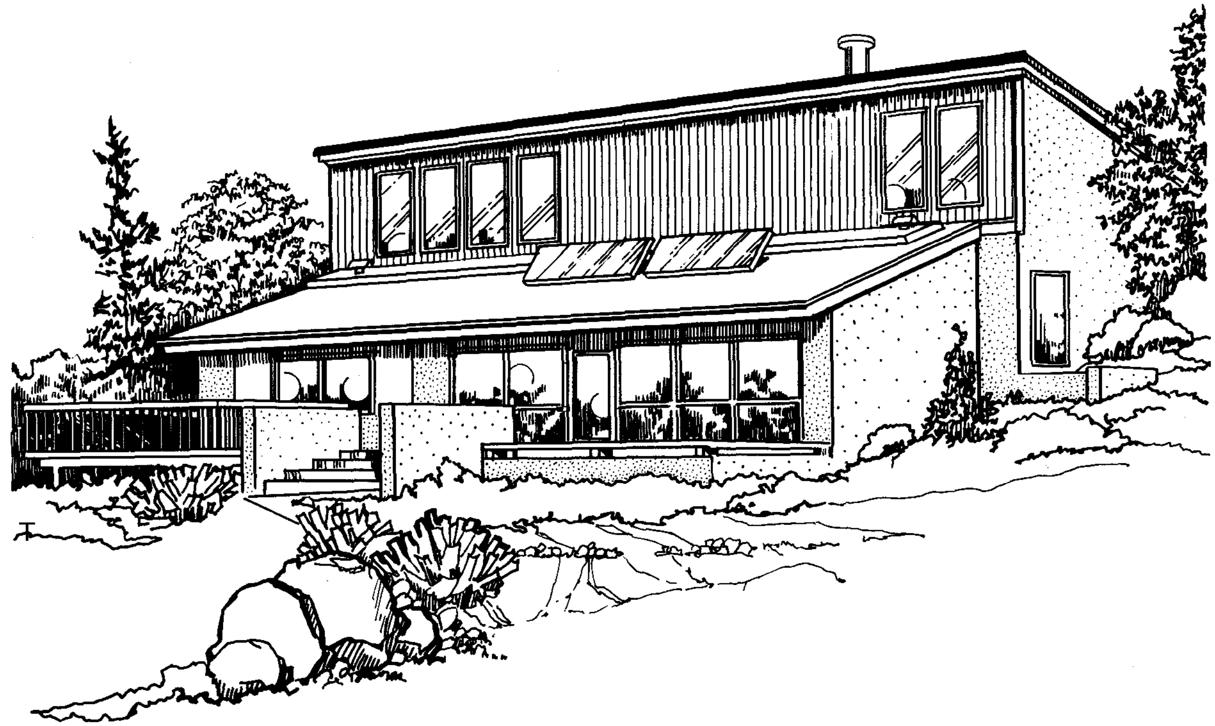
# West Sedona, AZ



**Builder:** Gary E. Wagley, General Contractor, Sedona, AZ

**Designer:** Sun System Engineering, West Sedona, AZ

**Solar Designer:** Jim Raney, Sedona, AZ

**Price:** $93,000

**Net Heated Area:** 1377 $ft^2$

**Heat Load:** 45.3 x $10^6$ BTU/yr

**Degree Days:** 3702

**Solar Fraction:** 84%

**Auxiliary Heat:** 1.49 BTU/DD/$ft^2$

**Passive Heating System(s):** Direct gain, indirect gain, sun-tempering

**Recognition Factors: Collector(s):** Double-glazed windows, 280 $ft^2$ **Absorber(s):** Tile floors and mass walls **Storage:** Masonry walls, concrete slab—**capacity:** 46,074 BTU/°F **Distribution:** Radiant, natural and forced convection **Controls:** Insulated shutters, fixed overhangs, exterior sun shading, earth berming, clerestory vent

**Back-up:** Electric furnace and woodburning stove

**Domestic Hot Water:** Two flat-plate collectors, roof-mounted, 82-gallon glass-lined tank

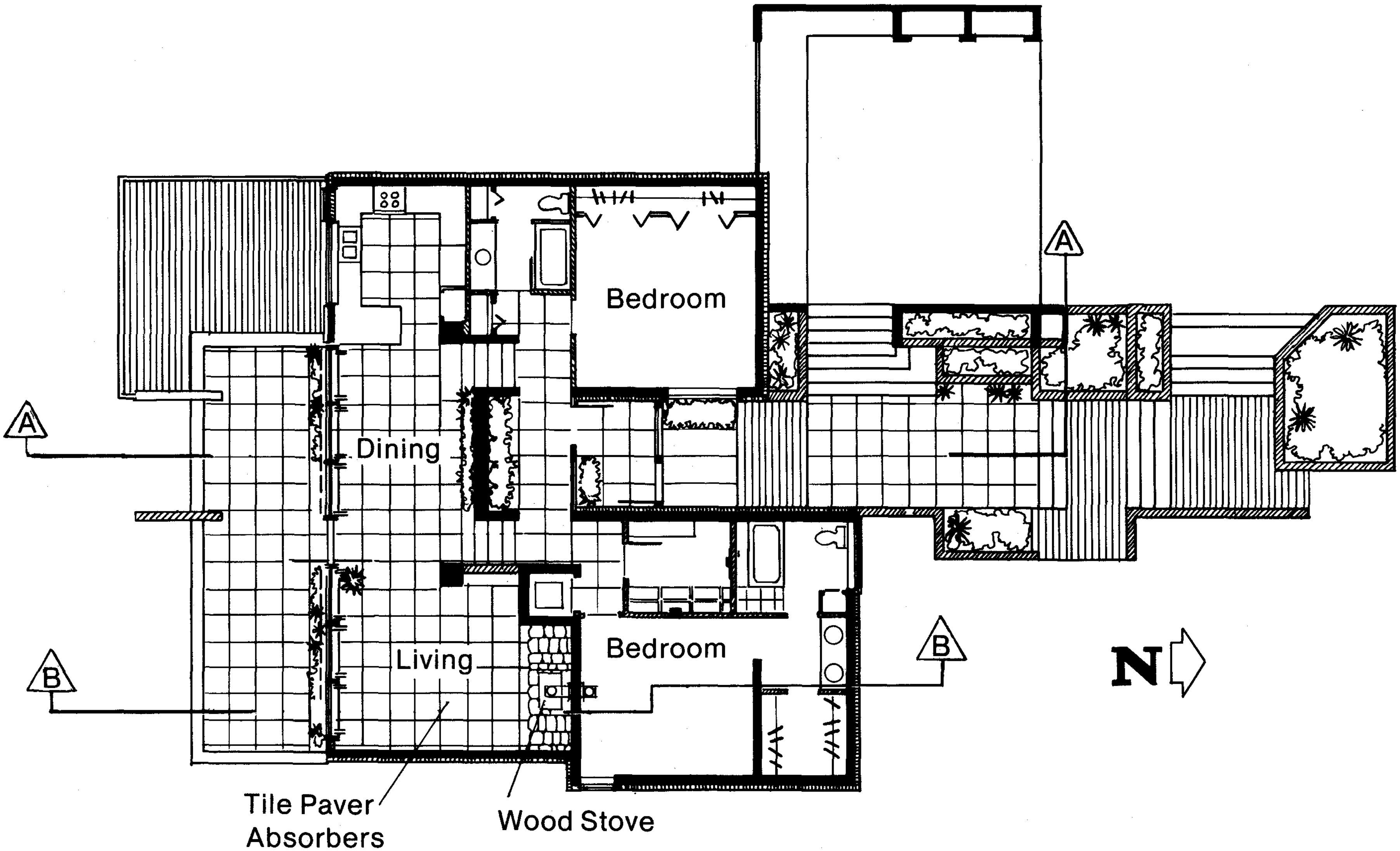
**Passive Cooling Type:** Natural and induced ventilation, night-sky radiation

The site is in north central Arizona where climate is characterized by light rainfall, very light winds, and large daily temperature swings. The structure is a rustic contemporary design situated on a south-sloping rectangular lot replete with indigenous vegetation. The house has been built into the slope so that it is earth-bermed on three sides. The main entry is on the north side where there is least exposure to prevailing southwest winds. The entry sytem is an air-lock vestibule located adjacent to a covered entry court which is additionally buffered by the carport and entry landscaping. Landscaping is also used to protect the west side from light winds, hot sun, and winter storms. To aid in this effect, the architect has located closets and utility areas along the interior of this west wall and omitted windows. There is only one window on the east side and it, too, has protective vegetation to reduce wind infiltration.

Double-glazed windows along the south wall of the house **collect** sunlight for the lower level: the living room, dining room and kitchen. On the upper level, the **collectors** are south-facing, fixed, doubleglazed clerestory windows above the bedrooms. Domestic Water is preheated by two roof-mounted flat-plate collectors.

Each passive collector transfers direct and indirect radiation to storage masses located on both levels. Direct radiation is **absorbed** and **stored** on the lower level by a floor of tile pavers covering a 6-inch concrete slab, and by 8-inch masonry walls along the east, west, and north sides of the interior. The sun's heat is directly **absorbed** and **stored** in the upper level by 8-inch masonry walls.

The efficiency of this structure's heating system is enhanced by the extensive use of forced **distribution.** A system of ducts and

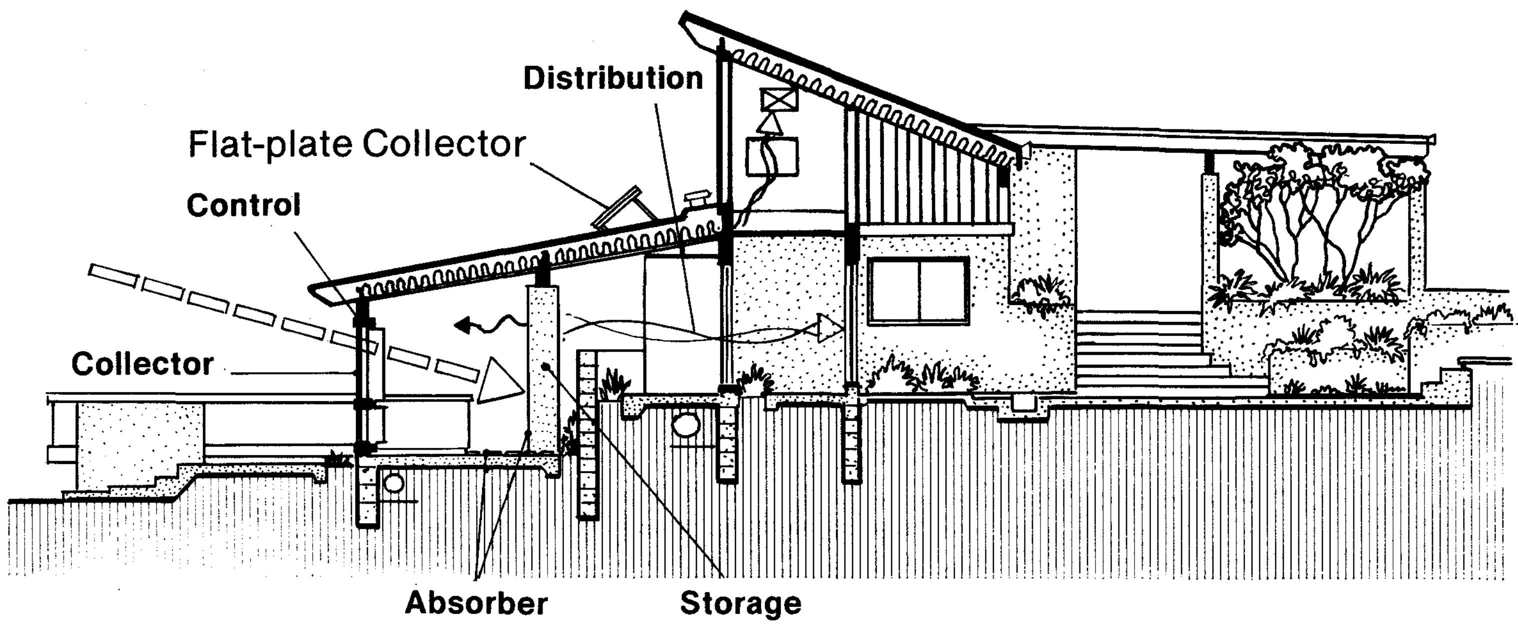


Bedroom
A
A
Dining
Living
Bedroom
B
B
N
Tile Paver Absorbers
Wood Stove

registers in the walls, ceilings, and floors connects to a central blower on the upper level. For back-up heating this blower has an integrated electric element. Except for moderate weather conditions, when natural convection and ventilation are adequate, this multi-phase **distribution** system is used in all seasons. In the winter mode the system operates in two stages. In moderate cold the first stage is activated automatically when the house thermostat demands heat and the ceiling sensor indicates that air in the clerestory is 12 degrees above the house thermostat. This turns on the furnace air handler which pulls the air down through ceiling vents and blows it back through floor registers in all rooms. This operation continues until either the thermostat is satisfied or the ceiling sensor indicates that air in the clerestory is down to 8 degrees above the house thermostat. If the house thermostat requires heat when the ceiling temperature is less than 8 degrees warmer, the second stage becomes operational. In this stage the back-up electric element within the furnace heats the air before it is blown back out the floor registers. The element will stay on until the house thermostat is satisfied or the temperature difference between the house and ceiling reaches 12 degrees again. In this back-up stage the owner has the option of firing up the woodburning stove located at the north wall of the living room when he notices that the back-up element indicator lamp is on. The stove draws its combustion air directly from the outside so that its use will not waste heated air from the house.

The duct system in the winter phase can also recirculate air from the clothes dryer through a filtered damper assembly, providing much needed winter moisture as well as heat.

All collectors are controlled by manually operated moveable insulation. On clerestory windows there are 1 1/2-inch foam in-

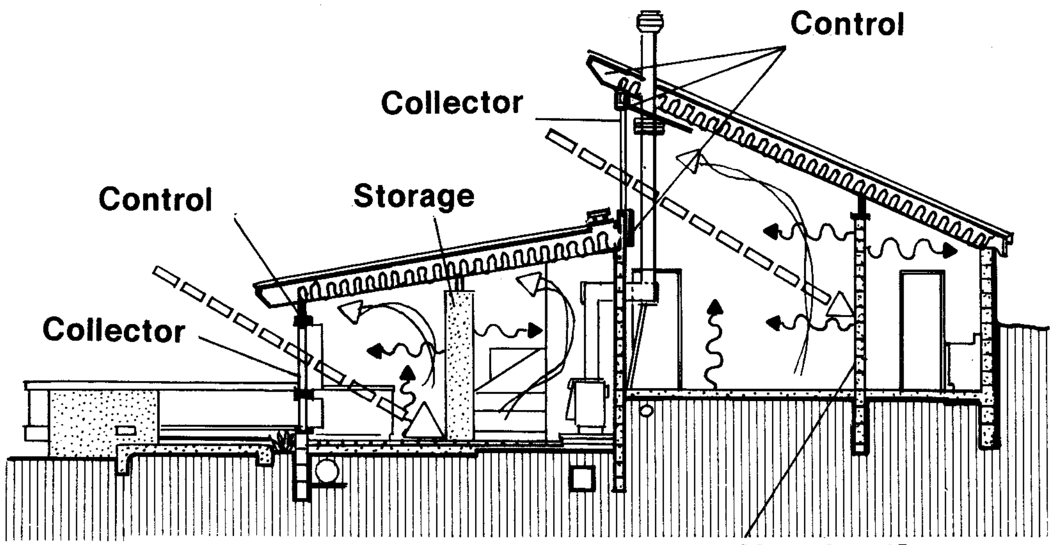


sulation shutters, split horizontally (4-foot tops and 2-foot bottoms). During summer days the top section is left closed to prevent direct radiation to storage masses while the bottom section can be left open for natural lighting. For the dining room and living room windows there are interior 11/2inch foam insulation shutters split vertically, and exterior pull-down shades for filtering light. Kitchen windows have exterior insulated shutters, and all south walls have fixed overhangs.

For summer cooling, windows are left open at night so that by natural convection heat is exhausted through vents in the clerestory. A fan can be turned on to increase the rate of this flow. During the day the moveable insulation covers collector windows to prevent direct radiation from heating the storage masses. If this is done, storage masses will cool interior air.

For more severe hot weather an evaporative cooler located outside the east wall is brought into operation by switching manual slide-in dampers and bypassing the furnace air handler. In this mode the fan in the cooler pumps cool humidified air into the subslab ducts and up through the floor registers. This air is then drawn up as hot air is exhausted by the fan, through the clerestory exhaust damper. Both this damper and the evaporative cooler are sealed off in the winter phase.

The roofs are vaulted and light-colored to reflect heat and light. Insulation in the roof is R-32; wall insulation averages R-19.

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This plan was taken from the book
"Passive Solar Homes – 91 new award-winning, energy-conserving single-family homes",
The U.S. Department of Housing and Urban Development, 1982

These homes were the winners of HUD's fifth (and final) cycle of demonstration solar homes. The 91 winning homes were selected from 550 builder applicants.
This was a time of great interest and activity in the passive solar home designs – many of the winning homes show a level of innovation not found in most of today's passive solar designs.