

RESILIENCY IMPLEMENTATION PLAN

Town of South Bethany, Delaware

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(riskfinder.climatecentral.org)

Background

The Town of South Bethany, Delaware was incorporated in 1969 along the Delaware seashore. Situated between the Atlantic Ocean and Jefferson Creek along Delaware State Route 1 (SR1), the Town consists of just under 240 total acres with over 157 acres of impervious area. West of SR1, the Town experiences low lying land, mostly below elevation 8' with a portion below elevation 3'. The water's edge, along the man-made canals, is protected mainly by hard-edge shorelines including bulkheads and rip rap, with minimal natural edges. The focus area of the study encompasses the entire Town of South Bethany (Figure 1). According to the most recent Comprehensive Plan there are 1,312 households within Town limits with 12-15 homes being added each year. There is minimal year-round residency in South Bethany.

A Resiliency Implementation Plan has been created to help strategize resiliency efforts due to the effects of climate change, sea level rise, increased storm frequencies and intensities, and dense development within the Town. This plan will outline approaches, updates, and techniques to address the consequences of climate change. Mitigating the effects of rising seas and more intense rainfall events will help ensure a prosperous future for South Bethany.

According to the 2022 *Global and Regional Sea Level Rise Scenarios for the United States* report published by NOAA, Sussex County is projected to realize a sea level rise between 1.18' and 1.73' by 2050. The intermediate scenario projects an SLR of 1.41' by 2050.

As additional background, the Town of South Bethany is included within the Sussex County Hazard Mitigation Plan, which has been recently updated and will be up for adoption in early 2023. Individual Towns in Sussex County typically do not have their own Hazard Mitigation Plans and thus are instead a part of the County's. Flooding and Coast Hazards are included within the larger plan as a county-wide effort. Individual Towns do have their own Floodplain Management Ordinance and FEMA FIRM maps.

Previous Works

South Bethany has completed various studies, reports, and plans for the community. The Comprehensive Plan was adopted by the State of Delaware in 2017, and amended in 2022. Various reports and studies have been completed on the canals and their water quality. The Sea Level Rise reports for the coastal area have been compiled; however, they are nearly a decade old. Very few recent works have been completed to address the low-lying nature of the bay side or the densely developed land that comprises South Bethany.

The following items from previous works, Town codes, and reviewing existing conditions are applicable to the Resiliency Implementation Plan:

• Bulkhead heights cannot be increased by the homeowners, per Town Code.

- Impervious definition does not agree with DNREC and other accepted coastal allowances for pervious/impervious conditions where DNREC considers stone/gravel/shell drives and paths to be impervious due to compaction over time.
- There are many public roadways with the Town rights-of-way that are below elevation 3.0'.
- Many roadways reside below the elevation of the lots adjacent to them.
- Nearly all lands that abut the canals, except canal ends, are privately owned.
- On-street parking should be 5' from property lines and no greater than 50% of a lots frontage. This is exceeded in many places.
- There is minimal public drainage infrastructure to drain streets.
- No freeboard requirement exists with the Code.
 - From the latest update to the Comprehensive Plan: "incorporate environmentally sustainable strategies and practices into town operations and ordinances."



Figure 1. Focus Area of Study-Town of South Bethany

Flooding

Various phenomena can cause flooding in the Town of South Bethany: some of which include increasing intensities of storms and rainfall, tidal surges, wind-driven events, high tide cycles, or a combination of tidal and storm events. Given the low elevations throughout South Bethany, flooding is a continuing issue the Town faces.

Rainfall Intensities

Rainfall has increased in intensity over the past few decades, with more volatile storm events. The standard intensity curves that have been used in the past for modeling rainfall are still applicable for a portion of the events currently, but fail to depict the reality of more frequent heavier rainfalls in shorter durations.

Rainfall intensities are increasing while the duration of the rain event is shortening. Increased rainfall amounts and intensities cause streets to flood as well as yards, catch basins, and drainage networks. Drainage infrastructure is inundated with runoff and water is slower to move and dissipate, resulting in temporary flooding, impassable roadways, and standing water for longer periods of time. Understanding the higher rates of rainfall and planning/designing for them will allow South Bethany to address localized flooding in the future.

Projected Sea Level Rise

Figure 2 below depicts sea level rise over time in Lewes, DE. Similar projections can be applied to South Bethany because there is insignificant fluctuation across the Delaware shoreline; the projections for the Lewes NOAA station apply to all Delaware coastal communities. The intermediate line shows a potential sea level rise amount of 1.41' by 2050 which will result in approximately 90 days of high tide flooding over elevation 2.6'.

There are many factors that affect sea level rise; for example, melting of land-based ice, warming of the ocean, decreased salinity in the oceans, weakening of the gulf stream, and land subsidence. As these factors change, the rate of sea level rise could also change. The current rate of warming lands and oceans is a pace that has not previously been seen in human history.

Annual Relative Sea Level Since 1960 and Projections to 2100



8557380 Lewes

Figure 2. (https://tidesandcurrents.noaa.gov/HighTideFlooding AnnualOutlook.html)



Figure 3: Exhibit Depicting the New MSL After Two Feet of Sea Level Rise

Figures 3 and 4 depict the extent of the open waters during the new median water elevation if there were to be two feet or four feet of sea level rise, respectively. The inundation scenario depicted in Figure 3 is realized occasionally now during high tides with tidal surges from storm events. With the potential for two feet of sea level rise in 50 years, this would become the average water elevation on a daily basis, with high tides and surges bringing additional water on-land daily. Therefore, in this potential scenario, there are areas in Town that could be inundated with open waters nearly all the time if no precautions are taken. The scenario depicting the four

feet of sea level rise (Figure 4) was experienced during Hurricane Sandy. This may not become a daily occurrence in the immediate future; however, it will likely occur a few times a year, creating issues for transportation and accessibility around the area. When the roadways are under two feet of water potentially twice a day during each high tide cycle, they are impassable.



Figure 4. Exhibit Depicting the New MSL After Four Feet of Sea Level Rise

Projected Flooding

NOAA projects that the number of High Tide Flood Days along the coast in Delaware will increase in the future. The number of flooding days doubled from 2000 to 2020 and is projected to hit triple digits (one-third of the days) by 2050. Per the National Weather Service (NWS), a High Tide Flooding Day occurs when the flood gauge on Jefferson Creek on the west side of Town reaches an elevation of 2.6-feet. At this stage, many roads and back yards have tidal waters overtopping them, even on bright sunny days with no precipitation. The current MHHW elevation for Jefferson Creek is 1.23'. As the MHHW and tides increase in height due to sea level rise, the number of instances when residents, visitors, and emergency vehicles are affected by the tide will increase.

Flooding during days without influence from storms or precipitation is often called Nuisance Flooding or Sunny Day Flooding (Figure 6). In 2000, Coastal Delaware experienced 4 days having a high tide deemed to be a Flood Day by NOAA. All those instances were storm driven (blizzard in January, nor'easter in March, remnants of Hurricane Gordan in September, and nor'easter in December.) By 2050, there is a potential to experience flood days in the triple digits (Table 1). With a third of the days reaching the flood threshold, most will occur during "sunny days."

NOAA High Tide Flood Days	Number of Days
2000	4
2020	8
2021 projected	7 - 12
2030 projected	15-30
2050 projected	50-135

Table 1: NOAA Projected High Tide Flood Days

A higher number of projected flood days creates additional disturbances to normal activities for those situated in flood-prone areas. Increased inland flooding causes quality of life issues such as the inability to walk to one's car, take a pet for a walk, or dying vegetation. Standing water, and slow drainage flood water can have negative health impacts in addition to the monetary impacts caused by flooding. Flooding is detrimental to the community and will affect the way of life for the residents and stakeholders in the Town.

Current Challenges

<u>Bulkheads</u>

The low-lying ground in the Town results in or causes temporary or localized flooding during higher tide events and some rainfall events, when the open waters rise higher than the bulkhead heights. Limiting the ability to raise bulkheads per Town code is problematic as sea levels continue to rise in the future. With more frequent high tide flooding days, the bulkheads will be breached more frequently.

NOAA has delineated an elevation of 1.8' above MHHW as the flood threshold. The flood stage is set at approximately elevation 2.5'. In 2000, there were 4 days that met or exceeded this threshold in the Delaware Coastal Bays region while in 2021 that number rose to 13 days (which is above the projected number of 7-12 by NOAA). By 2050, it is projected to increase to between 50 and 135 days, a potential increase of 10 times the frequency.

A majority of the bulkheads have been built at elevation 2' or lower, therefore easily being overtopped by tidal waters at elevation 2.5'. High tide flooding 90 times or more per year (or every 4 days) will cause standing water leading to wet, saturated grounds. This can become problematic due to the increase of nuisance pests, increased spread of disease, adverse effects on private property and infrastructure, as well as the quality of life.

A review of historic tide data shows that the major flooding events happen during the off-summer season, mostly during major hurricanes or storms. Runoff from the mainland and filling of the back bay basins, with minimal relief points to the Ocean, cause flooding onto the land in the Town. Westerly winds push the water mass towards South Bethany without giving relief or allowing it to subside during low tide periods. When the winds continue for some time, the effects are compounded, and the water builds up with tidal surges, inundating the areas within the Town. Often these tidal surges are compounded with rainfall events, but not always. The increase of sunny day flooding without any precipitation is becoming more frequent. Nor'easter events have a negative effect on the dunes protecting the beach side of South Bethany (as experienced in May 2022) but do not result in a large tidal surge on the bay side.

Most of the Town roadways are surrounded by lots, with only the dead end exposed to the canals at a bulkhead. However, York Road is exposed to the open waters and frequently inundated by tidal surges. Further, Canal Road is exposed to the marsh on the western side. Both roads can be improved by the Town to make them more resilient and passable by residents, visitors, and first responders during high tide events.

Pervious/Impervious Allowances on Private Property

Most of the land within South Bethany has been subdivided and developed. There are very few unimproved lots remaining. No parcels operate in a vacuum. Conjoined yards, with minimal

setbacks, connect the runoff and drainage between houses and within drainage areas. However, these systems are not consistent between houses.

Per current code, 55% of the building setback area must be 55% pervious on a single-family lot, allowing for 45% impervious coverage. This is in addition to the sometimes 100% impervious coverage within the building envelope with roofing, decks, walks, and other impermeable surfaces. Within the setback, including the driveways, pervious materials allowed include gravel, shells, sand, mulch, grass, natural vegetation, permeable pavers, pervious concrete, or porous asphalt. Any impervious surfaces proposed in the setback area require submission of a sketch showing the extents and material to be installed. Given the coastal nature of South Bethany, allowing gravel and shells to be considered as pervious materials can raise further issues (Figure 5). The code and Town typically only receive a sketch plan when a building permit is submitted. Home improvements, yard alterations, and/or weekend projects typically will not be submitted to the Town for review and approval, resulting in greater coverage on home lots than initially approved. Over time the pavers, gravel, concrete, and/or asphalt becomes installed without official review and/or approval. In some cases, the 55% pervious threshold is bypassed for nearly 100% impervious coverage on single lots.



Figure 5: Exhibit Depicting the New MSL after Four Feet of Sea Level Rise

With a typical lot size of 5,000sf in South Bethany and some streets containing 10 to 12 homes, the runoff from rainfall can vary drastically depending on the open space land coverage outside

the building footprint. With sandy soils in the Town, a lot covered in grass will produce 30% less runoff than a lot that takes advantage of the 55% setback allotment to be gravel or another "impervious" classified surface per Town code. With increasing rainfall intensities and climate change, higher volumes of runoff can be expected, increasing localized flooding issues within the Town.

The TR-55 runoff number calculator used in stormwater computations takes into consideration the relative impervious coverage associated with various land use activities (Table 2) in the form of a Curve Number (CN). The chart provides an estimate of the CN as a function of the Hydrologic Soil Group (A, B, C, or D, with A being the dominant soils classification in South Bethany), typical plant coverage, and impervious area within the investigation area. The ability for stormwater to runoff from the investigation area is depicted in the CN. Pavement has a CN of 98 no matter the soils underlying the application. Lawns in good condition range from 39 in A soils to 80 in D soils. Most of South Bethany has a sandy soil subsurface corresponding with a soil group of A and has a CN of 39 for a grassed lawn in good condition. Gravel, on the other hand, has a CN of 76.

Table 2 depicts the runoff volumes from a single lot during differing rainfall events and under different lot coverage rates. The 0% coverage lot is a fully grassed lot in good condition. There is hardly any runoff from the lot, as should be expected. The 36% coverage lot depicts the buildable area envelope completely covered in roof area, but all areas within the setback are pervious materials such as grass in good condition or an engineered pervious paver system. The 50% coverage represents a fully maximized building envelope with the addition of a paved or concrete driveway, and the remaining area in grass. The 72% coverage represents maximizing the allowable coverage per code, fully impervious building envelope, 55% impervious coverage in the setback, and remaining area in grass. The last one, the "maxed out" coverage, represents a fully impervious building envelope area out for a setback, and the remaining area in gravel as an allowable pervious material per code.

Lot Coverage	1-yr rainfall	10-yr rainfall	100-year rainfall
0%	12 cf	131 cf	392 cf
36%	87 cf	610 cf	1263 cf
50%	218 cf	871 cf	1612 cf
72%	479 cf	1350 cf	2221 cf
Maxed out	827 cf	1830 cf	2701 cf

Table 2: Runoff Volumes from a 5,000 sf Lot with Various Lot Coverages During Various Storm Events

Allowing gravel/stone/shells as pervious materials increases runoff from the lots. Many other local jurisdictions have excluded these materials from being considered pervious due to their compaction over time, as well as the increased runoff realized from their installation and diminished ability for runoff to filter through to the subbase of native soils. Without routine maintenance or ensuring the gravel is not compacted, the surface will become more impervious

over time. Higher than anticipated runoff and ponding of stormwater in localized areas covered in gravel will result in time due to compaction. Within coastal areas, State agencies consider gravel and shells to be an impervious surface since they will not allow for infiltration at the same high rate as initially installed after years of use in conjunction with the relative high ground water table to the surface. In order to meet the intent of DNREC SWM requirements, runoff should drain to a turf or lawn area. Despite constrained lot sizes in South Bethany, the presence of lawn/grass/turf areas greatly reduces the amount of runoff leaving the individual properties and meets the intent of the standard plan criteria set forth by DNREC. The higher the amount of imperviousness (as well as presence of gravel, stone, and other hard surface materials) on individual lots, the higher the runoff (Table 2). One factor is the width of perviousness available to infiltrate into the subsurface. As yards are covered with pavers, driveways, and stone, the area of grass is shrinking. There is less pervious area to handle a larger runoff amount causing worsening flooding issues during rainfall events.

Pervious/Impervious within Public Rights-of-Way

Currently, pervious concrete and porous asphalt are not allowed in the Town right-of-way Gravel, shell, and stone are allowed. While anticipated that shell, stone, and gravel would allow for infiltration into the future, over time, their compaction leads to increased runoff. An engineered system such as pervious concrete or porous asphalt with standard parameters for installation will provide better infiltration into the future versus other surface treatments that will become compacted.

Further, only 50% of the lot width is allowed to have this treatment by code. There are several cases within the Town currently that exceed this 50% coverage. Many areas in front of lots are covered from lot line to lot line with material that has been compacted over time adding to the impervious rate and runoff from the Town's rights-of-way.



Figure 6: Yard Inlet on York Road Inundated with Water and Sediment During a Sunny Day

Allowance for a pervious surface such as pervious pavement, porous concrete, or honeycomb pavers that can be filled with grass and maintained would decrease the amount of runoff from

the roadways and the Town control rights-of-way. This would decrease the amount of flooding realized within the streets and in front of houses and these surfaces would provide a solid surface to utilize for parking temporarily at the front of the house.

Low Elevations on Town Roads

Raising the elevations of the roads in the Town of South Bethany is one way to become more resilient to sea level rise. While raising bulkheads can become cumbersome with enforcement and timing, raising the roads is something the Town can have full control over. There are many sections now that are below elevation 3' and even some around or below elevation 2'. Increasing the height of these streets will increase the access for emergency vehicles and the residents alike. When there is nuisance flooding now, the streets are closed due to the depth of water (Figure 7). Raising them up will reduce the amount of standing water and allow for increased access. The existing driveways can be blended into the new grading with individual lots draining to the canals at the rear of their properties.



Figure 7: Google Street View Capture of York Road Showing Flooding

Raising the roads could be done when the roads are ready for reconstruction on a rolling basis. Not all roads will need to be updated or raised at once but could be put on a schedule to improve their ability to handle flooding. Underground runoff storage could be built into the roadway by creating a cistern below the roadway and pumping out the excess water once the tide recedes. If this is chosen, additional drainage could be provided along the roadway to assist with the localized flooding issues.

FEMA and Floodplain Enforcement

Due to the Town being developed over many years, and a relatively young Floodplain Ordinance, many houses within clusters in Town have varying elevations of critical structures and auxiliary units. Due to the nature of Town and the canals, and the fact that South Bethany is a coastal community, many have chosen to build with parking underneath the residence. This meets or exceeds the Base Flood Elevations (BFE's) required by the Ordinance and for FEMA regulations. However, the HVAC units and gas tanks at some houses are at various heights. Some units are on the ground, some are slightly elevated, some are completely elevated exceeding the FEMA requirements. Assisting homeowners to comply with the proper elevations needed can help the resiliency of individual houses and lessen the probability of affecting a neighbor's property. Lowlying equipment poses threat to neighboring properties and can become unusable due to water damage.

The lack of freeboard required in the Town Code could create adverse conditions in the future. With the increase in sea level and intensities in storm events, there is a high probability that the FEMA flood elevations will likely increase. This could cause a home built with a finished floor elevation (FFE) of 6.0' with no freeboard built in to be at higher risk of flooding in the future. It will also lead to higher insurance premiums for future homebuyers of those homes. FEMA maps do not consider future sea level rise or increased flooding potential (Figure 10). Building in freeboard to FFE's provides safety into the future for the residences constructed within Town.



Figure 8: New FEMA Policy, Risk Rating 2.0 Methodology

The manner in which FEMA Risk Rating 2.0 policies will be calculated and priced will have a larger fiscal impact on individual homeowners in the future (Figure 8). Policies will increase substantially with the new system. Building in freeboard as a requirement of construction within the Town will alleviate some of the impact of the increased premiums. Having lower FFE's will increase flood policy premiums. An increased FFE requirement will result in fewer claims and loss of use of homes due to flooding. For those not constructing new, mitigation techniques such as elevating their homes and raising outdoor machinery can lower the flood policy costs.



Figure 9: Mitigation Techniques for Risk Rating 2.0 Policies

Most coastal homes constructed currently with parking under the first floor, currently grandfathered, would meet the new code requirements. The FFE's of those structures are already elevated several feet and are above the 8.0' elevation requirement in a flood zone of 5.0' if a 3' freeboard was enforced. The height limitation may need to be reviewed if freeboard is enacted, but other neighboring communities have navigated this with minimal issues. An elevated structure will offer a lower flood insurance premium (Figure 9).



Figure 10: FEMA Map Showing Focus Area of Study-Town of South Bethany

Vulnerable Areas

Several of the Town owned roadways lie at or below elevation 2.0' (Figure 11). Some of the lowlying areas can even be seen on Google Street View with water on them. When the flood stage is set at elevation 2.5' by NOAA, many of the roadways and yards will be under water before a flood event occurs. Water on the roadway interrupts access by the residents, visitors, and emergency vehicles throughout. With minimal drainage to the canals and the creek, water tends to sit for longer durations. This can also cause public health concerns, negative impacts to public infrastructure, and alterations to daily life routines.



Figure 11: Existing Topography of South Bethany

It is important to note that both flooding from rainfall events and "sunny day", or tidally induced, flooding was considered in the vulnerability analysis. Town owned drainage infrastructure is at a minimum within South Bethany. Due to the lack of elevation change, there is not enough slope to provide a proper storm drainage network under the roadways. Along the SR1 corridor, DelDOT has a comprehensive drainage network that drains to the canals. With higher tidal levels, more intense rainfalls, and low lying lands, the ability to positively drain yards and roads becomes more difficult with time. However, installing more drainage infrastructure becomes challenging with minimal staff to maintain it, more weak spots for the tide to enter the uplands via the culvert

pipes when tide gates do not function properly, and the need for easements across private property for installation of discharge pipes.

What was once perceived to be a bolstered area that was highly protected showed its vulnerability in the spring of 2022. The dunes and the beach front were highly affected and eroded by an unlikely Nor'easter in May. The access across the dunes was disturbed for over a week's time and the level of the sand on the beach altered right before the start of summer. With differing weather patterns and more intense storms, unforeseen interruptions to daily activities will continue to increase.



Figure 12: Google Street View capture of York Road Showing Flooding

In order to prepare for future intensified storm events, the Town of South Bethany should consider re-building current infrastructure to increase accessibility and safety (Figure 13). Current infrastructure, such as York Road (Figure 12), already experiences roadway overtopping from tidal and storm events and should be raised to combat this issue. Grant funding exists to make these rebuild improvements towards a more resilient community.



Figure 13: Google Street View Capture of Cattail Road Showing Vulnerability of Infrastructure in Town

Goals

To become a more resilient Town, South Bethany must make infrastructure improvements to prepare for increasingly intense storms and rainfall. Further, the Town must look at the Code and how it currently is affecting the flooding issues throughout South Bethany. Dealing with increased rainfall and higher tides more frequently will be key to a resilient South Bethany. To accomplish this goal, the Town should:

- The local Hazard Mitigation Plan should cover flooding; from tidal surges, storm events, and heavy rainfalls which close local roads when they become inundated with water. Also, a plan should be in place to handle situations other than just hurricane/tropical storms such as the Nor'easter that hit the beachside in May of 2022or winter storms that result in heavy snowfall. Delaware Emergency Management Administration (DEMA) has been a great partner and this relationship should be continued. Ensuring the Local Hazard Mitigation Plan is expansive to deal with potential hazards that disrupt daily life should be pursued.
- Investigate a FEMA Building Resilient Infrastructure and Communities (BRIC), Pre-Disaster Mitigation (PDM), or Flood Mitigation Assistance (FMA) Grant. These will assist with planning to elevate all roads that are below elevation 4 and could possibly also assist with elevating bulkheads. Currently there are 10 roads in the Town of South Bethany that have

a lowest elevation on the centerline below elevation 2.0' making them more susceptible to flooding. The grant programs will pay for most of the planning and design.

- The BRIC or PDM grant can cover new designs within Town, including raised bulkheads, roadways, yards, and houses to create a more resilient community.
- Town Codes should be altered to require additional freeboard, properly define pervious materials allowed on private property, and inform what parking surfaces are allowed to be installed within the ROW at the front of homes. Due to the allotment of stones and other similar materials in yards, properties are contributing more runoff into the Right-of-Ways, which can lead to road closures and accessibility issues. The Town should plan for the worst-case scenario and be prepared. Active communities that have a vision and an end goal are more successful at achieving them.

Impractical Solutions

- One way to attempt to ensure the Town is more flood resilient is with the installation of a wall or berm around the exterior of the Town. However, this is not possible with the current regulations, budget, or public will. Building a large wall would cut off the boat access to the surrounding waterways, be problematic with tying the elevation back to higher ground around DeIDOT controlled SR1, and cut off viewsheds to the surrounding areas. Further, stormwater that fell behind the wall would have to be pumped to the outside. And this would further exacerbate the issue of the declining water quality in the canals since there would not be any flushing with natural water. Cutting off habitat and open wetlands would also not be permitted by DNREC.
- For the same reason above, even a natural barrier around the Town would isolate the Town from the surrounding natural areas. Since there is a large portion of the Town at such a low elevation, the use of a flood gate is not feasible. There isn't enough land currently with high enough elevation to be able to solve the issue with a handful of gates. Nearly the entire interface between the open waters and the upland portions of Town are around or below elevation 3.5'. Current Flood Stage is at 2.5' which means some roadways and some yards have standing water. With nearly 1.5' of sea level rise projected by 2050, the flood stage will be 4.0'. That means 50% of the roads on the bayside of Town will have standing water and nearly every single bulkhead will be overtopped during a flood surge tide
- Expansion of a canal system will only provide additional area for the water to flood, as well as additional maintenance issues. Overland flow at a low slope (living shorelines, low level planted berms) helps prevent major damage during flood stages. Deeper waters and harder surface edges (bulkheads and rip-rap) perform during non-flooding times. However during tidal surges the hard edges reflect the energy of waves around the vicinity and deeper canals would deliver additional water with more energy to the upland areas.

- All of the above are not feasible based on permitting, cost, and functionality. The biggest
 challenge is the low lying land in which South Bethany sits. In short, South Bethany cannot
 be flood proofed under the current conditions. Building a wall around the Town will not
 be permitted by DNREC, nor paid for by the Town, State, or FEMA. Expanding a canal
 system does nothing other than cause more maintenance problems and introduce more
 water quicker to the Town.
 - DNREC will not allow for wetlands to be disconnected. However, in future projects, green techniques will be required to be part of the final plan, expanding the wetlands and lessening the impervious impact on the habitats.
 - A structure (green or concrete) is not practical. The amount of maintenance required outweighs any pros that may come from a structure. De-watering the area when overtopped is costly and could create further maintenance concerns.
 - The will to cut off the Town from the surroundings is not present, at the local level nor at the State or Federal level.

Viable Approach to Resiliency

For the Town of South Bethany, the best way to ensure resiliency in the future is to allow for improvements to the current situations in Town. Low lying lands and current Town code inhibits rebounding from flooding due to storm and tidal events. Building back to and maintaining current standards and codes will ensure recuring disastrous results and repeating these steps will not improve the Town or it's resiliency. Below outlines some steps and milestones to better prepare the Town for the future and the effects of Climate Change.

Next Steps

Phase 1: January 2023-December 2025

- Within the next year, a committee should be formed to deal with Resiliency, Sea Level Rise, Climate Change, and Hazard Mitigation within the Town of South Bethany. The committee members can be appointed from those interested in serving. This effort would have zero impact on the Town budget as it would be a volunteer board. The committee can meet quarterly, bimonthly, or monthly to discuss areas of concern and maintain contact with State agencies. With Delaware becoming more prepared and active at the state level with Resiliency and mitigating the effects of Climate Change, the State is a great source of information and guidance. Similar efforts have been employed in Lewes, DE and St. Michaels, MD with positive impacts.
- Begin the process to design a higher elevation on York Road. Currently during minimal high tides (that do not even qualify as "flood" level) the waters in the Creek and Canal meet across the roadway. This causes travel concerns for the residents using York Road

to get to their homes as well as any emergency vehicles that may need access for calls in the area utilizing York Road as the only ingress/egress roadway. Elevating the street should be one of the top priorities for the Town. Funding is available through FEMA Hazard Mitigation Grant Program to design and construct a new flood resistant roadway.

- Investigate Ordinance updates for freeboard, building heights, pervious yard material definitions, lot coverages, and parking materials within the Town ROWs. Again, these are budget friendly updates that do not cost the Town to enact yet will result in a more resilient Town once homes are built under the new standards.
 - Add a 2' freeboard requirement in the Floodplain Ordinance. With zero freeboard now, if a home was built to the minimum requirement at the current Base Flood Elevation it will most likely be below the BFE in future FEMA map revisions. The BFE's are not expected to fall with increased sea level rise. This, in conjunction with the new manor of calculating Flood Insurance premiums will ensure homes are protected from flooding as much as possible while allowing for reasonable insurance premiums.
 - If additional freeboard is enacted, increasing the building height limitation should be addressed. Other local municipalities have allotted a higher building height after implementing freeboard requirements.
 - Routinely inspect the tide gates that have been installed. Ensuring the gates are functioning properly will keep tide waters from entering the roadway and upland areas through the infrastructure intended to keep it dry.
 - Investigate redundant system tide gates. There are new designs that are longer lasting and better at operating as desired; and reduce the incident rate of clogging or failing due to sticks or critters.
 - Most current bulkheads have a consistent height along a horizontal run of homes; effectively in a "block" together. Increasing bulkheads heights for flood protections should be a discussion held with all stakeholders within a "block" allowing all connecting side-by-side bulkheads to be raised at the same time. This will provide a more wholistic solution and avoid saw tooth heights varying between individual properties.
 - When rebuilding a road, consider a tank or cistern system below the surface of the roadway. This will allow for stormwater runoff from the roadway as well as the fronting houses to be stored within the underground system. Once the tide recedes and the rainfall has stopped, the water can be pumped to the canals and/or the Creek.
 - Considering stone and gravel to be at a minimum 50% impervious within a yard area (outside of a drive or within the Town's ROW) would decrease the amount of runoff to the Town streets during rainfall events. This would only affect new construction and complete renovation projects, not current residences that have these materials installed currently.

- Consider a standard engineered surface, or a few options, for the parking in front of individual residences within the Town ROW. An engineered porous/pervious application such as pervious pavers, geogrid, or other performance-based solution could be specified in the Town code and allowed for the sections between the edge of road and property line to decrease stormwater runoff but allow for a sturdy surface for parking needs. If parking in front within the ROW is encouraged, driveways may potentially shrink from double width to single width ultimately reducing the amount of impervious area on a property and lowering the amount of runoff into the ROWs.
- Continue to attend Sussex County Association of Towns (SCAT) meetings and be active with other coastal communities.
- Continue building and bolstering relationships in the Association of Coastal Towns (ACT) and potentially investigate an all-parties grant application for resiliency and flood mitigation projects. This would help with the economy of scale, provide a cohesive front across the coastal communities to the State and FEMA, and ensure that nobody is "left behind" in this endeavor. Maintain contact with the County and ensure the Hazard Mitigation Plan addresses the needs of South Bethany in an emergency.
- Investigate a new flood plain ordinance with added freeboard. This should be done prior to the next Comprehensive Plan update in 2026. Provide a higher standard for the construction within Town to provide a higher standard of living for the residents.
- Maintain the Community Rating System (CRS) certification. Currently at Class 8 (which provides a 10% discount to policy holders in South Bethany,) there are additional items that can be easily accomplished to receive points and bump the level to Class 7 or even 6. This would offer a greater discount on flood insurance for the residents of South Bethany, which is helpful in a time when Flood Insurance rates are being raised. Public outreach and information can assist with achieving additional points potentially reducing premiums. Reach out to Delaware Sea Grant to discuss if there are any simple and free techniques that they can provide to get additional points towards a better rating.
 - Public outreach, public notification, and particular messaging and phrasing are simple and easy solutions with assistance of others to achieve additional points. Further, a freeboard requirement would garner additional points (up to 2,042) to get to Class 7 or better. This report should be eligible for some points under the "other activities" scoring.
- Form a Capital Improvement Plan during budget time, building in a Resiliency Fund for projects to address localized flooding in Town. More frequently projects are popping up and requiring attention, both time and money. These are not accounted for in the budget normally. However, providing a fund that would address these instances will increase the ability to address them without delay. Soon, Bonding agencies are going to require Resiliency and Climate Change be addressed in Municipal operations to receive the

highest Bond Rating. Being prepared does have a budgetary impact in the future. Not being able to borrow at the best rate will cost South Bethany if not ready.

- The Resiliency Fund can be utilized to fund small projects themselves, as matching funds for grant applications, or to cover design fees for desired projects. As Delaware moves forward, there will be greater opportunities for grants throughout the state. Having a potential matching fund ready is attractive to grantors when providing funding for designs or implementation.
- Continue the routine schedule for maintenance of the existing stormwater infrastructure. Clean out catch basins and flush the pipes regularly. Introduce an inspection log to be maintained for the structures to stay ahead of potential replacement needs and understand the areas that require above average attention and maintenance.
- Determine if there are areas in Town where street trees can be planted. The benefits of trees in a community are vast. Providing additional trees would benefit stormwater issues, air quality, water quality, wildlife, and provide shade to the area.
- Continue to increase street elevations with additional paving lifts where possible. It is understood that streets with several driveways cannot simply be elevated by a large amount due to the adverse effects on private property and access concerns. However, it is possible to add a few inches when paving during routine maintenance. This will not fully combat the 1.41' projection of sea level rise but will be a cost effective and short-term targeted strategy until large scale planning for road reconstruction can be accomplished.

Phase 2: March 2024-December 2027

- Update the Comprehensive Plan for South Bethany and include Resiliency and Climate Change throughout. The Town is very susceptible to altering weather patterns in the future, and this should be included in the Comprehensive Plan for the Town.
- Plan for the next "Sandy superstorm."
- Look into enforcement of the FEMA codes, and how to ensure those that do not meet code (even if Grandfathered) can meet it in the future. Community outreach and assistance on these matters go further than telling people they are not in compliance. If there are a certain number of houses that need to be elevated to reduce the risk of flooding, sponsor a grant to assist in this outcome.
- Investigate installing a berm along Canal Rd. There may be some wetlands disturbance, so DEMA and DNREC must be informed and included in the planning process. Providing protection from back bay pressures during storm events, the berm will allow Canal Rd to remain dry for longer periods of time.
- Investigate an alternative design for the roadways. A new system will be needed to ensure there is no standing water throughout the Town. A box cistern detention system under the roadway, which can house the utilities and serve as a cistern of sorts for stormwater could be installed when reconstructing the roadways. Pumps will be needed to draw down the water inside the boxes, which have been utilized in other municipalities with

success so far. The roadways will need to be raised in the process to combat the projected sea level rise, and the higher the roadway the less frequently the pumps will need to be utilized. Once the roadways are elevated, the bulkheads can be raised without causing additional flooding issues in the roadway.

Phase 3: January 2028-December 2050

- Make South Bethany resilient! Plan for the next storm(s). Upgrade the stormwater.
- Ensure the code allows for resilient installations and mitigation techniques to be constructed.
- Ensure maintenance for any new infrastructure installed, either grey or green, has a budget item listed on the yearly budget. A routine maintenance schedule should be planned out. Once the technique is constructed, money is needed in the future to maintain the integrity and efficiency into the future.
- Grant research and planning should continue. The availability of funding has increased in scope and potential applications over the past few years and will continue to expand to combat sea level rise and to address aging infrastructure.
- Continue resiliency planning!

Appendix A



https://riskfinder.climatecentral.org/ Exhibit Showing Inundation of South Bethany with 2' of SLR



https://riskfinder.climatecentral.org/ Exhibit Showing Inundation of South Bethany with 3' of SLR



https://riskfinder.climatecentral.org/ Exhibit Showing Inundation of South Bethany with 5' of SLR