

Sea Level Rise Vulnerability Study

Town of Fenwick Island, Delaware



URS

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DNREC Coastal Management Assistance Grant | Sea Level Rise Vulnerability Study

Town of Fenwick Island, Delaware

INTRODUCTION

The issues of sea level rise and climate change are important subjects that many coastal towns in Delaware are currently discussing. After several back to back major weather events in recent years communities are starting to see the impacts caused by more frequent and stronger storms. For many towns Hurricane Sandy (October 2012) was the event that made sea level rise a top priority. The Town of Fenwick Island saw the most extensive damage compared to any other Delaware coastal town after Hurricane Sandy. Although the State is taking significant and concrete steps towards recognizing the effects of sea level rise, some may still consider that sea level rise is either too uncertain or will occur so slowly that local governments need not take action now. However, just as local governments manage land use and development to provide for the public's long-term benefit, safety and welfare, so too should local governments consider the long-term impacts associated with sea level rise. The Town decided that being proactive now and learning what the potential sea level rise impacts may be is vital to preserving and protecting the Town. The Town applied for and received grant assistance to complete a sea level rise vulnerability assessment through Delaware's Coastal Management Assistance Grant program in early 2014. Receiving funds from the DNREC Coastal Management Assistance Grant to complete a Sea Level Rise Vulnerability Study was the Town's first step in their resiliency planning.

COMPLETING VULNERABILITY STUDY

The overall goal of the Study was for the Town to better understand risks they may face in the future as sea level continues to rise and major coastal storms increase, as well as introduce possible solutions to mitigate those risks. That goal can be further broken down into three more specific goals. First, the Town wanted to document the extent of all possible sea level rise effects, which included impacts to structures, roads and utilities. Second, raising awareness among the Town's residents and business owners was important so everyone can be cognizant of general information about sea level rise as well as the Town's specific vulnerabilities. Lastly, the Town wanted to research a number of possible mitigation tools and identify the best solutions that can be used to protect the residents of Fenwick, the built environment and nature.



The following tasks were completed as part of this Study:

- Create Town specific maps showing inundation resulting from 1.6 feet (0.5 meter), 3.3 feet (1 meter) and 4.9 feet (1.5 meters) of sea level rise above current high tide
- Assess general impacts to structures, infrastructure, municipal buildings and services and private utilities
- Compile recommendations for mitigation measures that can be incorporated in ongoing coastal resiliency planning
- Public outreach, discussion with residents and business owners of Fenwick Island on sea level rise vulnerabilities and impacts

BACKGROUND

Even though gauging sea level rise seems to be a more current topic of discussion it has actually been documented since the late 1800s. Recordkeeping of sea level rise started in 1880 using tide stations and this method continues to be used today along with satellite confirmation. Tide stations record sea level by measuring the height of water referenced by a set point on land with a known elevation. Since 1880 the rise in sea level has been documented at eight inches. It is projected that sea level will continue to rise. So what causes sea level rise? It is a combination of two primary factors. The first cause is the increase in atmospheric heat which is warming our oceans, and as water warms it expands. This is also known as thermal expansion. The second cause is ice caps melting as land and the atmosphere are becoming warmer. Both are contributing factors though there are some uncertainties which make predicting future sea level rise difficult. The most challenging aspect to study is the behavior of ice caps. It is hard to predict how they will be affected by a warming climate, which causes future projections of sea level rise to be wide ranging. In addition to these changes to the world's oceans, certain locations also experience land subsidence – the lowering of land relative to the ocean usually due to soil consolidation, groundwater pumping, or isostatic balancing of the Earth's crust. Subsidence can exacerbate the impact of higher waters, and should be considered while discussing sea level rise. It is clear from evidence and research that sea level is and has been rising with many projecting the rate will continue to increase. However, due to the young and evolving science of sea level rise it is hard to give an exact prediction of the amount of rise any particular location should expect. In spite of this, it is important that coastal towns and cities use all of the available resources to start the process of proactive planning for future impacts to their communities.

Delaware has seen a greater change in sea level rise compared to that of the global rate. While sea level rise will have its effects on the State as a whole, it is a topic of discussion of particular importance to Sussex County and its many coastal communities. Sussex County is known for its Atlantic beaches, and has seen an increase in population and development along the coast due to people looking to move to coastal communities as full time residents or to buy a second home. It is essential that as these communities continue to grow, they plan now for impacts from sea level rise. An increase in sea level will certainly lead to more frequent inundation of low lying areas and will likely lead to increased damage due to severe storms and everyday flooding. These problems will continue to occur as long as low lying developed areas are not elevated and shoreline protections are not in place. Structures, roads and utilities within low lying areas can all become vulnerable to flood damages. Currently, beach and dune replenishment is the main tactic for protecting Sussex County's coastal communities. While this approach has provided protection during severe storms in recent years, such as Hurricanes Irene and Sandy as well as Nor'easters like Ida, more proactive and 'whole-town' methods will have to be taken to prepare for the long term effects of sea level rise.



As mentioned earlier, compared to other coastal communities in Sussex County the Town of Fenwick Island is in a unique situation in that both Ocean and Bay side will be impacted by sea level rise. The Town has been identified as one of a few towns in Delaware having the highest concentration of potential impacts to both

residential and commercial sites as well as community facilities in a 0.5 meter sea level rise scenario, the *lowest* scenario that DNREC recommends using when planning for future conditions.

GEOGRAPHY

All coastal communities in Delaware are at risk of increased flooding due to sea level rise, but Fenwick Island's location makes it unique compared to its neighbors. The Town occupies a narrow barrier island bordered by the Atlantic Ocean to the east and the Little Assawoman Bay to the west. This means potential flooding impacts from both the Ocean and Bay sides. Fenwick also has the lowest elevation of all the Delaware Atlantic Coast communities. Due to the geography and the characteristic of Little Assawoman Bay, the Town already regularly experiences back bay flooding during very high tides. In recent major storms, it has also been the Bay side that experienced the most damage. Given the fact that regular flooding is already happening, Fenwick, more so than other towns, needs to prioritize preparing for sea level rise and embrace solutions that will benefit the Town in the short and long term against sea level rise.



COMMUNITY OUTREACH

A community outreach meeting was held on November 5, 2014 at Fenwick's Town Hall. There were approximately 20 people, consisting of Town officials and community members that attended the meeting. The purpose of the community outreach meeting was to present background information on sea level rise and its affects to the Town, as well as begin to discuss possible mitigation solutions. The meeting also gave community members an opportunity to ask questions about sea level rise and voice their concerns on issues the Town is already facing due to an increase in major weather events. Three maps were presented to the public showing different scenarios at three sea level rise rates. The maps provided a clear visual of potential impacts from sea level rise and emphasized the importance of discussing this issue. One of the main concerns voiced by community members was bayside flooding that is already occurring during large storms, like Hurricane Sandy. Not only are properties being flooded but the streets are as well, limiting residents' mobility. A second issue discussed was money, state and federal, being put into fortifying the ocean side but very little attention has been paid to the Bay side. Part of the reason for this is property on the Bay side is private and it has been difficult getting all property owners to agree on a mitigation solution. Lastly, attendees all seemed to agree that the Town needs to look at common sense mitigation strategies, as opposed to large scale engineering efforts, and it is the responsibility of the Town to be proactive now to prevent serious outcomes.

A second community outreach meeting was held on February 27, 2015 at Town Hall. The presentation reviewed information provided at the previous meeting. The main focus for this meeting was to further discuss draft mitigation strategies and recommendations for the Town.

VULNERABILITY STUDY

The purpose of a vulnerability study is to estimate the people and property that are at risk of impacts from a hazard. The reasonableness of the results depends on:

- How well the hazards can be defined or delineated

- How much detail is available to describe the types and numbers of existing development (residences, commercial properties, and transportation and other public infrastructure) that is exposed to the hazards
- How much detail is available to project the anticipated types and numbers of new buildings and other development that are likely to be constructed over the period of interest

The reasonably anticipated effects attributed to rising sea level are of two types - those related to coastal flooding and those that will alter aspects of the environment and normal hydrology:

- Flood depths will increase and affect a larger area (and flooding may occur more frequently)
- Effects of damaging waves on top of storm surge inundation will extend farther inland
- Shoreline erosion will accelerate (Ocean and Bay sides)
- Groundwater levels will increase
- Wetlands will migrate inland or be lost to inundation
- Saltwater intrusion will extend farther inland

Ideally, in order to estimate the impact of those future conditions on existing development (and anticipated development), those conditions would be delineated or described with sufficient detail and justification. Some of the sea level rise effects can be estimated and shown on a map (notably flooding and erosion), while there are limitations that do not allow the same level of detail to be developed for other anticipated effects:

- Flood depths and areas affected. Using several assumptions, new flood elevations can be estimated, and projected boundaries of the “future” condition floodplain can be delineated on topographic mapping.
- Effects of waves. In theory, because wave heights are largely a function of stillwater depth and exposure to winds, the areas where waves may increase along with increased flooding could be approximated. This could be done by re-running FEMA’s computer models to calculate overland wave hazards, or by examining the predicted future flooding compared to ground elevation and delineating those areas where the depth of water is sufficient to support waves of a specific height.
- Shoreline erosion. Based on the State’s long-term data, the areas predicted to experience shoreline erosion over a period of time can be delineated.
- Groundwater/water table levels. The actual effects related to sea level rise are functions of soil types and other factors. If seasonal depths to groundwater were known at enough locations, and if an assumption is made that a 1-foot sea level rise will cause a commensurate rise in groundwater, then a rough estimation of where groundwater will be close enough to the surface to be a limiting factor could be made.
- Wetlands migration. The actual effects of sea level rise on the type and location of wetlands are functions of soil types, past land usage, and daily hydrology (drainage). A reasonable assumption might be that for every foot of sea level rise, the wetlands will migrate inland to encompass adjacent lands that are within one-foot elevation of the current wetland boundaries.
 - Expected changes include landward migration, change in occupant marsh grasses due to salinity changes, erosion, and ultimately the complete loss of wetland due to inundation.
- Saltwater intrusion. The actual effects of sea level rise on saltwater intrusion are functions of soil types and other factors, including fresh water extraction. Even with several assumptions, it would be very difficult to estimate the likely effects.

MAPPING

In order to best understand the physical relationship between the Town of Fenwick Island and rising sea level, a mapping workflow incorporating the best available topographic information and the sea level rise data was developed. The mapping investigated two types of future hazards: nuisance flooding from progressively higher tides, and extreme storm event flooding from future severe storms augmented by a higher sea level.

The Town supplied survey data describing the elevations of road centerlines, including the elevations of various benchmarks throughout the Town. This data was more recently collected and more precise than the two LiDAR topographic data sets covering the area collected in 2005 and 2012. The survey data covered all roads west of Route 1, and alternating blocks of Route 1 and Bunting Avenue.

In 2009 DNREC developed geospatial files describing a range of future sea level rise conditions corresponding to an increasing mean higher high water (high tide). These spatial data were compared with the Town's survey data to highlight the roads that are most vulnerable to sea level rise.

DNREC data was used along with the best available road alignments to analyze the impact of future nuisance flooding to the Town of Fenwick Island. Under a separate contract with DNREC, URS created a statewide map illustrating possible future elevations reached by severe storm surge and waves. This data set was utilized similarly against the Town's survey data to describe vulnerability to those conditions.

SLR SCENARIO MAPS

Three maps were created showing separate inundation scenarios at varying sea level rise increments. These are all potential conditions projected for the year 2100 based on the DNREC recommended estimates of rise in sea level; a description of each scenario appears below. The results of the mapping exercise further emphasized the need to be prepared for sea level rise. In even the Low Scenario many homes and businesses would see regular flooding at high tide. The three maps can be found in Appendix A.

The following is a brief description of each DNREC scenario, describing the expected inundation extent of daily high tide given the current state of shoreline protection and ground elevations throughout the Town:

Low Scenario

The Low Scenario is the slowest estimated sea level rise rate. For this map sea level rise was calculated 0.5 meter (approximately 1.6 feet) plus high tide. In this example almost all of the Bay side properties are inundated except for the businesses directly along Route 1.

Intermediate Scenario

In the Intermediate Scenario the sea level rise was at 1 meter (approximately 3.3 feet) plus high tide. Route 1 is completely under water in this scenario with some homes and/or businesses on the east side of Route 1 being inundated, in addition to all structures west of Route 1.

High Scenario

The High Scenario is 1.5 meter sea level rise (approximately 4.9 feet) plus high tide. In this the Town can expect maximum inundation of water for the entire community. In the High Scenario there would be no access to any of those homes or businesses east of Route 1.

CONCLUSION

The vulnerability of land, housing, infrastructure and critical facilities due to sea level rise is assumed to occur linearly. While over a long time frame this may occur, there could be severe fluctuations in both shoreline erosion and sea level rise.

Economic losses of housing due to a storm event based on water elevations expected in the future would be substantial. Roads and bridges will be damaged or otherwise impassable, and several important critical facilities could all be severely affected by the advancing water.

There is time to plan and execute mitigation strategies that reduce the impact of these sea level changes; however the strategies will require difficult decisions to be made and likely will require financial assistance from either state and/or federal agencies to insure completion of projects in time to minimize impacts. It will not be obvious that shorelines are retreating or water levels are rising in any given year or small time frame. These shoreline and water elevation changes might not be obvious until a significant storm strikes the area and then the changes will exacerbate the effects of such a storm event.

MITIGATION STRATEGIES | RECOMMENDATIONS

The effects anticipated under various sea level rise scenarios include those associated with daily high tide flooding, infrequent but extreme coastal storm flooding, and those associated with more gradual changes in groundwater levels and drainage. The vulnerability assessment describes some of the associated problems that may occur, with particular emphasis on the effects related to coastal flooding.

The recommendations address suggested modifications to the Town's planning and regulatory mechanism, including the Floodplain Management Ordinance, Building Code, Zoning Ordinance, Comprehensive Plan, and development of a Disaster Recovery Plan.

STRATEGIES

In the sections below, the following measures are explained in more detail, and the documents where changes to incorporate these measures could be made are identified:

- **Develop intergovernmental coordination, County, State, Federal and local municipal governments**
- **Enforce Flood Damage Reduction Ordinance and adopt a freeboard standard**
- **Coordinate the building code and Town code with the Flood Damage Reduction Ordinance**
- **Require planning for elevation and drainage improvements of certain roads to anticipate more frequent flooding**
- **Raise streets and bulkheads**
- **Create living shoreline or conservation easements**
- **Encourage salt-tolerant rain gardens**
- **Designate high ground for non-emergency car parking**
- **Disaster Recovery Plan**
- **Public communication and outreach**

RECOMMENDATIONS

Develop Intergovernmental Coordination

The scope of mitigation efforts necessary to address the possible sea level rise impact to the Town is substantial. Due to the Town's size, population and resources, assistance will be required from key governmental agencies. The Town should begin dialog and work with Sussex County, State of Delaware, federal

agencies and neighboring communities regarding mitigation strategies specific to Fenwick Island and the southeastern Sussex County coastal area.

Flood Damage Reduction Ordinance

The Town adopted the Flood Reduction Ordinance in January of 2015 that includes Flood Risk Maps, administrative procedures and criteria for developing in flood hazard areas. The Town in conjunction with Delaware Department of Natural Resources and Environmental Control (DNREC) has been working with the Federal Emergency Management Agency (FEMA) to produce these new flood risk maps and ordinance for Fenwick Island. These new initiatives were adopted as a response to the Federal *Homeowner Flood Insurance Affordability Act* and the State of Delaware *Executive Order 41*.

“HOMEOWNER FLOOD INSURANCE AFFORDABILITY ACT

The US Senate passed the Homeowner Flood Insurance Affordability Act on March 13, 2014. HR 3370 was signed by the President on March 21, 2014. The act repeals and modifies certain provisions of the Biggert-Waters Flood Insurance Reform Act (BW-12) passed in July 2012, that proposed vast revisions to flood insurance rates.”

“EXECUTIVE ORDER 41

Governor Jack Markell signed Executive Order 41 in September 2013 creating a Governor’s committee on climate and resiliency. The executive order focuses on three goals:

- 1. Continue to reduce greenhouse gas emissions.*
- 2. Require state agencies to develop strategies to improve the resiliency of state operations and facilities with a focus on using natural systems and green infrastructure.*
- 3. Requires state agencies incorporate measures for adapting to increased flood heights and sea level rise in the siting and design of buildings and infrastructure.”*

The following are important aspects of the Flood Damage Reduction Ordinance:

1. The Ordinance is written in regulatory language, rather than permissive and unenforceable language as the pervious ordinance was written in.
2. The Floodplain Administrator’s responsibilities are written to satisfy the Town’s commitment and responsibilities to the NFIP.
 - a. The Town of Fenwick Island’s Town Manager will be the Floodplain Administrator as adopted
3. The Ordinance includes specific requirements for development other than buildings that may appear to be “new,” but that are based on the overall performance expectation of the NFIP for any development, including activities other than buildings. The specific requirements come from FEMA guidance publications and ASCE 24 Flood Resistant Design and Construction (a standard referenced by the International Code Series). The specificity is intended to help both the Town official and the applicant understand what constitutes resistance to flood damage for such activities.
4. The Ordinance includes requirements for all development, including buildings and structures. The document also cites that the Town should use the flood provisions 2012 or later editions of the International Code Series to meet the NFIP requirements. Certain provisions of the ordinances exceed the standards of the building code as follows:
 - a. The provisions of the draft ordinance had included requirements for freeboard. This provision was removed to discuss at a later date. The Town should revisit this provision and include freeboard in the ordinance

- i. Freeboard is the single most effective means for reducing flood risk to a structure in the floodplain. Freeboard is standard for placing the first floor of a structure above the elevation of the calculated 1% flood level in order to allow for nature’s uncertainty and future changes in the watershed that will increase flood levels. Freeboard is relatively inexpensive to build into development, and typically pays for itself in reduced insurance premiums and prevented flood damage within the first 10 years of a structure’s lifetime. Significant Community Rating System (CRS) credit is available for this activity, which leads to lower flood insurance premiums for all policy holders in the community.
5. The Ordinance does not include “higher standards,” which are provisions that exceed the NFIP minimum requirements. It does include some provisions that were recommended by the Floodplain and Drainage Advisory Committee, not because the provisions are “higher standards,” but because they clarify the basic requirements of the NFIP.

Coordinate Town Codes

1. Evaluate and remove any barriers in the Flood Damage Reduction Ordinance and the Town Zoning Code that would prohibit additional freeboard. One known example is to amend the Section 160-2 (Definition) of the Town Code to include maximum building height to be Base Flood Elevation (BFE) plus two feet of freeboard.
2. Consider additional design requirements of building foundations to protect building structural integrity against the effects of buoyancy, uplift, debris impacts and other flood forces. ASCE-24 provides a standard of practice for flood resistant design and construction in flood-prone areas.
 - a. Example of model language: New construction and substantial improvement of any residential structure shall have the lowest floor, elevated to or above the base flood elevation plus two feet of freeboard. Support structures and other foundation members shall be certified by a registered professional engineer or architect as designed in accordance with ASCE 24, Flood Resistant Design and Construction, or shall be constructed with designs meeting this standard.
3. Amend the Town Code to provide adequate cross referencing with the Flood Damage Reduction Ordinance and ensure administrative review procedures are in place.

Raise Roads

1. Based on the typical problems experienced by roads in low-lying areas that are already being frequently inundated, identify requirements for elevated roads or for low-water crossings (i.e., design them to be low to avoid blocking drainage, but require owners to acknowledge access/egress limitations).
2. Require more underdrains/cross drains to allow for drainage.
3. Additional drainage and tide flaps/check valves to prevent Bay waters from flooding the Town via the storm drain system.

Raise Bulkheads

1. Can address long term SLR and adds an element of protection from storm-induced flooding and increased wave action.
2. Needs to be complete, and ideally uniform, throughout Town; Low points will be weak points.
3. Need to ensure storm damages are repaired quickly to bulkheads etc.

4. Could exacerbate interior drainage problems.
5. Ensure storm drain check valves are installed and maintained to prevent back-flow, yet still allow drainage under everyday circumstances.
6. Eliminating the canals in Fenwick Island would reduce the mileage of bulkhead that needs to be raised and maintained. These areas could then be used as rain gardens/detention basins that could reduce interior drainage issues. It is understood that this may be a controversial topic and elimination of the canals would change the character of the Town.

Require Shoreline Buffers, Create Living Shore Line or Conservation Easements

1. Deeper water in Little Assawoman Bay due to sea level rise will allow larger waves to impact shore protection along the Town's Bay shoreline, underscoring the need for wave mitigation on the bay side.
2. Construct or supplement living shoreline/wetlands as buffer to waves.
3. Restore/supplement Seal Island wetland for wave breaking capacity, this Island is well positioned to protect Town from longest fetch across Little Assawoman Bay and such a strategy preserves residents' water access along canals.

Salt-Tolerant Rain Gardens

1. Encourage salt-tolerant rain gardens to mitigate interior drainage issues created by raising bulkheads; rain gardens built in low areas adjacent to, or in, flow paths can help capture runoff.
2. Rain garden plants would need some level of salt tolerance, since the area is prone to flooding from the Bay.

Designate High Ground for Non-Emergency Car Parking

1. Commercial areas occupying high ground along Route 1 could lend parking to residents ahead of anticipated high water to avoid damages.

Disaster Recovery Plan

1. Encourage Town to develop Disaster Recovery Plan.
2. Goal of Plan should be to return Town services and repair Town infrastructure as quickly as possible in the event such catastrophic loss cannot be avoided. Planning for disaster avoidance is important, but a recovery plan is necessary since expectations of complete avoidance are untenable.
3. Undertake structural evaluation of existing Town owned buildings and facilities (including central water supply facilities and central sewerage facilities and plants operated by Outside Agencies) in light of the sea level rise estimates to determine vulnerability to flooding. These evaluations should include the elevation of the lowest floor relative to the current and predicted base flood elevation and consideration of whether inundation would likely cause structural damage (engineered buildings may get wet, but that does not necessarily render them inoperable) and whether low-cost measures can be implemented to reduce damage (e.g., relocate emergency generators, protect emergency fuel supplies, move highly vulnerable uses/contents, etc.). Certain cost effective measures may be eligible for federal grant funding.

4. After flooding events, the Town should request a list from FEMA of NFIP insured buildings that have received multiple claim payments. FEMA administers several programs to fund mitigation grants for projects that reduce future flood damage (although the benefit-cost analyses are based on existing floodplain mapping). The most likely programs are those that focus on what are called “repetitive loss” properties (after declared disasters, other funds become available). For those properties, the Town could investigate working with owners to obtain funding for:
 - a. Elevation-in-place (owners provide non-federal cost-share).
 - b. Relocating buildings to sites outside of the floodplain and/or away from areas subject to imminent collapse due to erosion (owners provide non-federal cost-share).
 - c. Dry floodproofing (nonresidential only (including public buildings), and only in FEMA-designated A/AE Zones).
 - d. Acquisition (e.g., if adjacent to Town owned facilities where the addition of land is desirable; Town provides non-federal cost share). *The Town has worked with FEMA/DEMA with this assistance process in the past, particularly after Hurricane Sandy.*

Public Communication and Outreach

1. Develop procedures and forms to facilitate making substantial damage determinations.
2. As part of pursuing changes in ordinances, schedule workshops to explain the short-term and long-term benefits of the changes. Use these workshops to provide information about current flood hazards and ways property owners can reduce vulnerability.
3. Evaluate recommendations to determine eligibility for credits under the NFIP’s Community Rating System (CRS), a program that provides discounts on federal flood insurance premiums as a function of how a community exceeds the minimum requirements.
4. The Town should evaluate options to offer planning and assistance to property owners who have frequent flooding issues and who are interested in voluntary action. A potential option is for such homeowners to participate in the FEMA voluntary buyout program. Further evaluation and understanding of the buyout program must be sought. Any property purchased through the program may be converted to open space or a wetland/ marsh expansion area.
5. Encourage public or private purchases of uplands adjacent to tidal marshes, to allow marshes to migrate inland and slightly uphill, as sea level rises, to prevent these marshes from drowning in place.
6. Purchases of out of Town properties as a location for auxiliary municipal location.
7. Provide information regarding details on different programs that should be considered. There is the voluntary buyout which is permanent (land can never be developed), the Severe Repetitive Loss (SRL) program <https://www.fema.gov/severe-repetitive-loss-program>, and the Increased Cost of Compliance program (ICC) <https://www.fema.gov/national-flood-insurance-program-2/increased-cost-compliance-coverage>.
8. Commit resources to maintain a working knowledge of assistance, grant, and other funding programs that the Town or residents could make use of to reduce their vulnerability to future flooding due to sea level rise.

CONCLUSION

The predicted levels of sea level rise present real and considerable challenges for the Town of Fenwick Island. Due to the Town's geographic location and relatively low elevation the Town is highly vulnerable to the combined impacts of climate change to rising sea levels. Mitigation measures recommended in this assessment provide the Town with a path forward to begin the long term planning process to protect the Town and its citizens. As stated previously the scope of mitigation efforts necessary to address the possible sea level rise impact to the Town are substantial. Due to the Town's size, population and resources, coordination and assistance will be required from key governmental agencies. The Town should begin dialog and work with Sussex County, State of Delaware, federal agencies and neighboring communities regarding mitigation strategies specific to Fenwick Island and the southeastern Sussex County coastal area.



REFERENCES:

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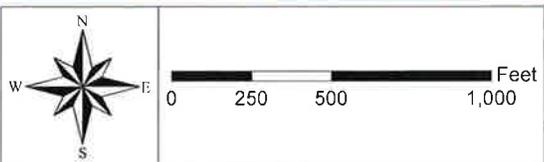
Recommended Sea Level Rise Scenarios for Delaware, December 2009, Developed by: DNREC Sea Level Rise Technical Workgroup

APPENDIX A

Maps

Legend

-  Town Boundary
-  Dry Streets
-  High Tide + 0.5m SLR



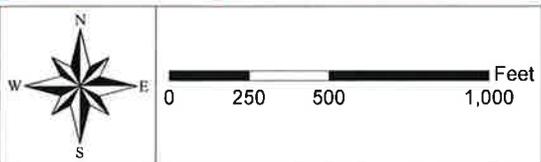
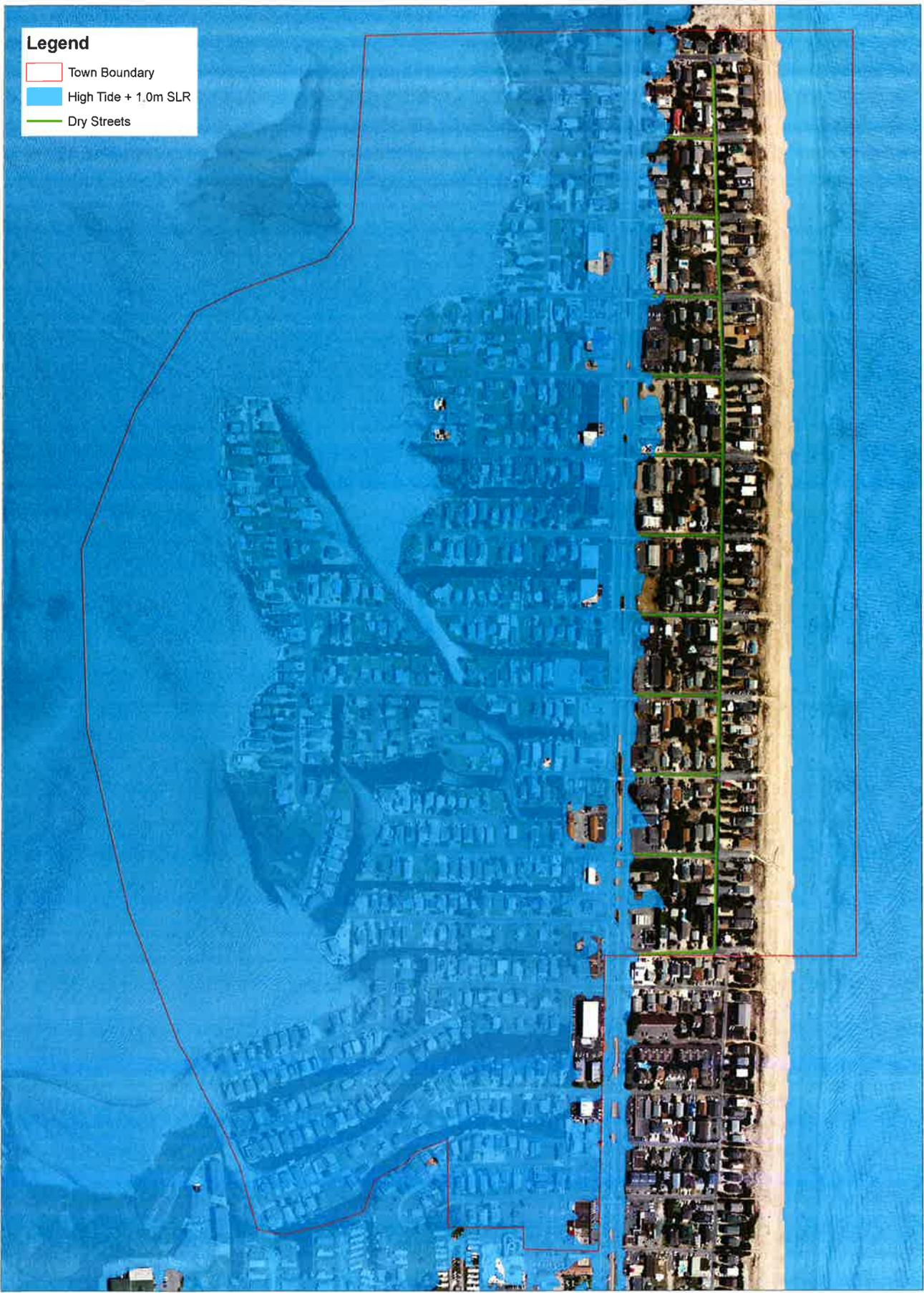
Town of Fenwick Island
SLR Inundation Map
MHHW + 0.5m SLR [Low]

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Data Sources:
SLR projections from D\BREC
Rosa provided by D\DOT

Legend

-  Town Boundary
-  High Tide + 1.0m SLR
-  Dry Streets



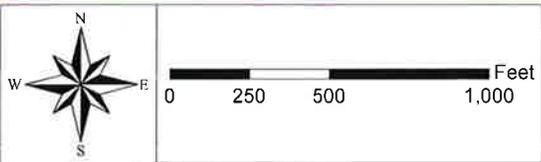
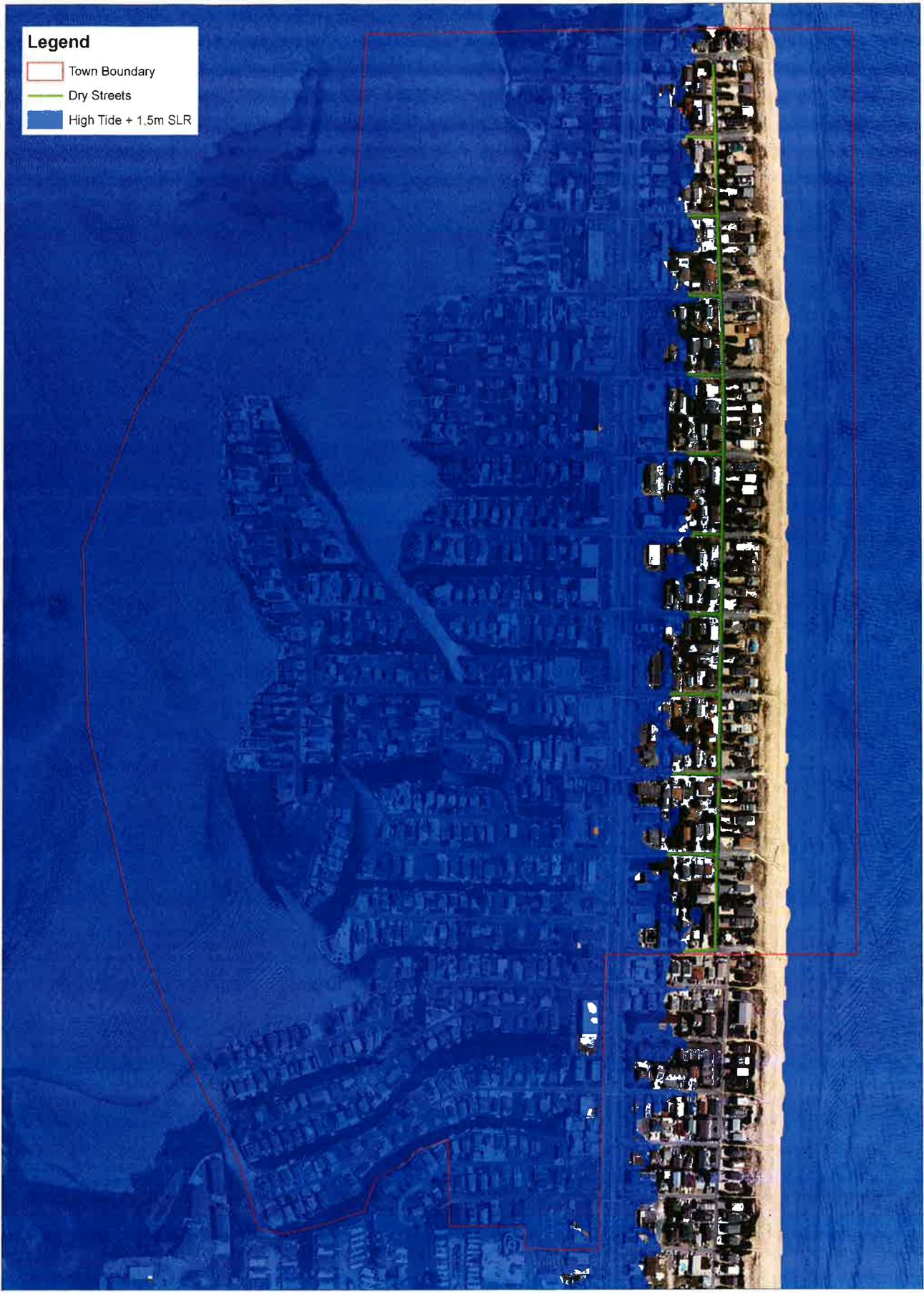
Town of Fenwick Island
SLR Inundation Map
MHHW + 1.0m SLR [Intermediate]

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Data Sources:
SLR polygons from DNR/DEC
Roads provided by De-ODT

Legend

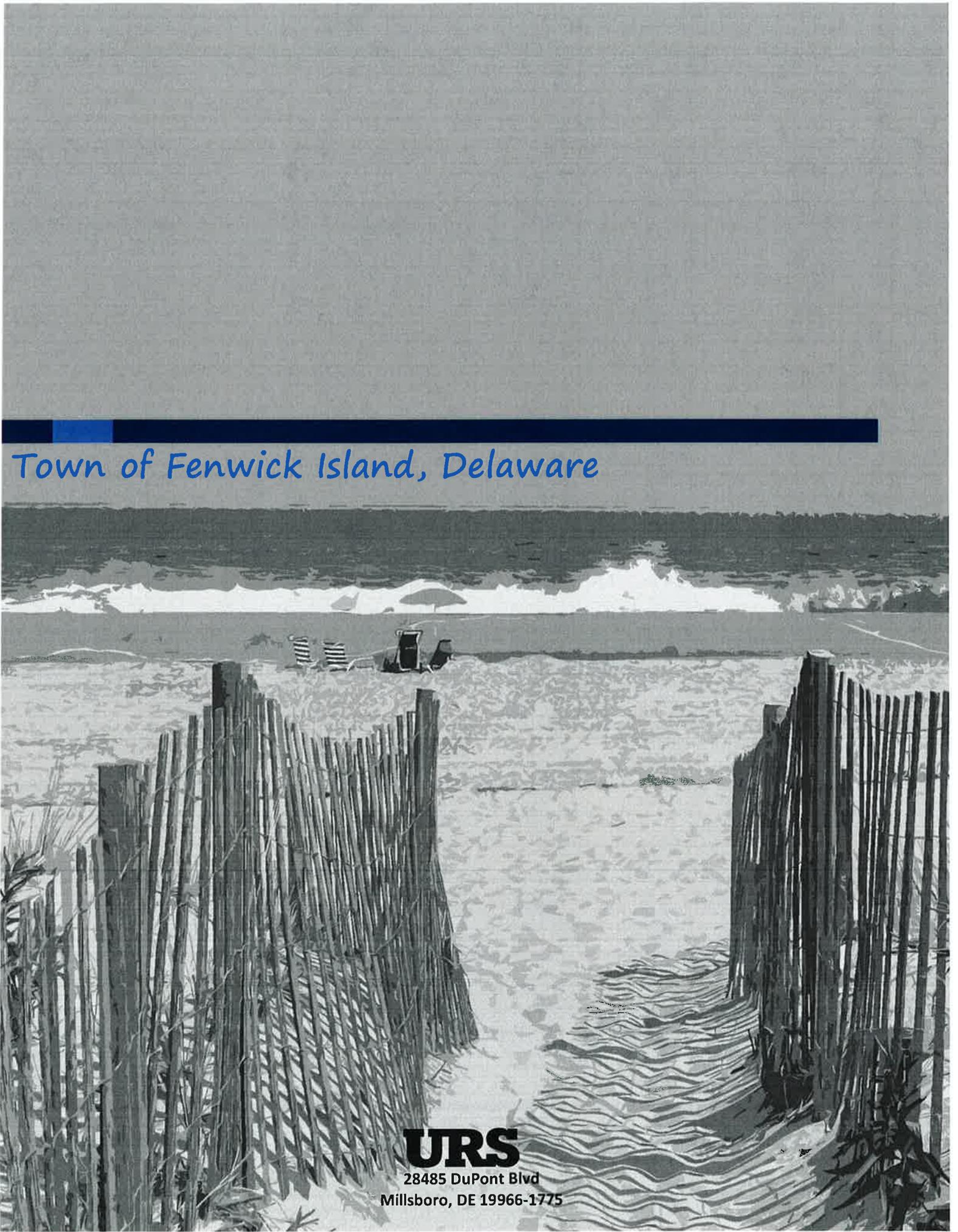
-  Town Boundary
-  Dry Streets
-  High Tide + 1.5m SLR



Town of Fenwick Island
SLR Inundation Map
MHHW + 1.5m SLR [High]

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Data Sources:
SLR provided from DNRBC
Revised provided by DEKDOT



Town of Fenwick Island, Delaware

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