Sea Level Rise

Proposed Ordinance

1. BACKGROUND

On 8 Feb 2016 the M&CC past a motion respect to SLR. It did not codify actual language into the City Codes. In addition a new SLR curve was issued in Nov 2017 which had higher projected SLR.

Given the critical nature of SLR as we have discussed at the two water workshops, Codifying the M&CC Motion to address SLR

Below are the applicable portion of the minutes from the 8 Feb 2016 M&CC meeting on this topic.

Presentation of a status report on the Coastal Management Assistance Grant (DNREC)

City Engineer Charlie O'Donnell of George, Miles & Buhr gave a PowerPoint presentation on the Evacuation Route & Critical Infrastructure Vulnerability Study, which was completed by the City and BPW using the Coastal Management Assistance Grant funds. A $10,000 matching grant was received from the State of Delaware Coastal Programs in summer 2015.

Mr. O'Donnell reviewed the Purpose & Scope of the Project. The City and BPW wanted to select a sea level rise planning scenario. Data from the study was presented to the Mitigation Planning Team at their January meeting and has forwarded a recommendation to Council.

They identified 17 evacuation routes and critical infrastructure locations throughout the city and ranked them per their risk level from flood. Maps were created showing the various scenarios, including the FEMA 100-year flood elevation (1% chance of occurring each year) and 500 year flood elevation (.2% chance of occurring each year).

A base map of the Mean Higher High-Water Tide (MHHW) was created using the higher of the two high tides of each day over a 19-year period and then added Sea Level Rise (SLR) of 1, 2 & 3-foot. These maps clearly show the effects of sea level rise on flooding throughout the city, confirming where we already knew there were issues.

Mr. O'Donnell reviewed the Existing Mean Higher High-Water Tide map. This is the base map. Then he reviewed the Existing FEMA 100-year flood elevation map, including the 500- year flood map in contrasting colors.

Mr. O'Donnell reviewed the DNREC 2009 Study of Sea Level Rise Scenarios (see chart below). The Mitigation Team has recommended using the intermediate (blue line) level when looking at future Capital Projects, out to 25 years, about .7 feet of SLR. For Land Use Development they chose 40 years, which would be 1.2 feet of SLR, at 2055.

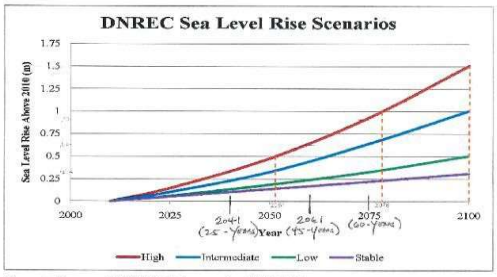

Figure 1. Proposed DNREC SLR scenarios 2010-2100.

It is the intention of the DNREC SLR Technical Workgroup that these SLR scenarios be reviewed and update periodically as new information and federal guidelines become available.

They determined to use the 100 year flood elevation plus 1-foot SLR map for land use planning purposes.

They identified 17 vulnerable areas of infrastructure and evacuation routes, reviewing the top five, as follows:

1 **Savannah Road/ Electric Sub Station**
2 **New Road at Canary Creek Bridge**
3 **Savannah Road- north side of Canal Bridge to Massachusetts Avenue**
4 **Cape Henlopen Drive at Freeman Highway & Cape Shores Development**
5 **Cedar Avenue- west end**

Mr. O'Donnell stated the next step is for Council to consider and approve the Mitigation Team's recommendation of adopting the intermediate (blue line) level SLR scenario when looking at future Capital Projects out to 25 years and for Land Use Development 40 years and the 100-year flood elevation plus 1-foot SLR. This will provide guidance when planning capital improvements & making land use decisions.

He is asking Council to consider the following mitigation efforts:

- Updating the city's existing Hazard Mitigation Plan, which is approximately 18 years old
- Identify potential mitigation projects on the beach side, which would require assistance from DNREC and the Army Corp of Engineers;
- Coordinate with DelDOT regarding Savannah Road Beachside and New Road at Canary Creek Bridge
- Consider effects of Nor'easter Jonas flooding
- Update the Emergency Evacuation Plan and time frames

Mayor Becker stated the city has already been in contact with DelDOT regarding areas of flooding during Storm Jonas, especially at Canary Creek Bridge on New Road and Savannah Road Beachside.

Mr. O'Donnell introduced Danielle Swallow, DE Coastal Program. *Ms. Swallow* was of tremendous assistance on this project.

Councilperson Morgan requested clarification regarding the Land Use recommendation. What does this help the city to decide? *Mr. O'Donnell* explained this would come into consideration when the city is amending subdivision and land development, zoning and building ordinances. These ordinances were revised 1½ years ago and hopefully the next time they will consider this data when making revisions.

Councilpersons Morgan questioned that the maps are based on 2009 data. *Mr. O'Donnell* explained that the Mean Higher High-Water maps are the result of 19 years of historical data. When making SLR projections, they are putting 1, 2 or 3 feet of water on top of that. This is called a bath tub model.

Councilperson Morgan requested clarification about the Mitigation Teams recommendation. They are recommending Council adopt the Intermediate Level of SLR, which is based on a 2009 projection. *Mr. O'Donnell* stated yes, that is the recommendation.

Ms. Swallow made comments on the 2009 data. These scenarios are based on global models with scientist all over the world. DNREC reviewed these global models and modified them for Delaware's elevation. These are just projections, *not* predictions. One variable is the rate of the ice sheet melting and the impact that would have on Delaware. The last information available was from 2009. DNREC is in the process of making adjustments and that data should be available sometime this year.

Councilperson Morgan thinks the City needs to be very flexible with acting on recommendations so we can adjust as it becomes the consensus that we will see a greater level of SLR.

Mr. O'Donnell agreed. He explained the recommendation is based on the standard lifespan of equipment/roads/etc. and long-term development. Once the State's adjustments are available the Mitigation Team will review the maps and will update Council.

Councilperson Osler stated as new information comes out, the recommendation can be revised if necessary. Nothing is set in stone. She requested clarification regarding criteria used when ranking the 17 vulnerable areas of infrastructure and evacuation routes.

Mr. O'Donnell explained they used five (5) criteria:

1. Importance to evacuation of people,
2. Critical infrastructure to remain operational,
3. Roads for evacuation of the city,
4. Number of people affected,
5. Number of vulnerable residents.

Tom Panetta, S. Washington Avenue, questioned if 25 years is long enough for Capital Improvements. It may be useful for upgrading but not for the replacement of major infrastructure, which can last much longer than 25 years. Also, 40 years for land planning is a relatively short time, especially in Lewes. The city needs to be very careful.

Rick Moore, Duchess Court, agreed with comments made. He believes that a mid-range projection is likely to be below what actually happens. He urged Council to look at longer time projections.

Ms. Swallow stated the City must make choices based on how much risk they are willing to accept. There is a degree of uncertainty with any of these projections. The higher-level projection has less certainty but it is possible, but there is more certainty we will meet the intermediate or lower levels. Whichever level is chosen, the city is picking the level of risk they are willing to plan to and the correlating cost. There is a balance between cost and risk. The city has the choice depending on their comfort level.

Mayor Becker stated the Intermediate level is what the Mitigation Planning Team felt comfortable with recommending.

ACTION: Deputy Mayor Beaufait made a motion to accept the Mitigation Planning Team's recommendation of adopting the Intermediate Sea Level Rise scenario (blue line) when looking at future Capital Projects out to 25 years and for Land Use Development 40 years and the 100 year flood elevation plus 1-foot SLR map, seconded by Councilperson Reardon.

Councilperson Osler stated that whatever Council choses, they may need to readjust. Realistically, if the city is planning a major infrastructure, reality is that Lewes is so developed in the major food areas, the choice will probably take care of itself in terms of where there is available building space. This is an important exercise but not the end of the discussion.

Councilperson Morgan agreed. He would like the Mitigation Planning Team be aware of the changing projections as they develop.

Mayor Becker stated that would be the anticipation. They will review the changes and bring to City Council. There is currently no benchmark set and this will do that. Adopting this will help strengthen the city's position in asking the State for assistance in dealing with the upgrading of some key infrastructure.

Councilperson Osler stated this could be useful when applying for grants and CRS points also. It is important to start somewhere, and this is a good middle ground, subject to change.

ACTION: All voting in favor, motion carried.

2. Excerpts from The 2015 Comprehensive Plan

Flooding and specifically Sea level rise is mention frequently throughout the Comp Plan, The section that are most salient ore:

- ENVIRONMENTAL PROTECTION PLAN

Policy for Protection of Environmentally Sensitive Areas: Lewes is very concerned about the health of the surrounding environmentally sensitive areas. Lewes strongly supports federal, state, and county efforts to protect these lands through acquisition, easements, regulations, and improved development rules. Lewes is working within its limited resources and authorities to consider, adopt, and implement, as feasible, plans, processes, and projects to mitigate the effects offlooding.

Recommendations: This Plan recommends that Mayor and Council consider:

- Annexing the City of Lewes well fields (which would necessarily require annexation of Cape Henlopen School District land because the well fields are not contiguous to the Lewes municipal boundary).
- Working with state and local authorities to raise road and bridge levels, including the Canary Creek Bridge and Savannah Road on the beach side, to reduce road flooding and improve evacuation capacity.
- Working with state and county authorities to protect the water quality of the Canary Creek watershed.
- Continuing to work on its long-term strategy on the effects of climate change based on the Quinn Report and the Hazard Mitigation Plan.
- Conducting public education related to flood-prone areas, evacuation procedures, property maintenance, and construction best practices.

Climate Change and Hazard Mitigation: During a public hearing for the 2005 Comprehensive Plan, a resident of Lewes asked what was being done to address climate change. At that time, little data was available regarding the effects of climate change or plans to address it. Since then, Delaware, Sussex County, and Lewes have all been the subject of study regarding the effects of climate change.

In June 2011, The City of Lewes Hazard Mitigation and Climate Adaptation Action Plan was presented to the City. It was prepared by the Delaware Sea Grant College Program, ICLEI-Local Governments for Sustainability, the University of Delaware Sustainable Coastal Communities Program, the City of Lewes Mitigation Planning Team Pilot Project Subcommittee, and the City of Lewes Pilot Project Workshop Participants. This document provides an overview of natural hazards and regional climate change impacts for Lewes:

> "Natural hazards identified as potential threats for the City of Lewes include, in order of significance to the City, coastal storms, flooding, severe thunderstorms, wind, winter storms, drought, extreme heat, wildfire, erosion, tornadoes and tsunamis." pg. 11

The plan's focus is on flooding as the hazard to which Lewes is most vulnerable as a result of these events, and goes on to say that:

> "Flooding in Lewes can be coastal or inland in nature. Coastal flooding is caused by high tides and storm surge from several different storm events – coastal storms, thunderstorms and winter storms. Inland flooding is related to excessive precipitation, run-off and infiltration factors that are affected by general topographic drainage features and elevation of infrastructure relative to the floodplain throughout Lewes." pp. 15-16

The plan then delineates the effects of anticipated sea level rise:

> "First, sea level rise will change flood patterns in the City of Lewes – causing current design flood events to occur more frequently. Additionally sea level rise will cause coastal flooding to reach farther landward, thus covering greater areas of land in the City of Lewes. These flood pattern changes can be applied to the many different hazardous events – coastal storms, severe thunderstorms, winter storms and tsunamis – that can cause flooding. Sea level rise will also cause certain dry areas in Lewes to become inundated, meaning that they will become permanently wet." pg.35

> "…the 100-year storm of today could become the 10-year or even 5-year storm event." pg. 45

To summarize, the key threats facing Lewes are coastal flooding and inland flooding as a result of coastal storms, sea-level rise and severe thunderstorms. Not only is flooding expected to occur more frequently, but its severity and scope are also expected to increase. Some additional effects include:

> "…erosion, which will also be greater as sea levels rise. This effect applies to both chronic erosion and storm-induced erosion. Sea level rise is known to cause saltwater intrusion into coastal aquifers. This impact could exacerbate future drought threats in Lewes. Finally in addition to the effects that sea level rise will have on natural hazards, it was noted…that sea level rise will alter local habitats and natural systems." pg. 35

The report also assesses vulnerabilities in Lewes and recommends some strategies:

> "…two key vulnerabilities were identified. The first is Lewes' water system and the combined threats of saltwater intrusion into the aquifer and the destruction of water conveyance systems that it faces from sea level rise. The second vulnerability is the destructive impacts on homes and City infrastructure from increased flooding." pg. 37

The report also identifies 34 critical facilities, of which nine are located within a flood prone area. Several of Lewes's main roads (including evacuation routes) lie within the floodplain. As a result, during a major flood event, access too many residences and critical facilities would be minimized or eliminated. Of special concern is the City's wastewater treatment plant, located in the floodplain between the Delaware Bay and the Lewes and Rehoboth Canal off of Savannah Road. According to the 1999 Greenhorne and O'Mara Flood Mitigation Plan and quoted in the 2011 Hazard Mitigation and Climate Change Adaptation Action Plan:

> "Potential damage to this facility poses a serious risk to the community. Access to this structure would likely be cut-off during a 100-year event. Damage to the facility could cause a break in service, which would affect all residents and shelters as well as emergency operations [services] at the Beebe Medical Center. Furthermore, flood damage could result in a failure at the plant that might lead to an overflow of the plants' contents, resulting in a serious health risk to the community." pg. 41

In addition, a release of untreated sewage into nearby waters "could not only harm the local ecosystem, but could also contaminate adjacent waterways and flooded properties." pg. 44. In fact, during Hurricane Sandy in 2012 the Howard Seymour Wastewater Treatment Plant did overflow and cause the release of a relatively small amount of untreated sewage into the surrounding wetlands and homes. Thereafter the BPW did additional "smoke tests" and took other steps to reduce intrusion into its stormwater system. There was no overflow during "Storm Jonas," the nor'easter in January 2016, despite its extreme high-tide.

The Hazard Mitigation Plan recommends that Lewes and BPW begin implementing six actions. The Mitigation Planning Team, as part of its current mitigation strategy, had already identified many of these actions. The six recommended actions:

1. Incorporate climate change concerns into the comprehensive plan and into future reviews of the building and zoning codes.
2. Improve outreach and education particularly focused on successful behavior changes related to home building and retrofits.
3. Ensure that aquifer information is integrated into all planning efforts.
4. Use elevation data to determine road levels and evacuation risk.

5. Evaluate the City and the Board of Public Works (BPW) infrastructure's flood vulnerability from direct flood impacts, as well as from indirect flood impacts to access routes.
6. Improve the City's level of participation in the community rating system (CRS).

The Quinn Report: In 2013, Lewes contracted with RC Quinn Consulting, Inc., to review its codes and regulations pertaining to flood mitigation with the objectives of improving the City's floodplain ordinance and potentially its rating in the Community Rating System (CRS) in the National Flood Insurance Program (NFIP). The Quinn report, Lewes, DE: Evaluation of Existing Rules, Codes, Documents, and Plans, includes specific recommendations to reduce future flood risk and improve the City's CRS rating. The report identifies opportunities where the City can take action that will benefit the entire community. The City adoption of the new Floodplain Ordinance in March of 2015 addresses several of the recommendations.

Some of the recommendations include making revisions to the City Code that would prohibit fill, buildings, and outside storage of materials in the 100-year floodplain, adopting the 2012 International Building Code (IBC), and adopting the new Flood Insurance Rate Maps (FIRM) when released. The City has already acted on the first two recommendations. Now that the FIRM maps have become final on March 16, 2015 (see http://www.riskmap3.com/node/4467), the City may be expected to address that recommendation also.

Climate Framework for Delaware: On September 12, 2013, Delaware Governor Jack Markell signed Executive Order 41: Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities from Reducing Emissions. Executive Order 41 directed state agencies to address both the causes and consequences of climate change by developing recommendations actionable by those agencies to reduce greenhouse gas (GHG) emissions that contribute to climate change, increase resilience to climate impacts, and avoid and minimize flood risks due to sea level rise. This led to the creation of the document Climate Framework for Delaware.

The document includes many recommendations for state agency implementation as part of this initiative. Some will be implemented by the individual state agencies. Others will require additional discussion and outreach with affected stakeholders and other interested parties. In addition, a mitigation target of 30 percent reduction in greenhouse gases from a 2008 baseline by 2030 was adopted for the state of Delaware, for which DNREC will develop an implementation plan. A few of the recommendations most relevant to Lewes include:

- The Department of Health and Social Services-Social Service Divisions should: Implement a statewide Smart-911 system and identify sites to be used as designated cooling and heating centers during extreme weather events.
- The Department of Natural Resources and Environmental Control should: Design and implement restoration activities to slow the current loss of coastal beach, marsh, and forest habitats and prepare to restore riparian buffers on wildlife areas, fishing and boating access areas, and private lands through voluntary incentive programs.
- The Department of Natural Resources and Environmental Control should: Consider relocating Fish and Wildlife facilities, including offices, education centers, boat ramps and equipment storage areas, and redesign or relocate facility access roads already at risk from flooding and storm surge.
- The Department of Natural Resources and Environmental Control should: Provide technical guidance and funding for appropriate climate adaptation measures, with priority to projects in areas that have taken steps to adopt best practices and meaningful standards for drainage and floodplain management.

- The Department of Natural Resources and Environmental Control should: Assist local governments in developing strategies to protect wastewater treatment facilities from flooding and assist suppliers of drinking water from groundwater sources to develop strategies for the protection of wells from flooding and salt water.
- The Department of Natural Resources and Environmental Control should: Develop a plan to provide alternative evacuation routes, access roads and trails, and to ensure communication is available for emergency response.
- The Department of State should: Evaluate the specific costs and benefits of creating a category of historic preservation tax credits to offset the costs of adaptation and protection measures.
- The Department of Transportation (DelDOT) should: Conduct a comprehensive analysis of the state's roadways, bridges, and other infrastructure to identify critical infrastructure that may be vulnerable to climate impacts, and identify and assess existing chronic flooding and erosion problems that affect transportation infrastructure. DelDOT should also build transportation enhancements (pathways, trails, roadscapes, etc.) to accommodate impacts of climate change.
- The Delaware Economic Development Office (DEDO) should: Evaluate the possibility of establishing a joint marketing effort to instill a deeper awareness of the available public transportation to Delaware's attractions. DEDO should also focus a Delaware Tourism Office outreach effort on realtors and rental agents at the Delaware beaches to create awareness of the benefits of changing the current standard of what constitutes a "weekly rental" of beach properties.
- The Office of State Planning Coordination should: Provide technical support to local government to address climate change impacts in their Comprehensive Plans and local ordinances. Provide technical assistance to support integration of climate impacts and to reduce greenhouse gas emissions through adaptation and mitigation at the local level.

This document presents an important first step towards adapting to climate change in Delaware, and the initiatives it recommends are ambitious in scope. However, with money in short supply and little legislative interest in raising taxes, implementation may be slow and frustrating. Lewes will monitor the state's progress, participate in outreach opportunities, and advocate for resources and projects as appropriate. When appropriate opportunities arise to take advantage of state initiatives in support of enhancing Lewes's resiliency, the City will strongly consider participating.

Saltwater intrusion: The aquifer from which the BPW draws Lewes's drinking water is close to the ocean and therefore, potentially susceptible to saltwater intrusion. The BPW previously moved its wells in part because the profusion of wells drawing from the aquifer in the former location did cause some saltwater intrusion into the BPW wells. The more water pumped, the sooner intrusion could occur. Much of the aquifer is located in Sussex County; the City should consider annexing the well-fields to enhance their protection. Because the well-fields are not contiguous to the City, the City also would need to annex Cape Henlopen School District Land to create contiguity with the well-fields.

Possible strategies to address flooding and sea-level rise: Lewes cannot prevent flooding or reverse sea-level rise; however, we have adopted a new floodplain ordinance. This ordinance requires residential and business properties to adhere to new building standards when building or renovating. The City is working with the County, State and Federal government to identify actions we can collectively take to address flooding and sea-level rise. Listed below are a number of possible approaches to address some of the effects of flooding and sea-level rise. Neither any one nor all would stem the flooding problems that periodically occur in flood zone areas. Furthermore, most of these ideas carry significant, indeed prohibitive, costs and many are within the purview of the state, the BPW, private land owners, etc. This discussion includes actions that the federal and state governments and private land owners might

undertake and does not constitute an action plan or even a listing of what the City might be able to undertake even in the unlikely event that sufficient resources become available.

Overarching strategies:

- Educate the public on identifying areas prone to flooding, evacuation procedures, property maintenance, and construction best practices.
- Continue to study, monitor, and collect data.
- Address encroachments into right of ways, wetland buffers, the beach, or flood prone areas.
- Consider flooding impacts to historic sites and districts by ensuring review programs balance flood protection with hazard mitigation strategies and provide opportunities to make these resources resilient to natural hazards.

Coastal and inland flooding:

- Raise minimum floor elevations to a reasonable projected future flood elevation (assuming that number is higher than the existing three feet of required freeboard for construction in a FEMA flood zone).
- Protect and expand existing flood storage lands.
- Increase the flood holding capacity of marshes.
- Maintain stormwater management facilities and flood structures.
- Raise major roads and evacuation routes above the flood plain.

Coastal flooding and salt water intrusion:

- Engineering and technology techniques such as flood sensors.
- Limits on shoreline hardening.
- With other government agencies and NGOs, facilitate the moving of historic structures to less flood-prone areas.

Inland flooding:

- Green BMPs, residential rain gardens, and roof gardens.

New development and redevelopment: There is limited opportunity for new development or redevelopment in Lewes in the time frame covered by this plan. Any development of this type will be subject to the new Floodplain Ordinance.

3. *Code Section that could be impacted*

This is not a complete list of Code sections, but contains the major sections that could be impacted.

a. *Section 197-73 Flood Plains A.(4) (a) [4]*

Basis for the City's ability to implement more stringent flood hazard area

"The City of Lewes may identify and regulate new local flood hazard or ponding areas. These areas should be delineated and adopted on a "Local Flood Hazard Map," using best available topographic data and locally derived information such as flood of record, historic high-water marks or approximate study methodologies."

b. *Section 197-73 Flood Plains B. "Definitions"*

Add a reference to define the local flood hazard areas

"Recommendation of Sea-Level Rise Planning Scenarios for Delaware: Technical Report, November 2017 Developed by Delaware Sea-Level Rise Technical Committee"

c. *Section 197-73 Flood Plains B. "Definitions"*

Add the required one-foot freeboard to either definition or in another section of 197-73

"FREEBOARD

A margin of safety added to the base flood elevation to account for waves, debris, miscalculations, or lack of data."

Section 170-19 Preliminary Consent E. (6)

"Minimization of tree and soil removal and grade changes, except to ease flood concerns."

d. *Section 170-19 Preliminary Consent E. (11)*

"Minimization of erosion and sedimentation, minimization of changes in groundwater levels, minimization of increased rates of runoff, minimization of potential for flooding and design of drainage so that groundwater recharge is maximized."

e. *Section 170-26 General Standards*

Add a section to clarify Flood Issue, this could be a separate section or under A. General Standards

4. *Questions that should be considered*

   a. Time horizon –
      i. The M&CC Motion contained a 25-year horizon for infrastructure, with consideration for life of structure, etc. The design requirements for infrastructure is within the control of M&CC. Based on this it may not be necessary to address City/BPW owned infrastructure.
      ii. The M&CC Motion-contained a 40-year horizon based on the mid-level curve (50% probability) for planning purposes. Given that housing stock and other structures have a much longer than a 40-year useable life, any new ordinance should consider a longer time horizon to safe guard the City.

      The choice of SLR needs to consider the impact on exisiting and future costs.

      The SLR curve is routinely updated, the most recent one was issued in Nov 2017 which contained an increase in the 40-year projection by ~6". The ordnance should either be directly tied the SLR in future revisions as issued by the Delaware Sea-level Rise Technical Committee or trigger a review the update by LPC or the M&CC.

   b. Applicability – At a minimum any new ordnance should apply to any developments done under Code Section 170, Subdivision and Land Development.

      Consideration should be given to how to assimilate any new requirements into existing buildings and during rebuilding after a natural disaster

5. Proposed Concept

   Define BFE for areas that are in or adjacent to zones that are equal to or greater than the FEMA 100 year flood zones to be the FEMA BFE plus the projected SLR using the mid-level curve in year "X" (as defined in the "new definition that will be added as proposed in 2. b. above) Including an allowance for uncertainty by requiring a one-foot freeboard