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AN EXURBAN HOUSING CLUSTER FOR BOZEMAN, MONTANA

Terminal Project in Architecture

By

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Submitted to the School of Architecture as fulfillment of
the requirements for the degree of Bachelor of Architecture

at

Montana State University

Bozeman, Montana
June, 1973

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1. Terminal Program Proposal

The proposed thesis program to complete requirements for the undergraduate degree in Architecture at Montana State University is to be a prototype cluster housing development located in plots 1, 2, 3, 5, 6, 7 of section 12 which lies in 5E3S south of Bozeman, Montana.

It is intended that not only the student's understanding and sensitivity of solving a housing problem of this sort will be advanced, but that the scheme will serve as a badly needed prototype for further housing developments in these types of areas. The state of the art will certainly be advanced if the School of Architecture can help to promote the idea of cluster housing to Montana's citizens.

It is assumed that a market exists for private ownership housing units in the Bozeman area, and that the student will consider himself the client who is building all units. Upon their completion he will sell them to individual owners who will maintain them under a form of Home Owners Association.

The site results from a planning study done for the then Zoning District No. 2 area in a student planning studio headed by David Wessel in which this student participated. The general site will therefore be assumed to be satisfactorily documented in that planning study.

It is anticipated that the housing units (5 to 15 in number) will be clustered in one specific area of the site leaving the majority of the site untouched.

The exact number of units will be determined during and after specific site studies including sewage disposal capabili-

ties of the soil, water supply availability, and soil suitability for roads and foundations.

After determination of the exact number of units to be included in the scheme, it will be decided what type of unit each will be. Possibilities of inclusion will be studio home units, luxury units, retired folks units, and standard family homes of varying sizes.

Thesis Advisor

David Wessel, Professor of Architecture
Montana State University

Resources Personnel

1. T. Woods, Professor of Architecture
Montana State University
2. Ifan Payne, Professor of Architecture
Montana State University
3. H. Eck, Professor of Architecture
Montana State University
4. Gordon Kelly, Engineer
Montana State University

Outline of Method Solution

Define objective and thesis

Gather resource and research information

Compile and reorganize resource and research information
pertinent to objective

Translation of resource and research, objective and
intuitive ideas into concrete form (design)

Formation of presentation material and documentation
for library

Information to be researched will include site data, mechanical systems, climatological data, and materials. Research will be carried on through interviews with advisor and resource personnel, other professionals if necessary, manufacturer data, library reference material, personal observations, interviews with present land owner, and any other means which become available.

The research information will be gathered in it's crude form and later analyzed, expanded upon or reduced until it becomes pertinent to the specific goal in mind.

The greater part of synthesis and design will take place after the compiling and analysis of research information. It is intended and understood that intuitive synthesis and design will be taking place at all times, but in the final stages all design decisions will be supported by the research and analysis and will be a logical end to the design process involved.

Communication and presentation of process and product will employ verbal descriptions and 2 and 3 dimensional visual presentations.

A 3-dimensional model, elevations, sections, plans, perspectives, and working details are to be employed in final presentation.

The presentation at end of winter quarter, 1973, will include all programming and research completed to that date, a site model, and some initial basic design decisions.

2. Why this Problem

The Gallatin Valley is experiencing a very damaging shift in the pattern of housing development. It is characterized by a move from the small urban area of Bozeman to the exurban areas around it. Characteristically, a tract of land is purchased by a developer and evenly divided into N number of lots with a spine access from which smaller access roads are provided to each lot. These lots are provided with power and sold to individuals who are free to build what they wish upon the lot installing, of course, their own water systems, their own sewage disposal systems, their own parking and garage facilities, their own recreational facilities, etc.

These subdivisions are too numerous to count and are located with no eye toward any type of comprehensive plan and are therefore eating up thousands of acres of prime agricultural land. They are often placed in soil having very poor bearing and percolation characteristics which results in much more expensive housing than would normally be necessary. Visual as well as ecological pollution is the result.

The site chosen for this cluster housing project is designated as a prime housing location by an exhaustive planning study done 2 years ago under Professor D. Wessel. The project is further aimed at informing the populace of the ills that can be cured by the use of cluster housing as opposed to aforementioned subdivisions. Communally owned land upon which all units are place, reduced length of access road, communal water and sewage facilities, and often times

parking and garage units can be combined to further reduce cost and land gobbling characteristics. This thesis problem will highlight and incorporate all these features.

3. Design Criteria

The design criteria will lead to the creation of comfortable housing that would allow those living on the site to experience maximum enjoyment of same as well as views to north of Gallatin Valley, Bozeman, and the Bridger Mountains.

The use of native building materials and construction skills, planning and massing as the result of specific unduplicable functional requirements and site conditions, the absence of any ornamentation that is not part of the structure, and to give identity to the enclosing form and enclosed space were the four points which served as general design criteria guides.

4. Program Writing - Research and Material

Most of the time and effort applied to writing the program went to climatological research, site research, and market research.

Climatological data collected included information about sun paths and angles, diurnal temperature graphs for mid-summer and mid-winter, a bioclimatic chart, a timetable of climatic needs chart, a wind rose, and information on snow and drifting conditions.

Sun angles, at high noon, varied from 70° (June 22) to 22° (Dec. 22) and the path being, as usual, from east to west across the Southern Hemisphere. Local conditions (moun-

tains, hills, vegetation) caused deep shadows to be cast across the site during morning and evening hours. Both of these conditions were to be of some influence in design decisions which were to follow.

The wind rose showed the greater percentage of the time wind blew from the South-West, and that the other major wind blew North and South up and down Leverich Canyon which extends to the South of the site. Those breezes blew down Leverich Canyon in the morning and up Leverich Canyon in the evening. Mrs. Emery L. Clark, longtime owner of the site, believes these morning and afternoon breezes are responsible for a more temperate temperature reading than is generally recorded down in the Gallatin Valley and in Bozeman itself.

The sun path diagrams, timetable of climatic needs chart, and the bioclimatic chart, when combined indicated several strong design criteria. Shade for living areas should be provided between noon and 6:00 PM from mid-May to the last of August and from 8:30 AM to noon and from 6:00 PM to sundown during the months of June, July, and August. During the remainder of the year, sun is a desirable element to have in the living areas of the house. This predicted that sun had to be scooped into the house when it lay between the angles of 22° to 50° at noon and from 9° to 35° at 9:00 AM and 3:00 PM. It was necessary to scoop this sun from the Southern Hemisphere and cast it into the northern boundaries of the houses as very desirable views, and therefore living areas were to be oriented toward the North.

Other requirements, as dictated by the climatological study, included a heating system that would handle average lows of 17° F in winter and average highs of 88° F in summer. Absolute lows dip into the minus 40° range and highs lie in the plus 90° range.

Cooling evening breezes down Leverich Canyon were to be caught during the months of June, July and August and especially between the hours of 10:00 Am and 4:00 PM during the month of July. The winds blowing from South-West need to be used during the same time.

Site research included topographical information, existing vegetation, water courses, soil types and limitations, roads, existing improvements, and vistas.

A surveying instrument was used to shoot three lines the entire length of the site and combined with a U.S. Geological Survey Map, a very accurate contour map of the entire site was compiled to one-foot intervals. It can be generally stated that the site is lowest at its northern end and rises on a slope of 4° to the southern end. This information is shown on Site Plan page I2.

Existing vegetation consisted mainly of cottonwoods around the perimeter of the site with a significant stand of evergreens along the South-West edge. This information is available in the Site Plan also. Some "brush" existed within the boundary of the site and will not be destroyed although it was of no great significance.

Leverich Creek lies in a course as per the Site Plan page I2 and was found to flow the year round. It has never

been known to flood on the site, so the right of way it has established for itself will be considered sacred and tampered with as little as possible, if at all.

The soil type according to Soil Interpretation for Land Use Planning and Development in the Gallatin Valley Area is Bridger Loam. General characteristics of it include slight limitations upon its use for foundations and basements, moderate limitations for sewage disposal and moderate limitations for street and road construction. The agricultural worth of the site is mainly for pasture.

An existing road follows the Eastern perimeter of the site from one end to the other; no building or other improvements are presently situated on the site and spectacular vistas lie from North-West to North-East of Bozeman, the Gallatin Valley and the Bridger Range. Secondary views exist in all directions of the immediate exurban environment.

Snow during winter months, according to Mrs. Clark, can be expected to average 2 feet in depth, and some local drifting to a depth of 4 feet does occur.

Market research, as best as could be obtained, was carried on in the guise of daily newspaper watches and interviews with local real estate personnel.

Personal interviews with Michaila Shyne of Bozeman Realty and Herb Pace and Marshall Bennett of the Bennett Agency revealed that family units of two bedrooms or larger having double car garages and as few stairs as possible were dominating the market. These three characteristics were continually

stressed. The market for condominiums and cluster housing units has been relatively unexplored in the area, and any ventures into it would be breaking new ground. Some difficulty in educating the public to the various benefits of exurban cluster living are foreseen, but the pattern, nation-wide, is certainly being met with more success all the time.

5. Initial Design Decisions

The first initial design decision was to decide the exact number of units to be placed upon the site. It was a rather arbitrary decision at best, but information on average size of exurban lots already in existence, interviews with real estate offices, knowing the type of client I wanted to appeal to, and having a "feel" for the site led me to believe one unit per acre was the correct density. The $6\frac{1}{2}$ acre site yielded 6 housing units therefore.

The next problem to be tackled was the placing of each unit upon the site. Maintaining an unobstructed view to the north for each unit and maintaining close and direct physical and visual access to Leverich Creek for each unit were the two factors most greatly affecting this design decision. Using 25 feet as the approximate maximum height per unit, I went to a longitudinal site section and found that units placed in the southern third of the site would be able to have a clear view of the northern vista over units placed in the northern one-half of the site. Furthermore, in plan, the two diagonal (page I2) sections of Leverich Creek (one within the southern third of the site and one within the northern half

of the site) afforded me the opportunity of "staggering" the units on these diagonals so that each house had direct access to Leverich Creek. The two clusters of three units each thus evolved from these basic site characteristics. This configuration can be seen on the Site Plan page I2. The housing units are membered from East to West in the North cluster 1, 2, 3; and again from East to West in the South cluster 4, 5, 6.

6. Access, Parking, Garages, Services

Access to these two clusters will be provided (as per Site Plan page I2) along the eastern boundary and following the route already established by a smaller access road. Two drives from it will then approach parking and three double-car garage spaces which lie to the rear of each cluster. The northern set of garages are cut into the site and at the rear elevation are only four feet above grade and are provided with grass roofs. These steps were taken to "reduce" the mass of the garages, to settle them into the topography of the site and to provide as pleasant a view from the southern units toward the North as possible. The garages behind the southern cluster will be slightly stepped into the site, but further attention will not be needed as they obstruct no one's view to the North. Garage plans and sections can be seen on page I10.

Ample parking around perimeters of garage and access drive is provided for miscellaneous vehicles (boats, trailers, etc.) and will not obstruct the forty feet needed by the garage occupants to easily enter and leave the garages.

Across the southern end of each double-car garage, a five-foot by twenty-two-foot storage or utility space is provided. Access to this space is provided by 5 four-foot folding doors. These doors will facilitate entry to the space when cars are present or not in the garages and will further provide for any division of the storage space that is thought necessary.

It is foreseen, in a number of years, that the very real oil shortage will cause conversion of home heating plants to wood or coal fired units. In this case, the garage units can be used as fuel storage with an area of the northern garage cluster being converted to a central hot water heating plant. The two car garage area will have become redundant by that time, as the fuel shortage would have almost certainly caused reductions in the sizes and numbers of cars.

A central well and pump house serving all six housing units is attached to the western end of the northern garage cluster (Site Plan page I3). Underground lines will serve the units crossing Leverich Creek where necessary underfoot bridges.

Foot bridges will also serve as crossing points for sewage lines. Two septic tanks as shown in Site Plan page I3, each with its own drain field, are provided, one to serve the south cluster and one to serve the north cluster.

A large utility bridge, fifteen feet wide, will be constructed on the site, as shown in Site Plan page I2, as soon as construction begins. This bridge will facilitate delivery of materials and construction processes. The bridge will remain on the site as a permanent fixture to allow ease of

delivery of large heavy objects and to allow access directly to the units on the west side of Leverich Creek for moving vans, etc.

7. Unit 3: A Detailed Look at One Unit

All six units have distinctly individualistic characteristics, as the six distinct individuals who spend the time, money and effort to live in this exurban situation will demand. These are sensitive people who are aware of their surroundings, who are aware of their individuality, and who are going to demand uniqueness in their homes. Yet a unifying and harmonious element which holds the housing units to the site as well as to each other, to avoid visual chaos is the vocabulary by which they are expressed. Native materials, roof slopes, and sun scooping characteristics as well as internal room configurations dictated by site characteristics serve as those harmonizing elements.

The floor plan of unit 3, on page I5, is shown to include a "rear entrance" and a "main entrance." Delivery of wet muddy shoes, groceries, and school children is provided into the kitchen onto an easily cleaned floor. This door is closer to the parking area and requires less carrying distance for groceries, etc. It is protected from wind and foul weather by a stone wall and the bulk of the house itself.

Oriented off the main entrance foyer to the west is the living area taking advantage of the northern view and afternoon and evening sun. Also visible is the artificially created pond which serves as a swimming and ice skating

recreational facility for all six houses. Nestled behind the living room and also adjacent to the foyer is the family room through which access is gained to the outdoor patio. It is oriented to take advantage of the evening sun also as well as the immediate outdoor landscape. The patio is protected against the North-South Leverich Canyon breezes and affords space for evening dining sheltered from wind and enjoying those sunny evening hours.

At the rear of the house the two bedrooms are staggered to the east allowing early morning sun to enter both bedrooms as well as the bath that is nestled between the two. Another bath, a mechanical room and a cloak closet form an island around which circulation takes place. Entry to that bath is semiprivate, opening into the east corridor and away from public areas of the house.

The dining area is placed in the north-east corner of the house and has two views to be enjoyed while dining. One is to the north of the Gallatin Valley and one is to the immediate Leverich Creek which flows by that corner of the house.

From east to west along the entire width of the house along a line which lies over the south end of the kitchen, as per photographs on pages 118 and 18, the roof splits level. A "clearstory" light runs the entire length of the house and allows light penetration the entire depth of the house from September to April. The depth of the "clearstory", the slope of the roofs, and the eave overhang (page 18) were all carefully calculated to allow this sunlight which enters at an

angle of 22° in December to 50° in September and April at noon.

Structurally, as per Structural Layout page I6, the house consists of a slab on grade with 4 x 8 columns supporting 4 x 12 roof rafters. A 2-inch t. and G. decking applied directly to the 4 x 12's which are at four foot centers, will serve as the roof.

Between the 4 x 8 columns standard 2 x 4 stud framed walls will enclose the structure leaving the columns exposed on the inside and outside both. Vertical cedar siding will serve as exterior cladding accented by stone walls thrusting themselves out into the site and heavy cedar shake shingles on the roofs.

Radiant slab hot water heating as shown on page I7 augmented along perimeters of extensive glass will heat the house. The heat generated by this system is of superior quality and has proven itself in the severe Bozeman climate.

Landscaping as per Site Plan page I2 is placed to enhance the privacy and aesthetic beauty of the housing units and views.

Drives and roads will be tarmacked with locally excavated and crushed stone rolled into its surface. The same material will serve as internal site walkways. This surface will facilitate snow removal and maintenance during winter months and at the same time be much more site harmonious than concrete walks would be.

Snow removal and year round site maintenance will be handled by a full or part-time employee. Provisions for his hiring will be spelled out in the covenants which control the six man Home Owners Association. Further covenants limit the scope and extent of landscaping or other improvements which an individual may want to carry out. Such improvements must not detract from the original character of the architecture or quality of the site.

Bibliography

A. Personal Interviews

1. Marshall Bennett - real estate
Bennett Agency
2. Michaela Shyne - real estate
Bozeman Realty
3. Mrs. Emery L. Clark - landowner
Bozeman, Montana
4. Herb Pace - real estate
Bennett Agency
5. Gordon Kelly - engineer
Montana State University Physical Plant

B. Publications

1. U.S. Dept. of Agriculture Soil Conservation Service, SOIL INTERPRETATIONS FOR LAND USE PLANNING AND DEVELOPMENT IN THE GALLATIN VALLEY AREA, MONTANA, AUGUST, 1970.
2. Gallatin County Health Dept., RULES AND REGULATIONS GOVERNING SEPTIC TANK AND DRAIN FIELD SEWAGE DISPOSAL FACILITIES.
3. Sweets Catalogues.

c. Books

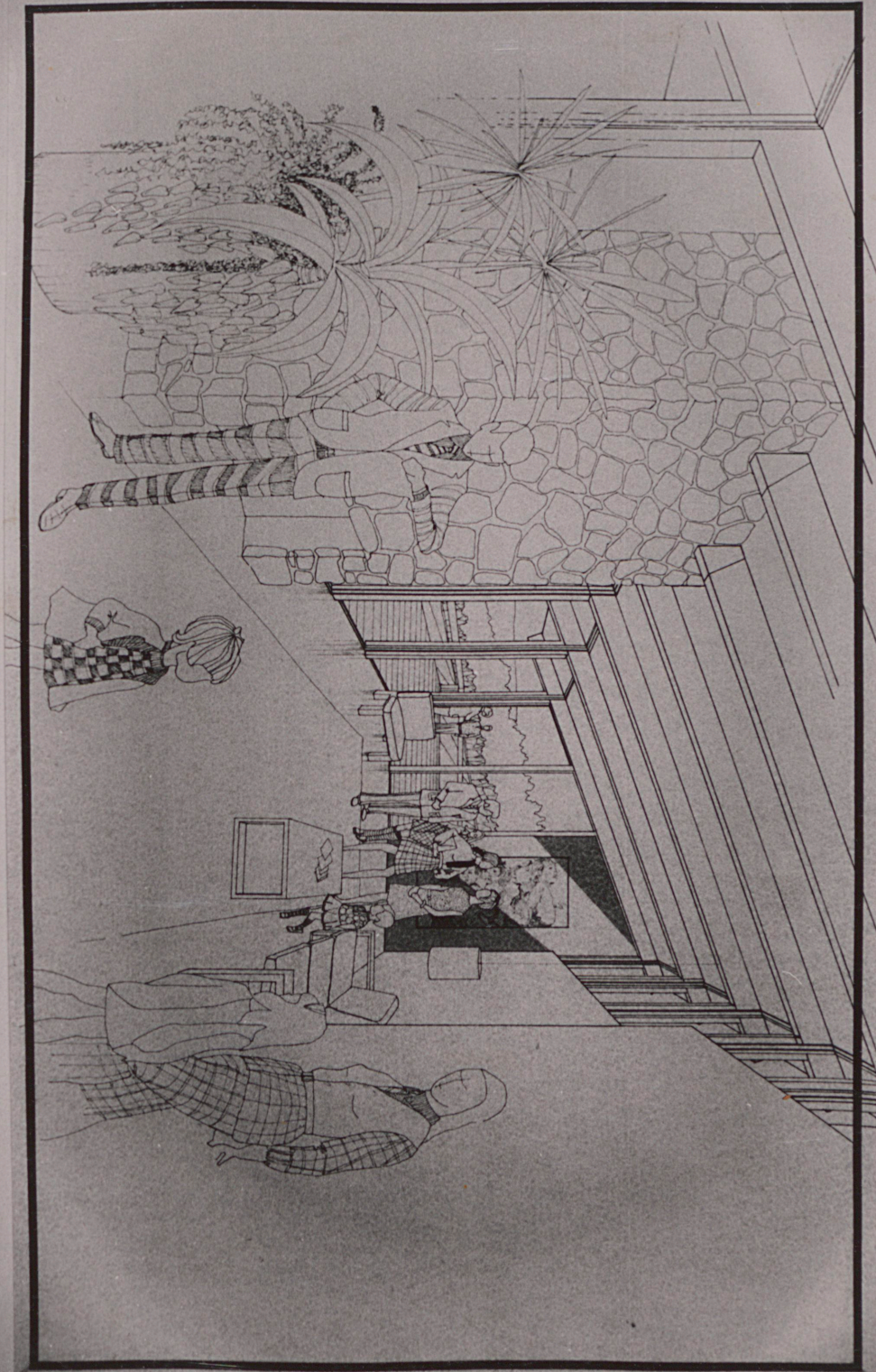
1. Caleb Hornbostel, MATERIALS FOR ARCHITECTURE, New York: Reinhold Book Corporation, 1968.
2. Sheppard and Wright, BUILDING FOR DAYLIGHT, London: George Allen and Unwin, Ltd., 1948.
3. Cereghini, Mario, BUILDING IN THE MOUNTAINS, ARCHITECTURE AND HISTORY.
4. Gay, Charles Merrick, MECHANICAL AND ELECTRICAL EQUIPMENT FOR BUILDINGS.
5. Graphics Standards.



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UNIT 2 : PERSPECTIVE

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SITE PLAN

EXHIBIT



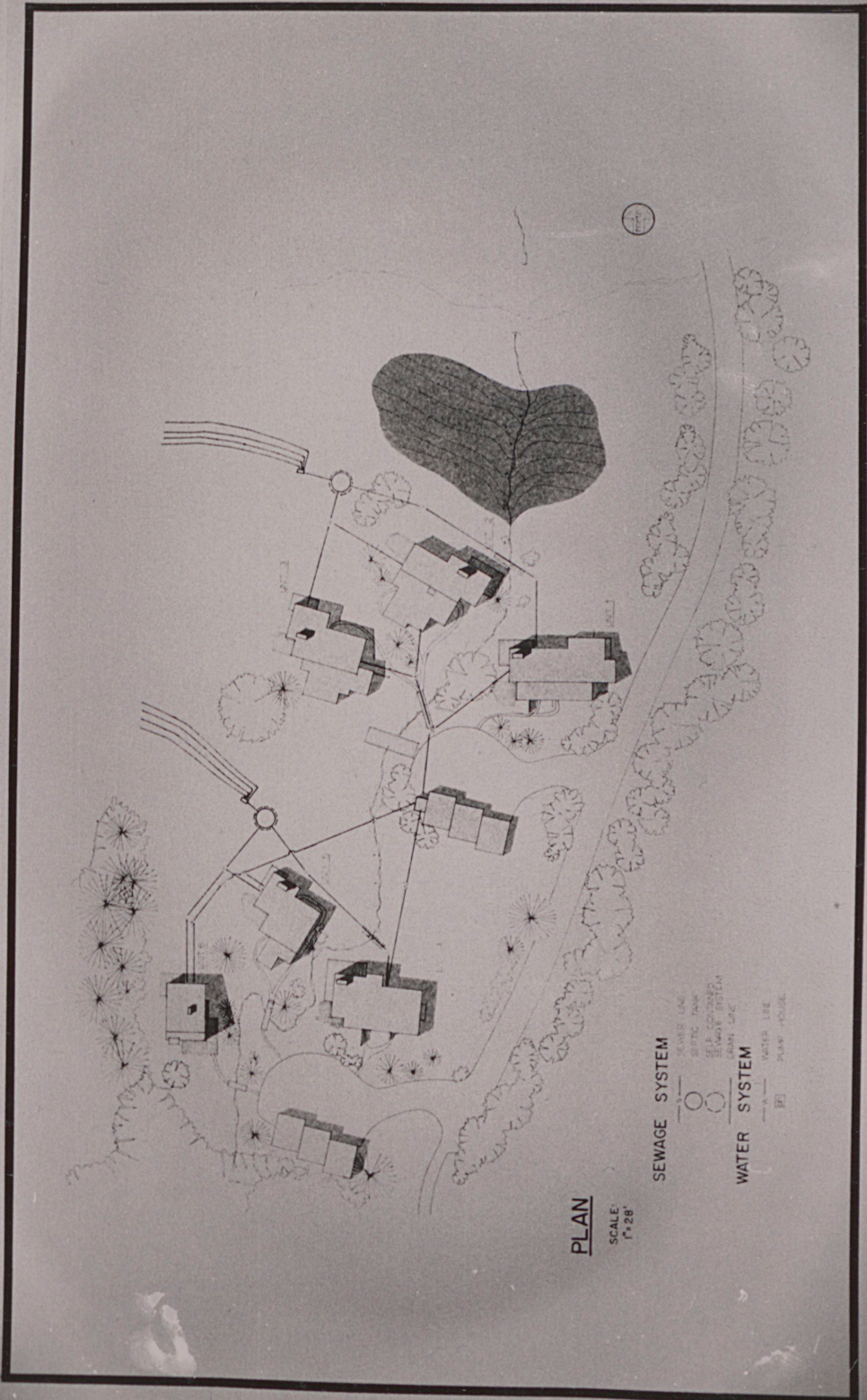
PLAN

SCALE:
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PLAN
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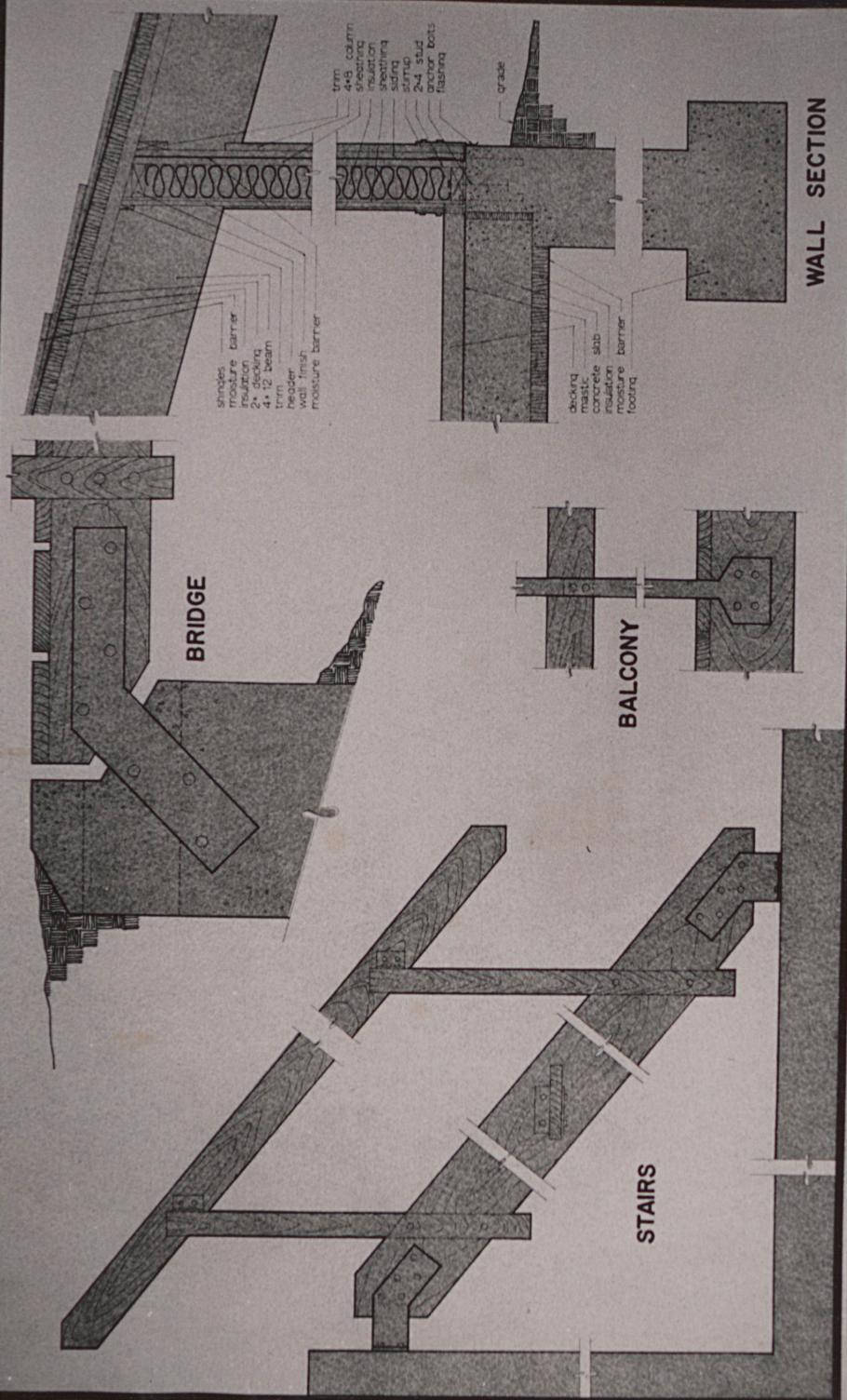
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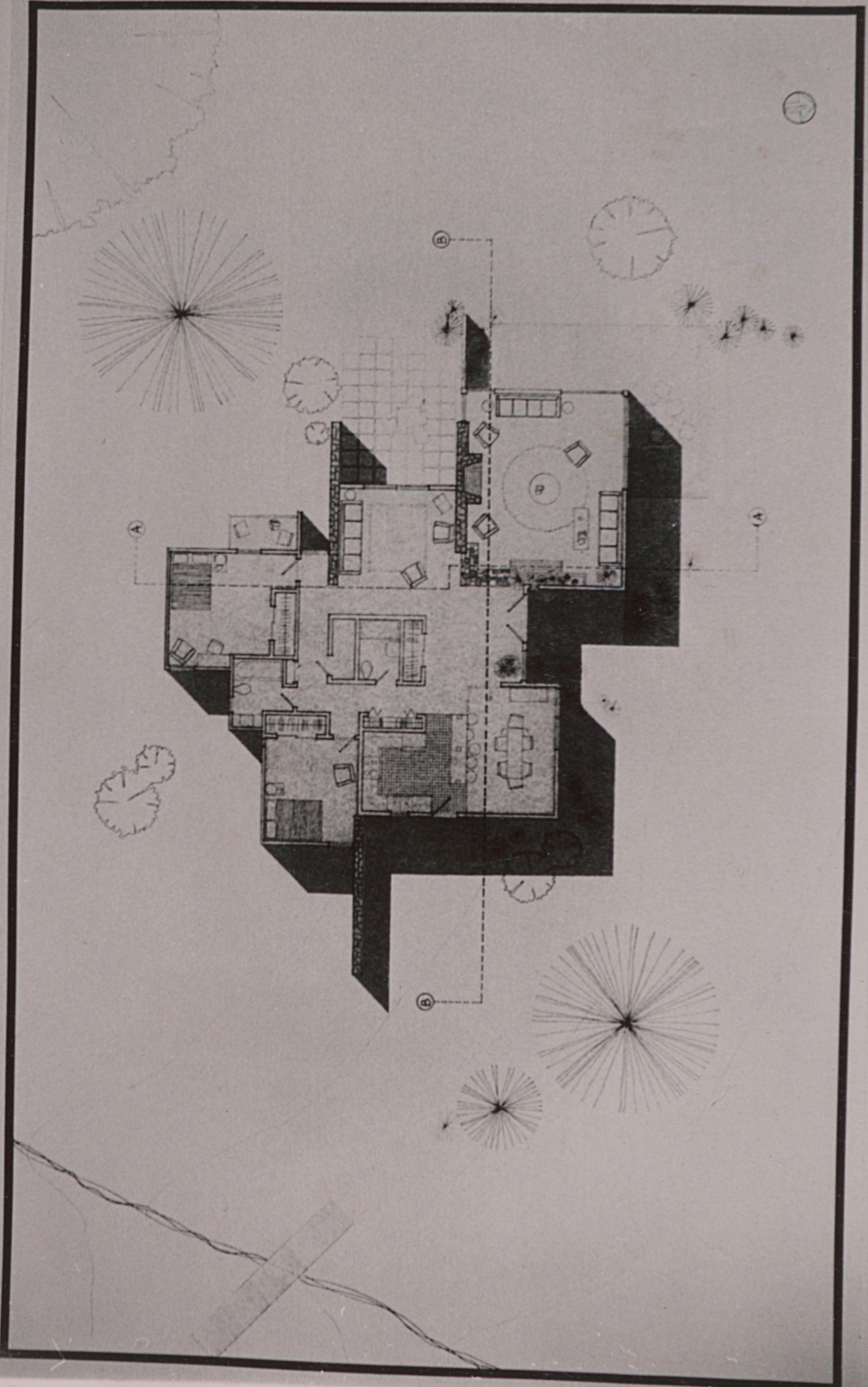
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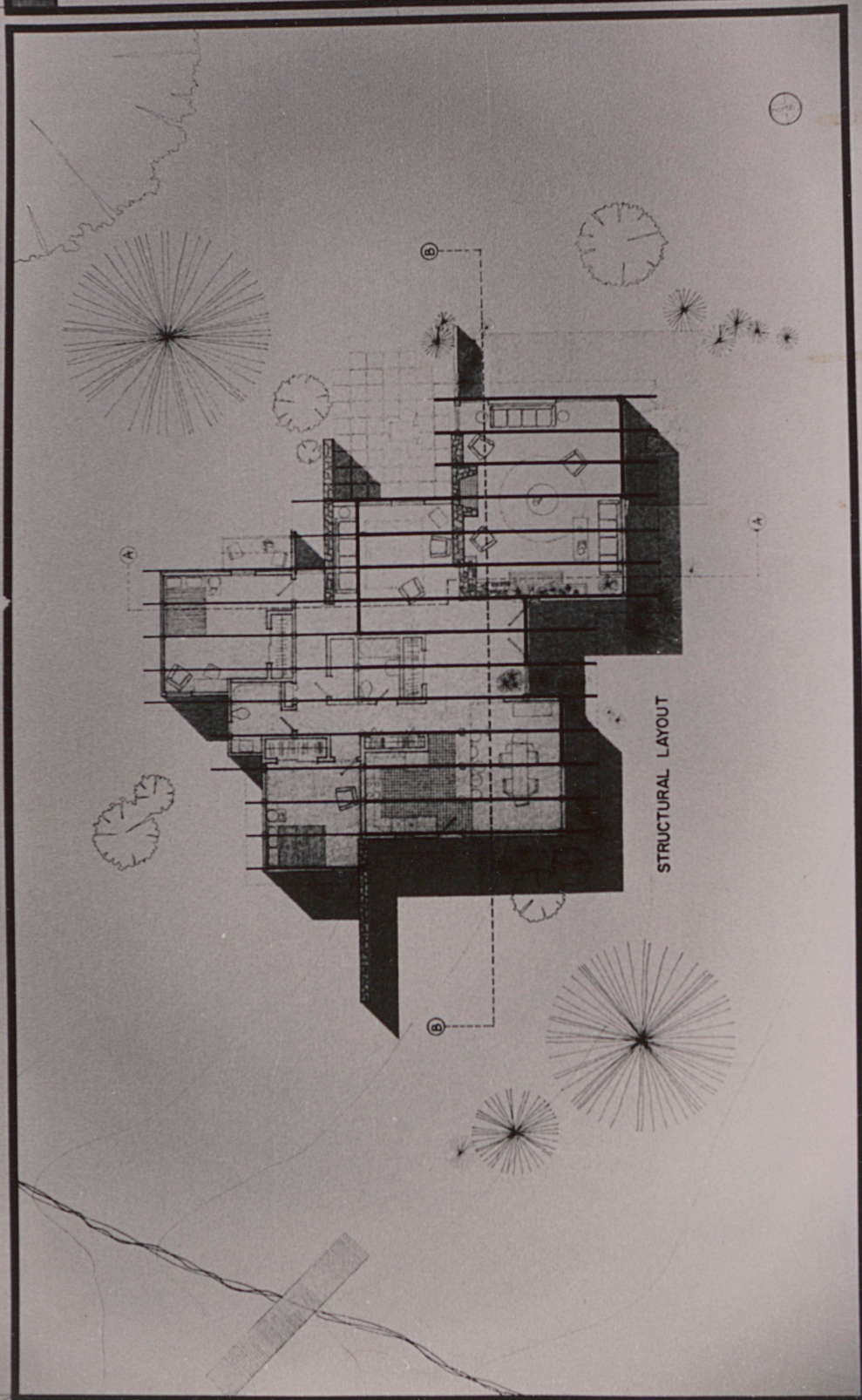


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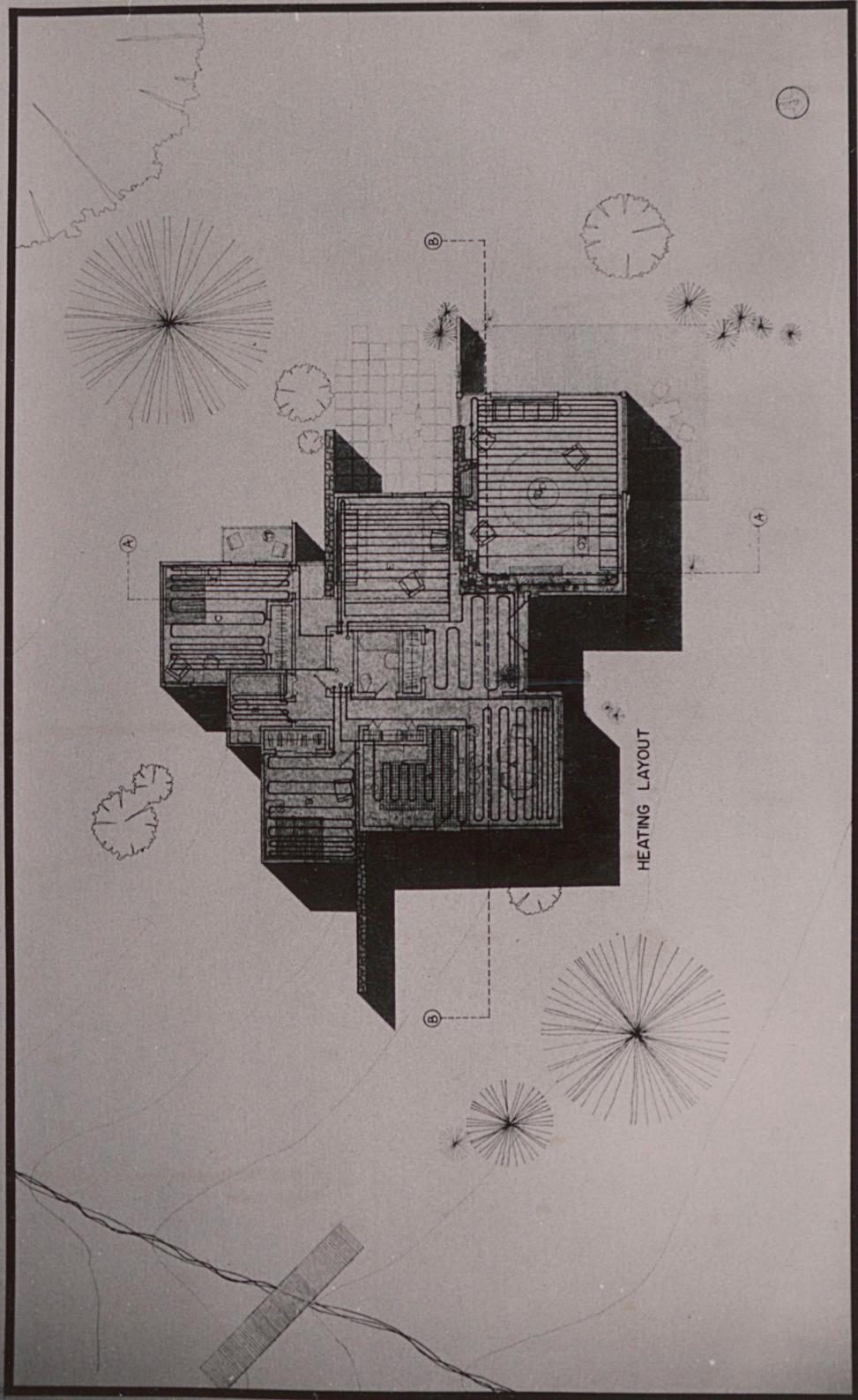
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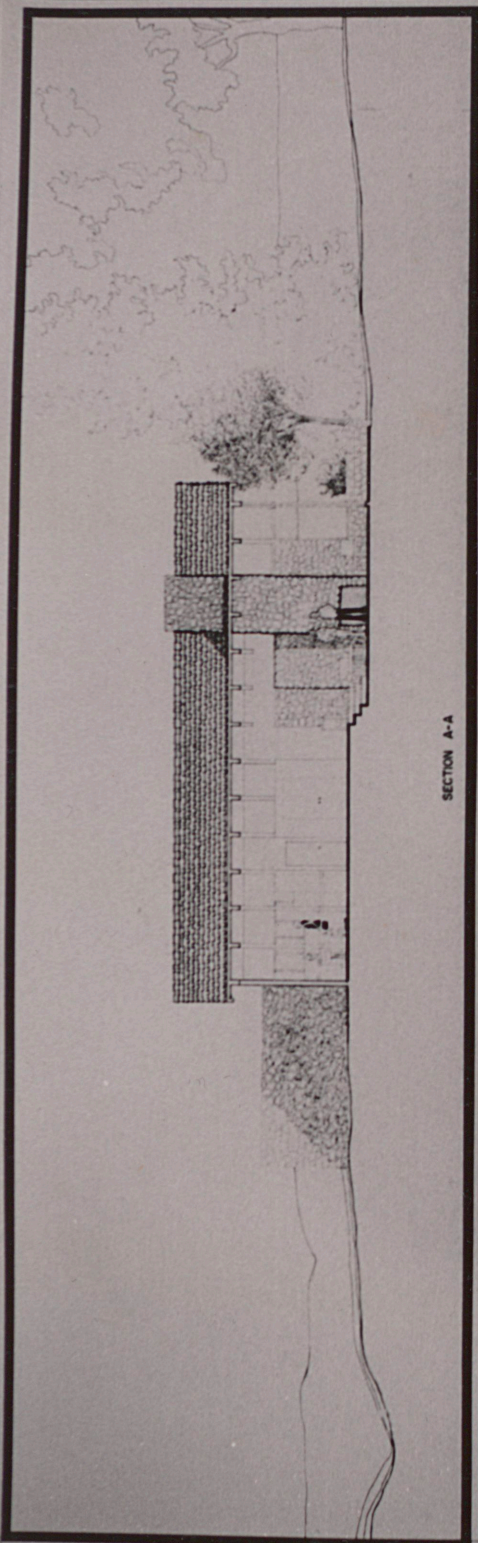


STRUCTURAL LAYOUT

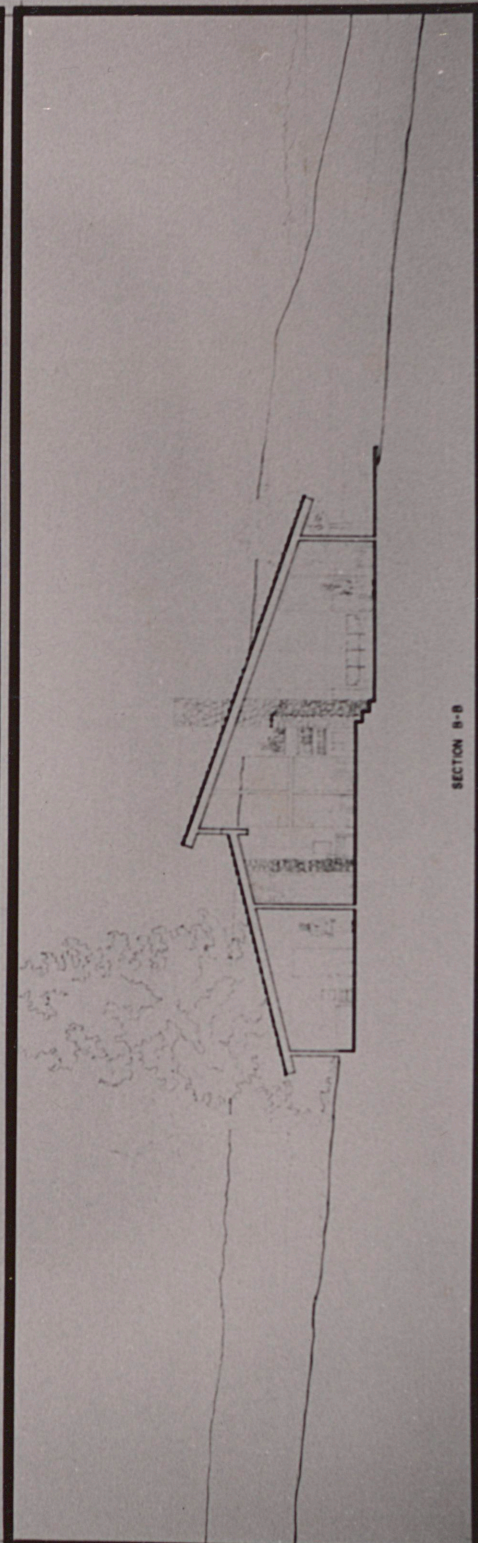


UNIT 3 SECTIONS

EXHIBIT



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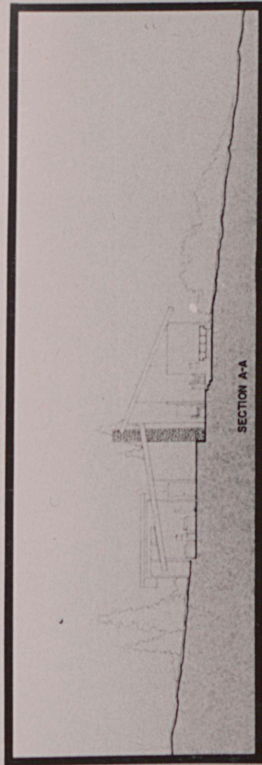


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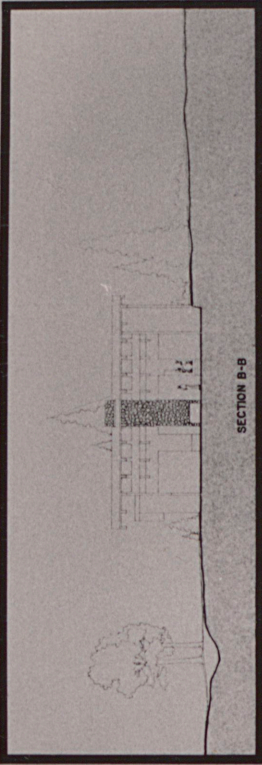
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UNIT 2

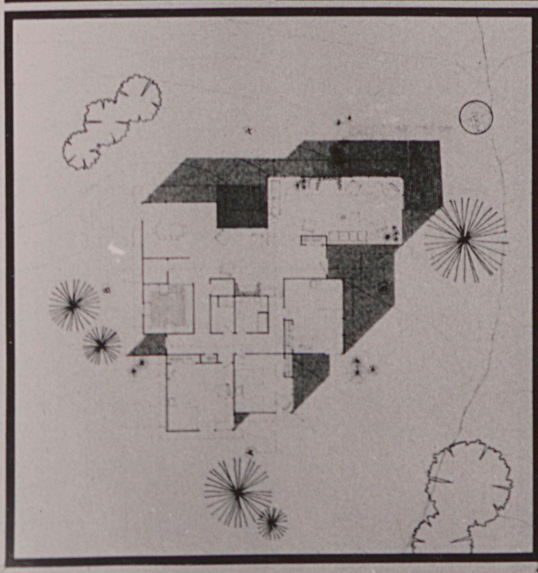
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SECTION A-A



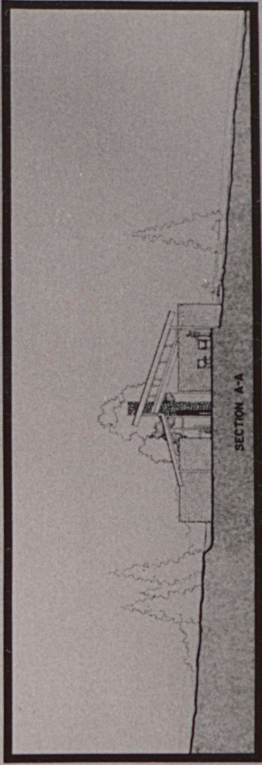
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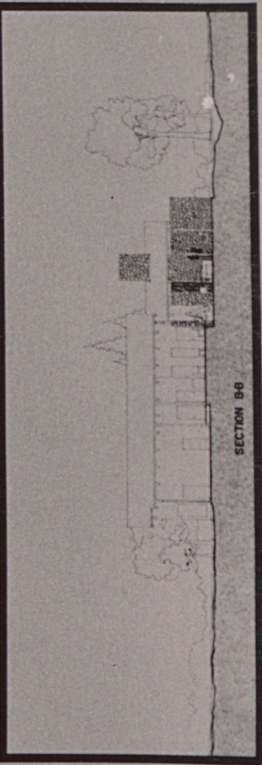
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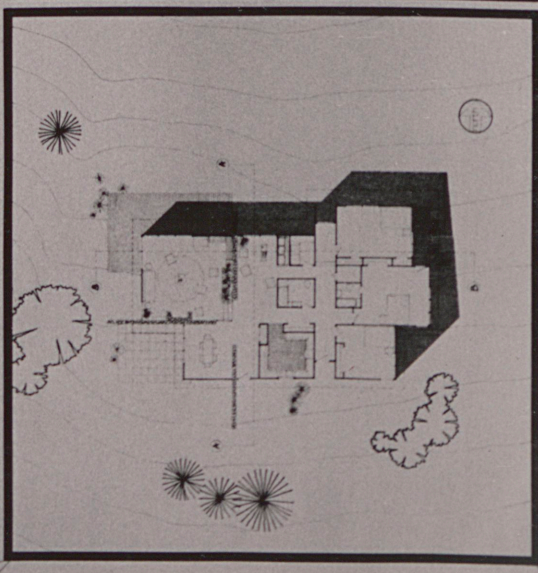
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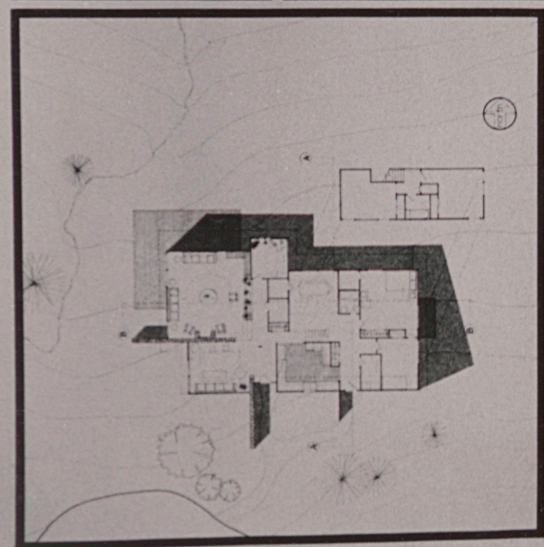
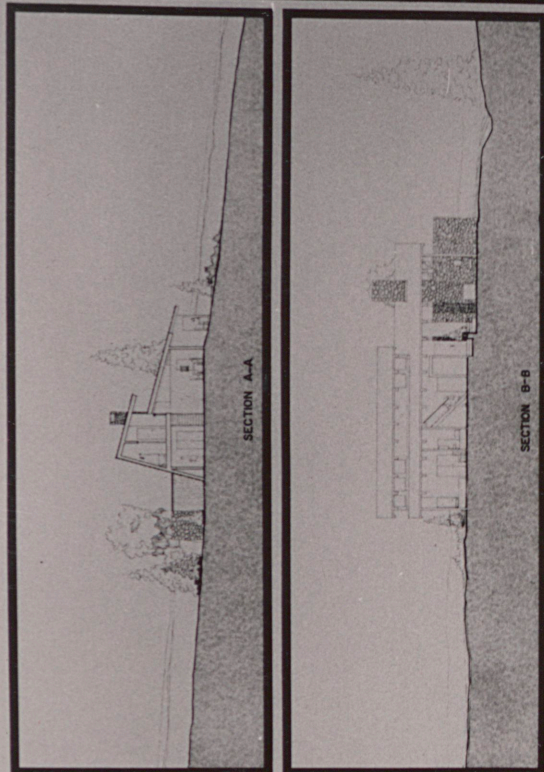
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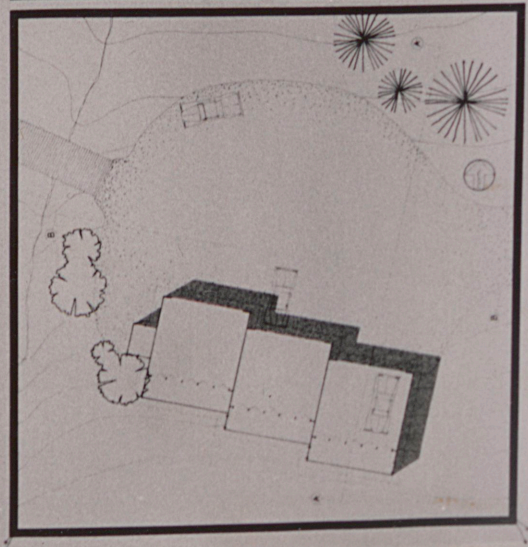
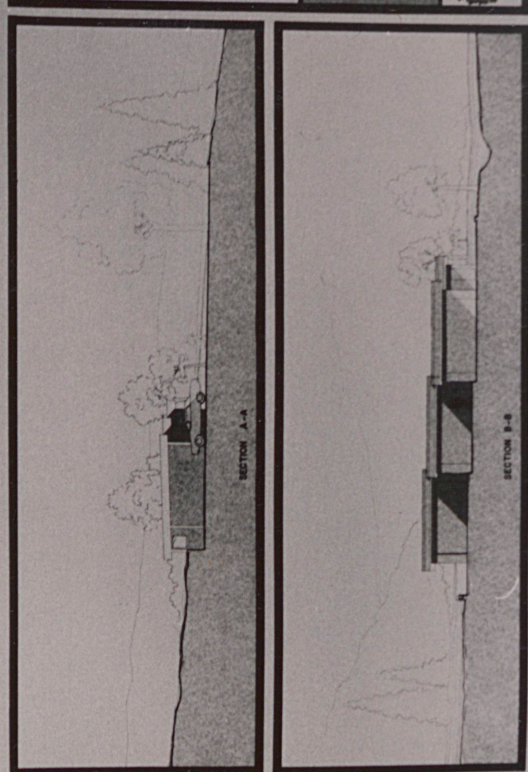
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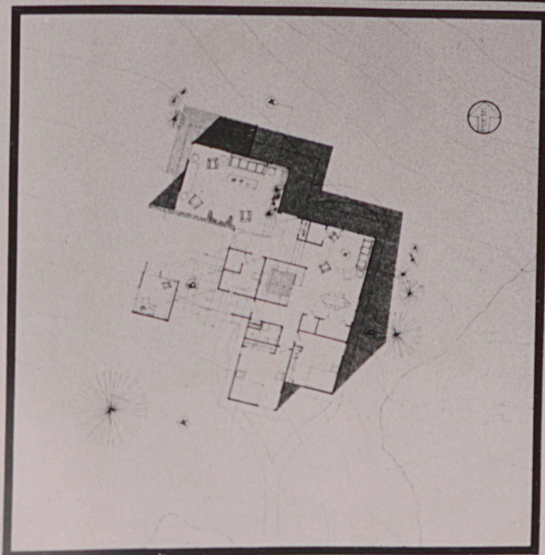
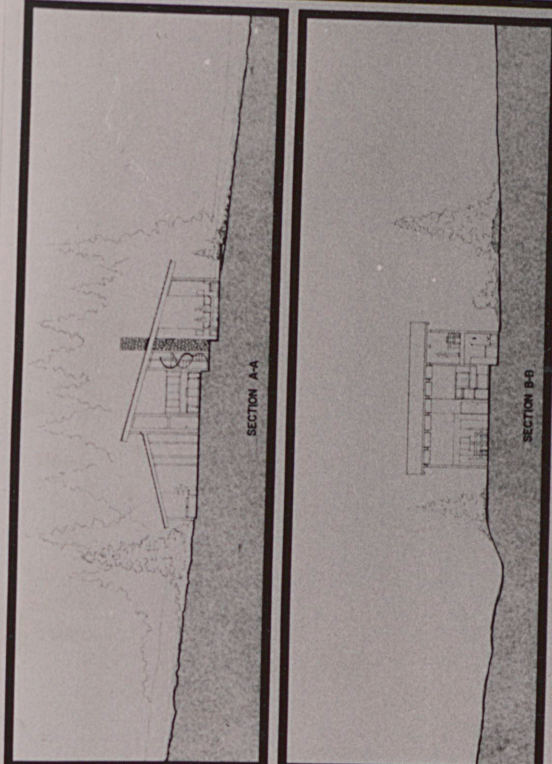
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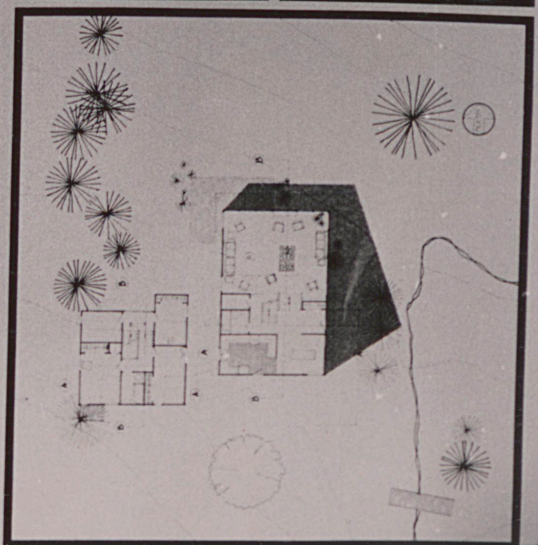
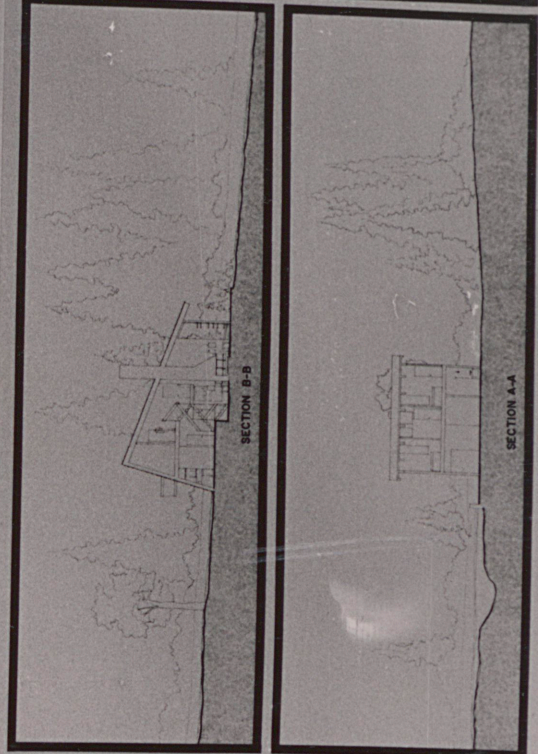
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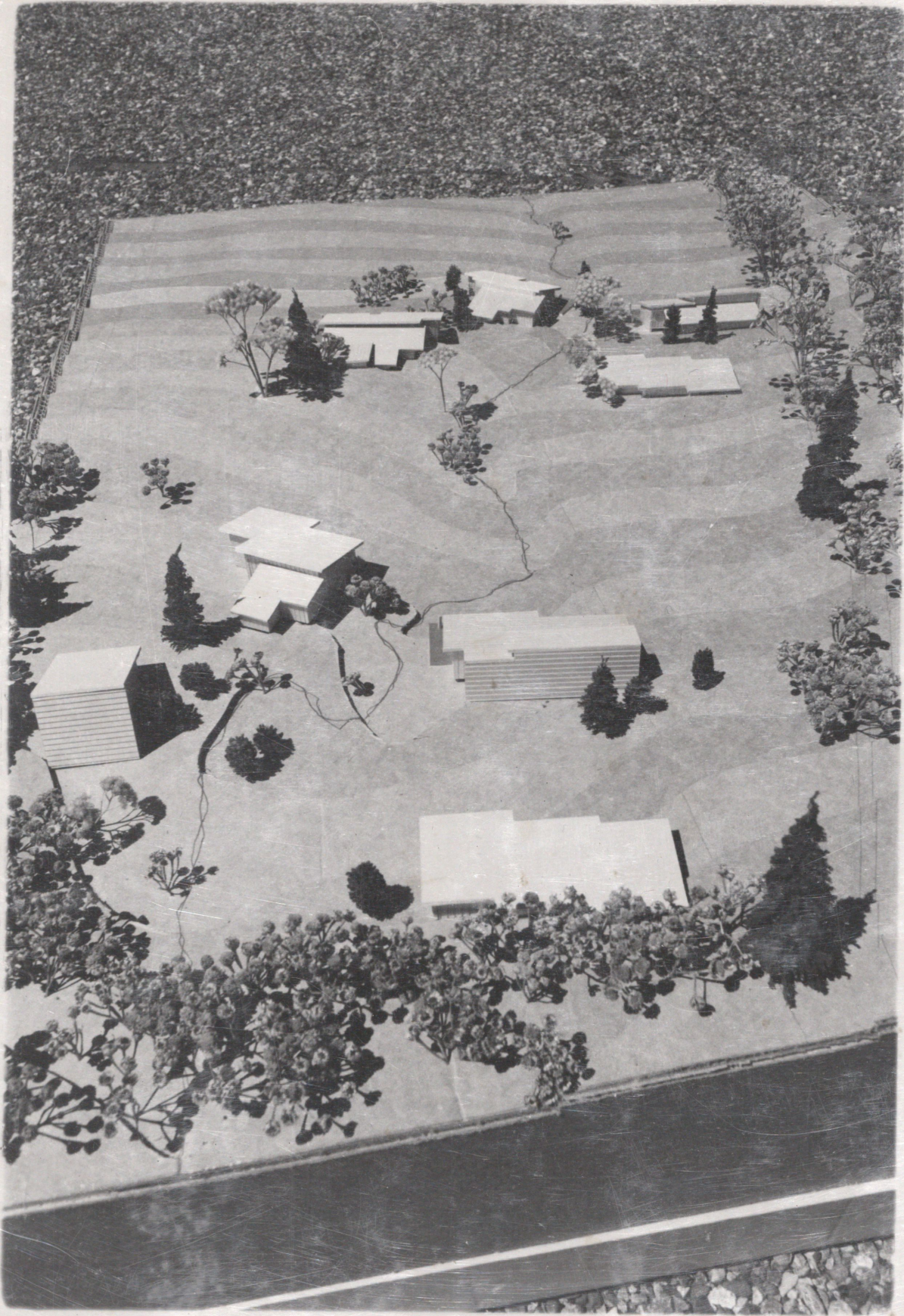












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