

Regenerating the Chesapeake

An Underwater Approach

by
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Regenerating the Chesapeake

A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
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by
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Primary Thesis Advisor



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Photo courtesy of: Travis Steffen

Abstract...

“Regenerating the Chesapeake” is a series of theoretical premises that will develop into a master plan design. City planning and community involvement projects will be targeted at improving viability and awareness in a economically challenged town.

I will explore solutions for the city of Crisfield, MD, helping to solve its current social, economical and ecological problems.

The project will focus on solutions that are both ecologically and fiscally sustainable well into the future for the town of Crisfield.

The town’s proximity to the waters edge as well as its rich fishing and crabbing culture will work as a platform and base for its sustainable ecotourism prospects. Newly developed ecotourism planning as well as rebuilding of the town’s ecological problems with fishing and crabbing will help secure Crisfield a financial and ecological place into the future.

[keywords]

sustainable design, ecotourism, viability, marine, fishing, awareness, education

Problem Statement...

Can a city built solely on a fishing industry survive into the future with a diminishing water ecosystem?

Statement of Intent...

[Typology]

Ecological and sustainable design.

[Claim]

By applying certain techniques in order to address the current water and marine ecosystem in place, future prosperity for fishing and crabbing can be achieved as well as a sustainable ecotourism destination. By addressing key problems, the town can build upon its success not just for the fishing industry but for ecotourism and all its benefits. The best approach will be to provide sustainable economic approaches, that once in place, can help rebuild and keep a town prospering even through tough economic times.

[Supporting premise]

The fishing industry is a \$70 billion a year industry that consists of over 37,000 industrial ships and employs over a million people worldwide(Gibbs, M. 2005).

Living resources in the bay face challenges from multiple sources, and poor water quality is a big piece of the puzzle. Balancing competing demands in the Chesapeake and restoring water quality to sustain viable commercial and recreational fisheries is an important aspect of planning.

The Environmental Protection Agency and the U.S. Congress are both taking steps that could revitalize bay restoration efforts. Responding to an executive order from President Obama on May 12th, 2010, the EPA recently released a draft report outlining a new plan of action. The EPA proposed a new accountability program which would allow regulators to enforce limits on all sources of pollution, with consequences for failure(Gibbs, M. 2005).

If ecotourism contributes in a significant way to conservation, then it is an especially fitting reprieve for marine life and other natural habitats because it is the very characteristic of the habitats and wildness that conservationists want to save that provide the incentive for travelers to visit, and that give a reason for local people to preserve.

Project Justification...

The fishing industry is facing many hardships, but no matter what there will be a demand for its services. In order to create a sustainable approach to a city's long-term health, people need to be mindful of how the city got to where it is today and how to continue and embrace its identity. Through the successful design of the city's layout, ecosystem and tourist attractions, the project will be able to preserve the city for future generations.

Project Justification...

For over 25 years, despite voluntary measures and regulations across six states and Washington, DC, the Chesapeake Bay, the nation's largest estuary, remains polluted, its tributaries largely unswimmable and unfishable. Agriculture produces about half that pollution. The rest comes from sewage treatment, atmospheric toxins and runoff from lawns and streets in cities and suburbs.

The Chesapeake Bay is a national, natural American treasure. It was formed 15,000 years ago when an immense glacier melted and flooded an ancient river valley. Today, the estuary marks where the Potomac and 150 other rivers, streams and creeks merge on their way to the Atlantic Ocean. The sprawling 166,000 square-kilometer watershed stretches through six states and the nation's capital, nourishing a multitude of land and marine species. The Chesapeake Bay is also the source of fresh drinking water, food and recreation for 17 million people (Gibbs, M).

The dramatic declines in the harvest of fish, oysters and crabs over the last 80 years stimulated ineffective responses by local citizens to save the bay. Most of the watermen who once made a decent living from crabbing, fishing and especially tonging/dredging oysters are unable to make a living now. As the children in the families of watermen leave of high school and choose to enter college or other professions, a 300-year-old way of life on the bay is nearing extinction. In exchange, people have developed urban sprawl in Hampton Roads and Northern Virginia/Southern Maryland and created agricultural economies in the Shenandoah and Susquehanna River Valleys with the political power to block regulation of farming practices.

The 17-18 million people who live in the watershed now have upset the natural balance through a number of different stressors. Life adapts over thousands of years of time, but in the last 40 years, the impacts of increased urbanization have dramatically lowered the productivity and biodiversity of the Chesapeake Bay. "Since the 1960s, well over half of the SAV has disappeared from the Bay waters" (Gibbs, M).

The Chesapeake Bay can be saved, but not if the stressors continue to increase. Since there is no mechanism in the American political system to limit population growth in the watershed, the choice is to change the behavior of the people living in the watershed so they generate less pollution per capita and total pollution does not exceed maximum daily limits.

Proposal...

The design proposal for the site will be to concentrate efforts around sustainable design and development. Not only boosting economic growth but creating long term solutions to the crabbing potential for the city. I am proposing a solutions that focus on social, economical and environmental sustainability for the city of Crisfield.

The Narrative...

[Why Save the Chesapeake Bay and Cities Along It?]

The Chesapeake Bay is the largest estuary in the United States. Encompassing six states and the District of Columbia and covering more than 64,000 square miles, it is one of the most productive estuaries in the world (Chesapeake Bay Underwater).

Unfortunately, the Chesapeake Bay faces serious problems due to human activities, including excess nutrient runoff, deforestation, over-fishing, wetland destruction from agricultural, urban, and suburban development, invasive species such as nutria and mute swans, and global climate change.

Ecosystem science and more specifically restoration is relatively young. Physics and astronomy have been actively pursued for over 500 years, chemistry and biology for several hundred years, but ecology and restoration along with ecotourism is largely a product of the 20th century. Like medical science, ecology has advanced rapidly over the past several decades and we can envision an active expansion of these fields over the next several decades (Chesapeake Bay Underwater).

Society generally does not question the intrinsic value of medical science, and even though the search for a cure for cancer (as one example) is a half-century old, we are not willing to say enough research, just focus on treatment and prevention. Similarly, we need to continue to learn more, but also *do* more on behalf of Chesapeake Bay. The question that we need to ask is the following: “What design do we need to restore the Chesapeake Bay?”

The Chesapeake Bay is always in the minds of those who live there.

Here is a good example, a poem written by Sean Allen:

As I write this I wonder
if you can recall
us sitting together,
watching the sun fall
upon the gentle waters
of the Chesapeake Bay.

And all those strange berries
that grew on that tree
that I stained my shirt with
so that you'd sit next to me
and not worry about pink marks
on the shorts you were wearing.

You say you remember
me introducing myself
bravely to your table
and I say I can still see
you beating me at basketball.

As the sun sets
on the Chesapeake Bay,
I fervently wish that
the three weeks we share
can remain a part of us
for as long as there is
water to dream on.

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A User/Client Description...

[User]

The users of this site are those who interact with the water in any way, primarily residents. The entire city of Crisfield relies on the bay. Because the entire city relies on the bay for its success, no one person or group of people is more important than another, but the community as a whole is what is important.

[Client]

The city of Crisfield will be the primary client but is not limited to public office. The city, business owners, fisherman and crabbers are among secondary clients.

A User/Client Description...

[User #1 - Fisherman/Crabbers]

The fisherman and crabbers are the lifeblood to the Crisfield economy. Their livelihood effects much of the local economy from the local food industry to tourism; if they aren't doing well, nobody is.

[User #2 - Tourists]

The tourists that experience this small fishing town and "crabbing capital of the world" will benefit greatly from an improved ecosystem that gives them lots to experience. Charter fishing, beaches and shopping will all be supported with a healthy ecosystem.

[User #3 - Community/Residents]

The residents of Crisfield are the most invested in the bay's well-being. With a healthy Chesapeake Bay, residents can continue living and making money in ways they have become accustomed to. The residents of Crisfield and the surrounding community would benefit greatly from an improved water ecosystem and a self-sustained ecotourism economy.

Major Project Elements...

[Scope]

The major elements of this project are both on land and sea. It will take an ecologically sustainable approach as well as a city planning approach to create a healthy and viable city. Involving all parts of the community will help establish awareness and educational components for the city to build off of and make working together easier. The various governments and local law makers will be the most influential people in helping the city rebuild for the future.

The master plan will involve creating a main thoroughfare through the city to the water's edge and repositioning certain local businesses to higher trafficked parts of town. Tourism will be highly developed and all other amenities will be positioned to better serve both the community as well as help sustain ecotourism.

Major Project Elements...

[Waterfront/Bay]

The waterfront and main part of the bay are used by much of the town. The amount of rehabilitation and revitalization of these areas has yet to be determined.

[Thoroughfare]

A main thoroughfare will be used to give visitors ease of access to the waterfront as well as to promote local businesses and amenities.

[Parks/Open Space]

Parks and open spaces will be used by both the local population as well as visitors and tourists visiting the site. These areas will provide both an educational element as well as provide relaxation and enjoyment for visitors.

[Tourist Destinations]

Alternative tourist experiences will give the town of Crisfield an edge in bringing in tourist dollars as well as more opportunity to help educate visitors to the area about important ecological benefits of keeping and supporting a healthy Chesapeake Bay.

Site Information...

[Macro to micro]

[Region]

The Chesapeake Bay bioregion is the largest estuary in North America. The Chesapeake Bay watershed includes an area of 64,299 square miles and includes parts of Maryland, Virginia, New York, Pennsylvania, Delaware, West Virginia and Washington DC.

Chesapeake Bay water temperatures vary from lows in the mid 30's during the winter to highs in the mid 80's during the summer. Water temperature affects fish populations in the Chesapeake Bay.

The Chesapeake Bay is a main feature for tourists who visit Maryland and Virginia each year. Fishing, crabbing, swimming, boating, kayaking and sailing are extremely popular activities enjoyed on the waters of the Chesapeake Bay. As a result, tourism has a notable impact on Maryland's economy.

[City]

Crisfield, in southern Somerset County, Maryland, is located at the mouth of the Little Annessex River at Tangier Sound. Crisfield's history is based in the seafood industry and the town features many excellent seafood restaurants. Home to the annual National Hard Crab Derby, Crisfield is proud of its ties to the Chesapeake Bay.

Founded in 1666 by Benjamin Summers, Crisfield was originally known as Annessex and the cove bordering Benjamin Summers' land was known as Somers Cove. By 1904, the city of Crisfield was the second largest city in the state of Maryland (the first being Baltimore) and one of the finest seaports in the country. It quickly became known as the "Seafood Capital of the World." The seafood industry, combined with the ability to export seafood and agricultural produce via the railroad, drew residents from as far away as New England and the Midwest.

[Site]

The site is parts of Crisfield that need revitalization and restructuring. These are included but are not limited to the waterfront, the destructed part of the bay, the city center and open spaces within the city.

The city of Crisfield used to attract people from all over the world and now has trouble bringing visitors to the site within its own state. As of the fall of 2011, the site faces an uncertain future.

Site Information...

[Macro to micro]

[Region]

[General information]

population.....2723
median age.....36.6
avg. household income.....\$34,519
median rent.....\$527



Photo courtesy of: <http://www.crisfieldchamber.com/userfiles/image/crisfieldmap2.gif>

[City]



Photo courtesy of: Google Maps

[Site]



Photo courtesy of: Google Maps

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Project Emphasis...

[Remediation]

Many years of misuse and neglect have left the Chesapeake Bay almost unsuitable for fishing, crabbing and recreation.

Remediation of the site would allow for Crisfield and its surrounding community an opportunity to research, investigate, regenerate and recover what was once a magnificent ecosystem that they could rely on. This would give them a chance to have a livable and viable community once again.

[Awareness/Education]

Understanding cause and effect is a part of every human, and if not properly understood, a problem will go unattended until it gets so bad someone has to notice.

By ensuring public awareness and participation in the process of remediation, an opportunity is presented to help change the public perception of what a healthy Chesapeake Bay should look like and how it should function.

[Sustainability]

Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment.

Crisfield will need to be able to sustain not just a healthy ecosystem to survive but also be able to continue a healthy and viable economy to ensure itself into the future. The concept of sustainability will create a connection with nature as well as tourism, promoting a town for the future.

Plans for Proceeding...

[Definition for a research direction]

The research will be conducted in the areas of site analysis, historical context, theoretical premise, project typology and programmatic guidelines.

The results of this research will guide the project and define the areas of research. This will culminate in a set of established objectives for the project.

[Design methodology]

A mixed-method, qualitative and quantitative approach will be used.

An ecosystem transformation strategy will be used followed by a theoretical premise for design. A quantitative and qualitative collection of data will be used concurrently, having priority assigned by theoretical premise guidelines. This data will be integrated at several stages of the design and will be dependent on the theoretical design.

Qualitative data will be gathered from direct observations, interviews, photography and film, surveys and researchable archives.

Quantitative data will include statistical data, scientific data and archives, but is not limited to just these.

[Documentation of the design process]

Documentation of the design process will be done by photography, video, sketchbook, digital renderings and scanned drawings.

Schedule for Proceeding...

[Week 1]	Semester Introduction	[Fall 2011]
[Week 2]	Design Methodology: Research Analysis(25%)	
[Week 3]	Design Methodology: Research Analysis(50%)	
[Week 4]	Design Methodology: Research Analysis(75%)	
[Week 5]	Design Methodology: Research Analysis(100%)	
[Week 6]	Design Development I.: Schematic Design(15%)	
[Week 7]	Design Development I.: Schematic Design(30%)	
[Week 8]	Design Development I.: Master Planning(40%)	
[Week 9]	Design Development I.: Master Planning(50%)	
[Week 10]	Thesis Break	[Spring 2012]
[Week 11]	Design Development II. Site Planning(60%)	
[Week 12]	Design Development II. Site Planning(70%)	
[Week 13]	Design Development II. Design Detailing(80%)	
[Week 14]	Design Development II. Design Detailing(90%)	
[Week 15]	Design Development II. Design Detailing(100%)	
[Week 16]	Thesis Presentation: Boards/Formal Review	
[Week 17]	Thesis Presentation: Formal Review	
[Week 18]	Thesis Presentation: Documentation	
[Week 19]	Graduation: Spring 2012 Commencement	

Previous Studio Experience...

[LA 271/Landscape Architecture 1] Kathleen Pepple

“Tea House” (Fargo, ND)

“Halverson Park Project” (Fargo, ND)

[LA 272/Landscape Architecture 2] Mark Lindquist

“Cold Smoke” (Fargo, ND)

Fargo Corridors (Fargo, ND)

[LA 371/Site Planning & Design] Stevie Famulari

“Defiant Gardens” (Fargo, ND)

Snow Symposium (Winnipeg, Canada)

Regent, ND Project (Regent, ND)

[LA 372/ Community Planning & Design] Kathleen Pepple

U.T.T.C. Campuss Project (Bismarck, ND)

Roosevelt Neighborhood (Fargo, ND)

[LA 471/ Urban Design] Jay Kost

Duluth Project (Duluth, MN)

[LA 472/Phytoremediation] Stevie Famulari

Phytoremediation Project (St. Regis, MN)

[LA 571/Environmental Planning] Catherine Wiley

Red River Valley Flooding

Theoretical Premise Research...

[Abstract]

An important test bed for large-scale coastal ecosystem restoration and management is the Chesapeake Bay. Human development in the region has created new challenges for science, as there is a need for more reliable predictions for future conditions. In order to be an effective guide for sustainable development, coastal science assessments must be integrated with environmental research, monitoring and modeling, as well as technological improvements, societal change and landscape dynamics.

[Introduction]

Human actions and activities over the years have made us more aware of the effects and interactions on the coastal ecosystems. Rather than analyzing each activity individually, we are now shifting our attention to the effects of multiple human activities altogether. It has also become more apparent that activities that take place a great distance from the coastal zones still affect coastal ecosystems.



Photo courtesy of: http://www.dailytravelphotos.com/images/2011/110403_uluwatu_bali_indonesia_hindu_temple_sunset_cliffs_MG_7897.jpg

[The Chesapeake Bay Ecosystem]

The largest estuary in the United States is the Chesapeake Bay. It is 300 km long and has a total area of tidal waters of 11,000 km². The bay's 167,000 km² watershed spreads over six states and the District of Columbia and includes over 15 million people. The vital ports of Baltimore, Maryland, and Hampton Roads, Virginia, are on the bay and at the head of one of the tidal tributaries is Washington, DC. Not only is the bay a highly productive estuary, but it also improves the quality of life of the people living near or on it (USDA).

In the 1970s, people began to finally understand the extent of the bay's environmental degradation, even though many entities such as fisheries management, port and harbor development, and waste disposal had been under scrutiny for many years (USDA).



Photo courtesy of: <http://desktop.freewallpaper4.me/view/original/6425/fish-underwater.jpg>

Theoretical Premise Research

Continued...

[Understanding the ecosystem]

Science has played a vital role in identifying the causes and effects of the degradation of the Chesapeake Bay, determining the relationships of these and other natural factors to the bay's living resources, setting achievable goals and finding practical solutions. This was possible because of the sustained investment by the bay states in marine research. As a result, scientists throughout the world view the Chesapeake Bay as at the leading edge of estuarine research.

Due to deforested landscape, there was a significant increase in sediments and nutrients that were entering the bay. While the nation was growing after the Civil War and the Industrial Revolution began, a record amount of metal contamination in the sediments of the bay was found. During this time, the technology was available for mechanized harvesting of oyster populations; the result was that the natural filters (the oysters) were greatly reduced. Beginning in the 1950s, more and more nutrient, waste and sediment spread into the bay due to natural areas being converted from the population growth. Agriculture played a large role in the increased nutrient runoff as increased production and the use of inexpensive chemical fertilizers drastically altered the coastal ecosystem (Transformation Strategy and Restructuring).



Photo courtesy of: Travis Steffen

[Predicting the future]

Science has played an important role in documenting the history of the Chesapeake Bay ecosystem decline. Researching the causes of the deterioration of the coastal ecosystem, the great challenge for science today is to reverse this degradation and create a sustainable future by taking on the task of predicting the future and advising decision makers to make the right choices.

The Chesapeake Bay Program emphasizes linked mathematical models to aid researchers in addressing this daunting task of evaluating these problems. These models estimate nutrient inputs resulting from atmospheric loadings and land uses, deliver nutrients to the bay through a hydrological model of the watershed, and predict the effects on productivity, water quality in the bay, and turbidity and living resources via a three-dimensional hydrodynamic and ecosystem model of the entire aquatic system.



Photo courtesy of: http://www.theenvironmentalblog.org/wp-content/uploads/2012/05/3314227532_e338e91363_o-600x340.jpg

Theoretical Premise Research

Continued...

The overabundance of sediment, contaminants and nutrients that flow into the bay from population growth and increased agricultural lands have lost the natural habitats that would have been able to retain them. In addition, climate change has caused greater extreme water temperatures in the bay than it has ever seen. The bay area has also seen a significant loss of important coastal wetlands due to sea levels rising. The impact of invasive species, habitat loss, pollutants, disease and climate change has affected the wildlife populations in the bay and surrounding area.

[Among the key findings on land use and its relation to water quality and habitats]

Due to the increased impervious surfaces during the 1990s, more rapid erosion of sediment and delivery of nutrients to streams occurred. While nitrogen and phosphorus concentrations have decreased at a majority of watershed sites, they are not decreasing quickly enough to significantly reduce the bay's nutrient loads.

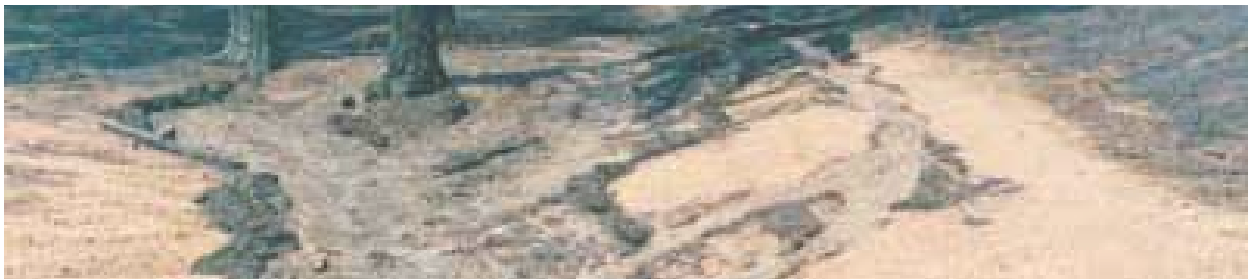


Photo taken by Travis Steffen

Underwater grasses and water clarity is adversely impacted by sediment in the bay; therefore, shoreline erosion and sediment trapping in reservoirs and wetlands must be focused on to increase the quality in the bay and watershed. Because the travel time of sediment and nutrients to the bay from the watershed can vary from weeks to hundreds of years, implementing improvements and management actions can lag. To better focus these efforts, knowing the travel times can be very beneficial.

The loss of submerged aquatic vegetation, or SAV, from shallow waters of Chesapeake Bay, which was first noted in the early 1960s, is a widespread, well-documented problem. Although other factors, such as climatic events and herbicide toxicity, may have contributed to the decline of SAV in the bay, the primary causes are eutrophication and associated reductions in light availability. The loss of SAV beds are of particular concern because these plants create rich animal habitats that support the growth of diverse fish and invertebrate populations. Similar declines in SAV have been occurring worldwide with increasing frequency during the last several decades. Many of these declines have been attributed to excessive nutrient enrichment and decreases in light availability (USDA).



Photo taken by Travis Steffen

Theoretical Premise Research

Continued...

[Among the key findings on the fish and bird populations]

Improving the water quality in the bay for fisheries may make them less prone to pathogens and disease. Contaminants can lead to reproductive abnormalities in fish; for example, some fish in the Potomac watershed have female eggs growing in their testes.

While concentrations of DDT and other pesticides have decreased in the last 40 years, PCB concentrations have remained mostly unchanged. Many fish-eating birds have had their populations slowly start to re-emerge, but there are still others that are at risk due to emerging contaminants.

Food sources and habitats for the seaduck population have been affected by poor water quality and invasive species, leading to a decline in the population.



Photo taken by Travis Steffen

[Among the key findings related to climate change]

The past 40 years have had more extensive and severe low dissolved-oxygen conditions influenced by population growth in the watershed and climate change than in the past 2,500 years.

Land subsidence and climate change have caused the sea level to rise, and will continue during the next century to cause landward migration and losses of tidal wetlands. Water clarity in the bay and sediment erosion in low shoreline areas are in turn affected by the rising sea level.

In order to restore and preserve the bay's ecosystem, new strategies must be developed and integrated to address climate change (USDA).



Photo courtesy of: http://images.brighthub.com/4b/8/4b8e2fc9e199333f0676954ed18159364acd8514_large.jpg

Theoretical Premise Research

Summary...

As an important test bed for large-scale coastal ecosystem restoration and management, Crisfield will serve as a template for other cities to follow. Human development in the region will create new challenges for Crisfield, and there is a need for more reliable predictions for future conditions.

In order to be an effective guide for sustainable development, local research assessments must be integrated with environmental research, monitoring and modeling, as well as technological improvements, societal change and landscape dynamics that benefit the ecosystem.

Science has played a critical role in identifying the causes of the degradation of the bay, determining the relationships of these and other natural factors to the bay's living resources, setting achievable goals and finding solutions. Crisfield's future is heavily dependent on the living resources in the bay and will greatly benefit if certain aspects of the bay can be revitalized.



Photo Courtesy of: Sunset - Wikipedia, the free encyclopedia. (n.d.). Wikipedia, the free encyclopedia. Retrieved December 8, 2011, from <http://en.wikipedia.org/wiki/Sunset>

Scientific research has played an important role in documenting the history of the Chesapeake Bay's ecosystem and its decline. With the new scientific data, I can design with sustainability in mind and will be able to use this new data to help improve the local ecosystem.

Researching the causes of the deterioration of the coastal ecosystem, the great challenge for science today is to reverse this degradation and create a sustainable future for Crisfield by taking on the task of predicting the future and advising decision makers to make the right choices.

Land subsidence and climate change have caused the sea level to rise, causing aquatic disturbances which will continue during the next century to cause landward migration and losses of tidal wetlands.

Water clarity in the bay and sediment erosion in low shoreline areas are in turn affected by the rising sea level. Dealing with this problem will be crucial for Crisfield's future and the economic challenge it currently faces.

Sunset - Wikipedia, the free encyclopedia.
(n.d.). Wikipedia, the free encyclopedia.
Retrieved December 8, 2011, from <http://en.wikipedia.org/wiki/Sunset>



Photo courtesy of: http://gs-press.com.au/images/news_articles/cache/Alice44-0x600.jpg

Case Studies...

[INTRODUCTION]

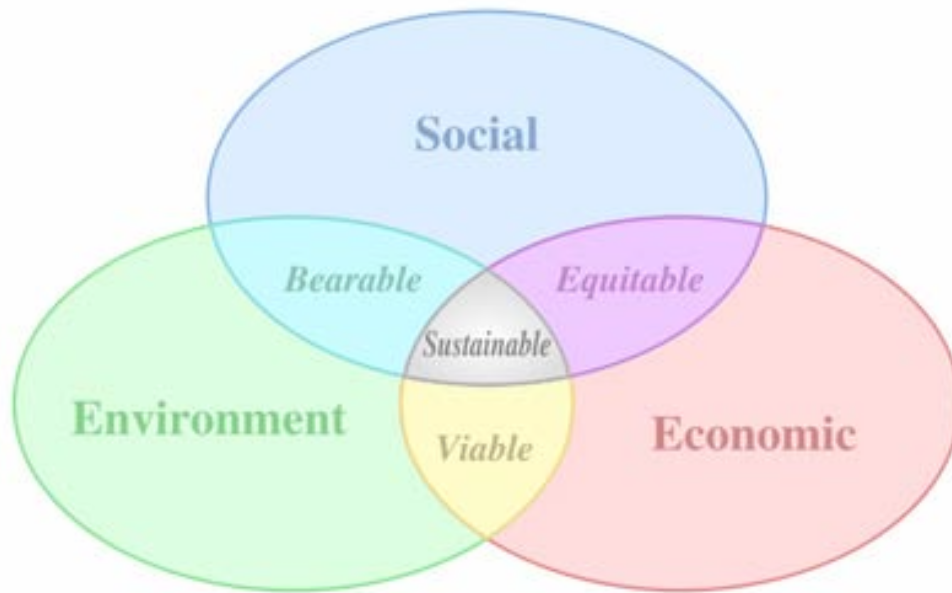
These case studies analyze waterfronts both locally to Crisfield, MD, and around the world and summarize lessons from these projects that will inform me in my design for creating a sustainable, viable and captivating intervention.

[Each case study examines the following]

- An overview
- How each study relates to the environment and wildlife habitat
- The public use of the space
- The basic facts of the case study and comparisons to Crisfield, MD
- Design and construction overview



[All three case studies will be used to gather information on how Crisfield can benefit socially, economically and environmentally.]



1.

Juneau Waterfront

Juneau, Alaska...

[Basic Facts]

Location: Juneau, Alaska, USA

Main points: urban waterfront, fish migration area, cruise ship tourism

Size / length of waterfront: 2.5 miles

Year implemented: currently under development

Clients: city and borough of Juneau, Juneau's Port Development Committee

Price: currently under development

[Relevant Issues]

[Habitat and Environment]

- Salmon migration corridor
- Over-water structure impacts
- Aquatic habitat
- Tidal habitat
- Aquatic habitat

[Public Use]

- Water touch points
- Historical context
- Urban revitalization
- Ecotourism
- Marina slips
- Waterfront promenade

[Overview]

The heart of Juneau is its waterfront. It is a center of tourism, commerce, industry, livelihood and social interaction. The waterfront features a broad mix of government offices, retail shops and a marina. Industrial uses converge tidal habitats, estuaries and forests. Playing an important role in a delicate ecology, the waterfront is surrounded by wilderness. Gold Creek contains a protection zone at the mouth that preserves a creek delta and natural tide flat. In other areas of the waterfront, the city's shoreline is supported with a steel sheet pile. Juneau is developing a phased seawalk to renovate its waterfront, provide destinations for residents and visitors and unite the city with its natural surroundings based on a waterfront master plan.

[Habitat and Environment]

Juneau and its waterfront will need to respond successfully to preserve the surrounding fragile ecosystem. At low tide, diverse marine flora can be seen, and at the mouth of Gold Creek, there is a protected zone which serves as migratory salmon habitat. As a result of Juneau's development, a safe passage has been provided through the urban waterfront. The variation in Juneau's tide levels and long tide flats have made it necessary for ship moorage and boardwalks to be built far off shore; therefore, open water portals featured between boardwalks illuminate the water, and shoreline benches in shallow water are untouched. Assets such as these serve to not only accommodate requirements for loading and operations along the waterfront, but also improve salmon migration conditions.



[Public Use]

Between May and September, the waterfront and downtown of Juneau are filled with cruise ship passengers. More marina facilities, parks, promenades and public recreation have been proposed in current planning documents for future design along the waterfront. Off-season when ships are not in port, the locals utilize areas along the Steamship Dock, the Cold Storage/South Ferry Dock, and sections of the walkway behind the Merchant's Wharf, since there are no formal public walkways.

[Lessons]

- Incorporate terminal into public walkway.
- Protected habitat zones for spawning salmon and other marine life.
- Use of boardwalks to elevate structures, allowing illumination of salmon migration corridor and views of the marine ecosystem.
- Multiple public recreation opportunities, such as marinas and boardwalks.



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Chicago Shoreline Protection Project

Chicago, Illinois...

[Basic Facts]

Location: Chicago, Illinois, USA

Main points: shoreline protection, revetment design, flood and storm damage reduction plan, public water access, recreation, construction phasing

Size / length of waterfront: 8 miles of Lake Michigan shoreline

Year implemented: 5.8 miles constructed, with completion anticipated in 2015

Clients: US Army Corps of Engineers, City of Chicago Department of Environment, Chicago Park District

Price: \$354 million

[Relevant Issues]

[Habitat and Environment]

- Littoral drift
- Dune habitat re-creation
- Migratory bird habitat
- Tree protection and preservation

[Public Use]

- Water access
- Gathering space
- Parkland and beaches
- Bicycle and pedestrian paths

[Design and Construction]

- Shoreline stabilization—construction over the existing revetment
- Phasing to allow

[Overview]

Storm erosion and natural weather caused the US Army Corps of Engineers and the City of Chicago Department of Environment to start replacements of Chicago's eight mile revetment. In order to protect areas of this revetment such as a federal highway, the lakefront park area, and Lake Shore Drive, the shoreline must be stabilized. A steel sheet pile faced stepped concrete revetment is the primary means of stabilization, and in some areas, rubble mound revetment and beaches interrupt the revetment. While many of the city's beaches feature natural, fine-grain sand from littoral drift with groins and are protected by off-shore breakwaters, this project has also looked into creating natural sand and gravel beaches with habitats that form naturally in shoreline areas that have yet to be disturbed.

[Habitat and Environment]

Re-creating Illinois' natural beach and dune habitat presents an opportunity for this project to correct the habitat that has been lost to development. Environmental improvements focus on aquatic and terrestrial improvements. Providing a habitat for aquatic life such as mussels, small freshwater fish and crayfish, the submerged stone at the toe of the revetment is a part of this habitat that consists of a fore-dune, back-dune, beach, wetland and forest plant communities. Due to the large amount of land needed for this habitat, a portion of the south side's shoreline is being explored.

Parkland trees, forbs and shrubs were featured to provide food and shelter for Lake Michigan's known migratory birds that frequent the shoreline's migratory bird corridor. A point was made throughout construction to preserve existing deciduous trees such as 100 year old elms, oaks and maples.

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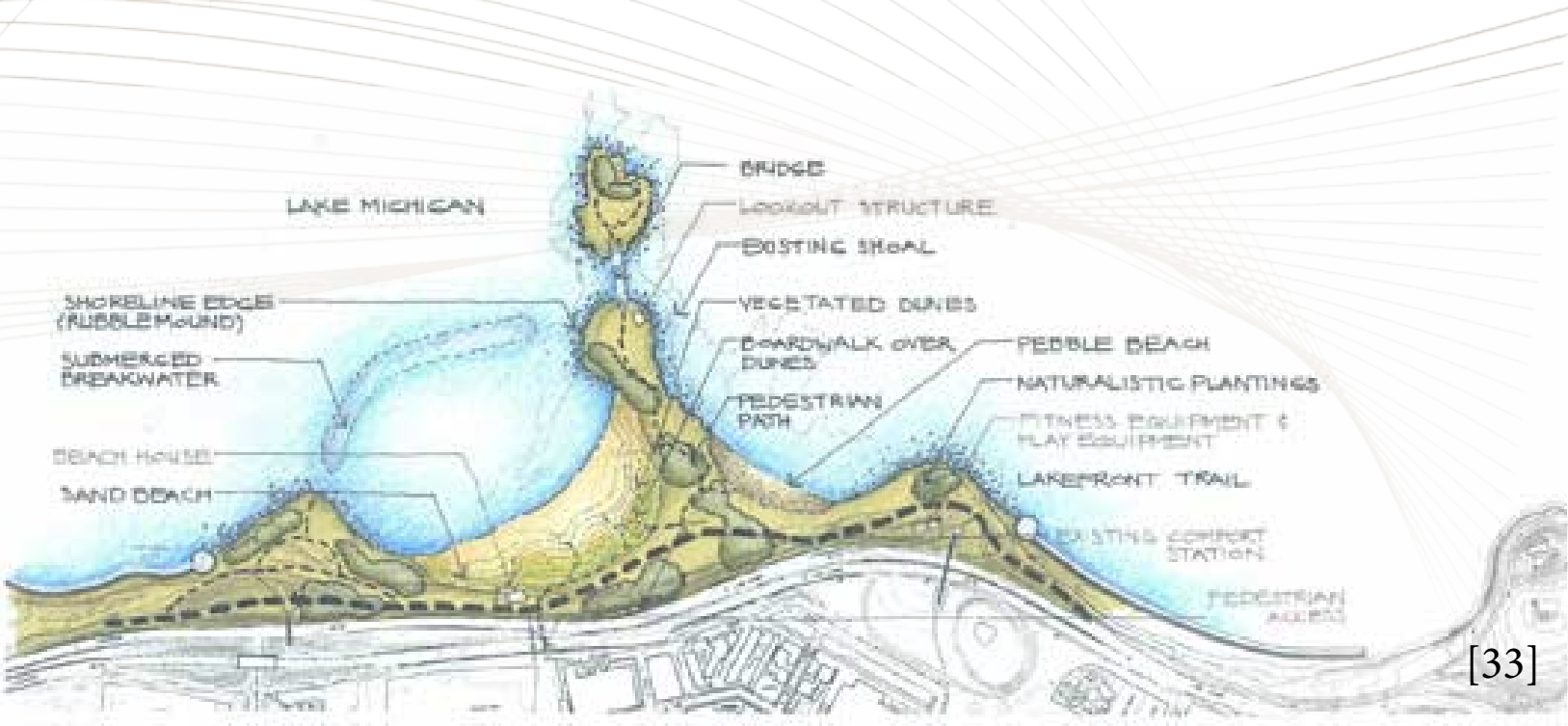
[Public Use]

Planning for this project was coordinated with the master plans for Grant, Burnham and Lincoln Parks, as creating a recreational and accessible waterfront was the main goal of the project. Planning also included a public input process in order to improve and protect the recreational use and access of the waterfront. Some of the features of the stepped revetment structure include areas for informal seating, a water-edge promenade for strolling and fishing, areas for sunbathing, and gathering area for events such as fireworks displays, the annual air show and boat regattas.

For accessibility for those with disabilities, periodic sloped walks are featured between the stepped levels. Instruments for safety such as ladders, seiche cables and throw buoys were included along the promenade. Areas with high visitor access potential were established with beaches, and further inland, existing recreational paths were widened, enhanced and even rerouted during construction to maintain use.

[Lessons]

- Sheet pile and stepped concrete revetment structure employed through most of the eight mile project, with greater design attention given to the waterfront and water touch points in high public use regions.
- Levels and waterfront promenade in revetment provide for recreation and wave energy deflection.
- Sloped walks traversing the stepped revetment levels provide accessibility.
- Ladders, throw buoys and seiche cables included as safety measures.
- Aquatic and terrestrial plant, animal and migratory bird habitat developed.
- Revetment construction provided opportunities for new parkland creation on fill areas and improvements to existing parkland and bicycle/pedestrian paths.
- Construction phases allow multiple contracts and maintain public shoreline access.



Västra Hamnen

Malmö, Sweden...

[Basic Facts]

Location: Malmö, Sweden

Main points: popular promenade with water access, habitat features in urban setting

Size / length of waterfront: 300 meters (about 1,000 feet)

Year implemented: 2001

Client: City of Malmö

Price: unknown

[Relevant Issues]

[Habitat and Environment]

- Remediated soil
- Habitat features combined with urban elements

[Public Use]

- Water touch points
- Historic and neighborhood context connections

[Design and Construction]

- Promenade intended for multiple uses
- Sustainable features incorporated throughout development process

[Overview]

In an area that was previously known as the Kockums shipyards (one of the largest shipyards in Europe), Västra Hamnen (“Western Harbor”) is a new district in Malmö’s now reclaimed waterfront. In the 1990s, after an economic decline, Malmö started redeveloping its waterfront. The first neighborhood developed within the Västra Hamnen district was Bo01 (bo-noll-ett).

Serving as a model for ecological and human sustainable design and development, Bo01 considers the requirements for a healthy ecosystem at each step of development. Bo01 requires that each step is viewed within the question of “how may this be both beautiful and environmental?” Visual diversity and buildings powered by local and renewable resources prevent Bo01 from becoming a generic suburb.

Västra Hamnen places great emphasis on its proximity to Öresund by featuring a promenade and boardwalk as well as large buildings designed to block wind from the waterfront.

[Habitat and Environment]

Most of the sub-tidal zone in Västra Hamnen was already rich in marine life. Life is expected to flourish since almost 6,000 cubic meters of toxic sediment were removed and replaced by class A soil and topsoil was increased. Green points focused on energy consumption, green materials, habitat features, and other design considerations to ensure that Bo01 had a high development quality.

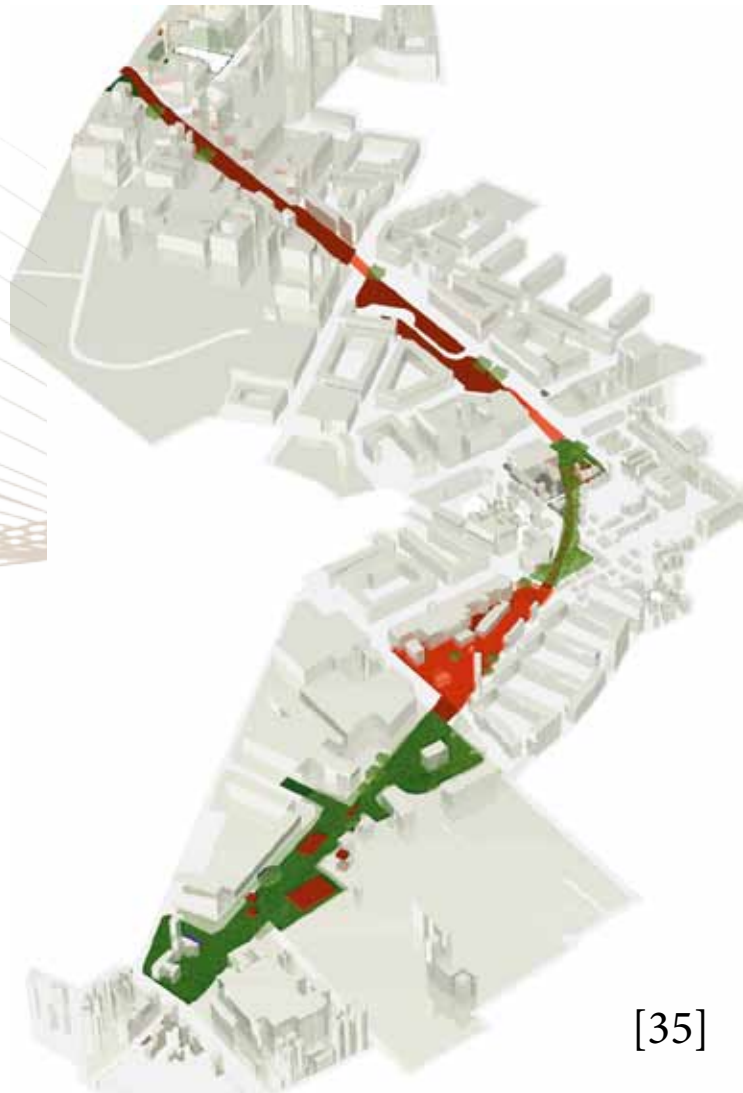
A major element in Bo01 is storm water design; this water flows through green roofs and ponds constructed in urban spaces, and then through open channels, and finally returning to sea. These open waterways add a green quality with lush plantings to an otherwise sterile environment.

[Public Use]

Currently Bo01 has several large and small businesses already established, with housing for about 1,000. Planning to house 10,000 people, Västra Hamnen will also feature offices and university classrooms that plan to have space for 20,000 more. Further Västra Hamnen developments will address the criticisms regarding affordable housing.

[Lessons]

- Habitat landscapes, such as gardens and bird houses, included in urban design.
- Water is accessible in multiple ways (swimming, diving, wading, viewing).
- Promenade designed for multiple uses (strolling, lounging).
- Boardwalk constructed on top of stone revetment.
- Stormwater managed on site and returned to the sea in open channels.



Case Studies

Summary...

Each case study takes a good look at how it impacts and can better benefit the habitat that it may encounter in the design. All three also look at the social and economical effects the designs will have on the community.

All three case studies focus on topics which I am looking at in Crisfield, MD, and relate very well. Selections for my case studies are examples that are related to my site.

The goal of the research is to determine how a professional program can be developed, and to discover a professional perspective on the design process of a sustainable and viable community.

From the analysis, I learned a process of steps and systematic requirements to follow in order to develop the solutions needed for a sustainable design. All three case studies looked at designs along the shoreline which I will also be focusing on. Västra Hamnen serves as a model for ecological and human sustainable design and development as well as a main corridor through the city to draw visitors to the water's edge. This will be a key aspect to my research and design of Crisfield's shoreline.

All designs look at dealing with storm water runoff and treating the water for chemical and toxins before it reaches the aquatic habits in the water.



Public use is looked at extensively in all three case studies and designed with the user in mind. Whether they are tourists, community members or the people working in these areas, the function for all is taken into account.

The ecosystem is looked at very closely in the Juneau, Alaska, case study and is probably my most important case study since I am taking into account that Crisfield's surrounding ecosystem is the most important aspect to its future survival. Without a healthy and sustainable aquatic ecosystem, Crisfield's history and economic livelihood will not be viable for much longer.

Promoting Crisfield as a viable and sustainable city for the future must be passed on to those who visit the site, and education components must be put into place within the city. The Chicago Shoreline project was able to incorporate a level of education within its design, allowing for more than just a shore beautification project, using a design that can be used as a model for other cities to follow.

With ecological, economical and social benefits in mind, these three case studies are all templates and promote healthy ideas to look at. The city of Crisfield will be a model for other towns founded on fishing and crabbing to follow and bring about a unique and viable approach to tourism.



Historical Context...

[Chesapeake Bay Overview]

From the Susquehanna River headwaters in the north to where the Bay meets the Atlantic Ocean in the south, the Chesapeake Bay is the largest estuary in the United States. Surrounded by Virginia and Maryland, the bay's watershed covers 64,299 square miles in Washington D.C., as well as parts of six states, with more than 150 streams and rivers flowing into the bay.

[Chesapeake Bay History]

Derived from melting glaciers during the last Ice Age, the bay formed its current shape about 2000 B.C., and Native American agricultural practices led to settling in the bay region around 1000 B.C. Many streams and rivers were given American Indian names, giving importance to the Native American history of the land in the bay area.

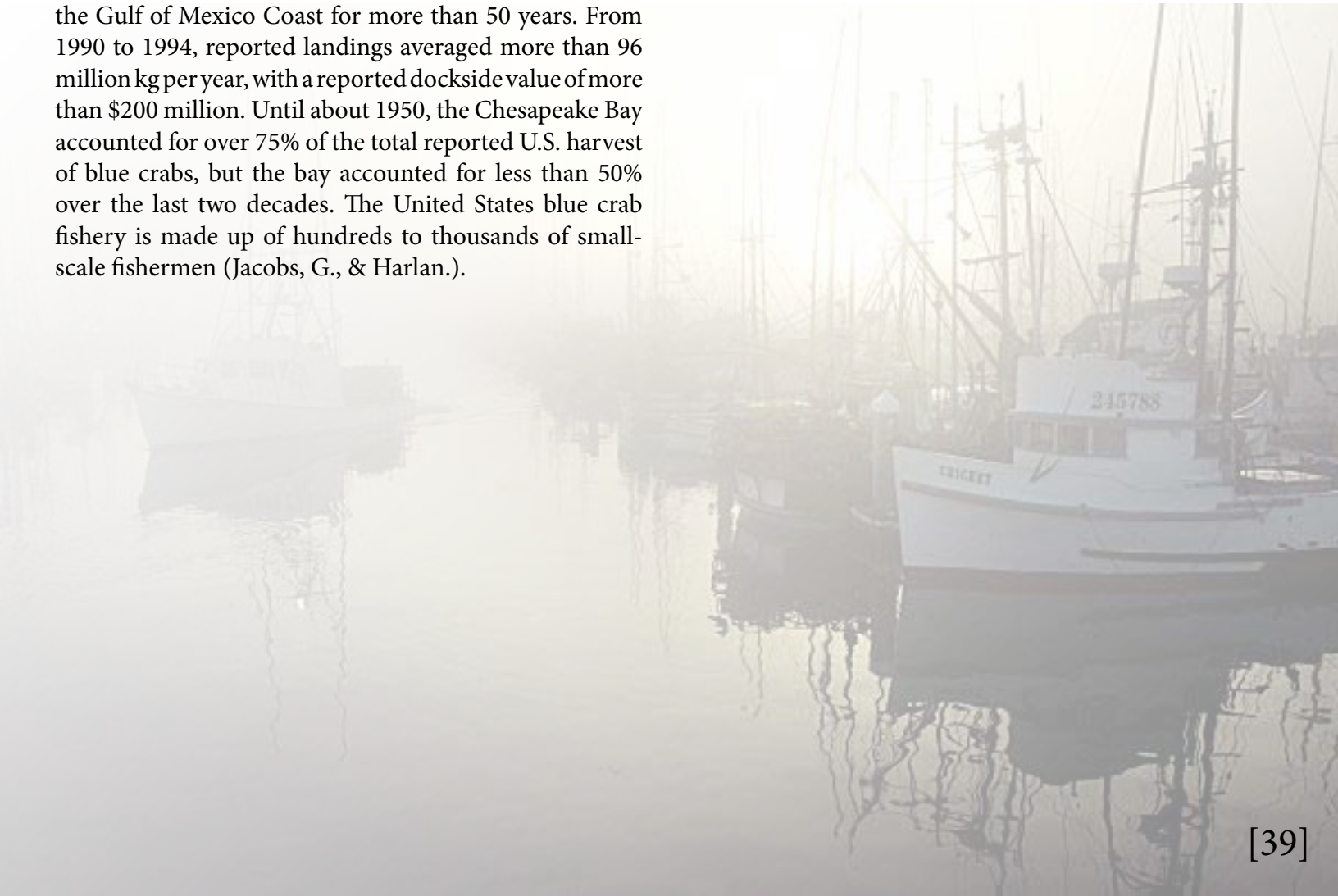
Before colonials such as Lucas Vásquez de Ayllón, the Spanish conquistador, came to America, Native Americans lived along the bay for many years. Near the area where Jamestown was established 100 years later, Vásquez established San Miguel de Guadalupe in the 16th century while mapping the Chesapeake Bay. Captain John Smith founded the first permanent American settlement, Jamestown, in 1607 (Helber, L. E.).

[Fishing & Crabbing]

Recreational fishing accounts for an estimated 85% of the bay's fishing, while fly fishers to commercial crabbers contribute to the bay's rich fishing culture. The Chesapeake Bay's economy has been greatly improved due to tourism from recreational fishing. There are more than 300 species of fish in the bay region, although most are migratory and only 32 species are in the bay all year. Popular game fish species include Blue Catfish, Black Drum and Striped Bass.

Major blue crab fisheries have existed on the Atlantic Coast of the United States for at least 100 years, and on the Gulf of Mexico Coast for more than 50 years. From 1990 to 1994, reported landings averaged more than 96 million kg per year, with a reported dockside value of more than \$200 million. Until about 1950, the Chesapeake Bay accounted for over 75% of the total reported U.S. harvest of blue crabs, but the bay accounted for less than 50% over the last two decades. The United States blue crab fishery is made up of hundreds to thousands of small-scale fishermen (Jacobs, G., & Harlan.).

Photo Courtesy of: Calvert Charters - Home. (n.d.). Calvert Charters - Home. Retrieved December 7, 2011, from <http://www.calvertcharters.com/SitePages/Home.aspx>



Historical Context

continued...

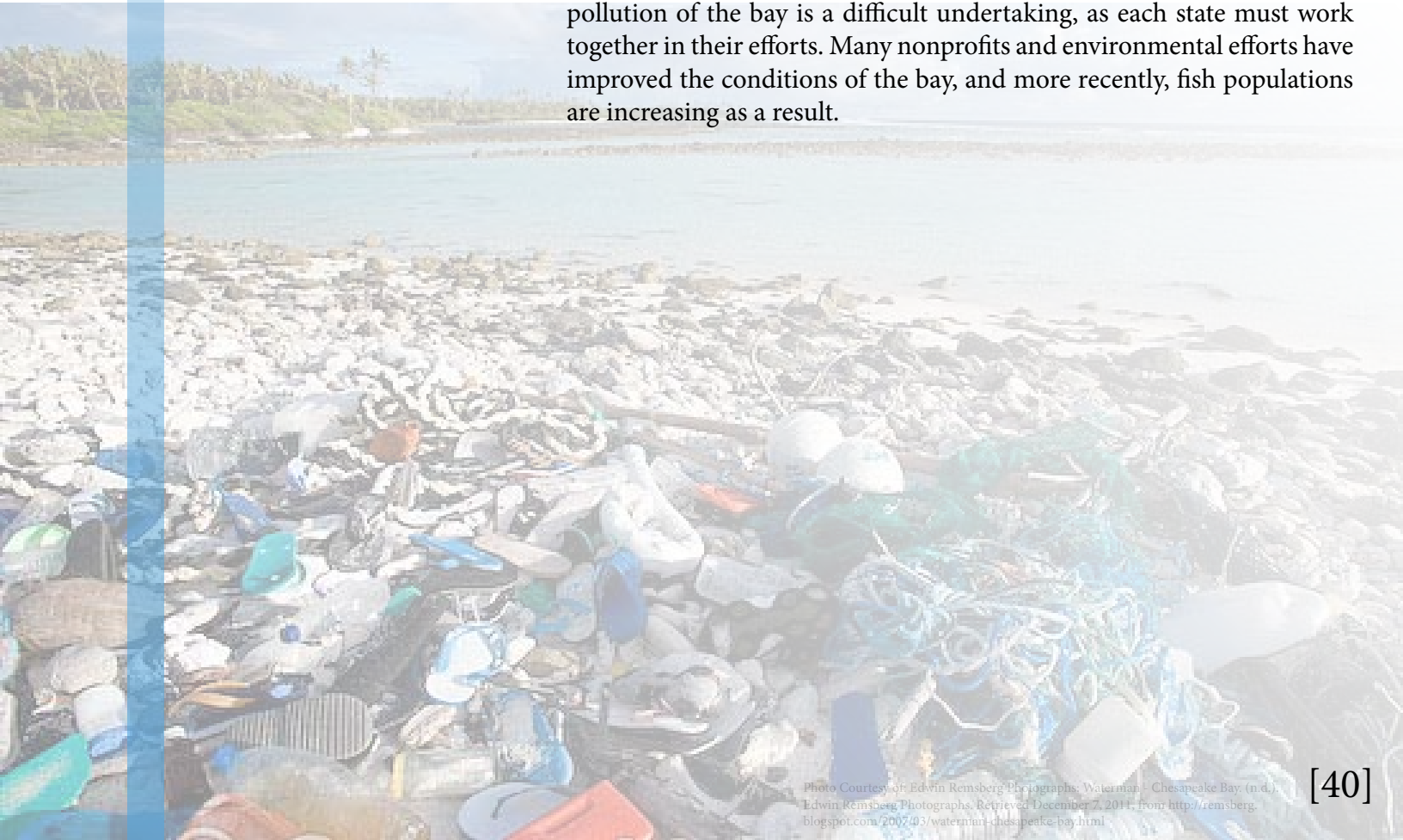
[Chesapeake Bay Conservation Issues]

Destruction of marshes and high levels of pollution caused by human development has harmed the bay area. Eutrophication, caused by farm runoff (a major cause of pollution consisting of mostly fertilizer) causes a significant increase in algae. This increase leads to less sunlight and dissolved oxygen in the water system, which is important to fish life and also affects water clarity.

While agriculture pollution has affected the bay area, industry that was drawn to the bay's ease of shipping and central location has also been another major source, although more recently some damage has been reversed, allowing fish populations to grow. Over-harvesting of the area's oysters, which are natural water filters, has also contributed to the bay's pollution.

Due to the bay's large area and tributaries across six states, reducing pollution of the bay is a difficult undertaking, as each state must work together in their efforts. Many nonprofits and environmental efforts have improved the conditions of the bay, and more recently, fish populations are increasing as a result.

Liggett, B. (n.d.). Another Giant Garbage Patch Found in the Atlantic Ocean | Inhabitat - Green Design Will Save the World. Inhabitat | Design For a Better World!. Retrieved December 7, 2011, from <http://inhabitat.com/another-giant-garbage-patch-found-in-the-atlantic-ocean/>



[Chesapeake Bay Waterman]

“Waterman” was an old term coined in the eleventh century in England, and it remained in use when the English settled in the Chesapeake area. Its used today to describe the men and women who make their living by oystering, crabbing and fishing in the bay. Most are independent fishermen who own their own boats and equipment and sell their catches to wholesale seafood houses. They fish in various types of weather year-round and may travel several miles to find their catch. Crabbing is popular in the summer months, and oysters, fish and eels are abundant in the winter, spring and fall. This job requires a love of water as the hours are long and money is not earned if the watermen aren’t working.

From the 19th century onward, the harvests of the watermen made historically significant contributions to the U.S. seafood supply. Their skills, customs, and lore, along with the fish and shellfish they provide, are fundamental to the Chesapeake Bay region’s identity. Unfortunately, years of rampant pollution have threatened to destroy this important piece of Maryland’s identity.

In 1983, the bay supported four major commercial fisheries: oysters, soft-shell clams, blue crabs and striped bass. The variety of fisheries protected watermen from economic hardship in years when one of the staple species was scarce and also reduced the likelihood that any one species would be overfished.



#1

Historical Context

continued...

[Future for the Waterman]

Over-harvesting and disease has led to devastated oyster beds and has changed the practice of open fishery to be strictly regulated by Maryland and Virginia. Being a waterman is becoming less profitable, and more and more watermen are leaving the water to find other sources of income. Small communities where watermen define the essence of the bay could diminish.

Environmentalists say the decline of the bay is linked to two things: over-fishing by waterman and pollution. The watermen say they've lived up to their end of the bargain but the states that border the bay haven't done enough to reduce the dangerous nitrogen and phosphorus levels that are polluting the bay. Now, the Waterman's Association, along with the Chesapeake Bay Foundation, are suing the EPA.

The state's secretary of natural resources says Virginia has spent over a billion dollars working with water treatment plants, industries and home builders, but the administration says farming is the state's number one industry, and only voluntary restrictions have been placed on farmers responsible for runoff from their lands.





[Today]

Many fear that if Virginia's watermen disappear, so will our access to the Chesapeake Bay crab and oysters---an economic resource that generates over a billion dollars annually for Virginia.

It has become clear that people are the only cause of the Chesapeake Bay's environmental problems; the issue now is implementing a protection plan and sustainable development while agreeing on a common goal.



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Thesis Goals...

[Goals for the thesis project]

- A concise and very clear theoretical premise that is a driving force for my research effort.
- A typology that is well-defined and carried throughout the case studies and summary.
- A clear description of the social, economical and ecological aspects of the design.
- An extensive and well-organized program.
- A useful and meaningful schedule.
- A well thought-out process of collecting and preserving the process of design.
- A design solution that is clear and represents the quality of work worthy of professionals, students and faculty in my field.
- Superior design models accompanied by useful and professional graphics.
- Well-organized oral presentation of the project.
- A compilation of my final project.



Photo courtesy of: Travis Steffen

Most important for my thesis is to have all three parts of sustainability kept in mind and balanced. The social, economical and environmental issues all need to be taken into account when designing from the beginning to the end of the project.

In order to achieve a high level of quality with my design, I will reinforce my organization and efficiency efforts. A thorough understanding of the social, economical and environmental context of the scope of the project will lead to a higher quality outcome for the city of Crisfield.

I will further enhance and communicate my graphic skills to better help explain not only the design solution but also the meaning with each solution put forth.

A professional level of production along with graphical representations will help the design as well as aid in others understanding of the design and all of the processes.

In both research and design development, detailed attention will be given to the social, economical and environmental issues concerning Crisfield, MD, and the surrounding Chesapeake Bay.



Photo courtesy of: Travis Steffen

Site Narrative...

As I approached the city of Crisfield by car, I noticed that many trees surrounded the main road into town, Route 413.

Tall evergreens were everywhere I looked. Small pockets of farming was placed within the trees. Around a bend every now and then was a glimpse of the familiarity of a wheat field.

During mid-July, the temperatures were hot and humid. Ninety plus Fahrenheit and 100% humidity made for a genuine and normative site visit to the city. As I got closer to the city, more and more small businesses began to spring up along Route 413, consisting mostly of fresh fish and crab shops where one can purchase local seafood by the pound.

Arriving in the city of about 2,700 people for the first time made me think of the movie *Jaws*. The reminder was not about the blood and the horror, but the quaint local shops, the nostalgic-looking pier and the fishing boats all placed in the background, bringing in their daily catches to be weighed.

I looked up as I got out of the car. I saw the town water tower with a large crab on it and knew I was in a community that embraced its heritage and wanted to promote its future.



Photo courtesy of: Travis Steffen

Once I started walking through the city of Crisfield, I began to get a feel for how the local community spent its days. Many of the local shops were open, including tourist-type shops, restaurants, bakeries, photo galleries and of course plenty of fishing shops, all attempting to bring in a tourist that might pass by.

The sounds of diesel ships and seagulls surround a person as he or she walks the sidewalks, while residents walk by along the boardwalk as one approaches the water. Once one reaches the pier, one has reached the end of the city. As I walked to the top of the two-level pier, I could see the whole city.

As I looked out into the open Chesapeake Bay, I could see boats, waves and endless possibilities for ecotourist opportunities. A beautiful sunset and local fisherman fishing off the pier brought about a feeling of relaxation and peacefulness.

The more I stayed in this wonderful little town full of history and fishing, the more I wanted to find out.



Photo courtesy of: Travis Steffen

Climate Data...

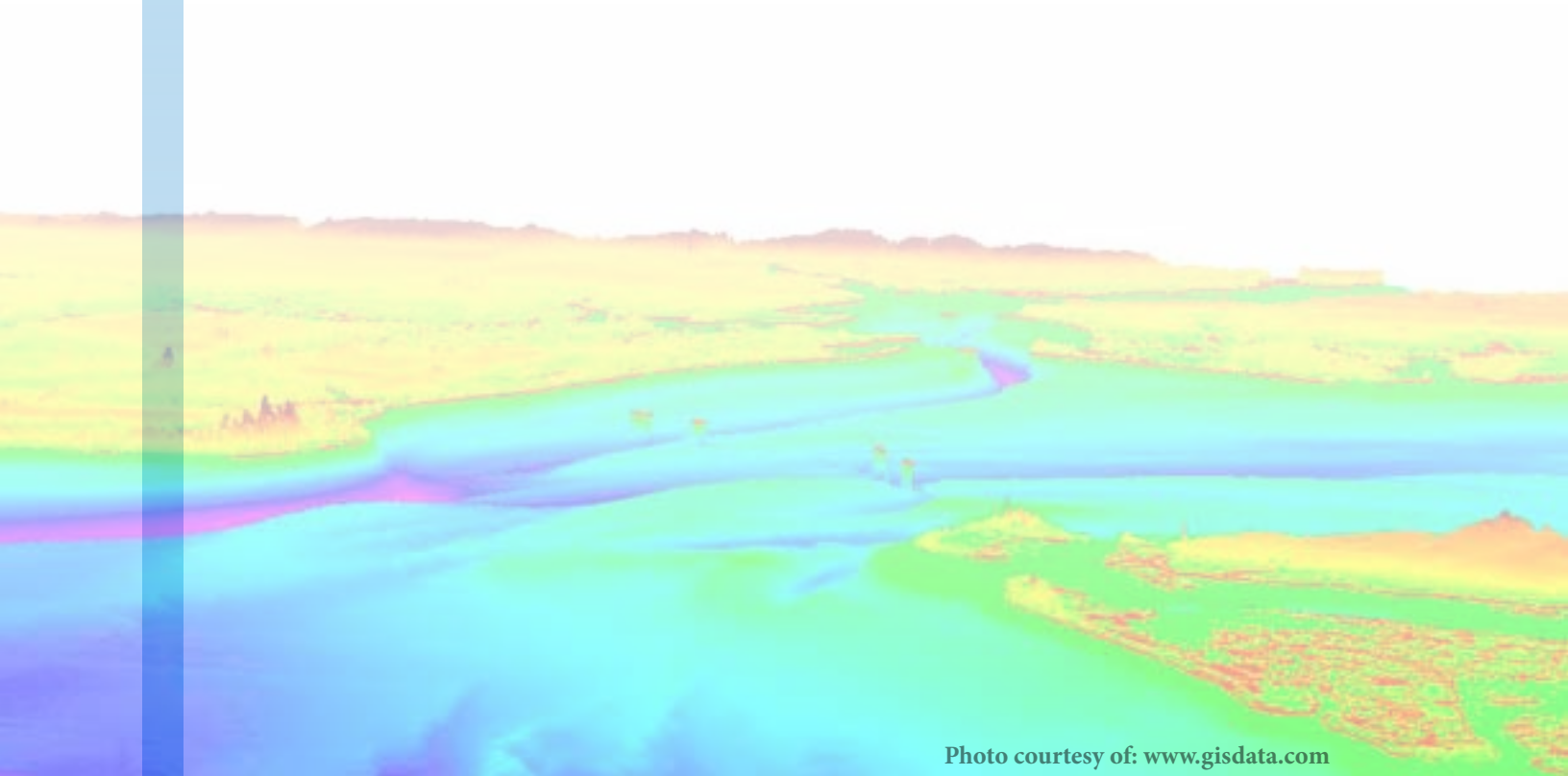
Unusual rain conditions, wind and temperature can have substantial effects on the Chesapeake Bay's aquatic habitat, wildlife, water quality and fish and shellfish populations.

All aquatic species can adapt to periodic changes in environmental conditions. However, researchers cannot predict with certainty how the diverse bay ecosystem will react to long periods of extreme weather conditions, and if the conditions are here to stay.

The Chesapeake Bay has a very humid climate. In the summers, the temperatures are hot, and in the winter, it's generally very mild weather. Temperatures in the northwest are substantially lower than the temperatures along the Atlantic Coast and near the Crisfield area. In January, the average temperature is 29 degrees Fahrenheit (-2 degrees Celsius) for the northwest.

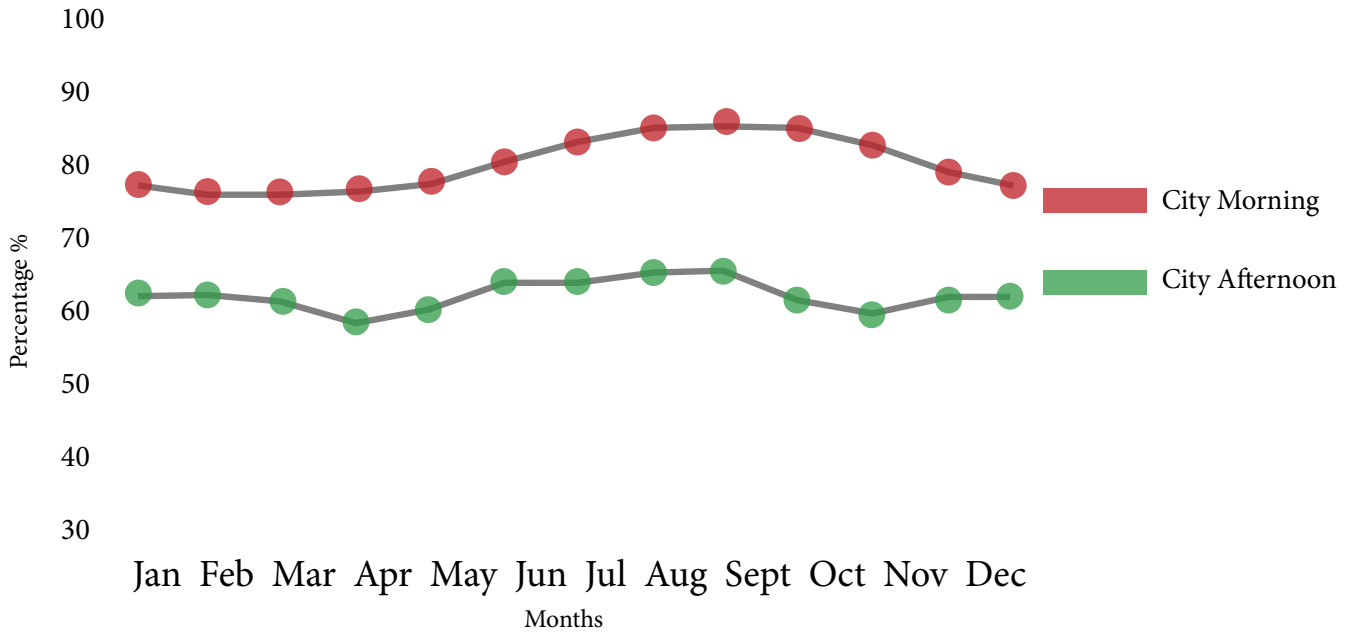
Along much of the Atlantic Coast, the average temperature during winter is 39 degrees Fahrenheit (4 degrees Celsius). In July, the average temperature is 68 degrees Fahrenheit (20 degrees Celsius) in the northwest. For the Chesapeake Bay region and in Crisfield, it is 75 degrees Fahrenheit (24 degrees Celsius).

That is the general climate for Crisfield, MD.

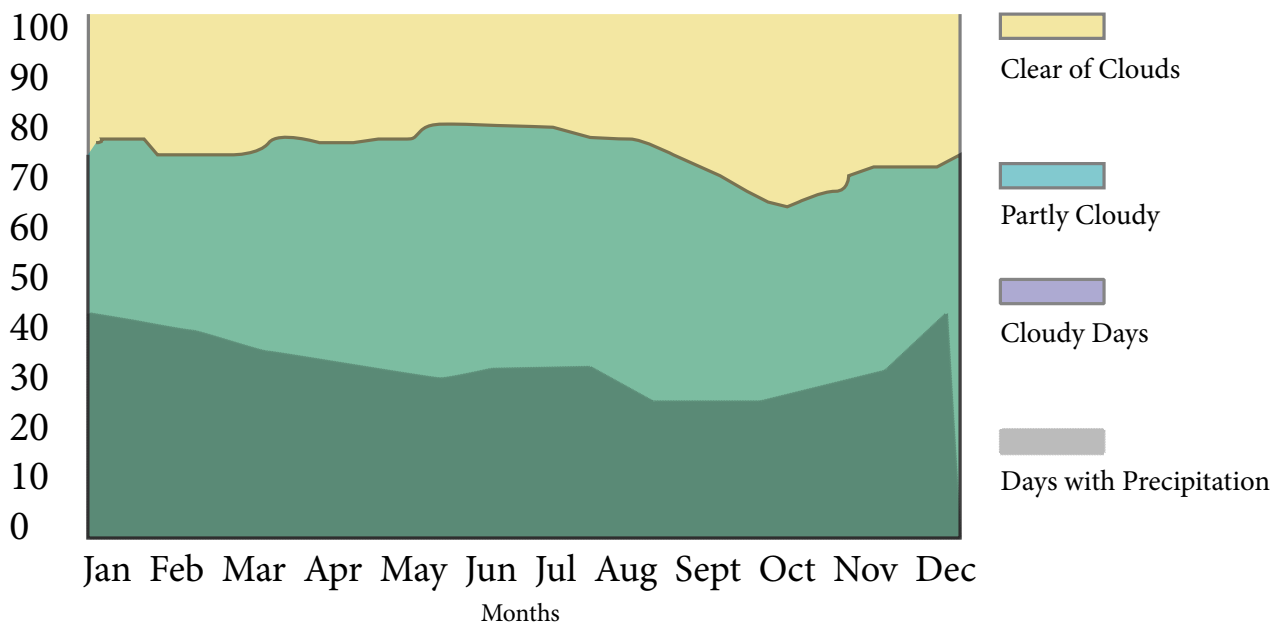


Climate Data...

Humidity



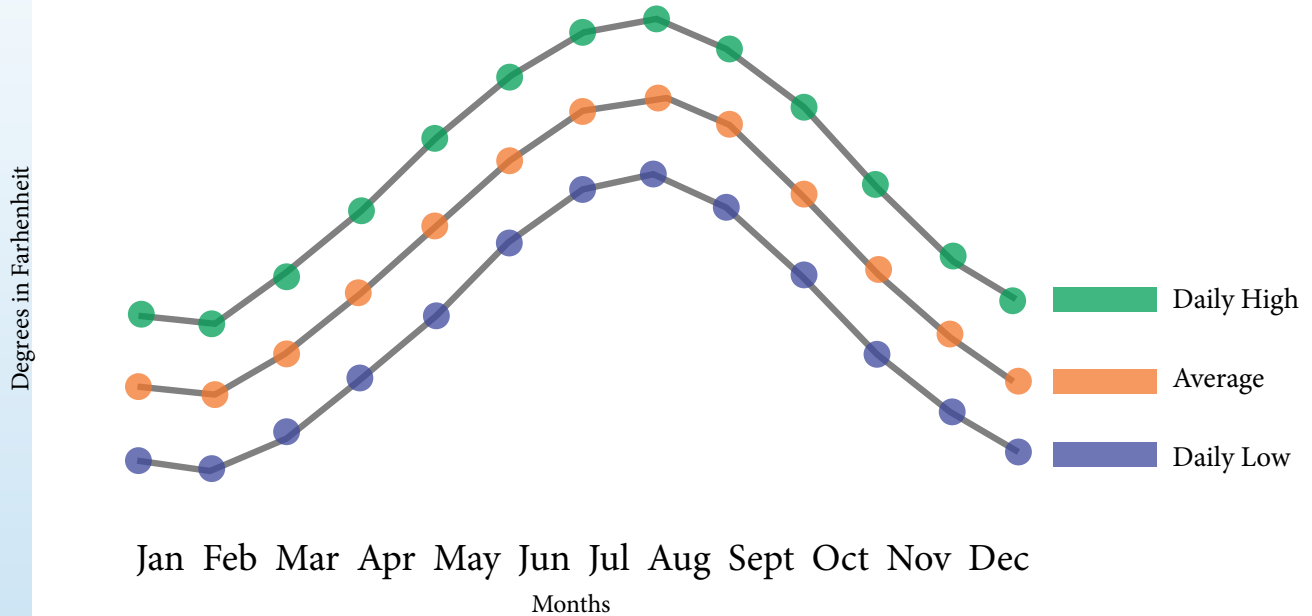
Cloudy Days



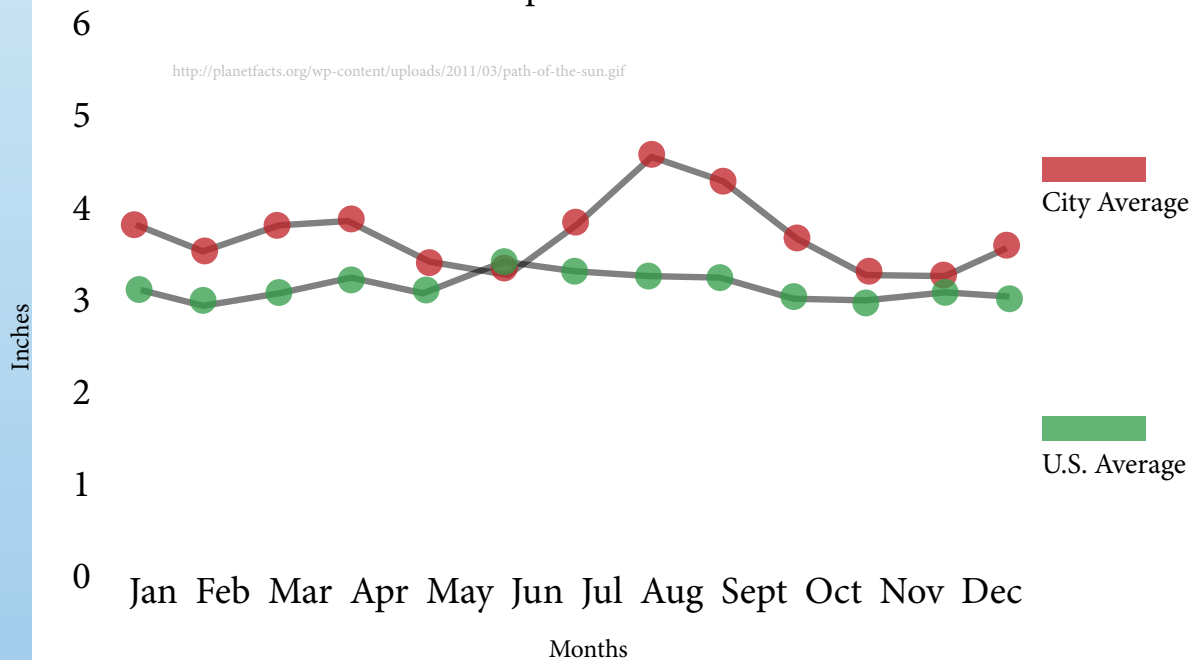
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Climate Data...

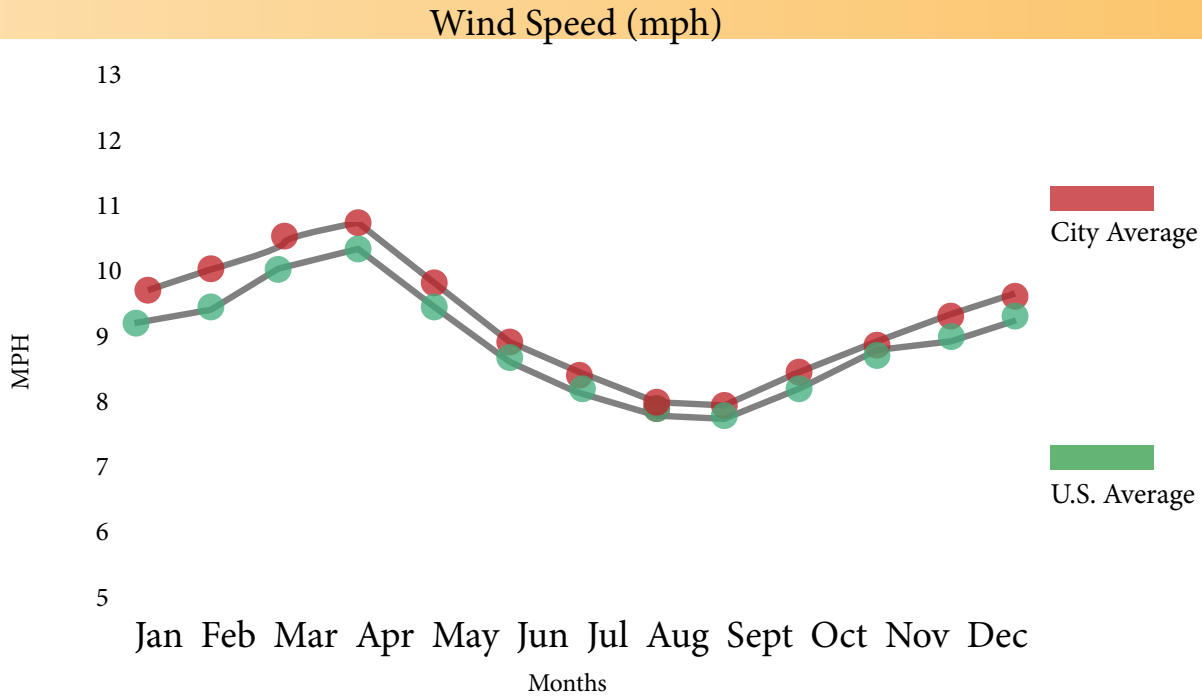
Average Temperatures (F)



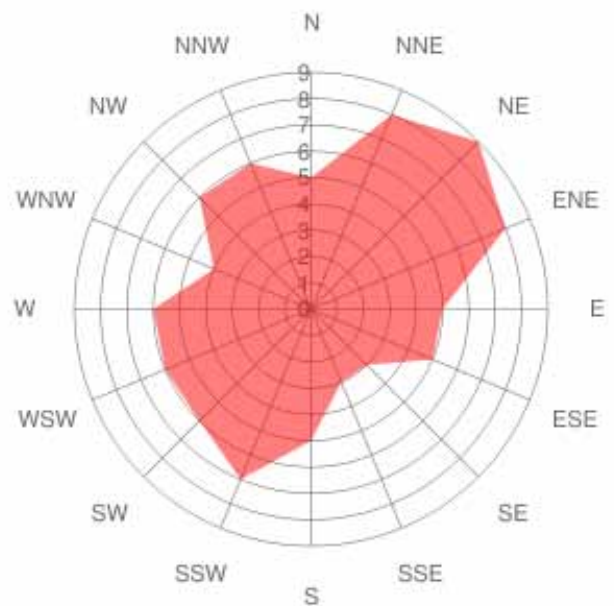
Precipitation



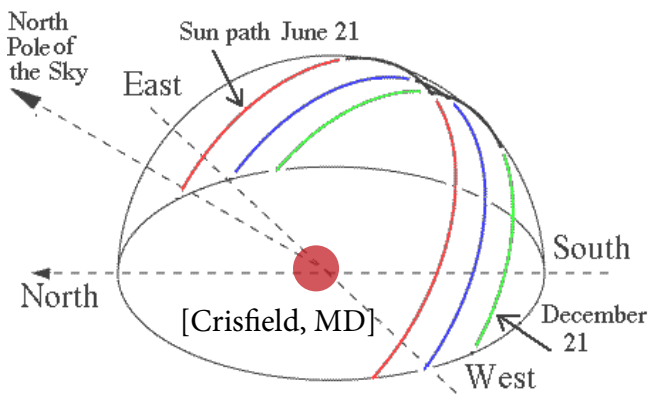
Climate Data...



The winds in Crisfield are variable; from the south comes heat, gusts and thunder; from the north or northwest, cold weather; and in winter, frost and snow; from the east and southeast, rain.



<http://planetfacts.org/wp-content/uploads/2011/03/path-of-the-sun.gif>



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Inventory & Analysis

Roads...



Photo courtesy of: Travis Steffen

Most major roads throughout the city are made of asphalt and are moderately lit with sidewalks.

Parking is mainly angled and usually is adequate in amount unless an event is taking place in the town.



Photo courtesy of: Travis Steffen

Route 413 is the main road and thoroughfare into and through the city of Crisfield.

The road is well maintained with frequent small shops along the way into Crisfield.



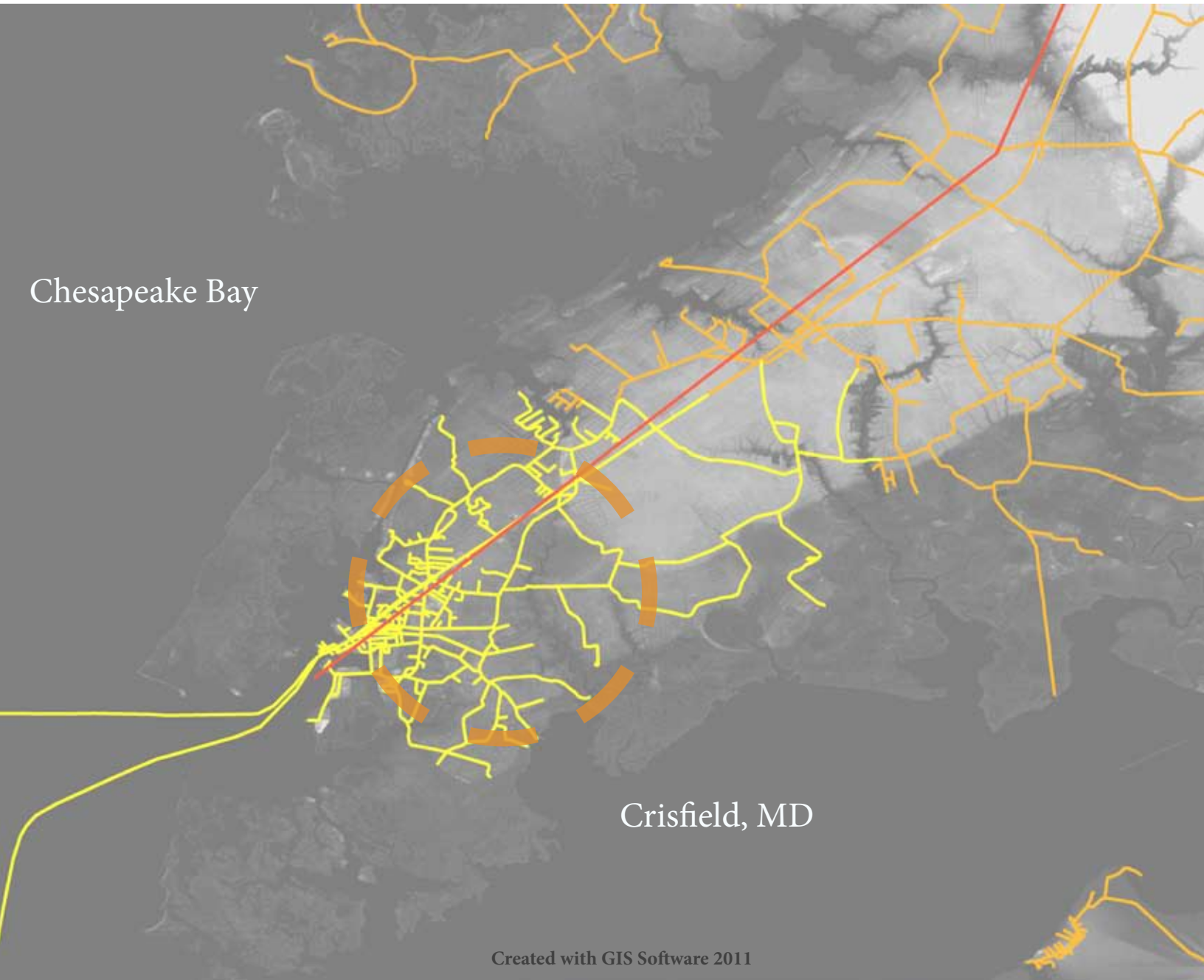
Major City Roads



Route 413 / Thoroughfare



Major Roads out of city limits



Chesapeake Bay

Crisfield, MD

Inventory & Analysis

Underwater Vegetation...



Photo courtesy of: Travis Steffen

Submerged aquatic vegetation (SAV) began to disappear from many of the Chesapeake Bay's shallow reaches in the 1960s and 1970s.

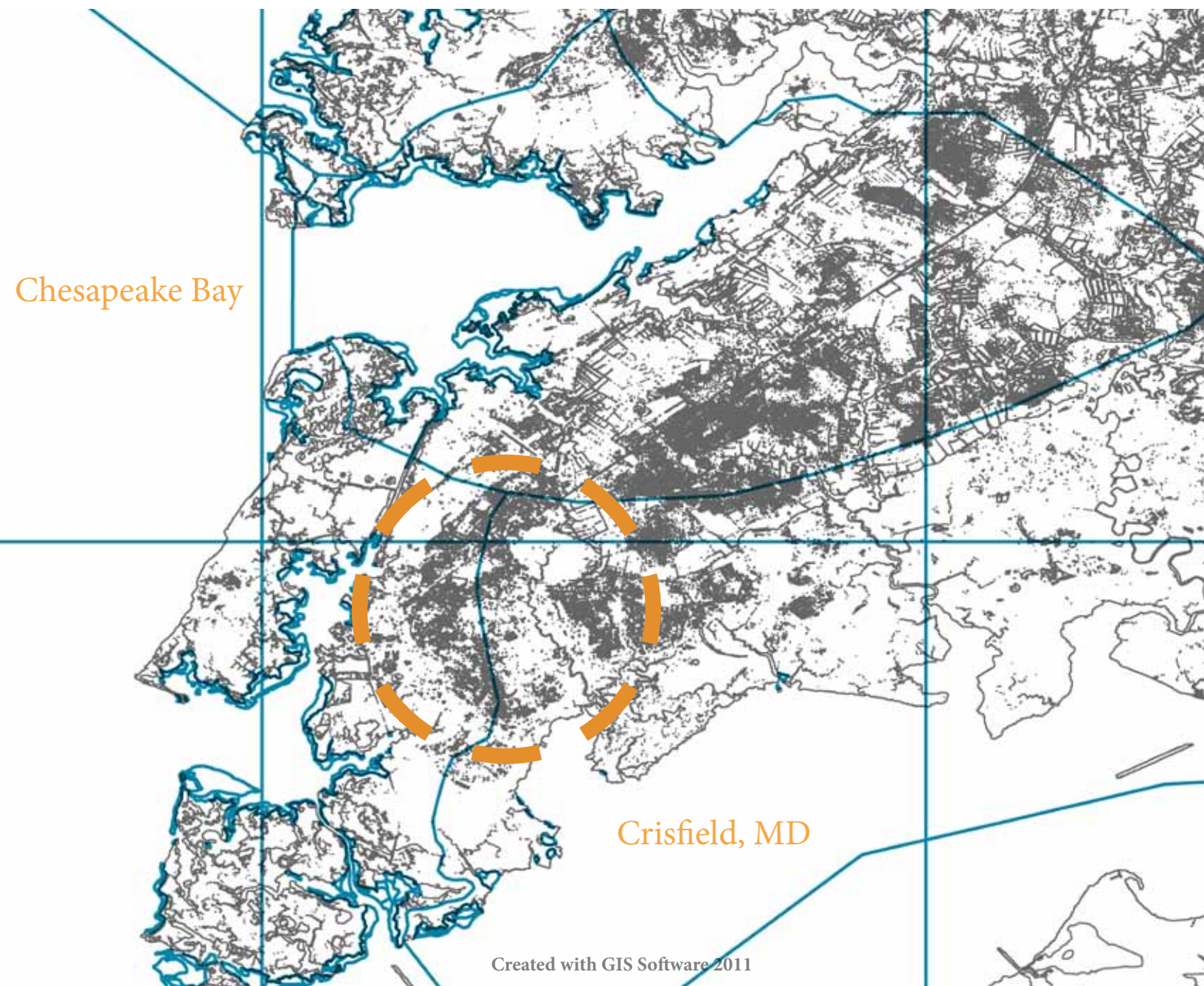
SAV is a necessity for fish habitat and breeding areas.



Photo courtesy of: Travis Steffen

SAV is critical to the bay's ecosystem because the grasses provide a habitat for fish and shellfish, help reduce shoreline erosion, absorb excess nutrients and trap sediment. SAV once grew in abundance, covering an estimated 200,000 acres along the shallows and shorelines of the Chesapeake Bay.

Underwater Vegetation Areas/Aquatic Habitat



Inventory & Analysis

Water's Edge & Watershed...



Photo courtesy of: Travis Steffen

Over the years, lands along the rivers, creeks and bays that were once predominantly woodland have been converted to agricultural areas with pockets of residential development increasing.



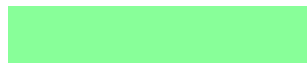
Photo courtesy of: Travis Steffen

The municipal wharf and much of the town that rests on the shoreline is built on a foundation of oyster shells.

With 600 miles of Chesapeake Bay shoreline in Somerset County, Crisfield looked into the future and could clearly see the area as a leading seafood producer.



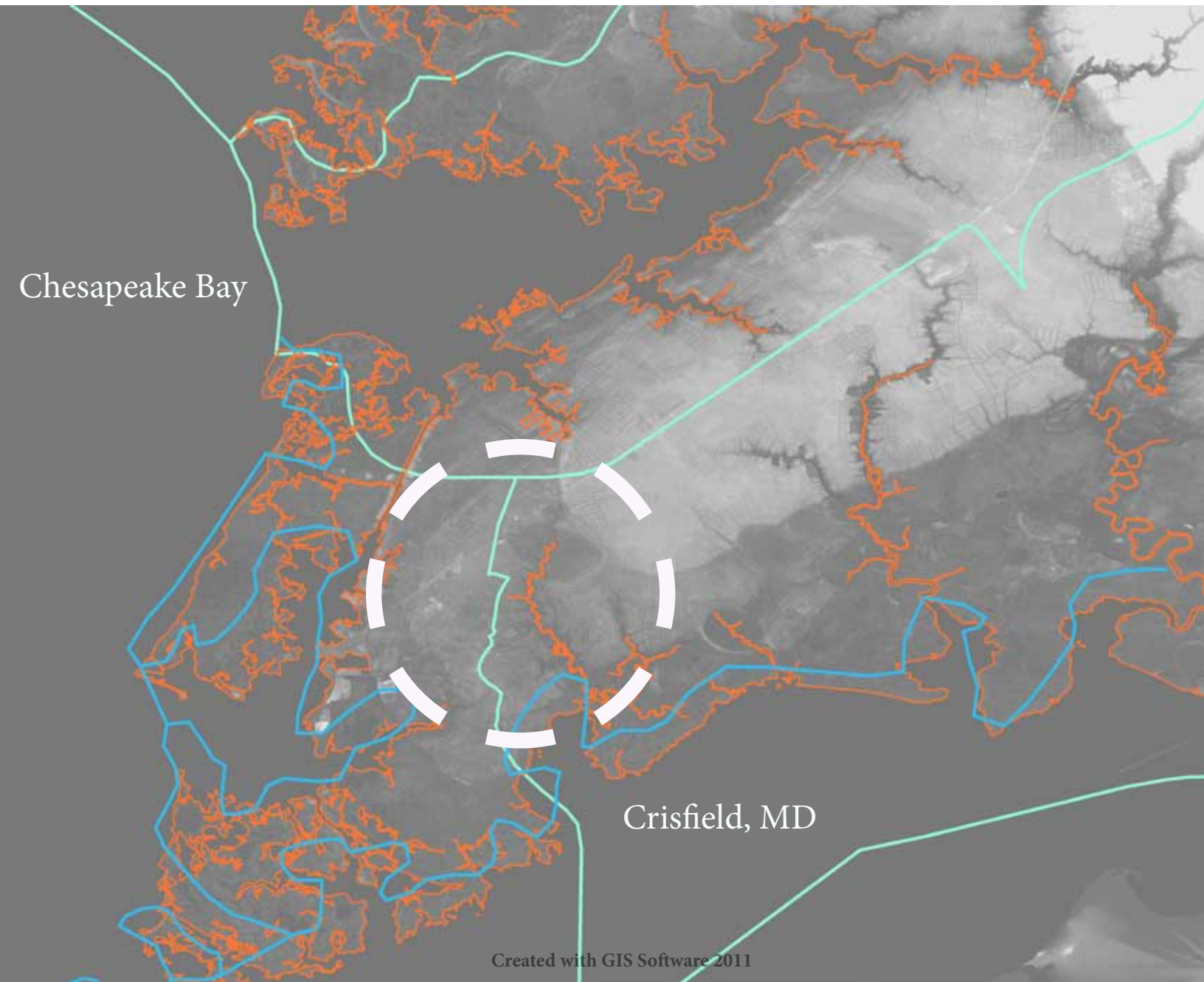
Somerset County Outline



Watersheds



Crisfield Water Edge



Chesapeake Bay

Crisfield, MD

Inventory & Analysis

Contour & Elevation...



Photo courtesy of: Travis Steffen

Much of Crisfield and the surrounding landscape is very flat with little slope or contour. Route 413 is the highest point along the peninsula and represents the watershed boundary as well.



Photo courtesy of: Travis Steffen

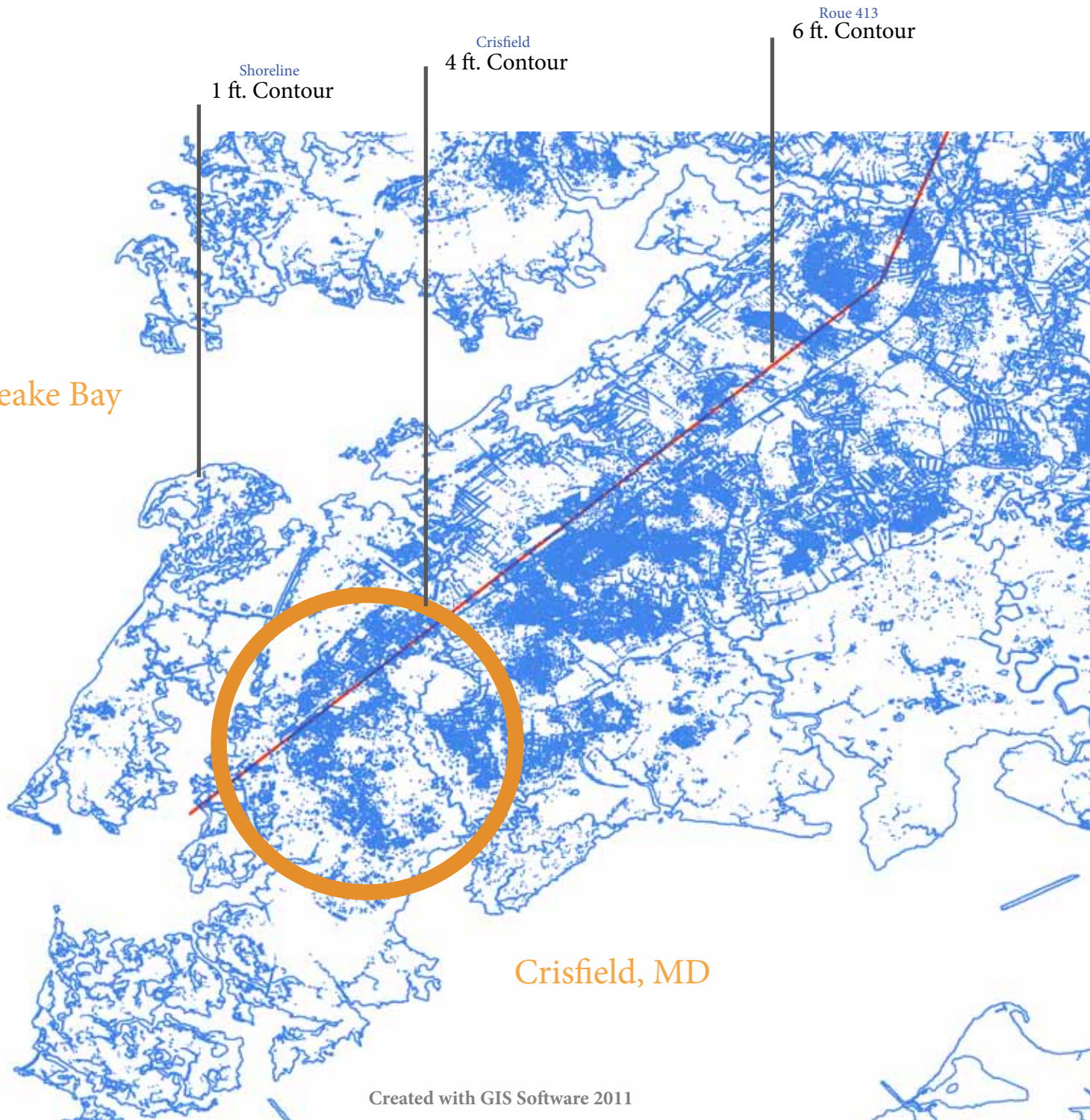
Due to its flat landscape, the docks and piers in the area appear to blend in with the land itself since there are few hills along the water's edge.

From the pier at the end of Route 413, one can see for miles because of the flat terrain in all directions.

With very flat terrain, slope is given with 1 ft contours. The City Center is at 4 ft elevation.

Contour Lines

Chesapeake Bay



Crisfield, MD

Inventory & Analysis

Viewsheds...



A

Photo courtesy of: Travis Steffen

Viewsheds along Route 413 into the town of Crisfield are limiting and are mainly going to contain views of city buildings and businesses.



B

Photo courtesy of: Travis Steffen

The viewshed at the end of Route 413 is of the Chesapeake Bay. Looking out into the bay, one can see Tangier Island about six miles out, along with smaller islands.



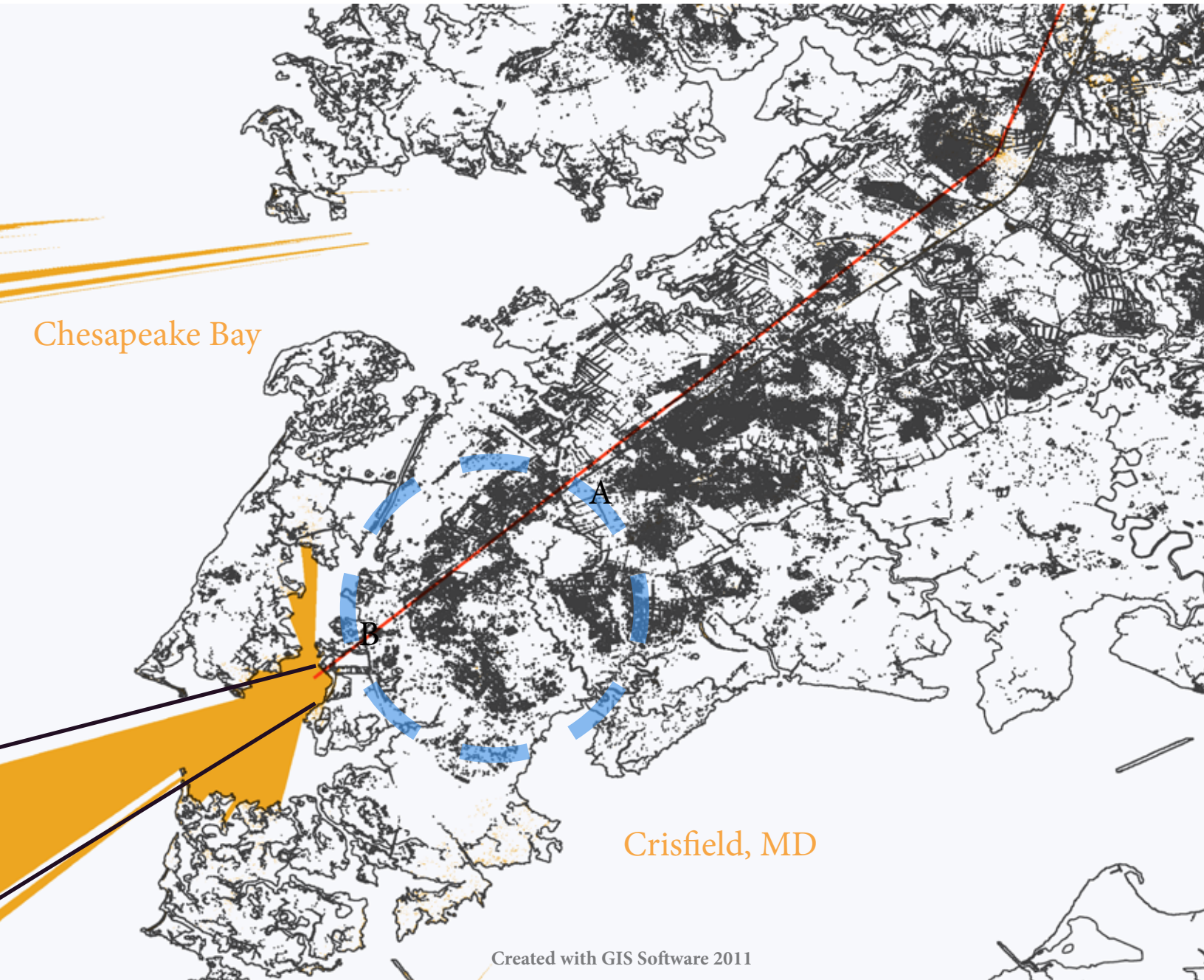
Viewsheds from Route 413



Not Visible



Water's Edge



Inventory & Analysis

Slope Analysis...



Photo courtesy of: Travis Steffen

Sources of nutrient pollution include agricultural runoff, erosion and sediment from development, stormwater runoff from roads, atmospheric deposition, and any other sources.



Photo courtesy of: Travis Steffen

All non-point sources of pollution eventually reach the waters of the Chesapeake Bay unless filtered or retained by some structural or nonstructural technique.

Forests, grasslands and wetlands are critical to restoring and maintaining the health of the aquatic environment.



0-25% Slope

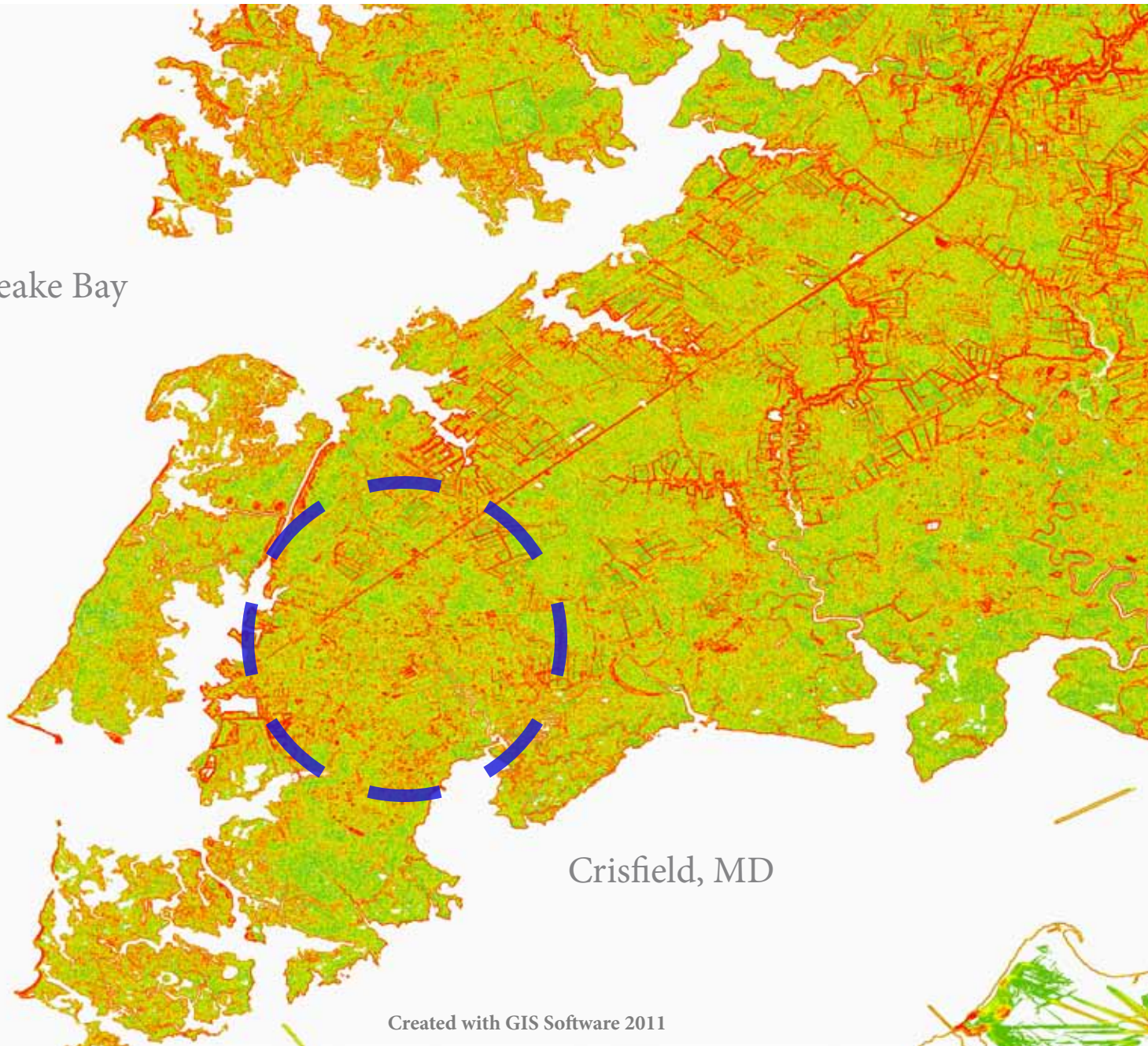


55-85% Slope



25-55% Slope

Chesapeake Bay



Crisfield, MD

Inventory & Analysis

Fish Spawning Areas...



Photo courtesy of: High Definition Wallpapers – HD 1920×1080

Hatching of blue crab eggs occurs at salinities of 23-33 ppt and temperatures of 66-84° F. (19-29° C). In the Chesapeake Bay, larval release appears to be concentrated at the extreme lower bay between the Virginia capes and at the mouths of the bay's southern rivers.



Photo courtesy of: High Definition Wallpapers – HD 1920×1080

The fish in the bay fall into two broad categories: resident and migratory. Resident fish live in the bay year-round while migratory fish visit the bay during various times of the year to feed or spawn.

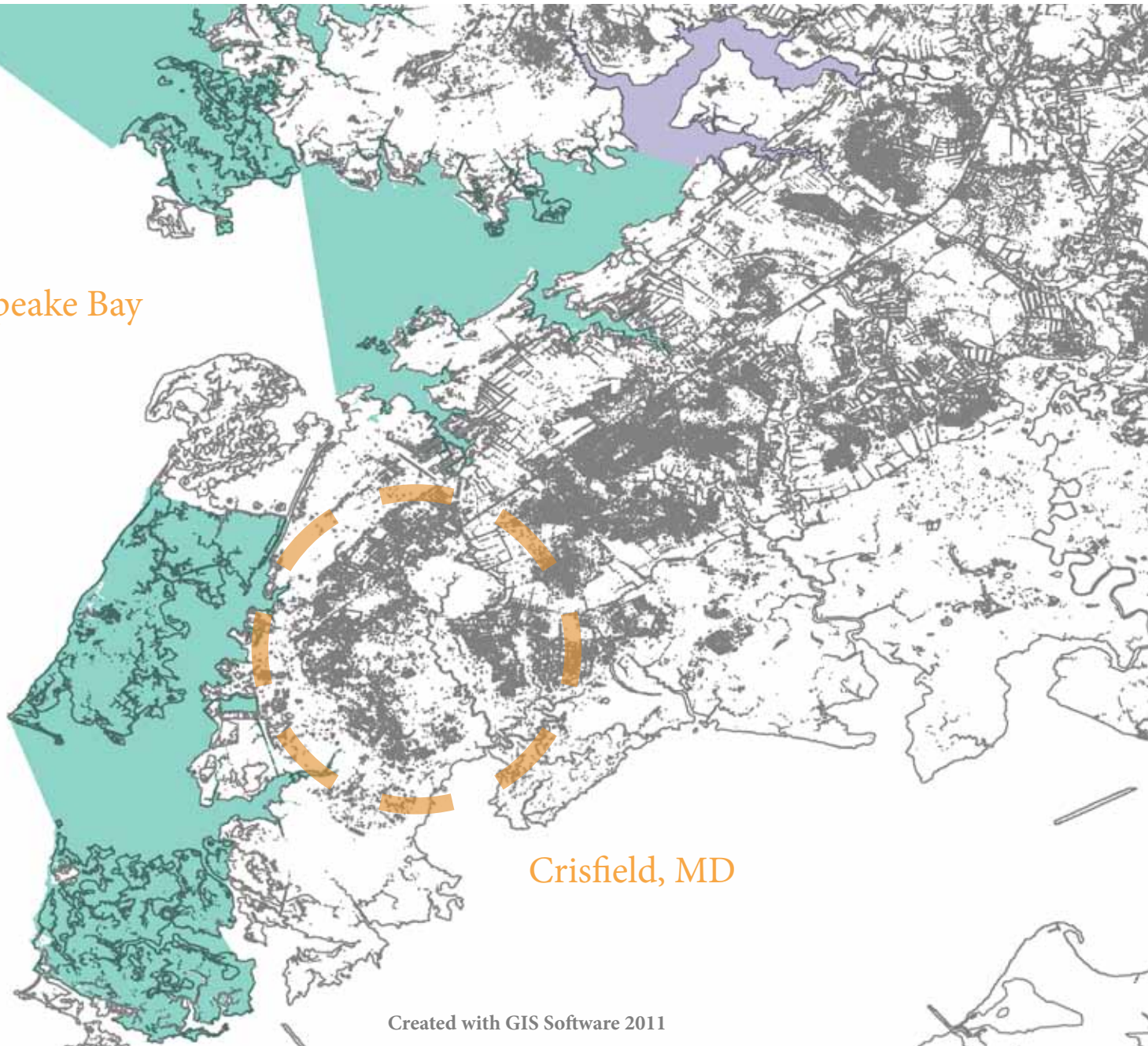


Primary Crab Spawning Areas



Primary Fish Spawning Area

Chesapeake Bay



Crisfield, MD

Inventory & Analysis

Soil Types...



Photo Courtesy of: File:Nc-red-clay-soil-1.jpg

Ultisols, commonly known as red clay soils, are one of twelve soil orders in the United States Department of Agriculture soil taxonomy. They are defined as mineral soils which contain no calcareous material anywhere within the soil, have less than 10% weatherable minerals in the extreme top layer of soil, and have less than 35% base saturation throughout the soil (Helber, L. E.).



Photo Courtesy of: http://sis.agr.gc.ca/cansis/taxa/genesis/pmdep/organic_bcs.jpg

Histosol is a soil consisting primarily of organic materials. It is defined as having 40 centimetres (16 in.) or more of organic soil material in the upper 80 centimetres (31 in.). Organic soil material has an organic carbon content (by weight) of 12% to 18% or more, depending on the clay content of the soil. These materials include muck (sapric soil material), mucky peat (hemic soil material), or peat (fibric soil material). Aquic conditions or artificial drainage are required. (Helber, L. E.).



Utisol Soil Type

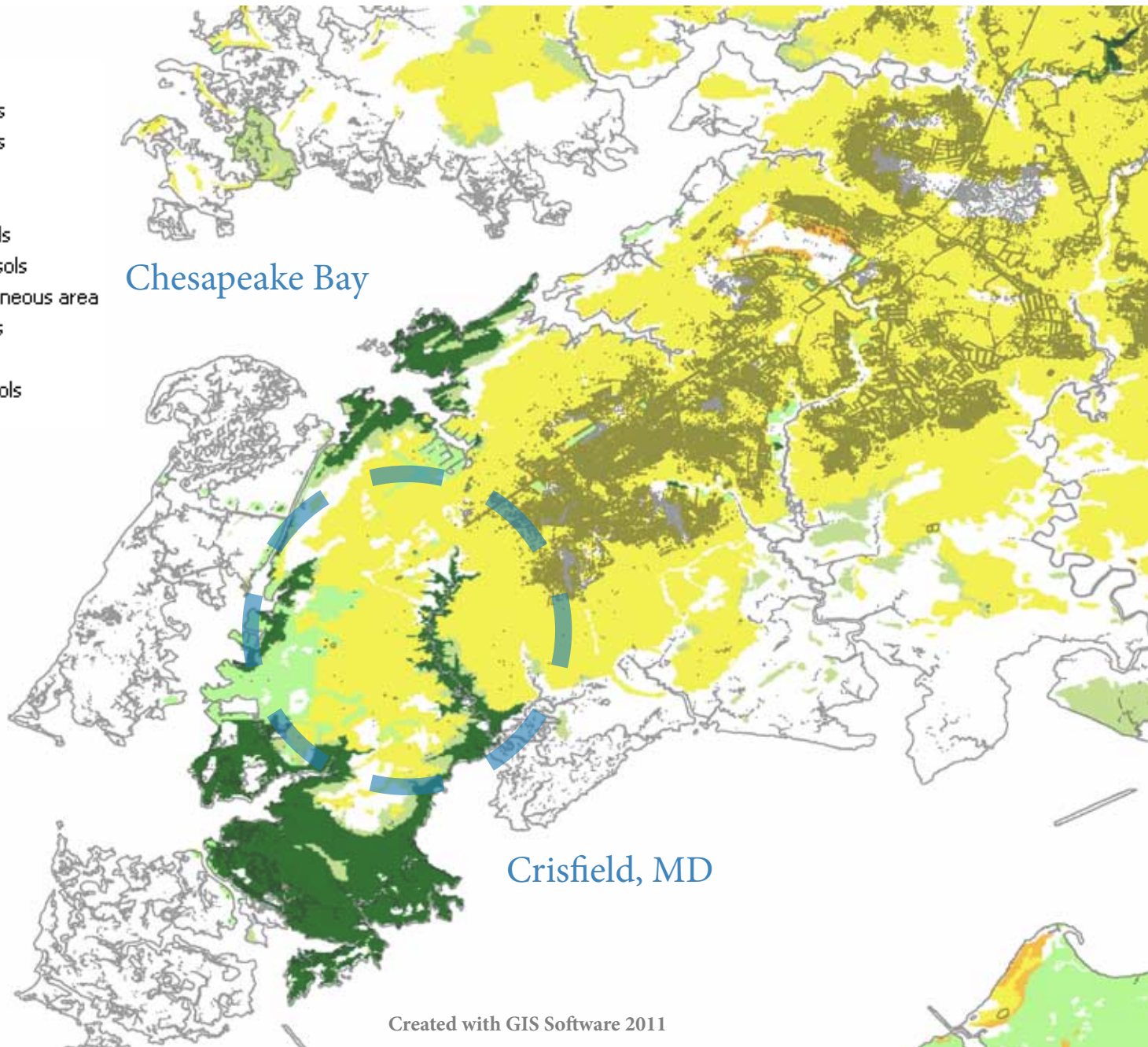


Altisol Soil Type



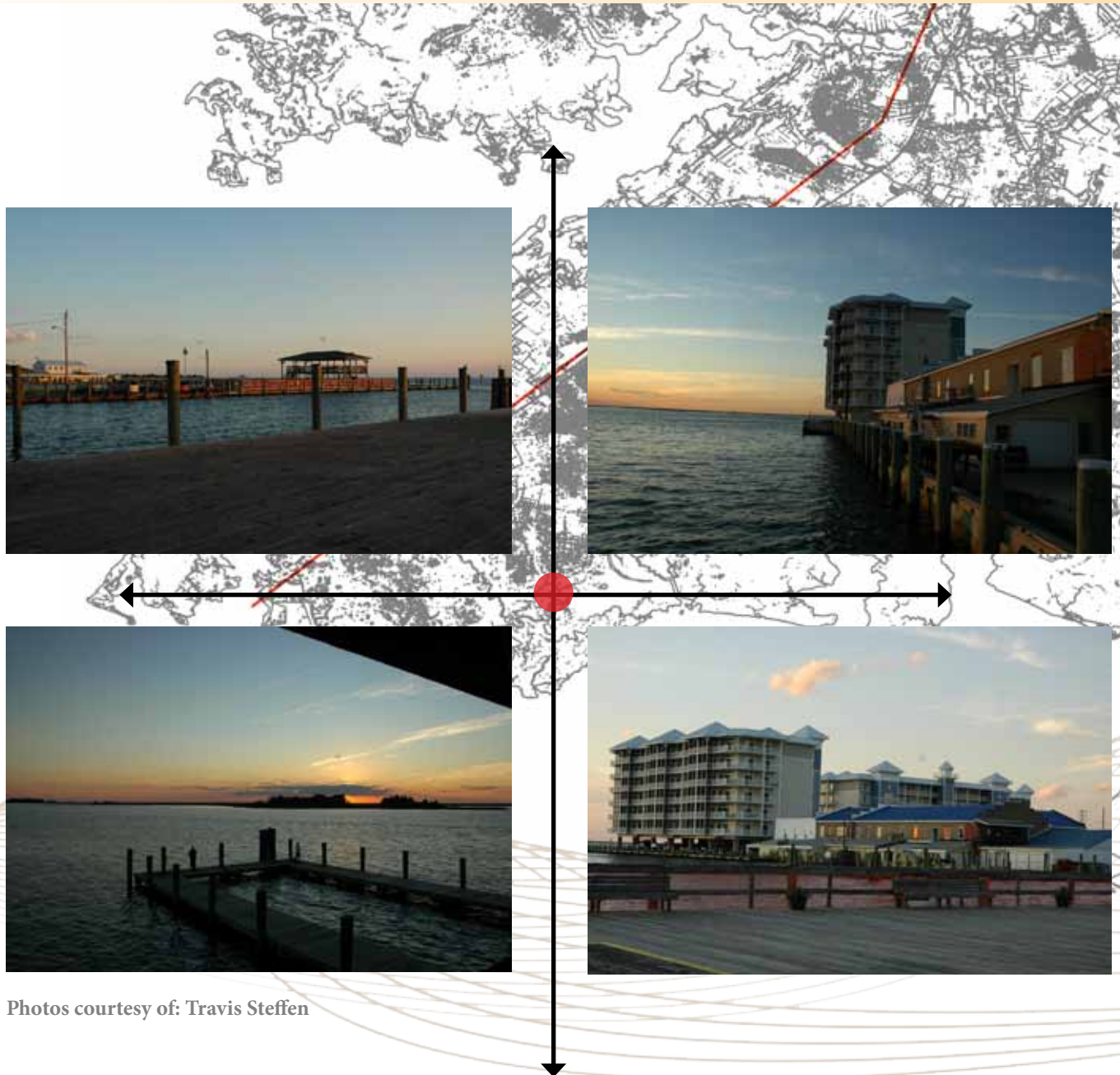
Histosol Soil Type

-  Alfisols
-  Andisols
-  Aridisols
-  Entisols
-  Gelisols
-  Histosols
-  Inceptisols
-  Miscellaneous area
-  Mollisols
-  Oxisols
-  Spodosols
-  Ultisols



Inventory & Analysis

Site Reconnaissance...



Photos courtesy of: Travis Steffen

Programmatic Requirements...

[List of requirements]

- **Promote ecotourism to the site by bettering the social, economic, & environmental issues at hand.**

Ecotourism will be able to promote protected areas of Crisfield with an intent to create low impact areas and alternatives to commercial tourism.

- **Improve water quality and aquatic habitat in the Chesapeake Bay.**

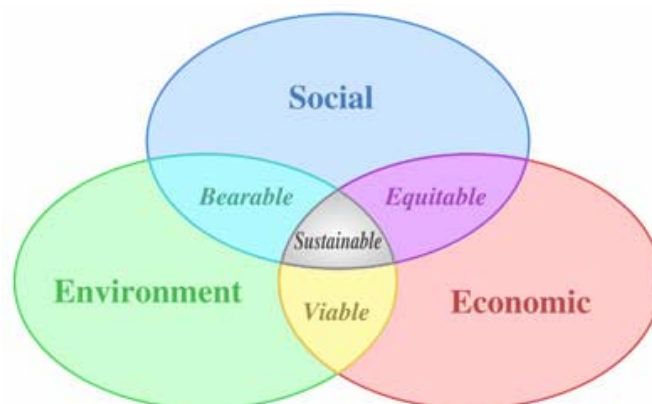
Healthy riparian areas have many characteristics including diverse plant species that provide cover and shade, water storage capacity and constant stream flow, vertical stream banks, and habitat for diverse wildlife species.

- **Promote visitors to the site by reinvesting in the downtown area.**

A downtown without pedestrians is doomed. If re-investment in downtown Crisfield is going to occur, the physical environment must attract pedestrians. In order to attract pedestrians, a safe and pleasing physical environment must be provided.

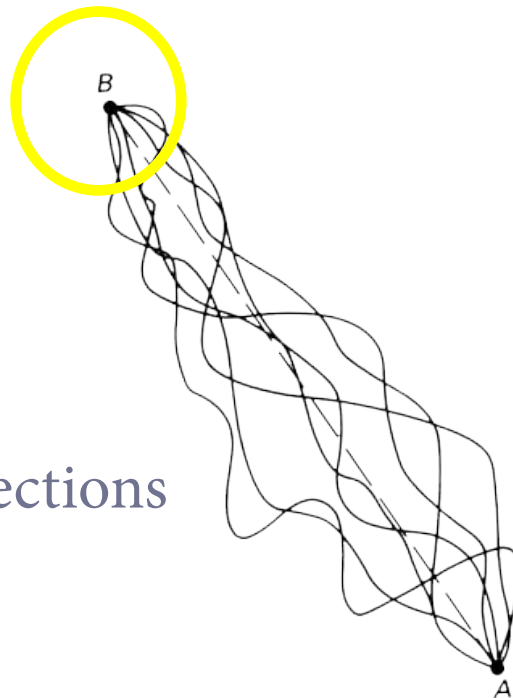
- **Connecting the entire city to improved areas by a pedestrian path while educating visitors about the site improvements and their ecological benefits to the city's future.**

The purpose is to educate the visitors, to provide funds for ecological concerns, and to directly benefit the economic development and political empowerment of the Crisfield community.

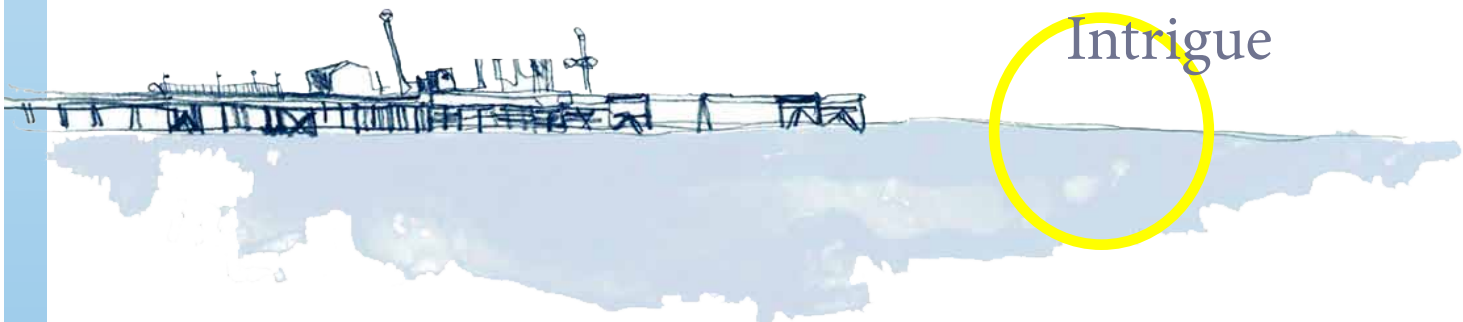


Design Process...

Connections

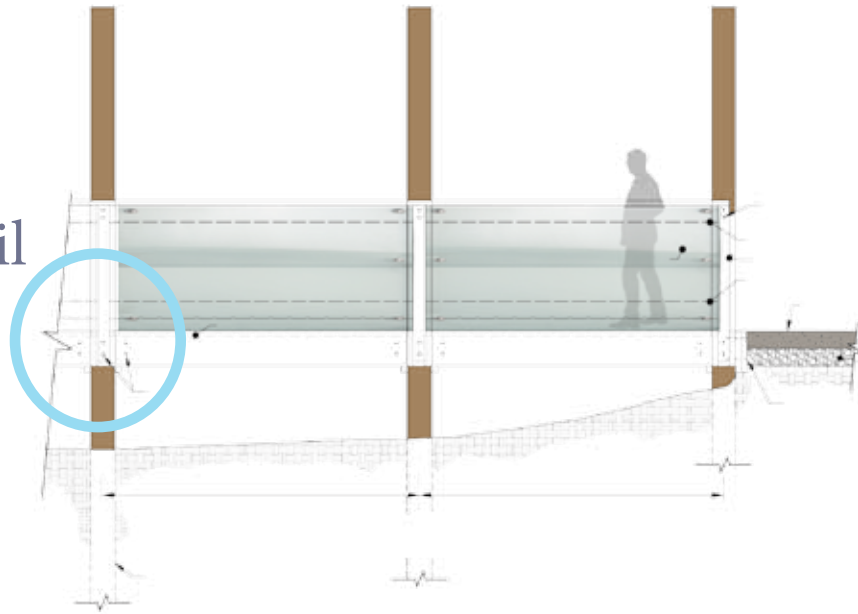


Throughout the design process many elements were taken into account, beginning with connections from “a” to “b” and creating a sense of intrigue at the same time. Creating sustainable design as well as connecting to surrounding shapes and materials is key. Lastly, working everything into a fine detail will make for the most successful design.

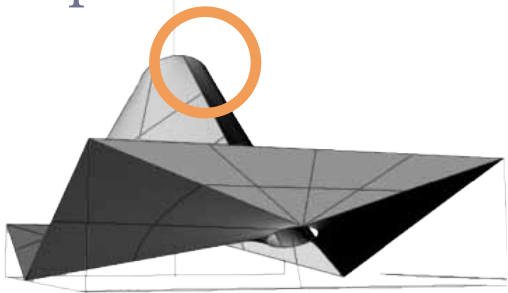




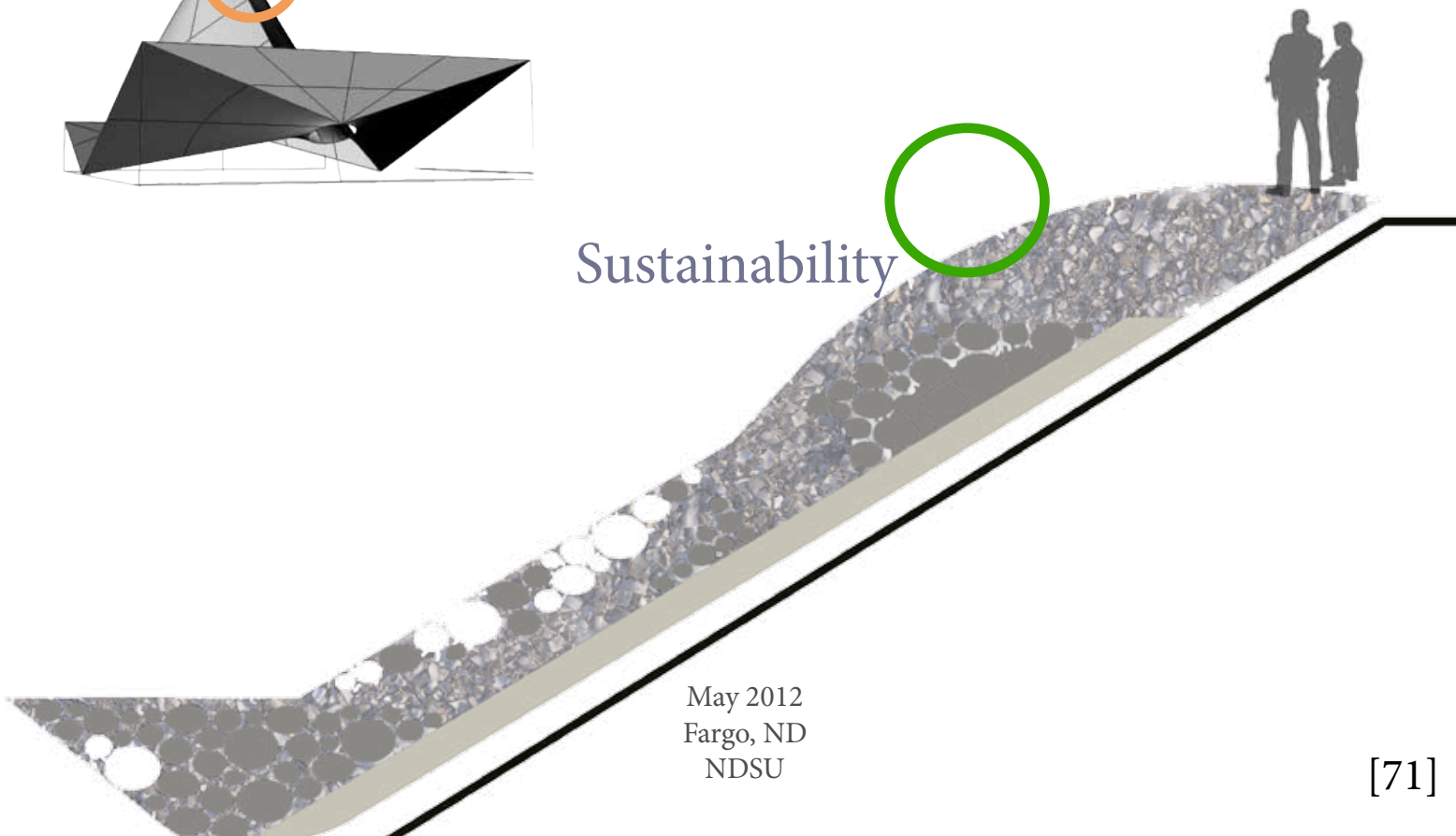
Detail



Shapes



Sustainability



Design Inspiration...

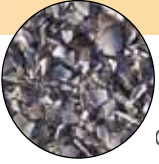
“Only after the last tree has been cut down...the last river has been poisoned...the last fish caught, only then will you find that money cannot be eaten.”

- Cree Indian Prophecy



Large & Medium Trees

Materials & Design...



Oyster Shells



Tall Grasses



New Lumber



Recycled Lumber



Recycled Asphalt



Recycled Concrete



Water

The newly designed Crisfield site is not only functional to the fishermen who live here, but is also a wonderful all-around experience for visitors. With one of the largest man-made biofilters ever made, Crisfield, MD, will see new growth in both tourist visitors as well as a much higher yielding production in blue crabbing efforts. This is truly a design founded on both form and function.

Master Plan...





Fishing Dock

Mountain

Interactive Parking

Tensile Structure Parking

Gazebo Hangout 2

Wave Walkway

Visitors Center

Oyster Shell Streets

Interactive Parking

Sailboat Knoll

Green Path

Oyster Shell Riprap

Educational Reflection

Gazebo Hangout 1

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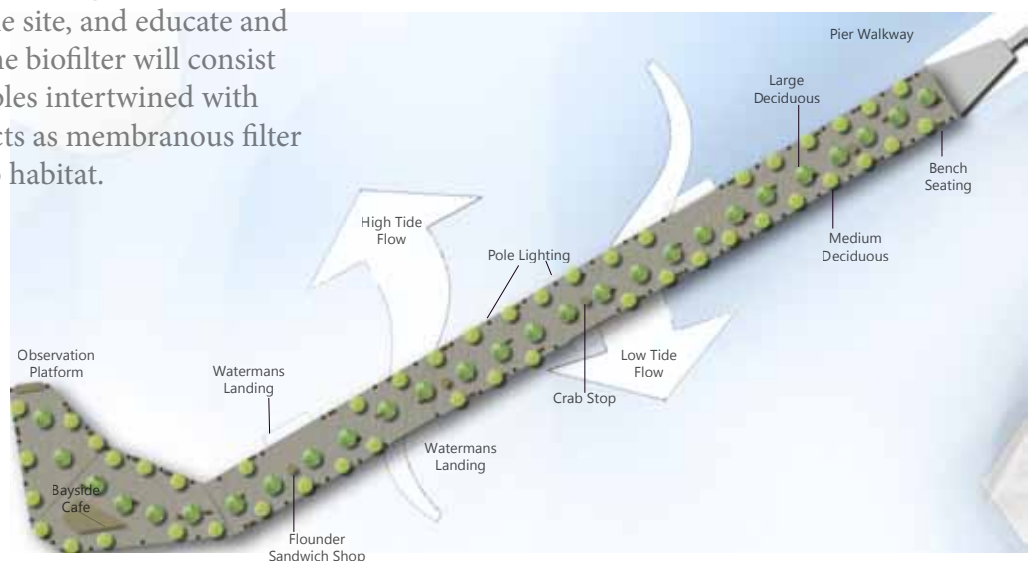
0 10 20 50 100 200

Phases 1, 2, 3 & 4...

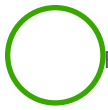
Phase 1 of the design will consist of the removal of many of the existing parking lots and broken sidewalks, and in turn reuse the material to help build the new pathways. Both concrete and asphalt will be used. Along the paths, new trees will be installed along with smaller shrub plantings. Also, the three educational water features will be placed.

Phase 2 of the design will consist of laying and installing of the oyster bay paths as well as adding new fishing docks and boardwalk along the water's edge and tying them into the rest of the city. Greenspace boardwalks will be installed and educational signage will be placed at this time.

Phase 4 of the design will consist of the construction of a multipurpose pier. The pier will consist of a 1500' biofilter that will clean and promote growth of SAV vegetation, draw visitors to the site, and educate and promote blue crab growth. The biofilter will consist of anchored stainless steel cables intertwined with underwater vegetation that acts as membranous filter and will second as a blue crab habitat.



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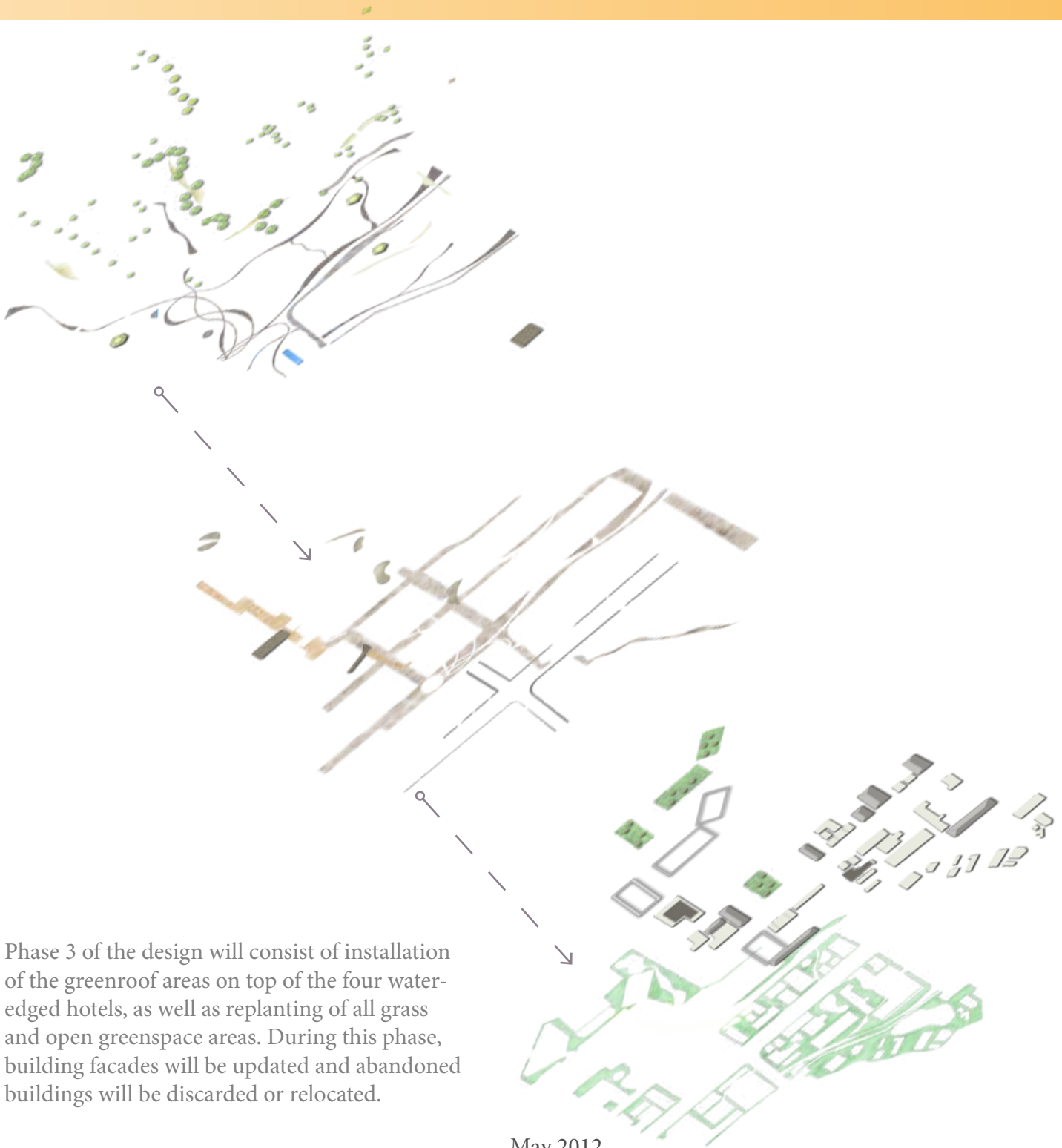
Functional 1500' filter to promote SAV growth



Attract visitors to the site while educating



Promote economic growth by aiding waterman



Phase 3 of the design will consist of installation of the greenroof areas on top of the four water-edged hotels, as well as replanting of all grass and open greenspace areas. During this phase, building facades will be updated and abandoned buildings will be discarded or relocated.

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Oyster Shell Reuse...

Oyster shell riprap is more versatile than traditional riprap since it filters toxins, can be used as walkways and is more aesthetically pleasing.

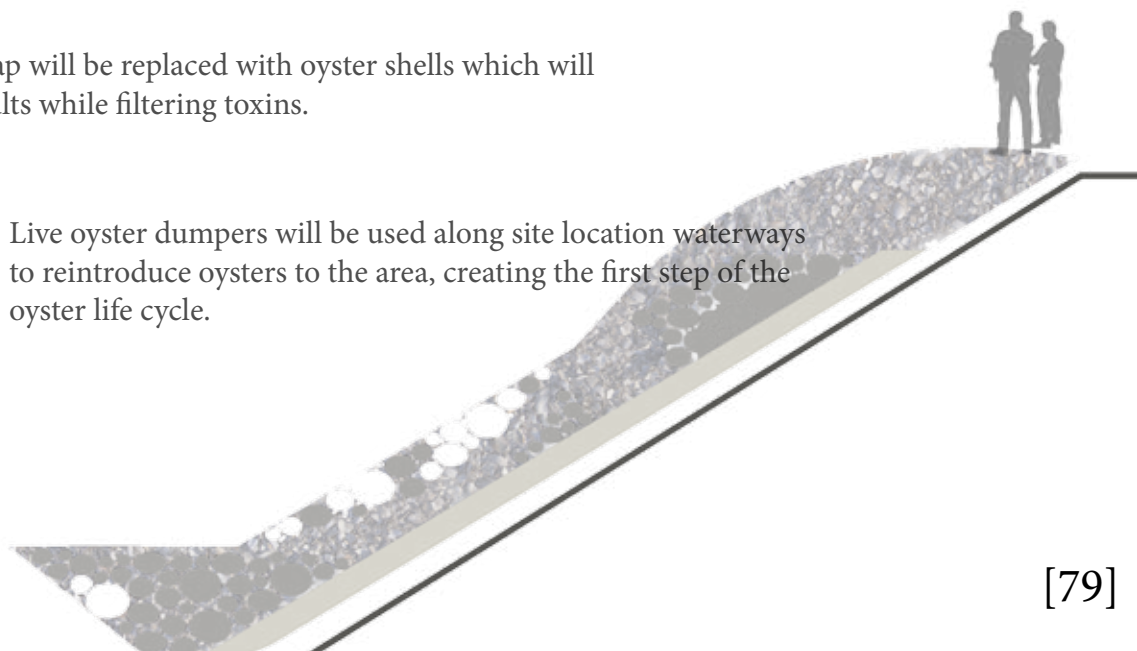
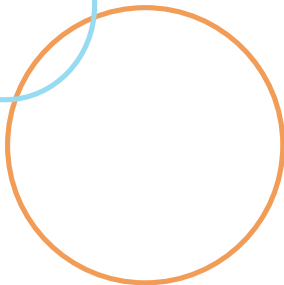
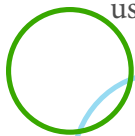


The use of oyster shells throughout the design is due to their unique ability to filter toxins and their abundance on location.

On land, oyster shells will be gathered as they wash ashore to be used along streetscape walkways.

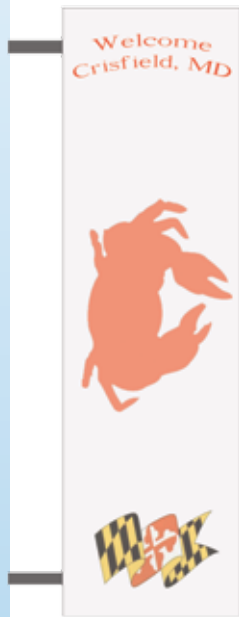
Traditional riprap will be replaced with oyster shells which will give similar results while filtering toxins.

Live oyster dumpers will be used along site location waterways to reintroduce oysters to the area, creating the first step of the oyster life cycle.



Streetscape...

Elements



Recycled Asphalt



American beech
Fagus grandifolia



Sweet Fern
Comptonia peregrina



Tulip poplar
Liriodendron tulipifera



Oyster Shells



Large & Medium
Shade Trees



Seating Benches



Added Lighting
& Street Signs



Redesigned Sidewalk
Added Pedestrian Lighting

Medium Deciduous Tree

Large Deciduous Tree
New Identifying Signage

Added Pedestrian Lighting

Newly Facaded Building

Large Deciduous Tree

The overall streetscape design is primarily to attract and educate visitors to the site and lead them to the pier. With the path design mimicking waves in order to create an open-close effect it will create a sense of wonder and shifting throughout the site.

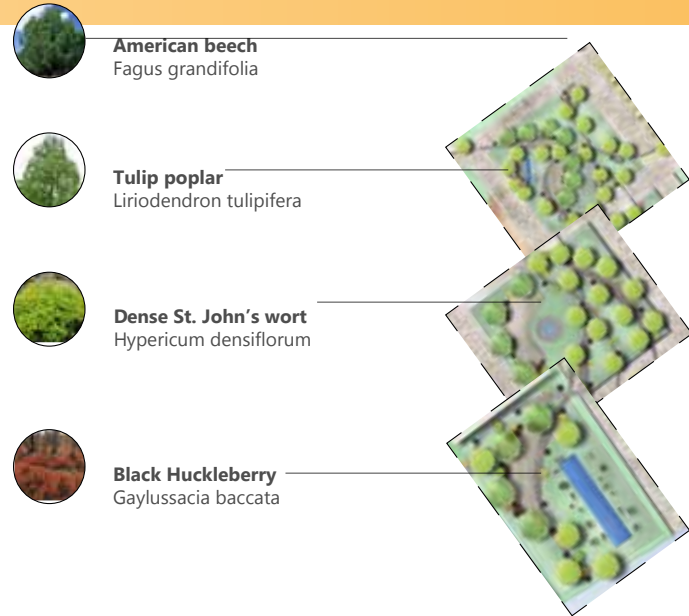


Educational Water...

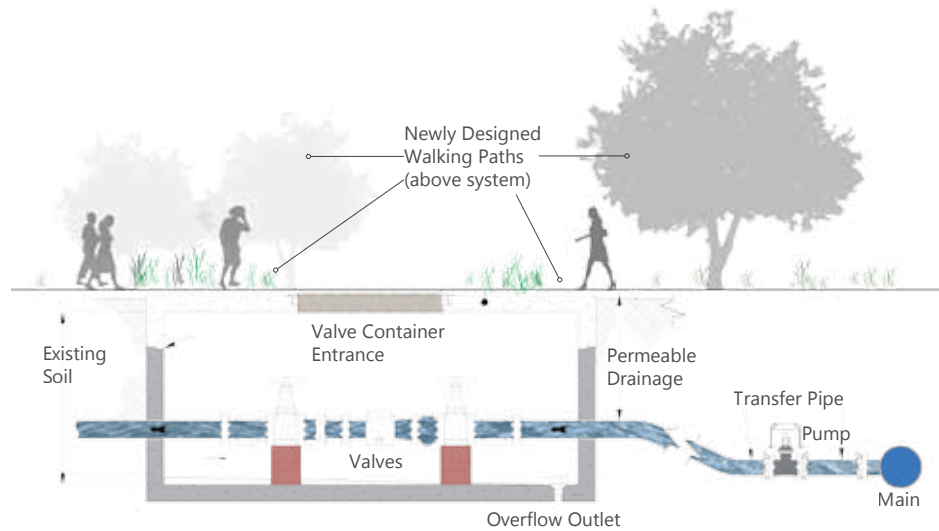


Educational water features will primarily be designed to inform site visitors about how important the water is socially, economically, and environmentally.

The blue crab population is vulnerable to increased harvest pressure, as well as the effects of habitat loss due to poor water quality. Proper management of the crab harvest, as well as water quality improvements and bay grass restoration efforts will help restore the Bay's blue crab population and maintain this valuable resource into the future.



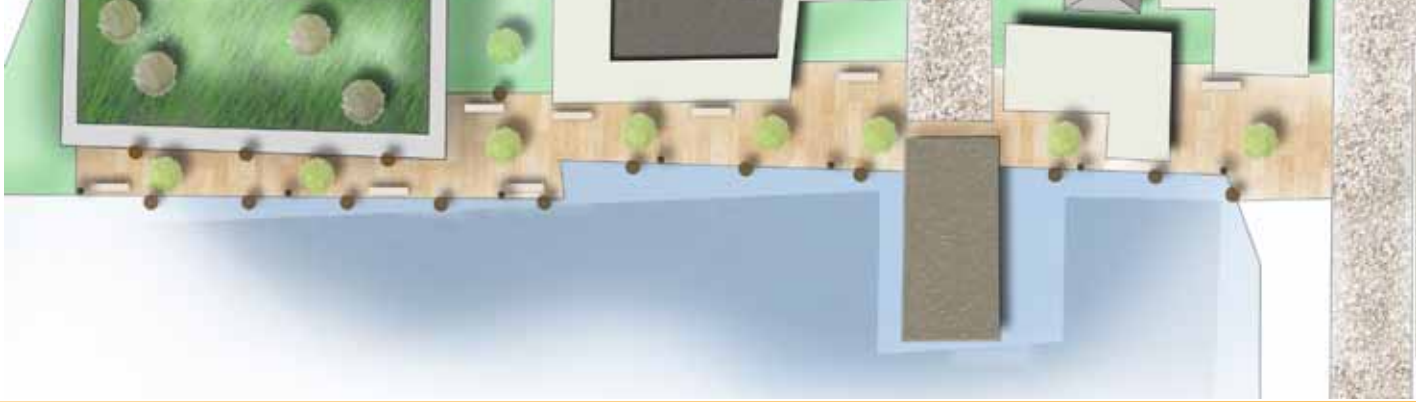
Water flow to Fountain & Waterfall



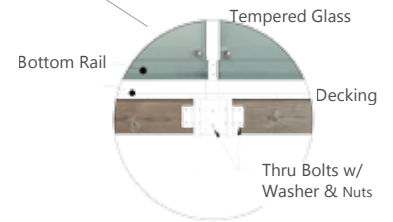
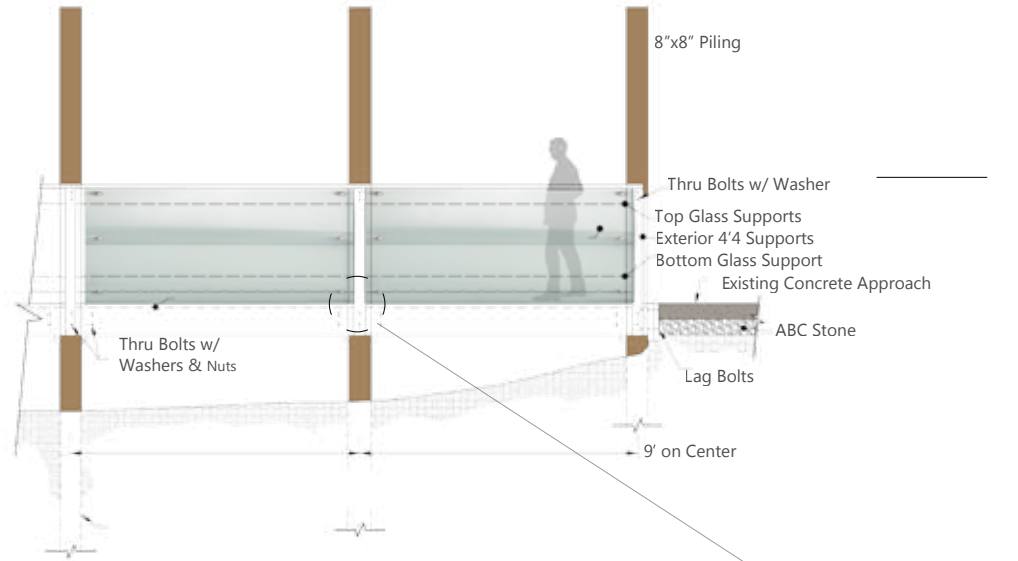
Boardwalk...



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Educational Kiosk

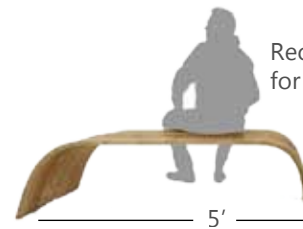


Recycled Lumber

New Lumber

The goals for the boardwalk area are to promote growth of business and traffic toward the water's edge as well as to educate visitors about working systems around them.

Recycled Wood for Bench Seating



White Fringetree
Chionanthus virginicus

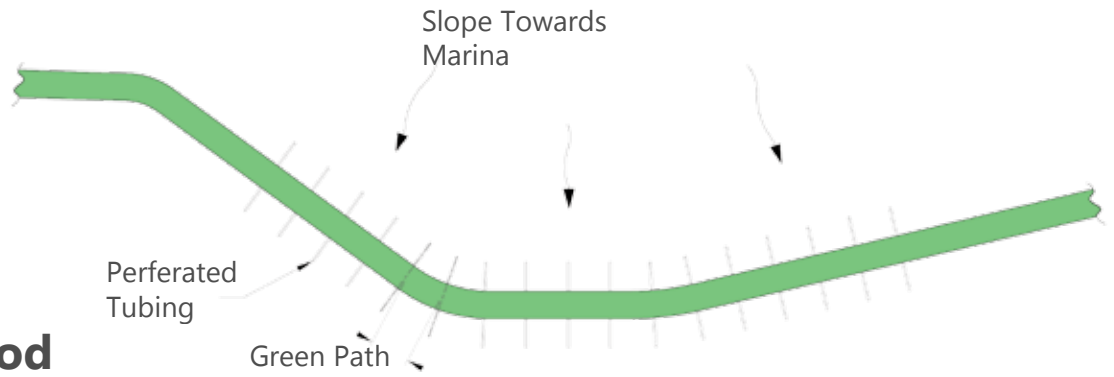
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Sailboat Knoll...

Sailboat Knoll is designed to connect those on land to those on the water, tying the sails on the boats to the tensile structures, helping visitors relate.

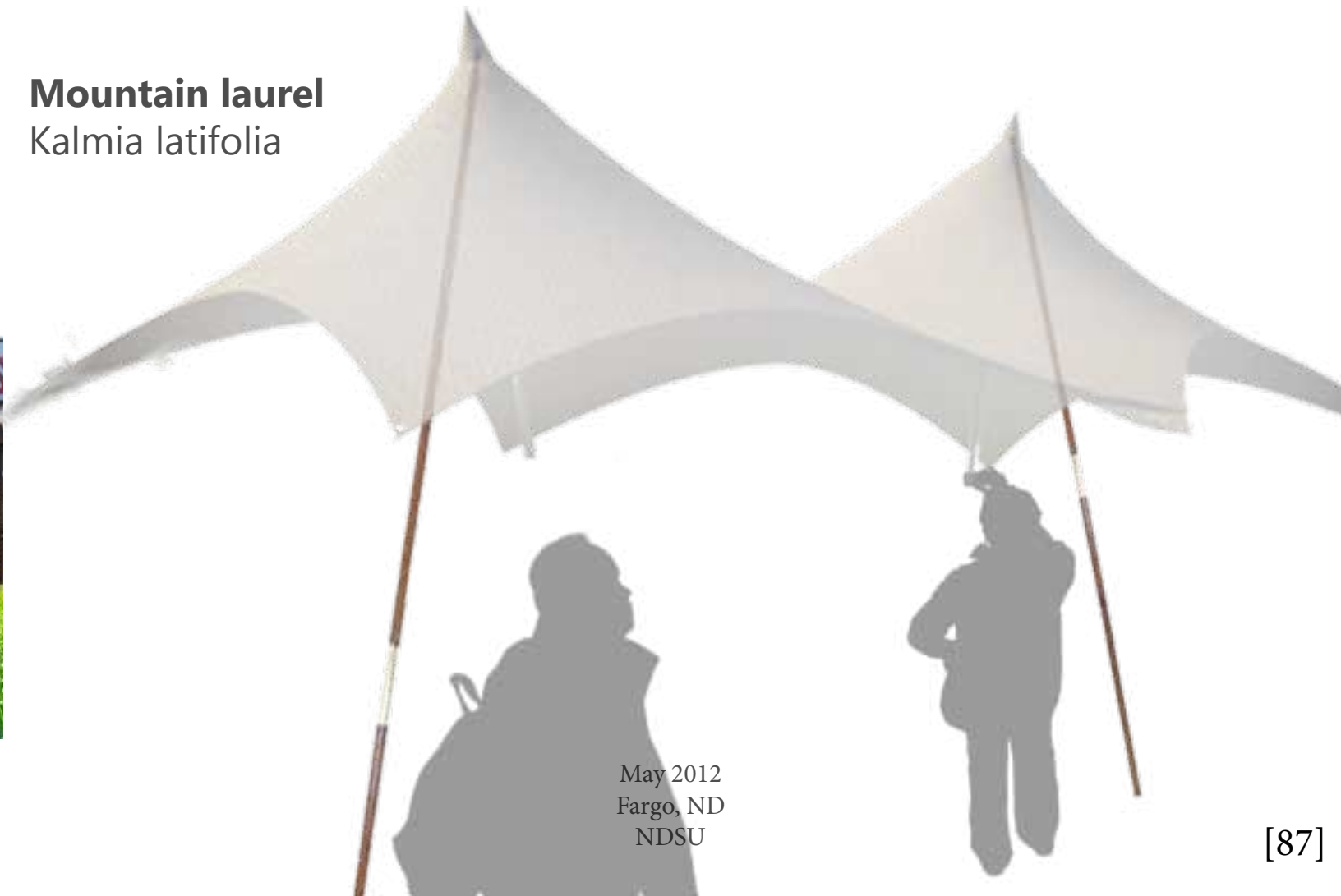


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American basswood
Tilia americana

Mountain laurel
Kalmia latifolia



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Pier Elements...

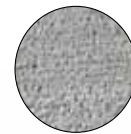
Submerged aquatic plants lined along the biofilter can affect the water quality of Chesapeake Bay by using dissolved nitrogen and phosphorus for their growth. By withdrawing the nutrients from the water, they make them unavailable for use by algae, which often reach pea-soup concentrations in summer in rivers that flow into the Bay. The grasses then convert these nutrients into plant tissue, which eventually is incorporated into Chesapeake Bay food webs by animals that consume live plants or detritus such as blue crabs. The grasses thus act as a 'nutrient pump,' recycling nitrogen and phosphorus from the sediments to the bay and the animals in it.



S.S. Cables



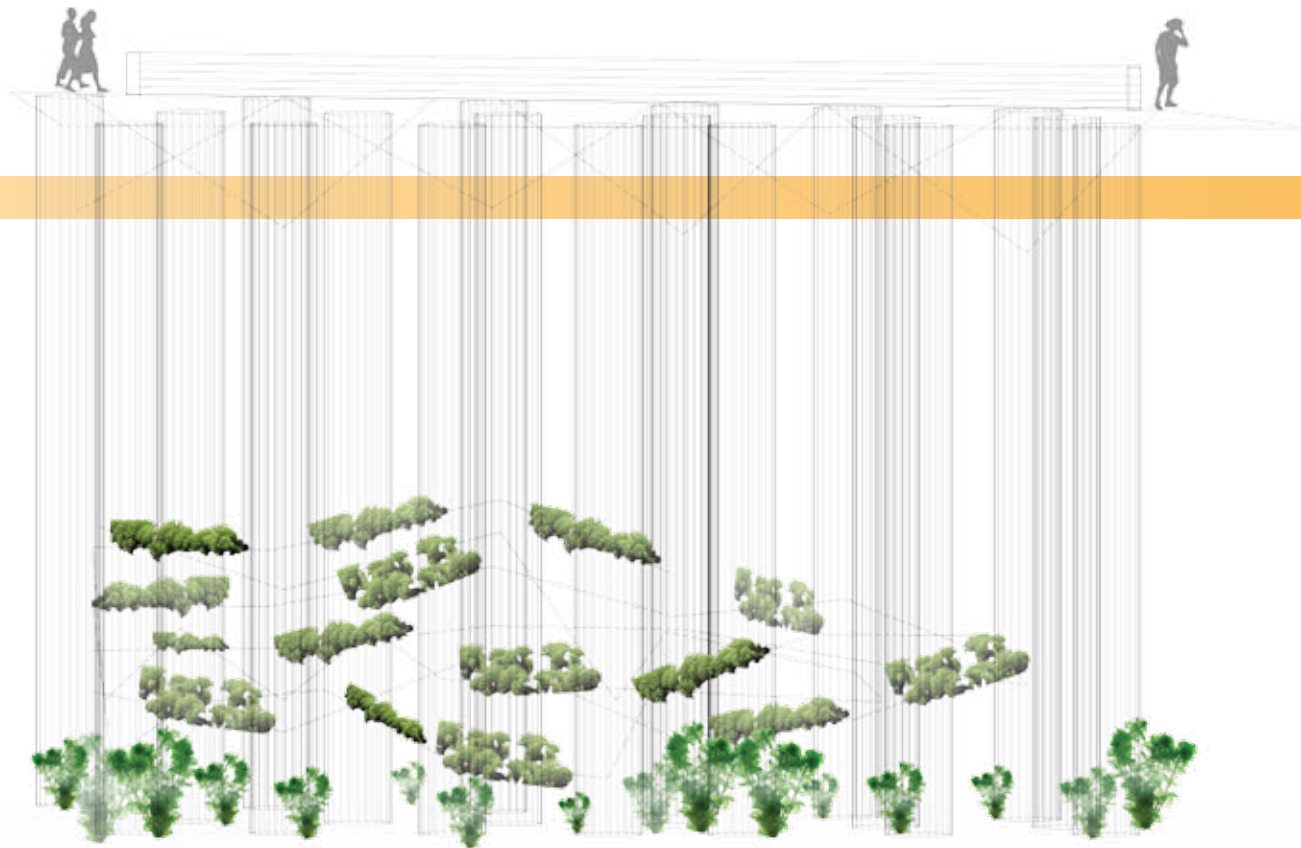
New Lumber



Concrete



Observation Platform for viewing Janes Island Wildlife Reservation and watermen at bay.



Eurasian watermilfoil



Hydrilla



Waterstar



Curly pondweed



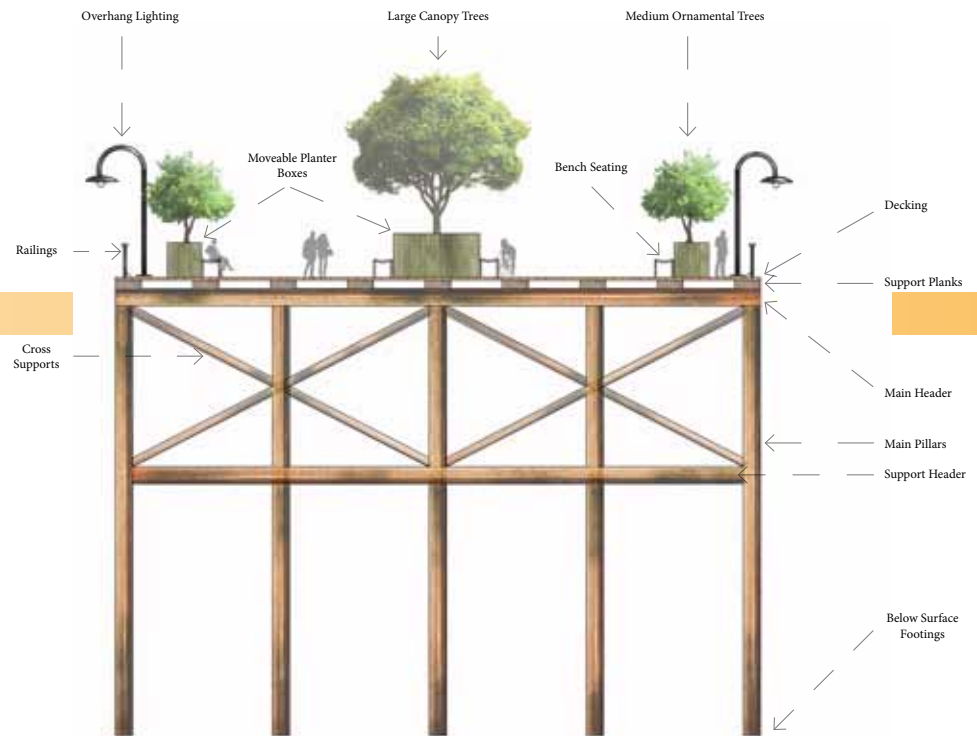
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Pier Elements...

Who Pays?

The city of Crisfield will fund most, if not all, of the initial capital needed, and provide infrastructure cost updates as needed. As blue crab production yields increase, more revenue is generated, providing an opportunity to increase sales tax on related sales.

Day Perspective



Pier Elements...

Who Benefits?

The city of Crisfield will greatly benefit from the new design, including local retail shops, tourist related businesses and watermen, as well as surrounding agricultural practices.

Night Perspective





From Beginning to End...

From the entrance onto the site all the way to the end of the new city, pier visitors will experience many things along the way. They will not only experience education about their surrounding ecology but will be witnessing working systems that will aid in a sustainable Crisfield, MD.



Both the museum and the dive center will have a profound impact on the history of the site as well as the resources to protect the site into the future.




The dive center will be responsible for further developing SAV growth strategies as well as educating visitors underwater.



Overall Results...

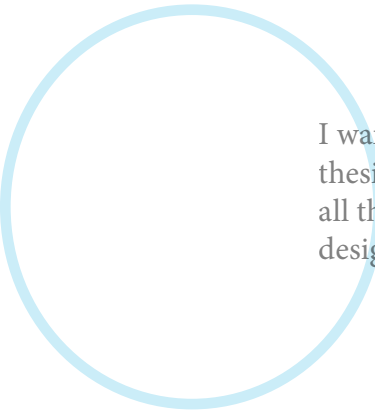


The overall design will have a profound effect on the city of Crisfield, its residents, visitors and the overall economy. With a new opportunity for blue crab production and an improved ecosystem, Crisfield will now be capable of succeeding well into the future as the “Crab Capital of the World.”



Programs Used:

Autodesk 2012
Autocad Civil 3D
Sketchup 8
Adobe InDesign
Adobe Photoshop
ArcGIS
ArcMap
GIS Explorer
Maxwell Render



I want to give a special thanks to my thesis advisor David Crutchfield and all the faculty that helped me with the design process.



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NDSU

An Underwater Approach

by Travis Steffen
LA 572 Thesis Design
2012

References...

Helber, L. E. (1995). Redeveloping mature resorts for new markets. In M. V. Conlin & T. Baum (Eds.), *Island tourism: Management principles and practice* (pp. 17-87). Chichester, England: John Wiley.

Gibbs, M. (2005). The right to development and indigenous peoples: Lessons from New Zealand. *World Development*, 33(8), 1365-1378.

Visiting Crisfield, Maryland. (n.d.). The Chesapeake Bay Guide - Travel, Boating, Fishing, History, and more. Retrieved October 5, 2011, from <http://www.baydreaming.com/crisfield.htm>

Baltimore), I. t., & World."&, o. o. (n.d.). Welcome to Crisfield, Maryland - History. Welcome to Crisfield, Maryland. Retrieved October 5, 2011, from <http://www.cityofcrisfield-md.gov/History3.html>

LA 663 Syllabys. (n.d.). NDSU Blackboard. Retrieved October 5, 2011, from https://bb.ndsu.nodak.edu/bbcswebdav/pid-1974397-dt-content-rid-3334231_2/courses/121-NDSU-1857/LA%20Thesis%20Manual

What We Do to Protect the Chesapeake Bay - National Wildlife Federation. (n.d.).

Home - National Wildlife Federation. Retrieved October 6, 2011, from <http://www.nwf.org/Wildlife/What-We-Do/Waters/Chesapeake-Bay.aspx>

What We Do to Protect the Chesapeake Bay - National Wildlife Federation. (n.d.). Home - National Wildlife Federation. Retrieved October 6, 2011, from <http://www.nwf.org/Wildlife/What-We-Do/Waters/Chesapeake-Bay.aspx>

Jacobs, G., & Harlan. (n.d.). Social Development Theory. International Center for Peace & Development. Retrieved October 13, 2011, from http://www.icpd.org/development_theory/SocialDevTheory.htm

Do We Need Any More Science to Restore Chesapeake Bay?. (n.d.). » | Chesapeake Bay Action Plan. Retrieved October 13, 2011, from <http://www.bayactionplan.com/2010/11/do-we-need-any-more-science-to-restore-chesapeake-bay/>

Complete Guide to Ethics Management: An Ethics Toolkit for Managers. (n.d.). Free Management Library (SM). Retrieved October 13, 2011, from <http://managementhelp.org/businessethics/ethics-guide.htm>

Transformation Strategy and Restructuring | expertise. (n.d.). Strategy Consulting - Making a Positive Sustainable Impact. Retrieved October 13, 2011, from <http://www.rhtconsulting.com/expertise/transformation-strategy-and-restructuring.html>

High Definition Wallpapers – HD 1920x1080 » Black Rock Coast HD Wallpaper. (n.d.). High Definition Wallpapers – HD 1920x1080 . Retrieved December 7, 2011, from <http://highdefinitionwallpapers.com/hd-wallpapers/nature-wallpapers/black-rock-coast-hd-wallpaper/>

NOAA - National Oceanic and Atmospheric Administration. (n.d.). NOAA - National Oceanic and Atmospheric Administration. Retrieved December 8, 2011, from <http://www.noaa.gov/>

Bay Facts. (n.d.). ThinkQuest : Library. Retrieved December 8, 2011, from <http://library.thinkquest.org/5721/climate.html>

Chesapeake Bay Pollution Threatens Watermen, Not Just Water - Environment Maryland. (n.d.). Home - Environment Maryland. Retrieved December 8, 2011, from <http://www.environmentmaryland.org/newsroom/clean-water-news/clean-water-news/chesapeake-bay-pollution-threatens-watermen-not-just-water>

Chesapeake Bay, Maryland – 1600x1200 – ID 39902 « Nature Desktop Wallpapers. (n.d.). Nature Desktop Wallpapers. Retrieved December 9, 2011, from <http://mynaturewallpapers.wordpress.com/2009/11/05/high-definition-wallpapers-3/chesapeake-bay-maryland-1600x1200-id-39902/>

File:Nc-red-clay-soil-1.jpg - Wikipedia, the free encyclopedia. (n.d.). Wikipedia, the free encyclopedia. Retrieved December 7, 2011, from <http://en.wikipedia.org/wiki/File:Nc-red-clay-soil-1.jpg>

Chesapeake Bay, Maryland – 1600x1200 – ID 31848 « Nature Desktop Wallpapers. (n.d.). Nature Desktop Wallpapers. Retrieved December 9, 2011, from <http://mynaturewallpapers.wordpress.com/2009/11/05/high-definition-wallpapers-3/chesapeake-bay-maryland-1600x1200-id-31848/>

City of Chicago project summary.
www.cityofchicago.org/city/en/depts/cdot/provdrs/shoreline_protectionproject.html
"Rehabilitation of the Chicago Shoreline: A Coastal Engineering Perspective."
Michael Krecic, P.E. Taylor Engineering, and Mark Wagstaff P.E. MWH Global.
Great Lakes Urban Habitat Symposium.
Chicago 2009 Morgan Shoal: Planning for a Sustainable Ecosystem & Shoreline Protection for Lake Michigan.
Rejman, Rob. Chicago Park District.

2003 Long Range Waterfront Plan for the City and Borough of Juneau.
Prepared by Bermello, Ajamil & Partners, Inc.,
November 22, 2004.
www.juneau.org/plancomm/Final_LRWP_112204.php

City of Malmö Official website.
www.malmo.se/English/Western-Harbour.html
"Visit Sweden."
www.visitsweden.com/sweden/Regions--Cities/Malmo/Coastline-experiences/Western-Harbour/
"Swede dreams," The Guardian.
Steve Rose
www.guardian.co.uk/artanddesign/2005/aug/29/architecture
"Malmö: Bo01 – an ecological city of tomorrow," case study, Sustainable Cities.
<http://sustainablecities.dk/en/city-projects/cases/malmo-bo01-an-ecological-city-of-tomorrow>
"Västra Hamnen in Malmö," Swedish Environmental Technology Council.
http://swentec.se/en/Start/find_cleantech/Plantscontainer/Vastra-hammen-in-Malmo/

"Chesapeake Bay," Lateral Line. N.p., n.d. Web. 11 Nov. 2016. <http://www.laterallineco.com/fishing_journal/chesapeake_bay/chesapeake_bay_saltwater_fishing_jou

"Watermen of the Chesapeake Bay - Chesapeake Bay Gateways Network." Chesapeake Bay Gateways Network - Your Chesapeake Connection. N.p., n.d. Web. 3 Dec. 2011. <<http://www.baygateways.net/watermen.cfm>>.

Chesapeake Bay Underwater. (n.d.). CBU. Retrieved November 11, 2009, from www.mdsg.umd.edu/images/uploads/siteimages/Living_Chesapeake/eelgrass.gif

Chesapeake Bay Underwater Grasses Undergo Significant Reduction in 2006 - Press Release - Chesapeake Bay Program. (n.d.). Chesapeake Bay Program - A Watershed Partnership. Retrieved December 6, 2011, from http://www.chesapeakebay.net/press_2006savacreage.aspx?menuitem=20280

Shoreline Management in Chesapeake Bay. (n.d.). CBAY. Retrieved September 3, 2006, from web.vims.edu/physical/research/shoreline/docs/ShorelineErosionInCBay.pdf

Maryland, My Maryland - a set on Flickr. (n.d.). Welcome to Flickr - Photo Sharing. Retrieved December 6, 2011, from <http://www.flickr.com/photos/terrymct/sets/72057594095366939/detail/>

USDA/Agricultural Research Service (2011, July 7). Chesapeake Bay pesticides: Some diminish, some persist. ScienceDaily. Retrieved December 9, 2011, from <http://www.sciencedaily.com/releases/2011/07/110707111031.htm>

"Chesapeake Bay Bridge-Tunnel." The Columbia Encyclopedia, Sixth Edition. 2008. Retrieved December 09, 2011 from [Encyclopedia.com: http://www.encyclopedia.com/doc/1E1-ChesapBBT.html](http://www.encyclopedia.com/doc/1E1-ChesapBBT.html)

1. <http://jedlangdon.com/wp-content/uploads/2010/07/Sustainability.jpg>

References...

- Sketchlog. (n.d.). Sketchlog. Retrieved December 3, 2011, from www.kaltoons.com/wordpress/2009/01/save-the-chesapeake-bay/
- Chesapeake Bay Foundation. (n.d.). Chesapeake Bay Foundation. Retrieved December 4, 2011, from <http://www.cbf.org/>
- Horton, T., Bourne, J. K., & Jr. (n.d.). Chesapeake Bay, Chesapeake Beach - National Geographic. Environment Facts, Environment Science, Global Warming, Natural Disasters, Ecosystems, Green Living - National Geographic. Retrieved December 4, 2011, from <http://environment.nationalgeographic.com/environment/habitats/chesapeake-save-bay/>
- # 2 Smyth, G. L. (n.d.). Abandoned Boat, Smith Island | Flickr - Photo Sharing!. Welcome to Flickr - Photo Sharing. Retrieved December 6, 2011, from <http://www.flickr.com/photos/glsmyth/3028981233/>
- #1 Edwin Remsberg Photographs: Waterman - Chesapeake Bay. (n.d.). Edwin Remsberg Photographs. Retrieved December 7, 2011, from <http://remsburg.blogspot.com/2007/03/waterman-chesapeake-bay.html>
- Liggett, B. (n.d.). Another Giant Garbage Patch Found in the Atlantic Ocean | Inhabitat - Green Design Will Save the World. Inhabitat | Design For a Better World!. Retrieved December 7, 2011, from <http://inhabitat.com/another-giant-garbage-patch-found-in-the-atlantic-ocean/>
- Calvert Charters - Home. (n.d.). Calvert Charters - Home. Retrieved December 7, 2011, from <http://www.calvertcharters.com/SitePages/Home.aspx>
- Western Harbour - Malmö stad. (n.d.). Malmö stad. Retrieved December 7, 2011, from <http://www.malmo.se/English/Western-Harbour.html>
- Additional Projects | BauerLatoza Studio. (n.d.). BauerLatoza Studio. Retrieved December 8, 2011, from <http://www.bauerlatozastudio.com/portfolio/landscape-architecture/additional-projects/>
- MRV Juneau Waterfront Master Plan. (n.d.). MRV Architects: Architecture, Interior Design and Planning. Retrieved December 8, 2011, from http://mrvarchitects.com/portfolio/juneau_waterfront.html
- Sunset - Wikipedia, the free encyclopedia. (n.d.). Wikipedia, the free encyclopedia. Retrieved December 8, 2011, from <http://en.wikipedia.org/wiki/Sunset>
- <http://www.cityofcrisfield-md.gov/>
- <http://media.photobucket.com/image/picture%20of%20fishing%20waterman%20black%20and%20white/pbramble/Hoopers001.jpg>
- <http://www.dphotographer.co.uk/users/10110/thm1024/nicolewaterman39.jpg>
- <http://www.terrageria.com/images/black-white/korea/skor52108-bw.jpeg>
- <http://www.aspexdesign.co.uk/artistic-photos/black-and-white-9.jpg>
- <http://www.saireecottagediving.com/blog/wp-content/gallery/february-2012/Koh-Tao-Underwater-Scuba-Divers.jpg>
- <http://www.cityofcrisfield-md.gov/>
- <http://media.photobucket.com/image/picture%20of%20fishing%20waterman%20black%20and%20white/pbramble/Hoopers001.jpg>
- <http://www.dphotographer.co.uk/users/10110/thm1024/nicolewaterman39.jpg>
- <http://www.terrageria.com/images/black-white/korea/skor52108-bw.jpeg>
- <http://www.aspexdesign.co.uk/artistic-photos/black-and-white-9.jpg>
- <http://www.saireecottagediving.com/blog/wp-content/gallery/february-2012/Koh-Tao-Underwater-Scuba-Divers.jpg>

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May 2012
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