

The Lewis and Clark Hidden Hills Journey

Log Book



Discoveries Made
By
Rob "Meriwether" Rothman

McCoy
Canyon

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(1) AT THE TIME OF PUBLICATION, THE THERMAL SOLAR SYSTEM REFERRED IN THIS BOOKLET WAS INCOMPLETE, AND THE SPECIFICATIONS NOTED ASSUME FUTURE COMPLETION, HOWEVER, THE SUPPLY AND RETURN LINES FROM THE UTILITY ROOM TO THE GARAGE THANKLESS HOT WATER HEATER LOCATION AND THE 4x4 PANEL RACK FOUNDATIONS HAVE BEEN INSTALLED AND APPROVED UNDER PERMIT. IN ADDITION, THE SOLAR COLLECTORS AND STORAGE TANK/HEAT EXCHANGERS AND STANDS ARE ON-SITE.

NOTE: MATERIALS AND SPECIFICATIONS REFERENCED HEREIN ARE BELIEVED TO BE ACCURATE, HOWEVER, DUE TO THE AVAILABILITY OF MATERIALS AND ADJUSTMENTS TO APPLICATIONS DURING CONSTRUCTION, ACTUAL BRANDS AND MODEL NUMBERS INDICATED MAY HAVE CHANGED WITH NO SIGNIFICANT REDUCTION IN SPECIFICATIONS.

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System Summaries

The following are Summaries of the various Utility and Technical Systems installed on the property. Detailed information for some of the more complicated systems is available in following sections. This information is believed to be accurate, but it is the user's sole responsibility to confirm any characteristics before relying on the information to make critical decisions.

High Voltage Electrical Distribution

As the existing Service Entrance (meter) box was rated at only 200 Amps, it was upgraded to a 400 Amp panel and new underground cable was connected to the utility service. A 200 Amp Sub Panel inside the Garage distributes power via circuits throughout the residence, a 225 Amp Sub Panel located in the Utility Room interfaces with the Solar Inverters and also distributes power to the Utility Building, Landscaping, Service Yard and Pool Bathroom. A third Sub Panel is a part of the Pool and Spa Control System and regulates power to the pool equipment.

Low Voltage Systems

For this summary, the term 'Low Voltage' is used to refer to any type of wiring that distributes voltages less than 48 volts, AC or DC, or communicates wirelessly. Since the development cycle of electronic devices can result in products becoming obsolete soon after their introduction date, specifying certain equipment during the design stages would have all but guaranteed installing, 3 years later, out-of-date technology! In order to enable the greatest level of installation flexibility with a minimum of invasiveness, a pre-wire plan was developed based on current best practice for technologies, not specific equipment requirements. As an example, while an excellent wireless mesh data network has been installed, there are multiple locations that have been "hard-wired" with CAT6 Network cable.

All Low Voltage wires run from the Electronics Room directly to each termination location, typically to a multi-connector wall plate. Some cable runs pass through junction boxes where they are interconnected or redirected. Junction boxes are located on each side of the garage and in the Utility Room. Two additional J-boxes, one near the electric meter and one near the water main, house the utility connections for CATV and land-line telephone, respectively.

Photovoltaic Solar System

The Photovoltaic (PV) Solar Array is installed on the hillside facing 240-degree Azimuth with a 20-degree tilt. Location is 25' off North Property Setback and 20' from Stable back wall to the South. This location will maximize energy production even with the large trees to the East and West.

56, 260-Watt, Canadian Solar CS-260SD solar panels provide up to 14.56Kw of power to all electrical circuits on the property or, when excess electricity is produced, it sold to Edison Electric and the cost is credited to the subscriber's Edison account. The only maintenance that the Solar Array requires is an occasional glass cleaning. The Array should only be cleaned early in the morning or in the evening when the glass is not hot. This will prevent the glass from cracking or becoming water spotted. It is also recommended to use only ionized water and soft brushes to gently remove dust. Many window cleaning contractors provide this service.

Potable Hot Water Heating Solar System

NOTE: DUE TO EXTENUATING CIRCUMSTANCES, THE THERMAL SOLAR SYSTEM HAS NOT BEEN COMPLETED. CERTAIN MATERIALS ARE ON-SITE AND ROUGH PLUMBING AND COLLECTOR RACK FOUNDATION POSTS HAVE BEEN INSTALLED AND APPROVED UNDER PERMIT. REFERENCES WITHIN THIS BOOKLET ARE MADE UNDER THE ASSUMPTION THE SYSTEM HAS BEEN COMPLETED.

The nine solar panels (on site) are located above the PV solar panels on the hillside. As with the PV Array, the only maintenance that the thermal Solar Panels require is an occasional glass cleaning. The Array should only be cleaned early in the morning or in the evening when the glass is not hot. This will prevent the glass from cracking or becoming water spotted. It is also recommended to use only ionized water and soft brushes to gently remove dust. Many window cleaning contractors provide this service.

The panels are connected in two Arrays, seven are used to heat the swimming pool and spa water and two are used to heat domestic hot water. The swimming pool Array connects directly to the gas pool heater and pre-heats water before entering the heater, if the water is not hot enough the heater increases the temperature to the desired level. All panels are "glazed" meaning that the solar collectors are enclosed in an insulated frame with a glass cover. This type of panel is more typically used in commercial swimming pool or domestic hot water applications and, due to its high-level performance, the swimming season can be expected to be as long as nine months, with minimal or no gas heat supplement. Alternatively, all solar heating capacity can be directed to the Spa during the "non-swimming" season to maintain a temperature more rapidly increased to optimal temperature.

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The domestic hot water system uses two panels to heat a special fluid which is used to heat water in two tanks located in the Utility Room. This is called a “closed loop system” and the water is heated through “heat exchanger” coils located inside the storage tanks. This “pre-heated” water is then fed to the cold inlet at the Tankless Water Heater (TWH) in the garage. The typical condition is for the pre-heated water to already be at or, most likely, above the desired temperature. The water is channeled through a special valve that automatically reduces the water to a safe temperature range or the TWH increases the temperature as needed.

Solar Farm

The two types of Solar Systems used collectively are referred to as a “Solar Farm” because the “planted” Arrays produce a “crop” of energy. Primarily, the PV solar provides the most quantifiable “crop yield” due to the heavy requirement technology places on the equipment and systems installed. The electricity production can be easily analyzed using the tools available on the Edison Electric website which monitors the solar generation and can be connected to the local network and monitored locally or by the PV installation company, if desired. An awareness of energy production is important in order to obtain maximum energy production. See details for information on how to monitor energy output.

Emergency Back-up Generator System

A Generac Guardian Series 22 kW automatic stand-by generator provides the automatic backup power you need to protect your home and family during a power outage. Primary fuel is the existing natural gas supply, it kicks in within seconds of determining power loss — automatically — and runs for as long as necessary until utility power returns. In the event that natural gas has been temporarily turned off, as in the event of an earthquake, the fuel supply is automatically diverted LP gas, stored in two 25-gallon (50 gallons total) tanks located next to the Generator in the Service Yard. The generator contractor can provide refill service.

In the event of a failure of the utility power grid, two Automatic Transfer Switches sense the loss of power and signal the Generator to power-up. Simultaneously, they physically disconnect the utility power lines. This is necessary to prevent electricity from the Generator feeding into the utility grid, the same way that the excess solar electricity is

fed to Edison, and injuring line-workers! It should be noted that the same danger exists with the Solar power generation but since the “power feedback” is normal and anticipated, it is safe for workers. However, in the event of a power grid failure, solar power generation is turned off, therefore, a grid-connected Solar System, even with battery back-up, will not function during a power outage. In most cases, any batteries connected to a solar system provide power to only a few dedicated circuits and, in most cases, cannot recharge until utility power has been restored.

The Generator system provides constant power to all property functions with 30 seconds of detecting an outage; however, emergency power failure lights have been installed throughout the residence that operate instantly and will illuminate the house during the transition time. Similarly, critical electronics also have interim battery backup. It is recommended to not operate swimming pool equipment by Generator power. All air conditioners will function, however, depending on actual usage they may operate sequentially in a priority-based order.

Low Voltage and Data Pre-Wiring

The following are the special instructions, specifications and other notes regarding the standards for electronic systems pre-wiring performed during construction.

Installation Notes

Electronics Room (ER)

All cables begin or end in the Electronics Room or to strategically located junction boxes throughout the property.

Cable Terminations

Each Low Voltage circuit will be terminated to an industry standard, commercial quality, connector and wall plate(s) in its individual location and to an industry standard connecting Block in the Electronics Room.

Grounding

An earth ground rod at least 8-feet in length for the sole purpose of grounding electronic equipment (Isolated Ground) is to be installed in the Electronics Room.

Wire Run Descriptions

Data Network

The Data Network consists RJ-45 access points conveniently located throughout the residence and property. All of these terminations run to a patch panel in the ER. An eero TrueMesh, Wi-Fi system that uses best-in-class encryption and security protocols to keep the network and data secure. Users can connect to the network using wireless devices virtually any place on the property, subject to physical constraints, or via wired jacks.

Door Lock Release

Door release wire carries a 12V pulse to open an electromagnetic door lock and is powered by the central telephone system.

Cable Company POE

Underground conduit for the cable company's connection runs from the power pole on the street to a junction box (Point of Entry POE) located near the Electric meter. Two (2) cables run from the J-box to the ER. One wire is redundant. This feed can supply Cable Television, Internet Access and Telephone Voice Service.

IP Security Cameras

A total of sixteen (16) security camera locations are installed. All cameras must be IP Type and Power Over Ethernet (POE) capable. Twelve (12) of the cameras are connected by homerun CAT5e cables. The four (4) remaining cameras connect to a Data Network hub located in the Stable Utility Room. All of these terminations run to a patch panel in the ER.

Satellite Dish Feed (Satellite Company POE)

A satellite dish can be located near the corner of the Accessory Building and the Utility Yard. Four (4) runs of video cable from a J-box in the Utility room to the Electronics Room.

Cable or Satellite Television Terminations

Coaxial video cable runs from the ER to each television location. These cables carry television signals to each TV or control box and is configured based on the provisions of the current service provider. Most components can be connected in the ER.

Security Cabling

All security wiring is run from the device location to the central location in the ER. Security cables are designated for high-current components such as sounders or direct wire applications such as keypad controllers. All sensors are to be wireless.

Surround Sound System

A 7.2 speaker surround sound system has been installed in the Theater Room.

Swimming Pool Remote Control

In addition to a hand-held wireless controller, a swimming pool controller is also located in the Loft / Den area.

Telephone

Hard-wired digital telephone cables connect from the ER to each potential telephone location throughout the property. All of these terminations run to a patch panel in the ER. Users can connect a phone system controller in the ER to individual instruments.

Telephone Paging

Four (4) 2-way telephone paging speakers have been installed and are wired into the ER. These speakers can be connected to equipment that will permit two-way, hands-free, voice communication throughout the property.

Whole House Audio

There are four installed speaker locations, three inside the main residence and one in the pool area. A dedicated power amplifier/tuner should be used to distribute audio signals to any or all of the four locations. Individual volume control and switching for each speaker pair is located in the Electronics Rack.

Minimum Cable Specifications

Data Cable

23/8 (23AWG 8C) Cat6, pure copper

Door Lock Release Cable

22/2 (22AWG 2C) stranded CL2, PVC

Security Alarm Cable

22/4 (24AWG 4C) solid copper.

Security Cameras

24/8 (24AWG 8C) Cat5e, pure copper

Surround Sound Speakers

14/2 (14AWG 2C) pure copper, oxygen-free, CL2, 105 Strand/0.16mm.

Telephone Cable

24/8 (24AWG 8C) Cat5e, pure copper

Telephone Paging

22/4 (22AWG 4C) Cat3

Video Cable (TV Video)

RG-6/U, 18AWG solid copper center, 60% braid and 100% foil shield

Whole House Speakers

14/2 (14AWG 2C or 4C) pure copper, oxygen-free, CL2, 105 Strand/0.16mm

Telephone System

This house has been configured for a hard-wired telephone system, and in particular, the Panasonic KX-TA824 Advanced Hybrid System is expressly designed to maximize home communications. Originally designed for the small-office environment, this industry standard has become popular in large-sized and luxury homes. With its wide array of features, it offers telephone, intercom and access control, plus a whole lot more. Many of the features are common to those that use sophisticated telephone systems in the workplace and in a residential setting, there are several features that enhance the occupant's security and convenience.



You can assign specific incoming lines to each phone, make room to room hands-free intercom calls at the touch of a button, talk with guests at the front door and open the pool area door or driveway gate! The KX-TA824 offers a variety of options to enable customized solutions and is easily user-modified via on-line controls. You can tailor your telephone system to the varied needs of your family KX-TA824

Custom Configuration

- 6 CO Lines (8 Max)
- 16 Extensions (24 Max)
- 4 Door phones
- Intercom with hands-free answer
- Indoor and Outdoor Paging
- 3-zone outdoor intercom
- Background Music Capability
- Flexible Ring Assignment
- Toll Restriction

Proprietary Telephone Features

- Auto-answer Intercom
- Backlit LCD Display & Keypad
- 24 Programmable Buttons

System Requirements

- 1 - KX-TA824 Hybrid System
- 16 Proprietary or SLT* phones
- 4 door phones, max
- 3-zone intercom amplifier

* Single Line Telephone

Photovoltaic (PV) Solar System

Construction Notes

Key Manufacturers

Inverter: Solar Edge Technologies Inc., Grass Valley, CA

Solar Panels, Canadian Solar, San Ramon, CA

Racking: Snap N Rack, San Luis Obispo, CA

Permit Notes

1. Solar PV System to be installed on a residential ground mount structure.
2. All components are UL listed and CEC certified, where warranted.
3. install in accordance with Article 690 of the 2013 CEC.
4. This system is a utility interactive system with no storage batteries.
5. The Solar PV installation shall not obstruct any plumbing, mechanical, or building roof vents.
6. A grounding electrode system in accordance with NEC 690-47 shall be provided.
7. A supplemental grounding electrode will be used at the inverter location consisting of an 8" X 10' copper clad ground rod.
8. Exposed non-current carrying metal parts of module frames, equipment, and conductor enclosures shall be grounded in accordance with 250.134 or 250.136 (A).
9. SCE will be notified prior to use and activation of any solar installation. System will be commissioned by owner per utility interconnection agreement.
10. Proper access and working clearance around existing and proposed electrical equipment will be provided as per section 110.26 CEC.
11. Alternate power source placard shall be plastic, engraved in a contrasting color to the plaque. If exposed to sunlight, it shall be UV resistant.
12. Metallic conduit containing DC conductors shall be identified with "Caution: High Voltage DC Circuit" every 5 feet.
13. All plaques and signage required by 2013 CEC will be installed as mandated.
14. Signage and Labeling Specifications shall be: Red background with white lettering, 3/8" letter heights, all capital letters, Arial or similar font, weather resistant
15. A DC disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the system conductors.
16. Photovoltaic modules are to be considered non-combustible.

PV System Components

-A- Solar Collectors

56 Canadian Solar CS6K-270M, 265-watt Solar Panels, are configured into two array sets, one with 34 panels and the other with 22. Collectively, 56 panels with a rated capacity of 14,840 watts or 14.8kW.

-B- Power Optimizers

Each panel is connected with a Solar Edge power optimizer. Each optimizer continuously monitors the energy production of its associated panel and controls delivery electrical of production. This method of connection enables each panel to be automatically adjusted or removed from the array in the event of poor production, relative to other panels, due to shading or damage.

-C- Solar Pass-Through

A weather resistant junction box located underneath the right-side corner of the array receives the output of the optimizers and delivers it to the equipment in the Utility Room.

-D & E- Photovoltaic Inverter #1 & 2

The inverter changes (inverts) the DC power to 240VAC DC (Direct Current) solar power generation from the solar array:

#1 Solar Edge SE7600A-US, 34 panels, 40 Amps

#2 Solar Edge SE5000A-US, 22 panels, 26 Amps

-F- PV Upload Center

Power from the Inverters is delivered through individual circuit breakers to combine the output power of both Inverters and sends it to the Utility Service Entrance Panel (Meter) located at the front of the residence. This electricity is supplied directly to the main 400 Amp Service Buss.

-G- Production Meter

Indicates the amount of energy produced and sent up-line for consumption or distribution to the utility.

-H- AC Power Disconnect

Physical disconnect switch to fully remove the PV Solar System from the balance of the high voltage electrical distribution network

Service Disconnect Breakers

There are two circuit breakers that connect the PV Solar System to the Primary High Voltage System of the residence. Both of the breakers must be opened in order to safety work on the Primary High Voltage System (Utility Power).

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-A-



Solar Collectors

-B-



Power Optimizers

-C-



Solar Pass-Through

-D & E-



Photovoltaic Inverter #1 & 2

-F-



PV Upload Center

-G-



Production Meter

-H-



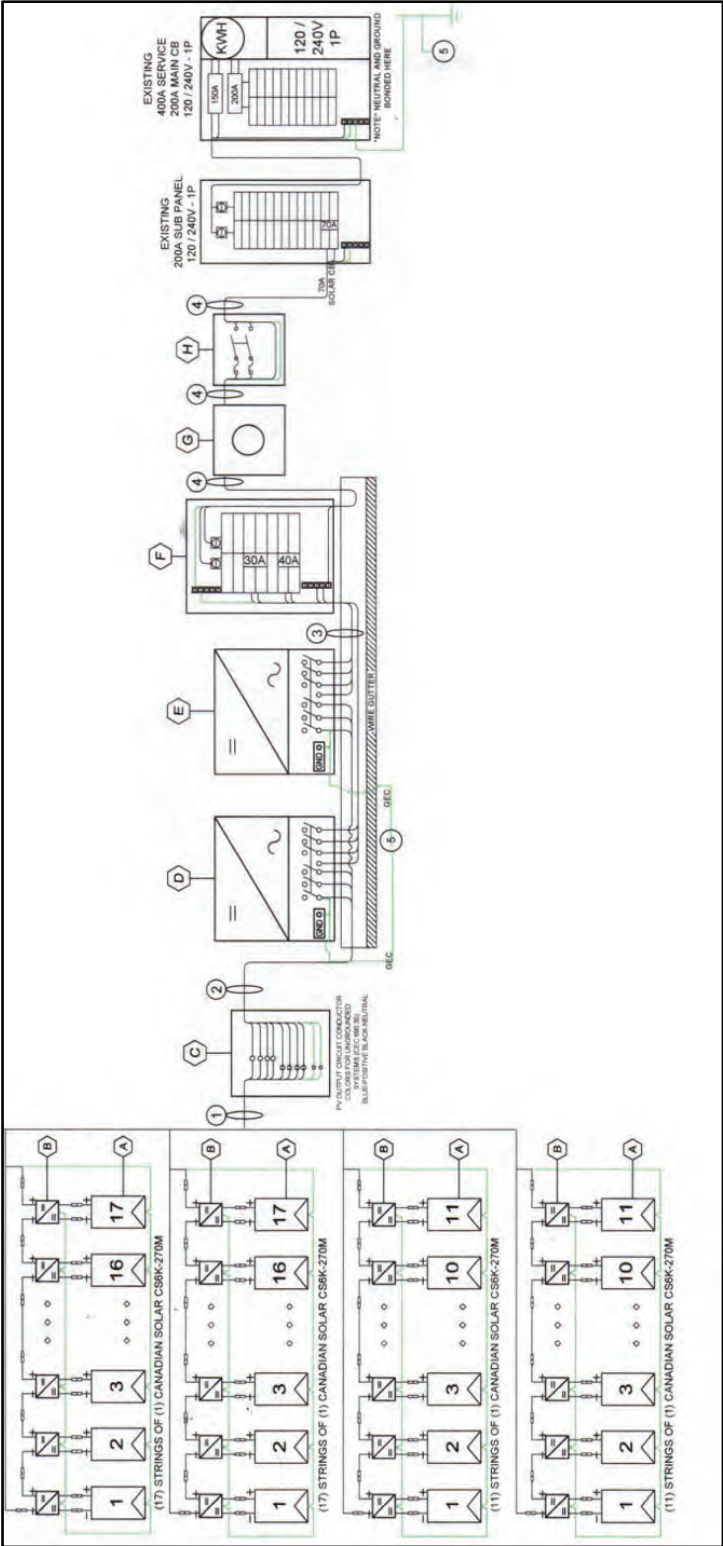
AC Power Disconnect



Service Disconnect Breakers

Photovoltaic System Schematic

- A. Solar Collectors
- B. Power Optimizers
- C. Solar Pass-Through
- D. Photovoltaic Inverter #1
- E. Photovoltaic Inverter #2
- F. PV Upload Center
- G. Production Meter
- H. AC Power Disconnect



Thermal Solar System: Potable Hot Water

This document is intended to familiarize the consumer with the proper installation, operation, and maintenance of their Thermal Solar System. This system is required to be installed by properly licensed solar or plumbing contractors in accordance with SRCC Standard OG-300 and all applicable national, state and local codes, ordinances and regulations governing solar water heating installations, as well as good trade practices. Failure to follow the procedures and practices described in this document may void the manufacturer's warranty for specific component parts. This information has been condensed from permit documents and is provided for general knowledge, not to instruct the user on service or maintenance procedures.

This section covers installation utilizing two solar collectors with two solar storage tanks with heat exchangers in a parallel configuration with a supplemental tankless water heater. Other installation designs and methods are possible, at the sole discretion of the user. Frequent reference is made throughout this manual to specific component parts. A technical description of each component and its function is found in at the end of this section.

System Description and Principle of Operation

System performance varies as a function of the household hot water load, including daily showers, laundry and kitchen uses, average ground water and ambient air temperatures, and, of course, the seasonal intensity of solar radiation. These variables, will determine how much energy and money your system will save on an annual basis. Your solar system is known as a "Forced Circulation / Closed Loop" system because it utilizes a mechanical pump to efficiently circulate the propylene glycol heat transfer fluid (HTF) throughout the system. The HTF protects the collector piping from freezing and inhibits scaling deposits that can reduce performance in "open-loop" systems utilizing potable water as the HTF. Proper application and maintenance of the HTF can protect your solar water heating system to minus 60° Fahrenheit!

The key components in the solar water heating system include the solar collectors, solar storage tanks with integral heat exchangers, circulation pump, differential temperature controller, expansion tanks, pressure gauges, mixing valve and the non-toxic propylene glycol heat transfer fluid (HTF). The solar collector is the heart of the system. Simply

stated, when the sun is shining, heat energy is absorbed by the solar collector's absorber plate and transferred to the HTF circulating through the solar collector. The system (PV powered) pump efficiently circulates this heated fluid through the collector piping and integral tank heat exchangers. The heat exchanger consists of copper tubing wrapped around the solar storage tank. As the HTF passes through the heat exchanger the heat in the fluid is transferred by conduction to the potable water in your solar storage tank. This process is continuously repeated during the average sunny day as the temperature in your solar storage tank rises.

The differential temperature controller is the brain of the system. The controller uses temperature sensors to constantly monitor the temperatures at the collectors and at the tanks. The controller automatically turns the pump on when useful heat is available at the collector and turns the pump off when there is insufficient solar heat available or the tank has reached maximum temperature. The system is designed to provide two modes of operation. The system will, 1) serve as a preheater to the tankless water heater, or 2) bypass the solar collector and run 100% on utility energy.

The Propylene Glycol HTF used in your system is chemically similar to antifreeze used in automobiles. It protects your solar system against freezing and since it has a higher boiling point than water, it can achieve a higher temperature without damaging expansion. Propylene glycol can degrade over time. The process of degradation is accelerated in presence of oxygen and/or heat. A preventive maintenance program should be established.

Installation Requirements - General

Shading Considerations

The collectors have been located in the optimal location at the time of installation. Trees in the area may or may not present a performance issue and should be trimmed if found to negatively impact performance. Due to the commercial nature of the solar panels, shading should not pose a problem.

Structural Considerations

The collectors are installed on the permanent concrete footings set on the property hillside. An independent soil engineering report has been completed which specifies the footing parameters.

Fluid Identity and Toxicity

The solar system uses a mixture of water and non-toxic buffered Propylene Glycol-based heat transfer fluid or HTF, this is heated in the collectors and indirectly heats the domestic hot water through the integral heat exchanger in the solar tank. Use of toxic heat transfer fluids is prohibited.

Maintenance and Servicing

Provide for clear access to the storage tank, pump, expansion tank, mixing valve and other key components. If a component in the potable water side of the system may require future service or maintenance, make the connections with unions or other approved methods.

Installation Requirements - Specific

Collector Orientation

The performance of solar water heating systems in the Northern Hemisphere is optimized when the collector is mounted facing True South. Performance, however, suffers very little when the collector is oriented no more than 45° East or West of True South.

Collector Tilt

Optimal annual efficiency is achieved by tilting the solar collector at an angle that equals your latitude plus an additional 10°. This tilt angle favors the lower winter sun when collector performance is at its lowest and minimizes overheating during the hottest summer months. To ensure proper water drainage from the glazing the collector must be sloped from horizontal. The minimum acceptable tilt angle from horizontal is 10°.

25005 Lewis and Clark Rd.	Latitude = 34.163386
Hidden Hills, CA 91302	Collector Tilt = 45°

Hardware

The most important structural consideration is to securely anchor the solar collector and the mounting hardware to the structural members of the rack with stainless steel hanger bolts, lag bolts, standoff mounts or other approved attachment methods. The solar collector shall be attached to the mounting hardware as detailed in the permit documents.

Bottom Clearance

The collector should be raised from the hillside surface to allow for rainwater and debris to pass under the collectors and for proper ventilation. There should be at least 12 inches of clearance between the hillside surface and the bottom of the collector rack framing.

Corrosion Prevention

When selecting mounting hardware and fasteners it is extremely important to avoid galvanic corrosion resulting from the direct contact of incompatible metals. Use of anodized aluminum mounting hardware and stainless-steel lag or hanger bolts, and fastening hardware is recommended.

Collector Loop Plumbing

The collector loop must be plumbed using copper or stainless-steel piping and copper, brass, bronze or stainless-steel fittings. Lead-free solder shall be used. Use of galvanized steel, CPVC, PVC, PEX or any other type of plastic pipe is prohibited. The collectors can produce temperatures that will melt plastic piping. The collector loop pipe sizing must be adequately sized to handle the design flow rates for the collector(s). $\frac{3}{4}$ " nominal diameter pipe is the minimum recommended for two collector systems. It may be necessary to increase the pipe size for longer pipe runs or reduce the pipe size for shorter runs or higher efficiency pumps. The pipe must be of a size where the velocity of the HTF does not exceed 4 feet per second. Hot HTF flowing at over feet per second in a pipe will erode the pipe and reduce system life.

The inside of pipes used in new solar installations can contain dirt, grease, solder flux or other impurities that over time affect the quality of the propylene glycol HTF. A thorough cleaning is required before charging the system with propylene glycol.

Pipe Insulation

The collector loop piping, plus any interconnecting hot water piping shall be well insulated with a high quality flexible closed cell insulation to minimize heat loss. The insulation shall have a maximum operating temperature of 220°F or higher. The wall thickness of the pipe insulation should not be less than $\frac{1}{2}$ ". Any above ground exterior pipe insulation is subject to UV degradation and must be jacketed, wrapped with aluminum foil tape, or painted with two coats of high quality water-based acrylic coating approved by the insulation manufacturer.

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WARNING: HOT PIPES MAY CAUSE BURNS IF TOUCHED. ENSURE THAT ALL PIPES AND FITTINGS ACCESSIBLE TO THE PUBLIC ARE WELL INSULATED. COMPONENTS ACCESSIBLE TO PUBLIC TRAFFIC MUST BE KEPT BELOW 140°F OR CLEARLY LABELLED WITH AN APPROPRIATE WARNING.

Differential Temperature Controller (DTC)

The Differential Temperature Controller continually monitors the water temperature in the tanks and the temperature of the HTF in the collectors. When the water temperature falls below the set value, it will automatically start the HTF Circulation Pump, provided that its temperature is high enough to heat the water.

The DTC must have a provision to manually turn the pump on and off (manual override) so that pump operation can be checked at any time and the pump can be manually stopped if required for maintenance or troubleshooting purposes.

Set the maximum tank temperature to the desired maximum temperature, this temperature must be lower than the rated maximum temperature of the tank and associated components. When the solar loop heats the tank to this temperature, the pump will shut off preventing further heat gains to the solar tank.

Collector Sensor Placement

The collector sensor shall be located on the solar loop return line as close to the collector as possible. Thoroughly wrap and weatherize the insulation with electrician's tape or insulation tape as provided by the manufacturer. Do not place cable in direct contact with piping.

Collector Grounding

An electrical potential between the collectors and ground may induce current in the collector sensor wire and the array must be grounded. Grounding shall be achieved by running a separate ground wire to the collectors from a copper ground rod.

Low Voltage Wiring

The low voltage wiring used to connect the sensor lead to the controller shall be a minimum 18 AWG, two conductors, stranded, PVC insulated, with a PVC UV rated jacket suitable for exterior use. The low voltage sensor wire must not be in direct contact with the pipe as the wire insulation may melt when in contact with a hot pipe.

Installing the Solar Tank

In plumbing the solar storage tank and expansion tanks make sure that all the components are accessible and easy to reach. Provide for clear access to key components. Make the connections with unions or other approved methods for devices that may require future service or maintenance. Place the solar tanks in the provided frames and secured to the concrete slab. Use appropriate earthquake straps to secure the tanks to the walls. Use only brass, copper and stainless-steel fittings in plumbing the solar storage tank and expansion tank. The use of galvanized fittings, CPVC, PVC or plastic pipe is prohibited. Di-electric nipples may be required. Hard copper connections to the city cold water supply line and the home hot water feed lines are recommended. Tank plumbing is required to provide for the isolation of the solar storage tank from the city cold water supply line by means of an isolating ball valve.

Line Thermometers

Line thermometers shall be installed in the collector supply and return lines to allow for a simple confirmation of proper system operation. On a sunny day the HTF return line should be approximately 5°F – 12°F warmer than the HTF in the collector supply line. Compare the temperature readings in the line thermometers.

Thermostatic Mixing Valve

A high quality thermostatic mixing valve is a required component in all OG-300 certified systems and should be plumbed in line with brass union connections for ease of future repair or replacement. The temperatures generated by your system will vary throughout the year. Your pre-heated water temperature will be hottest in the spring and summer months while cooler temperatures are to be expected from November through March. On sunny days the end of day solar tank temperatures may range between 110°F to 180°F depending upon the season and hot water demand. The mixing valve blends the hot and cold-water supplies to deliver hot water to your fixtures at a safe, controlled temperature.

WARNING: SCALDING CAN OCCUR WITHIN FIVE SECONDS WHEN WATER TEMPERATURES APPROACH 140°F. THE MIXING VALVE SHALL BE ADJUSTED BY YOUR CONTRACTOR TO PROVIDE WATER TO YOUR FIXTURES AT NO MORE THAN 122°F. USE A DIGITAL COOKING THERMOMETER HELD UNDER HOT RUNNING WATER TO OCCASIONALLY CONFIRM YOUR ACTUAL TEMPERATURE.

Tank Sensor Placement

Tank sensor shall have good thermal contact with the tank wall in order to accurately measure the temperature of the water at the bottom of the tank. It is recommended that the sensor be installed in a brass or copper thermal well screwed into the lower sensor port in the tank. Install the sensor in either of the two tanks or install two sensors and select on using a DPDT toggle switch. The use of a toggle switch will enable isolating one of the two tanks for maintenance.

Tank Insulation

The heat exchanger tanks have an insulation value of approximately R-17, no additional insulation is required.

Expansion Tank

The collector loop expansion tank shall be rated for Propylene Glycol based HTF and rated to operate up to 225°F and at a pressure not less than the discharge pressure setting of the pressure relief valve in the collector loop. The collector loop expansion tank should be sized so that the acceptance volume of the expansion tank exceeds the volume of fluid in the collector(s); this will allow the entire contents of the collectors to boil without resulting in the pressure relief valve discharging (this is sometimes referred to as a "steam back" system).

In addition to the collector loop expansion tank a POTABLE WATER EXPANSION TANK IS REQUIRED by the plumbing code on the potable piping to the solar tank.

Electrical and Wiring Requirements

The installation requires one 115 VAC 20A outlet to be installed near the solar storage tank. Plug the controller into the outlet. The circulation pump line cord is plugged into the receptacle on the controller

Heat Transfer Fluid (HTF)

The HTF must be a non-toxic fluid that meets FDA Generally Recognized as safe (GRAS) Classification. This requirement can be met by using a proprietary inhibited Propylene Glycol HTF. The preferred HTF material is DowFrost HD manufactured by Dow Chemical.

System Startup Procedures

Your solar water heating system must be charged, and the HTF quality maintained, by an experienced contractor. If the system is drained during the winter, or you notice a significant drop in collector loop pressure, contact your installation contractor immediately for service. The Propylene Glycol HTF provides the freeze protection for your system and must be properly maintained.

When the solar loop has been fully charged and the pressure is stabilized, set the differential controller to the "Automatic" setting. This will activate your circulating pump when the temperature differential between collectors and tanks is sufficient to provide useful heat. The controller will switch the pump on when the differential is 16°F. The controller will switch the pump back off when the differential falls to 8°F. The controller also allows you to limit the finished solar storage tank temperature if desired. The controller maximum tank default setting is 140°F; this setting can be adjusted as described in the controller's manual.

Modes of Operation (MO)

Your solar water heating system can, #1) serve as a pre-heater to your conventional water heater adding solar energy when and as available, #2) completely bypass the solar collector loop and solar storage tank and run 100% on utility energy when the solar system is shut down for maintenance, or #3) isolate one of the two solar tanks for maintenance while keeping the other solar tank in use. Adjust the valve settings in accordance with the schematic.

WARNING: IT IS HIGHLY RECOMMENDED THAT ONLY A LICENSED PROFESSIONAL MAKE ALL, BUT EMERGENCY VALVE SETTINGS AS IMPROPER SETTINGS MAY REDUCE SYSTEM FUNCTIONALITY, DAMAGE EQUIPMENT OR CREATE DANGEROUS CONDITIONS.

NOTICE: THE ACCOMPANYING SCHEMATIC IDENTIFIES THE VARIOUS PLUMBING COMPONENTS BY ASSIGNING EITHER A NUMBER OR LETTER TO THEM. THESE IDENTIFIERS ARE REFERRED TO IN THE INSTRUCTIONS BELOW. IT IS IMPORTANT TO UNDERSTAND THAT THE SCHEMATIC IS NOT NECESSARILY DRAWN TO PHYSICALLY MATCH A SPECIFIC INSTALLATION, HOWEVER, THE COMPONENTS REMAIN THE SAME. THE INSTALLER SHOULD LABEL ALL COMPONENTS TO MATCH THE SCHEMATIC.

MO #1 - Solar Preheat

This is the "Normal" position. Set the controller thermostat to the highest acceptable temperature setting. If the solar heated water leaving the tank is warmer than the set point of the tankless water heater, the gas heating elements will not come on. If the water temperature is cooler, the tankless water heater will instantly raise the temperature to the desired level. If the water temperature reaching the Mixing Valve is higher than its set point, cold water will mix with hot to lower the temperature.

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NOTE: VALVES PICTURED IN THE PLUMBING SCHEMATIC REPRESENT THE MO #1 SETTINGS. ADJUST THE VALVE SETTINGS IN ACCORDANCE WITH THE IMAGES IN THE PLUMBING SCHEMATIC.

MO #2 - 100% Solar Bypass

NOTE: THREE WATER VALVES FOR THE MUST BE ADJUSTED IN ORDER TO DISCONNECT THE WATER SUPPLY TO THE SOLAR WATER HEATING SYSTEM. PLEASE REFER TO THE PLUMBING SCHEMATIC.

In this mode of operation, you must turn off the circulation pump. To turn the pump off, change the operational setting from automatic to "off". Failure to turn off the pump can quickly damage the pump motor, shaft, bearings or impeller.

As the HTF charge remains in the solar loop, this setting should only be used in the event of emergencies or maintenance. Prolonged periods of solar shut down requires specific shut down procedures.

To Bypass All Solar Heating:

1. Close the Cold-Water Supply valve in the Utility Room. See Figure 1, #7
2. Close the Solar Pre-Heat Water Supply valve in the Garage. See Figure 2, #4
3. Open the Solar Bypass Valve in the Garage. See Figure 2, #2

Cold city water is now fed directly into the Tankless Water Heater, the Mixing Valve is still on-line and will continue to protect users from scalding. Reverse the setting to bring the Solar Pre-Heat into service.

MO #3 - Single Tank Isolation

Single tank isolation is a key feature in maintaining a constant supply of solar generated hot water. While the primary purpose of a dual-heater system is increased capacity, one of the windfalls is that when maintenance is required, for maintenance such as replacing Anode Rods or in the event of tank leaks, the entire system does not need to be shut down. Simply bypass the tank at issue and return it to service when maintenance is complete. Bypassing only one tank does not necessitate draining the Glycol system or turning off the Controller as it will continue functioning normally in the remaining heater.

Please note that, as mentioned earlier, there are other and less costly ways to plumb your system. If not having a redundant system, is important to you, your plumber can install the tanks in a "series" configuration rather than the "parallel" configuration that enables isolating one tank from the other.

NOTE: THREE WATER VALVES MUST BE ADJUSTED IN ORDER TO DISCONNECT THE WATER SUPPLY TO THE SOLAR WATER HEATING SYSTEM. TWO VALVES MUST BE ADJUSTED TO BYPASS THE HTF LOOP. PLEASE REFER TO THE PLUMBING SCHEMATIC.

To Bypass Solar Heater #1:

1. Close the two Supply Disconnect valves. See Figure 1, #9;
2. Open Tank Bypass valve. See Figure 1, #8;
3. Close both HTF Disconnect valves. See Figure 1, #14;

Tank #1 is now out of service. To restore service, return the valves to their original positions.

To Bypass Solar Heater #2:

1. Close the two Supply Disconnect Valves. See Figure 1, #11;
2. Open Tank Bypass valve. See Figure 1, #10;
3. Close both HTF Disconnect valves. See Figure 1, #15;

Tank #2 is now out of service. To restore service, return the valves to their original positions.

Emergency HTF Shutdown Procedures

Each Solar Heater's HTF loop can be isolated from total loop, if you find an HTF leak, by closing the HTF valves. See Figure 1: #14, Heat Exchanger #1 or #15, Heat Exchanger #2. Close either these valves and contact your installation contractor.

CAUTION: BYPASS ONLY ONE OF THE TWO TANKS AT A TIME USING THIS PROCEDURE. POTABLE WATER WILL CONTINUE TO FLOW THROUGH BOTH SOLAR TANKS EXCEPT THAT THE ONE DISCONNECTED WILL ONLY FUNCTION AS A STORAGE TANK. TO COMPLETELY SHUT DOWN THE HTF SYSTEM, PLEASE SEE MO #2 - 100% SOLAR BYPASS.

Long-Term Shutdown Procedures

Solar water heating systems can reach very high temperatures when there is no daily hot water usage. If a short summer vacation is planned, the differential temperature controller has a vacation function which, when activated, will dissipate heat at night. See the control manual to activate this function. Remember to deactivate this function upon your return!

During extended summertime non-usage of 4 weeks or more, it is advisable to either cover the solar collectors with an opaque material or to manually drain the collector loop HTF. It is recommended that you cover the collectors using an appropriately secured, re-usable and rugged, $\frac{3}{4}$ " exterior-grade piece of plywood. If you choose to drain the HTF in the collector loop, have a licensed contractor perform the work.

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Interestingly enough, due to the high-performance nature of your collectors, even if covered as suggested, it is possible that under very hot conditions the array will get hot enough to activate the HTF pump. For this reason, it is recommended to switch the controller to Vacation mode when covering your array.

Maintenance and Troubleshooting

The following procedures are intended to optimize the performance of your solar water heating system and to extend the life of the primary components. It is recommended to have your installer or licensed professional perform maintenance and repairs.

Heat Transfer Fluid (HTF)

It is extremely important to monitor the quality of the heat transfer fluid (HTF) on a periodic basis. The chemical composition of the HTF may change over time. A high-quality Propylene Glycol HTF capable of operating at high temperatures should be used. The water used to dilute the HTF is equally important, water containing salts, acids, calcium or other potential precipitates should not be used to dilute the HTF initially or during subsequent re-charges; de-ionized water is recommended. The recommended propylene glycol HTF is Dow Chemical "DowFrost HD". Technical and engineering data for DowFrost HD is available at www.Dow.com.

Sacrificial Anode Rod

The Sacrificial Anode Rods installed in your solar storage tanks, Figure 1, Y, are typically constructed from magnesium and are installed in "glass lined" water heaters and storage tanks to inhibit corrosion. As the name implies, the "sacrificial" anode rod is consumed so that the tank lining is not. At a certain point in this process, the anode rod is no longer effective, and the corrosive processes begin to eat away the tank's glass lining. By changing the anode rod after the fifth year of system operation, and every three to five years thereafter, it is possible to extend the life of the solar storage tank. If not changed, in time the solar storage tank, like any other gas or electric water heater, will begin to leak. The process is not reversible, and the tank must be replaced. System temperatures and water quality affect the rate at which the anode rod is consumed. In general, the higher the average system temperature, the faster the rate of corrosion.

Flushing the Potable Water Storage Tank

The hot water storage tanks in the Solar Heaters should be flushed annually to minimize sediment build-up on the bottom of the tank. If you live in an area with high mineral content in your water, flush the tank on a semi-annual basis. It is recommended that the tanks be flushed by a licensed professional.

To Drain a Potable Water Storage Tank

1. Isolate the Storage Tank to be drained by following the instructions under MO #3 - Single Tank Isolation;
2. Attach a length of high-temperature garden hose to the Flush Valve and place it into the floor drain. See Figure 1, #12 or #13;

CAUTION: DISCHARGE WATER MAY BE EXTREMELY HOT!

3. Open the TP valve near the top of the tank. See Figure 1, H or J;
4. Open the Flush valve on the bottom of the storage tank and drain a sufficient volume of water to remove the sediment. See Figure 1, #12 or #13;
5. For heavy deposits, as the tank empties, close the T&P valve and open the Water Supply valve fully and briefly to agitate the deposits;
6. When finished, return the valves to their original positions in the reverse order;
7. Make sure the tank is completely full of water and, carefully, partially open the T&P valve to eliminate air from the tank;
8. Open any hot water faucet on the second floor of the residence to bleed any remaining air in the lines.

Collector Cleaning

Be sure the collector glass is cool before cleaning. When the collector glass is clean it allows the collector to achieve a high level of thermal performance.

Pipe Insulation Maintenance

Check the exterior pipe insulation annually and patch or repair any exposed surfaces or degraded areas. Repaint as necessary with high quality exterior latex paint.

Broken Collector Glass

In the unusual instance of collector glass breakage, the glass should be replaced immediately. This will reduce the likelihood of water accumulating inside the collector and deteriorating the insulation. Contact your installation contractor.

Leaks

If you detect an HTF or water leak, or the collector loop pressure drops unexpectedly, contact your installation contractor immediately to diagnose the problem and recharge the system.

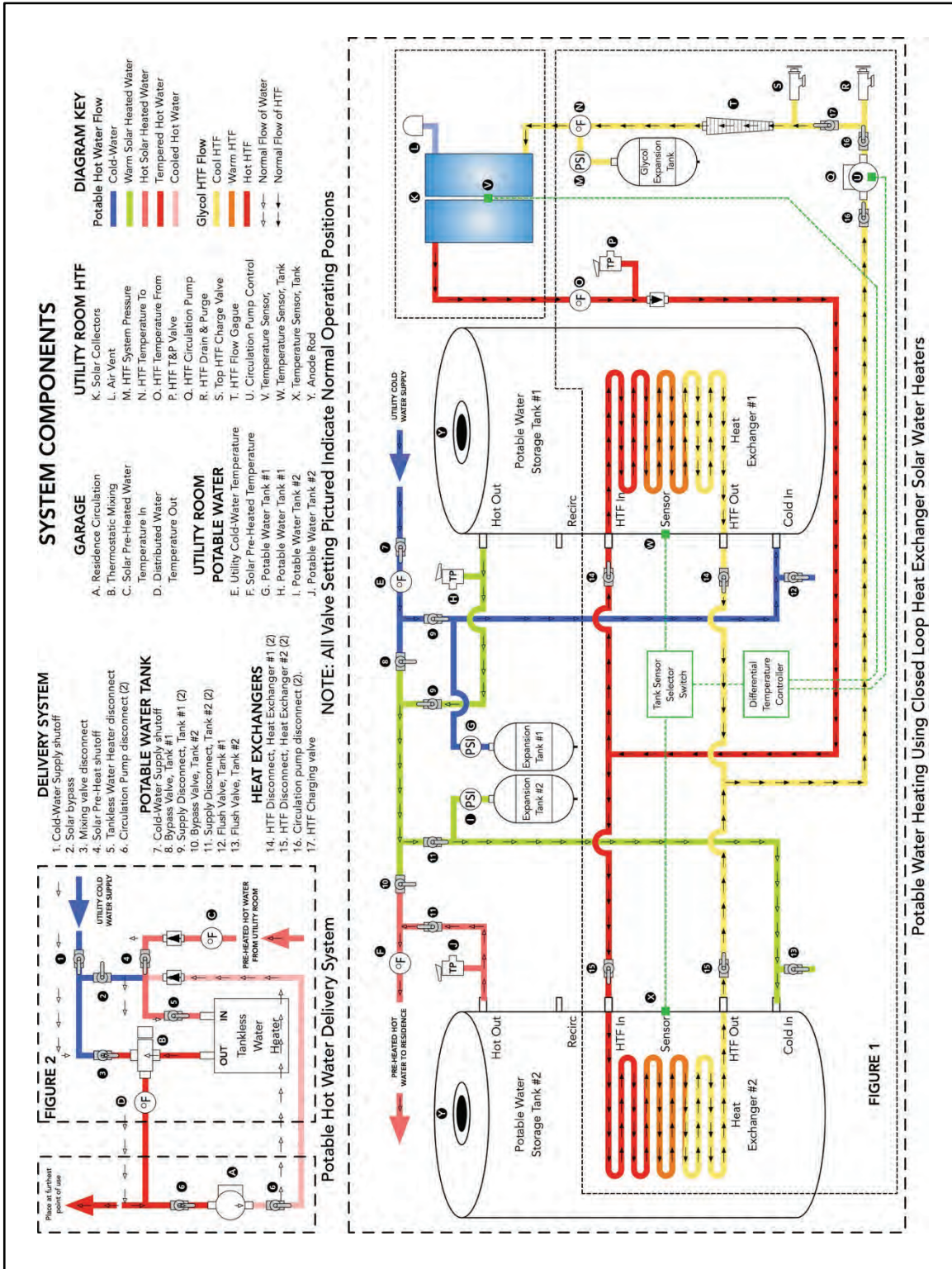
Overnight Water Cooling

If a full tank of hot water is cold in the morning, the check valve, Figure 1, U, may not be seating correctly and should be cleaned or replaced. Also make sure that the circulating pump is not running at night. Note that in a two-tank system, night time heat loss will be harder to detect, especially if you are operating in the solar preheat mode. Check the line thermometers in the collector loop piping to detect night thermosiphoning.

Estimated System Life

You can expect a long useful life from the primary components in your solar water heating system by adhering to the routine service and maintenance recommendations. The SunUp solar collectors have a design life of twenty-five to thirty years. The HTF must be maintained as specified in this manual to maximize collector life. The solar storage tank should last twelve to twenty years in most areas, provided the anode rod is periodically replaced. The circulating pump and differential control should last 10 to 15 years before needing to be replaced or upgraded. These component design values represent average figures for system components installed in the United States. The life of your components may vary. To obtain service, please contact your installation contractor or a licensed plumber.

Potable Hot Water System Schematic



System Operating Parameters

Collector Loop Pressure

The pressure in the collector loop will normally increase as the HTF heats up and expands during the day and cools down and contracts at night. The amount of pressure variation will depend on the degree of temperature swings and the size of the expansion tank. Larger expansion tanks allow more fluid expansion and contraction with less pressure variation.

Design setting:	46 PSI
Typical recommended initial system charge:	25 PSI – 60 PSIG
Normal operating pressure:	20 PSI – 100 PSIG

Operating pressures below the normal operating pressure may indicate a system leak; air venting or that the system was not sufficiently charged installation. It is not always possible to expel all the air from the system at the time of initial charge, small bubbles entrapped in the fluid will take a few days to a week to collect so that the air can be vented. If system pressure drops below normal operating pressure after air has been vented, the installer must top off the HTF and re-pressurize the system.

Temperature Differential

The temperature difference between the collector sensor and the solar tank sensor is a good indicator that the system is operating correctly. During the middle of the day, when the pump is running the normal operating differential will be 4°F – 40°F. If the solar tank reaches its maximum temperature the pump will stop. If this happens during the middle of the day, the collector temperature will rise rapidly while the tank temperature will remain static. In this case a temperature differential of up to 300°F is not unusual.

HTF Acidity

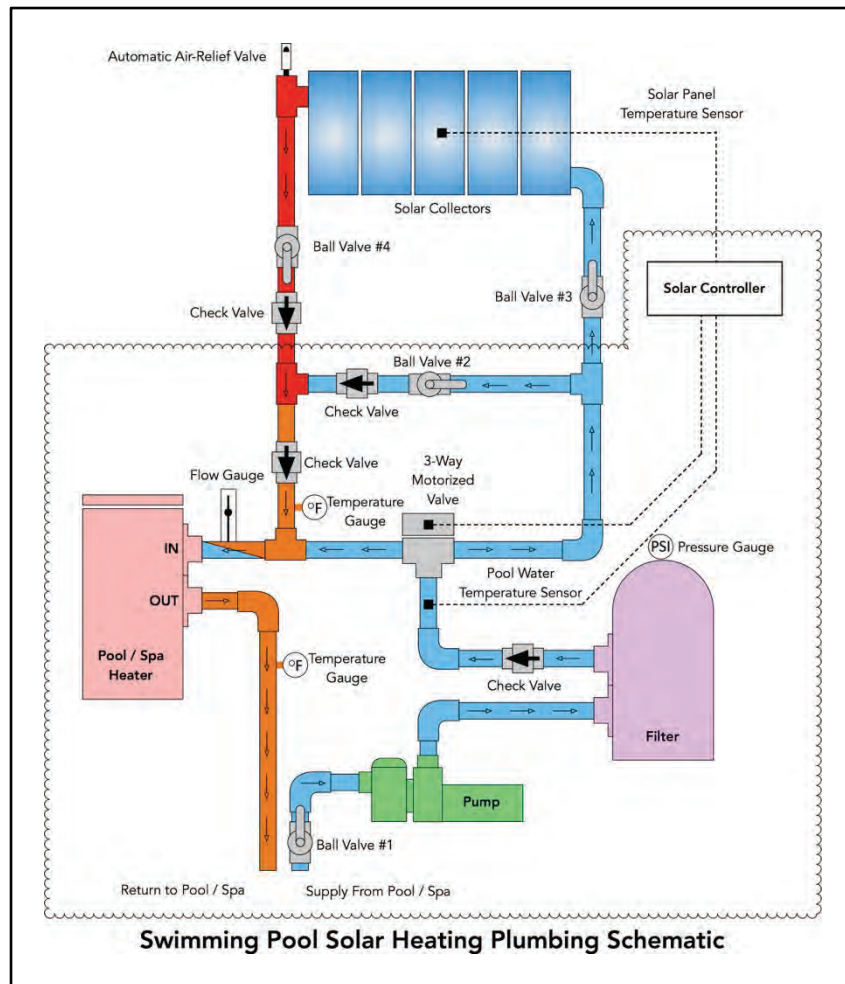
The propylene glycol HTF should be slightly alkaline at all times, the pH can be checked periodically by bleeding a few drops from the collector loop and testing with pH strip paper or other pH tester. Normal operating pH: 8 - 10 Acidic HTF will attack metals in the collector loop and result in decreased system life and poor operation. If the pH of the HTF falls outside the normal range, contact your installer, drain the system and replace the HTF.

Swimming Pool and Spa Solar Heating

The Swimming Pool and Spa array of seven collectors is connected to the pool equipment is an “open loop” design, meaning that the pool water is pumped into the collectors and returned to the heater where, if necessary, the temperature is increased. The use of glazed collectors is unique to residential pool heating which ordinarily utilize un-glazed, plastic collectors of far less efficiency. Because of this added efficiency, the system has the capacity to extend the swimming season by a factor of months. If this energy is directed solely to the spa, its temperature can be at, or close to, the desired temperature nearly all of the time. This makes reaching the desired temperature faster and more economically than by using the heater alone. Since the solar heating occurs during the day, the pumps operate on PV solar power.

Hot water is automatically sent to the Solar Collectors whenever there is ample sun to heat the water and the Pentair Controller is set to Solar Heating.

To enable water to be sent to the collectors, Open Ball Valves (BV) #3 and #4. When isolating the collectors, Close BV#3. Closing BV#4 is optional and prevents drainage from the collectors during servicing. In the event that water returning to the pool is too hot, adjust BV#2 to mix cooler pool water with the water returning from the collectors.



Thermal Solar Components

Air Vent

Relieve internal trapped air from pipes, may be installed to due to certain piping configurations.

Anode Rod

The “sacrificial” anode rod is installed in your solar storage tank to prevent corrosion. Anode rods have a finite life and require periodic replacement. Determine a replacement schedule with your installation contractor.

Ball Valves

Ball valves are used to allow (open) or prevent (close) fluid flow. The purpose of each valve in your solar system is identified in this document

Charge Valve

Used to charge the collector loop with Propylene Glycol and also to eliminate air from the system.

Check Valve

Check valves are also referred to as one-way valves or non-return valves. A critical Check Valve is installed in the collector loop to stop or minimize convective evening heat loss in the system. The heat in the solar storage tank will rise through the collector loop piping in the evening into the much cooler solar collector and dissipate heat unless prevented from doing so by a check valve.

Cold Water Dip Tube

Forces incoming city cold water to the bottom of the solar storage tank to prevent mixing with the warm water at the top of the tank.

Collector Sensor

Wired to the system controller. Works in conjunction with the tank sensor to automatically turn your circulating pump on and off at preset temperature differentials.

Differential Temperature Controller

Automatically turns the circulating pump on when there is sufficient heat for solar operation or to reduce temperature build up in the solar storage tanks.

Drain/Purge Valve

Used to charge the collector loop with Propylene Glycol, purge air from the loop and drain the heat exchange fluid.

Expansion Tanks

Pre-charged with air to allow for the expansion and contraction of water and HTF or potable water as it heats and cools, thus maintaining pressure within the design parameters.

Flush Valve

Used to drain the solar storage tank and to flush sediment from the tank on an annual basis.

Glycol (HTF) Circulating Pump

Circulates the HTF through the collector loop.

Heat Exchanger

Transfers heat from the solar collector loop to the potable water in the solar storage tank. The heat exchanger is double walled and vented. If a leak in the heat exchanger piping occurs there is no possibility that the potable water in your solar storage tank can be contaminated with the glycol HTF.

Heat Transfer Fluid (HTF)

The Heat Transfer Fluid shall be buffered Propylene Glycol and shall have a maximum operating temperature of no less than 280° F.

Hot Water Circulating Pump

Circulates hot water within the residence to maintain hot water temperatures at the desired temperature.

Line Thermometers

Used to determine proper system operation. Line thermometers will show an approximate HTF temperature difference of between 5°F and 12°F from the collector supply to the return lines on sunny days.

Pressure Gauge

Indicates the pressure in the charged Propylene Glycol collector loop or the Potable Water System.

Pressure Relief Valves (PRV)

Will discharge HTF from the collector closed loop at the valve pressure setting. If this valve opens and HTF fluid is expelled contact your contractor immediately. The PRV protects the collector and all components in the collector loop from pressures in excess of the PRV pressure setting.

WARNING: THE PRESSURE RELIEF VALVE SETTING MUST NOT BE HIGHER THAN THE MAXIMUM WORKING PRESSURE OF THE COMPONENTS IN THE COLLECTOR LOOP.

Tank Temperature Sensors

Wired to your controller. Works in conjunction with the collector sensor to turn your circulating pump on and off at preset temperature differentials.

Tank Thermometers

The tank thermometers will indicate the temperature of the water leaving the Storage Tanks, arriving at the Tankless Water Heater and after the Mixing Valve feeding your fixtures.

Tankless Water Heater

The auxiliary water heater is adequately sized to meet the full hot water load at the residence without the solar pre-heat.

Temperature and Pressure Relief Valve (T&P)

Universally required by the plumbing code on water heaters. Will automatically release and dump water at either 150 PSI of pressure or 210° F in temperature.

Thermostatic Mixing Valve

Automatically blends hot water from the solar storage tank with incoming city cold water to an acceptable set point. A mixing valve must be installed in your solar water heating system.

Solar Collectors

Absorbs the sun's heat energy and transfers this heat to the HTF or pool water circulating through the collectors.

Emergency Back-up Generator

An automatic backup generator is a backup electrical system that operates whether you are home or away. Within seconds of an outage, it automatically supplies power directly to your home's main electrical circuit panel. After utility power returns, the generator shuts itself off and waits for the next outage. It operates on natural gas with a liquid propane gas auxiliary fuel.

Generac has been designing and manufacturing backup power generators for residential, commercial and industrial applications since 1959. They have grown to be the world's largest provider of residential backup generators, selling five times as many generators as all of our competitors combined.

All generators require periodic oil and filter changes to ensure maximum performance for years of reliable service. Scheduled maintenance kits are available, and many Generac authorized dealers offer annual maintenance contracts for a worry-free ownership experience. It is recommended you have your unit serviced every 6 months by an authorized independent service dealer.

FOLLOW THESE TIPS FOR OPTIMAL EFFICIENCY WHEN USING YOUR GENERATOR

Environmental

1. Verify that the generator is not placed in direct path of irrigation systems.
2. Verify the generator has proper clearance of 18" from the back and 36" on sides.
3. Verify the unit mounting surface is in good condition.

Enclosure

1. Verify all foreign material is removed from inside and outside the enclosure.
2. Verify the air intakes are clean and free of debris.

Control Panel

1. Verify the control panel fuse has not opened.

Battery

1. Verify the battery terminals are clean and tight.

Fuel System

2. Check all fuel system fittings to ensure they are tight.
3. Verify the fuel system is clear of debris and corrosion.

Engine System

1. Verify engine oil level.
2. Inspect the air filter.

Smart Home

A Smart Home is one that provides its owners comfort, security, energy efficiency (low operating costs) and convenience at all times, regardless of whether anyone is home. "Smart Home" is the term commonly used to define a residence that has appliances, lighting, heating, air conditioning, TVs, computers, entertainment audio & video systems, security, and camera systems that are capable of communicating with one another and can be controlled remotely by a time schedule, from any room in the home, by pre-programmed "scenes" as well as remotely from any location in the world by phone or internet.

Installation of smart products has provided this home and its occupants various benefits that technology and personal computing have brought to us over the past 30 years — convenience and savings of time, money and energy. Most "Smart" products are available use a proprietary protocol, the means of communication between themselves, and are compatible with the internet, phone, and cell phones. Products that use the same protocol offer the ability to add products and hardware at the homeowner's own pace and budget. This system is designed grow to meet the needs of a changing family as time goes on. All of these products can be selected from various manufacturers, preventing an expensive obsolescence or non-competitive pricing.

More and more people are becoming aware of the ability to make their homes truly smart — and green — by utilizing home controllers integrated with home sub-systems to increase savings by controlling lighting, window coverings, HVAC, irrigation and by monitoring usage. Many home controllers have built-in monitoring systems whereby they calculate and log usage by all connected devices, giving the home owner heightened awareness and the knowledge to make changes as necessary. These systems can even be accessed over the Internet from anywhere in the world, so the homeowner can adjust consumption anytime, anywhere.

All hardware installed in this home has been selected based on the above considerations and automation options were selected whenever such options were available. The following is a listing of the installed devices. All devices can be connected to popular user interfaces such as Amazon Echo, Google Voice, Apple HomeKit, and others or to

Manufacturer's Apps loaded on a Tablet. Other costlier proprietary interfaces, such as Control4 Systems, may also be configured, if desired. This is a list of installed devices or types only, please refer to the Low Voltage and Data Summary for information regarding pre-wired devices.

Lutron Radio RA2 Light Switches and Dimmers

With over 50 Radio RA 2 devices installed, you can control lights, shades, and appliances from wall-mounted, tabletop, or handheld controls (not provided), in a specific room—or remotely from another room—or even from outside your home. You can also incorporate voice and audio control into your system with other connected home products. Conveniently control and monitor your home's lights and shades as you approach your home, from anywhere inside your home, or even while away. The system's two-way communication lets you know if lights are left on or if the shades are open, even when you can't see the areas being controlled. RA2 devices require programming by an authorized Lutron installer. Once programmed, the user can make personalized adjustments.

Honeywell Lyric T5 Wi-Fi Thermostats

The Lyric T5 is fully compatible with Apple HomeKit, Amazon Echo and other ecosystems and can be programmed based on schedule or operated via smart phone or tablet. Multiple means of accessibility ensure maximum comfort in and away from home. The Lyric T5 Wi-Fi Thermostat allows owners instant control from anywhere. Lyric uses geofencing technology to keep track of your smart phone's location. So, it knows when you're on your way home and makes sure your home is exactly how you like it when you arrive.

Nest Protect Smoke & Carbon Monoxide (CO) Alarm

The Nest Protect smoke & carbon monoxide (CO) alarm does much more than just sound an alarm when there's danger in your home. It speaks to you, telling you where the danger is and what the problem is. And before it sounds a piercing alarm, Nest Protect gives you a friendly Heads-Up warning that you can silence with a wave of your hand. It integrates with your mobile devices and even messages you if the batteries run low, avoiding that all-too-familiar midnight low-battery chirp. The Nest app on iOS, Android and the Web can be used to set up, control, and get alerts.

Window Coverings

All of the Hunter Douglas roller shades and Master Bedroom curtains are operated by wireless controls. Each set of windows has a dedicated hand-held remote controller. Additionally, all automated window coverings have the capability of being added to numerous wireless hubs and be included in pre-programmed scenes.

Onkyo A/V Receiver

Bluetooth, Wi-Fi, Airplay and Google Cast with Internet Music Subscription Services, features RS232, IR Input and 12 V Trigger Out.

eero Mesh Network

Mesh networks enable multiple routers to work in unison to deliver hyper-fast, super-stable Wi-Fi. Each device in the mesh network connects to the other devices, rather than each device connecting to your Internet Service Provider. Unlike a typical home network, which is built around a centralized hub, a mesh network consists of multiple routers communicating with each other. A mesh network has a greater range and is much faster and stronger than your normal Wi-Fi network. The range of your mesh network can be extended simply by adding nodes.

Most routers are flashed with software right before they're boxed at the factory. That means they typically don't see another software update the entire time they are in your home. The eero automatically pushes updates as they're available. This means your network will always have the latest software, features, and security. The connection between eeros and the cloud is completely secure using Transport Layer Security (TLS). This ensures that no third-party can listen to or intercept messages in transit between a server and that device. eero only supports WPA2 PSK AES network security, the most secure standard currently available and doesn't support WEP, WPA, or WPS, as these protocols are known to be insecure.

SolarEdge PV Inverters

The SolarEdge PV inverter combines sophisticated digital control technology with efficient power conversion architecture to achieve superior solar power harvesting and best-in-class reliability. A proprietary data monitoring receiver has been integrated into the inverter and aggregates the power optimizer performance data from each PV module. This data can be transmitted to the web and accessed via the SolarEdge monitoring platform for performance analysis and fault detection.

Pentair IntelliTouch Swimming Pool Control System

The IntelliTouch control system with ScreenLogic2 Interface allows you to control the key functions of a pool or spa using controllers such as an iPad®, iPhone®, iPod touch® mobile digital device, Android® device and PC or Mac® computers. You can also monitor and control your pool and spa from an Apple Watch® wrist wearable device. Or having Alexa™ activate your spa or water feature circuits or tell you the status of your pool with a simple voice command from your Amazon Echo® device.

Rain Bird ESP-Me Irrigation Controller

Access and control your irrigation system from anywhere, anytime, with the free mobile app for iPhone and Android devices Enables Wi-Fi access and control of the ESP-Me. Use your tablet or mobile device to set, monitor and make changes to watering schedules. Advanced mobile app provides convenient access, real-time alerts and water management tools. Save money and reduce water usage by as much as 30% with automatic weather adjustment

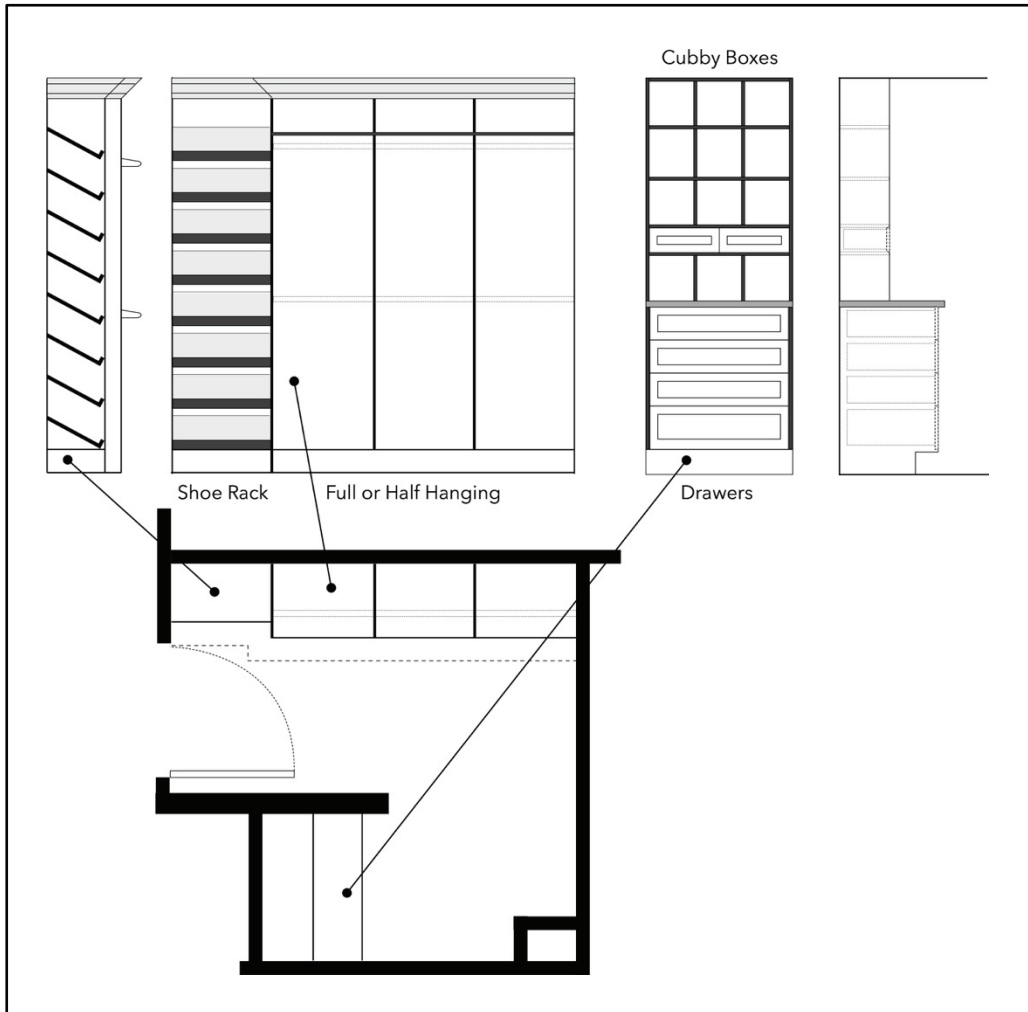
Lift Master 8500 Elite Wall Mount Garage Door Opener with MyQ®

This sleek, space saving design mounts on the wall beside the garage door, freeing up ceiling space and is equipped with Security+ 2.0® and MyQ® Technology. Receive alerts and control the opener from anywhere when paired with the MyQ Internet Gateway (828LM sold separately). Timer-To-Close automatically closes the door after a preset amount of time. Link MyQ to partners apps to provide more enhanced garage control options such as voice control and geofence closing. MyQ app on iOS and Android.

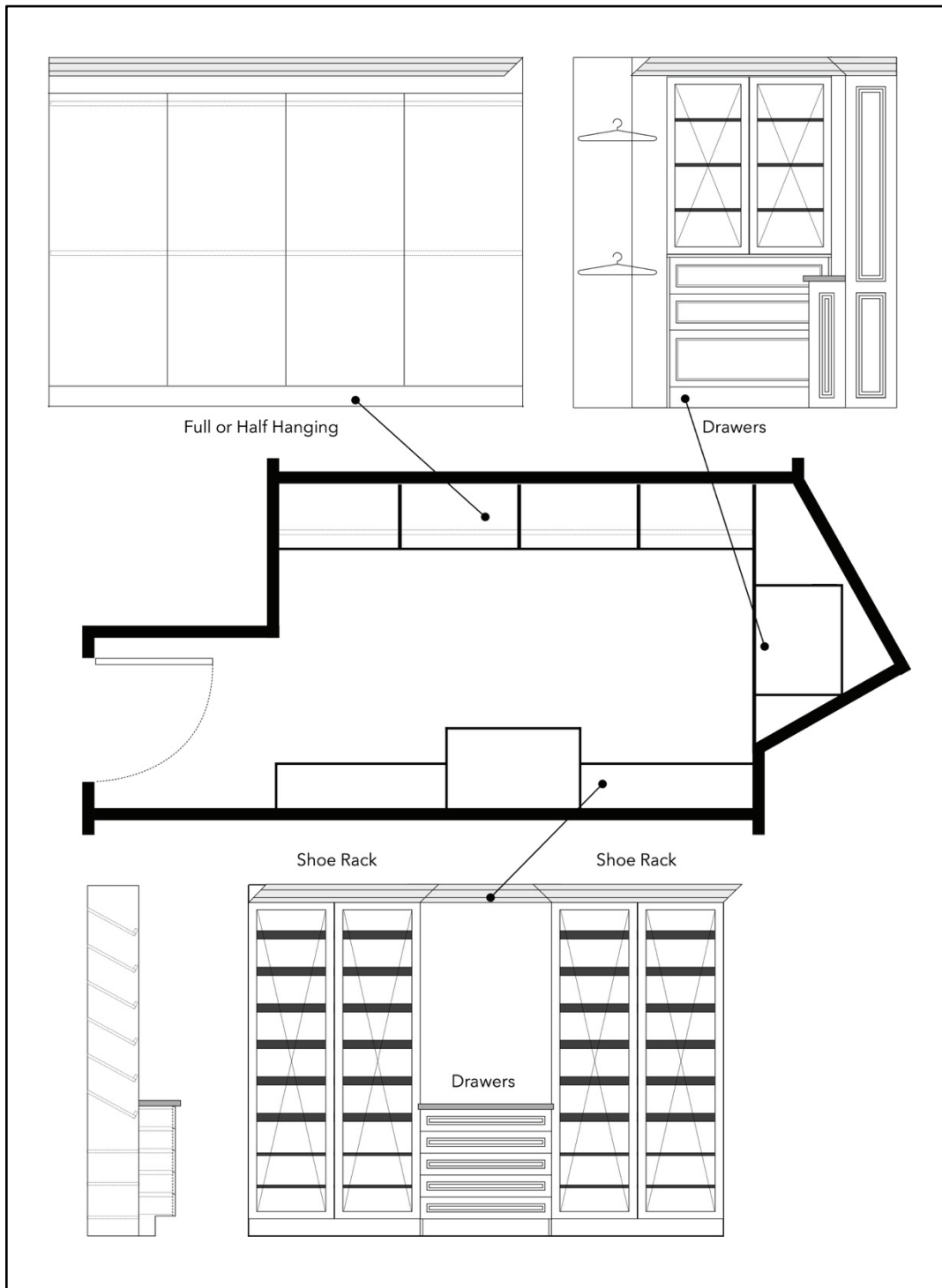
Closet Options

Due to the fact that there are far too many design options for closets, depending on one's individual taste, needs and preferences, closet poles, shelves and drawers have not been included in construction. The lack of simple poles and shelves is in deference to the probability that such an installation would only be an impediment to the ultimate design. This, however, does not mean that no consideration was given to potential layouts and features. All closets use common layout spacing and parameters. The following are, in the opinion of the author, the most logical and efficient basic layouts using these specifications. Using these designs places the customization focus on materials, style and custom features.

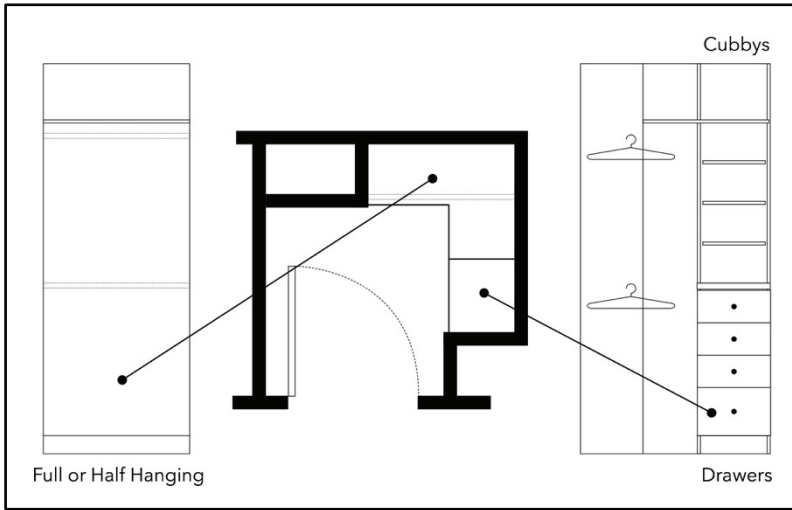
Small Master Bedroom Closet



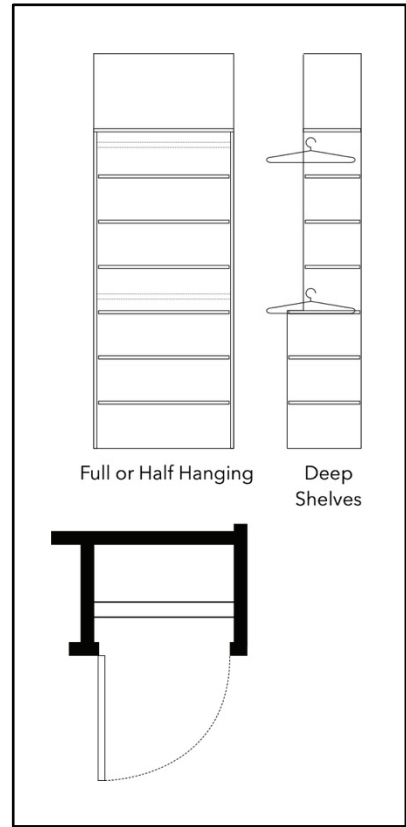
Large Master Bedroom Closet



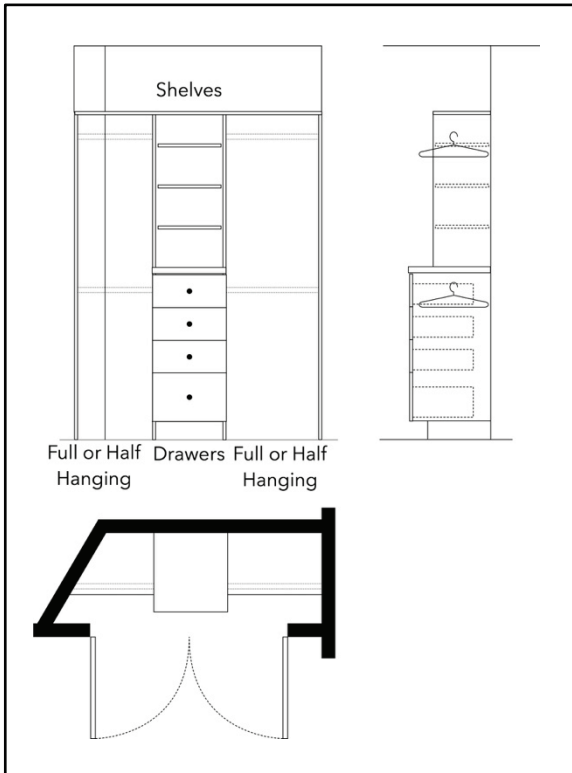
Bedroom #2



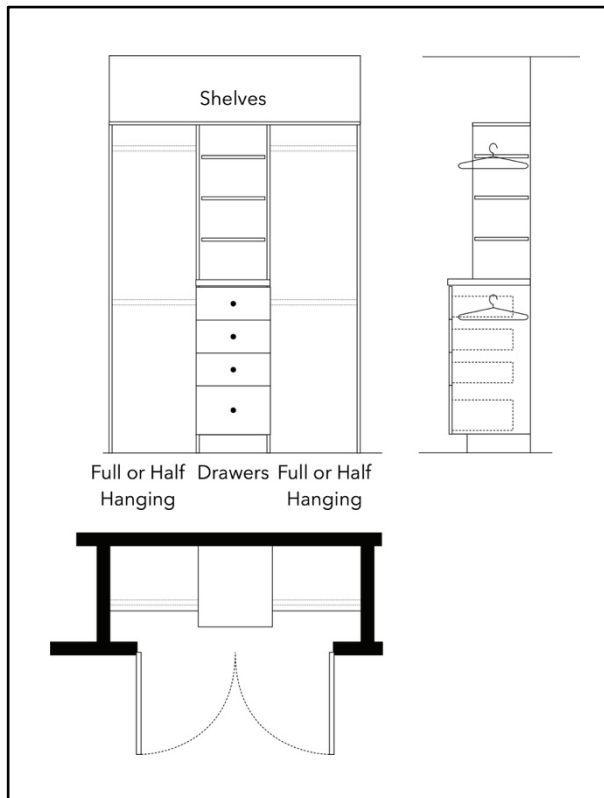
Bedroom #3



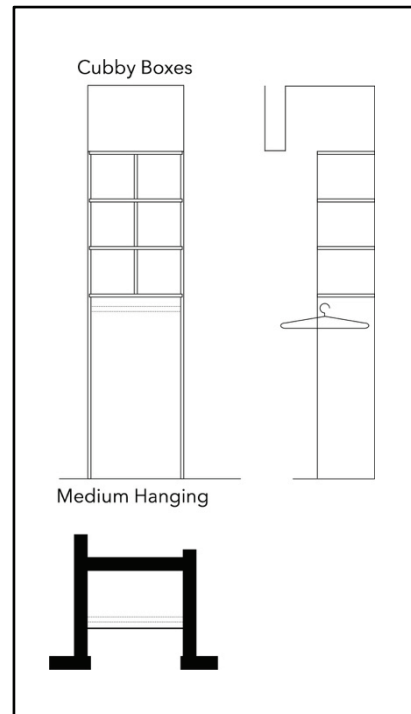
Bedroom #4 (Maid's Suite)



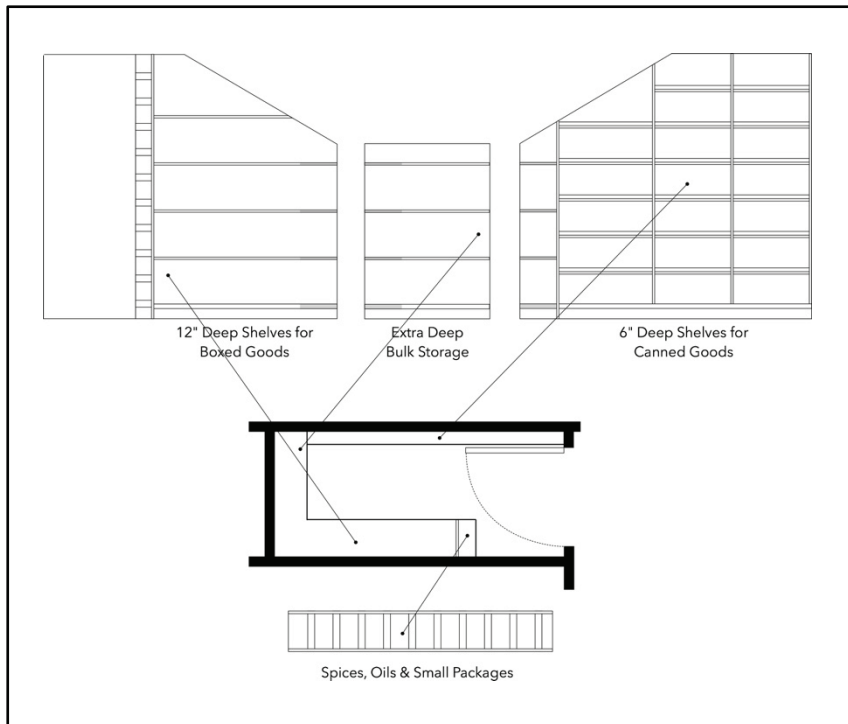
Bedroom #5 (Guest Suite)



Hall Coat Closet



Walk-in Food Pantry



Outdoor Cooking Center



This property has been prepared for a deluxe Outdoor Cooking Center that includes pre-plumbing for hot and cold water with waste line. Electrical conduit has been run to the breaker panel in the service yard and one 120-volt circuit has been installed. There is also a low voltage cable for outdoor LED lighting, if desired. The natural gas line is tapped from the pool heater line, providing maximum fuel flow for essentially any grill and combination of accessory burners. The allocated



space in the back yard enables installing many optional configurations of custom or pre-fabricated cooking centers. The concept pictured illustrates how all of the referenced appliances and storage can be accommodated in the existing layout, but, the size can be reduced significantly and still have a BBQ to be proud of.



Cooking Center Features

1. 42" Stainless Steel (SS) natural gas grill.

The design model includes:

- ✓ Four high performance Burners
 - ✓ One infrared rear burner
 - ✓ One RapidSear infrared burner
 - ✓ 1275 sq. in. cooking area
 - ✓ Up to 110,000 BTU
2. SS Dual Side burners with SS cover. Two 15,000 BTU Burners
 3. SS Sink, 32" to 36" with garbage disposal and high neck-faucet
 4. SS Wok Burner with SS cover. Adjustable from 1,000 to 60,000 BUTs!
 5. SS Outdoor Oven. 16,000 BTU
 6. SS Storage Cabinet
 7. SS Pull-out Trash Receptacle
 8. SS Storage Cabinet
 9. SS 24" Dishwasher
 10. SS Outdoor 24" Refrigerator
 11. SS Drawer Unit with three drawers
 12. SS Storage Cabinet with SS liner
 13. SS Storage Cabinet

Landscape Ideas



The fact that the slope is steep certainly limits usage possibilities but there are many ways to enhance the view, or actual value received from the hillside, from simply planting more native, drought tolerant plants – which don't require permanent irrigation - to converting more of the area to producing value, as does the Solar Farm, by installing a Wine Vineyard! Here are just a few ideas to consider!

Wine Vineyard

Grape Expectations is a full service "Vine to Wine" custom crush facility located in the quaint town of Westlake Village, California. They specialize in micro-boutique, high quality wine making, sourcing grapes from 100% locally grown vineyards from Hidden Hills to Hidden Valley, Pacific Palisades and the Santa Monica Mountains.

Every vineyard has its own challenges starting with the vineyard's micro climate, soil conditions, water availability and exposure to the sun. The selection of rootstocks and the different grape varieties and clones is the most important decision you will make.

Extensive professional knowledge coupled with years of experience has helped B. Alan, owner of Grape Expectations, adapt many varieties to the specific areas of Camarillo, the Santa Monica Mountains, Hidden Hills and Bell Canyon. Services include consultation, vineyard set-up and planting, maintenance, harvesting and wine production; a total “turn-key” operation. The vineyard in the drawing constitutes



358 vines, spaced every 3-feet. B. Allen has estimated that between 300 and 400 vines could be planted at a cost of \$85 per vine. This includes support structures and irrigation. Estimated vineyard cost is \$22,500 to \$43,000, depending on spacing and actual planting conditions. The additional slope steps to the right of the solar farm are not included in the vineyard price and are estimated to cost approximately \$10,000. Please contact B. Allen for additional information at (805) 279-3393 or email uclawiners@aol.com.

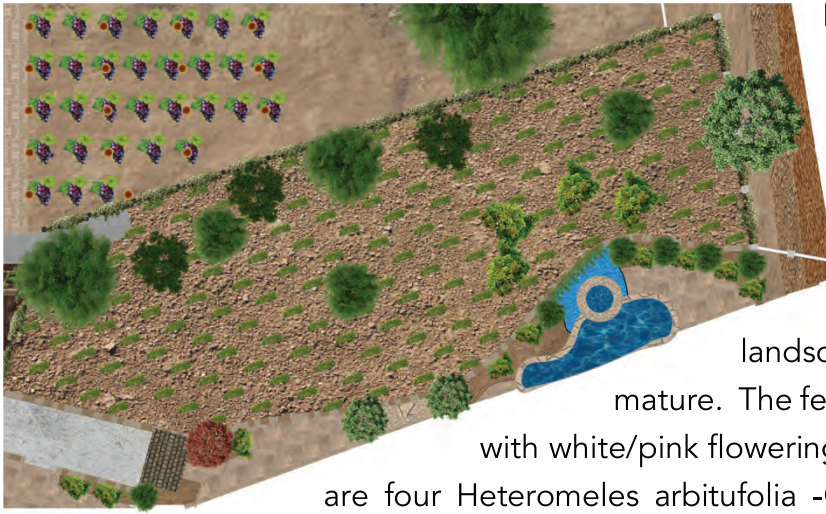


Example of a successfully established vineyard on a steep hillside.



Example of an established vineyard similar to what your vineyard might look like!

Ground Cover



Esthetically speaking, the lower hillside between the black fence and the retaining wall, would look nicer with some type of ground cover, true. However, keep in mind that the new

landscaping needs some time to mature. The fence will eventually be covered with white/pink flowering Bower vine plants and there are four *Heteromeles arbutifolia* -Christmas or California holly-planted behind the waterfall on the slope. These will quickly grow up to 15 feet high and will provide a dramatic backdrop.



California Holly (*Heteromeles arbutifolia*)

Planting ground cover in the slope area between the retaining wall and black fence was quoted by Green Paradise Creations, the project landscaper. They propose to install three drip irrigation lines on automatic control, apply pre-emergent weed preventative, mulch and prepare soil and plant 750 1-gallon myoporum parvifolium plants (top left), 3-feet on-

center for a price of \$12,642. As seen at the right, there are many choices for ground cover and prices are generally the same for equally sized plants. GPC can also quote planting additional California Pepper trees in the hillside gully.



Bower vine (*Pandorea jasminoides*)



Creeping boobialla (*Myoporum parvifolium*)



Various types of ground cover

Vegetable Garden



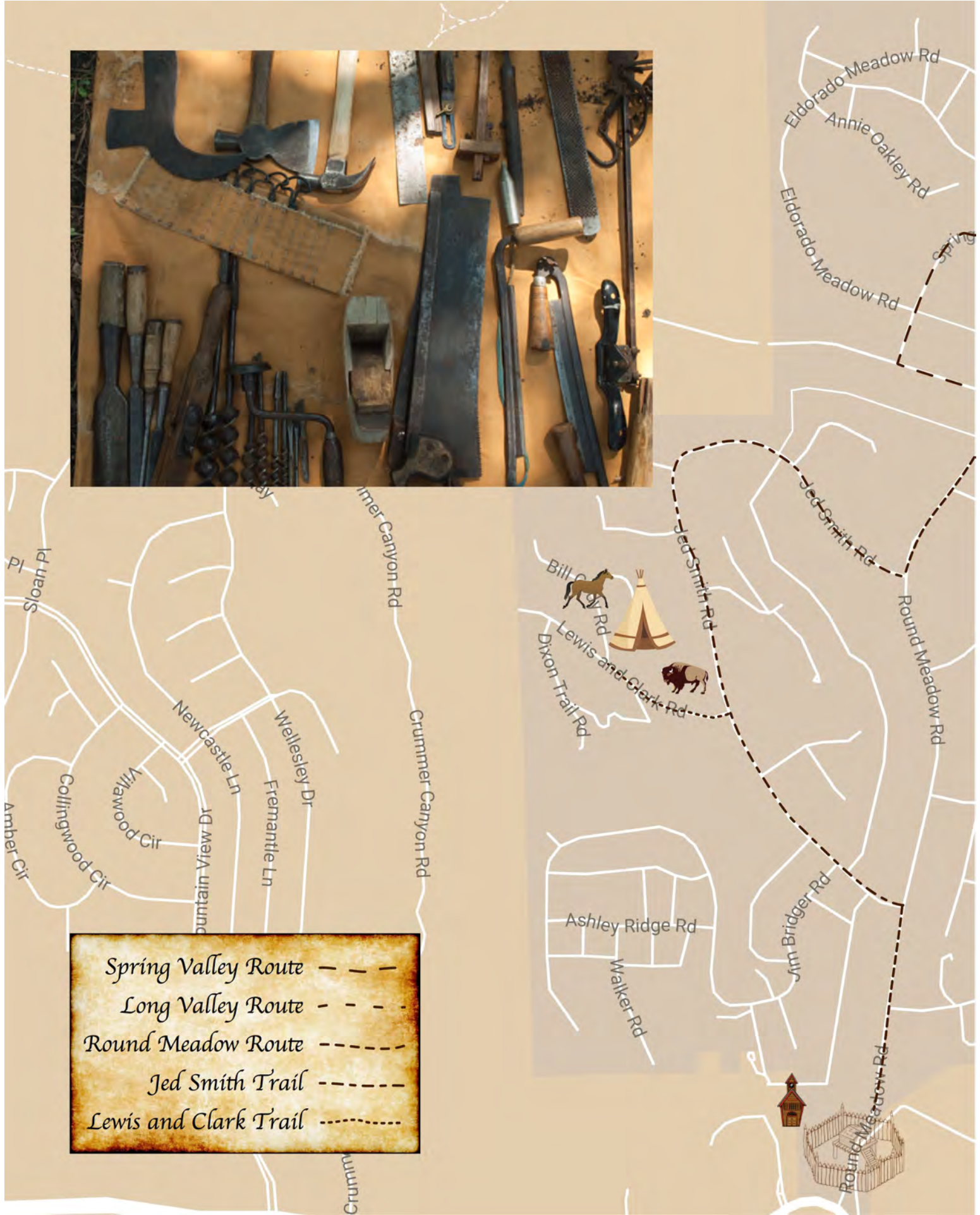
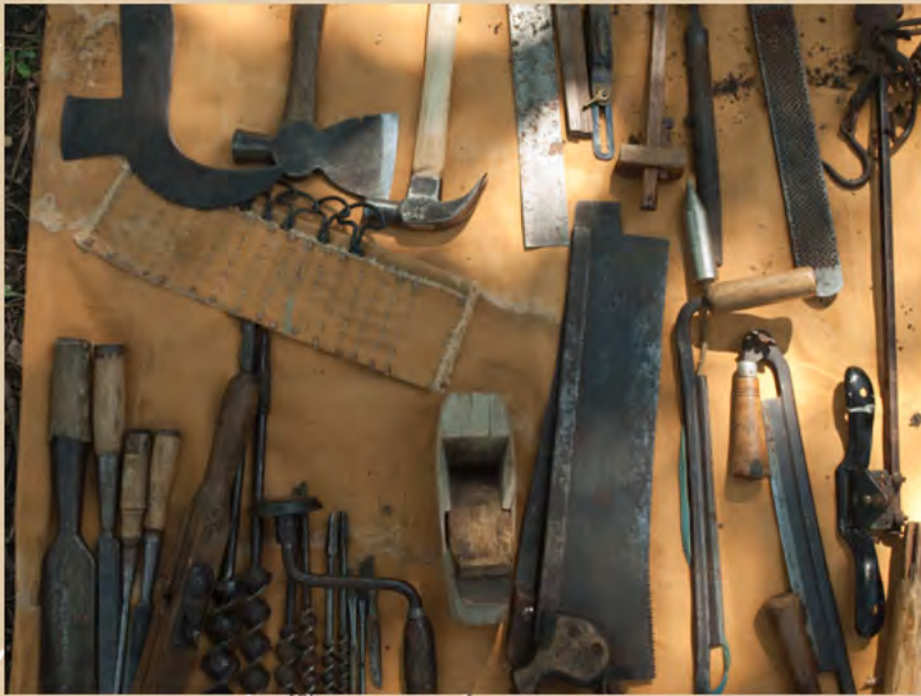
Working in the garden is a shared experience for the family and instills in children an understanding of the natural cycles of growth which provide lessons of lifelong value.

Creating a vegetable garden for your family is an excellent way to improve health, reduce your food expenses and enjoy a much wider variety of food.

Plan a garden that's big enough to produce enough vegetables for your family but not so big that excess goes to waste. The space identified is approximately 800 square feet, and, in just 500 square feet a family of four can enjoy a continuous supply of fresh produce up to eight months of the year.

The area is sloped so you will need to terrace the beds, or you will encounter problems with uneven water distribution and erosion. Build up the low side with boards or flat rocks.





- Spring Valley Route - - - - -
- Long Valley Route - - - - -
- Round Meadow Route - - - - -
- Jed Smith Trail - - - - -
- Lewis and Clark Trail ·····