

# Sea Level Rise & **Storm Surge** Issues For The Town Of South Bethany

Presented by

George Junkin, Chairperson South Bethany SLR & SS Committee

# Introductions

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## South Bethany Town Council Formed The Sea Level Rise (SLR) and **Storm Surge (SS)** Committee In June, 2013

- SLR & SS Committee's Mission Statement

Given the increasing information about future concerns that coastal communities like South Bethany may face from SLR & SS, as demonstrated by Hurricane Sandy in October 2013, the SLR & SS Adaptation Committee will:

- Gather information, perform analyses, explore adaptation options and make recommendations relative to SLR & SS concerns.

To provide adequate protection of both the property owners' and the Town's assets.

# Members Of The SLR & SS Committee Are:

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- George Junkin, Chairperson
- Jim Gross
- Jay Headman
- Frank McNeice
- Dick Oliver
- Al Rae
- Dave Wilson

# Key Points To Take Away

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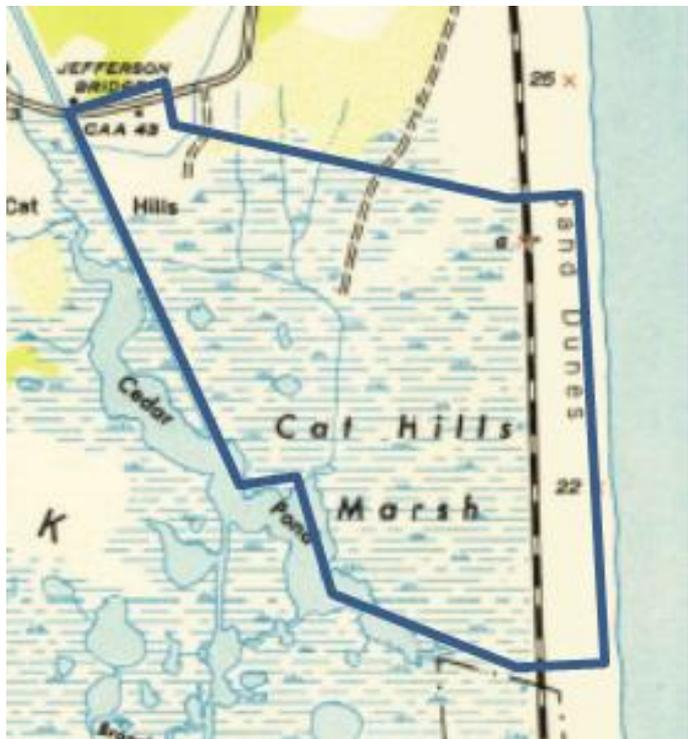
- South Bethany (SB) Is Very Vulnerable.
  - The Elevation/Height Of SB Is Between 1 Foot and 12 Feet Above Sea Level .
  - SB Sees Minor Tidal Flooding Numerous Times Per Year.
  - Storm Surge Has Caused Significant Damage In The Past.
- Local Sea Levels Have Been Rising Over The Past 100 Years And Are Predicted To Rise Significantly Over The Next 100 Years.
- South Bethany Can Adapt By Designing Houses With Height Margin Above The 100-Year Flood Elevation.

# The Majority Of South Bethany Is Low

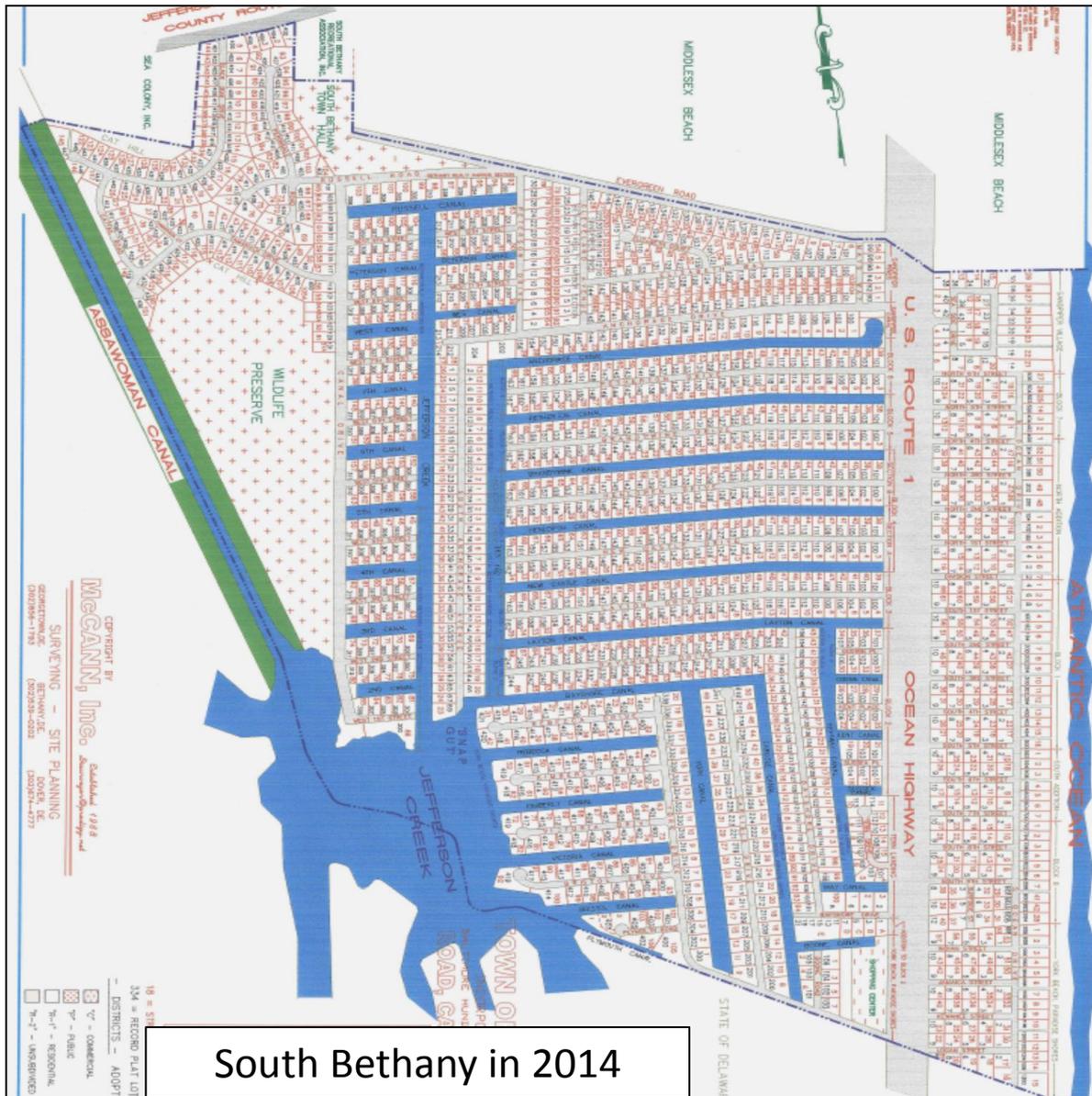
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- It was developed in the 1950s by digging five miles of dead end canals to drain the area known as Cat Hills Marsh.
- The dredged material was used to raise the level of the land.

# South Bethany In 1943 Compared To 2014

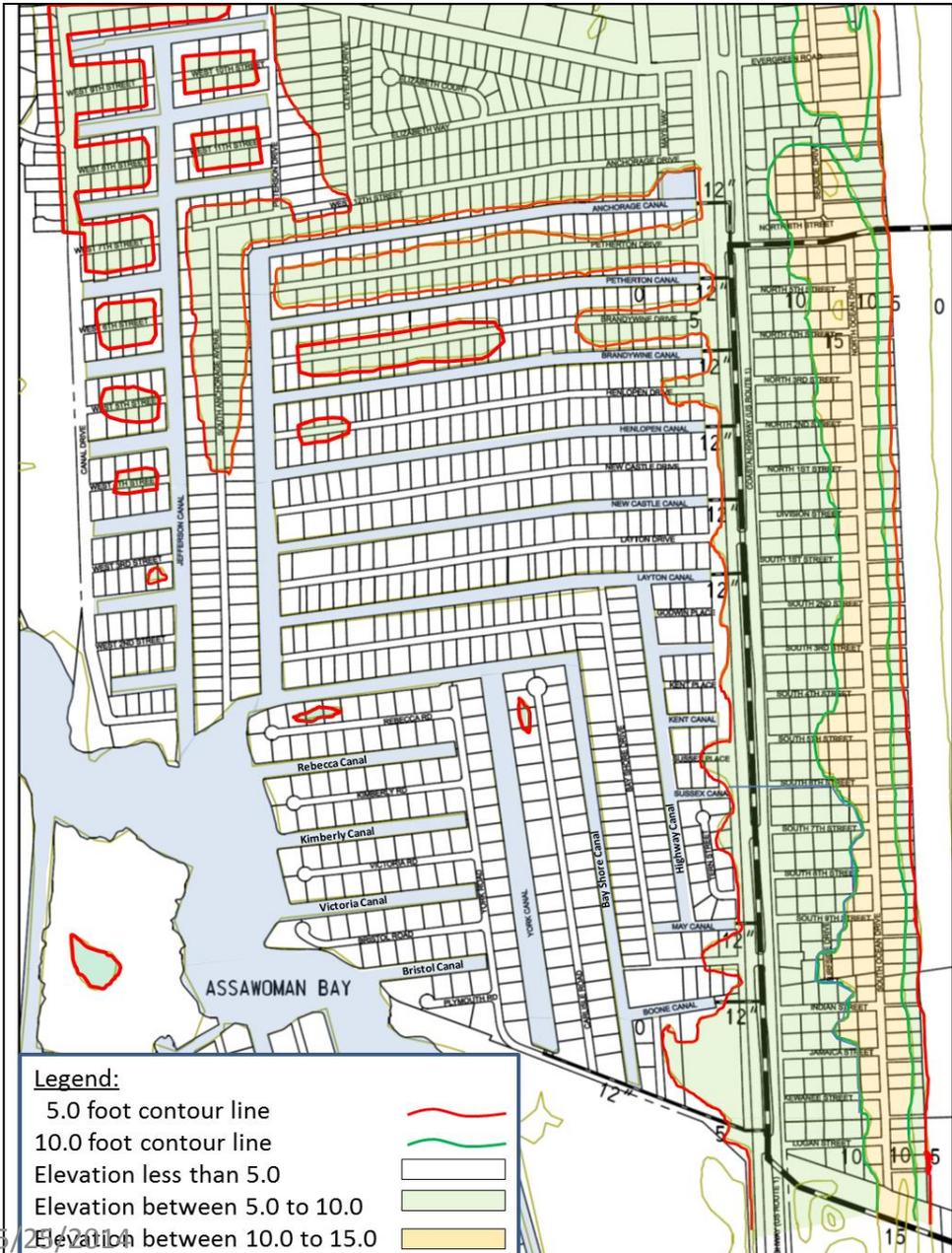


USGS 1943 Map



South Bethany in 2014

# The Elevation Of SB Is Between 1 Foot and 12 Feet



- The white areas on the map are less than 5 feet. This area was flooded during Hurricane Sandy.
- Green areas are between 5 feet and 9 feet.
- Yellow areas are between 9 feet and 12 feet.
- Ocean Drive is the highest, 9 feet to 12 feet.
- Dunes are about 16 feet.

# Detailed 2013 Elevation Survey Of Streets, Bulkheads And Storm Drains Shows That South Bethany Is Very Low



USGS Tide Gage

As A Point Of Reference:  
York Road Begins To  
Flood When The Tide  
Reaches 1.5 Feet.

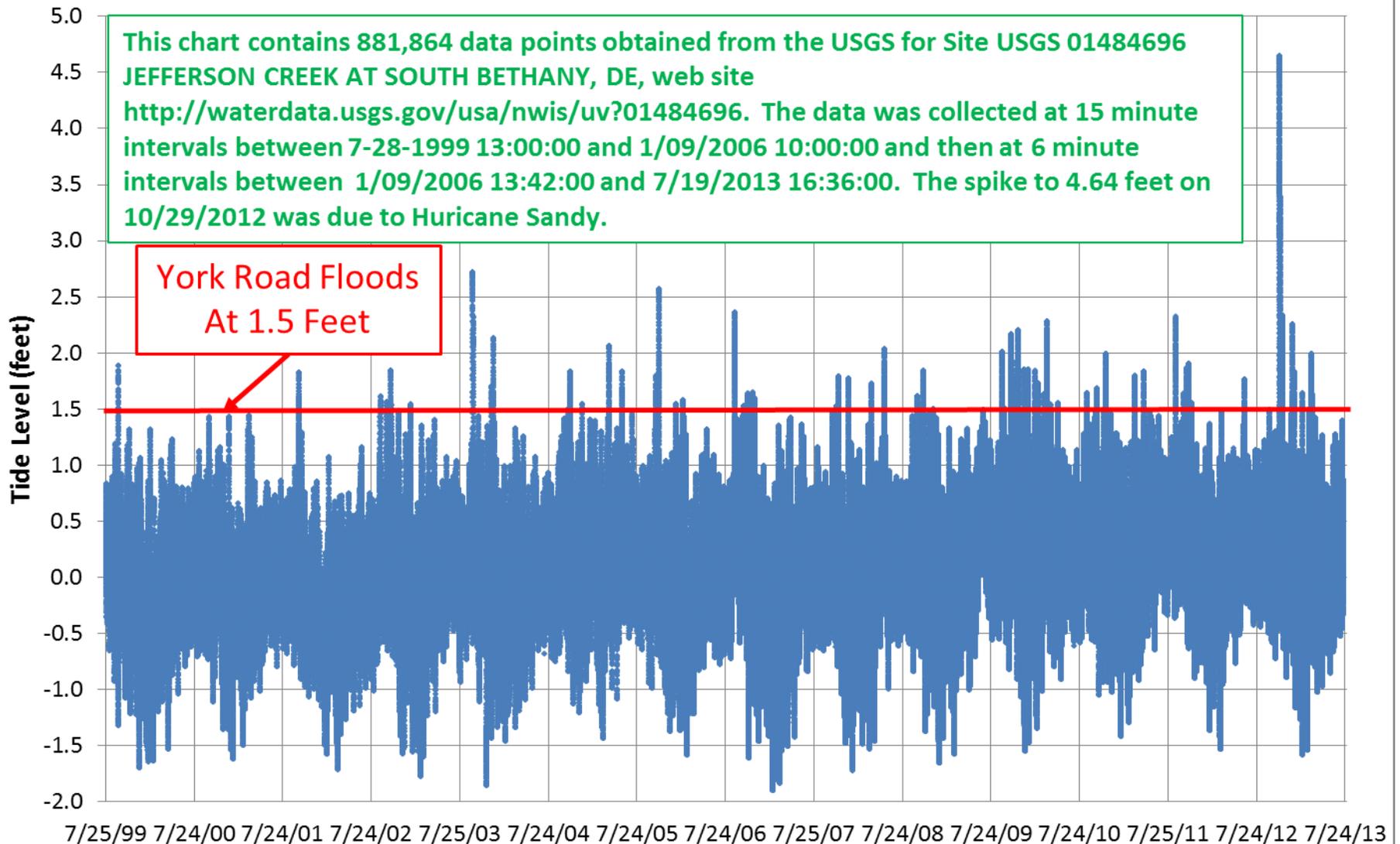
	This map, developed by the URS Corporation and funded by a grant from the DNREC Coastal Programs, may be found on the South Bethany Website.
2013 ELEVATION SURVEY	
TOWN OF SOUTH BETHANY SUSSEX COUNTY, DELAWARE	

# In July of 1999 The USGS Installed A Tide Gage At The End Of West 1<sup>st</sup> Street

- Since installation over 900,000 data points have been collected.
- Data is sent to a satellite and is available online.
- Link to website to view data <http://waterdata.usgs.gov/usa/nwis/uv?01484696>.



# 14 Years Of Tide Data Shows That York Road Floods Many Times Per Year



# Carlisle And York Roads Flood When The Tide Is Above 1.5 Feet



- In The First 10 Years Of Recorded Tide Data, Carlisle And York Roads Flooded An Average Of 2.2 Times Per Year.
- In The Last 4 Years They Flooded An Average Of 12 Times Per Year.

# We Have Well Documented History That Storm Surge Has Caused Significant Damage In The Past

Pictures From Four Significant Storms Are Included

- 1962 Nor'easter
- 1998 Nor'easter
- 2003 Nor'easter
- 2012 Hurricane Sandy

# History Tells Us That South Bethany Is Very Vulnerable To Storm Surge



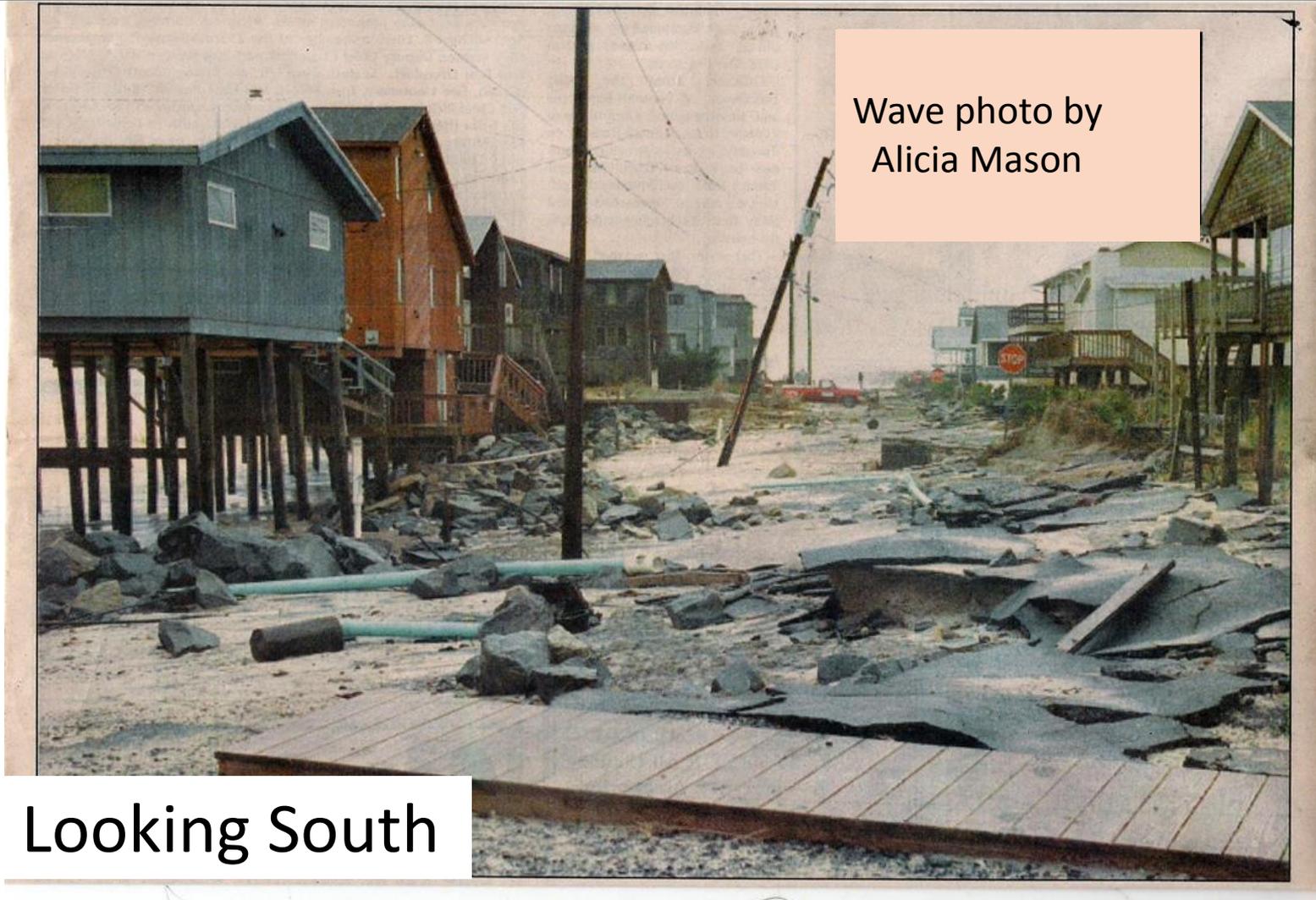
The 1962 Nor'easter Storm Surge On The Bay Side  
Was Almost As High As The Sandy Hurricane Storm Surge

# Damage To The Ocean Side Due To Nor'easters Is Very Well Documented



Ocean Drive And All Ocean Front Homes Were Destroyed In 1962

# Ocean Front Homes And Ocean Drive Were “Slammed” In 1998



# Ocean Front Was Again “Slammed” In 2003



Wave photo by

Angela Andriola

February 19, 2003

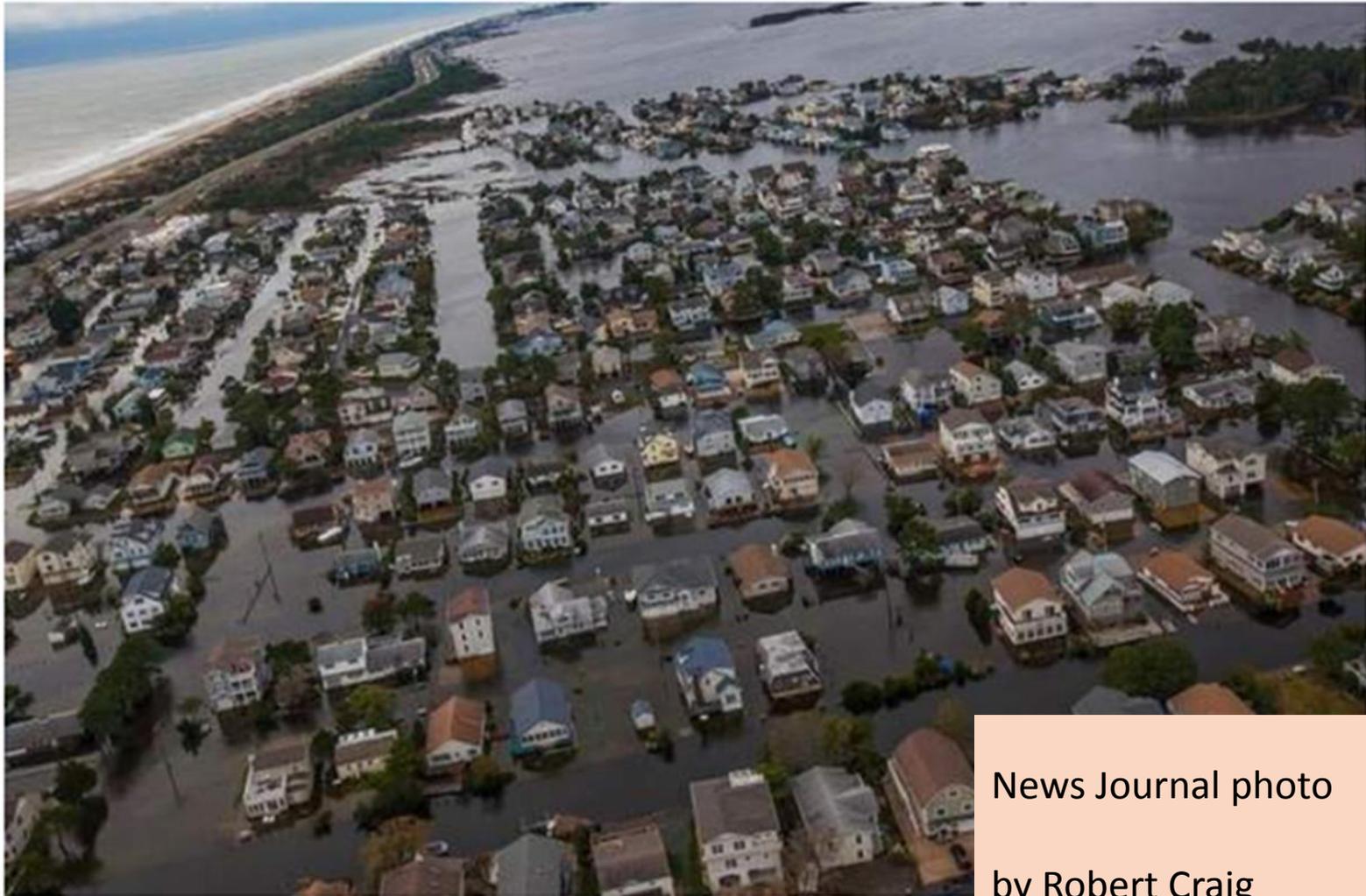
Looking North



12 WAVE FEBRUARY 19, 2003

delmarvariow.com

# Hurricane Sandy Caused More Damage On The Bay Side Than The 1962 Storm And It Caused No Damage On The Ocean Side



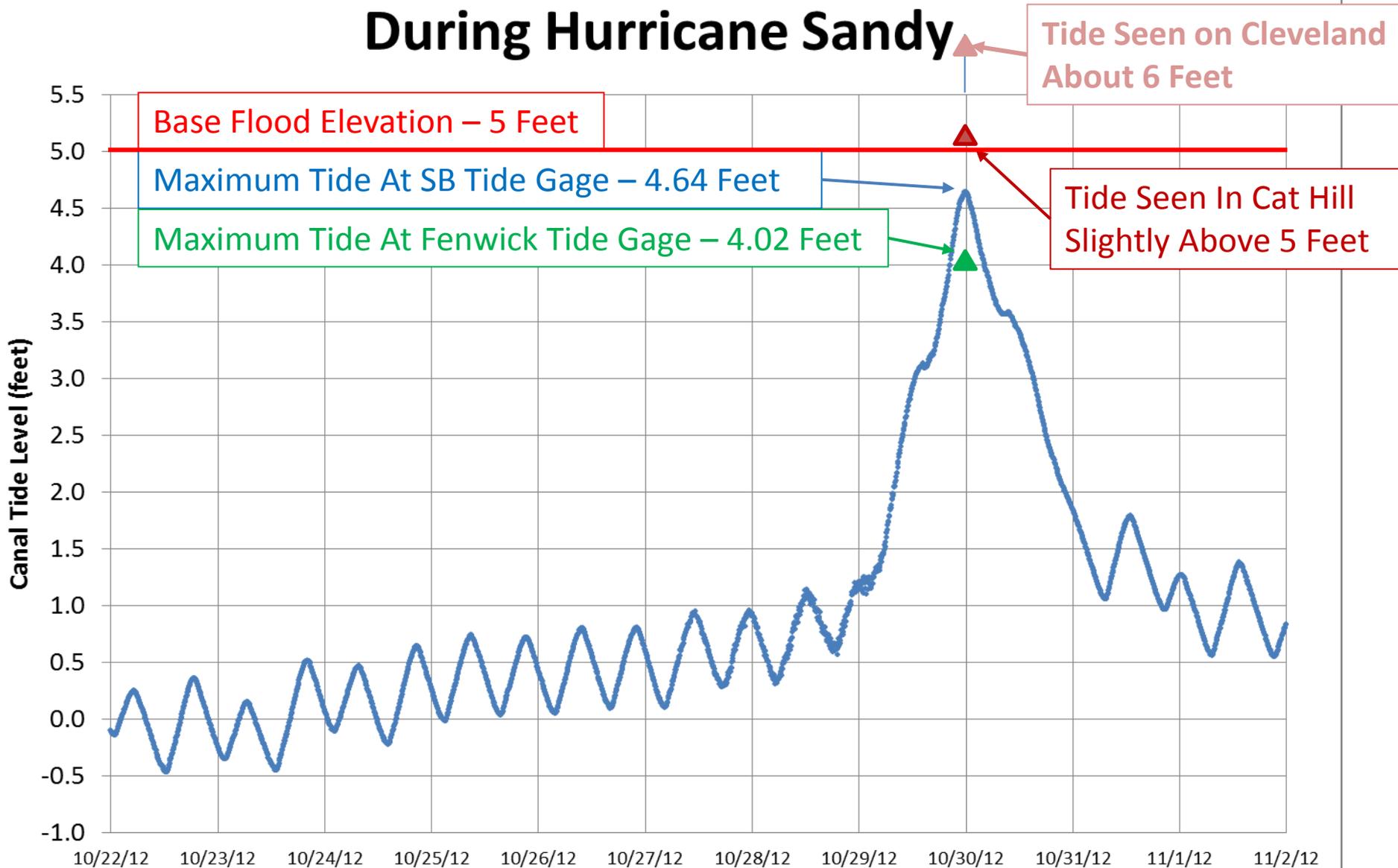
News Journal photo

by Robert Craig

# Many Homeowners On The Bay Side Had Over Two Feet Of Water Flooding Their First Floor



# South Bethany Tidal Gage Recordings During Hurricane Sandy



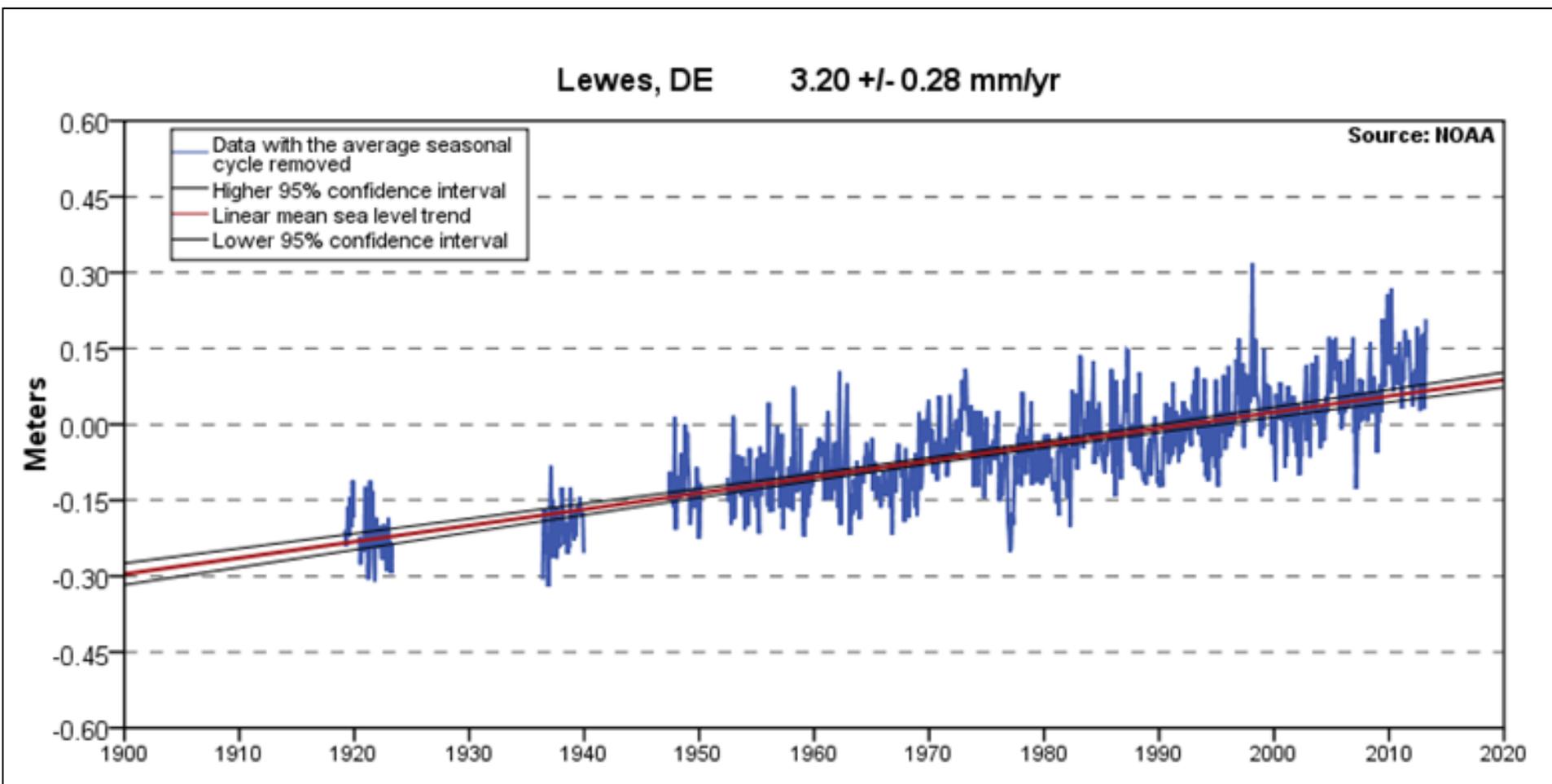
# Local Water Levels Have Been Rising Over The Past 100 Years

Historical Tide Data Is Documented For:

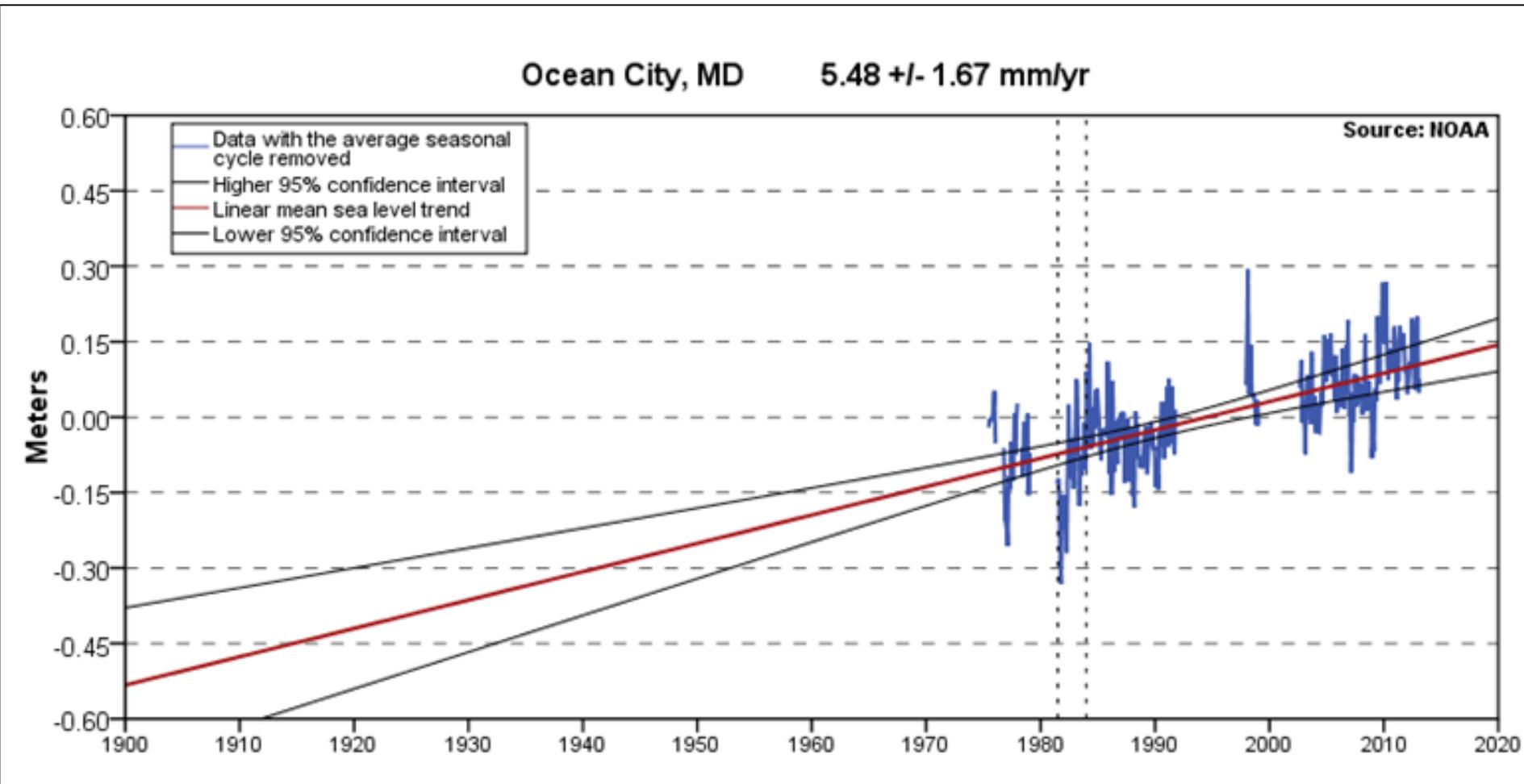
- Lewes 1.3"/10yrs. For the past 100 yrs.
- Ocean City 2.2"/10yrs. For the past 40 yrs.
- South Bethany 3.6"/10yrs. For the past 14 yrs.
- Ocean City 3.6"/10yrs. For the past 11 yrs.
- Lewes 3.1"/10yrs. For the past 11 yrs.

The Data Seems To Indicate That The Rate Of Sea Level Rise Is Increasing When Comparing Rates For The Last 100 Years To The Rates For The Last 40 Years And For The Last 11-14 Years.

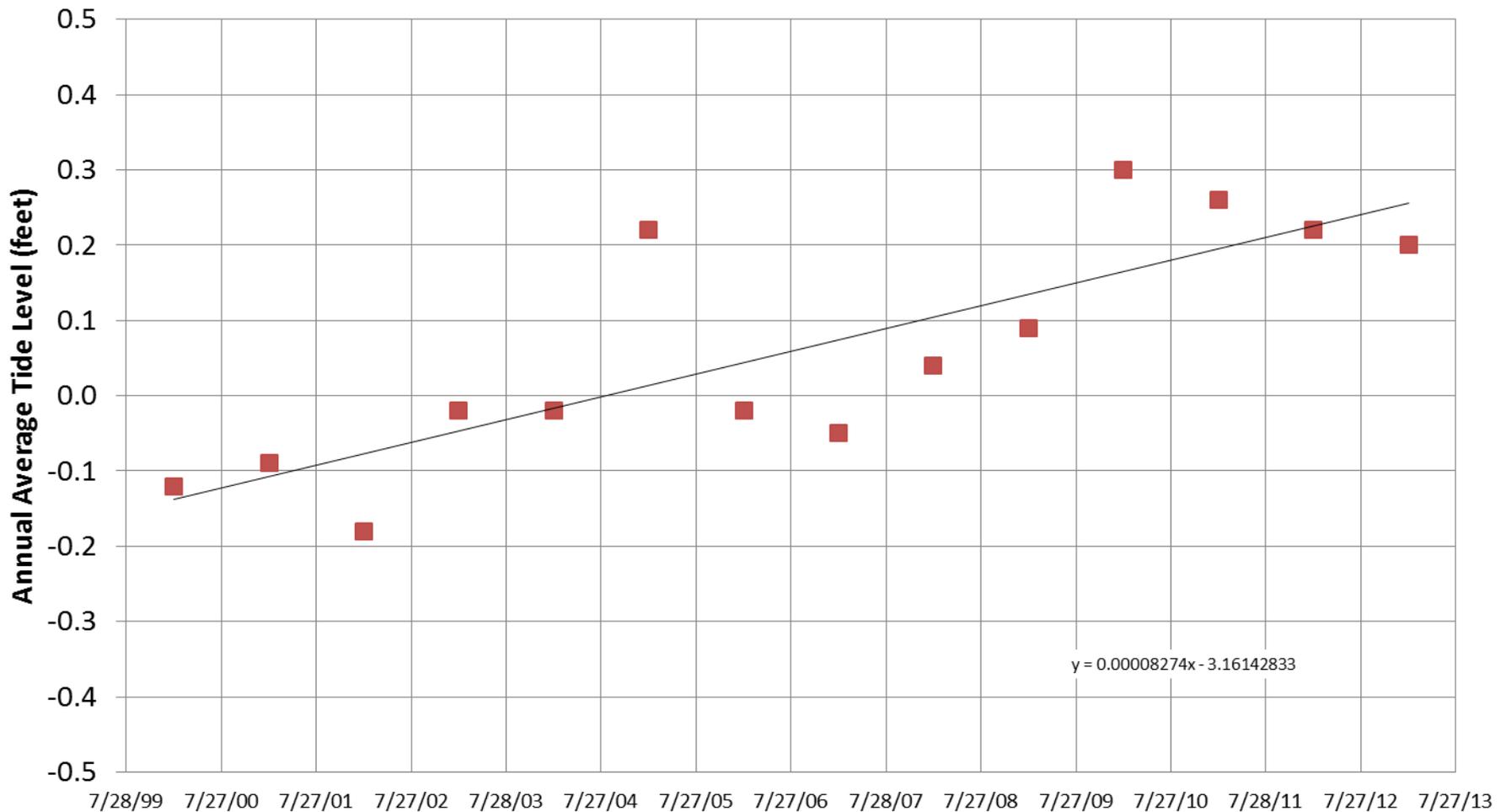
# Mean Sea Level At Lewes Has Risen 12.6 Inches In The Last 100 Years



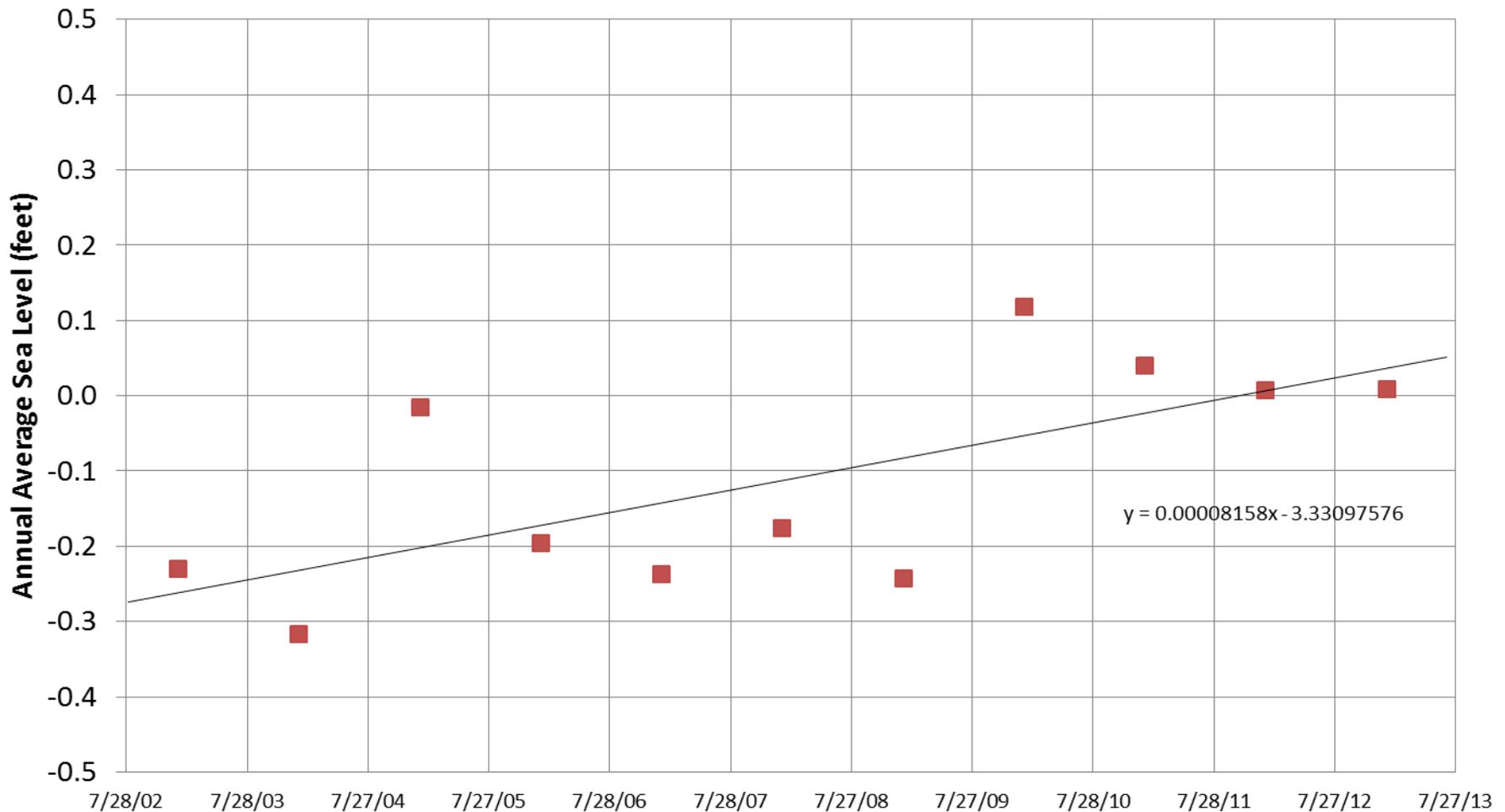
# Mean Sea Level At Ocean City Has Risen 8.8 Inches In The Last 40 Years



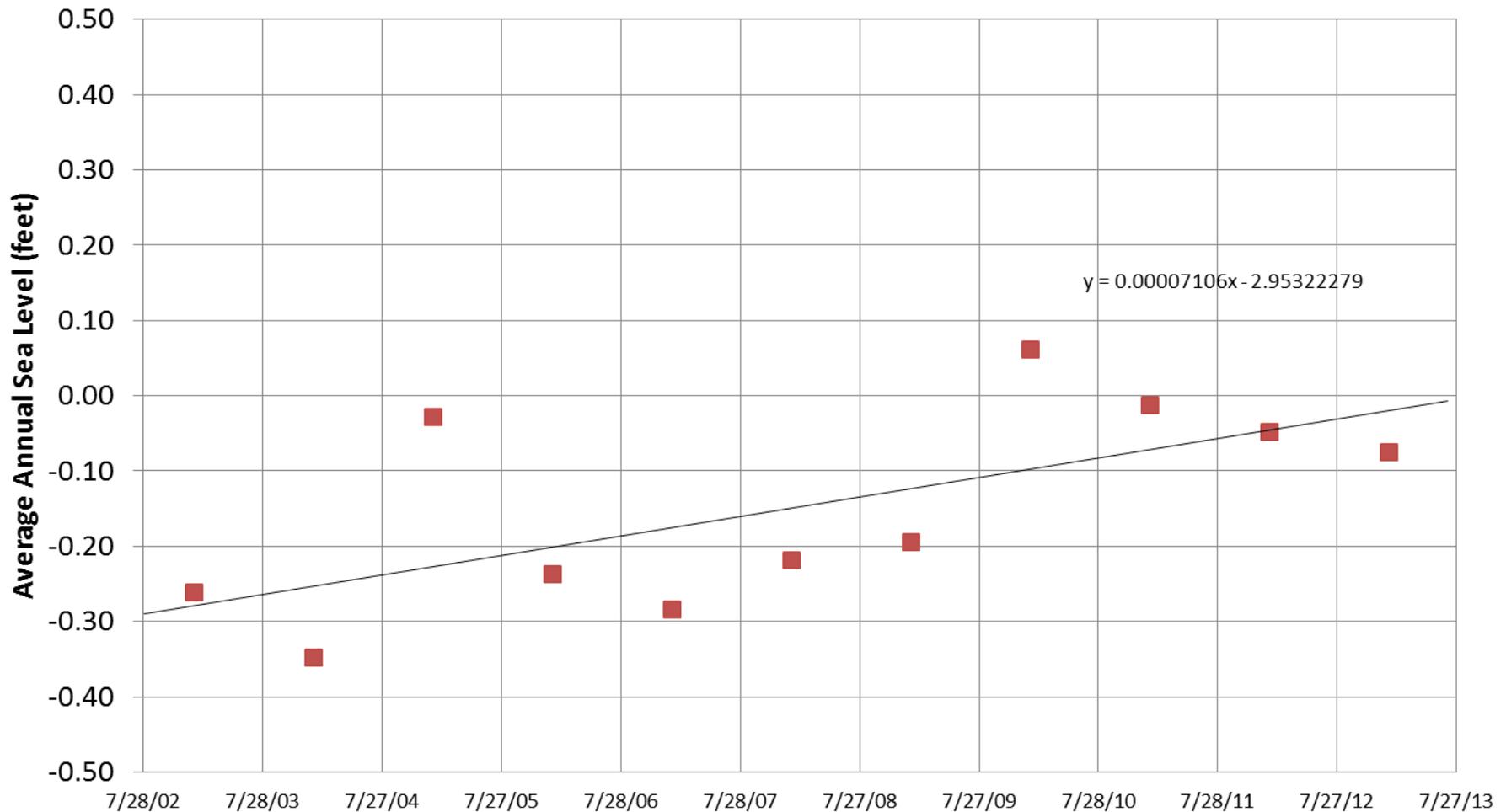
# 14 Years Of Annual Averages Show That The South Bethany Canal Average Tide Has Risen 5.1 Inches In The Last 14 Years



# 11 Years Of Annual Averages Show That Ocean City Average Tide Has Risen 3.9 Inches In The Last 11 Years

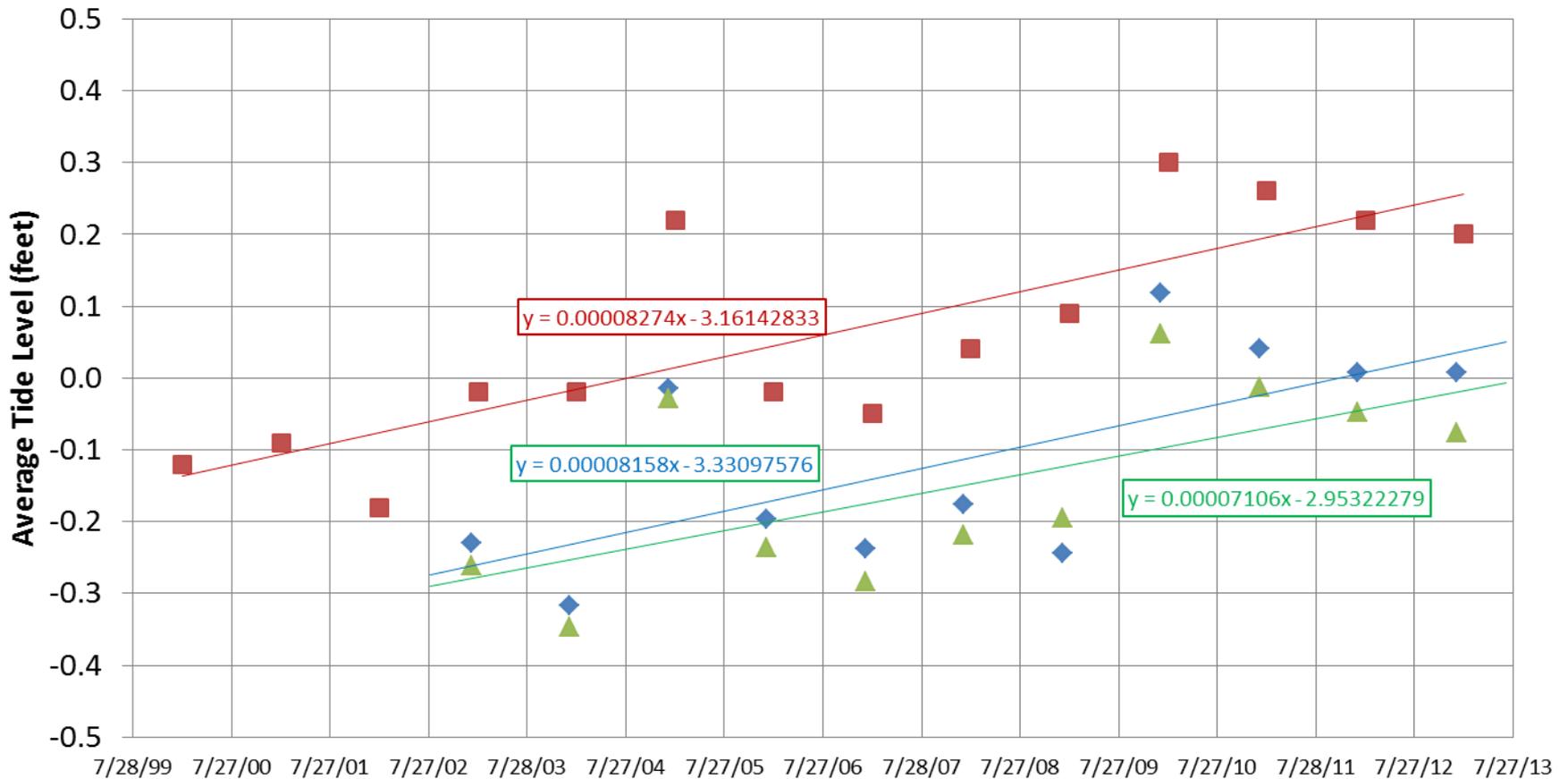


# 11 Years Of Annual Averages Show That The Lewes Average Tide Has Risen 3.4 Inches In The Last 11 Years



# Comparision Of Average Tide Levels Among The Canal, Ocean City And Lewes

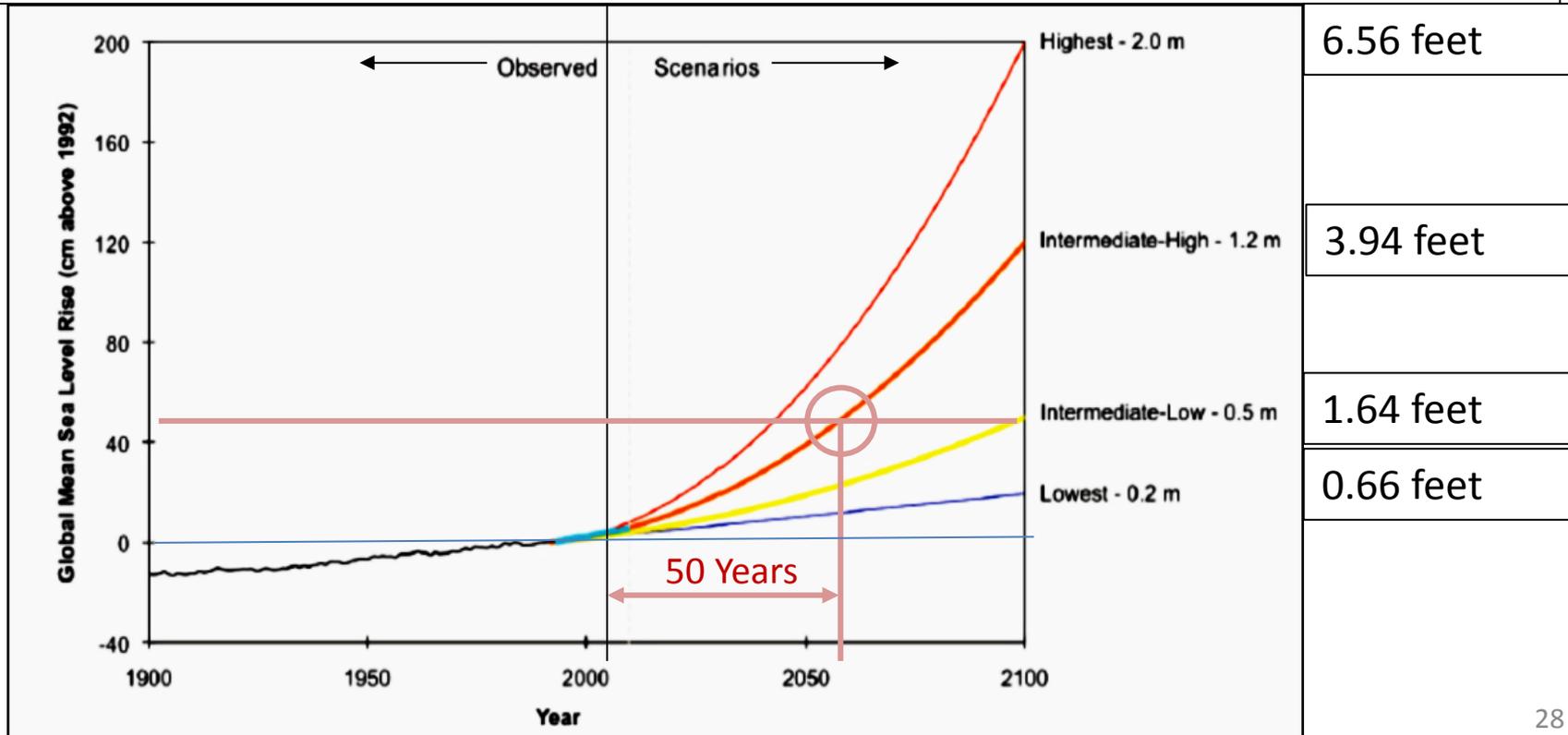
- Annual Average , SB Canals
- ◆ Annual Average, OC
- ▲ Annual Average, Lewes
- Linear (Annual Average , SB Canals)
- Linear (Annual Average, OC )
- Linear (Annual Average, Lewes)



# Local Sea Levels Are Predicted To Rise Significantly Over The Next 100 Years

# Predicting What The Sea Level Will Be In The Next 100 Years Is Debatable

- NOAA has developed four predictions ranging from 0.2 m to 2.0 m, depending on various scenarios, as shown below.
- A straight line projection for the Canal average tide level rate of rise, 3.6"/10 years or 45 centimeters (1.5 feet) in 50 years, falls right on the NOAA Intermediate – High prediction.



If the average canal water level continues to rise at the current rate (1.5 ft./50 yrs.), then 50 years from now:

- The storm surges that currently flood York Road would be at a level of 3.6 feet and cause the flooding as shown in green to the left.
- The average tide in the canals would be about 1.75 feet.
- The average tide would always flood York Road which has a elevation of 1.5 feet.



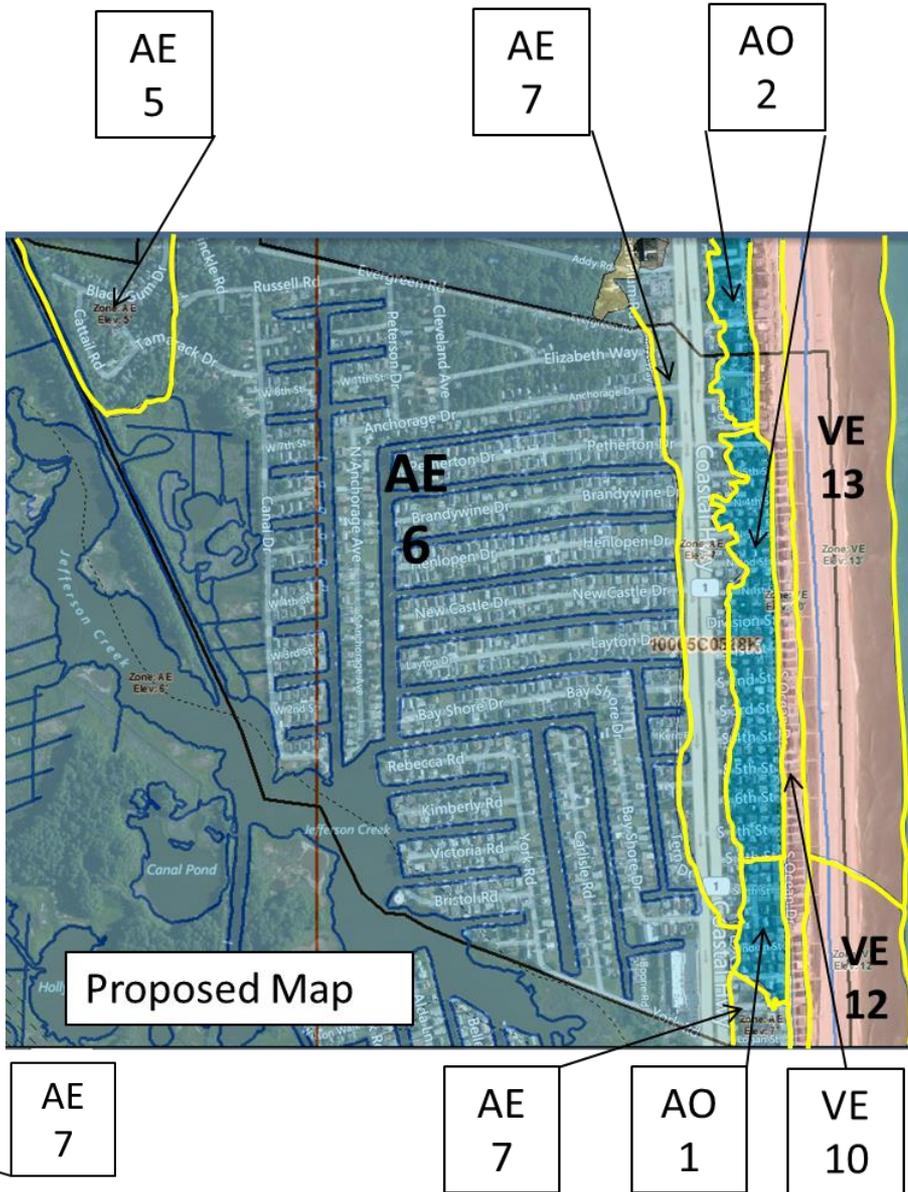
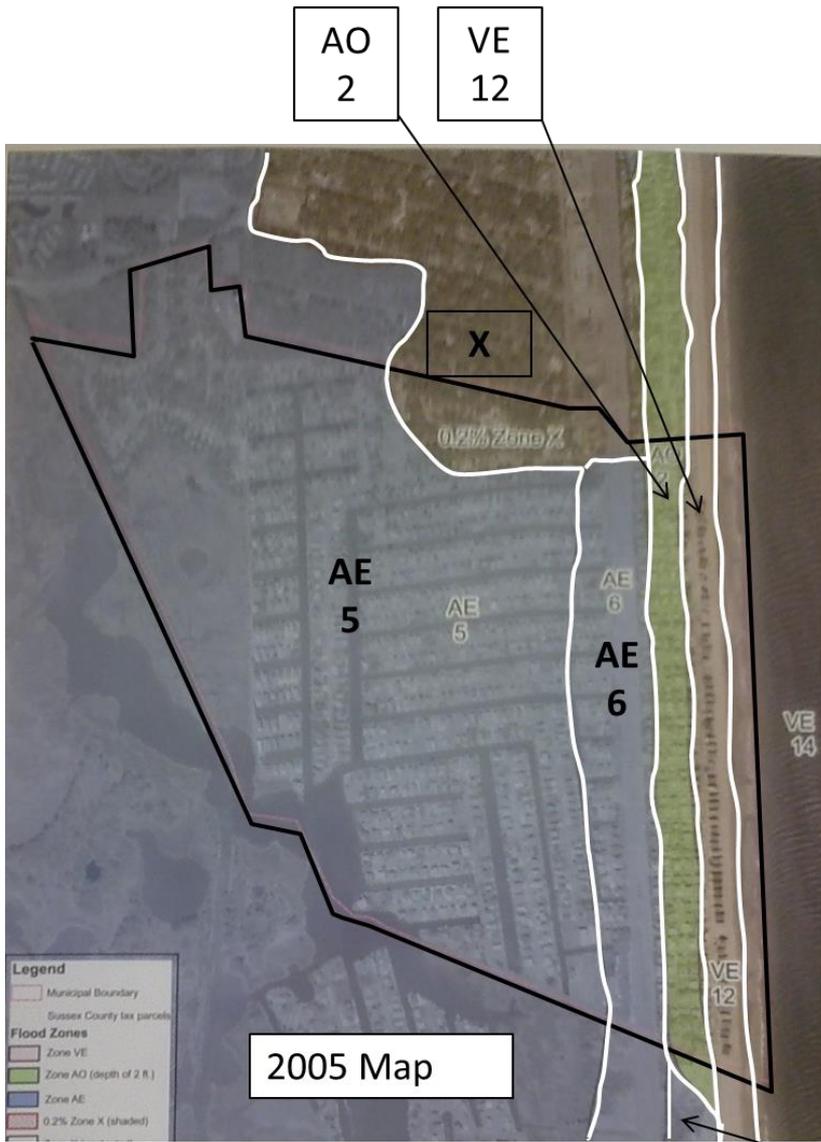
# South Bethany Can Adapt By Designing Houses With Height Margin Above The FEMA Base Flood Elevation (BFE)

This Height Margin Is Termed  
“Freeboard”

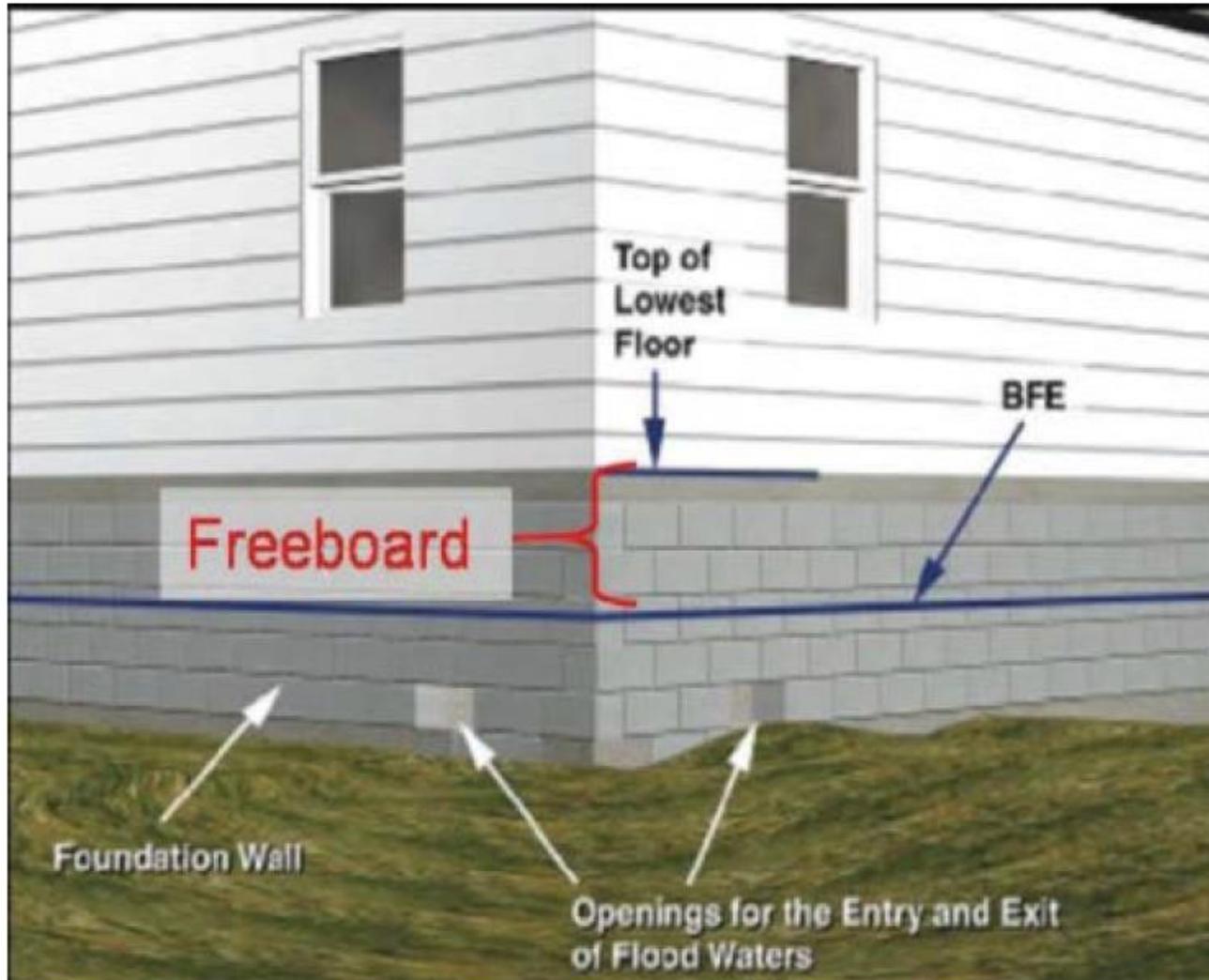
Freeboard Is Defined As:

A margin of safety added to the Base Flood Elevation to account for waves, debris, miscalculations, lack of data, or changes in climate.

# Base Flood Elevations (BFE) Are Found On Flood Insurance Rate Maps (FIRM)



# An Example Of A Home With Freeboard



# FEMA Consider Homes In A Zones Differently Than Those In V Zones (V Zone Is Ocean Front)

## Recommended Practice:



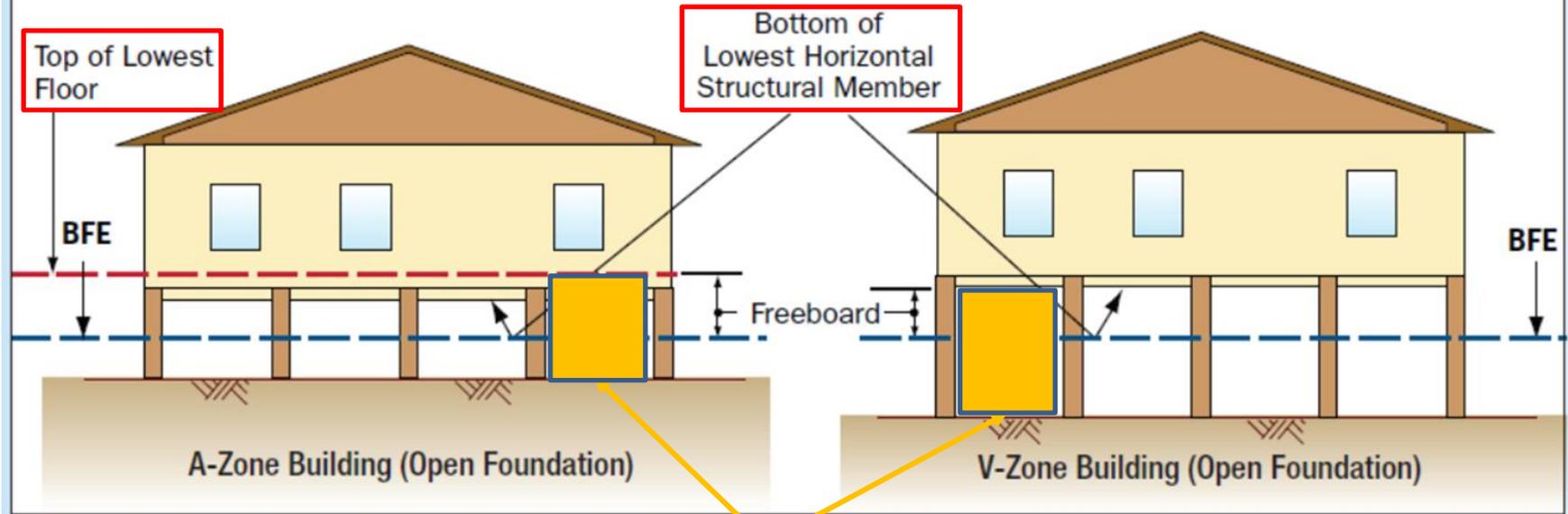
### A Zones in Coastal Areas:

Subject to Breaking Waves and Erosion During the Base Flood  
Lowest Horizontal Structural Member Above BFE (Freeboard)



### V Zones:

Bottom of Lowest Horizontal Structural Member  
Above BFE (Freeboard)



Only parking, access and storage is allowed below the lowest floor.  
Finished, habitable space is not allowed below the lowest floor.

# Freeboard Not Only Reduces Risk From Flooding, But Also Significantly Reduces National Flood Insurance Program (NFIP) Costs

## Examples of savings on NFIP1 with freeboard

	Annual savings in NFIP premiums	Savings over 30-year mortgage		Annual savings in NFIP premiums	Savings over 30-year mortgage	
Zone V <sup>2</sup>	1' freeboard	\$2,565 (33%)	\$76,950	Zone A <sup>3</sup>	\$725 (46%)	\$21,750
	2' freeboard	\$4,310 (56%)	\$129,300		\$984 (63%)	\$29,520
	3' freeboard	\$5,160 (67%)	\$154,800		\$1,074 (68%)	\$32,220

<sup>1</sup> NFIP premiums based on October 2010 rates for a one-floor residential structure with no basement built after a FIRM was issued for the community (post-FIRM rates differ from pre-FIRM rates). \$500 deductible/\$250,000 coverage for the building/\$100,000 for contents.

<sup>2</sup> Zone V: This Flood Insurance Rate Map (FIRM) designation refers to coastal areas that are subject to the highest levels of wave energy and flooding.

<sup>3</sup> Zone A: Also a FIRM designation, these areas are subject to flooding but with less wave energy than Zone V (i.e., wave heights less than 3 feet).

# Example Of A Home That Did Not Have Freeboard And Was Destroyed In 1962 Nor'easter.

It Was Replaced By One That Did Have Freeboard.

The Home Was Then Removed And Replaced By One With No Freeboard.

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Date Of Picture – 1954  
There was a dune in front of the home



Date Of Picture – 2003  
There was **no** dune in front of the home



Date Of Picture – 2013  
There is a dune in front of the home

Freeboard provides extra protection in case a storm is greater than a 100 year storm

# Example Of A Home That Did Not Have Freeboard And Was Replaced By One That Now Has Freeboard



# Example Of A House With Significant Freeboard Next To One With No Freeboard



# Older Ocean Front Homes Can Determine Their Freeboard From Medallions, Placed In The 1990s, That Mark The Base Flood Elevation



I found 31 medallions and almost all had a freeboard above the medallion of greater than 3 feet. The two smallest freeboards that I found were about 10 inches.

# A Very Typical “Crawl Space” Lift With Fill To Raise The Property – To Provide Freeboard And Prevent Lot Flooding

After a storm in 2008 that flooded the property, but not the house.

After the house was raised 3 feet and 1 foot of fill was added to the property with improved grading towards the street .



This Home Was At Ground Level And Was Inundated During Sandy. It Has Since Been Raised As Shown.



# Comparison Of Two Homes – One Without Significant Freeboard One With Significant Freeboard

Though on four courses of block, during Sandy the furnace and duct work were destroyed.

This home on pilings had virtually no damage during Sandy.



# The Bottom Line On Adaptation Is Build Homes With Freeboard

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From: Powell, Michael S. (DNREC), Division of Watershed Stewardship, Natural Hazards Program Manager

“The bottom line for me, based on providing assistance to flooded communities and property owners for the past 25 years, is this:”

- “Houses in South Bethany which are built with finished habitable space at or near the base flood elevation will sustain severe flood damage, probably repeatedly. “
- “When that flooding occurs they will wish they had taken steps to avoid being flooded, and it will be a lot more expensive at that time to redesign the house.”

# The Town Council Together With The SLR & SS And The Code & Charter Committees Are Assessing Proactive Reasonable Adaptation Responses To The SLR & SS Issues

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- Concern has been expressed on how a standard that results in raising homes would be applied when there are building height restrictions.
- The SLR & SS Committee is working with Council and the Code & Charter Committee to address the issue of increasing the maximum height restriction to encourage the building of homes with freeboard.

# Status Of Potential Code Changes

- At the Town Council Workshop Meeting on 5/22/14, the council voted to start the task to develop code changes to allow an option for higher building heights if freeboard is included in the design.

“Where freeboard of three feet or more is provided for new or improved buildings, the allowable building height may be up to 38 feet NAVD or 34 feet above the center of the road or as measured in Cat Hill.”

# Questions?

# Flood Insurance Issues

# Removing Grandfathering Was A Significant Issue Imposed By The Biggert-Waters Flood Insurance Reform Act Of 2012

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- The Grandfathering procedure provided eligible property owners the option of using risk data from previous FIRMs if a policy holder maintained continuous coverage through a period of FIRM revision or if the building was constructed “in compliance” with the requirements for the zone and BFE reflected on a previous FIRM.
- **A provision of the act, however, required FEMA to use revised flood risk data (zone and BFE) after a map revision. The legislation provided a 5-year mechanism to phase-in the new rates.** This provision impacted the Grandfather procedure and was to be implemented in the latter half of 2014.

# Senate Approves Bill To Curb Flood Insurance Rate Hikes And Reinstates Grandfathering, March 13, 2014

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- Reinstates grandfathering –If grandfathering was terminated, property owners mapped into higher risk would have to either elevate their structure or have higher rates phased in over 5 years. The new bill allows grandfathering to continue and sets hard caps on how high premiums can increase annually
- Repeals the property sales trigger – Repeals the provision that required homebuyers to pay the full-risk rate for pre-FIRM properties at the time of purchase.
- Repeals the new policy sales trigger – Repeals the provision in BW-12 that required pre-FIRM property owners to pay the full-risk rate if they voluntarily purchase a new policy.

# What is Covered Below The Lowest Elevated Floor?

8. Items of property in a **building** enclosure below the lowest elevated floor of an **elevated post-FIRM building** located in Zones A1-A30, AE, AH, AR, AR/A, AR/AE, AR/AH, AR/A1-A30, V1-V30, or VE, or in a **basement**, regardless of the zone. Coverage is limited to the following:
- a. Any of the following items, if installed in their functioning locations and, if necessary for operation, connected to a power source:
- (1) Central air conditioners;
  - (2) Cisterns and the water in them;
  - (3) Drywall for walls and ceilings in a **basement** and the cost of labor to nail it, unfinished and unfloated and not taped, to the framing;
  - (4) Electrical junction and circuit breaker boxes;
  - (5) Electrical outlets and switches;
  - (6) Elevators, dumbwaiters, and related equipment, except for related equipment installed below the **base flood** elevation after September 30, 1987;
  - (7) Fuel tanks and the fuel in them;
  - (8) Furnaces and hot water heaters;
  - (9) Heat pumps;
  - (10) Nonflammable insulation in a **basement**;
  - (11) Pumps and tanks used in solar energy systems;
  - (12) Stairways and staircases attached to the **building**, not separated from it by elevated walkways;
  - (13) Sump pumps;
  - (14) Water softeners and the chemicals in them, water filters, and faucets installed as an integral part of the plumbing system;
  - (15) Well water tanks and pumps;
  - (16) Required utility connections for any item in this list; and
  - (17) Footings, foundations, posts, pilings, piers, or other foundation walls and anchorage systems required to support a **building**.
- b. Clean-up.

But They Do Need To Be Above The Base Flood Elevation  
Per The South Bethany Code

# To Understand Your Insurance Risks You Must Have An Elevation Certificate

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) RESIDENTIAL

A5. Latitude/Longitude: Lat. N 38° 30' 48.20" Long. W 075° 03' 30.41"

Horizontal Datum:  NAD 1927  NAD 1983

A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance.

A7. Building Diagram Number 9

A8. For a building with a crawlspace or enclosure(s):

- a) ~~Square footage of crawlspace or enclosure(s)~~ 889 sq ft
- b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade 0
- c) Total net area of flood openings in A8.b 0 sq in
- d) Engineered flood openings?  Yes  No

A9. For a building with an attached garage:

- a) Square footage of attached garage 311 sq ft
- b) Number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade 0
- c) Total net area of flood openings in A9.b 0 sq in
- d) Engineered flood openings?  Yes  No

## SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1. NFIP Community Name & Community Number  
100051- SOUTH BETHANY

B2. County Name  
SUSSEX

B3. State  
DELAWARE

B4. Map/Panel Number  
10005 C 0520

B5. Suffix  
J

B6. FIRM Index Date  
01 / 06 / 05

B7. FIRM Panel Effective/Revised Date  
01 / 06 / 05

B8. Flood Zone(s)  
AE

B9. Base Flood Elevation(s) (Zone AO, use base flood depth)  
5

B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9:

- FIS Profile  FIRM  Community Determined  Other/Source: \_\_\_\_\_

B11. Indicate elevation datum used for BFE in Item B9:  NGVD 1929  NAVD 1988  Other/Source: \_\_\_\_\_

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)?  Yes  No

Designation Date: \_\_\_\_\_  CBRS  OPA

## SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on:  Construction Drawings\*  Building Under Construction\*  Finished Construction

\*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1–A30, AE, AH, A (with BFE), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/A below according to the building diagram specified in Item A7. In Puerto Rico only, enter meters.

Benchmark Utilized: DICARLO RTN

Vertical Datum: NAVD 1988

Indicate elevation datum used for the elevations in items a) through h) below.  NGVD 1929  NAVD 1988  Other/Source: \_\_\_\_\_

Datum used for building elevations must be the same as that used for the BFE.

- Check the measurement units for each elevation:
- a) Top of bottom floor (including basement, crawlspace, or enclosure floor) 2.5  feet  meters
  - b) Top of the next higher floor 5.7  feet  meters
  - c) Bottom of the lowest horizontal structural member (V Zones only) NA  feet  meters
  - d) Attached garage (top of slab) 3.5  feet  meters
  - e) Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments) 5.5  feet  meters
  - f) Lowest adjacent (finished) grade next to building (LAG) 3.4  feet  meters
  - g) Highest adjacent (finished) grade next to building (HAG) 3.5  feet  meters
  - h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support 3.1  feet  meters

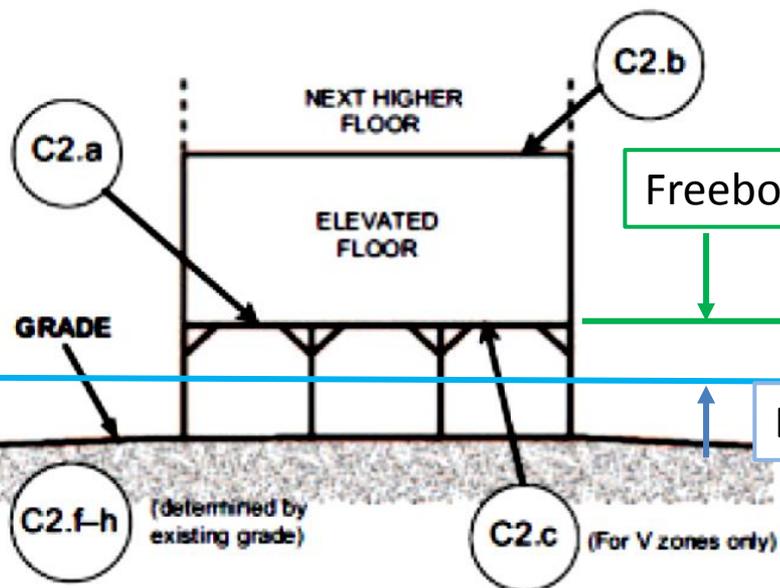
For South Bethany  
The Zones That  
Apply Are:  
AE, AO, VE, And X

**C2.a (Top of Bottom Floor) And C.2b (Top Of The Next Higher Floor)  
 Depends On Whether There Is An Enclosed Space  
 (Crawl Space Or Enclosed Floor) Beneath The Elevated Floor.  
 C2.c (Bottom Of Lowest Horizontal Structure) Is Applicable To The V Zone  
 A8.a-c Applies To An Enclosure Below The Elevated Floor**

**DIAGRAM 5**

**All buildings elevated on piers, posts, piles, columns, or parallel shear walls. No obstructions below the elevated floor.**

**Distinguishing Feature** – For all zones, the area below the elevated floor is open, with no obstruction to flow of floodwaters (open lattice work and/or insect screening is permissible).



**DIAGRAM 6**

**All buildings elevated on piers, posts, piles, columns, or parallel shear walls with full or partial enclosure below the elevated floor.**

**Distinguishing Feature** – For all zones, the area below the elevated floor is enclosed, either partially or fully. In A Zones, the partially or fully enclosed area below the elevated floor is with or without openings\*\* present in the walls of the enclosure. Indicate information about enclosure size and openings in Section A – Property Information.

