

**Flood Mitigation Plan for
Lewes, Delaware**

Submitted To:
The City of Lewes
East Third Street
Lewes, Delaware 1998

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1. Introduction

Purpose

This document is Lewes, Delaware's Flood Mitigation Plan. This Plan will create a comprehensive strategy for implementing technically feasible flood mitigation activities for Lewes. This Flood Mitigation Plan was designed to be compliant with 44 CFR §78.5 – Floodplain Management Plan development and includes the following minimum elements as specified in §78.5:

- A description of the planning process and public involvement
- A description of the existing flood hazard and identification of the flood risk
- Lewes' floodplain management goals
- Identification and evaluation of cost-effective and technically feasible mitigation actions considered
- Presentation of the strategy for reducing flood risks and continued compliance with the NFIP, and procedures for ensuring implementation, reviewing progress, and recommending revisions to the plan
- Documentation of formal plan adoption by Lewes

This report was also designed to be compliant with the activities outlined in §510 Floodplain Management Planning of the Community Rating System (CRS). Appendix A lists the specific activities for which Lewes seeks approval to obtain CRS points.

Literature Review

In addition to the general body of literature on hazard vulnerability and hazard mitigation, the following reports and data specific to the Delaware Coast and Lewes were reviewed and used during this study:

- Coastal Storm Damage 1923-1974, (1977)
- Coastal Vulnerability and Construction Standards Study, (1997)
- Delaware Bay Coastline- Delaware and New Jersey, Roosevelt Inlet-Lewes Beach, DE Interim Feasibility Study, Final Feasibility Report and Final Environmental Assessment, (May 1997)
- Delaware Geological Survey Summary Report, The Storm of January 4, 1992, (1992)
- Delaware Geological Survey Summary Report, The Coastal Storms of January 27-29 and February 4-6, 1998, Delaware and Maryland, (1998)
- Field Trip and Assessment within the States of Maryland and Delaware in Response to A "Nor'easter" Coastal Storm on January 4, 1992, (1992)
- Flood Insurance Rate Maps, Sussex County, Delaware and Incorporated Areas, FEMA (1995)

- Flood Insurance Study, Sussex County, Delaware and Incorporated Areas, FEMA (1998)
- Interagency Hazard Mitigation Report (FEMA-933-DR-Delaware), (1992)
- State of Delaware Coastal Storm Preparedness and Recovery Plan, Applied Technology and Management, Inc. for the Delaware Department of Natural Resources and Environmental Control, (October 1992)
- State of Delaware Hurricane Program Needs Assessment, Earth Tech for Delaware Emergency Management Agency, (1995)

The Planning Process

Greenhorne & O'Mara, Inc. assisted the City of Lewes in forming a Community Planning Group (CPG) as required by Section 510 of the Community Rating System. This group met four times to work through the hazard identification, risk assessment, and goal selection and to review possible floodplain management activities and the Flood Mitigation Plan. These meetings occurred on March 11, April 19, June 11, and July 20, 1999. The City of Lewes formally recognized the CPG during a City Council meeting held on June 14, 1999. This resolution also named members of the CPG. (For a list of members, see Appendix B). Most of the City's government divisions were represented by officials in the group including Lewes' Building Department and Code Enforcement, Public Works, Environmental Protection, Public Health and Public Information. Members of the community also served in the group to represent the residents of Lewes.

Non-County agencies including the United States Army Corps of Engineers (USACE), Delaware Department of Natural Resources and Environmental Control (DNREC), the Delaware Emergency Management Agency (DEMA) and the Federal Emergency Management Agency (FEMA) contributed to the planning process and assisted in the review of this report.

Input into the Plan was sought from residents and business owners affected by flooding. Newsletters, which included a questionnaire, were mailed to all property owners (residential and commercial) in Lewes in May 1999. A copy of the newsletter is included in Appendix B. The newsletter explained the process for preparing the Flood Mitigation Plan and asked for input from citizens. The newsletter also announced the public open house that was held on June 4th, 1999 to solicit input into the Plan. The public open house provided information on the planning process and results of the hazard identification and risk assessment. Citizens attending the meeting were encouraged to provide input on all aspects of the Plan including the identification of problems and possible solutions. Input received from questionnaires and from the public meeting has been incorporated into this Plan. Responses to the questionnaire are listed in Appendix C.

A second newsletter describing the Draft Plan was sent to all City of Lewes property owners. The newsletter informed the residents of where to view the Draft Plan and how to comment on the document.

A Formal Public Hearing on the Draft Plan was held at 7 p.m. on August 20th, 1999 at the City library. Handouts of the proposed goals and projects were provided to all attendees. Citizens of Lewes were given until August 23rd to comment on the final draft of the Flood Mitigation Plan. All comments were addressed before the plan was adopted. A copy of all of the citizen comments on the final draft are provided in Appendix C.

The National Flood Insurance Program

Communities that participate in FEMA's National Flood Insurance Program (NFIP) have a detailed Flood Insurance Study (FIS). The FIS presents flood elevations of varying intensity, including the level for the flood with a 1% annual chance of occurrence (also called the 100-year flood elevation or the base flood elevation (BFE)), and the 0.2% chance annual occurrence flood level (or the 500-year flood level). This information is presented on a Flood Insurance Rate Map (FIRM). Lewes has been a participating community in the NFIP since 1977. A Geographic Information Systems (GIS) map produced using aerial photography and information from Lewes' FIRM is included in the back of this document.

To participate in the NFIP, Lewes must, at a minimum, regulate development in their floodplains in accordance with the NFIP criteria. Before a permit to build in the floodplain is issued in Lewes, the community must ensure that two basic criteria are met:

- All new buildings and buildings undergoing substantial improvements will be elevated so they are protected from damage by the 100-year flood, and
- New floodplain development will not aggravate existing flood problems or increase damage to other properties.

Structures constructed before the NFIP criteria were incorporated into Lewes' ordinances in 1977 are called pre-FIRM structures. Post-FIRM structures are buildings that were constructed after 1977.

A large portion of Lewes lies within FEMA's Special Flood Hazard Area designation, which is the 100-year floodplain. FEMA's Special Flood Hazard Areas in Lewes are designated AE Zones for Special Flood Hazard Areas where base flood elevations are provided and VE Zones for the Special Flood Hazard Areas subject to coastal high hazard flooding and velocity flow where base flood elevations are also provided. A GIS map, included in the back of this document, displays the FEMA zones within the City.

In Article XI, Floodplain District Regulations, found in the Zoning portion of the Lewes Municipal Code, the City defines its own names for each of these flood hazard areas. The City calls FEMA's AE Zones the Coastal Floodplain. The City's Coastal High Hazard Area corresponds to FEMA's VE Zones¹. Coastal High Hazard Areas extend from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high

¹ Due to a typographical error, the current Lewes Municipal Code defines the Coastal High Hazard Area as areas mapped on FIRMS as AE and VE zones. One of the projects listed in Section 6 is to correct this error in the code.

velocity wave action, where waves are greater than 3 feet in height. Lewes is subject to flooding from both the Delaware Bay and the Lewes and Rehoboth Canal, which connects the Delaware Bay and Rehoboth Bay.

2. Lewes Background

Lewes is a moderately developed city with generally suburban development located along the Delaware Bay in the State of Delaware. The City is located on the bayside of Cape Henlopen, which marks the shoreline divide between the Atlantic Ocean and the Delaware Bay. The City is 4.2 square miles in area, and extends for approximately 5 miles along the bay shoreline; 2 of these miles are along a 500- to 1000-foot wide strip of land bordered on the north by the bay and on the south by the Broadkill River. This narrow, undeveloped barrier is known as Beach Plum Island and is located west of the rest of the City. The City of Lewes is bordered by the Delaware Bay to the north; unincorporated Sussex County to the south and to the west; and unincorporated areas of Sussex County including Cape Henlopen State Park to the east.

Population and Development Trends

Lewes is a small city that attracts many tourists and vacationers especially during the summer months. The permanent population of Lewes is 2,295 residents (U.S. Census Bureau, 1990). This number represents a 4.5 percent increase from the 1980 U.S. Census Bureau permanent population. The population of Lewes had been declining since at least 1960 until this increase in the 1980s. The latest figures for Lewes show the population continues to increase as the reported population for 1992 was 2,371 residents. Approximately 31 percent of Lewes residents are 65 years of age or older. During the summer months, when tourism in the city is at its peak, the population increases by as many as 6,000.

According to 1990 US Census data, there are 2,002 housing units in Lewes. Of these units, 1,517 (76 percent) are single family homes. Less than half of the units are used as rental properties or second homes. Land uses within the City include single- and multi-family residential, commercial, community facilities, parks and open space. The University of Delaware, the DNREC, and the U.S. Coast Guard also have facilities within the City.

The majority of development in Lewes involves single-family residential structures. There are currently four single-family residential communities under development within the City. Three of the communities are outside of the 100-year floodplain (as mapped on the City's FIRM), and one of them lies within FEMA's AE Zones.

The Economy and Tax Base

Sussex County's economy is based on agriculture, manufacturing, commerce, recreation, and tourism. Lewes' economy is based largely on the service/retail, recreation, and tourism industries. The beach and a variety of shops within Lewes attract many tourists to the area. Most of the commercial areas are located along Second Street and Savannah Road. Additionally, the Cape May-Lewes Ferry, Cape Henlopen State Park, and fishing opportunities in and around Lewes attract people to the City. The ferry transports one million people per year to and from Lewes. Cape Henlopen State Park, which is located one mile east of Lewes, also brings many people to the area. The park offers recreational facilities

including campsites, ocean and bay beaches, and nature trails. Lewes attracts fisherman because of its location and because of the boat charters and rentals that are available.

Flooding and flood damages could have a substantial negative effect on Lewes' economy. The severity of this effect would depend on the extent and duration of flooding. The greatest threat of flooding to Lewes comes from northeasters during the months of October through May, and hurricanes, which occur predominantly between July and October. Any major flood damage inflicted during summer, the height of tourist season, could have a devastating effect on Lewes' economy. Businesses depend on making the majority of their income during the summer months. If Lewes was forced to evacuate and the ferry, Cape Henlopen State Park, stores, restaurants, and hotels were closed for part of tourist season, the tourism and the retail/service industry could stand to lose a significant amount of income.

The City's income is generated from a variety of sources. The 1999 projected income is approximately \$2 million. It is estimated that approximately 40 percent of this income will be produced from the City's property tax and approximately 18 percent will be generated from realty transfer fees. The remaining income is produced from parking meters, building permits, business and mercantile licenses, grants, traffic tickets, land leases, parking violations, tax penalties, and dock rentals.

Any major flooding event would not have a significant impact on the City's main source of income, the property tax. However, the real estate market in the City could be effected by a storm event if major damage was sustained to structures. Flooding could effect the City's realty transfer fees, which are the City's second most important source of income. Additionally, income generated by vehicular traffic would be threatened by a flood event. Flooding or damage to structures would deter traffic from entering the City and would require that streets and street parking be closed off. Building permit revenues might actually increase as a result of a flooding event since property owners often perform improvements to structures that sustain flooding damages.

Ongoing Flood Damage Prevention Activities

There are currently several activities occurring within Lewes that help to prevent flood damage. The major activities are described below.

FEMA's Project Impact

Lewes was named a FEMA Project Impact Community on June 3, 1998 and signed an agreement with FEMA to partner with them as a Project Impact Community on February 16, 1999. FEMA's Project Impact is a nationwide initiative to reduce damage caused by natural disasters through preventative measures. The program is based on the notions that preventative actions must be determined at the local level and that both private sector participation and long-term commitment are needed. In order to help the communities become 'disaster resistant', FEMA attempts to bring the latest technology and mitigation practices to the local communities. FEMA partners with the communities and provides them

with technical assistance at the national and regional level and brings in other Federal and state agencies to do the same.

The partnership between the City of Lewes, Sussex County, the State of Delaware, FEMA and its national-level partners, and many of the City's business and industry stakeholders is referred to as 'The City of Lewes Partnership to Build a Disaster Resistant Community'. In The City of Lewes Project Impact Memorandum of Agreement, Appendix B lists 'Preliminary Identification of Hazard Mitigation Actions for Further Evaluation and Consideration by the City of Lewes Partnership to Build a Disaster Resistant Community'. A summary of these actions is listed below.

- The Development of a Hazard Mitigation Strategy
- Conducting a Hazard Vulnerability Analysis (HVA)
- Structural Mitigation and Retrofitting Actions (based on the findings of the HVA)
- Improving Emergency Operations Communications and Procedures
- Building Federal-City-State and Public/Private Partnerships as the most effective means of implementing measures to reduce the impacts of natural hazards
- Creating a Public Education Program for general awareness and understanding of natural hazard risks and Creating Mitigation Training Programs for use in schools and the community
- Creating a Broad-Based Public Information Program to promote awareness and understanding of the Project Impact Program in Lewes

FEMA's Hazard Mitigation Grant Program – Elevating Structures in Lewes

FEMA is providing partial funding for the elevation of eight residential structures in the City of Lewes through FEMA's Hazard Mitigation Grant Program (HMGP). The HMGP provides Federal funding to local municipalities for mitigation projects after a disaster declaration has been made. The projects must involve long-term preventative measures against future disasters and often include floodproofing or elevating structures in flood-prone areas, acquiring or relocating structures from hazard-prone areas, and developing and implementing building and construction standards to protect new or substantially improved structures from disaster damage. HMGP monies became available for such projects along the Delaware Coast after the 1998 northeasters. HMGP funding pays for 75 percent of the project cost. In Lewes, the property owners are paying for the remaining 25 percent of the cost to elevate the structures.

Municipal Code

Lewes uses the Southern Building Code Congress International (SBCCI) - 1994 as the City's Model Building Code. However, the City anticipates the adoption of the International Building Code in the year 2000. The City's code also describes building regulations for construction in the 'Floodplain District' (FEMA's Special Flood Hazard Area). The code

describes regulations for construction within the City's 'Coastal High Hazard Area' and the 'Coastal Floodplain'. These regulations follow the standard NFIP mandated restrictions for construction within these zones and are designed to prevent damage and losses associated with flooding.

DNREC's Building Line

DNREC regulations from 1983 define a building line for the Delaware Coast that is still used today. This line is shown on DNREC's Building Line Maps. The line was mapped using topographic data from 1979 and was located 100 feet landward of the 10 ft NGVD 29 elevation. No new construction, modification or expansion of existing structures is permitted seaward of the line or in the area defined as beach without prior approval from the Division of Soil and Water Conservation. Any person applying for a permit to construct seaward of the DNREC Building Line must meet certain criteria as set forth in Part 3, Prohibited Activities, of the Regulations Governing Beach Protection and the Use of Beaches (Revised and Effective December 1983). DNREC requires elevation of all structures located seaward of the DNREC Building Line above BFE. This includes showers and storage areas.

DNREC Dune Maintenance

DNREC conducts dune maintenance work in Lewes on an as needed basis and restores damaged dunes following coastal storms. Generally in February, DNREC performs a reconnaissance of the dune system in Lewes and determines which areas of the dune need to be rebuilt and which areas need new fencing and vegetation. Rebuilding of the dune involves using a bulldozer to move sand from the beach face back up onto the dune in order to restore its height and width. Every March, DNREC recruits volunteers from the City and community to help plant Cape American Beachgrass. Beach grass helps lower wind velocities at the dune surface causing deposition of sand. Over time this leads to higher and wider dunes which provide protection to the community during coastal storms.

US Army Corps of Engineers and DNREC Beach Replenishment Project

The U.S. Army Corps of Engineers-Philadelphia District (USACE) is currently working on a storm damage reduction project for the Delaware Coastline in Delaware and New Jersey. A feasibility study was cost shared with DNREC for this area and a Final Feasibility Report and Environmental Assessment for the Roosevelt Inlet-Lewes Beach, DE section of the project was completed in May 1997.

The design for the storm damage reduction project in the Lewes area includes a 100-foot wide berm/dune configuration. The berm will have an elevation of + 8.0 feet-North American Vertical Datum of 1988 or NAVD 88 (approximately + 7-feet National Geodetic Vertical Datum 1929 or NGVD 29) and a dune with an elevation of + 14.0 feet-NAVD 88 (approximately + 13-feet NGVD 29). The project also includes plans to use dune grass, dune fencing, suitable advance beachfill and to perform periodic nourishment to help maintain the design. A 710-foot long terminal groin, with a top elevation of + 8.0-feet NAVD 88 and a top

width of 12 feet, is also proposed to be placed at the western end of Lewes Beach. In developing this project, USACE and DNREC sought to increase protection to the shoreline from storm damage. The project addresses these goals by using the berm to provide a wider beach area. The wider beach area will dissipate wave energy and prevent dune breaching and overwash. The dune system will provide protection to the community by serving as a buffer during storms. The terminal groin increases the retention of the beachfill along the project shoreline and reduces shoaling in the inlet.

If funded under the current funding system, the USACE would fund 76 percent of this project. The State and the City of Lewes would be required to pay the remaining 24 percent. Currently, the USACE and DNREC are negotiating the cost sharing agreement for the preconstruction engineering design of the project.

3. Hazard Identification

The Delaware Coast is most susceptible to flooding caused by northeasters, which occur from October to May. These northeasters have traditionally resulted in the heaviest rainfalls, highest tides, and most significant damage along the Delaware Coast. The combinations of rain, wind, and storm surge cause northeasters to be damaging. Because northeasters can last for several days, they have the potential to accentuate several high tide elevations causing serious flooding along the ocean coast and in the inland bays.

Although hurricanes and tropical storms rarely make landfall along Delaware's shoreline, they still have the potential to cause devastating damage to coastal areas as they pass offshore or further inland. Like northeasters, they bring heavy rainfall, high winds and storm surge. Hurricanes and tropical storms are likely to occur from July through October.

Historical data indicate that slow-moving hurricanes and northeasters can cause significant damage to Lewes. Slow-moving storms allow ocean tides and storm surge to have an increased effect on Delaware Bay water levels in the Lewes vicinity. As these water levels rise, the City of Lewes becomes more susceptible to flooding from the Lewes and Rehoboth Canal, which connects the Delaware and Rehoboth Bays.

During storm events, storm surge from the Delaware Bay is limited due in large part to the breakwater structures located near Lewes. Between 1828 and 1898, the Federal Government constructed a rubblemound breakwater located at the entrance to Delaware Bay. Another breakwater structure is located approximately 1 mile north of Breakwater Harbor. These structures decrease the effects of storm winds flowing in a northeast direction on the Delaware Bay thus decreasing storm surge during northeasters.

Description of Past Flooding and Storm Damage

Historical data indicate that hurricanes caused significant damage along the Delaware coast in 1933, 1944, and 1956. In 1933, a hurricane passed approximately 100 miles west of Delaware's shoreline. Delaware communities located along both the ocean and bay shorelines experienced high flooding levels. Flooding caused damage to structures located along the shoreline as well as street flooding.

In 1944, a hurricane passed about 50 miles east of the Delaware shoreline and caused serious damage. Lewes experienced flooding that warranted evacuating residents from homes along the beach.

In 1956, Hurricane Flossy caused severe flooding of the Delaware coastline and interior bay coasts. Road crews at Lewes used 500 tons of broken concrete, gravel and boulders in an attempt to prevent storm surge flooding. However, combined winds and high tides still caused serious damage to the community.

The most severe recent northeasters occurred in 1962 and 1998. The storm in March 1962 (Ash Wednesday) was particularly severe, with strong northeast winds lasting through five

successive high tides. The high tides, combined with wind-driven waves, produced record high tide readings along the beach and inland bay areas, resulting in serious damage. The storm was estimated as the 100-year event for the Delaware coast. Readings from the tide gage located in Lewes at Breakwater Harbor show a maximum stillwater elevation of + 8.1 feet NGVD. Flooding caused damage to homes along the beach in Lewes and the Lewes and Rehoboth Canal overflowed resulting in damage to many canal-side structures. High water marks reported by Lewes residents put flood levels at the intersection of Savannah Road and Cape Henlopen Drive at + 8.61 ft NGVD 29. Similarly flood levels at the corner of New Hampshire and Cedar Avenues were reported to be + 8.92 ft NGVD 29. Both of these levels are above the Lewes Tide Gage level of + 8.1 ft NGVD 29 reported for the storm and suggest the storm was an approximately 60-70 year event (See Table 3.2).

In 1998, two back-to-back northeasters struck the Delaware coast between January 27-29, 1998 and February 4-6, 1998 producing heavy rains, high winds, waves and tides. The first storm produced rainfall totals over 3.5 inches, while the later storm produced rainfalls over 2.5 inches. Bay water levels rose and caused the water levels in the canal to rise well over their banks (see Figures 3.1 and 3.2). The portion of Lewes between the canal and Bay Avenue was inundated with floodwaters. At the University of Delaware's College of Marine Studies, high water levels reached the corner of the Marine Operations Building, and part of the floating dock was detached. However, the 1962 storm is considered more severe than the 1998 northeasters and is estimated as the 100-year event (according to flooding levels in the Lewes and Rehoboth Canal- see Tables 3.1 and 3.2), while the storms of 1998 are estimated to be a 15-year event. Residents at Savannah Road and Cape Henlopen Drive report flood levels of + 5.92 ft NGVD 29 at the intersection. This level is below the flood level recorded at the Lewes flood gage.



Figure 3.1. California Avenue flooded during the 1998 Northeaster.



Figure 3.2. View of houses impacted by floodwaters during the 1998 Northeaster.

Sources of Flood Hazards

Lewes is a coastal community and experiences flooding as a result of inundation from the Delaware Bay and from the Lewes and Rehoboth Canal. This canal connects Rehoboth Bay to Delaware Bay. Roosevelt Inlet is the entry to the canal from the Delaware Bay. During storm events, such as northeasters, bay waters rise causing the canal to flood. Several tidal creeks located near the canal further add to the severity of flooding. The area of land between the canal and Delaware Bay experiences the most severe flooding from the canal overflow. The stillwater elevations and estimated return periods for the Lewes and Rehoboth Canal and the Delaware Bay (at the Lewes gage) are shown as Table 3.1.

Table 3.1. Stillwater Elevations and Return Periods for Most Severe Storms in Lewes

Storm	Lewes and Rehoboth Canal* (Feet NGVD 29)	Estimated Return Period (Years)	NWS Tide Gage Lewes (Feet NGVD 29)	Estimated Return Period (Years)
January/ February 1998	5.9	15	7.2	~ 25
March 1962	8.9	100+	8.1	45
September 1944 (Hurricane)			8+ (estimated)	45

Sources – DGS Open File Report #40 (1998) and Flood Insurance Study, Sussex County, DE (1998) * High water marks surveyed by DNREC as reported by Lewes residents.

Stillwater elevations have been determined by FEMA for the Delaware Bay and by the USACE for the Lewes and Rehoboth Canal at Roosevelt Inlet. These elevations are shown in Table 3.2.

Table 3.2. Summary of Stillwater Elevations

	Elevation in feet (NGVD 1929)				
	10-Year	20-Year	50-Year	100-Year	500-Year
Delaware Bay (coastline in Sussex Co.)	6.6	--	8.5	9.3	11.3
Roosevelt Inlet	5.2	6.2	7.5	8.2	10.5

Sources –Flood Insurance Study, Sussex County, DE (1998) and USACE/DNREC Roosevelt Inlet-Lewes Beach, DE Interim Feasibility Study, Final Report and Environmental Assessment (1997)

Other Hazards

In addition to flooding, the City of Lewes is most vulnerable to damage from winds and erosion that accompany major storms. Long-term erosion is a problem for Lewes.

Hurricanes and severe storms, such as northeasters produce damaging winds and tornadoes that can impact utilities, structures, and produce damaging debris. Hurricanes rarely pass directly over the coast of Delaware, but several have passed either offshore or further inland resulting in wind damage to the coastal area. Remnants of hurricanes can also have strong winds. Tornadoes, spawned from hurricanes or storms, have the ability to lift and move objects weighing more than 300 tons a distance of 30 feet, toss homes more than 300 feet from their foundations, and siphon millions of tons of water from water bodies (FEMA 1997).

Older structures, constructed before the adoption of modern wind resistant structural techniques, could be at risk from wind hazards. During a wind event, falling trees and airborne debris may cause additional damage.

Erosion can be classified into two different categories (1) storm-induced erosion, and (2) long-term erosion. Storm-induced erosion is the result of a single storm event. Sand carried offshore during the event can be naturally restored as post-storm currents carry sands back. Long-term erosion occurs over several years and can be measured using maps or surveys taken during this time. Long-term erosion can be considered a permanent loss.

According to the Roosevelt Inlet-Lewes Beach, DE Interim Feasibility Study, Final Feasibility Report and Environmental Assessment (USACE/DNREC, 1997), the long-term erosion rate for Lewes Beach has been estimated by several different studies that produced varying results. Most of these studies' results suggest that the western to central portion of the shoreline has experienced greater erosion than the eastern portion. Results from a 1990 study based on

1892 to 1990 shoreline data from the University of Maryland estimate erosion rates from 0.5 feet/year to 10.7 feet/year for coastal areas in the City of Lewes. The higher loss rates were projected for Beach Plum Island. Erosion rates for the vicinity of Roosevelt Inlet are estimated at less than 4.0 feet/year. As this erosion occurs, the erosion hazard zone boundary will migrate further inland. These rates assume no further beach nourishment.

Since 1953, both beachfill and channel maintenance material have been used to nourish the beach in Lewes. Materials dredged from Roosevelt Inlet are routinely placed onto the beach in Lewes.

4. Vulnerability Assessment

Having investigated the different hazard issues of concern in the City, the study incorporated these into a series of analyses designed to assess current, relative vulnerability of the community to these hazards.

The most important hazards being investigated within this study are floods and related debris impact and erosion. To assess the flood hazards affecting Lewes, the following materials were reviewed: 1998 Flood Insurance Studies (FIS) and 1995 Flood Insurance Rate Maps (FIRM); FEMA Flood Zone Delineation Geographic Information System (GIS) maps; DNREC's 1997 Coastal Vulnerability and Construction Standards Study; historical flood studies and documentation of damage; and areas of reoccurring flood problems. Information regarding any other known flooding problems was also obtained from the community through the Community Planning Group, questionnaires, and the public meeting.

The 1997 Coastal Vulnerability and Construction Standards Study described four distinct Coastal Hazard Zones. They are the Beach Zone, the Erosion/Wave Zone, the Wave/Overwash Zone and the Flood Zone. A GIS map of these zones within Lewes is included in the back of this document. These zone designations describe each of these at-risk areas. Although these designations are similar to those used by FEMA and the Lewes, they were developed using slightly different and more conservative methods. The Beach Zone is not mapped within Lewes. The Erosion/Wave Zone corresponds to FEMA's VE-zone and the City's Coastal High Hazard Area. The Wave/Overwash Zone corresponds to FEMA's AO-zone. There are no FEMA AO-zones mapped on the City's FIRMs, but the 1997 study did map the Wave/Overwash Zone within Lewes. The Flood Zone corresponds to FEMA's AE-zone and the City's Coastal Floodplain Area.

Repetitive-Loss Structures

FEMA has mandated that this Floodplain Mitigation Plan address each repetitive-loss structure in Lewes. A repetitive-loss structure is defined as any structure that has filed two or more flood insurance claims in 10 years. Lewes had one repetitive loss structure.

The repetitive-loss structure is detailed in Appendix D of this report. Copies of this report that are for citizen review will not have Appendix D so as not to violate the Privacy Act. Following the 1998 Northeaster, the repetitive loss structure was elevated above the 100-year flood elevation and is no longer at significant risk from flood damage.

Vulnerable Areas within Lewes

There are two primary zones of risk for structures in the City of Lewes, the Erosion/Wave Zone and the Canal Flooding Zone.

Erosion/Wave Zone

Structures on the seaward side of Bay Avenue are located in the Erosion/Wave Zone, as shown on the aerial map. This zone extends eastward to include buildings in the Pilot Point Townhomes. The Erosion/Wave Zone corresponds to FEMA-designated flood zones VE11. Most of the structures located in this zone are residential.

Some coastal experts believe that the VE11 zone likely extends too far into the City of Lewes, thus the risk to some of these structures along Bay Avenue may be less than mapped by FEMA. The dunes, breakwaters and Cape Henlopen would probably protect homes in this area from damaging waves and erosion more than the FEMA maps indicate. However, homes in this area are still at risk of sustaining damage during major storms.

Canal Flooding Zone

As described earlier, during northeasters and tropical storms, elevated water levels in the Atlantic Ocean cause waters in the Delaware Bay and the Rehoboth Bay to rise. This in turn raises the water level in the Lewes and Rehoboth Canal, which floods much of the low-lying north side of Lewes. Houses in the Canal Flooding Zone include homes south of Bay Avenue from Roosevelt Inlet to Route 9. Two high-risk areas in this zone include Cedar Avenue from Iowa Avenue to Illinois Avenue and the Market Street vicinity. Most of the structures in the Canal Flooding Zone are residential, however some commercial businesses and the City's Wastewater Treatment Plant are located in this flood area. The University of Delaware's campus is partially in the 100-year floodplain. Further east on Pilottown Road, the USCG station is also located in the 100-year floodplain. The Canal Flooding Zone corresponds to FEMA-designated flood zones AE8 and AE9 (8 and 9 foot flood elevations during the 100-year storm).

Some of the new home construction in Lewes is located in the Canal Flooding Zone; the Cape Shores Development and most of the Pilot Point Townhomes are located within the zone. These structures are at a lower risk since post-FIRM construction requires main living floor levels to be above the 100-year storm elevation. Damage to these structures during a major storm would be minor.

After the 1998 northeaster, FEMA surveyed 30 "at-risk" structures along Cape Henlopen Drive, Cedar Street, Milton Avenue, Market Street, California Avenue and Houston Avenue. Of these structures, one would be flooded by the 10-year storm, seven would be flooded by the 20-year storm, and six would be flooded by the 50-year storm.

Many of the older, residential homes in the Canal Flooding Zone have been elevated by their owners. These homes will not be severely damaged during a major storm, although access to these homes may be restricted. The City of Lewes has applied to FEMA under the Hazard Mitigation Grant Program to elevate eight additional residential structures in this area. Funds for all 8 of the elevation projects have been approved.

During a major storm, there is a high-probability that the Atlantic Ocean will flood the Canal directly across Gordon's pond in Cape Henlopen State Park. FEMA's flood maps indicate the reformation of a VE zone (coastal storm surge) inland from Gordon's Pond. After waves from the Atlantic Ocean breach the dune, they would reform on Gordon's Pond and directly flood the canal.

Most of these structures at high risk of canal flooding are also in the **Overwash Zone**. During a major storm, this zone is characterized by damaging waves, high velocity flows and deposition of overwash sediment. The Overwash Zone encompasses the houses south of Bay Avenue, which also includes houses along Cedar Avenue. The Overwash Zone continues along Cape Henlopen Drive to the State Park Entrance. However, based on the storm history, most of the homes in this Overwash Zone are damaged by canal flooding and not high velocity flows and debris from the Delaware Bay.

Critical Facilities

Before, during and after a storm, it is imperative that critical facilities remain operational and that access is not eliminated. There are several critical facility structures within the City of Lewes: the Beebe Medical Center, the Lewes Convalescent Center, the Harbor Health Care Facility, City Hall (which houses the Department of Public Works and the police), the Fire Station, the Sewage Treatment Facility, the Electrical Distribution Center, the Ferry Port, the University of Delaware Marine Studies Facility, the United States Coast Guard (USCG) Station, Lewes Middle School, Shields Elementary School, Lewes Consortium School and the communications tower near Cape Henlopen State Park.

The Beebe Medical Center and the Lewes Convalescent Center were evaluated in a 1996 Hazard Mitigation Assessment completed by Greenhorne & O'Mara, Inc. This study found that the Beebe Medical Center is protected from flood waters because it is located on high ground along Savannah Avenue. However, flooding along Canary Creek and the Ebenezer Branch could block vehicular access along Savannah Avenue to the Beebe Medical Center. The study noted that an interruption in service the City's sewage treatment plant would probably cause a cessation of hospital functions. Interruptions in service from the electrical distribution center could also effect the medical center. The Convalescent Center is located near the Beebe Medical Center, at the corner of Vickers and Market Streets. It is also on high ground, but could face restricted access due to street flooding during a 100-year event.

Harbor Health Care is a long-term care facility located in Pilottown Village. The majority of the village lies within Zone X and thus would likely not incur flooding during a 100-year event. However, access to and from the facility would be restricted. Vehicles must travel along Pilottown Road, which is located partially within Flood Zone AE 9, to access the facility. Several residents have reported flooding along Pilottown Road during major storm events that could prevent vehicles from traveling along the roadway.

City Hall is located west of the canal and lies outside of both the 100- and 500-year floodplains. The portion of Freeman Highway connecting City Hall to more inland areas is located just outside of the 100-year floodplain at its intersection with Monroe Avenue. This

flooding is associated with the canal. As mentioned above, sections of Savannah Road that connect downtown Lewes to inland areas are shown on FIRMs to be inundated during the 100-year event by flooding from Canary Creek and Ebenezer Branch. Therefore, Freeman Highway offers the best passage between inland areas and the downtown area, but is in close proximity to the 100-year floodplain.

The Fire Station is located on Savannah Road southwest of the Lewes-Rehoboth Canal within Flood Zone X. Flooding from Ebenezer Branch and Canary Creek could restrict vehicular traffic along Savannah Road. More detailed information about the risk to the facility and possible hindrances to emergency services could be obtained through a hazard vulnerability assessment of the facility. A second fire station also serves Lewes that is located off of Ocean Highway near Nassau Road. This facility is not within the corporate boundaries of the City of Lewes.

The Sewage Treatment Facility in Lewes is located in the Canal Flooding Zone and within FEMA's AE 10-Zone. 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 effect all residents and shelters as well as emergency 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. Further analysis of the plant facilities and its hazard vulnerability would provide more information about the facility's susceptibility to flood damages and what preventative measures can be taken.

The City's Electrical Distribution Center is located on Schley Avenue in Flood Zone X. Kings Highway and Savannah Road provide access to the center from inland areas. According to the City's FIRMs, Savannah Road would experience some flooding during a 100-year event, but King's Highway would not. Therefore, it is likely that access to the center would be restricted by floodwaters, but possible via Kings Highway.

The Cape May - Lewes Ferry Terminal Facility in eastern Lewes is run by the Delaware River and Bay Authority and is located along the Delaware Bay within FEMA's VE14 and AE9 flood zones. Access to the terminal would be severely restricted during a 100-year event as the entire area surrounding the facility is within the 100-year floodplain. Cape Henlopen Drive is shown as being entirely submerged by the 100-year event on the community's FIRMs, and is the only roadway that provides access to the facility.

The USCG Station and University of Delaware's facilities near Roosevelt Inlet might experience restricted access due to street flooding during a major flood event. The Delaware River and Bay Cooperative operates from the university's facilities and is responsible for tracking all oil carriers within the bay in case of a spill. Access to the facilities is provided via Pilottown Road, which flooded during the 1962 and 1998 storm (Figure 4-1).



Figure 4.1. Pilottown Road under water from the 1998 Northeaster.

Cape Henlopen High School and Lewes Middle School are two facilities that might be used as shelters during a storm event. Shields Elementary School does not serve as a shelter, but is considered a critical facility. Cape Henlopen High School is located outside of the City of Lewes' corporate boundary in Zone X. Access to the school via Route 9 does not appear to be hindered by the 100-year flood according to the FIRM. The elementary and middle schools are located near the intersection of Savannah Road and Sussex Drive outside of the 100- and 500-year floodplains. Access to and from inland areas along Savannah Road would be difficult during the 100-year storm event as the road is shown as being inundated by floodwaters from Canary Creek and Ebenezer Branch on the FIRM.

The Lewes Consortium School is located on Dupont Avenue. The school is not a storm shelter facility, but is a learning facility for disabled children. The school is located in Flood Zone X, but due to street flooding during a 100-year event along Pilottown Road and Savannah Road, vehicular access to the facility could be difficult.

Evacuation Procedures

Evacuation procedures for Lewes are necessary since northeasters and hurricanes can cause serious flooding that threatens the safety of residents and visitors (Figure 4.2). These storms are often unpredictable and can quickly change course. Therefore, it is important to be prepared and have a warning system and evacuation plan in place.



Figure 4.2. Evacuation during a major storm would be difficult in floodprone areas, such as Cedar Avenue shown here.

The Delaware Department of Transportation (DelDOT) and DEMA coordinate with the City of Lewes to administer evacuation warnings. When evacuation is deemed necessary, the two state agencies and the Lewes police work together to inform residents. Evacuation Route signage is already in place along the three main routes away from the coast towards inland areas: King's/Freeman Highway, Savannah Road and Route 266.

Every year, a flyer is sent to all residents of Lewes that describes the risks of flooding to the community and provides contact numbers of City employees.

Areas of Natural And Beneficial Functions

Within Lewes, there are wetland areas located along the Lewes and Rehoboth Canal. These areas provide some flooding protection to structures located near the canal. When storm events lead to high water levels in the Rehoboth and Delaware Bays, water levels rise in the canal causing the canal to overtop. The wetland areas serve as buffers by storing floodwaters during these storm events and protecting structures from being flooded.

National Wetlands Inventory maps indicate that approximately 30-35 acres of undeveloped wetlands lie northeast of the canal between Savannah Road and Freeman Highway by the Sewage Treatment Facility. These wetlands are estuarine, meaning they are tidal wetlands, that are semi-enclosed by land but have sporadic access to the open ocean. Estuarine wetlands also extend approximately 200-800 feet northeast of the canal for the majority of the run of the canal between Route 9 and the Roosevelt Inlet. Lewes is bordered by estuarine wetlands that lie in undeveloped areas to the west and east of the City.

5. Goals

The Community Planning Group discussed possible goals during the second half of the second meeting. From that discussion, a proposed goal list was generated and distributed to each of the members. The members were prompted to evaluate the following about each goal: (1) already occurring, (2) do not pursue, (3) pursue with Federal funding only and (4) pursue without Federal funding. Each of the responses were compiled and a final goal list was generated. Goals that are already being focused on by the City of Lewes start with a 'Continue to'. The final list of goals by category is as follows:

Structural Projects

1. Continue to maintain a stable and adequate dune and beach system to protect the community from erosion and flood hazards. DNREC currently performs dune maintenance and USACE is planning a beach replenishment project.
2. Continue to maintain existing drainage systems and ensure that they are functioning properly.
3. Investigate structural solutions to replace existing drainage systems with more effective alternatives.

Damage Prevention

1. Investigate and implement through ordinance additional coastal construction techniques that will minimize damage caused by erosion and floods.
2. Continue to regulate reconstruction / development in the City through ordinances to provide adequate runoff and drainage capacity.
3. Continue to require that new construction be resistant to flood damage (e.g. by locating structure outside of a high-risk area, by elevation, or by minimizing the use of lower level enclosures).
4. Ensure publicly owned buildings and structures are adequately protected against the 100-year flood.
5. Reduce damage to infrastructure of Lewes that occurs during flooding events.

Property Protection

1. Ensure that high-risk, pre-FIRM residential structures do not get repeatedly flooded by elevating or relocating the structures out of the floodplain.
2. Reduce the impact of flooding on commercial structures through floodproofing, elevating, or relocating structures out of the floodplain.

3. Where practical and feasible, purchase residential or commercial structures in the floodplain and convert the land use to recreational use or ecological habitat.
4. Maximize the points available to Lewes under the Community Rating System (CRS) program to obtain Federal flood insurance rate reductions and make flood insurance more affordable, thus making flood insurance more attractive to property owners. The City is currently a member of the CRS.

Natural and Beneficial Functions of the Floodplain

1. Protect existing natural resources and open space, including parks and wetlands, within the floodplain and watershed.
2. Restore open space and degraded natural resources such as dunes and the marsh areas to improve their flood control function.
3. Acquire additional property, if feasible, to increase existing parks or open space.

Emergency Services

1. Direct people to safe and adequate shelters.
2. Provide residents with adequate warning of potential floods.
3. Provide adequate emergency response services.
4. Ensure that emergency response services and critical facilities functions, such as those provided by the Lewes Fire Department, are not interrupted by flooding.
5. Coordinate with State, County and adjoining towns to provide safe and efficient evacuation routes prior to floods.

Public Information

1. Ensure that property owners and visitors are aware of the potential hazards associated with floodplain areas.
2. Ensure that property owners and potential property owners are aware of the availability and benefits of obtaining Federal flood insurance.
3. Ensure that citizens are advised how to protect themselves and their property from flooding hazards.
4. Ensure that citizens are aware of potential Federal /state grant monies to elevate their structures.
5. Maintain accurate flood hazard maps that reflect the actual risk of damage to structures in Lewes.

6. Maintain maps that reflect the risk to public facilities through the use of GIS.

6. Projects

Possible Floodplain Management Projects were determined to address the goals listed in the previous section. These are listed below along with the goal to which they correspond.

Increased Cost of Compliance Coverage

If enacted, some of the projects below would force a resident of Lewes to comply with the current Lewes Zoning Code. It is important for residents who have flood insurance that was written or renewed after June 1, 1997 to know that Increased Cost of Compliance coverage under their existing flood insurance policy is now available. This coverage has been recently included as a rider on the existing policies of the insured in Lewes.

This new coverage may pay up to \$15,000 to offset costs associated with floodproofing, elevating, demolishing or relocating buildings that are (1) substantially damaged or (2) subject to repetitive flood loss. A repetitive-loss structure under the Increased Cost of Compliance is defined as a structure which has made flood insurance claims on 2 or more occasions during a 10-year period in which the average cost of repairing the flood damage exceeds 25 percent of the market value of the structure at the time of the flooding. In order for the residents of the City of Lewes to receive these monies under this definition of a repetitive-loss structure only, *the City must have a cumulative, substantial damage provision in its ordinance* (see Project 2). The City should carefully read the conditions and exclusions of this coverage.

A resident would apply for Increased Cost of Compliance coverage through their insurance company. The resident needs a letter from the City that would state that their structure is substantially damaged and there are specific code requirements that they have to meet. In addition a homeowner would need at least one estimate from a contractor who could do the work. The City would then have to determine if the structure is substantially or repetitively damaged. This determination is made when the resident applies for a building permit to begin repairing their flood-damaged structure or during a post-flood survey by the City of Lewes. The purpose of this coverage is to help residents offset the costs associated with complying with current ordinances.

1. Add / modify the following section to Article XI of the Lewes Zoning Code to have the floodplain ordinances comply with FEMA's Model Code.

§197-48 Determination of district boundaries.

Modify 4th sentence to read: "Zone VE is designated as Coastal High Hazard Areas (CHHA) and Zone AE is designated as Coastal Floodplain (CFP) for the purpose of this chapter." The purpose of this modification is to fix a typographical error which currently confuses Zone AE as both the CHHA and CFP zone.

2. Modify the definition of 'substantial improvement' and 'substantial damage' found in Article XI in the Lewes Zoning Code to incorporate cumulative improvements and damage over 10-years. The effect of this would be to require

property owners of pre-FIRM structures to adopt post-FIRM constructions requirements as both improvements and repairs and/or damages cumulatively reach 50 percent of the structures' market value. For example, if the owner of an existing pre-FIRM structure that has a market value of \$100,000 applied for a building permit to add an additional story to the structure for a cost of \$40,000 in 1990, and then applied for a permit to perform some foundation adjustments costing \$30,000 in 1993, the existing code for Lewes would not require this homeowner to comply with the 'substantial improvement' provision of the Code. If the definition of substantial improvement was modified to include cumulative improvements, in 1993 this homeowner would have performed improvements totaling 70 percent of the market value to the structure and would be required to comply with the 'substantial improvement' provision.

Similarly, if the structure was damaged and the homeowner made an insurance claim in 1992 for \$40,000 and another claim in 1998 for \$30,000, the existing code for the city would not require this homeowner to comply with the 'substantial damage' and 'substantial improvement' provisions of the Code. If the draft ordinances that follow were adopted, in 1998 this homeowner would have 70 percent of their structure damaged and would have to comply with the 'substantial damage' and 'substantial improvement' provisions.

The City of Lewes should modify the following definitions in §197-57 Definitions.

“Substantial improvement - Any reconstruction, rehabilitation, addition or other improvement of a structure, the cost of which, over a 10-year period equals or exceeds a cumulative total of 50 percent of the market value of the structure before the start of construction of the improvement. This term includes structures, which have incurred substantial damage, regardless of the actual repair work performed. The term does not, however include either;

- (1) Any project for improvement of a structure to correct existing violations of state and local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions; or
- (2) Any alteration of a historic structure, provided that the alteration will not preclude the structure's continued designation as a historic structure.”

“Substantial damage – Damage of any origin sustained by a structure over a 10-year period whereby the cumulative cost of restoring the structure to its before-damaged condition over the 10-year period would equal or exceed 50 percent of the market value of the structure before the damage occurred.”

Goals supporting: Goal 1 under 'Damage Prevention'.

- 3. Modify the current Lewes Zoning Code to enact stricter construction regulations in flood zones.** The recent Coastal Vulnerability and Construction Standards Study recommended supplements to existing building codes in Delaware to reduce the potential for long-term flood-related damages.

Pile Embedment Depth

Recommendation: Foundation pilings for structures in the Coastal High Hazard Area should be at or below -10.0 feet NGVD 29. In no instance will the bottoms of foundation pilings be permitted above -10.0 feet NGVD 29.

According to current codes it is up to the designer, a professional engineer or architect, to determine the depth of the piling foundation. The recommended ordinance standardizes a minimum depth to which foundations must be extended. There have been many instances of building loss due to insufficient depth of piling foundation and inadequate design observed in storm damage assessments. FEMA's Building Performance Assessments performed after major hurricane events have shown repeated evidence of low depth piling foundation leading to pilings being uprooted and structural collapse of the attached building.

Construction Under Piling-Supported Buildings - Breakaway Walls

The current City of Lewes Zoning Code states in §197-53 that for all new construction and substantial improvements, the enclosed areas below the lowest floor space shall be usable solely for parking of vehicles, building access or storage. The code should be modified to clearly specify the allowable types of floors in enclosed spaces. This will help reduce the amount of damage to enclosed spaces. The proposed code change is the following:

“The floor of an area enclosed with breakaway walls shall be either composed of soil, crushed shell, gravel, driveway stone, or other materials as approved by the City. Wooden floors, floor joists and floor beams are prohibited. Breakaway walls shall include openings that allow the automatic entry and exit of flood waters.”

Utilities

The language in §197-53(G) of the City's Zoning Code that related to utilities for new construction and substantially improvements should be strengthened, even though many of these recommendations may be already occurring. The existing code only applies to electrical water heaters, furnaces, electrical distribution panels and “other installed electrical equipment”. The model ordinance below would also address the location of utility connections relative to the structure.

It is recommended that the following ordinance be added to §197-53(G):

“(3) Plumbing, duct work and other utility components shall not be attached to breakaway walls. All utility connections servicing the elevated building will be attached to the landward side of foundation piles.

(4) Public and/or private utility facilities including, but not limited to the following shall be located and constructed above the flood protection elevation of the building: heating ventilation, plumbing, air conditioning equipment and other service facilities.”

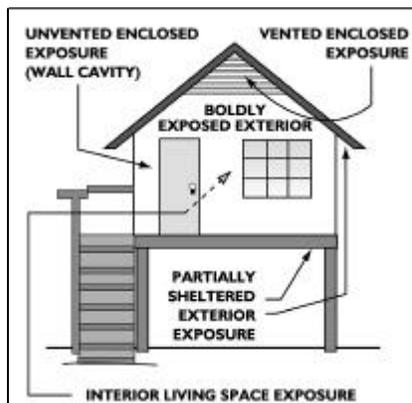
Flood and Corrosion-Resistant Materials

Building performance assessment reports conducted by FEMA have identified corrosion of connectors and fasteners. FEMA’s Technical Bulletin 8-96 outlines guidance for the use of metal connectors in coastal areas. A recommended ordinance is shown below:

“All materials used in new construction and substantial improvements, and exposed to floodwaters during design flood conditions shall be flood-resistant. All nails, bolts, screws and other fasteners exposed to salt air shall be hot-dip galvanized to meet ASTM a 153/A 153M-82. Sheet metal connectors such as wind anchors, joist hangers, and truss plates shall comply with the following table.”

Corrosion Resistant Requirements for Sheet-Metal Connectors

Location Class of Exposure	Coastal High Hazard Area	Areas of Shallow Flooding	Buildings Farther Landward
Partially sheltered exteriors	<ol style="list-style-type: none"> Galvanized sheet-metal connectors or truss plates are prohibited for exterior use Stainless steel-metal connectors Hot dip galvanized 3/16" steel plate or thicker 	<ol style="list-style-type: none"> Sheet-metal connectors with thicker galvanizing (optional- stainless steel) No truss plates on exterior 	Standard sheet metal connectors (optional- thicker galvanizing)
Boldly exposed exteriors	<ol style="list-style-type: none"> Galvanized sheet-metal connectors or truss plates are prohibited for exterior use Stainless steel sheet-metal connectors Hot dip galvanized 3/16" steel plate or thicker 	<ol style="list-style-type: none"> Sheet-metal connectors with thicker galvanizing (optional- stainless steel) No truss plates on exterior 	Standard galvanizing (optional- thicker galvanizing)
Vented enclosures	<ol style="list-style-type: none"> Sheet-metal connectors with thicker galvanizing (optional- stainless steel) TPI paints on truss plates Optional for truss plates- <ul style="list-style-type: none"> ◆ thicker galvanizing ◆ TPI Paints over thicker galvanizing or ◆ stainless steel 	<p>Within 6 feet of any vent</p> <ol style="list-style-type: none"> Sheet metal connectors with thicker galvanizing TPI paints for truss plates (optional- thicker galvanizing for all connectors in vented space) 	Standard galvanizing (optional- thicker galvanizing)
Unvented enclosures	<ol style="list-style-type: none"> Sheet-connectors with thicker galvanizing TPI paints on truss plates (optional for truss plates- thicker galvanizing) 	Standard galvanizing (optional- thicker galvanizing)	Standard galvanizing (optional- thicker galvanizing)
Interior living space	Standard galvanizing (optional- thicker galvanizing)	Standard galvanizing (optional- thicker galvanizing)	Standard galvanizing (optional- thicker galvanizing)



Goals supporting: Goals 1, 3, and 5 under ‘Damage Prevention’.

- 4. Obtain accurate flood maps of Lewes’ floodplains by petitioning FEMA to re-evaluate V Zone delineations.** Some coastal experts believe that the VE11 zone extends too far into the City of Lewes, thus the risk to some of these structures along Bay Avenue may be less than mapped by FEMA. The extensive dunes, breakwater structures and Cape Henlopen would probably protect homes in this area from damaging waves and erosion more than the FEMA maps indicate. The City of Lewes should work with DNREC to obtain current beach profiles and work with FEMA to obtain maps that accurately display the V-Zones in Lewes. FEMA’s Mitigation Division has already stated that they are open to discussing any new information that might effect the zone designation.

Goal supporting: Goal 5 under ‘Public Information’

- 5. Obtain additional elevation information for areas in the floodplain in the City of Lewes, especially areas northeast of the Lewes & Rehoboth Canal.** Residents in floodprone areas have expressed an interest in knowing where the 100-year flood elevation is in relation to their homes. The city can obtain elevations either by (1) completing a study to obtain detailed contour maps of these areas and creating a map showing the flood depths or (2) to increase the number of elevation reference points in floodprone areas complemented with signs which would indicate the 100-year flood elevation. Citizens could then use this information to mitigate against the effects of flooding by locating items of value above the flood elevation. Citizen comments indicate that signage is the preferred alternative.

Goal supporting: Goals 1 and 3 under ‘Public Information’

- 6. If funding becomes available, complete additional elevation certificates for structures in floodprone areas.** After the northeasters of 1998, FEMA completed elevation certificates for 30 structures in floodprone areas (Milton Ave, Cedar Ave, Houston Ave, Market Street and Cape Henlopen Drive). The City of Lewes used these certificates to determine which homes might be eligible for FEMA Hazard Mitigation Grant Program Funding. In Delaware, DEMA is responsible for administering this funding. The City assisted homeowners by submitting an application to DEMA for 75 percent funding of the elevation of 8 homes (the homeowners pay 25 percent of the cost). Funds for all 8 of the elevation projects have been approved. There are several structures in this area for which FEMA has not yet issued elevation certificates.

Goals supporting: Goal 1 under ‘Property Protection’

- 7. Continue to support Project Impact plans to perform a Hazard Vulnerability Assessment and Structural Mitigation and Retrofitting Actions within Lewes.** As described in the Critical Facilities portion of Section 4, NFIP maps for Lewes show that several critical facilities within the City would have restricted or no access as the result of flooding from the 100-year event. A Hazard Mitigation Assessment for the Beebe Medical Center, Lewes’ critical regional medical center that serves as both a medical provider and a shelter, was completed by FEMA in 1996. Only about 20 percent of the mitigation

recommendations within the report have been completed. A Hazard Vulnerability Assessment (HVA) with special attention given to critical facilities would reveal the specifics of the hazards to the critical facilities and offer information about the best possible structural mitigation and retrofitting actions for the facilities. The City is currently pursuing a contractor to perform a City-wide HVA.

Goals supporting: Goals 4 and 6 under ‘Damage Prevention’ and Goals 1, 2, 3, 4, 5 and 6 under ‘Emergency Services’

- 8. Publish and issue a brochure describing flooding hazards and evacuation procedures in Lewes.** A brochure describing the flooding threat from northeasters and hurricanes would help to educate and inform residents of the threat from floods and what to do in a flooding emergency. The brochure should contain information describing flooding hazards, list any TV or radio stations that will disseminate information during an emergency, and describe evacuation procedures and routes. The brochure could also offer information about the natural functions of the floodplain and include information about the wetland areas within the City and inform citizens about FEMA flood zones and Project Impact within Lewes.

The brochure could be sent semi-annually to all residents and should be available at the City Hall and Library. In order to make visitors and tourists more aware of the threat from flooding, the brochure could be distributed to hotels and to rental agencies to give to their clients.

This project could be done in coordination with or as part of the Project Impact plan to create a Public Education Program for general awareness and understanding of natural hazard risks. CRS credits are available for outreach projects as described in Section 330 of the Community Rating System Manual.

Goals supporting: Goals 1 and 3 under ‘Public Information’ and Goals 1 and 2 under ‘Natural and Beneficial Functions of the Floodplain’

- 9. Support the further evaluation and consideration of projects named in the ‘Preliminary Identification of Hazard Mitigation Actions for Further Evaluation and Consideration by the City of Lewes Partnership to Build a Disaster Resistant Community’ in Appendix B of the City of Lewes Project Impact Memorandum of Agreement.** As described in the Ongoing Flood Damage Prevention Activities portion of Section 2, several projects were named that will be further investigated and pursued as part of Project Impact. Flood mitigation projects relating to some of the hazard mitigation actions identified by Project Impact are described in the two preceding projects. However, additional activities were identified in the Memorandum of Agreement for each of the hazard mitigation actions that should be considered in this Flood Mitigation Plan.

The Development of a Hazard Mitigation Strategy

The hazard mitigation strategy will identify ‘natural, technological and societal hazards’ that pose a threat to Lewes. The strategy will ‘define mitigation policies, programs and projects’ that will reduce the human and economic costs incurred during disasters. The

strategy will rely on the groups/subcommittees of the Partnership and other sources for information. The strategy will focus on risk/hazard reduction measures that will promote long-term economic benefits.

Conducting a Hazard Vulnerability Assessment (HVA)

A comprehensive HVA will be performed to ‘identify hazards and assess the risks associated with those hazards’ for Lewes. This assessment will provide the City with information about risks that can then be used to prioritize mitigation activities. The partnership will use the latest technology to perform the assessment and will create a GIS mapping system to delineate hazard areas that will incorporate FEMA’s HAZUS maps for overlays. The integrity of the power distribution system will also be reviewed as part of the assessment.

Structural Mitigation and Retrofitting Actions

Recommendations from the HVA will be used to identify the Structural Mitigation and Retrofitting Actions. Additionally, some possible activities have already been identified including creating a central Emergency Operations Center (EOC) capability and performing additional mitigation activities identified in the Hazard Mitigation Study of the Beebe Medical Center (only about 20 percent of the recommendations have been implemented). Other projects include flood-proofing the City sewers, providing back-up generators for two critical facilities (City Hall and Cape Henlopen High School) and elevating roads within the City that are needed during and after disasters.

Improving Emergency Operations Communications and Procedures

This activity involves establishing communication links between Emergency Operations personnel from local and state agencies including the City, Sussex County EOC, DEMA and DNREC. Also, a reverse 911 system has been suggested to use in for disaster warnings. The development of a ‘comprehensive plan for emergency operations and evacuation’ has also been proposed.

Partnerships and Resource Development

Projects identified under this activity include ‘developing a strategy for the continued development of the Lewes Partnership to Build a Disaster Resistant Community’, creating a database of potential parties interested in the mitigation efforts and continually identifying funding sources for pre-disaster mitigation efforts. Additionally improving the coordination between regulatory agencies is suggested.

Public Education, Awareness and Training

The purpose of this activity is to promote broad based public education, awareness and understanding of natural hazard risks. Some of the projects that have been identified are developing a community education and awareness campaign for residents, summer residents/visitors, school children, business owners, the media and other stakeholders.

Creating a website, and developing a 'Hurricane Awareness Week' has also been suggested.

Media Awareness

A public information program has been suggested to educate people about Project Impact. In addition, a Media Awareness Work Group has been suggested to serve as a liaison between other Project Impact Work Groups and the general public. The group will keep the public informed about Project Impact activities and will offer information about disaster mitigation and recovery actions.

Goals supporting: Goals 4 and 6 under 'Damage Prevention', Goal 2 under 'Property Protection', Goals 1, 2, 3, 4, 5 and 6 under 'Emergency Services' and Goals 1, 2, 3, 4 and 6 under 'Public Information'

- 10. Continue to support USACE/DNREC plans to perform a beach replenishment project in Lewes.** A feasibility study for a storm damage reduction project in Lewes was conducted by USACE and DNREC and completed in May 1997. The study examined several alternatives to determine what type of storm damage reduction structures would be most beneficial to Lewes. The possibilities included non-structural measures such as taking no action, floodplain management and permanent evacuation. Structural measures considered were berm restoration, dune restoration, groin fields, constructing bulkheads, a seawall, an offshore detached breakwater, a perched beach, a terminal groin at the western end of Lewes Beach, and several combinations of these alternatives. After comparing general feasibility, costs and the level of protection each structure would provide, the study determined that combined berm and dune restoration and the placement of a terminal groin on the western end of Lewes Beach was the most appropriate alternative to pursue.

The study determined that berm restoration was only necessary for the first 900 feet of beach length east of Roosevelt Inlet. The remainder of the study area shows limited damage potential. The design width of the berm/dune configuration is 100-feet because this width will provide an equivalent distance between the structures and the shoreline as that of the areas along Lewes Beach which have lower damage potential. The width is measured from the design baseline located along the landward toe of the existing dune. The elevation of the berm will be + 8.0 feet NAVD 88 (approximately + 7 feet NGVD 29) which is consistent with the natural berm elevation as determined by historical profiles. The dune will have a top elevation of + 14.0 feet NAVD 88 (approximately + 13 feet NGVD 29), side slopes of 1V:5H, which parallels the existing profile, and a top width of 25 feet. Thus, the dune will be built along the berm, at a height of 6 feet above the berm and will have a total width of 85 feet. This will leave only 25 feet of the berm exposed. The berm and dune restoration will also include the use of dune grass, dune fencing and suitable beachfill with periodic nourishment. Material dredged from Roosevelt Inlet will be used for beachfill.

The terminal groin will be 710 feet in length and will be located at the Western end of Lewes Beach. The top height of the groin will be + 8.0 feet NAVD 88 (approximately + 7 feet NGVD 29) and will have side slopes of 1V:2H and a top width of 12 feet. The groin

is projected to reduce the annual nourishment necessary at Lewes shore by 50 percent. The groin will reduce the beach loss rate by helping to retain beachfill along the project shoreline and reducing shoaling in the inlet.

Benefits are derived from local costs foregone, reduced Federal maintenance dredging, and storm damage reduction benefits. Storm damage costs for with and without project conditions were calculated as described above with their difference being the benefit amount. Local costs foregone are calculated as monies spent by the state on current beach nourishment. The economic analysis yielded annual benefits of \$579,300, an annual cost of \$453,400 and a benefit to cost ratio of 1.28.

USACE and DNREC are currently negotiating a cost sharing agreement for the preconstruction engineering and design of the project. If funded under the current system, USACE funds would cover 76 percent of the project. The remaining 24 percent will be paid by the State and by the City of Lewes.

Goals supporting: Goal 1 under 'Structural Projects'

- 11. Investigate clearing the debris-filled ditches in the northwest wetland area of Lewes near Roosevelt Inlet.** Clearing the ditches in this area would help to improve storm drainage within the City. The City has attempted to address this issue in the past, however, no specific agency was ever deemed responsible for maintaining the ditches. In order to improve drainage in this area, the City should reexamine the situation and attempt to resolve the problem.

Goals supporting: Goal 2 under 'Structural Projects' and Goal 2 under 'Natural and Beneficial Functions of the Floodplain'.

- 12. Pursue plans to restore flood protection to properties along the north side of the Lewes and Rehoboth Canal by restoring eroded areas along the line of dredge spoils.** This project is connected to project 11 (see above). The project would also consist of the placement of a pipe through the dike to allow tidal inundation to the marsh during normal flow conditions. During storm conditions, elevated water levels in the canal would force a valve in the pipe to close. The berm would then prevent flooding of the tidal wetlands and adjacent properties along Cedar Avenue.

The City has been pursuing this project since 1995. The City is currently attempting to receive proper permitting for the project from USACE, but USACE has requested further information.

Goals supporting: Goals 2 and 3 under 'Structural Projects'

- 13. Send appropriate City personnel to training programs at FEMA's Emergency Management Institute (EMI).** Courses offered at EMI that would be applicable include:

- E278 - National Flood Insurance Program / Community Rating System,

- E273 - Managing Floodplain Development through the National Flood Insurance Program, and
- E279 - Retrofitting Floodprone Residential Buildings

A complete list of courses can be found at EMI's web page (www.fema.gov/emi).

Goals supporting: Goals 3, 4 and 5 under 'Public Information'.

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7. References

Applied Technology and Management, Inc. for DNREC, the State of Delaware Coastal Storm Preparedness and Recovery Plan, (October 1992)

City of Lewes Code, Article XI, Floodplain District Regulations, (April 1999)

The City of Lewes Project Impact Memorandum of Agreement, (February 1999)

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Delaware Geological Survey Summary Report, The Coastal Storms of January 27-29 and February 4-6, 1998, Delaware and Maryland, (1998)

Delaware Geological Survey Summary Report, The Storm of January 4, 1992, (1992)

Dewberry and Davis with Earth Tech, Inc. and Coastal Services for DNREC, Coastal Vulnerability and Construction Standards Study, (1997)

Earth Tech for Delaware Emergency Management Agency, State of Delaware Hurricane Program Needs Assessment, (1995)

Federal Emergency Management Agency (FEMA) Building Performance Assessment Team, Field Trip and Assessment within the States of Maryland and Delaware in Response to A "Nor'easter" Coastal Storm on January 4, 1992, (1992)

FEMA Mitigation Directorate, Engineering Principles and Practices of Retrofitting Floodprone Residential Structures, (FEMA 259), (January 1995)

FEMA Flood Insurance Rate Maps, Sussex County, Delaware and Incorporated Areas, (1995).

FEMA Flood Insurance Study, Sussex County, Delaware and Incorporated Areas, (1999).

University of Delaware, Geography Department for the Delaware Coastal Management Program, Coastal Storm Damage 1923-1974, Technical Report Number 4, (1977).

USACE / DNREC, Delaware Bay Coastline - Delaware and New Jersey, Roosevelt Inlet - Lewes Beach, DE, Final Feasibility Report and Final Environmental Assessment, (May 1997)

USACE / DNREC, Delaware Bay Coastline - Delaware and New Jersey, Roosevelt Inlet - Lewes Beach, DE, Final Appendix A Engineering Technical Appendix, (May 1997).

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Appendix A

Community Rating Service: Section 510

Floodplain Management Planning

Checklist

511 Credit Points**a. Organize and prepare the plan** (Maximum credit: 10 points).

1. 2, if the planning process is under the supervision of a professional planner;

The Flood Mitigation Plan was under the supervision and review of Greenhorne & O'Mara, Inc, a multidisciplinary engineering firm who has expertise in flood mitigation and flood planning. Points requested: 2.

2. 6, if the planning process is conducted through a committee composed of staff from those community departments that will be implementing the majority of the plan's recommendations.

A Community Planning Group was formed and consists of city officials and residents. These members assisted in the development of the Floodplain Mitigation Plan. City officials on the committee represent Lewes' Building Department, Code Enforcement and Zoning Regulations, Engineering and Public Works and Public Information job functions. State officials from DEMA and DNREC responsible in part for Environmental Protection and Emergency Management within the City also served on the committee as 'ex-officio' members. Points requested: 6.

3. 2, if the planning process and/or the committee are formally created or recognized by action of the community's governing board.

On June 14, 1999, the Mayor and City Council of Lewes formally recognized the Community Planning Group. Points requested: 2.

b. Involve the public (Maximum credit: 48)

1. 2, for at least one meeting to obtain public input on the draft plan held at the end of the planning process at least two weeks before submittal of the recommended plan to the community's governing body.

The Draft Floodplain Mitigation Plan will be issued to the public for review and a public hearing held on the Plan. Comments received during the review period and at the public hearing will be incorporated into the Final Plan before it is submitted to the City for approval and adoption. Points requested: 2.

2. 8, if one or more public meetings are held in the affected area(s) at the beginning of the planning process to obtain public input on flood problems and possible solutions.

An 'open-house' type public forum was held in Lewes, on June 4, 1999 at the Lewes Public Library, to obtain public input on the planning process. Approximately 2,600 newsletters were sent to all of the citizens of Lewes, informing them of the open house. During the open house, the public was presented with an overview of the Floodplain Mitigation Planning process and a description of the high-risk areas identified. The public was then asked to comment on the high-risk areas and fill out questionnaires to solicit input on the flooding problem in Lewes and potential solutions. Points requested: 8.

3. 4, if public information activities are implemented to explain the planning process and encourage input to the planner or planning committee.

A newsletter was distributed to all Lewes property owners in May 1999 to inform them of the preparation of the Floodplain Mitigation Plan and to invite them to a scheduled Public Meeting on June 4, 1999. A questionnaire was included in the newsletter asking residents and business owners to describe flooding problems and damage they were aware of and to suggest ways to protect their property and neighborhood from flooding. At the Public Meeting, preparation of the Flood Mitigation Plan was again described and residents were encouraged to share any information they knew about flooding problems and possible solutions. Points requested: 4.

4. 4, if questionnaires are distributed asking the public for information on flood problems and possible solutions. The questionnaires must be distributed to at least 90 percent of floodprone residents.

All residents of Lewes were sent a questionnaire asking them to report flooding issues and to suggest possible solutions. Points requested: 4.

5. 4, if written comments and recommendations are solicited from neighborhood advisory groups, homeowners' associations, parent-teacher organizations, the Chamber of Commerce, or similar organizations that represent the public in the affected area(s).

All property owners in Lewes were sent a questionnaire asking for input on flooding issues within the City and possible solutions; this process included any local organizations and associations. Points requested: 4.

6. 26, if the planning process is conducted through a planning committee that includes members of the public. If this is the same planning committee credited under 511.a.2 and 3, at least one half of the members must be representatives of the public, preferably from the floodprone areas. The committee must hold a sufficient number of meetings that involve the members in planning steps 241.d, e, f, g, and h.

Lewes created a Community Planning Group that includes two members representing the community. To see a list of the members of the committee, please see Appendix B. The other 5 members were City officials. There were also 5 "Ex-officio" members representing County, State, and Federal agencies. The committee initially met on February 26, 1999 to discuss the planning process and hazard identification (241.d). The second meeting occurred on April 16, 1999; part A discussed the risk analysis (241.e) and in part B the committee set goals for the County (241.f). The third meeting was held on June 4, 1999 to review the initial draft of the plan and receive comments on the plans and the proposed activities for the City (241.g). A fourth meeting was held on July 20, 1999 to review the final draft of the plan and discuss any comments (241.h). Points requested: 10 (2/5ths of 26)

c. Coordinate with other agencies (Maximum credit: 18)

1. 3, if the other agencies are contacted at the beginning of the planning process and asked for their input.

The agencies that were contacted at the beginning of the planning process include: Federal – US Army Corps of Engineers – Philadelphia, Federal Emergency Management Agency; State – Delaware Emergency Management Agency, Delaware Natural Resources and Environmental Control, Delaware Geological Society; Local – Representatives of Lewes’ Building Department and Code Enforcement, Engineering and Public Works, Environmental Protection, Emergency Management, Planning and Zoning Commission, Public Health, Public Information and Public Safety were contacted for their input. Points requested: 3.

2. 10, if meetings are held with representatives of agencies to review common problems, development policies, mitigation strategies, inconsistencies and conflicts in policies, plans, programs, and regulations.

In addition to having some agency members as ‘ex-officio’ members of the Community Planning Group, a meeting was held with the United States Army Corps of Engineers- Philadelphia District to discuss Federal plans and policies for Lewes. During Community Planning Group Meetings, ‘ex-officio’ members participated in the discussion of policies, mitigation strategies, plans and goals for Lewes. Points requested: 10.

3. 3, if the planning includes a review of the community’s needs, goals, and plans for the area.

During the April 19th meeting, the Community Planning Group discussed flooding risks and hazards to the area. In the second part of the meeting a general list of goals was developed and CPG members were asked to comment on the list and determine which goals were most appropriate for Lewes. Section 5 of the Plan provides a list of the City’s goals for reducing the vulnerability of structures to flooding and for improving the quality of life for its citizens. Points requested: 3.

4. 2, for sending the draft action plan to the other agencies and asking them to comment by a certain date.

The draft plan was sent to State, and Federal agencies for review and comment (see C1). Comments received from these agencies will be taken into consideration in preparing the Final Plan. Points requested: 2.

d. Assess the hazard (Maximum credit: 10)

1. 5, for including the following in the plan:

- a) a map of the known flood hazard areas. “Known flood hazards” means the floodplain shown on the Flood Insurance Rate Map (FIRM), repetitive loss areas, areas not mapped on the FIRM that have flooded in the past, and surface flooding identified in existing studies. No new studies need to be conducted for this assessment.
- b) A description of known flood hazards, including source of water, depth of flooding, velocities, and warning time, where such data are available.
- c) A discussion of past floods, where such data are available.

Maps showing the high-risk flooding areas are included in the back of this report. These maps show the zones from the City’s FIRM data as well as zones developed in DNREC’s 1997 Coastal Vulnerability and Construction Standards Study. The description of known flood hazards, including source of water and depth of flooding (where available) is also included in Section 3 of this report. Section 3 included a discussion of past flooding in Lewes. Points requested: 5.

2. 5, if the plan includes a map and description of other natural hazards, such as erosion, tsunamis, earthquakes, and hurricanes.

A description of other natural hazards including wind and erosion is included in Section 3, Hazard Identification. The report also includes a description and maps of erosion/wave hazard and wave/overwash areas. Points requested, 5.

e. Assess the problem (Maximum Credit: 30 points)

1. 2, for including the number and types of buildings subjected to the hazards identified in the hazard assessment:

In the Vulnerability Assessment (Section 4), the types of structures subject to the hazards identified are mentioned. Points requested: 1.

2. 6, If the plan includes a description of the impact that past or predicted flooding has on buildings, infrastructure, public health and safety.

The plan describes damages incurred to buildings and infrastructure during historical storm events. A detailed description of potential damage to critical facilities in Lewes is also provided. Evacuation routes and warning measures used to ensure public health and safety are also discussed within the Plan. Points requested: 6

3. 3, If the plan describes the need and procedures for warning and evacuating residents and visitors.

In Section 4, the Plan addresses evacuation routes and warning procedures to be used in the event of a serious storm. Points requested: 3.

4. 4, If the plan identifies critical facilities, such as hospitals, fire stations, and chemical storage companies.

In Section 4, the Plan identifies critical facilities in Lewes. Points Requested: 4.

5. 4, If the plan describes areas that provide natural and beneficial functions, such as wetlands, riparian areas, sensitive areas, and habitat for rare or endangered species.

In Section 4, a description of protection provided by wetland areas in Lewes is included. Points Requested: 4.

6. 4, If the plan includes a description of development, redevelopment, and population trends and a discussion of what the future brings for development and redevelopment in the floodplain, the watershed, and natural resource areas; and

Development and population trends and their effect on the floodplain and is described in Section 2. Points requested: 4.

7. 6, If the plan includes a summary of the impact of flooding on the community and its economy and tax base.

Impacts of flooding on the community and its economy and tax base are described in the Background (Section 2) and throughout the Vulnerability Assessment (Section 4). Points requested: 6.

f. Set goals (Maximum credit: 2).

The two credit points for this step are provided if the plan includes a statement of the goals of the community's floodplain management program.

The Community Planning Group Meeting established goals for the floodplain management program. At a meeting held on April 19th, an initial list of goals was developed from which members selected the most appropriate goals for Lewes. These goals are listed in Section 5 of the Plan. Points requested: 2.

g. Review possible activities (Maximum credit: 30)

1. 5, if the plan reviews preventive activities such as floodplain and stormwater management regulations and preservation of open space
2. 5, if the plan reviews property protection activities, such as acquisition, floodproofing, and flood insurance
3. 5, if the plan reviews activities to protect the natural and beneficial functions of the floodplain, such as wetlands protection

4. 5, if the plan reviews emergency services activities, such as flood warning and sandbagging
5. 5, if the plan reviews structural projects, such as reservoirs and channel modifications
6. 5, if the plan reviews public information activities, such as outreach projects and environmental education programs

All of these activities are discussed throughout the report. Goals were structured under each of these activities. From the goals, projects in each of these categories were developed. Points requested: 30

h. Draft an action plan (Maximum credit: 50)

1. 10, if the action plan includes recommendations for activities from two of the six categories credited in step 511.g, Review possible activities
2. 20, if the action plan includes recommendations for activities from three of the six categories credited in step 511.g, Review possible activities
3. 30, if the action plan includes recommendations for activities from four of the six categories credited in step 511.g, Review possible activities
4. 40, if the action plan includes recommendations for activities from five of the six categories credited in step 511.g, Review possible activities

The Plan discusses recommendations from five of the six categories [damage prevention, property protection, structural projects, public information, emergency services.] Points requested: 40.

1. 10 additional points are provided if the action plan establishes post-disaster mitigation policies and procedures

Points requested: 0.

i. Adopt the plan (Maximum credit: 2)

The 2 credit points for this step are provided if the plan and later amendments are officially adopted by the community's governing body.

The City of Lewes will adopt the plan before submitting to ISO. See attachments for documentation. Points Requested: 2.

j. Implement, evaluate and revise (Maximum credit : 10)

1. 2, if the community has procedures for monitoring implementation, reviewing progress, and recommending revisions to the plan in an annual evaluation report. The report must be submitted to the governing body, released to the media and made available to the public.

The City of Lewes will prioritize the projects discussed in the plan in the fall of 1999. The City will update the plan on an annual basis and produce an evaluation report. Points requested: 2.

2. 8, if the evaluation report is prepared by the same planning committee that prepared the plan.

The Community Planning Group that prepared the plan will complete the evaluation report on an annual basis. Points requested: 8.

Appendix B

Public Involvement

Comprehensive public involvement activities were undertaken during the preparation of this Floodplain Mitigation Plan to ensure that the citizens of the City of Lewes were able to provide input into the Plan. Input into the hazards, vulnerable areas, goals and mitigation projects was sought from all residents and business owners, and several replies were received.

The City of Lewes created a Community Planning Group (CPG) that includes one member of the public and five members of the City of Lewes government (a list of CPG members follows this page). The Planning Group also included “ex-officio” members representing State, and Federal agencies. The committee initially met on March 11, 1999 to discuss the planning process and hazard identification. The second meeting occurred on April 19, 1999; part A discussed the risk analysis and in part B the committee was given a general list of goals for the City. Committee members were asked to review the list, select the most appropriate goals for the community and suggest any additional goals.

Newsletters were sent to all property owners in the City of Lewes (approximately 2,600 owners). The newsletters described the Flood Mitigation Process, provided information on the open house meeting times, and included a questionnaire soliciting input into the Plan. The questionnaire prompted them to write about their flooding problem and describe possible solutions. The newsletter and questionnaire are included in this appendix.

An ‘open-house’ type public forum was held on June 4, 1999 in Lewes to obtain public input on the planning process. The meeting was announced in the project newsletter. During the open house, the public was presented with an overview of the Flood Mitigation Planning process and a description of the high-risk areas identified. The public was asked to comment on the high-risk areas and fill out questionnaires to solicit input on the flooding problem in Lewes and potential solutions.

A public hearing will be held to receive comments on the draft Floodplain Mitigation Plan on August 16th, 1999. Newsletters will be again sent out to the citizens of Lewes to inform them of this meeting. Copies of the goals and projects sections of this draft plan will be available for all attendees. In addition, copies of the entire draft plan will be available for check-out at City Hall. The final report will contain information on the outcome of this hearing and any other written comments from the citizens of Lewes.

List of the Floodplain Mitigation Plan Community Planning Group Members:

For the City of Lewes

Elaine M. Bisbee, City Manager (Public Information)

William Massey, Jr., Building Official (Building Department/Code Enforcement and Zoning Regulations)

Charles O’Donnell, III, City Engineer (Engineering, Public Works)

Ruth Anne Ritter, Board of Public Works, General Manager

Nelson Wiles, Project Impact Coordinator

For the Community:

William Miller

Gary Stabley

Ex-Officio Members:

Mr. Michael Powell, Delaware Department of Natural Resources and Conservation

Mr. Alan Redden, Delaware Department of Transportation

Mr. Lloyd Stoebner, Delaware Emergency Management Agency

Mr. Bob Green, Sussex County Engineering Department

Ms. Stephanie Nixon, FEMA Region III

Mr. Frank Schaefer, USACE - Philadelphia District

Mr. Timothy DeWire, USACE - Philadelphia District



City of Lewes

Flood Mitigation Plan

Volume I

May 1999

Lewes Flood Mitigation Plan

The City of Lewes is developing a Flood Mitigation Plan to identify actions that can be taken to reduce or eliminate the long-term risk of flood damage to residential, commercial, and public buildings within the City. The Plan will be a comprehensive strategy for implementing technically feasible flood mitigation activities.

By adopting the Flood Mitigation Plan, Lewes will be eligible to receive Federal Flood Mitigation Assistance grants to implement flood mitigation projects (see below).

The City has already characterized known flood hazards. Planners are studying previously conducted reports, Flood Insurance Maps, and other data sources to map flood hazards. This information will then be analyzed to determine the risk on residential, commercial and public buildings, public health and well being, and the City's economy. Following this "hazard identification and risk assessment," the City will develop goals for reducing flood losses. The Plan will list specific projects that should be implemented to reduce flood losses and provide options for funding sources.

Preparation of the Plan is being funded by a grant from the Federal Emergency Management Agency (FEMA). FEMA has provided Federal monies to the Delaware Emergency Management Agency (DEMA) for preparation of plans in communities throughout Delaware. The City's share of the cost is made up of existing studies and data contributed by the City and State.

The Lewes Flood Mitigation Plan will:

1. Identify existing flooding hazards;
2. Assess risks to residences, commercial buildings, and community facilities;
3. Establish goals for reducing losses from flooding; and
4. Identify projects that can be undertaken to reduce losses from flooding.

Flood Mitigation Assistance Program

The Flood Mitigation Assistance (FMA) Program, administered by FEMA, is one of several funding sources for constructing projects to reduce losses from flooding. The purpose of FMA is to assist State and local governments in funding cost-effective actions that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other insurable structures. The long-term goal of FMA is to reduce or eliminate claims under the National Flood Insurance Program (NFIP) through mitigation activities. The program provides cost-shared grants for three purposes: Planning Grants to States and communities to assess the flood risk and identify actions to reduce that risk; Project Grants to execute measures to reduce flood losses; and Technical Assistance Grants that States may use to assist communities to develop viable FMA applications and implement FMA projects. FMA also outlines the process for development and approval of Flood Mitigation Plans such as the one being prepared for Lewes.

Get Involved!!

Your input is important! We need to know how flood events affect your property and your quality of life in order to establish goals and projects for flood-loss reduction in the City of Lewes. You can help by:

- 1) Attending the Open House, Public Meeting being held on June 4th (see below for more information).
- 2) Completing the questionnaire included in this newsletter and mailing it to the address provided.

The Plan is scheduled to be completed in the summer of 1999 and you will be able to review and comment on it prior to its adoption by the City Council. A Public Hearing on the plan will also be held prior to its adoption.

After the Plan is adopted, it will provide real goals and projects that can be undertaken to reduce flood losses in the City of Lewes. The City will actively seek Federal and State grants, such as FMA funds, to construct flood mitigation measures identified in the Plan.

Come Learn More About The Plan.....

A presentation on the Flood Mitigation Planning Process will be conducted at the Open House, Public Meeting on Friday, June 4th. You are invited to attend to learn more about the Plan, ask questions, and provide input into the Plan. Displays will be set up for in the lobby of the Library for your viewing from 7:00 pm until 9:00 pm, and representatives from the City and our contractor will be available to discuss the Flood Mitigation Plan. We look forward to meeting you and receiving your comments.



***City Council Meeting
June 4, 1999 - 7:00 pm***

Lewes Public Library

The National Flood Insurance Program

The National Flood Insurance Program is a Federal program enabling property owners in participating communities to purchase insurance protection against losses from flooding. This Program is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods. As a participating community in the NFIP program, Lewes has adopted and enforces ordinances aimed at reducing future flood risks to new construction in Special Flood Hazard Areas.

Most homeowner insurance policies do not cover losses due to flooding; however, the NFIP makes flood insurance available to property owners and renters. Contact your insurance agent for details on available coverage and cost.

CITY OF LEWES FLOOD MITIGATION PLAN QUESTIONNAIRE

This questionnaire has been distributed to collect information about flooding in your community. Your participation will help us to develop a Flood Mitigation Plan that will benefit the City of Lewes and all of its residents. Please mail this questionnaire by June 11, 1999 to: Eric Letvin, Greenhorne & O'Mara, Inc., 9001 Edmonston Road, Greenbelt, Maryland 20770.

NAME: _____ PHONE: _____

ADDRESS: _____

1. Is this a residential or commercial property? _____

2. Do you own or rent the property? _____

3. Are you aware of any areas on your property or in your neighborhood that have experienced flooding? Please describe date of flood, area of flooding (yard, building), depth of flooding (1 foot, 2 feet, etc.)

4. What was the cause of the flooding? (Check all that apply)

- Lewes-Rehoboth Canal Insufficient storm drainage
 Delaware Bay Other (Please explain _____)

5. Please describe past damage to your property that resulted from flooding (include cost of damage if known)

6. Please describe any corrective measures taken to protect you property from flooding (include the cost and effectiveness of these measures, if available) _____

7. Do you have suggestions on how to protect your property/neighborhood from flooding? _____

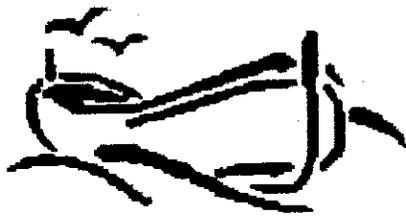
8. Additional comments: _____

Project Contact:

*Questions and comments regarding
the Lewes Flood Mitigation Plan may be directed to:*

William H. Massey, Jr.
Building Official
City of Lewes
P.O. Box 227 East Third Street
Lewes, Delaware 19958
(302) 645-7777

City of Lewes
P.O. Box 227 East Third Street
Lewes, DE 19958



City of Lewes

Flood Mitigation Plan

Volume 2

July 1999

Lewes Draft Flood Mitigation Plan Is Complete

The Lewes Draft Flood Mitigation Plan has been completed and is available for review and comment (see back). The Plan identifies actions that can be taken to reduce or eliminate the long-term risk of flood damage to residential, commercial, and public buildings within the City of Lewes. By formally adopting the Plan, Lewes will be eligible to receive additional Federal grants. Grant monies can be used to fund the implementation of some of the projects identified in the Plan.

Projects were identified based upon studies and expertise provided by the City, input from the Community Planning Group, and questionnaires from property owners. Lewes is not under specific requirements to complete all of the projects listed in the Plan, rather projects will be implemented as City, State, and Federal resources permit. In many cases, the City is already undertaking activities associated with these projects.

Lewes Flood Mitigation Plan Projects (not in order of priority):

1. Modify Article XI of the Lewes Zoning Code so the City's floodplain ordinances comply with FEMA's Model Code.
2. Modify the definition of 'substantial improvement' and 'substantial damage' found in Article XI of the Lewes Zoning Code to incorporate cumulative improvements and damage over 10-years.
3. Modify the current Lewes Zoning Code to enact stricter construction regulations in flood zones.
4. Obtain accurate flood maps of Lewes' floodplains by petitioning FEMA to re-evaluate V Zone delineations.
5. Obtain additional elevation information for areas in the floodplain in the City of Lewes, especially areas northeast of the Lewes & Rehoboth Canal.
6. If funding becomes available, complete additional elevation certificates for structures in floodprone areas.
7. Continue to support Project Impact plans to perform a Hazard Vulnerability Analysis and Structural Mitigation and Retrofitting Actions within Lewes.
8. Publish and issue a brochure describing flooding hazards and evacuation procedures in Lewes.
9. Support the further evaluation and consideration of projects named in the 'Preliminary Identification of Hazard Mitigation Actions for Further Evaluation and Consideration by the City of Lewes Partnership to Build a Disaster Resistant Community' in Appendix B of the City of Lewes Project Impact Memorandum of Agreement.
10. Continue to support the U.S. Army Corps and State plans to perform a beach replenishment project in Lewes.
11. Investigate clearing the debris-filled ditches in the northwest wetland area near Roosevelt Inlet.
12. Pursue plans to restore flood protection to properties along the north side of the Lewes and Rehoboth Canal by restoring eroded areas along the line of dredged spoils.
13. Send appropriate City personnel to training programs at FEMA's Emergency Management Institute.

We Want Your Comments!

The Draft Flood Mitigation Plan is available for review at the Lewes City Hall. In addition, a Public Hearing will be held on August 16, 1999 (see below) to describe each of the projects in more detail and to receive further comments. Please send any written comments by August 23rd to:

Mr. William F. Massey, Jr. Building Official
City of Lewes
P.O. Box 227
Lewes, Delaware 19958
(302) 645-7777

All comments will be addressed prior to the Plan's adoption by the City Council.

Please join us for the Flood Mitigation Plan Public Hearing

Monday, August 16, 1999
7:00 p.m.
Lewes Public Library

Information on the Flood Mitigation Plan goals and projects will be presented and property owners will have the opportunity to comment on the Plan. We look forward to seeing you there.

***City of Lewes
P.O. Box 227 East Third Street
Lewes, DE 19958***

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Appendix C

Community Input

Responses to the questionnaire are listed below. Included in the description is the source or sources of flooding: the Delaware Bay, the Lewes-Rehoboth Canal and/or insufficient storm drainage.

North of canal near bay coastline

General Flooding/Drainage Problems

Several residents in this area reported flooding that had not damaged their homes, but had reached their lots and caused damage to sheds, yards and landscaping. Residents along Bay Avenue, Cedar Street, Houston Avenue, Market Avenue, Midland Avenue and Nebraska Avenue reported these types of problems. Suggestions for improving these types of problems include continuing with beach replenishment (dredged materials from Roosevelt Inlet) and improving storm drainage. A resident also complained that American Legion Road sustains flooding from storms with easterly winds and suggested that the road be elevated.

Camden Avenue- Resident

Flooding Source- Canal

Damage to Property- Flooding in yard near house in 1998 storms.

Corrective Measures Taken- Before the '98 storms, in 1996, we elevated the entire house which cost approximately \$8,000.

Suggestions- Repair of broken dike near the west end of Lewes Beach along the canal. This breached dike allows incoming water to rush unhindered into side and main streets surrounding many houses in the neighborhood with water.

Camden Avenue- Resident

Flooding Source- Canal

Damage to Property- Flooding in yard during any full moon-high tide event or storm. Flooding of 3 feet from '98 northeaster caused several thousand dollars worth of damage to heat vents and insulation surrounding pipes.

Corrective Measures Taken- None

Suggestions- Better drainage or elevation of house

Cedar Street- Resident

Flooding Source- Canal

Damage to Property- Destroyed a furnace located under the house. Had to replace a shed for \$1200-1500 as a result of an estimated 10-12" of flooding in 1991.

Corrective Measures- None

Suggestions- None

Comments- I hope that you can find a solution that will really work.

Cedar Street- Resident

Flooding Source- Canal and insufficient storm drainage

Damage to Property- 3 feet of water in '98 northeaster damaged furniture, appliances, floors and walls.

Corrective Measures- Demolished house and foundation and rebuilt above floodplain. Flood insurance paid \$25,000 and I paid \$60,000.

Suggestions- Raise properties and repair dike on canal

Comments- I did this with my own money while I thought I would receive some FEMA funds for the foundation.

Cedar Street- Resident

Flooding Source- Canal

Damage to Property- Flooding in 1998 caused damage to contents of shed costing \$300-400.

Corrective Measures Taken- None

Suggestions- Elevate the house

Comments- I would like to be considered for federal funds to elevate the house above its existing foundation.

Cedar Street

Three other Cedar Street residents described damages from flooding from the '98 northeaster. Most damages were associated with garage, shed and yard flooding. Residents showed interest in elevating houses to prevent flood damage. Another resident noted serious flood damages from the '62 northeaster.

Clayton Avenue- Resident

Flooding Source- Canal

Damage to Property- Garage and yard sustained 2-3 feet of flooding from second northeaster of 1998.

Corrective Measures- Cleaned out drainage ditch adjacent to property

Suggestions- Maintain and repair any dikes or berms designed to reduce flooding. Clean-out the drainage ditch along dredge spoil area running parallel to Cedar Road on Lewes Beach at the end of Newark Ave., Clayton Ave, and the rest of the cul-de-sacs. This would transport water quicker and more efficiently.

Felton Avenue- Resident

Flooding Source- Bay and insufficient drainage

Damage to Property- None to building, but landscaping has sustained some. Flooding occurs 3 or 4 times per winter that almost reaches the house.

Corrective Measures- Know of none

Suggestions- Recreate drainage channel which is on public land alongside my property. It was dug about 1975 and since that time has received no maintenance. As it has silted over more each year, the floods have become more common and severe.

Lewes Avenue- Resident

Flooding Source- Canal

Damage to Property- Flooding of 3 feet surrounded the house in '98. Greenhouse heater was ruined (\$850) and raised garden was washed away.

Corrective Measures Taken- None available

Suggestions- None

Comments- House flooding was never severe until Rehoboth Avenue was built

Market Street- Resident

Flooding Source- Canal

Damage to Property- 2-3 feet of flooding in '62 and 6 inches of flooding in '98. Lost latticework around foundation and house jacks have been undermined.

Corrective Measures Taken- None

Suggestions- Repair the low berm on the canal

Massachusetts Avenue- Resident

Flooding Source- Canal and insufficient storm drainage

Damage to Property- Lost items stored under house and damage to landscaping

Corrective Measures Taken- Initially built house block foundation reinforced and to higher elevation (cost about \$3000 extra) and brought in fill around house (~ \$1000)

Suggestions- Improve the storm drainage

Comments- It appears that additional development along Market Street and the canal is worsening the situation.

Michigan Avenue- Resident

Flooding Sources- Canal and bay

Damage to Property- Too extensive to go in to it. In 1962, there was 3 feet of flooding in the structure.

Corrective Measures Taken- none

Suggestions- none

Comments- The property behind me put in a retainer levee and a new house next door is on elevated ground so I get their runoff.

Midland Avenue- Resident

Flooding Source- Canal

Damage to Property- 7-inches of flooding in the yard and damage to carpet, utilities and the dryer cost \$1100.

Corrective Measures Taken- Put appliances up on blocks

Suggestions- Put a bulkhead along the canal and fill in the marsh

Milford Avenue- Resident

Flooding Source- Canal and insufficient storm drainage

Damage to Property- Flooding of 1 foot at building in '62 and 6 inches in '98 led to damage of lower wall areas.

Corrective Measures Taken- Sandbags and pump were marginally effective in 2/98 northeaster.

Suggestions- Improve the banks of the Lewes-Rehoboth Canal west of the drawbridge on Savannah Road.

Milton Avenue- Resident

Flooding Source- Canal and insufficient storm drainage

Damage to Property- Landscaping- \$1000

Corrective Measures Taken- None

Suggestions- None

Milton Avenue- Resident

Flooding Source- Canal and insufficient storm drainage

Damage to Property- January '98 storm caused 2 feet of flooding in house and after every rain cul-de-sac floods and ponding remains for some time. Damage includes rust to property on floor, silt to clean up, paint peeling and wood swelling.

Suggestions- A dike would protect houses from flooding of the canal.

Nebraska Avenue- Resident

Flooding Sources- Bay and canal

Damage to Property- Heater shorted out when crawl space flooded in January/February 1997

Corrective Measures Taken- Installed a sump pump in the basement

Suggestions- None

Savannah Road (northern)- Resident

Flooding Sources- Canal

Damage to Property- Flooding in yard and crawl space of approximately 1-1.5 feet caused damage to lawnmower and tools stored under house.

Corrective Measures Taken- None

Suggestions- None

Savannah Road (northern)- Resident

Flooding Sources- Canal

Damage to Property- Damage to sewer pipes under house and electrical sockets. \$800 to repair the sewer damage.

Corrective Measures Taken- None

Suggestions- Raise the house

Comments- There have been many more times that the yard has flooded since 1962.

Eastern Lewes near Ferry Landing

General Flooding/Drainage Problems

A resident on West Cape Shores Drive noted that access to and from this area during the 1998 northeaster was difficult. Several cars got stuck in brackish water and sustained damage. The resident suggests keeping sand dunes from being damaged as a way to prevent storm damage. Another resident in the Cape Shores Development noted that 8-foot of dune were lost in the 1998 storm and suggested placing rip-rap to hold the dune.

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Flooding Sources- Bay

Damage to Property- Pavillon damaged during 1998 northeaster. Several condos near bay are in danger of flooding from bay.

Corrective Measures Taken- The properties are very near the water, so there is not much that can be done.

Suggestions- Lewes is best protected by preserving all wetlands to reduce runoff; at least that helps with flooding from the canal.

Southern Lewes along Savannah Road

Beebe Medical Center- Commercial

Flooding Source- Insufficient storm drainage

Damage to Property- Heavy rains resulted in 1-2 feet of flooding from storm sewer in lower-level of parking structure and in drive at rear of structure. Damage to elevator.

Corrective Measures Taken- Floodgate installed

Suggestions- None

School Lane- Resident

Flooding Source- Insufficient storm drainage

Damage to Property- Summer storms in '96, '97, and '98 have caused flooding of lawn, driveway and garage.

Corrective Measures- Placed 110 feet of storm drain to move water behind my house because water is from street runoff. This cost \$300.

Suggestions- Street needs a storm sewer or some means to channel water away from homes.

Comments- Not the most urgent problem in Lewes, but we have only been here 3 years. We're not sure what might happen if there were exceptionally heavy rains.

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Intersection of Freeman/King's Highway and Savannah Road

General Flooding/Drainage Problems

Residents along Coleman Avenue and Washington Avenue and Coleman Avenue stated that insufficient storm drainage and ponding after heavy rains had been observed along their streets.

23 Clark Ridge
Hockessin, DE 19707

August 19, 1999

Mr. William F. Massey, Jr., Building Official
City of Lewes
P.O. Box 227
Lewes, Delaware 19958

RE: Impact of Flood Mitigation Plan on property located at:
8 Houston, Avenue
Lewes Beach, DE 19958

Dear Mr. Massey:

This letter is in response to the City of Lewes Flood Mitigation Plan bulletin, Volume 2, dated July 1999 which requested written comments by August 23.

Please add the following to the list of Lewes Flood Mitigation Plan Projects:
"Clear the debris-filled ditches in the northwest wetlands of Lewes Beach along Houston and Delmar Avenues".

We own the property at 8 Houston Ave and routinely experience severe flooding on the Houston Ave cul'd sac and onto our property. Flooding was especially a problem during the January 1998 flood. Our cul'd sac did not drain for months through the spring of 1998 creating potential stagnant water health problems. During this time, I presented this drainage problem at a Lewes Board of Public Works meeting and communicated regularly with Ruth Ann Ritter. I was assured at that time that the problem would be corrected as soon as funding could be obtained.

The reason for this water problem is that the drainage ditch from Houston Ave to the Walsh property is completely clogged with debris and overgrowth that has accumulated since the Town of Lewes developed and sold our lot to our developer around 1996. The drainage problem on Houston Ave is also adversely impacted by the 10 foot high (approx) dredging dike which runs parallel to the ditch and our property line about 15 feet from the cul'd sac. The water has no place to drain. We are very concerned that we may have a real health risk the next time we have a wet summer or summer flooding.

Please add this item to your flood mitigation plan and advise when we can expect action. Thank you for considering the addition of this item to your plan. Please write or call me on (H) 302-239-2660 or (W) 302-992-6398 if you have any questions.

cc: Ruth Ann Ritter

Joe Smith
Joseph B. Smith, Jr.
Helen DeSantis Smith

44 Harborview Road
Lewes, DE 19958

August 23, 1999



Mr. William F. Manney, Jr.
Building Official
City of Lewes
PO Box 227
Lewes, DE 19958

Dear Mr. Manney:

As a result of your suggestion to me at the August 16, 1999, public meeting on flood mitigation to research my deed to determine responsibility for maintaining the earthen drainage ditch that runs in the rear of properties on Harborview Road, I have come to the conclusion that the City of Lewes has full responsibility to maintain this drainage ditch. Deed Book 1050, Page 182, at the Sussex County Deed Office, has a Deed of Easement to the City of Lewes, State of Delaware, dated October 8, 1980, stating that the City received "all permanent easements and rights of way, including the perpetual right to enter upon any real estate located in Harbor View Development at any time that it may see fit and maintain, replace, and repair" utility structures. This deed includes the right to remove bushes and trees and "all easements" as shown on the original plot, referring to the 20 foot drainage easement in the rear of and 15 foot drainage easement in front of the lots. This land belongs to the City of Lewes which, therefore, has sole responsibility to maintain it.

Moreover, I believe that issuing a Building Permit and Certificate of Occupancy inherently assures the person to whom they are issued that the drainage is proper on the lot. If not, then the permit and certificate should not have been issued. At a minimum, ameliorative measures should have been required before the Building Permit was issued. More than 20 years ago, the City approved this subdivision for development, and nothing in my deed even implies that I have the responsibility for maintaining the easements. Additional research also showed that other restrictions and covenants prevented me from elevating my lot without prior approval (Deed Book 728, Page 827).

I, therefore, request that the City of Lewes undertake all appropriate measures to ensure that the drainage from the properties on Harborview Road flows into the two easements and that the rear easement, which is severely overgrown, be cleared and graded to provide proper drainage. Additionally, I believe that under contract of the City an engineering firm conducted a study in the past on my neighbor's plot (Mr. Henry Meier at 40 Harborview Road) and made two recommendations to alleviate the pooling of water. The City has the study and, at a minimum, should consider implementing these measures as soon as possible.

Sincerely,

Gerald A. and Gertrude Lockhart

cc: Board of Public Works

40 Harborview Road, Lewes, De. 19958
August 16, 1999



William F. Massey, Jr.
City of Lewes
PO Box 227
Lewes, De.

Dear Mr. Massey:

FLOOD MITIGATION PLAN- FINAL DRAFT

My comments on information presented by the City in the meeting of 8/16/99 are as follows:

Items 3, 9. As part of assuring the integrity of the Lewes electrical service, check the function of an electrical installation at the intersection of Harborview and Pilotown Roads on the south corner. Is it tied in to underground distribution of electrical service to Harborview residents, and does it need to be elevated? Are there others elsewhere?

Item 5. The 100 year flood elevation defined by contour maps is unreliable because contour lines would be inaccurate and widely separated because of flat topography. A system of reference elevation benchmarks throughout the two most vulnerable zone categories would be better.

Item 8. Install a system of signs delineating evacuation routes to high ground and a shelter. Consider the desirability locating four or five evacuation areas throughout the vulnerable areas. Identify the dips(low areas) in each route and determine the need for road alterations. This will be difficult because of the need for surrounding lots to drain. The semi-annual brochures would explain.

Infirm residents of Harbor Healthcare may have to be evacuated early by ambulance. What about moving hundreds of wheelchair and bedridden people from the new nursing home and assisted living facilities which are planned alongside Canary Creek near New Road?. Note that at normal high tide the bridge is about 18 inches above the water level. (Raising the road and installing a new bridge would cause a dozen or more Lewes homes to be razed and create new drainage problems). How do you get them out of harm's way? It certainly would be reasonable for the City to insist that such a sensitive new facility must be located in a higher and more accessible area which will not be impacted by storm-surge.

Should there be an alternate shelter? A shelter area will have huge parking needs. After unloading, the traffic will need to pass downed wires to a predetermined parking area on high ground. Estimate the number of cars by first estimating the size of the population which must be moved. Portable toilets would be needed so a source for a sufficient number must be available. Where are the tank trucks for water supply and sewage removal, and will Lewes be able to get them or could they be pre-empted by Rehoboth,

Bethany Beach and Ocean City? Expect mass confusion nearby. There may be casualties; a dedicated ambulance should be available at the shelter for a Beebe shuttle. Can the City get buses to evacuate older residents further inland? The shelter facilities may require a separate study.

The city fire and police department and the U. S. Coast Guard should have access to at least two low-draft jet-type outboard boats to move around a flooded city. How will they prevent looting? I believe that the Roosevelt Inlet Coast Guard will need to help and they should be armed and vested with emergency police power. Some residents would be unwilling to evacuate unless a good plan is described in the brochure. What meetings are required with the U. S. Coast Guard and the Army Reserves? Are they ready?

Item 10. A beach replenishment project does not appear to be cost effective and will drain away FEMA funding for crucial items.

Item 11. The ditch system at the northwest wetland area was an integral part of the Lewes approval of this subdivision and does not drain the rear of lots at the west end Harborview Road. The ditching is overgrown and must be grubbed and cleared; eventually it needs to be cement lined to avoid ongoing clearing. The City has drainage easements front and rear on our lots and so retains responsibility for adequate drainage. Weekly mowing by the city at one rear drainage ditch on the south side is currently being done.

The approved subdivision lots are too flat. We have photographs of pools around our homes; a hurricane deluge would have nowhere to go. Water would rise to the level of the crawl space entry, outage of our sump pump electrical system could be expected and house wiring and furnace destruction would follow. We could not evacuate by auto because cars in our garages would swamp.

The city immediately needs a map of drainage ditching which shows invert elevations all the way to the outfall, total area served and the proper size to carry hundred-year storm runoff.

The FEMA program needs to clear the Lewes ditch route, install an adequate lined ditch and provide for collection swales or headers between the vulnerable lots. The city must meet with the U of D, the adjoining land owner, since two parallel ditches twenty feet apart as at present, do not seem to make sense. We consider the flood protection to be critical and about eighteen residents wish to meet with you in a week or two.

Sincerely,



Henry and Mary Meier

copy to concerned neighbors

CITY OF LEWES FLOOD MITIGATION PLAN

Please send all comments on the Final Draft Flood Mitigation Plan to:

Mr. Eric Letvin
Greenhorne & O'Mara, Inc.
9001 Edmonston Road
Greenbelt, Maryland 20770

or you may drop off comments to Mr. William F. Massey Jr. at City Hall

SEE DRAWING
6 ELEVATION DRAWING & ... THE TOWN
FOR HOMEOWNERS INFORMATION
Item #12 FLAP VALVE - MUST BE
PROTECTED SO IT CAN BE
OPERATIVE
FLAP VALVE
↓
== SILT WHEN THE FLAP
IS CLOSED, SILT CAN
ACCUMULATE AND PREVENT
OPERATION
(PERSONAL EXPERIENCE IN NEW HAVEN, CT)
MARKER

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It is totally absurd that years have gone by and ditches on Lewes Beach have not been maintained which would have allowed tidal flooding to leave the wetlands and return to the canal properly. Now is a poor time to waste funds thru these studies and reports when over the years the city did not continue to maintain existing flood protection. Where have our staff and elected leaders been while necessary repairs were overlooked for years!!! From questions asked it appears that on the mainland near the University property other ditches have not been maintained. The current drought will not last forever while pipes, dikes, valves, ditches now need & emergency attention.

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Appendix C

Community Input

Responses to the questionnaire are listed below. Included in the description is the source or sources of flooding: the Delaware Bay, the Lewes-Rehoboth Canal and/or insufficient storm drainage.

North of canal near bay coastline

General Flooding/Drainage Problems

Several residents in this area reported flooding that had not damaged their homes, but had reached their lots and caused damage to sheds, yards and landscaping. Residents along Bay Avenue, Cedar Street, Houston Avenue, Market Avenue, Midland Avenue and Nebraska Avenue reported these types of problems. Suggestions for improving these types of problems include continuing with beach replenishment (dredged materials from Roosevelt Inlet) and improving storm drainage. A resident also complained that American Legion Road sustains flooding from storms with easterly winds and suggested that the road be elevated.

Camden Avenue- Resident

Flooding Source- Canal

Damage to Property- Flooding in yard near house in 1998 storms.

Corrective Measures Taken- Before the '98 storms, in 1996, we elevated the entire house which cost approximately \$8,000.

Suggestions- Repair of broken dike near the west end of Lewes Beach along the canal. This breached dike allows incoming water to rush unhindered into side and main streets surrounding many houses in the neighborhood with water.

Camden Avenue- Resident

Flooding Source- Canal

Damage to Property- Flooding in yard during any full moon-high tide event or storm. Flooding of 3 feet from '98 northeaster caused several thousand dollars worth of damage to heat vents and insulation surrounding pipes.

Corrective Measures Taken- None

Suggestions- Better drainage or elevation of house

Cedar Street- Resident

Flooding Source- Canal

Damage to Property- Destroyed a furnace located under the house. Had to replace a shed for \$1200-1500 as a result of an estimated 10-12" of flooding in 1991.

Corrective Measures- None

Suggestions- None

Comments- I hope that you can find a solution that will really work.

Cedar Street- Resident

Flooding Source- Canal and insufficient storm drainage

Damage to Property- 3 feet of water in '98 northeaster damaged furniture, appliances, floors and walls.

Corrective Measures- Demolished house and foundation and rebuilt above floodplain. Flood insurance paid \$25,000 and I paid \$60,000.

Suggestions- Raise properties and repair dike on canal

Comments- I did this with my own money while I thought I would receive some FEMA funds for the foundation.

Cedar Street- Resident

Flooding Source- Canal

Damage to Property- Flooding in 1998 caused damage to contents of shed costing \$300-400.

Corrective Measures Taken- None

Suggestions- Elevate the house

Comments- I would like to be considered for federal funds to elevate the house above its existing foundation.

Cedar Street

Three other Cedar Street residents described damages from flooding from the '98 northeaster. Most damages were associated with garage, shed and yard flooding. Residents showed interest in elevating houses to prevent flood damage. Another resident noted serious flood damages from the '62 northeaster.

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Suggestions- Recreate drainage channel which is on public land alongside my property. It was dug about 1975 and since that time has received no maintenance. As it has silted over more each year, the floods have become more common and severe.

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Suggestions- None

Comments- House flooding was never severe until Rehoboth Avenue was built

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Corrective Measures Taken- None

Suggestions- Repair the low berm on the canal

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Suggestions- Improve the banks of the Lewes-Rehoboth Canal west of the drawbridge on Savannah Road.

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Corrective Measures Taken- None

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Flooding Sources- Bay and canal

Damage to Property- Heater shorted out when crawl space flooded in January/February 1997

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Suggestions- None

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Damage to Property- Flooding in yard and crawl space of approximately 1-1.5 feet caused damage to lawnmower and tools stored under house.

Corrective Measures Taken- None

Suggestions- None

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Flooding Sources- Canal

Damage to Property- Damage to sewer pipes under house and electrical sockets. \$800 to repair the sewer damage.

Corrective Measures Taken- None

Suggestions- Raise the house

Comments- There have been many more times that the yard has flooded since 1962.

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August 23, 1999



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Gerald A. and Gertrude Lockhart

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40 Harborview Road, Lewes, De. 19958
August 16, 1999



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City of Lewes
PO Box 227
Lewes, De.

Dear Mr. Massey:

FLOOD MITIGATION PLAN- FINAL DRAFT

My comments on information presented by the City in the meeting of 8/16/99 are as follows:

Items 3, 9. As part of assuring the integrity of the Lewes electrical service, check the function of an electrical installation at the intersection of Harborview and Pilotown Roads on the south corner. Is it tied in to underground distribution of electrical service to Harborview residents, and does it need to be elevated? Are there others elsewhere?

Item 5. The 100 year flood elevation defined by contour maps is unreliable because contour lines would be inaccurate and widely separated because of flat topography. A system of reference elevation benchmarks throughout the two most vulnerable zone categories would be better.

Item 8. Install a system of signs delineating evacuation routes to high ground and a shelter. Consider the desirability locating four or five evacuation areas throughout the vulnerable areas. Identify the dips(low areas) in each route and determine the need for road alterations. This will be difficult because of the need for surrounding lots to drain. The semi-annual brochures would explain.

Infirm residents of Harbor Healthcare may have to be evacuated early by ambulance. What about moving hundreds of wheelchair and bedridden people from the new nursing home and assisted living facilities which are planned alongside Canary Creek near New Road?. Note that at normal high tide the bridge is about 18 inches above the water level. (Raising the road and installing a new bridge would cause a dozen or more Lewes homes to be razed and create new drainage problems). How do you get them out of harm's way? It certainly would be reasonable for the City to insist that such a sensitive new facility must be located in a higher and more accessible area which will not be impacted by storm-surge.

Should there be an alternate shelter? A shelter area will have huge parking needs. After unloading, the traffic will need to pass downed wires to a predetermined parking area on high ground. Estimate the number of cars by first estimating the size of the population which must be moved. Portable toilets would be needed so a source for a sufficient number must be available. Where are the tank trucks for water supply and sewage removal, and will Lewes be able to get them or could they be pre-empted by Rehoboth,

Bethany Beach and Ocean City? Expect mass confusion nearby. There may be casualties; a dedicated ambulance should be available at the shelter for a Beebe shuttle. Can the City get buses to evacuate older residents further inland? The shelter facilities may require a separate study.

The city fire and police department and the U. S. Coast Guard should have access to at least two low-draft jet-type outboard boats to move around a flooded city. How will they prevent looting? I believe that the Roosevelt Inlet Coast Guard will need to help and they should be armed and vested with emergency police power. Some residents would be unwilling to evacuate unless a good plan is described in the brochure. What meetings are required with the U. S. Coast Guard and the Army Reserves? Are they ready?

Item 10: A beach replenishment project does not appear to be cost effective and will drain away FEMA funding for crucial items.

Item 11: The ditch system at the northwest wetland area was an integral part of the Lewes approval of this subdivision and does not drain the rear of lots at the west end Harborview Road. The ditching is overgrown and must be grubbed and cleared; eventually it needs to be cement lined to avoid ongoing clearing. The City has drainage easements front and rear on our lots and so retains responsibility for adequate drainage. Weekly mowing by the city at one rear drainage ditch on the south side is currently being done.

The approved subdivision lots are too flat. We have photographs of pools around our homes; a hurricane deluge would have nowhere to go. Water would rise to the level of the crawl space entry, outage of our sump pump electrical system could be expected and house wiring and furnace destruction would follow. We could not evacuate by auto because cars in our garages would swamp.

The city immediately needs a map of drainage ditching which shows invert elevations all the way to the outfall, total area served and the proper size to carry hundred-year storm runoff.

The FEMA program needs to clear the Lewes ditch route, install an adequate lined ditch and provide for collection swales or headers between the vulnerable lots. The city must meet with the U of D, the adjoining land owner, since two parallel ditches twenty feet apart as at present, do not seem to make sense. We consider the flood protection to be critical and about eighteen residents wish to meet with you in a week or two.

Sincerely,



Henry and Mary Meier

copy to concerned neighbors

CITY OF LEWES FLOOD MITIGATION PLAN

Please send all comments on the Final Draft Flood Mitigation Plan to:

Mr. Eric Letvin
Greenhorne & O'Mara, Inc.
9001 Edmonston Road
Greenbelt, Maryland 20770

or you may drop off comments to Mr. William F. Massey Jr. at City Hall

SEE DRAWING
6 ELEVATION DRAWING & ... THE TOWN
FOR HOMEOWNERS INFORMATION
Item #12 FLAP VALVE - MUST BE
PROTECTED SO IT CAN BE
OPERATIVE -
FLAP VALVE
↓
==> SILT WHEN THE FLAP
IS CLOSED, SILT CAN
ACCUMULATE AND PREVENT
OPERATION.
(PERSONAL EXPERIENCE IN NEW HAVEN, CT)
MARKER

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It is totally absurd that years have gone by and ditches on Lewes Beach have not been maintained which would have allowed tidal flooding to leave the wetlands and return to the canal properly. Now is a poor time to waste funds thru these studies and reports when over the years the city did not continue to maintain existing flood protection. Where have our staff and elected leaders been while necessary repairs were overlooked for years!!! From questions asked it appears that on the mainland near the University property other ditches have not been maintained. The current drought will not last forever while pipes, dikes, valves, ditches now need & emergency attention.

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Appendix D

Repetitive Loss Structures