

A SECOND GENERATION SOLAR VILLAGE

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Over the past three years, Susan and I have built eight custom solar homes in our own subdivision called First Village. We are now starting construction on our second solar village, La Vereda; of 19 passive solar homes on 10 acres.

Our First Village project is very different from our next project. These differences reflect what we have learned from our experience and shed some light on basic real estate fundamentals as they affect the residential solar development process.

First Village is a subdivision of solar homes, with water conservation and open space land planning designed to save the existing natural topography and landscape. Each home is on 5 acres and the sales prices ranged from \$95,000 to \$170,000. Five of the homes were built for sale and three were built for owners. Units No. 1 and 2, First Village were the first solar homes built for sale on the open market in New Mexico. At the time we designed these models we had no idea of the market, or public acceptance.

First Village has been a learning experience. We have developed passive solar technology in a real market laboratory. The effort by necessity has been interdisciplinary. Many specialists have contributed but the success of the project is a result of subordinating each specialty to our overall goal of market acceptance.

In comparing First Village to La Vereda it is helpful to divide our experience into three general categories of design: market, costs, and construction.

I. The Market

People who buy solar homes, at least in our market, have certain shared characteristics. They are well educated, have small families, and tend to be professionals or self-employed. They are either singles or couples buying their first home or older couples moving down to a smaller home. We have found that the buyers' attitude, ex-

pectations, and values are keys to market acceptance. Solar buyers tend to be environmentally aware and interested in good quality construction and design.

The solar buyer is interested in details. He sees his home as more than shelter. Any builder of passive solar homes will be considered as "more responsible" by the prospective buyer, just as the buyer sees himself as "more responsible" for purchasing a low energy structure. Part of the attractiveness of solar homes is a backlash against the shoddiness of present home building practices. Design, site planning, construction practices, and finished detailing must all fit together and give a consistent picture of responsible development, construction, and marketing. Sloppy construction or environmentally irresponsible site development will act as a red flag to a buyer regardless of design, price, or solar system performance.

Our First Village experience has convinced us that selling a solar home is easier if the community or subdivision is an all-solar project. A passive solar home is a new product in a conservative industry. To make it acceptable we suggest setting the homes in as complete and comprehensive a setting as possible.

A home is irreversibly tied to the immediate environment, and the home purchase decision cannot be separated from the influence of the adjoining properties. As social creatures we act collectively. The passive solar buyer will be attracted to a community of similar people and his new home will make more sense to him if the neighborhood is complementary to his self image rather than in conflict or indifferent.

There are two additional reasons for combining solar building with a complimentary land development program. We have found that solar cannot make a poorly conceived real estate venture successful. It can, however, give a well done project a small but important advantage in a local market. An all-solar development concentrates

public interest in solar on a single project. This increases the visibility of the builder and the project. With a new technology, such as passive solar, visibility is extremely important and prospective buyers are more interested in seeing a village of solar homes than a single home.

A solar village also allows the builder to take advantage of the sales momentum that accumulates with any multiphase real estate development. Momentum and neighboring solar homes helps assure the buyer that he is not alone and is making the right decision.

At First Village we have found that our work is of interest to schools, the city, local research labs, utility companies, other builders, lenders, civic groups, and many others. This community interest is extremely valuable in reaching prospective buyers and becoming visible and accepted in the market.

For example, at First Village we received grants in the first and second cycle of the H.U.D. Demonstration Program, have given hundreds of tours to local, regional, national, and international groups, put on public open houses, had the homes monitored by the Public Service Company of New Mexico and Los Alamos Laboratory. Public interest in our project and our community educational efforts have played an important role in our success.

To summarize our market experiences at First Village: the project was highly customized homes on 5-acre lots. The higher profit margins inherent in luxury housing gave us protection against the financial risk of introducing the new passive solar building style into our market. Our goal was to establish our reputation in Santa Fe as a quality, innovative builder who is environmentally responsible.

II. Design

There were 3 elements to the design process for First Village: site planning, designing each home, and designing the solar system for each home.

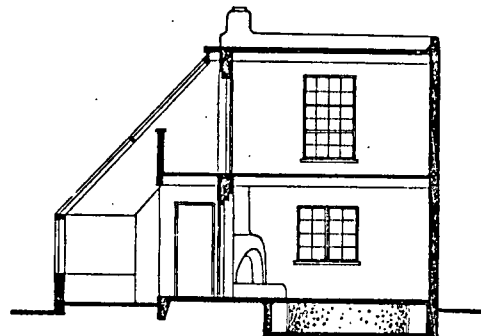
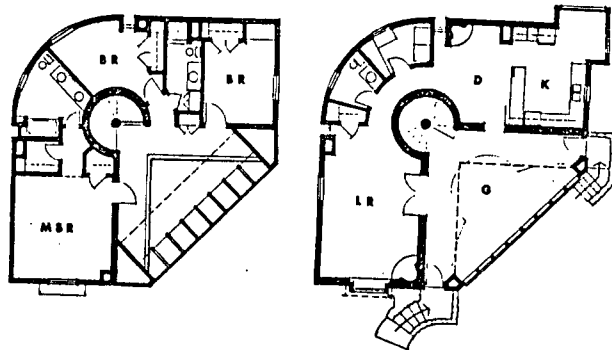
At the time there was little market experience on which to base our design decisions. Susan and I used ourselves as a model buyer and designed homes and a community we would like to live in.

Site planning was determined by the existing rural zoning of 1 dwelling per 5 acres. Once the site was purchased we had locked in our market segment and limited our design options. This is true with any real estate project where a developer must match the design and price to the location.

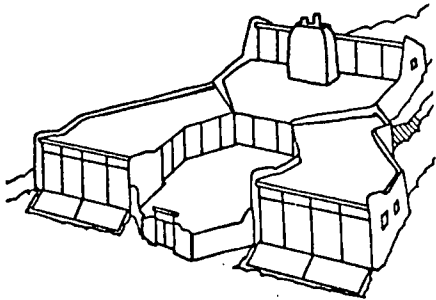
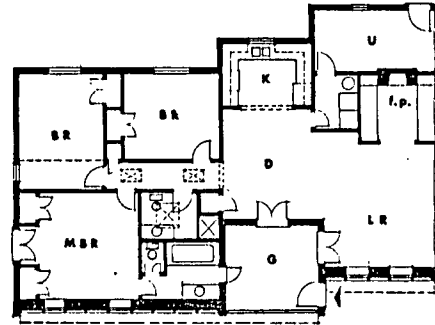
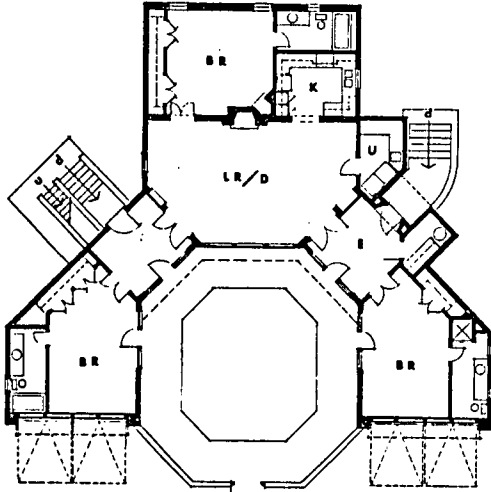
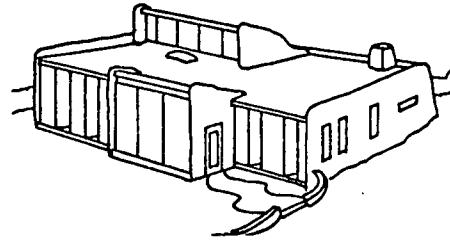


The development process works backwards from site selection, site planning, financing, and then final house and solar design. This is something that solar designers and builders should remember when developing a subdivision of solar homes.

The solar systems in many cases determined the house designs in the Village. We started with Unit #1, a hybrid system, and Unit #2, a "Sun Craft" active air system with rock storage. Both were designed for the first cycle of the H.U.D. Demonstration Program. Unit #1 was funded and was the only passive solar home included in the first cycle. It was also the first house in the program to sell which should have been an early signal to the program managers of passive solar potential.



Unit #1 combined the two zone approval with a solar greenhouse and radiant rock beds under the floor with excess heat pulled off the top of the greenhouse. This home has worked extremely well over the past several winters. The home gets a solar fraction of 90%.



Unit #4 was designed to get a grant on the second H.U.D. cycle which it did. We wanted to test the concept of vertical cast concrete Trombe walls filled with water. After our good experience with Unit #1 we were convinced that passive was the way. The two identical bedroom wings were closed to the south by the solid water walls. We opened them onto a central courtyard for light and views and made the rest of the house direct gain from the living room and a large clerestory shining onto a 10" cast concrete interior north wall. The home sold before construction and has been monitored. The performance has been acceptable in the water wall rooms and cold in the direct gain portions of the building. The home gets a solar fraction of about 70%.

Unit #3 was our first attempt to build a tract style home. It was more expensive than planned and a projected \$100,000 sales price turned into a \$125,000 actual price. The design combines the clerestory in the northwest corner bedrooms with a central mass backed atrium and greenhouse and alternating 16" cast concrete Trombe walls and direct gain windows on the south wall. We believe this home is close to a design

and performance optimum. The 1,800 sq.ft. home is set three to four feet into the ground and took six months to sell on the summer market. Once the weather turned cold it sold immediately, which proves that passive solar is experiential and sells best in the winter when it is obvious what someone is getting for their extra expense. The solar fraction is projected at 80 to 90%.

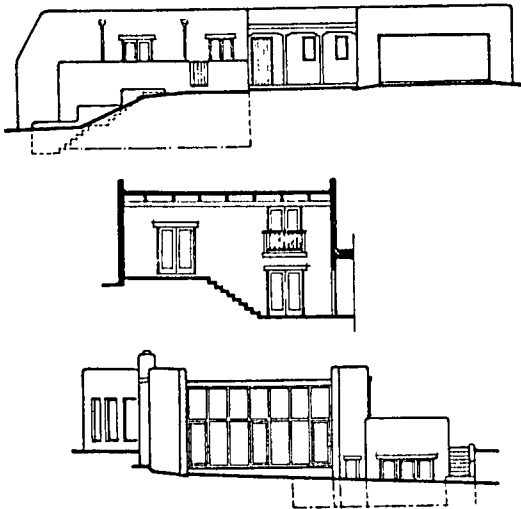
The last four homes in First Village represent the refinement of principles we used in Unit #3. The cast concrete 16" stagnated Trombe wall without shutters and reflectors is the basic solar system we have settled on. We use the solid Trombe wall with alternating vertical doors and windows cast into the wall. This gives us the ordinary functions of light and access along with solar for our south walls.

The use of clerestories for the north wall and sinking the homes three to five feet underground gives our work a look which has become our trademark in the Santa Fe market.

Unit A, First Village is our last unit in First Village. It is 2,400 sq.ft. with the greenhouse and is a split level style. The adobe mass wall acts as a buffer between the greenhouse and the living spaces. There is a rock bed under the living room to pull excess heat off the greenhouse.

The house and solar designs in First Village represent a learning process. We started from zero and developed effective solar systems that work in our climate and fit into acceptable styles using our local building materials and construction

techniques.



III. Construction and Costs

With passive solar homes the builder is the solar equipment manufacturer. Those planning our national solar program have made the same mistake as planners of the production housing program "Operation Breakthrough" of the last decade. They have assumed that the building business is similar to manufacturing. They projected that large cost savings can be achieved by volume production. In fact, homebuilding is a complex process that is already rationalized and fairly efficient.

In First Village we are building for approximately \$48 per sq.ft. All the homes have been prototypes which has raised their cost considerably. Passive solar construction is not just the addition of some glass on the south wall. We know that the passive solar home costs more and anybody who says it doesn't has never built one. Everything from the slabs to the roofs are built differently than tract construction techniques, and any deviation from the tried and true costs money in the building business.

In order to build our homes so they work, we use our own crews as much as possible. Plumbing, electrical and roofs are our only subcontract items. Over the past two years our men have become familiar with passive solar requirements and construction details.

In La Vereda the learning curve should start to work in our favor. Our goal with the standardization of solar construction details and an experienced crew is to bring cost down to \$40 to \$42 per sq.ft. with a 15% overhead and profit.

Success of passive solar in the regional market, like active systems, will depend

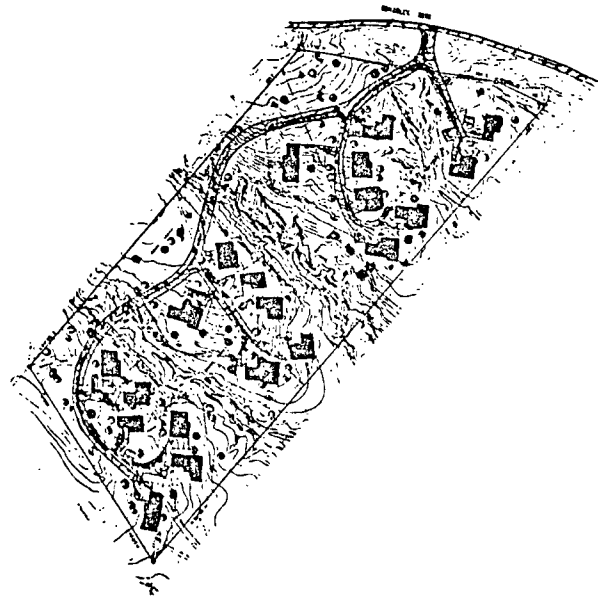
on costs. The whole area of incremental costs for passive solar construction over conventional construction is little understood and critical to the successful adoption of the technology.

In La Vereda we will use more subcontractors in combination with our own crews. The homes will be standardized and our concentration will be on lowering costs and understanding what our real incremental solar costs are.

La Vereda

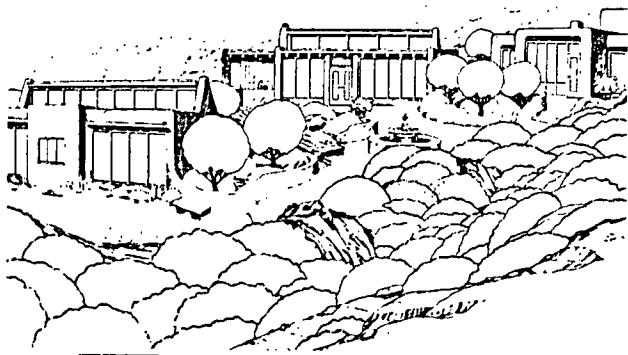
In First Village we set out to show that passive solar is possible. That is, is passive solar likely to be adopted on a wide scale. Our goal is to show that our homes can compete in the present medium income ranges of \$70,000 to \$100,000 housing. La Vereda will be a market test of passive solar as a viable product for the medium to small sized builder developer.

The project is 19 passive solar homes on 10 acres located in Santa Fe. We have placed all the homes on 4 acres and left 5 acres open with 1 acre taken for roads.



We clustered the homes into three villages with open space between each village. The streets and utilities are private and owned and maintained by the Homeowner's Association.

Where First Village was custom luxury prototype housing with high margins to offset the risk, La Vereda is production standard house designs with narrower margins and volume to offset the risk.



La Vereda is the first project of its sort in our market which gives us an advantage. In marketing, design, and construction we have tried to step carefully in the tracks left from First Village although La Vereda is clearly new ground for us and passive solar in our market.

1. Marketing

In La Vereda we have tried to follow the first rule of real estate fundamentals, location. We have assumed our segment is the same as First Village, just less affluent. The homes are less expensive and the lots are smaller and cheaper. \$20,000 is our sales value of the one-half acre in town urban lots vs. \$40,000 for First Village rural 5 acre lots.

The homes will range in size from 1,100 sq. ft. to 1,800 sq. ft. with four basic two and three bedroom models. The two bedroom homes will be expandable to a third bedroom.

Our location is excellent with surrounding homes all priced in the \$100,000 plus category.

We are counting on the quality buyer being willing to take less space and a smaller lot in return for a lower price. The extra price for passive solar has been offset by a smaller home for the money. Competing projects are 2/6 frame and stucco construction and are giving approximately 200 to 300 additional sq. ft. for the same price. This is our primary market risk and our exposure for making the homes passive solar.

We are also counting on our site planning approach of clusters and small individual lots with common ownership of substantial open space to transmit a different, more human sense of community and scale to the buyer.

Our promotion plan is to build models of each home in the first phase and detail the models with the same high quality finishes used in First Village. The homes will be priced to sell without all the extras. Quality finishes will be available but as trade-up extra for the buyers.

Our tie-in with the community is an important part of our marketing strategy.

The Public Service Company of New Mexico is monitoring the homes, and we received two passive solar design competition and construction awards, and we are planning open houses sponsored by local civic groups.

2. Design

The site plan is extremely important. The location of the property and the type of neighbors determined our planning approach. To get planned unit development zoning which allowed us the flexibility to site the homes for solar orientation required neighborhood approval. To get this approval we left open space as a buffer on the north portion of the property.

The solar system designs were fixed, based on our experience at First Village. We are using concrete Trombe walls and mass backed greenhouses and clerestories.

During the planning phase we have gone back and forth between the site plan and house designs. We have walked the site and located each house to fit the existing trees and topography. Some house designs were junked and others developed to fit the specific demands of the site.

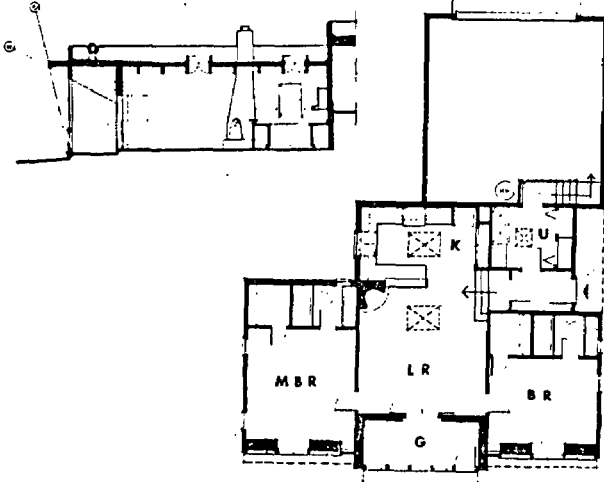
All the homes will be sunk from 3 to 5 feet underground, which should give the whole project a unique aesthetic once it is complete.

Water conservation will be used in each home and the Homes Association will have the ability to install other resource saving technology and if the homeowners in the community vote them.

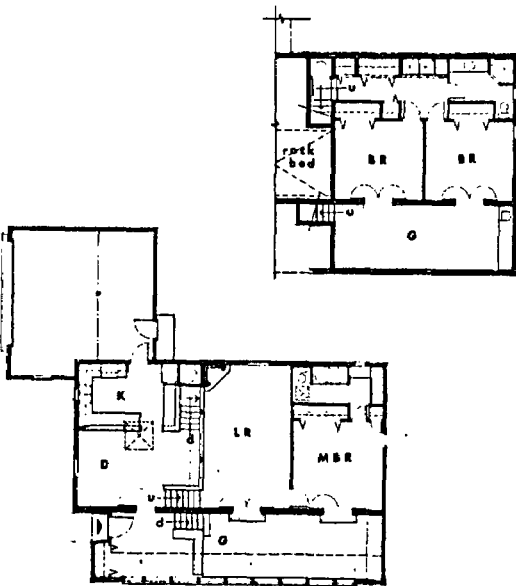
By doing the project in three phases over two years we will have the ability to make changes as we go in the site plan and house designs. This is extremely important given the newness of the product and our inexperience at this scale in the market.

The following model (#1) is one of our two bedroom units that is designed for a single person or couple. It combines the Trombe wall and greenhouse for solar heating.

Model home #4 uses the two zone approach with a mass backed greenhouse for solar and a small rockbed under the kitchen/dining area. This is our largest model at



1,800 sq.ft. and can be used as a family home or as a core house for a single or couple with space for guests or visiting family.



3. Construction and Costs

Costs remain our number one issue at La Vereda. We are just on the edge of

acceptable space for the price we charge.

Our construction and cost strategy will be somewhere in between a production tract builder using all subs and our First Village, all custom approach.

The ground between acceptable cost and quality is treacherous turf. If we drop quality too low we will lose our target market segment which is extremely quality sensitive; and, if we raise quality too high, cost control is critical to our success and we will price ourselves out of the market and lose everything.

We have found that there are two components in incremental passive solar cost. The first is the cost of the actual solar related construction, which is fairly easy to calculate. The second is, construction cost above and beyond regular building techniques. It is this second cost which is very hard to calculate and may prove to make passive solar homes unfeasible. We sink homes in the ground, provide extra insulation, build mass into the structures. All of this costs money and we feel it is necessary to get good comfort ranges and high solar fractions. Our experience shows this second type of cost may be equal or greater than actual solar related costs.

What is needed is standard ways of calculating incremental costs and good information on conventional costs to use as a standard or base. La Vereda is our opportunity to develop this kind of data.

4. Recommendations

Until all the homes in La Vereda are built and sold, we will not know our costs or the success of our strategy.

There are some tips that we would like to pass on to the passive solar builder/developer:

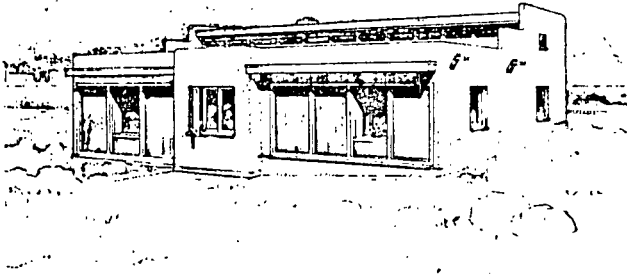
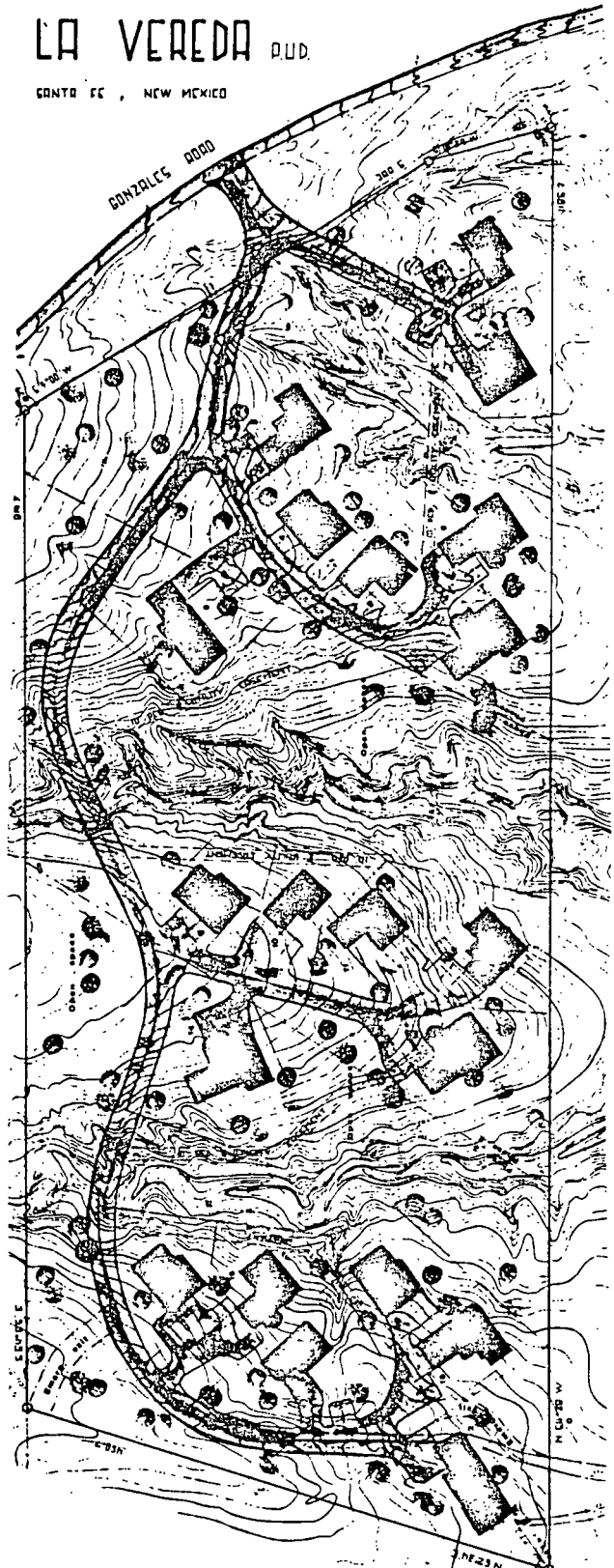
- . Pick the right location. Match the target segment with the location by analyzing existing housing nearby.
- . Start small and build into the development process, phases or chances to change the product as you learn about the market.
- . Select a passive solar approach that is proven in your region and with which you have direct experience. Keep it simple.
- . Work from real estate fundamentals to the solar design and not vice versa.
- . Be careful on costs. Lock them in if possible and deal with subs that have experience in the required construction.

- Spend time with your lenders, appraisers, and investors, educating them on the solar performance and the project's environmental goals.
- Prepare complete solar engineering on each home both for lenders and for promotion materials.

PRELIMINARY MASTER PLAN

LA VEREDA A.D.

SANTA FE, NEW MEXICO



MODEL #2