PLAN DEVELOPMENT
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3 BR. UNIT

GREENHOUSE & PREPARATION ROOM
View of the Clubhouse/Community Building from McGalliard Rd.
Fantasy Sketch
TERRA LAKE
REVISED SITE CONCEPT
PHASE I
COMMONS
DEVELOPMENT
STRUCTURE / SYSTEMS DEVELOPMENT
COOLING CYCLE
NATURAL VENTILATION

INSULATED BUNDS

55° EARTH
COOLING CYCLE
NATURAL VENTILATION ALTERNATIVE
HEATING

HOT WATER PREHEAT/STOR.

MECH SPS.

AIR TYP SOAR COLLECTOR

HOT AIR RECOVERY

FRESH AIR INTAKE

ROCK BED STOR.

GREENHOUSE

50° EARTH

1/10/84
HEATING

ROCK BED STORAGE VOLUME

3000 sq. ft. glazing area

\[
\text{Volume} = \frac{3000}{12} \times 36
\]
HEATING

WATER HEAT PUMP

HOT AIR RETURN
HEATING CYCLE

AIR TYPE SOLAR COLLECTOR
MECH. SYS.

WATER PREHEAT
KICKER STORAGE

ALLOW CLEAR OF ROCK
711 FT.
1 PF. TOWER
SOUTH
PARKING SKETCH
ORGANIZATIONAL
CONCEPT
MASSING STUDIES
FINAL MASSING
2 BR CONDOMINIUM
STUDY MODEL
SUN CONTROL
DETAIL OF SOLAR BLINDS

HEATING
OPEN & PARTIALLY PULLED UP

THE AMOUNT OF LIGHT/SOLAR HEAT GAIN/AND VIEW OUT CAN BE VARIOUS AND CONTROLLED EASILY

COOLING
CLOSED

SOLAR SHADING

UNIT SECTION

0 1 2 3 4

SUMMER
WINTER
INTAKE
RECORD DUC
LIVING

MECHANICAL
GREENHOUSE
PATIO
In ending, I would like to thank The College of Architecture and Planning for the opportunity to do this Thesis Project and for the training which I have received that enabled me to do it.

David D. Conklin
SITE PLANNING

Schellie & Rogier, Site Utilization and Rehabilitation Practices, National Sand and Gravel Association, 1963

National Sand and Gravel Association, Projects 1, 3, and 5, University of Illinois


White, Edward T., Site Analysis, Florida A&M University Architectural Media, 1983


National Association of Home Builders, Planning For Housing, Development Alternatives for Better Environment, 1980

Energy Efficient Community Development Techniques, Five Large Scale Case Study Projects from U.S. Department of Energy’s Site and Neighborhood Design(SAND) Program-Phase I


EARTH SHELTER

Minnesota University, Underground Space Center, Earth Sheltered Housing Design, Van Nostrand Reinhold Co., 1979


SOLAR TECHNIQUES

AIA Research Corp. for HUD, Solar Dwelling Concepts, Printed in U.S., May 1976


AIA Research Corporation, *Solar Heating and Cooling Demonstration Program*, A Descriptive Summary of HUD Cycle 4 and 4A Solar Residential Projects


Appendix 1 Building Type Study

I have included the five most important and influential of the forty odd buildings in my initial analysis.

Multiple-unit earth sheltered housing is focused on because of its direct relation to my project. The strengths and weaknesses of four examples will be discussed in relation to correlation diagrams. The last example served as a preliminary energy and cost estimate for my project. All examples, overall, are good solutions and were of much help with my project.
A study was conducted to show city officials and the owner of the site, a concrete block manufacturer, that it was possible to utilize the slopes of a 35-acre gravel pit. The gravel pit is a great open bowl first factored with slopes rising as high as 80 feet. The design provides three private streets running parallel with the slopes of the terrain. These streets serve as the main access. The streets provide access to the housing at the top and access to the structure. The structures, all earth-sheltered, are either facing southwest or northeast to allow optimum use of all of the slopes on the site. Only one face of each structure is exposed as a conventional facade, and each unit has a private yard space and is defined as private property in an attempt to offer the amenities of single family detached housing which characterizes the adjacent communities.

In addition to earth-sheltered construction, "on-site/in-house" production of the major building material is another means of conserving energy.
Residential Complex for Minnesota

The building concept is duplex units terraced on a hill.

Relationship of Spaces: The active living area occurs closest to the entry and the passive sleeping farest from the entry. The garages to the duplexes are placed at the bottom and at the top of the units and feed onto the loop roads.

Circulation: Loop roads provide access to the garages. The resident must then go up, or down, to his living areas via stairs.

Structure: Reinforced concrete.

Unique Features: -Site was once a gravel pit; is a large bowl 80 feet deep and has a lake in the center of the development.

-Unique section.

Image Features: -low profile, preserving environment.

Negative Aspects: -Site layout too rigid, much like typical development.

-No variety.

-Solar aspects and possibilities not explored.

Influences: The main influence here was not in the design, but in some of the development ideas. Such as the excavator being his own developer(something I am trying to convince the excavator in my project of), and using on site materials for the construction of the housing units. The site of this project is much like my own, and helps me to stress the prototypical nature of this type of development.
Seward Town Houses
Minneapolis, Minn.

The building concept, in essence, is underground row housing.

Relationship of Spaces: Again, the upper level has the active spaces (kitchen, living room, dining) and the lower level has the passive spaces. Also, the primary spaces are grouped toward the front for maximum views and sunlight, while the servant secondary spaces are grouped along the rear wall.

Circulation: The garage is located in front of the units and provide a buffer between the street front and the greenspace area. Entry into the units can be made from either side of the housing hill.

Structure: Reinforced concrete bearing walls and slabs.

Unique Features: - site: being located next to a busy freeway, this site illustrates the dampening effect of outside noise that earth sheltered homes possess.
- mechanical systems: both active and passive solar techniques are used to make the town house units as energy efficient as possible.
- garden: there is a large garden in front of each unit to which the units look out over.

Image Features: - contemporary townhouse design
- low profile

Influence: I like the straight forward approach of this project. In particular, the entry bridges on the south "garden" side of the building. The row house concept was also strong and seemed to work well.
One of the most innovative and unusual earth sheltered housing projects to date, the Seward town house development in Minneapolis, Minnesota, resulted from a cooperative effort involving the community and the architects. The site, located immediately adjacent to a very busy section of freeway and adjoining a major intersection, had become undesirable to most residential developers. It was slated for use by a major restaurant chain when Seward West Redesign, a nonprofit neighborhood corporation concerned about increasing commercialization of the area, proposed an alternative: an earth sheltered residential complex. The project was designed by architect Mike Dunn of Close Associates, Minneapolis.

The town houses, completed in 1980, demonstrate how a thoughtful, well-planned design can turn normally undesirable site characteristics to advantage through the application of earth sheltering and passive solar techniques. For example, the fact that the noisy freeway is located immediately north of the site dictated that the complex face south—the ideal orientation for passive solar gain. By facing the units south and creating a berm of earth on the north side and both ends of the complex, the architects successfully dampened the freeway noise. The limited size and completely flat topography of the site required a very efficient plan in order to fit twelve units on the 100- by 300-foot (30- by 91-m) site, resulting in a density of 15.8 units per acre. The efficiency in site planning results from the compactness of the two-level units and the use of retaining walls at the site edge to reduce the land area required for earth berms.

The twelve-unit (nine two-bedroom, three three-bedroom) development is completely covered by berms on the three sides; the roof is planted with long natural grasses. The north berm, designed as a continuation of the grassy edge predominant along the freeway, is punctuated by entrances to each of the units. On the south are located the primary entrances and the individual unit courtyards where owners may plant gardens or shrubs. To make the town house units as energy efficient as possible, the architects incorporated both an active solar system and passive solar features into the design.
housing design study for prototypical site

Excerpt from EARTH SHELTERED COMMUNITY DESIGN, page 171-177

In order to complete the illustration of the site analysis and design process for an energy-efficient community development, a preliminary design of several clusters of housing was prepared for the prototypical site. The major south-facing slopes on the site were selected because they present the greatest opportunities for energy-efficient development and therefore have been designated for multifamily dwellings, as shown in figure 6-3. Although one of the concepts of this development is to include a mixture of energy-efficient housing types in response to different site conditions, one of the major purposes of this study is to examine and illustrate earth sheltered housing at a multiple-unit scale. Because these south-facing slopes present the best opportunities on the site for earth sheltered housing, that is the only type of structure illustrated in the prototypical design.

On this portion of the site, the relatively steep, south-facing slopes, which are divided by two steep ravines, are the major forces in determining the location and form of the housing to be built here. As shown on the schematic site plan (fig. 6-3), the ravines—which will form part of the pedestrian walkway system—are to be protected. Vehicular access to any housing on the slopes must be from the top of the hills rather than the bottom, since no relatively flat area lies at the base of the hill. The buildable slopes in this area actually can be grouped into two categories: the middle portion and base of the hills, which have a slope of approximately 20 percent; and the upper portion of the hills, which flattens out to a slope of 10 percent. Two types of earth sheltered structures have been designed in response to these two distinct degrees of slope. Two-level attached elevational units stepping down the hillside are located on the steeper slopes, while groups of one-level attached elevational-type houses are located on the gentler slopes.

The fifty-eight two-level units are clustered into three main groups that are divided by the two ravines; their
exact orientation is determined by the topography. The majority of the units have excellent orientation for passive solar gain. The two-level attached units, shown on the following pages, are similar to conventional multifamily structures in that the entrances, garages, and parking are all located in one area at the top of the hill. The buildings are arranged so that one entrance typically serves four units. Both two- and three-bedroom units (1,550 square feet and 1,800 square feet—139.5 ca and 162 ca) are included in these complexes. These multiple-unit hillside structures present the opportunity to maximize densities on what is often considered almost unbuildable land. On these 20-percent slopes, approximately twelve units can be placed on 1 acre (0.4 ha), not including the land required for roads and devoted to open space. On a steeper slope, similar structures could be built at even greater densities. Although the units are attached and the density is relatively high, the development has few of the negative characteristics commonly associated with high-density developments. For example, each unit has extensive exclusive views of the surrounding amenities and little or no view of a neighboring structure except, perhaps, for a grass-covered rooftop.

The one-level earth sheltered structures are attached in groups of three to five units and are generally oriented toward the two ravines—a situation that results in excellent exposure for passive solar heating. The seventeen units all include three bedrooms (1,800 square feet—162 ca) and have attached double garages. The low, flat profile of these one-level units, combined with the earth berms and covered rooftops, would result in very natural, unobtrusive building forms. The scale and density of development would not be apparent when viewed from roads or from the central community area to the north of these housing clusters. Although these elongated one-level earth sheltered units clearly have potential energy-saving and aesthetic benefits, on relatively flat land they are not the best type of unit for maximizing densities. It would be possible to roughly double the density in these flat areas by substituting more conventional two-story town house units that have approximately the same general layout and solar orientation. Some of the same qualities of the more fully earth sheltered houses—e.g., berms around the first level and perhaps earth-covered roofs—could be integrated into the design of more conventional town houses to help them blend into the surrounding landscape and complement the earth sheltered structures further down the hill.

site plan