2017 Delaware Resilient and Sustainable Communities Summit Proceedings

November 27, 2017 at the Delaware Tech Del-One Conference Center in Dover, Delaware

Welcome & Opening Remarks

Shawn Garvin, Secretary, Delaware Department of Natural Resources and Environmental Control

Secretary Garvin stressed the importance of resiliency, the ability to bounce back, and sustainability, providing for our communities. Both are important given the state's vulnerability to hurricanes. For example, Hurricane Jose did not make landfall but brought strong winds and high surf to Delaware, causing the closure of State Route 1. Flood risk increases given that Delaware has the lowest land elevation of any state. Realizing this, the conference will discuss the newest sea level rise scenarios and the tools available to planners, engineers, researchers, etc. To address sea level rise and flood risk Delaware worked with communities such as Slaughter Beach and New Castle. Agencies worked with these towns to develop flood warning systems as well as floodplain tools. Climate change affects our health and safety and it is important to take action.

Panel Presentation I: Storms, Climatology and Changing Conditions in Delaware

Efforts to Provide Improved Storm Surge Forecasts

Alan Cope, Science and Operations Officer, National Weather Service, Phila./Mt. Holly Forecast Office National Weather Service

- 2017 was a busy hurricane season- there were 17 named storms, 6 of which were major hurricanes.
- Those storms that made landfall in the United States include Cindy, Emily, Harvey, Irma, Maria, Nate and Phillipe.
- The outlook for 2017 back in May indicated that there was a 45% chance of it being an above normal hurricane season which changed to 60% in August. El Niño comes with warmer waters and thus was a driving factor for the busy hurricane season.
- It is important to note that every storm has a unique footprint with "5 toes".
- The "big toe" varies from storm to storm and can be characterized as damaging wind, heavy rain and inland flooding, storm surge/water rise, battering waves/beach erosion, or tornadoes.
- Graphic model of how a storm will cause flooding on the Delaware shore.

    - Every point on the model takes into account the surge height and changes based on the hurricane category.
- The Storm Surge Watch/Warning Graphic issued by the National Hurricane Center shows areas that have a significant risk of inundation above ground level.
- The Potential Surge Flooding Map for New York City is a probabilistic model of storm surge that illustrates a range of possibilities.
    - The National Weather Service has a computation of total water level interactive map that adds together astronomical tide, storm surge and base tide anomaly to get the total water level. This can be found on http://water.weather.gov/ahps2/index.php?wfo=phi . The green squares on the map are the tidal forecast points and give the forecasted and observed water levels.

Coastal Storms and Their Impacts: A Brief History for Delaware

Dan Leathers, Delaware State Climatologist, University of Delaware

- One can argue that coastal storms are the most important environmental consequence because of the flooding, high winds, and heavy snow fall that occur as a result of them.
- There are two types of storms: mid latitude and tropical.
    - In efforts to understand more about these storms, university students looked at 26,000 weather maps. In particular they were looking for an area of low pressure off the Mid-Atlantic coast with one closed isobar. This indicates that there was a real coastal storm there. While looking at the maps students also took note of location, duration, and its intensity.
- Mid Latitude stroms: frequency is the highest in the late winter and early spring-- it peaks in March.
    - On average there are 32 storms per year.
    - There is no annual cycle when it comes to intensity but April has the strongest storms (lower pressures = stronger storms).
    - There are no long-term trends in either the frequency or intensity of coastal storms since 1945.
- Tropical Cyclones- those tracked within 200 miles of Lewes were taken into account
    - Between 1851- 2016 there have been 206 cyclones that have tracked in this area.
    - Tropical systems are the most numerous late in the summer – months August, September, and October.
    - The number of storms seems to behave in a cyclic manner. Every 60 years there is a peak in the number of storms– the 1880s, 1940s, and 2000s.
- Many storms first get their start in one of three areas: the Gulf of Mexico, Caribbean Sea/Atlantic Coast, or Cape Verde.
- Most of the storms that affect us get their start in the Caribbean Sea/ Atlantic Coast.
- Storms that originate in the other two areas aren't as strong by the time they reach us.

    - We do not really get flooding from those storms that start in the Gulf of Mexico because they need to pass land which weakens the storm.
- There have been 42 coastal flooding events at the Lewes tide gate since 1957.
    - 36 of these are moderate coastal flooding events and 6 are severe coastal flooding events.
    - 37 have been associated with mid-latitude cyclones and 5 with tropical weather systems.
    - Most of the major flooding events took place in October.
    - There was a significant number in March as well.
    - There have been more flooding events taking place at Lewes in the later years but there are still many questions to be answered. For instance, the number of major coastal flooding events has increased in recent decades but there has been no increase in the frequency, intensity of coastal storms in the mid-Atlantic.
- The Coastal Flood Monitoring System consists of flood inundation maps and is available through the University of Delaware.

Sea Level Rise and Tidal Flooding in Delaware

John Callahan, Climate Scientist, Delaware Geological Survey

- Delaware is vulnerable to coastal flooding for many reasons including hurricanes/tropical storms, nor'easters/mid-Atlantic cyclones, its flat and low-lying land, open topography, location of development (public infrastructure and communities), and coastal economy (tourism).
- When discussing the potential impacts of sea level rise to Delaware it is important to understand that sea level rise is separate from weather.
- There will be a change in the average water level without storms- gradual consequence of global warming.
- While sea level rise has continually increased within the past 2000 years there is a sharp uptick in the last 100 years of data.
- Delaware has been taking action to address sea level rise
    - there are many tools available, Executive Order 41 incorporates sea level rise in various activities, and the sea level rise technical committee, led by the Delaware Geological Survey and sponsored by Costal Programs, are updating the sea level rise scenarios put forth by DNREC in 2009.
- There are many factors that contribute to sea level rise- warming temperatures are causing the oceans to expand and the melting ice sheets are causing more water to go from land to oceans.
- There are regional factors that contribute to sea level rise as well: gravitational changes of Greenland where the water around Greenland will actually go down by them and up in the Mid-Atlantic, ocean circulation changes also are a regional factor where the Gulf Stream migrates over and the pull relaxes, and glacial isostatic adjustment, is the general idea that Delaware is sinking.

- The Delaware 2017 sea level rise scenarios are based upon the "business-as-usual" case of a greenhouse gas emissions future.
    - There are three planning scenarios—high, intermediate and low. We are unsure about Antarctica's contribution to sea level rise.
- There are observations made based on nuisance flooding. Nuisance flooding can be described as a minor coastal flood advisory level. Small increases of sea level rise can have a significant increase in the amount of nuisance flooding that occurs. It is projected that in 2030 Lewes will have ~70 days per year of nuisance flooding and ~150 days per year in 2045.

Question and Answer Period

- Will the presentations be made available online?
    - Yes
- How do we take the information from the sea level rise scenarios and enter that into a shorter timeframe?
    - One must evaluate its sensitivity to flooding and can pick one of the higher scenarios
- Are there indications of when to use the high scenario vs. low scenario?
    - You must ask yourself a series of questions: what kind of project are you doing? Can it be easily moved? Is it a critical facility? What kind of timeframe are you looking at?
- What level of certainty can you say that there will definitely be some sea level rise?
    - Sea level rise was, is, and will continue to occur. While projections are trying to figure out how much that will occur- in a couple of decades it doesn't matter which scenario is used but there will be some amount of sea level rise.
- In 1800-1850 there was a slight downward trend in sea level rise- wouldn't this be cyclic?
    - Temperatures have increased quite dramatically and sea level rise is a direct effect. Ocean expansion and glacier melting have increased which were not factors 300 years ago.
- Is there evidence of observed or projected changes in the water table?
    - Sea level rise causes groundwater inundation and saturates roots and crops. Hundreds of wells are being monitored.
- Speak more to the impact of development on the state and how it is going to be a direct impact on sea level rise.
    - Development results in more impervious surfaces in which water runs faster into streams. This can also increase flash flooding problems. A lot it depends on the development of the communities and the dunes and wetlands that surround them.

Keynote Speech: Communicating Storm Risk: Insights on Human Behavior in the Wake of Superstorm Sandy and the 2017 Hurricanes

Nancy Balcom, Associate Director, Connecticut Sea Grant

- Social research: why do people react how they do with the threat of a hurricane?

- It is important to recognize that people are expanding how they access information as well as they have their specific ways on how they like to do so.
- The elderly often prefer the television to access information while the younger generation may prefer their phones. Thus it is ideal to get information out on as many media platforms to reach as many people as possible.
- Social media is increasingly playing a bigger role in storms.
    - During Hurricane Harvey a pregnant mother who stayed in place was able to use social media to get rescue aid.
    - Twitter is being used to assess the damage in communities that were hit by a major storm and identify priority response areas.
- One study done in Connecticut identifies perceptions of risk when it comes to hurricanes and peoples' willingness to evacuate:
    - First Out- know they are at great risk to a coastal storm, don't perceive a lot of barriers to evacuate
    - Constrained- understands the risks of staying, cites the barriers, will evacuate if warned, and are less likely to be prepared.
    - Optimists: substantially underestimate risk from any hurricane, are the least prepared
    - Reluctant: Less afraid on average, tend to live further from the coast, would evacuate if told to do so by an official, perceive significant barriers to evacuate, will evacuate but they feel as if it will not be necessary
    - Diehards: lowest hurricane risk perception, least likely to evacuate for any category hurricane with or without official order, self-reliant, prepared, protect property, pets important barrier for 25%
- People in the study were asked, "Who are you most likely to listen to if told to evacuate?"
    - Local police/fire department was generally the highest and local government officials were high too.
    - But regardless it doesn't seem to really matter for the diehards who tells them. The diehards had problems leaving their pets as well as have mental, health, financial and transportation related constraints.
- The State University of New York College of Environmental Science and Forestry conducted a study looking at why people stayed in place during a hurricane rather than evacuating.
    - One disturbing account noted that a shelter gate was locked and prevented an individual in a wheelchair from entering. Thus the individual decided to go back to their home.
    - Other reasons why people decided to stay in place include that people can only imagine what they experienced, they didn't know about the hurricane or storm surge potential, they believed their house was high enough, the y have had previous bad experience with traffic, they waited too long, and/or they wanted to deal with the damage right away.
    - Some people noted that if their homes are more resilient they are more likely to evacuate because they know it will be there when they get back. But others thought the

opposite and said they would be less likely to evacuate because their home would be more able to withstand the storm.

- Connecticut residents are unsure if they live in an evacuation zone
    - It would be ideal if Connecticut were to adopt something such as the New York City Know Your Zone Campaign.
    - The zones are posted throughout the city in hopes that in the event of an evacuation, residents will know what zone they are in because they have seen the signs.
- How storms are communicated plays a major role in if people decide to evacuate.
- Compliance is 24 times greater when there is a mandatory evacuation.
- Almost half of the deaths from tropical cyclones are caused from storm surge.
    - It is difficult for people to visualize storm surges; maps that visualize storm surges are helpful.
    - Using local infrastructure that people are familiar with makes storm surge more tangible.

Question and Answer Period

- *Question not recorded
    - Local officials pay attention to a storm 6-7 days out while residents pay attention 4-5 days out.
- Puerto Rico is so far removed it is hard to be a sustainable community. How do we address these areas?
    - Puerto Rico now has the opportunity to build with a stronger code.
- Are there strategies in communities that address how to get aging populations better situated to have them evacuate?
    - There is a Connecticut town that is looking at what to do with tourists and the elderly during the hurricane season.

Panel Presentation II- Improving Resiliency at the Community Level

Lesson Learned from Major Storms- Del Dot Perspective

Alastair Probert, south district Engineer, DelDOT

- Public is always aware and they do not pressure Del Dot
- Infrastructure can be hardened
- Detour routes can be compromised
- Localized economy impacts
- Permitting issues get handled quickly after a storm

Success Story

- Water coming in from bay side just south of Dewey

- Institutional complacency
- Public is not understanding- they go to dinner and then can't get back
- Raised pavement on route 1 about 12 inches and take belly out then they can restore access to 95 percent of the road

Miami/Florida Keys

- Delaware was there for a week with heavy construction equipment
- Damaged was very localized
- Effects of the building codes on homes before 2006 were evident because the houses were extremely impacted/ destroyed
- Areas of Miami had no power for 6 days and infrastructure was overcome and shelves were empty
- Number of first responders taxed the system and we would have a similar scenario (Delaware demographic is similar to homestead)

Future Plans

- Table top exercises- what would be the damage, where would the flooding be, what can we do before the storm
- Cover up pipes and deal with water on the road rather than sand in the pipes
- Use GIS access information for locating buried facilities

Building Sustainable Coastal Communities through Partnership

Marianne Walch- Science and Restoration Coordinator, CIB

- Increased flooding and impervious surface
- Concentration of the development and impervious surfaces along the coast
- Makes communities more vulnerable to runoff, shoreline erosion and sea level rise
- At the same time we are losing wetlands that would typically protect those towns
- Work to build partnerships with the towns and identify needs in the public plan

Example- South Bethany

- Residential canal towns and very poor water quality (summer has large algal blooms)
- Route 1 corridor drains into Anchorage canal and single storm water outfall
- Town approached CIB and Del Dot to improve water quality and develop a watershed plan
- To identify and prioritize water quality issues
- CIB got a grant from Army Corp to improve this area
- Started with Wet swales for water quality benefits and good aesthetics, and bio-retention areas in the median of route 1

- The town is now doing projects on their own
- CIB is working on a storm water pond and wetland area for the town now

Example- Dewey

- Highly and compactly developed on a very narrow strip of land between the bay and ocean
- Route 1 goes directly through the town
- There is a lot of nuisance flooding issues specifically along the bay
- Storm water systems are old and under sized
- CIB has gotten funding from the state to get a master plan made for the best management practice for water quality, and storm water flooding.
- Projects include storm water practices, bio-retention areas, infiltration, replacing impervious surfaces with permeable ones, and building up the wetlands
- Town looking into changing town ordinances around property redevelopment with mitigation or storm water controls

Lessons Learned

- Planning in DE is important- towns are small, lacking expertise, unpaid volunteers leading the town
- CIB and other non-profits can help obtain funding, outreach, and empowering the communities to go forth on their own with the knowledge needed to continue

Improving Resilience at the Community Level Policy and Planning Perspectives

Connie Holland Director, Office of State Planning

Main ideas:

- Use of the land
- Healthy communities

State strategies for policies and spending- Updated for 2015

- Much better because of things that we have learned
- First map- most up to date mapping that they ever have had in the state
- First map provides the ability to hold a GIS analysis with sea level rise scenario and FRAM maps
- FirstMap has layers and layers of ag preservation and soils
- They are moving forward with resiliency and adaptation sections

Investment Level Maps

- They are using FirstMap and GIS analysis to look for patterns of where there should be development
- Just because you are out of the floodplain does not mean you will get to build there

- They are pushing for density- development in the areas that are already developed

Sea Level Rise Overlay maps

- Important to look at this and see where the issues are
- There are several large businesses in New Castle that have flooding issues
- We don't want to keep repeating the issues we have had in the past

Comprehensive Land Use Plans

- This is all good information and the state is making comprehensive plans about it
- Communities are updating them pretty regularly
- State Agencies are consistently at meetings for the towns and their updated plans
- Bowers
    - 2013 updated plan- new business district along center of town
- Frederica
    - 2015 updates- focused on new development on higher ground more inland with parks and river walks along the river where flooding occurs
- Little Creak
    - 2016 updates- reconsidered the plans for the business district to make it more resielent and possibly raise building levels
- Milford
    - 2016 plan update- Sea level rise maps and heat maps
- PLUS
    - Cape Henlopen Elm.- Reviewed through plus for state to comment on sea level rise and climate vulnerability

<u>Questions</u>

- Much of Sussex county is seeing one of the highest levels of development- what is being done at the state level to address the development and land use in this area as well as transportation- secondary and tertiary roads are seeing heavy levels of traffic?
    - Attend the meetings for the comprehensive plans
    - State planning is trying to do master planning- in the areas where density is expanded on- get people out of cars and on public transportation - transit accessible communities- you can't build your way out of congestion
    - Police power and zoning power lies with the towns not the state so make your thoughts heard to your town leaders
- Some of the things we talk about we can preplan but sometimes you need to wait to see how bad the storm is- How much preplanning can be done before so that when responders come we can have an organized plan to remediate the issue?

    - Florida- full expectation that they were going to get completely hammered- they asked for people to come and be prepared beforehand- they made a best guess and Delaware would probably do the same thing
    - When we get a Nor'easter Del Dot knows what to expect and the equipment needed
    - Ask other states what they have- sometimes you have to do an on the ground impact damage assessment after the storm hits
    - Looking for places throughout the state to put debris after sandy
- When the sea level rise advisory committee they voted against recommending that there would be a real estate disclosure regarding sea level rise, has the climate changed enough that this could be good legislation?
    - We should be as transparent as we can- Delaware should not put people in harm's way
    - Connie thinks it would matter

Stories from the Field- Lessons learned, Success Stories, and Best Practices

Transformation of NVF into a resilient and sustainable state asset

Cindy Todd and Mike Powell- DNREC

Overview of issue

- Remnants of zinc waste during flooding
- This area is more of a flash flood situation rather than gradual coastal flooding- very little warning
- Residents reached a tipping point from severe floods (2 500 yr floods in 4 years) many did not find it worth fixing their houses and tried to sell
- Building in the flood plain meant to grow your business you were growing your impacts of flood damage and risk
- Limiting factors for these types of projects are getting grant money and removing buildings

Yorkland Remediation Project

- 2011 masterplan made for the area of Red Clay Creek that experiences bad flooding
- Private public partnership- state is working on open spaces and public access- including trails
- ~ 8 miles of trail that can handle steam cars and pedestrians
- Making wetlands along Red Clay to assist with flooding issues
- Private partners brining in restaurants and shops and housing
- This project has removed or repurposed many buildings

- Idea is to energize this area and make it very exciting- encourage people to recreate and live in the area
- Millions of dollars' worth of flood damage was avoided by mitigation and management
- The project partners and town hope to lower flood risk and make the area more usable for everyone

Questions

What happens with the next flood? Will all these buildings get washed away?

- The project is a reuse of the flood plain, most of the buildings have been removed however new buildings will be up to code
- The wetland portion of the project will lower the flood height
- All of the environmental contaminant issues have been addressed
- Floodplain use will be adapted

Are there similar projects happening for the shore communities?

- No- only project that moved towards open space was Big Stone beach
- Less opportunity to does this work on the coast since the economy is driven by tourism

What was the process behind your risk tolerance that you defined?

- Projects like this are driven by opportunity- the floods happening that present a wake-up call
- After people have used their claim money the window closes
- NVF was in a bankrupt situation and violating their TMDL
- Factors converged around hurricane Floyd that allow for the project to move forward

Climate Change and Comprehensive planning in Milford

Rob Pierce, Planning and Economic Coordinator, City of Milford

Milford 2017 Comprehensive plan update

- Misipillion River impacts large area of down town during 100 yr flood
- Demographics put this area at higher risk because of the aging housing, aging demographics, low income, non-native speakers
- Businesses are at risk because a portion of down town central business district is located in the floodplain
- The plan will use the climate vulnerability assessment overlaid with sea level rise and inundation maps including FIRM and FRAM maps to evaluate Milford community assets
- The project is also focused on increased temperature events

- The plan developed a heat map with low income populations, elderly, and non-native speaking areas
    - Provide cooling centers near these places
- Milford's plan is unique because the resiliency recommendations were placed throughout the plan
- Recommendations to sea level rise : amend floodplain ordinances, collaborate with del dot on vulnerability analysis, reduce impervious coverage, protect and enhance urban tree canopy

Lessons Learned

- Engage early and often
- Emphasize resiliency
- Maps work better than tabular data
- Don't get into climate change debates

Questions:

How do you communicate risk and language?

- There was a focus on the human aspects of the sea level rise but they focused on resolutions to sea level rise and climate change rather than what caused it

Does this impact the conversation about energy use?

- Uptick on people investing in solar and decrease their electric bills
- Focused on energy efficiency from a cost savings perspective

Town of Slaughter Beach Resiliency

Harry Ward- Mayor, Town of Slaughter Beach

- They are the most northern beach on the bay in Sussex county
- Home to the only true harbor on the Delaware Bay
- 2 percent of it is developed- 98 % is conservation
- ~275 homes
- Bay side and marsh side and one main street- surrounded by nature water and wetlands- 3 commercial properties

Resiliency project with DCP

- Town council expected the project to: bring forth new ideas, establish a closer tie with state agencies, create true actionable items, mesh new and old residence ideas together, and educate the population about the issues
- The town's main concerns were: carved out shoreline, beach erosion, street flooding, marsh and property flooding

- People have short memories- many people didn't remember all the storms including 1962 which was the most damaging
- DCP held 2 public workshops and individual focus groups
- These workshops had a great turnout because they advertised the workshops well, fed them, and had a community that was ready to talk about it
- Conclusions
    - This project focused on short term solutions- Public and private things- Road warning signs, notification by radio and DelDot app, changing codes, tie down and secure propane tanks
    - Long term solutions to vulnerability from Delaware Bay and Marsh would be mitigation with beach replenishment

Questions:

Did you have any momentum from public as a result of utility concern?

- There is no elevation change and everyone is on septic system
- Looking at sewer for the community and it seems must more viable

Was sand replenishment one of the things you were able to work out with DNREC to receive?

- State has an arrangement with the ocean beaches because they are an economic driver
- There are limited funds and the small towns need to find other ways to express the needs
- Approaching it through the environmental standpoint

The two beaches that Sandy created were replenished, has that had an impact?

- The breach closure has lowered the water levels of flooding and given the marsh the ability to sink water and retain water during storms

Discussion Session: Turning today's Information into Action at the Local Level

Phil Barnes moderated this discussion session and posed the questions: What did you learn/ what new insights do you have as a result of this conference? Are there information/services from RASCL partnership that can be helpful for you?

Some insights and takeaways were expressed by the participants. One participant noted it was interesting to see who people will listen to in the event of an evacuation and that the police/fire department were the most trusted individuals to convey this information. Additionally a participant felt it was good to know that people are more likely to leave if a mandatory evacuation is put in place. Another participant noted on the importance of a project making economic sense to move it forward.

For example, to many it may not make economic sense to pump sand onto Pickering Beach's receding shoreline with 40 houses, but it makes sense to do so in the sense of resilience and the fact that it wouldn't cost too much. Another participant noted it was good to listen to new perspectives and understand different groups and the good work that is being done. This conference was a great networking opportunity and information learned regarding target audiences, new mapping, and data will be considered for future planning.

Participants also noted realizations that they made when listening to the presenters at the conference. A participant noted that there is a need for a collective approach rather than an individual approach. This is the best way to balance out mid- and long-term plans. Another realization made is the need to start working with children—building sensitivity and empathy among the youth will support high level investments and change. Another participant noted that it may help to take a grassroots approach and go from the bottom up to address resilience.

Participants noted that some people were missing at the table. The Department of Health and Social Services should be at the table because they can speak to providing mental health services and helping our lower income populations. The Delaware Emergency Management Agency should be present given their familiarity with the evacuation routes. State legislatures should also be present because they are an integral part of state government/legislation and also many of them have homes along the coastline that are vulnerable to sea level rise and flooding. Real estate companies, homeowners associations and condo associations should also be here because we all have common interests and in addition we can address further the possibility of doing some sort of community solar effort.

- Include HUD and real-estate services in the discussion
- Ensure DEMA gets out information about flood zones through campaign and apps
- No participation or help from aids of the state legislature
- It needs to make economic sense to move forward with a project- if the state gets to aquire land they are willing to put money into it
- Small communities playing a waiting game- will DNREC take care of the land after our houses wash away
- No state ear at the Summit
- What is the best way to balance short term with long term plans?- we can mitigate some level of impacts of sea levels but it takes many years to make green infrastructure
- Start working more with children to educate them for the future
- Grassroots approach and individual homeowners ask developers to have higher standards- one subdivision at a time
- City of Lewes- hazard mitigation plan but was good to listen to new perspectives about outreach and understanding how to speak with the public
- Targeting audiences like the elderly and at risk communities- many levels of data available for the local communities to share and use
- Considering homeowner associations and condo associations as a particular audience

- 49% of people are diehard and reluctant to leave- if they aren't going to leave when there is someone at the door telling them to leave it is a real uphill battle