

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

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|---|--|---|----------------------------------|--------------------------------|
| 2. AMENDMENT/MODIFICATION NO. 3 | | 3. EFFECTIVE DATE 1-Jul-2004 | 4. REQUISITION/PURCHASE REQ. NO. | 5. PROJECT NO. (If applicable) |
| 6. ISSUED BY US Army Corps of Engineers, Kansas City District 760 Federal Building, 601 East 12th Street Kansas City, Missouri 64106-2896 | | 7. ADMINISTERED BY (If other than item 6) | CODE | |

| | |
|---|--|
| 8. NAME AND ADDRESS OF CONTRACTOR <i>(No., street, county, State and ZIP Code)</i> | (x) 9a. AMENDMENT OF SOLICITATION NO. W912DQ-04-R-0015 |
| | 9B. DATED (SEE ITEM 11) 5/28/2004 |
| | 10A. MODIFICATION OF CONTRACT/ORDER NO. |
| | 10B. DATED (SEE ITEM 13) |

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above number 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 telegraph 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 you 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 APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

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

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.)
Family Housing Replacement, New Construction, PN 60301 and 60320, Fort Riley, Kansas
 The Solicitation is amended in accordance with the attached pages.

RECEIPT OF PROPOSALS IS DELAYED UNTIL 4:30 PM. LOCAL TIME, 12 JULY 2004.
RM 760 FEDERAL BUILDING, 601 E. 12TH ST., KCMO 64106-2896.

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.

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

The SOLICITATION is amended as follows:

1. SPECIFICATIONS:

- a. New Pages: Page Att-9 and Attachment 10 (33 pages) are new pages and are added to the Solicitation. Copies are attached.
- b. Revised Pages: The following pages are deleted and replaced with pages of the same numbers. Copies of the revised pages are attached.

31 thru 33 of 211
01012-10
01355A-6
01500A-6
- c. Revised Section: Section 01010 is deleted and replaced with a revised section of the same number. A copy of the revised section is attached.
- d. Revised Wage Rates: General Decision KS030001, dated 06/13/2003, no mods, is deleted and replaced with General Decision KS030001, dated 06/04/2004, one mod. A copy of the revised wage determination is attached.

2. DRAWINGS: The following changes are made narratively to the drawings.

- a. Sheet CS103: All references to Phases I, Phase II, and Phase D are deleted.
- b. Sheet CS103: The Legend Housing Unit Count is revised to read as follows:
Type A1 – 0
Type A2 – 2
Type B2 – 2
Type B3 – 4
Type C2 – 0
Type C3 – 6
Type D – 2
Total - 16
- c. Sheets A103 and A104: The windows shown on the elevations shall govern.
- d. Sheets A103 thru A108: The note “Stor. 69 SF” refers to storage floor area in the garage along the wall beside the parking area.
- e. Plan Detail 2 – Typical Unit Landscape Plan: Provide seeding at side yards and back yards on all disturbed grade. Provide sod as a betterment. Contractor must determine the extent of disturbed grade based on the civil drawings.
- f. Sheet A101 – Type A-1 Plan,
Sheet A104 – Type B-3 Plan,
and Sheet A106 – Type C-3 Plan: In each Second Floor Plan in each of the 3-bedroom units, there are two bedrooms labeled “Bedroom 2”. The bedroom closest to the Laundry in each case shall be changed to read “Bedroom 3”.

- g. Sheet A108 – Type E Plan: There are two bedrooms labeled “Bedroom 1”. The Master Bedroom with its own bathroom should remain “Bedroom 1”. The other bedroom shall be changed to read “Bedroom 4”.
- h. Sheet CU103 – Ellis Heights Electrical Utilities: The drawing background has been updated for better graphic clarification. No change to the scope of work is required. (Refer to the attached drawing.)
- i. Sheets CG101 thru CG103: Delete the requirement for a 6-foot-high chain link fence with privacy slats located at the construction limits. Add the following: “The Contractor shall install orange construction fence around the limits of construction. The Contractor may install a 6-foot-high chain link security fence around his trailers and material storage area.
- j. Sheets CS101 thru CS103 and CG101 thru CG103: The numerous arcs are anomalies that do not mean anything and shall be ignored.
- k. Sheet CU104: There is no connection to any storm sewer system. The new storm sewer will discharge on the slope into the valley to the west.
- l. Sheets A101 thru A108:
 - 1) The room size dimensions and areas noted on the floor plans for each housing unit are minimums.
 - 2) The total area (SF) for each room and housing unit noted on the drawings is approximate. The actual room dimensions govern when completing the design.
 - 3) The overall dimensions for each housing unit as shown on the floor plans are approximate. When there is conflict between room size and overall exterior dimensions, the room size will dictate actual final dimensions.
 - 4) On Units A2, B2, B3, C2, C3, D and E, locate the 2nd floor windows in the stairwell directly above the front entry doors. There will be no windows in the Storage Rooms.

3. REVISED DRAWINGS: Sheet CU103 is deleted and replaced with a revised sheet of the same number. A copy is attached.

4. For convenience, on the revised specification pages, essential changes have been emphasized by underlining or indication of text deleted. However, all portions of the revised specification pages shall apply whether or not changes have been indicated.

5. Offerors are required to acknowledge receipt of this amendment on the Bidding Form, in the space provided, or by separate letter or telegram prior to opening of bids. Failure to acknowledge all amendments may cause rejection of the proposal.

6. Proposals will be received until 4:30 p.m., local time, 12 July 2004 , in Room 760 Federal Building, 601 E. 12th Street, Kansas City, Missouri 64106-2896.

solicitation requirements will govern in the event of a conflict between these requirements and the Offeror's proposal.

Factor 1 - Project Management Plan, and sub factors: The Offeror will provide a project management plan that addresses sub factor items a thru-e below.

Subfactor a - Quality Control Plan: The Offeror must provide a complete and comprehensive Quality Control Plan to support the performance requirements of Section 01451 of this RFP. Describe the process by which the QC staff will monitor work in the field and how action is to be taken to correct deficiencies. Describe the process by which the QC staff will work with government quality assurance personnel and the Contracting Officer to insure timely action is taken on deficiencies or quality problems in the field. The Quality Control Plan shall be a rational, workable plan, and shall stand alone for easy monitoring by the Contracting Officer and the Contracting Officer's Representative. It shall not be dependent on the contractor's other internal management plans. The Offeror must indicate how it intends to incorporate the Corps Three Phase Inspection process to provide seamless integration with the Quality Assurance Operations performed by the Government.

Subfactor b - Proposed Staffing: The Offeror will provide a Project Management-Staffing Plan. This Plan will include an organizational chart indicating the positions of all key personnel, their primary duties, and state whether the person is an employee, a subcontractor, or a consultant. At a minimum the Offer shall provide a resume, including level of authority, for the Project Manager, Project Architect, Landscape Architect, Civil Engineer, Mechanical Engineer, Electrical Engineer, QC Manager and the Job Superintendent and should reflect each individual's involvement, if any, in the project examples provided. If it's possible these people may be reassigned, the names and resumes of the alternative professionals for each should be submitted. Additionally, each resume must list at least two professional references. The Government has a right to rereview the Contractor's key personnel if they should change or be replaced for any reason once the contract has been awarded. The organizational chart must also indicate whether key personnel are full or part time, and the geographic location where they are currently based.

Subfactor c - Subcontracting: All large businesses are required to submit a Subcontracting Plan before the contractor's proposal will be considered complete. Guidance in preparing an acceptable plan is provided at the end this section. However, the Subcontracting Plan will be rated as pass or fail as part of the evaluation process.

Subfactor d - Design & Construction Scheduling: The Offeror will provide a Project Management Plan for Integrated Design and Construction Scheduling from contract award thru contract closeout to support the requirements of Section 01320. This schedule will be graphically represented (bar chart), and must indicate specific dates for completion of all critical tasks and major milestones activities and their duration. The initial schedule submitted shall indicate compliance with the contract specifications and the delivery and completion times required by the RFP. The Offeror must clearly indicate any activities that are being "Fast Tracked." For this submittal the offeror should use a contract award date of 1 Aug 2004. After the Contract is awarded the schedule will be adjusted to reflect the actual date of award. After the project is awarded, the milestone schedule submitted by the offeror will be incorporated into the Contractor's baseline schedule and shall be considered contractually binding. As a minimum the schedule must include the following milestones:

Contract Award
Notice to Proceed with Design
 Design Start
 50% Design Submittal
 90% Design Submittal
 100% Design Submittal
 Design Approval

Notice to Proceed with Construction (for Each Phase)

Clearing and grubbing
Rough Grading and Drainage Complete
Site Utilities Complete
Curbs, gutters and pavement Complete
Foundations Complete
Framing
Mechanical & Electrical
Interior finishes
Exterior trim
Final Grade and Topsoil
Seeding, Sodding and Landscaping
Construction complete (BOD date)
Closeout procedures (O&M, As-Built drawings)

Notice to Proceed with Demolition

Utility Demo
Unit and foundation Demo
Final Grading
Seeding
Demolition Complete
Contract Closeout

Subfactor e - Construction Closeout: The Offeror will provide a plan specifically developed for project closeout activities for individual residences or groups of residences, and how he will incorporate his plan to complete the project. The project closeout schedule will be graphically represented, and must indicate the number of calendar days required for completion of required closeout tasks. These elements include:

- 1) Testing of equipment and systems with schedules and reports
- 2) Prefinal inspection date
- 3) Time required for correction of deficiencies
- 4) Anticipated transfer to the Government The plan must indicate specific dates for final project closeout tasks. These include:
 - a) Completion of personnel training requirements
 - b) Date O&M manuals and as-builts will be provided
 - c) Date Offeror intends to move off-site

Factor 2 - Offeror Relevant Experience. The Offeror shall provide a list of a minimum of three (3) project examples that are similar in terms of contract dollar value, and residential type projects. These examples must have been completed **or be 70% complete at the time of this solicitation** in the five (5) year period preceding the date of this solicitation. If the Offeror represents the combining of two or more companies, state if this project represents a joint venture of the listed parties. The offeror should address relevant experience for each project individually, as general contractor and as Architect/Engineer. Each example of a similar project will provide a general description of the project scope, location, **construction** cost, date of completion, solicitation (Government or private) and contract type (Design build or Design Bid build), and Owner/Architect references (names and telephone numbers). In addition, the Offeror will also provide a list of all projects, other than family housing that he has completed within the five (5) year period preceding the date of this solicitation, including Owner/Architect references.

Factor 3 - Offeror Past Performance Information: The Offer must submit a list of the five most recent projects that exceed \$5 Million dollars, that were completed within the last 5 years. The Offeror will provide a "Past Performance Evaluation Questionnaire" to the point of contact **and/or the person that represents the owner's opinion of the offeror's past performance** for each of the five (5) projects listed. The project point of contact for the listed

references must complete the questionnaire and mail, fax, or email it directly to Mr. Earl V. Smith, Contract Specialist, at Earl.V.Smith@nwk02.usace.army.mil no later than the closing date for receipt of proposals stated in the RFP. The offeror should address past performance for each project individually, as general contractor and as Architect/Engineer. The Offeror is responsible for ensuring that the completed questionnaires are submitted by the date stated on Standard Form 1442 provided with this RFP. A copy of the questionnaire is included at the end of Section 00110.

- Subfactor a.** Quality of Product/Service
- Subfactor b.** Reports and Document submittals
- Subfactor c.** Problem Solving
- Subfactor d.** Management Process
- Subfactor e.** Customer Satisfaction
- Subfactor f.** Recommend Contractor for future work
- Subfactor g.** Timeliness of Performance

Factor 4 - Government Requested Betterments: The Offeror will provide a list of betterments it can provide within the specified target ceiling. The Offeror can offer choose any combination of betterments, in any order. The Offeror shall not offer any additional betterments once the cumulative dollar value of the base price schedule and the betterments exceeds the target ceiling of this project. A listing of the Government requested betterments can be found in the bid schedule provided with this RFP.

4.00 PART II - PRICE PROPOSAL AND CONTRACTUAL/FINANCIAL PROPOSAL SUBMISSION INSTRUCTIONS

The Offeror's pricing shall be provided on the bid schedule only, do not provide a list of prices with the technical portion of the proposal.

The Price Proposal for the base bid will not be scored but will be evaluated subjectively. In selecting the best overall proposal, the Government will consider the value of each proposal in terms of the quality offered for the price. The price proposal section of the proposal shall refer directly to items of the proposal schedule and shall be identified as such. The price proposal shall be evaluated for realism, reasonableness, and completeness as described in Section 00120

The Offeror shall enter a price for each item listed in the base price schedule. Betterments offered will be awarded along with the base bid provided they are within the specified target ceiling for the funds available. No additional betterments will be awarded once the cumulative dollar value of the base bid and the betterments exceed the target ceiling of this project. A listing of base bid and Government requested betterments can be found in the bid schedule provided with this RFP.

a. Pro Forma requirements. This information should be submitted in an envelope labeled "Pro Forma Requirements." Provide original and (1) copy. This category consists of the following

- 1) Representations and Certifications
- 2) Subcontracting plan
- 3) Proposal bonds
- 4) Completed Standard Form 1442.

TEXT DELETED

b. Price Proposal Information. Offeror shall complete all portions of the Price Proposal Schedule and furnish in a separate envelope, one original and six (6) copies.

5.00 JOINT VENTURES

Joint Ventures shall submit the following additional documentation regarding their business entities:

General Decision Number: KS030001 06/04/2004 KS1

Superseded General Decision Number: KS020001

State: Kansas

Construction Types: Residential

Counties: Geary and Riley Counties in Kansas.

RESIDENTIAL CONSTRUCTION PROJECTS (Consisting of single family homes and apartments up to and including 4 stories)

| | |
|---------------------|------------------|
| Modification Number | Publication Date |
| 0 | 06/13/2003 |
| 1 | 06/04/2004 |

* CARP0918-002 04/01/2004

| | | |
|----------------|----------|---------|
| | Rates | Fringes |
| Carpenter..... | \$ 18.72 | 8.35 |

* CARP0918-003 04/01/2004

Morris County west of Highway 177 and north of Highway 56, excluding the city of Council Grove.

| | | |
|----------------|----------|---------|
| | Rates | Fringes |
| Carpenter..... | \$ 12.51 | 5.47 |

* CARP1445-003 04/01/2004

Morris County including the city of Council Grove, except that portion of the county lying North of Highway #56 and West of Highway #177.

| | | |
|----------------|----------|---------|
| | Rates | Fringes |
| Carpenter..... | \$ 16.30 | 6.50 |

SUKS2002-003 10/31/2002

| | | |
|-----------------------------|----------|---------|
| | Rates | Fringes |
| Drywall Finisher/Taper..... | \$ 16.16 | 0.00 |
| Electricians..... | \$ 13.73 | 0.00 |
| Glaziers..... | \$ 10.85 | 0.00 |
| Laborer, General..... | \$ 9.05 | 1.65 |

| | | |
|---|----------|------|
| Plumbers, including HVAC work..... | \$ 18.47 | 0.00 |
| Roofers..... | \$ 13.26 | 6.04 |
| Sheet metal workers, Excluding HVAC Duct Work..... | \$ 17.88 | 0.00 |
| Soft Floor Layer..... | \$ 12.00 | 0.00 |

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.
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Unlisted classifications needed for work not included within
the scope of the classifications listed may be added after
award only as provided in the labor standards contract clauses
(29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates
listed under the identifier do not reflect collectively
bargained wage and fringe benefit rates. Other designations
indicate unions whose rates have been determined to be
prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can
be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on
a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests
for summaries of surveys, should be with the Wage and Hour
Regional Office for the area in which the survey was conducted
because those Regional Offices have responsibility for the
Davis-Bacon survey program. If the response from this initial
contact is not satisfactory, then the process described in 2.)
and 3.) should be followed.

With regard to any other matter not yet ripe for the formal
process described here, initial contact should be with the
Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations

Wage and Hour Division

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

STATEMENT OF WORK

1. DESIGN OBJECTIVES.

1-1 DESIGN REQUIREMENTS. The design and construction shall comply with the minimum requirements contained in this Request for Proposals (RFP).

1-1.1 Primary Consideration. All proposals received MUST include must include a price for all items in the base bid as a minimum. Failure to meet this requirement may result in non-consideration of the Offeror's proposal. Betterments will only be considered upon verification that the primary consideration requirements have been met.

1-2. WORK SCOPE. This contract shall consist of the design and construction of a total of 30 duplexes, 2 single-family residences, supportive infrastructure, and landscape at Fort Riley, Kansas, in accordance with the requirements of this RFP.

1-2.1 Residences. For the purposes of this RFP, a duplex is defined as a one- or two-story structure divided by a common party wall into two separate residences, each with separate exterior entrances. The required number, type, and location of individual residences are as shown on the RFP documents.

1-2.2 Betterments. The Contractor shall refer to the Bid Schedule for a list of Government-requested betterments, or upgrades, to be included in the Contractor's proposal. Refer to Section 00110 - Proposal Submission Requirements and Instructions and Section 00120 - Proposal Evaluation and Award.

1-2.2 SITEWORK.

1-2.2.1 Sitework. Sitework 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.

1.2.2.2 Development for this Project is planned in two separate noncontiguous sites. As indicated in the drawings, these sites have been subdivided into lots. The number of lots per site may not be changed; however, the lot configuration may be slightly altered to fit the proposer's specific design assuming that it complies with other requirements of this RFP. Construct sixty-two (62) new dwelling units with approximate distribution of the housing units on the two sites as follows:

Site 1 - Ellis Heights:
22 duplexes and 2 single-family residences
(46 residences)

Site 2 - South O'Donnell Heights:
8 duplexes (16 residences)

1-2.3 Special utilities and supplementary construction. Refer to Design Analysis.

1-2.4 Demolition considerations and requirements. Demolition of seventy-two (72) existing housing residences located in Tobie and Fleetwood courts will be required as a part of this Project. Above ground demolition consists of eighteen (18) buildings comprising seventy-two (72) residences and is part of the base bid. Existing Concrete foundations shall be completely removed. In general, it

is the offeror's responsibility to ensure that any inherently unsafe conditions are not left behind after demolition operations are completed. Cap and install shut off valves on underground utilities. Remove all power, poles, conductors and transformers for housing units removed. Contractor shall grade and seed all areas disturbed by the contractor during demolition. These residences contain no asbestos materials to be removed prior to demolition. There is no lead paint abatement required in the buildings to be demolished. On drawings CD101 and CD102 provided with this RFP, it is the responsibility of the Contractor to remove all existing electrical conduits and ductbanks in their entirety from sites that are required to be demolished.

1-3 CONSTRUCTION FENCE. The Contractor shall install an orange construction fence around the entire limits of construction as indicated on drawings CG101 thru CG103. The Contractor must maintain the fence throughout the construction period. The fence must be neat and orderly. The fence will not be allowed to sag or flop. The fence shall be secured to metal posts every 10 feet with a tension wire secured to the top edge to prevent sagging and flopping. The Contractor shall also install a 6-foot-high chain-link security fence around his construction trailers and material bed-down area.

1-4 DESIGN FREEDOM. This Section 01010, the attached specifications, floor plans, elevations and site plans provided by the Government shall not be modified by the Design-Build Contractor. The size and location of the rooms and exterior features are prescriptive and shall not be changed by the Design-Build Contractor. Any proposed change or deviation to accommodate utilities by the Design-Build Contractor must be approved by the Contracting Officer.

1-5 HOUSING CONSTRUCTION METHODS. The Offeror may utilize the following construction methods: Site-built and factory-built housing components/modules. Use of factory-built housing methods must not result in alteration of the RFP Floor Plans.

1-6 DEFINITION OF HOUSING CONSTRUCTION METHODS. Terms for housing construction methods used in these criteria are defined as follows:

1-6.1 Site- or stick-built housing. Residences are wholly constructed at the site.

1-6.2 Factory-built components and modules. 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 residences.

1-7 SITEWORK AND HOUSING CONSTRUCTION COORDINATION. The Contractor will not be allowed to start construction of any housing unit, including its foundation, until all main utilities, curbs and gutters and roads are installed. The maintenance, upkeep and any repairs required to utilities, curbs and gutters, roads and pavements will remain the responsibility of the Contractor until such time as all housing units are complete and accepted by the Government. Prior to final acceptance by the Government, the Contractor shall repair any damage to these items at no additional cost to the Government. There will not be a separate acceptance date for these items.

2. CRITERIA REFERENCES.

2-1 DESIGN AND CONSTRUCTION CRITERIA. 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, and procedural 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. In the event there is a conflict between the Government specifications provided with this RFP and local and state codes or standards, the Government specification shall take precedence.

2-2 LOCAL AND STATE CODES AND STANDARDS. The following specifications, standards, bulletins, and handbooks form a part of this document to the extent specified herein.

2-2.1 International Residential Code (IRC), International Mechanical Code (IMC), International Plumbing Code (IPC), 2003 Editions. National Electrical Code (NEC), latest edition.

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 |
| 10 CFR 430 | National Appliance Energy Conservation Act (NAECA) |
| 16 CFR 1630 | Standard for Surface Flammability of Carpet and Rugs |
| 29 CFR 1926 | Occupational Safety and Health Administration (OSHA) Standards and Regulations |
| 40 CFR 247.12 | Comprehensive Procurement Guideline for Products Containing Recovered Materials, Construction Products |
| 49 CFR 192 | Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards |
| 42 USC 4321-4361 | National Environmental Policy Act (NEPA) |
| Army Regulation 200-1 | Environmental Protection and Enhancement, May 1990 |
| E.O. 13123 | Energy Efficiency and Water Conservation in Federal Facilities |

2-4 OTHER GOVERNMENT DOCUMENTS AND PUBLICATIONS. The following Government documents and publications form a part of this document to the extent specified

herein:

2-4.1 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

2-4.2 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 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).

2-5.1 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/>

2-5.2 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/>

2-5.3 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 1002.10 | Voluntary Specifications for Aluminum Insulating Storm Products for Windows and Sliding Glass Doors |

2-5.4 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/>

2-5.5 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) |
| A112.19.4 | Porcelain Enameled Formed Steel Plumbing Fixtures (DoD Adopted) |
| 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 |

2-5.6 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 |
| 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 |

2-5.7 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/>

2-5.8 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 |

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

| Spec. No. | Spec. Description |
|-----------|---|
| 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) |
| 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) |
| 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 |

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

| Spec. No. | Spec. Description |
|-----------|--|
| 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 |
| 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 |

2-5.9 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/>

2-5.10 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/>

2-5.11 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/>

2-5.12 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) |
|----------|--|
| BHMA 101 | Butts and Hinges |
| BHMA 301 | Door Controls, Closers |
| BHMA 501 | Auxiliary Locks and Associated Products |
| BHMA 601 | Bored and Preassembled Locks and Latches |
| BHMA 611 | Interconnected Locks and Latches |

2-5.13 Council of American Building Officials (CABO). The CABO One (1) and Two (2) Family Dwelling Code and Model Energy Code, are available from the COUNCIL OF AMERICAN BUILDING OFFICIALS (CABO) 5203 Leesburg Pike, Suite 708, Falls Church, VA 22041, Fax: 703-379-1546: <http://www.intlcode.org/>

2-5.14 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

2-5.15 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/>

2-5.16 International Conference of Building Officials (ICBO). The Uniform Building Code is available from the, INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO), 5360 S. Workman Mill Rd., Whittier, CA 90601-2258, Ph: 310-699-0541, Fax: 310-692-3853: <http://www.icbo.org/>

2-5.17 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/>.

2-5.18 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/>

2-5.19 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/>

2-5.20 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.nrfc.org>

2-5.21 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 30 | Flammable Liquids Code |
| NFPA 31 | Installation of Oil Burning Equipment |
| 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 701 | Standard Methods of Fire Tests for Flame Resistant Textiles and Films |

2-5.22 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/>.

2-5.23 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/>

2-5.24 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 430 | Waste Disposers |
| UL 507 | Electric Fans |
| UL 555 | Fire Dampers |
| UL 567 | Pipe Connectors for Flammable and Combustible Liquids and LP Gas |
| 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 the construction of 20, three-bedroom units and 42 four-bedroom units to be distributed in two housing sites totaling 28.1 acres. The site design, project composition, and gross density are fixed and shall not be altered except as required to accommodate site constraints such as grading limitations and utility routing. There are demolition aspects of this project related to the above Ellis Heights and South O'Donnell additions and existing infrastructure that will be replaced. In addition, there are two existing residential sites, Tobie and Fleetwood Courts that will be completely demolished only when the construction of the new units is completed. Tobie and Fleetwood Courts each consist of nine residential buildings and 4.6 acres and 4.1 acres, total area, respectively. The Contractor will not be allowed to start construction of any housing unit, including its foundation, until all main utilities, curbs and gutters and roads are installed.

3-2 RESIDENCE GROUPING AND ORIENTATION. The residence-grouping layout is indicated on the drawings and is fixed. The final grouping layout shall not vary significantly from this layout except as required for utility routing and accommodations for topography.

3-2.1 Grading. The grading will maintain existing topography to the extent possible, but must incorporate the specific grading requirements indicated below. The successful offeror is responsible for design and construction of the final grades. The contractor's grading design must manage site runoff, ensure drainage away from the residences and other site features and provide a smooth transition between graded and natural areas.

3-2.1.1 Grading within 15 feet of the building shall not be less than 4 percent away from the building.

3-2.1.2 Site grading in turfed areas between 15 feet and 50 feet from a building shall maintain existing topography to the extent possible, but must incorporate the specific grading requirements indicated below. The successful Offeror's proposed grading must manage all site runoff, ensure drainage away from residences and other site features, and provide a smooth transition between graded and natural areas.

3-2.1.3 Grading slopes over 3:1 shall not occur within the project boundaries.

3-2.1.4 All drainage swales shall have flat bottoms lined with sod or erosion control material to prevent erosion.

3-2.1.5 Driveways shall not be steeper than 5 percent slope.

3-3. CUL-DE-SAC DESIGN. The diameter of the cul-de-sacs shall be a minimum of 100 feet to accommodate the turning radius of moving vans and fire trucks.

3-3.1 INTERSECTION DESIGN. Provide intersections as indicated on the drawings.

3-3.2 STREET DESIGN. Curbs shall be depressed at entrances to driveways unless the rolled types of curbs are provided throughout. All gradients shall provide positive drainage with no ponding, 1 percent minimum slope, 6 percent maximum slope parallel to traffic.

3-3.2.1 Residential street widths shall have two 10-foot moving lanes, two 2-foot curb and gutter sections, and one 7-foot parking lane for a total street width of 31 feet back-to-back of curb. Curb width is assumed to be 6 inches.

3-3.2.2 Curb and gutters shall be concrete, roll type, 2'-0" wide. Portland Cement Concrete (PCC) curb and gutters shall be placed on 4-inches graded crushed

aggregate base course and 8-inches lime-modified subgrade. Joints in curbs and gutters shall be aligned to match the joints in the adjacent PCC pavements and sidewalks. The Design-Build Contractor is directed to the prescriptive design analysis and prescriptive specifications and drawings provided with this RFP.

3-3.2.3 Street Construction: Street paving shall be asphalt, on graded-crushed-aggregate base course. Kansas Department of Transportation (KDOT) specifications that conform to the Technical Manual requirements, as indicated in the Design Analysis, shall be acceptable. KDOT refers to the Kansas Department of Transportation Standard Specifications for Road and Bridge Construction. Subgrade for streets shall be compacted in conformance with "Pavement Design Analysis and Materials Recommendations" and as described in the Geotechnical Report furnished by the Offeror.

The Architect-Engineer shall design the project to ensure compliance with all the listed design criteria and the recommendations of the project geotechnical report. The asphalt pavement section for residential streets should be as follows:

2-inches AC surface course

2-inches AC intermediate course

4-inches graded-crushed-aggregate base course

9.5 inches aggregate sub-base course (rounded up to the nearest ½-inch increment)

8-inches lime-modified sub-grade

The pavement design is prescriptive and not negotiable.

The Contractor will not be allowed to start construction on any portion of any housing unit, including its foundation, until all curb and gutter, roads and pavements have been installed. Once the Contractor installs the first course of pavement, the Contractor will not drive on it until the surface course is installed and the road is complete. The maintenance, upkeep and any repairs required to the curb and gutter, roads and pavements shall remain the responsibility of the Contractor until such time as all housing units are accepted. The Design-Build Contractor shall use the prescriptive drawings and specifications provided with this RFP. The Design-Build Contractor shall incorporate these prescriptive drawings and specifications into the complete final design without editing. The Design-Build Contractor is not allowed to change, modify or deviate from the requirements of these drawings and specifications.

3-3.2.4 Street Signs: Provide street signs at all intersections. Signs shall comply with the Manual on Uniform Traffic Control Devices (<http://mutcd.fhwa.dot.gov>) for size and location. Street names will be provided by the installation. Signage letters shall be dark brown characters (FED-STD-595-A-#20059) on a standard buff white background (FED-STD-595-A-#33690). Posts shall be galvanized steel painted dark brown (FED-STD-595-A-#20059). The Offerer must match the existing street signage and conform to the existing Installation Design Guide.

3-3.2.5 Residence Driveway. Driveways shall be a minimum of 20 feet wide with a maximum gradient of 5 percent away from the garage. Pavement for driveways shall be Portland Cement Concrete, 6-inches PCC (with at least 0.05 percent crack control reinforcing steel), 6-inches graded crushed aggregate base course, 8-inches lime-modified sub-grade. The Design-Build Contractor is directed to the prescriptive Design Analysis and specification provided with this RFP.

Provide control joints at a maximum spacing of 12 feet.

3-3.2.6 Sidewalk design. Portland cement concrete sidewalks shall be provided on both sides of any street within the Project limits. Walks shall be 4-foot wide, 4-inches thick PCC (6-inches thick PCC at residential driveways), 4-inches graded

crushed aggregate base course, 8-inches sub-grade. Walks along the street shall have an 8-foot-wide grassed space maintained between the sidewalk and the back of the curb. Ramps for handicapped individuals shall be provided at intersections by depressing street curbs and adjacent sidewalk.

Sidewalks shall meet the requirements of the "Pavement Design Analysis and Materials Recommendations."

3-3.2.7 Asphalt Paths. An asphalt path currently exists through the middle of the proposed South O'Donnell site. Children use the path daily for access to the schools on First Division Drive. Provide a 10-foot-wide asphalt path as indicated on drawing CS103 that allows for continued use of the entire path during construction. Path paving shall be 2-inches thick asphalt KDOT BM-2, on 4-inches of graded-crushed-aggregate base course equal to KDOT AB-3. Connect the path to the existing pedestrian circulation. After completion of the new residential development, the Offeror shall connect the path to the new sidewalks as part of the path connection. For fencing purposes, the new path shall be constructed outside the limits of construction.

3-4 Outdoor Play Areas. The design of the children's outdoor play areas (playgrounds) shall comply with the safety requirements of ASTM F 1487 and ASTM F 1292. Playground grading shall be well-drained and should be sloped between 2% and 4%.

3-4.1 Child Safety and Accessibility.

3-4.1.1 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.

3-4.1.2 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 in the Ft. Riley Housing Areas shall be constructed of sand in sufficient thickness that meets the shock absorbency criteria in ASTM F1292. Playground safety surfaces shall be provided throughout all use zones and under all play equipment as required for the different types of playground equipment. To contain the sand safety surfaces, the contractor shall provide a concrete curb border that is flush with the surrounding grade and ground surfaces at the perimeter of the playground areas and at a safe distance from the playground equipment.

3-4.1.3 Playground equipment made of lumber treated with arsenic, such as CCA, is not acceptable.

3-4.2 Manufactured play equipment. Play equipment is part of the base bid. The Contractor shall provide the following play equipment:

3-4.2.1 Existing Playgrounds at Ellis Heights: Three play areas on the Ellis Heights site are to be demolished. The playground equipment shall be carefully removed in conformance with Section 02220, Demolition, and as directed by the Contracting Officer.

3-4.2.2 New Playgrounds at Ellis Heights and South O'Donnell Heights: Provide new playgrounds where indicated on the drawings with one each (except as noted)

of the following equipment at each new playground:

Swing Set: 6-swing set, 10 feet high, 4 rigid molded rubber adult seats, 2 pliable rubber (over stainless steel core) slash-proof infant seats, 4/0 straight link galvanized swing chain with hanger with bearings, equal to Playworld Systems - Standard Swing 0255.

Double Large Slide: Two 60-inch plastic slides, vinyl-coated steel ladder and deck, 3½-inch galvanized steel powder-coated posts, full-length handrails on ladder, equal to Playworld Systems - Double-Lightning, CH3982.

Jungle Gym: Geodesic dome structure, 17-foot diameter, 7-foot high, 1-1/16-inch OD powder-coated galvanized pipe, walk-in adult access, equal to Playworld Systems - Super Dome 0400.

Combination Play Unit: Short plastic slide, spiral slide, hop-scotch climber, deck-to-deck climber, pipe wall with steering wall, Tic-Tac-Toe, transition station with step, and 6-foot horizontal spiral ladder with access ladder, equal to Playworld Systems - Challengers 350-0007.

(2) Park Bench: 8-foot long, angle-leg, pressure-treated pine planks for seat and back, 2-3/8-inch painted galvanized steel pipe frame with end caps equal to Playworld System - Bench 1372.

Picnic Table: 8-foot long, portable, perforated steel top and seats, 2-3/8-inch galvanized steel pipe frame, powder-coated top and frame, equal to Playworld Systems - 1403.

3-4.3 Plant materials in play areas. Trees shall be integrated into play settings, which may vary from designs shown on the Site Plans, and shall be selected from Attachment 10. The intent is to furnish play lots with as much shade as possible (as trees mature) without compromising fall zone and other safety requirements.

3-5 Landscape Planting Plan. The Offerer shall obtain and use the services of a registered landscape architect, experienced in site planning and planting design. A complete, integrated landscape planting plan shall be provided for the overall housing Project. The design shall reflect appropriate groupings, foundation plantings, and street tree plantings to define the open spaces to ensure a completely landscaped Project. 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.

3-5.1 Suitable Plants for Use in Ft. Riley Housing Area. For the purposes of a plant list for this project, refer to Attachment 10. Plants to consider for use are listed in the category of "Upland Range" located at the back part of the document. Plants that require acidic soils should be avoided. The soil throughout the Ft. Riley Housing Area ranges from 7.0 - 8.2 pH; therefore, lime should not be used as a soil additive. No more than forty percent (40%) of trees or shrubs shall be of any single variety. There shall be a minimum of five (5) different species of trees and five (5) different species of shrubs.

3-5.2 Required Quantities and Minimum Sizes.

3-5.2.1 Each duplex unit and single-family residence shall receive a minimum of the plantings per unit as indicated on the Landscape Drawings in this RFP. Refer to the Landscape Drawings for the character and quantities of plantings.

3-5.2.2 Minimum Sizes:

Large deciduous trees - 1¾"-2" caliper (8-10 feet)
 Flowering tree - 5-6 feet
 Coniferous evergreen tree - 5-6 feet
 Deciduous or evergreen shrubs - 2-gallon
 Evergreen dumpster screening shrubs - 5-gallon
 Ground covers - 3-inch pots

3-5.3 Trees, shrubs, and ground cover. Plant varieties shall be nursery grown or plantation grown stock conforming to ANSI/ANLA Z60.1. They shall be grown under climatic conditions similar to those in the locality of the Project.

3-5.3.1 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. Poisonous plants and plants with thorns are not allowed and should be removed from the play areas. Refer to the U.S Army Center for Health Promotion and Preventative Medicine, Guide to Poisonous and Toxic Plants: chppm-www.apgea.army.mil/ento/default.htm.

3-5.3.2 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.

3-5.3.2.1 Single stem. Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

3-5.3.2.2 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.

3-5.3.2.3 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.

3-5.3.3 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.

3-5.3.4 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.

3-5.3.5 Broadleaf evergreen. Plants shall be provided that have ration 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.

3-5.4 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.

3-5.5 Measurement. Plant measurements shall be in accordance with ANSI/ANLA

Z60.1.

3-5.6 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.

3-5.7 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.

3-5.8 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. The Contractor shall be required to replace plants as often as necessary until they survive one full growing season.

3-5.9 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 as many times as necessary, until it survives one full 12 month growing season under this guarantee. Transplanting existing plants requires no guarantee but shall be done with care according to ANSI/ASLA standards.

3-5.10 Turf. Turf consists of seed or sod.

3-5.10.1 The Design-Build Contractor shall use the prescriptive specifications provided with this RFP. The Design-Build Contractor shall incorporate these prescriptive specifications into the complete final design without editing. The Design-Build Contractor is not allowed to change, modify or deviate from the requirements of these Landscape drawings and specifications.

3-5.11 Existing trees located beyond 50 feet from the buildings should be protected and saved except where substantial cut or fill is expected. Where existing trees can be saved, a construction fence should be placed at the drip line of the tree(s) and construction activities and storage should be prohibited from that area.

3-6 Postal Service. Provide individual rural-type mailboxes where indicated on the drawings. At each location, provide a maximum of five (5) individual mailboxes mounted on a steel post and frame set 90 degrees from the street between the sidewalk and back of curb on a 6-foot x 8-foot concrete pad and walk area. Mailboxes shall be metal construction and designed for loading and unloading from the same side. Final mailbox design, orientation and locations shall be submitted to the Contracting Officer and U.S. Postal Service for approval before fabrication and installation.

3-7 Street Numbers. Street Numbers will be painted on the curb immediately

adjacent to the curb radius at the entrance to each residence driveway as required by the new Installation Design Standards.

4 SITE ENGINEERING

4-0 General: It shall be the Contractor's responsibility to protect all existing utility lines from damage during excavation. Any damage resulting to existing utility lines and systems shall be repaired by the Contractor, to the satisfaction of the Contracting Officer, at no additional cost to the Government, except as noted in Item 4-0.1 below.

4-0.1 The Contractor shall contact Kansas One-Call for utility checks for gas lines owned by Williams Natural Gas, Sprint, Southwestern Bell, and American Cablevision. The Offeror is also directed to SECTION 01100 General, the paragraph titled "Protection of Utilities" provided with this RFP.

4-0.2 Fort Riley personnel will locate underground Post telephone and communications lines. The contractor shall deliver to the PW work order desk at building 85, 820 McClellan, or transmit via fax 913-684-8950, a diagram showing the approximate area that the posts telephone and communication lines need to be located. The Contractor shall mark the proposed route or limits of the excavation in white prior to the request so that the Government personnel will know where to mark for utilities. The Contractor should allow a minimum of three (3) working days for the utility locates to be conducted. The permit expires every ten (10) days. If the Contractor damages any marked lines during excavation, the Contractor shall contact the Government QA Representative immediately to determine whether the Contractor will perform repairs or reimburse the Government for repairs.

4-1 Soils.

4-1.1 Soil and Foundation Report (Geotechnical Report). A preliminary Soil and Foundation Report is provided as part of this RFP. Drawings indicating Subsurface Explorations and Geologic Profiles for the proposed site are 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 and preparing his own report. Inclusion of the draft report by the Government does not relieve the Design-Build Contractor of his responsibility to conduct a thorough investigation of the sites and take responsibility for the final design. The Design-Build Contractor's investigations and subsequent report must verify the validity of the draft soils report provided with this RFP and/or provide documentation of any conflicts between the draft report and his final design recommendations before proceeding with the design.

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 Foundation Types

4-1.1.1.13 Swell Potential

4-1.1.1.14 Soil Modification Techniques

4-1.1.1.15 Lateral Earth Pressure Coefficient

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 fast-track design and/or 50 percent design submission. If revisions are made to the 50 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 the Design Analysis and prescriptive specifications provided with this RFP and determined in accordance with ASTM D 1557 Method D.

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.

4-1.2.3 Refer to the Civil Site Design Analysis for specific requirements of pavement and subgrade preparation. In general, requirements are as follows:

Asphalt Concrete Surfaced Streets:

- 2-inches AC surface course
- 2-inches AC intermediate course
- 4-inches graded crushed aggregate base course
- 9.5-inches aggregate subbase course
- 8-inches lime-modified subgrade

Rigid Pavement Design, Residential Driveways:

- 6-inches pcc
- 6-inches graded crushed aggregate base course
- 8-inches lime-modified subgrade

Portland Cement Concrete Sidewalks:
 4-inches pcc
 4-inches graded crushed aggregate base course
 8-inches lime-modified subgrade

Portland Cement Curbs and Gutters:
 Portland Cement curbs and Gutters
 4-inches graded, crushed aggregate base course
 8-inches lime-modified subgrade.

4-1.3 Capillary water barrier. A capillary water barrier is required for all interior slabs on grade, including garages, carports and storage rooms.

4-1.4 Soil treatment. Soil treatment for termites shall be by the chemical method. Methods and extent of protection required are as follows:

4-1.4.1 Soil treatment shall comply with the attached Specification Section 02364 Termiticide Treatment Measures for Subterranean Termite Control.

4-2 Water Distribution System. Connection to the existing water distribution system shall be made at the locations shown on the RFP drawings. The Contractor shall connect to the existing waterline as follows: On Sheet CU101 - 8 inches on S. side of Williston Point Road. On Sheet CU104 - 8 inches on S. side of Smoky Hill and Wofford.

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 residence. Mains shall be looped with no dead ends where practical and be of adequate size to satisfy both domestic and fire flow requirements. Minimum main size is 6 inches. 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. In addition, a standard grade, non-magnetic, warning Tape will be installed above all underground utility lines. The tape will be buried 1 foot below the surface, running the entire length of the buried utility. The color of the tape will correspond to the utility it is protecting (see Section 02222 for specific requirements. The pipe, valves, and all other materials shall meet the American Water Works Association (AWWA) standards for a 150 psi working pressure system. Provide sacrificial anodes for all valves and metal pipe as directed by the Contractor's Cathodic Protection Engineer. 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 500 gpm at one-story units, 750 gpm at two-story structures, and 1000 gpm at structures which are three or more stories high, for a flow duration of 1-1/2 hours. This mandatory flow is over and above domestic requirements. Domestic requirements shall be based on 300 gal/day per residence for single-family housing, and 250 gal/day per residence for multi-family housing. Mains shall be sized to carry this flow with a 2.5 peak hourly factor. Flow shall be a minimum of 1000 gpm with a residual pressure of 20 psi at each fire hydrant, and a maximum of 150 psi at each outlet after allowing for friction, elevation, and other pressure losses. Pressure at each residence shall not exceed 75 psi. Design shall be based in the Flow data in Table 4-2 below. Water flow calculations shall be provided for Government review in the design analysis provided by the Contractor.

TABLE 4-1: FIRE FLOW DATA

| Hydrant Location | Static Pressure (psi) | Residual Pressure (psi) | Flow (gpm) |
|--------------------------------|-----------------------|-------------------------|------------|
| Washington and Lincoln Streets | 60 | 37 | 1021 |
| Lincoln and Roosevelt Streets | 55 | 30 | 919 |
| HQ Fire Station | 42 | 30 | 919 |
| Wofford Dr. and Thomas Ave. | 68 | 55 | 1061 |

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 12 inches 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 48 inches of earth cover. Sufficient cover must also be provided to protect the pipe against structural damage due to superimposed surface loads.

4-2.4 Fire hydrants. Hydrants shall conform to AWWA C502, Dry-Barrel Fire Hydrants, except as required by the local utility supplier. 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, with similar pump and hose connections. Fire hydrant spacing shall be no greater than 350 feet apart, by paved road. In addition, a hydrant shall be provided so that all parts of the residences can be reached by hose lines not over 350 feet long. Hydrant laterals shall be 6 inches minimum size, shall not exceed 10 feet in length, and shall have an underground shutoff valve. Valve box, at each lateral, shall be located within 10 feet 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.

4-2.5 Shutoff valve. Each residence shall be provided with a separate service and main shutoff valve, readily accessible to maintenance and emergency personnel.

Shutoff valves in walks are prohibited. Plastic shutoff valves are prohibited.

4-3 Sanitary Sewerage System. Connections to the existing sewage collection system shall be made at the location shown on the RFP drawings. 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 400 ft apart. Curved sewers are prohibited. Pipes shall be designed to flow full and maintain a minimum velocity of 2 ft per second. Drawing Sheet CU104 indicates that the Sta. 0+00, or existing Manhole 103, has a rim elevation of 1293.73 and a flow-in elevation of 1285.93. The correct flow-in elevation is 1275.31. The slopes on the 8-inch line for Line 1 run from 0.94% to 0.74%, well above the minimum slope for an 8-inch line as prescribed by KDHE. The Contractor shall connect to the existing sanitary system as follows: On Sheet CU101 - the 6-inch force main will be removed to the point of where the new manhole is shown, and in the future the discharge from the force main will drain through the new sewer system. On Sheet CU104 - The sheet does not show a sanitary sewer manhole near 1st Division and Smoky Hill. The sanitary sewer connection is to the existing manhole and 8-inch sewer on Wofford between the houses on the south side of Wofford. The flow of the existing force main is estimated to be 315 gpm (453,600 GPD) from the manufacturer's curve at 65 feet.

4-3.1 Sewer mains. Design shall be based on an average daily per capita flow of

sanitary sewage of 100 GAL per day with a 4.0 peak hourly factor. Mains shall be a minimum of 8 inch in diameter.

4-3.2 Sewer Building Laterals. Each residence lateral shall be connected directly to a sewer main. Combining multiple laterals is prohibited. 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 and allow for two-way cleanout capability, both toward the house and toward the sewer main. 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 one residence shall be a minimum of 6" 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 10 ft.

4-3.3.1 Cover. Sewer lines shall be located at a minimum depth of 3 ft.

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 velocity of flow in conduits during a design storm shall be 2.5 fps. 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 Site specific storm drainage criteria. The Contractor shall comply with all NPDES requirements and be responsible for all permits and applications.

4-4.2 Manholes. Manholes shall be located at intersections and changes in alignment or grade. Intermediate manhole maximum spacing shall be 250 ft for pipes 3 ft or less in diameter or box drains with the smallest dimension less than 3 ft. Maximum spacing for intermediate manholes on larger pipes and drain boxes shall be 500 ft. Manholes shall be precast concrete and shall conform to ASTM C 478 or AASHTO M 199. Steps shall be installed where the depth of the manhole exceeds 4 ft. The wall where the steps are installed shall be vertical. The manhole shall have a 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.

4-4.4 Pipe for culverts and storm drains shall be of RCP Class III, or PVC profile pipe.

4-5 Gas Distribution System. Provide a gas distribution system, connected to existing systems and designed in accordance with local codes or utility company requirements, whichever is more stringent. Gas distribution systems shall comply with the requirements of ASME B31.8. Connection to existing gas distribution system shall be made at the location shown on the enclosed RFP drawings. When connecting to existing steel piping system, provision shall be made to ensure that the integrity of the cathodic protection is not compromised. Shutoff valves shall be provided on the exterior of each residence. A gas regulator and

provision for future installation of an individual gas meter to monitor fuel use shall be provided for each residence. The residence service entrance shall be installed at a height sufficient to allow for future installation of the gas meter. 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. On Sheet CU101 - The Contractor shall connect to the existing 4-inch line near the intersection of Washington Street and Lincoln Street. On Sheet CU101 - The Contractor shall connect to the existing 6-inch gas line on the east side of 1st Division Road. (There is also a 12-inch gas line on the same side of the road.)

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 as described below.

4-5.1.1 Polyethylene pipe, with anodeless risers, 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.

4-5.2 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 residences.

4-5.5 Mains and service lines. Lines shall not be placed under any buildings. Lines shall be placed with a minimum of 30 inches of earth cover. Protective casings shall be provided to protect lines from superimposed street or heavy traffic loads.

4-6 Electrical Distribution. The main feed consists of overhead lines routed along First Division Road, which provides all electrical service to the new housing areas from Substation No. 1. Connection to the existing electrical distribution system shall be made at the location shown on the enclosed RFP drawings (Ellis Heights: near First Division Road and Williston Point Road; O'Donnell Heights: near First Division Road and Thomas Avenue). These lines have adequate capacity to provide electrical service for this Project. Pad-mounted transformers shall be fed from these lines using underground feeders. The distribution level voltage is 12.47 kV. Provide advanced written notice to all residents for all required power outages due to construction.

4-6.1 System design. Provide new electrical distribution system as necessary and connect to existing system. Connect to the existing pad-mounted switches at Ellis

Heights and provide new pad-mounted switches with primary master meters at new tie-in point at O'Donnell Heights. Coordinate utility interruptions in advance with Contracting Officer. System shall be a loop-primary radial system. Primary feeder cables shall be copper and concrete encased. High voltage conductors shall have protective shielding. Cable shall be buried a minimum of 3 ft below the finished grade to the top of the concrete encasement with continuous cable marker tape and tracer wire 6 inches 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 500 ft. The electrical on-site distribution system shall be designed in compliance with the rules and recommendations of ANSI C2, National Electrical Safety Code, and NFPA 70, National Electrical Code, whichever is more stringent. Underground direct-burial distribution is required unless otherwise directed. The distribution system and transformers shall be routed at the rear of the housing area. Provide tracer wire and warning tape over all electrical underground utilities (See Section 02222).

4-6.1.1 Provide three 15-kV primary conductors and one 600V concentric neutral. All primary conductor insulation shall be 133 percent and cross-linked polyethylene or ethylene propylene rubber (NEMA WC74). Loading at connections shall be balanced between all three phases. Distribution of primary feeders shall be loop fed so that if power is lost at any location, power can be supplied from another direction until the problem is corrected. Distribution system includes conductors, pad-mounted switches, pad-mounted transformers and pads. Coordinate the installation of the electrical system with the telephone and cable TV system companies.

4-6.2 Underground splices. Underground connection or splices are prohibited, except in boxes or manholes. Splices shall be in a self-draining, rodent-resistant box with a cover.

4-6.3 Service laterals. Route all service laterals underground. Minimize the length of secondary distribution service laterals from the transformer secondary to the building service entrances. Secondary service laterals shall be copper and may be direct-buried.

4-6.4 Service entrance. Provide only one service entrance per residence. Bury the service entrance conductors a minimum of 3 ft below finished grade with a minimum separation of 1 ft from telephone or TV cables. Route feeder from the service entrance to the individual residence in conduit below the building slab. Design the system such that the fault current available at the service entrance equipment will not exceed 10,000 amps.

4-6.5 Transformers. Provide pad-mounted transformers with 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 primary voltage shall be 7,200V, single-phase. The transformed secondary voltages shall be 240/120V, single-phase, three-wire, solid neutral service to residences. In selecting a transformer, the name plate rating shall not be less than 90 percent of the kilovolt/amperes (kVA) demand load calculated for the transformer. The demand load shall be calculated per NFPA 70, National Electrical Code. Transformers shall be low profile, pad mounted type, mineral oil insulated, with tamperproof enclosure and copper primary and secondary windings. Transformers shall be certified non-PCB and shall contain less than 50 parts per million PCB.

4-6.6 Street and area lighting. Residential roadway lighting, including collector streets, shall be provided in accordance with the IES Lighting

Handbook. Provide lighting at roadway intersections, and at intervals not exceeding 200 ft between intersections. Provide area lighting at intervals not exceeding 200 ft. along area walkways not otherwise illuminated, common area walks connecting playgrounds, and at all steps in area walkways. Area lighting shall be provided in accordance with the IES Lighting Handbook. Luminaires shall be actuated by photoelectric control, one photocell per circuit, and supplied from multiple circuits originating from a pad-mounted transformer. Street lighting poles shall be uniformly spaced and set back from the curb edge a minimum of 4 feet and between sidewalk and curb. Street and parking area light fixtures shall be high pressure sodium. Provide standard cobra-head style, 240-volt luminaires for street and area lighting. Luminaire finish shall be standard aluminum. Poles shall be round aluminum with standard anodized finish.

4-7 Metering. Metering of utilities shall be provided as follows:

4-7.1 Master Meters. Master meters for water, electricity, and gas shall be provided for both sites where not already existing. Individual residential meters are not required. Contractor is to provide proper rough-ins with shutoff valves of main disconnects for future installation of meters (gas, water, electric) for each individual residence.

4-7.2 Gas and water metering. Provide for future individual residence metering devices. Comply with local requirements. Meter and regulator location for gas meter shall be sight screened, and located to provide convenient access while not distracting from building appearance. Water meter well and piping with shut-off valves for future installation of water meter and yoke shall be provided.

4-7.3 Individual or main disconnects meter drops. Provide individual utility meter for all residences. Provide sockets for electric watt-hour meters at each residence. Provide manual by-pass jumper plates for each socket. Locate utility meter drops in an area readily accessible by service personnel. Sight screen meters and meter bases, and locate to provide convenient access while not distracting from building appearance.

4-8 Telephone. The telephone company will furnish and install distribution cables. Conduit required between underground terminal boxes and the buildings will also be furnished and installed by the telephone company. Contractor shall coordinate with the telephone company for the location, type, and installation of the required telephone system. Telephone company distribution cables and above-ground enclosures shall be routed at the rear of the housing area.

4-9 Television. The cable TV service provider will provide all site distribution systems for this project. Coordinate with the cable TV service provider to determine who is responsible for all trenching, conduit, boxes, and backfilling required to install the distribution systems. Cable TV distribution cables and above-ground enclosures shall be routed at the rear of the housing area.

4-10 Cathodic Protection. Cathodic Protection (CP) is mandatory on buried ferrous metallic structures as described below:

4-10.1 Corrosion control is mandated for all metallic underground storage tanks storing petroleum or hazardous substance by 40 CFR, Part 280 and AR 200-1 and on hazardous liquid pipelines (e.g., liquid fuel) by 49 CFR, Part 195.4-10.2 Corrosion control is mandated for all metallic underground storage tanks storing petroleum or hazardous substance by 40 CFR, Part 280 and AR 200-1 and on hazardous liquid pipelines (e.g., liquid fuel) by 49 CFR, Part 195.

4-10.2 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, Partially Buried, or Submerged Liquid Storage Systems, as appropriate.

4-10.3 New or supplemental CP systems shall be compatible with existing CP systems and other adjacent structures or components. New systems should be compatible with existing systems to allow ease of repair and maintenance.

4-10.4 CP and protective coatings shall be provided for the following buried and submerged ferrous metallic structures regardless of soil or water resistivity: 4-10.6 CP and protective coatings shall be provided for the following buried and submerged ferrous metallic structures regardless of soil or water resistivity:

4-10.4.1 Natural gas piping.

4-10.4.2 Other structures with hazardous products as identified by the installation.

4-10.5 Cast iron pipe shall be treated as follows:

4-10.5.1 For soil resistivity below 10,000 Ohm-cm at pipeline installation depth, provide CP, bonded joints, and protective coatings. Poly-wrap is not a sufficient coating.

4-10.5.2 For soil resistivity between 10,000 and 30,000 Ohm-cm at pipeline installation depth, provide bonded joints only.

4-10.6 Copper water service lines will be dielectrically isolated from ferrous pipe. Dielectric isolation shall conform with NACE RP-0286.

4-10.7 Ferrous metallic piping passing through concrete shall not be in contact with the concrete.

4-10.8 Tracer Wire: All non-conductive underground utilities will have a tracer wire buried directly above, and immediately adjacent to each line. The tracer wire will be a 12 gauge, solid copper, coated wire. The tracer wire will run the entire length of the buried utility line. The tracer wire will run on primary and secondary feeders from manhole to manhole (or valve box), and be terminated within each manhole, or valve box at a point easily reachable from the surface. On lateral lines, the tracer wire will run the entire length of the lateral and be terminated, next to the house above ground, at the point where the utility comes out of the ground. The wire will be snugly wrapped around the pipe a minimum of three times. If the lateral line enters the house below grade, the tracer wire will be terminated above the utility line, immediately next to the exterior of the foundation, in a standard non-waterproof exterior junction box attached to a vertical piece of 1/2" plastic PVC pipe buried a minimum of one foot below the surface. Within the junction box the continuous tracer wire will be left coiled, a minimum of one foot long, with the interior of the box labeled with a permanent marking pen, (i.e. Gas Line Tracer).

Warning Tape: Standard grade, non-magnetic, Warning Tape will be installed above all underground utility lines. The tape will be buried 1 foot below the surface, running the entire length of the buried utility. The color of the tape will correspond to the utility it is protecting.

Electrical = Red
Gas = Yellow
Water = Blue
Sewer = Green
Telephone = Orange
Cable TV and Others = Silver

4.11 SITE ENGINEERING. No conceptual utility plans have been developed for this project. Based on the tie-in points for each utility provided with this RFP, the determination of burial depths for the various utilities, and whether or not a lift station is needed, are parts of the final design solution and the responsibility of the Design-build Contractor after award. See also Section 01012 DESIGN AFTER AWARD and other parts of the contract documents provided with this RFP for additional information. The amount of cut and fill needed for each site is the responsibility of the Design-Build Contractor. The Contractor shall use the survey and site information provided with the RFP to make that determination. The Government takes no responsibility in that determination. The final grade and elevations are part of the design-build solution to be developed and completed by the Design-Build Contractor. However, the general layout and placement of the housing units on the site shall not be changed. It is the Design-Build Contractor's responsibility to fit the plan to the site.

5. ARCHITECTURAL DESIGN

5-1 ARCHITECTURAL DESIGN REQUIREMENTS. Designs shall conform to the plans as shown in the RFP drawings. Only minor variations are permitted to accommodate ductwork, piping, and other similar requirements.

5-1.2 ACCESSIBILITY. Design of accessible residences shall conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG). Refer to the RFP Drawings for designated accessible unit locations and information. The designated units shall be accessible to disabled persons with wheelchairs as well as visually and/or hearing impaired persons. This means required access clearances, room sizes, bathroom layout, kitchen layout, doors and hardware, grab bars, plumbing hookups, light switches and outlets and controls must meet accessibility requirements at time of construction, or they shall be readily and easily modifiable to meet accessibility requirements. The accessibility requirements for adjustable height cabinets and work surfaces and plumbing fixtures, and other accessibility requirements for the hearing and visually impaired, must also be made at time of construction.

5-1.2.1 Consumer Information for Accessibility Requirements. The Contractor shall furnish a report including drawings in accordance with the Uniform Federal Accessibility Standards, paragraph 4.34.4 "Consumer Information" for the modified and adaptable features of each applicable unit type of family housing.

5-1.3 HOUSING UNIT VARIATION. The goal is to provide distinctly different exterior appearances for each duplex. For the Base Bid which uses siding and no brick, the Contractor may provide more than one color of siding on the same building. All adjacent structures will vary in two or more of the following: Floor plan (combination of different residence types), elevation and orientation, and color of exterior materials. Refer to paragraph on exterior materials for permissible variations in exterior materials. Duplexes shall vary in color, in a random pattern, with no two adjacent structures being the same color. Elevations of the duplexes indicated in this RFP are included to indicate required form, massing and material usage.

5-1.4 MAINTAINABILITY. The design of residences, 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.

5-2 CRAWL SPACES.

5-2.1 The underfloor crawl spaces shall be built in conformance with the requirements of the latest edition of the International Residential Code (IRC).

5-2.2 The finished ground level of an underfloor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground water table rises to within 6 inches of the ground level at the outside of the building perimeter or where there is evidence that the surrounding water does not readily drain from the building site, the ground level of the underfloor space shall be as high as the outside finished ground level, unless an approved drainage system is provided that conforms to the IRC.

5-2.3 Provide crawl space ventilation in conformance with the IRC.

5-2.4 Crawl spaces shall be provided with a minimum of one access opening not less than 18 inches by 24 inches.

5-2.5 The Contractor may locate and specify either a secure, lockable Utility Room floor access door or a secure, lockable exterior access door for

consideration by Owner.

5-2.6 Refer to Section 5-4.6, Tornado Safe Rooms.

5-3 MATERIALS. All materials used shall be new and shall not be discontinued.

5-4 FIRE PROTECTION AND SAFETY. Residences will comply with the applicable National Fire Codes, including NFPA 101, Life Safety Code. Construction features will be provided in accordance with the International Residential Code (IRC), 2003 edition. The Design/Builder shall furnish a complete code analysis.

5-4.1 FIRE-RESISTANCE OF PARTY WALLS AND ROOFING MATERIALS. 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 residences) shall have the minimum fire-resistance rating of one hour.

5-4.2 ALARM SYSTEMS. Smoke detectors are required to sound an alarm only within the residence are not required to be transmitted to the installation fire department.

5-4.3 SAFETY OF HEATER/ MECHANICAL ROOMS. Rooms equipped with fuel-fired equipment such as a furnace and/or fuel-fired water heater that serve only one housing unit shall be separated by minimum one-hour rated fire-resistive construction. Provide easy access to the equipment controls and filters.

5-4.4 GARAGE WALLS. Walls between the garage and dwelling areas shall be separated by minimum one-hour rated fire-resistive construction. All openings in such rated walls shall conform to opening protection requirements in conformance with the applicable codes.

5-4.5 EGRESS. Every sleeping room and living area shall have a secondary means of egress where required by NFPA 101 and International Residential Code.

5-4.6 TORNADO SAFE ROOMS. Provide each and every family housing unit with a tornado safe room built in accordance with the standards in the Federal Emergency Management Agency (FEMA) Publication No. 320, "Taking Shelter from the Storm: Building a Safe Room Inside Your House." Refer to the attachments to the RFP for the 16-page set of "In-Residence Shelter" drawings, revised August 1999, indicating various methods for meeting the standards. For accessible units, the preferred location of the safe room is on the main level of the unit. The locations of the tornado safe rooms are located on the drawings provided with this RFP. Every in-house residence shelter shown on drawing A101 thru A108 contains a combination tub and shower.

5-5 SOUND ATTENUATION.

5-5.1 REQUIREMENTS. 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.

5-5.2 PARTY WALLS. Party walls construction between residences shall be designed to provide the minimum airborne sound transmission ratings and impact isolation ratings stated in Table 5-1.

**TABLE 5-1 - SOUND TRANSMISSION STANDARDS
FOR PARTY WALLS AND FLOOR/CEILING CONSTRUCTION**

| Area | FSTC ¹ | FIIC ² |
|-------------------------------|-------------------|-------------------|
| Party Walls (Unit Separation) | 52 | - |
| Habitable Areas Over Garages | 52 | - |

Note¹: Field Sound Transmission Class. See ASTM E336.

Note²: Field Impact Isolation Class. See ASTM E1007.

5-5.3 TESTING. Certified proof-of-performance field tests will be conducted by the Contractor 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 will take place on 4 units randomly selected by the Contracting Officer.

5-5.3.1 DEFICIENCIES. 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 additional units beyond the initial 4 units, of each system, may be required if the Contracting Officer determines that the quality of construction requires this additional testing.

5-5.4 PLUMBING AND HVAC EQUIPMENT. Design of plumbing and Heating, Ventilating, Air-Conditioning (HVAC) shall include design provisions such as location, enclosure and acoustical treatment, to minimize transmission of noise generated by equipment within each residence, particularly the single-story units, and to eliminate transmission of noise to other residences.

5-6 LIVEABILITY, DIMENSIONS AND AREAS. The floor plans in the RFP indicate the dimensions and area layouts for interior room and exterior spaces.

5-6.1 CEILING HEIGHTS. Ceiling heights in habitable rooms shall be a minimum of (8 ft). As a part of the betterments to the Contract RFP, provide 9-foot ceilings on the first floor of all residences, except those that are handicapped accessible.

5-6.2 LIVING, FAMILY AND DINING ROOMS. Living, Family and Dining Room areas shall have direct access and be open to each other as indicated on the floor plans in the RFP. The Family and Dining Rooms shall have direct access and be open to the Kitchen area as indicated on the floor plans in the RFP.

5-6.3 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 accommodate functional placement of furniture. Each bedroom shall be accessible without passing through another bedroom. Design consideration shall be given to the movement of oversized furniture in and out of the bedrooms. Bedroom closets shall maximize space with wood shelving and organizers. As a minimum, provide 2 shelves and 2 rods on 50 percent of the hanging space with shelves mounted at heights of approximately 3'-8" and 6'-0" above the floor. The remaining 50 percent of the closet space shall have one shelf and rod mounted at a height of approximately 6'-0" above the floor.

5-6.4 LAUNDRY. Separate Laundry Rooms or Closets shall be provided as indicated on the floor plans in the RFP. Two full-length shelves, (10 inches) minimum nominal depth, are required above the washer and dryer in all locations.

5-6.5 CLOSETS. Closet shelving. Closets (except linen closets) shall be equipped with a (12 inches) deep shelf and a clothes hanger rod. Linen closets shall have at least four full-depth shelves. Closet shelving and rods in excess of (4 ft) shall have center supports. Shelves and supports shall be capable of carrying (35 lbs./ft). Closet shelving shall be minimum (3/4 inch) thick solid wood, plywood, or high density particle board. In walk-in closets, provide one full height drawer or open shelf storage unit for each 6 feet of clothes hanger rod. Factory Finished welded wire shelving and closet organizers meeting the capacity requirements is also permitted. Intermediate supports must be anchored to studs.

5-6.5.1 CLOSET DOORS. All closet doors shall be swinging except for bi-fold doors where indicated at Laundry Closets on the floor plans in the RFP.

5-6.5.2 INTERIOR STORAGE ROOMS. Provide a minimum of three nominally (12 inches) deep shelves with a combined length of (24 ft) within each interior storage room in single-story units.

5-7 KITCHEN.

5-7.1 LAYOUT. The Kitchen shall provide efficient working arrangements between the sink, refrigerator, cooking and food preparation areas as indicated on the floor plans in the RFP.

5-7.2 DISHWASHER. The dishwasher shall be installed adjacent to the kitchen sink.

5-7.3 PANTRY. A full-height pantry with a minimum of six 12-inch deep adjustable shelves shall be provided.

5-7.4 Backsplash. The contractor shall provide a backsplash behind the range, extending to the underside of the range hood, finished to match the backsplash above the countertop.

5-8 BATHROOMS. Provide a combination tub with shower enclosure for the typical common bathrooms in the hall. The tub will be enameled cast iron. The enclosure will be a single- or multiple-piece unit with integral soap dish. All bathtubs except those in the master bedroom shall be furnished with a curtain rod. The master bathrooms shall have an enameled cast iron bathtub with a ceramic tile backsplash enclosure extending around the tub at a minimum height of 7 feet above the adjacent finish floor. Master Bathroom bathtubs shall have a recessed ceramic tile soap dish and a curtain rod. The towel bar holder and the toilet paper holder arms shall be ceramic with a plastic spring-loaded rod for the toilet paper holder. Provide one 24-inch-long ceramic towel bar for each half-bath and two 24-inch-long ceramic towel bars for each full bath. All bathroom accessories shall be rigidly attached to studs or blocking. Bathtubs in handicapped accessible units shall be ADA-compliant and incorporate grab bars and a seating bench within the tub.

At non-accessible housing units, the Master Bathroom shower stalls shall have ceramic tile floors and walls extending around the shower space at a minimum height of 7 feet above the adjacent finish floor. Ceramic tile shall be installed in compliance with the latest edition of "Handbook for Ceramic Tile Installation" published by the Tile Council of America, Inc. The shower tile installation shall be in conformance with the applicable "Shower Receptors and Walls" standards for the type of floor and wall construction provided.

At accessible housing units, the Master Bathrooms shall also have a single-or multiple-piece shower unit made of molded acrylic. Roll-in type showers are not required at accessible units. Molded acrylic shower units shall be capable of accommodating a person of 250 pounds without damage. Shower units shall incorporate a tempered glass door except that shower curtains shall be used at the accessible units.

5-8.1 MEDICINE CABINETS. A recessed medicine cabinet shall be provided in master bathroom only. Cabinets shall be corrosion-resistant with plate glass mirrors, hinged door type. Medicine cabinets shall be placed on a sidewall of the bathroom. Do not place recessed medicine cabinets in party walls. Medicine cabinet is in addition to mirror in all bathrooms. A single continuous length of corrosion-resistant plate glass mirror measuring the width of the vanity by 42 inches high shall be furnished in all bathrooms.

5-9 INTERIOR FINISHES

5-9.1 WALLS AND CEILINGS. Provide minimum 1/2-inch gypsum wallboard where studs are 16" o.c. maximum. Provide minimum 5/8-inch gypsum wallboard where studs are greater than 16" o.c. Walls shall be taped and smooth finished. All ceilings shall receive an off-white blown-on acoustical finish. Water-resistant wallboard shall be used in wet areas such as bath, powder, and laundry rooms. Ceiling board must be rated for ceiling use by the manufacturer. Cementitious backer board shall be used for ceramic tile applications. 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.

5-9.1.1 GYPSUM BOARD CONSTRUCTION. All gypsum board shall be installed with screws, shall be manufactured in the United States and shall not contain asbestos. Provide metal corner beads on all gypsum board exterior corners.

5-9.1.2 As a part of the Base Bid, the stairwells shall be finished in their entirety.

5-9.1.3 All electrical devices such as wall-mounted receptacles and light switches shall be masked prior to gypsum wallboard taping to protect devices from wallboard compound entering the devices or touching sheathing on electrical wiring or cable.

5.9.2 FLOORING. TEXT DELETED. Provide suitable transition strips between changes in adjacent flooring material. TEXT DELETED. Refer to the Architectural drawings A101 - A108 for the Floor Finishes Schedule, Betterments, and additional information.

5-9.2.1 STAIRS. Interior stairs shall be softwood with carpeted treads and risers.

5-9.2.2 SHEET VINYL. Sheet vinyl shall conform to ASTM F1303, Standard Specification for Sheet Vinyl Floor Covering with Backing, Type I, Grade 1, Class B. Wear layer shall be urethane/PVC containing 90% binder. Flooring shall be installed as a monolithic material with seams heat welded. Provide material equal to the following:

Congoleum "Ovations" 12-foot width, 10-year limited warranty.

5-9.2.3 CERAMIC TILE. Ceramic tile shall conform to ANSI 137.1, moderate grade and shall be lead-free. Ceramic tile shall be installed in compliance with the latest edition of the "Handbook for Ceramic Tile Installation" published by Tile Council of America, Inc., and each installation shall be in conformance with

applicable standards for the type of floor and wall construction provided. Ceramic tile shall be installed on shower floors and walls, except at accessible residences, and bathroom walls at master bathroom tubs (to a minimum height of 6-feet above the adjacent finish floor) including walls around tubs in non-accessible master baths.

Ceramic tile shall also installed above all kitchen counters and below the wall cabinets and behind ranges from the counter height to the bottom of the range hood.

5-9.2.3.1 CERAMIC PORCELAIN TILE. As a part of the Government desired betterments in the bid schedule, provide ceramic porcelain floor tile where shown on the drawings. Tile shall be a stone pattern, minimum 12" x 12" in size. Install in a thin-set mortar to match the level of the laminate flooring. Tile shall have the following characteristics:

Water Absorption: ASTM C373 0.1% max.
 Abrasive Wear: ASTM C501 200 min.
 Breaking Strength: ASTM C648 300 lbs. min.
 Bond Strength: ASTM C482 200 psi min.
 Coefficient of Friction: ASTM C 1028 0.6 dry (min.); 0.5 wet (min.)

5-9.2.4 CARPET. As part of the base bid, Carpet shall be Mohawk Aladdin Saxony, solid color, 100 percent polyester, with polyester primary and secondary backing, heatset, yarn weight of 38 ounces per square yard, 0.125-gauge, 3500 minimum density, with 10-year limited lifetime warranty or equal.

5.9.2.4.1 CARPET PADS. Carpet pad shall be ½-inch bonded urethane, minimum 6-pound density. Urethane pad will conform to ASTM.D.3676.

5-9.2.4.2 CARPET EDGING. Carpet edging shall be 1-1/2-inch minimum width floor flange and minimum 5/8-inch wide face.

5-9.2.4.3 CARPET STRIPS. Tackless strip shall be exterior grade Douglas Fir plywood, with minimum dimensions of 1-1/8 inches wide suitable for the cushion thickness specified. Tackless strips with two or three rows of staggered pins shall be used. For areas over 20 feet 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.

5-9.2.5 HARDWOOD FLOORING. As a betterment to the contract, the Offeror shall furnish and install hardwood flooring as indicated on the Drawings, complete with all required trim and accessories in accordance with the manufacturer's installation instructions, including wood base, base shoe molding, and reducer strips as required. All edges against dissimilar materials must incorporate a matching hardwood transition strip.

5-9.2.5.1 Hardwood flooring shall comply with NOFMA grading rules for species, grade, and cut. All materials shall carry NOFMA grade stamp. All materials shall be from one source and shall be of consistent quality, appearance and physical properties.

5-9.2.5.2 Products:

1. Provide one of the following manufacturers:
 - a. Harris Tarkett
 - b. Robbins
 - c. Bowen

2. Species: Red oak.
3. Grade: No. 1 clear.
4. Cut: Plain sawn.
5. Thickness: ¾-inch (19 mm).
6. Width: 2-1/4 inches.
7. Length: Manufacturer's standard random.
8. Edges: Square tongue and groove.
9. Matching: End matched.
10. Finish: Unfinished, for field-applied finish.
11. Backs: Channeled (kerfed).
12. Random Lengths: Standard random-length strips.

5-9.2.5.3 Finishing Materials:

1. Urethane Finish System: Complete system of compatible components that is recommended by finish manufacturer for application indicated.
 - a. Type: Water-based.
 - b. Stain: Penetrating and nonfading type, ultraviolet (UV) stable as recommended by urethane finish manufacturer for compatibility. Color: light oak.
 - c. Floor Sealer: Pliable, oil-based, penetrating type, as recommended by urethane finish manufacturer for compatibility.
 - d. Clear Finish Coats: Formulated for multicoat application on wood flooring.
2. Application: Minimum of 3 coats, 4 mil D.F.T. each.
3. Wood Filler: Formulated to fill and repair seams, defects, and open-grain hardwood floors; compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved samples, provide pigmented filler.

5-9.2.5.4 Felt Underlayment: Where strip or plank flooring is nailed to solid-wood subfloor, install flooring over a layer of asphalt-saturated felt stapled in place with minimum 3-inch overlaps. Run underlayment tight to stud partitions, as detailed on Drawings.

5-9.3 PAINTING. Finishes shall be lead free. All interior surfaces, except factory prefinished material, shall be painted a minimum of one prime coat and one finish coat.

5-9.3.1 WALLS. Walls in all rooms and all painted trim shall be painted with eggshell enamel. Colors shall be Post standard colors. All interior wall surfaces shall be painted with off-white paint equal to Sherwin Williams SW-1018. All ceilings, except basement study rooms, shall receive an off-white blown-on acoustical finish.

5-9.4 TRIM. As a part of the base bid, provide TEXT DELETED painted wood door casing, floor bases and other trim as required. All base shall be TEXT DELETED painted solid wood, 3 inches high with quarter-round base shoe. TEXT DELETED

5-10 GARAGES. Provide an attached double car garage for each residence as indicated on the floor plans in the RFP. Garage floors shall be concrete and have a construction joint installed between the garage floor slab and the driveway. Slope slabs to drain out the garage door. Garages shall be uninsulated except on walls and ceiling areas adjacent to heated spaces. Garage doors shall have

hardware that can be opened and locked from inside and outside of the garage. As part of the Base Bid, all interior walls and ceilings in garages shall be finished with gypsum board and shall be fire-taped finished in conformance with the applicable codes. The garage walls shall be completely finished with paint. The ceilings shall be completely finished with acoustical texture blown-on finish.

5-11 ROOFING AND DRAINAGE. Minimum slopes for roofs shall be 1:3.

5-11.1 ROOF WATER. Seamless guttering and downspouts shall be provided for all roof areas. Downspouts draining onto a lower roof shall have metal or plastic splash deflectors. Concrete splash blocks shall be provided under downspouts. No downspouts shall be drained across sidewalks or driveways. Provide 4-inch PVC drainage sleeves under walks if downspouts are unavoidable.

5-11.2 ROOF SURFACE. Roofing shall be limited to the following:

5-11.2.1 Minimum of 225-pound Class A wind-resistant fiberglass shingles conforming to ASTM D3018, Specification for Class A Asphalt Shingles Surfaced With Mineral Granules. Provide a 25-year warranty on roofing shingles. Roofing shingles shall be Tamko Elite Glass-Seal or equal. Color shall be "Rustic Black."

5-11.3 ROOF CONSTRUCTION.

5-11.3.1 Roof shingles shall be nailed (pneumatic nailing is permitted). Staples are not allowed.

5-11.3.2 Roof shingles must be installed per manufacturer's recommendations.

5-11.3.3 Do not install shingles when it is too windy.

5-11.3.4 Do not install shingles when temperature will not allow self-stick surfaces to adhere.

5-12 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 screen walls, and garages will match the primary dwelling unit. In order to create variety in the appearance of the neighborhood and along individual streets, a variety of exterior color schemes for the units shall be incorporated. Stucco, concrete, and aluminum siding are not permitted. The following siding materials are the only materials permitted for use.

5-12.1 BRICK. In addition to the vinyl siding required by the base bid, as a betterment, provide brick veneer to each unit as indicated on the drawings provided with this RFP. Brick shall conform to ASTM C216, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale). Provide brick cap and flashing for all offset brick veneer. Brick shall start three courses above the finished grade.

5-12.1.1 Brick color, finish and hue shall vary between adjacent units. Provide a minimum of two different brick colors for this Project.

5-12.2 VINYL SIDING. As part of the Base Bid, the Contractor shall furnish vinyl siding on all residences as shown on the RFP drawings. Vinyl siding shall be "American Legend Vinyl Siding" as manufactured by Wolverine Siding, Valley Forge, PA or an approved equal. Installation of the vinyl siding shall be in accordance with the manufacturer's printed instructions.

5-12.2.1 Siding Profiles. Siding profiles shall be horizontal patterns in double

4-inch clapboard and single 8-inch widths as shown on the RFP drawings. Vertical joints in the siding shall be kept to minimum, and full-length segments of siding shall be used at all exterior wall areas less than 12-feet in horizontal width. At exterior wall areas greater than 12-feet in width, the contractor shall indicate all vertical joint locations on the design drawings for approval. All vertical joints should have a wall stud or solid blocking behind the joint in the framed wall and should be staggered in accordance with the manufacturer's printed instructions

5-12.2.2 Siding Finishes. Siding finishes shall be selected by the Contracting Officer from samples submitted by the Contractor from the manufacturer's standard finishes.

5-12.2.3 Siding Colors. Siding colors shall be selected by the Contracting Officer from samples submitted by the Contractor from the manufacturer's standard finishes. Refer to paragraph 5-1.3 regarding housing unit variation.

5-12.2.4 Siding Design. Siding panels shall be formed to provide post-formed full-length edge interlock, so that after installation, fasteners will be concealed from view. All siding fasteners shall align and connect with wall studs in the framed wall.

5-12.2.5 Siding Accessories. Siding accessories may be utilized that are compatible with siding styles, profiles and colors. Accessory products may include installation components, soffits, window and door trims, corner lineals, corner systems and decorative moldings.

5-12.2.6 Siding Technical Standards. Siding products shall be produced in compliance with the ASTM D 3679 specification for Rigid Polyvinyl Chloride (PVC) siding.

Siding shall meet the weathering standard in ASTM D 3679 using ASTM D 1435 procedures.

Double siding shall be tested per ASTM D 5206 standard test method for windload resistance to withstand negative and positive windloads in compliance with the applicable International Building Code (IRC) requirements.

Siding products shall be in compliance with the following ASTM Fire and Smoke procedures and meet or exceed the applicable International Residential Code (IRC) and National Fire Protection Association (NFPA) requirements: ASTM E 84; ASTM D 1929; ASTM E119; ASTM D635; NFPA 268.

5-12.2.7 Siding Warranty. Siding products shall be provided with a transferrable lifetime warranty.

5-12.3 TRIM ELEMENTS. Provide prefinished trim elements and accessories to match siding as recommended by the siding manufacturer. All exposed wood is to be primed and painted.

5-12.3.1 Wood fascia and rakes shall be 1-inch nominal boards with solid blocking or 2-inch nominal boards without blocking. Plywood, hardboard, or gypsum board is required on the base bid. Cover fascia, rakes, and soffits with prefinished vinyl accessories to match siding in accordance with the vinyl siding manufacturer's printed instructions.

5-12.3.2 Miscellaneous trim such as window trim, door sills and window sills shall be covered with prefinished vinyl to match siding.

5-12.3.3 Front porch and step railings and balusters shall be prefinished steel

or composite plastic. Finish shall carry a 10-year warranty. The Offeror will select a railing style appropriate to the character of the residence. The style may vary between duplexes and this variation may be used to develop variation in the exterior appearance.

5-12.3.4 Ornamental Columns at Porch. Column shall be manufactured from cast stone, fiberglass, or composite material with minimum 8-inch size. 10-year warranty on the finish. Column shall be self-supporting and load-bearing. The style of the column, base and capitol shall be the contractor's option but shall be compatible with the porch railing. The style may vary between duplexes and this variation may be used to develop variation in the exterior appearance.

5-12.4 EXTERIOR CEILING AND SOFFITS. Exposure of roof framing and underside of roof/floor decks is not permitted. Exterior porch ceilings and roof eave soffits shall be pre-finished vinyl accessories to match the vinyl siding for the base bid.

5-12.5 REAR PATIOS. Concrete patios shall be provided and shall be sloped to drain away from the unit, with a broom-finished concrete floor surface. Concrete steps integral to the patio shall be furnished as shown on the Drawings. TEXT DELETED.

5-12.5.2 The rear patios shall be screened from each other and other units by a portion of the house or by a privacy screen wall as indicated. The privacy screen wall shall be included in the base bid and shall be constructed of the same materials as the main structure. A wood fence is not permitted.

5-12.6 PORCHES. Porches floors 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 (cedar) decks, where indicated on the drawings should be sealed not stained or painted. Steps shall be integral to the porch and shall be concrete and have railings and shall be a minimum of 48 inches wide. Porches shall be covered with roofs. Provide a roof over the entire porch as shown on the partial Roof Plan indicated on each Second Floor Plan.

5-13 WINDOWS. Window units shall be equal to: Capitol 7500 Series, double-hung, thermally broken extruded aluminum frame with tilt-in sashes, simulated divided lite, insulated glass, and insect screen. The window specified meets the following industry standards: AAMA/NWWDA 101/I.S.2-97 and ASTM F 588-97. The following specific criteria were met: NFRC overall design pressure testing (25), ASTM E330 structural testing (less than 0.4 residual deflection at a test pressure of 37.5 lb/sq ft), operating force (less than 30 lbs), ASTM E547 air infiltration testing (leakage not to exceed 0.25 cu ft/min/sq ft at a test pressure of 1.57 lbs/sq ft), ASTM E547 water resistance testing (no leakage when tested in three cycles of five minutes ea, with a one minute rest period between cycles at a test pressure of 3.75 lbs/sq ft), ASTM F 588-97 forced entry testing (passed), and ASTM 588-97 deglazing testing in operating direction at 70 lbs and remaining direction at 50 lbs. The Government will allow aluminum-clad wood, vinyl-clad wood, and solid-vinyl windows provided they meet all of the above salient characteristics.

5-13.1 Interior window trim and stools shall be solid-wood, paint-grades with a minimum thickness of 3/4-inch. Contractor to furnish wood blocking above the window heads for attachment of curtain rods.

5-13.2 All residences shall incorporate windows as shown on the RFP Drawings. Windows must be sized equal to, or larger than those shown on the Drawings, and must always comply with the requirements of the

International Residential Code (IRC).

5-13.3 In addition, windows shall be furnished for the entry vestibule areas, the stairwells, the hallways, and the general basement area, as indicated on the RFP Drawings.

5-13.4 Windows in sleeping rooms shall incorporate one operable window for emergency escape or rescue, in accordance with the Uniform Building Code. Escape or rescue windows shall have a minimum net clear openable area of 5.7 square feet. The sill height of the openable escape or rescue window shall not be more than 44 inches above finished floor.

5-13.5 Windows installed in the handicap accessible units shall also comply with the following ADA requirements:

- Operating heights for hardware accessible to the handicapped.
- Hardware specifically designed for use by the handicapped.
- Amount of force required to operate sashes and ventilators.
- Clear space in front of windows to accommodate wheelchairs and permit access to hardware and operable sashes and ventilators for users with disabilities.

5-14 NOT USED

5-15 WINDOW TREATMENTS. Provide horizontal 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. Vertical blinds shall be provided and installed at all patio doors.

5-16 NOT USED

5-17 DOORS. See Table 7-1 for thermal performance requirements for exterior doors.

5-17.1 ENTRANCE DOORS. The residence primary entrance door shall be 3 ft-6 inches in width by 6 ft-8 inches in height by 1-3/4 inch thick, thermal metal. Other residence entrance doors should meet this requirement but may be of 3-foot width. Sliding glass doors are not permitted. Incorporate a small insulated-glass area in each exterior door with curtain rods.

5-17.1.1 ENTRY DOORS. Main entry doors shall be equal to: Responsive Door "Energy-Building" steel door, 42 inches wide, prehung, 6-panel, 26-gauge with solid polyurethane core, primed and ready for field painting.

5-17.1.2 STORM DOORS. Storm doors shall be equal to: Columbia "New Crown" storm door, 42 inches wide, self-storing, 11-1/4-inch master frame. Marine glazed tempered glass with solar tint.

5-17.1.3 PATIO DOORS. Patio doors shall be equal to: Therma-tru "Smooth Star" flush glazed, Model S2010, compression-molded fiberglass on solid urethane foam core.

5-17.2 GARAGE DOOR. Garage doors shall be painted 24-gauge galvanized steel with embossed finish and stamped raised-panel design. Provide manufacturer's standard full-view glazed panels. Doors on non-accessible units shall be manually operated and complete with tracks, bottom seal, counterbalance and lock. Doors on accessible units shall have a power-operated opener. Provide two remote operators per door. Finish on door shall have a "lifetime" finish warranty.

5-17.2.1 Garage doors shall be equal to: Overhead Door Corp. 281 Series, white.

5-17.3 ALUMINUM SCREEN AND STORM DOORS. Screen and self-storing storm doors shall be provided for all residence exterior hinged doors. Frames shall be a minimum of 1-1/4 inches thick and 2 inches wide. Aluminum alloy materials shall be not less than 0.05-inch thick and 2 inches wide. Doors shall have solid bottom panels and midsection protective grills. Screening materials shall be nonferrous.

5-17.4 INTERIOR DOORS. Interior doors shall be a minimum of 3 feet wide, except that closet and bathroom doors may be 2 ft - 6 inches wide. Interior doors shall be a minimum of 6 ft - 8 inches in height by 1-3/8-inch thick, six-panel pressboard. All doors will be painted.

5-17.5 ATTIC ACCESS DOOR AND FRAME. Provide a lockable steel flush access door and frame located in a hallway ceiling of each residence for maintenance access only to the attics. The door size shall be 3-foot x 3-foot and shall be minimum 0.060-inch thick sheet steel set flush with the surrounding surface. The frame shall be minimum 0.060-inch thick sheet steel with exposed flange set flush with the surrounding surface. Hinges shall be concealed spring-loaded pin-type. Locks shall be a key-operated cylinder lock with interior release.

5-18 BUILDER'S HARDWARE. All provided hardware shall have the same finish. Hinges, locks, and latches will comply with the specifications indicated in Table 5-2, and the following subparagraphs:

TABLE 5-2 - HARDWARE SPECIFICATIONS

| Hardware Type/ Specification | Specific Requirements |
|--|---|
| Hinges BHMA 101 | 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. Minimum 3 per door. |
| Locks & Latches BHMA 601 | Series 4000, Grade 2. Provide trim of wrought brass, aluminum, or stainless steel. |
| Auxiliary Locks BHMA 501 | Series 4000, Grade 2. Provide matching trim of wrought brass, aluminum, or stainless steel. |
| Interconnected Lock & Latches BHMA 611 | Grade 2. Provide matching trim of wrought brass, aluminum, or stainless steel. |
| Closers BHMA 301 | Series C02000, Grade 2. |

5-18.1 LOCKS AND KEYS. Provide a master keying system. Locks for each residence, including garage door, shall be keyed alike. The Contractor shall provide one extra set of cores for each 50 residences 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 (BHMA) listed above. TEXT DELETED.

5-18.1.1 Front and back door locks, interior garage door, and garage door

cylinders must be Best Lock Corporation's Model 62K7AB4D-STK-612-RH, Brass Finish, M-keyway, interchangeable core, entrance locks. Key locks so that one key operates all locks in a unit. Prior to purchase, contact the Contracting Officer and locksmith for make and model numbers.

5-18.2 WEATHERSTRIPPING AND EXTERIOR THRESHOLDS. Provide nonferrous metal or vinyl weatherstripping for all residence exterior doors. Vinyl magnetic weatherstripping is acceptable for metal doors. Exterior thresholds shall be nonferrous metal. Low-rise thresholds shall be furnished for the accessible units.

5-18.3 APPLICATIONS. Locks and hinges shall be applied as follows:

5-18.3.1 Exterior hinged doors shall have 1-1/2 pair of hinges, lockset, and an auxiliary lock or interconnected lock and latch,

5-18.3.2 Interior hollow-core doors shall have two hinges and latchset with BHMA 601, F75 or F76 operations.

5-18.3.3 Doors in fire-rated walls, residence to garage, shall have 1-1/2 pair of ball-bearing hinges, lockset, auxiliary lock or interconnected lock, and closers.

5-18.3.4 Bathrooms. Doors of all bathrooms shall be provided with privacy locks.

5-18-4 VIEWPORT. Each windowless entrance door shall be provided with a through-door 180-degree viewer mounted at an eye level of approximately 5'-0" above the interior finish floor.

5-18.5 DOOR BELLS. Front entrances to each housing unit shall be provided with low-voltage door chimes. Provide an illuminated push button mounted on the exterior wall near the latch side of the entrance door. A locked storm door shall not prevent access to the door bell button.

5-19 BUILDING SIGNAGE.

5-19.1 ADDRESS. All new units shall be provided with an address sign located beside the front door so that it is well illuminated by the porch light. The address sign shall have seven digits and 3-inch high reflective numbers on a colored background to match the unit's exterior trim color and shall be installed in accordance with the Installation Design Standards.

5-20 CABINETS. Kitchen and vanity cabinets shall be 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 handles 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 and vanities shall be essentially of the same construction and appearance.

5-20.1 CABINET CONSTRUCTION. Cabinet design and construction shall conform to ANSI 161.1 and the requirements herein. Standard construction plywood shall conform to PS 1. Softwood lumber shall conform to PS 20. Hardwood plywood shall conform to PS 51. Particleboard shall conform to ANSI A208.1 or CS 236, Type 2, Grade B, Class 2. All hardwood shall be kiln-dried clear oak. Wall-hung cabinets shall be 12 inches deep. Kitchen base cabinets shall be 24 inches deep and 34-1/2 inches high at non-accessible housing units. Refer to Paragraph 5-1.2 for cabinet design requirements at accessible housing units.

5-20.1.1 Fronts and Framing. Cabinets shall have 3/4 inch thick by 1-1/2 inch

wide (minimum) hardwood flush framed fronts and framing members. Fronts and framing members shall be mortised and tenoned, dovetailed, doweled or biscuited and glued together. Top and bottom corners shall be braced with hardwood blocks that are glued and fastened in place, or an approved equal design.

5-20.1.2 Bottoms, Backs, Ends and Tops. Bottoms and ends of base and wall cabinets shall be $\frac{1}{2}$ inch hardwood plywood. Bottoms of base cabinets shall be braced with solid wood members glued and fastened in place. Backs of base and wall cabinets shall be $\frac{1}{4}$ inch hardwood plywood. Tops of wall cabinets shall be $\frac{1}{2}$ inch hardwood plywood.

5-20.1.3 Shelves. Shelves shall be $\frac{3}{4}$ inch hardwood plywood or $\frac{3}{4}$ inch particleboard and have a hardwood nosing and veneer on both sides. Shelves shall be vertically adjustable in 1-1/4 inch increments and be supported on the ends and on 24 inch centers. Shelf support rails, if used, shall be mortised into cabinet ends. Unless otherwise indicated, all base cabinets, except sink base cabinets, shall have one full width and depth shelf. Unless otherwise indicated, all wall cabinets, except over range and refrigerator wall cabinets, shall have two full width and depth shelves.

5-20.1.4 Roll-out Trays. Roll-out trays shall have $\frac{3}{4}$ inch thick by 1-1/2 inch wide (minimum) hardwood sides with $\frac{1}{4}$ inch hardwood plywood bottoms. Bottoms shall be rabbeted into the sides, fastened and glued.

5-20.1.5 Lazy Susans. Lazy Susans shall have two 28 inch diameter metal shelves that rotate with the doors attached. Shelves shall be designed to support 15 pounds per square foot, with maximum loading not to exceed 50 pounds per shelf. Shelf edges shall be turned up to prevent contents from sliding off during rotation.

5-20.1.6 Doors and Drawer Fronts. Door and drawer front designs shall be selected by the Contracting Officer from samples provided by the Contractor. Cabinet door and drawer fronts shall be designed for concealed hinges and one-half inch overlay.

5-20.1.6.1 Raised Panel. Doors shall have $\frac{3}{4}$ inch thick hardwood frames and 5/8 inch thick (minimum) hardwood raised panel inserts. Drawer fronts shall be $\frac{3}{4}$ inch thick hardwood. Routed finger pulls shall be provided on the backside of door and drawer fronts. Finger pulls shall be at the top of door and drawer fronts on base cabinets and at the bottom of wall cabinets.

5-20.1.7 Drawers. Drawer sides shall be $\frac{1}{2}$ inch hardwood. Drawer bottoms shall be $\frac{1}{4}$ inch hardwood plywood.

5-20.1.8 Hardware. Hardware shall conform to ANSI A156.9. Hardware shall be corrosion resistant steel or brass, and the finish and design selected by the Contracting Officer from samples provided by the Contractor. Hinges shall be concealed self-closing European type with a minimum 120 degree swing. Drawers and roll-out trays shall have nylon rollers and be mounted on 20-gauge steel drawer guides, both with a factory-applied baked epoxy enamel finish. Slides and guides shall be full extension and have 100 pound minimum load capacity.

5-20.1.9 Finish. Wood cabinets shall have a factory-applied natural wood finish selected by the Contracting Officer from samples provided by the Contractor. Cabinet finish shall consist of one coat of hand wiped quality wood stain; one coat of penetrating sealer; and two coats of a conversion varnish, or an approved equal finish system. All surfaces shall be sanded between coats. All interior and exterior cabinet surfaces shall be finished.

5-20.1.10 Toe Kick Cover Strips. Toe kick cover strips shall be $\frac{1}{4}$ inch hardwood

plywood finished to match cabinets and furnished in 8 foot lengths for placement after base cabinet installation. Also shoe molding (1/4 round) is required at all base cabinets where they meet the floor surface.

5-20.1.11 Pantry. Provide 12-inch deep, floor-to-ceiling pantry cabinet in each kitchen with five (5) adjustable shelves.

5-20.1.12 Kitchen Glass Panels. Provide glass panels in one upper cabinet (one pair of doors) in the Kitchen.

5-20.2 COUNTERTOPS. Countertops finish may be high pressure laminated plastic with post-formed tops. Minimum backsplash height is 4 inches.

5-20.2.1 Countertop Construction. Countertops shall be constructed of 3/4 inch particleboard conforming to ANSI A208.1 or CS 236, Type 2, Grade B, Class 2; and high-pressure plastic laminate sheet, not less than 0.042 inch thick, conforming to FS L-P-508 and NEMA LD 3; and be 25 inches front-to-back. Splices will not be allowed on countertops 12 feet or less long. Countertops shall be self-edged without an integral back splash. Countertops shall consist of high-pressure plastic laminate sheet cut, fitted and trimmed, to fit all exposed top surfaces. Countertops may be post-formed to meet this requirement. Edge treatments shall consist of 3mm thick PVC cut, fitted and trimmed, to fit all exposed countertop edges. Colors and patterns of high-pressure plastic laminate and PVC edge treatment shall be selected by the Contracting Officer from samples provided by the Contractor.

5-20.2.2 Sealer. Sealer shall be used to seal raw edges and areas of countertop core at miters, seams, sink cut-outs and dishwashers and shall conform to FS TT-S-176. Apply two coats of sealer to the exposed bottom of new countertops directly above dishwashers from the front edge of the countertop back 6 inches.

5-20.2.3 Sealing Compound. Sealing compound to be used to seal under sink rims and at joints between walls, back splashes and end splashes shall be paintable, non-hardening silicone rubber base sealant which conforms to FS TT-S-1543.

5-21 APPLIANCES. Provide the following equipment in accordance with specifications listed, one each per residence. A listing of currently labeled Energy Star appliances is available through the internet at the EPA Website: <http://www.energystar.gov/products/appliances.html>.

5-21.1 REFRIGERATORS. Comply with UL 250, Household Refrigerators and Freezers and shall bear the EPA "Energy Star" certified label. Provide refrigerators with frost-proof, top freezer, automatic defrosting, and ice maker. 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. Provide baked enamel finish. 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. Connect the icemaker to the building water service. Minimum refrigerator volume and maximum energy use are as follows:

5-21.1.1 Volume: 0.58 CM, 21 CF

5-21.1.2 Energy Efficiency: 722 kWh/yr.

5-21.1.3 Standard Housing Units: Contractor shall furnish a refrigerator, GE Model GTS22KCMWW, 21.7-cubic-foot top freezer with factory-installed icemaker, color white or equal. Provide 40 inches wide space for refrigerator.

5-21.1.4 Accessible Housing Units: Contractor shall furnish a refrigerator, GE Model GSS20DBMWW, 19.8-cubic-foot side-by-side refrigerator and freezer with factory-installed icemaker, color white or equal. Provide 40 inches wide space for refrigerator.

5-21.2 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. At Standard Housing Units, provide free-standing gas ranges and ovens. At the Accessible Housing Units, provide electric drop-in ranges and ovens. Also, the Accessible Housing Units shall be provided with capped gas piping stub-outs in the walls at the oven and range locations for future adaptability.

5-21.2.1 Standard Housing Units: 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. Furnish GE Spectra 30 freestanding XL44, Model JGBP28WEAWW, gas, self-cleaning, with sealed burners, electronic clock and timer, or equal.

5-21.2.2 Accessible Housing Units: Electric ranges shall have two, 150 mm (6-inch) and two, 205 mm (8-inch) coil heating elements and porcelain drip bowls, a self-cleaning oven, electronic oven controls, standard window, lift-up porcelain cook-top, . Furnish GE 30" Drop-in Electric Range with Self-Cleaning Oven, Model JDP39WWWW, or equal.

5-21.3 MICROWAVE OVENS. "User-furnished"

5-21.4 RANGE HOODS. Provide metal range hoods, the same length and finish as the range, with separately switched light and exhaust fan. The hood shall have a washable filter and be vented directly to the outside, not the attic. The fan shall be two-speed and shall have a capacity of not less than 78.7 L/s per meter of range hood (50 cfm per linear foot of range hood). The sound level shall not exceed 6 sones. Provide GE Profile 30, Model JV535CWW or equal. Provide stainless steel finish. Duct the fan to the exterior; also, refer to Section 01010, paragraph 10-6.3 for additional information.

5-21.5 GARBAGE DISPOSALS. Garbage disposals shall conform to UL 430 and ASSE 1008; 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. Furnish Insinkerator Model Badger 5, or equal.

5-21.6 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. Furnish GE Model GSD4500GWW, white, or equal.

5-21.7 COLOR. Kitchen appliances, except disposals, shall be of matching finish, white in color.

6. UNIT DESIGN - STRUCTURAL.

6-1 SELECTION OF STRUCTURAL SYSTEMS AND MATERIALS. The structural systems and materials to be selected for the design of the residences will be suitable for permanent-type construction; capable of carrying the required loads; and compatible with fire protection requirements, and architectural and functional concepts. Materials may be of any of those listed in table 6-1, or any combination, selected for desirability, economy, general availability, low maintenance costs over the design life of the residences, and resistance to fire.

- a. Design Considerations. It is required at the inception of the design that the structural system layout be properly coordinated with the architect to develop an overall effective plan. Installation of water lines, soil, waste, vent and drain lines may have ramifications for the selection of structural members by the designer, however relocation of plumbing fixtures from the locations depicted on the RFP drawings will not be allowed. Columns will be allowed in the garages. However, if columns are provided, the contractor shall provide and install two standard 8'-0" width garage doors. No columns will be allowed in the great room to reduce the span required.
- b. The Design-Build Contractor will establish the type of structure and construction used. In selecting the type of structural system, the total facility should be considered, since the choice will influence such features as heating, ventilation or air-conditioning, as well as architectural, lighting, and utility requirements.
- c. Structural Materials. When choosing structural materials for a specific Project, consideration will be given to:
 - (1) Availability of labor and materials.
 - (2) Design life of the facility and maintenance costs over this period.
 - (3) Feasibility of preassembling or precasting major structural elements.
 - (4) Site environment, including accessibility, climate, seismic hazard, subsurface conditions, and wind velocity.
- d. The structural floor systems shall be wood-framed construction with a crawl space below the first floor or each housing unit except at the following areas: garages and in-residence tornado shelters. The structural floor system at the garages shall be reinforced concrete slabs on grade. The structural floor system at the in-residence tornado shelters shall be in conformance with FEMA requirements. Refer to paragraph "TORNADO SAFE ROOMS" above for information regarding tornado safe rooms.

6-2 STRUCTURAL DESIGN REQUIREMENTS.

- a. Design Codes. Design methods and stress allowances or load factors for the various structural materials will be according to the 2003 International Residential Code and the current editions of the codes and specifications listed below.

TABLE 6-1 STRUCTURAL DESIGN METHODS AND STRESS ALLOWANCES

Materials Codes or Specifications

| | |
|----------|---|
| Aluminum | The Aluminum Association (AA), "Specifications for Aluminum Structures" |
| Concrete | American Concrete Institute (ACI), "Building Code Requirements for Reinforced Concrete" |

| | |
|------------------------------|---|
| Masonry | American National Standards Institute (ANSI), "American Standard Building Code Requirements for Reinforced Masonry" Brick Institute of America (BOA), "Recommended Building Code Requirements for Engineering Brick Masonry" National Concrete Masonry Association (NCMA), Specifications For the Design and Construction of Load Bearing Concrete Masonry" |
| Precast-Prestressed Concrete | Prestressed Concrete Manuals |
| Steel | American Institute of Steel Construction (AISC), "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" Steel Deck Institute (SDI), "SDI Design Manual for Composite Decks, Form Decks, and Roof Decks" |
| Steel Joists | Steel Joists Institute (SJI), "Standard Specifications and Load Tables, Open Web Steel Joists and Longspan Steel Joists," and similar publications covering deep longspan steel joists |
| Steel, Light Gage | American Iron and Steel Institute (AISI), "Specifications for the Design of Cold-Formed Steel Structural Members" "Design of Cold-formed Load-bearing Steel Systems and Masonry Veneer/Steel Stud Walls," TI 809-07 |
| Welding | American Welding Society Codes, Standards and Specifications |
| Wood | National Forest Products Association, "National Design Specifications for Stress Grade Lumber and its Fastenings" Truss Plate Institute (TPI), "Design Specification for Metal Plate Connected Wood Trusses" American Plywood Association (APA), "APA Design/Construction Guide " |

- b. Design Dead, Live, Snow and Wind Loads. The load assumptions for the design of buildings and other structures will conform to ASCE 7-98, "Minimum Design Loads for Buildings and Other Structures."
- c. Seismic Design. The seismic design of the new residences will be according to FEMA 302, "NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures". Use site class "D", $S_s = 0.13$, $S_1 = 0.06$ for seismic calculations. Acceptable lateral force resisting systems will be any of those listed in table 5.2.2 of FEMA 302. Wood framed structures with panel diaphragms and shear walls will be classified as light frame walls with shear panels. Light gage metal framing which uses tensioned diagonal bracing will be classified as ordinary steel concentrically braced frames.
- d. Design Dead Loads. Use actual weights of materials. For mechanical equipment, use weight of actual equipment plus a ten percent increase for future replacements.
- e. Design Live Loads. Use 40 psf for the floor live load. Use 60 psf for the floor live load at exterior cantilevered balconies if used. Uninhabitable attics will be designed for a live load of 10 psf. A minimum roof live load of 20 psf for maintenance and construction will be used.

- f. Climatic Considerations. Use a 20-psf ground snow load for determining snow loads. Use 90-mph design wind speed for determining wind loads. Foundations and utilities shall be located below the depth of maximum frost penetration. Minimum depth for heated structures is 34 inches. Minimum depth for unheated structures is 45 inches.
- g. Tornado Shelter Design. Provide tornado shelter design as described in Section 5-4.6, Tornado Safe Rooms

6-3 STRUCTURAL DESIGN DEVELOPMENT

- a. Building Design. Lateral structural design and siting considerations may conflict with functional considerations in building design. For instance, shear walls may limit horizontal flexibility and diaphragms may limit vertical circulation.
- b. Building Configuration. Lateral loading considerations may require limits on the height of structures and design configurations. It must be noted that the building configuration plays an important role in the performance of the structure when subjected to lateral wind and seismic forces. To obtain optimal lateral resistance and performance, a symmetrically configured structural framing system with effectively and efficiently placed lateral resisting elements (shear walls and braced frames) must be considered. Further, the nonstructural elements must be seismic and wind resistant in order to maintain the expected capability (against collapse or post-earthquake operations).
- c. Shelter Design for Tornado. Structures to be constructed in tornado areas will be designed so structural integrity and continuity are provided from the foundation to the roof, irrespective of the materials selected for the facility. All components of the structure must be tied positively together to establish an overall integrated resistance to high wind effects.

6-4 STRUCTURAL DESIGN CONSIDERATIONS

- a. If wind loading on the main lateral force resisting system and/or the components and cladding members are greater than the seismic loadings and thus the controlling forces that are used for structural design, the structural seismic detailing requirements given in FEMA 302 must also be used. Both wind and seismic loading for components and cladding must be investigated to determine controlling forces regardless of controlling loads on the main force resisting system.
- b. The tributary area "A" to be used in determining the exterior wind pressure coefficients for components and cladding shall be the actual loaded area of the structural element under consideration and not the entire area of the loading region in which the member resides. However, for rectangular tributary areas, the width need not be assumed to be less than one third of the length of the member.
- c. When determining the internal wind pressure coefficients for buildings, doors and windows shall be assumed opened or closed as required to produce the coefficients that will produce the greatest wind loadings, both inward and outward.
- d. When the design roof snow or snow on rain loading is less than 0.96 kN/sq m (20 psf), a roof live loading for construction and maintenance of 0.96

KN/sq m (20 psf) shall be used for the design of the structure. The minimum roof live load is used in lieu of and not in addition to the snow or rain on snow loading.

- e. The maximum net inward and outward loads used in the design shall be indicated on the contract drawings. The design engineer is responsible for calculating the wind loads based on the ASCE 7 wind load requirements. The component and cladding loads shall be calculated based on the tributary area of the member under consideration. A minimum tributary area of one square meter (10 sf) shall be used.
- f. Lateral Resistance. Walls used or required for lateral resistance to wind or earthquake shall be considered bearing walls and shall have a complete load path to the foundation.
- g. Embedded Steel. Nonstructural steel (handrails, etc.) embedded in concrete shall be prefinished galvanized steel or plastic. All damaged galvanized areas shall be repaired prior to embedment. In-house residence shelters shall be constructed as slab-on-grade in conformance with FEMA Standards as required by the Solicitation documents.
- h. Wood Flooring Systems. Wood flooring systems shall be glued and screwed. Glue lines shall not be considered for stress transfer.
- i. Subfloor. ¾-inch tongue and groove plywood, glued and screwed in place, is required for all rooms requiring a subfloor. ¾-inch tongue and groove plywood subfloor for wet areas (i.e., bathrooms, kitchens, laundry room, and utility rooms) is required and will be rated for Exposure 1 or exterior use.
- j. Underlayment: Sanded face underlayment (plywood) is required. Underlayment must be a minimum thickness of 8.7 mm (11/32 inches). Acceptable sanded face underlayment panels can be APA rated A-C, B-C, A-D, B-D, or C-C plugged. Underlayment should be rated for Exposure 1 or exterior use. Underlayment should be installed after interior finish work is complete to avoid damage to the underlayment.
- k. Construction Tolerances. Allowable variations from level, or specified slopes, shall be as follows:
 - For overall length, or surface of 10 feet or less: plus or minus 1/8-inch.
 - Up to 20 feet: plus or minus 1/4-inch.
 - Up to 40 feet: plus or minus 3/8-inch.

Walls are to be constructed straight, true, and plumb.
- l. Do not use keys in horizontal and vertical concrete construction joints. Specify the use of joints roughened to ¼-inch amplitude per ACI 318.
- m. All foundations are to be of reinforced, cast-in-place concrete.
- n. Use minimum 4,000 psi strength concrete measured at 28 days for all concrete work.
- o. Concrete stoops shall be provided at all exterior doors. All stoops shall have frost protection.

- p. Cast-in-place anchor bolt shall be used at all x-bracing or shear wall hold down locations. The use of expansion bolt anchors is not permitted for connections between elements of the main lateral force resisting system. Cast-in-place anchor straps are not allowed.
- q. Slab on grade construction shall be detailed so that the slabs are independent of the foundations and footings. A 6-inch sand cushion shall be provided between the bottom of the slab and any underlying foundation elements.
- r. Concrete Reinforcement: Fiber reinforced concrete is not an acceptable alternative to be utilized in this Project.
- s. Brick veneer with steel stud backup exterior wall systems shall strictly adhere to the criteria and detailing requirements of TI 809-05 and TI809-07.
- t. Steel or wood columns shall not be embedded over all or part of their height in CMU or concrete.
- u. CMU masonry shall be placed in running bond pattern only.
- v. In units where tensioned diagonal bracing is used, the stability of the structure shall not depend on any single connection. Redundancy shall be provided either by using multiple bays of tension only bracing members or by using members that are capable of resisting both tension and compression in the same bay.
- w. The use of field welding for connections between members of the main lateral force resisting system shall be avoided.
- x. The use of APA sheathing over light gage steel framing as structural roof or floor diaphragms is not allowed.
- y. Use of particle board for walls, floors, or roofs will not be allowed.
- z. If wood framing systems are selected for use on this Project, use APA's "Code Plus " system for walls, floors, and roofs.
- aa. Floor joists supporting plywood floor sheathing should be spaced no further than 16 inches on center.
- bb. Veneered plywood is to be used for walls, floors, and roofs. Oriented strand board (OSB) may be used at walls only.
- cc. If light gage steel is selected for the building's framing system, coordinate thermal requirements and detailing with HVAC system design. Brick veneer with steel stud backup exterior wall systems will strictly adhere to the criteria and detailing requirements of TI 809-05 and TI 809-07. The technical instructions are available in electronic form via the TECHINFO internet site <http://www.hnd.usace.army.mil/techinfo/>.

7. UNIT DESIGN - THERMAL PERFORMANCE.

7-1 THERMAL CHARACTERISTICS. Family 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^{1, 2}

| Weather Region | Wall ³ R Value | Ceiling/ Roof R Value ⁴ | Basement R Value ⁶ | Slab on Grade R Value ⁷ | Door R Value ⁸ | Glazed Openings U Value ⁹ | |
|----------------|------------------------------|--|----------------------------------|--|------------------------------|---|------------|
| | | | | | | Window | Door |
| 7 | 3.3 (19) | 6.7 (38) | 1.8 (10) | 0.9 (5) | 0.9 (5) | 2.2 (0.38) | 2.2 (0.38) |

Note¹: Metric R values are in square meter-kelvin (K)/watt. (English R values are bracketed, and are in square foot-degrees F/BTUH). ($R = 1/U$)

Note²: 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.

Note³: Requirements for opaque, exterior walls.

Note⁴: 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 percent of the ceiling was cathedral insulated to R-19, and then the required R-Value for the remaining roof would be:

$$(38 - 0.25 \times 19) / 0.75 = 44.33, \text{ or } R-45 \text{ (min).}$$

If metal framing is used, insulation between wall studs shall be derated per Table 8C-2 of ASHRAE 90.1 as follows:

| Size/Gauge of Member | Framing Spacing (inches) | Rating of Insulation (R) | Derated (R) Value |
|----------------------|--------------------------|--------------------------|-------------------|
| 2 x 4; 18-16 Ga. | 16" o.c. | R-13 | R-6.0 |
| | | R-15 | R-6.4 |
| 2 x 4; 18-16 Ga. | 24" o.c. | R-13 | R-7.2 |
| | | R-15 | R-7.8 |
| 2 x 6; 18-16 Ga. | 16" o.c. | R-19 | R-7.1 |
| | | R-21 | R-7.4 |
| 2 x 6; 18-16 Ga. | 24" o.c. | R-19 | R-8.6 |
| | | R-21 | R-9.0 |

Note⁵: Not used.

Note⁶: 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.

Note⁷: Requirements for perimeter insulation. Perimeter insulation shall extend downward to a total distance of 610 mm (24 inches) as described above.

Note⁸: Requirements for opaque doors in exterior walls (insulated metal).

Note⁹: Window requirements for double pane, low emissivity glass windows as specified in paragraph 5 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 shall be limited to 14 percent of the heated floor space. Solar Heat Gain Coefficient shall be limited to 0.55. Solar Heat Gain Coefficient 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. 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 5 percent of the Project buildings, which will be randomly selected by the Contracting Officer. If buildings are to be turned over in phases, the blower door test shall be

performed on 5 percent of the buildings completed in each 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 5 percent of the Project buildings shall be tested. This process shall continue until 100 percent of the total number of tested buildings pass the blower door test. All prototype 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 residences 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 residences.

8. UNIT DESIGN - PLUMBING.

8-1 Design and install plumbing system in accordance with the Ft. Riley Family Housing Guide, the International Residential Plumbing Code, American Society of Sanitary Engineering (ASSE), American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), Cast Iron Soil Pipe Institute (CISPI), Copper Development Association (CDA), Federal Specifications (FS), Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), Underwriters Laboratories (UL) and Military Specifications (MS). Perform inspection, testing and purging of the plumbing system as prescribed in the International Residential Code (IRC), International Fuel Gas Code (IFGC), American Gas Association (AGA), National Association of Home Builders (NAHB) and National Fire Protection Association (NFPA).

8-2 Water Piping. Limit under slab supply piping to residence service entrance only. Service line to each residence shall be no less than 25 mm (1 inch) diameter and shall include pressure-reducing valves. Size all water supply piping in accordance with methods outlined in the IRC, to limit water velocity in the pipe to 8 ft./sec unless a lower velocity is recommended by the plumbing fixture manufacturer(s). Do not route water piping in unheated spaces. Include an isometric diagram of the water system and the waste and vent system in the 100% design submittal after contract award. Allowable materials are listed below.

8-2.1 Copper tubing. All interior water piping shall be type K or L hard-drawn copper. Joints under the slabs are prohibited. Type M copper tubing shall not be installed. 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.

8-3 Soil, Waste, Vent, and Drain Piping. Soil, waste, vent, and drain, piping shall be cast iron or DWV PVC, if approved, suitable for installation in a residential waste, soil, vent, and drain system. Provide each fixture and piece of equipment, except water closets, requiring connection to the drainage system, with a trap. Provide deep seal trapped drain for cooling coil condensate drain. Building waste main lines shall be no less than 102-mm (4-inch) diameter. Size all soil, waste, and drain piping in accordance with the methods outlined in the International Residential Code. Offset water closet flanges are prohibited. Locate vents through roof on the back side of residence so as to not be visible from the front side of the unit. Install "Wye" connections for common drain lines between residences. Tee connections are not permitted. Use full-sweep, 90-degree ells in all drain connections.

8-4 Route piping concealed. All interior water pipe shall be routed concealed, except at the fixture connection. Install Individual shutoff or stop valves on water supply lines to all plumbing fixtures except bathtubs and showers. Install ball-type, 1/4-turn shutoff valves for each bathroom group. Connections to fixtures shall be copper. All vents through roof shall be on back side of residence. Avoid water piping in exterior and common walls.

8-4.1 Piping Location. Install water piping running in attics and spaces over garages on the warm side of insulation and wrap 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. Coordinate wall penetrations of interior tornado shelter with Federal Emergency Management In-Residence Shelter Requirements.

8-4.2 Pipe Support. Install hangers on all piping at intervals, horizontally and vertically, to conform with the IRC requirements. Install pipe hangers of such material and design as to rigidly secure piping without causing damage to the piping, fittings or insulation. Provide electrical bonding and grounding to conform to the National Electric code.

8-4.3 In Ground Shelter. Do not penetrate or route piping in walls of concrete reinforced interior shelter.

8-5 Gas Connections. Install schedule 40; black steel pipe, as specified in ASME B31.8 and conform to all aspects of NFPA 54 and ASME BPVC Section IV . The use of semi-rigid tubing and flexible connectors for gas equipment and appliances is prohibited. Provide accessible steel gas shutoff valve, with hand wheel or square wrench operator and coupling for each gas equipment item. Comply with IRC 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. Install entrance piping to ensure ample room for future meter installation at each residence. See paragraph 4 for gas line distribution requirements.

8-6 Plumbing Fixtures. Installation of soil lines may have ramifications for the selection of structural members by the designer, however relocation of plumbing fixtures from the locations depicted on the RFP drawings will not be allowed. Install residential type fixtures and trim complete with fittings, and chromium- or nickel-plated brass (polished bright or satin surface) trim. All fixtures, fittings, and trim in the Project shall be from the same manufacturer and shall have the same finish; faucets may be from a different manufacturer as the fixtures, fittings and trim, however, all faucets shall be from the same manufacturer for each of the new family housing units. Install metal (chrome plated or polished metal) corrosion resisting escutcheon plates at all water supply and drainpipe connections through walls or cabinets. Plumbing shall meet the following criteria:

8-6.1 Install water conservation type fixtures, free from defects and concealed fouling surfaces and in accordance with the International Residential Code.

8-6.2 Install chromium-plated type exposed traps, adjustable-bent tube, 20-gauge brass. Concealed traps may be material compatible with DWV piping.

8-6.3 Faucets shall conform to ANSI/ASME A112.18.1M and FS WW-F-1910. Single control faucets shall have all brass body and a single control to turn the water on and off and to regulate the volume and temperature of the flow. Install faucets designed so that the valve body has no wearing parts and all operating parts are easily renewed without disconnecting the faucet from the fixture on

which it is mounted or disconnecting the water supply lines. It shall have a water conservation device to control the volume flow to no more than 2.5 gpm regardless of water pressure. The faucet should be of a cartridge type design constructed so that all operating parts subject to wear are within the cartridge and are replaced as a single unit. The cartridge shall be interchangeable with any other single-control faucets used from the same manufacturer. The cartridge should also be so designed to take advantage of any back to back installations and allow a change in the polarity of the water without having to remove the cartridge or disconnect any water supply lines.

Lavatory - Moen Legend #4420 (single lever)4" center set with lift rod and waste assembly or approved equal. Install brass replacement cartridges by Moen, model #1200, or approved equal.

Kitchen - Moen Legend #7300 without spray or #7310 with spray (single lever)8" center set or approved equal. Install brass replacement cartridges by Moen, model #1200, or approved equal.

8-6.4 Install shower and bath combination controlled by a diverter valve. Install baths and shower and bath combinations with waste fitting pop-up, concealed with all parts removable and renewable through the overflow and outlet openings in the tub. Equip showers and shower and bath combinations 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). Install pressure balancing type control valves. Shower heads shall be the following makes and models to match existing post standards for availability of uniform parts, and ease of replacement.

Tub and shower - Moen Legend #L3189 (single lever) for shower/tub combinations or approved equal. Install brass replacement cartridges by Moen, model #1200, or approved equal.

8-6.5 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 conform to ANSI Z124. Enameled cast iron plumbing fixtures shall comply with ANSI A112.19.1, and enameled steel fixtures shall comply with ANSI A112.19.4.

8-6.6 Water closets. Water closets shall conform to ANSI/ASME A112.19.2m and shall have elongated bowl with inclined tank, close coupled, siphon jet flushing tank with floor outlet, wax gasket, and closed-front seat and cover. Water consumption shall be no more than 6 L (1.6 gal) per complete flushing cycle and have a Flush Performance Index of 10 or less as rated by the NAHB. Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards). Gerber "Ultra flush." Color to be white.

8-6.7 Lavatories. Install white self rimming Lavatories, with oval-shape, minimum 20 by 17 inches in size with overflow, and 4 inch faucet centers. Lavatories shall have metal pop-up drains.

8-6.8 Bathtubs. Install white slip resistant bathtubs constructed of enameled cast iron and conform to ANSI/ASME A112.19.1M, recess type, one piece tubs with tile flange. Install bathtubs complete with brass trip-lever tub drain, overflow, shower heads, shower and tub valves and tub diverter spouts. Exposed parts of the tub drain and overflow shall be chrome plated. Appropriately located integral grab bars are required for handicapped accessible units.

8-6.9 Showers. Shower stalls shall be installed with 2-inch drains, removable strainers, and the shower heads and shower valves specified. Appropriately located integral grab bars are required for handicapped accessible units. Provide ADA approved, one-piece, fiberglass shower stall base in the ADA accessible units.

8-6.10 Kitchen sinks. Install kitchen sinks of Type 302 stainless steel, 18 gauge minimum, seamless drawn, sound deadened with faucet ledge and hole for hand

spray. Install double bowl sinks, self-rimming without mounting rings, complete with cup strainer and neoprene stopper. Food waste disposers are specified in Section 5. Strainer and plug shall be eliminated where food waste disposers are provided. Sinks with ADA compliant depths, drain and p-trap offsets are required for handicapped accessible units.

8-6.11 Floor drains. Floor drains shall conform to ANSI/ASME A112.21.1. Cast iron body, cast iron grate, sediment bucket, and 2 inch outlet. Design shall ensure bucket replacement after cleaning by requiring top grate installation only with bucket in place. Install floor drains for general medium duty service, Jay R. Smith, 2005 series, or an approved equal. Provide a floor drain near HVAC units to receive condensate, and near clothes washers.

8-6.12 Clothes Washer Connections. Install drainage, hot and cold water supply for all automatic clothes washers. Washer connection, complete with 2-inch drain, 3/4-inch hose thread supplies with water shutoff valves shall be provided in standard manufactured recessed wall box with single-face plate. Boxes shall be constructed of plastic. Steel boxes shall have a corrosion-resistant epoxy enamel finish. Boxes shall be mounted a minimum of 2 feet-10 inches above the finish floor and include Electrical outlets for both washer and dryer.

8-6-13 Refrigerator Ice Maker Connection. Install cold water supply for refrigerator ice makers. Ice maker connection shall include an angle valve and a 1/4 inch hose thread supply, in line water filter and provide in standard plastic manufactured recessed wall box with single-face plate. Boxes shall be mounted a minimum 2 ft-10 inches above the finish floor.

8-6.14 Hose Bibbs. Install hose bibbs at the front and rear of each dwelling unit (no sharing). Hose bibbs shall be frostproof, shall be supplied with an integral vacuum breaker, shall have knob type shut off (no keys) and shall be positive draining type bibbs.

8-7 Cleanouts. Install cleanouts at each change in direction of sanitary sewer lines, at the intervals specified in the IRC, and at the building service entrance. All cleanouts shall be permanently accessible. Refer to Section 4 Site Engineering, for ground cleanout specifications. Interior and exterior cleanouts shall have standard locations in all residences to the greatest extent possible and shall conform to ANSI/ASME A112.36.2M.

8-8 Water Heater. Gas-fired water heaters shall have an input of 75,000 Btuh or less shall conform to ANSI Z21.10.1 and FS W-H-196. Install 50-gallon capacity water heaters with a 40.6 gph recovery rate at 90 degrees F. rise, shall be supplied with high performance power vent, flues and roof caps as necessary to make complete installations. All water heaters shall be supplied with pressure temperature relief valves conforming to ANSI Z21.22. Insulate hot water piping for the first 10 ft downstream of the water heater. The water heater relief drain shall be manufacturer approved, and shall be indirectly connected to the building sanitary sewer system. Install water heaters in accordance with Table 8-1, conform to manufacturer's required clearances and provide seismic bracing per IRC 1307.2.

Table 8-1: Water Heater Sizing

| Rheem | 3 BR | 4 BR |
|-------|--------|--------|
| | 3 Bath | 3 Bath |
| 41VRP | x | x |

Vent water heaters in accordance with manufacturer's instructions, and ensure combustion intake and exhaust are routed to back surface of roof peak. Install water heaters to allow easy removal and maintenance without obstructions.

8-9 Relief Valves. Water heaters and hot water storage tanks shall have combination pressure and temperature (P and T) relief valves. The pressure relief element of a P and T relief valve must have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P and T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Install relief valves rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 200,000 BTUH shall have 0.75 inch minimum inlets, and 0.75 inch outlets, with a vacuum relief valve installed on the cold water supply line to the water heater or hot water storage tank. The discharge pipe from the relief valve shall be of approved material, the size of the valve outlet and discharge over floor drain with an air gap.

8-10 Radon Removal System. Refer to paragraph 10.8 for Radon Removal System requirements.

8-11 Plumbing Calculations. Refer to Table 8.2 and Table 8.3 attached to the end of this section.

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, and NFPA 70, National Electrical Code (NEC), and applicable model codes, whichever is more stringent.

9-2 Service Entrance. Sightscreen or enclose all service entrances and exterior meters. Service feeders shall be underground with exterior meters. Individual electric watt-hour meters, Class 200, shall be installed for each dwelling unit. Provide interior panelboards with factory painted galvanized steel enclosures and with main breakers, sized in accordance with the NEC (200 amps minimum). Load centers are acceptable if commercial grade. Acceptable manufacturers of all electrical panelboards, disconnects, etc., may be any commercial, industrial-rated unit such as Square "D's" Q line, Cutler Hammer, General Electric or approved equal. Provide panelboards with flush, one-piece fronts and full size, plug-in circuit breakers. Panelboards may be surface or recessed mounted depending on their location. No recessed panelboards are to be located in party walls and fire walls. Driven ground rod and grounding wire design shall be required at each unit's main distribution panelboard per the NEC. Provide details indicating the grounding required in the construction documents. The panelboard shall have at least 24 full-size slots. Provide one full-size spare circuit breaker for every five active circuits. Walls housing service entrance panelboards shall have sufficient thickness to accommodate wiring bends. Provide a type-written panelboard directory clearly indicating each circuits purpose or use and the room served.

9-3 Panelboard Locations. Locate residence panelboards in the rear exterior corner of the garage.

9-4 Conductors. Provide copper conductors. Provide solid conductors for #10 AWG and below. Raceways are not required for interior conductors above grade.

9-4.1 Do not route branch circuit conductors on the exterior of the dwelling unit. Service entrance feeders may be run on the exterior, in conduit from grade to the meter can. Exterior above grade conduits shall be galvanized rigid steel. Exterior conduit below grade shall be schedule 40 (minimum) PVC. Provide slip joint per the NEC in the exterior conduit to the meter to allow for ground movement and expansion. EMT is permitted only in interior or protected locations.

9-5 Outlet Circuits. Provide separate circuits for lighting and convenience outlets. Offset outlets on party walls to maintain integrity of the fire wall and sound deadening rating of the wall.

9-6 Exterior Lighting and Outlets. Provide a minimum of one light fixture and one receptacle in each entry, and patio area. Locate the light fixture at the entry so it adequately illuminates the street address. Provide light fixtures on each side of the garage door. Provide exterior receptacles with ground fault protection and "In-Use" weatherproof covers. Switch light fixtures from the residence interior and incorporate motion detection. Control the entry and garage light fixtures on the same switch and photocell. Control the patio light fixtures from a separate switch and photocell.

9-7 Interior Lighting and Switched Outlets.

9-7.1 Provide all lighting in accordance with the IES Lighting Handbook. The

general type and style of light fixtures shall be in accordance with those indicated in Attachment. Provide 3500 K fluorescent lamps, with a color-rendering index (CRI) of 85 or better. Minimum efficiency standard for fluorescent lamps are as follows:

9-7.1.1 Fluorescent tubes, 4 feet: 90 lumens/watt.

9-7.1.2 Fluorescent tubes less than 4 feet: 80 lumens/watt.

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

9-7.2 Locations. Provide wall-switch operated ceiling lights in dining rooms, utility rooms, halls, bedrooms, kitchens, dinette areas, walk-in closets, and bulk storage areas. Provide wall-switch operated wall-mounted lights above the mirror over the lavatory in bathrooms and half baths. Provide additional light fixtures in rooms whose configuration requires them for adequate lighting. Provide a minimum of two ceiling-mounted light fixtures in the garage (one per vehicle bay). Control the garage lights via a switch (switches) located at each door opening into the garage.

9-7.2.1 Provide general lighting intensity in kitchens of 320 to 540 Lx (30 to 50 footcandles). Provide fluorescent kitchen light sources and lamps that are easy to change. Provide supplementary lighting the sink and under one of the wall cabinets for a work center to produce a composite lighting level of 210 Lx (75 footcandles) using fluorescent fixtures surface-mounted below wall cabinets. Provide a kitchen range hood with a light, fan, and switches.

9-7.2.2 Provide metallic fixture boxes for the ceiling fan/lights in the family room, living room, and all bedrooms, suitably supported from the ceiling structure so that it may support a ceiling fan, and with additional wiring to allow for independent wall switch control of the fan and light.

9-7.2.3 Light Fixture Types:

TEXT DELETED Entry Foyer - Manufactured by Progress Lighting, P.O. Box 5704, Spartanburg, SC 29304-5704, Prescott Collection, Product No.P3733-10, or equal.

Mirror Lighting in Bathrooms - Manufactured by Progress Lighting, P.O. Box 5704, Spartanburg, SC 29304-5704, Opal Glass, Product No's. P3034-10 or P3035-10 or equal. The length of the light fixture will be determined by width of the mirror it serves.

Kitchen (Ceiling) - Manufactured by Progress Lighting, P.O. Box 5704, Spartanburg, SC 29304-5704, Product No. P7336-30EB, or equal.

Kitchen (Undercabinet) - Manufactured by Progress Lighting, P.O. Box 5704, Spartanburg, SC 29304-5704, Product No. P7008-30EB, or equal.

Bedrooms, Dining and Living Rooms - Ceiling fan and light fixture manufactured by "Hampton Bay", Product "Huntington III" or equal. 52-inch diameter, 5 blades, Color "White" and "Polished Brass" with 4-light glass kit.

Walk-in Closets - Light fixture manufactured by "Progress Lighting", P.O. Box 5704, Spartanburg, SC 29304-5704, Product No. P3623 or equal.

Garages and Utility Rooms - Porcelain socket for 100W maximum incandescent lamp.

All Remaining Interior Lights - Manufactured by Progress Lighting, P.O. Box 5704, Spartanburg, SC 29304-5704, 5" Incandescent New Construction Air Tight IC Universal Housing, open/open shower trims as appropriate.

Exterior Lanterns for Residences (all locations) - Manufactured by Progress Lighting, P.O. Box 5704, Spartanburg, SC 29304-5704, BrassGuard Lanterns, Product No P5846-10, or equal. The photocell and motion detector do not need to be part of the light fixture.

Street Light - Manufactured by General Electric Lighting Systems 3010 Spartanburg Highway, Hendersonville, NC 28793 Product No. M2AC15S3H1LMC22F color: aluminum, or equal.

Street Light Posts - Manufactured by, General Electric Lighting Systems 3010 Spartanburg Highway, Hendersonville, NC 28793 Charleston Series, Product No.RRTA20SA4S7.02C/Aluminum or equal.

9-7.2.4 Provide a ceiling outlet in all garages for the garage door openers.

9-7.2.5 Provide separate wall switches for independent control of bathroom lights and exhaust fan.

9-8 Heat and Smoke Detectors. Provide heat and smoke detectors in accordance with NFPA 72 and NFPA 101, and other applicable codes. Provide a heat detector in the garage and in the kitchen. Interconnect heat and smoke detectors so that if any device goes into alarm, the alarm in all other devices shall activate. Detectors shall have battery backup. Include in the construction documents the minimum clearance requirements for detectors and HVAC air flow.

9-8.1 Provide fixed temperature, 120 volt, UL Listed heat detectors.

9-8.2 Provide photoelectric type, 120 volt, UL Listed residential smoke detectors with a built in piezo horn rated 85 dB at 10 feet, red LED alarm/power on indicator, test button, and tamper proof locking base. Detectors shall not contain radioactive material.

9-9 Carbon Monoxide Alarm Detectors: All residences shall receive carbon monoxide detectors as follows:

9-9.1 Locate one CO detector on each level of the residence. A required detector shall be located in vicinity of the bedrooms, such as in the corridor outside of the bedrooms. Do not provide CO detectors in garages, furnace rooms, unfinished basements or unfinished attics.

9-9.2 Hardwire CO detectors and wall-mount at the same height as the thermostat, approximately 52 inches off the floor. Avoid dead air spaces such as corners. Units may be powered from circuits powering smoke detectors. In all cases, follow manufacturer's guidelines and recommendations.

9-9.3 Provide CO detectors equipped with an audible alarm, battery back-up, 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. Pre-wire residences in accordance with local telephone company

requirements. Provide outlets in kitchen, family room, living room and bedrooms of each residence. Provide eight position modular jack connectors at all outlets. Provide jacks in the kitchen for a wall-mounted phone. All wiring methods shall comply with EIA/TIA Standard 570, Residential and Light Commercial Telecommunications Wiring Standard. Provide Category 5E Cable and jacks per TIA/EIA 568B, Commercial Building Telecommunications Cabling Standard. Pre-wire each residence separately from other residences in the same building. Provide two plug-in type terminal blocks in the garage located on an outside wall near the protected telephone terminal. Provide two outside telephone lines, one terminated to each terminal block. Terminate all interior wiring to one of these plug-in terminal blocks. The occupant shall be able to choose which line each telephone outlet is plugged into. Label each telephone circuit as "Telephone" along with the room served. Terminate the two outside telephone lines in a surface mounted, weatherproof, protected telephone terminal located on an outside wall adjacent to the building meter equipment. ("Demarcation Box"). Provide the protected telephone terminal cover with means for padlocking, accessible from the outside, and permanently labeled "Telephone". Only one protected telephone terminal shall be required for each separate building. Each protected telephone terminal shall accommodate a minimum of two outside telephone lines per residence. Provide a single #6, CU, green equipment grounding conductor, run in 1/2-inch non-metallic conduit, from the building metering equipment to the protected telephone terminal box. Coordinate the number of pairs and type of cable, type of modular jacks, and sizes of protected telephone terminals and outlet boxes with local Telephone Company (Sprint). Locate telephone jacks in locations as indicated on the RFP Floor Plans. Locate the protected telephone terminal unit near the side or rear of each residence and adjacent to the metering equipment.

9-10.1 Data. Pre-wire residences for data. Provide outlets in the kitchen, living room, family room, and bedrooms of each residence. Provide eight-position modular jack connectors at all outlets. All wiring methods shall comply with EIA/TIA Standard 570, Residential and Light Commercial Building Telecommunications Wiring Standard. Provide category 5E cable and jacks per TIA/EIA 568B, Commercial Building Telecommunications Cabling Standard. Pre-wire each residence separately from other residences in the same building. Terminate all wiring at the telephone system demarcation box. Label each data circuit as "Data" along with the room served. Locate data jacks in locations as indicated on the RFP Floor Plans.

9-11 Television.

9-11.1 Commercial Cable Television. Provide Cable television (TV) outlets in the living room, kitchen, family room, and bedrooms of each housing unit as indicated. Prewire each housing unit in conformance with all local cable TV company (Charter Cable) requirements. Prewire each residence separately from other residences in the same building. The local cable company (Charter Cable) has requested that the cables be run inside the house in the following manner. Contained within the stud walls or other hidden areas and in accordance with industry standards, run two separate and continuous RG-6 cables in conduit from each room outlet location to a central location at the exterior of the residence's garage near either the electrical meter or telephone demarc box with sufficient cable for the necessary connections. Provide (2) weatherproof enclosures per the Cable Company for connection to both Cable TV and Satellite TV. Boxes shall be approximately 12"Wx18"Hx8"D. Provide 2" conduit elbow from Cable TV box to below grade for direct buried cable from pedestal. Provide 2" conduit from Satellite TV box to 1" above finished grade and cap. Provide 2" conduit nipple between boxes. Label each pair of cables terminating in the garage as "Cable TV" along with the room served. Provide 8 inches of extra cable at each wall outlet in the designated rooms, neatly rolled up in a standard

electrical wall junction box, and covered with a solid plastic face plate. For additional technical information prior to installation, contact Mr. Tom Black, Charter Cable Field Service Supervisor at (785) 784-3853. Place cable television outlets in locations as indicated on the RFP Floor Plans. Locate the protected television terminal near the side or rear of each residence and adjacent to the protected telephone terminal.

9-12 Door Bell. Provide a low-voltage doorbell or buzzer and an illuminated push button at the front entrance to each residence.

9-13 Convenience Outlets. Provide grounded type outlets. Provide GFCI and convenience outlets in accordance with the NEC and attached RFP Floor Plans.

9-13.1 Provide a GFCI convenience receptacle with a waterproof, while-in-use cover near condensing units.

9-13.2 Special Outlets. Provide 240 volt electric outlets for electric dryer. Provide 240 volt electric outlet for range in ADA accessible units.

9-13.3 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. Locate service entrance conductors a minimum of 36 inches below finished grade. Locate conductors in conduit only where specifically required by the NEC.

9-13.4 Branch Circuit Conductors. Provide branch circuit conductors and over current devices as rated by NEC. Provide a minimum of one spare circuit space for every five active breakers in the panelboard per residence. Provide individual circuits for the washer, dryer (with receptacles located behind the washer and dryer), dishwasher, garbage disposal, freezer, furnace or air handling unit, air conditioning unit, and water heater. Provide two utility circuits (20-amp) in the kitchen area for the convenience outlets for small appliances serving the kitchen and dining area. Provide a separate 20-amp branch circuit for each refrigerator. Provide a separate 20-amp branch circuit for each bathroom receptacle per the NEC. Provide arc-fault circuit interrupter type circuit breakers for all circuits serving bedroom outlets.

9-14 Mechanical Equipment. Provide overcurrent protection sized per the manufacturer and direct connect all mechanical equipment. Provide local disconnecting means for all equipment. Disconnect switch for condensing units shall be fused, dead front, pullout type, NEMA 3R rated, of metal constructed housings.

9-14.1 Radon Removal System. Provide 20 amp, 120 volt circuit in junction box near radon removal pipe in attic for radon exhaust fan, attic light and outlet.

9-15 Demolition. Disconnect and remove electrical services for units to be demolished at Tobie and Fleetwood Courts. Maintain service to units not being removed.

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 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Residential Cooling Load Calculation methodology. Computer-generated load calculations shall be provided, and shall include complete input and output summaries. Design shall be based on Fort Riley, Marshall AAF 1% Dry-Bulb Temperature (°F) and 1% Mean Wet-Bulb Temperature (°F) weather data shown in Table 10-1.

TABLE 10-1 - WEATHER DATA

| Type of Design / Design Information | |
|---|------------|
| | Inch-pound |
| Heating | |
| Indoor Design Temperature | 70°F |
| Outdoor Design Temperature | 5°F |
| Annual Heating Degree Days | 4822 |
| Largest Number of Monthly Heating Degree Days | 1032 |
| Cooling | |
| Indoor Design Temperature | 75°F |
| Outdoor Design Dry Bulb Temperature | 96°F |
| Outdoor Design Wet Bulb Temperature | 74°F |

Note¹: Inch-pound data are based on degree days Fahrenheit to a base of 65 degrees F.

10-1.1 Load calculations. Computer generated load calculations shall be performed for each possible orientation up to four representative orientations for each housing type included in the project. Room airflow requirements shall be computed based on the individual room load. However, the minimum acceptable airflow shall be 0.5 cfm/ft² for all spaces. The design for each individual residence shall be based on the heating and cooling loads as well as room airflow requirements computed for the housing 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 Supply Air Ductwork System Layout. The family housing units shall be

equipped with a single supply air ductwork layout regardless of orientation. The family housing supply air ductwork system shall be sized at a maximum air pressure loss of 0.08" wg/100 feet. The sheet metal supply air ductwork system shall deliver and distribute the required airflow to each room with respect to its worst-case orientation. Balancing dampers shall then be used to reduce airflow to the appropriate level as required. Permanent access and required maintenance clearances shall be provided to all opposed blade dampers.

10-1.3 Return Air Ductwork System Layout. The family housing units shall be equipped with return air ductwork from each room being provided with conditioned supply air regardless of orientation. The family housing return air system shall be sized at a maximum air pressure loss of 0.05" wg/100 feet. The return air path shall return the required airflow from each room back to the gas-fired furnace, incorporating the least path of resistance into the design.

10-2 Equipment Safety and Efficiency. All equipment and associated materials provided, here to, should be the manufacturers standard cataloged product. Manufacturers standard cataloged product is the equipment that the manufacturers regularly engage in current production and is the manufacturers most recently approved equipment standard design.

10-2.1 All heating, ventilation and air-conditioning (HVAC) 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 are listed in Table 10-2 below. The listed efficiencies are the minimum acceptable level.

Table 10-2: Minimum Equipment Efficiencies

| | Natural gas fired equip | Ground Source Heat pump (ground coupled) ⁴ | | Electric cooling equip |
|--------------|-------------------------|---|---------------------|------------------------|
| Furnace AFUE | 90% ¹ | Size A ² | Size B ² | |
| SEER | | 12 ³ | 13 ³ | 12 ³ |

Note¹: Efficiency is based on DOE test procedure 10CFR430, Subpart B, Appendix N.

Note²: Size A heat pumps have a capacity of 5.9 kW (20,000 Btu/h or less. Size B heat pumps have a capacity of 5.9 kW to 13.5 kW (20,000 to 46,000 Btu/h)

Note³: Efficiency is based on DOE test procedure 10CFR430, Subpart B, Appendix M.

Note⁴: Ground Source Heat Pump Systems shall be evaluated for construction cost feasibility issues due to site-specific restrictions.

10-3 Heating, Ventilation and Air-Conditioning (HVAC) Systems. Each Family Housing Unit shall be provided with a central direct-expansion heating and air-conditioning split system. Split systems shall be designed, installed, balanced and adjusted to distribute conditioned heating and cooling air to all habitable rooms, including bathrooms. The furnace system air-balance shall be distributed to all spaces in proportion to the calculated load requirements. Supply fans serving the gas-fired furnaces shall be a direct drive type equipped with an adjustable blower speed control. The furnace system installation shall conform to SMACNA Installation Standards for Residential Heating and Air-Conditioning Systems.

10-3.1 The direct-expansion condensing unit shall be selected for 105°F ambient outdoor temperature. The direct-expansion cooling system capacities selected for installation shall not be oversized with respect to load calculations. The gas-fired furnace and heat exchanger equipment capacities selected for installation shall not be oversized more than 125 percent of the load calculations.

10-3.2 Exterior direct-expansion condensing unit(s) shall be pad-mounted on minimum 4" thick concrete housekeeping pad(s). Concrete housekeeping pad(s) shall be installed level and supported by compacted soil or concrete foundation to eliminate settlement. The condensing unit location shall be selected based on site-specific conditions and intended uses of outdoor space. Every effort shall be made to locate the condensing unit out of the occupant's direct line of sight, (shrubbery screening shall be located minimum distance of 36" away from condensing unit air intake or provide minimum 50% free open area wall/enclosure minimum 30" clear distance) locate condensing unit on sides of residence and avoid placement under windows.

10-3.3 The primary concern shall be equipment location and coordination within the mechanical utility room. The gas-fired furnace shall be located in the ground level mechanical utility room. The gas-fired furnace shall be arranged and coordinated with all other equipment devices to allow for ease of maintenance and proper venting. The mechanical utility room shall have a light and a GFCI electrical convenience receptacle.

10-3.4 Natural Gas-Fired Furnace Systems. The gas-fired furnace system shall be a high efficiency up flow unit. Gas-fired furnaces shall be equipped with hot surface ignitor, slow open redundant gas valve, direct-vent sealed combustion, monoport gas-fired burner and a 25-year heat exchanger warrantee. The furnaces shall have a direct drive supply fan with adjustable blower speed control, disposable filters, electronic analog thermostat controls and transformer. It shall be possible to service internal components and replace all controls from one side of the furnace. The contractor shall supply Carrier, model number 58MCA or equal

10-3.5 Gas-Fired Furnace Flue Venting System. The furnace units shall be vented in accordance with NFPA 211. High efficiency (AFUE \geq 90 percent) gas-fired furnaces shall be vented in accordance with AGA requirements and the manufacturer's instructions. Natural gas-fired furnace shall vent combustion products through code approved vent flue piping. Vent flue piping shall extend from outside the residence exterior wall. The flue piping discharge shall be located away from residence outside air intakes as indicated per the most current International Mechanical Code. Flue vent piping shall be routed across the attic space and terminated up through the roof on the rear exposure of the house peak. Coordinate flue vent pipe routing and size with manufacturers recommendations.

10-3.6 Direct-Vent Sealed Combustion Intake. Direct-vent sealed combustion air

system shall transfer air from the outside in accordance with the manufacturers installation specifications. Sealed combustion intake piping material shall conform to the most current International Mechanical Code. Combustion air intake piping shall be installed in accordance with SMACNA Installation Standards for Residential Systems. Combustion air intake piping shall be routed across the attic space and terminated up through the roof on the rear exposure of the house peak. Coordinate combustion air intake pipe routing and size with manufacturers recommendations.

10-3.7 Condensate Drain Piping. Condensate drains for high efficiency units shall be per manufacturer recommendations and shall be indirectly connected to the building sanitary sewer system or daylight minimum 6" above finished grade. Condensate drain piping that is daylight shall be terminated with a 90-degree elbow turned down toward finished grade.

10-3.8 Direct-Expansion Split Air-Conditioning Unit.

10-3.8.1 Direct-Expansion Split Air-Conditioning Unit shall consist of an air-cooled condensing unit, evaporator coil (cased "A" coil) and evaporator/blower as matched components with the gas-fired furnace. Both gas-fired furnace, evaporator coil and condensing unit shall be provided from the same manufacturer. Refrigerants used shall have an Ozone Depletion Potential (ODP) of .055 or less. The condensing unit shall contain, as a minimum, the features indicated in Table 10-3. Equipment shall be sized to meet the computer generated load calculation. The contractor shall provide a Carrier, Model number, 38BRC or equal.

TABLE 10-3 - DIRECT-EXPANSION SPLIT SYSTEM AIR-CONDITIONING
FEATURES

| |
|--|
| High and low pressure compressor protection. |
| Filter-drier. |
| Scroll compressor protected by internal temperature and current sensitive overloads. |
| Electric crankcase heaters. |
| Compressor start assist capacitor and relay |
| Thermostatic expansion valve (TXV) single flow |
| Anti-short-cycle timer. (factory installed) |
| Site Glass |
| Testing and charging refrigerant connections. |
| Standard 5-year limited warrantee on all parts and scroll compressor. |
| Fan and coil guards. |

10-3.8.2 Evaporator Coil. The cased "A" coil (evaporator coil) shall be provided with a liquid strainer, expansion device, pre-insulated housing, copper coils and insulated sloped condensate drain pan. Cased "A" coil face velocity shall not exceed 500 fpm air velocity.

10-3.8.3 The condensing unit and matching cased "A" coil shall deliver a Seasonal Energy Efficiency Rating (SEER), consistent with the minimum requirements shown in Table 10-2.

10-3.8.4 Refrigerant Charge Verification: When the direct-expansion split air-conditioning systems are completely installed, the contractor shall check refrigerant level, calibrate, and provide additional refrigerant charge as required for equipment start-up. While the direct-expansion split air-conditioning system is in operation the refrigerant will be adjusted for maximum energy efficiency and optimal evaporator coil leaving air conditions (LDB Temperature and LWB Temperature). A third party company shall test the direct-expansion refrigeration system(s) that was performed on the same 5 percent of the family housing units that had the blower door and duct tightness testing. If the direct-expansion refrigeration system(s) tested have a low or excessive refrigerant charge, all direct-expansion systems installed under this contract shall be tested. All direct-expansion refrigeration systems tested shall be certified by the third party company, in written documentation stating full compliance, prior to acceptance by the Government.

10-4 Air Distribution.

10-4.1 Ceiling Mounted Supply Grilles and Floor Mounted Registers. First floor ceiling mounted supply grilles and second floor baseboard supply registers shall be located to ensure the air distribution will completely cover all exterior wall surfaces with a blanket of conditioned air or may be of a compact design to eliminate 'dead air spots' within the room being served. Provide a minimum of one grille/register in each habitable room. Grilles/registers shall have louvered faces with individually adjusted airfoil blades. All grilles and registers shall be provided with integral opposed blade dampers. Plastic grilles and registers are prohibited. Grilles and registers core velocities shall be limited to 600 fpm maximum jet velocity, with a maximum air pressure drop of 0.06-inches wg. Ceiling mounted grilles shall have factory finish to match architectural finish schedule. Floor mounted registers shall have factory finish to match the architectural finish schedule. All Grille frames and register frames shall be installed tight and flush against each respective surface(s). Sponge-rubber gasket material shall be provided between ceiling mounted grilles and floor mounted registers as required for air leakage control. Sponge-rubber material shall be completely concealed and non-visible outside the grille or register. Grille and register boots shall be sealed with heavy liquid sealant around all longitudinal and transverse joints. Provide appropriate grille and register frame/trim for flush-mounted devices. Supply air boots connecting the supply branch ductwork to the grille and/or register shall be airtight and shall not interfere with opposed blade damper operation. Ceiling mounted supply grilles shall be installed at least 6-inch distance away from all walls.

10-4.2 Return air and exhaust air grilles. Grilles shall be fixed horizontal, louver face type similar in appearance to the supply grille face. Plastic grilles are prohibited. Core velocity shall be limited to 400 fpm maximum jet velocity, with a maximum air pressure drop of 0.05-inch wg. Grilles shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Return air and exhaust air boots shall be sealed tight to the wall or ceiling using duct mastic or caulking. Wall return grilles shall be located at least 6 inches distance above the floor or below ceiling. Return grilles shall be located in all rooms served

by conditioned supply air.

10-4.3 Ductwork. Provide sheet metal in thickness indicated, minimum 26-gauge, packaged and marked as specified in ASTM A 700. Galvanized sheet steel shall be lock forming quality, ASTM A 653, coating designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view. Galvanized sheet metal ductwork shall be externally insulated. Flexible ductwork shall not be installed in concealed locations. Ductwork located under-slab, intra-slab, or within crawlspace is prohibited. Concerns about condensation in ducts, varmints and static pressure problems are some of the reasons ducts are prohibited in crawl spaces. Volume dampers shall be provided integrally to the supply air floor registers and ceiling mounted grilles. No portion of the building construction (such as joist space in a floor or ceiling, wall stud space, etc.) shall be used as an air path. The requirements for ductwork set forth below apply to all ductwork installed in the residence, supply systems, return systems, exhaust systems, ventilation systems, and outside air supply ductwork.

10-4.3.1 The single supply air main ductwork shall be routed within a lowered soffit area located below the second floor, floor joists. The supply air ductwork shall be installed tight to the bottom of the second floor, floor joists and routed perpendicular to the floor joist. All supply air branch ductwork shall be tapped from the top of the single supply air main ductwork with 45-degree take-off boot taps and connected to a long sweep, 5-section 90-degree elbow. All supply air branch ducts shall be routed between the second floor, floor joists. The supply air branch ductwork shall serve the first floor ceiling supply grilles and second floor supply baseboard registers.

10-4.3.2 Maximum supply air ductwork pressure loss shall be limited to 0.08-inches wg/100ft for mains and branches. Maximum pressure loss in return air ductwork shall be limited to 0.05-inches wg/100ft for mains and branches.

10-4.3.3 All transverse and longitudinal ductwork joints shall be sealed airtight with heavy liquid sealant. Ducts shall have no visible or audible leaks to ensure quiet, economical system performance. Ductwork in conditioned spaces shall be constructed for a 2-inch static pressure construction class with seal class B, as described in the SMACNA HVAC Duct Construction Standard.

10-4.3.4 Provide a minimum of 2-inch thick mineral fiber blanket insulation (or other listed insulation with an equivalent R value) on the exterior of all supply, outside and return air ducts located within 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 air ductwork shall be sized for a maximum velocity of 600 fpm. Short runs of return air ductwork 5 ft or less directly upstream of the evaporator fan assembly shall be acoustically lined to minimize noise. Acoustic liner shall be minimum 0.5-inches thick, 3.0 PCF density, long textile fiber with anti-microbial

10-4.4 Filtration. Provide a disposable 1-inch pleated 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.

10-4.5 Crawl Space Airflow Design. Provide minimum two supply air horizontal discharge ductwork openings to supply conditioned heating and cooling airflow with sufficient enough "throw" across the entire crawlspace to create air mixing. The minimum total supply airflow delivered into the crawlspace shall be calculated to 0.05 CFM of the conditioned crawlspace floor area. The crawlspace returns shall be ducted back to the gas-fired furnace. Provide a minimum of two return air openings extending into the crawlspace. Locate the return air openings in opposite crawlspace areas and route back to the return air ductwork of the gas-fired furnace. All ductwork routed within the crawlspace shall be sealed airtight. All transverse and longitudinal seams/joints shall be sealed with heavy liquid sealant.

10-5 Temperature Controls. Thermostats shall be located on interior partitions, close to main system return air intake. Thermostat wall placement shall not be placed in the middle of an open wall space. Thermostat shall be installed above finished floor per ADA requirements. Placing a thermostat on the exterior wall, near an exterior opening or any place the thermostat is subject to unrepresentative temperatures is unacceptable.

10-5.1 Thermostats shall be Carrier, Model TSTATCCN, Energy Star labeled, standard non-programmable. The thermostat shall be equipped with standard features, OFF/COOL/HEAT/AUTO, fan shall switch for ON/AUTO, auto heat/cool changeover, equipment ON indicator, battery free, LCD display current and desired temperatures and two temperature set points for (1) heating and (1) cooling. Thermostat option when used for heat-pump applications, the thermostat shall have an emergency heat option, auxiliary heat indicator and auxiliary heat lockout.

10-6 Exhaust Fans. Reference ASHRAE Standard 62.2-2003, "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings." Specifically reference section 4, "Whole Building Ventilation".

10-6.1 Bathroom and shower room shall be ducted to the outside. Bathroom and/or shower room exhaust fans shall be switched separately from the lights. Each bathroom and/or shower room shall have its own fan. Exhaust fans shall not discharge near the air conditioning condensing unit, entry doors, windows, patios, porches, or garages. Exhaust 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 an integral back draft damper. Bathroom and/or shower exhaust fans shall be ceiling mounted and shall be sized to provide not less than 10 air changes per hour in the space served. Maximum allowable noise level for bathroom exhaust fans shall be 2 sones as installed.

10-6.2 Tornado Shelter. The lower level bathroom and shower room is being designed for a tornado shelter room. Coordinate the supply air ductwork routing and supply air grille serving the bathroom with the exhaust fan. Reference tornado shelter requirements for allowed maximum opening sizes in square-inches.

10-6.3 Kitchen range hood exhaust fan shall be a telescoping downdraft style hood for countertop island installation. Kitchen range hood exhaust shall be ducted to the outside. Exhaust ductwork shall be routed through the crawl space between floor joists. Exhaust fans shall not discharge near the air conditioning condensing unit, entry doors, windows, patios, porches, or garages. Exhaust 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 an integral back draft damper. Reference 2003 International Residential Code for One and Two-Family Dwellings, chapter 15, section M1502.

10-7 Dryer Vents. A minimum 4-inch diameter dryer vent shall discharge to the exterior and provide connection to occupant-owned dryer (one dryer per vent). Dryer vent material shall be rigid galvanized steel with exterior wall cap and integral back draft damper. Dryer vent piping maximum horizontal length shall be 14 feet, with no more than three 90-degree angle elbows (with minimum radius of 6 inches). Dryer vent piping maximum vertical length shall be 12 feet, with no more than three 90-degree angle elbows (with minimum radius of 6 inches). Dryer vents shall not exhaust closer than 10 feet horizontal distance to exterior openings (entry doors, windows, etc.); 10 feet above patios and sidewalks; or 3 feet vertical distance above exterior openings. Dryer vents shall not run through non-accessible spaces or garages. Dryer vent shall not terminate at the front exposure of the house.

10-8 Radon Removal System.

10-8.1 Radon Prevention and Testing. The housing units shall be constructed to include a passive system for control in the structure. This system shall be constructed in accordance with Indoor Radon Prevention and Mitigation.

10-8.2 Radon Vent Pipe Installation. Provide a sub-membrane depressurization system with a mechanical draft using minimum 4-inch diameter, plenum rated PVC vent piping installed vertically to remove radon gases. Radon vent piping shall be routed from below the soil-gas-retarder membrane up inside interior walls or chases through the housing unit, up through the attic and penetrate at least 12-inches above the roofline. A rainproof installation above the roof shall be provided. Radon vent pipe is to be routed through the attic space in a location that will facilitate radon gas fan maintenance.

10-8.3 Multiple branch vent pipe runs may be routed within the crawlspace and connected to one common stack as required.

10-8.4 A length of 4-inch diameter perforated pipe shall be installed horizontally beneath the radon membrane sheeting and connected to a 4-inch "T" fitting with a vertical standpipe installed through the sheeting, servicing each 1500 square feet of membrane area. Rough in shall be provided for electrical wiring to facilitate a switched radon fan and system failure-warning device. After the building envelope is complete, and with all HVAC systems operating on normal cycles, the Government may elect to test the facility for radon levels. The Government will test the housing unit for radon levels with the radon fan off. If the housing unit fails the radon test the in-line radon fan (and system failure warning device) shall be energized to remove captured radon gases. Refer to Table 8-2 for more information.

10-8.5 Radon mitigation. The design and construction of foundation walls, slabs, and crawl spaces shall include provisions for the reduction of radon entry and facilitate its removal. Radon mitigation shall comply with the requirements of ASTM E1465. Reference figure 10-1 at the end of this section.

10-9 Piping Requirements. Evaporator coil condensate drain piping, exterior refrigerant suction and exterior refrigerant liquid piping shall be insulated with minimum 1-inch thick cellular glass or unicellular foam pipe insulation. Exterior refrigerant piping insulation shall be covered with an aluminum or PVC jacket to prevent damage. Condensate drain piping shall be installed one pipe size larger than the drain pan condensate connection. The evaporator condensate drain piping shall be properly trapped, and not directly connected to a sanitary sewer system (air gap fitting required).

10-9.1 Refrigerant Piping Material. All refrigerant suction and liquid piping

above grade shall be copper piping, ASTM B 280, Type ACR, hard drawn straight lengths and soft annealed coils, seamless copper tubing. All refrigerant suction and liquid piping below grade and within slabs shall be copper piping, ASTM B 88, Type K, hard drawn straight lengths and soft annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation and have ends capped to protect cleanliness of pipe interiors prior to shipping. Above grade and within family housing unit provide brazed joints. Below grade and within slabs provide Type K, copper piping with no joints.

10-9.2 Evaporator Coil Condensate Drain Piping. All condensate piping above grade shall be copper piping, ASTM B 280, Type ACR, hard drawn straight lengths and soft annealed coils, seamless copper tubing. All condensate piping below grade and within slabs shall be copper piping, ASTM B 88, Type K, hard drawn straight lengths and soft annealed coils, seamless copper tubing. All copper tubing or piping shall be factory cleaned, ready for installation and have ends capped to protect cleanliness of pipe interiors prior to shipping. Above grade and within family housing unit provide brazed joints. Below grade and within slabs provide Type K, copper piping with no joints.

10-10 Testing, Adjusting, and Balancing. Adjusting and balancing of each family housing unit shall be the contractor's responsibility. The Contractor shall correct all residences not found in compliance, and shall be responsible for all labor and materials required for this effort. NEBB-01, SMACNA-07 or ASHRAE 111 shall be used as the standard for providing testing of air systems. The selected standard shall be used throughout the Family Housing Project. Instrumentation accuracy shall be in accordance with the standard selected. A firm certified for testing by the National Environmental Balancing Bureau (NEBB) shall accomplish all air testing. Prior to conducting testing, adjusting, and balancing, the contractor shall submit in written report declaring the air systems has been installed and is 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. Air testing shall not commence until approved by the Contracting Officer in written documentation. The facility shall be essentially complete with final ceiling, walls, windows, doors, and all partitions sealed and in place. Doors and windows in the family housing unit to be balanced shall be closed during testing and balancing operations. Air systems and exhaust fans shall be complete and operable. All data, including deficiencies encountered and corrective action taken, shall be recorded. After approval of the certified air balance written reports from the contracting officer indicating final acceptance, all HVAC adjustment device settings shall be permanently marked with phenolic paint/marker by the contractor's balancing engineer so that adjustments can be restored if disturbed at any time.

10-11 Duct Tightness Testing Requirements. The installation of the supply and return ductwork within the family housing units is an item of prime concern with respect to the energy efficient operation of the residence as a whole. The heating and air-conditioning designs that include ductwork outside of the conditioned envelope, the contractor will be required to test the proto-type units and all units that 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.

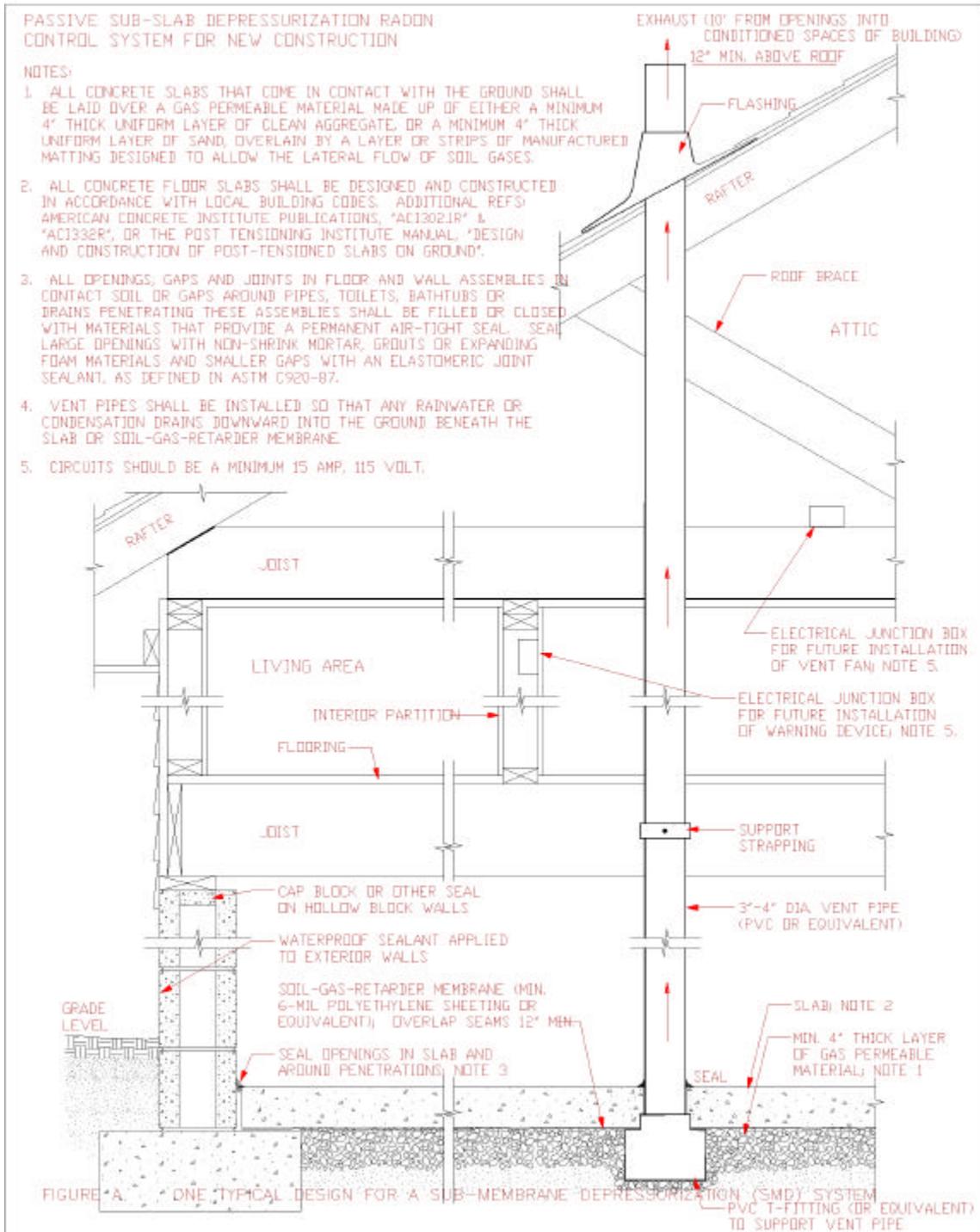
10-11.1 Duct tightness testing shall ensure that the leakage rate from ductwork shall not exceed 0.15 (L/s)/m^2 (0.03 cfm/ft^2). If the units tested fail to meet this requirement, the ductwork installation shall be examined, corrections made, and the test redone until the installation passes this requirement. The entire ductwork system that is installed in proto-type housing units and all

housing units that receive blower door tests shall be completely leak test validated, prior to any ductwork installed in any other housing unit. Several methods to accomplish this testing are acceptable.

10-11.1.1 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.

10-11.1.2 Testing may also be accomplished utilizing "Duct Blaster" methodologies and pressurizing the ductwork to 25 Pascal (0.1-inch of water).

10-12 The Contractor is advised that the EPA may test, or hire a consultant to test randomly selected residences 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 housing unit(s). If the EPA testing is conducted, the testing is not expected to interfere or delay the construction in any manner. Whole House Fans. As betterment bid, provide a whole house fan in each residence. Locate the fan in the ceiling of the bedroom hallway exhausting into the attic. Fan shall be a minimum of 36-inch propeller fan, 1/3 HP, belt driven, with automatic closing louver. Provide adequate attic ventilation for exhaust. Control fan by wall switch near fan, interlock with furnace/AC unit so that the furnace will not be energized when the whole-house fan is energized. Reference ASHRAE Standard 62.2-2003, "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings." Specifically reference section C4, "Selecting the Whole-House Ventilation System", equation $Q_{fan} = Q_r / (\epsilon f)$, where Q_{fan} =fan airflow rate, Q_r =ventilation air requirement, ϵ =ventilation effectiveness and f =fractional on-time



11. Paragraph 11 is not used in this section.

12. CONTRACTOR PREPARED SPECIFICATIONS

12-1 The contractor's DESIGNER OF RECORD is required to prepare the remaining specifications and drawings required to complete the design. The contractor's DESIGNER OF RECORD shall have the freedom to use the following in his Specifications: AIA Masterspec, CSI standard specification, manufacturer's standard data and installation instructions, COE guide specifications, or the new Uniform Facility Guide Specifications. The specifications shall be tailored to meet the requirements of this job. Specifications shall be brief and to the point. Inapplicable data and materials shall be deleted. All prescriptive information and guide specifications provided by the Government with this RFP shall be incorporated into the final specifications and drawings without editing.

Specific requirements are outlined in the Specification Outline portion of this RFP. See also Section 1012, "DESIGN AFTER AWARD" and other specifications provided with this RFP for detailed requirements and guidelines.

12-2 Contractor prepared specifications and individual specification sections for this work shall be organized into divisions and sections in accordance with Construction Specifications Institute (CSI), Master list of Tiles and Numbers for Construction Industry, latest edition.

12-3 Submittal requirements, submittal procedures and quality control are addressed in other specification sections provided with this RFP. The DESIGNER OF RECORD shall use all prescriptive specifications and drawings provided with this RFP without editing.

including title and location and specification section blocks and all columns of ENG Form 4288 (RMS) Submittal Register.

10.0 CONTENTS OF DESIGN SUBMITTALS

10.1 "FAST-TRACK" 100% site/utility design submittal if applicable.

10.1.1 The documents furnished with this RFP have established many of the factors influencing site decisions. Existing utility systems will be upgraded where necessary to meet design loads. Those not defined by the RFP are the responsibility of the Design-Build contractor:

10.1.2 All "fast track" drawings shall be developed to 100 percent completion. In addition to the individual utility plans, submit a combined utility plan drawn to the same scale as the individual utility plans.

a. General Site Layout: Scale shall be included.

b. Site Grading and Drainage Plans: Show locations of all sediment basins, diversion ditches, and other erosion control structures. Indicate the approximate drainage areas each will service. Indicate the materials, construction and capacity of each structure. Include limits of landscaping and seeded areas. General site grading and drainage shall be indicated by contour lines with an interval of not more than approximately .3 m [1 foot].

c. Road Alignment and Pavement Plans: Scale shall be no greater than as indicated and profiles showing pavement and shoulder widths, azimuths and curve data, limits of grading, and erosion control. The materials to be used shall be indicated.

d. Traffic Control Plan: Traffic routing and signage shall be in accordance with The Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Federal Highways Administration.

e. Utility Systems: The Contractor shall prepare a design narrative for the natural gas, water supply, storm drainage, and wastewater systems relating to this project. Include an analysis of the existing distribution systems capability to supply sufficient quantity at adequate levels. If any existing utility system appears to be inadequate, the Contractor shall notify the Government immediately that a design solution is required to augment the new utility systems needed to accommodate the requirements for the new facilities. Any design to remedy the situation, or any resulting related construction, are outside the scope of this project.

f. Sanitary Sewer Plan: Scale shall be as indicated and profiles showing location and elevation of pipe, thrust blocks, manholes, etc. Materials and construction of main and appurtenances shall be indicated.

g. Water Supply Line Plans: Scale shall be as indicated and profiles showing locations of valves, thrust blocks, connections, etc. Materials shall be indicated and specifications shall be provided for valves, pipes, etc.

h. Electrical Plan Requirements:
Required diagrams and details on Site Electrical Drawings.

- a. Off-Site Electrical Distribution Plan:
- b. Off-Site Primary Circuit Routing Plans:
- c. Off-Site One Line Diagram. (If applicable)

shall be attached, as an appendix, to the Environmental Protection Plan.

1.8 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report shall be signed by both the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor shall protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

1.9 SPECIAL ENVIRONMENTAL REQUIREMENTS

The Contractor shall comply with the special environmental requirements listed here and included at the end of this section.

1.10 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings, plans and specifications which may have an environmental impact will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.11 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

1.12 PERMITS

The Contractor shall obtain all needed permits or licenses. The Government will not obtain any permits for this project; see Contract Clause PERMITS AND RESPONSIBILITIES. The Kansas Department of Health and Environment, through the national pollutant discharge elimination system (NPDES), requires stormwater construction project permitting. The Contractor shall be responsible for implementing the terms and requirements of the appropriate permits as needed and for payment of all fees except the original NOI fee.

1.12.1 Stormwater Pollution Prevention Plan (SWP2)

The Contractor shall develop a stormwater pollution prevention plan (SWP2) specific to construction activities which are to be employed at this site. The plan shall be in conformance with the Kansas Department of Health and Environment's (KDHE's) National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit requirements for construction activities. Copies of

The main entrance shall be into the conference room. The second egress shall be a door in either of the offices. Entrance and egress doors shall be equipped with substantial locks.

The Contractor shall provide janitorial service and janitorial consumables, fuel for the heating facilities, electricity, telephone, unlimited internet access, copier, fax and printer consumables including but not limited to toner cartridges and paper, hot and cold running domestic water, and bottled water all at no cost to the Government.

The entire facility including the furniture and equipment will remain the property of the Contractor and shall be removed from the site at the completion of the work.

1.6.2 Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. The trailer shall be securely anchored to the ground at all four corners to guard against movement during high winds in accordance with the regulations of the State of Kansas for mobile homes. The trailer shall be fully skirted for the life of the project.

1.7 PLANT COMMUNICATION

The Contractor shall furnish three phone lines (2 telephone and 1 fax) to the Corps of Engineers Site Office. All three telephone lines shall be "full service" including long distance capabilities with the first \$75.00 of long distance charges on each to be borne by the Contractor. In the conference area there shall be telephone jacks for each of the three phone lines. In addition to the capabilities above, unlimited internet access shall be provided via either Digital Subscriber Line (DSL), cable modem, or T-1 direct to the ISP. Switching shall be provided to allow simultaneous usage in all three locations within the site office. Switch shall be a Cisco PIX501 with firewall. If special software is required by the provider in order to connect, this software shall be installed on the laptop provided under the terms of this contract. A static IP address shall be provided for this modem. The IP address, gateway address, subnet mask, and DNS address shall be provided in writing to the COR with a copy furnished to: US Army Corps of Engineers, 601 E. 12th Street (Mr. Clifford Hughes/CENWK-IM-I), Kansas City, MO 64106-2896.

1.8 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud that is tracked onto paved or surfaced roadways shall be cleaned away as soon as it is deposited. Materials resulting from demolition activities that are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored, elevated from the ground contact on cribbing, and protected from the weather.

1.9 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

ATTACHMENT 9

NOT USED

ATTACHMENT 10
FT. RILEY PLANT LIST

ATTACHMENT 10- FT. RILEY PLANT LIST

BOTTOMLAND: Deciduous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|-------------------------------|----------------|-------------------------------|---------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Elaeagnus angustifolia</i> Russian Olive | 12'-20' | 12'-20' | round | medium to fast | moderate | sun | 6.0-7.5 adapt- able |
| <i>Fraxinus americana</i> White Ash | 50'-80' | 50'-80' | round open | medium | moderate | sun | 6.0-7.5 adapt- able |
| 'Rose Hill' | 50'-80' | 50'-80' | oval round | medium | moderate | sun | 6.0-7.5 adapt- able |
| <i>Fraxinum pennsylvanica</i> Green Ash | 50'-60' | 25'30' | upright spread- ing | fast | moderate | sun | 6.0-7.5 adapt- able |
| 'Marshall's Seedless' | 50'-60' | 25'-30' | broadly pyrami- dal | fast | moderate to excel- lent | sun | 6.0-7.5 adapt- able |
| <i>Gleditsia tri- acanthos var. inermis</i> Thornless Honey- locust | | | | | | | |
| 'Imperial' | 30'-35' | | spread- ing ir- regular | fast | excellent | sun | 6.0-8.0 adapt- able |
| 'Moraine' | 40'-50' | | open, broadly upright | fast | excellent | sun | 6.0-8.0 adapt- able |
| 'Skyline' | 30'-45' | | pyrami- dal | fast | excellent | sun | 6.0-8.0 adapt- able |
| 'Sunburst' | 30'-35' | | broadly pyrami- dal | fast | excellent | sun | 6.0-8.0 adapt- able |

BOTTOMLAND: Deciduous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|--------------------|----------------|----------------------------|-----------------------|----------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Gymnocladus dioica</i> Kentucky Coffeetree | 60'-75' | 40'-50' | obovate | slow to medium | excellent | sun | 6.0-8.0 |
| <i>Juglans nigra</i> Black Walnut | 50'-75' | 50'-75' | oval round | slow | --- | sun | 6.0-6.5 |
| <i>Koelreuteria paniculata</i> Panicled Golden-rain-tree | 30'-40' | 30'-40' | round | medium | excellent | sun | 6.0-7.5 |
| <i>Maclura pomifera</i> var. <i>inermis</i> Thornless Osage-orange | 20'-40' | 20'-40' | round irregular | fast | excellent | sun | adapt- able |
| <i>Malus</i> species Flowering Crabapples | | | | | | | |
| 'Adams' | 20'-24' | | round | medium | excellent | sun/ part shade | 5.0-7.0 |
| 'Centurian' | 20'-25' | | narrow upright | medium | excellent | sun/ part shade | 5.0-7.0 |
| floribunda | 15'-25' | 15'-25' | spread- ing | medium | excellent | sun/ part shade | 5.0-7.0 |
| 'Liset' | 15'-20' | 10'-12' | colum- nar | medium | excellent | sun/ part shade | 5.0-7.0 |

BOTTOMLAND: Deciduous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|----------------------|-------------|------------------------------|--------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| 'Red Baron' | 12'-18' | | columnar | medium | excellent | sun/ part shade | 5.-0-7.0 |
| purpurea 'Lemoine' | 25' | 10'-25' | oval to round | medium | excellent | sun/ part shade | 5.0-7.0 |
| 'Red Jade' | 10'-15' | 10'-15' | weeping | medium | excellent | sun/ part shade | 5.0-7.0 |
| sargentii | 6'-8' | 10'-15' | low mound | medium | excellent | sun/ part shade | 5.0-7.0 |
| 'Snowdrift' | 15'-20' | 15'-20' | round | fast | excellent | sun/ part shade | 5.0-7.0 |
| 'White Candle' | 12'-15' | 2'-3' | columnar | medium | excellent | sun/ part shade | 5.0-7.0 |
| Morus rubra Fruitless Mulberry | 40'-70' | 40'-70' | open irregular | fast | excellent | sun/ part shade | apapt- able |
| Platanus acerifolia London Planetree | 70'-100' | 65'-80' | pyramidal round | medium | cankers severe problem | sun | 6.0-7.5 |
| Pyrus calleryana Callery Pear | | | | | | | |
| 'Aristocrat' | 30'-45' | | conical pyramidal | medium | excellent | sun | 6.0-7.5 adapt- able |
| 'Bradford' | 30'-50' | 20'-35' | conical oval | medium | excellent | sun | 6.0-7.5 adapt- able |

BOTTOMLAND: Deciduous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|--------------------|------------------------------------|---------------------------|----------------------------|----------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| "Capitol" | | | narrow upright | medium | excellent | sun | 6.0-7.5 adapt- able |
| 'Whitehouse' | | | columnar pyramidal | medium | excellent | sun | 6.0-7.5 adapt- able |
| <i>Quercus macrocarpa</i> Bur Oak | 70'-80' | 80'-90' | broad oval | slow | excellent | sun | 6.0-7.5 adapt- able |
| <i>Quercus muehlenbergii</i> Chinkapin Oak | 40'-50' | 50'-60' | open round | slow to medium | excellent | sun | 6.0-7.5 adapt- able |
| <i>Quercus palustris</i> Pin Oak | 60'-70' | 25'-40' | pyramidal | medium to fast | moderate | sun | 5.5-6.5 |
| <i>Quercus rubra</i> Red Oak | 60'-70' | 40'-50' | pyramidal spreading | medium to fast | moderate | sun | 6.0-7.0 |
| <i>Sapindus drummondii</i> Western Soapberry | 25'-50' | 25'-50' | round | very slow | --- | | adapt- able |
| <i>Sophora japonica</i> Japanese Pagodatree | 50'-75' | 50'-75' | round | medium to fast | moderate | sun | |
| <i>Taxodium distichum</i> Baldcypress | 50'-70' | 20'-30' | pyramidal | medium | excellent | sun | 5.0-6.5 |

BOTTOMLAND: Deciduous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|-----------------|-------------|----------------------------|--------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Tilia americana</i> Basswood/American Linden | 60'-80' | 30'-40' | pyramidal | medium | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Tilia cordata</i> Littleleaf Linden | 60'-70' | 30'-35' | upright oval | medium | moderate | sun | 6.0-7.5 adapt- able |
| 'Chancellor' | 40'-50' | | pyramidal | fast | moderate | sun | 6.0-7.5 adapt- able |
| 'Greenspire' | 40'-50' | | narrow oval | fast | moderate | sun | 6.0-7.5 adapt- able |

BOTTOMLAND: Coniferous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|-------------------|----------------|----------------------------|--------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Abies concolor</i> White Fir | 30'-50' | 15'-30' | pyramidal | slow to medium | excellent | sun/ part shade | 5.5-7.0 |
| <i>Juniperus chinensis</i> | | | | | | | |
| 'Ames' | 10'-15' | 6'- 8' | broad conical | slow | moderate | sun | 5.5-7.0 adapt- able |
| 'Blue Point' | 15'-20' | 5'- 6' | tear drop | medium | moderate | sun | 5.5-7.0 adapt- able |
| 'Densa erecta' | 25'-30' | 4'- 5' | narrow pyramidal | fast | moderate | sun | 5.5-7.0 adapt- able |
| <i>Juniperus virginiana</i> Eastern Redcedar | 40'-50' | 8'-20' | pyramidal | medium | moderate | sun/ part shade | 5.5-7.0 adapt- able |
| 'Burkii' | 10'-25' | | pyramidal | medium | moderate | sun/ part shade | 5.5-7.0 adapt- able |
| 'Canaerti' | 15'-30' | | compact pyramidal | medium | moderate | sun/ part shade | 5.5-7.0 adapt- able |
| <i>Picea glauca</i> var. <i>Densata</i> Black Hills Spruce | 30'-40' | 20'-25' | pyramidal | slow | moderate | sun/ part shade | 5.0-6.5 |

BOTTOMLAND: Coniferous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|--------------------|--|-------------------|----------------------------|------------------------------------|--------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| Pinus nigra var. nigra Austrian Pine | 50' 60' | 20' 40' | pyrami- dal- globu- lar | medium | moderate | sun | 5.5-7.0 |
| Pinus strobus Eastern White Pine | 50' 80' | 20'-40' | pyrami- dal flat top | fast | moderate | sun/ part shade | 5.5-7.0 |
| Pinus sylvestris Scotch Pine | 30' 60' | 20' 40' | pyrami- dal flat top | medium | moderate | sun | 5.5-7.0 |

BOTTOMLAND: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|-----------------|----------------|----------------------------|--------------------|----------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Berberis mentorensis</i> Mentor Barberry | 3'- 5' | 5'- 7' | round spreading | medium to fast | excellent | sun/ part shade | 6.0-7.5 |
| <i>Berberis thunbergii</i> Japanese Barberry | 3'- 6' | 4'- 7' | round | medium | excellent/ moderate | sun | 6.0-7.5 |
| <i>Berberis thunbergii</i> var. <i>atropurpurea</i> | 3'- 6' | 4'- 7' | round | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Nana' or 'Crimson Pygmy' | 18"- 2' | 2'- 3' | spreading mound | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Aurea' | 2'- 3' | 2'- 3' | round | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| <i>Cephalanthus occidentalis</i> Buttonbush | 5'-10' | 5'-10' | round | --- | --- | sun/ part shade | --- |
| <i>Chaenomeles japonica</i> Japanese Floweringquince | 3'- 4' | 3'- 6' | mound | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Jet Trail' | 2'- 3' | 3'- 6' | mound | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |

BOTTOMLAND: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|----------------------------------|-------------|----------------------------|--------------------|----------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| 'Texas Scarlet' | 2'- 3' | 3'- 6' | mound | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| Chaenomeles speciosa Common Flowering- quince | 6'-10' | 6'-10' | round upright | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Cameo' | 4'- 6' | 3'- 5' | upright | fast | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Rubra' | 4'- 5' | 3'- 5' | upright | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| Cornus racemosa Gray Dogwood | 10'-15' | 10'-15' | erect multi- stem | fast | excellent | sun/ part shade | 6.0-7.5 |
| Cornus stolonifera (Cornus sericea) Redosier Dogwood | 7'- 9' | 10'+ | broad spread- ing round | fast | moderate | sun/ part shade | 6.0-7.5 |
| Cotoneaster acutifolia Peking Cotoneaster | 5'-10' | 4'- 5' | erect round top | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| Cotoneaster apiculata Cranberry Cotoneaster | 2'- 3' | 3'- 6' | spread- ing mound | slow | excellent | sun/ part shade | 6.0-7.5 |

BOTTOMLAND: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|---------------------------|-------------------|----------------------------|-----------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Cotoneaster divaricata</i> Spreading Cotoneaster | 5'- 6' | 6'- 8' | spread- ing round | medium to fast | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| <i>Elaeagnus umbellata</i> Autumn Olive | 12'-18' | 12'-18' | spread- ing | medium to fast | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| <i>Euonymus alatus</i> Winged Euonymus | 15'-20' | 15'-20' | mound spread- ing | slow | excellent | sun/ part shade | 5.5-7.5 |
| 'Compactus' | 8'-10' | 8'-10' | rounded spread- ing | slow | --- | sun/ part shade | 5.5-7.5 |
| <i>Euonymus atropur- pureus</i> Eastern Wahoo | 12'-24' | 10'-25' | irregu- lar | medium to fast | moderate | sun/ part shade | 5.5-7.5 |
| <i>Euonymus europaeus</i> European Euonymus | 12'-30' | 10'-25' | upright broad | medium to fast | moderate | sun/ part shade | 5.5-7.5 adapt- able |
| <i>Forsythia x inter- media</i> Border Forsythia | 8'-10' | 10'-12' | upright mound | medium to fast | excellent/ moderate | sun/ part shade | 6.5-7.5 adapt- able |
| 'Karl Sax' | 5'- 7' | 5'- 7' | upright | medium to fast | excellent/ moderate | sun/ part shade | 6.5-7.5 adapt- able |
| 'Lynwood Gold' | 5'- 7' | 5'- 7' | upright | medium to fast | excellent/ moderate | sun/ part shade | 6.5-7.5 adapt- able |
| 'Spring Glory' | 5'- 7' | 5'- 7' | upright | medium to fast | excellent/ moderate | sun/ part shade | 6.5-7.5 adapt- able |

BOTTOMLAND: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|-----------------|-------------|----------------------------|--------------------|----------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| Hibiscus syriacus Rose of Sharon | | | | | | | |
| 'Anemoniflora' | 8'-10' | 8'-10' | erect spreading | medium | moderate | sun/ part shade | 6.5.-7.5 adapt- able |
| 'Ardens' | 8'-10' | 8'-10' | erect spreading | medium | moderate | sun/ part shade | 6.5-7.5 adapt- able |
| 'Coelestis' | 8'-10' | 8'-10' | erect spreading | medium | moderate | sun/ part shade | 6.5-7.5 adapt- able |
| 'Collie Mullins' | 8'-10' | 8'-10' | erect spreading | medium | moderate | sun/ part shade | 6.5-7.5 adapt- able |
| 'Diana' | 8'-10' | 8'-10' | erect spreading | medium | moderate | sun/ part shade | 6.5-7.5 adapt- able |
| Hypericum prolificum Shrubby St. Johnswort | 1'- 4' | 1'- 4' | low mound | slow | excellent | sun/ part shade | 6.5-8.0 adapt- able |
| Kolkwitzia amabilis Beautybush | 6'-10' | 4'- 8' | upright | fast | excellent | sun | adapt- able |
| Ligustrum amurense Amur Privet | 12'-15' | 8'-12' | round pyramidal | fast | moderate | sun/ part shade | 6.0-7.5 adapt- able |

BOTTOMLAND: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|------------------|-------------|----------------------------|---------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Ligustrum obtusifolium</i> Border Privet | 10'-12' | 12'-15' | broad horizontal | fast | moderate | sun/ shade shade | 6.0-7.5 adapt- able |
| <i>Lonicera morrowii</i> Morrow Honeysuckle | 6'- 8' | 6'-10' | broad round | fast | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Lonicera tatarica</i> Tatarian Honey- suckle | 10'-12' | 10' | upright round | fast | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| 'Arnold Red' | 10'-12' | 10' | upright round | fast | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| 'Grandiflora' | 10'-12' | 10' | upright round | fast | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| 'Morden Orange' | 10'-12' | 10' | upright round | fast | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Philadelphus x lemoine</i> Mockorange | | | | | | | |
| 'Belle Etoile' | 4'- 6' | 4'- 6' | upright round | fast | excellent | sun/ part shade | 6.0-7.0 adapt- able |
| 'Innocence' | 6'- 8' | 6'- 8' | upright round | fast | excellent | sun/ part shade | 6.0-7.0 adapt- able |

BOTTOMLAND: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|---------------------------|-------------------|----------------------------|-----------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Philadelphus x virginalis</i> Mockorange | | | | | | | |
| 'Albatre' or 'Glacier' | 4'- 5' | 4'- 5' | upright round | fast | excellent | sun/ part shade | 6.0-7.0 adapt- able |
| 'Minnesota Snowflake' | 6'- 8' | 6'- 8' | upright round | fast | excellent | sun/ part shade | 6.0-7.0 adapt- able |
| <i>Physocarpus opulifolius</i> Common Ninebark | 5'- 9' | 6'-10' | upright spread- ing | medium to fast | excellent | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Potentilla fruticosa</i> Bush Cinguefoil | | | | | | | |
| 'Abbotswood' | 1'- 2' | 2'- 4' | low mound | slow | excellent | sun/ part shade | 6.0-7.5 |
| 'Coronation Triumph' | 3'- 4' | 3'- 4' | upright mound | slow | excellent | sun/ part shade | 6.0-7.5 |
| 'Gold Drop' | 1'- 2' | 2'- 4' | low mound | slow | excellent | sun/ part shade | 6.0-7.5 |
| 'Primrose Beauty' | 2'- 3' | 3'- 5' | low mound | slow | excellent | sun/ part shade | 6.0-7.5 |
| <i>Prunus americana</i> Wild Plum | 12'-20' | 8'-10' | upright thicket | fast | excellent/ moderate | sun/ part shade | adapt- able |

BOTTOMLAND: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|------------------|----------------|----------------------------|--------------------|----------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Rhus aromatica</i> Fragrant Sumac | 2'- 6' | 6'-10' | low irregular | slow to medium | excellent | sun/ part shade | 6.0-7.5 |
| <i>Ribes alpinum</i> Alpine Currant | 3'- 6' | 6'-12' | round | medium | moderate | sun/ part shade | 6.0-7.5 |
| <i>Salix purpurea</i> 'Streamco' Streamco Willow | 12'-15' | 8'-10' | round multi-stem | fast | --- | sun/ part shade | 6.0-7.5 |
| <i>Salix x cottetii</i> Banker's Willow | 3'- 6' | | low spreading | fast | --- | sun/ part shade | 6.0-7.5 |
| <i>Sambucus canadensis</i> American Elder | 5'-12' | 4'- 8' | broad round | fast | moderate | sun/ part shade | 5.5-7.0 |
| <i>Spiraea x bumalda</i> 'Anthony Waterer' Anthony Waterer Spiraea | 2'- 3' | 4'- 6' | low mound | fast | moderate | sun/ part shade | 6.0-7.5 |
| <i>Spiraea nipponica</i> 'Snowmound' Snowmound Spiraea | 3'- 5' | 3'- 5' | low mound | fast | moderate | sun/ part shade | 6.0-7.5 |
| <i>Spiraea prunifolia</i> Bridleweath Spiraea | 4'- 9' | 6'- 8' | upright | fast | moderate | sun/ part shade | 6.0-7.5 |

BOTTOMLAND: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|-------------------------|-------------|----------------------------|-----------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Spirea x vanhouttei</i> Vanhoutte Spirea | 8'-10' | 10'-12' | vase- shape mound | fast | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Syringa x chinensis</i> Chinese Lilac | 8'-15' | 8'-15' | broad spread- ing | medium | moderate | sun | 6.0-8.0 adapt- able |
| 'Alba' | 8'-15' | 8'-15' | broad spread- ing | medium | moderate | sun | 6.0-8.0 adapt- able |
| 'Saugeana' | 8'-15' | 8'-15' | broad spread- ing | medium | moderate | sun | 6.0-8.0 adapt- able |
| <i>Syringa vulgaris</i> French Hybrid Lilac | 8'-15' | 6'-15' | upright | medium | moderate | sun | 6.0-7.5 |
| <i>Viburnum carlesii</i> Koreanspice Viburnum | 4'- 8' | 4'- 8' | round | slow | excellent | sun/ part shade | 6.0-7.5 |
| <i>Viburnum dentatum</i> Arrowwood Viburnum | 6'-15' | 6'-15' | round | medium | excellent | sun/ part shade | 6.0-7.5 |
| <i>Viburnum lantana</i> Wayfaringtree Viburnum | 10'-14' | 10'-15' | round | medium | excellent | sun/ part shade | 6.0-7.5 |
| <i>Viburnum lentago</i> Nannyberry Viburnum | 15'-18' | 6'-10' | open upright | medium | excellent | sun/ part shade | 6.0-7.5 |

BOTTOMLAND: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|---------------------------|-------------------|----------------------------|-----------------------|----------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| Viburnum opulus European Cranberry- bush Viburnum | 8'-12' | 10'-15' | oval round upright | medium | moderate | sun/ part shade | 6.0-7.5 |
| 'Compactum' | 4'- 5' | 5'- 6' | round | medium | moderate | sun/ part shade | 6.0-7.5 |
| Viburnum setigerum Tea Viburnum | 8'-12' | 6'-9' | upright multi- stem | slow to medium | excellent | sun/ part shade | 6.0-7.5 |
| Viburnum trilobum American Cranberry- bush Viburnum | 8'-12' | 8'-12' | oval round | medium | excellent | sun/ part shade | 6.0-7.5 |
| 'Compactum' | 4'- 5' | 5'- 6' | round | medium | excellent | sun/ part shade | 6.0-7.5 |
| Weigela florida Old Fashioned Weigela | 6'- 9' | 9'-12' | round | medium | excellent | sun/ part shade | adapt- able |
| 'Vanicek' | 6'- 9' | 9'-12' | round | fast | excellent | sun/ part shade | adapt- able |

BOTTOMLAND: Broadleaf Evergreen Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|------------------------------------|-------------------|----------------------------|-------------------------------|----------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Berberis juliana</i> Wintergreen Barberry | 6'-10' | 6'-10' | round | medium | excellent | sun/ part shade | 6.0-7.5 |
| <i>Euonymus fortunei</i> 'Green Lane' Green Lane Euonymus | 4'- 5' | 4' | irregu- lar | fast | moderate | full sun or shade | 5.5-7.5 |
| <i>Euonymus kiaut- schovicus</i> 'Manhattan' Manhattan Spread- ing Euonymus | 8'-10' | 8'-12' | round | fast | excellent | full sun or shade | 5.5-7.5 |
| <i>Mahonia aquifolium</i> Oregon Grapeholly | 3'- 6' | 3'- 5' | tall upright or low broad | slow | moderate | sun/ pre- fers shade | 6.-0-7.5 |
| 'Compactum' | 2'- 3' | 2'- 3' | round | slow | --- | shade | 6.0-7.5 |
| <i>Pyracantha coccinea</i> Scarlet Firethorn | 6'-18' | 6'-18' | open irregu- lar | medium to fast | moderate | sun/ part shade | 5.5-7.5 |

BOTTOMLAND: Coniferous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|-------------------|----------------------------|-----------------|----------------------------|-------------------------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| Juniperus chinensis 'Pfitzeriana' Pfitzer Juniper | 5'-10' | 15'-20' | spread- ing | fast | moderate | sun | 5.5-7.0 adapt- able |
| 'Pfitzeriana Compacta' | 4'- 6' | 5'- 7' | spread- ing | medium | moderate | sun | 5.5-7.0 |
| 'Pfitzeriana Nana' | 3'- 4' | 4'- 5' | spread- ing | medium | moderate | sun | 5.5-7.0 adapt- able |
| Juniperus sabina Savin Juniper | 4'- 6' | 5'-10' | spread- ing | slow | moderate | sun | 5.5-7.0 adapt- able |
| 'Skandia' | 12"-18" | 3'- 4' | low spread- ing | slow | moderate | sun | 5.5-7.0 adapt- able |
| Pinus mugo var. mugo Mugo Pine | 2'- 5' | 4'- 8' | globu- lar | slow | moderate | sun/ part- shade | 5.5-7.0 |
| 'Pumilio' | 2'- 5' | 2'- 5' | round mound | slow | moderate | sun | 5.0-7.0 |
| Taxus cuspidata Japanese Yew | | | | | | | |
| 'Densa' | 3'- 4' | 6'- 8' | spread- ing | slow | excellent/ moderate | sun/ shade | 5.5-7.5 |
| 'Nana' | 4'- 5' | 6'- 8' | spread- ing | slow | excellent/ moderate | sun/ shade | 5.5-7.5 |

BOTTOMLAND: Coniferous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|-------------------------------|---------------------|---------------|----------------------|----------------|----------------------------|---------------|----------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| Taxus x media Anglojap Yew | | | | | | | |
| 'Hatfield' | 8'-12' | 6'-10' | broad pyrami- | slow | excellent/ moderate | sun/ shade | 5.5-7.5 |
| 'Hicksii' | 10'-12' | 2'- 3' | colum- nar | fast | excellent/ moderate | sun/ shade | 5.5-7.5 |
| 'Densifomis' | 3'- 4' | 6'- 8' | broad spread- ing | medium slow | excellent moderate | sun/ shade | 5.5-7.5 |

BOTTOMLAND: Deciduous Ground Cover and Vines

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|-----------------------------------|-----------------|----------------------------|-----------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Ajuga reptans</i> Carpet Bugle | 4" | | spread- ing ground cover | fast | moderate | sun/ shade | adapt- able |
| <i>Campsis radicans</i> Common Trumpet Creeper | 30'-50' | | climb- ing | fast | excellent/ moderate | sun/ shade | adapt- able |
| <i>Chaenomeles japonica</i> 'Alpina' Alpine Flowering- quince | 1' | 3'- 4' | mound ground cover | slow | moderate | sun/ part shade | adapt- able |
| <i>Clematis paniculata</i> Sweetautumn Clematis | 30'-40' | | climb- ing | fast | excellent/ moderate | sun/ shade | 6.5-7.5 |
| <i>Cotoneaster dammeri</i> 'Royal Beauty' Royal Beauty Cotoneaster | 1'-18" | 5'- 6' | mound ground cover | fast | excellent | sun/ shade | 6.0-7.5 adapt- able |
| <i>Cotoneaster horizontalis</i> Rock Cotoneaster | 2'- 3' | 5'- 8' | spread- ing ground cover | slow/ medium | excellent | sun/ shade | 6.0-7.5 adapt- able |
| <i>Forsythia viridissima</i> 'Bronxensis' Bronx Forsythia | 1' | 1'- 2' | compact drawf shrub | slow | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Hemerocallis</i> species Daylillies | 1'- 3' | | ground cover | | excellent/ moderate | sun | adapt- able |
| <i>Lonicera sempervirens</i> Trumpet Honey- suckle | 10'-20' | | vine | fast | moderate | sun/ shade | 6.0-7.5 |
| <i>Parthenocissus quinquefolia</i> Virginia Creeper | 30'-50' | | climb- ing vine | fast | excellent/ moderate | sun/ shade | 6.0.7.5 |

BOTTOMLAND: Deciduous Ground Cover and Vines

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|-----------------------|-------------|----------------------------|-----------------------|----------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| Parthenocissus tricuspidata Boston Ivy | 30'-50' | | climb- ing vine | fast | excellent/ moderate | sun/ shade | 6.0-7.5 |
| Viburnum opulus 'Nanum' Dwarf European Cranberrybush Viburnum | 18"- 2' | 18"- 2' | low shrub | medium | moderate | sun/ part shade | 6.0-7.5 |

BOTTOMLAND: Evergreen Ground Cover and Vines

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|--------------------|-------------------|----------------------------|---------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Euonymus fortunei</i> Wintercreeper <i>Euonymus</i> | 4"- 6" | | ground cover | fast | moderate | sun/ shade | 5.5-7.5 adapt- able |
| <i>Hedera helix</i> English Ivy | 6"- 8" | | ground cover | fast | moderate | sun/ shade | 6.0-7.5 |
| <i>Juniperus chinensis</i> var. <i>sargentii</i> Sargent Juniper | 18"-24" | 7'- 9' | low spread- ing | slow | --- | sun | 5.5-7.0 adapt- able |
| <i>Juniperus horizontalis</i> Andorra Creeping Juniper | 12"-18" | 6'- 8' | low spread- ing | medium | moderate | sun | 5.5-7.0 adapt- able |
| 'Plumosa Youngs- town' | 1'- 2' | 8'-10' | low spread- ing | slow to medium | moderate | sun | 5.5-7.0 adapt- able |
| 'Bar Harbor' | 6"-12" | 6'- 8' | low spread- ing | fast to medium | moderate | sun | 5.5-7.0 adapt- able |
| <i>Juniperus procumbens</i> Japgarden Juniper | 8"-24" | 10'-15' | low spread- ing | slow | moderate | sun | 5.5-7.0 adapt- able |
| 'Nana' | 8"-12" | 10'-15' | low spread- ing | slow | moderate | sun | 5.5-7.0 adapt- able |
| <i>Juniperus sabina</i> var. <i>tamarisci-</i> <i>folia</i> Tam's Juniper | 12"-18" | 10'-15' | low spread- ing | fast to medium | moderate | sun | 5.5-7.0 adapt- able |

BOTTOMLAND: Evergreen Ground Cover and Vines

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|--------------|---------------|----------------------------|-------------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Lonicera japonica</i> 'Halliana' Hall's Japanese Honeysuckle | 1'- 2' | | ground cover | fast | moderate | sun/ shade | 6.0-8.0 adapt- able |
| <i>Pachysandra terminalis</i> Japanese Pachysandra | 6"-12" | | ground cover | slow | moderate | part shade/ shade | 5.0-7.0 |
| 'Green Carpet' | 4"- 6" | | ground cover | slow | moderate | part shade/ shade | 5.0-7.0 |
| <i>Vinca minor</i> Periwinkle | 3"- 6" | | vine | moder- ate | moderate | sun/ shade | 6.0-7.5 |

UPLAND RANGE: Deciduous Trees

| Botanical Name Common Name | Mature Height | CULTURAL CONDITIONS | | | | ENVIRONMENTAL | |
|---|--------------------|---------------------|--|-------------------------------|----------------------------|-----------------------|--|
| | | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Acer saccharum</i> 'Green Mountain' Green Mountain Sugar Maple | 50'-65' | | upright oval | slow | moderate | sun | 6.0-7.5 adapt- able |
| <i>Acer tataricum</i> Tatarian Maple | 15'-20' | 15'-20' | round spread- ing | slow to medium | excellent | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Celtis occidentalis</i> Common Hackberry | 40'-60' | 40'-60' | spread- ing ir- regular | medium to fast | moderate | sun | 6.0-7.5 adapt- able |
| <i>Cercis canadensis</i> Eastern Redbud | 20'-30' | 25'-35' | spread- ing ir- regular | medium | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Crataegus crusgalli</i> 'Crusader' Crusader Thornless Hawthorn | 20'-30' | 20'-25' | broad round | slow to medium | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Crataegus phaeno- pyrum</i> Washington Hawthorn | 25'-30' | 20'-25' | broadly colum- nar | slow to medium | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Crataegus punctata</i> var. <i>inermis</i> 'Ohio Pioneer' Ohio Pioneer Dotted Hawthorn | 20'-35' | 20'-30' | round/ spread- ing | slow to medium | moderate | sun | 6.0-7.5 adapt- able |
| <i>Elaeagnus angustifolia</i> Russian Olive | 12'-20' | 12'-20' | round | medium to fast | moderate | sun | 6.0-7.5 adapt- able |
| <i>Fraxinus americana</i> 'Rose Hill' White Ash Rose Hill | 50'-80' | 50'-80' | oval round | medium | moderate | sun | 6.0-7.5 adapt- able able |

UPLAND RANGE: Deciduous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|-------------------------------|-------------|-------------------------------|---------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Fraxinus pennsylvanica</i> 'Marshall's Seedless' Marshall's Seedless Green Ash | 50'-60' | 25'-30' | broadly pyramidal | fast | moderate/ excellent | sun | 6.0-7.5 adapt- able |
| <i>Gleditsia triacanthos</i> var. <i>inermis</i> Thornless Honeylocust 'Imperial' | 30'-35' | | spread- ing ir- regular | fast | excellent | sun | 6.0-8.0 adapt- able |
| 'Moraine' | 40'-50' | | open, broadly upright | fast | excellent | sun | 6.0-8.0 adapt- able |
| 'Skyline' | 30'-45' | | pyrami- dal | fast | excellent | sun | 6.0-8.0 adapt- able |
| 'Sunburst' | 30'-35' | | broadly pyrami- dal | fast | excellent | sun | 6.0-8.0 adapt- able |
| <i>Koelreutaria paniculata</i> Panicked Golden- raintree | 30'-40' | 30'-40' | round | medium | excellent | sun | 6.0-7.5 |
| <i>Maclura pomifera</i> var. <i>inermis</i> Thornless Osage- orange | 20'-40' | 20'-40' | round irregu- lar | fast | excellent | sun | adapt- able |

UPLAND RANGE: Deciduous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|---------------------|-------------|----------------------------|--------------------|----------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| Malus species Flowering Crabapples | | | | | | | |
| 'Adams' | 20'-24' | | round | medium | excellent | sun/ part shade | 5.0-7.0 |
| 'Centurian' | 20'-25' | | narrow upright | medium | excellent | sun/ part shade | 5.0-7.0 |
| floribunda | 15'-25' | 15'-25' | spread- ing | medium | excellent | sun/ part shade | 5.0-7.0 |
| 'Liset' | 15'-20' | 10'-12' | colum- nar | medium | excellent | sun/ part shade | 5.0-7.0 |
| 'Red Baron' | 12'-18' | | colum- nar | medium | excellent | sun/ part shade | 5.-0-7.0 |
| purpurea 'Lemoine' | 25' | 10'-25' | oval to round | medium | excellent | sun/ part shade | 5.0-7.0 |
| 'Red Jade' | 10'-15' | 10'-15' | weep- ing | medium | excellent | sun/ part shade | 5.0-7.0 |
| sargentii | 6'-8' | 10'-15' | low mound | medium | excellent | sun/ part shade | 5.0-7.0 |
| 'Snowdrift' | 15'-20' | 15'-20' | round | fast | excellent | sun/ part shade | 5.0-7.0 |
| 'White Candle' | 12'-15' | 2'-3' | colum- nar | medium | excellent | sun/ part shade | 5.0-7.0 |

UPLAND RANGE: Deciduous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|--------------------|--------------------------------|---------------------------|----------------------------|--------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Morus rubra</i> Fruitless Mulberry | 40'-70' | 40'-70' | open irregular | fast | excellent | sun/ part shade | apapt- able |
| <i>Pyrus calleryana</i> Callery Pear | | | | | | | |
| 'Aristocrat' | 30'-45' | | conical pyramidal | medium | excellent | sun | 6.0-7.5 adapt- able |
| 'Bradford' | 30'-50' | 20'-35' | conical oval | medium | excellent | sun | 6.0-7.5 adapt- able |
| 'Capitol' | | | narrow upright | medium | excellent | sun | 6.0-7.5 adapt- able |
| 'Whitehouse' | | | columnar pyramidal | medium | excellent | sun | 6.0-7.5 adapt- able |
| <i>Quercus macrocarpa</i> Bur Oak | 70'-80' | 80'-90' | broad oval | slow | excellent | sun | 6.0-7.5 adapt- able |
| <i>Quercus muehlenbergii</i> Chinkapin Oak | 40'-50' | 50'-60' | open round | slow to medium | excellent | sun | 6.0-7.5 adapt- able |
| <i>Quercus rubra</i> Red Oak | 60' 70' | 40' 50' | pyramidal spreading | medium to fast | moderate | sun | 6.0 7.0 |
| <i>Sapindus drummondi</i> Western Soapberry | 25'-50' | 25'-50' | round | very slow | --- | | adapt- able |

UPLAND RANGE: Deciduous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|--------------|----------------|----------------------------|--------------------|---------------------------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Sophora japonica</i> Japanese Pagodatree | 50'-75' | 50'-75' | round | medium to fast | moderate | sun | |
| <i>Taxodium distichum</i> Baldcypress | 50'-70' | 20'-30' | pyramidal | medium | excellent | sun | 5.0-6.5 |
| <i>Tilia americana</i> Basswood/American Linden | 60'-80' | 30'-40' | pyramidal | medium | moderate | sun/ part shade | 6.0-7.5 adapt- able |
| <i>Tilia cordata</i> Littleleaf Linden | 60'-70' | 30'-35' | upright oval | medium | moderate | sun | 6.0-7.5 adapt- able |
| 'Chancellor' | 40'-50' | | pyramidal | fast | moderate | sun | 6.0-7.5 adapt- able |
| 'Greenspire' | 40'-50' | | narrow oval | fast | moderate | sun | 6.0-7.5 adapt- able |

UPLAND RANGE: Coniferous Trees

| Botanical Name Common Name | Mature Height | CULTURAL CONDITIONS | | | | ENVIRONMENTAL | |
|---|--------------------|---------------------|--|-------------------|-------------------------------|-----------------------|---------------------------|
| | | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| Juniperus chinensis | | | | | | | |
| 'Ames' | 10'-15' | 6'- 8' | broad conical | slow | moderate | sun | 5.5-7.0 adapt- able |
| 'Blue Point' | 15'-20' | 5'- 6' | tear drop | medium | moderate | sun | 5.5-7.0 adapt- able |
| 'Densa erecta' | 25'-30' | 4'- 5' | narrow pyrami- dal | fast | moderate | sun | 5.5-7.0 adapt- able |
| Juniperus virginiana Eastern Redcedar | 40'-50' | 8'-20' | pyrami- dal | medium | moderate | sun/ part shade | 5.5-7.0 adapt- able |
| 'Burkii' | 10'-25' | | pyrami- dal | medium | moderate | sun/ part shade | 5.5-7.0 adapt- able |
| 'Canaerti' | 15'-30' | | compact pyrami- dal | medium | moderate | sun/ part shade | 5.5-7.0 adapt- able |
| Pinus nigra var. nigra Austrian Pine | 50'-60' | 20'-40' | pyrami- dal- globu- lar | medium | moderate | sun | 5.5-7.0 |

UPLAND RANGE: Coniferous Trees

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|--------------------|---------------------|-------------------|----------------------------|----------------|--|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| Pinus ponderosa Ponderosa Pine | 60' 160' | 25' 30' | columnar | medium | moderate | sun | 5.5 7.0 adapt- able |

UPLAND RANGE: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|---|---------------------|---------------|-----------------|----------------|----------------------------|--------------------|----------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| <i>Berberis mentorensis</i> Mentor Barberry | 3'- 5' | 5'- 7' | round spreading | medium to fast | excellent | sun/ part shade | 6.0-7.5 |
| <i>Berberis thunbergii</i> Japanese Barberry | 3'- 6' | 4'- 7' | round | medium | excellent/ moderate | sun | 6.0-7.5 |
| <i>Berberis thunbergii</i> var. <i>atropurpurea</i> | 3'- 6' | 4'- 7' | round | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Nana' or 'Crimson Pygmy' | 18"- 2' | 2'- 3' | spreading mound | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Aurea' | 2'- 3' | 2'- 3' | round | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| <i>Cephalanthus occidentalis</i> Buttonbush | 5'-10' | 5'-10' | round | --- | --- | sun/ part shade | --- |
| <i>Chaenomeles japonica</i> Japanese Floweringquince | 3'- 4' | 3'- 6' | mound | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Jet Trail' | 2'- 3' | 3'- 6' | mound | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |

UPLAND RANGE: Deciduous Shrubs

| Botanical Name Common Name | CULTURAL CONDITIONS | | | | | ENVIRONMENTAL | |
|--|---------------------|---------------|-------------------------|-------------|----------------------------|--------------------|----------|
| | Mature Height | Mature Spread | Form | Growth Rate | Disease/ Pest Resistant | Sun/ Shade | pH Range |
| 'Texas Scarlet' | 2'- 3' | 3'- 6' | mound | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| <i>Chaenomeles speciosa</i> Common Flowering- quince | 6'-10' | 6'-10' | round upright | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Cameo' | 4'- 6' | 3'- 5' | upright | fast | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| 'Rubra' | 4'- 5' | 3'- 5' | upright | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| <i>Cornus racemosa</i> Gray Dogwood | 10'-15' | 10'-15' | erect multi- stem | fast | excellent | sun/ part shade | 6.0-7.5 |
| <i>Cotoneaster acutifolia</i> Peking Cotoneaster | 5'-10' | 4'- 5' | erect round top | medium | excellent/ moderate | sun/ part shade | 6.0-7.5 |
| <i>Cotoneaster apiculata</i> Cranberry Cotoneaster | 2'- 3' | 3'- 6' | spread- ing mound | slow | excellent | sun/ part shade | 6.0-7.5 |

