

ARCHITECTURE FOR ENVIRONMENTAL LEARNING:
A National Outdoor Leadership School in Baja, Mexico
by
Taylor Galyean

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JUNE 1994

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OF TECHNOLOGY

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Submitted to the Department of Architecture on May 6, 1994
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Master of Architecture

ABSTRACT

An understanding of people, program, and place establishes a foundation from which to make architectural decisions. The focus of this thesis is to understand the needs of those involved in an outdoor education school in Baja, Mexico and assemble a comprehensive architectural solution to these needs.

The outdoor education school has the mission to be the best source and teacher of wilderness skills to protect the user and the environment. The people of this school share a common interest to live harmoniously with their surroundings and work to achieve a life-style that has a minimum impact on the natural environment.

The site is on the east coast of the Baja Peninsula in a desert coastal ecosystem. The school is acquiring additional property and has the need for a master plan that looks to their long term needs. The master plan interweaves the issues of being in a small community and the organization of the program with the natural environment.

At all scales the focus of the facility is education. Building designs are direct solutions to the needs of the people in this environment. The site embodies the workings of the school and a relationship to the surrounding area.

The natural environment does not act as the setting for the architecture of the school, but is seen as the focus letting the architecture become the framework through which one observes the natural environment.

Thesis Supervisor: Andrew Scott

Title: Associate Professor of Architecture

This thesis is dedicated to
Jane Elizabeth Elliott Galyean
for her example of continual learning and support of education for all

I would like to acknowledge the following people for their help and support

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Introduction

This thesis is presented as a collection of images to walk the reader through the design. Supplemental text at the beginning of each chapter sets the ground work for the illustrations that follow.

The organization for which the design exploration has been done is the National Outdoor Leadership School(NOLS). NOLS is a non-profit organization whose mission is to be the best source and teacher of wilderness skills that protect the user and the environment. There are NOLS branch schools in many locations around the world. The particular branch of interest for this design is the facility in Baja, Mexico. The Baja Branch has acquired additional property making the total area approximately two acres. The design of this thesis looks to the future for the potential master plan of the facility.

The thesis is presented in chapters. The chapters structure the information by initially introducing the reader to the site. The design is presented by looking at the details of the method of construction. Specific buildings are developed in detail to show the

implementation of the construction method. The master plan is presented followed by details, the main square, and Solar Aquatics System. The last chapter is the discussion of landscape and the first stage in implementing the master plan.

People Program Place

People

The people inhabiting the facility are a collection of individuals with a common concern and appreciation for the natural environment. The inhabitants fall into three categories: students, field instructors, and support staff. It is important to understand the people inhabiting the facility to offer appropriate environments.

Students are at the facility for the shortest amount of time. Arriving in the morning, they stay for a twenty-four hour period as they prepare for their course. For students, the branch facility is a place of transition between the developed world and the wilderness: a place and time for a change in mind set from the life-style of living in an urban environment to the preparation of living in the wilderness. After thirty days the students return to the facility where they adapt themselves for the return to their previous world. Upon returning to the facility they de-issue gear, clean up, say their good byes and head home.

Field instructors teach the courses in the wilderness. The instructors arrive a few days before a course to begin preparations for the expedition, making their stay the total length of a week between the beginning and end of a course. The life style of an instructor is often transient and the opportunity to have a place to stay for a few days that is their own is much valued.

The support staff run the workings of the facility. Their jobs include directors, logistics coordinator, rations, equipment issue and maintenance, cooking, general maintenance, and course support. The support staff live at the facility for up to nine months. Living at the facility means that there is a need for places of privacy that allow the support staff their own space.

Program

The program consists of storage, gathering, housing and service spaces. The function of the facility is primarily that of support for the courses that are in the field. Much of the program involves the storing and issue of gear. While the structures that provide this are basically storage buildings, the quality of these spaces

must reflect the activity that occurs within them on a daily basis as staff students and instructors prepare for a course. The facility also demands places of gathering and community as an integral part of daily work, rest and recreation. These include the main house which provides dining, courtyards, patio, and a library, as well as the main courtyard surrounded by service and storage and many other smaller scale areas throughout the site. These areas should be flexible in addressing the need for various degrees of privacy that each inhabitant requires.

The campus offers appropriate and different accommodation for instructors, students and the support staff.

Lastly, the program includes the service areas. These include the bathhouse, wash house, workshop, and kitchen.

For a complete program see Appendix A.

Place

The Baja peninsula is the fourth-longest peninsula in the world, spanning between 23 degrees and 32

degrees latitude. The peninsula was created by the shift of the North Pacific Plate and the North American Plate along the San Andreas Fault that runs down the Gulf of California. This shift moved Baja from mainland Mexico.

The most striking feature of Baja is the spine of mountains running along the length of the peninsula. Due to the uplift of the mountain, they tend to be more gradual to the west and dramatic to the east. There are four major mountain ranges along this spine with the highest peak being Picacho del Diablo (10,154 feet).

Since the peninsula spans many degrees of latitude the climate varies considerably. The one characteristic that tends to refer to the entire peninsula is its dry desert qualities. The variation in climate supports a great diversity of flora and fauna.

A more complete description of the site is discussed in the chapter Observations of the Site.

Observations of the Site

In desert country everything from the color of a mouse or the shape of a leaf up to the largest features of the mountains themselves is more likely than not to have the same explanation: dryness.

So far as living things go, all this adds up to what even an ecologist may so far forget himself as to call an "unfavorable environment." But like all such pronouncements this one doesn't mean much unless we ask "unfavorable for what and for whom?" For many plants, for many animals, and for some men it is very favorable indeed. Many of the first two would languish and die, transferred to some region where conditions were "more favorable." It is here, and here only, that they flourish. Many men feel healthier and happier in the bright dry air than they do anywhere else. And since I happen to be one of them, I not unnaturally have a special interest in the plants and animals who share my liking for just these conditions

Joseph Wood Krutch

Location

The Site is part of the coastal desert of Baja California. Located on the eastern coast of Baja, the site is in Coyote Bay and is set within the Bay of Concepción. The Bay of Concepción is prominent in the Bay of California. The siting, a nesting of bays, offers

protection from the torrents of the open sea.

Highway Mex 1 is the major road in Baja that runs north to south. The site is directly off of Mex 1. To the south the nearest urban area and airport is Loreto approximately 60 miles from the site. Approximately 20 miles to the north, Mulegé is the closest town.

Surrounding Environment

The site is one of several properties that have been developed in Coyote Bay. Most of the houses are occupied from fall to spring by people from the United States. The method of building varies considerably. Houses range from the predominant simple box house made of brick with a concrete finish and a pitched roof, to the traditional use of palm fronds and wood, to the importation of hi-tech metals and fiberglass.

Coyote Bay appears to be moderately developed compared to neighboring bays. There is an increase in demand for the properties in Baja and one can only assume that future development is a strong possibility for Coyote Bay. To understand the impact that further

development may have, two bays north of the site show different degrees of development and are used for illustration. The less developed bay is a community of recreational vehicles parked on the beach from fall through spring before being driven north for the summer.

The more densely developed bay shows an incredible variety of building types, the most common being a roof structure that provides shade for the recreational vehicles that are parked underneath. Other more complete structures made from a tremendously varied array of materials define the small streets for the resort village.

Because development seems inevitable, it is the responsibility of NOLS to offer an example of building in the coastal desert that is sensitive and respectful to the surrounding environment.

Existing Site Structures

The site includes three inhabitable structures and a water tower that serves several properties. The buildings include a main house, a storage building,

and a sleeping shelter. These structures are made of masonry construction with a wood framed roof. The main house is the oldest structure on the site and is showing decay by the percolation of the salt water through the ground into the walls. The other two buildings, built in the last ten years, are in good condition.

Climate

The climate data is gathered from the weather station in La Paz which is found 200 miles to the south of Coyote Bay. This information is compiled with observations from inhabitants of the area.

Daily means in degrees Fahrenheit are: January 65, March 69, May 77, July 85, September 84, November 74, Annual 76.

Temperature ranges are: winter, maximum 87 and minimum 35; summer, maximum 105 and minimum 63.5.

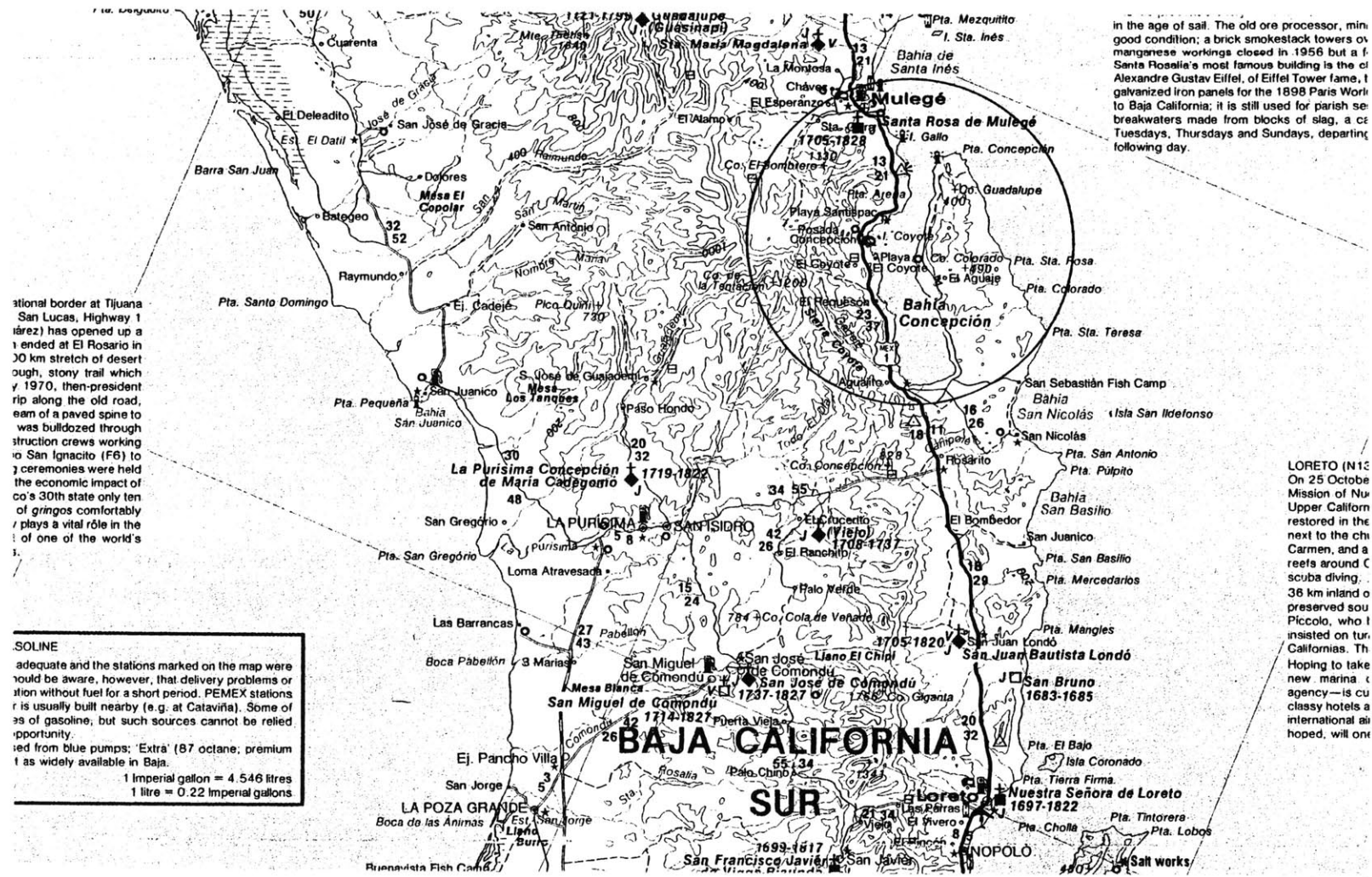
Average rainfall is 7.7 inches annually.

Summer winds come from the southwest and winter winds from the northwest. The site is significantly

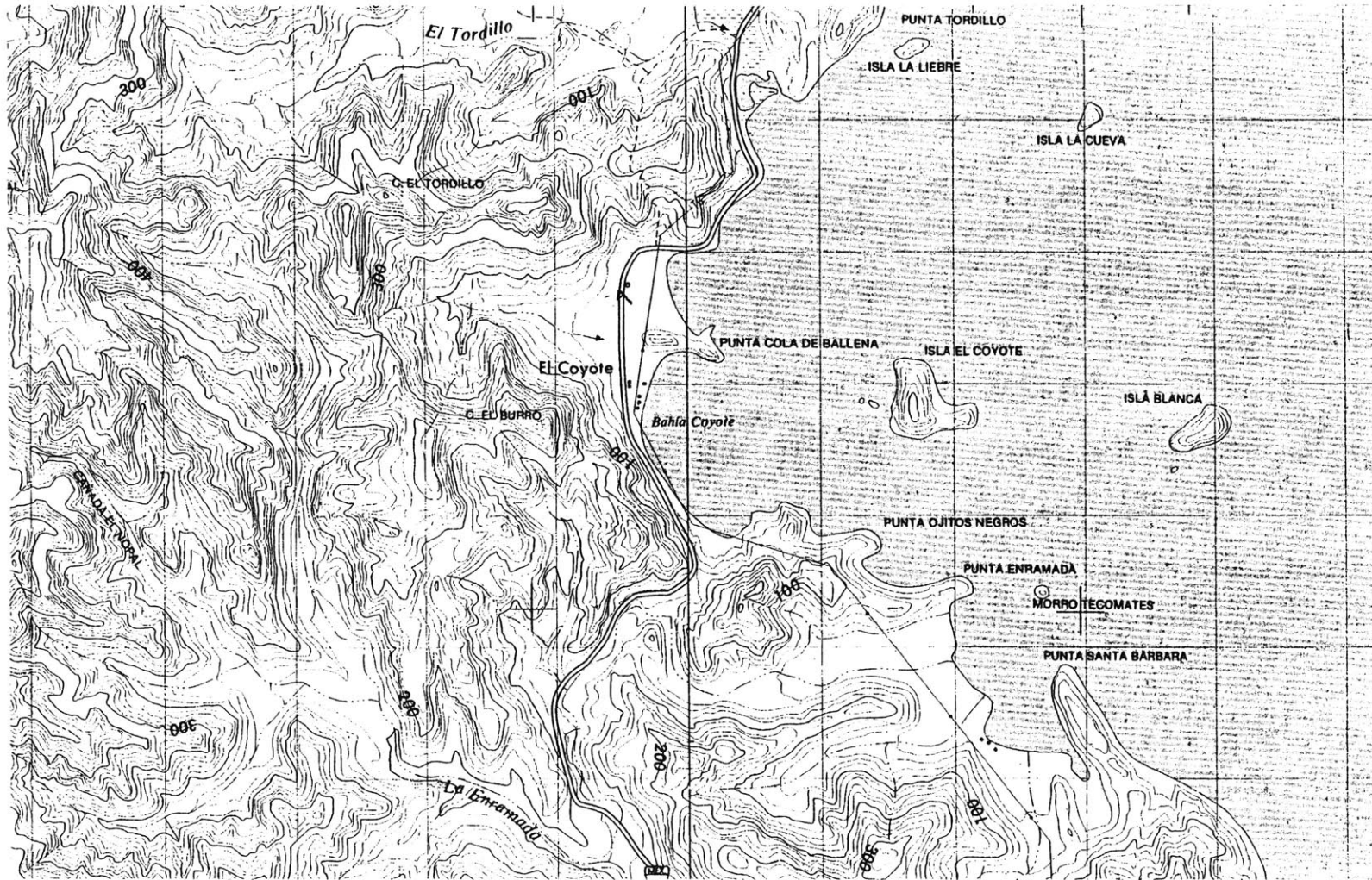
sheltered from wind.

Flora

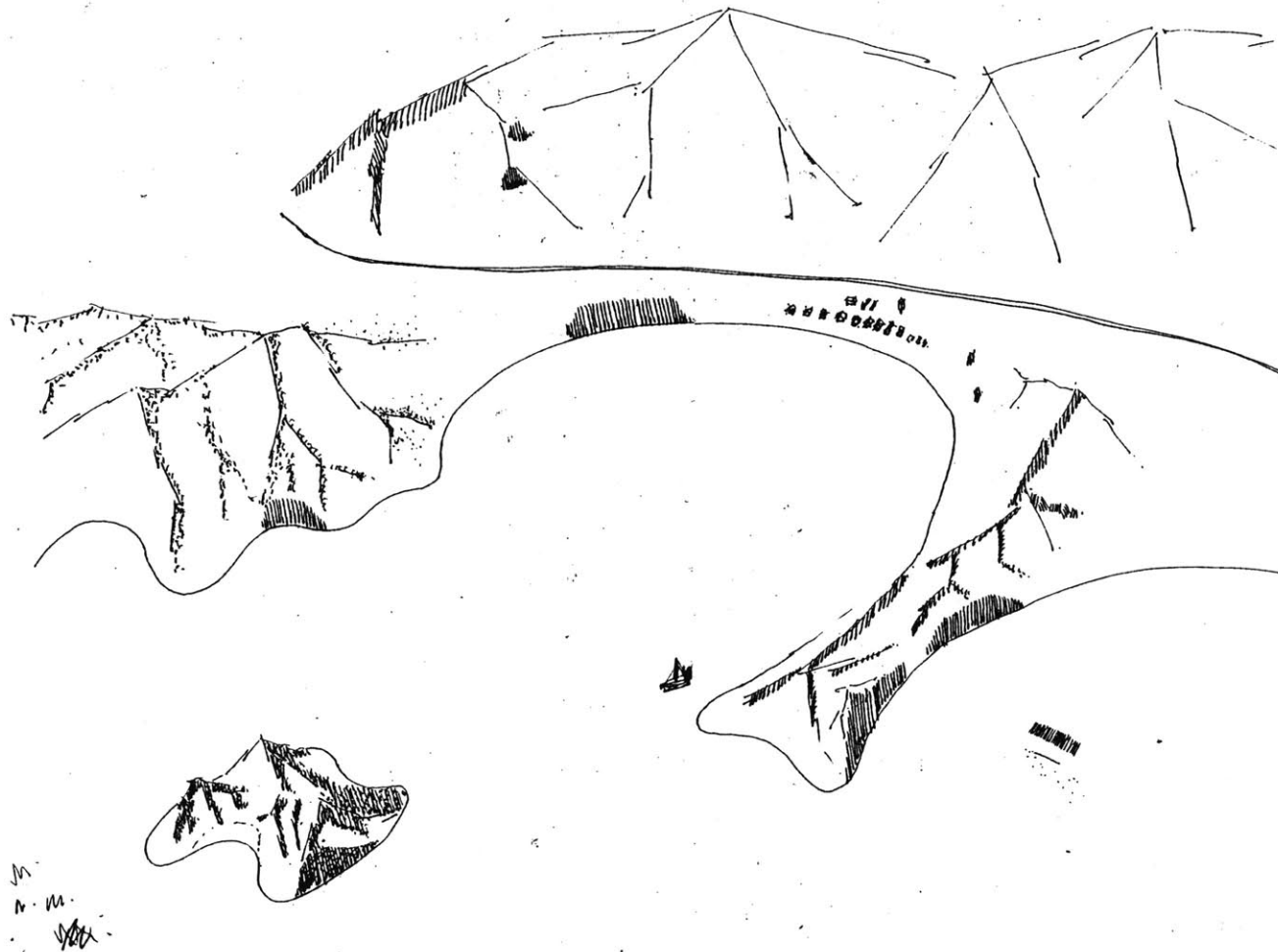
The vegetation on the site includes a variety of plants that can survive the high salt content of the water. The noted vegetation includes: Mesquite, Cholla, Cardón, Frutilla, Mangrove, Bougainvillea, Palm, Huitatave, and Pickleweed. These plants are illustrated in the following pages.



Map of Bay of Concepción



Map of Coyote Bay

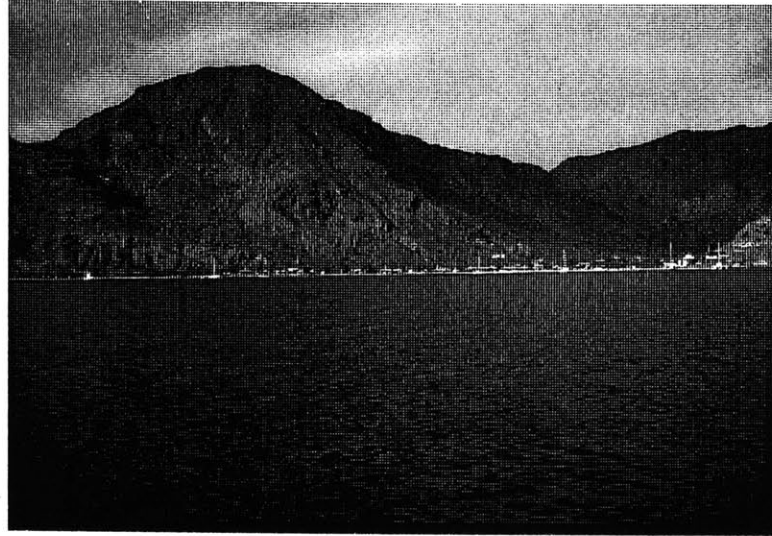


Sketch of Coyote Bay from the East

Approaching Coyote Bay from the East

1 mile from site

The site is being approached by boat from the east. The sequence of photographs are being taken on the return from re-rationing courses in the Bay of Concepción.



Approaching Coyote Bay from the East

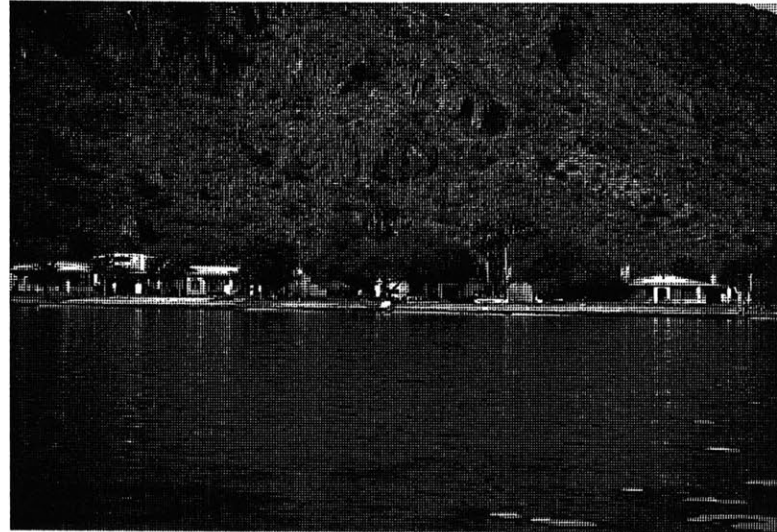
.25 miles from site



Approaching Coyote Bay from the East

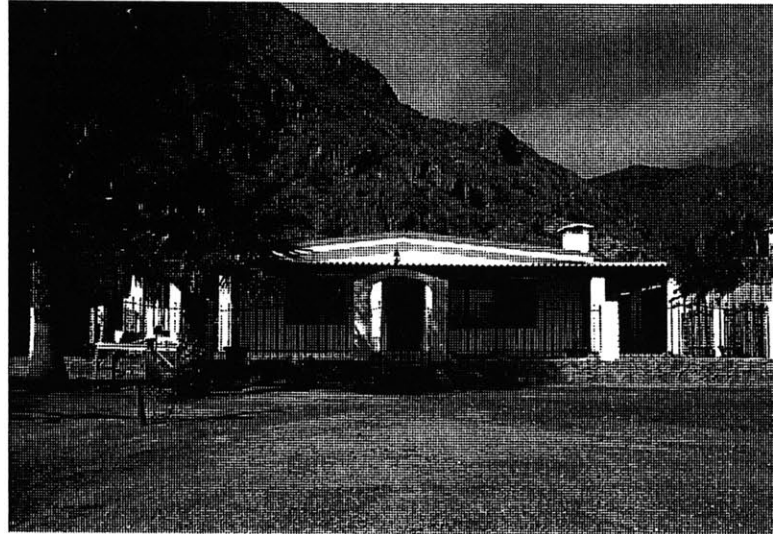
.1 miles from site

The neighboring houses to the site can be identified.

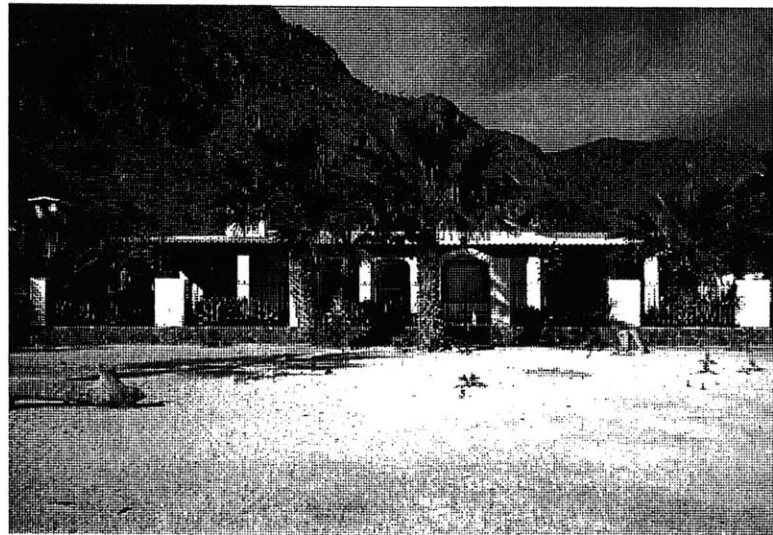


House in Coyote Bay

The house is built in the same manner as the main house on the site.

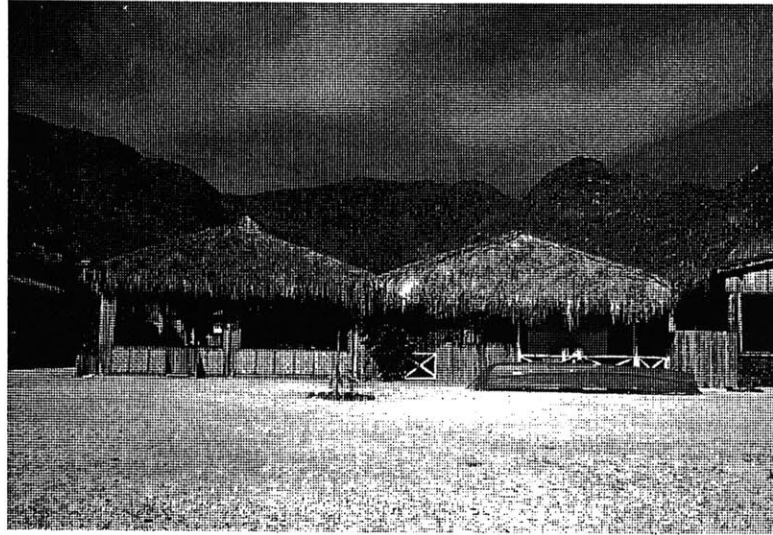


House in Coyote Bay



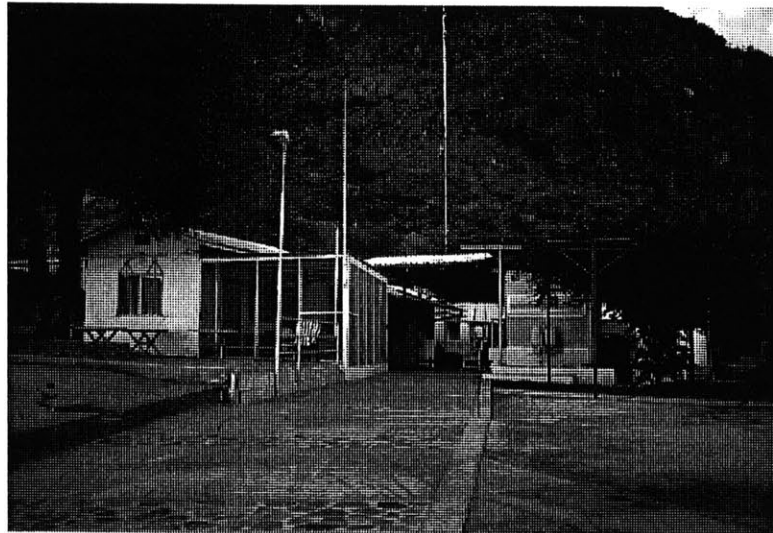
House in Coyote Bay

This house shows the use of palm frons in the roof structure and the recreation vehicles are parked underneath.

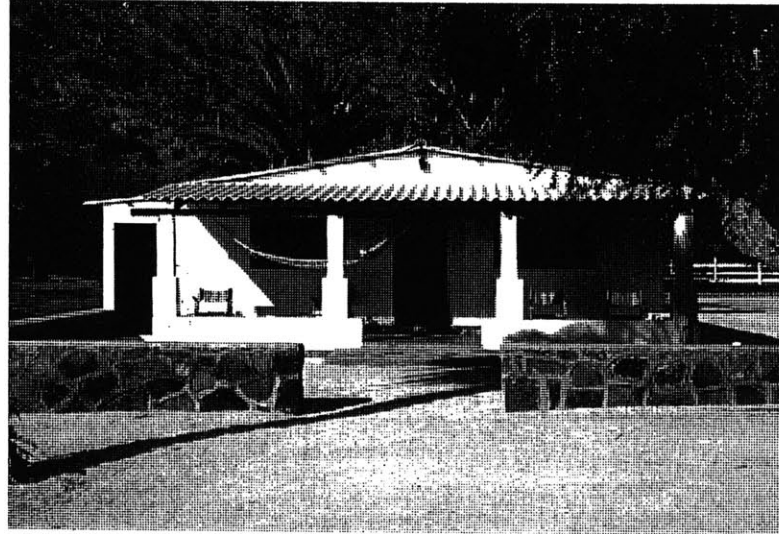


House in Coyote Bay

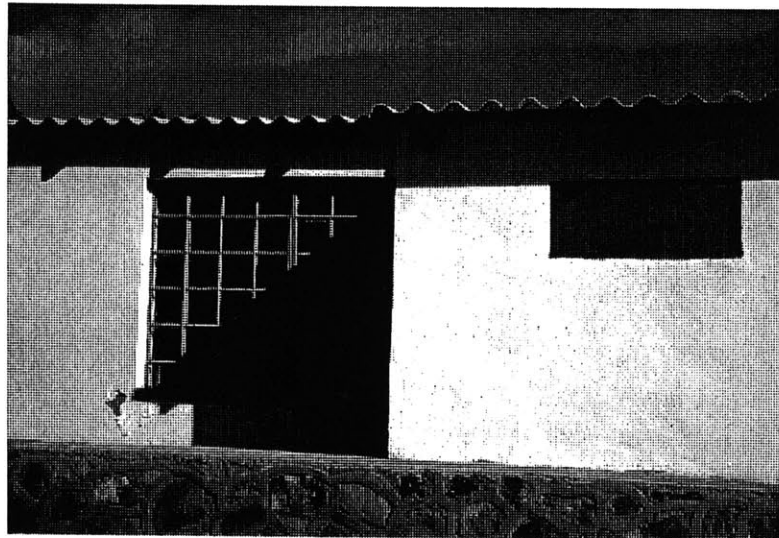
This house is built by a successful businessman who has gone to great efforts to import high-tech materials.



House in Coyote Bay

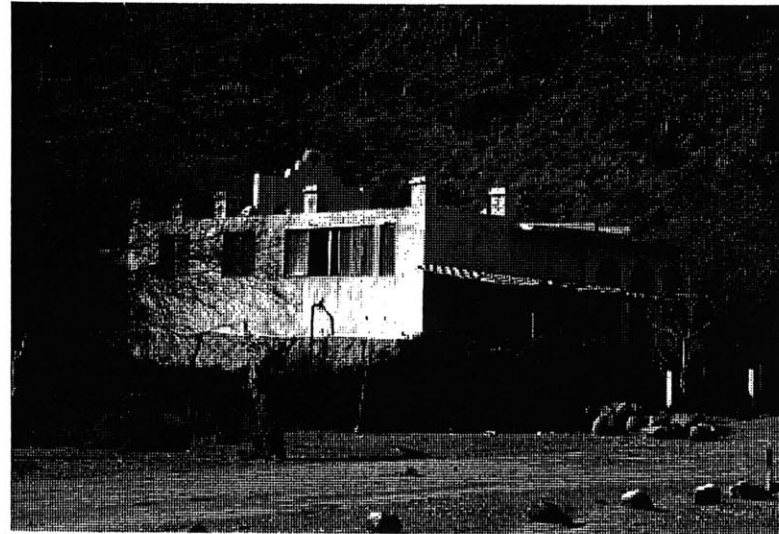


Detail of House in Coyote Bay



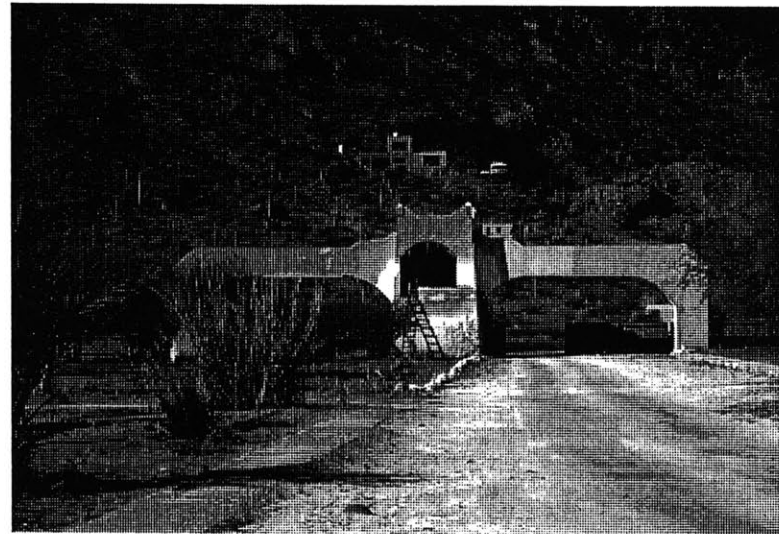
Abandoned Building

The building is found in the northwest corner of the site. The initial purpose of this building was to be a stopping point for travelers along highway Mex 1.

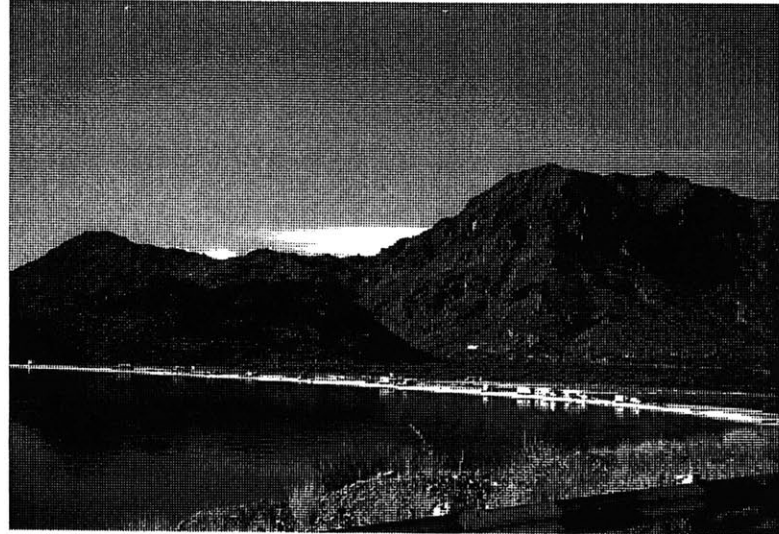


Gateway to Trailer Park

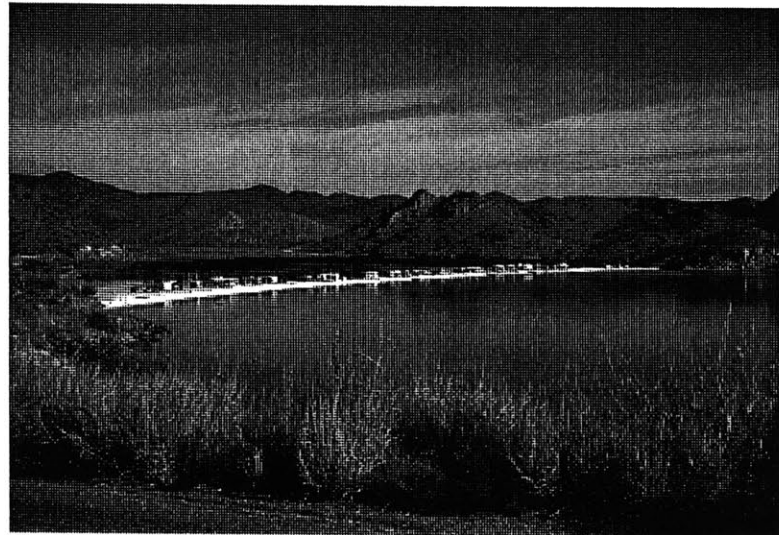
The trailer park is the property sharing the north boundary of the site. The park is only partially occupied. Most of the properties have a roof structures providing shade for recreational vehicles.



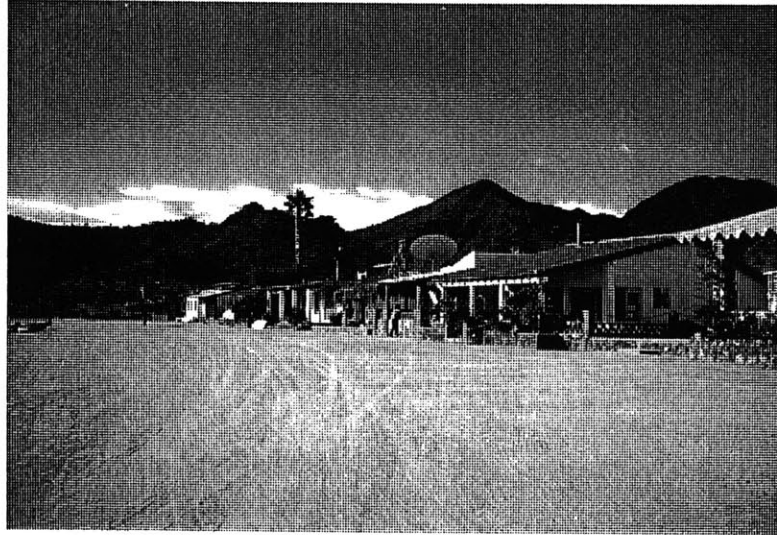
Less Developed Bay to the North of Coyote Bay



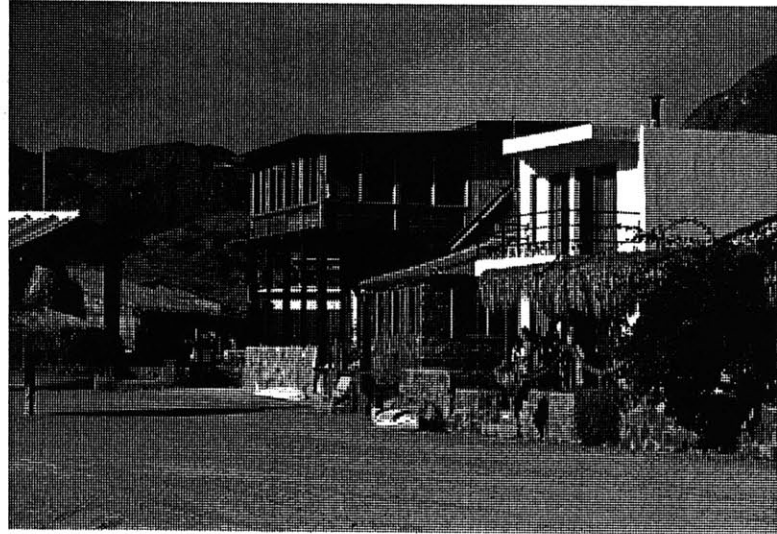
Less Developed Bay to the North of Coyote Bay

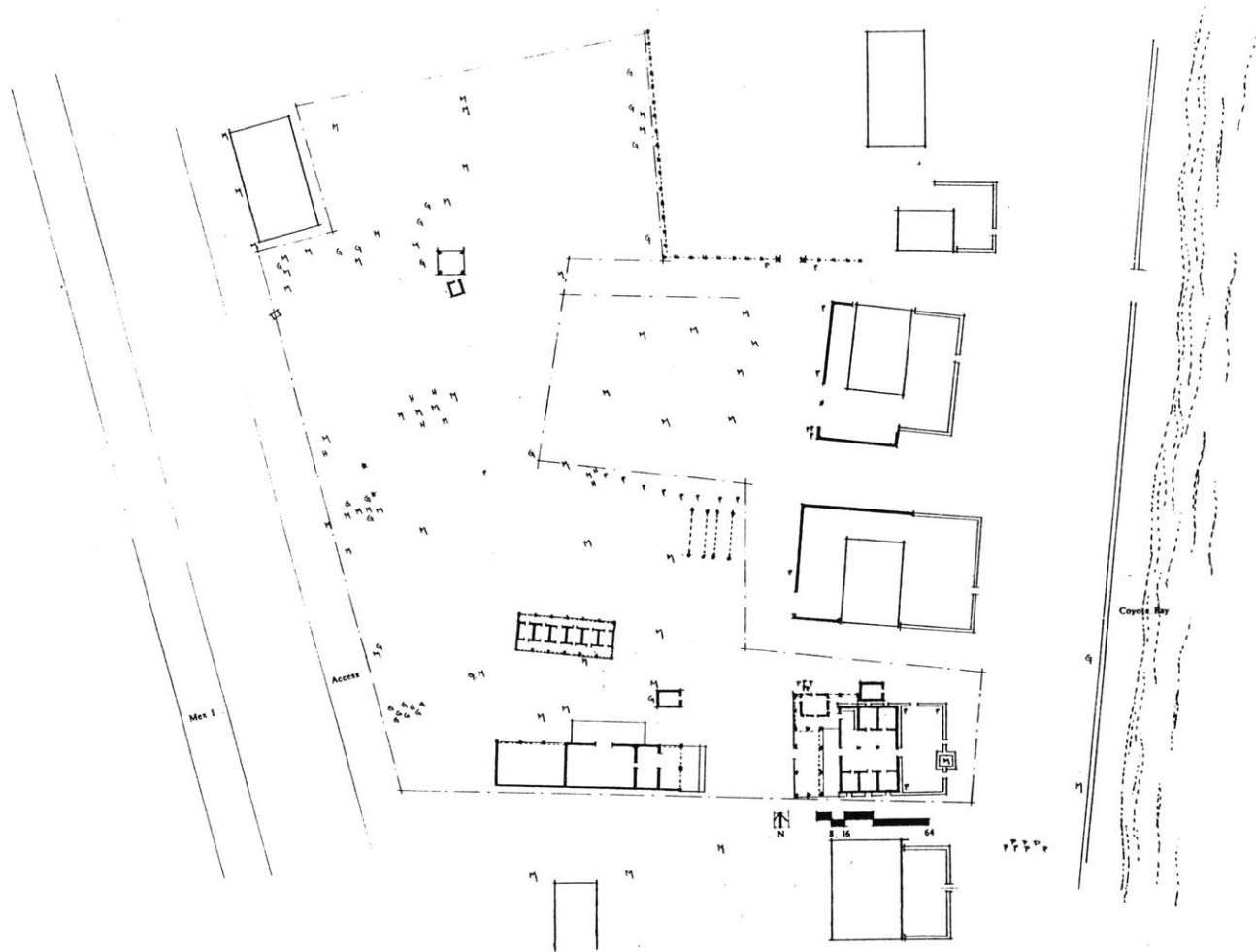


Detail of More Developed Bay

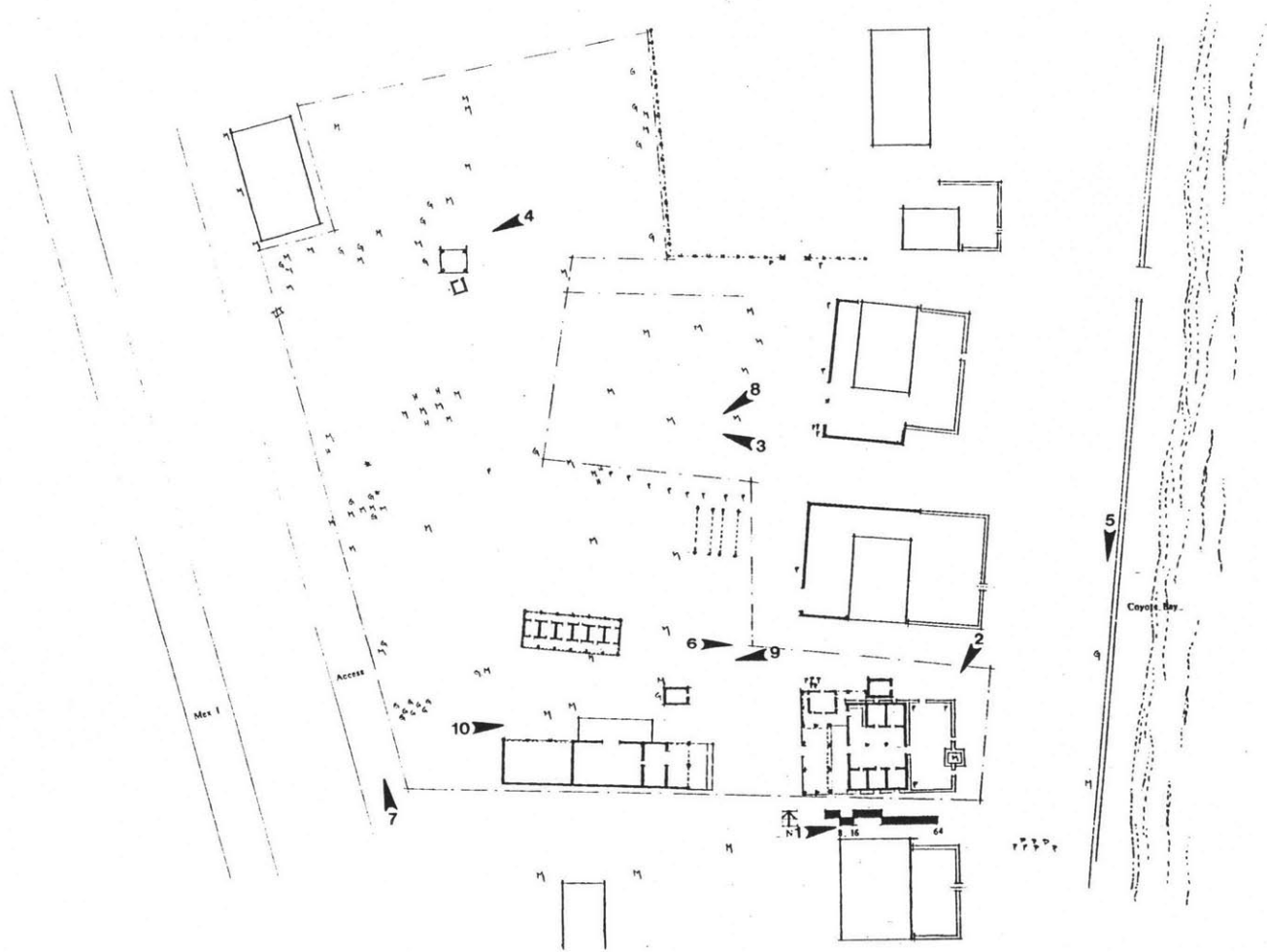


Detail of More Developed Bay





Plan of Existing Site



Plan of Existing Site Showing Views of Photographs

Morning View of Main House Looking Out to Coyote Bay

View 1



Morning View of Main House

View 2



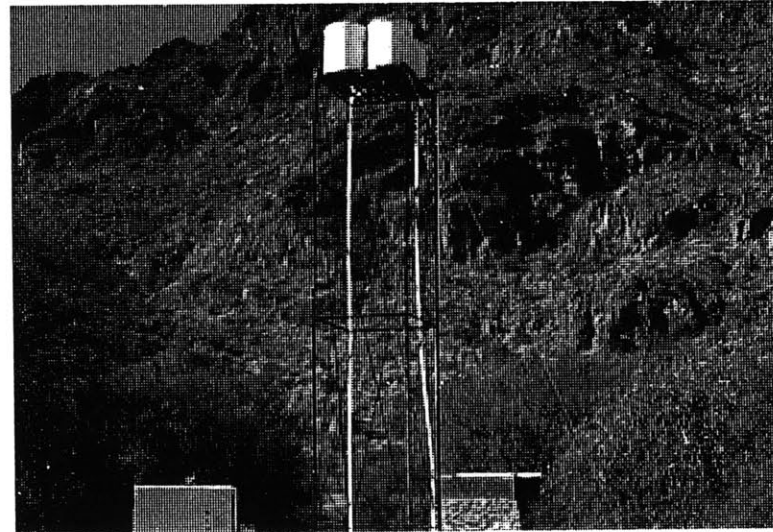
View 3

Morning View of Site Interior



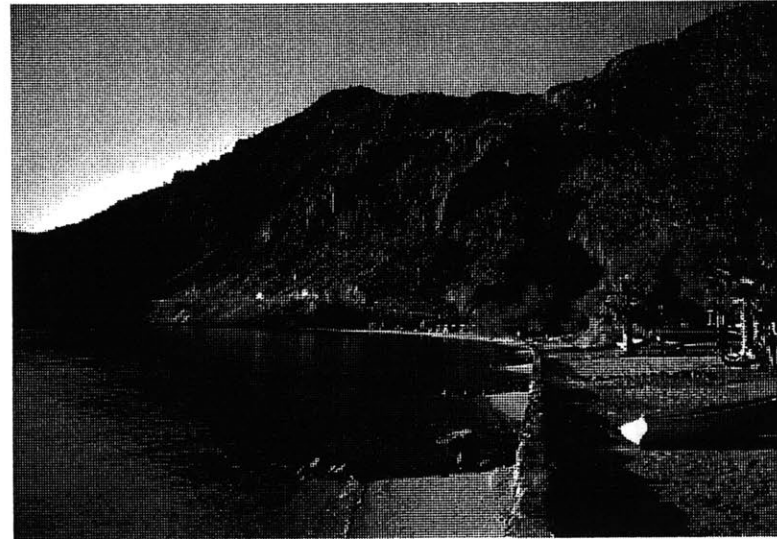
View 4

Water Tower Against Mountains



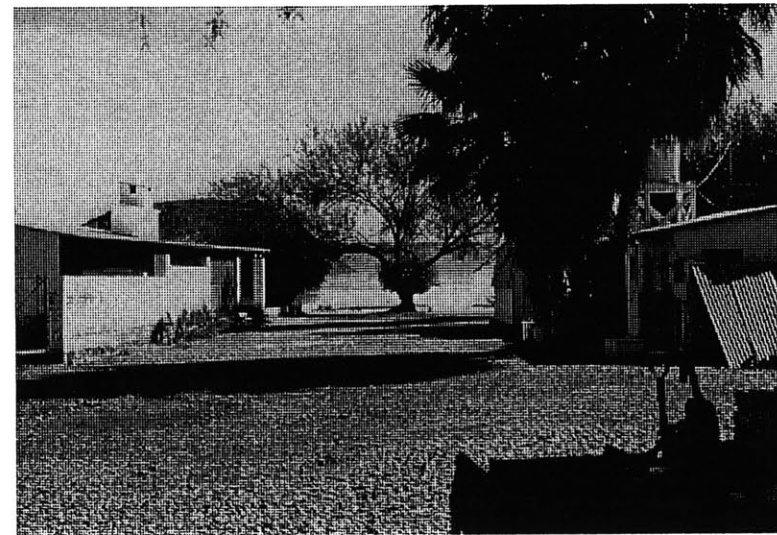
View 5

Beach Front and Sea Wall



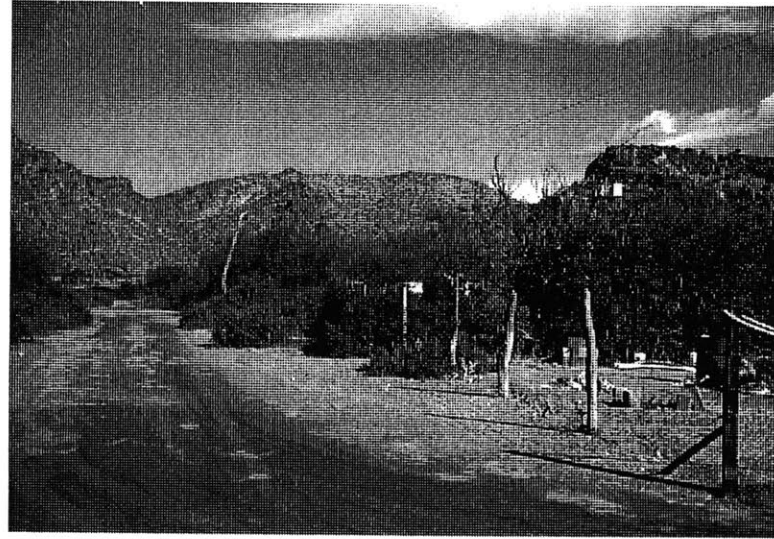
View 6

View Between Houses Towards Coyote Bay



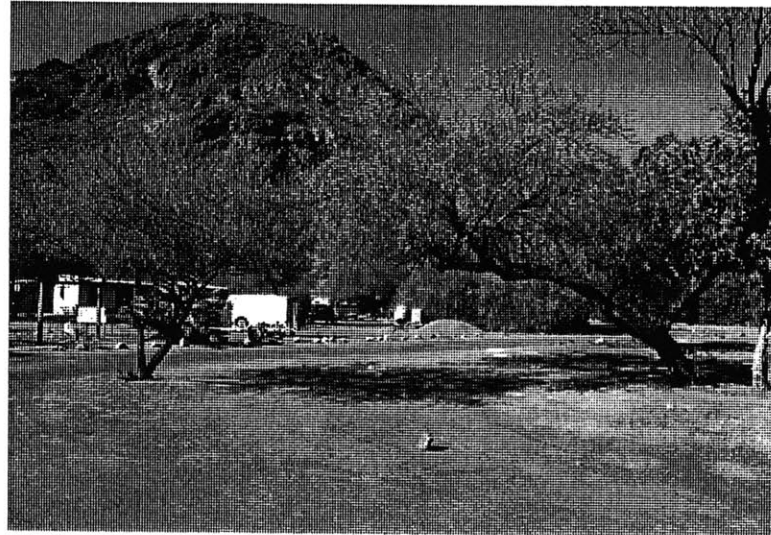
View 7

Access Road



View 8

Road of Site Interior



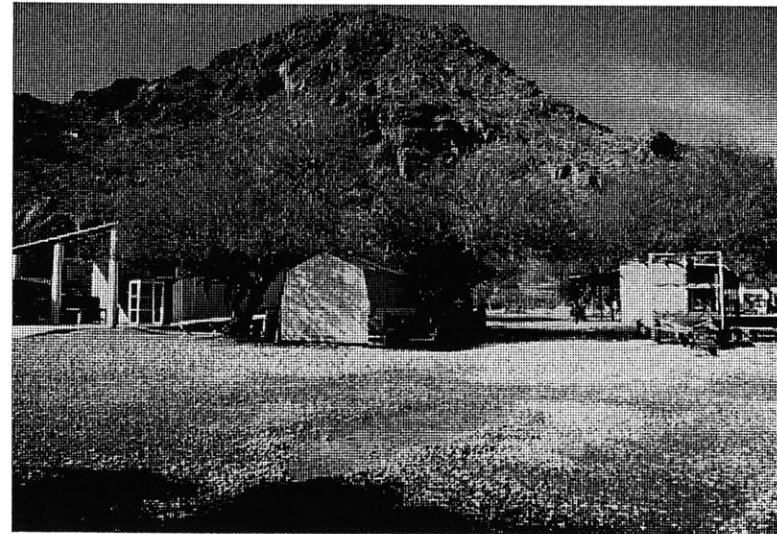
View 9

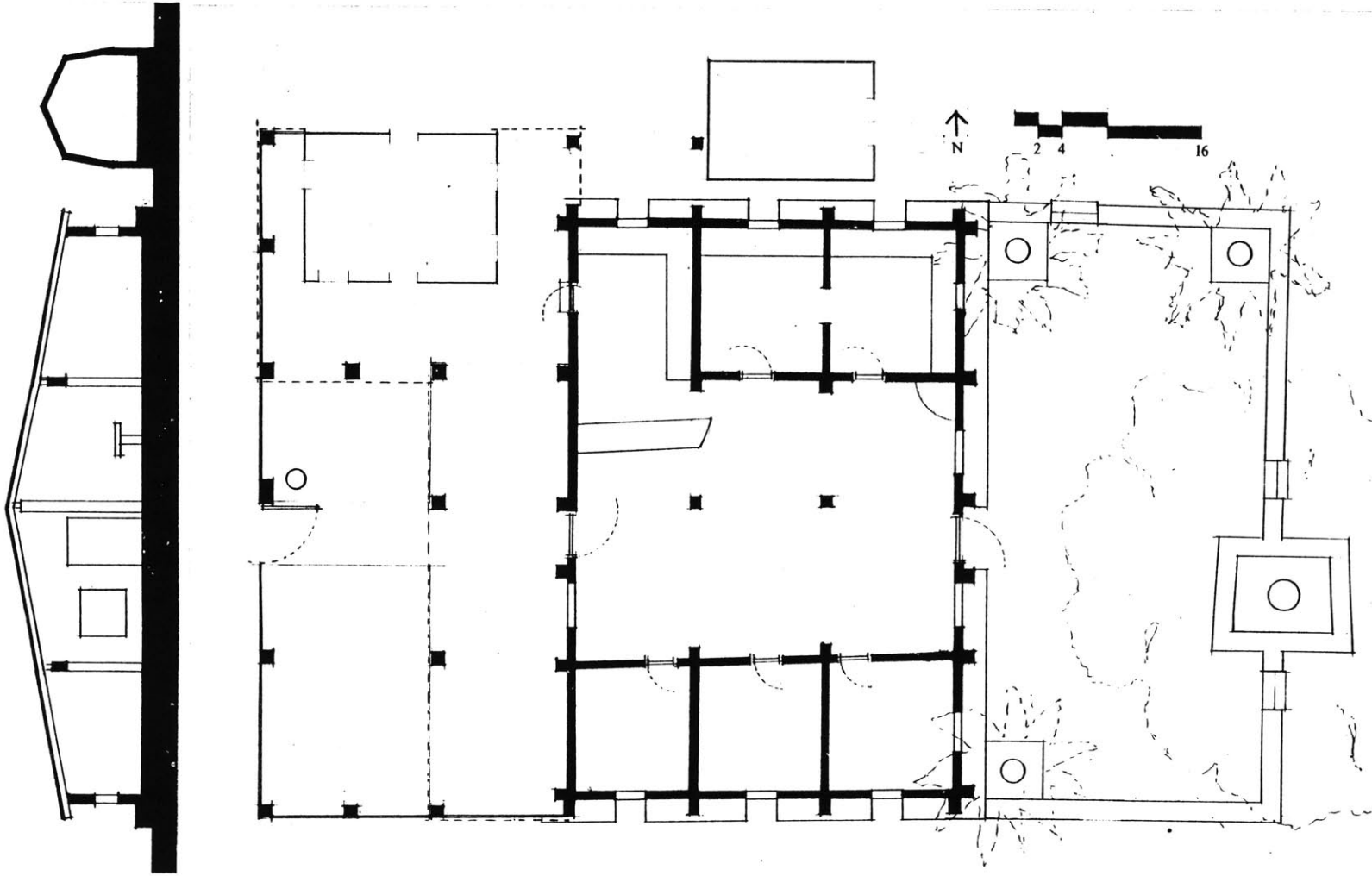
North Side of Workshop



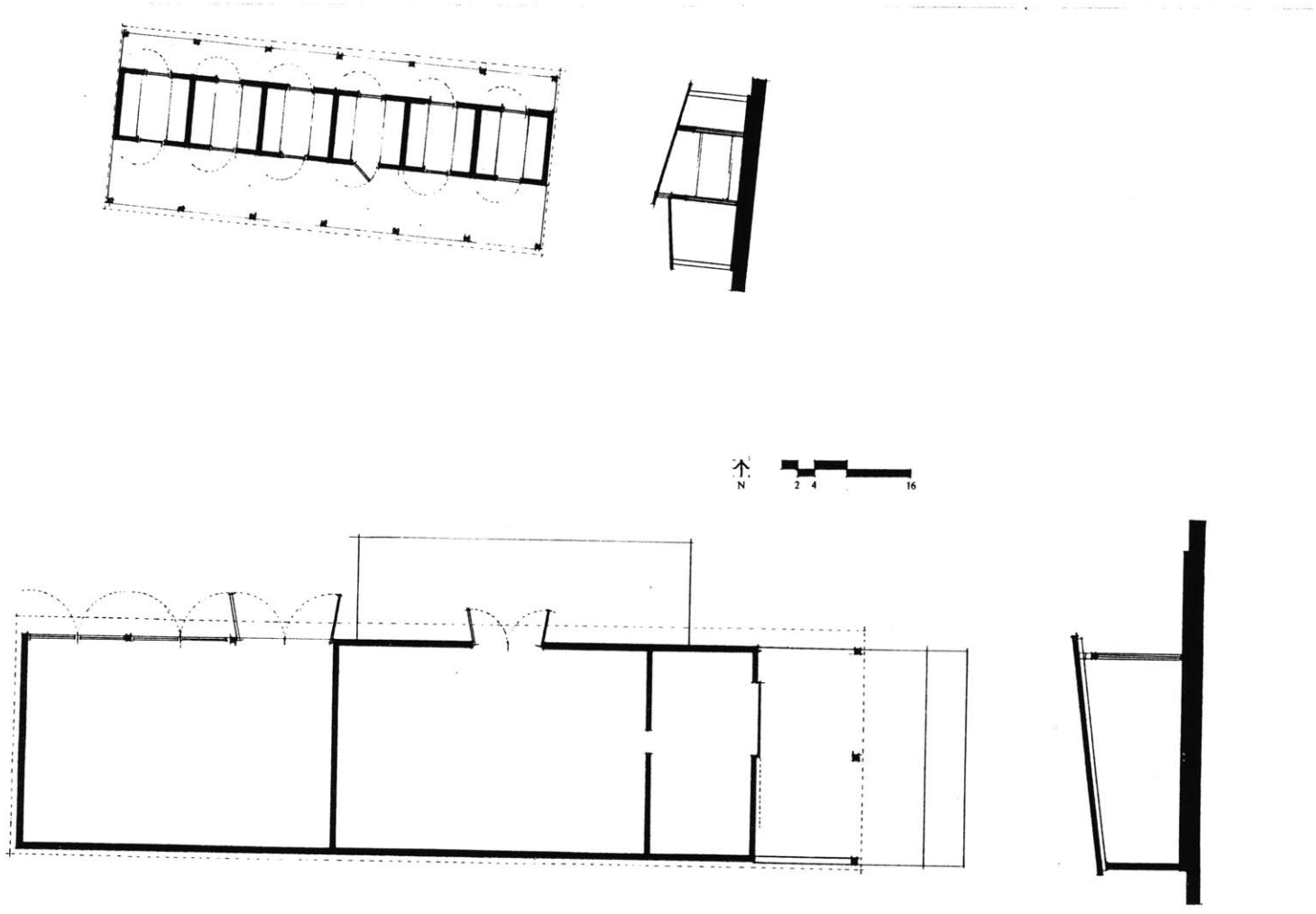
View 10

Workshop and Instructor Housing



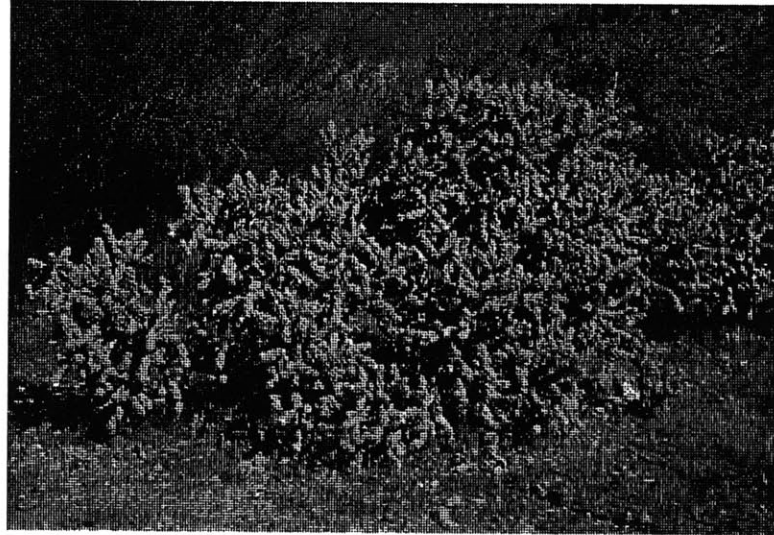


Plan and Section of Existing Main House



Plans and Sections of Workshop and Instructor Housing

Cholla



Bougainvillea



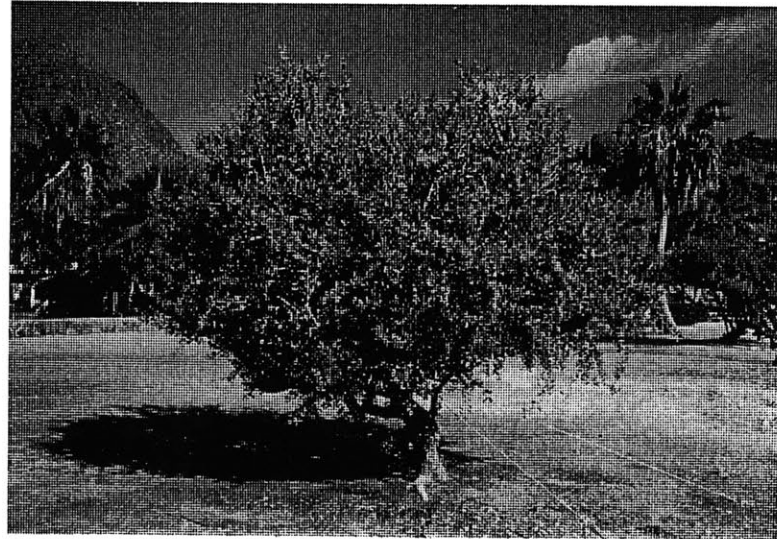
Mesquite



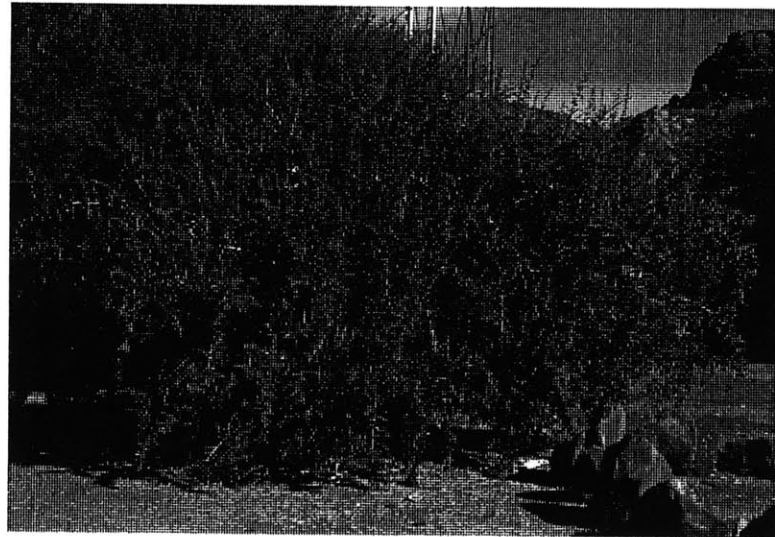
Pickleweed

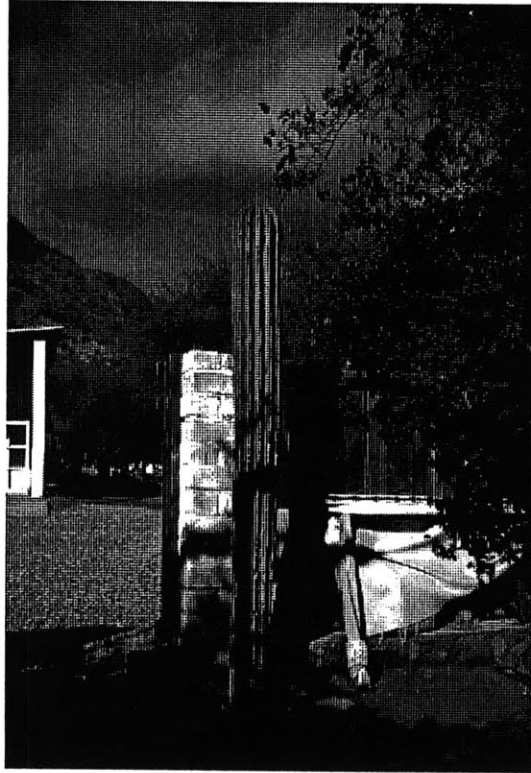


Mangrove

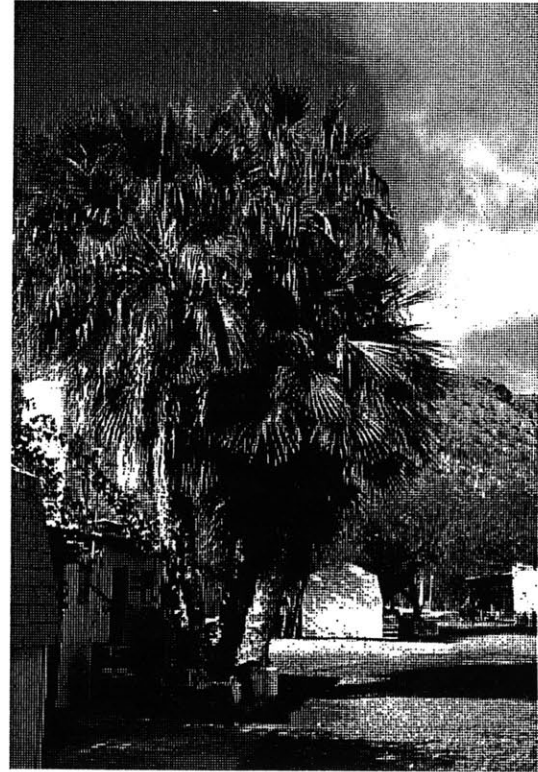


Huitave



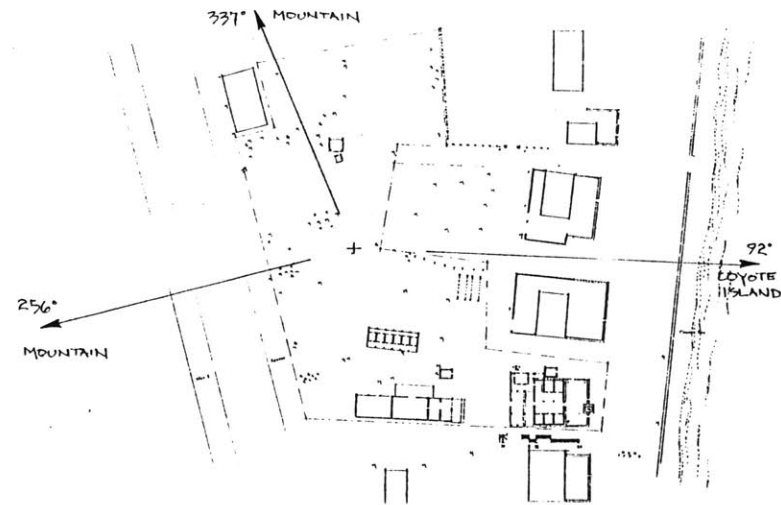


Cardón

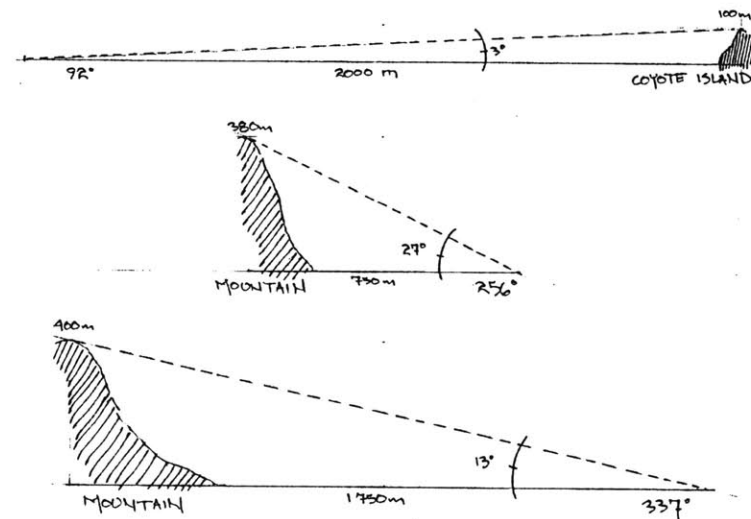


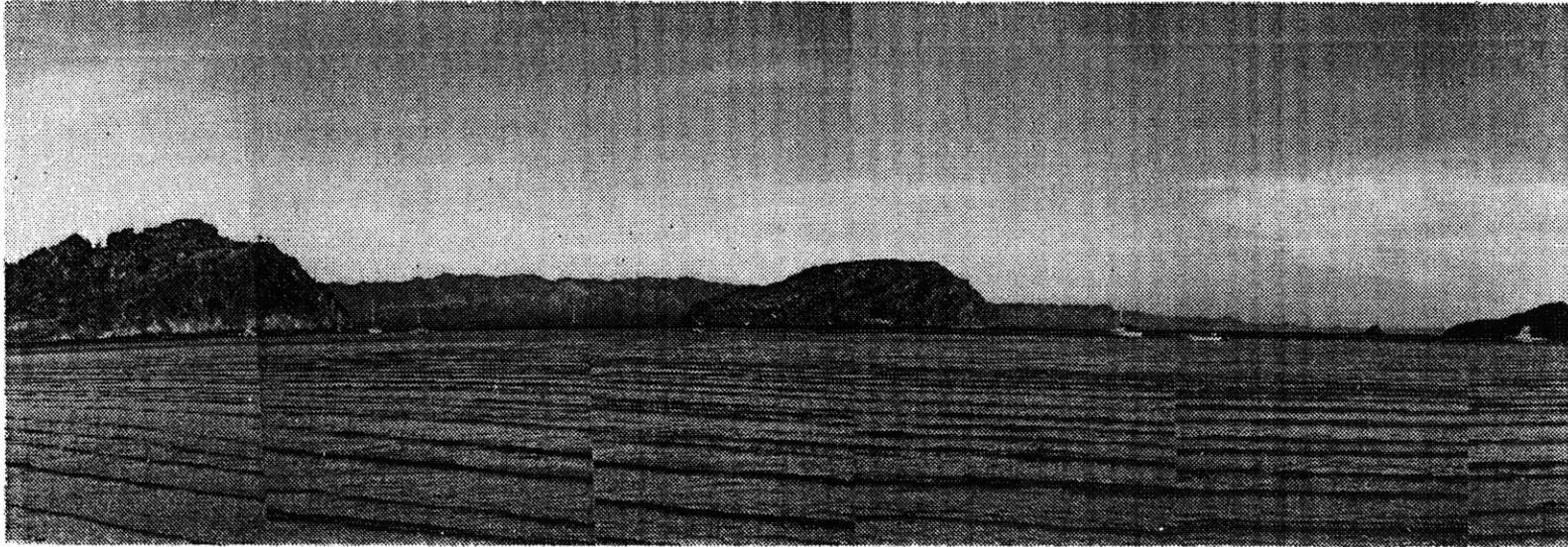
Mexican Fan Palm

Plan Diagram of Views to Landmarks

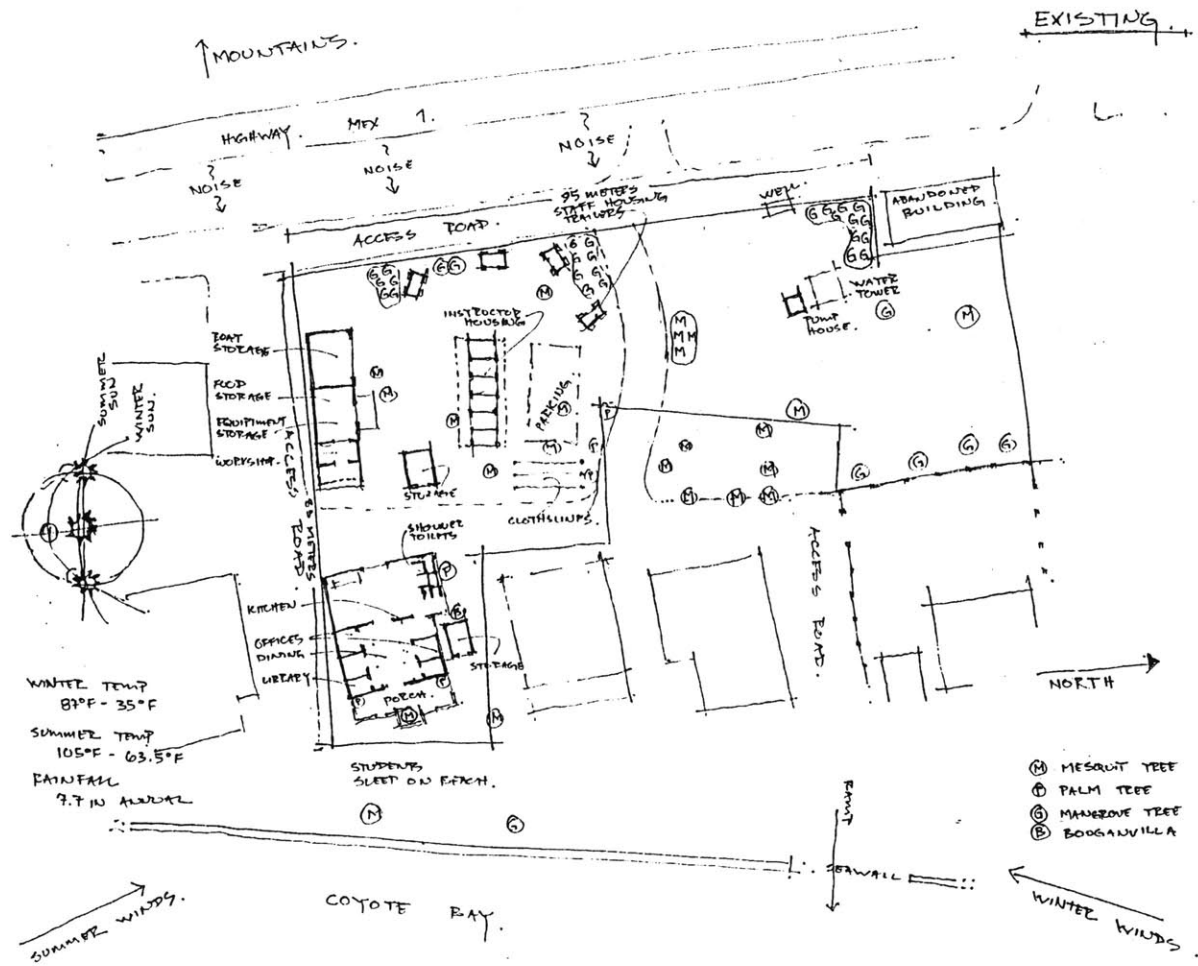


Section Diagram of Views to Landmarks

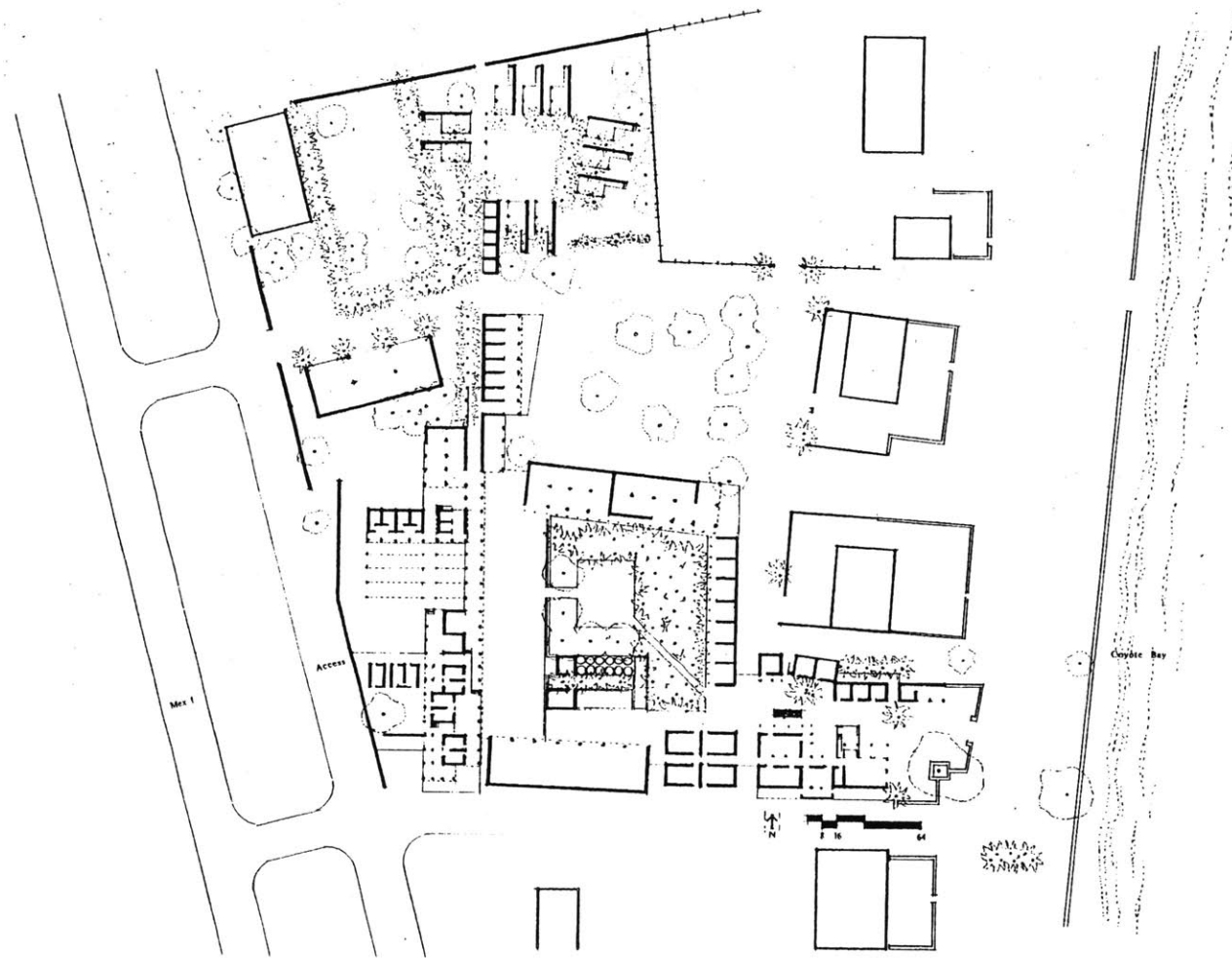




View to Coyote Island



Interpretive Sketch of Existing Site



Proposed Master plan

Method of Construction

I presently found that the white luminous canvas overhead and canvas used instead of windows afforded such agreeable diffusion of light within, was so enjoyable and sympathetic to the desert, that I now felt more oppressed by the thought of the opaque solid overhead of the much to heavy Midwestern house.

The desert devils would come whirling like a dancing dervish and go in drifting spirals of dust high in the air. Occasionally a devil would come cross the camp and it would shudder in its grasp like a ship - but hold fast. No damage.

I believe we pay too slight attention to making slight buildings beautiful or beautiful buildings slight. Lightness and strength may now be synonymous.

Usually we spend so much too much to make buildings last, as we say. Unqualified to build, we are still busy making caves for survival.

So, Ocotilla - our little desert camp - you are an ephemera.

Frank Lloyd Wright

Precedents

The precedents presented include those of aboriginal cultures and a few modern examples that show a

sensitivity to the natural environment. The building method of many aboriginal cultures has been the use of easily found resources used to provide direct solutions to the needs of the inhabitants.

The Anasazi Indians molded the material of the region -the local clay- to build the walls that define shelters in the cliffs. The intensification of local materials to make a livable environment for the inhabitants demonstrates a sensitivity to both method of construction and nature.

In the desert environment of Arizona, Frank Lloyd Wright built a temporary camp, Ocotilla. This camp was constructed of basic wood framing with canvas roofing.

Ocotilla uses a simple palette of materials to build a variety of structures for many uses which directly respond to the needs of living in a desert environment.

Typical Methods (Student Issue Building)

The method of building in this facility is demonstrated in the Student Issue Building. A concrete foundation pad is built to spread the load of the building evenly

over the ground. This type of foundation is needed since the supporting earth is a thin crust over wet sand. A masonry construction of walls builds a minimal enclosure, and a concrete frame poured around the masonry infill structurally reinforces the walls. The roof builds off of the masonry wall structure and is supported by wood columns which extend it past the enclosure. The roof and structure lean out generously providing shade for the walkway underneath. The extension of the wood structure, up and beyond the roof surface, allows for temporary fabrics to extend the shelter of the building. The extended roof also provides a transition zone between the enclosure and the outside.

Vocabulary of Materials

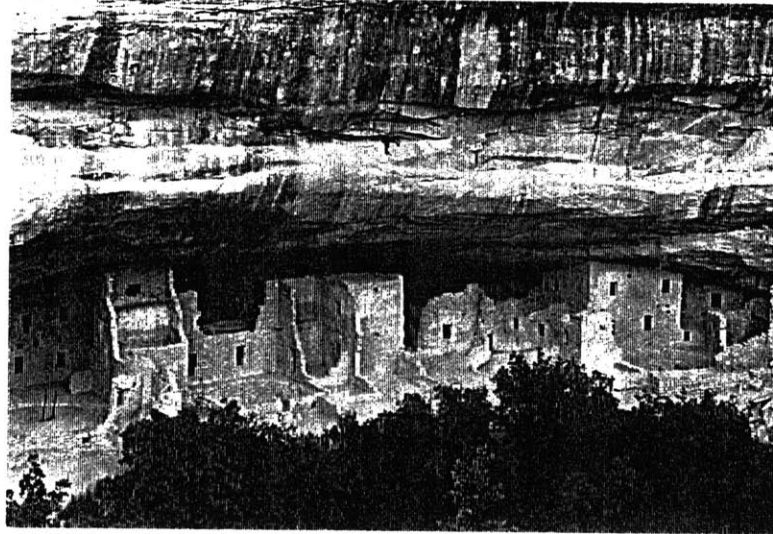
This method of construction allows for different materials to be interchanged to accommodate the needs of the building.

In the concrete wall frame system the infill can be concrete block, stone, open concrete block (allowing ventilation), glazing and/or shutters.

The roofing materials are to be either a ceramic tile or palm frons. The tile is heavy but very durable, while the palm frons are the most sensitive solution to the surrounding environment. However harbor insects and are a fire hazard. The choice of the material is determined by use.

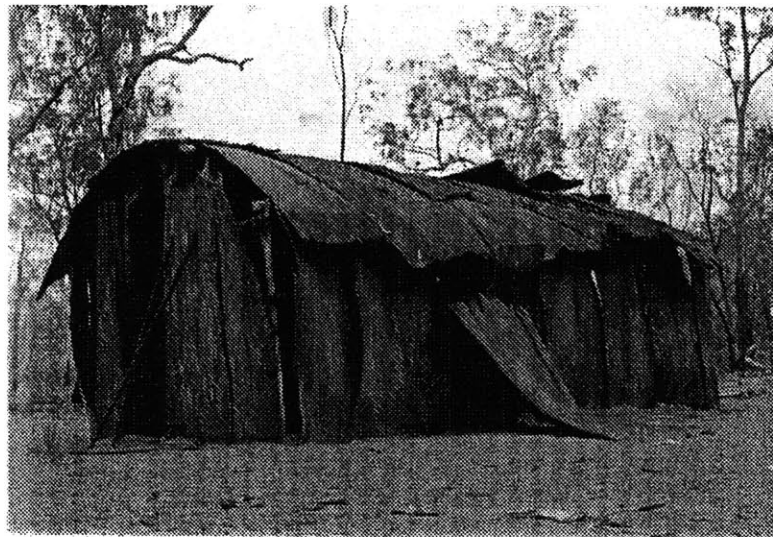
Anasazi Dwelling of Mesa Verde

Pueblo, page 32.



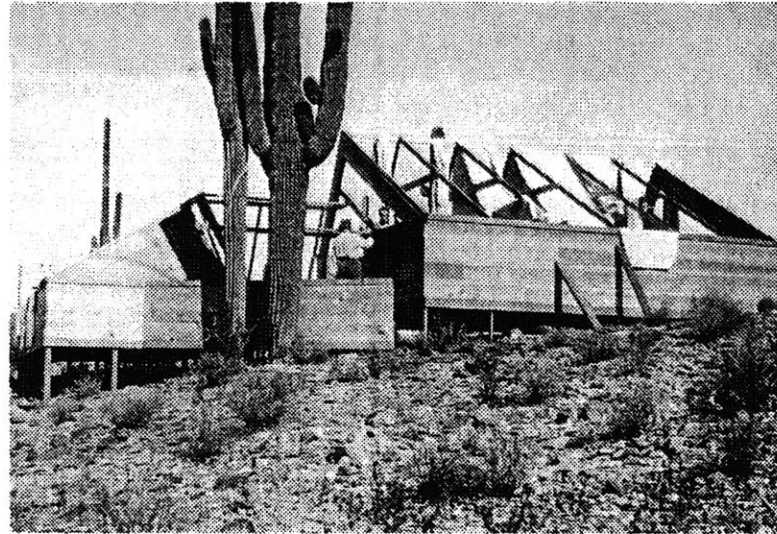
Aboriginal Structure of Australia Made from Tree Bark

Leaves of Iron, page 65



Ocotilla under Construction

Frank Lloyd Wright Selected Houses 3, Taliesin West, page 26



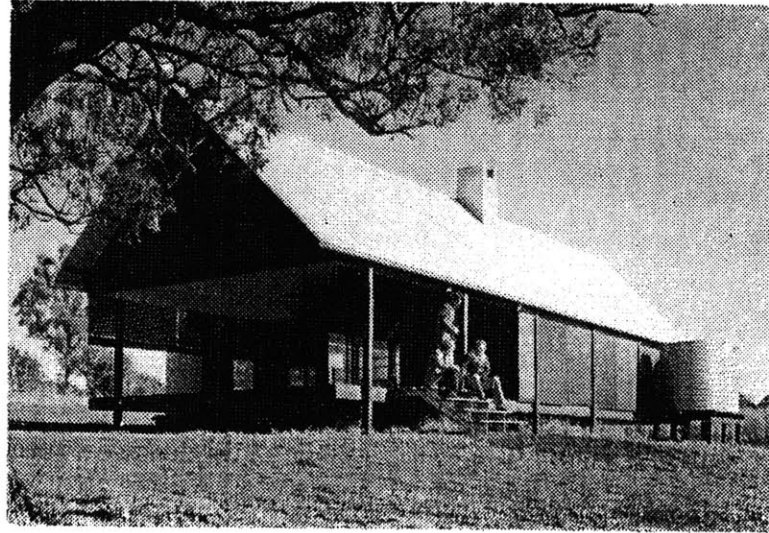
Ocotilla Interior

Frank Lloyd Wright Selected Houses 3, Taliesin West, page 29



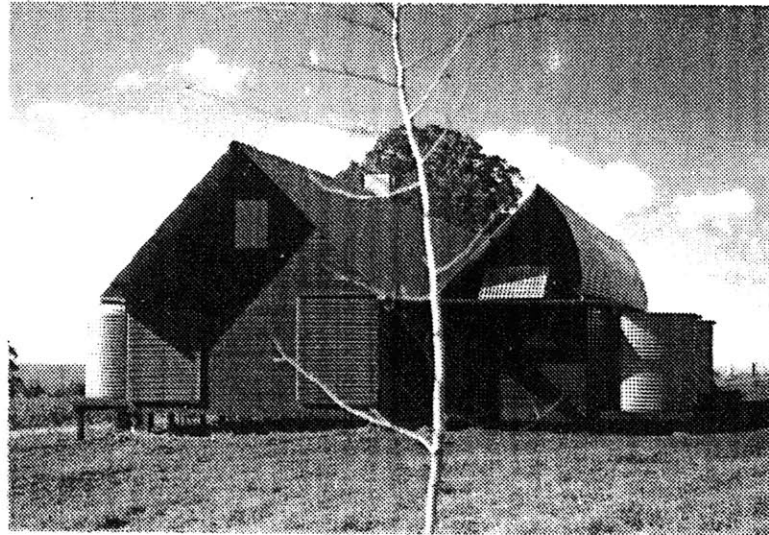
Leaves of Iron, page 94

Glen Murcutt House



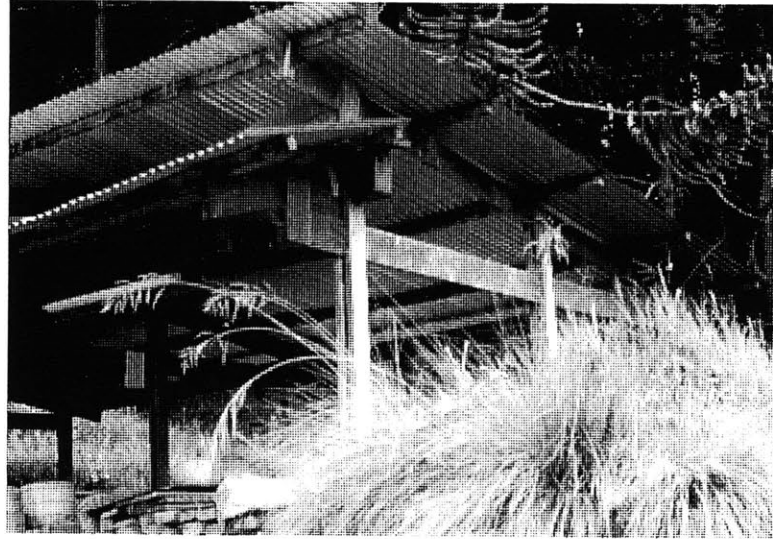
Leaves of Iron, page 95

Glen Murcutt House



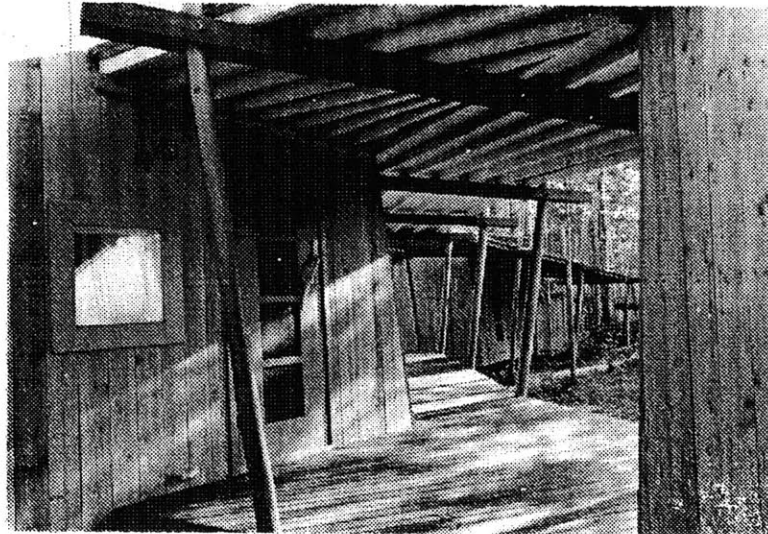
African Roof Structure in Burundi

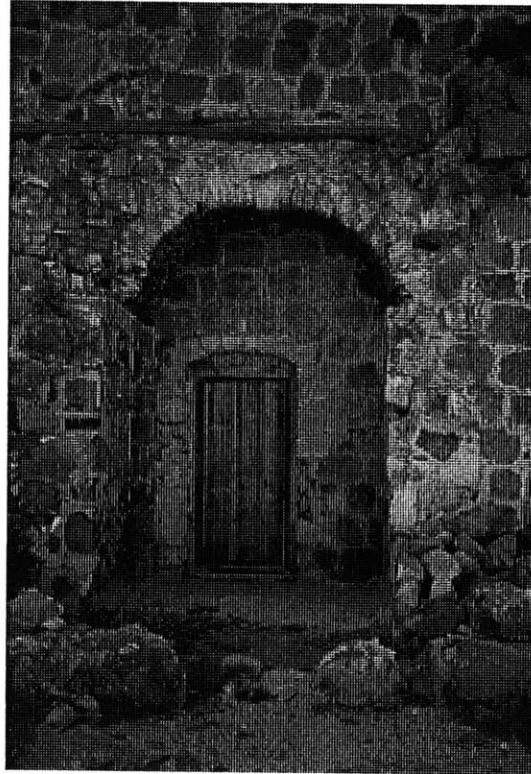
Photograph by Mark Daley



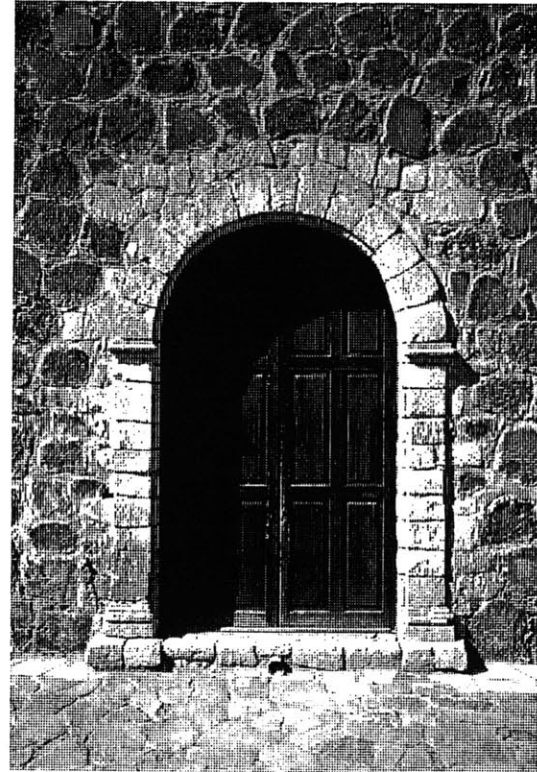
Georg Grotenfelt House

An Architectural Present - 7 Approaches, page 159



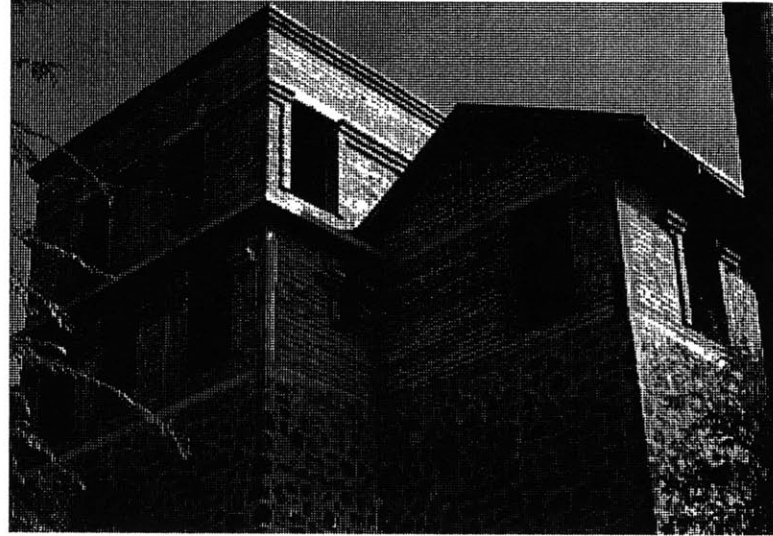


Mission in Mulegé



Mission in Mulegé

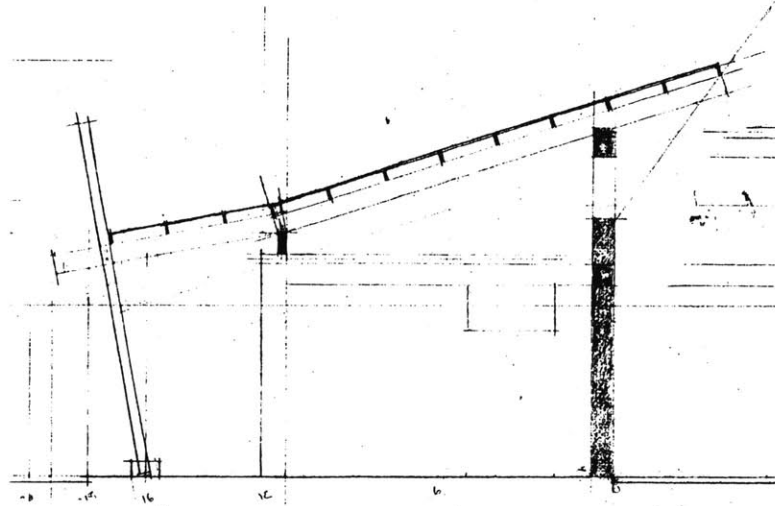
House in Mulegé



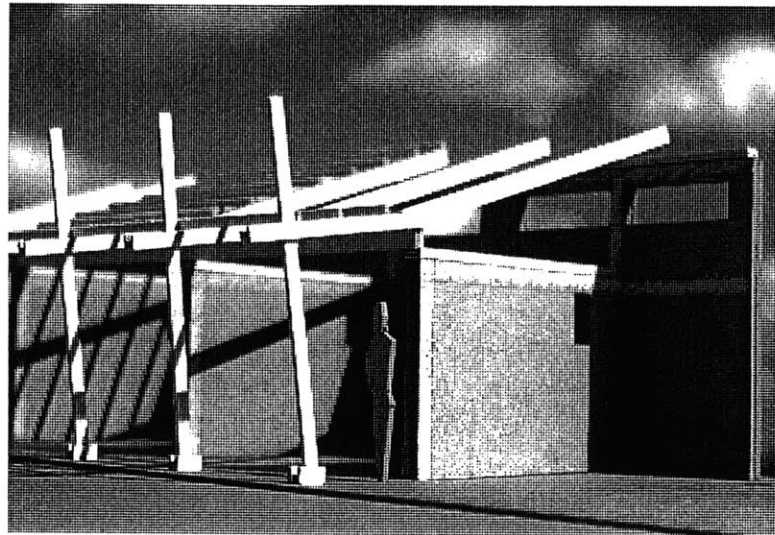
Building under Construction in Mulegé

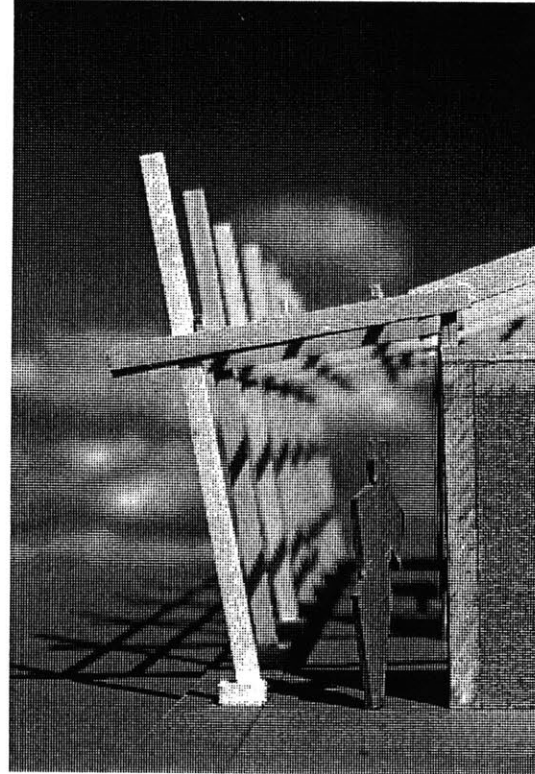


Section of Student Issue



Proposed Student Issue Building





Proposed Student Issue Building

Main Structure

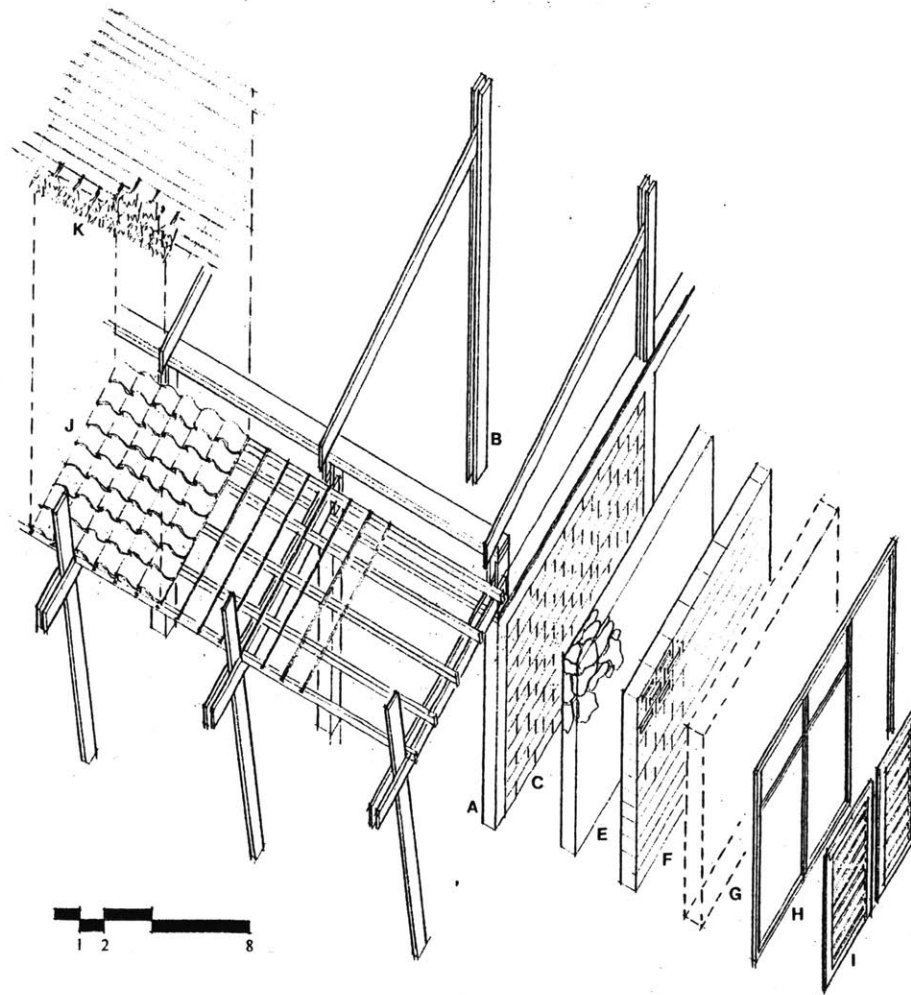
- A. Concrete Frame
- B. Wood Column

Wall Infill

- C. Concrete Block
- E. Stone
- F. Open Concrete Block
- G. Frame Only; No Infill
- H. Steel Frame with Glazing
- I. Shutter

Roofing Material

- J. Ceramic Tile
- K. Palm Frons



Vocabulary of Materials

Specific Buildings

Instructor Housing

The instructors are often transient and spend a great deal of their time “in the field,” living in community with many other people. Therefore, privacy for the instructors while “in town” is important. The instructor housing is made up of individual rooms furnished with a bed and a desk. The individual rooms are grouped in twos allowing the accommodation of couples. The bed in each room can be opened to become a double sized bed.

Each pair of rooms has an outside area to which it relates. The outside areas have different qualities, and the instructors would chose a room depending on its location.

Many instructors drive to the Baja facility and have all their worldly possessions in their vehicles. For them, the relationship of room to vehicle must be close. Vehicles can be driven up to the instructor housing units and particular rooms have a more direct relationship to the vehicles.

There is a large outside gathering space reserved for instructors which looks to the mountains to the west and is centered around a large mangrove tree for shade.

Another shared space is above the center units. This elevated area has a long view to the water and out over the main square and can provide sleeping under the stars.

Storage for instructor gear is found to the north of the instructor housing.

Main House

The main house is set up to define and embrace the view out towards the bay.

The main house is the place where all inhabitants will gather for eating and socializing.

The library has two parts: a book storage area and a reading room. The book storage area is a solid walled room protecting the books from the salty air and harsh sunlight. The reading room has a table and opens onto the large tiled porch area which in turn opens to the sea.

The administrative offices extend along the north side of the main house and are separated into two types. The larger offices at the west end are for the logistics coordinator and the directors. There is a raised second floor area above the logistic coordinators office which gives a view framed by the architecture to the ocean. The other offices are for research projects.

The kitchen has access to food storage on either side of road. A herb garden is located on the north side of the kitchen and a temporary fabric roof material can be erected to shade the garden during hot months. The kitchen also has a covered outside work area.

The cleaning area is positioned between the kitchen and eating area.

The eating area is an enclosed area off of and opening on to the large open porch. Above the eating area is a large room that can be used for gathering and sleeping by students. Cubby holes define the south side of the loft and give the students a place to store their gear.

Bath House

The bath house is the concentration of all the water on

the site. The water tower is the focal point and is made of five platforms rising above the ground to the height of sixty feet. The platforms are accessed by an internal ladder and the water tanks are found at forty eight feet on the fourth platform. The second and third platforms are areas for people to occupy.

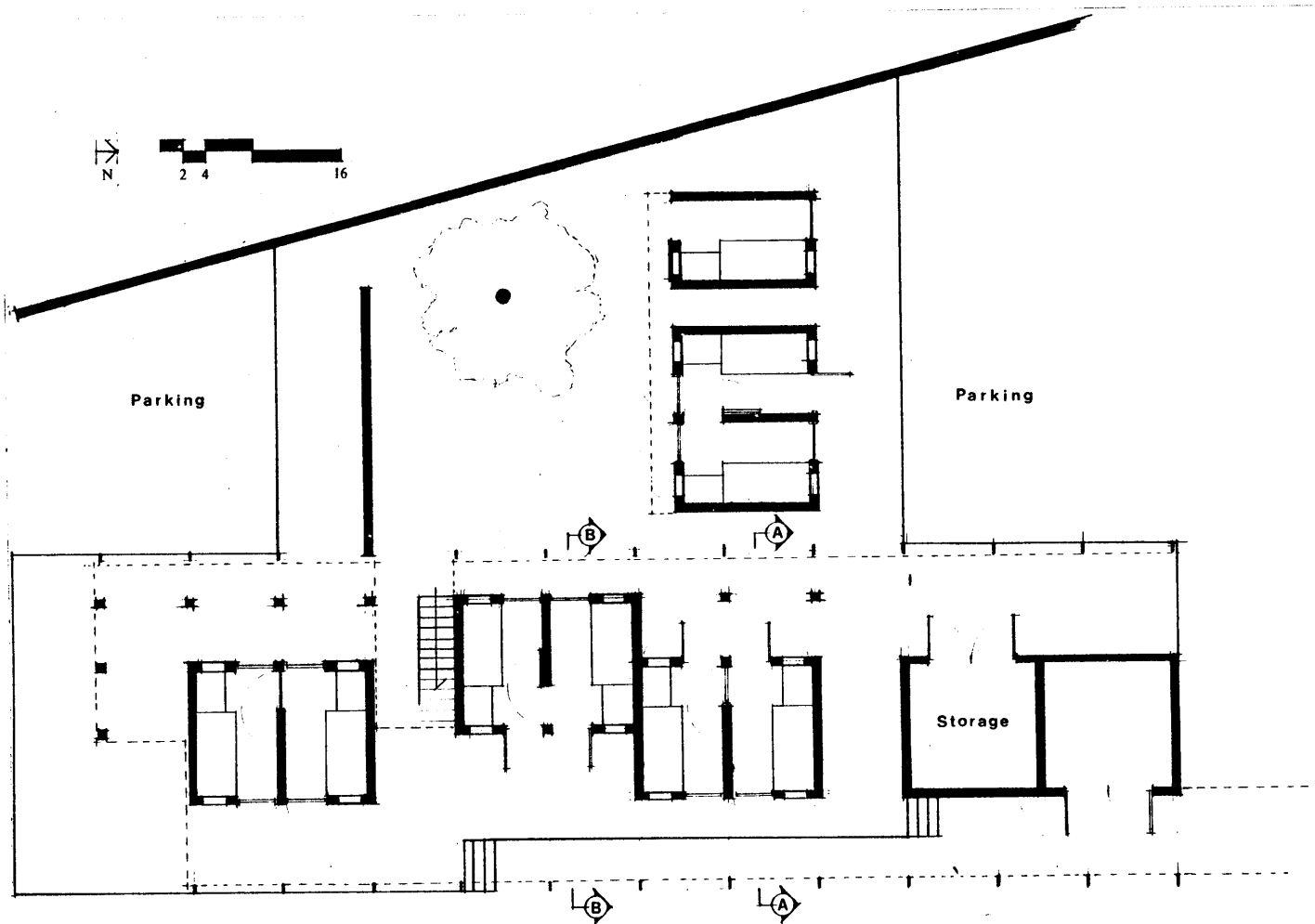
The toilets are located on the ground level and the second level of the water tower. The second level toilets have a view to the mountains, reminiscent of defecating in the wilderness while looking out to open expanse.

The showers are designed as a series of large rooms that act as both a changing room and shower.

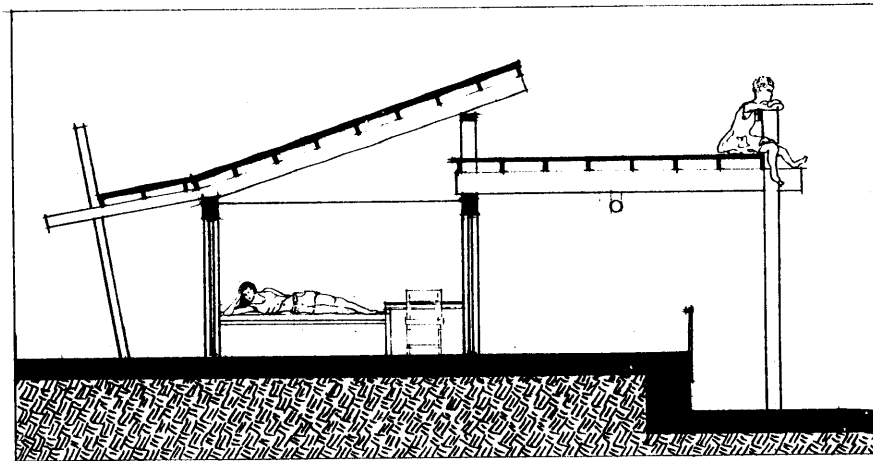
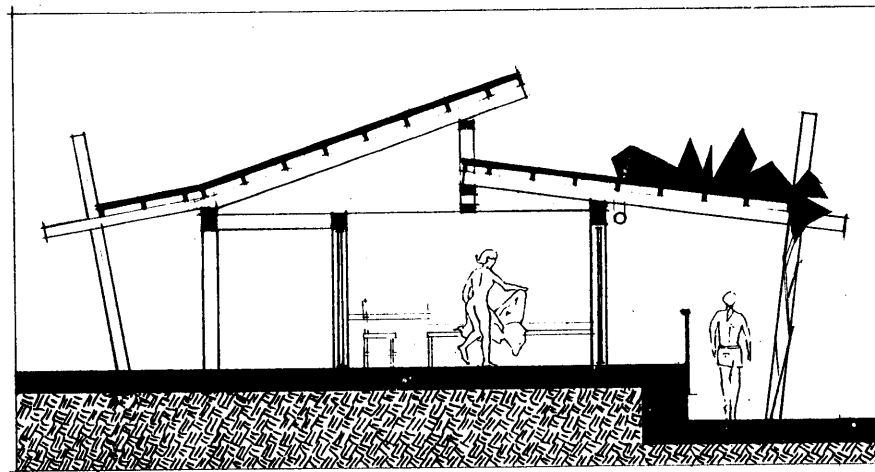
The water tower is structurally reinforced by a series of plywood panels and creating a climbing wall.

The bath house also serves as the central water distribution system, feeding washing machines (with drying lines to the south of the building) as well as the boat washing spine that runs along the western edge of the main courtyard. All water is considered precious in this environment and its uses and path have been carefully planned to minimize waste of this

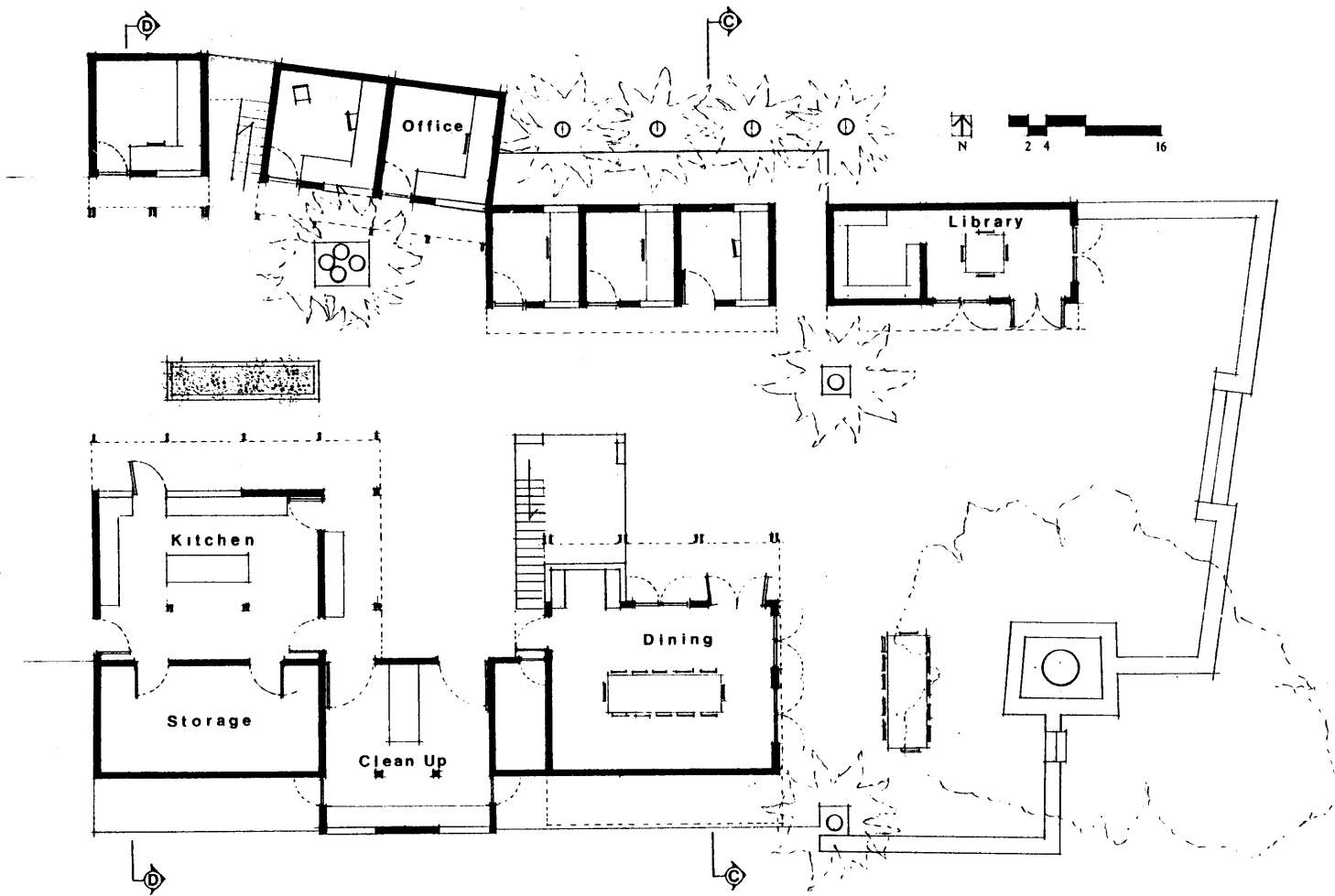
resource. All gray water and sewage is filtered to tertiary quality (potable) water through a Solar Aquatics Sewage System, providing ample resources for drinking water and irrigation.



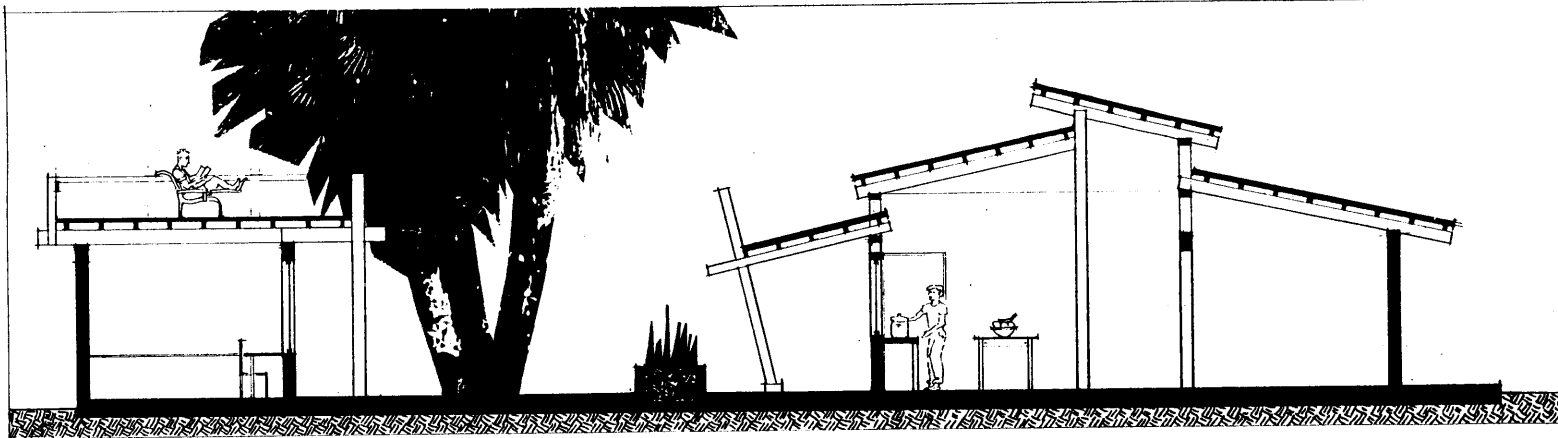
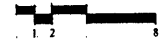
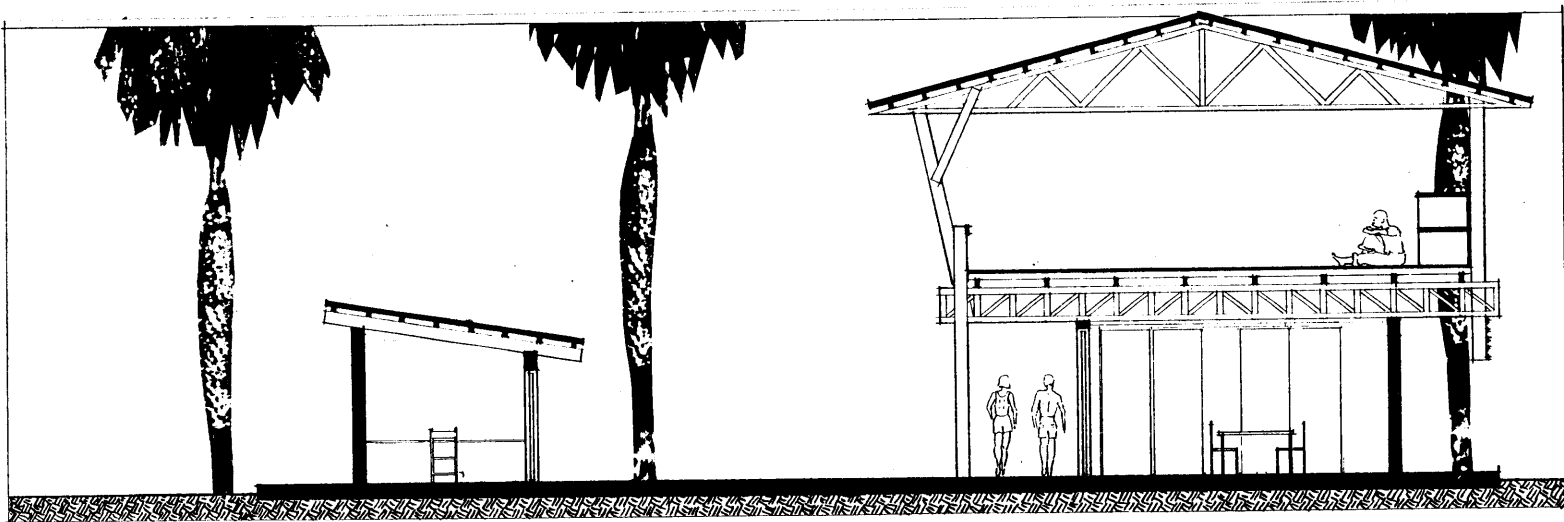
Plan for Proposed Instructor Housing



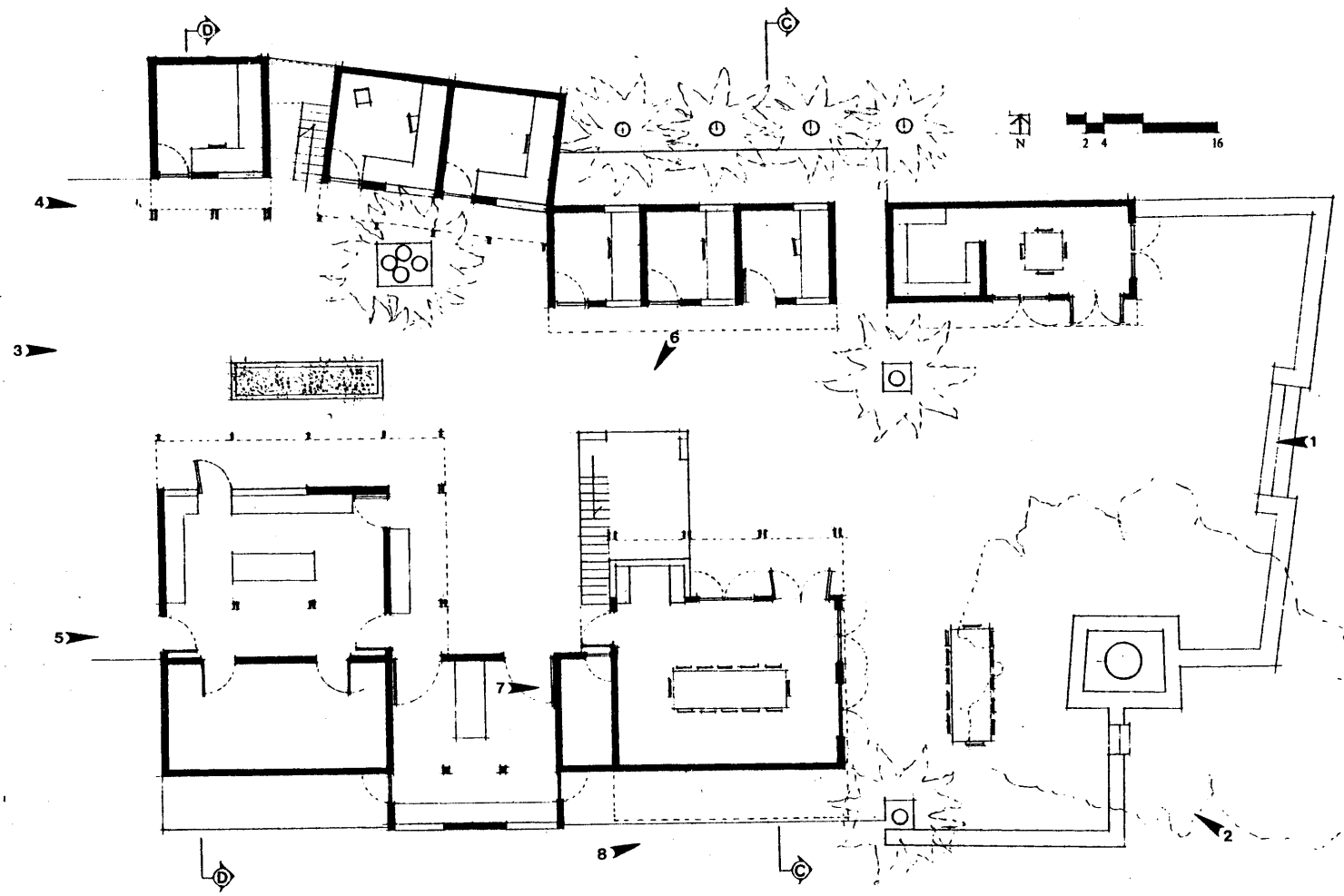
Section of Proposed Instructor Housing, AA Above and BB Below



Plan of Proposed Main House



Sections of Proposed Main House, CC Above and DD Below



Plan of Proposed Main House With Photograph Views

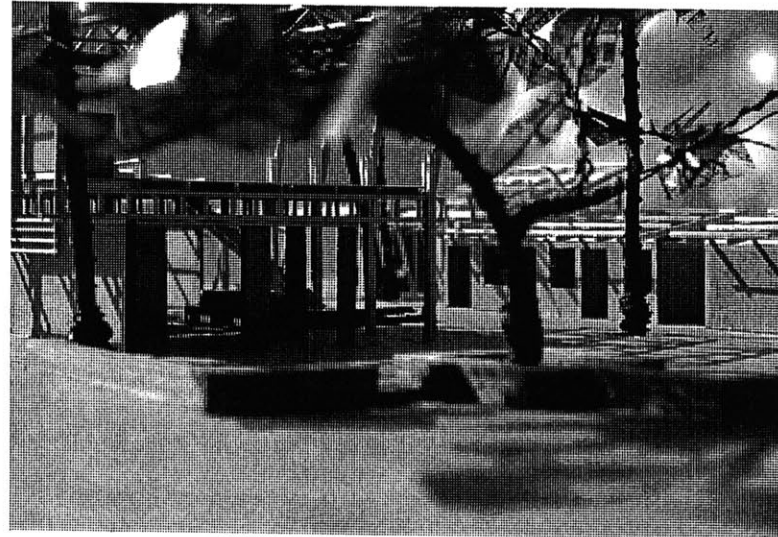
View 1

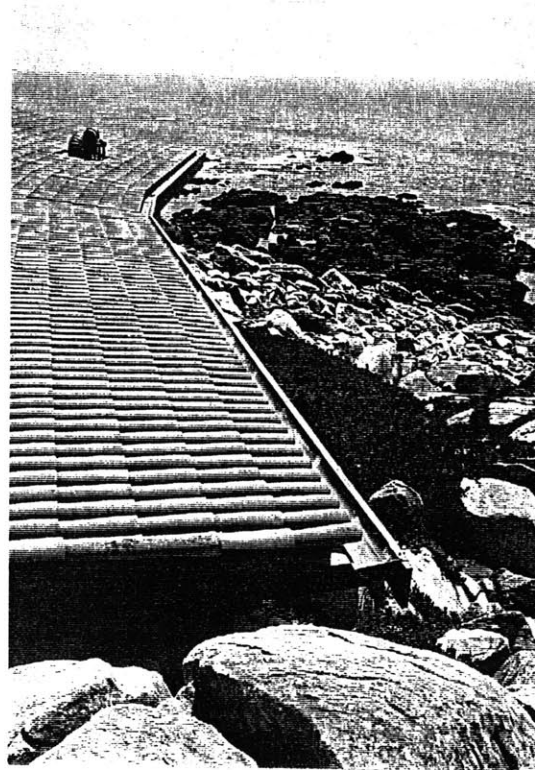
Main House; View from the East



View 2

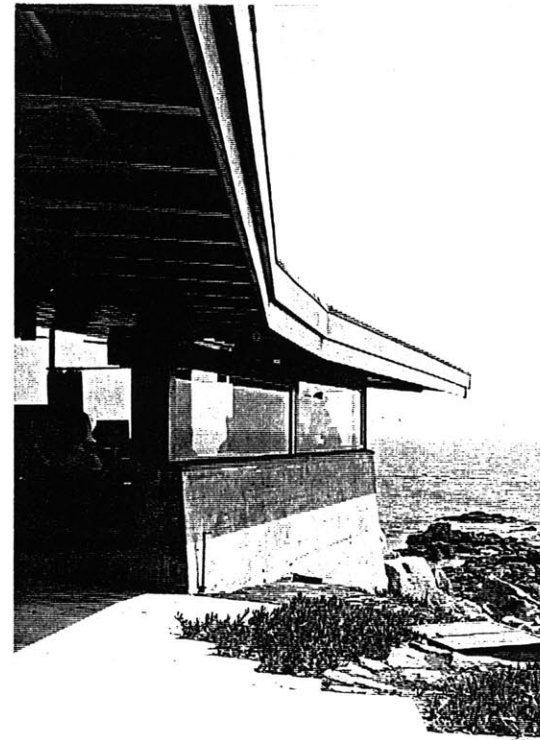
Main House; View from the Southeast Corner of Porch





Boa Nova Tea House

Alvaro Siza, A+U, page 18

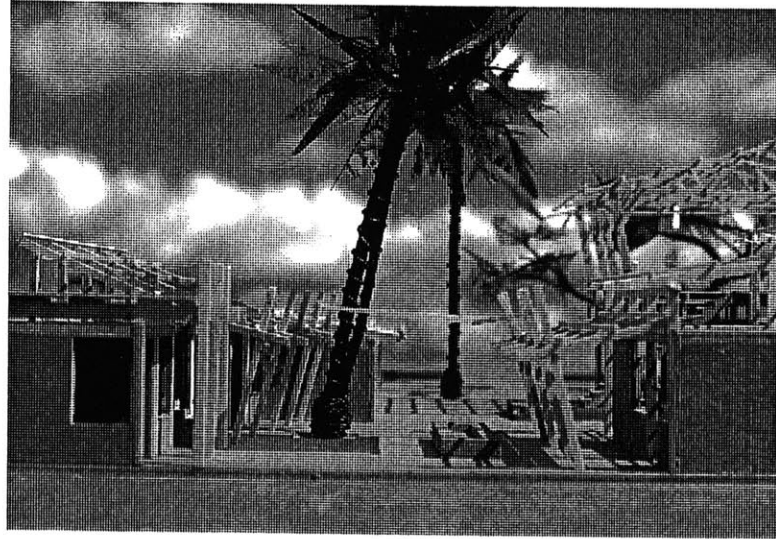


Boa Nova Tea House

Alvaro Siza, A+U, page 19

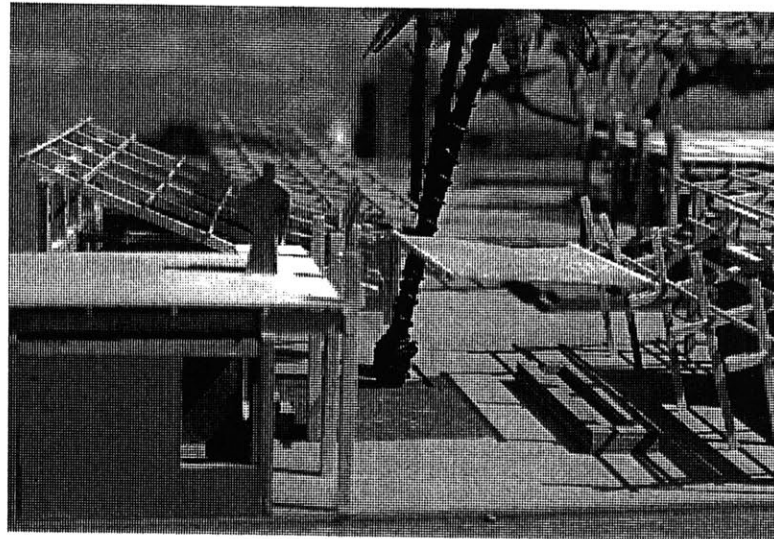
View 3

Main House; View from Road



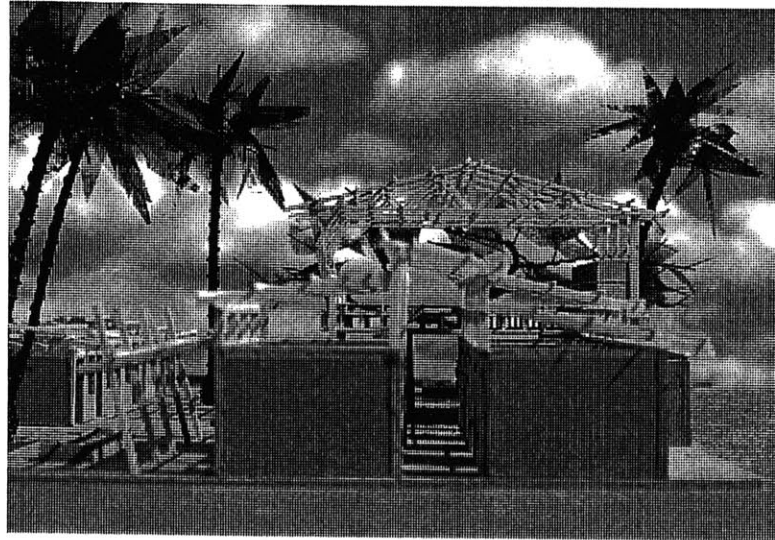
View 4

Main House; View from Above the Offices



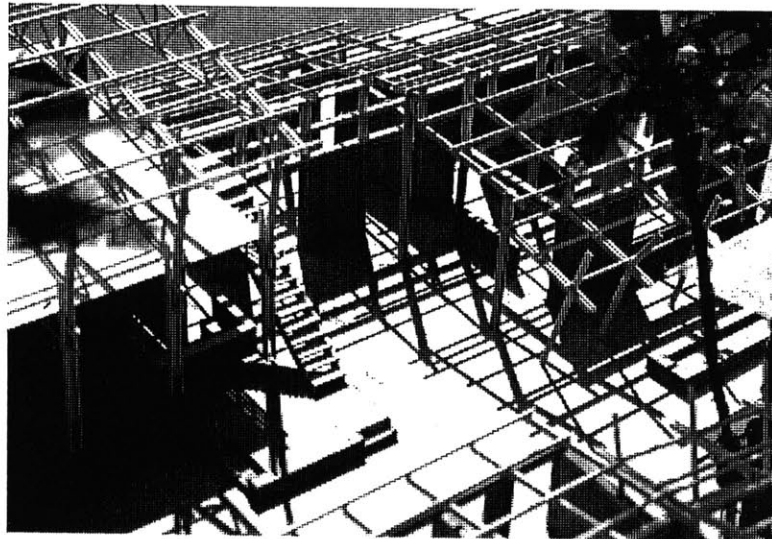
View 5

Main House; View down Inner Access



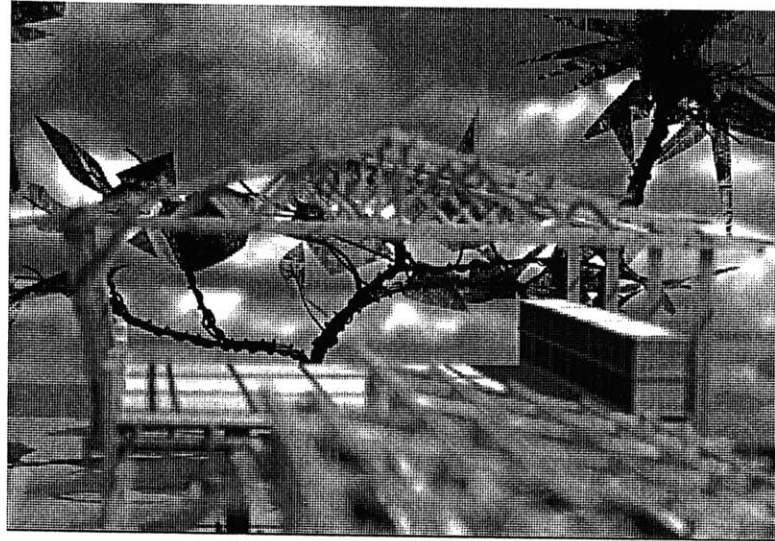
View 6

Main House; Bird's-eye View of Outside Kitchen Area and Stairs



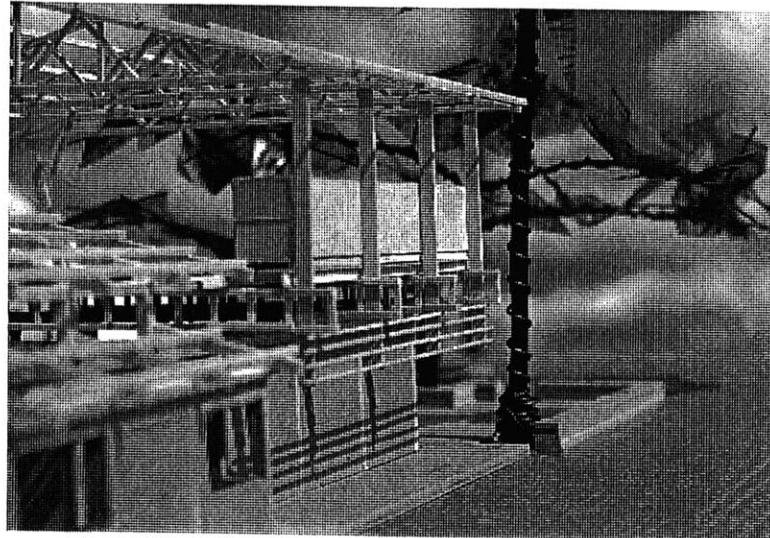
View 7

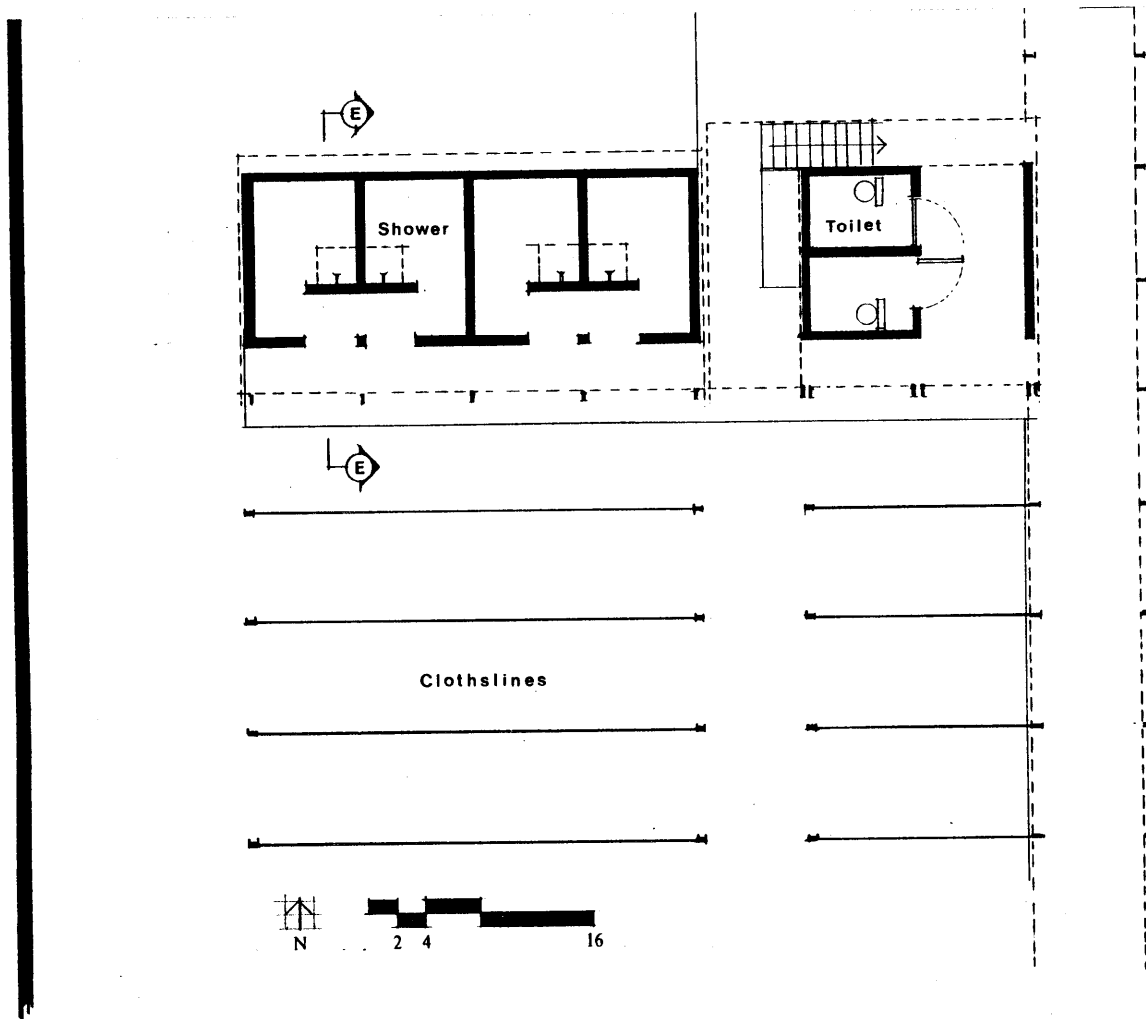
Main House; View of Loft



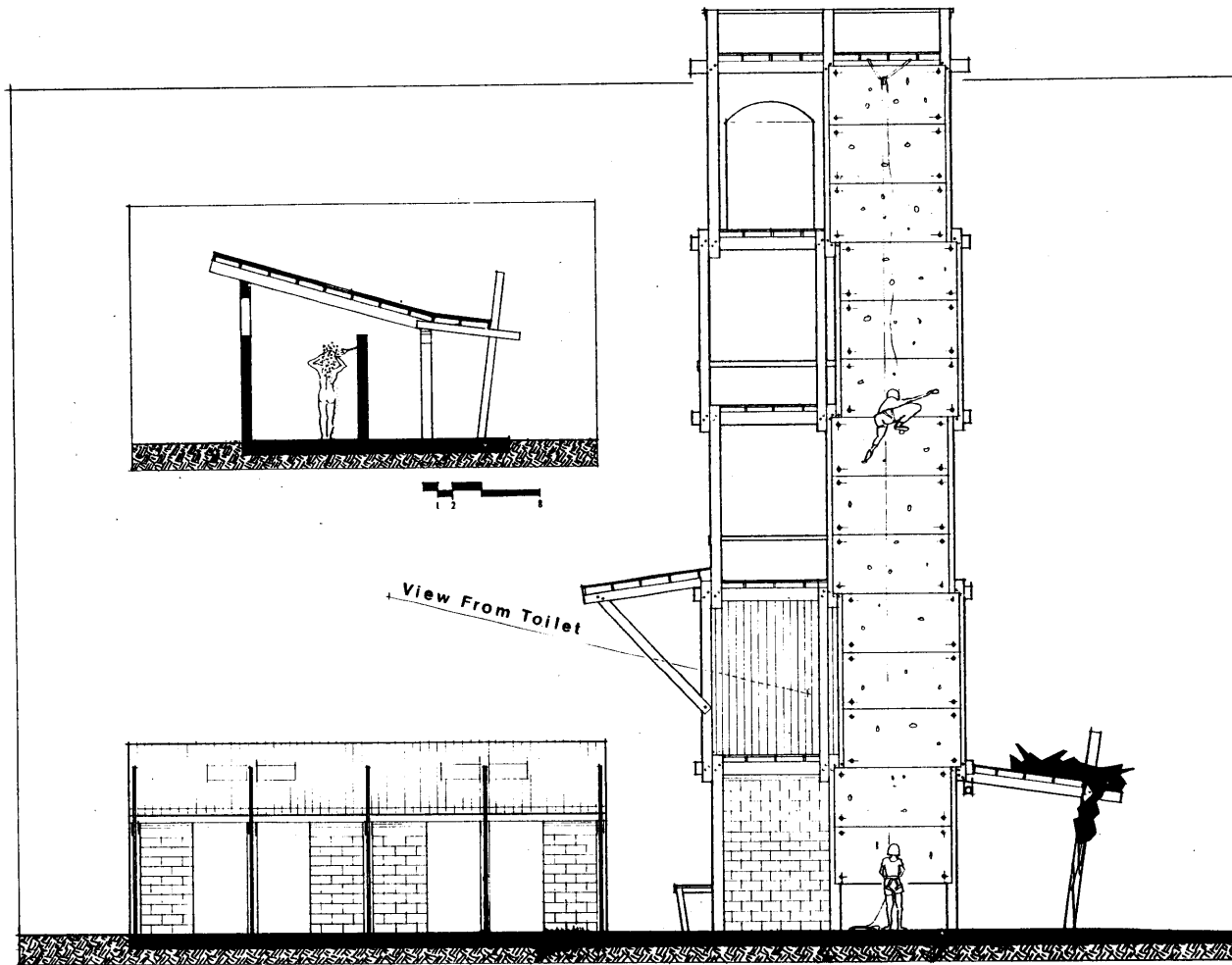
View 8

Main House; View along South Side

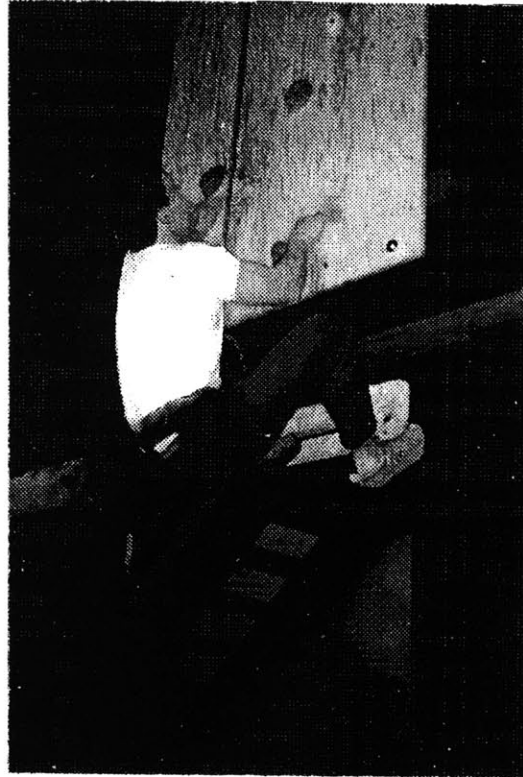




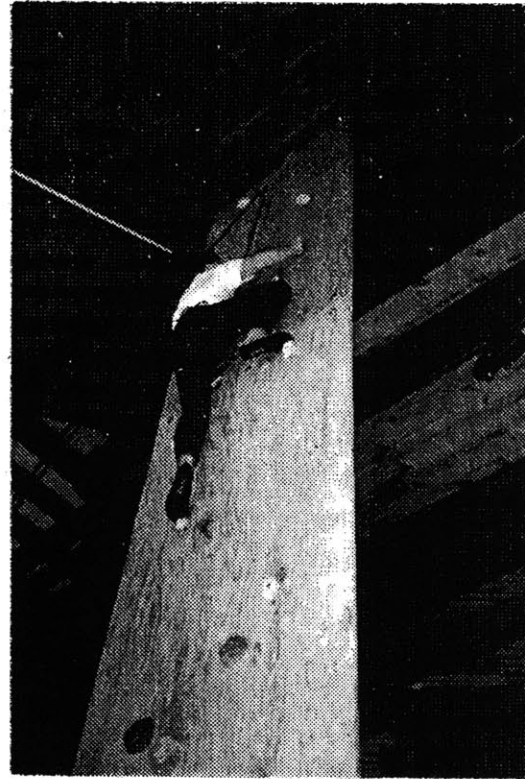
Plan of Proposed Bathhouse



Elevation and Section of Proposed Bathhouse, Section EE Inset



Climbing Wall



Climbing Wall

Master Plan

The long term master plan is designed with the understanding of the changing needs of the facility.

Precedents

The precedents referred to show organizational methods for a complex of buildings.

Ocotilla, designed by Frank Lloyd Wright, is a temporary camp in Arizona. Many of these buildings are of similar construction and show only minor alteration in the building method. The placement of the structures creates a large gathering space in the center and smaller more private spaces nestled in the buildings. There is a clear understanding of the larger public space and the smaller private spaces.

Taliesin West replaced the temporary Ocotilla. Taliesin West is organized with a spine of access from which different size spaces are connected.

The plan of the Malm Funeral Chapels of Alvaro Aalto, demonstrates a branching access.

Program

The program of built spaces is approximately one third of the site area. Diagrams show the exploration of where the building area would be placed on the site for the desired organization.

Proposed Master Plan

The proposed master plan has a north to south access spine that serves as a register for the buildings of the campus. The access is covered and provides the main artery for the transport of resources within the site.

The main views of the site are reinforced by the master plan. The view to the mountains is reinforced by the entrance road. The view to Coyote Island is reinforced by the main house.

A courtyard serves the support staff housing, the workshop, and the main working square. The courtyards all have specific characteristics for their intended use.

The support staff courtyard is found at the north end of the site; the location providing privacy from the workings of the rest of the site and creating a central

focus apart from the more public areas.

The workshop courtyard serves as a place of construction as well as maintenance of vehicles and machines. Vehicles come to the workshop from the access road. The view from the workshop is to the mountains in the west. The workshop area is out of the middle of activity but still has a visual relationship with the main courtyard.

The main courtyard is a large space surrounded by outfitting activities including a large washing area to the west that drains into the Solar Aquatic System. The system is located in the southern area of the courtyard and provides an educational and practical display of resource conservation. The central space of the courtyard is for gathering, the issuing of gear, and the teaching of classes. The large area of palms to the east shades a great deal of the main courtyard and creates an area underneath that can be used for sitting, gathering, and laying in hammocks.

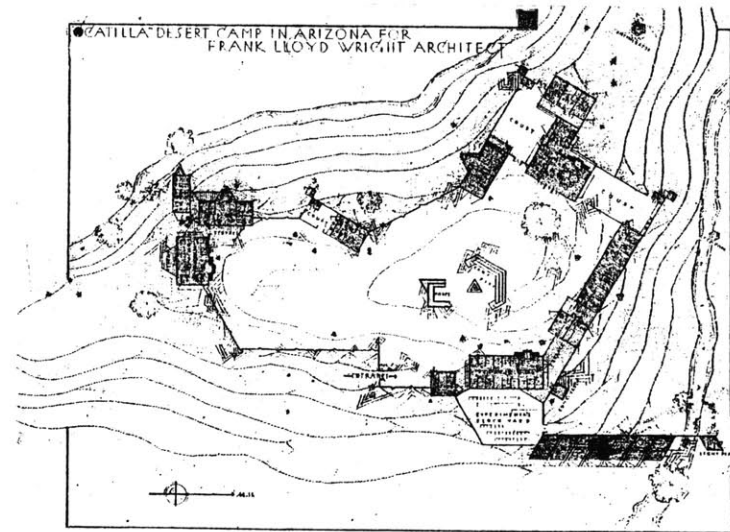
Analysis of Master Plan

The diagrams show particular aspects of the master

plan. The concerns illustrated are public and private areas, shade, views, and water distribution.

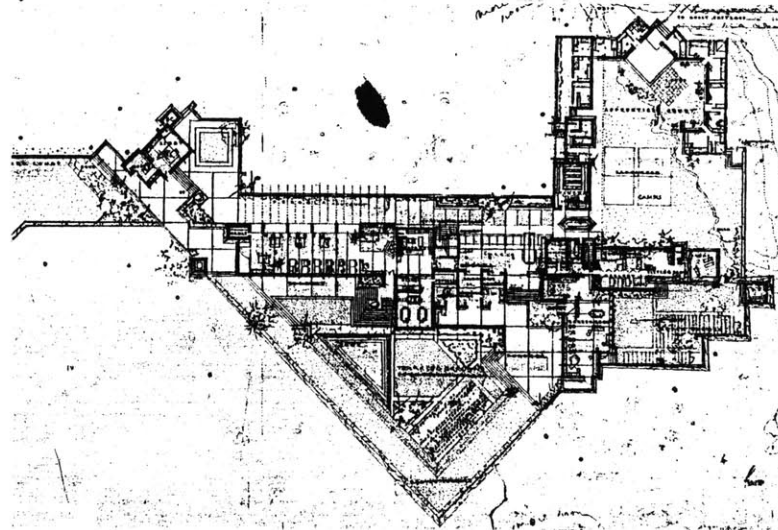
Plan of Ocotilla

Frank Lloyd Wright Selected Houses 3, Taliesin West, page 24



Plan of Taliesin West

Frank Lloyd Wright Selected Houses 3, Taliesin West, page 53



Plan of Malm Church of Alvaro Aalto

Alvaro Aalto, page 157

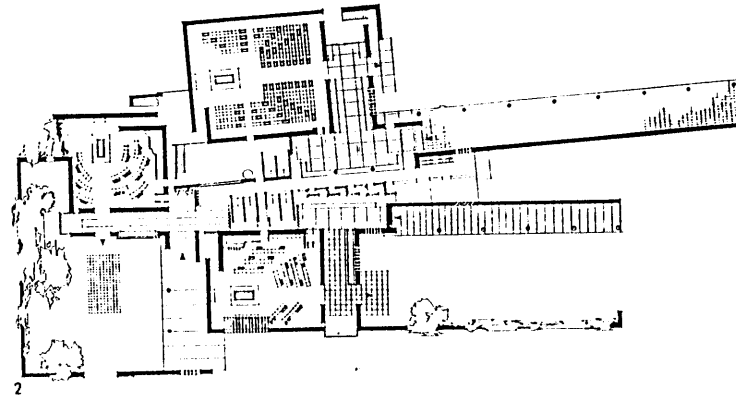


Diagram of Area Density of Program to Site

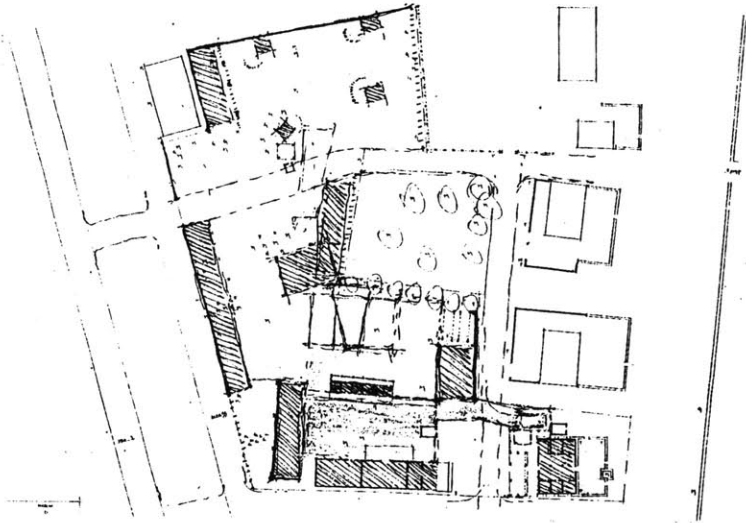
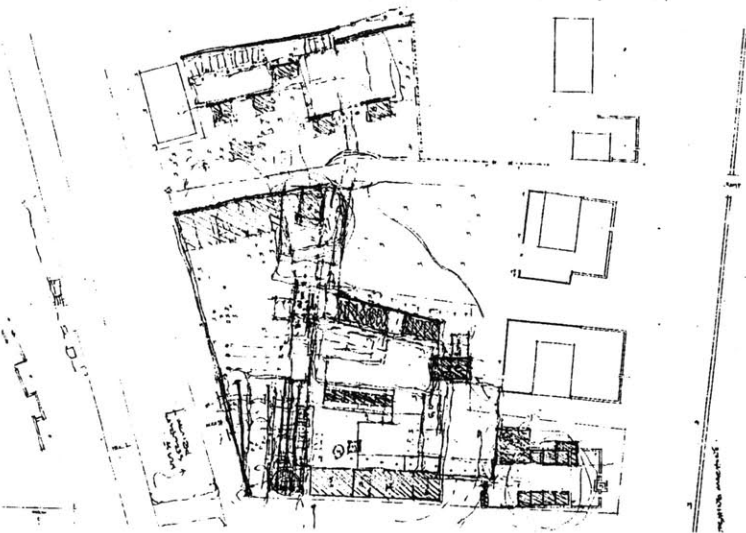
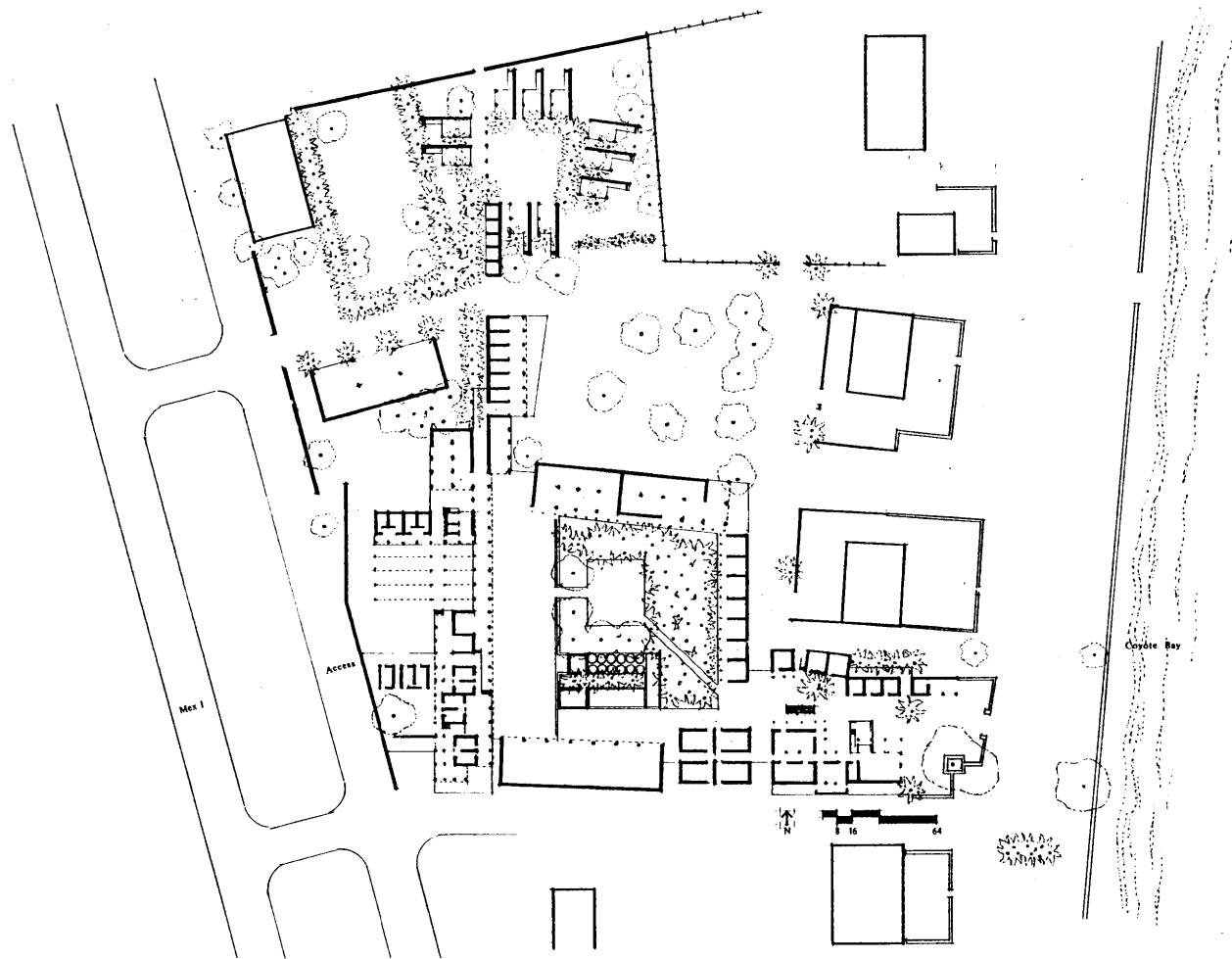
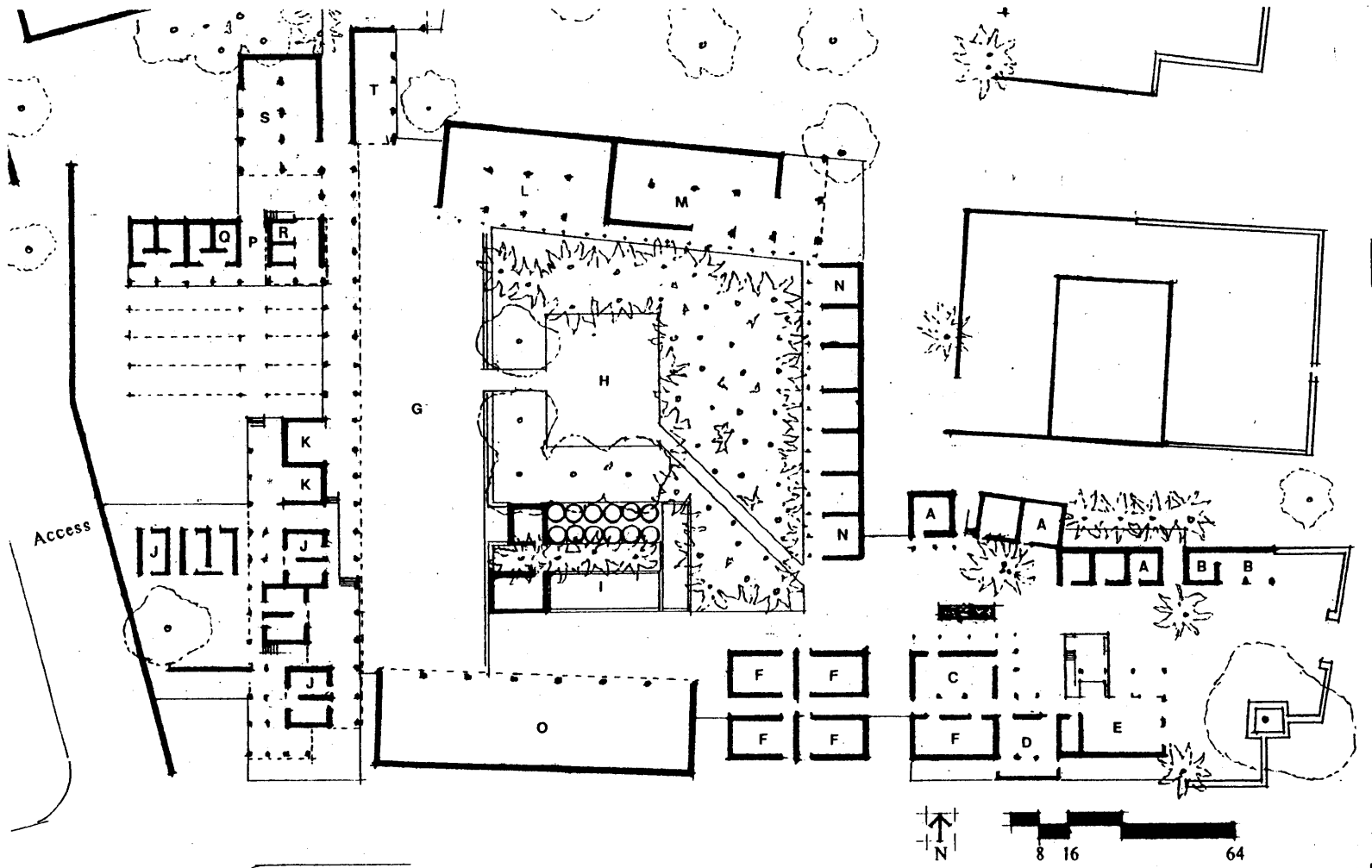


Diagram of Area Density of Program to Site

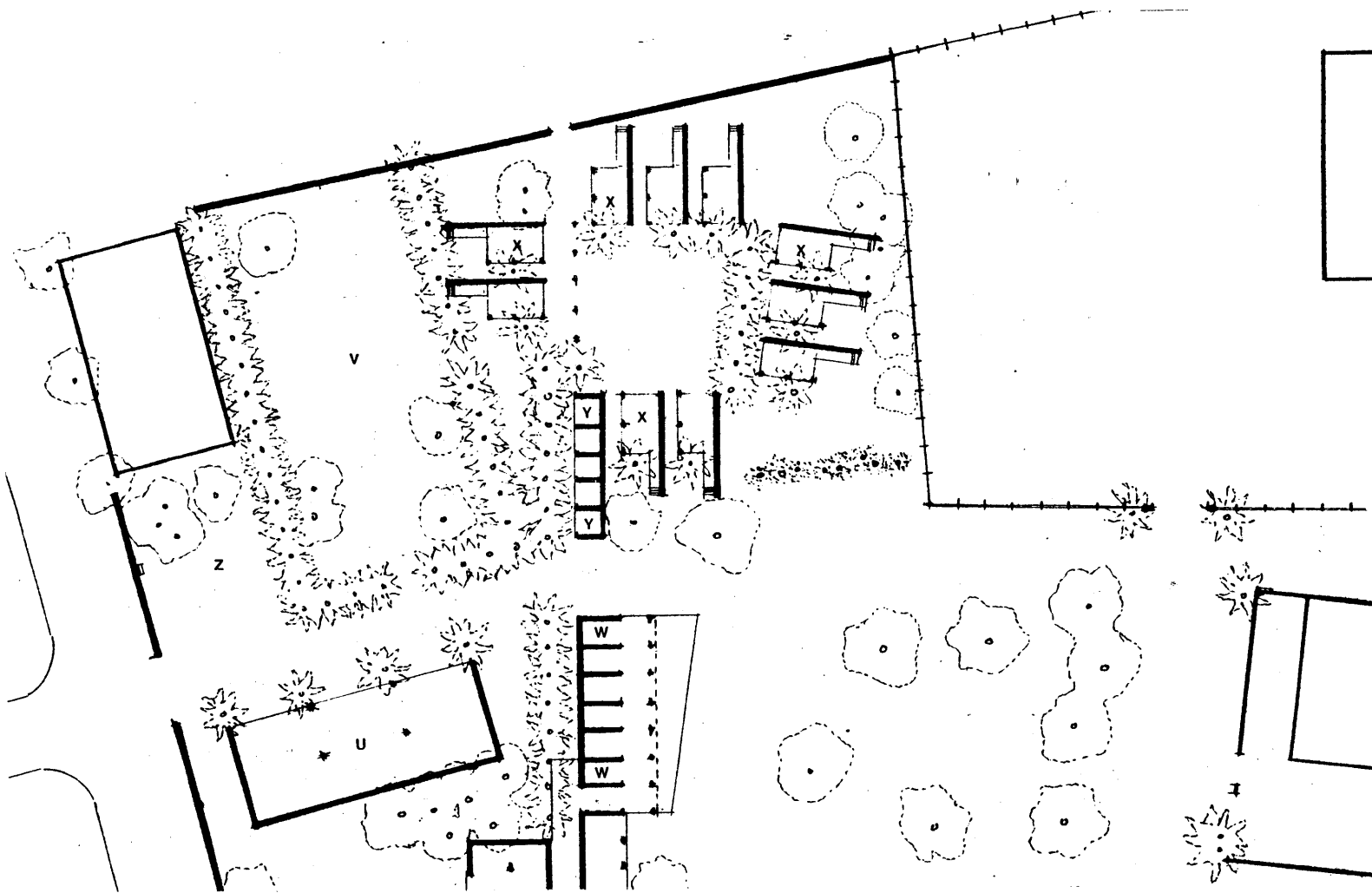




Proposed Master plan



Southern Half of Proposed Master Plan



Northern Half of Proposed Master Plan

Key for Master Plan

- A. Offices
- B. Library
- C. Kitchen
- D. Cleaning/ Dish Washing
- E. Dining
- F. Food Storage
- G. Boat Washing
- H. Central Gathering Space
- I. Solar Aquatic System
- J. Instructor Housing
- K. Instructor and Student Storage
- L. Equipment
- M. Rations
- N. Student Issue Bays
- O. Boat Storage
- P. Bath House
- Q. Showers
- R. Toilets
- S. Workshop
- T. Boat Workshop
- U. Garage for Vehicles
- V. Parking
- W. Utility Storage
- X. Support Staff Housing
- Y. Support Staff Storage
- Z. Composts and Incinerator

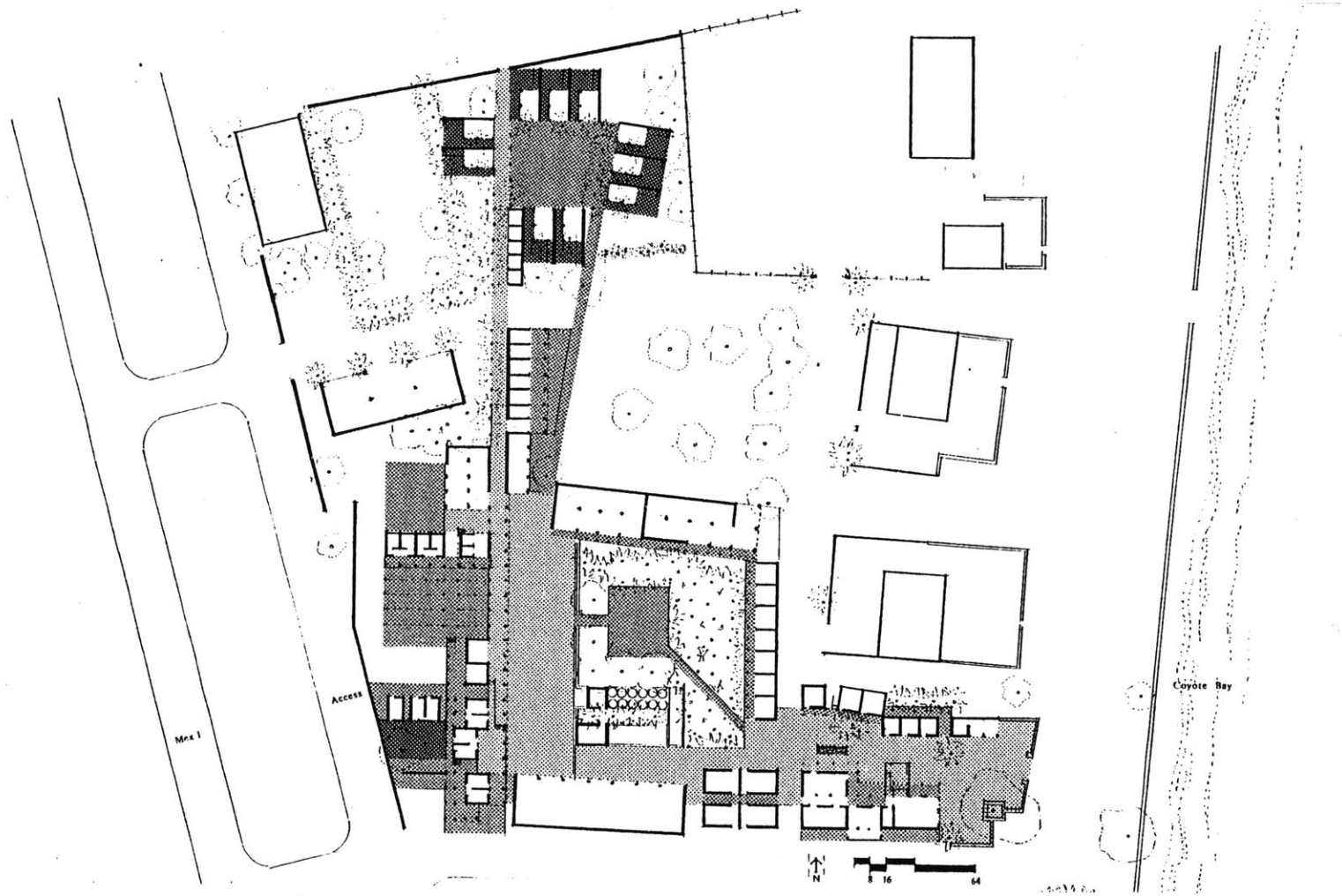


Diagram of Public and Private

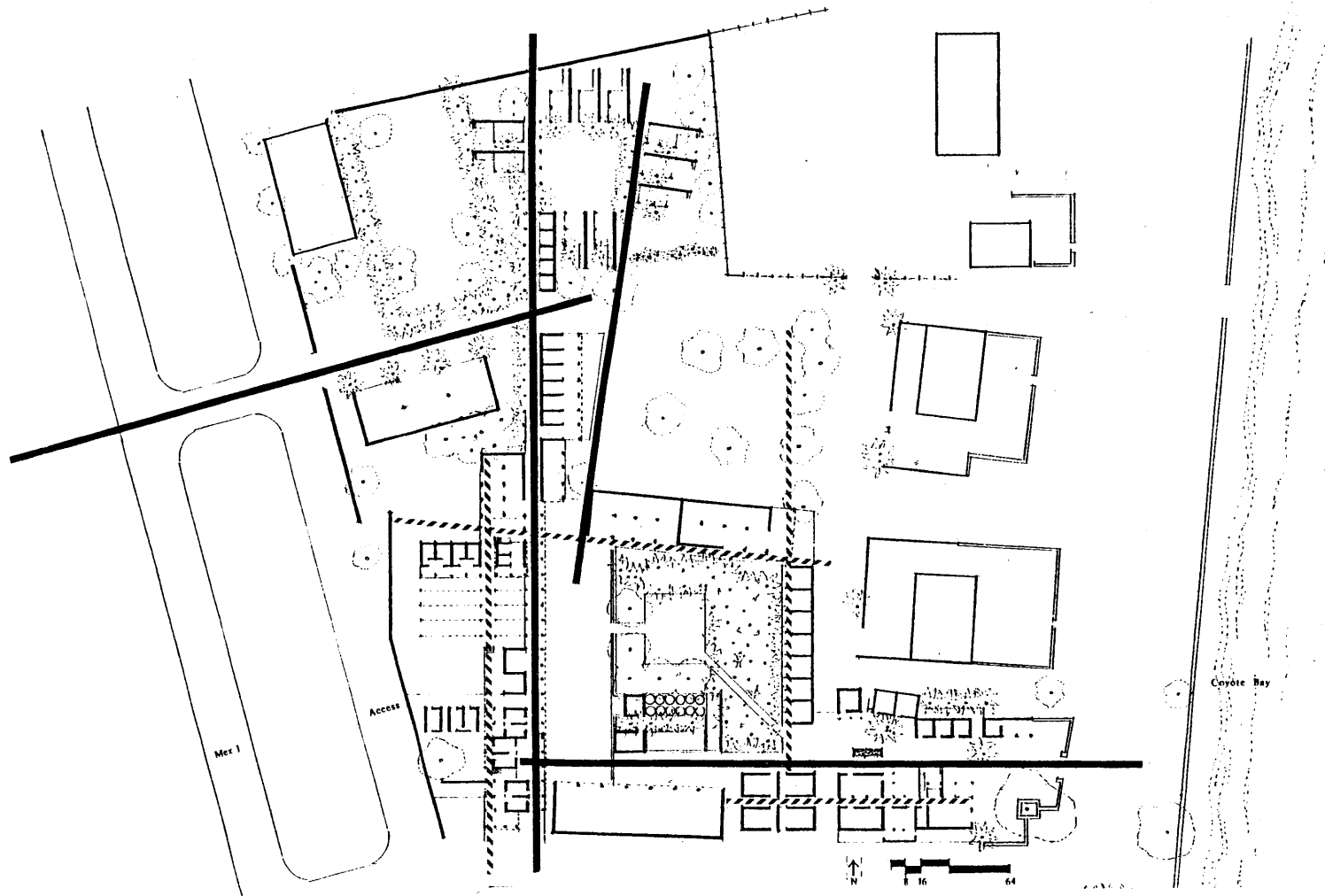


Diagram of Views

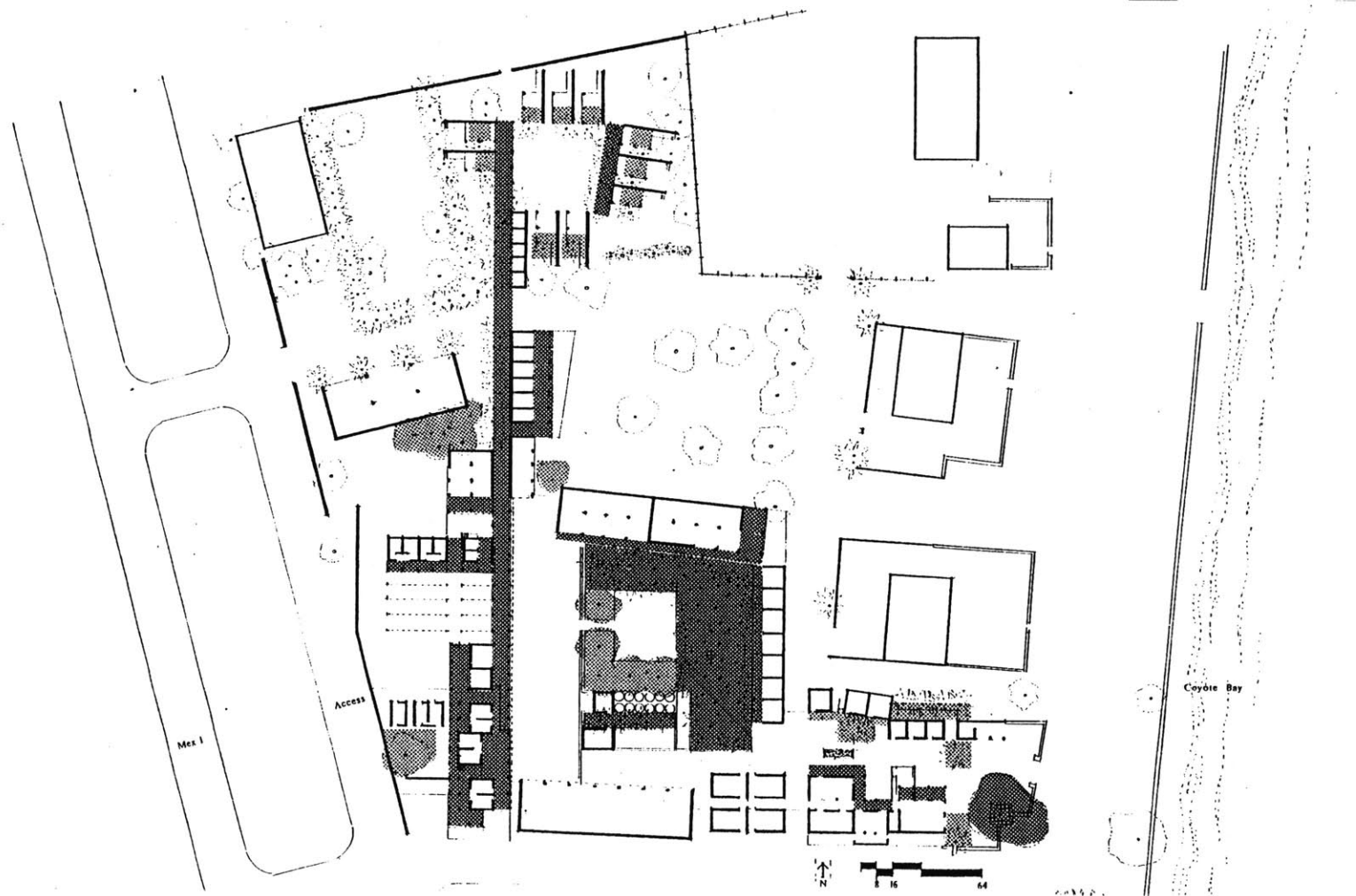


Diagram of Shade with Late Spring/ Early Fall Afternoon Sun

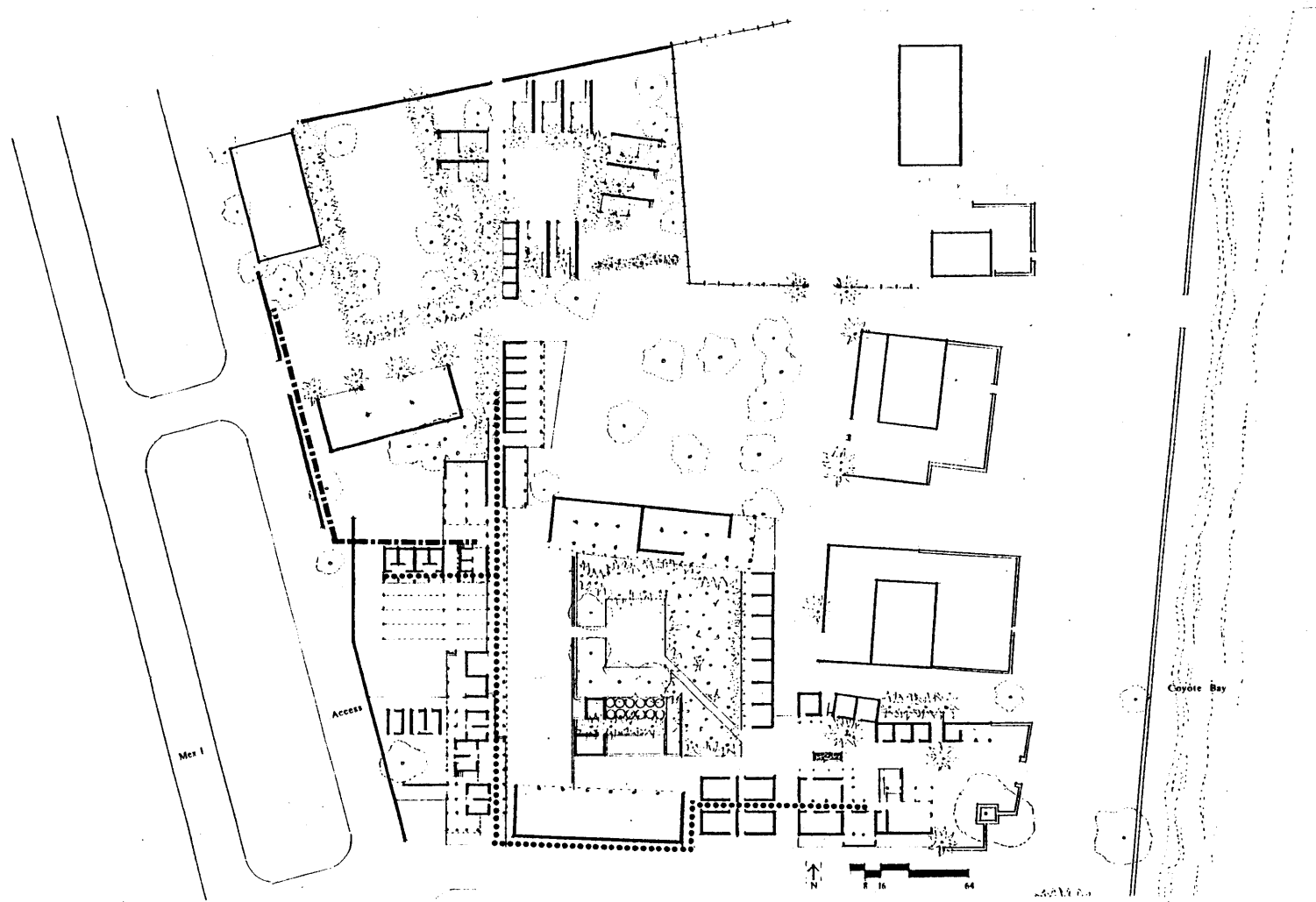


Diagram of Water Distribution

Main Square

Precedents

The plaza in Cordoba shows the confluence of two access. The plaza defines a larger area at the meeting of these access.

The Luis Barragan park has a large water pool that defines a path. The trees on either side set up a rhythm and a space under which to gather.

Plants and Water

The forest of palms becomes an oasis for the site. This landscaping brings life to the courtyard, defining an area that supports human life in the desert climate of Baja. The trees extend the use of the buildings into the square providing a sheltered area under which to gather and work.

The mesquite trees are shorter in height and more human in scale. These trees act as barriers, giving privacy to the central gathering space.

The water for boat washing runs along the spine of the site underneath the arbored walkway covered with

bougainvillea. The water is used for cleaning and is collected at the bottom of the washing area before running into the Solar Aquatics System for treatment.

The Solar Aquatic System is on the south side of the square reinforcing the south edge of the central gathering area. The prominent location makes the system visible as an example of responsible resource conservation.

Paving

The mission provides examples of stones and paving found in the region.

The suggested paving in the courtyard defines the difference between the areas intended for washing, gathering, vehicle access, and pedestrian movement.

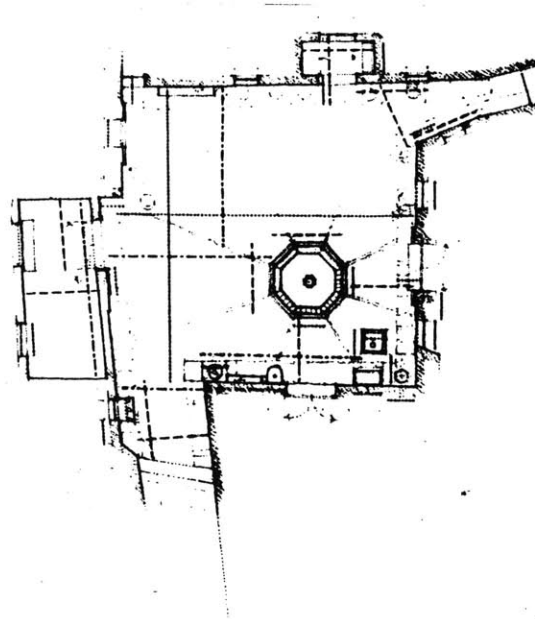
The wash area and floors of most service buildings are concrete for good drainage and easy maintenance.

The center gathering area is paved with small stones to give it a human scale and is placed in patterns which define areas for the issuing of group gear.

The vehicle access surface is flag stone to provide a

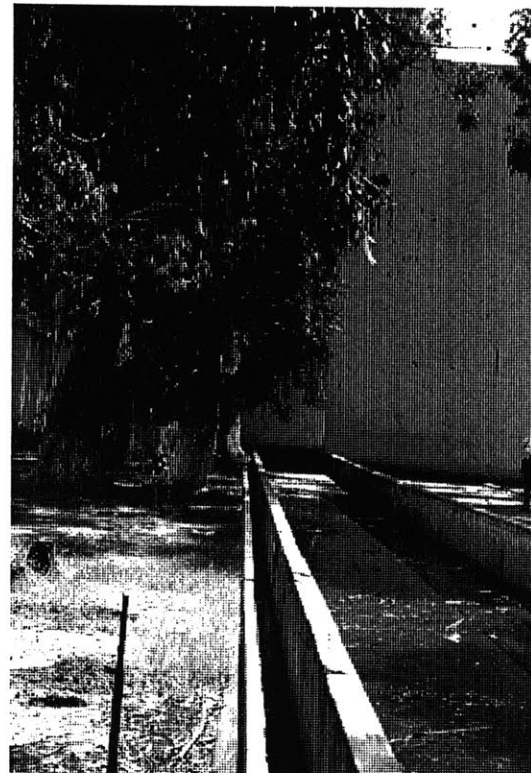
hard surface when it rains and discourage fast driving.
The flag stone clearly defines the area where vehicles
are suggested to drive.

Tile is used in the community spaces of the main
house and for the surfaces in the instructor housing.



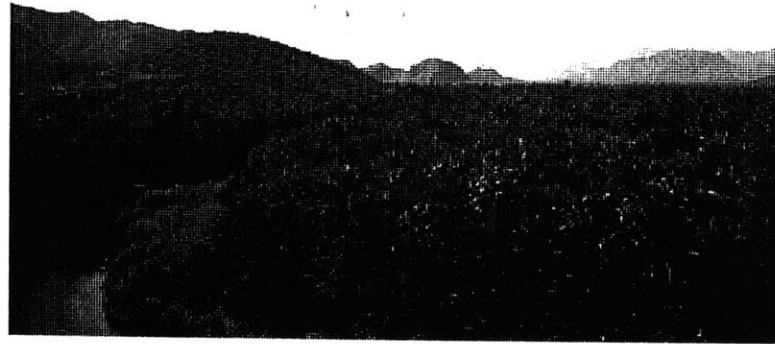
Plaza de las Flores, Cordoba

Fragments

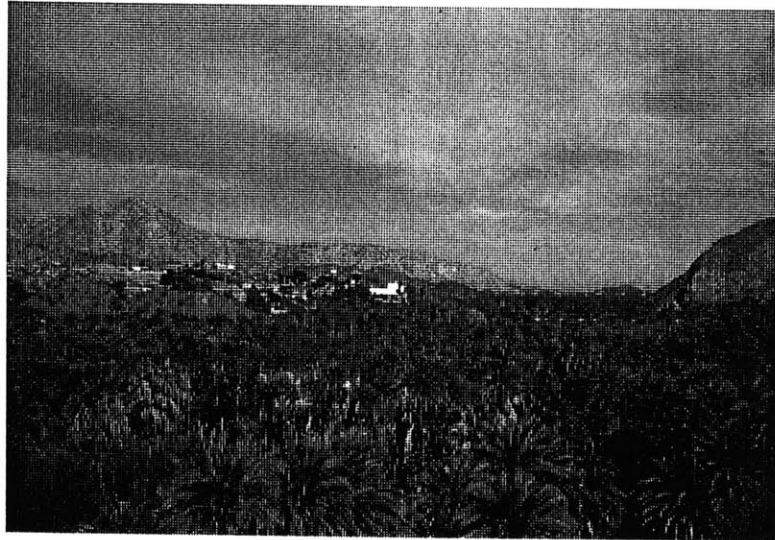


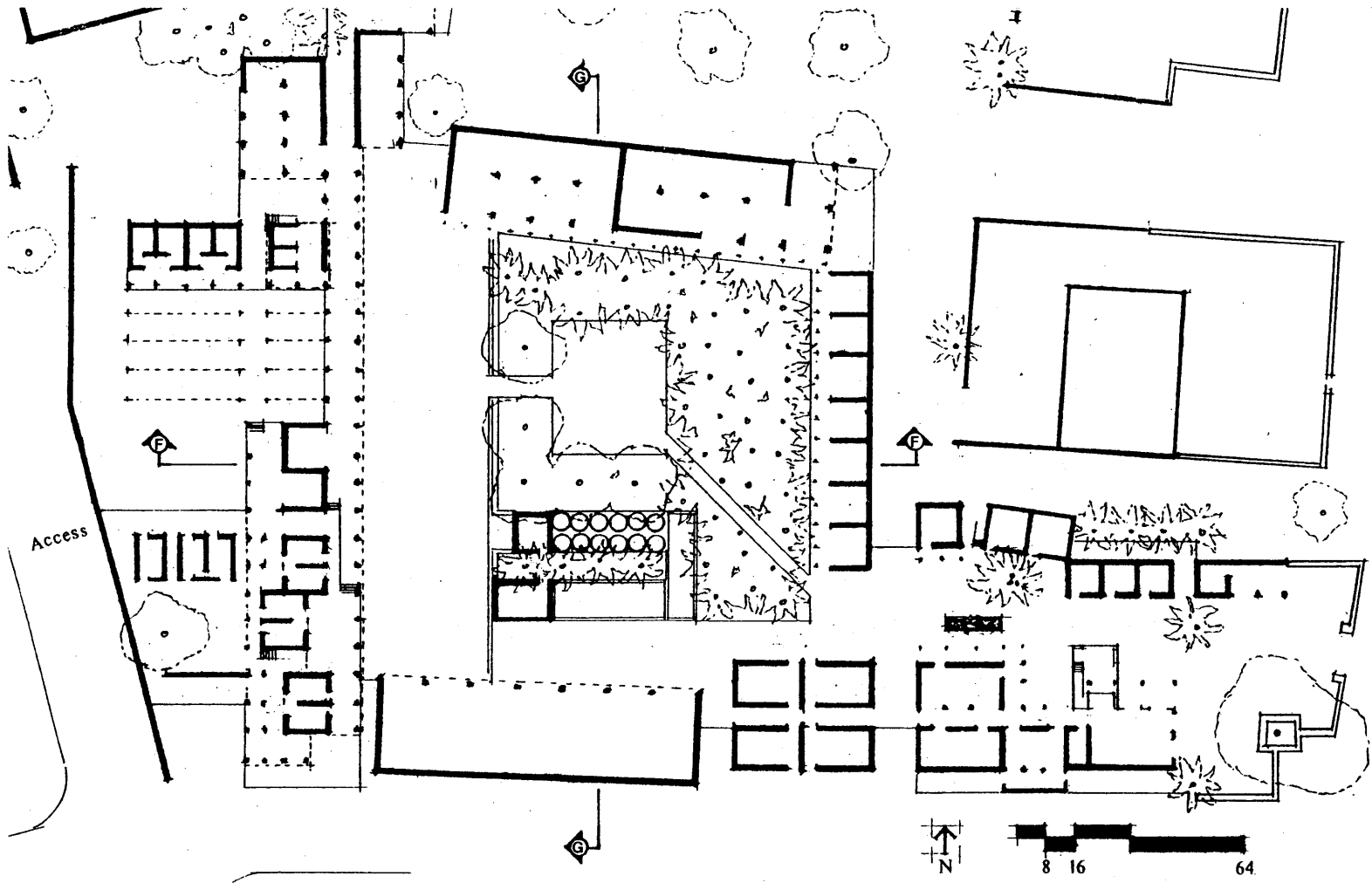
Luis Barragan

Mulegé Palm Trees

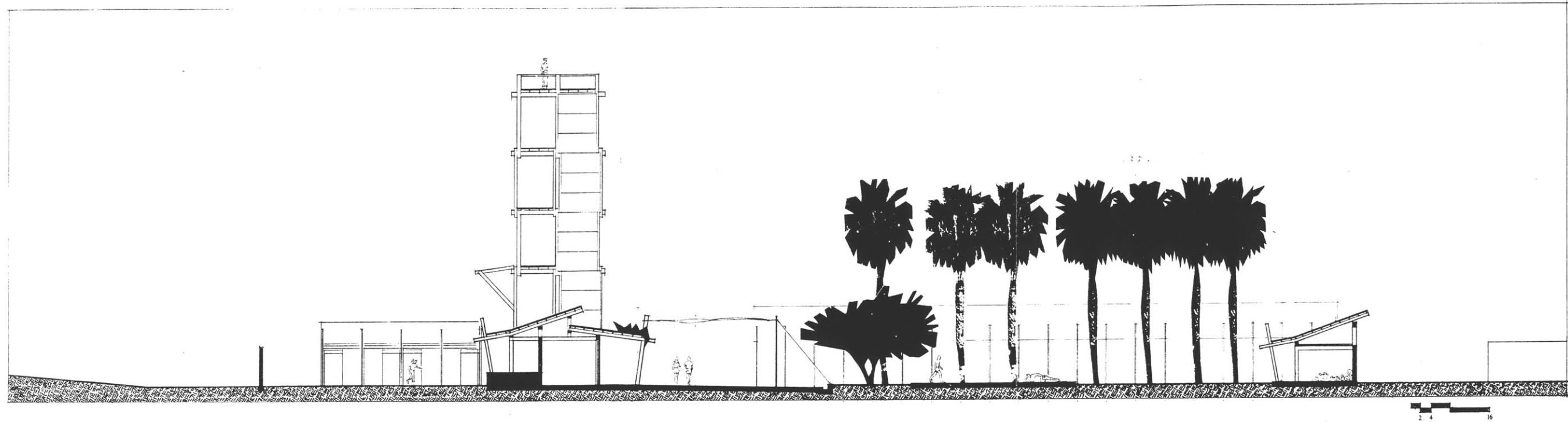


Mulegé Palm Trees

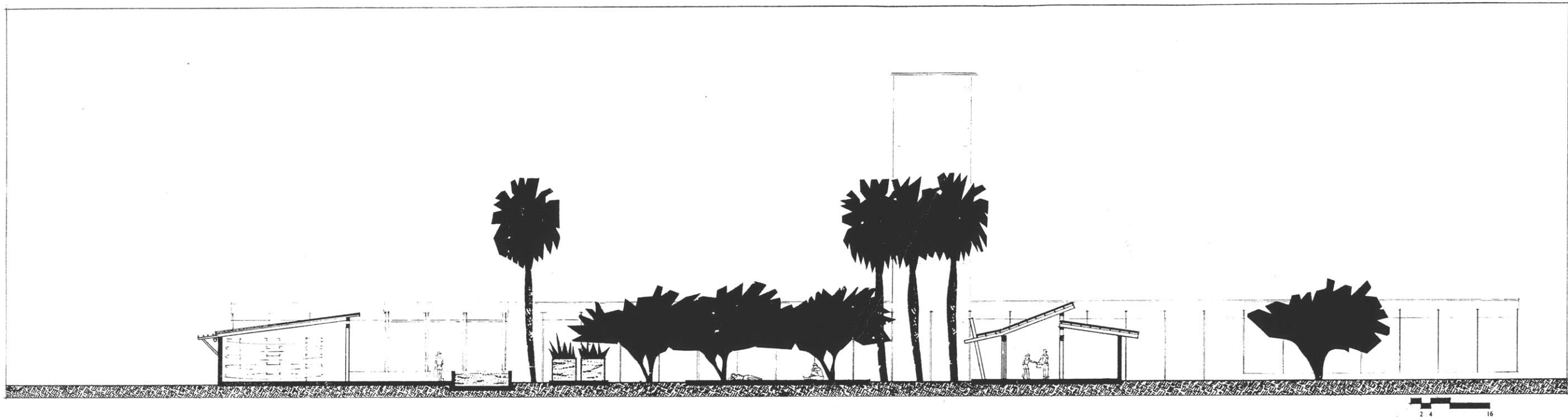




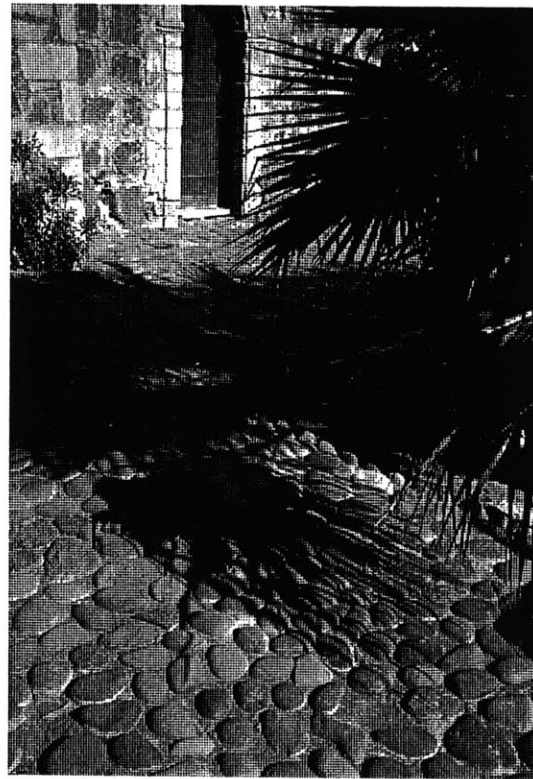
Plan of Proposed Main Working Square



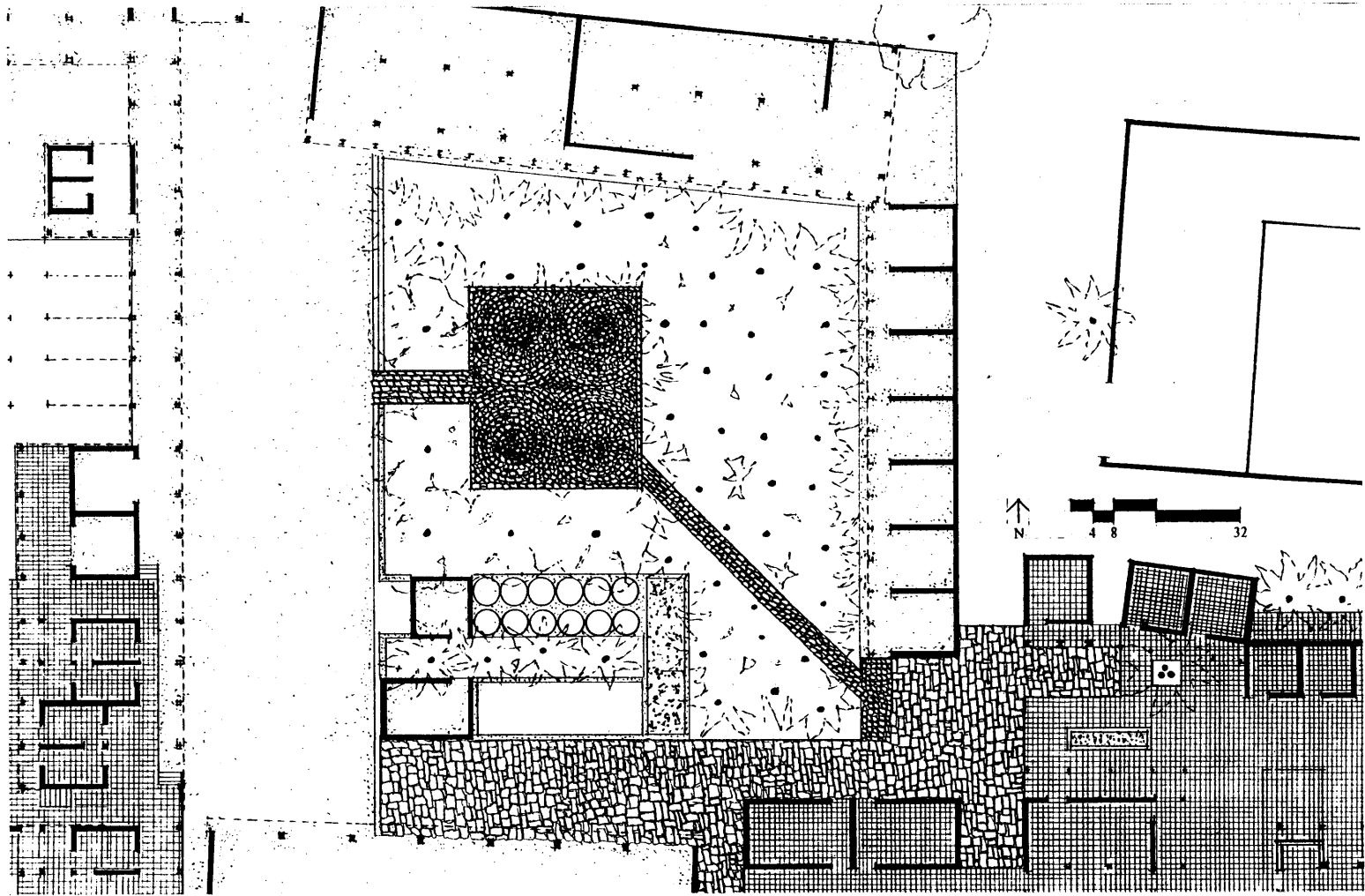
Section FF of Proposed Main Working Square



Section GG of Proposed Main Working Square



Paving From Mission



Proposed Paving for Square

Solar Aquatics System

The Solar Aquatics System is an artificial reconstruction of a wetlands environment for the decomposing of sewage. A Solar Aquatics System requires several steps to take the sewage through the necessary stages for purification.

Degritting removes larger objects from the system. These elements are usually tin cans, etc. that are foreign to the system.

The sewage is then run through solar tanks that are aerated and take the water to the primary level of treatment.

The clarifier is next, taking the sewage through a secondary level of treatment. Here the sludge is settled out of the sewage. The sludge is dried and recycled as fertilizer.

The marsh process takes the water and removes the high concentrations of nitrogen.

Near the end of the process is the solar tanks or a solar pond which has lush vegetation to support the microorganisms which enrich the water with oxygen.

The last stage disinfects the water using ultraviolet waves that kill the unwanted contaminants.

The volume of influent needed to support this system is that of a small community. It is in the interest of the inhabitants of Coyote Bay to invest in the facility together.

Information on this system was found through the Ecological Engineering Associates in Marion, Massachusetts.

The following photographs are from the facility in Providence, RI.

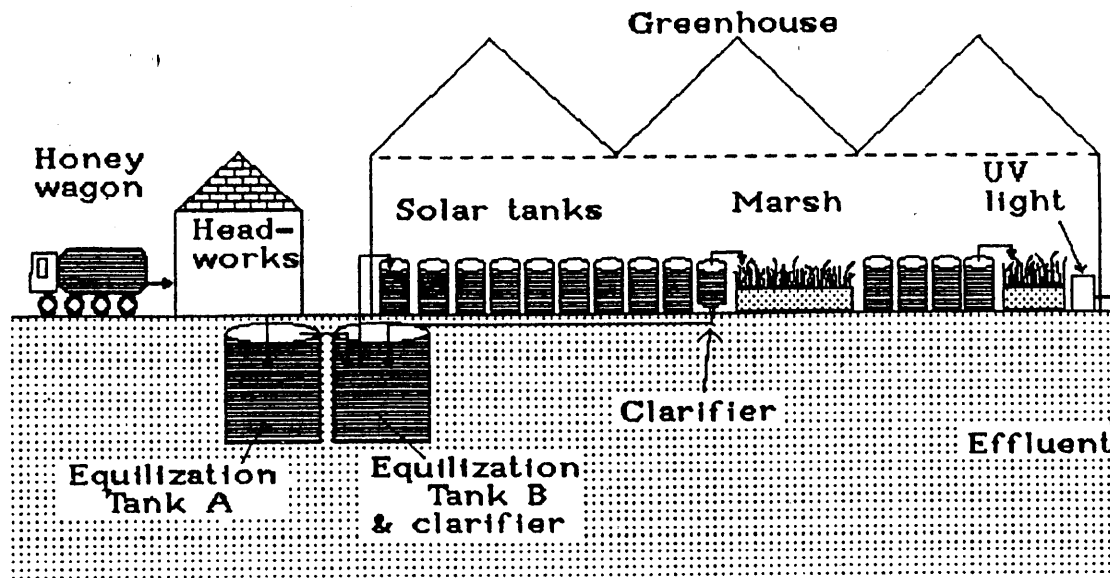
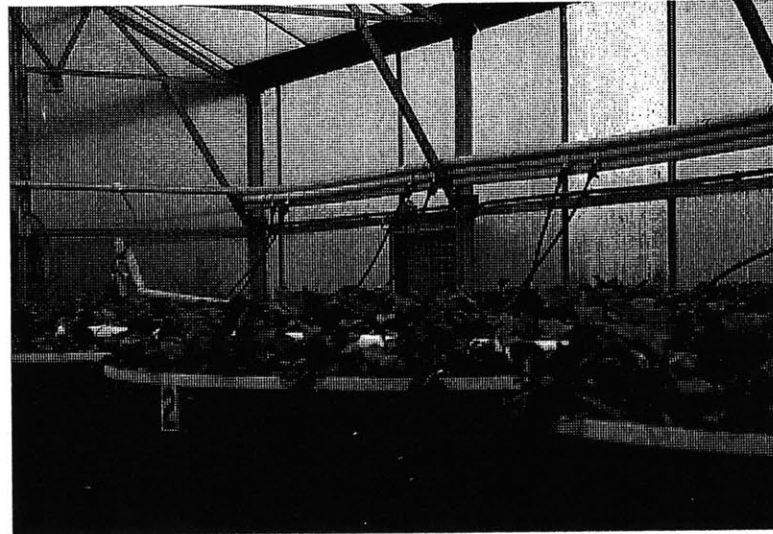


Diagram of Solar Aquatics System in Harwich Connecticut

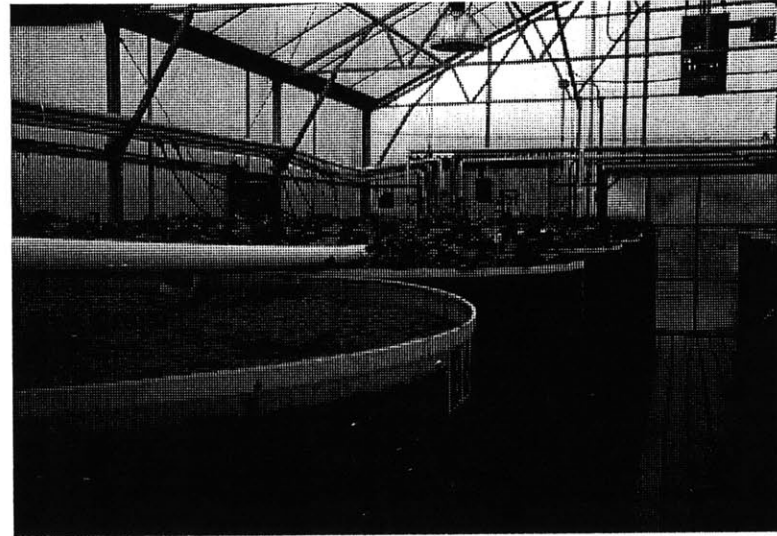
Solar Tanks of Primary Stage



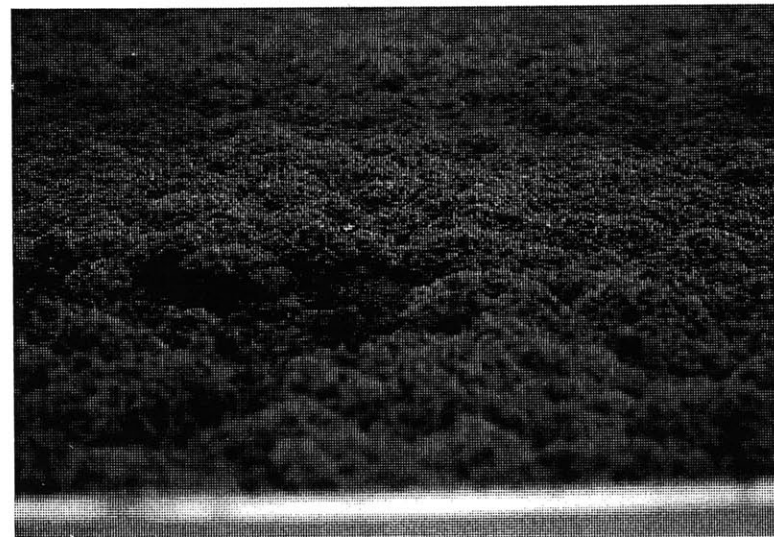
Plants in Solar Tanks of Primary Stage



Clarifier



Vegetation on Clarifier



Marsh



Pumping Water from Marsh to Solar Tanks



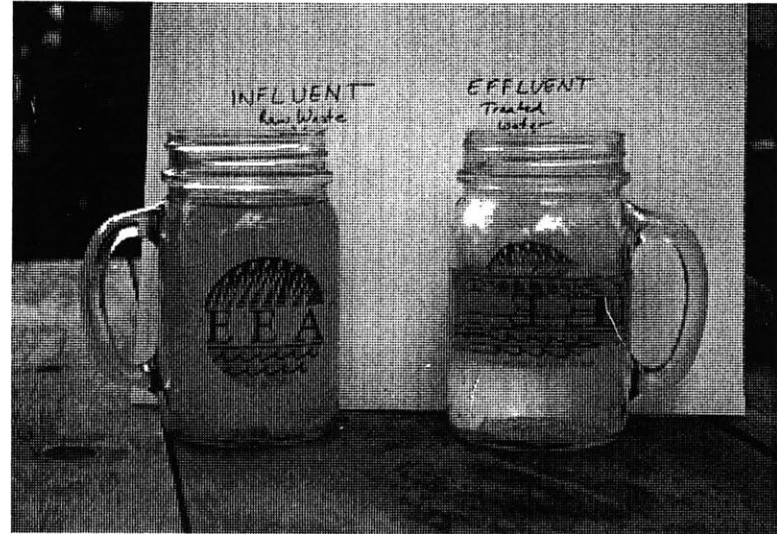


Solar Tanks of Final Stage of System



Vegetation in Solar Tanks of Final Stage of System

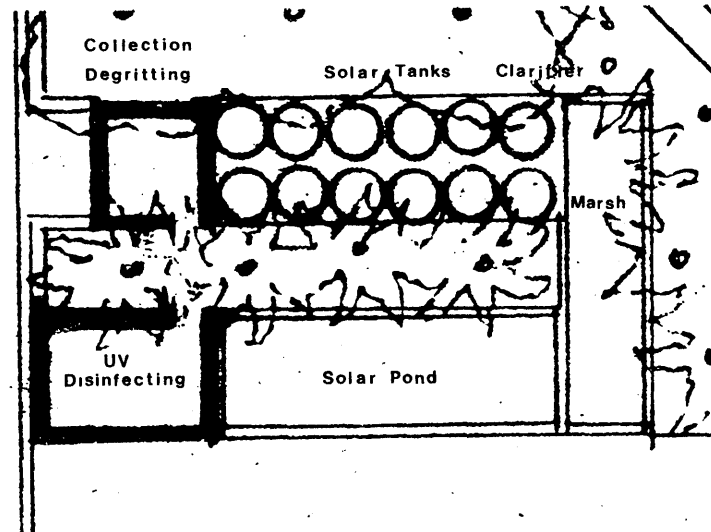
Influent and Effluent from Solar Aquatics System



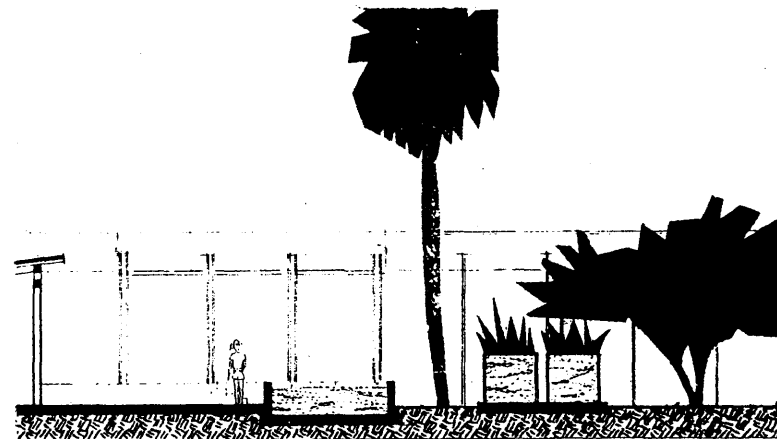
View Inside of Greenhouse in Providence, RI



Plan of Solar Aquatic System for NOLS



Section of Solar Aquatic System for NOLS



Landscape

Landscaping is used to transform the site into an oasis, making this particular area of Baja more inhabitable. The landscaping is relatively inexpensive and is merely the addition of plants that are already part of this environment. The extent of planting proposed is possible through the use of gray water for irrigation.

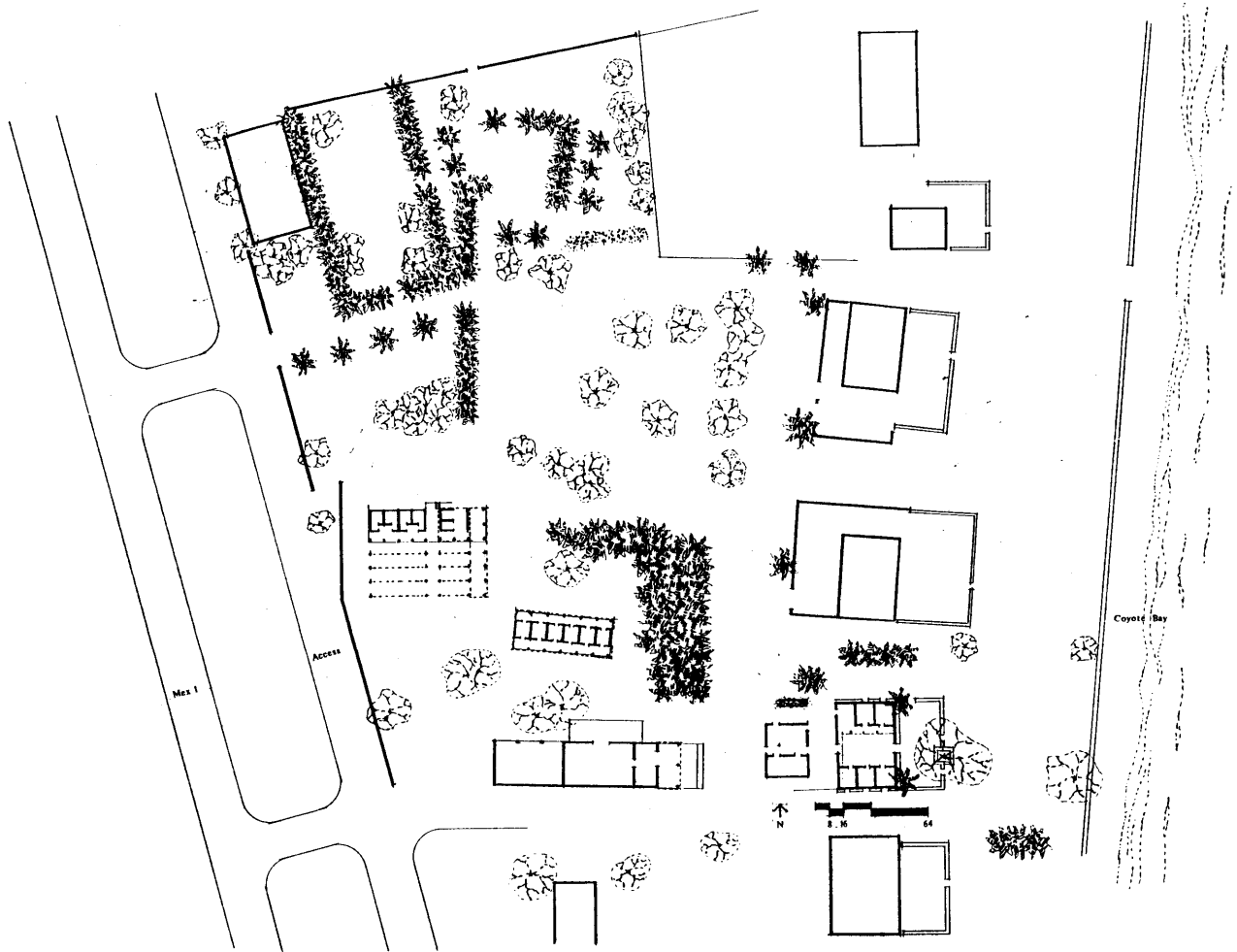
Proposed Landscaping

The proposed landscaping is designed to initiate the relationships set up in the organization of the mature master plan.

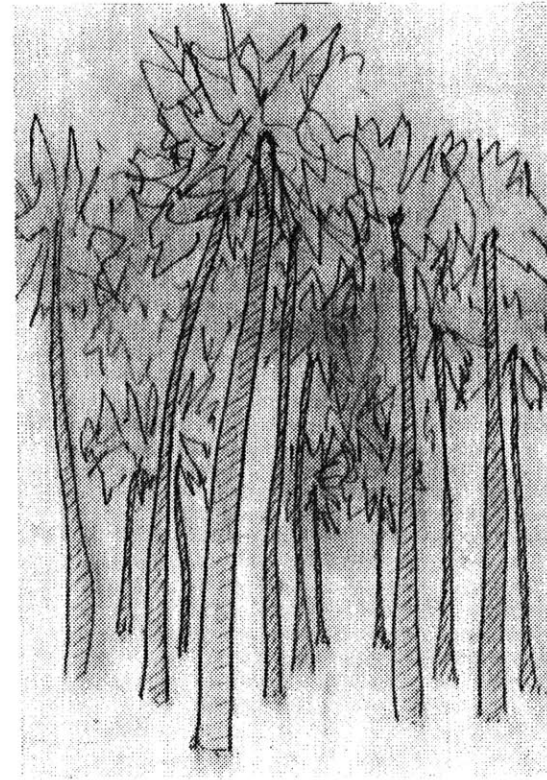
Stage One for Master Plan

Planting as completed in the first stage, sets up the wanted organization and will be mature as the full project reaches completion.

The bathhouse, the most urgently needed new building, is shown with the existing structures and the proposed landscaping.



Plan of Landscape Proposal and Stage One of Master Plan



Perspective in Palm Trees

Conclusion

Approaching the design of the National Outdoor Leadership School in Baja with a holistic attitude has been important. This approach gives a sense of unity to the facility. The many variables collectively contribute to a comprehensive design.

Having considered the broad range of issues, one should not lose scope of this facility as an educational environment. The main educational objectives were to reinforce a harmonious relationship between the facility and the surrounding environment and to be an example to future developments.

The relationship between the facility and the surrounding environment is experienced by the buildings of the facility framing views to landmarks. The landscaping with local vegetation integrates the outside spaces of the facility with the surrounding environment. The conscious use of local, non-toxic materials and the efforts towards resource conservation are part of the attitude of a respect for the natural world that the facility wishes to foster.

The simple direct approach to design problems using materials available locally, is an example to future developments. This approach towards building accompanied with the solutions for resource conservation reinforces the attitude of living harmonious in one's environment.

This is one step in proposing solutions to the efforts to build sensitively and responsibly. Continual exploration of these ideas will enrich the solutions.

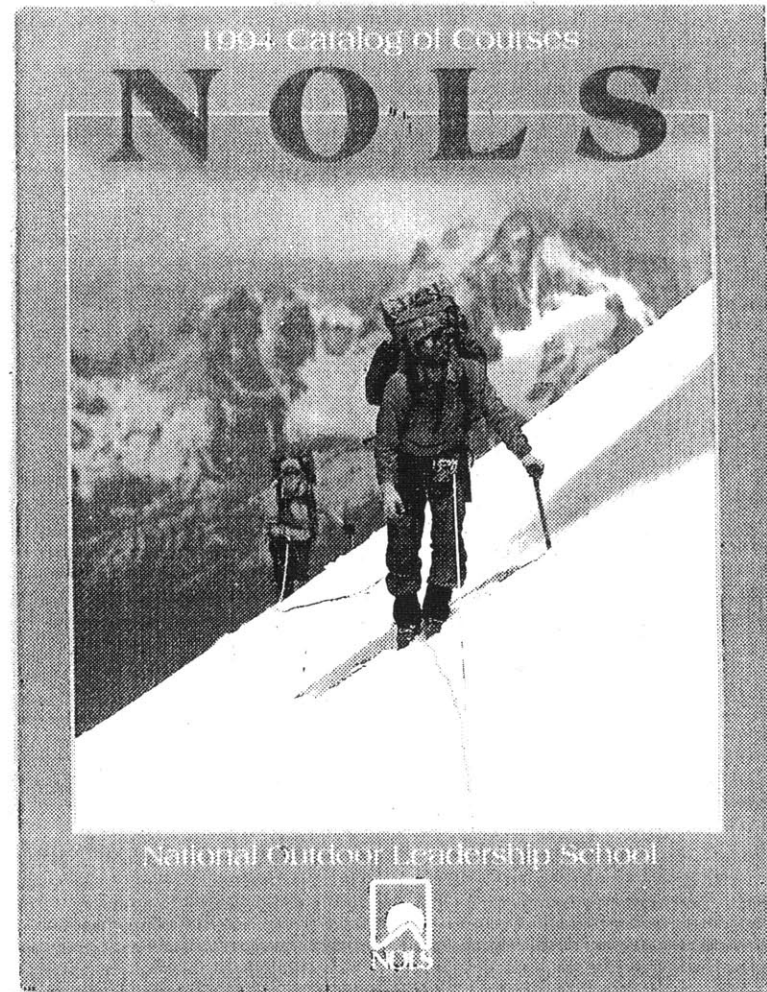
Appendix A: Program

6468 sq. ft.	MAIN BUILDING	1152 sq. ft.	STUDENT ISSUE
732 sq. ft.	Offices	1008 sq. ft.	7 Bays @ 144
	3 @ 100 sq. ft.	144 sq. ft.	Student Luggage Storage
	3 @ 144 sq. ft.		
144 sq. ft.	Roof Deck	1152 sq. ft.	EQUIPMENT
260 sq. ft.	Library		Issue and Gear Storage
	Book Storage 100 sq. ft.		Offices
	Reading Room 160 sq. ft.		Sewing / Repairs
2560 sq. ft.	Outside Porch Area	1152 sq. ft.	RATIONS
336 sq. ft.	Kitchen		Issue and Food Storage
432 sq. ft.	Loft		Offices
324 sq. ft.	Cleaning/ Dish Washing		
432 sq. ft.	Dining	3392 sq. ft.	BATH HOUSE
1248 sq. ft.	Food Storage	192 sq. ft.	4 Toilets @ 48 sq. ft.
	Course	384 sq. ft.	4 Showers @ 96 sq. ft.
	House	768 sq. ft.	3 Platforms in Wat. Tower @ 256 sq. ft.
		2048 sq. ft.	Clotheslines
5792 sq. ft.	MAIN SQUARE	3264 sq. ft.	WORK SHOP
3072 sq. ft.	Boat Washing	768 sq. ft.	General Workshop
1280 sq. ft.	Gathering	384 sq. ft.	Boat Repair Workshop
1440 sq. ft.	Solar Aquatics System	1536 sq. ft.	Outside Workspace
		576 sq. ft.	6 Storage Units @ 96 sq. ft.
1248 sq. ft.	INSTRUCTOR HOUSING		Fuel Dump
864 sq. ft.	9 Units @ 96 sq. ft.		Generator
384 sq. ft.	Roof Deck		Washing Machine
7024 sq. ft.	SUPPORT STAFF HOUSING	2392 sq. ft.	BOAT STORAGE
4400 sq. ft.	10 Houses @ 440 sq. ft.		Kayaks
	160 sq. ft. Inside space		Dinghies
	100 sq. ft. Outside space		Wind Surfers
	180 sq. ft. Roof Deck		
2304 sq. ft.	Shared Outside Space		
320 sq. ft.	5 Storage Units @ 64 sq. ft.		

Appendix A: Program

9690 sq. ft.	VEHICLE STORAGE
2016 sq. ft.	Garage for 6 Vehicles
7680 sq. ft.	Outside Parking for 24 Vehicles
2304 sq. ft.	COMPOST AND INCINERATOR
45,030	TOTAL SQUARE FEET
16,716	TOTAL BUILT (COVERED) SQ. FEET

Appendix B: NOLS Catalog Course Descriptions



Appendix B: Catalog Course Descriptions

WATER

COURSES



Practicing tacking in Drascombe long boats.

Winds, tidal currents and other conditions sometimes make sea conditions too hazardous for safe travel. Watching the weather, learning to judge sea conditions and accepting the capabilities of the group and the equipment are what safe coastal travel is all about. Days on shore will provide opportunities for classes, day hikes, snorkeling and fishing.

MEXICO SEA KAYAKING COURSE

AGE: 16 Minimum, 21 Average
DURATION: 21-22 Days
LOCATION: Baja California (Mexico)

The Sea of Cortez—that narrow strip of ocean between Mexico's main land and Baja California—is the site of this kayaking expedition along desert coast. You will learn paddling techniques, ocean safety, hazard evaluation and navigation, as well as minimum-impact camping practices adapted to desert coastal environments.

Along with learning to handle a sea kayak safely and skillfully, you may observe coastal wildlife: whales, dolphins, sea lions and water birds. Skin diving offshore gives you the opportunity to explore the underwater marine world.

Weather, especially wind, often limits our ability to travel on the water. On non-paddle days, you will hike the Sonoran desert, home to the tall cardon cactus, as well as cholla and smaller barrel cacti. Wild fig trees grow in arroyos.

Between desert and sea lies the narrow intertidal zone of the rocky coast. At low tide, small pools reveal a startling variety of marine life: octopi, crabs, sea urchins, anemones and shells. Throughout the course, you will learn about the natural history of both inland and ocean environments, and we bring along a reference library so you can pursue specific subjects in depth.



MEXICO SAILING COURSE

AGE: 16 Minimum, 21 Average
DURATION: 22 Days
LOCATION: Baja California (Mexico)

Mexico's Sea of Cortez is the location for this three-week sailing course. You will travel the Baja coast, sailing or rowing if there's not enough wind by day and beach camping at night. The sea, the boat and the coastline will be your classroom.

Your crew are 22-foot Drascombe longboats. Sailing, seamanship and navigation learned on these open boats may be used on any vessel size or type without reliance on electronic gadgetry. The Drascombe's proven seaworthiness allows both comfortable travel and access to beaches unreachable by larger craft.

Besides our core outdoor living skills, you'll learn basic seamanship: sailing theory, small boat handling, navigation, and person overboard procedures. You will also receive an in-depth look at the unique natural history of the Sonoran desert ecosystem.

MEXICO WOMEN'S SEA KAYAKING COURSE

AGE: 16 Minimum, 21 Average
DURATION: 22 Days
LOCATION: Baja California (Mexico)

This course is identical to our Baja sea kayaking expedition, but for women only. We have found that women often learn outdoor skills more effectively when they participate in a less competitive, non-coeducational setting.

Expect a strong emphasis on technical skills and leadership training. Since the first step in becoming a good leader is developing self-confidence, this course stresses individual initiative, responsibility and expedition behavior in a supportive environment.

Name: Lucy Smith
Nationality: USA
Age: 42
Education: East Carolina, B.S. in Medical Technology
Instructor since: 1975
a year of 362 weeks in the field—one of NOLS' most senior staff.
Other Experience: Multiple Himalayan expeditions.

Have you seen many changes at NOLS over the years? Once you get into a remote setting with people, the core stays intact and is as applicable as it was 20 years ago.

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WATER

COURSES



The Women's Sea Kayaking Course puts a strong emphasis on paddling and leadership skills.

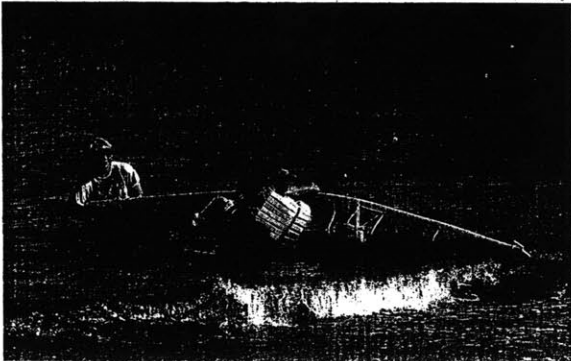
Often courses encounter Mexican fishing or ranching families living along the coast, providing a unique insight into a different culture.

MEXICO WOMEN'S SEA KAYAKING COURSE

AGE: 16 Minimum, 21 Average
DURATION: 22 Days
LOCATION: Baja California (Mexico)

This course is identical to our Baja sea kayaking expedition, but for women only. We have found that women often learn outdoor skills more effectively when they participate in a less competitive, non-coeducational setting.

Expect a strong emphasis on technical skills and leadership training. Since the first step in becoming a good leader is developing self-confidence, this course stresses individual initiative, responsibility and expedition behavior in a supportive environment.



Instructor Tamé Pokony helps student work on her high brace.

Have you seen many changes at NOLS over the years? Once you get into a remote setting with people, the core stays intact and is as applicable as it was 20 years ago.

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Appendix B: Catalog Course Descriptions

SEMESTER

COURSES

SEMESTER IN MEXICO

AGE: 17 Minimum, 20 Average
DURATION: 78 Days
LOCATION: Baja California (Mexico)

Baja California's scenic desert, mountains and ocean are the location for this course emphasizing fundamental skills and judgment essential to well-rounded outdoor travelers. This narrow peninsula between the Gulf of California and the Pacific is the winter

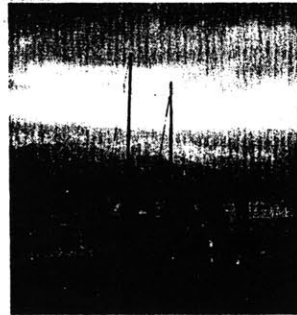


Beaching and unpacking the kayaks for the night, Isla Carmen, Mexico.

ing ground for hundreds of birds and marine mammal species.

The coast is stark, rugged, and dry, and fresh water may be hard to come by. Yet only a few steps away lies a rich variety of marine life—waters teeming with fish, sea lions, dolphins and whales. Where the sea roils against land or forest meets desert, you will encounter natural history firsthand, gaining insight into the regions' unique plant and animals.

You will practice sea kayaking and



Unloading Driscombe long boats to camp for the night.

sailing, desert and mountain backpacking. Each skill enhances and reinforces the knowledge and judgment needed for the others. Fall semesters include rock climbing. January spring semesters feature a natural history section; those beginning in mid-February emphasize cultural exchange. With local rancheros, you'll hike to world-famous cave paintings and visit remote subsistence ranchos.

Safety, education and enjoyment of the backcountry are priorities in becoming an adept outdoor leader. As with all expeditions, group dynamics are an integral part of daily life. The land is remote; our courses are self-contained "communities." Hiking, kayaking and sailing are physically demanding, and getting along with fellow expedition members is a necessity.

Sections include:
Backpacking. During these three or four weeks, you will learn the fundamentals of backcountry travel, safety and hazard evaluation, minimum-impact camping techniques, route selection, group relations and leadership, geology and wildlife. This section is strenuous and challenging. You'll practice map reading in both

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SEMESTER

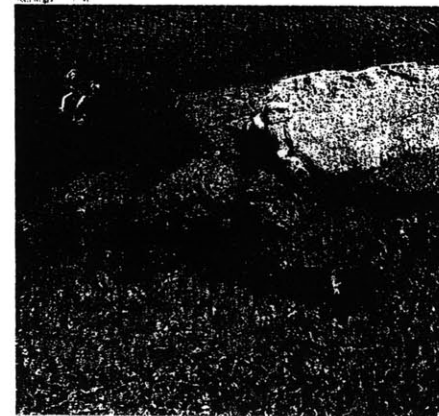
COURSES

desert and forest terrain that is rugged and sometimes confusing, as well as learning how to make a dry camp far from potable water.

Sailing. The course will voyage in our Driscombe longboats, sailing days and camping on shore at nights. These 22 foot, traditional style open boats are seaworthy and fun to sail. Students do most of the steering, sail handling and planning. You'll learn coastal navigation, anchoring, seamanship and other skills needed to crew any kind of sail vessel. Some sections feature a dinghy base camp to quickly master sailing basics, while others utilize a longer sailing expedition taught entirely with longboats.

Sea Kayaking. This section is similar to the Baja California Sea Kayaking Course (page 16). A water expedition means learning about weather, winds, waves and coastline geography. You will practice paddling techniques and apply safety skills as you move down the coast.

This land and sea habitat is the home of whales, dolphins, sea lions and wintering birds, whose natural history you'll study. In tide pools that serve as temporary aquariums live crabs, starfish, sea urchins, anemones and sea cucumbers. While staidly sailing, you will discover the vividly col-



Rocky shoreline provides interesting habitat for snorkelers.

ored undersea world that lies at the edge of this desert ecosystem.

Magdalena Bay Sea Kayaking (January courses only). With luck, you'll closely observe California gray whales and a host of bird species: divers and turnstones, herons, terns and gulls, loons and grebes. Along the shoreline are mangrove swamps, dunes and sand beaches. Classes emphasize sea kayaking, ecology and natural history.

Rock Climbing (fall only). Students establish a desert base camp and spend a week practicing technical rock climbing. You will progress at your own speed, gradually learning fundamental climbing abilities of balance, strength and agility. Classes cover knots and rope systems, signals, belaying and rappelling.

Students Leah Prose Hill, Meredith Egan and Dana McMillan check the map, Sierra San Pedro Martir, Mexico.

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Appendix B: Catalog Course Descriptions

25 AND OVER

COURSES



Coming into shore to camp for the night.

25 AND OVER MEXICO SEA KAYAKING COURSE

AGE: 25 Minimum, 30 Average
DURATION: 14 Days
LOCATION: Baja California
(Mexico)

Like the Mexico Sea Kayaking Course (page 16), this shorter course explores the sea and land environment along the Baja California coast. The marine ecosystem teems with fish, birds, sea lions and occasional whales. The mountainous inland, with its huge cacti and stark geology, offers superb desert hiking.

Travel is by kayak; instruction covers the basics of paddling, wind and wave theory, and route selection. Classes also focus on meteorology and the natural history of plants and animals. The route can be challenging, with stiff winds along a relatively unpopulated coastline. You will learn

to evaluate hazards and develop the judgment necessary for safe, enjoyable sea kayaking.



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NOLS CORE CURRICULUM

The mission of the National Outdoor Leadership School is to be the best source and teacher of wilderness skills and leadership that protect the user and the environment.

SAFETY AND JUDGMENT

Basic first aid, safety and accident prevention, hazard evaluation, wilderness medicine-related injury prevention and treatment, rescue techniques, emergency procedures.

LEADERSHIP AND TEAMWORK

Responsibility, initiative, "leader of the day" opportunities, small group expeditions, group dynamics, expedition planning.

OUTDOOR SKILLS

Campsite selection, shelter and stove use, fire-building, sanitation and waste disposal, cooking and baking, nutrition and rations, equipment care and selection, keeping warm and dry, route finding and navigation, backpacking, kayaking, horse-packing, sailing, fishing, telemark skiing, dog sledding, caving, climbing, canoeing.

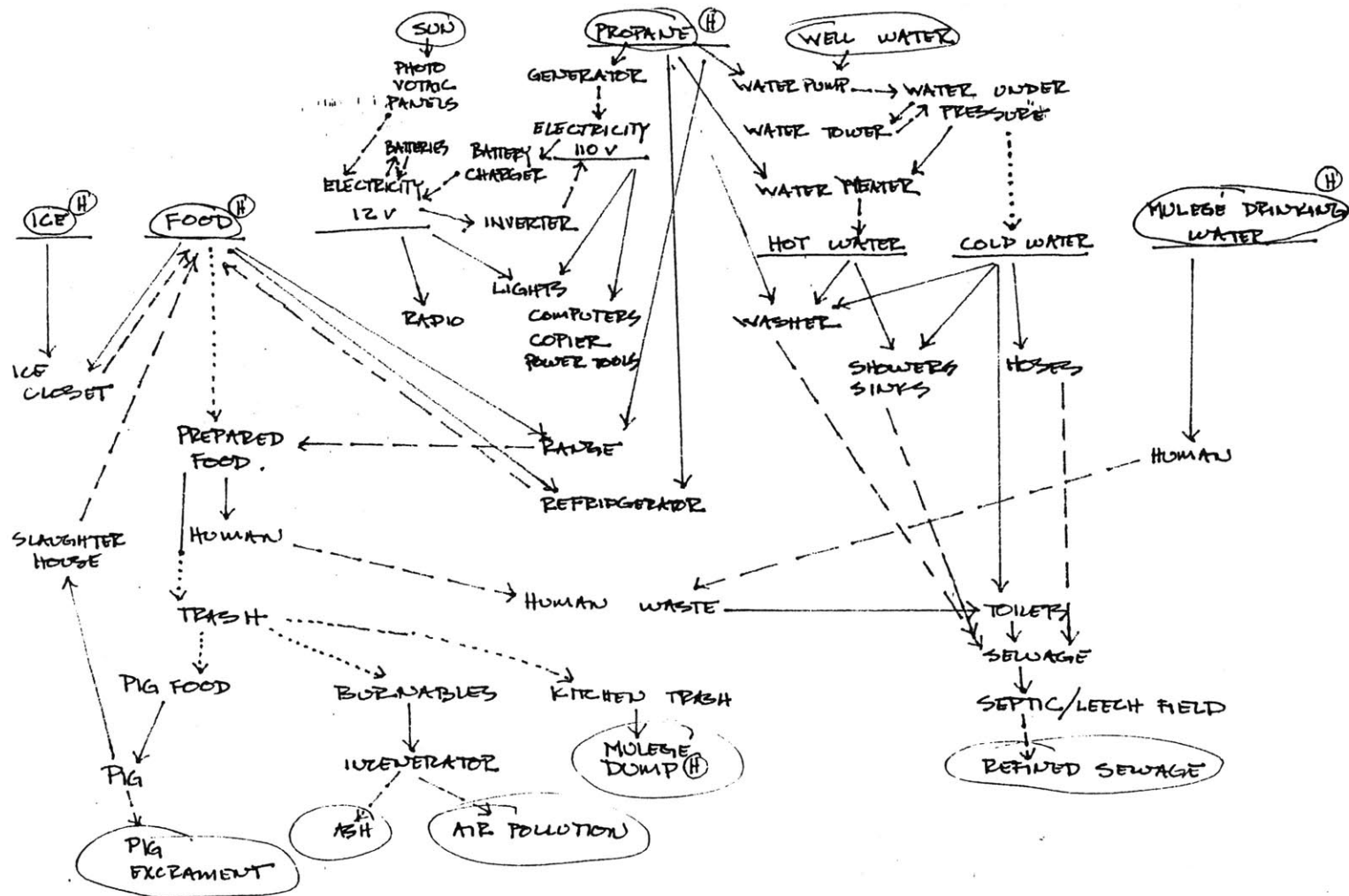
ENVIRONMENTAL STUDIES

Minimum-impact camping and resource protection, ecosystems, flora and fauna identification, geology, weather, astronomy, land management and cultural issues, public service, wilderness ethics.

COLLEGE CREDIT

Many NOLS students elect to earn optional college credit either by 1) making arrangements with their college or university to earn credit via an off-campus or independent study program; or 2) prearranged credit through the University of Utah, Division of Continuing Education, Department of Recreation and Leisure (and Department of Biology for some NOLS courses). Further information will be sent in your enrollment packet or is available by calling the NOLS Admission Office at (307) 332-6973.

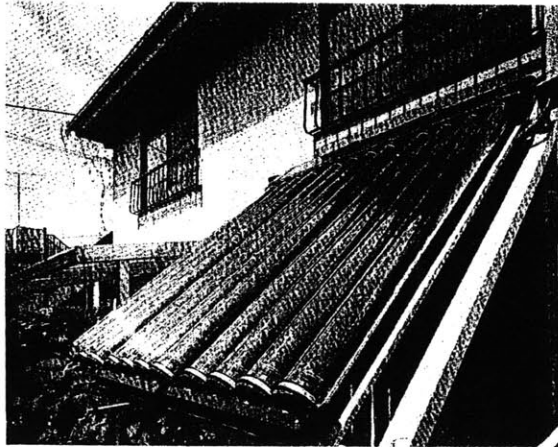
Appendix C: Input Output Resource Diagram



Appendix D: Bathhouse Fixtures

Sun Family Solar Water Heater

We have found that in hot climates, the PK-20 has just one much horsepower - in some cases, even with a family of four. In light of this we are now offering the PK-10 system. This is one four-tube 21 gallon collector. In hot areas the PK-10 can be cycled twice a day (totally drawn down and refilled). You will still need a PK-20 Sub System, which can handle up to 6 PK-10s. If you want to add one or more collectors later it is a simple task.



The Sun Family solar heater keeps water hot through the night, the same way a thermos bottle keeps your coffee at the right temperature—with a vacuum layer that drastically reduces heat loss. Made of super-strong, high-tech glass, that can withstand the blow of a 1½" hailstone, the heater utilizes a double tube design that provides a full 360° of heat collecting surface.

Regardless of the sun's angle, the Sun Family unit soaks up the maximum possible amount of heat, morning, noon, and evening, in every season of the year. Even sunlight reflected from the roof is captured and absorbed. Combine a Sun Family with a supplemental instantaneous-demand water heater, and you'll always have all the hot water you need—at tremendous savings. Since the PK-20 both heats and stores a generous 42 gallons of water, you need no separate tank. And because it's directly connected to your water supply, you'll always have a high level of pressure, no matter at what level it's installed. It can be mounted at ground level, or against a wall. Modular design allows interconnecting as many units as required. This makes the system highly successful for large apartment houses, as well as small, individual installations. The Sun Family heater is the most exciting development in water heating to date—and the most cost effective system on the market. We at Real Goods give it our highest recommendation.

Early tests show the Sun Family Water Heater providing approximately 35,000 BTU per day in the Sacramento climate.

The subsystem contains an expansion tank, P/T valve, dribble valve, tempering valve, and the check valve. The accessory kit consists of the subsystem with timer and pump. The kits are shipped freight collect from California.

■45-409 PK-10 Solar Water Heater	\$995	■45-407 PK-20 Solar Water Heater	\$1,995
■45-408 Subsystem	\$165	■45-408 Subsystem	\$165
■05-216 Crating Charge	\$30	■05-211 Crating Charge	\$60
■45-410 PK-10 Accessory Kit	\$215	■45-411 PK-20 Accessory Kit	\$215

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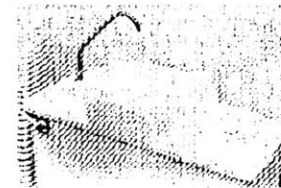
REAL GOODS

Water Conservation



Toilet Lid Sink

This ingenious water saver supplies clean water for hand washing, then uses it to fill the tank for the next flush. These units have been used in Japan for decades. The unit, constructed of durable plastic, has the appearance of porcelain, fits rectangular tanks (up to 8" wide) and is attached with moisture-resistant Velcro. When the toilet is flushed, incoming fresh water is rerouted through the chrome fixture into the basin, then filtered into the tank and bowl. Water automatically shuts off when it reaches normal fill level in the tank. This sink is a boon to people with limited arm or hand movement, since they need not struggle with faucet handles. And it's so easy that children are more likely to wash their hands. Excellent for small spaces, too: no separate washbasin is needed. Installation is very simple, requiring no tools and only a few minutes of time.



46-120 Toilet Lid Sink (15"-17" long)	\$35
46-121 Toilet Lid Sink (17"-20" long)	\$35
46-122 Toilet Lid Sink (20"-21½" long)	\$35

Low Flow Toilets

Toto LF-16 Toilet

The Toto LF-16 is a 1.6 gallon per flush (gpf) toilet, which has the highest performance results of any 1.6 gpf toilet on the market according to Uniform Plumbing Code requirements. Manufactured in Japan, the Toto is easy to install and uses standard U.S. flush mechanisms, mounting hardware, and rough-in dimensions. Constructed of high-quality vitreous china, it meets all current code standard requirements (IAPMO, BOCA, SBCCI). The water surface area is 8 x 7½ inches, or 60 square inches. Shipped from the East Coast. Seat not included. Add the additional freight charges to the standard order form shipping charges.

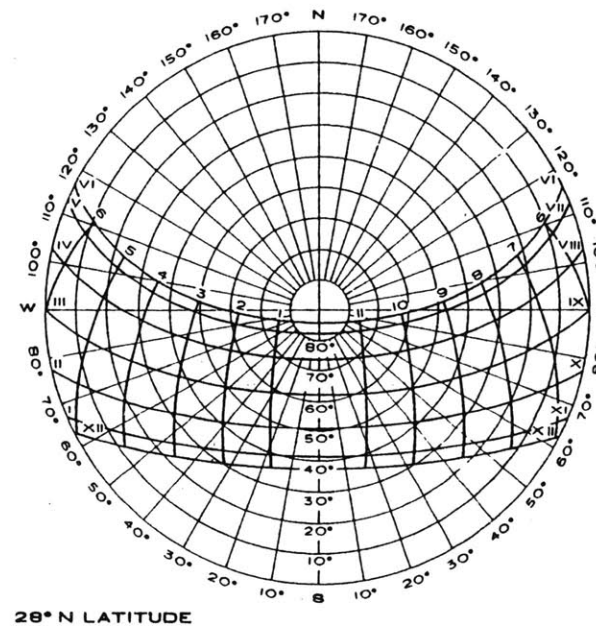


■44-701-W Toto LF-16 (white)	\$190
■44-701-B Toto LF-16 (bone)	\$215
■44-701-G Toto LF-16 (gray)	\$215
05-207 Western US add'l freight/Toto	\$45
05-208 Eastern US add'l freight/Toto	\$20
05-209 HI & AK add'l freight/Toto	\$110

ALTERNATIVE ENERGY SOURCEBOOK

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Appendix E: Sun Angle Diagram



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