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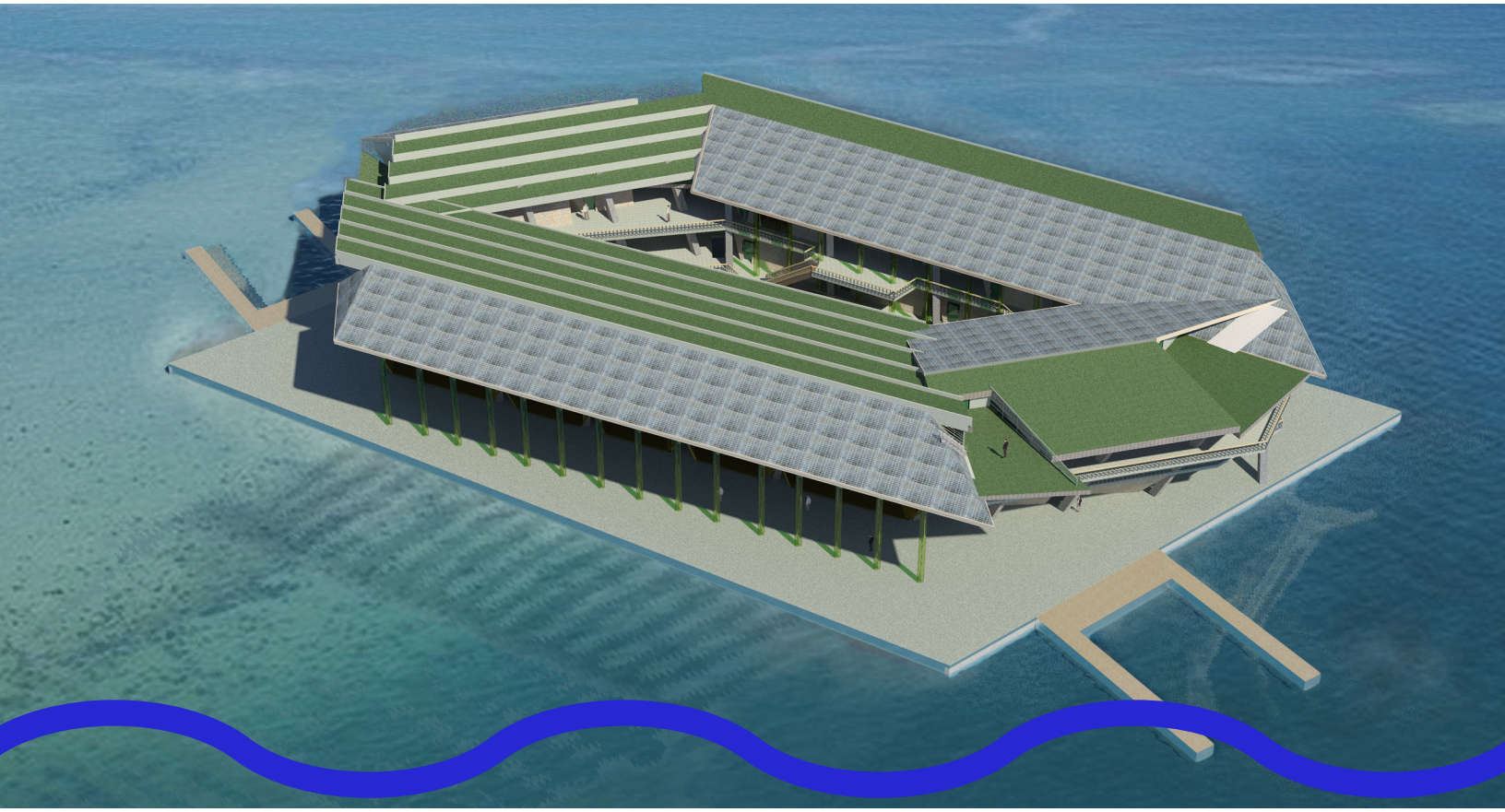
By: Nicholas Klever



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A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University

By

Nicholas M. Klever

In Partial Fulfillment of the Requirements
for the Degree of
Master of Architecture

Primary Thesis Advisor

05/12/11
Thesis Committee Chair

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Name: Nick Klever Date: 5-12-11

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Statement of Intent

Thesis Abstract

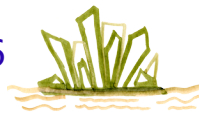
This thesis projects itself into the future to answer the questions of what will happen if the current climate changes continue and we are faced with the rising of the sea. The rising sea levels will reclaim a portion of the land area on all the continents of the world. Approximately seventy five percent of our global population would be forced to relocate because we can not survive underwater. A new community development could be created in such a way that would allow a portion of the population from coastal areas to live on the surface of the water. This is important because if all of the population were to condense onto dry land it would cause problems with providing enough resources to support such a large influx of people.

The project would need to provide everything that is necessary for a large population to be self sufficient. A mixed use structure or community would be the only choice for such a project to be successful. This new floating city would focus on bringing the imposing water into the everyday lives of the inhabitants in order to create a way of life that is able to coexist with the aquatic environment.

The new development will be focused on a coastal city that has already been devastated by flooding in the aftermath of several hurricanes causing hundreds of thousands to lose their homes, many of which have still not returned. The city of New Orleans has a very rich culture and in order to preserve it they are looking for alternatives to the rudimentary dikes and levees. This would make them more open and receptive to such a forward thinking proposal of a new way of life.

Such a development would be a radical change from the current system of living. It would be completely autonomous from any support from the infrastructure that operates on the mainland. Only relying on themselves to gather the necessities the residents would understand and learn how to extract energy and other beneficial resources from the sea. Planning regulations would have to be put in place to regulate the consumption of those resources to ensure that the limits of the marine ecosystem are not strained. The construction of this community would have to protect its residents from the strongest tropical storms that they could experience. This community is meant as a permanent residence for those who lost everything when the rising seas had taken back their shorelines and the cities that so close to the coast.

Keywords: Water, Community, Changing Environment, Culture, Sustainable



Problem Statement

How can design professionals respond to the current trends in climate change and create new homes for the inhabitants of coastal areas as the sea levels rise?

Typology

A small community that will be a place of refuge and sanctuary for the people who have lost their connection to the world that they knew. This community will provide all the necessities for the comfort of the residents and will promote a strong connection with the ocean.

Claim

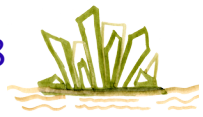
Development of a water based community will provide an alternative to retreating inland for the future inhabitants of currently existing coastal areas that are forced by rising sea levels to relocate.

Premises

As designers there has always been a need for us to address changing conditions in the environment. Another factor that designers must always be mindful of is caring for the health, safety, and welfare of the general public. So how do we come up with an alternative plan for housing all of these refugees from cities that have suffered from their cities being deluged?

New housing developments will need to be constructed to shelter those who have none as a result of a flooding of their city. Those who chose to stay in the area of their previous home are doing so because of a connection with the ocean that cannot be broken. Such a connection can be sought through a community that is designed to be an integral part of the water ecosystem. A community such as this would be required to be completely self sustaining and be able to gather all necessary resources from the ocean itself.

The coastal areas around the world are home to some of the most densely populated areas. This is because the ocean is providing them with the necessary resources and being closer to the source makes access to those resources is much more readily available.



Theoretical Premise/ Unifying Idea

A new home for a displaced population will have to be created because of a climatic change that has caused a portion of the earth's land area to disappear into the oceans. We need to find and maintain an equilibrium with the environment in order to continue to gather resources from it. The increase in water will make it more crucial to look into gathering the majority of our resources from the oceans.

Project Justification

Our existence on this earth is governed by the climates. Our current manner of living has produced changes in the environment and now the environment is going to force us to change the way we live. The global warming trend is causing the earth's ocean levels to rise and there are many low lying areas along the coasts that will be flooded. The entire population will be affected by those who are relocating to dry land.

The proposal

The Narrative

We as a population of human beings existing on this earth and are responsible for our actions against mother nature. The actions I am referring to are the exploitation of resources without regard for the impact on the environment. Mother nature has turned the tables as we are now facing a changing environment that will have a dramatic effect on our way of life, that is believed to be our own doing by the concept of global warming. The changes that global warming is creating will have the heaviest impact on the oceans of the world, but it will take time for the full effects to be realized.

The oceans are often referred to as the last frontier, “that we know more about the surface of the moon than we do about the bottoms of our own oceans”( ). Now global warming is causing melting to occur in the polar regions of the world adding massive quantities of freshwater to the oceans and coincidentally the ocean levels are rising. How much the ocean levels rise can only be speculated at this point, but even the most conservative predictions have shown that there will be several cities around the world that will become inundated by the rising waters.

Inhabitants of those cities will become refugees and be forced to retreat to the safety of dry ground. How far they move inland might be changed by the way architecture will respond to this new water filled environment. There will be a percentage of the population that will not want to give up their way of life and the connection to the water. They have either economical or emotional ties to the water.

This thesis will try to answer a question that I have always been interested in. Is there a way to engineer a community that would have the capacity to ride out the waves of this fluctuating future? The question also arises as to how well this community will integrate into the aquatic ecosystem. The community members can live in an environment where they are submerged into the water environment that makes up the majority of our earth. A community that will be as compact as possible in order to maintain the smallest footprint while also being designed to appear as an integral part of the surroundings. A structure that can house all the necessities and make them accessible so the community members never need to leave the structure. This does not mean that they can’t go out and explore the wonders of the environment that they live in. In fact, it would be encouraged so they can learn about it and study it and invent their own solutions to the problems that mother nature has now faced them with in hopes to aid other similar communities around the world.

User/ Client Description

Client/ Owner

This project will need to be developed through city agencies in collaboration with investment companies. The project would be initiated by the city of New Orleans in order to seek alternative means of revenue from the highly valued land that was lost beneath the waves. Investment companies with interests in the water technology that will be developed on this floating community will provide much of the financial support and will be the owners of this community, however a state government will also be in place as this community will be a city-state.

Residents/ Users

The population of what was New Orleans will be inhabiting this developing community. There will be much diversity among all who wish to fulfill a commitment to living sustainably and harmoniously with the environment. The members of this community will include some of the brightest people from areas all around the world that are coming together to collaboratively create solutions that will enable the human society to embrace living on the waters surface, or possibly beneath it. Other residents will include the leaders of this community and the group of investors who support the community.

Visitors

Visitors of the community will be shuttled by boat to the site. They will have different reasons for visiting some will be important government officials coming for business and most likely be traveling to visit a current resident of the community. In all cases, visitors will need a special pass in order to gain access to the community to tighten security between the community and the rest of the nations. This precaution would be necessary to prevent malicious activity by modern pirates that are present in the Gulf of Mexico.

Peak Usage

There will be a constant state of activity which will yield a constant level of usage by members of the community. The largest demands for power and energy will come from the development and testing of new technologies by the engineers and scientists during the day. The project will strive to create a thriving community within the boundaries of the ocean.

Parking requirements (harbor)

There are no parking requirements within the community because there will be no vehicles. Bicycles will be the main form of travel from one end of the community to the other. Docks will be located along the existing river bed in order to maintain shipping lanes because that will continue to be the only path that has sufficient draft for the passage of cargo freighters. A port will also exist for the protection of watercraft available for public use and of the visiting guests.

Health Issues

A common symptom that the residents will have to cope with is the sensation of vertigo, a loss of orientation in which way is “up” or “down”. This happens because all of the surroundings are indiscernible and there is no way to differentiate directions.

The platform that will be supporting the larger structure will be floating on the ocean. The ocean will be able to move the structure as it fluctuates. This will cause some of the population of this floating community to experience motion sickness.

The population will include people of all ages. Therefore those who are young or elderly may be limited by physical restrictions that the design of the community will address in order to make all community members feel like they belong.

There will be swamp land nearby the floating community that will be home to some animals that may pose a threat to human health because they can carry and spread diseases. Birds will also congregate around the floating structure because it provides a place of refuge for them. This poses a risk to human health because of sanitation, maintainence of the community can eliminate this potential risk.

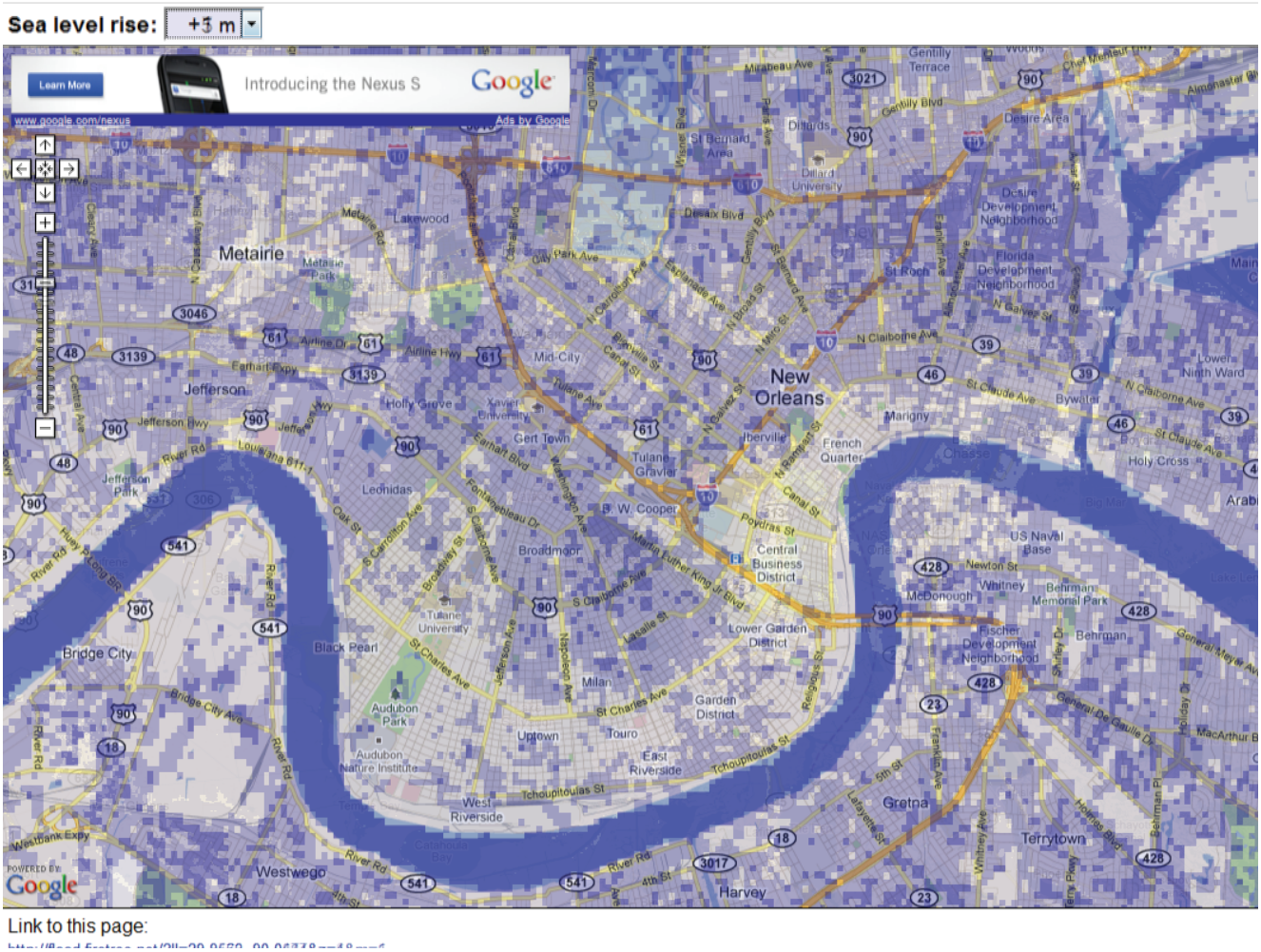
Site Information

Site : New Orleans, LA

Region

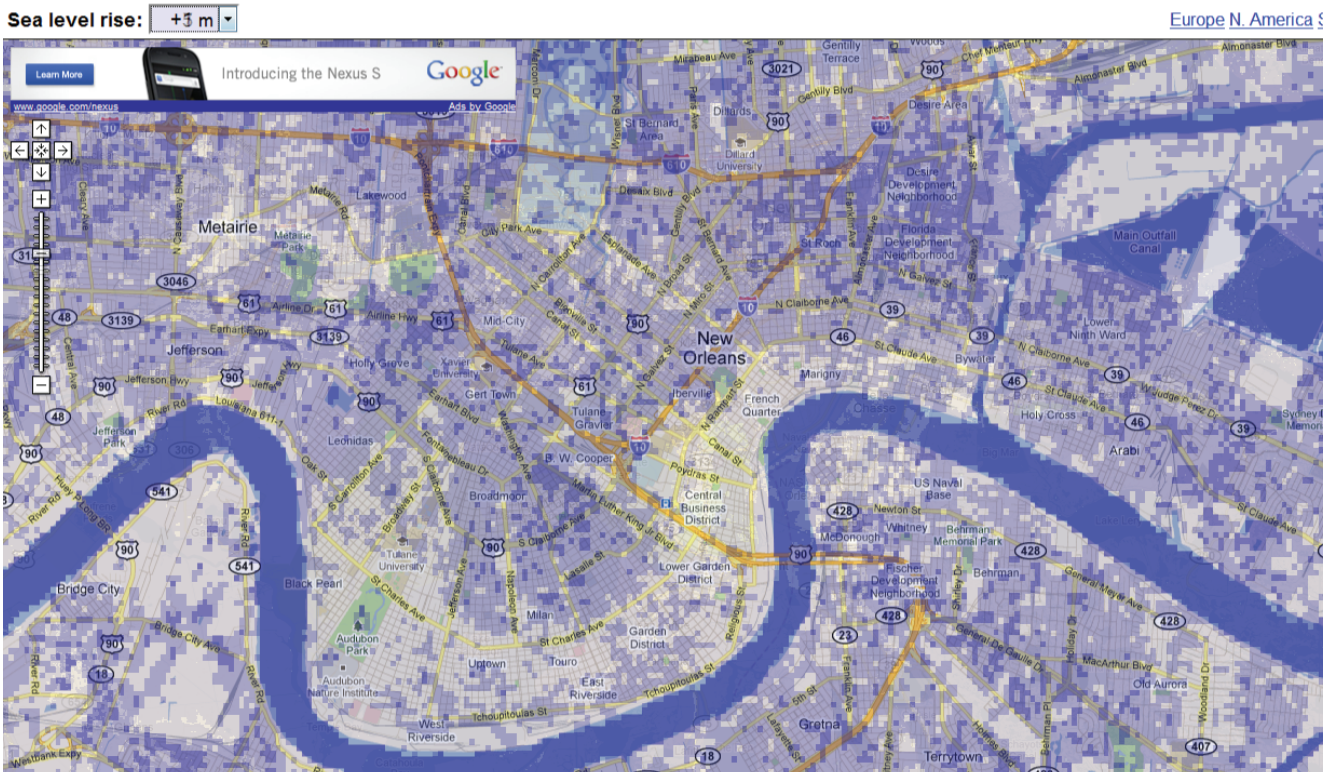
This thesis will focus on an area that is prone to flooding because of the low elevations near the coast of the Gulf of Mexico. There are several major rivers that empty into the gulf and any of the cities located near these rivers would make good candidates to study the implementation of such a large scale project because they are already drawing many of their resources from the ocean environment, so all the necessary knowledge and technology already exists in these cities.

City



The city of New Orleans is located at an altitude that is partially above and below sea level. It is only because of the presence of engineered dikes and levees, as well as an intrusive system of water pumping stations, that the land beneath the city is able to be built upon. During the recent hurricanes, the city has already experienced disaster when the storm surges flooded sixty percent of the city, causing thousands of human injuries or deaths and hundreds of thousands to evacuate and lose their homes.

Site



The site must be located off shore because when the land of New Orleans goes underwater there will not be enough water to support the growth of a new community. It will be floating among the oil rigs that are present in the Gulf of Mexico.

Major Project Elements

Public Spaces

Garden Plots - The residents of the community should be provided with garden plots where they can grow hydroponic plants in order to be more self sustaining and grow their own food.

Gathering/Open Public areas - people need a place where they can assemble in groups of whatever size is necessary for any range of possible activities. There will be one located in the center of each zone of the community.

Entertainment - not all activities in this community will be work related. People need places where they can relax and enjoy themselves.

Education - This community will include all ages and it will be important for the elderly to be examples for the youth to follow and desire to acquire their knowledge of how important this community is and how to maintain it.

Health - The community will have its own health care facilities in order to take care of its inhabitants throughout all stages of their lives. This will require several separate facilities that will specialize in common health problems at different ages.

Private Spaces

Residences - The living quarters of this community will consist of individual multi family units that will be grouped together to form a tight community where people can interact. Families would be able to purchase multiple units as needed to provide adequate space for all family members living in the community.

Semi Private Spaces

Business Offices - The members of the community will still be able to conduct business as usual because of how the current communication tools are being adopted into most business office situations. The residents will have to hold jobs. These offices will be located near the government offices.

Government Offices - These offices will be the place where the management of the community as a whole will be taking place. These offices will be located above the water line because of ease of access for those individuals like foreign and domestic dignitaries that will visit the community.

Project Emphasis

Primary Emphasis

The project will emphasize in the creation of a self sustaining community that has established a sustainable symbiotic relationship with its natural surroundings. A community that is located in such a remote environment will need to rely on environmental technology, for the operation of necessary systems like communication and transportation within the community and with the rest of the world. The fundemental difference between this community and other land based communities will be the foundation on which it is supported. Like all foundations it will need to be strong enough to support the loads of the structure that encloses space. The foundation will also be a series of compartments that store the essential materials for survival.

Secondary Emphasis

A secondary goal of this project is to research building systems technologies that will enable the recycling of resources to reduce the amount of waste introduced into the natural ecosystem. Research into filtration systems will also be associated with the waste management research to ensure that anything that cannot be reused and needs to be released will have no adverse effects on the surrounding ecosystem.

Plan for Proceeding

Definition of a Research Direction

Research for the examination of this thesis project will be focused on the theoretical premise and unifying idea. Related areas of investigative research will be conducted in historical context, typological studies, programmatic requirements, and a thorough site inventory and analysis.

Plan for Design Methodology

The thesis research will be gathered and analyzed using a mixed method concurrent strategy. This strategy enables me to browse quantitative and qualitative data as is needed to answer pertinent questions. This is beneficial in allowing the theoretical premise to guide my data collection. The quantitative data collected will be both statistical and scientific. The qualitative data will be gathered through interviews of persons directly involved. At specific points throughout the research process the data that has been collected will be organized and analyzed to check its relevance to the development of the unifying idea. Research results will be compiled and analyzed in order to produce documentation of the results in graphical and written formats.

Plan for Documenting a Design Process

All materials needed to complete this project including the design process and research will be recorded onto a CD at the time of completion. This CD will contain copies of the work to be saved in this thesis book for future researchers to use effectively. Materials gathered will include writings, drawings, design sketches, photographs, and digital and physical models.

Previous Studio Experience

SECOND YEAR 2007-2008

Fall Semester Darryl Booker

Tea House Fargo, ND
Boat House, Minneapolis, MN
Biohaus Boulder, Colorado

Spring Semester Malini Srivastava/ Mike Christenson

Foregin Analysis Project (Team of 3)
Community Development (Team of 6) Fargo, ND

THIRD YEAR 2008-2009

Fall Semester Ronald Ramsay

Agincourt Public School Agincourt, IA
Moorhead Library Project Moorhead, MN

Spring Semester Steve Martens

Kinesis Childrens Museum Fargo, ND
Tribal Community Center (Team of 2) White Earth, MN

FOURTH YEAR 2009-2010

FAll Semester Don Faulkner

Transbay High Rise (Team of 2) San Francisco, CA

Spring Semester Mike Christenson/ David Crutchfield

India Study Abroad Tour
Urban Analysis/ Redevelopment Jaipur, India

FIFTH YEAR

Fall Semester Mark Barnhouse

Water Resource Experiment Station Linton, ND

Spring Semester Bakr Aly Ahmed

Thesis New Orleans, LA

THE PROGRAM

Examining the Global Population of Coastal areas.

The urban environment is continuing to expand, and now we have reached the point in global history when there are more people living in cities than in rural agricultural communities. This expansion has lead to the development of mega regions resulting from the converging of several major metropolitan cities, like New York, Boston, and Washington D.C.

This new expansion is resulting in a pinching of the agricultural economy as more land is used for building cities than producing food. The industrialization of agriculture has been created in response to this reduction in available land for production while maintaining or increasing the level of productivity of the land.

Many of the major urban centers, 90 percent of the largest cities in the world (Keuning, Olthius, 2010), that make up these mega regions have been developed on the shores of a water body, whether it is a freshwater lake or river or a large saltwater ocean. The presence of water is related to prosperity because water is an integral part of everyday life and is also used for commercial production and shipment of goods. One possible solution to alleviate the pressure of a limited number of agricultural acreage would be to move out beyond the borders of land and begin to inhabit the waterways that are adjacent to the city. This solution also enables the city itself to become more dense by moving centrally located environmental green areas to the fringes, floating along the river (Keuning, Olthius, 2010).

Currently, more than fifty percent of the U.S. population lives within 50 miles(80Km) of the coast. That percentage is continuing to rise. The coastal area has not been unanimously defined because it has great impact on all areas of adjacent land. Through the latest census data it has been determined that the highest population density within the coastal zone exists at an elevation of 20m above sea level or less. 450 million people populate this zone (Small, C., & Nicholls, R. J. 2003). The population of the world living within 80 Km of a coastline of the world ocean is 1.4 billion which is a total of twenty percent. This places much of the global population at risk for the environmental hazards associated with coastal areas. How do we prepare ourselves for avoiding massive loss of lives and damage in the face of rising sea levels and increasing storm intensities?

Sustainable Coastal Communities

During hurricane Katrina, 80 percent of the city of New Orleans was flooded when the levees failed. It is estimated that more than 1,720 people died in the storm and most of them were residents of New Orleans. Mobility was a key issue when considering the escape of the residents. 20 percent of the total population of 455,00 were stuck in the city with no escape. These were the people who either did not have access to private vehicles or could

not move. They were the poor, infirm, aged, and immobile. In order to escape the city, those without access to private vehicles had to rely on the public government evacuation and often needed accommodations and other support services (Glavovic, B. C. 2008).

Virtually every aspect of life continues to be affected by the 2005 hurricanes. Profound loss of identity and sense of place is common among residents that have returned to rebuild. Those living on the edge of city have had to adapt to a new life without many of the qualities that used to make this place feel like home.

The social and physical vulnerability of the city will persist until the underlying causes are addressed by the overseeing governments. These causes include declining economic opportunity, poverty, inequality, and social dysfunction, aging and dilapidated infrastructure, political corruption, nepotism and cronyism that overshadows rebuilding efforts (Glavovic, B. C. 2008).

Human exploitation and alteration of coastal resources increased the vulnerability of this area to flooding and storms.

To address the rebuilding and restructuring of neighborhoods the mayor of New Orleans enacted an amendment to the constitution. The amendment would give the Master Plan that was to be created for the city the force of law. There have been many planning programs that have been put into action since the storms to identify areas of the city that need to support (Glavovic, B. C. 2008).

The most recent and current one is the Unified New Orleans Plan that was developed in 2006. The plan developed thirteen district plans as well as an overall city plan. Earlier neighborhood planning was integrated to offer design and planning solutions. The city plan focused on policy and regulatory mechanisms in an effort to prioritize rebuilding and safe future developments and expansion (Glavovic, B. C. 2008). The public voice is creating a paradox of returning to normal with the need to mitigate future risks. The “right to rebuild” for individuals is trumping the concerns of risk avoidance by public officials. The most at risk areas for storm damage are the same areas that are suffering from tragic inequities and vulnerabilities and they need to be restructured in order to become more self sufficient and resilient. The goals of the process are to enable residents to return to their neighborhoods without recreating the vulnerabilities that existed before. Another issue that needs to be addressed is the prioritization of the available resources for redevelopment (Glavovic, B. C. 2008).

Resilience is the capacity to absorb the impacts of hazardous events and retain the necessary structures, processes, and feedback functions of a community. It comprises self organizing capabilities and the capacity for learning and adapting. Vital measures need to be taken in a more holistic manner to develop a proactive approach that seeks to address vulnerability, rather than relying on reactive solutions to provide assistance to a community whose coping capacity has been exceeded. Avoiding and mitigating hazards

is central to resilience. Land use planning is the foundation which is essential for successful development of a community that can withstand and overcome environmental hazards. (Glavovic, B. C. 2008). Also important to this framework is the interconnected systems between humans and nature. These systems are closed circuit systems, where things are continually recycled and balance is created (Glavovic, B. C. 2008). All of these systems have constraints that are set by biophysical limits. We as a species need to learn our place in these systems and understand that living outside of the carrying capacity of the natural systems will have very destructive consequences.

These natural systems that we live in are very complex and interwoven with each other. These systems cannot be reduced to simpler systems and critical feedback loops with the systems exist. These feedback loops are the sources for maintaining a natural balance. They are unpredictable because our knowledge of them is incomplete, we need to understand that the human impacts on these systems will cross thresholds of irreversible and devastating impacts that will imperil the well being of the human species (Glavovic, B. C. 2008).

The implementation of the resilient spatial planning layout will be the responsibility of local government. It will be responsible for mediating the access to natural resources. The government should be responsive to the diversity of ecosystem resources that are used by their constituents to create and improve their livelihood. Political actions will need to create both opportunities and constraints on access to ecosystem resources in order to provide choices. These choices will directly and indirectly affect the source and sink functions of natural ecosystems (Glavovic, B. C. 2008).

In the City of New Orleans there is a compelling need to address the root causes of physical and social vulnerability. In the process a robust infrastructure will be critical to the development of a new sustainably resilient city. Planners must then become the guides to empower a community to construct the necessary infrastructure. This must be a collaborative effort with an emphasis on public involvement in the design process to ensure successful strategies are implemented for all residents.

Predictions of Water Level Increases over the Next 100 years

NOAA predicts an average global rise in sea levels of 1.7 meters by the year 2050, and more than double that by the year 2100. Local conditions in sea level rise will vary greatly due to microclimate and topography issues. In the area of New Orleans there is a high risk of the effects of the sea level rise being exponentially compounded by the acts of man. Throughout history the city has needed to pump water out of the ground in order for the expansion of the city to take place. The extraction of water from the surrounding soils has lead to a topography that is subsiding. The city is sinking! The worst case scenario predictions estimate that there could be as much as a 7 meter

(21 Ft.) increase in sea level by the year 2100.

Changes Occurring Along a Submerging Coastline

There are several fundamental factors that affect global sea level rise and local sea level rise. On a global scale changes in the volume of ocean basins due to tectonic activity will affect the overall level of sun radiation use. Melting snow from continental glaciers is also a currently changing phenomena that increases the total amount of water present. On a local scale the apparent sea level rise is determined not by the ocean buy by land. Subsidence of the land at the coast will produce a relative rise in sea level. The subsidence of land is determined by the compaction of recently deposited alluvial sediments, withdrawal of fluids (mostly oil and water), and drastic changes in sedimentation patterns. The EPA predicts a 50cm to 200cm rise in sea level by the end of this century. Over the previous century the sea level rise was only 10cm to 15cm (Salinas, L. M., Delaune, R. D., & Patrick, W. H., Jr. 1986).

Forcing the Mississippi River to flow down its current path prevents it from depositing the sediment it carries into the delta and carries it all the way to the edge of the continental shelf before finally depositing it. This loss of sediment deposition is the primary cause for the loss of wetlands in the state of Louisiana. Current rates of land retreat are 1355 Ha/Yr. in brackish marshes, 701 Ha/Yr. in saline marshes, 499 Ha/Yr. in freshwater marshes, 223/Yr. in swamp forests. Once these ecosystems retreat the only thing that is left is open water. The relative sea level on the coast of Louisiana will rise at a rate of one meter per year (Salinas, L. M., Delaune, R. D., & Patrick, W. H., Jr. 1986).

Marsh degradation appears to be related to human intervention in the coastal waterways. Construction of the Calcasieu Ship Channel for safe passage up river and the dredging and cutting of canals for petroleum operations are examples of such intervention. The marshes closest to the river have the best chance for continuation because they are located nearer to the source of sediment which will allow them to grow at a rate necessary to maintain their hold on the coast (Salinas, L. M., Delaune, R. D., & Patrick, W. H., Jr. 1986).

Bottomland hardwood forests along the lake edges will be replaced by wet cypress forests, but eventually they will disappear completely. The bottomland forest is a very ecologically productive area, providing safe habitat for many flora and fauna that don't like to be constantly wet. Even cypress forest can die out when exposed to sustained flooding of five feet or more. The high water level lead to anaerobiosis which causes undue stress and leads to slow degradation that will affect the trees around it connected by waterways (Salinas, L. M., Delaune, R. D., & Patrick, W. H., Jr. 1986).

Barrier islands only exist now in the Atchalfalaya and Modern Mississippi deltas. There used to be many more off the shore of Louisiana but it has now lost 41% of the total mass of barrier islands since 1887. The erosion of existing barrier islands is occurring at 65 Ha/Yr. The islands are beginning to migrate landward at 20 M./Yr. (Salinas, L. M., Delaune, R. D., & Patrick, W. H., Jr. 1986). The barrier islands are the first line of defense to protect the coastal marshes from saltwater intrusion and erosion from wave action. They are now poorly developed because of limited accumulation of eolian sand and the frequent overwashing of the islands.

Marshes on the landward side of the islands act as a foundation for the build up of sediments for accretion of the island and will possibly slow down the landward migration of the barrier islands (Salinas, L. M., Delaune, R. D., & Patrick, W. H., Jr. 1986).

Coastal Exploitation

A devastating environmental legacy has been left behind by the sugar, timber, and petroleum industries. Oil and gas common practices for waste removal began with direct dumping into the water then moved to disposal in open shallow water pits and once the industry moved to offshore locations they pumped the waste back down to the ocean floor. In an effort to restore the coastal environment, the government would attempt to make those responsible for the degradation pay for their actions. This action was disbanded because common practices within the industry of selling and reselling of companies and oil leases made it difficult to pinpoint the individuals responsible for the oil drilling.

Cries for more levees have overtaken the coastal restoration program. As a result to the public demand Congress passed and amendment to the state constitution to allow hurricane protection levees as an expenditure of Wetlands Conservation and Restoration Fund. An unprecedented level of water development projects sprang up as a push for industrial and real estate development in southern Louisiana was underway. Draining of wetlands was eradicating 500 square miles of wetlands annually for agriculture and development. This combined effect of channeling the rivers and draining wetlands virtually guaranteed ongoing engineered protection measures for the increasing settlements and infrastructure being brought into the flood plain (Austin, 2006).

In 1987, a federal partnership between the EPA and Louisiana Geologic Survey studied coastal erosion. The problem had been recognized for twenty years but no solutions had been generated. Coast 2050 outlined that 14 billion dollars would be necessary for restoring the natural drainage and moving sediments back into the marshes. Coastal Wetlands Planning Protection Act appropriated 50 million annually to fund wetland enhancement.

With the disappearance of coastal wetlands there has been a rise in the cost of development because the wetland ecosystem performed free and necessary services of waste removal and storm protection.

Attempts to link the oil and gas industry to coastal land loss have drawn heated criticism from industry officials and their government allies. New Orleans has been in an interesting paradox with the oil industry because it is their largest economically lucrative industry and it is also causing damage to the environment that places them at great risk for harm. In the 1970s, petroleum revenues accounted for half of the states total budget. In 1990, the revenue had dropped to twenty percent of the states total gross product.

As the resources on which the wealth disappeared, first the plantations, then the cypress forests, and now the oil and gas, many of those who made money have left the region. For those that remain the long term environmental changes resulting from the building of levees, cutting of trees, digging of canals, drilling of wells, and contamination from the well fields have destroyed any hope for the returning to their previous livelihood strategies. There is a vehement opposition by the inhabitants to suggestions for them to leave their land and start fresh. They will not leave their homeland behind. Louisiana's approach to economic development is a tragic example of a failure to balance the role of the developer and steward of its natural resources with the state government (Austin, 2006).

A Cost Benefit Analysis of Coastal Defense and Societal Activities

In urban areas where no further loss of coastline is desired a shoreline nourishment policy is required with a seaward implementation. That means to create shoreline into the sea that is expected to be eroded away over time to return to a basal coastline level. In terms of effective policies for nourishment of coastal areas a foreshore nourishment plan is the most effective. Using a stochastic optimization model it can be predicted that the return period that will be most efficient to sustain economic development will be six years. This means that new sand or other soil will have to be added every six years to maintain the base coastal working environment (Van Vuren, S., Kok, M., & Jorissen, R. E. 2004).

In areas with natural ecosystems importance the model does not place an economic value on the landscape. The value comes from the societal acceptance of the natural ecosystem as an important contributor to the cycle of life. In the interest of economics it would be desirable to allow the shoreline to retreat far inland. The optimal return period to obtain the lowest cost of maintenance would be 30 years according to the model. Over this time period a dynamic zone would be defined by the coastal recession. The distance of recession would be 55 meters under the current conditions and up to 150 meters in future conditions (Van Vuren, S., Kok, M., & Jorissen, R. E. 2004).

This economic optimization model would change the environment contained within this dynamic zone. The natural ecosystem that matures over hundreds of years would be replaced by an ecology that adapts and grows quickly. By definition the ecology that naturally exists along a coastline is one such environment that would quickly change to survive in new conditions. The ecology that takes many year to mature would naturally exist at further distances from the sea. As a result the coastal environment zone would shrink and become more homogenous. One option to combat this change in environment would be to implement a coastal defense policy with a shorter return rate that will have a smaller dynamically affected area. In this instance it would be important to understand the local societal values of this natural ecosystem before implementing a plan to combat the rising sea levels.

Nature's Marine Ecosystems and it Services

The majority of the population around the globe takes for granted all the things that the marine ecosystem makes possible. An example of the services that are provided are fisheries, global materials cycling, transformation, sequestration of waste and other pollutants, ocean coastal based recreation and tourism, coastal land development, cultural and future scientific values.

Evaluating the interconnection between land and sea is a critical step in understanding the importance of the marine ecosystem and the services it provides all living organisms. Management and protection of vital marine resources is difficult to achieve in today's political system because of an inability to deal with the uncertainty of scientific projections. There is also a problem related to comparing the cost and benefit analysis of short and long term solutions because they are vastly different time scales (Alexander et al., 1997).

For example fisheries management focused on short term gains rather than maximum sustainable yields over the long term. This lack of regulation on harvest of fisheries led to a widespread overharvest of all marine fish stocks (Alexander et al, 1997). In 1992 almost 28,000 fishermen lost their jobs in New Foundland and Labrador Canada after overfishing of the northern cod. This intensive overharvesting of fish in one season, while the fishing is good, is most likely because there are no incentives for conservation. Private property rights over a fishery would provide a potential incentive. (Alexander et al, 1997).

The ocean ecosystem is a vital part of the earth's cycles of the basic element that are the building blocks of all life; carbon, nitrogen, oxygen, phosphorous, and sulfur. Currently anthropogenic changes in the oceans are affecting the carbon cycle through the direct release of CO_2 into the atmosphere by burning fossil fuels. Carbon is sequestered in continental rock in two forms, sedimentary organic matter and solid phase carbonates. The atmosphere will gradually weather these two compounds differently, organic matter, the fossil fuels, is oxidized and returns to the atmosphere directly as CO_2. The carbonate is weathered through the water cycle as it is

broken down by weakly acidic rain water and washed into the ocean. The dissolved bicarbonates are then absorbed into the living organisms producing particulate carbonate again adhering to the skeletal structure. As the organisms die off they are buried in the ocean floor. There they remain buried and return back to the solid rock form(Alexander et al, 1997).

The oceans are used as a repository for unwanted material. The aquatic ecosystems act upon these systems to through biological processes that transform them, either detoxification or merely sequestration. Large amounts of inorganic nutrients are pumped from wastewater and fossil fuel burning into estuarine environments. The nutrients are removed from the water by absorption by plant materials especially phytoplankton and riparian wetland vegetation. The addition of too much of these nutrients can lead to eutrophication. This process leads to a reduction of oxygen which will harm fish and other organisms in the environment. Toxic algae blooms that can affect marine animals as well as humans will be stimulated by this ecosystem degradation (Alexander et al, 1997).

Tourism is the industry that is most closely tied to a properly functioning marine ecosystem. The marine environment makes large economic contributions to coastal settlements simply by being there for people to experience directly. Tourism is the world's largest economic endeavor. The major marine ecosystems that attract attention from tourists are coral reefs, polar oceans, and coastal wetlands and estuaries. Estimates of the value of the local economy of wetlands through aggregate provision of recreational opportunities, fish production, storm protection, and water treatment are about $9,000 per acre. There exist competing demands on the ecosystem exist that are incompatible with the sustaining the wildlife populations of the environment. Proper care is needed to consider the value of services provided from the naturally functioning ecosystem, otherwise valuable tourism industries could be lost if newly permitted uses disrupt the ecosystem (Alexander et al, 1997).

Ocean Current Energy Potential

The creation of the Energy Policy Act of 2005 gave the Department of Interior, specifically the Mineral Management Service (MMS) the rights to oversee the renewable energy programs. MMS is also required to produce an annual report that outlines all the possible renewable energy, including wind, wave, ocean current, solar energy, hydrogen generation, and alternative uses for fossil fuels, that is available for extraction and implementation.

Ocean currents are drive by wind and solar heating of water near the equator. These currents flow in one direction only at a relatively constant rate (MMS, 2006). Some examples of usable ocean currents are the Gulf Stream, Florida's Straits Current, and California current. Ocean currents tend to be concentrated near the surface. The speeds of ocean currents are generally lower than average wind speeds. The kinetic energy contained in flowing bodies is proportional to the cube of their velocity. The characteristic that makes water a potentially significant source of energy is that it is 835 times more dense than air. This means that for the same area of flow the energy contained in a 12 mph current of water is equivalent to the energy contained in a 110 mph gust of wind.

Resources for extracting ocean current energy are at an early stage of development. Submerged turbines are similar in function to land based wind turbines. There have been several prototypes that have been developed and tested. The basic elements for capturing energy from hydrodynamic lift or drag include rotor blades, a generator for converting rotational energy into electricity, and a means for transporting the electrical current produced (MMS, 2006).

There are a few potential problems that exist, including the avoidance of drag from cavitations, air bubbles creating turbulence and reducing efficiency of the turbine. Preventing the growth of marine organisms that would cause reduced efficiency and physical deterioration. Combining that along with corrosion control illustrate the major maintenance issues with submerged structures. The reliability of the system to perform with minimal or no maintenance is an important issue because of the high costs associated with making repairs in a marine environment (MMS, 2006).

Before the implementation of an ocean current power system can be planned, the environmental impacts need to be researched and addressed. Considerations for the protection of fish and marine mammals could create large economic and political implications. The slow moving blades of the turbines would be safe for fish to freely swim through without endangering themselves. Design additions like protective fences and sonar activated brakes could prevent larger marine animals from being injured or causing damage. The impact of economic activity such as shipping routes and commercial fishing would need to be anticipated when considering locations for a submarine turbine energy station (MMS, 2006). Political involvement would be important when the time came to implement strategies to mitigate potential for incidental disruption of fisheries would be to zone fishery exclusion areas around the turbines. This action could transform these energy stations into attractive tourist destinations for divers because it would provide a sanctuary for the marine environment. Concerns have been raised about the local effects on the marine ecosystem such as temperature and salinity changes. Any changes in salinity would most likely produce a negative impact on the surrounding estuary ecosystems of coastal areas.

To make underwater turbines economically cost effective in the current energy market, a constant flow rate of 2 m/s would be necessary. However it is possible to generate electricity with current velocities as low as 1m/s (MMS, 2006).

Spatial Planning and the Environment - Water framework Directive

The existence or our human society places various demands on our land because of competing needs. Spatial planning is needed to prioritize the three basic demands of land use in a civilization. Encouraging social progress and welfare by providing space for housing and other services such as schools and hospitals as well as promoting economic growth through development of industrial estates, transport and infrastructure. The element that is most often forgotten in the planning of a city is providing space for the natural environment within our urban framework to sustain biodiversity and ecosystems services that are naturally provided for society (Carter, 2007). Spatial planning regulates the development and use of land to create and maintain a balance between the varied demands society places on land resources.

Environmental problems most often arise from the way in which land wad developed and used. Spatial planning lies at the heart of addressing environmental problems to reconcile development pressures with environmental concerns (Carter, 2007).

Water is a finite resource. This applies limits to which it can provide for necessary societal functions of essential life processes. Availability of water resources is also threatened by human activities that cause pollution or the over extraction of groundwater.

Planning can impact our environment in a positive or negative manner depending on how aware those who have authority are about the environmental consequences of their actions. In a planning solution that strives to minimize the impact of a development on the environment this would be the result: minimizing diffuse sources of pollution, decrease demands for water and wastewater treatment, limit the risk of flooding, reducing the recharge rates of groundwater storage aquifers, and protecting aquatic habitats and biodiversity (Carter, 2007).

Planning policies provide a guide for planners when making decisions concerning development. Spatial plans include policies relating to transport, housing, recreation, nature conservation, and economic development. Policies of spatial planning can require water efficiency and conservation in housing developments. Locating point source generators of pollution at a far distance from water bodies. Implementing buffer zones along edges of water bodies to minimize the effects of erosion and limit the amounts of pollutions that reach the water by rainwater run off. Development controls empower local planning officials with the authority to grant or refuse a proposal of new developments. Spatial land use planning is intensely political. Contents of land use plans reflect political, social and economic priorities (Carter, 2007).

Coastal Housing and Hurricane Damage Mitigation

Learning how to build structures that are strong enough to survive a hurricane with little or not damage requires a holistic approach to analysis of construction assemblies. In order to scientifically test the interaction of high winds and wind driven rain requires a full scale testing facility where actual models of failure for construction assemblies can be tested (Leatherman, Chowdhury, Robertson, 2007).

Use of ring shank nails for securing roof sheathing to structure enables a building to withstand a medium category four storm instead of a low category three storm without increasing construction costs. Water intrusion from wind driven rain permeates the soffit and fascia and contributes to roof collapse (Leatherman, Chowdhury, Robertson, 2007). When hurricane winds travel around and over buildings intense uplift pressure is exerted along the edges and at the corners of buildings. Flow separation induces the formation of a turbulent shear layer. Strong vortices build along roof structure and create areas of increased negative pressure at the edges and corners that may cause roof failure. Designing more aerodynamic roof shapes that suppress the generation of these vortices will lead to significantly less roof damage during a storm. Aerodynamic edge shapes will reduce forces of uplift by displacing the location of vortices relative to the roof structure (Leatherman, Chowdhury, Robertson, 2007).

Residential homes can be built with a modified elevated foundation. Materials used in construction need to be stronger and more resistant to mold. Improvements have aided in moisture management and building envelope sealing and insulation. This approach reduces energy costs by $1,000 annually and the home is more resistant to failure during a hurricane (Guikema,2009)

Infrastructure Design in Disaster Prone Regions

Infrastructure is the networks that transport people and goods, distribute energy, and maintain communications and buildings in which people live and work (Guikema, 2009). The extent to which the infrastructure functions after a disaster depends on design choices that trade off between current construction costs and future repair and replacement costs. Traditional design practices would be to design the buildings to meet specified wind forces and flooding levels outlined in the current standards or a preselected yearly probability. Current standards regulate that a building should be able to survive the stresses imposed by a hurricane that has a probability of occurring every 50 years on average. This system is inaccurate because it assumes the same standards that balance between benefit and cost for all designs and doesn't consider alternatives. Each building is different and they all have individual criteria that affect the costs of reinforcement and failure. The Standards do not address the environmental impacts related to failure of a building which determines the robustness of the reinforcement system. Traditional design does not consider the level of dependence upon natural ecosystems to enhance protection from storms.

A more case based and holistic set of standards need to be developed for infrastructure to be resilient in the face of damaging storms. Recent advances have allowed engineers to consider a wider range of the impacts on the design process. These include life cycle financial impacts of failures during a disaster and indirect economic cost of infrastructure failures. (Guikema, 2009).

Shelter After Disaster

The concept of getting back to the way things were is a futile and dangerous proposition. Every action changes the outcome of events and therefore things will never be the way they were after a disaster, things will only return to what is normal or familiar as all things try to achieve balance.

In today's world the most widely used response to disaster is to ask for help in the provision of the necessities in the effort of relief. In the interest of continuing on as a resilient community should, we need to step away from this desire to provide relief because by its very nature it means a temporary solution. More effort and resources should be focused on the tasks of rebuilding the necessary components of the community. Relief is the enemy of construction (Davis, 1978).

Quick action is critical to the health of the community, and quick action means planned action. Planners and government officials as well as the public will need to create new legislation that dictates a revised land use and land occupancy plan in an emergency. Planners will also be instrumental in developing extended city layouts that plan for remodeling and growth. A role caster plan will also need to be in place to delegate specific jobs so the public knows who is in charge of doing what and when it needs to be done.
The rebuilding effort will need the coordination and organization skills that the government can provide in gaining access to the necessary resources, and other problems of infrastructure. The government should not get involved as the primary regulator of work that can be done by the individual, like rebuilding houses.

Under the immediate impact of disaster people are ready and willing to change long standing traditions. In the preparation of a community to be resilient to disaster it is important for the government legislation to act quickly to introduce and implement improved customs and infrastructure that will benefit humans and the natural ecosystems (Davis, 1978). If quick action is necessary it is important to create building systems that are quick to assemble and easy for groups of people to erect without the use of heavy machinery.

Mixed Use Income Residential Communities

Mixed income housing accommodates varying income levels and is available to people at all stages of their lives. This concept is a new and vital ideal to create a more climate sensitive residential development (Urban Land Institute(ULI, 2009). It enables the design of more compact neighborhoods, where all services are located within walking distance, greatly reducing the number of miles driven by vehicle. Preferred combinations for the mix of income in a development is an equal proportion between market rate, moderate income, and low income units (ULI, 2009). Recent studies have shown that the combining of income levels into residential developments has several benefits. There is an increased standard in the design of affordable housing. Introducing low income residents into communities deconcentrates the poverty within a city and provides a healthier environment for low income housing.

The success of a development is determined by many interrelated factors pertaining to the residents that can be achieved by design. Using high quality standards for design, not just of the building and units but all aspects of the development, and construction that are comparable to other market value residential units is imperative to making a mixed income community desirable. Designing the amenities that meet the current expectations of market demand and providing access to all residents provides opportunities for all residents to have a community space where they can come together. Care must be taken in the design of the units to ensure that they are not distinguishable by income level. Dispersing the low income units evenly aides in creating a more homogenous residential community. Mixed income developments can not create a market for themselves unless the scale of the development is on the level of an entire neighborhood or small city, therefore the location of these mixed income developments has to respond to the needs of the market in order to succeed(ULI,2009). The provision of services to residents is also an attractive addition, linking the development with local schools in particular is important for children and adults to learn necessary skills.

Floating Technology

There are many oncoming social changes that are making the expansion of the waterfront more and more desirable. Beginning in this century and continuing into the future the demand for adaptability and mobility in technology is controlling every aspect of life. The connectivity of everything is pushing for a global ecology, but this is not where we need to go. Industry and technology are enabling global connectivity however that does not infer that each step forward for progress results in a centralization of resources and power. If we are going to be prepared for this age of climate change we have to diversify and act locally if we are to have a chance at adapting to these changes.

The ability to float on water is controlled by the density of the liquid the surface area of the object. Weight is also a major factor in flotation because if an object can displace enough liquid then it will float, the amount of liquid needed to be displaced is equal to the weight of the object trying to float.

the University of Waterloo and the LSU Hurricane center have been working on designing a foundation system that will float as an attempt to save the historic shotgun houses from being destroyed by floods. (English, 2010) It consists of a steel frame that is bolted to the underside of the house. The frame is supporting large blocks of polystyrene foam that is sealed and protected from the floating debris. Attached to the steel frame are steel posts at each corner, the posts rest in a hole and keep the house located on its site as the building moves upward with the water and floats on the foam blocks. The house is supported by the original foundation piers during normal conditions and the foam blocks are not in contact with the ground.

Summary

Through extensive research into new and old coastal development I have gained a large quantity of knowledge that is based on how the human developments interact with nature. This is the backbone of resilient and sustainable design that requires a balance and equilibrium to be achieved.

My research has led me in a direction where it is believed that in order to achieve balance with nature we must be willing to give something up, in he most recent changes in climate it appears that we will have to give up our claim to land. Even if the land is the site for a wealthy and prosperous city, as is the case with most coastal cities, we will have to be able to give it up because it is a part of nature.

Very early on in my research I was very interested in the ways in which the designs of buildings had changed. Over time the climate of the earth has changed naturally, buy our actions upon the land have great impacts on the way that the natural ecosystems operated. This lead me to an interest in documenting and understanding how long the residual marks of our presence could be seen in the proliferation of the natural world that we help shape.

An economic analysis of the loss of land can be performed in order to set goals to minimize the effect of the loss on the surrounding societies. There are also analyses that have been conducted to identify the value of specific ecosystems to society based upon the services that those ecosystems provide . During my research I was amazed at how much a coastal estuary or wetland ecosystem can provide and the far reaching effects of the loss of those services. What was devastating to me was learning how quickly these ecosystems are being lost in Louisiana. Viewed from a far removed position it seems like a feeble attempt to restore the wetlands that have been lost because of all of the historical events that gained momentum and began to turn that large ecological wheel. The study of New Orleans and its history gave me insight into ways that regulation and planning are necessary in order to ensure the existence of resources. Now all the coastal city can do is prepare for the consequences in the future.

Using what I learned through my research of the potential to extract renewable energy from the ocean that can directly serve societal functions. In order to produce enough energy for an entire community requires the implementation of several different sources of renewable energy, including the solar energy that is so plentiful in the wide open space of the ocean. Hydropower from ocean currents is a reliable source because the flow is relatively constant and the water has a high energy density. Devices to harness this energy would be installed beneath the waters surface and create a minimal visual impact unlike the large wind farms that are present on land.

An ecological wastewater treatment model is based on decentralization in an adaptation of current water treatment technologies to mimic the natural tidal marsh ecosystems which have natural water treatment processes. The necessary technologies are being tested and put into practice in other areas of the world and are and integral part of the local economies.

A key factor in the success of a community for those who have little or nothing with be using design strategies for combining mixed income so as not to create exclusive neighborhoods or groups of people that would destroy the trust and respect between members of a community. This is an essential requisite for people to feel secure and safe in large groups. The research conducted in this area of study helped me to identify that there are benefits to the integration of income levels because it tends to spread out the population of the poor and provides them with a healthier environment in which to assimilate back into the normal culture.

Planning is the largest issue with the development of a community because it gives specific individuals the power to make decisions that will benefit one group, but inevitably will also cause damage to another group that is on the other side of the spectrum. Public involvement in the planning process is crucial because it can address the political, social and economic and ecologic goals of all community members.

The coastal areas are also inherently prone to natural disasters like hurricanes and tsunamis. I conducted research into design alterations and additions that would reduce or eliminate the damage incurred during a storm to housing and infrastructure which can permanently alter the lives of residents of coastal cities as seen by what happened in the city of New Orleans during the large storms of 2005.

I. Crescent Hydropolis Resort

Project Type: Hotel/ Resort Community

Architect: Joachim Hauser

Start/ Completion: 2005- 2011

Location: Dubai, UAE; just off Jumeriah Beach

Size: 260 Hectacres

Cost: $ 483,414,000

Distinguishing Characteristics

This project is one of the first underwater hotels that is being constructed. The designer was inspired by the infamous Jules Verne novel 20,000 Leagues Under the Sea when he started this project. The maximum depth of the hotel is 20 meters below surface of Indian Ocean. The hotel features a pair of observation domes which allow an expansive view of the water. The hotel is a total experience that expresses water in a way to be appreciated, Inspiring and developing an awareness of the sea instead of being taken for granted. The design of the large community is responsible for accommodating 3,000 visitors per day plus hotel guests (Hydropolis, 2010).

Existing Program Elements

3 Main Sections

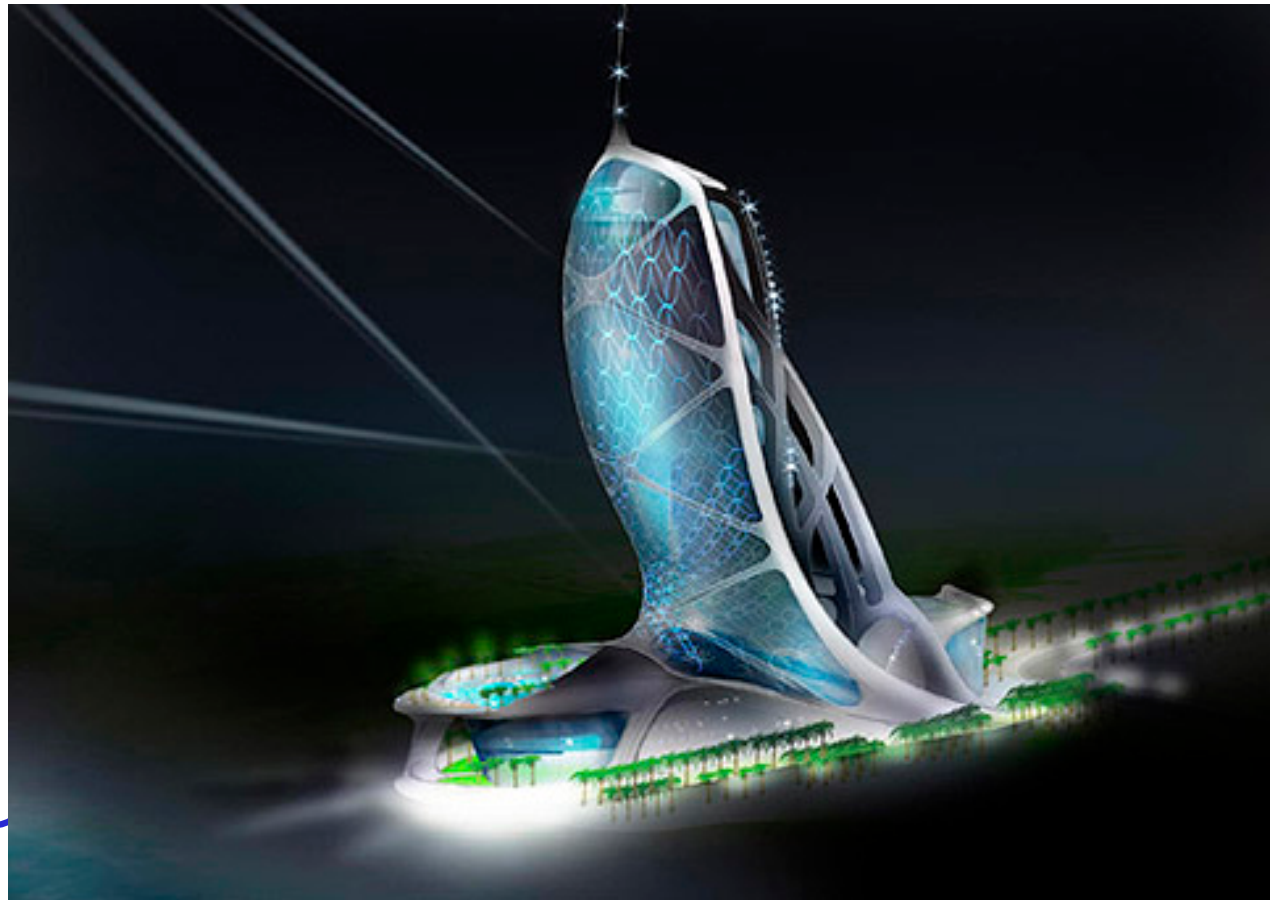
1. Land Welcome Station
   - Cosmetic Surgery Clinic
   - Marine Biology Research Lab
   - Conference facilities
   - Meeting Rooms
   - Storage Room for Supplies
   - Loading Area
   - Parking
   - Restaurant
   - Cinema
   - Viewing Platform

2. Connecting Train Tunnel

   The train is powered by a noiseless fully automated cable. The support rail is comprised of modular steel guides. The train has a 1,000 person capacity

   1,700 Ft. travels between land and water

3. 220 themed suites submarine complex
   - Restaurant/ Bar
   - Meeting Rooms
   - Ballroom, located at the center of complex
   - Catering Services

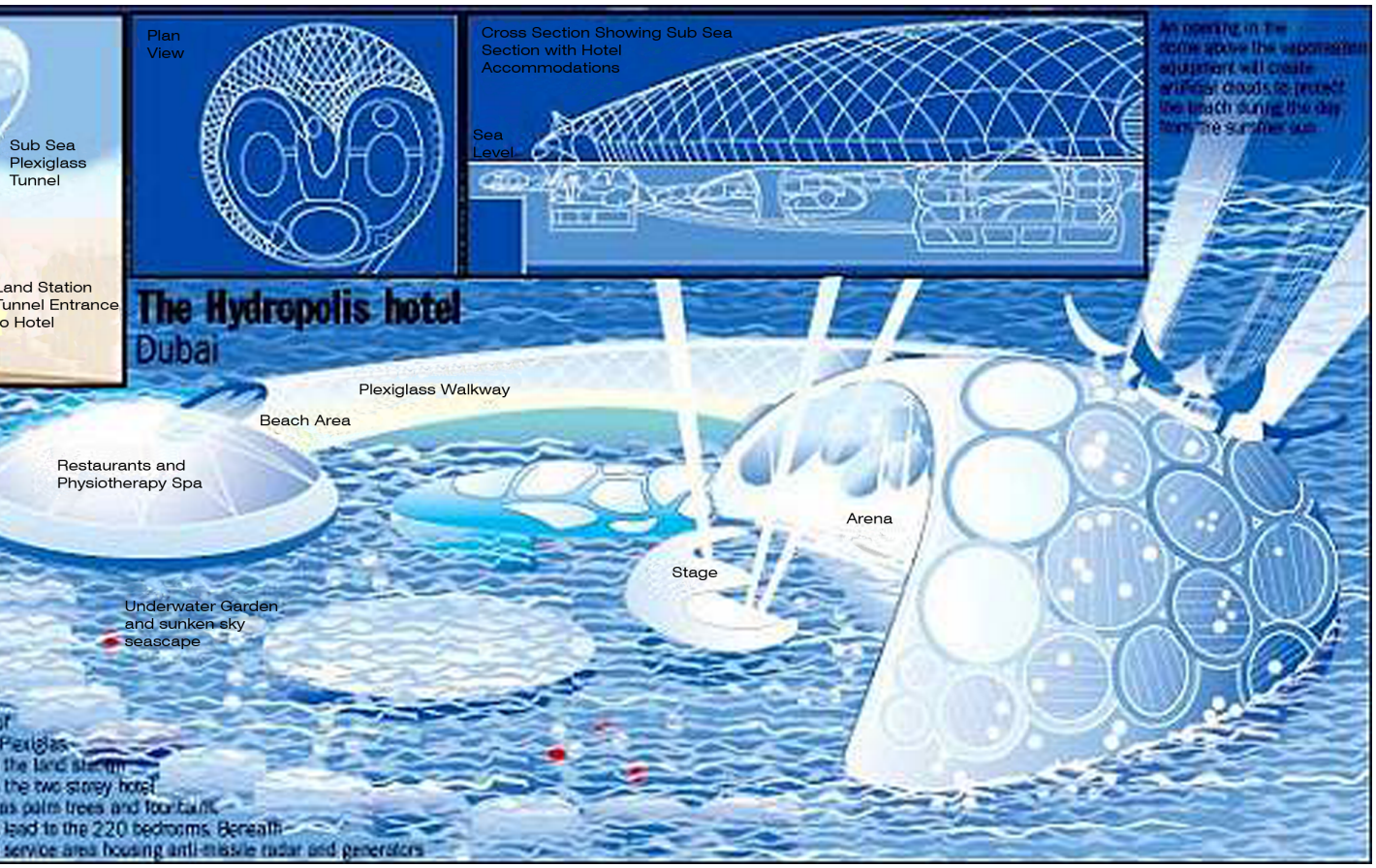


Commonality

This luxury resort community has a very intimate relationship with the water that surrounds it. This project also has a desire to express the connection that humans have with the water environment.

Uniqueness

Unlike so many other water projects which are just dreams on paper this project has crossed that barrier and will soon become a reality. The project is now halted because of the current global economic situation. The visitor is gradually brought into contact with the surrounding environment. The high rise tower that exists on land is your first glimpse of what lies beneath the waves. The train ride to the hotel completely immerses you and exposes you to the underwater world because it is completely transparent, like being in an aquarium exhibit. The hotel suites are neither floating on the surface nor anchored directly to the bottom, the entire structure seems to float on the water partially submerged like an iceberg.



Structure

The structure is composed of precast reinforced concrete and plexiglass panels that were manufactured in Germany and then shipped to Dubai. The assembly and construction will begin by placing floating piles on the location of the site. Construction will be taking place at the surface throughout the process. As the building starts to become more complete and get heavier, the mass will start to sink and drive the piles into the ocean floor.

Plan / Section

The connection of all three parts is much easier to determine in plan view and looks very organic in the connection of the three parts. The interrelationship of spaces within the individual components is easily identifiable in the section. The relative size of the space can be understood in section and the plan will relate the space within the context of the other space

Hierarchy

The hierarchy of space can be represented with the level of exposure to water. On the surface of the water is where all of the public space is located, where you can have large expansive views. Underneath the surface, in the tunnel and hotel suites the spaces are very close and intimate. The tunnel is a different space because of the more open view, so it is not quite as intimate and private as the hotel suites.

Natural Light

There is a large abundance of natural light in all three components of this large complex. In the land tower the skin is completely glazed to allow for unobstructed views of the seascape. In the translucent train tunnel the ambient sunlight that penetrates into the water will be visible. The tunnel is only a maximum depth of 20 meters where a large amount of sunlight is still not absorbed by the water. Inside the hotel, all of the exterior walls of the suites have large circular plexiglass walls that are like large port holes and again allow for the light from the exterior to enter.

Massing

The land tower is a singular solid mass that rises vertically from the earth. It has a very smooth and aerodynamic appeal. The tunnel is a circular tube that has been engineered with the curvature of the tube to aid in the dissemination of the pressure forces exerted by the surrounding water. The hotel itself is also a curvilinear shape that was also designed to withstand the forces of water pressure. On the interior are two circular void shapes.

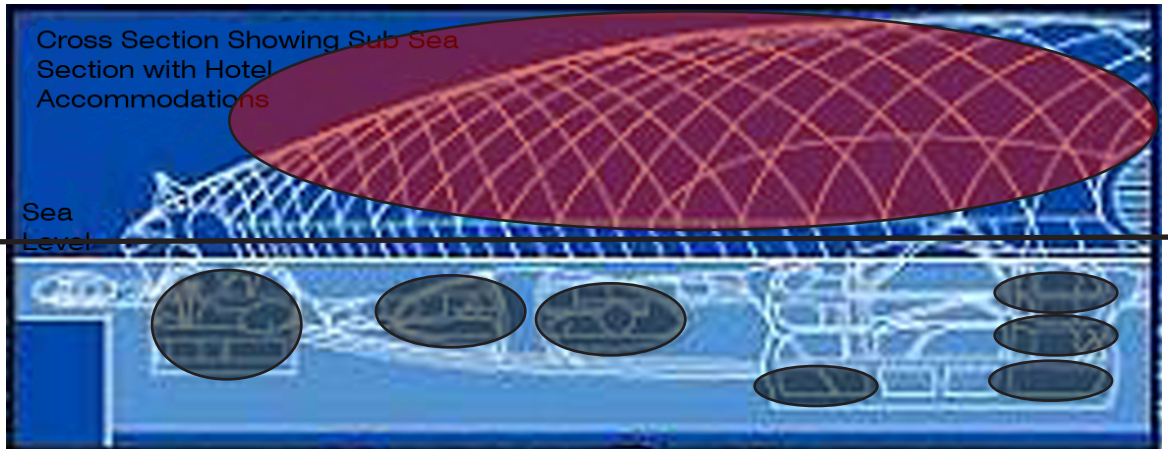
Circulation to Space

The spaces within are large open usable spaces that can be only visually related to each other. There is no flow of one space within another. A circulation corridor that is only as large as it needs to be will transport the visitor from one space to another.

Geometry

The geometry of the structure is a figure eight inscribed in a circle. The curves are designed to minimize the effect of water pressure and to maximize the ability of the resort to survive the occasional typhoon that could pass through the area.

The water marks a line of demarcation within the structure. The spaces that exist above the water line are very large and open and below that line the there are many much smaller individualized spaces that same space



II. Amphibious 1000

Project Type: Semi Submerged Luxury Hotel and Resort

Architect: Giancarlo Zema Design Group

Location: Qatar

Distinguishing Characteristics

It is the first semi submerged luxury hotel. The project will extend 1 Km into the sea. Four semi-submerged hotels, each offering 75 luxury suites, will be located in the sea section of the resort. The organization and form of the complex is said to resemble a creature crawling from the sea. The land area is a compacted city core that supplies all infrastructure needs. The floating suites have a submerged portion that is made of acrylic panels and fitted with a reflective lighting system to allow guests to admire the marine environment at all times of day. Each of the suites generates it own energy using solar panels on the roof. It is possible to explore areas of the coast employing the Trilobis eco-yachts (Zema, 2008).

Existing Program Elements

On Land

Exhibition Rooms with aquariums along the edges of a corridor leading to an underwater observatory station

Residential Buildings

Fitness Area

Theater with retractable roof for hosting open air shows

Interactive Museum of Marine Life

Marina

Service Core

Revolving restaurant

Viewing Platform

A green bridge connects the mainland structures to the floating area.

At Sea

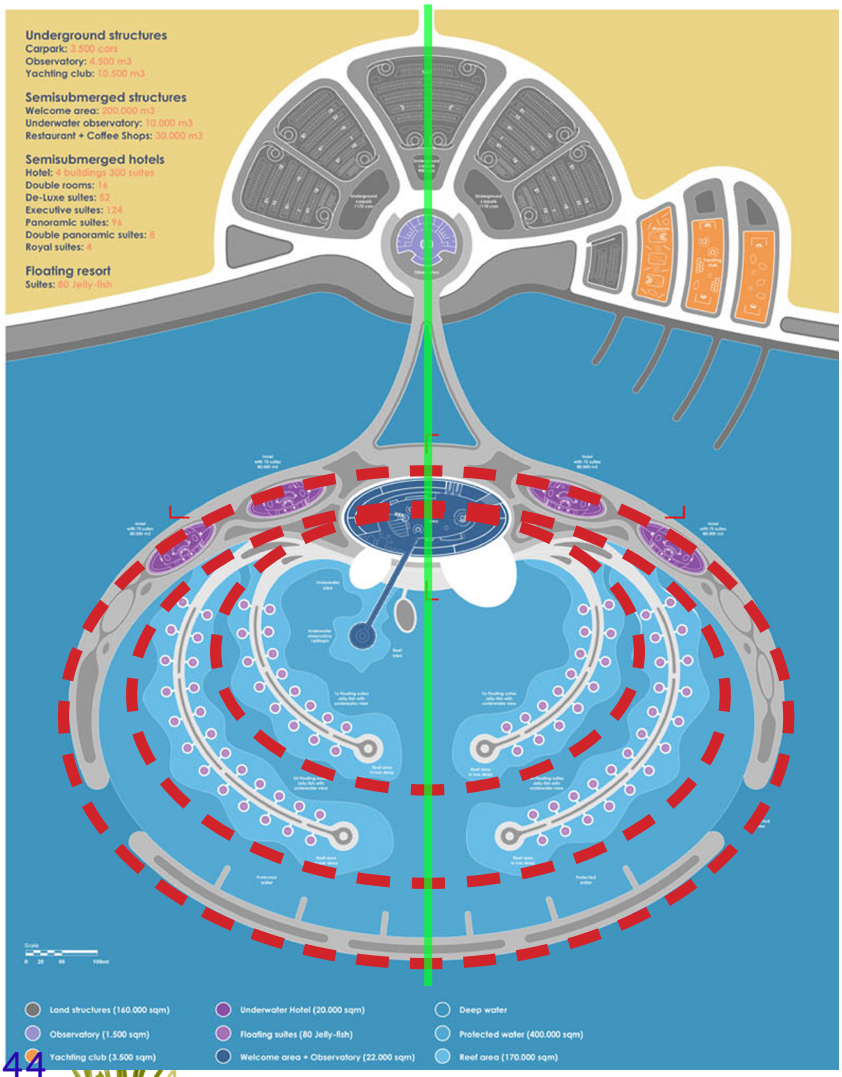
Four Luxury Hotels on large arm. Halls of hotels are submerged 10 m. Below sea. Four piers inside the artificial harbor. 20 floating suites are anchored to each pier. The suites are Jellyfish 45 structures. They are floating residential units designed by the Zema Design Group in 2003. Each suite is 50 m. In diameter and can accommodate six to eight beds.

Commonalities

Like some many of the current radical proposals, this project comes out of the Middle East. Similarly to the Hydropolis it is composed of a land based area as well as a water based area.

Uniqueness

This project is composed of many individual pieces that in the event of a storm could simply lift up the anchors and float away to a safe location. The land complex also goes into the detail of incorporating water ponds into all the public gathering spaces so the public never loses the connection to water.



Structure

The land based portion of the development is constructed with concrete and steel construction with glass on the interior spaces of the large courtyards. The structure protruding into the water is simply a pier construction that has been expanded to allow thousands of people to use it. The suites are made of aluminum and glass and are completely free standing from the pier structure. The outer ring of the water complex acts like a break wall to ensure calm seas within the complex.

Plan to Section

The plan is organized around a radial pattern. This pattern has to foci, o
on land and one in the water. The spaces that the elements are arranged arou
are the most important public functions. The observation tower is the center of
land development and the large welcome area is the center for the water hote

Hierarchy

The radial pattern of these structures always implicitly creates hierarchy
the object or space that is being radiated from has a higher importance than th
outlying structures. In this instance the closer to land you are the more public
the space becomes. The relative size of the four hotels In comparison to the
individual units create a hierarchy. The land based structures are the largest
because it brings you to them first.

Natural Light

Being on the coast exposes you to harsh natural light. The individual su
have large overhangs covering the exterior balconies, but the other structures
have no exterior protection from natural light other than the glass itself which i
electrochemical and can adapt to changing light levels by changing its opacity
(Zema, 2008).

Massing

The onshore masses are very narrow and have large interior voids to create public courtyards complete with water features to keep things col. The spaces on the water are very solid without many transition spaces between exterior and interior space. Each space is very isolated from each other.

Circulation to space

The circulation and space are completely separated from each other. The space is just an object that is placed in this long ocean front promenade that is there for people to stop and rest if they need it. The amount of circulation space is much greater than the amount of visible inhabitable space. This might be because some of the inhabitable space is below water.

Geometry

The geometry is based on curvilinear lines that are used to mark the boundaries of the resort complex. The spaces are of round or elliptical geometric shape, almost as if they were objects that had been smoothed by the erosion of the waves.

Symmetry to Balance

The axis road from land brings you in along the main axis along which the plan is symmetrical. The land structures prevent the visitor from realizing this at this point, but once they reach the shoreline it becomes apparent that symmetry exists. The hotels are equally spaced on each side of the welcome center, which give it a prominent location in the site. The semicircular piers jutting out into the ocean are equally proportioned and the repetition of the floating units arrayed along them emphasize this fact.

III. Lily Pad: A Floating Ecopolis

Project Type: Floating Ocean City

Architect: Vincent Callebaut

Start/ Completion:

Location: Anywhere

Size: accommodates a population of 50,000

Distinguishing Characteristics

The goal of this development community is to create a harmonious coexistence between humans and nature. It is designed to be amphibious, some areas are submerged under the waves and other areas are terrestrial. An artificial lagoon is centralized in the design. This lagoon is used to collect and purify rainwater. The design is divided into three marinas and three artificial mountains. The mountains function as ecological niches, aquaculture fields and biologic corridors Each mountain supports a different function of work, entertainment or commerce. All of the surfaces above the waters surface are covered with a stratum of plants. The refugees live within the mountain structure. The structure is unique because it is a net producer of energy with zero carbon emissions. All energy is created using renewable systems like solar, thermal and photovoltaic energies, wind energy, hydraulic, tidal power station, osmotic energies, phytopurification, biomass.(Callebaut, 2009)

Existing Program Elements

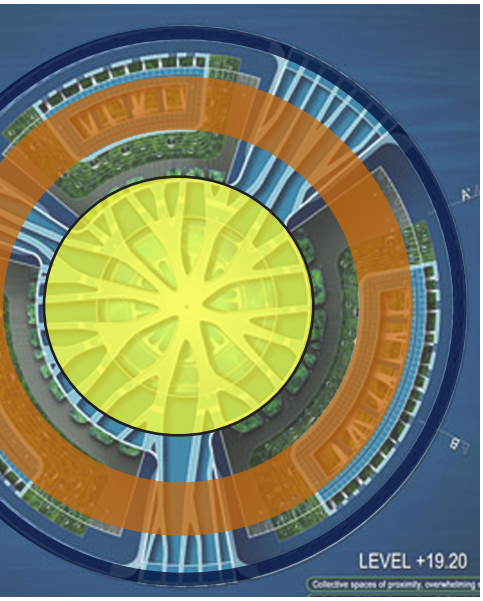
- 3 Marinas
- 1 lagoon
- 3 ecological mountains
  - 1 devoted to work
  - 1 devoted to entertainment
- Living Quarters in the bubble below the surface.

Residential units

This structure is similar to the other case studies because it creates a connection with nature, however this community does it in a more holistic manner.

This case development is completely autonomous. It produces it own energy and food and it has no supports anchoring it to the ocean floor. The structure also collects a source of water for use.

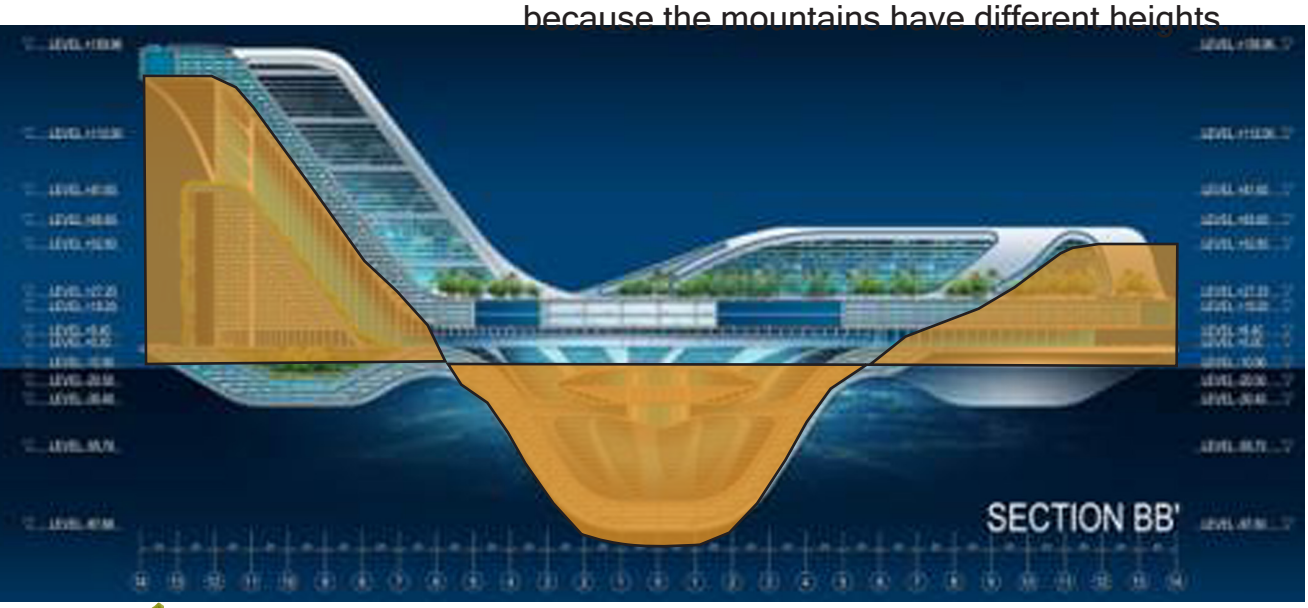
Structure

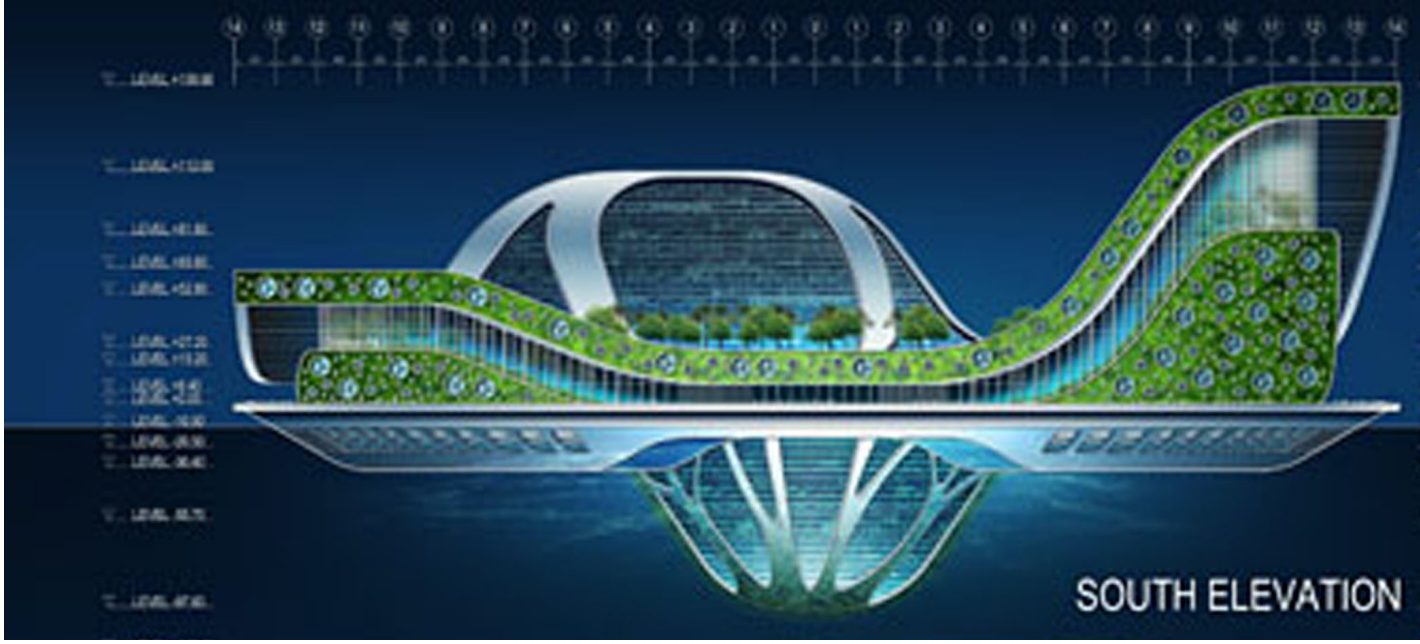


The structure is directly inspired from an amazonian lily pad. The structure floats above the main deck. The structure is covered by a double skin made of polyester fibers coated with titanium dioxide. When it reacts with ultraviolet light it is enabled to absorb pollutants in the atmosphere by catalytic effect. The lagoon is totally immersed below sea level to act as a ballast for the structure.

Plan to Section

There is a slight inverse relationship between the plan and section that is created by the central lagoon. In all other aspects the plan and section relationship is proportional because the three mountains are the main component that houses all functions within. A slight variation exists because the mountains have different heights.



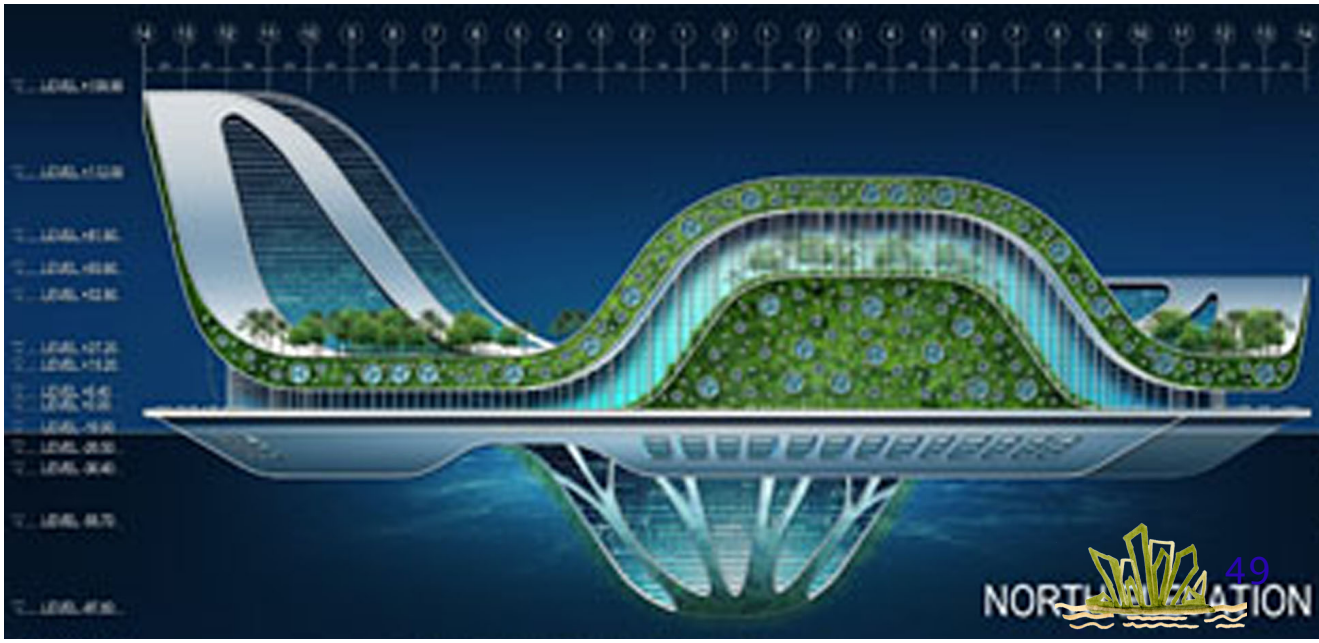


Hierarchy

This structure has a round shape and a centralized organization of space. The importance of water is implicitly expressed by placing it at the central focus, this is also for functional reasons. The design is very introspective, with the three mountains concentrating the views and energy of the community towards the center. All spaces are organized in concentric rings around the central lagoon. The spaces that need access to potable water most are the ones closest to the center, like the residences.

Natural Light

The natural light that exists out in the open ocean is powerful and glare is an important issue. In order for light to be useful, it must first be diffused or filtered in some way. The plantings that grow on the exterior of the structure accomplish this before allowing the sunlight to penetrate into the interior functions of the mountains. The lagoon in the center is also a key to reflect into the spaces that are on the base platform. This light would have too much glare and would need to be screened before it could be used.



Massing

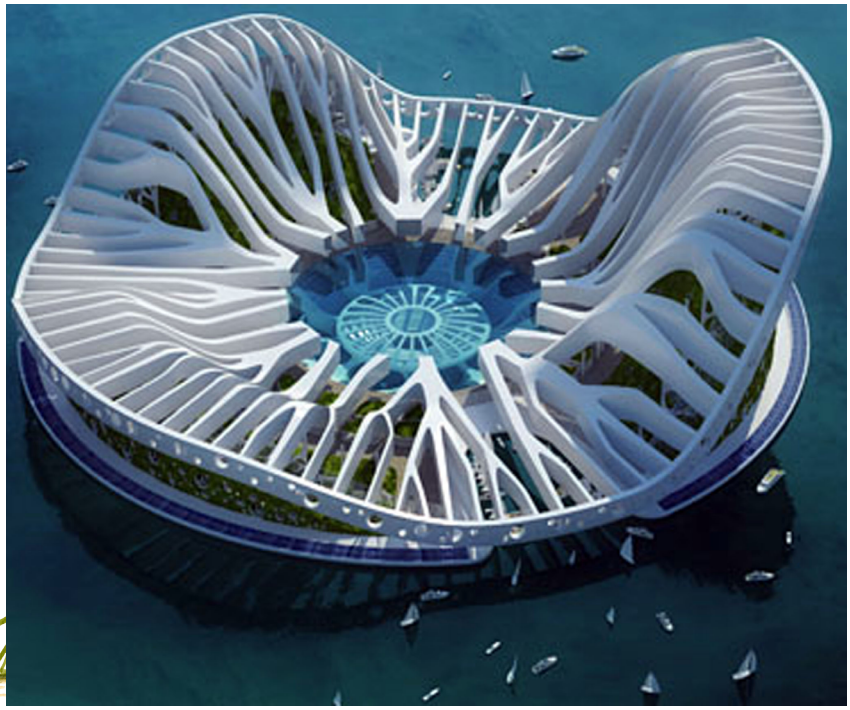
There are three main masses that are on the perimeter of this round platform structure. A void is located at the center of this structure. There are smaller masses that exist beneath the larger mountain structure that can be seen in elevation. A void separates the two masses and allows for daylight penetration.

Circulation to Space

The circulation on the entry platform level is straight forward and directs you to the central area or pathways that lead into the large structures that follow a circular arc that relates to the central lagoon. Entering into the space within the mountain opens up a new maze of small circulation pathways that lead to all of the separate spaces that are provided within the structure.

Geometry

The basic geometry that this structure is based on is the circle. It is very evident in plan and can be seen in elevation in the circular openings of the wind turbines. The other curves that are creating the form of the mountains are very smooth and flowing. The shape of the central lagoon is parabolic in shape.



Typological Research Summary

In order to be able to further develop my project, I must first look at the precedents that have been laid down before me. I chose to research large scale hotel and resort complexes, in particular those that had a water theme and had at least one portion of the design submerged beneath the sea. These resorts provide a wide variety of mixed uses in one concentrated area in order to create a space that everyone will at least enjoy a part of. The resorts have their goals set on making monetary profits and because of this they will examine all possibilities of creating space that can be used effectively by its guests.

The specific cases that I have chosen to examine are the Crescent-Hydropolis Resort in Dubai, the Amphibious 1000 in Qatar, and the Lily Pad which has no permanent port of call. In researching these proposals for design, none of which have yet been built, I was interested in examining how each one related itself to the water and how its visitors were given opportunities to physically interact with and learn about the existing local marine environment.

In my analysis of all the cases it is apparent to me that although the idea of a floating community living in the ocean has been around for several decades, the technologies needed to make it economically feasible are lagging behind. Each of these designs was well planned spatially. As I could easily envision these resort communities being used by the thousands of people that the architects have predicted would be using them. Each of the structures had flawless exterior finishes that were smooth and aerodynamic. These formal decisions were generated by the impact of the site exerting its force on the buildings, the forces of pressure exerted by water are much greater than air because of its greater density. This was also a reason for the common material choices that were strong and durable that were impervious to water.

In my analysis I focused on the Lily Pad design because it proved to me that it was capable of being completely autonomous from land resources once it was placed in the water. This was a representation of successful implementation of my design concept behind the theoretical premise. The ability to produce all the necessary energy requirements and provide all of the basic needs drawing on all the resources from the water.

The other two cases had elements which were completely exposed to water, however, they had a direct connection to land via a tunnel or a pier. The program elements of these structures were divided between being sited on dry land or in the water. These two projects also had structural elements that anchored it to the ocean floor. An anchoring system is crucial to this thesis because I am aware that the inhabitants of my community will be displaced from their homes and they will not want to leave that location.

It is obvious that these are resort communities and their habitation will only be temporary. They are offering the novel experience of sleeping with the fishes and living to tell about it. This experience doesn't come without a price, thus it is perceived that this is reserved for the extremely wealthy individuals. This is exactly the opposite of what I plan to accomplish with my development because many of the people who will be evacuated from cities that have gone under will have nothing, they would be refugees.

The Hydropolis Hotel had began the construction process, but it was now stalled because of the lack of finances, like so many other projects that are struggling to finish in this economic situation. This is the only case that I came across that had even gone beyond an initial proposal for a design competition. The client for this luxurious hotel is the royal sheikh. Dubai is one of the only places where a project like this might get off the ground and that's exactly why the architect proposed it there. Dubai has seen many incredibly unbelievable structures get built in the last five years, but now the building boom is slowing.

The Amphibious 1000 complex investigated the possibility of each individual having separate living quarters than would allow greater privacy. This might work in a relatively small luxury resort complex, but it would not translate well into a large scale community. It is very similar to what has been happening for years around U.S. metropolises with urban sprawl. Everybody has their own individual house that is separate from it surroundings. This urbanization plan is a mind-set that needs to be washed away if we are going to be successful in creating sustainable and resilient communities for the future.

The City of New Orleans

Permanent European settlement was begun by France almost 200 years after the Spanish had entered the area. Robert Cavelier, Sieur de La Salle explored the Mississippi downstream to its mouth, and he claimed the entire drainage basin for France in 1682. Establishing the first permanent settlement in the Louisiana Territory at Natchitoches in 1714. Colonization proceeded under the direction of Pierre Le Moyne, Sieur d' IBERVILLE and his brother, Jean Baptiste Le Moyne, Sieur de BIENVILLE.

The early history of the colony is a tragic one, as the first settlers were ill-suited to the rigors of frontier life. In 1717, France granted a monopoly on commerce to John Law in order to promote development of the territory. His mississippi scheme was designed to entice investment in what he claimed was a land of fabulous mineral wealth. The scheme fell apart in 1720, with no financial rewards to the investors, but the territory gained population as a result of Law's promotion. German peasants from the Upper Rhine area contributed to the betterment of the region when they began to settle land upstream from New Orleans in the 1720s.

Louisiana became a French crown colony in 1731. Crops, grown on plantations, included indigo, rice, and tobacco; trade was primarily by water, and the few roads ran along the levees. In 1762, Louisiana was ceded to Spain as a result of the French and Indian War, and Great Britain gained control of Florida, which extended to the east bank of the Mississippi. At the same time, Acadians (Cajuns), driven from Nova Scotia by the British, began migrating to Louisiana. The Acadians settled in the eastern prairies around the present site of Saint Martinville and later along the Lower Mississippi and Bayou Lafourche.

The Spanish made feeble attempts to offset the growing French population, but were eventually absorbed themselves. In 1800 they returned Louisiana to France by the Treaty of San Ildefonso. Although Napoleon I originally intended to establish a new empire in America, he sold Louisiana to the United States in 1803. The $15-million Louisiana-Purchase represented about 4 cents an acre. The native Creole population and the American newcomers resolved some of their conflicts by living in different areas of the city. Eventually, the Americans concentrated their numbers in new uptown (upriver of Canal Street) neighborhoods. For a certain period (1836-1852), they even ran separate municipal governments to avoid severe political, economic and cultural clashes. Evidence of this early cleavage still survives in the city's oldest quarters.

Louisiana became the 18th state on April 12, 1812. During the War Of 1812, British ships moved up the Mississippi River to New Orleans. On Jan. 8, 1815, Gen. Andrew Jackson's troops defeated the British at New Orleans. The battle ended 15 days after the Treaty of Ghent was signed, ending the war. Jean lafitte aided the American cause.

By 1860 the population exceeded 700,000, and a class system based on plantations with slave labor had developed. At the same time, yeoman farmers were practicing subsistence farming--Anglo-Saxons in the hills and Acadians to the south. During the Civil War, the importance of the port of New Orleans and Louisiana's strategic position on the Mississippi made it an early Union target; the state's economy was devastated. Streams had been the major travel routes since the beginning of settlement. By the 1860 peak of steamboat travel, nearly all of the state could be reached by these craft.

For much of the period since World War II, the petroleum industry sparked the development of the state (with the notable exception of the oil slump that took place during the mid-1980s). By the 1960s, Louisiana had become a major space-age industrial center; as industry grew, the state became urbanized. Urgent environmental problems of the 1980s included industrial pollution, disposal of toxic waste, and erosion of the coastline (Austin, 2006).

Patterns of Human Settlement and Their Ecological Consequences.

The first people who lived on this land of the Americas where the Native Americans. Their social belief was that the land belonged to no one. This caused them to create as little disturbance as possible. They believed that they had no rights to change the earth in order to benefit from it, nor was their a need for such action (Russell, 19997).

The other settlers that had an impact on this land were the immigrants who came over from Europe. The Spanish, the French, and the English were all followers of the Christian faith. Their faith had told them that the earth was created by god to be used wisely by man to benefit him. This belief was the driving force behind their desire to claim rights to their own parcels of land. Each settler set out to change and manipulate the earth that he claimed in a way that he thought would most benefit him. Their beliefs also carried with them the idea that if you were not working the land you had no right to it, and someone else who would use it better could come in and take it, by force if necessary (Russell, 1997).

The European view of land as a commodity to be profited from had lasting effects on the shape of the natural ecologies. The political boundary lines set by the public officials did not consider the natural elements of topography, water rights, or location of woodlots that existed in the land that was being divided. A federal ordinance of 1785 created the General Land Office Survey system. The system imposed the rational rectilinear grid survey on the land. This was developed under the current philosophies of the enlightenment (Russell, 1997). Each grid comprised a one square mile area that was later split into quarters for sale to immigrants wanting land of their own. This survey of the country transformed the wilderness into a familiar geometry. The system also created a pattern of settlement that was very different from what would have came from natural spreading across the land. The patchwork development had no relation to the quality of the natural resources present on the land (Russell, 1997).

The government regulations in place have a lasting effect on the development of natural ecologies. Land use regulations were driven by adequate land for subsistence of everyone and then in the interest of protecting a specific valuable resource with no consideration about the preservation of rare and diverse wildlife species or habitats. Existing woodlots that are remnants of unused and abandoned land are all rectilinear or square and are fairly evenly distributed across the landscape (Russell, 1997).

Settlement populations sprang up in high density along navigable water ways because of it low effort means of transportation. Transportation and trade allowed for areas to specialize in a different commodity which segregated the ecologies located along the rivers. The trading industry also led to transportation of species to areas where they are not naturally native to or could not have migrated to. This sometimes had devastating effects to the local biomes totally wiping out a native species (Russell, 1997).

Urban development leads to a divorced connection with the natural world because of reduced subsistence. Those who dwell in cities are little aware of their dependence on the produce of the land. Large concentrations of people in cities create new demands on the land, which require more intensification of use in order for supply to meet demand. When a use changes the former use leaves behind lasting visible disruptions on the native ecosystem. As a city spreads it consumes fertile soils existing on its periphery that were used to provide necessities. This consequently decreases the potential productivity of remaining land available for agricultural use. Many large metropolises are located in areas along rivers inside the floodplain and others are extending over dried up marshland (Russell, 1997).

Coastal cities are often forced to rely on water sources at a great distance from their locale because their abundant water source becomes contaminated by industry pollution or saltwater intrusion (Russell, 1997).

Coastal Exploitation: History of Industry

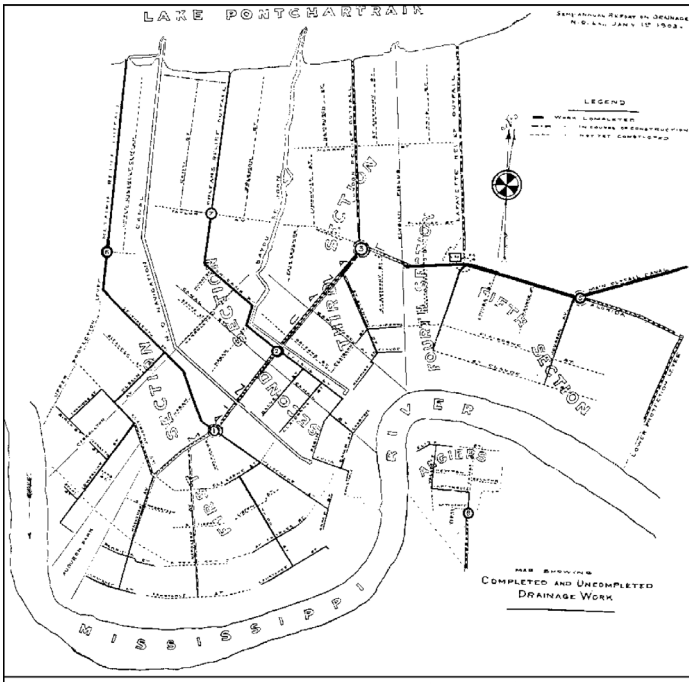
The agricultural production and industrial refinement of sugar cane was the first great industry to proliferate along the coastal area of Louisiana. Following the sugar was the logging industry coming after the cypress trees. Large private landowners were in the business of logging the virgin cypress trees from their property and exporting them to the global market. By the 1930s little more than one percent of the cypress forests remained and the industry all but disappeared. The mark left on the land was a spiderweb like series of trails left behind from dragging the trees out of the swamp. Severance taxes were created and implemented after the industry had moved out in a response to the minimal economic gains received by the state for the exhaustion of this valuable timber resource.

Shrimping was soon the major industry for the region. Many people from all over the nation came to Louisiana to purchase or build boats in order to stake a claim in the large numbers of jumbo shrimp found in the brackish coastal waters. In 1921 the state of Louisiana issued the first coastal zone oil lease. During 1934-36 the entire industry was restructuring itself to survive the harsh conditions of extracting petroleum in the Gulf of Mexico (Austin, 2006).

A flood in 1927 inundated 150,000 homes. Afterward billions of dollars were appropriated for the construction of levees to protect the lives of the 600,000 people affected by the flood. The levee construction eventually channeled the river along its entire length following plans developed by the Army Corps of Engineers begun in 1879 to prevent destructive floods.

History of New Orleans Drainage System

On February 6, 1893 the city council of New Orleans passed an ordinance recognizing that the drainage of the city was in extra ordinarily disastrous condition. The ordinance provided the means for conducting the necessary investigations to formulate a complete and comprehensive drainage system for the city. A topographic and hydrographic study were needed to proceed with engineering planning (ACE,2006). A plan was formulated for the removal of rainwater falling within the inhabited urban areas of the city and removal of ground water from saturated soils surrounding the city for building. The removal of this water had to be accomplished with the most economical arrangement of pumps that would perform efficiently.

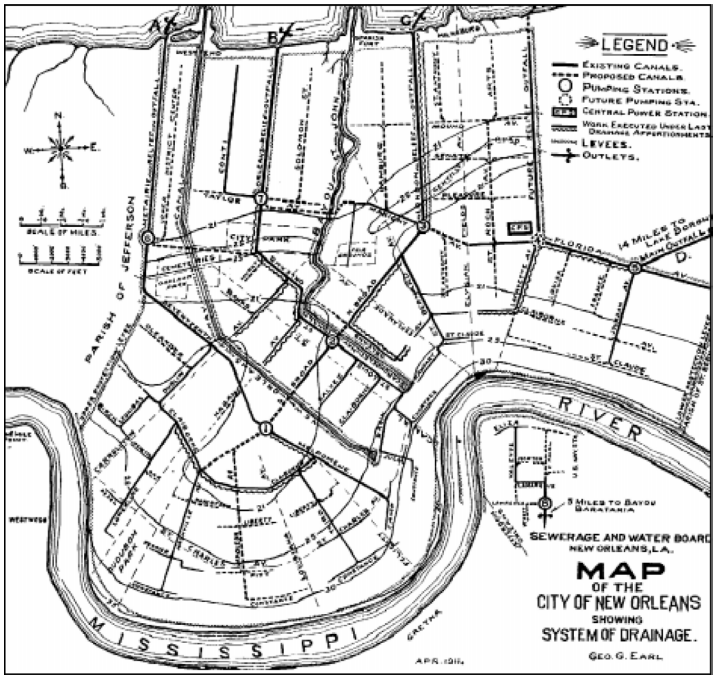


The very first plan that was accepted by the Drainage Advisory board and the Engineering committee was submitted in 1895, contained in it the location and design of eight mechanical pumping stations and canals to discharge the water out of the city. The total distance of all the canals was 95 miles, of that 30 miles was to be covered with wood planks. The total capacity of the drainage system equaled 8,327,000 gallons per minute. The city wide plan was created by the city engineer, L.W. Brown. In the beginning all the discharge from the pumps was drained into Lake Pontchartrain, this was halted for fear of pollution. The canals were created along Broadstreet, eventually delivering the water to lake Borgne. These canals could handle the daily requirements of the system, but an overflow system of canals needed to be designed in order to handle the violent rainstorms that came through the area. These canals were designed to divert all the water into Lake Pontchartrain because it would be far to costly to pump the excess volume of water all the way to Lake Borgne and it was deemed that storm water run off was not as polluted as municipal water.

Initial construction began in 1896. The plans have continually been modified and the original plan of 1895 has never existed as it was proposed. Pump stations number 4 and 8 were omitted from the initial construction by the Drainage Commission. Pump stations 1, 3, and 6 were not built in their originally proposed locations (ACE, 1996). In 1902 recommendations had been approved to improve the timber lining of existing canals, alter the discharge basin at Draining Pumping Stations Nos. 1 and 2, and modify the suction basin intake pipes at Draining Pumping Stations Nos. 6 and 7 (Sewerage and Water Board 1903b).

Albert Baldwin Wood was assistant manager of the pumping stations in 1902 and later became the manager of both the drainage pumping stations and the sewerage pumping stations. He was promoted to Mechanical Engineer in 1906 after he developed a dramatically superior drainage pumps that vastly increased the capacity of the New Orleans drainage system. In 1906, Wood responded to increased demands for pumping capacity, and developed a six-foot centrifugal drainage pump, the largest in the world at that time. A short time later, Wood invented flapgates, which prevented water from backing up in the system when the pumps were stopped. These flapgates became standard in drainage engineering (Enzweiler 1992:76).

In 1899, the New Orleans drainage system encompassed about 16,000 acres, with a drainage pumping capacity of 1,200 cubic feet per second (Sewerage and Water Board 1926). By 1905, the city drainage system served 22,000 acres, with 20 miles of lined and covered canals, three miles of wood lined canals, and 17 miles of open and unlined canals, plus many miles of pipelines and drains, and six east bank pumping stations were operating, with a drainage pumping capacity of 5,000 cubic feet per second. The system at this date represented about 44% of what was planned in 1895 (Sewerage and Water Board 1905:9; Sewerage and Water Board 1926). (ACE, 1996).



In 1910 it was evident that alterations needed to be made to the drainage plan to address the city's rapid development. The increase in housing and businesses as well as roads was creating large impervious surfaces that were causing an overwhelming of the drainage system. The recommendation to solve this problem was increased capacity of the drainage pumps. Specific recommendations were for the installation of new constant duty pumps with a 500 cubic feet per second capacity, doubling the size of the original centrifugal pumps.

Mr. A. B. Wood triumphed again when he developed the screw pump. A series of rigorous tests were performed on his conceptual idea and all proved successful. The screw pumps implemented at the pumping stations measured 12 feet in diameter, the largest in the world at that time. The city had 11 of these pumps built and installed. By September 1, 1914, the drainage system served about 35 square miles, and had cost $9.3 million ( ). In 1926 Wood designed a 14 ft. diameter pump and the city had constructed and installed 14 of them in the system. By 1970, the New Orleans Drainage system consisted of 167 miles of open and covered canals, 45 miles of pipelines, and 14 pumping stations with a capacity of 28,000 cubic feet per second. Pumping capacity reached 34,880 cfs by 1977 (The Consultant 1977:6). By the mid-1980s, the New Orleans drainage system had a primary storm water collection system consisting of 83 miles of covered canals, 57 miles of large pipelines, 83 miles of open canals, and 1258 miles of subsurface drain pipes, served by 18 large pumping stations and three smaller stations with a combined capacity of 22,500,000 gallons of water per minute (Sewerage and Water Board n.d.). Of the over one hundred pumps in New Orleans' drainage system in 1991, 48 of them are Wood designs (Ruth 1991). In 1992, the total pumping capacity

of the 22 New Orleans Drainage system pumping stations had reached 47,000 cubic feet per second (ACE, 1996).

History of floating structures

The emergence of rafts that could float on water and support a load introduced man to the possibilities of living on the water's surface instead of the land surface. The first floating residence was a simple straw raft with a straw hut centered on top of the raft. The next evolution of the house boat was made of stronger wood material. The industrial age brought the invention of steel to the building scene, and it was used in all of the building fields. Steel made the houseboats stronger and more resistent to damage, but the conditions afloat are very destructive. A houseboat made from wood or steel will need to make frequent trips to the boatyards for maintainence and repairs, usually every five years (Keunning, Olthius 2010). The invention of reinforced concrete has been instrumental in the houseboat and barge industry. The weathering resistance of the concrete has many benefits but it is much heavier than steel and polysytrene foam. Current bouyant foundation systems rely on combining concrete, steel, and hardened polystyrene (Keunning, Olthius 2010). This materials have been tested and proven through various applications from floating boat docks to floating roads.

New advancements in concrete technology that have helped concrete excel in the floating foundation are introducing new lighter weight materials as aggregate and other lightweight reinforcements. A possibility that is on the horizon is creating a concrete layer cake with layers of polystyrene sandwiched between layers of concrete. This creates the potential for create large slabs of floating foundation that could be formed to almost any shape and could support an entire city (Keunning, Olthius 2010).

The perfect floating platform is still out there to be created through the right combination of materials. The characteristics of the ideal floating foundation are easily identifiable.It is lightweight and easy to produce using a local materials that can be obtained cheaply. It is strong and will resist weather from salt or fresh water and can be easily shaped into large platforms without the use of other materials. An anthropomorphic analogy to the structure of the ideal floating foundation would be the structure of the human bone (Keunning, Olthius 2010).

Site Analysis

The city of New Orleans is most often misunderstood by an incorrect association with the rest of the United States. The general stereotype of New Orleans is that it is one of the poorest American port cities. In reality, the proper context of the city is that it is a Caribbean port city, and is one of the richest cities in that classification. It is a place that at first might not seem desirable. The city is a divided city which split along heritage lines based on the colonization of the city by both the French and Americans.

The boundaries within the city are very abrupt and distinctive. One side of the street is visibly a part of one district and the other side of the street will be recognizably different at the boundaries of all the districts in the city. The architecture can tell someone where he she is in the city. The famous French Quarter is the heart of the city not only because it is the oldest and has been least effected by the destructive power of severe storms that frequent the area, it is also the center of all tourist attractions.

The narrow streets provide just enough room for vehicular traffic in one direction. The sidewalks are also congested with tourists constantly moving about during all times of the day. The buildings are low to the ground, not being more than three stories in height. One never has to strain their neck in order to see the top of a building or to talk to someone perched on an upper level balcony overlooking the street. The roads and sidewalks are in a state of disrepair. They have cracked and heaved to create hills and valleys along with potholes. All of these things occur as a result of the differential settlement of the alluvial soils that the city rests on.

Looking down every block a person can get a view of the river no matter where he or she is because the city is so devoid of changes in topography. The river is what dominates the landscape and the built environment reflects that. The moist air carries the smells of nearby refineries processing sugar cane and crude oil. Mixed in among are the smells of food being prepared in the restaurants that are on all the corners and some in between. There are very few barriers to prevent sound travel which enables the noise of the freeway to be heard as a constant background noise. Occasionally the background noise is pierced by the blowing of a whistle coming from the boats preparing to dock in the harbor on the river. More often than not the sound of a band playing off in the distance will entice individual curiosity as the evening hours descend upon the city. I mentioned earlier that the streets are full of people but they are all very quiet and keeping to themselves. The relaxed conversations are taking place in the courtyards which are protected from the streets by building walls and are kept in the shade to provide comfort during the hot days of summer.

There is only one way to get out of the city to see the coast. Following the river the one hundred nineteen miles to the mouth of the Mississippi River is the best way to see how the city and the other communities in the area are dependant on the river and how they each respond to the dangers of living in such an area. When you are out on the coastal waters, even behind the barrier islands a person is fully exposed to the natural elements of sun and wind. The cool spray of the water and the slightly salty taste hint that a person is no longer near any organized civilization and that you are entering into a new ecosystem. The repetitive and monotonous nature of the waves make your view in all directions look the same. The only reference points are the numerous oil platforms that can be seen in all directions and the shoreline.

The sky is filled with silhouettes of birds floating on the ocean breezes, they remain silent until something catches their attention, either food or danger. Passing along the shoreline someone may be taken by surprise when a large white bird takes off from along the banks of a canal because someone invaded its territory or disrupted its hunt for food. The vast open space of the ocean takes away all notions of scale, making a single person feel very small and insignificant. The water is in control out here. The ocean has an intriguing split personality, at one moment it can be calm and peaceful and at other times it can have enough energy to destroy solid structures and wash away land features. The water color changes gradually from a dirty brown in the shallow turbid waters to a brilliant turquoise green near the edge of the continental shelf and when the ocean plunges deep into the basin the water turns a characteristic deep blue tone. The combination of the moisture and the cool sea breeze chills the body quickly. On the sea things are constantly moving; up and down and side- to - side. The only stationary objects are the oil platforms that dot the horizon. A persons body will be constantly responding to the motion to maintain balance and prohibit falling. After extended exposure to the cyclical motion the body will become numb to the minor adjustments that must continually be made. The temporary deafness experienced after the tanker ship blows their air horn to announce their arrival into a shipping lane, is very disruptive.

Qualitative

Existing Grids

Movement is based on the path of the river as it meanders towards the Gulf of Mexico. A grid has been established that begins at the river and moves outward. The pathways are either running parallel or perpendicular to the meandering river. The perpendicular arteries are terminated at the shores of Lake Pontchartrain. This means that all travel is directed towards and is shaped by a body of water.

Views and Vistas

The streets traveling perpendicular to the Mississippi River offer views of the river; however, the river can not be seen because it is hidden behind the levee walls that protect the city. The view of the hard concrete wall is softened by green climbing plants that have latched on to the wall. Looking through one of the Levee gates will offer a very small glimpse of the river. The only tall buildings in the city can be seen from almost every location and are a nice vista when framed by the buildings looking down a street of the French Quarter.

Materials

Rough textures of crumbling brick, concrete and asphalt dominate the human urban environment. Wood exteriors of homes create a homogenous feel to every residential block. They have an order of long horizontal lines that contrasts the brick which is broken into smaller sections. All of the building materials are of anthropomorphic scale, easily handled by people. Many of the materials are those that originate from clayey muddy soils like bricks.

Geometry

All of the structures that are supported along the river and in the ocean are constructed with foundations based on a triangular shape. Two vertical pillars are connected with horizontal beams that are tied together by diagonal cross bracing to keep things from shifting in the fluctuating water.

Light Quality

The reflective surface of the water causes a dangerous amount of glare which causes colors to be washed out and the shadows to be diminished and faded. The harsh light from the sun causes the colors of object to appear as a shade of white or blue. Wearing sunglasses or other dark eye protection is necessary to protect your eyes from the damage that the high intensity light can cause.

Shade/ Shadow

Exterior spaces are provided with half shade at all times of the day in response to the harsh sunlight that exists during the majority of the year. The shade provides a constant area of refuge that is used frequently by the residents. Public sidewalks are covered by a balcony on the upper levels of buildings that stretches all the way to the street. There are many buildings that have a fully glazed street facade that has large doors that are the entire height of the story and are centrally located. The large openings allow for ventilation and the glazing on either side allows light into the space and at least one row of window units is operable to assist with air flow through the space. The space is vented by large doors in the back of the building. The public squares are all planted with large shade trees along the perimeter of the square and smaller planting or open green space is located in the center.

Topography

The greatest elevation change across the entire city from the shores of Lake Pontchartrain to the banks of the Mississippi River is only 18 inches. Variations in the levels of the residential buildings only occur between the new storm surge resistant housing that is built on concrete masonry pillars that elevate it a whole storey above grade level. This creates a contrast to the other residential units that are sitting on grade. The highest level of topography exists in the most historic part of the city, the French Quarter, closest to the river. In order to expand the city beyond the natural ridge along the bank of the Mississippi River, the surrounding marsh land needed to be drained first. The loss of water caused the land to compact and subside to a level that is currently below sea level. This occurrence created a bowl shape that is rimmed by the major water features that define the city. The elevation change is not noticeable because it occurs over a five mile distance.

Built Features

Viewing from the site makes many things visible. There are countless numbers of platforms that protrude out of the ocean. The actual density of structures is very sparse but because there are no obstructions of the horizon on the site the visible area encompasses a ten mile radius. All of these platforms are used for some aspect of the off shore oil industry that exists in the Gulf of Mexico. A field of white poles that are arranged in a line which are marking the area of a submerged oyster bed are seen when looking towards the shoreline. The white poles catch the attention because they have all shifted to lean in different directions creating a diversity that an individual's mind knows was not there when the markers were first erected. The Shoreline is covered with a tall marsh grass and there are singular trees growing in isolated areas of the shoreline.

Water

Water is completely surrounding in all directions. At present the existing water is of brackish composition. As the sea level increases the water will develop higher salinity. This will completely change the current ecosystem and displace many varieties of flora, fauna, and people. The water appears to be stable but the currents are causing a movement below the surface. This movement is only perceptible when using a reference point that is stationary and anchored to the ocean floor, or being submerged in the ocean. There exists a high level of turbidity near shorelines and barrier islands which is a result of the traffic corridors that have been dredged out for cargo ships to navigate to the mouth of the Mississippi River. The water is truly pure and clean unless you venture into the area of the Gulf that was affected by the most recent oil drilling leak.

Wind

There are no features present, either natural or man made, that exist in sufficient densities to affect the flow of the wind. The flow of wind had a great impact on the disturbance and movement in the vertical direction that is experienced on the ocean because of an increase in wave height. Surrounding structures are designed to be minimally affected by forces of wind by allowing the wind to pass through and present the smallest cross sectional area perpendicular to the direction of predominant winds in the area. Winds are strongest during the early afternoon hours when temperature differences are at their highest. Hurricane season occurs in late Summer and extends through the end of Fall.

Human Characteristics

The most prominent human feature are the many hundreds of oil platforms that can be seen dotting the horizon no matter where you look. There are never any people that can be seen working on the outside of the rigs from distances of more than a few hundred yards. On average there are no signs. There is a constant presence of cargo ships that travel through this waterway.

Distress

There is never a constant sign of environmental distress, but there is a high probability that something will go wrong on one of the oil rigs or cargo ships that will cause the contents to leak out disrupt the natural ecosystem.

Quantitative

Soils

Agricultural Classifications

Two Soil Types Present

Landscape: Brackish Marshes
Order: Histols
Sub Order: Saprists
Great Group: Haplosaprists
Sub Group: Terric
Series: Clovelly
Engineering Classification: Muck
Parent Material: Organic over clayey sediments
Drainage: Very Poor
Permeability: Very Slow

Landscape: Saltwater Marshes
Order: Histols
Sub Order: Saprists
Great Group: Haplosaprists
Sub Group: Typic
Series: Lafitte
Engineering Classification: Muck
Parent Material: Organic over clayey sediments
Drainage: Very Poor
Permeability: Rapid (Drained)

LSU Agricutural Center Research and Extension. (2008)

Water Table

The water level in these soils exists in a range between six inches below the surface to five feet above the surface.

Utilities

All utilities are transported underground. Except for electrical power that is transferred by cables. Electric cables are also present to power the trolleys.

Vehicular Traffic

There are heavy traffic corridors that slice through the city at right angles to each other, HWY 10 traveling North and south through the city and I-90 traveling East and West through the city following the course of the river. Outside of the main arteries the streets are very narrow, one way streets are common place. Parking along streets can restrict the ability of vehicles to pass each other on two way streets. Bicycles are seen sharing the roads with the motor vehicles. Trolleys and buses constitute a strong public transportation system. The Trolleys have tracks that travel down existing roads that are used by other vehicles.

Pedestrian Traffic

There is a well developed promenade along the bank of the Mississippi River where people can be seen in the morning getting their daily exercise. People walk along the river at all times of the day. The major markets also are located along the river front. Beyond the areas of the French Quarter and Central Business District the pedestrian travel dramatically decreases.

Topographic Survey

The Slopes that exist are less than 1% across the entire city. This means that drainage of water has been a concern for all buildings in this area. Most of the areas within the city are paved except for a few localized green squares that always have paved walkways meandering through them. Any water that falls within the city has to be mechanically pumped out of the city and drained into the Mississippi River or Lake Pontchartrain.

Plant Cover

The shorelines are completely covered with gasses that have grown to be several feet tall. Providing cover to hide almost all animals that are dependent on this ecosystem. Natural vegetation has to be able to deal with the high water table that will make the roots of plants submerged in water. There is no vegetation growing in the open ocean. On land the conditions are right for almost all vegetation to flourish. In the home it has to be well maintained otherwise it will quickly become over grown.

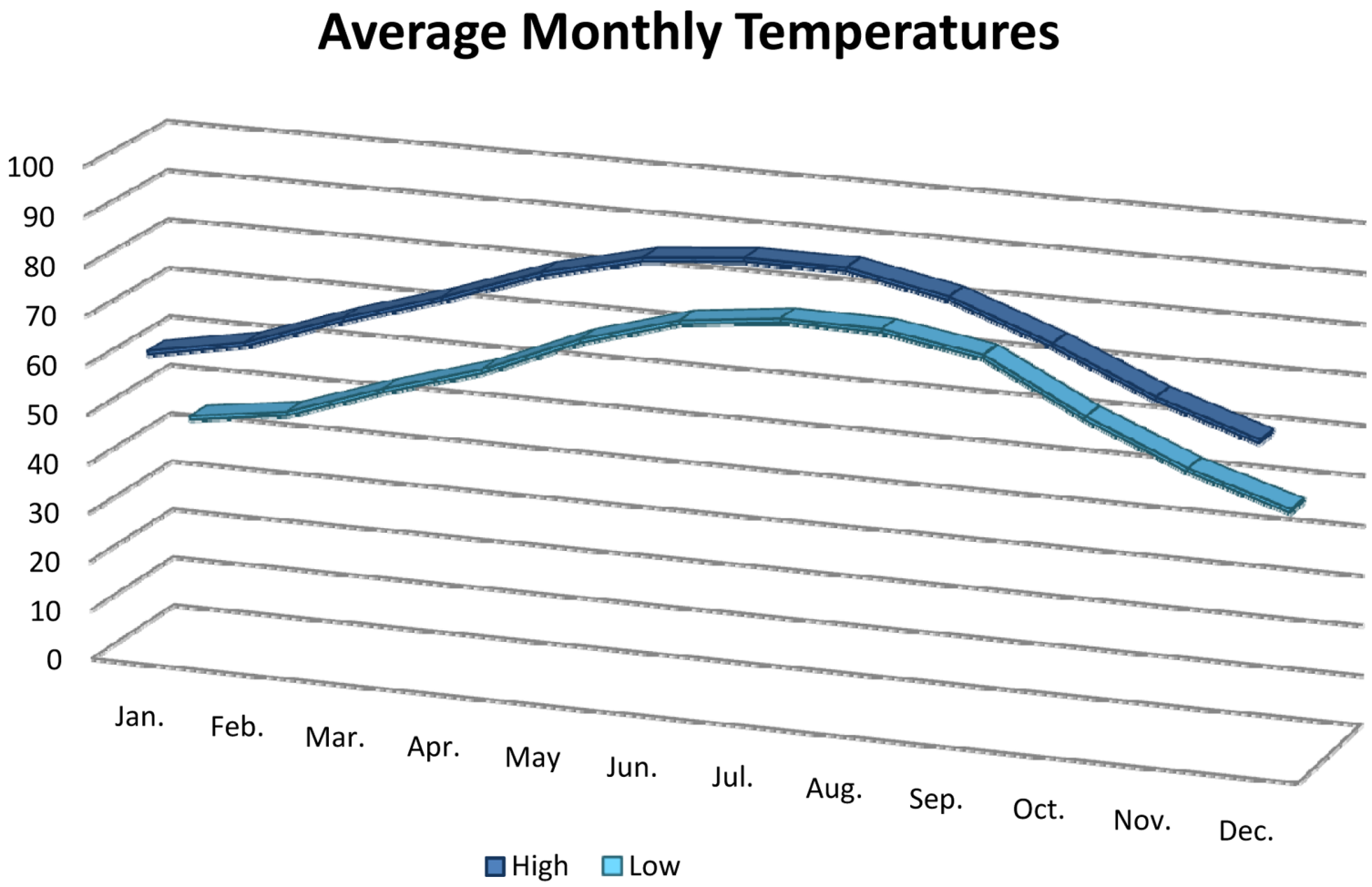
Natural Coastal Plants:

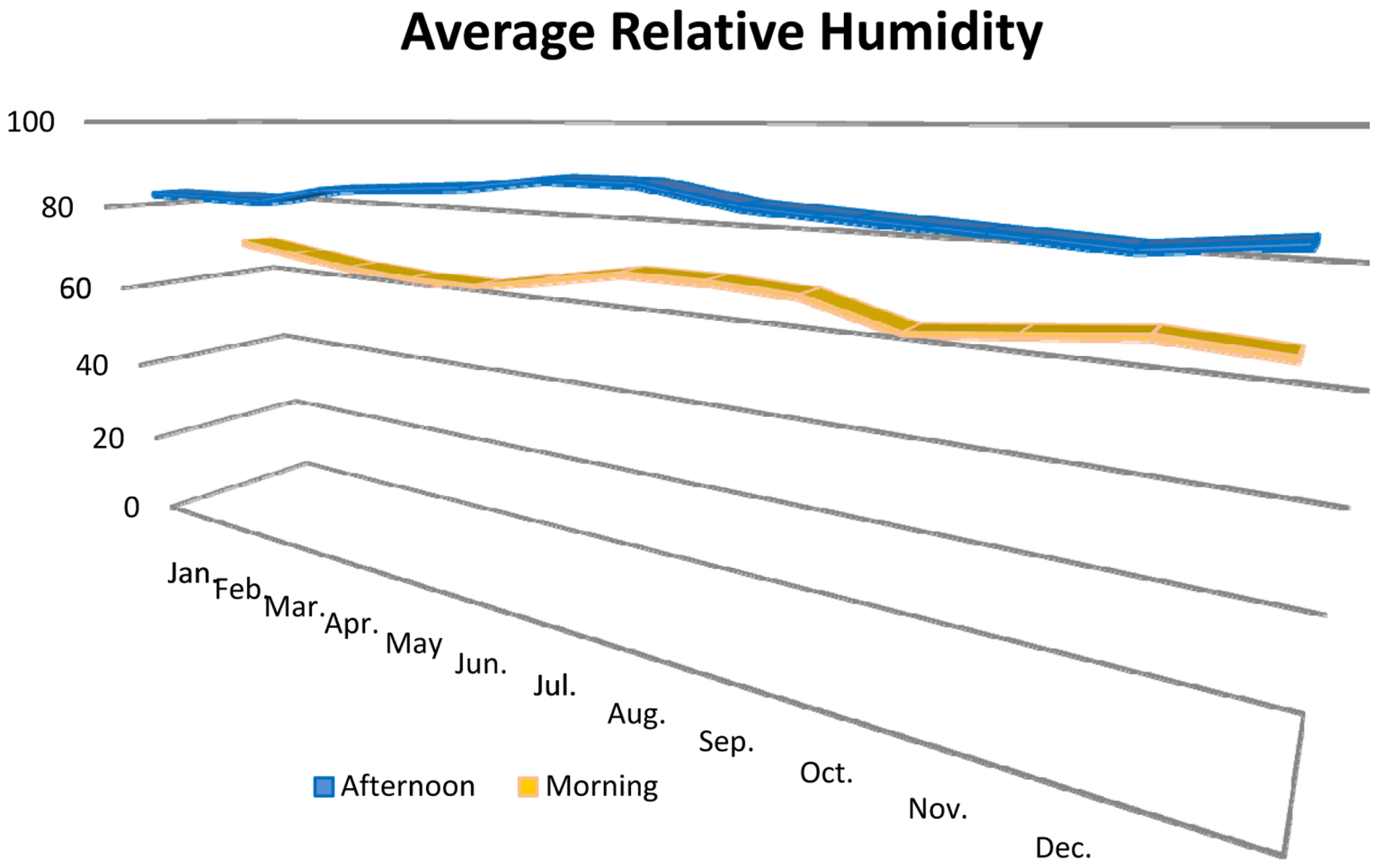
- Marshhay Cordgrass
- Onely Bullrush
- Big Cordgrass
- Dwarf Spikes Hedge
- Marsh Morning Glory
- Widgeongrass
- Sumpweed

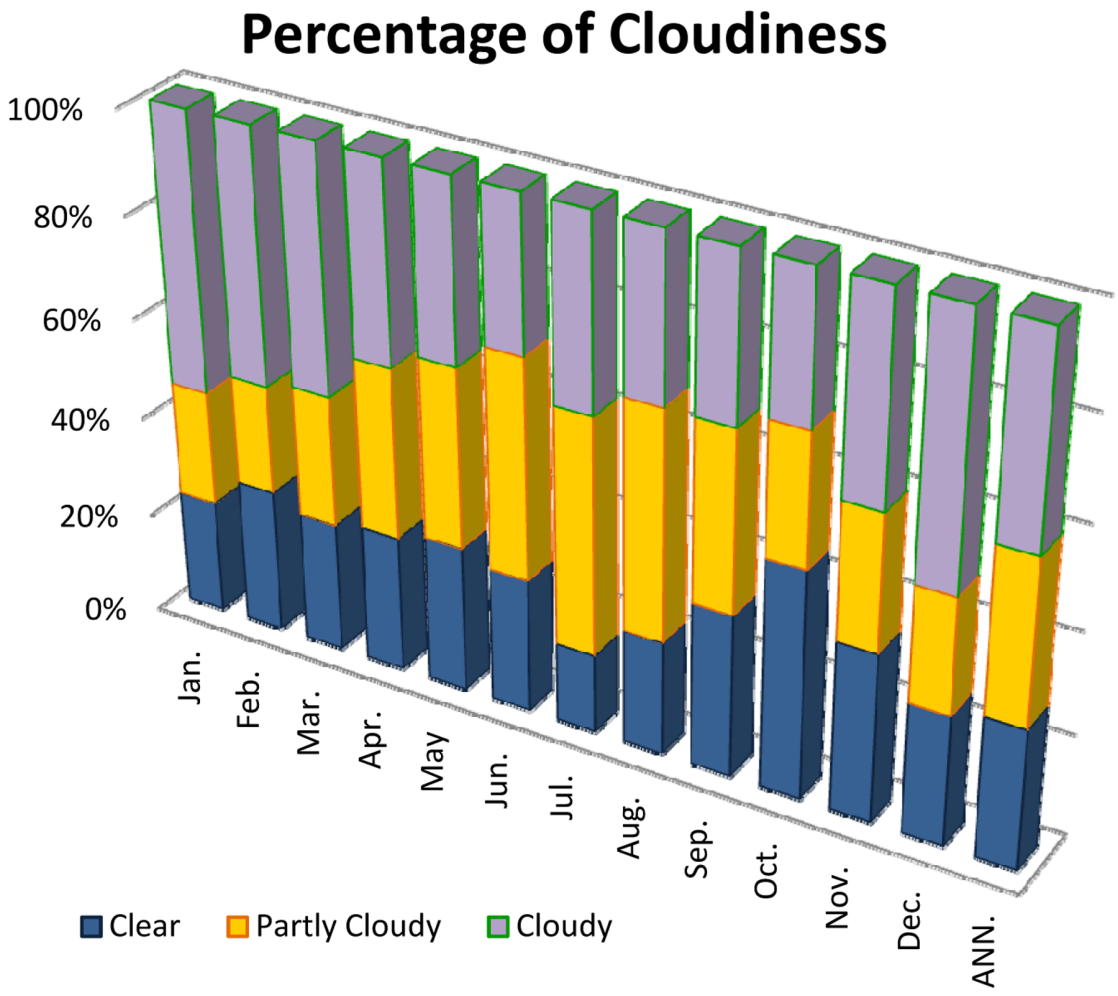
Site Character

The hard and impervious surfaces that exist throughout the city are broken up into small pieces and large cracks and depressions result. This is through the settling of the ground and fill beneath. Many of the stores and other private establishments are operational but show signs of damage that need to be repaired as a result of the powerful hurricanes that destroyed the city in 2005. Discoloration on some of the remaining buildings is a lasting reminder of the ever present danger of water inflow into the city. Many of the private lots are not cared for and because of quality conditions for plant growth there are many front yards that are overgrown with green plants. Plant growth has even begun to take hold on the vertical faces of the homes and anywhere else that it can get a hold in with its roots.

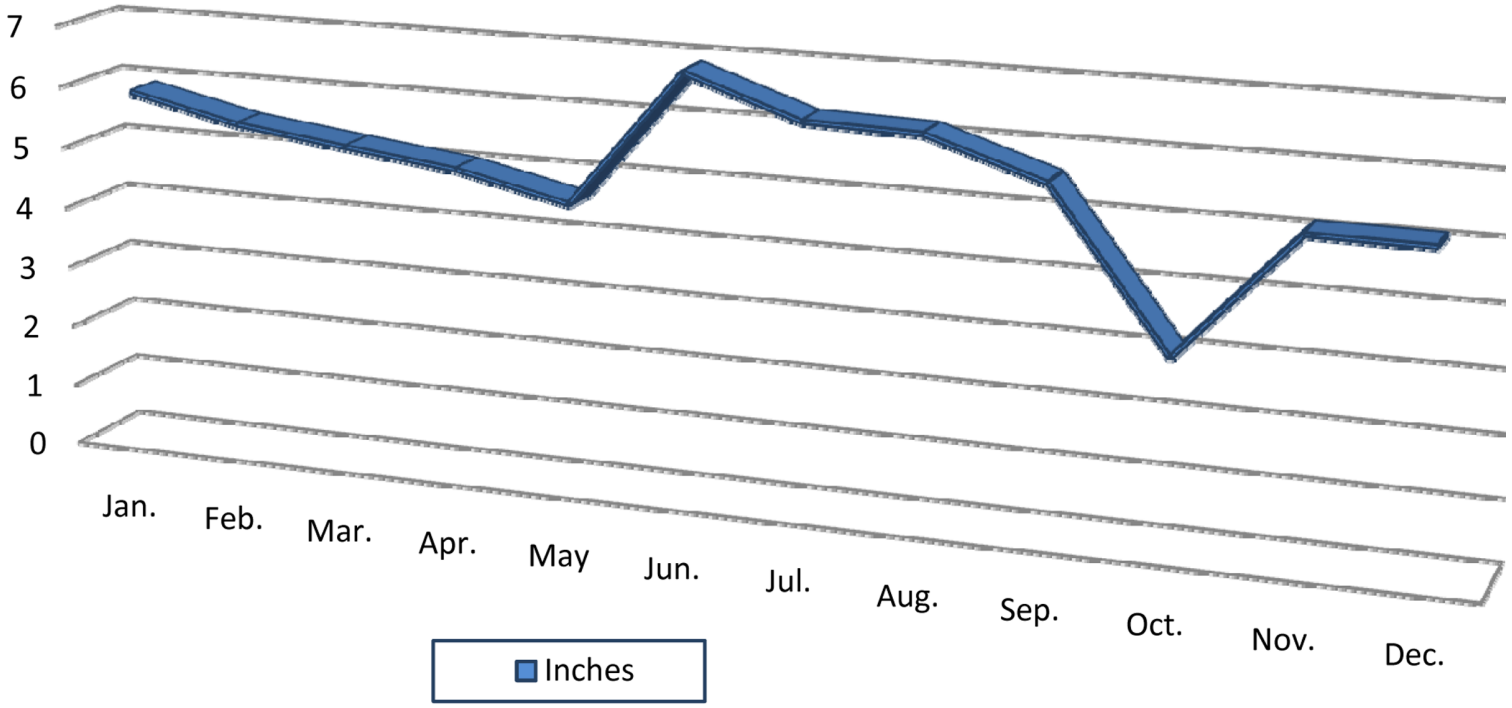
Taken from
www.metro-new-orleans.com

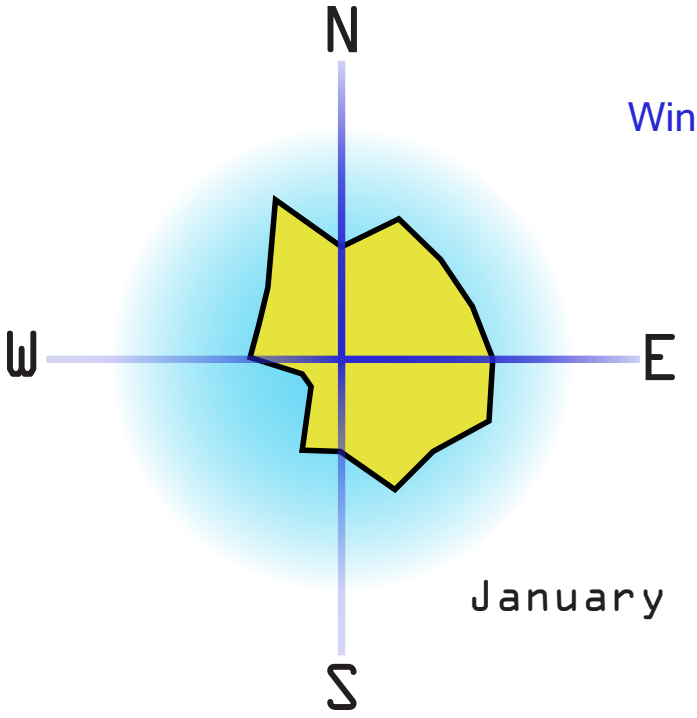

Average Monthly Temperatures
100
90
80
70
60
50
40
30
20
10
0
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
High
Low


Average Relative Humidity
100
80
60
40
20
0
Jan
Feb
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
Afternoon
Morning


Percentage of Cloudiness
100%
80%
60%
40%
20%
0%
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
ANN.
Clear
Partly Cloudy
Cloudy

Average Monthly Rainfall





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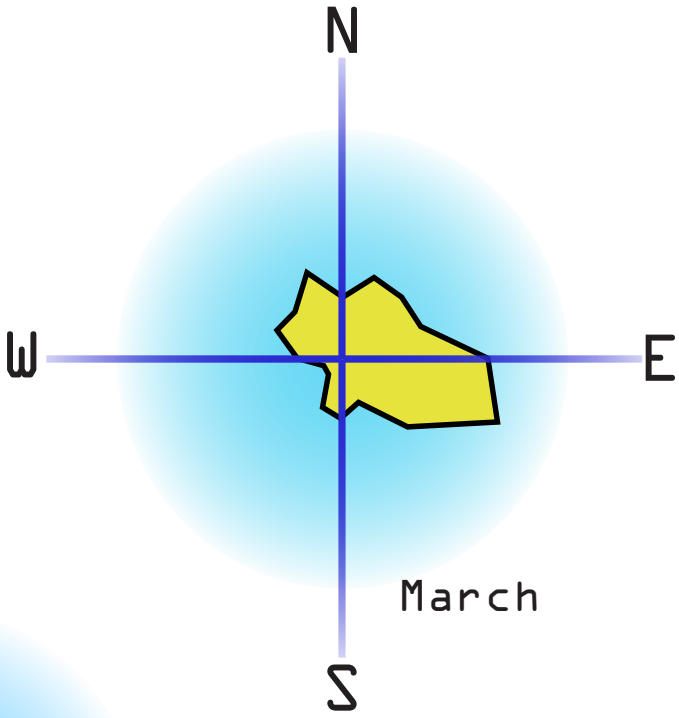

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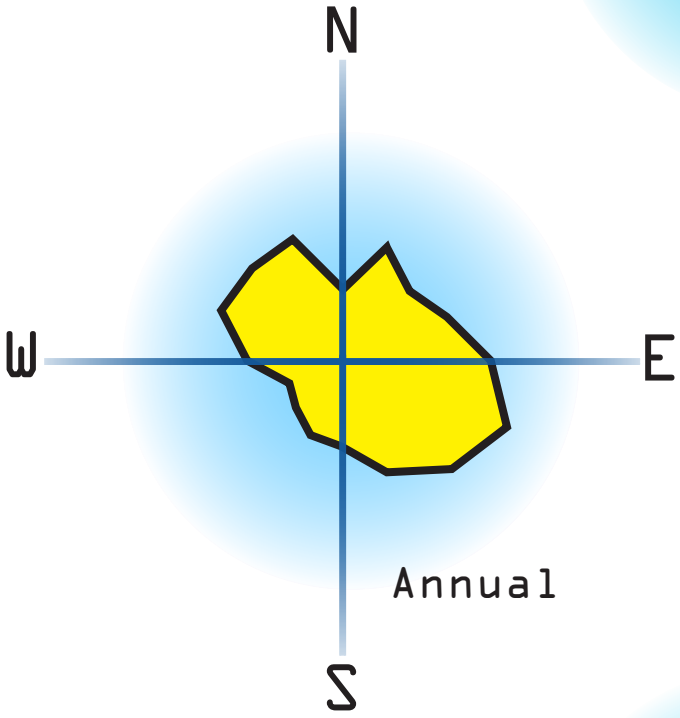
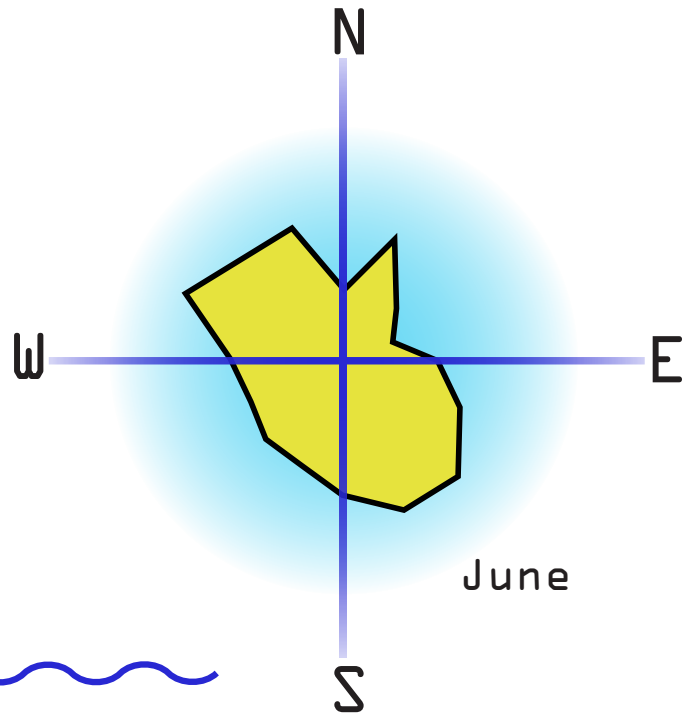


Annual



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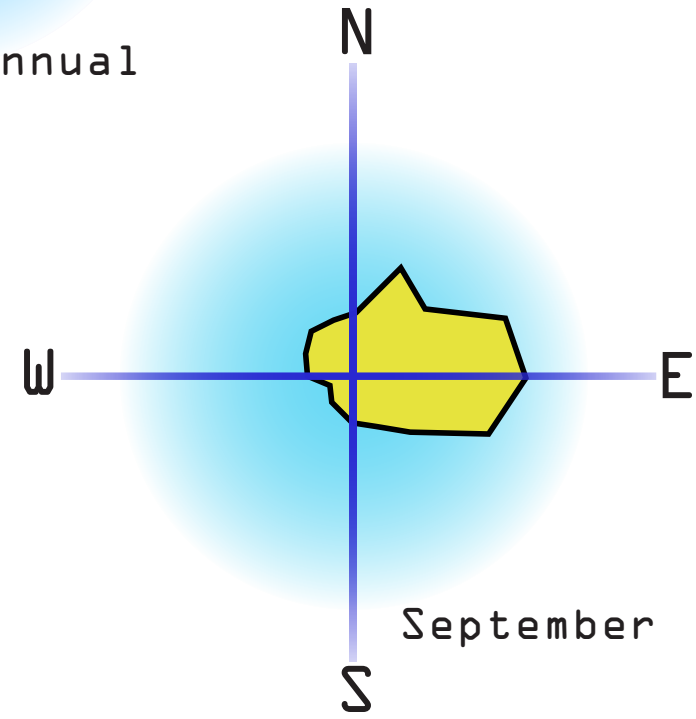

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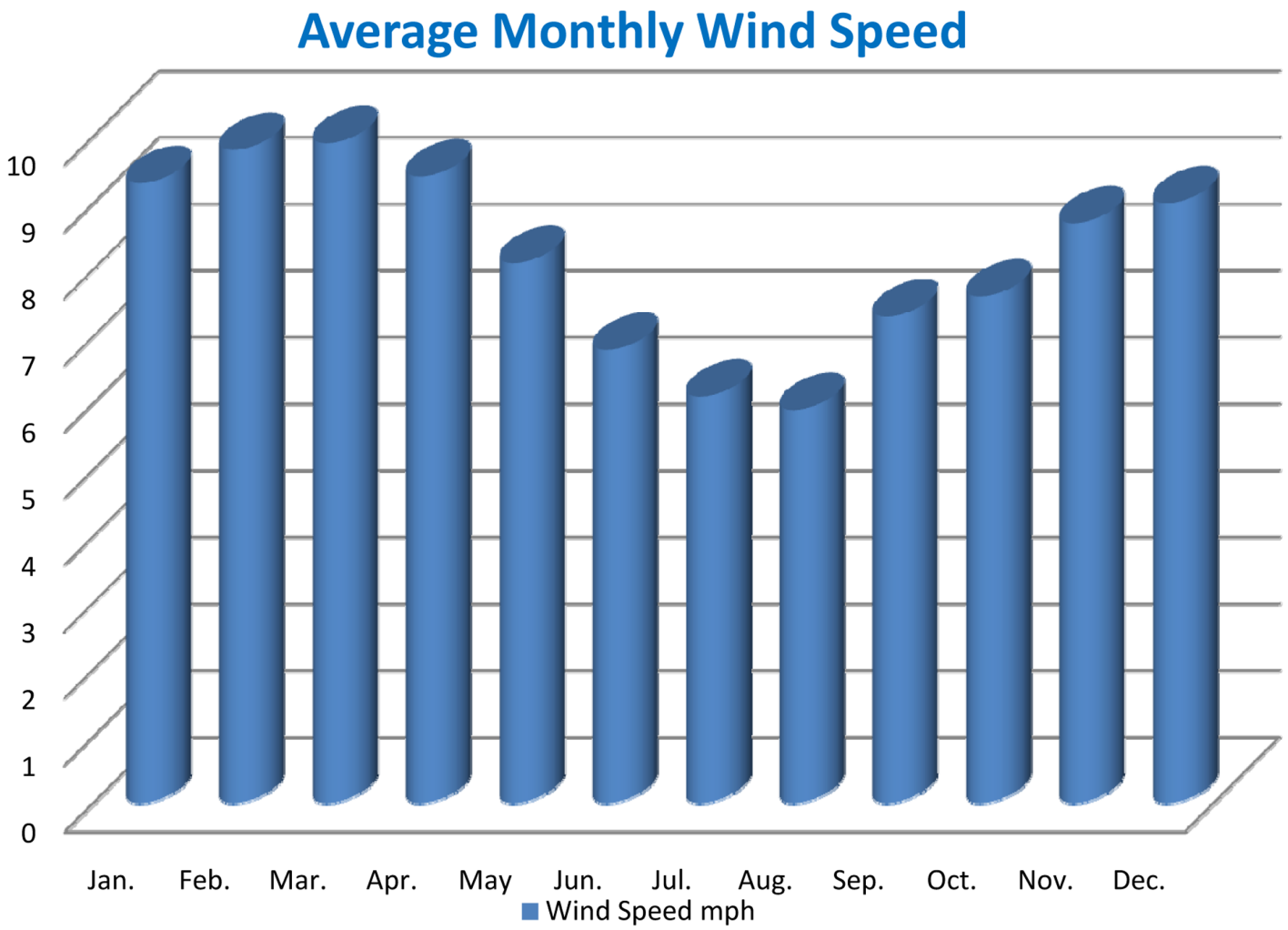
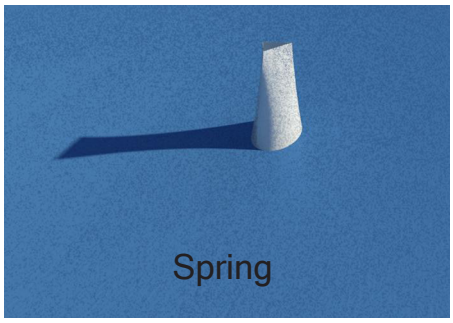
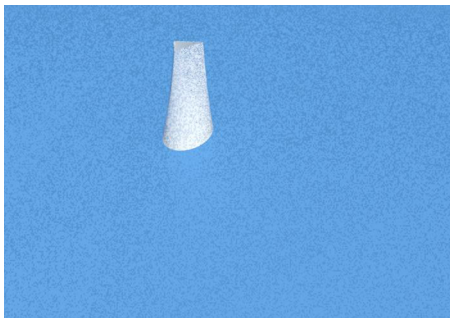
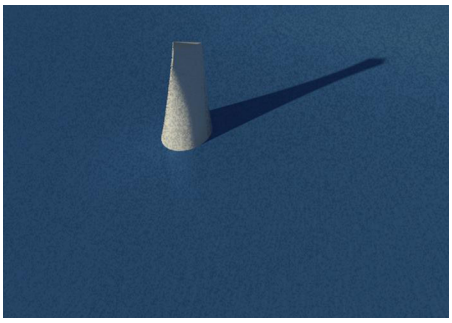
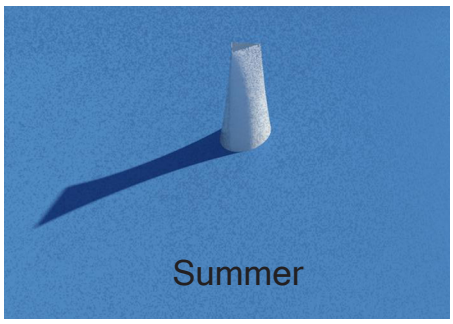
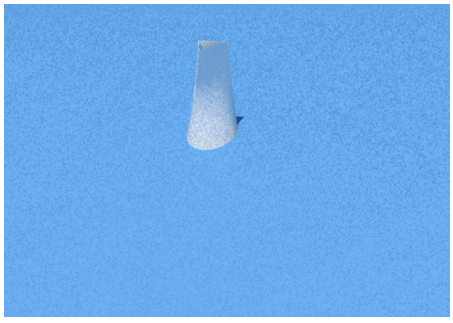
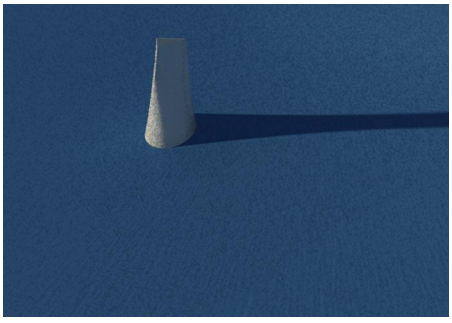
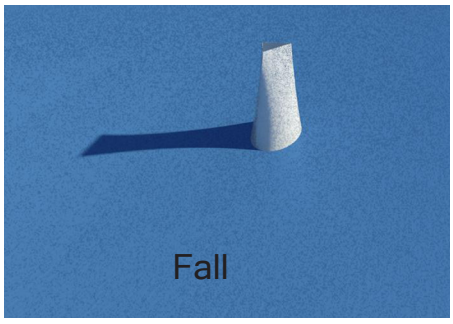
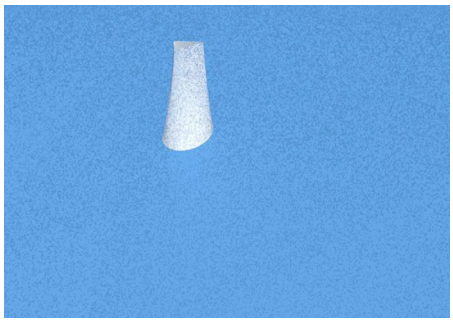
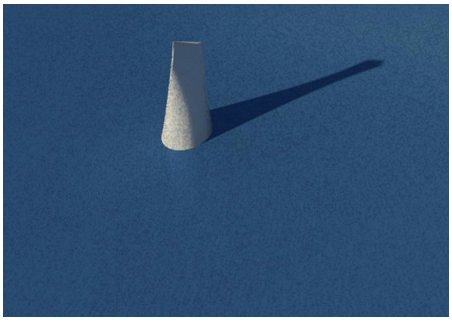
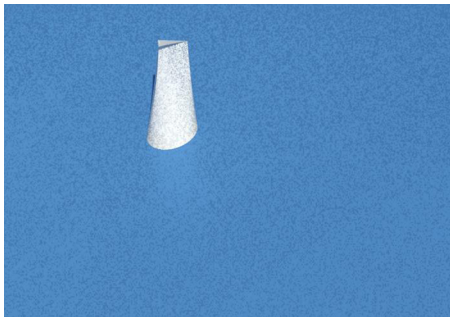

Average Monthly Wind Speed
10
9
8
7
6
5
4
3
2
1
0
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
Wind Speed mph

Solar Study

	Morning	Noon	‘Evening
Spring			
Summer			
Fall			
Winter			

Thesis Project Goals

Academic

This thesis project will enable me to discover issues that will be important to future changes of our planet Earth. Looking forward will create a unique opportunity for future students and faculty to refer back to this thesis project and compare my research findings and design solutions to the reality of the events that I am predicting.

Water is one of the most important resources that we have taken for granted over centuries. The project will challenge me to realize how all human activity impacts the environment. A goal that I have set for myself is to understand ways to mitigate these negative impacts and enhance the positive effects of our interactions. All of these goals relate to the development of cyclical systems that aim to reduce the gross amount of resources that society uses. A by product of these systems is the reuse and reduction of waste.

There have been many buildings produced that have strived for a net zero carbon footprint. This thesis project will challenge me to take that idea to the next level and attempt to produce a community development that will follow the same ideal.

This project will be designed for a specific location but with the realization that this problem will be a global concern. Speculating for the implementation of this design solution in other countries and how they might be different in other contexts. How will a floating project define its political influences or the limits of its borders?

Professional

The profession is moving towards changing the way we inhabit a space, either creating greater density within the core of cities. Reducing the urban sprawl is the name of the game. This project will exemplify a creative alternative that many architects are investigating more and more as the truth about the future comes closer to reality.

The project solution will incorporate new ideas in the realms of planning, spatial design, and construction. The multi-faceted nature of the scope of this project will prove to myself and future employers that I can think of and manage all of the different professions that must work together in order to complete a project successfully.

During the site analysis, I will set a goal to talk to many of the native residents of the New Orleans area, especially those from the area of the Lower Ninth Ward which was devastated by hurricane Katrina. The main focus of this conversation will be trying to convey my ideas about rebuilding the city at sea and my goal is to gain their approval, this will vastly improve my abilities to interact with potential clients which will serve me well in the profession.

The final production of presentation materials for the exhibit of my work will also further develop those skills so that I may not be limited by the computer software to show what sort of design ideas I have imagined over the course of the project. Those presentation skills will not only help place me into an architectural firm, but I can use them to help the firm acquire more work.

Personal

I have been surrounded by water ever since I was very young. I grew up fishing around my home of St. Cloud, Minnesota and have developed a great appreciation for this source of food and entertainment. I do believe that water is the most precious resource that has been taken for granted because it is thought to be a renewable resource, but in reality it is more finite than fossil fuels. The most prominent goal for the thesis is to understand ways that I can personally change and impact the way that we exploit this resource.

It has been said that I have spent more time on or in the water than on land. Being a fisherman has led me to develop a great understanding of how the water ecosystem is greatly affected over a period of time by increased human development with the introduction of chemicals that we use to maintain a certain aesthetic. This project will help me develop solutions to the problems that I have seen with residential lake homes and their impact on the natural hydrological system. The project includes all the aspects of design that I have found over the years that have a lasting affect on me.

I have always believed that I know who I am as a person and have never faltered in my core values this project will take all of these values and incorporate them into my design. Over the years of design studio I have evolved a logical concentration toward structural feasibility with my design projects. This project will be a testing ground where I will attempt to work at the edge of or outside my comfort zone in order to make myself a more well rounded designer.

Programmatic Requirements

5,000 Residential Complexes..... 5,000,000 Ft.

Residential Units

Efficency ..... 460 Sq. Ft.
One Bedroom ..... 500 Sq. Ft.
Two Bedroom ..... 750 Sq. Ft.
Three Bedroom..... 1060 Sq. Ft.
Roof Top Gardens ..... 5500 Sq. Ft.
Hatchery ..... 2120 Sq. Ft.

Public Open Spaces ..... 5,000,000 Ft.

Welcome Center ..... 500,000 Ft.

Health Care ..... 100,000 Ft.

Fitness Center ..... 25,000 Sq. Ft.

Ideation Center ..... 300,000 Ft.

Administration Offices
Indoor Open Lounge
Outdoor Green Space
Library
Computer/ Technology Center
Large Presentation Auditorium

Classroom Learning Tower
Large Scale Experiments
Laboratory
Cafeteria
Teacher/ Professional Offices

Government Headquarters .....

Corporate Office Towers .....

Hydroturbine power station ..... 1,800,000. Ft.

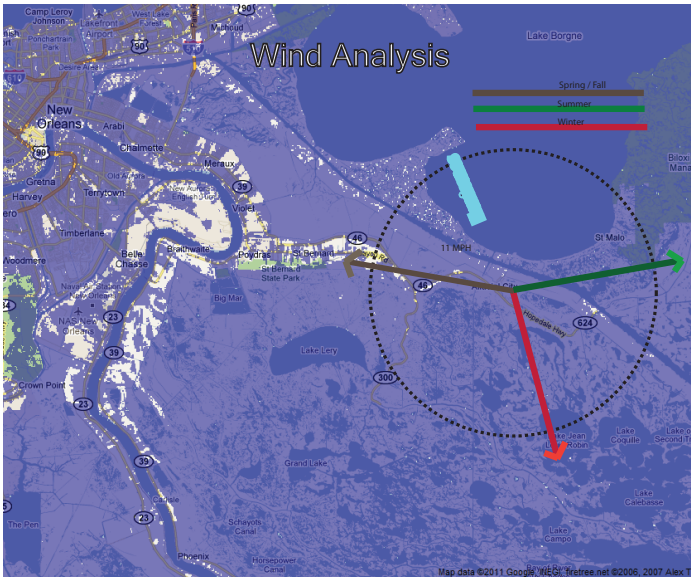
Aquaculture Growing Area ..... 1,000,000. Ft.

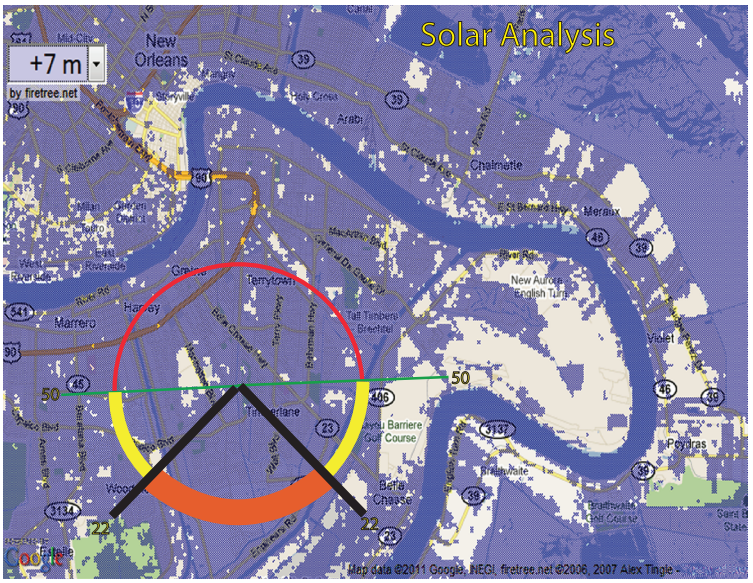
1 Private Marina ..... 1,000,000 Ft.

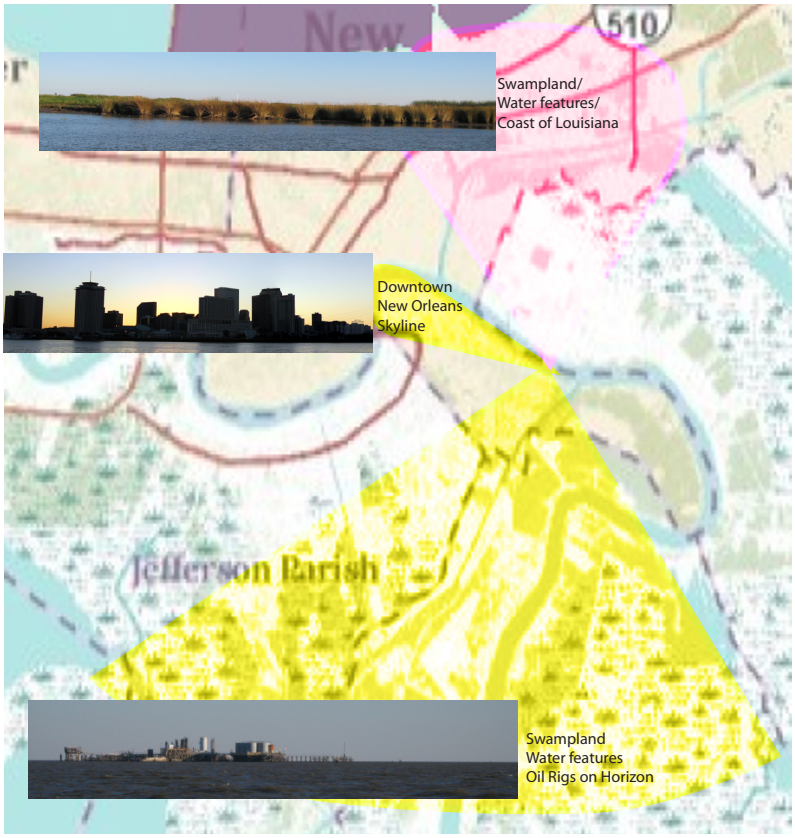
River Front Park ..... 800,000 Ft.

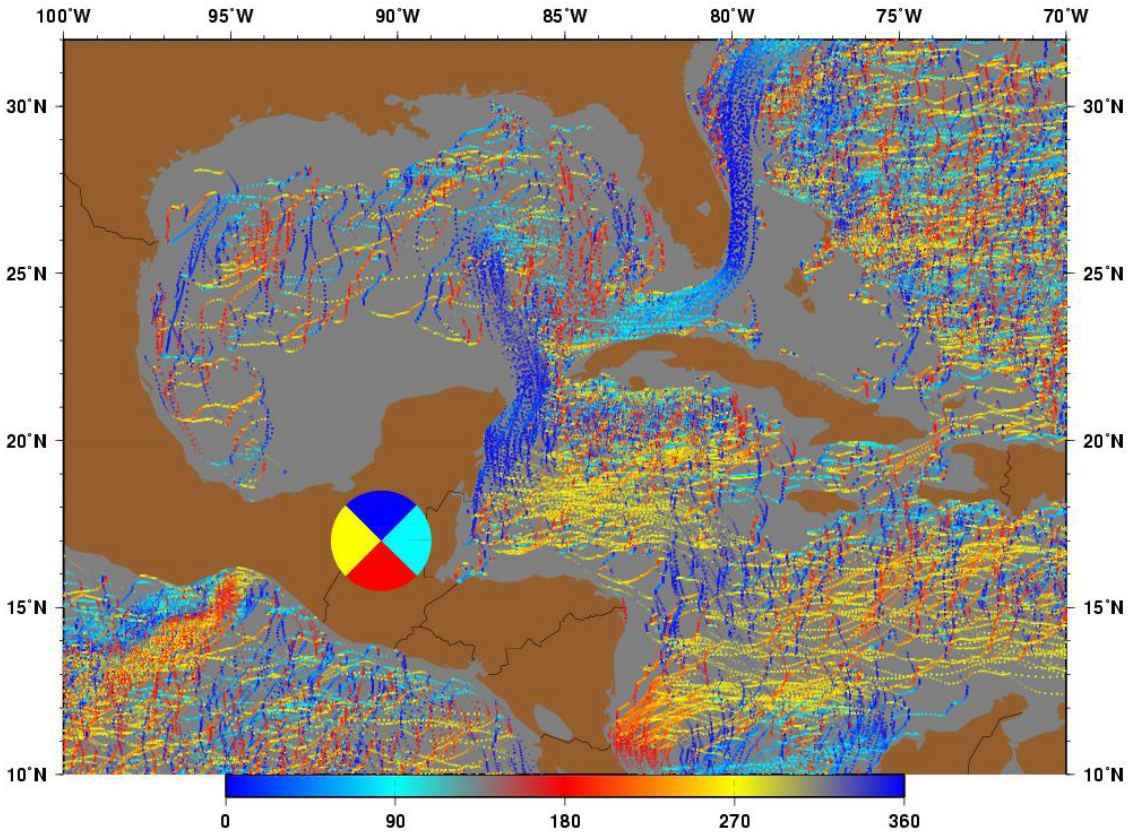
Design Documentation

Context Analysis



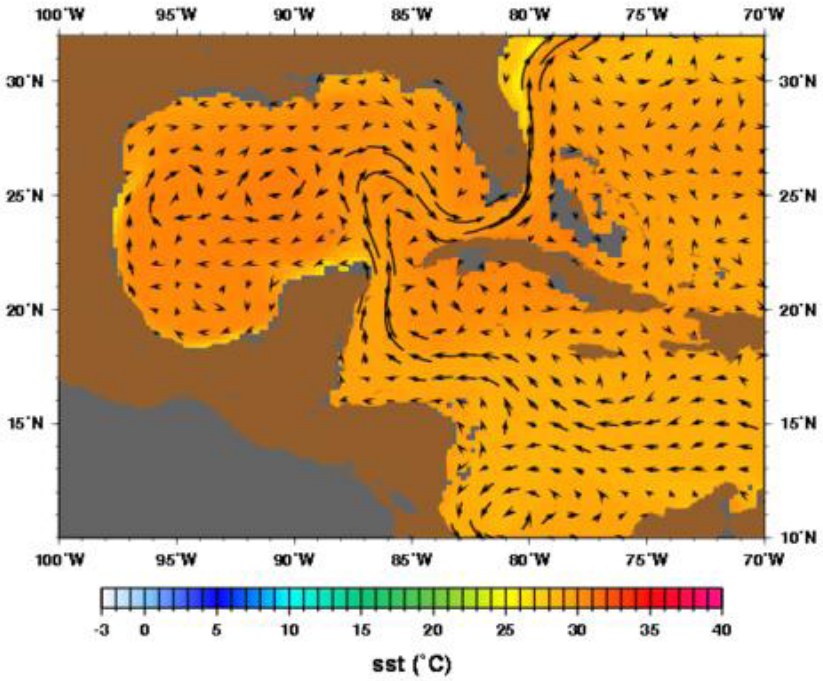




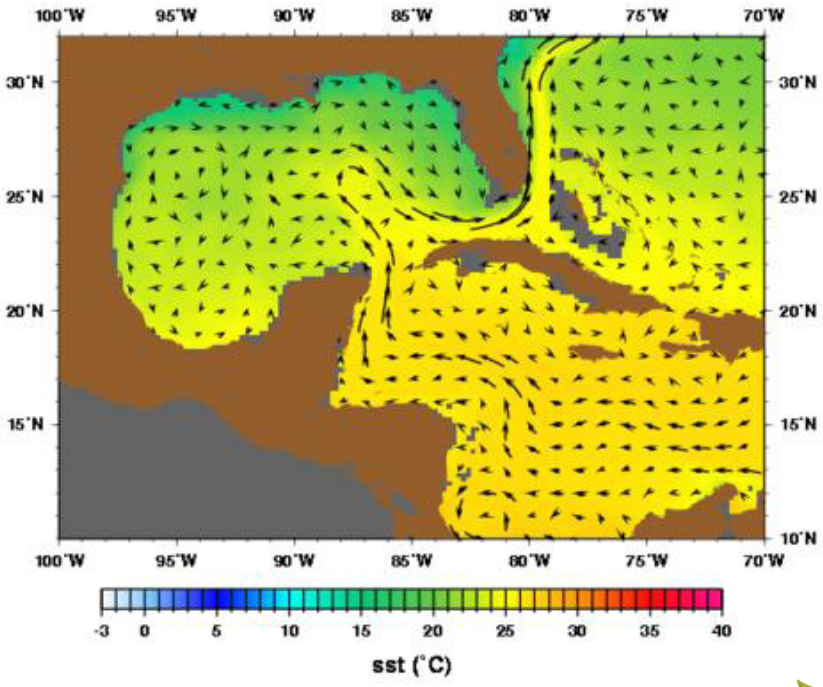

100°W
95°W
90°W
85°W
80°W
75°W
70°W
30°N
25°N
20°N
15°N
10°N
0
90
180
270
360

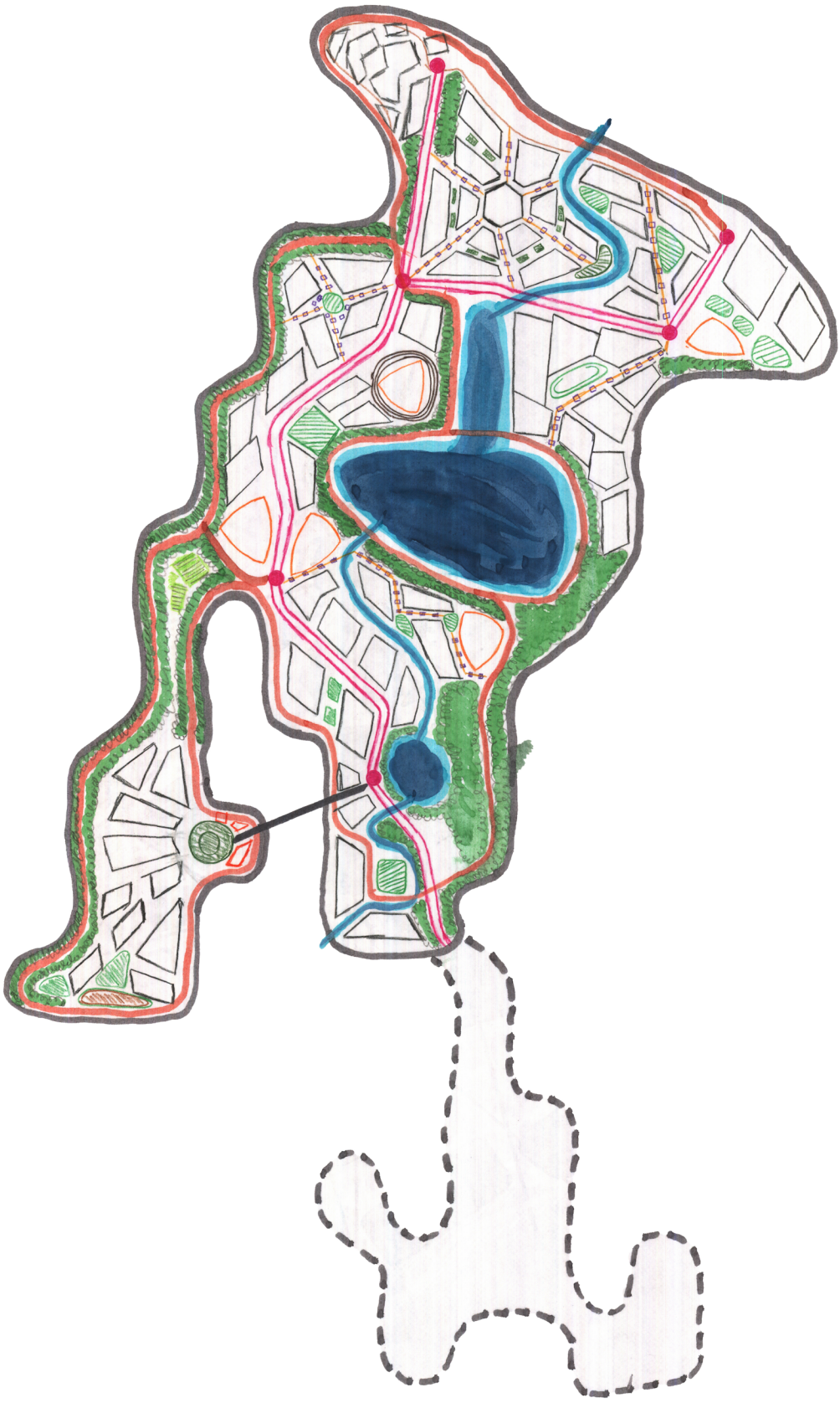
Master Plan of Resilient Community

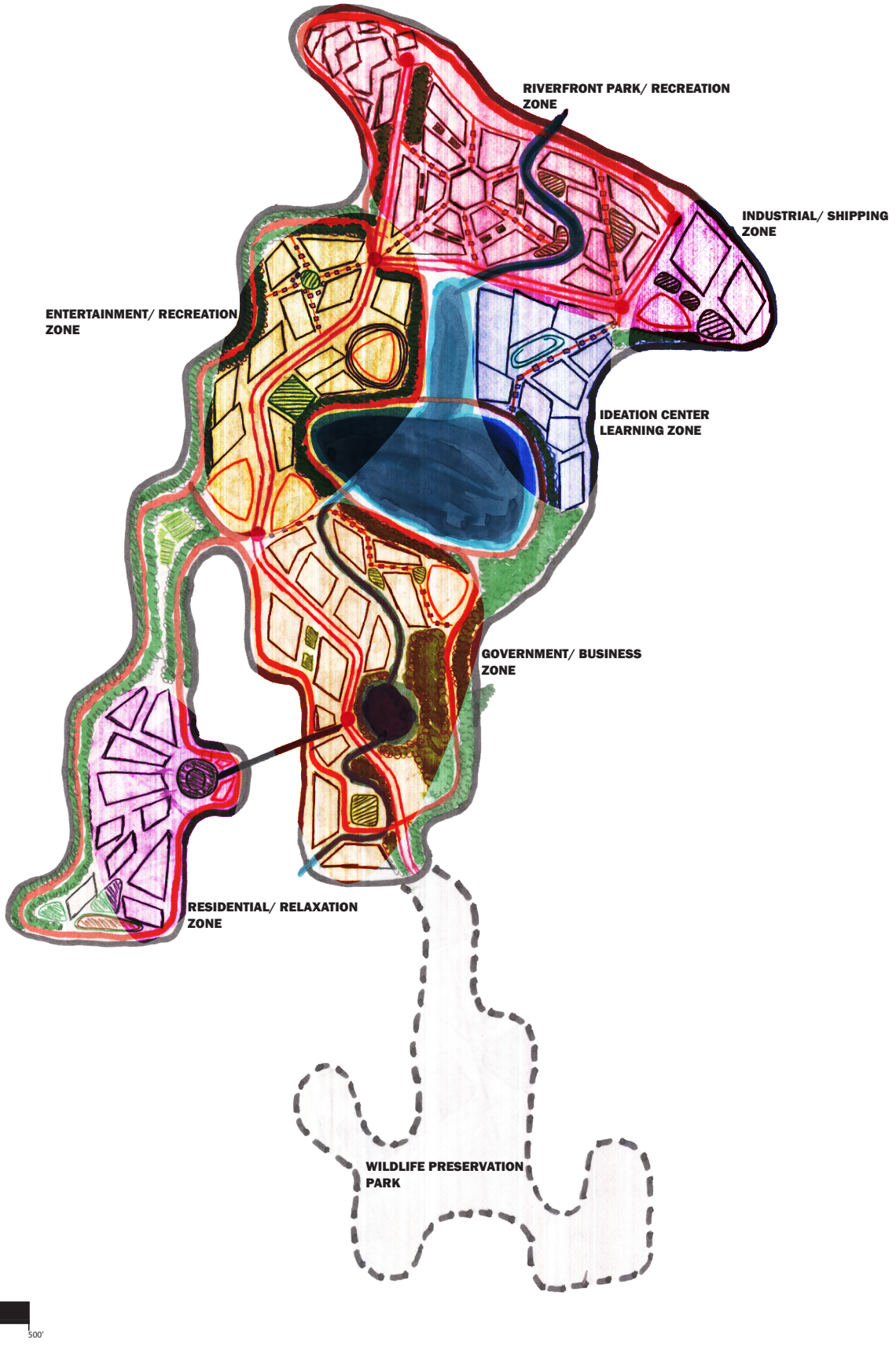
August

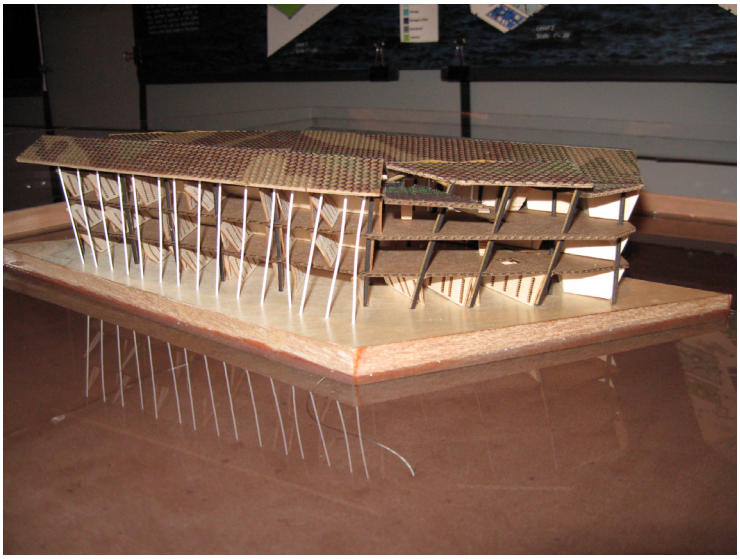


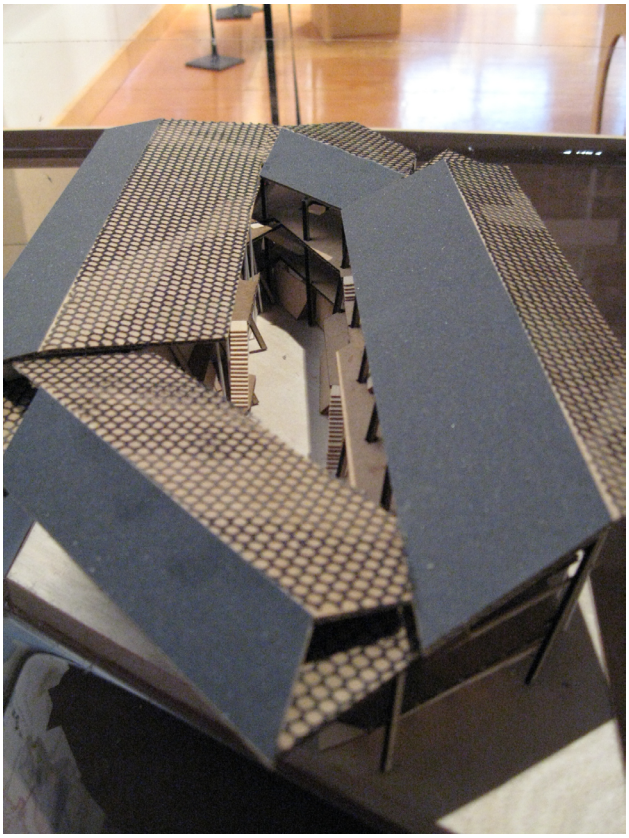
January

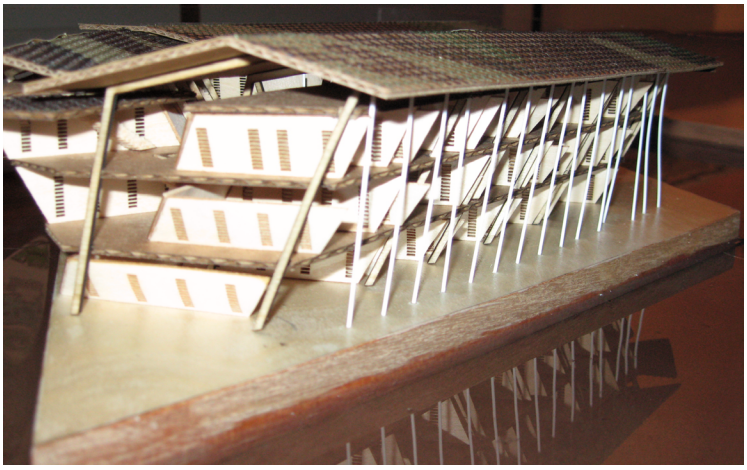


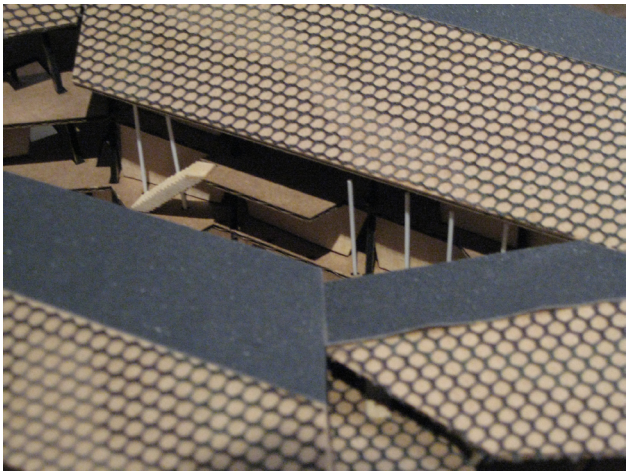


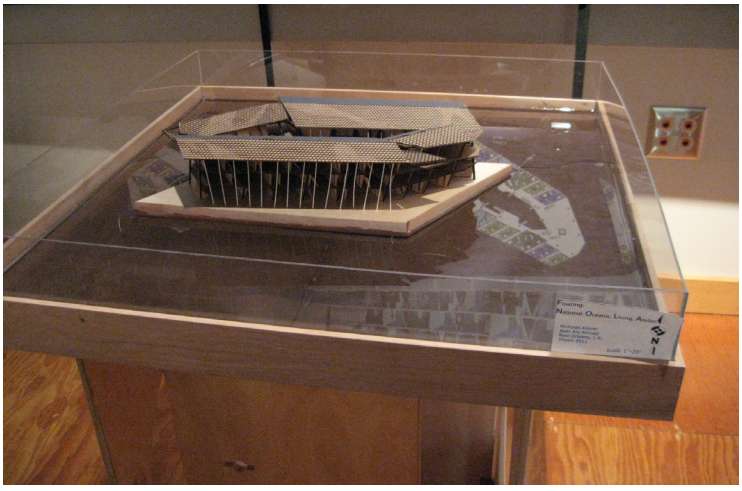

RIVERFRONT PARK/ RECREATION ZONE
INDUSTRIAL/ SHIPPING ZONE
ENTERTAINMENT/ RECREATION ZONE
IDEATION CENTER LEARNING ZONE
GOVERNMENT/ BUSINESS ZONE
RESIDENTIAL/ RELAXATION ZONE
WILDLIFE PRESERVATION PARK
250'
0'
500'

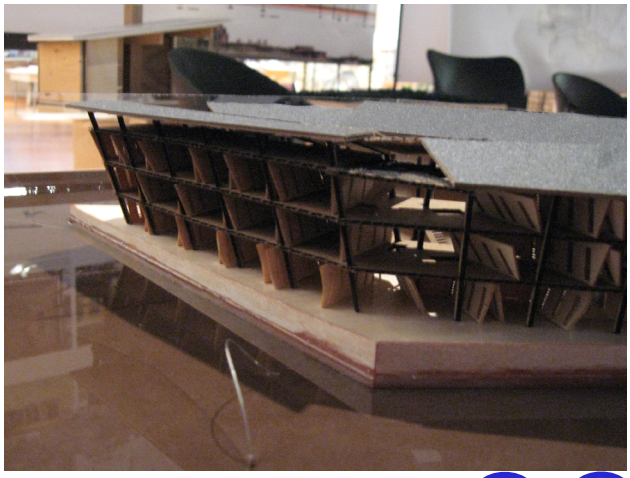


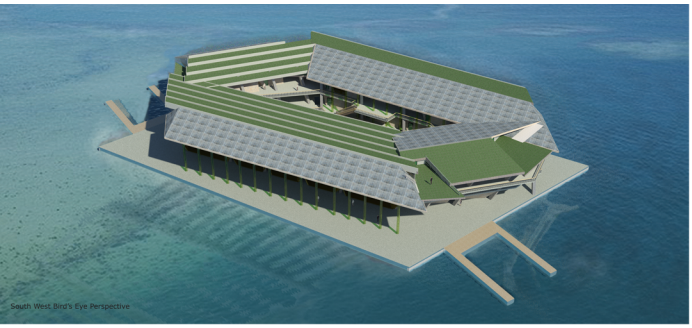




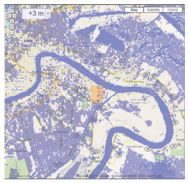


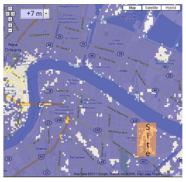


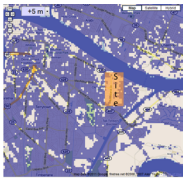




South West Bird's Eye Perspective

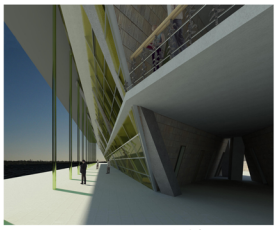






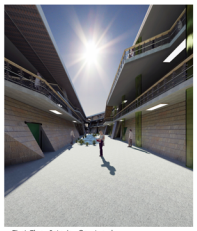
FLOATING:
NATIONAL. OCEANIC. LIVING. ATELIER.

Interior Room Perpsective



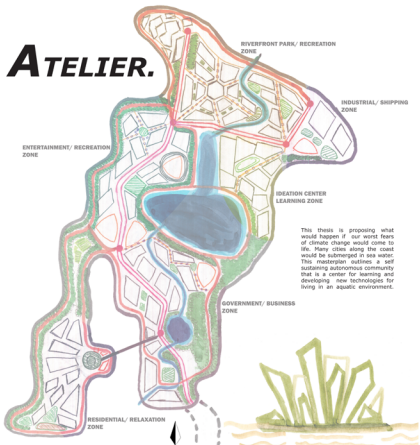
Exterior platform

Interior Courtyard Perspective



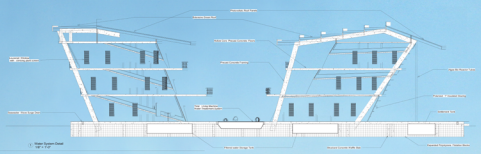
First Floor Interior Courtyard

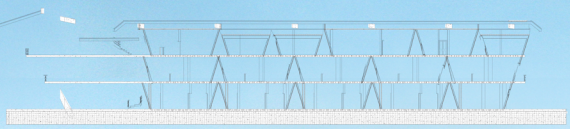
Community Skyline view

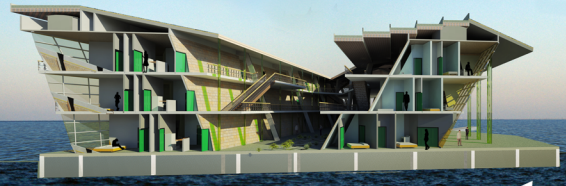


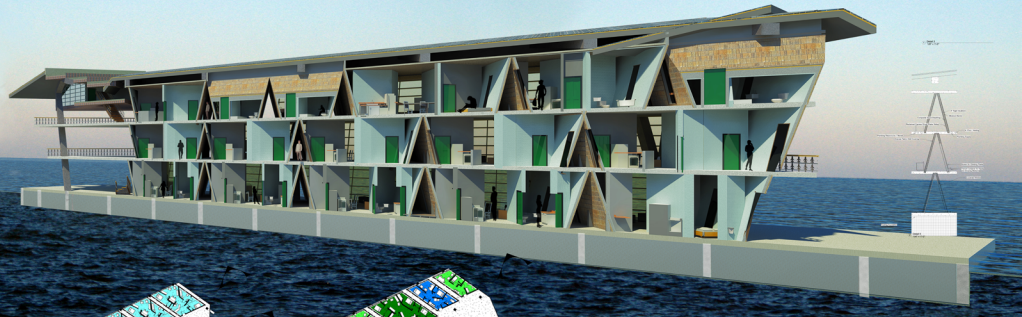
This thesis is proposing what would happen if our worst fears of climate change would come to life. Many cities along the coast would be submerged in water. This thesis develpor outlines a self sustaining autonomous community that is a center for learning and developing new technologies for living in an aquatic environment.

The initial formal concept was derived from the site and its unstables soils that caused differential settlement and visually striking angles. The organic angular forms generated by the growth of crystals created a symbol of growth for the community.







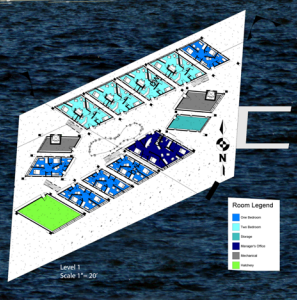


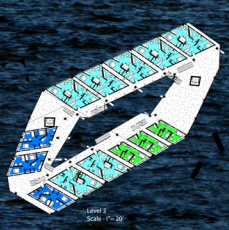
This residential complex would be the initial model that would inform the rest of the community buildings in the later phases of the development.

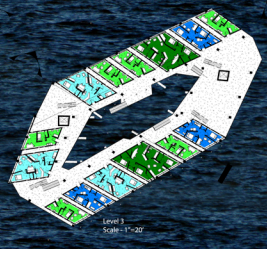
This residence uses technologies to harvest energy from the surrounding environment. Almost half of the roof is covered in photovoltaics to harvest the ubiquitous solar energy found in the open ocean.

The use of live growing plants it also an essential to relieve the monotony of the aquatic environment and improving the quality of life. Screens of climbing plants will cover all ventilation openings to perform natural air filtration.

The water filtration systems is openly displayed in the community. A tidal living machine located in the center of the interior Courtyard encircles the water in five steps. At the end the purified water is stored in roof tanks. A portion of the solar panels on the roof are dedicated to heating the clean water in the tanks.







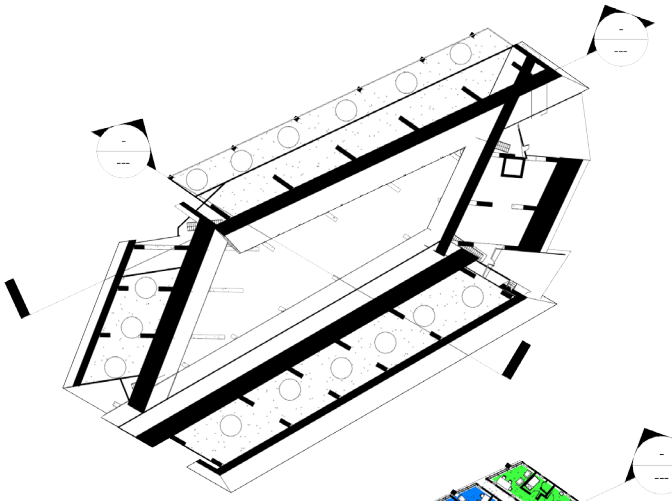
The Floating Platform is composed of a reinforced concrete waffle-slab structure that is filled in with high density polystyrene foam with a hardened exterior. Water storage tanks and pumps are also housed in the cavities of the foundation. The individual housing units are composed of four modular sizes to accommodate different lifestyles.

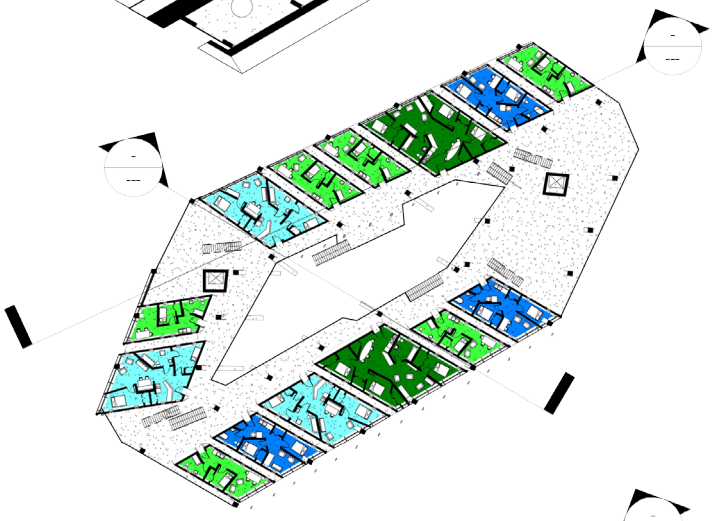
The floors are constructed of precast hollow core concrete which house the plumbing systems for water use and space heating. The wall structure is lightweight steel framing filled with rockwool. The exterior finish is wood siding that could be reclaimed from the uninhabitable buildings of the past. The interior material would be a lightweight canvas fabric.

NICHOLAS KLEVER — ARCH THESIS SPRING 2011 — SKETCHUP, ADOBE INDESIGN, ADOBE ILLUSTRATOR — AUTODESK REVIT, SKETCHUP, ADOBE INDESIGN, ADOBE ILLUSTRATOR

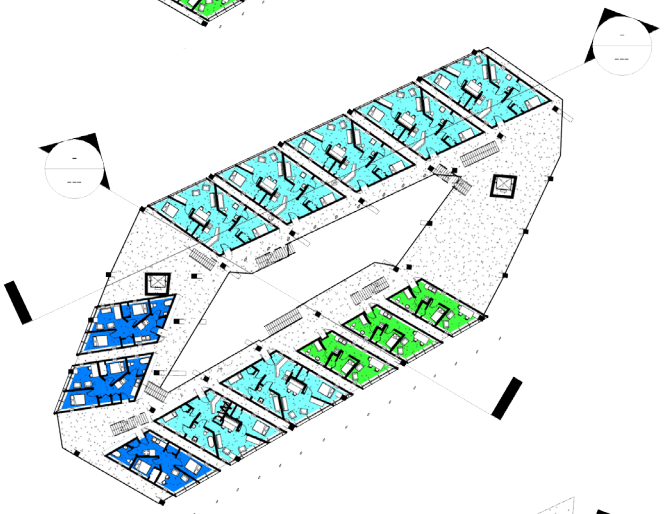
This sketch was used as the ideal vision of a skyline view of the community on the scale of its entirity. The sketch was used as a driver for the form of all the small scale details.

Roof Level Plan

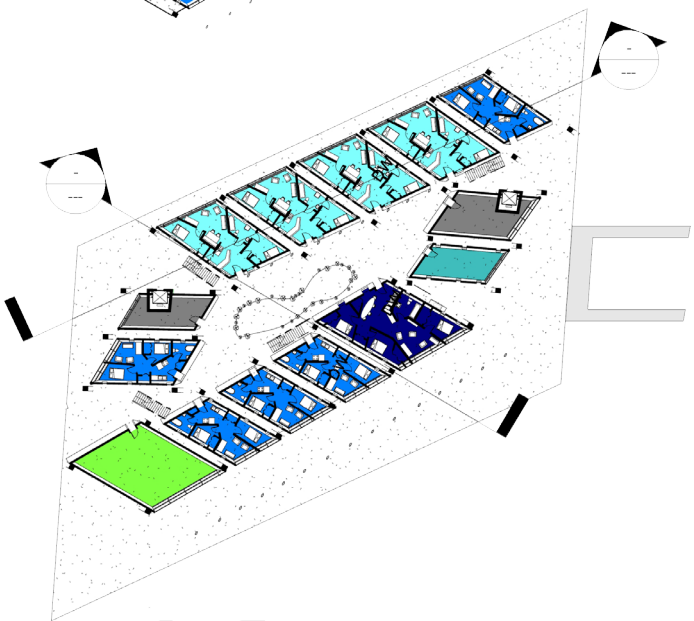




Level 2 Plan



Level 1 Plan



Sea Level Plan

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