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## Napa Phelps River Ranch Housing

HVAC System Options

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This report addresses the air conditioning (HVAC) system options that can reasonably be added to the existing buildings. Ownership has requested an analysis of the existing buildings and feasibility of adding air conditioning to the buildings. There are several possible types of HVAC systems that could be installed to provide cooling. Some systems are more efficient, some have lower installation costs, and some have lower maintenance costs. The following HVAC systems were chosen for a comparative evaluation. The options are generally listed in the order of best to worst in terms of a combination of cost, value, and reliability based on what we have seen used in similar projects.

### A. Background

The existing facility consists of four (4) buildings. Two dormitory buildings serve as housing for 14 residents each. One staff apartment building serves as housing for on-site staff. One multipurpose building serves as an office, dining, and kitchen space.

The buildings are constructed on slab with radiant heating and no cooling. Walls are built of 12" thick rammed earth with dual pane metal framed windows. The roof is metal, drawings indicate that the metal roofing sits on wood sheathing over 2x6 sleepers on structural panel sheathing with rigid insulation filling the gaps between sleepers.

The existing HVAC in the buildings consists of a radiant slab heating system and central ventilation system. Heating is controlled by thermostats distributed in the hallway of the dorms to control temperature. Ventilation is provided by a central supply fan system in the corridor. Each dorm door is fully louvered for ventilation, with openings also at the top of the corridor walls.

### B. HVAC System Options

1. Option 1 (Multi-Zone Heat Pump System with Wall-Mounted Fan Coils)

- a. System Description: This system consists of multi-zone heat pump condensing units located at grade, serving multiple wall-mounted fan coil units installed in each building. Each residence, the common bathroom, and the hallway will be provided with a fan coil unit, allowing for individual zone temperature control. Refrigerant will be routed from the outdoor condensing units to each indoor fan coil. Each dorm building would require 3 condensing units, the staff apartment building would require 1 condensing unit, and the multipurpose building would require 2 condensing units
  - b. Pros:
    - (1) Provides individual comfort control in each room.
    - (2) Operates efficiently with inverter-driven variable speed compressors.
    - (3) Equipment is compact and generally easy to maintain.
    - (4) Reliable system type with long service life.
  - c. Cons:
    - (1) Requires multiple refrigerant lines per unit.
    - (2) Creates a duplicate heating system with the radiant heating as the heat pumps would also heat. Likely would abandon the radiant heating system.
  - d. Cost Estimate for the HVAC work: \$375,000
2. Option 2: Single-Zone Heat Pump System with Large Ducted Air Handler
- a. System Description: In the dorms and multi-purpose this system would consist of two single-zone heat pump condensing units located at grade, connected to two large air handlers installed in the hallway under the roof. The air handler would be ducted to all rooms, providing uniform heating and cooling. Refrigerant piping connects the outdoor condensing unit to the indoor air handler. At the staff apartments, recommended system would remain the multi-zone heat pump with wall mounted fan coil units in each apartment.
  - b. Pros:
    - (1) Provides consistent temperature throughout the building.
    - (2) Sets a single temperature for control for improved energy efficiency.
    - (3) Potential lower first cost than option 1.
  - c. Cons:

- (1) Ductwork installation requires additional ceiling and shaft space.
  - (2) Single-zone design limits individual room temperature control.
- d. Cost Estimate for the HVAC work: \$300,000