# HURRICANE SALLY:
## *IMPACTS AND OPPORTUNITIES FOR NW FLORIDA*

healthy gulf

September 16, 2021

## Introduction

Hurricane Sally came ashore as a category 2 storm at 4:45 a.m on September 16, 2020 at Gulf Shores, AL. Maximum sustained winds at landfall were 110 mph, and the impacts of heavy rains, wind and storm surge were felt mainly to the east—including in the west Florida counties of Escambia and Santa Rosa.

The storm damaged thousands of structures in the two county area, mainly due to wind and rain. Tropical weather is a normal occurrence along the northern Gulf coast, and each storm offers the opportunity to take a critical look at impacts and how the community can do better in the next storm.

As an organization that is focused on protecting the health of waterways and communities, Healthy Gulf chose to investigate land use/development practices and policies and regulations and how they relate to the impacts from Hurricane Sally. Policies that help to protect residents and businesses from the impacts of flooding and extreme weather events, can also be protective of water quality and the natural environment. In making communities more resilient against flooding, there are also opportunities to help to correct disparities in impacts resulting from long-term societal issues such as poverty and unequal access to environmental protections.

We chose to seek answers to a few fundamental questions, including:

How did the storm impact socially-vulnerable populations?

How do the areas and people most impacted by Hurricane Sally relate to areas designated by the Federal Emergency Management Agency as flood hazard areas?

How do flood impacts compare between older communities and those built under newer stormwater and flood requirements?

How much of a factor was climate change in the impacts of the storm?

What opportunities are there to improve Federal, State and local programs, policies and laws so as to better protect people, communities and waterways?

## Meteorological observations

Hurricane Sally brought maximum wind gusts ranging from 75 – 92 mph across Escambia and Santa Rosa Counties, placing the storm's strength at a Category 1 level in the two-county area after landfalling in Gulf Shores, AL as a Category 2 storm.

| Location | Wind Gust (mph) | Date | Time | Instrument |
|---|---|---|---|---|
| Fort Morgan* | 121 | 16-Sep | 442am | NOS-PORTS |
| Buoy 42012 | 110 | 16-Sep | 1210am | NDBC |
| Dauphin Island | 104 | 16-Sep | 506am | NOS-PORTS |
| Dauphin Island | 99 | 16-Sep | 319am | NDBC |
| Elberta | 99 | 16-Sep | 414am | CHILI |
| Gulf Shores | 93 | 16-Sep | 253am | WeatherFlow |
| Foley | 93 | 16-Sep | 345am | WeatherFlow |
| NAS Pensacola (NPA) | 92 | 16-Sep | 618am | AWOS |
| West Mobile (KMOB) | 82 | 16-Sep | 635am | ASOS |
| 1.0 NE Pace | 82 | 16-Sep | 140am | WeatherSTEM |
| 2.3 N Brent, FL | 81 | 16-Sep | 710am | WeatherSTEM |
| 2.1 NE Bellview | 81 | 16-Sep | 450am | WeatherSTEM |
| 0.7 W Gonzalez | 80 | 16-Sep | 1100am | WeatherSTEM |
| 0.8 N Myrtle Grove | 78 | 16-Sep | 910am | WeatherSTEM |
| 2 S Navarre | 78 | 16-Sep | 120am | WeatherSTEM |
| 2.3 N Ferry Pass | 77 | 16-Sep | 710am | WeatherSTEM |
| Foley | 76 | 16-Sep | 344am | CHILI |
| Gulf Breeze | 76 | 16-Sep | 609am | WeatherFlow |
| Mobile Downtown (KBFM) | 75 | 16-Sep | 608am | ASOS |
| 1.6 E Bratt, FL | 75 | 16-Sep | 220am | WeatherSTEM |

Rainfall totals from 7am September 14 through 7am September 17 show a range of from 12.74 inches in northern Santa Rosa County to 24.88 inches at Pensacola NAS.

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...Escambia County...
NAS Pensacola 4 W            24.88 in   SPOTTER
Pensacola 1.9 NE             22.25 in   COCORAHS
Pensacola                    22.12 in   URBANET
Pensacola 18.9 WSW           19.86 in   COCORAHS
Pensacola 4.7 N              19.61 in   COCORAHS
Pensacola 6.4 N              17.74 in   COCORAHS
1 SSE Brownsville            14.53 in   URBANET
Goulding                     13.64 in   URBANET
Century 12.1 W               12.74 in   COCORAHS

...Santa Rosa County...
Navarre                      19.95 in   PUBLIC
Gulf Breeze                  18.97 in   PUBLIC
Pace                         15.07 in   PUBLIC
Jay                          14.16 in   USA Mesonet
Milton 2.9 NW                13.05 in   COCORAHS
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Post storm measurements found a storm surge as high as 7 – 9 feet occurred in upper Escambia and Blackwater Bays, with the highest directly-recorded storm surge occurring in Pensacola at 5.6 feet. This was the third highest storm surge ever measured in Pensacola, surpassed only by Hurricane Ivan in 2004 and the 1926 hurricane. (1)

| Location | Peak Inundation (ft, MHHW) | Time (Z) | Date |
|---|---|---|---|
| Pensacola* | 5.60 | 1154 | 16-Sep |
| Dauphin Island | 3.10 | 1536 | 15-Sep |
| Bayou La Batre | 2.38 | 1630 | 15-Sep |
| East Fowl River | 2.34 | 1918 | 15-Sep |
| Weeks Bay | 2.19 | 1536 | 16-Sep |
| Dog River | 1.99 | 1748 | 15-Sep |
| Coast Guard Sector, Mobile | 1.95 | 1654 | 15-Sep |
| West Fowl River | 1.83 | 1648 | 15-Sep |
| Mobile State Docks | 1.60 | 1712 | 15-Sep |
| Chicasaw Creek | 1.35 | 1748 | 15-Sep |

**Note: Inundation at the Pensacola gauge was the 3rd highest storm surge on record for that location. The only higher water levels were: 9.54 ft MHHW during 2004 Hurricane Ivan and 7.42 ft MHHW during the 1926 Miami Hurricane.*


*Flooding at Ninth Ave. and East Romana St in Pensacola during Hurricane Sally.*

It is important to note some distinctions between Hurricane Sally and the April 30 – May 1 2014 flood event that caused severe flooding in northwest Florida and south Alabama. As a tropical system that also included a storm surge and high winds, Sally caused flood levels to be higher in certain tidally-influenced areas than would have been the case with rainfall alone. The 2014 event also brought a higher intensity of rainfall, as more rain fell over a shorter period of time and that resulted in larger numbers of flooded structures in the 2014 event.

## Impacts on natural systems

Massive negative impacts on surface water quality were caused by Hurricane Sally as intense rainfall sent millions of gallons of contaminated stormwater runoff across lawns, parking lots, streets and other developed areas and into nearby waterways. Those pollutants included lawn and garden chemicals, sediment, nutrients (phosphorus and nitrogen) bacteria and pathogens from flooded septic systems and overflowed domestic wastewater infrastructure, and others. While these impacts are known to have occurred, it is not possible to easily quantify the breadth of impacts from those pollutants in the absence of comprehensive sampling and testing in the days following the storm.

One form of Sally-related pollution that can more easily be measured is the number of sanitary sewer overflows, which occur when wastewater infrastructure such as lift stations and pipes are inundated with rainwater. This excess volume of water causes untreated sewage to backup and overflow into streets and nearby waterways, putting human and environmental health at risk from pathogens and elevated levels of nutrients that cause algal blooms in waterways.

The Emerald Coast Utilities Authority (ECUA) provides wastewater services in most of southern Escambia County and the City of Pensacola. ECUA reported 90 sanitary sewer overflows that discharged over 354,000 gallons of raw sewage, with most of it reaching nearby bays and bayous.

After many years of ECUA's failure to adequately maintain its wastewater collection system resulted in excessive instances of sanitary sewer overflows, the Florida Department of Environmental Protection mandated that upgrades be made through a 2012 consent order with the utility. In the nine years since commencement of the order the utility has made various improvements to its system as part of planned upgrades that will take more than two decades to complete. It is quite likely that even with the large number of sanitary sewer overflows that occurred with the passage of Sally, that the incidence of overflows would have been worse in the absence of recent upgrades to the system.

It is important to note that natural systems such as forests, wetlands, beaches and dunes are well-adapted to hurricanes. While Hurricane Sally downed trees and flattened sand dunes, those changes are part of the ecology of natural systems and are not cause for concern. For example, on local coastal barriers such as Santa Rosa Island and Perdido Key, storm surges from Sally had the effect of pushing sand from the Gulf side of these lands toward the sound/lagoon side, helping these areas migrate landward in the face of sea level rise.

## Impacts on human communities

Healthy Gulf reviewed Hurricane Sally damage reports collected by local governments in Escambia and Santa Rosa Counties along with the City of Pensacola. While there were some variations in data collection among the three jurisdictions, all reported damage to residential and commercial structures is shown in Table 1 and Figure 1 below.

| Area | Damage Reports Analyzed | Categories Included |
|---|---|---|
| Escambia County | 1622 | Residential, Commercial |
| Santa Rosa County | 1527 | Residential, Commercial |
| City of Pensacola | 542 | Residential, Commercial, Public Facility |

*Table 1*

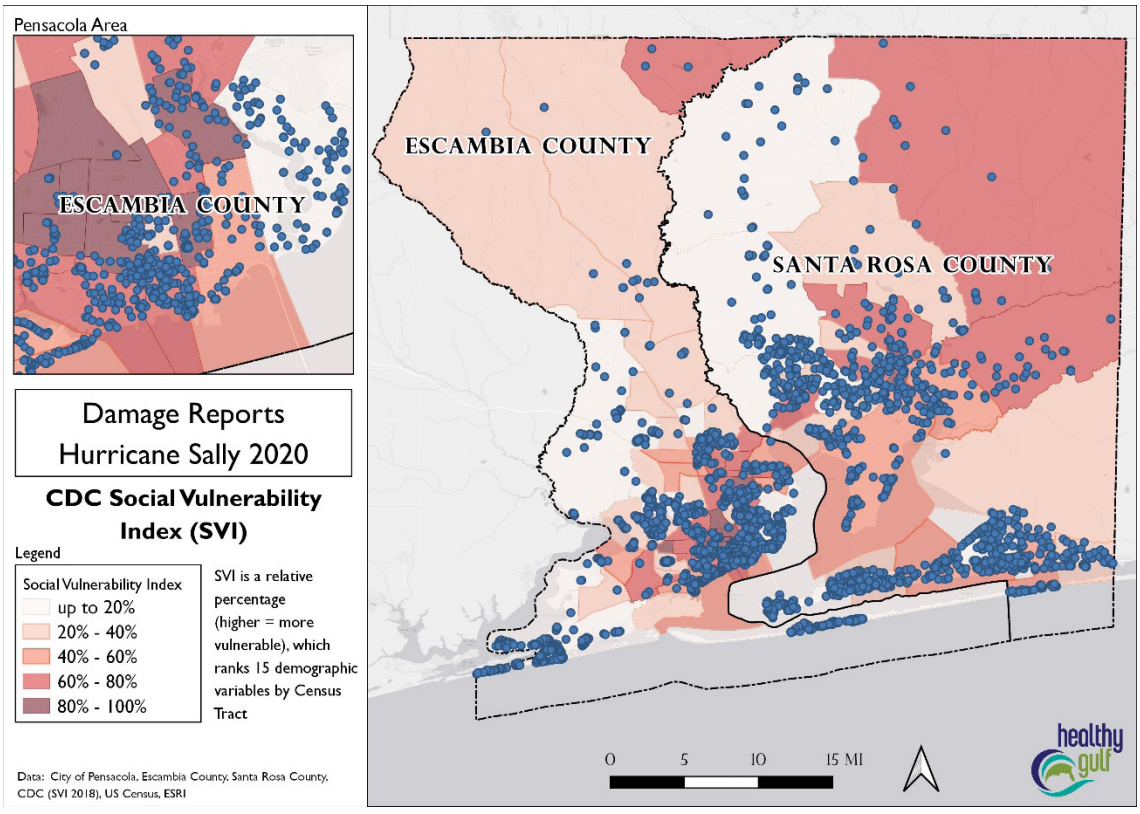


*Figure 1*

## Impacts on vulnerable populations

In order to assess whether storm damages were disproportionately impacting vulnerable populations, we compared local damage reports to the Center for Disease Control and Prevention's (CDC) social vulnerability index (SVI) for the area. The index "uses 15 U.S. census variables to help local officials identify communities that may need support before, during, or after disasters." Those 15 variables fall into four larger categories: socioeconomic status, household composition and disability, minority status and language, and housing type and transportation. The results appear in Chart 1 below.

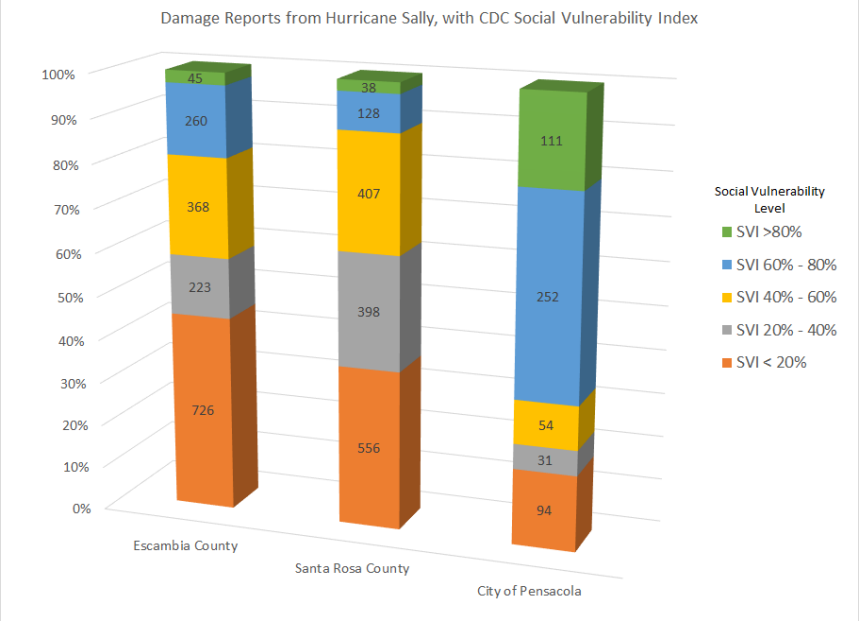


*Chart 1*

The clearest trend that emerged in this analysis is the exceptional amount of damage reports in the two highest SVI categories inside the City of Pensacola, representing 67% of all damage reports inside the city. In Escambia County only 19% of damage reports occurred in the two highest SVI categories, while in Santa Rosa the number was 11%. The disproportionate impacts in Pensacola could be a reflection of greater numbers of older, poorly-maintained housing stock in areas of high social vulnerability. This disparity warrants a more detailed investigation.

## Damage reports compared to FEMA flood zones

The Federal Emergency Management Agency (FEMA) publishes maps showing flood areas (both 100 year and 500 year floodplains) and flood risk nationwide, including in the two-county area of Northwest Florida. These maps drive the National Flood Insurance Program (NFIP) in which government-backed flood insurance is made available. Escambia and Santa Rosa Counties and the City of Pensacola participate in FEMA's Community Rating System (CRS), "a voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum requirements of the NFIP."

Healthy Gulf reviewed Sally damage reports and how their location compared to the distribution of FEMA-designated flood zones. The results are in Table 3 below.

| Area | Damage Reports Analyzed | Damage Reports: 100 yr | Damage Reports: FEMA 500 yr | Damage Reports: Minimal Flood Risk | Damage Reports: Floodways |
|---|---|---|---|---|---|
| Escambia County | 1622 | 805 | 87 | 730 | 0 |
| Santa Rosa County | 1527 | 444 | 35 | 1032 | 16 |
| City of Pensacola | 542 | 77 | 0 | 465 | 0 |

*Table 2* Damage Reports in FEMA flood zones. FEMA flood zones included in 100 year flood are: A, AE, AH, AO and VE. FEMA flood zones included in 500 year flood zone included X 0.2% Flood Risk. FEMA flood zones included in minimal flood risk included X Minimal Flood Zone.

The most meaningful review of these reports can be made for Santa Rosa County, as it is the only jurisdiction that distinguished between flood damage and wind damage in its reporting. In Santa Rosa County, 427 damage reports are classified as "flood" related (out of a total of 1527). Of those, 217 (51%) are within the 100 year flood zone, 12 (3%) are within the 500 year flood zone and 186 (44%) are within the minimal risk flood zone.

That means that an astonishing 44% of flood incidents in Santa Rosa County occurred outside of FEMA-designated flood zones. This mirrors a trend seen nationwide in which many incidents of flooding occur outside of FEMA flood zones, reflecting limitations in the ability of FEMA's modeling to capture flood events that are geographically isolated in that they are not directly associated with adjacent surface waters such as rivers and bays. FEMA flood maps also do not account for climate change and the rising seas and more intense rain events that come with it.

For those areas that do occur inside FEMA flood zones, the designation does bring benefits in terms of notification of flood risk. For example, in downtown Pensacola's Tanyard neighborhood most of the area has been in a FEMA-designated flood zone for decades, and new structures built over that time have had to meet requirements to be elevated above the level of flood that has a 1% chance of occurring in any year (the 100 year flood).

These FEMA maps are publicly available online and are an easy way for those considering moving into the neighborhood to check flood risk and to make a well-informed decision as to whether they choose to accept that risk. Furthermore, for those buyers who do not complete full due diligence before their purchase and are unaware of flood risk, any Federally-backed mortgage requires that flood insurance be purchased as a condition of the purchase of a home in a FEMA-designated flood zone. This helps to ensure that those who do choose to live in FEMA-designated flood areas are at least insured against flood damage and are aware of flood risk.

In terms of FEMA requirements and the Community Rating System (CRS), local governments can choose to implement various measures to reduce flood risk and gain discounts for residents who do purchase Federal flood insurance. Each community is issued a score from 1 – 10 on the CRS, with lower numbers representing a better score that achieves higher flood insurance discounts. Escambia County has a CRS score of 6 (20% discount), Santa Rosa County has a CRS score of 5 (25% discount), while Pensacola scores a 7 (15% discount).

### Flooding and new development—Santa Rosa County

With flood-specific incident reports available in Santa Rosa County, this allowed the opportunity to take a closer look at the age of structures impacted by flooding in Sally. The question we sought to answer was whether newer structures were less likely to be flooded than older ones.

Santa Rosa County has significant flood issues that regularly impact residents in heavy rainfall events, and County officials often state that these flood problems occur in areas built before recent flood requirements were instituted. Therefore, they maintain, flooding is much less common for structures built in recent years.

Two significant flood-related upgrades have occurred in Santa Rosa County's codes over the past 25 years. In 1996 the County implemented a 100 year stormwater retention standard for subdivisions and commercial developments. In 2005 the County instituted a requirement that new structures built in flood zones be elevated at least 3' above the base flood elevation (100 year flood).

The results of the analysis appear in the histograms below. Chart 2 shows the year-built distribution of all structures in Santa Rosa County.

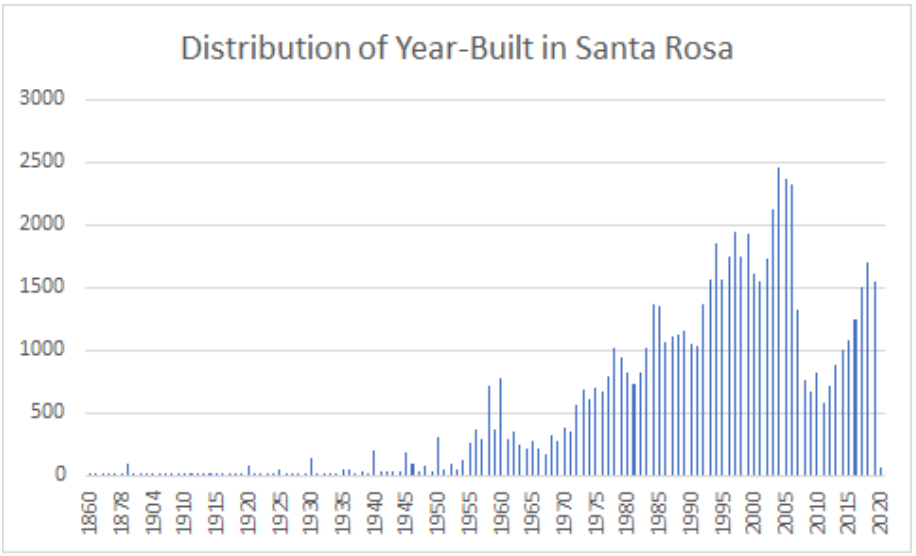


*Chart 2*

Chart 3 displays the year-built distribution of only those structures that flooded during Sally.

The analysis shows that 113 structures built from 2000 – 2019 received flood damage in Sally, indicating that new development is not immune from flooding. However, when compared to structures built during the County's peak years of construction activity from 1985 – 2007, structures built in the last 20 years are less likely to flood. As new development occurs around many of these newly-built structures, it will be interesting to see whether that trend continues.

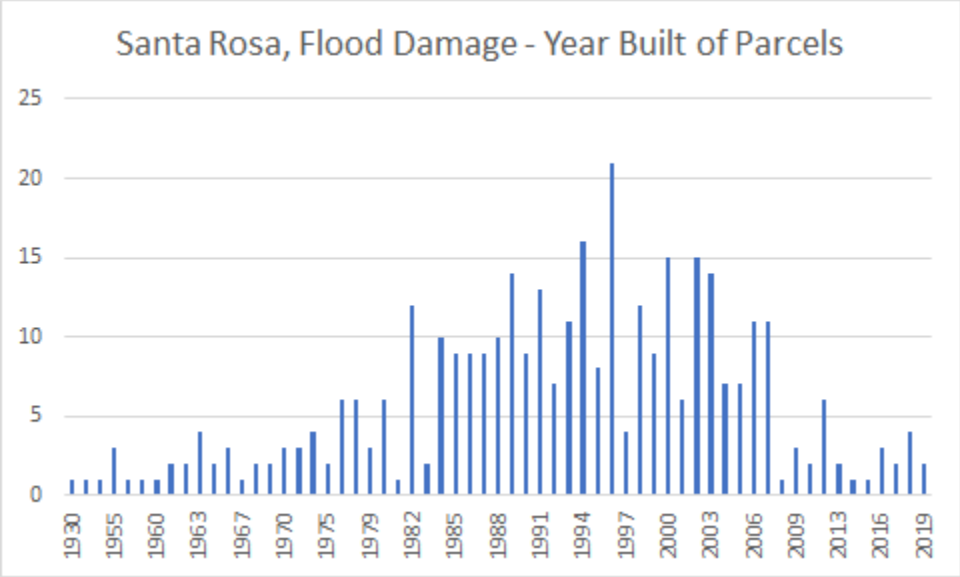


*Chart 3*

### Climate change and Hurricane Sally

The warming of the planet due to the burning of fossil fuels and deforestation is causing multiple changes to the atmosphere and ocean that made Hurricane Sally a more damaging storm than it would have been decades ago. As the atmosphere warms much of the heat has been absorbed by the ocean, causing the thermal expansion of seawater that causes ocean levels to rise. In more recent decades the melting of land-based glaciers has further driven sea level rise.

Sea level rise measured at the NOAA tide gauge on the downtown Pensacola waterfront has recorded about 10” of rise since monitoring began in 1923 (Fig. 2). Along the mostly gently sloping waterfronts in northwest Florida, that seemingly small vertical rise can represent dozens to hundreds of feet of horizontal shoreline retreat.

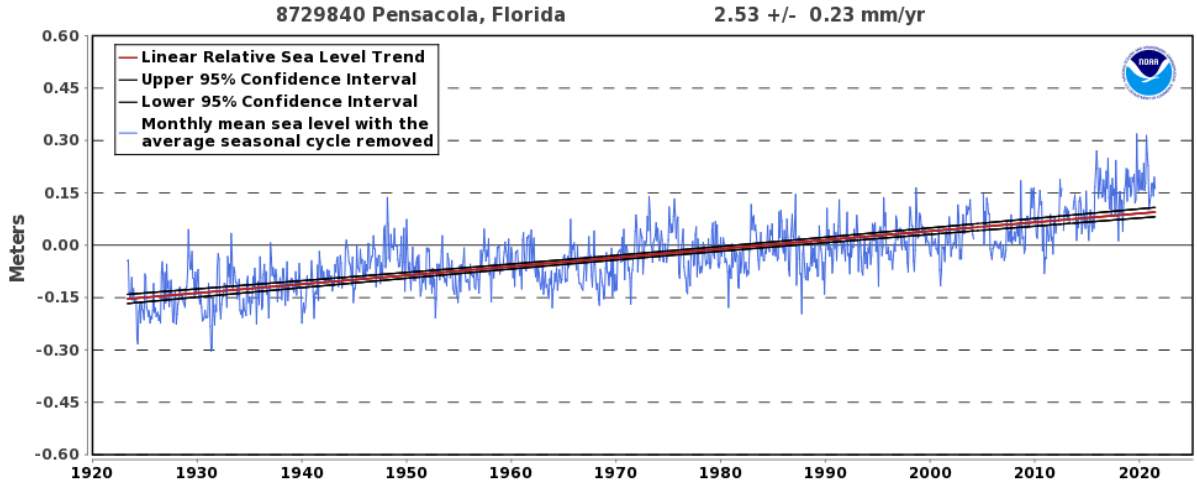


*Figure 2*

As the storm surge from Sally was about 10" higher due to the elevated sea level, this lead to a greater extent of flooding as storm surge came ashore across the land or by moving landward through underground storm sewers. Most importantly, there has been a dramatic acceleration in the rate of local sea level rise since the early 1990s, with more rise occurring in the past quarter century than in the previous 75 years.

Additionally, a warmer atmosphere holds more moisture, and so larger rain events in the southeastern U.S. now drop about 27% more rain than they did 50 years ago, which is consistent with Hurricane Sally. (2) Finally, scientists report that tropical weather systems are now more likely to stall and therefore increase rainfall and its associated flooding—another characteristic of Sally. Many scientists believe that warmer temperatures at the poles have reduced the temperature contrasts that drive atmospheric circulation, causing systems to move slower. But that link to climate change is still under investigation and is not yet definitive. (3)

What is important to understand about climate change and flooding in northwest Florida is that climate change has made the incidence of flooding worse and it is expected to do so at an accelerated rate in the decades ahead.

## Recommendations for reducing flood risk

### *Use vulnerability indices to make smart decisions*

In 2021 the City of Pensacola released a vulnerability index that models how rising seas will affect the city in the decades ahead. The index looked at a range of public infrastructure such as roads and wastewater systems, in addition to impacts on private properties such as residential and commercial buildings. This is an incredibly valuable planning tool that will not directly reduce flooding, but will give the community the information needed to make smart investments in resilience measures such as stormwater retention, floodproofing of infrastructure and the relocation or removal of repetitive flood loss structures. Both Counties have completed similar work, as Santa Rosa County completed a *Flood Vulnerability Model* in 2020, while in 2016 Escambia County released its *Coastal Vulnerability Assessment: Escambia County, Florida*. These indices should not be allowed to "sit on a shelf," and instead should be considered prominently as part of decisions about growth and development as well as flood mitigation strategies.

*A home near downtown Pensacola being elevated after flooding in the 2014 flood event.*

### *Create stormwater problem areas maps for all local jurisdictions*

Santa Rosa County staff have assembled a data layer in the County's publicly-accessible mapping (GIS) system that shows where flooding trouble spots exist in the County. This helps the staff track and prioritize where improvements should be made, while assisting with additional scrutiny given to development projects proposed in these areas. It also helps the public better understand where the greatest threats from flooding exist in the County. We believe that Escambia County and the City of Pensacola should each create a similar map to assist with development review and public awareness of flood problems in those jurisdictions.

This is especially necessary since even though the two county area is currently receiving updated FEMA flood maps, those maps continue to underrepresent areas of flood risk. For example, the Long Hollow area near downtown Pensacola is a well-known area of flood risk that saw multiple structures flood in the 2014 storm event and Hurricane Sally. Yet this area does not appear as an area of higher flood risk on the FEMA maps. The public dissemination of locally-generated maps that capture such flood prone areas could help to fill this gap in information related to local flood risk.

### *Consider stormwater utilities for Escambia and Santa Rosa Counties*

Pensacola is the only jurisdiction among the three reviewed here in which a stormwater utility is used to provide dedicated funding for stormwater projects. Property owners in the city are assessed annually based on the square footage of impervious surface on their property, raising around $3 million each year. This per square foot assessment makes the utility very equitable, in that each property owner only pays for their specific contribution to stormwater runoff. After just over 20 years of existence, the city is now shifting from the funding of mainly water quality projects to more emphasis on projects that address flooding.

The utility gives Pensacola a huge advantage over other local governments in having consistent funding available, allowing for long-term planning for projects that make the most difference. Both Escambia and Santa Rosa Counties should look to implement similar programs, which are more likely to receive support if local governments clearly demonstrate to citizens the improvements that can be made through such dedicated funding.

### *Consider eliminating funding for new development in flood-prone areas*

Under such a scenario, developers and builders would be free to create new residential and commercial development as allowed under each community's comprehensive plan and land development code. But in areas of high flood threat as identified by indicators such as FEMA flood zones, vulnerability indices, the presence of wetlands and high water tables, and other measures, local governments could choose to require that stormwater facilities and roads remain as private property rather than being turned over to local government for maintenance. This would allow property owners in the area to fund maintenance through a homeowner's association rather than having taxpayers fund the continued maintenance of roads and stormwater facilities. Such a policy would remove the burden on taxpayers for fixing flooding problems that are more likely to occur in these flood-prone areas.

This type of policy would not create any restriction of private property rights, as access to taxpayer-funded infrastructure maintenance is a privilege and not a right, and government can choose to remove that privilege in areas that are likely to create burdens on taxpayers due to high flood risk. The Bristol Park neighborhood in Escambia County and Holley by the Sea in south Santa Rosa County both have chronic flood issues. Both subdivisions were built in areas known to be vulnerable to flooding. Now taxpayers countywide are funding drainage improvements in these areas. A 2016 report commissioned by Santa Rosa County estimated a cost of $86 million to fix flooding problems in the neighborhood. Transferring the burden for infrastructure maintenance in new higher flood risk neighborhoods from taxpayers to property owners would discourage development in these areas and protect taxpayers without affecting private property rights.

### *Create stormwater master plans to FEMA standards*

No jurisdiction in the area has conducted a comprehensive stormwater master plan that meets Federal Emergency Management Agency (FEMA) standards. Those that do will have better data to inform future decisions on where and how to accommodate new land development, as well as prioritization of proposed flood reduction projects. Communities with a FEMA-sanctioned stormwater master plan achieve a better score on the Community Rating System, reducing flood insurance premiums for residents.

### *Let some areas flood*

Trying to stop or reduce flooding in certain areas is not feasible due to engineering and/or cost considerations. Communities across the nation are learning to adapt to flooding and to accommodate it where possible. In accommodating flooding, communities can realize the benefits that come from new public park spaces that bring recreation and natural beauty to neighborhoods. This has already been done in locations such as Admiral Mason Park in downtown Pensacola, and there are additional opportunities such as in the city's Tanyard neighborhood where some residents have advocated for the "daylighting" of a former creek and the creation of public space in an area of chronic flooding.

*Citizens attend a walking tour exploring the possible "day-lighting" of an old creek in downtown Pensacola.*

### *Allow stormwater credit trading to create flexibility in managing stormwater*

As communities in the area seek to limit urban sprawl and encourage more development in already developed areas, meeting stormwater retention requirements entirely onsite can become more difficult due to space constraints.

For example, programs in some cities require that 50% of runoff be captured onsite, while a volume of runoff equivalent to the remaining 50% can be funded to occur elsewhere in the watershed. This allows for more compact development patterns that create communities with transportation choices and that ultimately generate less impervious surface and less stormwater runoff than more sprawling, spread-out communities.

### *Conduct a more detailed analysis of damages in high SVI areas*

Local governments in Escambia and Pensacola should conduct a more detailed review of Sally damages in areas of high social vulnerability in order to further isolate the cause of damage and potential solutions. This is important to know as solutions are vastly different depending on whether damages are from flooding or wind. Our review found that the impacts on communities with high social vulnerability were most pronounced in the City of Pensacola and secondarily in Escambia County.

### *Accelerate the transition to renewable energy*

Climate change is making flooding worse in northwest Florida, and there is ultimately one main solution: stopping the use of coal, oil and natural gas and transitioning to renewable energy. Climate change is creating more of the largest hurricanes in the Atlantic basin, making rain events more intense and driving a dramatic acceleration in sea level rise that is drowning shorelines and causing higher storm surges. In order to avoid the worst impacts of climate change, we must reduce and eventually eliminate our emissions of carbon dioxide and methane from the use of fossil fuels.

Since electric utilities alone cannot make the transition rapidly enough, local governments should install solar facilities for their own use and support programs and policies to encourage the use of solar energy by businesses and residences. Recent efforts to make communities more friendly to walking, bicycling and transit should also be hastened. The City of Pensacola has a goal of using 30% renewable energy for city operations by 2030, and Milton is looking to use solar energy to power its new wastewater treatment facility. These efforts supplement the large Department of Defense solar fields installed at local military bases, and the creation of new solar fields by utilities such as Gulf Power.

Sources cited:


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2. *Third U.S. National Climate Assessment* nca2014.globalchange.gov/
3. *Hurricane stalling along the North American coast and implications for rainfall* www.nature.com/articles/s41612-019-0074-8


*Healthy Gulf is a nonprofit organization that works to protect and restore the Gulf of Mexico and the people and communities along its shores. For more information or questions please contact Florida – Alabama Coastal Organizer Christian Wagley: christian@healthygulf.org or (850) 687-9968.*