

1) The home will be constructed predominately of ICFs, providing excellent insulation and good thermal mass for exterior walls; floor will be concrete slab to absorb solar heat in the winter and provide a cooling effect in the summer.

2) The roof will be metal, with rain gutters installed and plumbed to a cistern so rainwater can be used for domestic use and irrigation.

3) There will be adequate windows on the south side of the home to provide both solar heating in the winter as well as daylighting for all south rooms. Thermal mass walls will be added in the family room to prevent overheating in the summer and provide nighttime warmth in the winter. Windows on the north side of the building will provide daylighting and ventilation to the bathrooms, hallways and den. Windows on the west and east sides of the building are small to minimize heating during the early morning and late afternoon hours while still providing some daylighting and ventilation.

4) A large solar water heating tank will provide domestic hot water, using LPG as a back-up. A wood stove in the family room will be used for back-up winter heating.

5) Porches on the east and west sides of the home will provide shade during the early morning and late afternoon hours. Shade sails will be used to expand the porch to the south side of the home and increase the shade in southeast and southwest corners during spring, summer and autumn.

6) Interior windows above the dining area will be used to allow warm family room air to rise into the upper level providing a heating effect in the winter and a cooling effect in the summer.

7) The passive solar analysis (sheet 5) indicates that approximately 50% of the winter heating requirement will be provided by the sun. The home is cooled entirely through the passive solar design, even though daytime temperatures climb into the 90s.

## ***Design Summary, Drawings and Solar Analysis***

### ***Solar & Shade Off-Grid Home in Four Hills Ranch, Northern Arizona***



7709 West Painted Rock Trail, Williams, AZ 86046

Designer: Thad Johnson

**Solar & Shade Off-Grid Home**  
Four Hills Ranch  
Williams, AZ 86046

Sheet  
**1**

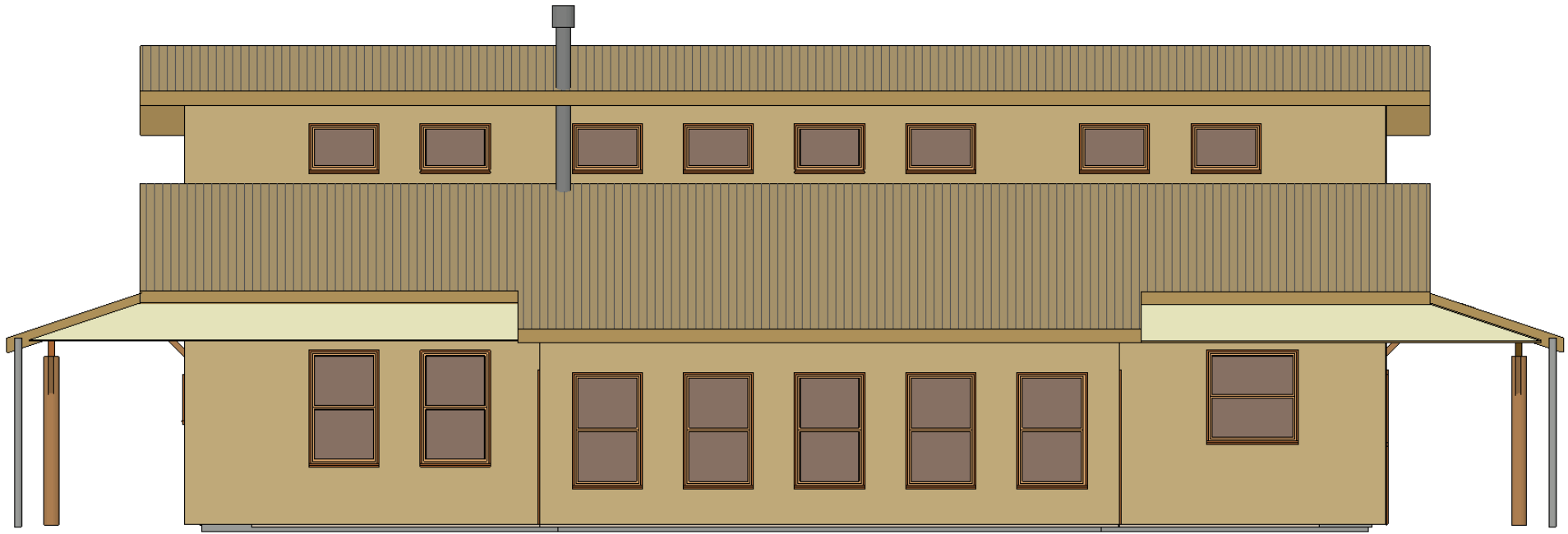
Sheet Title:

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***Design Concept Overview***

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A1





Sheet Title:

*South Elevation*

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Rev  
A1

**Solar & Shade Off-Grid Home**

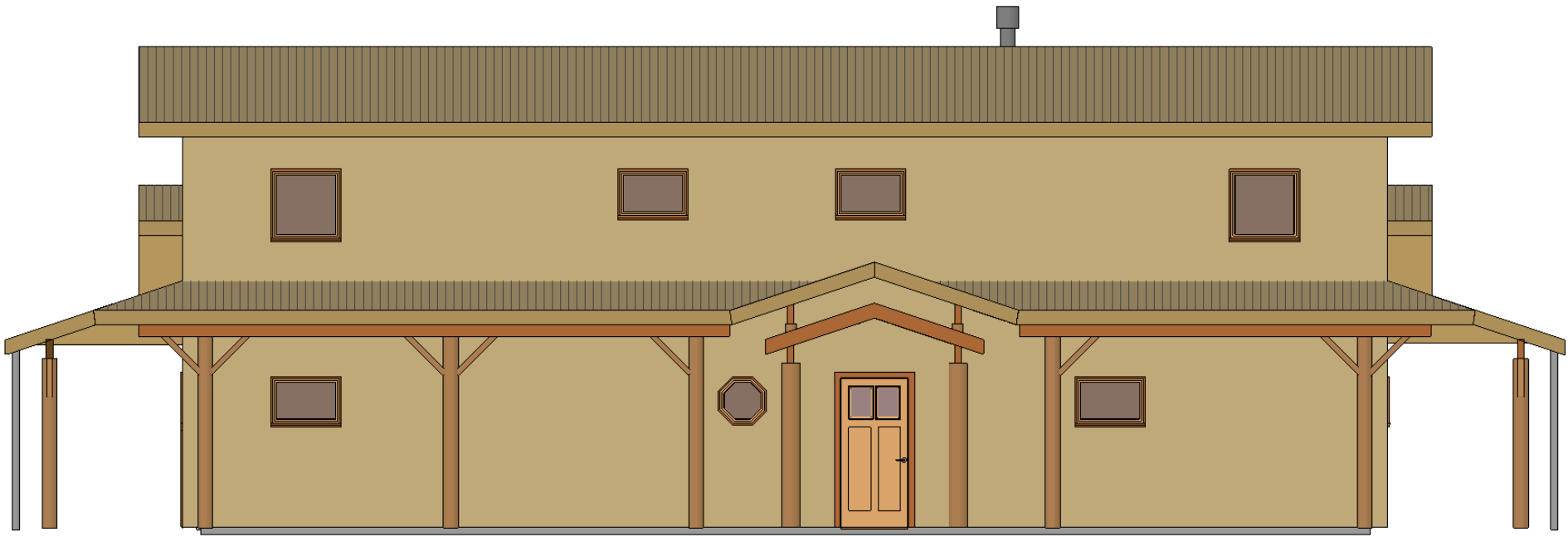
Four Hills Ranch  
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Sheet  
**2**



Sheet Title: *North Elevation*

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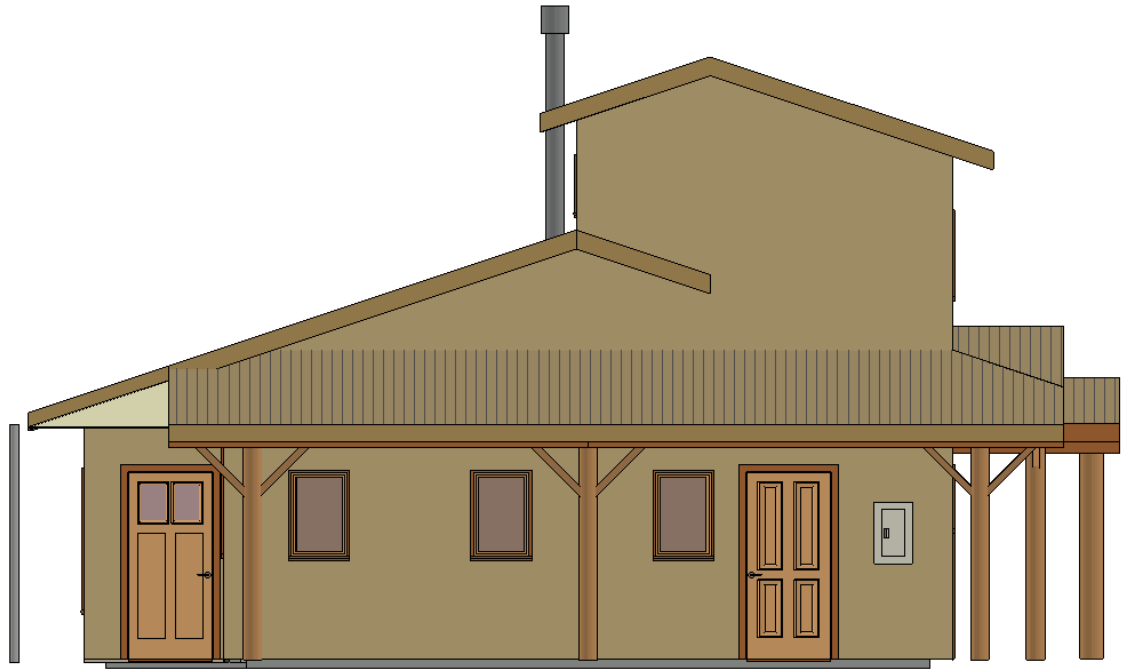
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**Solar & Shade Off-Grid Home**  
Four Hills Ranch  
Williams, AZ 86046

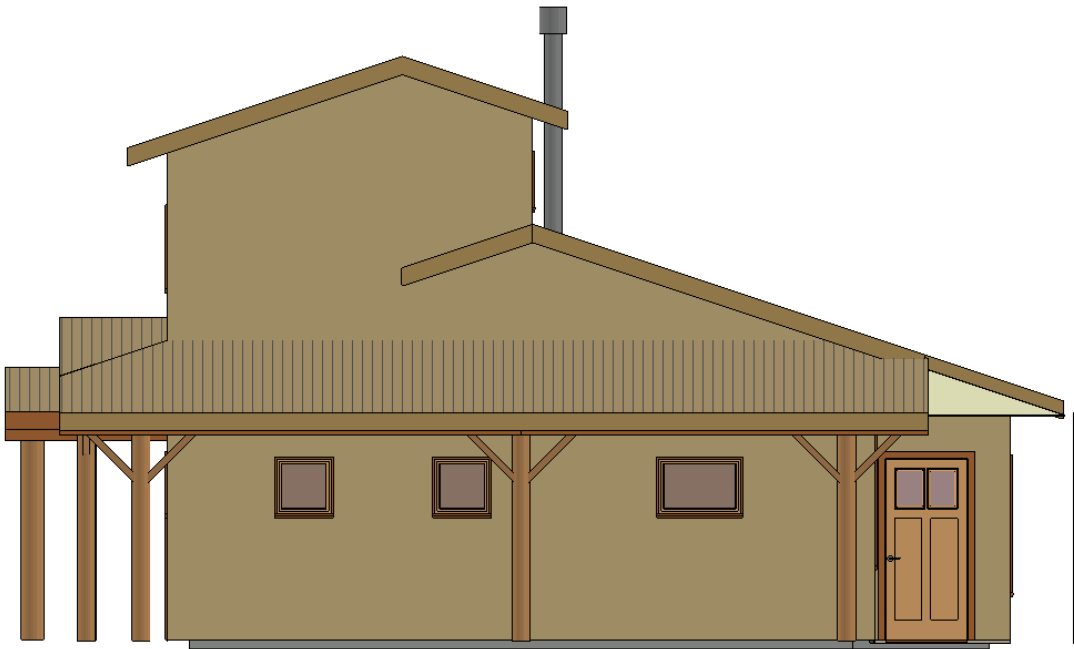
Sheet  
**3**

Designer: **Thad Johnson**

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EAST ELEVATION



WEST ELEVATION

Sheet Title:

*Side Elevations*

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Four Hills Ranch  
Williams, AZ 86046

Designer: Thad Johnson



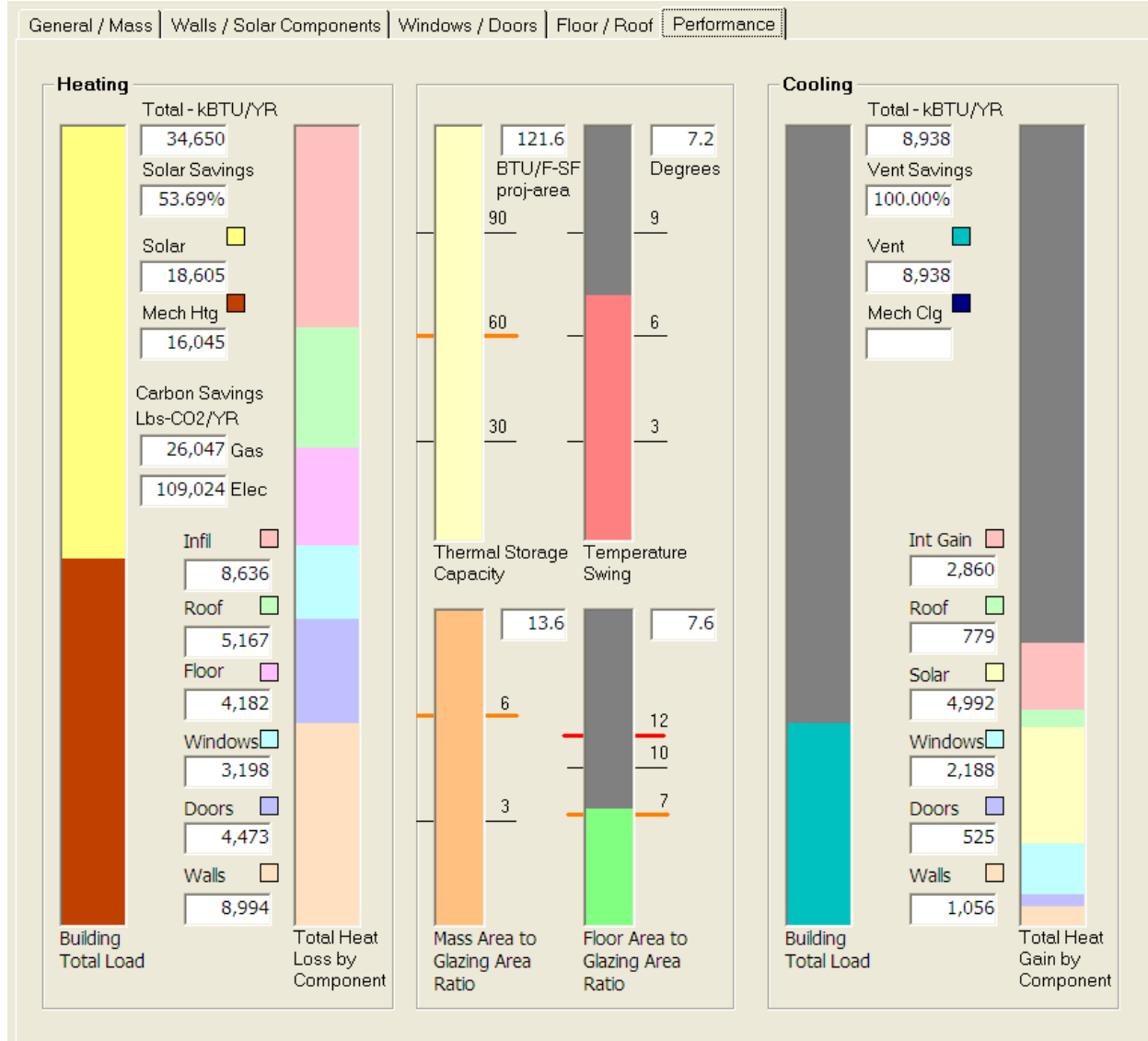
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Sheet  
**4**

## PASSIVE SOLAR ANALYSIS:

This home was designed with extra thermal mass to help maintain comfortable interior temperatures during the summer months. At this altitude, the sun is intense, and the thermal mass will be able to absorb heat from the interior air and release it overnight when temperatures drop and windows are opened.

The sun will provide about 50% of the winter heating requirement. During very cold nights, the owners will need to use R-8 insulated covers on the master bedroom and family room south windows to minimize back-up heating with their wood burning stove.



Note: Used Solaequis Software for Passive Solar Analysis

Sheet Title:

*Passive Solar Analysis*

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**Solar & Shade Off-Grid Home**

Four Hills Ranch  
Williams, AZ 86046

Designer: Thad Johnson

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Sheet  
5

FAMILY ROOM LOOKING EAST TO WEST:



Sheet Title:

*Interior View*

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A1

**Solar & Shade Off-Grid Home**

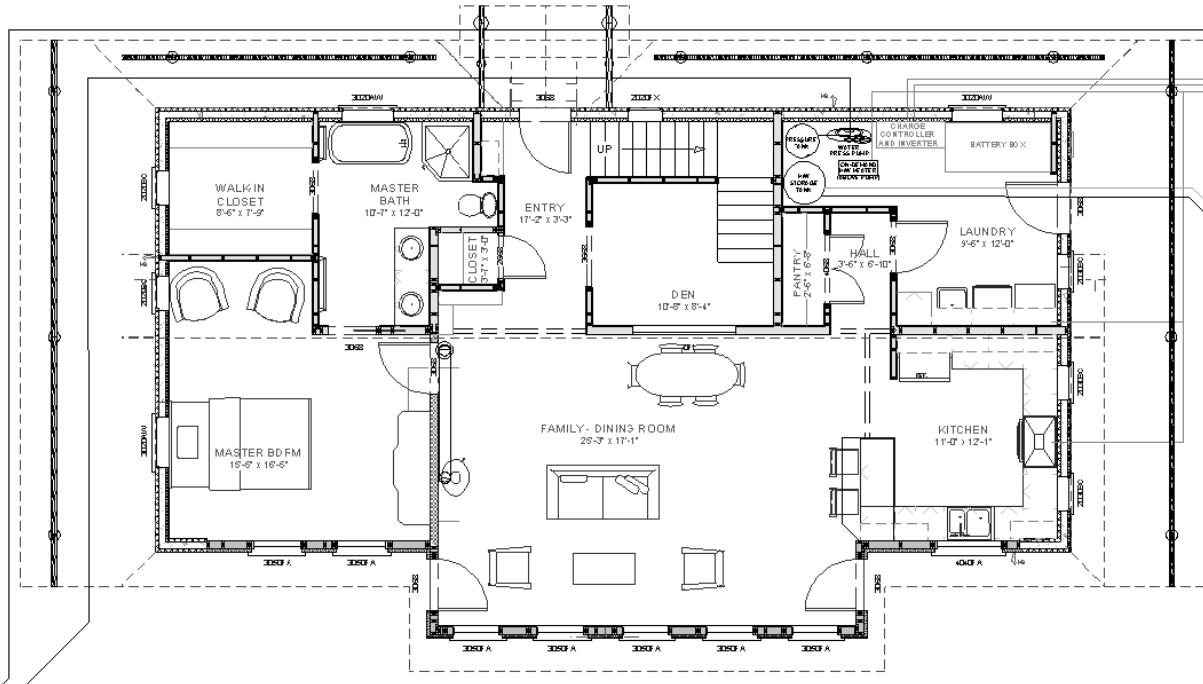
Four Hills Ranch  
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Sheet  
**6**



LIVING AREA  
1536 sq ft

ONE (1) SOLAR HOT WATER COLLECTOR

TWELVE (12) SOLAR PV/MO CILLES

SEE TO-HILL # WATER CETERM (PARTIALLY BURIED)

Sheet Title: *1st Level Floor Plan*

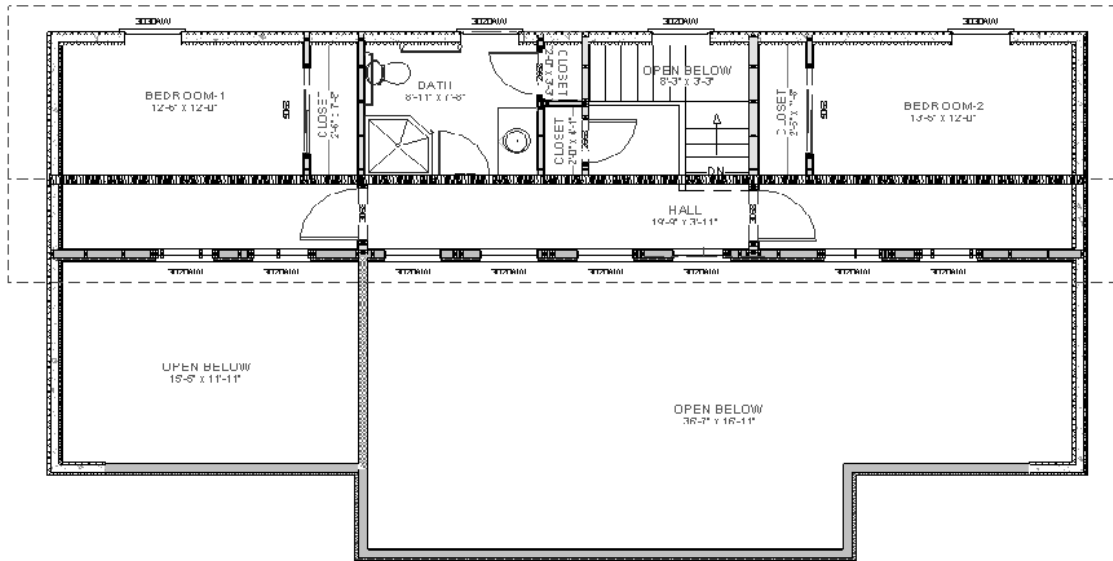
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Four Hills Ranch  
Williams, AZ 86046

Designer: *Thad Johnson*

Sheet  
**7**



LIVING AREA  
682 sq ft

Sheet Title:  
*2nd Level Floor Plan*

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**Solar & Shade Off-Grid Home**  
Four Hills Ranch  
Williams, AZ 86046

Sheet  
**8**

Designer: Thad Johnson

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