

**AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT**

1. CONTRACT ID CODE \_\_\_\_\_ PAGE \_\_\_\_\_ OF \_\_\_\_\_ PAGES

2. AMENDMENT/MODIFICATION NO. \_\_\_\_\_ 3. EFFECTIVE DATE \_\_\_\_\_ 4. REQUISITION/PURCHASE REQ. NO. \_\_\_\_\_ 5. PROJECT NO. *(If applicable)* \_\_\_\_\_

6. ISSUED BY \_\_\_\_\_ CODE \_\_\_\_\_ 7. ADMINISTERED BY *(If other than Item 6)* \_\_\_\_\_ CODE \_\_\_\_\_

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)* \_\_\_\_\_ (X) 9A. AMENDMENT OF SOLICIATION NO. \_\_\_\_\_  
 9B. DATED *(SEE ITEM 11)* \_\_\_\_\_  
 10A. MODIFICATION OF CONTRACT/ORDER NO. \_\_\_\_\_  
 10B. DATED *(SEE ITEM 11)* \_\_\_\_\_  
 CODE \_\_\_\_\_ FACILITY CODE \_\_\_\_\_

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

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers  is extended,  is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:  
 (a) By completing items 8 and 15, and returning \_\_\_\_\_ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)* \_\_\_\_\_

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

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

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

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

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

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

Item 14. Continued.

**CHANGES TO SPECIFICATIONS**

1. Replacement Sections – Replace the following section with the accompanying new section of the same number and title, bearing the notation "ACCOMPANYING AMENDMENT NO. 0007 TO SOLICITATION NO. DACA63-02-R-0013:"

SECTION 01001 STATEMENT OF WORK

(Note: Change is in paragraph 6.4.2.1 on page 01001 – 56)

END OF AMENDMENT

**STATEMENT OF WORK**

**1. DESIGN OBJECTIVES.**

1-1 The design and construction shall comply with the specifications and requirements contained in this Request for Proposals (RFP). The design and technical criteria contained and cited in this RFP establish minimum standards for design and construction quality. All housing units constructed in accordance with these standards are “Energy Star Homes”.

1-2 Work Scope. The objective of this solicitation is to obtain housing complete and adequate for assignment as quarters for military personnel and their families. This contract shall consist of the design and construction of a total of **70 senior and junior noncommissioned officer** housing units, **parking, roads and site amenities (AM#4)** on Government-owned land at **Fort Sam Houston, Texas**, which comply with this RFP. Work shall consist of the following:

1-2.1 Housing Units. Housing units with patio or balcony, **carport (AM#4)**, exterior storage, individual central heating systems, energy conservation systems and central air conditioning, and including the following Contractor-furnished/Contractor-installed (CF/CI) equipment and appliances: range, refrigerator, garbage disposal, dishwasher, water heater, carbon monoxide alarms, and smoke detectors. **The 20 SrNCO units are to be sited together. The 50 JrNCO units are to be sited together. SrNCO and JrNCO units are not to be mixed amongst each other. The exception to this are the accessible housing units mentioned in paragraph 1-2.2. (AM#4)** Housing units shall be a mix of three- and four- bedroom housing units as shown in Table 1-1:

**TABLE 1-1 - HOUSING UNITS**

Pay Grade	Number of Bedrooms	Number of Units
E-7 through E-9 (SNCO)	3	20 units
E-1 through E-6 (JNCO)	4	50 units

1-2.2 Accessible units. No less than five (5) percent of the units shall be handicapped accessible. This would result in a minimum of one (1) Sr. NCO unit and three (3) Jr. NCO units being handicapped accessible. These housing units shall be designed and built in such a way that they may be easily and readily modified to accommodate physically challenged occupants at time of occupancy. Design of accessible housing units shall conform to the Uniform Federal Accessibility Standards (UFAS) and American Disabilities Act Accessibility Guidelines (ADAAG). Accessible housing units shall be located at the northern portion of the site bound by Patch, Chaffee and W.W. White Roads (north of unit 881 and east of units 831 to 834). The requirement to have an additional two (2) percent of housing units equipped with warning devices for the hearing and visually impaired will be met at the time the unit is assigned to an occupant needing this equipment.

1-2.3 Site area and density.

1-2.3.1 Site area. The site/s is/are described on the RFP drawings included as part of this solicitation and includes approximately 17.2 hectares [42.6 acres]. Site work includes all design and construction of the site design to include grading, storm drainage, erosion control, pedestrian and vehicular circulation, utility systems, outdoor lighting, play lots and physical security.

1-2.3.2 Site density. This project consists of 70 housing units on **7.1 hectares [17.7 acres] of land area (AM#5)**. The project site is approved for **LOW DENSITY** siting. Site development shall comply with the minimum requirements for **LOW DENSITY** siting. The new housing area will be constructed on the site located

along the eastern boundary of the existing Patch-Chaffee housing area. The site is bound on the north by Hardee Road and to the south by Wilson Street. **For construction purposes, the southern boundary will be Taylor Street. Chaffee Road (AM#4)** and Forage Avenue encompass the western and eastern boundaries, respectively for the construction of new homes. An additional area at the northwest corner of the Allen Road/Patch Road intersection can be developed as green space, as needed. **The existing playground located between Patch and Chaffee Roads and Crockett and Lawton Roads will remain. (AM#4)** The southern portion of the site (between Road S-23, Wilson Street and Taylor Street) used to house an aircraft maintenance shop and other industrial facilities and has been determined to be a contaminated site. This area shall not be developed for new construction. Refer to paragraph 14- ENVIRONMENTAL for additional information.

1-2.4 Special utilities and supplementary construction. If OPTION 1- Ground Coupled Heat Pumps, is selected, site gas distribution is not required.

1-2.4.1 Waste Area. Waste material, except for **regulated** asbestos containing material, shall be disposed of by the Contractor. Disposal area shall be located off Government controlled property, at the Contractor's expense and responsibility.

1-2.4.2 Haul Routes. See the Project Location Map in the RFP drawings.

1-2.4.3 Bench Marks. See the topographic maps in the RFP drawings.

1-2.4.4 Contractor's Staging Area and Storage Yard. A Contractor's storage area and storage yard shall be located within the project boundaries, as described in paragraph 1-2.3.2 above and as directed by the Contracting Officer.

1-2.4.5 Security Fencing. A 1.83 m (6 ft) high temporary chain link construction fence **(AM#5)** shall be installed and maintained around the construction site (including the staging area and storage yard) during construction for security and the safety of children, pedestrians and others living nearby. This fencing shall remain in place for the duration of the contract. Stored materials, equipment and construction trailers shall be located within the staging area and storage yard.

1-2.5 Demolition considerations and requirements. Demolition will consist of any utilities and/or subsurface structures (i.e. foundations, piers) that have been abandoned in place and which fall within the boundaries of new construction and existing roads and curb and gutter, as needed, to construct the proposed design. **Replace Road No. S-23 between Lawton and Crockett Roads. Replace the street located one block east of Road No. S-23, between Harney and Schofield Roads. This street may be rerouted, as deemed necessary. (AM#4)** Utility systems and streets must be demolished in such a manner as to maintain active service and vehicular circulation to the existing housing area. Existing maps indicate that several buildings and a swimming pool once existed on the site between Crockett and Wilson Roads and between Road No. S-23 and Forage Road. These areas shall be thoroughly investigated to determine the extent and/or presence of subsurface structures that may have been abandoned in place and will require removal before construction. The approximate location of the swimming pool has been identified on the topographic maps included in the RFP. See paragraph 14- ENVIRONMENTAL for environmental demolition concerns that may be encountered.

1-3 Energy Star Homes Program Requirements: The Contractor, at the direction of the USACE Contracting Officer's Representative, shall be required to submit to the EPA the necessary information and certifications to register the units constructed in this project as Energy Star Homes. The contractor constructing housing units in accordance with this Statement of Work is not required to be a registered Energy Star Contractor. The required information can be submitted to EPA in several methods:

1-3.1 Through the Internet by clicking on the *certificate automation system* icon at the World Wide Website <http://yosemite.epa.gov/appd/eshomes/eshomes.nsf> and following the instructions

1-3.2 By emailing to [certificates@epa.gov](mailto:certificates@epa.gov)

1-3.3 By mailing to the EPA Customer Service Manager (address & tel. no. below):

The following information needs to be submitted for each home [note: homes can be submitted *individually* (each home individually tested/rated) or in a "*batch*" (for batches of homes, particular unit types). The following data should be provided for each home (note: this can be in the form of a spreadsheet, database, word processing file or email; if the format changes in the future EPA will inform the contractor of the changes):

Contractor company name (ex. Jones Construction Co.)

Contractor telephone number (ex. 703-123-4567)

Name of company/organization performing testing/rating (ex. Jones Construction Co.)

Telephone number of company/organization performing testing/rating (ex. 703-123-4567)

Street address of home being submitted, including city, state & zip code (ex. 123 Smith St., City, State 12345)

Type of verification:

**"FEP"** --- if this particular home underwent infiltration testing (and possibly duct leakage testing). Please list the tested infiltration value in ACH/nat (natural air changes per hour) and if tested, the duct leakage to nonconditioned spaces in cfm and % of air handler flow at a pressure of 25 pascals.

**SEP"** --- if this particular home did *not* undergo infiltration and/or duct leakage testing, but was a member of a batch out of which at least 15% DID; if so, then the address of a home that was a tested member of this batch should also be identified as the tested member of the batch.

1-3.4 The following statement: "This home qualifies as an EPA Energy Star Home by conforming to the residential energy efficiency specifications and quality control confirmation of U.S. Army Corps of Engineers TI 801-02, Family Housing, **01-/Oct-/01 (AM#4)**, which has been determined by the EPA and USACE to be an **Equivalent Program** to the EPA Energy Star Homes Program." In addition, the "checklist" of home specifications that the USACE Contracting Officer's Representative uses to ascertain if the TI 801-02 specifications and testing results were met should be submitted. The statement and checklist should have the USACE Contracting Officer's Representative's signature affixed.

The year the house was built (ex. 2001)

The year the house was submitted for Energy Star certification (ex. 2001)

The name and title/rank, mailing address, email address, telephone number and fax number of the USACE Contracting Officer's Representative overseeing the contractor's adherence to construction specifications, quality control of construction and testing/rating activities.

1-3.5 The Contractor will make arrangements with the EPA for receipt of the "Energy Star Homes" certificates and unit plaques and shall provide the certificates to the USACE Contracting Officer's Representative and include in the project the installation of the plaques on each of the housing units. Coordination point with the EPA regarding Energy Star certification and plaques shall be as follows:

United States Environmental Protection Agency

Climate Protection Division

US EPA 6202J

Washington DC 20460

ENERGY STAR Homes Customer Service Manager

ATTN: Mr. Brian Ng, Ng.Brian@epa.gov, 202-564-9162, fax: 202-565-2079

<http://www.energystar.gov/homes>

Technical questions on the Energy Star Homes Program in general can be addressed to:

ENERGY STAR Homes Technical Coordinator

ATTN: Mr. Glenn T. Chinery, Chinery.Glenn@epa.gov, 202-564-9784, fax: 202-565-2079

1-4 Design Freedom. Requirements stated in this RFP are **minimums**. Innovative, creative, or cost-saving proposals which meet or exceed these requirements are encouraged. Existing housing plans or modifications thereof that meet the design and construction criteria specified herein, which an offeror has previously constructed and priced, may be submitted. They may include designs incorporating factory fabricated

components or modules. Deviations from space and adjacency requirements are discouraged unless the changes result in improvement to the facilities.

1-5 Housing Units. Site-built, factory-built units are acceptable options for this project.

1-6 Definition of Housing Unit Types. Terms for housing unit types used in these criteria are defined as follows:

1-6.1 Site-built housing. A residential building or housing unit wholly or substantially constructed at the site.

1-6.2 Factory-built housing. Construction consisting of components, sub-assemblies such as modules, panelized walls, roof trusses, floor joists, and other factory-assembled components, which are transported to the construction site and further assembled into completed housing units. All interior and exterior walls, regardless of whether they are structural (load bearing) or not, are plant fabricated (panelized). Panels must be fabricated to the extent that the structure of the panel or truss is factory-assembled. Finishes such as interior wall board may be site applied.

1-6.3 Deleted

1-6.4 Deleted

1-6.5 Deleted

1-6.6 Duplex. One or two-story housing units joined together by a common party wall and each housing unit entered directly from the exterior.

1-6.7 Deleted

1-6.8 Detached house. A single-family housing unit which is not attached to another housing unit.

1-7 Design Quality. The objectives are to obtain housing structures and complimentary site development within funds available and to optimize livability. Design quality is achieved through the optimization of interior planning, integration of housing structures to the site, and balancing architectural attractiveness, variety, function, and design for low-cost maintenance and operation. Offerors should consider sustainable design applications, as described in paragraph 13, in developing proposals.

1-8 Installation Real Property Master Plan. The installation real property master plan provides comprehensive documentation of the existing conditions of natural, man-made, and human resources. It also guides the future land-use development. The real property master plan should be consulted as it is the mechanism for ensuring that individual projects are sited to meet overall installation goals and objectives for land use development

1-9 Installation Design Guide. Design of this project shall incorporate the design guidance and criteria contained in the Installation Design Guide, excerpts of which are contained in VOLUME IV, ATTACHMENTS .

1-10 Energy and Resources Conserving Features. Public Law 102-486, Executive Order 13123, and Federal Regulations 10 CFR 435, require Federal buildings to be designed and constructed to reduce energy consumption in a life-cycle, cost-effective manner using renewable energy sources when economical. Products designed to conserve energy and resources by controlling the amounts of consumed energy or by operating at increased efficiencies should be considered. Minimum requirements for this project are High-efficiency central air conditioning and/or heating units, setback thermostats, and water flow-limiting plumbing fixtures. Offerors are required to provide Energy and Resource conserving improvements that at least insure compliance with the Energy Star Homes Program parameters.

1-11 Prototype Housing Units. The purpose of the prototype housing unit is to verify the details of the approved design and material selections, and to establish the quality level against which the remaining work

will be judged. At the plant, or at the site, construction connection details shall be exposed for study by authorized Government inspectors for a period of time agreed to by the Contractor and the Contracting Officer. The housing unit or units at the plant and/or the prototype at the site are subject to Contracting Officer's approval. At the site, the complete prototype shall be constructed for each housing unit type. Each stage of work shall be completed and accepted on the prototype prior to starting work on the same stage for similar housing units in the project.

1-11.1 "Site-Built." A prototype housing unit shall be required for each housing unit type.

1-11.1.1 Where multiple prototype units are being constructed, one or two prototype units shall be left in the "rough in" stage (no interior finishes) so that the utility systems and framing construction is exposed. Exteriors of these prototypes shall be completely finished. When the last new units are constructed, these "rough in" stage prototype units shall be completed and turned over to the Government with the last turn-over group.

1-11.2 "Factory-Built." A prototype housing unit shall be required for each housing unit type of each run fabricated at the plant for manufactured or factory-built homes.

1-11.3 Deleted

1-11.4 Factory-Built. If the housing units are classified as factory-built housing, all wall panels which are fabricated in the plant for shipment to the site shall have prototype units constructed and assembled for in-plant inspection by the Government. This shall include, as a minimum, wall framing, roof and ceiling framing, connection details, utility piping, wiring and ductwork, interior and exterior wall finishes which form part of the factory-built wall. In addition, the Contractor shall construct as part of the factory-built prototype, installed samples of wall insulation, finished siding (if not part of wall assembly), sample installed bathtub and sink and installed kitchen sink and cabinets to demonstrate proper installation and wall connections. Portions of the work shall be left unfinished or exposed to demonstrate interior construction details.

1-11.4.1 One Floor Prototype. If only one floor of the prototype is factory-built, factory assembly of the factory-built portion of the prototype is required. In all cases, the factory prototype shall consist of one of each building type. The factory prototype shall be assembled to verify assembly connections, details, construction, and transportation of the finished housing unit.

1-11.4.2 Structural Integrity. Manufactured and factory-built homes shall be of individual housing units attached to one another in a manner which shall provide a finished structural assembly having an appearance and structural integrity comparable to a site-built single or multi-family residence built to applicable codes.

1-11.4.3 Construction Tolerances. Assembled housing units shall be true and plumb and all within specified construction tolerances for all alignments represented on the drawings. Adjacent walls shall be attached at roof and floor levels in such a manner as to preclude placing any wood member in cross-grain bending or cross-grain tension, and to avoid putting nails in withdrawal.

1-12 Deleted

**2. CRITERIA REFERENCES.**

2-1 Criteria to be used for design and construction shall be taken from the most current references at the date of issue of the RFP. Administrative, contractual, procedural, and environmental features of the contract shall be as described in other sections of the RFP. Referenced codes and standards herein and those listed below are minimum acceptable criteria.

2-2 Local and State Codes or Standards. The following specifications, standards, bulletins, and handbooks form a part of this document to the extent specified herein. (AM#4)

2-2.1 Local. Fort Sam Houston Installation Design Guide. ETL 1110-3-491 SUSTAINABLE DESIGN FOR MILITARY FACILITIES.

2-2.2 State.

2-3 Federal Laws. The Federal laws and regulations listed in Table 2-1 form a part of this document. They are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20401-9325 (202) 512 - 1800

TABLE 2-1 – FEDERAL LAWS & REGULATIONS	
CFR/USC No.	Description
P.L. 102-486	Energy Policy Act of 1992
10 CFR 430	National Appliance Energy Conservation Act (NAECA)
10 CFR 435	Voluntary Performance Standards for New Commercial and Multi-Family High Rise Residential Buildings; Mandatory for Federal Buildings.
10 CFR 436	Methodology and Procedures for Life Cycle Cost Analyses
16 CFR 1630	Standard for Surface Flammability of Carpet and Rugs
40 CFR 247.12	Comprehensive Procurement Guideline for Products Containing Recovered Materials, Construction Products
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks
49 CFR 192	Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards
49 CFR 195	Transportation of Hazardous Liquids by Pipeline
24 USC 5301	Public Law 93-383, Community Development
42 USC 4321-4361	National Environmental Policy Act (NEPA)

TABLE 2-1 – FEDERAL LAWS & REGULATIONS	
CFR/USC No.	Description
42 USC 4901-4918 & 49 USC 1431	Noise Control Act of 1972
Army Regulation 200-1	Environmental Protection and Enhancement, May 1990
E.O. 13123	Energy Efficiency and Water Conservation in Federal Facilities

2-4 Federal Specifications and Standards. The specifications listed form a part of this document to the extent specified herein. Federal Standard 795, Uniform Federal Accessibility Standards, and federal specifications are available from the Commanding Officer, Naval Publications and Forms Center, ATTENTION: NPODS, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.

2-5 Other Government Documents and Publications. The following Government documents and publications form a part of this document to the extent specified herein:

2-5.1 Americans With Disabilities Act Accessibility Guidelines, are available from U.S. Architectural and Transportation Barriers Compliance Board, 1331 F Street, N.W., Washington, D.C. 20004-1111

2-5.2 Federal Emergency Management Agency, Mitigation Directorate; 500 C Street, SW; Washington DC 20472: National Performance Criteria for Tornado Shelters and FEMA 320, Taking Shelter from the Storm: Building a Safe Room Inside Your Home. <http://www.fema.gov/>

2-5.3 NBS Handbook 135, Life-Cycle Costing Manual for the Federal Energy Management Program. Available from the National Institute of Science and Technology, formerly National Bureau of Standards (NBS).

2-5.4 Standard for the Surface Flammability of Carpets and Rugs; and (Unnumbered) Handbook for Public Playground Safety, CFR 16-1630. Available from the Consumer Product Safety Commission, Directorate for Compliance and Administrative Litigation, Department of Regulatory Development, Washington, DC 20207, (301) 492-0626 or 492-0400.

2-5.5 United States Environmental Protection Agency criteria are available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650: EPA/600/8-88/087, Radon-Resistant Residential New Construction; EPA/625/5-88/024, Application of Radon Reduction Methods; and EPA/625/5-87/019, Radon Reduction Techniques for Detached Houses.

2-6 Non-Government Publications. The following publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are Department of Defense (DoD) adopted are those listed in the Department of Defense Index of Specifications and Standards (DODISS).

2-6.1 Air Conditioning Contractors of America, Inc. (ACCA). 1712 New Hampshire Ave. NW. Washington DC 20009; (202) 483-9370; FAX (202) 588-1217; <http://www.acca.org/>.

2-6.2 Air-Conditioning and Refrigeration Institute (ARI). Information listed below is available from ARI, 4301 Fairfax Dr., Suite 425, ATTN: Pubs Dept., Arlington, VA 22203, Ph: 703-524-8800, Fax: 703-528-3816, Internet E-Mail: ari@dgsys.com, Directory of Certified Unitary Air Conditioners, Unitary Heat Pumps and Sound Rated Outdoor Unitary Equipment; ARI 210/240, Unitary Air Conditioning and Air-Source Heat Pump Equipment: <http://www.ari.org/>

2-6.3 AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA), AMCA 210, Laboratory Methods of Testing Fans For Rating, is available from AMCA, 30 West University Drive, Arlington Heights, IL 60004, (312) 394-0150: <http://www.amca.org/>

2-6.4 American Architectural Manufacturers Association (AAMA). AAMA specifications shown in Table 2-2 are available from AAMA, 1540 East Dundee Rd., Suite 310, Palatine, IL 60067-8321, Ph: 708-202-1350, Fax: 708-202-1480 2700 River Road, Suite 118, Des Plaines, IL 60018, (312) 699-7310.

**TABLE 2-2 - AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION SPECIFICATIONS**

No.	Description
AAMA 101	Voluntary Specification for Aluminum Prime Windows and Sliding Glass Doors
AAMA 101V	Voluntary Specification for Poly (Vinyl Chloride) (PVC) Prime Windows and Sliding Glass Doors
AAMA 1002.10	Voluntary Specifications for Aluminum Insulating Storm Products for Windows and Sliding Glass Doors
AAMA 1402	Standard Specifications for Aluminum Siding, Soffit, and Fascia

2-6.5 American Gas Association (AGA). Standards and specifications are available from AGA, 1515 Wilson Blvd., Arlington, VA 22209, Ph: 703-841-8556, Fax: 703-841-8406: <http://www.aga.org/>

2-6.6 American National Standards Institute, Inc. (ANSI). Copies of the standards listed in Table 2-3 are available from ANSI, 11 West 42nd St., New York, NY 10036, Ph: 212-642-4900, Fax: 212-302-1286: <http://www.ansi.org/>

**TABLE 2-3 - AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS**

Std. No.	Std. Description
A112.19.1	Enameled Cast Iron Plumbing Fixtures
A112.19.2	Vitreous China Plumbing Fixtures (DoD Adopted)
A112.19.3	Stainless Steel Plumbing Fixtures (Designed for Residential Use)
A112.19.4	Porcelain Enameled Formed Steel Plumbing Fixtures (DoD Adopted)

**TABLE 2-3 - AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS**

Std. No.	Std. Description
A112.19.5	Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards) (DoD Adopted)
A161.1	Recommended Construction and Performance Standards for Kitchen and Vanity Cabinets
B16.5	Steel Pipe Flanges and Flanged Fittings (DoD Adopted)
B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings (DoD Adopted)
B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes (DoD Adopted)
B31.8	Gas Transmission and Distribution Piping Systems
C2	National Electrical Safety Code
ANSI C105 AWWA A21.5	Polyethylene Encasement for Ductile-Iron Pipe Systems
Z21.10.1	Water Heaters, Gas, Volume I, Storage Type, 75,000 BTUH Input or Less
Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
Z60.1	American Standard for Nursery Stock
Z124.1	Plastic Bathtub Units
Z124.2	Plastic Shower Receptors and Shower Stalls

2-6.7 American Plywood Association. APA B840-K-88, 303 Siding Manufacturing Specifications, are available from the American Plywood Association, P.O. Box 11700, Tacoma, WA 98411, (206) 565-6600.

2-6.8 American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) documents, listed in Table 2-4, are available from ASHRAE, 1791 Tullie Cir., NE, Atlanta, GA 30329-2305, Ph: 404-636-8400 Fax: 404-321-5478 1791 Tullie Circle, N.E., Atlanta, GA 30329, (404) 636-8400: <http://www.ashrae.org/>

**TABLE 2-4 – AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR-CONDITIONING ENGINEERS (ASHRAE)**

No.	Description
ASHRAE -	Handbook of Fundamentals
ASHRAE -	Residential Cooling Load Calculations
ASHRAE 62	Ventilation for Acceptable Indoor Air Quality

**TABLE 2-4 – AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR-CONDITIONING ENGINEERS (ASHRAE)**

No.	Description
ASHRAE 52	Method of Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter
ASHRAE 111	Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air Conditioning, and Refrigeration Systems

2-6.9 American Society of Mechanical Engineers (ASME). ASME B16.11, Forged Fittings, Socket-Welding and Threaded, and ASME B31.8, Gas Transmission and Distribution Systems, are available from ASME, 22 Law Dr., Box 2300, Fairfield, NJ 07007-2900, Ph: 800-843-2763, Fax: 201-882-1717: <http://www.asme.org/>

2-6.10 American Society of Sanitary Engineers (ASSE). ASSE 1006, Residential Use (Household) Dishwashers, and ASSE 1008, Food Waste Disposal Units, Household, are available from ASSE, AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE), P.O. Box 40362, Bay Village, OH 44140, Ph: 216-835-3040, Fax: 216-835-3488:

2-6.11 American Society for Testing and Materials (ASTM). ASTM specifications listed in Table 2-5 are available from ASTM, AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) 1916 Race St., Philadelphia, PA 19103, Ph: 215-299-5585, Fax: 215-977-9679: <http://www.astm.org/>

**TABLE 2-5 - AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) SPECIFICATIONS**

Spec. No.	Spec. Description
A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A526	Specification for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality (DoD Adopted)
B117	Method of Salt Spray (Fog) Testing (DoD Adopted)
C90	Specification for Hollow Load-Bearing Concrete Masonry Units (DoD Adopted)
C216	Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) (DoD Adopted)
D3676	Rubber Cellular Cushion Used for Carpet or Rug Underlay
D1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft 2700kN-m/m)
D1785	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 (DoD Adopted)

**TABLE 2-5 - AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)  
SPECIFICATIONS**

Spec. No.	Spec. Description
D2513	Standard Specification for Thermoplastic Gas Pressure Piping (DoD Adopted)
D2683	Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing (DoD Adopted)
D2846	Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot and Cold-Water Distribution Systems (DoD Adopted)
D3018	Specification for Class A Asphalt Shingles Surfaced with Mineral Granules (DoD Adopted)
D3679	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding
E84	Standard Test Method for Surface Burning Characteristics of Building Materials (DoD Adopted)
E90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions (DoD Adopted)
E108	Standard Methods of Fire Tests of Roof Coverings
E119	Standard Methods of Fire Tests of Building Construction and Materials
E162	Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source (DoD Adopted)
E283	Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors
E330	Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
E336	Standard Test Method for Measurement of Airborne Sound Insulation in Buildings
E547	Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential
E648	Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source
E779	Measuring Air Leakage by the Pressurization Method
E1007	Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures
E1465	Standard Guide for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings

**TABLE 2-5 - AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) SPECIFICATIONS**

Spec. No.	Spec. Description
F1292	Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment
E1423	Standard Practice for Determining the Steady State Thermal Transmittance of Fenestration Systems
E 1554	Determining External Air Leakage of Air Distribution Systems by Fan Pressurization.
F 1066	Standard Specification for Sheet Vinyl Composition Floor Covering
F1487-98	Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
G90	Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight

2-6.12 American Water Works Association, Inc. (AWWA). Specifications listed below are available from AWWA, 6666 West Quincy, Denver, CO 80235, Ph: 800-926-7337, Fax: 303-795-1989, AWWA C500, Gate Valves for Water and Sewerage Systems (DoD adopted); AWWA C502, Dry-Barrel Fire Hydrants; and AWWA C503, Wet-Barrel Fire Hydrants: <http://www.awwa.org/>

2-6.13 Associated Air Balance Council (AABC). AABC MN-1, National Standards for Total System Balance, is available from AABC, 1518 K St., NW, Washington, DC 20005, Ph: 202-737-0202, Fax: 202-638-4833: <http://www.aabchq.com/>

2-6.14 American Association of Textile Chemists and Colorists (AATCC). AATCC 134, Electrostatic Propensity of Carpets, is available from AATCC, P.O. Box 12215, Research Triangle Park, NC 27709, (919) 549-8141.: <http://www.aatcc.org/>

2-6.15 Builders Hardware Manufacturers Association, Inc. (BHMA). Specifications shown in Table 2-6 are available from the Builders Hardware Manufacturers Association, Inc. (BHMA), 355 Lexington Ave., New York, NY 10017, Ph: 212-661-4261, FAX: 212-370-9047.

**TABLE 2-6 - BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA) SPECIFICATIONS**

No.	Description (Specs. are DoD Adopted)
ANSI/A156.1	Butts and Hinges
ANSI/A156.4	Door Controls, Closers
ANSI/A156.5	Auxiliary Locks and Associated Products
ANSI/A156.2	Bored and Preassembled Locks and Latches

**TABLE 2-6 - BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA) SPECIFICATIONS**

No.	Description (Specs. are DoD Adopted)
ANSI/A156.12	Interconnected Locks and Latches

2-6.16 Building Officials & Code Administrators International, Inc. (BOCA). The BOCA National Building Code is available from Building Officials & Code Administrators International, Inc., (BOCA), 4051 W. Flossmoor Rd., Country Club Hills, IL 60478-5795, Ph: 708-799-2300, Fax: 708-799-4981: <http://www.boca.org/>

2-6.17 Carpet and Rug Institute (CRI). CRI Standard for Installation of Commercial Textile Floor Covering Materials, CRI 104, is available from the Carpet and Rug Institute, 310 Holiday Ave. P.O. Box 2048, Dalton, GA 30722-2048, Ph: 706-278-0232: <http://www.carpet-rug.com/>

2-6.18 deleted (AM#3)

2-6.19 Electronic Industries Association Telecommunications Industry Association (EIA/TIA). EIA/TIA Standard EIA/TIA-570, is available from Electronic Industries Association, Engineering Department, Order From: Global Engineering Documents, 7730 Carondelet Ave., Suite 407 Clayton, MO 63105, Ph: 800-854-7179, or 714-979-8135, Fax: 314-726-6418

2-6.20 Illuminating Engineering Society of North America (IESNA). The IESNA Lighting Handbook, is available from Illuminating Engineering Society of North America, (IESNA), 120 Wall St., 17th Floor, New York, NY 10005-4001, Ph: 212-248-5000, Fax: 212-248-5017: <http://www.iesna.org/>

2-6.21 **International Conference of Building Officials (ICBO). The 2000 International Building Code and 2000 International Residential Code are available from the, INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO), 5360 S. Workman Mill Rd., Whittier, CA 90601-2298, Ph: 800-252-3602, Fax: 913-764-2272: <http://www.icbo.org/> (AM#3)**

2-6.22 National Association of Architectural Metal Manufacturers Association (NAAMA). NAAMA Metal Finishes Manual, is available from the NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM), 11 So. LaSalle St., Suite 1400, Chicago, IL 60603, Ph: 312-201-0101, FAX: 312-201-0214:

2-6.23 National Association of Corrosion Engineers (NACE). NACE RP-0286, The Electrical Isolation of Cathodically Protected Pipelines, is available from NACE, P.O. Box 218340, Houston, TX 77218: <http://www.nace.org/>

2-6.24 **International Code Council (ICC). The International Plumbing Code, 5203 Leesburg Pike, Suite, 708, Falls Church, VA 22041-3401, 703-931-4533 [AM#0003].**

2-6.25 National Electrical Manufacturers Association (NEMA). NEMA standards listed below are available from the National Electrical Manufacturers Association (NEMA), NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA), 2101 L St., NW, Suite 300, Washington, DC 20037-1526 Ph: 202-457-8474 Fax: 202-457-8473 NEMA DC 3, Wall-Mounted Room Thermostats; and NEMA WD 1, General Requirements for Wiring Devices: <http://www.nema.org/>

2-6.26 NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB), NEBB-01, Procedural Standards for Testing-Adjusting-Balancing of Environmental Systems, is available from NEBB, 875 Grove Mount circle, Gaithersburg, MD 20877-4121, Ph: 301-977-3698, Fax: 301-977-9589: <http://www.nebb.org/>

2-6.27 National Fenestration Rating Council (NFRC). NFRC 100-91, Procedure for Determining Fenestration Product Thermal Properties, is available from NFRC, 1300 Spring Street, Suite 500, Silver Spring, MD. Telephone: (301) 589-NFRC, <http://www.nfrc.org>

2-6.28 National Fire Protection Association, Inc. (NFPA). NFPA codes listed in Table 2-7 are available from the National Fire Protection Association, Inc. (NFPA), 1Battery March Park, P.O. Box 9101, Quincy, MA 02269. Telephone: (617) 770-3000, Fax: (617) 770-0700: <http://www.nfpa.org/>

**TABLE 2-7 - NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) CODES**

Code No.	Code Description
NFPA 13	Installation of Sprinkler Systems
NFPA 13R	Installation of Sprinkler Systems in Residential Occupancies Up To and Including Four Stories
NFPA 54	National Fuel Gas Code
NFPA 70	National Electrical Code (DoD Adopted)
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
NFPA 101M	Alternative Approaches to Life Safety
NFPA 255	Method of Test of Surface Burning Characteristics of Building Materials
NFPA 501A	Manufactured Home Installations
NFPA 501D	Recreational Vehicle Parks and Campgrounds
NFPA 701	Standard Methods of Fire Tests for Flame Resistant Textiles and Films

2-6.29 National Sanitation Foundation, 3475 Plymouth Road, Ann Arbor, MI 48105. Telephone: (313) 769-8010, Fax: (313) 769-8010: <http://www.nsf.org/>.

2-6.30 National Wood Window and Door Association (NWWDA) standard, NWWDA I.S.2, Standard for Wood Window Units is available from the National Wood Window and Door Association (NWWDA), 1400 East Touhy Ave., Suite 470, Des Plaines, IL 60018, (847) 299-5200, Fax: (847) 299-1286: <http://www.nwwda.org/>.

2-6.31 Sheet Metal and Air Conditioning Contractors National Association (SMACNA). SMACNA Installation Standards for Residential Heating and Air Conditioning Systems and SMACNA-07, HVAC Systems, Testing, Adjusting, and Balancing, are available from SMACNA, 4201 Lafayette Center Drive, Chantilly, VA 22180, (703) 803-2980, Fax: (703) 803-3732: <http://www.smacna.org/>

2-6.32 Southern Building Code Congress International, Inc. The Standard Housing Code is available from Southern Building Code Congress International, Inc., 900 Montclair Road, Birmingham, AL 35213-1206. Telephone: (205) 5921-1853, Fax: (205) 591-9775: <http://www.sbcci.org/>.

2-6.33 Underwriters Laboratories, Inc. (UL) specifications listed in Table 2-8 are available from the Underwriters Laboratories, Inc. (UL), 333 Pfingston Road, Northbrook, IL 62096. Telephone: (847) 272-8800. Fax: (847) 509-6220: <http://www.ui.com/>.

**TABLE 2-8 – UNDERWRITERS LABORATORIES SPECIFICATIONS**

No.	Description (Specs. Are DoD Adopted)
UL 174	Water Heaters, Household Electric Storage Tank Type
UL 430	Waste Disposers
UL 507	Electric Fans
UL 555	Fire Dampers
UL 746C	Polymeric Materials - Use in Electrical Equipment Evaluations
UL 749	Household Dishwashers
UL 858	Household Electric Ranges
UL 923	Microwave Cooking Appliances
UL 900	Test Performance of Air Filter Units

### 3. SITE PLANNING AND DESIGN.

3-1 Scope. This project consists of **70** housing units with site amenities on **17.2 hectares (42.6 acres)** of land area. Of the 70 units, 20 will be designed for Sr. Non-Commissioned Officers (NCO) and 50 for Jr. NCOs. **Site amenities include, but are not limited to, the construction of new residential streets and the replacement of existing streets, as directed in the RFP, recreational features, sidewalks, utilities and drainage. (AM#4)** Imaginative site design is encouraged, however, the site boundaries, project composition, and gross density are fixed. Based on the graphic and narrative description of site opportunities and constraints provided, the offeror shall verify that the site meets the program requirements.

#### 3-2 REFERENCES.

The design of this facility shall comply with the requirements of the applicable parts of the following references:

CESWD Architectural and Engineering Instruction Manual (CESWD-AEIM)

Uniform Federal Accessibility Standards, Federal Register (UFAS)

Americans with Disabilities Act Guidelines (ADA)

TM 5-803-5, Installation Design

TM 5-803-14, Site Planning and Design

TM 5-813-5, Water Supply, Water Distribution Systems

TM 5-814-1, Sanitary and Industrial Wastewater Collection- Gravity Sewers and Appurtenances

TM 5-814-2, Sanitary and Industrial Wastewater Collection- Pumping Stations and Force Mains

TM 5-820-4, Drainage for Areas Other Than Airfields

TM 5-822-2, General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas

TM 5-822-5, Pavement Design for Roads, Streets, Walks, and Open Storage Areas

TM 5-822-7, Standard Practice for Concrete Pavements

TM 5-848-1, Gas Distribution

DG 1110-3-204, Design Guide for Army and Air Force Airfields, Pavements, Railroads, Storm Drainage, and Earthwork

MIL-HDBK-**1008C (AM#4)**, Fire Protection for Facilities

MIL-HDBK-1190, Facility Planning and Design Guide

HQUSACE Architectural and Engineering Instructions- Design Criteria (USACE AEI)

3-3 Area Development Plan. Provide a housing area development plan that shows the spatial and functional arrangement of all housing requirements. The plan should ensure an economical, compatible and functional residential land use development that utilizes the advantages of the site, fosters visual order, and provides a

sense of community. The area development plan shows consideration for the site opportunities and constraints, housing program requirements, and specific site design criteria and guidance provided. The recommendations of the Installation Real Property Master Plan and Installation Design Guide should be addressed.

3-3.1 Density. The project site is approved for LOW DENSITY siting. Land area for density calculations excludes slopes greater than 10 percent, major highways, flood plains and flood areas, lakes and water courses. Designated major recreation areas greater than 1.2 ha [3 acres] may be excluded from the density calculation.

3-3.2 Land use. The plan for the area should reflect an optimum balance of housing unit floor area, open space, play lots, recreational amenities and pedestrian and vehicular circulation. The plan should show an efficient, organized and economical land use arrangement that is compatible and functional. This plan should show the relationship of the area to adjacent land uses.

3-3.3 Noise. Use mitigation techniques to moderate predictable noise in accordance with the Installation Compatible Use Zone Program. All possible methods of mitigating the impact to the site and adjacent areas should be explored.

3-3.4 Buffer area. Provide appropriate buffer areas to separate and visually isolate the community from undesirable external influences and to separate adjacent officer and enlisted personnel housing areas from each other. The width of a street should be a minimum acceptable buffer zone between officer and enlisted personnel housing areas. Buffer areas may be used for recreational amenities, such as basketball courts, tot lots and trees. All possible methods of mitigating the impact to the site and adjacent areas should be explored. Buffer screening is desired along the southern and eastern boundaries of the site to separate the housing area from industrial and troop areas, respectively. Landscaping or berming is the desired method of screening.

3-3.5 Housing unit grouping. Variety in groupings, arrangements, and siting configurations of housing units is encouraged to fit varying terrain conditions and to provide compatible and functional residential layouts and street scapes. Building arrangements should be informal and imaginative with setbacks and orientation to provide for the best view, privacy, and variety. The proper grouping of housing units will provide backyard screening, separation of pedestrian and vehicular traffic, play lots and natural open spaces. The layout should reflect simplicity of design and provide a visual sense of community and should mirror the density and style reflected in the existing Patch-Chaffee housing area but does not limit the layout to a strictly linear configuration.

3-3.6 Housing unit variation. Housing unit variation shall afford distinctly different exterior appearances within each housing unit type. Provide stylistic compatibility that will give the neighborhood a sense of order. Housing units shall vary in two or more of the following: Floor plans, massing, elevation, carport location, and exterior materials. One floor plan for each housing unit type is acceptable if sufficient variety is achieved by means of other variations mentioned above. In addition, housing units shall vary in color and siting. A reverse floor plan (mirror-image), although an acceptable means of creating variety, shall not constitute a housing unit change. Offerors shall comply with land-use restraints set forth in this document. Five percent of the units shall be handicapped accessible and shall meet the requirements of the Uniform Federal Accessibility Standards (UFAS) and the Americans with Disabilities Act (ADA) and should be located at the northern portion of the site bound by Patch, Chaffee and W.W. White Roads (north of unit 881 and east of units 831 to 834). This would result in one (1) Sr. NCO unit and three (3) Jr. NCO units being handicapped accessible. The design should reflect life cycle maintenance and energy efficiency.

3-3.7 Housing unit orientation. Housing units shall be oriented, to the maximum extent possible within the constraints of the site available, so that a major section of the roof faces within 20 degrees of South. The purpose of proper orientation is to expose a minimum surface area to direct solar gain while allowing the units the potential for passive solar applications. Additional consideration will be given during the quality evaluations with respect to unit orientations and passive solar applications considered and included. For additional passive solar information and considerations, see paragraph 11- ENERGY CONSERVATION, of this Statement of

Work.

3-3.8 Grading. The grading should maintain existing topography while recognizing standard gradients for the housing units and various functions. If feasible, there should strive to be a balance of the quantity of cut and fill, which would create a smooth transition of graded areas into the existing natural site. The plan should reflect selective site clearing that preserves groups of trees, where applicable. Grading should manage site runoff. The principles of positive drainage should be applied to control the conditions that remove rainfall away from facilities and functions.

3-3.8.1 Turfed Areas. In any turfed area, the minimum slope shall be 2%. In housing unit backyards, the maximum slope shall be 3%. In other areas the finished grade should slope away from the buildings at 5% for at least 3 meters. In areas outside of housing unit yards, turfed slopes may vary between 2% minimum and a maximum of 25%, however the maximum slope should be avoided, if possible. Should slopes in excess of 25% be required, slope protection such as slope paving, should be employed or retaining walls shall be used to effect grade changes.

3-3.8.2 Roads, Streets, Access Drives and Parking Areas. Longitudinal grade changes in excess of 1% shall be accomplished by vertical curves. Profiles are mandatory for vertical control of centerline gradients.

3-3.8.3 Parking Areas. Pavement grades shall provide positive drainage with a 1% minimum slope in the direction of drainage. The maximum slope in the direction of parking shall be 1-1/2%. The slope perpendicular to the direction of parking shall be 5% maximum for bituminous or concrete surfaces and 3% for other surfaces.

3-3.8.4 Sidewalks. Sidewalks with a slope gradient equal to or less than 3% are preferred. Sidewalk transverse cross-slope shall be a 2% minimum with a maximum no greater than 5%. Any walkway with a slope greater than 4.2% shall be designated as a ramp. Sustained walkway grades greater than 3.3% shall have a level landing of at least 1.83m x 1.83m (6 ft x 6ft) at 18.3m (60 ft) intervals for rest and safety. Walks and ramps serving facilities that are accessible to and usable by the physically handicapped shall meet the requirements of UFAS and ADA.

3-4 Site Design Criteria. The following specific criteria, based on site density, are to be used as guidance in site design, and proposals will be **evaluated AM#4** accordingly.

3-4.1 Housing units per hectare (ha) [acre (ac)] by site density are shown in Table 3-1 on the following page.

Pay Grade	Low Density	
	units/ha	units/ac
E-6 & Below	9.9-17.3	4-7
E-7 - E-9	7.4-12.4	3-5

3-4.4 Parking requirements by site density.

3-4.4.1 Low density: Two off-street stalls and one guest on-street stall per unit.

3-4.5 Children's outdoor play areas. Children's outdoor play areas are a requirement per number of housing units. See paragraph 3-7 for size and equipment specifications.

3-4.5.1 Play lot: One 325 m<sup>2</sup> [3,500 ft<sup>2</sup>] play lot per 30 housing units. The play lot shall be designed to accommodate two age groups; 12 months to 5 years age group and 5 to 9 years age group. The play lot shall

have a capacity for approximately 15 to 35 children. These play lots should be located within site lines of the housing units and in close proximity to the Jr. NCO units.

**(AM#5)**

**3-4.6 Site amenities Additional site amenities to be included in the design include picnic tables and grills at the play lots, half-court basketball courts and walks. New walks shall be located only on one side of the street and shall be designed to connect the new housing area to both new and existing amenities. The amenities should be sited so as to provide easy access to the units that will be located at the site boundaries.**

3-5 Building Setbacks and Spacing. Clearances between and adjacent to buildings must consider requirements for fire protection, safety, privacy, and emergency access in addition to the following minimum criteria. Setback or yard dimensions shall be from the building wall to an imaginary lot line around each building measured perpendicular to the building. Wall lengths with horizontal offsets of 1.8 m [6 ft] or more may be measured separately when determining yard depth. Distance between buildings shall be not less than the sum of setbacks or yards, as required.

3-5.1 Minimum setbacks and spacing for low density sites is shown in Table 3-4.

**TABLE 3-4 - MINIMUM SETBACKS AND SPACING, LOW DENSITY SITES**

Description	Meters	[Feet]
From front of house to curb of residential street.	7.5	25
From house to major/arterial highway. (Edge of pavement)	45.0	150
From house to collector street. (Edge of pavement)	30.0	100
Side of carport <b>(AM#4)</b> to curb.	6.0	20
Side of house to curb <sup>1</sup> .	6.0	20
Between sides of carports <b>(AM#4)</b> and houses <sup>1</sup> .	1.5	5
Between outside walls of houses <sup>1</sup> .	6.0	20
Between rear walls of houses.	24.0	80
Between side and rear walls of houses.	12.0	40
Between street face of carport <b>(AM#4)</b> and curb or sidewalk when second off- street parking space is next to <b>(AM#4)</b> carport.	2.4	8
Between street face of carport <b>(AM#4)</b> and curb or sidewalk when second off- street parking space is between carport <b>(AM#4)</b> and street.	8.5	28

Note<sup>1</sup>: When patios are located within a yard, separation shall not be less than 12.0 m [40 ft].

### 3-5.3 Setback Notes.

3-5.3.1 Where the slope is 3:1 or steeper, top and toe of slope shall be a minimum of 4.5 m [15 ft] from the building.

3-5.3.2 Courts, outer and inner, shall have dimensions not less than the sum of the required yard distances. An inner court shall have a minimum area of 9.29 m<sup>2</sup> [100 ft<sup>2</sup>] for a one-story building.

3-6 **Circulation and Parking (AM#4)**. The vehicular and pedestrian circulation system shall promote safe, efficient movement of vehicles and pedestrians within the housing area. It should maintain the maximum separation of vehicles and pedestrians. Safe circulation systems have a clear hierarchy of movement, lead to a clear destination, and do not interrupt other functions. The following criteria shall be considered for designing streets and drives for vehicles and pedestrians:

3-6.1 Vehicular circulation. Vehicular circulation layout is determined by applying the design vehicle templates to the site design. The passenger car class includes passenger cars and light delivery 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-semitrailer combinations, and trucks or truck tractors with semi-trailers in combination with full trailers. Templates showing the turning movements for design vehicles are provided by the American Association of State Highway and Transportation Officials (AASHTO). Design site entrances, exits, service drives, and special circulation areas to accommodate the largest vehicle that uses the area. In the case of family housing the largest vehicle to use the area on a weekly basis would be the 12 m (40 ft) garbage truck. Provide the vehicle clearances that are required to meet traffic safety for emergency vehicles, service vehicles, and moving vans. Streets shall include required traffic control and street identification signage, maximum spacing between drives, right-angle turns, and limit points of conflicts between traffic.

#### 3-6.1.1 Definitions.

##### 3-6.1.1.1 Nonresidential Streets

3-6.1.1.1.1 Arterial. Major roads and street systems external to the residential area.

3-6.1.1.1.2 Collector. Feeder street connecting external street system with residential streets in the subdivision and adjoining areas subject to future development. No houses shall be located on collector streets, and no driveway or access shall be from collector streets

##### 3-6.1.1.2 Residential Streets

3-6.1.1.2.1 Loop. Both ends open to traffic.

3-6.1.1.2.2 Cul-De-Sac. Only one end open to access street and a turnaround (T, Y, or Circle) at the other end.

3-6.1.2 Cul-De-Sac Design. The circulation system may be based on cul-de-sacs a maximum 182.8 m [600 ft] long, measured from the center of the cul-de-sac to the centerline of the access street.

3-6.1.3 Intersection Design. Provide "T" intersection offsets of at least 38.1 m [125 ft]. The preferred angle of intersection is right-angle (90 degrees).

3-6.1.4 Street design. Street dimensions are determined by the selected design vehicle templates. Separation, corner clearances, and sight distance are established when the design vehicle templates and speed limits are selected. Streets shall be designed for vehicles with not less than 2721.5 kg [6,000 lb] code wheel load. Pavement shall be asphaltic concrete as described in the furnished **Attachment 7A-GEOTECHNICAL REPORT (AM#5)**. The Installation desires that Road No. S-23 is utilized for the whole run

of the community. **Replace Road No. S-23 between Lawton and Crockett Roads. Replace the street located one block east of Road No. S-23, between Harney and Schofield Roads. This street may be rerouted, as deemed necessary. (AM#4).** Streets shall be provided with standard barrier type reinforced concrete curbs and gutters. Reinforcement shall be #10M bars. Turning **radii** on streets and service roads shall be designed to accommodate a fire department ladder truck. Curbs shall be depressed at entrances to driveways. All gradients shall provide positive drainage with no ponding. Longitudinal street grades shall vary between 0.3% minimum and 6% maximum. Vertical curves shall be provided where longitudinal grade changes equal 1% or more.

3-6.1.5 Housing unit access drive. Access drives should provide traffic safety distances which allow safe entry and exit. Access drives serving more than 8 housing units, or subject to service and emergency truck traffic shall be designed as a street.

3-6.2 Privately owned vehicle (POV) parking. POV stalls without vehicle overhang shall be a maximum 2.7 m x 5.5 m [9 ft x 18 ft]. The design vehicle template that is used to design this space shall be described. Design on-street parking stalls to be of sufficient length and width to allow safe movement into and out of the stall and to adequately separate the parked vehicle from the traffic flow. On-street parking will not be allowed on service roads. Signage should be provided which reflects this requirement. Provide compact passenger car dimensions only when recommended by a Site Traffic Impact Study.

3-6.2.1 Housing unit POV parking. POV parking areas consisting of more than 4 vehicles backing into the street are unacceptable.

3-6.2.2 Off-street parking lots. A 90-degree parking layout is preferable. Maintain two-way movement and avoid dead-end parking lots. Provide more than one entrance and exit drive. In large parking lots provide a minimum 10 percent of the total paved area for landscape plant material.

### **3-6.3 Deleted (AM#4)**

3-6.4 Pedestrian circulation. Pedestrian circulation should be safe, separated from vehicle circulation, and relate to the housing units, parking, and community facilities. Pedestrian circulation should be based on pedestrian desired lines of walking between facilities. Desired lines should be weighted to predict the most traveled routes. These routes would require paving. Topography and vegetation can be used to reinforce a sense of movement. Design pedestrian concentration areas with adequate paved area.

3-6.4.1 Sidewalk design. Sidewalks shall be provided on one side of the street. Walks shall be a minimum of 1.22 m [4 ft] wide (except for those in the vicinity of the handicapped accessible units and accessible site amenities) exclusive of curb width, and made of nonreinforced concrete with a minimum thickness of 100 mm [4 in]. Walks in the vicinity of the handicapped accessible units and accessible site amenities shall be designed as specified in UFAS and ADA. Where walks are adjacent to the curb, the curb width is not to be included as sidewalk. Ramps for handicapped individuals shall be provided at intersections by depressing street curbs and adjacent sidewalk and shall meet the requirements specified in UFAS and ADA. Concrete construction shall also apply to porches, patios, stoops and walks unit entrances.

3-6.5 Signs. Locate all proposed signs on a site plan in accordance with distance and placement guidelines. The signing system should provide consistency and continuity to the overall visual image of the installation. The signs shall be coordinated with the design of other site furnishings to minimize the number of streetscape elements and reduce clutter.

3-6.5.1 Traffic signs. Traffic signs shall be in accordance with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Federal Highways Administration.

3-7 Children's Outdoor Play Areas. The design of the children's outdoor play areas shall comply with the safety requirements of ASTM F 1487 and ASTM F 1292. The children's outdoor play areas are unsupervised

play areas and do not have a supervised play program for child development. These areas are not part of trained recreation, youth center or child development staff support. Supervised outdoor play areas occur at youth centers and child development centers.

### 3-7.1 Child Safety and Accessibility.

3-7.1.1 Accessibility to children and adults with disabilities. Play areas shall be accessible to children and adults with disabilities. In addition to wheelchair users, the needs of children and adults who walk with canes, walkers, or crutches; who have limited use of the upper body; who have visual or hearing disabilities, or who have developmental disabilities shall be considered. Design criteria based on child dimensions should be used for the proper functioning of the play area. Every part of a play area may not be accessible to all its users, but the social experience provided should be accessible to everyone. When more than one play activity of the same type is provided, one shall be accessible. When one activity is provided, it shall be accessible. A diverse play area has the greatest potential for meeting the needs of all users. Separate play areas for the physically challenged are not acceptable. Integrating all children in the same play setting will be emphasized. Guidelines available from this design district for accessible routes, ramps for wheelchair access, transfer points, wheelchair accessible platforms, and accessible stepped platforms should be followed.

3-7.1.2 Age appropriate scale. Age appropriate scale is a term used to describe equipment which will allow safe and successful use by children of a specific chronological age, mental age, and physical ability. Play equipment height and complexity will not exceed the user's ability. The children's outdoor play areas will meet age appropriate scale for the age groups that the areas are designed to accommodate.

3-7.1.3 Use zones. In accordance with ASTM F 1487, a use zone is a clear, unobstructed area under and around play equipment where a child would be expected to land when jumping or falling from a piece of play equipment. These zones require a playground safety surface in accordance with ASTM F 1292. Requirements for use zones vary for the age group and for different pieces of equipment. All use zones for play equipment should be shown on the site plan to ensure there is no conflict between play activities on the ground and swinging or jumping from the equipment. Use zones will not overlap except for spring rocking equipment, balance beams, and play houses.

3-7.1.4 Playground safety surface. A playground safety surface is constructed of a material that meets the shock absorbency criteria recommended in ASTM F 1292. Playground safety surfaces shall be provided throughout all use zones and under all play equipment as required.

3-7.1.5 Inappropriate play events. The following play events are not appropriate for use in unsupervised play areas: Chain walks, chain or tire climbers, fulcrum seesaws, log roles, May poles, merry-go-rounds, rotating equipment, spring rocking equipment intended for standing, swinging exercise bars, trapeze bars, and whirls.

3-7.2 Play lot. Provide play lots that are located within the site lines of the housing units to be supported. Connect play lots to the units by a walkway system that meets the requirements as specified for sidewalks above. Provide shade. Each play lot shall be provided with the following age appropriate play events and equipment for the two age groups to be accommodated:

3-7.2.1 Pathway. The pathway should encompass the perimeter of the area, accommodate wheeled toys, and consist of different textures, colors, and patterns for games.

3-7.2.2 Gathering place. This setting provides an open space for groups of different sizes and people of all ages. Provide an infant crawl area. The seating materials may include boulders, timbers or logs arranged with vegetation to create a room like atmosphere. A shelter may be provided.

3-7.2.3 Sand play setting. This setting supports creative play and social interaction. It provides children with a manipulative play environment. The play elements include sand, water, sand tables, containment barriers and boulders. The sieve size for sand should consist of a fine washed plaster sand. The sand used here is not the same sieve size as the sand used for the use zones. This setting should be located adjacent to the play

village.

3-7.2.4 Play village. This setting supports a playhouse and a water source. It should be located adjacent to the sand play setting.

3-7.2.5 Dramatic play setting. This setting supports dramatic play elements such as playhouses, play platforms, and an open area for seating on the ground.

3-7.2.6 Manufactured play equipment setting. This setting includes an age appropriate composite structure consisting of multiple play events for each of the following age groups; 12 months to 2 years of age, 2 to 5 years of age and 5 to 9 years of age. Other play events include freestanding equipment such as spring rocking equipment, swing, and balance beam. The swing should be located as a freestanding play event on the perimeter.

3-7.3 Sports and games areas. Provide half-court basketball courts. Other design elements include asphalt surfacing, fences, drinking fountains, lighting, seating and trash receptacles.

3-7.4 Plant materials. Plants and ground cover should be integrated into play settings. Plants provide a variety of learning opportunities, as they become a source for play material for crafts, dramatic play, and sensory experience. Plants define space and provide shade. Poisonous plants and plants with thorns are not allowed and should be removed from the play areas.

3-8 Landscape Planting Plan. The offeror shall obtain and use the services of a qualified landscape architect, experienced in site planning and planting design. A complete, integrated landscape planting plan incorporating the Fort Sam Houston Landscape Master Plan shall be provided for the overall housing project. The design shall reflect appropriate groupings, and street tree plantings to define the open spaces to ensure a complete landscaped project. Undesirable views shall be screened from the housing units and play areas. **Housing will have screening along the southern and eastern boundaries of the site to screen the housing areas from industrial and troop areas, respectively (AM#5).** The screening may be accomplished through the use of landscaping, berms or a combination of the two. The screening shall be at least 50% effective when installed and should be designed offer a minimum of 85% coverage after 3 growing seasons. Screening with fencing is not desirable. It is important that the Western border of the site be screened from the adjoining work areas. Foundation plantings for each house will not be required although a series of typical planting plans may be provided to guide the new residences in installing the foundation plantings themselves. Choose plant materials on the basis of plant hardiness, climate, soil conditions, low maintenance, and quality. Selected plant materials shall be easily maintained and tolerant of the specific site conditions. Planting or seeding shall occur only during periods when beneficial results can be obtained.

3-8.1 Trees, shrubs, and ground cover. Plant varieties shall be nursery grown or plantation grown stock conforming to ANSI/ANLA Z60.1. The varieties chosen shall be chosen from the approved list accompanying the existing master plan. They shall be grown under climatic conditions similar to those in the locality of the project.

3-8.1.1 Quality. Well-shaped, well-grown, vigorous, healthy plants having healthy and well-branched root systems shall be provided. Plants shall be free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement, and abrasion. Plants shall be provided that are typical of the species or variety, and conforming to standards as set forth in ANSI/ANLA Z60.1.

3-8.1.2 Shade and flowering trees. A height relationship to caliper shall be provided as recommended by ANSI/ANLA Z60.1. Height of branching should bear a relationship to the size and variety of tree specified, and with the crown in good balance with the trunk. Trees shall not be "poled" or the leader removed.

3-8.1.2.1 Single stem. Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

3-8.1.2.2 Multi-stem. All countable stems, in aggregate, shall average the size specified. To be considered a stem, there should be no division of the trunk which branches more than 150 mm [6 in] from the ground level.

3-8.1.2.3 Specimen. A plant shall be provided that is well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

3-8.1.3 Deciduous shrub. Plants shall be provided that have the height and number of primary stems as recommended by ANSI/ANLA Z60.1. An acceptable plant shall be well shaped with sufficient well-spaced side branches recognized by the trade as typical for the variety grown in the region.

3-8.1.4 Coniferous evergreen. Trees shall be provided that have the height-to-spread ratio as recommended by ANSI/ANLA Z60.1. Trees shall not be "poled" or the leader removed. An acceptable plant shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

3-8.1.5 Broadleaf evergreen. Plants shall be provided that have ratio of height-to-spread as recommended by ANSI/ANLA Z60.1. An acceptable plant shall be well shaped and recognized by the trade as typical for the variety grown in the region.

3-8.1.6 Ground cover. Plants shall be provided with the minimum number of runners and length of runner as recommended by ANSI/ANLA Z60.1. Plants shall be furnished that have heavy, well developed, and balanced top with vigorous well developed root system, and shall be furnished in containers.

3-8.1.7 Measurement. Plant measurements shall be in accordance with ANSI/ANLA Z60.1.

3-8.1.8 Percolation test. Test for percolation shall be done to determine positive drainage of plant pits and beds. All soil and drainage conditions detrimental to the growth of plant material shall be identified and a proposal correcting the conditions shall be submitted.

3-8.2 Soil test. A soil test shall be performed for pH, chemical analysis, and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of plant material specified.

3-8.3 Installation. Verify the location of underground utilities. When obstructions below ground or poor drainage affect the planting operation, proposed adjustments to plant location, type of plant, and planting method or drainage correction shall be submitted. The plant material shall be installed during appropriate planting times and conditions recommended by the trade for the type and variety of plant material specified. Plant pits shall be excavated and backfilled as recommended by the trade and ANSI/ANLA Z60.1. The planting operation shall be performed only during periods when beneficial results can be obtained. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted.

3-8.4 Pruning. The total amount of foliage shall be pruned by one-fourth to one-third on installed trees and shrubs to compensate for loss of roots and transplanting shock. The typical growth habit of individual plants shall be retained. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

3-8.5 Maintenance during planting operation. Installed plants shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue until the plant establishment period commences.

3-8.6 Plant establishment period. On completion of the last day of the planting operation, the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect for the remaining contract time period not to exceed 12 months. When the planting operation extends over more than one season or there is a variance to the planting times, the plant establishment

periods shall be established for the work completed.

3-8.7 Maintenance during establishment period. The maintenance of plants shall include straightening plants, tightening stakes and guying material, repairing tree wrap, protecting plant areas from erosion, maintaining erosion material, supplementing mulch, accomplishing wound dressing, removing dead or broken tip growth by pruning, maintaining edging of beds, checking for girdling of plants and maintaining plant labels, watering, weeding, removing and replacing unhealthy plants.

3-8.8 Unhealthy plant. A plant shall be considered unhealthy or dead when the main leader has died back, or 25 percent of the crown is dead. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit in accordance with the following warranty paragraph.

3-8.9 Warranty. Furnished plant material shall be guaranteed to be in a vigorous growing condition for a period of 12 months regardless of the contract time period. A plant shall be replaced one time under this guarantee. Transplanting existing plants requires no guarantee.

3-8.10 Turf. Turf consists of seed, sod, and sprigs. There may be several different types of turf mixtures applied; one for lawn areas around housing units and one for field or recreation areas. The boundaries of each area shall be clearly defined on the planting plan.

3-8.10.1 Seed quality. State approved seed of the latest season's crop shall be provided in the original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with applicable State seed laws. Seed mixtures shall be proportioned by weight. Weed seed shall not exceed one percent by weight of the total mixture.

3-8.10.2 Sod. State approved sod shall be provided as classified by applicable State laws. Each individual sod section shall be of a size to permit rolling and lifting without breaking.

3-8.10.2.1 Quality. The sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 50 mm [2 in] in any dimension, woody plant roots, and other material detrimental to a healthy stand of turf. Sod that has become dry, moldy, or yellow from heating, or has irregular shaped pieces of sod and torn or uneven ends shall be rejected.

3-8.10.2.2 Thickness. Sod shall be machine cut to a uniform thickness of 306 mm [1ft 1/4 in] within a tolerance of 6 mm [1/4 inch] excluding top growth and thatch. Measurement for thickness shall exclude top growth and thatch.

3-8.10.2.3 Time limitation. The limitation of time between harvesting and placing sod shall be 36 hours.

3-8.10.3 Sprig quality. The cultivar shall be provided as healthy living stems, stolons, or rhizomes with attached roots, including two or three nodes, and shall be from 100 mm to 150 mm [4 in to 6 in] long, without adhering soil. Sprigs shall be provided which have been grown under climatic conditions similar to those in the locality of the project. Sprigs shall be obtained from heavy and dense sod, free from weeds or other material detrimental to a healthy stand of turf. Sprigs that have been exposed to heat or excessive drying shall be rejected. The time limitation between harvesting and placing sprigs shall be 24 hours.

3-8.10.3.1 Soil test. A soil test shall be performed for pH, chemical analysis, and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of turf specified.

3-8.11 Temporary turf cover. When there are contract delays in the turfing operation or a quick cover is required to prevent erosion, the areas designated for turf shall be seeded with a temporary seed. When no other turfing materials have been applied, the quantity of one-half of the required soil amendments shall be

applied and the area tilled.

3-8.12 Installation. The turf shall be installed during appropriate planting times and conditions recommended by the trade for the type and variety of turf specified. The turf operations shall be performed only during periods when beneficial results can be obtained. Drainage patterns shall be maintained. The turf shall be installed by using the methods as recommended by the trade for the type and variety of turf specified.

3-8.13 Protection. Immediately after turfing, the area shall be protected against traffic or other use by erecting barricades and providing signage as required.

3-8.14 Turf establishment period. The turf establishment period for establishing a healthy stand of turf shall begin on the first day of work under the turfing contract and shall end three months after the last day of the turfing operation. An unsatisfactory stand of turf shall be repaired as soon as turfing conditions permit.

3-8.15 Satisfactory stand of turf.

3-8.15.1 Seeded lawn area. A satisfactory stand of turf from the seeding operation for a lawn area is defined as a minimum of 160 grass plants per square meter. Bare spots shall be no larger than 150 mm [6 in] square. The total bare spots shall not exceed two (2) percent of the total seeded area.

3-8.15.2 Seeded field area. A satisfactory stand of turf from the seeding operation for a field area is defined as a minimum of 100 grass plants per square meter. The total bare spots shall not exceed two (2) percent of the total seeded area.

3-8.15.3 Sodded area. A satisfactory stand of turf from the sodding operation is defined as living sod uniform in color and texture. Bare spots shall be no larger than 50 mm [2 in] square.

3-8.15.4 Sprigged area. A satisfactory stand of turf from the sprigging operation is defined as a minimum of 20 sprigs per square meter. Bare spots shall be no larger than 225 mm [9 in] square. The total bare spots shall not exceed two (2) percent of the total sprigged area.

3-8.16 Maintenance during establishment period. The maintenance of the turfed areas shall include eradicating weeds, eradicating insects and diseases, protecting embankments and ditches from erosion, maintaining erosion control materials and mulch, protecting turf areas from traffic, mowing, watering, post-fertilization, and replacing unsatisfactory turf areas.

3-9 DELETED

#### 4. SITE ENGINEERING.

##### 4-1 Soils.

4-1.1 Soil, Foundation and Pavement Report (Geotechnical Report). A preliminary Soil, Foundation and Pavement Report is provided as part of this RFP. A drawing indicating Subsurface Explorations and Geologic Profiles for the proposed site is also provided. The report provides an overview of soils and geologic conditions, and is furnished for informational purposes only. The offeror to whom this contract is awarded shall, with his or her consulting professional geotechnical engineer experienced in geotechnical engineering, be responsible for determining site specific geotechnical conditions.

4-1.1.1 The Contractor provided site specific geotechnical conditions report shall include, but not be limited to:

4-1.1.1.1 Classification of soil and rock.

4-1.1.1.2 Depth to bedrock.

4-1.1.1.3 Extent of boulders.

4-1.1.1.4 Bearing capacity of soil and rock.

4-1.1.1.5 Settlement potential.

4-1.1.1.6 Compaction requirements.

4-1.1.1.7 Groundwater characteristics.

4-1.1.1.8 Infiltration and permeability.

4-1.1.1.9 Erosion and siltation.

4-1.1.1.10 Surface and subsurface drainage.

4-1.1.1.11 Soil resistivity.

4-1.1.1.12 DELETED

4-1.1.2 The offeror and his or her professional geotechnical engineer consultant shall certify in writing that the design of the project has been developed consistent with the site specific geotechnical conditions. The certification shall be stamped by the consulting professional geotechnical engineer and shall be submitted with the **60 (AM#4)** percent design submission. If revisions are made to the **60 (AM#4)** percent design submission, a new certification shall be provided with the final design submission.

##### 4-1.2 Soil compaction.

4-1.2.1 Soil compaction shall be achieved by equipment approved by a professional geotechnical engineer. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the compaction specified with the equipment used. Compact each layer to not less than the percentage of maximum density specified in Table 4-1, determined in accordance with ASTM D 1557 Method D.

**TABLE 4-1 – SOIL COMPACTION**

Subgrade Preparation, Fills, Embankments, and Backfills	Minimum Compaction Requirements (Percentage of Maximum Density)
Structures & Building Slabs	90
Streets, Paved Areas, Bike Paths	90
Sidewalks	85
Grassed Areas	80

4-1.2.2 The requirements shall be verified or modifications recommended by the consulting professional geotechnical engineer in the report wherever engineering, soils, or climatic factors indicate the necessity. Any modification to the stated compaction requirements shall require the approval of the Contracting Officer.

4-1.3 Capillary water barrier. A capillary water barrier is required for all interior slabs on grade, including **(AM#4)**, carports and storage rooms. As a minimum, the capillary water barrier shall be 6 inches.

4-1.4 Soil treatment. Soil treatment for termites shall be by the chemical method. Methods, and extent of protection required, shall comply with local or state industrial standards, whichever is the more stringent.

4-1.5 DELETED

4-1.6 Radon mitigation. The Contractor shall refer to paragraph 14- ENVIRONMENTAL for radon issues.

4-2 Water Distribution System. Connection to the existing water distribution system shall be made at the nearest water main capable of meeting the requirements for service to the facilities.

4-2.1 Water Mains and Building Service Connections. Mains shall be considered as that part of the distribution system supplying fire hydrants, or fire hydrant laterals. Service connections supply water from the main to the building. Separate meters will be provided at each unit. Mains shall be looped with no dead ends and be of adequate size to satisfy both domestic and fire flow requirements. Minimum main size is 0.15 m [6 in]. Sufficient sectional control valves shall be provided so that no more than two fire hydrants will be out of service in the event of a single break in a water main. A copper tracer wire shall be placed directly above all non-metallic mains when plastic marking tape does not provide means of determining alignment of pipe by metal detecting equipment. The pipe, valves, and all other materials shall meet the American Water Works Association (AWWA) standards for a 1,034.2 kPa [150 psi] working pressure system. Provide sacrificial anodes for all valves and metal pipe. Building connections shall be designed and constructed in accordance with the National Standard Plumbing Code.

4-2.2 Flow requirements. Water must be supplied by mains of appropriate capacity to provide 37.9 L/s [500 gpm] **at one-story units and 56.8 L/s [750 gpm] at two-story structures, (AM#3)** for a flow duration of 1-1/2 hours. This mandatory flow is over and above domestic requirements. Domestic requirements shall be based on 1135.6 liters/day (300 gal/day) per housing unit for single family housing **and duplexes, AM#3** Mains shall be sized to carry this flow with a 2.5 peak hourly factor. Pressure shall be a minimum of 137.9 kPa [20 psi] at the required flows indicated above for each fire hydrant, and a maximum of 1,034.2 kPa [150 psi] at each outlet after allowing for friction, elevation, and other pressure losses. Pressure at each housing unit shall not exceed 517.1 kPa [75 psi]. Fire flow data is included as ATTACHMENT 9.

4-2.3 Trenches. Water and gas mains may be installed in the same trench, with the gas main placed on a shelf at least 0.3 m [12 in] above and to one side of the water mains. (Coordinate with the local gas utility supplier to determine system acceptability). Water mains shall have a minimum of 0.9 m [3 ft] of earth cover.

Minimum cover above water lines shall be 0.75 m [2 ft 6 in] in grassed areas and 0.9 m [3 ft] in paved areas. Adequate cover must be provided for freeze protection. Where frost penetrates to a depth greater than the minimum above, greater cover will be required. Sufficient cover must also be provided to protect the pipe against structural damage due to superimposed surface loads. Lines laid lower than the minimums stated shall be concrete encased with a minimum concrete thickness of 0.15 m [6 in].

4-2.4 Fire hydrants. Hydrants shall conform to AWWA C502, Dry-Barrel Fire Hydrants. Valves shall conform to AWWA C500, Gate Valves for Water and Sewerage Systems. Fire hydrants shall be compatible with those presently in use at the installation or local Government Jurisdiction, with similar pump and hose connections for one 115 mm (4-1/2") pumper connection and two 65 mm (2-1/2") hose connections. Fire hydrant spacing shall be no greater than 152 m [500 ft] apart, by paved road. In addition, a hydrant shall be provided so that all parts of the housing units can be reached by hose lines not over 107 m [350 ft] long. Hydrant laterals shall be 0.15 m [6 in] minimum size, shall not exceed 15.2 m [50 ft] in length, and shall have an underground shutoff valve. Valve box, at each lateral, shall be located within 3 m [10 ft] of the hydrant, and shall not be located where obstructed by parked vehicles, shrubbery, etc. Guard post barriers shall be provided where hydrant locations are subject to vehicle damage. A minimum 1.5 m (5 ft) clearance shall be maintained between fire hydrants and poles, trees, shrubs or other permanent obstructions. Hydrants shall be located no closer than 1 m (3 ft) and no further than 2 m (7 ft) from the street curb line. Fire flow data, for hydrants in the existing Patch-Chaffee area, is included as ATTACHMENT 9.

4-2.5 Shutoff valve. Each building shall be provided with a separate service and main shutoff valve, readily accessible to maintenance and emergency personnel. Shutoff valves in walks are prohibited.

4-2.6 Valve Boxes. Valve boxes shall be cast iron of approved manufacture. Boxes shall be extension type with slide type adjustment and with flared base. The word "WATER" shall be cast in the cover. The boxes shall be of such length as will be adapted, without full extension, to the depth of cover required over the pipe at the valve location. Valve boxes shall be suitable for traffic. Cast iron valve boxes shall be bonded with the ferrous valve and cathodically protected. Cast iron valve boxes shall have a protective coating applied using a coal tar epoxy.

4-2.7 Materials for Water Lines. Acceptable materials for water lines are as follows:

4-2.7.1 Service Lines less than 80 mm (3") in diameter: galvanized steel, polyvinyl chloride (PVC) plastic, Oriented PVC plastic polyethylene or copper tubing.

4-2.7.2 Service Lines greater than or equal to 80 mm (3") in diameter: ductile iron, PVC, filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe or steel.

4-2.7.3 Distribution Lines greater than or equal to 80 mm (3") in diameter: ductile iron, PVC through 900 mm (36") nominal diameter plastic, Oriented PVC plastic filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe or reinforced concrete.

4-3 Sanitary Sewerage System. Connection to the existing sewage collection system shall be made at the closest sewer line(s) capable of servicing the housing units. Sewage collection systems shall be designed and constructed in accordance with the National Standard Plumbing Code criteria in this paragraph, and installation requirements. Pipe sizes and slopes shall be calculated using the Manning Formula. Manholes are required at all changes of direction and spaced not more than 152 m [500 ft] apart. A fixed siderail ladder shall be provided for manholes greater than 3.6 m (12 ft) in depth. The word "SEWER" shall be cast in manhole covers. Curved sewers are prohibited. Pipes shall be designed to flow full and maintain a minimum velocity of 0.6 m [2 ft] per second. If siphons are used, two lines of equivalent capacity shall be used with cleanouts. Where pumping is required, force mains shall be sized to minimize pumping head, with a 0.9 m to 1.5 m [3 ft to 5 ft] per second velocity.

4-3.1 Sewer mains. Design shall be based on an average daily per capita flow of sanitary sewage of 378.5 L [100 GAL] per day with a 4.0 peak hourly factor. Mains shall be a minimum of 0.2 m [8 in] in diameter.

4-3.2 Sewer Building Laterals. Each building lateral shall be connected directly to a sewer main. Manholes shall be provided where lateral lines exceed 30 m (100 ft) in length from the housing unit to the service main line.

Combining multiple building laterals is prohibited. Two-way cleanouts shall be provided to allow cleaning of all lines to grade. Cleanouts, in yard areas, shall be set in a box with a hinged cover. Laterals from one building shall not cross under another building. Lines shall be sized in accordance with the National Standard Plumbing Code. Sewer laterals serving a housing unit shall be a minimum of 0.15 m [6 in] in diameter.

4-3.3 Trenches. Sewer and water lines, mains or laterals, shall be placed in separate trenches. The separate trenches shall maintain a minimum lateral separation of 3.0 m [10 ft].

4-3.4 Cover. Sewer lines shall be located at a depth greater than the frost penetration. Minimum cover above the top of pipes shall be 0.6 m [2 ft] in areas not subject to vehicular loads and 0.9 m [3 ft] in all other areas. If the minimum cover can not be met, the length of pipe shall be concrete encased with a minimum 0.07 m [3 in] thickness of concrete.

4-3.5 Acceptable Materials for Sanitary Sewer Lines. Non-reinforced Concrete (bell and spigot), Plastic (PVC or ABS), reinforced plastic mortar pipe, reinforced thermosetting resin pipe, ductile iron, cast iron soil pipe or clay (extra strength). Cement used for concrete pipe fittings, manholes and other sanitary sewer structures shall be Type V.

4-3.6 Design Criteria. Gravity lines shall be sized based upon peak flow and designed to provide a minimum velocity of 2 feet per second (fps) at the average daily flow rate and a minimum velocity of 2.5 fps to 3.5 fps at 1/2 the peak flow rate. The maximum flow velocity shall not exceed 10 fps, based on peak flow. For gravity lines, Manning's formula shall be used. Manning's "n" values less than 0.013 shall not be permitted despite manufacturer's reports of "n" values between 0.009 and 0.011. When the required 2 fps flow velocity at the average flow rate cannot be met in gravity sewer lines (lateral or main) due to inadequate flow, a minimum slope of 0.6% shall be provided for 150 mm (6") lines and 0.4% for 200 mm (8") lines.

4-4 Storm Drainage System. The storm drainage system shall be properly coordinated with surrounding properties to ensure that runoff does not cause damage to other properties. All drainage lines, if required, shall remain in conduit to stable grade. The minimum pipe size shall be 300 mm (12") inside diameter. The minimum velocity of flow in conduits during a design storm shall be 0.07 m/s [2 ft 6 in/s]. Storm water collection, disposal (and retardation) system shall be designed for a minimum of a 10-year return frequency. Rainfall intensities for project locations shall be in accordance with local community/locality/State Transportation (Highway) agency design parameters.

4-4.1.1 Storm Runoff. The Rational Method as described in **ATTACHMENT 6 (AM#4)** shall be used to calculate storm runoff. Stormwater detention shall be incorporated which minimizes erosion and settling. Detention should be designed to avoid creating an area that is unsightly, difficult to maintain or a menace to health or safety.

4-4.1.2 Storm Drainage Design. Runoff from other properties presently directed towards the new project site shall be incorporated into the new storm drainage system design to ensure that this runoff does not cause damage to surrounding properties and the new housing area. Storm drains shall be designed in accordance with criteria in **ATTACHMENT 6 (AM#4)**. Storm drain systems shall be designed so that the hydraulic grade line for the computed design discharge is as near optimum depth as practicable, and velocities are not less than 2.5 fps when the drains are one-third or more full. Energy dissipators shall be provided at storm drain outlets where outlet velocities exceed 5 fps. Storm drain inlets shall be located so that no collection swales flow across a street or sidewalk to reach a storm drain, other than where cross gutters are used. Side opening catch basins are preferable. Where a grating must be used, it shall be of "bicycle proof" design. Sidewalk culverts are not permitted.

4-4.2 Manholes. Manholes shall be located at intersections and changes in alignment or grade. Intermediate

manhole maximum spacing shall be 76.2 m [250 ft] for pipes 0.9 m [3 ft] or less in diameter or box drains with the smallest dimension less than 0.9 m [3 ft]. Maximum spacing for intermediate manholes on larger pipes and drain boxes shall be 152 m [500 ft]. Manholes shall be precast concrete and shall conform to ASTM C 478 or AASHTO M 199. Steel ladders shall be installed where the depth of the manhole exceeds 0.9 m [3 ft]. The ladder shall be galvanized after fabrication in accordance with ASTM A 123. The wall along the ladder shall be vertical. The manhole shall have a 0.6 m [2 ft] minimum opening as measured from the face of the steel ladder.

4-4.3 Drainage of roads and pavements. Provide a positive crown or sheet drainage to all streets and roads. Pavement collectors for storm water shall be by curb inlets and gutters. Open areas shall be drained by field inlets and an underground collection system. No roadside ditches shall be permitted. Overland flow shall be held to a minimum, where feasible. The maximum flow in all gutters shall be restricted to the quantity which will cause flooding of 1/2 the adjacent traffic lane at the design storm flow. When this flow is reached, it shall be intercepted and removed to an underground system. Inlets in the sag of vertical curves on streets that act as sumps shall be oversized 100%. Design shall be based on the Rational Formula and other criteria contained in ATTACHMENT 8.

4-4.4 Pipe for culverts and storm drains may be of concrete, clay, corrugated steel, corrugated aluminum alloy, PVC, or PE. Cement used in concrete pipe, fittings, manholes and other storm drainage structures shall be Type V.

4-5 Gas Distribution System. Gas lines are owned by City Public Service (CPS). CPS will design and construct the new gas distribution system and service lines, up to and including the meter. A gas regulator and meter to monitor fuel use shall be provided for each housing unit. The meter and regulator will be provided and installed by CPS. All new construction shall be coordinated with CPS. The Contractor is responsible for design and construction of service lines within in the units and the laterals connecting to the CPS installed meters. Service laterals shall be designed in accordance with local codes and CPS requirements. Gas lines shall comply with the requirements of ASME B31.8. Shutoff valves shall be provided on the exterior of each building. Contact CPS for determination of all costs associated with connection to the gas distribution system and meters. Existing lines that are to be abandoned shall be either removed or physically disconnected from all gas sources and purged. Abandoning existing gas piping shall be done in accordance with ANSI B31.8, Gas Transmission and Distribution Piping Systems. Installation of gas piping will be in accordance with ANSI B31.8 and 49 CFR 192.

4-5.1 Materials. Materials and appurtenances shall be free of defects and suitable to accomplish the stated objectives of gas distribution systems. Pipe shall be polyethylene or steel as described below.

4-5.1.1 Polyethylene pipe shall conform to ASTM D2513, Standard Specification for Thermoplastic Gas Pressure Piping Systems, with fittings complying with either ASTM D2513 or ASTM D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing. Connections to metal pipe shall comply with ANSI B16.5, Pipe Flanges and Flanged Fittings, or manufacturer's recommended standards.

4-5.1.2 Steel pipe shall conform to ASTM A 53, Grade A or B, Type E or S, Schedule 40; or seamless or electric resistance welded, Schedule 40; black, as specified in ASME B31.8. Furnace butt welded pipe may be used in sizes 40 mm [1-1/2 inch] and smaller. Fittings 40 mm [1-1/2 inch] and smaller shall conform to ASME B16.11. Pipe flanges and flanged fittings larger than 40 mm [1-1/2 inch], including bolts, nuts, and bolt patterns shall be in accordance with ASME B16.5, Class 150. Butt weld fittings shall be in accordance with ASME B16.9. Weld neck flanges shall be used.

4-5.2 Testing. Prove that the entire system of gas mains and service lines is gas-tight by an air test, in accordance with ANSI B31.8. The test shall continue for at least 24 hours between initial and final readings of pressure and temperature.

4-5.3 Drips. Unless high pressure natural gas is used, drips shall be installed at the low points, immediately

following reduction from high pressure to medium pressure (at supply points) and at occasional low points throughout the system to provide for blowing out the lines.

4-5.4 Valves. Plug valves shall be installed at intersections of mains and other locations so that interruptions to service can be confined to no more than 30 housing units.

4-5.5 Mains and service lines. Lines shall not be placed under any buildings. Lines shall be placed with a minimum of 0.6 m [2 ft] of earth cover. Protective casings shall be provided to protect lines from superimposed street or heavy traffic loads.

4-6 DELETED

4-8 Electrical Distribution. Connection to the existing aerial **(AM#2) or underground** medium voltage electrical distribution system shall be made as directed by the Ft. Sam Houston exterior electrical shop. Point of contact is Jaime Machado at 210-221-3350. Existing aerial **(AM#2) or underground** power lines on and around the site can be seen on the attached site drawings. **(AM#2) Aerial connection shall be made utilizing hot line stirrups, surge arrestors, fused cutouts, terminators, rigid galvanized steel conduit riser, and all other necessary hardware for a complete installation. (AM#2) Underground connection shall be as directed by the exterior electrical shop.**

4-8.1 System Design. The electrical on-site distribution system shall be designed in compliance with the rules and recommendations of ANSI C2, National Electrical Safety Code; NFPA 70, National Electrical Code whichever is more stringent; and ANSI C84.1, Electric Power Systems and Equipment – Voltage Ratings. Provide new electrical distribution system as necessary and connect to existing system. Distribution system shall be a load-balanced 3-phase loop-primary radial system incorporating a minimum of two sectionalizers. Sectionalizer feeder loads shall be as balanced as possible. Primary feeder cables shall be copper or aluminum. Medium voltage conductors shall have protective shielding. Use of concentric neutral type cable is not allowed. Medium voltage conductors shall be buried a minimum of 1.2 m [4 ft] below the finished grade with continuous cable marker tape 0.3 m [1 ft] below grade. Cable markers shall be installed along the length of direct-burial cable runs to identify their routes from the surface. Markers will be provided at changes of direction and at intervals not to exceed 152.4 m [500 ft]. Underground direct-burial distribution is required.

4-8.2 Underground splices. Underground connection or splices are prohibited, except in boxes or manholes. Splices shall be in a self-draining, rodent-resistant manhole or box with a cover.

4-8.3 Secondary Feeders. Each transformer shall feed a single secondary underground type distribution pedestal (free standing, pad-mounted enclosure with enclosed molded case breakers); and each pedestal shall feed underground service laterals (to allow disconnection of power to individual houses), street lighting, etc.

4-8.4 Secondary Distribution Pedestals. Pedestals shall have a circuit breaker panel with a main circuit breaker and branch circuit breakers for each housing unit service, street lighting circuit, etc. The pedestal load center shall be rated for the available fault current from the transformer. The load center enclosure shall be both NEMA 3R and NEMA 12. Enclosure shall be capable of being locked. The pedestal line terminals and the circuit breaker panel bus shall, as a minimum, be rated for 125% of the maximum nameplate output of the connected transformer.

4-8.5 Service laterals. Service laterals shall be underground. The length of secondary distribution service laterals from the transformer secondary to the building service entrances shall be minimized. Voltage drop in each service lateral shall not exceed three percent at the calculated maximum demand load. Service laterals shall be sized to supply no less than the largest total demand load as determined by the National Electrical Code, Article 220, Part B or Part C, whichever is greater. However, an additional 88 percent demand factor may be applied to laterals that feed buildings with two or more dwelling units.

4-8.6 Service entrance. Only one service entrance per building shall be provided. The service entrance conductor shall be buried a minimum of 0.9 m [3 ft] below finished grade with a minimum separation of 0.3 m [1

ft] from telephone or TV cables. System shall be designed such that the fault current available at the service entrance equipment will not exceed 10,000 amps.

4-8.7 Transformers. Transformers shall be pad-mounted and have two non-fused switches for the loop connection. The high voltage compartment of the transformer shall include a load break switch with fused circuit for the transformer. The transformer secondary voltages shall be 120/240 V, single-phase, three-wire, solid neutral service to housing units. In selecting a transformer, the nameplate rating shall not be less than 90 percent of the kilovolt/amperes (kV/A) demand load calculated for the transformer. Demand load shall be calculated by the method listed in the National Electrical Code, Article 220, Part B or Part C, whichever is greater.

4-8.8 Street, sidewalk, and area lighting. Residential roadway lighting, including collector streets, shall be provided. Provide lighting at roadway intersections, and at intervals not exceeding 60.9 m [200 ft] between intersections. Roadway poles and fixtures shall match existing poles located at the intersections along the northwest boundary of the site. Lighting shall be provided at intervals not exceeding 60.9 m [200 ft] along sidewalks not otherwise illuminated. Sidewalk poles (approximately 4 m tall) and fixtures shall match existing found in the residential area adjacent to the site. Area lighting shall also be provided for all playgrounds and tot lots. Luminaries shall be actuated by photoelectric control, one photocell per circuit, and supplied from multiple circuits originating from secondary distribution pedestals. All lighting levels shall be provided in accordance with the IES Lighting Handbook. **Wooden poles are not allowed. (AM#4)**

4-8.9 Existing power lines. Existing aerial and underground medium voltage power lines traverse across the site and are identified on the attached site drawings. These lines shall be demolished and new lines shall be provided per Ft. **(AM#2) Sam Houston** exterior electrical shop.

4-9 Metering. Metering of utilities shall be provided as follows:

4-9.1 DELETED

4-9.2 Individual meter and meter drops. Individual utility meter drops (including water) shall be provided for each dwelling unit (duplexes contain two dwelling units). Provide electric watt-hour meters adjacent to the service entrance point. Provide manual by-pass jumper plates for each watt-hour meter socket. Locate utility meter drops in an area readily accessible by service personnel. Meters and meter bases shall be sight screened, and located to provide convenient access while not distracting from building appearance.

4-9.3 Gas metering. Individual housing unit metering devices, which comply with local requirements, shall be furnished and installed by CPS. Separate meters shall be provided at duplexes. Meter and regulator location shall be sight screened, and located to provide convenient access while not distracting from the appearance of the units.

4-9.4 Water meter requirements. Water meters are required at each unit. Separate meters shall be provided at duplexes. Each water meter shall be sized to provide 1.26 liters per second @ 34.5 kPa loss (20 gpm @ 5 psi loss) and shall be the nutating disc type, bronze case, bronze disc, straight reading register (gallons).

4-10 Telephone. The **(AM#2) local** telephone company **(AM#2)** \_\_\_\_\_ will furnish and install distribution cables **(AM#2) and all other materials needed to provide telephone service to each dwelling unit up to the protected telephone terminal ("Demarcation Box") located on the side of each dwelling unit. Contractor is responsible for contacting the local telephone company during design and implementing the local telephone company's cable distribution design into the electrical site plan. Contractor shall provide the local telephone company the site design to enable the local telephone company to produce a telephone cable distribution design. During construction, contractor shall coordinate with local telephone company and allow local telephone company on the site to install their cabling and other necessary materials to provide telephone service to each dwelling unit. Local telephone company is Southwestern Bell. Primary POC for Southwestern Bell is Ms. Linda Zugina at 210-483-3966. Secondary POC is Mr. Simon Martinez at 210-483-3959.**

4-10.1 **(AM#2) All existing aerial/underground telephone cables (AM#2) that traverse through the site (AM#2) will be located and identified by FT. Sam Houston to enable contractor to relocate affected cables as part of the design. It is the contractor's responsibility to ensure this is done. Ft. Sam Houston POC for this is Mr. Carlos Santillan at 210-221-1418. The attached electrical site drawings identify some, but most likely not all existing cables. (AM#2)**

**After cables have been identified, contractor's cable relocation design** shall be coordinated with the Ft. Sam Houston Information Technology Business Center (ITBC). POC is Mr. Rick Coleman at 210-221-5955. Outage allowance shall be per Ft. Sam Houston ITBC.

4-10.2 **(AM#2) Deleted.**

4-11 Television. A cable TV distribution system shall be provided for each dwelling unit. There is an existing cable TV distribution system located in the vicinity of the east and west sides of the site. Local cable TV Company shall provide contractor with a connection point(s) to these existing systems. Contractor shall provide all trenching and backfilling in accordance with local cable TV Company requirements. All other materials required for a complete and operable system other than those listed in section 9 will be furnished and installed by the local cable TV company. Close coordination between the contractor and the local cable TV Company shall be maintained throughout the entire design-build process. Local cable TV Company is Time Warner. POC for Time Warner is Peter Perez at 210-352-4466. E-mail address for Mr. Perez is Peter.Perez@twcable.com.

4-12 Cathodic Protection. Cathodic Protection (CP) is mandatory on buried ferrous metallic structures as described below:

4-12.1 Department of Transportation guidance as stated in 49 CFR, Part 192, requires that all metallic natural gas piping be coated and cathodically protected regardless of the soil resistivity.

4-12.2 CP systems must be designed to provide protective potential to meet the requirements of the National Association of Corrosion Engineers (NACE) Standard RP-0169, Control of External Corrosion on Underground or Submerged Metallic Piping Systems, or NACE Standard RP-0185, Control of External Corrosion on Metallic Buried, as appropriate.

4-12.3 New CP systems shall be compatible with other adjacent structures or components.

4-12.4 When plastic pipe is used to extend a steel gas distribution main, an insulated No. 8 AWG copper wire shall be exothermically welded to the existing steel main and run the length of the new plastic main. This wire can be used as a locator tracer wire and to maintain continuity to any future steel gas main extension.

4-12.5 CP and protective coatings shall be provided for the following buried and submerged ferrous metallic structures regardless of soil or water resistivity:

4-12.6.1 Natural gas and propane piping.

4-12.6.2 DELETED

4-12.6.3 DELETED

4-12.6.4 Fire protection piping.

4-12.6.5 Ductile or cast iron pressurized piping under floor (slab on grade) in soil.

4-12.6.6 Underground heat distribution and chilled water piping in ferrous metallic conduit.

4-12.6.7 DELETED

4-12.7 Cast iron pipe shall be treated as follows:

4-12.7.1 For soil resistivity below 10,000 Ohm-cm at pipeline installation depth, provide CP, bonded joints, and protective coatings.

4-12.7.2 For soil resistivity between 10,000 and 30,000 Ohm-cm at pipeline installation depth, provide bonded joints only.

4-12.8 Copper water service lines will be dielectrically isolated from ferrous pipe. Dielectric isolation shall conform with NACE RP-0286.

4-12.9 For ductile iron piping systems (except for ductile iron piping under floor in soil) conduct an analysis to determine if CP and/or bonded or unbonded coatings are required. Unbonded coatings are defined in ANSI/AWWA C105/A21.5.

4-12.10 Conduct an economic analysis to determine if CP and protective coatings should be provided for gravity sewer lines and the following structures in soil resistivity conditions above 10,000 Ohm-cm:

4-12.10.1 Potable water lines.

4-12.10.2 Concentric neutral cable.

4-12.10.3 Other buried and submerged ferrous metallic structures not covered above.

4-12.11 Ferrous metallic piping passing through concrete shall not be in contact with the concrete.

**5. UNIT DESIGN - ARCHITECTURE.**

5-1 Unit Design. The architectural work includes the design and construction of 70 housing units. 20 SrNCO units and 50 JrNCO units are to be constructed. The SrNCO dwelling units are to be single story or two story, three bedroom detached houses. The JrNCO units are to be single story or two story, four bedroom detached houses or duplexes.

5-2 These dwellings shall convey a visual image consistent with Fort Sam Houston’s design characteristic and it’s physical organization. The dwellings are to be part of the New Post, zone 2a. The dwellings are to be compatible with the Noncommissioned Officers Quarters’ massing, proportion and scale and material and color, window and doors, and details. The New Post, zone 2a definitions are established in the Fort Sam Houston Design Guide (FSH DG). Also covered in the FSH DG are exterior guidelines and interior guidelines.

5-3 Designs shall provide unit net areas which do not fall below the minimum values shown in the table below.

**TABLE 5-1**

Pay Grade	Number Of Bedrooms	Minimum Net Floor Areas	
		m <sup>2</sup>	ft <sup>2</sup>
O-1/3 (CGO) W-1/4 E-7/9 (SNCO)	3	125	1,350
E-1/6 (JNCO)	4	125	1,350

5-3.1 Net area definition. Net area is defined as the space inside the exterior and party walls. Net area excludes:

5-3.1.1 Exterior and party walls.

5-3.1.2 Half thickness of interior walls adjacent to excluded areas.

5-3.1.3 Utility and laundry rooms.

5-3.1.4 Interior and exterior bulk storage.

5-3.1.5 Washer and dryer closet.

5-3.1.6 Furnace, domestic water heater, and solar equipment spaces.

5-3.1.7 Stairwells.

5-3.1.8 Landings.

5-3.1.9 Walls and interior spaces specifically designed for passive solar systems (other than required habitable areas).

5-3.1.10 Weather vestibules (not to exceed 1.5 m<sup>2</sup> [16 ft<sup>2</sup>]) sheltering the main entry.

5-3.1.11 Unfinished attic and basement space.

5-3.1.12 Patios or balconies and terraces.

5-3.1.13 Carports and garages.

5-3.1.14 Increases required to meet accessibility standards.

5-3.1.15 Open or screened porches without heating, air conditioning, or interior-type finishes. In localities subject to adverse weather conditions, such as wind-driven mist or noxious atmosphere, or both, open porches may be enclosed with appropriate fenestration or screening, or both, and not considered to increase the net area of the housing units, provided that air conditioning or heating, or both, is not added and the basic character of the enclosed area is still that of a porch.

5-3.2 Allowable net area increases. The minimum net floor area is noted in table 5-1. Proposals to increase the net area of the SrNCO dwellings will be considered a betterment. SrNCO dwellings may increase by 15% of the area shown in table 5-1, while lowering the total number of SrNCO dwellings by 10%. 18 SrNCO dwellings may be constructed if each contains **143.75 square meters (1552.5 net square feet) (AM#4)**. The net area increase does NOT apply to the JrNCO dwellings.

5-3.2.1 5% of the dwelling units are to be ADA accessible. Physical limitations may include any of several types of disabilities. The unit should anticipate a variety of conditions. Accessible housing units shall be designed in such a way that they may be easily and readily modified to accommodate physically challenged occupants, if necessary, at time of occupancy. This means required access clearances, room sizes, bathroom layout, kitchen layout, doors and hardware, grab bars, plumbing hookups, light switches and outlets, controls, and warning devices must meet requirements at time of construction. Readily modifiable means that requirements for adjustable height cabinets and work surfaces, plumbing fixtures, and the warning devices for the hearing and visually impaired can be made either at time of construction or at time of occupancy.

5-3.2.2 Deleted

5-3.2.3 Deleted

5-4 Functionality. Rooms shall be sized and arranged for efficient use, good circulation, and furniture placement. The distribution of space for food preparation living and dining, sleeping, bathing, halls, closets, and services should be balanced and should enhance the intended functions. The master bedroom shall be isolated from the other bedrooms. The submitted floor plan shall pursue an open plan between the kitchen, living and dining room.

5-4.1 Habitable rooms shall not be used as halls for entry into a housing unit or for primary circulation within a housing unit.

5-4.2 Provide convenient access between carport and service area, and between kitchen and service area.

5-4.3 Do not use a sliding glass door as a primary housing unit access.

5-5 Indoor and Outdoor Integration. Emphasize factors that enhance indoor and outdoor living. Consider size, layout and location of patios, balconies and yards, and features that encourage family use of outdoor areas.

5-6 Fire Protection and Safety. Housing units will comply with the applicable National Fire Codes, including NFPA 101, Life Safety Code, and the Mil Hdbk 1008C, Fire Protection for Facilities. Construction features will be provided in accordance with the International Building Code (IBC).

5-6.1 Fire resistance of walls and roof material. Walls separating living units from exterior bulk storage shall be of U.L. design for 1-hour fire rating partitions and shall extend from ground to the underside of the roof sheathing, as a single design assembly. Penetrations in the fire rated partitions shall maintain the rated integrity. This requirement shall be in addition to any code requirements. Provide class A (ASTM E 108, Standard Methods of fire tests of roof covering) roof covering material throughout. party walls and roof material.

Party walls shall extend without openings, from ground to the underside of roof sheathing. Provide firestops at floor, and ceiling or roof line. Provide Class A (ASTM E108, Standard Methods of Fire Tests of Roof Coverings) roof covering material throughout. Party walls (walls separating housing units) shall have the minimum fire-resistance ratings shown below:

5-6.1.1 Duplexes, one hour.

5-6.1.2 Deleted.

5-6.1.3 Deleted.

5-6.2 Party floors. Party floors shall have a topping slab of 50 mm [1-1/2 inch] lightweight concrete, or similar material. Party floors shall have a minimum one-hour fire-resistance rating, in accordance with ASTM E119.

5-6.3 Equipment rooms. Rooms equipped with fuel-fired equipment such as boiler rooms, furnace rooms, and rooms with fuel-fired water heaters, which serve more than one housing unit shall be separated by one-hour fire-rated construction. Direct access to these rooms from the exterior is preferred. Rooms with fuel-fired equipment that serve only one housing unit shall be lined with 13 mm [1/2-inch] gypsum board or equivalent noncombustible material.

5-6.4 Alarm systems. Smoke detectors which are located within the housing unit and which sound an alarm only within the housing unit are not required to be transmitted to the installation fire department.

5-6.5 Deleted.

5-7 Sound Attenuation.

5-7.1 Testing. Certified proof-of-performance field tests will be conducted to demonstrate that the floor and wall systems as constructed provide the required sound isolation. Tests for air-borne sound shall be made in compliance with ASTM E336. Tests for impact sound shall be made in compliance with ASTM E1007. Testing of 10 percent (minimum) of each type of floor and wall system is required. Location of test sites will be chosen at random by the Contracting Officer.

5-7.1.1 Any wall or floor system found to be inadequate shall have the deficiencies corrected and the additional qualifying tests conducted at the Contractor's expense. Testing at the Contractor's expense of greater than 10 percent of each system may be required if the Contracting Officer determines that the quality of construction requires this additional testing.

5-7.1.2 Walls and floor ceiling systems shall be designed to meet or exceed the requirements stated below. In cases where the field tested performance of the systems does not meet the designed performance, the maximum acceptable difference between field tests and sound transmission ratings shall be 2 decibels (dB) for airborne sound ratings and 5 dB for impact sound ratings.

5-7.2 Party walls and floor and ceiling construction between housing units (party floors) shall be designed to provide the minimum airborne sound transmission ratings and impact isolation ratings stated in Table 5-2.

**TABLE 5-2 - SOUND TRANSMISSION STANDARDS  
FOR PARTY WALLS AND FLOOR/CEILING CONSTRUCTION**

---

Area	FSTC <sup>1</sup>	FIIC <sup>2</sup>
Party Walls (Unit Separation)	52	
Primary Habitable Areas (Living, Dining, Family Room, Bedrooms, Circulation)	52	
Habitable Wet Areas (Kitchen, Bath, Utility, Laundry, Equipment)	52	-

Note<sup>1</sup>: Field Sound Transmission Class. See ASTM E336.

Note<sup>2</sup>: Field Impact Isolation Class. See ASTM E1007.

5-7.3 Floor construction. Floor construction between occupancies shall be designed to provide the minimum FSTC and FIIC ratings stated in Table 5-2. Materials used to obtain the required sound attenuation for the floor construction shall not be liquid-soluble or softened by moisture. Sound insulation shall have a flame-spread rating of 25 or less and a smoke development rating of 50 or less when tested in accordance with ASTM E84.

5-7.4 Plumbing and HVAC equipment. Design of plumbing and Heating, Ventilating, Air-Conditioning (HVAC), and dehumidifying equipment shall include design provisions such as location, enclosure and acoustical treatment, to minimize transmission of noise generated by equipment within each housing unit and to eliminate transmission of noise to other housing units.

5-8 Dimensions and Areas. Minimum areas and dimensions for interior spaces are shown in Table 5-3. Minimum areas and dimensions for exterior spaces are shown in Table 5-4.

**TABLE 5-3 - MINIMUM AREAS AND DIMENSIONS - INTERIOR SPACES**

Space	Area		Length		Width/Depth		Height <sup>1</sup>
	m <sup>2</sup>	ft <sup>2</sup>	mm	ft-in	mm	ft-in	mm
Living <sup>2</sup>	14.0	150	3550	11-8	3550	11-8	2300
Dining (/3 BR) <sup>2</sup>	8.4	90	2900	9-6	2900	9-6	2300
Dining (4/ BR) <sup>2</sup>	10.2	110	3200	10-6	3200	10-6	2300
Family Room <sup>2</sup>	8.4	90	2900	9-6	2900	9-6	2300
Kitchen <sup>3,6</sup>	6.0	64	2450	8-0	2450	8-0	2300
Eating in Kit. <sup>4</sup>	6.7	72	2600	8-6	2600	8-6	2300
Refrigerator & Freezer	0.5	6	900	3-0	600	2-0	1800
Washer/Dryer <sup>5</sup>	1.7	18	1800	6-0	900	3-0	2300
BR #1	14.0	150	3550	11-8	3550	11-8	2300
BR #2	11.1	120	3000	10-0	3000	10-0	2300
BR #3	9.0	100	3000	10-0	3000	10-0	2300

**TABLE 5-3 - MINIMUM AREAS AND DIMENSIONS - INTERIOR SPACES**

Space	Area		Length		Width/Depth		Height <sup>1</sup>
	m <sup>2</sup>	ft <sup>2</sup>	mm	ft-in	mm	ft-in	mm
BR #4/5	8.4	90	2900	9-6	2900	9-6	2300
Full Bath <sup>6</sup>	-	-	-	-	1500	5-0	2300
Equipment room <sup>8</sup>	- <b>(AM#4)</b>	- <b>(AM#4)</b>	-	-	-	-	2300
Vestibule	1.2	13	1000	3-3	1200	4-0	2300
Hall & Stairway <sup>7</sup>	-	-	-	-	1000	3-3	2300

Note<sup>1</sup>: Ceiling heights in habitable rooms shall be a minimum of 2300 mm [7 ft-6 inches]. Ceiling heights can be reduced in parts of these rooms to 2100 mm [7 ft] to accommodate ducts.

Note<sup>2</sup>: Room dimensions are exclusive of circulation. Circulation paths along one side of a room are permitted but add 1000 mm [3 ft-3 inches] to the minimum dimension.

Note<sup>3</sup>: A minimum of 1200 mm [4 ft] must be maintained in front of and between cabinets.

Note<sup>4</sup>: Minimum area and dimensions are measured from face of cabinets to walls.

Note<sup>5</sup>: Minimum area and dimensions are indicated for a washer and dryer closet. This area may also be provided in a utility room. When so provided, area and dimensions are exclusive of circulation.

Note<sup>6</sup>: Accessible units must conform to UFAS. UFAS requires greater minimum dimensions.

Note<sup>7</sup>: Clear width is measured between railings.

Note<sup>8</sup>: The length and width/depth shall accommodate the equipment installed and any required area to access and maintain the equipment.

**TABLE 5-4 - MINIMUM AREAS AND DIMENSIONS - EXTERIOR SPACES**

Spaces	Area		Length		Width/Depth		Height <sup>1</sup>
	m <sup>2</sup>	ft <sup>2</sup>	mm	ft-in	mm	ft-in	mm
<b>Carport (AM#2)</b>	21.6	240	3650	12-0	6100	20-0	2300
Balconies	6.7	72	1800	6-0	1800	6-0	2300
Patio - 3 BR	13.6	144	-	-	3000	10-0	2400
Patio - 4 BR	17.0	180	-	-	3000	10-0	2400

Note<sup>1</sup>: Ceiling heights apply when patios and balconies are covered.

5-8.1 Minimum area requirements for kitchen cabinets, counters, and pantries are shown in Table 5-5. Flat area is shown for countertops and drawers. Combined shelf area is shown for pantry and base, wall and wall cabinets.

**TABLE 5-5 - KITCHEN CABINET, COUNTER, & PANTRY AREA**

Type of Housing Unit	Wall		Base		Drawer		Counter		Pantry	
	m <sup>2</sup>	ft <sub>2</sub>	m <sup>2</sup>	ft <sup>2</sup>						
Others 4 BR	2.8	30	3.8	40	1.7	18	1.5	16	1.5	16
Others 3 BR	2.3	24	3.0	32	1.3	14	1.1	12	-	-

5-8.2 Minimum closet width requirements are stated in Table 5-6. **(AM#4)**.

**TABLE 5-6 – MINIMUM CLOSET WIDTHS<sup>1</sup> (AM#4)**

Type of Unit	EM	
	Mm	Ft
Coat/Entry Hall	900	3
Master <sup>2</sup> BR #1	1800	6
BR #2	1200	4
BR #3	1200	4
BR #4	1200	4
Broom	900	3

Type of Unit	EM	
	Mm	Ft
Linen <sup>3</sup>	600	2

**Note<sup>1</sup>: Minimum inside clear depth for standard/broom closets shall be 600 mm [2 ft].**

**Note<sup>2</sup>: Walk-in closet is preferred.**

**Note<sup>3</sup>: Minimum clear inside depth for linen closets shall be 430 mm [1 ft-6 inches].**

**(AM#4)**

5-8.3 Minimum requirements for interior, exterior, and combined bulk storage are shown in Table 5-7.

**TABLE 5-7 – MINIMUM INTERIOR, EXTERIOR, & COMBINED BULK STORAGE<sup>1</sup> (AM#4)**

Type of Unit	Type of Storage	EM	
		m <sup>2</sup>	ft <sup>2</sup>
3 BR	Int.	3.0	32
	Ext.	3.7	40
	Comb.	7.9	85
4 BR	Int.	3.7	40
	Ext.	4.5	48
	Comb.	9.3	100

**Example<sup>1</sup>: If interior bulk storage is 2.3 m<sup>2</sup>, then exterior bulk storage must be 4.2 m<sup>2</sup> to obtain the combined bulk storage requirement of 6.5m<sup>2</sup>. (AM#4)**

5-9 Major Zones. Living and Dining, Kitchen, Family Room, and Bedrooms.

5-9.1 Living and dining. The living room should have direct access to the front entrance foyer and to the dining area without passing through another room. When circulation is required along the perimeter of the space or between areas in open plans, minimum circulation space of 1000 mm [3 ft-3 inches] shall be added to the required minimum room dimension.

5-9.1.1 The dining area may be an extension of, or an "L" off the living room.

5-9.1.2 The dining area shall be directly accessible from the kitchen without passing through another room.

5-9.1.3 For Senior Officer family units, provide separate dining rooms or areas to accommodate furniture and seating for not less than 10 persons.

5-9.2 Kitchen and auxiliary dining area.

5-9.2.1 The kitchen shall provide an efficient work triangle. A base cabinet, minimum 380 mm [15 inches] wide, shall be provided on the handle side of the refrigerator. The range shall not be located adjacent to the refrigerator, in a corner, or adjacent to a passageway. The dishwasher shall be installed adjacent to the kitchen sink. Provide a backsplash behind the range, extending to the underside of the range hood, finished to match the countertop or range and the range hood. Space for a tenant-owned upright freezer shall be provided adjacent to the kitchen or in areas such as the utility room (AM#4). Space for a tenant-owned microwave oven shall be provided in the kitchen by way of a microwave cabinet.

5-9.2.2 Provide auxiliary dining areas in the form of table space in the kitchen or in a family room adjacent to, or as an extension of, the kitchen. The auxiliary dining area shall not be located in the living or dining rooms.

5-9.2.3 In the kitchen, shoe molding (1/4 round) is required at all base cabinets where they meet the floor surface.

5-9.3 Family room. Provide a separate family room, adjacent to and contiguous with the kitchen, for all three-, four-bedroom units.

5-9.4 Bedrooms. Bedrooms shall be designed to accommodate king-size beds in master bedrooms and twin beds in the other bedrooms. Window, door, and closet placement should enhance furnishability. Each bedroom shall be accessible without passing through another bedroom.

5-10 Minor Zones. Bathrooms, Laundry, Closets, and Bulk Storage.

5-10.1 Bathrooms. Emphasis shall be placed on size, furnishings, layout, and privacy. Direct access to a bathroom from the master bedroom is required for three- and four- bedroom units. Compartmented bath design, for family and guest use, is encouraged. Determine the number of bathrooms based on Table 5-8.

**TABLE 5-8 - BATHROOM REQUIREMENTS**

Number of Bedrooms per Floor	Number of Bathrooms Per Floor
3 - 5	2

5-10.1.1 A full bath shall contain a water closet, lavatory, and either a tub with shower assembly or a shower stall. One full bath in each housing unit shall include a tub with shower assembly and shall be directly accessible from the bedroom hall without passing through another room. Showers, and tubs with shower assemblies, shall include shower curtain rods with curtain rings. A half bath contains a lavatory and a water closet.

5-10.1.2 Provide lavatories mounted in 610-mm [2-ft] wide (minimum) countertops, with vanity bases. Countertops shall be high pressure laminated plastic, ceramic tile, marble, or homogeneous, non-porous, solid surface type materials, with minimum 100 mm [4 inches] high back splashes. Maximize vanity storage space.

5-10.1.3 Bathroom accessories may be surface mounted or recessed, of non-corrodible metal or ceramic tile, and shall include a toilet paper holder, soap dish (at sink and at tub/shower), toothbrush and tumbler holder, and grab bar at tub or shower stall, bathrobe hook, and towel bars totaling not less than 1100 mm [42 inches] for a full bath and not less than 750 mm [30 inches] for a half bath.

5-10.1.4 A mirror glass above the vanity and a recessed medicine cabinet shall be provided in each bathroom. Cabinets shall be corrosion-resistant with plate glass mirrors, sliding or hinged door type. Do not place recessed medicine cabinets in party walls.

5-10.1.5 Tubs and showers shall not be placed under windows.

5-10.1.6 Exhaust shall be provided in all baths, shall be ducted directly to the exterior of the building, and shall be a part of an engineered ventilation system (See paragraph 10).

5-10.2 Laundry. Washer and dryer space may be provided in an enclosed recess off the hall in two-bedroom units. Three-bedroom and larger units shall have a separate utility room.

5-10.2.1 The space provided shall have doors that provide full access when open. A minimum of two full-length shelves, 250 mm [10 inches] minimum nominal depth, are required above the washer and dryer.

5-10.2.2 Minimum net clear door width to washer and dryer space when open is 1600 mm [5 ft-4 inches] for an enclosed recess and 800 mm [2 ft-8 inches] if located within a utility room. Doors shall be either undercut or louvered to provide adequate make-up air for the dryer in accordance with typical household.

5-10.3 Closets. Closets shall provide the minimum widths indicated in Table 5-6. A broom closet shall be provided convenient to the kitchen, and a coat closet shall be located convenient to the housing unit entrance.

5-10.3.1 Closet shelving. Closets (except linen closets) shall be equipped with a 305 mm [12 inches] deep shelf and a clothes hanger rod. Linen closets shall be provided with at least four full-depth shelves. Closet shelving and rods in excess of 1200 mm [4 ft] shall have center supports. Shelves and supports shall be capable of carrying 52 kg/m [35 lbs/ft]. Closet shelving shall be minimum 19 mm [3/4 inch] thick solid wood, plywood, or high-density particleboard. Factory Finished welded wire shelving shall not be used.

5-10.3.2 Closet doors. Closet doors should be located to permit placement of furniture in the corners of the rooms by providing a 460-mm [18-inch] return adjacent to a furnishable wall. Closets 1800 mm [6 ft] or more in width shall have sliding doors, maximum 2000 mm [6 ft-8 inches] high. Wall closet width shall not extend beyond either doorjamb more than 510 mm [20 inches]. Wardrobe closet doors (sliding and bi-fold) shall be provided with both top and bottom door tracks. Accordion doors are not permitted.

5-10.4 Bulk storage. Provide each housing unit with interior and exterior bulk storage space meeting the minimum requirements of Table 5-7. Provide interior storage in a separate room or included as an extension of the utility room when one is provided. Provide exterior storage in     (AM#4)     a separate exterior enclosure, or within the housing unit with access from the exterior. Exterior storage space shall be lockable.

5-10.4.1 Utility room. The utility room may contain a utility sink. The utility room should be located adjacent to the rear entrance. If a utility sink is not submitted a hose bib will be located near the rear entrance at a hardstand.

5-10.4.2 Bulk storage space should be at least 1200 mm [4 ft] in depth and a minimum clear height of 2000 mm [6 ft-6 inches], except that space under stairs may be counted at 1/2 area if the space is 1200 mm [4 ft] or more in height.

5-10.4.3 Provide a minimum of three nominally 305 mm [12 inches] deep shelves with a combined length of 7300 mm [24 ft] within each bulk storage room.

5-10.4.4 Common walls and ceilings between adjacent storage areas shall be finished on both sides.

5-10.4.5 The equipment room shall contain heating and cooling systems equipment. The equipment room shall be accessible from the exterior. Consideration should be given to design accessibility to the equipment room by maintenance personnel even after the resident fences in the yard at a later date. There shall be a lighted dry covered flat surface for maintenance personnel to work. The HVAC filters are to be accessible from within the dwelling.

## 5-11 Interior Finishes

5-11.1 Provide three interior color/finish schemes.

5-11.2 Walls and ceilings. Provide a minimum of 13 mm [1/2-inch] gypsum wallboard, taped and smooth or orange peel finished. Water-resistant wallboard shall be used in wet areas such as bath, powder, and laundry rooms. Cementitious backer board shall be used for ceramic tile applications. An orange peel ceiling finish may be provided in areas other than kitchen, laundry, or bathrooms. Interior finish shall have a flame-spread rating of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E84. Clear acrylic corner guards may be used to protect corners. Wallpaper shall not be used.

5-11.3 Kitchen and eating area walls and ceiling. Combined kitchen and eating rooms shall have the same type of wall and ceiling finishes.

5-11.4 Flooring and stairs, base, and carpet. Kitchen, laundry, and utility flooring shall be sheet, seamless vinyl with wood base. Bedrooms may contain sheet vinyl with wood base but prefer wood flooring. The hall, and living-dining area flooring shall be sheet vinyl with wood base or vinyl composition tile with wood base. Wood flooring or a factory-made, prefinished wood plank floor with wood base in the living-dining area will be considered a betterment. Bathrooms shall be of ceramic tile flooring with ceramic tile base or seamless sheet vinyl with wood base. Interior stairs shall be hardwood with clear finish, or softwood with carpet. Additional consideration will be given to designs which incorporate ceramic tile bathroom floors and hardwood stairs with a clear finish. This material identification is not justification to exceed the mandatory price limitation set forth in this solicitation.

5-11.4.1 Vinyl composition floor tile shall conform to ASTM F1066, Standard Specification for Vinyl Composition Floor Tile, and have a minimum thickness of 2.381 mm [3/32-inch].

5-11.4.2 Sheet vinyl shall conform to ASTM F1303, Standard Specification for Sheet Vinyl Floor Covering with Backing, Type II, Grade 2. Flooring shall be installed as a monolithic material with seams welded or bonded for a seamless installation. No seams shall be permitted in spaces less than 12 feet in width.

5-11.4.3 Ceramic tile shall conform to ANSI 137.1, moderate or heavy grade.

5-11.4.4 Carpet shall be installed in the stretch method over carpet pad utilizing tackless strips in accordance with CRI-104. Carpet shall meet the following criteria:

5-11.4.4.1 Properties: Tufted construction, 100 percent branded continuous filament nylon or polyethylene terephthalate, soil hiding, multi-colored, loop or cut pile, 1/8 guage, yarn weight 800 grams per square meter [28 ounces per square yard], total weight grams per square meter [60 ounces per square yard], 5000 minimum density, synthetic primary and secondary backing.

5-11.4.4.2 Tuft bind for tufted carpet shall meet a minimum of 44 N (10 pounds) when tested in accordance with ASTM D1335, 1967; R-1972

5-11.4.4.3 Carpet shall meet requirements of 16 CFR 1630 and have a minimum average critical flux of .45 watts per square centimeter when tested in accordance with ASTM E648.

5-11.4.4.4 Deleted

5-11.4.4.5 Ten-year warranty from the carpet manufacturer against edge ravel, delamination, and tuft bind.

5-11.4.4.6 Carpet pad shall be 1/2 inch bonded urethane, minimum 6-pound density. Urethane pad will conform to ASTM.D.3676.

5-11.4.4.7 Carpet edging shall be 38 mm [1-1/2-inch] minimum width floor flange and minimum 15.5 mm [5/8-inch] wide face.

5-11.4.4.8 Tackless strip for stretch-in installation over carpet pad shall be exterior grade Douglas Fir

plywood, with minimum dimensions of 29 mm by 7 mm [1-1/8-inch wide] suitable for the cushion thickness specified. Tackless strips with two or three rows of staggered pins shall be used. For areas over 6100 mm [20 ft] long, tackless strip with three rows of pins shall be used. Pins of the proper length shall be provided to penetrate through carpet backing, but shall not be a safety hazard.

5-11.4.4.9 Carpet containing recovered material is designated in 40 CFR 247.12 as an affirmative procurement item. Products containing recovered material will be provided when price, performance, and availability meet project requirements. Various nylon and polyethylene terephthalate carpet offer the opportunity to meet this requirement.

5-11.5 Painting. Primers, paints, and stains shall meet or exceed the requirements of [Unified Facilities Guide Specification 09900, Paints and Coatings](#), provided in the Technical Specifications. The paint selected shall be scrub able. Finishes shall be lead free. **(AM#5)** Walls and ceilings in kitchen, baths, laundry, utility rooms, and all painted trim shall be painted with semi-gloss enamel. Colors shall be submitted by the Contractor and approved by the Contracting Officer. Blown-on acoustical finish is prohibited. Orange peel finish on gypsum walls and ceilings may be used.

5-12 Carport If trash or bulk storage areas are included in the carport, such areas are in addition to the required car storage area. Refer to Table 5-4 for minimum dimensions. Set the carport slab elevation a minimum of 100 mm [4 inches] below the level of the housing unit floor and the floor of the adjoining exterior storage. Slope slabs to drain away from the housing unit.

5-13 Roofing and Drainage. Slopes for the roofs are to maintain the **1:2 pitch (AM#3)** established at Patch-Chaffee.

5-13.1 Roof water. Gutters and downspouts shall be provided for all roof areas. The gutter system should minimize maintenance. The Design should prevent water run-off onto porous materials. Downspouts draining onto a lower roof shall have metal or plastic splash deflectors. Concrete splash blocks shall be provided under downspouts if not connected to the storm drainage system.

5-13.2 Roof surface. Emphasis shall be placed on low maintenance and durability of roof material. The number of roof penetrations shall be minimized. Wood shake or shingle roofs are prohibited. The following roof materials may be used, but are listed in declining order of preference.:

5-13.2.1 Deleted

5-13.2.2 Minimum of 245 kg [540 lb], standing or flat seam, metal roofing, \_\_\_\_\_ **(AM#2)** factory finish. The metal roof assembly shall conform to UL580 class 90.

5-13.2.3 Clay, concrete tile.

5-13.2.3.1 Clay roofing tile shall be machine formed natural clay tiles, one piece "S" Mission, kiln-fired to vitrification and free from surface imperfections. Provide specially shaped, color-matched units as indicated or required for ridges, rakes and hips. Provide with cast-in anchor lugs, transverse weather checks and fastening holes.

5-13.2.3.2 Concrete roof tiles shall be extruded, interlocking concrete roofing tile units, shape as indicated, with integral color. Include specially shaped, color-matched units as indicated or required for ridges, rakes and hips. Provide with cast-in anchor lugs, transverse weather checks and fastening holes.

5-13.2.3.3 Underlayment shall be ASTM D 2178, Type VI.

5-13.2.4 Deleted

5-13.2.5 Deleted

5-13.3 Deleted.

5-14 Exterior Finishes. Emphasis shall be placed on low maintenance and durability for exterior finish materials. Materials shall be residential in size, scale, and texture. Exterior finish materials for exterior bulk storage buildings and carports (AM#4) will match the primary dwelling unit. The following siding materials may be used, but are listed in declining order of preference:

5-14.1 Stucco. Portland cement plaster or synthetic stucco shall have integral color. Stucco total surface area shall be divided into panels with control joints spaced no more than 300 mm [10 ft] apart to form a panel of less than 14 m<sup>2</sup> [150 ft<sup>2</sup>]. Contractor shall follow manufacturer's installation instructions explicitly and shall certify accurate and correct installation of all stucco type materials.

5-14.2 Deleted

5-14.3 Deleted

5-14.4 Exterior Insulation Finish System (EIFS). EIFS may be used if high quality materials and installation checks are used. A drainage EIFS system shall be used. Provide a complete secondary weather barrier with a water-shedding drainage plane and flashings. Provide sealed isolation joints around all penetrations. Provide pan flashing at windows. Use wet-mix base coats. Use 6-ounce or heavier mesh. Use high-impact mesh at the ground level and in traffic areas. Use silicone sealants for joints. Contractor shall follow manufacturer's installation instructions explicitly and shall certify accurate and correct installation of all EIFS type materials.

5-14.5 Deleted

5-14.5.1 Deleted.

5-14.5.2 Deleted

5-14.5.3 Deleted.

5-14.5.4 Hardboard and cement asbestos shingle siding are not acceptable.

5-14.6 Trim elements. Aluminum or vinyl clad wood trim is preferred over painted or stained wood trim. Painted exterior surfaces shall be minimized. When exterior exposed wood trim is used, the following requirements apply:

5-14.6.1 Wood fascia and rakes are required and shall be 25 mm [1 inch] nominal boards with solid blocking or 50 mm [2-inch] nominal boards without blocking. Plywood, hardboard, or gypsum board are not permitted for fascias or rakes.

5-14.6.2 Exposed wood, such as window trim, door sills, window sills, railings and balusters, wood fencing, solar shading devices including louvers, arbors, and trellis shall be treated for rot resistance in accordance with NWWDA Industry Standards I.S.4, Water Repellant Preservative Treatment for Millwork.

5-14.6.3 Exterior surfaces requiring painting shall receive a minimum of one prime coat and two finish coats of paint. Wood trim frames, etc., shall be back primed. Exterior semi-transparent stains, two coats, are acceptable, where appropriate for wood, plywood, etc.

5-14.6.4 Mounting brackets shall be installed to accommodate a ¾" to 1" flag pole. The mounting bracket will be installed on the front side of the house at a convenient location for use.

5-14.7 Exterior ceilings and soffits. Exposure of roof framing and underside of roof/floor decks are not permitted. Exterior ceilings and soffits will be trimmed or otherwise architecturally treated and coordinated with

siding. Exterior ceilings and/or soffits may be prefinished metal, vinyl, plywood, or 9.5 mm [3/8-inch] 303 medium density overlay siding material, EXT-APA conforming to American Plywood Association Standard B840, 303 Siding Manufacturing Specifications. Cement asbestos ceiling or soffit are not permitted.

**5-14.7.1 Mounting brackets for small satellite dishes. Metal mounting brackets are to be fastened to the roof framing structure at the soffit. The residents will furnish their own satellite dishes. One mounting bracket for each single family and two mounting brackets for each duplex shall be installed. The duplexes shall have the brackets located as not to require one neighbor to enter the other neighbors yard to access their respective bracket/dish. The dishes shall have an unobstructed path so as to achieve clear signals. The brackets are to be located on the rear elevation or one of the side elevations; whichever gives a clear unobstructed signal. The brackets are not to be located on the front elevation of any of the units. (AM#2)**

5-14.8 Patios. Patios shall be sloped to drain and have a broom-finished concrete floor surface.

5-14.9 Balconies and porches and stoops shall be sloped to drain away from the unit and have a concrete floor surface which provides a waterproof and non-slip surface. Plastic coating or films over concrete decks are not acceptable. Exposed wood decks, stained or painted, are not acceptable. Balcony topping shall have a minimum thickness of 38 mm [1 1/2-inch] with welded-wire mesh reinforcement. Exposed wood rails and trim shall be treated to deter damage from moisture decay and insect infestation or be iron bar stock, painted with rust inhibiting black paint.

5-14.10 Exterior Stairs. Exterior stair treads and landings shall be constructed of concrete or steel, and provided with non-slip type treads. Exposed wood rails and trim shall be treated to deter damage from moisture decay and insect infestation or be iron bar stock, painted with rust inhibiting black paint.

5-15 Glazed Openings. Windows and glazed door (50 percent or more glass) units shall meet the following standards and must be certified by an independent testing laboratory. Windows that slide (double-hung, single-hung, and horizontal sliding) and glass exterior doors shall meet the standards for hung units. Standards for casement windows shall apply to all hinged or fixed windows. Other window types may be used if they have been tested and conform to the standards for hung windows. The Contractor shall provide the manufacturer's certification that the window provided meets the following test requirements:

5-15.1 Required tests. Hung units will meet a National Fenestration Rating Council (NFRC) design pressure rating of 25. Casement windows will meet NFRC design pressure rating of 40. Evidence of passing the following specific tests and minimum standards are required to achieve these design pressure standards.

5-15.1.1 Structural testing. Using ASTM E330 test results shall demonstrate no glass breakage, damage to hardware, or permanent deformation that would cause any malfunction or impair the operation of the unit. Residual deflection of any member shall not exceed 0.4 percent of its span. Hung windows shall be tested at pressures of 1796 Pa [37.5 lb/ft<sup>2</sup>], and casement windows shall be tested at pressures of 2873 Pa [60.0 lb/ft<sup>2</sup>].

5-15.1.2 Operating force. The force necessary to unlatch and open units shall not exceed 13.6 k [30 lb] for hung units and 15.9 k [35 lb] for casements.

5-15.1.3 Air infiltration. Using ASTM E283 leakage rate shall not exceed 0.65 l/min/m<sup>2</sup> [0.25 ft<sup>3</sup>/min/ft<sup>2</sup>] for hung units and 0.39 l/min/m<sup>2</sup> [0.15 ft<sup>3</sup>/min/ft<sup>2</sup>] for casements, at a test pressure of 7.66 k/m<sup>2</sup> [1.57 lb/ft<sup>2</sup>].

5-15.1.4 Water penetration. Using ASTM E547, no leakage shall be evident when tested in three, five-minute cycles with a one-minute rest period between cycles at 18.3 k/m<sup>2</sup> [3.75 lb/ft<sup>2</sup>] for hung units and 29.3 k/m<sup>2</sup> [6.0 lb/ft<sup>2</sup>] for casements.

5-15.1.5 U-Value. Whole window U-values shall comply with Table 7-1. U-values shall be calculated using ASTM E1423 and NFRC 100-91.

5-15.2 Glazed doors. Glazed doors shall have insulated steel, vinyl clad wood, or thermally broken aluminum frames conforming to the above requirements. Finish shall be factory applied and conform to 44-C-22431 in accordance with the requirements of the National Association of Architectural Metal Manufacturers (NAAMM) Metal Finishes Manual. Operable panels shall be equipped with screens. Sliding panel screens shall have extruded aluminum tubular frames mitered at corners, channel-shaped corner angle reinforcement, and nylon bottom rollers. Doors shall have interior operated latch, and securing pin or throw-bolt in frame. Screening shall be nonferrous.

5-15.3 Glazing. Units shall be double glazed with low E-glass. The design shall consider the work involved in repair and replacement of individual panes and overall window groups.

5-15.4 Interior window stools shall be solid-wood, paint-grades with a minimum thickness of 19-mm [3/4-inch].

5-16 Screens. Screens shall be provided at all operable sashes. Screens and frames shall be aluminum, of window manufacturer's standard design, and conform to AAMA 1002.10, Voluntary Specification for Aluminum Insulating Storm Products for Windows and Sliding Doors.

5-17 Window Treatments. Provide 25 mm [1 inch] metal blinds at windows and glazed hung doors. Color shall be manufacturer's standard off white, and shall be coordinated with wall color. Drapes shall not be provided. Shades are not permitted.

5-18 Doors. See Table 7-1 for thermal performance requirements for exterior doors.

5-18.1 Entrance doors. The housing unit primary entrance door shall be 900 mm [3 ft] in width by 2050 mm [6 ft-8 inches] in height by 45 mm [1-3/4 inch] thick, thermal metal. Other housing unit entrance doors should meet this requirement but may be of lesser width. Equipment room entrance door shall be 900 mm [3 ft] in width by 2050 mm [6 ft-8 inches] in height by 45 mm [1-3/4 inch] thick, metal. **Exterior door frames shall be painted hollow metal, reinforced to accept door hardware. (AM#5)**

5-18.2 Bulk storage door. Exterior bulk storage door shall be a minimum 35 mm [1-3/8 inch] thick, exterior grade, thermal metal, or hollow core metal. **(AM#4)**.

5-18.3 Aluminum screen and storm doors. Screen and self-storing storm doors shall be provided for all housing unit exterior hinged doors. Frames shall be a minimum of 32-mm [1-1/4-inch] thick and 51 mm [2 inches] wide. Aluminum alloy materials shall be not less than 1.27-mm [0.05-inch] thick and 51 mm [2 inches] wide. Doors shall have solid bottom panels and midsection protective grills. Screening materials shall be aluminum.

5-18.4 Interior doors. Interior doors shall be 2050 mm [6 ft -8 inches] in height by 35 mm [1-3/8 inch] thick, hollow core wood or hollow panel. Wood doors will be painted. Door frames shall be paint grade solid wood construction. Pre-hung and pre-finished doors and frames may be used.

5-19 Builders Hardware. Hinges, locks, and latches will comply with the specifications indicated in Table 5-10, and the following subparagraphs:

**TABLE 5-10 – HARDWARE SPECIFICATIONS**

Hardware Type/ Specification	Specific Requirements
---------------------------------	-----------------------

**TABLE 5-10 – HARDWARE SPECIFICATIONS**

Hardware Type/ Specification	Specific Requirements
Hinges ANSI/BHMA A156.1	Hinges shall be 102 mm x 102 mm [4 in x 4 in] at exterior doors, and 90 mm x 90 mm [3-1/2 in x 3-1/2 in] at interior doors. Ball bearings shall be of a base material of brass or bronze except as noted for fire rated door.
Locks & Latches ANSI/BHMA A156.2	<b><u>(AM#5) Series 4000, Grade 1, at exterior doors. Grade 2 at interior doors. Provide trim of wrought brass, aluminum, or stainless steel.</u></b>
Auxiliary Locks ANSI/BHMA A156.5	Series 4000, Grade 2. Provide matching trim of wrought brass, aluminum, or stainless steel.
Interconnected Lock & Latches ANSI/BHMA A156.12	Grade 2. Provide matching trim of wrought brass, aluminum, or stainless steel.
Closers ANSI/BHMA A156.4	Series CO2000, Grade 2.

5-19.1 Locks and keys. Lock cylinders shall have six pin tumblers and interchangeable cores that are removable by a control key. Provide a master keying system. Locks for each housing unit, including exterior storage and garage door(s), shall be keyed alike. The Contractor shall provide one extra set of cores for each 50 housing units and furnish four keys for each key change and for master key system and control key. Locks and keys shall conform to the standards and requirements of the Builders Hardware Manufacturers Association ANSI/BHMA A156.2 listed above.

5-19.2 Weatherstripping and exterior thresholds. Provide nonferrous metal or vinyl weatherstripping for all housing unit exterior doors. Vinyl magnetic weatherstripping is acceptable for metal doors. Exterior thresholds shall be nonferrous metal.

5-19.3 Applications. Locks and hinges shall be applied as follows:

5-19.3.1 Exterior hinged doors shall have 1-1/2 pair of hinges, lockset, and an auxiliary lock or interconnected lock and latch,

5-19.3.2 Each windowless entrance door will have a viewer mounted at eye level.

5-19.3.3 Exterior bulk storage door shall have 1-1/2 pair of hinges and lockset.

5-19.3.4 Interior doors shall have one pair of hinges and latchset with ANSI/BHMA A156.2, F75 or F76 operations.

**5-19.3.5 Doors in fire-rated walls shall have 1-1/2 pair of steel ball-bearing hinges, lockset, auxiliary lock or interconnected lock and latch and closer. (AM#5)**

**5-19.3.6 Hardware Trim. Lock trim shall be cast, forged or heavy wrought construction of commercial plain design. In addition to meeting the test requirements of BHMA/ANSI A156.2 or 156.13, lever roses**

**and escutcheons shall be a minimum of 1.27mm (.05 inches) thick. If reinforced, the outer shell shall be a minimum of 0.89mm (.035 inches) thick and the combined thickness shall be a minimum of 1.78mm (.07 inches) except the knob/lever shanks which shall be a minimum of 1.52mm (.06 inches) thick. (AM#5)**

5-20 Postal Service and Building Signage.

5-20.1 Postal Service. All new units shall be provided with an individual mailbox.

5-20.2 Building Signage. All new units shall be provided with building identification signage in accordance with the Installation Design Guide requirements.

5-20.3 Housing numbers. Provide a five-digit number for each dwelling unit. Provide a minimum 100 mm (4 inch) high house identification numbers/ letters in a Helvetica medium font colored black on a reflective white background mounted on 12-gauge aluminum for each dwelling unit. The house identification shall be mounted near each entry. The Contracting Officer will assign housing numbers.

5-20.4 Occupant Identification Signage. Provide occupant identification signage similar to existing family housing signage. Signage shall be interchangeable and made of plastic with routed letters. Total sign height shall be 50 mm (2 inch) overall including the frame. Signs shall be mounted 1500 mm (5 feet) above finish grade at side of entry. All signage should conform to the guidelines established by TRADOC sign standards (TRADOC Reg. 420-14). Names and rank shall be as directed by the Contracting Officer.

5-21 Kitchen Cabinets. Cabinets may be pre-fabricated and pre-finished or factory manufactured of wood. Wall cabinets shall have adjustable shelves. Cabinets shall have magnetic catches except where spring-loaded self-closing hinges are provided. Cabinets shall include knobs/handles and or pulls and shall conform to ANSI A161.1, Recommended Performance and Construction Standards for Kitchen and Vanity Cabinets, except where modified below. Wall and base cabinets shall be essentially of the same construction and appearance. Refer to Table 5-5 for minimum kitchen cabinet area requirements. Additional cabinet space may be achieved with tall wall cabinets.

5-21.1 Cabinets construction. Construct cabinets with frame fronts and solid ends, or of frame construction throughout. Frame members shall be mortised and tenoned, dovetailed or doweled, and glued together. Brace the top and bottom corners with hardwood blocks that are glued with water-resistant glue and nailed in place. Wood cabinet materials and dimensions - Materials and minimum dimensions and thicknesses for cabinet construction materials shall comply with Table 5-11.

**TABLE 5-11 – KITCHEN CABINET SPECIFICATIONS**

Element Description	Specific Requirements
Frame Members	19 mm x 38 mm [3/4 in x 1-1/2 in] kiln-dried hardwood.
Base Cabinet Toe Space	64 mm deep x 102 mm high [2-1/2 in x 4 in].
Cabinet Bottoms, Backs & Tops (Unexposed)	5 mm [ 3/16 in] hardwood plywood. Provide bottoms in kitchen sink cabinets. Brace bottoms with wood members glued in place.

**TABLE 5-11 – KITCHEN CABINET SPECIFICATIONS**

Element Description	Specific Requirements
Cabinet Ends & (Exposed Backs/Bottoms)	Hardwood plywood, 5 ply, good grade for natural finish. Base Cabinets: 13 mm [1/2 in] Wall Cabinets: 10 mm [3/8 in]
Doors	16 mm [5/8 in] hardwood plywood, good grade for natural finish, with hardwood trim. Raised panel or recessed panel.
Drawer Slides/Glides	20 gauge metal. Grade 2 ANSI/BHMA A156.7
Drawer Fronts	16 mm [5/8 in] solid hardwood, matching doors.
Drawer Bottoms	3 mm [1/8 in] softwood plywood, Grade A-B veneer. Bottoms 380 mm [15 in] wide shall be braced and glued in place.
Interior Partitions	13 mm [1/2 in] hardwood or softwood plywood, Grade A-A or comparable veneer.
Shelves	13 mm [1/2 in], softwood plywood (Grade A-B Veneer), hardwood plywood (good grade veneer), or glued-up solid wood. Support shelves on ends and on 610 mm [24 in] centers. Shelf edges exposed to view shall be rounded, filled, sanded, and finished.

5-21.2 Countertops. Countertops finish may be high pressure laminated plastic 1.1-mm [0.043-inch] thick for post-formed tops or 1.3-mm [0.05-inch] thick for countertops with separate backsplash, and shall be applied with heat-resistive adhesive. Countertops may also be ceramic tile or homogeneous, non-porous, solid surface materials. Minimum backsplash height is 100 mm [4 inches]. The substrate for countertops (except solid surface countertops) shall be 19 mm [3/4-inch] thick exterior plywood. The area behind the oven-rang and range hood shall be protected by a back splash.

5-22 Appliances. Provide the following equipment in accordance with specifications listed, one each per housing unit. A listing of currently labeled Energy Star appliances is available through the Internet at the EPA website: <http://www.energystar.gov/products/appliances.html>.

5-22.1 Refrigerators. Comply with UL 250, Household Refrigerators and Freezers and shall bear the EPA “Energy Star” certified label. Provide refrigerator with frostproof top freezer, automatic defrosting, and icemaker. Refrigerator shall have two vegetable bottom baskets, at least four adjustable shelves, at least two shelves and egg container in door; freezer compartment shall contain separate interior shelves, multiple door shelves, and ice maker. Provide reversible (left swing and right swing interchangeable) doors. Refrigerators shall conform to the energy compliance standards of 10 CFR 430, including those refrigerators manufactured before the code took effect. The use of refrigerants with an Ozone Depletion Potential (ODP) of .05 or less is required. Minimum refrigerator volume and maximum energy use are as follows:

5-22.1.1 Volume: 0.58 CM, 21 CF

5-22.1.2 Energy Efficiency: 722 kWh/yr.

5-22.2 Ranges and ovens. Ranges shall be 760 mm [30 inches] wide and provided with porcelain enamel cooktop, oven, clock and timer, oven light, and cooking surface light. Oven shall have black glass window door, broiler pan, and self-lock racks.

5-22.2.1 Gas ranges shall have two, 150 mm [6-inch] and two, 205 mm [8-inch] burners, a self-cleaning oven, and AGA-approved electronic ignition. Gas ranges shall be in accordance with AGA Z21.1, American National Standard for Household Cooking Gas Appliances.

5-22.2.2 Electric ranges shall have four tubular plug-in surface elements of 4,500 watts minimum, removable reflector bowls, infinite-control switches, and range-indicating lights. Ovens shall be equipped with one, 2,000-watt (minimum) tubular broil element and one, 700-watt (minimum) bake element, oven indicating light, thermostatic heat control, utensil drawer, and self-cleaning oven. Electric ranges shall conform to UL 858, Household Electric Ranges.

5-22.3 Deleted

5-22.4 Range hoods. Provide metal range hoods, the same length as the range, with a stainless steel finish, with separately switched light and exhaust fan. The hood shall have a washable filter. The fan shall have a capacity of not less than 78.7 L/s per meter of range hood [50 cubic ft per minute per linear foot of range hood]. The sound level shall not exceed 6 sones. Duct the fan to the exterior and provide backdraft protection. Range hood shall also have fire extinguishing system for range that will also shut off power or fuel to range in case of extinguishment. Acceptable device is Guardian Model as manufactured by Twenty First Century or equal.

5-22.5 Garbage disposals. Garbage disposals shall conform to UL 430; Waste Disposers; continuous feed, minimum 1/2 HP motor, stainless steel grinding elements, two 360-degree stainless steel swivel impellers, manual motor reset, and sound insulation. A plug connector is required. Garbage disposal shall be InSinkErator model 555ss, Waste King Gourmet Series model SS3100, or approved equal.

5-22.6 Dishwashers. Dishwashers shall conform to UL 749, Household Electric Dishwashers, and be UL listed, electric type, with air gap, racks, lift-out utensil holder, spraying arms, and detergent dispenser. Unit shall be listed as "Energy Star" compliant and shall bear the "Energy Star" label. The automatic controls shall cycle through the Wash, Rinse, Dry / Heat, and Stop phases, and shall be capable of rinse and hold cycle as well as a no heat drying feature. The unit shall contain instantaneous, or in-line, water heater booster, with automatic thermostat set for 60 degrees C [140 degrees F]. Rated energy use for standard capacity models will not exceed 620 kWh/yr. The dishwasher shall have factory applied sound isolating and insulating features for a sound rating no greater than 5 sones

5-22.7 Water heater. See paragraph 8- UNIT DESIGN- PLUMBING.

5-22.8 Ceiling Fans. Ceiling fans are an optional feature. Supports required for future installation are to be included. **See Chapter 9 Electrical, paragraph 9-7.2.3 for additional requirements. (AM#5)**

5-22.9 Color. Kitchen appliances, except disposals and range vent hood, shall be of matching finish, stainless steel/white/almond in color.

5-23 Maintainability. The design of housing units including the selection and specifying of exterior and interior finishes, equipment, appliances, and systems shall include consideration of maintenance ease and cost. Avoid products that require continuing maintenance at high cost. Avoid products with finishes that cannot sustain frequent and harsh scrubbing.

5-24 Fireplace and Chimney. Fireplaces and chimneys are not to be used.

Ft Sam Houston D-B Harris Heights Family Housing, PN 37152

FSHHF

TI 801-02, Army Family Housing, 01 Oct 01

ACCOMPANYING AMENDMENT NO. 0007 TO SOLICITATION NO. DACA63-02-R-0013

## 6. UNIT DESIGN - STRUCTURAL.

Structural design shall comply with International Building Code and Council of American Building Officials (CABO) One and Two Family Dwelling Code, except as modified herein.

**See following sheets for additional Design Criteria and 'ATTACHMENT – 6 (AM#4) SWD ARCHITECTURAL AND ENGINEERING INSTRUCTIONS MANUAL' (AEIM) for Structural Plates.**

### 6.1 Description.

6.1.1 **General.** The structural criteria established herein shall be used for structural loading, design and installation of all structural systems and foundations, including manufacturing, erection, supervision, testing, and quality assurance of the completed installation of the housing units. All structural calculations shall be checked and initialed as such by a registered structural engineer other than the original design engineer. Refer to ATTACHMENT 7, Geotechnical Report for Foundation Design Analysis requirements and recommendations. The structural work generally consists of design, using the DESIGN LOADS and DESIGN CRITERIA below, but not limited to:

- (1) Foundations.
- (2) Retaining Walls.
- (3) Load Bearing and Non-Load Bearing Walls
- (4) Vertical Framing Members.
- (5) Horizontal Framing Members, including roof decks and diaphragms, roof beams and joists.
- (6) Interconnection Details including all nailing and fastening requirements.
- (7) Special Conditions, such as expansion, construction, and control joints, and changes in floor levels.
- (8) Attachment provisions for architectural, mechanical, and electrical elements.
- (9) Site fencing structure and foundations.

**6.2 References.** Design methods and stress allowances or load factors for the various structural materials shall be in accordance with the current editions of the codes and specifications listed below. Recommendations made in the codes, specifications and industry standards in this paragraph are requirements of this RFP, unless specified otherwise in this RFP.

(1) American Concrete Institute (ACI 318M) Building Code Requirements for Reinforced Concrete - latest edition.

(2) American Concrete Institute (ACI 302), Guide for Concrete Floors and Slab Construction.

(3) International Building Code - latest edition.

(4) American Plywood Association, "APA Design/Construction Guide" "SDI Diaphragm Design Manual latest Edition."

(5) American Institute of Steel Construction (AISC), Manual of Steel Construction, latest edition.

(6) American Iron and Steel Institute (AISI), Cold Formed Steel Design Manual - latest Edition.

(7) American Welding Society (AWS), Structural Welding Code.

(8) National Forest Products Association, "National Design Specification for Stress Grade Lumber and its Fastening."

(9) American Plywood Association, "APA Design/Construction Guide."

(10) Truss Plate Institute, "Design Specification for Metal Plate Connected Wood Trusses."

(11) Council of American Building Officials (CABO) One and Two Family Dwelling Code – latest edition.

**6.3 Selection of Structural System.**

6.3.1 The overall structural system shall be selected based on durability, maintainability, and cost-effectiveness. The lateral support system shall consist of a horizontal roof diaphragm and shear walls. The horizontal roof diaphragm shall be developed with "Roof Sheathing". The shear walls shall be developed with "Structural Sheathing", "Let-in Bracing" or "Steel Strap Bracing", or a combination of Structural Sheathing and Let-in Bracing, or a combination of Structural Sheathing and Steel Strap Bracing.

6.3.2 **Foundation System.** The foundation system shall be as required by ATTACHMENT 7, Geotechnical Report.

**6.4 Design Loads.**

6.4.1 **Dead Loads.** The structural system shall be designed and constructed to safely support all dead loads, permanent or temporary, including but not limited to self weight, partitions, insulation, ceiling, floor covering, and all equipment that is fixed in position. Use ASCE 7-98 for weights of common building materials, or other recognized sources if not in ASCE 7-98.

**6.4.2 Vertical Live Loads.**

6.4.2.1 As a minimum, design loads shall be as stated in ASCE 7-98 (Minimum design loads for buildings and other structures) code. \_\_\_\_\_ **(AM#7)**

\_\_\_\_\_ Other criteria is as follows:

Minimum Roof Live Load - 98 K/sq.m (20 psf)

6.4.2.2 Floors shall be designed to support live loads in accordance with the ASCE 7-98 Code except:

Floor Live Load - 195 K/sq.m (40 psf)

Note: Loads may be reduced as permitted by the ASCE code.

6.4.3 **Horizontal Loads** (Acting Inward and Outward). The structural system wind design, including components and cladding shall be designed in accordance the ASCE 7-98 code, and the seismic design shall be designed in accordance with the **TM 5-809-10** - latest edition. An importance factor of 1.0, an exposure category is "C", the required wind speed and **Seismic Zone I** are to be used.

**6.5 Design Criteria.**

6.5.1 **Foundation Design.** The foundation analysis and design, and minimum dimensions and reinforcement shall be in accordance with ATTACHMENT 7, Geotechnical Report.

6.5.2 **Roof Slope.** All housing units shall have pitched roofs.

**6.5.3 Serviceability.**

6.5.3.1 **Foundation Settlement Strength.** An adequate level of protection against structural failure due to uniform and/or differential foundation settlement or general shear shall be provided.

**6.5.3.2 Vertical Deflection of Suspended Horizontal Framing Members.** Building serviceability shall not be impaired by vertical deflections. The sum of the instantaneous vertical deflections due to live load plus long-term sustained load deflections shall not exceed the span divided by:

- (1) 240 at roofs.
- (2) 600 at masonry lintels for masonry walls.

**6.5.3.3 Horizontal Deflection.** Horizontal deflection shall not exceed the limits set forth in the International Building Code - latest edition when the structure is subjected to the required seismic or wind loads.

**6.5.3.4 Ultimate Strength of Structural Elements.** An adequate level of protection against structural failure under extreme loads shall be provided. The proposer shall check the usual loading conditions for normal factors of safety and the extreme loading conditions, if present, for appropriate (unusual) factors of safety to provide levels of protection appropriate for the conditions.

#### **6.5.4 Durability - Time Reliability.**

6.5.4.1 Structural components shall be protected from condensed moisture that could impair their structural adequacy through deterioration.

6.5.4.2 Special attention shall be given to protection for corrosion or oxidation of metals, decay of wood and wood base materials, spalling of concrete, leaching of mortar, and deterioration of adhesives. Prevention of these hazards shall be especially important. Nonstructural steel (handrails, etc.) embedded in concrete shall be galvanized or painted wrought iron. All damaged galvanized areas shall be repaired prior to embedment.

6.5.4.3 The materials used in structural elements, components, and assemblies shall be resistant to or protected from damage by exposure to normal climatic conditions.

#### **6.6 General Design Criteria.**

6.6.1 The design drawings shall contain General Notes which shall contain a list of the design loading criteria, a list of the strengths of the engineering materials used, the design soil values, a nailing schedule, and any other data that would be pertinent to remodeling and/or future additions.

6.6.2 Walls mostly below grade that are supported laterally by diaphragms at or near the top and bottom, shall be designed using loadings based on at-rest soil pressures.

6.6.3 Free standing earth retaining walls shall be loaded with active soil pressure and surcharge loading if present, and with this loading the vertical resultant shall be in the middle 1/3 of the footing base width. For this design, factors of safety for overturning and sliding shall be at least 1.5. Retaining walls shall be constructed of reinforced concrete only. Weep holes shall be provided in the wall to eliminate saturated soil conditions behind the wall.

6.6.4 Free standing exterior garden walls shall be designed to resist lateral wind and seismic forces, for the minimum requirements set forth in this document, as per the International Building Code - latest edition.

6.6.5 Diaphragms shall have continuous chord members on all edges and shall have direct positive connection for transferring load to all members of the main lateral force resisting system.

6.6.6 Sheetrock wall covering shall not be used as a lateral resisting element of the lateral design.

6.6.7 The minimum design wind pressure on interior partitions shall be 24 KN/sqm (5psf) normal to the partition. All interior partitions shall be laterally braced.

6.6.8 Radon Mitigation: The Contractor shall design radon mitigation in accordance with **Paragraph 14, Environmental**. A 150mm minimum capillary barrier is required to encapsulate the 100mm perforated pipes of the sub-slab suction system. A polyethylene vapor barrier with a minimum thickness of 0.15mm (6 mils) will be required below the floor slab and above the capillary water barrier.

### 6.7 Concrete Design.

6.7.1 **General**. All concrete on this project shall have a minimum compressive strength of 21 mpa (3000 psi) at 28 days unless noted otherwise. All foundation walls and footings shall be constructed of reinforced cast-in-place concrete.

6.7.2 **Testing**. Testing of concrete work shall be done at the proposer's expense by an approved independent testing laboratory.

6.7.3 **Forms**. Materials for forms shall be plywood, metal, metal-framed, aluminum, reinforced fiberglass, or plywood-faced, to provide continuous, straight, smooth, exposed surfaces.

6.7.4 **Reinforcing Materials**. Reinforcing Bars: ASTM A 615 M-96a, minimum Grade 300, deformed.

### 6.7.5 Concrete Materials.

- (1) Cement: ASTM C 150, Type I-II Portland cement low alkali (0.6% or less).
- (2) Fine Aggregate: ASTM C 33.
- (3) Coarse Aggregate: ASTM C 33.
- (4) Air-Entraining Admixture: ASTM C 260.
- (5) Flowing Concrete Admixture: ASTM C 1017, Type 1 or 2.
- (6) Calcium Chloride will not be permitted.
- (7) Fly Ash: ASTM C 618, Class "F"; fly ash content shall not exceed 20% of cement content or 45 kg (100 Lbs) of fly ash per .76 cu m. (Per cubic yard) of concrete, whichever is less.

6.7.6 \_\_\_\_\_ **(AM#4)**

6.7.7 **Ready-Mix Concrete**. ASTM C 94.

6.7.8 **Slabs and Foundation Systems**. Refer to Attachment 7, Geotechnical Report for Foundation Design Analysis requirements and recommendations.

### 6.7.9 Additional criteria is as follows:

- (1) Water/Cement ratio shall be less than or equal to 0.42
- (2) Slump at placement shall not be greater than the design mix slump. If contractor elects to pump mix, pumping aids will be allowed, provided shrinkage potential does not increase.
- (3) 7-day wet mat moist curing will be required.
- (4) Reduction of cement content shall be done by using fly ash. The volume of fly ash when combined with portland cement shall be 20% plus/minus 5% of the volume of portland cement plus fly ash.
- (5) High range water reducers (HRWR) will be allowed if it is shown that concrete produce with HRWR is not subject to increased shrinkage, segregation, and retarding/flash setting. Testing will be performed on concrete with the proposed HRWR to determine shrinkage potential.
- (6) A mix design shall be required that incorporates a 24 mm to 38 mm (1.0 to 1.5 inches) coarse

aggregate maximum with appropriate gradation specification. Follow ACI guidance for use of well graded aggregates.

(7) Use ACI 223 guidelines for the use of shrinking-compensating cements.

**6.7.10 Conduits and Pipes.** Horizontal runs of conduits and pipes will not be embedded in foundation ribs and slabs supported by ground. Vertical penetrations will conform to ACI 318-89. Aluminum conduit and pipes will not be embedded in any concrete structure.

**6.7.11 Slab Joints.** Slabs will be placed in lane fashion. Area of sections bounded by crack control joints will not exceed 54 sq. m (600 square feet), and distance between crack control joints will not exceed 7500 mm.

**6.7.11.1** Slab crack control joints may be construction joints, expansion joints, or weakened plane joints consisting of plastic insert "T" strips (minimum depth shall be 1/4 depth of slab thickness) placed in the fresh concrete. Saw cut joints will not be allowed. Reinforcement will be continuous through crack control joints. Bars shall be located "t/4" below the slab surface, with a minimum of 38mm, and starting 50 mm from edge of slab. The ends of crack control and corners of isolation joints will meet at a common point so far as practical. Stop reinforcing at expansion joints and provide smooth slip dowels (minimum 13 mm diameter) across the joint. Dowels shall be ASTM A 36 material.

**6.7.11.2** When thickened slabs are employed under column bases or partitions, crack control joints parallel to the thickened slabs shall be offset from the thickened areas.

**6.7.11.3** Walls, when used or required for lateral resistance to wind or seismic, shall be founded on a full foundation.

**6.7.11.4** Reentrant corners in slabs will be reinforced with a minimum of one No. 13x900 mm bar (metric) at 45 degrees to the corner.

## **6.8 Masonry Design.**

**6.8.1** CMU walls and partitions shall be designed in accordance with TM 5-809-3/AFM 88-3, Chapter 3 (New EI 01S903) – Structural Design For Buildings. Specify and design for type "S" mortar [ $F_m' = 9300\text{kPa}$  (1350 psi)].

**6.8.2** All masonry exterior, bearing, and shear walls (structural walls) shall be reinforced.

**6.8.3** See AEIM paragraph 13, "Walls and Partitions" for additional requirements for CMU design and construction.

## **6.9 Structural Steel Design.**

**6.9.1** Detailing of structural steel framing, if any, including connections, shall be complete. All weld types, weld sizes, bolt layouts, bolt sizes, connection plates, members sizes and locations, and stiffener plates sizes and locations shall be shown.

**6.9.2** All members, elements and connections that are a part of the main vertical and/or lateral force resisting system must be completely detailed.

**6.9.3** Steel columns shall not be embedded over all or part of their height in CMU or concrete walls.

## **6.10 Cold Formed Steel Structural Framing Design.**

6.10.1 Cold formed steel structural framing design shall comply with the American Iron and Steel Institute (AISI), Cold Formed Steel Design manual, Latest Edition, except as herein noted.

6.10.2 The detailing of cold formed steel structural framing, including connections, shall be complete. All welded connections, metal connectors, bolt layouts, bolt sizes, screw fastener patterns, and screw sizes shall be shown in details, notes and calculations. All members that are a part of the main vertical and/or lateral force resisting system must be completely detailed.

6.10.3 Walls, when used or required for lateral resistance to wind or seismic, shall be considered bearing walls.

6.10.4 **Structural Vertical Wall Framing.** Structural vertical load bearing, or non-load bearing wall framing shall be no less than 90 mm (3-5/8") wide, C-shaped metal studs minimum 18-gage thickness at 400 mm on center with minimum 14-gage thickness continuous runner tracks top and bottom of the walls. Vertical studs which are attached to diagonal steel tension strap bracing shall be a minimum 16-gage thickness and have three horizontal rows of equally spaced blocking (blocking shall be the same size member as the vertical studs) between the studs for the horizontal distance of the brace. Wall framing shall be attached to the foundation with minimum 9.5 mm diameter anchor bolts spaced no more than 1200 mm on center. Provide a minimum 50 mm x 50 mm x 3 mm (2"x2"x1/8") washer at each anchor bolt welded to the top surface of the wall bottom runner track. All vertical studs shall be attached by welding or self-tapping screws to the wall top and bottom runner tracks. Welding shall be for the full width of both flanges of the vertical studs or there shall be at least one #12 self-tapping screw through the runner track flange to each flange of the vertical studs.

6.10.5 **Roof Trusses.** Roof trusses shall be designed for the loads indicated. The truss diagonal members shall be no less than 90 mm (3-5/8") wide, C-shaped, minimum 18-gage thickness with minimum 90 mm (3-5/8") wide, 14-gage thickness metal runner track top and bottom chords or a combination of wood combined with a metal unit which is made to adapt with the wood for the top chord outrigger for overhangs. The design of trusses shall be integrated into the vertical and lateral load carrying systems. Truss member connections shall be sized for axial loads and any eccentricity of the members. All diagonal members shall be welded to the truss top and bottom chords for the full width of both flanges of the diagonal members (self-tapping screw connection will not be allowed).

6.10.6 **Sheathing.** No particle board other than grade 2-M-W or fiberboard is to be used in structural applications, including roof sheathing and structural sheathing. The sheathing used shall have adequate and appropriate span rating" per the American Plywood Association (APA) (Design Specifications and Construction Guide) for the application and conditions proposed.

6.10.6.1 **Roof Sheathing.** Roof sheathing shall be APA STRUCTURAL I or II RATED SHEATHING, Exposure 1 or better, 15 mm (19/32-inch) minimum thickness. Joints shall be tongue and grooved or be square edges provide with H clips. All roof sheathing laid shall be covered with felt when a storm is approaching. Roof sheathing damaged due to moisture shall be replaced.

6.10.6.2 **Structural Wall Sheathing.** APA STRUCTURAL II RATED SHEATHING, Exposure 1 or better, 12 mm (15/32-inch) minimum thickness, square edges. Solid blocking (the same size as the wall studs) shall be required at all edges.

6.10.6.3 **Structural Interior Concealed Sheathing.** APA B-D interior, grade 2 or better, 12 mm (15/32-inch) minimum thickness, square edges. Solid blocking (the same size as the wall studs) shall be required at all edges.

6.10.7 **Steel Strap Tension Bracing.** Straps shall be a minimum 14-gage thickness by a minimum 50 mm wide. Straps shall be welded to each intersecting vertical wall stud and to the wall top and bottom runner track for the full width of the stud and runner track flange.

## 6.11 Structural Wood Design.

6.11.1 Wood design shall comply with the Uniform Building Code - latest edition except herein noted.

6.11.2 The detailing of structural wood framing, including connections, shall be complete. All metal connectors, bolt layouts, bolt size, nailing patterns and nail size shall be shown in details, notes and calculations. Staples shall not be used for the connections of structural components. All members that are a part of the main vertical and/or lateral force resisting system must be completely detailed.

6.11.3 Exterior wood structural members that are exposed to view such as columns and beams (minimum 100 mm nominal thickness) shall be of lumber that is graded for appearance and decay treated.

6.11.4 Walls, when used or required for lateral resistance to wind or seismic, shall be considered bearing walls.

6.11.5 **Moisture Content.** 19 percent maximum.

6.11.6 **Vertical Wall Framing** (less than 150 mm wide). Studs for walls shall be stud grade lumber. Vertical (load bearing and non-load bearing) wall framing shall be no less than 2X4's at 400 mm on center with single sole and double top plates. Wood may be any species listed in the Uniform Building Code - latest edition which meets the following values:

- (1) Fb (extreme fiber stress in bending):
  - Single Member use: 3.6 Mpa (525 psi) minimum
  - Repetitive member use: 4.1 Mpa (600 psi) minimum
- (2) E (Modulus of elasticity) 6200 Mpa (900,000 psi) minimum

6.11.7 **Structural Framing** (Other than vertical wall framing less than 150 mm wide). Stress Grade lumber. Wood may be any species listed in the Uniform Building Code - latest edition which meets the following values:

- (1) Fb (extreme fiber stress in bending):
  - Single Member use: 6.9 Mpa (1,000 psi) minimum
  - Repetitive member use: 7.9 Mpa (1,150 psi) minimum
- (2) E (Modulus of elasticity): 7,580 Mpa (1,100,000 psi) minimum

6.11.8 **Boards** (less than 50 mm nominal thickness). No. 2 or better per WWPA rules.

6.11.9 **Roof Trusses.** Wood trusses shall be designed for the loads indicated and in accordance with the Truss Plate Institute, "Design Specification for Metal Plate Connected Wood Trusses". The design of trusses shall be integrated into the vertical and lateral load carrying systems. Truss connection plates shall be sized for axial loads of members, eccentricity, and net metal section. A minimum plate size of 9675 sq. mm (15 sq. In) shall be required at any respective connection. The top chord of gable end trusses shall not be notched for the installation of outriggers for a roof overhang of the end of the gable. The outriggers shall be installed on top of the gable end truss top chord.

6.11.10 **Sheathing.** No particle board other than Grade 2-M-W or fiberboard is to be used in structural applications, including roof sheathing and structural sheathing. The sheathing used shall have adequate and appropriate span ratings per the American Plywood Association (APA) (Design Specifications and Construction Guide) for the application and conditions proposed.

6.11.10.1 **Roof Sheathing.** Roof sheathing shall be APA STRUCTURAL I or II RATED SHEATHING or Particle board Grade 2-M-W, Exposure 1 or better, 15 mm (19/32-inch) minimum thickness. Joints shall be tongue and grooved or be square edges provided with H clips. All roof sheathing laid shall be covered with felt when a storm is approaching. Roof sheathing damaged due to moisture shall be replaced.

6.11.10.2 **Structural Sheathing.** APA STRUCTURAL II RATED SHEATHING

or Particle board Grade 2-M-W, Exposure 1 or better, 12 mm (15/32-inch) minimum thickness, square edges. Solid blocking (the same size as the vertical studs) shall be required under all edges.

**6.11.10.3 Structural Interior Concealed Sheathing.** APA B-D interior, Grade 2 or Particle board Grade 2-M-W or better, 12 mm (15/32-inch) minimum thickness, square edges. Solid blocking (the same size as the vertical studs) shall be required under all edges.

**6.11.11 Let-in Tension Bracing.** Minimum 25 mm nominal thickness by 10 mm actual width "Boards" or "Simpson CWB or TWB" steel strap tension bracing or an approved equivalent (flat steel straps are not acceptable).

**6.11.12 Laminated Veneer Lumber.** Joints and beams fabricated from laminated veneer lumber may be used. Products must have National Research Board approval.

### **6.12 Construction Tolerances.**

Allowable variations from level, or specified slopes, shall be as follows:

- (1) For overall length, or surface of 3000 mm (10 ft) or less: plus or minus 3-mm (1/8-inch).
- (2) Up to 6100 mm (20 ft): plus or minus 6 mm (1/4-inch)
- (3) Up to 12 000 mm (40 ft): plus or minus 9 mm (3/8-inch).

**7. UNIT DESIGN - THERMAL PERFORMANCE.**

7-1 Thermal Characteristics. See Table 10-1 for identification of appropriate weather region. Housing unit construction shall provide at least the minimum R values / maximum U values indicated in Table 7-1 for the appropriate weather region. R and U values shall be calculated in accordance with ASHRAE methods.

**TABLE 7-1 – THERMAL CHARACTERISTIC REQUIREMENTS<sup>1,2</sup>**

Weather Region	Wall <sup>3</sup> R Value	Ceiling / Roof R Value <sup>4</sup>	Crawl Space R Value <sup>5</sup>	Basement R Value <sup>6</sup>	Slab on Grade R Value <sup>7</sup>	Door R Value <sup>8</sup>	Glazed Openings U Value <sup>9</sup>	
							Window	Door
10	2.2 [13]	5.3 [30]	2.2 [13]	0.9 [5]	NR	0.9 [5]	2.9 [0.50]	2.2 [0.38]

Note<sup>1</sup>: Metric R values are in square meter-kelvin (K)/watt. [English R values are bracketed, and are in square foot-degrees F/BTUH]. (R = 1 / U)

Note<sup>2</sup>: R values listed represent the minimum acceptable insulation values for each construction type. Listed U values represent the maximum thermal conductance allowed for windows and doors.

Note<sup>3</sup>: Requirements for opaque, exterior walls.

Note<sup>4</sup>: For buildings with ventilated attics, no credit may be taken for the roof construction. R value shall be computed for construction between conditioned space and ventilated attic or building exterior. Insulation for floors which extend over outside air spaces shall conform to the ceiling and roof requirements.

If cathedral ceilings are being used, the effective R-Value of the overall roof area must meet the required "Ceiling/Roof" performance level. The effective R-Value of the overall roof area can be determined by calculating the weighted average of the R-Values of the different areas (based on the percentage of the total roof area each type covers). For example, if the Ceiling/Roof insulation required was R-38 and 25% of the ceiling was cathedral insulated to R-19, and then the required R-Value for the remaining roof would be: (38-0.25\*19)/0.75=44.33, or R-45 (min).

Note<sup>5</sup>: Requirements for crawl space exterior walls below uninsulated floors.

Note<sup>6</sup>: Requirements for basement wall insulation extending downward 3050 mm [10 ft] from outside finished grade, or downward from outside finished grade to basement floor, whichever is less.

Note<sup>7</sup>: Slab and perimeter insulation not required.

Note<sup>8</sup>: Requirements for opaque doors in exterior walls (insulated metal).

Note<sup>9</sup>: Window requirements for double pane, low emissivity glass windows as specified in paragraph 5-15.3 of this STATEMENT OF WORK. Total Window (including glazing and frame) U values as rated by the National Fenestration Rating Council (NFRC) shall be used. Glazing area in Weather Region 10 shall be limited to 14 percent of the heated floor space. Solar Heat Gain Coefficient in Weather Region 10 shall be limited to 0.40.

7-2 Thermal Insulation.

7-2.1 Characteristics. Thermal insulation shall have a flame-spread rating of 25 or less and a smoke-development rating of 50 or less, exclusive of the vapor barrier, when tested in accordance with ASTM E84. A vapor barrier shall be provided on the warm-in-winter side of exterior wall and ceiling insulation, except in humid areas as defined below. Polyurethane is allowed as an insulation material for slabs and outside concrete or unit masonry walls. It is prohibited as an injected insulation material in walls or floor cavities or within the building envelope.

### 7-3 Air Infiltration.

7-3.1 To limit air infiltration buildings will be sealed with an air infiltration barrier, installed in accordance with the manufacturer's recommendations. The building envelope shall be caulked, gasketed, weatherstripped or otherwise sealed: around window and door frames, between wall cavities and frames, between walls and ceiling and roof, between walls and floors, at access doors and panels, at utility penetrations through walls, floors, and roofs, and at any other exterior envelope joint which may be a source of air leakage. These steps, in combination with provision of a continuous vapor barrier and sealed ductwork as specified in paragraph 10, shall constitute tight building construction.

7-3.2 A blower door test, performed in accordance with ASTM E 779, Measuring Air Leakage by the Pressurization Method, shall be performed on 15 percent of the project buildings, which have been randomly selected by the Contracting Officer. If buildings are to be turned over in phases, the blower door test shall be performed on 15 percent of the buildings completed in each phase (not to exceed 10 buildings per phase). No additional testing will be required if ALL of the tested buildings pass the test requirements. If less than 100 percent of the tested buildings pass the test, an additional 10 percent of the project buildings (not to exceed 10 buildings) shall be tested. This process shall continue until 100 percent of the total number of tested buildings pass the blower door test. All proto-type units will be included in the required blower door testing procedures.

7-3.2.1 Before beginning the test, all combustion devices shall be turned off, and all intentional openings in the building envelope (dryer vent, bathroom and kitchen exhausts, etc.) shall be sealed. All doors and windows shall be closed and latched.

7-3.2.2 To pass the blower door test, the building shall have an air tightness rating within the range of 3 to 4 ACH at 50 Pa [0.2 inch of water]. The Contractor shall correct all housing units not found in compliance, and shall be responsible for all labor and materials required to reduce air leakage to within acceptable parameters. All testing shall be performed by a firm certified by the Associated Air Balance Council, the National Environment Balancing Bureau, or State licensed to perform such tests within the state where the project is being constructed.

7-3.2.3 Any measures taken to reduce the air leakage to acceptable values shall be permanent, and shall be implemented on all similar housing units.

## 8. UNIT DESIGN - PLUMBING.

8-1 Plumbing system shall be designed and installed in accordance with the **International Plumbing Code** (IPC). Inspection and testing of the plumbing system shall be performed as prescribed in the Plumbing Code. Additional consideration in the technical evaluation will be given to systems which incorporate measures beyond the requirements of this STATEMENT OF WORK which are designed to increase energy conservation, ease of maintenance, or occupant comfort such as water filtration and purification, higher efficiency water heating systems, higher grade plumbing fixture materials (such as enameled cast iron tubs as opposed to enameled steel or plastic), etc. Plumbing systems shall be designed with consideration to the effects of expansive soils. Specific provision minimizing the detrimental impacts of expansive soil on under slab and underground piping systems shall be identified in the bidders proposals.

8-2 Water Piping. Under slab supply piping shall be limited to housing unit service entrance only. Service line to each housing unit shall be no less than 25 mm [1 inch] diameter. All water piping shall be sized in accordance with methods outlined in the International Plumbing Code, to limit water velocity in the pipe to 2440 mm/sec [8 ft/sec] unless a lower velocity is recommended by the plumbing fixture manufacturer(s). An isometric diagram of the water system shall be included in the design submittal. Allowable pipe materials are listed below:

8-2.1 Copper tubing. Water piping under concrete slabs shall be copper tubing, type K, annealed. Joints under the slabs are prohibited. All interior water supply piping shall be run above grade and shall be copper tubing, type K, L, or M hard-drawn copper. Type M copper tubing shall not be installed in exposed areas where the tubing may be exposed to external damage. Additional consideration in the technical evaluation shall be given to designs using copper types K or L. Fittings for soft copper tubing shall conform to ANSI B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes, and for hard-drawn to ANSI B16.22, Wrought Copper and Copper alloy Solder Joint Pressure Fittings.

8-2.2 Not used.

8-3 Soil, Waste, Vent, and Drain Piping. Soil, waste, vent, and drain, piping may be cast iron, copper, steel, or plastic suitable for installation in a residential waste, soil, vent, and drain system. Each fixture and piece of equipment, except water closets, requiring connection to the drainage system, shall be provided with a trap. Provide deep seal trapped drain for cooling coil condensate drain. Soil, waste, and drain piping installed below floor slabs shall be service weight hub and spigot cast iron. Building waste main lines shall be no less than 102-mm (4-inch) diameter. Building waste main line shall be provided with a two-way cleanout where the line leaves the building. All soil, waste, and drain piping shall be sized in accordance with the methods outlined in the **International (AM#3)** Plumbing Code. An isometric diagram of the sanitary sewer system shall be included in the design submittal.

8-4 Gas Connections. The use of semirigid tubing and flexible connectors for gas equipment and appliances is prohibited, except that the final connections to the kitchen ranges shall be made using flexible connectors conforming to ANSI Z21.45, Flexible Connectors of Other Than All Metal Construction for Gas Appliances, not less than 1000 mm [40 inches] long. Provide accessible gas shutoff valve and coupling for each gas equipment item. Comply with IBC or model code seismic requirements. Exposed horizontal piping shall not be installed farther than 150 mm [6 inches] from the nearest parallel wall in laundry areas or areas where clothes hanging could be attempted. See paragraph 4-5 for gas line distribution requirements.

8-5 Plumbing Fixtures. Fixtures shall be provided complete with fittings, and chromium-plated or nickel-plated brass (polished bright or satin surface) trim. All fixtures, fittings, and trim in a project shall be from the same manufacturer and shall have the same finish.

8-5.1 Plumbing shall meet the following criteria:

8-5.1.1 Exposed traps shall be chromium-plated, adjustable-bent tube, 20-gauge brass. Concealed traps may be plastic (ABS).

8-5.1.2 Faucets shall be single-control type, with seals and seats combined in one replaceable cartridge designed to be interchangeable among lavatories, bathtubs and kitchen sinks. Water flow shall be no more than .158 L/s [2.5 gpm] from any faucet. Kitchen faucets shall have extended height and shall include a retractable spray with hose.

8-5.1.3 Shower and bath combination shall be controlled by a diverter valve. Baths and shower and bath combinations shall be provided with waste fitting pop-up, concealed with all parts removable and renewable through the overflow and outlet openings in the tub. Showers and shower and bath combinations shall be equipped with a combination valve and flow control device to limit the flow to 0.158 L/s [2.5 gpm] at pressures between 137.9 to 413.7 kPa [20 and 60 psi]. Showers valves shall be pressure-balanced mixing valve with integral service stops, Symmons model 96-2 Temptrol, or approved equal.

8-5.1.4 Piping shall be concealed. Individual shutoff or stop valves shall be provided on water supply lines to all plumbing fixtures except bathtubs and showers. Shutoff valves shall be provided for each bathroom group. In multi-story units, additional consideration shall be given in the technical evaluation to designs which provide separate shutoff valves for each floor.

8-5.1.5 Fixtures shall be water conservation type, in accordance with the International Plumbing Code, and shall meet the water conservation requirements of State of Texas and City of San Antonio.

8-5.1.6 Vitreous china plumbing fixtures shall conform to ANSI A112.19.2, Vitreous China Plumbing Fixtures. Stainless steel fixtures shall be in accordance with ANSI A112.19.3, Stainless Steel Plumbing Fixtures (residential design). Plastic fixtures shall not be used. Enameled cast iron plumbing fixtures shall comply with ANSI A112.19.1. Enameled steel fixtures shall not be used.

8-5.1.7 Where tubs are installed in an end-to-end configuration in adjacent bathrooms the shower valve faucet end of the tubs shall not be back to back, but shall be located at opposite ends of the tubs to allow for maintenance and repair.

8-5.2 Water closets. Water closets shall have regular bowl with inclined tank, close coupled siphon jet, floor outlet with wax gasket, closed-front seat and cover, and an anti-siphon float valve. Water consumption shall be no more than 6 L [1.6 gal] per complete flushing cycle. Water closet trim shall conform to ANSI A112.19.5, Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards).

8-5.3 Lavatories. Lavatories shall be rectangular counter top type, minimum 508 by 457 mm [20 by 18 inches] in size or oval minimum 480 by 410 mm [19 by 16 inches] in size. Lavatories shall be vitreous china or cast iron self rimming. Lavatories shall have pop-up drains.

8-5.4 Bathtubs. Bathtubs shall be slip resistant and shall be constructed of enameled cast iron, porcelain enameled formed steel, or gel-coated, glass fiber reinforced polyester resin with wainscot. Metal bathtubs shall have fiberglass or ceramic tile wainscot. Bathtub wainscot shall extend to a minimum height of 1524mm (60") above finished floor.

Combination bathtub/shower shall have a wainscot to 1980mm (78") above finished floor. Wainscot shall be of ceramic tile over membrane waterproofing on a cementitious substrate; or gel-coated, glass-fiber reinforced polyester.

8-5.5 Showers. Shower stalls shall be of ceramic tile, floor to ceiling, over membrane waterproofing on a cementitious substrate; or gel-coated, glass-fiber reinforced polyester. Shower receptors shall be slip resistant cast stone or slip resistant gel-coated, glass-fiber-reinforced polyester. Shower stall wainscots shall be ceramic tile or gel-coated, glass-fiber-reinforced polyester and shall extend to a minimum height of 1980mm (78") above finished floor.

8-5.6 Kitchen sinks. Kitchen sinks shall be Type 302 stainless steel, 18-gauge minimum, seamless drawn,

and sound deadened. Sinks shall be double bowl, self-mounting without mounting rings, complete with cup strainer and plug. Bowls shall be minimum 230mm (9 inches) deep. Food waste disposers shall be in accordance with UL 430 and ASSE 1008, and shall have a minimum motor size of 370 watts [½ horse power]. Strainer shall be eliminated where food waste disposers are provided.

8-6 Clothes Washer Connections. Drainage and hot and cold water supply shall be provided for automatic clothes washers. Washer connection, complete with 50-mm [2-inch] drain, 20-mm [¾-inch] hose thread supplies shall be provided in standard manufactured recessed wall box with single-face plate. Boxes shall be constructed of plastic or sheet steel. Steel boxes shall have a corrosion-resistant epoxy enamel finish. Boxes shall be mounted a minimum of 865 mm [2 ft-10 inches] above the finish floor. Electrical outlets for both washer and dryer shall also be provided.

8-7 Refrigerator Ice Maker Connection. Cold water supply shall be provided for GF refrigerator ice makers. Ice maker connection shall include an angle valve and a ¼ inch hose thread supply, and shall be provided in standard manufactured recessed wall box with single-face plate (plastic or steel). Boxes shall be mounted a minimum 2 ft-10 inches above the finish floor.

8-8 Hose Bibbs. Hose bibbs shall be provided at one side and at the rear of each building for each ground level housing unit. Hose bibbs shall be supplied with an integral vacuum breaker. Valve body shall be all brass. Valve handle shall be metal. Valve seats, washers, and stem packing shall be fully serviceable without removal of the valve body. Vacuum breaker shall be brass and shall not have any exposed plastic.

8-9 Piping Location. Water piping running in crawl spaces and attics shall be installed on the warm side of insulation and shall be wrapped with insulation and a vapor barrier jacket. Determination of the warm side shall be the same as determined for vapor barrier location. No water piping runs in exterior walls shall be allowed, except in climates where the 99 percent dry bulb temperature is 1.7 degrees C [35 degrees F] or higher.

8-10 Cleanouts. Cleanouts shall be provided at each change in direction of sanitary sewer lines, at the intervals specified in the National Standard Plumbing Code, and at the building service entrance. All cleanouts shall be permanently accessible. Ground cleanouts shall be two-way type, installed in a 305-mm by 305-mm [12-inch by 12-inch] concrete pad, flush with grade.

8-11 Water Heater. Water heaters shall have round, glass lined tanks, and shall have factory applied insulation having a minimum metric R value of 2.8 (in-lb R = 16). Access shall be provided through the insulation for service and maintenance openings. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. The water heater temperature and pressure relief valve shall be installed in accordance with code. Water heaters shall be sized in accordance with Table 8-1 for a 32 degrees C [90 degrees F] rise. Water heater energy factors shall meet or exceed the minimum requirements of 10 CFR 430. Additional consideration in the technical evaluation will be given to designs which include water heaters which exceed the minimum energy efficiency requirements and which utilize high efficiency, power vented, or sealed combustion water heaters.

**TABLE 8-1 - WATER HEATER SIZING**

Requirements by Fuel Type	2 BR		3 BR		4 BR		5 BR	
	1 Bath	2 Bath	2 Bath	3 Bath	2 Bath	3 Bath	2 Bath	3 Bath
Gas & Oil:								
Storage (L [gal])	114 [30]	151 [40]	151 [40]	194 [50]	194 [50]	194 [50]	194 [50]	194 [50]
1 hour draw (L [gal])	227 [60]	265 [70]	273 [72]	310 [82]	341 [90]	341 [90]	341 [90]	341 [90]
Recovery (L/h [gph])	114 [30]	114 [30]	121 [32]	121 [32]	151 [40]	151 [40]	151 [40]	151 [40]

**TABLE 8-1 - WATER HEATER SIZING**

Requirements by Fuel Type	2 BR	3 BR	4 BR		5 BR	
	1 Bath	2 Bath	2 Bath	3 Bath	2 Bath	3 Bath
Electric:						
Storage (L [gal])	114 [30]	189[50]	189[50]	250 [66]	250 [66]	250 [66]
1 hour draw (L [gal])	167 [44]	273 [72]	273 [72]	333 [88]	333 [88]	333 [88]
Recovery (L/h [gph])	53 [14]	83 [22]	83 [22]	83 [22]	83 [22]	83 [22]

Note: Storage capacity, input, and recovery may vary with manufacturer. Any combination of the above which produces the required hour draw will be acceptable.

8-11.1 Gas fired water heaters shall be in accordance with ANSI Z21.10.1, Water Heaters, Gas, Volume I, Storage Type, 22 kW [75,000 BTUH] Input or less, and shall be high efficiency type. Water heaters with powered ventilation shall be vented in accordance with manufacturer’s instructions. Additionally, natural gas-fired heating equipment with a max rated input capacity of 586 kw (2.0 MMBtuh) or less shall be in compliance with Nitrogen Oxide limits as specified in 30 Texas administrative Code, part 1, Chapter 117, Subchapter D, Division 1, Rule 117.465. Gas fired water heaters shall have annual energy use of 246 therms or less based on 10 CFR 430, Subpart B, Appendix E.

8-11.2 Water heaters shall be installed in the mechanical equipment room at floor level. Adequate space shall be available for required clearances as well as proper servicing and removal and replacement without disassembly of any other equipment in the room.

8-11.3 **BID OPTION 1** Electric water heaters shall comply with UL 174, Water Heaters, Household Electric Storage Tank Type, and shall have an Annual Energy Use (kWh) of 4,773 or less based on DOE test procedure 10 CFR430, Sub-Part B, Appendix E. Water heaters shall be connected to the ground coupled heat pump desuperheater.

8-12 Fire Protection. Provide a wet chemical fire extinguishing unit for each kitchen range, mounted in cabinet above or beside the kitchen range exhaust hood. System shall be a minimum 2 ½ lb capacity, stored pressure type with automatic detection of fire and release of extinguishing agent through fixed nozzles. System shall provide pressure actuated shutoff of range energy source (either gas or electric) and shall include an audible discharge alarm. System shall be UL listed “Residential Range Top Extinguisher Unit”. System shall be “The Guardian” as manufactured by Twenty First Century International Fire Equipment and Services Corporation of Irving, Texas, or approved equal.

**9. UNIT DESIGN - ELECTRICAL.**

9-1 Conformance to Code. The electrical system shall be designed in compliance with the rules and recommendations of ANSI C2, National Electrical Safety Code; NFPA 70, National Electrical Code (NEC); **(AM#4)** and applicable model codes, whichever is more stringent. Provide main circuit breaker in the main panel for each dwelling unit, sized in accordance with the NEC.

9-2 Service Entrance. Service entrances, exterior meters, and panels shall be enclosed or sight screened. Service feeders shall be underground with exterior meters. Panel boards shall be dead front, painted galvanized steel, and furnished with main breakers. Panel board doors shall be flush one-piece fronts. Panel boards may be surface or recessed mounted depending on their location. In hallways, panel boards shall be recessed. Back-to-back panel boards shall be offset a minimum of 400 mm [16 inches] horizontally. Tandem circuit breakers shall not be used. Printed labels, in the panel board, shall be provided for all installed circuits. Recessed panel boards are not to be located in party walls and fire walls.

9-3 Panel Board Locations. Each dwelling unit shall have it's own distribution panel board. Panel boards shall be located in the utility/laundry room, or hallway.

9-4 Conductors. Conductors shall be copper and not smaller than #14 AWG.

9-5 Outlet Circuits. All general receptacle and lighting circuits shall be 15 Ampere circuits, fed by 15 Ampere circuit breakers unless noted otherwise. Receptacles on opposite sides of common walls shall be horizontally offset a minimum of 300 mm (12 inches) to maintain the integrity of the fire wall and sound deadening rating of the wall.

9-5.1 Separate Circuits. Lighting and receptacles shall be on separate branch circuits. Where half-switched receptacles are installed for auxiliary cord-connected lighting, the entire receptacle shall be fed from the same circuit. Such circuits may be either lighting or receptacle circuits.

9-5.2 Outlets Per Circuit. Circuits for lighting or general purpose receptacles shall be limited to a maximum of six (6) current consuming outlets. This requirement shall supersede any others.

9-5.3 Outlet grounding. All equipment, appliances, lighting fixtures, and receptacles shall be grounded by an equipment grounding conductor which shall be terminated at a grounding screw in the outlet box. A grounding jumper shall connect the equipment, fixture, or receptacle to this grounding screw.

9-6 Exterior Lighting. Provide energy efficient high quality lighting for each housing unit. The minimum efficiency standard for lighting is 50 lumens/watt. This efficiency can be achieved with fluorescent and compact fluorescent lighting. Lighting must also be color corrected with a Color Rendering Index (CRI) of 60 or better. Provide a minimum of one lighting fixture in each dwelling unit's entry, carport, and patio or balcony area(s). Light fixtures at entry and patio or balcony areas shall be switched from the dwelling unit interior. Provide a fixture in the patio area, except that the patio area light shall not be provided where the patio is adjacent to an exterior entrance and is adequately served by the lighting fixture required herein before.

9-7 Interior Lighting and Switched Outlets.

9-7.1 Efficiency. Interior lighting will be both efficient and color corrected. Color Rendering Index (CRI) of 85 or better and a standard lighting color of 3500 K are required. Incandescent fixtures are not allowed. Minimum efficiency standard for lighting are as follows:

9-7.1.1 Fluorescent tubes 1220 mm [4 ft] and longer: 90 lumens/watt.

9-7.1.2 Fluorescent tubes less than 1220 mm [4 ft]: 80 lumens/watt.

9-7.1.3 Compact fluorescent and other lamps: 50 lumens/watt.

9-7.2 Locations. Provide light fixtures operated by wall switches for all rooms except living rooms. Living room shall have a convenience duplex receptacle, half controlled by a wall switch, located at the room entrance. Wall-switch operated ceiling lights shall be provided in dining and utility rooms, halls, bedrooms, kitchens, and dinette areas. Additional light fixtures shall be provided in rooms whose configuration requires them for adequate lighting. Wall-switch operated wall-mounted lights shall be provided in bathrooms and half baths located above the mirror over the lavatory. Walk-in closets and interior and exterior bulk storage rooms shall be provided with ceiling lights, either wall switch or pull-chain operated. A minimum of one lighting fixture, ceiling or wall mounted, as appropriate, shall be provided in the carport.

9-7.2.1 Dining room ceiling light fixtures (hanging type) shall be movable by means of a track, chain and hooks, or other means in order to accommodate other than the typical dining room furniture arrangement. Fixtures may be designed for incandescent use, and do not have to meet the 50 lumens/watt requirement. A ceiling fan with integral lighting fixture may be substituted for this requirement.

9-7.2.2 The general lighting intensity in kitchens shall be 320 to 540 Lx [30 to 50 foot-candles]. Supplementary lighting shall be provided at the sink and under one of the wall cabinets for a work center to produce a composite lighting level of 810 Lx [75 foot-candles] using either down-lights, surface-mounted fluorescent fixtures below wall cabinets or wall-mounted fixtures (1520 mm [5 ft] and higher above the floor) as appropriate. Kitchen range hood shall be provided with a light, fan, and switches.

9-7.2.3 The ceiling mounted light fixtures in the living room, family room (if provided), dining room, and all bedrooms shall be provided with a metallic fixture box suitably supported from the ceiling structure so that it may support a ceiling fan. Additional wiring and a switch shall also be provided next to light switch to allow for independent wall switch control of the fan and light.

9-8 Smoke Detectors. A household fire warning system, per NFPA 70, National Electrical Code; NFPA 72, National Fire Alarm Code; and NFPA 101, Life Safety Code, shall be installed in each unit. Hard-wired smoke detectors shall be located and installed on the ceilings of each dwelling unit in accordance with the requirements of NFPA 70, 72, 101, and UL 217. Each sleeping room shall have a separate smoke detector. All smoke detectors shall be of the photoelectric type. All smoke detectors shall have audible annunciation using the temporal 3 pattern. Smoke detectors in handicapped adaptable units shall also have visual annunciation with a 177 Candela rating. The mounting bases shall be permanently wired and supplied by a dedicated circuit. Circuit breaker for smoke detector circuit shall be clearly labeled and provided with a warning for occupants not to shut off. All smoke detectors within a living unit shall be interconnected so that operation of any smoke detector shall cause the alarm audio and visual devices in all smoke detectors in that unit to activate. All smoke detectors shall be interconnected with battery backup. Smoke detectors shall not be located near air exchange vents. Additional consideration in the technical evaluation will be given to designs that provide smoke detectors with pull out trays for changing batteries. This type of smoke detector allows the occupant to change the battery without having to remove the detector from its mounting. Activation of a smoke alarm shall not cause activation of a carbon monoxide alarm.

9-9 Carbon Monoxide Alarms. Provide carbon monoxide (CO) alarms equipped with a fuel burning appliance inside of the dwelling unit. Activation of a CO alarm shall not cause activation of a smoke alarm. CO alarms will be provided as follows:

9-9.1 One CO alarm shall be located on each level of the dwelling unit. A required alarm shall be located in vicinity of the bedrooms, such as in the corridor outside of the bedrooms. CO alarms will not be provided in furnace rooms or unfinished attics.

9-9.2 CO alarms shall be hard-wired and wall-mounted at the same height as the thermostat, approximately 1.3 m [52 inches] off the floor. Dead air spaces such as corners shall be avoided. Units may be powered from circuits powering smoke detectors. In all cases, manufacturer's guidelines and recommendations shall be followed.

9-9.3 CO alarms shall be equipped with an audible alarm, continuous digital display, peak level memory, test button, and test reset button and shall be UL listed by passing standard test UL 2034.

9-10 Telephone. Provide dual jack outlets in family room (if provided), living room, and each bedroom of each dwelling unit. Provide a single jack outlet in the kitchen. Eight position modular jack connectors shall be provided. The jack provided in the kitchen shall be for a wall-mounted phone. Wiring methods shall comply with EIA/TIA Standard 570, Residential and Light Commercial Telecommunications Wiring Standard. Cable and jacks shall be Category 5e per TIA/EIA 568A, Commercial Building Telecommunications Cabling Standard. Cable shall be unshielded twisted pair (UTP), #24 AWG, solid copper station. Each dwelling unit shall be pre-wired separately from other dwelling units in the same building. All wiring shall terminate in a surface mounted, weatherproof, protected telephone terminal ("Demarcation Box") located on an outside wall adjacent to the building electric metering equipment. Each dwelling unit shall have a protected telephone terminal. The protected telephone terminal cover shall be provided with means for padlocking, shall be accessible from the outside, and shall be permanently labeled, "Telephone". Gas protected telephone terminals shall be provided for all incoming phone lines. A single #10, CU, green equipment grounding conductor shall be run in 16 mm (1/2-inch) non-metallic conduit from the electric metering equipment to the protected telephone terminal box. Home run style wiring shall be utilized between each jack and the protected telephone terminal. 4-pair cable shall be home run from each outlet except 2-pair cable may be used for kitchen outlet. No circuits shall be routed on the interior or exterior surfaces of dwelling units, or on the surfaces of walls in other structures. Outlet boxes shall be 117 mm (4-11/16 inches) square by 53 mm (2-1/8 inches) deep. Sizes of protected telephone terminals shall be coordinated with local Telephone Company.

9-11 Commercial Cable Television. Cable Television (CATV) outlets shall be located in the kitchen, living room, family room (if provided), and bedrooms. A minimum of two outlets shall be provided in the living room to allow flexibility in furniture layout. Outlets shall be located next to telephone jacks (kitchen excluded) to allow connection of a satellite receiver. Each dwelling unit shall be pre-wired in conformance with all local CATV company requirements. Each dwelling unit shall be pre-wired separately from other dwelling units in the same building. All wiring shall terminate on an 8-output coupler located inside a surface mounted, weatherproof, protected television terminal ("Demarcation Box") located on an outside wall adjacent to the protected television terminal. Each dwelling unit shall have a protected television terminal. The protected television terminal cover shall be provided with means for padlocking, shall be accessible from outside and shall be permanently labeled "Television". A single #10, CU, green equipment grounding conductor shall be run in 16 mm (1/2-inch) non-metallic conduit from the electric metering equipment to the protected television terminal box. Home run style wiring shall be utilized between each jack and the protected television terminal. Cable shall be RG-6 with minimum coverage of 67%. Type of tap offs, and sizes of protected television terminals and outlet boxes shall be coordinated with local cable TV Company. Local TV Company is Time Warner and the POC is Mr. Peter Perez at 210-352-4466. E-mail address is peter.perez@twcable.com.

9-11.1 Satellite Television. Provide two home run coax cables (one set per dwelling unit) from protected television terminal to exterior mounted satellite dish bracket (as described in architectural section 5). Cables shall be type RG-6 with minimum coverage of 67% and shall be completely concealed except for the length between where the cables exit the house and the bracket. This exposed length shall be minimized to the largest extent possible, but sufficient slack shall be provided to allow easy connection to an occupant installed dish. Sufficient slack shall also be provided within the protected television terminal to allow connection to any of the 8-output coupler's jacks. Type F male connectors shall be provided on the ends of both cables.

9-12 Doorbell. The front entrance to each dwelling unit shall be provided with a low voltage bell or buzzer. Doorbell shall be hard-wired. Handicapped adaptable dwelling units shall also be provided with hook up provisions for future installed wall-mounted strobe visual annunciators in the entry hallway and kitchen.

9-13 Convenience Receptacles. In addition to receptacles required by NEC, provide convenience receptacles in the following areas:

9-13.1 Equipment room

9-13.2 Hallway outside bedrooms

9-14 Special Receptacles. Provide 240 V electric receptacles for electric dryer (this is in addition to the 120 V receptacle required for a gas dryer) and electric range. Provide a switched 120 V receptacle under kitchen sink for garbage disposal.

9-15 Wiring. Maximum use shall be made of nonmetallic-sheathed cable for branch circuit wiring, and of service entrance cable for heavy-duty interior circuits and for service entrance conductors. Installed conductors in conduit shall be used only where specifically required by the NEC except that all exposed electrical wiring shall be put in steel metal conduit and receptacle boxes.

9-16 Branch Circuit Conductors. Branch circuit conductors and over current devices shall be as rated by NEC. A minimum of one spare circuit space in the panel shall be provided per dwelling unit. Individual circuits shall be provided for the clothes washer, clothes dryer (with receptacles located behind the washer and dryer), dishwasher, garbage disposal, freezer, electric range, furnace or air handling unit, air conditioning unit, and water heater. Two utility circuits (20 amp utilizing #12 AWG wire) shall be provided in the kitchen area for the convenience outlets for small appliances serving the kitchen, dining area, and family room area. The furnace or air handling unit and the air conditioning unit shall be provided disconnect switches in addition to the branch circuit breaker.

9-17 Exterior Receptacles.

9-17.1 One duplex receptacle shall be provided in each dwelling unit's entry, carport, and patio or balcony area(s).

9-17.2 One duplex receptacle, fed and switched with the front entrance door light, shall be provided for holiday lighting. This is in addition to the one required by paragraph 9-17.1.

9-17.3 Receptacles shall have weatherproof "Taymac" type covers that are rated NEMA 3R with a plug cord attached.

9-18 Ground Fault Protected Receptacles. All receptacles that are required to have ground fault protection shall be fed by a ground fault interrupting circuit breaker except that the dedicated receptacle in the bathroom shall itself be the ground fault interrupting type.

**10. UNIT DESIGN - HEATING, VENTILATING, AND AIR CONDITIONING.**

10-1 Design. Heat gain and loss calculations shall be, as a minimum, in accordance with the current edition of the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals or ACCA Manual J. The cooling load calculations shall be in accordance with ASHRAE Residential Cooling Load Calculations. Computer-generated load calculations shall be provided, and shall include complete input and output summaries. Design shall be based on the weather data shown in Table 10-1 and Table 10-2. HVAC system shall be designed to minimize noise transmitted to the habitable space. The design noise criteria (NC) shall be no greater than 40 in any habitable space.

**TABLE 10-1 – WEATHER DATA<sup>1</sup>**

Type of Design / Design Information	Metric	Inch-pound
Weather Region	10	
Heating <sup>2</sup>		
Indoor Design Temperature	21 °C	70 °F
Outdoor Design Temperature	-1 °C	30 °F
Annual Heating Degree <sup>3</sup> Days	870	1570
Largest Number of Monthly Heating Degree Days <sup>3</sup>	278	500
Cooling		
Indoor Design Temperature	24 °C	75 °F
Outdoor Design Dry Bulb Temperature	36 °C	97 °F
Outdoor Design Wet Bulb Temperature	24.5 °C	76 °F

Note<sup>1</sup>: From TM 5-785, Engineering Weather Data.

Note<sup>2</sup>: Bin weather data is available from TM 5-785, Engineering Weather Data.

Note<sup>3</sup>: Metric data are based on Celsius degree days to a base of 18 degrees C. Inch-pound data are based on degree days Fahrenheit to a base of 65 degrees F.

**TABLE 10-2**

BIN WEATHER DATA FOR FORT SAM HOUSTON, TEXAS	
TEMPERATURE RANGE, C (F)	ANNUAL OBSERVATION, HRS
40/43 (105/109)	0
38/40 (100/104)	20
35/38 (95/99)	195
32/35 (90/94)	423
30/32 (85/89)	593
27/30 (80/84)	847
24/27 (75/79)	1375
21/24 (70/74)	1121
18/21 (65/69)	918
16/18 (60/64)	760
13/16 (55/59)	636
10/13 (50/54)	594
7/10 (45/49)	481
4/7 (40/44)	371
2/4 (35/39)	237
-1/2 (30/34)	121
-4/-1 (25/29)	46
-7/-4 (20/24)	12
-9/-7 (15/19)	2
-12/-9 (10/14)	1
-15/-12 (5/9)	0

NOTE: Data from TM 5-785, Engineering Weather Data

10-1.1 Load calculations. Computer generated load calculations shall be performed for each possible orientation up to four representative orientations for each building type included in the project. Room air flow requirements shall be computed based on the individual room load. However, the minimum acceptable air flow

shall be 2.5 (L/s)/m<sup>2</sup> [0.5 cfm/ft<sup>2</sup>] for all spaces. The design for each individual housing unit shall be based on the heating and cooling loads as well as room airflow requirements computed for the building type and orientation which it most closely matches. Internal loads shall be included in the computerized load calculations in accordance with ASHRAE recommendations for residential analyses.

10-1.2 Duct system layout. For a given building type, a single duct layout may be used regardless of orientation, provided that the system is sized to provide the required air flow for each room at its worst case orientation. Balancing dampers shall then be used to reduce air flow to the appropriate level as required. Permanent access to dampers shall be provided.

10-2 Equipment Safety and Efficiency. All materials and equipment shall be the standard cataloged product of manufacturer's regularly engaged in production of such materials and equipment, and shall be the manufacturer's latest standard design. Each major component of the heating [and cooling] system[s] shall have the manufacturer's information on a plate secured to the equipment.

10-2.1 All heating and cooling equipment proposed and installed in this contract shall bear the Energy Star Label.

10-2.2 Equipment shall comply with the requirements of American Gas Association (AGA), American National Standards Institute (ANSI), Air Conditioning and Refrigeration Institute (ARI), American Society for Testing and Materials (ASTM), Gas Appliance Manufacturers Association (GAMA), National Electric Manufacturers Association (NEMA), National Fire Protection Association (NFPA), Underwriters Laboratories, Inc. (UL) or other national trade associations as applicable.

10-2.3 Equipment efficiencies as listed in Table 10-3 below are minimum acceptable levels. Energy conservation as it relates to equipment operating costs will be considered in the evaluation process. Additional consideration in the technical evaluation will be given to designs which include higher than minimum efficiency equipment.

**TABLE 10-3 - MINIMUM EQUIPMENT EFFICIENCIES**

	Natural gas fired equip	Electric heat pump (ground coupled)	Electric cooling only split DX cond. Unit and matched coil
Furnace AFUE	90% <sup>1</sup>		
Heating Mode COP		4	
Cooling EER <sup>2</sup>		12.7	10
SEER <sup>3</sup>		15	12.7

Note<sup>1</sup>: Efficiency is based on DOE test procedure 10CFR430, Sub-Part B, Appendix N.

Note<sup>2</sup>: EER measured in accordance with ARI 210/240 at rating conditions.

Note<sup>3</sup>: Efficiency is based on DOE test procedure 10CFR430, Sub-Part B, Appendix M.

10-3 Heating and Cooling Systems. Each housing unit shall be provided with central heating and air conditioning system[s]. Systems shall be designed, installed, balanced, and adjusted to distribute heat and cooling to all habitable rooms, as well as bathrooms, in proportion to the calculated load requirements of these spaces. Fans in air handlers and furnaces shall be multi-speed, direct drive type. Fans in air handlers and furnaces shall not be variable-speed type. System installation shall conform to SMACNA Installation Standards for Residential Heating and Air Conditioning Systems except as altered by this document. Additional

consideration in the technical evaluation will be given to systems utilizing modular components, plugged power, stainless steel heat exchangers, drawer-type burner assemblies, additional space in the mechanical room, and other features which contribute to ease of system maintenance. Additional consideration will also be given to designs which provide measures beyond the requirements of this STATEMENT OF WORK to increase energy conservation or occupant comfort such as division of each housing unit into more than one conditioning zone for increased control.

10-3.1 Equipment sizes selected for installation shall not be oversized more than 125 percent of the calculated loads (exception, gas fired furnace heating capacity may exceed 125 percent of the calculated heating load in order to match air handler selection with required cooling loads).

10-3.2 Mechanical space shall be provided to house all mechanical equipment. Exterior air conditioning units shall be concrete pad-mounted, with location selected based on site specific conditions and intended uses of outdoor space. Effort shall be made to locate the unit(s) out of the occupant's direct line of sight (screen with shrubbery or wall, locate on sides of housing unit, avoid placement under windows, etc.). However, the primary concern shall be coordination with the mechanical area location. Mechanical equipment shall be located in an externally accessible equipment room, and shall be arranged to allow for ease of maintenance, and for proper venting if required. This equipment room shall be provided with a light and electrical receptacle. The mechanical equipment room shall be a part of the dwelling structure. The mechanical equipment room shall be provided with a floor drain to accept condensate. The mechanical equipment room shall have a depressed floor to prevent condensate or leakage from entering the dwelling. The mechanical equipment room shall have a concrete pad outside the access door. Mechanical equipment shall not be located in attic spaces. A desirable feature is to locate the mechanical equipment access on the side of the dwelling or otherwise accessible without traversing areas that may be fenced. See paragraph 5-6.3 for additional requirements for mechanical spaces containing fuel-fired heating equipment.

10-3.3 Forced warm air systems. Warm air furnaces shall be induced combustion, upflow, high efficiency, natural gas furnaces. Furnaces shall be equipped with electronic ignition. High efficiency (AFUE > 90 percent) gas furnaces shall be vented in accordance with AGA requirements and the manufacturer's instructions. Condensate drains for high efficiency units shall be manufacturer approved, and shall be indirectly connected to the building sanitary sewer system. Combustion air shall be provided from the outside in accordance with the appliance listing. Furnaces shall be equipped with centrifugal fan, disposable filters, controls, and transformer. Fans shall be multi-speed, direct-drive type. It shall be possible to service and replace all controls and internal components from one side of the furnace. Heat exchangers shall be guaranteed for a minimum service life of 10 years. Furnaces shall be equipped with a cooling coil by the same manufacturer, matched to the selected air conditioning equipment.

10-3.4 Not used.

10-3.5 Split system air conditioning:

10-3.5.1 Electric air conditioning equipment shall consist of an air-cooled condensing unit and evaporator as matched components with the furnace, all by the same manufacturer. Refrigerants used shall have an Ozone Depletion Potential (ODP) of .05 or less. The condensing unit shall contain, as a minimum, the features indicated in Table 10-4. Equipment shall be sized to meet the total load determined by computer calculation. Equipment may be oversized to no more than 125 percent of the computer generated load. Fans shall be multi-speed, direct drive type.

**TABLE 10-4 – SPLIT SYSTEM AIR CONDITIONING & HEAT PUMP FEATURES**

High and low pressure compressor protection.
Filter-drier.
Hermetically sealed compressor with built-in overloads and locked rotor protection.

**TABLE 10-4 – SPLIT SYSTEM AIR CONDITIONING & HEAT PUMP FEATURES**

Electric crankcase heaters.
Start and run capacitors.
Anti-short-cycle timer. (factory installed)
Testing and charging refrigerant connections.
Compressor guaranteed for a minimum service life of 5 years.
Fan and coil guards.

10-3.5.2 The evaporator coil shall be provided with a liquid strainer, expansion device, pre-insulated housing, copper or aluminum coil, and insulated condensate drain pan. Coil face velocity shall be limited to 2.8 m/s [550 fpm].

10-3.5.3 The condensing unit and matched coil shall deliver a Seasonal Energy Efficiency Rating (SEER), consistent with the minimum requirements shown in Table 10-3.

10-3.5.4 Not used.

10-3.5.5 Refrigerant Charge Verification: When split-system air conditioning systems are selected for installation, the contractor shall check, calibrate, and charge the refrigerant system following installation and start-up of the equipment. These tests shall be accomplished on the same 15% of the units which undergo blower door and duct tightness testing. If the tested units show a low or excessive refrigerant charge, all new systems shall be checked after start-up, but prior to acceptance by the Government.

10-3.6 **Bid Option 1** Ground Coupled Heat Pumps: In lieu of gas fired warm air furnace, split system electric cooling, and gas fired water heater, Bid Option 1 shall provide ground coupled heat pump for heating and cooling and electric water heater coupled to a desuperheater for water heating.

10-3.6.1 One ground-coupled heat pump shall be provided for each living unit. Units shall be rated in accordance with ARI 330 GSHP (Closed Loop). Units shall have a head loss of not more than 36 kPa (12 feet of water) at the flow rate used to obtain the ARI 330 rating. Units shall have extended range capability to include entering liquid temperature down to 0 degrees C (32 degrees F) in heating and up to 38 degrees C (100 degrees F) in cooling. Units shall be located in the externally accessed utility room adjacent or close to the domestic water heater. A desuperheater shall be provided to use the Ground-Coupled Heat Pump as a heat source for domestic hot water during the cooling season. A 10 kilowatt (minimum) emergency backup electric resistance duct heater shall be incorporated into the system design for each unit.

10-3.6.2 The loop piping shall be PE3408 (high density polyethylene) with minimum cell classification 355434C per ASTM D 3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials. The piping shall experience 0 failures after 5,000 hours under condition "C" (100 percent reagent at 100 degrees C) when tested in accordance with ASTM D 1693, Standard test method for environmental Stress-Cracking of Ethylene Plastics. A 50 year limited warranty must be issued by the pipe manufacturer. U-type fittings shall be shop fabricated under quality controlled conditions of the same material designation. Joining shall be by the butt fusion or saddle (sidewall) fusion method in accordance with the manufacturer's Heat Fusion Qualification Guide. Ground loops shall be installed by a certified installer, trained by the International Ground Source Heat Pump Association or factory trained by the ground coupled heat pump manufacturer. A certified fusion technician will perform all pipe fusions. Bore shall be vertical with a minimum 6 meter (20 feet) separation. Bores shall be fully backfilled with thermally enhanced grouts (Bentonite-Quartzite mixture).

10-3.6.3 Design of closed-loop ground source heat pump shall conform to ASHRAE publication, Design/Data Manual for Closed-Loop Ground-Coupled Heat Pump Systems. Accurate calculations supporting the units selected, sizing of pumping modules, bore pipe sizing and bore depth shall be provided. Based on ore data at the site, the bore depth (AM#2) is expected to be a minimum of 29.5 meters per kW (340 ft per ton) of cooling at the site. The Contractor shall verify bore depths (AM#2) by performing a soil thermal conductivity test at the site. Total bore length per ground coupled heat pump unit shall be as determined by applying the calculated length per ton to the installed nominal tonnage per unit and not the calculated unit design load.

10-3.6.4 Contractor shall use mandatory specification section 15741 Vertical Ground-Coupled Heat Exchanger System (VGCHES).

10-3.7 Not used.

10-3.8 Not used.

10-3.9 Not used.

10-3.10 Unacceptable systems. Room unit heaters, space heaters, room (window) air conditioning units, floor furnaces, gravity warm air systems, and electric resistance heaters are not permitted.

10-4 Air Distribution. Provide systems conforming to the recommendations of the ASHRAE Air Distribution Manual or the SMACNA Residential Comfort System Installation Standards Manual. For two-floor housing units with a single air conditioning unit, provide separate, main supply ducts with volume control dampers for each floor. These main ducts shall be run directly from the air handler or furnace to the appropriate building level. As a minimum, provide a separate ducted return for each floor level. Two-floor housing units with 93 m<sup>2</sup> [1,000 ft<sup>2</sup>] or greater net floor area on each floor shall be provided with a separate heating and cooling unit and supply and return ducted system for each floor. Additional consideration in the technical evaluation will be given to designs which incorporate air distribution systems totally within the conditioned envelope.

10-4.1 Supply diffusers. Wall, ceiling, and/or baseboard supply diffusers shall be located to ensure that the air distribution will completely cover all surfaces of exterior walls with a blanket of conditioned air. At least one diffuser shall be provided in each habitable room. Diffusers shall have louvered faces with individually adjustable blades, and shall be provided with integral opposed blade damper. Diffusers shall be provided with air deflectors as required for proper air flow in the space. Plastic diffusers are prohibited. Core velocity shall be limited to 3 m/sec [600 fpm] maximum, with a maximum pressure drop of 0.82 Pa/m [0.1 inch water]. Airflow from any single diffuser shall be limited to 94.4 L/s [200 cfm] maximum. Ceiling mounted units shall have factory finish to match ceiling color, and be installed with rims tight against ceiling. Sponge-rubber gaskets shall be provided between ceiling or wall and surface-mounted diffusers for air leakage control. Diffuser boots shall be sealed tight to the wall or ceiling they penetrate using duct mastic or caulking. Suitable trim shall be provided for flush-mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Wall supply registers shall be installed at least 150 mm [6 inches] below the ceiling. Supply diffusers shall not be located within 1.5 m any light fixture or fixture box intended for future ceiling fan installation.

10-4.2 Return and exhaust grilles. Grilles shall be fixed horizontal or vertical louver type similar in appearance to the supply diffuser face. Plastic units are prohibited. Core velocity shall be limited to 2 m/sec [400 fpm] maximum, with a maximum pressure drop of 0.5 Pa/m [0.06 inch water]. Grilles shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Register/grille boots shall be sealed tight to the wall or ceiling they penetrate using duct mastic or caulking. Wall return grilles shall be located at least 150 mm [6 inches] above the floor. Return grilles shall be located in hallways, finished basements, or other normally unoccupied spaces to minimize the sound level in occupied spaces. Return grilles shall not be located immediately adjacent to furnace return air plenum. Return grilles shall not be locate low in a wall location that may be blocked by furniture such as sofa of bed headboards. **A desirable feature is filter frames in return grilles allowing filter maintenance from inside the living unit.**

10-4.3 Ductwork. Ductwork shall be externally insulated sheet metal or flexible metal. Length of flexible duct shall be limited to 1.8 m [6 ft]. Flexible ductwork shall not be spliced or joined and shall be a single continuous piece from diffuser boot to trunk/branch duct. Systems composed entirely of flexible ductwork with distribution boxes are prohibited. Sub-slab, intra-slab, or crawlspace ductwork is also prohibited. Volume dampers shall be provided at each branch take-off. All ductwork shall be concealed. No portion of the building construction (such as joist space in a floor or ceiling, wall stud space, etc.) shall be used as a duct. The requirements for ductwork set forth below apply to all ductwork installed in the housing unit, supply systems, return systems, exhaust systems, ventilation systems, and outside air supply ductwork.

10-4.3.1 Maximum velocity in supply ducts shall be limited to 4.6 m/s [900 fpm] for mains and 3.1 m/s [600 fpm] for branches.

10-4.3.2 Ducts shall be airtight with no visible or audible leaks to ensure quiet, economical system performance. Ductwork in conditioned spaces shall be constructed for a 250 Pa [1 inch] static pressure construction class with seal class C, as described in the SMACNA HVAC Duct Construction Standard, unless a higher pressure class and/or seal class is required by actual, system operating conditions. Ductwork in unconditioned spaces shall be constructed for a 500-Pa [2-inch] static pressure construction class with seal class C, unless a higher pressure class and/or seal class is required by actual, system operating conditions. All duct seams and joints shall be sealed using duct mastic. Tape shall not be used as a means for sealing ductwork.

10-4.3.3 For flexible ductwork, the inner core shall be mechanically fastened to all fittings, preferably using drawbands installed directly over the inner core and beaded fitting. If beaded fittings are not used, then the inner core shall be fastened to the fitting using #8 screws equally spaced around the diameter of the duct, and installed to capture the wire coil of the inner liner (3 screws for ducts up to 300 mm [12 inch] in diameter and 5 screws for ducts over 300 mm [12 inch] in diameter). The inner core must be sealed to the fitting using mastic or tape. Tape used for sealing the inner core shall be applied with at least 25 mm [1 inch] of tape on the duct lining and 25 mm [1 inch] of tape on the fitting, and shall be wrapped at least three times. The outer sleeve (vapor barrier) must be sealed at connections with a drawband and three wraps of approved tape. The vapor barrier must be complete without any holes or rips, and seams shall be sealed with mastic or approved tape. Pressure sensitive tapes used in conjunction with flexible duct connections shall be as recommended by the duct manufacturer and shall be UL 181A listed and so indicated with a UL 181A mark or aluminum-backed butyl adhesive tape (15 mil minimum). Drawbands shall be stainless steel worm drive hose clamps or UV resistant nylon duct ties.

10-4.3.4 Provide a minimum of 51-mm [2-inch] thick mineral fiber insulation (or other listed insulation with an equivalent R value) on the exterior of all ducts in unconditioned spaces. Exhaust ductwork does not require insulation. Insulation shall be faced with a vapor barrier material having a performance rating not to exceed 1.0 perm. Insulation, vapor barrier, and closure systems shall be non-combustible as defined in NFPA 255, with a flame-spread rating of not more than 25, and a smoke development rating of not more than 50, as defined in ASTM E-84.

10-4.3.5 Return, exhaust, and ventilation air ductwork shall be sized for a maximum velocity of 4.6 m/sec [900 fpm]. Short runs of return air duct (1525 mm [5 ft] or less) which directly precede the air handler or furnace shall be acoustically lined to minimize noise.

10-4.4 Not used.

10-4.5 Filtration. Provide a pleated 25 mm [1 inch] panel filter, sized for and installed in the return air system in accordance with UL 900. Filter shall be rated for 20 percent efficiency as determined by ASHRAE 52, Method of Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter. All filters shall be easily accessible for changing and maintenance and shall be installed in the return grilles whenever possible. Additional consideration in the technical evaluation shall be given to designs utilizing electrostatic filters. Kitchen exhaust hoods shall be provided with aluminum grease filters sized to fit the exhaust duct.

10-5 Thermostats and Humidistats. Thermostats shall be located on interior partitions, approximately 1530mm [5 ft] above the finished floor. Locating a thermostat on the wall adjacent to a stairway, on an exterior wall, or where it is subject to unrepresentative temperatures is unacceptable.

10-5.1 Thermostats shall be Energy Star labeled, microprocessor-based, with built-in key pads for scheduling of day and night temperature settings. Thermostats shall be programmable for heating only, cooling only, or heating and cooling as required. When out of the scheduling mode, thermostats shall have continuous display of time, with AM and PM indicator, continuous display of day of week, and either continuous display of room temperature with display of temperature set point on demand, or continuous display of temperature set point with display of room temperature on demand. In the programmable mode, the display shall be used for setting and interrogating time program ON-OFF set points for all 7 days of the week. The time program shall allow two separate temperature-setback intervals per day. Thermostats shall have a means for temporary and manual override of the program schedule, with automatic program restoration on the following day. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for one year in the event of a power outage. Maximum differential shall be  $\pm 1$  degree C [ $\pm 2$  degrees F]. For a listing of Energy Star labeled thermostats see <http://www.epa.gov/appdstar/hvac/thermostats.html>.

10-6 . Not used.

10-7 Exhaust Fans. **Kitchen range hood exhaust fans shall be ducted to the outside. Exhaust fans shall not discharge near the air conditioning condensing unit, entry doors, patio or balconies, carports (AM#4).** Fans shall be tested and rated in accordance with AMCA 210, and shall operate with 120-volt, single-phase power supply. Exhaust fans shall be provided with backdraft damper. **(AM#3).**

Kitchen range exhaust fans shall be two-speed, and shall be sized for an exhaust rate of  $7.6 \text{ (L/s)/m}^2$  [ $1.5 \text{ cfm/ft}^2$ ]. Maximum allowable noise level for range hood exhaust fans shall be 6 sones as installed.

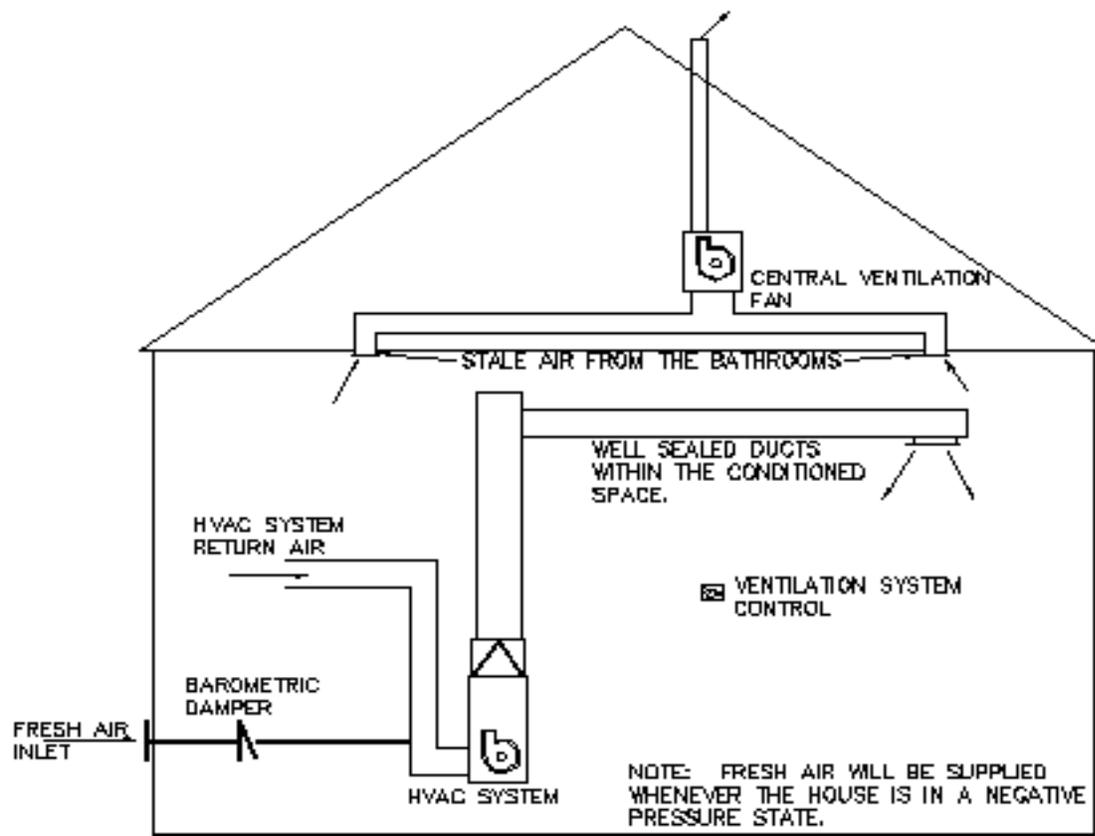
10-8 Dryer Vents. A 100-mm [4-inch] diameter dryer vent shall discharge to the exterior, and provide connection to occupant-owned dryer (one dryer per vent). The vents shall be rigid aluminum with exterior wall cap and backdraft damper. Vent pipes shall be a maximum of 6100 mm [20 ft] long, with no more than three right angle elbows (with minimum radius of 150 mm [6 inches]), and have a maximum vertical run of 3660 mm [12 ft]. Dryer vents shall not exhaust near the air conditioning condensing unit, entry doors, patio or balconies, carports **(AM#4)**. Dryer vents shall not run through non-accessible spaces **(AM#4)**. **A desirable feature is horizontal dryer venting. Vertical dryer venting through roof is discouraged.**

10-9 **Ceiling Fans. Provision of ceiling fans is encouraged as a means of increasing occupant comfort, and as an aid to improve the performance of heating and cooling systems. Ceiling fans with lights may be substituted for ceiling fixture requirements in bedrooms, dining room, living room, and family room. Ceiling fans will be low profile 1050 – 1350 mm (42-52 inch), four blade type. Motors shall be three speed reversible, with air volume range between 600 and 3300 l/s (1300 and 7000 cfm) and speeds between 75 and 225 rpm. Maximum power consumption shall be 80 watts and 0.7 amps. Manufacturer's 20 year warranty is required. (AM#2)**

10-10 Piping Requirements. Air conditioner condensate drains, refrigerant suction, and exterior refrigerant liquid lines shall be insulated with 25 mm [1 inch] (minimum) thick cellular glass or unicellular foam pipe insulation. Exterior refrigerant line insulation shall be encased in either an aluminum or PVC jacket to prevent damage. Condensate lines shall be one size larger than the drain pan connection, be properly trapped, and not directly connected to a sanitary sewer system (air gap fitting required).

10-11 Radon Mitigation. Due to moderate level Radon test readings in the area, both passive barriers and sub-slab suction system are required for every housing unit in accordance with TI 810-91. The passive barrier consists of a capillary water barrier and 6 mil polyethylene sheet under floor slab as well as sealing all pipe and conduit penetrations of floor slab. The sub-slab suction system consists of a 100mm (4 inch) diameter perforated PVC piping system located in the capillary water barrier connected to a non-perforated 100 mm PVC pipe stubbed up through the floor slab and capped for future extension to an exhaust fan. See paragraph 14 for additional requirements.

10-12 Active Ventilation Engineered IAQ Enhancement. The bathroom exhausts, within each unit, shall all be ducted together to a common exhaust plenum equipped with a single long-life, low cfm, two-speed fan. The fan shall be sized to provide the required exhaust rate in each bathroom space when operated at low speed. Control for this fan shall be accomplished from a wall mounted switch, located in the linen closet, labeled HI-LOW-OFF. The OFF position of the switch shall illuminate a "RED" LED to indicate the off condition of the ventilation system. The supply ventilation portion of the system shall consist of a small duct providing a connection for fresh (outdoor air) air to the furnace return duct. This duct shall contain a barometrically-controlled vent which shall admit outdoor air to the unit whenever the housing unit is experiencing a negative pressure. ASHRAE 62-1989, "Ventilation for Acceptable Indoor Air Quality" recommends ventilation air supply rate at a minimum of 0.35 air changes per hour (ACH) but not less than 15 cfm per person. This is supplied by either natural infiltration or a combination of natural infiltration plus active ventilation. The fresh air supply duct shall be sized to provide no more than this minimum 0.35 Air Changes per hour maximum ventilation rate (but in no case shall the ventilation air introduced into the unit from the combination of natural infiltration and active ventilation be less than recommended by ASHRAE 62 with consideration for two (2) occupants per bedroom). This system is a recommended "Energy Star Homes" approach for improving indoor air quality in residential construction. The Active Ventilation Engineered IAQ Enhancement described in this paragraph is considered to be a minimum level compliance item (See Diagram below.) in weather regions 5 through 11. In weather regions 1-4 extreme cold conditions and energy efficiency considerations may require the use of alternate approaches, some including heat recovery ventilators (HRV). Contractors are encouraged to present and propose other systems/methods which are enhancements/improvements to the system described and can ensure adequate fresh ventilation air (0.35 AC/Hr Max) is provided to the interior spaces of the housing units. Contractors are encouraged to review "Energy Star" materials and information available to them through the EPA and/or by visiting the Energy Star Web page. See, for example, [http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/attachments/lib/\\$file/BalancedVentSys.pdf](http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/attachments/lib/$file/BalancedVentSys.pdf) and [http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/attachments/lib/\\$file/SupplyVent.pdf](http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/attachments/lib/$file/SupplyVent.pdf).



## ACTIVE VENTILATION SYSTEM SCHEMATIC

10-13 Testing, Adjusting, and Balancing. Adjusting and balancing of each housing unit shall be the Contractor's responsibility. Following adjusting and balancing, testing of air and water systems shall be performed on 10 percent of the project buildings (not to exceed 10 buildings), which have been randomly selected by the Contracting Officer. If buildings are to be turned over in phases, testing shall be performed on 10 percent of the buildings completed in each phase (not to exceed 10 buildings per phase). No additional testing will be required if at least 90 percent of the tested buildings pass the test requirements. If less than 90 percent of the tested buildings pass the test, an additional 10 percent of the project buildings (not to exceed 10 buildings) shall be tested. This process shall continue until 90 percent of the total number of tested buildings pass. The contractor shall correct all housing units not found in compliance, and shall be responsible for all labor and materials required for this effort. AABC MN-1, NEBB-01, SMACNA-07 or ASHRAE 111 shall be used as the standard for providing testing of air and water systems. The selected standard shall be used throughout the project. Instrumentation accuracy shall be in accordance with the standard selected. Testing shall be accomplished by a firm certified for testing by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Prior to testing, adjusting, and balancing, the Contractor shall verify that the systems have been installed and are operating as specified. Where specific systems require special or additional procedures for testing, such procedures shall be in accordance with the standard selected. Approved detail drawings and all other data required for each system and/or component to be tested shall be made available at the job site during the entire testing effort. Testing shall not commence until approved by the Contracting Officer. The facility shall be essentially complete with final ceiling, walls, windows, doors, and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems, hydronic systems, and exhaust fans shall be complete and operable. All data, including deficiencies encountered and corrective action taken, shall be recorded. Following final acceptance of certified reports by the Contracting Officer, the setting of all HVAC adjustment devices shall be

permanently marked by the Contractor's balancing engineer so that adjustment can be restored if disturbed at any time.

10-14 Duct Tightness Testing Requirements. The installation of the supply and return ductwork within the units is an item of prime concern with respect to the energy efficient operation of the housing unit as a whole. With that consideration in mind, for heating and air conditioning designs which include ductwork outside of the conditioned envelope, the contractor will be required to test the proto-type units and all units which are blower door tested for tightness (see paragraph 7-3.2) to ascertain the leakage levels from the ductwork in accordance with the following requirements. For system designs which place all the ductwork within the conditioned envelope of the structure or systems which utilize evaporative cooling, no ductwork testing will be required.

10-14.1 Duct tightness testing shall ensure that the leakage rate from ductwork (where the ductwork system is not entirely within the conditioned envelop) shall not exceed  $0.15 \text{ (L/s)/m}^2$  [ $0.03 \text{ cfm/ft}^2$ ]. If the units tested fail to meet this requirement, the ductwork installation shall be examined, corrections made, and the test redone until the installation passes this requirement. No ductwork systems may be installed in other units until the proto-type units ductwork systems have been validated. Several methods to accomplish this testing are acceptable

10-14.1.1 Testing may be done in accordance with ASTM Standard E 1554-94, "Determining External Air Leakage of Air Distribution Systems by Fan Pressurization". This method describes the process and methodology required to accomplish basically a 'blower door subtraction' method of duct tightness testing.

10-14.1.2 Testing may also be accomplished utilizing "Duct Blaster" methodologies and pressurizing the ductwork to 25 Pascal [0.1 inch of water].

10-14.2 The contractor is advised that the EPA may test, or hire a consultant to test randomly selected housing units constructed in this project. These tests will be completed without cost to the contractor, however, the contractor will be required to coordinate access to the selected unit. If accomplished, this testing is not expected to interfere or delay the construction contractor in any manner.

## 11. ENERGY CONSERVATION.

11-1 Energy conservation techniques shall be considered as they relate to site design, site engineering, unit design, and unit engineering. Techniques which conserve energy, improve livability, and can be justified by life cycle cost analysis as cost effective are encouraged. Integration of energy conservation systems with the housing unit's design (lighting, structure, mechanical systems, and aesthetics) is essential to facilitate livability and maximum energy savings. If an alternative energy generation method is intended for use as the project's primary energy source, documentation shall be submitted to the Contracting Officer, verifying the system's reliability and ability to meet the project's peak demand. The following paragraphs suggest energy conservation techniques which are considered desirable. The listing is not all inclusive, and the techniques suggested may not be cost effective at a given location or site. Additional consideration in the technical evaluation will be given to designs which incorporate valid energy conservation techniques.

11-2 Passive Solar Applications. Passive solar architectural applications shall routinely be considered as a part of all project designs.

11-2.1 Not used

11-2.2 Storage mass. If thermal performance calculations indicate a need for additional mass (beyond that provided by the housing unit structure) substantiating data will be submitted. The storage mass will be well integrated into the housing unit design. The thermal mass surface area in the space must be a minimum of three times the glazing area. Six to nine times the glazing area is recommended to control temperature swings. The surfaces to absorb solar energy must not be more than 10% covered.

11-2.3 Shading. Movable window treatments are required. These shall be metal blinds. Cooling season shading of glazed surfaces on the east, west, and south elevations shall be considered.

11-3 Not used.

11-4 Not used.

11-5 Not used.

11-6 Condenser Heat Recovery. In regions authorized for cooling, consideration shall be given to installation of a heat exchanger to recover condenser heat and desuperheat for use in heating domestic water. A standard, domestic water heater shall be provided in conjunction with this system to provide hot water during the heating season. Heat pump water heaters can be considered in hot climates.

11-7 Not used.

11-8 Systems and techniques which take advantage of rebates and incentives offered by utilities are preferred and shall be stated by the government and local utility districts.

## 12. CONTRACTOR PREPARED SPECIFICATIONS

12-1 The successful offeror shall prepare a specification for all work included in the scope of work. The specification shall be tailored to this job. Inapplicable materials shall be deleted. Any reference, description, procedure or other matter required to develop a complete, accurate and concise specification shall be provided. The specification shall include but is not limited to:

12-1.1 A description of the technical requirements

12-1.2 Criteria for determining whether the requirements are met

12-1.3 Quality control requirements and procedures

12-2 Specifications for features of the work shall be organized into divisions and sections in accordance with Construction Specifications Institute (CSI), Master List of Titles and Numbers for the Construction Industry, latest edition. See **Section 01016 (AM#4)** DESIGN DOCUMENT REQUIREMENTS for additional requirements.

12-3 Individual specification sections shall be in the format of CSI, Section Format, A Recommended Format for Construction Specification Sections, latest edition. Exceptions are:

12-3.1 Measurement Procedures and Payment Procedures shall only be used in those section(s) where rock excavation is specified. No other sections shall contain these subparagraphs of the paragraph SUMMARY.

12-3.2 Except as otherwise noted in this paragraph, CONTRACTOR PREPARED SPECIFICATIONS, the paragraph SUMMARY shall not be used.

12-3.3 Submittal requirements, submittal procedures, quality control procedures, and construction operations shall be those contained in the attached **(AM#4)** Section 01320, Section 01330, including the submittal register, Section 01451, Section 01500, Section 01560, and Section 01770. These specification sections shall be incorporated into the contractor prepared specification packages without editing and shall be coordinated with all other specification sections prepared by the contractor.

12-3.4 Section 09900, PAINTS AND COATINGS; shall establish a minimum level of quality for paints, stains, and varnishes to be used in this project.

12-4 Not Used.

12-5 Not Used.

12-6 Contractor prepared specifications shall be reviewed by the Contracting Officer or his designated representatives during the design portion of the project. Contractor will incorporate all required changes after resolution of comments and prior to work initiation on the next phase of the project.

### 13. SUSTAINABLE DESIGN CONSIDERATIONS:

13-1 Sustainable design techniques shall be considered as they relate to site design, site engineering, unit design, and unit engineering. Techniques which conserve energy, improve livability, and can be justified by life cycle cost analysis as cost effective are encouraged. Integration of energy conservation systems with the housing unit's design (lighting, structure, mechanical systems, and aesthetics) is essential to facilitate livability and maximum energy savings. The following paragraphs define the goals and general objectives for inclusion of sustainable design considerations in this project. This information is taken from US Army Corps of Engineers, ETL 1110-3-491. The listing is not all inclusive, and the techniques suggested may not be cost effective at a given location or site. \_\_\_\_\_ **(AM#6)**

#### 13-2 Goals and Objectives of Sustainable Design.

13-2.1 The overall USACE goal of Sustainable Design is to be environmentally responsible in the delivery of facilities. The key traditional elements for decision making in the facility delivery process are cost, quality and time. These elements need to be expanded to include the ecological and human health impacts of all decisions.

13-2.2 Each project generates its own set of goals. However, sustainable design goals should apply to all projects. The goals for improving the environmental performance of facilities include: (a) use resources efficiently and minimize raw material resource consumption, including energy, water, land and materials, both during the construction process and throughout the life of the facility, (b) maximize resource reuse, while maintaining financial stewardship, (c) move away from fossil fuels towards renewable energy sources, (d) create a healthy and productive work environment for all who use the facility, (e) build facilities of long-term value, and (f) protect and, where appropriate, restore the natural environment.

13-3 Sustainable Design and Construction of the Built Environment. Design and construction of sustainable buildings should be in accordance with the following concepts:

13-3.1 Site Work and Planning--Environmentally sensitive planning looks beyond the boundary of the project site to evaluate linkages to transportation and infrastructure, ecosystems and wildlife habitat and community identification. Site planning evaluates solar and wind orientation, local microclimate, drainage patterns, utilities and existing site features to develop optimal siting and appropriate low maintenance landscape plant material.

13-3.2 Building Layout and Design--Optimize building size, and maintain an appropriate building scale for the environment and context of the building or a building component. Layout the rooms of a building for energy performance and comfort, and design for standard sizes to minimize material waste. Pay careful attention to the location of exterior windows. Avoid structural over-design and the resultant waste. Design components of the building environment for durability and for waste recycling.

13-3.3 Energy--Building orientation and massing, natural ventilation, day-lighting, shading and other passive strategies, can all lower a building's energy demand and increase the quality of the interior environment and the comfort and productivity of occupants.

13-3.4 Building Materials--Environmentally preferable building materials are durable and low maintenance. Within the parameters of performance, cost, aesthetics and availability, careful selection and specification can limit impacts on the environment and occupant health.

13-3.5 Indoor Air Quality--Indoor air quality is most effectively controlled through close coordination of architecture, interiors and mechanical, plumbing, and electrical design strategies that limit sources of contamination before they enter the building. Construction procedures for IAQ and post-occupancy user guides also contribute to good long-term IAQ.

13-3.6 Water Usage-- Site design strategies that maximize natural filtration of rainwater are desirable. Water

conservation is enhanced by the use of low flow plumbing fixtures and water appropriate landscaping.

13-3.7 Recycling and Waste Management--Waste and inefficiency can be limited during construction by sorting and recycling demolition and construction waste, reuse of on-site materials and monitoring of material use and packaging. Accommodating recycling into building design reduces waste while generating revenues.

13-3.8 Building Commissioning, Operations and Management--Effective building commissioning is essential to ensure proper and efficient functioning of systems. Facilities operations benefit from energy and water saving practices, waste reduction and environmentally sensitive maintenance and procurement policies.

#### 14. ENVIRONMENTAL.

14-1 Environmental Assessment. A Final Environmental Assessment (EA) for New Housing Construction, Patch-Chaffee Area, Fort Sam Houston (FSH), Texas, dated December 2000, has been completed for the proposed action of constructing new family housing units adjacent to the Patch-Chaffee area. There is a FINDING OF NO SIGNIFICANT IMPACT (FONSI) for this proposed action. This proposed action is in compliance with the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190), as amended. These units will replace 70 existing housing units at the Harris Heights community. Demolition of the existing housing units at Harris Heights will be under a separate contract after completion of new housing and relocation of tenants. The other demolition contract will include work tasks such as environmental sampling/survey, environmental abatement, physical structures and utilities demolition, and necessary site restoration.

14-2 Protection Of Historical Properties And Cultural Resources. The proposed site for new housing at Patch-Chaffee is adjacent to the proposed National Historic Landmark District (NHL). The proposed construction may have the potential to affect the historic landscape of the Patch-Chaffee area. However, the new housing units will be constructed to preserve the FSH historic heritage in accordance with FSH Installation Design Guide (IDG) and Historic Landscape Master Plan. In addition, the Secretary of the Interior's Standards for Historic Preservation will be utilized in developing the design. Therefore, no adverse impact to the historic landscape is expected.

14-3 Protection of Biological Resources. The new housing construction will not result in adverse impacts on flora and fauna because construction would occur in existing residential areas. The few trees and shrubs removed during construction activities will be replaced during landscape planting of these areas. The Historic Landscape Master Plan for FSH has been adopted for the entire installation, and requires xeriscape landscaping for all new re-vegetation efforts. Xeriscaping will primarily utilize drought-tolerant species of grasses, perennials, ground covers, vines, shrubs, and trees. Removal of trees is best accomplished during late summer to early spring (mid-August to beginning of February) in order to avoid destroying bird nests and to be in compliance with the Migratory Bird Treaty Act.

14-4 Land Use and Visual Resources. The existing land use category will need to be revised to a family housing category. Development on vacant lots will result in a slight beneficial impact on land use. The adjacent area will remain residential, and the overall quality and character of the neighborhoods will be enhanced by the replacement of vacant lots with new homes consistent with the existing architectural styles. The land use category will be consistent with the Real Property Management Plan (RPMP) goals and objectives, and especially in reducing the FSH housing deficit.

14-5 Water Resources. The proposed site for new construction is not located within a floodplain or wetland area. Construction in the Patch-Chaffee area, an already disturbed area, is not anticipated to impact surface water resources at FSH. The overall increase in housing units after project completion will not significantly impact aquifer water level because of utilizing water-saving fixtures units, and landscaping with xeriscape methods.

14-6 Utilities: The removal of existing housing units in the Harris Height community will off-set the demand of water, gas, or electricity. In addition, the Water Use Reduction Program will encourage water conservation practice on post. Mechanical designer for new housing will utilize an energy conservation system for heating and cooling. The new housing shall use new, energy efficient building products to reduce electrical powder demand. Therefore, there is no increase in electrical power consumption anticipated due to the proposed action.

14-7 Noise Impact: Noise resulting from construction activity is anticipated to be moderate, short-term, and generated only during regular working hours. Noise level is expected to return to normal levels after completion of construction. Noise level within the Patch-Chaffee area will slightly increase upon occupancy, but will not have significant impact.

#### 14-8 Water Quality and Prevention of Water Pollution.

14-8.1. Water Supply. The pressure, quantity, and quality of the existing water supply system are adequate for the family housing development. New water lines and valves, etc., will be designed and constructed under this contract. See further discussion of the water distribution system in Section 01001 Statement of Work, paragraph 4- SITE ENGINEERING.

14-8.2 Municipal Wastewater. The existing sanitary system is adequate for the family housing development. New sewer lines, manholes, etc., will be designed and constructed under this contract. See further discussion of the sanitary sewer system in Section 01001 Statement of Work, paragraph 4- SITE ENGINEERING.

14-8.3 Industrial Wastewater. No industrial wastewater will be generated during construction.

14-8.4 Protection of Surface and Storm Water. Construction sites that are two (2) ha (or 5 acres) in size or larger are required to have a National Pollutant Discharge Elimination System (NPDES) Storm Water Construction Permit. In accordance with Federal Register, Volume 63, Number 128, July 6, 1998, the Contractor/designer shall prepare a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP narrative and the Erosion and Sediment Control Plans shall be prepared and submitted in accordance with specifications Section 01421 – Basic Storm Water Pollution Prevention Plan.

#### 14-9 Air Quality and Prevention of Air Pollution

14-9.1 The construction of new housing in the Patch-Chaffee area will have an insignificant impact on the air resources of the region. Construction activities will have short-term and minor adverse impacts on air quality by increasing fugitive dust emissions. However, these increases will be temporary and localized.

14-9.2 Burning of debris and waste material at the project site is prohibited.

14-9.3 Dust control practices and other particulate emissions during construction shall be in compliance with the Clean Air Act (CAA), Texas Clean Air Act (TCAA), and in accordance with specification Section 01561 DUST CONTROL.

14-9.4 The Final Environmental Assessment, dated December 2000, indicated no concern for radon. However, the email message (dated February 2002) from Mr. David Walker (Fort Sam Houston Directorate of Safety, Environment and Fire Compliance Branch), stated some current radon readings on base were above 4 picocuries (pCi/l) and one reading was as high as 13 pCi/l. Since then, a design directive on radon has been requested from the Directorate of Safety, Environmental and Fire Compliance Branch. The design directive is not available during the preparation of this document; therefore, the most current and the highest radon measurement (13 pCi/l) in one existing building in close proximity to the proposed housing units, is used to determine the design requirements for radon prevention in this contract. Based on this reading (13 pCi/l) per TI 810-91, INDOOR RADON PREVENTION AND MITIGATION (dated August 1998), design requirements for radon prevention shall consist of Passive Barriers (Letter Code A) and Sub-slab Suction Systems (Letter Code C) for the proposed family housing units. These requirements shall be incorporated in the mechanical, and structural/foundation design for the proposed family housing units (also reference paragraphs UNIT DESIGN- HEATING, VENTILATING, AND AIR CONDITIONING and UNIT DESIGN- STRUCTURAL in this document). Prior to the preparation of design documents, the Contractor shall verify, with the Directorate of Safety, Environment and Fire Compliance Branch, if 13 pCi/l is still the highest radon measurement in the existing buildings. The Contractor shall use the latest and the highest radon measurement to verify the design requirements (Letter Codes) per TI 810-91 for radon prevention.

14-10 Municipal Solid Waste. The Contractor shall dispose of municipal solid waste and demolition debris off-post at their own expense.

14-11 Regulated Waste. Regulated materials such as asbestos, lead-based paint, or pesticides are not anticipated in the construction of new housing. An environmental survey, sampling, and abatement of

regulated materials is not required in this contract. If removal of utility poles or pole-mounted, wet-type transformers are required, the Contractor shall notify the Contracting Officer's Representative and the Directorate of Safety, Environment, Fire and Compliance Branch.

14-12 Fuel Contaminated Area. The contaminated area is located at the southeast area of the block that is bound on the north by Taylor Road, on the south by Wilson Street, on the west by Road No. S-23, and on the east by an unnamed dirt road which is an extension of 15th Street (south of Wilson St. and intersects Wilson St. and Taylor Road). This block was intended to be a part of the initial proposed family housing project site. The contaminated area is the previous location of a demolished aircraft hangar maintenance shop B/1198. As requested by the Corps of Engineers, CESWF-PER-DD, one composite soil sample was obtained by CESWF-EC-DG at five (5) separate sub-sample locations around the perimeter of the previous hangar footprint. For screening purposes, the composite sample was analyzed for eight (8) RCRA metals, Total Petroleum Hydrocarbon (TPH, Method TNRCC 1005), and Semi-Volatile Compounds (EPA method 8270). The composite soil sample had several fuel constituents as well as metals. The levels of fuel constituents in the composite soil sample cannot be compared to TNRCC Texas Risk Reduction Program (TRRP), 30 TAC 350, regulations because they are not from a discrete sample. The results indicate at least one of the soil sub-samples is contaminated and the previous hangar site has a fuel release but the horizontal and vertical extent of contamination is unknown. In addition, there are four (4) soil borings obtained from this entire block, soil borings locations are different from the sub-sample locations for soil analysis, but no groundwater is detected from ground surface to 13 feet depth. The sites of demolished Buildings No. 1194, 1195, and 1144 are in the same block and north of the previous hangar B/1198. From information provided by the Directorate of Safety, Environment and Fire Compliance Branch, these demolished buildings were administrative offices. Because the extent of contamination is unknown, the Directorate of Safety, Environment, Fire and Compliance Branch is recommended by the Corps of Engineers to pursue reporting of a release, and further environmental investigations to delineate extent of contamination, with guidance from TNRCC through another contract. Therefore, construction work is not recommended in the entire block (see description above) under this contract.

14-13 The Proposed Project Site. The proposed location for the family housing project (excluding the block that contained the previous hangar site, see par. 14-12) is described in paragraph 1-2.3.2. The proposed site is currently unoccupied. Based on the 1985 site plan list, the following structures were demolished: P-1100 Swimming Pool, T-1101 Bath House, T-1119 Enlisted Barracks, T-1123 Drug & Alcohol Abuse Center, T-1126 Laboratory, T-1172 Battalion HQ, T-1173 Facility Engineer Storehouse, T-1174 Warehouse, T-1175 Maintenance Shop, T-1176 Warehouse. The FSH Directorate of Safety, Environment, Fire and Compliance Branch has verified that the proposed project site has no known contamination from previous activities of the demolished facilities, based on the Preliminary Assessment/Site Investigation (PA/SI) study (dated September 1998) under another contract.

14-14 Construction Material for New Housing Units.

14-14.1 Construction material shall not contain any asbestos.

14-14.2 Potable water supply system shall have lead free pipes and joints.

14-14.3 Paint to be used for the new housing units shall have a certificate stating that the paint does not contain more than 0.06 percent lead by weight of the total non-volatile compounds, mercury containing mildewcide, insecticide, and it meets the Federal Volatile Organic Compound (VOC) regulations and state air pollution requirements.

14-14.4 Pesticides, fungicides, or insecticides utilized for foundation treatment or grass fertilization shall be EPA approved. It shall be applied by licensed and certified personnel with licensed equipment and transporter.

14-15 Federal, State, Local Permits and Notifications.

14-15.1 EPA's NPDES Storm Water Construction Permit. This permit is required for storm discharges prior

to construction. All submittals shall be in accordance with Section 01421 Storm Water Pollution Prevention Plan. EPA administers the NPDES Storm Water Construction Permit program for larger than 2.0 hectares (or 5 acres) construction sites until July 3, 2003. Texas Pollutant Discharge Elimination System (TPDES) will administer the Storm Water Construction Permit for construction sites larger than 2.0 hectares (or 5 acres) after July 3, 2003. The Contractor shall evaluate the time frame of the construction activities and determine if the permitting authority has shifted from EPA to Texas Natural Resource Conservation Commission (TNRCC). Section 01421 shall be edited to reflect this change, if necessary

14-15.2 Notice of Intent (NOI). The Contractor shall submit NOI prior to construction. NOI shall be submitted no later than 48 hours before start of construction.

14-15.3 Storm Water Pollution Prevention Inspection and Maintenance Report. The Contractor shall submit Inspection & Maintenance Reports during construction in accordance with Storm Water Construction Permit and Section 01421 Storm Water Pollution Prevention Plan.

14-15.4 Notice of Termination (NOT). NOT shall be submitted upon completion of each construction contract.

14-15.5 The Contractor shall supply a "Customer Service Inspection" certificate for the water supply in accordance with the TNRCC regulations. The completed and signed certificate shall be submitted to the Contracting Officer for review and final approval.

14-15.6 The Contractor shall allow adequate time to obtain digging permit from DPW prior to any digging, drilling or excavation activities.

14-15.7 Per TAC 30, rule 290.39, the plans and specifications of the water distribution and wastewater collection systems prepared by the design and build Contractor shall be reviewed and approved by Texas Natural Resource Conservation Commission (TNRCC) for obtaining a public water system permit. Typically, the review process may require 30 to 60 days.

14-15.8 Backflow preventers shall be certified to operate in accordance with state regulations. Testing of backflow preventers shall be performed by certified personnel. If no State requirement exists, the Contractor shall have the manufacturer's representative test the device to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation, at the time of the final inspection for the facility, stating that the tests have been performed and that the backflow preventers operate properly in accordance with State regulations. The individual performing the tests shall sign this documentation.