Great Lakes Aquatic Research Center

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The Great Lakes Aquatic Research Center combines a research institution, a graduate school and a public exhibition facility into a single project. The research center deals mainly with freshwater studies of the Great Lakes as well as smaller bodies of water located in the area. The graduate school is connected with the University of Wisconsin, Milwaukee, and is based on the premise that students assist in experimentation, becoming almost a part of the research staff. The public exhibit area supports the research center by informing the public about activities taking place. The total square footage of the project is approximately 80,000 square feet and is located along the shore of Lake Michigan in downtown Milwaukee.

The following is an overview of the nine months which were spent designing the project. These nine months were spent dealing with the selection of the site, programming, site analysis, a building type study, conceptual design and design development.
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As the useable land area of the world continues to shrink, human attention is turning more and more to the sea and its inhabitants. The aquatic world forms a large portion of the entire ecosystem of the Earth, so aquatic research offers a wide ranging view of life on our planet and the conditions that make life possible. Any changes in the marine environment could have far reaching and disastrous results for all of us. Perhaps this explains the increasing interest by legislators, researchers, students and the general public in the Earth's aquatic systems.

Many people feel that the oceans are a "panacea capable of solving all of our present and future problems". One example which supports this idea and is worthy of mention is the biomedical interest in natural products research using marine organisms. These organisms may provide the key for unraveling a number of perplexing clinical problems which have not been solved by the traditional approach of using warm-blooded vertebrates as experimental material. The ever increasing range of discoveries to be made through the field of aquatic study will require an increase in the number of modern and well designed facilities available for this type of research. Not only are research laboratories needed, but training facilities for future scientists and technicians and public information centers which will educate the public as to the exciting occurrences in the field, as well.
The Great Lakes Aquatic Research Center will provide facilities in 3 areas:

1. Research laboratories which will accommodate work being done in a variety of fields related to aquatic study.

2. A learning facility devoted to graduate training in various fields of aquatic science as well as a facility which can be made available to undergraduates who would utilize it for special programs and seminars.

3. A public viewing aquarium; a display area for the purpose of informing the public about activities taking place at the center and serving as an educational tool for greater public awareness and understanding of the Lake and its environment.

The Great Lakes Aquatic Research Center will be located in Milwaukee, Wisconsin and will function as a research and learning center for graduate students and faculty from the University of Wisconsin - Milwaukee.
The choice of the Great Lakes as the area for GLARC research development and the choice of Milwaukee as a home port stems from several major factors. First, the shorelines of Lakes Michigan and Superior form forty percent of Wisconsin's boundaries and more than one-third of the state's population lives along the waterfront. Subject to a variety of uses and misuses, the waters and the shores of the Great Lakes constitute a precious resource for the Lake States as well as the two nations which share them. The Lakes are also objects of great scientific interest in themselves and are a rich training ground and research field for natural and social scientists, environmental engineers and planners. A university located in a major port city and with water-related curricula and research programs naturally strives to exploit unique capabilities and facilities for teaching and research connected with the Great Lakes. Milwaukee Harbor is relatively ice-free in winter so that vessels can work most of the year. It is also the regular year-round terminus of two cross-lake railroad ferry routes. These ferries are of invaluable service as research vessels and provide unique opportunities for winter research as do Coast Guard ice-breakers also based in Milwaukee.

The site is in Juneau Park, a lakeside park adjacent to downtown Milwaukee. Juneau Park is bounded on the west by Prospect Avenue, and on the east by Lake Michigan and is divided in half by Lincoln Memorial Drive. The GLARC site is located on land east of Lincoln Memorial Drive. This piece of land did not exist until 1893 when the city of Milwaukee filled a 300-foot wide strip along the shore line. Subsequent Wisconsin law allowed extension of the fill 1500 feet into the lake. The site is approximately 1,120,000 square feet in area and is bounded on the north by McKinley Marina, on the east by Lake Michigan, on the south by the site of the Milwaukee Art Center and War Memorial, and on the west by a manmade lagoon.

The site is a very slightly sloping piece of land. Vegetation consists of a scattering of small saplings, none more than 20' high. At the present time the site can be reached by a gravel road which is shared by the Yacht Club and a small gravel parking lot is located adjacent to the south end of the marina harbor.

Presently the portion of the park on which the GLARC site is located is of little use to city inhabitants. A few picnic tables are located around the lagoon and under a lakeside shelter, but these are the only added amenities on the site. None of the trees are large enough to provide any protection and will take several years to reach
a useful size. A wide gravel walk runs along side the lake and various activities take place here, such as fishing, walking, jogging, and bench sitting. These are virtually the only activities taking place on the site itself.

It is intended that the Great Lakes Research Center serve as a "shot in the arm" to this portion of the park. The public portion of the center will allow people to actively participate in gaining knowledge about the lake as opposed to simply observing it. The center should also serve to draw the public to the park and to act as a link with the nearby Art Center. With the addition of new park land on the west side of the lagoon (see proposed highway plan) any park lost to laboratory space or parking would be retained. Thus the center would help to draw the public to the unused portion of the park, would relate the activities of the Milwaukee Art Center to activities going on in Juneau Park and the landscape design for GLARC would encompass the entire eastern portion of the park bringing it to a level of beauty and usefulness far exceeding its present state.
Planning by Related Organizations

At present Milwaukee has no official park plan for Juneau Park; however, the new lake freeway of Milwaukee was approved as part of the General Plan of Freeways for Milwaukee County in May, 1963. A portion of the freeway is proposed to be located along the foot of Juneau Park Bluff in downtown Milwaukee. A plan has been formed which would involve the creation of a sloping land form over the freeway, extending from the upper level of Juneau Park to the new Marina landfill creating a space approximately 900 feet long. This would permit easy pedestrian access from the upper park to the lakefront level, unimpeded by any roadway. The land form is shaped to compliment and blend with the War Memorial development and Marina landfill. Seven acres of useable park space would be created - 4 acres in the area of the steeply sloped bluff which is unusable as active park space. This new concept would change a portion of relocated Lincoln Memorial Drive causing it to pass through the tunnel adjacent to the freeway and then swing eastward across the lagoon on a new structure.
If the freeway relocation were to take place, the new piece of land which would be added to the park would create a strengthening link between the downtown and lakeshore pieces of Juneau Park. People would have direct access to the lakeshore park rather than to have to go around the war memorial in order to enter the park as they must do now.

The Milwaukee Art Center and War Memorial presently uses the surrounding grounds for summer art festivals. A good possibility exists for combining this activity with outdoor displays and activities sponsored by GLARC and Regattas which are staged by the Milwaukee Yacht Club. The only planned activity which really takes place in the park itself is the use of the park as an observation area for the 4th of July fireworks display. There is no reason why GLARC would interfere with this activity; in fact it could serve to enhance the activities of the day.
Similar Projects

There have been very few projects similar to GLARC on which to base a similar project study. The field of marine biology, though not a new field, has only recently developed a good deal of importance in the scientific community and has expanded to envelop a number of relatively new areas of study such as coastal zone management and bio-medical studies. One example which combines an aquatic research laboratory and a public aquarium or display area is the Seattle Public Viewing and Research Aquarium in Seattle, Washington, but few others have developed facilities which actually place emphasis on the research portion rather than to the public part of the facility.

Similar projects study must then be divided into aquarium projects and laboratory projects. The International Ocean Exposition in Okinawa, Japan is an excellent public space which deals with all facets of ocean activity and incorporates an interesting relationship between land and sea based structures. The Boston Aquarium by Roche and Dinkeloo was also studied for it incorporates some very exciting environments which encourage involvement between the public and aquarium life. Laboratory projects which were studied include the Atlantic Environmental Research Laboratories for NOAA near Biscayne Bay, Florida; The Welcome Marine Laboratory at Leeds University in England; The Richard Medical Research Building in Philadelphia by Lou Kahn; and a complex of biology laboratories for Haileybury College in Hertfordshire.
Research Organization
General Objectives

The Great Lakes Aquatic Research Center has set up the following general objectives for the work which will take place under its jurisdiction:

1. Deeper understanding of how the Great Lakes, their drainage basins and coastal zones function as natural systems---physical, chemical and biological.

2. Improved prediction of man's influences on natural systems.

3. An understanding and emphasis to be placed on the interdependence of biological, chemical, geological, geophysical and the physical processes of the Great Lakes and the ocean world as well.

4. Advancement in understanding of the impacts of technological, economic and social trends in the Great Lakes region.

5. The furthering of regional and national aquatic endeavors.

6. The furthering of education of the general public in the area of aquatic research.

7. Training of scientists and environmental engineers.
Areas of Research

Principal areas of research will be in the fields of biology, marine chemistry, geology, geophysics, marine ecology, hydrobiology, limnology, coastal zone management and lake hydrodynamics.

Scientists in the biology department study fish ecology, behavior, growth, longevity, nutrition, poisons and the effect of antibiotics on freshwater organisms. Also under study are the effect of pollutants on aquatic life.

Marine chemists study the composition of lake water, how and why it varies from place to place and how it is affected by natural and human phenomena.

Dynamic responses of lake waters to influences of sun, wind, and Earth rotation are of great importance to the controlling of transport and dispersal of wastes and other materials which set the stage for biological production.

Broad regional geophysical investigations need to be made on the Lakes using gravity, magnetic and seismic methods to determine structure of sediments and bedrock and for shore erosion studies.

Coastal processes are concentrated upon and experimental findings will be applied to various planning projects. Individuals in fields such as anthropology, architecture, urban/regional planning, economics and law may participate.
Organization and Growth

The organizational attitude regarding personnel is informal and highly unstructured. The research staff is not ranked nor is there a need for physical barriers in the building between administrative staff and research staff or research staff and the technical staff. It is intended that all participants in the facility shall have a comfortably adequate amount of space with no extra amenities accorded to rank. No research activity shall be given a higher priority than any other, nor shall any administrative activities receive a higher level of interest.

User/personnel categories are as follows:

Administrative – directors and managers, secretaries, receptionists

Research – scientific and technical staff including librarians and exhibition designers

Education – graduate students

Support – vessel operators, office staff, maintenance staff, fisheries technicians, draftspersons and cartographers

The staff of GLARC will undergo a constant growth and shrinkage depending on the various projects which will be undertaken. The periods of highest staff population will be in the summer; however, the majority of employees hired during this period will be spending most of their time in the field. Estimates for the maximum number of users are listed in the program and it is unlikely that the number of users will exceed these maximums. It is entirely possible, however, that an addition or a second facility may be built to house an expanding research program.

Funding

The annual progress of funds is directly administered through GLARC from state sources, from the V.W. Sea Grant Program and from extramural grants and contracts. Substantial additional funding is also administered through other departments. This new facility will be funded by the state and the Wisconsin Alumni Research Foundation.
Administration

The administration area shall house all administration offices, administrative conference area and reception. In this area all business meetings and decisions will take place as well as meetings with various outside visitors. This area could be termed as the communication center of the facility for it will release information to the public and communications entering the research facility must also be filtered through the administrative area.

The administrative area should remain easily accessible to other areas of the building. The spirit of this facility is one of openness and democracy and all persons associated with the center, whether they belong to the maintenance department, student body, or research faculty, should be made to feel comfortable in the administrative area. An informal atmosphere with a definite feeling of involvement is desired so that everyone may feel free to participate in administrative activities.

The administrative area will also be the most public area of the research center itself and therefore it must be easily accessible to visitors and express the spirit of the center as well as its more specific administrative purpose.

Total Area 1,535 square feet
Functions

Research

The research area shall consist of both general and special laboratories, offices for the research staff, an aquarium room, and a library. The research area should be considered the center of activity and the main emphasis of this facility. All other areas actually provide support, in some way, of the research function: the administrative area plans and keeps research activities running smoothly, the public space provides advertisement, the educational aspect profits from research activities and support spaces offer support either directly or by supporting other functions. It is important then that all of these support spaces be carefully integrated into the research area in order that a feeling of unity be attained.

Flexibility in the research area is quite important. Research projects will be changing constantly and these changes will bring about different space requirements, new equipment will be used and the number of researchers will be constantly varying. Along with these changes will come variations in the use of environmental systems, amounts of electricity and piped in products. Thus it is very important to provide for as much flexibility as possible in arranging space, plugging in equipment, and the placement of systems outlets.

In addition, a way to provide for this flexibility that will not become overly costly or waste space is desired. At the same time that flexibility is being considered so must the functioning of the various divisions which may require differing physical configurations but will be subject to change at various times.

Another issue in the research area is the promotion of socializing between the staff and students. It is important that all members of the staff be in frequent contact with each other and with students for this is an important method of education in itself. Too often researchers will tend to shut themselves off in the laboratory and human contact may become secondary to work which is being done. Socialization, therefore, becomes a relief to the research routine, a way of creating a more together atmosphere in the research center and for the gaining of knowledge and ideas.

Total Area 17,680 square feet
Functions

Education

The educational areas of the building will be provided for the few organized classes which graduate students will have. Most student time will be spent in regular research laboratories assisting the research faculty but they will participate in some lecture classes and some laboratory demonstrations. There will also be seminars and lectures open to the community and space must be provided for large groups to attend these presentations.

The attitude that shall be presented by this facility is one of integrated activity and this holds true for educational aspects. These lecture rooms and demonstration laboratories must not be isolated from the research area but planned as an entity. Students at the facility are researchers at a particular level of training and should not be treated as anything different. Indeed it is quite important to promote as much exposure and socializing between faculty and students as possible.

Total Area 9,400 square feet
Public Facility

The public aquarium and information center is a function quite separate from the research center, yet it must maintain a close relationship to it because the public space supports the research activities by announcing, explaining, and illustrating them. Public understanding of research going on at the center is one of the main purposes of this facility and the public display space is the vehicle to that understanding.

The aquarium must also act as the link or buffer between the park space and the research center. The main reason for the siting at this facility in the park is this public display area and thus it must become an important space which will act as a drawing card or commercial to the lake world and the research activities taking place at the center.

Since the philosophy behind the center is a better understanding of our freshwater systems - more specifically Lake Michigan - the center must in some way interact with the Lake itself. The degree of interaction is open and may vary, but it becomes a critical issue in the aquarium's design.

Circulation will also be an important consideration. Although it is not estimated that the facility will attract huge crowds at all hours of the day, there will be times when very large amounts of people must be accommodated. By contrast there will be times when very few people will be visiting the center but they must not be made to feel lost or isolated because they are in a small group. It would seem that a careful circulation plan rather than a huge circulating space would be a wise answer to the problem. (See building types study for an analysis of circulation patterns.)

Total Area 5,700 square feet
Support Areas

The support areas include a wide variety of functions. Basically they will provide space which is auxiliary to the other four functions of education, administration, research, and the public aquarium. These areas need to be well integrated with the activities which they support and not given a separate portion of the building which might tend to give them a ranking.

One of the areas to be included in the support category is the photography lab. This area will be used by research personnel and students alike and should be readily accessible to either. Researchers and students would use the lab primarily for photographs of specimens. It may also be used by exhibition designers who would print photos for actual exhibit purposes or use photography as a design tool.

Another area of support is the lounge which would be used by anyone connected with the center. The lounge would function primarily as a place to eat meals or drink coffee during breaks but it should also be accessible for anyone who wanted to come in and relax at any time of the day.

The computer room is an area of support which will function in conjunction with the library. All students and research personnel will probably make use of the computers at some point in their work and administrative personnel will also use them. The computer area will be run by an authorized person who will function in a librarian-type capacity.

The lounge, photography lab and computer area are the three main areas in the support category. The charts covering the individual Functional areas cover the remaining support areas in more detail.

Total Area 6,175 square feet
The Great Lakes Aquatic Research Center will require a good deal of site work as there are several functions which must take place on the exterior of the building. These functions include parking, a loading area, boat dock and storage, a garage, an outdoor research space, and outdoor recreation area for the use of faculty and students. It is also possible that the public aquarium will require an outdoor space which could be related to an entrance as well as a penetration into or under the lake. In addition to these amenities, the site itself needs to be further developed to increase the value of the site as a park. Careful planning must be undertaken so that the center does not interfere with park activities.

PARKING

Both public and private parking space must be provided. This parking may be combined or it would be possible to create two separate lots. There is also a possibility of sharing parking space with McKinley Marina which is adjacent to Juneau Park. The public space would have its heaviest utilization on weekends while the student and staff parking would be used primarily through the week so it would be possible to combine them.

LOADING AREA

The loading dock or area must be provided for the delivery of materials, equipment, fish, books, and mail. The loading dock should be located close to the aquarium room so that specimens can be transferred immediately to a comfortable environment. A service road will have to be provided to the loading dock. It is possible that the service lane for the Milwaukee Art Center could be shared in some manner.

GARAGE

The garage shall house a mobile field lab, a maintenance truck and will house several boat trailers. A separate drive or entrance need not be provided since there are so few vehicles and there will be a minimal traffic flow to and from the garage.

BOAT DOCK

Since GLARC will require several research vessels of good size, a boat dock must be incorporated into the design. Care must be taken so that this dock does not interfere to any great extent with public lakeside activities.
DOCK STORAGE

Dock storage must be provided adjacent to the boat dock area for storage of boat parts, outboard motors, and various pieces of equipment for boat maintenance and the boats themselves. It is important that this storage space not become a junk yard or take on a tool shed look. Possibly it could be incorporated into the main building itself. There must not be any barriers either that would prohibit a vehicle from pulling up to the storage area.

OUTDOOR RECREATION SPACE

The staff and students of GLARC will require some sort of outdoor activity space, which would function as a picnic area, volleyball court, or even meditation space. It is quite possible that this function could easily be incorporated into the development of the park so that it might become a semi-public space or even openly public.

OUTDOOR RESEARCH SPACE

There are various research activities which can be or need to be performed out of doors. It provides a pleasant change from the laboratory and extra space can be gained by keeping some people and experiments outside. This area would need to be somewhat sheltered but natural light must be able to enter the area. This space should be located very closely to at least one research space and preferably to several.
The critical issues of the Great Lakes Aquatic Research Center are divided into three main categories: site issues, research facility issues, and public facility issues.

SITE

The interface between this facility and the rest of Juneau Park is of the utmost importance. The factors which will require a great deal of consideration are the siting of the building, the configuration and attitude of the building design.

The development of the park surrounding the facility is critical in that it must work to enhance the center but must also provide a rich park space which provides alternative activities.

A final site consideration is the need to tie the Center and Juneau Park in with the War Memorial/Art Center and the nearby downtown area. At present there exists a very definite separation and this must be alleviated if this new facility is to function as intended.

RESEARCH

Flexibility in the research facility is a problem common to this building type. Since scientific activities will constantly be changing, thus affecting research and office space requirements as well as environmental needs, flexibility of research spaces, offices and systems is extremely critical.

Circulation of environmental systems as well as people is an important consideration. The need for so much flexibility of environmental systems as well as the number of systems involved makes their circulation a difficult issue to contend with. The circulation of people, materials and fish must also be dealt with very carefully. In some cases there may arise a conflict between circulation of systems and people, requiring a solution which provides the most direct and comfortable means of reaching various destinations.

The involvement of personnel both socially and scientifically is another critical issue. The facility must allow and even encourage a maximum amount of involvement between all users which will increase understanding between various disciplines, contribute to student learning experiences and encourage the relaxed and open environment which the center wishes to maintain.
PUBLIC

Circulation is an important issue in the public facility as well. The movement of people quickly and comfortably through the various displays must be carefully planned.

Another issue is the degree of involvement between the public facility and the lake itself. It would seem that some involvement is necessary but care must be taken so as not to disturb the public shoreline and the boats in the harbor area.

A final issue which doesn't fit into any single category is the degree of separation between the public and private facilities. A decision must be made as to how public the research facility needs to be and as to how the separation should be handled.

In addition to these main issues some thought must be given to the physical image of the facility. This image should very definitely reflect the buildings function and should act as an attention grabber to the public. Since the facility is located in a park it would seem that a fun sort of "non-building" attitude could be taken.
In reviewing the site analysis there doesn't seem to be any great problems in placing a facility of this type on the site. Access from any point along Lincoln Memorial Drive into the site would not be difficult. Probably the best entrances would be either near the War Memorial or at the entrance to the Yacht Club but access could be made over the lagoon as well by erecting a small bridge.

Drainage on the site is already taken care of since the highest point is in the center and the site slopes gently down to the surrounding bodies of water. Since this piece of land is not natural there would not seem to be any factors prohibiting further manipulation of any land forms or bodies of water as long as proper drainage is maintained.

Winds blow from all directions into the site. The lakeshore is particularly cool and pleasant in the summertime because of breezes from both the southeast and southwest so it would probably be a good idea to shelter outdoor spaces. The northerly winds can be bitter cold in the winter which suggests some shielding on the northeast and particularly on the northwest sides of the building.

There seems to be very few factors on the site which would prohibit the placing on the GLARC facility. The one edge which probably should not be impinged upon too greatly is the harbor edge but building could take place nearby. All views out of the site as well as into the park are pleasant and there is quite a varied landscape surrounding the park. The nature of the project probably calls for a lake orientation which presents no problem; however, there are no poor views which would necessitate shielding. Since people traffic on the site is relatively sparse, the only place that a building might interfere would be along the lake shore and if incorporated properly there is a chance that a facility of this type could work in quite well. There are no particularly offensive sounds or smells on the site which might need shielding and utilities are brought in on the northern and southern ends. Thus it would seem that a building could be placed at almost any point and made to work along quite well with the existing park.
Each of the three aquarium or display buildings included in the study have some intriguing ideas which could easily apply to the project. The New England Aquarium in Boston has an interesting spiral of ramps on the perimeter of the building for traffic moving upward and a spiral ramp surrounding a central giant tank for people moving down through the building. If the GLARC aquarium were to become more than a single story structure some variation of this circulation pattern could become a viable solution. The architects designing The New England Aquarium also attempted to create an atmosphere where color, lighting, structure, space, works of art and other details all work together to create particular moods in various portions of the building.

The final example to be included in the building type study is neither a research building nor an aquarium but it provided an interesting and intriguing concept nevertheless. The Aquapolis at the International Ocean Exposition is a floating and semi-submersible city which is the world's first artificial seaborne environment of its kind. At the Exposition it is acting as a display area and visitors are allowed to experience spaces above the water, at the water and under the water. This idea could work very well at the GLARC site with such an abundance of water readily available and allowing visitors to experience the lake environment both inwardly and outwardly in a space would seem to allow for nearly the ultimate in lake oriented activities.

The Aquarium at the International Ocean Exposition in Japan represents a much smaller and more simple approach to aquarium design than the New England Aquarium. Here circulation takes place primarily on a single main floor and fish are displayed in very large tanks where they may swim freely. A solution of this size and simplicity would seem to apply more directly to the needs of the GLARC display facility which is presently programmed as a small "support" type of area to the larger research space.
Concepts
**Scheme 1a**

This was the concept which I chose to use. In this scheme the research facility is located along the harbor and the public facility is placed in a new "research lagoon". The research lagoon would be used by scientists for actual field experimentation and investigation. An underwater research lab would provide direct access to the lagoon and three observation bubbles are placed at different levels of the lagoon for public viewing of underwater activities.

The research building is wrapped around an interior courtyard where outdoor experimentation would take place. Circulation is open to the courtyard and rooms are wrapped around the circulation. The research areas back up to the docks for easy loading of boats. The public facility is organized by a ring type of circulation and would open onto a system of exterior decking which would be covered with canvas and used for outdoor display in the summer. Parking would be located in a single lot.

This final scheme represents the culmination of all the best points of the preceding concepts. The functional aspects of this scheme far outweigh those of the others. The boat dock is conveniently located to the research areas at all times of the year and is separated from public activities. The public facility in the lagoon presents some exciting possibilities and is placed closely enough to the research facility to create a strong tie between the two. This scheme does not interfere with shoreline activities and creates activity in the portion of the park having the least use.
Scheme 1b

In this concept the research facility is located along the shoreline and the public areas are placed in a separate building resting halfway on land and halfway in the water. The research areas overlook the lake and open onto the pier for easy loading of research vessels. Administrative and teaching areas are oriented to the lagoon. Circulation is linear. The public facility is arranged around a linear pattern of circulation which opens into a nodal type of circulation which revolves around a giant tank.

This concept provides a good orientation toward the lake. The possibilities for the public facility are interesting and the relation between the research areas and the coastline are good. However, there could be a major problem with pedestrian circulation along the shoreline interfering with dock activities and the winter harbor is really too far away. In addition to these basic problems this scheme seems to break up the park too much and would seem to alienate the north end of the site.
Scheme 2

In this concept the facility is located in the most northern portion of the site. It is pushed up against the north breakwater and is oriented toward the lake. The public area is located out over the edge of the lake and is planned on a linear scheme. The research facility extends behind the public area and the other side of the breakwater is used as the harbor. The breakwater itself makes a pedestrian walkway which leads to an observation tower located at the end of the breakwater. This could be an interesting and functional scheme; however, it is located just too far away from other park activities. Folks coming on foot from the War Memorial would have a very long walk and it would be difficult to fit parking in next to the building.

This building concept is much the same as the concept in #2; however, the building has been moved up the coast and the research facility overlooks a newly formed lagoon. The main difference between this concept and that of #2 is a covered walkway separating the public facility and research center. There are some major functional problems with the location of the harbors in this scheme. The summer harbor is not conveniently located to the research areas and the winter harbor is just too far away.
Scheme 3

In this concept the entire facility is located in a newly formed "research lagoon". The scheme consists of a bridge-like structure containing public, administrative and teaching facilities above water and research laboratories below the water. The public area would be entered from the south side of the park and the research end is entered from the north side but the entire building is connected. The harbor for this concept is located in the marina harbor area. This could be an exciting and interesting scheme; however, there are some problems. The harbor is really too far away from the research facility and there seems to be no good reason for placing all laboratories underwater.
Scheme 4

In this scheme both the public and research facilities are located in the same building. The public facility is oriented toward the lake and the summer harbor is placed directly in front of it. The marina harbor serves as the winter harbor. The old lagoon is expanded and comes up almost to the edge of the building dividing the park almost in half. This scheme provides a gateway to the park and an excellent orientation to the lake, but there are some problems with mixing dock activities with a public walkway and the winter harbor would be too far away from the building. Also the linear scheme for the public area may not be the most exciting manner of designing a display area.
Scheme 5

The scheme consists of dividing the public facility and the research facility into two separate buildings which would be connected by a walkway across a new lagoon. The research facility is located next to the harbor which would make boat loading convenient. The public facility is located across the park to serve as a "gateway" to the park and an underwater viewing theater is located in the middle of the new lagoon for visitors to study underwater life. Visitor parking and research parking would be separate.

The main problem with this scheme is the great distance between the two buildings which would create inconvenience for staff movement. The underwater theater is also rather disconnected from the public facility and there would be no interaction between the public and the research facility itself. This scheme does, however, attempt to create a connection between the War Memorial and the public facility while creating a pleasant, active backdrop to shoreline activities.
Exhibition Concepts

Before a clearcut concept could be formed of how the public display building might go together, a decision had to be made about what types of displays it might contain and the manner in which they should be linked together. The primary role of this "display center" is to let people know about things which are happening at the research center in connection with the Great Lakes area and to stimulate some interest and awareness of the area in which they live. Thus it seemed important to make the public building into something more than a simple aquarium where people stand around and gawk at fish and are allowed no real involvement. It was decided that the best way to create this required involvement was to tell a story; to make people walk through a predetermined series of spaces comprised of displays which would tell the story not only visually but also through hearing, touch and even smell. Since the story which was to be told had to have some sort of sequence to follow, I decided to use a historical sequence whereby displays would begin with the formation and composition of the Great Lakes and end with lake research which is being done for the future.

The first step in the visitors' sequence must be orientational. It is important to let people know what they are getting into; what might be learned or experienced, the purpose of the experience and more practical ideas about how much they'll have to pay or how long it takes to go through the displays. The orientation can be achieved by a set of preliminary displays, a guide, posters and signs, movies or a series made up of several of these. After the orientation process has taken place the actual story can then begin. It seems that the first exhibit should be one which really catches the interest of the visitor and throws him into the mood of the experience. So the first display is based on the idea that -

"Man Becomes A Fish"

In this exhibit humans are introduced to the water world through light, color, sound, movement and visual detail. What is it really like to live - move - see and hear under water? This exhibit will attempt to answer these questions through artificial means, thus placing a sort of "other dimension" where they can become tuned in to the world which they have come to learn about.

"The Aquatic Environ"

In this second exhibit visitors learn more about the water - how it came to be, what it is made of, what makes it move, why it is colored, and so on. This exhibit might also begin to explain about the formation of the
Lakes. It would most likely be very easy to change and move this display around since no permanent water (aquarium) exhibits would be included.

"The Beginnings Of Lake Life"

Once the visitor has learned about this life sustaining substance which makes up the Lakes it would seem logical to find out about the actual life which exists there. How did it come to be, what did it look like and which creatures living today are closest to their ancient ancestors. This exhibit would include small aquariums, graphics, slides, and various three dimensional displays.

"The Shoreline"

This exhibit would explain how the pond, the stream and the lake relate to each other and how the edges of each form a very special living system which has close interrelationships. This exhibit might have a green house type of feeling with a scaled down pond, stream and lakeshore, living trees and plants and small shore animals.

"Biology Of Aquatic Life"

Ideally this exhibit would become a visual sensual type of display where visitors could see how fish, small shore animals, plants and lower aquatic life forms are put together and why they're put together in that way. This could be a moveable and easily changed display since there would be no need for permanent aquariums.

"Common Species"

In this aquarium display one could view some of the most common living creatures of the Great Lakes at close range. The aquarium displays could be further reinforced with graphics, slides and 3-dimensional displays.

"Touching Pool"

This small pool would be filled with aquatic plants and live water animals such as snails, sponges, etc., which could be touched without being harmed.

"Research Equipment"

This exhibit would give a basic overview of aquatic experimentation - how it is done,
equipment which is used, processes which are followed and a historical overview of the research field. Displays could be made up of graphics, actual equipment, short movies or slide shows, actual experimentation which could take place in front of the visitor or with his/her participation and other three dimensional displays.

"Oddities And Rarities In The Aquatic World"

This would be another small aquarium display with all the strangest creatures of the lakes residing here. This exhibit would include rare species, specimens which were flukes of nature and those with very odd and interesting characteristics. Graphics and an audio or written storyline could go along with the aquaria.

"Giant Tank"

The giant tank would be a several story high tank of water containing fresh water fish. The fish would be able to swim about and live in an environment very close to their natural environ. Many of the species seen in this exhibit might be inhabitants of aquarium exhibits which had already been visited but people would be shown these same specimens in a different environment and be able to view the interaction of different species together.

"Underwater Viewing Bubbles"

The underwater viewing bubbles would consist of 3 bubbles placed at various levels of the lagoon. Each bubble would look out upon a different area of research which would be taking place in the lagoon. People might also have the chance to see research technicians in wet suits working underwater and there would be many roving schools of fish to watch. Nothing more than several soft seats and some stand up viewing space needs to be included in these bubbles.

Upon leaving the last viewing bubbles visitors would ascend to the surface and leave the building and, hopefully, they will leave the building with more knowledge and greater understanding of the world in which they live.
Design Development
My original concept about the image of this project was perhaps the most important factor contributing to the physical layout and appearance of the project. I built the concept around the public display building representing a machine having circulation tubes and major and minor mixing points for various activities. This "machine" would be connected to the research building which would have the image of the control box or computer - clean, simple lines, functional and scientific appearing.
Throughout the design of the public structure I worked with a variety of sizes and shapes of spaces. I visualized the entire structure as being a series of pods of varying size, height and shape all linked together by circulation tubes. The anchor or "hub" of the "machine" was a 3 story high cylindrical aquarium building which would contain all small aquaria. Visitors would move in and out of this "hub" at least 3 times during their movement through the displays. A secondary hub was the giant tank which took on a cylindrical shape as well for obvious reasons. The giant tank pod was also three stories high though not so large in diameter as the aquarium pod. The idea for the circulation system came from the circulation used at the Boston Aquarium. Rather than to circulate upward through a single building as in the Boston example, visitors to GLARC would move upward from pod to pod, weaving in, out and around the center hub and would then descend around the giant tank, to the underwater viewing bubbles, come back up to the first level and exit. In the beginning of
the project, visitors did not go into the research building but entered into a tube which carried them to the main entrance pod of the public building. After some consideration, however, it seemed very necessary to require visitors to enter the research building in a controlled fashion in order to reinforce the connection between the two buildings and to stress the importance of the research center. This idea would seem to work very well for the public relations aspect since so often a scientific facility spells big mystery to the average person. By being allowed to enter through the research building visitors would be able to get some sort of feeling for the place and would at least know that the building was not inhabited by a bunch of Dr. Frankensteins.
The structural system which I originally looked at for the public building was a system of steel piers which would be set into the water. Pods structured with steel and covered by a metal skin would be supported by these piers. However, the more work that was done with various shapes, the more it seemed that the pods needed to be set on more massive bases so the structure for the entire system was changed to concrete; pedestals of concrete would hold up metalclad concrete pods.
I began the design of the research building by working with various patterns for people and mechanical circulation. A simple 2-story building based on one double loaded interior hallway seemed to be the simplest solution albeit extremely dull. The mechanical room was located in the center of the first floor and systems were run through the hallway horizontally and vertically through shafts also located in the hall. The second floor was actually only half of a floor with a large sunny roof deck to the south of the building which would allow for outdoor labworks and recreation. A circulation tube for the public and one for personnel to reach the underwater lab joined the public building and research. Visitors to the public building entered on a ramp up to the second floor reception area and then entered the tube/bridge which would take them to the public building.

One important criteria which had to be considered was the size and shape of the laboratory module. After some consideration I decided to utilize a 10' square module grouped in chunks measuring 50' x 30'. These large pieces could be divided into offices, storage or lab space and moved around as the need arose. Labs and offices would thus be easily accessible and large offices for several people or very small offices could be arranged with no problem.
After the midterm I belatedly decided that this was an extremely dull and uninspired piece of work which led me to rethink my original decisions. The solution which followed was based on the original concept of a linear building with a single corridor, etc., but it was far more interesting and worked in a more logical manner. This design was worked around a 3-story high wall of mechanical circulation. All labs and other facilities worked off one side of this wall and circulation tubes were hung off of the other side of the wall. Holes were minimally placed for circulation through the wall so that personnel would be forced to walk through the sunny tubes to get to any other portions of the building. Small lounges located off of the tubes would help to promote socializing between people from different departments. The mechanical wall would be used primarily for vertical circulation of mechanical and transport systems, while horizontal circulation would take place through the ceilings. Labs were laid out using the same 10' modules and most were placed on the first floor along the dock for easy access to boats. A large mechanical room was placed in the center of the first floor for easy systems circulation. The garage and loading dock was located at the western end of the building for easier access to the site entrance. I located the admin-
istrative offices on the second floor along with the public reception area for visitors to the public building. Visitors would enter on a ramp which would be connected to the second floor circulation tube and would go directly to the reception area where they could be channeled into the public tube connecting the research building with the public display. The second floor also contained more research laboratories and teaching labs. The third floor I reserved for functions which would involve all personnel and students; the library, computer area, photography lab, lecture rooms and a large lounge and kitchen. This lounge was intended for large lunch hour groups and snack times while the smaller more intimate lounges located off the tubes were intended for small conferences, reading, intimate discussions or relaxation.
The structural system which I chose for the research building was a mix of steel and concrete block. Steel trusses placed on 20' centers would span the 50' distance in the labs to allow for complete flexibility of plan. The trusses would be supported by steel columns on the one side and by the concrete block mechanical wall on the other. For support of the circulation tubes I decided upon a system of concrete block walls placed perpendicular to the mechanical wall. Holes would be "punched" into these walls and the tubes would simply be run through them.
By the middle of the term the public building was made up of varying forms which did not work together very well. The solution seemed to be to choose a unit or shape which would work well for all display spaces in order to simplify the massing of the building. After a great deal of consideration it seemed that the way to go would be to create a series of round pods. Each would vary in height and diameter according to the functions which would be taking place there. The reasoning behind the round forms originally stemmed from the fact that the design already included two cylindrical shaped pieces which worked well and had become strong points in the design. Since the majority of the exhibits were basically undesigned and would indeed be changed many times throughout the life of the building it was impossible to decide what the "perfect" display space would be for a building of this type. Indeed it would seem almost irrelevant in many cases since most moveable exhibits would be designed and built at the research center to fit the space in which it would be placed. Thus the spaces which had to be designed were those that contained permanent exhibits. The round forms worked well for these and seemed to also present no problems for traveling exhibit areas. Also the cylindrical pods gave a metaphoric suggestion of groups of water tanks connected together with tubular hosing. The concrete pedestals which had been cylindrical shaped from the beginning for obvious structural reasons worked well with the round pods.
In the design of the elevations it seemed logical at first to allow sunlight to enter those display areas which did not contain water since sunlight causes algae to form on aquarium tanks. The round circulation tubes also had windows so that visitors could view the surrounding landscape and also achieve some sense of where they were in relation to the sequence of pods. Since both the tubes and the pods were clad in metal I decided to leave the tubing smooth and cover the pods with a corrugated type of metal siding. Roofs were left flat and systems were placed on top of these. Upon considering these elevations there seemed to be a definite lack of interest and a problem with the scale of some of the smaller pods. Upon reviewing my earlier decision about allowing sunlight into display areas it became apparent that windows were not required in the pods since sunlight could come from skylights and a display area requires an inner directedness which could not be achieved if people were allowed to look out of windows.
Thus when visitors would be in the pods their concentration would be focused on the exhibit but as they left the pod to move through the circulation tube to the next pad they would be allowed to look at the surrounding lake, lagoon and research center, an added reinforcement to the exhibits which they had been experiencing. I also took a second look at the structural system of the pods which didn't seem to make a great deal of sense. I wanted a feeling of metal or of a tank or ship so I was cladding the pods in metal yet the under structure was concrete. I then changed the structure to steel which would be set down upon the concrete pods. An addition was also made to the roof line by slanting beams up to a center ring which gave the cylinders a more mechanical type of look. The center of the ring supports any systems which might be required for the individual pod and these are allowed to stick up above a small parapet and become a part of the building elevation.

It seemed most logical to provide the display building with its own mechanical room which would be run completely separate from the research building. Since aquariums require such an extensive water purification system the main mechanical room was placed under the water in the central aquarium cylinder. The main filter and holding tanks were located on the roof of this building and fresh water was piped from here to the giant tank. Individual pods had separate air conditioning units located on the roofs of each and other systems (electricity, plumbing, heating, etc.) were run through the floor.
The design process for the elevations of the research building consisted mainly of deciding where doors, windows and solid wall needed to be located and then allowing that to happen at that particular point. I allowed the structure to be exposed on the exterior and infilled with operable windows between columns. Where no windows were needed I decided to use textured concrete panels and above between the tops of windows and the second floor I decided on a smooth metal sort of fascia panel system. This system was used on the east, west and northern sides of the building. The southern elevation consisted of the smooth metal circulation tubes backed up against the concrete wall. I decided to provide as much window space as possible in the tubes to let in the warm southern sun.
The site needed far more time and attention than I was able to give to it so I kept site planning confined to only the most essential issues. I placed the entrance road in a position similar to what it had been originally. Parking was confined to one side of the road only so that the lagoon could be viewed through the trees on the other side of it. It seemed ridiculous for the Yacht Club to have its own parking lot which would not be used much through the week in the summer and would be rarely used during the winter so I devised a sharing plan whereby the GLARC employees would share a lot with the Yacht Club. Employees would use this lot during the week but on the weekend when the Yacht Club attendance would be quite high there would be very few employees. An adjoining lot was provided for visitors and any overflow. I agonized over the shape of the new GLARC lagoon but finally decided to echo the smooth roundness of the lake shore on the east side of the lagoon and echo the rough, undulating movement of the old lagoon on the west side.

There is much potential for further development on this site. The area around the lagoon could be made into a natural outdoor exhibit. This might also happen along the lakeshore. The problem of the weak city link to Juneau Park still exists and there is a great need to provide some sort of bridging if the city does not build the new roadway and tunnel.
The main problem with this project for me, was the project itself. The project began as a research center with a small public exhibit area connected to that. I had intended that my main stream of concentration be centered on the research facility but as the exhibit building grew in size and importance I was torn between two projects which were very different in every way. I never felt that I was fully able to devote enough attention or thought to either project which became a frustration.

Although the research building is designed to a fairly complete stage, I feel that I could have been somewhat more creative with the design and although the public building is an exciting and interesting concept, I wish that I could have gotten into a greater degree of detail. What I would have done differently with either of the two buildings I cannot say at this time - for there has been on period of contemplation since the design has been "finished" for such a short time. I can say, however, that I would have approached this project differently in the very beginning so that I would not have been forced into making a compromise in either building.