Woods Hole Sea Grant

The Future of Massachusetts Beaches: Relocate, Nourish, or Lose Them

Proceedings of a Workshop on Beach Nourishment held at the Woods Hole Oceanographic Institution

Friday, May 4, 2007

Edited by Jeffrey Brodeur and Sheri DeRosa

Contents

Beach Nourishment: General

Environmental/Resource Issues: Beach Nourishment and Sediment Sources

Public/Private Partnerships for Beach Nourishment Planning in Massachusetts

Afternoon Session

Beach Nourishment Case Examples: Massachusetts Public Projects

Beach Nourishment Case Examples: Massachusetts Private Projects

Public/Private Partnerships for Beach Nourishment and Beneficial Re-use of Dredged Material

Beach Nourishment and Funding in New Jersey and Delaware

Editors Note: *All efforts were made to include slides shown during individual presentations. However, some speakers refer to slides that are not included in this document for a variety of reasons. We apologize for the confusion.*

MS. MCDOWELL: Okay. Jim has told me we have a very tight schedule today, so it's 8:32, let's begin. I'm Judy McDowell; I'm the Director of the Woods Hole Sea Grant Program, and on behalf of Bill Clark from Cape Cod Cooperative Extension and myself, we'd like to welcome you to Woods Hole on this beautiful, sunny day. And it's a very important topic that you've all come to address. Today, it's important for the future of not only Massachusetts beaches, Cape Cod beaches and that is the beach nourishment question.

This is a very important topic, and you are among the lucky ones who actually registered on time and got a seat because we had so much response for this workshop that we had to turn many people away. We will have the proceedings available for those who couldn't make it today.

But without further ado, I'd like to introduce Jim O'Connell, who has spent his many, many years working on beaches in his capacity with the Massachusetts Coastal Zone Management for many years, and now for the past decade working with Cooperative Extension and the Woods Hole Sea Grant Program. This is the topic that Jim feels very passionate about. And I hope you enjoy your day and come to some very strong recommendations in your deliberations.

So, welcome. You will have some breaks where you can enjoy the sunny weather and the view, but you're here to work, I hope. I hope you enjoy yourself. So, Jim, the podium is yours.

MR. O'CONNELL: Good morning and welcome to the workshop on the Future of Massachusetts Beaches: Relocate, Nourish, or Lose Them, a workshop on beach nourishment. As Judy mentioned, the response has been incredible. The registration closed two weeks before the deadline because we filled to capacity with 160 people, and we have turned away over 70 people who would have liked to have come. So, it's obviously a timely topic and a topic of great interest to a lot of people just based on the response that we got, but this is the only day we're going to have it.

The workshop is designed to really be sort of an educational and informational forum on beach nourishment, an idea exchange. We're going to have a series of presentations from the design parameters of beach nourishment, the compatibility, and available, potential available sources of beach nourishment material. There will be discussions on the potential environmental impacts and potential mitigation techniques for environmental impacts, and then the series of on-the-ground case histories. Some of the projects are still in the planning and regulatory review phase and some of them are complete. So, you're going to get a complete spectrum of presentations on some of these real-life case histories. If you walk out of this room at the end of the day with more knowledge about beach nourishment than you had when you walked in, then I would suggest that's a simple measure that the workshop was a success. And I would almost have to guarantee you you're going to know something more about beach nourishment when you leave here today than when you came in.

When I first started thinking about what our next workshop was going to be, I came up with a title of "Nontraditional Coastal Erosion and Full Alternatives in Massachusetts." So, I put a draft agenda together on some topics that I thought would be of interest, salt marsh building, topple berms for stone erosion protection, beach nourishment and particularly wanted to focus in on the logistics of relocating structures particularly buildings away from eroding shores.

So I put together a Planning Committee and here's the Planning Committee names right here. After the second day of discussions on the workshop, it was clear that we had more information to

fill one day on one topic, thus the Beach Nourishment Workshop. So this is what we put together, and I want to thank the Planning Committee members for helping us out to put this together and come to the conclusion that we need to talk about this particular important item.

So, what is the present status in the potential future of Massachusetts beaches? Americans have had a great fondness for beaches throughout the country for a long time. I would suggest that probably beginning sometime in the 19th or particularly the 20th century that fondness turned into a love affair. And I would suggest that there are some people who would suggest that we are loving our coast to death perhaps.

The future of Massachusetts beaches along unarmored shores looks bright. The beaches are wide; they're sandy; they're healthy. That's the one I was supposed to show.

AUDIENCE: (Laughter.)

MR. O'CONNELL: Now do you get the point? Beautiful, unarmored shores and particularly our barrier beaches. The future of beaches in Massachusetts along armored shores is not so bright. And there's a particular reason for that, several reasons. One of them is the primary source of sediment that created and allows for the continued existence of our beaches, dunes, and barrier beaches in Massachusetts comes from the erosion of our glacial uplands, such as we see here in the Wellfleet area out in the Cape Cod National Seashore. One of our issues is we are a very densely developed shore. We've been developing for a number of years and approximately 70% of the population now lives within coastal counties of Massachusetts. This is an aerial photograph of Hull, Nantasket Beach in Hull.

So, in order to protect that valuable upland development where everybody lives, we do erosion control structures, such as revetments, sea walls, bulkheads, and you can see just within a hundred years some of the things we're seeing along the shore. This is the same area a hundred years apart. It was a relatively wide sandy beach here, and this is what it looks like today because we have cut off the sediment source and continuing erosions and sea-level rise is moving the high-water line more landward.

But not only are we losing our dry beaches at high tide, there are some areas now in Massachusetts where we have lost our dry beach at low tide. This is the New Seabury area in Mashpee. We're losing the reserved rights of fishing, fowling, and navigation as well as the intertidal habitats because the high water line is moving landward. There are very few communities in Massachusetts that do not have some linear length of shore that no longer has a dry beach at high tide due to human activities, erosion, an ongoing sea-level rise such as Dennis, Plymouth, Hull, Falmouth, Eastham. We're in a real erosion management dilemma here in Massachusetts trying to balance the protection of valuable upland property, but we're trying to preserve our environmental resources and coastal environmental resources such as our beaches, dunes, and barrier beaches.

Approximately 70 to 80% of the Massachusetts shore is exhibiting a long-term erosional trend. What I've noted in the data is in many areas along Massachusetts the erosion rates have accelerated particularly since around the 1950's. When I worked with communities to give them unbiased opinions on the pros and cons of a variety of different types of erosion control structures, I often times use the State data, the CZM's data, to calculate how long I think the high-water line will be before

the high-water line actually migrates and actually creates no dry beach at high tide. There are now revetments along these three coastal banks here.

In this particular area here in Eastham if the State data are correct, the high-water line will catch up with that revetment somewhere between 15 and 20 years from now and there will be no dry beach at high tide in this particular location.

Now, if the International Climate Change Predictions are correct, and we do get an accelerated rise in sea level, which I think most scientists now accept there will be an accelerated rise, the debate now is really how much, and I think they've even documented that in one of their most recent reports that they have actually seen the rise over the last few decades. I would suggest that if we do get that rise that we are going to see this process of a loss of dry beaches along armored shores accelerated in the future as well. But not only are we using the dry beaches, but we're also using the sandy deposits such as we see here in Duxbury. We're seeing the lag deposits, the cobbles, and the pebbles exposed for a longer time during the year because when the sand is removed during storms, there's not enough volume of sand entering back into the system to replace the material that's re-routed offshore, such as Duxbury, such as Nantasket Beach in Hull.

So, how valuable are our beaches? Well, there would be some that would suggest they're priceless including myself in many ways. There are about 155 million people living in coastal counties around the country and about a half a million people live within 500 feet of the shore. In Massachusetts, about 36,000 people live within 500 feet of the shore, and I would guarantee you that they have one or more favorite beaches that they go to in their own neighborhoods.

In 1992, the U.S. Travel and Tourism Administration estimated that beaches contributed nationwide about $170 billion to the annual economy of the United States. There are other reports such as the Clean Beaches Council, Jim Houston, that state that, although you can't see the one on the left hand side, it's 180 million Americans make about 2 billion visits to beaches and spend approximately $74 billion on visits to ocean and bay beaches each year around this country.

The Massachusetts Office of Tourism and Travel, and you'll find this on the Cape Cod Chamber of Commerce's website, estimated that about 4.5 million people visit the Cape Cod National Seashore in 2006. About 4.7 million annual person trips are to the Cape and Islands, and about 48% of that 4.7 million people traveled to beaches, and that was the highest category of traveled trips, higher than shopping, which was next after this one.

Now, Massachusetts, where are we in Massachusetts? According to a report by Haddad and Pilkey in 1998, New England beach nourishment experience is different from other regions of the United States. Nourishment is small in New England by U.S. standards, and the total number of volume of nourishment projects is declining. That's contrary to the steady rise in nourishment projects in other parts around the country, so I ask myself, "Why?" Is it because we have a short beach season, a short tourist season? Is it because we don't have the sand availability to do beach nourishment? Well, Haddad and Pilkey suggest that another reason besides those is that we have a fragmented nature in our beaches. We don't have those long ribbons of sand that you'll find from New Jersey south all the way down to Florida and down around the Gulf of Mexico. But there are other reasons as well.

For example, in the residential section on the north part of Nantasket, the Corps of Engineers

had a $2 million, 66,000 cubic yard dune restoration project. The residents in the community decided that they didn't want the project for a variety of reasons in part because the waterfront people were going to lose their view, more difficult access, and they were going to lose some of the parking that they had carved out in the back wings over the years.

If we move a few miles south to Hummarock Beach in the Town of Scituate, the Corps of Engineers, if the data are correct, estimated that about 74 structures along Hummarock are going to be lost within the next 50 years if the data are correct. So, they suggested and proposed a $6 million beach nourishment project. That project was turned away by the community and the residents in part because of public access issues and public access concerns for the receipt of federal dollars, and we'll hear more about that one in presentations a little bit later.

What I'm seeing more often in Massachusetts in particular are small beach nourishment projects. For example, I see a number of communities now going out in the early to mid-spring and just putting a veneer of beach compatible sand over the lag deposits, the cobbles, the pebbles, and the slipper shells to create a more pleasant experience during the summertime for the Town residents. They're not expecting that that sand's going to last very long, but for the summertime is very pleasing for the residents who are using that particular beach. The cost benefits are not always in terms of money. This is the same project here after it was spread out. You can see the slipper shells on the seaward side.

Small neighborhood projects, neighborhood organization projects. This is the top of the Town of Falmouth too. You can see the top slide here is in 2003. There's no dry beach at high tide here. So, the neighborhood organization got together and put a small amount of sand in this beach here. This is three years later. They still have a dry beach during the summertime to enjoy where they didn't before and that's three years later. So, it is cost-effective according to that neighborhood organization, and this is what I think may be the future of Massachusetts as the small beach nourishment projects.

I would suggest that there are a lot of areas in Massachusetts that are candidates for successful beach nourishment projects. For example, on the south side of the Cape where we have a low-wave climate and low erosion rates such as we see here, the groins are already in place. We have hundreds of groins along the south side of the Cape. This is that same area on the ground. Here's the high water line. How many years will it be before there is no dry beach at high tide for those residents to enjoy? The groins are already in place. Perhaps this will be a successful candidate for a beach nourishment project.

The Town of Harwich just last month announced that they're going to put together a comprehensive beach nourishment plan for their community on a small scale, and it's going to become a priority for that Town. So, it's happening already.

Well, I'd like to move along with the agenda now with the conference. We have a number of great speakers and a number of very interesting talks, and I'm hoping to be able to answer these questions at the end of the day: Is beach nourishment feasible in Massachusetts? Is it cost-effective? Are these small neighborhood length nourishment projects cost effective? Where would they be most cost effective and where would they have longevity? Has it been successful in the past in Massachusetts and what are the benefits and the detriments? Do we know what the environmental impacts are? And, particularly, do we know the methodology where we can either minimize or avoid

adverse impacts of the coastal resources that we're all trying to protect?

So, with that, I'd like to turn it over to our first speaker. Our first speaker is Kirk Bosma. Kirk is a Professional Engineer at the Woods Hole Group with expertise in the areas of numerical modeling, coastal processes, sediment transport, analysis of near-shore wave conditions, and the impact of the waves on coastal erosion. He has managed and engineered projects that have included components of beach nourishment, coastal construction, inlet stabilization, and wave tide and current data.

He's currently evaluating beach nourishment alternatives on Nantasket Beach in Massachusetts, Camp Ellis Beach in Maine, and Hammonasset Beach in Connecticut. So, with that beach nourishment overview and engineering design considerations, Kirk Bosma.

MR. BOSMA: Thanks, Jim. It's a pleasure to be here today. As Jim mentioned, my name is Kirk Bosma. I'm a Coastal Engineer with the Woods Hole Group, and the title of my talk is Beach Nourishment Overview and Engineering Design Considerations. What I'd like to do is just touch on some of the components that make up a beach nourishment project, and how you would complete a design, specifically in the State of Massachusetts.

To back it up a step from Jim's presentation, and thinking nationally in terms of beach use, over the last three decades the population along our U.S. coast has doubled. Approximately 50% of all Americans live in coastal counties, but that land mass only makes up 17% of the landmass in the contiguous 48 states. Something that kind of blew my mind was that 3,600 new residents are moving into coastal communities daily, and with that every year 1,500 homes are being built in coastal communities.

As Jim mentioned, beaches are a valuable tourist and economic driver, and the bottom line is that this will continue to be the case. Coastal growth is not going to stop. People are going to continue to come to beaches. They have created this love affair with beaches not only in Massachusetts, but also in a national sense. So, retreat isn't always going to be an option simply because people are going to continue to move into the coastal area. Another factor is that beaches are also a valuable habitat area for many endangered species.


Nantasket, MA

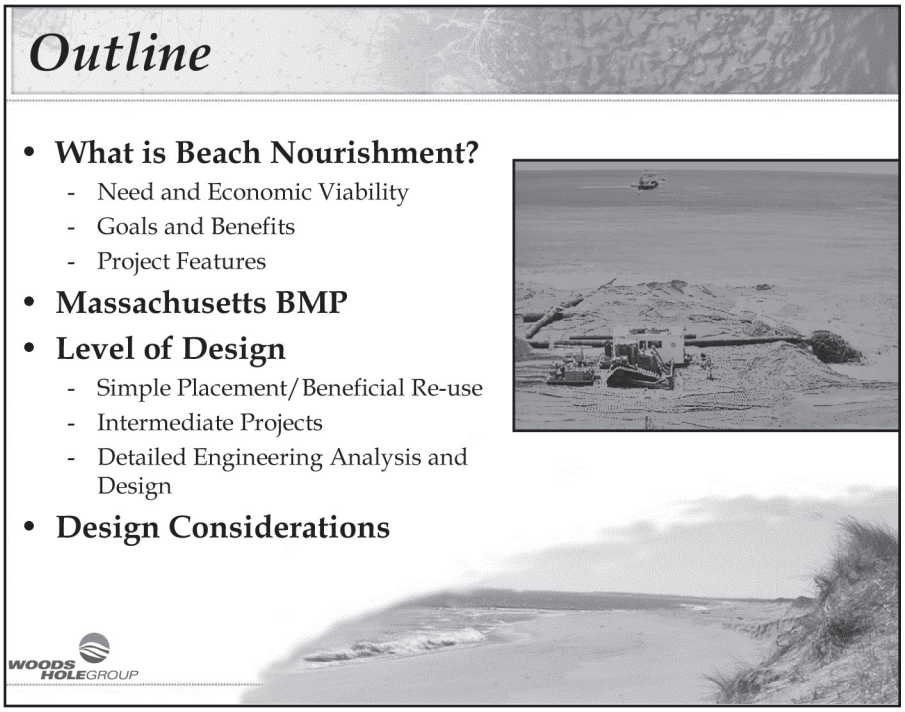
So, given the fact that we have all these people in coastal communities, the problem is we also have beach erosion going on in many of these coastal areas. Here's Nantasket, Massachusetts in Hull, a heavily structured shoreline with no useable beach at high tide. Protecting coastlines has now become an important part of any civil engineering project. This is

a video from Nantasket Beach during that Patriots' Day storm. It's courtesy of Mike Galvan at DCR. And you can see the rather long wave periods, wave breaking everywhere. So, a significant impact on the coastal community.

Camp Ellis, Maine, which is a valuable area for the State of Maine. They've lost 30 homes at this particular site. This is actually a photo from the recent Patriots' Day storm. They lost a few more homes. Erosion is a significant problem there.

So, here's what I want to talk about today. Beach erosion clearly is an issue; and will continue to be. What is the solution? Well, beach nourishment is one alternative that's available. I'm going to discuss exactly what beach nourishment is. Is it economically viable to actually do this? What are some of the goals and benefits? What are some of the project features?

I will also touch briefly on Massachusetts Best Management Practices, which was recently released, and give some basic guidelines on how to conduct beach nourishment projects in Massachusetts. Also, what levels of design are available? Not every site is going to require a really detailed engineering design, others may. Along with that I'm going to discuss some of the considerations and tools that one might use to design a beach nourishment project.

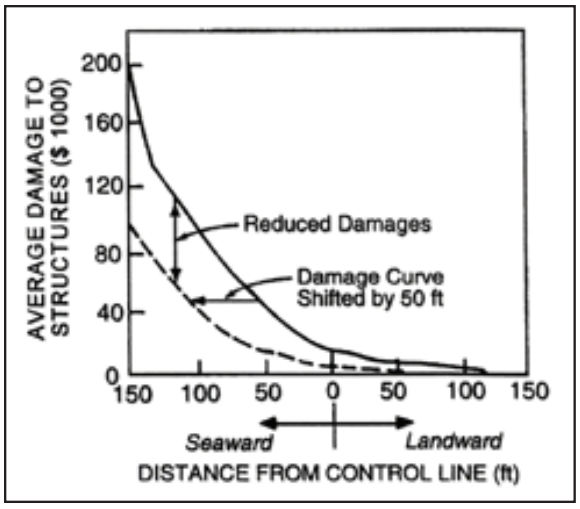


Beach nourishment is usually the most non-intrusive option available to a coastal engineer. It started back in the 1920's in New York. Coney Island was kind of the first known beach nourishment project. Subsequently, Santa Monica, California in 1940; Biloxi, Mississippi in the 1950's. However, the contemporary landmark beach nourishment project took place in Miami Beach, Florida in the 1970's.

The project consisted of a 325-foot wide beach nourishment project that stretched over 10 miles of coastline. It cost approximately $64 million and consisted of 13 million cubic yards of material placed on the beach. At the time, Congress deemed this project with the Golden Fleece Award, which basically represented the project that was viewed as the greatest waste of money for the year. Subsequently, several years and 21 million users per year late, this project was given engineering excellence awards.

We've progressed a bit since 1970. Currently, approximately one billion cubic yards of sand is placed on beaches across the U.S. each year. Is this economically viable? Well, certainly this should be assessed on a site-by-site basis, which includes the value of the upland property you're trying to protect. But, as a general rule of thumb, if a beach nourishment project has a lifetime of approximately two-years, it's probably not economically viable. If the lifetime extends to a 5 or 10-year cycle, it probably is going to be economically viable.

Some of the major goals and benefits for beach nourishment are (1) building additional recreational beach, which typically would drive additional economic and tourist benefits. (2) Increased storm protection, both in the terms of wave energy absorption and as sacrificial sediment source for the beach. This graph shows the benefits of increased beach width relative to potential damage. Even a 50-foot increase in beach width results in some significant savings in dollars. (3) beach nourishment can also provide environmental habitat. Beaches are also home to a lot of endangered species; (4) beach nourishment typically only has beneficial effects on adjacent shores.

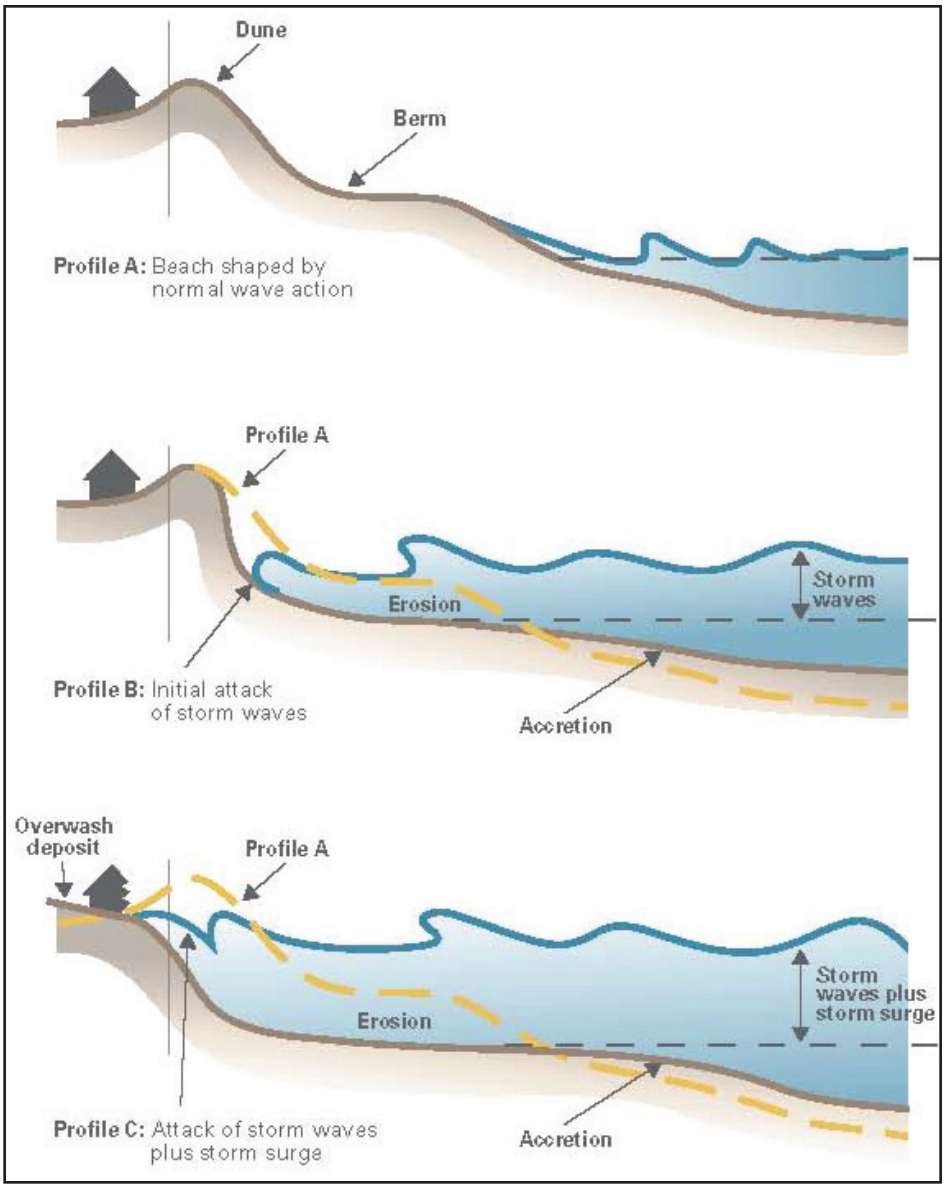


One of the big hurdles with beach nourishment can be public perception, or the viewpoint that sand is lost quickly. In other words, the idea that we shouldn't do a beach nourishment project because the minute sand is placed on the beach, a big storm is going to come through and take all the sand away. Well, sand doesn't disappear. It's actually rearranged on the beach. And beach nourishment is the only type of solution that actually directly addresses the deficit of sand in the nearshore zone. It's adding sand into the system. No other solution actually makes sand. Other solutions typically are designed to rearrange the sand in the system to benefit a certain portion of the beach.

This is your typical beach nourishment or beach profile layout taken from the Coastal Engineer-

ing Manual. The beach consists of a dune and a beach berm. With a storm, the wave energy increases and storm surge raises the mean water level. Initially, the beach berm is eroded and that material is transferred offshore. Eventually, it erodes the dune and creates an offshore bar system.

Beach nourishment then is designed to effectively enhance some of those features of the beach. Here you see a representative schematic of the cross-shore profile. For nourishment design components, the beach berm width could be increased, extending the natural berm further seaward. You could also increase the dune elevation and dimensions of the dune. The dune could be stabilized with vegetation, if that is acceptable. Or maybe it's some combination of dune construction and beach nourishment. Additionally, implementation of something called advanced nourishment, which is an additional, sacrificial component of the beach nourishment, could be constructed to extend the lifetime to the next renourishment cycle. Finally, there is the idea of a nearshore berm by placing the sand offshore. The idea is to break the wave energy and transport the material onshore. It is unclear how successful this has been and has had some mixed results. Why put sand in a spot and hope it moves on shore when you can really put it directly on the problem?

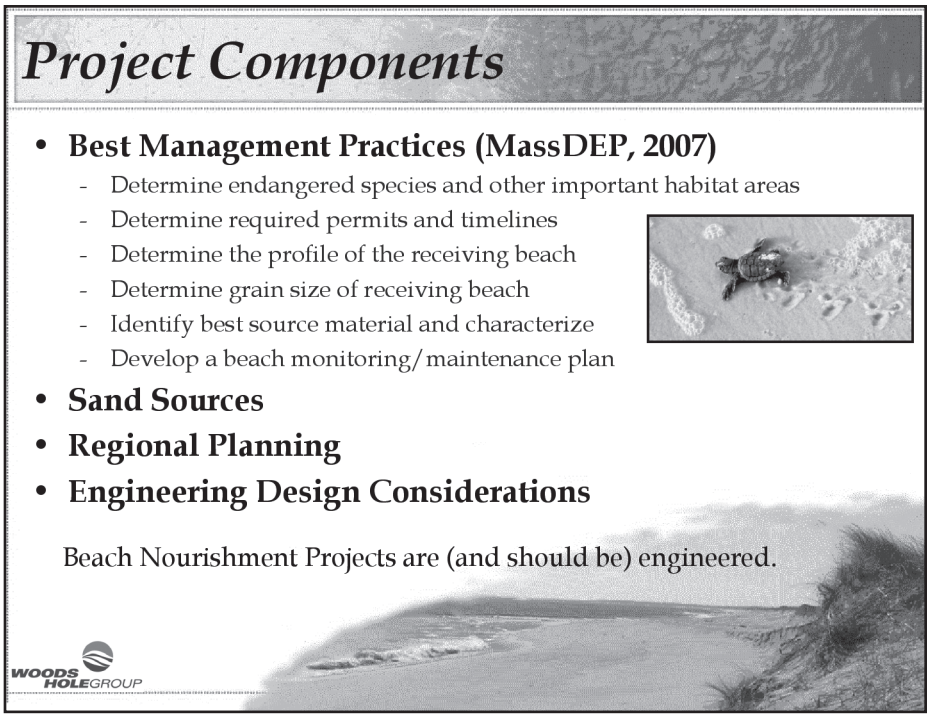


From a plan view perspective, a feeder beach can be used. In this case, sand is placed updrift of the area to nourish, and requires a very strong littoral drift in one dominant direction, such that sand would basically feed the eroding beach through time.

Other design considerations relate to controlling sediment losses. Where does the sand go? Some of it moves offshore to equilibrate the profile, more of it is transported alongshore during a natural spreading process. To reduce alongshore losses, the edges of the nourishment can be ta-

pered. Also, beach nourishment could be used in conjunction with structures to help stabilize the placed sediment.

The Best Management Practices have just been published by Mass. DEP and present the basic guidelines in Massachusetts. The focus is primarily on the environmental components, the permits, grain size compatibility, and then beach monitoring and maintenance.



What I want to talk about today is complimentary to the best management practices and goes into a little bit more detail about the regional planning and engineering design considerations. Throughout the rest of the day we're going to hear a lot about some of the environmental considerations. For example, John Ramsey is going to discuss the compatibility of sediment at the borrow sites. For my discussion, I'm assuming sand is available, it is compatible with my beach, and all the environmental concerns have been met. Therefore, I'll focus on how you layout a beach on an eroding shoreline. A key point is that beach nourishment projects are and should be engineered. I'll also take a look at different levels of design, and how that affects a beach nourishment design.

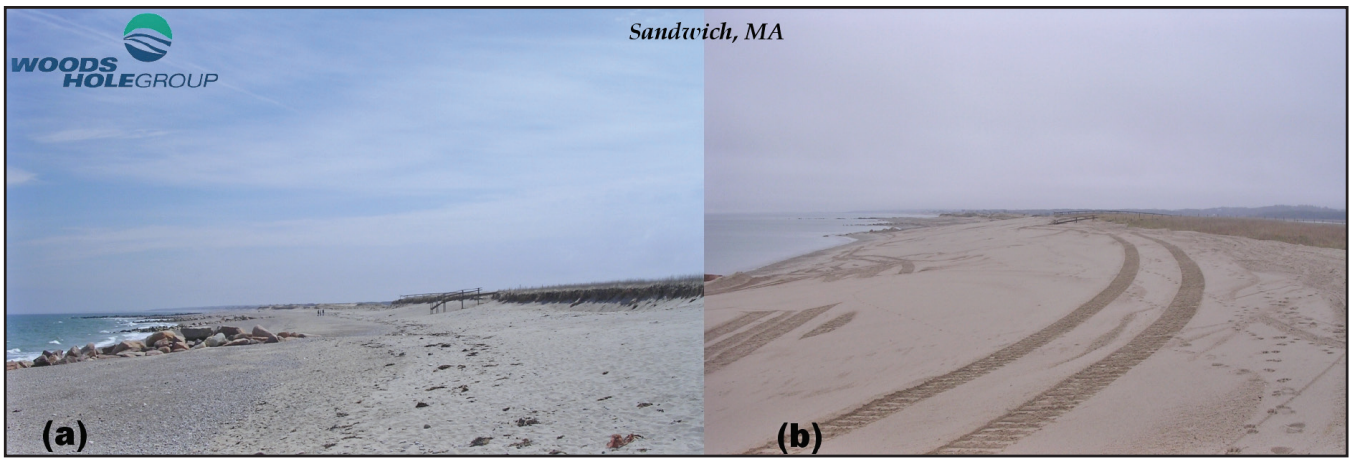
There are three primary levels of design I want to discuss. Obviously, there may be design levels in between, but the three basic ones are (1) simple placement and/or, beneficial re-use, which is almost always a project of opportunity-type setting. (2) An intermediate size project, which is typically local size projects that Jim was referring to in the opening talk, and then (3) the more detailed engineering analysis and design projects that really focus on the bigger size, cost-benefit type projects.

Of course the question arises, "Well, what level's right for me?" A simple answer is it must be considered on a site-by-site basis, but there are other factors aw well. What's the purpose of the nourishment? What are the expectations of nourishment? Is it expected to last a certain amount of time? Is it expected to serve some recreational benefit or some protection benefit? Is it supposed to protect against a certain level storm? What about potential environmental concerns? If it is a small nourishment, a Level I or Level II design may suffice, but if there is significant environmental concerns, a detailed engineer analysis may be required to determine the potential impacts to the environmental resources.

Level I, placement and/or beneficial re-use. This is a very simple beach nourishment project,

where a beach is chosen to simply accommodate the material or dispose of clean, compatible dredge material. For example, just spreading some sand on the beach for the summer.

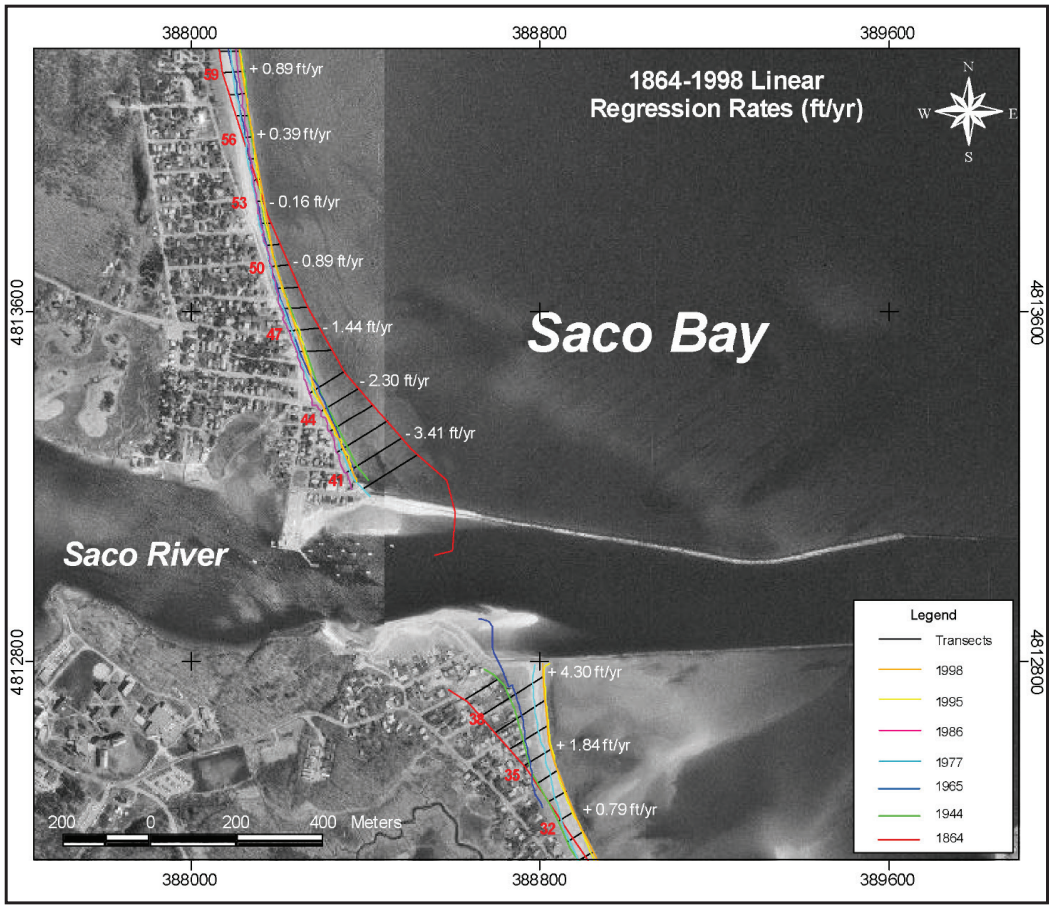
In New Seabury, in front of the golf course, they literally simply place sand on the beach. No design template or profile is considered, and it simply serves as a reservoir of sand. Of course, there is some brief evaluation of the grain size and compatibility to make ensure the quality of the material being placed on the beach. Additionally, an evaluation of environmental resources in the area will be required, but no focus is given to the physical processes. This level is not really intended to be a beach nourishment in the standard sense, rather it is more of a dredge disposal location.



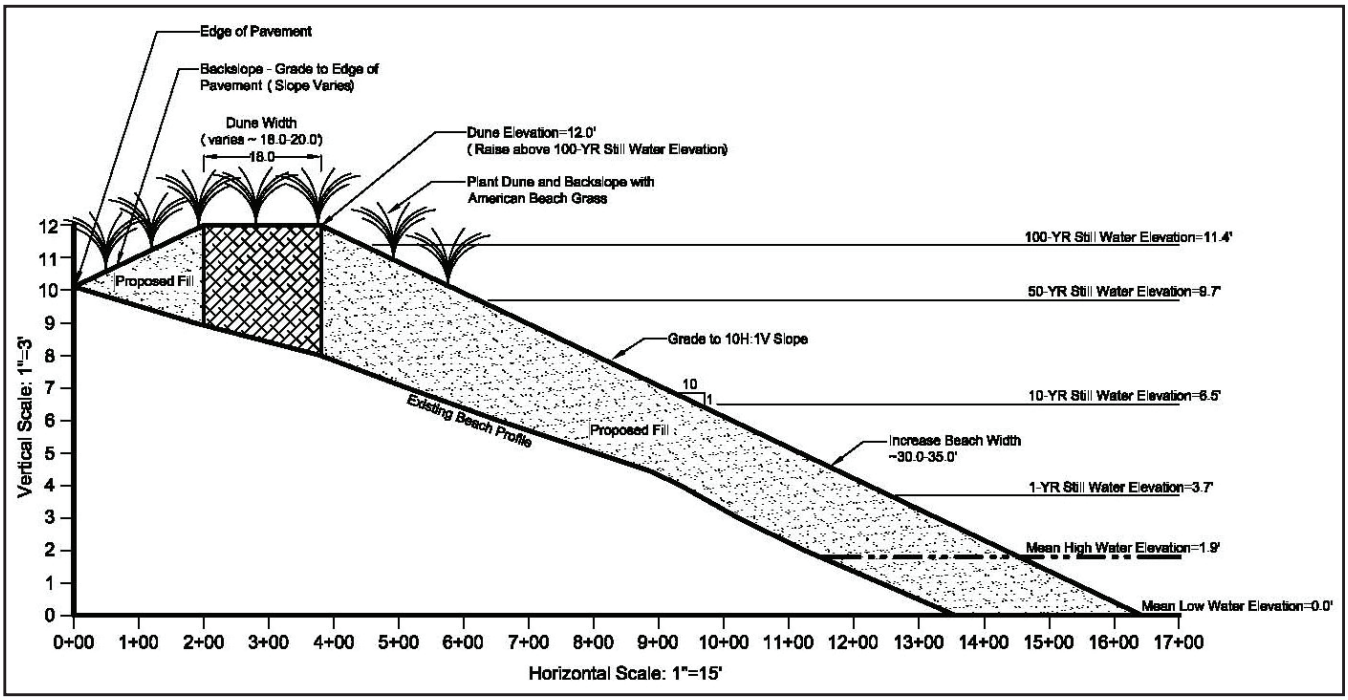
Sandwich, Mass., a project completed a few years ago when there was an emergency dredging needed in the Cape Cod Canal. For this project, sand was simply placed above mean high water, was not necessarily expected to last, and simply was intended to get sand in the system and serve as a reservoir of sand.

The intermediate project level has some additional design considerations above and beyond simply placing sand on the beach or into the system.

This is Saco Bay. Shoreline change analysis is can be a key component. Looking back in time can provide a good deal of information about a site. For example, at Camp Ellis, Saco, ME, significant erosion exists approximately 2,000-3,000 feet north of the jetty, which identifies the area of key concern in this location.



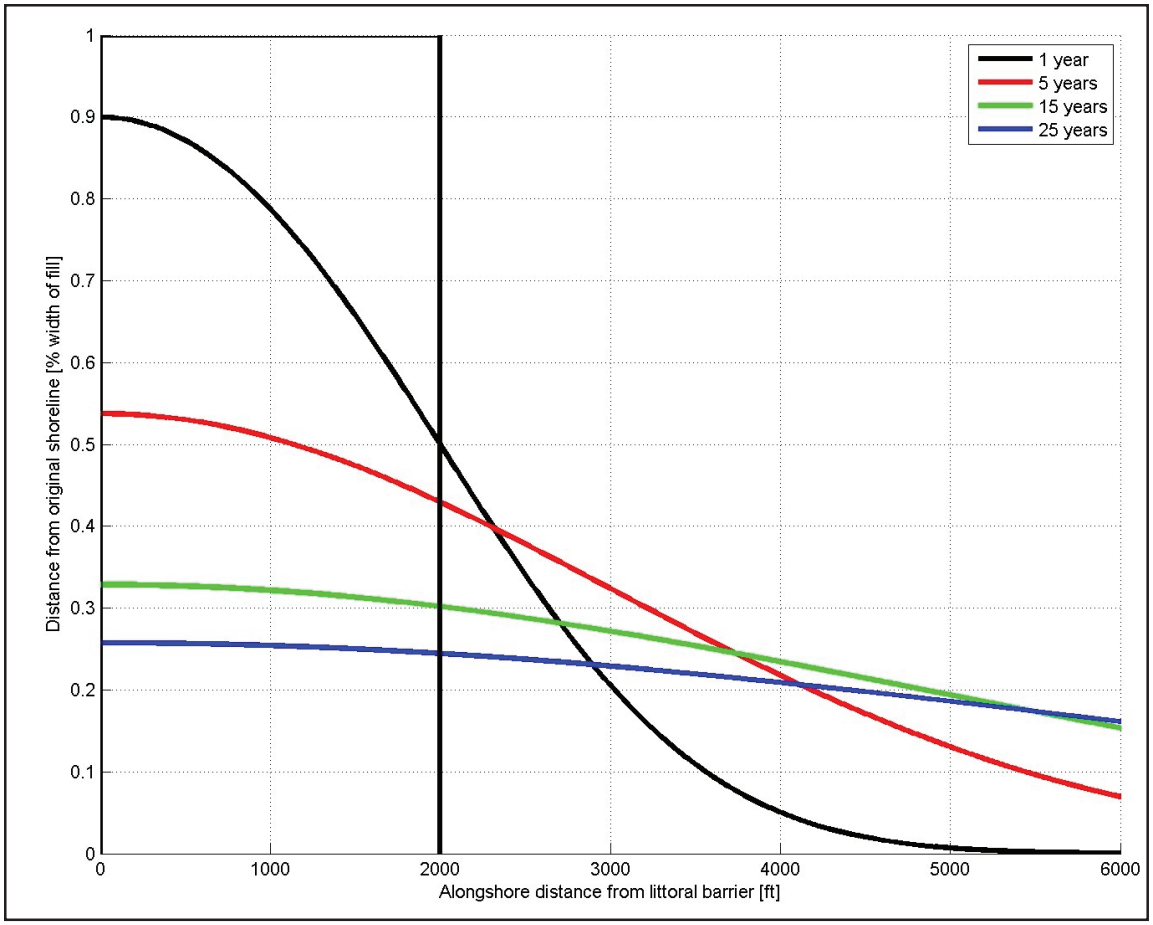
Additionally, a Level II design may include actual cross-sectional design, dune designs, vegetation, determining how many cubic yards per linear foot should be placed.



Overfill ratio calculations can also be evaluated at this level of design. I think John Ramsey will probably cover a lot of this in the subsequent talk. Basically, the overfill ratio evaluates the required volume of borrowed material needed to match your native beach material, and is a measure of sediment compatibility.

Finally, a level II design may also include analytical lifetime estimates. That is, how long is the sand expected to last using basic Pelnard-Consider type equations and solutions. This is an example of a basic lifetime analysis. This figure presents the initial beach nourishment width, and evaluates the spreading of the nourishment through time. After 1, 5, 15, 25 years the sand starts to spread out and reduces the width of beach.

This intermediate level design may also include first order assessment of the physical processes at the site. For example, determining the design wave height, storm surge levels, etc.

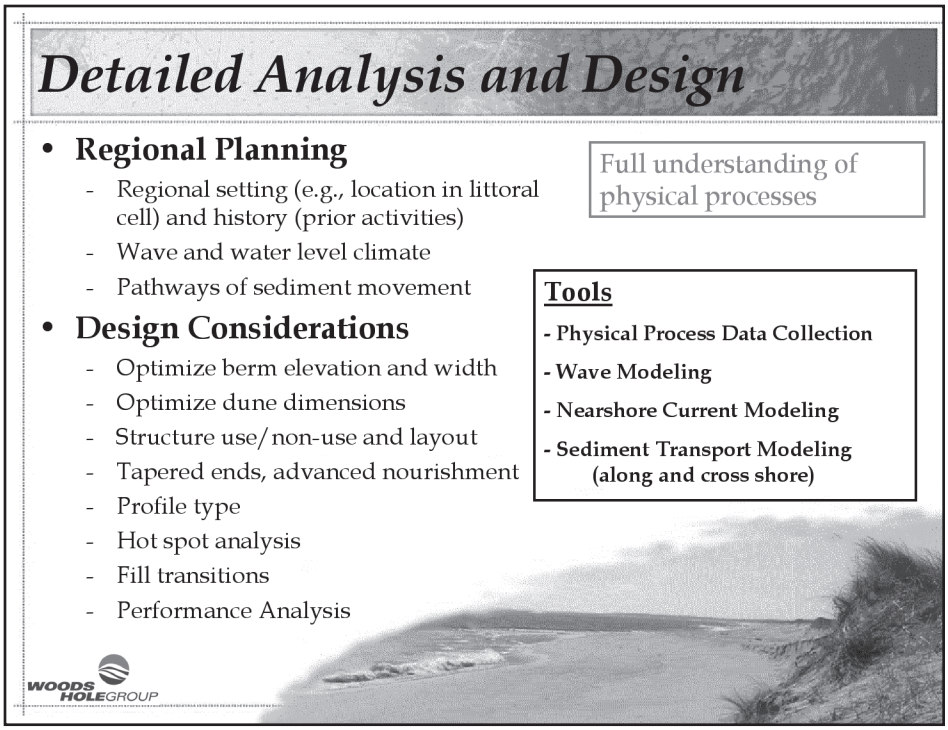


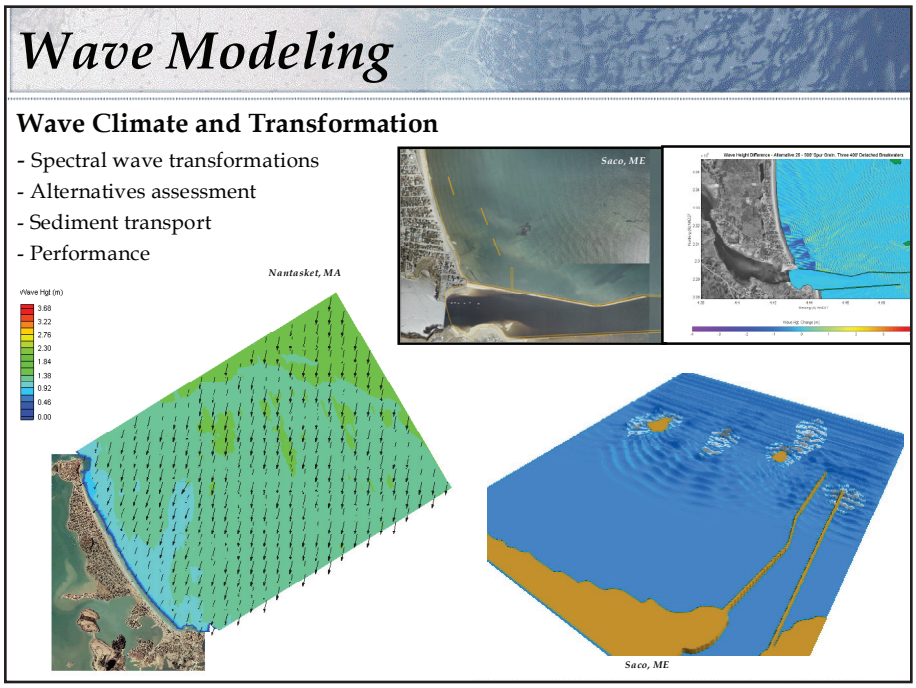
Finally, detailed analysis and design. That would be full-blown beach nourishment design when you evaluate the regional setting and physical processes in more detail.

Included in this level of design is a wide variety of design considerations aimed at optimizing the design, extending nourishment lifetime, and providing the ability to evaluate potential structure use and layout if structures exist at the site.

This level of detailed design provides the full understanding of the physical processes. Some of the basic tools include, physical processes data collection, wave modeling, nearshore wave-induced current modeling, and sediment transport modeling.

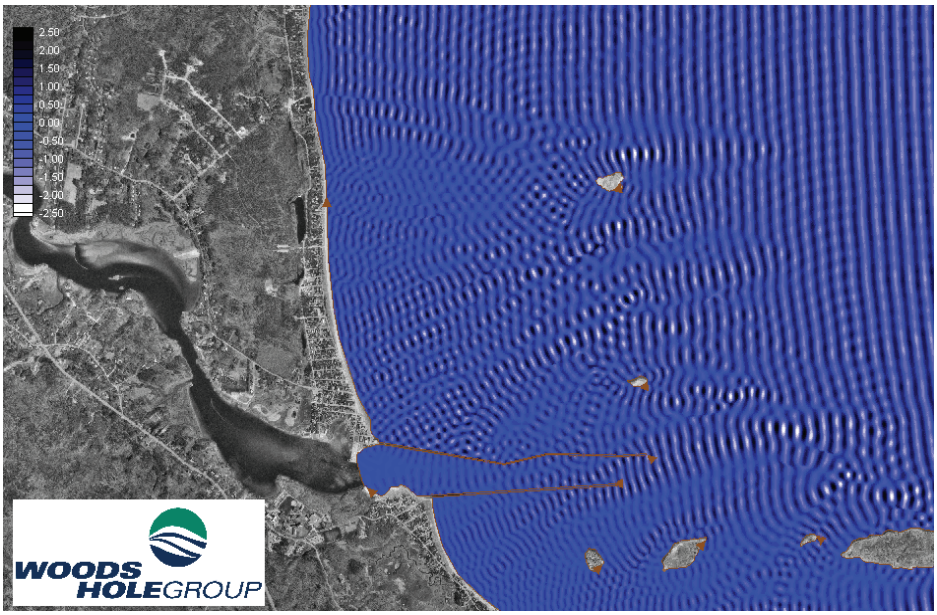
I'll quickly presents some of these tools in relation to the more detailed projects that I've been working on. Physical data collection; waves and currents and tides, bathymetry/topography at a site is critical to insure the models accurately represent reality. Typically, models are calibrated to observed waves, tides and/or currents. This example is from a wave model of Nantasket, Massachusetts. The figure shows an entire yearlong simulation of wave height at Nantasket. The red line shows the model result and the blue shows observed data from a buoy. So, at a certain level it provides comfort that the model is doing a pretty good job of simulating what is happening out there at the site.





Here are some examples of wave models. At Saco, Maine, the large structures, complex bathymetry, and offshore islands require a detailed understanding of the waves in order to design an appropriate beach nourishment project. Here a Boussinesq wave model, a phase resolving model was used to resolve the surface expression of waves. This type of model allows you the ability to identify alternatives that may influence the wave energy at the site and help you determine the best performing nourishment options. At this location, it was critical to get the protection and nourishment right since 30 homes have been lost to the ocean.

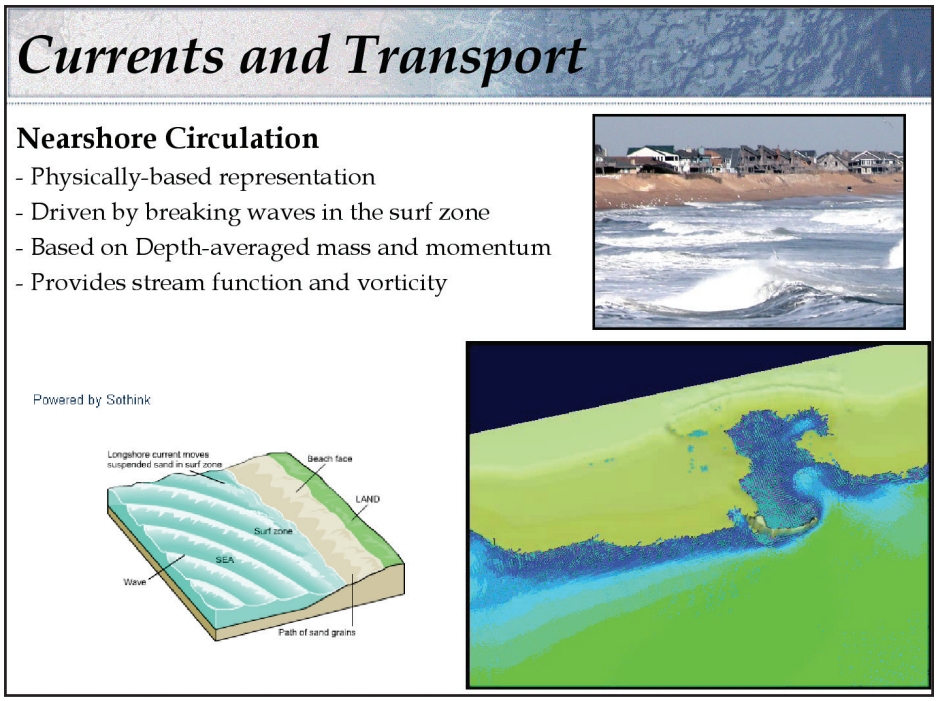
As another example, this is that part of that yearlong simulation in Nantasket, Massachusetts. The power of modeling is that specific storm events can also be simulated to predict what may have



happened. In this animation, the reds and yellows indicate an increase in wave height and the arrows show the wave direction. In part of this animation, the model simulates the Patriot's Day Nor'easter progressing through the domain. From these results we can begin to predict how sand is moving on the beach.

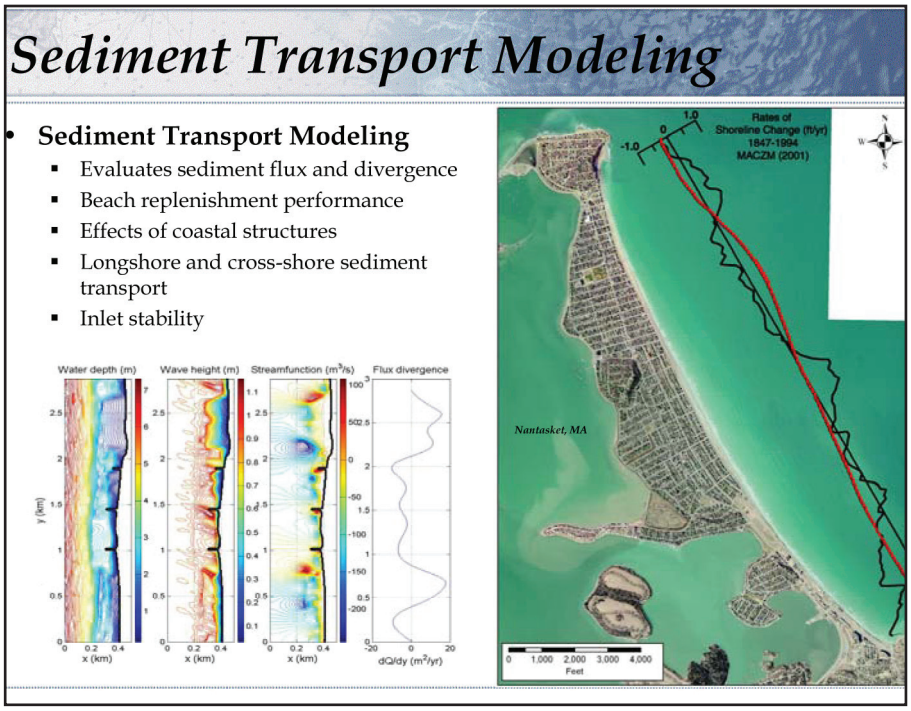
Finally, here is one last example of a wave model. This model shows the sea surface elevation. Blue indicates areas of waves crest, white indicates wave troughs. The model shows how the incoming waves were transformed and focused on this location of the beach. It was a key finding for this particular location. This model also provides the currents and transport, so the wave model results can be used to evaluate sediment transport pathways.

Which feeds into the next tool, nearshore current modeling. A couple of quick examples, including a simple schematic showing waves approaching the coastline, generating surf-zone currents, and moving sand along the beach.



The second example is more complicated and detailed, where the black arrows indicate the current movement in the surf zone, including the up rush and downrush of the waves as they move sand in the nearshore. At this step, beach nourishment layout options can start to be analyzed in a bit more detail.

Sediment transport modeling is another important tool in laying out and evaluating a beach nourishment project. It is important to understand both the alongshore and cross-shore movement of sediment. In the longshore sense, this figure shows the longshore movement of sand on Nantasket Beach. Due to time, I'm not going to get into the details of the alongshore sediment transport model.

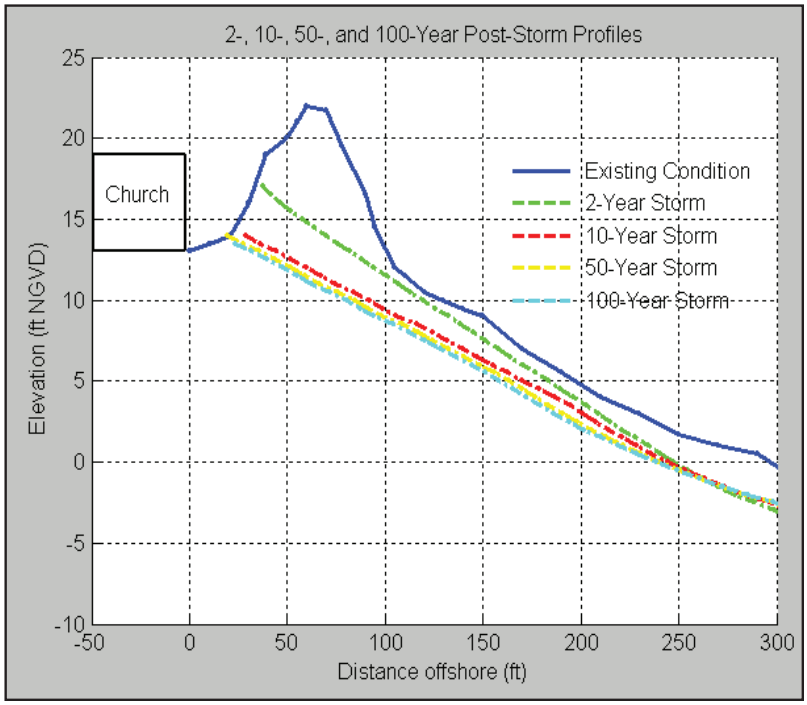


For the cross-shore, here is an example of a site in Long Island, NY with a dune protecting a historic church. Once simulating existing conditions, storm events can be simulated to determine the impact on the profile during those storm events. We all know how sand moves onshore and offshore in the seasonal sense, but it is also important to assess what happens when storm impacts the profile. With these results, a dune design and dimensions can be determined.

Finally, the projection of how the beach nourishment performs. Using the sediment transport models, a comprehensive sediment budget can be developed and evaluation of beach nourishment performance can be conducted.

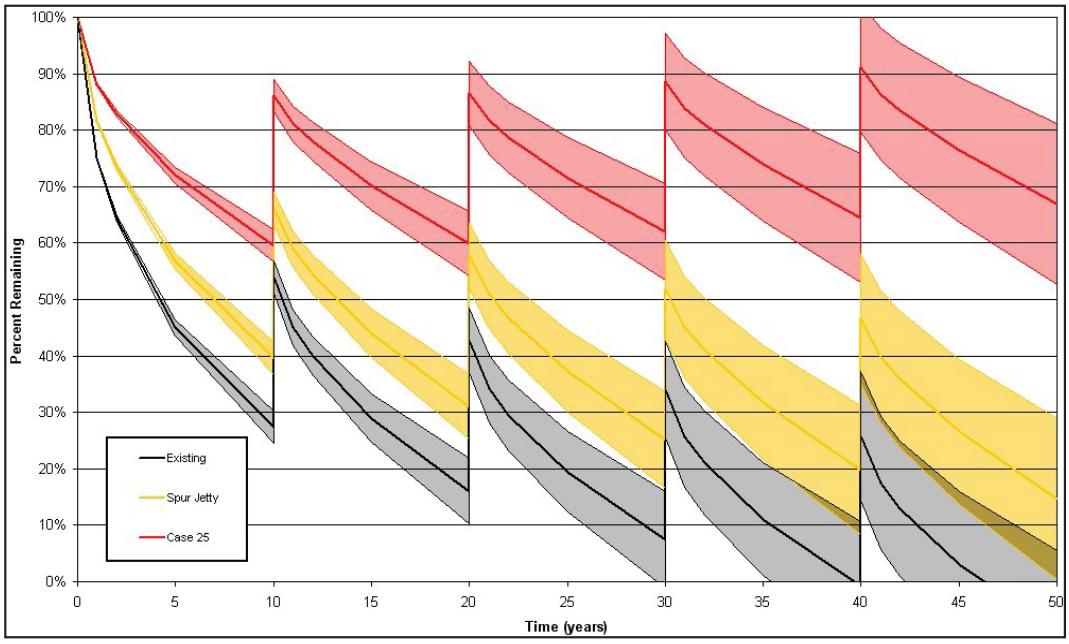
For example, this example shows the success of different beach nourishment alternatives combined with various structural components.

The horizontal axis shows time, while the vertical axis indicates the percent of the original fill volume remaining in the nourishment template area. In this case, new sand is input into the system from a federally dredged channel every 10 years. Through time, the red curve indicates an alternative that is actually stemming the erosion at this location through the combination of a nourishment, recharging of sediment every 10 years, and a structural enhancement. In other cases, such as the black line, which shows nourishment alone, the placed sand can't overcome the erosion.



So, we've covered the beach nourishment in terms of the need, economic viability, project features, and level of design, where different levels may be required for different sites or different projects. I quickly glossed over some of the tools that can be applied. I'd be happy to discuss any of those with you after this session.

Finally, I want to stress that public management and expectations is a key part of a beach nourishment project, especially in Massachusetts. My colleague, Lee Weishar, always says, "Beach nourishment projects are the only civil engineering project that is designed to fail." For example, if you designed and built a bridge, yet it was designed to fail, that wouldn't result in an acceptable outcome. So, public perception is a key part of beach nourishment. Beach nourishment is a viable option and can work in Massachusetts. Hopefully, we can continue to push that forward. Thank you.



MR. O'CONNELL: We're going to hold the questions until the next speaker and then bring the two speakers back up. Thank you, Kirk. I didn't recognize our Agent Timers over here; Steve Humphries and Steve McKenna who put up the cards. I think it's important for the speakers to keep on track, and me to not talk so long so to keep the day going. We have a lot of talk, and I did forget to give him the (Bell.)

MR. BOSMA: I was waiting for that.

MR. O'CONNELL: So, when you hear the bell—somebody grab a hook. Our next speaker is John Ramsey, but John didn't give me a bio.

MR. RAMSEY: Yeah, I did. That's okay. Don't worry about it.

MR. O'CONNELL: Tell them who you are.

MR. RAMSEY: Besides I've got 13 minutes to say who I am because we're way ahead of schedule here.

MR. O'CONNELL: No, twenty minutes.

MR. RAMSEY: I'm just teasing. Hi. My name is John Ramsey. I'm with the Coastal Engineering on Cape Cod since 1991. I've basically been doing a lot of beach nourishment projects both locally throughout Massachusetts as well as working in Florida, Louisiana and some other places along the coast.

I'm here basically to kind of follow under Kirk's talk and Jim's talk a bit and talk a little bit more about beach nourishment and some of the sediment compatibility issues as well as some of the sources. There are certainly a lot of hot topics here. One thing that Kirk alluded to is we have different levels of projects, and I think one thing that people should keep in mind regarding the projects is that not only is it from a design standpoint and an expectation standpoint, but when you get to a certain point when intermediate or large scale projects, we're actually looking at these as shore protection. The primary purpose once you get to a larger project is actually shore protection and some of the beneficial use projects are just to keep that feeder beach going as Kirk pointed out.

The first thing is certainly I want to talk a little bit about sediment compatibility. We have a very unique coast here. We're very different from much of the East Coast. We have a glacially derived shoreline as Jim had pointed out. This is a glacial lag deposit. Again, when this erodes during major storms, we have a lot of features here of drumland deposits all that kind of thing that actually when they erode they leave large boulders and everything else that's in here, all the fines wash away and what we end up with is a whole mixture of gravel, sand, cobble, and boulder material on the beach.

And as far as compatibility goes, this is very unique because if you go down to Florida etcetera most of the grain sizes in those beaches are pretty consistent. We certainly have on the outer Cape by the National Seashore is fairly consistent, and the outer coast of Nantucket and Martha's Vineyard are also very similar but much of our coast and especially much of our developed coast have a lot of these glacial features with headlands that have been eroded and then pocket beaches in between, no long ribbons of sand as Jim had pointed out.

In addition, we also have to look at waves and tides. How does this influence how our beaches form? One thing about Massachusetts, again another unique thing, is we have a very highly variable tide range here. If you look out on the deck you're looking into Vineyard Sound there. The tide range there is only on the order of a foot and a half every day. We go up on the north shore here. The spring tide range is over 11 feet. That's just from a tide range perspective. Certainly we have a lot of Northeast storms that influence this area, the south shore much more protected, typically more calm; however, we get the every 20-25 years we get the hurricanes come up and cause some significant damage. And we do get both large storm surge especially in Buzzards Bay, which is right here. And also a lot of waves that come with that and beach overwash. So, certainly, we have the full range of conditions you might see around the country all within a very small area.

The last thing I'd like to point out is seasonal variability. It's very common everywhere that we have different seasonal changes. The winter wave climate tends to create steeper beaches. In Massachusetts because we typically have these mixed sediment beaches, this is actually Hummarock, we actually end up with cobble, more cobble exposed for the winter. You come back in the late spring/

early summer and you actually see a lot of that covered over. You actually might get to the point in a lot of these places where it's covered over to the point where the beach actually looks sandy. However, you really need to keep in mind all the components that are actually making of that beach when you're looking at sediment compatibility.

As I talked already about the glacial origin, this is Priscilla Beach. We really have—you also get these kinds of layered systems where you might have a finer grain sediment down here, a little finer grain here, and then comes gravel sand nets. So, you want to make sure when you are assessing compatibility that you look at all the different grain sizes that make up your beach.

Here, we have the jetty effects. Everybody's talked about so far what the impact of structures etcetera are. Here's a picture from Ellisville, Massachusetts. You can see the groins here. Obviously the materials trapped updrift of all these groins. That ends up being finer grain sand in general. If you go downdrift from these, you can actually see pockets of gravel, cobble, and such. So, you really need to, again, make sure you're looking at all the influences that make up your beach.

So, what do we have in Massachusetts? Again, we talked a bit about sediment sources and the types of materials we see, and we do have a high variability. If you go up to Nahant Beach—it's actually one of the flattest beaches in the state. You'll see this beautiful fine grain sand. It's about .2 mm for those who are from an engineering standpoint, but it's really this nice fine powdery sand. And it's a very nice protected beach between headlands. We go down. More typical beach sand—this is from Sconset down in Nantucket. It's very typical of the outer Cape as well. And then we get some more glacially derived material. This is actually from a protected beach, Spectacle Island, which is inside of Boston Harbor. That actually has—even though it's an area that's very protected from waves, the sediment that is making up that beach is actually derived from two drumlands as well as an old dump, so there's actually a lot of material that's very unique native in Massachusetts.

And then the bottom one I'm just showing here is Winthrop. Winthrop Beach is one of those armored beaches that has slowly eroded over time and lowered. Even though the sediment has become potentially a bit coarser. Even if you look at old pictures, you do see a mix of this type that exists on the beach. It's a gravel sand and even this cobble beach. So, you really need to take that into consideration when we're looking at sediment sources. And the only thing I want to point is, this is from Spectacle Island, we certainly need to think about those other effects, anthropogenic effects. This is kind of an odd one. We certainly want to look at this whole concept of, you know, how groin structures etcetera effect it, but in Spectacle Island we actually have a fair component of beach glass that sits on the beach. It's a great place to collect it if you want to. But the other thing is we also see a lot of beaches with what the British would call shingle or cobble. You really need to, again, assess the effects of that and how much of your beach nourishment especially in some of these coarser areas that you want to actually incorporate that material at your beach and then let the waves sort it out later on.

As Kirk mentioned, I am going to talk a bit about compatibility and how we determine it. DEP has come out with these Best Management Guidelines that we worked on with CZM, and, basically, what it is is we go through this whole exercise of grain size curves and how you determine what is appropriate for the beach. Now, again, this is more from an engineering standpoint of what will stay there best. If you end up with material that's finer and still is beach compatible in general that's

sandy, you might want to place it in a dune not necessarily within the intertidal zone because it's not going to perform the way you want.

In this case, this is a grain size curve. This is percent passing sieves for those of you who didn't know that. This area over here is gravel, sand, and then silt and clay. So, these green bands separate it, and this material most of the percentage is in the sand range. This is from Plymouth Beach. The blue line is a composite sample. All the samples averaged together and then the gray band shows the full range of sediments that we see. So, we have material that's actually very sandy in the beach where the stuff has up to about 30% gravel. So, that kind of gives us an idea of what we have on the beach.

One borrow site was looked at at a place called Browns Bank. It's a very sandy deposit. It has a slightly finer grain size than the actual native beach. And then we also looked at an upland source. This place is called Camelot Park, and that has a component of gravel and a bit of a coarser material than was found offshore. We look at all those curves together. At first blush, you might say, well, the blue curve, which represents the composite beach sample. This curve over here—that's the offshore source, this is the upland source, and at first glance you say, well, all those curves look pretty good. This is not going to be a big issue. We can use either one of those sources. But as pointed out, you'd actually have to go through this compatibility analysis, and, again, I'm not going to talk in great detail about the engineering, but this is kind of a nomagraph once you calculate and this is outlined in the Best Management Practice Guideline for DEP. You actually go through this process of calculating out the different sediment parameters based on grain size curves, and this area over here would say that the beach nourishment would be stable and performed well. This area over here would say that the beach nourishment is unstable.

In the case we just showed, this area or this site—this Browns Bank offshore site in this case ends up being an unstable sediment. Basically, this is overfill factors and this curve is 10 so it's greater than 10, which means for every cubic yard of beach that you have, you would need more than 10 cubic yards of material in order to be equivalent to have the same lasting power. What you're looking for is actually something—you want something more around 1, which means 1 cubic yard of material from the borrow site is equivalent to 1 cubic yard on the beach.

And how does this just sort of, kind of following on that whole thing, how does this correspond to what we think of. Obviously finer grain material moves offshore. It's more highly erodable that's commonsense, but from a equilibrium beach profile how does the material behave, and this is just a quick video.

Basically, if you have fill, the material's coarser, you're going to have a much better lasting project. That's always what you're aiming for or at least material that's consistent with what's there. So, that would form at the same slope basically as the material that the native beach is. Finer material if you put it on the beach and this is one of those cases where basically you right after the beach—Kirk had mentioned that people say, "Well, the material's lost." Very often in these beneficial re-use projects that we see if the material is compatible, it's put on the beach. It gets washed offshore, and from that perspective it's not only that it doesn't last well, but it also you potentially will have greater environmental impacts because it's covering over nearshore resources.

So, that's sort of the sediment compatibility side. I also wanted to touch on a lot of what seems to be a hot topic. How do we get sand to the beach? Obviously, there's a lot of ways of getting mate-

rial from marine sources and that's about 95% of the nourishment in the United States comes from marine sources and about 5% come from upland. But these are the various things I want to talk about.

Offshore sand mining, which has been done a couple times in Massachusetts but not in quite a while, and then a lot of these beneficial re-use or even beneficial mining projects, inlet and channel dredging, channel over-dredging, inlet bypassing, ebb or flood shoal dredging, I'll explain that in a minute, back passing as well, I'll actually explain that in a minute and talk about it a little later on for Dead Neck, and then, of course, upland source.

Now, the first thing is assess the alternatives. We already talked about sediment compatibility but a lot of things that everybody needs to keep in mind are some of these other issues. Constructability. If you're kind of designing a beach nourishment project, you don't want to have to handle the material four or five or six times where you're going from truck to barge to helicopter etcetera to deliver material. I mean, it sort of gets to the point where the logistics of it become unconstructable.

Environmental considerations are certainly key. There's fisheries resources, there's threatening endangered resources on the beach as well as marine mammal resources offshore. All of these things need to be considered when you're looking at beach nourishment.

Cost. You can't really get away from it. I mean, if it ends up costing $100 a cubic yard to deliver material for a beach nourishment project, then chances are you're just not going to do the project.

And then, obviously, other impacts. Other impacts, you know, one of the things that always comes up to me is kind of a trucking thing. These are the kind of impacts people don't think about, and there's always the air quality issues relative to trucking, but a lot of it comes down to, you know, in some of these very developed communities, they can get 15,000 truckloads through these very busy communities during rush hour and working around everything else. And is the community going to support it, and is it going to be a viable project? you really need to keep all of these things in mind when you're designing or proposing a project.

Obviously, from a marine environmental impact standpoint, you know, upland source is obviously the most ideal thing. Again, here's the success. One of the biggest keys is finding an economical, and when I mean economical borrow site, I also mean basically we have to come up with compatibility first, and you don't want to get into a situation where you're actually having to engineer material maybe a little bit from this pit, a little bit from that pit, and try to blend them all together. If it's silky, you have to wash it, so, obviously, finding an economical borrow site is a key consideration.

You need high-quality transport routes. A lot of communities have secondary roadways etcetera. It becomes a big issue. You don't want to do full-depth road reconstruction after you're done. So, you're really looking for some roads that are designed to, you know, Mass. Highway standards if you're going to try to want to do this, and even then, you're probably going to have to do major road repairs if it's a large scale project.

Small scale projects completely different issue. Limited volume projects. In general, the rule of thumb is 200,000 maybe a little bit more. In a construction season you might be able to do for a project if you have 200,000 cubic yards if you have a source nearby. That's a big project for an upland

source. John Winkleman's going to be talking about Revere Beach, which was a very unique situation. I think it's about 700,000 cubic yards but it was done from an upland source, but, again, the source was very readily available and actually worked out to be a good project. But this is probably the exception to the rule. In general, you really need to consider if you're doing a major beach nourishment project, it's going to be very difficult to do it from an upland source.

Marine sources. I'm just going to go through a bunch. Every other source I'm talking about is a marine source. We've got inlet or channel dredging. This is something that's been done quite often down in Barnstable County. We have Wayne Jaedtke, the County Dredge, and he's going to be talking a little later. This is the Codfish in Green Pond.

This actually works out really well. This is a nice, you know, a lot of these projects 1,000/2,000 cubic yards throw it right on the beach. Compatibility for our projects is rarely an issue for these types of quick inlet dredging. Is it going and doing channel dredging further up in an estuary. Sometimes it does become a compatibility issue but most of these projects are just dredging the inlet where it infills the sediment back on the beach anyways so it's usually compatible with the beach.

MR. O'CONNELL: About 5 minutes, John.

MR. RAMSEY: Okay. Marine sources, again. Inlet bypassing. Ted Keon's going to talk a little bit about this project here in Mill Creek. This is in Chatham. These are the jetties. Obviously, this jetty was extended as infills tremendously and has actually now gone outside the bounds here, and certainly the constant inlet bypassing is nothing new. This is actually—makes an ideal management strategy for a lot of our inlets. This is about taking this material and putting it on the downdrift beach, which has obviously has eroded quite a bit. And potentially mining the material updrift of the jetties and putting it downdrift.

Back passing. There's an example of Dead Neck. This is the end of a littoral system because all the material just keeps migrating this way. There's a possibility, and I'll talk about this later today, of mining this and putting it back. There are some other examples where this might work. Little Pond in Falmouth, very small example. Tashmoo is another possibility. Very viable type thing, but, again, it depends on the system.

Ebb and flood shoal dredging. We don't have a lot of systems with large ebb and flood shoals in Massachusetts. One notable exception is this new inlet in Chatham. This is where flood shoal where this is—the barrier beach is a flood shoal forms. Inside of the inlet when the flood tide brings it in, an ebb shoal would be formed outside. Again, this is not a very common thing in Massachusetts, but in other places they have used their successful sources for beach nourishment projects. In Falmouth, you can go down to Bourne's Pond and there a little bar that builds up off shore of the inlet, and that's dredged pretty much every year. I guess you could consider that ebb shoal dredging.

And, of course, the big controversial topic "Offshore sand mining." One of the things to keep in mind with these projects, offshore sand mining really is for big projects. It's big equipment. This is the type of thing that is done for engineered shore protection projects. You'd have to deal with exposure to open ocean waves. You must consider the effects of potentially altering the bottom. I don't want to talk too much about that.

And then quote/unquote "New Impacts of Benthic Resources." These areas haven't been

dredged before so it's not a maintenance dredging. It's actually coming up in new impacts. As I mentioned Dead Neck and Long Beach have both actually done offshore sand mining but about 1990 was the last one done. And then Winthrop and Sconset are being proposed right now.

This is just a quick overview of sites that have been noted for offshore borrow sites. You see the big aerial ones around Boston. It's not that there's more sand there. It's just that people looked a little bit closer. There's obviously a lot down in Nantucket Sound as well. Of course, including our lovely Horseshoe Shoal, which may have another (Inaudible.) shortly.

Type of dredging. Cutter-suction dredges. These are large dredges. They handle about three to four foot waves and work. Their mobility is limited. They usually need a deeper borrow or a thicker borrow site so they don't have to move very much. They pump it—the material—directly on the beach hydraulically. Therefore, you really need to have a borrow site that's pretty close to the beach. You can certainly get booster pumps and stuff to bring it along. Once you exceed a few miles, you're starting to get very expensive and people don't have enough pipeline to get it to the beach.

Much more common, this is actually trailet-suction harbor dredges. This was being proposed, I think, well for Sconset and Winthrop right now. These are large ships that have a hopper inside. They basically suck up the material from the bottom—it's deep water in here—held in the harbor, brought to an offshore buoy, and placed on the beach. Over here is what you see in maybe in a place like Singapore or something where they actually spray the material out of the harbor onto the beach. Huge turbidity problems. And just to note here it's something we don't do in Massachusetts.

AUDIENCE: (Laughter.)

MR. RAMSEY: I don't think anybody would be too happy with us if we did that. The way we do it is actually obviously the buoy or something offshore. We lay the pipelines just like every other dredging project that you see hydraulically. The material comes out as a slurry. You have a berm placed along the beach. The water flows along this berm on the inside, and all the coarse grain material drops out and the water returns pretty clean as long as the borrow site was clean in the first place.

And then, of course, this is similar to what Kirk showed. Here's Ocean City—oh, maybe it's Atlantic City, but this is just beach nourishment as its being filled. You just keep extending the pipeline down and build it that way.

The last thing I just want to touch on quickly is environmental impacts. Obviously, this is going to be a hot topic today. (Bell.) Thanks, Jim. I'm almost done.

MR. O'CONNELL: Where's the hook?

MR. RAMSEY: Removal of benthic assemblages is probably the biggest issue. Obviously removing everything on the bottom when you do a sand mining project, you need to worry about increased turbidity because from a turbidity standpoint, you actually might— if there's a lot of fine grain material there and you de-water it, you have turbidity problems. For the cutter-suction dredges you create a deep hole. It might create an anoxic pit. I haven't seen any problem like that proposed in Massachusetts. It shouldn't be a big deal. And, obviously, recovery period is dependent changes, the bottom sediment. So, if you're really not changing the type of material on the bottom, recovery generally is fast, and the NRC has documented typically its less than a year—can go up to several years

specifically where you change bottom habitat.

And I just threw this up here, suggestive reading. This is the top of the list NRC book. It was a whole consortium of people from environmental activities through coastal engineers etcetera. It has a broad perspective. The next two are more engineering text. And then the last two are more geology text just for the Cape, but they really give a good background on geologic history, understanding our coast. I'll leave you with that. There he is.

MR. O'CONNELL: We're ahead of schedule now. We'd love to stay ahead of schedule because I guarantee you at 4:00 this afternoon we're going to possibly not be ahead of schedule. The intent is to answer some questions if anybody would like to—John and Kirk, if you wouldn't mind. If anybody has any questions for these two folks, we have 10 minutes before we bring on the resource agencies.

Now, I can't keep track of time, but we do have two ace keepers over here, Stan Humphries and Steve McKenna.

Do we have any questions for either one of these technical folks?

UNIDENTIFIED SPEAKER: There are a couple of offshore wind farm projects proposed. Number one, would the construction of the wind farm—do those make available sand for beach nourishment?

MR. RAMSEY: It's my understanding at least the wind farm that I have heard is they're basically jet-plowing in cables etcetera, so, no. They would just be plowing material out of the way so they could lay their cables, and they would not be provided, you know, opportunity for beach nourishment.

UNIDENTIFIED SPEAKER: Secondly, does the distance of a wind farm have any impact on the coastal processes?

MR. RAMSEY: That's a loaded question. Do I have to answer that? Just kidding. Again, I think it depends on where it's located. There certainly are local impacts associated with any type of structure that's built in the ocean. Whether that ends up impacting the coast is really something you need to assess on the side-specific basis. Do you agree with that?

MR. BOSMA: Yes.

MR. RAMSEY: I don't want to touch that political issue right here.

MR. BOSMA: It definitely depends on the site itself, I mean, the physical processes that are going on at that site. So, there's ways to evaluate that to see what goes on. But it is certainly a site-by-site thing.

UNIDENTIFIED SPEAKER: Thank you.

UNIDENTIFIED SPEAKER: Is it always a win to take offshore sand and maybe breaking wave energy out there and move it onshore?

MR. RAMSEY: Is it always a win?

UNIDENTIFIED SPEAKER: Yeah.

MR. RAMSEY: Well, I think, again, I'd hate to say a site-specific basis. I think in general, I mean

both Kirk and I are probably more proponents for beach nourishment. We think it's a good thing. I think it's better than hard engineering structures. I think all the coastal community has realized that beach nourishment is by far the way to go. Is it always best to take offshore sand to do that? No, it's not always. Certainly you would need to look at the environmental impacts, and you're going to hear from those folks about what the environmental impacts are. But from my standpoint, I think that those are temporary and in general can be mitigated if the project's designed properly.

MR. BOSMA: And an offshore sand source doesn't necessarily mean its a win from a physical processes standpoint either, because it does modify the wave field a certain degree so that actually may impact an area of the coast in a different manner. That's something that needs to be looked at from a physical basis where you take off for sand. I agree with John that I think any sand you can get from anywhere to put on a beach is a positive thing.

MR. HARRINGTON: Tom Harrington. Most of the research that's (Inaudible.) design knowledge of beach fill has always been based on the median grain size until very recently. And with such a wide of grain sizes, have you looked at how you would place the material to best mimic what's on the beach now?

MR. RAMSEY: I think—we've started looking at that but I think the idea— we sort of leave it up to nature to resort the material knowing maybe, Kirk could talk about it, obviously, Nantasket Beach is one of those types of beaches which is kind of gap-rated. We have pretty fine sediment and then we have cobble. Probably the idea would be is to place the cobble as a separate berm or as a shore protection berm, but then over time, obviously, it's going to mix in with the sand and let it happen. I don't think we get into the point of trying to, you know, engineer material. I think that that's just a very difficult thing to do. I think the idea would be more to let nature take its course. And obviously the median mean grain size issues are something that is difficult for us to deal with, but certainly you just have to look at the grain size distribution. It's not necessarily straight forward, but we still aim for somewhere around median grain size as an overall.

MR. BOSMA: A couple comments to that. Nantasket specifically which I'm working on is we are starting to look at mixed grain size nourishment and what that means. I mean, John talks a lot about how their natural profile is kind of grade-aided so-to-speak. We have developed stuff to look at what does it mean when you start putting mixed grain size and can you orient it in certain ways that may help the situation. How effective it would be versus just, you know, let nature take its course is one thing. And sometimes I wonder if we focus almost too much on grain size when it's hard enough to find a source as it is. I mean, if you get a source, you know, yeah, we'd love it to be the best source available and most compatible and last as long as possible, but getting sand on the beach in a source that maybe doesn't have issues associated with it is kind of critical too.

MR. DICKSON: Hi. Steve Dickson from Maine. In his opening remarks Jim mentioned sea-level rise and perhaps an acceleration in the rate of sea-level rise and that obviously doesn't matter much for a beach nourishment project with a fill longevity of five years and in a design or a planning of that. But I know Kirk you've looked at fill longevity in repeated cycles say out to 50 years when they're associated with a structure that's being put in place and looking at the long-term benefits and cost. Is there any modeling or inclusion of sea-level rise either historic or scenarios for the future

in some of these larger projects—long-range projects?

MR. BOSMA: I mean, I know that Saco specifically we actually had included over a 50-year time horizon that expected trend in sea-level rise. And that's one of the powers of some of the models is you can adjust things. You can put a storm surge in to figure out what the storm surge may happen, evaluate sea-level rise. So, certainly when we start to look at some of these more complicated coastal environments where the expectations are high and it's critical that it last. Hammonasset Beach in Connecticut, which sees millions and millions of visitors per year. Camp Ellis, Maine; Nantasket; those are some of those types of things where we're doing 50-year time horizons. Sea-level rise is definitely included in that massive study.

MR. RAMSEY: I think the one thing to point out here and whether it's included directly or indirectly, shoreline change—historic shoreline change obviously includes sea-level rise in it, so it kind of gives you at least a linear trend on what you anticipate sea-level rise to be. There are, certainly, there are concerns about accelerated sea-level rise but if anybody can pin that down to even within a 100% I'd be kind of happy. So, I think most beach nourishments are sort of more designed on that linear trend based on just the fact that we have shoreline data that indirectly or it provides that sea-level rise information.

MR. DICKSON: Thank you.

MR. O'CONNELL: I was just asking them if before they answer your question if they would just say their name like Ramsey because I think these proceedings are going to be incredibly valuable, and I want to know who says what so we can call them to task.

MR. BOERI: Bob Boeri from Mass. Coastal Zone Management. Kirk, I just had a question for you. You had talked about the value of nearshore berms, and I was wondering if you were familiar with two projects I think that have been incredibly successful. One was a past project in Long Beach, California. The other is an ongoing project in Rhode Island where some material was taken out of the Providence River, sand material that was placed in a nearshore location and eventually had a tremendous amount of accretion on the beach from that offshore berm. It's been trapped through also placement of markers in the sand which turned out to be thousands of beer cans from collective—they end up on the beach. But they've actually ended up with a tremendous accretion on the beach, and I was wondering if you're familiar with that.

MR. BOSMA: I am familiar with the Rhode Island one, and, again, I think one of the big things I would stress is getting sand in the system is the biggest thing now. Whether it's more successful to put it directly on the beach or in a nearshore berm is a question maybe at that site if it was put directly on the beach it would have been even longer lasting and greater beach width. But I am aware that they have been successful in certain situations that's why I kind of brought it up as a potential design consideration.

MR. BOERI: Yeah. I would agree that placing on the beach is the first option, but the second option?

MR. RAMSEY: Yeah, just to follow up. We're running out of time here, but placement on the beach certainly is the option. And certainly environmental considerations prevent that. Jupiter Island has recently done a project when they dredge the inlet. I think the key to this is making sure that when

you dispose the material that you're disposing of it very shallow so that it can move on the beach, which sort of requires in Massachusetts specifically more summertime conditions so that when you're bottom dumping it, you're really bottom dumping it close in. Jupiter Island's been successful because they've been able to keep within the 12 to 14 foot contour. A lot of material that's 25-30 feet out it never arrives at the beach. So, that's kind of a critical thing for open ocean conditions.

MR. BOSMA: You forgot to say your name.

MR. RAMSEY: Ramsey, no Bosma; I don't know.

MR. VAUTRINOT: Al Vautrinot from Duxbury Beach. You talk about the nearshore berm being placed in shallow—how shallow?

MR. RAMSEY: I think in order to be successful, again, it's, you know, obviously you guys have a large high grade, but if you can get it in on median-low water contour of somewhere around 10 or 12 feet you're probably in relatively good shape. (Bell.)

MR. BOSMA: Your name.

MR. RAMSEY: Man, Ramsey. I'm sorry I didn't say it.

MR. O'CONNELL: Thank you.

MR. RAMSEY: I think we're going to have to stop here.

MR. WALSH: Mike Walsh. Just one last on that. Point Judith—it's Point Judith Harbor in Rhode Island, and that material is placed in 15 to 18 feet of water that was basically stipulated by Jon Boothroyd in Rhode Island, and it was very successful and cost consideration was huge on that. So, we've got to keep that in mind here. Yeah, it's nice to place sand on the beach but until somebody wants to cough up the money for it, we're stuck with what we've built.

MR. RAMSEY: Right. And I think from the Army Corps standpoint, there's always the least cost alternative. And I think thinking about that down the road is a lot of what people should be grabbing onto is hooking into Army Corps projects, cost-sharing more with them to try to actually get the material on the beach. But it's something you have to get in early in the planning process to make that happen.

MR. O'CONNELL: One of our speakers will be addressing the cost-share and how individuals can get involved, particularly in the federal level, early in the process to possibly facilitate getting more work done and also financial contributions.

So, I think we're going to move on now. I did want to do one thing. I think it's important. I wanted to read John's bio. He's doing another presentation later, but I wanted to read it now just so I can get it in there. John's the Principal Coastal Engineer with Applied Coastal Research and Engineering. Since co-founding Applied Coastal in 1988, John has performed and provided technical oversight for projects involving coastal engineering service and numerical modeling of coastal processes. He continues active involvement in a variety of societies. He's President of the Association of Coastal Engineers, as well as a member of the American Society of Civil Engineers Coastal Zone Management Committee.

MR. RAMSEY: Okay. You can stop now.

MR. O'CONNELL: Not an avid kayaker. Doesn't think he was the first one to go through the new breach at Nauset Beach, which I think I was Sunday morning.

MR. RAMSEY: In a kayak, I hope.

MR. O'CONNELL: Okay. We're going to shift—yes, it was. We're going to shift gears now. We're going to move into the resource agencies considerations, environmental considerations, and our first speaker is Jim Mahala. Jim's worked with the Department of Environmental Protection here in Massachusetts for over 40 years as a Coastal Geologist in the Wetlands Protection Program. He also holds a Bachelor of Science degree in geology from State University of New York, 1982. Don't show the grades. And a Masters of Science degree in Coastal Geology from Western Washington University, and Jim's going to talk about the wetlands program considerations and beach nourishment projects.

MR. MAHALA: Thank you, Jim. Jim Mahala with the Southeast Regional Office of DEP. I'm a Coastal Geologist at DEP and have been there for some time. I'm going to be talking about coastal erosion in general; talk a little bit about storm damage and threats to coastal development; talk about erosion control alternatives and what's available to homeowners and others who are affected by erosion. I'll also talk about the regulatory framework under the Wetlands Protection Act and how it treats erosion control projects as well as beach nourishment projects and offshore sand mining.

This is a photo taken after the No-Name storm in 1991 of Cape Cod National Seashore in Truro. These are classic eroding glacial bluffs or coastal banks providing sediment to the shoreline. Erosion is a process that's critical to the continued existence of our beaches, dunes, and barrier beaches. This shoreline has eroded on an average annual rate of two-and-a-half to 3 feet a year.

Here is another example of an eroding coastal bank on the south shore of Nantucket. This stretch of shoreline has some of the highest average annual rates of erosion in the Commonwealth. Along this shoreline, the average annual erosion rate is in the vicinity of 10 feet per year. Erosion is very interesting along this shoreline though as it tends to be very episodic. You may not get any significant erosion for several years and then you could lose 25 or 30 feet in a matter of six weeks or less.

This is an old photo of the Chatham Breach, the old breach that is, and this resulted in dramatic changes along the inner shoreline. The breach formed into a new inlet resulting in an increase in tidal range, currents and wave action. It posed significant challenges to the local Conservation Commission and DEP in terms of erosion control alternatives. And we'll look at some other photos of the erosion as a result of that breach.

Erosion is not generally a problem unless it affects structures or buildings developed along the shoreline. This was a photo I took of a resort along the eastern shore of Nantucket that is being threatened by the erosion after the No-Name storm.

Just down the shore in the Codfish Park area of Nantucket the No-Name storm undercut the low-lying coastal dune resulting in a few houses falling onto the beach.

Chatham, again, going back probably to 1988. As a result of the higher tides, currents and wave action caused by the new inlet, rapid erosion of the inner Chatham shoreline resulted in storm damage to several buildings. This is another building in that same vicinity being threatened by the erosion and ultimately needed to be removed.

This is the old parking lot at the end of Andrew Harding's Lane that some of us might remember. It succumbed to the ocean and the asphalt had to be removed.

So, let's look at the regulatory framework in terms of how we deal with erosion control projects. For coastal banks that are functioning as a sediment source, and these are typically the banks exposed on open shorelines, the Regulations are very strict. They prohibit any new bulkhead, revetment or seawall except when required to prevent storm damage to buildings that were constructed prior to the effective date of the Coastal Wetland Regulations (1978). And a coastal engineering structure may only be permitted if the applicant demonstrates that there are no other feasible means of protecting the building in question, and that the structure be designed to minimize adverse effects on adjacent and nearby coastal beaches.

I think the Regulations are trying to reflect the fact that sediment source type coastal banks play a very important role in nourishing our shorelines and providing sand for dunes and barrier beaches as well. That function is what the Regulations intend to protect.

Similarly, the standards for coastal beaches require that any project not have an adverse effect by increasing erosion, decreasing the volume, or changing the form of the coastal beach. Again, it's a very high standard. It's a no adverse effect standard essentially prohibiting structures that interfere with the natural process except those that can be allowed under that coastal bank exception that I just referred to.

One alternative that is available to individuals facing shoreline erosion is to retreat or relocate threatened structures. This alternative is preferable since there's no impact to the shoreline whatsoever. Often though it's deemed not to be feasible due to small lot sizes and high costs. However, in certain instances, it may be the only alternative. Along the south shore of Nantucket, for example, the erosion rate is so high that any type of long-term stabilization would disrupt the natural flow of sand along the shore resulting in adverse impacts. So, along that type of a shoreline retreat is possibly the only feasible alternative.

Revetments, bulkheads and seawalls are engineered alternatives. They have their impacts though. They often result in the loss of the fronting coastal beach. They permanently remove a sediment source and they need to be maintained. Often along highly eroding shorelines they can be undermined resulting in failure. We've seen several seawalls that had to be completely repaired along the Mashpee shoreline due to this beach-lowering process.

And, lastly, there's beach nourishment. This is an alternative that the Regulations tend to look at more favorably since it mimics the natural process, and you're supplementing natural beach volume and the beneficial functions of coastal beaches. Often, on a small-scale basis, beach nourishment is considered to be an expensive alternative. However, it becomes more cost effective for larger projects.

Now, let's look at the impacts of shoreline armoring. This is a picture of a vertical concrete seawall constructed in a zigzag configuration along the western shore of Lieutenant's Island in Wellfleet. In less than a decade, the beach was extremely lowered as we can see the footings for the concrete walls are exposed and the access stairway is considerably elevated above the beach. This is a result of waves interacting with the wall resulting in scour. It's also a result of eliminating a significant sediment source. Here's another view of that same seawall from the other direction. It's also

leaning seaward as sediments are being removed from behind it.

The Coastal Beach standards, in addition to the earlier standard I showed, allow beach nourishment with clean sediment of a grain size compatible with that on the existing beach. So, clearly the Regulations allow and encourage measures that are similar to the natural functions of the beaches.

You should also be aware that some of our rare and endangered species inhabit these areas, and the Regulations have a no adverse effect standard in terms of impacting rare species habitat, and Dr. Scott Melvin will be talking about that later today.

In terms of looking for sediment sources for our nourishment projects, typically we have three areas. One is upland sources. This source is typically used for small-scale projects and mitigation-related projects. Another source of sediment comes from navigational dredge projects, which are our most common source of sand for beach nourishment. These happen typically on an annual basis and have been very effective in keeping sand in the system.

Offshore sand mining is another area that is certainly capable of providing sand for large-scale projects. The concept of offshore sand mining though is relatively new to the New England area, but it's one of the topics I'll be talking about today.

Let's now look at the performance standards for Land Under the Ocean as it relates to sand mining projects. Sand mining projects are for the sole purpose of beach nourishment. They're not related to improvement or maintenance dredging. So, there is a high standard in terms of the effects of removal of nearshore areas of Land Under the Ocean. Specifically, projects in these areas cannot be permitted to increase storm damage or erosion of our shoreline. So, we don't want to allow sand mining in a location that will exacerbate erosion along the shoreline.

In addition, sand mining projects on Land Under the Ocean, if water-dependent, and generally speaking offshore sand mining for beach nourishment is deemed to be a water-dependent activity, are required to minimize adverse effects on marine fishery and wildlife habitat caused by alterations in water circulation, changes in water quality, alterations in the distribution of sediment grain size and the destruction of submerged aquatic vegetation.

One of the important environmental considerations associated with sediment sources is compatibility. Potential sediment sources need to be analyzed for grain size and then compared to the existing beach sediments for compatibility. Ideally, the grain size of the source material should be the same grain size or slightly larger than the native beach material. Obviously, sediment sources that are finer-grained than the native beach sediments will tend to be less stable on the beach, and therefore, will be more mobile.

Another way to analyze for compatibility is through composite sampling. Composite sampling means looking at the range of sediment sizes across a beach profile. This would entail sampling at the dune and then working across the beach and into the nearshore zone. Composite sampling averages out the sediment sizes so that you come up with one representative grain size for the beach.

Here is an example of noncompatible beach sediments that were recently observed. This material probably was placed there as a result of a prior dredge project. These fine-grained, organic-rich sediments were likely dredged sediments that were deposited in a dewatering trench along the beach. They were subsequently buried with probably four or more feet of sandy sediments. Over

time, the sandy sediments have eroded away exposing these noncompatible sediments that probably shouldn't have been placed there in the first place.

This photo shows an example of a beach nourishment project in Chatham at Cockle Cove where sand was obtained from a dredge project at the mouth of Stage Harbor. A good compatibility match resulted in the beach being restored and it has remained relatively stable.

Mass. DEP has recently published BMP's or Best Management Practices for beach nourishment projects. The first bullet in this slide show where one could view the BMP's at DEP's web site. One of the primary goals of the BMP's is to provide information on how to assure sediment compatibility for beach nourishment projects in order to maximize project longevity and minimize adverse effects. It also promotes the beneficial re-use of compatible dredged sediment. It's certainly desirable to keep dredged material that is beach compatible in the nearshore zone and in the system where it's best needed. Often on dredge projects we like to locate disposal areas on the downdrift side of shoreline structures such as jetties where the beach has been impacted through the interruption of sediment moving alongshore.

Let's look at the major environmental issues associated with offshore sand mining. Obviously, sediment proposed to be mined needs to be characterized thoroughly in terms of sediment grain size to ensure compatibility and to minimize turbidity impacts at the borrow area during dredging operations.

Depth of closure is a very important consideration for offshore sand mining projects. Depth of closure is that depth beyond which there's no appreciable movement of sediment due to wave action. Generally, on the open coast and in a high-wave energy environment, you're approaching 30 feet of depth at mean low water. This is an important consideration because sand mining at water depths shallower than the depth of closure may increase erosion of the shoreline or adversely change sediment transport patterns.

Borrow area dredging should avoid creating deep holes or pockets to prevent potential water quality problems. Benthic communities need to be characterized in the proposed borrow area so that we can avoid important fisheries habitats and to minimize impacts by imposing time of year restrictions on dredging activities to protect spawning habitats.

Borrow areas need to be monitored following dredging to evaluate physical and biological recovery of the ocean bottom. This is an important point since offshore sand mining projects have not occurred to any great extent here in New England. As a result, we need to review this and see what the benthic recovery periods really are.

Let's look at the important environmental issues associated with beach nourishment placement. The design beach nourishment profile should be similar to the natural beach profile. Often what we see here in Massachusetts are beach nourishment projects that are designed to place sediment above the high tide line, and this results in a very unnatural and overly steep beach profile. Following placement, the fill material erodes and ultimately reaches an equilibrium profile. This process often happens very rapidly when you construct a steep beach profile, and people often view the beach nourishment project as a failure because the sediment erodes so rapidly.

When beach nourishment projects are located near submerged aquatic vegetation and salt

marsh areas, the fill should be properly set back or tapered to avoid impacts to these sensitive areas. Design engineers may also consider the use of sand retention structures, such as adjustable groins or dune fencing to enhance project longevity. Obviously, the construction of new groins has the potential to interfere with alongshore sediment transport and therefore may not be appropriate in some locations. Beach nourishment projects need to be monitored to determine how the profile changes over time, to assess project performance and to identify erosional hotspots. We also need to monitor the biological recovery of the intertidal and nearshore habitats as a result of direct and indirect burial.

This is an example of a groin field on Martha's Vineyard. Obviously, you can slow the alongshore movement of sediment and retain sand on the beach longer in a groin field, but groins do have an impact to the downdrift shoreline as a result of the interruption of the sediment transport process. That's the type of impact we like to avoid. Here's another example of a jetty at a tidal inlet where the alongshore sediment transport is being interrupted. Here is a photo of the Barnstable County Dredge, which conducts a number of navigational dredging projects on Cape Cod every year.

So, thank you very much.

MR. O'CONNELL: We're going to again hold questions. We've got four resource agencies. The DEP, State Division of Marine Fisheries, National Marine Fisheries, and the Natural Heritage and Endangered Species. So, when they're all done, we'll bring them back up for questions.

Our next speaker is Vin Malkoski. He's a Senior Marine Fisheries Biologist for the National—for the Massachusetts Division of Marine Fisheries. His current duties include management of the Division's Environmental Review, artificial clean vessel act, and scientific diving programs. He is a member of the Atlantic States Marine Fisheries Commission Habitat and Artificial Reef Committee, the New England Fishery Management Counsel Habitat Plan Development Team, the Mass. Hazard Mitigation Committee, and the Massachusetts Dredge Team. Vin, representing Mass. Division of Marine Fisheries.

MR. MALKOSKI: Good morning. What I'd like to talk to you about today is a little bit of the things that need to be considered relative to beach fill and mining projects. There are a lot of concerns recognizing that we have a little bit different focus—you can't hear me; can you? How's that? Is that any better?

AUDIENCE: Yes.

MR. MALKOSKI: Okay. Thank you. Sorry about that. We have a little bit different focus than probably many of the folks here in this room, and what I'd like you to see is the area of jurisdiction. This is Mass. General Laws, Chapter 130. This is what we are responsible for in terms of the ocean. And it is, again, a different thrust than what some of you folks may have to deal with. What I'd like you to also remember is that when we're talking about living marine resources we have a very different ability to affect what happens. Any construction project—the person doing the project, the applicants control when, where, how, how long. When it comes to biological resources, we control nothing. Okay. So you need to keep that in mind.

Our programs work on the same rules as NEPA, MEPA and then all the other regulatory structures. We seek to avoid impacts first, minimize, seek restoration and look for mitigation as a final

option if all the other cannot be satisfied.

Issues of concern. Little site specific data resources habitat. There is general knowledge of what's out in the ocean. If you ask me what's out in the sound there today, I can probably tell you to a fair degree what species are likely to be there right now and what they're possibly doing. And I tell you if Jim O'Connell boat has striped bass on it today? No, I cannot. Can I tell you if they're going to be there on a regular basis? No. Will they be there at the same time every year? Not likely. Within a range, but they're not going to be there all the time. So, it's very important that before you do large-scale alterations of some portion of habitat that you understand how it's functioning in its current state. And, again, as has been pointed out, Massachusetts has been colonized for a long time, and there's been a lot of activity. So, anything new that's done to it like an extraction or a fill is a new activity.

In the case of things like large-scale mining projects, you're now impacting unrelated habitat areas. So, the perspective would be you're performing work on a landside project—you're solving a landside issue, which obviously needs to be addressed, but in order to take that material you're impacting another area that's very remote. So, in this case, the use of the term borrow site for example is on a geological timeframe, so you do want to think about that. You're impacting multi-state species. If we all took habitat in Nantucket Sound then potentially you're affecting species that range from here through the mid-Atlantic. And these species are managed by us and all the other states in between here and the mid-Atlantic. So, sometimes people will think that I have a very narrow perspective on what has to be done for a project. In reality, I may have a coast-wide perspective, and it's very important that I maintain that.

Construction impacts. These are the same as any other construction project in the water for the most part. There's going to be a fill, there's going to be an extraction, there's excavation, and there are side impacts around those.

Questions of restoration and mitigation. Restoration is pretty tough. The nature of the civil project is that you're building a beach. So, if there was some other type of habitat there that's evolved as the beach—the original beach left has been buried as a result and need to protect the beach, there's not a lot you can do to restore that.

Mitigation also becomes very tough especially if you're talking about an extraction area offshore. There aren't a lot of choices certainly not of the in kind in place for it. From our perspective temporary nature of the fill activity, obviously beach is moved. That's what they do. So, as they go back to the equilibrium profile as they, you know, move over time. Resource areas that were initially outside of the impact area may no longer be. So, we're going to have impacts through eelgrass and shellfish habitat.

Okay. These are all of the activities that we review and participate within. Many of you folks have—we've interacted at meetings. Again, direct fill can be an issue. If there are other habitats, there was shellfish, there's eelgrass, and obviously we work to try to avoid those. Some of that can be helped. If you're working at an extraction site, your job is to remove that material. So there are going to be operations.

Operations we're putting on the resource area. This is becoming increasingly more of a concern. I know some folks here are chafing at the idea of horseshoe crab windmills. This is something fairly

new. We're charged with addressing this as part of our management responsibilities coast-wide. In other areas, for example, the harvest of horseshoe crabs has been shut down completely. Amongst other things, they provide an important food source for several species and endangered birds, their eggs do. So, it's critical for us that with them as with other resources that those impacts be avoided.

Introduction to pollutants. This is typically going to be from the operation of equipment in that environment. Entrainment of larvae if you're pumping something with sand, you're taking a lot of water with it. It's up to 70% water. Is this a significant level of impact? I don't know. I don't know if anyone's ever looked at it.

Physical alterations. Again, my perspective is fisheries resources. Excavation. Now, I know there's a lot of debate as to whether or not things recover and there are some studies looking at work that's been done for the fishing industry and fishing impacts as of—there's actually a much larger body of work on impacts from fishing and recovery. They suggest that for softer sediments two to three years; for hard sediments, 6 to 10, possibly longer, and that depends on depth. Very soft sediments add greater depth, something in excessive of 100 feet, which is generally not a concern here, but those can be many, many years.

Taking examples from other construction projects in the State like the Hubline Project where a gas pipeline was laid through Mass. Bay entrenched into the bottom so the sand or the material was not removed. It was simply displaced and then pushed back in place. There are large areas along the pipeline that four years later have evidenced no recovery whatsoever. And that's a variety of materials.

So, there's really a great deal of variability and a lot more work that needs to be done to try to determine what these are before claims can be justified in terms of—without any impact.

Okay. Failure of project design. This is something that we're seeing less and less of and we're very much grateful. If the project is not well designed, it's materials are not compatible, obviously the work doesn't do what it was supposed to and the stuff ends out someplace or I perhaps may not want to see it in a much more rapid fashion.

Of concern particularly for the large-scale extracted techniques is how often are people going to be coming back? And this speaks to active and cumulative impacts down below. This is something that we have to very much address because obviously mining and beach fill activities are not the only thing happening in the ocean. Maybe the only thing that some of you folks focus on primarily but it's not the only thing happening. So, those same habitat areas may also be impacted by, well, for example, shoals community could be something like a wind farm. All right. It could be fishing activity. That's certainly all out there. So, if there's going to be a long term ongoing removal or alteration of portions of the bottom, this is important to consider.

One of the things is that everyone needs to think about—we've talked a lot today about compatibility and finding an appropriate source of material. And it's fair to say that just because the bottom of Nantucket Sound is principally sand, we all know that you cannot pick a spot at random, harvest 10,000 cubic yards of sand and throw it on the beach someplace and be assured that it's going to be a good match. You have to go out, and you have to do the proper work to select what's going to happen there. Likewise, one could not assume that because all of Nantucket is sand or another area has cobble or ledges or whatever that all those areas of similar habitat or similar bottom type servicing habitat functions and values.

If you ask any fisherman, you cannot go to any place where there's a rock and know that you're going to catch a fish in Nantucket Sound. Some you can; some you can't. So equal consideration needs to be given to the biological considerations when looking at sites and what potential impacts might be.

Minimization. Time of year. Typically for the beach placement this is going to often be against when the preferred times to work are. Obviously when it's calm and when the conditions are good, summer is when you might want to be working on the beach. In terms of productivity, use of the beach by marine resources, it's probably one of the worst times. So, there's always some issue there.

Project sequencing. Sometimes we can work things out so the aspects of the project take place at the least harmful times. Sometimes resources can be removed. There are instances where the shellfish for example are removed from the site, project done, and then the shellfish put back or reseeding. There's always a danger here because you're trading a known for a maybe, but you do have to keep that in mind.

Alternative construction techniques. If there are alternatives to driving on the beach or obtaining material from a particular area, obviously, we're going to look to have these explored.

Operation and maintenance plans. They're as important for us as they are for you guys because we need to know what to expect coming down the road. We also need to see what the performance standards are going to be for recovery and how that's going to be assessed and whether or not it works. These are also important too in consideration of alternative construction techniques.

We've heard today about deposits of nearshore berms, and there are areas in the country where this works. A concern of ours is that when a technique like that gains rapid popularity, there's sometimes a very fine line between it being a very viable useful technique to achieve getting material on the beach and simply a low-cost alternative to taking it out to an offshore disposal area. All right. I'm sorry. There's no other way to put that. And if proper considerations going to be given to use of this, and I don't doubt that it's a viable technique in some areas, it also makes to achieve the same level of study and work is being done for the mining and all the rest of the—can't be accomplished now.

Again, restoration, this one's kind of hard. The beach itself in the nearshore area, the nature of the project, the nature of beaches, it is dynamic. Hopefully you can try to get some of it back. Maybe you can do some light restoration of other areas.

Replanting of resource. Shellfish are a little bit easier. Eelgrass can be tough if eelgrass was, in fact, impacted. Your ratios to get your acre of eelgrass back; you're probably looking at a 5:1 ratio of either replanting or area planting. So, there's a lot of effort that needs to go into that.

Monitoring the restoration efforts and contingency plans as we all know is absolutely key. It doesn't help any of us to have somebody submit a monitoring plan and walk away. We need to know what's going to happen next. Thank you.

MR. O'CONNELL: Vin. (Bell.)

AUDIENCE: (Laughter.)

MR. O'CONNELL: If we can keep up this pace we'll have a longer open discussion with everybody

in the audience and all the speakers as well at the end of this forum.

Our next speaker following on the fisheries interest is Louis Chiarella. He's responsible—he's from the National Marine Fisheries Service. He's responsible for overseeing the New England Field Office for Habitat Conservation covering the area from Maine to Connecticut. The field office is responsible for consulting with federal and state agencies on activities they undertake or authorize that may adversely impact living marine resources and their habitats including coastal development, dredging, energy development, and transportation. The office provides advice to agencies on ways to avoid, minimize, or mitigate these adverse impacts.

In addition, Lou works closely with the New England and Mid-Atlantic Fisheries Management Councils on fulfilling their requirements to describe and identify essential fish habitat and minimize adverse effects of fishing on essential fish habitats. So, with that, Lou. I wanted to say something on the original agenda. Paul Diodati was supposed to do a presentation, but Paul's out of state, so he had a senior marine biologist in his place and quite a good experienced person. Lou.

MR. CHIARELLA: What I'm going to talk a little bit about today are some of the considerations that we need to look at when we're talking about beach nourishment activities and their potential effects on fisheries habitat. You're going to see a bit of a theme, I think, in the resource agencies and what it is we're looking for or looking at when reviewing these types of projects, whether it be a beach nourishment project or an LNG facility or some upland coastal development.

We're going to be looking at the overall environmental mitigation principals that come forward in a lot of different laws and acts including the National Environmental Policy Act, Clean Water Act, and National Marine Fisheries Service's Magnuson-Stevens Act; they all talk about these three major principals.

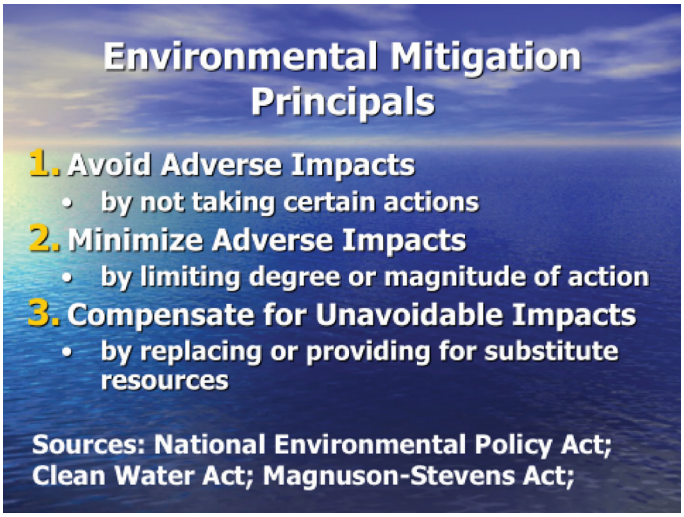
The first being avoiding adverse impacts. Is there something that can be done by not taking an action? Does an action have to occur? If it does occur, how much can be done to avoid impacts to resources?

Once we get past the avoidance component, we look at minimizing adverse impacts. What can we do to make sure that the impacts that are going to be occurring are as minimal as possible? Typically, that's done by limiting the degree or magnitude of the action. In cases of beach nourishment, you may be looking at some alternative designs. Do you need as much fill? Does it have to have as much fill put on the beach area that's going to impact the offshore area? The material that you're using, do you have to use as much? Can you find alternative locations so that you're not necessarily impacting the offshore environment?

And then, lastly, once we've got to the point of avoiding and minimizing impacts, if there still are impacts that are unavoidable and aren't so severe that it would potentially prevent a project from going forward, are there unavoidable impacts that can be compensated for? Basically, by replacing or providing for substitute resources, sometimes that's the case, but it's not always the case. There are instances where the impacts are so severe from a fisheries perspective that compensation is not appropriate.

What are our areas of concern in terms of a beach nourishment project?

We are certainly concerned about the impacts to the offshore borrow areas. I've heard already this morning kind of a synonymous discussion of offshore borrow areas or mining areas. Typically, when you think of borrowing, it means that you're taking it and it's going to be returned. Very rarely is the material returned, so we tend to lean towards characterizing these sites as mining sites. It's a removal or an extraction of the material typically on a permanent basis.



We're certainly concerned about nourishment on the site itself. Basically, the impacts to that beach—to the beach profile because typically what's happening is we're not just dealing with the part of the beach that's high and dry, we're dealing with parts of the beach that are intertidal and subtidal as well, so that the overall project extends the beach profile further offshore. So, there are potential impacts to fisheries and habitats on the beach area and the offshore area.

And then, lastly, we can't stress enough that we also need to consider the renourishment cycle. Typically, when dealing with beach nourishment, we're not talking about a one-shot deal. We're talking about an activity that has a limited lifetime of 2 to 3 to 5 years. There's going to be a renourishment cycle so there's going to be a recurring impact to the resources as part of that nourishment cycle.

What types of information do we need to know relative to the borrow site?

This is key because, as Vinny had said before, we have very limited information on the real specifics of the fisheries and the habitats in any given location. So, typically, what needs to be done is that information has to be gathered for the project at hand.

So, the first thing that we're really concerned about is characterizing the habitat. Basically, first off, we need to know the substrate type. Is it a high-energy sand type of environ-

ment or is it a low-energy gravel and mud-type of environment? Typically, when we talk about low energy, we're talking about the offshore borrow site. Typically when we talk about low energy you hear mostly about gravel sites but mud is also in deeper water and is considered a very low energy site, and it's these low energy sites that typically are going to experience greater impacts because their recoverability is typically on a greater timescale.

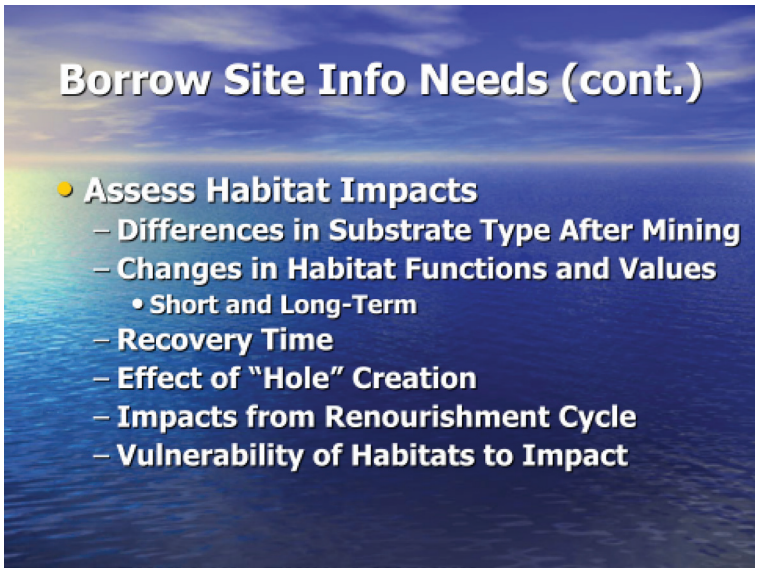
We need to know about fish utilization. What fish are utilizing the area? What's their abundance? We're typically more concerned about impacts to early life history stages because that's what supporting the overall populations of these species. We're concerned about the functions and values of the habitat, not just so much that the fish are there, but when they're there, what are they doing with that habitat? Is it a nursery habitat? Are they feeding there? Are there structural components that are really important for shelter that helps them avoid predators?

Other things we're concerned about are the invertebrate community. What organisms are in or on top of the bottom that may be forage for our fisheries resources. So, we need to know what types of invertebrates are there. And then what part of the invertebrate community is the epifauna? It's going to be those organisms that are kind of attached to the bottom whether they're attached in a sand area, whether they're attached to rocks and boulders.

Structural complexity is a really important feature for a lot of our fisheries communities. Typically, we have greater productivity in complex areas and the more epifauna or attached organisms that we have on rocks and boulders and gravel typically the higher quality that habitat is.

And here, again, the recoverability of these types of habitats are typically a lot greater than we see in a high-energy area. It could be as much as 10 years in some rock and boulder communities. So, we're really concerned about what's in the area, how it's being utilized, and the functions and values of that habitat.

We need to have an assessment of those habitat impacts. One of the important things to know in the borrow area is that we're going to be digging a hole of a certain depth, and, first off, we need to note once you remove that top material to put on the beach, what's going to be left behind. If we're talking about a gravel community, gravel substrate, and you go in and you dig down 6 feet to remove that material, what's going to be left? If gravel is going to be left behind, we're going to be left with similar substrate. If we're going to make that material finer and it's going to be sand left behind, we're going to ultimately end up with a different habitat type there with different functions and values.



So, for those functions and values, what are the long-term effects/what are the short-term effects? So, looking at the profile of material, what's there now and

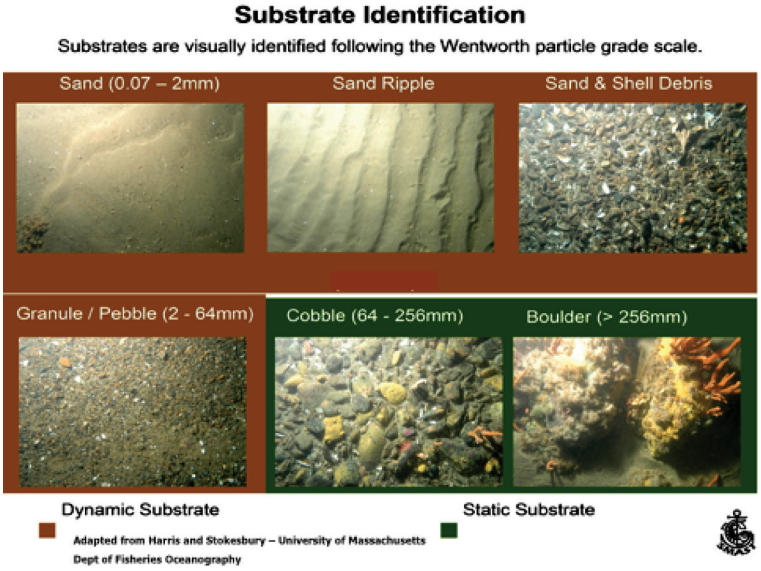
what's going to be left there afterwards is very important.

We're interested in recovery time. Once the material is removed, how long is it going to take for that habitat to recover to the degree of its functionability prior to the removal of the material? If it's a high energy sand habitat, recoverability may be very short. As you start getting into more complex habitats and gravels and cobbles and boulders that recovery time is going to increase.

What's the overall effect of the creation of the hole? As you go in into the mining site, it's creating a hole. There was a point in time when beach nourishment was first done, the operators would go out, dig a very small, very deep hole and over time what happened is those holes filled in with very fine sediment. Those areas became anoxic and nothing would live in them. Over time, what's happened and really the practice nowadays is to dig a shallower hole, but by digging a shallower hole, you're actually impacting a greater area to get the same amount of material.

So, what's the effect of the creation of that hole in the borrow area? Here, again, what's the impact of the renourishment cycle? Do you have to do this activity every two years or is it going to be every five or six years? The greater the time between the renourishment cycle typically overall the less impact there is going to be cumulatively. And then what's the vulnerability of those habitats—the impact? Here, again, it's really going to focus a lot on the energy of the area. Higher energies are going to include sand areas and they are typically going to be less vulnerable than more complex gravel and cobble areas.

When looking at borrow sites or other areas for that matter we need to focus on substrate identification. I've heard a lot about beach nourishment utilizing sand. That's typically the smaller grain sizes. Here they're categorized as dynamic substrates. These substrates are moving constantly whether its daily with the tides or very frequently with storms. As we start getting into larger and larger sediment types into the cobble and boulder areas, more complex habitats, more things occurring, and these areas are typically more static substrates. It takes a real severe event for the bottom habitats to be disturbed.

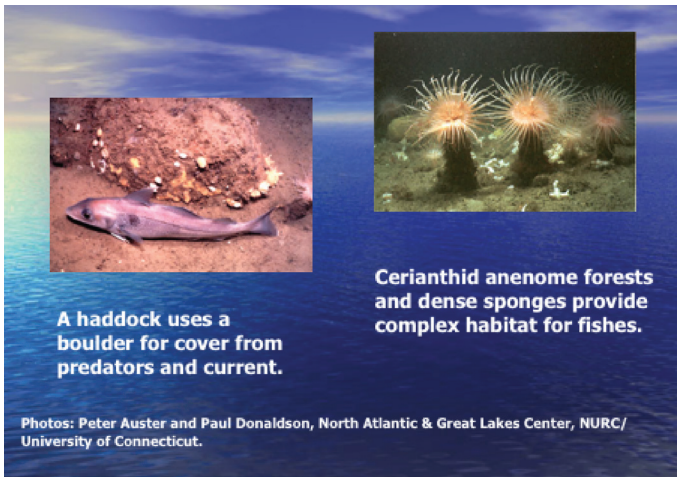


What you're not seeing here is kind of the other end of the scale. If you look at the sand and if you were to picture this going off to the left, the more fine materials are going to be the muds. If we had muds up here, they would also be highlighted as green as being a very static substrate.

Just in general some of the concerns with the offshore borrow areas, the rocky/cobbly areas, fish are utilizing them here. We just happen to be showing a haddock. There are a variety of uses typically as a shelter from predators, also a very good food source.

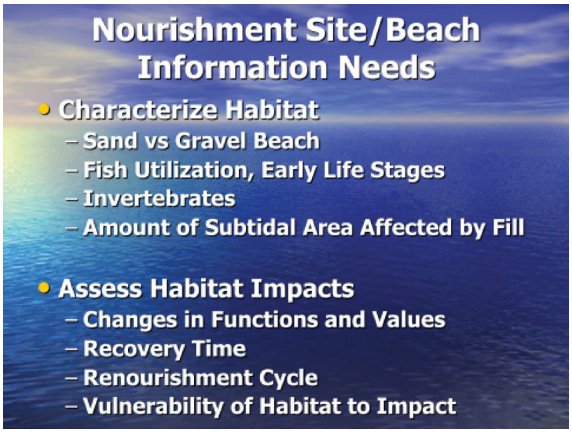
And in the next picture we're looking at more of a sandy, more-fine silty area that's containing

cerianthid anemones, which are also providing that complex structure that provides shelter for the fisheries resources. We are almost looking at two levels or two extremes of bottom type: a hard bottom boulder cobble habitat providing shelter; a more fine sandy muddy habitat that also has different organisms there providing shelter and important resources for the fisheries.



What do we need to do in looking at the nourishment sites? Well, basically, the same characterization we did for the borrow areas, we need to do for the onshore beach site. What type of sediment is there? Fish utilization? The invertebrates? The thing that differs here is the amount of subtidal area affected by the fill. The purpose of the beach nourishment and shoreline protection is to take that profile, move it further offshore, as we're moving it further offshore, we're filling whatever habitats are in those nearshore intertidal and subtidal habitats. We need to know what's there so we know what the impacts are.

Here, again, you also need to assess the habitat impacts, the changes in functions and values, recovery time, the renourishment cycle, yet again, and the vulnerability of those habitats.



And just some photographs that I have taken from the Maine Geological Society's website. This is Western Beach in Scarborough, Maine, basically showing the beach profile before the dredging activities. As you look into the area where you start seeing kind of the tide coming up, there's potentially resources there. There's an area that's black. I don't know what it is. It could potentially be a mussel bed. Do we have a mussel bed that's right offshore that's going to get filled as part of this activity? These are the things that we're going to be concerned about and we're going to want assessed.

The hydraulic discharge and the material. Obviously just the discharge alone is putting a lot of turbidity into the water. That turbidity plume is going to expand out for a period a ways offshore, which may effect fisheries resources. Fortunately, with something like this, this is going to be more of a temporary impact, but still one that needs to be assessed.

Post-nourishment. Same area looking at the beach profile. The area that was offshore before, that black area, is now gone. If that was a mussel bed and I'm not

saying it was because I don't know what was there, but if that was a mussel bed that would now be filled.

Other considerations. We need to take a look at the impacts on fishing activities. That's one of our primary responsibilities here, looking at impacts to fisheries and fisheries resources. How's the activity going to affect a fisherman's ability to fish? We need to make sure that we have a substantial alternatives analysis. Alternatives for the beach design as well as alternatives for the sources and material.

What are the ecological costs of the activity? Lost functions and values and costs to the ecosystem.

Economic cost of the activity. What are the costs to the fishing industry? Long-term costs of monitoring. This typically does not get handled well enough in a lot of the environmental impact statements. What are the costs of long-term monitoring of the activity and the potential costs of compensatory mitigation.

So, in conclusion, we're going to take a look at whether or not the mitigation principals have been met. Has the initial project been designed to avoid the impacts? Has the magnitude of the project been reduced to minimize impacts?

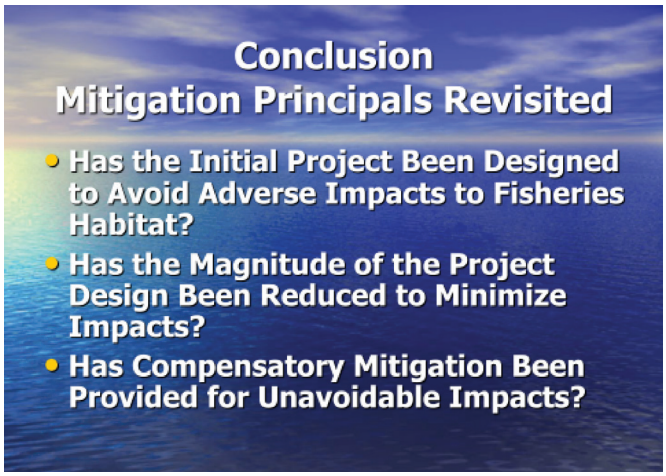
And if we have an acceptable project, has compensatory mitigation been provided for?

Thank you.

MR. O'CONNELL: Thank you, Lou. Our reporter needs a two minute break. (Off the record.)

COURT REPORTER: Thank you. All set.

MR. O'CONNELL: Okay. So, back again, we're going to resume. Get the lights. Our next speaker, Scott Melvin, is representing the Division of Fisheries and Wildlife, Natural Heritage and Endan-



gered Species Program. He's a Senior Zoologist with the Natural Heritage and Endangered Species Program of our Division of Fisheries and Wildlife. He is an Adjunct Assistant Professor with the Department of Natural Resource Conservation at the University of Massachusetts, Amherst. He holds a Ph.D. in Wildlife Ecology and Zoology from the University of Wisconsin in Madison. Welcome, Scott.

MR. MELVIN: Good morning. Thank you. As most of you realize our beaches and coastal waters provide essential habitat for a variety of species and populations that are not only locally important but regional and in some cases continental significance. So, any sort of a discussion on impacts of beach nourishment must take into consideration a whole variety of wildlife issues ranging all the way from rare tiger beetles on the beaches to continentally significant populations of hundreds of thousands of wintering sea ducks, which may be affected by offshore mining of sand in places like Nantucket Sound and off the coast of Nantucket.

What I'm going to do in the short time that I have today is focus specifically on two species of state listed rare wildlife, two beach nesting bird species, the Piping Plover and the Least Tern, and talk about potential benefits for beach nourishment to those two species, and also how we within the Division of Fisheries and Wildlife are using regulatory tools to try and prevent potential adverse effects of beach nourishment projects and dredging projects are used.

Piping Plover is listed as endangered pursuant to our State and Native Species Act and to the Federal Endangered Species Act. We currently have roughly 480 pairs nesting in Massachusetts, a slight decline from our peak of 538 pairs in 2002. They're only about 1,700 pairs nesting in the Atlantic Coast population, which is distributed from North Carolina to Newfoundland. So, here we have a species with a fairly unique distribution. It extends roughly a thousand miles long and only about a hundred yards wide.

The birds nest on sandy coastal beaches and dunes. They just started nesting again for the season in Massachusetts within the past week or so. The nest is just a simple scrape in the sand on the fore dunes in relatively gradually sloping situations, unvegetated or very sparsely vegetated.

Chicks are precocial that means they're up and running around within hours after hatching and need to be able to make their way down to foraging areas on the lower beach in the wet sand areas or in the bayside foraging habitats on the inlet bay sides of barrier beaches.

The other species of interest I want to talk about today is the Least Tern. Least Tern is listed as a species of special concern under our State Endangered Species Act. They also nest on sand beaches, tend to be a bit more narrower in their nesting habitat or requirements. Piping Plovers they tend to require wider and less vegetative sites. We currently have a population of roughly 2,600 breeding pairs in Massachusetts after some gradual declines of a 10 or 15 year period. We've seen some fairly significant declines in numbers of Least Terns in Massachusetts over the past several years. Least Terns are currently nesting at roughly 60 sites in the state, and we have nesting Piping Plovers at roughly 110 sites.

We have three primary regulatory tools for protecting populations of Plovers, Terns, and their habitats in Massachusetts. One is the Federal Law, the Federal Endangered Species Act. I'm not going to deal with that today because I deal primarily with State laws, but recognize that where Piping Plovers are also federally listed as threatened. The Federal Endangered Species Act protects them and

their habitats, even though they're not on the program today. The U.S. Fish and Wildlife Service, our federally-funded parts, have a prior responsibility for administration and enforcement of the U.S. Endangered Species Act and any sort of beach nourishment projects that are going to affect Piping Plover habitat, you need to include consideration of the Federal Endangered Species Act in permanent review particularly if it's a project that is involving any sort of federal permitting or federal funding.

The two primary State laws that provide protection to Piping Plovers and Least Tern populations and habitat our are State Endangered Species Act and our State Wetlands Protection Act. Mass. Fish and Wildlife is the agency that has prime administrative authority for the State Endangered Species Act. The Wetlands Protection Act, DEP has primary administrative and regulatory authority with local regulatory authority held by the local Conservation Commissions. Mass. Fish and Wildlife throughout Heritage Program acts as the scientific authority as part of the species provisions of the Wetlands Protection Act.

A quick overview of performance standards under these two State laws and the Endangered Species Act. It's illegal to kill, harm, or harass or disrupt a nesting, breeding, feeding, or migratory activity of State-listed rare wildlife.

And why is that? Under current regulations, disruption of nesting activity can occur through the modification, degradation, or destruction of habitat. One of the books that you have for regulatory protection of habitat for Piping Plovers and Least Terns.

Under the Wetlands Protection Act, the performance standard that we're dealing with here is that projects of all shore wetland resource area shall not have any short or long-term adverse effects on the habitat of State-listed wildlife.

Our basic objectives as we apply these regulatory tools to Piping Plovers and Least Terns are to maintain and hopefully even enhance that the quality and quantity of nesting habitat both of those short-term or long-term. We want to be able to maintain chick access to foraging habitat in the case of Piping Plovers. It was to protect the birds from direct take, that is directly being killed, harmed, or harassed.

Piping Plovers and Least Terns are very much dependent on maintaining natural processes of coastline erosion and accretion to maintain their nesting/chick-rearranging foraging habitat—chick-rearing foraging habitat.

So, what we're looking to maintain is a situation with relatively wide, gradually sloping front beaches, broad accreting spit, pursuant to provide very attractive nesting habitat for both Plovers and Least Terns. Broad, gradually sloping overwashed sands provide important forage to habitat and provides a nesting habitat. And overwash areas that if wide enough can provide nesting habitat but also to provide travel corridors for Piping Plover chicks to move back and forth between foraging habitat on bayside intertidal areas and ocean side beach inlet areas.

This is a closer view of what we consider to be ideal Piping Plover and Least Tern nesting habitat, particularly these broad, unvegetated, sparsely vegetated overwash areas as well as similar habitats on the front beach.

This illustrates exactly the sort of situation that we're trying to avoid and prevent. This is about

a 12-year-old photo taken at Dead Neck in Osterville from the prior beach nourishment activity. You can see we have a very high pile of sand that was built. So high that it's only going to be overwashed by a very significant storm event. So, what has evolved is a very narrow beach with a very high, steeply start foredune, not suitable nesting habitat for either species. A high relatively inaccessible top of this nourished area with very dense vegetation that again is not going to be suitable for nesting, and such a high steep foredune that chicks cannot move up and down it.

Let's talk a little bit about what we learned about project design and how we fit that into our regulatory involvement now. One place where we've learned a lot is Duxbury Beach. As anyone in here is aware a very significant sacrificial dune was built and then rebuilt in the early 1990's. We worked with cooperators there at the Duxbury Beach Reservation in the Town of Duxbury and others. We designed an experimental project that would meet some design requirements for the sacrificial dune, but we hope would also be acceptable to Piping Plovers and Least Terns. This included a 16 foot-high sacrificial dune, 6:1 slope on the ocean side, and a herringbone design of beach grass planting roughly 20 feet wide with 20 foot wide areas that were unvegetated.

In a nutshell, that design was basically unacceptable to the birds. In an intervening period over 150 nest attempts by Piping Plover, and I believe only one has actually occurred on the sacrificial dune as designed here, essentially all of the nesting occurs out here particularly on the front beach as indicated in the gradually sloping unvegetated largely sparsely vegetated areas, and this design has been unattractive for Least Terns as well.

So, as a result of projects like this and looking at nesting situations where, literally, scores of Piping Plovers around the state over the years, we realize now that Piping Plovers in most cases are going to nest in situations where the slope is 10:1 or less, ten horizontal to one vertical.

So that is one of the design criteria that we're looking for, any sort of a beach nourishment project. It is 10:1 slope or less than that. And we found this is what the birds prefer, this is what they're attracted to. The folks at Duxbury moved to using a very gradually sloping situation when they fill in the gaps in the sacrificial dune. You can see an area that they filled in more recently here, and they have seen very rapid use of colonization by Piping Plovers to this 10:1 sloping fill where they've put it in.

Couple of examples of how Least Terns and Piping Plovers can respond very positively to beach nourishment when it is properly designed and implemented. This is Kalmus Park at the entrance to Hyannis Harbor. Dredge material was put on this site in late winter and spring of 1998. You can see the very gradually sloping 10:1 horizon to vertical ratio slope. No sand fencing, no vegetation, and we saw very rapid colonization in use by both Least Terns and Piping Plovers. I think the benefit was most dramatic for Least Terns. Saw a large colony of over 800 pairs established almost immediately after the nourishment was completed in 1998, and so for several years here this site was supporting far and away the largest nesting colony of Least Terns in the state. One of the largest colonies we've seen in recent decades and a very beneficial effect.

You notice the use dropped off after four years. That was a result of predators moving in and forcing the colony to move but realize this is not an atypical situation. Least Terns tend to operate on a real boom or bust cycle. We saw very high productivity at this site during this period, and our feeling is this is the sort of situation that can very beneficially drive the whole regional population of

Least Terns for maybe a decade or so. So a very positive impact from this particular project.

Example of a very positive benefit to Piping Plovers was beach nourishment that took place during the late 1990's and it's continued in small projects at Dead Neck in Osterville. The beach nourishment that has the impact we're looking at here began in 1999 and the year—that same year we saw the population of Piping Plovers jump from 4 to 8 pairs and has increased to the 20 pairs in 2005 and a little bit over that in subsequent years, and there's a very high productivity there. So, you have a very definite positive effect of a beach nourishment project that was designed as a criteria that we're talking about today.

Example of a site that could use some beach nourishment, Barge Beach on Cuttyhunk Island in Buzzards Bay becomes so cobbly and rocky there that Piping Plovers no longer nest there and numbers of Least Terns are very small. It doesn't do the birds any good to put out beach nourishment with the proper slope, no vegetation, and then not protect them from human recreational activities. So, a very important part of the regulatory process is that when beach nourishment occurs, if its likely to attract Piping Plovers or Least Terns that is managed in such a way that it doesn't turn into a population unsafe for the birds. The birds come in and are just so harassed that they're not able to be reproductive and successful.

So, one of the things that we're looking at when these projects are permitted is that adequate protection from off-road vehicle impacts and adequate fencing and monitoring to protect the birds of the habitat from the intensive pedestrian activities.

So, to wrap up with the last three slides is a summary of design criteria that our agency is looking for in any sort of a beach nourishment project. No work on the beaches between April 1 and August 31 when the birds are nesting and rearing chicks, although there may be instances where with intensive monitoring the work can extend to April 15 if it's going to be providing a significant positive benefit. No storage of pipes or actual work—the removal of pipes again during that period. The dredging work that may be occurring on the waters and channels right near the beach, no work within 300 feet of birds that may be nesting or rearing chicks. Material for beach nourishment needs to be compatible. Again, we're looking for something that's gradually sloping, no steeper than a 10:1 slope, and a 6:1 slope on the backside of beach nourishment may be acceptable if we're just dealing with providing access by chicks to bayside foraging habitat.

We're looking for minimum elevation to echo some of Jim Mahala's comments. (Bell.) Nourishment that matches existing beach profile. Avoid plantings and vegetation or if absolutely necessary minimize those, avoid or minimize using sand fencing which may have adverse effects on the profile or what beach nourishment the birds are using. And as already stated provide monitoring and protection of the birds so if they use the site it doesn't turn into a population site.

To wrap up, I think beach nourishment may be a very important management tool more important particularly if we're going to be looking at long-term degradation of the loss of nesting habitat of some of these beach nesting birds by sea-level rise as is exasperated by global warming but the key is going to be sure that these projects are designed and carried out and monitored in such a way that they do provide benefits to the birds over the long term. Thank you.

MR. O'CONNELL: Okay. I'd like to ask the last four speakers to come up and field some questions. We've got 10 minutes for questions with Division of Marine Fisheries, Natural Marine Fisheries, DEP, and the National Heritage of Endangered Species. Folks, so we've got 10 minutes. Fire away. We'll set up for the next round.

MS. BOLEYN: Brenda Boleyn, Truro. As a biologist, I'm pleased to hear the attention that's being paid to benthic habitats, and I'm wondering if the details of those efforts are to be found in the new Best Management Practices document that DEP --

MR. MAHALA: We'll, certainly there's --

MR. O'CONNELL: Could you say your name before just so—

MR. MAHALA: Jim Mahala. Certainly we address the necessity to avoid or minimize impacts to those habitats. For water-dependent projects on land under the ocean though is a minimized standard. So, you know, we generally follow the whole protocol of avoid, minimize, and then mitigate and that's essentially what the Best Management Practices do. It's a fairly lengthy document. There's a short summary of it in the beginning and then there's attachments that make it probably 20 or 30 pages so some of the supporting documents might go into that a little bit more.

MS. BOELYN: Thank you.

MR. BRADY: Yes. This is a question for Mr. Melvin. What is the benefit again of the periodic overwash of the beach to the various birds?

MR. O'CONNELL: What was your name?

MR. BRADY: I'm sorry. My name is Bob Brady (Inaudible.) Village.

MR. MELVIN: The benefit of a periodic overwash is to create or maintain these gradually sloping unvegetated or sparsely vegetated habitats that the birds are attracted to.

MR. VAUTRINOT: Al Vautrinot from Duxbury, again. We have a project in the back of our minds, and I don't know whether the question belongs here or later on in the day, but we've had significant loss of the salt marsh on the back side of our beach, and we're toying with the idea of trying to rebuild it—this dredge spoil that we might get, excuse me, beneficial dredge material—

AUDIENCE: (Laughter.)

MR. VAUTRINOT: —that we might get when they do dredging in the harbor. Is this a regulatory morass we're getting into that we'll never get out of?

AUDIENCE: (Laughter.)

MR. VAUTRINOT: We actually consider looking into this.

MR. MAHALA: Well, that's a good question. This is Jim Mahala. The displacement of intertidal habitat for the salt marsh could be a regulatory issue under Chapter 91 Regulations. If it was done for shore protection purposes, then it might be an activity that we could allow but the loss of intertidal habitat for salt marsh habitat is—it could be a regulatory issue under Chapter 91. We can talk about that more.

MR. VAUTRINOT: To create new salt marsh is what we want to do.

MR. MAHALA: Well, but you're displacing intertidal habitat and that's a concern, and I would probably—I'm a wetlands person in general not a Chapter 91 Regulator, and I would probably want to confer with my Chapter 91 staff.

MR. VAUTRINOT: But 10 years ago it was salt marsh and now it's all gone.

MR. MAHALA: That's a consideration. Maybe it could be viewed as a restoration project.

MR. VAUTRINOT: I think the other two gentlemen, the fisheries guys, they're the ones I wanted to hear their answer.

AUDIENCE: (Laughter.)

MR. O'CONNELL: Lou.

MR. CHIARELLA: Lou Chiarella. I think from the federal side of things it's going to be the same type of situation. We do look at changes from one habitat type to another habitat type, so you're probably talking about an unvegetated intertidal area making it a vegetated salt marsh. It's something that can be considered. Certainly, I think the timeframe involved—if its something that happened fairly recently and you want to reestablish it if you have an easier time to do that then say this was something that was here 20 or 30 years ago and we want to put it back, that's going to be harder because the new habitat would have probably have established itself and we have to look at the trade-offs there. But it's something that could be considered.

MR. MALKOSKI: I really don't have anything to add. It's a case-by-case. It depends on what's there now, how its functioning now, and what the value of that habitat is right now versus what it might be, and also to a degree it would depend on how successful you may actually be at reestablishing marsh or whether it's just some green stuff growing where there's mud now. Do you know what I'm saying because sometimes that happens, and it's very hard to do, so the degree of success will determine it.

MR. VAUTRINOT: Thank you.

MR. O'CONNELL: I'd like to follow up on that as well. A question or comment I'm not exactly sure, but Al happens to be Vice President of the Duxbury Beach Reservation. I'm also one of the Vice Presidents there as well. The situation that we're in, and I've run into other situations with this as well, Jim O'Connell, is that the alternative—

AUDIENCE: Microphone.

MR. O'CONNELL: It's a—

AUDIENCE: Say your name.

MR. O'CONNELL: Question or comment on what Mr. Vautrinot just brought up which is if we build a salt marsh (Inaudible.) protection to protect the landward area. And I've run into a couple situations where the alternative was to revet. But the owners wanted to try something non-structural that may or may not work, probably won't work as well as a revetment as far as protecting the upland area but it will work to a degree.

So, they wanted to try the wetland building. The alternative was they had an opportunity to revet. So, I mean that's a situation I think that probably would be easier for the regulators, but it's

a situation that I've seen several times over the past couple of years. In being involved with the Duxbury folks, we wanted to build a marsh to protect the back road, the only road to 300 homes. We were initially discouraged from doing that, but if we really didn't—we pursued it enough to discuss it with the regulators to tell them what the alternative may be, which would be a variance but it's the only road to 300 homes. If they lose that, emergency vehicles can't get there. So, it's a little bit more behind the scenes that we'd have to discuss with the regulator.

MR. ROGGEVEEN: Dirk Roggeveen from the Nantucket Conservation Commission. This is a question for the fisheries guys. We have a proposal for beach nourishment in Sconset Beach, which you'll hear more about later in the meeting. There's an area of cobble relatively close to shore. It provides excellent habitat for various species of fish that have got commercial value locally. The representatives at this point got—represented that some of the sand nourishment will regain its slope offshore. We'll be covering this cobble area. I was wondering whether there was any experience with replacing cobble such as layering it on top with sand either once or annually and cover the existing cobble and/or other opportunities for mitigation because of circumstances such as that?

MR. MALKOSKI: I'll take that. Vinny Malkoski, Marine Fisheries. Those options have been discussed, and they are being looked at as part of the permanent process. Again, you're trading a known for a maybe and you have a dynamic environment which by default the materials going to move. So, that's an area where in kind in place may not be possible in which case the challenge is to find something that's appropriate somewhere else if that can be done.

So, but it is under discussion amongst the technical groups, the agencies are working on the project review.

MS. MERRILL: Katelyn Merrill, East Cape Engineering. I have a question for Jim Mahala. With all of a kind of checker-board approach for erosion control structures, do you see a more comprehensive beach nourishment program making those regulations now stricter to kind of get more of a unified approach as opposed to having—still allowing revetments and that type of thing happen?

MR. MAHALA: Well, I don't see the regulatory framework changing anytime soon, but certainly we would encourage sort of a regional basis to address erosion control and not just do it on an individual property-by-property basis. So, certainly, beach associations, municipalities, and the State could be taking a more active role in encouraging people to address erosion problems on a more regional basis.

MR. O'CONNELL: Tom.

MR. HARRINGTON: Tom Harrington, Stevens Institute and New Jersey Sea Grant, I should say. I have questions for the Fisheries Group. The shoreline where we nourish the beach naturally goes through episodic changes to the elevations of 10 feet in the uplands and the burial of 10 feet or so maybe five meter, a quarter depth. Has there been any work done to quantify this natural variability and how the species adapt to that so that we can better evaluate the impact of the nourishment on it?

MR. CHIARELLA: Lou Chiarella. I think there's been some minimal work done probably the majority of any work that's been done has been through the Army Corps of Engineers. I know they had done a pretty significant study off of New Jersey with the beach nourishment that occurs there which

is pretty significant, and, you know, for the most part the species that are living in that high energy environment where you have so much sand being moved so frequently the species that utilize that are well adapted to that type of situation. The problem arises when you're trying to or you're going to create a different type of situation where you have more of a situation where its a lower energy, cobble environment, and you're going to start making that a lot more active then we have a problem with the species not being well adapted or suitable to the changes.

MR. MALKOSKI: Vinny Malkoski, Mass. Marine Fisheries. (Bell.) What I would add to that is there was a lot of work on New Jersey. The fisheries portion of those monitoring studies was somewhat less than some of the other aspects of those. There isn't a lot to a degree the fish weren't so, you know, you're looking at something that's an actual system versus something—somebody was changing it. I guess one of the problems that exists is the translation. People see a study done in Florida. They'll see it done in New Jersey, and they'll try to apply it to another piece of coast, and, certainly, there's baselines but there's still going to be a need for more site specific and more area specific work as well.

MR. O'CONNELL: And there will be more opportunity this afternoon in the open discussion when we'll have all the speakers up here, and we'll open it up for dialogue. We're going to have to move on to the next session now. Thank you, folks. (Applause.)

All right. We're moving into another phase here. Public and Private Partnerships for Beach Nourishment Planning in Massachusetts. Our first speaker is Andrea Langhauser. She's a Senior Planner in the Mass. DEP Chapter 91 Waterways Regulation Program where she's primarily engaged in permit review and policy development. Andrea has worked with the Chapter 91 Waterways program since 1988 with the exception of a five-year run as a Watershed Team Leader in Southeastern Massachusetts for the Massachusetts Watershed Initiative.

Prior coming to Mass. DEP, she was the First Conservation Agent for the Town of Falmouth, an Environmental Consultant on Cape Cod. She has a Bachelor of Science in Environmental Biology from SUNY College of Environmental Science in Forestry in Syracuse, New York. Massachusetts General Law Chapter 91 Public Waterfront Access.

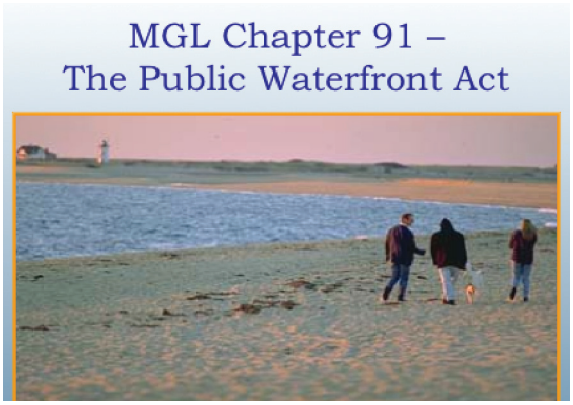
MS. LANGHAUSER: Any other Stumpies in the room? Yea, there's always one or two. I'm going to give you a brief—can you hear me okay?

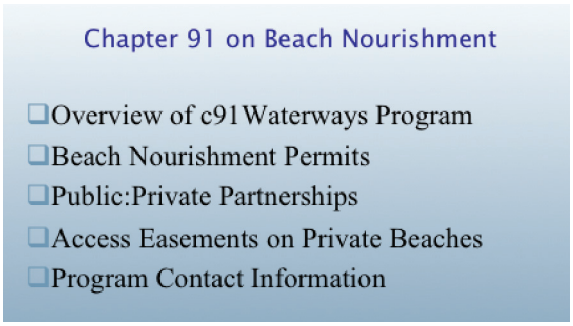
AUDIENCE: (Nodding.)

MS. LANGHAUSER: I'm going to give you a brief overview of the Chapter 91 program because a lot of people generally aren't that familiar with it, and then we're going to speak to beach nourishment permits and go right into the public and private partnerships that can occur in a beach nourishment project and speak specifically to access easements.

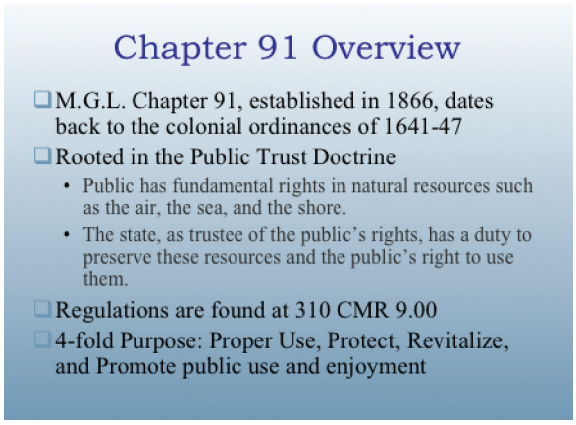
Most importantly, there are program contacts for you to address further questions such as the Duxbury Beach issue. It's good that I'm starting a new group because Chapter 91 is, actually, a little different from other wetland—other environmental programs at MassDEP. We generally expect that you're going to address your environmental issues through the MEPA review, through the Wetlands review, that DMF comments are going to be known, and Natural Heritage comments are going to be known and so when you get to us, we'd like to just be talking about the project basics and moving on.

The Chapter 91 was first established in 1866 but it dates back to the Colonial laws and even into Roman law which speaks to the Public Trust Doctrine that exists along the shores, the natural right to air, sea, and the shore. The State, as trustee, through the Mass. DEP Waterway Regulation Program, has the duty to preserve these resources and to protect the public's rights to use them. And that's what makes us different from our sister program, the Wetland's Protection Act. We're asking that the review of the environmental protection happen well within the wetland's program. We're going to be speaking to the public use in that project.





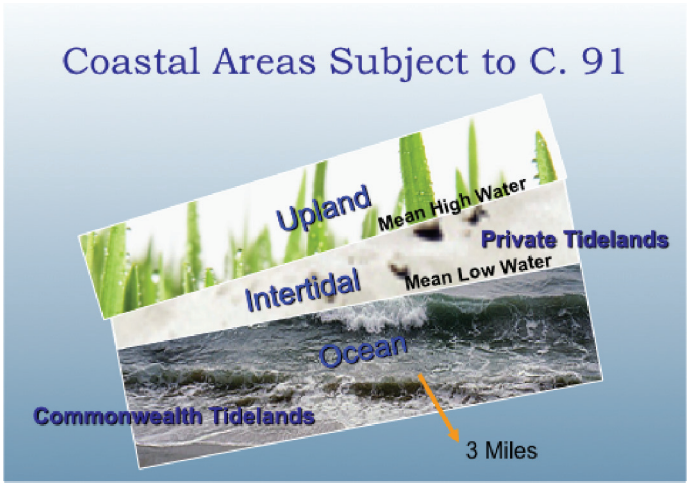
Our Regulations are found at 310 CMR 9.00 and there's a four-fold purpose to our Regulations. You want to make sure that there's a proper use. Jim spoke to both to water dependent and non-water dependent uses in a project. If a project is a water dependent use such as dredging or boating, marinas, then it's presumed to serve a proper public purpose, and it goes through the review with just performance standards that deal with engineering and public access.



If it's a non-water dependent use, if it's a use that would like to be at the shore but doesn't have to be at the shore like the private home or restaurant, then it has additional performance standards that are going to be put in place to ensure that there are public uses on the property in our jurisdictional area that are very much a part of the project and not just incidental. We protect the public use of tidelands and assume wetlands has done their job – although we do have the responsibility to add environmental protection measures if the wetlands review omitted something important.

We revitalize urban waterfronts. The reason I bring that up isn't because of beach nourishment and dredging but because Chapter 91's jurisdiction goes back to the natural waterline. The natural high water line, you know, the historic mean high water prior to human alteration. And so we have jurisdiction of filled tidelands as well as floated tidelands. And we are promoting the public use and enjoyment of our waterfront and waterways.

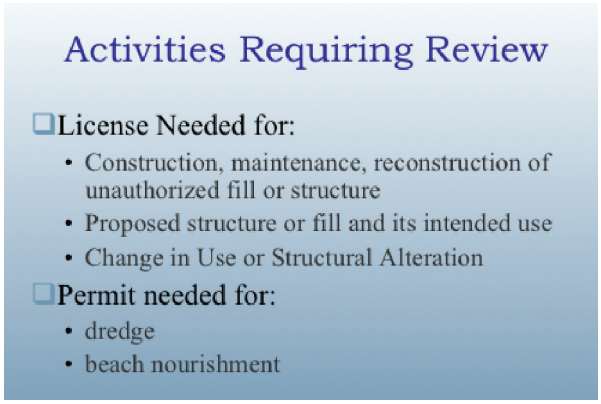
I'm assuming that since we're talking about beach nourishment, we're generally talking about the undeveloped shore. We don't have jurisdiction landward of the mean high water. So, upland beach issues (the Piping Plovers, the Least Tern habitat) have already been addressed by the time the project gets to Chapter 91.



Our jurisdiction extends three miles out to the State property line. We have two types of tidelands from mean high to mean low that wet sand area that's called private tidelands. The public's rights in those tidelands are fishing, fowling, and navigation and access related thereto. Beyond the mean low water, and I mean the historic mean low water when you're dealing in filled lands, the Commonwealth still has rights for—all legal use of those lands, and that's where we speak to public use of lands having public access for strolling, for all sorts of public uses in your own filled land.

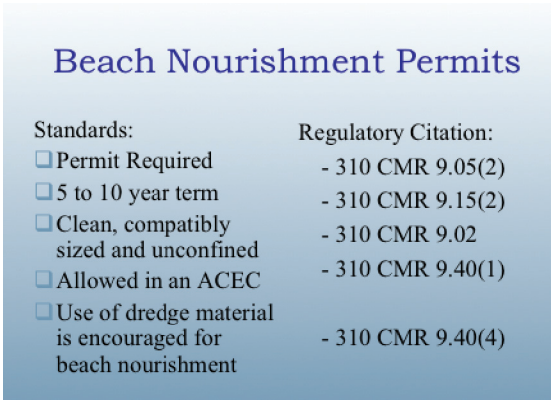
There are generally two types of permits. A license is the 30-year permit, and that's going to be for the construction of and maintenance and reconstruction of building structures for the use of the structure and the implied use. A license amendment is used for changes in use and structural alteration. It's a permit that you would get for beach nourishment or dredging.

Rather than speak to all the performance standards, I put down the regulatory citation and it's, of course, very difficult to actually read out the regulatory citation, but I'll give it my best shot. A permit is required and you can find that at 310 CMR 9.05(2). A beach nourishment project generally would have a five-year term. If it's a permit for maintenance dredge, you can get up to 10 years. The term speaks to, you know, how often you have to nourish a beach and our ability to come back and take a look at the situation that's changed five-years later.



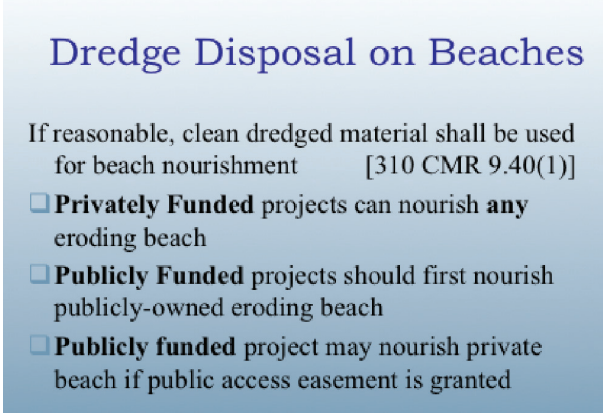
As mentioned by the other folks here, obviously the sediments used to nourish the beach have got to be clean, compatibility sized and unconfined. It is allowed in an Area of Critical Environmental Concern. And we do encourage dredge material for beach nourishment, and that's what I'm going to be speaking about today.

As Jim Mahala said it's best to keep the dredge materials right in the same area that they came from and beach nourishment allows that to happen. So, as identified in our Regulations at 9.40(1) if it's reasonable, the clean dredged material shall be used for beach nourishment. If it's a privately funded project, you can nourishment any eroding beach.



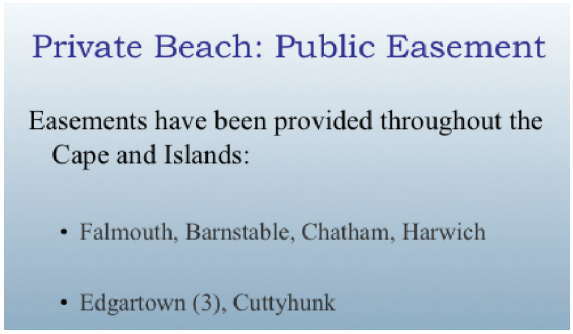
We do have a case in Nantucket where privately funded dredge project put the spoil on a public beach so everybody benefited. If it's a publicly funded project, the spoils should first nourish a publicly owned eroding

beach - public money/public beach/best public use. If it's a publicly funded project, it can nourish private beaches but a public access easement has to be granted. Generally, the beach nourishment projects we're speaking of are happening in between mean high and mean low water. That's an area that we refer to as private tidelands so the public right to access doesn't include strolling. It would normally only include access for fishing, fowling, and navigation, so if a publicly funded project wants to nourish a private beach we ask those private land owners to provide an easement for public strolling access.

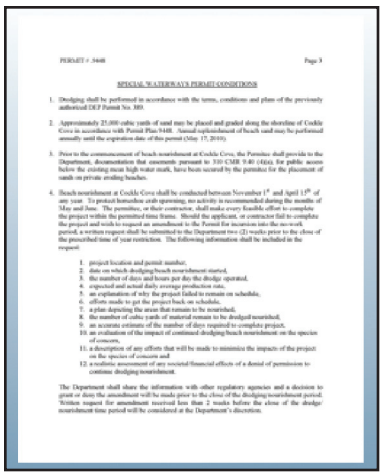


Easements have been provided very regularly. I guess down here in the southeast regional area we've got examples in Falmouth, Barnstable, Chatham, Harwich. There's been a number in Edgartown and over on Cuttyhunk Island in Gosnold.

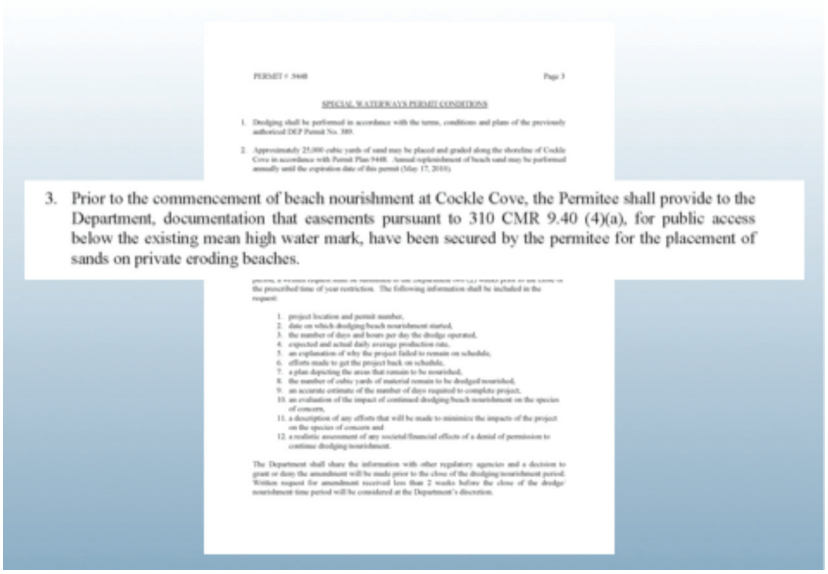
You don't have to read this. See. This is just a Chapter 91 permit, one of the three pages of the Chapter 91 permit, but here is an example in Chatham where dredging in Cockle Cove putting beach nourishment on private beaches. We do have a special condition in these cases where we say that prior to commencement of the beach nourishment, the permitee has to provide the Department with documentation that an easement for public access below the mean high water line has been secured and is in place to dredge the private beaches.



As you see in this condition, the Department isn't a party to the easement. It's an easement that's established by the municipality and the private landowners, often a group of landowners, but we are—we're putting it in a condition of the State license that the project not start until we see it and make sure it happens.



There's a lot of reasons for a private landowner to want to do beach nourishment. Obviously, they want to protect their beach. They want to maintain their property value. They want to sit in the sand, but they also are, you know, looking to storm damage prevention and flood control protecting their property values, of course. There is a fear of formally allowing public access, and this is where Chapter 91 and the municipality have to, you know, address that as very real even when applicants are probably allowing strolling all the time. It's recognized that our access easement only extends seaward of the wet sand. It's below mean high water and it's only for strolling. It's not for sitting down and picnicking and sunbathing. And reasonable restrictions are allowed, absolutely are going to have to be allowed.



3. Prior to the commencement of beach nourishment at Cockle Cove, the Permitee shall provide to the Department, documentation that easements pursuant to 310 CMR 9.40 (4)(a), for public access below the existing mean high water mark, have been secured by the permitee for the placement of sands on private eroding beaches.

You don't have to read this. This is an example of a public access easement. I'm going to highlight the points in there that I think are valuable. This sample access easement is from the DEP beach nourishment guidance manual that Jim Mahala gave you the website to -

The grantor—since the private landowner has received a direct benefit from the publicly funded beach nourishment project, we're asking that he voluntarily provide this easement and that he grant the easement in perpetuity over the property only below mean high water.

The grantee—the private landowner, gives to the Town, the residents of the Town and the public generally so it's for all the public, a public on-foot-right-of-passage along and across the shore between mean high water and the entire nourished area subject to the following restrictions and limitations.

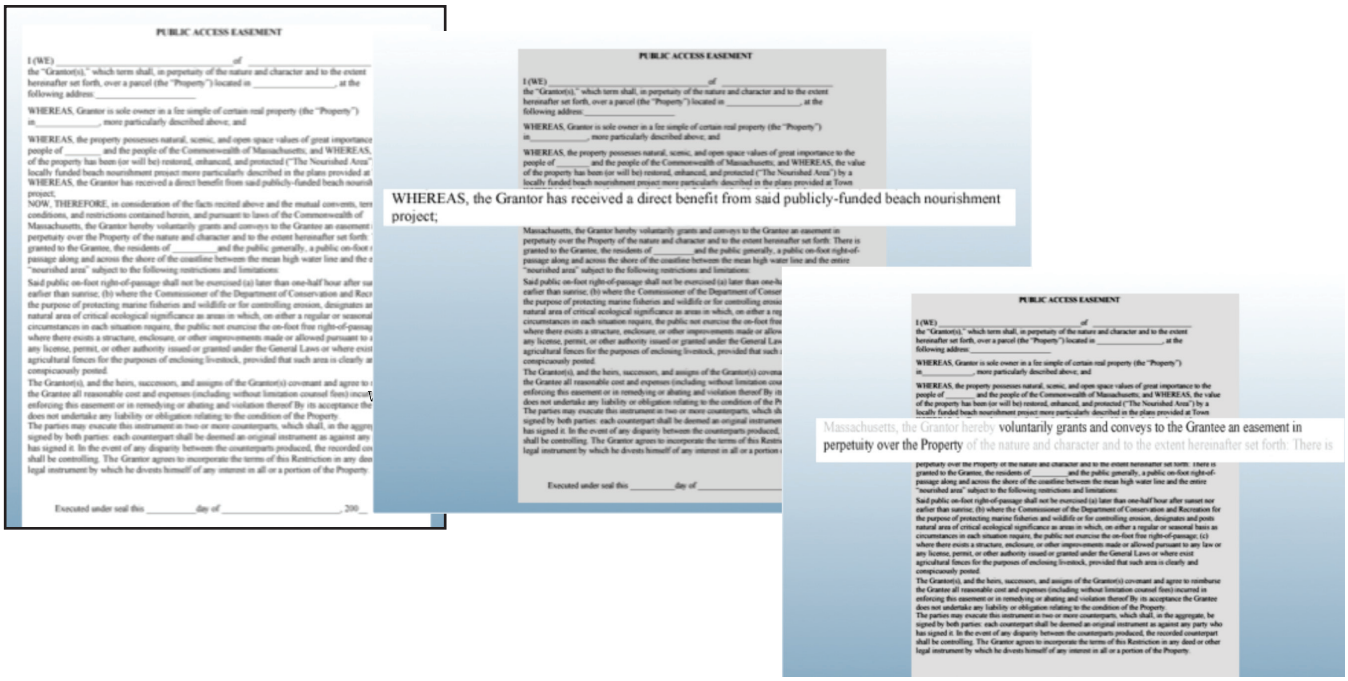
The whole paragraph, all this paragraph here, speaks to those limitations that you can place on

Private Beach:Public Easement

Private Landowner will be motivated by

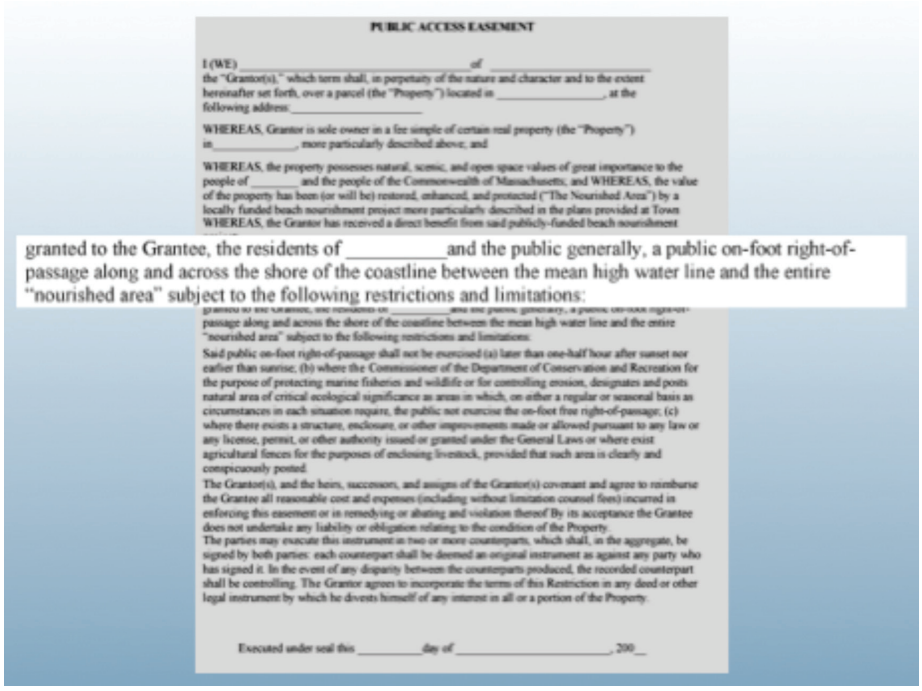
DESIRE to protect eroding beach
- maintain property value
- storm damage protection
- flood control

FEAR of formal public access
- use limited to strolling on "wet sand"
- reasonable restrictions allowed



an easement, but we're asking that it be for the general public and that it be for strolling between the mean high water line and the nourished area.

Some of the restrictions in that paragraph I pointed out are that you can restrict the hours. In this case,—strolling shall not be exercised later than one half-hour after sunset and nor earlier than sunrise. So the fishermen, they get a little bit of a break at this site. They can be there at all the crazy hours that the fish are there.



PUBLIC ACCESS EASEMENT

I (WE) _____ of _____
the "Grantor(s)," which term shall, in perpetuity of the nature and character and to the extent hereinafter set forth, over a parcel (the "Property") located in _____, at the following address: _____

WHEREAS, Grantor is sole owner in a fee simple of certain real property (the "Property") in_____, more particularly described above; and

WHEREAS, the property possesses natural, scenic, and open space values of great importance to the people of _____ and the people of the Commonwealth of Massachusetts; and WHEREAS, the value of the property has been (or will be) restored, enhanced, and protected ("The Nourished Area") by a locally funded beach nourishment project more particularly described in the plans provided at Town
WHEREAS, the Grantor has received a direct benefit from said publicly-funded beach nourishment

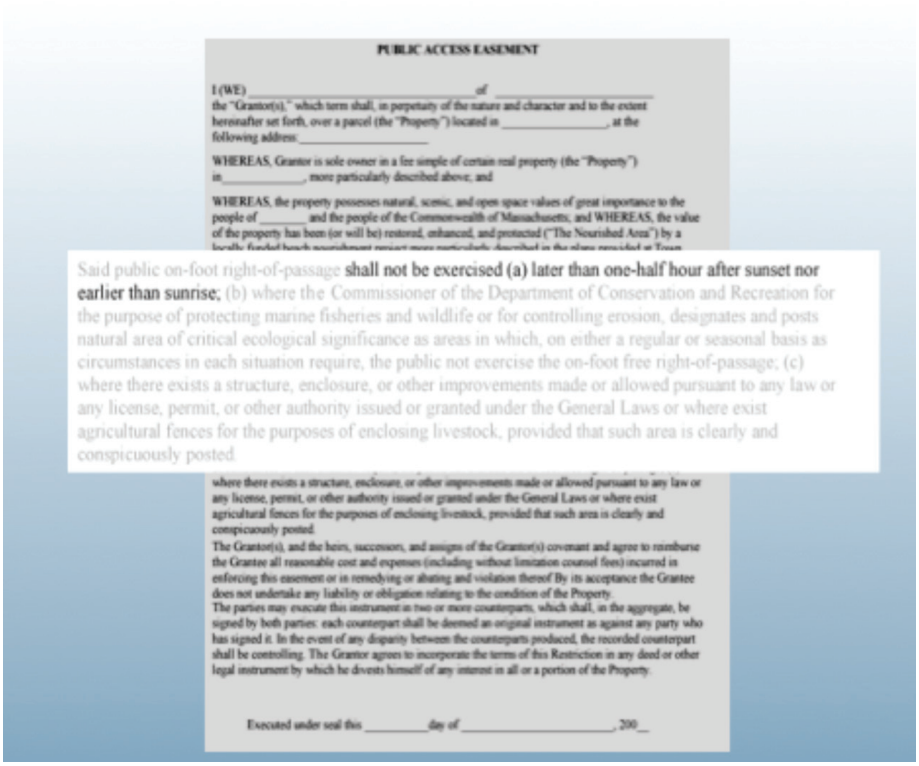
granted to the Grantee, the residents of _____and the public generally, a public on-foot right-of-passage along and across the shore of the coastline between the mean high water line and the entire "nourished area" subject to the following restrictions and limitations:

Said public on-foot right-of-passage shall not be exercised (a) later than one-half hour after sunset nor earlier than sunrise; (b) where the Commissioner of the Department of Conservation and Recreation for the purpose of protecting marine fisheries and wildlife or for controlling erosion, designates and posts natural area of critical ecological significance as areas in which, on either a regular or seasonal basis as circumstances in each situation require, the public not exercise the on-foot free right-of-passage; (c) where there exists a structure, enclosure, or other improvements made or allowed pursuant to any law or any license, permit, or other authority issued or granted under the General Laws or where exist agricultural fences for the purposes of enclosing livestock, provided that such area is clearly and conspicuously posted.

The Grantor(s), and the heirs, successors, and assigns of the Grantor(s) covenant and agree to reimburse the Grantee all reasonable cost and expenses (including without limitation counsel fees) incurred in enforcing this easement or in remedying or abating and violation thereof By its acceptance the Grantee does not undertake any liability or obligation relating to the condition of the Property.
The parties may execute this instrument in two or more counterparts, which shall, in the aggregate, be signed by both parties: each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling. The Grantor agrees to incorporate the terms of this Restriction in any deed or other legal instrument by which he divests himself of any interest in all or a portion of the Property.

Executed under seal this _____day of _____, 200__

There is a reasonable restriction for protection of public fisheries, wildlife, or controlling erosion for our areas for critical ecological significant areas. So, we do recognize if it were a wildlife sanctuary or something like that that you may not want—it may not be appropriate to have strolling through the entire area, and you can put a restriction in for wildlife.



PUBLIC ACCESS EASEMENT

I (WE) _____ of _____
the "Grantor(s)," which term shall, in perpetuity of the nature and character and to the extent hereinafter set forth, over a parcel (the "Property") located in _____, at the following address: _____

WHEREAS, Grantor is sole owner in a fee simple of certain real property (the "Property") in_____, more particularly described above; and

WHEREAS, the property possesses natural, scenic, and open space values of great importance to the people of _____ and the people of the Commonwealth of Massachusetts; and WHEREAS, the value of the property has been (or will be) restored, enhanced, and protected ("The Nourished Area") by a

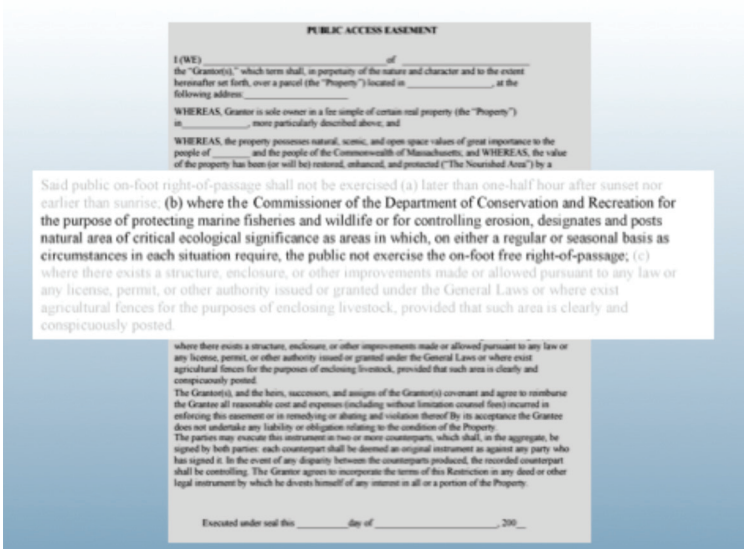
Said public on-foot right-of-passage shall not be exercised (a) later than one-half hour after sunset nor earlier than sunrise; (b) where the Commissioner of the Department of Conservation and Recreation for the purpose of protecting marine fisheries and wildlife or for controlling erosion, designates and posts natural area of critical ecological significance as areas in which, on either a regular or seasonal basis as circumstances in each situation require, the public not exercise the on-foot free right-of-passage; (c) where there exists a structure, enclosure, or other improvements made or allowed pursuant to any law or any license, permit, or other authority issued or granted under the General Laws or where exist agricultural fences for the purposes of enclosing livestock, provided that such area is clearly and conspicuously posted.

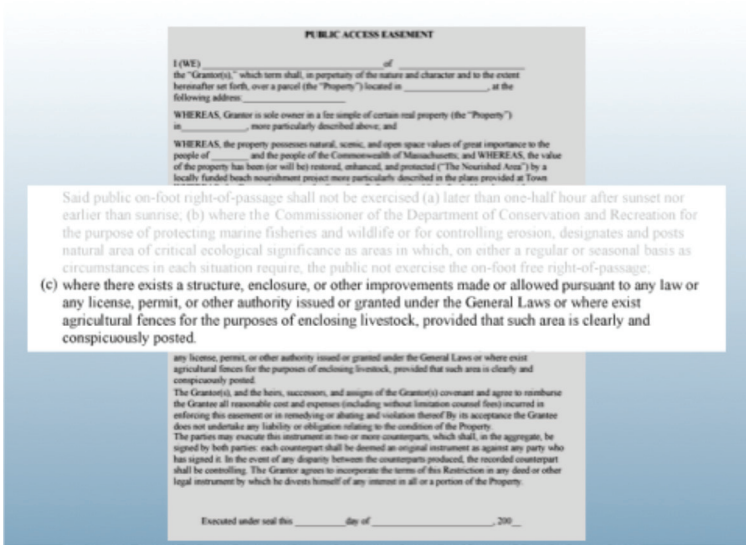
The Grantor(s), and the heirs, successors, and assigns of the Grantor(s) covenant and agree to reimburse the Grantee all reasonable cost and expenses (including without limitation counsel fees) incurred in enforcing this easement or in remedying or abating and violation thereof By its acceptance the Grantee does not undertake any liability or obligation relating to the condition of the Property.
The parties may execute this instrument in two or more counterparts, which shall, in the aggregate, be signed by both parties: each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling. The Grantor agrees to incorporate the terms of this Restriction in any deed or other legal instrument by which he divests himself of any interest in all or a portion of the Property.

Executed under seal this _____day of _____, 200__

The third restriction in this sample easement is that if there were existing structures or, and don't worry, if there were existing structures that are lawfully present, or if you have fencing for agricultural purposes then the strolling doesn't have to be exercised in those areas as long as you post it, you know, like if it's a horse paddock.

So, there you go. Those are the kind of easement we have. If you have any questions about Chapter 91 generally I'm here. And,





also, most of our questions are going to be in the southeast region so I wanted to give you Mitch Ziencina's contact information too. Just in case any other of the state agencies haven't told you the secret to e- mailing anybody in this state it's firstname.lastname@state.ma.us. So, as long as you know how to spell my name] Andrea.Langhauser@state.ma.us you can get any one of us by e-mail. (Bell.)

MR. O'CONNELL: Thank you, Andrea. All right, Mark. Where's your bio? Did you give it to me?

MR. HATFIELD: It's safe to say no.

MR. O'CONNELL: Good, so I'm not negligent. All right. We've got Mark Habel now from the Army Corps of Engineers, New England Division. He's going to talk about Public and Private Partnerships with more on the Operation and Maintenance on Corps of Engineers projects and how to get involved early on in that process for possible joint projects.

MR. HATFIELD: Actually, I'm not Mark Habel and I'm not John Winkleman either but that's okay. Mark wasn't able to make it today, and so I volunteered to fill in for him. Has my 15 minutes started?

AUDIENCE: He's got to raise the microphone. He has to.

MR. HATFIELD: If you don't provide a bio then you get one minute. So, I work with Mark in the planning branch. I'm also the Project Manager. I actually work more in the riverine flooding section, flood plain management.

AUDIENCE: Can't hear you. Get close to the mic.

MR. HATFIELD: I actually work with Mark in the planning branch as a Project Manager. I manage one of the sections for the Flood Plain Management Group and Riverine Flooding. Good morning. How does the Corps get involved in beach nourishment? I have the job of trying to educate you in

a very short time how that might be. You need to think that there's two ways. We can either build a new project, or we can work with or glean the benefits of an existing project, typically a navigation project.

If it's a new project, we have several authorities that we can access to do that. Typically they revolve around hurricane and storm damage reduction benefits, but we've also used the material from ecosystem restoration project through some of those small authorities. It would be 1135, 111, and Section 14 program to do nourishment work as well.

When you're thinking of new projects, there's two ways just like there's two ways back that's required. There's two ways to do a new project. The general investigations think big. They're big projects.

Those other authorities that I was showing you are what we call small projects meaning they're limited in the amount of federal expenditure that we can apply to the project.

The Corps typically is looking to reduce shore damage, property damage to public lands and infrastructure as well as private property. Recreation is a low benefit priority to the Corps. Doesn't mean it can't be done, but in today's climate with limited budgets and tight funding, recreation usually makes its way closer to the bottom of the pile than the top of the pile. And typically when we build a project on the shore, we need public access as part of that.

General investigations. When I talked about big projects. These are congressionally directed. They take something even through a Water Resources Development Act or some other resolution to engage us. Think big. Think Atlantic City, Miami Beach, Fire Island. Those are the types of projects that are done under the general investigation program. It requires specific authority at every level both studying and construction and appropriation. So that tends to drag the project on and take time. Those projects take a long time.

The feasibility studies are done on a 50-50 cost-share basis. And, typically, construction—the non-federal sponsor is required to pay 35 to 50% of the cost of doing the work. We have not done a large beach job in New England since the 1980's. I think someone mentioned earlier Revere Beach. That was the last one that we did. Renourishment is part of the non-federal responsibility particularly.

You may be familiar with some of our hurricane protection projects that aren't shore protection projects but the hurricane barriers—we've actually authorized or at one point we had authorized two large beach projects also Westerly, Rhode Island and Point Judith. We went right up through authorization and then had trouble landing the local match to pull that off, so those were never done, and I think have both been deauthorized at this point. Again, Congressional direction is (Inaudible.).

Continuing authorities programs. Those are the small projects with the federal limitations on dollars spent that dictate each of those authorities, but we have been given authority by Congress to investigate, design, and construct certain projects under different authorities at our own discretion.

Studies at cost-share 50-50 after the first hundred thousand dollars, and then, again, construction is usually cost-shared on a 65/35 basis. It tends to creep up based on depending on the benefits that are attributed to that project. And then, again, maintenance is generally nonfunded—non-federally funded.

One thing you should keep in mind that any lands or easements that we apply to the project that are secured by the non-federal sponsor are credited towards the non-federals 35%, which is a nice feature.

Section 103, one of those small authorities that's a hurricane and storm damage reduction authority. We're limited to the $3 million investment. Again, we're really looking for public infrastructure or some private property when we're doing those types of projects.

The cost sharing on the study phase is the same. We have done other types of projects other than your traditional beach project with this authority. We have done some house elevation projects down in Connecticut and Rhode Island over the years. Again, public access and future maintenance those are the same kind of authority.

Some of the 103 projects we've built in Massachusetts, Town Beach at Oak Bluffs, Plum Island Beach, Clark Point Beach. Right now we have two 103 investigations underway. One at Marshfield and the other one at Nantasket Beach, which you also heard about earlier this morning.

Section 1135 allows us to go and do environmental restoration that's associated with some type of project that we've built. That actually has a $5 million limit on our expenditure, and some of the projects that we've done under that authority of Gaililee Salt Marsh, Sagamore Marsh, which is just around the corner here, Allins Cove in Rhode Island should be complete this year, Boyds Marsh and Broad Meadows in Quincy. All of those are really marsh restoration projects and a lot of the material—we can use the material for beach nourishment as well, and a lot of that material is all sediment.

Section 111 is an interesting authority if you can prove that we caused the damage to one of our navigation projects. We can investigate the cost-share and the mitigation of that damage. Currently, we only have one such study going on and that's at Saco associated with the Saco jetties, of course, and the erosion that's taking place at Camp Ellis. Once we come up with a fix for that type of damage it's cost-shared at the same percentages as the original navigation project and that's also limited to a $5 million federal expenditure. Obviously, Saco is not going to be under $5 million, so we're going to have to seek separate authorization and appropriation to get that built. Anyhow, here's just a topo of the Saco area. The breakwaters are in green, the navigation channel's in red, the purple lines that are running off the north jetty are proposed breakwaters to help with the erosion problem that's taking place, and this project will probably involve a substantial amount of sand fill in order to rebuilt the beach something on the order of 300,000 yards, I think.

Section 14 is another small project authority. Again, we typically use this for river—extreme bank erosion on rivers to protect like public infrastructure like roads or sewer, libraries and things like that. These are small projects typically $1 million federal—we're mandated by $1 million federal cap on those investments, and it's a 75/35 cost-sharing arrangement. But it can also be used for shore protection measures up coast as well. I haven't see it happen recently, but it can be done.

I talked at the beginning about there are two ways to really access the Corps in these new projects and then there's existing projects. The type of shore protection or beach nourishment that we typically get involved in is through our navigation's operation and maintenance of now existing projects. We look to place material on the shore when we can, where we can, but I think as Mike brought up earlier in the discussion/question/answer period how we're always driven by the least cost plan. We start there. If a least cost plan is to put the sand on the beach and its permittable, by

all means we do it. But often there are other places that we can put it either in the near shore or some other site that's more permittable, and that's where that becomes the base plan for what we do. If the local sponsor if the town or the city or state comes to us and says, "No. We really want you to put this on the shore" and that becomes Plan B or C, they have to pick up the difference of the cost between the base plan and whatever that other plan may be.

And, of course, we could do that through our contractors either hopper by one dredging, which we've heard about. And this is more discussion just about the base plan, and then the locally desired plan that they have to pay 100% of the difference in cost.

There is a thing called a Section 933 study. If we have to or we're asked to and we have the funding to do it, we can actually look at the economic justification of participating in the difference of that cost. I haven't seen too many of those done either but it does exist.

Here's just an example of one of our maintenance jobs at Aunt Lydia's Cove. We're typically up there every couple years with the Currituck, which is our hopper dredge. We dredge out the entrance channel to the cove, and then we're dumping it in the disposal site just off the bars there.

That's just a shot of the Currituck. That's typically summer work. I think they usually come up in the spring/summer timeframe.

Another maintenance job that's in the work is Clinton Harbor in Connecticut. They're looking to dredge the 8-foot channel and pump that material over to Hammonasset Beach. Wells Harbor; we have a federal navigation project there that we often maintain, and I think you can see the dredge there with the pipeline strung out behind it. We actually pumped that material down to the beach, filled the little toe dike that we could then train the material a little better so it just didn't run off into the surf and built the beach up that way. This is just a shot of the material coming out of the pipe.

Getting back to improvement projects or new projects. Obviously, beach nourishment can be a disposal method for those types of projects. Those are usually cost-shared at 80% federal/20% non-federal. Some projects we've done recently: Hyannis Harbor in 2000. We put spoil in different places on different beaches and in areas of Lewis Bay. Westport Harbor, hopefully, will go this fall. Oak Bluffs Harbor maybe next spring we're deepening the entrance channel. The East Boat Basin we're looking to expand that project down in Sandwich, and then the Woods Hole project right here, which I'll show you in a second.

Westport Harbor we're putting in a federal channel and we'll put the material pipe directly to Horseneck Beach. That's about a 20,000 yard job. Oak Bluffs Harbor, as I mentioned, we're deepening that. It's not a huge job, 6,000 cubic yards of that is also going to the Town Beach for nourishment purposes.

And this is the East Boat Basin. You can see the expansion that we're investigating at this point at the major dredge and at the conservation (Inaudible.). We expect to generate something to the tune of 500,000 yards of material, some of which may be able to be used in shoreline protection. We haven't got that far in that study yet, so we'll have to wait and see.

This is the Woods Hole study, which hopefully will begin this year as well. We're doing a cost-share effort between us and the town and NOAA. We're looking at putting in a federal navigation

channel down here at Woods Hole with a turning basin and some berthing area work. We anticipate that a significant amount of that material could also be used as beach fill. There are some beaches within a one mile pump. One mile typically as a rule of thumb where you'd like to be you don't have to get some booster pumps involved, but certainly the more coarse the material or muddied, you get booster pumps anyways so. But this is typically all sand in the other channel.

Ecosystem restoration under the 206 authority, these are projects just straight out ecosystem restoration (Bell.) where we can get involved if we show economic justification. Some of the projects we've done are shown here, and they're typically—here's an example of one Ninigret Pond in Charlestown, Rhode Island, where we actually dredged out the estuaries. Some of the areas found were tidal shoal (Inaudible.) dredged down. The dredge goes down several feet, pump the material to the beach, and then we're reestablishing eelgrass beds within the pond kind of to augment the existing beds that are already there. We've done most of that work already. We're going to finish up the eastern dredging (Inaudible.).

And then there's just the planning assistance, the State's program, which is a technical assistance story which allows us to partner with any city/state/community to do any type of planning study that he may want to do and that's not only 50-50 cost-sharing. And that's about all I have. Actually, John Winkleman was going to talk about regional sediment management, but I've used up all his time. Maybe he can talk about that after lunch.

MR. O'CONNELL: We've got three minutes if we stay on schedule for question and answers, but we'll obviously extend that to 10 and give the speakers the due respect, so if we have any questions for Andrea Langhauser for DEP on Chapter 91 issues or for Chris Hatfield for the Corps of Engineers feel free. I'll start with the first question for Andrea wherever she is, if you don't mind. Moderator privilege.

MS. LANGHAUSER: Yeah, I guess.

MR. O'CONNELL: When you—for the public access strolling rights using public monies and posting the material on private property, the public has the right to stroll between the low or mean high water and the rest of the dry beach.

MS. LANGHAUSER: Right.

MR. O'CONNELL: How do you know where the mean high water was? Do you assign it? Is it required for it to be signed or staked?

MS. LANGHAUSER: You could if you want. You could work those issues out. The reason our jurisdiction -

AUDIENCE: Mic.

MS. LANGHAUSER: Oh, mic. I am Andrea Langhauser. The reason the access easement goes back to the mean high water prior to the dredging is because this is action of human alteration. So, the public didn't lose any jurisdiction. How do you know where it is? I would say that you might—if the easement owner is concerned—if the easement landowner is concerned about that, then they should work the issues out in the easement itself. We could sign it. Even though we allow signs everywhere, I'm personally not a big proponent of them. There's sign pollution after a while.

MR. O'CONNELL: Yeah.

MR. HOFFER: Don Hoffer, Falmouth Beaches. The Corps of Engineers, what's your max pumping capacity in the miles from the dredge?

MR. HATFIELD: Chris Hatfield with the Corps. I have no idea. It depends on the size of the dredge, I guess. If you had a big enough dredge you could pump pretty far but I'm not aware of an upper limit. Mike, do you have any thoughts?

MR. WALSH: Mike Walsh with the Corps. Economically, you know, you could probably go two miles without a booster pump. Once you get into booster pumps you can bump that up another two miles, but after four miles I think you're kind of taking your limit.

MR. HATFIELD: I've actually seen some dredging jobs down in Florida where they have multiple booster pumps. It's quite an operation to see them pumping miles and miles.

MR. HAYES: For you, Andrea. Is there any provision on state constructed and funded DPW projects that are causing downdrift damages? Is there any proviso for any state rebates on that (Inaudible.) damage caused --

MS. LANGHAUSER: Norm Hayes.

MR. O'CONNELL: Could you say your name?

MR. HAYES: Norm Hayes.

MS. LANGHAUSER: Hi Norm.

MR. HAYES: Hi Andrea.

MS. LANGHAUSER: Any proviso for—is it easement? Is it an easement question?

MR. HAYES: No.

MS. LANGHAUSER: What's your question?

MR. HAYES: It's similar to the federal regulations that Mr. Hatfield talked about. If you have an engineering structure funded and permitted by this Commonwealth of Massachusetts—

MS. LANGHAUSER: Yep.

MR. HAYES: —flat out under a DPW contract that is causing detrimental damage to both the banks and the beaches. Is there any proviso with State funds to be reimbursed for the town for that damage?

MS. LANGHAUSER: I'm sorry, Norm. I'm going to have to defer because if it were constructed by the State, then it would be constructed by the old DEM/DCR and our Waterways Program—I said it was established back in 1866. It used to have construction and permitting in the same group, but not since I've been there since '88, so I don't know how DCR would handle that. It's not an aspect that I get involved in, but I can put you in touch with someone.

MR. HAYES: That would be great. Thank you.

MR. KEON: Ted Keon, Chatham, for Andrea as well. You've already took the first half of my question on the previous mean low water.

MS. LANGHAUSER: Previous mean high?

MR. KEON: Mean high water. You also indicated, in fact, you used the example of the Cockle Cove that the easement is in perpetuity but in actuality it's only as long as the existing project is in place, so that if it erodes back to the previous mean high, the easement (Inaudible.) they don't have to limit the easement beyond where the project was before the project was.

MS. LANGHAUSER: Thanks for that clarification, Ted. The sample easement that is in the guidance document speaks to a term in perpetuity. I guess the state is encouraging you to use that term, but that being said, it's an easement that's established between the municipality and the land owners, and if the term were limited to the extent of the project, I don't think we would have any concern with that. We actually have spoken about that in the office that, you know, either the length, you know, the five-year term of the permit or perpetuity, they both have reasonable—those are both reasonable. So, we put perpetuity in the guidance document just to encourage you to ask for that.

MR. O'CONNELL: I'm going to throw a little complication into that discussion right there. As far as in perpetuity, okay, so the dry sand erodes back. I did some underground surveying on 10 beaches around Massachusetts over a six-year period, and I saw the mean high water line, the actual high water contour, fluctuating on average about 65 to 70 feet between winter and summer in Cape Cod Bay. This month it's half that in the Nantucket Sound/Vineyard Sound area. But in Cape Cod Bay you've got the mean high water fluctuating on average 65 feet. So, it's more or less.

What a complicating thing to do. I guess you can go to the official mean high water contour from NOAA and stake it out but I guess—it seems like there's a lot of flexibility here as far as between the homeowner or the public to interpret where that easement actually is and where it isn't when the material erodes.

MS. LANGHAUSER: Hence the question about signs. He always has some ulterior motive sometimes. I always have to try to figure it out. You know, if it's natural accretion and national erosion then we generally use the term that Jim would never use, which is the "wet sand."

MR. O'CONNELL: This is some of the high water lines.

MS. LANGHAUSER: Stay in the wet sand; you're fine.

MR. O'CONNELL: I can't wait to get into the consulting business.

AUDIENCE: (Laughter.)

MR. WENNEMER: Jay Wennemer from Marshfield. I have a question for Chris. In Marshfield, we have sea walls that require a lot of money to maintain. We also have on repetitive dredge projects. Is any consideration given to using that dredge spoil to protect the sea walls to extend the beach in front of it in the calculation of required match by the municipality?

MR. HATFIELD: I think the areas that we're looking at in Marshfield in the Bass Creek neighborhood, at least in front of it, and another Brant Rock area, so I would assume that's an option that we're looking at. In fact, the Nantasket work that we're designing right now is beach fill in front of any existing seawall. So, we'll look at it.

MR. O'CONNELL: Okay. Jay, are those running flooding projects—I mean flood mitigation projects? Bass Creek I think is a flood mitigation project; isn't it?

MR. WENNEMER: Yes. No. I'm speaking to the current dredging project for the narrows of Green Harbor River where people are paying for a large part of the project. I was interested in if we transport that material to—in front of the seawall that we're actually working on right now as opposed to disposing of it offshore, which is the case. Could that added cost be considered—somehow it is being justified through the Army Corps of Engineers to help pay for it to protect the seawall.

MR. HATFIELD: Just for everybody's information, I think, and correct me if I wrong, Mike, but I think the material at Green Harbor is going to be placed in the nearshore just to the south of the inlet as feeder material for the beach. Could it be? Probably, but is it the base plan or the least costly plan? Probably not. And so that's why we're not taking it where you suggest it. Could the Town pay for that difference? I think they could, but I'm not sure that the Town of Marshfield has stepped up to the plate to offer that kind of money yet.

MR. O'CONNELL: We're only going to take a couple more questions because we need to break.

MS. FREEDMAN: Janet Freedman. Chris, I just had a question on the—didn't the Corps establish now that you have to look at beneficial re-use first so you can't consider if it's cheaper to dump offshore but there's no beneficial re-use that's out now?

MS. HATFIELD: Now, you've gone beyond the limits of my knowledge. Can you comment on that, Mike?

MR. WALSH: In all -

MS. HATFIELD: And I'm putting you on the spot.

MR. WALSH: Yeah, I'll try. I mean, Mike Walsh with the Corps of Engineers. Certainly beneficial re-use is—we are directed to look at that. That's preferable. Whether or not that changes the federal standard I'm not really clear that it does. The federal standard is that we need to find the least cost, environmentally acceptable alternative, so the way we would historically interpret that if it's acceptable then we can do that whatever it is with the material.

I know right now we're all talking about assuming it's good clean sand and it's suitable to go on a beach. Does the beneficial re-use, and I know what's behind that change, does that force us then to consider going on a beach over and above any other alternatives. We don't see it that way. We still have to look at the least cost.

MR. HATFIELD: Mike is actually from our Maintenance Navigation Group, and as I mentioned before, plans to work on new projects or design existing projects and, therefore, is to why I deferred to him to answer that a little bit more than myself.

MALE VOICE: I thought --

MR. O'CONNELL: If you could hold your questions, we're going to have an open dialogue this afternoon and it's going to open up to everybody. We're going to have lunch now. We're going to start promptly at 12:30. We're going to start with the case history, so I think you're going to find those pretty fascinating. The first one is probably the largest nourishment project you'll see in this region, I believe. So, we'll see you back at 12:30 promptly. Thank you.

(Off the record.)

MR. O'CONNELL: All right. We're going to begin the program now. I guess the folks out in the hallway are here for the same reason that a lot of us are which is networking, sharing experiences, personal and professional. We're going to begin now—we're going to begin the session on Case Examples.

We're going to start with John Winkleman from the Army Corps of Engineers. He's going to talk about Revere Beach. John received his M.S. in Ocean Engineering from the University of Rhode Island in 1998. He performed his thesis research on Breakwater Damage Progression and Proposed Waterways Excursion Stages.

Following the completion of his graduate school, John began working in the San Francisco District Corps of Engineers in 1998 as a Coastal Engineer. While he was at the San Francisco District, he worked on a wide range of projects including coastal habitat restoration, shoreline protection, beach restoration, coastal structure repairs, and navigation improvements. John became a Corps working diver in 2001—Vinny, you might want to talk to him and put him on board on a team —and he's a member of the District's Dive Team and Coastal Structures Inspection Team. He was transferred to the New England District in 2002. He's continued his work in coastal engineering also as a District Dive Coordinator.

Over last year he became significantly involved in the review of the post-Katrina, Mississippi, Louisiana, and Texas storm drain damage, protection studies and designs including the Joint Surge Study by FEMA and the Corps.

So, let's talk about Revere Beach and see what's happening up on the North Shore. John.

MR. WINKLEMAN: Great. Thank you. Jim, do you have a laser pointer up here? Can everybody hear me okay?

AUDIENCE: So far.

MR. O'CONNELL: I can.

MR. WINKLEMAN: If you can't, I'm in trouble. I'm going to actually talk about regional sediment management first. It was the second half of the presentation that Chris had given just before lunch. Mark Habel was supposed to give both of them, but this is almost more important than the importance of Revere Beach that I'll be talking about. I can go through that study pretty quickly. But I just wanted to go through this just to bring it to everybody's attention.

Regional Sediment Management is a sort of new Corps of Engineers policy and program that started back in the mid-90s and is really just becoming a more well known policy or program. The idea is to manage sediment regionally. Instead of just looking at a short stretch of shoreline or one navigation project really look at a system holistically to manage it correctly.

As part of that you want to maximize the beneficial re-use so you don't want to just be narrow-minded. You want to look left and right down your beach and up your beach to see if it makes sense to use that material somewhere else and maybe in a more beneficial way. And then to bring it into the watershed, sediments that had come down rivers and make it to our coast, you know, have a long path. There's a lot of things that happen to that sediment on the way. It makes a lot of sense to man-

age that sediment in the watershed and when it gets to the coast.

It's not an authority to perform work. We still have to fit in to one of the authorities or congressionally directed projects that Chris had mentioned.

Next slide. One tool that RSM—one way that RSM could be used though when seeking funds is to use RSM as almost a catchword of the day kind of thing. Not to minimize what RSM is, but a lot of people throughout the country have had success in obtaining Congressional-level funding with RSM. They like the idea of looking at things large scale in a way that makes sense instead of microscale—just solving small spot problems.

Two examples that we have in New England—I'll start with the bottom one first—is the study that we did with minimal funds on Cape Cod with the Cape Cod Canal's dredging of clean sand and placing it on numerous—any number of beaches around Cape Cod, and then most recently we were supposed to get money to do a recon-level study for the south shore of Rhode Island. We didn't receive that funding because we never received the federal budget this year thanks to our hardworking Congress. Meeting was number one commitment.

AUDIENCE: (Laughter.)

MR. WINKLEMAN: This is the Cape Cod Canal study that we looked at. These are all the beaches that we looked at placing the sand on. One thing I should point out about that study it's a couple years old now. We still haven't had any state or local town interest about partnering with—by putting that sand on beaches. It can't all be federal.

The program receives minimal funding basically just enough to send some money to each district to do workshops, to attend meetings, to attend the national level Corps Regional Sediment Management Meeting each year. This program—this funding is vastly outpaced now by Congressional ads. States/communities are interested in doing a regional sediment type study. They go to their Congressman, and Congress hands that money directly for that purpose; $7 million last year went to various states.

This has been our funding for the last number of years. We didn't start receiving funding until 2005, and it's actually gone down thanks to our limited federal budget that we received in 2007.

These are the scale projects that are going on around the country and that New England is missing out on. In California, they're looking at every dam that's within the state and looking at every littoral cell along the coast to manage the sediment properly. That's not happening in the Northeast.

This is a webpage for the program itself. I'm going to send this webpage to Jim, and he can e-mail it to everybody so you don't have to worry about writing it down. We also have one for the North Atlantic Division Corps of Engineers as well. I'll e-mail that to Jim.

How do we advance the RSM strategy? You have to understand that sediment is a natural resource. I think most people in this room probably realize that. It's not something that should just be discarded to get rid of. In many cases it has a very good use. We're definitely interested as an agency to improve that use. We need to have improved coordination amongst the federal/state players and local communities, towns, non-profits play a big part in this. And we need to improve our understanding of the coastal system. We still have not done large scale studies of our coast. We want to

do projects more often as small scale projects. We don't understand how things interact often from a physical science point of view. With funding and leverage you can use RSM – one goal of RSM to help leverage funding.

A definite trend is Congressional assistance. There are a lot of other states pursuing that and so should Massachusetts.

Recommendations to the Commonwealth. Massachusetts as a state should pursue this kind of funding, this kind of authority that other states are doing. You can study large-scale efforts—I mean large stretches of coastline in Massachusetts and partner with other states. Gulf Coast is Mississippi and Florida together, so it could be Rhode Island and the southeast shore of Massachusetts. It could be Massachusetts, New Hampshire, or southern Maine. It doesn't just have to be one state.

And with that, I will end that presentation. Sorry for rushing through it so fast.

All right. Now, I'm going to race through another presentation. Revere. Just for the few people in this room that probably don't know where Revere is, it's just north of Boston. It's got protection from the northeast wave direction on the northern part of the beach. You can have protection from the east but it still has some significant exposure especially from the southeast to the east.

The beach fill project as I understand it, and I've only reviewed the project, I wasn't involved in the design of the project, it was finished in July of '91. I'm not sure if that's correct or not. We did the design back in the 1980's. It was a joint partnership between the Corps and DCR. The Corps lab looked at it in '94 and basically verified numerical modeling efforts that they were working on, and it showed that the beach fill should perform well. A large part of that is because of the grain size. Natural or existing grain size at the time was 0.21 mm, 0.49 mm sand was placed, that came from an upland source as John Ramsey said this morning. I believe it was actually a highway cut fill, so it was almost a perfect alignment of the stars kind of thing where they had sand readily available and it was used. 600,000 yards of sand was placed on the beach over about 14,000 feet, which gives you 43 cubic yards of sand per linear foot of beach, and that's an important number to remember. It will come up again in the presentation.

As part of the project, we've been lucky enough to get monitoring funds about every 2 to 3 years. The only problem with the monitoring is that it's only wading depth. They only go out to about the mean low or low water line, which misses about two-thirds of the beach profile. The active beach profile goes down to a depth of probably somewhere between 20 and 30 feet at this location, so you're missing a lot of data.

Starting in 2003 they switched from the traditional surveying method to GPS surveying methods. And this is just an example of the GPS survey. These are actually a series of points, X, Y, Z points at each station.

I was brought in just last year to basically take this data that was doing nothing. It was basically sitting in a binder being plotted on regular paper graph paper and compared profiles. I was asked to see if I could do some kind of analysis to see if the beach fill was performing at all to what was expected. The primary software package I used for this was called RMAP. It's a Corps product or a Corps partnered product. It's a different, nicer way to handle survey data if anybody's interested in getting this software, you can e-mail me or go to a Corps web page and look up RMAP, and I'm sure

it will pop up in Google.

What you can do with this is you can plot all your profiles for all your stations for a station for a given year. You can compare multiple profiles. You can do any number of analysis with the software. This is just for Station 64+00, middle of the beach, these are all profiles. You really can't make sense of what's going on with that.

So, one thing you can do is you can do an average profile, which is in green. And then I looked at December of '03 profile, you can see that's the red line compared to the average profile, and then where we were in January of '06, you can see this grayish-tan line . You can make a little bit more of a visual comparison to see sort of an envelope where you started, where you're at now, and what's the average there.

And then the standard deviation is the other thing you can have which is really more telling. This is for Station 64+00 once again but it's pretty representative of all the other profiles. The maximum standard deviation was under 2 feet. I know that the axis is pretty hard to read, but that is the format that comes out of the software. But under a 2 foot variation at the maximum point of variation is a fairly good performance on the beach fill.

Another number that you can get out of RMAP is the volume underneath the profile. So, imagine you have your beach profile, you have your mean low or low water plain is what I used, you can calculate the volume of beach above that line for any given profile. And this is one of the primary tools I used for this comparison or study, just because it tells you a little bit more than just following the contour on the beach. I did that as well and it followed the trends of the volume analysis, so I'm just going to show you the volume analysis.

Back in November '91 shortly after the fill was placed, we had—this is beach volume here approaching 120 cubic yards per linear foot. In January of '06, we have just under 105 cubic yards per linear foot, so that's approaching about a 15 cubic yard loss per linear foot along this profile. If you just look at the end points, I would say it's worth looking at December '93 possibly as well since—as John Ramsey and Kirk talked about —you have to have your beach fill profile equilibrate. If you have a construction beach profile, it's usually steeper than the natural slope is going to be so it takes some time to reach that equilibrium—equilibrium somewhere in there. And if you look at '93 to 2006 there's only about a 6 yard loss. And this is all with the understanding that we're only looking at the upper third of the profile missing the lower two-thirds so you can't put this in the bank, but I think if you look at the range on the Y axis, over time you haven't lost that much sand. It's gone up/it's gone down but the net change has not been that significant.

Moving up the beach, same kind of thing. Fairly small loss depending on which one you choose. Either way it's still a small loss in beach volume.

And we're just going to move right up the beach from south to north. The same trend. Fairly small change considering the 15 year time span. Except profiles 53 and 57, approaching the middle of the beach it's a little different. There might be a hotspot here. It's something that did come up this morning. For some reason in most beach fill projects of any length, you find spots that just do not perform the same as the rest of the beach due to local bathymetry or something, wave focusing. This has been a fairly steady decline and only looking at the upper third, but it seems like the trend is pretty obvious here.

MR. O'CONNELL: Two minutes, John.

MR. WINKLEMAN: Okay. Moving to the north of that one though, 64 for the middle of the beach, the trend is obvious. Again, it seems like a fairly—if you look just at January of 2006 versus '91, it's maybe a 15 yard loss, which is not too bad over 15 years if you look at the '93 profile it's under 3.

Where it kind of makes sense to lose sand is at the northern end of the beach. End loss is something that came up this morning in Kirk's and John Ramsey's presentation. Beaches have a tendency to lose sand—beach fills have a tendency to lose sand off their ends. It's a natural—it's a bump in the natural system basically. Nature has a tendency to try to smooth that.

So, at the southern end of this project we have a headland feature for the beach fill, in the northern end we don't. So, you would expect to start to see this downward trend. If you compare it back to the beginning, it's really not a loss. And then you really at the very end—we're getting close to the end now you really see this loss, this pattern. And at the very end, you see that same thing, which is sort of what you expect at the end.

A quick summary, the beach has performed fairly well over the last 15 years. (Bell.) Considering most beach fills need nourishment every 3 to 5 years, 30% of their fill volume. This one's done fairly well, and it's undoubtedly due to the semi-protected direction from the north, the headland feature to the south, and the large grain sizes. It was double the—over double the natural grain size.

And then conclusions. If you're going to do beach profiles, just make sure you go out to the depth of closure. That's a point to take home. And if you're going to do beach profiles for any beach, a current beach or a fill beach, try to do it in the same season to avoid seasonality effects. I guess I'll wrap it up and keep it on time.

MR. O'CONNELL: Okay. Thank you, John. I remember when the Corps was designing or planning that project looking at the sediment. There was a big disagreement on the color of the sand as I recall it. Anyway, our next speaker is going to bring us, again, up to the Boston area and a little north of Boston. It's Joe Orfant.

Joe has worked with the Commonwealth of Massachusetts for over 30 years. For the past 12 years as the Planning and Project Manager for the Boston Harbor Beaches Program, which has received considerable attention in the media lately. Currently, he is Chief of Bureau of Project Design and Management and Planning and Engineering for the Department of Conservation and Recreation in Massachusetts. He studied architecture at Yale and conservation at the ICCROM in Rome, Italy. He's going to have to tell me what that is. Joe.

MR. ORFANT: We're still arguing about the color of Revere. Actually, it was fun to follow John on this because one of the earliest projects I did at the old MBC was work on the permitting for the Revere Beach project. So, it's a pleasure to see what we've intuited that it's performed as well as we thought it was and turned out it worked so well.

I'm going to talk about our attempt to do a similar large scale nourishment project in the Town of Revere on Revere Beach, which is a DCR beach, just a couple miles south of Revere, north of Boston. Less technical my presentation, it's more from the perspective of the client meaning the agency

and the community, and it's our 8-year odyssey which has brought us to this point of trying to bring this to fruition.

And eight years into the study, design, planning, and permitting for the winter project, it's hard to remember that it actually grew out of the 1993 plan for the future of the Boston Harbor beaches. It was a plan prepared for a special commission that proposed—Jim, where's the—oh, yeah. Sorry. It's a generational thing. Even though I've been with the State for 30 years, I was a teenager when I started.

AUDIENCE: (Laughter.)

MR. ORFANT: There we go. The plan proposed a series of recommendations which were predominantly landscaped and user amenities to improve the beach-goer's experience of the Boston Harbor beaches, and it was intended to build upon the improvements in water quality brought about by the Deer Island construction. And just to show that we actually did build a lot of these, this is Savin Hill Beach proposed and constructed, which also included a small beach nourishment component, which was quite controversial at the time.

At Winthrop, we've also proposed similar kinds of landside improvements comparable to what we've done in South Boston and Dorchester, but, in retrospective, none of these projects have been as easy as they were imagined. And looking at Winthrop when we started to look at it we realized we had a much larger problem on our hands. It was obvious that until we addressed the shore protection needs at Winthrop that basically the fool-hardy had put a couple billion dollars into shoreside and landside improvements, which would be lost or destroyed in a single storm.

So, beginning in 1999, we brought on Parsons Brinckerhoff as our prime consultant assisted by Applied Coastal, John Ramsey, who spoke and you'll hear again, has worked on this project with us, and we undertook a comprehensive reassessment of shore protection at Winthrop.

One of the most troubling discoveries of our—the findings of our initial review baseline report is the discovery since the late 1950's the northern end of the beach has lowered some 4 to 8 feet as you can see here. So, a conceptual Shore Protection Design Report reassessed all existing and potential shore protection measures and determined that none of the structural alternatives either existing or likely breakwaters, groins, seawalls, revetments, toe protection, none of them would be effected in the absence of a natural sediment source to maintain the beach. And not surprisingly beach nourishment led the list of alternatives to control wave overtopping and frequent flooding in the adjoining neighborhood.

Now, as public policy, the State's commitment to protect Winthrop Beach goes back to the aftermath of the Portland Gale of 1898 when Winthrop Beach was turned over to the Metropolitan Park System. The seawall was initially constructed, and Winthrop Beach entered the Metropolitan Park System as a constituent beach. Revere Beach is touted as the, and rightly so, as the first public beach in America. Winthrop Beach was probably the second.

But over time the wall alone, as you can see, has proved to be insufficient protection for the roadway and the neighborhood. A continued lowering of the beach over time has resulted in failure of portions of the groins and eventually would result in loss of toe protection exposed to seawall foundation and resulted failure of the wall, which you've seen previously in past storms. Particularly

because of urbanization and armoring of the natural sediment sources has occurred and so beach nourishment is—normal beach nourishment is cut off.

So, if nourishment is to be the logical solution and the proposal to nourish Winthrop Beach with some 500,000 yards of a particular coarse of material that would match its character, the real task was how to get 500,000 yards of material to Winthrop to do this. Winthrop is essentially an island. Unfortunately, its an island located in the heart of the Metropolitan District and it has only two connections to the mainland. One is a bridge, the other's a causeway, so—sorry, bridge. And, so, the problem is how do you bring if by conventional methods like at Revere how would you bring—truck in the 500,000 materials? Well, squeezing 33,000 truck trips through that bridge or through congested neighboring urban neighborhoods like this was essentially inconceivable.

And Winthrop's open ocean setting and it's frequent exposure to punishing northeasters also meant that any nourishment must be accomplished as quickly as possible. It's just sort of common-sense. A partially completed nourishment exposed to one or two storm seasons would be at real risk for partial or complete loss, which actually happened in the 1950's in Revere when Hurricane Carol destroyed a then beach nourishment underway. And that, of course, would represent millions of dollars lost in partial investment. So, trucking in material which could take up to three and a half years, which accommodation with the access problem essentially eliminated that from consideration.

The same open exposure and the lack of suitable—meant also lack of suitable marine resources that would facilitate an ocean delivery of upland resource—upland source materials. So, the controlling criteria quickly became for designing appropriate nourishment program for Revere with the ease of access obviously, timeliness of delivery, efficiency, as well as we'll discuss further on simplicity in terms of the technology employed.

A public review and consultation process began simultaneously with our study and design process. We met in a series of five public meetings with the community between 1999 and 2001 and also in a series of five intensive and very issue-oriented community—Citizens Advisory Committee meetings, which had the added benefit of creating a very sophisticated and well informed opinion—citizen re-group for us who have become strong advocates for the project.

Also simultaneously commencing in June of '99, we began review and the design development with the MEPA-appointed beaches TAC Commission, which is part of the MEPA review for the beaches program. And at the urging of our colleagues at Coastal Zone Management, we entered into what's known as the highway methodology, which is the pre-application review process for the federal permits, particularly the 401 permit. The Committee's made up of representatives of State and Federal Resource Agencies, some of the folks you've heard from today. We met five times over 16 months, and through the process we identified to carry forward into our environmental analysis five upland alternatives for further development in addition to our preferred alternative of an offshore source.

We arrived at our offshore source after a borrow site screening process that evaluated 12 potential sources, and the NOMES I site topped the list largely because of its accessibility and suitability for extraction by hopper dredge, which goes to the issue of simplicity and appropriate technology, and because it was also a near perfect match to the material in Winthrop.

Given the strengths composed by Winthrop, an offshore borrow using the NOMES I site was

the clear preference for the project team at least; certainly not for many the environmental regulators who had legitimate concerns over impacts on marine resources. But particularly given the suitability for a hopper dredge and the promise of rapid placement in 1 or 2 months before the worst of the storm season could hit us. So, while the Pre-application Review Committee could reach consensus that beach nourishment was clearly the least environmentally damaging project alternative, the LEDPA, for Winthrop they couldn't come to an agreement with us on a borrow source.

Remaining points of contention for over methodology for assessing potential impacts at the borrow site, disagreement over how to characterize its value, and while we were fully prepared to do a detailed marine biological study, we were unable, through that process, to come to an agreement on the scope of that study or its duration. And there were discussions of how long and what was the suitable amount of time, which ranged from 1 year to 10 years of study. Not an easy thing to do under these kinds of considerations.

Recognizing that consensus at that point was beyond reach, we decided to move forward and file our draft Environmental Impact Report. At the heart of the report was an alternatives analysis that investigated and evaluated the five upland alternatives as well as the offshore NOMES alternative. The report also included an essential fish habitat analysis for NOMES and an initial assessment of likely impacts.

Our MEPA certificate on our draft DIR from—we received in January of 2003 laid out a scope for fine DIR which—and to show the extent of the level of detailed review of this, it's a step from common practice and carried forward three alternatives for us to investigate. Two upland alternatives as well as the offshore alternative for us to further develop and refine.

Again, defining the scope for that biological study of the NOMES site, which was also included in that certificate, would be a big stumbling block. And in the process of trying to put that together, we were faced with an individual endangered species consultation, which last 180 days, so it added further to the delay of our project to the start of that work. The trolley component was the piece—the biggest piece.

As I said the, I'm confused, sorry, the FEIR, the Final Environmental Impact Report, our further refined the engineering analysis of two potential upland sourcing options of the initial five, as well as the detailed biological assessment of NOMES and its impact, potential impact on the site.

The engineering team did a remarkable job in investigating the upland alternatives. A really remarkable job of developing the engineering alternatives, and, in my mind, they did an extraordinary job of reducing the placement of the sand on the beach from an anticipated 18 to 36 months down to 5 months using the upland alternatives, theoretically. The only drawback to that is it required a 12-month mobilization period beforehand, but the real problem was that it remained extremely cumbersome and complex to pull off. This is with way too many critical opportunities for delay and partial failure, which could result in complete failure.

One of the things you heard earlier —better keep moving—the goal is to reduce the amount of handling of the material. So, getting the kind of material that is required through the process on to the beach at Winthrop was extraordinarily complex given the constraints of Winthrop, its location, the lack of marine facilities. And also, surprisingly, one of the other, and this should come as no surprise to folks who know that the environment—take notes, there's going to be a quiz on this at

the end—this is just to show the extent of trying to identify available marine facilities where we could stockpile and transport the materials. The team looked at everything from Searsport, Maine down to Bridgeport, Connecticut, and no surprise to anyone they're actually very few I think it was one or possibly two potential sources for that. So, it was extremely limited. And, again, this is given the constraints at Winthrop.

The upland alternatives are poor competitors with the hopper dredge for simplicity and efficiency. Obviously, this has other impacts. And we did receive, finally, a MEPA certificate for our fine DIR in February of '06, and with that we had a statement policy from MEPA and for the Commonwealth that beach nourishment and specifically beach nourishment using our preferred alternative NOMES was the appropriate solution for Winthrop, and a direction to work out the remaining permitting, which is what we've been doing since February of '06.

As of April, we've now secured all the necessary state permits, and we're under review for our Corps permits. The National Marine Fisheries Service has indicated to us their concerns over the potential impacts. We've also been required again to do an individual endangered species analysis that they're requiring to do that 180 days consultation will mean effectively we'll miss our window for construction again this fall. This has been a sort of ongoing saga. We have a small window of opportunity when we can do this work giving other permitting and environmental constraints. Once again, we're going to have to delay it for another year, which is a tough message to bring back to the community. We need to work with our colleagues and the resource agencies to address their concerns over fisheries.

Meanwhile, what's happening back at Winthrop. Whoops, NOMES borrow site. Back at Winthrop. A quick view this is the Pearl Street entrance at the beginning of the project in 1999. This is how the same location looked in January of '06—'05—'06, sorry, I get confused. January of '06. This is not storm action. This is just the result of two successive monthly high tides, which resulted in a substantial sinkhole behind the wall confirming for us our thoughts about the vulnerability of Winthrop. The goods news in this story is that we were able to act immediately and with support of other agencies, particular permitting agencies, put in a 600,000 emergency temporary fortification for the total of the wall. And the good news is we have not had until this spring any significant northeasters. This performed well. We have new sinkholes that opened up in last month's storm. (Bell.) Wow.

So, this is where I close to say that the issue is how can we communicate this to a community of 5,000 people whose homes and property and very often lives are at real danger, and how do we explain to them this continued process and the need for patience for what could prove to be at least another year and a half or so of permitting. That's my job.

MR. O'CONNELL: I really like this photograph. I've seen it many times in many places in Massachusetts actually. We'll see what happens, Joe. We'll keep track of that.

We're going to move a little south of Boston now, actually about 30 or so miles south of Boston, and go to Plymouth Long Beach. Sean Kelly is here who is a Senior Coastal Engineer with Applied Coastal Resource and Engineering. Since joining Applied Coastal in 1999, Sean has been actively involved in a broad range of coastal engineering and analysis projects including measurement and modeling of coastal processes.

Sean has conducted a shoreline case change studies where numerical models including GENESIS, and a shoreline model that he has developed himself were used to predict long-term shoreline response to the incident wave climate and assess beach nourishment alternatives. These engineering design studies include Cockle Cove Beach in Chatham, which we'll hear a little bit about later, Plymouth Long Beach in the Town of Plymouth, Winthrop Beach, and Juniper Island in Florida. I hope Florida's in January.

MR. KELLY: No. September.

MR. O'CONNELL: All right, Sean, Plymouth Long Beach.

MR. KELLY: Thank you, Jim. I'm going to give a brief overview of the design process that we use to find out, obviously, nourishment for Plymouth Long Beach. They're still in the permitting phases. It's still kind of in limbo. I'm going to also share my time with John Ramsey whose going to be able to provide some of the—more of the historical background of the project as it evolved.

So, Plymouth Long Beach is a barrier spit that protects the main basin of Plymouth Harbor from the open ocean of Cape Cod Bay. It's a spit that's about more than 2 miles long, about 12,500 feet long. Buried in that spit along the spine of it is a stone dike that was constructed originally at the turn of the last century mostly in the response to the Portland Gale of 1898, but prior to that they historically had problems with breaching of the spit sometimes large enough to drive ships through.

My bulk involvement began in 2003 in this project. We had in 2004 designed a beach nourishment that was intended to address areas of overwash that have developed relative to the condition of the dike the way it exists now with the secondary benefit of reducing recreational pressure on the mid-portion of the beach. On the northern part of the beach, which is a prime bird habitat, so the placement of the nourishment would be in this southern section, that's the area that's labeled the crossover, where there's a beach road that crosses over the dike. Most of the condition of the beach to the north its a pretty nice wide beach. In some places the dike is actually buried in 30 feet of dune. To the south, there are places where there's not even a mid-tide beach.

So, one of the major constraints that we had to work within when we were designing this is that the Town wanted to use an upland source in this particular phase of the project, which has some issues associated with it. This was a free source of sand because it was coming from Town property. The site was located only 5 miles inland on a highway route. It's off of Exit 5 on Route 3 behind the Home Depot in Plymouth. They've got their sewage treatment plant in there.

So, the way it was working out is that we had a decent amount of sand to do the nourishment in an area that was close to the beach. So, here's some pictures that I have that show the dike in the southern section. This is a section that was reconstructed in the 1970's by the Army Corps, but here already at this time we see a failure of the structure that allows an overwash that digs up the coastal road behind it. Here's another section of the southern dike looking to the south towards Warren's Cove. This is a large stone about 6 or 7 ton that was displaced in the 1978 northeast storm, and its been sitting there ever since. But you can also see—there's the coastal road—but the stone aprons that are part of the one big structure on either side of the main portion of the dike.

And here farther to the north at that area of the crossover is an area of the dike that was not re-

constructed in that 1970's effort, and you can see that the wrackline or the high water line is actually moved beyond the structure. I'm having a problems with that.

So, this is the route that was proposed between the borrow site in the Camelot Park area off of Exit 5 through a highway section that connects with Route 3A and then the south end of the beach right at Eel Pond or Eel River rather.

Part of what we were constrained with, and aside from using the upland source, was the project had to be completed for practical reasons within one winter season, which really limits us to the number of truckloads that we can get out there, which was estimated to be about 15,000 dump truck loads. So, by that we're limited to about 330,000 cubic yards of material that we can place on the beach.

Now, even though that we're trucking the sand, because the Town owns the source that we're using for the nourishment, the cost to the Town would only be about $9.00 per yard which is very favorable for this project to an offshore dredge project. Plus we get the extra benefit by using an upland source that we don't have to deal with the environmental—green environmental impacts that would occur from an offshore dredge project.

So, as we had the source identified, we're looking at it to try to do a compatibility analysis to make sure that the source is going to provide a good nourishment material for the beach. So, we do 7 or 8 transects based about a thousand feet apart along the southern section that we were going to be nourishing, did the grain size analysis. You've already seen these two plots. I believe this it the third time you've seen the bottom right. Through this analysis the material in the borrow site was shown to be compatible with the native beach. The native material on the beach is about .33 mm median diameter. The material from the borrow site was slightly coarser at .4 mm. So, generally, we've heard before today, nourishment material should be slightly coarser or equal size or coarser than the material that's native on the beach to ensure that we get a good performance out of the nourishment.

So, once we had identified the source we know how much material we have available to us and the design. The next step is to do a design analysis to try and optimize different parameters that we can use to define the nourishment—the length of shoreline work that we're going to protect—the width of the berm.

We know the volume of the material that we're going to use, but also we want to get as much design life out of this project to ensure that it provides adequate protection and doesn't get washed away within a few years. We'll do that to the best of our ability.

So, the analysis that I performed is based on publicly available sources of data beginning with grade data from the Army Corps of Engineers. They have a wave information study that provides 20 year old records for a number of different—hundreds of locations around the coastal U.S. This one, in particular, is from a station from an older study. It was located right off of Long Beach. We also use bathymetry data from NOAA and aerial photographs from Mass. GIS. All this input is analysis.

I have some wave modeling results. The wave model is used simply to determine how waves are transformed from the offshore site, which is that little triangle on the left-hand plot. So, you know

those wave events at Long Beach. This is just a finer scale model where we see how the waves—this is just a contour plot that shows larger waves indicated by red down to 0 foot waves as the blue and the arrows indicate the direction of the waves.

So, between using 32 model runs we are able to determine representative wave conditions along the entire beach, which was used as an input into a shoreline change model that was developed along the beach. The shoreline model is calibrated using long-term trends that were determined from the historical shoreline record, getting the shorelines from either aerial photographs or into the 1800's using surveys that were available in T-sheet form. And once we have calibrated the model, verified its performance, we use it to estimate the performance of any number of different design options that we can think of. What this particular one is just a small 1,200 foot nourishment, and this plot, the south end of the beach is to the left; the north end of the beach is to the right. This small dash line is the actual—the dike that's buried in the beach. So, we placed the nourishment in the model, and see how that evolves over this 10-year simulation period.

So, using these tools, the goal is to optimize the nourishment design balancing the length of the nourished shoreline. Obviously the longer the nourishment is the more shoreline that's protected or is nourished. In balancing that with the expected design life using, again, the limited amount of sediment that we have available from the upland source.

This whole plot shows just three different scenarios in another form. The one that we ultimately selected was a hundred foot wide berm that had a 4,500 foot length that used the total 330,000 cubic yards that were available to us. And this has—at the 10-year total period we expect to have it somewhere around 40% of the fill remaining.

At this point, I'll turn it over to John Ramsey who will give you some more of the background and the politics of the project.

MR. RAMSEY: Thank you, Sean. Dave Gould couldn't come I guess so I'm going to try to finish this off and at least give a little bit of background and history on the project. Plymouth has been working on this project for quite some time in various stages through the Army Corps. Originally put the dike in there to protect the navigation channel behind the beach.

In 1989 the Town or the Corps asked the Town to file Notice of Intent for the dike extension. Obviously, this is a structure on a barrier beach and DEP probably rightfully appealed that project. And since that time the Town has been trying to move forward with a design project of some type. In 1993 and '94, there was a design completed for a stand-alone 600,000 cubic yard beach nourishment with no source identified, but the idea then was probably to go offshore to Browns Bank or some other nearby site and dredge from there.

After that design was done, basically the Town went back and negotiated with DEP. And in 1997 they received a Superseding Order of Conditions which allowed them to actually go forward with the Corps project and extend the dike to 2,000—originally 2,000 feet now, the next was 2,500 feet, and, also, as long as they also did the beach nourishment, the 600,000 cubic yard beach nourishment.

After that time period, the Town went and looked for offshore borrow sites and tried to keep the permitting process rolling. This certainly has been quite a complicated project, and I think went

in capacity as far as the offshore borrow site. You saw that Brown's Bank borrow site; it turned out to be too fine and there was some other issues. Obviously, the same environmental issues that we heard about relative to fisheries resources.

Since that time and basically our involvement as the company started in 2003/2004, basically we were asked to come in, as Sean had explained, and design a project from an upland source. The Town had said we pushed this idea of an offshore source; we just don't feel like we're getting where we need to go. So, let's try to see if we can do this from upland. We actually had the opportunity. We have this Camelot Park site, which turns out to be compatible. We designed the project. Everything was going great. We actually, you know, the Corps had extended their design to a 2,500 foot extension site because more had eroded. You saw how that kind of shifted seaward, or I should say the shoreline has shifted landward more appropriately.

And, basically, at that point, we were moving to the permitting process and we—our local Order of Conditions was appealed by the homeowners out there who didn't want to see—they've been through the process in the 70's when the Corps came out and re-did the dike. They didn't want to see a big roadway with all the construction equipment coming down the beach again. So, basically, we were—in 2004 we were appealed, and then the remainder of this really has nothing to do with a beach nourishment project, sort of we've been on hold since 2004/early 2005 and now we've been trying to see what to do, so right now the Corps is going through the process of, you know, they finished their evaluation for the harbor navigation channel project, and basically that is just taking that material and dumping that, you know, in the least cost alternative where you're dumping it offshore. We've been working a bit with the Corps to say we actually want to try to use fill. The Town's made a deal with the County Dredge to use the County Dredge—the Barnstable County Dredge to come over and actually take the portion of material that is beach compatible and put that up on the beach.

That's actually the last slide. This is the channel that hugs the back of the beach right here. In this area in the Corps work, they determined that this area is pretty sandy. We went out and evaluated the material and it's not—certainly isn't the .35 mm material that we'd like. It's more in the .2/.25 mm range, so it's certainly not great beach nourishment material from a design perspective, but what we're planning on doing is looking into options for possibly using that as a dune just for what little shore protection we can get out of it. We have not looked at placing exactly what we are replacing but that's sort of where the process stands right now just to give you an idea.

And with that, I don't hear a buzzer, and I'm going to wrap that up. Do you want to buzz me? Do you want to buzz me? (Bell.) Thank you.

AUDIENCE: (Laughter.)

MR. O'CONNELL: We're almost 15 minutes over schedule. So, what did I tell you by 4 o'clock? I'd like to—actually, I would like to get the three speakers back up here again. We have to do it if you have any questions. I'm going to keep it from probably down to five minutes rather than ten just to see if we can catch up a little bit. But, again, at the end of the day we're going to bring all the speakers up and hammer them all at the same time.

MR. RAMSEY: Jim, my goal was to finish early so I could create habitat for bureaucrats.

MR. O'CONNELL: (Laughter.) So, this was presented on Public Projects. The next one will be the Private Projects. If anybody has any questions for Joe, John, or Sean feel free. I'm going to try to set up for the next topics.

MS. BOLEYN: Brenda Boleyn, Truro. Mr. Orfant, did I hear you say that you have a 180-day review period for the NESA review imposed twice within two years?

MR. ORFANT: Well, for two different actions. One, it was imposed the first time for the trolling component of our 12-month biological, marine biological study, and now as we're applying to the Corps for our permits for the actual dredge, NEMSIS is also required and individual assessment for that as well.

MS. BOLEYN: I see. Thank you.

MS. FREEDMAN: Janet Freedman. I'm kind of confused about why you don't use finer grain sand or very fine sand on these projects or even medium sand. It sounds like you reject because we've had very good luck on our projects using dredging tidal deltas and using that for beach replenishment by pumping, but we will pump it into the intertidal area and let the beaches fill themselves and those beaches performed very well even in this last storm where other areas had a lot more damage.

MR. RAMSEY: Well, I guess the short answer to that is what we want to do is look at what's compatible. There's nothing wrong with using fine sand if there is fine sand in the system and that is compatible with what's there. The problem is if what you're doing is you're nourishing with fine sand in some area that's much coarser, what ends up happening, you know, certainly from a design standpoint of shore protection, a lot of that goes off shore and doesn't provide the storm benefit, but it also goes offshore and actually covers over resources.

MS. FREEDMAN: See I would disagree. I think—well, it goes offshore but on the beach with fine or very fine sand it takes a lot longer to erode than just a lot longer to recover after a storm.

MR. RAMSEY: The question was answered.

MS. FREEDMAN: I find that the fine sand beaches are actually more stable than the perhaps --

MR. RAMSEY: Well, I think natural beaches that are fine sand tend to be very, very wide beaches and tend to be very stable. One of the examples I used very early on today was Nahant Beach. Nahant Beach is a great example of the very, very fine sand beach, and from a natural standpoint, that is very stable. What we're trying to avoid is putting fine grain sand on beaches that are relatively steep and coarse grain naturally because that doesn't work well. But if it is already a fine grain beach certainly fine grain sediment would --

MS. FREEDMAN: We have ones that have coarser sand beaches that as they break from medium sand, coarse sand, and fine sand that --

MR. RAMSEY: Certainly, it's part of the existing profile. It is certainly something you can use for nourishment. I was just more saying don't bring in something that is not part of it.

MR. WALSH: Mike Walsh with the Corps of Engineers. Just building on top of that chunk when we talk about designing shore protection beach I understand what you're saying about grain size, but from my perspective when I'm looking at disposal of and beneficial use of dredge material from a navigation project and I'm just trying to just get rid of the stuff really, I just need—

MR. RAMSEY: Understand.

MR. WALSH: —to find a place for it, and its a little bit finer than what's on the beach. I guess, you know, I'm struggling to understand why not put something a little bit finer on a beach. I'm just trying to get rid of it anyways. And I would expect it to be some beneficial—

MR. RAMSEY: Certainly there's beneficial use from a sediment transport standpoint. I think some of the things you have to keep in mind are obviously a lot of the environmental issues. If you put in a dune and you don't have a lot of Plovers and those types of endangered species concerns that that will be preferable because it's going to be more stable in that case if it's part of the profile as is mentioned, that's fine. I think, again, it keeps going back to the concept if you're going to use fine-grain material and it's not part of the natural system, then you need to find some place to dispose of it that might be in a dune as long as that doesn't harm things. Because if you put it in the active system, you're going to lose it very quickly, and then you're going to have fisheries issues. You're going to be covering over shellfish beds and all the other stuff that pops up.

MR. WINKLEMAN: Can I answer that, John?

MR. RAMSEY: Sure.

MR. WINKLEMAN: This is John Winkleman, Corps of Engineers. It also depends too on the system. If you have an inlet system and a natural beach, stretch of natural beach, the materials are going to be trapped in that inlet typically are the finer materials that get trapped in the inlet, you know, if you're going to a flood shoals. If you're dredging a flood shoal, it's probably going to be the finer material that came from that natural system. So, you're kind of reintroducing that material back to the natural system and that fine-grain was basically refiltered out from that natural system. So, that's part of the equation too you have to consider.

MR. RAMSEY: And I think that would be the most landward part of the flood shoal or the most seaward part of the upshoal would be the finer material, but it is part of the system. But if you were dredging the whole shoal, you'd get probably the same mix that you have on the beach. So, I mean, it should all be there. It's not just finer sand that's trapped in the inlets but it's the full—could be a full range. I know like North River we actually have cobble. It's put in the inlet that they've been dredging out quite a bit. So, I mean, you get the full range; it just depends on where you're looking.

MR. O'CONNELL: I have a question for Joe

MR. ORFANT: Sure.

MR. O'CONNELL: With the temporary $600,000 temporary protection project for the wall is there a need for beach nourishment?

MR. ORFANT: Absolutely, because as the analysis shows, we don't get sufficient protection against storm surges or flood overtopping. Those are real problems along there. And, of course, the revetment itself is a structure that's going to have to be maintained. And that's going to be undermined continually over time as well, as well as the wall, so, yeah, we could continue. That's always a fall back position. Go back, build the wall fortification and continue to maintain that and abandon the secondary benefit of the recreational beach, which sort of in our kind of focus on a public safety project, we've also sort of forgotten that there is a goal for recreational beach there, but obviously

that's quite secondary to the need for protection.

MR. O'CONNELL: The residents may not agree with you that it's secondary but—

MR. ORFANT: Right. Right.

MR. O'CONNELL: They could use another beach in Charlestown.

MR. ORFANT: Right.

MS. FREEDMAN: Janet Freedman. I just had a question on Winthrop Beach on those photos that you showed showing the erosion over time, do you get accretion there too?

MR. ORFANT: Well, there is a natural movement even in that sand-star system, and John can explain probably or Corps better than I can, but there is some. There's some return and there's a drift to the south. So, there actually is a fairly wide beach that's developed behind the breakwaters, the five sisters, but that northern end particularly is pretty well gone.

MR. RAMSEY: I don't think I need to add anything.

MR. LEACH: What was the cost on that total Winthrop project and is the Corps helping you with that?

MR. ORFANT: No. The Corps is not participating in this project other than regulatory.

MR. LEACH: And are you applying to them as was suggested?

MR. ORFANT: The Corps did a recognizance study on their 59 project back in, I think, '96, and they declined to participate in the project then. The project that the nourishment is between 7 and 9 million using the offshore dredge. The estimate for the upland alternative is 36 million, and the landside improvements are four or five million.

MR. LEACH: So that will be all borne by the city?

MR. ORFANT: All borne by the state.

MR. O'CONNELL: That was Tom Leach by the way from Harwich.

COURT REPORTER: Thank you.

MR. O'CONNELL: I have one last question if nobody else—this is for John and Sean. I just want to make sure that I get this clear. The Order of Conditions was appealed by a homeowner primarily because of trucking and impacts that they feel to their properties. You're in that appeal process now, and the Town is still moving forward?

MR. RAMSEY: We have—I don't want to speak for the Town, but right now we've sort of been on hold. The Town decided not to pursue the permitting right now, so we're still kind of in the holding pattern of appeal in deciding that, you know, the Town says that they want to go forward with it, but we really haven't actively moved forward.

MR. ORFANT: I was thinking in the time period since we had stopped the project too, the issues with the trucking have become a lot more difficult because there's been a substantial amount of development around the area of the borrow site. They've gotten a whole—a couple new strip malls and there's tons and tons of traffic. So, it would be a completely new thing that we'd have to look at.

MR. O'CONNELL: What's the time length before you run out of your—before the Town runs out of their ability to be able to not have to go back and start the permitting process all over?

MR. RAMSEY: You know, since we're under appeal, I'm not exactly sure what the—somebody from DEP—

MR. O'CONNELL: That might be a DEP question.

MR. RAMSEY: We're probably getting close.

MR. O'CONNELL: Okay. What's the time frame under—if the Town—the Order of Conditions was appealed? Do they have a time frame before they move on it, and then they have to go to square one and refile all over again?

MR. KELLY: Jim, one of the things is that they don't diligently pursue their issuing of the permit after a two-year period, and the appeal could be dismissed and the NOI dismissed. We've been giving the Town some extra time to decide what they want to do. At this point, there's no deadline for them to decide.

MR. RAMSEY: Can I have that in writing?

AUDIENCE: (Laughter.)

MR. RAMSEY: It is.

MR. O'CONNELL: There's a little flexibility and rightfully so to see if they can resolve it. Anyways, thank you, very much. We're going to move on to the next session.

MALE VOICE: It's called department discretion.

MR. O'CONNELL: We're going to move into the Private Project area now. I've got several private projects here. You're going to see a familiar face on more time. We've got Dead Neck in Osterville in Barnstable, and there's going to be a joint presentation here between John Ramsey, who you've heard a couple times, the Coastal Engineer with Applied Coastal Research and Engineering.

He's going to be joined by Lindsey Counsell. Now, Lindsey is currently the Director of the Three Bays Preservation a not-for-profit Watershed Advocacy Group based in Osterville. He's also the Riverways Coordinator for the Marstons Mills River and Chairman of the Town of Barnstable Committee Preservation Committee. He's the former Chairman of the Barnstable Conservation Commission, the Sandy Neck Governing Board, and Open Space Committee and Past President of the Barnstable Land Trust. We'll begin with John on Dead Neck in Centerville.

MR. COUNSELL: Actually, we're beginning with me.

MR. O'CONNELL: Oh, we're beginning with Lindsey, a new face.

MR. COUNSELL: Yes. Thank you, Jim. Three Bays actually owns and operates Dead Neck Island. There's two islands here. It gets a little confusing sometimes. This is the Dead Neck portion. There's a divide here and this is Sampson's Island, which is owned by the Audubon Society. Sampson's Island is about 35 acres, and Dead Neck's about 85 that we maintain.

There's a lot of activity out there in the season. We get over a thousand boats a year on the Dead Neck side, and it's really an important resource for the neighborhood for the area for beach use.

The thing that Three Bays has been able to do is to build these partnerships that you've heard about. It's really important for us to reach out to the community through speaking engagements; we do walks on the beach, and we do significant numbers of mailings. And obviously out there we have our beach users, folks that we see all the time, but there are other groups that we've reached out to over the years, one being the Local Land Trust, which I was heavily involved in, and in the past they've been great partners with us in some of our watershed work.

But other groups that you might not suspect that use these areas is the Local Bird Watcher Groups. One surprising party that we came upon was a local Anglers Club. Guys that have been out fishing these areas for years. I spoke to them on a number of occasions, kept them abreast of what we were doing, and it was really an important thing for us to be involved with.

Another surprising partner was the yacht clubs. One of the things the yacht clubs do is they have youth sailing programs, and it's the young kids they like to have sort of different activities for, and we get them out there on the beach to show them what the beach nourishment program is, to show them the wildlife, the little plant communities and the animals and the shore. So, it's a great opportunity to reach out and then, of course, we speak to the adults at evening meetings to let them know what we're doing out there and fill them in on our activities.

Other groups that are obviously important are landowner associations, folks that have a vested interest in the area. But some other surprising people that have come along through the years is the recreational shellfishers for example. In the Town of Barnstable they have a recreational group that I think is 500 members now, and they're very active in the area. Also active in our area is a number of aquaculture grandfolks, and the shellfish committee in the Town, and the Town staff. All groups that are important that we keep informed of what we're doing on the beach, when our projects are, and what we're planning to do out there.

And, obviously, the last group that's very important is our local waterways committee. They're very important. The harbormaster and those folks, but also another group that we've recently reached out to is the Village Associations in our area. They're critical partners for us as well.

One of the surprising things that we did early on and we were fortunate to partner with Mass. Audubon, the Coastal Waterbird Program was to identify the resources. You've heard a bit about that earlier. Your upland wild life uses, your aquatic species, and your plant communities, but one of the things we realize is that the island really needs day-to-day monitoring and constant monitoring to keep up with what was going on.

And you can see, and then with this slide here, right after a storm some of the snow fencing failed, and as Scott Melvin had mentioned, you know, you've got to get rid of all that stuff. You have to stay on top of it because that seriously impacts the wildlife using the area.

In terms of the funding, we've been fortunate enough to partner with the Town of Barnstable, and we have done a lot of work with them—with the County Dredge. And the way we work that three days is we provide the permitting in our area. We get the permits to do the navigation channels, and then we partner with the Town on the work. But also we've all been able to secure some private funding as well through private grants and foundations and that's been quite successful. Folks that are interested in environmental protection we've reached out to them, and they provided some grant money.

But the other one that's happened most recently is we've worked with the Landowner Incentive Program out there partnered with Mass. Wildlife, and they're now assisting us in the day-to-day management. That's an important component because we do work with the Coastal Waterbird Program. They manage the birds, and we manage the day-to-day operation of picking up trash and meeting the folks. We've been able to build a good relationship out there so the conflicts when we go for permits really have been minimized. Thank you.

MR. RAMSEY: And I could probably at this point completely say the same. That's okay. You're going to have to suffer just a little bit more. I just want to talk a little bit about the history of beach nourishment. Here, this, on Dead Neck, is probably the, I guess, maybe poster child for remaining the longest actively maintained beach nourishment project in Massachusetts. Certainly, you know, it falls in that kind of moderate level. It's not a huge beach nourishment; it's small, but it's on the Nantucket Bay or the Nantucket Sound side of the Cape. Therefore, it doesn't have a huge transport.

But one of the things we've heard about is Revere Beach is a good example of a more open ocean beach that has survived for 15 years, this kind of design life that's ideal. One of the things it's great if we can make it so that we're not having to nourish all the time. You know, you mentioned the right kind of material. If you get the right kind of material, the right design; therefore, we get a good design life out of it and some of the fisheries issues go away. If we're not coming back every 2, 3, 5 years for renourishment.

The history here, 1985 was the first nourishment that was done here. It was about 120,000 yards. It was dredged from an offshore site, offshore of Dead Neck in that area that was known as, I guess, Bass Hole, and a lot of people go out there and go fishing. So, I think it's still even eelgrass that's out there now. I was very involved with that before my history here.

But that beach nourishment basically lasted for 14 years, not really didn't completely last 14 years, but somewhere around 10/11 was looking like it needed to be renourished. A second nourishment was done in 1999 with 212,000 cubic yards. And that material was dredged out of both the Cotuit main entrance, which is to the west and the West Bay Cut, is to the east, and some of the navigation channels in the estuary.

After the '85 project, this is the east end of Dead Neck, the area that's nourished. It's about a 2,000 foot-long stretch. As you can see, this area was to the point where it was getting breached. You know, very poor condition, and one of the things is this is a natural barrier beach. What we do is we have obviously a lot of expensive property behind here. There's not just expensive property, it's basically unarmored property. You know, if we let this resource go away, what we're going to be looking at is ending up having those people behind their armor and we lose that resource for shorebirds, etcetera.

After the nourishment in 1999, obviously, that area was widened quite significantly. There was about 200,000 cubic yards of materials placed there, again, medium-size beach nourishment, and the whole idea is this is one of those systems that the sediment transport trends are actually opposite of what now most of the Cape is because of orientation. Basically, this material actually wandered back towards the west and ended up going back towards Cotuit Bay entrance. So, the nourishment of material here is anticipated that it would migrate towards the top of the picture.

But, basically, where's that laser, we've been monitoring this since 2002. We've been doing

shoreline surveys. This is kind of the results of the shoreline survey between 2002 and 2006. This is the nourishment area. The reds and the oranges are areas showing us that this area is eroding. The highest version actually is kind of in the middle of beach nourishment. Then this area generally relatively stable, and then we're seeing a lot of accretion towards this end. I'm not surprised the material migrates on the beach.

The rates that we're looking at, the worst rates are somewhere around 15 to 25 feet per year in migration, but, again, as you saw, there's a very wide beach nourishment and it's certainly meant to erode about that rate. This is just looking at the different shorelines. You see the September 2002 shoreline, the first one we did, and you see the study propagation of the shoreline factor. Again, the biggest loss is somewhere in the middle area.

What Lindsey had shown is we have an, obviously, a reduction in beach width but also the dune scarping. One thing that we certainly need to deal with is, you know, when we do have a major blow like we had over the Patriot's Day storm, we certainly get a lot of dune scarping. Over the summer that tends to kind of fall back maybe not to Scott Melvin's satisfaction as far as slopes, but certainly this type of habitat is worthwhile.

The one thing what I should point out, Scott has shown the bird numbers going up and up and up. One of the things we see at Dead Neck is the numbers are actually going down a bit, and likely to that is because this area has become more and more stable and gets more and more vegetated. So, keep that in mind. What it means, obviously, is that in the future we always want to make sure that they're on unvegetated areas which are certainly more beneficial for shorebird nesting.

Again, these are really sexy non-colored graphs are actually the best ones here for us engineers but horrible for everybody else. Again, we see this is erosion. This is the west end; this is the east end, and this is just looking at different profiles—actually monitor profiles. This is cubic yards of loss. Again, it would be great if we could go all the way up to depth of closure, but this is a wave-type survey. It just gives us a general idea of how the beach nourishment is performing. And, worst case scenario, we've lost about 400 cubic yards per foot right in the middle.

If you look over at East Bay or the east to the West Bay entrance, the reason why we don't have much erosion here is usually you get most erosion at the ends is basically we're protected there by the jetty. And this area you don't get erosion as much because transport is from this—here to here. And, so we end up seeing is that the material that's eroded from here is actually traveling through here and we don't get as much erosion on that end of the beach.

This is another one of those energy plots. This is we had about 200,000 cubic yard beach nourishment at the beginning of this. The following year they actually did a little bit more, but this kind of shows how that beach nourishment is performing. Basically, right now we're down to about 120,000 cubic yards left out of the 200,000 cubic yards we initially nourished.

We're actually starting to move forward with some permitting efforts. Obviously you've heard through this whole process that the permitting tends to be a relatively long process. And, certainly, we had the offshore source. We've kind of done all the dredging and all the navigation channels around, and we're looking for a new source of sand.

One thing that's sort of become obvious to everybody whose out there is the Sampson's Island,

which is that separate island all the way at the west end has been progressively migrating getting larger with or without the beach nourishment is what happened because it's a trend that is extended back into the 1800's. But it's getting to the point where the homeowners over here have started losing some of their groins. The ends of the groins are actually falling in the water, where it use to be 2 or 3 feet deep at the end of the groins is now on the order of 20 feet deep. People are now swimming across it, so it's just becoming a safety hazard because this is the main way in and out of the system during the summer, so kids swimming here is becoming kind of a danger.

And, basically, this is going to continue to migrate here. Is it going to ever pop through or connect and close out the other inlet? Probably not. But at the same time it's gotten to the point where it's starting to effect the water quality and efficiency of that inlet channel.

So, what do we do? One of the things that we've been looking at is historic trends on navigation channel that used to go through here in 1947. That spit was given—that spit was actually cut off in the dredging project to get that channel back where habitable. They're probably having similar problems, what we're having probably not quite as, I guess, erosive as it has become. But it certainly is something that has been done in the past.

So, basically, what we want to do is restore this channel back to this area. We want to take this much material that everyone's talking about and back-pass it back to the nourishment area. But in addition to this, partnering, etcetera, that Lindsey talked about, Audubon, we're looking at developing bird nesting areas, which has been done at the County Dredge before bird nesting areas on Sampson's Island. Again, covering over the beach grass and making it so it's good for nesting habitat.

Another idea that we're still looking in to see right near the back and actually it's better shown on the next slide. Right here in the back area here is where a lot of people come in with boats and put them on shore and then walk across over here and take it down to the recreational beach. The idea is that we're actually talking about late use of the material and actually widening this resource, widening this beach to keep people actually out of the dune areas. No matter how much fencing etcetera and encouragement or discouragement you may have people—people still want to wander in there. So, if you can make that resource more recreational friendly, we're hoping that we keep the people on the backside.

Right now we're in the process of actually just evaluating this. The survey's been done. We've actually taken all this—all these colors here to look at how much material we can start looking—we'd look at. These are the—this 1947 channel marked in yellow and the 1934 channel is actually marked in orange. These channels previously did exist, and we'll try to permit this hopefully as our maintenance dredging project rather than some sort of crazy barrier spit with our dredging projects, but we'll see how that goes and we'll condition the permitting process probably sometime late in 2007.

And, with that, I'm done. Thank you. I still beat it. (Bell.)

MR. O'CONNELL: Thank you, John. Do any of the regulators want to offer an opinion on that project? I'm sorry. I've been in this business too long myself. Well, let's continue with these Private Projects. We're going to go to Long Beach. Didn't we do Long Beach earlier today? No.

MS. FIELDS: A couple times.

MR. O'CONNELL: We're going to do Long Beach not in Plymouth this time, but Long Beach in Centerville on the south side of Barnstable. We have Leslie Fields, our Coastal Geologist with over 20 years experience in the area of Coastal Geology and Coastal Processes Evaluation. She currently works at the Woods Hole Group where she specializes in analyzing shoreline change, anamorphic evolution of coastal systems, coastal hazard evaluation and mitigation, environmental impact analysis, GIS development, and permitting.

While at the Woods Hole Group, Ms. Fields has designed, permitted, and conducted a number of beach nourishment projects located throughout southeastern Massachusetts, and you're about to hear about one right now which I would suggest might be a successful one. So, show us how it's done.

MS. FIELDS: All right. Thank you, Jim. I'm going to be talking today about a beach nourishment project that the Woods Hole Group designed, permitted, and constructed back in 1990. And it was one of the earliest beach nourishment projects on Cape Cod preceded only I think by the Dead Neck project that John just spoke of. So, I'll be talking about the Long Beach nourishment project in Centerville.

Centerville is located in the Town of Barnstable on the south shore of the Cape. The project site is near the center of a coastal embayment that forms Centerville Harbor. To the west we have the Wianno headland section. To the east we have Squaw Island Marsh system and further to the east Hyannis Harbor. The project area is located on the Long Beach barrier island right here, which protects the Centerville River and the East Bay estuary system. The Long Beach barrier island, the western half, is undeveloped and in a natural state. The eastern 28 and 2,900 feet or so is developed with homes but seasonal and year-round homes.

And then immediately to the east of the project site is Craigville Beach, which is one of the Town of Barnstable's largest and most heavily used recreational beaches.

Long Beach has a history of shoreline erosion as can be seen here by this diagram. Red indicates erosion, blue lines indicate erosion. These are many that were derived from the CZM Shoreline's Page Database. So, over here to the west of the project area, the Wianno area, we have long-term erosion. Over the period from about 1844 to 1924 as we move closer to the East Bay inlet area, we see an area of accretion that's attributable primarily to the construction of jetties back in the late 1800's which have acted to impound sediment moving from west to east, which is the dominant direction drift in this area.

And in the Long Beach area we have long-term erosion and erosion decreases from west to east, great for erosion at the western end of a natural land on the order of 1.6 feet per year towards the center of the embayment where the project site is. Those rates were around 3/10's of a foot to 5/10's of a foot per year over the long term.

And then as we move into the Craigville Beach area and further east there's—the area has experienced 1 foot accretion.

So, what have I done in this area to combat that erosion? Over in the Wianno area back in the 40's they constructed a rather large groin field in that area, and then, as I said, the late 1800's they built the jetties at the entrance to East Bay. Those jetties were extended in the mid-40's and 50's. And

then over in the project site in this area here the homeowners built a series of revetments, bulkheads, seawalls in the mid-60's, and one person actually constructed a groin in the 70's so that's this area right here. So, overall, again, just long-term erosion in the Long Beach barriers that complex.

The Woods Hole Group was originally contacted by the group of homeowners along the developed section of Long Beach with concerns about erosion. This is an aerial photograph from 1989 before the project was constructed. You can see the sort of straight line along the beach here. That represents the series of revetments and bulkheads that were built to combat the erosion. You can see the narrowness of the beach. In many places, beach width is less than 10 feet, and in many cases where that beach was very narrow, there was a structure that started to deteriorate. So, the homeowners were faced with either fixing the structures or some other alternatives. So, they came to us to find out, you know, what can we do?

This is just another aerial photograph, an oblique aerial photograph showing the site before we came in and filled the project. You can see the groin here, downdrift erosion on this side, very narrow beach, and on the updrift side the beach was also very narrow in this area and the structures are definitely exposed subjected to wave activity during storms.

And, again, just a couple more pictures before the project was built. The top photograph shows the area to the west of the groin. You see some build up on that side of the groin, but we see a very severe downdrift offset and erosion on the east side of the groin. Further on down the beach, we can see the line of revetments here, and at high tide we've got a very narrow beach less than 10 feet.

So, we took a look at the site and asked ourselves is this the place where nourishment is suitable, and we came to the conclusion that it was a good candidate site for beach nourishment for a number of reasons listed here.

First of all, that the site is near the center of an embayment, and so it would experience less erosion than you might see say at the updrift end of the project site. It's also somewhat sheltered from southwest winds and waves by the mild headland here. And that the developed section of the barrier in the middle, which we're really mostly interested in, was also downdrift of the natural section of the barrier which over time would act as a feeder for the nourishment site.

As far as the design goes, we came up with a design that would protect the existing structures and the upland areas behind from storm activity. It was a design that would provide a recreational beach, and it was also one that we hoped would last 7 to 10 years before there were considerations for renourishment.

One of the only constraints we had was that we didn't want to build the nourishment any higher than the crest of the existing seawalls and revetments so that limited us on the landward side of the design. With that consideration, we were able to build a berm crest to an elevation of +7.5 feet about mean low water. The berm width was designed to be anywhere from a hundred to a 60 feet, so we're building the beach out about 100 to—about 160 feet seaward of the existing walls. We designed it with a 10:1 seaward slope to a natural grade, and using these conditions in most areas that amounted to a fill of about 32 cubic yards per linear foot.

As far as the nourishment layout, we actually permitted nourishment along the entire Long Beach barrier or along most of it I'll say. So, the nourishment was permitted over 6,500 feet of the

barrier. That particular design needed 300,000 cubic yards of material to build. We also permitted an offshore borrow site which is shown by this shaded area here. And there were a number of things that we looked at when we designed that or a number of criteria

One of them was that we tried to maximize the areas that were already being dredged for navigation purposes of the East Bay inlet, so that's this little segment right here. And then we also selected these parts of the borrow site out here because of the compatibility of sediment and quantity of sediment that was needed.

And the third criteria was we knew that we were going to be using a hydraulic cutterhead dredge, and we wanted to stay within about a mile of the project site in order to minimize cost. And, so, this particular end of the borrow site here happens to be about 3,000 feet from this end of the developed barrier and about 5,480 feet from the other end. So, we needed a booster pump about halfway down the beach as we started building it.

Timeline. The homeowners came to us in 1986 with the problem. We did the design and environmental impact analyses. We moved into the permitting, went to MEPA, EIR was required once that was accepted. We went through Conservation Commission and DEP, CZM, Army Corps, and then finally in January of 1990 we were constructing the project. Overall it was a two and a half year time period. I think compared to today's time period if we were trying to permit an offshore borrow site this is record speed compared to today's time schedules.

Okay. Construction. Just a few quick pictures of the construction in January, 1990. Of the 6,700 feet of beach that we permitted, we only really nourished about half of that or 3,000 linear feet of beach. We put 90,000 cubic yards of material on the beach for an average fill of about 32 cubic yards per linear foot. We were able to move mean high water seaward by about a hundred feet. Total pumping time was 22 days for an average pump rate of 5,500 cubic yards a day.

Just a couple of pictures of before and after. These photos were from the western end of the project site. You can see the seawall here. This is about 7 or 8 feet in height right here, and the beach went here up to the wrackline is less than 10 feet. And then after the project here's that same seawall. We've got about 1 foot of it showing here, and the beach width is about 100 feet. We also planted the landward end of the project with beach grass, part of it dune growth and just sand trapping.

Two more photographs before and after from the air. This is that same photograph I've showed before. You can see the groin in the middle of the project here with the downdrift erosional offset. You can also see along this portion of the beach the exposed structures, and all those beaches are covered in the after photograph. This was taken about, the after photograph, about 6 months after the project was constructed.

Monitoring. We were fortunate enough to be able to monitor the project for about 5 years after it was built, and this graph right here shows some of those results. Along the X axis is just distance along the shoreline. This is the western end; this is the eastern end. Along the Y axis you have volume and cubic yards per linear foot.

So, the black line shows what we built there in February of 1990. You can see that we put in fill from about 1,500 all the way over here to about minus 1,300. Most of the fill was placed right in the center of the project area. Then we came back in May 1991, about 1.3 years after the project was con-

structed. Survey showed that we had about 90% of fill remaining at that time. That's shown by the red line. We've had erosion or retreat of the shoreline right in the middle of the fill area but we also had spreading at the end, shown here by the red line above the black line. More spreading towards the east in the downdrift direction as would be expected.

Then in June 1992 we came back 2.3 years after the project was constructed. At that time we had about 82% of the fill left. Again, we have erosion mostly right in the center of the project with a little bit more spreading in the downdrift direction.

Then May 1995, five and a half years after the project was built, we had 66% of the fill remaining. That's shown by the green line, and the trend pretty much continues. More erosion in the center with some continued spreading in the downdrift or easterly direction.

Now, I don't have the 1998 survey data plotted on here but about 8 years after the project was constructed, those data show that we have about 60—more like 58% of the fill remaining about 8 years after the project was built.

At this time, so in 1998 the homeowners got together again and decided that they wanted to renourish the beach partly because in some areas the beach was eroding back and becoming quite narrow again in a few areas but also because there was equipment here on Cape that can do the work. The same equipment that did some of the Hyannis Harbor dredging and the countless beach nourishment that was shown earlier.

Costs. January—the cost of the project was borne completely by the Long Beach Homeowners Association, so it's completely privately funded, and it was paid for primarily by the oceanfront property owners. The riverfront property owners were asked to contribute whatever they could towards their beach partner directly in front of them. So, that's how the Homeowner's Association worked that out.

Cost of the 1990 nourishment for construction were $340,000 for a unit price of $3.77 dollars a yard. For the average property owner, a beachfront owner that owned a 100 foot lot just imagine about $12,600 with hopefully a contribution from their riverfront partner behind.

In 1999 we placed less material, about 59,000 cubic yards as opposed to the 90,000 in 1990. That cost $300,000 for a unit price of $5.08 and to that property owner who owns about a 100 feet of frontage that amounted to about $11,110. On top of those costs the engineering design and environmental permitting costs were around 15 to 20% of the construction cost. And compared to today, 2007 cost, if these folks were to try to hire the Barnstable County Dredge, and I hope I'm quote this right, Wayne, those rates would be about $6.50 a yard, or if we were to truck it in from the upland they might be paying upwards of $25 a cubic yard. So, the rates have really escalated over the last 10 to 15 years.

And, in conclusion, the project has been a very successful project with benefits that included improved storm damage prevention, improved recreational resource, increased property values. The homeowners have been educated about the need for this sort of project and the importance, and as such, they're planning for future renourishment in this area through fundraising and also trying to identify new borrow sites. Thank you very much.

MR. O'CONNELL: Just in time. (Bell.)

MS. FIELDS: Thanks.

MR. O'CONNELL: I guess my 85,000 e-mails to the speakers saying please keep on track. We've overburdened everybody with a number of speakers. So, I e-mailed them repeatedly saying if you go over, you're taking time from your neighbor, so I guess aggressive behavior works sometimes; other times you get thrown in jail.

All right. Our next speaker is Les Smith. Les is going to be talking about the Sconset project on the eastern shore of Nantucket. Les has been an Environmental Consultant for the past 30 plus years. For the last 10 years he's the Founding Principal at Epsilon Associates. He's a noble Commissioned Officer. He also worked for the State Coastal Zone Management Office in the late 1970's. And as a result that's when the Wetland Protection Regulations was actually written and promulgated. He was one of the co-authors of the State's Wetlands Protection Regulations.

He was also head of the Scientific and Engineering staff at CZM at that time in the late 1970's, which I think was a pretty difficult time because they had the Wetlands Protection Act, but they didn't have the right implemented regulations. I guess there was a lot of flexibility in reviewing projects at that time.

This guy, he does dredging analysis called the Coastal Wetlands Evaluation, Chapter 91 Coastal Erosion and Analysis, and he shares the Co-Chair of the Technical Committee of the Duxbury Beach Reservation, the not-for-profit owners of the four and a half mile Duxbury Beach, which is a pleasure to go to. Actually, their reservation just released a book called the "Duxbury Beach Book" with nine chapters starting with the geological history all the way to today available for purchase if anyone's interested. How does that sound?

So, Les, he was previously on the CZM Advisory Board, and he's also on the Boston Society of Civil Engineers Waterway Group. And with that, Les, let's hear about the eastern shore of Nantucket, probably other than with the National Seashore one of the most exposed areas in Massachusetts of the seashore that's not developed.

MR. SMITH: Thank you, Jim. I'm feeling very old. This has been a very interesting and exciting project. It's still ongoing so it's still exciting. I have a great team. Epsilon is in charge of the proper permitting aspects of the project.

Coastal planning and engineering. We have several folks, Rick Spadoni, Sandy Tate, and Tom Pierro right back there. If you have any tough questions, they'll answer them. Also working with Normandeau Associates; they're doing fisheries work. BlueWave is involved in simple fisheries, mitigation, and permit strategy work. It's a very good team. Don Duos and Steve Barrett of BlueWave and Mike Shure and Jodi Pagliar at (Inaudible.)

Here's the outline of our talk. Talk about project purpose, our alternative analysis, various project elements, our schedule, how we characterize the environment, the impact analysis we did, our proposed mitigation and monitoring, and the outreach and status of our environmental review.

The purpose is to protect 3.1 miles of eroding shoreline on the East Coast of Nantucket from—I forget how to work this thing—up here at Sesachacha Pond down to Codfish Park. And then there's an element here and also in front of the Town sewer beds.

The alternatives we looked at similar to what we've seen in some of the other projects. I think Winthrop's been through a similar analysis, a do nothing. Obviously, that wasn't too attractive to our clients. This is actually—this is funded and the project proponent of private landowners, this is the Sconset Beach Preservation Fund, I should have mentioned that earlier.

Other alternatives we've looked at: retreat, armoring, bank stabilization, and the preferred alternative which we all know decided on as beach nourishment. You've heard a number of these in the past. Why do nothing? Why not do nothing? Take a look at what the top of the coastal bank has done or actually projecting its going to do, this is based on looking at historic records of the top of the coastal bank, and we're projecting by the year 2025 that the costal bank line will be back here at the edge of Baxter Road. There's a number of homes along here you probably can see it will be gone by that time. Also, the road, obviously, will be starting to be impacted, so these houses here have no way of getting to their houses. Obviously, there's some severe implications of doing nothing.

Retreat alternatives. They have been retreating. They've been moving houses over the last number of years. This was one that was move not too many years ago. It's right just off of the lighthouse. They're actually proposing to move the lighthouse as well. So retreat is a reality out there. They're running out of land to retreat to.

Structural alternatives. We certainly have looked at those over the years, and the project proponents that we're looking at alternatives for a number of years and implementing some alternatives, but it's to the point now where beach nourishment appears to be the preferred alternative.

Look to seawalls or revetments and there's no doubt you would understand this is off of Long Island and this revetment or seawall has no beach in front of it now. Obviously we've heard about how you have to have a sediment source for our beaches, and if we were proposing like this today, we would still need a beach nourishment because we would need to provide a sediment source.

We've heard about the Winthrop breakwater and that structural solution, obviously needs a beach with it as well. We've looked at groins. We've looked at geotextile tubes as components for the project, but based on kickback from various environmental regulatory officials and also in terms of the project design, we've decided to eliminate those from the project.

But also one component of the project has been bank stabilization using geotextile fabric and bring the sand in from upland sources or build up terraces in front of the properties in front of the coastal banks of the properties.

This is the, I guess, it's what's being referred to as the Patriot Day Storm or Patriot Day Plus and Minus Storm. It took out the coastal bags that had been constructed here. As I mentioned they're sacrificial. Fortunately, behind those terraces the houses weren't really impacted. There wasn't too much bag retreat.

The adjacent properties that didn't have the terraces had some significant removal of total coastal bank and slumping and some up to 30 feet of loss. But as a stand alone solution bank stabilization isn't going to do it. It's sacrificial. It needs to be done in conjunction with a larger project.

So, what do we look at? We look at the sand source alternatives. We looked at an on-island upland sources. They're very limited. We've been using up on-island sources for our terraces. Do we

know a lot about those? I've actually been going to off-island sources for some of our terrace work. We looked at dredging projects. Other problems with location, none of them are nearby. Obviously we've heard that everybody likes to nourish their beaches with sand and dredging projects, so they weren't about to recommend that sand right out to Sconset.

All I can say is the type of volume we're talking about 2.6 million cubic yards. I think this is probably the largest project we've heard today. A lot of sand is needed so in terms of off-island sources, we started looking at the timeframe. It was like 2 to 13 years to bring the sand in; 44 to $100 million to bring the sand in. Environmental impacts of 130,000 truck trips to bring the sand in.

There are two possible ways to bringing the sand in we looked at, One was to bring the sand over to the Steamship Dock and then truck it to the source or to the nourishment location. The other is to bring it in by barge and to off-load it there.

And after doing those evaluations, it was determined that both the truck traffic, the use of the Town ferry dock would basically be dominated by this type of activity. So, that would be unacceptable.

And I noted bringing it in by barge. The type of barges we would use would basically dominate all the barges in this region for this type of effort for 2 to 13 years depending upon—which technique we use. If we went with that type of approach, we'd probably need to put some sort of structure in and that would result in downdrift effects as well. So, we resulted in selecting the offshore borrow site as the preferred source.

We also needed to look at the grain size characterization. We hear a lot about grain size earlier. We did a number of transects shown here. Two hundred samples from the bank, dune, beach, and nearshore showing the distribution of samples straight from—whether we had dune areas, which is down this portion where the red profiles are, three's on the beach. Looking at high bank we took three samples, three from the beach; low bank, two samples, and three from the beach. We also took some usual samples.

And here's what we found. The coastal bank grain size .4; a lot of silt, 13.6 silt, grain size of the dune, the beach. We (Inaudible.) surf zone starts getting in coarser, obviously the silt content gets reduced. Offshore is somewhat coarser as well, low silt content. In terms of the mean grain size and also the median was very close as well, .83 mm and a 2.8% silt content.

So, we looked at where can we get the sand? We looked at a number of different offshore borrow site locations, a number of these different shoals out in Nantucket Sound, and a number of these off of Sconset including the preferred one with the ultimate selected.

Here's an exclusion of a criteria that we ran on the project. Basically it came down to grain size, and you can see the grain sizes here. The preferred borrow site we ultimately selected at a .86 which is very, very close to our beach. If you remember that was .83. The other grain size is we're going to borrow—potential borrow sites were less. And then this primitive rip was explained to the heavy charter and commercial fishermen, whereas our selected borrow site had no exclusions.

First project elements and we'll be coming back to the borrow site a little bit later. Various project elements I included beach and dune nourishment, dredging sand from an offshore borrow site,

and the coastal bank terracing.

In terms of the beach nourishment that extended again from Sesachacha Pond down to Codfish Park 2.7 miles. And then we have in terms of a cross-sectional area, we have a design fill of 1.1 million cubic yards and then advance fill of 1.4 million which is a sacrificial portion of the building.

The dune element. The dune down at Codfish Park is going to be constructed on a 10 foot, excuse me, 1,100 foot section of Codfish and then an 800 foot section down at the Town sewer beds as a cross-section of the dune.

In terms of our offshore borrow site, the one that was selected here is 2.9 miles from the shoreline, water depths of about 30 to 60 feet, dredge cut of about 10 feet, again, perfectly compatible sediment with the beach.

Here's a plan view and a one-cross section view of the borrow site. You can see the cuts are in the neighborhood of 10 feet some a little greater depending upon—you see some little sand variable locations—very, very active area, high currents in this area.

Our coastal bank terraces with a cross-section of what they look like. I showed you the ones pre-Patriot's Day storm. You can see including geotextile fabrics and vegetative plantings.

Our project schedule. We have a time-of-year restriction of winter flounder that restricts us to the end of May. We are assuming construction starting early June lasting to November. We have Plover nesting, and we'll get into the Plover nesting, basically, at the extreme ends of the project so we'll be working from the middle and then working north or south from the middle.

Our characterization and impact analysis involve looking at a physical characterization modeling.

Fishery resources. Shore birds and rare waterbirds and historical and archaeological.

Under physical characterization and modeling we looked at sediment characterization. We've talked about that already. Waves, tides, currents and modeling, sediment transport, and budgets, and then turbidity sampling and modeling.

This is the modeling of a wave height analysis that was done by CP&E, and they looked at the 50 year storm. This is the borrow site out here. And these are heights, and basically we're not seeing any changes within certainly a mile or so of the shoreline with this 50 year storm. There's actually a reduction in this out here of wave heights.

Also looked at wave direction analysis. Also the direction changes are pretty limited to nearby the borrow site.

Sediment budget and transport. The middle of the project is right in the nodal zone. We're getting 62,000 cubic yards moving south, 153,000 cubic yards moving north.

Turbidity. Now sampling. We were all sampling before the Patriots' Day storm, and we see it after with the YSI meter. It shows the sampling days again, so the same locations. We're finding that the turbidity, the average turbidities after the storm were at 40 to 50 TSS before the storm in the high range. The maximum ranges were somewhat high as you might expect 30 before the storm and

up to 115 after the storm. So, very, very high turbidity just under natural conditions.

We also model turbidity. The model of turbidity out at the borrow site basically with the assumption—the model had assumption you had a 10% silt. Our borrow site only has 1%. We still are finding that the amount of turbidity was less than 30 NTU's.

And then 30 minutes after the hopper dredging stops it basically dissipates to next to nothing. In the nearshore we looked at turbidity during flood tide, and then I got an ebb tide, and, again, less than 30 NTU's.

Shorebird nest and nesting areas. I mentioned before they're at the extreme northern end of the project area and the southern end, so we can work from the middle and then work in each direction from there.

Marine waterbirds. We'll be doing surveys of waterbirds. We've talked to Bob Kennedy, and on-island ornithologist. Basically, doing a number of boat transects. There are extensive populations that use the shoal during the winter months. The borrow site has a depth of 30 to 50 feet which is below the depth of diving of a lot of the ducks. The long-tailed duck was the predominant bird species that we found. We're continuing those surveys today. Basically, the borrow site represents .08% of their available foraging habitat, and we only found one occurrence of a threatened species, which was one occurrence of the loon species.

Fishery sampling. Excessive fishery sampling—how much time do we have?

MR. O'CONNELL: Less than a minute.

MR. SMITH: Okay. Maybe run through it very quickly. Accessing fishery sampling program shown here, benthic sampling, sampling of the water cone, bottom sampling, shellfish surveys. Here are all the survey locations both at the borrow site and nourishment location.

We did nearshore size scan surveys, identifying existing cobble habitat conditions, dive surveys, finding cobble in the nearshore going out to about 100 feet offshore getting more complex with depth. Basically borrow the mitigation monitoring that's discussed earlier in avoidance minimization, know that loss of wetlands, and we're proposing to mitigate for that cobble habitat, those impacts with the creation of artificial waves. (Bell.) Times up, again. Proposing to create three reefs, a total of about 60 reefs—60 acres of mitigation using clean railroad ties augmented by natural rock mitigation. This is something we're still discussing with the regulatory agencies, and I'm sure we'll be talking about it through the regulatory process. And then significant public outreach, and this is the last slide here.

In terms of our environmental permitting process it has been a poor process. We're waiting for our comments from the (Inaudible.) at the end of last month. We've come to the endangered species process review. We're going through that now. We've been though the meeting process and our final Environmental Impact Report Certificate where right now was submitted. All of our State permits—CZM is going to be going in shortly, and we're right in the middle of the Conservation Commission process. We've had two hearings. We anticipate everything probably about four more hearings before the Conservation Commission. Thank you very much.

MR. O'CONNELL: I'd like to call the other speakers up here for a few minutes. We're staying on

track. We're still only about 15 minutes behind schedule. Leslie Fields, Les Smith, John Ramsey and Lindsey Counsell if you have any questions about Long Beach or Sconset or Dead Neck now's the time.

Again, there's no break scheduled this afternoon, so if you can be respectful of the speakers if you need to do something, do it quickly. Anybody have any questions for these folks?

MR. HOFFER: Don Hoffer, Falmouth. This is for Leslie. How did that grass hold up that you planted on that beach?

MS. FIELDS: It was fine, Don. I mean, it lasted until the beach started to retreat back and then there was storm activity that was going to eat away at it, but it grew quite well, built a dune.

MR. KEON: John—Ted Keon.

MR. RAMSEY: Ramsey?

MR. KEON: On the Dead Neck proposal where I don't even know if it's being proposed or a concept of cutting through and actually, I assume, you'd be creating a separate island?

MR. RAMSEY: Actually, what we're looking at, in fact, is taking that little spit. You know, so we're actually taking it and cutting it all the way to the edge, and using—

MR. KEON: You are or are not?

MR. RAMSEY: That's what we're planning to do is cutting the whole thing off. We're not going to try to leave it a trapped island. It's just that we note they used to have a historic channel through there, so more sampling that has a history of having a channel there, and then the channels obviously migrated through that whole area of the spit, so we're talking about actually dredging the entire spit.

MR. KEON: I wasn't sure. My only point was that I know I've already had very preliminary discussions of interest, and if Scott could speak for perhaps the lack of islands for habitat where they'd be very desirable interests in having island habitat.

MR. RAMSEY: Which would probably be good normally. I think in this case because we have Sampson's Island right there which is great for habitat. Already it is somewhat separated. I think the big theory you know that would actually attract more boats to a smaller island in the middle of Cotuit's main entrance but hard to say.

COURT REPORTER: Could I get your name again, sir.

MR. RAMSEY: That was Ted Keon.

COURT REPORTER: Thank you.

MR. HANKS: Jim Hanks, Mashpee. Did you have a chance to look at what would now be the water quality in Cotuit Bay if it was all fenced in?

MR. RAMSEY: We did look at it primarily. Basically what happens is we get a slight improvement. If you think of Cotuit Bay there's not a lot of tide attenuation going through the entrance and we actually did run it through yesterday's project models. We get about—in Cotuit Bay itself it's only about a half or 1% decrease in nitrogen concentrations that we run the model on. So, it's not a huge

positive but certainly it's in the positive direction. Thank you.

MS. FREEDMAN: Janet Freedman. Do you have people on the other side at the ones where the groins are being undermined as that channel narrows? Are they arguing that you're creating adverse impacts on their properties?

MR. RAMSEY: At the moment nobody's arguing certainly that that is being created. Actually, I don't know if you want to speak to that. That's a political issue. I'm going to step away.

MR. COUNSELL: Smart man. Yes. Lindsey Counsell. We have had many communications with those folks and giving them our data to show them that the island is moving as much as 11 feet a year. So, they're willing to partner with this and work those things out.

MR. MCKENNA: Yeah, Steve McKenna, Coastal Management. Question for you Leslie. The borrow pit from your project, did you monitor that and what were the results over time?

MS. FIELDS: And that project was built almost 20 years ago and so as part of the permitting, monitoring wasn't required except for they required one survey. We went in there in 1989, did some dive surveys. It's an area that's on a shoal, there's eelgrass growing on the shoal around where we were dredging, and after the surveys, three of the surveys, we didn't find eelgrass growing, you know, in the borrow pit. It hadn't filled in quite as quickly as we had anticipated. So, there's still a bit of a depression there even today but it does support eelgrass today.

MR. MCKENNA: Thank you.

MR. BRADY: Bob Brady, (Inaudible.) Village. Have any of these projects used these larger fabric tubes or is that to new a technology to think of?

MR. COUNSELL: The fabric tubes have been used on the coastal bank down at Sconset. They've actually used a number of different approaches, and interacted with the Conservation Commission in terms of what is working and what is not. Some of them get sacrificed and washed down the beach, and we've been working on coming up with a design, and I think we'd have a pretty good design now that with anchors as more longevity even though the sand is removed the fabric stays at that location. That's at least the goal. That didn't happen this past storm because we hadn't put the anchors in place yet. That is the goal for them fully.

MR. RAMSEY: No, they're not geotextiles. They're coir, which is coconut fiber, and that will actually move into a natural jute material. So, it's a shorter duration of biodegration in the environment. That's something we've been working with the Conservation Commission.

MR. O'CONNELL: Thank you. We're going to move on. Okay. The next session is Public/Private Partnerships for Beach Nourishment and Beneficial Re-Use of Dredged Material. Our first speaker is Wayne Jaedtke. He's the Program Manager for the Barnstable County Dredge Program. Wayne did not give me a bio. He said, "You know me." So, I'll tell you a short story.

Actually, he's probably one of the more creative dredge operators that I know because he makes a lot of field judgments and makes some very accurate ones. He's very created. Well, when he was—the story is when he was being interviewed for the County Dredge Program, at the table in front of the people who could potentially hire him the word was that he said, "I don't think—I'm not sure I can operate that dredge." And I looked at him, and I go, "What do you mean?" Here's a guy coming

for an interview, he said, "It's too small." He's used to operating much larger dredge vessels. I believe it was Great Lengths and Dredge that he worked for previous years. So, he's going to talk about the Barnstable County Dredge Program, which in my perspective, is probably a very highly successful program and a model for other, not only areas in this state but probably other states as well. Live up to it, Wayne.

MR. JAEDTKE: Well, I'm a Dredgeman by trade and public speaker is secondary, definitely so. You're going to have to bear with me here. The County of Barnstable Dredge Program started in 1996, and it ends up—we're coming up on a mile mark for us that ends up by the end of July, which will be the end of our fiscal year, we're going have dredged over one million cubic yards on Cape Cod only in the county of Barnstable and—actually, we've done projects on Martha's Vineyard, Tashmoo Harbor and the inner harbor, you know, by the jetty there on Oak Bluffs, Oak Bluffs inlet.

But 92% of the material that we've dredged, 92% of it has been migrating sands so that we've used for beach renourishment. The program started with the County of Barnstable established a Dredge Advisory Committee. And this goes back to—some of the members have notes that go back to the 1970. So, they've pursued them for quite a while. And there's one member from every Town on the Cape except for Brewster. Brewster doesn't have any harbors so they didn't show any interest in the program.

The Dredge Advisory Committee, like I say, started years ago, and they ended up at—they put together a program that defined the needs of Cape Cod, and they came up with 96 projects; 96 projects around the Cape that the towns were interested in doing dredging for the program.

They ended up they pursued a state grant through the Department of Environmental Management, which is now DCR, Department of Conservation Recreation. And the Department of Environmental Management gave the County of Barnstable a $1 million grant back in '95 to pursue the purchase of dredge equipment in place of funding dredge projects Cape-wide. And the standard procedure was for the towns to pay 25% of the cost in the stick to—pay for 75% of the cost of the dredging projects. But only 10% of the work was getting done, so what they allowed me to save for was if they didn't get the grant that they would not pursue any more costs or anymore reimbursements for the dredging on the Cape.

And so the Department of Environmental Management gave the county three years to make a program work, and then if they decided to take the equipment away they could have. But in the third year, actually in the second year we were able to break even, and the third year we were actually in the plus a little bit so it worked out real well for us.

The Dredge Program, the County Dredge Program, operates as an Enterprise Account. It ends up that the money that we take in from the towns is what we use for operating the dredge, maintaining the equipment, and replacing the equipment.

The County charges the towns by the amount of material that is removed in the cup, so if we don't work, you know that we actually—we don't make any money and the Town doesn't—they're not out any money. So, we're paid by the cubic yard of material dredged. So, it's a win-win for the Town, and it makes us want to keep the pump turning.

So, at present the County of Barnstable is charging $6.45 per cubic yard, and the projects that

require less than 4,000 in lineal feet of pipeline. So, we can mine sand from one of the inlets. We pump it 4,000 feet for a price of 6.45. The price has risen. In 1996 when the dredge was acquired, we started at 3.33 and then we went to 6.45, so the price has increased. It's not quite doubled, but it's still low for the work that's being completed. Probably the going rate right now—I know the Corps was talking about it—but up in Maine the price for theirs including the mobilization and demobilization of equipment and the executing the work, they're charging—they were paying $10 per cubic yard, so it's well below the rate. And that was on a large project.

A lot of our projects they end up they can average anywhere from a 1,000 cubic yards up to a big project for us is like 26,000 cubic yards. So, it is a price as the yardage goes up usually the price comes down, so when they were talking an 80,000 cubic yard project, you know, that's a big project for us. I mean, we are building it, and without that kind of a dredge.

But we end up—so we charge $6.45 for a project where the pipeline length is less than 4,000 feet, and if we go over that we end up—we get into booster rates, and the County of Barnstable put up $200,000 for us to purchase a booster pump. We ended up—we purchased the booster pump and a pipeline to go with it. And now we can pump up to 12,000 feet—12,000 feet from the borrow site. Excuse me, I'm getting a dry mouth here.

The dredge operates with a four-man crew. It end up that—it's a small program. We end up—so we operate with a four-man crew. Everybody is pretty multitasking between the program manager to the deckhands, you know. So, I do it all and everybody else pitches in too.

A typical job for us we'd start with the Towns acquiring the permits. The Dredge Advisory Board defined the County work starts after the permits are acquired by the towns. It ends up if the Town didn't want to put forth the effort to acquire the permits, then the County isn't out any money to pursue the permits. So, that's where we come into it. So, the Town pursues the permits.

Permitted projects are the ones that have the priority for the dredge program. When you have the permits, you move up in the line to being first. So, then we put together the schedule for the year you know as the projects come to the board, they end up—they list it as permits first and then things that are going to be permitted. They move into a secondary position. So, we put together a dredge schedule for the year. The Dredge Advisory Board approves it, and then we end up—we go to work.

What we'd do is we'd start with the hydrographic survey. We go up and we survey the inlet, the harbor, or the channel, and we do a map of the volumes to be removed, and then we move into the phase of mobilizing equipment. We end up—we have a hydraulic dredge with the discharge pipeline. We move that on site. We'll execute the dredging, and we'll do a postcard survey and the quantities to figure out the material that has been removed. And then the Town will pay us by the cubic yard.

The equipment that the Dredge Program operates is it's a hydraulic dredge. It's an Ellicott 670, which is a 715 horsepower. It has a 26 foot digging depth is the maximum on it, and it's swing-width is 100 foot, so we can do a 100 foot cut.

The production varies anywhere from 50 yards to 300 cubic yards. It depends on the pipeline length that you're pumping on and the type of material. The heavier the materials, it takes more horsepower to push it the distance. So, the shorter lines your volumes are high per hour; the long

lines it's low per hour. But what we found is it averages out, you know, over the projects that we have. Some projects we make a lot of money on and some we pay for a little bit of it. But that's the way the program was set up by the Advisory Board.

The pipeline that we pump through is a plastic pipe. It ends up—it's a high-density polyethylene plastic; it floats so it's easier to work with on projects. The pumping distance with the dredge like was mentioned was 4,000 feet, and then with the booster we can go up to 12,000 feet. Then we have some other equipment to shift the pipeline around. We have a tow boat that we actually move the equipment for from project to project.

To date, we've been dredging for 11 years since 1996. We've done 43 different dredge areas around the Cape and the Islands. We've done 158 projects in the last 11 years. And at the end of June we'll have removed one million, let's see, 1,001,600 cubic yards. So, just over a million yards, which is a big feat for us. That's going to be an average of 14.3 projects per year and 91,000 cubic yards per year; 92% of the material dredged has been used for beach renourishment.

So, where am I? Yeah. The benefits of having a local dredge program. One is the crew that operates it everybody's local to the Cape so we know the Cape. We know the Cape waterways and the shoals, and we have quite a few propellers noting that.

AUDIENCE: (Laughter.)

MR. JAEDTKE: And we can have a propeller on a boat last a month and we can have them last a day. So, we're always digging in shallows where no other boats can go. So, we're in harms way there.

The Codfish has been able to do all the dredge projects that the towns on the Cape have brought to the schedule. So, nobody's been turned away. We've had two that we ended up—we had to postpone to the (Inaudible.). Then the next fiscal year due to Environmental Windlass closing, but it ends up that's the minimum trouble we've had.

So projects vary anywhere from 1,000 cubic yards to a 30,000 cubic yards, and this works well for the towns. They can budget, you know, or they can design the project to what they can afford. So, it ends up that they don't have to have 30, 40, 50,000 cubic yards. They don't have to wait for that kind of yardage to be passed before we can show up. We've done a lot of projects in Falmouth. In fact, Falmouth averages probably no more than about 1,400 cubic yards per job on their projects. They've got one big one but everything else is like one or two days worth of work, but we still do it. I try to put it to the end of our schedule because it is expensive to do it, and due to the time of year extent, time of year restrictions, they're the more costly ones so they're the last ones on the list.

Some of the other benefits of a local dredge program is mobilization time for us is minimal. It ends up that we can move the project in a day, you know, and sometimes weather-wise, you know, it can take a week, but we can move from project to project on short notice. It ends up the dredging the river and the inlets in the harbors, you know, it has provided safe navigation for boaters. The dredge is always available to respond to local emergencies. I've been talking with the group out in Chatham and they show some interest in the new inlet as I call it; they call it a break.

AUDIENCE: (Laughter.)

MR. JAEDTKE: The dredgemen deal with the same harbors, and we've become very familiar with

the sensitive areas such as shellfish beds and salt marshes and the bottom conditions on the Cape, so it ends up, we're always dealing with the same harbors, so it's a benefit for both the towns and the Dredge Program.

Local contacts with the town. It ends up that we've gotten to know all the towns on a personal basis, so it ends up that if we do need help on short notice, you know that somebody's there to work with us. We're always dealing in remote areas. We're out there in the middle of the winter when nobody else is around. And sometimes if we get stuck or something like that, the DPW is usually the first ones there to bail us out.

The dredge projects are much smaller now. Since we've started the program, you know, we started with a lot of larger projects and now we're probably anywhere from averaging 3 to 5,000 cubic yards per project. They're not very large though. It requires more mobilization. The County Dredge operates on a 10-hour day, 6 days per week, and not the 24 hours/7 days a week that most of your larger dredge programs operate on.

The challenges that we have are working through the winters on Cape Cod is the morale of the crew. Come February you don't want to be in Truro.

AUDIENCE: (Laughter.)

MR. JAEDTKE: So, the smaller dredge project—then increase in the moving time between dredge projects. It ends up as the mobilization of the dredge equipment between the smaller projects is we have to mobilize more often. It ends up, you know, a lot of weather delays had come up. We spend about 50% of our time during our time of year restrictions moving the dredge from site to site, so it can be very costly if we miss the weather break where we can make a run with it to the next project or we can't make it. So, like I said, we spend half of our time moving from project to project.

Working within the TOY restrictions, the time of year restrictions, these govern our working schedule. Presently, we ended up we put the dredge schedule together according to the environmental windows. So, we end up—we move from project to project according to the time of year restrictions. It ends up it increases a number of times we move like we were in Pleasant Bay going back in December, and now we're going back again, so, but it ends up it's due to the time of year restrictions.

In the last three to five years the time of year restrictions have shortened our dredge windows as much as 40 days on a project. Some of them that they didn't have like Falmouth, you know, they didn't have restrictions, now they do have restrictions where they're closed for like three almost four months in the spring when we used to do it.

Another challenge of dredging in the summer is trying to tell somebody the beach is closed and that's common.

AUDIENCE: (Laughter.)

MR. JAEDTKE: So, come June when everybody's down here, you know it ends up you have to take over a certain portion of the beach, and you do have to close it because people want to put out their beach blankets; they don't want to pick them up.

AUDIENCE: (Laughter.)

MR. JAEDTKE: Thank you.

MR. O'CONNELL: Thank you, Wayne. The name of his dredge is the Codfish, but he moves around so much I'm surprised he doesn't name the dredge the Vagabond. That's a million plus cubic yards of sand that's gone up on Cape Cod beaches which I think is an incredible benefit at that cost per cubic yard is phenomenal.

Our next speaker is Dr. Lee Weishar. He's going to talk about an interesting little turn of events, Public/Private Partnerships, private people paying for public dredging disposal anyway. I think he's pretty notable, and it's an interesting topic, and he's going to present one of those cases.

Lee has worked in both the public and the private sector after receiving his Ph.D. in 1980. He worked at the U.S. Army Corps of Engineers Coastal Engineering Research Laboratory in Vixburg, Mississippi. During this time he conducted many field investigations at beach and highly-learned processes. He was a Principal Investigator for three large-scale experiments investigating nearshore waves, currents, and sediment transport processes conducted at the Field Research Facility located in Duck, North Carolina.

After leaving the Corps of Engineers, Lee moved to New England in 1989 and joined the Woods Hole Group. Currently he's a Senior Scientist with the Woods Hole Group. He's involved in a lot of complex problems that require evaluation of numerical and observational problems assessing physical and ecological restorations. He's completed three large-scale beach nourishment projects and several large-scale marsh restoration projects in Saudi Arabia, New Jersey, and New England. He earned a Professional Wetland Scientist Certification in 2005, and his main interest remain in the investigation of nearshore processes and ecosystems including marsh restoration. Let's hear about a public/private partnership in Harwich.

MR. WEISHAR: Thanks. Well, you just got through hearing Wayne Jaedtke, and I have to tell you that I was one of Wayne's biggest fans because of the fact that, and Wayne you can pay me after this, but the Codfish and the work that they do is truly incredible, and I've had the good fortune to work with Wayne on doing beach nourishment projects and also what I call beach disposal projects, and they do an incredible job.

But what I want to talk about today is forging public and private partnerships and talked about whether it's a good idea or not because of the fact that there's certainly some hurdles that you're going to go through if you start to embark on this. And, so, basically, I want to talk about some of those hurdles, and some of the problems that you may or may not incur.

Well, first, what we're going to talk about today is why build the partnerships and are they one-sided? And depending upon who you talk to, you will definitely get an opinion in Cape Cod. It is you can't do anything on the Cape and probably in Massachusetts where somebody doesn't have an opinion on something.

What it takes to build a partnership. It takes a lot of work, and it takes a lot of perseverance. And then we're going to talk about public reaction, and I was just referring to that because public reaction is really reality, and the fact that once the public makes up its mind or starts talking about something and once it gets into the newspapers, they start to take on a life of their own. And it's a really big deal, and it could be good, and a lot of times it's not so good.

And I'm going to talk a little bit about the project itself, and then it requires help to get the

project to go. You have to help the town officials to answer the questions, answer the mail because of the fact that indeed the first thing that happens is is that their phone rings off the hook.

So, formulating a partnership, why would you want to do that? In our particular case, we had a jetty that was trapping sand from a harbor and starving downdrift beaches. We also had some navigation issues that the town had, and we had an opportunity to help them.

And then limited resources. The town came up short with money. They needed to dredge their navigation channel on that very quick basis, and so they reached out, and we were happy to help them out. And then we also needed to nourish the beach due to sediment losses, again, due to the continued trapping of sediment offshore.

Where our project is? This is Wychmere Harbor; Saugatucket Harbor. The project I'm going to talk about was done in Wychmere Harbor. Our disposal area is right here immediately downdrift. You can see in here just a little bit of sand trapped by this jetty. This has been going on for decades and that sand no longer moves downdrift, and you can actually see up here at Allen's Harbor the same thing is occurring, and the fact that for the last multiple decades that sand is being trapped and is lost to the system.

Additionally, the Corps of Engineers, excuse me, doesn't compare to this when the town dredges this part of the channel, and they dispose off here in an offshore borrow site because of the fact that they use the hopper dredge Currituck, and it's more cost effective right now to dredge the sand out here and dispose of it.

So, this has posed some problems for the downdrift property owners as one might imagine. And so we started working with the town and offered to provide some funding to do some of the emergency dredging. And the first thing was is that the public said well, you know, a private owners trying to buy sand, you know, buy a public resource. This is a bad thing, and it started to kind of take on a life of its own as I said. And another perception was is that a private homeowner was diverting town resources from other needed areas. And indeed there were—there are other areas in the Town of Harwich that need nourishment also. Because absolutely that whole section of beach does require sand.

And then basically the damn rich people are buying sand again. You know, what are you going to do? They're getting free sand from the town, you know, they have influence, they're paying the Selectmen off, they're paying the Conservation Commission off, and, you know, the sand's going on our beaches. And that's obviously not true or was not true at least in our case anyway, but it's a problem and the town officials have to deal with that.

So, what are the facts? Well, the facts are somewhat different than the public perception because of the fact that sand bypassing is critical in Cape Cod and in Massachusetts. It is an excepted practice in the rest of the United States. I've had the good fortune of working in almost every coastal community in the—or coastal state in the United States when I was working for the Corps of Engineers. I helped design some of the large new-scale beach nourishment projects in Miami, some of the renourishment projects.

And sand bypassing is excepted everywhere else. It's very common but not here, not in this state. And so you saw the picture before where the jetties were trapping the sand and that's a huge problem. In our particular case the town dredging budget was depleted. They couldn't pay for the entire

amount that was—the amount was 10,000 cubic yards. They didn't have enough money to do that. And, so, we offered to step up and help them.

In this particular case where the town was in the permitting disposal sites, there was only a very few places, actually only one place that they could dispose the material and you might imagine that it had just fortuitously happened to be on the downdrift properties where our project was. So, that worked out very fortuitously and also fostered the view from the public, "Well, those rich guys are buying sand again."

It was the cheapest disposal alternative because you just heard Wayne say that the longer you add the pipe or the longer the pipe is the more expensive it is to pump. And we were immediately downdrift of where they were dredging and so the shorter the length of pipe, the faster the project goes; the faster the project goes, the cheaper it is.

And we were able to provide the town with some immediate funding. Now, you might think it would be easy to give the town a fairly large check. Not true.

AUDIENCE: (Laughter.)

MR. WEISHAR: I'm here to tell you it is really difficult to go up and say, "How would you like to have this amount of money and, by the way, just dump the sand on our beach." Well, that took on kind of a life of its own, and fortunately after the facts were actually known, it was worked out fairly quickly. But getting to that point it was kind of a rocky road just to whether or not the town was actually going to accept the money. And Tom Leach, the Harbormaster, is in the audience today, and Tom was instrumental in having that occur and, of course, he wanted the dredging done because it's his harbor, but he went the extra mile to help us get samples.

Well, this is what the project looked like before. This is immediately before Wayne got on the beach, and the Codfish did the dredging, and I can say that I don't think I've ever seen Wayne on the beach that he's not on the bulldozer side, so he likes to get up and get some stick time. It's a rumor that he actually does get on the Codfish, but I've never seen him.

AUDIENCE: (Laughter.)

MR. WEISHAR: Anyways, so you can see this is the high tide line. This is the storm wrackline right at the base of the dune. This is not the jetty—this is the second jetty that's downdrift actually. And then here we are just starting to pump. Wayne is actually here. He's bulldozed up some sand up onto the groin to create a disposal area, and we're sitting here. There he is with his loader getting ready to move pipe.

And, again, you can see here are the harbor jetties in the background, and these are now constructed on that harbor or on that fill of the sand that you saw that's on the jetty, so us having a chance to go reclaim that sand and put it downdrift are probably not good now because the condo owners aren't going to appreciate that.

And here's where we are about 10 days after the project was completed. You can see this is a jetty. The sand right here has moved on down. Now, this was not a beach nourishment project. This was a beach disposal project, so you might ask, "What's the difference?" In a beach nourishment project we would go and we would have engineered the beach nourishment, and we probably would

have placed it, well, we wouldn't have probably—we would have placed it along the toe of the bluff, but because of the fact that it was an emergency dredging and we weren't paying to construct a beach nourishment project, we built a long section of beach basically immediately downdrift of the jetty knowing that diffusion which if people were here this morning, which I think most all of you were, the diffusing process was going to smooth that sand out rather quickly.

And, so, the beach still looks absolutely wonderful. And it's performing quite well within the constraints of how the sand was put up.

Now, what are the project facts? We dredged about 10,000 cubic yards; placed it on the downdrift beach. The projected lasted about two weeks to complete from start to end in pumping. It was not a continuous project because of the fact that it was an emergency dredging. Wayne was chasing speed bumps out in the entrance channel, so there were also some resource areas that he had to avoid, some shellfish areas and whatnot. So, he was constantly moving the dredge around to get to the areas that were shoaled and also to avoid those resource areas.

Sand quickly redistributed on the beach. I talked to you or explained that basically we built a large lump of sand downdrift of the groin knowing it was going to be redistributed. And the beach remains extremely healthy. As a matter of fact, it went to being quoted, I guess, now named the Patriot Storm quite well, and it's done very much—very well.

Why participate? Well, I talked to you about a lot of the downside because of the fact it takes a hero to get out in front to help the town officials communicate, but from our perspective, our clients' perspective, the 10,000 yards was obtained relatively inexpensively, about 6.50 a cubic yard. And, so, there's a pretty large or significant cost savings from obtaining material from dredging.

Also, hydraulically placed sand resists erosion. I don't know if that has been discussed in detail, but when you hydraulically place sand on the beach the dewatering process essentially takes the air and voids out of the sand. It takes the bulking out and it makes it much more resistant to erosion. And, as I said, disposal projects are not necessarily beach nourishment funded.

Well, just to facilitate a project, communication with the harbormaster is critical especially in our case because of the fact that this was a project that was sliding in on Wayne's dance card, so-to-speak, and so we were—I was always calling up, "Hey, Tom, where's the dredge?" "Is it coming?" "Yeah, it's coming." "Where is it?" "Well, it's hung up." "It's taking a little bit longer because I think it actually came from Martha's Vineyard." So, it took a little bit of time to get there.

You need to talk to others in the town, the Selectmen, the Conservation Commission members because of the fact that these are the people that are just everyday folks, and they're answering the newspapers banging on their door, and it is—you have to help them answer the mail and answer the phone calls.

So, the bottom line, it's a very worthwhile project. It was worthwhile for our client, and it was worthwhile for the Town. And, again, they are actually in the process of doing another emergency dredging, and we're hoping that we can help them out yet once again because of the fact that the beach still could use some more sand, and after the Patriot's Day storm, another section of the beach, actually updrift of the groin, we've got a little bit of erosion, so we're trying to plus that up with that sand.

And with that, I didn't hear the dingy, but what I really—(Bell.) What I really wanted to do—I was going to wait for that and go "Hello, hello."

MR. O'CONNELL: I was so fascinated when you were talking, I forgot to turn it on.

MR. WEISHAR: I don't know how to stop it, so there you go.

MR. O'CONNELL: We'll leave the questions till after Ted, but I wonder if that will happen again? Just wondering if we'll see that project again?

Continuing on the theme. We're going to talk about beneficial re-use of dredge material as a feeder beach. Ted Keon, the Director of the Coastal Resources Department with the Town of Chatham.

Ted Keon is the primary liaison for Chatham's marine and shoreline activities. He oversees the planning and the implementation of projects effecting Chatham's waterways and coastal shorelines and water-dependent infrastructure and also provides oversight to Chatham's town landings and water access.

Prior to his position with Chatham, Mr. Keon, again another one, was the Chief of the Coastal Planning Section of the Philadelphia District of the U.S. Army Corps of Engineers. This seems like the retirement area (Inaudible.).

AUDIENCE: (Laughter.)

MR. O'CONNELL: During the time with the Corps of Engineers, Mr. Keon was actively involved in the planning and development of numerous shoreline protection, navigation, and other coastal related projects and activities along the coast of New Jersey, Delaware, which we'll hear about shortly, and Delaware Bay. He holds a Bachelor's and Master's Degree in Physical Geography from the University of Delaware and Arizona State University. And Ted is now actively dealing with the, what would Wayne call it, a new inlet, and what would you call it?

MR. KEON: It's still a breach. It's still a breach.

MR. O'CONNELL: Temporary? Well, Ted, feeder beaches.

MR. KEON: Thank you and good afternoon. Lee, I thought I was the biggest fan of the County Dredge Program.

AUDIENCE: (Laughter.)

MR. WEISHAR: If I said biggest, I meant big.

MR. KEON: Again, thank you very much. I'm going to talk about a project where you've actually seen a number of the pictures in some of the earlier presentations. I hope I can try to, what was it Jim, "lend substance and insight into this issue"?

MR. O'CONNELL: That sounds really good, lends substance and insight. Wow. I forgot to say that. I know you told me, but—

MR. KEON: Anyway, a few years ago we embarked on a project to develop a nourishment project for an area called Cockle Cove in Chatham. The team we had on this was a really good team. We had Stan Humphries from ENSER, Stan, I think that was five or six firms ago for you?

AUDIENCE: (Laughter.)

MR. KEON: John Ramsey from Applied Coastal and Ron Bourne from Bourne Consulting, and they did a great job preparing this project for us.

MR. KEON: Chatham as you probably know is located on the elbow of the Cape. Cockle Cove specifically is along Nantucket Sound or the south side shoreline. Cockle Cove is approximately in this location. What is of note and has been mentioned a number of other presentations, is that we are essentially the eastern most downdrift area of a series of groins and jetties that stretch back frankly to here, Falmouth. So, we really are at the end of the line, if you will.

Here's a photo from 1938. Again, Cockle Cove located across from here, try not to follow all the meanderings of these creeks because they are going all over the place. What I really want you to look at is the amount of sand that is in a sense pouring across what was a very old inlet jetty system that's been there since the 1800's, late 1800'.

Dominant littoral transport is from the west to the east along this entire section in Nantucket Sound. And there was a significant sediment transport to the eastern side. As the development of shoreline protection became sort of commonplace using groins and jetties in the 50's and 60's and so forth, we really had the beginning of a constant interruption of littoral transport. And as you see here in '66 that flow was beginning to shut off. By the early 70's it was pretty much shut off, and this material was really all that was left in the system and that was being moved on shore.

By the 80's we essentially had a full starvation situation. Almost no sediment was getting around that last jetty system and on to the downdrift portions of Cockle Cove and so forth, so all they had left was what was there. There really was nothing coming back into the system.

Since 1980, we lost approximately 200 feet of shoreline just downdrift. We're now looking backwards if you will from the last photos. That's that same jetty system. We were losing, upwards of 10 feet per year by the time I started looking at the problem when I got in the Town in the late 90's. Here we had an upland cedar grove that was caving in and falling down into the shoreline on an annual basis. We really were in a very rapid retreat mode with no sediment input whatsoever and continued loss due to natural transport.

The reason this is significant for the Town other than just the concern about the erosion of the private shoreline was the fact that we have two of our primary public recreational beaches along this area. This area specifically what we refer to as Cockle Cove and the public parking lot, and this is Ridgevale Beach. Just a little bit further to the east is our Harding's Beach area, and those three beaches, Harding's, Ridgevale, and Cockle are the principal recreational areas in Town. We don't have much in the way of a public parking lot or access along our eastern shoreline, so really all our recreational bathing beach areas are on the Nantucket Sound. So these are very important recreational resources for us.

At the head of, if you will, this littoral cell starting with Mill Creek, we had a portion that is entirely private. There are two homes right here that are bulkheaded. Then we have an unstructured area and then right here we have an area that also is bulkheaded and above that it's unstructured.

Given the predominant west to east transport, we looked at a beach nourishment project and how would be the best way to design it. Using a coastal processes analysis from Applied Coastal, we

wanted to figure out what would be the best location for placement. We have, as I just mentioned, a revetment seawall along two homes at that location so that provided sort of a modest headland if you will. And what was confirmed, because of this large jetty, you have a significant shadow zone to the west of that revetment, and that this area has a predominant west to east transport.

So the whole idea was to let's put the sand at the head of the littoral cell that would feed the rest of the public beaches down here. In other words, let's fill the hole instead of trying to just place the material on the public beach. As Lee just indicated, where it's appropriate, and the private beach may, in fact, be the better place to put it. It was such an obvious situation for us. If we put it here we would have had a much more significant salient feature jutting out, so let's really start using this headland area here as the backstop and then fill this area. Essentially let that erode and provide the feeding zone for the rest of the public beach through natural processes. We can really localize the disturbance, if you will, of where we put the material and then natural processes would create a conveyer of sand down into the public zone.

In the private area we had to deal with four property owners. We, as was discussed earlier, had to appropriately deal with the strolling easement requirement of Chapter 91. That was going along quite well until the very end when two of those property owners decided that they didn't want to play anymore. Fortunately for us from a project development point of view they were the two downdrift ones, so we could still place the material updrift of them; they just got all the benefits without any strolling easement.

We didn't really get into some of the further issues with the strolling easement, but one of the consistent concerns of any property owner is their liability. And you try to explain to them that it's not going to burden you. In many ways, there is actually a relief of some liability through a subtle Massachusetts law that I can't get into because I'm not the lawyer, but if you allow strolling on your private lands in some ways you actually remove liability from you. And that's an important facet during discussions with homeowners. But, frankly, they also felt that if they had this easement that their property rights and their property value would decrease and it's hard to overcome that.

We did ask for and receive a modest financial contribution from these owners. It helped. It wasn't really a 50% contribution by any means but it was significant. And, actually, just for fairness, one of the individuals that had promised to sign the strolling easement (it was actually his siblings that decided they didn't want to do it) walked into my office and threw down the check anyway. So, it was appreciated.

The project site is located here. We needed, obviously, to locate a sand source. We considered briefly looking for offshore sources. There is a lot of sand in the system here, but we really didn't want to go down that direction. It just—we knew it would be a significant regulatory issue.

We have, fortunately, a nearby federal navigation project. So, we had a readily available source of sand, if you will, through navigation. The Corps typically would dredge with the Currituck, so that vessel would not be appropriate to put sand up on the beach in our project, so we had to use a different alternative and that was with the County program. The distance there is approximately 11,000 feet so we knew that this would be a booster-type project.

When looking at the federal channel we started looking at where would be the best to place to dredge the sand. We've been noticing, and the harbormaster was quite concerned about the vessel

traffic, that the tip of Harding's Beach was growing and actually starting to protrude into the channel. So, that became a very obvious place to mine the sand, if you will, for our project. It was also a very good source of sand in the sense of its grain size because this areas has higher velocity water. Therefore, there was more coarse material on that site than if you were to go into some of the more quiet shoaled areas. So, the material was very, very good for this kind of work.

We did the project over two seasons, both fall and winter seasons. Fall of '03, we utilized, and this is what we originally assumed would be the way to go, a booster pump stored on a barge offshore of Harding's Beach, and it worked. It wasn't a bad way to go, but ultimately it was not the preferred. Nantucket Sound can still be a pretty, ugly area to work in, and just access to the booster pump for maintenance fueling, etcetera, is still difficult.

We really got chased out during that winter of '03. if you recall, because of horrendous ice conditions and that basically shut us down and chased the dredge out for the year. When they came back in the fall of '04, the much preferred approach which worked much better, was to put the booster on the land and the access was just much more convenient.

At the other end, it was a direct pump out type of a project. You recall earlier someone mentioned the concept of finger dikes to try to keep the sand in the placement area. I don't have, unfortunately, a good picture of it, but what we really did was the same idea only we used piles of Codium that were on the beach, and it was unbelievable how well that worked to constrain the sand in the area that you wanted it. As you see, we did about a 30,000-yard project.

We then put sand fencing using AmeriCorps volunteers in the upper part of the beach. We wanted the beach to be there and the sand to stay there because we wanted that sand to erode and nourish our downdrift areas. That's the way the project looked soon after completion. Here's another from an aerial view of that.

And this is really sort of the whole concept of the feeder beach. I'm standing to the west, excuse me, the east of where we placed the sand up here. So, that's the beach. Not a single drop of sand was placed anywhere from that bulkhead to where I'm standing and that was all natural littoral transport down toward the east feeding where I'm standing, the public portion of the beach.

We have to start looking at the renourishment of this. We all wish we could see stable beaches but, frankly, the whole design of this beach is to erode. That's the source of sand to move down into the public area so we want it to erode, but in order to maintain the sand source we have to start thinking about renourishment means.

John Ramsey showed a similar picture recently within a year or so ago. We started to get another situation where this jetty-groin system here has completely filled to entrapment and is now naturally bypassing that jetty and the old channel is completely shut off. In fact, we had buoys that were sitting high and dry out there. It wasn't a very good navigable waterway and it is now taking this right-hand turn. So, that's a concern that we have to look at. The navigation impacts are fairly obvious. There's very shallow water here, and we also have some water quality concerns about flushing of this estuary system above it.

I'm actually seeing this as a potential opportunity to continue our nourishment program. This is simply conceptual at this stage, but in order to reestablish the flushing and navigation, to restore

the channel in its old location, and to provide some additional trapping capacity, we could perform inlet bypassing on the updrift side of the jetty. We could actually remove some of that material to provide some of the trapping of the jetty-groin system again. And in both cases that material could be moved downdrift onto the feeder beach area. Again, we're no where other than looking at this as an idea. And I'm done. (Bell.)

MR. O'CONNELL: Okay. Let's see. Wayne, Lee, and Ted. If anybody has any questions for these three folks on these three projects now is the time. Wayne, I just have a comment. I thought one of your serious time of year restrictions was icing.

MR. JAEDTKE: It's very—

MR. O'CONNELL: You should see Wayne out there in February in Truro Harbor socked in. I think you go down to the Virgin Islands at that time, if I'm correct?

MR. JAEDTKE: Yes, I do.

MR. LYTTLE: Hi. David Lyttle. This is a little off-point, but since you and both Ted and Wayne brought it up, if you three were all betting men, and this is referring to the new cut in the North Beach, I'm kind of interested in your comments as to whether you think it's going to stay or not because I understand there's still water going out at low tide there?

MR. WEISHAR: Definitely—

MR. LYTTLE: You guys brought it up so that's the only reason that I'm asking.

MR. WEISHAR: I've been asked that question 700 times a day for the last three weeks. I honestly don't know. As I've said repeatedly when we first looked at it and we saw the aerial photography at low water, which is really more indicative, it really looked like it was going to fill in reasonably fast, but when you go down there and you stand there at low water and you see the volume and the speed at which the water is going out, you are much less confident of that. So, I don't know. Conditions could still close it up. We have a very efficient inlet, the Chatham inlet now. We need some energy to bring the sand that's in the offshore borrows back into the system and clog that system up. But I'm not going to fall on my sword and really make a prediction.

MR. O'CONNELL: I think he was suggesting we need an east/northeast storm. Another one?

MR. WEISHAR: Not a storm.

MR. O'CONNELL: To push the sand into the channel?

MR. WEISHAR: Well, we need the summer wave conditions to set up is what we need. So, to answer your question, David, is that from a process point of view, the old new inlet opened up because of the fact that there was about a foot and a half tide difference between the outside/inside plus a couple, an hour and a half or so, tide lag and so that drove that system really hard. Ted was just remarking before that it's been very quiet. We went from this, you know, Patriot's Day storm to just kind of flat calm, so there's not much energy to drive the littoral system to plug up the new inlet.

One side says if you look at the Graham Geise model that's supposed to break up and go away. If you look at the processes it says it ought to plug up and we ought to have a few more years before that south end of North Beach goes away because of the fact that you've still got a huge inlet that is

servicing Pleasant Bay, and the tide currents and the volume that goes through, you know, the old new inlet is tremendous. So, nature was going to take its own course, but I guess if you ask me to bet, I'm going to bet that it's going to close up before this time.

MR. O'CONNELL: Without venturing the future of in the past, that's the location that Graham predicted that Nauset would break before the breach that presently exists occurred. It was the most narrow part of the barrier. It was also—it was located in the mid-1800's. It's also if the other inlet were not open, correct me if I'm wrong, probably the preferred location for a more hydraulic efficiency to drain Pleasant Bay.

MR. WEISHAR: Yes.

MR. O'CONNELL: If it remains open, there would probably be a benefit to Pleasant Bay, obviously not to the mainland property owners though. Wish we had a picture.

MR. JAEDTKE: I say it stays open.

AUDIENCE: (Laughter.)

MR. KEON: He's looking for more work.

AUDIENCE: (Laughter.)

MS. FREEDMAN: Janet Freedman. I have a question for Wayne. You said that you're averaging about 91,000 cubic yards a year since you started the program.

MR. JAEDTKE: Yes.

MS. FREEDMAN: Is that what you need to do to have a program be feasible economically?

MR. JAEDTKE: The last time we raised our rates was two years ago, and we were running into the red. So, we don't have a lot of money in our account, our amortization account, to replace the dredge which we were shooting for in 20 years, and it ends up—I would say yes. It takes that or real close to that. It's either that or you're going to have to raise your rates. Either you do a lot of yardage or you charge a lot for it.

MS. FREEDMAN: Do you want to come to Rhode Island?

MR. JAEDTKE: That's quite a mobilization.

MR. HANKS: Just another comment (Inaudible.) as Wayne said as far as the driver of the rate increase is fuel costs.

MR. O'CONNELL: I think you're on.

MS. LANGHAUSER: I have a question.

MR. O'CONNELL: Go ahead.

MS. LANGHAUSER: Andrea Langhauser, Chapter 91, Mass. DEP. Ted, you said when you had easements for the Cockle Cove project you did them from the term of the project, and they weren't easy to obtain. Now that you're going to have to go back and renourish, do you wish you had gotten the easements in perpetuity?

MR. KEON: Maybe I was not clear. Not for the term of how—the project is—the term is until the

sand is gone. So, if I pumped it today, I would still theoretically have the easements in place. I would have to essentially have receded to the pre-project condition for the easement to be null and void or expired.

So assuming I can get back, if we do go back, before its eroded, the easement still stand. From a public perspective, sure. I'd love to have it in perpetuity, but the homeowners would have gone south. They would have said absolutely not because that would imply if we just did it once and then we'd never go back, they forever and a day will have, you know, a public access that frankly is a difficult thing to sell.

MS. LANGHAUSER: Well, that's interesting, just as a follow up, because we talked theoretically in the office of going to the life of the project and we just didn't think it was practical point in time. You know, legal easement tied to a physical process, we didn't know how anybody would know when it came and went.

MR. KEON: Well, I mean, it's actually—we surveyed it. We have pre-project conditions, and when we filed the easement with the County and registered it, we actually provided the easement plan by planometric map showing where the position of the pre-project condition was, and we do monitor it, so at any point either party could request that information or confirm through that information where it is, and if the property owner says see you've made it to that point, you know, tear it up, I would agree with it.

MR. O'CONNELL: It comes—it gets back to the sign question.

MS. LANGHAUSER: (Inaudible.)

MR. O'CONNELL: (Inaudible.) the signs just maybe—

MS. LANGHAUSER: Ted knows where the sign is.

MR. O'CONNELL: Pardon?

MS. LANGHAUSER: Ted knows where the sign is. He's got (Inaudible.).

MR. O'CONNELL: It could be either a GPS position where the rights are extinguished or a linear measurement from a house.

MS. LANGHAUSER: Right.

MR. O'CONNELL: But something where the property owners feels protected that its not forever because that's not really—that doesn't sound fair.

MS. LANGHAUSER: Right. Lee, do you have easements on your project?

MR. WEISHAR: The Town has easements. Actually, Harwich went through and designated large sections of beach through the Chapter 91 process. And the Chapter 91 permits were in place. It was some of the other permits that weren't for the rest of the beaches. And, so, those have the standard for the lack of the better life of the project. When the fills gone, the easements gone basically.

MR. O'CONNELL: All right. Thank you. We're going to move to the last section. We're going to move a little bit further south.

You have a questionnaire in your packet. If you wouldn't mind filling that out either faxing it

in or sending it in or leaving it at the registration desk. It's just about your experience today at the workshop.

For those of you who don't know where the new breach is, I just thought I'd point it out to you. That's the breach that broke in 1987. Here's the area that was predicted where it would break, and now it's part of the barrier and that's where the inlet was in the mid-1800's. That's where, depending on who you talk to, whether it's an inlet or a breach.

AUDIENCE: It's a breach.

MR. O'CONNELL: Here's where it's located right now. Now, I'd like to think I was the first one to kayak through it Sunday morning.

All right. We're going to move south now and find out what other states are doing, particularly their nourishment projects, they'll talk a little bit about their volumes, and talk about where their funding sources come from. I think Massachusetts needs to step up to the plate in some way, although funding is a tough decision—tough topic.

We're going to talk about the New Jersey experience first with Dr. Tom Herrington. Tom's an Associate Professor of Ocean Engineering at the Department of Civil, Environmental, and Ocean Engineering. He is the Assistant Director of the Center for Maritime Systems at Stevens Institute of Technology in Hoboken, New Jersey. He's the Acting New Jersey Sea Grant Coastal Processes Specialist, our counterpart in New Jersey. Let's see, and the Director of the New Jersey Coastal Protection Technical Assistance Service. His teaching and research interests include coastal hydrodynamics, sediment transport, wave instruction interaction, coastal meteorology, coastal hazard mitigation, and the development of a coastal observing system—big topic now around the country.

Dr. Herrington is an author and has co-authored over 50 technical publications in the field of coastal and ocean engineering including the New Jersey Sea Grant Manual for Coastal Hazard Mitigation. He's a contributing author to the New Jersey State Hazard Mitigation Plan. Holds a Bachelor's Degree in Civil Engineering and an M.S. and Ph.D. in Ocean Engineering from the Stevens Institute of Technology. Welcome from New Jersey; Tom, thanks for coming.

DR. HERRINGTON: Thank you, very much. Listening to the talks this morning and this afternoon, I'm not going to tell you that everything that we do in New Jersey is applicable to the problems you have in Massachusetts, but what I do want to do is give you a feel for the way we implemented the shore protection plan in New Jersey, and some of the issues that have come up since this implementation.

As Jim just said, I wear many hats. Today, I will specifically be talking about our work for the State of New Jersey through their Coastal Protection Technical Assistance Service, which funded most of our research.

So, today what I'd like to do is one, give you a historical perspective of the conditions in New Jersey that leads to why we do what we do there, to give you some background.

Also the social/economic value of our coast in New Jersey is a big driver in the decision that we made to stabilize our coast. So, the fundamentals were there and the challenge was how will we fund it. Luckily, we had a supportive Legislature in New Jersey that developed a stable funding mecha-

nism to help us fund these projects which are very costly you'll see. So, I'm going to talk about the construction, how it's done, the post-project performance, and then finally some of the unexpected consequences that we've run into, most of which I blame Ted for because he was responsible for that at the Philadelphia District at the time.

Just to orient you, do you have a—

MR. O'CONNELL: It should be there. All right. Who borrowed it? I did.

DR. HERRINGTON: New Jersey, our shoreline, being pretty linear obviously compared to what you have here. It's 127 miles from the tip of Cape May to Sandy Hook, which is a barrier spit. It is comprised mostly of barrier island beaches. We do have two headlands; one up in Monmouth County, the northern portion of the coast, and one at the very tip of Cape May.

The coast is just like your cost extremely developed, extremely old. It was formed basically at the end of the last glacial period when sea-level rise slowed down enough for the deposits to form on the barrier islands. And because of that formation, Wicker in 1950, who was the Army Corps' Philadelphia District Engineer, said from a review of all the data available, that there was no source of sediments in New Jersey and that's true. There are no natural sources. There's very limited sources from the rivers, so we are primarily an eroding coast. Between sea-level rise and storm impacts, we erode.

We're also very developed. Cape May, which is down here, Cape May City was one of the earlier sea-side resorts in the country with the turn of the century in the 1800's. And the northern coast also developed very early on in the 1860's. Grant actually made the summer White House in Long Branch, New Jersey, and six of his predecessors also used it as a summer White House.

So, it's an old coast, and there's been a lot of research on it and a lot of talk but not much action for many, many years.

Just to back up, one of the real attributing aspects to our coastal processes is the location of New England and Long Island in particular relative to the coast of New Jersey. We basically have a wave climate that sees strong northeasterly wave events from about the middle portion of the coast south. That wave energy is actually blocked by Long Island at the northern part of the coast. So, we actually see less sediment transport up here during the winter and much more on the southern portion of the coast.

In population density, New Jersey is 9 million people. And then with Philadelphia right here and New York City right here, the coast is accessible to about 30 million people within an hour's drive. So, it's a very, very heavily utilized coastline.

Because of that natural geography of the New York Bight, our transport patterns over the long term are mostly north to south from the center portion of the coast to Cape May and then north—or south to north in Monmouth County, the northern county. And that's led to some problems that we've had to address.

Most of our shoreline change, just like yours, is episodic in nature. Strong nor'easters and hurricanes are the strongest agents for change. They will change the coast instantly for decades to come, and we've seen that historically.

The development of the coast started in earnest in the 1920's, and the first major impact to the

coastal development was the 1944 hurricane. It didn't hit us. It went close enough by the coast to create the largest tidal surge measured in Atlantic City and still the surge to date reaching almost 10 feet above mean low or low water. The impact of that was tremendous. That was recorded as almost like a tidal wave that took out the coastal communities in one shot.

Then the one that you're familiar with I'm sure—the March 1962 Nor'easter which was a very strong low-pressure system that sat off the eastern seaboard for four days, generated a sequence of high tides that did not recede for two days. And the consequence to that was most of our islands were completely overwashed. We had new inlets open, not just the few we do have now. And we saw tremendous damage not only on the ocean-front structures but all the way across the barrier islands.

So, our response to this event was the "Jersification" of the shore as Orin Pilky likes to call it.

AUDIENCE: (Laughter.)

DR. HERRINGTON: Which was hard structures, and these were mainly designed to stabilize and retain sediments along a coast that had no sources of sand. So, we're just trying to slow things down. This is the groin field in Monmouth County. You can see the downdrift impacts. Most of these were constructed and built by the local municipalities. There's about 60 municipalities along the coast of New Jersey, and you can tell where the boundaries are by the length of the groins pretty much. The terminal groins will indicate a municipal boundary.

AUDIENCE: (Laughter.)

DR. HERRINGTON: We also not only try to slow down the sediments but when the erosion gets too chronic then you end up with a situation of hard shore fronts, hardening the coast. Here we have a bulkhead with a stone toe and a stone revetment to hold the line against the ocean. And then this is the very famous seawall in northern Monmouth County, which was actually built by the railroad. There was a railroad line back here in the 1800's. They built this wall, and then abandoned the railroad, so that's always a bad sign.

AUDIENCE: (Laughter.)

DR. HERRINGTON: The federal interest in New Jersey goes back to the Rivers and Harbors Act of 1907. Much of the coast, almost all of the coast has been under study since the 1950's. The projects were never built because the State of New Jersey had no way to match the funds required to get the federal money to build the projects.

In 1991, through a state funding bill in the amount of $15 million, it was a Legislative bill, they put aside $15 million to build two projects through an economic development fund, and that allowed the State to actually match the 65/35 cost-share that's required by the federal government to build shore protection projects. And the two they decided to build were two very important tourism communities, Cape May City at the southern end of Cape May County, and Ocean City at the northern end of Cape May County. So, Cape May County made out pretty well.

Just some statistics on those two projects. The Cape May beach fill, now these are massive, massive fill projects, they're designed to prevent damage in the 50-year storm event. Cape May had between a 25 and 108 foot wide berm at elevation +8 NGVD. That's maybe three or four feet above sea level, and it's renourished on a two-year cycle. And the initial fill was just placed in July of 1991,

and then it went through a series of renourishments, and now we placed something like 3.7 million cubic yards at a cost of $28 million at Cape May.

And this is just to give you an idea of what happens in that type of project. This is a pre-construction profile, and post construction where you translated the beach out a certain distance. This is between October 1990 and October 2000 so this is the overall change. And this is kind of a historical change on the beach recently from 2004 to 2005 that shows it is extremely stable. The beach doesn't erode very much. It is in place, and it had been very successful.

The Ocean City Nourishment Project started a year later, in 1992. It had two phases of construction. And then it also goes through periodic renourishment. It's a 100 foot wide berm at +8 and a 3-year renourishment cycle. This project, a number of interesting things occurred, one, there's was a storm rehab during construction and we are going to talk about that in a second. That's a key event in the history of New Jersey. In July of 1993 they had to go in and put in about another 850,000 cubic yards of material. And then we've had a number of renourishments where we put 11.9 million cubic yards at a total cost of $57 million. And the reason for that, and it was mentioned earlier, is that there's a hotspot on this fill project, so almost all this renourishment has been placed over a 15 block area along the northern inlet coast where the ebb shoal is actually creating a focusing effect and accelerating the erosion on the project.

And this is the kind of change you get on a project of this magnitude. This is in 1991, preconstruction. When I was a kid, I used to surf under this boardwalk at high tide, and now the beach is maintained at a width of 100 feet. This is a post-construction. I think it was mentioned earlier this morning these are actually designed with some advanced nourishment, so the actual shoreline position is back here when it's kind of transitioned.

The design objectives of these, and I just wanted to bring these slides in and it was mentioned a little bit, is to advance the entire profile a certain distance. And typically it's 100 feet in New Jersey's case and may be a little bigger or smaller where you are. But if you notice it includes everything underneath the profile. It's what we call a depth of closure, now 25 to 30 feet below the water level in New Jersey. And when we construct these projects, it's almost impossible to place the sand accurately underwater. So, what we do is we fill in a design or a construction template which looks like a trapezoid almost, which contains all the volume necessary to move the entire profile out to 30 feet of water depth, 100 feet in width, but we rely on the ocean to erode this kind of overfill and replicate the natural profile.

Now, this is, from a public relations standpoint, a nightmare. Because when you show somebody this beach and then in a half year it erodes almost half its width, it's automatically fingered as a failure. And it's been a very, very difficult thing to get the local communities to understand the way the projects are designed. We made some kind of headway over 10 years but not very much.

How long does it take to transition? It depends. You can get a storm and this is what happened in the case of Ocean City and Cape May. We had the December 1992 Nor'easter that came in and eroded the profile dramatically during the construction phase. They had tremendous damage. We actually had four storms in a row starting with the Halloween Storm in 1991, also called the Perfect Storm, and ending in March of 1993. This four sequences of storms is unprecedented in the historic record we have in New Jersey. And it created unprecedented damage in those 18 months.

So, New Jersey, at that point, is in a cross-road situation similar to what you're talking about here today. What should New Jersey do? You know, in the Legislature it was discussed at length, should we retreat from the coast. Is it too expensive to maintain the coast?

Well, they decided to put it to a referendum vote and it was overwhelmingly approved. The proposal was to establish a $15 million dollar stable source of funds to match federal beach fill projects and 85% of the voters said, "Yes, we need that." And the reason is because when you survey New Jerseyans they say they identify with the coast. The coast of New Jersey is important to them as a state symbol, as a recreational resource, and to them it's worth protecting in any way.

Since 1993 we've actually gotten this fund up to $25 million annually. And the reasons varied but they're really good. The coastal tourism economy in New Jersey is somewhere between 18 and $20 billion annually. The cost of one project is about $10 million. So, the tradeoff is unbelievable. That money translates into wages, 17.7 billion in wages, 3.8 billion in state revenue, tax revenue, and, again, the recreational outlay is intense.

And the way we funded this is through a real estate transfer tax. Every time somebody rents a room in Atlantic City or a house, summer house, on Long Beach Island there's a tax and that goes into the fund. And the Legislators were smart enough to put a poison pill into it where it's also attached to Medicare funding support.

AUDIENCE: (Laughter.)

DR. HERRINGTON: So, if you kill it —it's the only way to do it, but there's no way any Legislator's going to take away that (Inaudible.).

So, this funding was used to cost-share several federal projects starting in 1994 with the Monmouth County project. We'll talk a little bit about that, and then these follow up projects. Today we have 65 miles of the coast, almost half the coast, has been pumped and restored. We have about 140 million cubic yards of material in place at the cost of $404 million.

Just briefly, the Monmouth County project is 21 miles long. It's the longest shore protection project in the United States. Again, it's a hundred foot-wide berm at +8 and a six-year renourishment cycle. When this project was constructed, it was so massive many of the coastal experts in the nation said there's no way it's going to stay. You're trying to build something that's like throwing money away in the ocean. And we've actually had to increase the renourishment interval to 8 years because of the performance of the projects. It's been extremely successful.

Again, the type of change we are talking about, this is that seawall I showed you before, and this is the beach they placed in front of it; 250 feet wide in construction designed to be 100 foot wide when it's done.

Now, this project for this massive size has led to very unexpected consequences. And these are the things we're dealing with now that may be of issue to you in the future. One is that that beach fill in Monmouth County never did that natural transition with the wave action, and the reason for that is because that blocking effect of Long Island. We have a very strong littoral transport from south to north, about 200,000 cubic yards per year is moving up into Sandy Hook. And it doesn't allow the profiles to adjust naturally into an offshore sandbar and a beach berm, and the impact of that is that it's impacting and degrading—-- the recreational resources; the surfing, the swimming, the fishing.

All have been negatively impacted, and there's been some local resistance now because they really want these problems addressed before we move forward with other projects. And, so, that's a bigger issue for us now.

The second thing is New Jersey, even prior to the other beach fill projects, had put in a regulation that any money from the state used for designing and building coastal protection projects has to include the construction of a coastal sand dune. It is a great idea but it has led to some unintended consequences. With the size of these beach fills, these dunes grow extremely rapidly. They grow very high in height, they begin to block ocean views, and now homeowners are saying we don't want to give you an easement to build this because you're going to devalue my property.

And so that's an issue, and there's also some environmental issues because the dunes actually grow out across the beach berm, and they're taking away that habitat we've learned about today, from the Least Terns and Piping Plovers. So, one size fits all regulations are not working, that's what we're finding out.

This is just to give you an idea of change. This is the Monmouth County Project. This is the pre-fill profile. This is the placed fill, and then this is from November of '96 through April of '98. There isn't much change at all after the fill was placed, but when we looked over the longer term, and this has never been renourished, this profile's still exactly the same in October of 2003. And if you notice this extremely steep offshore drop in the foreshore, here you just have waves that just crash right along the foreshore slope and, obviously, that's not good for swimming or surfing, and you end up with waves that break like this.

The impact of this has been so much local resistance that we actually had a $10 million project held up in Long Beach Island at the center of the state and this is a critically eroding area. Homeowners and recreational users of the beach have initiated a number of lawsuits against the U.S. Army Corps of Engineers and the State of New Jersey to stop this project and because of that, we've only pumped about 2 miles of the whole project right in the middle. That's all they have easements for. So, we're still working through that.

Here's some of that dune growth impact I was talking about. This is a post-fill view of Ocean City, New Jersey. It varies. It may be 100 foot wide (Bell.)—almost done—here the dunes have grown all the way up to the high water line and dunes will do that as the natural progression, but now we have no beach berm here and there's very little habitat. So, there's all these tradeoffs with what you want to do with your beach. You have to really think about your management plan.

And then the growth, this is a pre-fill view of Ocean City, New Jersey and this is it post-fill. Here the dune has just been in for two years and already it's starting to block the view from the Boardwalk and the lower units there, that becomes a huge issue.

And then, finally, in Monmouth County the length of those structures—all those groins that I showed you—they're so long that they began to impact the transfer patterns, negatively, and the performance has already started to decline so now we've gone in and we've had to notch—we're going to remove most of these structures but it was too expensive, so they cut notches out. The one benefit is that it keeps the fishing habitat, the very unnatural fishing habitat, but it still allows the sediment transport.

So, just to conclude real quickly, we found that beach nourishment has exceeded the expectations that New Jersey had. It's economically viable. We generate $20 billion in coastal tourism and revenue, and over the 50-year project lengths we're probably going to look at 5 to $8 billion in cost depending on the cost of pumping sand. So, it's a win for New Jersey from the funding standpoint. As I mentioned, there's a poison pill in that funding mechanism, so that's not going to go away, and now we just need to start to address those unanticipated consequences I mentioned.

So, with that, I give you back the floor.

MR. O'CONNELL: Now, that's a fascinating story. We're going to move a little bit further south now for our final speaker. We're going to go to Delaware and see how Delaware—see if Delaware has the same unintended consequences and talk a little bit about their funding as well.

We've talked about the Delaware beaches. Tony Pratt is joining us. He's the Program Administrator of the Shoreline and Waterways Management Section of the Delaware Department of Natural Resources and Environmental Control. He oversees programs related to beach construction regulation, technical engineering services, beach and dune building and maintenance, waterway management, and coastal hazard and mitigation.

He's an adjunct Assistant Professor in the Marine Policy Program of the graduate college of Marine Studies at the University of Delaware. He was a member of both the National Research Council's Committee on Beach Nourishment and Protection and the Coastal Engineering Research and Education Needs as well as the H. John the III, Heinz the III Center—hold on—as well as the H. John Heinz, III, Center Panel on Risk Vulnerability and the True Costs of Coastal Hazards.

Tony is also currently the Co-Leader of the National Shoreline Management Study, Writing Group for the U.S. Army Corps of Engineers, and Delaware's Beach Replenishment Task Force. Interestingly, he was the Deputy Mayor of Lewes, Delaware from 1992 to 1998. He holds a Bachelor's Degree from Hampshire College in Amherst, Massachusetts. Welcome back. Come tell us about Delaware.

MR. PRATT: It took a long time to get back here. Thanks, Jim. When Jim asked me to do this, I was really curious as to what the favorable comparison would be between Massachusetts' situation and Delaware's but the comparison is obvious. In Massachusetts state although small, we're so far south, we have New England barriers, no glaciation to speak of, but as the speakers have gone on today, it is apparent and as Tom pointed out, you know, the parallels in the process of determining your faith as we did and are doing as New Jersey has done, and it is remarkably parallel to what we went through in the mid-1980's too.

I'm going to show just a few slides. Just so you know I'm going to show some pictures and a lot of these are repetitive of things you've seen today, so I'm going to try to blaze through them because I know I'm the only thing between you and Jim's beer and the lobster.

AUDIENCE: (Laughter.)

MR. O'CONNELL: Really? Get the bell.

MR. PRATT: Don't say that. You better take me first here. The use of historic vote is always interesting. Rehoboth Beach, Delaware, 1906, we've seen pictures like this from Massachusetts earlier today

and by the dates here are 1920 you see down here those same houses are now right on the edge of the sea, and you think, "Oh my gosh, we're about to fall in." The very first projects ever done in Delaware were done around that time—1920's you saw the construction of groins because at that time in Delaware and most East Coast States, Gulf Coast for that matter and particularly West Coast development was very punctuated. You know, how you could treat erosion didn't much matter because if you could somehow stabilize the coast in a very short distance of the shoreline, the consequence of downdrift were not of any concern. And we went on to years and years of erosion problems and treating them in various ways.

I throw this picture in. This is some cool dudes of 1956. I kind of wish we worked in that era. We'd wear fedoras and trench coasts, and this guy—he must have been in Massachusetts, he's got a sou'western on.

AUDIENCE: (Laughter.)

MR. PRATT: This is Broadkill Beach. I remember going to Nantucket when I was about 8 years old. My parents got me a sou'western and I wore it proudly for years, and all the rain, of course, ran down my back.

But, you know, we've had this problem for a long time. And we began to really take it seriously as a lot of things came together. This is a picture taken in Delaware in about 1946, we believe. It's not dated, but what you see in the background is Indian River Inlet. Along the linear barrier span up in here and this beautiful system here of sand, which has got a highway old Route 14, now Route 1 in Delaware, a little neck of land extending out to a whole-scene barrier system with nice wetlands habitat from behind. And it's kind of significant to see what that looked like then and that today looks just like that.

AUDIENCE: (Oohing.)

MR. PRATT: It's the same place. So, while we see this sea-level rise and littoral drift and sand moving down the coastline at Indian River inlet which is severely offset to the north. You can really sort of make that out in the top of the picture. At the same time that the coastal dynamics are playing out, we're kind of moving ever closer to the shore. So, obviously, the pinpoint comes together, the theme of the day; right? It's pinching out. We also have found since World War II a tremendous amount of free time. This country enjoys a lot of leisure time, a great deal of affluence, and as Tom pointed out, you know, 30 million people—was that the number?

MR. HERRINGTON: (Nodding.)

MR. PRATT: And 30 million people in driving. When New Jersey fills up with 30 million, they come to Delaware.

AUDIENCE: (Laughter.)

MR. HERRINGTON: Okay.

MR. PRATT: And we take half the crowd in Philadelphia, all the Baltimorons and the—

AUDIENCE: (Laughter.)

MR. PRATT: —and we bring them to Delaware. Don't repeat me; all right?

MR. HERRINGTON: You can take (Inaudible.)

MR. PRATT: I'm safe outside of Boston; right? But we tend to be catering to a very congested crowd, and when you get down to sort of the socioeconomics, which we looked at long and hard, you begin to think about what's the quality of the experience. You know, if you have this kind of space here, you might venture to come back and spend your $200 a night for a hotel room, or, in the case of Delaware, rent the private house for somewhere between 7 and $10,000 per week, which is what we get, or you can buy your house on the open market, ocean-front, single-family residential in the exclusive Delaware neighborhoods that we cater to the Washingtonians for somewhere around 7 to $10 million a pop. That's the prices that are ongoing there.

But if you came down and you had this kind of experience, this is low tide, these are houses sitting on the edge of the water. This happens to be a community South Bethany, and if you had that kind of experience, would you be willing to pay the premium rate for this rental next year and chances are you wouldn't.

And what's interesting in my new home in Delaware and my old home in Massachusetts was much bigger, but in Delaware we have this funny little thing on the Delmarva Peninsula where it's made up of three states. So, we actually find ourselves in a competitive market. We're peddling beaches because beaches are good business. It's good in lots of ways. I'm going to get into that in just a few minutes, but if that guy and his family had a bad experience in Delaware, they're going to go to Maryland or North Carolina or Virginia or New Jersey or Massachusetts and find that more favorable experience.

We find ourselves in a competitive market for people who are going to seek a beach vacation. They're not going to probably go to the mountains as an alternative. They're not going to go to Disneyland as an alternative most likely. They're going to find a beach somewhere that suits their needs. How about a dry beach being just one?

And how about enough room to elbow yourself out of a crowd? We've seen it. I talk at Delaware quite a bit about the experience of coming down to the beach in the early morning, and if you have about 50 feet of dry sand between the demarcation line, it could be a boardwalk or it could be a house or it could be a seawall, whatever it is, but if you've got only 50 feet of dry sand, you'll sit down in the morning, you're the early bird, you get up, you have all this space, and the next party that comes down they're going to sit about 40 feet away. In about 20-30 minutes, 40 minutes later, the next group's 20 feet away, half-way in between, and then by the end of the day, and I know Tom so I'm going to do this, here's what we look like. You know, sitting elbow-to-elbow to somebody you don't know. The cigarette ashes flicking over your shoulder and the newspapers being thrown at your side. Are you going to pay anything to go do that? Chances are you're not.

And when it gets really bad and there's no beach at all, and we have seen this example unfortunately around this country, most notably and I'm going to pick on Tom and New Jersey quite a bit today because it's been my good/bad example for a long time, we can look at Atlantic City, New Jersey and Miami Beach, Florida cities that urbanized early on and Cape May was another one.

But most notably Atlantic City and Miami Beach are two cities that urbanized very high for the time, great high hotel units, and then when the beach disappeared, the thing that began to happen is they couldn't rent the rooms at the same rate. Therefore, the upkeep of those units and the buildings began to diminish and they began to rent to a lower clientele. In fact, it wasn't even a beach user anymore; it was anybody who wanted to just pay a few bucks to stay there. And so we saw these cities on beaches that really had nothing to do with a beach proximity. It was low rent, cheap housing, and all the things that come with that.

And so we began to look at the social impacts of disregarding our urbanized coastlines and what the consequences were of doing that. At the same time with the diminishment of beaches, you see this is an October 3 picture pretty early in the season. We had probably had a little bit of a storm, but when the beach diminishes in Delaware it's very similar to most Atlantic states, we had something like 100 to 125 foot of difference horizontally between the high water mark of the summer and the high water mark of the winter and anywhere to 6 to 10 feet vertically, and this scene can turn into this scene very rapidly, same building.

We don't—we have not in Delaware ignored the full beneficial, excuse me, the full economic range of benefits that beaches provide. They are natural systems. They provide habitat for any number of species, winged species, infauna in the beach, and beach nesters and plants that are very unique to it. This is kind of a faded out picture, but there's a Least Tern hiding in the grass, (Inaudible.) is in a backdune environment, and it does seek some shelter in a vegetated grassy area.

This is an important component of what makes up the beaches. The full components of beaches are they provide habitat, they provide recreational experience, and they provide benefits of storm protection to structures that are part of the communities behind them.

Here's another picture of infauna. So, one of the things that is also forgotten sometimes in the equation is what the system, the sand system, in a barrier system, barrier island-type system does for protecting a land or aquatic habitat. This quiescent cove in here, this is actually Fenwick Island down here if anybody knows the Delaware Peninsula very well or Delmarva Peninsula, this is Fenwick Island looking up toward Bethany Beach up here. This is Little Assawoman Bay, but this has played out time and again. We'll have the pictures today showing sandy shock absorbers, if you will, to ocean energy allowing a quiet and very productive estuarian habitat to be there. Should we mismanage the sediment out here, and we have mismanaged sediment badly in this country, but should we mismanage this and we find a very large diminishment, and then Delaware's like New Jersey. We don't think there's any natural sources of sand anymore—ways to redistribute what we have in the system. If we mismanage this and this opens up, this becomes a very energetic system and the wetlands are lost.

So, we began to look at what our alternatives were, and you've seen a lot of pictures of sand coming out of pipes today, so I'm not going to dwell on that. This is the Rehoboth Beach, Dewey Beachfill Project, which was completed in 2005. This project consistent of about 1.9 million cubic yards of sand being placed. The building that was—with very little beach in front of it, and then the surf zone is right there. You can see the beach being gut out in front of it in this location. And we see these kinds of changes on the beach face itself. Those are the same structures. You see these two buildings here is before nourishment began, and then as the beach is being built they're well behind

the very wide berm here.

And so, you know, you get the picture, and for 1.9 million cubic yard beach you get from this strand here to something like this which works the progress in the dune line and in front of the houses here where there had been very little before.

If anybody who is interested in the number of cubic yards per linear foot, in this lower section of Dewey Beach down in here, it was about 175 cubic yards per linear feet. And we went from this kind of recreational experience in the summer of 2004 in front of that same building that had water around it to this kind of experience. That building is actually off to the left but that's now the beach we offer for recreational use.

So, how do we get started? First of all, and I know the buzzer's going to go off pretty soon here, we first started to think about cooperating with the Corps of Engineers in—I think I'm losing my light here, there it is—in Corps of Engineer projects beginning in the mid-1980's. And we realized that that was going to be a long and torturous process.

In fact, beginning with authorization to begin studying the Delaware coast in about 1984 we saw first construction start in 2005. That's how long it took. So, we began to really think about state projects, and Tom doesn't know the story, but I'm going to tell it to him, I was on a committee that was looking at what was Delaware going to do and what were the alternatives? And I said, "Well, send me to New Jersey for a day, and I'll show you what our future looks like."

So, I went to Cape May, and I went all the way up as far as Monmouth and took a lot of pictures of a lot of places that were in bad shape, and one of the ones I've gotten a lot of mileage out of is North Cape May prior to the nourishment project that Tom talked about that was so large, and there's two young woman sitting on beach chairs on top of the armor-stone and seawall and there's a young couple walking on kind of the intertidal zone, and I get a lot of yuks in Delaware. You can see the picture, and I say, "Well, it's just a sand grain of a larger size. It's still kind of performing. It's very stable but you can sit on it, you can walk on it, that's your choice." I'm not very amenable for that kind of stuff. But as we began to look at do we save projects for interim to buy into the larger federal projects, we realized we need to think about local partners. We need to figure out, you know, could we convince the General Assembly in my state that this was justified that we could spend the kind of money we needed to spend, and what were those costs? What were the benefits going to be? Could we build a political will? And what are the environmental concerns?

You've got three hours of me because I'm going to sit here and talk because nobody's behind me. I'll tell you all these things. The options we looked at immediately and the people who talked about this there's no action. We can take an action.

First of all the loss of tourism. We have a down turnaround demand, community economic downturn, damaged and destroyed buildings, loss of habitat, debris of the littoral system and tort liability. You know, doing nothing is not as simple as just benign neglect that's going to go away. We have failed structures, and we have seen it all to often in Delaware. I've seen septic systems sitting in the shore face. I've seen pilings broken off and sitting there. Gas cans and gas tanks, any number of things. Without the money to go in and recover this stuff to pull out of the littoral system and make this beach clean and verifiably usable, we're going to end up closing off those sections of shoreline

that used to be oceanfront communities.

The next alternative is to retreat, and we're fortunate to have a University of Delaware program that has to have—has a Master's student and a Ph.D. student look at the cost related to that. And I'm going to say this very quickly, but if you were to buy out an oceanfront community, and I've got one in that community in South Bethany where there's no beach, 65 oceanfront houses at conservative cost, let's just use a diminished cost value of one million bucks, I've got $65 million invested immediately in full and buying every house. I then have the further cost of removing every one of them and cleaning the beach to the point where it's now usable. And what I've just gained in that community is the width of a berm, about 100 feet. I would then have to in my State of Delaware buy the road behind it, remove all the infrastructure, all the power lines, the sewer line, the water line, and then the second row of houses to be able to create the dune zone that a nourishment project would create. So, you need to put it on equitable terms.

In many cases when we let these beaches diminish to the point where there's nothing left, you've got to buy up probably two rows. And every time you buy out that front row, what you're buying is two things, the actual value of the house, whatever it is, and if you take a house, you know, out here at Cape Cod and you move it somewhere inland to the middle of Massachusetts, you know what the real value of that house is. The increased value, the resale value of the house was called proximity value. Because it's approximate to the resource that's in demand, you have inflated the value of that house because of it's proximity. And every time you buy the oceanfront house out and move it away, that proximity value shifts to the next house. So, you buy it the second time, and when you buy the second row, it shifts to the third row because they're now oceanfront.

So, if you're a wise bureaucrat like me, I think, well I'm going to buy a proximity value and in my scenario Delaware 6, 7, 8 rows of houses from the ocean back to where it might be safe, I'm going to buy that six times. And that's a very, very huge cost. Billions of dollars when we add it all up versus the cost of nourishment.

So, we began to think about that, and I said, "Well, you know what, it doesn't make much sense right now. Let's not do that." So, we began to think about nourishment as the way to go. We began to think well let's determine to an economic analysis what the risk if we do not take an action, you're kind of diminishing beach and dune widths.

So, we had a contract—it's the best money I ever spent under $50,000, and I had a Resource Value Economics Team from Bethesda, Maryland come in, Jack Boss & Associates, and they produced a report that in 1998 gave us some baseline data. There are an estimated 21,335 people who will live in the Delaware beach communities and the neighboring areas. An estimated 202,069 additional Delaware residents live within days traveling distance. Estimated 171,718 Maryland residents live within a day-use. And estimated 14,561 housing units valued at 3.5 billion dollars, and an estimated 5.1 person trips to Delaware beaches each year, and the consumer surplus for these exceeds 380 million. This is Delaware. We're 25 miles of total coastline. I mean, come on folks, this is not Massachusetts. It's not New Jersey. This is 25 miles, and these are the kind of numbers we came up with. Visitors spend more than $573 million in beach-related trips and expenditures each year and it goes on and on. You can read this yourself.

Current policies provide beach nourishment to the ocean beaches at a cost of—this is after we've

done a couple projects—and our costs are approximately $1.8 million per year thereby mitigating the effects of long-term erosion and sustaining the ability to attract and accommodate beach visitors.

So, if we looked ahead at that point in 1998 for a 5-year period, the following economic losses are predicted without nourishments. So, in 1998 we took stock of where we were, and said if we don't do this for the next five years, we're going to lose 268,000 visitors who will chose to vacation somewhere else. More than $20.1 million consumer surplus will be lost for those who no longer vacation on Delaware beaches. Tourist related revenues would decrease by more than $30 million, and this reduction in revenues will cause the loss of 625 beach area jobs, reduce wages and salaries, yada yada.

Beach area property values would drop nearly $43 million in value but the state will have avoided $9 million in cost for nourishment.

So, with that in hand, the gentleman or somebody said, "Well, this doesn't seem to make too much difficulty for us to make a decision here, and we have been in the business since then to do this. We pay for these projects." For the state projects, 100% state funding and we pay—we partnered with the federal government on the 35% rate versus their 65. And we're about to do a $25 million project this winter. We actually had 2007 funding.

We have two funding sources, and I'm right down to the end here. We have equal parts for our nourishment projects. We have equal parts bond bill and state accommodations taxes. Hotel and motel taxes is 1% statewide, and that generates about $2 million per year for us, which we matched then with bond money giving me about a $4 million budget to work with every single year. And for a small state like Delaware, that's not too bad. We do eventually and sometimes typically you get a little higher order than that.

So, where are we? Very quickly. In 2004, we looked like this. It really wasn't a great experience, and these houses, these buildings were very, very threatened, and that same location in 2005, here's that same building. It's a scale. This is not fenced off and that's a planted dune at this point. I should update this picture but that's our gain. We are scheduled in 2008 for the first renourishment of this one.

And I think that was it. That's it.

MR. O'CONNELL: Wow. Thirty seconds. (Bell.) We're now only 11 minutes behind schedule. Wow, what a day. Thank you. Do we have any questions for Tony and Tom? Do you want to come back up Tony and Tom for a minute? So, Tony, it's such a long walk to the water now.

MR. PRATT: I know. We've had complaints about that.

MR. STOCKER: This is Joel Stocker from Connecticut. You just mentioned that Delaware pays for it all, and then you mentioned the 65/35. Are you still paying 65?

MR. PRATT: Yes. Tony Pratt answering. Sixty-five for federal projects. We have two types of projects we've done. We've done some projects that are 100% state cost to buy us some reusable beach until we got to the larger federal projects, which we're now seeing the third of the three in Delaware being conducted this coming fall. For the federal and state partnership projects, the Corps of Engineers larger projects, the federal cost is 65% and we match 35% into that.

MR. STOCKER: And the cost benefits ratios come back to the federal as well as the state?

MR. PRATT: They do. They justify their project based on the total cost—the total project cost measured against the benefits that that total project will provide in the form of storm damage abatement.

MR. HERRINGTON: That's a good point to add to that. They're not allowed to count recreational benefit, so that tourism dollar generation is not counted into that cost-benefit ratio, although it's a real benefit.

MR. PRATT: It's a huge benefit. It's a market benefit.

MR. O'CONNELL: Any questions?

MR. ROBBINS: Greg Robbins. Where do you get the sand, and why doesn't anyone prevent you from getting it?

MR. HERRINGTON: Well, it depends on the project location for New Jersey—Tom Harrington answering. In the coastal barrier islands, we get it from the inlets, so we're mining the ebb shoal and the flood shoal, mostly the ebb shoals, and it actually helps the cost-benefit ratio because the federal government is improving navigation at the same time. So, that's where most of that comes from. The larger amount of county fill, it's been offshore borrow areas, and we've had some of the same issues that were discussed earlier today. But they're surveyed and monitored and it takes a couple years to get them figured out.

MR. PRATT: All our projects are in state waters within three miles of the coastline, and Delaware, the Delmarva and not so much in New Jersey, southern end of New Jersey is interesting. You know, I came—grew up in Massachusetts. I'm used to a glaciated coast where there's a lot of bedrock exposed.

I live in the Town of Lewes, which is right on the mouth of Delaware Bay and they tell me, I mean, I don't know for sure, but they tell me that if you dug straight down, you have to go 10,000 feet through sand and clay and gravel to hit bedrock. So, we're sitting on Appalachian outwash from glaciated mountains that outwashed to the coastal plain, and it's very thick, very deep. Two miles/three miles/five miles offshore we have the remnants of our old beach system that was there, you know, pre-glaciation and post-glaciation as the sea level has risen back up. We have just tremendous of a resource for sediment offshore.

MR. O'CONNELL: It begs a good question. I don't think this is the place to get into the debate, but essential fish habitat, you know, I'm not a fishery biologist, but you're removing—you're taking a depth away. You're removing the surface which is the habitat. I know in New Jersey they've done extensive studies on the time it takes for the benthic habitat to recover. In this area, it's suggested that in this area biological resources as well as the recovery rates are different, and I think that's one of our—what I'm going to hold. I'm not sure we have the data to be able to match whether or not we do have that type of recovery.

MR. PRATT: Well, in the case of Delaware, we actually—we're very concerned. We tapped initially into a shoal that extends off of Cape Henlopen and extends southeastward off of Rehoboth. The shoal is called Hen and Chicken Shoal. And there was a gentleman at NOAA who was one of the ini-

tial investigators for essential fish habitat in the country. His name is Mark Monaco. And we asked Mark to come over and take a look at this because we were concerned if that shoal was of benefit. And outside of that shoal, we have a very homogenous bottom. It's very flat, very little relief, and very consistent it its quality.

We had done benthic work. We have had sleds go through and try to discern areas that are less biologically productive and we avoid them, but for the most part its blue muscle, starfish kind of habitat, and then fin-fish migrating through it.

In the case of Hen and Chicken Shoals there was very little use of it because it's fairly barren. It does hold some promises of sharp pumping, so we don't use that shoal anymore. We went off of that shoal at the request of our fisheries biologist who asked that we not utilize it. We're looking at maybe a use of it at a more northern end where we thing sand is being replaced back into it.

We also talked about, you know, the relief in a flat homogenous bottom. Can we create relief that would make sense for fish. I mean, if a shoal that comes off the bottom or a rise that comes off the bottom is beneficial, could we come in an take for a larger area 5 to 10 feet off and leave a mound of 5 feet or 10 feet, so we could, you know, even scope the bottom to create some topography. So, we're open to working in any capacity we can to help habitat, at the same time understanding, you know, there's two human uses that are in competition is the fishery use and there's the recreational beach users, and so we get clamoring from both ends, you know, within our state.

MR. HERRINGTON: New Jersey's a little—they get off a little easy because the number one fishery in New Jersey is surf clams, and it's a dredged clamming operation so they're doing exactly the same thing in their fisher area, so the bar areas are identified, and there's actually—they allow the clammers in to clam out the area first, fish it out, and then they'll go in an take out the bar. So, it works out pretty well for the most part.

MR. O'CONNELL: Interesting. Janet.

MS. FREEDMAN: Janet Freedman. Do you have public access easements when you do these projects? And then what if somebody refuses? Can you take their property?

MR. PRATT: Perfect question. I was hoping somebody would ask that. It is now 4:30 on Friday. At some point today my lawyer filed a condemnation against somebody for an easement. So, it's done today. It was done today as we speak. But in Delaware, and I'll let Tom address New Jersey, we have two—we've actually gone through two generations of easements. We have state easements. We have required for years, forever, for 30, 40, 50 years that require not just the ability to walk through an area but to actually sit down. We let them sit in Delaware. It's unbelievable.

AUDIENCE: (Laughter.)

MR. PRATT: You can actually rest, but it's a requirement, and we will not expend any public funds. It's interesting in our state because we have had a long history of state-run projects, we actually have had our own dredge program in Delaware for a long time. We've nourished Delaware Bay beaches for a long time. If you want to retire and come where it's a little warmer in the winter, I've got a job for you.

AUDIENCE: (Laughter.)

MR. JAEDTKE: It's not warm enough.

AUDIENCE: (Laughter.)

MR. PRATT: I know. Well, global warming, it's coming our way.

MR. O'CONNELL: If you can wait 50 years, we'll take it.

MR. PRATT: But the federal jobs also require a federal easement, which is as stringent or more stringent than what we have issued in the past. And it is in perpetuity. You know, these easements we have gotten in the past and the ones we are now getting because we didn't match the federal language in our old easements are forever. You give up your rights to public end to the government to enter your property to build a project.

Where the public has rights is from the base of the dune. We don't let the public into the dune for lots of reasons. But the berm itself from the fence to the waterline is always open to the public. It's an absolute requirement, and we need 100% compliance. I'm getting ready to condemn four easements right now. I've got power of eminent domain.

MR. WEISHAR: Lee Weishar. So, from the homeowners perspective, they're giving up their rights to the beach but you are assuming the responsibility for maintaining that beach?

MR. PRATT: That's correct.

MR. HERRINGTON: That's right.

MR. WEISHAR: It seems like a no-brainer to me.

MR HERRINGTON: If—

MR. PRATT: Well, it's funny because, I'm sorry, Tom.

MR. HERRINGTON: No, go ahead.

MR. PRATT: We do get people who complain. Our project we're about to start here in September looks like is the ten communities of Bethany and South Bethany, and I have to be frank, I got a little bit disgruntled with the attitudes of people in Rehoboth when I went through this about three years ago with them, and I just said I'm never doing—I'm never going to grapple again to build somebody's beach for them. I don't care if it's one person out of the community. I'm just not going to do it. And, so, when we had—we had a required public meeting on this and it was a Saturday down in Bethany Beach and somebody raised their hand and said, "Well, right now, there's no dune," and, of course, the water under their house are the first people calling whenever there's a problem, "You've got to do something." So, you know, now we're going to build a dune and you can't access every house, well, there's something like four houses in each block between streets. So, this happens to be the second house in, and we said we're going to allow you to cross at the streets and we'll put one in the middle. "Well, I can walk right out and go to the beach. I'm going to have to go 40 feet over here and cross." And my answer to them was like, "Well, take our $25 million dollars and go to some place that it's appreciated. Next question."

AUDIENCE: (Laughter.)

MR. PRATT: I mean, what can you say? Honestly.

MR. HERRINGTON: They would add some—

MR. PRATT: I did. I just said that.

MR. O'CONNELL: Did you go away?

MR. PRATT: No, no. They signed the easement.

MR. HERRINGTON: New Jersey. New Jersey has almost the exact same policy, although we don't allow—there's still some riparian rights where people—well, if its a federal project, they do have to give up the whole riparian they have, so people can go anywhere on the beach. But we have run into the same kind of resistance about dunes and access pass over the dune, and we've also run into cases where the dune has grown to a height where the view has been impacted, and it has been challenged in court. And the Federal District Court in Philadelphia has ruled consistently in the favor of the homeowner, whereas the beach gets too big, the dune gets too big, and it devalues the property, then the State and the local municipality are responsible to make restitution for that lost value.

So, there's—the legal precedent is set where you can get very complicated. And now the Legislature in New Jersey is working in the Assembly to push some legislation through to make it basically a nuisance not to have a dune and give some leverage to the State. But right now we're at the mercy of the Federal District Courts.

MR. O'CONNELL: We can keep asking them questions and I'd like to, but I have one question I'd like to ask John Winkleman from the Corps of Engineers, so we can open it up to all—yourselves as well. But I find these stories just fascinating here.

But, John, quickly. I was astounded that you—the Corps of Engineers is looking for partnerships and looking for beneficial re-use of the sediment that's going to be dredged from the Cape Cod Canal. And you stated that you haven't gotten any partners. Does the State or the municipalities in the close proximity to the Cape Cod Canal, do they know about that? Have they been notified? Have you actually sat and discussed with them face-to-face? I find that astounding.

MR. WINKLEMAN: John Winkleman, Corps of Engineers. Yeah, we've—Mark Habel, who's on the planning side who was going to give that presentation, made sure that we sent copies to the State, so the State had that, DCR has that, other state agencies have it. And we sent it to individual towns, so most of the towns should have it, or they were sent it and lost it. We could send it again, but surprising—I mean, for cheap money, we pay for the dredging. The only thing that we're asking to be paid for was the difference of going to the least cost alternative to first pumping on the beach, so you're going to get a new beach for a couple dollars a yard essentially is what it came out to be versus the numbers we're seeing here, so it's kind of dumbfounding when you think about the math.

MR. O'CONNELL: Your last dredging project on the west end of the canal, there was a homeowner organization that was willing to put that up in the Town of Falmouth. It was a little too late—

MR. WINKLEMAN: Right.

MR. O'CONNELL: —I think in the planning process because the permits were already placed. I would guarantee you they're interested, but they're a private entity. I'm just astounded that none of the state and local government agencies have come forward actually. I just, I don't know, I can't believe that they read what you sent them. I think you have to resend it.

MR. WINKLEMAN: Yeah. Maybe, maybe we should. But, yeah, the case you brought up, I mean, that's the thing. If you get involved with the federal government because of the permitting and our funding cycles, it has to be, you know, you want to get in a couple years ahead of the dredging project to make sure everything is going to go smoothly. And that's what we were trying to do. We were trying to avoid that exact situation. We wanted to have reports on the shelf, an agreement on the shelf, so when things start to role, you know, we recall we know where are partners are and we can make it happen in a reasonable timeframe. So far we'll have to resend that report, I guess.

MR. O'CONNELL: When's the scheduled dredging? Do you have any guess? Do you know how much time there is for people to gear up and actually get into an agreement?

MR. WINKLEMAN: Well, I'm not sure what the next scheduled dredging on the Cape Cod Canal is. I think we'd have plenty of time before the next one.

MR. O'CONNELL: And can you accept applications from private entities, or they need to go through the town?

MR. WINKLEMAN: It can be—when you're talking private, you're starting to get into the Federal Government expending public dollars on private beaches. We can do that, but then they have to provide public access and you get into some of the issues that have been brought up today. Non-profit groups like the Nature Conservancy and everything can certainly partner with us as well. But, you know, private people can participate. You just have access issues—it's a sticky point. Yes, Lee.

MR. WEISHAR: Yeah, Lee Weishar. I can elaborate on that because, in fact, we did that permitting for that job.

MR. O'CONNELL: I know.

MR. WEISHAR: The Corps excepted the Chapter 91 Access Agreement for that particular project, and when we approached the Corps of Engineers, they tiered the capability of the projects, and the private projects are down at the bottom of the pile, understandably. And, unfortunately, so when we got in there, we were trying to get the Corps to change their contract and they're just—we're just a little bit too late to take advantage of it, but I'm sure we'll be back out.

MR. O'CONNELL: Good. That might get the ball rolling. Any more questions? If not, the beer's on Tom and Tony.

AUDIENCE: (Laughter.)

MR. O'CONNELL: Well, I want to thank all the speakers. I think this was fantastic. I'd like to say thank you to the Planning Committee and the Sea Grant, the Cooperative Extension, and the Coastal Ocean Institute for putting this together and the WHOI facility folks for letting us use it.

You'll all be receiving the verbatim proceedings as soon as we can all get them edited and just get the um's and the ah's out, and after that you'll be receiving part of the procedures—part of the registration packets, so thank you all for coming. I appreciate it.

AUDIENCE: Thank you.

(Whereupon, the conference was concluded at 4:40 p.m.)