SPECIFICATION SECTION 00 01 10 – STATEMENT OF WORK

Family Housing Replacement

<LOCATION>

U.S. ARMY CORPS OF ENGINEERS

g<DATE>

“< >” indicates fields that RFP preparer fills out in accordance with project requirements.
“[ ]” indicates notes to RFP preparer
## CONTENTS

### SECTION 00 01 10 STATEMENT OF WORK

1.0 GENERAL

1.1 DESIGN OBJECTIVES AND CRITERIA

1.1.1 General Information
1.1.2 Goal and Objectives
1.1.3 Work Scope
1.1.4 Blank
1.1.5 Design Freedom
1.1.6 Design Quality
1.1.7 Installation Real Property Master Plan
1.1.8 Installation Design Guide
1.1.9 Energy and Resources Conserving Features

1.2 STANDARDS AND CRITERIA

1.2.1 References and Glossary
1.2.2 Building Codes and Standards

2.0 NEIGHBORHOOD AND SITE DESIGN CRITERIA

2.1 NEIGHBORHOOD DESIGN

2.1.1 General
2.1.2 Neighborhood Development

2.2 SITE PLANNING AND DESIGN

2.2.1 Site Planning
2.2.2 Site Development
2.2.3 Unit Type

2.3 SITE DESIGN CRITERIA

2.3.1 Site Density
2.3.2 Unit Types by Density
2.3.3 Maximum Units per Building by Grade
2.3.4 Parking Requirements by Site Density
2.3.5 Recreational Vehicle (RV) Storage
2.3.6 Building Setbacks and Spacing

2.4 PUBLIC RECREATIONAL FACILITIES AND SITE AMENITIES

2.4.1 General
2.4.3 Children's Outdoor Play Areas

3.0 SITE ENGINEERING

3.1 VEHICULAR AND PEDESTRIAN CIRCULATION

3.1.1 General
3.1.2 Roads and Streets
3.1.3 Curb, Gutter, and Sidewalk
3.1.4 Driveways
# Unit Design

## General

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.1</td>
<td>31</td>
</tr>
<tr>
<td>4.3.2</td>
<td>32</td>
</tr>
<tr>
<td>4.3.3</td>
<td>33</td>
</tr>
<tr>
<td>4.3.4</td>
<td>33</td>
</tr>
<tr>
<td>4.3.5</td>
<td>33</td>
</tr>
<tr>
<td>4.3.6</td>
<td>34</td>
</tr>
<tr>
<td>4.3.7</td>
<td>34</td>
</tr>
<tr>
<td>4.3.8</td>
<td>34</td>
</tr>
<tr>
<td>4.3.9</td>
<td>34</td>
</tr>
<tr>
<td>4.3.10</td>
<td>34</td>
</tr>
<tr>
<td>4.3.11</td>
<td>35</td>
</tr>
<tr>
<td>4.3.12</td>
<td>37</td>
</tr>
<tr>
<td>4.3.13</td>
<td>38</td>
</tr>
<tr>
<td>4.3.14</td>
<td>39</td>
</tr>
</tbody>
</table>

All contractor installed appliances shall be ENERGY STAR certified.

## Bathrooms

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
</tr>
</tbody>
</table>

## Bedrooms

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
</tr>
</tbody>
</table>

## Breakfast Area

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
</tr>
</tbody>
</table>

## Dining Room

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
</tr>
</tbody>
</table>

## Entrance Foyer

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
</tr>
</tbody>
</table>

## Circulation

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
</tr>
</tbody>
</table>

## Kitchen Area

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
</tr>
</tbody>
</table>

## Laundry/Utility Room

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
</tr>
</tbody>
</table>

## Living/Family Room

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
</tr>
</tbody>
</table>

## Interior Storage and Closets

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
</tr>
</tbody>
</table>

## Interior Finishes

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
</tr>
</tbody>
</table>

## Cabinets and Countertops

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
</tr>
</tbody>
</table>

## Appliances

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
</tr>
</tbody>
</table>

## Interior Doors

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
</tr>
</tbody>
</table>

## Hardware

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
</tr>
</tbody>
</table>

## Postal Service and Building Signage

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
</tr>
</tbody>
</table>

# Outdoor Living Areas

## General

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
</tr>
</tbody>
</table>

## Balconies

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
</tr>
</tbody>
</table>

## Patios and Decks

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
</tr>
</tbody>
</table>

## Exterior Stairs

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
</tr>
</tbody>
</table>

# Foundations

## General

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
</tr>
</tbody>
</table>

## Basements

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
</tr>
</tbody>
</table>

## Slabs-on-Grade or Crawl Spaces

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
</tr>
</tbody>
</table>

## Tornado Protection Shelter

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
</tr>
</tbody>
</table>

# Roof and Attic Construction

## Roofs

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
</tr>
</tbody>
</table>

## Gutters and Downspouts

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
</tr>
</tbody>
</table>

## Materials

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
</tr>
</tbody>
</table>

## Attics

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
</tr>
</tbody>
</table>

# Exterior Construction

## General

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
</tr>
</tbody>
</table>

## Structural Design

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
</tr>
</tbody>
</table>

## Trim

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
</tr>
</tbody>
</table>

## Exterior Ceilings and Soffits

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
</tr>
</tbody>
</table>

## Windows and Glazed Doors

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
</tr>
</tbody>
</table>

## Exterior Doors

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
</tr>
</tbody>
</table>

## Main Entry

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
</tr>
</tbody>
</table>
4.7.9 Garages .......................................................................................................................... 49
Provide attached garages for all but apartment-type units, which will have consolidated parking. .................................................................................................................. 49
4.7.10 Exterior Storage ........................................................................................................... 50
4.7.11 Trash Area ................................................................................................................... 50

5.0 BUILDING SYSTEMS .................................................................................................... 51
5.1 WATER .............................................................................................................................. 51
5.2 SANITARY SEWER ......................................................................................................... 55
5.3 GAS ................................................................................................................................... 55
5.3.3 Fuel Oil Storage and Distribution .................................................................................. 56
5.3.4 Liquefied Petroleum (LP) Gas Storage and Distribution ............................................. 56
5.4 INTERIOR ELECTRICAL SYSTEMS .......................................................................... 56
5.4.1 Unit Electrical System ................................................................................................. 57
5.4.2 Telecommunications and Cable Television (CATV) System ........................................ 59

6.0 FIRE AND LIFE SAFETY ............................................................................................. 67
6.1 FIRE AND LIFE SAFETY ............................................................................................. 67
6.1.1 General ....................................................................................................................... 67
6.1.2 Flame-Spread and Smoke-Developed Indices ................................................................ 67
6.1.3 Smoke Alarms .............................................................................................................. 67
6.1.4 Automatic Sprinklers .................................................................................................. 68
6.1.5 Fire-Resistant Separation ............................................................................................ 68
6.1.6 General Alarm Systems .............................................................................................. 68
6.1.7 Carbon Monoxide (CO) Alarm .................................................................................... 68
6.1.8 Fire-Retardant-Treated (FRT) Plywood ..................................................................... 68
6.1.9 Overseas and Leased Housing Requirements. NA ...................................................... 69

7.0 ENVIRONMENTAL ......................................................................................................... 70
7.1 ENVIRONMENTAL ......................................................................................................... 70
7.2 SOUND ATTENUATION ............................................................................................... 71
7.2.1 Air-Borne Sound ......................................................................................................... 71
7.2.2 Structure-Borne Sound. Not used ............................................................................... 71
7.2.3 Testing ......................................................................................................................... 71
7.2.4 Plumbing and HVAC Equipment .................................................................................. 72

8.0 ENERGY EFFICIENCY AND WATER CONSERVATION ........................................... 73
8.1 ENERGY EFFICIENCY ..................................................................................................... 73
8.2 WATER CONSERVATION AND LANDSCAPING ...................................................... 76
9.0 SUSTAINABILITY .......................................................................................................... 81
9.2 BUILDING COMMISSIONING ...................................................................................... 82
9.3 SUSTAINABLE DEVELOPMENT WORKBOOK AND RATING SYSTEM ............ 83

APPENDIX A REFERENCES ............................................................................................... 85
APPENDIX B GLOSSARY ..................................................................................................... 93
<table>
<thead>
<tr>
<th>Table Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2-1</td>
<td>Maximum Units per Building Type and Grade</td>
<td></td>
</tr>
<tr>
<td>Table 2-2</td>
<td>Site Densities</td>
<td>10</td>
</tr>
<tr>
<td>Table 2-3</td>
<td>Housing Unit Types by Density</td>
<td>10</td>
</tr>
<tr>
<td>Table 2-4</td>
<td>Maximum Number of Units per Building by Grade</td>
<td>11</td>
</tr>
<tr>
<td>Table 2-5</td>
<td>Project Housing Units by Grade</td>
<td></td>
</tr>
<tr>
<td>Table 2-6</td>
<td>Minimum Setbacks and Spacing – Low Density Sites</td>
<td></td>
</tr>
<tr>
<td>Table 2-7</td>
<td>Minimum Setbacks and Spacing – Medium and High Density Sites</td>
<td>12</td>
</tr>
<tr>
<td>Table 2-8</td>
<td>Site Amenities</td>
<td>14</td>
</tr>
<tr>
<td>Table 2-9</td>
<td>Support Facilities</td>
<td></td>
</tr>
<tr>
<td>Table 3-1</td>
<td>Soil Compaction</td>
<td>20</td>
</tr>
<tr>
<td>Table 4-1</td>
<td>Unit Floor Area</td>
<td>29</td>
</tr>
<tr>
<td>Table 4-2</td>
<td>Minimum Area and Dimensions – Interior Spaces</td>
<td>31</td>
</tr>
<tr>
<td>Table 4-3</td>
<td>Bathroom Requirements</td>
<td>32</td>
</tr>
<tr>
<td>Table 4-4</td>
<td>Minimum Closet Widths</td>
<td>35</td>
</tr>
<tr>
<td>Table 4-5</td>
<td>Minimum Bulk Storage</td>
<td>36</td>
</tr>
<tr>
<td>Table 4-6</td>
<td>Kitchen Cabinet, Counter &amp; Pantry Area</td>
<td>38</td>
</tr>
<tr>
<td>Table 4-7</td>
<td>Minimum Kitchen Cabinet Specifications</td>
<td>39</td>
</tr>
<tr>
<td>Table 4-8</td>
<td>Hardware Specifications</td>
<td>41</td>
</tr>
<tr>
<td>Table 4-9</td>
<td>Minimum Area and Dimensions of Exterior Spaces</td>
<td>43</td>
</tr>
<tr>
<td>Table 5-1</td>
<td>Water Heater Sizing</td>
<td>51</td>
</tr>
<tr>
<td>Table 8-1</td>
<td>Optimum Solar Glazing</td>
<td>74</td>
</tr>
</tbody>
</table>
SECTION 00 01 10 STATEMENT OF WORK

1.0 GENERAL

1.1 DESIGN OBJECTIVES AND CRITERIA

1.1.1 General Information.

The design and construction shall comply with the specifications and requirements contained in UFC 4-711-01 and with this Statement of Work. In the event of conflicts the Statement of Work governs. The design and technical criteria contained and cited herein establish minimum standards for design and construction quality. All housing units constructed in accordance with these standards shall meet the Army's sustainable design and development (SDD) policy minimum requirements (see Appendix A).

1.1.2 Goal and Objectives.

The Military Family Housing Goal Statement defines the ideal end-state for military communities and housing. It is not intended to be static, but responsive to the dynamics of military family housing needs. The Military Family Housing Goal is:

- To provide quality-housing neighborhoods to contribute to a strong force of skilled people who provide the readiness of our Military Forces.

Military family housing objectives support the family housing goal. These objectives are:

- To bring the existing required housing inventory up to contemporary housing standards (i.e., codes, safety, maintainability, livability, amenities) through repair, improvement and replacement.

- To meet sustainability requirements of the Army Sustainable Design and Development Policy, latest edition, EPAct 05, EISA07, EO 13693.

Housing Improvement projects shall:

- Be designed and constructed to minimize life cycle costs. Use Life-Cycle Cost Analysis (LCCA) set out in subpart A of 10 CFR part 436 (most recent ACSIM SDD) and UFC 1-200-02.

- Lessen impact on the environment by incorporating Low Impact Development (most recent ACSIM SDD Policy Memo).

- Incorporate SDD principles and maximize water consumption reduction and optimize energy efficiencies and performance. (Most recent ACSIM SDD Policy Memo.)

- Include utility replacement, as required.

- Provide street replacement.

- Provide streetscape improvements.

- Provide community amenities.
• Improve heating, air conditioning, and domestic hot water generating efficiencies.

• Comply with current DoD Antiterrorism Standards for Buildings.

The PRIMARY CONSIDERATION of the solicitation process is to provide the entire number of housing units identified in this Statement of Work. All proposals received MUST include the total number of units required to be considered for evaluation and award. In no case will a smaller number of units be accepted to allow inclusion of betterments or enhancements. Betterments and enhancements will not be considered unless the proposal includes ALL units required. Contractors are encouraged to review the statement of work to familiarize themselves with all of the available options and alternatives included therein. In many instances several finishes or materials are identified for a specific item; however, the primary consideration of this solicitation is obtaining all units scheduled for construction in this project.

Betterments or enhancements that exceed the proposal requirements shall be clearly listed and identified in the proposal. Where evaluators agree the betterments are of value to the Government, proposals may receive additional consideration in the evaluation process provided that all required living units are included in the proposal. The Scope of Work indicates the following may receive additional consideration:

*****list of betterments that occur throughout the scope of work?*****

1.1.3 Work Scope.

The objective of this project is to obtain housing complete and adequate for assignment as quarters for military personnel and their families. This contract shall consist of the design and construction of a total of <NUMBER OF NEW UNITS> housing units and site improvements on Government-owned land at <LOCATION> which comply with this document. <NUMBER OF NEW UNITS> new housing units are to be constructed and <NUMBER OF DEMO UNITS> units are to be demolished, comprising <TOTAL SF OF DEMO> square feet.

Construct <NUMBER OF NEW UNITS> housing units in accordance with the following quantity and rank distribution;

<table>
<thead>
<tr>
<th>Rank/Grade</th>
<th>3 bedroom units</th>
<th>4 bedroom units</th>
<th>5 bedroom units</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;RANK 1&gt;</td>
<td># OF 3BR UNIT FOR RANK 1&gt;</td>
<td># OF 4BR UNIT FOR RANK 1&gt;</td>
<td># OF 5BR UNIT FOR RANK 1&gt;</td>
</tr>
<tr>
<td>&lt;RANK 2&gt;</td>
<td># OF 3BR UNIT FOR RANK 2&gt;</td>
<td># OF 4BR UNIT FOR RANK 2&gt;</td>
<td># OF 5BR UNIT FOR RANK 2&gt;</td>
</tr>
<tr>
<td>&lt;RANK 3&gt;</td>
<td># OF 3BR UNIT FOR RANK 3&gt;</td>
<td># OF 4BR UNIT FOR RANK 3&gt;</td>
<td># OF 5BR UNIT FOR RANK 3&gt;</td>
</tr>
<tr>
<td>&lt;RANK 4&gt;</td>
<td># OF 3BR UNIT FOR RANK 4&gt;</td>
<td># OF 4BR UNIT FOR RANK 4&gt;</td>
<td># OF 5BR UNIT FOR RANK 4&gt;</td>
</tr>
</tbody>
</table>

Project includes living areas, kitchen, bathrooms, bedrooms, storage, garages, private entrance, patios, backyard fencing, landscaping, and individual unit utility meters. Supporting facilities include site work, walkways, roads, all required utility systems, storm drainage, street lighting, and information systems. Heating and air conditioning shall be provided by self-contained systems. Residential automatic fire sprinkler system shall be provided at minimum. Generally, the Department of Defense (DoD) Minimum Antiterrorism for Buildings standards are applicable to multi-family housing only (apartments).

Accessibility for individuals with disabilities shall be provided in five (5) percent of the project total units. Project shall comply with the Army Standard for Family Housing and UFC 4-711-01. Design and construction includes requirements of current Sustainable Design and Development Policy.
Update (Environmental and Energy Performance). Facilities shall be designed to a minimum life of 40 years in accordance with DoD's Unified Facilities Code (UFC 1-200-02) including energy efficiencies, building envelope and integrated building systems performance. See also Sec 2.3. Imaginative site design is encouraged; however, the site boundaries, project composition, and gross density are fixed. Based on the graphic and narrative description of site opportunities and constraints provided, the Contractor shall verify that his proposed site plan meets the program requirements and fits into the space available.

1.1.3.1 Special Utilities and Supplementary Construction.

Utilities include water, sanitary sewer, storm drains, gas, electric, cable TV/internet, and phone. See existing conditions drawings for connection points. Sanitary sewer may require a lift station.

1.1.3.2 Demolition Requirements.

The contractor shall demolish \(<\text{NUMBER OF DEMO UNITS}>\) units – approximately \(<\text{TOTAL SF OF DEMO}>\) square feet. The existing units \(<\text{do}>\) \(<\text{do not}>\) contain asbestos; refer to the appendices for asbestos survey reports for each of the units. All hazardous materials shall be handled in accordance with all applicable federal, state, and local regulations. The existing units \(<\text{do}>\) \(<\text{do not}>\) contain lead paint, although given the age of the units it cannot be ruled out. Several outdoor items (hydrants, striping, storm drain grates) do contain lead paint. Refer to the lead paint report that is with the asbestos reports.

The Existing Conditions-Demolition Plan indicates all items to be removed. In general all existing items (playground, lift station, manholes, roads, curbs, parking shelters, etc.) shall be demolished and removed unless otherwise noted on the Demo Plan. Buried utility lines may be abandoned in place as practical up the point of connection. The gas line shall be removed entirely. The storm drain outfalls may be re-used.

Native trees and shrubs and natural areas shall be preserved wherever possible.

Existing utilities shall be removed up to the points of connection as shown on the existing conditions drawings.

1.1.4 Blank

1.1.5 Design Freedom.

Requirements stated in this document are minimums. Innovative, creative, or cost-saving proposals which meet or exceed these requirements are encouraged and may receive additional consideration in the evaluation process provided that all required units are included in the proposal. Contractor’s existing housing plans or modifications thereof that meet the design and construction criteria specified herein, which a Contractor has previously constructed and priced, may be submitted for consideration. They may include designs incorporating factory fabricated components or modules.

1.1.5.1 Waivers.

Deviations from area, space and adjacency requirements are discouraged unless the changes result in improvement to the facilities and do not violate the definitions and limitations of the project. Both the design and construction of a facility must comply with the Army Standard for Family Housing and with this Standard Design Criteria document. A request for variance or waiver of design criteria must be submitted and approved prior to execution. For guidance on variance from this Standard
Design Criteria document, contact the Center of Standardization for Army Family Housing, Norfolk District USACE.

Only USACEHQ has the authority to approve exceptions to the Standard Design Criteria. Only the Deputy Chief of Staff, G-9 Installations has the authority to approve exceptions to the Army Standard.

1.1.5.2 General.

To the maximum extent possible within the contract cost limitation, the buildings shall conform to the look and feel of the surrounding neighborhood architectural style as expressed herein. The Government will evaluate the extent to which the proposal is compatible with the intent of the architectural theme expressed in the RFP during the contract or task order competition. The first priority in order of importance is that the design provides building mass, size, height, and configuration compared to the architectural theme expressed herein. The second priority is that design is providing compatible exterior skin appearance based upon façade, architectural character, exterior detailing, matching nearby neighborhood material/color pallets, as described herein. Architectural themes for the new housing project area shall be based on current contemporary building forms found around <LOCATION>; i.e. building exterior skin, roof lines, delineation of entrances, proportions of fenestration in relation to elevations, shade and shadow effects, materials, textures, exterior color schemes, and organizational layout.

1.1.5.3 Priorities

The design shall address the Housing Community’s identified priorities. Implement these priorities considering the following: (a) Achievable within the Construction Contract Cost Limitation (CCL); (b) Meets Milestones within Maximum Performance Duration; (c) Achieves Full Scope identified in this Solicitation; (d) Best Life-Cycle Cost Design; (e) Meets the Specified Sustainable Design (most recent ACSIM SDD policy memo) and LEED requirements; and, (f) Complies with Energy Conservation Requirements Specified in this RFP.

Priority #1. Provide good interior functional layout with well-proportioned spaces with the focus on livability and improved quality of life. Provide furniture layouts and efficient circulation patterns. Centrally locate and arrange circulation space to serve as many functional areas as possible without the need for a number of extended hallways. Consider furniture placement in each habitable room to accommodate at least two furniture arrangements to serve the typical family in that type of house. Consider the placement of windows, doors, electrical outlets and switches, and HVAC supply and return registers in furniture arrangements. Consider the vertical as well as the horizontal dimension of the rooms

Priority #2. Visual Compatibility: Facility Massing (Size, Height, Spacing, Architectural Theme, etc.) Exterior Aesthetic Considerations: The buildings massing, exterior functional aesthetics, and character shall create a comprehensive and harmonious blend of design features that are sympathetic to the style and context of the Installation.

Priority #3. Architectural Compatibility: Exterior Design Elements (Materials, Style, Construction Details, etc.) Roofs, Exterior Skin, and Windows & Door Fenestrations should promote a visually appealing compatibility with the desired character while not sacrificing the integrity and technical competency of building systems.

<Priority 4>

<Priority 5>
See appendix for exterior colors that apply to Architectural character at the Installation. The manufacturers and materials referenced are intended to establish color only, and are not intended to limit manufacturers and material selections.

1.1.6 Design Quality.

The objectives are to obtain housing structures and complimentary site development within funds available and to optimize livability. Design quality is achieved through the optimization of interior planning and circulation, integration of housing structures to the site, and balancing architectural attractiveness, variety, function, and design for low-cost maintenance and operation. Contractors shall consider sustainable design applications in developing proposals. See Section 9.0.

1.1.7 Installation Real Property Master Plan.

<Not applicable> Comply with the Installation Property Master Plan. Refer to the Appendix.

1.1.8 Installation Design Guide.

Design of this project shall incorporate the design guidance and criteria contained in the Installation Design Guide, to the extent excerpts of which are contained in this document. Installation Design Guide is

1.1.9 Energy and Resources Conserving Features.

Public Law 109-58 Energy Policy Act of 2005, Executive Order 13693 and Federal Regulations 10 CFR 435 require Federal buildings to be designed and constructed to reduce energy consumption in a life-cycle, cost-effective manner using renewable energy sources when economical. Products designed to conserve energy and resources by controlling the amounts of consumed energy or by operating at increased efficiencies shall be considered unless shown not be life cycle cost effective per 10 CFR 435. The Energy Independence and Security Action of 2007 (EISA 07), section 523 requires at least 30% of hot water demand to be met using solar hot water heater when life cycle cost effective. Section 441 of EISA 07 extends the life cycle costing period from 25 year out to 40 years. The new housing shall achieve energy consumption at least 40% below baseline of building meeting ASHRAE 90.1-2007. See Sections 8.0 and 9.0 for further requirements.

The minimum requirement for the project is to achieve Silver certification in accordance with USGBC LEED for Homes Rating System. See Section 9.0.

1.2 STANDARDS AND CRITERIA

1.2.1 References and Glossary.

References used in this document are contained in Appendix A and a Glossary of Terms is contained in Appendix B. All referenced documents form a part of this Scope of Work and this contract.

1.2.2 Building Codes and Standards.

1.2.2.1 Criteria to be used for design and construction shall be taken from the most current references at the date of issue of the RFP. Administrative, contractual, and procedural features of the contract shall be as described in other sections of the RFP. Referenced codes and standards are minimum acceptable criteria. All referenced documents form a part of this solicitation to the extent specified herein.
1.2.2.2 Applicable Codes and Referenced Standards.

Except for specific environmental issues, generally local and state codes do not apply.
2.0 NEIGHBORHOOD AND SITE DESIGN CRITERIA

2.1 NEIGHBORHOOD DESIGN

2.1.1 General.

The goal of neighborhood design for military family housing is to develop and sustain a residential environment that responds to the military family, and reinforces the connection between families and community.

See Sec 2.3 which provides more detail on site design criteria. Imaginative site design is encouraged; however, the site boundaries, project composition, and gross density are fixed. Based on the graphic and narrative description of site opportunities and constraints provided, the Contractor shall verify that his proposed site plan meets the program requirements and fits into the space available.

2.1.2 Neighborhood Development.

In designing or improving a neighborhood, an important planning element is to understand the nature of the housing area—the relationship of each dwelling unit to a cluster of units, neighborhood, playgrounds, green space and the community as a whole. Housing areas shall be planned so that community members can identify “their own” place in the overall neighborhood. Plan the site so that housing units are clustered into mini- or sub-neighborhoods, or are organized around a central element, such as a cul-de-sac or common area.

2.2 SITE PLANNING AND DESIGN

2.2.1 Site Planning.

Site designs shall ensure that construction avoids, to the maximum extent practicable, wetlands, coastal and shoreline zones, and natural habitats when making neighborhood improvements or executing construction projects. These projects must undergo environmental impact analyses in compliance with the 1969 National Environmental Policy Act (NEPA) as implemented by Council on Environmental Quality regulations found at 40 CFR 1500-1508, and in accordance with State of <US State or territory> and municipality of <Project City> Conservation Commission rules. The projects also must conform to state and local regulations pertaining to storm water management, wetlands, coastal and shoreline zones as further described in Section 7.1.

New units shall not be constructed in a 100-year floodplain. Military Family Housing sites shall have a maximum Day-Night Average Level (DNL) rating of 65. These standards also apply to housing sites near heavily traveled highways or other noise generating facilities.

Site preparation and site improvements, required exclusively for support of a housing project, shall be included in the design and be included in total project cost. Site preparation work shall include demolition of existing housing units and slab foundations, sheds, roadway pavements to include curbs, sidewalks, playground equipment, utilities, selected trees, invasive species, and fencing, etc. Site improvements include utility systems, roads, streets, curbs and gutters, walks, driveways, off-street parking, street lighting, recreation areas, lawns, landscaping, and finish grading as required to support function and livability of housing.

2.2.2 Site Development.

Objectives of site development are to:

- Plan and provide adequate infrastructure;
Use residential building blocks to create neighborhood identity;

Orient buildings and paved surfaces to optimize solar control and minimize heat-islands;

Strengthen the neighborhood with efficient traffic patterns for vehicles and pedestrians;

Create a full range of private and shared recreational facilities; and

Use sustainable landscape design to minimize impact on the environment and reduce water consumption.

Minimize disturbance to site and surrounding areas.

2.2.2.1 Site Verification. An analysis must be performed by the Contractor and the analysis results documented in a written and graphic summary of site opportunities and constraints for the housing project. Sites for this project are fixed and currently support the units, in accordance with the anticipated unit size and location on the site.

2.2.2.2 Area Development Plan. Provide a housing area development plan that shows the spatial and functional arrangement of all housing requirements. The plan shall ensure an economical, compatible and functional residential land use development that utilizes the advantages of the site, fosters visual order, and provides a sense of community. The area development plan shows consideration for the site opportunities and constraints, housing program requirements, and specific site design criteria and guidance provided. The recommendations of the Installation Real Property Master Plan and Installation Design Guide shall be addressed.

2.2.2.3 Density. The project site is approved for medium density. See Section 2.3. Land area for density calculations excludes slopes greater than 20 percent, flood plains and flood areas, lakes and water courses, and local non-buildable buffer zones to these areas.

2.2.2.4 Land Use. The plan for the area shall reflect an optimum balance of housing unit floor area, open space, play lots, neighborhood parks, and pedestrian and vehicular circulation. The plan shall show an efficient, organized and economical land use arrangement that is compatible and functional. This plan shall show the relationship of the area to adjacent land uses.

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

2.2.2.6 Buffer Area. Provide appropriate buffer areas to separate and visually isolate the community from undesirable external influences and to separate adjacent officer and enlisted personnel housing areas from each other. The width of a residential street shall be a minimum acceptable buffer zone between officer and enlisted personnel housing areas. All possible methods of mitigating the impact to the site and adjacent areas shall be explored.

2.2.2.7 Housing Unit Grouping. Variety in groupings, arrangements, and siting configurations of housing units is encouraged to fit varying terrain conditions and to provide compatible and functional residential layouts and streetscapes. Building arrangements shall be informal and imaginative with setbacks and orientation to provide for the best view, privacy, and variety. The proper grouping of housing units shall provide backyard screening, separation of pedestrian and vehicular traffic, natural open spaces, and where required under Section 2.4. The layout shall reflect simplicity of design and provide a visual sense of community.

2.2.2.8 Housing Unit Variation. Housing unit variation shall afford distinctly different exterior appearances within each housing unit type. Provide stylistic compatibility that will give the
neighborhood a sense of order. Housing units shall vary in two or more of the following: Floor plans, massing, elevation, garage location, and exterior materials. One floor plan for each housing unit type is acceptable if sufficient variety is achieved by means of other variations mentioned above. In addition, housing units shall vary in color and siting. A reverse floor plan (mirror-image), although an acceptable means of creating variety, shall not constitute a housing unit change. Contractors shall comply with land-use restraints set forth in this document. To accept the design freedom objective of the RFP, Contractors are encouraged to offer 2 or 3-story construction townhouse units. The preferred colors are earth tones and pastels available in commonly used durable materials. The design shall reflect life cycle maintenance and energy efficiency.

2.2.2.9 Housing Unit Orientation. Housing units shall be oriented, to the maximum extent possible within the constraints of the site available, so that the building is oriented to take advantage of solar energy applications, and expose the minimum surface area to direct solar gain during the cooling season. Orientation for the potential use of solar applications shall be considered even if such applications are not included as part of this project. Additional consideration may be given during the quality evaluations with respect to unit orientations and passive solar applications considered and included. For additional orientation, passive design, and other considerations see Sections 8 & 9 of this RFP. Housing units shall be designed, to the maximum extent possible within the constraints of the site available, so that the long axis of the building is within 20 degrees east or west of true South, and such that a majority of the roof faces within 20 degrees of South.

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

2.2.3 Unit Type.

Acceptable construction options for this project and definitions for housing unit types used in these criteria are as follows:

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

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

- Townhouses. One, or two or three-story housing units having one (end units) or more party walls. Configurations, such as triplexes, are considered to be townhouses. “over/under” style duplexes are not permitted.

2.3 SITE DESIGN CRITERIA.

The following specific criteria, based on site density, are to be used as guidance in site design, and proposals shall be evaluated accordingly.
2.3.1 Site Density.

Densities for family housing projects, expressed in units per acre, are listed in Table 2-2. Density ranges represent minimums and maximums for new construction. The project site shall be \(<\text{SITE DENSITY}\>\) density as shown on the RFP drawings included as part of this solicitation, which consist of approximately \(<\text{SITE ACREAGE}\>\) acres of buildable land. Site work includes all design and construction of the site design to include grading, storm drainage, erosion control, pedestrian and vehicular circulation, utility systems, outdoor lighting, landscaping and physical security, and where required under Section 2.4, play lots and neighborhood parks.

<table>
<thead>
<tr>
<th>Density Factors – Number of Units per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1)</td>
</tr>
<tr>
<td>Medium (2)</td>
</tr>
<tr>
<td>High (3)</td>
</tr>
<tr>
<td>4-6</td>
</tr>
<tr>
<td>7-10</td>
</tr>
<tr>
<td>11-15</td>
</tr>
</tbody>
</table>

1. Suburban, moderately developed, and rural areas.

2. Developed urban areas, not included under “High” location.

3. Dense metropolitan areas and most overseas locations where land is not available to meet at least medium density. Only in exceptional cases will high-rise building density of up to 40 units per acre or 100 units per building be programmed.

2.3.2 Unit Types by Density.

The project shall comply with the requirements for its density siting. The existing site has several natural limits and boundaries that are shown on the site plan, which limit buildable areas and/or the extent of those areas (see site plan included in the RFP).

<table>
<thead>
<tr>
<th>Bedooms/Grade</th>
<th>Low Density</th>
<th>Medium Density</th>
<th>High Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>3, 4, &amp; 5 Bedrooms E-1 - E-9, W-1 - W-4 O-1 - O-3</td>
<td>1-2 Floor Detached Homes, Duplexes or Townhouses</td>
<td>1-3 Floor Duplexes or Townhouses</td>
<td>1-3 Floor Townhouses</td>
</tr>
<tr>
<td>3 &amp; 4 Bedrooms O-4 - O-5</td>
<td>1-2 Floor Detached Homes, or Duplexes</td>
<td>1-3 Floor Duplexes or Townhouses</td>
<td>1-3 Floor Duplexes or Townhouses</td>
</tr>
<tr>
<td>4 Bedrooms O-6 - O-10</td>
<td>1-2 Floor Detached Homes</td>
<td>1-3 Floor Detached Homes</td>
<td>1-3 Floor Detached Homes</td>
</tr>
</tbody>
</table>

2.3.3 Maximum Units per Building by Grade.
Maximum number of housing units per building by grade is shown in **Table 2-4**.

**Table 2-4 – Maximum Number of Units per Building by Grade**

<table>
<thead>
<tr>
<th>Building Types</th>
<th>E-1 - E-6</th>
<th>E-7 - E-9 &amp; O-1 - O-3</th>
<th>O-4 - O-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartments</td>
<td>12</td>
<td>8</td>
<td>N/A</td>
</tr>
<tr>
<td>Townhouses</td>
<td>8</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

2.3.4 Parking Requirements by Site Density.

Parking shall be provided as follows. Each parking space provided in a garage or driveway counts as an off-street parking stall. For CONUS projects, the preference is for a total of three off-street parking spaces per unit. Where site constraints preclude this, provide a minimum of two off-street areas (for tenants) and 0.5 guest on-street spaces per unit. For high density OCONUS sites, two off-street spaces and 0.25 guest on-street spaces per unit is acceptable.

2.3.5 Recreational Vehicle (RV) Storage

<Provide one 3.0 m x 6.0 m [10 ft by 20 ft] space per 20 housing units. The area shall include 2.0 m [6 ft] high chain link security fencing and security flood lighting of 2.7 Lx [0.25 foot candles] at the boundary fence. Area shall have an all-weather surface and an access drive. Design shall permit access to all spaces without moving other vehicles.>

2.3.6 Building Setbacks and Spacing.

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

2.3.6.1 Minimum setbacks and spacing for low density sites are shown in **Table 2-6**.

**Table 2-6 – Minimum Setbacks and Spacing – Low Density Sites**

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

1. When patios are located within a yard, separation shall not be less than 12.0 m [40 ft]

2.3.6.2 Minimum setbacks and spacing for medium and high density sites are shown in Table 2-7.

### Table 2-7 – Minimum Setbacks and Spacing – Medium and High Density Sites

<table>
<thead>
<tr>
<th>Wall Definitions</th>
<th>Wall A</th>
<th>Wall B</th>
<th>Wall C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains the housing unit main entrance; or the principal window(s) of the living room, dining room, family room, or a balcony</td>
<td>Contains window(s) other than in wall 'A'</td>
<td>Contains no windows</td>
<td></td>
</tr>
<tr>
<td>Building to Building (each yard)</td>
<td>6 ft. + 2 ft. for each level + 5 percent wall length</td>
<td>4 ft. + 1 ft. for each level + 5 percent wall length</td>
<td>7 ft. 6 in minimum</td>
</tr>
</tbody>
</table>
### Building to Street (face of curb)

<table>
<thead>
<tr>
<th>Wall A</th>
<th>Wall B</th>
<th>Wall C</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 ft.</td>
<td>15 ft.</td>
<td>10 ft.</td>
</tr>
</tbody>
</table>

| Building to retaining wall with a height of 1.2 m [4ft] or more, above a floor with windows. | 15 ft. | 7 ft. 6 in | 5 ft. |

2.3.6.2.1 Attached garage to Street (face of curb).

- Front: 20 ft.  Side or Back: 15 ft.
- Driveway length for parking, measured from back edge of sidewalk: To park two cars, double wide driveway: 20 ft.

2.3.6.3 Setback Notes.

- Where the slope is 3:1 or steeper, top and toe of slope shall be a minimum of 15 ft. from the building.
- Courts, outer and inner, shall have dimensions not less than the sum of the required yard distances. An inner court shall have a minimum area of 100 ft² for a one-story building and an additional 50 ft² for each additional story.

2.4 PUBLIC RECREATIONAL FACILITIES AND SITE AMENITIES

2.4.1 General.

Where required below, each neighborhood or cluster of housing units shall have open areas, picnic tables, benches, children’s play equipment, and other recreation facilities for common use. Each neighborhood shall have age-appropriate play lots for children, common open areas, landscaped areas with trees, picnic area, sitting areas, walking, bike and jogging paths, and other recreation activities for common use by the residents. Each housing area shall have specialized recreation facilities, including large open playfields and courts, room for support facilities, bike, jogging, and walking paths, and wooded natural landscape areas.

Provide site amenities and recreational facilities as specified in Table 2-8 based on number of family housing units, or fraction thereof, in the neighborhood. Playground equipment and surfaces must comply with the following standards:

- For guidelines on safety of playgrounds, review CPSC Publication No. 325 – *Handbook for Public Playground Safety.*

### Table 2-8 – Site Amenities

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity of Amenities</th>
</tr>
</thead>
<tbody>
<tr>
<td>School bus stop enclosures</td>
<td>1 per 100 housing units, or as required</td>
</tr>
<tr>
<td>Benches</td>
<td>2 per tot lot, play lot, rec. court, and playfield</td>
</tr>
<tr>
<td>Bicycle racks</td>
<td>1 per tot lot, play lot, rec. court, and playfield</td>
</tr>
<tr>
<td>Trash receptacles</td>
<td>1 per tot lot, play lot, rec. court, playfield, picnic and sitting areas,</td>
</tr>
<tr>
<td>Play Lot $^2$ (12mo.-5yrs) (5-9 years)</td>
<td>1 per 30 housing units but min 1 each per neighborhood</td>
</tr>
<tr>
<td>Fenced Dog Park</td>
<td>1 per neighborhood (optional)</td>
</tr>
<tr>
<td>Picnic areas</td>
<td>1 per 50 housing units (min two tables)</td>
</tr>
<tr>
<td>Natural landscaped areas</td>
<td>1 per neighborhood (optional)</td>
</tr>
<tr>
<td>Common open areas</td>
<td>1 per neighborhood</td>
</tr>
<tr>
<td>Open athletic fields</td>
<td>1 acre per 150 housing units (optional)</td>
</tr>
<tr>
<td>Tennis courts</td>
<td>1 per 150 housing units (optional)</td>
</tr>
<tr>
<td>Basketball courts</td>
<td>1 per 100 housing units (optional. Provide one half-court)</td>
</tr>
<tr>
<td>Walkways</td>
<td>1 per neighborhood</td>
</tr>
<tr>
<td>Bike paths $^2$</td>
<td>1 per neighborhood</td>
</tr>
</tbody>
</table>
2.4.2 Housing Maintenance Facilities and Self-Help Centers.

Leave aside an area/space for the future construction of a small 4.25 x 7.6 m (14’ x 25’) self-help facilities to support military family housing garden care tools and equipment, they must meet the functional requirement. Facilities located within a housing area shall be architecturally compatible with the surrounding units and installation architectural standards.

2.4.3 Children's Outdoor Play Areas.

The design of the children's outdoor play areas shall comply with the safety requirements of ASTM F 1487 and ASTM F 1292. The children's outdoor play areas are unsupervised play areas and do not have a supervised play program for child development. These areas are not part of trained recreation, youth center or child development staff support. Supervised outdoor play areas occur at youth centers and child development centers.

2.4.3.1 Child Safety and Accessibility.

- Accessibility to children and adults with disabilities. Play areas shall be accessible to children and adults with disabilities. Determination of accessibility shall be in accordance with ASTM F-1951 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment. In addition to wheelchair users, the needs of children and adults who walk with canes, walkers, or crutches; who have limited use of the upper body; who have visual or hearing disabilities, or who have developmental disabilities shall be considered. Design criteria based on child dimensions shall be used for the proper functioning of the play area. Every part of a play area may not be accessible to all its users, but the social experience provided shall be accessible to everyone. When more than one play activity of the same type is provided, one shall be accessible. When one activity is provided, it shall be accessible. A diverse play area has the greatest potential for meeting the needs of all users. Separate play areas for the physically challenged are not acceptable. Integrating all children in the same play setting shall be emphasized. Where available, guidelines from the installation or Design District for accessible routes, ramps for wheelchair access, transfer points, wheelchair accessible platforms, and accessible stepped platforms shall be followed.

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

- 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 shall 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 shall not overlap except for spring rocking equipment, balance beams, and play houses.

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

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

2.4.3.2 Play Lot.

Provide play lots that are located within the site lines of the housing units to be supported. Connect play lots to the units by a walkway system. Provide shade. Each play lot shall be provided with the following age appropriate play events and equipment for the two age groups to be accommodated:

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

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

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

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

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

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

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

3.1 VEHICULAR AND PEDESTRIAN CIRCULATION

3.1.1 General.

Vehicular and pedestrian circulation systems shall provide convenient and safe access and circulation within the housing area, and to adjacent service areas. <GENERAL DESCRIPTION OF EXISTING AND DESIRED SITE CIRCULATION SYSTEM>

3.1.2 Roads and Streets.

Street systems shall minimize through traffic in housing areas. Streets must be adequate to accommodate occupant traffic, service vehicles, including maintenance, trash removal, buses, moving vans (transcontinental road tractor and trailer), and firefighting equipment, and snow removal equipment. The development of improved vehicular circulation systems is one of the best ways to strengthen identity of neighborhoods. Although the street system shall provide safe, convenient access to housing units to and from the neighborhood, it must not play a dominant role with respect to overall housing area environment. Street widths shown are exclusive of curb and gutter whether or not curb and gutter is provided. The street system shall defer to, and be supportive of, pedestrian-oriented systems and shall be designed with the following hierarchy of street types:

3.1.2.1 Residential Street.

A residential street shall have a minimum width of 6.1 m (20 ft.), with 3.0 m (10 ft.) wide travel lanes. A residential street carries low volumes of traffic and functions as access to each housing cluster. Where parallel on-street parking is provided, a minimum of 3.0 m (10 ft.) for each lane of on-street parking shall be provided. Coordinate with Para 3.2.1.

- Loop. Both ends are open to traffic.
- Cul-De-Sac. Only one end is open to a collector street with a turnaround (T, Y, or Circle) at the other end. Cul-De-Sac shall be dimensionally sized to allow easy turn-a-round for vehicles cited in 3.1.2
- Employ speed reduction methods, such as lowering the speed limit.
- Vehicular circulation patterns shall acknowledge pedestrian circulation.
- Provide for a separate and distinct pedestrian circulation system that emphasizes safety. Also, make sure the pedestrian system conforms to currently accepted accessibility requirements (curb cuts, ramps, slip resistant surfaces, etc.) Ensure all elements of the walkway system conform to the ADAAG or UFAS, whichever is stricter.
- Provide demarcation for crosswalks either through conventional striping or a change in materials at collector and arterial streets. Locate crosswalks at intersections to the maximum extent possible.

3.1.2.2 Intersection Design.

Provide "T" intersection offsets of at least 125 ft. The preferred angle of intersection is right-angle (90 degrees) or as close as possible.
3.1.3 Curb, Gutter, and Sidewalk.

Granite curbs and gutters shall, wherever programmatically possible and not in conflict with Low Impact Development, be provided on all new streets. Sidewalks are required on at least one side of each street (see 3.1.5 for additional information on sidewalks). A "greenbelt" space shall separate sidewalk and curb for pedestrian safety. Depress standing curbs at driveways, intersection corners, cross walks, and wheelchair accessibility ramps.

3.1.4 Driveways.

Driveways shall have a minimum width of 18 ft. to accommodate the 2-car garages. The minimum length for driveways utilized for off-street parking shall be 20 ft., measured from back edge of sidewalk, if applicable, or edge of street. Driveway grades shall provide safe access, and shall not exceed 12%. Driveways for handicapped individual accessible units shall have slopes less than 5%.

3.1.4.1 Housing Unit Access Drive.

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

3.1.5 Pedestrian Circulation.

Provide pedestrian-oriented circulation systems. Pedestrian circulation shall be based on pedestrian desired lines of walking between facilities and weighted to predict the most traveled routes. Consideration shall be given to access play areas and recreation areas without crossing streets to the extent possible/practicable. Pave sidewalks and walks, and provide appropriate surfaces for jogging, exercise, and bike paths. Walkways shall provide pedestrian access to and from housing units, public sidewalks, and other common use areas. Walkways shall be a minimum of 4 ft. wide exclusive of curb width, and made of reinforced concrete with a minimum thickness of 6 in. Where walks are adjacent to the curb, the curb width is not to be included as sidewalk. Jogging paths and bikeways shall be a minimum of 6 ft. wide. Pedestrian circulation shall be separated from vehicular circulation as much as possible. Walks must conform to current accessibility standards. See appendices.

3.1.6 Signage and Pavement Marking.

Provide street signs and markings according to Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices, and Installation standards. <Foreign locations must also adhere to Host Nation standards for street signs and markings>.

3.2 PARKING

3.2.1 Private Parking.

Each unit shall have a minimum of <NUMBER OF OFFSTREET TENANT PARKING SPACES> off-street parking spaces as noted in section 2.3.4. An additional <NUMBER OF OFFSTREET GUEST PARKING SPACES> spaces per unit off-street parking spaces shall be provided for guests and entertainment functions. These spaces may be included in the requirement of providing double wide driveways with two-car garages, providing four off-street parking spaces per unit. <Where necessary in high density areas, 90-degree and gang parking, and 0.25 guest parking spaces per unit, may be allowed. However, parking areas consisting of
Design on-street parking stalls to be of sufficient length and width to allow safe movement into and out of the stall and to adequately separate the parked vehicle from the traffic flow. Refer to paragraphs 2.1.1, 2.3.4, and 3.1.4.

3.3 SOILS

3.3.1 Soil and Foundation Report (Geotechnical Report).

A preliminary Soil and Foundation Report is provided as part of the RFP. A drawing indicating Subsurface Explorations and Geologic Profiles for the proposed site is also provided. The report provides an overview of soils and geologic conditions, and is furnished for informational purposes only. The Contractor 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. The Contractor-provided site specific geotechnical conditions report shall include, but not be limited to:

- Classification of soil and rock.
- Depth to bedrock as applicable.
- Extent of boulders.
- Bearing capacity of soil and rock.
- Settlement potential.
- Compaction requirements.
- Groundwater characteristics.
- Infiltration and permeability.
- Erosion and siltation.
- Surface and subsurface drainage.
- Soil resistivity as applicable.
- pH, Sulfates, and Chlorides
- Onsite and/or offsite disposal of excavated materials.

- Other Required Report Information

3.3.2 Certification.

The Contractor 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 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.
3.3.3 Soil compaction.

Soil compaction shall be achieved by equipment approved by a professional geotechnical engineer. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the compaction specified with the equipment used. Compact each layer to not less than the percentage of maximum density specified in Table 3-1 determined in accordance with ASTM D 1557. 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.

Table 3-1 – Soil Compaction

<table>
<thead>
<tr>
<th>Subgrade Preparation, Fills, Embankments, and Backfills</th>
<th>Compaction Requirements (Percentage of Maximum Density)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structures &amp; Building Slabs, Streets</td>
<td>95</td>
</tr>
<tr>
<td>Paved Areas, Bike Paths</td>
<td>90</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>85</td>
</tr>
<tr>
<td>Grassed Areas</td>
<td>80</td>
</tr>
</tbody>
</table>

3.3.4 Capillary Water Barrier.

A capillary water barrier is required for all interior slabs on grade, including garages, and storage rooms. As a minimum, the capillary water barrier shall consist of clean, non-porous rock, crushed gravel, or uncrushed gravel. Max particle size shall be 1.5 inches and no more than 2 percent by weight shall pass the 3/16-inch size (No. 4) sieve.

3.4 STORM WATER MANAGEMENT

3.4.1 General.

Develop a storm water management system using local requirements for collection, detention/retention and controlled flow volume discharge. Refer to 3.4.2.3 for additional information. Low Impact Development (LID) principles for storm water management, such as decentralized storm water retention, shall be used in the land development process to conserve and protect natural resource systems and reduce infrastructure costs. Note: Consider children’s safety in design and construction of storm water structures. Refer to UFC 3-210-10, Low Impact Development for information on applying LID principles for storm water management.

3.4.2 Storm Water Runoff.

Areas shall be designed for positive drainage away from housing units. Finish grade around perimeter of each housing unit shall slope a minimum of 5% (6 in. fall in 10 ft.) to carry surface water away from foundation walls. Where lot lines, walls, slopes, or other physical barriers prohibit 6 in. fall in 10 ft., drains or swales shall be provided to ensure drainage away from structure. 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 ft. 6 in/s. Rainfall intensities for project locations shall be in accordance with local community/locality/State Transportation (Highway) agency design parameters.
3.4.2.1 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 unless LID principles are proposed. Open areas shall be drained by field inlets and an underground collection system unless LID principles are proposed. No roadside ditches shall be permitted unless required as part of overall plan for Low Impact Development.

3.4.2.2 Pipe for culverts and storm drains shall be constructed of permanent, durable material appropriate for the soil conditions of the site.

3.4.2.3 Site specific storm drainage criteria. Storm water shall be managed in accordance with Massachusetts Storm Water Management Policy, the City of <MUNICIPALITY> Storm Water Management and Erosion Control Bylaw, and EISA 07 – Energy Independence and Security Act of 2007, section 438.

3.4.3 Foundation Drains.

Drains shall be provided in accordance with IRC or IBC, whichever is applicable per project scope. Foundation drains shall be provided with cleanouts.

3.4.4 Manholes.

Manholes shall be located at pipe intersections and changes in pipe 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. Steel ladders shall be installed where the depth of the manhole exceeds 3 ft. The ladder shall be galvanized after fabrication in accordance with ASTM A123. The wall along the ladder shall be vertical. The manhole shall have a 2 ft. minimum opening as measured from the face of the steel ladder.

3.5 WATER DISTRIBUTION

Water Distribution system shall be designed and constructed in accordance with State and Local Codes and regulations. Connection to the existing water distribution system shall be made at the existing water main on General Greene Avenue. All existing water mains and services shall be abandoned. Refer to city of <MUNICIPALITY>, Department of Public Works, Water and Sewer Division for specific requirements.

3.5.1 Metering.

Meters are required for family housing areas to accurately monitor the consumption and cost data for water utilities. Metering of utilities shall be provided as required by the private utility provider as follows:

City of <MUNICIPALITY>
<Department of XXX
Street address
State
Phone: (xxx)xxx-xxx
Fax: (xxx)xxx-xxx
Cost of all utility work is to be borne by the project and shall be accounted for and itemized in the bid schedule regardless of who performs the work.

3.5.1.1 Group water meter requirements. Group water meters are required for new and replacement housing projects where total daily water demand exceeds 25,000 gal. Meters shall be equipped with electronic or radio frequency transmitters for remote monitoring. The method of remote monitoring must be coordinated with installation utility systems. The size of the group for metering shall be at least five but no more than 20 single family detached, duplex, or townhouse units. Refer to City of <MUNICIPALITY>, Department of Public Works, Water and Sewer Division for specific requirements. Each single family detached home shall be individually metered.

3.5.2 Water Mains and Building Service Connections.

Connection to the existing water distribution system shall be made at the locations shown on the RFP drawings. Mains shall be considered as that part of the distribution system supplying fire hydrants, or fire hydrant laterals. Service connections supply water from the main to the building. Mains shall be looped with no dead ends and be of adequate size to satisfy both domestic and fire flow requirements. Minimum main size is 8in. Sufficient sectional control valves shall be provided so that no more than two fire hydrants shall be out of service in the event of a single break in a water main. A copper tracer wire shall be placed directly above all non-metallic mains when plastic marking tape does not provide means of determining alignment of pipe by metal detecting equipment. The pipe, valves, and all other materials shall meet the American Water Works Association (AWWA) standards for a 150 psi working pressure system. Provide sacrificial anodes for all valves and metal pipe or as designed by an NACE certified (or equal) cathodic protection expert. Provide a curb stop/shut-off valve on service connections for each building that is located close to the water main. Shutoff valves in walks are prohibited. Building connections shall be designed and constructed in accordance with the National Standard Plumbing Code.

3.5.2.1 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 1,000 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 housing unit for single family housing, and 250 gal/day per housing unit for multi-family housing. Mains shall be sized to carry this flow with a 2.5 peak hourly factor. Pressure shall be a minimum 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 housing unit shall not exceed 75 psi.

3.5.2.2 Trenches. Where feasible, and acceptable to local utility supplier or servicing agency, use common trenches for two or more utilities and applicable underground utility marking protocol. Water and gas mains may be installed in the same trench, with the gas main placed on a shelf at least 12 in above and to one side of the water mains. (Coordinate with the local gas utility supplier to determine system acceptability). Water mains shall have a minimum of 5 ft. of earth cover. Adequate cover must be provided for freeze protection to meet local conditions. Where frost penetrates to a depth greater than the minimum above, greater cover shall be required. Sufficient cover must also be provided to protect the pipe against structural damage due to superimposed surface loads. Lines laid lower than the minimums stated shall be concrete encased with a minimum concrete thickness of 6 in.
3.5.3 Fire hydrants.

Hydrants shall conform to AWWA C502, Dry-Barrel Fire Hydrants, or AWWA C503, Wet-Barrel Fire Hydrants, except as required by the local utility supplier. Dry-Barrel Fire hydrants must be used in areas subject to freezing. Valves shall conform to AWWA C500, Gate Valves for Water and Sewerage Systems. Fire hydrants shall be compatible with those presently in use at the installation or local jurisdiction, with similar pump and hose connections. Fire hydrant spacing shall be no greater than 300 ft. apart, by paved road. Hydrants shall be located a minimum of 40 feet away from the structure that they are protecting, unless otherwise approved by the Authority Having Jurisdiction. Hydrants shall be located between 3 and 7 feet from the access lane or street. In addition, a hydrant shall be provided so that all parts of the housing units can be reached by hose lines not over 350 ft. long. Hydrant laterals shall be 6 in minimum size, shall not exceed 50 ft. in length, and shall have an underground shutoff valve. Valve box, at each lateral, shall be located within 10 ft. of the hydrant, and shall not be located where obstructed by parked vehicles, shrubbery, etc. Guard post barriers shall be provided where hydrant locations are subject to vehicle damage.

3.6 SANITARY SEWER

Sanitary sewer system and connections shall be designed according to City of <MUNICIPALITY>, Department of Public Works, Water and Sewer Division requirements and regulations. <The existing sewer pump station shall be completely removed and replaced>. Contractor shall coordinate sanitary sewer services required for family housing with privatized utility vendor holding license to operate and maintain sanitary sewer collection system. Vendor may elect to design and construct sanitary sewer service requirements to serve family housing units.

3.6.1 Sewer Mains.

Connection to the existing sewage collection system shall be made at the location shown on the RFP drawings. 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 in in diameter. Manholes are required at all changes of direction and spaced not more than 400 ft. apart. Curved sewers are prohibited. If siphons are used, two lines of equivalent capacity shall be used with cleanouts. Where pumping is required, force mains shall be sized to minimize pumping head, with a 3 ft. to 5 ft. per second velocity.

3.6.2 Sewer Building Laterals.

Each building lateral shall be connected directly to a sewer main. Combining multiple building laterals is prohibited. Cleanouts shall be provided at the 5 ft. line from the building to allow cleaning of all lines to grade. Cleanouts, in yard areas, shall be set in a box with a hinged cover. Laterals from one building shall not cross under another building. Lines shall be sized in accordance with the National Standard Plumbing Code. Sewer laterals serving one or two housing units shall be a minimum of 6 in in diameter. Laterals serving three or more housing units shall be a minimum of 8 in in diameter.

3.6.3 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.

3.6.4 Cover.
Sewer lines shall be located at a depth greater than the frost penetration. Minimum cover above the top of pipes shall be 3 ft. If the minimum cover cannot be met, the length of pipe shall be concrete in accordance with State Codes, or with a minimum 3 in thickness of concrete.

3.7 GAS DISTRIBUTION SYSTEM

3.7.1 General.

Gas piping systems, gas utilization equipment and related accessories, venting systems, and combustion air configurations must comply with applicable provisions of the IBC and the IRC as modified by UFC 1-200-01, and NFPA 54. Contractor shall coordinate natural gas service requirements with the privatized utility vendor holding license to operate and maintain the natural gas distribution system. Vendor shall design and construct the natural gas supply and service lines from the exterior meter. *<All costs associated with bringing the new natural gas service to family housing units shall be the responsibility of the Gas Utility Company.>*

3.7.2 Metering.

Meters are required for family housing areas to accurately monitor the consumption and cost data for gas utilities. Metering of utilities shall be provided as required by the private utility provider.

3.7.2.2 Individual meter and meter drops. Individual utility meter drops shall be provided for all housing units. Locate utility meter drops in an area readily accessible by service personnel but not in front of houses. Meters and meter bases shall be sight screened, and located to provide convenient access while not distracting from building appearance. Meter locations shall be coordinate with the Gas provider.

3.7.3 Gas Distribution System.

Connection to existing gas distribution system shall be made to the updated gas line within the site, preferably in a location which minimizes the length of required new gas main. Provide a gas distribution system, connected to existing systems and designed in accordance with local codes, utility company requirements, or installation regulations, whichever is more stringent. Gas distribution systems shall comply with the requirements of ASME B31.8. 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 building. A gas regulator and an individual gas meter to monitor fuel use shall be provided for each housing unit. Existing lines that are to be abandoned shall be removed. It is the Contractor’s responsibility to coordinate with the Gas supplier any requirements and pressure information to complete the gas design.

3.7.3.1 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.

3.7.3.2 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.

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

3.7.3.4 Mains and Service Lines. Lines shall not be placed under any buildings. Lines shall be placed with a minimum of 2 ft. of earth cover. Protective casings shall be provided to protect lines from superimposed street or heavy traffic loads.
3.8 ELECTRICAL DISTRIBUTION

3.8.1 General.

Design and install electrical systems to conform to applicable criteria in National Electrical Code (NFPA 70), National Electrical Safety Code (IEEE-C2), applicable provisions of IBC or IRC, and the following Unified Facility Criteria: 3-501-01 (Electrical Engineering), 3-520-01 (Interior Electrical Systems), 3-530-01 (Interior and Exterior Lighting Systems and Controls), and 3-550-01 (Exterior Electrical Power Distribution). Transformers or any other items containing PCBs are prohibited. Provide new exterior electrical distribution systems with underground primary and secondary feeders. Make connections to the existing electrical distribution system at locations approved by the utility.

<Utility POCs;

City of <MUNICIPALITY >
<Department of XXX
Street address
State
Phone: (xxx)xxx-xxx
Fax: (xxx)xxx-xxx>

[Design shall include details showing the power system connection to the utility and clearly delineating what the utility is responsible for and what the construction contractor is responsible for.

[RFP Preparer shall insert paragraph describing how connection is to be accomplished. Clearly delineate Contractor responsibilities (materials and equipment, installation, and funding) as well as private utility responsibilities, where applicable. Include private utility company information and point of contact if applicable.]]

3.8.2 Electrical Distribution System.

Provide new electrical distribution system as necessary and connect to existing system. System shall be a loop-primary radial system. Primary feeder cables shall be copper (or aluminum as per UFC 3-550-01). Medium and high voltage conductors shall have protective shielding. Medium and high voltage cables shall be buried a minimum of 4 ft. below the finished grade in a concrete duct bank with continuous cable marker tape 1 ft. below grade. Cable markers shall be installed along the length of direct-burial cable runs to identify their routes from the surface. Markers shall be provided at changes of direction and at intervals not to exceed 100 ft.

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

3.8.2.2 The length of secondary distribution service laterals from the transformer secondary to the building service entrances shall be minimized.

3.8.2.3 Provide one service entrance per building. The service entrance conductor shall be buried a minimum of 3 ft. below finished grade with a minimum separation of 1 ft. from telecommunications or CATV cables.
3.8.2.4 Transformers. Transformers shall be pad-mounted and have two non-fused switches for the loop connection. The high voltage compartment of the transformer shall include a fused load break switch. The transformed secondary voltages shall be 120/240 V, single-phase, three-wire, solid neutral service to housing units. In selecting a transformer, the name plate rating shall not be less than 80 percent of the kilovolt/amperes (kV/A) demand load calculated for the transformer. [RFP Preparer shall insert transformer sizing and demand requirements.]

3.8.3 Street and Area Lighting.

Guidance for minimum lighting of walkways, streets, and parking areas is available from the Illuminating Engineering Society of North America (IESNA) and UFC 3-530-01. Provide lighting at roadway intersections, and at intervals not exceeding 200 ft. between intersections. Area lighting shall be provided at intervals not exceeding 200 ft. along area walkways not otherwise illuminated, common area walks connecting to lots, and at steps in area walkways. Area lighting shall be provided in accordance with the IESNA and UFC 3-530-01 recommendations whichever is more stringent. Luminaires shall be actuated by photoelectric control, one photocell per circuit, and supplied from multiple circuits originating from a pad-mounted transformer. Area lighting fixtures shall be full cut off type to minimize light pollution. All new street and area lighting shall be LED.

[RFP Preparer add if applicable: Coordinate fixture and power connection requirements with local utility if exterior electrical distribution system is privatized.]

3.9 OUTSIDE PLANT TELECOMMUNICATIONS

The contractor shall design the telecommunications wiring and cable systems in accordance with applicable TIA Criteria and UFC 3-580-01 (Telecommunications Interior Infrastructure Planning and Design).

The telecommunications service provider serving the installation is responsible for installing and maintaining the outside plant telecommunications up to the demarcation point (the point where the service provider wiring connects to government owned wiring). Conduit required between Maintenance Holes (MH) and Hand Holes (HH) and the buildings shall be contractor provided. Trenching and backfill required to install the service provider cables shall be included in the construction contract. Contractor provided boxes, conduits, and trenching shall comply with local telecommunications service provider criteria. The contractor shall coordinate with the telecommunications service provider early on, to ensure timely installation.

[RFP Preparer shall insert specific company and point of contact information here along with any specific requirements for connection of the telephone service.]

3.10 TELEVISION AND CABLE TV SYSTEM AND INTERNET

CATV service Provider shall be responsible for installing and maintaining the distribution system from signal source to final connections at building termination. The Contractor shall provide trenching, conduit, boxes (to include a locatable entry point at the 5 foot line), and backfilling required to install commercial and/or Contractor provided distribution systems.

[RFP Preparer shall insert specific company and point of contact information here along with any specific requirements for connection of the television/CATV service.]
3.11 CATHODIC PROTECTION

Protect ferrous materials in underground utility systems from corrosion as appropriate and required by local conditions in accordance with UFC 3-570-02A Cathodic Protection and UFC 3-570-02N Electrical Engineering Cathodic Protection.

Cathodic Protection (CP) is mandatory on any buried ferrous metallic structures as described below. Metallic pipes that enter a building from the exterior must have an isolation flange. This will ensure that the CP system does not protect the piping in the building. Department of Transportation guidance as stated in 49 CFR, Part 192, requires that metallic natural gas piping be coated and cathodically protected regardless of the soil resistivity.

[RFP Preparer is encouraged to provide resistivity tests as part of the RFP. Edit this section for only applicable and allowable systems.]

3.11.1 Underground Storage Tanks. Not Used.

3.11.2 System Design. Cathodic protection systems must be designed by an NACE certified (or equal) expert 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.

3.11.3 New or supplemental cathodic protection systems must be compatible with existing cathodic protection systems and other adjacent structures or components. New systems must be compatible with existing systems to allow ease of repair and maintenance.

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

3.11.5 Application. Cathodic protection and protective coatings must be provided for the following buried and submerged ferrous metallic structures regardless of soil or water resistivity:

- Natural gas and propane piping.
- Fire protection piping.
- Ductile or cast iron pressurized piping under floor (slab on grade) in soil.
- Other structures with hazardous products as identified by the installation.

3.11.6 Cast Iron. Cast iron pipe must be treated as follows:

- For soil resistivity below 10,000 Ohm-cm at pipeline installation depth, provide CP, bonded joints, and protective coatings.
- For soil resistivity between 10,000 and 30,000 Ohm-cm at pipeline installation depth, provide bonded joints only.
3.11.7 Copper. Copper water service lines shall be dielectrically isolated from ferrous pipe. Dielectric isolation must conform to NACE RP-0286.

3.11.8 Ductile Iron. For ductile iron piping systems (except for ductile iron piping under floor in soil) conduct an analysis to determine if cathodic protection and/or bonded or unbonded coatings are required. Unbonded coatings are defined in ANSI/AWWA C105/A21.5.

3.11.9 Sewer Lines. Conduct an economic analysis to determine if cathodic protection and protective coatings must be provided for gravity sewer lines and the following structures in soil resistivity conditions above 10,000 Ohm-cm:

- Potable water lines.
- Concentric neutral cable.

3.11.10 Other buried and submerged ferrous metallic structures not covered above.

Ferrous metallic piping passing through concrete must not be in contact with the concrete.
4.0 FAMILY HOUSING SIZE AND FEATURES STANDARDS

4.1 UNIT SIZE BENCHMARKS

4.1.1 Family Housing Size Standards.

Table 4-1 provides family housing standards for unit sizes based on rank and number of bedrooms. Title 10 of United States Code, Section 2826 (10 USC 2826) directs the Services to design and construct military family housing to local standards. For new and replacement construction the project’s DD Form 1391 specifies the programming benchmark gross area in the scope description with a unit cost based on this benchmark gross area. The project shall be designed and constructed according to these requirements.

Table 4-1 – Unit Floor Area

<table>
<thead>
<tr>
<th>Rank and Number of Bedrooms</th>
<th>Programming Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GSF ( \text{m}^2 )</td>
</tr>
<tr>
<td>O9-O10 - 4BR (1)</td>
<td>4000</td>
</tr>
<tr>
<td>O7-O8 - 4BR</td>
<td>3330</td>
</tr>
<tr>
<td>O6 - 4BR</td>
<td>2520</td>
</tr>
<tr>
<td>O4-O5 - 4BR</td>
<td>2310</td>
</tr>
<tr>
<td>O4-O5 - 3BR</td>
<td>2020</td>
</tr>
<tr>
<td>E9 &amp; W4/5 - 4BR</td>
<td>2310</td>
</tr>
<tr>
<td>E9 &amp; W4/5 - 3BR</td>
<td>2020</td>
</tr>
<tr>
<td>E7/8-W1/3-O3 - 5BR</td>
<td>2510</td>
</tr>
<tr>
<td>E7/8-W1/3-O3 - 4BR</td>
<td>2150</td>
</tr>
<tr>
<td>E7/8-W1/3-O3 - 3BR</td>
<td>1860</td>
</tr>
<tr>
<td>E1-E6 - 5BR</td>
<td>2300</td>
</tr>
<tr>
<td>E1-E6 - 4BR</td>
<td>1950</td>
</tr>
<tr>
<td>E1-E6 - 3BR</td>
<td>1630</td>
</tr>
</tbody>
</table>

4.1.2 Unit Floor Area Calculation.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Senior General/Flag Officer O9-O10 housing shall be designed to a maximum of 4000 GSF with no additional size allowances for special command positions or arctic/harsh climates.</td>
</tr>
<tr>
<td>2.</td>
<td>For housing units other than those for O9-O10 (see note 1), add up to 27.9 m² (300 ft²) for harsh climates. Harsh climates are defined as having more than 7,500 Heating Degree-Days (HDD), annually, or 5,500 Cooling Degree-Days (CDD), annually.</td>
</tr>
<tr>
<td>3.</td>
<td>For housing units other than those for O9-O10 (see note 1), benchmark floor area may be increased by 10% for housing units for an officer holding a special command position as defined by AR 420-1, for the commanding officer of a military installation, and for the senior non-commissioned officer of a military installation. Area shall be increased in [RFP Preparer shall insert number and type of units] for this project. See Appendix A.</td>
</tr>
<tr>
<td>4.</td>
<td>Where required for High Risk Personnel (HRP) physical design solutions shall be included in above floor areas. HRP is determined in part by threat analysis under UFC 4-020-01. See Appendix A.</td>
</tr>
<tr>
<td>5.</td>
<td>The applicable gross floor area considers a standard U.S. exterior wall with a total thickness of 6 inches. With ever increasing requirements for insulation and energy efficient construction in order to meet evolving sustainable design and development policies, the thickness of exterior walls exceeding 6 inches from the inside wall surface will no longer be included in the applicable gross floor area limitations. Gross floor area shall be calculated using American National Standard for Single-Family Residential Buildings, Square Footage-Method for Calculating: ANSI Z765.</td>
</tr>
</tbody>
</table>

- **Note**: Appendices C1 and C2 contain examples for calculating floor area.

4.2 ACCESSIBILITY REQUIREMENTS

4.2.1 Installation Requirements.

Provide **NUMBER OF REQUIRED ABA/ADA UNITS** ABA compliant units for handicapped accessibility (mobility features). [RFP Preparer insert other installation defined requirement for the distribution/assignment of ABA units by type/grade/location, etc]. Accessible housing units, inclusive of garages, shall be designed in such a way that they may be easily and readily modified to accommodate physically challenged occupants, if necessary, at time of occupancy. This means required access clearances, room sizes, bathroom layout, kitchen layout, doors and hardware, grab bars, plumbing hookups, light switches and outlets, controls, and warning devices must meet requirements at time of construction. Readily modifiable means that requirements for adjustable height cabinets and work surfaces, plumbing fixtures, and the warning devices for the hearing and visually impaired can be made either at time of construction or at time of occupancy. For the purpose of determining the number of adaptable or accessible units required, an installation means the area under the purview of the Housing Office. For each installation, a minimum of five percent (5%) of units, but not less than one unit of each type must be designed and constructed as an adaptable single-story ground level unit. Design and construct a minimum of two percent (2%) of each unit type, but not less than one unit, as adaptable for persons with hearing disabilities. [RFP Preparer insert specific project requirements here.]

4.2.2 Site Requirements.

Public elements of the site or project must be accessible, including walkways, tot-lots, playgrounds, etc. as defined elsewhere in this solicitation.

4.2.3 Construction Project Requirements.
New and replacement construction and renovation projects must comply with the current “DOD Accessibility Standards” (see appendices).

4.2.4 Renovation Project Requirements.

Renovation projects must comply with accessibility standards when their scope of work includes “Alterations” of existing dwelling units, unless requirements for the installation have been satisfied. Alterations are defined as work that modifies the functional arrangement of a unit, or moves load-bearing structures or members within unit. As an example, replacement of kitchen cabinets in-kind is not an alteration, but modifying kitchen and dining areas while installing new cabinets is an alteration. Specially designated units shall be constructed or improved in accordance with standards.

4.3 UNIT DESIGN

4.3.1 General.

Centrally locate and arrange circulation space to serve as many functional areas as possible without the need for extended hallways. Consider multiple furniture placement layouts in determining location of windows and doors, electrical outlets and switches, and HVAC supply and return outlets. Habitable rooms shall not be used as halls for entry into a housing unit or for primary circulation within a housing unit. The design of housing units including the selection and specifying of exterior and interior finishes, equipment, appliances, and systems shall include consideration of maintenance ease and cost. Contractor-furnished/Contractor-installed (CF/CI) equipment and appliances: oven-range, range exhaust hood <Combination Microwave exhaust hood>, garbage disposal, dishwasher; <shelf and power outlet for microwave>; and ice maker connection for refrigerator. Government-furnished/government-installed (GF/GI) kitchen equipment and appliances: <washer/dryer>; refrigerator/freezer with icemaker; <microwave>. Tenant-furnished/Tenant-installed equipment and appliances: <microwave oven, washer/dryer>. Contractor shall provide connection points for both gas dryer and electric dryer. Avoid products that require continuing maintenance at high cost. Minimum area and dimensions for interior spaces are contained in Table 4-2.

Table 4-2 – Minimum Area and Dimensions – Interior Spaces

<table>
<thead>
<tr>
<th>Space</th>
<th>Area</th>
<th>Length</th>
<th>Width/Depth</th>
<th>Height (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m²</td>
<td>ft²</td>
<td>m</td>
<td>ft.-in</td>
</tr>
<tr>
<td>Living (2)</td>
<td>150</td>
<td>11-8</td>
<td>11-8</td>
<td>8-0</td>
</tr>
<tr>
<td>Dining (4/5 BR) (2)</td>
<td>110</td>
<td>10-6</td>
<td>10-6</td>
<td>8-0</td>
</tr>
<tr>
<td>Dining (GO) (2)</td>
<td>144</td>
<td>12-0</td>
<td>12-0</td>
<td>8-0</td>
</tr>
<tr>
<td>Family Room (2)</td>
<td>90</td>
<td>10-0</td>
<td>10-0</td>
<td>8-0</td>
</tr>
</tbody>
</table>
1. Ceiling heights in habitable rooms shall be a minimum of 8 ft-0 inches.

2. Room dimensions are exclusive of circulation. Circulation paths along one side of a room are permitted but add 3 ft-3 inches to the minimum dimension.

3. A minimum of 4 ft. must be maintained in front of and between cabinets.

4. Minimum area and dimensions are measured from face of cabinets to walls.

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

6. Accessible units must conform to current accessibility standards (see appendices), which require greater minimum dimensions.

7. Clear width is measured between railings.

### 4.3.2 Bathrooms.

Locate full bathrooms near bedrooms and out of sight of other areas of the house. In two-story units, at least a half-bath shall serve the first floor. When a half-bath is provided on the main floor, consider access to both guests and family activities. Open a half-bath to circulation space rather than to a habitable room. The master bedroom shall have a private full bathroom. Include a tub with shower assembly in at least one full bathroom in each unit which is directly accessible from the bedroom hall without passing through another room. Bathrooms shall be design in accordance with National Kitchen and Bath Association (NKBA) guidelines and recommendations.

<table>
<thead>
<tr>
<th>Space</th>
<th>Min</th>
<th>Front</th>
<th>Side</th>
<th>Depth</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitchen (3/6)</td>
<td>64</td>
<td>8-0</td>
<td>8-0</td>
<td>8-0</td>
<td>8-0</td>
</tr>
<tr>
<td>Eating in Kitchen (4)</td>
<td>72</td>
<td>8-6</td>
<td>8-6</td>
<td>8-0</td>
<td>8-0</td>
</tr>
<tr>
<td>Refrigerator &amp; Freezer</td>
<td>6</td>
<td>3-0</td>
<td>2-0</td>
<td>6-0</td>
<td></td>
</tr>
<tr>
<td>Washer/Dryer (5)</td>
<td>18</td>
<td>6-0</td>
<td>3-0</td>
<td>7-0</td>
<td></td>
</tr>
<tr>
<td>BR #1</td>
<td>150</td>
<td>11-8</td>
<td>11-8</td>
<td>8-0</td>
<td></td>
</tr>
<tr>
<td>BR #2</td>
<td>120</td>
<td>10-0</td>
<td>10-0</td>
<td>8-0</td>
<td></td>
</tr>
<tr>
<td>BR #3/4/5</td>
<td>100</td>
<td>10-0</td>
<td>10-0</td>
<td>8-0</td>
<td></td>
</tr>
<tr>
<td>Half Bath (6)</td>
<td>25</td>
<td>5-0</td>
<td>5-0</td>
<td>8-0</td>
<td></td>
</tr>
<tr>
<td>Full Bath (6)</td>
<td>48</td>
<td>8-0</td>
<td>6-0</td>
<td>8-0</td>
<td></td>
</tr>
<tr>
<td>Vestibule</td>
<td>13</td>
<td>3-3</td>
<td>4-0</td>
<td>8-8</td>
<td></td>
</tr>
<tr>
<td>Hall &amp; Stairway (7)</td>
<td>-</td>
<td>-</td>
<td>3-3</td>
<td>8-0</td>
<td></td>
</tr>
</tbody>
</table>

| **Table 4-3 – Bathroom Requirements** |
### Number of Bedrooms per Floor | Number of Bathrooms Per Floor (Min.)
---|---
None | 1/2
1 – 2 | 1
3 – 5 | 2

Note: General Officer (GO) units shall have three full bathrooms, with one on the first floor configured for accessibility.

4.3.2.1 Provide lavatories mounted in 24 inches wide (minimum) countertops, with vanity bases. Countertops shall be marble, granite, or homogeneous, non-porous, solid surface type materials, with minimum 4 inches high back splashes. Lavatories and countertops shall be mounted at not less than 36 inches.

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

4.3.2.3 A recessed medicine cabinet shall be provided in each bathroom. Cabinets shall be corrosion-resistant with plate glass mirrors, sliding or hinged door type. Do not place recessed medicine cabinets in party walls.

4.3.2.4 Tubs and showers shall not be placed under windows.

4.3.2.5 Bath Exhaust Fans with sone noise level less than 1.0 shall be provided in all baths, shall be ducted to the exterior of the building, and shall be a part of an engineered ventilation system.

4.3.3 Bedrooms.

Family housing units must include a master bedroom, plus one or more additional bedrooms. Separate these sleeping areas from all other functional areas of the house, conveniently located near bathrooms. Provide access to bathrooms from bedrooms, without passage through other rooms of the house. For new construction bedrooms shall be designed to accommodate a king size bed in master bedroom, and a full size bed in other bedrooms. Each bedroom shall be accessible without passing through another bedroom. *In new construction, units for the rank of O7 and above shall have a bedroom located on ground floor adjacent to public areas with a private full bath. Each bedroom shall be accessible without passing through another bedroom.*

4.3.4 Breakfast Area.

A secondary eating area may be provided in the form of an oversized kitchen, breakfast bar, or family room and dining area. This secondary eating area may be in direct sight of food preparation areas, but not in direct sight of a bathroom.

4.3.5 Dining Room.
The primary eating area may be a separate dining room off the living room. If so, it shall be of adequate size to accommodate a table and chairs, and china cabinet or buffet. The dining room shall not be in direct sight of bathrooms or food preparation area, but shall be directly accessible from the kitchen without passing through another room. Design the circulation pattern through the dining room so that traffic flow is directed along one wall, and not through middle of room.

<Provide a separate dining room for O7 and above sized to seat at least 10 persons.>

4.3.6 Entrance Foyer.

Provide each housing unit with a lighted foyer and nearby coat closet. Locate entrance adjacent to living room. Provide access to other areas without passing directly through the living room. Foyers shall have a minimum dimension of 1.45 m (4 ft.) in each direction, and entrance door shall not be in direct sight of living room.

4.3.7 Circulation.

Hallways, stairways, and stairwells shall be dedicated to circulation. Particular attention shall be given to these areas to minimize floor space lost to circulation. Proper placement of door openings can produce more usable floor space. Design circulation areas to permit movement of a queen size box spring. Minimum hallway width of 3 ft. 6 in is recommended.

4.3.8 Kitchen Area.

Locate kitchen adjacent to dining room and family room, with direct access to each. Convenient access from kitchen to a covered parking area, and to interior utility and exterior service areas, is desirable. Provide 4 ft. minimum space between fronts of cabinets.

The kitchen shall provide an efficient work triangle. A base cabinet, minimum 18 inches wide, shall be provided on the handle side of the refrigerator. The range shall not be located adjacent to the refrigerator, in a corner, or adjacent to a passageway. The dishwasher shall be installed adjacent to the kitchen sink. Provide a backsplash behind the range, extending to the underside of the range hood, finished to match the countertop or range and the range hood. Space for an upright refrigerator/freezer (see table 4-2, verify size) shall be provided adjacent to the kitchen or in area such as the laundry/utility area or garage. In the kitchen, shoe molding (1/4 round) is required at all base cabinets where they meet the floor surface. Kitchens shall be designed in accordance with National Kitchen and Bath Association (NKBA) guidelines and recommendations.

4.3.9 Laundry/Utility Room.

Provide a laundry/utility area large enough to accommodate side-by-side washing machine and dryer, plus cabinets for storing laundry supplies, located out of sight of entry, entertainment, and eating areas, and within conditioned space. Do not locate laundry/utility area within a bedroom, bathroom, or kitchen. Exhaust from moisture-producing equipment (e.g. clothes dryers) must be vented to the exterior. Vent-less clothes dryers are not acceptable. Minimum net clear door width to laundry/utility area is 2 ft-8 inches.

4.3.10 Living/Family Room.

The living room shall have direct access to the front entrance foyer and to the dining area without passing through another room. Units shall be provided with a family room, separate from the living room, adjacent to and contiguous with the kitchen. Each room shall include one wall with a minimum length of 12 ft. to accommodate a sofa and end tables. Often several compatible living
functions can be combined advantageously into a single “Great Room.” However, a Great Room shall be able to accommodate multiple furniture arrangements associated with spaces that are combined. Benefits of such arrangements are that the combined space can be used more efficiently. For adjacent spaces to be considered a combined room, a clear opening between them, at least 2.4 m (8 ft.) wide, shall permit concurrent and separate use of the space. Minimum dimension of living room shall be 12 ft. When circulation is required along the perimeter of the space or between areas in open plans, minimum circulation space of 3 ft-3 inches shall be added to the required minimum room dimension. The family room shall not be part of a Great Room.

4.3.11 Interior Storage and Closets.

Provide storage areas in the form of clothes closets, linen closets, and bulk storage in housing unit for seasonal personal effects. Storage areas shall have a clean arrangement, easy access, and not be of odd shapes.

4.3.11.1 A broom closet shall be provided convenient to the kitchen, and a coat closet shall be located convenient to the housing unit entrance. Consider coat storage (such as hooks, cubby, area, or “landing zone”) at the garage/service entry into the home.

4.3.11.2 Closets.

Minimum closet requirements are shown in Table 4-4.

- Closet shelving. Closets (except linen closets) shall be equipped with a 12 inches deep shelf and a clothes hanger rod. Linen closets shall be provided with at least four full length, full depth shelves. Closet shelving and rods in excess of 4 ft. shall have center supports. Shelves and supports shall each be capable of carrying 35 lbs/ft. Closet shelving shall be minimum 3/4 inch thick solid wood, or plywood. Factory finished welded wire shelving meeting the capacity requirements is also permitted. Intermediate supports must be anchored to studs.

- Closet doors. Closet doors shall be located to permit placement of furniture in the corners of the rooms by providing an 18-inch return adjacent to a furnish-able wall. Closets 6ft. or more in width shall have sliding or hinged doors, maximum 6 ft-8 inches high. Wall closet width shall not extend beyond either door jamb more than 20 inches. Sliding doors shall be provided with both top and bottom door tracks.

<table>
<thead>
<tr>
<th>Table 4-4 – Minimum Closet Widths¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Unit (1)</strong></td>
</tr>
<tr>
<td>m</td>
</tr>
<tr>
<td>Coat/ Entry Hall</td>
</tr>
<tr>
<td>Master BR #1 (2)</td>
</tr>
<tr>
<td>BR #2</td>
</tr>
<tr>
<td>BR #3</td>
</tr>
<tr>
<td>BR #4/5</td>
</tr>
<tr>
<td>Type of Unit</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Broom</td>
</tr>
<tr>
<td>Linen (3)</td>
</tr>
</tbody>
</table>

1: Minimum inside clear depth for standard/broom closets shall be 600 mm [2 ft].
2: Walk-in closet is preferred.
3: Minimum clear inside depth for linen closets shall be 430 mm [1 ft-6 inches].

4.3.11.3 Bulk storage. Provide each housing unit with interior and exterior bulk storage space meeting the minimum requirements of Table 4-5. Interior bulk storage is in addition to required closet area and exterior storage. Provide interior storage in a separate room or included as an extension of the utility room when one is provided. Provide exterior storage in a garage, a separate exterior enclosure, or within the housing unit with access from the exterior. Bulk storage space shall be at least 4 ft. in depth and a minimum clear height of 6 ft-6 inches, except that space under stairs may be counted at 1/2 area if the space is 4 ft. or more in height. Provide a minimum of three nominally 12 inches deep shelves with a combined length of 24 ft. within each bulk storage room. Common walls and ceilings between adjacent storage areas shall be finished on both sides.

Table 4-5 – Minimum Bulk Storage

<table>
<thead>
<tr>
<th>Type of Unit</th>
<th>Type of Storage</th>
<th>Enlisted/Officer O1-O3</th>
<th>Officer O4-O6</th>
<th>Officer O7-O10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>m²</td>
<td>ft²</td>
<td>m²</td>
</tr>
<tr>
<td>3 BR</td>
<td>Interior</td>
<td>3.0</td>
<td>32</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>Exterior</td>
<td>3.7</td>
<td>40</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Combined</td>
<td>7.9</td>
<td>85</td>
<td>10.3</td>
</tr>
<tr>
<td>4 BR</td>
<td>Interior</td>
<td>4.6</td>
<td>50</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Exterior</td>
<td>4.6</td>
<td>50</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>Combined</td>
<td>9.3</td>
<td>100</td>
<td>11.2</td>
</tr>
<tr>
<td>5 BR</td>
<td>Interior</td>
<td>4.6</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Exterior</td>
<td>4.6</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Combined</td>
<td>10.2</td>
<td>110</td>
<td>-</td>
</tr>
</tbody>
</table>
Example: If interior bulk storage is 2.3 m$^2$, then exterior bulk storage must be 4.2 m$^2$ to obtain the combined bulk storage requirement of 6.5 m$^2$.

4.3.12 Interior Finishes.

Select sustainable materials and finishes to achieve a balance between occupant convenience and satisfaction, appearance, durability, maintenance cost, and life cycle cost.

4.3.12.1 Flooring.

- Carpet may be installed in all living areas except kitchens, baths, laundry room, utility areas, vestibules, storage rooms, entryways, patios, porches, and areas exposed to weather elements. Install Carpet and Rug Institute (CRI) “IAQ” labeled carpet, pad, and adhesives, and underlayment that complies with flooring manufacturer’s recommendations.

  - Carpet shall meet requirements of 16 CFR 1630 and have a minimum average critical flux of 0.45 watts per square centimeter when tested in accordance with ASTM E648.

  - Static electricity build-up shall be permanently less than 3.5 KV at 70 degrees F with 20 percent relative humidity as determined by American Association of Textile Chemists and Colorists (AATCC) Test Method 134, Electrostatic Propensity of Carpets.

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

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

  - Provide ten-year warranty from the carpet manufacturer against edge ravel, delamination, and tuft bind.

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

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

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

- Kitchen area flooring and bathrooms shall have ceramic tile flooring with ceramic tile base. Laundry/utility area flooring shall be ceramic tile or seamless sheet vinyl. Interior stairs shall be hardwood with clear finish, or carpet. Additional consideration may be given to designs which incorporate ceramic tile bathroom floors and hardwood stairs with a clear finish. This material identification is not justification to exceed the mandatory price limitation set forth in this solicitation. Provide wood base unless otherwise indicated.

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

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

4.3.12.2 Walls and Ceilings.

Cathedral or vaulted ceilings are encouraged to improve the visual quality of living spaces. For new construction, minimum ceiling height shall be 8 ft., except where minor drops occur for structural or utility soffits. Provide 1/2-inch gypsum wallboard, taped and smooth finished. Water-resistant wallboard shall be used in wet areas such as bath, powder, and laundry room. Cementitious backer board shall be used for ceramic tile applications. Textured ceiling finish may be provided in areas other than kitchen, laundry, or bathrooms. Combined kitchen and eating areas shall have the same type of wall and ceiling finishes. 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.

4.3.12.3 Paint.

Primers, paints, and stains shall meet or exceed the requirements of Uniform Federal Guide Specification 09 90 00, Paints and Coatings, provided in the Technical Specifications. [RFP Preparer shall edit current edition of UFGS 09 90 00 to list only the applicable finish systems] Finishes shall be lead free. All interior surfaces, except factory pre-finished material, shall be painted a minimum of one prime coat and one finish coat. Walls and ceilings in kitchen, baths, laundry, utility rooms, and all painted trim shall be painted with semi-gloss enamel. A blown-on acoustical finish is prohibited.

4.3.13 Cabinets and Countertops.

Cabinets shall be frameless and countertop underlayment must comply with ANSI A208.2 or ANSI/HPVA HP-1 standards for low formaldehyde emissions. Sustainable alternative materials shall be considered where they provide comparable strength, quality and durability. Cabinet construction shall meet AWI custom grade requirements.

Cabinets shall have magnetic catches except where spring-loaded self-closing hinges are provided. Cabinets shall include knobs/handles and or pulls and shall conform to ANSI A161.1, Recommended Performance and Construction Standards for Kitchen and Vanity Cabinets, except where modified below. Wall and base cabinets shall be essentially of the same construction and appearance.

Minimum requirements for kitchen cabinets, counters, and pantries are shown in Tables 4-6 and 4-7. In lieu of materials indicated, materials complying with the Woodwork Institute Manual of Millwork Premium Grade are acceptable. Flat area is shown for countertops and drawers. Combined shelf area is shown for pantry and base, wall and wall cabinets.

Table 4-6 – Kitchen Cabinet, Counter & Pantry Area

<table>
<thead>
<tr>
<th>Type of Housing Unit</th>
<th>Wall m²</th>
<th>Wall ft²</th>
<th>Base m²</th>
<th>Base ft²</th>
<th>Drawer m²</th>
<th>Drawer ft²</th>
<th>Counter m²</th>
<th>Counter ft²</th>
<th>Pantry m²</th>
<th>Pantry ft²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Officer O6-O10</td>
<td>3.4</td>
<td>36</td>
<td>4.4</td>
<td>46</td>
<td>2.1</td>
<td>22</td>
<td>1.9</td>
<td>20</td>
<td>1.9</td>
<td>20</td>
</tr>
<tr>
<td>Other - 4/5 BR</td>
<td>2.8</td>
<td>30</td>
<td>3.8</td>
<td>40</td>
<td>1.7</td>
<td>18</td>
<td>1.5</td>
<td>16</td>
<td>1.5</td>
<td>16</td>
</tr>
</tbody>
</table>
### Table 4-7 – Minimum Kitchen Cabinet Specifications

<table>
<thead>
<tr>
<th>Element Description</th>
<th>Specific Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frameless Cabinets</td>
<td>3/4 in x 1-1/2 in kiln-dried hardwood.</td>
</tr>
<tr>
<td>Base Cabinet Toe Space</td>
<td>2-1/2 in x 4 in. high</td>
</tr>
<tr>
<td>Cabinet Bottoms, Backs &amp; Tops (Unexposed)</td>
<td>3/16 in hardwood plywood. Provide bottoms in kitchen sink cabinets. Brace bottoms with wood members glued in place.</td>
</tr>
</tbody>
</table>
| Cabinet Ends & (Exposed Backs/Bottoms) | Hardwood plywood, 5 ply, good grade for natural finish.  
Base Cabinets: 1/2 in  
Wall Cabinets: 3/8 in |
| Doors | 5/8 in hardwood plywood, good grade for natural finish, with hardwood trim. Raised panel or recessed panel. |
| Drawer Slides/Glides | 20 gauge metal. |
| Drawer Fronts | 5/8 in solid hardwood, matching doors. |
| Drawer Bottoms | 1/8 in softwood plywood, Grade A-B veneer. Bottoms 15 in wide shall be braced and glued in place. |
| Interior Partitions | 1/2 in hardwood or plywood, Grade A-A or comparable veneer. |
| Shelves | 3/4 in, softwood plywood (Grade A-B Veneer), hardwood plywood (good grade veneer), or glued-up solid wood. Support shelves on ends and on 24 in centers. Shelf edges exposed to view shall be rounded, filled, sanded, and finished. |

### 4.3.13.1 Countertops.

Countertops shall be granite, or similar, 1-inch thick tops with same material ¾” thick backsplash. Countertops shall be of solid surface materials. Minimum backsplash height is 4 inches. The substrate for countertops (except solid surface countertops) shall be 3/4-inch thick exterior plywood.

### 4.3.14 Appliances.

All contractor installed appliances shall be ENERGY STAR certified.

<Provide the following equipment in accordance with specifications listed, one each per housing unit. A listing of currently labeled ENERGY STAR® appliances is available>
through the internet at the EPA website: http://www.energystar.gov. Appliance color shall be stainless steel, except disposals, and shall have matching finish.>

4.3.14.1 Refrigerators – Government Furnished and Government Installed

<4.3.14.1 Refrigerators.

Comply with UL 250, Household Refrigerators and Freezers and shall bear the EPA ENERGY STAR® certified label. Provide refrigerator 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. Refrigerators shall conform to the energy compliance standards of 10 CFR 430, including those refrigerators manufactured before the code took effect. The use of refrigerants with an Ozone Depletion Potential (ODP) of .05 or less is required. Minimum refrigerator volume and maximum energy use are as follows:

Volume: 0.58 CM, 21 CF

Energy Efficiency: 722 kWh/yr.>

<4.3.14.2 Ranges and Ovens.

Ranges shall be 30 inches wide and provided with porcelain enamel cook-top, oven, clock and timer, oven light and cooking surface light. Oven shall have black glass window door, broiler pan, and self-lock racks. Use gas range and oven. Unit shall be listed as ENERGY STAR® compliant and shall bear the ENERGY STAR® label.

• Gas ranges shall have two, 6-inch and two, 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.>

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

<4.3.14.3 Microwave Ovens – Government Furnished and Installed>

<4.3.14.3 Microwave Ovens.

[Applicable only to General Officer's housing units. RFP Preparer insert "(DELETED)" and delete remainder of text if not required.]

Provide microwave oven(s) for the following housing units: [Insert requirement]. Ovens shall conform to UL 923, Microwave Cooking Appliances, and be UL listed, minimum 0.042 m³ [1.5 ft³], stainless steel interior, automatic oven light, built-in browning element, and temperature probe. Unit shall be listed as ENERGY STAR® compliant and shall bear the ENERGY STAR® label.>
4.3.14.4 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 washable filters. The fan shall have a capacity of not less than 50 cubic ft per minute per linear foot of range hood. The sound level shall not exceed 4 sones. Duct the fan to the exterior and provide back-draft protection.

4.3.14.5 Garbage Disposals.

Garbage disposals shall conform to UL 430; Waste Disposers; continuous feed, minimum 1/2 HP motor, stainless steel grinding elements, two 360-degree stainless steel swivel impellers, manual motor reset, and sound insulation. [RFP Preparer shall insert or delete paragraph for foreign applications: A plug connector is required.]

4.3.14.6 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 140 degrees F. Rated energy use for standard capacity models shall not exceed 620 kWh/yr.

4.3.14.7 Water Heater. See paragraph 5.2.4.

4.3.14.8 Ceiling Fans. See paragraph 5.5.11.3.

4.3.14.9 Washers and Dryers. [RFP Preparer shall insert requirements for overseas locations – Delete if Not Applicable.]

Provide standard hookup for washing machine. Provide standard gas and standard electric hookup for dryer.

4.3.15 Interior Doors.

Interior doors shall be 6 ft. -8 inches in height by 1-3/8 inch thick, hollow core or solid wood or panel doors. Wood doors shall be painted.

4.3.16 Hardware.

Hinges, locks, and latches shall be stainless steel and shall comply with the specifications indicated in Table 4-8, and the following subparagraphs:

**Table 4-8 – Hardware Specifications**

<table>
<thead>
<tr>
<th>Hardware Type/Specification</th>
<th>Specific Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges/BHMA 101</td>
<td>Hinges shall be 4 in x 4 in at exterior doors, and 3-1/2 in x 3-1/2 in at interior doors.</td>
</tr>
</tbody>
</table>
Locks & Latches/BHMA 601
Series 4000, Grade 2, at exterior doors. Grade 2 or 3 at interior doors. 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 CO2000, Grade 2.

4.3.16.1 Locks and keys.

Lock cylinders shall have seven pin tumblers and interchangeable cores which are removable by a control key. Provide a master keying system. Locks for each housing unit, including exterior storage and garage door(s), shall be keyed alike. The Contractor shall provide one extra set of cores 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. [RFP Preparer shall include special requirements for conformity with Installation master keying system.]

4.3.16.2 Weather stripping and Exterior Thresholds.

Provide nonferrous metal or vinyl weather-stripping for all housing unit exterior doors. Vinyl magnetic weather-stripping is acceptable for metal doors. Exterior thresholds shall be nonferrous metal.

4.3.16.3 Application.

Locks and hinges shall be applied as follows:

- Exterior hinged doors shall have 1-1/2 pair of hinges, lockset, and an auxiliary lock or interconnected lock and latch.
- Each windowless entrance door shall have a viewer mounted at eye level.
- Exterior bulk storage door shall have -1/2 pair of ball-bearing hinges and lockset.
- Interior doors shall have one and a half pair of hinges and latch set with BHMA 601, F75 or F76 operations.
- Doors in fire-rated walls, housing unit to garage, shall have 1-1/2 pair of ball-bearing hinges, lockset, auxiliary lock or interconnected lock and latch and closer.
- Garage side exterior doors shall have 1-1/2 pair of hinges and lockset.

4.3.17 Postal Service and Building Signage.

4.3.17.1 Postal Service.
All new units shall be provided with an individual mailbox. [RFP Preparer shall coordinate with the Installation and the local postal authority with respect to mail delivery requirements as well as installation requirements.]

4.3.17.2 Building Signage.

All new units shall be provided with building identification signage in accordance with the Installation Design Guide requirements. Each unit shall have an individual street address located on the wall near the entrance.

4.4 OUTDOOR LIVING AREAS

4.4.1 General.

Each ground-floor family dwelling unit except shall have an adjoining private or semi-private outdoor space, partially or completely surrounded by privacy screening. Emphasize factors that enhance indoor and outdoor living. Consider size, layout and location of patios, balconies and yards, and features that encourage family use of outdoor areas. Minimum requirements for exterior spaces are in Table 4-9.

<4.4.2 Balconies.

Each living unit located entirely above ground floor shall have a 72sf (min) balcony with no dimension less than 1.8 m [6 ft]. Provide direct access from balcony to living room, dining room, or family room. Construct balconies using solid decks with an impervious, non-slip surface, sloped to drain to outer edge. Balcony topping shall have a minimum thickness of 38 mm [1 1/2-inch] with welded-wire mesh reinforcement. Plastic coating or films over concrete decks, and exposed wood decks, stained or painted are not acceptable. Exposed wood rails and trim shall be treated to deter damage from moisture, decay and insect infestation.>

4.4.3 Patios and Decks.

Screen patios and decks from streets, common areas, and adjacent living units. Provide direct access from patios and decks to living room, dining room, or family room areas. For each living unit that opens to the exterior at ground level, provide a minimum patio area of 120 ft² with a minimum dimension of 8 ft. An acceptable alternative is a raised deck of the same size, constructed of weather-resistant materials. Consider using sustainable materials, such as post-consumer recycled plastics and certified wood, for deck and screen construction. Patios shall be sloped to drain away from all buildings and have a broom-finished concrete floor surface.

4.4.4 Exterior Stairs.

Design stairs to permit movement of a king-size bed box spring. Each unit shall have private exterior walkway and/or stairs sheltered from wind and precipitation. Wood exterior stairs are prohibited. Stairs shall have a minimum width of 3 ft. 6 in. Exterior stair treads and landings shall be constructed of concrete or masonry, and provided with non-slip type treads. Exposed wood rails and trim shall be treated to deter damage from moisture, decay and insect infestation.

Table 4-9 – Minimum Area and Dimensions of Exterior Spaces

<table>
<thead>
<tr>
<th>Spaces</th>
<th>Area</th>
<th>Length</th>
<th>Width/Depth</th>
<th>Height</th>
</tr>
</thead>
</table>

00 01 10 - 43
### FOUNDATIONS

#### General.

Design foundations in accordance with UFC 1-200-01 and the International Residential Code (IRC). Fiber reinforced concrete is not an acceptable material for use in this project.

#### Basements.

Basements may only be provided when proven to be cost effective on a life-cycle cost basis related to economics, energy efficiency, operations and maintenance, structural integrity, and site constraints.

#### Slabs-on-Grade or Crawl Spaces.

Type, thickness, and location of insulation shall comply with applicable provisions of ASCE 32-01 (Frost-Protected Shallow Foundations), and IBC or IRC. Crawl spaces, if used, shall be insulated and encapsulated.

#### Tornado Protection Shelter.

[RFP Preparer shall include the following paragraph only when the project is being constructed in a location which is considered by FEMA guidelines (FEMA 320) to be "High Risk", the provision of tornado shelters must be included in the DD Form 1391 and all project programming to support inclusion of this technical requirement. For guidance in determining the probability of tornadic gust winds, refer to ASCE 7 – Commentary, Figure C6-1A. Tornadic Gust Wind Speed Corresponding to Annual Probability of Occurrence, and the following publications:

- FEMA – National Performance Criteria for Tornado Shelters.]

*The design of the housing unit shall include the provision for a tornado shelter to protect the occupants during tornado events. This shelter shall be sized and designed as*
recommended by the FEMA P-320 or equivalent. The tornado shelter shall be incorporated into the building design whereby an interior space shall be designated as the tornado shelter. This interior space shall be constructed in accordance with FEMA criteria to provide protection from wind, airborne debris missiles, and shall include ventilation considerations.>

4.6 ROOF AND ATTIC CONSTRUCTION

4.6.1 Roofs.

Roofs shall have a minimum slope of $4:12$ [6:12 preferred] for maintainability, and to provide residential scale to the neighborhood. Install fall protection anchor points on all roofs. Wood shingles and shakes are prohibited. Design roof overhangs, gutters and downspouts, roofing materials, and attic ventilation in accordance with roofing installation standards to conserve energy and reduce maintenance costs. See UFC 3-190-04FA Roofing and Waterproofing, for additional guidance. Roofs shall have eave overhangs of 12 in, and gable overhangs of 8 inches minimum. Roofing material shall comply with UFC 01-200-02 and ASHRAE 90.1 recommendations. Parapet walls are prohibited.

4.6.2 Gutters and Downspouts.

Gutters 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 if not connected to the storm drainage system.

4.6.3 Materials.

Roofing shall be limited to the following:

- Minimum of 540 lb., standing or flat seam, metal roofing with 0.027 inch thick zinc-copper-titanium alloy factory finish.
- Aluminum standing seam roofing 0.032 inch thick.
- <Clay, concrete, metal, or fiberglass tile>. [RFP Preparer shall add information when allowed for use.]
- <Copper> [RFP Preparer shall add minimum thickness for roofing.]

4.6.4 Attics.

Attic solar power ventilation shall be provided when proven to be life-cycle cost effective; otherwise provide traditional power ventilation. Do not terminate exhaust fans or plumbing vents in attic, unless plumbing vents have air admittance valves (AAV) that comply with IRC provisions.

4.7 EXTERIOR CONSTRUCTION

4.7.1 General.
Use sustainable, low maintenance finish materials, such as brick, integrally colored stucco, factory pre-finished cement board siding, vinyl siding. Materials shall be residential in size, scale, and texture. Avoid materials requiring field finishing. Provide vapor barrier/diffusion retarder as required by dew point analysis. Aluminum siding, hardboard and cement asbestos shingle siding shall not be used. Exterior finish materials for exterior bulk storage buildings and garages shall match the primary dwelling unit. The following siding materials may be used, but are listed in declining order of preference: [RFP Preparer shall edit order of preference to reflect installation preferences and edit out materials not to be used below and in this paragraph.]

- **Brick.** 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. For grade beam design, the brick shall run a minimum of one course below the finished floor and shall be flashed at that level.

- **Stucco.** Portland cement plaster or synthetic stucco shall have integral color. Stucco total surface area shall be divided into panels with control joints spaced no more than 10 ft. apart to form a panel of less than 150 ft². Contractor shall follow manufacturer's installation instructions explicitly and shall certify accurate and correct installation of all stucco type materials. [Installations on the East Coast and all those installations where high humidity is typical in the climate, extreme caution shall be exercised with consideration to the correct specification and installation of this type finish material in a humid climate. Designer shall suitably investigate the benefits and potential problems with this material selection prior to its inclusion in the solicitation.]

- **Factory-prefinished cement board siding.** Factory-prefinished siding shall have a minimum non-prorated 15-year warranty on the finish. Siding shall be kept a minimum of 6 inches above finish grade. Lap siding shall be either single pieces with 8 inches maximum width course or single pieces shaped to simulate 8 inches maximum width courses (double-four, double-five, triple-four sidings are acceptable). Siding shall be installed in accordance with manufacturer's recommendations. A manufacturer's representative shall instruct the installer of the siding, appurtenances, and accessories as to the manufacturers required installation procedures. The Government construction inspectors responsible for the job shall be included in their instruction. Panel materials in large surfaces shall be avoided unless surfaces are broken with textures or battens. Battens for prefinished materials shall also be factory finished. Requirements for various siding materials are as follows:

- **Vinyl siding shall conform to the requirements of ASTM D3679, Rigid Poly (Vinyl Chloride) (PVC) Siding and shall be a minimum of 0.044 inch thick.**

4.7.2 Structural Design.

Structural design shall comply with the International Building Code (IBC). One and two family housing, including townhouses, shall comply with International Residential Code (IRC). Structures which qualify as "Manufactured Homes" shall comply with the Federal Manufactured Housing Construction and Safety Standards Act (FMHCSS) [USC Title 42], except as modified herein.

4.7.2.1 Lateral Resistance. Walls used or required for lateral resistance to wind or earthquake, shall be considered bearing walls and shall have full foundations.

4.7.2.2 Embedded Steel. Nonstructural steel (handrails, etc.) embedded in concrete shall be galvanized or painted wrought iron. All damaged galvanized areas shall be repaired prior to embedment.

4.7.2.3 Wood Flooring Systems. Wood flooring systems shall be glued and nailed. Glue lines shall not be considered for stress transfer.
4.7.2.4 Subfloor. Plywood is preferred as subfloor material, and is required for wet areas (i.e., bathrooms, kitchens, utility rooms). The subfloor shall be rated for exposure 1 or exterior use.

4.7.2.5 Underlayment: Sanded face underlayment (plywood) is required with vinyl tile, sheet vinyl, and carpet. Underlayment must be a minimum thickness of 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 shall be rated for Exposure 1 or exterior use. Underlayment shall be installed after interior finish work is complete to avoid damage to the underlayment. Ceramic tile shall be installed on mortar bed or cement board underlayment.

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

- Wood fascia and rakes are required and shall be 1 inch nominal boards with solid blocking or 2-inch nominal boards without blocking. Plywood, hardboard, or gypsum board are not permitted for fascias or rakes.
- Exposed wood, such as window trim, door sills, window sills, railings and balusters, wood fencing, solar shading devices including louvers, arbors, and trellis shall be treated for rot resistance in accordance with NWWDA Industry Standards I.S.4, Water Repellent Preservative Treatment for Millwork.
- Exterior surfaces requiring painting shall receive a minimum of one prime coat and two finish coats of paint. Wood trim frames, etc., shall be back-primed. Exterior semi-transparent stains, two coats, are acceptable, where appropriate for wood, plywood, etc.

4.7.4 Exterior Ceilings and Soffits.
Exposure of roof framing and underside of roof/floor decks is not permitted. Exterior ceilings and/or soffits shall be trimmed or otherwise architecturally treated and coordinated with siding. Exterior ceilings and/or soffits may be pre-finished metal, vinyl, plywood, EXT-APA conforming to American Plywood Association Standard B840, 303 Siding Manufacturing Specifications. Cement asbestos ceiling and/or soffits are not permitted.

4.7.5 Windows and Glazed Doors.
Provide windows and glazed door (50 percent or more glass) that meet minimum egress requirements in the Life Safety Code (NFPA 101). Operable windows must be manually operated and lockable. Provide non-ferrous screens for operable windows. Maximize amount of natural light in living areas. Consider passive solar energy impact on heating and cooling loads when selecting, sizing, and locating windows. Tilt-in windows are recommended to facilitate cleaning by occupants. Provide glass door and window treatments for occupant privacy. Window screens shall be provided for operable windows in habitable rooms and spaces. Windows above ground floor shall have screens capable of withstanding a minimum force of 60 pounds as a concentrated load applied to the middle of the screen. Screens must be removable for window cleaning and emergency egress purposes without the use of any special tools. Removable window guards or child safety locks may be provided in lieu of reinforced window screens. Window guards shall be in compliance with ASTM F2090-10 – Standard Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms.

4.7.5.1 Window Operation. Windows that slide (double-hung, single-hung, and horizontal sliding) and glass exterior doors shall meet the standards for hung units. Standards for casement
windows shall apply to all hinged or fixed windows. Other window types may be used if they have been tested and conform to the standards for hung windows. All operable windows must include window opening control devices (WOCD) for Fall prevention, and must comply with ASTM F2006 or 2090 as applicable, in accordance with the National Defense Authorization Act (NDAA) 2019. The Contractor shall provide the manufacturer's certification that the window provided meets the following test requirements:

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

- **Strength.** Using ASTM E330 test results shall demonstrate no glass breakage, damage to hardware, or permanent deformation that would cause any malfunction or impair the operation of the unit. Residual deflection of any member shall not exceed 0.4 percent of its span. Hung windows shall be tested at pressures of 37.5 lb./ft², and casement windows shall be tested at pressures of 60.0 lb./ft².

- **Operating force.** The force necessary to unlatch and open units shall not exceed 30 lb. for hung units and 35 lb. for casements.

- **Air infiltration.** Using ASTM E283 leakage rate shall not exceed 0.25 ft³/min/ft² for hung units and 0.15 ft³/min/ft² for casements, at a test pressure of 1.57 lb./ft².

- **Water penetration.** Using ASTM E547, no leakage shall be evident when tested in three, five-minute cycles with a one-minute rest period between cycles at 3.75 lb./ft² for hung units and 6.0 lb./ft² for casements.

- **U-Value.** U-values shall be calculated using ASTM E1423 and NFRC 100-91. See Section 8.0 for additional information.

- **Fall Prevention; Certification of compliance with ASTM F2006 or F2090 as applicable.**

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

4.7.5.3 **Glazing.** Units shall be double glazed with low E-glass minimum.

4.7.5.4 **Window Stools.** Interior window stools shall be solid-wood, paint grade with a minimum thickness of 3/4-inch. Solid surfacing is an acceptable window stool.

4.7.5.5 **Screens.** Screens shall be provided at all operable sashes and sliding doors. Screens shall be nonferrous, of window manufacturer’s standard design, and conform to AAMA 1002.10, Voluntary Specification for Aluminum Insulating Storm Products for Windows and Sliding Doors.

*RFP Preparer may wish to discuss and consider "sunscreen" material with the installation if in hot climates. Sunscreens (screen composed of more dense mesh screening material than standard insect screens) fit in the same screen track and continue to act as an effective insect screen and also as a Solar Heat Gain Coefficient (SHGC) reducer shall be considered for installation in west-
and east-facing windows, and in south-facing windows that do not have passive solar overhang shading. In hot climates solar heat gain through the windows is often responsible for 50% or more of the air conditioning load, and sunscreen is an effective, low-cost, passive and persistent means of reducing it. This is not a mandatory requirement.

4.7.5.6 Window Treatments. Provide cordless pull up/down honeycombed shades or similar cordless treatment at all windows and glazed hung doors. Blinds shall be compliant with ANSI/WCMA A100.1-2018. Color shall be manufacturer’s standard off white, and shall be coordinated with wall color. Provide single-draw traverse rod and draperies at sliding glass doors.

[RFP Preparer shall edit to indicate drapery specification.]

4.7.7 Exterior Doors.

- Provide insulated exterior doors for increased energy performance. Provide dead-bolt locks on all hinged entry doors. Provide impact-resistant side light at entry door, or a wide-angle viewer. Doors shall be selected to contribute to energy performance goals. See Section 8.0 for additional information on thermal performance requirements. Do not use a sliding glass door as the primary housing unit access.

4.7.7.1 Entrance Doors. The housing unit primary entrance door shall be 3 ft. in width by 6 ft-8 inches in height by 1-3/4 inch thick, thermal metal. Other housing unit entrance doors shall meet this requirement but may be of lesser width.

4.7.7.2 Bulk Storage Door. Exterior bulk storage door shall be a minimum 3 ft. in width by 1-3/8 inch thick, exterior grade, thermal or hollow core metal. Doors may be omitted when storage areas are located in garages.

4.7.7.3 Aluminum Screen and Storm Doors. [RFP Preparer shall insert “Not Used” and delete remainder of text if not applicable.] Screen and self-storing storm doors shall be provided for all housing unit exterior hinged doors. Frames shall be a minimum of 1-1/4-inch 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.

4.7.8 Main Entry.

Design main entries to provide a sense of identity for each individual unit. Visual impact from the street is extremely important. Avoid a common entry to several units. Each unit shall have an appropriate number or letter designation. Provide each front entrance with a door chime or door knocker. Provide a slip-resistant finish for porch surfaces. Protect entry door with a minimum 0.6 m (2 ft.) overhang, or covered porch. Provide interior and exterior lighting at each main entrance.

4.7.9 Garages

[RFP Preparer edit appropriately where project requirements prevent provision of a garage.]

Provide attached garages for all but apartment-type units, which will have consolidated parking. Enclosed bulk storage may be included in the garage as discussed in paragraph 4.3.11.3. If trash or bulk storage areas are included in the garage, such areas are in addition to the required car storage area. Refer to Table 4-6 for minimum dimensions. Garages shall be attached to
housing unit they serve. Provide convenient access between garage and service area, and between kitchen and service area. Design garages to compliment architectural features, materials, and roof slopes of house. Provide light switches and duplex convenience outlets in each garage. Garage floor surface must be a minimum of 4 in lower than finished floor of attached housing unit and the floor of the adjoining exterior storage; slope floor to drain liquids away from unit walls. Design and construct attached garages to prevent infiltration of contaminants into housing units. Garage doors shall have hardware that can be opened and locked from inside and outside of the garage. Automatic garage door operation shall be provided. Garage doors shall be prefinished insulated metal or fiberglass.

For accessible units or units designated to be adaptable for access, the garage shall allow space for accessible path of travel (with automobile and other items in the garage) from vehicle into house. For attached garages, path shall be interior. The required step down from the housing unit into the garage shall be maintained; accessibility may be achieved by a modular aluminum ramp system.

4.7.10 Exterior Storage.

Provide an outside service door opening to exterior storage areas, wide enough to accommodate lawn mowers and typical lawn tools, except when storage is provided in garage. Locate outside service door near outdoor living and lawn areas. Provide paved access to the door. Provide a switch-controlled light at outside service door. Exterior storage space shall be a minimum of 50 ft² for the four-bedroom units.

4.7.11 Trash Area.

Provide each living unit with a covered paved pad area large enough for two 30-gallon containers, plus any recycling containers required by the installation. Locate pad near trash pickup point but behind the front of the house, and provide paved access for occupant. Locate trash area outside living unit envelope. Provide with a trash enclosure or screening, if trash area is visible from street, common area or other living unit. Garages may be designed to provide adequate trash container enclosures. Locate dumpster areas, if provided, in areas least offensive to housing occupants, and provide adequate shielding with fencing or screening. [RFP Preparer shall insert following if applicable.] <An exterior trash area is undesirable [due to rodent issues] [due to aesthetics], therefore trash containers will be stored within the garage. Provide ample space for anticipated size of containers while allowing vehicular mobility>
5.0 BUILDING SYSTEMS

5.1 WATER

5.1.1 General.


5.1.2 Water Supply and Distribution.

Connection to the existing water distribution system shall be made at the locations shown on the RFP drawings and as described in section 3.5. Provide an interior shut-off valve on water supply line entering each housing unit, readily accessible to maintenance and emergency personnel. It is the contractor’s responsibility to coordinate the water distribution system with the local water supply distributor.

5.1.3 Exterior Hose Bibs.

Provide hose bibs in easily accessible locations at front and rear of each ground floor living unit, and provide frost-proof hose bibs in areas subject to freezing temperatures and provide an integral vacuum breaker.

5.1.4 Domestic Hot Water.

Water heaters shall be ENERGY STAR® labeled and shall be storage or tankless as described. Where fuel-fired water heaters are provided, sealed combustion units are recommended. Water heater sizing for storage type water heaters may be in accordance with Table 5-1. Additional consideration in the technical evaluation will be given to designs which include water heaters which exceed the minimum energy efficiency requirements, which use power vented or sealed combustion water heaters. At least 30% of hot water demand must be met using solar hot water heater.

### Table 5-1 – Water Heater Sizing

<table>
<thead>
<tr>
<th>Requirements by Fuel Type</th>
<th>3 BR</th>
<th>4 BR</th>
<th>5 BR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 Bath</td>
<td>2 Bath</td>
<td>3 Bath</td>
</tr>
<tr>
<td>Gas &amp; Oil:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage (gal)</td>
<td>40</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>1 hour draw (gal)</td>
<td>70</td>
<td>72</td>
<td>82</td>
</tr>
<tr>
<td>Recovery (gph)</td>
<td>30</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>
5.1.4.1 Gas fired water heaters. Gas fired water heaters shall be in accordance with ANSI Z21.10.1, Water Heaters, Gas, Volume I, Storage Type, 75,000 BTUH Input or less, and shall be sealed combustion high efficiency type. Water heaters with powered ventilation shall be vented in accordance with manufacturer's instructions. Tanks shall have drain pans.

5.1.4.2 Electric water heaters. Electric water heaters shall comply with UL 174, Water Heaters, Household Electric Storage Tank Type, and shall have an Annual Energy Use (kWh) of 4,773 or less based on DOE test procedure 10 CFR430, Sub-Part B, Appendix E.

5.1.4.3 Tankless Water Heaters. Whole home gas tankless water heaters shall have a minimum recovery efficiency of 83%, minimum gallons per minute of 0.0 and maximum gallons per minute of 3.9 at 77 degrees F temperature rise.

5.1.5 Plumbing.

Plumbing system shall be designed and installed in accordance with the International Residential Code (IRC) and UFC 3-420-01 Design: Plumbing Systems. Inspection and testing of the plumbing system shall be performed as prescribed in the Plumbing Code. Additional consideration in the technical evaluation may be given to systems which incorporate measures beyond the requirements of this Statement of Work which are designed to increase energy conservation, ease of maintenance, or occupant comfort such as water filtration and purification, higher efficiency water heating systems, higher grade plumbing fixture materials (such as enameled cast iron tubs as opposed to enameled steel or plastic), etc.

5.1.5.1 Water Piping. Under slab supply piping shall be limited to housing unit service entrance only, and as such shall be encased, never shall the pipe be attached/embedded into the concrete. Service line to each housing unit shall be no less than 1 inch diameter. All water piping shall be sized in accordance with methods outlined in the International Residential Code (IRC), to limit water velocity in the pipe to 8 ft./sec unless a lower velocity is recommended by the plumbing fixture manufacturer(s). An isometric diagram of the water system shall be included in the design submittal. Allowable pipe materials are listed below:

- Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe. If plastic pipe is selected for interior water piping, it shall be Chlorinated Polyvinyl Chloride (CPVC) plastic pipe, conforming to ASTM D-2846, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Hot- and Cold-Water Distribution Systems. CPVC thicknesses shall meet Standard Design Ratio 11 for sizes ½-inch to 2 inches and shall be schedule 80 pipe for sizes larger than 2 inches.

5.1.5.2 Soil, Waste, Vent, and Drain Piping. Soil, waste, vent, and drain, piping may be cast iron, copper, steel, or plastic suitable for installation in a residential waste, soil, vent, and drain system. Each fixture and piece of equipment, except water closets, requiring connection to the
drainage system, shall be provided with a trap. Soil, waste, and drain piping installed below floor slabs shall be service weight hub and spigot cast iron or plastic pipe. Building waste main lines shall be no less than 4-inch diameter. All soil, waste, and drain piping shall be sized in accordance with the methods outlined in the International Residential Code (IRC). An isometric diagram of the complete sanitary sewer system shall be included in the design submittal.

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

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

- Water closets. Water closets shall have regular bowl with inclined tank, close coupled siphon jet, floor outlet with wax gasket, closed-front seat and cover, and an anti-siphon float valve. Water consumption shall be no more than 1.6 gal per complete flushing cycle. Water closet trim shall conform to ASME/ANSI A112.19.5, Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards). Water conservation to include dual flush technology is strongly encouraged. Tank-type water closets shall be certified to the performance criteria of the EPA WaterSense Tank-Type High-Efficiency Toilet Specification and shall have a maximum full-flush volume of 1.28 gal (4.8 L). Dual-flush fixtures shall also comply with the provisions of ASME A112.19.14. (From ASHRAE 189.1)

- Lavatories. Bathroom lavatories shall be rectangular counter top type, minimum 20 by 18 inches in size or oval minimum 19 by 16 inches in size. Lavatories shall be vitreous china, cast iron rimless type (without rings), or cross-link acrylic molded counter top with integral bowl. Lavatories shall have pop-up drains. Residential lavatory sinks shall have a maximum flow rate of 1.5 gpm when tested in accordance with ASME A112.18.1/CSA B125.1. Residential bathroom lavatory sink faucets shall comply with the performance criteria of the EPA WaterSense High-Efficiency Lavatory Faucet Specification.

- Bathtubs. Bathtubs shall be slip resistant and shall be constructed of enameled cast iron, porcelain enameled formed steel, or gel-coated, glass fiber reinforced polyester resin with wainscot. Metal bathtubs shall have fiberglass or ceramic tile wainscot.

- Showers. Shower stalls shall be of ceramic tile, floor to ceiling, over membrane waterproofing on a cementitious substrate; or gel-coated, glass-fiber-reinforced polyester. Shower receptors shall be slip resistant cast stone or gel-coated, glass-fiber-reinforced polyester. Shower stall wainscots shall be ceramic tile or gel-coated, glass-fiber-reinforced polyester. Showerheads shall have a maximum flow rate of 2.0 gpm when tested in accordance with ASME A112.18.1/CSA B125.1. Residential showerheads shall comply with the performance requirements of the EPA WaterSense Specification for Showerheads.

- Kitchen sinks. Kitchen sinks shall be Type 302 stainless steel, 20-gauge minimum, seamless drawn, and sound deadened. Sinks shall be double bowl, self-mounting without mounting rings, complete with cup strainer and plug. Food waste disposers, where provided, shall be in accordance with UL 430 and ASSE 1008, and shall have a minimum motor size of ½ horse power. Strainer and plug shall be eliminated where food waste disposers are provided. Kitchen sinks shall have a maximum flow rate of 1.8 gpm when tested in accordance with ASME A112.18.1/CSA B125.1. Kitchen faucets shall be permitted to temporarily increase the flow greater than 1.8 gpm but shall not exceed 2.2 gpm and must automatically revert to the
established maximum flow rate of 1.8 gpm upon physical release of the activation mechanism or closure of the faucet valve.

5.1.5.4  Plumbing shall meet the following criteria:

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

- Faucets shall be single-control type, with seals and seats combined in one replaceable cartridge designed to be interchangeable among lavatories, bathtubs and kitchen sinks, or having replaceable seals and seats removable either as a seat insert or as a part of a replaceable valve unit. Water flow shall be no more than 2.5 gpm from any faucet.

- Shower and bath combination shall be controlled by a diverter valve. Baths and shower and bath combinations shall be provided with waste fitting pop-up, concealed with all parts removable and renewable through the overflow and outlet openings in the tub. Showers and shower and bath combinations shall be equipped with a combination valve and flow control device to limit the flow to 2.5 gpm at pressures between 20 and 60 psi.

- Piping shall be concealed. Individual shutoff or stop valves shall be provided on water supply lines to all plumbing fixtures except bathtubs and showers. Shutoff valves shall be provided for each bathroom group.

- Fixtures shall be water conservation type, in accordance with the International Residential Code (IRC) and ASHRAE 189.1.


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

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

5.1.5.6  Refrigerator Ice Maker Connection. Cold water supply shall be provided for refrigerator ice makers. Ice maker connection shall include an angle valve and a 1/4 inch hose thread supply, and shall be provided in standard manufactured recessed wall box with single-face plate (plastic or steel). Boxes shall be mounted a minimum 2 ft-10 inches above the finish floor.

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

5.2.1 General.

Provide Drain-Waste-Vent (DWV) plumbing that complies with the International Residential Code (IRC) and UFC 3-420-01 Design: Plumbing Systems. Locate vent stacks to rear of housing units, and consolidate or eliminate through-the-roof penetrations, when possible.

5.2.2 Sanitary Sewer System.

Connection 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 International Residential Code (IRC). Pipes shall be designed to flow full and maintain a minimum velocity of 2 ft per second.

5.2.3 Condensate and Overflow Drains. Provide drains for air-conditioning condensation, humidifier overflow, occupant-supplied washing machines, and water heater drain and relief valves. Drains shall discharge to exterior whenever possible. Drainage to waste water drain shall be coordinated with local sewer authority for availability.

5.2.4 Cleanouts. Cleanouts shall be provided at each change in direction of sanitary sewer lines, at the intervals specified in the International Residential Code (IRC), and at the building service entrance. All cleanouts shall be permanently accessible. Ground cleanouts shall be installed in a 12-inch by 12-inch by 6 inches thick concrete pad, flush with grade.

5.3 GAS

5.3.1 General.

Fuel gas piping systems, fuel gas utilization equipment and related accessories, venting systems, and combustion air configurations must comply with applicable provisions of the IBC and the IRC as modified by UFC 1-200-01, and NFPA 54. This section applies to incidental underground piping under building and above ground steel piping and corrugated stainless steel tubing (CSST) both outside (up to 5 feet beyond exterior walls) and within buildings in compliance with NFPA 54.

[RFP Preparer delete if not applicable: Compliance with Host Nation codes and regulations is also required for overseas locations.]

5.3.2 Gas Distribution System.

[RFP Preparer shall insert " (DELETED)" if not applicable and delete remainder of text in sub-paragraphs.] [Coordinate with the installation to determine the responsible agency for installation of exterior gas lines, meters, regulators, hot taps, valves, etc. The RFP Preparer shall then add a sentence to this paragraph to inform the Contractor of his or her responsibility.]

See section 3.7 for gas line distribution requirements. Contractor shall coordinate with <GAS PROVIDER> for the connection to gas line distribution piping and installation of new meters, pressure regulators and isolation valves. Gas Meter entry shall incorporate swing joints to allow for movement on all 3 axes. Meters shall not be on front of houses.
5.3.2.1 Materials. Materials and appurtenances shall be free of defects and suitable to accomplish the stated objectives of gas distribution systems. Pipe shall be polyethylene or steel as described below.


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

5.3.2.2 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.

5.3.2.3 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.

5.3.2.4 Gas Connections. The use of semi-rigid tubing and flexible connectors for gas equipment and appliances is prohibited, except kitchen ranges. Make final connections to kitchen ranges using flexible connectors not less than 40 inch long. Provide accessible gas shutoff valve and coupling for each gas equipment item. Provide accessible gas shutoff valve and coupling for each gas equipment item. Comply with model code seismic requirements. Exposed horizontal piping shall not be installed farther than 6 inches from the nearest parallel wall in laundry room or areas where clothes hanging could be attempted.

5.3.3 Fuel Oil Storage and Distribution.

[Floor Plan Preparer shall insert "DELETED" if not applicable and delete remainder of text in all paragraphs.]

- Fuel oil storage and distribution system shall be installed to supply the fuel oil-fired heating equipment. Provide a complete fuel oil storage and distribution system designed in accordance with local codes, installation requirements, NFPA 30, and NFPA 31, whichever are more stringent.

5.3.4 Liquefied Petroleum (LP) Gas Storage and Distribution.

[Floor Plan Preparer shall insert "DELETED" if not applicable and delete remainder of text in all paragraphs.]

LP gas pressure shall be reduced to a minimum service pressure of 3.5 kPa [½ psi] prior to the building entrance. LP gas pipe connectors shall be in accordance with UL 567.

5.4 INTERIOR ELECTRICAL SYSTEMS
5.4.1 Unit Electrical System.

5.4.1.1 Service Entrance: Service entrances, exterior meters, and panels shall be enclosed or sight screened. Service feeders shall be underground with exterior meters. Panelboards shall be painted galvanized steel and furnished with circuit breakers. Panelboard doors shall be flush one-piece fronts and hinged. Provide main circuit breaker in the main panel for each housing unit, sized in accordance with the NFPA 70. Meters and doors to service rooms shall not be on front of houses.

5.4.1.2 Service Panel: Provide 200 amp minimum electrical service to each living unit and include surge protection at each service entrance panelboard and service transformer.

5.4.1.3 Metering: Provide meter bases to facilitate installation of individual electric meters at a later date. Automated Meter Reading (AMR) meters, complying with ANSI/NEMA standard, C12.1 Code for Electricity Metering and approved by the utility, shall be installed. Provide visual screening for meters and meter bases, and do not locate meters adjacent to unit entrances.

5.4.1.4 Panelboard Locations: Housing unit panelboards shall be located in the utility or laundry room, attached garage, or hallway. Panelboards may be surface or recessed mounted depending on their location. Panelboards installed in hallways shall be recessed. Offset a minimum of 16 inches horizontally back-to-back panelboards. Do not install recessed panelboards within party walls or fire walls. Working space for panelboards shall be provided in accordance with NFPA 70.

5.4.1.5 Branch Circuits: All branch circuit conductors shall be copper. Branch circuit conductors and over-current protection devices shall be sized in accordance with NFPA 70. A minimum of (1) spare 20 amp circuit in the panelboard shall be provided per housing unit. Dedicated circuits shall be provided for the washer, dryer, dishwasher, garbage disposal, freezer, electric range, furnace or air handling unit, air conditioning unit, and water heater. Two 20 amp branch circuits shall be provided in the kitchen area for the convenience receptacles for small appliances serving the kitchen, dining area, and family room area. Provide Ground-Fault Circuit-Interrupter (GFCI) and Arc-Fault Circuit-Interrupter (AFCI) protection in accordance with NFPA 70.

5.4.1.6 Outlet Circuits: Lighting and convenience outlets shall be on separate circuits. Outlets on party walls shall be offset to maintain integrity of the fire wall and sound deadening rating of the wall. Place no more than ten duplex receptacles on a 20 amp branch circuit.

5.4.1.7 Convenience Receptacles: Housing units shall be provided with listed Tamper-Resistant (TR) receptacles. In addition to receptacles required by NFPA 70, provide convenience receptacles in the following areas:

- Utility/Laundry Rooms
- Mechanical Rooms
- Hallway outside bedrooms
- Garage

5.4.1.8 Special Receptacles. Provide dedicated 120V and 240V receptacles for electric dryer and electric range. Future tenants shall have the option to use electric or gas appliances without receptacle modification.
5.4.1.9 Provide Nonmetallic-Sheathed Cable (Types NM, NMC, and NMS) for branch circuit wiring, and Service-Entrance Cable (Types SE and USE) for heavy-duty interior circuits and for service entrance conductors. Installed conductors in conduit shall be used only where specifically required by the NFPA 70.

5.4.1.10 Lighting.

Illumination levels for housing units shall be per UFC 3-530-01 (Interior and Exterior Lighting Systems and Controls, Change 1) and the Lighting Handbook published by the Illuminating Engineering Society of North America (IESNA).

5.4.1.10.1 Exterior Lighting and Outlets: Provide energy efficient, high quality LED lighting for each housing unit. The minimum efficiency standard for exterior lighting is 120 lumens/watt. Lighting shall also be color corrected with a Color Rendering Index (CRI) of no less than 70 for exterior applications. Provide a minimum of one light fixture and one ground-fault-protected outlet in each housing unit's entry, garage, and patio or balcony area(s). Light fixtures at entry and patio or balcony areas shall be switched from the housing unit interior. Provide a fixture in the patio area, unless the patio is adjacent to an exterior entrance and is adequately served by the lighting fixture required at the entrance. Lights for common areas shall be photo-electric cell controlled. Lights in common areas shall have high impact-resistant plastic lenses, and/or be otherwise made vandal-proof.

5.4.1.10.2 Interior Lighting and Switched Outlets.

- Efficiency: Interior lighting shall be both efficient and color corrected. The minimum efficiency standard for interior lighting is 120 lumens/watt. Use a color rendering index (CRI) of no less than 80 for interior applications. Use a correlated color temperature (CCT) of no greater than 4100K.

- Locations: Provide LED type lighting fixtures operated by wall-mounted switches for all rooms except living rooms. Living rooms shall have a convenience outlet, half controlled by a wall switch, located at the room entrance. Wall-switch operated ceiling lights shall be provided in the dining, utility, hallways, bedrooms, kitchens, dinette areas, and basements. Additional light fixtures shall be provided as needed to meet minimum illumination requirements. Wall-mounted lights shall be provided in bathrooms and half baths located above the mirror over the lavatory and operated by a wall switch. Walk-in closets, interior and exterior bulk storage rooms shall be provided with ceiling lights, operated by a wall switch. A minimum of one lighting fixture, ceiling- or wall-mounted, as appropriate, shall be provided in the garage. Where exterior bulk storage is located within the enclosed walls of a garage, each space shall be lighted separately. Garage lights shall be controlled by a switches located at each door opening into the garage.

  o Dining room ceiling light fixtures (hanging type) shall be movable by means of a track, chain and hooks, or other means in order to accommodate other than the typical dining room furniture arrangement.

  o The general lighting intensity in kitchens shall be per UFC 3-530-01. Supplementary lighting shall be provided at the sink and under one of the wall cabinets for a work center. Kitchen range hood shall be provided with a LED lights, fan, and switches.

  o The ceiling light fixture boxes in the living room, dining room, and bedrooms shall be provided with a metallic fixture box 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. Ceiling fan/ light combination in these rooms may receive additional consideration. Wall switch operated and ENERGY STAR® labeled ceiling fans
in living/dining area, family room, and bedrooms are desirable. Fans should be provided with LED type lamps.

5.4.2 Telecommunications and Cable Television (CATV) System.

The housing unit Telecommunication and Cable Television (CATV) systems shall be in accordance with TIA-570-D (Residential Telecommunications Infrastructure Standard), UFC 3-580-01 (Telecommunications Building Cabling Systems Planning and Design) and with local service provider’s requirements.

The Telecommunications System and/or Cable Television (CATV) provider serving the installation should be responsible for installing and maintaining the distribution system up to the demarcation point, and the construction contractor is generally responsible from the demarcation point into and throughout the dwelling unit(s). At the demarcation point, locate Network Interface Device (NID) at a discrete location of the unit that is accessible, preferably near the utility room, and the Distribution Device (DD) centrally located within the unit and tenant accessible. Grounding and bonding shall be performed in accordance with NFPA 70.

Housing unit cabling shall be a minimum of a combination of Category 6A wiring, RG-6 coaxial cable, and 2-fiber optical cable (optional) in accordance with TIA-570-D (Grade 2) residential cabling capability. Conduit is generally not required, but should be considered at metal stud framing, between units of a multifamily structure, and other vulnerable locations. Provide (1) 1-inch diameter conduit from the demarcation point to the attic, basement or crawl space to facilitate future telecommunication wiring.

Provide as a minimum Category 6A rated, eight-position outlet / connector type telecommunications outlets in the kitchen, living room, family room, dining room, and all bedrooms, with multiple modular jacks compatible with multiple furniture arrangements in each room. Kitchen outlets shall be wall-mounted type. Each housing unit telecommunications system shall be wired separately from other housing units in the same building.

Provide, as a minimum, Coaxial, F-type, Cable Television CATV outlets in living room, kitchen, family room, and all bedrooms. Ensure that all CATV outlet locations are adjacent to a duplex electrical receptacle and are compatible with multiple furniture arrangements. Each housing unit CATV system shall be wired separately from other housing units in the same building.

5.5 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) SYSTEM

5.5.1 General.

Design HVAC systems in accordance with applicable provisions of UFC 3-410-01, Heating, Ventilating, and Air Conditioning Systems, International Residential Code, and ACCA Manuals D, J, and S. Equipment shall be ENERGY STAR® labeled and meet the requirements of ASHRAE 90.2. Sealed combustion heating units are recommended. Portable room heaters, floor furnaces, and heat lamps are prohibited. Electric resistance heat is not permitted, except as backup for heat pump systems, or when determined cost-effective on a life-cycle basis. Bedrooms shall have a return air register, transfer grill, or undercut door to maintain pressure balance within the house. Design shall be based on the weather data contained in UFC 3-400-02, Engineering Weather Data.

Each housing unit shall be provided with central heating and air conditioning systems. Systems shall be designed, installed, balanced, and adjusted to distribute heat and cooling to all habitable rooms, as well as bathrooms, in proportion to the calculated load requirements of these spaces.
Fans in air handlers and furnaces shall be multi-speed, direct drive type. System installation shall conform to SMACNA (1998) Residential Comfort System Installation Standards Manual, to include SMACA SMACNA RES COM SYS INSTAL STDS and SMACNA RES SHEET MTL GUD, except as altered by this document. Additional consideration in the technical evaluation may be given to systems utilizing modular components, plugged power, drawer-type burner assemblies, additional space in the mechanical room, and other features which contribute to ease of system maintenance. Additional consideration may also be given to designs which provide measures beyond the requirements of this Statement of Work to increase energy conservation or occupant comfort such as division of each housing unit into more than one conditioning zone for increased control.

5.5.2 Air Conditioning.

Provide air conditioning for interior living spaces.

5.5.3 Equipment Sizing.

Equipment sizes selected for installation shall not oversized more than 125 percent of the calculated loads.

Design HVAC systems in accordance with applicable provisions of ACCA Manual S HVAC equipment sizing guidelines. Equipment should be Energy Star® labeled.

5.5.4 Mechanical Room.

Mechanical space shall be provided to house all mechanical equipment. Exterior air conditioning units shall be concrete pad-mounted, with location selected based on site specific conditions and intended uses of outdoor space. Effort shall be made to locate the unit(s) out of the occupant's direct line of sight (screen with shrubbery or wall, locate on sides of housing unit, avoid placement under windows, etc.). However, the primary concern shall be coordination with the mechanical area location. Mechanical equipment shall be located in an externally accessible utility room, and shall be arranged to allow for ease of maintenance, and for proper venting if required. This utility room shall be provided with a light and electrical receptacle. See paragraph 6.1.5 for additional requirements for mechanical spaces containing fuel-fired heating equipment. Outdoor units and mechanical room doors shall not be located on the front of houses.

5.5.5 Load Calculations.

Computer generated load calculations shall be performed for each possible orientation up to four representative orientations for each building type included in the project. Room air flow requirements shall be computed based on the individual room load. However, the minimum acceptable air flow shall be 0.5 cfm/ft² for all spaces. The design for each individual housing unit shall be based on the heating and cooling loads as well as room airflow requirements computed for the building type and orientation which it most closely matches. Internal loads shall be included in the computerized load calculations in accordance with ASHRAE recommendations for residential analyses and ACCA Manual J Residential Load Calculation.

5.5.5.1 Indoor Design Conditions.

Per the IRC, the interior design temperatures used for heating and cooling load calculations shall be a maximum of 72°F for heating and minimum of 75°F for cooling.

5.5.6 Equipment Safety and Efficiency.
5.5.6.1 All material and equipment shall be the standard cataloged product of manufacturer's regularly engaged in production of such materials and equipment, and shall be the manufacturer's latest standard design. Each major component of the heating and cooling systems shall have the manufacturer's information on a plate secured to the equipment.

5.5.6.2 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.

5.5.6.3 All equipment shall be ENERGY STAR® labeled and meet ENERGY STAR® specifications for efficiencies. Energy conservation as it relates to equipment operating costs will be considered in the evaluation process. Additional consideration in the technical evaluation may be given to designs which include higher than minimum efficiency equipment.

5.5.7 Mechanical Systems.

5.5.7.1 Forced warm air systems. Warm air furnaces shall be induced combustion, up flow natural gas furnaces. Furnaces shall be equipped with electronic ignition. Natural gas furnaces shall be equipped with a flue to exhaust flue gases above the building roof. Units shall be vented in accordance with NFPA 211. Where high efficiency (AFUE > 90 percent) gas furnaces are selected for use these units shall be vented in accordance with AGA requirements and the manufacturer's instructions. Condensate drains for high efficiency units shall be manufacturer approved, and shall be indirectly connected to the building sanitary sewer system. Combustion air shall be provided from the outside in accordance with the appliance listing. For areas with a 97.5 percent outdoor dry bulb design temperature below 20 degrees F, combustion air shall be provided in accordance with SMACNA Installation Standards for Residential Systems listed in paragraph 5.5.1. Furnaces shall be equipped with centrifugal fan, disposable filters, controls, and transformer. Fans shall be multi-speed, direct-drive type. It shall be possible to service and replace all controls and internal components from one side of the furnace, minimum 24" service clearance or as recommended by manufacturer whichever is greater. Heat exchangers shall be guaranteed for a minimum service life of 10 years. In areas authorized for air conditioning, furnaces shall be equipped with a cooling coil by the same manufacturer, matched to the selected air conditioning equipment.

5.5.7.2 Forced hot water systems. Convectors and baseboard or wall radiation units shall have steel core and fin or nonferrous core and fin construction. Heating hot water shall be produced by natural gas, boilers. A single boiler or multiple modular boilers shall be provided for each building with each housing unit in multi-family housing individually, and thermostatically controlled based on heating water temperature set-point. Each boiler shall be provided with its own circulating system. Circulation shall be by means of a two-pipe reverse return system with the circulating pump(s) prevented from operation when the outside temperature is above 65 degrees F, adj. Any sub-slab hot water distribution piping shall be installed without joints beneath the slab. Minimum acceptable individual convector control shall be accomplished by means of dampers at each unit. Additional consideration in the technical evaluation shall be given to designs which treat each convector as an individual heating zone by means of self-contained or thermostatically controlled valves located at each unit. Greatest consideration shall be given to systems incorporating thermostatically controlled valves. Hot water piping shall be vented at all high points, and shall be provided with isolation valves at each vent to facilitate servicing. A minimum velocity of 2 fps shall be maintained in the hot water piping. Strainers shall be provided as required to protect system equipment.

5.5.7.3 Split system air conditioning. The use of heat pumps shall be allowed only after a thorough analysis of all available energy sources and systems. Geothermal heat pumps shall be
used in any geographical location where their equipment efficiencies exceed those listed for air to air heat pumps and they are life cycle cost effective.

- Electric air conditioning equipment shall consist of an air-cooled condensing unit and evaporator) as matched components with the furnace, all by the same manufacturer. Refrigerants used shall have an Ozone Depletion Potential (ODP) of .05 or less. The condensing unit shall contain, as a minimum, the features indicated below. Equipment shall be sized to meet the total load determined by computer calculation. Equipment may be oversized to no more than 115 percent of the computer generated load. Fans shall be multi-speed, direct drive type.

  - High and low pressure compressor protection.
  - Filter-drier.
  - Hermetically sealed compressor with built-in overloads and locked rotor protection.
  - Electric crankcase heaters.
  - Reversing valve. (heat pump only)
  - Start and run capacitors.
  - Anti-short-cycle timer. (factory installed)
  - Testing and charging refrigerant connections.
  - Compressor guaranteed for a minimum service life of 5 years.
  - Fan and coil guards.

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

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

- Supplementary electric heat. Each heat pump shall be provided with supplementary electric resistance heat. Electric resistance heat shall be sized to provide 100 percent of the calculated heat loss of the particular unit. Electric resistance heaters in excess of 5 kw shall be staged by means of an outdoor thermostat. Outdoor thermostat shall be installed and operated in accordance with the heat pump manufacturer's instructions.

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

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

- Exception 1. Room unit heaters may be used where required by outdoor design conditions to maintain a minimum temperature of 40 degrees F in mechanical rooms where required for equipment protection.

- Exception 2. Electric resistance heaters may be used for supplemental heat in air-to-air heat pumps.

5.5.9 Air Distribution.

For a given building type, a single zone duct layout may be used regardless of orientation, provided that the system is sized to provide the required air flow for each room at its worst case orientation and a maximum allowable temperature difference of 4 degrees F is not anticipated. Balancing dampers and motorized zone dampers (multi-zone system) shall then be used to reduce air flow to the appropriate level as required to meet space temperature requirements. Permanent access to dampers shall be provided. Ducts shall be placed within the conditioned building envelope. Maximum duct leakage is six percent (6%), when tested in accordance with ASTM E-1554.

Provide systems conforming to the recommendations of the ACCA Residential Duct systems, Manual D or the SMACNA Residential Comfort System Installation Standards Manual. For two-floor housing units with a single air conditioning unit, provide separate minimum of, main supply ducts with volume control dampers for each floor. These main ducts shall be run directly from the air handler or furnace to the appropriate building level. As a minimum, provide a separate ducted return for each floor level. Two-floor housing units with 1,000 ft² or greater net floor area on each floor shall be provided with a separate heating and cooling unit and supply and return ducted system for each floor. Additional consideration in the technical evaluation may be given to designs which incorporate air distribution systems totally within the conditioned envelope.

5.5.9.1 Supply Diffusers. Wall, ceiling, and/or baseboard supply diffusers shall be located to ensure that the air distribution shall completely cover all surfaces of exterior walls with a blanket of conditioned air or may be of a compact design so long as ‘dead spots’ within the units are avoided. At least one diffuser shall be provided in each habitable room. Diffusers shall have louvered faces with individually adjustable blades, and shall be provided with integral opposed blade damper. Dampers at diffusers shall not be the means of achieving air balance point. Diffusers shall be provided with air deflectors as required for proper air flow in the space. Plastic diffusers are prohibited. Core velocity shall be limited to 600 fpm maximum, with a maximum pressure drop of 0.1 inch water. Airflow from any single diffuser shall be limited to 200 cfm maximum. Ceiling mounted units shall have factory finish to match ceiling color, and be installed with rims tight against ceiling. Sponge-rubber gaskets shall be provided between ceiling, or wall and surface-mounted diffusers for air leakage control. Diffuser boots shall be sealed tight to the wall or ceiling they penetrate using duct mastic or caulking. Suitable trim shall be provided for flush-mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Wall supply registers shall be installed at least 6 inches below the ceiling.

5.5.9.2 Return and Exhaust Registers. Grilles shall be fixed horizontal or vertical louver type similar in appearance to the supply diffuser face. Plastic units are prohibited. Core velocity shall be limited to 400 fpm maximum, with a maximum pressure drop of 0.06 inch water. Registers shall be provided with sponge rubber gasket between flanges and wall or ceiling. Register boots shall be sealed tight to the wall or ceiling they penetrate using duct mastic or caulking. Wall return registers shall be located at least 150 6 inches above the floor. Return registers shall be
located in hallways, finished basements, or other normally unoccupied spaces to minimize the sound level in occupied spaces.

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

5.5.9.4 Velocity. Maximum velocity in supply ducts shall be limited to 900 fpm for mains and 600 fpm for branches. Return, exhaust, and ventilation air ductwork shall be sized for a maximum velocity of 900 fpm. Short runs of return air duct (5 ft or less) which directly precede the air handler or furnace shall be acoustically lined to minimize noise.

5.5.9.5 Air Tightness and Sealing. Ducts shall be airtight with no visible or audible leaks to ensure quiet, economical system performance. Ductwork in conditioned spaces shall be constructed for a 1 inch static pressure construction class with seal Class C, as described in the SMACNA 2006 HVAC Duct Construction Standards for Metal and Flexible, unless a higher pressure class and/or seal class is required by actual, system operating conditions. Ductwork in unconditioned spaces shall be constructed for a 2-inch static pressure construction class with seal Class C unless a higher pressure class and/or seal class is required by actual, system operating conditions. All duct seams and joints shall be sealed using duct mastic. Tape shall not be used as a means for sealing ductwork.

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

5.5.9.7 Duct Insulation. Provide a minimum of 2-inch thick mineral fiber insulation (or other listed insulation with an equivalent R value) on the exterior of all ducts. 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 E84.

5.5.9.8 Dampers. Fire dampers shall be located and installed in accordance with NFPA requirements, and shall conform to the requirements of UL 555. Fire dampers shall be automatic operating, and shall be rated for the maximum system velocity and pressure. Fire dampers shall be equipped with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, shall not impair the operation of the damper. Dampers
shall not reduce the duct or the air transfer opening cross-sectional area. Access doors shall be provided at all fire dampers.

5.5.9.9 Filtration. Provide a pleated 1 inch panel filter, sized for and installed in the return air system in accordance with UL 900. Filter shall be rated for 20 percent efficiency as determined by ASHRAE 52.2, Method of Testing Air Cleaning Devices for Removal Efficiency by Particle Size. All filters shall be easily accessible for changing and maintenance and shall be installed in the return grilles. Additional consideration in the technical evaluation shall be given to designs utilizing electrostatic filters. Kitchen exhaust hoods shall be provided with aluminum grease filters sized to fit the exhaust duct.

5.5.10 Temperature Control.

5.5.10.1 Location. Thermostats shall be located on interior partitions, approximately 5 ft above the finished floor. Locating a thermostat on the wall adjacent to a stairway, on an exterior wall, or where it is subject to unrepresentative temperatures is unacceptable.

5.5.10.2 Thermostats. Thermostats shall be microprocessor-based, with built-in key pads for scheduling of day and night temperature settings. Thermostats shall be programmable for heating only, cooling only, or heating and cooling as required. When out of the scheduling mode, thermostats shall have continuous display of time, with AM and PM indicator, continuous display of day of week, and either continuous display of room temperature with display of temperature set point on demand, or continuous display of temperature set point with display of room temperature on demand. In the programmable mode, the display shall be used for setting and interrogating time program ON-OFF set points for all 7 days of the week. The time program shall allow two separate temperature-setback intervals per day. Thermostats shall have a means for temporary and manual override of the program schedule, with automatic program restoration on the following day. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for one year in the event of a power outage. Maximum differential shall be ±2 degrees F. For a listing of ENERGY STAR® labeled thermostats refer to ENERGY STAR® Website at [http://www.energystar.gov](http://www.energystar.gov).

5.5.10.3 Humidistats. Where required, humidistats shall be designed for indoor application and shall have a measurement range from 15 to 90 percent relative humidity (RH). The instrument shall be of the wall-mounted or return duct-mounted type, as required by the application, and shall be provided with any required accessories.

5.5.11 Ventilation.

Provide an exhaust fan (maximum 1.5 sone) in each bathroom, and an exhaust fan (maximum 5.0 sone) in each kitchen. Exhaust fans must discharge to exterior; discharging into attic or crawl space is prohibited. Provide mechanical ventilation in accordance with ASHRAE 62.2.

5.5.11.1 Exhaust Fans. All exhaust fans, to include bathroom and kitchen range hood exhaust fans, shall be ducted to the outside. Exhaust fans shall not discharge near the air conditioning condensing unit, entry doors, patio or balconies, or garages. Fans shall be tested and rated in accordance with AMCA 210, and shall operate with 120-volt, single-phase power supply. Exhaust fans shall be provided with backdraft damper. Bathroom 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. Kitchen range exhaust fans shall be two-speed, and shall be sized for an exhaust rate of 1.5 cfm/ ft². Maximum allowable noise level for range hood exhaust fans shall be 6 sones as installed.

5.5.11.2 Dryer Vents. A 4-inch diameter dryer vent shall discharge to the exterior, and provide connection to occupant-owned dryer (one dryer per vent). The vents shall be rigid aluminum with
exterior wall cap and backdraft damper. Vent pipes shall be a maximum of 20 ft long, with no more than three right angle elbows (with minimum radius of 6 inches), and have a maximum vertical run of 12 ft. Dryer vents shall not exhaust near the air conditioning condensing unit, entry doors, patio or balconies, or garages. Dryer vents shall not run through non-accessible spaces or garages.

5.5.11.3 Ceiling Fans. Provision of ceiling fans is required as a means of increasing occupant comfort and as an aid to improve the performance of heating and cooling systems. Ceiling fans with lights may be substituted for ceiling fixture requirements in bedrooms and in the dining room. Ceiling fans if provided shall be low profile 42-52 inch, four blade type. Motors shall be three speed reversible, with air volume range between 1300 and 7000 CFM and speeds between 75 and 225 rpm. Maximum power consumption shall be 80 Watts and 0.7 amps. Manufacturer's 20 year warranty is required. Ceiling box and switching for ceiling fans shall be provided for future use if fans are not provided in the contract.

5.5.11.4 Active Ventilation Engineered IAQ. ASHRAE 62.2 -2016, “Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings” shall be used to determine ventilation air required. Infiltration shall not be counted as ventilation air. Calculations shall be provided to the government showing that the ventilation rates meet ASHRAE 62.2 based on dedicated supply system or intake, with no infiltration credit taken. All ventilation air that enters the house must be conditioned before it enters the space. All exhaust fan switches shall be clearly labeled.

5.5.12 Humid Area Design. Not Applicable

5.5.13 Humidification. Not Applicable

5.5.14 Testing, Adjusting, and Balancing.

Adjusting and balancing of each housing unit shall be the Contractor's responsibility. Following adjusting and balancing, testing of air and water systems shall be performed on 10 percent of the project buildings (not to exceed 10 buildings), which have been randomly selected by the Contracting Officer. If buildings are to be turned over in phases, testing shall be performed on 10 percent of the buildings completed in each phase (not to exceed 10 buildings per phase). No additional testing will be required if at least 90 percent of the tested buildings pass the test requirements. If less than 90 percent of the tested buildings pass the test, an additional 10 percent of the project buildings (not to exceed 10 buildings) shall be tested. This process shall continue until 90 percent of the total number of tested buildings pass. The Contractor shall correct all housing units not found in compliance, and shall be responsible for all labor and materials required for this effort. AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 shall be used as the standard for providing testing of air and water systems. The selected standard shall be used throughout the project. Instrumentation accuracy shall be in accordance with the standard selected. Testing shall be accomplished by a firm certified for testing by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Prior to testing, adjusting, and balancing, the Contractor shall verify that the systems have been installed and are operating as specified. Where specific systems require special or additional procedures for testing, such procedures shall be in accordance with the standard selected. Approved detail drawings and all other data required for each system and/or component to be tested shall be made available at the job site during the entire testing effort. Testing shall not commence until approved by the Contracting Officer. The facility shall be essentially complete with final ceiling, walls, windows, doors, and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems, hydronic systems, and exhaust fans shall be complete and operable. All data, including
deficiencies encountered and corrective action taken, shall be recorded. Following final acceptance of certified reports by the Contracting Officer, the setting of all HVAC adjustment devices shall be permanently marked by the Contractor’s balancing engineer so that adjustment can be restored if disturbed at any time.

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

- Duct tightness testing shall ensure that the leakage rate from ductwork (where the ductwork system is not entirely within the conditioned envelop) shall not exceed 0.03 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. No ductwork systems may be installed in other units until the proto-type units’ ductwork systems have been validated. Several methods to accomplish this testing are acceptable

- Testing may be done in accordance with ASTM Standard E 1554, “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.

- Testing may also be accomplished utilizing “Duct Blaster” methodologies and pressurizing the ductwork to 0.1 inch of water.

5.5.14.2 Air Barrier Tightness and Testing

Meet requirements on IRC Section N1102.4 for both envelope air leakage requirements and testing.

6.0 FIRE AND LIFE SAFETY

6.1 FIRE AND LIFE SAFETY

6.1.1 General.

Design, construct, and improve family housing projects to comply with IBC or IRC as applicable, and as modified by UFC 01-200-01, UFC 3-600-01, and IRC.

6.1.2 Flame-Spread and Smoke-Developed Indices.

Materials must have flame-spread (FS) and smoke-developed (SD) indices in accordance with UFC 3-600-01.

6.1.3 Smoke Alarms.

Provide hard-wired smoke alarms in accordance with UFC 3-600-01. Interconnect alarm devices in such a manner that actuation of one alarm shall activate all other alarms in an individual unit. Provide an audible-visible type smoke detection device in housing unit where there is a vision or hearing impaired occupant. In buildings with a fire alarm system, provide smoke detectors with
local sounder bases. When smoke is detected in a single unit, sound local alarm only. When smoke is detected in two (2) adjacent units, sound building-wide evacuation signal and send alarm.

6.1.4 Automatic Sprinklers.

Provide sprinkler protection in accordance with UFC 3-600-01. Sprinkler systems shall comply with NFPA 13D (one- and two-family dwellings), NFPA 13R (low-rise multi-family dwellings), or NFPA 13 (all others) as applicable. Provide hydrant flow test data prior to beginning design of sprinkler system.

6.1.5 Fire-Resistant Separation.

Provide fire and smoke separations in compliance with UFC 3-600-01.

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

- Townhouses, two hour between units and one hour between unit and its attached garage.

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

6.1.5.3 Heater rooms. Direct access to these rooms from the exterior is required. Rooms with fuel-fired equipment that serve only one housing unit shall be lined with 1/2-inch gypsum board or equivalent noncombustible material.


When a general building alarm system is required by NFPA 101, such as those required for housing units four stories or higher, the required systems shall transmit alarms to the installation fire department. Exceptions are made for housing units not located on military installations and for housing units located on installations without an installation-wide or central fire reporting system. Smoke detectors which are located within the housing unit and which sound an alarm only within the housing unit are not required to be transmitted. If a fire alarm system is provided, sound building-wide alarm and send alarm signal to supervising station if smoke detectors in two (2) adjacent units detect smoke.

6.1.7 Carbon Monoxide (CO) Alarm.

Provide a CO alarm hard wired with battery back-up on each habitable floor of units with combustion equipment, appliances, or fireplace, in accordance with UL 2034, NFPA 720, and NFPA 101. Seal existing homes with attached garages to prevent air infiltration, or provide a CO alarm. See Paragraph 4.7.9. Provide CO alarms in the hallway outside of sleeping rooms and inside sleeping rooms with gas fire appliances located inside the sleeping room.

6.1.8 Fire-Retardant-Treated (FRT) Plywood.

Use of FRT plywood is prohibited, except as permitted by the IBC. FRT plywood must not be used in any part of the roof or roofing system.
6.1.9 Overseas and Leased Housing Requirements. NA
7.0 ENVIRONMENTAL

7.1 ENVIRONMENTAL

7.1.1 General.

Construct facilities in compliance with Federal, State, interstate, and local requirements, both substantive and procedural, with respect to lead-based paint, asbestos, radon, and any other housing-related environmental requirements.

7.1.2 Environmental Planning.

[RFP Preparer should indicate responsibility/POCs for the NEPA documentation.]

Housing improvement and construction projects must comply with environmental laws and regulations, including the National Environmental Policy Act (NEPA). Appropriate environmental analyses, permits and the preparation of a NEPA compliant document will be prepared by the <LOCATION>. NEPA documentation and other environmental permitting must be completed prior to initiating an improvement or construction project.

7.1.3 Asbestos.

Follow OSHA and EPA regulations and guidance for asbestos management, remediation, and abatement. The Department of Defense Environmental Cleanup Program provides insight into this issue. Asbestos materials must not be used in construction, repair or maintenance at shore facilities. Use asbestos-free substitute materials.

7.1.4 Lead-Based Paint.

Follow OSHA, EPA, and HUD regulations, statutes, and guidance for inspection, assessment, in-place management, and abatement of lead-based paint, lead-in-dust, lead-in-soil, and related hazards. The Department of Defense Environmental Cleanup Program provides insight into this issue.

7.1.5 Volatile Organic Compounds (VOC).

Paints shall have a maximum VOC concentration of 100 grams per liter (g/l). Use sealants and adhesives that have a maximum VOC concentration of 250 g/l.

7.1.6 Not Used

7.1.7 Freon and Chlorofluorocarbons (CFCs).

Specify CFC-free refrigerators, air conditioning systems, and insulation options.

7.1.8 Not Used

7.1.9 Mold.
Prevention of mold must be considered during design, and be adhered to throughout construction. Humidity and moisture must be controlled to prevent mold growth in buildings.

7.1.10 Radon

Follow EPA recommendations for construction and mitigation. Family housing should be designed, constructed, and improved in accordance with EPA document - *Model Standards and Techniques for Control of Radon in New Residential Buildings*, 59 CFR 13402 (March 1994). Guidelines for evaluation and need and required testing can be found in UFC 3-490-04A, *EPA Radon Mitigation Standards*, and UFGS 13287 *Radon Mitigation* (Latest Edition). Typically passive systems will require installation of under slab PVC vented to roof, and slab depressurization. Typically in-line fans are installed at the attic level.

7.1.11 Non-Native Invasive Species

The Department of Army Sustainable Design and Development Policy Update dated 16 December 2013 requires that any existing invasive plants be removed from the project site and destroyed or disposed of in an authorized landfill. The Policy also requires that invasive plants are not planted on the project site in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 189.1-2011 *Standard for the Design of High-Performance Green Buildings* (ASHRAE 2011). The project contract specifications shall include provisions for the removal of species considered to be invasive according to "The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts," prepared by the Massachusetts Invasive Plant Advisory Group and dated April 1, 2005 (http://www.newfs.org/docs/docs/MIPAG040105.pdf).

7.2 SOUND ATTENUATION

7.2.1 Air-Borne Sound.

Walls, partitions, and floor/ceiling assemblies separating dwelling units from each other or from public or service areas shall have a Sound Transmission Class (STC) rating of not less than 50 (45 if field tested) for air-borne noise when tested in accordance with ASTM E 90. Field test assemblies in accordance with ASTM E 336. Do not apply this requirement to dwelling unit entrance doors. However, assure that frames and sills of such doors are tight fitting.

7.2.2 Structure-Borne Sound. Not used

7.2.3 Testing.

Certified proof-of-performance field tests shall be conducted to demonstrate that the floor and wall systems as constructed provide the required sound isolation. Tests for air-borne sound shall be made in compliance with ASTM E336. Tests for impact sound shall be made in compliance with ASTM E1007. Testing of 15 percent (minimum) of each type of floor and wall system is required. Location of test sites will be chosen at random by the Contracting Officer.
7.2.3.1 Correction of Deficiencies. Any wall or floor/ceiling system found to be inadequate shall have the deficiencies corrected and the additional qualifying tests conducted at the Contractor's expense. Testing at the Contractor's expense of greater than 10 percent of each system may be required if the Contracting Officer determines that the quality of construction requires this additional testing. 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.

7.2.4 Plumbing and HVAC Equipment.

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

8.1 ENERGY EFFICIENCY

8.1.1 General.

Energy and water conservation standards and policies for new construction have been established to minimize energy and water consumption through applications of developed sustainable energy-efficient designs, construction, improvement, and appliance equipment selections and replacement. Building systems operation shall not require special attention by unit occupants. Materials and equipment shall be readily available and manufactured by firms of established performance in their field. If an alternative energy generation method is intended for use as the project's primary energy source, documentation shall be submitted to the Contracting Officer, verifying the system's reliability and ability to meet the project's peak demand.

8.1.2 Energy Performance.

Contractor shall meet the requirements of EISA 2007, 10 CFR 435, EPACT 2005, and Executive Order 13693. Federal Regulations 10 CFR 435 requires that the proposed building energy consumption shall be at least 30% below the consumption of a baseline building meeting the minimum requirements of ICC International Energy Conservation Code (IECC), August, 2009 if life-cycle cost-effective. The energy consumption calculation shall be based on Section 405. Life-cycle cost effectiveness shall be determined in accordance with 10 CFR 436. Energy consumption for the purposes of calculating the 30% savings shall include space heating, space cooling, and domestic water heating systems. If a 30% reduction is not life-cycle cost effective, the design of the proposed building shall be modified so as to achieve an energy consumption level at the maximum level of energy efficiency that is life-cycle cost effective. EISA 2007, section 523 requires at least 30% of hot water demand to be met using solar hot water heater when life cycle cost effective. Section 441 of EISA 2007 extends the life cycle costing period from 25 year out to 40 years. Use of renewable forms of energy shall be used for all projects, when life cycle cost effective.

8.1.3 Blank

8.1.5 Building Products and Appliances.

New and replacement building products and appliances shall be ENERGY STAR® qualified and labeled.

8.1.6 Specific Energy Conserving Practices.

The following paragraphs suggest energy conservation techniques which are considered desirable. The listing is not all inclusive, and the techniques suggested may not be cost effective at a given location or site. Additional consideration in the technical evaluation may be given to designs which incorporate valid energy conservation techniques. Systems and techniques above minimum requirements which take advantage of rebates and incentives offered by utilities are preferred and shall be stated by the government and local utility districts.

8.1.6.1 Passive Solar Applications. Passive solar architectural applications shall routinely be considered as a part of all project designs. Unique applications such as attached sun spaces, earth sheltering, mass trombe walls, solar chimneys, solar dehumidifiers, and other innovations may be considered. Operational controls, such as shading and venting mechanisms, to control the amount of heat admitted into the housing unit during the day, reduce the amount of heat escaping from the housing unit at night, and provide for thermal comfort of the occupants, are parts of this system.
8.1.6.2 Additional South Glazing. If used as part of the solar energy system, glazing shall be of the commercially available off-the-shelf type and shall face within 15 degrees of solar south. The glazing shall be architecturally compatible with the housing unit and the environment, face directly into the living space so that the walls, floors, ceiling, and other massive objects can absorb the entering solar energy, and shall have a whole-window U value less than 0.28 ft²-degrees F/BTUH. The optimum amounts of solar glazing that will admit enough solar energy are shown in Table 8-1.

<table>
<thead>
<tr>
<th>Average Winter Outdoor Temperature</th>
<th>36° latitude</th>
<th>40° latitude</th>
<th>44° latitude</th>
<th>48° latitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Climates</td>
<td>GA/FA</td>
<td>GA/FA</td>
<td>GA/FA</td>
<td>GA/FA</td>
</tr>
<tr>
<td>20°</td>
<td>0.24</td>
<td>0.25</td>
<td>0.29</td>
<td>0.31</td>
</tr>
<tr>
<td>25°</td>
<td>0.22</td>
<td>0.23</td>
<td>0.25</td>
<td>0.28</td>
</tr>
<tr>
<td>30°</td>
<td>0.19</td>
<td>0.20</td>
<td>0.22</td>
<td>0.24</td>
</tr>
<tr>
<td>Temperate Climates</td>
<td>GA/FA</td>
<td>GA/FA</td>
<td>GA/FA</td>
<td>GA/FA</td>
</tr>
<tr>
<td>35°</td>
<td>0.16</td>
<td>0.17</td>
<td>0.19</td>
<td>0.21</td>
</tr>
<tr>
<td>40°</td>
<td>0.13</td>
<td>0.14</td>
<td>0.16</td>
<td>0.17</td>
</tr>
<tr>
<td>45°</td>
<td>0.10</td>
<td>0.11</td>
<td>0.12</td>
<td>0.13</td>
</tr>
</tbody>
</table>

1. Sizing South facing Glazing, GA/FA = glazing area/floor area. Window area on the other sides of the house shall total no more than 5% of the floor area.

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

8.1.6.4 Shading. Movable (non-fixed), cordless window treatments are required. These can take the form of heavy draperies to be drawn by the occupants at night and opened in the day. Movable thermal insulation is considered the optimum installation. Cooling season shading of glazed surfaces on the west and south elevations shall be considered.

8.1.6.5 Pre-engineered Active Solar Applications. Pre-engineered active solar applications proposed for domestic water heating shall be evaluated for life-cycle cost effectiveness using a recognized process design program. Whether site-mounted or unit-mounted, systems must be designed for maximum ease of maintenance and for architectural compatibility with the total family housing environment. Systems shall be designed to provide no more that 60 percent of the housing unit's annual water heating load.
8.1.6.7 Wind. Wind power may be considered in regions where determined cost effective. Factors such as average wind speed, available wind power, and wind variability shall be considered when investigating the annual useful energy production potential. New wind project must be coordinated with HQDA (G-3).

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

8.1.6.9 Energy Recovery Ventilator. Energy recovery ventilators shall be considered for use with systems designed to introduce outside ventilation air into the housing unit to address indoor air quality concerns, particularly in extreme cold climates. The increased cost and system complication associated with the introduction of outside air shall be carefully weighed against severity of indoor air quality deficiencies before the decision is made to supply outside air at the air handler. When utilized, energy recovery ventilators shall pre-condition outside air by permitting energy transfer from exhaust air. Units shall have easily accessible controls and filters.

8.1.7 Insulation.

Insulation shall comply with thermal performance guidelines of UFC 01-200 -02, IRC, and AHSRAE 90.2.

8.1.7.1 Characteristics.

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

8.1.7.2 Humid Area Design. Not applicable

8.1.8 Air Infiltration.

To limit air infiltration buildings shall be sealed with an air infiltration barrier, installed in accordance with the manufacturer's recommendations. The building envelope shall be caulked, gasketed, weather-stripped 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 5.5.9 shall constitute tight building construction.

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

- 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.

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

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

8.2 WATER CONSERVATION AND LANDSCAPING

8.2.1 General.

Incorporate environmentally and economically beneficial landscape practices in support of Executive Order 13693, Planning for Federal Sustainability in the Next Decade, dated 25 March 2015. Landscaping may consist of shrubs, trees, decorative fencing, earth sculpting, rocks or special gardens, and identification signs. Native trees and shrubs and natural areas shall be preserved where possible. Grade sites so that slopes follow natural contours as much as possible.

8.2.2 Landscape Planting Plan.

The Contractor shall obtain and use the services of a qualified 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, variety, foundation plantings, and street tree plantings to define the open spaces to ensure a complete landscaped project. Choose plant materials on the basis of plant hardiness, climate, soil conditions, low maintenance, and quality. Selected plant materials shall be easily maintained and tolerant of the specific site conditions. Planting or seeding shall occur only during periods when beneficial results can be obtained. Non-Native Invasive Species shall be removed from the housing area and only native species shall be used in the project’s Landscape Planting Plan as specified in the Section 7.1.11 (Environmental).

[RFP Preparer should detail any conservation-related site constraints, similar to example below;]

<The protection of wetland resources is recognized as an important consideration in the redevelopment plan for the Heritage Housing project area. The City of Natick local bylaw includes a No Disturbance Zone; which are lands within 25 feet of wetlands, and a No Build Zone; which are lands within 15 feet of any No Disturbance Zone. In the design of the housing configuration, the contractor will adhere to a minimum 40 foot wetland setback. The Natick Soldier Systems Center will provide to the contractor the location of>
8.2.3 Boundaries.

Landscape boundaries of neighborhoods to create buffers and separate neighborhoods and clusters from major streets or incompatible off-site activities, and use landscaping to emphasize and reinforce sub-areas within the community. The reestablishment of a 40 foot wetland buffer with native plants provides opportunities for improvements to water quality and wildlife habitat in keeping with LEED certification.

8.2.4 Measurement.

Plant measurements shall be in accordance with ANSI/ANLA Z60.1.

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

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

8.2.5 Plants.

- Plants shall be native species that shall require minimum maintenance and watering. Xeriscaping design principles, and plants of differing heights, shapes, color, and texture, shall be used in landscaping. 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.

8.2.5.1 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.

- Shade and Flowering Trees. A height relationship to caliper shall be provided as recommended by ANSI/ANLA Z60.1. Height of branching shall bear a relationship to the size and variety of tree specified, and with the crown in good balance with the trunk. Trees shall not be "poled" or the leader removed.
  - Single Stem. Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
  - Multi-Stem. All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 in from the ground level.
  - 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.

- 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.

- 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.

- 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.

- 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.

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

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

- Sod. State approved sod shall be provided as classified by applicable State laws. Each individual sod section shall be of a size to permit rolling and lifting without breaking.
  
  o Quality. The sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 2 in in any dimension, woody plant roots, and other material detrimental to a healthy stand of turf. Sod that has become dry, moldy, or yellow from heating, or has irregular shaped pieces of sod and torn or uneven ends shall be rejected.

  o Thickness. Sod shall be machine cut to a uniform thickness of 1ft 1/4 in within a tolerance of 1/4 inch excluding top growth and thatch. Measurement for thickness shall exclude top growth and thatch.

  o Time Limitation. The limitation of time between harvesting and placing sod shall be 36 hours.

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

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

- **Satisfactory Stand of Turf.**
  
  - **Seeded Lawn Area.** A satisfactory stand of turf from the seeding operation for a lawn area is defined as a minimum of 160 grass plants per square meter. Bare spots shall be no larger than 6 in square. The total bare spots shall not exceed two (2) percent of the total seeded area.
  
  - **Seeded Field Area.** A satisfactory stand of turf from the seeding operation for a field area is defined as a minimum of 100 grass plants per square meter. The total bare spots shall not exceed two (2) percent of the total seeded area.
  
  - **Sodded Area.** A satisfactory stand of turf from the sodding operation is defined as living sod uniform in color and texture. Bare spots shall be no larger than 2 in square.
  
  - **Sprigged Area.** A satisfactory stand of turf from the sprigging operation is defined as a minimum of 20 sprigs per square meter. Bare spots shall be no larger than 9 in square. The total bare spots shall not exceed two (2) percent of the total sprigged area.

8.2.6 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. Drainage patterns shall be maintained. 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.

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

8.2.6.2 Maintenance During Planting Operation. Installed plants shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue until the plant establishment period commences. The maintenance of turfed areas shall include eradicating weeds, eradicating insects and diseases, protecting embankments and ditches from erosion, maintaining erosion control materials and mulch, protecting turf areas from traffic, mowing, watering, post-fertilization, and replacing unsatisfactory turf areas.

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

8.2.7 Plant Establishment Period.

On completion of the last day of the planting operation, the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect for the remaining contract time period not to exceed 12 months. When the planting operation extends over more than one season or there is a variance to the planting times, the plant
establishment periods shall be established for the work completed. The turf establishment period for establishing a healthy stand of turf shall begin on the first day of work under the turfing contract and shall end three months after the last day of the turfing operation. An unsatisfactory stand of turf shall be repaired as soon as turfing conditions permit.

8.2.7.1 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.

8.2.7.2 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.

8.2.8 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. Unhealthy or dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit. A plant shall be replaced one time under this guarantee. Transplanting existing plants also requires a guarantee.

8.2.8.1 Performance Standard

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement. Seeded areas shall have an average 75% percent vegetative cover and contain no bare areas with less than 25% cover larger than 500 square feet. Areas not meeting this performance standard shall be reseeded.

8.2.9 Not Used
9.0 SUSTAINABILITY

9.1 GENERAL.

Executive Order 13693, Planning for Federal Sustainability in the Next Decade, dated 25 March 2015, states, it is the policy of the United States and Federal agencies shall increase efficiency and improve their environmental performance. Energy Independence and Security Act (EISA 2007) is to move the United States toward greater energy independence and security, to increase the production of clean renewable fuels, to protect consumers, to increase the efficiency of products, buildings, and vehicles, to promote research on and deploy greenhouse gas capture and storage options, and to improve the energy performance of the Federal Government, and for other purposes. The Energy Policy Act of 2005 is to ensure jobs for our future with secure, affordable, and reliable energy. The following paragraphs define the goals and general objectives for inclusion of sustainable design considerations in this project. The listing is not all inclusive, and the techniques suggested may not be cost effective at a given location or site. Additional consideration in the technical evaluation may be given to designs which incorporate and identify Sustainable Design techniques included in the proposal.

9.1.1 Objectives

Objectives of this sustainability directive include: reduction of greenhouse gas emissions attributed to facility energy use, water conservation, use of recovered and recycled materials, waste reduction, and maintenance of healthful indoor environments. Results shall reduce life cycle operating costs and improve quality of life for families.

9.1.2 Other Federal Requirements and Guidelines.

All projects shall be planned, programmed, budgeted, designed, built, and reported to meet the requirements of UFC 1-200-02 High Performance and Sustainable Buildings Requirements and Memorandum, ASA(IE&E), 16 Dec 2013, subject: Sustainable Design and Development Policy Update. If the requirements as defined in Memorandum, ASA(IE&E), 16 Dec 2013, subject: Sustainable Design and Development Policy Update conflict with UFC 1-200-02, then the requirements listed in the Memorandum shall take precedence.

9.1.3 Sustainable Design and Construction of the Built Environment.

Design and construction of sustainable housing shall be in accordance with the following concepts:

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

9.1.3.2 Building Layout and Design. Optimize building size, and maintain an appropriate building scale for the environment and context of the building or a building component. Layout rooms of a building for energy performance and comfort, and design for standard sizes to minimize material waste. Pay careful attention to the location of exterior windows. Avoid structural over-design and the resultant waste. Design components of the building environment for durability and for waste recycling. Be aware that the site for the units is fixed and may be constrained by the regulatory requirements for wetlands and waterways.
9.1.3.3 Energy. Building orientation and massing, natural ventilation, day-lighting, shading and other passive strategies, can all lower a building's energy demand and increase the quality of the interior environment and the comfort and productivity of occupants.

9.1.3.4 Building Materials. Environmentally preferable building materials are durable and low maintenance. Within the parameters of performance, cost, aesthetics and availability, careful selection and specification can limit impacts on the environment and occupant health.

9.1.3.5 Indoor Air Quality. Indoor air quality is most effectively controlled through close coordination of architecture, interiors and mechanical, plumbing, and electrical design strategies that limit sources of contamination before they enter the building. Construction procedures for IAQ and post-occupancy user guides also contribute to good long-term IAQ.

9.1.3.6 Water Usage. Site design strategies that maximize natural filtration of rainwater are desirable. Water conservation is enhanced by the use of low flow plumbing fixtures and water appropriate landscaping.

9.1.3.7 Recycling and Waste Management. Waste and inefficiency can be limited during construction by sorting and recycling demolition and construction waste, reuse of on-site materials and monitoring of material use and packaging. Accommodating recycling into building design reduces waste while generating revenues.

9.1.3.8 Building Commissioning, Operations and Management. Effective building commissioning is essential to ensure proper and efficient functioning of systems. Facilities operations benefit from energy and water saving practices, waste reduction and environmentally sensitive maintenance and procurement policies.

9.1.4 Leadership in Energy and Environmental Design (LEED)

The USACE Army LEED Implementation Guide dated September 2014, and the Army Sustainable Design and Development Policy update (17 Jan 2017) states all Army Family Housing (AFH), new or replacement construction, shall be certified at the LEED for Homes Silver level with at least 15 LEED energy points from the GBCI. Certification requires the services of a green rater.

LEED for Homes requires a qualified LEED Green Rater and Home Energy Rating System (HERS) rater be hired for the project. General services include:

• Perform design review of design submittals for incorporation of LEED and Energy Star requirements and participate in concept and final design review conferences.

• Perform all inspections, as defined by LEED and Energy Star requirements, of each dwelling unit. Sampling for Energy Star certification is not permitted.

• Provide document preparation, collection and submittals for LEED certification and Energy Star certification.

• Energy Star certify homes and provide Energy Star labels.

• Energy modeling necessary for LEED for Homes, Energy and Atmosphere credits are required to be performed by a qualified energy rater and performed using RESNET-approved software.

9.2 BUILDING COMMISSIONING
9.2.1 General.

Commission dwelling units to ensure that building shell and systems function as proposed. Repairs or adjustments made in test homes must also be made to remaining homes in each group. At a minimum, commissioning includes:

- Testing for envelope and duct leakage: Paragraphs 8.1.7 and 5.5.9 specify performance standards.
- Testing for air pressure relationships under operating conditions: Paragraphs 4.7.9 and 5.5.14 specify requirements for garage-to-unit separation and “balancing” indoor pressure.
- Testing for proper ventilation of all HVAC, combustion equipment and appliances under operating conditions, to ensure they meet manufacturer’s specifications.
- Testing of carbon monoxide output of combustion equipment and appliances, to ensure they meet manufacturer’s specifications.
- Ensuring lighting and appliances are ENERGY STAR® certified.
- Ensuring that Operation and Maintenance documentation is complete for building shell and systems (see manufacturer’s documents). Provide a tenant’s O&M Handbook for each unit and five additional copies for the <LOCATION> Housing Office.

9.3 SUSTAINABLE DEVELOPMENT WORKBOOK AND RATING SYSTEM

9.3.1 General.

Project shall use the US Green Building Council Leadership in Energy and Environmental Design for Homes (LEED for Homes) criteria. Homes shall comply with Memorandum, ASA (IE&E), 16 Dec 2013, subject: Sustainable Design and Development Policy (SDD) Update. Homes shall achieve a minimum LEED for Homes Silver rating.

Refer to solicitation paragraph 01 33 29 for additional requirements for LEED.

9.3.2 Documentation and Validation

Like other Army construction projects, Army Family Housing projects shall utilize the US Green Building Council sustainability tools. All new Army Family Housing (AFH) shall be certified at the LEED for Homes (LEED-H) Silver level with a minimum of 15 energy points from the GBCI.

Contractor is required to complete Energy & Sustainability Record Card. A copy is provided at the end of this section.

A LEED for Homes checklist shall be completed with each design submission required.

9.3.3 Blank
APPENDIX A  REFERENCES

GOVERNMENT PUBLICATIONS


Department of Defense (DoD)

ACSIM Policy Memorandum (Oct 2010) – Sustainable Design and Development


DoD Directive 4165.63-M (Sep 1993) – Housing Management


DoD Instruction 4715.3 (May 1996) – Environmental Conservation Program


UFC 1-200-01 – Design: General Building Requirements

UFC 1-200-02 – High Performance and Sustainable Building Requirements

UFC 2-600-01 – Installation Design

UFC 3-190-04FA – Roofing and Waterproofing, Chapter 11 – Steep Roofing

UFC 3-400-01 – Design: Energy Conservation

UFC 3-400-02 – Engineering Weather Data

UFC 3-410-01FA – Design: Heating, Ventilating, and Air Conditioning

UFC 3-420-01 – Design: Plumbing Systems

UFC 3-600-01 – Design: Fire Protection Engineering For Facilities

UFC 4-010-01 – Design: DoD Minimum Anti-terrorism Standards for Buildings


UFC 4-020-01 – Sustainable Development
UFC 4-711-01–Family Housing

Department of the Army

Army Standard for Family Housing, latest document

USD (AT&L) Memorandum, *Department of Defense Unified Facilities Criteria*

AR 200-1 – *Environmental Protection and Enhancement May 1990*

Department of Energy (DOE)


*National Environmental Policy Act (NEPA) of 1969*
http://ceq.eh.doe.gov/nepa/regs/nepa/nepaeqia.htm

Environmental Protection Agency (EPA)

*Comprehensive Procurement Guidelines* (for recycled content standards)
http://www.epa.gov/cpg/products

EPA Act 05 – *Energy Policy Act of 2005*

Federal Highway Administration (FHWA), Department of Transportation


Office of Management and Budget (OMB), http://www.whitehouse.gov/omb/

OMB Circular A-45 - *Rental and Construction of Government Quarters*

U.S. Government Printing Office (GPO)


10 CFR 430 – *Energy Conservation Program for Consumer Products,*
http://www.access.gpo.gov/nara/cfr/waisidx_05/10cfr430_05.html

http://www.access.gpo.gov/nara/cfr/waisidx_05/10cfr435_05.html

10 CFR 436, Subpart A – Methodology and Procedures for Life Cycle Cost Analyses

16 CFR 1630 - *Standard for the surface flammability of carpets and rugs (FF 1-70),*
http://www.access.gpo.gov/nara/cfr/waisidx_05/16cfr1630_05.html

40 CFR 280


49 CFR 192

49 CFR 195


Executive Orders (EO)

EO 12902, Energy Efficiency and Water Conservation at Federal Facilities, (revoked by E13123)


EO 13148 – Greening the Government Through Leadership in Environmental Management


10 USC 2826 – Military Family Housing: Local Comparability of Room Patterns and Floor Areas

NON-GOVERNMENT PUBLICATIONS

Air Conditioning Contractors of America (ACCA), http://www.acca.org/

ACCA – Manual D - Duct size design

ACCA – Manual J - Heating and cooling load calculations

ACCA – Manual S - Residential HVAC equipment selection


ANSI A161.1 – HUD Approved Construction Specifications

ANSI A208.2 – Medium Density Fiberboard (MDF) For Interior Use

ANSI B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ANSI B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes

ANSI/HPVA-HP-1 – Hardwood and Decorative Plywood

ANSI/NEMA C12.1 Code for Electricity Metering.


ANSI Z21.10.1 – Gas Water Heaters

American Society of Civil Engineers (ASCE), http://www.pubs.asce.org

ASCE 7, Minimum Design Loads for Buildings and Other Structures

ASCE 32-01, Design and Construction of Frost-Protected Shallow Foundations

American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) http://www.ashrae.org/

ASHRAE 62.2 – Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

ASHRAE 119 – Air Leakage Performance for Detached Single-Family Residential Buildings


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

ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units
ASTM C216 – Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)


ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort – Method D

ASTM D3018 – Specification for Class A Asphalt Shingles Surfaced with Mineral Granules


ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen


ASTM E336 – Standard Test Method for Measurement of Airborne Sound Insulation in Buildings,

ASTM E413 – Classification for Rating Sound Insulation,


ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference


ASTM F1303 – Standard Specification for Sheet Vinyl Floor Covering with Backing

ASTM E1423 - Standard Practice for Determining Steady State Thermal Transmittance of Fenestration Systems


UL 749 – Household Dishwashers

UL 923 – Microwave Cooking Appliances

UL 1315 – Metal Waste Paper Containers

UL 1746 – External Corrosion Protection Systems for Steel Underground Storage Tanks

UL 2034 – Standard for Single and Multiple Station Carbon Monoxide Alarms

Woodwork Institute (WI), http://www.wicnet.org

Manual of Millwork
### APPENDIX B GLOSSARY

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AABC</td>
<td>Associated Air Balance Council</td>
</tr>
<tr>
<td>AAV</td>
<td>Air Admittance Valve or Vent</td>
</tr>
<tr>
<td>ACPH</td>
<td>Air Changes per Hour</td>
</tr>
<tr>
<td>ABA</td>
<td>Architectural Barriers Act of 1968</td>
</tr>
<tr>
<td>AICUZ</td>
<td>Air Installations Compatible Use Zones</td>
</tr>
<tr>
<td>AMR</td>
<td>Automated Meter Reading</td>
</tr>
<tr>
<td>BMP</td>
<td>Best Management Practice</td>
</tr>
<tr>
<td>CATV</td>
<td>Cable Access Television</td>
</tr>
<tr>
<td>CEQ</td>
<td>Council on Environmental Quality</td>
</tr>
<tr>
<td>CFC</td>
<td>Chlorofluorocarbon</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon Monoxide</td>
</tr>
<tr>
<td>CPG</td>
<td>Comprehensive Procurement Guidelines (see EPA)</td>
</tr>
<tr>
<td>DD Form 1391</td>
<td>Department of Defense internal planning document delimiting project cost and defining functional parameters</td>
</tr>
<tr>
<td>DNL</td>
<td>Day Night (average sound) Level</td>
</tr>
<tr>
<td>ENERGY STAR®</td>
<td>Government-backed program helping businesses and individuals protect the environment through energy efficiency, <a href="http://www.energystar.gov/">http://www.energystar.gov/</a></td>
</tr>
<tr>
<td>FEMP</td>
<td>Federal Energy Management Program</td>
</tr>
<tr>
<td>FIIC</td>
<td>Field Impact Insulation Class</td>
</tr>
<tr>
<td>FPL</td>
<td>Forest Products Laboratory, <a href="http://www.fpl.fs.fed.us">http://www.fpl.fs.fed.us</a></td>
</tr>
<tr>
<td>FRT</td>
<td>Fire-Retardant-Treated (plywood)</td>
</tr>
<tr>
<td>FS</td>
<td>Flame-spread (index)</td>
</tr>
<tr>
<td>FSTC</td>
<td>Field Sound Transmission Class</td>
</tr>
<tr>
<td>HPVA</td>
<td>Hardwood Plywood and Veneer Association</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating Ventilation and Air Conditioning</td>
</tr>
</tbody>
</table>
IAQ – Indoor Air Quality
IBC – *International Building Code™*
IESNA – Illuminating Engineering Society of North America, [www.iesna.org](http://www.iesna.org)
IIC – Impact Isolation Class
IRC – *International Residential Code™*
LER – Light Efficacy Rating
LID – Low Impact Development
NEBB – National Environmental Balancing Bureau
O&M – Operations and Maintenance
PCB – Polychlorinated Biphenyl
SD – Smoke-developed (rating)
SHPO – State Historic Preservation Office
STC – Sound Transmission Class
TV – Television
UFAS – *Uniform Federal Accessibility Standards*
UFGS - *Unified Facilities Guide Specifications*
VOC - Volatile Organic Compounds
APPENDIX C-1
NET AND GROSS AREA CALCULATIONS – SINGLE STORY

(Mechanical Room and Exterior Storage excluded from Gross SF)

Note: Insulated walls demarcating the conditioned space of the unit should be treated as exterior for the purposes of calculating net square footage.

Total Gross 2,137 SF

Total Net 1,851 SF

"Benchmark" 2,310 SF

"Benchmark" 1,860 SF
APPENDIX C-2
NET AND GROSS AREA CALCULATIONS – TWO STORY

(Mechanical Room and Exterior Storage included in Gross SF)

<table>
<thead>
<tr>
<th>Total Gross</th>
<th>Second Floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD</td>
<td>27'-2&quot; x 28'-8&quot; = 779 SF</td>
</tr>
<tr>
<td>(Less open to below)</td>
<td>3'-2&quot; x 3'-10&quot; = -12 SF</td>
</tr>
<tr>
<td>EE</td>
<td>21'-10&quot; x 17'-8&quot; = 386 SF</td>
</tr>
<tr>
<td>FF</td>
<td>9'-10&quot; x 11'-0&quot; = 108 SF</td>
</tr>
<tr>
<td>Subtotal Second Floor</td>
<td>1,261 SF</td>
</tr>
<tr>
<td>First Floor</td>
<td></td>
</tr>
<tr>
<td>AA</td>
<td>27'-2&quot; x 33'-3&quot; = 915 SF</td>
</tr>
<tr>
<td>BB</td>
<td>21'-10&quot; x 10'-10&quot; = 236 SF</td>
</tr>
<tr>
<td>CC</td>
<td>9'-10&quot; x 11'-0&quot; = 108 SF</td>
</tr>
<tr>
<td>Subtotal First Floor</td>
<td>1,269 SF</td>
</tr>
<tr>
<td>Total Gross</td>
<td>2,520 SF</td>
</tr>
</tbody>
</table>

"Benchmark" 2,520 SF

<table>
<thead>
<tr>
<th>Total Net</th>
<th>Second Floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>28'-4&quot; x 27'-0&quot; = 711 SF</td>
</tr>
<tr>
<td>E</td>
<td>21'-0&quot; x 16'-0&quot; = 336 SF</td>
</tr>
<tr>
<td>F</td>
<td>9'-0&quot; x 11'-0&quot; = 99 SF</td>
</tr>
<tr>
<td>(Less Open to Below and 10 SF Landing)</td>
<td>G-H</td>
</tr>
<tr>
<td>G</td>
<td>12'-4&quot; x 10'-10&quot; = -134 SF</td>
</tr>
<tr>
<td>H</td>
<td>5'-8&quot; x 7'-4&quot; = -42 SF</td>
</tr>
<tr>
<td>(Less Interior Storage)</td>
<td>5'-4&quot; x 2'-4&quot; = -12 SF</td>
</tr>
<tr>
<td>(Less Interior chase)</td>
<td>5'-8&quot; x 1'-0&quot; = -6 SF</td>
</tr>
<tr>
<td>Subtotal Second Floor</td>
<td>1,036 SF</td>
</tr>
<tr>
<td>First Floor</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>26'-0&quot; x 32'-0&quot; = 832 SF</td>
</tr>
<tr>
<td>(Less under stair run)</td>
<td>13'-4&quot; x 41'-0&quot; = -53 SF</td>
</tr>
<tr>
<td>B</td>
<td>21'-4&quot; x 9'-8&quot; = 206 SF</td>
</tr>
<tr>
<td>(Less Laundry)</td>
<td>8'-8&quot; x 5'-4&quot; = -46 SF</td>
</tr>
<tr>
<td>(Less Mech. Room)</td>
<td>6'-0&quot; x 4'-0&quot; = -24 SF</td>
</tr>
<tr>
<td>(Less Ext. Storage)</td>
<td>6'-0&quot; x 5'-8&quot; = -34 SF</td>
</tr>
<tr>
<td>C</td>
<td>9'-4&quot; x 11'-0&quot; = 103 SF</td>
</tr>
<tr>
<td>Subtotal First Floor</td>
<td>984 SF</td>
</tr>
<tr>
<td>Total Net</td>
<td>2,020 SF</td>
</tr>
</tbody>
</table>

"Benchmark" 2,030 SF
APPENDIX D – DDFORM 1391

APPENDIX E – GEOTECH DATA

APPENDIX F - REAL PROPERTY MASTER PLAN

APPENDIX G - INSTALLATION DESIGN GUIDE

APPENDIX H – LEED CHECKLIST