b) Heater in unit not working.
 - Code 2 Heat
- (a) All heating system failures not listed as Code 1.
 - Code 3 - Interior
- (a) Floor damage
- (b) Paint chipping or peeling
 - Code 1 - Intrusion Detection Systems - N/A.
 - Code 2 - Intrusion Detection Systems other than those listed under Code 1
 - Code 1 - Kitchen Equipment
- (a) Dishwasher.
- (b) All other equipment hampering preparation of a meal.
 - Code 2 - Kitchen Equipment
- (a) All other equipment not listed under Code 1.
 - Code 2 - Plumbing
- (a) Flush valves not operating properly
- (b) Fixture drain, supply line commode, or water pipe leaking.
- (c) Commode leaking at base.
 - Code 3 - Plumbing
- (a) Leaking faucets

- Code 1 - Refrigeration
 - (a) Mess Hall.
 - (b) Medical storage.
- Code 2 - Refrigeration
 - (a) Mess hall - other than walk-in refrigerators and freezers.
- Code 1 - Roof Leaks
 - (a) Temporary repairs will be made where major damage to property is occurring.
- Code 2 - Roof Leaks
 - (a) Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.
- Code 1 - Sprinkler System
 - (a) All sprinkler systems, valves, manholes, deluge systems, and air systems to sprinklers.
- Code 1 - Tank Wash Racks (Bird Baths)
 - (a) All systems which prevent tank wash.
- Code 1 - Water (Exterior)
 - (a) Normal operation of water pump station.
- Code 2 - Water (Exterior)
 - (a) No water to facility.
- Code 1 - Water, Hot (and Steam)
 - (a) Barracks (entire building).
- Code 2 - Water, Hot
 - (a) No hot water in portion of building listed under Code 1

1.4.5.5. Should parts be required to complete the work and the parts are not immediately available, the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Government, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractor's proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Government will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Government will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

1.4.6. Equipment Warranty Identification Tags

1.4.6.1. Provide warranty identification tags at the time of installation and prior to substantial completion shall provide warranty identification tags on all Contractor and Government furnished equipment which the Contractor has installed.

- (a) The tags shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Tag each component of contractor furnished equipment that has differing warranties on its components.
- (b) Submit sample tags, representing how the other tags will look, for Government review and approval.
- (c) Tags for Warranted Equipment: The tag for this equipment shall be similar to the following: Exact format and size will be as approved.

EQUIPMENT WARRANTY - CONTRACTOR FURNISHED EQUIPMENT

MFG NAME MODEL NO.

SERIAL NO.

CONTRACT NO.

CONTRACTOR NAME

CONTRACTOR WARRANTY EXPIRES

MFG WARRANTY(IES) EXPIRE

EQUIPMENT WARRANTY - GOVERNMENT FURNISHED EQUIPMENT

MFG NAME MODEL NO.

SERIAL NO.

CONTRACT NO.

DATE EQUIP PLACED IN SERVICE

MFG WARRANTY(IES) EXPIRE

(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag

1.4.6.2. Execution: Complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

1.5. MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Submit; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems prior to final inspection and transfer of the completed facility for approval, as specified in applicable technical specification sections.

1.6. OPERATION AND MAINTENANCE MANUALS

1.6.1. General Requirements

1.6.1.1. Inasmuch as the operations and maintenance manuals are required to operate and maintain the facility, the operations and maintenance (O&M) manuals will be considered a requirement prior to substantial completion of any facility to be turned over to the Government. Beneficial occupancy of all or portions of a facility prior to substantial completion will not relieve the Contractor of liquidated damages, if substantial completion exceeds the required completion date.

1.6.1.2. Provide one permanent electronic copy on CD-ROM and 2 hard copies of the Equipment Operating, Maintenance, and Repair Manuals. Provide separate manuals for each utility system as defined hereinafter. Submit Operations and Maintenance manuals for approval before field training or 90 days before substantial completion (whichever occurs earlier). If there is no separate CLIN for O&M Manuals, the Government will withhold an amount representing \$20,000, as non-progressed work, until submittal and approval of all O&M manuals are complete.

1.6.2. Definitions

1.6.2.1. Equipment

A single piece of equipment operating alone or in conjunction with other equipment to accomplish a system function.

1.6.2.2. System

A combination of one or more pieces of equipment which function together to accomplish an intended purpose (i.e. HVAC system is composed of many individual pieces of equipment such as fans, motors, compressors, valves, sensors, relays, etc.)

1.6.3. Hard Cover Binders

The manuals shall be hard cover with posts, or 3-ring binders, so sheets may be easily substituted. Print the following identification on the cover: the words "EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUALS," the project name, building number, and an indication of utility or systems covered, the name of the Contractor, and the Contract number. Manuals shall be approximately 8-1/2 by 11-inches with large sheets folded in and capable of being easily pulled out for reference. All manuals for the project must be similar in appearance, and be of professional quality.

1.6.4. Warning Page

Provide a warning page to warn of potential dangers (if they exist, such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, high pressures, etc.). Place the warning page inside the front cover and in front of the title page. Include any necessary Material Safety Data Sheets (MSDS) here.

1.6.5. Title Page

The title page shall include the same information shown on the cover and show the name of the preparing firm and the date of publication.

1.6.6. Table of Contents

Each volume of the set of manuals for this project shall include a table of contents, for the entire set, broken down by volume.

1.6.7. GENERAL

Organize manuals according to the following format, and include information for each item of equipment. Submit a draft outline and table of contents for approval at 50% contract completion.

TABLE OF CONTENTS

PART I: Introduction

- Equipment Description
- Functional Description
- Installation Description

PART II: Operating Principles

PART III: Safety

PART IV: Preventive Maintenance

- Preventive Maintenance Checklist, Lubrication
- Charts and Diagrams

PART V: Spare Parts Lists

- Troubleshooting Guide
- Adjustments
- Common Repairs and Parts Replacement

PART VI: Illustrations

1.6.7.1. Part I-Introduction

Part I shall provide an introduction, equipment or system description, functional description and theory of operation, and installation instructions for each piece of equipment. Include complete instructions for uncrating, assembly, connection to the power source and pre-operating lubrication in the installation instructions as applicable. Illustrations, including wiring and cabling diagrams, are required as appropriate in this section. Include halftone pictures of the equipment in the introduction and equipment description, as well as system layout drawings with each item of equipment located and marked. Do not use copies of previously submitted shop drawings in these manuals.

1.6.7.2. Part II-Operating Principles

Part II shall provide complete instructions for operating the system, and each piece of equipment. Illustrations, halftone pictures, tables, charts, procedures, and diagrams are required when applicable. This will include step-by-step procedures for start-up and shutdown of both the system and each component piece of equipments, as well as adjustments required to obtain optimum equipment performance, and corrective actions for malfunctions. Show performance sheets and graphs showing capacity data, efficiencies, electrical characteristics, pressure drops, and flow rates here, also. Marked-up catalogs or catalog pages do not satisfy this requirement. Present performance information as concisely as possible with only data pertaining to equipment actually installed. Include actual test data collected for Contractor performance here.

1.6.7.3. Part III-Safety

Part III shall contain the general and specific safety requirements peculiar to each item of equipment. Repeat safety information as notes cautions and warnings in other sections where appropriate to operations described.

1.6.7.4. Part IV-Preventive Maintenance

Part IV shall contain a troubleshooting guide, including detailed instructions for all common adjustments and alignment procedures, including a detailed maintenance schedule. Also include a diagnostic chart showing symptoms and solutions to problems. Include test hookups to determine the cause, special tools and test equipment, and methods for returning the equipment to operating conditions. Information may be in chart form or in tabular format with appropriate headings. Include instructions for the removal, disassembly, repair, reassembly, and replacement of parts and assemblies where applicable and the task is not obvious.

1.6.7.5. Part V-Spare Parts List

Part V shall contain a tabulation of description data and parts location illustrations for all mechanical and electrical parts. The heading of the parts list shall clearly identify the supplier, purchase order number, and equipment. Include the unit price for each part. List parts by major assemblies, and arrange the listing in columnar form. Include names and addresses of the nearest manufacturer's representatives, as well as any special warranty information. Provide a list of spare parts that are recommended to be kept in stock by the Government installation.

1.6.7.6. Part VI-Illustrations

Part VI shall contain assembly drawings for the complete equipment or system and for all major components. Include complete wiring diagrams and schematics. Other illustrations, such as exploded views, block diagrams, and cutaway drawings, are required as appropriate.

1.6.8. Framed Instructions

Post framed instructions are required for substantial completion. Post framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, including equipment, ductwork, piping valves, dampers, and control sequence at a location near the equipment described. Prepare condensed operating instructions explaining preventive maintenance procedures methods of checking the system for normal safe operation, valve schedule and procedures for safely starting and stopping the system in type form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. Submit proposed diagrams, instructions, and other sheets prior to posting. Post the framed instructions before field training.

1.6.9. (Reserved. See 1.7 for Field Training)

1.6.10. System/Equipment Requirements

1.6.10.1. Facility Heating System

Provide information on the following equipment: boilers, water treatment, chemical feed pumps and tanks, converters, heat exchangers, pumps, unit heaters, fin-tube radiation, air handling units (both heating only and heating and cooling), and valves (associated with heating systems).

1.6.10.2. Air-Conditioning Systems

Provide information in chillers, packaged air-conditioning equipment, towers, water treatment, chemical feed pumps and tanks, air-cooled condensers, pumps, compressors, air handling units, and valves (associated with air-conditioning systems).

1.6.10.3. Temperature Control and HVAC Distribution Systems

Provide all information described for the following equipment: valves, fans, air handling units, pumps, boilers, converters and heat exchangers, chillers, water cooled condensers, cooling towers, and fin-tube radiation, control air compressors, control components (sensors, controllers, adapters and actuators), and flow measuring equipment.

1.6.10.4. Central Heating Plants

Provide the information described for the following equipment: boilers, converters, heat exchangers, pumps, fans, steam traps, pollution control equipment, chemical feed equipment, control systems, fuel handling equipment, de-aerators, tanks (flash, expansion, return waters, etc.), water softeners, and valves.

1.6.10.5. Heating Distribution Systems

Provide the information described for the following equipment: valves, fans, pumps, converters and heat exchangers, steam traps, tanks (expansion, flash, etc.), and piping systems.

1.6.10.6. Exterior Electrical Systems

Provide information on the following equipment: power transformers, relays, reclosers, breakers, and capacitor bank controls.

1.6.10.7. Interior Electrical Systems

Provide information on the following equipment: relays, motor control centers, switchgear, solid state circuit breakers, motor controller, EPS lighting systems, wiring diagrams and troubleshooting flow chart on control systems, and special grounding systems.

1.6.10.8. Energy Monitoring and Control Systems

The maintenance manual shall include descriptions of maintenance for all equipment, including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

1.6.10.9. Domestic Water Systems

Provide the identified information on the following equipment: tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, switching gear, and automatic controls.

1.6.10.10. Wastewater Treatment Systems

Provide the identified information on the following equipment: tanks, unit process equipment, pumps, motors, control and monitoring instrumentations, laboratory test equipment chemical feeders, valves, scrapers, skimmers, comminutors, blowers, switching gear, and automatic controls.

1.6.10.11. Fire Protection Systems

Provide information on the following equipment: alarm valves, manual valves, regulators, foam and gas storage tanks, piping materials, sprinkler heads, nozzles, pumps, and pump drivers.

1.6.10.12. Fire Alarm and Detection Systems

- (1) The maintenance manual shall include description of maintenance for all equipment, including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
- (2) Provide all software; database with complete identification of programmable portions of system equipment and devices, and all other system programming data on all modes of the system; connecting cables; and proprietary equipment necessary for the operation, maintenance, testing, repair and programming, etc. of the system and that may be required for implementation of future changes to the fire system (additional and/or relocated initiating devices, notification devices, etc.
- (3) Provide all system and equipment technical data and computer software with the requisite rights to Government use, in accordance with the applicable contract clauses.
- (4) Training shall include software and programming required for the effective operation, maintenance, testing, diagnostics and expansion of the system.

1.6.10.13. Plumbing Systems

Provide information on the following equipment: water heaters, valves, pressure regulators backflow preventors, piping materials, and plumbing fixtures.

1.6.10.14. Liquid Fuels Systems

Provide information on the following equipment: tanks, automatic valves manual valves, filter separators, pumps, mechanical loading arms, nozzles, meters, electronic controls, electrical switch gear, and fluidic controls.

1.6.10.15. Cathodic Protection Systems

Provide information on the following material and equipment: rectifiers, meters, anodes, anode backfill, anode lead wire, insulation material and wire size, automatic controls (if any), rheostats, switches, fuses and circuit breakers, type and size of rectifying elements, type of oil in oil-immersed rectifiers, and rating of shunts.

1.6.10.16. Generator Installations

Provide information on the following equipment: generator sets, automatic transfer panels, governors, exciters, regulators starting systems, switchgear, and protective devices.

1.6.10.17. Miscellaneous Systems

Provide information on the following: communication and ADP systems, security and intrusion alarm, elevators, material handling, active solar, photovoltaic, nurse call, paging, intercom, closed circuit TV, irrigation, sound and material delivery systems, kitchen, refrigeration, disposal, ice making equipment, and other similar type special systems not otherwise specified.

1.6.10.18. Laboratory, Environmental and Pollution Control Systems

Provide information on the following equipment: wet scrubbers, quench chambers, scrub tanks, liquid oil separators, and fume hoods.

1.7. FIELD TRAINING

Field Training is a requirement for substantial completion. Conduct a training course for the operating staff for each particular system. Conduct the training is to be conducted during hours of normal working time after the system is functionally complete. The field instructions shall cover all of the items contained in the Equipment Operating, Maintenance and Repair Manuals. The training will include both classroom and "hands-on" training. Submit a lesson plan outlining the information to be discussed during training periods. Submit this lesson plan for approval 90 days before contract completion before the field training occurs. Record training on DVD and furnish to the Government within ten (10) days following training. Document all training and furnish a list of all attendees.

1.8. PRICING OF CONTRACTOR-FURNISHED AND INSTALLED PROPERTY AND GOVERNMENT-FURNISHED CONTRACTOR-INSTALLED PROPERTY

Promptly furnish and require any sub-contractor or supplier to furnish, in like manner, unit prices and descriptive data required by the Government for Property Record purposes of fixtures and equipment furnished and/or installed by the Contractor or sub-contractor, except prices do not need to be provided for Government-Furnished Property.

1.9. LEED REVIEW MEETINGS

1.9.1. Pre-Closeout Meeting. Approximately 30 days before submittal of LEED closeout documentation, the Contractor and the Government's project delivery team (including Installation representative) will meet to review the documentation, determine which, if any, credits will be audited and identify any corrections/missing items prior to the closeout LEED documentation submittal.

1.9.2. Approximately 14 days after submittal of LEED closeout documentation, the Contractor and the Government's project delivery team (including Installation representative) will meet to review the LEED closeout

documentation. The review conference will include discussion of and resolution of all review comments to ensure consensus on achievement of credits and satisfactory documentation. At the review conference a final score will be determined and endorsed in writing by all parties.

1.10. RED ZONE MEETING

At approximately 80% of contract completion or 60 days before the anticipated Beneficial Occupancy Date (BOD), whichever occurs first, the Contractor and the Government's project delivery team will conduct what is known as the Red Zone Meeting to discuss the close-out process, to schedule the events and review responsibilities for actions necessary to produce a timely physical, as well as fiscal, project close-out. The Red Zone meeting derives its name from the football term used to describe the team effort to move the ball the last 20 yards into the end zone. The close-out of a construction project sometimes can be equally as hard and most definitely requires the whole team's efforts. The ACO will chair the meeting. If not already provided, shortly before the meeting, the Contractor shall provide an electronic copy or access to the CADD as-built drawings, completed commensurate with the amount of work completed at the time of the Red Zone Meeting, as an indicator of the Contractors' understanding of and ability to meet the USACE CADD Standards and to ensure that the Contractor is making progress with CADD As-Built requirements. EXHIBIT 1 is a generic meeting checklist.

1.11. FINAL CLEANING

Clean the premises in accordance with FAR clause 52.236-12 and additional requirements stated here. Remove stains, foreign substances, and temporary labels from surfaces. Vacuum carpet and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean or replace filters of operating equipment if cleaning isn't possible or practicable. Remove debris from roofs, drainage systems, gutters, and downspouts. Sweep paved areas and rake clean landscaped areas. Remove waste, surplus materials, and rubbish from the site. Remove all temporary structures, barricades, project signs, fences and construction facilities. Submit a list of completed clean-up items on the day of final inspection.

1.12. INTERIM FORM DD1354 "TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft provided with the final design package(s) (see Section 01 33 16, paragraph 3.7.5) and submit an accounting of all installed property on Interim Form DD1354 "Transfer and Acceptance of Military Real Property." Include any additional assets/improvements/alterations and cost updates from the Draft DD Form 1354. Contact the COR for any project specific information necessary to complete the DD Form 1354. This form will be a topic for the Red Zone Meeting discussed above. For information purposes, a blank DD Form 1354 (fill-able) in ADOBE (PDF) may be obtained at the following web site: <http://www.dtic.mil/whs/directives/infomgt/forms/eforms/dd1354.pdf> Submit the completed Checklist for Form DD1354 of Government-Furnished and Contractor-Furnished/Contractor Installed items. Attach this list to the updated DD Form 1354. Instructions for completing the form and a blank checklist (fill-able) in ADOBE (PDF) may be obtained at the following web site: http://www.wbdg.org/ccb/DOD/UFC/ufc_1_300_08.pdf

EXHIBIT 1

SAMPLE

Red Zone Meeting Checklist

Date: _____

| | |
|-------------------------------|--|
| Contract No. | |
| Description / Location | |
| Contractor | |
| Contracting Officer | |

| Action | Completion Milestone | √ |
|--|-----------------------------|----------|
| Inspections | | |
| Fire | | |
| Safety | | |
| Pre-final | | |
| Mechanical Test & Balance | | |
| Commissioning | | |
| Landscaping Complete | | |
| Erosion Control | | |
| Beneficial Occupancy Date (BOD) | | |
| Furniture Installation | | |
| Comm Installation | | |
| As-Built Drawings | | |
| Provide all O&M manuals, tools, shop drawings, spare parts, etc. to customer | | |
| Training of O&M Personnel | | |
| Provide Warranty documents to Customer | | |
| Contract completion | | |

| | | |
|---|--|--|
| Ribbon cutting | | |
| Payroll Clearances | | |
| DD Form 2626 - Construction Contractor Performance Evaluation | | |
| DD Form 2631 – A-E Performance Rated after Construction | | |
| Status of Pending Mods and REA's/Claims | | |
| Final Payment Completed | | |
| Release of Claims | | |
| Return of Unobligated Funds | | |
| Move Project from CIP to General Ledger | | |
| Financial completion | | |

End of Section 01 78 02.00 10

Appendix A
Geotechnical Information

Preliminary Geotechnical Engineering Report

**Central Receiving Warehouse
Fort Leonard Wood, Missouri**

April 29, 2010

Project No. B5105006

Prepared for:

Tompkins Architects
Lee's Summit, Missouri

Prepared by:

Terracon Consultants, Inc.
Springfield, Missouri

Offices Nationwide
Employee-Owned

Established in 1965
terracon.com

Terracon



April 29, 2010

Tompkins Architects
612 Northwest Kay Drive
Lee's Summit, Missouri 64063

Attn: Mr. James Tompkins, AIA
P: [816] 525-9833

Re: Preliminary Geotechnical Engineering Report
Central Receiving Warehouse
Fort Leonard Wood, Missouri
Terracon Project Number: B5105006

Dear Mr. Tompkins:

Terracon Consultants, Inc. (Terracon) has completed the preliminary geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal number PB510103g dated January 19, 2010. This report presents the findings of the subsurface exploration and provides preliminary geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Brandie Courtois
for Eric M. Hollabaugh, E.I.
Staff Professional

Ty G. Alexander, P.E.
Senior Associate
PE-2009002087



Craig K. Denny, Ph.D., P.E.
Senior Consultant

Enclosures
cc: 3 – Client
1 – Client (PDF)
1 – File



Terracon Consultants, Inc. 764 North Miller Avenue, Suite 100 Springfield, Missouri 65802
P [417] 864-5100 F [417] 864-0871 terracon.com

Geotechnical

Environmental

Construction Materials

Facilities

Thursday, July 15, 2010

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APPENDIX A – FIELD EXPLORATION

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| Exhibit A-2 | Geologic Map |
| Exhibit A-3 | Boring Location Diagram |
| Exhibits A-4 to A-9 | Boring Logs |
| Exhibit A-10 | Field Exploration Description |

APPENDIX B – LABORATORY TESTING

| | |
|-------------|--------------------------------|
| Exhibit B-1 | Laboratory Testing Description |
| Exhibit B-2 | CBR Test Results |
| Exhibit B-3 | Standard Proctor Test Results |

APPENDIX C – SUPPORTING DOCUMENTS

| | |
|-------------|--|
| Exhibit C-1 | General Notes |
| Exhibit C-2 | Unified Soil Classification System |
| Exhibit C-3 | General Notes – Description of Rock Properties |

Preliminary Geotechnical Engineering Report

Central Receiving Warehouse ■ Fort Leonard Wood, Missouri

April 29, 2010 ■ Terracon Project No. B5105006

**EXECUTIVE SUMMARY**

A preliminary geotechnical exploration has been performed for the proposed Central Receiving Warehouse to be located immediately north of Ordinance Drive approximately 1,000 feet northeast of its west intersection with 1st Street in Fort Leonard Wood, Missouri, as shown on the Vicinity Map (Exhibit A-1) in Appendix A. Six (6) borings, designated B-1 through B-6, were performed to depths of approximately 10 to 30 feet below the existing ground surface in the proposed building and pavement areas.

Based on the information obtained from our preliminary subsurface exploration, the site can be developed for the proposed project. The following preliminary geotechnical considerations were identified:

- Existing uncontrolled fill was encountered to depths of approximately 2 to 4½ feet in some of the borings within the proposed building and pavement locations. In our opinion, the existing fill is not suitable to support new foundations, floor slabs, or pavements. We recommend existing uncontrolled fill be removed where present below building and pavement areas.
- The proposed structure may be supported on shallow footings bearing on suitable native clay or newly placed compacted structural fill.
- The native on-site soils and existing fill appear suitable for use as compacted structural fill; however, if they do not meet the low plasticity fill criteria, they should not be utilized within the low volume change zone beneath at-grade building areas.
- The near-surface native soils and existing uncontrolled fill are active and prone to volume change with variations in moisture content. For this reason, we anticipate a low volume change zone will be beneficial beneath grade-supported floor slabs. Construction of this low volume change zone may require overexcavation in some areas.
- This summary should be used in conjunction with the entire report for preliminary design considerations. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations. Although this report discusses design parameters, these parameters are preliminary. This preliminary report is not intended to be relied upon for final design.

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT CENTRAL RECEIVING WAREHOUSE FORT LEONARD WOOD, MISSOURI

Project No. B5105006

April 29, 2010

1.0 INTRODUCTION

A preliminary geotechnical engineering exploration has been completed for the proposed Central Receiving Warehouse to be located immediately north of Ordinance Drive approximately 1,000 feet northeast of its west intersection with 1st Street in Fort Leonard Wood, Missouri, as shown on the Vicinity Map (Exhibit A-1) in Appendix A. Six (6) borings designated B-1 through B-6 were performed to depths of approximately 10 to 30 feet below the existing ground surface within the proposed building and pavement areas. Logs of the borings along with a vicinity map, geologic map, and boring location diagram are included in Appendix A of this report.

The purposes of this Preliminary Geotechnical Engineering Report are to describe our understanding of the project, present data and provide professional opinions and preliminary geotechnical engineering recommendations relative to:

- subsurface soil and bedrock conditions
- groundwater conditions
- earthwork
- pavement design considerations
- foundation design and construction considerations
- floor slab design and construction considerations
- preliminary seismic considerations

2.0 PROJECT INFORMATION

2.1 Project Description

| ITEM | DESCRIPTION |
|---------------------------------------|--|
| Site layout | See Appendix A, Exhibit A-3: Boring Location Diagram |
| Structures | The project will include a single-story warehouse with a plan footprint of approximately 18,000 square feet, a loading dock area, and associated parking and access drives. A mobile track-mounted rack system is planned within the structure. |
| Building construction | Metal with light gage studs and structural steel. Slab-on-grade floor. (assumed) |
| Finished floor elevation (FFE) | Not provided |

Preliminary Geotechnical Engineering Report
 Central Receiving Warehouse ■ Fort Leonard Wood, Missouri
 April 29, 2010 ■ Terracon Project No. B5105006



| ITEM | DESCRIPTION |
|--------------------------------------|---|
| Maximum loads | Columns: 50 kips Walls: 1 klf (assumed) Slabs: 150 psf max (assumed) Rack system tracks live load: 1 klf |
| Maximum allowable settlement | Columns: 1-inch (assumed) Walls: ¾ inch over 40 feet (assumed) |
| Grading | Not provided. Cuts and fills are assumed to be on the order of 5 feet or less. |
| Cut and fill slopes | Assumed to be no steeper than 3H:1V (Horizontal to Vertical). |
| Free-standing retaining walls | Based on the preliminary site plan, we understand retaining walls are expected on the eastern and western ends of the site. The size and height of the walls were not provided. Global stability analysis of the retaining walls is outside the scope of this preliminary report. |
| Below grade areas | None anticipated |

2.2 Site Location and Description

| ITEM | DESCRIPTION |
|------------------------------|--|
| Location | Immediately north of Ordinance Drive approximately 1,000 feet northeast of its west intersection with 1 st Street in Fort Leonard Wood, Missouri. |
| Existing improvements | The proposed project site currently contains an existing warehouse facility that is scheduled for demolition. The remainder of the site is partially developed with paved and gravel parking areas and grass lawn areas. Railroad tracks run along the north edge of the site. |
| Current ground cover | Non-paved areas are grass lawn areas. |
| Existing topography | The site generally slopes moderately downward to the west and south. |

3.0 SUBSURFACE CONDITIONS

3.1 Geology

Based on the 2003 Geologic Map of Missouri, Missouri Department of Natural Resources, the uppermost bedrock strata below the sites consist primarily of the Roubidoux (Or) and the underlying Gasconade (Og) formations. The Roubidoux formation is described as being comprised primarily of sandstone, sandy dolomite, dolomite, chert, sandy chert, and cherty

Preliminary Geotechnical Engineering Report

Central Receiving Warehouse ■ Fort Leonard Wood, Missouri

April 29, 2010 ■ Terracon Project No. B5105006



dolomite. The Gasconade formation is described as being comprised primarily of coarsely-crystalline, cherty dolomite.

Solution features, including caves and sinkholes, are commonly present in these formations. Numerous sinkholes are known to exist throughout Fort Leonard Wood, and two sinkholes are present approximately ½ mile north-northeast and northwest of the project site.

It is difficult to predict future sinkhole activity. Sinkholes and caves in this area are in various stages of development and can appear at any time. Site grading and drainage may alter site conditions and could possibly cause sinkholes in areas that have no history of this activity.

3.2 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

| Stratum | Approximate Depth to Bottom of Stratum (feet) | Material Description | Consistency/Density |
|---------|---|--|----------------------------------|
| 1 | 2 to 4½ | Uncontrolled fill ¹ generally consisting of lean clay, lean to fat clay, and fat clay containing varying amounts of sand and gravel | N/A |
| 2 | 2½ to 18 in two borings, four borings terminated in Stratum 2 | Native fat clay and gravelly fat clay containing varying amounts of sand, cobbles, and weathered bedrock zones | Stiff to hard |
| 3 | Not determined, two borings terminated in Stratum 3 | Dolomite and sandstone containing clayey zones | Moderately to severely weathered |

1. Uncontrolled fill is material that was placed without moisture and density control. This material is typically variable in composition, consistency, density, and moisture.

The native soil encountered in the upper portions of the borings generally consisted of fat clay which was of moderate to high plasticity, and had the following measured liquid limits, plastic limits, and plastic indices:

| Sample Location | Depth (feet) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) |
|-----------------|--------------|------------------|-------------------|----------------------|
| Boring B-1 | 3.5 – 5.0 | 77 | 30 | 47 |
| Boring B-2 | 1.5 – 3.0 | 52 | 26 | 26 |
| Boring B-3 | 1.5 – 3.0 | 31 | 17 | 14 |
| Boring B-6 | 1.0 – 6.0 | 47 | 18 | 29 |

Preliminary Geotechnical Engineering Report

Central Receiving Warehouse ■ Fort Leonard Wood, Missouri

April 29, 2010 ■ Terracon Project No. B5105006



Conditions encountered at each boring location are indicated on the individual boring logs in Appendix A of this report. Stratification boundaries on the boring logs represent the approximate location of changes in soil and rock types; in-situ, the transition between materials may be gradual.

3.3 Groundwater

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was observed at the following depths in the borings:

| Location | Depth to groundwater while drilling (feet) | Depth to groundwater immediately after drilling (feet) | Depth to groundwater 24 hours after drilling (feet) |
|------------|--|--|---|
| Boring B-1 | 3.0 | 3.0 ¹ | 2.0 |
| Boring B-2 | None | 3.0 ¹ | N/A ² |
| Boring B-3 | None | 6.0 ¹ | 8.5 |
| Boring B-4 | None | None | None |
| Boring B-5 | None | None | 5.2 |
| Boring B-6 | None | None | N/A ² |

1. Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally occurring water levels could not be obtained with drilling fluids in the borehole.
2. Delayed water level not obtained. Boring was backfilled immediately after drilling completion for safety reasons.

Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Sandy and gravelly zones were observed in the native soils encountered in the borings performed for this project. These sandy and gravelly zones can store and transmit water of variable quality and quantity. These sandy and gravelly zones may be encountered during foundation or utility excavation.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. In addition, perched water can develop over low permeability soil or rock strata. Therefore, groundwater levels during construction or at other times in the life of the structures may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 PRELIMINARY RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Existing fill material was encountered at Borings B-1, B-2, B-3, B-4, and B-6 to depths of approximately 2 to 4½ feet below existing grade. The limited data suggest the fill was not placed with strict moisture and density control. The existing uncontrolled fill was generally comprised of lean to fat clay and fat clay with varying amounts of sand and gravel. Conditions can also vary between boring locations.

The lateral and vertical extent of the existing uncontrolled fill is not known; existing fill could be present in unexplored areas and to greater depths than indicated by our borings. The extent of existing fill may not be determined even during construction. In our opinion, support of the planned structure on or above existing uncontrolled fill involves significant risk. Foundations and floor slabs supported on or above existing uncontrolled fill that has not been uniformly placed and compacted with strict moisture and density control may not perform predictably. Further, the composition and amount of existing uncontrolled fill could vary significantly across the site. The support of the proposed foundations, slabs, and pavements on existing fill for the project should be addressed in the final geotechnical report.

Highly plastic, fat clay soils are present on this site. Such soils are commonly referred to as “expansive” or “swelling” soils because they expand or swell as their moisture content increases. However, these soils also “contract” or “shrink” as their moisture level decreases. Footings, floor slabs and pavements supported on expansive soils will move upward and downward and such movements will result in distortion, possibly causing cracking or structural damage to the structure. Support of the proposed foundations, slabs, and pavements on these materials should be addressed in the final geotechnical report.

Performance of foundation systems depends on many factors including, but not limited to the depth of footings, amounts of cut or fill, bearing material, and foundation loads. Structural loads, final grades, and other design details should be provided when available. Although this report discusses design parameters, these parameters are preliminary. This preliminary report is not intended to be relied upon for final design.

4.2 Earthwork

4.2.1 Site Preparation

Existing uncontrolled fill material was encountered in some of the borings performed during this preliminary exploration. We suspect these fills were not placed with moisture and density

Preliminary Geotechnical Engineering Report

Central Receiving Warehouse ■ Fort Leonard Wood, Missouri

April 29, 2010 ■ Terracon Project No. B5105006



control; no documentation was provided and the limited test data indicates variable conditions. In the absence of any documentation, we cannot know if the existing fill was uniformly placed and compacted. If the owner's risk tolerance is high, such that the owner is willing to accept the risks associated with potential post construction settlements of foundations and floor slabs, then additional tests could be conducted prior to the onset of site grading operations to further evaluate the existing uncontrolled fill. However, it is possible that unsuitable fill material could go undetected, even with additional testing. Typically, if the owner's risk tolerance is low, then all existing uncontrolled fill is removed and replaced at the outset. Support of proposed foundation elements on existing fill should be addressed in the final geotechnical report.

Demolition debris, including existing foundation elements, which may be encountered as a result of the demolition of the existing building, will need to be considered when developing final earthwork recommendations for the new structure.

4.2.2 Typical Compaction Requirements

Controlled, compacted fill is typically placed in lifts of 9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used and in lifts of 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used. Controlled, compacted fill is generally compacted to at least 95% of the material's maximum standard Proctor dry density (ASTM D 698). The moisture content of clay fill is typically within the range of optimum moisture content to 4% above the optimum moisture content value as determined by the standard Proctor test at the time of placement and compaction.

Cohesionless fill material is generally uniformly compacted to at least 95 percent of the standard Proctor maximum dry density at workable moisture levels. Moisture levels are typically maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

4.2.3 Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Additional recommendations in this regard should be provided in the final geotechnical engineering report.

4.3 Foundations

In our opinion, a shallow spread footing foundation system bearing on the medium stiff to hard native clay or on newly placed compacted structural fill appears suitable for support of the proposed structure. As noted above, the risk associated with placing foundations on existing fill should be addressed in the final geotechnical report prepared for the project. Preliminary design considerations for shallow foundations are presented in the following sections.

4.3.1 Shallow Foundation Design Recommendations

The on-site native clay soils encountered in the borings appear generally suitable for support of shallow foundations. Shallow foundations could be used to support lightly loaded structures provided the footings are supported by suitable material. Depending on the design footing elevation and bearing material, bearing pressures in the range of 2,000 psf to 3,500 psf may be possible on soil. Shallow foundations could be supported on suitable native clay soils or compacted structural fill which has been properly placed and compacted. Shallow foundations in the vicinity of Fort Leonard Wood are typically constructed at a minimum depth of 36 inches below finished grade for frost protection. Shallow foundations designed and constructed according to specific recommendations made in a geotechnical report could be expected to experience total settlement less than approximately 1 inch and differential settlement of approximately one half of the total settlement.

Remedial measures are expected to be performed where uncontrolled fill is present prior to construction of structures on this site. We anticipate that remedial measures would include removal and replacement of the uncontrolled fill. Specific recommendations regarding foundation design should be included in a final geotechnical engineering report prepared for the project.

4.4 Preliminary Seismic Considerations

The 2009 International Building Code (IBC) requires structural design to be in accordance with the appropriate seismic site classifications based upon subsurface rock and soil conditions. Based upon the nature of the subsurface materials encountered in our borings, we recommend a Site Class D be used for preliminary seismic evaluation in accordance with the *2009 International Building Code*, Table 1613.5.2.

4.5 Floor Slab

4.5.1 Preliminary Design Recommendations

Because of the moderate to high shrink-swell potential of some of the clay soils encountered in the borings, a low volume change layer would typically be developed below floor slabs on grade. It has been our experience that LVC layers can vary from 12 to 36 inches in thickness, depending on the sensitivity of the floor slab and/or supported features to movement. A low volume change layer thickness of 24 inches is common on projects at Fort Leonard Wood. The low volume change layer usually consists of low plasticity soil or a granular material such as sand, gravel or crushed stone. Lean to fat clay soils and fat clay soils, similar to those encountered in our borings performed at this site, are not typically suitable for use as low volume change material. Further testing at the individual building locations is often performed to verify the existence of suitable material.

Preliminary Geotechnical Engineering Report

Central Receiving Warehouse ■ Fort Leonard Wood, Missouri

April 29, 2010 ■ Terracon Project No. B5105006



The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

4.5.2 Construction Considerations

Many of the clay soils in this locale have the potential to increase or decrease in volume with variations in moisture content. Soil having high plasticity characteristics (i.e., fat clay) generally has a greater potential for moisture related volume change than less plastic materials such as lean clay. However, even low plasticity soils can swell significantly if their moisture levels are initially low. Recommendations for addressing these conditions should be provided in the final geotechnical report.

4.6 Lateral Earth Pressures

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed to resist applicable earth pressures. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction, and the strength and material properties of the materials being restrained. Design parameters for lateral earth pressures should be provided in the final geotechnical report.

Backfill placed against structures typically consists of granular soils or low plasticity cohesive soils. To control hydrostatic pressure behind the wall, drains are typically installed at the foundation wall with a collection pipe leading to a reliable discharge. If this is not possible, then combined hydrostatic and lateral earth pressures should be calculated for the backfill. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent excessive lateral pressures.

4.7 Pavements

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. This data should be obtained prior to final pavement section design. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with UFC 3-250-01FA dated January 16, 2004.

Pavement construction at Fort Leonard commonly requires the top 8 inches of subgrade soils supporting pavements be treated with lime. As an alternative, consideration can also be given to placement of 8 inches of granular subbase material instead of the 8 inches of lime treated subgrade.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our preliminary geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

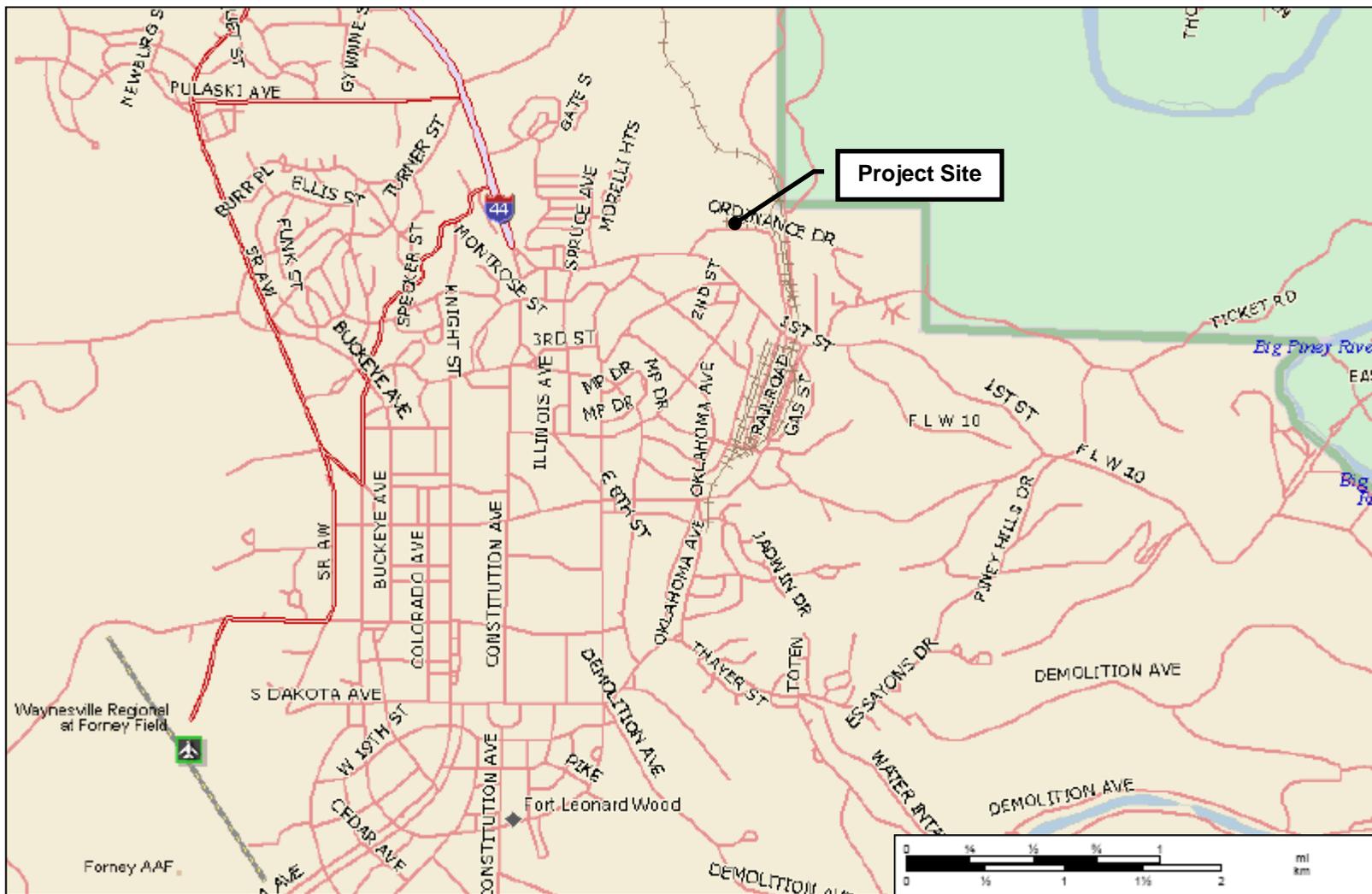
The analysis and preliminary recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or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

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

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

APPENDIX A

FIELD EXPLORATION



| | | | |
|------------------|-----|-------------|---------------|
| Project Manager: | TGA | Project No. | B5105006 |
| Drawn by: | TGA | Scale: | GRAPHIC |
| Checked by: | TGA | File Name: | B5105006_VMAP |
| Approved by: | TGA | Date: | 3/31/10 |

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Consulting Engineers & Scientists

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| |
|---|
| VICINITY MAP |
| CENTRAL RECEIVING WAREHOUSE ORDINANCE DRIVE FORT LEONARD WOOD, MISSOURI |

| |
|---------|
| Exhibit |
| A-1 |



| | |
|------------------|-----|
| Project Manager: | TGA |
| Drawn by: | EMH |
| Checked by: | TGA |
| Approved by: | TGA |

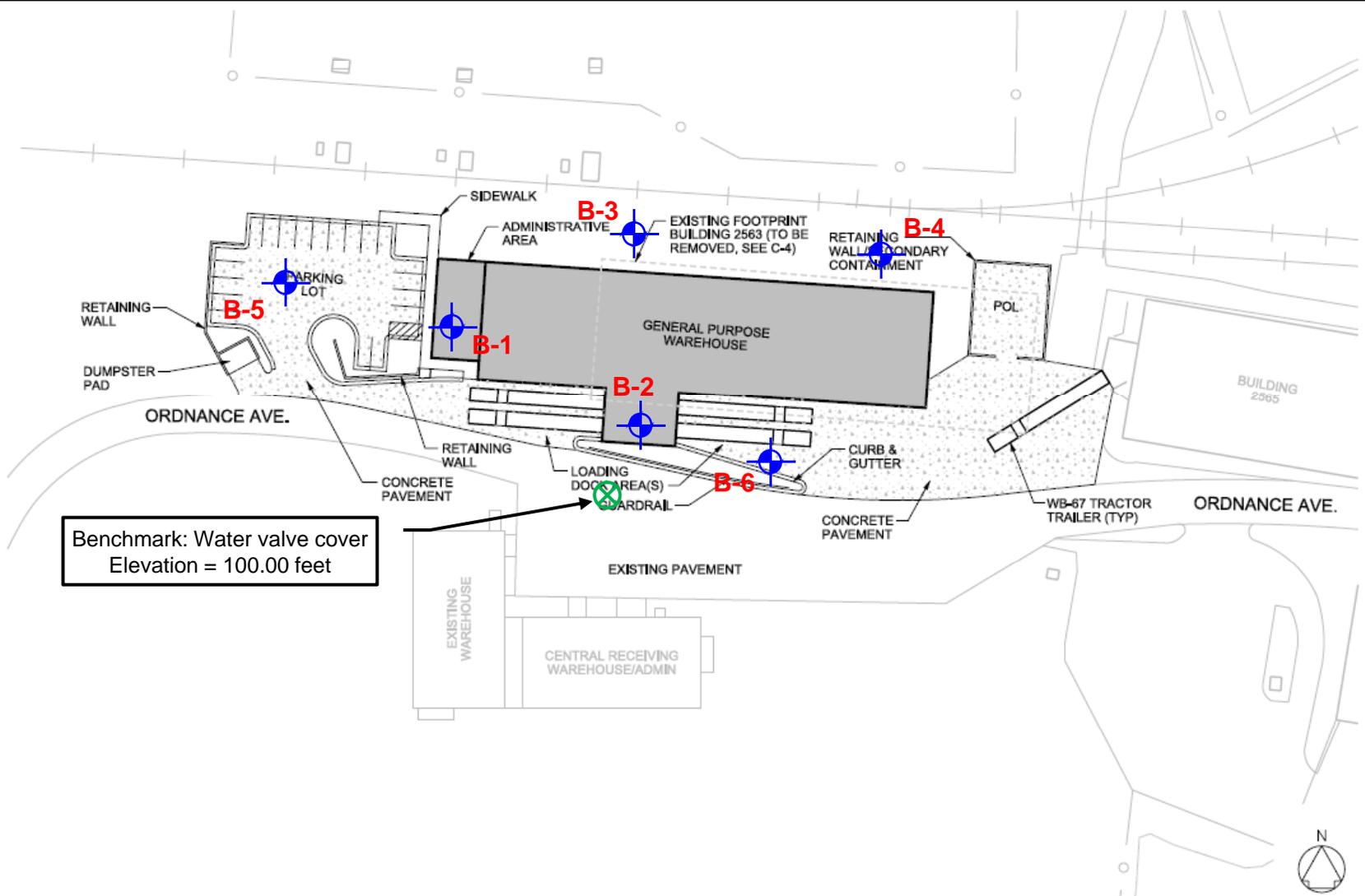
| | |
|-------------|---------------|
| Project No. | B5105006 |
| Scale: | GRAPHIC |
| File Name: | B5105006 GMAP |
| Date: | 3/31/2010 |

Terracon
Consulting Engineers & Scientists

764 N. Miller Avenue, Suite 100 Springfield, MO 65802
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| |
|---|
| GEOLOGIC MAP |
| CENTRAL RECEIVING WAREHOUSE ORDINANCE DRIVE FORT LEONARD WOOD, MISSOURI |

| |
|---------|
| Exhibit |
| A-2 |



Benchmark: Water valve cover
Elevation = 100.00 feet



Site Improvement Plan

NOTES

1. BASE DRAWING PROVIDED BY OTHERS
2. DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

| | | | |
|------------------|-----|-------------|---------------|
| Project Manager: | TGA | Project No. | B5105006 |
| Drawn by: | TGA | Scale: | GRAPHIC |
| Checked by: | TGA | File Name: | B5105006BPLAN |
| Approved by: | TGA | Date: | 4/1/10 |

Terracon
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| |
|--|
| BORING LOCATION DIAGRAM |
| CENTRAL RECEIVING WAREHOUSE ORDINANCE DRIVE FORT LEONARD WOOD, MISSOURI |

| |
|------------|
| Ex. No. |
| A-3 |

LOG OF BORING B-1



US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Central Receiving Warehouse
LOCATION: 1st Avenue and Ordnance Drive; Fort Leonard Wood, Missouri
BORING NUMBER: B-1
COORDINATES: N 37.7721, W 92.10104 ;
ELEVATION: +98.5 (ft) DATE(S) DRILLED: 2/23/10 - 2/24/10

| FIELD DATA | | | | DRILLING METHOD(S): HS, DB, WB | | LABORATORY DATA | | | | | | | | |
|---|-------------|------------------|---------------------|--------------------------------|---|-----------------|--------|--|-------------|------------------|---------------|----------------------|---------------------|----------------|
| DEPTH (ft) | SOIL SYMBOL | BREAKS: bb or mb | SAMPLE/DRILL METHOD | BLOWS | TORVANE KG/CM SQ (equally spaced along sample) | RC: % | RQD: % | Additional Field Data | USCS SYMBOL | ATTERBERG LIMITS | | MOISTURE CONTENT (%) | LAB VISUAL GROUPING | OTHER LAB DATA |
| | | | | | | | | | | LIQUID LIMIT | PLASTIC INDEX | | | |
| Driller: SB Logged by: TGA GROUNDWATER INFORMATION: ▽ 3.0(ft): Water Level during drilling. ▽ 2.0(ft)**: Water level after drilling. ▽ 2.0(ft)**: Water Level 24HR after drilling. ** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally occurring water levels could not be obtained with drilling fluids in the borehole. | | | | | | | | | | | | | | |
| DESCRIPTION OF STRATUM | | | | | | | | | LEGEND | | | | | |
| 0.0 - 0.3 | | | | HS | | | | 3' ROOT ZONE | | | | | | |
| 0.3 - 2.0 | | | | SS-1 | | | | FILL, GRAVELLY LEAN CLAY, GRAY | | | | | | |
| 2.0 - 3.0 | | | | SS-2 | | | | FAT CLAY, WITH GRAVEL, RED BROWN, VERY STIFF TO HARD | CH | 77 | 47 | 20.4 | | S:74 U:+9000 |
| 3.0 - 11.5 | | | | SS-3 | | | | | CH | | | 24.9 | | U:7000 |
| 11.5 - 12.5 | | | | SS-3 | | | | ***DOLOMITE, SEVERELY WEATHERED, GRAY | | | | | | |
| 12.5 - 13.0 | | | | SS-3 | | | | - PRACTICAL AUGER REFUSAL AT 12.5 FEET; BORING ADVANCED BELOW 12.5 FEET USING DIAMOND-BIT DRILLING TECHNIQUES. | | | | 11.3 | | |
| 13.0 - 14.0 | | | | SS-3 | | | | FAT CLAY, GRAVELLY, WITH OCCASSIONAL THIN LIMESTONE SEAMS, RED BROWN | | | | | | |
| 14.0 - 16.0 | | | | SS-3 | | | | - 100% WATER LOSS WHILE CORING/WASH BORING FROM 12.5 FEET TO 30 FEET | | | | | | |
| 16.0 - 18.0 | | | | SS-3 | | | | | | | | | | |
| 18.0 - 20.0 | | | | DB | | | | | | | | | | |
| | | | | | | | | RC:14 RQD:3 | | | | | | |

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG_A_2005 B5105006.GPJ 4/1/10

LOG OF BORING B-1



US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Central Receiving Warehouse
LOCATION: 1st Avenue and Ordnance Drive; Fort Leonard Wood, Missouri
BORING NUMBER: B-1
COORDINATES: N 37.7721, W 92.10104 ;
ELEVATION: +98.5 (ft) DATE(S) DRILLED: 2/23/10 - 2/24/10

| FIELD DATA | | | | DRILLING METHOD(S): HS, DB, WB | LABORATORY DATA | | | | | | | | | |
|--|-------------|------------------|---------------------|--------------------------------|---|-------|--------|-----------------------|--|------------------|---------------|----------------------|---------------------|----------------|
| DEPTH (ft) | SOIL SYMBOL | BREAKS: bb or mb | SAMPLE/DRILL METHOD | BLOWS | TORVANE KG/CM SQ (equally spaced along sample) | RC: % | ROD: % | Additional Field Data | USCS SYMBOL | ATTERBERG LIMITS | | MOISTURE CONTENT (%) | LAB VISUAL GROUPING | OTHER LAB DATA |
| | | | | | | | | | | LIQUID LIMIT | PLASTIC INDEX | | | |
| Driller: SB Logged by: TGA GROUNDWATER INFORMATION: ▽ 3.0(ft): Water Level during drilling. ▽ 2.0(ft)**: Water level after drilling. ▽ 2.0(ft)**: Water Level 24HR after drilling. ** Boring advanced using mud rotary drilling techniques. <small>Meaningful post drilling observations to detect naturally occurring water levels could not be obtained with drilling fluids in the borehole.</small> | | | | | | | | | | | | | | |
| DESCRIPTION OF STRATUM | | | | | | | | | LEGEND | | | | | |
| FAT CLAY, GRAVELLY, WITH OCCASSIONAL THIN LIMESTONE SEAMS, RED BROWN - 100% WATER LOSS WHILE CORING/WASH BORING FROM 12.5 FEET TO 30 FEET (continued) | | | | | | | | | Topsoil Fill (made ground) CH - USCS High Plasticity Clay Limestone | | | | | |
| 22 | | | | | | | | | | | | | | |
| 24 | | | | 2 | | | | | CH | | 23.9 | | | |
| 26 | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | |
| 30 | | | | 12 | | | | | CH | | 22.2 | | | |
| | | | | 9 | | | | | | | | | | |
| | | | | 12 | | | | | | | | | | |
| BOTTOM OF BORING ***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES. NOTE: BORING B-1 CAVED IN AT A DEPTH OF 2 FEET APPROXIMATELY 24 HOURS AFTER BORING COMPLETION. | | | | | | | | | | | | | | |

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG_A_2005 B5105006.GPJ 4/1/10

LOG OF BORING B-2



US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Central Receiving Warehouse
LOCATION: 1st Avenue and Ordnance Drive; Fort Leonard Wood, Missouri
BORING NUMBER: B-2
COORDINATES: N 37.77194, W 92.10067 ;
ELEVATION: +104.0 (ft) DATE(S) DRILLED: 2/25/10 - 2/25/10

| FIELD DATA | | | | DRILLING METHOD(S): PA, WB | | LABORATORY DATA | | | | | | | | |
|---|-------------|------------------|---------------------|----------------------------|---|-----------------|--------|-----------------------|---|------------------|---------------|----------------------|---------------------|----------------|
| DEPTH (ft) | SOIL SYMBOL | BREAKS: bb or mb | SAMPLE/DRILL METHOD | BLOWS | TORVANE KG/CM SQ (equally spaced along sample) | RC: % | ROD: % | Additional Field Data | USCS SYMBOL | ATTERBERG LIMITS | | MOISTURE CONTENT (%) | LAB VISUAL GROUPING | OTHER LAB DATA |
| | | | | | | | | | | LIQUID LIMIT | PLASTIC INDEX | | | |
| Driller: SB Logged by: TGA GROUNDWATER INFORMATION: ▽ NONE(ft): Water Level during drilling. ▽ 3.0(ft)**: Water level after drilling. ▽ (ft): Water Level 24HR after drilling. | | | | | | | | | | | | | | |
| DESCRIPTION OF STRATUM 4" ASPHALTIC CONCRETE 0.3' FILL, LEAN TO FAT CLAY, WITH SAND AND GRAVEL, BROWN 2.0' FAT CLAY, GRAVELLY, WITH COBBLES, RED BROWN, BROWN, VERY STIFF TO HARD | | | | | | | | | LEGEND ■ Asphalt ▨ Fill (made ground) ▩ CH - USCS High Plasticity Clay | | | | | |
| 2 | ▨ | | PA | | | | | | | | | | | |
| 2 | ▨ | | SS-1 | 12 | | | | | CH | 52 | 26 | 12.3 | | S:44 U:+9000 |
| 4 | ▨ | | SS-2 | 21 | | | | | CH | | | 15.2 | | |
| 4 | ▨ | | PA | 21 | | | | | | | | | | |
| 4 | ▨ | | SS-2 | 32 | | | | | | | | | | |
| 4 | ▨ | | SS-2 | 40 | | | | | | | | | | |
| 6 | ▨ | | WB | | | | | | | | | | | |
| 8 | ▨ | | WB | | | | | | | | | | | |
| 10 | ▨ | | SS-3 | 10 | | | | | CH | | | 32.6 | | U:6000 |
| 10 | ▨ | | SS-3 | 12 | | | | | | | | | | |
| 10 | ▨ | | SS-3 | 9 | | | | | | | | | | |
| 12 | ▨ | | WB | | | | | | | | | | | |
| 14 | ▨ | | SS-4 | 15 | | | | | CH | | | 27.8 | | |
| 14 | ▨ | | SS-4 | 27 | | | | | | | | | | |
| 14 | ▨ | | SS-4 | 50/5" | | | | | | | | | | |
| 16 | ▨ | | WB | | | | | | | | | | | |
| 18 | ▨ | | WB | | | | | | | | | | | |
| 18 | ▨ | | SS-5 | 50/3" | | | | | CH | | | 18.9 | | |
| 20 | ▨ | | SS-5 | | | | | | | | | | | |

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REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-3



US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Central Receiving Warehouse
LOCATION: 1st Avenue and Ordnance Drive; Fort Leonard Wood, Missouri
BORING NUMBER: B-3
COORDINATES: N 37.77227, W 92.10067 ;
ELEVATION: +105.5 (ft) DATE(S) DRILLED: 2/25/10 - 2/25/10

| FIELD DATA | | | | DRILLING METHOD(S): HS, WB | LABORATORY DATA | | | | | | | | |
|------------------------|-------------|------------------|---------------------|--|--|--|--|--------------------------------|------------------|---------------|----------------------|---------------------|----------------|
| DEPTH (ft) | SOIL SYMBOL | BREAKS: bb or mb | SAMPLE/DRILL METHOD | BLOWS TORVANE KG/CM SQ (equally spaced along sample) | RC: % ROD: % Additional Field Data | Driller: SB Logged by: TGA | | USCS SYMBOL | ATTERBERG LIMITS | | MOISTURE CONTENT (%) | LAB VISUAL GROUPING | OTHER LAB DATA |
| | | | | | | GROUNDWATER INFORMATION: | | | LIQUID LIMIT | PLASTIC INDEX | | | |
| | | | | | | NONE(ft): Water Level during drilling. 6.0(ft)**: Water level after drilling. | | | | | | | |
| | | | | | | (ft): Water Level 24HR after drilling. | | | | | | | |
| | | | | | | * Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally occurring water levels could not be obtained with drilling fluids in the borehole. | | | | | | | |
| DESCRIPTION OF STRATUM | | | | | | LEGEND | | | | | | | |
| 0.0 - 0.1 | | | | | | 1" ROOT ZONE | | Topsoil | | | | | |
| 0.1 - 4.0 | | | | | | FILL, LEAN CLAY, WITH GRAVEL, GRAY, BROWN | | Fill (made ground) | | | | | |
| 4.0 - 50/2" | | | | | | FAT CLAY, GRAVELLY, RED BROWN, BROWN, VERY STIFF TO HARD - WITH CHERT SEAMS AT 4.5 FEET TO 6 FEET | | CH - USCS High Plasticity Clay | 31 | 14 | 10.7 | | S:58 U:7000 |
| 50/2" - 18.0 | | | | | | - POSSIBLE COBBLES AT 13.5 FEET | | Limestone | | | | | |
| 18.0 - 50/1" | | | | | | (See next page for description) | | | | | | | |

LOG_A_2005 B5105006.GPJ 4/1/10

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-4



US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Central Receiving Warehouse
LOCATION: 1st Avenue and Ordnance Drive; Fort Leonard Wood, Missouri
BORING NUMBER: B-4
COORDINATES: N 37.77227, W 92.1002 ;
ELEVATION: +107.0 (ft) DATE(S) DRILLED: 2/24/10 - 2/24/10

| FIELD DATA | | | | | DRILLING METHOD(S): HS | | LABORATORY DATA | | | | | | |
|------------------------|-------------|------------------|---------------------|--|--|---|---|-------------|------------------|---------------|----------------------|---------------------|----------------|
| DEPTH (ft) | SOIL SYMBOL | BREAKS: bb or mb | SAMPLE/DRILL METHOD | BLOWS TORVANE KG/CM SQ (equally spaced along sample) | RC: % ROD: % Additional Field Data | GROUNDWATER INFORMATION: | | USCS SYMBOL | ATTERBERG LIMITS | | MOISTURE CONTENT (%) | LAB VISUAL GROUPING | OTHER LAB DATA |
| | | | | | | Driller: SB | Logged by: TGA | | LIQUID LIMIT | PLASTIC INDEX | | | |
| | | | | | | <input type="checkbox"/> NONE(ft): Water Level during drilling. <input type="checkbox"/> NONE(ft): Water level after drilling. <input type="checkbox"/> NONE(ft): Water Level 24HR after drilling. | | LL | PI | | | | |
| DESCRIPTION OF STRATUM | | | | | | LEGEND | | | | | | | |
| 22 | | | HS | | | FAT CLAY, GRAVELLY, WITH OCCASSIONAL COBBLES, RED BROWN, STIFF TO HARD (continued) | Topsoil Fill (made ground) CH - USCS High Plasticity Clay | | | | | | |
| 24 | | | SS-6 | 5 5 8 | | | | CH | | 45.1 | | U:5500 | |
| 26 | | | HS | | | | | | | | | | |
| 28 | | | | | | | | | | | | | |
| 30 | | | SS-7 | 10 14 8 | | | | CH | | 22.3 | | U:3500 | |
| | | | | | | BOTTOM OF BORING | | | | | | | |

LOG_A_2005 B5105006.GPJ 4/1/10

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-5



US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Central Receiving Warehouse
LOCATION: 1st Avenue and Ordnance Drive; Fort Leonard Wood, Missouri
BORING NUMBER: B-5
COORDINATES: N 37.77216, W 92.10151 ;
ELEVATION: +85.0 (ft) DATE(S) DRILLED: 2/23/10 - 2/23/10

| FIELD DATA | | | | DRILLING METHOD(S): PA | LABORATORY DATA | | | | | | | | | |
|-------------|-------------|------------------|---------------------|--|--|---|----------------|--------------------------------|------------------|---------------|----------------------|---------------------|----------------|--|
| DEPTH (ft) | SOIL SYMBOL | BREAKS: bb or mb | SAMPLE/DRILL METHOD | BLOWS TORVANE KG/CM SQ (equally spaced along sample) | RC: % ROD: % Additional Field Data | GROUNDWATER INFORMATION: | | USCS SYMBOL | ATTERBERG LIMITS | | MOISTURE CONTENT (%) | LAB VISUAL GROUPING | OTHER LAB DATA | |
| | | | | | | Driller: SB | Logged by: TGA | | LIQUID LIMIT | PLASTIC INDEX | | | | |
| | | | | | | NONE(ft): Water Level during drilling. NONE(ft): Water level after drilling. | | | | | | | | |
| | | | | | | NONE(ft): Water Level 24HR after drilling. | | | | | | | | |
| | | | | | | DESCRIPTION OF STRATUM | LEGEND | | | | | | | |
| 0.0 - 0.3 | | | PA | | | 4" ROOT ZONE | | | | | | | | |
| 0.3 - 2.5 | | | SS-1 50/6" | 8 | | FAT CLAY, GRAVELLY, RED BROWN, HARD | | Topsoil | | | | | | |
| 2.5 - 3.0 | | | PA | | | ***DOLOMITE, SEVERELY WEATHERED, WITH CLAY SEAMS, GRAY | | CH - USCS High Plasticity Clay | CH | | 25.8 | | | |
| 3.0 - 4.0 | | | SS-2 50/2" | | | | | Limestone | | | | | | |
| 4.0 - 8.5 | | | PA | | | | | Sandstone | | | 12.6 | | | |
| 8.5 - 10.0 | | | SS-3 15/50 | 5 | | ***SANDSTONE, SEVERELY WEATHERED, CLAYEY, BROWN, RED BROWN | | | | | 24.3 | | | |
| 10.0 - 10.0 | | | | | | BOTTOM OF BORING | | | | | | | | |
| | | | | | | ***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES. | | | | | | | | |

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG_A_2005 B5105006.GPJ 4/1/10

LOG OF BORING B-6



US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Central Receiving Warehouse
LOCATION: 1st Avenue and Ordnance Drive; Fort Leonard Wood, Missouri
BORING NUMBER: B-6
COORDINATES: N 37.77196, W 92.10047 ;
ELEVATION: +101.5 (ft) DATE(S) DRILLED: 2/23/10 - 2/23/10

| FIELD DATA | | | | DRILLING METHOD(S): PA | LABORATORY DATA | | | | | | | | | |
|--|-------------|------------------|---------------------|------------------------|---|-------|--------|-----------------------|-------------|------------------|---------------|----------------------|---------------------|----------------|
| DEPTH (ft) | SOIL SYMBOL | BREAKS: bb or mb | SAMPLE/DRILL METHOD | BLOWS | TORVANE KG/CM SQ (equally spaced along sample) | RC: % | RQD: % | Additional Field Data | USCS SYMBOL | ATTERBERG LIMITS | | MOISTURE CONTENT (%) | LAB VISUAL GROUPING | OTHER LAB DATA |
| | | | | | | | | | | LIQUID LIMIT | PLASTIC INDEX | | | |
| GROUNDWATER INFORMATION: | | | | | | | | | LL | PI | | | | |
| Driller: SB Logged by: TGA NONE(ft): Water Level during drilling. NONE(ft): Water level after drilling. NONE(ft): Water Level 24HR after drilling. | | | | | | | | | | | | | | |
| DESCRIPTION OF STRATUM | | | | | | | | | LEGEND | | | | | |
| 0.0 - 0.5 | █ | | PA | | | | | | | | | | | |
| 0.5 - 2.0 | ▨ | | SS-1 | 10 30 25 | | | | | | | | | | |
| 2.0 - 4.5 | ▨ | | SS-2 | 8 12 13 | | | | | CH | 47 | 29 | 20.8 | | |
| 4.5 - 10.0 | ▨ | | SS-3 | 10 17 21 | | | | | CH | | | 20.8 | | |
| 10.0 - 10.5 | | | | | | | | | | | | | | |
| BOTTOM OF BORING NOTE: BORING B-6 WAS LOCATED WITHIN AN EXISTING PARKING/DRIVE AREA. THE BORING WAS BACKFILLED IMMEDIATELY AFTER DRILLING; NO DELAYED WATER LEVEL MEASUREMENT WAS OBTAINED. | | | | | | | | | | | | | | |

LOG_A_2005 B5105006.GPJ 4/1/10

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

Preliminary Geotechnical Engineering Report

Central Receiving Warehouse ■ Fort Leonard Wood, Missouri

April 29, 2010 ■ Terracon Project No. B5105006

**Field Exploration Description**

The boring locations were laid out by a Terracon engineer utilizing a site plan provided by the client and measuring from available site features prior to the arrival of the drill crew. Right angles for the boring locations were estimated. Ground surface elevations indicated on the boring logs were measured in the field using a surveyor's level and grade rod and were referenced to the existing water valve cover in the eastbound lane of Ordinance Drive as indicated on the boring location diagram. These temporary benchmarks were assigned an elevation of 100 feet. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with an ATV-mounted rotary drill rig using continuous flight solid-stem and hollow-stem augers and mud rotary boring techniques to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split-barrel sampling procedure. A bulk sample obtained from auger cuttings was collected for standard Proctor and CBR testing from Boring B-6.

In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. Where safe to do so, the borings were left open in order to obtain a delayed groundwater level reading. Following delayed groundwater level readings, the borings were backfilled to within 2 feet of the ground surface with Portland cement grout. The remaining 2 feet were backfilled with auger cuttings.

A field log of each boring was prepared by the field engineer. These logs included visual classifications of the materials encountered during drilling as well as an interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

APPENDIX B

LABORATORY TESTING

Preliminary Geotechnical Engineering Report

Central Receiving Warehouse ■ Fort Leonard Wood, Missouri

April 29, 2010 ■ Terracon Project No. B5105006

**Laboratory Testing**

Soil samples were tested in the laboratory to measure their natural water content and a calibrated hand penetrometer was used to estimate the approximate unconfined compressive strength of some samples. The calibrated hand penetrometer has been correlated with unconfined compression tests and provides a better estimate of soil consistency than visual examination alone. The test results are provided on the boring logs included in Appendix A.

One standard Proctor compaction test (ASTM D 698) and one California Bearing Ratio (CBR) test were performed on a sample of material obtained from Boring B-6.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system is attached to this report. All classification was by visual manual procedures. Selected samples were further classified using the results of Atterberg limit testing and minus #200 sieve analysis. The Atterberg limit test and minus #200 sieve results are provided on the boring logs.

California Bearing Ratio of Laboratory-Compacted Soils



Report Number: B5105006
 Service Date: 03/22/10
 Report Date: 03/26/10
 Task:

764 North Miller Avenue, Suite 100
 Springfield, Missouri 65802
 P [417] 864 5100 F [417] 864 0871

Client

Project

TOMPKINS ARCHITECTS
 612 NORTHWEST KAY DRIVE
 LEE'S SUMMIT, MISSOURI 64063

CENTRAL RECEIVING HOUSE
 ORDINANCE DRIVE
 FORT LEONARD WOOD, MISSOURI

Project No. B5105006

SAMPLE INFORMATION

| | | | |
|-----------------------|----------------------------------|----------------------------|----------------------|
| Sample Number: | _____ | Proctor Method: | ASTM D698 - Method A |
| Boring Number: | B-6 | Maximum Dry Density (pcf): | 115.6 |
| Sample Location: | BULK | Optimum Moisture: | 13.4 |
| Depth: | 1.0-6.0 | Liquid Limit: | 47 |
| Material Description: | LEAN CLAY, REDDISH BROWN & BROWN | Plasticity Index: | 29 |

CBR TEST DATA

| | |
|-------------------------|-----|
| CBR Value at 0.100 inch | 2.0 |
| CBR Value at 0.200 inch | 1.7 |

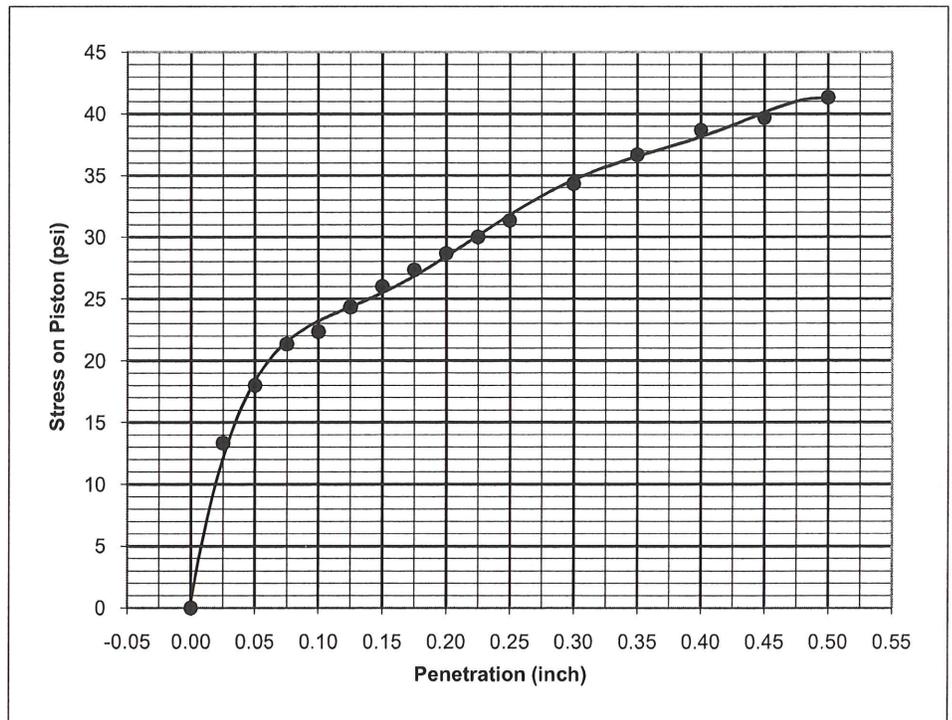
| | |
|---------------------------|--------|
| Surcharge Weight (lbs) | 10 |
| Soaking Condition | Soaked |
| Length of Soaking (hours) | 96 |
| Swell (%) | 0.1 |

DENSITY DATA

| | |
|----------------------------------|-------|
| Dry Density Before Soaking (pcf) | 109.8 |
| Compaction of Proctor (%) | 95.0 |

MOISTURE DATA

| | |
|---------------------------|------|
| Before Compaction (%) | 16.0 |
| After Compaction (%) | 15.9 |
| Top 1" After Soaking (%) | 17.4 |
| Average After Soaking (%) | 17.7 |



Comments: 35 BLOWS
 Test Methods: ASTM D1883

Services:

Terracon Rep:
 Reported To:
 Contractor:
 Report Distribution

Started:
 Finished:

Tested by: R. Neal
 Reviewed by: [Signature]

California Bearing Ratio of Laboratory-Compacted Soils

Report Number: B5105006
 Service Date: 03/22/10
 Report Date: 03/26/10
 Task:



764 North Miller Avenue, Suite 100
 Springfield, Missouri 65802
 P [417] 864 5100 F [417] 864 0871

Client

TOMPKINS ARCHITECTS
 612 NORTHWEST KAY DRIVE
 LEE'S SUMMIT, MISSOURI 64063

Project

CENTRAL RECEIVING WAREHOUSE
 ORDINANCE DRIVE
 FORT LEONARD WOOD, MISSOURI

Project No. B5105006

SAMPLE INFORMATION

| | | | |
|-----------------------|----------------------------------|----------------------------|----------------------|
| Sample Number: | _____ | Proctor Method: | ASTM D698 - Method A |
| Boring Number: | B-6 | Maximum Dry Density (pcf): | 115.6 |
| Sample Location: | BULK | Optimum Moisture: | 13.4 |
| Depth: | 1.0-6.0 | Liquid Limit: | 47 |
| Material Description: | LEAN CLAY, REDDISH BROWN & BROWN | Plasticity Index: | 29 |

CBR TEST DATA

CBR Value at 0.100 inch: 1.4
 CBR Value at 0.200 inch: 1.2

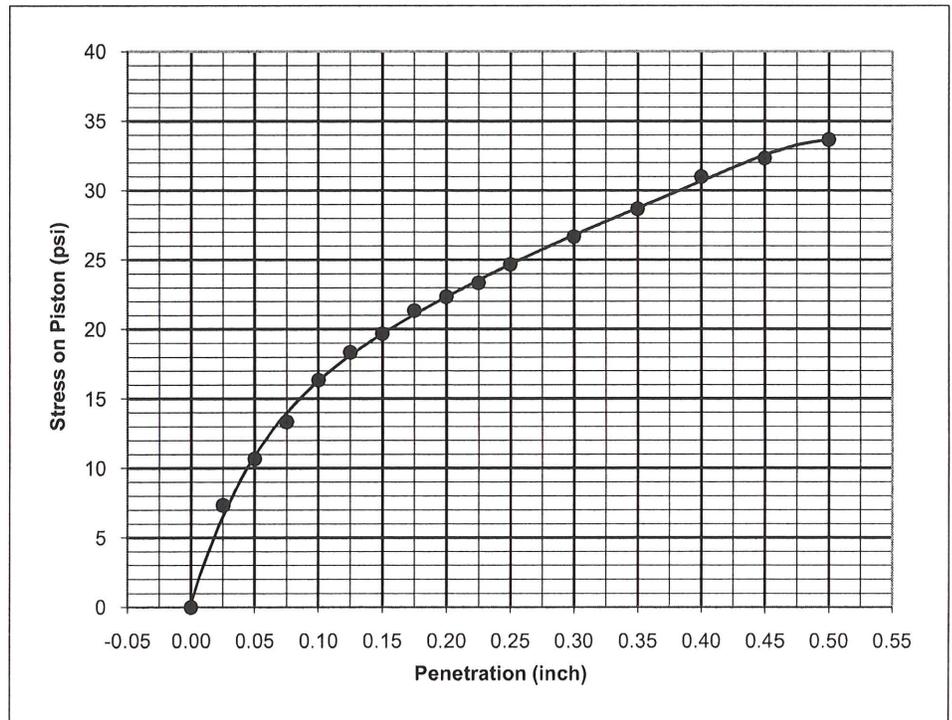
Surcharge Weight (lbs): 10
 Soaking Condition: Soaked
 Length of Soaking (hours): 96
 Swell (%): 0.1

DENSITY DATA

Dry Density Before Soaking (pcf): 103.5
 Compaction of Proctor (%): 89.5

MOISTURE DATA

Before Compaction (%): 16.5
 After Compaction (%): 15.9
 Top 1" After Soaking (%): 19.1
 Average After Soaking (%): 17.5



Comments: 10 BLOWS
 Test Methods: ASTM D1883

Services:

Terracon Rep:
 Reported To:
 Contractor:
 Report Distribution

Started:
 Finished:

Tested by: R. Neal
 Reviewed by: [Signature]

Section:

California Bearing Ratio of Laboratory-Compacted Soils



Report Number: B5105006
Service Date: 03/22/10
Report Date: 03/26/10
Task:

764 North Miller Avenue, Suite 100
Springfield, Missouri 65802
P [417] 864 5100 F [417] 864 0871

Client

TOMPKINS ARCHITECTS
612 NORTHWEST KAY DRIVE
LEE'S SUMMIT, MISSOURI 64063

Project

CENTRAL RECEIVING HOUSE
ORDINANCE DRIVE
FORT LEONARD WOOD, MISSOURI

Project No. B5105006

SAMPLE INFORMATION

| | | | |
|-----------------------|----------------------------------|----------------------------|----------------------|
| Sample Number: | _____ | Proctor Method: | ASTM D698 - Method A |
| Boring Number: | B-6 | Maximum Dry Density (pcf): | 115.6 |
| Sample Location: | BULK | Optimum Moisture: | 13.4 |
| Depth: | 1.0-6.0 | Liquid Limit: | 47 |
| Material Description: | LEAN CLAY, REDDISH BROWN & BROWN | Plasticity Index: | 29 |

CBR TEST DATA

| | |
|-------------------------|-----|
| CBR Value at 0.100 inch | 2.4 |
| CBR Value at 0.200 inch | 2.0 |

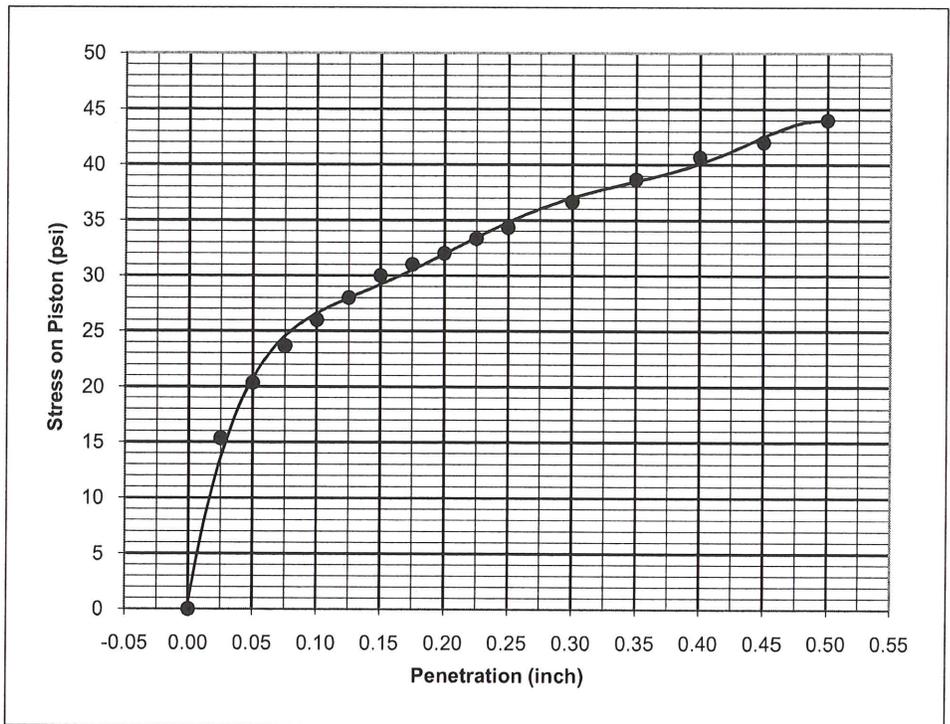
| | |
|---------------------------|--------|
| Surcharge Weight (lbs) | 10 |
| Soaking Condition | Soaked |
| Length of Soaking (hours) | 96 |
| Swell (%) | 0.2 |

DENSITY DATA

| | |
|----------------------------------|-------|
| Dry Density Before Soaking (pcf) | 108.8 |
| Compaction of Proctor (%) | 94.1 |

MOISTURE DATA

| | |
|---------------------------|------|
| Before Compaction (%) | 16.9 |
| After Compaction (%) | 16.6 |
| Top 1" After Soaking (%) | 16.8 |
| Average After Soaking (%) | 16.3 |



Comments: 60 BLOWS
Test Methods: ASTM D1883

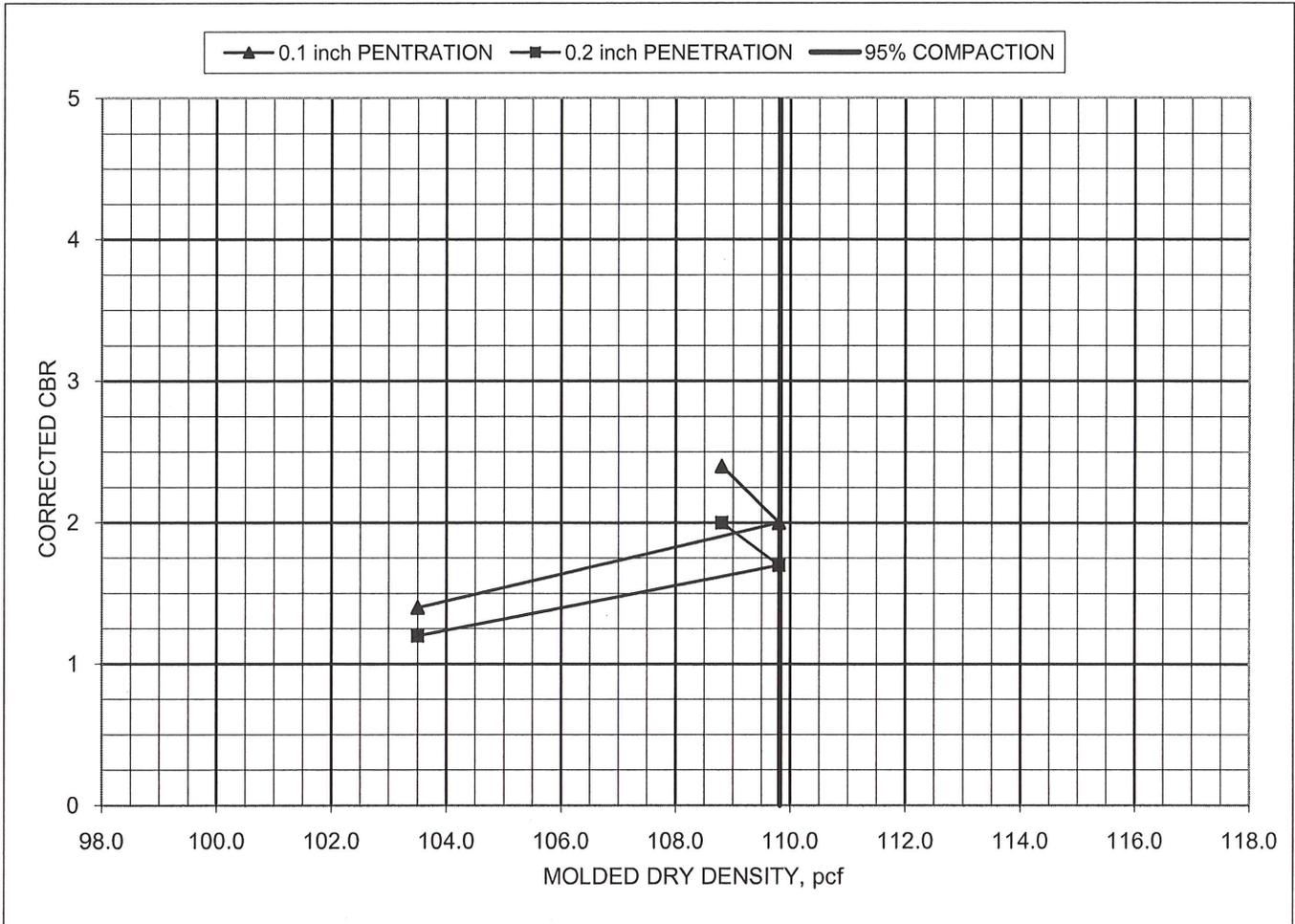
Services:

Terracon Rep:
Reported To:
Contractor:
Report Distribution

Started:
Finished:

Tested by R. Neal
Reviewed by [Signature]

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOILS ASTM D1883



| <u>MOLDED</u> <u>WATER</u> <u>CONTENT,</u> % | <u>MOLDED</u> <u>DRY</u> <u>DENSITY,</u> pcf | <u>MOLDED</u> <u>COMPACTION,</u> % | <u>CORRECTED</u> <u>CBR</u> 0.1 inch | <u>CORRECTED</u> <u>CBR</u> 0.2 inch |
|---|---|--|--|--|
| 16.5 | 103.5 | 89.5 | 1.4 | 1.2 |
| 16.0 | 109.8 | 95.0 | 2.0 | 1.7 |
| 16.9 | 108.8 | 94.1 | 2.4 | 2.0 |

BORING NO. B-6 SAMPLE NO. BULK DEPTH, feet 1.0-6.0

DESCRIPTION LEAN CLAY, REDDISH BROWN & Brown

JOB NAME: CENTRAL RECEIVING WAREHOUSE MAXIMUM DENSITY, pcf 115.6

JOB LOCATION: FORT LEONARD WOOD, MISSOURI OPTIMUM MOISTURE, % 13.4

JOB NO.: B5105006 LIQUID LIMIT 47

DATE: 3/29/2010 PLASTICITY INDEX 29

TESTED BY: *R. Neal* APPROVED BY: *K. Jones*



Laboratory Compaction Characteristics of Soil

764 N. Miller Ave., Ste. 100
Springfield, Missouri 65802
[417] 864 5100

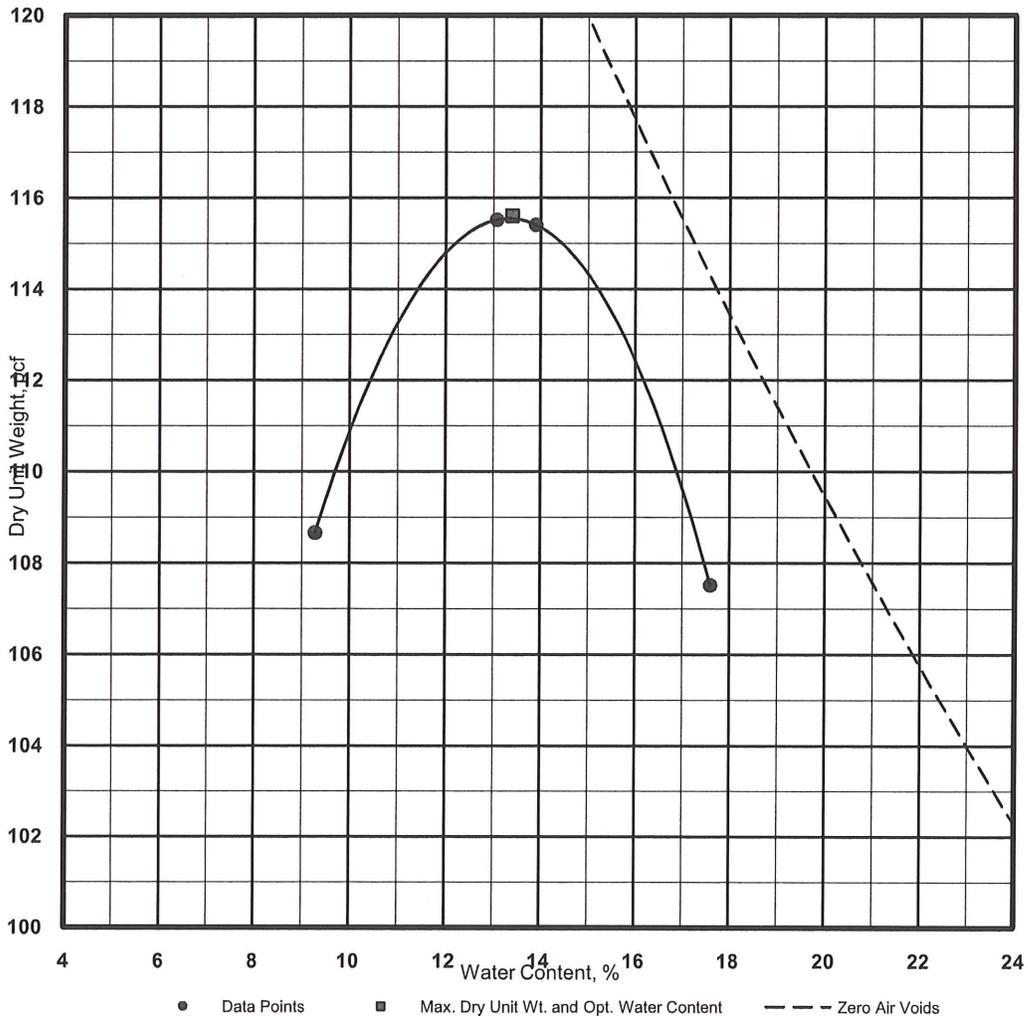
Client Name: Tompkins Architects
 Project Name: Central Receiving Warehouse
 Location: Ordinance Drive
Fort Leonard Wood, Missouri
 Source Material: B-6, Bulk, 1.0-6.0 feet
 Sample Description: Lean Clay with Gravel, reddish brown & brown
 Material Designation: CL Sample date: 2/23/2010
 Test Method: ASTM D698 (Standard)
 Test Procedure: Method A
 Sample Preparation: Dry Preparation
 Rammer: Mechanical Manual

Project No.: B5105006 Date: 3/8/2010

| TEST RESULTS | |
|------------------------|------------------|
| Maximum Dry Unit Wt.: | <u>115.6</u> pcf |
| Optimum Water Content: | <u>13.4</u> % |
| Rock Correction Values | |
| Maximum Dry Unit Wt.: | <u>120.3</u> pcf |
| Optimum Water Content: | <u>11.7</u> % |

Natural Moisture, %: _____
 % passing # 200 sieve: _____
 Reviewed by: [Signature]
 Tested by: R. Neal

Zero air voids for specific gravity of 2.70



APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

| | |
|--|-------------------------------|
| SS: Split Spoon – 1- ³ / ₈ " I.D., 2" O.D., unless otherwise noted | HS: Hollow Stem Auger |
| ST: Thin-Walled Tube - 2" O.D., unless otherwise noted | PA: Power Auger |
| RS: Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted | HA: Hand Auger |
| DB: Diamond Bit Coring - 4", N, B | RB: Rock Bit |
| BS: Bulk Sample or Auger Sample | WB: Wash Boring or Mud Rotary |

The number of blows required to advance a standard 2-inch O.D. split- spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

| | | |
|------------------|----------------------------|----------------------|
| WL: Water Level | WS: While Sampling | N/E: Not Encountered |
| WCI: Wet Cave in | WD: While Drilling | |
| DCI: Dry Cave in | BCR: Before Casing Removal | |
| AB: After Boring | ACR: After Casing Removal | |

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

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

CONSISTENCY OF FINE-GRAINED SOILS

| <u>Unconfined Compressive Strength, Qu, psf</u> | <u>Standard Penetration or N-value (SS) Blows/Ft.</u> | <u>Consistency</u> |
|---|---|--------------------|
| < 500 | 0 – 1 | Very Soft |
| 500 – 1,000 | 2 – 4 | Soft |
| 1,001 – 2,000 | 4 – 8 | Medium Stiff |
| 2,001 – 4,000 | 8 – 15 | Stiff |
| 4,001 – 8,000 | 15 – 30 | Very Stiff |
| 8,000+ | > 30 | Hard |

RELATIVE DENSITY OF COARSE-GRAINED SOILS

| <u>Standard Penetration or N-value (SS) Blows/Ft.</u> | <u>Relative Density</u> |
|---|-------------------------|
| 0 – 3 | Very Loose |
| 4 – 9 | Loose |
| 10 – 29 | Medium Dense |
| 30 – 49 | Dense |
| > 50 | Very Dense |

RELATIVE PROPORTIONS OF SAND AND GRAVEL

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

GRAIN SIZE TERMINOLOGY

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

RELATIVE PROPORTIONS OF FINES

| <u>Descriptive Term(s) of other Constituents</u> | <u>Percent of Dry Weight</u> |
|--|----------------------------------|
| Trace | < 5 |
| With | 5 – 12 |
| Modifiers | > 12 |

PLASTICITY DESCRIPTION

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

UNIFIED SOIL CLASSIFICATION SYSTEM

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A | | | | Soil Classification | | |
|--|---|--|--|---|-----------------------------------|---------------------------------|
| | | | | Group Symbol | Group Name ^B | |
| Coarse Grained Soils: More than 50% retained on No. 200 sieve | Gravels: More than 50% of coarse fraction retained on No. 4 sieve | Clean Gravels: Less than 5% fines ^C | $Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E | GW | Well-graded gravel ^F | |
| | | Gravels with Fines: More than 12% fines ^C | $Cu < 4$ and/or $1 > Cc > 3$ ^E | GP | Poorly graded gravel ^F | |
| | Sands: 50% or more of coarse fraction passes No. 4 sieve | Clean Sands: Less than 5% fines ^D | Fines classify as ML or MH | GM | Silty gravel ^{F,G,H} | |
| | | Sands with Fines: More than 12% fines ^D | Fines classify as CL or CH | GC | Clayey gravel ^{F,G,H} | |
| | Fine-Grained Soils: 50% or more passes the No. 200 sieve | Silts and Clays: Liquid limit less than 50 | Clean Sands: Less than 5% fines ^D | $Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E | SW | Well-graded sand ^I |
| | | | Sands with Fines: More than 12% fines ^D | $Cu < 6$ and/or $1 > Cc > 3$ ^E | SP | Poorly graded sand ^I |
| | | Silts and Clays: Liquid limit 50 or more | Inorganic: | Fines classify as ML or MH | SM | Silty sand ^{G,H,I} |
| | | | Organic: | Fines classify as CL or CH | SC | Clayey sand ^{G,H,I} |
| Highly organic soils: | | Inorganic: | $PI > 7$ and plots on or above "A" line ^J | CL | Lean clay ^{K,L,M} | |
| | | | $PI < 4$ or plots below "A" line ^J | ML | Silt ^{K,L,M} | |
| | | Organic: | Liquid limit - oven dried | OL | Organic clay ^{K,L,M,N} | |
| | | | Liquid limit - not dried | OH | Organic silt ^{K,L,M,O} | |
| | Inorganic: | PI plots on or above "A" line | CH | Fat clay ^{K,L,M} | | |
| | | PI plots below "A" line | MH | Elastic Silt ^{K,L,M} | | |
| Organic: | Liquid limit - oven dried | OH | Organic clay ^{K,L,M,P} | | | |
| | Liquid limit - not dried | OH | Organic silt ^{K,L,M,Q} | | | |
| Primarily organic matter, dark in color, and organic odor | | | | PT | Peat | |

^A Based on the material passing the 3-in. (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

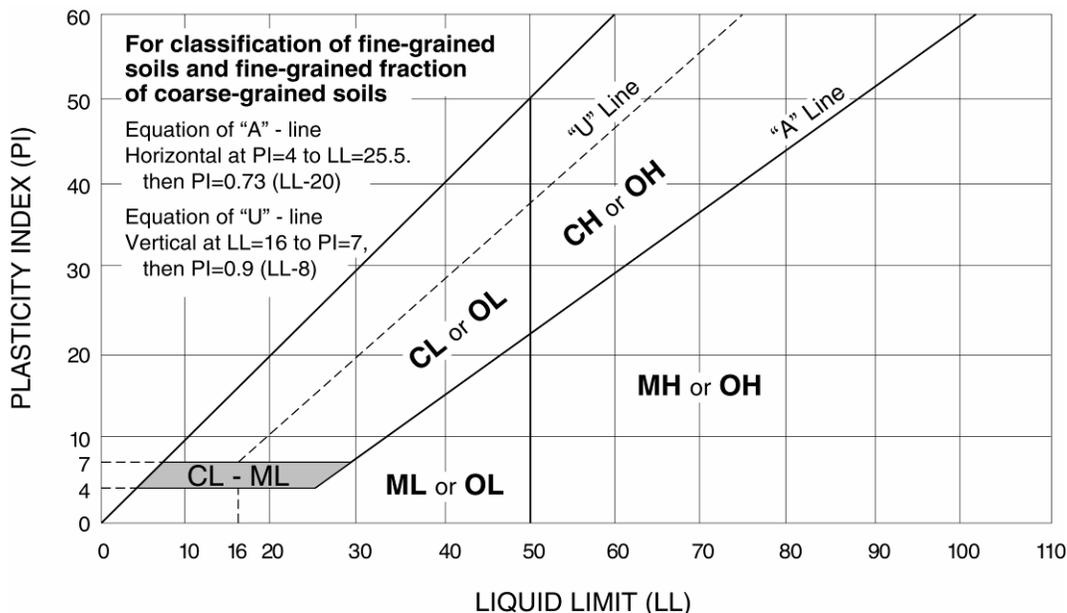
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



GENERAL NOTES

Description of Rock Properties

WEATHERING

| | |
|-------------------|--|
| Fresh | Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline. |
| Very slight | Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline. |
| Slight | Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer. |
| Moderate | Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock. |
| Moderately severe | All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. |
| Severe | All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left. |
| Very severe | All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining. |
| Complete | Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers. |

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

| | |
|-----------------|--|
| Very hard | Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick. |
| Hard | Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen. |
| Moderately hard | Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow. |
| Medium | Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick. |
| Soft | Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure. |
| Very soft | Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail. |

Joint, Bedding, and Foliation Spacing in Rock ^a

| Spacing | Joints | Bedding/Foliation |
|------------------|------------------|-------------------|
| Less than 2 in. | Very close | Very thin |
| 2 in. – 1 ft. | Close | Thin |
| 1 ft. – 3 ft. | Moderately close | Medium |
| 3 ft. – 10 ft. | Wide | Thick |
| More than 10 ft. | Very wide | Very thick |

a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

Rock Quality Designator (RQD) a

| RQD, as a percentage | Diagnostic description |
|----------------------|------------------------|
| Exceeding 90 | Excellent |
| 90 – 75 | Good |
| 75 – 50 | Fair |
| 50 – 25 | Poor |
| Less than 25 | Very poor |

a. RQD (given as a percentage) = length of core in pieces
4 in. and longer/length of run.

Joint Openness Descriptors

| Openness | Descriptor |
|-----------------------|-----------------|
| No Visible Separation | Tight |
| Less than 1/32 in. | Slightly Open |
| 1/32 to 1/8 in. | Moderately Open |
| 1/8 to 3/8 in. | Open |
| 3/8 in. to 0.1 ft. | Moderately Wide |
| Greater than 0.1 ft. | Wide |

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

Appendix B

List of Drawings

| Sheet | Description |
|-------|---|
| G-001 | COVER SHEET – FLW_RFP_G-001.dgn |
| G-002 | SHEET INDEX – FLW_RFP_G-002.dgn |
| G-003 | GENERAL LOCATION AND VICINITY MAP – FLW_RFP_G-003.dgn |
| CD101 | CIVIL SITE DEMOLITION PLAN – FLW_RFP_CD101.dgn |
| CS101 | CIVIL SITE IMPROVEMENT PLAN – FLW_RFP_CS101.dgn |
| CG101 | CIVIL SITE GRADING PLAN – FLW_RFP_CG101.dgn |
| CU100 | CIVIL SITE UTILITY EXTENSION PLAN – FLW_RFP_CU100.dgn |
| CU101 | CIVIL SITE UTILITY PLAN – FLW_RFP_CU101.dgn |
| A-101 | ARCHITECTURAL CONCEPTUAL BUILDING LAYOUT – FLW_RFP_A-101.dgn |

The following survey files will also be provided electronically:

FLW-CentralreceivingWarehouse.dtm
Border-i_civ2d.dgn
NWKSurv_sym.cel
Tsaec.rsc
Color.tbl
SurveyLevelsAEC_2-0_3-0.dgn
xxxV-FLW-CentralReceivingWarehouse_civ-3d.dgn

Appendix C
Utility Connections

FLW Gas Service Request Form

GENERAL INSTRUCTIONS

1. Form Shall be Prepared for each Service Location and type.
2. Please Fill-in Information in the Highlighted Areas.
3. Provide Site Plans with Final Grade Elevations and other services.
4. Provide Site Plans with Proposed service location.
5. Early Coordination is Required to verify Service will be available when needed. Delays due to insufficient time for service availability are not the responsibility of this agency.

| | | | |
|--|---|-----|----|
| Submitted By: | Name: | | |
| Company: | | | |
| Contract Number with Government: | | | |
| Corps of Engineers or DPW Contract: | | | |
| Contact Information including e-mail and telephone numbers: | | | |
| Reason for Request: | | | |
| New Permanent Service: | <table border="1"> <tr> <td>YES</td> <td>NO</td> </tr> </table> | YES | NO |
| YES | NO | | |
| Upgrade Service: | <table border="1"> <tr> <td>YES</td> <td>NO</td> </tr> </table> | YES | NO |
| YES | NO | | |
| Temporary Construction Service: | <table border="1"> <tr> <td>YES</td> <td>NO</td> </tr> </table> | YES | NO |
| YES | NO | | |
| Service Part of Multiple requests for same contract: | <table border="1"> <tr> <td>YES</td> <td>NO</td> </tr> </table> | YES | NO |
| YES | NO | | |
| (Attach all together when submitting) | <table border="1"> <tr> <td></td> <td>of</td> </tr> </table> | | of |
| | of | | |
| General Service Information: | | | |
| Project Name: | | | |
| Project Locations: | | | |
| Building Number | | | |
| xxx | | | |
| Square Footage: | | | |
| x | | | |
| (Please Check One) | | | |
| Others: | | | |
| Estimated Demand | | | |

FLW Electric Service Request Form

GENERAL INSTRUCTIONS

1. Form Shall be Prepared for each Service Location and type.
2. Please Fill-in Information in the Highlighted Areas.
3. Provide Site Plans with Final Grade Elevations and other services.
4. Provide Site Plans with Proposed service location.
5. Early Coordination is Required to verify Service will be available when needed. Delays due to insufficient time for service availability is not the responsibility of this agency.

| | | |
|----------------------|--|--|
| Submitted By: | Name: | |
| | Company: | |
| | Contract Number with Government: | |
| | Corps of Engineers or DPW Contract: | |
| | Contact Information including e-mail and telephone numbers: | |

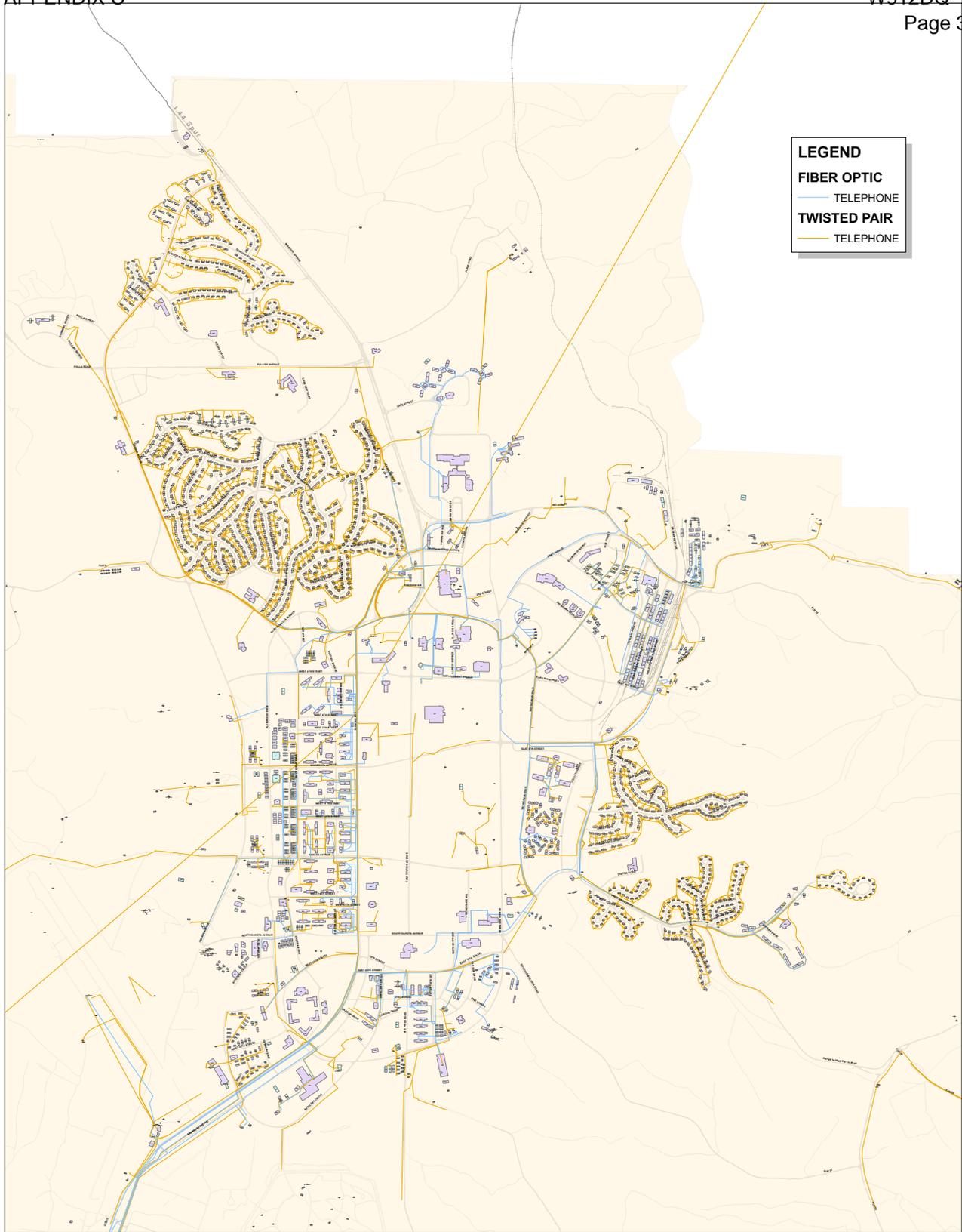
| | | |
|---|-----|----|
| Reason for Request: | | |
| New Permanent Service: | YES | NO |
| Upgrade Service: | YES | NO |
| Temporary Construction Service: | YES | NO |
| Service Part of Multiple requests for same contract: | YES | NO |
| (Attach all together when submitting) | of | |

| | | | |
|---|--|----------------------------------|-----------------------------------|
| General Service Information: | | | |
| Project Name: | | | |
| Project Locations: | | | |
| Building Number | | | |
| Occupancy Type (NEC 220.12) | | | |
| Square Footage: | | | |
| Service Voltage <i>(Please Check One)</i> | 120 <input type="checkbox"/> | 120/240 <input type="checkbox"/> | 208Y/120 <input type="checkbox"/> |
| | 480Y/277 <input type="checkbox"/> | 480 <input type="checkbox"/> | 240 <input type="checkbox"/> |
| | Others: <input style="width: 100px;" type="text"/> | | |
| Phase | Single <input type="checkbox"/> | Poly <input type="checkbox"/> | |
| Estimated Demand KVA | <input style="width: 100px;" type="text"/> | | |

FLW Electric Service Request Form

| | | | |
|---|------------|--|--|
| Connected Load Breakout Information: | | | |
| Largest Motor: | | | |
| Horsepower: | | | LRA: <input style="width: 80%;" type="text"/> |
| Voltage: | | | FLA: <input style="width: 80%;" type="text"/> |
| Phase: | | | Starting PF: <input style="width: 80%;" type="text"/> |
| Starting Method: | | | Running PF: <input style="width: 80%;" type="text"/> |
| VFD controlled / Style: | | | NEMA Code: <input style="width: 80%;" type="text"/> |
| Cooling Load: | KVA | <input style="width: 80%;" type="text"/> | Power Factor <input style="width: 80%;" type="text"/> |
| Heating Load: | KVA | <input style="width: 80%;" type="text"/> | Type: <input style="width: 80%;" type="text"/> |
| Interior Lighting: | KVA | <input style="width: 80%;" type="text"/> | Power Factor <input style="width: 80%;" type="text"/> |
| Exterior Lighting | KVA | <input style="width: 80%;" type="text"/> | Type: <input style="width: 80%;" type="text"/> |
| Receptacle Load: | KVA | <input style="width: 80%;" type="text"/> | |
| Kitchen Load: | KVA | <input style="width: 80%;" type="text"/> | |
| General Load: | KVA | <input style="width: 80%;" type="text"/> | |
| Total Connected Load: | KVA | <input style="width: 80%;" type="text"/> | |

| | | | |
|--|--|--------------------------|--|
| Below Information is required for Installation Coordination | | | |
| Service Type <i>(Please Check One)</i> | Underground | <input type="checkbox"/> | |
| | Overhead | <input type="checkbox"/> | With DPW APPROVAL ONLY |
| Service | | | |
| Raceway Size | <input style="width: 80%;" type="text"/> | | |
| Number of Raceway Sets | <input style="width: 80%;" type="text"/> | Spares | <input style="width: 80%;" type="text"/> |
| Conductors Size | <input style="width: 80%;" type="text"/> | Insulation Type | <input style="width: 80%;" type="text"/> |
| Number of Conductors | <input style="width: 80%;" type="text"/> | | |
| Conductor Type | AL <input type="checkbox"/> | CU | <input type="checkbox"/> |
| Service Equipment Type | | | |
| NEMA TYPE | <input style="width: 80%;" type="text"/> | | |
| Switchboard | CB <input type="checkbox"/> | Fuse | <input type="checkbox"/> |
| Panelboard | CB <input type="checkbox"/> | Fuse | <input type="checkbox"/> |
| Safety Switch (SE Rated) | CB <input type="checkbox"/> | Fuse | <input type="checkbox"/> |
| Over Current Protection Device | <input style="width: 80%;" type="text"/> | | |
| Ampacity | <input style="width: 80%;" type="text"/> | | |
| AVG Motor and other Equipment Efficiency | <input style="width: 80%;" type="text"/> | | |
| Ground Fault Protection | Yes <input type="checkbox"/> | No | <input type="checkbox"/> |



LEGEND

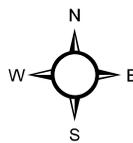
FIBER OPTIC
 TELEPHONE

TWISTED PAIR
 TELEPHONE

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 UPDATED EXISTING CONDITION
 MAPPING SHOULD BE ACQUIRED
 FROM THE FORT LEONARD WOOD
 PUBLIC WORKS.

Disclaimer.

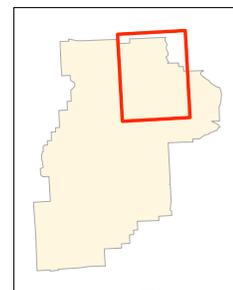
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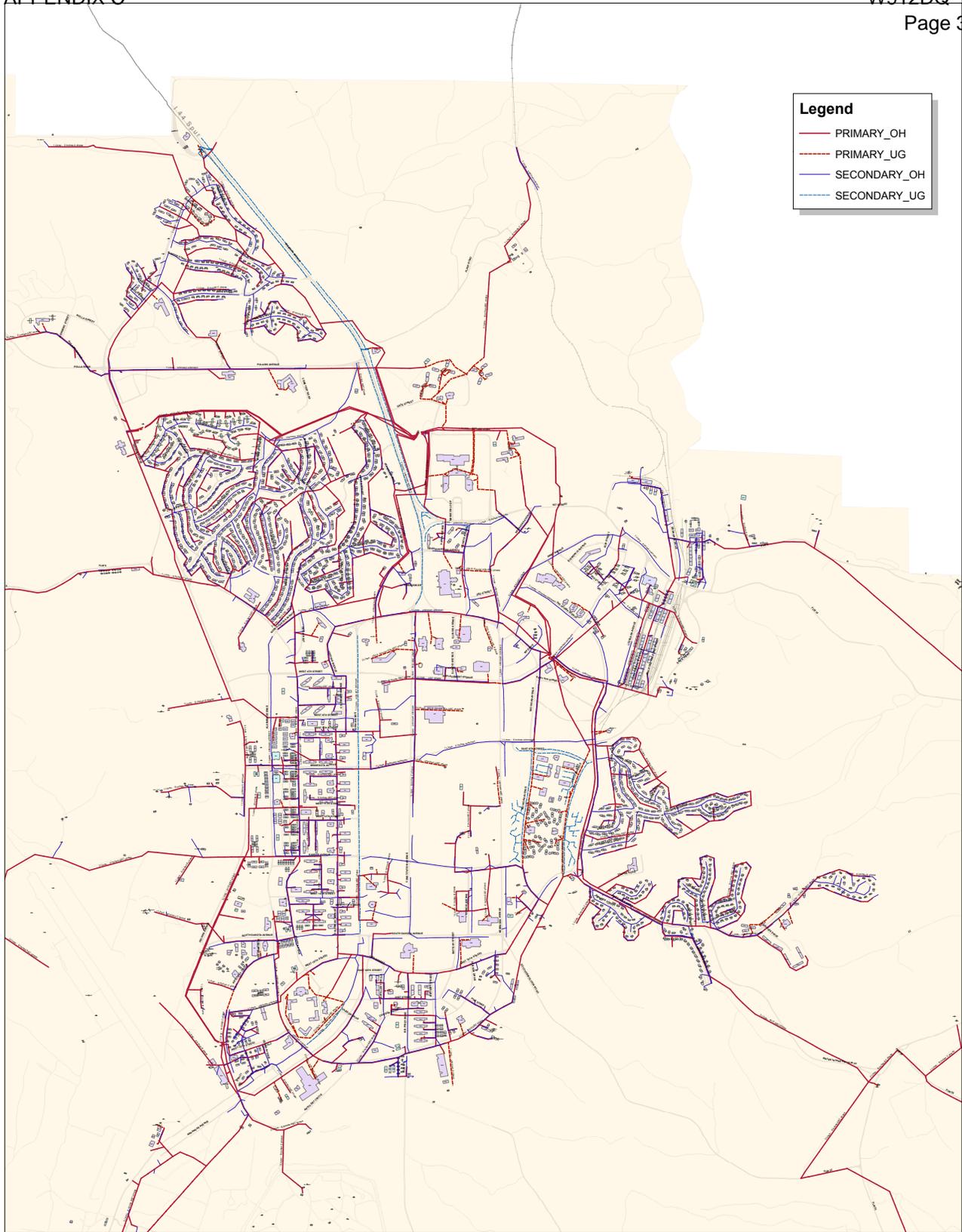
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 BASE INFORMATION MAPPING
 COMMUNICATION UTILITY PLAN

JULY 2007

SHEET 2 OF 8



Thursday, July 15, 2010



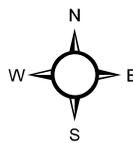
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- PRIMARY_OH
- PRIMARY_UG
- SECONDARY_OH
- SECONDARY_UG

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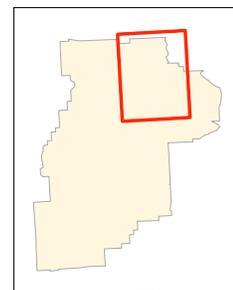
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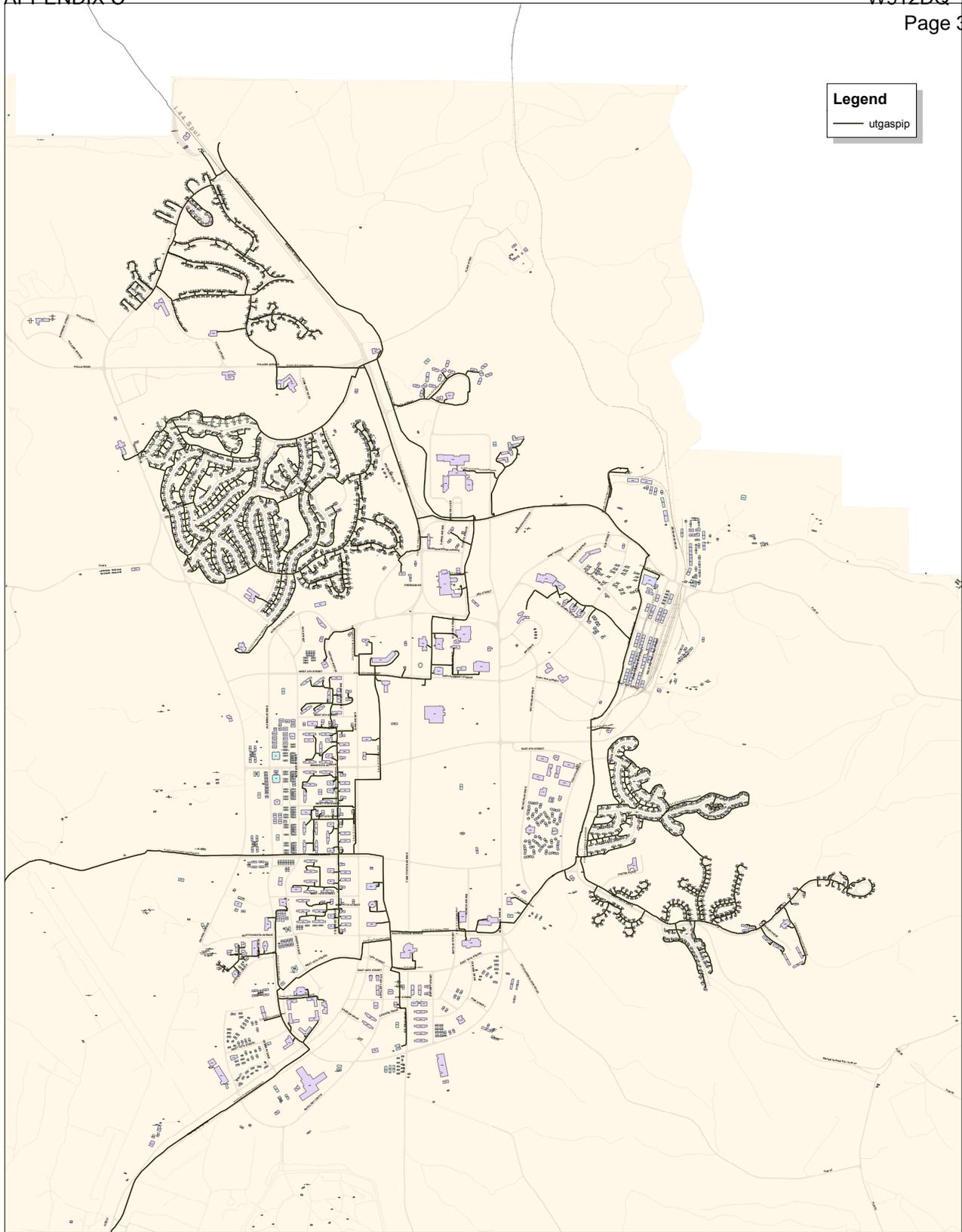
FORT LEONARD WOOD, MISSOURI
 BASE INFORMATION MAPPING
 ELECTRIC UTILITY PLAN

JULY 2007

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Thursday, July 15, 2010

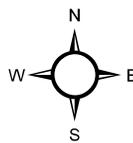


Legend
 — utgaspip

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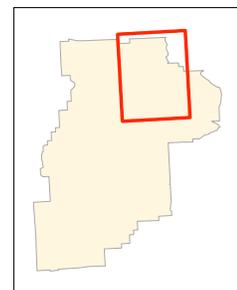
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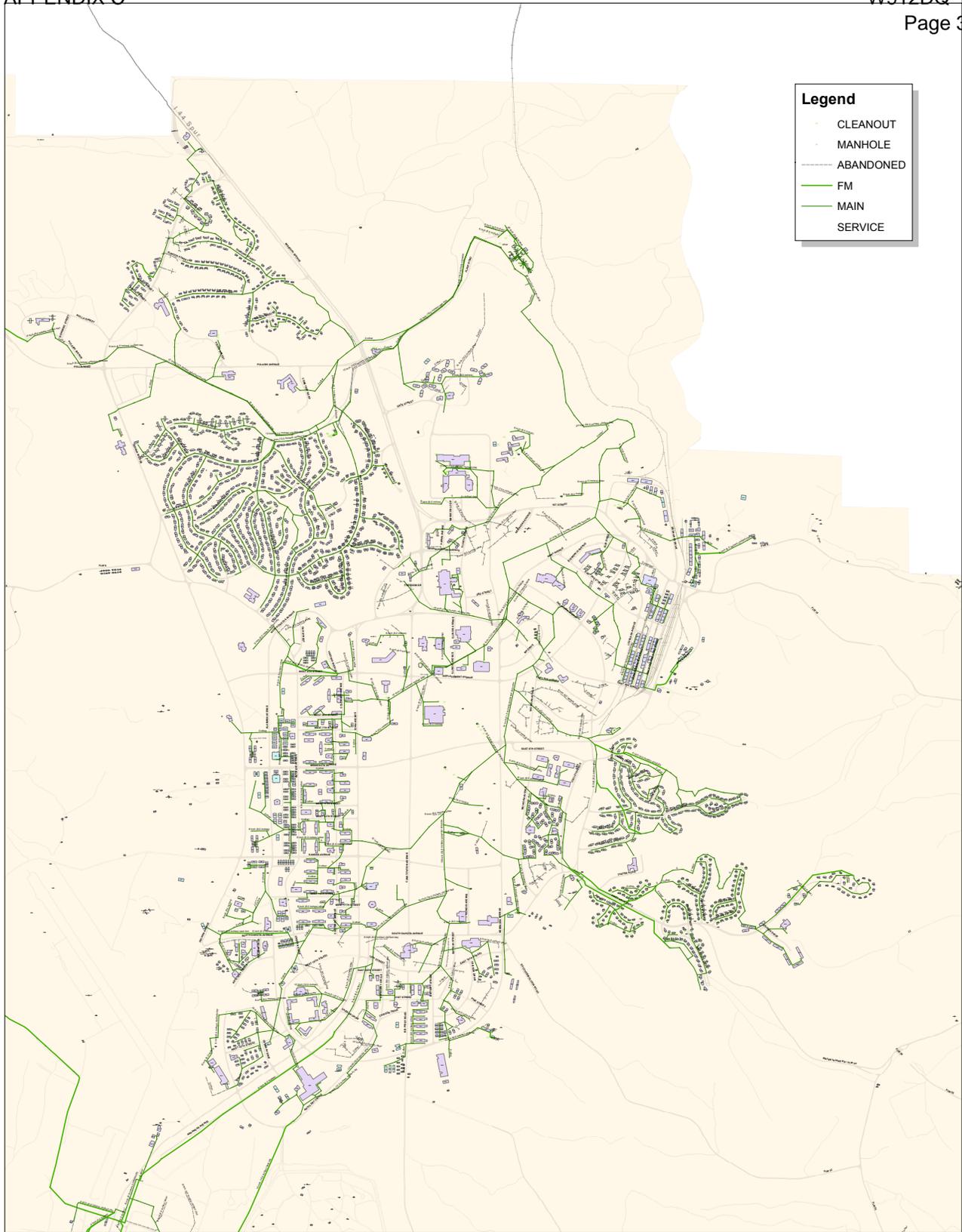
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 BASE INFORMATION MAPPING
 NATURAL GAS UTILITY PLAN

JULY 2007

SHEET 4 OF 8



Thursday, July 15, 2010



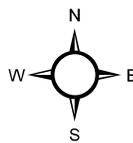
Legend

- CLEANOUT
- MANHOLE
- ABANDONED
- FM
- MAIN
- SERVICE

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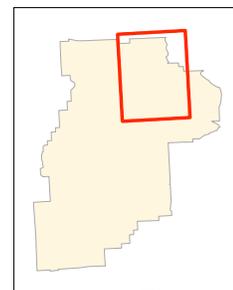
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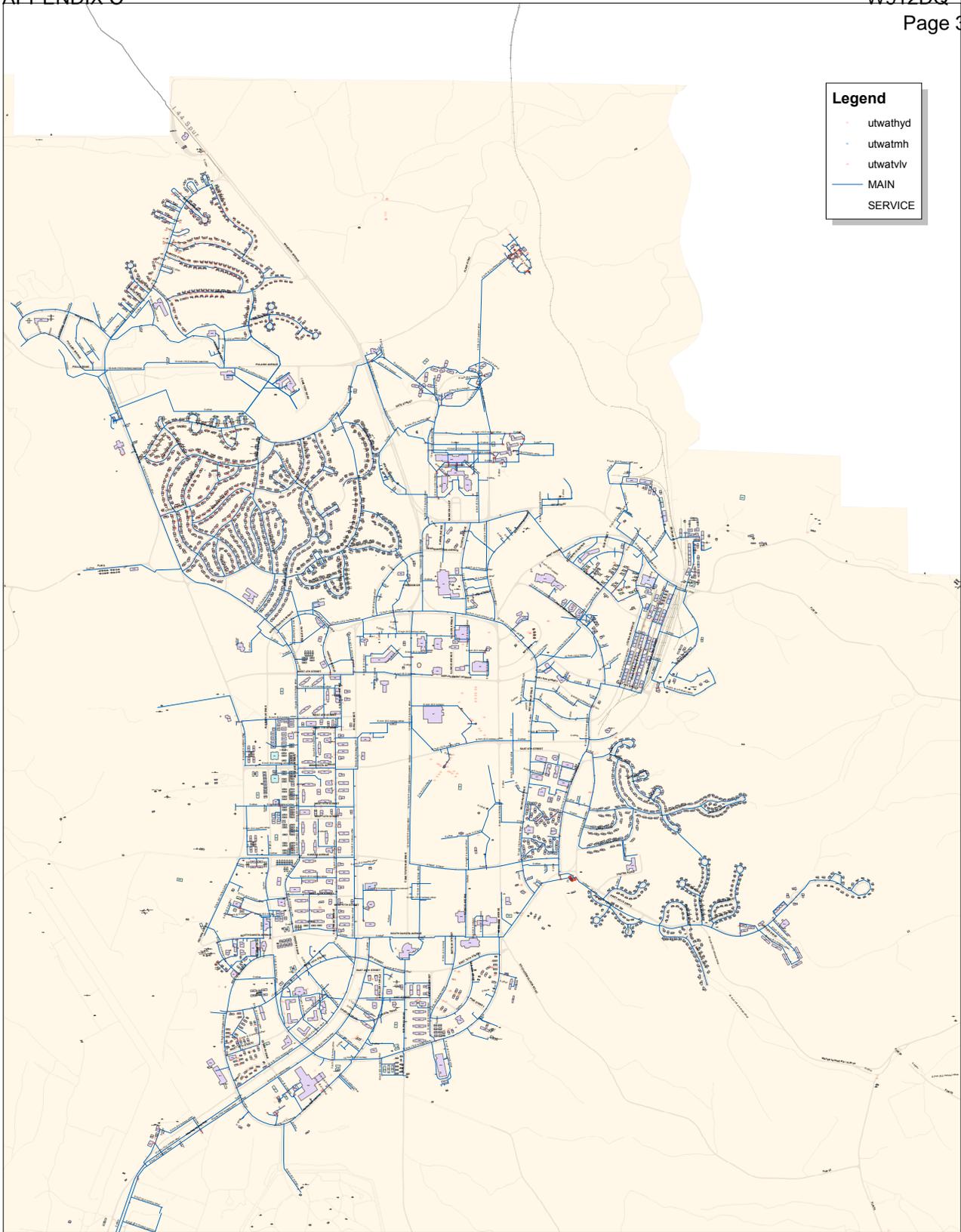
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 WASTEWATER UTILITY PLAN

JULY 2007

SHEET 7 OF 8



Thursday, July 15, 2010



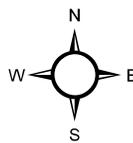
Legend

- utwathyd
- utwatmh
- utwatlv
- MAIN
- SERVICE

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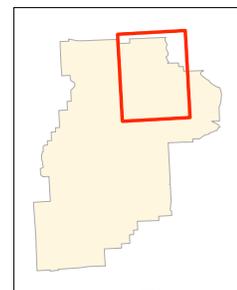
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 BASE INFORMATION MAPPING
 WATER UTILITY PLAN

JULY 2007

SHEET 8 OF 8



Thursday, July 15, 2010

ADVANCED WATER METER SPECIFICATION

31 MAR 2009

General specifications for all meters

| | |
|----------------------------|--|
| Quantities Measured: | Gallons of Water |
| Measurement Configuration: | Water Supply to a building. For buildings that already have a water meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a water meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output into a data gathering device. If the existing meter will not accept a pulse kit or if no meter exists, a new water meter will be installed, also requiring a pulse output to a data gathering device. |
| Operating Temperatures: | 32 degrees F to 120 degrees F. When exterior mounting is required, consider the local ambient temperature extremes and protect from freezing with insulated, moisture proof enclosures and heat tracing as required. |
| Humidity Operating Range: | 5% to 90% RH (non-condensing) |
| Accuracy: | 1.5% of scale. |
| Frequency: | Not less than one pulse per revolution. Meter pulser shall be coupled to the meter dial to provide a pulse rate of not less than one pulse per gallon of water. |

For non-LonWorks meter applications

Digital Output Only: Pulse Output

For LonWorks meter applications

Digital Output Only: Pulse Output

Water Meters shall be the turbine, propeller, or displacement type with pulse output chosen to meet the specific application (pipe size, flow, pressure, etc.).



Turbine Type Meters

Turbine type meters shall conform to AWWA C701 Class I or Class II depending on the application. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading

remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C701.



Propeller Type Meters

Propeller type meters shall conform to AWWA C704. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706 or an encoder-type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C703.



Displacement Type Meters

Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in U.S. gallons. Meters in sizes 1/2 through 1 shall be frost-protection design as required by the local environmental conditions. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C700.



Compound Type Meters

Compound type meters shall conform to AWWA C702 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. The main casing shall be tapped for field testing purposes. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The

meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register

designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C702.



Fire Service Type Meters

Provide Fire Service Type Meters as required by the Installation. Fire service type meters shall be proportional type or turbine type conforming to AWWA C703 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Any isolation valves

installed as part of the meter assembly shall either have tamper switches or be position indicating valves in accordance with NFPA. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C703. When turbine type main line meters are used, the meter shall be supplied with a separate check valve, as a unit.



Meter Boxes

Meter boxes shall be of cast iron, concrete, or plastic. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid suitable for vehicle wheel loads. Boxes set in sidewalks, not subject to vehicular traffic, shall be concrete with cast iron lid and cast iron meter reader lid. Plastic boxes and lids can be used in unpaved areas or grass areas not subject to vehicular traffic. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.



Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

Gate Valves Smaller than 3 Inch in Size

Gate valves smaller than 3 inch size shall meet MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators. Valves shall open by counterclockwise rotation of the valve stem.

Gate Valves 3 Inch Size and Larger

Gate valves 3 inch size and larger shall meet AWWA C500 or UL 262 and be of one manufacturer. Valves shall be AWWA C500, nonrising stem type with double-disc gates or UL 262, inside-screw type with operating nut, split wedge or double disc type gate, and designed for a hydraulic working pressure of 175 psi. Valves shall open by counterclockwise rotation of the valve stem.

End of Specification

EXECUTION:**Connections to Publicly or Privately Operated Water Utility Lines**

Contractor shall provide materials for the connections to the existing water lines. Final connections and the turning on of water shall be made by the utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of water lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new water lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

Connection to Government Owned/Operated Water Lines

Provide the name and location of the utility or operating agency of the existing water lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing water lines in accordance with approved procedures. The Contractor's Connection Plan shall be submitted and approved prior to making any connections to existing water lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made. Reactivation of any existing water lines will only be done by the Government.

Location of Meters

The location of meters and meter boxes shall be shown on the drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

Disinfection

Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

Field Tests and Inspections

Prior to hydrostatic testing, obtain Contracting Officer approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer will conduct

field inspections and witness field tests. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the approved Statement of Work.

Testing Procedure

Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at copper pipe joints, copper tubing joints (soldered, compression type, brazed), plastic pipe joints, flanged joints and screwed joints.

Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system. Hold this pressure for not less than 2 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

CLEANUP

Upon completion of the installation of water meters, all debris and surplus materials resulting from the work shall be removed.

End of Specification

Appendix D
Results of Fire Flow Tests

WATER FLOW TEST REPORT

FLW FIRE HYDRANT FLOW TEST

HYDRANT # & LOCATION 2200-009 Bldg 2553, Ordinance Street DATE: 1/16/2008
 TEST BY: DPW Day or Week: Monday TIME OF DAY: 8:30 MIN. OF FLOW: 5
 WATER SUPPLIED BY: Fort Leonard Wood Water Plant
 PURPOSE OF TEST: Flow Test

DATA

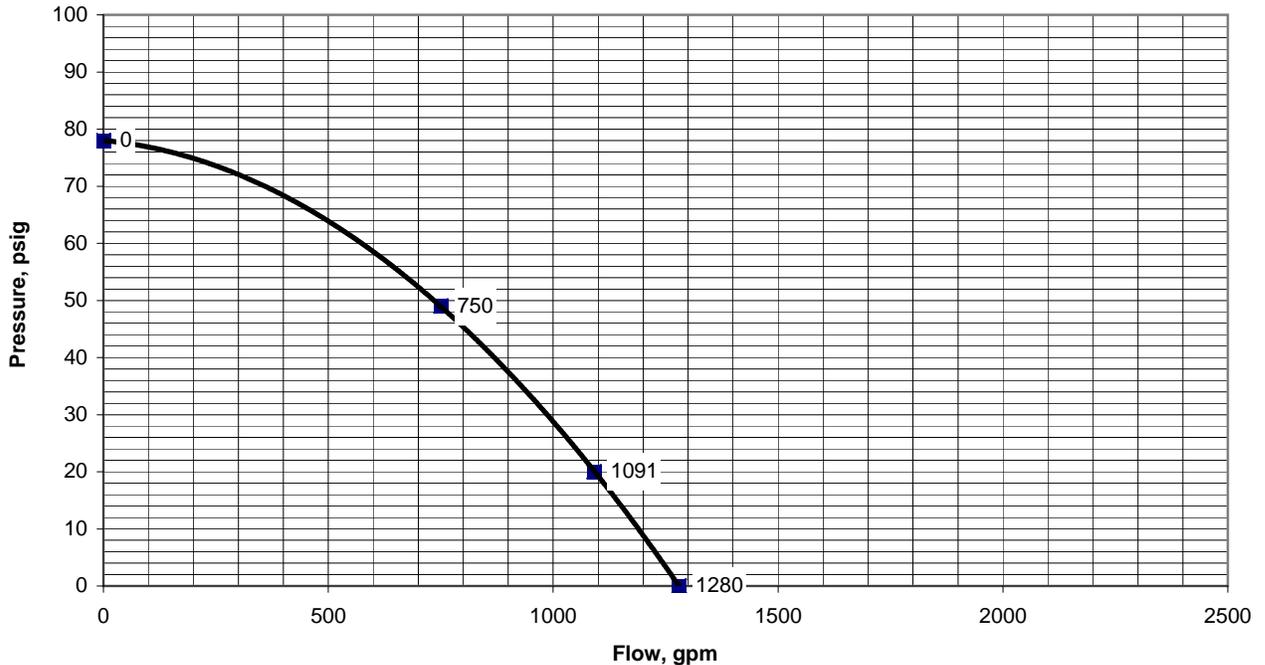
| FLOW HYDRANT(S) | A1 | A2 | A3 |
|-------------------------|----------------|----------|----------|
| SIZE OPENING: | <u>2.5</u> | _____ | _____ |
| COEFFICIENT: | <u>0.9</u> | _____ | _____ |
| PITOT READING: | <u>20</u> | _____ | _____ |
| GPM: | <u>750</u> | <u>0</u> | <u>0</u> |
| TOTAL FLOW DURING TEST: | <u>750</u> GPM | | |

STATIC READING: 78 PSI RESIDUAL: 49 PSI

RESULTS: AT 20 PSI RESIDUAL 1091 GPM AT 0 PSI 1280 GPM

ESTIMATED CONSUMPTION: 3752 GAL.

REMARKS: Static 2200-009 2007 Clow
 Flow 2200-010 1986 Mueller



WATER FLOW TEST REPORT

FLW FIRE HYDRANT FLOW TEST

HYDRANT # & LOCATION 2200-013 Bldg 2563 across street. DATE: 7/26/2008
 TEST BY: DPW Day or Week: Saturday TIME OF DAY: 8:30 MIN. OF FLOW: 5
 WATER SUPPLIED BY: Fort Leonard Wood Water Plant
 PURPOSE OF TEST: Flow Test

DATA

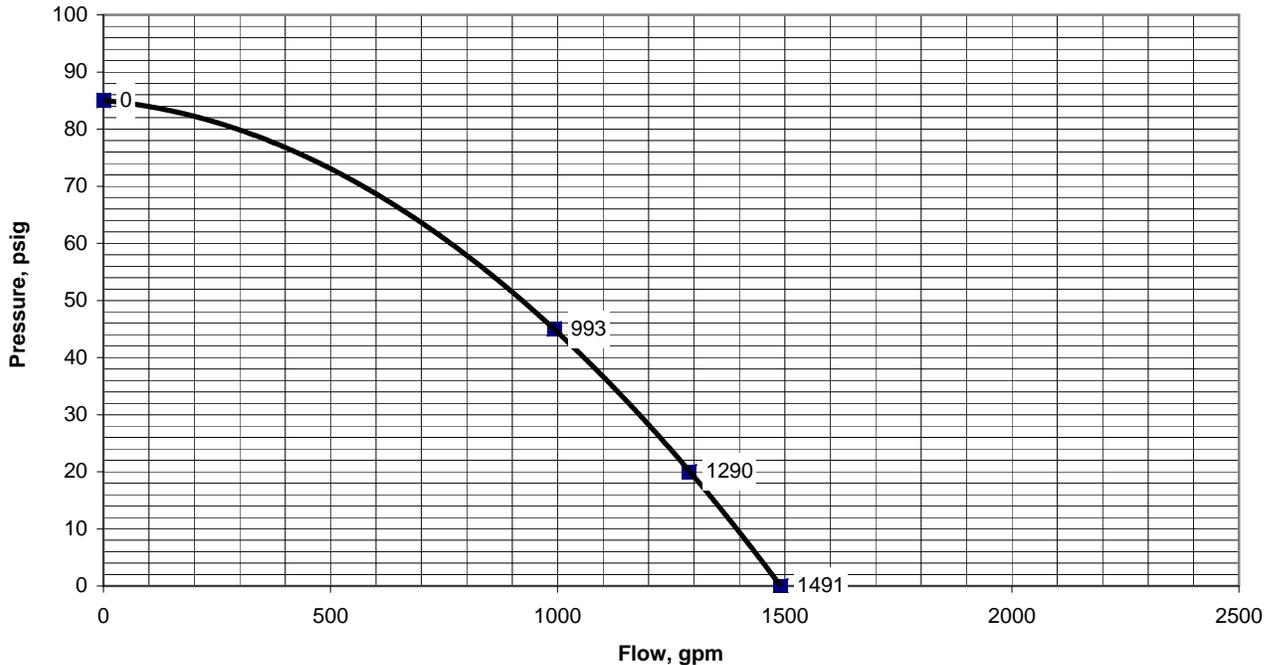
| FLOW HYDRANT(S) | A1 | A2 | A3 |
|-------------------------|-----------------------|----------|----------|
| SIZE OPENING: | <u>2.5</u> | _____ | _____ |
| COEFFICIENT: | <u>0.9</u> | _____ | _____ |
| PITOT READING: | <u>35</u> | _____ | _____ |
| GPM: | <u>993</u> | <u>0</u> | <u>0</u> |
| TOTAL FLOW DURING TEST: | <u>993</u> GPM | | |

STATIC READING: 85 PSI RESIDUAL: 45 PSI

RESULTS: AT 20 PSI RESIDUAL **1290** GPM AT 0 PSI **1491** GPM

ESTIMATED CONSUMPTION: **4963** GAL.

REMARKS: Static 2200-013 1971 American
 Flow 2200-016 1956 American



Appendix E
Environmental Information

ENVIRONMENTAL REQUIREMENTS**ENVIRONMENTAL DIVISION****STANDARD CONTRACT LANGUAGE (revision of 21 December 2009)**

1. **NATIONAL ENVIRONMENTAL POLICY ACT (NEPA):** NEPA requires that all Army facilities complete an environmental impact analysis according to 32 Code of Federal Regulations Part 651 and Army Regulation 200-2, for proposed actions. This analysis considers the anticipated direct, indirect, and cumulative impacts of the specific proposed action on the natural, human, and socioeconomic environment. This project was reviewed by the DPW Environmental Division and a NEPA document prepared which contains a site analysis and site specific requirements. This is a legally binding document and the requirements contained in it must be adhered to in addition to the Standard Environmental Contract Language. The contractor shall reference the NEPA review documents and shall contact the Environmental Division (596-0882) for clarification of any requirement: The documentation will be at the Environmental Division if none is available in the contract, and the contractor shall seek out that information if it has not otherwise been provided prior to the beginning of any contracted activities.

2. **NATURAL RESOURCES:**
 - 2.1. **Forest Products** – If the work area contains trees that must be removed, the area must be surveyed for salvageable forest products, which must be disposed of in accordance with AR 405-90, Disposal of Real Estate, and AR 200-1, Environmental Protection and Enhancement. At such time as the project limits are established, the DPW Natural Resource Branch (NRB) must conduct a survey and provide a map and fair market value of the timber.
 - 2.2. **Threatened & Endangered Species** – If the area contains potential roost trees (dead or dying trees with sloughing bark) for the Indiana bat, a federally endangered species, these trees may only be removed during the period of 01 November through 31 March of the following year.
 - 2.3. **Cultural Resources** – The Contractor shall protect existing historical, archaeological, and cultural resources within the work area and shall be responsible for their preservation during the life of the Contract. Work affecting these resources is not allowed unless prior approval is received by the Fort Leonard Wood DPW Natural Resources Branch. If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this include but are not limited to any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other unexpected constructed feature; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made.

3. **WATER QUALITY:**
 - 3.1. **Spill Prevention and Response Plan** – A Spill Prevention and Response Plan is required and shall include the procedures, instructions, and reports to be used in the event of a spill of a substance regulated by 40 CFR 112, 40 CFR 265, and/or regulated under State or Local laws and regulations. This plan shall include the name of the individual who will report any spills or hazardous substance releases, and the individual who will follow up with complete documentation.
 - 3.2. **Spill Response** – Spills of hazardous materials/wastes, and spills of petroleum/oil/lubricants, shall be immediately reported and cleaned up to the satisfaction of the Fort Leonard Wood Environmental Branch at the Contractor's expense. Spills must be reported immediately to the local Fire Department (911), the Fort Leonard Wood Environmental Branch (573/596-0882), and the Contracting Officer (CO/COR). The Contractor shall cease all activity in the area of the spill or in the area of discovered contamination and shall not commence work in that area until so directed by the CO/COR. Contractor shall provide verification, as required, that Contractor employees are properly trained in spill response and cleanup in accordance with all Federal, State, Local, and Fort Leonard Wood laws and regulations and guidance. The

Contractor shall prepare the "Fort Leonard Wood Spill Report" form, **Attachment 1**. The completed form shall be submitted to the Environmental Branch via the CO/COR.

- 3.3. **Secondary Containment** – All petroleum, oil, lubricants, hazardous materials, and hazardous wastes in 55-gallon containers or larger must have secondary containment capable of holding at least 110% of the capacity of the single largest container. This also applies to animal-based and vegetable-based grease commonly associated with dining facilities.
- 3.4. **Rinsate** – Rinsate from cement trucks must be contained on site and not allowed to discharge from the site.
- 3.5. **Backflow Preventers** – All facilities must have backflow preventers on service lines plus potential cross contamination sources.
- 3.6. **Stormwater Runoff and On-site Erosion and Sediment Control** – All sites with land disturbing activities, regardless of size, must install erosion and sediment control measures to prevent erosion and sediment from leaving the land disturbance site. Land disturbing activities 1-acre or greater require a Permit from the Missouri Department of Natural Resources. All sites must be final stabilized through re-vegetation or medium such as gravel or rock.
- 3.6.1. **Stormwater Runoff** – Section 438 of the Energy Independence and Security Act of 2007 requires "The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow."
- 3.6.2. **On-site Erosion and Sediment Control** – All sites with land disturbing activities less than 1-acre must install erosion and sediment control measures to prevent erosion and sediment from leaving the land disturbance site and be restored per the approved FLW Excavation Permit, ("Dig Permit") FLW Form 364. Land disturbing activities 1-acre or greater require a Land Disturbance Permit from the Missouri Department of Natural Resources. Refer to Section 6.6 for the Land Disturbance Permit requirements.

4. TOXIC SUBSTANCES:

- 4.1. **Lead-Based Paint** – No lead-based paint (LBP) or materials containing LBP may be used at Fort Leonard Wood. With a demolition or renovation, if the presence of lead-based paint (LBP) is unknown, it should be assumed to be present, especially in structures built prior to 1980. Demolition of structures containing LBP must be done using precautions to prevent the release of the hazardous substance, such as whole component removal. If whole components containing LBP are removed or if a building is demolished, Missouri Department of Natural Resources (MDNR) Solid Waste Regulations require disposal in a State-permitted demolition or sanitary landfill. Or, a structure may be remediated by removing the lead-based paint using lead-safe work practices; however, any lead-based paint removed or recovered from the site must be handled as Hazardous Waste IAW Federal, State, Local, and FLW Regulations. For additional information, contact the DPW Environmental Branch (573/596-0882).
- 4.1.1. For any lead-based paint remediation performed by a Contractor other than the Base Maintenance Contractor, all lead-based paint and/or other hazardous wastes must be packaged, labeled, marked, and disposed of by the Contractor performing the work according to Federal, State, Local, and FLW Regulations. All hazardous waste manifests must be signed by the FLW Hazardous Waste Program Manager. Manifests shall be provided at least 48 hours prior to the expected shipment date. Under no circumstances will hazardous waste be handled or removed from the site without first consulting with the FLW Hazardous Waste Program Manager. The appropriate test method to make a non-hazardous determination, should the Contractor elect to have the waste tested, is the Toxicity Characteristic Leaching Procedure (TCLP), EPA Method 1311, which is described in Appendix 11, 40 CFR Part 261. All test results shall be provided to the FLW Hazardous Waste Program Manager for review. This includes TCLP testing and any other analytical testing performed that impacts the determination of wastes from this site.
- 4.2. **Non-Liquid Polychlorinated Biphenyls** – PCBs may be present in the caulk used in windows, door frames, masonry columns and other masonry building materials in many buildings, including schools, built

or renovated between 1950 and 1978. The contractor shall coordinate all potential NLPCB related work (i.e., work on such facilities and structures as described above) with the FLW environmental office, who must approve all sampling and work. No PCBs may be used at Fort Leonard Wood. If building materials containing PCBs are to be removed, a PCB Removal Plan shall be submitted to the Fort Leonard Wood Environmental Branch for approval prior to commencement. Contact the Fort Leonard Wood Environmental Branch at 573/596-0882 for further clarification.

4.3. **Asbestos Containing Materials** – No Asbestos Containing Materials (ACMs) may be used at Fort Leonard Wood. All 9-square-inch floor tile is assumed to contain asbestos and some 12-square-inch tile contains asbestos, therefore, floor tile that is broken, in poor condition, or is to be disturbed needs to be tested for asbestos content prior to beginning work. Furthermore, if any suspect ACMs are discovered, the project must stop, and the suspect material must be tested for asbestos content. If applicable, the Contractor is responsible for testing and must coordinate the testing with the Fort Leonard Wood DPW Environmental Branch. The testing may be done only by certified individuals. If testing confirms that asbestos is present, then the ACMs may be removed only by individuals certified to remove ACMs, and the ACMs must be disposed of in accordance with all applicable Federal, State, and Local regulations, including Fort Leonard Wood policies. Upon conclusion of the Asbestos removal, the Contractor is required to complete the “Fort Leonard Wood Asbestos Project Compliance and Completion” form, [Attachment 2](#), and submit the completed form to the Environmental Branch via the CO/COR. Contact the Fort Leonard Wood DPW Environmental Branch at 573/596-0882 for more information.

5. WASTE MANAGEMENT:

5.1. **Debris Burning** – Fort Leonard Wood restrictions do not allow construction materials, demolition materials, or any debris to be burned.

5.2. **Solid Wastes** – Solid wastes (excluding land clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill shall be the minimum acceptable off-site solid waste disposal. The Contractor shall verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. The Contractor shall comply with Federal, State, local laws and regulations and Fort Leonard Wood guidance pertaining to the use of landfill areas.

5.3. **Contractor Generated Hazardous Wastes/Excess Hazardous Materials** – Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable State and local regulations. Hazardous materials are defined in 49 CFR 171 – 178. The Contractor shall, at a minimum, manage and store hazardous waste in compliance with 40 CFR 262. The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. The Contractor shall segregate hazardous waste from other materials and wastes, shall protect it from the weather by placing it in a safe covered location, and shall take precautionary measures such as berming or other appropriate measures against accidental spillage. The Contractor shall be responsible for storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 – 178, State, and local laws and regulations. The Contractor shall transport Contractor generated hazardous waste off Government property in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. The Contractor shall dispose of hazardous waste in compliance with Federal, State, and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the local Fire Department (911), the Fort Leonard Wood Environmental Branch (573-596-0882), and the Contracting Officer Representative. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility. The disposition of Contractor generated hazardous waste and excess hazardous materials are the Contractor's responsibility.

5.4. **Disposition of Materials** – All materials removed and not reused or designated as salvage material in this project shall become the property of the Contractor. The Contractor shall dispose of such materials at a State and Resource Conservation and Recovery Act approved Treatment, Storage, and Disposal Facility or permitted off-post landfill licensed by the state of Missouri. The Contractor shall lawfully dispose of such materials at the Contractor's sole expense in accordance with the following rules. On a case by case basis, and only with written permission from DPW Environmental Branch and also direction from the

Contracting Officer (CO) or Contracting Officer's Representative (COR), natural land clearing wastes and or clean fill may be allowed to remain on Fort Leonard Wood (FLW) property. Any costs contained in the contract for off site (FLW) disposal shall be reimbursed to the government when disposition of natural land clearing waste and or clean fill is authorized for use on FLW property.

5.5. Recyclable Materials – The Contractor shall recycle products whenever possible and to the fullest extent practicable. Recycling shall be in accordance with all Federal, State, Local, and Fort Leonard Wood laws and regulations and guidance. The Contractor shall deliver all uncontaminated recyclable materials to the Fort Leonard Wood Recycling Center, Building 2549 during normal business hours M-F 0800-1630. Current recyclable materials include clean corrugated and non-corrugated cardboard, plastic and aluminum. Wood pallets in good condition shall be recycled during normal business hours M-F 0800-1630 (see Recycle Center attendant before unloading pallets). Unusable pallets shall be broken up and placed in dumpsters. Materials not currently recyclable by the Fort Leonard Wood Recycling Center shall be disposed of as provided below.

5.6. Disposal of Waste, Natural Materials.

5.6.1. Burning of Woody Natural Materials. Burning of woody natural materials, logs, stumps, limbs etc is allowed only with an Air Curtain Destructor or equivalent high efficiency equipment and only with written approval by the DPW Environmental Branch. The DPW Environmental Branch will review the proposal to determine the potential impact to the Installation's Air Quality Permit and Air Monitors. If authorization is granted, the Contractor will still be subject to shut-down if deemed necessary by the DPW Environmental Branch in order to prevent impacts to training and operations and/or avoid Air Quality Permit compliance impacts. Tonnage of woody natural materials burned will be recorded on the FLW Construction and Demolition waste management report, Attachment #3. All ash generated will be disposed of in accordance with all federal, state, local and FLW guidance and regulations at the contractors expense.

5.6.2. Cantonment – The Contractor shall dispose of leaves and grass clippings (removed from bags) generated by this project at the Fort Leonard Wood Compost Area or off of FLW property and in accordance with all federal, state, local laws and FLW regulations and guidance. The Contractor shall dispose of logs greater than 6 inches in diameter either by disposal at a Fort Leonard Wood Fire Wood Cutting Site (or other designated location on Fort Leonard Wood after written approval is provided by the DPW Environmental Branch and direction is provided by the CO or COR), or by sale or retention for sale, or off of FLW property in accordance with all federal, state, local laws and FLW regulations and guidance. The Contractor shall dispose of wood chips, tree stumps and logs, limbs and brush less than 6 inches in diameter and all other natural waste material off of FLW property, in accordance with all federal state local laws and Fort Leonard Wood regulations and guidance. Or on a case by case basis a site on FLW property may be provided for disposition. Written permission from DPW Environmental must be obtained prior to disposition which will only be done at the direction of the CO or COR. Natural chipped materials may also be beneficially reused on the project site to include permanent on-site erosion control berms only per the NPDES permit not to exceed three (3) feet high by six (6) feet wide, or for disposition or sale as mulch.

5.6.3. Range and Training Areas, potentially containing metal residue from munitions firing - As determined by DPW Environmental Branch and DPTM, all waste natural materials potentially containing metal residue from munitions firing shall remain on site and shall not be mulched, chipped or placed in drainage ways. Any other disposition of materials from these areas shall be in accordance with all federal, state, local laws and FLW regulations and guidance.

5.6.4. Range and Training Areas, without metal residue from munitions firing - Logs greater than 6 inches in diameter *may be* sold or placed at a designated location on Fort Leonard Wood after written approval is provided by the DPW Environmental Branch and direction is provided by the CO or COR). Stumps and Brush less than 6 inches in diameter shall be disposed off of FLW property and in accordance with all federal, state, local laws and FLW regulations and guidance. Wood chips may be used for onsite erosion control berms not to exceed (3) feet high by (6) feet wide, used as mulch or sold. Whole Stumps may be used on site for erosion control in drainage areas or as project design features such as lane markers. No natural Materials listed in 5.6.3 may be brought on to the Training Areas (TAs) or Ranges from other sites for disposition unless they are to be used on site for erosion control or project design features. The Contractor shall remove and dispose of all unused natural waste material from FLW property in accordance with all federal, state, local laws and FLW regulations and guidance before the contract is completed.

- 5.7. **Disposal of Waste, Fill Materials** – The Contractor shall dispose of clean waste fill materials (unpainted cinder block, brick and concrete with no exposed steel, rock, asphalt, and clean soil with no organic material) at a landfill off-Post licensed by the State of Missouri to accept such waste, or on a case by case basis and only with written approval by DPW Environmental Branch and also with direction from the CO or COR may use the Fort Leonard Wood Clean Fill site or other sites on FLW approved for use by the DPW and DPW Environmental Branch. Concrete shall have no exposed or protruding steel. The Contractor shall dispose of contaminated waste fill materials at a landfill off-post licensed by the State of Missouri to accept such waste. The Contractor shall provide all necessary information for disposal to the landfill operator, including any required testing of materials and completion of forms required by the Missouri Department of Natural Resources (MDNR).
- 5.8. **Disposal of Demolition Waste** – The Contractor shall recycle all construction and demolition waste to the fullest extent possible. The Contractor shall complete the “Fort Leonard Wood Construction and Demolition Waste Management Report”, **Attachment 3**, as specified in the document and comply with all guidance contained in the document. The completed form shall be submitted to the Environmental Branch via the CO/COR. In accordance with Executive Order 13423 “Strengthening Federal Environmental, Energy and Transportation Management” January 24, 2007 a minimum of 50% by weight of the total project solid waste shall be diverted from the landfill. The Contractor shall dispose of demolition waste at a landfill off-post licensed by the State of Missouri to accept such waste. Disposal of demolition waste shall be in accordance with 10 CSR Chapter 80-4. The Contractor shall provide all necessary forms and information for the disposal to the landfill operator and MDNR.
- 5.9. **Disposal of Hazardous Waste** – The contractor shall be responsible for the costs of testing and disposal of hazardous waste; all hazardous wastes must be packaged, labeled, marked and disposed of by the contractor performing the work IAW Federal, State, Local, and FLW Regulations. All hazardous waste manifests must be signed by the FLW Hazardous Waste Program Manager. Manifests shall be provided at least 48 hours prior to the expected shipment date. Under no circumstances will hazardous waste be handled or removed from the site without first consulting with the FLW Hazardous Waste Program Manager. The appropriate test method to make a non-hazardous determination, should the contractor elect to have the waste tested, is the Toxicity Characteristic Leaching Procedure (TCLP), EPA Method 1311, which is described in Appendix 11, 40 CFR Part 261. All test results shall be made available to the FLW Hazardous Waste Program Manager for review. This includes TCLP testing and any other analytical testing performed which impacts the determination of wastes from this site. The Contractor shall dispose of any wastes classified as hazardous wastes under the Resource Recovery and Conservation Act (RCRA) in accordance with all Federal, State, local, and Fort Leonard Wood laws and regulations and guidance regarding storage, manifesting, shipment, treatment and disposal of such materials. The storage, containerization, characterization, labeling, placarding, documentation, transportation and final disposition of all hazardous waste will be accomplished in accordance with all Federal, State, local, and Fort Leonard Wood laws and regulations and guidance. The Contractor will procure all necessary licenses, permits and authorizations. All mercury containing thermostats and switches, PCB ballasts and fluorescent lighting will be disposed of through the Fort Leonard Wood base maintenance Contractor according to the Fort Leonard Wood SOP “Lighting and Thermostat Recycle/Disposal Guidance.” The Contractor shall lawfully dispose of materials at the Contractor’s sole expense. Notification and approval by the Contracting Officer and the Fort Leonard Wood Environmental Coordinator is required 10 business days prior to any action related to the disposal of hazardous waste. The Government will have and exercise full and complete control over determining suitability of the Treatment, Storage, and Disposal Facility (TSDF).
- 5.10. **Disposal of Other Waste** – The Contractor shall dispose of any wastes not specifically covered here at a landfill off-post licensed by the State of Missouri to accept such waste.
- 5.11. **Waste Management Documentation** – The Contractor shall document all wastes disposed of outside of Fort Leonard Wood by delivering to the CO/COR a landfill disposal form signed and dated by the landfill operator which shows the nature, amount and location of materials delivered to the landfill. In case of sale of logs or retention for sale of logs, the Contractor shall provide a signed statement indicating the disposition of the logs. Construction and Demolition debris will be documented on the Fort Leonard Wood Construction and Demolition Waste Management Report form, attached.
- 5.11.1. When applicable, the Contractor shall provide the generator, at each site, a properly prepared, typed and error-free, hazardous/special waste manifest and the Toxic Characteristic Leaching Procedure (TCLP) EPA method 1311 analysis appropriate to the waste and current waste profile from

the TSDF each time waste is offered for transportation off site. A written Land Disposal Restriction Notice shall accompany each hazardous/special waste manifest, as required. The Contractor shall ensure the completed manifest is returned to the generator within 35 days from the initial transporter's date of signature. The Contractor shall provide the generator at each site a certification of disposal statement for each hazardous/special waste manifest initiated. The Contractor shall also document all waste disposals by delivering to the CO/COR copies of the landfill disposal form signed and dated by the landfill operator which shows the nature, amount, and location of materials delivered to the landfill. In case of sale of logs or retention for sale of logs, the Contractor shall provide a signed statement indicating the disposition of the logs. Copies of this documentation shall be provided to the Contracting Officer prior to requesting final payment on the affected order(s). The work outlined above is a subsidiary portion of the contract work, and is assigned a value of 5% of the value of each affected project. The Contractor shall assign a value of that amount in the breakdown for progress payments. If the Contractor fails to maintain and provide environmental documentation as required herein, the Government will consider that satisfactory progress has not been achieved, thereby requiring the retention of 5% from any request for progress payment, on top of any other retainage applied for cause.

6. **PERMITS:** It shall be the responsibility of the Contractor to obtain *all* permits/licenses required for performance of the contract. The Contractor shall be responsible for determining the fee basis and paying all filing fees and taxes. Payment of fines, penalties, and associated fees for noncompliance or improper performance of applicable work shall be the responsibility of the Contractor. The Contractor shall perform all work in compliance with the Permit. The Contractor shall allow entry to State and Federal regulatory agency inspectors. The Contractor shall be responsible for any fines and penalties associated with non-compliance. The Contractor Copies of the permit applications and associated documentation shall be routed through the Contracting Officer/Contracting Officer Representative to the appropriate DPW Divisions for review and approval prior to submittal. A transmittal letter signed by the current DPW Director will be provided as the Missouri Department of Natural Resources (MDNR) will not accept or process the application for the associated permit without the signed transmittal letter. This is a time consuming effort and the Contractor should begin the permit process well in advance of the Notice to Proceed in order to avoid delaying the start of the project. A copy of all approved permits shall be submitted to the Contracting Officer/Contracting Officer Representative and the Environmental Branch (573/596-0882).

6.1. **Drinking Water Permits** – Should a water main extension or a fire hydrant be installed required as part of this contract, or any modification to the water system that would require a permit as outlined in 10 CSR 60-3, the Contractor is responsible for obtaining that permit from MDNR. Water permits are issued from the Jefferson City Office. In addition to the permit application, eight sets of DRAFT professional engineer stamped plans and specifications must be submitted for the DPW to review prior to final approval from the Director. Government comments must be resolved prior to preparation of final documents. Once approved, two sets of Final Missouri Professional Engineer stamped plans and specifications, along with the completed permit application forms, are submitted to the DPW Operations Division. Once the cover letter has been signed by the DPW Director, the Contractor will then forward plans/specs/permit application/fees to MDNR. Should MDNR require additional information, the same procedures will be followed prior to forwarding to the State. A copy of the permit must be provided to the DPW Environmental Branch for official records within five (5) business days of receipt. Any permit application fees are to be paid by the Contractor. The Contractor is responsible for full compliance with all terms and conditions of the permit. This work may not proceed until the State issued permit is provided and posted at the job site as required by the permit. Once the project is complete, the Contractor's Professional Engineer will complete the "Statement of Work Completed" form, furnished with the permit and provide the signed form to the DPW Environmental Branch for forwarding to MDNR.

6.2. **Waste Water Permits** – Should a waste water main extension or a Lift Station be installed as part of this contract, or any modification to the wastewater system that would require a permit as outlined in 10 CSR 20-6.010, the Contractor is responsible for obtaining that permit from MDNR. Waste water permits are issued from the Rolla Satellite Office. In addition to the permit application, eight sets of DRAFT professional engineer stamped plans and specifications must be submitted for the DPW to review prior to final approval from the Director. Government comments must be resolved prior to preparation of final documents. Once approved, two sets of Final Missouri Professional Engineer stamped plans and specifications, along with the completed permit application forms, are submitted to the DPW Operations

Division. Once the cover letter has been signed by the DPW Director, the Contractor will then forward plans/specs/permit application/fees to MDNR. Should MDNR require additional information, the same procedures will be followed prior to forwarding to the State. A copy of the permit must be provided to the DPW Environmental Branch for official records within five (5) business days of receipt. Any permit application fees are to be paid by the Contractor. The Contractor is responsible for full compliance with all terms and conditions of the permit. This work may not proceed until the State issued permit is provided and posted at the job site as required by the permit. Once the project is complete, the Contractor's Professional Engineer will complete the "Application for Letter of Authorization" form, furnished with the permit, and provide the form to the DPW Environmental Branch to be submitted to MDNR. If a waste water Lift Station is required as part of this contract, a backup generator is required for support in the event electrical power becomes unavailable.

6.3. Air Permits – Air emissions sources require construction permits in Missouri. Air permits are issued for the specific design and equipment (stacks, vents, exhaust systems, open vats, storage tanks (sources of evaporation), incinerators, boilers, generators (i.e., any combustion equipment), etc.). It is the Contractor's responsibility to obtain permits before construction starts and ensure compliance with the permit. Route all air permit requests through the CO/COR.

6.4. Land Disturbance Permits (National Pollutant Discharge Elimination System Permits) – Land disturbance is defined as any activity that disturbs the root zone of vegetation or disturbs compacted soil to an erodible state such as clearing, grubbing and grading. Should the project entail land disturbance of 1-acre or greater, but less than 5-acres, State Form O must be completed (in accordance with 10 CSR 20-6.200) and provided to the Contracting Officer/Contracting Officer Representative. For projects that cause land disturbance of 5 acres or more, State Forms E and G must be completed (in accordance with 10 CSR 20-6.200) and provided to the Contracting Officer/Contracting Officer Representative (CO/COR). In addition, a Storm Water Pollution Prevention Plan (SWPPP) must be provided (in accordance with 10 CSR 20-6.200) that includes a site specific sketch/drawing showing all planned erosion control devices. In addition to the appropriate State forms, a USGS 1" = 2,000' scale map showing the exact location of the project is required. Once approved, a signed cover letter from the Director of Public Works will be provided to the Contractor to include with the application. The Contractor will forward the permit application/drawings/fees to the MDNR. Any permit application fees are to be paid by the Contractor.

6.4.1. The Contractor is responsible for compliance with all terms and conditions contained in the permit until the Permit is formally terminated by the Missouri Department of Natural Resources. Earth disturbing activities may not proceed until the State issued permit is obtained and posted at the job site as required by the permit. **Attachment 4** provides a sample copy of a Permit.

6.4.2. Each site with a Land Disturbance Permit must provide copies of the completed weekly inspection reports and completed inspection reports no more than 48-hours after a rain event. The Contractor must also complete and submit monthly the "Fort Leonard Wood Land Disturbance Permit Compliance Self Certification" form, **Attachment 5**. All inspection reports and monthly Compliance Certification submittals are required until the Permit is terminated by the Missouri Department of Natural Resources. All submittals are to be provided within 5-days of completion to the DPW Environmental Branch via the CO/COR.

6.4.3. Interim soil stabilization is required until final stabilization is met. All sites must be final stabilized as per the Missouri Permit: "The project is considered to be stabilized when perennial vegetation, pavement, buildings, or structures using permanent materials cover all areas that have been disturbed. With respect to areas that have been vegetated, vegetative cover shall be at least 70% of fully established plant density over 100% of the disturbed site." Use of Missouri native perennial vegetation is highly encouraged.

6.5. Missouri Separate Storm Sewer (MS4) Permit – Construction activities occurring on Department of Army Fort Leonard Wood property are regulated by a Municipal Separate Storm Sewer System (MS4) Permit. This is a permit, regulated by the Environmental Protection Agency under the Clean Water Act and administered by the Missouri Department of Natural Resources, legally mandates that Fort Leonard Wood decrease the quantity and increase the quality of stormwater runoff through improved site design, and

selection and maintenance of Best Management Practices that minimize point and non-point pollution sources. This permit requires that Fort Leonard Wood maintain a rigorous land disturbance oversight program that proactively enforces adherence to land disturbance permit requirements regulating pre- and post-construction runoff from permitted activity, and report the status of compliance annually.

7. **ENERGY AND SUSTAINABILITY:** The Federal government is committed to designing, locating and constructing, maintaining, and operating its facilities in an energy efficient and sustainable manner. It shall be the responsibility of the Contractor to comply with all of the following federal energy and sustainability executive orders and policies. The Contractor shall be responsible for determining the applicability of each of these for their project. Copies of each of these requirements can be obtained from the Contracting Officer/Contracting Officer Representative or the Environmental Branch (573/596-0882).
- 7.1. **Heating, Ventilation, Air Conditioning (HVAC)** – The Army standard is that no Class I or Class II ozone-depleting substances (ODSs) may be used and that any alternative refrigerants must have a Toxicity Clearance through the Center for Health Promotion and Preventive Medicine (CHPPM). Contractors may access the list of CHPPM Toxicity Clearances at the following website: <http://chppm-www.apgea.army.mil/tox/product.aspx>
- 7.2. **DoD Green Procurement Program (GPP)** – The DoD GPP requires green products and services to be purchased to the maximum extent practicable. The Contractor shall comply with applicable Federal Acquisition Regulations (FARs). The Contractor shall consult with the contracting official to determine the applicability of the GPP to their project.
- 7.3. **Executive Order 13423 – Strengthening Federal Environmental, Energy, and Transportation Management, 26 Jan 07** – The Federal Government is required to adhere to the environmental, energy and transportation requirements outlined in the state executive order. Therefore, Contractors must be able to work with the federal government to comply with these requirements. Examples of required goals include improved energy efficiency and reduced green house gas emissions, reduced water consumption, green procurement, and high performance building requirements.
- 7.4. **Energy Policy Act of 2005** – The Contractor shall support the Federal Energy Reduction Goals as required by the Energy Policy Act of 2005. Contractor must adhere to the regulations and specifications contained within this Act. Contractor must consider the cost of required energy reductions when preparing Request for Proposal.
- 7.5. **Energy Independence and Security Act of 2007** – The Contractor shall support the Federal requirement that all lighting in Federal Buildings use Energy Star products. The Contractor shall ensure compliance with Subtitle C – High-Performance Federal Buildings. This requirement has applications to building energy use and HVAC systems as well as the following stormwater requirements. Refer to Section 3.6.1 for the stormwater requirements.
- 7.6. **Army's Sustainable Design and Development (SDD) Policy**
- 7.6.1. **Military Construction Program** – All vertical construction projects with climate-controlled facilities (mechanically heated or cooled for human comfort) must achieve the SILVER level of Leadership in Energy and Environmental Design – New Construction (LEED-NC). This requirement applies to all construction on Ft. Leonard Wood, including Army Reserve, Army Readiness Centers and Armed Forces Reserve Centers, regardless of funding source and including BRAC. All LEED projects must be registered with the US Green Building Council and must be certifiable by the USGBC. Five percent of Army building projects are chosen for validation, in which case, certification is required. Associated costs shall be captured in the DD Form 1391.
- 7.6.2. **Garrison-level Approved Projects** – Projects authorized to be approved by the Garrison Commander - shall incorporate SDD features to the maximum extent possible but are exempt from meeting the minimum score requirement for the SILVER level of LEED. Incorporating SDD can increase energy efficiency and reduce energy costs, increase the tonnage recycled minimize pollution
- 7.6.3. **Exemptions**

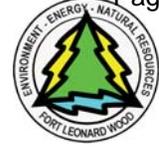
- 7.6.3.1. Horizontal construction projects (ranges, roads, airfields, etc.) shall incorporate SDD features to the maximum extent possible, but are exempt from meeting the minimum score requirement for the SILVER level of LEED.
- 7.6.3.2. The requirement to achieve the SILVER level of LEED applies to permanent facility construction only; required interim facilities are exempt. An interim facility requirement is a short-term urgent requirement for facilities lasting three years or less, normally.
- 7.6.3.3. Renovation and Repair projects are required to incorporate SDD features and be scored using LEED-NC, but are exempt when they do not exceed the garrison commander authority or they have a repair to replacement ratio less than or equal to 25%.

7.7. Conformance with the Fort Leonard Wood ISO 14001 Environmental Management System - The Contractor shall perform work under this contract consistent with the policy and objectives identified in the Fort Leonard Wood ISO 14001 Environmental Management System (EMS). The Contractor shall perform work in a manner that conforms to all appropriate Environmental Management Programs and Operational Controls identified by the Fort Leonard Wood EMS. In the event of an environmental nonconformance or noncompliance associated with the contracted services, the Contractor shall take corrective and/or preventative actions. In the case of a noncompliance, the Contractor shall respond and take corrective action immediately. In the case of a nonconformance, the Contractor shall respond and take corrective action based on the time schedule established by the EMS Coordinator. In addition, the Contractor shall ensure that their employees are aware of the roles and responsibilities identified by the SMS and how these requirements affect their work performed under this contract. Information can be found in the Contractor Section of the DPW Environmental Division Website.

- 7.7.1. All on-site Contractor personnel shall complete FLW EMS awareness training, and as is identified in the Training Requirements of the Contractor Section of the DPW Environmental Division Website (www.wood.army.mil/dpwenv).



Fort Leonard Wood Directorate of Public Works Environmental Division



Spill Report

Any spill or release of POLs, hazardous waste, or hazardous material into the environment must be reported immediately by calling 911. Within 3 days of the incident, complete and submit this Spill Report Form to the DPW Environmental Branch in Building 2101, which is located at the intersection of 2nd Street and Replacement Avenue. The form may also be submitted via fax (573-596-0869) or email (angela.rinck@us.army.mil). For more information, call 573-596-0882 during duty hours.

Report to DPW made by:

Name: _____ Signature: _____

Title: _____ Location: _____

Date: _____ Time: _____

Material spilled: _____

Volume spilled: _____

Location of spill: _____

Date, time, and duration of spill: _____

Cause of spill (Attach additional pages if necessary):

Corrective action taken to control and/or mitigate the effects of the spill (Attach additional pages if necessary):

Plan for preventing recurrence (Attach additional pages if necessary):

Other contacted, i.e. Fire Department:

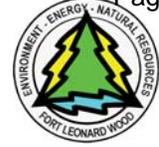
Name: _____ Date/Time: _____

Name: _____ Date/Time: _____

Name: _____ Date/Time: _____



**Fort Leonard Wood
Directorate of Public Works
Environmental Division**



Construction and Demolition (C&D) Waste Management Report

The contractor shall make all reasonable efforts to recycle and recover C&D waste from this project. A minimum of 50%, by weight, of total project solid waste shall be diverted from the landfill in accordance with Executive Order 13423 "Strengthening Federal Environmental, Energy, and Transportation Management", 24 January, 2007. Waste management consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project mandates. Companies and facilities used for recycling, reuse, and disposal shall be appropriately permitted for the intended use to the extent required by federal, state, and local regulations. The contractor shall provide on-site instructions for separating, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project. Records shall be maintained to document the quantity of waste generated, the quantity of waste diverted through sale, reuse, or recycling, and the quantity of waste disposed of by landfill or incineration. This form shall be used to record the information. The contractor shall submit this report of all non-hazardous C&D waste generation no later than 10 days after each fiscal quarter ends, starting the first quarter that C&D waste is generated. This report shall be submitted through the contracting officer or representative to the Directorate of Public Works Solid Waste Program Manager 573-596-0882, Building 2101. Contractor shall provide an electronic or paper copy.

Project name: _____ Location: _____

Contract number: _____ Report period covered: _____ to _____

Contractor: _____ Prepared by: _____

Gov't contract inspector: _____ Date: _____

Email: _____ Phone: _____

| Waste Type | Total Generated (by weight in tons) | Management Method (by weight in tons) | |
|--|--|---------------------------------------|-------------------|
| | | Recycled or Salvaged | Disposed |
| Examples: Concrete | 505,000 | 500,000 crushed for reuse at _____ | 5,000 to landfill |
| Mixed debris | 1,000 | 0 | 1,000 to landfill |
| Scrap metal | 10 | 10 recycled to A1 metals | 0 |
| Wall board/Sheet Rock | | | |
| Stumps, Brush, Wood Chips (beneficially reused on site) | | | |
| Stumps, Brush, Wood Chips (off FLW) | | | |
| Scrap Metal | | | |

| Waste Type | Total Generated (by weight in tons) | Management Method (by weight in tons) | |
|-----------------------------|--|---------------------------------------|----------|
| | | Recycled or Salvaged | Disposed |
| Concrete | | | |
| | | | |
| Clean fill (FLW clean fill) | | | |
| Clean fill (off FLW) | | | |
| | | | |
| Compost (FLW compost) | | | |
| Compost (off FLW) | | | |
| | | | |
| Other | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| TOTAL | | | |

Landfill name: _____

Comments:

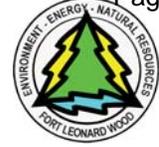
Example Waste Types:

- Wallboard Recycled to manufacturer.
- Stumps & Brush Logs less than 6 inches in diameter, all limbs, twigs, stumps and other brush.
- Concrete Contaminated concrete will be disposed of at an off-post authorized landfill.
- Clean fill Uncontaminated soil, rock, sand, gravel, concrete unpainted and with no exposed steel, unpainted brick, unpainted cinderblock, asphalt, and NO organic material.
- Compost Leaves, grass, and straw removed from trash bags (absolutely no trash or trash bags).
- Scrap metal Turned in as recyclable material.
- Wood chips

Specific guidance for disposition of C&D and Land Clearing materials is contained in the Environmental Requirements section of each project contract.



Fort Leonard Wood Directorate of Public Works Environmental Division



Land Disturbance Permit Compliance Self Certification

The permit below is in compliance with all stipulations of the State of Missouri Land Disturbance Permit:

Permit number: _____

Project name or description: _____

Project building number or location: _____

Contract number (if applicable): _____

I certify that all of the Best Management Practices, including performing Weekly Site Inspections, under this State of Missouri Land Disturbance Permit are currently maintained in compliance with applicable federal law (40 CFR Section 319 of the Federal Clean Water Act) and the site specific Storm Water Pollution Prevention Plan.

Check only one:

- There is **no** outstanding compliance issues remaining on this site.
- There are compliance issues which will be corrected within seven days per the Permit.

Print and Sign
Land Disturbance Permit
Continuing Authority

Compliance Self Certification Date

Print and Sign
Land Disturbance Site Manager
(if applicable)

Compliance Self Certification Date

This certification must be submitted to the following address within 15 days from the end of each month until the permit is terminated by the Missouri Department of Natural Resources.

Fort Leonard Wood Directorate of Public Works
Environmental Compliance Branch (LMNE-LNW-PWEE)
Storm Water Program Manager
1334 First Street
Fort Leonard Wood, MO 65473



**Fort Leonard Wood
Directorate of Public Works
Environmental Division**



Construction Permit Application Review Process

The following is Directorate of Public Works review process for all permit applications. This process must be followed to ensure timely review of permit applications.

1. Contractor shall provide the completed application and supporting documentation (including the Professional Engineer stamped drawings for water and waste water main extensions) to the Contracting Officer Representative (COR). Note this is a time consuming effort and the contractor should begin the permit process well in advance of the NTP in order to avoid delaying the start of the project.
2. The COR will submit the above to the Fort Leonard Wood Directorate of Public Works (DPW).
3. Appropriate staff of Fort Leonard Wood DPW (Planning Division, Operations Division, Engineering Division, and Environmental Division) will review.
4. DPW staff comments and/or approves.
5. DPW returns plans/specifications to COR/Contractor with the application transmittal letter signed by the Director of Public Works. This letter serves as the official Permit request. The Missouri Department of Natural Resources (MDNR) *will not* process any permit application for projects located on Fort Leonard Wood without this DPW transmittal letter.
6. Contractor submits documents, application, and Permit fee to the MDNR.
7. MDNR reviews/comments/issues Permit. Note: MDNR will not issue a Permit until their comments, if any, are adequately addressed.
8. Contractor provides copy of correspondence and Permit to the Fort Leonard Wood DPW Environmental Branch to maintain in the compliance file.
9. Construction may begin.
10. All permitted activities will be inspected for compliance by staff from Fort Leonard Wood, the Missouri Department of Natural Resources, and/or the Environmental Protection Agency, Region VII.
11. As the Permit holder, the Contractor is responsible for full compliance, and all fines, penalties, or other stipulations.



**Fort Leonard Wood
Directorate of Public Works
Environmental Division**



State Permit – Review Processing

The following table provides a short list of contracted actions that generally require an additional environmental compliance review or require a permit or other document. This is not an all-inclusive list. If in doubt, please contact the Environmental Division for assistance at 573-596-0882 or visit the Environmental Division Web page at www.us.army.mil/dpwenv

| REGULATORY AREA | DOCUMENT, PERMIT or NOTIFICATION | COST (estimated) | STATE PROCESSING TIME (estimated) | FLW CONTACT |
|--|--|------------------|---|---------------|
| Asbestos Work: Required for all Friable Asbestos projects | Notification 10-days prior to work start | \$0 | none | Keith Duncan |
| Land Disturbance- Erosion Control: Any earth disturbance 1-acre or greater | Erosion Control Permit | \$300 | Up to 6-months from date State receives application and fee payment | Shannon Kelly |
| Drinking Water: New/changes to the systems to include distribution system | Water Permit to "Construct" | \$50-\$3K | Up to 6 months from date State receives application, with plans/specs, and fee payment. PE stamp required | Carl Stenger |
| Waste Water: New/changes to: systems to include collection system | Water Permit to "Construct" | \$50-\$3K | Up to 6 months from date State receives application, with plans/specs, and fee payment. PE stamp required | Carl Stenger |
| Tanks- Underground: New/changes to: Underground Storage Tanks | Notification required | \$100 | Minimum 30-days upon receipt of notice and fee payment, prior to work start | Carl Stenger |
| Tanks-Aboveground: New/changes to Aboveground Storage Tanks | Permit to "Construct" | \$150 | Approx 60-days from date State receives request for permit determination and receives fee payment | Carl Stenger |
| Tanks: Install new fuel storage tanks | Permit to "Construct" | \$150-\$10K | Up to 9-months from date State receives application with plans/specs and fee payment | Carl Stenger |
| Utilities: Install new/replace emergency generators | Air Permit to "Construct" | \$150-\$10K | Up to 9-months from date State receives application with plans/specs and fee payment | Steve Flier |
| Utilities: New/changes to: large facility HVAC systems | Air Permit to "Construct" | \$150-\$10K | Up to 9-months from date State receives application with plans/specs | Steve Flier |
| Utilities: Replace Boiler or install new boiler(s) | Air Permit to "Construct" | \$150-\$10K | Up to 9-months from date State receives application with plans/specs | Steve Flier |

APPENDIX

PROCEDURE FOR COORDINATION OF TREE REMOVAL

FORT LEONARD WOOD, MISSOURI

The following is a process for the coordination of tree removal on all Fort Leonard Wood projects.

- During the charette an initial discussion on the removal of trees shall be conducted. As the site plan is developed during the charette a preliminary determination shall be made on the removal of trees. The civil design engineer is responsible for coordinating this issue with FLW DPW personnel. At a minimum this shall include Dan James (573-596-2814), Brian Nelson (573-596-0901), and Thomas Glueck (573-596-2814) of the FLW DPW staff.
- Early in the design process (10-35%) the civil designer shall conduct a site visit to verify the survey shows all trees and their location.
- Upon completion of the 35% design the civil engineer shall coordinate closely with FLW DPW in regards to the removal of trees. This will require a site visit, which at a minimum will include Dan James, Brian Nelson, and Thomas Glueck of the DPW staff. The civil engineer shall ensure that FLW DPW fully understands the trees to remain and the trees to be removed during construction. Any site plan changes recommended based on the site visit shall be coordinated through the project manager for coordination with all stake holders and PDT members.
- At the 65% design submittal the civil engineer will coordinate any changes from the 35% submittal with the appropriate DPW personnel. This includes adjustments to the site layout, final grading, storm drainage, and utility impacts on the removal of trees. A site visit shall be conducted if deemed necessary.
- At the final design submittal the civil engineer will coordinate any changes from the 65% submittal with the appropriate DPW personnel. This includes adjustments to the site layout, final grading, storm drainage, and utility impacts on the removal of trees. A final plan-in-hand shall be conducted by the civil engineer to ensure that DPW personnel are in agreement on trees to be removed and those to remain. The site visit shall include DPW personnel and a representative from the Corps construction office. This shall be coordinated with Jesse Vance (816-389-3529).
- Prior to the start of construction one final site visit shall be held by the Corps construction office (Jesse Vance) to mark trees for removal. This shall include all necessary DPW staff to include at a minimum Dan James and Thomas Glueck.



Missouri Department of Natural Resources

Managing Construction and Demolition Waste

Solid Waste Management Program fact sheet

7/2006

This guidance is provided primarily for construction and demolition contractors, construction and demolition waste haulers, roofing contractors, remodeling businesses, homebuilders and homeowners. Cities and counties that issue building permits may also find the information helpful. The guidance covers only those residuals commonly produced during building construction and demolition. You may obtain information about managing other wastes by contacting the sources listed on the last page of this fact sheet.

This fact sheet is not intended for guidance on the management of surface coatings removed from bridges, water towers or other similar outdoor structures.

Waste types

During building construction and demolition, you may produce one or more of the following types of residuals:

1. Clean fill
2. Recovered materials
3. Regulated construction and demolition waste
4. Hazardous materials and hazardous wastes, or
5. Asbestos-containing materials.

Management requirements differ for each of these.

1. Clean fill is “uncontaminated soil, rock, sand, gravel, concrete, asphaltic concrete, cinder blocks, brick, minimal amounts of wood and metal and inert (nonreactive) solids...for fill, reclamation or other beneficial use” [§260.200(4), RSMo].

Minimal means the smallest amount possible. For example, concrete containing wire mesh or rebar may be used as clean fill. However, exposed rebar should be removed before use. Under no circumstances are roofing shingles, sheet rock, wood waste or other construction and demolition wastes defined as clean fill.

Concrete, cinder blocks, bricks or other clean fill materials that are painted with non-heavy metal-based paints are also considered clean fill. Before use as clean fill, it is the generator's responsibility to determine if the painted materials are hazardous wastes. The most typical contaminants are lead and other heavy metals. This determination can be made by representative sampling or by applying historical knowledge of the materials in question. If asphaltic concrete is to be used as clean fill; it is generally recommended that it not be crushed or ground any smaller than necessary. This will help to minimize the leaching of chemicals found within the asphaltic material. Although not regulated as waste, placement of clean fill materials may be subject to requirements of the department's Water Protection Program if it is placed in contact with surface or subsurface waters of the state, or would otherwise violate water quality

PUB002045



standards. Contact the department's Water Protection Program at (573) 751-1300 if you have any questions regarding this approval. Local requirements concerning the use of clean fill may apply as well. Contact the Hazardous Waste Program at (573) 751-3176 for questions on determining whether materials intended as clean fill may be hazardous and disposal options.

2. Recovered materials are those removed for reuse (lumber, doors, windows, ceramic tile and glass) and those removed to be recycled into new products.

Potentially recyclable construction and demolition wastes may include scrap metals, asphalt shingles, sheet rock, lumber, glass and electrical wire. However, it is important to remember that recovered waste must be used in some way. Separating out certain wastes to be recycled into new products without having a market for them is expensive and pointless. Storing recovered materials indoors is expensive. Storing them outdoors may lower their value, since most will degrade or deteriorate when exposed to the weather. Depending on how they are stored, they may harbor rodents, provide breeding grounds for insects or be a potential fire hazard. Recyclables may not be collected and dumped on the ground while waiting for markets to develop. Therefore, before you deliver recyclable materials to a processing or recovery facility, be sure the facility is legitimate. The Planning Unit of the department's Solid Waste Management Program (SWMP) has information about many recycling facilities in Missouri. You may contact the Planning Unit at (573) 751-5401.

If you plan to remove reusable or recyclable materials from construction and demolition waste, the sorting must take place at the construction or demolition site.

The wastes cannot be hauled from the site and dumped for later sorting, except at a permitted processing facility or at a facility that has received a permit exemption from SWMP. Although the Missouri Department of Natural Resources strongly encourages the recovery of potential waste materials whenever possible, these activities must be done legally.

3. Regulated construction and demolition wastes are those that are not classified as clean fill and that are not being reused or recycled. Regulated non-hazardous construction and demolition wastes must be disposed of at a permitted landfill or transfer station. They must not be burned to avoid violating air and solid waste laws. They must not be buried (except at a permitted landfill). They must not be hauled to private or public property and dumped or buried, even with the landowner's permission. If that happens, everyone involved, including the contractor(s), subcontractor(s), the hauler(s) and the landowner(s) can and will be held liable for the illegal disposal (§§260.210, 260.211 and/or 260.212, RSMo). If you are a building contractor, you need to know that burying construction waste from a building anywhere on the property is illegal (§260.210.1, RSMo). See page four for a description of penalties for illegal disposal of construction and demolition waste.

4. Hazardous Materials and Hazardous Wastes. Although you may find a variety of hazardous materials in old buildings, lead-based paint and asbestos are the most common ones that demolition contractors need to deal with. Asbestos is discussed in the next section of this document.

Recent studies conducted by the U.S. Agency for Toxic Substances and Disease Registry, and by independent researchers, show that the health effects of lead exposure are greater than previously thought. Children are especially vulnerable to the effects of lead poisoning. Because lead and other toxic heavy metals may be contained in the wastes noted above, they require careful management and disposal.

For many years, lead-based paint was used in residences and businesses for its stable coating properties. Although lead-based paint was virtually banned by the Consumer Product Safety Commission in 1978 for residential application, it is often encountered when buildings are renovated or demolished. Also, lead-based paint is still manufactured and sold for corrosion or rust inhibition on steel structures and for other industrial purposes. In older buildings, lead was also used for roofs, cornices, tank linings, and electrical conduits. In plumbing, soft solder, an alloy of lead and tin, was used for soldering tinplate and copper pipe joints.

Additional guidance for handling demolition waste containing lead-based paint or other heavy metals (such as cadmium or chromium) is available by calling the department's Hazardous Waste Program at (573) 751-3176.

Hazardous waste requirements for demolition wastes - Demolition-related waste categories typically include

- Paint Residue - Paint chips, paint scrapings, and paint-contaminated blast residue from building renovations or demolition projects,
- Demolition Debris - Masonry, metal and boards that have been painted with lead-based (or other heavy metal-based) paint, and
- Scrap Metal - Metal objects that contain lead or other heavy metals.

For households, the following management options apply, whether or not a contractor is doing the work for you.

- Paint Residue - Paint residue may be placed in the household trash. Before disposal, wrap tightly in a plastic bag or other container. It will be picked up by your trash hauler and taken to a sanitary landfill for disposal.
- Demolition Debris - May be placed in your household trash. It may be picked up by your trash hauler and taken to a sanitary or demolition landfill for disposal.
- Scrap Metal - Scrap metal should be taken to a salvage yard operator for recycling. If this is not possible, the metal may be placed in your household trash and picked up by your waste hauler for disposal at a sanitary or demolition landfill.

For generators other than households - This category includes commercial and business enterprises, institutions and industrial buildings, and other structures not specifically identified.

Paint Residue - Paint residue must be laboratory tested before disposal. The appropriate test method is the Toxicity Characteristic Leaching Procedure (TCLP), EPA Method 1311, which is described in Appendix 11 of the Code of Federal Regulations, Title 40, Part 261 (40 CFR Part 261). The test must include the eight metals noted in 40 CFR Part 261.24 (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver).

Environmental laboratories capable of conducting a TCLP may be found in the telephone Directory's *Yellow Pages*. If one or more of analytical limits meets or exceeds the regulatory limit, the waste is hazardous. Hazardous wastes must be managed, transported, and disposed of according to the Missouri Hazardous Waste Management Law and Regulations.

This may require that the generator send paint residue to a permitted hazardous waste disposal facility. In some cases, a lead smelter may accept lead-based paints for use in their lead production processes.

If laboratory analysis shows that the paint residue is non-hazardous, it must be disposed of at a sanitary landfill as "special waste". Paint residue may not be disposed of in a demolition landfill.

Procedures for managing special wastes are included in the guidance, titled *Special Waste* technical bulletin (PUB2050). The landfill may require you to complete a special waste disposal request form, and provide the results of testing on the paint waste to show that it is not hazardous before accepting the waste.

Demolition Debris - Demolition debris painted with heavy metals need not be tested before disposal. Such wastes may be disposed of in either a sanitary or a demolition landfill in Missouri.

Scrap Metal - Scrap metal painted with heavy metals may be sent to a salvage yard for recycling. If this is not possible, the metal may be disposed of at a sanitary or demolition landfill.

5. Asbestos. All public, institutional, or commercial buildings (and in some instances, residential structures) must be inspected for asbestos before renovation or demolition activities begin. Before planning a demolition project, bidding a project, letting a bid or beginning the demolition, it is important to know if the building has any asbestos-containing materials (ACM) and who is responsible for removing them. Buildings may contain asbestos in materials such as ceiling or floor tile, as insulation or soundproofing on ceilings, pipes, ductwork or boilers, or on the outside as transite siding or in shingles. The presence of ACM cannot be confirmed just by looking. A thorough inspection of any regulated building must be conducted by a Missouri certified asbestos inspector to determine the presence and condition of ACM. Depending upon the results of the inspection, a registered asbestos abatement contractor may be required. Contact the department's Air Pollution Control Program's Asbestos Unit at (573) 751-4817 for more specific information about managing ACM. Visit www.dnr.mo.gov/env/apcp/Asbestos.htm for more information about asbestos requirements.

If the ACM is to go to a landfill or transfer station, contact the facility in advance to see if they accept ACM and if they have any special handling or packaging requirements.

Penalties for illegal disposal of construction and demolition wastes The Missouri Solid Waste Management Law provides for civil penalties for persons who dispose of or allow the disposal of regulated construction and demolition wastes in unpermitted areas.

The law also contains criminal provisions for some types of illegal construction and demolition waste disposal. There may be additional penalties for violations of Air and Hazardous Waste Laws depending on the situation and means of disposal. For Solid Waste Management Law violations alone:

1. **Civil Penalties:** Any person who disposes of construction and demolition waste or allows the disposal of construction and demolition waste in an area not permitted for such disposal may be assessed a civil penalty of up to \$1,000 per day per violation (§260.240, RSMo).
2. **Criminal Penalties:** Any person who purposely or knowingly disposes of or causes the disposal of regulated quantities of construction and demolition waste or other solid waste may be prosecuted for violating the criminal provisions of §§260.211 and 260.212, RSMo. Convictions may include fines of \$20,000 or more, community service, and/or clean up of the illegally dumped waste. In some cases, persons convicted of illegal dumping have served time in jail.
3. The Missouri Air Conservation Law and regulations provide for civil penalties of up to \$10,000 per day per violation for persons who violate the requirements for handling, packaging, transporting or disposing of ACM. The federal Clean Air Act also contains civil and criminal penalties for violations. The same penalties apply for persons who illegally dispose of construction and demolition waste by burning.

Other requirements

Other legal requirements related to managing construction and demolition wastes include:

1. Anyone engaged in building construction, modification or demolition must maintain a record of all sites used for construction and demolition waste disposal for one year. The records must be made available to department staff upon request (§260.210.7, RSMo).
2. Cities and counties that issue building permits are required to notify each permittee, in writing, of the legal requirements for construction and demolition waste disposal (§260.210.8, RSMo).
3. A person shall be guilty of conspiracy...if he knows or should have known that his agent or employee has violated the civil or criminal provisions of the law related to illegal disposal of construction and demolition waste or other solid waste (§260.212.9, RSMo).
4. Anyone selling, conveying or transferring property that contains construction and demolition waste or other solid waste (whether buried or not), must disclose the existence and location of the waste disposal site to a potential buyer early in the negotiation process (§260.213, RSMo).
5. Anyone hauling materials that could fall or blow off a vehicle, including construction and demolition waste, must cover the load or secure it so that none of it can become dislodged and fall from the vehicle (§307.010, RSMo). In addition, many landfills and transfer stations in Missouri require all incoming loads to be covered. Some facilities accept open loads, but may charge you extra for them.
6. A person commits the crime of littering if they throw or place, or cause to be thrown or placed, any garbage, trash, refuse or rubbish of any kind on the right-of-way of any public road or highway, in or on any waters of the state or the stream banks, and on any public or private property (owned by another without their consent) (§577.070, RSMo).

Additional information

You may obtain additional information about properly managing construction and demolition wastes from the sources listed below.

Missouri Department of Natural Resources

Air Pollution Control Program (573) 751-4817

Hazardous Waste Program (573) 751-3176

Solid Waste Management Program (573) 751-5401

Water Protection Program (573) 751-1300

Regional Offices

Kansas City Regional Office (816) 622-7000

Northeast Regional Office (Macon) (660) 385-8000

St. Louis Regional Office (314) 416-2960

Southeast Regional Office (Poplar Bluff) (573) 840-9750

Southwest Regional Office (Springfield) (417) 891-4300

Solid Waste Management Program (573) 751-5401

On the Web

Construction and Demolition information is available from the Solid Waste Management Program at www.dnr.mo.gov/env/swmp/index.html.

Environmental publications are available at www.dnr.mo.gov/pubs/.

Additional considerations and sources

Hazardous waste requirements are found in the Missouri Hazardous Waste Management Laws, Sections 260.345 through 260.575 of the Revised Statutes of Missouri (RSMo).

The Missouri Hazardous Waste Regulations are found in Title 10, Division 25 of the Code of State Regulations (CSR). Most of the federal environmental requirements in Title 40 of the Code of Federal Regulations (CFR) is adopted by reference into the Missouri regulations.

Solid waste requirements are found in the Solid Waste Management Law in Sections 260.200 through 260.345 RSMo, and the regulations in Title 10, Division 80 in the CSR. Copies of the Revised Statutes of Missouri are available through the Reviser of Statutes at (573) 526-1288, or are available online at www.moga.mo.gov.

Copies of the Missouri Code of State Regulations are available through the Missouri Secretary of State at (573) 751-4015, or are available online at www.sos.missouri.gov/adrules/csr/csr.asp.

Federal regulations may be viewed at federal depository libraries or may be purchased from a U.S. Government Bookstore, the U.S. Government Printing Office, or from a commercial information service such as the Bureau of National Affairs. Federal Regulations are also available online at www.gpoaccess.gov/cfr/index.html.

Other Guidance

The Missouri Department of Health and Senior Services - Office of Lead Licensing and Accreditation may be contacted for information regarding training, licensure and work practice standards for lead abatement activities. Disposal is an abatement activity. See Missouri Revised Statutes 701.300 and 701.338.

Please note that many municipalities have their own additional requirements that might be more strict than those discussed above.

For more information, call or write

Missouri Department of Natural Resources
Hazardous Waste Program
P.O. Box 176, Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-7560 office
(573) 751-7869 fax
www.dnr.mo.gov/env/hwp/index.html

Missouri Department of Natural Resources
Solid Waste Management Program
P. O. Box 176, Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-5401 office
(573) 526-3902 fax
www.dnr.mo.gov/env/swmp/index.html

Missouri Department of Natural Resources
Air Pollution Control Program
P.O. Box 176, Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-4817 office
(573) 751-2706 fax
www.dnr.mo.gov/env/apcp/index.html

Missouri Department of Health and Senior Services
Office of Lead Licensing and Accreditation
P.O. Box 570, Jefferson City, MO 65102-0570
1-888-837-0927 or (573) 526-5873
(573) 526-0441 fax
www.dhss.mo.gov/Lead/

Appendix F
Conceptual Aesthetic Considerations



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Appendix G

GIS Data

Appendix

Spatial Data Standard for Facilities, Infrastructure and Environment (SDSFIE) Guide for GIS Deliverables Created as Part of Military Design and Construction Projects

Fort Leonard Wood, Missouri

Introduction

This Appendix provides guidance for implementing Engineering and Construction Bulletin (ECB) No. 2006-15, “Standardizing Computer Aided Design (CAD/CADD) and Geographic Information Systems (GIS) Deliverables for all Military Design and Construction Projects” (http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2006_15.pdf). This guidance establishes the requirements for geospatial data deliverables produced as part of design, design-build, or design-bid-build contracts for Fort Leonard Wood, Missouri. It includes description of the:

- Coordinate System and Datums;
- Data Quality Standard;
- Deliverables;
- SDSFIE-Compliant GIS Deliverable Specification; and
- Metadata.

Coordinate System and Datums

All geospatial deliverables (CADD or GIS format), whether obtained via survey or any other data collection process, shall be measured in meters. The coordinate system for all geospatial data will be UTM Zone 15. The vertical datum, if applicable, will be North American Vertical Datum 1988 (NAVD 88). The horizontal datum will be WGS84.

Precise specifications of the UTM Coordinate System, are as follows:

Grid Coordinate System Name: Universal Transverse Mercator

UTM Zone Number: 15

Transverse Mercator Projection

Scale Factor at Central Meridian: 0.999600

Longitude of Central Meridian: -93.000000

Latitude of Projection Origin: 0.000000

False Easting: 500000.000000

False Northing: 0.000000

Planar Coordinate Information

Planar Distance Units: meters

Coordinate Encoding Method: coordinate pair

Coordinate Representation

Abscissa Resolution: 0.000032

Ordinate Resolution: 0.000032

Geodetic Model

Horizontal Datum Name: D_WGS_1984

Ellipsoid Name: WGS_1984

Semi-major Axis: 6378137.000000

Denominator of Flattening Ratio: 298.257224

Data Quality StandardAs Built Survey

An as-built condition survey should be performed to capture the information listed in this Appendix. All relevant features shall be identified on as-built drawings and shall be GPS or conventional surveyed to the level of accuracy specified below.

Coordinate Accuracy

The Contractor shall use conventional surveying and other methods, such as a total station or GPS for field data collection at an accuracy level in accordance with “Geospatial Positioning Accuracy Standards, Part 4: Architecture, Engineering Construction, and Facilities Management. Published by the FGDC and available at http://www.fgdc.gov/standards/standards_publications/index.html.

Horizontal and vertical accuracy of features, where vertical coordinates are collected, shall be +/- 2cm.

Surveyor Certification Requirement

The surveyor shall verify the survey for accuracy and a statement will be provided to the government stating the level of accuracy for the data being reported (in metric units). In addition to the accuracy statement, the following information should be provided in a survey report:

- Coordinate system & datum used;
- Projection;

- Units of measure (vertical and horizontal);
- Attribute description (GPS data dictionary—features, attributes and attribute values);
- Source - Receiver type, antenna type, receiver settings, number of positions per point feature, correction method and any field other relevant field procedures utilized;
- Survey method;
- Equipment list;
- Calibration documentation;
- Description of control points and control diagrams;
- Field notes; and
- Field-collected data (in addition to the post-processed final data used to prepare the geospatial data deliverable).

Utilities

Underground and aboveground utility lines shall be surveyed at a minimum of two points along every straight run, at every change of direction, at every tie in point, and at any change in line size.

Deliverables

The intent of the deliverable set is to provide the Installation with comprehensive geospatial information about the facility footprint and site features that exist outside the building(s). The electronic deliverables must be in the file format and data standard used by the Installation's Operations and Maintenance System (as noted in "Coordinate System and Datums", above).

The Installation requires deliverables in the following software formats:

- GIS Files
 - ESRI geodatabase file.
 - The coordinate system, projection, datum(s) and units will be defined for the layer and will be documented in the metadata.
 - Where captured, vertical coordinate information will be stored as a feature attribute as meters above mean sea level. Polygon-z, polyline-z, and point-z formatted files are not requested.
- CADD Files
 - MicroStation DGN files in A/E/C CADD format, using the coordinate system, projection, datum, and units specified in the RFP.

100% Design (Design Complete)

Final design deliverables for each design package should consist of (A) the drawings and specifications, and (B) the GIS file(s):

- 100% complete drawings, specifications, calculations/design analysis, and a list of all comments and their resolution for that work package. All final design drawings will be in the A/E/C CADD Standard format, current version as agreed upon by the government and the contractor. The A/E/C CADD Standard is available at <https://tsc.wes.army.mil/products/standards/aec/aecstdweb.asp>. Metadata shall be delivered with each CADD file, and will meet the standard specified in this Appendix.
- A corresponding SDSFIE-compliant GIS deliverable for the feature layers listed in Table 1 of this Appendix. For each listed layer the contractor should provide either a GIS deliverable or a statement that no features in that layer will be constructed, be modified, or pose a design constraint for the project. The SDSFIE standard is available at <http://www.sdsfie.org>. Metadata shall be delivered with each GIS data layer and will meet the standard specified in this Appendix.

As-Built (Construction Complete)

Final construction deliverables shall consist of (A) the as built drawings and specifications, and (B) the GIS file(s). The contractor will provide a submittal of the CADD and GIS files that depict the as-built condition of the site. The data layers to be delivered, the coordinate accuracy of the features, the required attribution, and the metadata will meet the standards specified in this Appendix.

For each layer listed in Table 1, the contractor will provide either a GIS deliverable or a statement that no features in that layer were constructed or modified. The tie in to a utility main line is considered a modification of the utility main line, and the portions of main lines that were exposed should therefore be included in the deliverable.

SDSFIE-Compliant Deliverable Specification

Geodatabase Template

Upon request the government will provide the contractor with an SDSFIE-compliant GIS layer template to be used for populating the GIS deliverables required under the contract. The contractor shall populate the layers without modifying the template. The contractor shall ensure that layers to be delivered but not included in the template, should the template not be complete, are fully compliant with the current SDSFIE standard.

There may be circumstances in which SDSFIE compliance cannot be maintained. In such circumstances, proposed deviations with the standard must be communicated by the contractor and reviewed by the government. Approval for the deviation shall be documented.

Data Integrity Check

The contractor shall utilize a topology build and clean routine and assure the following:

- No erroneous overshoots, undershoots, dangles or intersections in the line work;
- Lines should all be continuous, i.e. do not create dashed lines with many small line segments;
- Point features should be digitized as points, not graticules, cells, symbols or icons;
- No sliver polygons;
- All polygons completely close and have a single unique centroid; and
- Digital representation of the common boundaries for all graphic features must be coincident, regardless of feature layer.

Required GIS Data Layers and Required Attributes

Table 1 lists the SDSFIE-compliant GIS data layers that are to be delivered as part of this contract. The list is based on a review of the type(s) of facility(s) being constructed. However, it is possible that some layers in the list will not be used.

Metadata

The contractor shall prepare metadata conforming to the most current version of the Federal Geospatial Data Committee's (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM) at http://www.fgdc.gov/standards/standards_publications. Appendix A of the ECB, http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2006_15.pdf, is the FGDC metadata profile for Army Installations and should be followed as closely as possible. An ESRI Metadata Stylesheet for Army Geospatial Data is posted at <https://gis.hqda.pentagon.mil>. Metadata content will accompany all electronic geospatial data submissions. This includes both CADD and GIS formats. A metadata file shall accompany, at minimum, each CADD data set and/or each GIS data set. Metadata should be prepared to FGDC standards and delivered in XML format readable by software applications that use the FGDC XML format standard (such as ESRI ArcMap 9.x).

Table 1. SDSFIE Layer Names and Required Attributes.

Note: Required attributes, where specified, are listed following the SDSFIE layer name. Elevation information, reported as meters above mean sea level, is required for layers where “coord_z” is listed as a required attribute.

airfield_light_point

airfield_surface_centerline

airfield_surface_edge_line

airfield_surface_marking_area

airfield_surface_marking_line

airfield_surface_site

area_size (acres); area_u_d (area unit of measure, acres); perim (meters); perim_u_d (perimeter unit of measure, meters); coord_x (centroid, WGS84 UTM); coord_y (centroid, WGS84 UTM); paved_d (paved code, Yes/No); feat_name (airfield name)

athletic_court_area

athletic_field_area

athletic_miscellaneous_area

borrow_area

breakline

building_floor_area

building_room_area

building_space_area

canopy_pavilion_site

communications_amplifier_point

communications_antenna_site

coord_X (WGS84 UTM), coord_y (WGS84 UTM), area_size(acres), area_u_d(area unit of measure), perim(perimeter dimension, meters), perim_u_d(perimeter unit of measure, meters)

communications_coaxial_line

communications_device_point

communications_equip_point

communications_fiberoptic_line

communications_handhole_point

communications_manhole_site

communications_pedestal_site

communications_splitter_point

communications_telephone_point

communications_terminator_point

communications_twisted_pair_line

communications_vault_site

Table 1. Continued

compressed_air_pipe_line
 control_point
 culvert_centerline
 curb_line
 digital_elevation_model_point
 easement_right_of_way_area
 electrical_cable_line
 dispostn_d (disposition code, domain); instl_ty_d (installation type code, domain)
 electrical_capacitor_point
 electrical_ductbank_line
 electrical_generator_point
 electrical_junction_site
 electrical_meter_point
 electrical_motor_point
 electrical_pedestal_point
 electrical_regulator_point
 electrical_substation_site
 dispostn_d (disposition code, domain); sst_ty_d (type of service label, domain)
 electrical_switch_point
 electrical_transformer_bank_point
 electrical_transformer_vault_point
 elevation_contour_line
 fence_line
 fuel_fitting_point
 fuel_flow_direction_arrow
 fuel_hydrant_point
 fuel_junction_site
 fuel_line
 fuel_meter_point
 fuel_pump_booster_station_point
 fuel_source_point
 fuel_tank_site
 gate_line
 gate_point
 hazardous_materiels_storage_area
 hsb_cat_d (the general nature of hazardous waste, domain); area_size (acres);
 area_u_d(area unit of measure, acres); perim (perimeter dimension), perim_u_d (meters);
 coord_x (WGS84 UTM); coord_y (WGS84 UTM);

Table 1. Continued

hazardous_materiels_storage_location_site
 heat_cool_anchor_point
 heat_cool_flow_direction_arrow
 heat_cool_junction_site
 heat_cool_line
 heat_cool_marker_point
 heat_cool_meter_point
 heat_cool_plant_area
 heat_cool_pump_point
 heat_cool_rectifier_point
 heat_cool_regulator_point
 heat_cool_valve_point
 hospital_structure_site
 industrial_waste_fitting_point
 industrial_waste_flow_direction_arrow
 industrial_waste_grit_chamber_point
 industrial_waste_junction_point
 industrial_waste_lagoon_area
 industrial_waste_line
 industrial_waste_meter_point
 industrial_waste_neutralizer_point
 industrial_waste_oil_water_separator_site
 industrial_waste_tank_point
 industrial_waste_treatment_plant_area
 industrial_waste_valve_point
 natural_gas_fitting_point
 natural_gas_flow_direction_arrow
 natural_gas_junction_point
 natural_gas_light_point
 natural_gas_line
 natural_gas_marker_point
 natural_gas_meter_point
 natural_gas_rectifier_point
 natural_gas_regulator_reducer_point
 natural_gas_valve_point
 pedestrian_sidewalk_centerline
 pipeline_line

piprod_d (pipeline product code, domain); oper_nm (operator name, mixed case)

Table 1. Continued

radar_site
 railroad_bridge_centerline
 railroad_centerline
 tot_len (total length of track, meters); length_u_d (length unit of measure, meters);
 feat_name (name of railroad, mixed case); cond_d (condition
 code, domain); traf_vol_d (traffic volume code, domain)
 railroad_feature_point
 railroad_station_site
 railroad_yard_area
 recreation_park_area
 recreation_trail_centerline
 regulated_aboveground_storage_tank_site
 regulated_storage_tank_farm_area
 regulated_underground_storage_tank_site
 road_bridge_area
 road_bridge_centerline
 road_centerline
 category_d; num_lanes; feat_len; length_u_d; feat_name; road_name; alt_name;
 rou1_typ_d; rou1_name; rou2_typ_d; rou2_name; rou3_typ_d; rou3_name
 road_feature_point
 road_guardrail_line
 road_site
 slab_area
 solid_waste_compactor_point
 solid_waste_dump_area
 solid_waste_incinerator_point
 solid_waste_landfill_area
 solid_waste_material_recovery_facility_point
 solid_waste_stockpile_area
 solid_waste_transfer_station_point
 spill_containment_feature_area
 spill_containment_tank_point
 spot_elevation_point
 storm_culvert_site
 storm_sewer_armor_point
 storm_sewer_culvert_line
 storm_sewer_downspout_point
 storm_sewer_fitting_point

Table 1. Continued

storm_sewer_flood_area
storm_sewer_flow_direction_arrow
storm_sewer_headwall_line
storm_sewer_inlet_point
storm_sewer_junction_point
storm_sewer_line
storm_sewer_oil_water_seperator_site
storm_sewer_open_drainage_area
storm_sewer_open_drainage_line
storm_sewer_pump_point
storm_sewer_reservoir_point
structure_existing_site
structure_future_site
tower_site
tunnel_centerline
utility_electric_utility_site
utility_pole_guy_point
utility_pole_tower_point
utility_pole_tower_site
vehicle_parking_area
wastewater_discharge_point
wastewater_filtration_bed_area
wastewater_fitting_point
wastewater_flow_direction_arrow
wastewater_grease_trap_point
wastewater_grit_chamber_point
wastewater_junction_point
wastewater_lagoon_area
wastewater_line
wastewater_neutralizer_point
wastewater_oil_water_separator_site
wastewater_pump_ejector_station_site
wastewater_pump_point
wastewater_septic_tank_point
wastewater_treatment_plant_site
wastewater_valve_point
water_fire_connection_point
water_fitting_point

Table 1. Continued

water_hydrant_point
water_junction_point
water_line
water_marker_point
water_meter_point
water_pump_point
water_regulator_reducer_point
water_reservoir_area
water_tank_site
water_valve_point
water_vent_point

Appendix H
Exterior Signage

Exterior Signs must be approved through DPW.

POC: Kyong Rainbolt 573-596-0900

11.4 EXTERIOR SIGN STANDARD

Signs have a major effect on the appearance of Fort Leonard Wood and the professionalism of its units. The number of signs on the installation shall be held to the absolute minimum required for directions, identification, and customer service. This section establishes standards for standardizing sign material, color, style, types, and placement throughout the installation.

Standardized signage systems facilitate movement, provide a sense of orientation, and reinforce standards of excellence and visually communicate information. Signs are highly visible features that must be attractive and compatible with their surroundings. Careful consideration must be given to what a sign says, how it is said, its visual appearance and organization, its location, structural support system, and relation to other signs within the installation.

Signage creates a unifying element throughout FLW that visually ties the installation visual zones and themes together and builds a ~~reference and continuity that translates into~~ confidence and ~~reassurance when traveling throughout~~ the installation. The standards to apply for signage color, type, and sizing are found in [Technical Manual \(TM\) 5-807-10, Signage](#) (See Section 9, [paragraph 9.6 Pavement Marking Standards](#)).

11.4.1 Sign System Characteristics

There are several basic design characteristics that, by serving to convey necessary information clearly and attractively, are an integral part of any successful signage system. These characteristics are:

Simplicity: Provide only needed information, avoid redundancy, and eliminate over-signing with resultant clutter and visual confusion. Sign messages must be clear, simple, and easy for individuals to process quickly.

Continuity: The system will be applied uniformly and consistently throughout the entire installation. The importance of consistent implementation extends from the larger issues of sign type and size down to accurate color continuity and matching typestyles.

Visibility: Signs will be located at significant decision points and oriented to provide clear sight lines for the intended user. Coordinate locations with respect to landscaping, utilities, adjacent

signage, and various other street design elements to ensure long-term maximum visibility.

Legibility: Sign typestyle, line spacing, color, and size all combine to create the crucial design characteristics of legibility. Sign design will take into consideration users such as motorist, pedestrians, or bicyclists and the relative travel speed at which each type of user will be traveling when viewing the signs.

11.4.2 Vocabulary-Communications

A common language has been created for establishing a signing system. The different components that create the sign package have been named and referred to within the total signing system.

The creation of a "signage language" helps generate a unified bond within sign types that make up a signage family. This signage language may be considered in terms of the following:

- Information or Message
- Typography
- Presentation: height, shape, style, color, materials and graphics
- Architectural Influence: 3D qualities of the sign and the method of support such as a masonry base unit
- Graphic Architecture: the placement of the letters and artwork within the sign panel and their relationship to each other.

11.4.3 Types of Exterior Signs

There are six basic categories of exterior signs: Identification, Motivation, Guide, Mandatory/Prohibitory, Information, and Regulatory signs.

11.4.3.1 Identification Signs

There are four basic types of identification signs: Installation, Military Headquarters, Military Facility, and Community Facility Identification signs. These are signs that identify entrances to the installation, areas within the installation, major tenants, buildings, and organizational or functional components. They identify a location, and greet the visitor to that location. They should be compatible in scale and character with the architecture and also blend with the natural surroundings.

Wall mounted identification signs may be used instead of freestanding signs. Wall mounted signs eliminate visual clutter and minimize maintenance.

These signs are designed to include the following:

Typeface: Lettering is self-adhesive backing material.

- Building Title: Helvetica Medium, Upper and lower case
- Building Addresses: Helvetica Medium, Upper and lower case

Color:

- Panel: Dark Brown (Pantone 18-1027 TPX. See Supplemental Page L-4a)
- Lettering: White
- Post: Dark Brown
- Exposed panel backs and edges: Dark Brown
- All paint: Semi gloss

Materials

- Panel: Double-face 1/8" thick aluminum
- Post: Steel Pipe
- Foundation: Concrete pier or direct burial

See [Technical Manual \(TM\) 5-807-10, Signage](#), for further sign specifications and for sign placement guidelines.

11.4.3.1.1 Installation Identification Signs

Installation identification signs name the installation and display the official US Army plaque. The designation "United States Army" must appear at the top of the sign in accordance with [AR 420-70](#), para 2-7h. Every installation entrance shall have an installation identification sign displaying only the US Army plaque, with the words "United States Army, Fort (Name of Fort), and gate name as indicated in Figure 11.22, Installation Entrance Signs. The placement of Senior Mission Commander logo, unit crest, and other installation identification signs, monuments, or displays shall be located inside the installation beyond the cleared area of the Access Control Point (ACP) of entry. When used service-wide, these signs convey a uniform image of strength and



Fig. 11.22 – U.S. Army Standard Installation Entrance Sign

stability to the public. Emblems, branch colors, unit mottos, names, and titles of individuals are not to be displayed.

Installation identification signs consist of three types:

Sign Type A1 - Main Entrance Sign identifies the principal visitor entrance.

Sign Type A2 - Secondary Entrance Sign identifies entry points with relatively high volumes of visitor traffic.

Sign Type A3 - Limited Access Entry Gate Sign identifies entry points with limited public access.

See [Technical Manual \(TM\) 5-807-10, Signage](#), paragraph 3-3, for sign specifications and paragraph 3-11 for sign placement guidelines.

11.4.3.1.2 Military Headquarters Identification Signs

Military head-quarters identification signs identify military activities and facilities and carry unit name information and street addresses (Fig. 11.23).

Military headquarters identification signs consist of four types:

Sign Type B1 - Installation Headquarters Sign identifies the central administration of the installation.

Sign Type B2 - Command, Division, and Brigade Headquarters Sign

Sign Type B3 - Battalion Headquarters Sign

Sign Type B4 - Headquarters Building Entrance Sign identifies the building entrance for all levels of authority. In addition, Type B4 is used to identify a unit headquarters that has a special entry point other than the main entrance of a building.

Name plate attachments are prohibited. Insignias, emblems, branch colors, unit mottos, names, or titles of individuals will not be used on these signs.



Fig. 11.23 – Headquarters Identification Sign

Identify buildings with either a free-standing or building-mounted sign, but not both. Building mounted signs are preferred. Free-standing building identification signs should be kept to a minimum. A primary objective of the installation orientation system is to reduce the number of signs and to eliminate the visual clutter that results from the over use of signage. Locate signs only where they are needed to provide orientation. As a general rule, provide one sign for each building. An option to the standard building identification sign is the use of facility-mounted, individual letter-type signs affixed to the buildings. The size and location of these signs should be standardized throughout the installation, normally over the building main entrance. See Figure 11.24.

These signs are designed to include the following:

Typeface: The letter shall be mounted to the wall according to the manufacturers' specifications.

- Building Lettering Size: 2mm to 25mm (1/16" to 1") deep, Helvetica medium typeface.
- The depth separates them from the plane of the wall and gives them a crisp appearance, while the Helvetica medium typeface relates to other Army signs.

Color:

- The color or finish of the letters should compliment the predominant color of the building while providing enough contrast with the background for visibility.
- Use a light-color or bright metallic finish for the lettering on dark buildings and a standard brown or dark bronze finish for the lettering on light colored buildings.

Materials:

- Several letter materials are available through sign manufacturers; however, rigid foam with aluminum facing is the preferred letter material.
- Letter material should be selected based on durability, architectural compatibility, and cost effectiveness.

11.4.3.1.3 Military Facility Identification Signs

Military facility identification signs are used to identify company level organizations and other military facilities not included in the

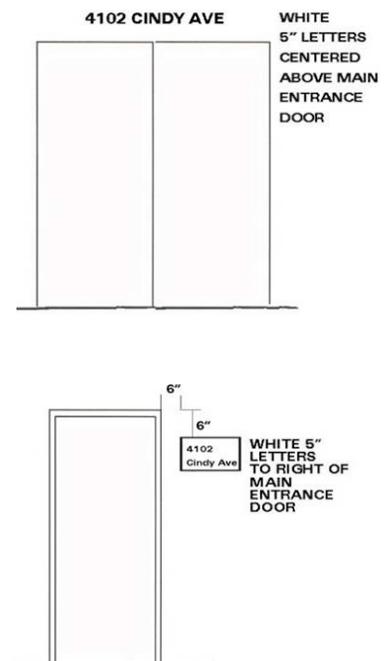


Fig. 11.24 - Street Address Location at Entrance Doors

installation identification or military headquarters sign types. Insignias, emblems, branch colors, unit mottos, names, or titles of individuals will not be used on these signs.

Military facility identification signs consist of seven types:

Sign Type C1 - Centralized Primary Facility Sign, identifies multiple service units in one or a complex of buildings. In addition, one service unit comprised of sub-services which are used by a large volume of military and civilian personnel may be identified by Type C1.

Sign Type C2 - Centralized Secondary Facility Sign, may be used where the volume of civilian traffic does not warrant the use of sign Type C1, such as military unit storage facilities.

Sign Type C3 - Primary Facility Sign, identifies a large scale facility serving a large volume of military and civilian personnel, but does not list individual services units or sub-services.

Sign Type C4 - Secondary facility Sign identifies company level organizations and individual service units.

Sign Type C5 - Primary Entrance Sign identifies the main entry points of a service facility.

Sign Type C6 - Secondary Entrance Sign, identifies the same information as Type C5, but is smaller in size.

Sign Type C7 - Restricted Facility Sign identifies the facility name or area which is restricted.

11.4.3.1.4 Community Facility Identification Signs

These identify activities and facilities used for non-military purposes. The standards for community signs also apply to signs for private firms operating on base. AAFES facilities and nationally recognized food chain franchises operated by AAFES may utilize their individual registered trademark signage in general compliance with these standards. These signs should be kept at a low profile and design and color should match the installation-wide system.

Community identification signs consist of seven types:

Sign Type D1 - Centralized Primary Facility Sign identifies several activities or organizations in one or a complex of buildings.

Sign Type D2 - Primary Facility with Changeable Message Board identifies an individual organization or facility and provides a changeable message board for information on activities.

Sign Type D3 - Primary Facility Sign identifies an organization.

Sign Type D4 - Secondary Facility Sign, identifies the same information as Type D3, but is smaller in size.

Sign Type D5 - Building Entrance Sign identifies the facility entrance and hours of operation.

Sign Type D6 - Recreation Facility Sign identifies an outdoor recreation or park facility and hours of operation.

Sign Type D7 - Bus Stop Sign identifies bus routes, stops, and schedules.

1

1.4.3.2 Motivation Signs

These signs are used to boost morale, improve safety, aid in recruiting, and accomplish other special objectives. Motivation signs are unique in appearance and do not have specified graphic layouts.

Motivation signs include three types:

Sign Type E1 - Installation Motivation Sign identifies the principle commands or divisions stationed at the installation.

Sign Type E2 - Standard Motivation Sign is used to support campaigns and special events.

Sign Type E3 - Unit Motivation Sign is used to express unit pride and display organizational insignias, emblems, and mottos.

11.4.3.3 Guide Signs

These signs are the essential means for locating destinations and routing travel to those destinations within a military installation. This includes site directory map signs at all entrance gates and other key points with the installation, large street name signs at all intersections, and large-lettered destination signs of not more than three lines. These signs provide the most efficient means of guiding traffic to destinations within the installation.

11.4.4.4 Mandatory/Prohibitory Signs

This category of signage is intended to maintain security and safety on the installation perimeter and at other specific secure areas. These signs notify visitors of restrictions, as well as other security procedures. The guidelines for design, fabrication, and placement of warning signs are found in [Technical Manual \(TM\) 5-807-10, Signage](#), paragraph 3-9.

There are several types of installation warning signs as follows:

Sign Type G1 - Warning Sign is intended as a search and authorized personnel warning sign.

Sign Type G2 - Warning Sign is intended as a restricted area warning sign.

Sign Type G3 - Warning Sign, identifies general hazards, regulations and security information as Type G2, but is smaller in size.

Sign Type G4 - Safety Sign identifies specific dangers and warns personnel and visitors of physical hazards and unsafe practices.

Sign Type G5 and G6 - Parking Sign.

Handicapped parking signs should show the international handicapped symbol in white on the required blue background. Strictly limit reserved parking signs to visitors, customers, handicapped, key officials, and incentive award winners (NCO of the Quarter). Use metal signs approximately 4" high and mechanically fastened to the vertical curb face. Design and color should match the installation-wide system.

Sign Type G7 - Special Traffic Conditions Sign, such as tactical equipment limits and trail crossings, follow guidelines established in [MTMC Pamphlet 55-14, Traffic Engineering for Better Signs and Markings](#) and standards in the [Manual of Uniform Traffic Control Devices \(MUTCD\)](#).

11.4.3.5 Information Signs

These are used to provide educational information and directional guidance for visitors. These signs is used to give priority to the destinations of facilities that are likely to have a great deal of first time traffic include the Commissary, Post Exchange, Clinic, Community Center, clubs, billeting, and major Army activities.

These signs are designed to include the following:

Typeface: Lettering is self-adhesive backing material.

- Helvetica Medium, upper and lower case

Arrow:

- Place at the end indicating direction (Fig 11.25)
- Stroke width: Helvetica Medium cap

Color:



Fig. 11.25 – Guidance Signs Locate at Major Decision Points

- Panel: Dark Brown (Pantone 18-1027 TPX. See Supplemental Page L-4a)
- Lettering: White
- Post: Black
- Exposed panel backs and edges: Dark Brown
- All paint: Semi gloss

Materials:

- Panel: Double-face, 1/8" thick aluminum
- Post: Black steel signposts are encouraged. Black vinyl sleeves for signpost and dark brown adhesive vinyl sheeting for the backs of signs provide a low-maintenance option.
- Foundation: Concrete pier or direct burial

There are two types of information signs:

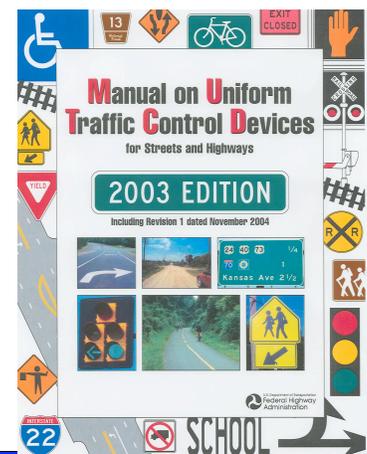
Sign Type H1 - Exhibit Information Sign.

Sign Type H2 - Guidance Sign provides direction guidance motorist or pedestrian in, around, and out of the installation. The legibility and placement of this sign, as well as the order of information, is critical to their effectiveness. These signs should be placed in central locations and at major decision points along circulation routes.

Messages will be grouped in the following order according to their arrow direction: forward, left, and right. In addition, placement of the message on the sign panel is determined by the arrow direction. Destinations forward and left are listed first and have flush left messages. Destinations right are listed next and have flush right messages. The arrow is centered in the space between the message and the edge of the sign. Prioritize destinations to be listed by giving the highest priority to the destinations that are most often sought by people new to the garrison or that serve as highly visible landmarks on the garrison. Those who live or work on the garrison or who visit frequently do not need the degree of help required by a first time or infrequent visitor. These signs are designed to include the following:

11.4.3.6 Regulatory Signs

These signs provide the rules for travel and parking on the installation. They include highway signs, warning signs, parking



control signs, etc. Related to these signs are pavement markings and traffic signals. [Manual of Uniform Traffic Control Devices \(MUTCD\)](#) (Fig. 11.26) standardizes regulatory devices throughout the country to ensure that they mean the same to, and require the same action by, all motorists (Fig.11.27). Therefore, compliance with the MUTCD will contribute to the safe, orderly, and efficient movement of traffic. Also see [MTMC Pamphlet 55-14, Traffic Engineering for Better Signs and Markings](#).

These signs are designed to include the following:

Typeface: Lettering is self-adhesive backing material.

- Helvetica Medium, upper and lower case

Color:

- Panel: Sign color, size and shape prescribed by the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)
- Post: Black
- Exposed panel backs and edges: Dark Brown

Material:

- Panel: Double-face, 1/8" thick aluminum
- Post: Steel breakaway pipe
- Foundation: Concrete pier or direct burial

11.4.4 Street Addresses

The addressing procedures prescribed in [Department of Defense Manual \(DODM\) 4525.8-M, DoD Official Mail Manual](#) are mandatory for use by all DoD components. DoD 4525.8-M, Chapter 3 prescribes the following:

All DoD addresses shall be assigned so they are compatible with the United States Postal Services automated delivery point sequencing (C3.3).

- The DoD installation is responsible for assigning city-style, street address on the installation (C3.3.2.2).
- Street addresses shall be assigned and used even though a DoD activity may deliver the mail to the addressee (C3.3.2.2.1).



Fig. 11.27 – MUTCD Regulatory Signs

- Only geographically locatable civilian-style street address (such as 4102 Cindy Avenue) shall be used (C3.3.2.2.4).
- Installations shall not use one street address for the entire installation and then use secondary unit designators such as "Building 123" to designate the delivery addresses on the installation (C3.3.2.2.5).
- Addresses such as "Building 123 Roberts Street" are not a valid address format and shall not be used (C3.3.2.2.6).

11.4.5 Address Placement Standards

- Place addresses by the front entrance of the building so they can be seen (C3.3.2.3.1).
- Place both the street name and address number on the building if both the building number and street address are visible from the street.
- Building identification signs will use street addresses.
- Buildings without identification signs shall have the address number and street name centered above the main entrance or located to the right side.

11.4.6 Circuit Running Trail Sign Standards

- Sign panel shall be fabricated of 1/8" thick aluminum or approved equal. All exposed surfaces of the sign panel including the reverse side and edges shall have a field or factory applied paint or enamel finish over primer.
- Signs shall be secured to posts with two 0.25 inch carriage bolts cut flush with the nut. Head of bolt shall be painted to match face of sign. Non-compatible metals shall be isolated by coating or gasket material so as to prevent galvanic action.
- Post shall be 3 x 3 wood or 3 inch diameter pipe or 3 inch tube. Post shall be treated to resist structural degeneration or corrosion. Finish on post may be either natural or white paint or factory applied white low sheen enamel.
- Post shall be set so that at least 60 centimeters (24 inches) of length is set firmly in earth. Type font shall be Helvetica Medium, 10 centimeters (4 inches) high, painted in white enamel on a colored panel.
- Unless otherwise directed, sign shall give distance in miles or quarter fractions thereof.

- Sign shall contain two lines of type. The upper line shall read “MILE”. The lower line shall consist of a numeral/s indicating unit distance. Center each line on the sign panel.
Example: MILE MILE
3/4 3
- See Fig. 11.28 and Paragraph. [9.12.5 Recreational Running Trails](#) for additional guidance.

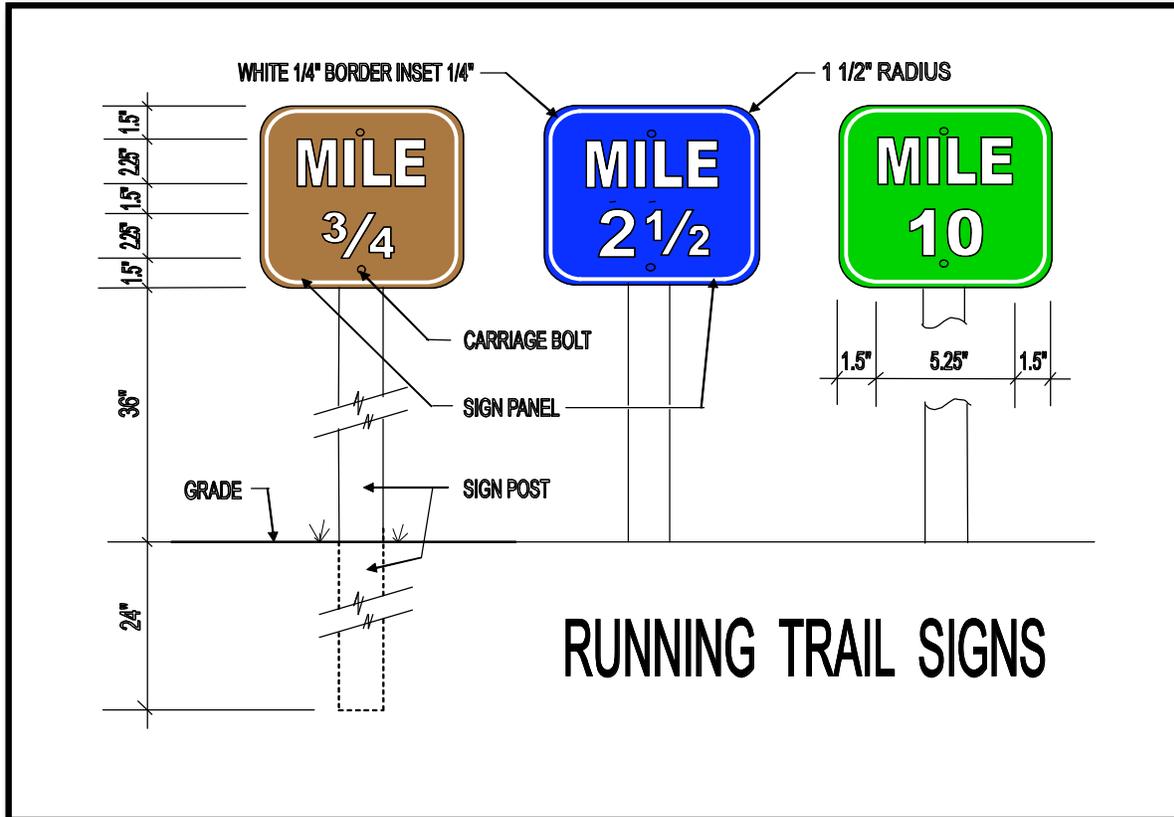


Fig. 11.28 - Signage for Circuit Running Trails Detail

11.4.7 Electronic Exterior Signs

All exterior flashing signs, traveling lights, or signs animated by lights of changing degrees of intensity or color are prohibited.

11.4.8 Housing Area Sign Standards

Street and address identification signs within housing areas should be complimentary to the architectural setting of the housing area and approved by the installation Real Property Planning Board. Housing numbers should be placed on the curb in front of the respective house and on the house where lighting will effectively light the numbering.

dilution of their importance. Colors for military emblems must be in accordance with the Institute of Heraldry.

11.4.12.2 Department of the Army Plaque

The plaque should be displayed on installation identification signage to emphasize the heritage and professionalism of the United States Army. The design of the plaque must be in accordance with [Army Regulation \(AR\) 840-1, Department of the Army Seal, and Department of the Army Emblem and Branch of Service Plaques](#), and must be reproduced in full color.

11.4.12.3 Insignias

The use of branch insignia, shoulder sleeve insignia, coat of arms, and/or distinctive insignia on headquarters signs is permitted. All military emblems must appear in full color. Motivational symbols or motifs will not be used.

11.4.13 Reduce Visual Clutter

Over-signing detracts from a uniform sign system and if left uncontrolled will eventually destroy the integrity of the system. (Fig. 11.31)

Clutter creates confusion and ineffectiveness. Often motorists and pedestrians are confused by the bombardment of messages that have no relationship to each other, or the communication is on such a minimal level that the sign serves no purpose.

11.4.14 Location Maps

The location map is an integral element of an installation entrance. The location map display provides information and sense of place to the viewer. The design and construction should be of compatible architectural materials found throughout the installation (Fig. 11.32).

The location map will contain the following characteristics within the design.

- Plexiglas secured over map for protection against graffiti and the elements
- Architecturally compatible materials used for the base
- Paved walk-up area
- Litter receptacle

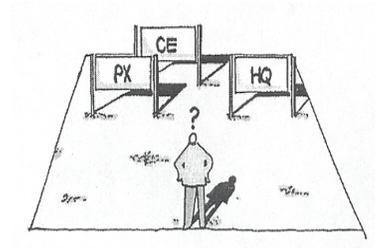


Fig. 11.31 - Visual Clutter Causes Confusion

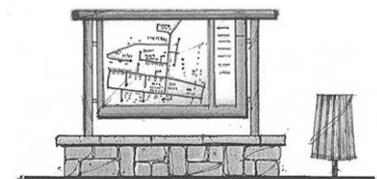


Fig. 11.32 - Location Maps Provide a Sense of Place

- Provide parking adjacent
- Provide current takeaway maps

9.6 PAVEMENT MARKING STANDARDS

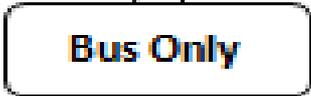
9.6.1 Pavement markings shall be as described in Part 3 of the [Manual of Uniform Traffic Control Devices \(MUTCD\)](#), also see Chapter 6, Site Elements, paragraph 6.4.4.3.4, for traffic related signage.

9.6.2 Concrete curbs and gutters shall not be painted. Markings shall be restricted to the pavement surface and marking paint shall not be applied to concrete curb, gutter, or any portion thereof including curb cuts for vehicle or wheelchair access.

9.6.3 Markings intended to prohibit parking shall be applied to the pavement surface parallel to the curb and gutter in a continuous band for the entirety of the restricted length of pavement.

9.6.4 Where appropriate a boxed area shall be created with diagonal lines to establish a no parking zone in street conditions such as curb side parking, etc.

Exterior Signage Requirements for Exterior Parking/Direction Signs



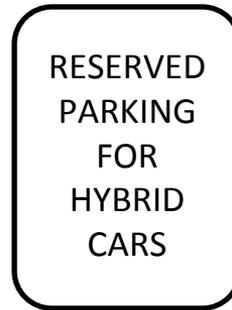
18" W X 24"



12" W X 18" H



12" W X 18" H



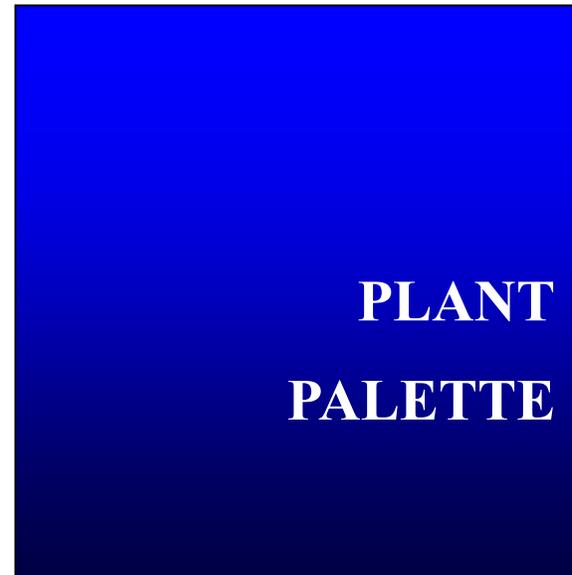
12" W X 18" H



12" W X 6" H

Appendix I

Acceptable Plant List



O.1 The visual image conveyed by a military installation is created by the architectural character site organization, and the landscape design. Section 10, *Landscape Design Standards* describes the required selection, placement, and maintenance of plant material at Fort Leonard Wood. Planted material includes trees, shrubs, bedding plants and ground covers such as grass for lawns. These plants collectively provide a simple and cost effective enhancement to the general appearance of the installation. Moreover plantings add an element of human scale to open spaces and can be used functionally to screen undesirable views, buffer winds, reinforce the hierarchy of the circulation system, or provide a visual transition between dissimilar land uses and enhance Force Protection measures. (See Fig. O.1 and Fig. O.2)



Fig. O.1 – Landscaping improves the overall visual quality of the installation

O.2 Plant selection and placement must be carefully considered for reasons of sustainability as discussed in Section 10 *Landscape Design Standards*.

O.3 A plant palette has been created to simplify this process of plant selection and placement. The plant selection list, which follow, have been created corresponding to each of the Visual Zones established in Section 5, *Visual Themes and Zones*. The Visual Zone Map and Table are included in this Appendix as Fig. O.3 and Table O-1.



Fig. O.2 – Trees provide shade and visual interest including seasonal color.

Note: Print single sided only. Pages O-3 through O-93 will automatically print in landscape.

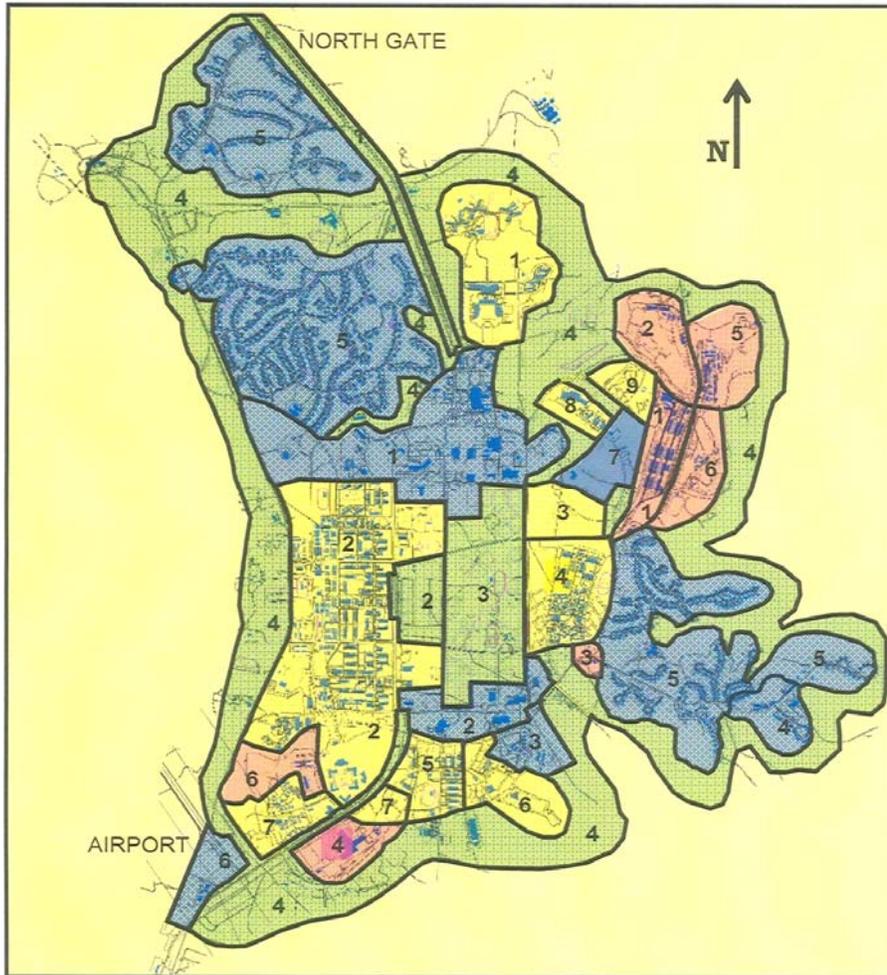


FIG. O-3 FORT LEONARD WOOD VISUAL ZONES MAP

| TABLE O-1 VISUAL THEME AND ZONE RELATIONSHIP CHART | | | |
|---|---|--|--|
| OPEN AREA THEME | COMMUNITY LIFE THEME | MISSION THEME | INDUSTRIAL THEME |
| Visual Zones | Visual Zones | Visual Zones | Visual Zones |
| 1-Missouri Ave. Entry Corridor 2-Gammon Field 3-Outdoor Recreation 4-Natural Environment | 1-Town Center 2-Community Activities Area 3- Preservation Area 4- Sturgis Heights 5-Family Housing 6-Airport Facilities 7-Tech Park | 1-Maneuver Center 2-Initial Entry Training 3-Permanent Party Barracks 4-Specker Barracks 5-MP Troop Complex 6-US Army Reserve 7-Army Nat'l Guard 8-Battalion Reception 9- Special Training | 1-Supply Facilities 2- Logistics 3-Water Treatment 4-TMP 5-Public Works 6-Vehicle Maintenance |

Appendix J

Drawings

| | |
|-------|--|
| G-001 | Cover Sheet |
| G-002 | Sheet Index |
| G-003 | General Location and Vicinity Map |
| CD101 | Civil Site Demolition Plan |
| CS101 | Civil Site Improvement Plan |
| CG101 | Civil Site Grading Plan |
| CU100 | Civil Site Utility Extension Plan |
| CU101 | Civil Site Utility Plan |
| A-101 | Architectural Conceptual Building Layout |



**US Army Corps
of Engineers**
Kansas City
District

GENERAL PURPOSE WAREHOUSE

PN 75078, FY 2010

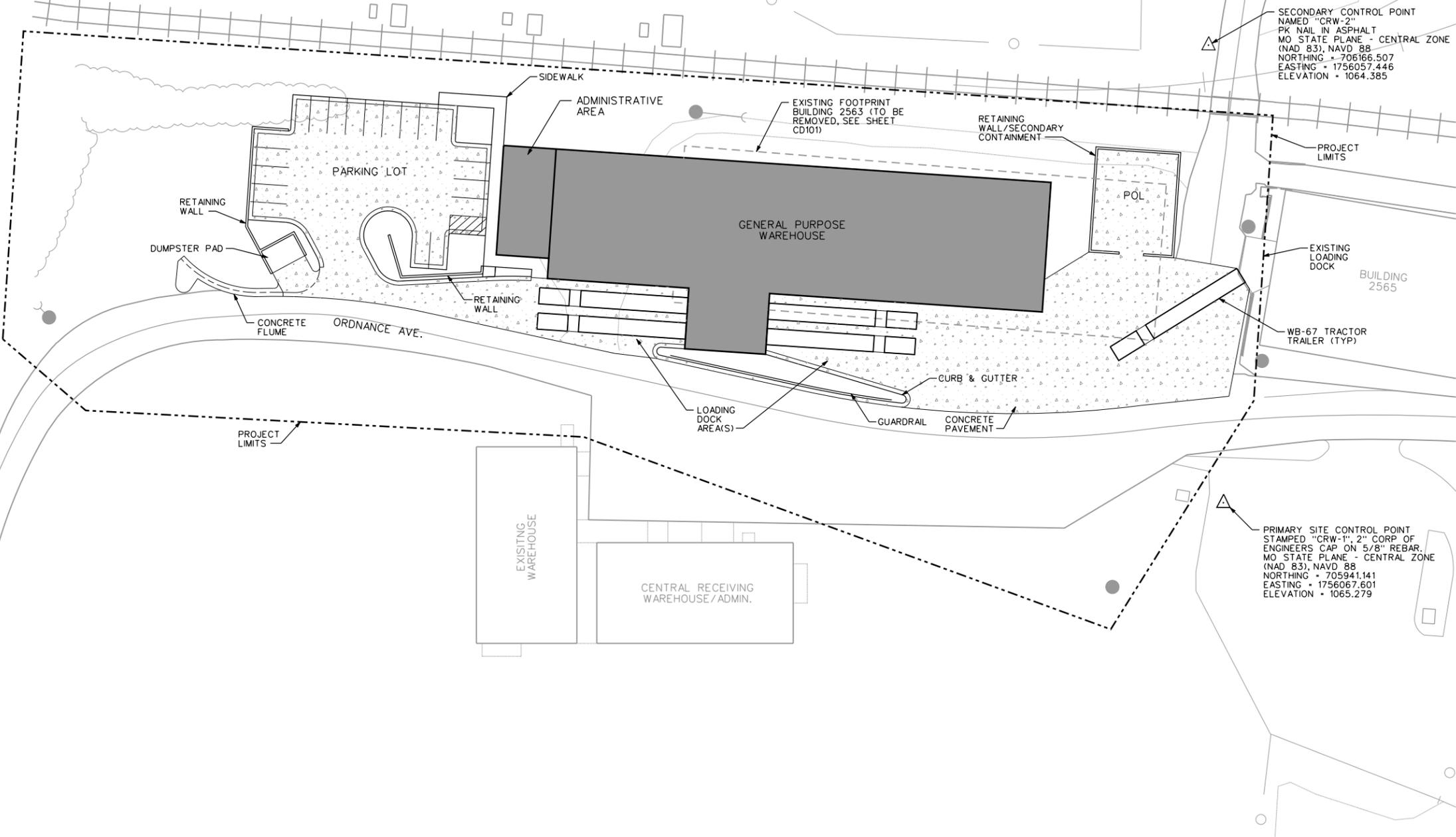
FORT LEONARD WOOD, MISSOURI

**Final RFP
June 2010**

Thursday, July 15, 2010

NOTES:
1. FOR DRAWING INDEX, LEGEND, ABBREVIATIONS, AND GENERAL NOTES, SEE SHEET G-003.

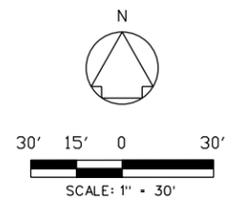
US Army Corps of Engineers Kansas City District



SECONDARY CONTROL POINT
 NAMED "CRW-2"
 PK NAIL IN ASPHALT
 MO STATE PLANE - CENTRAL ZONE
 (NAD 83), NAVD 88
 NORTHING = 706166.507
 EASTING = 1756057.446
 ELEVATION = 1064.385

PRIMARY SITE CONTROL POINT
 STAMPED "CRW-1", 2" CORP OF
 ENGINEERS CAP ON 5/8" REBAR.
 MO STATE PLANE - CENTRAL ZONE
 (NAD 83), NAVD 88
 NORTHING = 705941.141
 EASTING = 1756067.601
 ELEVATION = 1065.279

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CONCEPTUAL

NOT TO BE USED FOR CONSTRUCTION

DATE OF ISSUE JUNE 2010 Thursday, July 15, 2010

| | | |
|--------------------------|--------------------------|----------------------------------|
| Designed by: K. DOYLE | Chkd. by: DER | Date: JUNE 2010 |
| Drawn by: BEC | Submitted by: C. ROPE | Drawing Code: F-442-20-01 |
| | Project no. 75078 | |
| | Plot scale: 1" = 30' | CADD File Name: FLW_RFP_CS101 |

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 KANSAS CITY, MISSOURI

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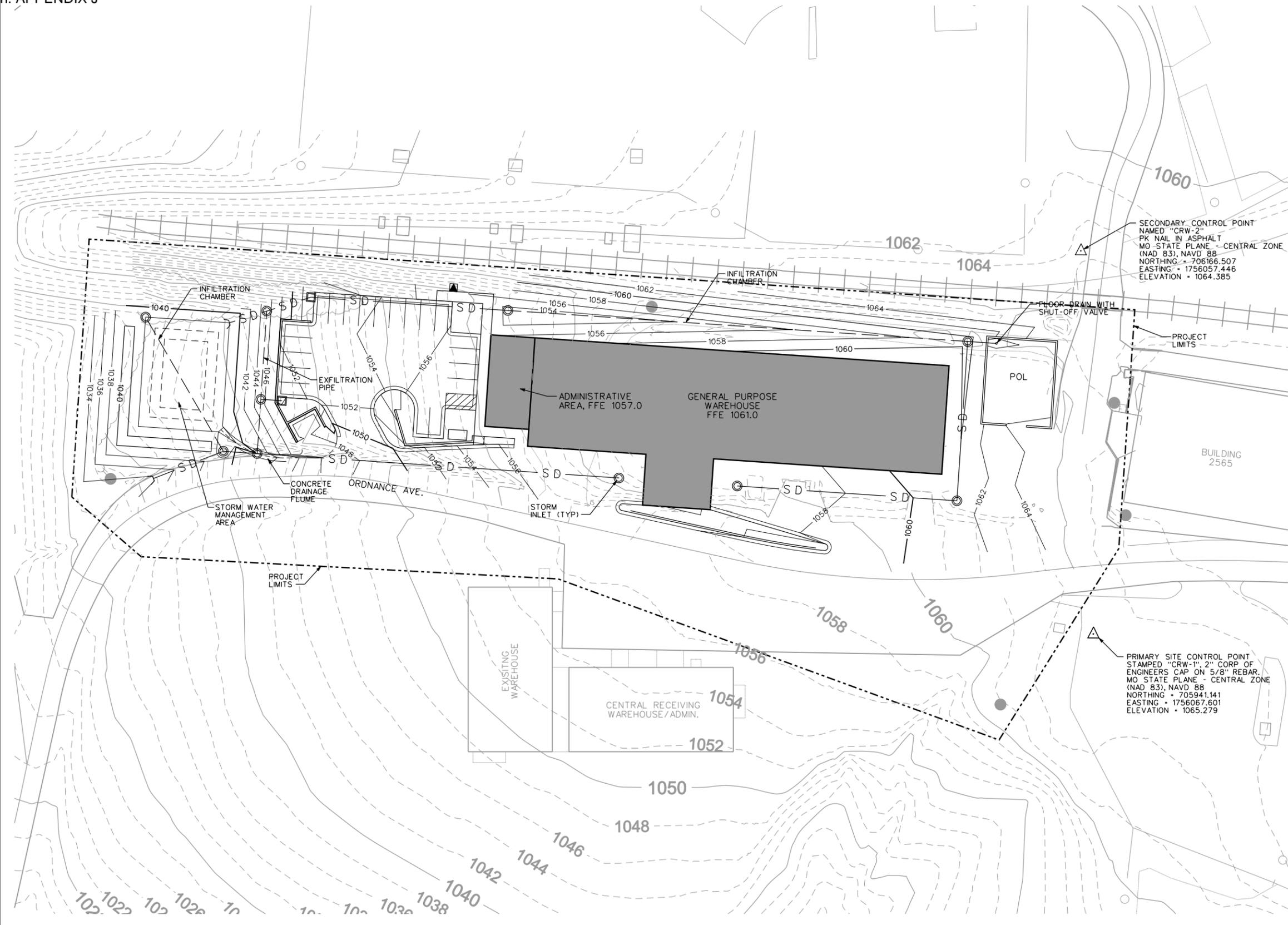
FORT LEONARD WOOD, MISSOURI
 GENERAL PURPOSE WAREHOUSE PROJECT
 PN 75078

CIVIL
 SITE IMPROVEMENT PLAN

Sheet reference number:
CS101

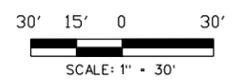
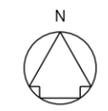
NOTES:
1. FOR DRAWING INDEX, LEGEND, ABBREVIATIONS, AND GENERAL NOTES, SEE SHEET G-003.

US Army Corps of Engineers Kansas City District



SECONDARY CONTROL POINT
NAMED "CRW-2"
PK NAIL IN ASPHALT
MO STATE PLANE - CENTRAL ZONE
(NAD 83), NAVD 88
NORTHING - 706166.507
EASTING - 1756057.446
ELEVATION - 1064.385

PRIMARY SITE CONTROL POINT
STAMPED "CRW-1", 2" CORP OF
ENGINEERS CAP ON 5/8" REBAR.
MO STATE PLANE - CENTRAL ZONE
(NAD 83), NAVD 88
NORTHING - 705941.141
EASTING - 1756067.601
ELEVATION - 1065.279



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|---------------------------------|------------------------------------|------------------------------|
| Designed by: K. DOYLE BEC | Chkd. by: DER | Date: JUNE 2010 |
| Submitted by: C. ROPE | Project no. 75078 | Drawing Code: F-442-20-01 |
| Plot scale: 1" = 30' | CADD File Name: FLW_RFP - CG101 | |

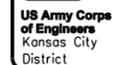
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GENERAL PURPOSE WAREHOUSE PROJECT
PN 75078
CIVIL
SITE GRADING PLAN

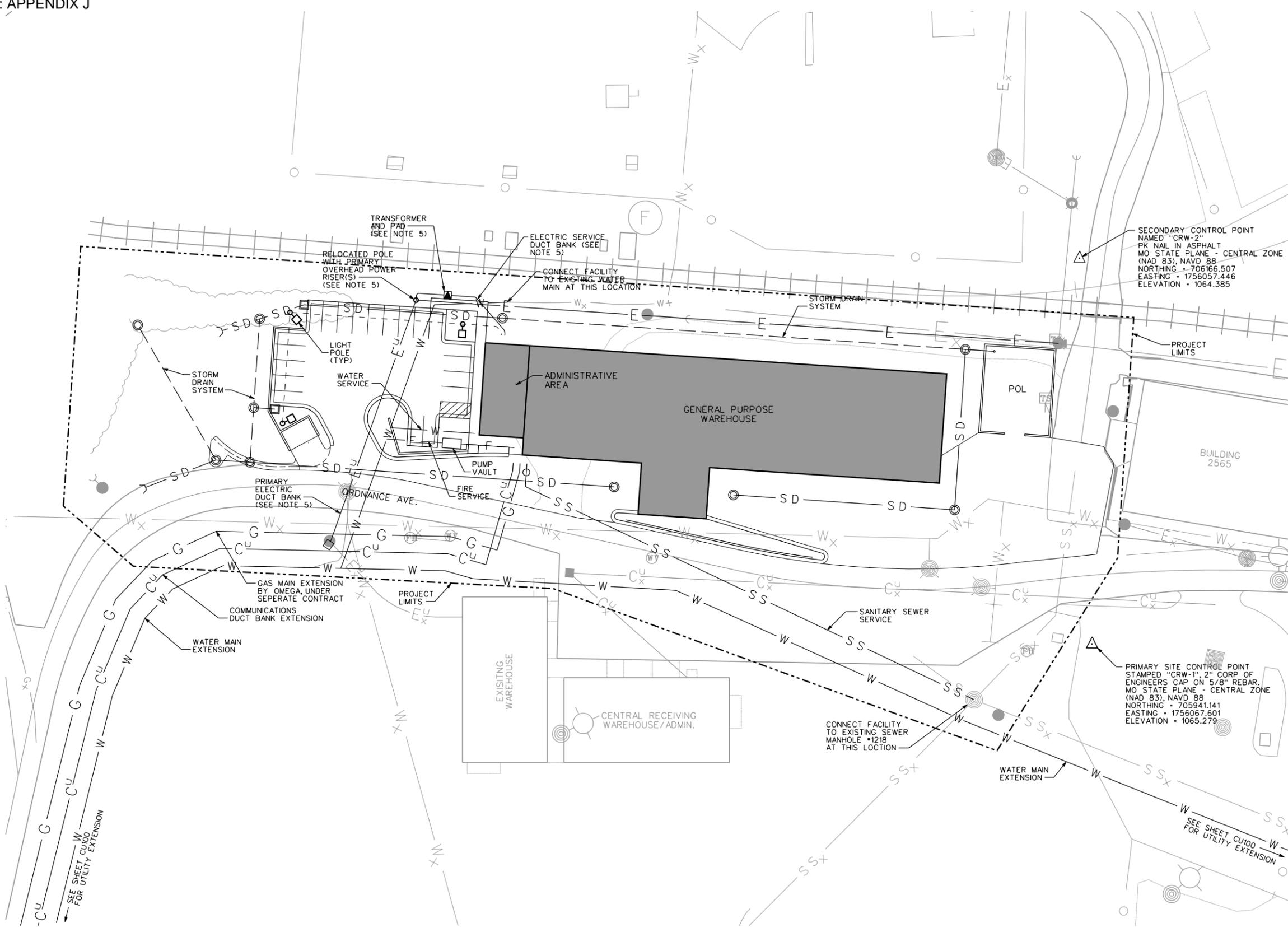
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GENERAL NOTES:

- FOR DRAWING INDEX, LEGEND, ABBREVIATIONS, AND GENERAL NOTES, SEE SHEET G-003.
- FOR UTILITY MAIN EXTENSION CONTINUATION, SEE SHEET CU100.
- UTILITIES SHOWN WERE USED FOR PLANNING PURPOSES AND ARE NOT TO BE PART OF D-B CONTRACTOR'S PROPOSAL.
- FINAL LOCATIONS AND DEPTH OF BURIAL FOR ALL UTILITIES SHALL BE COORDINATED WITH CORP PRIOR TO CONSTRUCTION.
- BY LACLEDE, UNDER SEPERATE CONTRACT.



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|-----------------|---------------|
| Date: | JUNE 2010 |
| Designed by: | K. DOYLE |
| Drawn by: | BEC |
| Chkd. by: | DER |
| Submitted by: | C. ROPE |
| Project no.: | 75078 |
| CADD File Name: | FLW_RFP_CU101 |
| Drawing Code: | F-442-20-01 |
| Plot scale: | 1" = 30' |

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GENERAL PURPOSE WAREHOUSE PROJECT
PN 75078

CIVIL UTILITY PLAN

Sheet reference number:
CU101

CONCEPTUAL
NOT TO BE USED FOR CONSTRUCTION

DATE OF ISSUE JUNE 2010 Thursday, July 15, 2010

APPENDIX K
Utility Cost Information

The following utility rates for this installation are provided for the purpose of performing life cycle cost calculations in response to this solicitation and for design development in accordance with Section 01 33 16 Design After Award:

| Utility "A" Rate | | |
|------------------|---------|-----------------|
| Electric | 0.0574 | per kwh |
| LP Gas | 1.8405 | per gal |
| Water | 0.9618 | per Kgal |
| Sewer | 1.1516 | per Kgal |
| Trash | 4.1929 | per CuYd |
| Fuel Oil | 2.8688 | per gal |
| Natural Gas | 12.4418 | per mmbtu (Dth) |

Appendix L

LEED Project Credit Guidance (OCT 09)

This spreadsheet indicates Army required credits, Army preferred credits, project-specific ranking of individual point preferences, assumptions guidance for individual credits, and references to related language in the RFP for individual credits.

| LEED Credit Paragraph | LEED Project Credit Guidance | Army Guidance: Required - Preferred - Avoid | | Project Preference Ranking: (1=most preferred, blank=no preference, X=preference not applicable to this credit, Rqd=required) |
|--------------------------|---|---|-----|---|
| PAR | FEATURE | | | REMARKS |
| SUSTAINABLE SITES | | | | |
| SSPR1 | Construction Activity Pollution Prevention (PREREQUISITE) | Rqd | Rqd | All LEED prerequisites are required to be met. |
| SS1 | Site Selection | | X | See paragraph LEED CREDITS COORDINATION. |

| | | | | |
|-------|---|------|---|--|
| SS2 | Development Density & Community Connectivity - OPTION 1 DENSITY | | X | See paragraph LEED CREDITS COORDINATION. |
| | Development Density & Community Connectivity - OPTION 2 CONNECTIVITY | | X | See paragraph LEED CREDITS COORDINATION. |
| SS3 | Brownfield Redevelopment | | X | See paragraph LEED CREDITS COORDINATION. |
| SS4.1 | Alternative Transportation: Public Transportation Access | | X | See paragraph LEED CREDITS COORDINATION. |
| SS4.2 | Alternative Transportation: Bicycle Storage & Changing Rooms | Pref | | Assume that non-transient building occupants are NOT housed on Post unless indicated otherwise. |
| SS4.3 | Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 1 | | | Requires provision of vehicles, which cannot be purchased with construction funds. Assume Government will not provide vehicles unless indicated otherwise. Assume that 50% of GOV fleet is NOT alternative fuel vehicles unless indicated otherwise. |
| SS4.3 | Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 2 | Pref | | |
| SS4.3 | Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 3 | | | Requires provision of vehicle refueling stations. Installation must support type of fuel and commit to maintaining/supporting refueling stations. |
| SS4.4 | Alternative Transportation: Parking Capacity | Pref | | |

| | | | | |
|--------------------------------|--|------|-----|---|
| SS5.1 | Site Development: Protect or Restore Habitat | | | |
| SS5.2 | Site Development: Maximize Open Space | Pref | | Assume AGMBC option for aggregated open space at another location on the installation is not available to the project unless indicated otherwise. |
| SS6.1 | Stormwater Design: Quantity Control | Pref | | See paragraph STORMWATER MANAGEMENT. |
| SS6.2 | Stormwater Design: Quality Control | Pref | | See paragraph STORMWATER MANAGEMENT. |
| SS7.1 | Heat Island Effect: Non-Roof | | | |
| SS7.2 | Heat Island Effect: Roof | Pref | | Coordinate with nearby airfield requirements, which may preclude this credit. |
| SS8 | Light Pollution Reduction | Pref | | |
| <u>WATER EFFICIENCY</u> | | | | |
| WEPR1 | Water Use Reduction (Version 3 only) | Rqd | Rqd | All LEED prerequisites are required to be met. |
| WE1.1 | Water Efficient Landscaping: Reduce by 50% | Pref | | See paragraph IRRIGATION. Project must include landscaping to be eligible for this credit. |
| WE1.2 | Water Efficient Landscaping: No Potable Water Use or No Irrigation | Pref | | Project must include landscaping to be eligible for this credit. |
| WE2 | Innovative Wastewater Technologies - OPTION 1 | | | |
| WE2 | Innovative Wastewater Technologies - OPTION 2 | | | |
| WE3 | Water Use Reduction | Pref | | See paragraph BUILDING WATER USE REDUCTION. |
| | | | | |
| | | | | |

| ENERGY AND ATMOSPHERE | | | | |
|--------------------------------|---|------|-----|---|
| EAPR1 | Fundamental Commissioning of the Building Energy Systems (PREREQUISITE) | Rqd | Rqd | All LEED prerequisites are required to be met. |
| EAPR2 | Minimum Energy Performance (PREREQUISITE) | Rqd | Rqd | All LEED prerequisites are required to be met. |
| EAPR3 | Fundamental Refrigerant Management (PREREQUISITE) | Rqd | Rqd | All LEED prerequisites are required to be met. |
| EA1 | Optimize Energy Performance | Rqd | 1 | Earning of LEED EA1 points as indicated in paragraph ENERGY CONSERVATION , as a minimum, is required. |
| EA2.1 | On-Site Renewable Energy | Pref | | See paragraph ENERGY CONSERVATION . |
| EA3 | Enhanced Commissioning | | | The Commissioning Authority may be provided through the Design-Build Contractor only if in accordance with USGBC Credit Interpretation Ruling (CIR) dated 9/15/06. Commissioning Authority activities begin during design phase and continue well beyond beneficial occupancy. Assume Government will not provide CxA post-occupancy activities unless indicated otherwise. |
| EA4 | Enhanced Refrigerant Management | | | |
| EA5 | Measurement & Verification | | | Assume Government will not provide post-occupancy activities unless indicated otherwise. |
| EA6 | Green Power | | X | See paragraph LEED CREDITS COORDINATION . |
| MATERIALS AND RESOURCES | | | | |

| | | | | |
|-------|---|------|-----|--|
| MRPR1 | Storage & Collection of Recyclables (PREREQUISITE) | Rqd | Rqd | All LEED prerequisites are required to be met. Coordinate with Installation during design development on collection service and receptacles. |
| MR1 | Building Reuse | | | |
| | | | | |
| | | | | |
| MR2.1 | Construction Waste Management: Divert 50% From Disposal | Pref | | See paragraph CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT. |
| MR2.2 | Construction Waste Management: Divert 75% From Disposal | Pref | | |
| MR3 | Materials Reuse | | | |
| | | | | |
| MR4.1 | Recycled Content: 10% (post-consumer + 1/2 pre-consumer) | Pref | | See paragraph RECYCLED CONTENT. |
| MR4.2 | Recycled Content: 20% (post-consumer + 1/2 pre-consumer) | Pref | | |
| MR5.1 | Regional Materials:10% Extracted, Processed & Manufactured Regionally | | | |
| MR5.2 | Regional Materials:20% Extracted, Processed & Manufactured Regionally | | | |
| MR6 | Rapidly Renewable Materials | Pref | | See paragraph BIOBASED AND ENVIRONMENTALLY PREFERABLE MATERIALS and |

| | | | | |
|-------------------------------------|---|------|-----|---|
| | | | | paragraph FEDERAL BIOBASED PRODUCTS PREFERRED PROCUREMENT PROGRAM. |
| MR7 | Certified Wood | Pref | | See paragraph BIOBASED AND ENVIRONMENTALLY PREFERABLE MATERIALS. |
| INDOOR ENVIRONMENTAL QUALITY | | | | |
| EQPR1 | Minimum IAQ Performance (PREREQUISITE) | Rqd | Rqd | All LEED prerequisites are required to be met. |
| EQPR2 | Environmental Tobacco Smoke (ETS) Control (PREREQUISITE) | Rqd | Rqd | All LEED prerequisites are required to be met. Assume all buildings are smoke free unless indicated otherwise (family housing, barracks and other lodging are facility types where smoking may be permitted in some cases). |
| EQ1 | Outdoor Air Delivery Monitoring | | | |
| EQ2 | Increased Ventilation | | | |
| EQ3.1 | Construction IAQ Management Plan: During Construction | Pref | | See paragraph CONSTRUCTION IAQ MANAGEMENT. |
| EQ3.2 | Construction IAQ Management Plan: Before Occupancy | Pref | | See paragraph CONSTRUCTION IAQ MANAGEMENT. |
| EQ4.1 | Low Emitting Materials: Adhesives & Sealants | Pref | | See paragraph LOW-EMITTING MATERIALS. |
| EQ4.2 | Low Emitting Materials: Paints & Coatings | Pref | | See paragraph LOW-EMITTING MATERIALS. |
| EQ4.3 | Low Emitting Materials: Carpet/Flooring Systems | Pref | | See paragraph LOW-EMITTING MATERIALS. |
| EQ4.4 | Low Emitting Materials: Composite Wood & Agrifiber Products | Pref | | See paragraph LOW-EMITTING MATERIALS. |
| EQ5 | Indoor Chemical & Pollutant Source Control | Pref | | System requiring weekly cleaning to earn this credit is not a permitted option unless indicated |

| | | | | |
|---|---|------|-----|---|
| | | | | otherwise. |
| EQ6.1 | Controllability of Systems: Lighting | | | |
| EQ6.2 | Controllability of Systems: Thermal Comfort | | | |
| EQ7.1 | Thermal Comfort: Design | Pref | | See paragraph APPLICABLE CRITERIA |
| EQ7.2 | Thermal Comfort: Verification | | | Project must earn credit EQ7.1 to be eligible for this credit. Assume Government will not provide post-occupancy activities unless indicated otherwise. |
| EQ8.1 | Daylight & Views: Daylight 75% of Spaces | Pref | | See paragraph DAYLIGHTING. |
| EQ8.2 | Daylight & Views: Views for 90% of Spaces | Pref | | |
| INNOVATION & DESIGN PROCESS | | | | |
| IDc1.1 | Innovation in Design | | | See paragraph INNOVATION AND DESIGN CREDITS. Assume Government will not provide any activities associated with ID credits. |
| IDc1.2 | Innovation in Design | | | |
| IDc1.3 | Innovation in Design | | | |
| IDc1.4 | Innovation in Design | | | |
| IDc2 | LEED Accredited Professional | Rqd | Rqd | LEED AP during design and construction is required. |
| REGIONAL PRIORITY CREDITS (Version 3 only) | | | | See paragraph LEED CREDITS COORDINATION. |

04 MAY 10

 Appendix M

Owner's Project Requirements Document for LEED Fundamental Commissioning

Project: General Purpose Warehouse PN 75078

Approved: _____

| | | |
|-------|-------------------------------|-------|
| Name | Owner's Representative | Date |
| _____ | _____ | _____ |
| Name | Design Agent's Representative | Date |
| _____ | _____ | _____ |

Overview and Instructions

The purpose of this document is to provide clear and concise documentation of the Owner's goals, expectations and requirements for commissioned systems, and shall be utilized throughout the project delivery and commissioning process to provide an informed baseline and focus for design development and for validating systems' energy and environmental performance.

The Owner's Project Requirements Document is a required document for LEED-NC EA Prerequisite Fundamental Commissioning of the Building Energy Systems. It shall be completed by the Corps District/Design Agent based on coordination with the Installation/User/Proponent and shall be approved by the Installation/User/Proponent representative.

The intent of the Owner's Project Requirements Document is to detail the functional requirements of a project and the expectations of the building's use and operation as it relates to commissioned systems. This template contains the basic recommended components indicated in the LEED Reference Guide. It should be adapted as needed to suit the project, remaining reflective of the LEED intent.

The Owner's Project Requirements Document should ideally be completed before the start of design and furnished to the design team. It must be completed prior to the approval of Contractor submittals of any commissioned equipment or systems to meet LEED requirements.

Updates to the Owner's Project Requirements Document throughout the course of project delivery shall be made by the Corps District/Design Agent based on decisions and agreements coordinated with and agreed to by the Installation/User/Proponent.

The Owner's Project Requirements Document shall be included in the project's LEED documentation file under EA PR1, Fundamental Commissioning of the Building Energy Systems.

04 MAY 10

Owner's Project Requirements Document for LEED Fundamental Commissioning

Table of Contents

1. Owner and User Requirements
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 - Building Fenestration
 - Building Envelope
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 - Accommodations for After-Hours Use
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 - Types of Lighting
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 - HVAC Controls
 - Domestic Hot Water
 - Lighting Controls
 - Daylighting Controls
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 - EMCS
 - Occupant Training and Orientation
 - O&M Staff Training and Orientation

TABLE 1

04 MAY 10

1. Owner and User Requirements

What is the primary purpose, program and use of this project? (example: office building with data center)

Describe pertinent project history. (example: standard design development)

Broad Goals

What are the broad goals relative to program needs?

What are the broad goals relative to future expansion?

What are the broad goals relative to flexibility?

What are the broad goals relative to quality of materials?

What are the broad goals relative to construction costs?

What are the broad goals relative to operational costs?

Other broad goals: *(Insert as applicable)*

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2. Environmental and Sustainability Goals

What are the project goals relative to sustainability and environmental issues? (example: LEED Silver rating)

What are the project goals relative to energy efficiency? (example: Meet EPACT)

What are the project goals and requirements for building siting that will impact energy use?

What are the project goals and requirements for building facade that will impact energy use?

What are the project goals and requirements for building fenestration that will impact energy use?

What are the project goals and requirements for building envelope that will impact energy use?

What are the project goals and requirements for building roof that will impact energy use?

Other: *(Insert as applicable)*

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3. Indoor Environmental Quality Requirements

What is the intended use for all spaces? For all spaces that have an intended use that is not readily apparent from the space name, provide this information in Table 1.

What is the anticipated occupancy schedule (numbers of occupants and time frames) for all occupied spaces? Indicate the default occupancy schedule below and for all spaces that have an occupancy schedule that differs from the default, provide this information in Table 1.

What accommodations for after-hours use are required? (example: access control, lighting controls, HVAC controls) Indicate general accommodations required below and for all spaces that have special requirements, provide this information in Table 1.

What are the lighting, temperature, humidity, air quality, ventilation and filtration requirements for all spaces? Indicate the default requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1.

Lighting: _____

Temperature: _____

Humidity: _____

Air Quality: _____

Ventilation: _____

Filtration: _____

What are the acoustical requirements for all spaces? Indicate the default acoustical requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1.

What is the desired level of occupant ability to adjust systems controls? Indicate the default desired levels below and for all spaces that have a desired level that differs from the default, provide this information in Table 1.

Lighting: _____

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Temperature: _____

Humidity: _____

Air Quality: _____

Ventilation: _____

What, if any, specific types of lighting are desired? (example: fluorescent in 2x2 grid, accent lighting, particular lamps)

4. Equipment and System Expectations

(Complete for each category as applicable or indicate "none identified" or "N/A". Add desired features information for other anticipated commissioned systems as applicable)

Indicate desired features for the following commissioned system: Space Heating

Desired Type: _____

Quality: _____

Preferred Manufacturer: _____

Reliability: _____

Automation: _____

Flexibility: _____

Maintenance Requirements: _____

Efficiency Target: _____

Desired Technologies: _____

Indicate desired features for the following commissioned system: Ventilation

Desired Type: _____

Quality: _____

Preferred Manufacturer: _____

Reliability: _____

Automation: _____

Flexibility: _____

Maintenance Requirements: _____

Efficiency Target: _____

Desired Technologies: _____

Indicate desired features for the following commissioned system: Air Conditioning

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Desired Type: _____

Quality: _____

Preferred Manufacturer: _____

Reliability: _____

Automation: _____

Flexibility: _____

Maintenance Requirements: _____

Efficiency Target: _____

Desired Technologies: _____

Indicate desired features for the following commissioned system: Refrigeration

Desired Type: _____

Quality: _____

Preferred Manufacturer: _____

Reliability: _____

Automation: _____

Flexibility: _____

Maintenance Requirements: _____

Efficiency Target: _____

Desired Technologies: _____

Indicate desired features for the following commissioned system: HVAC Controls

Desired Type: _____

Quality: _____

Preferred Manufacturer: _____

Reliability: _____

Automation: _____

Flexibility: _____

Maintenance Requirements: _____

Efficiency Target: _____

Desired Technologies: _____

Indicate desired features for the following commissioned system: Domestic Hot Water

Desired Type: _____

Quality: _____

Preferred Manufacturer: _____

Reliability: _____

Automation: _____

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Flexibility: _____
Maintenance Requirements: _____
Efficiency Target: _____
Desired Technologies: _____

Indicate desired features for the following commissioned system: Lighting Controls

Desired Type: _____
Quality: _____
Preferred Manufacturer: _____
Reliability: _____
Automation: _____
Flexibility: _____
Maintenance Requirements: _____
Efficiency Target: _____
Desired Technologies: _____

Indicate desired features for the following commissioned system: Daylighting Controls

Desired Type: _____
Quality: _____
Preferred Manufacturer: _____
Reliability: _____
Automation: _____
Flexibility: _____
Maintenance Requirements: _____
Efficiency Target: _____
Desired Technologies: _____

Indicate desired features for the following commissioned system: Emergency Power

Desired Type: _____
Quality: _____
Preferred Manufacturer: _____
Reliability: _____
Automation: _____
Flexibility: _____
Maintenance Requirements: _____
Efficiency Target: _____
Desired Technologies: _____

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Indicate desired features for the following commissioned system: Other - _____

Desired Type: _____

Quality: _____

Preferred Manufacturer: _____

Reliability: _____

Automation: _____

Flexibility: _____

Maintenance Requirements: _____

Efficiency Target: _____

Desired Technologies: _____

5. Building Occupant and O&M Personnel Requirements

How will the facility be operated? Who will operate the facility?

Will the facility be connected to an EMCS? If so, what are the interface requirements? (example: monitoring points, control points, scheduling)

What is the desired level of training and orientation for building occupants to understand and use the building systems?

What is the desired level of training and orientation for O&M staff to understand and maintain the building systems?

APPENDIX N
LEED Requirements for Multiple Contractor Combined Projects

Not Used

| | | | | | |
|-----------------------|--------------------------------|-------------------------------------|---|--------------------------|--|
| LEED Credit Paragraph | LEED 3.0 Strategy Table | Building CTR Substitution Permitted | Site CTR Substitution Permitted (Separate Contract) | Required Points Strategy | |
|-----------------------|--------------------------------|-------------------------------------|---|--------------------------|--|

BUILDING: GENERAL PURPOSE WAREHOUSE (GPW)

| PAR | FEATURE | | | | REMARKS |
|-----|---------|--|--|--|---------|
|-----|---------|--|--|--|---------|

CATEGORY 1 – SUSTAINABLE SITES

| | | | | | |
|-------|---|-----|-----|---|--|
| SSPR1 | Construction Activity Pollution Prevention (PREREQUISITE) | NIC | NO | R | Site Ctr (separate contract) is the primary permittee. Building Ctr is secondary permittee to primary permittee. |
| SS1 | Site Selection | NIC | NO | 1 | Site CTR responsible (separate contract). |
| SS2 | Development Density & Community Connectivity | NIC | NO | | Not Targeted |
| SS3 | Brownfield Redevelopment | NIC | NO | | Not Targeted |
| SS4.1 | Alternative Transportation: Public Transportation Access | NIC | NO | | |
| SS4.2 | Alternative Transportation: Bicycle Storage & Changing Rooms | NO | NO | 1 | Combined Credit Building and Site CTR responsible. |
| SS4.3 | Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 1 | NIC | YES | | Not Targeted |
| SS4.3 | Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 2 | NIC | YES | | Not Targeted |
| SS4.3 | Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 3 | NO | NO | | Not Targeted |
| SS4.4 | Alternative Transportation: Parking Capacity | NIC | NO | 2 | Site CTR responsible (separate contract). |
| SS5.1 | Site Development: Protect or Restore Habitat | NIC | YES | 1 | Site CTR responsible (separate contract). |
| SS5.2 | Site Development: Maximize Open Space | NIC | YES | 1 | Site CTR responsible (separate contract). |
| SS6.1 | Stormwater Design: Quantity Control | NIC | YES | 1 | Site CTR responsible (separate contract). |
| SS6.2 | Stormwater Design: Quality Control | NIC | YES | | |
| SS7.1 | Heat Island Effect: Non-Roof | NIC | YES | 1 | Building CTR responsible. |
| SS7.2 | Heat Island Effect: Roof | YES | NIC | 1 | Building CTR responsible. |
| SS8 | Light Pollution Reduction | NO | NO | 1 | Combined Bldg/Site credit. Building CTR responsible for building lighting rqmts. Site CTR responsible for site lighting rqmts. |

CATEGORY 2 – WATER EFFICIENCY

| | | | | | |
|-------|---|-----|-----|---|---|
| WEPR1 | Water Use Reduction: Reduce by 20% (PREREQUISITE) | NO | NO | R | |
| WE1.1 | Water Efficient Landscaping: Reduce by 50% | NIC | YES | 2 | Site CTR responsible (separate contract). |

| | | | | | |
|-----------------------|--------------------------------|-------------------------------------|---|--------------------------|--|
| LEED Credit Paragraph | LEED 3.0 Strategy Table | Building CTR Substitution Permitted | Site CTR Substitution Permitted (Separate Contract) | Required Points Strategy | |
|-----------------------|--------------------------------|-------------------------------------|---|--------------------------|--|

BUILDING: GENERAL PURPOSE WAREHOUSE (GPW)

| PAR | FEATURE | | | | REMARKS |
|-------|--|-----|-----|---|---|
| WE1.2 | Water Efficient Landscaping: No Potable Water Use or No Irrigation | NIC | YES | 2 | Site CTR responsible (separate contract). |
| WE2 | Innovative Wastewater Technologies - OPTION 1 | NO | NO | | Not Targeted |
| WE2 | Innovative Wastewater Technologies - OPTION 2 | NIC | YES | | Not Targeted |
| WE3.1 | Water Use Reduction: 30% Reduction | YES | NIC | 2 | Building CTR responsible. |
| WE3.2 | Water Use Reduction: 35-40% Reduction | YES | NIC | | |

CATEGORY 3 – ENERGY AND ATMOSPHERE

| | | | | | |
|-------|---|-----|-----|----|--|
| EAPR1 | Fundamental Commissioning of the Building Energy Systems (PREREQUISITE) | NO | NO | R | Building CTR responsible for commissioning of building systems. D/B CTR responsible for commissioning of site systems. |
| EAPR2 | Minimum Energy Performance (PREREQUISITE) | NO | NIC | R | Building CTR responsible. |
| EAPR3 | Fundamental Refrigerant Management (PREREQUISITE) | NO | NIC | R | Building CTR responsible. |
| EA1 | Optimize Energy Performance | YES | NIC | 10 | Building CTR responsible. Must comply with EPACT 2005 minimum energy performance. |
| EA2 | On-Site Renewable Energy | YES | NO | | Not Targeted |
| EA3 | Enhanced Commissioning | NO | NO | 2 | Building CTR responsible. |
| EA4 | Enhanced Refrigerant Management | YES | NIC | | Building CTR responsible. Evaluate during design |
| EA5 | Measurement & Verification | YES | NIC | 3 | Achievable |
| EA6 | Green Power | NO | NIC | | Not Targeted |

CATEGORY 4 – MATERIALS AND RESOURCES

| | | | | | |
|-------|---|-----|----|---|--|
| MRPR1 | Storage & Collection of Recyclables (PREREQUISITE) | NIC | NO | R | Combined Bldg/Site credit. Building CTR provides collection area in Building. Site CTR provides enlarged dumpster area(s) to accommodate recycling receptacles as well as dumpsters. |
| MR1.1 | Building Reuse- Structure: Maintain Existing Walls, Floors & Roof | YES | NO | | Not Targeted |
| MR1.2 | Building Reuse- Interior: Maintain 50% of Non-Structural Elements | YES | No | | Not Targeted |

| | | | | | |
|-----------------------|--------------------------------|-------------------------------------|---|--------------------------|--|
| LEED Credit Paragraph | LEED 3.0 Strategy Table | Building CTR Substitution Permitted | Site CTR Substitution Permitted (Separate Contract) | Required Points Strategy | |
|-----------------------|--------------------------------|-------------------------------------|---|--------------------------|--|

BUILDING: GENERAL PURPOSE WAREHOUSE (GPW)

| PAR | FEATURE | | | | REMARKS |
|-------|--|-----|-----|---|--|
| MR2.1 | Construction Waste Management: Divert 50% From Disposal | NO | NO | 1 | Combined Aggregate credit. Building CTR responsible for diversion of minimum 50% of waste generated. Site CTR responsible for diversion of minimum 50% of waste generated. No on-post recycling facility available for GC use. |
| MR2.2 | Construction Waste Management: Divert 75% From Disposal | NO | NO | | Combined Aggregate credit. Building CTR responsible for diversion of minimum 75% of waste generated. Site CTR responsible for diversion of minimum 75% of waste generated. |
| MR3.1 | Materials Reuse: 5% | NO | NO | | Not Targeted |
| MR3.2 | Materials Reuse: 10% | NO | NO | | Not Targeted |
| MR4.1 | Recycled Content: 10% (post-consumer + 1/2 pre-consumer) | NO | NO | 1 | Combined Cumulative credit. Building CTR responsible for minimum 15% recycled materials. D/B CTR responsible for minimum 1% recycled materials. (Target steel, metals, finishes) |
| MR4.2 | Recycled Content: 20% (post-consumer + 1/2 pre-consumer) | NO | NO | | Combined Cumulative credit. Building CTR responsible for minimum 30% recycled materials. D/B CTR responsible for minimum 1% recycled materials. |
| MR5.1 | Regional Materials: 10% Extracted, Processed & Manufactured Regionally | NO | NO | 1 | Combined Cumulative credit. Building CTR responsible for minimum 3% regional materials. D/B CTR responsible for minimum 30% regional materials. (Target masonry, CMU, concrete, asphalt) |
| MR5.2 | Regional Materials: 20% Extracted, Processed & Manufactured Regionally | NO | NO | | Combined Cumulative credit. Building CTR responsible for minimum 6% regional materials. D/B CTR responsible for minimum 60% regional materials. (include landscaping, interior finishes) |
| MR6 | Rapidly Renewable Materials | YES | NIC | | Not Targeted |
| MR7 | Certified Wood | YES | NIC | | Building CTR responsible. Evaluate during design |

CATEGORY 5 – INDOOR ENVIRONMENTAL QUALITY

| | | | | | |
|-------|--|-----|-----|---|---|
| EQPR1 | Minimum IAQ Performance (PREREQUISITE) | NO | NIC | R | Building CTR responsible. |
| EQPR2 | Environmental Tobacco Smoke (ETS) Control (PREREQUISITE) | NO | NO | R | Smoking is prohibited in non-residential federal facilities. Building CTR responsible for building ETS control features. D/B CTR responsible for site ETS features. |
| EQ1 | Outdoor Air Delivery Monitoring | YES | NIC | 1 | Building CTR responsible. |
| EQ2 | Increased Ventilation | YES | NIC | | Building CTR responsible. Evaluate during design |
| EQ3.1 | Construction IAQ Management Plan: During Construction | YES | NIC | 1 | Building CTR responsible. |
| EQ3.2 | Construction IAQ Management Plan: Before Occupancy | YES | NIC | 1 | Building CTR responsible. |
| EQ4.1 | Low Emitting Materials: Adhesives & Sealants | YES | NIC | 1 | Building CTR responsible. |
| EQ4.2 | Low Emitting Materials: Paints & Coatings | YES | NIC | 1 | Building CTR responsible. |

| | | | | | |
|-----------------------|--------------------------------|-------------------------------------|---|--------------------------|--|
| LEED Credit Paragraph | LEED 3.0 Strategy Table | Building CTR Substitution Permitted | Site CTR Substitution Permitted (Separate Contract) | Required Points Strategy | |
|-----------------------|--------------------------------|-------------------------------------|---|--------------------------|--|

BUILDING: GENERAL PURPOSE WAREHOUSE (GPW)

| PAR | FEATURE | | | | REMARKS |
|-------|---|-----|-----|---|--|
| EQ4.3 | Low Emitting Materials: Flooring Systems | YES | NIC | 1 | Building CTR responsible. |
| EQ4.4 | Low Emitting Materials: Composite Wood & Agrifiber Products | YES | NIC | 1 | Building CTR responsible. |
| EQ5 | Indoor Chemical & Pollutant Source Control | YES | NIC | 1 | Building CTR responsible. Fax/Copy and Janitor |
| EQ6.1 | Controllability of Systems: Lighting | YES | NIC | 1 | Building CTR responsible. Task Lighting |
| EQ6.2 | Controllability of Systems: Thermal Comfort | YES | NIC | | Building CTR responsible. Possible with UFAD. |
| EQ7.1 | Thermal Comfort: Design | YES | NIC | 1 | Building CTR responsible. |
| EQ7.2 | Thermal Comfort: Verification | YES | NIC | 1 | Building CTR responsible. |
| EQ8.1 | Daylight & Views: Daylight 75% of Spaces | YES | NIC | | Not Targeted |
| EQ8.2 | Daylight & Views: Views for 90% of Spaces | YES | NIC | | Not Targeted |

CATEGORY 6 – INNOVATION & DESIGN PROCESS

| | | | | | |
|--------|------------------------------|-----|-----|---|--|
| IDc1.1 | Innovation in Design | YES | YES | 1 | |
| IDc1.2 | Innovation in Design | YES | YES | 1 | |
| IDc1.3 | Innovation in Design | YES | YES | 1 | |
| IDc1.4 | Innovation in Design | YES | YES | 1 | |
| IDc1.5 | Innovation in Design | YES | YES | 1 | |
| IDc2 | LEED Accredited Professional | NO | NO | 1 | |

CATEGORY 7 – REGIONAL PRIORITY CREDITS

| | | | | | |
|--------------|--|-----|-----|-----------|--|
| SSc4.1 | Alternative Transportation, Public Transportation Access | NIC | NO | | |
| SSc6.1 | Stormwater Design, Quality Control | NIC | YES | 1 | |
| WEc3 | Water Use Reduction for 40% | YES | NIC | 1 | |
| EAc1 | Optimize Energy Performance for 28% | YES | NIC | 1 | |
| EAc2.1 | On-Site Renewable Energy | YES | NO | | |
| IEQc7.1 | Thermal Comfort, Design | YES | NIC | 1 | |
| TOTAL | | | | 55 | |

| | | | | | | | | |
|-----------------------|--------------------------------|--|-------------------------------------|--|---|--|--------------------------|--|
| LEED Credit Paragraph | | | Building CTR Substitution Permitted | | Site CTR Substitution Permitted (Separate Contract) | | Required Points Strategy | |
| | LEED 3.0 Strategy Table | | | | | | | |

BUILDING: GENERAL PURPOSE WAREHOUSE (GPW)

| PAR | FEATURE | | | | | | | REMARKS |
|-----|---------|--|--|--|--|--|--|---------|
| | | | | | | | | |

Section: APPENDIX P

APPENDIX P USGBC Registration of Army Projects

Typical Registration Procedure

1. Complete the online registration form (see guidance below) at the USGBC website <http://www.leedonline.com>.
2. Pay the registration Fee.
3. The USGBC will follow up final invoice, the LEED-online passwords and template information.

Completing the Registration Form

BEFORE YOU BEGIN:

Create a personal account with USGBC if you do not have one.

You will need the following information:

Project name as it appears in P2 (obtain through USACE Project Manager)

Building number/physical address of project.

Zip code for Installation/project location

Total gross area of buildings in project

Total Construction cost for buildings only (see Project Details Section instructions below)

ACCOUNT/LOGIN INFORMATION SECTION

1. The person registering the project **must have an account with USGBCS** (login and password) to complete the form. If you have an account, select "I already have a USGBC Web site account" and enter email and password (twice). If you do not have an account, you may select "Create a new USGBC website account" and follow the instructions. It is recommended that you create an account separately on the USGBC website before you start the form. **IMPORTANT:** USACE team members are members of USGBC and are eligible for Members price. USACE team members registering projects should be sure to include USACE Corporate Access ID on the form (if you do not have it contact richard.l.schneider@usace.army.mil or judith.f.milton@usace.army.mil for the number).
2. The Account/Login Information is filled out by the person registering the project. It may be a Contractor or a USACE staff member.

PROJECT TYPE SECTION

Self-explanatory.

GENERAL PROJECT INFORMATION SECTION

Project Title: Match the project name used in P2. Contact the USACE Project Manager for this information.

Is project confidential: Indicate NO except if the project has security sensitivity (elements that are FOUO are higher security) indicate YES.

Project Address 1 and 2: This is the physical location of the project. Provide building number, street address, or what ever is known to best describe the location of the project on the installation.

Project City: Installation Name
State, Country, Zip Code: Self-explanatory
How Did You Heat About LEED: USACE Requirement

Primary Contact Information

The Primary Contact may be a Contractor or a USACE staff member. USBGC considers this individual to be the primary contact for all aspects of the project.

PROJECT DETAILS

Project Owner, First Name, Last Name, email: The Project Owner is the USACE Project Manager.

Organization Name: U.S. Army Corps of Engineers. This field MUST be completed this way because it will be used as a search field for higher HQ to find all USACE registered projects.

PROJECT DETAILS

Owner Type: Military Base

Project Scope: Provide brief description (example: barracks complex)

Site Conditions: Provide brief description (example, wooded with steep grades)

Occupant Type: Provide brief description (example, military and civilian employees)

Owner Occupied: No

Gross Square Footage: Provide total area all buildings in project.

Project Budget: Do not include the cost for design, site work, demolition, abatement or other work,- do not include Government contingency or supervision cost. For design-build and construction projects registered after award, use the awarded contract cost for construction of buildings only. For projects prior to award of design-build or construction contract, use the total Primary Facility cost from the DD1391 or updated Primary Facility cost based on design development if available.

Current Project Phase: Identify phase at time of registration (example: design start, construction start)

Project Type: Self-explanatory

PAYMENT INFORMATION

Self-explanatory

APPENDIX Q
REV 1.1 – 31 MAY 2009
AREA COMPUTATIONS

Computation of Areas: Compute the "gross area" and "net area" of facilities (excluding family housing) in accordance with the following subparagraphs:

(1) Enclosed Spaces: The "gross area" is the sum of all floor spaces with an average clear height $\geq 6'-11"$ (as measured to the underside of the structural system) and having perimeter walls which are $\geq 4'-11"$. The area is calculated by measuring to the exterior dimensions of surfaces and walls.

(2) Half-Scope Spaces: Areas of the following spaces shall count as one-half scope when calculating "gross area":

- Balconies
- Porches
- Covered exterior loading platforms or facilities
- Covered but not enclosed passageways and walks
- Open stairways (both covered and uncovered)
- Covered ramps
- Interior corridors (Unaccompanied Enlisted Personnel Housing Only)

(3) Excluded Spaces: The following spaces shall be excluded from the "gross area" calculation:

- Crawl spaces
- Uncovered exterior loading platforms or facilities
- Exterior insulation applied to existing buildings
- Open courtyards
- Open paved terraces
- Uncovered ramps
- Uncovered stoops
- Utility tunnels and raceways
- Roof overhangs and soffits measuring less than 3'-0" from the exterior face of the building to the fascia

(4) Net Floor Area: Where required, "net area" is calculated by measuring the inside clear dimensions from the finish surfaces of walls. If required, overall "assignable net area" is determined by subtracting the following spaces from the "gross area":

- Basements not suited as office, special mechanical, or storage space
- Elevator shafts and machinery space
- Exterior walls
- Interior partitions
- Mechanical equipment and water supply equipment space
- Permanent corridors and hallways
- Stairs and stair towers
- Janitor closets
- Electrical equipment space
- Electronic/communications equipment space

| RMS SUBMITTAL REGISTER INPUT FORM | | | CONTRACT NUMBER | | DELIVERY ORDER | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|------------------------------------|---|------------------------|--------------------|-------------------|--------------|------------------|-------------------|-------------------|------------------------|------------------------|---------------|--------------------------|---------------------------|--------------------------|----------------------------------|-------------------------|---------|---------|----------------------|------------------|----------------------|---------------------|-------------------------|---------------------------|
| TITLE AND LOCATION | | | | | | | | | | | | | | | | | | | | | | | | | |
| Button | <-----Right click for Instructions | | TYPE OF SUBMITTAL | | | | | | | | CLASSIFICATION | | | | REVIEWING OFFICE | | | | | | | | | | |
| SECTION | PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | 01 - PRECON SUBMITTALS | 02 - SHOP DRAWINGS | 03 - PRODUCT DATA | 04 - SAMPLES | 05 - DESIGN DATA | 06 - TEST REPORTS | 07 - CERTIFICATES | 08 - MFRS INSTRUCTIONS | 09 - MFRS FIELD REPORT | 10 - O&M DATA | 11 - CLOSEOUT SUBMITTALS | FO - FOR INFORMATION ONLY | GA - GOVERNMENT APPROVED | DA - DESIGNER OF RECORD APPROVAL | CR - CONFORMANCE REVIEW | DA / CR | DA / GA | DO - DISTRICT OFFICE | AO - AREA OFFICE | RO - RESIDENT OFFICE | PO - PROJECT OFFICE | DR - DESIGNER OF RECORD | AE - ARCHITECT / ENGINEER |
| 00 72 00 | 52.236-13 | Accident Prevention Plan | X | | | | | | | | | | | | | X | | | | | | | | | |
| 00 73 00 | 1.11 | Dev. From Accept. Design. No Deviation from Contract | | | | | X | | | | | | | | | | | X | | | | | | | X |
| 00 73 00 | 1.11 | Dev. From Accepted Design - Deviates from Contract | | | | | X | | | | | | | | | | | X | | | | | | | X |
| 00 73 00 | 1.17 | Supplemental Price Breakdown | X | | | | | | | | | | | X | | | | | | | | | | | |
| 00 73 00 | 1.18 | SSHO Qualifications | X | | | | | | | | | | | | X | | | | | | | | | | |
| 01 10 00 | 5.2.3.1 | (if concrete pavement) Joint Layout Plan with design drawings | | | | | X | | | | | | | | X | | X | | | | | | | | |
| 01 10 00 | 5.5.2 | Building Envelope Sealing Performance Testing | | | | | X | | | | | | | X | | | | | | | X | | | | |
| 01 10 10 | *** | Tests as Req by Codes - DOR Develops Test Program | | | | | X | | | | | | | X | | | | | | | X | | | | X |
| 01 10 00 | 5.8.3 | BAS Review Information | | X | | | | | | | | | | X | | | | | | | X | | | | X |
| 01 10 00 | 5.8.3 | BAS Performance Verification Test | | | | | X | | | | | | | X | | | | | | | X | | | | X |
| 01 10 00 | 5.8.4 | Testing Adjusting and Balancing | | | | | X | | | | | | | X | | | | | | | X | | | | X |
| 01 10 00 | 5.8.5 | Commissioning | | | | | X | | | | | | | X | | | | | | | X | | | | X |
| 01 10 00 | 6.15 | Environmental As Required for Site Specific | | | | | X | | | | | | | | | X | | | | | X | | | | X |
| 01 10 00 | 6.16 | Permits as required for Site specific | | | | | X | | | | | | | | | X | | | | | X | | | | X |
| 01 10 00 | 5.10.2 | Fire Protection Tests | | | | | X | X | | | | | | X | | | | | | | X | | | | X |
| 01 32 01.00 10 | 3.4.1 | Preliminary Project Schedule | X | | | | | | | | | | | | X | | | | | | X | | | | |
| 01 32 01.00 10 | 3.4.2 | Initial Project Schedule | X | | | | | | | | | | | | X | | | | | | X | | | | |
| 01 32 01.00 10 | 3.4.3 | Design Package Schedule | X | | | | | | | | | | | | X | | | | | | X | | | | |
| 01 32 01.00 10 | 3.6.1 | Periodic schedule updates from the Contractor | X | | | | | | | | | | | | X | | | | | | X | | | | |
| 01 32 01.00 10 | 3.7 | Time Extension Request (Schedule) | X | | | | | | | | | | | | X | | | | | | X | | | | |
| 01 33 00 | 1.8 | Submittal Register - DOR Input Required | X | | | | | | | | | | | | X | | | | | | X | | | | X |
| 01 33 00 | 1.8 | Submittal Register Updates (Design Packages, etc.) | X | | | | | | | | | | | | X | | | | | | X | | | | X |
| 01 33 00 | 1.3.1 | Substitution of Manuf or Model Named in Proposal | | X | X | | | | | | | | | | X | | | X | | | X | | | | X |
| 01 33 16 | 1.2 | Identify Designer(s) of Record | X | | | | | | | | | | | | X | | | | | | X | | | | X |
| 01 33 16 | 1.1.2 / 3.2.4 | Fast Track Design Package(s) | | | | | X | | | | | | | | | X | | | | X | X | | | | |
| 01 33 16 | 1.2 | Identification of all Designers of Record | X | | | | | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.2.1 | Site and Utility Des Package, incl. Substantiation | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.2.2/3.5 | Interim Des Subm Package(s), incl. Substantiation | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.1 | Drawings | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.2 | Sitework Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.3 | Structural Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.4 | Security Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.5 | Architectural Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.6 | Mechanical Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.7 | Life Safety Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.8 | Plumbing Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.9 | Elevator Design Analyses (as Applicable) | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.10 | Electrical Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.11 | Telecommunications Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.2.12 | Cathodic Protection Design Analyses | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.3 | Geotechnical Investigations and Reports | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.4 | LEED Submittals | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.5 | Energy Conservation Documentation | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.6 | Specifications | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.5.7 | Building Rendering | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.2.4/3.7 | Final Des Submittal Package(s), incl. Substantiation | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.7.5 | DD Form 1354 (Transfer of Real Property) | | | | | | | | | | X | | | | X | | | | | X | | | | |
| 01 33 16 | 3.2.5/3.8 | Design Complete Submittal Package(s) | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | 3.3.3 | Design and Code Review Checklists | | | | | X | | | | | | | | | X | | | | | X | | | | |
| 01 33 16 | A-2.0 | SID - Interim and Final (as applicable) | | X | X | | X | | | | | | | | X | | | | | | X | | | | |
| 01 33 16 | B-2.0 | FFE (as Applicable) | | | | | X | | | | | | | | X | | | | | | X | | | | |
| 01 45 04.00 10 | 3.2 | Design and Construction QC Plan | X | | | | | | | | | | | | | X | | | | | X | | | | |
| 01 57 20.00.10 | 1.2 | Environmental Protection Plan | X | | | | | | | | | | | | | X | | | | | X | | | | |
| 01 78 02.00 10 | 1.2.1 | Final as-Built Drawings | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.2.3.11 | Non-Hazardous Solid Waste Diversion Reports | | | | | | X | | | | | | X | | | | | | | X | | | | |
| 01 78 02.00 10 | 1.2.7 | Provide final as-built CADD and BIM Model files | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.2.9 | Provide scans of all other docs in Adobe.pdf format | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.3.1 | Equip-in-Place list of all installed equip and cost | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.3.2 | Data on equip not addressed in O&M manuals | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.3.3 | Final as-built specs - electronic files | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.4.2.1 | Warranty management plan - FAR 52.246-21 | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.4.2.1 | Certificates of Warranty for extended warranty items | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.4.2.1 | Contractor's POCs for implementing warranty process | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.4.2.1 | List of each warranted equip, item, feature or system | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.5 | See also Section 01 10 00 par. 5.8.4 and 5.8.5 | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.6.1.2 | Equipment O&M Manuals - 1 electronic / 2 hard copies | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.7 | Field Training DVD Videos | | | | | | | | | X | | | X | | | | | | | X | | | | |
| 01 78 02.00 10 | 1.8 | Pricing of CF/CI and GF/CI Property | | | | | | | | | | | X | | X | | | | | | X | | | | |
| 01 78 02.00 10 | 1.11 | List of Completed Cleanup Items | | | | | | | | | | | X | | | | | | | | X | | | | |

APPENDIX AA

Fire Department Required Information



**DESIGN SPECIFICATION FOR CONSTRUCTION OF
FIRE DETECTION AND FIRE SUPPRESSION**

4 May 2010 Update

FLW FIRE PROTECTION & PREVENTION DIVISION STAFF POC.

| | |
|--|--|
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Introduction

The purpose of these specifications is to describe information, references and recommended practices relating to Life Safety, Fire Protection, and Mass Notification. It was developed to standardize the design and construction of fire protection and mass notification systems at facilities throughout the Fort Leonard Wood, Missouri. These guidelines are intended to convey the minimum standards to successfully provide reliable fire protection and mass notification systems. It is further intended that design engineers tailor this document with respect to specific project requirements at Fort Leonard Wood while maintaining a standardized system configuration as required by the latest edition of the UFC 3-600-01 Fire Protection Engineering for Facilities and UFC 4-021-01 Mass Notification Systems. UFC 3-600-01 is the primary fire protection reference for all DOD facilities, followed by the NFPA Codes and Standards. In the event of a conflict between any UFC and other criteria, the UFC shall govern.

Application

This document has been developed as a guideline; it is not the intent of this document to limit, restrict, or discourage anyone from enhancing the specifications to fit specific requirements in a given area or situation. However, the minimum standards shall not be compromised.

Scope of UFC3-600-01:

“This UFC establishes fire protection engineering policy and criteria for all DOD components. The provisions of this UFC are applicable to all new and existing DOD facilities located on or outside of the DOD installations, whether acquired or leased, by appropriated or non-appropriated funds, or third party financed and constructed. Facilities covered by this document include all types of buildings and their contents, structures, whether considered temporary or permanent, mobile and stationary equipment, waterfront facilities, outside storage and shore protection for ships and aircraft.”

Orientation/Pre-design Meeting

The A/E orientation and/or pre-design meetings are crucial to any part of a project to ensure a full understanding of the fire protection and mass notification goals and expectations. The Fire Protection Engineer shall play an integral part of the design team, and shall be involved in every aspect of the design as it relates to fire protection. During orientation/pre-design, the project scope should be secured and a design strategy established. Expectations unique to the facility will be conveyed by the Fire Prevention Plan Review Staff.

Design Analysis

A fire protection design analysis is required for all designs and shall address the fire protection and mass notification requirements of the project as required by UFC 3-600-01 Sec 1-4 and UFC 4-021-01. The name and qualification of the fire protection engineer who supervised/prepared the design analysis shall be provided IAW UFC 3-600-01 Section 1-5 for services and qualifications.

The contractor shall verify and confirm in writing at shop drawing submittal that fire alarm and mass notification systems will meet intelligibility requirements per UFC 4-021-01. A test of intelligibility will be performed per the UFC.)

Code Analysis

Utilize the latest version of applicable codes and standards. Unified Facilities Criteria (UFC) UFC 3-600-01 Fire Protection Engineering, UFC 4-021-01 Mass Notification, the National Fire Protection Association Codes (NFPA) and the International Building Code (IBC) are the principal codes used. UFC 3-600-01, and UFC 4-021-01, Mass Notification Systems, provide detailed guidance for incorporating fire protection and mass notification engineering measures in the design and construction of Department of Defense (DOD) facilities. NFPA 101, Life Safety Code is the primary code pertaining to all life safety issues. The IBC should be used primarily to determine allowable building construction sizes for the specific occupancy and construction type. The IBC should also be used to address other building code criteria not covered by UFC 3-600-01 or NFPA standards (i.e. building separation requirements, minimum construction standards, etc.). Other applicable codes and standards include, but are not limited to, ADA requirements. All equipment and material shall comply with the applicable provisions of NEMA, FM, UL, and CSA. ***NOTE:*** *In the event of a conflict between any Unified Facilities Criteria's (UFC) and other criteria, the UFC shall govern.*

Fire Alarm Reporting Systems

The FLW Fire Alarm Central Station Radio Receiving System is a Monaco D-21 system that operates using VHF bandwidth (138.925Mhz) and FSK protocol. The fire alarm central system

is located off the Installation at the Pulaski County (PC) E-911 Center and Bldg 580, Fire Station 1 on FLW.

All buildings shall be equipped with Monaco BT-XF transceiver and shall have at least 60 zones reporting, unless there are less than 56 devices in the building. If less than 56 devices, one zone shall report for each device plus 4 spare zones. Each zone is a relay in the fire alarm control panel with a pair of wires rerouted to the BT-XF. Sixty zones will have sixty sets of wires routed between the FACP and BT-XF, and 60 relay contactors in the FACP. Each FACP initiating device, supervisory device and a system trouble shall be zoned. The contractor shall provide the wiring location contact points between the FACP and BT-XF with the fire alarm submittals for review and for FLW Fire Department use in programming of the Monaco D-21 System.

MASS NOTIFICATION (MNS)

The FLW Wide-Area Mass Notification Central Control Station is a Wheelock / ATI CCSWH system that operates using UHF bandwidth (407.870MHz) and FSK protocol. The mass notification central system is located at building 3200 on the Installation within the Emergency Operations Center (EOC). EOC uses a React-4000 computer system for local MNS. The switch over between the mass notification (MNS) and fire alarm system (FAS) shall be automatic. The systems must be user friendly and shall not require resetting by the user in the buildings. **Note:** Separate wireless transmitters/receivers (transceivers) are required for the fire alarm and mass notification central systems. When local MNS micro-phone is required, a remote secured panel or keyed micro-phone lock-out shall be required next to the annunciator panel unless location is specified.

Programming EOC Mass Notification Computer: The programming is a contractual agreement. Call the EOC at 573-563-5157 for details. Coordination with Fire Alarm/Mass Notification Acceptance Testing by the FLW Fire Protection & Prevention Division is required.

FIRE ALARM SYSTEMS (FAS)

Fire Alarm Control Panel shall be an intelligent addressable panel. The system shall be activated into alarm mode by the actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset through the fire alarm control panel manually restored or through a supervised automated receiver to the normal operating mode. Main fire alarm control panel and auxiliary panels shall be colored red and marked for the fire alarm system. Each building shall be required a fire alarm control panel (FACP). Multiple buildings may share a BT-XF. Lesson Learned: Multiple buildings sharing the same FACP has created maintenance issues, lost of systems and repairs from ground faults, improper wiring methods and lightning from weather. Power surges from lightning can transverse the ground causing electrical shorting of system. **Note:** The fire department would prefer intelligent addressable panel with a integral radio alarm transceiver compatible with the base fire alarm receiving system when applicable for space savings, training of fire alarm repair technician, standardization of alarm maintenance, and reduce overall cost.

Fire Reporting System Programming. The fire alarm designer shall provide the Fire Prevention Plan Review Staff upon submittal of plans; specifications and the addressing data of the point of contact for the fire alarm control panel to determine the number of zone-id's that will be required for programming the BT-XF and the installation fire reporting system.

Fire Alarm System Performance and Integrity:

- (1) **Notification Appliance Circuits:** The notification appliance circuits (NACs) shall be Class A per NFPA 72 Chapter 6.4 and perform per NFPA 72 Chapter 6.7. The fire alarm system amplifiers, circuits, wiring shall not be more than 75% loaded. If a mass notification system fails the intelligibility test, then it easy for a contractor to add more speakers provided the circuit is not fully loaded. Many speakers each at low power increases intelligibility. Few speakers each at high power results in less intelligibility. Contractors should be advised to put a speaker in every occupied room. If not, then he must be ready to add speakers if the intelligibility test fails.
- (2) **Initiating Device Circuit:** The initiating device circuits (IDCs) shall be Class A per NFPA 72 Chapter 6.4 and perform per NFPA 72 Chapter 6.5. All addressable initiating devices shall be of the intelligent bi-directional type and listed for use with applicable control panels. Conventional initiating devices are to be used only in conjunction with addressable interface modules where environmental conditional prevent intelligent devices to be installed.
- (3) **Signal Line Circuits:** The signal line circuits (SLCs) shall be a class A Style 7 per NFPA 72 Chapter 6.4 and perform per NFPA 72 Chapter 6.6.

Wiring Method of Fire Alarm System: The wiring method used shall comply with applicable codes i.e. NFPA 70, 72, 101 be approved by the local FLW AHJ prior to installation. All terminal and junction locations used for fire alarm circuits shall be labeled and provided with specific identifying characteristics (i.e. painted red) and the fire alarm circuit identification shall be accomplished in accordance with NFPA 70 Art 760.30. Wiring method used shall be installed in such fashion that outgoing and return conductors, exiting and returning to control units, respectively, are separately routed and encased (both wire sets shall be enclosed in separate conduit lines where each conduit line is also geographically separate). The outgoing and return (redundant) circuit conductors shall not run in the same cable assembly, enclosure or raceway per NFPA 72 Chapter 6.

Fire Alarm System Remote Display (Graphic Annunciator) located in the lobby/vestibule shall be used in large buildings, multi-story buildings, and secured buildings. Graphic annunciator shall have a plan view of the building. Indicator lamps shall be shown on the plans. LEDs shall be red for alarm condition, amber for supervisory malfunction condition, and yellow for trouble condition. Plan views shall be approximately to scale and in no case smaller than 15 inches in length or width. Annunciator shall have a door with piano hinge and two point cylinder

lock or two cylinder locks. Lock shall be operable using the same key as the FACP to lock out switches. Annunciator shall contain a LED test switch, audible trouble signal and a trouble switch to silence the audible alarm, but not extinguish the trouble LED. Annunciator shall be surface mounted.

For other buildings a remote annunciator panel will be required in the lobby/vestibule shall have a minimum of a reset switch, trouble switch, silence switch, and LED test switch with indicating lights and addressable visual monitor. Lock shall be operable using the same key as the FACP to lockout switches.

Notification Appliances Device Specification. Strobes with clear lens & red housing shall be used for building equipped with Fire Alarm System. Strobes for MNS shall be Amber lens with white housing. The MNS strobes shall be synchronized with the fire alarm strobes. Strobes will be located as required by ADAAG and NFPA 72. Strobes will be provided in common areas, restrooms, meeting areas, and other spaces required by the ADAAG. Provide plans with ceiling mounted appliances. This is expected for an Army facility and clearly allowed by ADA. Wall mounted appliances are not desired and any shown shall be required on wall elevations with all the interior elevations including systems furniture, screens, etc. See attached standard design direction for FLW. File FLW_6-13. *Note: One piece notification device with red housing is permitted for FAS/MNS.*

Initiating Devices Specification: Initiating Devices shall be analog addressable unless environmental conditions warrant otherwise the initiating devices shall be in according to their specific application for protection and as required by applicable codes and references.

(1). Manual Pull Stations. Dual action manual pull stations shall be installed in gymnasiums, schools and similar areas where they may be subject to false activation or mechanical jarring. Single action pull stations should be used in other areas as required. Do not use manual pull stations with break-glass rods. All pull stations will be key accessible.

(2). Photo Electric Smoke Detector shall be used when such detectors are required. Under floor detectors shall be indicated on the graphic annunciator panel showing the detector location in respect to the floor plan. Detectors shall be application specific to the facilities and equipment being protected.

(3). Heat Detectors when required shall be combination rate of rise heat detectors for wide temperature range changes are expected (i.e. over ovens, fuel-fired equipment, attic areas, etc.). Fixed temperature heat detectors shall be installed where wide temperature range changes are not expected. The temperature rating of fixed temperature detectors shall be based on the maximum ambient temperature expected in the facility in conjunction with manufacturer's recommendations. Heat detectors shall be resettable from FACP. NFPA 72 will be followed.

(4). Duct Detectors and spot type smoke detectors shall be installed on separate zones. Duct detection will not be used to replace open area detectors. Each duct smoke detector shall have a remote indicator/or test station located in an accessible space.

(5). Beam Detectors may be utilized in areas susceptible to false alarms and other areas where conventional detection is not feasible i.e. industrial operations, high ceilings, etc. and shall have a remote indicator/or test station located in an accessible space.

Acceptance Testing. Fire detection and suppression systems shall be tested in accordance with applicable NFPA codes and manufacture requirements. Prior to starting operational testing of a fire alarm system, notify the Contracting Officer and Fire Prevention Plan Review Staff at least five days in advance for scheduling this event. A Fire Prevention representative must be present during all test phases and procedures. Use applicable NFPA and manufactures checklists to accomplish testing of these systems. Upon full acceptance of testing on a fire detection/suppression systems, the installing contractor shall provide a written record of test completion verifying that NFPA and manufacture's requirements have been met. Voice intelligibility (CIS readings) for mass notification per the UFC 4-021-01 shall be required as part of acceptance testing. Provide all documentation for testing, to include manufacture data and installed equipment sheets.

Fire Alarm Control & Mass Notification Panels and Sprinkler Riser Location

All panels and sprinkler risers shall be located in electrical rooms and/or mechanical room near the outside mechanical room door. User not permitted access to these rooms. All equipment shall have a minimum 36 inches separation from other mechanical room equipment. Spacing required for firefighter access.

Contractor Training

The Contractor shall provide Government maintenance personnel the capability to operate, maintain, test, repair, and expand the system, to include as a minimum, the following.

- (1) Contractor shall provide all software: database with complete identification and addresses for all programmable system equipment and devices, and all other systems programming data on all modes of the system: connecting cables; and proprietary equipment necessary for the operation, maintenance, testing, repair, and reprogramming, etc. of the system, to include that which may be required for implementation of future changes to the fire alarm system (additional and/or relocated initiating devices, notification devices, etc).
- (2) Contractor shall provide all system and equipment technical data and computer software with the requisite rights to use by the government.
- (3) Contractor shall provide fire department personnel two basic training sessions on the operation of the fire alarm and mass notification.

TEMPORARY BUILDING NUMBERS

The contractor shall be required to obtain the assigned Building Number from DPW. A temporary building sign will be required at each entrance to the building and shall be Brown background with white letters. The sign shall be visible from the road. This is required for EMS & Fire response.

HOT WORK PERMITS

FLW Fire Protection & Prevention Division Prevention Unit issues the “HOT WORK PERMIT”. A permit will be issued for each building under construction or renovation. It shall be the responsible of the contractor to provide copies furnished to each sub-contractor and check the site after hot work activity. The contractor shall provide an electronic copy of all hot work permits issues at the end of each month to the Fire Department Fire Prevention Unit.

FIRE HYDRANTS

The FLW Fire Protection & Prevention Division recommends the use of Mueller Centurion as per the Installation Design Guild (IDG), or a Clow Medallion, when fire hydrants are part of the project. If existing fire hydrants are to provide coverage for a new project or major renovation, that the existing fire hydrants that provide protection to that building shall be replaced. The contractor shall paint the fire hydrants Nutmeg Brown in color as per the IDG. The fire hydrant shall be color coded per UFC 3-600-01 section 3-7.3.1 Fire Flow and Marking of Hydrants shall be accomplished by marine type reflective tape around the brim of the bonnet. The contractor shall provide flow test results to the fire department for updating DPW and Fire Department records.

SPRINKLER SYSTEMS

If required shall be installed in accordance to UFC 3-600-01 and NFPA 13.

- (1) Post Indicator Value shall be required on Sprinkler systems. Tamper switch is required.
- (2) Fire hydrants shall be required within 150 feet of the fire department pre-connection.
- (3) Fire Department connections because of force protection 25 meter requirements and fire department accessibility shall be three to eight feet curb/sidewalk side of streets and parking lots where applicable. UFC 3-600-01 Sec 1-3.9 “Antiterrorism requirements (i.e. Force Protection) must not preclude any fire protection requirements.”
- (4) Hydrostatic Testing and Acceptance Testing shall be witnessed by the Fire Prevention Unit Staff.
- (5) FLW Installation in some areas has a spiking problem with the water system. So a pressure reducer maybe required on the sprinkler system.

- (6) Backflow preventers are required on the sprinkler systems and jockey pumps.
- (7) Strainers shall be required IAW NFPA 13.

STANDPIPES

Wet or Dry Standpipes shall be required on projects as needed in relation to Force Protection and fire department access. UFC 3-600-01 Section 4-5.1. Contractor shall contact the Fire Prevention Unit Plan Review Staff for determination.

REMOTE FIRE DEPARTMENT CONNECTIONS

Remote Fire Department Connections (FDC's) shall be required on all buildings with sprinkler systems and standpipes when force protection and fire department access is limited. Fire Department connections shall three to eight feet curb/sidewalk side of streets and parking lots where applicable.

PENETRATION

Fire Wall penetrations shall be sealed as per application and code. Fire wall penetration for DOIM cable trays and wiring, Cable TV, and Phone Service shall use an EZ-PATH type system that permits installers to install wiring under normal conditions, but will seal in case of fire.

FLOW TESTING

FLW Fire Protection & Prevention Division shall provide flow testing results of water supply for projects requiring sprinkler systems upon written request or Email request. It will be responsibility of the Fire Protection Engineer to determine if the flow test shall be a witness test.

FIRE DEPARTMENT ACCESS.

Knox Box is required on all permanent buildings. The type of Knox Box (recess or surface mount) and color will be determined during the design review. The Knox Box must be keyed to the FLW Fire Protection & Prevention Division account. An approved application will be furnished to contractor upon request. Note: When contractor receives the Knox Box, Fire Prevention Staff will need to verify the keying of the lock before installation.

The Knox Box will be installed at the nearest exit to the annunciator panel or at an approved fire department location. The Knox box will have tamper switches connected to the supervisory side of the fire alarm system that transmits a supervisory (Fire Auxiliary) signal to the E-911 center if the Knox Box is tampered with. Generally, on building with brick exterior finish, a recess mounted Knox Box will be required. Knox Box #3275 Dark Bronze with tamper switches and

#3290 recessed mounting kits will be required. For building that need surface mounting, Knox Box #3266 Dark Bronze with tamper switches will be required.

GATED/FENCED FACILITIES

- (1) Knox Key Switch override keyed to the FLW Fire Protection & Prevention Division Knox Box account shall be required on all electric control gates.
- (2) For non-electric gates and force protection requirements a residential Knox Box keyed to the Fire Department Knox Box account shall be required on the gate post or bollards at each entrance.
- (3) FLW Fire Protection & Prevention Division may furnish to contractors a lock box for the contractor keys when the building is enclosed for emergency access.

CONTRACTORS SITE OFFICE AND STORAGE TRAILERS.

- (1) Construction Site Offices will be installed to ACOE standards. At least one 5 lb ABC Dry Powder Fire Extinguisher will be visible and accessible in each trailer.
- (2) Separation between office trailers and storage trailer will be 10 feet. Storage trailer/Conex may sit next to each other.
- (3) A 20 LB ABC Fire Extinguisher shall be accessible in the storage trailer/Conex area.
- (4) 20 Lb ABC Fire Extinguishers shall be required within 75 feet travel distance on all levels of building construction and renovation.

FIRE EXTINGUISHERS

Fire Extinguisher is considered real property by FLW with the required fire extinguisher cabinet IAW UFC 3-600-01.. The size and location shall be determined during design analysis; 20 lb extinguishers are not appropriate for business type occupancies (NOT USER FRIENDLY) and should only be placed in higher hazard areas. Fire extinguishers shall be installed in accordance IAW NFPA 10, except where modified by UFC 3-600-01. *Note: Issues have arisen in the past where the fire extinguisher cabinets are the wrong size for the fire extinguishers used.*

HOOD & DUCT SYSTEMS

Hood and duct systems for commercial cooking equipment that produces smoke or grease-laden vapors must comply with IAW NFPA 96. System will be a Class K wet extinguishing system and will also include a class K portable fire extinguisher located per IAW NFPA 96. Openings in duct shall be provided at the sides or the top of the duct whichever is more accessible, and at changes in direction. Horizontal ducts require access every 12 feet; vertical ducts require access at each floor and at every change of direction.

O & M and As-Built Drawings.

COE Projects: Provide through the COE to the Fire Protection & Prevention Division in Micro Station CADD format and PDF one copy of CD's As-builds' and one copy of O & M and ½ size prints of plans for the Fire Alarm, and Mass Notification System. This is need for fire preplanning, programming the Fire Reporting System and fire alarm/mass notification repairs.

Other Projects: Provide through the Contracting Officer to the Fire Protection & Prevention Division in Micro Station CADD format and PDF two copies of CD's As-built and one copy of O & M and ½ size prints of plans for the Fire Alarm, and Mass Notification System. This is need for fire preplanning, programming the Fire Reporting System and fire alarm/mass notification repairs.

Appendix BB
KCD CADD Standards

US ARMY CORPS OF ENGINEERS

KANSAS CITY DISTRICT

Last Updated: January 2009

**KCD CADD STANDARD 3.0
FOR
MILITARY AND CIVIL WORKS PROJECTS**

1. APPLICABILITY. For military and Civil projects, KCD and it's A/E contractors will use, as a guide, the sheet numbering and CADD file naming system as shown in the latest version of the A/E/C CADD Standard as published by The CADD/GIS Technology Center. This document will provide specific guidance as to the implementation of the standard as used in the Kansas City District. Any issue covered in this document is developed within guidelines of the AEC CADD Standard and supersedes that document. It also addresses some of the items not delineated in the CADD standards, which are required to provide uniformity among disciplines and consistency with current and future projects.

2. REFERENCE: BQP 5.6.07, [Management of Electronic Files](#) , [Project File Structure](#), [A/E/C CADD Standard \(Release 2.0\)](#)

3. DRAWING FILE CREATION. The following steps are required in order to create a new drawing file:

[STEP 1: Determine CADD file type.](#)

[STEP 2: Determine and assign a file name.](#)

[STEP 3: Determine drawing working units.](#)

[STEP 4: Select and attach seed file.](#)

[STEP 5: Attach border \(reference\) file.](#)

STEP 1: Determine CADD file type. All drawing files are either "sheet" files or "model" files. The use of Model Files is mandatory for any drawing that may be used as a reference file by another discipline. In vertical construction all floor plans and elevations (architectural, structural, mechanical, electrical etc) shall be drawn in model files. Each floor of a building shall be in a separate model file. All model files shall be registered one directly above another. The border file shall be considered a model file. Elevations may be located in a single model file or as separate model files for each elevation view, as determined by the Project Development Team (PDT). For Model File application, see Option 2(Use of Design Model Only), and Figure 2-3, pgs.10 & 11, Ch.2 A/E/C CADD Standard 3.0. File naming convention is different for model files and sheet files (See *Step 2 below*).

STEP 2: Determine and assign a file name.

A. Standard Sheet File Naming (*for one building, one volume drawing set*):

Each CADD sheet file will be given a unique file name that is derived from the project location, project code, discipline, sheet type, and the sequential number of sheets within the type. Drawing names will contain 9 characters with a three (3) character extension. (See [paragraph 5](#) for file and sheet naming conventions regarding multiple building/multiple volume drawing sets). An example format for a standard sheet file is as follows: **L05_AE102.DGN**

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| | | | | | | |
|---|----|---|----|---|----|------|
| L | 05 | - | AE | 1 | 02 | .DGN |
|---|----|---|----|---|----|------|

| | | | | | |
|---|---|---|---|---|---|
| L | P | D | S | S | T |
| O | R | I | H | E | Y |
| C | O | S | E | Q | P |
| A | J | C | E | U | E |
| T | E | I | T | E | O |
| I | C | P | T | N | F |
| O | T | L | T | C | I |
| N | C | P | E | L | |
| | O | N | E | | E |
| | D | | | | |
| | E | | | | |

LOCATION.

Military Location codes are as follows:

| | |
|---|---------------------------------|
| G | GRAND FORKS AFB, NORTH DAKOTA |
| K | LAKE CITY ARMY AMMUNITION PLANT |
| L | FORT LEONARD WOOD, MISSOURI |
| M | MCCONNELL AFB, KANSAS |
| R | FORT RILEY, KANSAS |
| U | US Army Reserve |
| V | FORT LEAVENWORTH, KANSAS |
| W | WHITEMAN AFB, KANSAS |

Civil Works Location codes are as follows:

| | |
|----|-----------------|
| BC | BRUSH CREEK |
| BR | BLUE RIVER |
| BS | BLUE SPRINGS |
| CL | CLINTON LAKE |
| DC | DAVID CITY |
| HA | HARLAN COUNTY |
| HL | HILLSDALE LAKE |
| HT | HARRY S. TRUMAN |
| KA | KANOPOLIS |
| KC | KANSAS CITY |
| KR | KANSAS RIVER |
| LT | LITTLE BLUE |
| LB | LONGBRANCH |
| LV | LONGVIEW LAKE |
| ME | MELVERN LAKE |
| MI | MILFORD LAKE |
| MK | MILL CREEK |
| MO | MISSOURI RIVER |
| OS | OSAGE |
| PA | PAOLA |
| PE | PERRY LAKE |

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| | |
|----|-----------------|
| PO | POMONA LAKE |
| RA | RATHBURN |
| SM | SMITHVILLE LAKE |
| ST | STOCKTON LAKE |
| TK | TURKEY CREEK |
| TT | TUTTLE CREEK |
| WA | WAYNESVILLE |
| WE | WELDON SPRINGS |
| WI | WILSON LAKE |

PROJECT CODE. Project codes are assigned by IM to the Project Manager (PM), who will distribute this project code to all team members at the time of Project creation on the server. The code is sequential as projects are created. The subdirectory created for a project will consist of the project location and code and the name of the project. In the past, project folders on the server (E drive) were identified with only 3 digits (i.e., R27, L06, etc.) It is now common to see project folders with additional descriptive letters as shown in the examples below. Although the project folder (directory name) is permitted to have a longer name, CADD file names within a directory will use only the first 3 digits (i.e., R27). Examples :

CIVIL WORKS:BC05 (*PROSPECT BRIDGE on Brush Creek*)**MILITARY:**R16_CDC (*CHILD DEVELOPMENT CENTER, Fort Riley*)

L36_FY08BARRACKS (FY08 Barracks, Fort Leonard Wood)

DISCIPLINE. Disciplines (general) are designated by the following codes:

| | |
|----|----------------------------|
| AE | ARCHITECTURAL |
| B- | GEOTECHNICAL |
| C- | CIVIL |
| E- | ELECTRICAL |
| G- | TITLE, LEGEND, AND BORDERS |
| IN | INTERIOR DESIGN |
| S- | STRUCTURAL |
| M- | MECHANICAL |
| P- | PLUMBING |
| V- | SURVEY |

Each discipline requires 2 characters. Therefore designators using only one letter, such as "E" must be followed by a dash ("-") so the completed discipline code is "E-". The designer or sheet originator shall determine the correct discipline designator for each sheet based on drawing content. See the following appendices for each discipline's designators:

Site (Survey, Civil, Landscaping)
 Structural
 Architectural
 Interiors
 Fire Protection
 Mechanical (Plumbing and HVAC)
 Electrical (Lightning Protection/Grounding, Lighting, Power, Telecommunications, and Special Systems)

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SHEET TYPE. See KCD CADD Standards spreadsheets, that follow, for sheet type descriptions and designators used in this district.

SEQUENCE. The drawing sequence number within the discipline and sheet type: Sequences less than 10 are padded with zeroes in the file name.

CADD SYSTEM FILE TYPE. CADD system file types are as follows:

- DGN MICROSTATION DESIGN FILES
- DWG AUTOCAD DESIGN FILES

The CADD file type designator is provided only in the CADD directory file name and on the project index sheet. It is not required in the file name block on the border sheet.

Page 6: B. Model File Naming:

Model files contain the design elements for numerous sheet files. Model file naming conventions are very similar to sheet file conventions with some exceptions. The word "MODEL_" must be inserted immediately after the project code to indicate model files. Sheet type codes are different from regular sheet files and are provided in the A/E/C CADD Standard in Chapter 2, Table 4. An example file name format for a model file is as follows: **L05MODEL_A-FP102.DGN** (*architectural floor plan model file.*)

| | | | | | | | | | |
|----------|--------------|-----------|--------------|-----------|----------|------------|------------|-----------|-------------|
| L | 05 | V1 | MODEL | -A | _ | A- | FP | 01 | .DGN |
| LOCATION | PROJECT CODE | VOLUME | | BUILDING | | DISCIPLINE | SHEET TYPE | SEQUENCE | FILE TYPE |

Location column and project code column are assigned by the Project Manager. This is the project directory.

Volume is only used with projects using multiple volumes to separate large quantities of sheets. i.e. Large Site package with large building having 200-300 sheets can be subdivided into manageable volumes (bound sets) of drawings.

Building column is only used with multiple buildings being submitted. i.e. Range projects have a GIB and Control Tower. One would be building A and the other building B.

Discipline is as indicated in the matrices submitted or AEC 3.0 Cadd Standards

Sheet type is based on common terms. FP is Floor Plan, RP is roof plan, PP is power plan, LP is lighting Plan, GP is grounding plan, etc.

Sequence number is based on the sheet files. i.e. if multiple sheet files use the floor plan then use the root numbers of that group. A model file for sheets 101,102,103 and 104 would be 100. If

3 digit sheet files are used then 2 digit model files are possible. i.e. Sheet 101 with model file 01 is OK since the first "1" is designating "plan" sheet.

Enter file name here

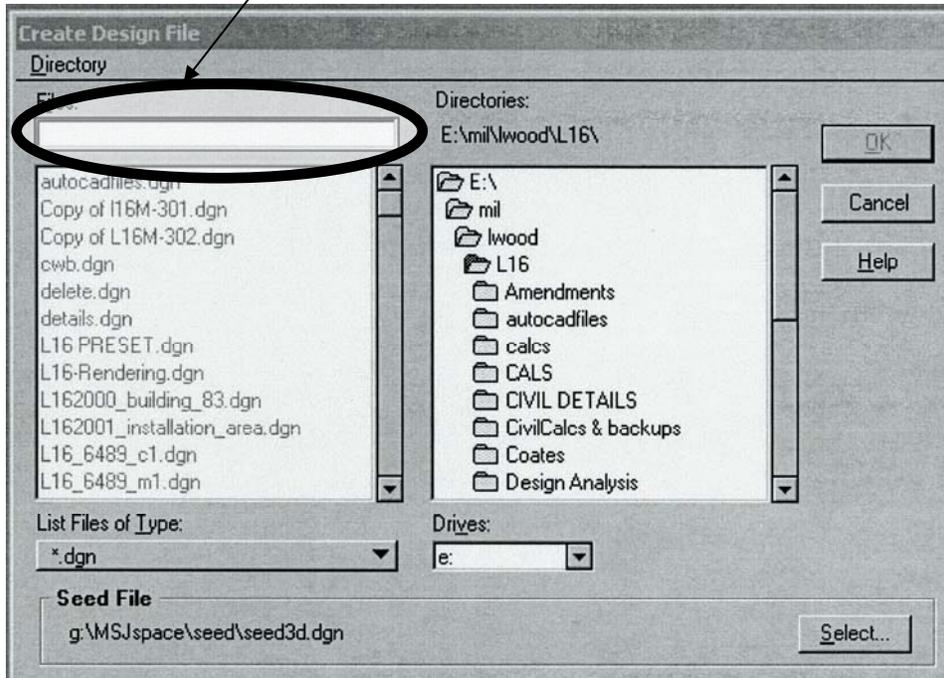


Figure 1.1

STEP 3: Determine drawing working units.

Vertical Construction projects may be designed in either English (inch-pound) or metric units. Project unit of measure will be determined by the PM (project manager) in concert with the PDT before design process begins, based on customer preference and the unit of measure most advantageous to the government.

Remodel and rehabilitation work, including vertical construction, levee's, channels, etc. may be done in English units, if the original construction and as-built drawings are in English units.

Working Units for MicroStation:

| | <u>MU</u> | <u>SU</u> | <u>PU</u> |
|---------------|-----------|-----------|-----------|
| English AEC | 1ft | 12 inch | 8000 |
| English Civil | 1ft | 100 | 10 |
| Metric AEC | 1mm | 1 | 100 |
| Metric Civil | 1M | 1000 | 1 |

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AEC working units are used primarily for vertical construction or design features requiring a high level of CADD precision. Civil working units are primarily used by civil disciplines for site, survey, and mapping files. It is typical to have both AEC and Civil working unit files in the same project, however, the PDT should develop a plan to determine which working units will be used to maintain compatibility.

STEP 4: Select and attach seed file.

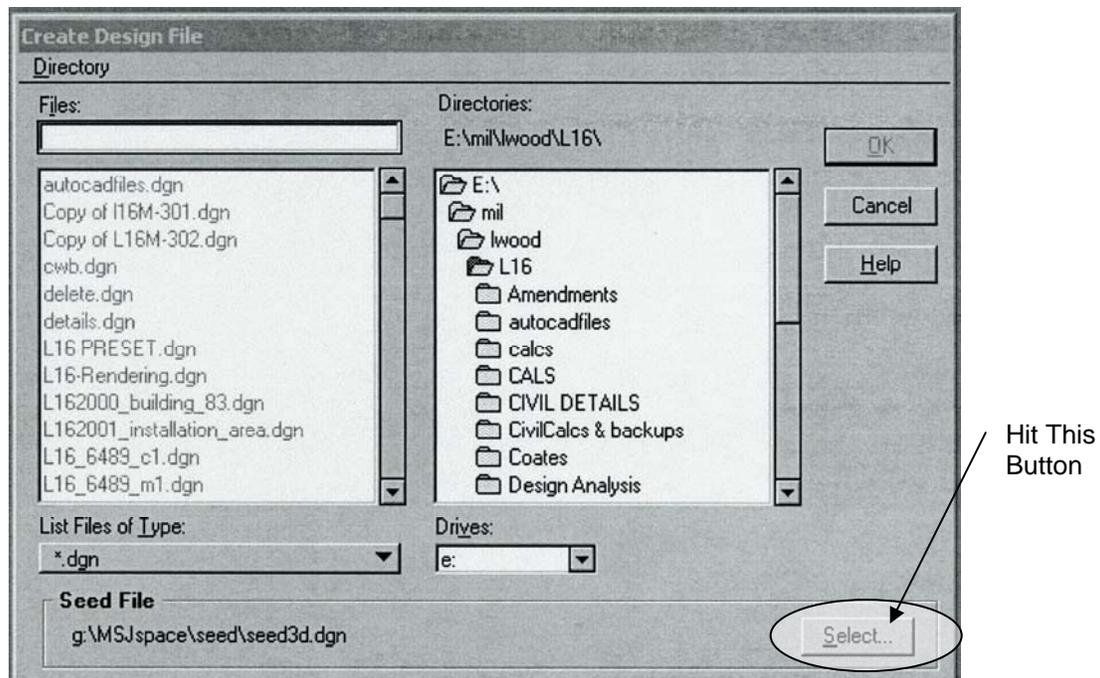
SEED FILES: Seed files automatically set sheet file defaults for dimensioning, color table, view attributes, locks, AEC global positioning, display depth, active depth, etc. in accordance with the A/E/C CADD Standard and KCD standards. Although these defaults can be changed by the designer/engineer, it is highly recommended that the defaults remain in place to provide consistency from drawing sheet to drawing sheet. This is especially important with regard to referencing of files from one sheet to another. Seed files are available in both 2d and 3d files. Select seed file based on 2d vs. 3d and required working units. Design files should typically be selected as 3d. 3d files ensure compatibility with other CADD features and programs such as INROADS, 3D rendering, and fly-throughs. 2d files should be limited to schedules and text-type files.

Available AEC seed files are:

| | |
|------------------|--------------------------------------|
| Arch_2d_E.dgn | AEC 2 dimension foot-pound (English) |
| Arch_3d_E.dgn | AEC 3 dimension foot-pound (English) |
| Arch_2d_M10.dgn | AEC 2 dimension metric 10pu |
| Arch_3d_M10.dgn | AEC 3 dimension metric 10pu |
| Arch_2d_M100.dgn | AEC 2 dimension metric 100pu |
| Arch_3d_M100.dgn | AEC 3 dimension metric 100pu |

Civil seed files: are based on the survey file.

Seed files are selected by "hitting" the SELECT button in the CREATE DESIGN FILE dialog box (See Figure 1.2)



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Figure 1.2**STEP 5: Attach border (reference) file.**

The Border file shall be created as a 2 dimensional (2d) model file and placed in the project directory. This allows it to be attached as a reference file to both 2d and 3d project sheet files. The border shall be placed in the file life size, English (2'-0"x 3'-0"), Metric (609.6mm x 914.4mm). Generic project border files for both English and metric units of measure and for both AEC and civil drawings have already been created as cells and are currently located in the following cell library:

<G:\MSJspace\cell\MilCon\Borders.cel>

IMPORTANT NOTE: It is recommended that at the beginning of the project design phase, a single team member be assigned to create the required project border file by abstracting the correct border file cell from the cell library and creating a project border model file. With input from the PM, the border sheet originator shall make the necessary changes in the title block information (project name, number, date, drawing code, etc.) that will be common to all drawing sheets. Example of a border sheet file name:

R13MODEL_G-BS01.DGN

There should never be more than one border model file per volume per project.

4. SHEET NUMBERING CONVENTION. (Sheet Identifiers) In accordance with the A/E/C CADD Standard, each drawing sheet in a contract set shall be numbered according to the discipline, subject, and sequence within that subject, according to the following syntax examples:

- AE502** where "AE" is the discipline designator (Architectural elements), "5" is the sheet type designator (Details), and the "02" is the sequence number.
- M-403** where "M-" is the discipline designator (Mechanical elements), "4" is the sheet type designator (Large Scale Views), and the "03" is the sequence number.

This is the correct format for the sheet number entry of drawing title blocks. Note that only the sequence numbers are padded with zeroes when they are less than 10. Specific designators for disciplines and sheet types for KCD drawing files provided are based on those shown in the A/E/C CADD Standard.

5. SPECIAL RULES FOR PROJECTS WITH MULTIPLE BUILDINGS.

Often, a contract will include the design of multiple buildings or features which are to be packaged together as a single project under a single contract. Examples are the UEPH and Barracks projects, which included barracks buildings, soldier community buildings, dining facilities and COFs within a single project. Under these circumstances, it is desirable to number the drawing sheets and name the CADD files in a manner which identifies the building or feature to which each drawing applies.

5.1 File Naming. There are two ways to handle file naming for this type of project. The project could be published with one volume and multiple features/buildings within that volume. It is also permissible to publish multiple volumes with buildings in each volume. The PDT should develop a strategy at the beginning of the project to determine how the project design should be packaged. The PDT should also determine volume contents and letters designated to each building and feature.

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Example: Project L05 –MODEL FILE NAMING

| | | | | | | | |
|----------|--------------|--------|----------|---|------------|----------|-----------|
| L | 05 | V1 | -A | _ | A- | 101 | .DGN |
| LOCATION | PROJECT CODE | VOLUME | BUILDING | | DISCIPLINE | SEQUENCE | FILE TYPE |

Location column and project code column are assigned by the Project Manager. This is the project directory.

Volume is only used with projects using multiple volumes to separate large quantities of sheets. i.e. Large Site package with large building having 200-300 sheets can be subdivided into manageable volumes (bound sets) of drawings.

Building column is only used with multiple buildings being submitted. i.e. Range projects have a GIB and Control Tower. One would be building A and the other building B.

Discipline is as indicated in the matrices submitted or AEC 3.0 Cadd Standards

Sequence number is based on the matrices or AEC 3.0 Cadd Standards. Always start with a sheet number ending in 1 unless sheet is an overall sheet with areas identified by a key plan. i.e. AE100 that keys sheets AE101,AE102, etc. As long as the Architectural (for building) and Civil (for Site) utilize these overall sheets, the sub-disciplines do not need to provide an overall sheet. i.e. AE100 does not need to have a matching EP100 sheet. EP can start with EP101. Key plans are required for these types of plans.

5.2 Sheet Naming & Project Directory Naming. For multi-building projects, a building prefix will be added to the sheet number. Each drawing sheet in a contract set will be numbered according to the building, discipline, subject, and sequence within that subject, according to the following syntax:

B_AE101

where B is the building identifier, and all other characters are the same as described in paragraph 4. Building identifiers should be identified and assigned by the PM and PDT prior to commencement of design work.

All files in a project will reside in the same drawing directory. Subdirectories for different buildings under the same volume will not be used.

Comprehensive examples of file naming conventions for single building, multiple building, multiple volume, and multiple building/multiple volume are located in [Appendix G](#).

6. ENTERING TITLE BLOCK INFORMATION.

Upon completion of referencing in the border sheet for a new sheet file, the title block should be filled in as completely as possible. Examples of the correct text font and attributes for each block are provided as part of the border sheet file just outside the border. These examples should be copied in and edited.

IMPORTANT NOTE: Do not change the text font or attributes without consulting with the project PDT team for concurrence.

Input the following:

Sheet Reference Number. Use naming convention as described in [paragraph 4](#). Use the same text size for both projects having one building (See Figure 1.3) and those projects having multiple buildings (See Figure 1.4).

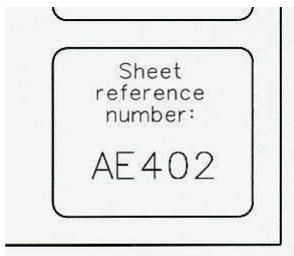


Figure 1.3

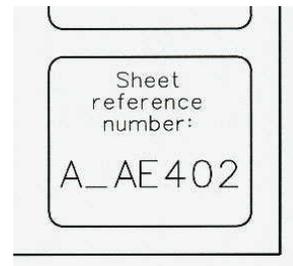


Figure 1.4

Sheet Title (See Figure 1.5). Provide a brief title that describes the sheet content.

IMPORTANT NOTE: The title provided in the title block must match, exactly, the title listed on the project index sheets. Any abbreviations used in one location must be used in the other. KCD uses third-party software to create CD's and the title information must match at both locations.

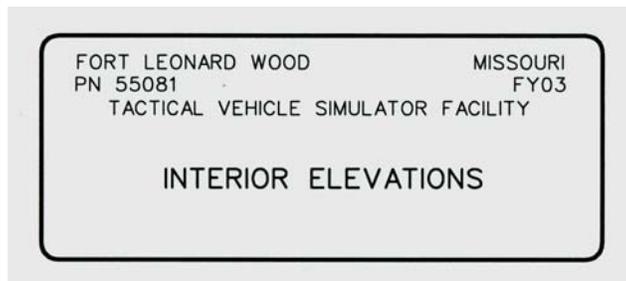


Figure 1.5

Designed By (See Figure 1.6). Provide designer/engineer's [first initial /last name](#) that developed the information shown on the sheet.

Date (See Figure 1.6). Information is to show up in All Border Sheets. The date will be provided and inputted by the border sheet originator and will appear as part of the border reference file sheet. Format is Month and Year.

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Drawn By (See Figure 1.6). Provide **first initial /last name** of person who did the actual CADD work on the drawing. This may be the designer/engineer.

File No. (See Figure 1.6). Information is to show up in All Border Sheets. The drawing file number will be provided and inputted by the border sheet originator and will appear as part of the border reference file sheet. It can be found in the 1391 next to the Project number. The PM will provide this information to the Design Team.

Checked By (See Figure 1.6). Provide **first initial /last name** of the individual who performed the peer review for the drawing. Initials should be entered only after peer review is completed. For A/E's this is your Quality Control Reviewer.

Plot Scale (See Figure 1.6). Provide the plot scale selected for the drawing. Example: 1/8" = 1'-0" equals a plot scale of 8:1.

Submitted By (See Figure 1.6). In House Provide **first initial /last name** of the designer's supervisor. A/E's to provide initials of Professional of Record here.

CADD File Name (See Figure 1.6). Provide the file name developed as per naming conventions provided in paragraphs 3 & 5. Do not include the CADD type extension ".dgn" or ".dwg".

| | | |
|--|---------------|-----------------|
| U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI | Designed by: | Date: X |
| | Drawn by: | File no. |
| | Checked by: | Plot scale: |
| | Submitted by: | CADD File Name: |

Figure 1.6

7. AMENDMENTS & MODIFICATIONS TO DRAWING SHEETS.

Changes to drawings as a result of amendments or modifications shall be clearly indicated and highlighted on the drawings. All symbols and text used to indicate modifications and amendments shall appear on the sheet file (not the model file). Use the following standard conventions to indicate amendments and modifications:

A. Clouds. Each change on the drawing sheet shall be surrounded by a "cloud" symbol. This symbol can be generated using an MDL command in Microstation by typing in "MDL L CLOUD". The correct color, line weight and level shall be indicated by an example shown on the right side of the border sheet.

B. Numbered Triangles. Each cloud shall include a corresponding small triangle with a number such as "1" within the triangle. An example, which can be copied into the drawing, is shown on the right hand side of the border sheet in the proper size, level and color. The triangle should be placed close to the appropriate cloud or attached to the cloud with a line (same weight, color and level as the cloud). *The numbering system is provided in [paragraph 7.1](#).*

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C. Text Description (Optional). Provide a brief text description of the change if it is not obvious. Use standard (note) text size, color, and line weight. Level shall be the same as the triangle.

D. Revision Block Entries (See Figure 1.7). Amendments and modifications shall also be indicated in the revision block, in the upper right-hand corner of the border sheet. Sample text and triangles, in the required color, line weight, and level, shall be provided to the right hand of the border sheet and should be copied into the active drawing file and edited. Note that all entries in the revision block shall be on Level 5 and shall always be shown (turned on). Entries in the revision block should be made starting at the top of the block and working downwards with successive entries. Entries in the columns shall be as follows:

Symbol Entry: Triangle with corresponding number of modification or amendment. Number should match the triangle number used on the clouded areas (changes) that correspond to the amendment or modification.

Description Entry: Indicate whether it is an amendment or modification provided by a general description of changes if applicable. DO NOT enter any amendment or modification number unless so directed by the project manager. The description must be general but specific enough to provide some information regarding the changes. Examples of good and bad descriptions are as follows:

Bad Examples: "Amended Sheet"
"Modifications as Shown"

Good Examples: "Amendment – Change Note 4 & Add Notes 6-7"
"Modification – Delete Detail C & D"

Date Entry: Provide a date as agreed upon by the PDT and project manager.

| | | | |
|--------|--|---------|-------|
| | | | |
| | | | |
| △ | MODIFICATION - REVISE FLASHING ON DETAIL 3 | 2/7/04 | |
| △ | MODIFICATION - ADD INSULATION TO DETAIL 4 | 6/30/03 | |
| △ | MODIFICATION - DELETE GENERAL NOTES | 6/14/03 | |
| △ | AMENDMENT - CHANGE DETAIL 5 | 1/20/03 | |
| △ | AMENDMENT - CHANGE TEXT NOTES | 1/3/03 | |
| Symbol | Description | Date | Appr. |

Figure 1.7

7.1 Multiple Amendments and/or Modifications.

A. Most Current Amendment and/or Modification.

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All elements of the most current change to include bubbles, leaders, triangles, and text associated with the change shall be placed on a level 63, with the exception of the revision block text and graphics (triangle) which shall always be placed on level 5 and shall always remain visible on the drawing.

B. Preceding (Previous) Amendments and Modifications.

Each time an amendment/modification is followed by a succeeding amendment/modification on a drawing sheet, the preceding amendment/modification identification graphics and text shall have the level changed or be deleted from the drawing so that only the most current amendment/modification identification graphics and text information are visible. It shall be the responsibility of the discipline's section chief or the individual designer of the drawing sheet to determine if the changes are to be retained on a separate level or deleted from the drawing.

Acceptable options are as follows:

Option 1: Retain all changes. Place most current change on Level 63. Place all previous changes on Level 62. Turning on both levels 62 and 63 would show all amendments and modifications. In summary:

| | |
|----------------------------|-------|
| Current Change | LV 63 |
| Previous Changes | LV 62 |
| Revision Block Information | LV 05 |

Option 2: Retain only most recent change (amendment or modification). Delete all references to previous changes except for the revision block. In summary:

| | |
|----------------------------|--------------------|
| Current Change: | LV 63 |
| Previous Changes: | Delete All Changes |
| Revision Block Information | LV 05 |

C. Revision Block Entries.

As noted previously, all amendment and modification changes shall be entered in the revision block and these entries shall always be turned on (LV 05). Each succeeding amendment or modification made to a drawing sheet shall be given a new (the next consecutive) number (1, 2, 3, 4, etc.) within the corresponding triangle. This numbering is independent for each drawing sheet and has no corollary with other drawing sheets even though the amended change may be part of the same amendment or modification. In other words, a change as a part of Amendment XYZ could appear as a "1" on drawing sheet no. A-02 because it is the first amended change on that sheet, but a change that is part of Amendment XYZ on drawing sheet no. A-04 could be labeled as "2" because there was a previous change recorded on that sheet.

Succeeding amendments and/or modifications shall be entered in the revision block above the preceding entries using the same format so that they appear in the order in which the changes were made with the most current change appearing on top. (See *Figure 1.7*)

Upon notification that the project contract has been awarded, all amendment graphics and corresponding text information on the drawing shall be deleted from the drawings. Information regarding amendments in the revision block shall always remain.

8. Cell Library Names: Each discipline group is responsible for the maintenance of their individual cell libraries. Existing cell libraries can be found at G:\MSJspace\cell. Cell library

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"mst8000" is provided as a general library of symbols, etc. used by multiple disciplines.
Libraries should be named in the following manner:

Discipline_cell type_eng.cel
Discipline_cell type_met.cel

Example:

Arch_doors_eng.cel (This is an architectural cell library containing cells relating to doors and is in English units)

9. COMMENTS. Comments should be directed to the Project Manager. All comments or proposed changes shall be coordinated with the CADD standards committee members. Members are as follows:

Jim Turner, ED-D
Mike Coates, ED-DA
John Hunt, ED-DA
Dan Winkel, ED-DM
Hank Mildenerger, ED-GC

KCD CADD STANDARD 3.doc

Appendix CC

Mechanical Controls

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AND OTHER LOCAL BUILDING SYSTEMS Dated 09-18-2008

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PART 1 GENERAL

1.1 REFERENCES

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

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500-D (1998) Laboratory Methods of Testing

Dampers for Rating

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASME B16.34 (1996) Valves - Flanged, Threaded, and Welding End

ANSI/ASME B16.15 (1994) Cast Bronze Threaded Fittings, Classes 125 and 250

ANSI C12.1 (1995) Code for Electricity Metering

ANSI C12.10 (1997) Electromechanical Watthour Meters

ANSI C12.20 (2002) Electricity Meter - 0.2 and 0.5

Accuracy Classes

ANSI/EIA 709.1B (2002) Control Network Protocol Specification

ANSI/EIA 709.3 (1998) Free-Topology Twisted-Pair Channel Specification

ANSI/FCI 70-2 (2003) Control Valve Seat Leakage
ANSI/EIA 852 (2001) Tunneling Component Network
Protocols Over Internet Protocol Channels
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-
CONDITIONING
ENGINEERS (ASHRAE)
ASHRAE Fundamentals Hdbk (2001) Fundamentals Handbook
AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
ASTM A 269 (1996) Seamless and Welded Austenitic
Stainless Steel Tubing for General Service
ASTM B 88 (1996) Seamless Copper Water Tube
ASTM B 88M (1996) Seamless Copper Water Tube (Metric)
ASTM D 1693 (1997a) Environmental Stress-Cracking of
Ethylene Plastics
ASTM D 635 (1997) Rate of Burning and/or Extent and Time of Burning of Self-
Supporting
Plastics in a Horizontal Position
ASME INTERNATIONAL (ASME)
ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC VIII D1 (1998) Boiler and Pressure Vessel Code;
Section VIII, Pressure Vessels Division 1
-Basic Coverage
FEDERAL COMMUNICATIONS COMMISSION (FCC)
FCC Part 15 (2002) FCC Rules and Regulations Part 15:
Radio Frequency Devices (Volume II)
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
IEEE C62.41 (1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits
IEEE Std 142 (1991) IEEE Recommended Practice for
Grounding of Industrial and Commercial Power Systems
INSTRUMENT SOCIETY OF AMERICA (ISA)
ISA S7.0.01 (1996) Quality Standard for Instrument Air
LONMARK INTERNATIONAL (LonMark)
LonMark Interoperability Guide (2002) LonMark Application-Layer
Interoperability Guide; Version 3.3
LonMark SNVT Master List (2002) LonMark SNVT Master List; Version
11, Revision 2
LonMark XIF Guide (2001) LonMark External Interface File Reference Guide; Revision
4.0B
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
NEMA 250 (2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
NFPA 70 (2002) National Electrical Code
NFPA 90A (1996) Installation of Air Conditioning and Ventilating Systems
UNDERWRITERS LABORATORIES (UL)
UL 1585 (2001) Class 2 and Class 3 Transformers
UL 555 (1995) Standard for Fire Dampers

UL 555S (1996; R2000) Leakage Rated Dampers for
Use in Smoke Control Systems
UL 94 (1996; Rev thru Jul 1998) Tests for
Flammability of Plastic Materials for
Parts in Devices and Appliances
UL 916 (2004) Energy Management Equipment

1.2 DEFINITIONS

The following list of definitions may contain terms not found elsewhere in the Section but are included here for completeness.

- a. **Application Specific Controller:** A device that is furnished with a pre-established built in application that is configurable but not re-programmable. An ASC has a fixed factory-installed application program (i.e Program ID) with configurable settings.
- b. **Binary:** A two-state system where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level. 'Digital' is sometimes used interchangeably with 'binary'.
- c. **Binding:** The act of establishing communications between ANSI/EIA 709.1B devices by associating the output of a device to the input of another.
- d. **Building Control Network:** The ANSI/EIA 709.1B control network installed under FORT LEONARD WOOD, MO. DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS consisting of a backbone and one or more local control busses.
- e. **Building Point of Connection (BPOC):** The BPOC is the point of connection between the **Fort Leonard Wood LAN** network (an IP network) backbone and the building control network backbone. The hardware at this location, that provides the connection is referred to as the BPOC Hardware. In general, the term "BPOC Location" means the place where this connection occurs, and "BPOC Hardware" means the device that provides the connection. Sometimes the term "BPOC" is used to mean either and its actual meaning (i.e. location or hardware) is determined by the context in which it is used.
- f. **Channel:** A portion of the control network consisting of one or more segments connected by repeaters. Channels are separated by routers. The device quantity limitation is dependent on the topology/media and device type. For example, a TP/FT-10 network with locally powered devices is limited to 128 devices per channel.
- g. **Configuration Parameter:** Controller setting usually written to EEPROM. Also see 'Standard Configuration Parameter Type (SCPT)'
- h. **Control Logic Diagram:** A graphical representation of control logic for multiple processes that make up a system.

- i. Domain: A grouping of up to 32,385 nodes that can communicate directly with each other. (Devices in different domains cannot communicate directly with each other.) Part of the Node Addressing scheme.
- j. Explicit Messaging: A method of communication between devices where each message contains a message code that identifies the type of message and the devices use these codes to determine the action to take when the message is received. These messages are non-standard and often vendor (application) dependent.
- k. External Interface File (XIF): A file which documents a device's external interface, specifically the number and types of LonMark objects; the number, types, directions, and connection attributes of network variables; and the number of message tags.
- l. Functional Profile: The description of one or more LonMark Objects used to classify and certify devices.
- m. Gateway: A device that translates from one protocol to another. Gateways are also called Communications Bridges or Protocol Translators.
- n. General Purpose Programmable Controller (GPPC): Unlike an ASC, a GPPC is not furnished with a fixed application program. A GPPC can be (re-)programmed, usually using vendor-supplied software.
- o. LonMark Object: A collection of network variables, configuration parameters, and associated behavior defined by LonMark International and described by a Functional Profile. Defines how information is exchanged between devices on a network (inputs from and outputs to the network).
- p. LNS Plug-in: Software which runs in an LNS compatible software tool. Device configuration plug-ins provide a 'user friendly' interface to configuration parameters.
- q. LonMark: See LonMark International. Also, a certification issued by LonMark International to ANSI/EIA 709.1B devices.
- r. LonMark International: Standards committee consisting of numerous independent product developers and systems integrators dedicated to determining and maintaining the interoperability guidelines for the LonWorks industry. Maintains guidelines for the interoperability of ANSI/EIA 709.1B devices and issues the LonMark Certification for ANSI/EIA 709.1B devices.
- s. LonMark Interoperability Association: See 'LonMark International'.
- t. LonWorks: The overall communications technology, developed by Echelon Corporation, for control systems. The term is often used to refer to the technology in

general, and may include reference to any/all of the: protocol, network management, and interoperability guidelines where the technology is based on the ANSI/EIA 709.1B protocol and employs interoperable devices along with the capability to openly manage these devices (via multiple vendors) using a network configuration (or service) tool.

u. LonWorks Network Services (LNS): A network management and database standard for ANSI/EIA 709.1B devices.

v. Monitoring and Control (M&C) Software: Software which performs supervisory functions such as alarm handling, scheduling and data logging and provides a user interface for monitoring the system and configuring these functions. Can reside on the BPOC building level server or a remote IT server.

w. Network Variable: See 'Standard Network Variable Type (SNVT)'.

x. Network Configuration Tool: The software used to configure the control network and set device configuration properties. This software creates and modifies the control network database (LNS Database).

y. Node: A device that communicates using the ANSI/EIA 709.1B protocol and is connected to an ANSI/EIA 709.1B network.

z. Node Address: The logical address of a node on the network. Variations in node addressing are possible, but the 'Domain, Subnet, Node' format is the established standard for this specification.

aa. Node ID: A unique 48-bit identifier assigned (at the factory) to each ANSI/EIA 709.1B device. Sometimes called the Neuron ID.

bb. Program ID. An identifier (number) stored in the device (usually EEPROM) that identifies the node manufacturer, functionality of device (application & sequence), transceiver used, and the intended device usage.

cc. Repeater: A device that connects two control network segments and retransmits all information received on one side onto the other.

dd. Router: A device that connects two channels and controls traffic between the channels by retransmitting signals received from one subnet onto the other based on the signal destination. Routers are used to subdivide a control network and to control bandwidth usage.

ee. Segment: A 'single' section of a control network that contains no repeaters or routers. The device quantity limitation is dependent on the topology/media and device type. For example, a TP/FT-10 network with locally powered devices is limited to 64 devices per segment.

ff. Service Pin: A hardware push-button on a device which causes the device to broadcast a message (over the control network) containing its Node ID and Program ID. This broadcast can also be initiated via software.

gg. Standard Configuration Parameter Type (SCPT): Pronounced 'skip-it'. A standard format type (maintained by LonMark International) for Configuration Parameters.

hh. Standard Network Variable Type (SNVT): Pronounced 'snivet'. A standard format type (maintained by LonMark International) used to define data information transmitted and received by the individual nodes. The term SNVT is used in two ways. Technically it is the acronym for Standard Network Variable Type, and is sometimes used in this manner. However, it is often used to indicate the network variable itself (i.e. it can mean "a network variable of a standard network variable type"). In general, the intended meaning should be clear from the context.

ii. Subnet: Consists of a logical (not physical) grouping of up to 127 nodes, where the logical grouping is defined by node addressing. Part of the Node Addressing scheme.

jj. TP/FT-10: A Free Topology Twisted Pair network defined by ANSI/EIA 709.3. This is the most common media type for an ANSI-709.1 control network.

kk. UMCS Network: An IP network connecting multiple building level control networks.

ll. The existing Fort Leonard Wood UMCS is a solution that utilizes the Web services interface of the BPOC Internet Server to collect data to the Installation Microsoft SQL Server. Using Web Services, SOAP and XML the data from the BPOC Internet Server will be integrated into the SQL database.(4-02-08)

mm. User-defined Configuration Parameter Type (UCPT): Pronounced 'u-keep-it'. A Configuration Parameter format type that is defined by the device manufacturer.

nn. User-defined Network Variable Type (UNVT): A network variable format defined by the device manufacturer. Note that UNVTs create non-standard communications (other vendor's devices may not correctly interpret it) and may close the system and therefore are not permitted by this specification.

1.3 SYSTEM DESCRIPTION

The Direct Digital Control (DDC) system shall be a complete system suitable for supervisory control and monitoring using Lonworks Network Services and web client server software of the heating, ventilating and air conditioning (HVAC) and other building-level systems as specified and shown.

1.3.1 System Requirements

Systems installed under this guide specification shall have the following characteristics:

- a. The Direct Digital Control system shall connect to BPOC hardware that has a built in web server that allows web access to all data points maintained by the building level DDC.(04/02/08)
- b. The control system shall be an open implementation of LonWorks technology using ANSI/EIA 709.1B as the communications protocol and using LonMark Standard Network Variable Types as defined in LonMark SNVT Master List for communication over the network.
- c. LonWorks Network Services (LNS) shall be used for all network management including addressing and binding of network variables. A copy of the LNS database shall be submitted to the project site as specified.
(1) Lonmark version 3.3 shall be used (Lonmaker Professional Turbo is the network management tool presently being used at FLW).(12/10/07)
- d. All communication between the UMCS and building networks shall be via the ANSI/EIA 709.1B protocol over the IP network in accordance with ANSI/EIA 852.
(12/12/07)
- e. Integrate the control system to the installation's existing UMCS.
The existing UMCS is a solution that utilizes the Web services interface of Echelon's i.LON® 100 Internet Server(BPOC) to collect data to the Installation Microsoft SQL Server (check with DPW MES for current version). Using Web Services, SOAP and XML the data from the Echelon's i.LON® 100 Internet Server shall be integrated into the SQL database as required in the sections of the specifications detailing the data collection requirements. The system shall be configured using LonMaker with Echelon's LNS and DDE software (check with DPW MES for current LNS server configuration requirements).(4-02-08)
- f. The hardware shall perform the control sequences as specified and shown.
- g. The building level systems shall have a stand alone architecture where failure of a single controller shall not impact more than one system.
- h. Control sequence logic shall reside in DDC hardware in the building. The building control network shall not be dependent upon connection to a Utility Monitoring and Control System (UMCS) for performance of control sequences in this specification. The hardware shall, to the greatest extent practical, perform the sequences without reliance on the building network.
- i. The hardware shall be installed such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.
- j. The hardware installed under this specification shall be readily available from the General Services Administration (GSA) supply schedule.

k. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software shall be licensed to U.S. Army with Fort Leonard Wood Directorate of Public Works Systems Manager as the agent and will otherwise remain with the Government such that the Government or their agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

l. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software shall be turned over directly to the DPW Management of Engineered Systems section @ building 2224 in the DPW compound.

m. The Contractor shall provide sufficient documentation and data, including rights to documentation and data, such that the Government or their agents can execute work to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

n. Hardware shall be installed and configured such that the Government or their agents are able to perform repair, replacement, and upgrades of individual hardware without further interaction with the Contractor.

o. Control hardware shall be installed and configured to provide all input and output Standard Network Variables (SNVTs) as shown and as needed to meet the requirements of this specification.

p. All DDC devices installed under this specification shall communicate via ANSI/EIA 709.1B. The control system shall be installed such that a SNVT output from any node on the network can be bound to any other node in the domain.

q. The M&C software installed under this specification shall allow for graphical navigation between systems, graphical representations of systems, access to real-time data for systems, ability to override points in a system, access to all monitoring and control functions as shown on the point schedule.

r. The DDC system shall incorporate a labeled HVAC ventilation shutdown switch located as shown.

s. DDC Contractor personnel loading, configuring and providing DDC software on government owned computers and network access shall comply with AR-25-2 IT network security requirements.

t. DDC contractor shall use government provided computers only after DDC hardware is installed in building.

u. DDC Contractor shall provide application specific controllers(ASC's) utilizing standard Lonmark Functional profiles and manufacture plug in software as specified for all terminal and zone unit hardware.(04/02/08)

v. DDC Contractor shall coordinate software installation with DPW MES 10 days in advance.(8-11-08)

1.3.2 Job Requirments Building []

These requirments are in addition to requirments specified and shown.

1.3.3 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.3.4 Drawings

The Government will not indicate all offsets, fittings, and accessories that may be required on the drawings. The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall provide all work necessary to meet such conditions.

1.4 SUBMITTALS

The Following items shall be submitted for government approval.

a. DDC contractor design drawings shall be submitted in hardcopy(4 copies) completed as stated in section 3.3.2 of this specification..

b. Product specific data shall be submitted for each product provided under this specification.

c. Software: The most recent version unless otherwise stated, of all software provided under this specification shall be delivered as a technical data package to the DPW MES section. Software CD'S shall be clearly marked and labeled with a CD index and software index , type of software, software version, software company name and DPW building number(s) software covers. Software shall be in it's native format(No zip files)

d. Software CD's shall be provided for each building on multi-building projects.

e. Coordination is required for turnover of the technical data with DPW MES section.

f. Contractor shall provide a software list of all software used with name, type, model number and version. (03-05-08)

g. All passwords shall be provided. (03-05-08)

(1) Unless otherwise stated the most recent version of the Programming software for each type (manufacturer and model) of General Purpose Programmable Controller (GPPC) shall be submitted as a Technical Data Package and shall be licensed to the project site as shown. Software shall be submitted on CD-ROM and 5 hard copies of the software user manual shall be submitted for each piece of software provided. Programing software CD shall be clearly marked and labeled with product name, version and bldg. number.

(03/05/08)

(2)GPPC Application Programs

All installed GPPC Application Programs shall be submitted on CD-ROM as a Technical Data Package. The CD-ROM shall include a list or table of contents clearly indicating which application program is associated with each device. 2 copies of the GPPC Application Program's CD-ROM shall be submitted. software CD shall be clearly and labeled.

(3)XIF files

External interface files (XIF files) shall be submitted as a technical data package for each model of DDC Hardware provided under this specification. XIF files shall be submitted on CD-ROM. XIF files and CD shall be clearly marked which device the file is associated with, labeled, indexed and building number. A copy shall be provided for each building on multi-building projects.

(4) LNS Database

Two copies of the LNS Database for the complete control network provided under this specification shall be submitted as a Technical Data Package. Each copy shall be on CD-ROM and shall be clearly marked identifying it as the LNS Database for the work covered under this specification and with the date of the most recent database modification. A copy shall be provided for each building on multi-building projects.

(5)LNS Plug-in

LNS Plug-ins for each Application Specific Controller shall be submitted as a Technical Data Package. LNS Plug-ins distributed under a license shall be licensed to the project site. Plug-ins shall be submitted on CD-ROM and clearly marked and identified with the device the software is associated with. Hard copy manuals, if available, shall be submitted for each plug-in provided.

(6) 2 copies of as built drawings in MICROSTATION format shall be provided on separate CD-ROM in the close out submittal package.

(7) BPOC Application and Graphic's Programs

All installed BPOC application and graphic's programs shall be submitted on dedicated CD-ROM as a Technical Data Package. The CD-ROM shall include a list or table of contents clearly indicating which application program is associated with each device. 2 copies of the BPOC Application Program's CD-ROM shall be submitted. software CD shall be clearly marked and labeled. **Software, license and all passwords shall be submitted for each building on multi-building projects**

(8) Server Software

All installed server software shall be submitted on CD-ROM as a Technical Data Package. The CD-ROM shall include a list or table of contents clearly indicating which application program is associated with each device. 1 copy of the server application program CD-ROM shall be submitted. software CD shall be clearly marked and labeled. Software, license and all passwords shall be submitted for each building on multi-building projects

(9) Coordination is required with DPW MES section for completion of software submittal requirements. (03/05/08)

1.5 PROJECT SEQUENCING

1.6 QUALITY CONTROL (QC) CHECKLISTS

The QC checklist in appendix A shall be completed initialed and signed as shown. The QC Representatives shall verify each item in the Checklist and initial in the provided area to indicate that the requirement has been met. The QC Representative shall sign and date the Checklist prior to submission to the Government

1.7 DELIVERY AND STORAGE

Products shall be stored with protection from the weather, humidity, and temperature variations, dirt and dust, and other contaminants, within the storage condition limits published by the equipment manufacturer.

1.8 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

The HVAC control System Operation and Maintenance Instructions shall include:

- OPERATION AND MAINTENANCE DATA for each piece of control equipment.
- Printouts of configuration settings for all devices.
- Routine maintenance checklist. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.
- Qualified service organization list.
- Start-Up and Start-Up Testing Report.
- Performance Verification Test (PVT) Procedures and Report.

1.9 MAINTENANCE AND SERVICE

1.9.1 Description of Work

The adjustment and repair of the system shall include the manufacturer's required sensor and actuator (including transducer) calibration, span and range adjustment.

1.9.2 Personnel and Fort Leonard Wood Security Requirements

Service personnel shall be qualified to accomplish work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

1.9.2.1 Fort Leonard Wood AR25-2 IT Security Requirements

Fort Leonard Wood IT Security Requirements for personnel loading and configuring Direct Digital Control software on contractor supplied and government owned computer hardware and Fort Leonard Wood Network access.

a. The DDC contractor shall start AR25-2 information assurance security requirements coordination through their security manager immediately after contract award.

b. The Following items shall be coordinated through the Information Assurance Security Officer (IASO) in the Management of Engineering Systems Branch of the Directorate of Public Works (DPW) phone # 573-596-1917.

(1) The operating system (OS) software if applicable shall be **reinstalled** on contractor supplied computers by the Government IT department, the contractor shall coordinate operating system (OS) installation with the Information Assurance Security Officer (IASO) in the Management of Engineering Systems branch of the Directorate of Public works (DPW). All computers shall remain on site@ DPW IASO office after Government (OS) configuration is complete. (03-05-08)

(2) Coordination is required for domain, internet protocol address and subnet values.

(3) DDC contractor shall submit to the DPW IASO the full name, date of birth, place of birth, and social security number of all personnel that will have access to government owned computers and access to the Fort Leonard Wood network.

(4) DDC contractor personnel that will perform warranty work shall maintain an active AKO account and CAC card(Common Access Card) for the duration of the warranty period.

1.9.3 Scheduled Inspections

Two inspections shall be performed at six-month intervals and all work required shall be performed. Inspections shall be scheduled in [June and December][____]. These inspections shall include:

- a. Visual checks and operational tests of equipment.
- b. Fan checks and filter changes for control system equipment.
- c. Clean control system equipment including interior and exterior surfaces.
- d. Check and calibrate each field device. Check and calibrate 50 percent of the total analog inputs and outputs during the first inspection. Check and calibrate the remaining 50 percent of the analog inputs and outputs during the second major inspection. Certify analog test instrumentation accuracy to be twice the specified accuracy of the device being calibrated. Randomly check at least 25 percent of all digital inputs and outputs for proper operation during the first inspection. Randomly check at least 25 percent of the remaining digital inputs and outputs during the second inspection.
- e. Run system software diagnostics and correct diagnosed problems.
- f. Resolve any previous outstanding problems.

1.9.4 Scheduled Work

This work shall be performed during regular working hours, Monday through Friday, excluding Federal holidays.

1.9.5 Emergency Service

The Government will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the system. A telephone number where the service supervisor can be reached at all times shall be provided. Service personnel shall be at the site within 24 hours after receiving a request for service. The control system shall be restored to proper operating condition.

1.9.6 Operation

Scheduled adjustments and repairs shall include verification of the control system operation as demonstrated by the applicable tests of the performance verification test

1.9.7 Work Requests

Each service call request shall be recorded as received and shall include its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. A record of the work performed shall be submitted within 5 days after work is accomplished.

1.9.8 System Modifications

Recommendations for system modification shall be submitted in writing. No system modifications, including operating parameters and control settings, shall be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the Operations and Maintenance Instructions, and other documentation affected.

1.10 SURGE PROTECTION

1.10.1 Power-Line Surge Protection

Equipment connected to ac circuits shall be protected against or withstand power-line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

1.10.2 Surge Protection for Transmitter and Control Wiring

DDC hardware shall be protected against or withstand surges induced on control and transmitter wiring installed outdoors and as shown. The equipment protection shall be protected against the following two waveforms:

- a. A waveform with a 10-microsecond rise time, a 1,000-microsecond decay time and a peak current of 60 amps.
- b. A waveform with an 8-microsecond rise time, a 20-microsecond decay time and a peak current of 500 amperes.

1.11 INPUT MEASUREMENT ACCURACY

Sensors, transmitters and DDC Hardware shall be selected, installed and configured such that the maximum error of the measured value at the SNVT output of the DDC hardware is less than 150% of the maximum allowable error specified for the sensor or instrumentation.

1.12 BUILDING CONTROL NETWORK

The building control network shall consist of a backbone and one or more local control busses as specified.

1.12.1 Backbone Media

The backbone shall be a TP/FT-10 network in accordance with ANSI/EIA 709.3 or an IP network as specified according to the following criteria:

a. The backbone shall be an IP network as specified if both of the following conditions are met:

(1) the Network Bandwidth Calculations for a heavily loaded network show that more than 70% of the 78 kbps (kilobits per second) bandwidth is used or the Network Bandwidth Calculations for a normally loaded network show that more than 30% of the 78 kbps bandwidth is used.

(2) the Government has approved the Network Bandwidth Calculations submittal.

(3) The network bandwidth use of the as built network shall be tested and noted on the as built riser diagram drawing. (03-05-08)

b. The backbone shall be a TP/FT-10 network otherwise.

1.12.2 Control Network Requirements

The control network shall meet the following requirements:

a. The backbone shall have no control devices connected to it. Only ANSI/EIA 709.1B Routers and ANSI/EIA 709.1B TP/FT-10 to IP Routers or approved building level servers may be connected to the backbone.

b. The backbone shall be installed such that a web server/router at the [Building Point of Connection \(BPOC\)](#) location as shown may be connected to the backbone.

c. The local control bus shall use ANSI/EIA 709.1B over a TP/FT-10 network in doubly-terminated bus topology in accordance with ANSI/EIA 709.3

d. The local control busses shall be installed such that no node (device connected to the control network) has more than two ANSI/EIA 709.1B Routers and ANSI/EIA 709.3 Repeaters (in any combination) between it and the backbone, including the [web server\(BPOC\)](#) connected to the backbone.

- e. All DDC Hardware shall connect to a local control bus.
- f. All DDC Hardware shall be locally powered; link power is not acceptable.
- g. The local control bus cable twisted pair conductors color code shall be white/blue or white-blue/blue, these colors shall be dedicated to the local control buss. (12/10/08)
- h. The local control bus cable shall be shielded, plenum rated and have a purple jacket. The jacket color shall be dedicated to the local control bus cable. (12/10/08)

1.12.3 Building Point of Connection(BPOC) Requirements

The DDC Building point of connection and hardware shall consist of hardware, inside-plant horizontal cables and connecting hardware to transport data (LAN) signals between equipment items in a building.

- a. BPOC hardware and connections shall be located inside a Nema 12 enclosure as specified and shown.
- b. A dedicated ¾” inch metal raceway and [jetline (dpw)] [two category six comm cables (corps)] shall be provided from the DDC BPOC hardware enclosure back to the telecommunications closet containing the building Wide Area Network (WAN) connections and devices.
- [c. CAT 6 communication cables shall be terminated on the IT patch panel in the building comm. room that houses the WAN connections and terminate cabling in the BPOC enclosure with two RJ-45 jacks as shown .](12/10/07)
- c. After raceway and jetline are installed coordinate immediately with DPW operations for cabling and RJ-45 jack installation.
- d. The Contractor shall provide a patch cable from the BPOC hardware and patch into the LAN jacks.
- e. BPOC hardware shall be configured for operation on the local area network (LAN).
- f. BPOC hardware shall have the IP-852 routing option configured and enabled to communicate with the existing enterprise LNS UMCS.
- g. BPOC shall have SOAP/XML web services interface
- h. BPOC shall have all the latest software patches and software updates installed and running coordination with DPW MES required. BPOC I-LONe4 hardware and firmware shall be downgraded to I-LONe3 (9-19-08)

- i. BPOC shall have a built in web server and web pages that allows access to data points on the building level DDC system as shown.
- j. BPOC shall provide a Remote Network Interface(RNI) for the LonMaker Intergration Tool.
- k. BPOC shall have monitoring and control capabilities of the building level Lonworks control network as shown using Lonworks Network Services.
- l. BPOC hardware shall be located in mechanical equipment rooms with outside access if available.
- m. BPOC shall support the LonScanner Protocol Analyzer

1.13 LNS SERVER Requirements^(12/10/07)

Contractor provided CPU and OS to be used for LNS Server and installed in an enclosure meet NEMA 250 type 12 requirements, with a continuous hinged and gasketed exterior door with 3-point latch kit handle, enclosure manufacture provided intergal hasp and staple for padlocking, door clamps and a data pocket in the door.^(12/10/07) To include LonMaker and Lon DDE Server. Government computer equipment shall be used for software installation and configuration.

- a. Windows XP Professional License (Army Gold Version to be loaded by DOIM prior to Contractor Loading Software), P4 Processor 2 GHz Minimum, Min 2 Gig Ram, CD-ROM Drive, Graphics card capable of 1280x1024 True color, 1 DVI, VGA & 1 S-Video (with add-in PCI-Express video card); Mouse & Keyboard XP Compatible (USB); 80 Gig STA Hard Drive Minimum free space, not taking into account the size of the LNS applications for LNS network interface driver requirements; 1 Gig/100 MB Network Interface Card NIC10/100/1000 LAN, J45); SLTA-10 Serial LonTalk Adapter installed, configured; LNS Server Installed and Configured; LNS Database Resides on PC
- b. Domain shall be set to Facility Building Number.
- c. LNS Server and Database shall be connected to the Lonworks TCP/IP 852 Lon Network running under the Lonworks IP852 configuration server as a full client.
- d. Contractor shall provide 1 Copy Echelon LNS DDE Server Software License (Model 37200-20 LNS DDE Server OEM Edition) to Directorate of Public Works (DPW) Systems Manager.
- e. LNS Server shall NOT be connected to the Installation LAN without the approval of the DPW Systems Manager.

f. Uninterruptible Power Supply(UPS) shall power CPU for 30 minutes, UPS shall have automatic shutdown and restart feature.

g. A dedicated ¾” inch metal raceway and [jetline (DPW local req)] [two category six comm cable(corp req)] shall be provided from the DDC CPU hardware enclosure back to the telecommunications closet containing the building Wide Area Network (WAN) connections and devices.] (07-08-08)

[h. After raceway and jetline are installed coordinate immediately with DPW operations for cabling and jack installation.] DPW REQ.

[h. CAT 6 communication cables shall be terminated on the IT patch panel in the building comm. room that houses the WAN connections and terminate cabling in the CPU enclosure with one RJ-45 jack as shown .](12/10/07) CORPS REQ.

i. CPU server enclosure shall contain ventilation louvers on the side near the bottom of the enclosure and a 100 cfm ventilation fan venting out of the side of the enclosure near the top.

j. CPU server shall have a minimum of 1” inch of clearance on the sides and a minimum of 6” inches of clearance for the front and back.

k. Coordination is required with DPW for Computer hardware use and software installation. (12/10/07)

l. All passwords shall be provided to the DPW MES section. (03-05-08)

[1.13 EXISTING AREA LNS SERVER Requirements(12/10/07)

a. Domain shall be set to Facility area, coordinate with DPW MES section.

b. LNS Server and Database shall be connected to the Lonworks TCPIP 852 Lon Network running under the Lonworks IP852 configuration server as a full client.

c. Coordination is required with DPW for Computer hardware use and software installation. (12/10/07)]DPW REQ.

d. Contractor shall provide 1 Copy Echelon LNS DDE Server Software License (Model 37200-20 LNS DDE Server OEM Edition) to Directorate of Public Works (DPW) Systems Manager. (7/08/08)

e. LNS Server shall NOT be connected to the Installation LAN without the approval of the DPW Systems Manager

f. All passwords shall be provided to the DPW MES section. (08-11-08)

e. All required software shall be loaded on the server(8-11-08)

1.14 Panel Mounted Override Switches

a. A labeled manual override switch shall be provided for DDC outputs that enable chillers. Override switches shall be located at the DDC chiller controller.

b. A labeled manual override switch shall be provided for DDC outputs that enable boilers. Override switches shall be located at the DDC boiler controller.

c. Manual override switches shall meet user input device hardware requirements.

PART 2 PRODUCTS

PART 2 of this specification covers requirements for Products (equipment). Installation requirements for these products are covered in PART 3 of this Specification.

2.1 GENERAL EQUIPMENT REQUIREMENTS

Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of these and similar products. The standard products shall have been in a satisfactory commercial or industrial use for two years prior to use on this project. The two year use shall include applications of equipment and materials under similar circumstances and of similar size. DDC Hardware not meeting the two-year field service requirement shall be acceptable provided it has been successfully used by the Contractor in a minimum of two previous projects. The equipment items shall be supported by a service organization. Items of the same type and purpose shall be identical, including equipment, assemblies, parts and components. Manufacturer's catalog data sheets documenting compliance with product specifications shall be submitted as specified for each product installed under this specification.

2.1.1 Operation Environment Requirements

All products shall be rated for continuous operation under the following conditions:

a. Pressure: Pressure conditions normally encountered in the installed location.

b. Vibration: Vibration conditions normally encountered in the installed location.

c. Temperature:

(1) Products installed indoors: Ambient temperatures in the range of (32 to 112 degreesF) and temperature conditions outside this range normally encountered at the installed location.

(2) Products installed outdoors or in unconditioned indoor spaces: Ambient temperatures in the range of (-35 to +151 degreesF) and temperature conditions outside this range normally encountered at the installed location.

d. Humidity: 10% to 95% relative humidity, noncondensing and humidity conditions outside this range normally encountered at the installed location.

2.2 ENCLOSURES AND WEATHERSHIELDS

2.2.1 Enclosures

Enclosures shall meet the following minimum requirements:

a. Outdoors: Enclosures located outdoors shall meet NEMA 250 Type 4 requirements.

b. Mechanical and Electrical Rooms: Enclosures located in mechanical or electrical rooms shall meet NEMA 250 type 12 requirements, with a continuous hinged and gasketed exterior door with 3-point latch kit handle, enclosure manufacture provided intergal hasp and staple for padlocking, door clamps and a data pocket in the door.

c. Other Locations: Enclosures in other locations including but not limited to occupied spaces, above ceilings, and plenum returns shall meet NEMA 250 Type 1 requirements. Enclosures supplied as an integral (pre-packaged) part of another product are acceptable.

2.2.2 Weathershields

Weathershields for sensors located outdoors shall prevent the sun from directly striking the sensor. The weathershield shall be provided with adequate ventilation so that the sensing element responds to the ambient conditions of the surroundings. The weathershield shall prevent rain from directly striking or dripping onto the sensor. Weathershields installed near outside air intake ducts shall be installed such that normal outside air flow does not cause rainwater to strike the sensor. Weathershields shall be constructed of galvanized steel painted white, unpainted aluminum, aluminum painted white, or white PVC.

2.3 TUBING

2.3.1 Copper

Copper tubing shall conform to ASTM B 88 and ASTM B 88M

2.3.2 Stainless Steel

Stainless steel tubing shall conform to ASTM A 269

2.3.3 Plastic

Plastic tubing shall have the burning characteristics of linear low-density polyethylene tubing, shall be self-extinguishing when tested in accordance with ASTM D 635, shall have UL 94 V-2 flammability classification or better, and shall withstand stress cracking when tested in accordance with ASTM D 1693. Plastic-tubing bundles shall be provided with Mylar barrier and flame-retardant polyethylene jacket.

2.4 NETWORK HARDWARE

2.4.1 ANSI/EIA 709.1B Network Hardware

2.4.1.1 ANSI/EIA 709.1B Routers

ANSI/EIA 709.1B Routers (including routers configured as repeaters) shall meet the requirements of ANSI/EIA 709.1B and shall provide connection between two or more ANSI/EIA 709.3 TP/FT-10 channels.

2.4.1.2 ANSI/EIA 709.3 Repeater

ANSI/EIA 709.3 Repeater shall be physical layer repeaters in accordance with ANSI/EIA 709.3.

2.4.1.3 Gateways

Gateways shall perform bi-directional protocol translation from one non-ANSI/EIA 709.1B protocol to ANSI/EIA 709.1B. Gateways shall incorporate exactly two network connections: one shall be for connection to a TP/FT-10 network in accordance with ANSI/EIA 709.3 and the second shall be as required to communicate with the non-ANSI/EIA 709.1B network.

2.4.1.4 Building Point of Connection Hardware Requirements.

a. Processor- MIPS32

b. Channel Type- 72101-3 and 72102-3 TP/ft-10 free topology twisted pair, 72103-3, 72104-3 PL-20N or PL-20C power line, L-N coupling.

c. Lonworks Network Connector-screw terminals

d. Operating Input Voltage- 100-240VAC, 50-50 Hz

e. Controls- Service button, Reset button

f. Indicators - power, Ethernet activity, Digital inputs, Relay outputs, RNI connection Status and Lonworks Service.

g. Ethernet connector- RJ-45, 8 conductor

h. Ethernet Port-10/100BaseT, auto-selecting, auto polarity

- i. Serial Ports- Isolated RS-485 and EIA-232 serial.
- j. Serial Connector- Screw terminals
- k. Modem Connector- RJ-11,6 conductor
- l. Console Port- EIA-232
- m. Console Connector- DB-9
- n. Digital Inputs- 2 ea. optically isolated dry contact inputs, 30 V AC/DC
- o. Relay Outputs- 2 SPST relays rated at 240VAC @ 10A or 24VDC@10A
- p. Impulse Meter Inputs- DIN 43 864
- q. Impulse Meter Connector- Screw terminals
- r. Operating Temperature 0-50°C
- s. Dimensions- Height:3.51inches,Width:5.47inches,Depth: 2.60inches
- t. Mounting- DIN, Enclosure 8TE

2.5 WIRE AND CABLE

All wire and cable shall meet the requirements of NFPA 70 and NFPA 90A in addition to the requirements of this specification.

2.5.1 Terminal Blocks

Terminal blocks which are not integral to other equipment shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2.5.2 Control Wiring for Binary Signals

Control wiring for binary signals shall be 18 AWG copper and shall be rated for 300-volt service.

2.5.3 Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG or thicker stranded copper and shall be rated for 600-volt service.

2.5.4 Control Wiring for Analog Signals

Control Wiring for Analog Signals shall be 18 AWG, copper, single- or multiple-twisted, minimum 50 mm (2 inch) lay of twist, 100% shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper

cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.5.5 Transformers

Transformers shall be UL 1585 approved. Transformers shall be sized so that the connected load is no greater than 80% of the transformer rated capacity.

2.6 AUTOMATIC CONTROL VALVES

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Valve bodies shall meet ANSI/ASME B16.34 or ANSI/ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150% of the system design operating pressure. Unless otherwise specified or shown, valve leakage shall meet ANSI/FCI 70-2 Class IV leakage rating (0.01% of valve Kv). Unless otherwise specified or shown, valves shall have globe-style bodies. Unless otherwise specified:

- a. bodies for valves 40 mm (1.5 inches) and smaller shall be brass or bronze, with threaded or union ends
- b. bodies for 50 mm (2 inch) valves shall have threaded ends
- c. bodies for valves 50 to 80 mm (2 to 3 inches) shall be of brass, bronze or iron.
- d. bodies for valves 65 mm (2.5 inches) and larger shall be provided with flanged-end connections.
- e. for modulating applications, valve Kv (Cv) shall be within 100 to 125% of the Kv (Cv) shown.
- f. for two position applications (where the two positions are full open and full closed) the Kv (Cv) shall be the largest available for the valve size.
- f. valve and actuator combination shall be normally open or normally closed as shown.

2.6.1 Ball Valves

Balls shall be stainless steel or nickel plated brass. Valves shall have blow-out proof stems. In steam and high temperature hot water applications, the valve-to-actuator linkage shall provide a thermal break.

2.6.2 Butterfly Valves

Butterfly valves shall be threaded lug type suitable for dead-end service and modulation to the fully-closed position, with carbon-steel bodies and non-corrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from (-20 to +250 degreesF). The rated (Cv) for butterfly valves shall be the value (Cv) at 70% (60 degrees) open position. Valve leakage shall meet ANSI/FCI 70-2 Class VI leakage rating.

2.6.3 Two-Way Valves

Two-way modulating valves used for liquids shall have an equal-percentage characteristic. Two-way modulating valves used for steam shall have a linear characteristic.

2.6.4 Three-Way Valves

Three-way modulating valves shall provide equal percentage flow control with constant total flow throughout full plug travel.

2.6.5 Duct-Coil and Terminal-Unit-Coil Valves

Control valves with either flare-type or solder-type ends shall be provided for duct or terminal-unit coils. Flare nuts shall be provided for each flare-type end valve.

2.6.6 Valves for Chilled-Water, Condenser-Water, and Glycol Service Valve internal trim shall be Type 316 stainless steel. Valves (4 inches) and larger shall be butterfly valves.

2.6.7 Valves for High-Temperature Hot-Water, Hot-Water and Dual Temperature Service Valves for hot water service between (210 degreesF) and (250 degreesF) and dual-temperature service shall have internal trim (including seats, seat rings, modulating plugs, and springs) of Type 316 stainless steel. Internal trim for valves controlling water below (210 degreesF) shall be brass, bronze or Type 316 stainless steel. Nonmetallic valve parts shall be suitable for a minimum continuous operating temperature of (250 degreesF) or (50 degreesF) above the system design temperature, whichever is higher. Valves (4 inches) and larger shall be butterfly valves. For high-temperature hot water service above (250 degreesF) valve bodies shall be carbon steel, globe type with welded ends on valves (1 inch) and larger. Valves smaller than (1 inch) shall have socket-weld ends. Packing shall be virgin polytetrafluoroethylene (PTFE). Internal valve trim shall be Type 316 stainless steel.

2.6.8 Valves for Steam Service

Bodies for valves (4 inches) and larger shall be iron or carbon steel. Internal valve trim shall be Type 316 stainless steel. If the specified (Cv) is not available the valve manufacturer's next largest size shall be used.

2.7 DAMPERS

2.7.1 Damper Assembly

A single damper section shall have blades no longer than (48 inch) and shall be no higher than (72 inch). Maximum damper blade width shall be (8in). Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. Blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section shall not be located directly in the air stream. Damper axles shall be (0.5 inch) minimum, plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed (0.04 inches water gauge) at (1,000ft/min) in the wide-

open position. Frames shall not be less than (2 inch)in width. Dampers shall be tested in accordance with AMCA 500-D.

2.7.2 Operating Linkages

Operating links external to dampers, such as crank arms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers, shall withstand a load equal to at least 300% of the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crank arms shall control the open and closed positions of dampers.

2.7.3 Damper Types

2.7.3.1 Flow Control Dampers

Outside air, return air, relief air, exhaust, face and bypass dampers shall be provided where shown and shall be parallel-blade or opposed blade type as shown on the Damper Schedule. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Unless otherwise shown, dampers shall be AMCA 500-D Class 2 and shall not leak in excess of (20cfm per square foot) at (4 inches water gauge) static pressure when closed. Outside air damper seals shall be suitable for an operating temperature range of (-40 to +167 degreesF). Dampers shall be rated at not less than (2000ft/min) air velocity.

2.7.3.2 Mechanical Rooms and Other Utility Space Ventilation Dampers

Utility space ventilation dampers shall be as shown. Unless otherwise shown, dampers shall be AMCA 500-D class 4 and shall not leak in excess of (80cfm per square foot) at (4 inches water gauge) static pressure when closed. Dampers shall be rated at not less than (1500ft/min) air velocity.

2.7.3.3 Smoke Dampers

Smoke-damper and actuator assembly shall meet the current requirements of NFPA 90A, UL 555, and UL 555S. Combination fire and smoke dampers shall be rated for (250 degreesF) Class II leakage per UL 555S.

2.8 SENSORS AND INSTRUMENTATION

Unless otherwise specified, sensors and instrumentation shall incorporate an integral transmitter or be provided with a transmitter co-located with the sensor. Sensors and instrumentation, including their transmitters, shall meet the specified accuracy and drift requirements at the input of the connected DDC Hardware's analog-to-digital conversion. Sensors and instrumentation, including their transmitters, shall meet or exceed the specified range.

2.8.1 Transmitters

The transmitter shall match the characteristics of the sensor. Transmitters providing analog values shall produce a linear 4-20 mAdc, 0-10 Vdc or SNVT output

corresponding to the required operating range and shall have zero and span adjustment. Transmitters providing binary values shall have dry contacts or SNVT output. Transmitters with SNVT output are Application Specific Controllers (ASCs) and shall meet all ASC requirements. (note: ASCs are specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE)

2.8.2 Temperature Sensors

2.8.2.1 Sensor Ranges and Accuracy

Temperature sensors may be provided without transmitters. Temperature sensors, including transmitter if used, shall have minimum operating ranges, minimum accuracy and maximum drift as specified below for the application:

a. Conditioned Space Temperature

- (1) Operating Range: (+50 to +86 degrees F)
- (2) Accuracy: +/- (1 degree F) over the operating range.
- (3) Drift: Maximum (1 degree F) per year

b. Unconditioned Space Temperature

- (1) Operating Range: (+20 to +150 degrees F)
- (2) Accuracy: +/- (1 degree F) over the range of (+30 to +131 degrees F) and +/- (4 degrees F) over the rest of the operating range.
- (3) Drift: Maximum (1 degree F) per year

c. Duct Temperature

- (1) Operating Range: (+40 to +140 degrees F)
- (2) Accuracy: +/- (2 degrees F).
- (3) Drift: Maximum (2 degrees F) per year.

d. Outside Air Temperature

- (1) Operating Range: (-30 to 130 degrees F).
- (2) Accuracy:
 - (a) +/- (2 degrees F) over the range of (-30 to +130 degrees F).
 - (b) +/- (1 degree F) over the range of (+30 to +100 degrees F).
- (3) Drift: Maximum (1 degree F) per year.

e. High Temperature Hot Water

- (1) Operating Range: (+150 to +450 degrees F).
- (2) Accuracy: +/- (3.6 degrees F).
- (3) Drift: Maximum +/- (2 degrees F) per year.

f. Chilled Water

- (1) Operating Range: (+30 to +100 degrees F)
- (2) Accuracy: +/- (0.8 degrees F) over the range of (+35 to +65 degrees F) and +/- (2 degrees F) over the rest of the operating range
- (3) Drift: Maximum (0.8 degrees F) per year

g. Dual Temperature Water

- (1) Operating Range: (+30 to +240 degrees F)
- (2) Accuracy: +/- (2 degrees F).
- (3) Drift: Maximum (2 degrees F) per year

h. Heating Hot Water

- (1) Operating Range: (+70 to +250 degrees F)
- (2) Accuracy: +/- (2 degrees F).
- (3) Drift: Maximum (2 degrees F) per year

i. Condenser Water

- (1) Operating Range: (+30 to +130 degrees F)
- (2) Accuracy: +/- (1 degree F).
- (3) Drift: Maximum (1 degree F) per year

2.8.2.2 Point Temperature Sensors

Point Sensors shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper.

2.8.2.3 Averaging Temperature Sensors

Averaging sensors shall be a continuous element with a minimum length equal to 3m per square meter (1 foot per square foot) of duct cross-sectional area at the installed location. The sensing element shall have a bendable copper sheath.

2.8.2.4 Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, (2 inch) lagging neck and extension type well. Inside diameter and insertion length shall be as required for the application.

2.8.3 Relative Humidity Sensor

Relative humidity sensors shall use bulk polymer resistive or thin film capacitive type non-saturating sensing elements capable of withstanding a saturated condition without permanently affecting calibration or sustaining damage. The sensors shall include removable protective membrane filters. Where required for exterior installation, sensors shall be capable of surviving below freezing temperatures and direct contact with moisture without affecting sensor calibration. When used indoors, the sensor shall be capable of being exposed to a condensing air stream (100% RH) with no adverse effect to the sensor's calibration or other harm to the instrument. The sensor shall be of the wall-mounted or duct-mounted type, as required by the application, and shall be provided with any required accessories. Sensors used in duct high-limit applications shall have a bulk polymer resistive sensing element. Duct-mounted sensors shall be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage. Relative humidity (RH) sensors shall measure relative humidity over a range of 0% to 100% with an accuracy of +/-3%. RH sensors shall function over a temperature range of (25 to 130 degrees F) and shall not drift more than 2% per year.

2.8.4 Carbon Dioxide (CO₂) Sensors

Carbon dioxide (CO₂) sensors shall measure CO₂ concentrations between 0 to 1000 parts per million (ppm) using non-dispersive infrared (NDIR) technology with an accuracy of +/-75 ppm and a maximum response time of 1 minute. The sensor shall be rated for operation at ambient air temperatures within the range of (32 to 122 degrees F) and relative humidity within the range of 0 to 95% (non-condensing). The sensor shall have a maximum drift of 2%. The sensor chamber shall be manufactured with a non-corrosive

material (such as gold-plating) that does not affect carbon dioxide sample concentration. Duct mounted sensors shall be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage.

2.8.5 Differential Pressure Instrumentation

2.8.5.1 Differential Pressure Sensors

Differential Pressure Sensor range shall be as shown or as required for the application. Pressure sensor ranges shall not exceed the high end range shown on the Points Schedule by more than 50%. The over pressure rating shall be a minimum of 150% of the highest design pressure of either input to the sensor. The accuracy shall be +/-2% of full scale.

2.8.5.2 Differential Pressure Switch

The switch shall have a user-adjustable setpoint. The setpoint shall not be in the upper or lower quarters of the range. The over pressure rating shall be a minimum of 150% of the highest design pressure of either input to the sensor. The switch shall have two sets of contacts and each contact shall have a rating greater than it's connected load. Contacts shall open or close upon rise of pressure above the setpoint or drop of pressure below the setpoint as shown.

2.8.6 Flow Sensors

2.8.6.1 Airflow Measurement Array (AFMA)

AFMAs shall contain an airflow straightener if required by the AFMA manufacturer's published installation instructions. The straightener shall be contained inside a flanged sheet metal casing, with the AMFA located as specified according to the published recommendation of the AFMA manufacturer. In the absence of published documentation airflow straighteners shall be provided if there is any duct obstruction within 5 duct diameters upstream of the AFMA. Air-flow straighteners, where required, shall be constructed of (.125 inch) aluminum honeycomb and the depth of the straightener shall not be less than (1.5 inches). The resistance to air flow through the AFMA, including the airflow straightener shall not exceed (0.08 inch water gauge) at an airflow of (2,000 fpm). AFMA construction shall be suitable for operation at airflows of up to (5,000 fpm) over a temperature range of (+40 to +120 degrees F). In outside air measurement or in low-temperature air delivery applications, the AFMA shall be certified by the manufacturer to be accurate as specified over a temperature range of (-20 to +120 degrees F).

a. Pitot Tube AFMA: Each Pitot Tube AFMA shall contain an array of velocity sensing elements. The velocity sensing elements shall be of the multiple pitot tube type with averaging manifolds. The sensing elements shall be distributed across the duct cross section in the quantity and pattern specified by the published installation instructions of the AFMA manufacturer. Pitot Tube AFMAs shall have an accuracy of +/- 3% over a range of (500 to 2,500 fpm).

b. Electronic AFMA: Each electronic AFMA shall consist of an array of velocity sensing elements of the resistance temperature detector (RTD) or thermistor type. The sensing

elements shall be distributed across the duct cross section in the quantity and pattern specified by the published application data of the AFMA manufacturer.

Electronic AFMAs shall have an accuracy of $\pm 3\%$ percent over a range of (125 to 2,500 fpm) and the output shall be temperature compensated over a range of (32 to 212 degrees F).

2.8.6.2 Orifice Plate

Orifice plate shall be made of an austenitic stainless steel sheet of (0.125 inch) nominal thickness with an accuracy of $\pm 1\%$ of full flow. The orifice plate shall be flat within (0.002 inches). The orifice surface roughness shall not exceed (20 micro-inches). The thickness of the cylindrical face of the orifice shall not exceed 2% of the pipe inside diameter or 12.5% of the orifice diameter, whichever is smaller. The upstream edge of the orifice shall be square and sharp. Where orifice plates are used, concentric orifice plates shall be used in all applications except steam flow measurement in horizontal pipelines.

2.8.6.3 Flow Nozzle

Flow nozzle shall be made of austenitic stainless steel with an accuracy of $\pm 1\%$ of full flow. The inlet nozzle form shall be elliptical and the nozzle throat shall be the quadrant of an ellipse. The thickness of the nozzle wall and flange shall be such that distortion of the nozzle throat from strains caused by the pipeline temperature and pressure, flange bolting, or other methods of installing the nozzle in the pipeline shall not cause the accuracy to degrade beyond the specified limit. The outside diameter of the nozzle flange or the design of the flange facing shall be such that the nozzle throat shall be centered accurately in the pipe.

2.8.6.4 Venturi Tube

Venturi tube shall be made of cast iron or cast steel and shall have an accuracy of $\pm 1\%$ of full flow. The throat section shall be lined with austenitic stainless steel. Thermal expansion characteristics of the lining shall be the same as that of the throat casting material. The surface of the throat lining shall be machined to a \pm (50 micro inch) finish, including the short curvature leading from the converging entrance section into the throat.

2.8.6.5 Annular Pitot Tube

Annular pitot tube shall be made of austenitic stainless steel with an accuracy of $\pm 2\%$ of full flow and a repeatability of $\pm 0.5\%$ of measured value. The unit shall have at least one static port and no less than four total head pressure ports with an averaging manifold.

2.8.6.6 Insertion Turbine Flowmeter

Insertion Turbine Flowmeter accuracy shall be $\pm 1\%$ of reading for a minimum turndown ratio of 1:1 through a maximum turndown ratio of 50:1. Repeatability shall be $\pm 0.25\%$ of reading. The meter flow sensing element shall operate over a range suitable for the installed location with a pressure loss limited to 1% of operating pressure at maximum flow rate. Design of the flowmeter probe assembly shall

incorporate integral flow, temperature, and pressure sensors. The turbine rotor assembly shall be constructed of Series 300 stainless steel and use Teflon seals.

2.8.6.7 Vortex Shedding Flowmeter

Vortex Shedding Flowmeter accuracy shall be within $\pm 0.8\%$ of the actual flow. The flow meter body shall be made of austenitic stainless steel. The vortex shedding flowmeter body shall not require removal from the piping in order to replace the shedding sensor.

2.8.6.8 Positive Displacement Flow Meter

The flow meter shall be a direct reading, gerotor, nutating disk or vane type displacement device rated for liquid service as shown. A counter shall be mounted on top of the meter, and shall consist of a non-resettable mechanical totalizer for local reading, and a pulse transmitter for remote reading. The totalizer shall have a six digit register to indicate the volume passed through the meter in gallons, and a sweep-hand dial to indicate down to 0.25 gallons. The pulse transmitter shall have a hermetically sealed reed switch which is activated by magnets fixed on gears of the counter. The meter shall have a bronze body with threaded or flanged connections as required for the application. Output accuracy shall be $\pm 2\%$ of the flow range. The maximum pressure drop at full flow shall be (5psig).

2.8.6.9 Flow Meters, Paddle Type

Sensor shall be non-magnetic, with forward curved impeller blades designed for water containing debris. Sensor accuracy shall be $\pm 2\%$ of rate of flow, minimum operating flow velocity shall be (1 foot per second). Sensor repeatability and linearity shall be $\pm 1\%$. Materials which will be wetted shall be made from non-corrosive materials and shall not contaminate water. The sensor shall be rated for installation in pipes of (3 to 40 inch) diameters. The transmitter housing shall be a NEMA 250 Type 4 enclosure.

2.8.6.10 Flow Switch

Flow switch shall have a repetitive accuracy of $\pm 10\%$ of actual flow setting. Switch actuation shall be adjustable over the operating flow range. The switch shall have Form C snap-action contacts, rated for the application. The flow switch shall have non flexible paddle with magnetically actuated contacts and be rated for service at a pressure greater than the installed conditions. Flow switch for use in sewage system shall be rated for use in corrosive environments encountered.

2.8.6.11 Gas Utility Flow Meter

Gas utility flow meter shall be diaphragm or bellows type (gas positive displacement meters) for flows up to (2500 SCFH) and axial flow turbine type for flows above(2500 SCFH), designed specifically for natural gas supply metering, and rated for the pressure, temperature, and flow rates of the installation. Meter shall have a minimum turndown ratio of 10 to 1 with an accuracy of $\pm 1\%$ of actual flow rate. The meter index shall include a direct reading mechanical totalizing register and electrical impulse dry contact output for remote monitoring. For gas flows of less than (1500 cubic feet/second), the electrical impulse dry contact output shall provide not less than 1 pulse per (100 cubic

feet) of gas and shall not exceed 15 pulses per second for the installed application. For gas flows(1500 cubic-feet/second) or greater, the pulse rate shall not be the greatest pulse-rate available but not to exceed 15 pulses per second for the installed application. The electrical impulse dry contact output shall not require field adjustment or calibration.

2.8.7 Electrical Instruments

Electrical Instruments shall have an input range as shown or sized for the application. Unless otherwise specified, AC instrumentation shall be suitable for 60 Hz operation.

2.8.7.1 Watt or Watthour Transducers

Watt transducers shall measure voltage and current and shall output kW, kWh, or kW and kWh as shown. kW outputs shall have an accuracy of $\pm 0.25\%$ over a power factor range of .1 to 1. kWh outputs shall be a pulse output and shall have an accuracy of $\pm 0.5\%$ over a power factor range of .1 to 1.

2.8.7.2 Watthour Revenue Meter (with and without Demand Register)

All Watthour revenue meters shall measure voltage and current and shall be in accordance with ANSI C12.1 with an ANSI C12.20 Accuracy class of 0.2 and shall have pulse initiators for remote monitoring of Watthour consumption. Pulse initiators shall consist of form C contacts with a current rating not to exceed two amperes and voltage not to exceed 500 V, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations. Meter sockets shall be in accordance with ANSI C12.10. Watthour revenue meters with demand registers shall have an analog output for instantaneous demand in addition to the pulse initiators.

2.8.7.3 Current Transducers

Current transducers shall accept an AC current input and shall have an accuracy of $\pm 2\%$ of full scale. An integral power supply shall be provided if required for the analog output signal. The device shall have a means for calibration.

2.8.7.4 Current Sensing Relays (CSRs)

Current sensing relays (CSRs) shall provide a normally-open contact with a voltage and amperage rating greater than its connected load. Current sensing relays shall be of split-core design. The CSR shall be rated for operation at 200% of the connected load. Voltage isolation shall be a minimum of 600 volts. The CSR shall auto-calibrate to the connected load.

2.8.7.5 Voltage Transducers

Voltage transducers shall accept an AC voltage input and have an accuracy of $\pm 0.25\%$ of full scale. An integral power supply shall be provided if required for the analog output signal. The device shall have a means for calibration. Line side fuses for transducer protection shall be provided.

2.8.8 pH Sensor

The sensor shall be suitable for applications and chemicals encountered in water treatment systems of boilers, chillers and condenser water systems. Construction, wiring,

fittings and accessories shall be corrosion and chemical resistant with fittings for tank or suspension installation. Housing shall be polyvinylidene fluoride with O-rings made of chemical resistant materials which do not corrode or deteriorate with extended exposure to chemicals. The sensor shall be encapsulated. Periodic replacement shall not be required for continued sensor operation. Sensors shall use a ceramic junction and pH sensitive glass membrane capable of withstanding a pressure of (100 psig at 150 degrees F). The reference cell shall be double junction configuration. Sensor range shall be 0 to 12 pH, stability 0.05, sensitivity 0.02, and repeatability of +/-0.05 pH value, response of 90% of full scale in one second and a linearity of 99% of theoretical electrode output measured at (76 degreesF).

2.8.9 Oxygen Analyzer

Oxygen analyzer shall consist of a zirconium oxide sensor for continuous sampling and an air-powered aspirator to draw flue gas samples. The analyzer shall be equipped with filters to remove flue air particles. Sensor probe temperature rating shall be (815 degrees F). The sensor assembly shall be equipped for flue flange mounting.

2.8.10 Carbon Monoxide Analyzer

Carbon monoxide analyzer shall consist of an infrared light source in a weather proof steel enclosure for duct or stack mounting. An optical detector/analyzer in a similar enclosure, suitable for duct or stack mounting shall be provided. Both assemblies shall include internal blower systems to keep optical windows free of dust and ash at all times. The third component of the analyzer shall be the electronics cabinet. Automatic flue gas temperature compensation and manual/automatic zeroing devices shall be provided. Unit shall read parts per million (ppm) of carbon monoxide in the range of 0 to 500 ppm and the response time shall be less than 3 seconds to 90% value. Unit measurement range shall not exceed specified range by more than 50%. Repeatability shall be +/-2% of full scale with an accuracy of +/-3% of full scale.

2.8.11 Occupancy Sensors

Occupancy sensors shall have occupancy-sensing sensitivity adjustment and an adjustable off-delay timer with a range encompassing 30 seconds to 15 minutes. Occupancy sensors shall be rated for operation in ambient air temperatures ranging from (50 degreesF) to (104 degreesF) or temperatures normally encountered in the installed location. Sensors integral to wall mount on-off light switches shall have an auto-off switch. Wall switch sensors shall be decorator style and shall fit behind a standard decorator type wall plate. All occupancy sensors, power packs, and slave packs shall be UL listed. In addition to any outputs required for lighting control, the occupancy sensor shall provide a contact output rated at 1A at 24 Vac or a SNVT output.

2.8.11.1 Passive Infrared (PIR) Occupancy Sensors

PIR occupancy sensors shall have a multi-level, multi-segmented viewing lens and a conical field of view with a viewing angle of 180 degrees and a detection of at least 6 meters (20 feet) unless otherwise shown or specified. PIR Sensors shall provide field-adjustable background light-level adjustment with an adjustment range suitable to the

light level in the sensed area, room or space. PIR sensors shall be immune to false triggering from RFI and EMI.

2.8.11.2 Ultrasonic Occupancy Sensors

Ultrasonic sensors shall operate at a minimum frequency 32 kHz and shall be designed to not interfere with hearing aids.

2.8.11.3 Dual-Technology Occupancy Sensor (PIR and Ultrasonic)

Dual-Technology Occupancy Sensors shall meet the requirements of both PIR and Ultrasonic Occupancy Sensors.

2.8.12 Vibration Switch

Vibration switch shall be solid state, enclosed in a NEMA 250 Type 4 or Type 4X housing with sealed wire entry. Unit shall have two independent sets of Form C switch contacts with one set to shutdown equipment upon excessive vibration and a second set for monitoring alarm level vibration. The vibration sensing range shall be a true rms reading, suitable for the application. The unit shall include either displacement response for low speed or velocity response for high speed application. The frequency range shall be at least 2 Hz to 200 Hz. Contact time delay shall be 3 seconds. The unit shall have independent start-up and running delay on each switch contact. Alarm limits shall be adjustable and setpoint accuracy shall be +/-10% of setting with repeatability of plus or minus 2%.

2.8.13 Conductivity Sensor

Sensor shall include local indicating meter and shall be suitable for measurement of conductivity of water in boilers, chilled water systems, condenser water systems, distillation systems, or potable water systems as shown. Sensor shall sense from 0 to 10 microSeimens per centimeter (uS/cm) for distillation systems, 0 to 100 uS/cm for boiler, chilled water, and potable water systems and 0 to 1000 uS/cm for condenser water systems. Contractor shall field verify the ranges for particular applications and adjust the range as required. The output shall be temperature compensated over a range of (32 to 212 degreesF). The accuracy shall be +/-2% of the full scale reading. Sensor shall have automatic zeroing and shall require no periodic maintenance or recalibration.

2.8.14 Compressed Air Dew Point Sensor

Sensor shall be suitable for measurement of dew point from (-40 to +80 degreesF) over a pressure range of (0 to 150 psig). The transmitter shall provide both dry bulb and dew point temperatures on separate outputs. The end to end accuracy of the dew point shall be (+/-5 degreesF) and the dry bulb shall be (+/-1 degreeF). Sensor shall be automatic zeroing and shall require no normal maintenance or periodic recalibration.

2.8.15 NOx Monitor

Monitor shall continuously monitor and give local indication of boiler stack gas for NOx content. It shall be a complete system designed to verify compliance with the Clean Air Act standards for NOx normalized to a 3% oxygen basis and shall have a range of from 0 to 100 ppm. Sensor shall be accurate to +/-5 ppm. Sensor shall output NOx and oxygen

levels and binary output that changes state when the NOx level is above a locally adjustable NOx setpoint. Sensor shall have normal, trouble and alarm lights. Sensor shall have heat traced lines if the stack pickup is remote from the sensor. Sensor shall be complete with automatic zero and span calibration using a timed calibration gas system, and shall not require periodic maintenance or recalibration.

2.8.16 Turbidity Sensor

Sensor shall include a local indicating meter and shall be suitable for measurement of turbidity of water. Sensor shall sense from 0 to 1000 Nephelometric Turbidity Units (NTU). Range shall be field-verified for the particular application and adjusted as required. The output shall be temperature compensated over a range of (0 to 212 degreesF). The accuracy shall be +/-5% of full scale reading. Sensor shall have automatic zeroing and shall not require periodic maintenance or recalibration.

2.8.17 Chlorine Detector

The detector shall measure concentrations of chlorine in water in the range 0 to 20 ppm with a repeatability of +/-1% of full scale and an accuracy of +/-2% of full scale. The Chlorine Detector transmitter shall be housed in a non-corrosive NEMA 250 Type 4X enclosure. Detector shall include a local panel with adjustable alarm trip level, local audio and visual alarm with silence function.

2.8.18 Floor Mounted Leak Detector

Leak detectors shall use electrodes mounted at slab level with a minimum built-in-vertical adjustment of (0.125 inches). Detector shall have a binary output. The indicator shall be manual reset type.

2.8.19 Temperature Switch

2.8.19.1 Duct Mount Temperature Low Limit Safety Switch (Freezestat)

Duct mount temperature low limit switches (Freezestats) shall be manual reset, low temperature safety switches with a minimum element length of 3m per square meter (1 foot per square-foot) of coverage which shall respond to the coldest (18 inch) segment with an accuracy of +/- (3.6 degreesF). The switch shall have a field-adjustable setpoint with a range of at least (+30 to +50 degreesF). The switch shall have two sets of contacts, and each contact shall have a rating greater than its connected load. Contacts shall open or close upon drop of temperature below setpoint as shown and shall remain in this state until reset. The switch shall be temperature compensated.(9-18-08)

2.8.19.2 Pipe Mount Temperature Limit Switch (Aquistat)

Pipe mount temperature limit switches (aquastats) shall have a field adjustable setpoint between(60 to 90 degreesF), an accuracy of +/- (3.6 degreesF) and a (10 degreesF) fixed deadband.The switch shall have two sets of contacts, and each contact shall have a rating greater than its connected load. Contacts shall open or close upon change of temperature above or below setpoint as shown.

2.8.20 Damper End Switches

Each end switch shall be a hermetically sealed switch with a trip lever and over-travel mechanism. The switch enclosure shall be suitable for mounting on the duct exterior and shall permit setting the position of the trip lever that actuates the switch. The trip lever shall be aligned with the damper blade.

2.9 INDICATING DEVICES

All indicating devices shall display readings in English (inch-pound)] units.

2.9.1 Thermometers

Thermometers shall not contain mercury. Unless otherwise specified, thermometers shall have an accuracy of $\pm 3\%$ of scale range. Thermometers shall have a range suitable for the application with an upper end of the range not to exceed 150% of the design upper limit.

2.9.1.1 Piping System Thermometers

Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 230 mm (9 inch) scale. Piping system thermometers shall have an accuracy of $\pm 1\%$ of scale range. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern. Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

2.9.1.2 Air-Duct Thermometers

Air-duct thermometers shall have perforated stem guards and 45-degree adjustable duct flanges with locking mechanism.

2.9.2 Pressure Gauges

Gauges shall be suitable for field or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270-degree arc. Gauge range shall be suitable for the application with an upper end of the range not to exceed 150% of the design upper limit. Accuracy shall be $\pm 3\%$ of scale range. Gauges shall meet requirements of ASME B40.1.

2.9.3 Low Differential Pressure Gauges

Gauges for low differential pressure measurements shall be a minimum of 90 mm (3.5 inch) (nominal) size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauge range shall be suitable for the application with an upper end of the range not to exceed 150% of the design upper limit. Accuracy shall be plus or minus two percent of scale range.

2.10 OUTPUT DEVICES

Output Devices with SNVT input are ASCs and shall meet all ASC requirements in addition to the output device requirements. (note: ASCs are specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE.)

2.10.1 Actuators

Actuators shall be electric (electronic). All actuators shall be normally open (NO), normally closed (NC) or fail-in-last-position (FILP) as shown. Normally open and normally closed actuators shall be of mechanical spring return type. Electric actuators shall have an electronic cut off or other means to provide burnout protection if stalled. Actuators shall have a visible position indicator. Electric actuators shall provide position feedback to the controller as shown. Actuators shall smoothly open or close the devices to which they are applied. Electric actuators shall have a full stroke response time in both directions of 90 seconds or less at rated load. Electric actuators shall be the direct-coupled type. Where multiple electric actuators operate from a common signal, the actuators shall provide an output signal identical to its input signal to the additional devices.

2.10.1.1 Valve Actuators

Valve actuators shall provide shutoff pressures and torques as shown on the Valve Schedule.

2.10.1.2 Damper Actuators

Damper actuators shall provide the torque necessary per damper manufacturer's instructions to modulate the dampers smoothly over its full range of operation and torque shall be at least .7 Nm (6 inch-pounds) per .93 square meters (1 square foot) of damper area for opposed blade dampers and 1 Nm (9 inch-pounds) per .93 square meters (1 square foot) of damper area for parallel blade dampers.

2.10.2 Relays

Control relay contacts shall have utilization category and ratings selected for the application, with a minimum of two sets of contacts enclosed in a dust proof enclosure. Each set of contacts shall incorporate a normally open (NO), normally closed (NC) and common contact. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage.

2.11 USER INPUT DEVICES

User Input Devices, including potentiometers, switches and momentary contact push-buttons with SNVT output are Application Specific Controllers (ASCs) and shall meet all ASC requirements. (note: ASCs are specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE) Potentiometers shall be of the thumb wheel or sliding bar type. Momentary Contact Push-Buttons may include an adjustable timer for their output. User input devices shall be labeled for their function.

2.12 MULTIFUNCTION DEVICES

Multifunction devices are products which combine the functions of multiple sensor, user input or output devices into a single product. Unless otherwise specified, the multifunction device shall meet all requirements of each component device. Where the

requirements for the component devices conflict, the multifunction device shall meet the most stringent of the requirements.

2.12.1 Current Sensing Relay Command Switch

The Current Sensing Relay portion shall meet all requirements of the Current Sensing Relay input device. The Command Switch portion shall meet all requirements of the Relay output device except that it shall have at least one normally-open (NO) contact.

2.12.2 Thermostats

Thermostats shall be multifunction devices incorporating a temperature sensor and a temperature indicating device. Thermostats shall not contain mercury (Hg).

In addition, the thermostat shall have the following as specified and shown:

- a. A User Input Device which shall adjust a temperature setpoint output.
- b. A User Input Momentary Contact Button and an output indicating zone occupancy.
- c. A three position User Input Switch labeled to indicate heating, cooling and off positions ('HEAT-COOL-OFF' switch) and providing corresponding outputs.
- d. A two position User Input Switch labeled with 'AUTO' and 'ON' positions and providing corresponding outputs.
- e. A multi-position User Input Switch with 'OFF' and at least two fan speed positions and providing corresponding outputs.

2.13. Flexible Pipe Connections

The flexible pipe connections shall be designed for (150 psi and 250 degreesF) service, and shall be constructed of rubber or tetrafluoroethylene resin tubing with a reinforcing protective cover of braided corrosion-resistant steel, bronze, monel, or galvanized steel. The connectors shall be suitable for the service intended and shall have threaded or soldered ends. The length of the connectors shall be as recommended by the manufacturer for the service intended.

2.13.1 Vibration Isolation Units

The vibration isolation units shall be standard products with published loading ratings, and shall be single rubber-in-shear, double rubber-in-shear, or spring type.

2.14 DIRECT DIGITAL CONTROL (DDC) HARDWARE

2.14.1 General Requirements

All DDC Hardware shall meet the following requirements:

- a. It shall incorporate a "service pin" which, when pressed will cause the DDC Hardware to broadcast its 48-bit NodeID and its ProgramID over the network. The service pin shall be distinguishable and accessible.
- b. It shall incorporate a light to indicate the device is receiving power.

- c. It shall incorporate a TP/FT-10 transceiver in accordance with ANSI/EIA 709.3 and connections for TP/FT-10 control network wiring. It shall not have connections to any other network media type.
- d. It shall not have connections to any other network media type.
- e. It shall communicate on the network using only the ANSI/EIA 709.1B protocol.
- f. It shall be locally powered; link powered devices are not acceptable.
- g. LonMark external interface files (XIF files), as defined in the LonMark XIF Guide, shall be submitted for each type of DDC Hardware.
- h. Application programs and configuration settings shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration settings.
- i. It shall have all functionality specified and required to support the application (Sequence of Operation or portion thereof) in which it is used, including but not limited to:
 - (1) It shall provide input and output SNVTs as specified and required to support the sequence and application in which it is used.
 - (2) It shall be configurable via standard or user-defined configuration parameters (SCPT or UCPT), SNVT network configuration inputs (nci), or hardware settings on the controller itself as specified and as required to support the sequence and application in which it is used.
- i. It shall meet FCC Part 15 requirements and have UL 916 or equivalent safety listing.

2.14.2 Hardware Input-Output (I/O) Functions

DDC Hardware incorporating hardware input-output (I/O) functions shall meet the following requirements:

- a. Analog Inputs: DDC Hardware analog inputs (AIs) shall perform analog to digital (A-to-D) conversion with a minimum resolution of 8 bits plus sign or better as needed to meet the accuracy requirements specified in paragraph INPUT MEASUREMENT ACCURACY. Signal conditioning including transient rejection shall be provided for each analog input. Analog inputs shall be capable of being individually calibrated for zero and span. The AI shall incorporate common mode noise rejection of at least 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10,000 ohms.
- b. Analog Outputs: DDC Hardware analog outputs (AOs) shall perform digital to analog (D-to-A) conversion with a minimum resolution of 8 bits plus sign, and output a signal

with a range of 4-20 mA_{dc} or 0-10 V_{dc}. Analog outputs shall be capable of being individually calibrated for zero and span.

c. Binary Inputs: DDC Hardware binary inputs (BIs) shall accept contact closures and shall ignore transients of less than 5 milli-second duration. Isolation and protection against an applied steady-state voltage up to 180 Vac peak shall be provided.

d. Binary Outputs: DDC Hardware binary outputs (BOs) shall provide relay contact closures or triac outputs for momentary and maintained operation of output devices.
(1) Relay Contact Closures: Closures shall have a minimum duration of 0.1 second. Relays shall provide at least 180V of isolation. Electromagnetic interference suppression shall be provided on all output lines to limit transients to non-damaging levels. Minimum contact rating shall be one ampere at 24 Vac.
(2) Triac outputs: Triac outputs shall provide at least 180 V of isolation.

e. Pulse Accumulator: DDC Hardware pulse accumulators shall have the same characteristics as the BI. In addition, a buffer shall be provided to totalize pulses. The pulse accumulator shall accept rates of at least 20 pulses per second. The totalized value shall be reset to zero upon operator's command.

2.14.3 Application Specific Controller (ASC)

Application Specific Controllers (ASCs) have a fixed factory-installed application program (i.e. Program ID) with configurable settings. ASCs shall meet the following requirements in addition to the General DDC Hardware and DDC Hardware Input-Output (I/O) Function requirements:

a. ASC's shall be LonMark Certified.

b. Unless otherwise approved, all necessary Configuration Parameters and network configuration inputs (ncis) for the sequence and application in which the ASC is used shall be fully configurable through an LNS plug-in. This plug-in shall be submitted as specified for each type of ASC (manufacturer and model). (note: configuration accomplished via hardware settings does not require configuration via plug-in)

2.14.3.1 Local Display Panel (LDP)

The Local Display Panel shall be an Application Specific Controller (ASC) with a display and navigation buttons. It shall provide display and adjustment of SNVT inputs and SNVT outputs as shown.

2.14.4 General Purpose Programmable Controller (GPPC)

A General Purpose Programmable Controller (GPPC) is not installed with a fixed factory-installed application program. GPPCs shall meet the following requirements in addition to the general DDC Hardware requirements and Hardware Input-Output (I/O) Function:

- a. The programmed GPPC shall conform to the LonMark Interoperability Guide.
- b. All programming software required to program the GPPC shall be delivered to and licensed to the project site as specified.
- c. Copies of the installed GPPC application programs as source code compatible with the supplied programming software shall be submitted as specified. The submitted GPPC application program shall be the complete application necessary for the GPPC to function as installed and be sufficient to allow replacement of the installed controller with a GPPC of the same type.

2.15 COMPUTER HARDWARE

2.15.1 LNS CPU Hardware

Contractor provided Computer Hardware shall be a standard unmodified digital computer of modular design currently being manufactured. The modular components of the server shall be products of a single manufacturer which advertises service in all 48 contiguous states. Computer hardware shall meet the following minimum requirements.

Windows XP Professional License (Army Gold Version to be loaded by DOIM prior to Contractor Loading Software, , Mouse & Keyboard XP Compatible (USB)); 1 Gig/100 MB N); LNS Server Installed and Configured; LNS Database Resides on PC

- a.), P4 Processor 2 GHz Minimum
- b. **Random Access Memory (RAM):** Min 2 Gig Ram
- c. **Communications ports: One serial port, one enhanced parallel port and one USB port in addition to any ports required for the keyboard and mouse.**
- d. **Hard Drives and Controller:** 80 Gig SATA Hard Drive Minimum free space, not taking into account the size of the LNS applications for LNS network interface driver requirements.
- e. **CD/DVD-RW Drive: Combo CD-RW with 32x read, 24x write and 16x rewrite and DVD-RW with 12x read; 4x re-write; 2x write.**
- f. **Floppy Disk Drive and controller: N/A**
- g. **Video output card:** Graphics card capable of 1280x1024 True color, 1 DVI, VGA & 1 S-Video (with add-in PCI-Express video card); **at a minimum refresh rate of 70 Hz.**
- h. **Network Interface Card (NIC):** network Interface Card NIC10/100/1000 LAN, J45
- i. **Monitor: N/A**
- j. **Keyboard: 101 key keyboard having a minimum 64 character standard ASCII character set based on ANSI INCITS 154.**
- k. **Mouse: Optical 2-button mouse with a minimum resolution of 400 dots per inch.**

2.15.2 Workstation Hardware (Desktop and Laptop) Government Furnished

2.16 COMPUTER SOFTWARE

2.16.1 Operating System (OS)

a. The operating system (OS) will be Government furnished and installed software for government furnished computer equipment;

b. The operating system(OS) and license for contractor furnished computer hardware shall be provided by the contractor. (04-02-08)

2.16.2 Office Automation Software

Office Automation Software shall consist of the [e-mail,]spreadsheet and word processing portions of the project site's standard office automation software. Government supplied.

2.16.3 Virus Protection Software

Virus Protection Software shall consist of the project site's standard virus protection software complete with a virus definition update subscription. Government supplied.

2.16.4 Not Used

2.16.5 ANSI/EIA 709.1B Network Configuration Tool

The network configuration tool shall meet the following minimum requirements:

a. It shall solely use LonWorks Network Services (LNS) for all network configuration and management of ANSI/EIA 709.1B devices.

b. It shall be capable of executing all LNS compliant plug-ins.(4-24-08)

c. It shall be capable of performing network database reconstruction of an ANSI/EIA 709.1B control network, such that if connected to an existing ANSI/EIA 709.1B network it has the ability to query the network and create an LNS database for that network and an associated network drawing.

d. It shall allow configuration of the network while off-line such that an operator may set up changes to the network while disconnected from the network, and then execute all of them once connected.

e. It shall have a graphics-based user interface capable of commissioning, operation, design and maintenance of the control network. It shall be able to display and print a graphical representation of the control network.(4-24-08)

f. It shall be capable of generating and printing the following reports:

(1) Table containing domain/subnet/node address and node identifier for the entire network or any subset thereof, selected by the user.

(2) Table containing Standard Network Variable (SNVT) input and output details for any ANSI/EIA 709.1B device on the network

(3) Table containing Standard and User-Defined Configuration Properties (SCPTs and UCPTs) for any ANSI/EIA 709.1B device on the network.

g. It shall be capable of merging two existing standard LNS databases into a single standard LNS database.

h. It shall support remote access via Lonworks or IP networks.(03-05-08)

i. It shall permit multiple applications and users to manage and interact simultaneously with a network. (3-05-08)

j. It shall allow multiple users to access a shared LNS server via the Lonworks network, a local area network(LAN), or the internet.(03-05-08)

k. It shall include software for an IP-852 routing interface. (03-05-08)

2.16.6 Monitoring and Control Software

The monitoring and control (M&C) software shall be an LNS client-server software and graphic package. The software shall accommodate [3000] points. The server software shall support clients as specified and shown and shall support no less than [5] clients simultaneously without requiring additional server software installation. M&C software shall reside on the BPOC.

2.16.6.1 Passwords

The M&C software shall provide access to user-based M&C functionality. The M&C software shall have at least 4 levels of user permissions. Passwords shall support a minimum of eight(8) alpha-numeric characters and symbols. Passwords shall prompt users to change passwords every 180 days. User permission levels (from most restrictive to most permissive) shall include:

(1) M&C

- a. Permission Level 1: View System Graphic Displays.
- b. Permission Level 2: Permission Level 1 plus acknowledge alarms and set up (configure) trends and reports.
- c. Permission Level 3: Permission Level 2 plus override SNVTs and set up (configure) alarms, schedules and demand limiting
- d. Permission Level 4: Permission Level 3 plus create and modify System Graphic Displays and create custom programs.

Passwords shall not be displayed. The system shall maintain a disk file logging all activity of the system. If the file format is not plain ASCII text, the Contractor shall provide a means to export or convert the file to plain ASCII text. This file shall maintain, as a minimum, a record of all operators logged onto the system, alarm acknowledgments, commands issued and all database modifications. Passwords shall not be logged. The

activity log shall be maintained at the server hardware. The system shall automatically provide a mechanism for archiving the log files for long term record storage.

(2)BPOC^(12/10/07)

The BPOC software shall provide access to user-based M&C functionality. The BPOC software shall have at least 3 levels of user permissions. Passwords shall support a minimum of eight(8) alpha-numeric characters and symbols. Passwords shall prompt users to change passwords every 180 days. User permission levels (from most restrictive to most permissive) shall include:

- a. Permission Level 1: View System Graphic Displays plus acknowledge alarms and
- b. set up (configure) trends and reports.

- c. Permission Level 2: Permission Level 1 plus override SNVTs and set up (configure) alarms, schedules.

- d. Permission Level 3: Permission Level 2 plus administrator rights, create and modify system graphic web pages and create custom programs. Passwords shall not be displayed. The system shall maintain a disk file logging all activity of the system. This file shall maintain, as a minimum, a record of all operators logged onto the system, alarm acknowledgments, commands issued and all database modifications. Passwords shall be logged. The activity log shall be maintained at the server hardware. The system shall automatically provide a mechanism for archiving the log files for long term record storage.

2.16.6.2 Protocol Drivers

The BPOC Software shall include drivers to other (non-ANSI/EIA 709.1B) protocols. The protocol driver shall allow all M&C Software functions to write values to and read values from points on the legacy system. The M&C software shall support reading points from the legacy system and writing these values to SNVTs on the ANSI/EIA 709.1B network, and reading SNVTs from the ANSI/EIA 709.1B network and writing these values to points on the legacy network. Use of the driver to integrate additional legacy systems shall not require programming but may require configuration.

2.16.6.3 System Graphic Displays

The monitoring and control (M&C) software and BPOC shall include graphical displays through which an operator can perform real-time access and manipulation of the M&C functions as specified and shown. The graphical displays shall consist of building-level system (air handler units, VAV boxes, chillers, boilers etc) graphic displays, alarm displays, scheduling displays, trending displays. Data associated with an active display shall be updated at least once every 5 seconds.

- a. Navigation Scheme: System graphic displays of building-level

systems and points shall be hierarchical displays using a building-to-equipment point-and-click navigation scheme. Each display shall show the building name and number. Each display shall show system wide data such as outside air temperature and humidity in the case of an HVAC system application.

(1) Each Building or Building Sub-Area display shall show the building foot print and basic floor plan, and shall clearly show and distinguish between the individual zones and the equipment serving each zone and space. The building display shall also show all space sensor and status readings, as applicable, for the individual zones such as space temperature, humidity, occupancy status, etc. The building display shall show the locations of individual pieces of monitored and controlled equipment.

(2) Each equipment display shall show a line representation of the individual pieces of equipment using the symbols and M&C point data types as specified. Different colors and textures shall be used to indicate various components and real time data. Color and texture meanings shall be consistent across all displays.

(3) Each display shall clearly distinguish between the following point data types and information:

- (a) Real-time data.
- (b) User-entered data.
- (c) Overridden or operator-disabled points.
- (d) Devices in alarm (unacknowledged).
- (e) Out-of-range, bad, or missing data.

b. Navigation Commands: The system graphic displays shall support English language operator commands via point-and-click mouse or keyboard entry for defining and selecting points, parameters, graphics, report generation, and all other functions associated with operation. The operator commands shall be usable from any operator workstation with individual operator passwords as specified.

(1) Command Input: Operator's commands shall be full words and acronyms selected to allow operators to use the system without extensive training or any data processing backgrounds. The system shall prompt the operator in full words and acronyms for all required information, identifying acceptable command formats. The operator's response shall be a point-and-click selection, word, phrase, or acronym including parameters where required.

(2) Command Input Errors: The system shall supervise operator inputs to ensure they are correct for proper execution. Operator input assistance shall be provided whenever a command cannot be executed because of operator input errors. The system shall explain to the operator why the command cannot be executed.

Conditions for which operator error assist messages shall be generated include:

- (a) The command used is incorrect or incomplete.
- (b) The operator is restricted from using that command.
- (c) The command addresses an out-of-range or bad data point.

- (d) The command addresses a point that does not exist.
- (e) The command would violate constraints.

(3) Special Functions: The system shall provide the following point-and-click mouse functions, in addition to all other commands specified:

(a) HELP: shall produce an indexed or menu-driven display of all commands available to the operator. The HELP command, followed by a specific command shall produce a context sensitive listing with a short explanation of the purpose, use, and system reaction to that command.

(b) DISPLAY DIAGRAM: shall display diagrams of specific utility systems or other systems as specified.

(c) DIAGRAM DEVELOPMENT: shall allow the user to develop diagrams of specific utility systems or other systems as specified.

(d) PRINT REPORT: Shall allow the operator to initiate printing of reports.'

(4) Operator's Commands: The operator's commands shall provide the means for entry of control and monitoring commands, and for retrieval of information. Processing of operator commands shall commence within 1 second of entry, with some form of acknowledgment provided at that time. The operator's commands shall perform tasks, including:

- (a) Request a display of any SNVT or calculated point or any group of related SNVTs and calculated points
- (b) Startup and shutdown selected systems or devices.
- (c) Override any SNVT point to an operator selected value.
- (d) Release the override of a SNVT.
- (e) Modify time and event scheduling.
- (f) Initiate reports.
- (g) Generate and format reports.

(5) System Graphic Display Hierarchy: The system graphic display shall have a hierarchical structure with at least five levels:

- (a) Unit: The unit that a point is associated with, such as an AHU.
- (b) Building Sub-Area: A part of a building.
- (c) Building: The building that a point is located in or near.
- (d) Building Group: A group of buildings.
- (e) Facility: Installation included in the UMCS.

c. Display Editor: The display editor shall enable the user to create, modify, and delete displays and graphic symbols. The primary use shall be for adding and modifying one-line diagrams, status displays, system summaries, and system directories, as new

controllers, points, data, and other necessary changes are made. The basic functions shall include:

- (1) Create and save displays and graphic symbols.
- (2) Group and ungroup graphic symbols. The grouped symbol shall be manipulated as a single symbol.
- (3) Modify a portion of a graphic symbol.
- (4) Save graphic symbols as a library object.
- (5) Rotate and mirror a graphic symbol.
- (6) Delete a graphic symbol.
- (7) Place a graphic symbol on a display.
- (8) Cancel the display of a graphic symbol.
- (9) Assign conditions which automatically initiate the display.
- (10) Overlay alphanumeric and graphics.
- (11) Save new, modified, or existing graphics as new graphics.
- (12) Integrate real-time data with the display.
- (13) Define the background color.
- (14) Define the foreground color.
- (15) Locate the symbols.
- (16) Position and edit alphanumeric descriptors.
- (17) Establish connecting lines.
- (18) Establish sources of latest data and location of readouts.
- (19) Display analog values as specified.
- (20) Cursor control (up, down, right, left).
- (21) Create and display alphanumeric displays.
- (22) Assign graphics a depth such that when there are coincident graphics the one with the lower depth is displayed.
- (23) Modify graphic properties based on SNVT values, calculated values or values obtained from a legacy system.
- (24) Creating conditional displays such that different graphic symbols or text are displayed based on SNVT values, calculated values or values obtained from a legacy system.
- (25) Symbols Library: The library of callable display symbols shall include: Pump, Motor, Two- and Three-way Valves, Flow Sensing Element, Point and Averaging Temperature Sensors, Pressure Sensor, Humidity Sensor, Single and Double Deck Air Handling Unit, Fan, Chiller, Boiler, Air Compressor, Chilled Water Piping, Steam Piping, Hot Water Piping, Ductwork, Unit Heater, Pressure Reducing Valve, Damper, Electric Meter, Limit Switch, Flow Switch, High- and Low- Point and Averaging Temperature Switches, High- and Low- Pressure Switches, Coil, Solenoid Valve, Filter, Condensing Unit, Cooling Tower, Variable Frequency Drive (VFD), Heat Exchanger, Current Sensing Relays. Symbols shall at a minimum conform to ASHRAE Fundamentals Handbook where applicable.

2.16.6.4 Scheduling

The M&C software shall be capable of changing the value of any SNVT in the LNS Database to any legal value according to a schedule. A minimum of 100 user-definable schedules shall be supported and the specified scheduling functions shall be operator

accessible and adjustable via graphics display. The graphics display shall include the following fields and functions:

- a. Current date and time. The OS and M&C software shall automatically make Daylight Savings Time adjustments. Daylight savings time adjustment shall be capable of being disabled by the operator.
- b. Building name and number.
- c. System identifier and name.
- d. System group. Systems shall be capable of being grouped by the user to perform according to a common schedule.
- e. Weekly schedules. Each system shall have a weekly schedule based on a seven day per week schedule with independent schedules for each day of the week including no less than 6 value changes per day.
- f. Holiday and special event schedules. System scheduling shall support holiday and special event calendar schedules independent of the daily schedule. Special event schedules shall include one-time events and recurring events. Scheduling of one-time events shall include the beginning and ending dates and times of the event. Holiday and special event schedules shall have precedence over device weekly schedules.

2.16.6.5 Alarms

The M&C and the BPOC software shall be capable of generating alarms and handling network variable inputs of type SNVT Alarm from the control network. BPOC Software shall be capable of handling and managing no less than 3,000 alarm points.

- a. Alarm Data. Alarm data to be displayed and stored, as applicable and as specified, shall include:
 - (1) Identification of alarm including building, system (or sub-system), and device name.
 - (2) Date and time to the nearest second of occurrence.
 - (3) Alarm type:
 - (a) Unreliable: Indicates that the source device has failed due to the sensing device or alarm parameter being out-of-range or bad data.
 - (b) High Alarm.
 - (c) Low Alarm.
 - (4) Alarm set point and deadband(if analog).
 - (5) Engineering units.
 - (6) Current value or status of the alarm point.
 - (7) Alarm priority: There shall be two alarm priority levels; critical and informational. Critical alarms shall remain in alarm until acknowledged by an operator and the alarm condition no longer exists; informational alarms shall remain in alarm until the alarm condition no longer exists or until the alarm is acknowledged.
 - (8) Alarm Message: A unique message with a field of 60 characters shall be provided for each alarm. Assignment of messages to an alarm shall be an operator editable function.

(9) Alarm Secondary Message: Secondary messages shall be assignable by the operator for printing to provide further information, such as telephone lists or maintenance functions, and shall be editable by the operator. The system shall provide for 100 secondary messages, each with 25 lines of 60 characters each.

(10) Acknowledgement status of the alarm and, where acknowledged, the time and date of acknowledgement.

(11) User who acknowledged the alarm.

b. Alarm Notification and Routing: The M&C software shall be capable of performing alarm notification and routing functions. Upon receipt or generation of an alarm the M&C software shall immediately perform alarm notification and routing according to an assigned routing for that alarm. The M&C software shall support at least 50 alarm routes; an alarm route shall be a unique combination of any of the following activities:

(1) Generate a pop-up display on designated workstation monitors. The pop-up display shall include identification of the alarm, date and time of the alarm, alarm message, and current value/status of the alarm point. Alarms shall be capable of being acknowledged from the pop-up display by operators with sufficient permissions. Pop-up displays shall be displayed until acknowledged.

(2) Send an e-mail message via simple mail transfer protocol (SMTP; RFC 821). The e-mail shall contain a scripted message and all alarm data. The e-mail recipient and scripted message shall be user configurable for each alarm route.

(4) Print alarms to designated alarm printers. The printed message shall be the same as the pop-up message.

c. Alarm Display and Acknowledgement. The BPOC software shall include an alarm display. A minimum of the most recent 100 system alarms shall be available for display as shown, along with all associated alarm data. Alarms shall be capable of being acknowledged from this display. Multiple alarms shall be capable of being acknowledged using a single command. Operator acknowledgment of one alarm shall not automatically be considered as acknowledgment of any other alarm nor shall it inhibit reporting of subsequent alarms.

d. Alarm Storage and Reports: The BPOC software shall store each alarm and its associated alarm data to hard disk. The stored data shall be user-sortable and formatted for printing.

2.16.6.6 Trending

The M&C and BPOC software shall be capable of performing real-time trending on a minimum of 3,000 points simultaneously with a minimum trending capacity of 100 points per second. The M&C and BPOC software shall be capable of displaying and printing a graphical representation of each trend, and of multiple trended points on the same graph. The software shall be capable of saving trend logs to a file. If the file format is not plain ASCII text in a Comma-Separated-Value (CSV) format, the Contractor shall

provide a means to export or convert the file to plain ASCII text in a CSV format. Each trend shall be user-configurable for:

- a. Point to trend.
- b. Sampling interval with a minimum sampling interval no greater than 1 second, and a maximum sampling interval no less than 1 hour.
- c. Start and Stop Time of Trend: Start and stop times shall be determined by one or more of the following methods:
 - (1) Start Time and Stop Time
 - (2) Start Time and Duration
 - (3) Start Time and number of samples

2.17 Panel Mounted Override Switches

Panel mounted switches shall have the following.

- a. Switches shall have Hand-Off-Auto settings.
- b. Switches shall have LED command status indicators
- c. Override switches shall meet user input device requirement.

2.18 Emergency Ventilation Shutdown button.

Provide hardware mounted 48" inches above the floor near entrance/exit doors in the interior of the building as shown. Hardware shall have the following:

- a. Red solid lid labeled "Raise Lid-Push Button".
- b. Solid lid shall be padlockable .
- c. Maintained push button
- d. Emergency ventilation shutdown button shall be labeled- EMERGENCY VENTILATION STOP. (03-05-08)

2.19 UNINTERRUPTIBLE POWER SUPPLY (UPS)

The uninterruptible power supply (UPS) shall be a self contained device suitable for installation and operation at the location of CPU Server and Workstation hardware and shall be sized to provide a minimum of 30 minutes of operation of the connected hardware. Equipment connected to the UPS shall not be affected in any manner by a power outage of a duration less than the rated capacity of the UPS. UPS shall be complete with all necessary power supplies, transformers, batteries, and accessories and shall include visual indication of normal power operation, UPS operation, abnormal operation and visual and audible indication of AC input loss and low battery power. The UPS shall be UL 1778 approved. UPS powering Server Hardware shall support notification to the server via serial interface of impending battery failure. (12/12/07)

PART 3 EXECUTION

3.1 EXISTING CONDITIONS SURVEY

The Contractor shall perform a field survey, including testing and inspection of the equipment to be controlled and submit an Existing Conditions Report documenting the current status and it's impact on the Contractor's ability to meet this specification. For those items considered nonfunctional, the Contractor shall provide (with the report)

specification sheets, or written functional requirements to support the findings and the estimated costs to correct the deficiencies. As part of the report, the Contractor shall define the scheduled need date for connection to existing equipment. The Contractor shall make written requests and obtain Government approval prior to disconnecting any controls and obtaining equipment downtime. Existing devices which are not to be replaced shall be inspected, calibrated, and adjusted as necessary to place them in proper working order.

3.2 CONTROL SYSTEM INSTALLATION

3.2.1 General Installation Requirements

3.2.1.1 HVAC Control System

The HVAC control system shall be completely installed, tested and ready for operation. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.2.1.2 Device Mounting Criteria

All devices shall be installed in accordance with manufacturer's recommendations and as specified and shown. Control devices to be installed in piping and ductwork shall be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified. Spare thermowells shall be installed adjacent to each thermowell containing a sensor and as shown. Devices located outdoors shall have a weathershield.

a. A minimum of (3) three inches of clearance shall be maintained at network interface connections.

b. DDC control panels **shall not** have top penetrations.

c. Air Handling Unit Freezestats, Duct Smoke Detectors and Static pressure Hi limits mounted 8' feet above grade shall have a labeled hardware reset located in the DDC control panel that serves the AHU.

d. Outdoor air sensors and transmitters shall be located on north facing walls or installed in AHU outdoor intake ductwork at the intake louvers.

3.2.1.3 Labels and Tags

Labels and tags shall be keyed to the unique identifiers shown on the As-Built drawings. All Enclosures and DDC Hardware shall be labeled. All sensors and actuators in mechanical rooms shall be tagged. Airflow measurement arrays shall be tagged to show

flow rate range for signal output range, duct size, and pitot tube AFMA flow coefficient. Duct static pressure taps shall be tagged at the location of the pressure tap. Tags shall be plastic or metal and shall be mechanically attached directly to each device or attached by a metal chain or wire. Labels exterior to protective enclosures shall be engraved plastic and mechanically attached to the enclosure or DDC Hardware. Labels inside protective enclosures may be attached using adhesive, but shall not be hand written.

Metal raceways above drop ceilings that contain DDC wiring shall be clearly labeled.

3.2.2 DDC Hardware

DDC Hardware shall be installed in an enclosure. Except for DDC Hardware used to control Terminal Units, where multiple pieces of DDC Hardware are used to execute one sequence all DDC Hardware executing that sequence shall be on a common local control bus and isolated from all other DDC Hardware via an ANSI/EIA 709.1B Router or ANSI/EIA 709.3 Repeater.

a. All DDC Hardware installed shall have an ANSI/EIA 709.1B domain of **assigned DPW building number** and a subnet 255.255.255.0.

b. **CPU hardware shall be installed in a ventilated enclosure and have a 110 volt convenience outlet installed and other devices as shown.**(12/10/07)

3.2.3 Local Display Panel (LDP)

Local Display Panels shall be installed in each mechanical room containing an air handler and shall provide SNVT inputs for display and outputs for adjusting SNVT values as shown on the Points Schedule.

3.2.4 Gateways

Gateways may be used for communication with non-ANSI/EIA 709.1B control hardware subject to all of the following limitations:

- a. Each gateway shall communicate with and perform protocol translation for non-ANSI/EIA 709.1B control hardware controlling one and only one package unit.
- b. Non-ANSI/EIA 709.1B control hardware shall not be used for controlling built-up units.
- c. Non-ANSI/EIA 709.1B control hardware shall not perform system scheduling functions.

3.2.5 Network Interface Jacks

a. Lon Network Interface Jack.

(1) A standard network interface jack shall be provided for each node on the control network. For terminal unit controllers with hardwired thermostats or **sensors** this network interface jack shall be located at the thermostat for terminal units or within 3 m (10 ft) of the controller. Locating the interface jack at the thermostat is preferred. For all other nodes the network interface jack shall be located within 3 m (10 ft) of the node. If the network interface jack is other than an **1/8 inch phone jack**, the Contractor shall provide an interface cable with a standard 1/8 inch phone jack on one end and a connector

suitable for mating with installed network interface jack on the other. No more than one type of interface cable shall be required to access all network interface jacks. **Contractor shall furnish [5] interface cable(s).** (03-05-08)

b. LAN Interface Network Cable (patch cable)

(1) Contractor shall provide a cat 6 patch cable from the RJ45 LAN jack connector located inside the DDC network control enclosures to the BPOC hardware and CPU hardware.

3.2.6 Room Instrument Mounting

Room instruments, including but not limited to wall mounted thermostats and sensors located in occupied spaces shall be mounted 1.5m (60 inches) above the floor unless otherwise shown on the Thermostat Schedule:

a. Thermostats for Fan Coil Units shall be unit mounted unless stated otherwise.

b. All other Thermostats shall be wall mounted.

3.2.7 Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.2.8 Duct Smoke Detectors

Contractor shall connect the DDC System to the auxiliary contacts provided on the Smoke Detector as required for system safeties and to provide alarms to the DDC system.

3.2.9 Occupancy Sensors

A sufficient quantity of occupancy sensors shall be provided to provide complete coverage of the area (room or space). Occupancy sensors shall be installed in accordance with NFPA 70 requirements and the manufacturer's instructions. Occupancy sensors shall not be located within 1.8 m (6 feet) of HVAC outlets or heating ducts. PIR and dual-technology PIR/ultrasonic sensors shall not be installed where they can "see" beyond any doorway. Ultrasonic sensors shall not be installed in spaces containing ceiling fans. Sensors shall detect motion to within 0.6 m (2 feet) of all room entrances and shall not trigger due to motion outside the room. The off-delay timer shall be set to [15] minutes unless otherwise shown. All sensor adjustments shall be made prior to beneficial occupancy, but after installation of furniture systems, shelving, partitions, etc. Each controlled area shall have one hundred percent coverage capable of detecting small hand-motion movements, accommodating all occupancy habits of single or multiple occupants at any location within the controlled room.

3.2.10 Temperature Limit Switch

A temperature limit switch (freezestat) shall be provided to sense the temperature at the location shown. A sufficient number of temperature limit switches (freezestats) shall be installed to provide complete coverage of the duct section. Manual reset limit switches shall be installed in approved, accessible locations where they can be reset easily. The

temperature limit switch (freezestat) sensing element shall be installed in a serpentine pattern and in accordance with the manufacturer's installation instructions.

3.2.11 Averaging Temperature Sensing Elements

Sensing elements shall be installed in a serpentine pattern located as shown.

3.2.12 Air Flow Measurement Arrays (AFMA))

Outside Air AFMAs shall be located downstream from the Outside Air filters. Pitot Tube AFMA shall not be used if the expected velocity measurement is below 3.5 m/s (700 fpm)[or for outside airflow measurements].

3.2.13 Duct Static Pressure Sensors

The duct static pressure sensing tap shall be located at 75% to 100% of the distance between the first and last air terminal units. If the transmitter is wired in a homerun configuration to an AHU controller, the transmitter shall be located in the same enclosure as the air handling unit (AHU) controller(s) for the AHU serving the terminal units.

3.2.14 Relative Humidity Sensors

Relative humidity sensors in supply air ducts shall be installed at least 3m (10 feet) downstream of humidity injection elements.

3.2.15 Flowmeters

The minimum straight unobstructed piping for the flowmeter installation shall be at least 10 pipe diameters upstream and at least 5 pipe diameters downstream and in accordance with the manufacturer's installation instructions.

3.2.16 Dampers

3.2.16.1 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators shall not be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

3.2.16.2 Damper Installation

Dampers shall be installed straight and true, level in all planes, and square in all dimensions. Dampers shall move freely without undue stress due to twisting, racking (parallelogramming), bowing, or other installation error. Blades shall close completely and leakage shall not exceed that specified at the rated static pressure. Structural support shall be used for multi-section dampers. Acceptable methods include but are not limited to U-channel, angle iron, corner angles and bolts, bent galvanized steel stiffeners, sleeve attachments, braces, and building structure. Where multi-section dampers are installed in ducts or sleeves, they shall not sag due to lack of support. Jackshafts shall not be used to link more than three damper sections. Blade to blade linkages shall not be used. Outside and return air dampers shall be installed such that their blades direct their respective air streams towards each other to provide for maximum mixing of air streams.

3.2.17 Valves

3.2.17.1 Ball Valves

Two-position (open/closed) ball valves may only be used on chilled water, condenser water, hot water, or steam applications. Modulating ball valves may only be used for chilled water and condenser water applications (modulating ball valves shall not be used on steam or hot water applications). In modulating applications a characterizing equal-percentage disc shall be used.

3.2.17.2 Butterfly Valves

In two-way control applications, valve travel shall be limited to 70% (60 degrees) open position.

3.2.18 Local Gauges for Actuators

Pneumatic actuators shall have an accessible and visible pressure gauge installed in the tubing lines at the actuator as shown.

3.2.19 Wire and Cable

Wire and Cable shall be installed without splices between control devices and in accordance with NFPA 70 and NFPA 90A. Instrumentation grounding shall be installed per the device manufacturer's instructions and as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. Cables and conductor wires shall be tagged at both ends, with the identifier shown on the shop drawings.

Electrical work shall be as specified in Section 16415A

ELECTRICAL WORK, INTERIOR and as shown.

Wiring external to enclosures shall be run as follows:

- a. Wiring other than low-voltage control and low-voltage network wiring shall be installed in raceways.
- b. Low-voltage control and low-voltage network wiring not in suspended ceilings over occupied spaces shall be installed in raceways, except that nonmetallic-sheathed cables or metallic-armored cables may be installed as permitted by NFPA 70.
- c. Low-voltage control and low-voltage network wiring in suspended ceilings over occupied spaces shall be installed in raceways, except:(1) nonmetallic-sheathed cables or metallic-armored cables may be installed as permitted by NFPA 70.

3.2.20 Copper Tubing

Copper tubing shall be hard-drawn in exposed areas and either hard-drawn or annealed in concealed areas. Only tool-made bends shall be used. Fittings for copper tubing shall be brass or copper solder joint type except at connections to apparatus, where fittings shall be brass compression type.

3.2.21 Plastic Tubing

Plastic tubing shall be run within covered raceways or conduit except when otherwise specified. Plastic tubing shall not be used for applications where the tubing could be subjected to a temperature exceeding (130 degreesF). Fittings for plastic tubing shall be for instrument service and shall be brass or acetal resin of the compression or barbed push-on type. Except in walls and exposed locations, plastic multitube instrument tubing bundle without conduit or raceway protection may be used where a number of air lines run to the same points, provided the multitube bundle is enclosed in a protective sheath, is run parallel to the building lines and is adequately supported as specified.

3.2.22 Connection to Liquid and Steam Lines

Tubing for connection of sensing elements and transmitters to liquid and steam lines shall be Series 300 stainless steel with stainless-steel compression fittings.

3.2.23 Connection to Ductwork

Connections to sensing elements transmitters in ductwork shall be plastic tubing.

3.2.24 Software Installation

Note: Work shall be performed on Fort Leonard Wood. IP address's will not be available on new construction until the IT network is installed

a. Software install shall be coordinated through the DPW Systems manager. The DDC contractor shall provide a complete software list to the DPW systems manager.(4-02-08)

b. DDC contractor shall install and validate software on government furnished computers as specified and shown. The Contractor shall provide hardware and software locks if required for access for all computers and servers. Coordinate install with DPW MES section.

c. ANSI/EIA 709.1B Network Configuration Tool: The Contractor shall provide **and install** the network configuration tool software as specified and shown.

(1) The server version of the software shall be installed on server hardware if required, and client versions shall be installed on workstation or laptops and validated as specified and shown. (06-09-08)

d. Monitoring and Control Software: The Contractor shall install the monitoring and control software as specified and shown. The server version of the software shall be installed on server hardware, and client versions shall be installed on workstation or server hardware.

e. DDC Contractor will be required to load server software on IT servers remote to DPW.

f. All LNS plug-in software shall be provided and installed on 5 five government owned computers and validated at the project site with a government representative present.. Provide copies of software to program plug-ins if not currently on configuration server

and laptops must be same version as used to program plugin. All passwords shall be provided to the DPW MES section (09/18/08)

g. GPPC programming software shall be provided and installed on 5 five government owned computers and validated at the project site with a government representative present.(9/18/08)

h. IP address's will not be available on new construction until the IT network is installed and established by the FLW IT department.(06-09-08)

i. Provide 1 LNS DDE Server OEM license to DPW MES branch (7/08/08)

3.2.25 Software and Firmware Updates

Software updates shall be provided for system, operating, application software, LNS Database, General Purpose Programmable Controller and Applications Specific Controllers and operation in the system shall be verified. Updates shall be incorporated into operations and maintenance manuals, and software documentation.

a. There shall be at least one scheduled update near the end of the first year's warranty period, at which time the latest release version of the system, operating and application software shall be installed and validated.

b. There shall be at least one scheduled review and possible update of the LNS Database near the end of the first year's warranty period; this shall be coordinated with the Directorate of Public Works site project manager.

c. There shall be at least one scheduled update near the end of the first year's warranty period to flash the firmware on the Application Specific Controllers with the latest updates to the manufactures specifications.

d. There shall be at least one scheduled update near the end of the first year's warranty period to flash the firmware on the General Purpose Programmable Controller in conjunction with the update of the LNS Database.

e. Coordination with government personnel required 10 days in advance.(9-18-08)

3.2.26 Connections to Utility Meters(06/09/08)

a. Buildings with a gas meter.

(1) Coordination is required with gas utility for termination. Phone # 314-607-0122

(2) Provide a dedicated 1 ¼" raceway and 22 GA. Shielded twisted pair cable with a drain wire from the gas meter pulse output to the BPOC pulse meter input 1.

(3) Raceway bends shall be made with long radius elbows or long mogul type conduit bodies.

(4) Configure the BPOC software to read 1 pulse equals 10 cubic feet of gas.

(5) Provide a graphic on the BPOC graphic pages and enable the data logger.

(6) Show point name and SNVT name on the point schedule drawing.

b. Buildings with electric meters.

- (1) Coordination is required with power utility.
- (2) Provide a 3 pair twisted pair cable with a drain from the meter to the DDC enclosure
- (3) Raceways from electric meters outputs are in the electrical section.
- (4) Provide Graphic's and Standard Network Variable's (SNVTS) for energy(KWh) and power demand(KW) and provide data logs for each point
- (5) Show point names and SNVT names on the point schedule drawing.

c. Buildings without Utility Meters

- (1) Provide a dedicated 1 ¼" raceway terminated with a pull box and jet line(pull string) from the gas riser back to DDC enclosure.
- (2) Provide a dedicated 1 ¼" raceway terminated with a pull box and jet line(pull string) from the utility electric meter back to DDC enclosure.

3.2.27 CPU HARDWARE and SOFTWARE 6/09/08

- a. CPU DDC hardware shall be mounted in an NEMA 12 enclosure that meets the requirements of this specification..
- b. The enclosure that houses the CPU hardware shall have a intrusion alarm point that is viewable on the BPOC graphic pages and sent as a critical alarm e-mail as specified and shown..
- c. The CPU hardware enclosure shall have a cooling fan and make-up air louver that provides 100 cfm of air as shown.
- d. The CPU enclosure shall have an uninterruptible power supply that provide power for the CPU hardware as specified. (UPS).
- e. CPU software install shall be coordinated with DPW MES section.
- d. ANSI/EIA 852 Configuration Server: The Contractor shall install and configure the ANSI/EIA 852 Configuration Server as specified and shown.

3.2.28 Emergency Ventilation Shutdown

Emergency ventilation shutdown button hardware shall shut off all building ventilation fans upon activation and provide an alarm input to the DDC hardware as shown.

(03-05-08)

3.3 DRAWINGS AND CALCULATIONS

Contractor shall prepare and submit shop drawings.

3.3.1 Network Bandwidth Usage Calculations

The Contractor shall perform Building Control Network Bandwidth Usage Calculations for a normally loaded and a heavily loaded control network. Calculations shall be

performed for network traffic on the backbone. A heavily loaded control network is characterized as one performing the following activities simultaneously:

- a. Transmitting every point in the building indicated on Points Schedules as being available to the Building Point of Connection (BPOC) location in response to polling requests at 15-minute intervals (for trending at UMCS).
- b. Transmitting five points to the Building Point of Connection (BPOC) location in response to polling requests at 2-second intervals.
- c. Transmitting 100 points to the Building Point of Connection (BPOC) location in response to polling requests at 5-second intervals.
- d. Transmitting occupancy commands from the Building Point of Connection (BPOC) location to every system schedule sequence in a one-minute interval.
- e. Transmitting occupancy override commands from the UMCS to every system schedule sequence in a one-minute interval. A normally loaded control network is characterized as one performing the following activities simultaneously:
 - a. Transmitting every point in the building indicated on Points Schedules as requiring a trend to the UMCS in response to polling requests at 15-minute intervals (for trending at UMCS).
 - b. Transmitting 50 points to the UMCS in response to polling requests at 5-second intervals.
 - c. Transmitting occupancy commands from the UMCS to every system scheduler sequence in a one-minute interval.

3.3.2 DDC Contractor Design Drawings

Drawings shall be on 17 by 11 inches sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and identifiers shown. Each control system element on a drawing shall be assigned a unique identifier as shown. The DDC Contractor Design Drawings shall be delivered together as a complete submittal.

Deviations shall be approved by the Contracting Officer. DDC Contractor Design Drawings shall include the following:

- a. Drawing Index and HVAC Design Drawing Legend: The HVAC Control System Drawing Index shall show the name and number of the building, military site, State or other similar designation, and Country. The Drawing Index shall list all Contractor Design Drawings, including the drawing number, sheet number, drawing title, and computer filename when used. The Design Drawing Legend shall show and describe all symbols, abbreviations and acronyms used on the Design Drawings.
- b. Valve Schedule: The valve schedule shall contain each valve's unique identifier, size, flow coefficient K_v (C_v), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure to torque data, dimensions, and access and clearance requirements data. The valve schedule shall contain actuator selection data supported by calculations of the force required to move and seal the valve, access and clearance requirements. A valve schedule shall be submitted for each HVAC system.

c. Damper Schedule: The damper schedule shall contain each damper's unique identifier, type (opposed or parallel blade), nominal and actual sizes, orientation of axis and frame, direction of blade rotation, actuator size and spring ranges, operation rate, positive positioner range, location of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The Damper Schedule shall include the AMCA 500-D maximum leakage rate at the operating static-pressure differential. A damper schedule shall be submitted for each HVAC system.

d. Thermostat and Occupancy Sensor Schedule: The thermostat and occupancy sensor schedule shall contain each thermostat's unique identifier, room identifier and control features and functions as shown. A thermostat and occupancy sensor schedule shall be submitted for each HVAC system.

e. Critical Alarm Handling Schedule: The critical alarm handling schedule shall contain the same fields as the critical alarm handling schedule Contract Drawing with Contractor updated information and any other project-specific information required to implement the alarm handling function. A critical alarm handling schedule shall be submitted for each HVAC system.

f. Equipment Schedule: The equipment schedule shall contain the unique identifier, manufacturer, model number, part number and descriptive name for each control device, hardware and component provided under this specification. An equipment schedule shall be submitted for each HVAC system.

g. Occupancy Schedule: The occupancy schedule drawing shall contain the same fields as the occupancy schedule Contract Drawing with Contractor updated information. An occupancy schedule shall be submitted for each HVAC system.

h. Points Schedule: The Points Schedule drawing shall contain the same fields as the Points Schedule Contract Drawing with Contractor updated information. A Points Schedule shall be submitted for each HVAC system. [Point schedules shall be completed as specified and as described in the point schedule drawing instructions.](#)

i. Riser diagram of building control network: The Riser Diagram of the Building Control Network shall show all network cabling, DDC Hardware, and Network Hardware including:

- (1) All DDC Hardware with room number and location within room.
- (2) DDC Hardware unique identifiers and common descriptive names.
- (3) All Network hardware with room number and location within room.
- (4) Network hardware unique identifiers.
- (5) All cabling.
- (6) Room number and location within room of all cabling termination points.
- (7) Room number and location within room of all network interface jacks.

(8) As built drawing shall contain network bandwidth readings.(3-10-08)

A single riser diagram shall be submitted for each building.

k. Control System Schematics: The control system schematics shall be in the same form as the control system schematic Contract Drawing with Contractor updated information. A control system schematic shall be submitted for each HVAC system.

l. Sequences of Operation: The HVAC control system sequence of operation and shall be in the same format as the Contract Drawings and shall refer to the devices by their unique identifiers. No operational deviations from specified sequences will be permitted without prior written approval of the Government. Sequences of operation shall be submitted for each HVAC control system.

m. Controller, Motor Starter and Relay Wiring Diagram: The controller wiring diagrams shall be functional wiring diagrams which show the interconnection of conductors and cables to each controller and to the identified terminals of input and output devices, starters and package equipment. The wiring diagrams shall show necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for control systems and for packaged equipment control systems shall be identified back to the panel board circuit breaker number, controller enclosures, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown. Wiring diagrams shall be submitted for each HVAC control system.

3.3.3 Draft As-Built Drawings

The Contractor shall update the Contractor Design Drawings with all as-built data and submit as specified.

3.3.4 Final As-Built Drawings

The Contractor shall update the Draft As-Built Drawings with all final as-built data and submit as specified.

- a. Contractor shall provide 5 hard copies of as built drawings as specified.
- b. Contractor shall provide 2 copies of as built drawings as specified on CDROM in Microstation format.
- c. 11"x17" laminated copy of the as built DDC control drawings shall be provided in the data pocket of the control enclosure. Drawings provided in each enclosure shall show the DDC system that the enclosure serves.

3.4 HVAC SYSTEMS SEQUENCES OF OPERATION

3.4.1 Alarm Handling

The Contractor shall install and configure DDC Hardware to provide alarm handling functionality for critical alarms as specified and shown, either in a piece of DDC Hardware dedicated to this function or in DDC Hardware

performing other functions. The DDC Hardware providing alarm handling functionality shall provide the following capabilities as required:
Configure critical alarm e-mails as specified and shown at the BPOC to send e-mails to the following e-mail address: leon.dpwdde@conus.army.mil

3.4.1.1 The following critical alarms shall be sent via e-mail.

- a. CPU intrusion alarm.
 - b. Air Handling Units not running during occupied periods.
 - c. Chiller or condensing unit alarms if enabled.
 - d. Boiler alarms if enabled.
- (06-09-08)

3.4.2 Scheduling

3.4.2.1 System Mode

AHUs shall operate in Occupied, Warm-Up-Cool-Down, or Unoccupied modes as Specified and shown. VAV boxes, Fan Coils, and other terminal equipment shall operate in Occupied or Unoccupied modes as specified and shown. Chillers, boilers, and other sources of heating/cooling for hydronic loads do not require scheduling; these systems receive requests for heating/cooling from their loads.

3.4.2.2 System Scheduler Requirements

The System Scheduler functionality shall reside in either a piece of DDC Hardware dedicated to this functionality. A single piece of DDC Hardware may contain multiple System Schedulers A unique System Scheduler shall be provided for: each AHU including it's associated Terminal Units, and a group of stand-alone Terminal Units acting according to a common schedule. Each System Scheduler shall provide the following functionality:

- a. Scheduled Occupancy Input: Accept network variable of type SNVT_occupancy (as defined in the LonMark SNVT Master List). Input shall support the following possible values: OC_STANDBY, OC_OCCUPIED and OC_UNOCCUPIED.
- b. Occupancy Override Input: Accept network variable of type SNVT_occupancy (as defined in the LonMark SNVT Master List). Input shall support the following possible values: OC_STANDBY, OC_OCCUPIED, OC_UNOCCUPIED, and OC_NUL.
- c. Space Occupancy Inputs: For systems with multiple occupancy sensors, accept multiple inputs of network variable type SNVT_Occupancy (as defined in the LonMark SNVT Master List). Input shall support the following possible values: OC_OCCUPIED, OC_UNOCCUPIED, and OC_NUL. For systems with a single occupancy sensor, accept a network variable input of type SNVT Occupancy or a hardware binary input (BI) indicating the space occupancy status as Occupied or Unoccupied.

- d. Air Handler Occupancy Output: For a System Scheduler for a system containing an air handler, output one or more SNVTs indicating the desired occupancy status as one of the following possible values: Warm-Up-Cool-Down (when required by the AHU Sequence of Operation), Occupied and Unoccupied.
- e. Terminal Unit Occupancy Output: For a System Scheduler for a **group of stand-alone terminal units acting according to a common schedule**, or a group of terminal units served by a single air handler, output one or more SNVTs indicating the desired occupancy status as one of the following possible values: Occupied and Unoccupied.
- f. Default Schedule: Incorporate a 24-hour 7-day default schedule as shown on the drawings which may be activated and deactivated by the System Scheduler Logic.
- g. Communication Determination: Determine the time elapsed between receipts of the scheduled occupancy input SNVT, and use this elapsed time to activate and deactivate the Default Schedule as specified. (This provides the capability for the system scheduler to use its Default Schedule if it loses communication with the **BPOC**).

3.4.2.3 System Scheduler Output Determination

- a. Air Handler Occupancy Output: If more than **120** minutes have passed since the last receipt of the Scheduled Occupancy input, the Air Handler Occupancy Output shall be determined by the default schedule and the Space Occupancy Inputs. Otherwise, the output shall be determined as follows:
- (1) If the Override Occupancy Input **is not** OC_NUL, the Air Handler Occupancy Output shall be determined as follows:
 - (a) The output shall be Occupied when the Override Occupancy Input is OC_OCCUPIED.
 - (b) The output shall be Unoccupied when the Override Occupancy Input is OC_UNOCCUPIED.
 - (c) If the system Sequence Of Operation specifies Warm-Up-Cool-Down mode, the output shall be Warm-Up-Cool-Down when the Override Occupancy Input is OC_STANDBY.
 - (2) If the Override Occupancy Input is OC_NUL and the Schedule Occupancy input is OC_OCCUPIED, the Air Handler and Stand-Alone Terminal Unit Occupancy Output shall be OC_OCCUPIED.
 - (3) If the Override Occupancy Input is OC_NUL, the Schedule Occupancy input is not OC_OCCUPIED, and less than required number of Space Occupancy Inputs (as shown on the Occupancy Schedule Drawing) are OC_OCCUPIED (or the hardware BI is Unoccupied), the Air Handler Occupancy Output shall be determined by the Scheduled Occupancy Input

- (a) The output shall be Occupied when the Scheduled Occupancy Input is OC_OCCUPIED.
 - (b) The output shall be Unoccupied when the Scheduled Occupancy Input is OC_UNOCCUPIED.
 - (c) If the system Sequence Of Operation specifies Warm-Up-Cool-Down mode the output shall be Warm-Up-Cool-Down when the Scheduled Occupancy Input is OC_STANDBY.
- (4) If the Override Occupancy Input is OC_NUL and at least the required number (as shown on the Occupancy Schedule Drawing) of Space Occupancy Inputs are OC_OCCUPIED (or the hardware BI is Occupied), the Air Handler Occupancy Output shall be Occupied.

b. Terminal Unit Occupancy Output: If more than 120 minutes have passed since the last receipt of the Scheduled Occupancy input, the Terminal Unit Occupancy Output shall be determined by the default schedule. Otherwise, the output shall be determined as follows:

- (1) If the Override Occupancy Input **is not** OC_NUL, the Terminal Unit Occupancy Output shall be determined as follows:
 - (a) The output shall be Occupied when the Override Occupancy Input is OC_OCCUPIED or OC_STANDBY (to allow AHU-dependent Terminal Units to operate in Occupied mode when their associated AHU is in Warm-Up-Cool-Down.
 - (b) The output shall be Unoccupied when the Override Occupancy Input is OC_UNOCCUPIED.
- (2) If the Override Occupancy Input **is** OC_NUL, the AHU-Dependent Terminal Unit Occupancy Output shall be determined as follows:
 - (a) The output shall be Occupied when the Scheduled Occupancy Input is OC_OCCUPIED or OC_STANDBY (to allow AHU-dependent Terminal Units to operate in Occupied mode when their associated AHU is in Warm-Up-Cool-Down.
 - (b) The output shall be Unoccupied when the Scheduled Occupancy Input is OC_UNOCCUPIED.

3.4.2.4 Air Handler System Scheduling

- a. The AHU Occupancy Output SNVT shall be bound from the System Scheduler to the DDC Hardware that executes the Occupancy Mode Determination part of the Air Handler Sequence of Operation
- b. For Air Handlers using occupancy sensors, the occupancy sensor output SNVT (of type SNVT_Occupancy) shall be bound to a Space Occupancy Input of the System Scheduler.
- c. The Terminal Unit Occupancy Output SNVT shall be bound from the System Scheduler to each AHU-Dependent Terminal Unit.
- d. AHU-Dependent Terminal Units with occupancy sensors shall have their Effective Occupancy SNVT (of type SNVT_Occupancy) bound to a Space Occupancy Input of the System Scheduler.

3.4.2.5 Stand-Alone Terminal Unit Scheduling

The Terminal Unit Occupancy Output shall be bound from the System Scheduler to the DDC Hardware that executes the Occupancy Mode Determination part of the Terminal Unit Sequence of Operation.

3.4.3 Sequences of Operation for Air Handling Units

3.4.3.1 All-Air Small Package Unitary System

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. Fan ON-AUTO Switch

(1) ON: With the thermostat fan ON-AUTO switch in the ON position, the DDC Hardware shall start the fan and it shall run continuously.

(2) AUTO: With the thermostat fan ON-AUTO switch in the AUTO position, the DDC Hardware operates the fan according to HEAT-OFF-COOL[-EMERG HEAT] switch.

b. HEAT-OFF-COOL[-EMERG HEAT] Switch

(1) HEAT-COOL[-EMERG HEAT]: With the thermostat switch in the HEAT or COOL [or EMERG HEAT] positions, the DDC Hardware shall operate the package unit according to the Occupancy Mode.

(2) OFF: With the thermostat switch in the OFF position, the DDC Hardware shall de-energize the heating unit and cooling unit [and emergency supplemental heat].

c. Occupancy Modes

(1) Occupied: The unit DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied or when the input from the System Scheduler is occupied.

(2) Unoccupied: The unit DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied and when the input from the System Scheduler is unoccupied.

d. Safeties: The unit shall run subject to the unit manufacturer's safeties.

e. Zone Temperature Control

(1) In the Occupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.

(2) In the Unoccupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint (ZN-T-SP) as shown.

(3) The DDC Hardware shall cycle the fan, cooling unit, heating unit[, and emergency supplemental heat], in accordance with the HEAT-COOL[-EMERG HEAT] switch setting, to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP).

3.4.3.2 Heating and Ventilating Unit (or Unit Ventilator)

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switches: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the supply fan

shall start and run continuously, subject to Safeties.

(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes:

(1) Occupied: The Unit's DDC Hardware shall be in the Occupied Mode when the input from the System Scheduler (SYS-OCC) is occupied [or when the local space occupancy input(s) (ZN-OCC) indicate that the space is occupied].

(2) Unoccupied: The Unit's DDC Hardware shall be in the Unoccupied Mode when the input from the System Scheduler (SYS-OCC) is unoccupied [and when the local space occupancy input(s) (ZN-OCC) indicate that the space is unoccupied].

[(3) Warm Up/Cool Down: The Unit's DDC Hardware shall be in the Warm Up/Cool Down Mode based on input from the System Scheduler.]

c. System Enable and Loop Enable

(1) Occupied mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Zone Temperature Control loop [and Mixed Air Damper Control]shall be enabled.

(2) Unoccupied mode: All control loops shall be disabled. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Zone Temperature Control loop shall be enabled.

[(3) Warm Up/Cool Down: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Zone Temperature Control loop [and Mixed Air Damper Control]shall be enabled.]

d. Proofs and Safeties

(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

- (2) Proofs: Supply fan status (proof) (SF-S)
- (3) Safeties:
 - (a) Heating Coil discharge air temperature low limit (freezestat) (HTG-DA-T-LL)
 - (b) Supply air smoke (SA-SMK)
 - [(c) Return air smoke (RA-SMK)]
- (4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Zone Temperature Control

(1) When this loop is enabled, the DDC Hardware shall modulate the heating valve [and outside air, relief, and return air dampers in sequence] to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP). [Sequencing shall be as shown: Upon a rise in zone temperature above zone temperature setpoint (ZN-T-SP), subject to the zone temperature setpoint deadband as shown, the outside air, relief, and return air dampers shall modulate to maintain zone temperature at setpoint. During occupied mode, outside air damper minimum position (OA-D-MIN) shall be as shown.] Upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the heating valve shall modulate towards open to maintain zone temperature setpoint.

(2) When this loop is disabled, the heating valve shall be closed [and the outside air damper and relief damper shall be closed and the return damper shall be open].
 [f. Mixed Air Damper Control When this is enabled, the outside air and relief air dampers shall be open and the return air damper shall be closed. When this is disabled, the outside air and relief air dampers shall be closed and the return air damper shall be open.]

3.4.3.3 Single Zone with Heating and [DX][Cooling] Coils

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switch: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:

- (1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.
- (2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.
- (3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:

(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and all control loops shall be enabled.

(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Heating Coil Temperature Control loop shall be enabled. The Outside Air Flow Control, Economizer Damper Control, and [DX] Cooling Coil Control loops shall be disabled.

[3] Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Minimum Outside Air Flow Control loop shall be disabled. All other control loops shall be enabled.]

d. Proofs and Safeties:

(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

(2) Proofs:

(a) Supply fan status (proof) (SF-S)

(3) Safeties:

(a) Heating coil discharge air temperature low limit (freezestat) (HTG-DA-T-LL)

(b) Supply air smoke (SA-SMK)

(c) Return air smoke (RA-SMK)

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air flow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Economizer Damper Control:

(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers (Economizer dampers) in sequence with the [DX] cooling coil control and heating coil control valve as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown.

(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.

(3) Economizer Enable Logic. The economizer shall be ON when the outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2degreesF) deadband.

g. Heating Coil Control: When this loop is enabled the DDC Hardware shall modulate the heating coil control valve in sequence with the cooling coil valve and economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. When this loop is disabled, the heating coil control valve shall be closed.

h. [DX] Cooling Coil Control: When this loop is enabled the DDC Hardware shall [stage the DX Unit] [modulate the cooling coil control valve] in sequence with the heating coil valve and economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. When this loop is disabled, the [DX unit shall be off] [cooling coil control valve shall be closed].

3.4.3.4 Single Zone with Dual-Temperature Coil

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switch: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.

(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:

(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and all control loops shall be enabled.

(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreeC (5 degreeF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Dual

Temperature Coil Temperature Control loop shall be enabled. The Minimum Outside Air Flow Control, and Economizer Damper Control loops shall be disabled.

[(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops enabled.]

d. Proofs and Safeties:

(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

(2) Proofs: Supply fan status (proof) (SF-S)

(3) Safeties:

(a) Dual Temperature coil discharge air temperature low limit(freeze stat) (DT-DA-T-LL)

(b) Supply air smoke (SA-SMK)

(c) Return air smoke (RA-SMK)

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air flow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Economizer Damper Control:

(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers (Economizer dampers) to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown.

(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.

(3) Economizer Enable Logic. The economizer shall be ON when the outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreeC (2 degreeF) deadband.

g. Dual Temperature Coil Control:

(1) When this loop is enabled, the DDC Hardware shall select heating or cooling mode based on a pipe-mounted dual-temperature supply water sensor. A single sensor may be used for multiple instances of this sequence.

(2) The DDC Hardware shall modulate the coil control valve in sequence with the economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown.

(3) When this loop is disabled, the control valve shall be closed.

3.4.3.5 Single Zone with Heating and Cooling Coils and Return Air Bypass

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switch: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.

(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:

(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and all control loops shall be enabled.

(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Heating Coil Temperature Control loop shall be enabled. All other control loops shall be disabled. [(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled.]

(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled.]

d. Proofs and Safeties:

(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

(2) Proofs: Supply fan status (proof) (SF-S)

(3) Safeties:

(a) Heating coil discharge air temperature low limit (freezestat) (HTG-DA-T-LL)

(b) Supply air smoke (SA-SMK)

(c) Return air smoke (RA-SMK)

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air flow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Economizer Damper Control:

(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, return air, [and relief air dampers] (Economizer dampers) in sequence with the bypass and supply dampers and the heating coil control valve as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown.

(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.

(3) Economizer Enable Logic. The economizer shall be ON when the outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2degreesF) deadband.

g. Heating Coil Control: When this loop is enabled the DDC Hardware shall modulate the heating coil control valve in sequence with the bypass and supply dampers and the economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. When this loop is disabled, the heating coil control valve shall be closed.

h. Cooling Coil Control: When this loop is enabled the DDC Hardware shall open the 2-position cooling coil control valve. When this loop is disabled, the 2-position cooling coil control valve shall be closed.

i. Bypass and Supply Air Damper Control: When this loop is enabled the DDC Hardware shall modulate the bypass and supply air dampers in sequence with the heating coil control valve and the Economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. When this loop is disabled the bypass damper shall be closed and supply air damper open.

3.4.3.6 Single Zone with Humidity Control

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switch: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.

(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or 1 WarmUp/CoolDown].

c. System Enable and Loop Enable:

(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and all control loops shall be enabled.

(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS), the Preheat Coil Control loop and Reheat Coil Control loop shall be enabled and all other loops shall be disabled.

[(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled.]

d. Proofs and Safeties

(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

(2) Proofs: Supply fan status (proof) (SF-S)

(3) Safeties:

(a) Preheat coil discharge air temperature low limit (freezestat) (PH-DA-T-LL)

(b) Supply air smoke (SA-SMK)

(c) Return air smoke (RA-SMK)

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside

air flow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Preheat Coil Control Loop: When this loop is enabled the DDC Hardware shall modulate the preheat coil valve to maintain the preheat coil discharge air temperature (PH-T) at setpoint (PH-T-SP) as shown. When this loop is disabled, the preheat coil valve shall be closed.

g. Cooling-and-Dehumidification Coil Control: When this loop is enabled the DDC Hardware shall modulate the cooling and dehumidification valve to maintain either the zone temperature (ZN-T) at setpoint (ZN-T-SP) or zone relative humidity (ZN-RH) at setpoint (ZN-RH-SP), whichever calls for more chilled water flow. The valve shall be modulated in sequence with the reheat valve and humidification valve as shown to avoid simultaneous cooling and reheating, and simultaneous dehumidification and humidification. When this loop is disabled, the coil valve shall be closed.

h. Reheat Coil Control: When this loop is enabled the DDC Hardware shall modulate the reheat coil valve to maintain the zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. The valve shall be modulated in sequence with the cooling-and-dehumidification valve as shown to avoid simultaneous cooling and reheating. When this loop is disabled, the coil valve shall be closed.

i. Humidification Control: When this loop is enabled the DDC Hardware shall modulate the humidifier valve to maintain zone relative humidity (ZN-RH) at setpoint (ZN-RH-SP). The valve shall be modulated in sequence with the cooling-and-dehumidification valve as shown to avoid simultaneous dehumidification and humidification. When the supply air duct humidity (SA-RH) rises above 80% relative humidity, the humidifier valve shall begin to modulate towards closed and shall, under proportional control, continue to gradually move towards closed until the supply air duct humidity reaches 90% relative humidity, at which point the humidifier valve shall be fully closed. When this loop is disabled, the humidifier valve shall be closed.

3.4.3.7 Multizone [Dual-Duct] [with][without] Return Fan

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switches:

Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.

(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the supply fan

shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

[Return fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches shall start the fan. The return fan motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the return fan shall run subject to Safeties.

(2) OFF: With the H-O-A switch in OFF position, the return fan shall be off.

(3) AUTO: With the H-O-A switch in AUTO position, the return fan shall run subject to the supply fan running.]

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:

(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). All control loops shall be enabled. The Zone Temperature Control loops serviced by the AHU shall also be enabled.

(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS), the Hot Deck Coil Control loop and all Zone Temperature Control loops shall be enabled, and all other control loops shall be disabled. [(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside AirFlow Control loop shall be disabled and all control loops shall be enabled. The Zone Temperature Control loops serviced by the AHU shall also be enabled.]

d. Proofs and Safeties:

(1) The supply fan[, return fan,] and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

(2) Proofs:

(a) Supply fan status (proof) (SF-S)

(b) [Return fan status (proof) (RF-S)]

(3) Safeties:

(a) Mixed air temperature low limit (freeze stat) (MA-T-LL)

(b) Supply air smoke (SA-SMK)

[(c) Return air smoke (RA-SMK)] (4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air flow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Mixed Air Temperature Control With Economizer:

(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers to maintain the mixed air temperature (MA-T) at setpoint (MA-T-SP) as shown.

(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.

(3) Economizer Enable Logic. The economizer shall be ON when the outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2degreesF) deadband.

g. Hot Deck Coil Control:

(1) When this loop is enabled the DDC Hardware shall modulate the hot deck heating coil valve to maintain the hot deck temperature (HD-T) at setpoint (HD-T-SP) as shown. When this loop is disabled, the hot deck coil valve shall be closed.

[2) The DDC Hardware shall reset the hot deck temperature setpoint (HD-T-SP) using a linear reset schedule as shown. Reset of the setpoint (HD-T-SP) shall be based on [Outside Air Temperature] [Coldest Zone Temperature].

h. Cold Deck Coil Control: When this loop is enabled the DDC Hardware shall modulate the cold deck cooling coil valve to maintain the cold deck temperature (CD-T) at setpoint (CD-T-SP) as shown. When this loop is disabled, the cold deck cooling coil valve shall be closed.

i. Zone Temperature Control:

(1) The zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.

(2) The DDC Hardware shall modulate the hot deck and cold deck dampers to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP). Sequencing shall be as shown: Upon a rise in zone temperature above zone temperature setpoint the zone cold deck damper shall modulate towards open as the hot deck damper modulates towards closed. Upon a fall in zone temperature below zone temperature setpoint the hot deck damper shall modulate towards open as the cold deck damper modulates towards closed.

3.4.3.8 Multizone with Hot Deck Bypass [with][without] Return Fan

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule.

Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switches:

Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.

(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties. [Return fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches shall start the fan. The return fan motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the return fan shall run subject to Safeties.

(2) OFF: With the H-O-A switch in OFF position, the return fan shall be off.

(3) AUTO: With the H-O-A switch in AUTO position, the return fan shall run subject to the supply fan running.]

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:

(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). All control loops shall be enabled. The Zone Temperature Control loops serviced by the AHU shall also be enabled.

(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS), and all Zone Temperature Control loops shall be enabled. The Minimum Outside Air Flow Control, Mixed Air Temperature Control With Economizer, and Cold Deck Coil Control loops shall be disabled. [(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled. The Zone Temperature Control loops serviced by the AHU shall also be enabled.]

(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled. The Zone Temperature Control loops serviced by the AHU shall also be enabled.]

d. Proofs and Safeties:

(1) The supply fan[, return fan,] and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

(2) Proofs:

- (a) Supply fan status (proof) (SF-S)
 - (b)[Return fan status (proof) (RF-S)]
 - (3) Safeties:
 - (a) Mixed air temperature low limit (freeze stat) (MA-T-LL)
 - (b) Supply air smoke (SA-SMK)
 - (c)[Return air smoke (RA-SMK)]
 - (4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.
- e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air follow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.
- f. Mixed Air Temperature Control With Economizer:
- (1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers to maintain the mixed air temperature (MA-T) at setpoint (MA-T-SP) as shown.
 - (2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.
 - (3) Economizer Enable Logic. The economizer shall be ON when the outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2degreesF) deadband.
- g. Cold Deck Coil Control: When this loop is enabled the DDC Hardware shall modulate the cooling coil valve to maintain the cold deck supply air temperature (SA-T) at setpoint (SA-T-SP) as shown. When this loop is disabled, the cooling coil valve shall be closed.
- h. Zone Temperature Control: The Zone Temperature Control loops shall always be enabled.
- (1) The zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.
 - (2) The DDC Hardware shall modulate the zone bypass and cold deck dampers, and the zone reheat coil valve to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP). Sequencing shall be as shown: Upon a rise in zone temperature above zone temperature setpoint, subject to the zone temperature setpoint deadband as shown, the zone cold deck damper shall modulate towards open as the bypass deck damper modulates towards closed. Upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the bypass damper shall be full open and the zone heating valve shall modulate towards open.

3.4.3.9 Variable Air Volume System [with][without] Return Fan

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switches:

Supply fan variable frequency drive (VFD) unit shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other VFD inputs and switches and shall cause the VFD to run at 100% speed. The VFD shall accept an occupant accessible emergency shutoff switch as shown. The supply fan variable frequency drive (VFD) unit shall have an integral H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties. Fan speed shall be under manual-operator control.

(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop Signal (SF-SS) and Safeties. Fan speed shall be under control of the DDC Hardware. [Return fan variable frequency drive (VFD) unit shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other VFD inputs and switches and shall cause the VFD to run at 100% speed. The return fan variable frequency drive (VFD) unit shall have an integral H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the return fan shall run subject to Safeties. Fan speed shall be under manual-operator control.

(2) OFF: With the H-O-A switch in OFF position, the return fan shall be off.

(3) AUTO: With the H-O-A switch in AUTO position, the return fan shall run subject to the supply fan running. Fan speed shall be under control of the DDC Hardware.]

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or Warm Up/Cool Down].

c. Proofs and Safeties:

(1) The supply fan[, return fan,] and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the VFD as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

(2) Proofs:

(a) Supply fan status (SF-S)

[(b) Return fan status (RF-S)]

(3) Safeties:

(a) Cooling coil discharge air temperature low limit (freezestat) (CLG-DA-T-LL)

(b) Supply air duct pressure high limit (SA-P-HL)

(c) Supply air smoke (SA-SMK)

(d) Return air smoke (RA-SMK)

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware

via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

d. System Enable and Loop Enable

(1) Occupied mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). All control loops shall be enabled. The Zone Temperature Control loops for VAV boxes serviced by the AHU shall also be enabled.

(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled (except fan-powered VAV box Zone Temperature Control loops) and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 5 degreesF deadband the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS), the Supply Duct Static Pressure Control[, Return Fan Volume Control][, Preheat Control] loops shall be enabled. The Minimum Outside Air Flow Control, Mixed Air Temperature Control, and Cooling Coil Control loops shall be disabled.

[(3) Warm Up/Cool Down: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled. The Zone Temperature Control loops for VAV boxes serviced by the AHU shall also be enabled.]

e. Fan Capacity Control:

(1) Supply Duct Static Pressure Control. When this loop is enabled the DDC Hardware shall modulate the supply fan variable frequency drive unit to maintain the duct static pressure (SA-P) at setpoint (SA-P-SP) as shown, as measured by the duct static pressure tap and sensor as shown. When this loop is disabled, the DDC Hardware capacity modulation output to the VFD shall be zero percent.

[(2) Return Fan Volume Control. When this loop is enabled the DDC Hardware shall modulate the return fan variable frequency drive unit to maintain a constant volumetric airflow difference at setpoint (F-DIFF-SP) as shown, as measured by the airflow measurement arrays located in the supply and return ducts as shown. When this loop is disabled, the output to the VFD shall be zero percent.]

f. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall modulate the minimum outside air damper to maintain the minimum OA volumetric flow (MINOA-F) at setpoint (MINOA-F-SP) as shown. When this loop is disabled, the minimum outside air damper shall be closed.

g. Mixed Air Temperature Control With Economizer

(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers to maintain the mixed air temperature (MA-T) at setpoint (MA-T-SP) as shown.

(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.

(3) Economizer Enable Logic. The economizer shall be ON when the

outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2 degreesF) deadband.

h. Cooling Coil Control: When this loop is enabled the DDC Hardware shall modulate the cooling coil valve to maintain the supply air temperature (SA-T) setpoint (SA-T-SP) as shown. When this loop is disabled, the cooling coil valve shall be closed.

[i. Preheat Coil Control: When this loop is enabled the DDC Hardware shall modulate the preheat coil valve to maintain the preheat coil discharge air temperature (PH-DA-T) at setpoint (PH-DA-T-SP) as shown. When this loop is disabled, the preheat coil valve shall be closed.]

3.4.4 Sequences of Operation for Terminal Units

3.4.4.1 Zone Temperature Control - Cooling-Only VAV Box Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. Occupancy Modes:

(1) Occupied: The VAV box DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is occupied or when the input from the System Scheduler (SYS-OCC) is occupied.

(2) Unoccupied: The VAV box DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is unoccupied and the input from the System Scheduler (SYS-OCC) is unoccupied.

b. Safeties: This system has no safeties.

c. Zone Temperature Control

(1) In the Occupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted **thermostat**, as shown. The DDC Hardware shall modulate the VAV box damper to maintain VAV box supply air flow (VAV-SA-F) at setpoint as measured by a multi-point flow sensing element at the inlet to the VAV box. Sequencing shall be as shown: Upon a rise in zone temperature (ZN-T) above zone setpoint (ZN-T-SP), subject to the zone temperature setpoint deadband as shown, the airflow setpoint shall be adjusted between minimum and maximum flow based on the difference between zone temperature and zone temperature setpoint as shown.

(2) In the Unoccupied Mode the VAV box damper shall be at its minimum position.

3.4.4.2 Zone Temperature Control - VAV Box with Reheat Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. Occupancy Modes:

(1) Occupied: The VAV box DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is occupied or when the input from the System Scheduler (SYS-OCC) is occupied.

(2) Unoccupied: The VAV box DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is unoccupied and the input from the System Scheduler (SYS-OCC) is unoccupied.

b. Safeties: VAV boxes with electric resistance heating elements shall require proof of air flow before activating the heating elements.

c. Zone Temperature Control:

(1) In the Occupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.

(2) In the Unoccupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint as shown.

(3) The DDC Hardware shall modulate the VAV box damper to maintain VAV box supply air flow (VAV-SA-F) at setpoint as measured by a multi-point flow sensing element at the inlet to the VAV box. Sequencing shall be as shown: Upon a rise in zone temperature above zone temperature setpoint (ZN-T-SP), subject to the zone temperature setpoint deadband as shown, the airflow setpoint shall be adjusted between minimum and maximum flow based on the difference between zone temperature and zone temperature setpoint as shown. Upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the airflow shall be maintained at a fixed air flow setpoint (with a setting independent of the cooling minimum air flow), and the heating valve shall modulate towards open or the staged electric resistance heating coil(s) shall cycle on in sequence.

3.4.4.3 Zone Temperature Control - Fan Powered VAV Box

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. Occupancy Modes:

(1) Occupied: The VAV box DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is occupied or when the input from the System Scheduler (SYS-OCC) is occupied.

(2) Unoccupied: The VAV box DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is unoccupied and the input from the System Scheduler (SYS-OCC) is unoccupied.

b. Safeties: VAV boxes with electric resistance heating elements shall require proof of air flow before activating the heating elements.

c. Zone Temperature Control

- (1) In the Occupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.
- (2) In the Unoccupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint as shown.
- (3) Sequencing shall be as shown:
- (a) In occupied and unoccupied modes, upon a rise in zone temperature above zone temperature setpoint (ZN-T-SP), subject to the zone temperature setpoint deadband as shown, the airflow setpoint shall be adjusted between minimum and maximum based on the difference between zone temperature and zone temperature setpoint as shown. The DDC Hardware shall modulate the VAV box damper to mix supply and plenum return air as it maintains VAV box supply airflow (VAV-SA-F) at setpoint as measured by a multi-point flow sensing element at the inlet to the VAV box.
- (b) In occupied mode, upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the VAV box fan shall cycle on (note that the fan is always on in the occupied mode for a series box), the DDC Hardware shall modulate the VAV box damper to mix supply and plenum return air to maintain a fixed air flow setpoint (with a setting independent of the cooling minimum air flow), and the heating valve shall modulate towards open or the staged electric resistance heating coil(s) shall cycle on in sequence.
- (c) In unoccupied mode, upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the VAV box fan shall cycle on (note that the fan is always on in the occupied mode for a series box), the VAV box damper shall be at its minimum position, and the heating valve shall modulate towards open or the staged electric resistance heating coil(s) shall cycle on in sequence.

3.4.4.4 Perimeter Radiation Control Sequence

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. Occupancy Modes

- (1) Occupied: The radiator DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied or when the input from the System Scheduler is occupied.
- (2) Unoccupied: The radiator DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied and when the input from the System Scheduler is unoccupied.

b. Safeties: This system has no safeties.

c. Space Temperature Control

- (1) In the Occupied Mode the DDC Hardware shall modulate the heating control valve to maintain space temperature at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.

(2) In the Unoccupied Mode the DDC Hardware shall modulate the heating control valve to maintain space temperature at the configured setpoint as shown.

3.4.4.5 Unit Heater and Cabinet Unit Heater

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. Off-Auto Switch

(1) OFF: With the thermostat OFF-AUTO switch in the OFF position, the DDC Hardware shall stop the fan and close the heating control valve.

(2) AUTO: With the thermostat OFF-AUTO switch in the AUTO position, the DDC Hardware shall control the unit in accordance with its Occupancy Mode.

b. Occupancy Modes

(1) Occupied: The unit heater DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied or when the input from the System Scheduler is occupied.

(2) Unoccupied: The unit heater DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied and when the input from the System Scheduler is unoccupied.

c. Safeties: The unit shall run subject to the unit manufacturer's safeties.

d. Space Temperature Control

(1) In the Occupied Mode the DDC Hardware shall modulate the heating control valve and cycle the multi-speed fan to maintain space temperature at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.

(2) In the Unoccupied Mode the DDC Hardware shall modulate the heating control valve and cycle the multi-speed fan to maintain space temperature at the configured setpoint as shown.

3.4.4.6 Gas-Fired Infrared Heater

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control

a. On-Off-Auto Switch

(1) ON: With the thermostat ON-OFF-AUTO switch in the ON position, the DDC Hardware shall energize the heater and the heater shall run continuously.

(2) OFF: With the thermostat ON-OFF-AUTO switch in the OFF position, the DDC Hardware shall de-energize the heater.

(3) AUTO: With the thermostat ON-OFF-AUTO switch in the AUTO position, the DDC Hardware shall control the heater in accordance with its Occupancy Mode.

b. Occupancy Modes

(1) Occupied: The unit DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied.

(2) Unoccupied: The unit DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied.

c. Safeties: The heater shall run subject to the unit manufacturer's safeties.

d. Space Temperature Control

(1) In the Occupied Mode the DDC Hardware shall operate the heater to maintain space temperature at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.

(2) In the Unoccupied Mode the DDC Hardware shall operate the heater to maintain space setpoint at the configured unoccupied setpoint as shown.

3.4.4.7 Dual Temperature Fan-Coil Unit

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. Off-Auto Switch

(1) OFF: With the thermostat OFF-AUTO switch in the OFF position, the DDC Hardware shall stop the fan and close the dual-temperature control valve.

(2) AUTO: With the thermostat OFF-AUTO switch in the AUTO position, the DDC Hardware shall control the unit in accordance with its Occupancy Mode.

b. Occupancy Modes

(1) Occupied: The unit DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied or when the input from the System Scheduler is occupied.

(2) Unoccupied: The unit DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied and when the input from the System Scheduler is unoccupied.

c. Heat/Cool Modes: The DDC Hardware shall automatically switch the fan coil unit DDC Hardware between the heating and cooling modes and the resultant control action, based on a pipe-mounted dual-temperature supply water temperature sensor.

d. Safeties: The unit shall run subject to the unit manufacturer's safeties.

e. Space Temperature Control

(1) In the Occupied Mode the DDC Hardware shall modulate the dual-temperature control valve and cycle the multi-speed fan to maintain space temperature at the configured setpoint or at the occupant-adjustable setpoint via the [wall-mounted] thermostat, as shown.

(2) In the Unoccupied Mode the DDC Hardware shall modulate the dual-temperature control valve and cycle the multi-speed fan to maintain space temperature at the configured setpoint as shown.

3.4.5 Sequences of Operation for Hydronic Systems

3.4.5.1 Hydronic Heating Hot Water from Distributed [Steam][HTHW] Converter Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. System Enable and loop enable

(1) This system shall monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system shall be enabled (SYS-ENA). If all systems served by this system are not enabled, this system shall not be enabled.

(2) When this system is enabled (SYS-ENA) and the hot water pump is proofed on, the Heat Exchanger Control loop shall be enabled.

b. HAND-OFF-AUTO Switch: The hot water pump motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the pump shall start and run continuously.

(2) OFF: With the H-O-A switch in OFF position, the pump shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the pump shall run subject to the Hot Water Pump Start/Stop (HW-PMP-SS) command.

c. Proofs and Safeties:

(1) DDC Hardware shall monitor all proofs and safeties.

(2) Proofs: Hot water pump status (HW-PMP-S)

(3) Safeties: None

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

d. Heat Exchanger Valve Control: When this loop is enabled DDC Hardware shall modulate the [steam][high temperature hot water] valve to maintain the Hot Water Supply Temperature (HWS-T) at setpoint (HWS-T-SP). The Hot Water Supply Temperature Setpoint (HW-T-SP) shall be [determined from a linear reset schedule] as shown. When this loop is disabled, the valve shall be closed.

3.4.5.2 Hydronic Heating Hot Water From Single-Building Boiler

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. System Enable and loop enable

(1) This system shall monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system shall be enabled (SYS-ENA). If all systems served by this system are not enabled, this system shall not be enabled.

(2) When this system is enabled (SYS-ENA) and the hot water pump is proofed on, the boiler control and hot water temperature control loops shall be enabled.

b. HAND-OFF-AUTO Switch: The hot water pump motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the pump shall start and run continuously.

(2) OFF: With the H-O-A switch in OFF position, the pump shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the pump shall run subject to the Hot Water Pump Start/Stop (HW-PMP-SS) command.

c. Proofs and Safeties:

(1) DDC Hardware shall monitor all proofs and safeties.

(2) Proofs: Hot water pump

(3) Safeties: None

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

d. Boiler Control: When this loop is enabled, the DDC Hardware shall turn the boiler on. When this loop is disabled, the boiler shall be off.

e. Hot Water Temperature Control: When this loop is enabled the DDC Hardware shall modulate the 3-way mixing valve to maintain hot water supply temperature (HWS-T) at setpoint (HWS-T-SP). The Hot Water Supply Temperature Setpoint (HWS-T-SP) shall be [determined from a linear reset schedule] as shown. When this loop is disabled, the valve shall be in its normal (failsafe) position.

3.4.5.3 Hydronic Dual-Temperature System with [Steam][High Temperature Hot Water] and Chilled Water

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. System Enable and loop enable

(1) This system shall monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system shall be enabled

(SYS-ENA). If all systems served by this system are not enabled, this system shall not be enabled.

(2) When this system is enabled (SYS-ENA), and the HEATING/COOLING switch is in HEATING and the dual-temperature return water temperature (DTWR-T) is above the dual-temperature return water low-limit temperature (DTWRR-T-LL) setpoint of 65 degreesF, the [single-building boiler] [Heat Exchanger Control loop] shall be enabled.

([3] When this system is enabled (SYS-ENA), and the HEATING/COOLING switch is in COOLING and the dual-temperature return water (DTWR-T) is below the dual-temperature return water high-limit temperature (DTWR-T-HL) setpoint of 85 degreesF, the chiller shall be enabled.]

b. Switchover valve operation

(1) With the HEATING/COOLING switch in the HEATING position, the switchover valve shall open the heat-cool system piping to the [heat exchanger] [boiler] and close the heat-cool system piping to the [central plant chilled water] [single-building chiller] whenever the dual-temperature return water temperature (DTWR-T) is above the dual temperature return water low-limit temperature (DTWR-T-LL) setpoint of 18 degreesC (65 degreesF).

(2) With the HEATING/COOLING switch in the COOLING position, the switchover valve shall open the heat-cool system piping to the [central plant chilled water] [single-building chiller] and close the heat-cool system piping to the [heat exchanger] [boiler] whenever the dual-temperature return water temperature (DTWR-T) is below the dual-temperature return water high-limit temperature (DTWR-T-HL) setpoint of 29 degreesC (85 degreesF).

(3) For any other combination of HEATING/COOLING mode switch position, DTWR-T-LL switch position, and DTWR-T-HL switch position, the heat-cool switchover valve shall maintain its last state.

(4) The DDC Hardware shall monitor the status of the DTWR-T-LL and DTWR-T-HL switches.

c. HAND-OFF-AUTO Switch: The Dual-Temperature water pump motor starter shall have an H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the pump shall start and run continuously.

(2) OFF: With the H-O-A switch in OFF position, the pump shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the pump shall run subject to the Dual-Temperature Water Pump Start/Stop (DTW-PMP-SS) System Enable (SYS-ENA) command.

d. Proofs and Safeties

(1) DDC Hardware shall monitor all proofs and safeties.

(2) Proofs: None

(3) Safeties: Heat exchanger differential pressure switch (HX-P-LL) shall be direct-hardwire interlocked to the [steam][high temperature hot water] valve.

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Heat Exchanger Valve Control: When this loop is enabled and there is hot water flow through the heat exchanger as sensed by the differential pressure switch (HX-P-LL) safety, the DDC Hardware shall modulate the [steam][high temperature hot water] valve to maintain the Hot Water Supply Temperature (HWS-T) at setpoint (HWS-T-SP). The Hot Water Supply Temperature Setpoint (HW-T-SP) shall be [determined from a linear reset schedule] as shown. The DDC Hardware shall monitor the status of the HX-P-LL safety. When this loop is disabled, the valve shall be closed.]

3.4.5.4 Hydronic Secondary with Variable Speed Pump

Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. System Enable and loop enable:

(1) This system shall monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system shall be enabled (SYS-ENA). If all systems served by this system are not enabled, this system shall not be enabled.

(2) When this system is enabled (SYS-ENA) the Pressure Control loop shall be enabled.

b. HAND-OFF-AUTO Switch: The hot water pump variable frequency drive (VFD) unit shall have an integral H-O-A switch:

(1) HAND: With the H-O-A switch in HAND position, the pump shall start and run continuously. Pump speed shall be under manual-operator control.

(2) OFF: With the H-O-A switch in OFF position, the pump shall stop.

(3) AUTO: With the H-O-A switch in AUTO position, the pump shall run subject to the Hot Water Pump Start/Stop (HW-PMP-SS) command and pump speed shall be under control of the DDC system.

c. Proofs and Safeties

(1) DDC Hardware shall monitor all proofs and safeties.

(2) Proofs: None

(3) Safeties: None

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

d. Pressure Control: When this loop is enabled the DDC Hardware shall modulate the pump variable frequency drive unit to maintain the pipe system pressure at setpoint as shown, as measured by the differential pressure tap and sensor as shown. When this loop

is disabled, the DDC Hardware capacity modulation output to the VFD shall be zero percent.

3.5 CONTROLLER TUNING

The Contractor shall tune each controller in a manner consistent with that described in the ASHRAE Fundamentals Hdbk. Tuning shall consist of adjustment of the proportional, integral, and where applicable, the derivative (PID) settings to provide stable closed-loop control. Each loop shall be tuned while the system or plant is operating at a high gain (worst case) condition, where high gain can generally be defined as a low-flow or low-load condition. Upon final adjustment of the PID settings, in response to a change in controller setpoint, the controlled variable shall settle out at the new setpoint with no more than two (2) oscillations above and below setpoint. Upon settling out at the new setpoint the controller output shall be steady. With the exception of naturally slow processes such as zone temperature control, the controller shall settle out at the new setpoint within five (5) minutes. The Contractor shall return the controller to its original setpoint and shall record and submit the final PID configuration settings with the O&M Instructions and on the associated Points Schedule.

3.6 START-UP AND START-UP TEST

The Contractor shall perform the following startup tests for each control system to ensure that the described control system components are installed and functioning per this specification.

- a. General: The Contractor shall adjust, calibrate, measure, program, configure, set the time schedules, set alarms, and otherwise perform all necessary actions to ensure that the systems function as specified and shown in the sequence of operation and other contract documents.

- b. Systems Check: An item-by-item check shall be performed for each HVAC system;
 - (1) Step 1 - System Inspection: With the system shut down, it shall be verified that power and main air are available where required and that all output devices are in their failsafe and normal positions. Each local display panel [and each M&C Client] shall be inspected to verify that all displays indicate shutdown conditions.
 - (2) Step 2 - Calibration Accuracy Check: A two-point accuracy check of the calibration of each HVAC control system sensing element and transmitter shall be performed by comparing the SNVT output from the DDC Hardware the sensor is connected to the actual value of the variable measured at the sensing element. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensor accuracy. The calibration of the test instruments shall be traceable to National Institute Of Standards And Technology standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-DDC system readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

(3) Step 3 - Actuator Range Check: With the system running, a signal shall be applied to each actuator through the DDC Hardware controller. Proper operation of the actuators and positioners for all actuated devices shall be verified and the signal levels shall be recorded for the extreme positions of each device. The signal shall be varied from live zero to full range, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. Where applicable, it shall be verified that all sequenced actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.

c. Weather Dependent Test: Weather dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the actual results shall be verified in the appropriate season. Test Report: Upon completion of the Start-Up Test, the Contractor shall prepare and submit a Start-Up and Start-Up Testing Report documenting the results of the tests performed and certifying that the system is installed and functioning per this specification, and is ready for the Performance Verification Test (PVT).

3.7 PERFORMANCE VERIFICATION TEST (PVT)

3.7.1 PVT Procedures

The performance verification test procedures shall explain, step-by-step, the actions and expected results that will demonstrate that the control system performs in accordance with the sequences of operation, and other contract documents. [The PVT shall include a one-point accuracy check of each sensor.][The PVT shall include inlet and outlet air temperature measurements for all AHU-dependent terminal units.]The PVT Procedure shall describe a methodology to measure and trend the network bandwidth usage on the network backbone and compare it to the Bandwidth Usage Calculation submittal. A control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

3.7.2 PVT Execution

The Contractor shall demonstrate compliance of the control system with the contract documents. Using test plans and procedures approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall measure and trend the Network Bandwidth Usage and compare it to the Bandwidth Usage Calculation submittal. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on Government approval of the Start-Up and Start-Up Testing Report and completion of balancing. The tests shall not be conducted during scheduled seasonal off periods of base heating and cooling systems.

3.7.3 PVT Report

Contractor shall prepare a PVT report documenting all tests performed during the PVT and their results. The PVT report shall include all tests in the PVT Procedures and any

other testing performed during the PVT. Failures and repairs shall be documented with test results.

3.8 TRAINING

A training course shall be conducted on site for [5] operating staff members designated by the Government in the maintenance and operation of the system, including specified hardware and software. The training period, for a total of [36][] hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site and the Government reserves the right to videotape the training sessions for later use. Audiovisual equipment and [5] sets of all other training materials and supplies shall be provided. A training day is defined as 8 hours of classroom instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility.

3.8.1 Training Documentation

The Contractor shall prepare training documentation consisting of:

- a. Course Attendee List: A List of course attendees which shall be developed in coordination with and signed by the [HVAC] shop supervisor.
- b. Training Manuals: Training manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Where the Contractor presents portions of the course material by audiovisuals, copies of those audiovisuals shall be delivered to the Government as a part of the printed training manuals. Training manuals shall be delivered for each trainee with two additional copies delivered for archival at the project site.
- c. Quick Reference Commissioning Guide: Training manuals shall include a step by step quick reference commissioning guide for all DDC hardware that has a TP/FT-10 transceiver and a NodeID. Quick reference guide shall be clearly labeled identifying the hardware it references.

3.8.2 Training Course at site Content

For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, the layout and location of each controller enclosure, the layout of one of each type of unitary equipment and the locations of each, the location of each control device external to the panels, preventive maintenance, troubleshooting, diagnostics, calibration of sensors, adjustment, commissioning, tuning, repair procedures, use of LNS Plug-ins, use of BPOC software and use of the GPPC Programming software . Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the Start-Up and Start-Up Testing Report shall be presented as benchmarks of HVAC control system performance by which to measure operation and

maintenance effectiveness.

3.8.3. Training off site.

A training course shall be conducted for 2 operating staff members designated by the contracting officer at the DDC controls manufacture training facility in the maintenance and operation of the DDC system, including specified hardware and software. The training period shall be a total of 36 hours of normal working time, shall be conducted within 30 day after successful completion of the performance verification test. The training shall be conducted at the controls equipment suppliers factory authorized training center. Audiovisual equipment and 2 sets of all other training supplies and materials shall be provided. A training day is defined as 8 hours of classroom instruction, including 2 fifteen minute breaks and excluding lunch time, Monday through Friday, during the daytime shift in effect at the training facility. The Contractor shall provide all per diem and transportation from the 2 operating staff members place of residence to the training site and all return transportation from the training site to the 2 staff members place of residence. The contractor shall provide all meals , rooms and accessories for training the 2 operating staff members.

3.8.3.1 Off site training course content at Controls manufacture training facility.

For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, commissioning, tuning, repair procedures, use of LNS Plug-ins, ANSI/EIA 709.1B Network configuration Tool, use of BPOC software and hardware, Central workstation PC monitoring and control software and use of the GPPC Programming software. Instructors shall be U.S. citizens.

3.9 Points Schedule Drawing Instructions

DRAWING INSTRUCTIONS

Points Schedule

Overview

The Points Schedule conveys a great deal of information critical to the design, installation, and subsequent performance of the control system. It includes hardware input/output information, device ranges and settings, ANSI 709.1 communications protocol data, and information about data that is to be used at the operator workstation by the Monitoring and Control software.

Some columns in the Points Schedule relate to functionality provided by the Monitoring and Control (M&C) Software. These columns indicate SNVTs which the building (DDC) Contractor must provide for use by the UMCS. When the building system is then

integrated into a UMCS, these columns tell the UMCS Contractor what functionality to configure at the M&C Software.

DDC Contractor Instructions:

THE CONTRACT DRAWING POINTS SCHEDULES ASSUME THAT THE ENTIRE SEQUENCE OF OPERATION IS PERFORMED IN A SINGLE PIECE OF DDC HARDWARE. IN CASES WHERE MULTIPLE PIECES OF DDC HARDWARE ARE USED (INCLUDING ANSI-709.1 SENSORS AND ACTUATORS), SEPARATE THE POINTS SCHEDULE INTO SEPARATE TABLES EACH WITH ITS OWN HEADER INFORMATION (SEE BELOW) SO THAT EACH PIECE OF DDC HARDWARE HAS A TABLE DEDICATED TO IT. ALL TABLES FOR A SINGLE SEQUENCE OF OPERATION SHALL BE ON A SINGLE DRAWING WHICH MAY SPAN MULTIPLE SHEETS. SHOW COMMUNICATION BETWEEN MULTIPLE PIECES OF DDC HARDWARE PERFORMING A COMMON SEQUENCE THROUGH THE USE OF NVI AND NVO ENTRIES IN THE I/O COLUMN (SEE I/O COLUMN INSTRUCTIONS BELOW), ADDING ROWS TO THE TABLE(S) AS NEEDED.

POINT SCHEDULES ARE NOT REQUIRED FOR THE ALARM GENERATION SEQUENCE OF OPERATION; THE ONLY INFORMATION REQUIRED FOR THIS SEQUENCE IS THE “ALARM GENERATOR DDC HARDWARE INFORMATION” HEADER.

Responsibilities

The designer is responsible for the initial set of Points Schedule entries. The DDC Contractor is responsible for the bulk of the entries and submits the Points Schedule as a Design Drawing for government approval, then finalizes it as an as-built submittal. The as-built is then used as a contract drawing for use by the UMCS Contractor. Contractor responsibilities are described in the specifications and in the Points Schedule drawing notes.

- Entries required of the **designer** are shown bracketed as: [___]
- Entries required of the **UMCS Contractor** are shown bracketed as: / ___ /
- Entries required of the **DDC Contractor** are shown bracketed as: < ___ >
- Spaces where no entry is ordinarily required contains a tilde: “ ~ “ (equivalent to an “n/a” or null value)

Many designer or contractor entries have already been filled in on the sample drawings. In these cases, the value is a recommended value that must be verified or changed by the appropriate party (as indicated by the bracket type). Brackets that do not contain values (ie [___], < ___ >, or / ___ /) indicate that an entry is required. When editing the Points Schedules, delete the brackets after verifying/providing the entry. Do not leave cells

blank, instead show the tilde (“~”) to indicate a null value or that no further entry is required.

UMCS and DDC Contractor Instructions:

ENTRIES SHOWN BRACKETED AS: < ___ > ARE REQUIRED ENTRIES FROM THE DDC CONTRACTOR. SOME ENTRIES WITHOUT BRACKETS MAY BE REQUIRED IN SOME INSTANCES AS DESCRIBED IN THESE INSTRUCTIONS.

ENTRIES SHOWN BRACKETED AS: / ___ / ARE REQUIRED ENTRIES FROM THE UMCS CONTRACTOR. SOME ENTRIES WITHOUT BRACKETS MAY BE REQUIRED IN SOME INSTANCES AS DESCRIBED IN THESE INSTRUCTIONS.

SPACES WHERE NO ENTRY IS ORDINARILY REQUIRED CONTAINS A TILDE: “~ “ (EQUIVALENT TO AN “N/A” OR NULL VALUE)

WHEN AN ENTRY APPEARS INSIDE OF BRACKETS, IT IS A RECOMMENDED ENTRY THAT MUST BE VERIFIED OR CHANGED BY THE APPROPRIATE PARTY (AS INDICATED BY THE BRACKET TYPE). WHEN EDITING THE POINTS SCHEDULES, DELETE THE BRACKETS AFTER VERIFYING/PROVIDING THE ENTRY. DO NOT LEAVE CELLS BLANK, INSTEAD SHOW THE TILDE (“~”) TO INDICATE A NULL VALUE OR THAT NO FURTHER ENTRY IS REQUIRED.

Points Schedule Description and Instructions

Points Schedule columns and entries are described below. In each case, designer responsibilities are described, followed by the Contractor responsibilities.

Header Information

DDC Hardware Identifier

A unique identifier is used to identify the control hardware device on the Points Schedule, Control System Schematic and other drawings and helps to maintain consistency between drawings. Note that this DDC Hardware identifier is different than the NodeID and the Node field of the address, which are described below.

DDC Contractor Instructions:

DDC HARDWARE IDENTIFIER: SHOW THE IDENTIFIER FOR EACH PIECE OF DDC HARDWARE. MAINTAIN CONSISTENCY AND UNIQUENESS OF DDC HARDWARE IDENTIFIERS BETWEEN ALL DRAWINGS.

DDC Hardware Location

Physical location of the DDC Hardware, minimally this is the room number the DDC Hardware is located in.

DDC Contractor Instructions:

DDC HARDWARE LOCATION: SHOW THE PHYSICAL LOCATION OF THE DEVICE. LOCATION SHALL INCLUDE THE BUILDING AND ROOM NUMBER AND MAY ALSO INCLUDE FURTHER INFORMATION SUCH AS ENCLOSURE/PANEL IDENTIFICATION.

Node Address

The logical address of the node (DDC Hardware) on the network, which consists of three fields: domain, subnet, and node.

DDC Contractor Instructions:

NODE ADDRESS: USE THE DOMAIN VALUE AND SUBNET RANGES SPECIFIED. SHOW THE DOMAIN, SUBNET AND NODE ADDRESSES FOR ALL DEVICES ON THE NETWORK.

Node ID

A unique 48-bit identifier assigned (at the factory) to each ANSI-709.1 device. Sometimes called the Neuron ID.

DDC Contractor Instructions:

NODE ID: SHOW THE MANUFACTURER SUPPLIED NODE ID FOR EACH DEVICE.

Alarm Generator DDC Hardware Information Header

DDC Contractor Instructions:

ALARM GENERATOR DDC HARDWARE INFORMATION: FOR ALL POINTS REQUIRING AN ALARM, CONFIGURE DDC HARDWARE TO PROVIDE ALARM GENERATION AS SPECIFIED IN SECTION 15951. IF THE ALARM GENERATION IS NOT PERFORMED IN THE DDC HARDWARE CONTAINING THE POINT TO BE ALARMED, SHOW THE DDC HARDWARE IDENTIFIER, LOCATION, ADDRESS AND NODE ID FOR THE DDC HARDWARE PERFORMING THE ALARM GENERATION ON THE POINTS SCHEDULE. IF THE ALARM GENERATION IS PERFORMED IN THE DDC HARDWARE CONTAINING THE POINT TO BE ALARMED, INDICATE THIS BY RECORDING "INTEGRATED" AS THE DDC HARDWARE IDENTIFIER.

General Columns Description and Instructions

Function

Basic description of the function performed by this group of points.

Name

This is the point name.

DDC Contractor Instructions:

NAME COLUMN: SHOW POINT NAMES AS NEEDED AND AS INDICATED BY BRACKETS (<__>). THE NAME SHALL BE CONSISTENT WITH POINT NAMES SHOWN ON ALL OTHER DRAWINGS AND SHALL USE THE ESTABLISHED POINT ABBREVIATIONS.

DDC Contractor Instructions:

NAME COLUMN: USE THE POINT NAMES SHOWN ON THE POINTS SCHEDULE FOR ALL GRAPHIC DISPLAYS

Description

Summary description of the point.

Setting

Shows setpoints and settings related to each point.

DDC Contractor Instructions:

SETTING COLUMN: CONFIGURE DEVICES TO USE THE SETPOINTS AND SETTINGS SHOWN. WHEN A SETPOINT OR SETTING IS NOT SHOWN, USE VALUES IN ACCORDANCE WITH THE SPECIFICATION AND SHOW THE SETPOINT OR SETTING USED. INCLUDE THE APPROPRIATE ENGINEERING UNITS FOR ENTRIES IN THIS COLUMN.

Range

Shows the range of values associated with the point. For example, it could be a zone temperature setpoint adjustment range, a sensor measurement range, occupancy values for an occupancy input, or the status of a safety.

DDC Contractor Instructions:

RANGE COLUMN: CONFIGURE DEVICES TO USE THE RANGES SHOWN. WHEN A RANGE IS NOT SHOWN, USE VALUES IN ACCORDANCE WITH THE SPECIFICATION AND SHOW THE RANGE USED. FOR SENSORS SHOW THE ACTUAL SENSOR RANGE (THIS RANGE MUST AT LEAST ENCOMPASS THE RANGE SPECIFIED IN SECTION 15951). FOR DAMPER ACTUATORS SHOW THE ACTUAL RANGE OVER WHICH THE VALVE OR DAMPER IS ACTUATED. INCLUDE THE APPROPRIATE ENGINEERING UNITS FOR ENTRIES IN THIS COLUMN.

nci/CP Name

The name of the network configuration input (nci) or configuration parameter (CP) for this setting as specified.

DDC Contractor Instructions:

nci/CP NAME COLUMN: ENTRIES IN THIS COLUMN ARE ONLY REQUIRED FOR GENERAL PURPOSE PROGRAMMABLE CONTROLLERS (GPPC) OR APPROVED APPLICATION SPECIFIC CONTROLLERS (ASC) LACKING LONWORKS NETWORK SERVICES (LNS) PLUG-INS. SHOW ALL NETWORK CONFIGURATION INPUTS (nci) OR CONFIGURATION PROPERTIES (CP) THAT RELATE TO THE POINT. FOR CPS OF A USER-DEFINED NETWORK CONFIGURATION PARAMETER TYPE (UCPT), PROVIDE EITHER THE STANDARD NETWORK VARIABLE TYPE (SNVT) THAT RELATES TO THE CP, OR (FOR UCPTS NOT BASED ON A SNVT) PROVIDE DETAILED DESCRIPTIONS OF THE FIELDS AND UNITS OF EACH CP. EXPAND ROWS AND USE ADDITIONAL SHEETS AS REQUIRED TO PROVIDE CONFIGURATION PROPERTY DESCRIPTIONS.

I/O Type

Shows the input/output signal type (if any) associated with the point. Point types can be either hardware I/O:

Analog Input (AI), Analog Output (AO), Binary Input (BI), Binary Output (BO))
or network variable points:

Network Variable Input (NVI), Network Variable Output (NVO).

DDC Contractor Instructions:

I/O TYPE COLUMN: SHOW THE I/O TYPE FOR EACH POINT AS ONE (OR MORE) OF THE FOLLOWING:

- AI FOR ANALOG INPUTS
- AO FOR ANALOG OUTPUTS
- BI FOR BINARY INPUTS
- BO FOR BINARY OUTPUTS
- NVO FOR NETWORK VARIABLE OUTPUTS

- NVI FOR NETWORK VARIABLE INPUTS

IF MORE THAN ONE PIECE OF DDC HARDWARE IS USED TO IMPLEMENT A SEQUENCE AND THE VALUE OF A PHYSICAL INPUT TO ONE IS NEEDED BY THE OTHER, SHOW THE POINT AS BOTH A HARDWARE INPUT (AI OR BI) AND A NETWORK VARIABLE OUTPUT (NVO) ON THE FIRST AND AS A NETWORK VARIABLE INPUT (NVI) TO THE OTHER DDC HARDWARE. SIMILARLY FOR OUTPUTS SHOW A NETWORK VARIABLE OUTPUT (NVO) ON ONE CONTROLLER, AND A NETWORK VARIABLE INPUT (NVI) AND HARDWARE OUTPUT (AO OR BO) ON THE OTHER.

AN ENTRY OF NVO IS ONLY REQUIRED FOR OUTPUTS THAT ARE USED BY ANOTHER PIECE OF DDC HARDWARE; POINTS THAT HAVE SNVTS ONLY FOR DISPLAY OR TRENDING AT AN LDP OR M&C SOFTWARE WORKSTATION ARE ASSUMED TO BE NVOS AND DO NOT NEED AN NVO ENTRY IN THE I/O COLUMN.

FOR EVERY ENTRY OF NVO OR NVI SHOW THE SNVT NAME AND TYPE IN THE SNVT NAME AND SNVT TYPE COLUMNS UNDER LDP AND M&C DISPLAY.

LDP and M&C Display Columns

LDP View Req'd An "X" entry in this column indicates that the point is to be viewable from a Local Display Panel (LDP).

M&C Disp Req'd

An "X" entry in this column indicates that the point is to be displayed on a workstation via Monitoring and Control (M&C) software.

DDC Contractor Instructions:

DDC CONTRACTOR: AN "X" IN THIS COLUMN INDICATES THAT A SNVT FOR THIS POINT MUST BE AVAILABLE FROM THE DDC HARDWARE PERFORMING THE SEQUENCE FOR THIS SYSTEM. PROVIDE A SNVT OUTPUT FOR THESE POINTS AND SHOW THE SNVT NAME AND SNVT TYPE. (SEE INSTRUCTIONS FOR THE "SNVT TYPE" COLUMN)

DDC Contractor Instructions:

DDC CONTRACTOR: AN "X" IN THIS COLUMN INDICATES THAT THE GRAPHICAL DISPLAY FOR THIS SYSTEM MUST DISPLAY THE VALUE OF THIS POINT. UNLESS OTHERWISE APPROVED,

GRAPHIC DISPLAYS SHALL USE THE POINT NAME, AS SHOWN IN THE “NAME” COLUMN, FOR THE POINT.

M&C Trend Req’d

An “X” entry in this column indicates that the point is to be trended by the Monitoring and Control (M&C) software.

DDC Contractor Instructions:

M&C TREND REQ’D COLUMN: FOR ALL POINTS WITH AN X IN THIS COLUMN A SNVT FOR THIS POINT SHALL BE AVAILABLE. PROVIDE A SNVT OUTPUT FOR THESE POINTS AND SHOW THE SNVT NAME AND SNVT TYPE. (SEE INSTRUCTIONS FOR THE “SNVT TYPE” COLUMN)

DDC Contractor Instructions:

M&C TREND REQ’D COLUMN: FOR ALL POINTS WITH AN “X” IN THIS COLUMN, SET UP A TREND AT THE M&C SOFTWARE AS SPECIFIED.

SNVT Type

DDC Contractor Instructions:

SNVT TYPE COLUMNS: IF THE SNVT TYPE IS SHOWN ON THE POINT SCHEDULE CONTRACT DRAWING, THE PROVIDED SNVT SHALL BE OF THIS TYPE. IF NECESSARY, A SNVT TYPE TRANSLATOR MAY BE USED TO CONVERT TO THIS SNVT TYPE. IF THE USE OF A TYPE TRANSLATOR RESULTS IN THE SHARING OF A SNVT BETWEEN DDC HARDWARE, IT MUST BE DOCUMENTED ON THE POINTS SCHEDULES. WHERE NO SNVT TYPE IS SHOWN, SHOW THE SNVT TYPE.

FOR ALARMS, SHOW THE SNVT TYPE FOR THE ALARM OUTPUT OF THE DDC HARDWARE PERFORMING THE ALARM GENERATION.

Overrides Columns

LDP Ovr’d Req’d An “X” entry in this column indicates that the point can be overridden (adjusted) from a Local Display Panel (LDP).

DDC Contractor Instructions:

DDC Contractor Instructions:

LDP OVRD REQ'D COLUMN: FOR ALL POINTS WITH AN X IN THIS COLUMN PROVIDE A SNVT INPUT BY WHICH THE VALUE OF THE POINT CAN BE OVERRIDDEN. SHOW THE SNVT NAME AND TYPE FOR EACH POINT REQUIRING AN OVERRIDE.

M&C Ovr'd Req'd

An “X” entry in this column indicates that the point can be overridden (adjusted) from an operator workstation.

DDC Contractor Instructions:

M&C OVRD REQ'D COLUMN: FOR ALL POINTS WITH AN X IN THIS COLUMN USE THE SNVT NAME AND TYPE SHOWN TO PROVIDE OVERRIDE CAPABILITY. CONFIGURE THE M&C SYSTEM DISPLAYS TO ALLOW AN OPERATOR TO OVERRIDE THESE POINTS AS SPECIFIED.

Alarms Columns

Alarm Condition

This column shows the conditions under which an alarm occurs.

DDC Contractor Instructions:

ALARM CONDITION COLUMN: PROVIDE A NETWORK VARIABLE OF TYPE SNVT_ALARM OR SNVT_ALARM_2 FOR EACH POINT WITH AN ALARM CONDITION. CONFIGURE THE ALARM SNVT TO HAVE A PRIORITY OF 0 FOR ALARMS WITH AN ENTRY OF “INFO” IN THE ALARM PRIORITY COLUMN, AND A PRIORITY OF 3 FOR ALARMS WITH AN ENTRY OF “CRIT” IN THE ALARM PRIORITY COLUMN. FOR ALL ALARMS WITH AN “X” IN THE BUILDING ROUTING REQ'D COLUMN, BIND THIS ALARM SNVT TO THE DDC HARDWARE PERFORMING THE REDUNDANT ALARM HANDLING (SEE BUILDING ROUTING REQ'D COLUMN INSTRUCTIONS).

Alarm Priority

This column shows the priority for alarms as either Critical (CRIT) or Informational (INFO). As specified critical alarms remain in alarm until acknowledged by an operator and the alarm condition no longer exists; informational alarms shall remain in alarm until the alarm condition no longer exists or until the alarm is acknowledged.

DDC Contractor Instructions:

ALARM PRIORITY COLUMN: SEE ALARM CONDITION COLUMN

DDC Contractor Instructions:

ALARM PRIORITY COLUMN: WHEN CONFIGURING THE ALARM HANDLING AT THE M&C SOFTWARE, USE THE ALARM PRIORITY SHOWN TO DETERMINE IF THE ALARM IS CRITICAL (CRIT) OR INFORMATIONAL (INFO).

M&C Routing Name

This column shows the alarm routing that is to be used for each alarm. The entry in this column corresponds to an Alarm Routing Group as shown on the Alarm Routing Schedule drawing.

UMCS Contractor Instructions:

M&C ROUTING NAME COLUMN: CONFIGURE ALARM HANDLING AT THE M&C SERVER ACCORDING TO THE ALARM ROUTING SHOWN ON THE POINTS SCHEDULE, THE ALARM ROUTING SCHEDULES AND AS SPECIFIED.

Bldg Routing Req'd

An X in this column indicates that the redundant alarm handling is required for this alarm. Redundant alarms are primarily used for (extremely) critical processes and are intended to be redundant with alarms sent to a UMCS such that in the event the UMCS is 'down' an alarm will still be sent.

DDC Contractor Instructions:

BLDG ROUTING REQ'D COLUMN: PROVIDE REDUNDANT ALARM HANDLING AS SPECIFIED FOR EACH ALARM WITH AN X IN THIS COLUMN. SEE ALARM CONDITION COLUMN.

Points Schedule Application Notes

These notes describe Points Schedule entries for specific rows shown in the Schedule.

Analog and Binary Inputs

Any analog input (AI) or binary input (BI) can be viewed from an LDP or displayed using M&C software at a workstation, but AI's and BI's should not be overridden from an LDP or workstation. In the event an AI or BI must be overridden, such as during start-up testing, it can be overridden using a network configuration tool.

System Reset Button (RST-BUT)

The activation of any safety will result in system shutdown. The system remains shutdown until manually reset devices are reset and the system RST-BUT as a binary input (BI) local to the DDC controller is pressed. Reset could also be performed from a workstation or local display panel (LDP) using a network variable input (NVI) SNVT.

DDC Contractor Instructions:

SYSTEM RESET BUTTON (RST-BUT): IF THE “I/O TYPE” COLUMN CONTAINS “BI”, THE SYSTEM MUST BE CAPABLE OF BEING RESET VIA A LOCAL HARDWARE PUSH-BUTTON.

IF THERE IS AN “X” IN THE LDP OVRD REQ'D OR M&C OVRD REQ'D COLUMN, THE SYSTEM MUST ALSO BE CAPABLE OF BEING RESET VIA SNVT INPUT (SEE INSTRUCTIONS FOR M&C OVRD REQ'D AND LDP OVRD REQ'D COLUMNS)

DDC Contractor Instructions:

SYSTEM RESET BUTTON (RST-BUT): IF THERE IS AN AN “X” IN M&C OVRD REQ'D COLUMN, CONFIGURE M&C SOFTWARE GRAPHIC DISPLAYS TO PROVIDE SYSTEM RESET CAPABILITY.

System Occupancy (SYS-OCC)

Most systems will obtain their occupancy mode command (OCC, UNOCC, Warm-up/Cool-down) from a System Scheduler. The occupancy mode for the system is overridden via an override input to the System Scheduler, not to the DDC Hardware performing the specific system sequence of operations, so the system should never have an ‘X’ in either the M&C or LDP Override columns.

Systems which do not require scheduling will not have a SYS-OCC row shown on the Points Schedule. For example, many infrared heating systems operate according to a manual on/off or occupancy sensor.

DDC Contractor Instructions:

SYSTEM OCCUPANCY (SYS-OCC): SHOW OCC, UNOCC, WUCD (WARM-UP/COOL-DOWN) IN THE RANGE COLUMN BASED ON THE SYSTEM-SPECIFIC SEQUENCE OF OPERATIONS AND OCCUPANCY SCHEDULE.

Systems that do not require scheduling should not have the SYS-OCC row shown in the Points Schedule. One example might be Infrared heating systems where the occupancy mode of the IR system is dictated by the occupant via manual system on/off control or via an occupancy sensor.

Zone Occupancy (ZN-OCC) and Effective Occupancy (EFF-OCC)

The operational mode (occupied or unoccupied) of a piece of DDC Hardware used to provide environmental control of a space or zone can be dictated by either the System Scheduler (SYS-OCC) or by a binary input (BI) occupancy signal from the zone (ZN-OCC). This BI occupancy signal (ZN-OCC) can be from either an occupancy sensor or from an (occupant accessible) push button.

The EFF-OCC signal is a network variable output (NVO) from the DDC Hardware (controller) which indicates the current operational mode for the system. This output is used for monitoring of the system and (for terminal units requiring air handler service) as an input to the System Scheduler to allow the System Scheduler to place the serving AHU into occupied mode.

LDP View and Override

Minimum Outside Air Flow

The minimum outside air flow is the quantity of outside air required for fresh air or for makeup. Where the outside air flow is controlled using DDC Hardware, an air flow measurement array, and a flow control damper, this is shown as the minimum outside air flow setpoint (MINOA- F-SP). Otherwise (where there is no closed loop control), the minimum OA flow quantity is shown in the Points Schedule as “Minimum Outside Air Flow Setting”. It does not have a point NAME because it is not an actual signal (not measured using an installed sensor).

DDC Contractor Instructions:

MINIMUM OUTSIDE AIR FLOW: FOR SYSTEMS CONTROLLING TO A MINOA SETPOINT, USE THE MINOA-F-SP SHOWN WHEN CONFIGURING THE DDC HARDWARE PERFORMING THE SEQUENCE OF OPERATION. FOR OTHER SYSTEMS SET THE MINIMUM OUTSIDE AIR FLOW TO THE MINIMUM OUTSIDE AIR FLOW SETTING SHOWN AS SPECIFIED.

PID Loop Settings

The PID Loop Settings are all the settings required to configure PID control, including but not limited to the P, I and D gains, deadbands and reset schedules.

DDC Contractor Instructions:

PID LOOP SETTINGS: SHOW ALL PID LOOP SETTINGS IN THE SETTINGS COLUMN, INCLUDING ENGINEERING UNITS FOR EACH SETTING. ADJUST ROW HEIGHT AS NEEDED TO SHOW ALL PID SETTINGS.

Filters

Unit Status

The Unit Status point indicates if the system is operating in heating/cooling mode. This status is used as a monitored point at the M&C Software and as a heating/cooling request to a chiller, boiler or heat exchanger. For systems other than heat exchangers, a network variable of type SNVT_HVAC_STATUS is used for this point and the range shown for

this point applies to the mode Field of the SNVT. For heat exchangers a network variable of type SNVT_SWITCH is used.

Heating Request and Cooling Request

DDC Hardware controlling chillers, boilers and heat exchangers receive Unit Status inputs from their serviced equipment in the form of heating/cooling requests. The Chiller, Boiler or Heat Exchanger System Enable schedule shows under what conditions the equipment will be enabled.

APPENDIX A

QC CHECKLIST

DPW DIRECT DIGITAL CONTROL QC CHECKLIST

This checklist is not all-inclusive of the requirements of this specification and should not be interpreted as such.

Initial each item in the space provided (|____|) verifying that requirement has been met. Items should be verified for Closeout:

1. DDC contractor has met AR 25 security requirements for loading and configuring software on government owned computer equipment. |____|
2. All DDC Hardware (nodes) are numbered on Control System Schematic Drawings. |____|
3. Signal lines on Control System Schematic are labeled with the signal type. |____|
4. Local Display Panel (LDP) Locations are shown on Control System Schematic drawings|____|.
5. Points Schedule drawings have been sub-divided by device (DDC Hardware), including DDC Hardware node numbers |____|.
6. All DDC Hardware as shown is installed on a TP/FT-10 local control bus. |____|
7. All Application Specific Controllers (ASCs) are LonMark certified. |____|
8. Communication between DDC Hardware is only via ANSI/EIA 709.1B using SNVTs. Other protocols and network variables other than SNVTs have not been used. |____|
9. Explicit messaging has not been used. |____|
10. System Scheduler functionality has been installed for all HVAC systems and default schedules have been configured at each System Scheduler.
 - (a) AHU Schedules |____|
 - (b) VAV Terminal Unit Schedules |____|

- (c) Cabinet Unit heater Schedule |____|
 - (d) Unit Heater Schedule |____|
 - (e) Fan Coil Unit Schedule |____|
11. All sequences are performed as specified using DDC Hardware. |____|
12. On site Training schedule dates and course attendee list has been developed and coordinated with DPW maintenance shops and submitted. |____|
13. Off site Training schedule dates and course attendee list has been developed and coordinated with course attendee's and submitted. |____|
14. Building Point of Connection(BPOC) requirements are completed as specified and shown..
- (a) Graphic's completed as specified. |____|
 - (b) System Schedule's configured as specified. |____|
 - (c) Datalogs have been configured as specified. |____|
 - (d) IP 852 routing has been licensed, configured and enabled as specified. |____|
 - (e) All Software and license has been submitted to DPW systems manager. |____|
 - (f) FTP password is set|____|
 - (g) User passwords have been configured. |____|
 - (h) Correct Channel Mode: IP 852 standard|____|
 - (i) Is RNI used in conjunction with IP-852|____|
 - (k) IP 852 enabled in Visio|____|
15. CPU hardware and has been installed as specified.
- (a) CPU enclosure. |____|
 - (b) UPS installed. |____|
 - (c) Circulation fan and louvers. |____|
 - (d) RJ-45 jack installed in enclosure. |____|
16. LNS Plug-ins have been loaded on required computer hardware and validated. |____|
17. LNS Database loaded and configured on required computer hardware. |____|
18. Programming software for each type of General Purpose Programmable Controller (GPPCs) has been installed on required computer hardware and validated.
19. LNS Plug-ins have been submitted on CD-ROM to the DPW Systems Manager, and licensed for all ASCs.
20. Programming software for each type of General Purpose Programmable Controller (GPPCs) has been submitted on CD-ROM to DPW Systems manager and licensed to the project site as shown |____|
21. Server software has been licensed and submitted to the DPW systems manager.

(7-08-08)

22. Two (2) copies on CD-ROM of Installed GPPC Application programs shall be submitted as a technical data package to the DPW Systems Manager for each model of DDC Hardware provided under this specification. CD-ROM shall include list or table of contents.

23. Two (2) copies on CD-ROM of External interface files (XIF files) shall be submitted as a technical data package to DPW Systems Manager for each model of DDC Hardware provided under this specification. CD-ROM shall include a table of contents.

24. Two(2) copies on CD-ROM of the LonWorks Network Services (LNS) Database for each building control network has been submitted to DPW Systems manager and is up-to-date and accurately represents the final installed system. CD-ROM shall be clearly marked identifying job and bldg. number(s).

25. All software has been licensed to U.S.Army with Fort Leonard Wood DPW Systems Manager as the agent and turned over to the DPW Systems Manager located in bldg. 2200

26. A software list for all software used on this project with version, type and all software passwords have been provided to the DPW systems manager.(03-05-08)

27. 5 copies of O&M Instructions including software users manuals, indexed and in booklet form have been completed and submitted.

28. Laminated copy of Final as built drawings in data pocket of control enclosures.

29. 5 copies of Final As-built Drawings, including the Points Schedule drawing completed as specified, drawings accurately represent the final installed system.

30. 2 copies of the as built drawings submitted on a labeled CD-ROM in Microstation or Autocad format.

30. On site training course has been completed.

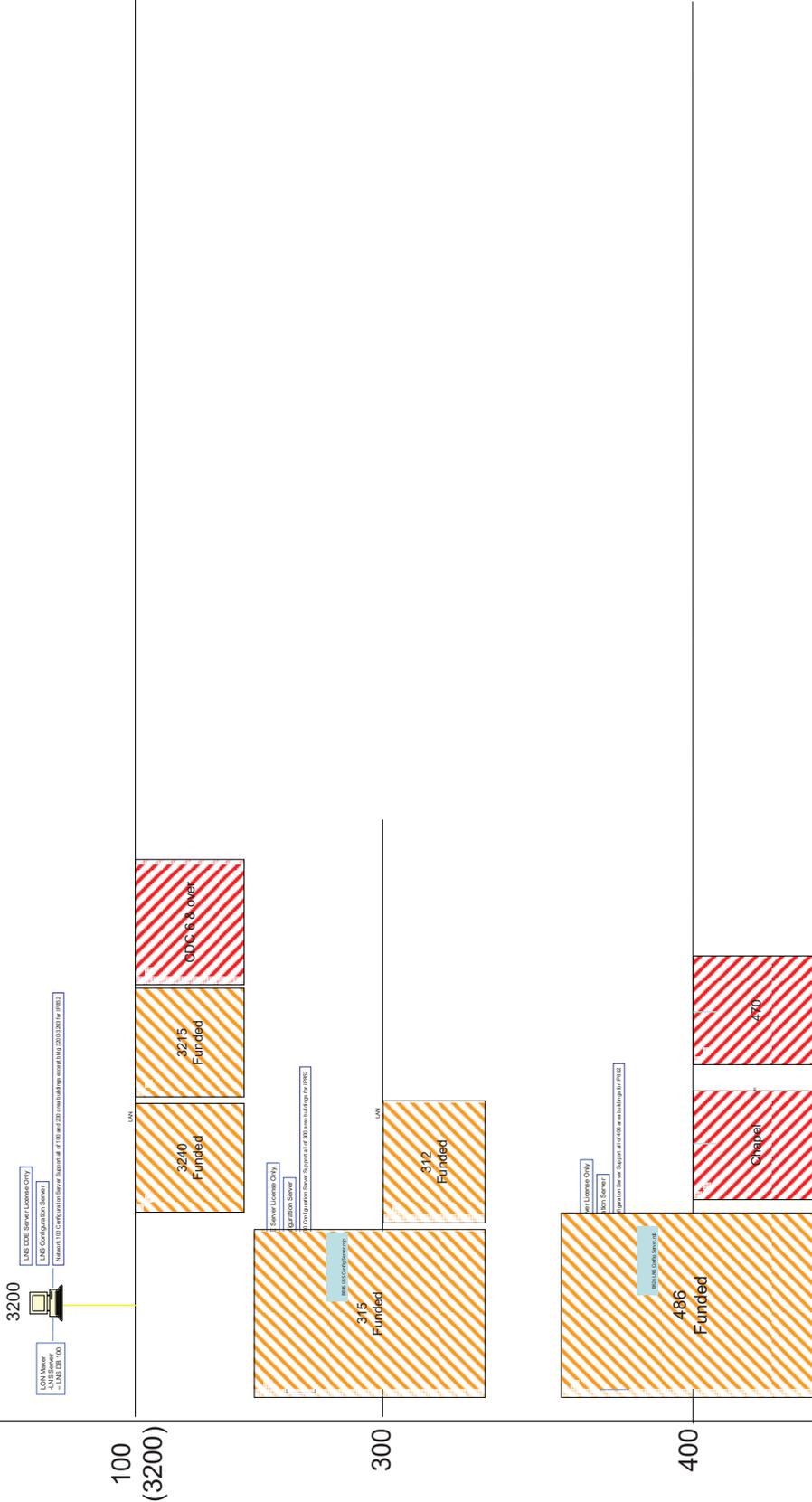
31. Off site training has been completed.

(QC Representative Signature) (Date)

FLW Lonworks DDC Enterprise Configuration

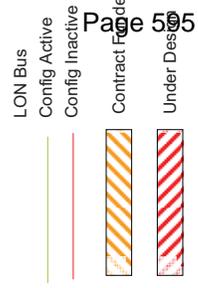
[DDC Sharepoint site](#)

Continue on page 1



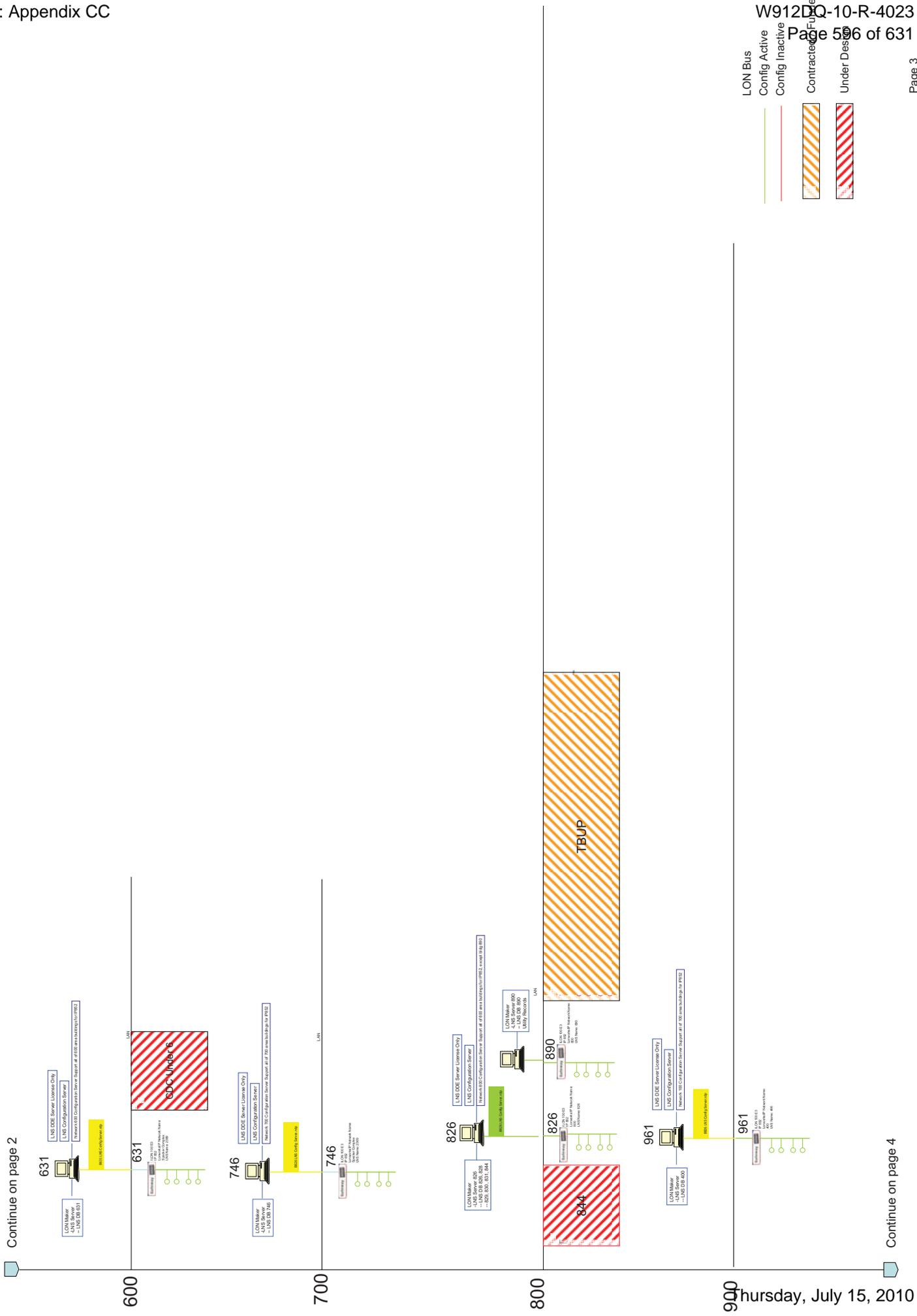
Thursday, July 15, 2010

Continue on page 3



FLW Lonworks DDC Enterprise Configuration

[DDC Sharepoint site](#)



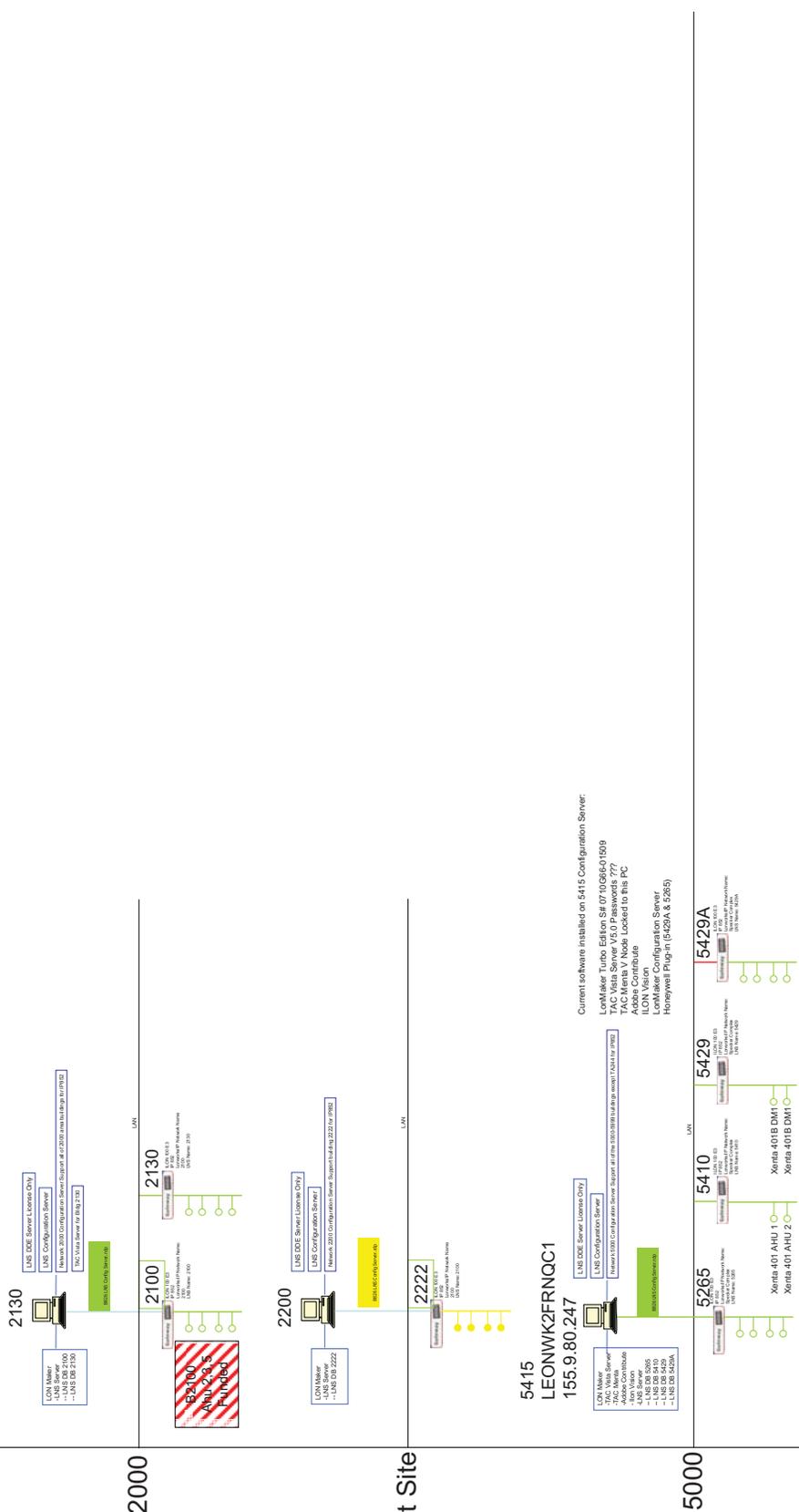
Continue on page 2

Continue on page 4

FLW Lonworks DDC Enterprise Configuration

[DDC Sharepoint site](#)

Continue on page 4



Thursday, July 15, 2010

Continue on page 6

Legend for configuration status:

- LON Bus: Green line
- Config Active: Red line
- Config Inactive: Yellow line
- Contract For: Yellow hatched box
- Under Des: Red hatched box

FLW Lonworks DDC Enterprise Configuration

[DDC Sharepoint site](#)

Continue on page 5

| |
|------|
| 500 |
| 1100 |
| 1200 |
| 1300 |
| 1400 |
| 1500 |
| 1900 |
| 2200 |
| 2300 |

Thursday, July 15, 2010

- LON Bus
- Config Active
- Config Inactive
- Contract Filled
- Under Design

APPENDIX DD
Project Specific Requirements

PROJECT SPECIFIC REQUIREMENTS

1. Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

2. AVAILABILITY AND USE OF UTILITY SERVICES

a. Payment for Utility Services

All temporary utility connections and services for site trailers, field offices, construction power, etc., shall be at the Contractor's expense. The utility usage during construction, and until the time of beneficial occupancy by the Government, shall be paid for by the Contractor at the prevailing rates charged by the Government, or where the utility is produced by the Government, at reasonable rates as determined by the Contracting Officer. The Contractor shall carefully conserve utilities, if any, that are furnished without charge. The Contractor shall establish a Utilities Sales Agreement with the DPW Energy Branch 15 working days before final connection of any utility is desired. Contractor must contact the DPW Energy Branch at 573-596-0645 with the following information to establish a utility sales contract:

- a. Company Name
- b. POC on-site
- c. POC for signing contract (must be an authorized person to sign a legal document on behalf of the company.
- d. Company Address
- e. Company Phone Number
- f. On-site Phone Number
- g. E-mail Address
- h. Location of Work

Once contract is signed the DPW Energy Branch will email the utility company with authorization to provide utilities to your company.

b. Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary connections, distribution lines, and meter bases and meters required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall make arrangements with the post Utilities Officer before final electrical connection is desired so that a utilities contract can be established. The Contractor shall provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The temporary plan shall be submitted for approval in accordance with EM 385-1-1.

c. Advance Deposit

An advance deposit is not required for the utilities usage that is to be paid to the Government. However, a deposit, or upfront payment, may be required by the Utility for the connection fee to a non-Government distribution system.

d. Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. The Contractor shall then remove all the temporary distribution lines, meter bases, and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

3. Project and Safety Signs

The requirements for the signs, their content, and location shall be as shown on the examples provided at the end of this section. The signs shall be erected within 15 days after receipt of the notice to proceed. The data required by the safety sign shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

4. CONTRACTOR'S TEMPORARY FACILITIES

a. Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

b. Storage Area

The Contractor shall construct a temporary 6 foot high chain link fence around trailers and materials. The fence shall include plastic strip inserts so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

c. Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

d. Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

e. Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

f. New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F, shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges up to a maximum of \$75.00 per month.

g. Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

5. GOVERNMENT FIELD OFFICE

a. Resident Engineer's Office

The Contractor shall furnish bottled drinking water with cooler.

There shall be two private offices, one at each end of the facility. Each private office shall be furnished with one desk, two office chairs, two cushioned fold up chairs, and one four drawer legal size file cabinet.

The center area between the offices shall be a conference area furnished with a minimum 16' x 3' conference table and 12 chairs. The center area will also have one

desk with office chair. The center area shall also be provided with one plans rack with a minimum of 10 rack clips and a minimum 6' x 2.5' plan table.

The entire facility including the furniture provided by the Contractor will remain the property of the Contractor and shall be removed from the site no sooner than 30 calendar days after completion of the work.

6. TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

7. CLEANUP

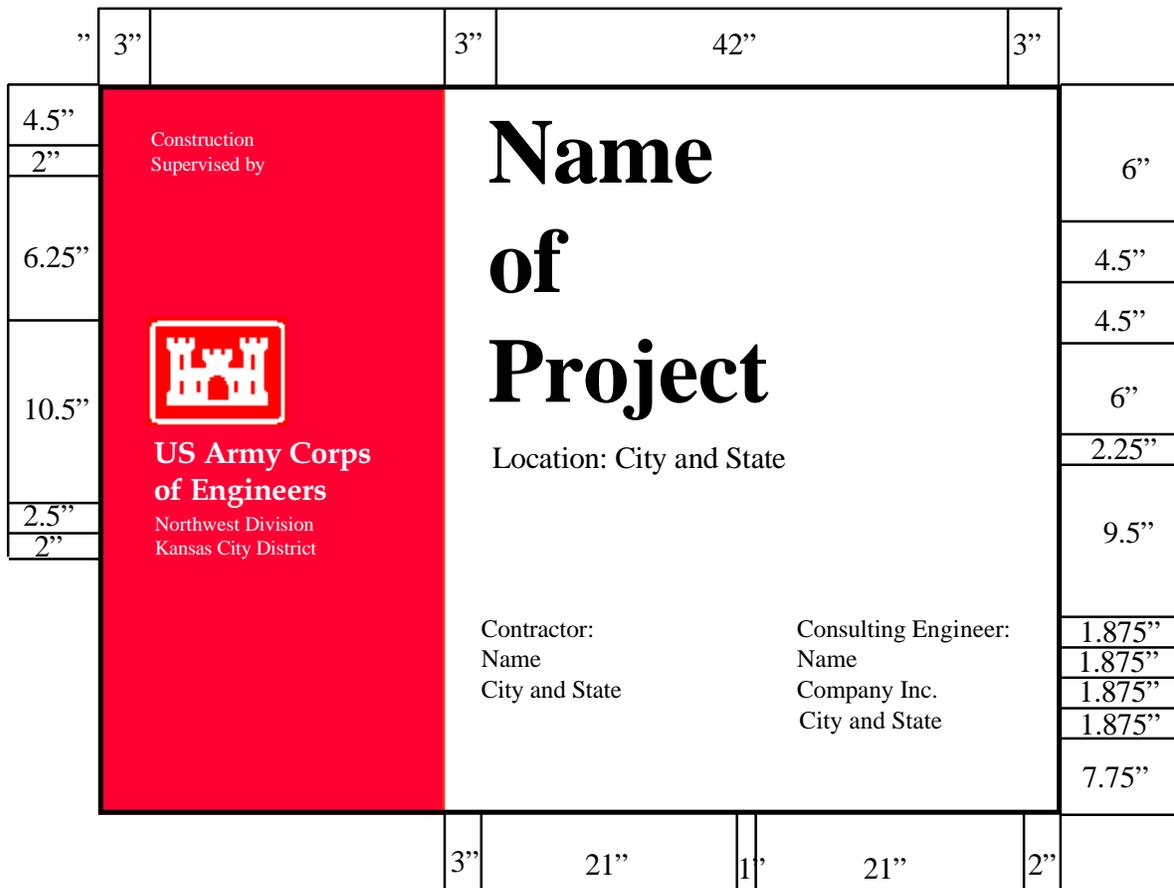
Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

8. RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

The graphic format for this 4'x 6' sign panel follows the legend guidelines and layout as specified below. The large 4'x 4' section of panel on the right is to be white with black legend. The 2'x 4' section of the sign on the left with the full Corps signature (reverse version) is to be screen printed Communications Red on the White background.

This sign is to be placed with the Safety Performance Sign (See Fig. 2).



Legend Group 1: One to two-line description of Corps relationship to project
 Color: White
 Typeface: 1.25" Helvetica Regular
 Maximum line length: 19"

Legend Group 2: Division\ District Name Placed below 10.5" Reverse Signature (6" Castle).
 Color: White
 Typeface: 1.25" Helvetica Regular

Legend Group 3: One- to three-line project title legend describes the work being done under this contract.
 Color: Black
 Typeface: 3" Helvetica Bold
 Maximum line length: 42"

Legend Group 4: One- to two-line identification of project or facility (civil works) or name of sponsoring department (military).
 Color: Black
 Typeface: 1.5" Helvetica Regular
 Maximum line length: 42"

Cross-align the first line of Legend Group 4 with the first line of the Corps Signature (US Army Corps) as shown.

Legend Groups 5a-b: One- to five-line identification of prime contractors including: type (architect, general contractor, etc.), corporate or firm name, city, state. Use of Legend Group 5 is optional.
 Color: Black
 Typeface: 1.25" Helvetica Regular
 Maximum line length: 21"

All typography is flush left and rag right, upper and lower case with initial capitals only as shown. Letter- and word-spacing to follow Corps standards

| Sign Type | Legend Size | Panel Size | Post Size | Specification Code | Mounting Height | Color Bkg/Lgd |
|-----------|-------------|------------|-----------|--------------------|-----------------|---------------|
| CID-01 | Various | 4' x 6' | 4' x 4' | HDO-3 | 48" | WH-RD/BK |

CONSTRUCTION SIGN (CORPS OF ENGINEERS DESIGN)
 (Use with Fig 2)

Fig. 1
 Thursday, July 15, 2010

SAFETY PERFORMANCE SIGN

Each contractor's safety record is to be posted on Corps managed or supervised construction projects and mounted with the construction project identification sign.

The graphic format, color, size and typefaces used on the sign are to be reproduced exactly as specified below. The title with First Aid logo in the top section of the sign and the performance record captions are standard for all signs of the type. Legend Groups 2 and 3 below identify the project and the contractor and are to be placed on the sign as shown.

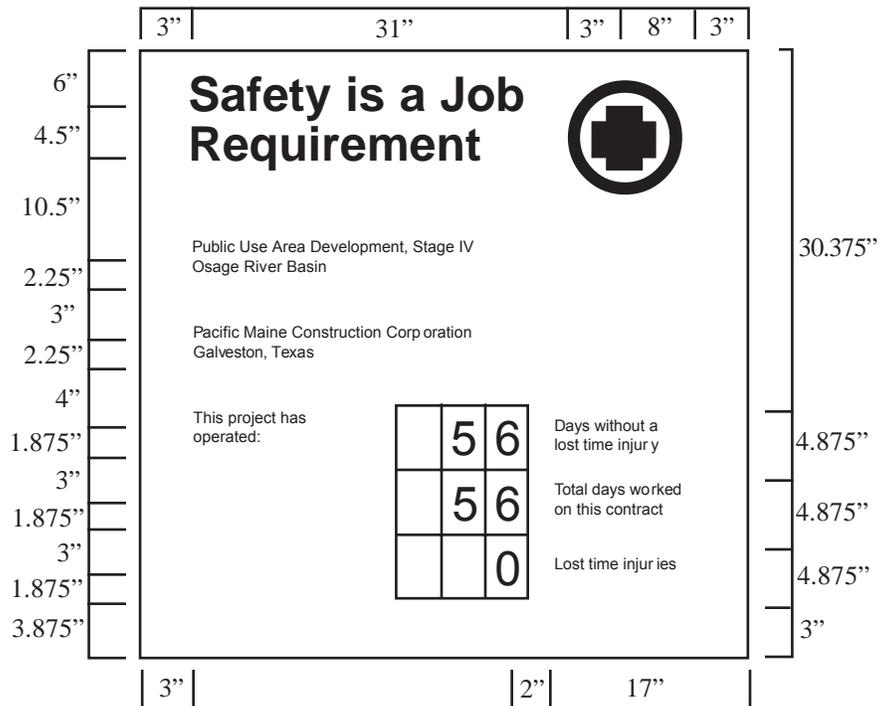
Safety record numbers are mounted on individual metal plates and are screw mounted to the background to allow for daily revisions to posted safety performance record.

Legend Group 1: Standard two-line title "Safety is a Job requirement" with (8 od.) Safety Green First Aid logo.
Color: to match PMS 347
Typeface: 3" Helvetica Bold
Color: Black

Legend Group 2: One to two-line project title legend describes the work being done under this contract and name of host project.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

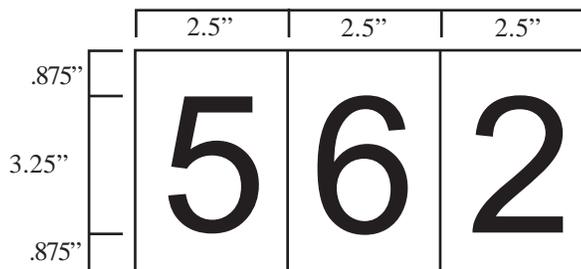
Legend Group 3: One to two-line identification; name of prime contractor and city, state address.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 4: Standard safety record captions as shown.
Color: Black
Typeface: 12.5" Helvetica Regular



| Sign Type | Legend Size | Panel Size | Post Size | Specification Code | Mounting Height | Color Bkg/Lgd |
|-----------|-------------|------------|-----------|--------------------|-----------------|---------------|
| CID-02 | Various | 4' X 4' | 4" X 4" | HDO-3 | 48" | WH/BK - GR |

Replaceable numbers are to be mounted on white .060 aluminum plates and screw-mounted to background.
Color: Black
Typeface: 3" Helvetica Regular
Plate size: 2.5" X 5"



All typography is flush left and rag right. Upper and lower case with initial capitals only as shown. Letter - and word - spacing to follow Corps standards.

Appendix EE
Interior Furnishing Standards

Following is an excerpt from the Ft. Leonard Wood Installation Design Guide

J.1 FINISH STANDARDS

Each building needs to have its own identity, which will orient visitors to the installation. Standardized finishes provide a unifying element and are important for administrative and financial reasons. They provide flexibility, are easier to manage and are more cost effective.

Since it is not possible to change to new standards all at once, it is important to at least try to maintain a certain standard for each building. When small projects are completed within a building, the new materials or furnishings must still work with the existing space. If the newer standards will not coordinate with the existing finishes and furniture, a different selection may be required. For example, if the carpet is worn and needs to be replaced, a carpet should be selected that is similar to the new standard but that will coordinate with the existing colors and materials. Whenever possible, projects should be planned for a larger contiguous area of work so that the new standards may be installed. Changing only a small portion of the finishes can be unsuccessful if the end result is obvious. The durability, maintenance and quality of the finishes should be based on the particular image and function of the space and the building.

J.2 Common Finish Recommendations

All door hardware to be a consistent finish – satin finished stainless steel.

All outlet and switch cover plates to be ivory to blend with the neutral color scheme.

All toilet accessories to be brushed stainless steel.

Acoustical ceiling grid to be white. All ceiling mounted accessories: grilles, speakers, smoke detectors, etc. to be white to match ceiling. (Exceptions: sprinkler heads)

All doors within a building to be finished the same –either painted or stained.

All artwork to have black metal frames.

Refer to specifications for additional detail for all fixtures, furnishings and finishes.

Color selections, when not indicated for finishes, to be approved by Department of Public Works (DPW).

J.3 Administrative Finish Recommendations

Administration buildings on the Post are typically

masonry with multiple penetrations to allow daylight into the space. There are more architectural elements on the exterior and interior to create focal points and add interest. The interiors are typically warm, comfortable, inviting and professional.

The individual finish selections are referenced by the alphanumeric code which is used in the index and specifications.

CPT-1 Carpet

CPT-2 Accent Carpet

PT-1 Wall Paint

PT-2 Accent Paint

PT-3 Ceiling Paint

PT-4 Multi-color Paint

PL-1 Plastic Laminate

PL-2 Plastic Laminate VCT-1 Vinyl Floor Tile

VCT-2 Vinyl Floor Tile — Slip Resistant

VS-1 Rubber Stair Tread VB-1 Rubber Base

WO-1 Walk-off Mat

VWC-1 Vinyl Wallcovering VWC-2 Vinyl Wallcovering

FWC-1 Fabric Textile Wallcovering

CT-1 Ceramic Floor Tile

CT-2 Ceramic Floor Tile — Accent

CT-3 Ceramic Wall Tile

CT-4 Ceramic Wall Tile — Accent

ACT-1 Acoustic Ceiling Tile WD-1 Wood Finish

J.4 Specifications

08710 — Hardware

Item:

Locksets/Latchsets

Fort Leonard Wood IDG

Item code:

HW-1

Description:

Heavy duty mortise lock with lever handle conforming to Federal Specification FFH-106C/GEN 7-19-74 and ANSI A156.13. Ensure it meets ADA Standards

Material Finish:

Satin Finish Stainless Steel

*Item:***Door Closers***Description:*

Surface mounted closer with sliding track arm. Provide hold open on all doors except fire doors. Mount closers inside rooms. Avoid mounting closers in corridors. Do not mount closers on door head.

Material/Finish:

Painted-aluminum color (BHMA 689)

09300 –Ceramic Tile*Item:***Ceramic Floor Tile***Item code:*

CT-1, CT-2

Description:

2"X2" (51X51 mm) unglazed ceramic mosaic tile for restroom floors.

Color/Pattern:

Color and finish per DPW.

*Item:***Ceramic Wall Tile***Item code:*

CT-3, CT-4

Description:

4-1/4"X4-1/4" (108X108 mm) glazed ceramic tile scored

to look like 2"X2" (51X51 mm) tile for restroom walls. *Color/Pattern:*

Color and finish per DPW.

09511 –Ceiling Materials

Item:

Acoustical Ceiling Tile *Item code:*

ACT-1

Description:

Standard for all new installations is 24"X24" (610X610 mm) system. Acoustical fissured 24"X48" (614X1219 mm) ceiling panels scored in the center to give appearance of 24"X24" (610X610 mm) panels for existing ceiling grid system only. Use scored tile in retrofit areas to match existing 24"X24" (610X610 mm) tiles.

24"X24" (610X610 mm)

Material/Finish:

Mineral base panels with white painted finish. Use black tile for specialty applications such as audio/visual rooms that require blackout and use only with black grid.

Item:

Ceiling Suspension System

Description:

15/16" (24 mm) exposed tee suspension grid.

Material/Finish:

Steel with baked white enamel finish. Use backed enamel black finish for specialty applications such as audio/visual rooms that require blackout and use only with black tile.

09660 – Resilient Tile Flooring

Item:

Vinyl Composition Tile

Item code:

VCT-1

Description:

Class 2 through pattern, smooth surface, 1/8"X12"X12" (3X305X305 mm) vinyl tile.

Color/Pattern:

Color and pattern per DPW.

Adhesives:

Water resistant type recommended by manufacturer suitable for the substrate.

*Item:***Slip Resistant Vinyl Composition Tile***Item code:*

VCT-2

Description:

For use at building entries. Class 2 through pattern, abrasive mineral coating factory applied to surface of tile in a grid pattern, 1/8"X12"X12" (3X305X305 mm) vinyl tile.

Color/Pattern:

Color and pattern per DPW.

Adhesives:

Water resistant type recommended by manufacturer suitable for the substrate.

*Item:***Rubber Stair Tread***Item code:*V S - 1 *Description:*

Johnsonite or equal. Conform to ASTM F-1344-93, Standard specification for rubber floor tile. Treads: 13 1/4" (33.66 cm) overall depth, 1/4" (6 mm) gauge, Heavy duty Safe-T-Grip (G), Square Nose Risers: Smooth, 1/4" (6 mm) gauge.

Color/Pattern:

Color and pattern per DPW.

09660 – Resilient Base

Item:

Rubber Base

Item code: VB-1

Description:

4"X1/8" (63X3 mm) rubber wall base. Cove profile at all flooring surfaces. Provide in polls for seamless installation *Color/Pattern:*

Color and pattern per DPW.

09680 – Carpet

Item:

Office and General Use Carpet

Item code:

CPT-1, CPT-2,

Description:

Carpet for office and general commercial uses to meet the following minimum requirements.

Face Construction: Tufted or woven level loop, multilevel loop, cut and loop or woven. Fully cut pile is not acceptable.

Face Fiber: 100% branded nylon – either Antron, Ultron or Zeftron nylon with anti-stain treatment. Type 6, 6 or 6 branded by fiber manufacturer.

Gau^e: Minimum 1/10 inch (3 mm)

Stitches: 13.5 per inch (25 mm) for woven and cut and loop. 10.3 per inch (25 mm) for loop.

Pile Height: Minimum 9/32" (7 mm) for cut and loop. (.281) Minimum 5/32" (4 mm) for loop (.156) Minimum 7/32" (6 mm) for loop (.219)

Pile Weight: Minimum 79 oz. (2.2 kg) for cut and loop.

[30 oz. (0.8 kg) for cut and loop] Minimum 64 oz. (1.8 kg) for loop. [28 oz. (0.79 kg) for bonded] Minimum 70 oz. (2.0 kg) for woven. [28 oz. (0.79 g) loop pile]

Average Density: 6000 minimum

Primary Backing: Polypropylene

Static Control: Built into the fiber; less than 3.5 Kv., for normal office environments; less than 2.0 Kv. for computer/technical rooms.

Fire Characteristics: Radiant flux - .45 or greater; Smoke density: -450 or less

Wear Classification: Severe

Color/Pattern:

Color and pattern per DPW. Multiple colors (3 or greater in open areas.)

Item:

Carpet Tile

Description:

Carpet to meet the following minimum requirements. Weave: Tufted

Surface Texture: Cut pile.

Face Yarn: 100% branded nylon – either Antron, Ultron or Zeftron nylon with anti-stain treatment. Type 6, 6 or 6 branded by fiber manufacturer.

Dye Method: Solution or approved yarn dye

Gauge: Minimum 1/8 inch (3 mm)

Stitches: 9 per inch (25 mm)

Pile Height: .177" (5 mm) to .203" (5 mm)

Face Weight: 28 oz. (0.79 kg) per sq. yd. (1 sq. yd. = 0.836 sm)

Total Weight: 138.4 oz. (3.9 kg) per sq. yd. (1 sq. yd. = 0.836 sm)

Average Density: 6000 minimum

Standard Backing: to be equal to Milliken PVC-Free Comfort Plus® cushion

Static Control: Built into the fiber; less than 3.5 Kv., for normal office environments; less than 2.0 Kv. for computer/technical rooms.

Fire Characteristics: Radiant flux - .45 or greater; Smoke density: -450 or less

Wear Classification: Severe

Color/Pattern:

Color and pattern per DPW. Color and material to match the color scheme for the building.

09920 – Painting

Item:

Interior Solid Color Paint *Item code:*

PT-1, PT-2, PT-3

Application:

All interior wall surfaces and gypsum board ceilings. *Color/Quality:*

Color per DPW. Provide manufacturer's first quality materials.

Paint Schedule:

Eggshell Finish: Gypsum board, plaster and cementitious surface.

Semi-gloss: Wood trim, doors, door frames, and metal surfaces.

Item:

Interior Multi-Color Paint

Item code:

PT-4

Application:

Office environments, commercial spaces, and smooth textured walls.

Color:

Color per DPW.

Material:

Spray applied polychromatic, polymer paint consisting of discrete beads of pigment coated with resin and suspended in an aqueous solution. Use materials recommended by manufacturer for substrate to be applied.

Material Compatibility:

Provide block fillers, primers, finish coat materials and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

Material Quality: Provide the best-quality grade of multicolored coatings. Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.

09950 — Wallcoverings*Item:***Vinyl Wallcovering***Item code:*

VWC-1, VWC-2

Application:

For use in conference rooms, offices, break rooms, corridors and other high use areas.
(Also for installation over concrete block.)

Color/Pattern:

Color per DPW.

Description:

Federal Spec: CCC-W-408, Type II

Fire Characteristics:

ASTM E84 Flame spread not more than 25. Smoke developed not more than 50.

Backing:

Sheeting

Item:

Textile Wallcovering

Item code:

FWC-1 Application:

For use in executive offices and conference rooms for 0-6 officers and above.

Color/Pattern:

Color per DPW.

Description:

Federal Spec: CCC-W-408

Fire Characteristics:

ASTM E84 Flame spread not more than 25. Smoke developed not more than 50.

Fiber Content:

100% Olefin

Backing: Acrylic

10100 – Visual Display Boards

Item:

Marker / Tack Boards

Description:

Porcelain enamel marker boards and plastic impregnated cork tack boards.

Material / Finish:

Design: match design of systems furniture or related building finish standard, for a coordinated system.

Marker Boards: Provide balanced, high pressure-laminated porcelain enamel boards of 3-ply construction consisting of face sheet, core material, and backing. Provide writing surface with gloss finish for use with liquid felt-tipped markers.

Tack boards: Provide seamless sheet, 1/4" (6 mm) thick hardboard backing.

Accessories: Provide chalk tray for marker boards. Provide four markers (red, green, brown and black) and an eraser for each unit.

Item:

Bulletin Board Cabinet

Application:

For use in lobbies and common areas for display *Material / Finish:*

Black anodized aluminum, square profile frame with double doors. 3" (76 mm) depth with black hook fabric.

Item:

Trophy Display Case

Application:

For use in lobbies and common areas for display. *Material / Finish:*

Black anodized aluminum frame with clear tempered glass on 4" (102 mm) solid base.

10800 — Washroom Accessories

Item:

Soap Dispenser

Description:

Recessed drawer-type soap vessel. 9-1/2" (241 mm) wide X 5-1/2" (140 mm) high X 4" (102 mm) deep. (If recessed unit cannot be installed, use similar surface mounted model.)

Material / Finish:

Stainless steel with brushed finish.

*Item:***Paper Towel Dispenser***Description:*

Recessed, semi-recessed or surface mounted, 14" (356 mm) wide X 28" (711 mm) high X 4" (102 mm) deep. (A combination paper towel/waste receptacle is an appropriate option and can be recessed, semi-recessed or surface mounted.)

Material / Finish:

Stainless steel with brushed finish.

*Item:***Waste Receptacle***Description:*

Fully recessed 14" (356 mm) wide X 28" (711 mm) high X 4" (102 mm) deep. (If recessed unit cannot be installed, use similar surface mounted model.)

Material / Finish:

Stainless steel with brushed finish.

Item:

Partition Mounted Napkin Disposal

Description:

Surface mounted on toilet partition. 10-11/16" (271 mm) wide X 15-1/8" (384 mm) high X 4-3/16" (106 mm) deep. Disposable liners.

Material / Finish:

Stainless steel with brushed finish.

*Item:***Toilet Paper Dispenser***Description:*

Surface mounted two roll, side by side, dispenser, similar to Bobrick Model B-686. Provide tumbler lock. 5-7/8" (149 mm) wide X 10-1/2" (267 mm) high X 5-5/8" (143 mm) deep.

Material / Finish:

Stainless steel with brushed finish.

12511 – Horizontal Louver Blinds*Item:***Horizontal Louver Blinds***Description:*Operation: Manual

Handrail: Channel-shaped section fabricated from minimum 0.025" (1 mm) thick sheet steel with rolled edges at top, equipped with end braces. All hardware required for operation of blind at handrail to be enclosed in metal head. Finish of rail to be in same color as slats unless otherwise indicated.

Bottom Rail: Fabricated from steel with rolled edges. Contour section to match slat curvature. Provide metal or plastic end closure caps, same color as rail. Finish rail in same color as slats unless otherwise indicated. Slats: Spring-tempered aluminum slats, alloyed for maximum strength, with forming burrs removed. Slat thickness and ladder support distances adequate to preclude visible sag or bow after continued use. 1" (25 mm) wide, lengths as required, not to exceed 142" (3,607 mm) other components sized to suit.

Ladders: Construction design to support and maintain slat at proper spacing and alignment in open or closed position.

Braided Polyester Cord: Fabricated of not less than 0.045" (1 mm) nor more than 0.068" (1.73 mm) diameter. Integrally braided ladder rungs of not less than 4 threads; space ladders no further than 24" (610 mm) apart and no more than 7" (178 mm) from ends of slats.

Tilting Mechanism: Provide low friction gear tilter, drum and cradle at each ladder, tilt rod, tape clips and grommet guides to prevent wear on ladder and cords. Mechanism designed to hold slats at any angle and prevent movement of slats due to vibration.

Wand Operation: Detachable, clear plastic wand of appropriate length to suit blind installation and to provide convenient operation.

Lifting Mechanism: Crash-proof cord locks with cord separators, braided polyester cords fitted with pulls. Include cord equalizers of self-aligning type designed to maintain horizontal blind position.

Installation Brackets: Provide pre-finished metal mounting brackets designed to facilitate removal of headrail. Provide intermediate brackets at spacing recommended by manufacturer. Include hardware necessary for secure attachment of brackets to adjoining construction and headrails. Provide brackets adequate to support the weight of blind assemblies plus force applied to operate blinds, with mounting holes located to accommodate either horizontal or vertical mounting.

Finish: provide standard factory applied finish system; chemical conversion coating followed by baked-on synthetic resin enamel finish coat. Color shall be as selected by the Contracting Officer.

Fabrication: Prior to fabrication, verify actual opening dimensions by site measurements. Do not proceed with fabrication until unsatisfactory conditions have been resolved. Adjust dimensions for proper fit at openings. Cooperate with other trades for securing headrails to substrates and other finished surfaces.

Fabricate horizontal louver blind components from noncorrosive materials which do not require lubrication during the normal expected life.

Fabricate blind units to completely fill the opening from head to sill and jamb to jamb. For continuous installations, fabricate blind units so that breaks between units occur only at mullions or other defined vertical separation.

Space blind slats to provide overlap for light exclusion when in fully closed position. Equip horizontal louver blind units with the following operations:

Full-tilting operations with slats rotating approximately 180 degrees. Place tilt-operating controls on left side of blind when facing blind unit. Exceptions may occur due to unique location of window, etc. Height raising, with lifting cord locks for holding blind at any point of travel. Place pull cords on right side of blind when facing it.

12910 – Artwork

Item:

Artwork Frames

Material / Finish:

Frames to be aluminum extrusions with gloss black anodized finish. Frames to be standard for all buildings.

All poster pieces to be dry mounted on foam core and wired for hanging. Alternate methods for hanging are not permitted.

15540 – Plumbing Fixtures

Item.

Standard Faucet

Description:

Supply with swing spout, water economy aerator with maximum 2.2 gpm flow, single lever handle; chrome plated brass P-trap and arm with escutcheon. *Material/Finish:*

Chrome plated brass

Item:

Standard Sink

Description:

Single compartment oval approximately 17" x 11", homogenous solid surface sink integral with countertop with 1, 2 or 3 holes to match selected faucet

Support:

Plastic laminate vanity or metal framing refer to DPW for framework details.

Material / Finish:

Solid surface of polyester/acrylic alloys

Item:

Break Area Faucet

Description:

Goose neck design with paddle wrist handles or single lever mixing valve. Aerator with 2.5 GPM (15.8 cu m/sec) flow. 8" (203 mm) centers.

Material / Finish:

Chrome

Item:

Break Area Sink

Description:

Single compartment stainless steel sink with three holes at 4" (102 mm) centers (verify with faucet selection); 25" (635 mm) wide X 22" (559 mm) deep X 6-1/2" (165 mm) high.

Material / Finish:

Brushed Stainless Steel.

15942 – Air Diffusers

Item:

Air Diffusers

Description:

Air devices shall be steel, square diffusers, flush core, fixed pattern, lay in type for use with a "T" bar suspended or framed ceiling. Coordinate for type of ceiling construction and location. Spline ceiling construction surface mounted air device shall be used in ceilings, and use sidewall bar type registers in the case of vertical surfaces. All air device supply ducts shall incorporate a lockable balancing damper where the diffuser/register run out interfaces with the zone truck duct, for balancing purposes. In spline ceilings, provide accessible ceiling tile access at the location of these balancing dampers

Material / Finish:

Steel construction, baked white enamel finish.

16515 – Light Fixtures

Item:

Retro-Fit Diffuser

Description:

2" (51 mm) squares parabolic diffuser conversion kit. For use in converting existing 2'X4' (610X1,219 mm) prismatic lenses.

Material / Finish:

Chrome finish.

Item:

Retro-Fit Diffuser

Description:

2" (51 mm) squares parabolic diffuser conversion kit. For use in converting existing 2'X2' (610X610 mm) prismatic lenses.

Material / Finish:

Chrome finish.

Item:

2'X2' (610X610 mm) Fluorescent Lay-in Fixture *Description:*

2" (51 mm) squares parabolic fluorescent fixture with semi-specular lens. Provide 90 min. emergency battery pack as required for emergency lighting.

Material / Finish:

Chrome finish.

Item:

2'X4' (610X1,219 mm) Fluorescent Lay-in Fixture *Description:*

2" (51 mm) squares parabolic fluorescent fixture with semi-specular lens. Provide 90 min. emergency batter pack as required for emergency lighting.

Material / Finish:

Chrome finish.

Item:

2'X4' (610X1,219 mm) Fluorescent Surface Mounted Fixture

Description:

Surface mounted, 2" (51 mm) squares parabolic fluorescent fixture.

Material / Finish:

Housing to be white baked enamel steel. Lens to be semi-specular clear anodized aluminum.

Item:

Linear Fluorescent Cove Light

Description:

Continuous linear parabolic fluorescent lighting constructed of die formed, 19 gauge steel with factory applied enamel finish. Prefabricated extensions and corner boxes for uninterrupted runs. No holes or knockouts on exposed surfaces. Continuous appearance of louver. Mitered louver at corners 6-1/4"X6" (159X152 mm) housing. At all cove lighting direct lamps to provide light on wall and/or ceiling surfaces above the cove location.

Material/Finish:

White baked enamel steel.

Item:

Compact Fluorescent Downlight

Application:

For use in lobbies, corridors, and other public spaces.

Description:

8" (203 mm) diameter recessed downlight with semi-specular clear alzak reflector and a minimum lamp size of 2-26 watt quad compact fluorescent lamp.

Material/Finish:

White trim ring with clear alzak reflector.

Item:

Compact Fluorescent Wallwasher *Application:*

For use to highlight artwork and to lighten walls of small spaces. Optional incandescent fixture when required for color rendition.

Description:

8" (203 mm) diameter recessed wallwasher with semispecular clear alzak reflector and a minimum lamp size

of 1-26 watt quad compact fluorescent lamp.

Material/Finish:

White trim ring with clear alzak reflector.

Links

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APPENDIX FF

Pallet Rack Storage System

The Pallet Rack Storage System is a GFGI item. Provide a minimum of 1,152 pallet spaces (including floor and top shelf locations). Assume that a 5,000 pound capacity, conventional, electric lift truck will be used to place and retrieve pallets. Determine the correct aisle width based on a combination of planned pallet loads and the actual forklift to be procured for use with the system.

Warehouse Area: Provide area for storage of goods on pallet racks. The Pallet Rack Storage System is a GFGI item. Coordinate with Government to provide suitable space, lighting and structural support for the system and to define detailed requirements. Provide the detailed design layout necessary to purchase and install a complete Pallet Rack System that utilizes industry standard components and dimensions. The rack system shall take full advantage of the clear height specified for the warehouse area. System design is to be based on 48" wide X 40" deep X 48" high pallets weighing no more than 2,500 pounds each. Where possible use a standard 9'-3" module (108" open) shelf length. Provide at least two heavy duty (non-waterfall type) pallet supports per pallet space plus wire shelf decking. Provide sufficient rack depth for pallets so that they may be placed flush with the aisle beam face without overhanging on the back side. Install top shelves below the top of 240" high standard width uprights so that pallets at the end of a row will not accidentally slip off to the side. Pallet rack system design shall include a 4-inch (minimum) clear space between adjacent pallets and a 4-inch (minimum) clear space between the top of each pallet and the bottom of the shelf beam above it. Pallet rack system design shall be such that the top of the load on the top shelves shall be a minimum of 20 inches below the clear unobstructed height required in the warehouse. Assume that a fork lift with a 240" mast will be used to place and retrieve pallets.

Appendix GG
LEED Project Checklist



LEED 2009 for New Construction and Major Renovation

Project Checklist

General Purpose Warehouse - PN 75078
Jan. 18, 2010

10 12 4 Sustainable Sites Possible Points: 26

| Y | N | ? | | | |
|---|---|---|------------|---|---|
| Y | | | Prereq 1 | Construction Activity Pollution Prevention | |
| 1 | | | Credit 1 | Site Selection | 1 |
| | 5 | | Credit 2 | Development Density and Community Connectivity | 5 |
| | 1 | | Credit 3 | Brownfield Redevelopment | 1 |
| | 6 | | Credit 4.1 | Alternative Transportation—Public Transportation Access | 6 |
| | 1 | | Credit 4.2 | Alternative Transportation—Bicycle Storage and Changing Rooms | 1 |
| 3 | | | Credit 4.3 | Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles | 3 |
| | 2 | | Credit 4.4 | Alternative Transportation—Parking Capacity | 2 |
| 1 | | | Credit 5.1 | Site Development—Protect or Restore Habitat | 1 |
| 1 | | | Credit 5.2 | Site Development—Maximize Open Space | 1 |
| 1 | | | Credit 6.1 | Stormwater Design—Quantity Control | 1 |
| 1 | | | Credit 6.2 | Stormwater Design—Quality Control | 1 |
| 1 | | | Credit 7.1 | Heat Island Effect—Non-roof | 1 |
| 1 | | | Credit 7.2 | Heat Island Effect—Roof | 1 |
| | 1 | | Credit 8 | Light Pollution Reduction | 1 |

6 4 Water Efficiency Possible Points: 10

| Y | N | ? | | | |
|---|---|---|----------|------------------------------------|--------|
| Y | | | Prereq 1 | Water Use Reduction—20% Reduction | |
| 4 | | | Credit 1 | Water Efficient Landscaping | 2 to 4 |
| | 2 | | Credit 2 | Innovative Wastewater Technologies | 2 |
| 2 | | 2 | Credit 3 | Water Use Reduction | 2 to 4 |

15 9 11 Energy and Atmosphere Possible Points: 35

| Y | N | ? | | | |
|----|---|---|----------|--|---------|
| Y | | | Prereq 1 | Fundamental Commissioning of Building Energy Systems | |
| Y | | | Prereq 2 | Minimum Energy Performance | |
| Y | | | Prereq 3 | Fundamental Refrigerant Management | |
| 10 | | 9 | Credit 1 | Optimize Energy Performance | 1 to 19 |
| | 7 | | Credit 2 | On-Site Renewable Energy | 1 to 7 |
| | 2 | | Credit 3 | Enhanced Commissioning | 2 |
| 2 | | | Credit 4 | Enhanced Refrigerant Management | 2 |
| 3 | | | Credit 5 | Measurement and Verification | 3 |
| | 2 | | Credit 6 | Green Power | 2 |

3 6 5 Materials and Resources Possible Points: 14

| Y | N | ? | | | |
|---|---|---|------------|---|--------|
| Y | | | Prereq 1 | Storage and Collection of Recyclables | |
| | 3 | | Credit 1.1 | Building Reuse—Maintain Existing Walls, Floors, and Roof | 1 to 3 |
| | 1 | | Credit 1.2 | Building Reuse—Maintain 50% of Interior Non-Structural Elements | 1 |
| 1 | | 1 | Credit 2 | Construction Waste Management | 1 to 2 |
| | 1 | 1 | Credit 3 | Materials Reuse | 1 to 2 |

Materials and Resources, Continued

| Y | N | ? | | | |
|---|---|---|----------|-----------------------------|--------|
| 1 | | 1 | Credit 4 | Recycled Content | 1 to 2 |
| 1 | | 1 | Credit 5 | Regional Materials | 1 to 2 |
| | 1 | | Credit 6 | Rapidly Renewable Materials | 1 |
| | 1 | | Credit 7 | Certified Wood | 1 |

11 4 Indoor Environmental Quality Possible Points: 15

| Y | N | ? | | | |
|---|---|---|------------|--|---|
| Y | | | Prereq 1 | Minimum Indoor Air Quality Performance | |
| Y | | | Prereq 2 | Environmental Tobacco Smoke (ETS) Control | |
| 1 | | | Credit 1 | Outdoor Air Delivery Monitoring | 1 |
| | 1 | | Credit 2 | Increased Ventilation | 1 |
| 1 | | | Credit 3.1 | Construction IAQ Management Plan—During Construction | 1 |
| 1 | | | Credit 3.2 | Construction IAQ Management Plan—Before Occupancy | 1 |
| 1 | | | Credit 4.1 | Low-Emitting Materials—Adhesives and Sealants | 1 |
| 1 | | | Credit 4.2 | Low-Emitting Materials—Paints and Coatings | 1 |
| 1 | | | Credit 4.3 | Low-Emitting Materials—Flooring Systems | 1 |
| 1 | | | Credit 4.4 | Low-Emitting Materials—Composite Wood and Agrifiber Products | 1 |
| 1 | | | Credit 5 | Indoor Chemical and Pollutant Source Control | 1 |
| 1 | | | Credit 6.1 | Controllability of Systems—Lighting | 1 |
| | 1 | | Credit 6.2 | Controllability of Systems—Thermal Comfort | 1 |
| 1 | | | Credit 7.1 | Thermal Comfort—Design | 1 |
| 1 | | | Credit 7.2 | Thermal Comfort—Verification | 1 |
| | 1 | | Credit 8.1 | Daylight and Views—Daylight | 1 |
| | 1 | | Credit 8.2 | Daylight and Views—Views | 1 |

1 5 Innovation and Design Process Possible Points: 6

| Y | N | ? | | | |
|---|---|---|------------|--------------------------------------|---|
| | | 1 | Credit 1.1 | Innovation in Design: Specific Title | 1 |
| | | 1 | Credit 1.2 | Innovation in Design: Specific Title | 1 |
| | | 1 | Credit 1.3 | Innovation in Design: Specific Title | 1 |
| | | 1 | Credit 1.4 | Innovation in Design: Specific Title | 1 |
| | | 1 | Credit 1.5 | Innovation in Design: Specific Title | 1 |
| 1 | | | Credit 2 | LEED Accredited Professional | 1 |

4 Regional Priority Credits Possible Points: 4

| Y | N | ? | | | |
|---|---|---|------------|--|---|
| 1 | | | Credit 1.1 | Regional Priority: Sustainable Sites, Credit 1 | 1 |
| 1 | | | Credit 1.2 | Regional Priority: Sustainable Sites, Credit 5.1 | 1 |
| 1 | | | Credit 1.3 | Regional Priority: Sustainable Sites, Credit 6.2 | 1 |
| 1 | | | Credit 1.4 | Regional Priority: Materials and Resources, Credit 2 | 1 |

50 27 33 Total Possible Points: 110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Appendix HH

Additional As-Built Requirement

The Contractor shall provide one set of full size mylar as built.