

Architectural Form Derived from:

# Natural Forces



A Scuba Divers Resort  
Key Largo, Florida

V. Chad Hamlin  
22, April 2002

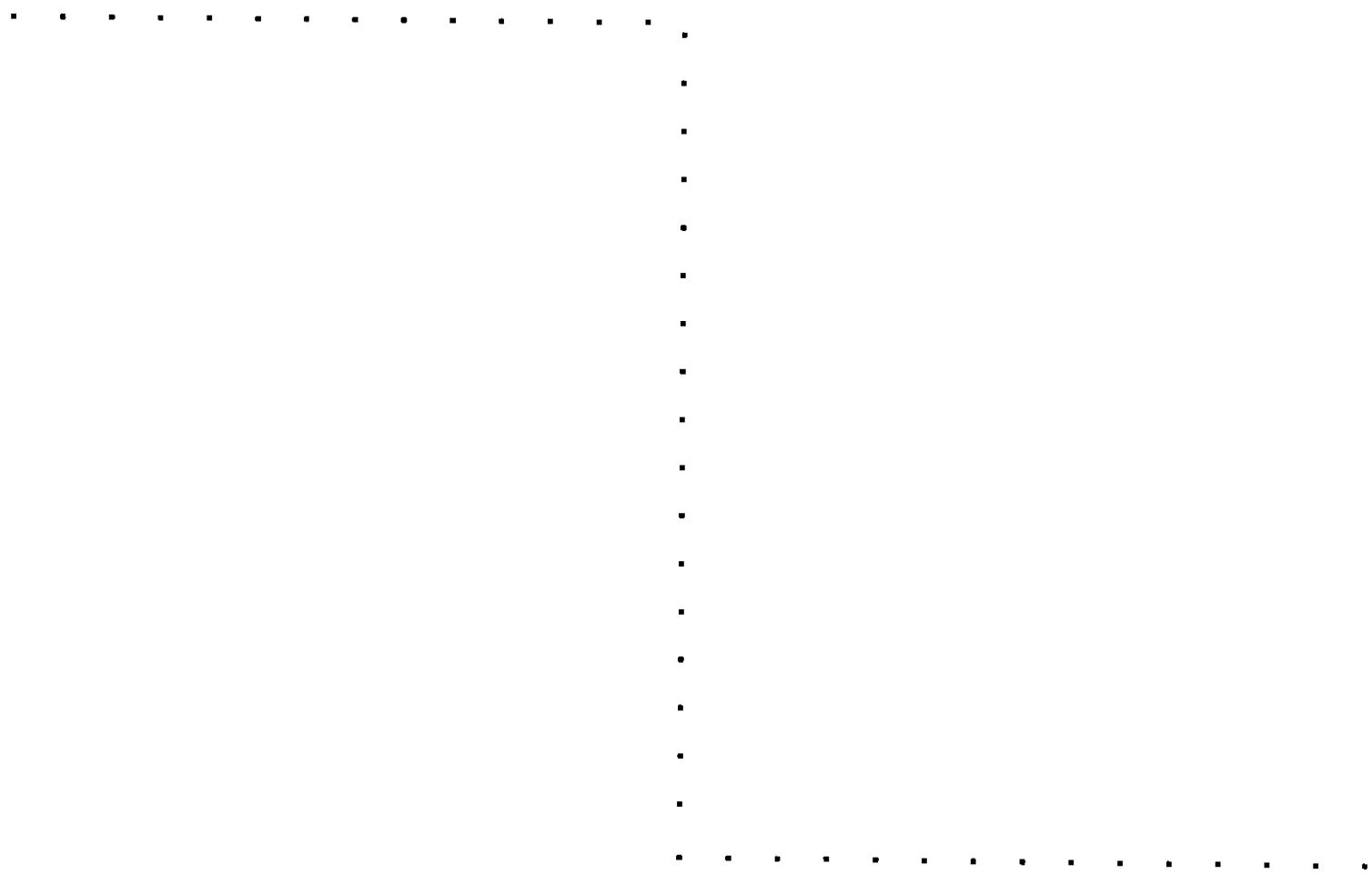
· · Bachelor of Architecture  
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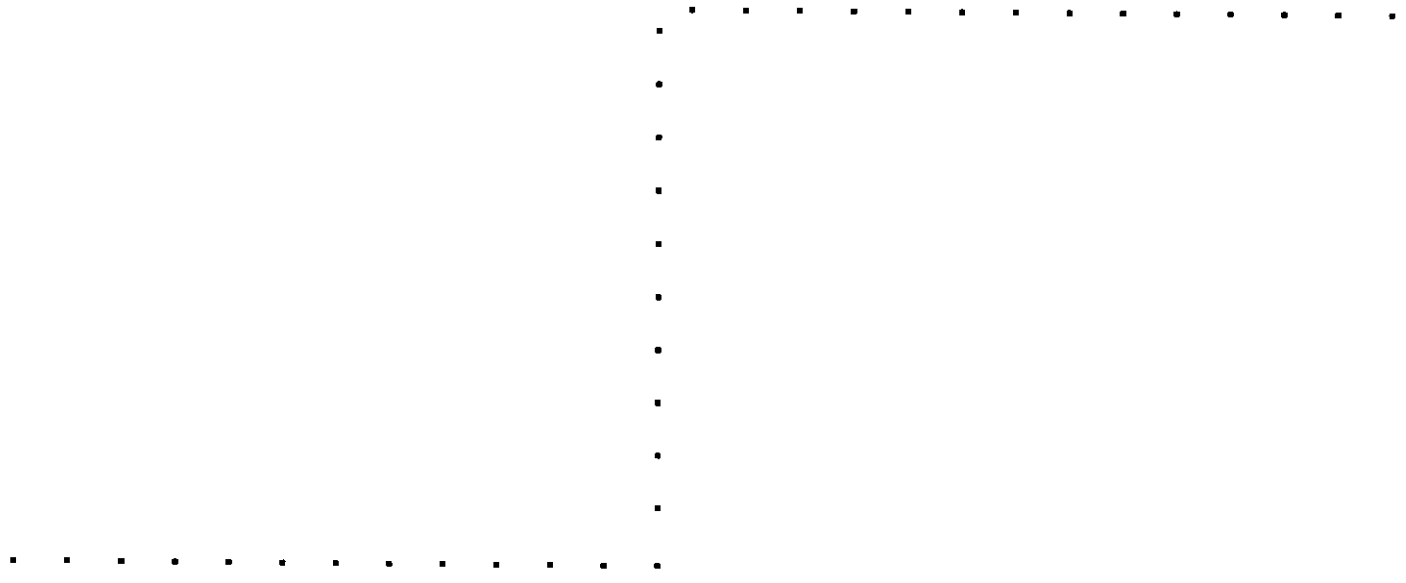
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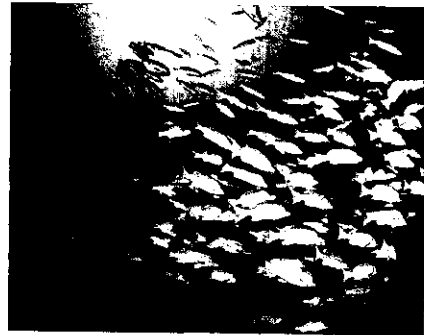




Key Largo, Florida



Belize, South America



Cozumel, Caribbean



Barrier Reef, Australia

Architectural forms derived from natural forces

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# preface

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. As a young child, I spent a great deal of my time growing up in the  
. midwest, and spent my time playing in the ever present fields and  
. building impermeable "forts" out of old corn stalks and other  
. makeshift materials. Aside from the time spent in Indiana, I had  
. the opportunity to visit the Florida Keys with my family and friends  
. quite often. It was during these vacations and through  
. experiences with the locals that I began to gain an appreciation  
. for an entirely new environment. The world beneath the sea,  
. which until then had only been seen in pictures and movies,  
. entranced me and provided questions for which I had no  
. answers.

. As I grew older, my desire to personally experience the marine  
. environment grew; unfortunately, a childhood ailment made my  
. chances nearly impossible. As a result, I quickly became  
. fascinated with the work of Jacques Cousteau. Cousteau was a  
. pioneer of his time through his work in the developing of S.C.U.B.A  
. (self contained underwater breathing apparatus), and his  
. breathtaking underwater photography. It was through my  
. research, and continuing visits to the Florida Keys that I began to  
. gain an appreciation for not only the beauty of our natural  
. underwater environments, but for their complexity and fragility as  
. well. My experience and involvement with this natural  
. environment was from an observatory position above the waves  
. until multiple ear surgeries made it possible for me to take part in  
. the sport of scuba diving. It was then, and only then, that I was  
. able to gain first hand knowledge of what the underwater world  
. had to offer.

. Now, a number of years later, I have become quite the avid  
. scuba diver and have been faced with the impossible task of  
. describing the undersea environment to my friends and family.  
. Much like myself, they are unable to truly experience the feelings  
. of fluidity, floatation, color and texture, from the world above. It is  
. for these reasons, that I have chosen to blend the mysteries of the  
. underwater world with an architectural investigation for my senior  
. thesis project.

. . . .

# introduction

As architects, we are presented with unique opportunities to design and construct buildings and structures in all parts of the globe. Our designs, generally limited by the capabilities of the materials and structure, tend to be very static in nature and lacking in response to the forces which surround them. Winston Churchill once said, "We shape our buildings, and afterwards our buildings shape us." Essentially, the buildings that we design are not behaving as they were originally intended. This has been the case for some time now, but architects such as William McDonough, a renowned architect currently dealing with sustainability, is beginning to open the eyes of many designers. Mr. McDonough is showing us that the buildings we design can use the forces given to us by nature to produce energy as well as to inspire our forms. The wind, the rain, and the sun all help to shape our unbuilt environment so why should they not have an influence on our design decisions? Until recent years, architects have creatively combined materials in unique ways to form the walls, roofs and floors of our buildings, but our buildings continue to be unresponsive to the forces that act upon them and further define the line between what is indoors and outdoors.



Can an architectural solution be influenced by the sun, wind, and water in such a way that its form and environment enhance the experience of those who inhabit it?

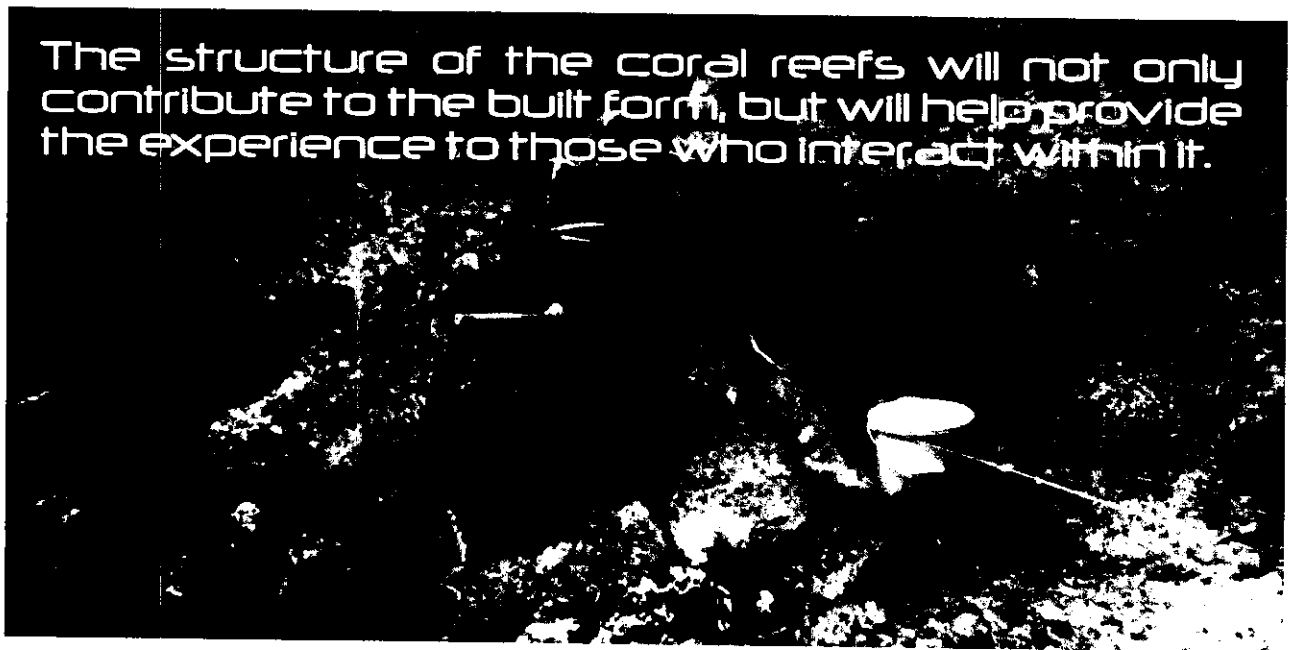


We shape  
our buildings,  
then  
afterwards  
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Winston Churchill

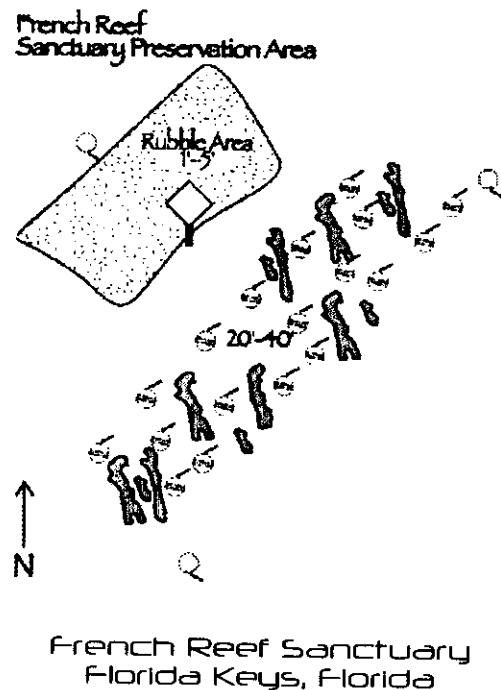
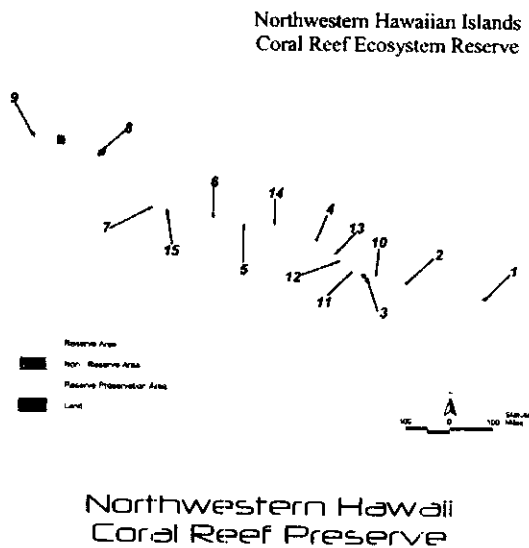
Typically, during site analysis, the first step in the design process, we are concerned with vehicle access, pedestrian flow, and the noise from nearby highways, but these are not all of the tools that we have in order to create a successful design. Aside from these characteristics, each site possesses other traits that give it its own individuality. These forces range from physical (human movement, topography), to environmental (wind, gravity, temperature, light, earth.) In many cases, sheltering from these natural forces is important to the purpose of the building, but this is not to say that these forces cannot have an impact of the form and function of our structures. Including these natural forces as design determinants and beginning to investigate their use in enhancing the quality of life for the users is the focus of my thesis project.

The structure of the coral reefs will not only contribute to the built form, but will help provide the experience to those who interact within it.



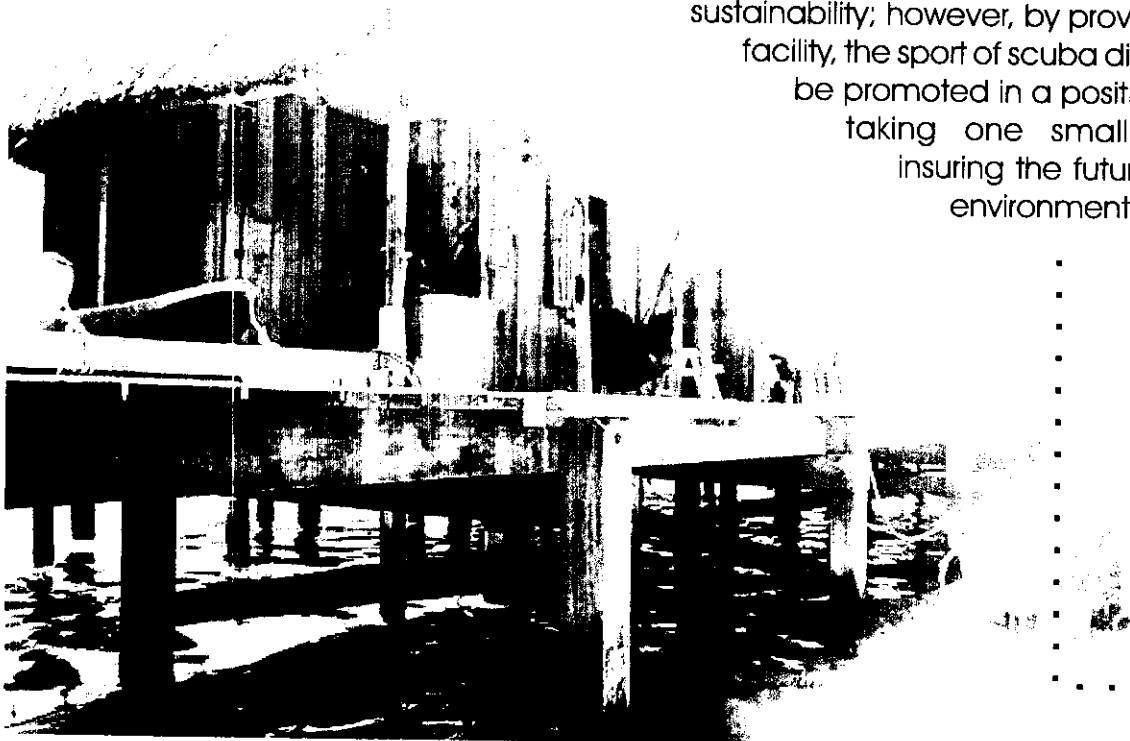
# Issues & positions

On nearly a daily basis, we hear of the destruction and/or depletion of our natural resources as well as our fragile ecosystem. Disturbing information that concerns our rainforest and other such environments have bombarded us, but there is more to the story. These are not the only living environments that are affected by the things we do nearly every day. As an example, our subaquatic ecosystems and the animals that inhabit them are suffering from the damage caused at the surface level. It is easy to understand how and why this takes place . . . We cannot see the damage therefore we do not understand how to correct it. More to the point, the destruction being done to the marine mammal environment is rarely intentional, unlike the malicious deforestation that is taking place in the tropical rainforest. From a practical standpoint, there is little that can be done to prevent these actions from taking place aside from increased education concerning these environments. The types of animals that are affected are diverse but the efforts to save them remain the same regardless of the location. Institutions where these types of activities often take place are called research and rescue foundations. The number of institutions that are taking part in this are growing in number, but suffering financially. It is here that I feel this can become an architectural investigation.



We know that there are many different ways in which to educate someone but in order to fully understand the issues in question one must use more than their visual perception. We read and we learn, that is simple, but can architects make the educational atmosphere more efficient and enjoyable by introducing a higher level of human involvement and visualization of that which cannot easily be seen.

Historically, the design of buildings within the natural setting of the Florida Keys disregards issues that are important to coral reef preservation and responsible diving. But, if the facility is designed with the utmost respect for the surrounding environment, it would be a small sacrifice for the benefit of the entire system. By employing "earth-friendly" design, the facility would have more purpose than providing a place for education, lodging, and tourist activity. Unfortunately, the construction of any type of coastal facility can have negative affects on the local ecological systems, but minimizing their effects is the key. Throughout this architectural investigation, I have made an effort to minimize these effects by using "earth friendly" structural systems and disturbing the existing natural systems as little as possible. These issues of context, structure, and organization will be covered later in this report. It was not my intention during the course of this project to delve in the issues of ecological footprint, and sustainability; however, by providing this type of facility, the sport of scuba diving can and will be promoted in a positive manner, thus taking one small step towards insuring the future of our marine environment.



Architectural form derived from natural forces

# project description

There are coral reefs found in 109 countries across the globe. Unfortunately, 93 of these reefs have either been damaged or destroyed by human activity. At the current rate of destruction, the entire coral reef system will be gone in approximately 20 years. Only 15 percent of the worlds coral reefs are found in the Carribean. South Florida and the Florida Keys is home to the only true coral reef in the continental waters of the United States. This reef is located in water that is between 15 - 30 feet deep and stretches from the shores of Miami to the Dry Tortugas which are 67 miles east of Key West. South Florida is home to several million scuba divers, snorkelers, fisherman, and divers each year. This is an astonishing number considering a distant second is the entire country of Australia, with an area of reef ten times larger.

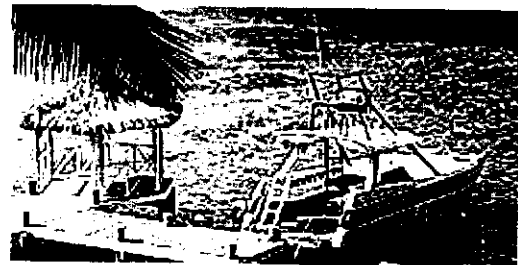
Until now, many scuba training classes and excursions have taken place in makeshift training facilities where the proper amount of instruction, education and hospitality is questionable. The Scuba Divers Resort will be a step in the right direction by providing a facility whose business and success depends on the vitality of the natural reefs. The Scuba Divers Resort will provide a resort like atmosphere for the "amphibious" visitors while providing state of the art instructional and educational facilities. Experienced divers as well as those just beginning their diving experiences will be accommodated in a facility that provides all the amenities of a resort while delivering an in-depth diving education coupled with sensitization to coral reefs. The Scuba Divers Resort will provide a new, unique and exciting venue for the instruction and enjoyment for those who wish to venture below the sea.



Local Dive Boat Fleet



Typical Dive Shop



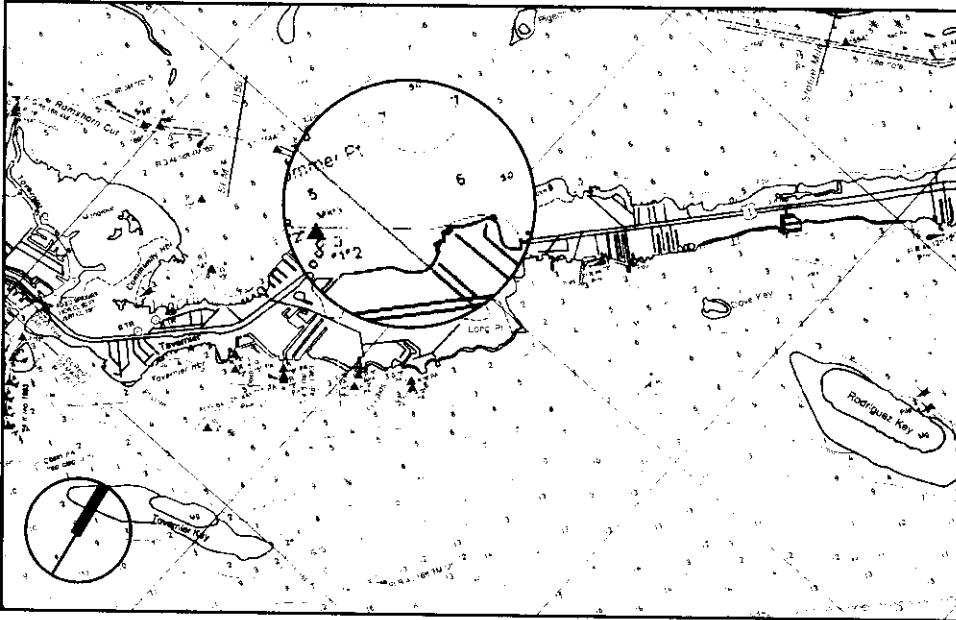
Portion of Water Front Dive Institution

# program summary

Space	Square Footage
<b>Lobby and Reception</b>	<b>1,500</b>
Covered Entry	400
Guest Waiting Area	300
Front Desk	150
Restrooms (2 @ 200)	400
File Storage	100
<b>General Administration</b>	<b>1,300</b>
Office Space (3 @ 120)	360
General Administration	200
Conference Room	200
Employee Lounge	200
Restrooms (2 @ 150)	300
<b>Patron Lodging</b>	<b>9,500</b>
Lodging for 32 (16 @ 500)	8,000
House Keeping Storage (2 @ 100)	200
House Keeping Support (2 @ 150)	300
House Keeping Break Room (2 @ 150)	300
Ice and Vending (2 @ 50)	100
<b>Dive Shop</b>	<b>5,500</b>
Classroom Space (2 @ 500)	1,000
Instruction Pools (2 @ 1,200)	2,400
Locker rooms (2 @ 200)	400
Equipment Storage	200
Equipment Maintenance	150
Tank Filling Stations (4 @ 60)	240
Equipment Storage	200
<b>Restaurant &amp; Lounge</b>	<b>4,200</b>
Waiting Area	200
Kitchen	800
Indoor Seating	1,440
Outdoor Seating	1,000
Mechanical Service Room	200
Restrooms (2 @ 150)	300
<b>Service Spaces</b>	<b>2,500</b>
Mechanical Room	1,200
General Storage	300
Receiving	400
Temporary Storage	200
Loading Dock	100
<b>Net Area</b>	<b>24,500</b>
<b>Net Area x 50 %</b>	<b>Gross Area</b>
	<b>36,700</b>

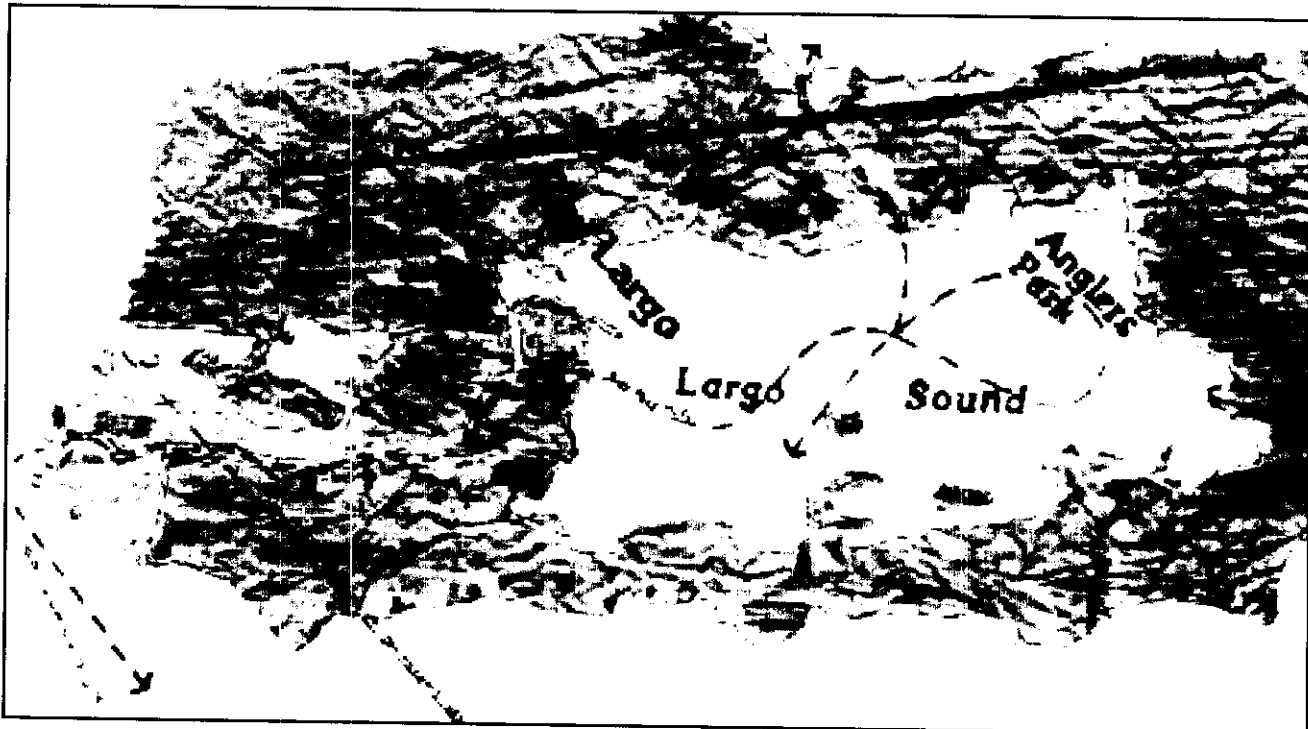
# contextual influences

## south florida bay map



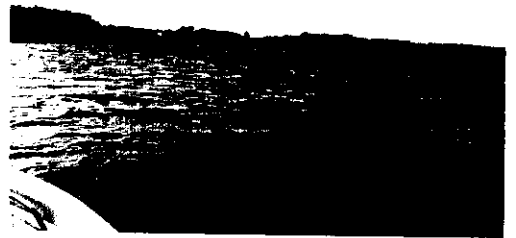
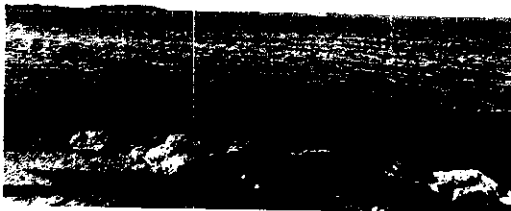
The site is located on the Bayside of Key Largo Florida in the Florida Keys, approximately one and a half hours south of Miami. Contextual elements include US1, the major thoroughfare, known as Overseas Highway, as well as various marinas and tourist venues.

## site analysis, october 2001



# site photos

In October of 2001, I was fortunate to have the opportunity to travel to the site of my thesis project, The Scuba Divers Resort. These photos were taken while on the trip. Unfortunately, the days that I was able to visit the site and take photographs was cut short as a hurricane swept through the area and shut the community down for approximately a week.



Architectural form derived from natural forces

# design objectives

1

To respond to natural forces such as Sun, Wind, and Rain, in a manner that they enhance the experience of those who inhabit the structure.

2

Develop a facility that responds to both the social and physical context in a way that allows the building to fit into the existing island lifestyle.

3

Respect the eco-systems which exist, above and below the water, by providing a structural system that has a minimal ecological foot print upon the site.

4

Respect the eco-systems which exist, above and below the water, by providing a structural system that has a minimal ecological foot print upon the site.



# project research ...

navy pier

Chicago, Ill

atlantis pavilion

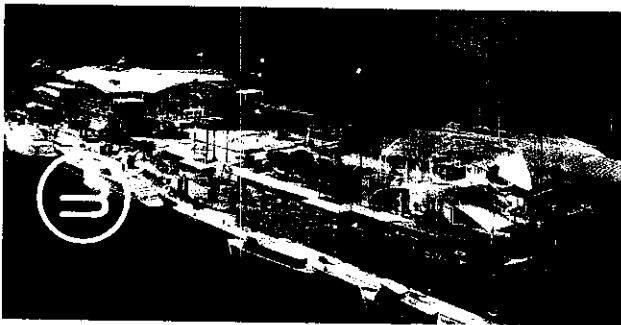
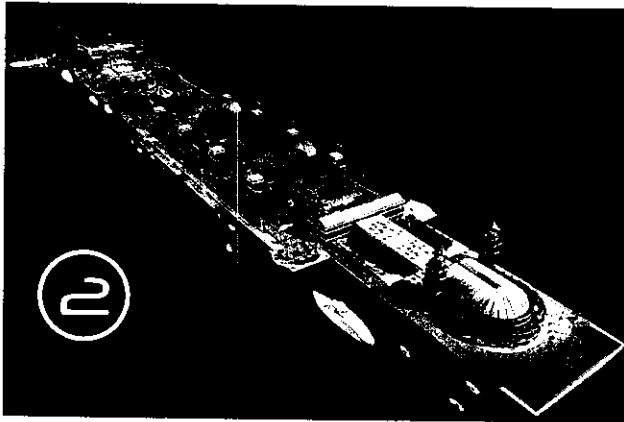
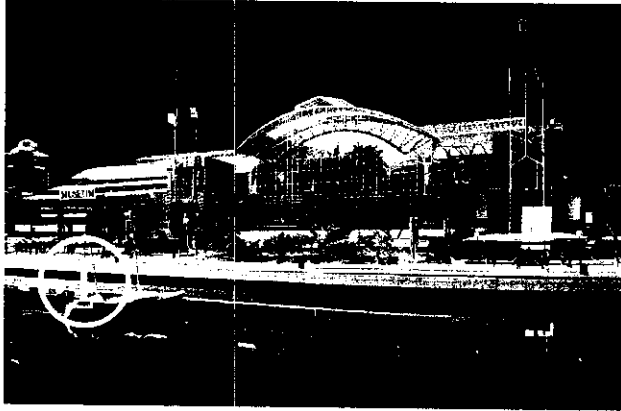
Toronto, Canada

dolphins plus

Key largo, Florida

# precedent studies

## Navy Pier, Chicago Illinois



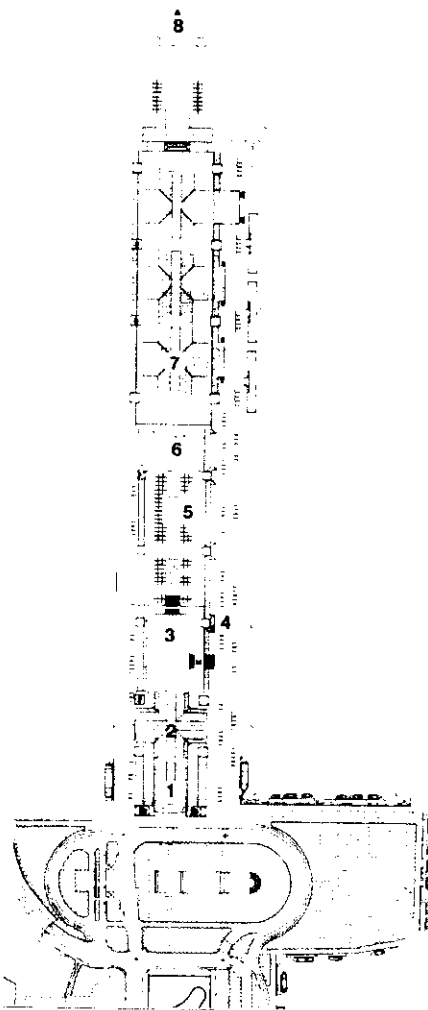
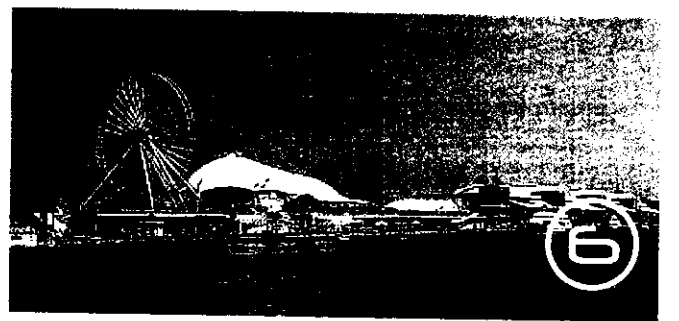
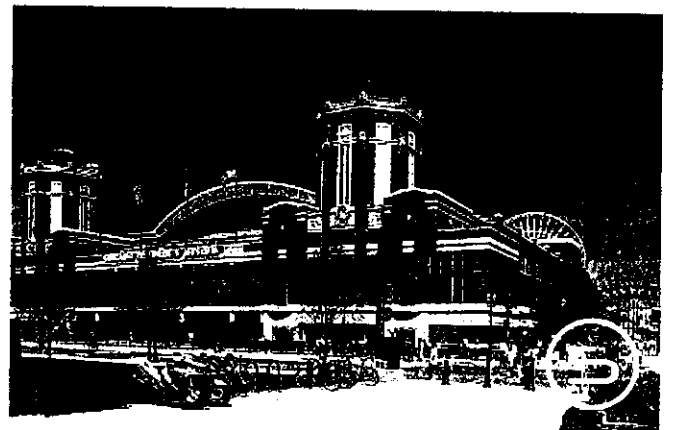
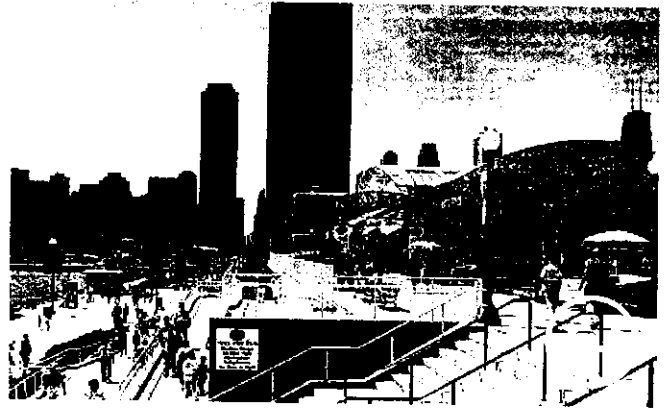
Chicago's, Navy Pier, originally called the Metropolitan Pier, has not always served as the public venue that it is known for today. The pier was originally built for commercial shipping in 1916, then retrofitted for the U.S. Navy during World War II, and abandoned as a port in the 1970's. The pier was constructed as part of Daniel Burnham's master plan for the city. The 400 foot wide pier extends 3,100 feet into Lake Michigan.

I selected Navy Pier as a precedent study early on in the project for several reasons. Navy Pier was a successful project that included several types of functions which, together, created a place for public exhibition, festivals, and a wide variety of markets for the tourists and Chicagoans. Most importantly to my early studies, Navy Pier exhibited the possibilities of constructing a large public venue on a peninsula type setting.

1. Renovated Head House
2. Aerial of Navy Pier
3. Renovated Expo Hall

# site photographs

- 4. arts terrace
- 5. museum
- 6. ferris wheel



site plan

# precedent studies

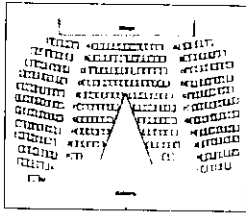
atlantis pavillion, toronto, canada



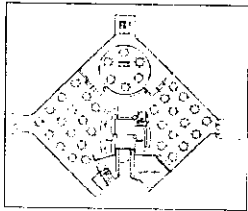
The Atlantis Pavilion is located in Toronto, Canada. Atlantis Pavilion is an integral part of Ontario Place, a public waterfront venue. The Atlantis Pavilion is a spectacular complex that provides wonderful views of the Toronto skyline and a variety of different venues including a nightclub, restaurants, rooftop patios, and theatrical events.

Originally, the Atlantis Pavilion was of interest because of the unique methods of water front construction. There are three "pavilions" that are completely surrounded by water. Each pavilion is linked to the adjacent pavilion by a series of skywalks. Upon further investigation, the Atlantis Pavilion became a source of inspiration for the interior design of the Scuba Divers Resort.

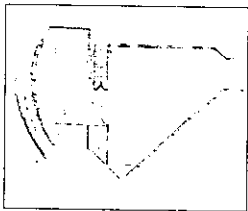
# site photographs



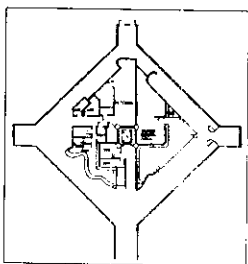
atlantis auditorium



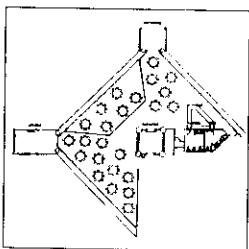
deluge restaurant



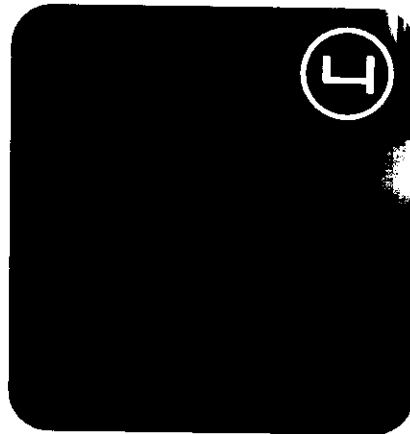
deluge mezzanine



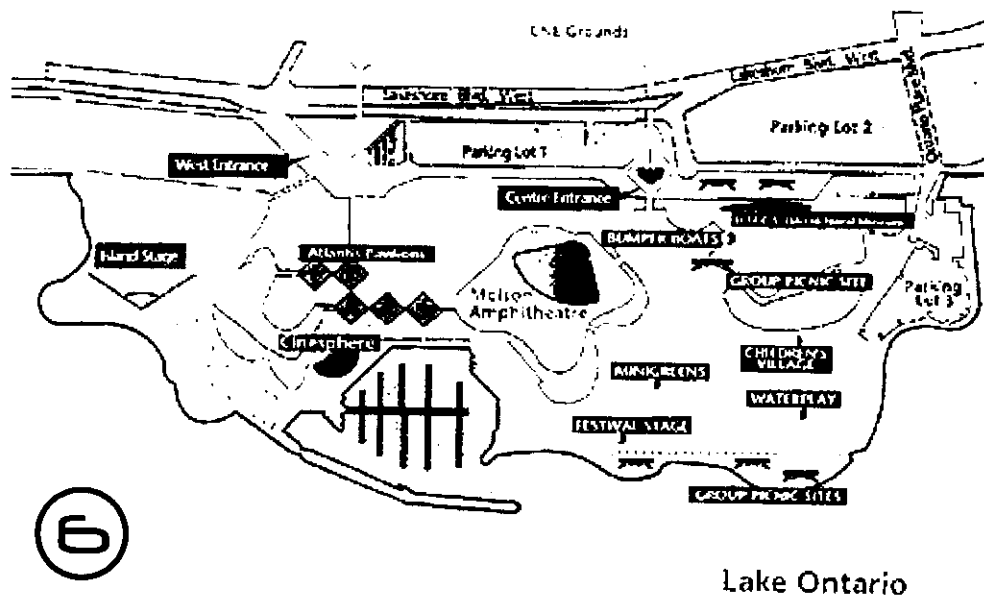
nemo's restaurant



atlantis room



1. atlantis pavilion
2. atlantis nightclub
3. zoots bar & grille
4. atlantis auditorium
5. nemo's restaurant
6. ontario place



Lake Ontario

Architectural form derived from natural forces

hamlin

# precedent studies . . . .

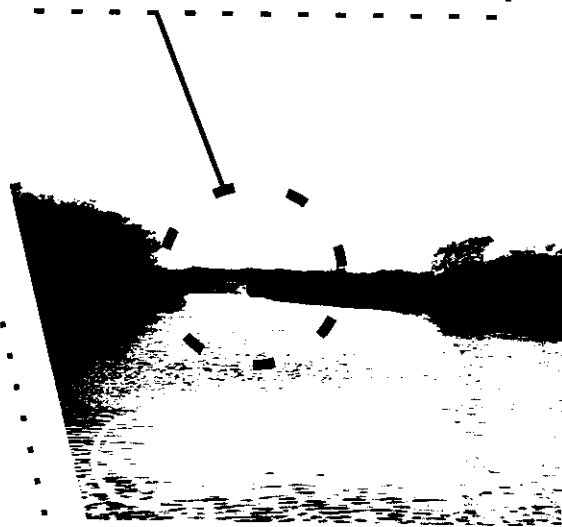
dolphins plus, key largo, florida

Dolphins Plus is an education and research facility located in Key Largo, Florida. Dolphins Plus houses 10 Atlantic Bottlenose Dolphins and 2 California Sea Lions. The focus of Dolphins Plus is to educate the public about dolphin, and their coral reef environment while giving them the opportunity to join their world. While at Dolphins Plus, swimmers can go in the water and interact with the dolphins "up close and personal." Dolphins Plus is at the forefront of dolphin assisted therapy, which is ran by Island Dolphin Care, and an active member of the Southeast Marine Mammal Stranding Network.

Dolphins Plus was selected as a precedent study for a number of reasons. Primarily, the facility is located near the proposed site for the Scuba Divers Facility. I had the opportunity to visit the facility and speak one on one with the trainers and educators that work with the people and animals. My visit to Dolphins Plus was cut short by an approaching hurricane, but while there I was able to gain valuable insight to the culture and concerns of the locals and their environment.



Dolphins Plus is located just a short walk from the proposed Scuba Divers Resort. I believe that a joint effort between each facility would help each to reach their goals.



■ ■ ■ ■ ■  
1. canal used for natural water circulation

■ 2. samantha (a dolphin at the facility)

■ 3. outdoor teaching facilities

■ 4. facility approach from gulf of mexico

■ 5. visitor interaction / education

■ 6. facility dolphin trainer

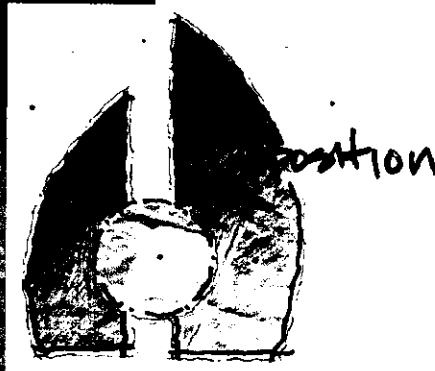
# site photographs



Architectural form derived from natural forces

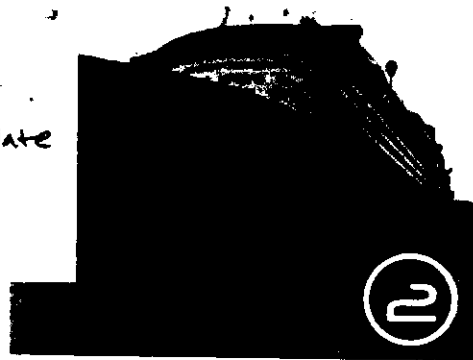
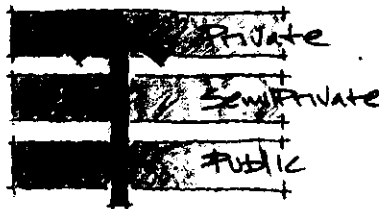
# concepts and sketches

conceptual imagery



The conceptual image of the sailing ship, provided me with a design inspiration that appeared in the building in several forms. These forms include the wind catching sails along the public level, as well as the organization of the complex.

Vertical zoning was an important concept during the projects development. The resort is divided into three levels including the public, semi-private, and private, much like that of a cruise ship.



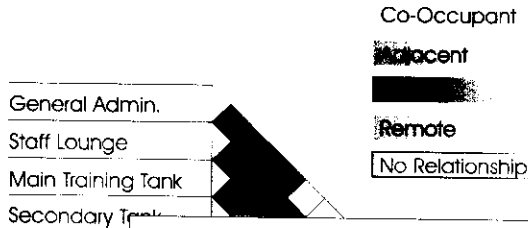
The idea of the facility bridging the land and sea was important to the organization and the appeal of the building. This idea was investigated through shipwreck imagery and became a dominating concept.



# space relationships

Research Station

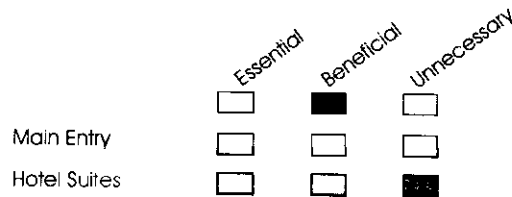
**Interrelationship Matrix**  
Chad Hamlin . Architectural Thesis Proposal . Fall 2001



These relationship matrices were used early in the project development stage in order to understand the complex spaces and how they should interact. This method of organization proved to be a valuable design tool.

Underwater Views

**Interrelationship Matrix**  
Chad Hamlin . Architectural Thesis Proposal . Fall 2001



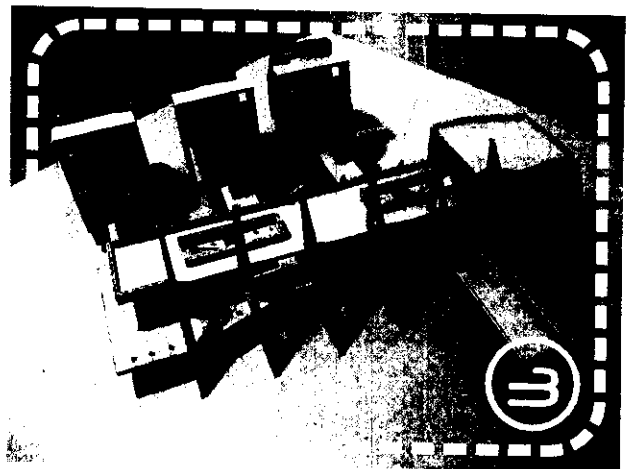
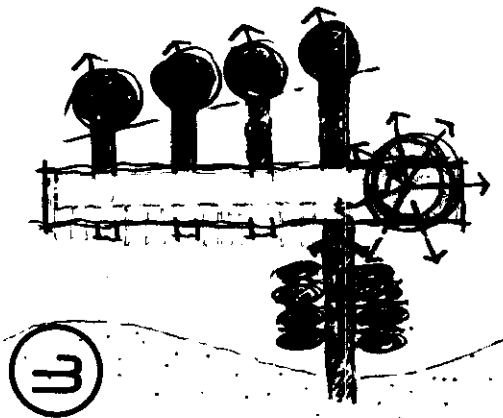
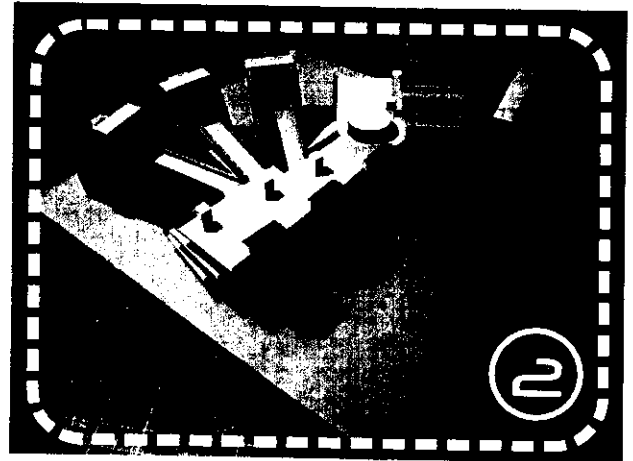
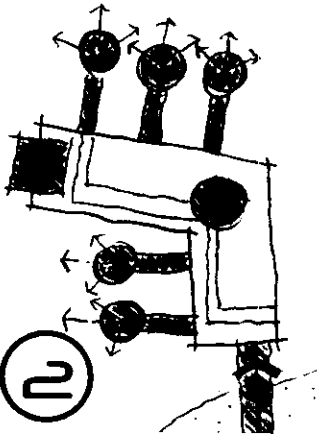
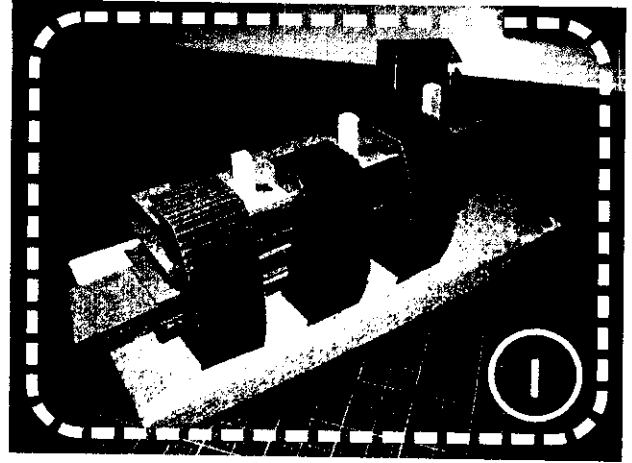
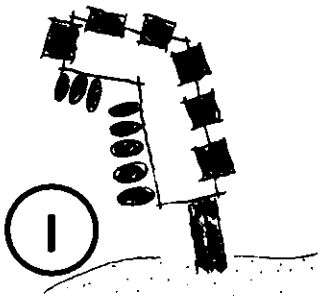
View Connections

**Interrelationship Matrix**  
Chad Hamlin . Architectural Thesis Proposal . Fall 2001



# process models

Throughout the course of the project, I worked out several solutions that dealt with the buildings relationship to the nearby shore. Scenarios that involved the entire building being sea-based as well as land-based were investigated. In the end, a scenario that bridged land and sea proved to be the appropriate solution.



# Development ...



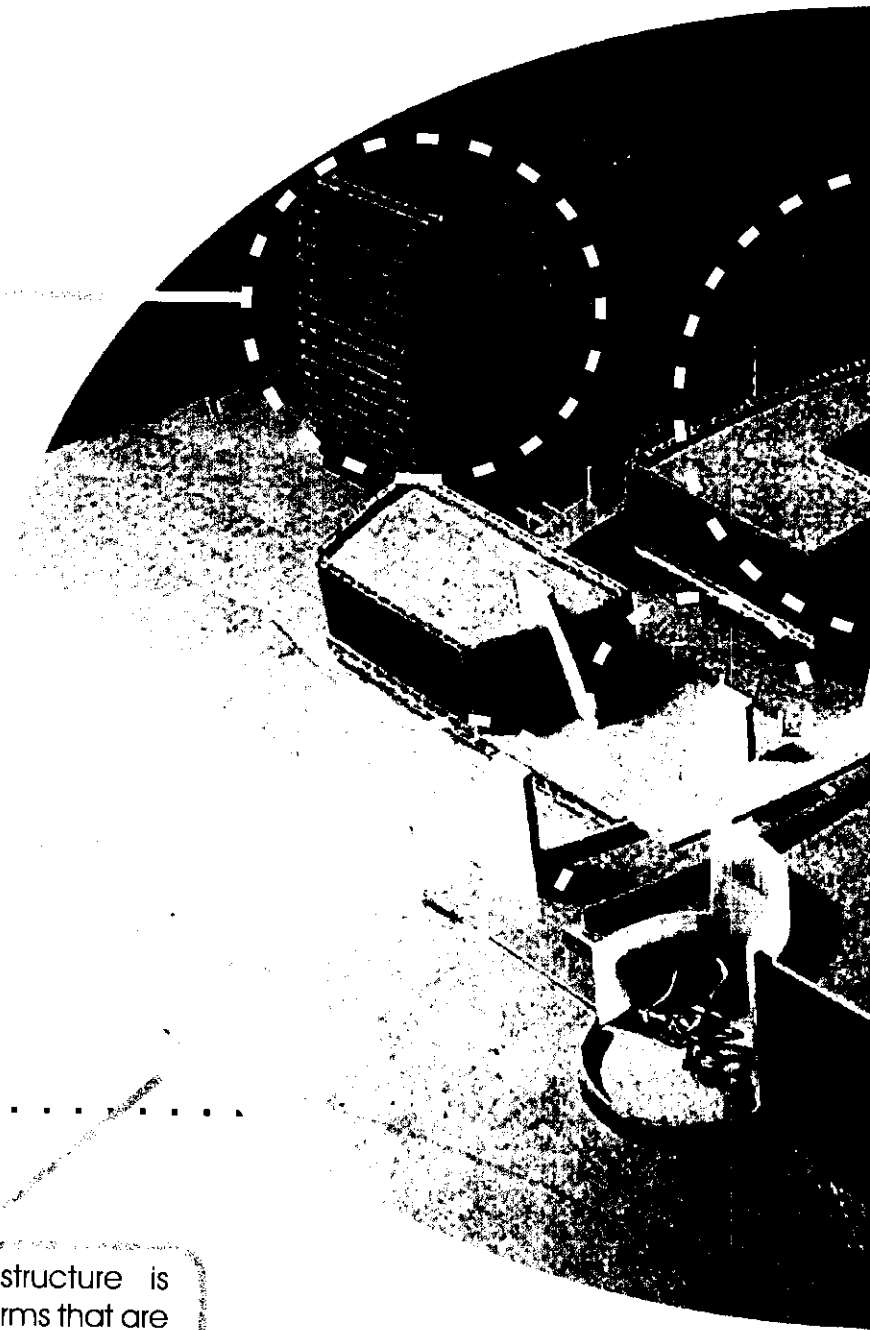
mid-thesis review  
february 11, 2002

design drawings  
march 27, 2002

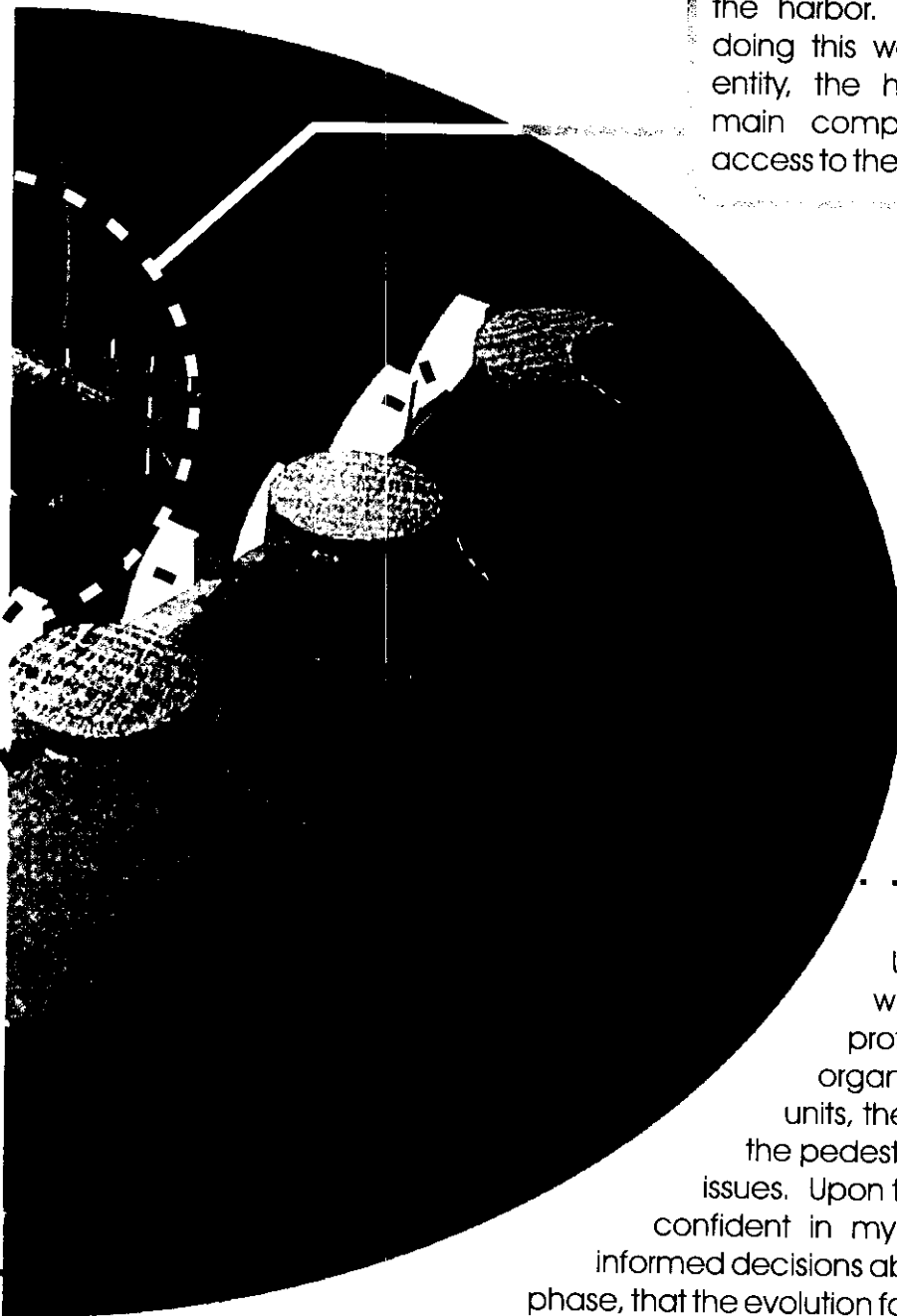
model images  
march 127, 2002

# mid-thesis review

Throughout the course of the semester, the issue of housing was a constant debate. For the mid-thesis review, I investigated a scheme where the housing units were isolated on the west side of the facility. A benefit of this scheme, was that the housing units were able to use wind forces to aide in natural ventilation on an individual basis.



A portion of the buildings structure is expressed by the large sail like forms that are located along the west side of the facility. At the time of the mid-thesis review, these were purely structure and static.



It was in this scheme that the diving institute was pulled apart from the main facility and placed into the center of the harbor. The reason for doing this was so that each entity, the housing and the main complex, had equal access to the diving institute.

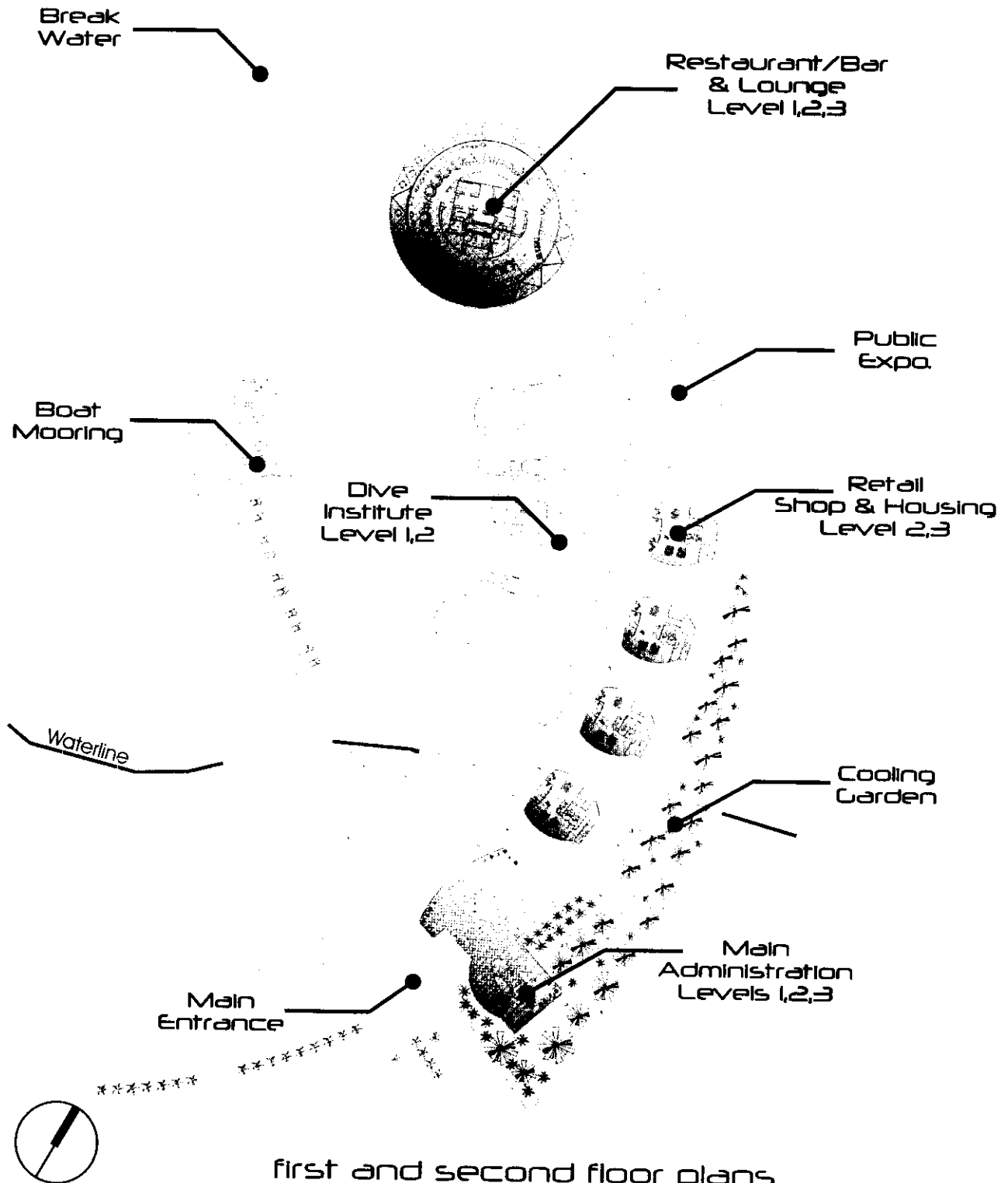
The wooden dowels in this model are representational of the scuba diving tanks that would be located in the mid section of the main facility. By doing this, the dive tanks would be highly visible to the visitors and add to the character of the facility. A major drawback to this location is the difficult access that it provides from the housing and the divers institute.

Until the mid-thesis reviews, I was struggling with a number of decisions that had quite a profound impact on the buildings' form and its' organization. The location and number of housing units, the placement and size of the dive tanks, and the pedestrian circulation were all included in this list of issues. Upon the completion of this round of reviews, I was confident in my conceptual ideas and began to make informed decisions about the key issues noted above. It was at this phase, that the evolution for the final design began to unfold.

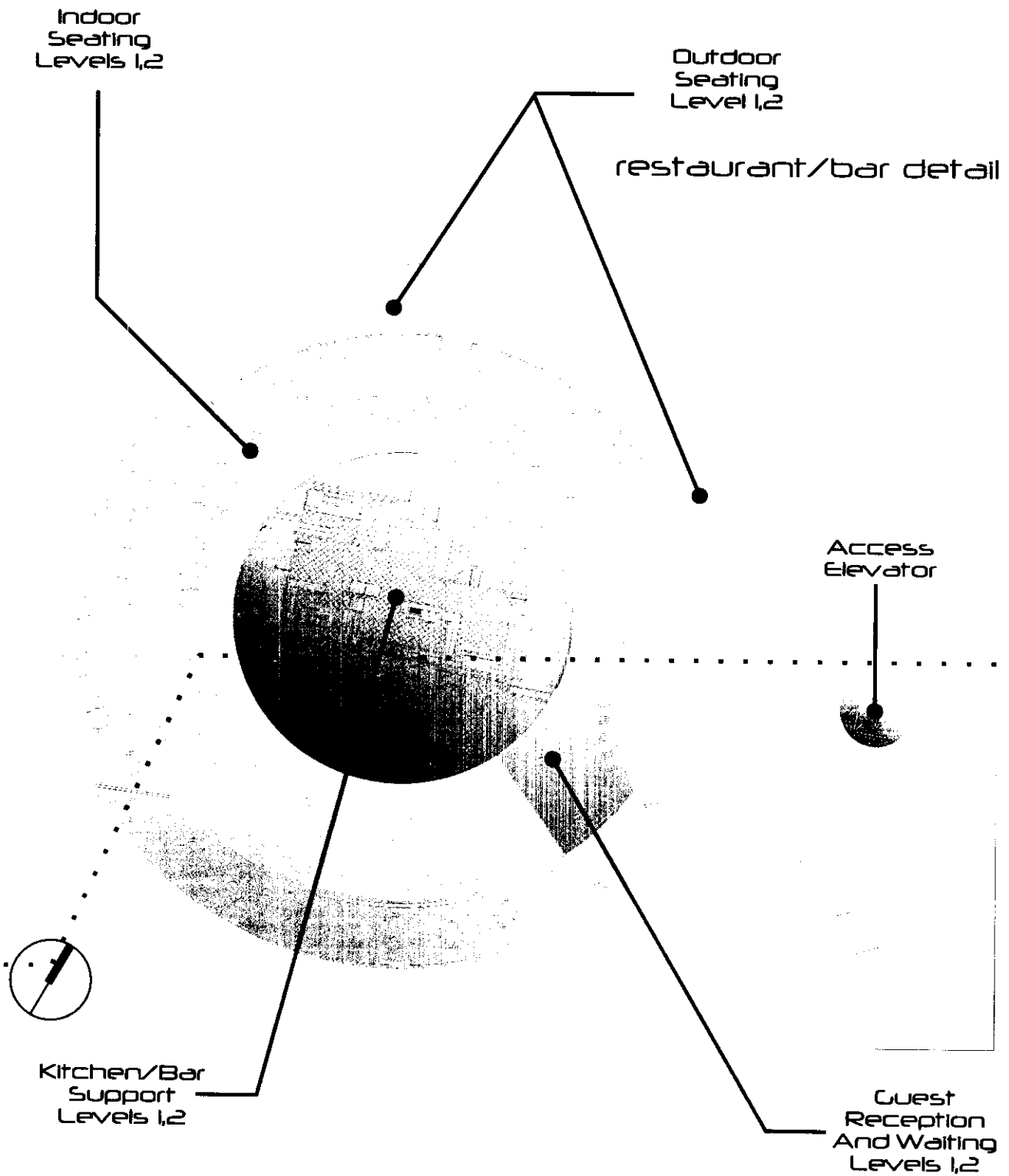
Soon after this review, the decision was made to incorporate the housing units into the main body of the complex. Quite a bit of study and exploration was needed in order to find out the most optimal way of organizing the diving institute and relocating the dive tanks. The drawings and diagrams that follow represent the evolution that took place and the ways in which I chose to solve the problems.

# design drawings

March 27, 2002



continued ...

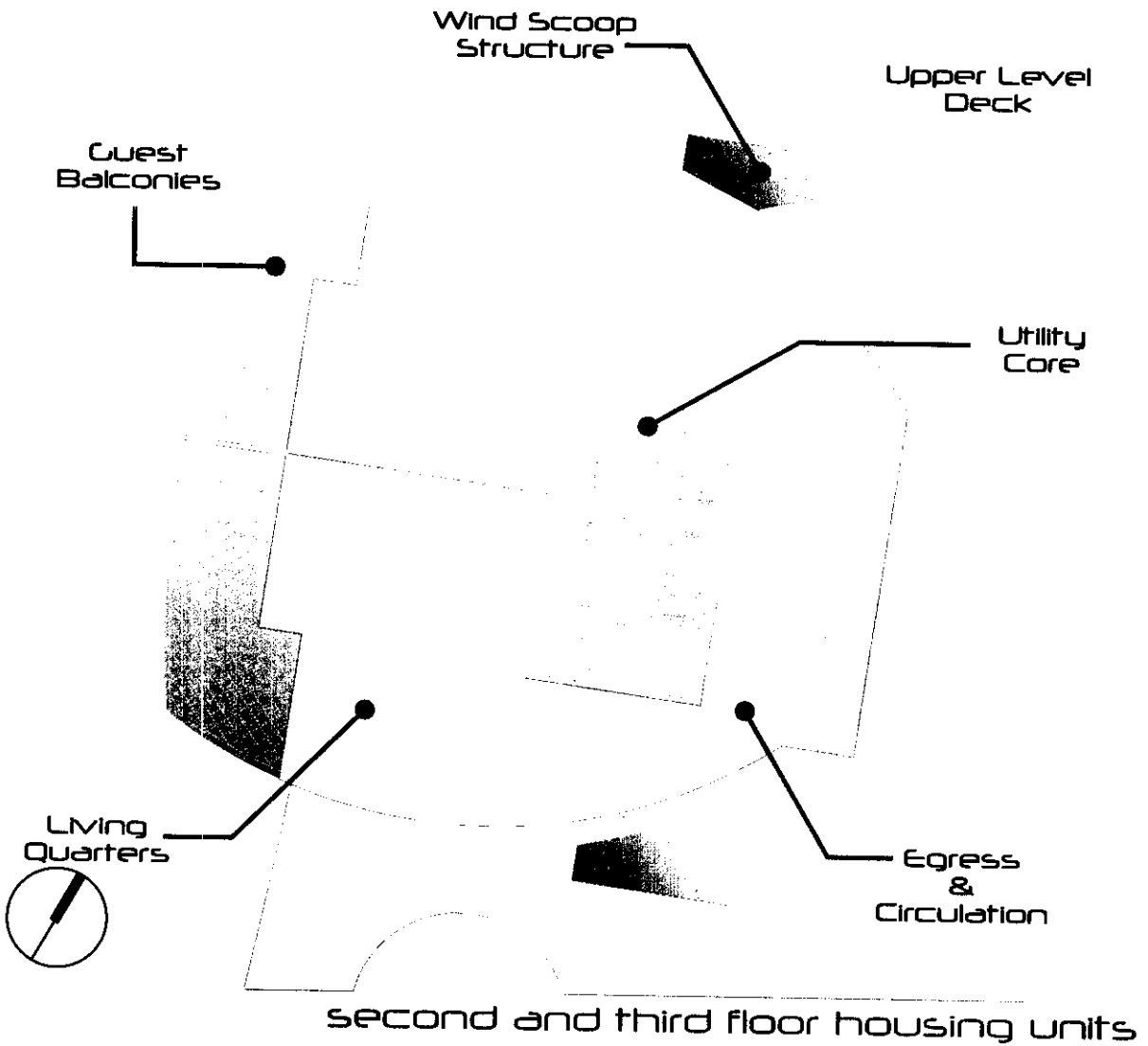


Architectural form derived from natural forces

hamlin

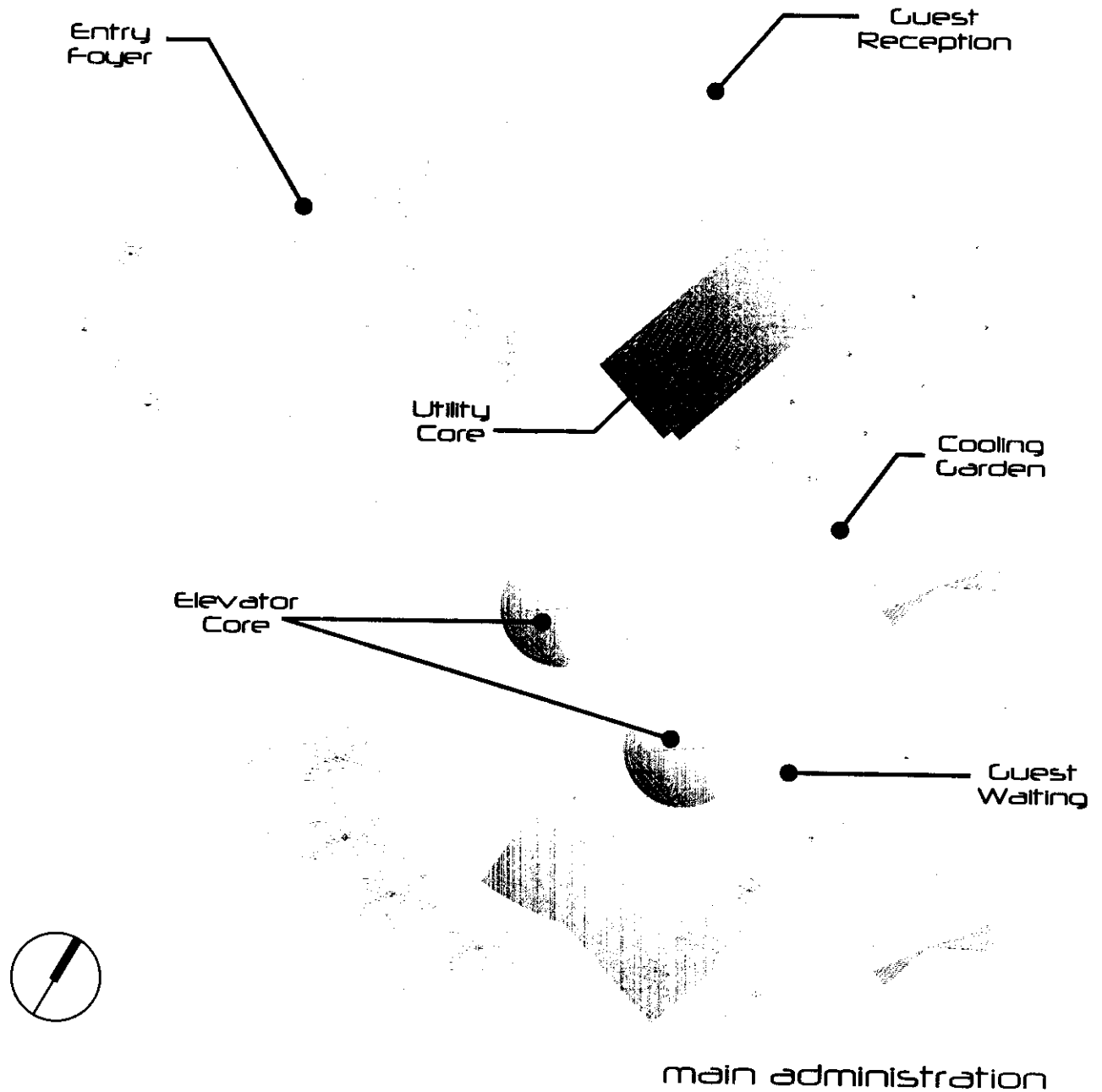
# design drawings

March 27, 2002





continued ...

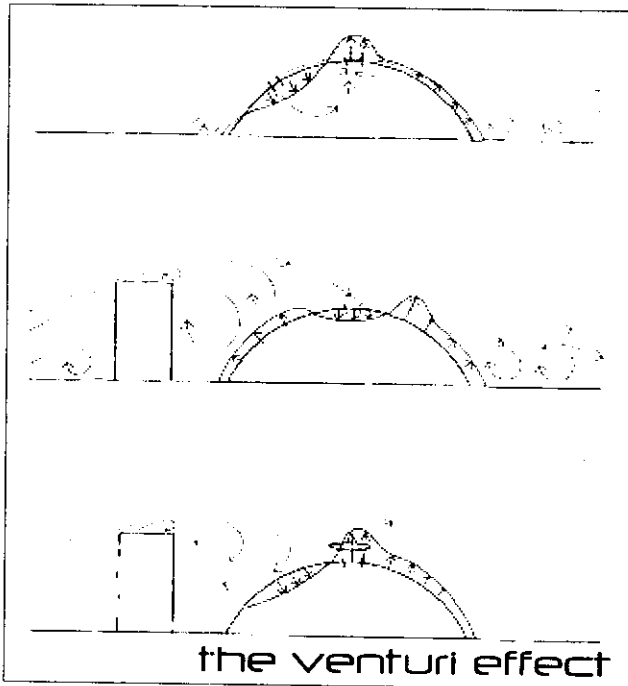


Architectural form derived from natural forces

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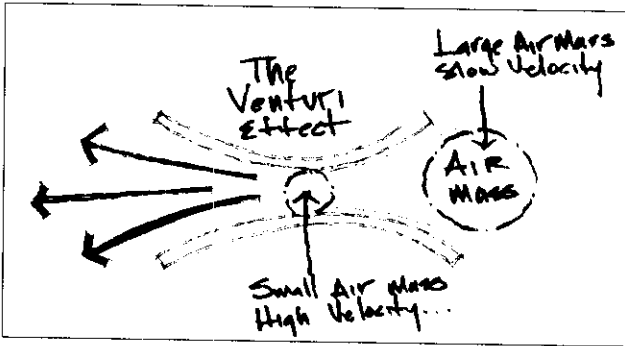
# design drawings

March 27, 2002



There are several areas of the project that the "Venturi Effect", a method of aiding natural ventilation, was used. The Venturi Effect can be based on a model of an airplane hanger shown at the left. The Accelerated wind flow across the semi-curved roof form results in a well-defined negative pressure at the roof ridge. With a slightly positive pressure and a slightly negative pressure, a driving force is created and aids in cross ventilation. This can be used to assist in the stack effect.

This is the idea in two different areas of the building. First, in the plan of the housing units. The curved form is utilized so that wind forces are accelerated throughout the facility and aid in creating comforting breezes. Second, in the section of the housing/retail units, a wind scoop is formed that accelerates wind speeds over the building envelope and creates suction which will draw the warm, humid air out of the occupied spaces.

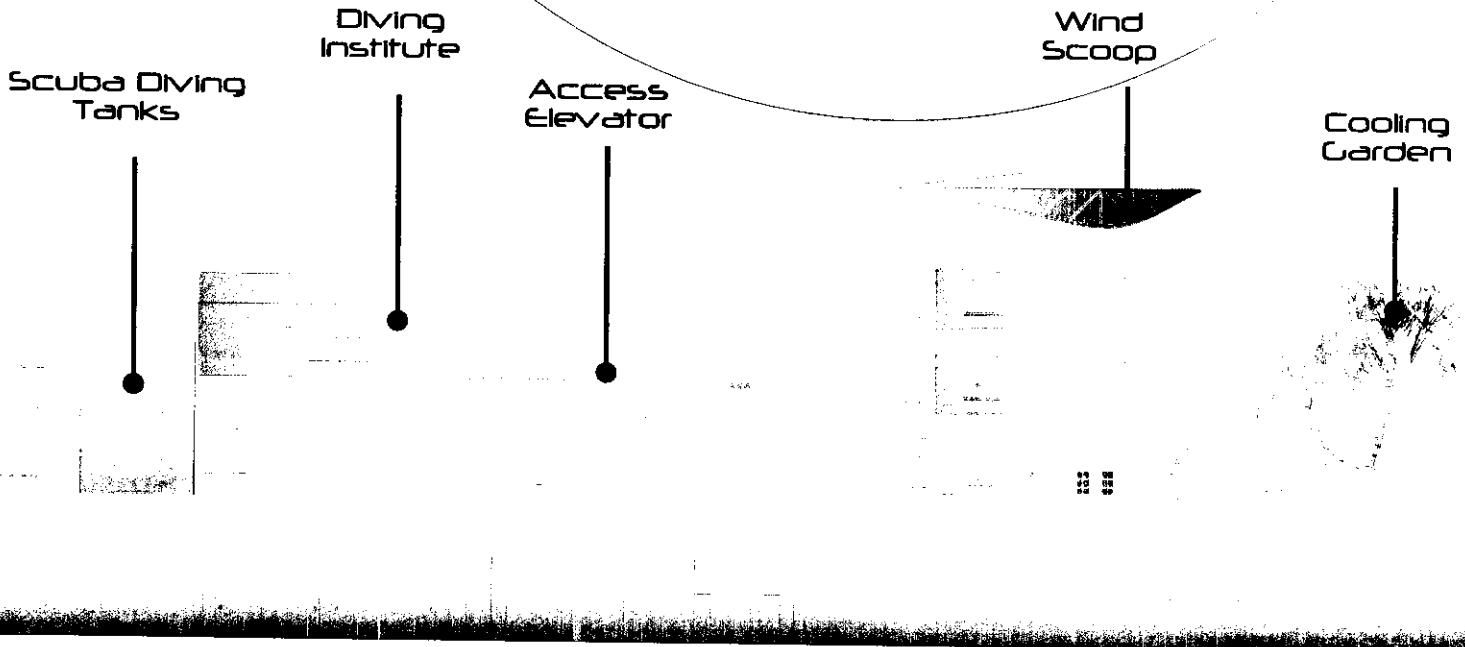
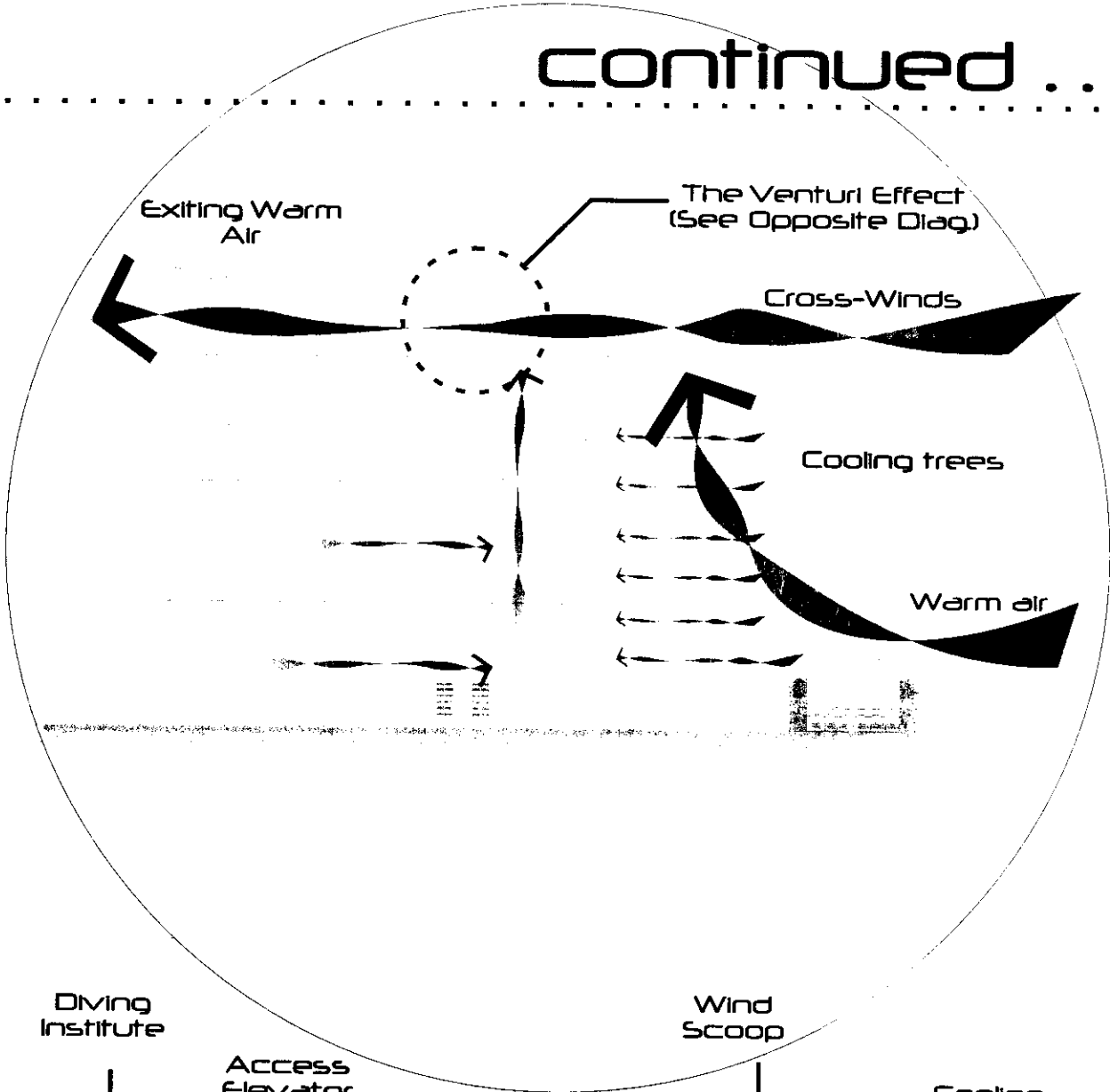


Break Water

Harbor Entry Marker

Restaurant Bar/Lounge

continued ...



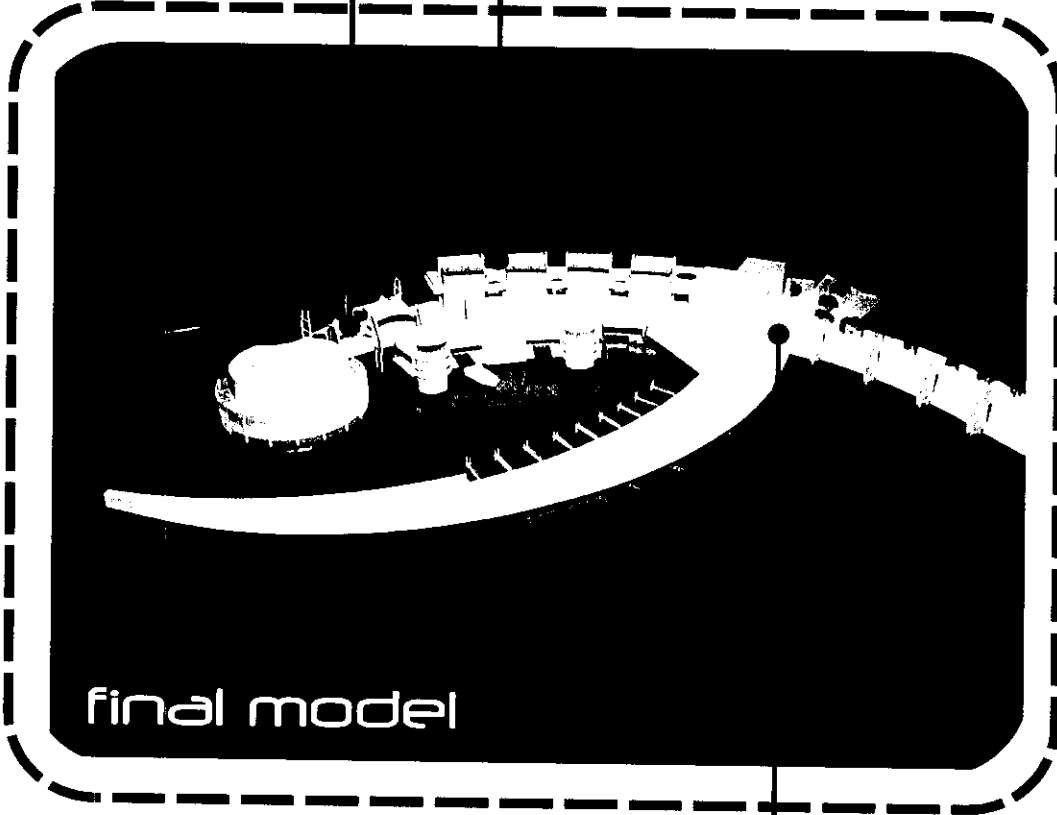
East/West Building Section

Architectural form derived from natural forces

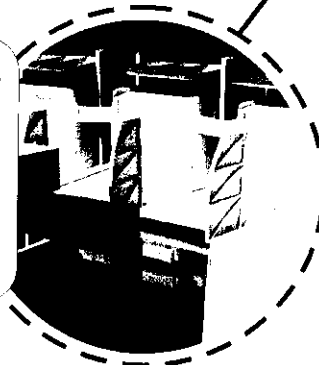
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# model images

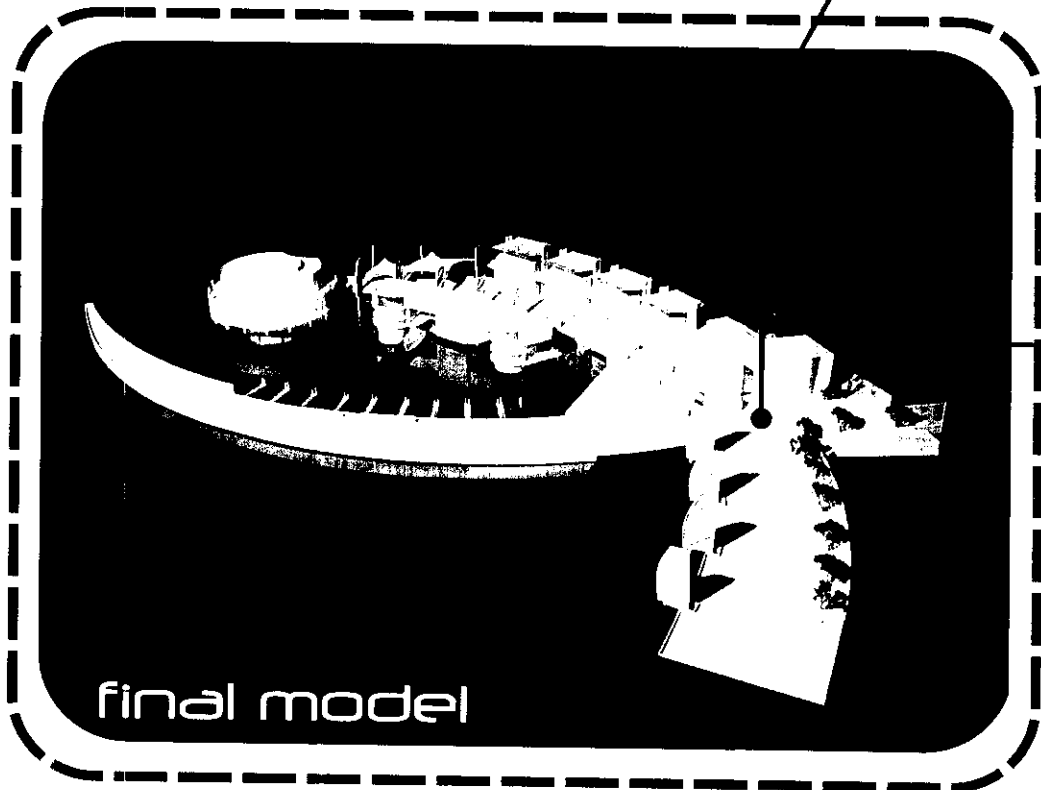
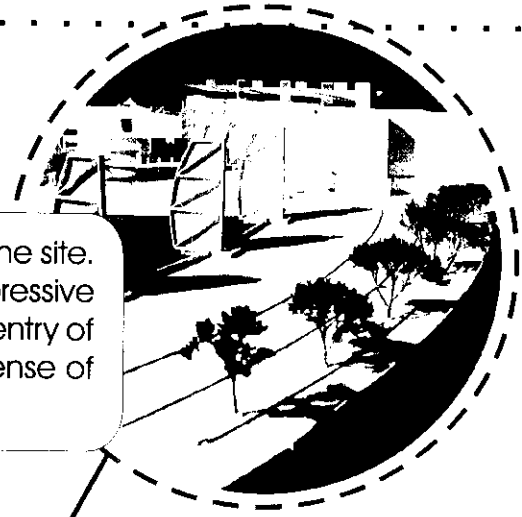
March 27, 2002



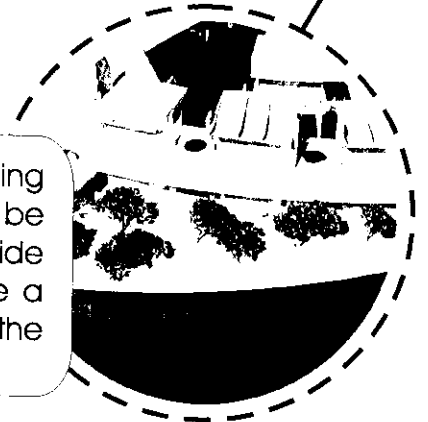
The portion of the elevation pictured in this image is the retail and housing units. The retail portion is located on the ground floor, and the housing units are located on the second and third floor. The units benefit, in plan, from the venturi effect which aids in natural ventilation.



As a guest, you would enter from the South West side of the site. When approaching the building, a first glimpse of the expressive structure is possible and begins to lead you to the main entry of the building. The Expressive structure also provides a sense of division from the pedestrian traffic to the vehicular traffic.



This is an aerial image of the cooling gardens. The cooling gardens are used to filter the incoming air so that it may be cooled enough to use in the stack ventilation system. Aside from the functional purpose, the cooling gardens provide a nice place for relaxation, reflection, and conversation for the guest's.



# reflection

April 19, 2002

As a student of architecture, I have become more and more interested in how a building can and should fit into the natural context. This thesis provided a chance for me to explore a new building type within a context that must respond to the context and the natural forces around it. The method of design allowed me to examine the various forces in nature and allow for them to become an influential design feature in my architecture.

As I moved forward with this project, I learned that there was more to take away from the thesis experience rather than a nice project and detailed drawings. Throughout my five years at Ball State, I have been taught that the concept or "big idea" is important to the development of a design. This was impressed even further during the course of my thesis development. As a final thought, I have learned that the presence of a "big idea" and a sound direction are not only important, but essential to the development and success of a project. I feel as if these lessons learned can and will assist me as I continue to develop my skills as a architectural designer.

# suggested readings

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## Websites

[Http://www.dolphinsplus.com](http://www.dolphinsplus.com)

Special thanks to the staff at Dolphins Plus, located in Key Largo Florida, for their interviews and on-site tours.

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