NCRB-NCRF-NCIGA

north carolina
RATE BUREAU
REINSURANCE FACILITY
INSURANCE GUARANTY ASSOCIATION

November 17, 2020

CIRCULAR LETTER TO ALL MEMBER COMPANIES

Re: The NC Rate Bureau's Private Flood Insurance Program
Independent Evaluation of the NC Flood Program

In March, the NC Rate Bureau introduced the rates, rules, and forms for a private flood insurance product designed for the residential market. This program was filed in September 2019 with the Department of Insurance and was approved by the Commissioner of Insurance with minor changes to the filed minimum premium and inland flood loss cost multiplier on February 28, 2020. You can view circular **P-20-1** here.

The NC Realtors engaged a team from the Brantley Risk and Insurance Center at Appalachian State University to perform an independent evaluation of the North Carolina Rate Bureau's flood insurance program. The NC Realtors have graciously allowed the Rate Bureau to distribute that study to member insurance companies, and the complete study is attached to this circular.

The study concludes:

"Our overall conclusion is that the Rate Bureau plan is a healthy addition to the flood insurance marketplace within North Carolina, and that it in fact may provide a reasonable well-fitting model for other states to offer private flood insurance on a widespread basis. We see an observable positive benefit of the Rate Bureau's plan to the State Of North Carolina."

This evaluation was comprehensive in nature, and included review of several aspects of our program, including the stand-alone policy, lender acceptance, the opportunity to insure to value, model selection, the rating algorithm, and the price aspect of the program.

The Rate Bureau continues to be available to work with companies on any aspect of evaluating and/or implementing the Flood Program in North Carolina. Feel free to reach out to Personal Lines Director, Andy Montano (by email: afm@ncrb.org or by phone: 919-582-1020) with any questions or to get started with this program.

Sincerely,

Joanna Biliouris

Chief Operating Officer

JB:ko
Attachment
P-20-2

An Evaluation of the North Carolina Rate Bureau's Residential Flood Insurance Program

September 4, 2020

Submitted to:

NC REALTORS®

Submitted by:

David C. Marlett
Lorilee A. Medders
Catherine A. Lattimore

An Evaluation of the
North Carolina Rate Bureau's Residential Flood Insurance Program

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EXECUTIVE SUMMARY

Floods are the most common and destructive natural disaster in the United States, with 90 percent of natural disasters involving floods. All 50 states have experienced floods or flash floods in the past five years (National Association of Insurance Commissioners and Floodsmart.gov). In North Carolina, flooding can result from multiple sources – flash flooding, river flooding, tropical storms and accompanying coastal flooding, dam breaks/levy failure, snow melts and debris jams. All 100 counties in the state have suffered floods in the past five years.

The U.S. Geological Survey's floodplain maps, upon which flood insurance requirements have historically been based, are best understood as estimates — and not necessarily reliable ones. Experts agree a large portion of the flood-risk maps are obsolete, and thus the premiums charged under the National Flood Insurance Program may not reflect actual risk. Indeed, FEMA estimates that 15 to 20 percent of insured flood claims happen outside the USGS designated floodplains. And in North Carolina this estimate is closer to 30 percent.

A private flood insurance marketplace has begun to develop in most states. The North Carolina Rate Bureau (Rate Bureau), among other NC stakeholders, recognized the need for improved information regarding North Carolina's exposure to flood, its historic flood losses, flood insurance needs and alternatives for administering and funding flood insurance for residential and commercial property owners in the state; and presented to the North Carolina Department of Insurance a filing for a new residential flood insurance program for the state. On September 16, 2019, Rate Bureau General Manager Raymond Evans submitted the filing to North Carolina insurance Commissioner Mike Causey with supporting documents. The North Carolina Realtors Association, also a stakeholder in the future of flood risk assessment and insurance in North Carolina, has asked us to provide a third-party, objective evaluation of the Rate Bureau's filed residential flood insurance plan for the development of private flood insurance market rates. This report is in response to their request.

The authors wish to acknowledge and thank several of our industry and regulatory colleagues for their responsiveness to requests for information as well as their unique perspectives on the North Carolina Flood Insurance Program. These contributors include:

Chief Deputy Commissioner Dr. Michelle Osborne of the North Carolina Department of Insurance; Mr. Dave Evans and Mr. John Rollins, both consulting actuaries within Milliman's Property & Casualty practice; flood insurance specialist Charlotte Hicks; and from the North Carolina Rate Bureau, General Manager Mr. Raymond Evans, Chief Operating Officer Joanna Biliouris, Director of Personal Lines Andrew Montano, and Actuary Rebecca Williams.

All errors and mistakes in this report remain those of its authors, David Marlett, Lorilee Medders and Catherine Lattimore.

EXECUTIVE SUMMARY – KEY FINDINGS

Flood insurance is important to North Carolina's housing market. If homeowners are unable to obtain flood insurance, a flood event (which we know can and has happened in all of the state's 100 counties) can reduce the ability to rebuild or purchase new homes. Flood insurance, on the other hand, reduces homeowner uncertainty and eases the financial burdens of living in a state such as North Carolina, where the risk of flood is widespread, and in some areas, substantial. Based on our evaluation of the Rate Bureau plan and its potential implications for both the flood insurance market and the housing market, we see no significant downside risks. Instead, we submit there is opportunity for private insurers and real estate professionals to capitalize on the program in ways that grow these markets and simultaneously improve the socio-economic value of living in North Carolina. The major findings in our report on the Rate Bureau plan are highlighted below.

- Stand-alone, admitted insurance policy: The Rate Bureau program structure is a stand-alone flood insurance policy, and is a product which can be sold by insurance carriers that are licensed and overseen/regulated by the North Carolina Department of Insurance. While there are pros and cons to the Rate Bureau's choice to provide coverage on a stand-alone basis, it makes possible a broad array of coverage choices to homeowners. This also means that any flood insurance coverage litigation would be in state court (as opposed to NFIP coverage litigation, which primarily occurs in federal court). Additionally, the use of a stand-alone product helps to ensure the existence of "continuous coverage" under NFIP requirements and helps ensure mortgage company acceptance. It does not ensure the continuity of "grandfathering" that may have been enjoyed under the NFIP, however, when leaving the NFIP for private coverage. For instance, an NFIP policyholder who has benefited from premium subsidies may not be subsidized if he or she later returns to NFIP coverage after leaving for private coverage.

- Lender acceptance: A federal rule related the flood insurance became effective July 1, 2019, implementing provisions of the Biggert-Waters Flood Insurance Reform Act of 2012. The rule requires lenders to accept private flood insurance when issuing loans for real property within designated high-risk flood areas. This rule provides federally regulated lending institutions with guidance concerning private flood insurance. The Rate Bureau flood program, in our opinion, meets the criteria outlined in the rule, and the program's conforming conditions endorsement includes the required language noted in the rule: "This policy meets the definition of private flood insurance contained in 42 U.S.C. 4012a(b)(7) and the corresponding regulation."[1]

[1] See https://bankingjournal.aba.com/2019/07/parting-the-waters-of-uncertainty-for-private-flood-insurance/

- Opportunity to fully insure to value: The Rate Bureau has developed a feasible private market template that can allow a natural separation between the private and public flood insurance markets. The Rate Bureau rate plan allows homeowners to insure their home fully to value. The NFIP coverage for the building is limited to $250,000, while building coverage under the Rate Bureau plan is limited only by the building's value. This difference is important, especially given the large flood insurance coverage gap that persists in the state today. A homeowner, under the NFIP, would have to go to the excess private market for coverage above NFIP limits, and they can now have full coverage with just a single policy. Furthermore, the Rate Bureau plan allows for expanded coverage for other structures and loss of use/additional living expenses.

- Price "winners" and "losers": We examined the validity of the Rate Bureau claim that 94 percent of North Carolina properties achieve a lower premium under the Rate Bureau rates than under the NFIP rates, and find the statement to be valid based on a replicable study of actual North Carolina exposure data, the Rate Bureau rating plan and rating data available from the NFIP. The distribution of flood risk and Rate Bureau flood insurance premiums in North Carolina are heavily skewed, with the majority of the state subject to low risk and minimum premiums (which are lower than the NFIP minimum premiums). In these areas, more than 95 percent of hypothetical flood policyholders "win" under the Rate Bureau plan. On the high-risk (and high premium) end of the market basket, approximately 40 percent of hypothetical policyholders still "win." The net "win" rate, given the skewed distribution, does approximate 94 percent, as stated by the Rate Bureau.

- Appropriateness of the catastrophe loss model selection: The KatRisk flood model selected is a well-vetted model and stood out for several reasons which are important for the North Carolina risk profile. Among other features, the model's high level of resolution (30-meter by 30-meter grid areas), its treatment of inland flooding and precipitation-based flooding, and the fact that its attention to elevation means there is no need for a homeowner to separately obtain an elevation certificate all contributed to the KatRisk model's selection for the Rate Bureau to use in building its rate plan. No one other modeler that submitted its model for consideration offered all of these. And it compares favorably to the NFIP's use of FEMA-designated flood zone for base flood insurance rates.

- Fairness of the rating algorithm: The algorithm for pricing the Rate Bureau product appears to be solidly grounded actuarially and statistically, and incorporates as rating variables only those factors than can be shown to significantly impact flood losses. For instance, the elevation of a structure is directly related to the potential flood risk, and aside from the geographic risk accounted for in a given grid area, as the overall largest impact on losses and Rate Bureau plan pricing.

- Risk-to-premium principles compared to NFIP: Properties under the Rate Bureau program are priced to result in no cross subsidy, with a price-to-risk match even at the highest premium level. The NFIP program, on the other hand, has a long history of intentional cross subsidies and suppressed top-end premiums. If the subsidy is to stay within the program (as opposed to being shifted to taxpayers more widely), then NFIP policyholders at low risk of flood must necessarily pay artificially higher premiums to create affordable premiums for policyholders at highest risk of flood. In other words, NFIP premiums are historically more compressed than those set by the Rate Bureau. The skewness of the premium distribution mentioned above means most policyholders would pay less under Rate Bureau pricing, but those who would pay more might pay much more since Rate Bureau prices are not compressed. Going forward, this difference is expected to phase out as the NFIP Risk Rating 2.0 becomes effective, and the NFIP rating structure continues to move in the same general direction as the Rate Bureau's rating plan.

- Concern about higher flood insurance premiums: It is reasonable to be concerned that where flood insurance premiums may be higher under the Rate Bureau rates, housing values may be reduced. Nevertheless, these concerns are limited since 1) the NFIP plan remains an option for homeowners who would otherwise see premium increases; and 2) the Rate Bureau plan as a less expensive and/or higher coverage alternative to NFIP coverage may help promote real estate in many pockets of North Carolina.

Given the significant and increasing flood risk faced by much of the state, multiple flood insurance options are better than only one. We do not see a downside risk for the real estate market of having a viable private market for flood insurance using the Rate Bureau's forms and rating plans. Adequate consumer participation is critical for the Rate Bureau plan's viability, but for the majority of policyholders (who would pay the minimum premium under the Rate Bureau rates), participation is a matter of selling flood insurance to them at all rather than just selling the Rate Bureau program over the NFIP.

1 Introduction

Flood is the most common and most destructive natural disaster peril in the United States, with 90 percent of natural disasters involving flooding. All 50 states and all 100 counties in North Carolina have experienced floods or flash floods in the past five years (National Association of Insurance Commissioners and Floodsmart.gov). In North Carolina, flooding can result from multiple alternative sources – flash flooding, river flooding, tropical storms and accompanying coastal flooding, dam breaks/levy failure, snow melts and debris jams.

Flood insurance provides the necessary financial assistance to cover the cost of repair and rebuilding; the department of Housing and Urban Development found that flood-insured households were 37% more likely to have rebuilt their homes after Hurricanes Katrina and Rita (Kousky et al., 2018). Flood insurance is a necessary product to limit the local and global impact of severe flooding events and to ensure the resilience of impacted communities.

The damage to U.S. homes and businesses from a flood generally is not covered under a traditional property insurance policy. Instead, a special flood insurance policy, federally backed by the National Flood Insurance Program (NFIP), is purchased to protect against flood losses. Despite the risk, most North Carolina property owners do not buy flood insurance, leaving the vast majority of properties within the state uninsured against flood.

The $12 billion plus difference between total and insured losses stemming from Hurricane Florence exposes the extent to which flood risk is underinsured in North Carolina. This issue extends across the United States; looking back at the 2017 hurricane season, Harvey, Irma, and Maria had a combined total cost of damage of $217 billion with only $92 billion being covered by insurance realizing a $125 billion insurance gap (Lloyd's, 2019). The underinsurance of flood risk has severe financial implications for individuals as well as communities. Lloyd's city risk index lists flood as contributing $12.55 billion to the United States' GDP at risk and $42.91 billion of the global GDP at risk (Lloyd's 2018). Despite the known benefits of insurance, the flood insurance gap continues to persist throughout the United States.

Disconcerting details surround U.S. flood risk, the NFIP and the take-up rate on flood insurance among homeowners. Only 15 percent of surveyed U.S. homeowners report having a flood insurance policy despite the fact that 98 percent of U.S. counties are impacted by flood events (Insurance Information Institute, 2019; FEMA). In North Carolina, flood insurance coverage is estimated to be much lower than this, at approximately 3.5 percent (based on 141,000 flood policies and nearly 4 million households in the state) while 100 percent of North Carolina counties are impacted by flood events (FEMA). This low rate of coverage persists despite the fact that North Carolina is ranked 7th in the nation for properties at risk of flood (CIPR, 2017).

Given financial challenges within the NFIP, resulting in questions regarding its long-term viability as well as its capacity to keep up with changes in the likelihood and impact of flood losses, the North Carolina Rate Bureau (Rate Bureau) in late 2019 submitted a proposal to the North Carolina Department of Insurance (NCDOI) for a private market flood insurance policy form and rating plan (Rate Bureau, 2019). The stated goal of the Rate Bureau's Flood Insurance Program is

> To develop a long term, quality flood solution for the state of North Carolina that is accepted by lenders and offers residential risk coverage options that are equal to or greater than the current policy offered by the NFIP (Rate Bureau, 2019).

By early 2020, the proposed plan, including the necessary rate filing, was approved by the NCDOI for use by member insurers. Nevertheless, as of the date of this report no insurer has yet notified the Rate Bureau of the intention to sell flood insurance using the Rate Bureau's flood insurance program.[2]

This report focuses on the Rate Bureau's North Carolina Flood Insurance Program, which necessarily begins with a primer on North Carolina's flood risk, so Section 2 provides a discussion of North Carolina's primary sources of flooding, historic flooding and modeled losses. Section 3 describes and evaluates key elements of the Rate Bureau flood insurance plan. Section 4 follows by discussing the various market challenges and implications of the Rate Bureau plan, including commentary on why, as of the time of this report, there has been no insurer participation in the program. Section 5 summarizes the report and offers concluding thoughts.

[2] Although an insurer does not need to file rates with the NCDOI to use the Rate Bureau program, it is necessary to notify the Rate Bureau to have access to the rating tables and algorithms for use.

2 North Carolina Flood Risk

One reason that flood risk is especially difficult to cover is because it is a widespread and dynamic risk. Flooding typically falls into one of three categories: coastal surge flood, fluvial, and pluvial. Coastal flood occurs in areas that lie on the coast of a large body of water and is the result of extreme tidal conditions caused by severe weather. Storm surge is the most common form of coastal flooding and is when high winds from hurricanes and other storms push water onshore. Fluvial, or riverine flooding, occurs when excessive rainfall over an extended period of time causes a river to exceed its capacity; it can also be caused by heavy snow melt and ice jams. The damage from this type of flooding can be widespread as the overflow in one area affects smaller rivers downstream and can cause dams and dikes to break. According to FEMA, fluvial flooding is the most common type of flood event (Maddox, 2014). The third type of flooding, pluvial or surface flooding, occurs when heavy rainfall creates a flooding event that is independent of an overflowing body of water, although it usually happens in conjunction with coastal or fluvial flooding. This type of flooding typically happens when drainage systems become overwhelmed or when land is so saturated it is unable to absorb runoff. None of these types of flooding are covered under typical homeowners or property insurance coverages, but would be covered under a flood insurance policy.

2.1 North Carolina Exposure & Loss

2.1.1 North Carolina Flooding by Region

In coastal states such as North Carolina it is easy to believe the greatest flood risk exists in coastal and near coastal counties. This is not necessarily the case. Hurricanes are popularly thought to be the main source of flood events in North Carolina even though non-tropical storm precipitation more frequently actually causes flooding. Furthermore, even when a tropical storm is involved, it is not uncommon for precipitation to wreak havoc in areas far inland of a storm's landfall. Florence was a classic case of this.

Indeed, if North Carolina historic flooding is evaluated by region, it is clear that in every portion of the state flooding is a significant risk. Figure 1 shows for each region of the state the number of flood events recorded through April, 2020.

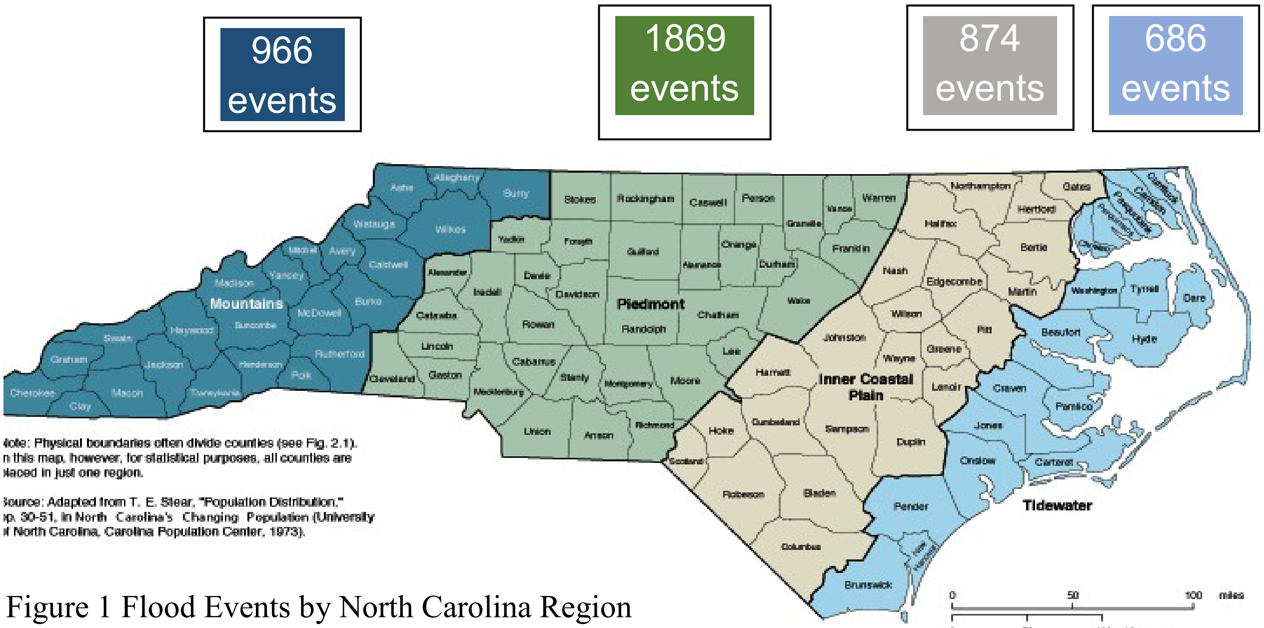

Figure 1 Flood Events by North Carolina Region
(Storm Events Database)

The map in Figure 1 makes it possible to visualize the direct relationship of landmass to flood frequency. Here, the state is divided into four geographical regions – Mountains, Piedmont, Inner Coastal Plain and Tidewater.

Statistically, in North Carolina the likelihood of a flood event in any region is substantial; in any county, there is some non-zero probability of flooding. It is noteworthy that the lowest frequency of flooding has been in Hyde and Tyrell Counties – both in the Tidewater region – where each has experienced only three (3) flood events historically. Meanwhile, the highest frequency of flooding has occurred in Mecklenburg and Wake Counties – both in the Piedmont region – with 102 and 132 flood events, respectively. Appendix A provides the historic frequency of North Carolina flood events by county.

Coastline exposure growth had been high since the 1960s, but since 2005 has slowed to approximately four (4) percent annually. Four major hurricanes made landfall in Florida in 2004, then hurricanes Katrina, Rita and Wilma made 2005 the costliest U.S. insurance history (AIR, 2016). After multiple “lucky” years, the U.S. eastern and gulf coastlines more recently have experienced multiple major hurricanes (category 3 or stronger) make landfall in 2017 and 2018.

Inland river flooding linked to hurricanes and heavy storms is a huge risk in the Southeast, but receives far less attention in emergency planning than coastal areas (Colten, 2014). Along the Eastern Seaboard, a dense network of rivers flows down from the eastern Appalachians across the Piedmont, and drains into the Atlantic Ocean. Steep gradients move water quickly down the mountain slopes. On the Piedmont, many small streams merge, becoming rivers on the low-lying coastal plain. When tropical weather systems come ashore and move inland, they rise toward the Appalachian Mountains. As the saturated air moves upward, it cools and releases huge quantities of rain. Combined with heavy rainfall dumped on lower elevations by these tropical systems these effects create downpours that funnel into rivers and rush toward the sea, often spilling over the banks of overwhelmed bodies of water.

The Great Flood of 1916 (July) is a notable example of how severe such inland flooding can be. According to historical data, the remnants of two tropical systems that both passed near the area within a week led to the flooding. It destroyed hundreds of homes in the Asheville and Western Carolina area, along with industrial plants, warehouses, and businesses sited along the French Broad River. It damaged or washed away railroad tracks and demolished all three bridges across the river in Asheville. Riverside Park, a popular amusement park and gathering place on the French Broad, was demolished by the waters. Upstream from Asheville, the waters breached or destroyed all the dams that supplied hydropower to the city. At the entrance to the Biltmore Estate, water reportedly reached nine feet deep during the flood. Overall, the damage totaled an estimated $21 million, equivalent to more than $500 million in today's dollars (NOAA, 2016).

Inland exposure to flood is difficult to assess. Defining whether a property is exposed to inland flooding is problematic the various sources of flooding to which inland properties are exposed.

2.1.2 North Carolina's Modeled Exposure to Flood Loss

North Carolina is ranked 7th in the nation both in terms of number of properties at risk as well as value at risk, according to CoreLogic. FEMA's NFIP coverage reporting provides the best detailed exposure data publicly available. As of May 31, 2018, the NFIP's Total Insured Value (TIV) exposure across policies for single-family permanent dwellings in North Carolina was just under $33 billion, with dwelling insurance limits of just under $26 billion.[3] As one might expect, the exposure data reveal the highest total NFIP exposure in North Carolina lies in the coastal zip codes. For instance, in Currituck and Dare Counties, several individual zip codes hold NFIP TIV exposure in excess of $1 billion:

[3] AIR Worldwide and RMS adjusted exposure data for Actual Cash Value (ACV) and coinsurance factors, but effectively do not impact modeled results meaningfully, having both based their figures on the information provided by the NFIP.

Zip code 27907 (Carova Beach, Corolla), Currituck County:	$1.08 billion
Zip code 27949 (Duck, Kitty Hawk, Southern Shores), Dare County:	$1.33 billion
Zip code 27948 (Kill Devil Hills), Dare County:	$1.3 billion

These high exposure amounts are largely owing to the volume of property owners (at least 2,500 in each zip code above) for whom flood insurance is mandatory, as none of these zip codes boast an average (per-property) TIV of greater than $400,000. The highest average Building TIVs are in zip codes representing portions of Duplin (Inner Coastal Plain) and Durham, Gaston and Iredell (all Piedmont) Counties.[4] High average exposure amounts within inland zip codes indicate that, contrary to popular belief, the highest values are not necessarily on or near the coast.

2.1.3 Exacerbating Risk Factors

Several factors have contributed to increases in the risk of all three types of flooding in North Carolina.

Weather and land changes. Exposure to all three types of flooding changes over time because of weather patterns, erosion, and new development. Multiple studies have shown that extreme precipitation events have become more frequent and more intense in parts of the United States since the early 1990s; heavy rainfall events are one of the primary contributors to flooding. An increase in the frequency and severity of high precipitation events increases the likelihood and impact of all three types of flooding.

Land use changes. Construction in floodplains, increased use of impermeable surfaces such as asphalt, the removal of wetlands and river bank vegetation, deterioration of water-management infrastructure, and the building of dams, levees, or channels can alter the ability of land to accommodate heavy precipitation and can change the natural flow of rivers and streams which in turn increases the potential for flooding. The increase in wildfires from climate and land use changes also has an impact on flooding as less water is retained and erosion increases.

Growing population density. The impact of flooding events is enhanced by the movement of people to hurricane and flood prone areas. From 1980 to 2017, there was an increase of 95

[4] These high-exposure zip codes include 28349 (Kenansvile, Sarecta), Duplin County; 28625 (Statesville and surrounds), Iredell County; 27709 (City of Durham), Durham County; 28166 (Troutman), Iredell County; and 28101 (McAdenville), Gaston County.

people per square mile, more than double, in counties along the U.S. shoreline that experienced hurricane-strength winds from Florence in September 2018 (Dapena, 2018). Overall, areas most vulnerable to hurricane strikes, namely counties along the Gulf and East coast, had an increase of 160 people per square mile, compared to an increase of 26 people per square mile in the mainland over the same period (Dapena, 2018). This increase in population and exposure in hurricane and flood prone areas is a significant driver of the increasing cost of storms and outlines yet another way that flood risk is changing.

Development & urbanization. Development of the built environment has impacted the flood risk significantly and may increase flooding in multiple ways -- removing vegetation and soil, grading the land surface, and constructing drainage networks increase the runoff from rainfall and snowmelt into streams. The peak discharge, volume, and frequency of floods increase in nearby streams. Changes to stream channels during urban development can limit their capacity to hold and move floodwaters along. Furthermore, existing roads and buildings in flood-prone areas are exposed to increased inundation and erosion as development continues around them. While North Carolina still has a significantly smaller share of its population living in urban areas than the national average, the state has increasingly urbanized over the past two decades. 1920 marked the first year that more U.S. residents lived in urban areas than rural areas (51 percent versus 49 percent). In North Carolina, this transition did not occur until 1990, when 50.4 percent of state residents were living in urban areas compared to 49.6 percent living in rural areas.[5] Even today, among North Carolina's 100 counties, only eight (8) are as urbanized (or more) as the nation. Mecklenburg County (where the state's largest city, Charlotte, is located) is the most urbanized, with 99 percent of its population living in an urban area and 86% of its land area classified as urban as of 2010. New Hanover, Wake, and Forsyth Counties have more than half of their land area classified as urban as well. The City of Charlotte was one of the two fastest growing cities in the U.S. during 2000-2016. Similarly, today Raleigh-Durham is reportedly a national "top 10" metro area for population growth. [6] It is notable that these two metropolitan areas are sited within the two counties that have experienced the highest frequency of flooding in the state over the past 20 or so years (Mecklenburg and Wake).[7]

[5] According to the University of North Carolina Population Center, in 1990, only South Dakota (50%), Mississippi (47%), Maine (45%), West Virginia (36%) and Vermont (32%) had smaller shares of their population living in urban areas than did North Carolina. Retrieved from https://demography.cpc.unc.edu/2016/02/25/nc-in-focus-when-did-we-transition-to-majority-urban/

[6] As reported by the U.S. Census Bureau, 2010, and Update, 2017, as well as the University of North Carolina Population Center.

[7] Recognizing their vulnerability to flood, the City of Charlotte and Mecklenburg County teamed collaborated with the U.S.G.S. to develop a flood information and notification system (FINS) to address the need for prompt notification of flood conditions (Konrad, 2003). The system automatically notifies the National Weather Service

Inflation. The general increase in prices or economic inflation could increase flood losses due to rising cost of building stock, contractors, and other direct and indirect materials impacting claims settlements. Demand surge inflation also remains a strong driver of losses.[8]

Demographics. There is migration toward cities and toward the most southerly parts of the country. Urban areas are growing faster than the rest of the nation, and there is a migration from the northern industrial sector to southern (warmer and often coastal) areas. It seems reasonable to expect with migration and the rise in coastal population the quantity of exposed property will rise.[9] Additionally, as previously stated, urbanization of the state, especially as it occurs in coastal areas, can be expected to increase the state's flood risk considerably.

Climate change. Setting aside politics and/or views on the causes and mitigation timelines, it is widely acknowledged that climate change has potential consequences for severe weather and catastrophic events. Even without belief in a warming globe, climate change/ volatility is apparent, and is already linked to upticks in storm severity over recent years. Although we now have the tools to accurately record all flood events, we will not know for sure if the climate is affecting storm frequency and severity and inland flooding until years from now. Climate change and sea level rise may cause severe flooding, however, even in the absence of storms.

2.2 A Look at Hurricanes Florence and Hazel

In order to see the evolving nature of NC's flood risk, a closer look at the impact of Hurricanes Hazel and Florence on the state reveals important similarities and contrasts. The two storms lend themselves to a natural comparison because of their nearly identical landfall locations and paths across the state. Hurricane Hazel made landfall as a category 4 hurricane near Calabash, NC on October 15th, 1954 (Storm Events Database). Hurricane Florence made landfall as a category 1 hurricane near Wrightsville Beach, NC, about 50 miles northeast of Calabash, on September 14th, 2018 (Storm Events Database). Table 1 provides a side-by-side comparison of the two storms' key data.

At the time of its occurrence, Hurricane Hazel was considered the most destructive hurricane to ever affect the state; coastal winds were estimated as high as 150 MPH and storm surge reached 12-18+ feet (Storm Events Database). The storm caused 19 fatalities in North Carolina, destroyed or damaged over 50,000 homes and caused $1.48 billion in total damage to the state

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and emergency responders in the region when rainfall and streamflow indicate the likelihood of flooding, giving these agencies additional time to issue warnings and evacuate areas if necessary.

[8] Demand surge inflation can be accounted for during flood loss modeling, pre and post-underwriting.

[9] Also available at U.S. Census.

(inflated to 2019 dollars) ("Storms to Life" Report, 2010). Current catastrophe models estimate that if Hurricane Hazel were to strike in 2019 rather than in 1954, total damage would likely have reached $4.7 billion.[10] The $3.22 billion difference in damages between when the storm actually occurred and the losses if the same storm were to occur today, clearly shows the increase in financial impact that results from the continuing development and redistribution of land use in hurricane prone areas.

Hurricane Florence, although just a Category 1 storm at landfall, had an even greater impact on the state. With wind speeds near 90 MPH and storm surge of 10 feet, Florence resulted in 39 deaths in NC and caused a total of $23 billion in damage ("Storms to Life" Report, 2018). Although Hazel was a more powerful and intense storm, Florence had a bigger financial impact on the state. This seemingly disparate impact of Florence is due not only to demographic and economic changes in North Carolina during the intervening years between Hazel and Florence, but also due to the storm's geographic span and movement after landfall. Florence was a more "spread out" and slower moving storm than Hazel and as such affected a larger portion of the state. After landfall, Hazel continued to move at around 55 MPH, but Florence only traveled forward at a speed of around 5 MPH (Storm Events Database). Because Florence sat and hovered, the state was exposed to its destructive elements for a longer period of time, which resulted in greater damages. Florence brought significantly more rain than did Hazel, resulting in substantially more flooding damage (in addition to wind damages). The Waccamaw River in Freeland, N.C., for example, peaked five days after Florence made landfall, with water levels reaching 22.61 feet. The Waccamaw has flood data going back to 1940 and Florence caused the highest level on record (U.S. Geological Survey).

The difference in the nature of these storms explicitly demonstrates the evolution of catastrophic events over time due to climate change as well as other factors. On average, hurricanes in particular are becoming slower moving and wetter events, therefore causing more damage from extreme flooding and storm duration.

[10] This estimate is based on an average of the modeled losses from three separate and proprietary commercial flood models.

	HAZEL	FLORENCE
LANDFALL DATE	10-15-1954	9-14-2018
LANDFALL LOCATION	Wrightsville Beach, NC	Calabash, NC
LANDFALL CATEGORY	Category 4	Category 1
HIGHEST CATEGORY	Category 4	Category 4
PEAK WIND SPEED	150 MPH	140+ MPH
PEAK STORM SURGE	18 Feet	10 Feet
MAX SUSTAINED WIND SPEED	NA	90 MPH
FORWARD WIND SPEED POST LANDFALL	55 MPH	2-6 MPH
GREATEST PRECIPITATION RECORDED		35.93 inches
NC FATALITIES	19	39
U.S. FATALITIES	1,200	53
HISTORIC NC PROPERTY DAMAGE		
FROM ALL PERILS	$136 million in 1954$ $1.48 billion in 2019$	$23 billion total damage + $2.5 billion economic output loss $9.5-12.5 billion insured property loss
WIND	NA	
FLOOD	NA	$10-13 billion uninsured $4.5-7.5 billion privately insured $10 million NFIP insured
MODELED NC PROPERTY DAMAGE (ASSUMING IT STRUCK IN 2019)		
FROM ALL PERILS	$4.7 billion	
WIND	$1.7 billion	
SURGE	$1.4 billion	
INLAND FLOOD	$1.2 billion	

Table 1. Hurricanes Hazel and Florence – Key Data (Storm data source: Storm Events Database); Hazel financial estimates source: multiple proprietary flood insurance models, 2019; Florence financial estimates: CoreLogic and Karen Clark & Co., 2019)

According to a recent study by the U.S. Geological Survey, Hurricane Florence broke 28 flood records across North and South Carolina, with record stream flows at multiple sites.[11] These "peaks of record" broke previous records that had just been set by Hurricane Matthew in 2016.[12] Despite more than 30 years of available North Carolina stream data (up to 70 years of data at some sites), a majority of the number one and two records are from these two recent flooding events, and others are within the top five levels ever measured at those sites. Of the 28 record-breaking sites in the Carolinas, FEMA data estimated that only 10 of them had a 1-in-67 chance or greater of flooding to that level in any given year. Nine (9) had a less than 1-in-500 chance of flooding to that level, three (3) had a 1-in-500 chance, and six (6) had somewhere between a 1-in-500 chance or a 1-in-100 chance (U.S. Geological Survey). Localities most heavily flooded from Florence (and their probability of experiencing flooding in a given year) include:

- Northeast Cape Fear River near Chinquapin, NC (78 years)
- Waccamaw River in Freeland, NC (77 years)
- Cape Fear River at William O Huske Locke near Tarheel, NC (71 years)
- Black River near Tomahawk, NC (70 years)
- Trent River near Trenton, NC (67 years)
- Little River near Star, NC (64 years)
- Flat Creek near Inverness, NC (50 years)
- Cape Fear at Lock No. 1 near Kelly NC (49 years)
- Big Shoe Heel Creek near Laurinburg, NC (31 years)
- Lumber River near Maxton, NC (30 years).

Despite the severity of damages caused by Florence it should not overshadow other flood events that have occurred in the state. Nor should the tropical storm as a cause of flood overshadow other potential flood drivers.

[11] "Streamflow" is the volume of water passing through a particular point (USGA website), and today can be measured over specified durations of time and/or in real time.
[12] Hurricane Dorian later broke several records as well, although Florence proved to be a more severe flood event across the state.

3 Evaluation of the Rate Bureau's Residential Flood Program[13]

3.1 Explanation and Limitations of the Methodologies

The North Carolina Flood Insurance Program developed by the Rate Bureau made, in our opinion, considerable effort to ensure the loss estimation and rating methodologies underlying the filed flood insurance rates are sound. Experts from diverse areas of the insurance industry were brought in to create a property flood subcommittee for the choice and utilization of policy forms, loss modeling and insurance rating. The primary goal in program development was to match price to risk and cover residential property types.

3.1.1 Overarching Considerations

The rating plan was developed to reflect the expected future costs associated with insuring residential flood policies.[14] These expected future costs include claims, claim settlement expenses, operational and administrative expenses, and a fair and reasonable profit.

Milliman, Inc. was engaged to assist in developing the rates and rating plan for the North Carolina Flood program. Milliman is an actuarial consulting firm, well-known and well regarded for its work and expertise in catastrophe (and particularly flood risk). We are satisfied, based on our evaluation, that Milliman used ratemaking methods that comply with statutory standards and are also consistent with those used in other Rate Bureau property lines, where appropriate.

At the direction of the Rate Bureau Flood Subcommittee, Milliman developed rates primarily using the KatRisk model to provide estimates of expected losses. First, Milliman staff developed the 30 meter resolution grid used for base rate development. They also created rating development, market basket, and NFIP portfolio exposure sets to be run with the KatRisk model such that the output could be used to support various components of the Rate Bureau rate filing.

Milliman staff developed the analysis, performed all of the calculations supporting the results, and reviewed the filed rates to determine if they were calculated in accordance with the Casualty Actuarial Society's Statement of Principles Regarding Property and Casualty Insurance Ratemaking, all under the direction of the Rate Bureau subcommittee, Milliman applied the rate standards set forth in the North Carolina General Statutes, including G.S. 58-36-10, which

[13] Except where otherwise noted, the details of the Rate Bureau plan were taken from the Rate Bureau's program proposal/rate filing documents, which can be accessed at http://www.ncrb.org/Portals/0/ncrb/personal%20lines%20services/Rate%20Filings/2019/2019%20Flood%20Filing.pdf?ver=2019-09-16-150750-377

[14] Milliman actuarial staff testified the rates were developed consistent with the *Statement of Principles Regarding Property and Casualty Insurance Ratemaking* as published by the Casualty Actuarial Society.

provides that rates must not be excessive, inadequate, or unfairly discriminatory and that certain statutory rating factors must be given due consideration.

3.1.2 Selection of the Flood Loss Model

In Section 2 of this report, there was discussion of flood exposure and losses within North Carolina. This section focuses on the Rate Bureau's selection of a flood loss model to assist in developing its flood insurance rates and premiums.

Why flood loss modeling is needed. An understanding of where the risk potential is, how great it may be and/or actual loss experience does not inform insurers of how to most appropriately price the risks, optimally build their risk portfolios, or what amount of reinsurance to purchase. Risk assessment methods (such as the FEMA and North Carolina flood mapping systems) do not attempt to estimate future losses, but rather to measure and/or visualize the risk in particular areas. Catastrophe loss models, on the other hand, have as their primary purpose the estimation of losses, from which insurers can make important risk pricing, aggregation and transfer decisions. Since the North Carolina Flood Insurance program described here is a new program, there is no historical data from the program to review or evaluate. The NFIP historical loss data is not of sufficient granularity or credibility for use by the Rate Bureau in the development of flood insurance rates; NFIP data is generally not available below the census tract and flood zone level. Second, flood models are used to estimate the expected flood losses because they provide a more accurate way of quantifying the exposure to floods than using prior insurance ratemaking methodologies. Floods are highly variable in their frequency, severity, and place of occurrence. They often occur in places with little or no flooding in recent history. By simulating thousands of possible flood events, flood models provide a more complete perspective on the distribution of the types of floods that could occur and avoid the volatility that could result from using actual flood losses.

The selected model. The North Carolina Flood Insurance Program is a new program with no historical premium, loss or expense experience. The loss data used for rating is output from the KatRisk SpatialKat inland flood and storm surge models (KatRisk model) using input data developed by Milliman. The developed rates match insurance premium to flood risk based on the KatRisk model for all residential risks in North Carolina. KatRisk is an independently owned, relatively young and relatively small catastrophe modeling business. Formed in 2012 and composed of 12 total staff in the U.S. and Germany, it is a new business relative to several other commercial catastrophe modelers. But catastrophe modeling itself is relatively young, with the earliest models formed in the 1980s. KatRisk has no outside investors, and thus should be counted on to provide an independent view of the modeled climate and weather-related perils. KatRisk produces a model that estimates both inland flood and hurricane storm surge losses based on a 50,000-year event set.[15] The KatRisk model has been used by multiple insurance and insurance-related entities and companies, and is actively being used to establish rates for flood insurance in multiple states by multiple insurance carriers. Additionally, the model was used in the recent NFIP risk rating 2.0 initiative, the NFIP reinsurance placement, and the NFIP flood catastrophe bond, which adds to its credibility as a choice.

The model selection process. As part of the development of the Rate Bureau's flood insurance program, an industry Flood Subcommittee selected Milliman, Inc., a well-known actuarial consulting firm, to conduct a flood insurance feasibility study and to assist in the selection of the catastrophe loss model the Rate Bureau would employ for loss estimation. In December 2018, Milliman presented a "blind" comparison of five (5) potential flood model vendors to the Rate Bureau. Based on their model capabilities, KatRisk and one other were invited to present their models in more detail to the Rate Bureau. KatRisk performed the loss for each hazard separately and then on a combined basis to allow the Rate Bureau to evaluate how to price each hazard separately and together.[16] Based on the thoroughness of the presentation, Q&A, and reputation of the KatRisk model, it was selected in March 2019 as the model upon which North Carolina flood insurance rates would be based.

The importance of flood loss modeling to achieve appropriate rates. Catastrophe models identify and quantify the likelihood of occurrence of specific natural disasters in a region and estimate the extent of future incurred losses. Actuaries often use historical losses as a basis to develop appropriate estimates of future incurred losses. For catastrophic risks, the historical record is often limited or biased, and catastrophe models are used as the basis for estimating future incurred losses. In most areas of the U.S. that are catastrophe vulnerable, catastrophe loss modeling has become preferred by insurers, reinsurers and regulators rather than relying purely on the historical record. The key elements of catastrophe models – hazard, building inventory (of the risk portfolio), vulnerability and financial – each yield separate outputs, with final outputs producing information about loss estimates. Catastrophe modelers test the model outputs against real-life events that are in the historic record to verify their accuracy. In New Hanover County, for example, the storm-surge model closely predicted Hurricane Fran (1996) retrospectively, which was approximately a 100-year flood. Hurricane Hazel (1954) closely

[15] The intent of loss modelers, including KatRisk, is to ensure that the utilized event set contains actual events from the historical record as well as simulates events that could occur, probability weighted, such that more extreme events that are less likely to happen (or happen with less frequency) are included, but given less weight.

[16] It should be noted that one cannot simply add the inland flood and storm surge hazard together, as there are times where a single location may be impacted by a hurricane that causes both a storm surge and an inland flood loss. In this case, the maximum of the two event losses is employed for that specific location for that specific event.

matched the same water levels as Fran. Now observed through 2017, just two 100-year-equivalent floods in New Hanover County have happened within a span of more than 63 years — indicating the modeling estimations may be doing well generally (FEMA, 2019).

The status of flood loss models today. In theory, catastrophe models should work well for evaluating flood risk since models are based on simulations created by analyzing the characteristics of past and potential events rather than fixating on analysis of past loss history. A variety of companies have produced catastrophe models for flood and today are marketing them to insurers. The flood events over the last few years are helping insurers, reinsurers, and modeling companies to be able to validate their models against real losses which in conjunction with obtaining more comprehensive data will aid in improving model accuracy. Despite the complexity of flood risk, it is arguably more definable than hurricane and earthquake risk, and these are already being rated largely based on loss estimates from catastrophe models. Wind is a chaotic process; in a hurricane one house can be hit by strong gusts while the one beside it is spared. Flood, on the other hand has a lower level of intrinsic variability because flood heights are relatively consistent from one patch of land to the next. The primary difficulty in developing flood models comes from not having the necessary data.

What catastrophe models do. In general, catastrophe models work by combining mathematical representations of the natural occurrence patterns and characteristics of catastrophes and information on property values, construction types, and occupancy class to provide information to insurers about the potential for losses before they occur (Clark, 2002). Insurers use catastrophe modeling to anticipate the likelihood and severity of potential future events so that they can appropriately prepare for the financial impact. These models are typically built to be capable of estimating Average Annual Losses (AALs), Probable Maximum Loss (PML) and Tail Value-at-Risk (TVaR).[17] AAL is the sum of all modeled event losses divided by the number of years modeled, and can be used to represent the pure premium required annually to cover the loss exposure over time. The PML provides the size of loss associated with a given exceedance probability (the modeled probability of a certain size of loss or greater). The TVaR tells us the average exposure above the PML. All of these measures are subject to substantial uncertainty, and the appropriateness of the assumptions, data and sensitivity of a given model are critical to obtaining useful results. The statistical concept underlying a catastrophe model is that the

[17] These estimated measures are the summary results yielded by loss models primarily because insurers and reinsurers can utilize these most easily for pricing and risk aggregation purposes. Primers on the fundamentals of catastrophe models and modeled results can be found at commercial modeler websites and n various research reports. The State of Florida hurricane wind model standards contain valuable information about how catastrophe models work and the results to expect. The latest Report of Activities (including standards) is available at https://www.sbafla.com/methodology/Portals/Methodology/2017_HurricaneROA.pdf?ver=2017-11-29-102746-453.

model recreates historical data and simulates additional events based on standard statistical distributions. This means that while the distributions will look similar between historic and simulated events, the simulated event distribution will naturally have longer and slightly wider tails (more extremes). Testing to ensure that model results can match historical records is a well-used methodology for checking both the model and the underlying input data.

Variability in modeled results. The NFIP has made available the modeled gross AALs and exposure data for the Top 100 counties in the nation. Appendix B includes modeled loss results for the top 100 counties (by gross AAL) from two models – AIR Touchstone Version 5.0 and RMS Risklink Version 17 – for exposure data as of May 31, 2018. New Hanover County tops the North Carolina Counties that appear on the lists, ranking as 35th in the nation based on RMS modeling and 41st based on AIR modeling. The RMS and AIR models differ with respect to which North Carolina counties make their respective Top 100 Gross AAL county lists. In addition to New Hanover, RMS includes eight more North Carolina Counties: Craven 45th), Brunswick (58th), Pender (61st), Dare (65th), Carteret (73rd), Beaufort (76th), Onslow (79th) and Pamlico (96th). AIR, on the other hand, includes seven additional counties: Brunswick (42nd), Dare (52nd), Onslow (55th), Carteret (64th), Hyde (91st), Pamlico (94th) and Currituck (100th). These differences in modeled results between just two (of several) commercial modelers illuminates the variations that exist between model assumptions, data and processes. Even though catastrophe loss models overall employ similar process (as described earlier in this report), the detailed methods and data employed differ widely. While which models (if any) simulate flood loss estimates that are “in the ballpark” is still relatively unknown, it is clear that for now the use of multiple models is beneficial as it provides more than one set of estimates, and allows for some model comparisons. Because of the complexities of modeling flood and the immaturity of the US models, true exposure and loss to the flooding will take time to analyze. In general, exposure can be expected to track the U.S. population, currently growing at 0.8 percent annually,[18] and development that accompanies its movements.

3.1.3 Important Characteristics of the KatRisk Flood Model

The model selection process discussed above would have necessarily taken into account similarities and differences among the model descriptions and modeled performance of the modelers who submitted proposals to the Rate Bureau. Here we focus on a broader conversation regarding the specific characteristics of the KatRisk model that may contribute to the accuracy of its model process and the credibility of its estimates.

[18] Based on estimates since the U.S. Census “Profile of General Population and Housing Characteristics: 2010”. Available at https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF.

Model resolution. Floodplain is a general term for a normally dry area subject to flooding from natural waterbodies, including rivers, streams, lakes and the ocean, as a result of storms and sea-level rise. Earlier in this report, we stated that FEMA estimates that 15 to 20 percent of insured flood claims happen outside the USGS designated floodplains and that in North Carolina this is likely much closer to 30 percent. Regardless of whether a property lies in or out of the 100-year floodplain, it is important to understand there is likely a flood risk, no matter how small the probability of occurrence. With enough rain or a big storm surge, almost any location can flood. And the chances of flooding increase the closer the property is to the water source, as well as the longer the period of time considered. FEMA produces the Flood Insurance Rate Maps (FIRMs) that are used by the NFIP to rate their flood insurance policies, and the accuracy and usefulness of these maps have been under scrutiny from the private insurance market. FEMA has spent in excess of $200 million in recent years to update the maps (Adriano, 2018). While FEMA attempts to keep track of land use and gradient changes through letters of map revisions, FEMA flood maps have been criticized for not considering the evolving nature of flood risk. Commercial flood loss models do not generally utilize the FIRMs heavily; most utilize sophisticated GIS systems that differentiate between geographic areas based on a number of factors, including distance from water, water flow, topography, the built environment that may direct water flow, etc. No flood loss model includes a fuller set of a geographic area's variables nor considers these variables within a "tighter" area of land mass than does the KatRisk model; it is much more detailed to the grid than either FEMA or most other commercial flood loss models. The potential downside of using the KatRisk model given this difference is that higher resolution, more granular pricing can result in wider swings in loss estimates than a lower resolution (or simpler) model might experience. As mentioned previously, there are significant uncertainties around model estimates and large ranges of output values among different models, or over multiple iterations (versions) of a single model, as modeled assumptions change. There also tends to be an uncertainty tradeoff between lower resolution and higher resolution models – higher resolution models offer more specificity but also result in more volatility around the estimates. Either way, the model uncertainty is, to a large degree, expected, and its sources understood.

Treatment of precipitation. The KatRisk model includes the impact of rainfall on flooding, which the FEMA maps do not. The model generates precipitation events by utilizing the historic record and using statistical methods common in the field of meteorology. Using statistics rather than using global circulation models (that are used by most other modelers for generating rainfall events) may be advantageous since global circulation models are known to do a poor job with clouds and precipitation. A statistical method which takes the historic record, and then allows for shifts in the historical data as well as alterations to the overall magnitudes provides distributions of events that reflect the historical record, but appropriately have a longer and more dense tail as extreme events are simulated based on probabilities. KatRisk is one of the only event-based flood models that includes hurricane rainfall-induced flooding in its inland flood model which, according to estimates may account for as much as 70% of the loss from inland flooding (inland flooding only, not including storm surge). This means that other models may miss a large component of the overall losses.[19]

Treatment of inland flooding. Almost all of the models differentiate between fluvial and pluvial flooding events. Many have integrated flood with existing hurricane and storm surge models to give a more comprehensive view of tropical storm impacts while also providing a model specific to inland flooding. Inland flooding has proved more difficult to model that coastal (storm surge) flooding, and despite boasting unique features in their underlying tropical storm assumptions, processes and/or output calculations, commercial modelers of hurricane wind and surge generally have hesitated to boast about their inland flood modeling capabilities. Related to the ways in which the KatRisk model incorporates rainfall (thus increasing the model's knowledge of a major source of inland flooding), the KatRisk model stands out in its efforts to effectively model inland flooding. For North Carolina this is particularly important. In addition to stronger hurricanes, the amount of precipitation that falls during heavy storms (top 1 percent magnitude of storm events) has increased 27 percent over the last 60 years in the Southeast. And higher intensity storms are projected to increase inland flooding as a result of heavy runoff by up to 40% by 2050 in North Carolina (Walsh et al., 2014).

Other notable model characteristics. The KatRisk flood loss model contains at least a couple of additional qualities that are likely relevant to having been chosen by the Rate Bureau for setting rates. First, in order to more accurately model the variety of potential building characteristics in North Carolina, KatRisk underwent a process of generating new vulnerability curves (linking the intensity of weather events to expected damageability). These new curves capture basement-only units, finished versus unfinished basements, and mobile home tie-downs. Second, use of the KatRisk model may result in no elevation certificate needed for the Rate Bureau to set rates (saves ~$700 in consumer costs). Because the floor of interest elevation (typically the basement or 1st floor for a single unit dwelling) is included in the KatRisk-Milliman rating model, rating the risk may not require elevation information from the consumer.[20]

[19] Events like Hurricane Florence, for example, currently may not be represented in the storm event set from other modelers.

[20] A mortgage company, however, may still require elevation certification unless properly educated that this information is built into the Rate Bureau rating process.

3.1.4 The Rate Bureau Plan Rating Variables & Algorithms

Overall, the Rate Bureau rating plan is straightforward, although the necessary work behind the scenes is complex. Regardless of property type, a flood insurance policy is assigned a base rate for each coverage based on the physical location of the structure, which takes into account flood risk differentials at a high resolution. High resolution results in a granular rating, such that the insurance pricing is effectively done at the property level (rather than at the zip code or zone level). A series of rating variables were chosen that are based on the property and insurance policy characteristics, account for the type of flood peril and coverage, and were statistically validated for their relationship to the risk and/or exposure.[21] Using these rating variables, rating factors are applied to the base rate, each of which adjusts the insurance rate upward or downward, subject to a minimum premium. From there, adjustments to the rate level are made to appropriately match the KatRisk output to the policy form, and to account for expenses, profit, and contingencies. Optional endorsements that are projected to have an impact on losses, if chosen, are also priced. Description of the base rate, each rating variable and the rating algorithm is provided here.

The base rate. The starting point for a property's flood insurance rate primarily depends on the geographic risk. Milliman developed a grid by dividing the state into more than 140 million unique 30 meter X 30 meter sections, and allocated to each one a unique Grid ID. [22] KatRisk then computed the Base Risk Average Annual Loss (AAL), and the Base Risk Grid AAL is defined for each Grid ID (i.e., there are over 140 million unique base rates in North Carolina).[23]

Assigning the appropriate base rate. To obtain a rate for a policy, a Grid ID must first be assigned. Companies will determine the latitude and longitude of the insured location, and the Grid ID with the centroid nearest to the latitude and longitude of the insured location will be assigned to the policy.

Storm Surge Percentage & Storm Surge Exposure Indicator. The Storm Surge Percentage is the ratio of Storm Surge AAL to Storm Surge and Inland Flood AAL. If the Storm Surge Percentage is greater than zero, the policy is considered to have storm surge exposure. Otherwise it is

[21] The validation results are highly credible; standard errors for the regression coefficient estimates were relatively low. Estimated coefficients for the relationship between rating variables and losses were developed using sound statistical modeling techniques and random samples of input data, including the use of more than one validation data set, all of which are intended to yield unbiased estimates of expected loss based on the property characteristics.

[22] Given that there are over 140 million unique Grid IDs, the logistics of merging the Grid ID with the associated rating elements are complex. The Rate Bureau is providing production support for this calculation.

[23] The Grid ID is used to look up the Base Risk Grid AAL, Storm Surge Percentage, and Storm Surge Exposure Indicator, which are all used for rating.

considered to be without storm surge exposure. Rates vary for policies with and without storm surge exposure.

The rating variables – property characteristics. The rating plan adjusts the insurance rate upward or downward based from the base rate according to several rating variables.

First floor height – the distance of the first floor above the surface of the ground

Floor of interest – the policyholder's bottom living floor (for instance, condominium unit-owners may be located above the first floor)

Type of below ground area and finish – walkout versus full basement, finished versus unfinished basement

Number of stories – a property having multiple stories means portions of the living space face a reduced likelihood of damage from what is faced by the floor of interest

Coverage A (for main dwelling) Replacement Cost Value (RCV) – the cost to rebuild the main dwelling to similar function and level of quality

Construction – exterior wall types

Tie down – whether mobile homes are tied down in accordance with North Carolina Building Code

Building equipment lower than the first floor – surcharge applies to Coverage A (dwelling) and Coverage D (loss of use) if there is building equipment used for the service of the dwelling located in a crawl space or an attached garage with a floor that is lower than the first floor

Deductible chosen by policyholder – a single deductible is chosen for all coverages, and any deductible up to a maximum of $20,000, 20% of Coverage A, or 20% of Coverage C can be selected

Coverage B equal to 10% of Coverage A is included for detached garage, within the Coverage A Limit, in the base policy. [24] Several optional endorsements provide for additional Optional Other Structures Coverage, which is priced based on the Coverage A Premium and the percent of the Optional Other Structures Limit relative to Coverage A Limit.

[24] A rating factor, or adjustment, is made here for a property having a detached garage because all else the same, if a home has a detached garage, it has a larger amount of Coverage A and Coverage B insured than a home without a detached garage. The adjustment is applied to Coverage A when Coverage B is purchased.

Coverage limits chosen by policyholder – selected separately by coverage for Dwelling (Coverage A), Other Structures (Coverage B)[25], Contents (Coverage C), and Loss of Use (Coverage D).

The rating variables – optional, additional coverages. A policyholder may elect a different level of coverage for other structures than what is automatically provided within the base policy, or may desire additional coverages, that are available by endorsement to the base policy (for which rates are filed separately by insurers). Some of these available endorsements are listed below:[26]

Broadened coverage for dwelling and other structures – makes available additional and broadened coverage for other structures at an additional limit of up to 10% of the Coverage A limit[27], and may provide coverage for items otherwise listed in the policy as Property Not Covered (such as a building or structure located on or over a body of water, fences, retaining walls, seawalls, bulkheads, wharves, piers, bridges or docks, as well as other structures); and an additional limit of up to 5% of the Coverage A limit for trees, shrubs and plants

Increased limits for other structures – additional amount of coverage for a specific structure that will only apply for the specific scheduled structure and will be in addition to the 10% limit already provided

Increased limits for loss assessment – provide up to $1,000 for a policyholder's share of loss assessment charged against the policyholder by a corporation or association of property owners, for direct loss caused by flood to property owned by all members collectively

Increased Cost of Compliance (ICC) Coverage – reimburses policyholder for cost to comply with certain state or local floodplain management laws after a qualified loss (can be provided for limits of at least $30,000)

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[25] A Coverage B (Other Structures) coverage equal to 10% of Coverage A is included automatically for a detached garage, within the Coverage A limit, in the base policy.

[26] The full list includes 22 possible endorsements, and can be found at file:///G:/My%20Drive/Desktop/RESEARCH/Flood/Flood%20Presentation%20Updated%202_4_20.pdf

[27] If this Optional Other Structures Coverage is purchased, it covers detached garages and so the detached garage coverage factor mentioned in an earlier footnote is removed from Coverage A as part of the rating algorithm.

Building Ordinance or Law Coverage – reimburses policyholder for the cost associated with demolishing, repairing, rebuilding, or constructing a structure if a covered loss prompts additional changes due to laws or regulations (can be rated as a percent of Coverage A limit)

Personal Property Replacement Cost coverage – Coverage C (Personal Property) defaults to an Actual Cash Value (ACV) loss settlement without this endorsement and a (surcharge applies if replacement cost loss settlement is selected).

The importance of the Insurance to Value (ITV) factor. As described earlier, the rating algorithm begins with a base rate, either with or without storm surge exposure. The insurance premium calculation first multiplies the Base Risk Grid AAL by the Coverage A Replacement Cost. An Insurance to Value (ITV) factor provides an adjustment for selecting Coverage A limits that are below the dwelling's RCV.[28] This is particularly important for flood as the current maximum NFIP Building Limits are $250,000, often forcing the policyholder to underinsure unless an additional excess flood insurance policy is purchased in the private market. The Rate Bureau rating plan allows insureds to insure their home fully to value, but also provides appropriate rates when they choose not to do so. The minimum coverage limits that can be selected by a policyholder are found in Table 2.

Coverages	Minimum Limits
Coverage A – Dwelling (One- to Four-family)	$15,000
Coverage C – Personal Property (One- to Four-family)	No Minimum
Coverage C – Personal Property (Tenant	$6,000
Coverage A – Dwelling (Condominium Unit)	$5,000
Coverage C – Personal Property (Condominium Unit)	$10,000
* No minimum limit is required for the owner of a unit rented to others.	

Table 2. Minimum Coverage Limits under the Rate Bureau Flood Insurance Program

[28] ITV is calculated primarily based on the Coverage A Limit and Replacement Cost. The adjustment does not increase proportionally to ITV. For example, insuring a property at 50% ITV results in less than a 50% adjustment. This is appropriate because marginal increases in the value insured should result in a lower increase in losses at higher coverage limits relative to value compared to lower coverage limits relative to value.

Incorporation of the rating variables and endorsements into the rating algorithm. Once the base premium is calculated and adjusted for the ITV factor, a rating factor for each rating variable is multiplied by the base premium. The separate cost of any endorsement(s) selected by the policyholder are added to the premium.

The final premium calculation. A Loss Cost Multiplier (LCM) that allows for insurer expenses, profit and contingencies, and may vary based on the Storm Surge Percentage, is incorporated at the end of the rating algorithm. The result is the final flood insurance premium, subject to a minimum premium. Table 3 indicates the minimum premium by property type.

Mobile Home	$150
Tenant	$150
Condominium Unit	$150
All other One-to-Four Family	$175

Table 3. Minimum Annual Premiums under the Rate Bureau Flood Insurance Program

Comparison with the NFIP rating system. The NFIP rating algorithm generally is less complex but also less straightforward than that of the Rate Bureau. It is based primarily on five (5) rating variables that determine the flood insurance premium.

Flood zone – whether the property is sited in a flood zone (and the higher risk the flood zone, the higher the flood insurance base premium will be)

Type of building – single family homes, two- to four-family homes, apartment buildings, and other non-residential buildings may have different base rates

Elevation of the lowest living floor – the higher the lowest inhabited floor (any floor not used solely for storage, access, or parking) is relative to the Base Flood Elevation (BFE)[29], the lower the premium may be.

How much coverage is needed – the more insurance coverage purchased, the higher the premium, but the lower the rate per coverage unit

Choice of deductible – the higher the deductible the lower the insurance premium.

[29]The BFE is the elevation in feet to which floodwater is anticipated to rise during the 1% annual chance storm as shown on FEMA's Flood Insurance Rate Maps.

Three of these NFIP rating factors – elevation of lowest living floor, coverage limits and deductible – are in common between the NFIP and the Rate Bureau plans, while the other two are different from the Rate Bureau rating factors. The NFIP's use of FEMA-designated flood zone for base rates is a lower resolution (thus less granular) approach that results in fewer possible base rates than does the Rate Bureau use of 30-meter grid IDs. The NFIP's use of building type is different from the construction type used by the Rate Bureau plan since NFIP's building type is more about use and occupancy than about construction. The Rate Bureau's construction rating factor more directly relates the rating variable to building vulnerability and expected damage costs than does the NFIP's building type rating factor.

In addition to these differences, the minimum premium charged by the NFIP is higher than that charged by the Rate Bureau plan. This difference is discussed in a later section, but suffice to say that the expenses associated with a federal government insurance plan result in higher fixed charges than are necessary within a private market insurance plan.

3.1.5 Choice of Policy Forms & the Definitions of Flood & Eligibility

The Rate Bureau Flood Insurance Program made the choice to use a stand-alone policy form to offer flood insurance rather than use an endorsement that attaches to a multi-peril hazard insurance policy. Moreover, the Rate Bureau has chosen to base its stand-alone policy, the Personal Flood Policy FD 00 01 Form, on an Insurance Services Office (ISO) form template. While the market implications of these choices are evaluated in a later section of this report (Section 4), here we focus solely on the impacts on coverage and rates.

Admitted insurance provided as a stand-alone policy. For private insurers to successfully participate in the flood insurance market, they must offer a flood insurance agreement either as an endorsement to the homeowners policy or as a stand-alone flood contract. It may be difficult, however, to design an endorsement that regulators are willing to accept as both properly aligned with the underlying policy and at least as liberal as NFIP coverage. The stand-alone policy developed by the Rate Bureau is an admitted North Carolina insurance product, meaning it is sold by insurance carriers that are licensed and overseen/regulated by the NCDOI. Any insurance litigation would be in state court (e.g., wind vs. water issue would be tried in North Carolina state court only). Furthermore, this helps to ensure the "continuous coverage" under NFIP requirements and helps ensure mortgage company acceptance.[30] A stand-alone

[30] Lenders may, at their discretion allow private flood insurance in lieu of any NFIP flood insurance coverage that may otherwise be required, and are expected to follow the "FEMA 6" to determine the viability of the private coverage as substitute for NFIP coverage. The FEMA6 are the items that any private flood policy has to match or exceed to qualify (to meet continuous coverage requirement under NFIP): 1) Underwritten and sold by a licensed, admitted carrier or approved surplus lines carrier; 2) 45 day notice of policy cancellation by the carrier; 3) Coverage at least as broad as that provided by the NFIP policy; 4) Mortgage interest clause similar to that found in the NFIP policy; 5) One year limit to file suit after a claim is denied; and 6) policyholder cancellation provisions as

flood policy provides flexibility in form design and eliminates the issue of alignment with an underlying property policy. Section 4 of this report focuses on the choice of the stand-alone policy in more detail. Here, suffice it to say the choice to provide coverage on a stand-alone form makes it possible for the policyholder to have a wide array of coverage choices (as indicated above) and pay a risk based premium (as calculated in the rating algorithm) that is commensurate with those choices.

The choice of the ISO Form template. The Rate Bureau ultimately selected a policy form template that is available from the Insurance Services Office (ISO). Since most residential and commercial property insurance policies are developed using ISO Forms, the choice of ISO means the policy can look familiar to insurance agents and consumers, much like a standard homeowners policy. Thus, insurers can more easily customize the forms for use in the marketplace (using the flexibility of the rating algorithm), and do so not only in North Carolina, but potentially expand the offering to other states without large changes in coverages, terms and conditions. Furthermore, because the ISO forms have been used widely by the industry for many years they are court tested and have been tweaked over time to include language that reflects what has been learned from court precedent.

Comparison with NFIP forms. The Rate Bureau clearly designed the flood insurance policy with a favorable comparison to the NFIP policy in mind. In every single category of coverage, terms and conditions, we submit to you that the Rate Bureau forms offer superior language to what is found in the NFIP forms. Indeed, the Rate Bureau policy forms, in a side-by-side comparison with the NFIP forms, at the same price point, holds substantially greater value for the policyholder. Given the more generous basic policy language and the fact that the Rate Bureau policy also offers 22 optional endorsements from which a policyholder can choose, even at a higher price point, a Rate Bureau policy may hold greater value for a policyholder. Some examples of these differentiating features include:

- The definition of "flood" is more liberal within the Rate Bureau policy language than within the NFIP policy language[31]
- Property & policyholder eligibility is more encompassing under the Rate Bureau policy language (Refer to Appendix C)

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restrictive as those of the NFIP. Details available at https://www.fdic.gov/regulations/compliance/manual/5/v-6.1.pdf

[31] The Rate Bureau's Personal Flood Policy FD 00 01 Form includes as "Flood": The overflow of inland and tidal waters from a natural or manmade body of water; the unusual or rapid accumulation of surface waters from any source; mudslide or mudflow as caused by certain flooding as specified in the policy; collapse or sinking of land along the shore of a body of water caused by certain flooding as specified in the policy. As such, there is no requirement that it be over two properties or two acres, it more clearly covers mudflow and arguably adds coverage for mudslide.

- NFIP coverage, as we know, provides relatively low maximum coverage limits, while the choice of Rate Bureau coverage is unlimited
- NFIP policies have no coverage minimum, while the Rate Bureau policies do (important for ITV considerations)
- NFIP coverage has a 30-day waiting period for coverage to begin, while Rate Bureau coverage has no waiting period[32]
- NFIP policies provide no allowance for additional living expenses or loss of use, while the Rate Bureau policies do
- NFIP makes no coverage provision for civil authority / civil ordinance prohibitions due to property damage, while the Rate Bureau provides up to two weeks coverage
- Both the NFIP and Rate Bureau policies reimburse for loss assessment charges (such as in a condo owners association) up to $1,000, but under the NFIP policy any amount paid reduces Coverage A policy limits while the Rate Bureau policy pays the amount in addition to Coverage A limits
- NFIP dwelling and contents each are subject to a separate $500 deductible while the Rate Bureau policy is subject to only one deductible for dwelling and contents
- NFIP policies limit the option for RCV to coverage of principal dwellings only while the Rate Bureau policies offer RCV for any dwelling
- Rate Bureau policy language makes it easier for a policyholder to cancel the policy and get a pro rata refund than does the NFIP policy language
- The rate manual allows an insured to select either a flat dollar site deductible, a site deductible as a percent of Coverage A Limit, or a site deductible as a percent of Coverage C Limit.[33]

3.2 Illustrations of the Premium Calculation

3.2.1 Key components of the pricing algorithm and form

Beyond just the GPS location (i.e., grid area) of the insured property for determination of the insurance base rate, each rating factor impacts the final insurance premium to some extent. Homeowner choices of coverage limits have a direct impact on the premium since these choices directly affect the Total Insured Value (i.e., the amount to which the insurer is exposed).

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[32] Although the Rate Bureau did not put a waiting period in the program, an insurer may consider a waiting period when choosing whether and how to implement the program; insurers are not required to write policies without a waiting period.

[33] For example, a homeowner may have a $100,000 Coverage A Limit and select a 2% deductible as a percent of Coverage A Limit, or a tenant may have a $100,000 Coverage C Limit and select a 2% deductible as a percent of Coverage C Limit. In either case, the policy effectively has, and is rated equivalent to, a $2,000 flat dollar site deductible. This deductible structure allows insureds and companies flexibility to utilize deductible definitions that work best for them, with consistent treatment across each option in the rating plan.

The physical characteristics of the property that impact premium the most are first floor height, floor of interest and number of stories.

3.2.2 Illustrative Examples

The intent of this section is to illustrate the impact that characteristics of a dwelling and can have on a Rate Bureau flood insurance policy premium. There are several different physical attributes of homes that are considered in the calculation of Rate Bureau Flood Insurance premiums. This section will illustrate examples of policy premium calculations using a variety of rating factors that correspond to common dwelling characteristics in order to understand how the filed rating factors are used in premium calculations and to compare the impact that dwelling characteristics have on price. All of the example calculated premiums have been summarized in Table 5 at the end of the section as an aid for quick reference and comparison.

In order to focus the on the impact of dwelling characteristics, it is necessary to make assumptions about the underlying policy and coverages that will be held constant throughout the examples. In the following examples of premium calculations, these policy assumptions have been used: $200,000 Coverage A, $100,000 Coverage C, 100% Coverage A ITV, $0 Coverage D, $5,000 deductible, and no endorsements. Note that as with any homeowners policy, changing any of these coverages would have an impact on premium. However, they will be held constant here, as the purpose of this section is not to explore the impact of an insured's coverage options (which are flexible), but rather the physical characteristics of the home. Appendix D contains the assumptions, calculations and rating tables used for each of the illustrations below.

Illustration A: Base Premiums – Single Story Dwelling In order to see how different characteristics change policy premiums, it is necessary to have a dwelling that will be used as a baseline for comparison. The baseline home used in these examples is the standard 1-to-4 family single-story home.[34] Based on data provided by the Rate Bureau, the average flood insurance premium for this home in a non-storm surge exposed county is $553. This is the Base Premium, and it will be used for comparison throughout the other examples.

Due to the storm-surge flood exposure that exists in the coastal region of North Carolina, a separate baseline premium is needed for homes within these storm surge exposed areas. Because of the additional exposure that exists, these areas on average have a higher Base Grid AAL factored into their premiums. Additionally, many of the filed Rate Bureau rating factors are different for locations without storm surge exposure vs. those with storm surge exposure. While these differences in rating factors are generally not substantial, they do have an additional impact on premiums. The data provided by the Rate Bureau indicates that the

[34] Example premiums assume frame construction with first floor height of 1 unless noted otherwise.

average flood insurance premium for a standard 1-to-4 family single-story, frame construction home in a storm surge exposed county is $1,110 (Storm Surge Base Premium). As expected, when compared to the Base Premium for the home in a non-storm surge exposed area, the premium for the single-story home with storm-surge exposure is significantly higher.

Illustration B: Number of Stories This example uses the Rate Bureau filed rate factors to explore how the premiums change if the dwelling is multi-story building rather than a single story. As previously mentioned, there are different rating factors for locations Without Storm Surge Exposure and for those With Storm Surge Exposure. Additionally, there are also different factors for Coverage A and Coverage C. In order to apply these factors to the Base Premium and Storm Surge Base Premium to see how they change, there needs to be an assumption about what percentage of the premium is attributable to each coverage part. For the sake of these examples, it is assumed that for non-storm surge exposed areas 68% ($376) of the Base Premium is for Coverage A and 32% ($177) is for Coverage C and for storm surge exposed locations, the split of Storm Surge Base Premium is 71% ($788) and 29% ($322) for Coverages A and C respectively.[35] Using these assumptions and the filed rate factors for Number of Stories, the premiums for a two-story home are $334.23 without storm surge and $651.34 with storm surge.

When compared to the Base Premiums, these calculated premiums for a two-story building are substantially less – about 40% less for both dwellings with and without storm surge exposure. It makes sense that premiums for multi-story buildings are lower than their single-story counter parts. In a multi-story home, some of the living space and contents are elevated above the first floor. Because of this increase in elevation, the potential flood exposure of the elevated portion of covered property is inherently decreased. It follows that the premiums would be reduced as well to align with the reduction in exposure.

Illustration C: Floor of Interest Another important rating factor in the NCRB flood insurance policy is the “Floor of Interest.” The Floor of Interest is defined as the lowest floor that has living space. Note that the Floor of Interest factor does not apply to basements/ below ground areas in 1-to-4 family homes – as there is a separate rating factor for this – but does apply to apartments or condos that are in a below ground area. For most 1-to-4 family dwellings, the floor of interest is the first floor for which there is no adjustment to the Base Premium needed. However, this rating factor becomes increasingly important when considering multi-family dwellings that are split by level as well as condo units. Use of the Floor of Interest rating factors in calculating the premiums for both below ground and second floor condo units, we get:

[35] Assumption based upon coverage amounts selected for example ($200,000 Coverage A and $100,000 Coverage C) and the NCRB filed Base Rate Adjustment Factors – Section B pg. 2 of 13

	Below Ground	2nd Floor
Without Storm Surge	$1,050.25	$61.69
With Storm Surge	$2,043.50	$140.71

Table 4. Sample Premiums for Condominiums

As expected, the premiums for below ground units are dramatically higher when compared to the Base Premiums which indicates the increased susceptibility of below ground areas to flooding events.

Both of the calculated premiums for a Second Floor Condo are below the minimum premium amount that is outline in the Rate Bureau Rate Filing which means that premium for both of these policies would not be the calculated amount but rather would be the minimum premium for a condo unit which is **$150**.

While the Floor of Interest factor applies to a smaller percentage of homes (since for most dwellings the first floor is the floor of interest for which there is no premium adjustment needed), it is still an important rating consideration and has an even more significant impact on policy premiums than the Number of Stories factor. The premium for multiple story structures is lessened by the reduction in exposure that comes from having a portion of the covered property above the first floor, as the livable square footage and contents are spread over multiple levels. Alternatively, the floor of interest rating factor accounts for the entirety of covered property being above (or below) the first floor, which therefore results in even more significant changes to premiums.

Illustration D: Application of Multiple Factors It is also important to consider how the premium changes when more than one rating factor applies. All other things considered equal, the premium for a two-story building, is less than that of a one-story building. However, an even lower premium would apply to a two-story building that has an elevated first floor to further reduce flood exposure.

The First Floor Height is another noteworthy rating factor which considers elevation of the dwelling and it will be used in this example. Like the Floor of Interest, this factor adjusts for all of the covered property being elevated but instead of just considering elevation based on which floor coverage applies to, it considers the elevation of the entire dwelling structure. There is an inverse relationship between the first-floor height and the flood policy premium; the higher the first floor, the lower the cost.

The application of multiple factors in the calculation of policy premium is done the same way with each rating factor applied to the appropriate coverage part base premium and compounding on each other in order to develop the final premium. An example of this is the calculation of premiums for a two-story home that has been slightly elevated and has a first floor height of 4 feet, which is $146.06 without storm surge (so becomes the minimum premium) and $270.40 with storm surge.

3.2.3 Summary

There are rating factors related to the physical characteristics of a dwelling other than the factors that are used in the examples provided here (i.e. construction type, mobile home tie-downs, and type of below ground area finish). However, it is no coincidence that the rating factors utilized in these example premium calculations all relate to the elevation of the covered structure and contents from the ground. These factors have the largest impact on policy premiums because of the inherent nature of flood risk. A dwelling and contents can either be flooded or not, and the depth of the floodwater directly impacts the extent of damage and cost of repairs. By elevating a building/contents the risk of a flood as well as the potential damage of the flood is inherently decreased which is reflected in an appropriate adjustment to the premium. While it is important to be aware of all rating factors that could influence policy premiums – including the coverages chosen – the elevation of a structure is directly related to the potential flood risk and aside from the Base Grid Risk AAL, has the largest impacts on pricing from a dwelling characteristic standpoint.

	Without Storm Surge Exposure	With Storm Surge Exposure
Single-Story (Base Premium)	$553.00	$1,110.00
Two-Story	$333.60	$651.34
Basement Condo	$1,050.25	$2,043.50
2nd Floor Condo	$150 (calculated at $61.69)	$150 (calculated at $140.71)
Two-Story w/ First Floor Height of 4ft.	$175 (calculated at $146.06)	$270.40

Table 5. Summary of Effective Premium Amounts for Illustrated Properties

4 Potential Costs & Market Implications of the Rating Program

4.1 Insurance Market Implications of the Rating Plan

In this report, we have examined the North Carolina Flood Insurance Program in the context of North Carolina flood risk, and in light of available NFIP coverage. We have also commented on the choice of loss model, dissected the rating algorithm, and calculated premiums under the program for several realistic property scenarios. Also important to the ultimate viability of the program, however, is its marketability and its potential impact on other markets, namely the many and varied real estate markets in the state. We now turn to these issues for the final portion of our evaluation.

4.1.1 Rate Bureau Statement Regarding Insurance Rate Implications

In its NCDOI rate filing for the flood insurance program, the Rate Bureau states:[36]

> *Based on a risk level analysis of 500,000 actual locations in North Carolina, we estimate that 94% of residential properties in North Carolina would see a lower premium with the filed rates compared to NFIP rates effective in April 2019.*

The Rate Bureau employed multiple exposure sets to develop, validate, and review the rating plan for the flood insurance program -- developed by Milliman and run through the KatRisk model. The Rate Bureau created a market basket of 500,000 parcel records to primarily serve as a validation exposure set for the rating plan, and as a basis for comparison against current NFIP rates. The Rate Bureau applied distributions for property and coverage related characteristics based on multiple data sources available to them, and made data adjustments necessary for realistic reinsurance assumptions and to closely resemble the coverage of the NFIP program.[37] Full insurance to value for Coverage A was assumed to simplify the rate comparison with the NFIP.

We examined the validity of the Rate Bureau statement above, based on data available from the Rate Bureau, the NFIP, the U.S. Census Bureau and the State of North Carolina, and find the statement to be valid based on a replicable study of actual North Carolina exposure data, the Rate Bureau rating plan and rating data available from the NFIP.

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[36] September 16, 2019 Memorandum from the Rate Bureau's Raymond Evans to the North Carolina Insurance Commissioner Mike Causey, accompanying the North Carolina Residential Flood Filing file:///G:/My%20Drive/Desktop/RESEARCH/Flood/2019%20NCRB%20Flood%20Filing.pdf

[37] For reinsurance assumptions, a statewide portfolio based on the highest take-up rate that could reasonably occur was developed.

4.1.2 Study of the Rate Bureau Market Basket Premiums

For a reasonable comparison of premiums, it is ideal to begin with a characteristic, or typical, risk for pricing purposes, and to compare the price charged by the Rate Bureau and the NFIP programs. Since North Carolina flood has no single characteristic property and coverage profile, the next best alternative is to begin with a standard, or uniform, set of property and coverage assumptions. Rate Bureau premiums were calculated for a market basket of 500,000 properties using the following assumptions:

- $200,000 Coverage A (dwelling)
- $100,000 Coverage C (contents & personal property)
- 100% Insurance-to-Value (ITV) for Coverage A
- $0 Coverage D (loss of use)
- $5,000 Deductible
- Single Story
- First Floor Height=1
- Construction=Frame
- No Endorsements

The only discernable difference between property profiles is the location (so the base rate AAL differs due to grid location and whether there is storm surge exposure). Appendix E contains the Rate Bureau premium distribution and minimum premium by county for the uniform risk described.

Note about the minimum premium used.[38] Note that the minimum premium shown in the premium distribution is $200 rather than the $175 minimum premium referred to earlier in this report. When the Rate Bureau initially filed rates based on this rating plan, the minimum premium was set at $200. Although the minimum premium for the Rate Bureau program has since been adjusted to $175, the “94 percent win” statement was made based on a $200 minimum premium. If we can validate the statement using the higher minimum premium level, we de facto establish that the statement is also valid at the reduced minimum premium level, given that no other material change has been made to the rating plan since the filing.

[38] Although the Rate Bureau was flexible in the choice of a reasonable minimum premium, some minimum price is necessary to cover expected costs related to a flood policy. Those who purchase flood insurance in locations where KatRisk-modeled AAL is close to zero may have exposure to flood risk higher than anticipated by the model. And flood policies with a low AAL inherently have much higher expenses as a percent of expected costs, so that is reflected with the minimum premium.

Rate Bureau mode & median premiums. A view of the descriptive statistics for the premium distribution in Appendix E reveals that for the market basket in most counties, the most common premium (mode) and the 50th percentile premium (median) are the minimum premium. For 45 percent of counties, even the 90th percentile premium is the minimum premium.[39]

Rate Bureau average premiums. If we average the average premiums by county, we find the statewide "average of averages" to be approximately $709. We begin to see the expected market divergence if we compare the "average of average" premium for counties with few to no locations exposed to storm surge (approximately $553) with that for storm-surge exposed counties ($1110). These figures are at least twice as high as the minimum premium, and overall, storm-surge exposed counties average a premium twice as high as those in non-storm-surge exposed counties.

Rate Bureau range of premium levels. A review of the premium distribution reveals a wide range of possible insurance premiums within county. For every county there are properties with sufficiently low modeled flood risk to result in a minimum premium. The top end of the premium range, however, varies widely, both within county and across counties. For the market baskets in Brunswick, Carteret, New Hanover and Onslow Counties in particular, at least one premium is greater than $90,000. Even in Tyrrell County, which has the lowest maximum premium in the market basket at $8,312, the maximum premium is quite high as compared with the minimum premium.

Skewness of the Rate Bureau premium distribution. Taken together, the mode, median, average and range tell the story of a skewed distribution. While most premiums across the state may fall at or close to the minimum premium level, the average premium is substantially greater than the median premium in most counties, indicating that a significant number of homes in the market basket are at locations subject to a risk level sufficient to be matched with quite high premiums (property with the highest premium, in excess of $100,000, located in Onslow County). Appendix E illustrates this skewness within county, and also across counties, for the top 50 counties, having the highest average premiums. The chart emphasizes that overall in counties with higher flood exposure (i.e., higher average premium), there is higher variability in the range of premiums.

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[39] The 55 counties for which this does not hold include Ashe, Avery, Beaufort, Bertie, Bladen, Brunswick, Camden, Carteret, Cherokee, Chowan, Clay, Columbus, Craven, Cumberland, Currituck, Dare, Duplin, Edgecombe, Gates, Graham, Greene, Halifax, Haywood, Hertford, Hoke, Hyde, Jackson, Johnston, Jones, Lenoir, McDowell, Macon, Madison, Martin, Mitchell, Nash, New Hanover, Northampton, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Pitt, Robeson, Sampson, Scotland, Swain, Transylvania, Tyrrell, Washington, Watauga, Wayne, Wilson, Yancey.

4.1.3 Comparison with the NFIP Premium Distribution

Comparatively speaking, the notable differences between premiums in the NFIP program and premiums within the Rate Bureau program are consistent with the differences in the goals of the two programs, and the rating plans that result.

Importance of the minimum premium. In the NFIP program, there is a per-policy charge of $50 as well as a Homeowners Flood Insurance Affordability Act Surcharge of $25 for Primary residences and $250 for all other NFIP policies. Thus, even for only a $20,000 Coverage A limit, the NFIP minimum premium starts at $144 dollars. For $200,000 Coverage A limit, the NFIP premium is well above the Rate Bureau's minimum premium (even if the Rate Bureau minimum premium were still set at $200 instead of having been lowered to $175). A major factor then in the accuracy of the "94 percent win" statement made by the Rate Bureau is that the Rate Bureau carries a lower minimum premium for the market basket of a realistic risk distribution of $200,000 Coverage A limit properties. Since most properties in most counties fall within a low risk zone, the overall impact of the minimum premium difference as a driver is sizable.

Impact of risk-to-premium matching. Long established actuarial principles generally determine the setting of private market insurance premiums and are adhered to in the setting of rates and premiums for the Rate Bureau program. Insurance premiums are required to yield revenues that will pay expected future claims and insurance program expenses (costs), and theoretically premiums for an individual policy are based on the expected claims plus fees for each individual policy, over the long run on average. Also theoretically, no cross subsidy exists, where one group of policy holders pays artificially higher premiums so that other policyholders will pay artificially lower premiums. Last, premiums are no higher than necessary to ensure that these principles are met. Properties under the Rate Bureau program are priced to result in no cross subsidy, with a price-to-risk match even at the highest premium level (refer to Onslow, Brunswick and other counties at the super high end of the price range). The NFIP program, on the other hand, has a long history of intentional cross subsidies and suppressed top-end premiums. If the subsidy is to stay within the program (as opposed to being shifted to taxpayers more widely), then NFIP policyholders at low risk of flood must necessarily pay artificially higher premiums to create affordable premiums for policyholders at highest risk of flood. Although the NFIP has made inroads in recent years toward more risk-based rate tables and premiums, grandfathering of subsidies for properties having continuous coverage remains in effect for a substantial (up to 1/5th of the NFIP policy base).

Less skewed distribution for NFIP premiums. Based on a higher minimum premium, a lower maximum premium, and cross-subsidies in between, the NFIP premium distribution is considerably less skewed than the Rate Bureau's premium distribution. In other words, NFIP premiums are more compressed than those set by the Rate Bureau. On the low-risk (and low premium) end of the market basket (impacting the great majority of properties), in the neighborhood of 95 percent of hypothetical policyholders "win" by purchasing from the Rate Bureau rather than from the NFIP. On the high-risk (and high premium) end of the market basket (equivalent to those in the SHRAs and impacting far fewer properties), approximately 40 percent of hypothetical policyholders still "win." Weighted for their contribution to the overall market basket, the net percentage of hypothetical "winners" is just under 94 percent.

4.1.4 Potential Implications of Rating for Program Take-up Rates

The rating plan's potential effect on consumer/policyholder participation is an important consideration in the evaluation of the Rate Bureau program. Adequate consumer/policyholder participation is critical for the program's sustainability. That being said, it appears that even NFIP take up rates are particularly low in areas where purchase is voluntary; and worse, many who are required to purchase the coverage do not purchase it. The limited available data suggest that in some areas, meeting the goal of widespread take up rates for flood insurance would require a significant increase in insurance policy purchases. The insurance premium partially determines the willingness and ability to purchase a policy.

The Rate Bureau rating structure presents different value propositions for different groups – the homeowner group for which this plan is less expensive than NFIP coverage, the group for which this plan's cost differs little or not at all from the NFIP, and the group for which this plan is more expensive but still a good value if can afford the higher premium. While in theory, it is important to be mindful of consumer interest, from a practical perspective, insurers themselves must be sufficiently comfortable not only with the profitability prospects of the Rate Bureau's rating plan, but with its marketability to consumers in order to sell flood insurance under the plan in North Carolina.

The value propositions. As stated in the previous section, we have validated that the vast majority of homeowners enjoy lower premiums under the Rate Bureau plan than under the NFIP, owing to a lower minimum premium and to more precise risk-premium matching. From a participation standpoint, however, this factor alone may not ensure adequate program participation since this group consists largely of homeowners who do not currently participate in the NFIP insurance program. For this large group, participation is a matter of selling flood insurance at all rather than just a matter of selling the Rate Bureau program over the NFIP program. Homeowners for whom the Rate Bureau plan does not offer lower premiums, on the contrary, are likely already considering or are already consumers of flood insurance. The value proposition of the Rate Bureau program for these homeowners is evolving.

A changing value proposition. The premium comparisons made by the Rate Bureau as part of its rate filing, and our analysis of these comparisons, are based on the NFIP's current rating structure. Given that FEMA is planning to introduce a significant change to the way the NFIP calculates flood insurance premiums (known as Risk Rating 2.0), the value proposition story will evolve. The new NFIP premium rates are scheduled to go into effect on October 1, 2021, for all NFIP policies across the country. According to FEMA, the Risk Rating 2.0 will continue the overall strategy of phasing out NFIP subsidies,[40] with premiums for individual properties being matched to their actual flood risk.[41] According to FEMA, Risk Rating 2.0 will not use flood zones in calculating a property's flood insurance premium, but instead will use the specific features of an individual property, including structural variables such as the foundation type of the structure, the height of the lowest floor of the structure relative to base flood elevation, and the replacement cost value of the structure. Additionally, Risk Rating 2.0 promises to incorporate a broader range of flood frequencies and sources than the current system,[42] as well as geographical variables such as the distance to water, the type and size of nearest bodies of water, and the elevation of the property relative to the flooding source. Based on these scheduled changes to the NFIP program, it is reasonable to expect overall more accurate pricing from the NFIP going forward. It is notable that due to the minimum premium considerations and the reduction in subsidies that more properties will experience premium increases than premium decreases under the NFIP Risk Rating 2.0. For high risk areas, where premiums may increase the most, this rating change makes the Rate Bureau plan more competitive with the NFIP pricing; this could improve the Rate Bureau plan take-up rate among this segment of the population.

4.2 Insurance Market Implications of Stand-alone Flood Policy Choice

The Rate Bureau flood insurance program is a "stand-alone" policy. The coverage is only for flood related losses as described by the policy. An alternative option would have been to combine with the existing homeowners insurance policy. The current homeowners policy offers broad multi-hazard insurance coverage while excluding specific perils, flood being one. By adding flood coverage through an endorsement, it would be covered by the Homeowners

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[40] This phase out began with the Biggert-Waters Flood Insurance Reform Act of 2012 and continued with the Homeowner Flood Insurance Affordability Act of 2014.

[41] Because of statutory limitations on annual premium increases, however, the NFIP will not be able to increase rates faster than the existing limit for primary residences of 5%-18% per year.

[42] The current NFIP rating structure considers only two sources of flood risk – the 1%-annual-chance fluvial (river) flood and the 1%-annual-chance coastal flood.

Policy which would act as a single policy. The following section explains the pros and cons of each approach and provides an explanation regarding the decision of the Rate Bureau.

4.2.1 Pros & Cons of Combining with Homeowners Insurance

Advantages of combining with homeowners Insurance. The homeowners insurance policy contains an exclusion that removes most coverage for flood damage. If property owners wish to insure against flood losses, they must purchase a separate policy, with separate terms, conditions and deductible. A single homeowners policy that removes the flood exclusion related wording would have several advantages. First, it would be a single application process, likely faster and simpler than two separate policies. The property owner would avoid the NFIP policy 30 day waiting period required by FEMA. There would be a single deductible, rather than potentially two deductibles that could be required following an event like a hurricane. This would be less confusing for the consumer and streamline the claims settlement process because there would be a reduction in coverage gaps and claim litigation.

A single multi-hazard policy that includes flood could also benefit insurers and society as a whole. If all policyholders have coverage, there is less adverse selection resulting from only high risk property owners purchasing coverage. Property owners with a perceived lower flood risk would not have the option of forgoing coverage, since it is automatically included. The result is an increased number of consumers with protection against flood losses, with a large number of exposure units to spread the risk and diversity the exposure. The spread of risk over a larger territory would reduce the variability of losses over time and insurers could benefit from a more stable financial environment.

Disadvantages of combining with homeowners insurance. Merging flood risk into a single homeowners policy would result in a higher premium. This is not surprising since the policy now covers flood risk. The increased amount depends upon exposure and the rating formula. Property owners that currently do not have flood insurance would likely be upset at the resulting increase and feel like they are paying for coverage they do not need. Insurers, agents and regulators would bear the brunt of their frustration.

4.2.2 Pros & Cons of a Stand-alone Policy

Advantages of a stand-alone policy. The main advantage of a stand-alone policy is that it presents less obstacles to implementation. From a practical standpoint, it would be a challenge to get insurers to support any changes to existing homeowners policies that include covering flood. Given the flood risk, catastrophic exposure and correlation with hurricane damage, insurers likely would not want to participate. They have limited experience in rating, underwriting, and adjusting flood insurance coverage. The additional exposure would require more capital and reinsurance coverage, possibly creating capacity constraints. Premiums would need to be increased, resulting in upset policyholders and creating a reputational risk. Insurers already have concerns about their ability to adjust rating if needed given regulatory restrictions. Given these factors, insurers would likely resist the move to add flood coverage to their homeowners policies, thereby stalling efforts to develop a private flood market.

In North Carolina, a stand-alone flood policy has another potential advantage. By separating from the homeowners policy, it keeps flood risk out of the state property residual markets (commonly called the Beach and FAIR plans). The Coastal Property Insurance Pool, formerly known as the Beach Plan, was created in 1969 by the General Assembly to provide an adequate market for essential property insurance, ensuring the economic welfare of the beach and coastal areas of North Carolina. The FAIR Plan was created in 1969 by the General Assembly to provide an adequate market for essential property insurance, with the mission to encourage property improvements and arresting the decline of properties within the state of North Carolina.[43] Adding the potentially catastrophic flood risk could endanger their solvency, especially given the correlation between flood and wind losses resulting from a hurricane. Since today, the NFIP can serve as the residual market for high flood risks, a stand-alone flood insurance policy may meet the state's needs without necessitating legislative change to protect the mission of the Beach and Fair plans.

Disadvantages of a stand-alone policy. Stand-alone policies have drawbacks as well. Its disadvantages, to a large extent, mirror the advantages of the combined flood and homeowners policy. An endorsement may be the simplest option up front, as it effectively serves to eliminate the flood exclusion from the underlying policy, subject to terms and conditions. The form specifies modifications to the policy's definitions, insured perils, coverage amounts, property not covered, exclusions, and general conditions, and is designed to minimize coverage gaps and overlaps with the underlying policy. A stand-alone policy has different applications, billing, renewal dates, conditions, etc. Thus, renewal and cancellation timelines, billing and other issues become more complicated when an insurer adds a stand-alone flood policy to its homeowners insurance offerings. Moreover, the multiple policies (residential multi-peril plus separate residential flood) may confuse consumers (e.g., language, terms, exclusions), storm losses may create discrepancies regarding cause of loss (wind versus water) involve multiple claims adjusters and deductibles for the same event.

[43] https://www.ncjua-nciua.org/

4.3 Real Estate Market Implications

4.3.1 Historic Relationships between Hazard Exposure, Hazard Insurance Costs, Hazard Mitigation / Risk Adaptation Measures and Property Values

The Rate Bureau private flood insurance program offers expanded coverage and an updated risk identification model using a more granular approach. A logical question for property owners and realtors is the possible impact on property values. On one hand, a negative impact should be limited because the existing NFIP coverage and hazard identification model remains in place. That remains an option for property owners who do not wish to partake in the Rate Bureau program. On the other hand, the Rate Bureau program could yield benefits to property owners based on revised lower levels of flood hazard, greater affordability and availability of coverage, and incentives for mitigation. Based on prior research, hazard identification, changes in insurance affordability and availability, and mitigation all can be correlated with changes in property values.

Hazard Identification. There is a body of research that provides evidence that identification of flood risk has a significant impact on property values. Most studies focus on the increased flood risk negatively impacting home values and confirm this intuitive concept. Previous studies estimate price discounts of varying magnitude between 2-8 percent on sales of houses within the 100-year floodplain.[44] Additional research finds exposed properties trade at a 7-8 percent discount relative to unexposed comparable by using the National Oceanic and Atmospheric Administration's sea level rise calculator and housing prices from Zillow Transactions. Studies have also found price reductions for homes previously impacted by flood losses, with larger price reductions for homes more severely damaged. A Rand Corporation report examined flood insurance in New York and developed projections for the potential consequences resulting from changes in flood maps on households and communities. They found the resulting premium increases from map changes were projected to reduce property values and increase loan defaults compared to no changes.[45] Market prices are more significantly impacted if buyers are specifically informed of characteristics (in addition to what is already publicly visible). One researcher estimated that the seller's disclosure of an AE zone reduced housing prices by approximately four (4) percent.[46] In addition to supporting the relationship between higher flood risk and negative home values, research has also found positive effects on home values whose risk was assessed downward.[47]

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[44] Bin and Polasky, 2004; Bin et al., 2008; Atreya et al., 2013; Bin and Landry, 2013.
[45] Dixon et al 2017.
[46] Pope, 2008.
[47] Indaco 2018 investigates the effects of flood insurance on the housing markets of three urban coastal areas (New York City, Virginia Beach and Miami-Dade. They found a downward revision of risk in the flood risk had an effect on property values with increases of approximately 10 percent in New York and 30% in Virginia Beach.

Economic and social benefits of flood insurance. Affordable flood insurance is necessary for social adequacy, maintaining property values, and resilience of the surrounding community.[48] When a property owner suffers flood damage, their property value obviously decreases and funds will be needed to repair the damage. The property owner can use savings if adequate, perhaps government aid if provided, but most likely will rely on flood insurance. Reimbursement for the cost to rebuild following a flood not only benefits the owner, but those of surrounding properties. Property values decline for everyone (even insured property owners) If others are unable to rebuild and homes are left in disrepair. Property values in damaged neighborhoods suffer as buyers are reluctant to purchase homes with damaged and vacant nearby.

As discussed earlier in this report, the NFIP offers flood insurance to property owners living in communities that choose to participate. Coverage is voluntary, except for property owners living in a Special Flood Hazard Area (SFHA) with a federally backed mortgage who are subject to the mandatory purchase requirements.[49] There are minimal availability constraints in participating communities, though the insured maximum coverage for residential properties is limited to $250,000. Homes with a value greater than $250,000 are unable to obtain coverage to fully insure their homes without private flood insurance. Under the current system, property owners living outside of participating communities and those with buildings exceeding $250,000 are not fully protected by the NFIP. This is a significant concern because insured property owners recover more quickly after a flood. Without adequate insurance, the financial status of the population may be diminished to the point they are unable to rebuild or purchase housing. Research by Gallagher and Hartley (2017) finds reductions in credit scores and increased debt and delinquencies following Hurricane Katrina, though property owners with flood insurance have lower debt levels. Ratcliffe et al (2019) using data from FEMA, the Census data and a major credit bureau, find that hurricanes and flooding disasters lead to negative impacts on financial health, including credit scores, bankruptcy, mortgage delinquency and foreclosures. They provide evidence that the negative effects of disasters persist, or even grow

[48] Insurance "affordability" is usually described in somewhat vague terms, often in relation to income. The Homeowners Flood Insurance Affordability Act of 2014 suggests that premiums are unaffordable if the premium exceeds 1% of the property's insurance coverage.

[49] By law and regulation, federal agencies, federally regulated lending institutions, and government- sponsored enterprises (GSEs) must require the property owners in an SFHA to purchase flood insurance as a condition of any mortgage that these entities make, guarantee, or purchase. Government-Sponsored Enterprises (GSEs) are private companies with congressional charters. Examples of GSEs providing mortgages that would be affected by the mandatory purchase requirement include the Federal Home Loan Mortgage Corporation (Freddie Mac) and the Federal National Mortgage Association (Fannie Mae). Congressional Research Service, May 2019, https//crsreports.congress.gov R45242

over time. We previously mention in this report the research showing that insured households were 37 percent more likely to have rebuilt their homes after Hurricanes Katrina and Rita.[50] Without insurance, properties are less likely to be rebuilt and neighborhoods decline, particularly in low- and middle-income areas.[51]

Mitigation. Flood mitigation efforts (such as elevating structures) can effectively reduce the frequency and severity of flood losses, but do they have an impact on the market value of a home? This is a challenging question, because some mitigation measures are easily observed and can be valued by buyers while other features are hidden. Though the breadth of research on flood mitigation and home values is limited, we can draw inferences from studies using hurricane mitigation. Research on hurricane mitigation has examined the effects of both visible (hurricane shutters, roof shape) and features hidden by construction (secondary water barriers). Generally, the findings are that visible mitigation features are positively correlated with price increases. The visible and hidden features are positively correlated with 4-10 percent price increases if an inspection provides verification.[52]

4.3.2 Potential Implications of the Rate Bureau Program on the NC Real Estate Market

Understandably, there may be concerns about the possibility that structural insurance market changes could adversely impact real estate activity and values. Having evaluated the program in light of the NFIP program, we are indeed cautiously optimistic that the structural changes to flood insurance offerings initiated by the Rate Bureau have the potential to favorably impact the North Carolina real estate market overall and create no significant market problems, even in high-risk pockets. For two major reasons, we view the Rate Bureau plan as a benefit to the real estate market. First, for the vast majority of property owners, we have validated the Rate Bureau claim that flood insurance costs less under the Rate Bureau plan than under the NFIP plan. Second, in the market pockets where purchasing from the Rate Bureau results in a higher premium than under the NFIP, property owners still have a value proposition. The Rate Bureau's North Carolina Flood Program provides substantially more "handsome" coverage than does the NFIP program. To the extent that a property owner can afford the Rate Bureau's higher price, the quality of the Rate Bureau insurance product appears across the board to be higher than that of the NFIP, and thus offers the property owner a quality-price tradeoff decision. On the other hand, to the extent that a property owner cannot afford the higher

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[50] Turnham et al. 2011.

[51] Affordability of flood insurance contributes to the large proportion of low- and middle-income houses forgoing insurance (FEMA 2018).

[52] Gatzlaff, McCullough, Medders and Nyce (2018).

price, the NFIP program is available as a residual “market of last resort” for flood insurance coverage. Thus, we do not see any noteworthy downside risk to the real estate market of having a viable private market for flood insurance using the Rate Bureau forms and rating plan.

One motivation for the NFIP’s suppression of flood insurance premiums has been the objective of encouraging widespread adoption of flood insurance, presumably for both social and economic purposes. These purposes de facto include real estate development. While there is no objective definition of affordability, the Homeowners Flood Insurance Affordability Act of 2014 suggests that premiums may become unaffordable where the premium exceeds one (1) percent of a property’s coverage limit (Congressional Research Service, 2019). Other measures of affordability relate household income to the cost of housing, or are based on household income. Regardless of the measure used, we know from low NFIP participation rates that affordability is a likely challenge for some homeowners. The Rate Bureau plan provides a private “market price” alternative to the NFIP plan, leaving the NFIP to serve as a residual, or high-risk-only market (as it de facto serves now).

Residual markets exist to address government concerns about insurance availability and many states have residual market mechanisms. Residual markets are intended to offer basic insurance coverage for substandard (high) risks at rates *higher* than those available for standard and preferred risks in the private market, but *lower* than the private market rates may indicate for the substandard risks. States and insurance markets that have attempted to force insurance affordability onto the marketplace by way of rate suppression have historically created unhealthy private markets, requiring market corrections and benefitting from the separation of the private (low-to-moderate risk) and public (high risk) markets.[53] In the case of the North Carolina Flood Program, the Rate Bureau has developed a feasible private market template that can allow a natural (free market) separation between the private (insurance filed under Rate Bureau rates) and public (NFIP) markets.

Flood insurance is important to North Carolina’s housing market. If homeowners are unable to obtain flood insurance, a flood event (which we know can and has happened in any of the state’s 100 counties) can result in impaired credit and debt levels that reduce the ability to rebuild or purchase new homes. While the concern is valid and worthy of consideration that higher flood insurance premiums may depress housing values, we submit that 1) the NFIP plan remains an option for homeowners who would otherwise see premium increases; and 2) the Rate Bureau plan as a less expensive and/or higher quality alternative to NFIP coverage may

[53] Medders, Nyce and Karl (2014) provide a thorough treatment of the adverse impacts of such government interventions within their evaluation of the Florida homeowners insurance market.

help promote real estate in many pockets of North Carolina. Given the increasing flood risk faced by much of the state, multiple flood insurance options are better than only one.

5 Conclusions

Analysts estimate that in excess of 40 million U.S. households face a measurable flooding risk (Rollins, 2019). And the estimate is increasing with pressures from demographics, climate change and other factors. North Carolina's flood exposure is no exception, and indeed is arguably growing faster than the national average. The Rate Bureau has introduced a template for insurers to use if they are interested in providing flood insurance to North Carolina property owners on an admitted (regulated) basis.

Our evaluation of North Carolina flood exposure reveals a state with a substantial and growing risk of flood events and as well as properties which are vulnerable to them. An analysis of the Rate Bureau's flood insurance plan – the model and rating algorithm on which it is based and the coverage forms which guide its offerings and limitations – indicates a framework focused on exposure-appropriate coverage and risk-appropriate premiums. Our treatment of the socioeconomic implications of the new plan highlight the important relationships between flood risk, risk-based insurance coverage, hazard mitigation and property values. **Our overall conclusion is that the Rate Bureau plan is a healthy addition to the flood insurance marketplace within North Carolina, and that it in fact may provide a reasonable well-fitting model for other states to offer private flood insurance on a widespread basis. We see an observable positive benefit of the Rate Bureau's plan to the State Of North Carolina.**

Despite what we see as overall substantial net benefit to the state from the Rate Bureau plan, the actual take-up rate in the program by insurers so far is zero (0). This lack of interest by insurers may be due to multiple factors at play. First, the onset of the COVID-19 pandemic coincided rather closely with timing of the NCDOI's approval of the Rate Bureau plan. The effect of COVID-19 on strategic and tactical planning by insurers in their underwriting capacity as well as in their more generic operational planning cannot be overstated. Second, interested insurers may wait to file rates under the Rate Bureau plan until the NFIP's Risk Rating 2.0 becomes effective, at which time their offerings and rates will appear relatively more competitive from the start. Third, insurers may be slow to adopt any new lines of business during the current socio-political climate, in which any new venture may be considered high risk. It is possible that North Carolina's property insurers may all be waiting on a "first mover" to lead the way into a statewide flood insurance market.

Based on our evaluation of the Rate Bureau plan and its potential implications for both the flood insurance market and the housing market, we see no significant downside risks. Instead, we assert that there is untapped opportunity for private insurers and real estate professionals to capitalize on the program in ways that grow these markets and simultaneously improve the socio-economic value of living in North Carolina.

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APPENDIX A

APPENDIX A: North Carolina Flood Frequency by Region & County as of April, 2020

Mountains

Wilkes	*56*
Alleghany	*31*
Ashe	*61*
Avery	*30*
Watauga	*81*
Burke	*69*
McDowell	*46*
Caldwell	*68*
Yancey	*26*
Mitchell	*29*
Madison	*44*
Buncombe	*51*
Henderson	*77*
Rutherford	*41*
Polk	*27*
Transylvania	*64*
Haywood	*35*
Jackson	*29*
Swain	*24*
Macon	*42*
Graham	*15*
Cherokee	*14*
Clay	*6*
	966

Piedmont

Yadkin	*37*
Alexander	*19*
Catawba	*30*
Lincoln	*28*
Cleveland	*29*
Gaston	*36*
Mecklenburg	*102*
Iredell	*42*
Davie	*18*
Rowan	*43*
Surry	*69*
Stanly	*71*
Anson	*56*
Richmond	*40*
Montgomery	*48*
Davidson	*61*
Forsyth	*62*
Stokes	*35*
Rockingham	*64*
Guilford	*93*
Randolph	*63*
Moore	*58*
Lee	*40*
Chatham	*52*
Caswell	*41*
Person	*36*
Granville	*33*
Alamance	*54*
Vance	*22*
Orange	*52*
Durham	*77*
Wake	*132*
Franklin	*44*
Warren	*31*
Union	*81*
Cabarrus	*70*
	1869

Inner Coastal

Gates	*21*
Bertie	*31*
Hertford	*20*
Martin	*39*
Pitt	*46*
Lenoir	*47*
Duplin	*41*
Sampson	*45*
Bladen	*25*
Columbus	*30*
Robeson	*23*
Scotland	*37*
Hoke	*35*
Harnett	*44*
Cumberland	*66*
Johnston	*63*
Wayne	*48*
Nash	*47*
Wilson	*22*
Greene	*30*
Edgecomb	*47*
Halifax	*46*
Northampton	*21*
	874

Tidewater

Washington	*31*
Tyrell	*29*
Dare	*13*
Beaufort	*49*
Hyde	*7*
Currituck	*13*
Camden	*25*
Chowan	*20*
Carteret	*71*
Pasquotank	*29*
Perquimans	*22*
Craven	*61*
Pamlico	*42*
Jones	*35*
Onslow	*68*
Pender	*48*
New Hanover	*74*
Brunswick	*49*
	686

APPENDIX B

NFIP Storm Surge Analysis Report

Data as of May 31, 2018

All Lines of Business

Values represent NFIP exposure after applying ACV and Coinsuranc

Gross AAL and Exposure by County for NC Counties in Top 100 Ranked by Gross AAL

Storm Surge	County	Locations	Building Value	Contents Value	Building Limit	Contents Limit	Gross AAL	U.S. Rank
RMS RiskLink v17								
	NEW HANOVER	11,694	4,069,080,201	341,661,599	3,147,289,800	766,702,300	7,718,636	35
	CRAVEN	4,246	1,207,354,112	97,714,940	887,325,800	215,702,100	4,695,438	45
	BRUNSWICK	15,907	4,179,575,095	438,759,297	3,785,582,700	950,911,400	3,140,389	58
	PENDER	4,510	1,044,369,572	96,108,641	1,003,832,800	222,021,000	2,937,757	61
	DARE	19,118	5,150,541,804	477,860,086	4,618,089,600	834,148,700	2,540,076	65
	CARTERET	10,194	3,143,858,239	231,508,517	2,754,095,900	563,124,100	2,092,996	73
	BEAUFORT	4,074	826,473,116	59,811,966	710,045,200	94,146,600	2,058,094	76
	ONSLOW	3,947	890,718,580	88,763,620	836,508,100	225,059,700	1,816,784	79
	PAMLICO	1,975	440,444,844	36,255,809	400,878,600	87,424,600	924,735	96
AIR Touchstone v5.0								
(values & limits in 000s)	NEW HANOVER	11,778	4,092,975	343,834	3,166,695	772,796	7,180	41
	BRUNSWICK	15,899	4,177,416	438,526	3,783,633	950,073	6,662	42
	DARE	19,095	5,142,138	476,929	4,612,340	832,583	4,614	52
	ONSLOW	6,505	1,436,288	135,329	1,443,760	318,767	4,157	55
	CARTERET	10,469	3,213,521	238,880	2,810,866	582,625	3,003	64
	HYDE	1,146	232,856	17,316	207,296	28,405	1,052	91
	PAMLICO	1,966	437,857	36,122	399,106	87,030	998	94
	CURRITUCK	5,178	1,778,721	173,897	1,184,545	303,009	745	100

Source data available at https://www.fema.gov/media-library/assets/documents/129784

APPENDIX C

APPENDIX C: ELIGIBILITY FOR COVERAGE UNDER THE RATE BUREAU FLOOD PLAN

ELIGIBILITY

A Personal Flood Policy may be issued to provide insurance under:

Coverage A – on a dwelling building:

1. Used solely for residential purposes except that certain incidental occupancies or up to five roomers or boarders are permitted;

2. Containing not more than four apartments; and

3. Which may be in a townhouse or rowhouse structure; or

4. In the course of construction.

B. Coverage A – on a mobile home:

1. Used solely for residential purposes except that certain incidental occupancies or up to five roomers or boarders are permitted;

2. Containing not more than one apartment;

3. For a policy period of not longer than one year; and

4. At the permanent location described in the policy.

Coverage A – on a condominium or cooperative unit:

1. Used solely for residential purposes except that certain incidental occupancies or up to two roomers or boarders are permitted; and

2. The unit may not be occupied by more than one additional family.

Coverage C in:

1. A dwelling or mobile home eligible under Coverage A;

2. A dwelling with rental apartments including furnishings, equipment and appliances in halls or utility rooms; or

3. Any apartment, cooperative or condominium unit used as private living quarters of the insured or rented to others.

Coverage D for:

1. The additional living expenses incurred to maintain the insured's household; or

2. The loss of the fair rental value of: a. A building eligible for insurance under Coverage A or B; or b. Private living quarters eligible under Coverage C.

APPENDIX D

Illustration B: Number of Stories

It is assumed that for non-storm surge exposed areas 68% ($376) of the Base Premium is for Coverage A and 32% ($177) is for Coverage C and for storm surge exposed locations, the split of Storm Surge Base Premium is 71% ($788) and 29% ($322) for Coverages A and C respectively.[1] Using these assumptions and the filed rate factors for Number of Stories, the premiums for a two-story home can be calculated as follows:

Premium Calculation for a Two-Story Dwelling

Without Storm Surge = Covg. A Base Cost * Stories Factor + Covg. C Base Cost * Stories Factor

= (65% * $553)*.630 + (32% * $553)*.550

= $376*.630 + $177*.550

= $236.88 + $97.35

= **$334.23**

With Storm Surge = Covg. A Base Cost * Stories Factor + Covg. C Base Cost * Stories Factor

= (71% * $1110)*.610 + (29% * $1110)*.530

= $788*.610 + $322*.530

= $480.68 + $170.66

= **$651.34**

North Carolina
Residential Flood

Number of Stories Factors

	Without Storm Surge Exposure		
Number of Stories	Coverage A	Coverage C	Coverage D
1	1.000	1.000	1.000
2	0.630	0.550	0.580
3 or more	0.470	0.410	0.420

	With Storm Surge Exposure		
Number of Stories	Coverage A	Coverage C	Coverage D
1	1.000	1.000	1.000
2	0.610	0.530	0.520
3 or more	0.440	0.400	0.310

[1] Assumption based upon coverage amounts selected for example ($200,000 Coverage A and $100,000 Coverage C) and the NCRB filed Base Rate Adjustment Factors – Section B pg. 2 of 13

Illustration C: Floor of Interest

These illustrated premium calculations use of the Floor of Interest rating factors in calculating the premiums for both below ground and second floor condo units.

Premium Calculation for a Below Ground Condo[2]

Without Storm Surge = Covg. A Base Cost * Floor Factor + Covg. C Base Cost * Floor Factor

= (68% * $553)*1.96 + (32% * $553)*1.77

= $376*1.96 + $177*1.77

= $736.96 + $313.29

= **$1050.25**

With Storm Surge = Covg. A Base Cost * Floor Factor + Covg. C Base Cost * Floor Factor

= (71% * $1110)*1.87 + (29% * $1110)*1.77

= $788*1.87 + $322*1.77

= $1473.56 + $569.94

= **$2043.5**

Premium Calculation for a Second Floor Condo[3]

Without Storm Surge = Covg. A Base Cost * Floor Factor + Covg. C Base Cost * Floor Factor

= (68% * $553)*.109 + (32% * $553)*.117

= $376*.109 + $177*.117

= $40.98 + $20.71

= **$61.69**

With Storm Surge = Covg. A Base Cost * Floor Factor + Covg. C Base Cost * Floor Factor

= (71% * $1110)*.123 + (29% * $1110)*.136

= $788*.123 + $322*.136

= $96.92 + $43.79

= **$140.71**

[2]Apartment or Condo unit in a below ground area uses Basement Only Factors for which the Coverage C filed factor is 1.77

[3] Examples fall within the Grid Base Risk AAL Group 2 for the selection of rating factors. Group 2 Grid Base Risk AAL is 73.58 to 1477.81.

North Carolina
Residential Flood

Floor of Interest Factors

Floor of Interest	Without Storm Surge Exposure - Group 2		
	Coverage A	Coverage C	Coverage D
Apartment or Condo Unit in a Below Ground Area	1.960	1.000	2.070
Second Floor	0.109	0.117	0.400
Third Floor and Above	0.012	0.014	0.400
All Others	1.000	1.000	1.000

Floor of Interest	With Storm Surge Exposure - Groups 1,2, and 3		
	Coverage A	Coverage C	Coverage D
Apartment or Condo Unit in a Below Ground Area	1.870	1.000	2.630
Second Floor	0.123	0.136	0.396
Third Floor and Above	0.015	0.018	0.396
All Others	1.000	1.000	1.000

Illustration D: Application of Multiple Factors

This illustration is based on a two-story home that has been slightly elevated and has a first floor height of 4 feet.

Premium Calculation for a Two-Story Dwelling with First Floor Height of 4 feet

Without Storm Surge = Covg. A Base Cost * Story Factor * Height Factor + Covg. C Base Cost * Story Factor* Height Factor

= (68% * $553)*.630*.432 + (32% * $553)*.550*.450

= $376*.630*.432 + $177*.550*.450

= $236.68*.432 + $97.35*.450

= $102.25 + $43.81

= **$146.06** – below minimum premium, so policy cost would actually be minimum premium of **$175**

With Storm Surge = Covg. A Base Cost * Story Factor * Height Factor + Covg. C Base Cost * Story Factor* Height Factor

= (71% * $1110)*.610*.412 + (29% * $1110)*.530*.424

= $788*.610*.412 + $322*.530*.424

= $480.68*.412 + $170.66*.424

= $198.04 + $72.36

= **$270.40**

North Carolina
Residential Flood

First Floor Height Group Assignments and Factors

Without Storm Surge Exposure - Group 2

First Floor Height (Feet)	Coverage A	Coverage C	Coverage D
0	1.000	1.000	1.000
1	0.801	0.807	0.737
2	0.642	0.652	0.543
3	0.514	0.526	0.400
4	0.412	0.424	0.400
5	0.330	0.343	0.400
6	0.264	0.277	0.400
7	0.212	0.223	0.400
8	0.170	0.180	0.400
9	0.136	0.145	0.400
10 and above	0.109	0.117	0.400

With Storm Surge Exposure - Groups 1,2, and 3

First Floor Height (Feet)	Coverage A	Coverage C	Coverage D
0	1.000	1.000	1.000
1	0.811	0.819	0.734
2	0.657	0.671	0.539
3	0.533	0.549	0.396
4	0.432	0.450	0.396
5	0.350	0.369	0.396
6	0.284	0.302	0.396
7	0.230	0.247	0.396
8	0.186	0.203	0.396
9	0.151	0.166	0.396
10 and above	0.123	0.136	0.396

APPENDIX E

North Carolina
Residential Flood

Minimum Flood Premiums by County for a Uniform Risk

County	Locations	Locations with Minimum Premium	Percentage
Alamance	68,015	64,797	95.3%
Alexander	25,055	23,874	95.3%
Alleghany	9,614	8,827	91.8%
Anson	11,809	11,614	98.3%
Ashe	16,997	13,274	78.1%
Avery	14,117	11,465	81.2%
Beaufort	24,056	10,858	45.1%
Bertie	10,474	8,211	78.4%
Bladen	18,772	13,022	69.4%
Brunswick	61,824	28,893	46.7%
Buncombe	101,190	94,423	93.3%
Burke	45,291	42,791	94.5%
Cabarrus	69,489	65,879	94.8%
Caldwell	41,505	37,491	90.3%
Camden	4,604	2,343	50.9%
Carteret	41,563	18,160	43.7%
Caswell	16,787	16,608	98.9%
Catawba	83,574	79,107	94.7%
Chatham	32,754	31,392	95.8%
Cherokee	18,947	16,748	88.4%
Chowan	7,632	6,314	82.7%
Clay	8,677	7,392	85.2%
Cleveland	48,147	46,914	97.4%
Columbus	33,075	22,347	67.6%
Craven	41,148	23,059	56.0%
Cumberland	116,622	96,378	82.6%
Currituck	15,417	9,452	61.3%
Dare	31,046	8,975	28.9%
Davidson	91,001	85,997	94.5%
Davie	27,319	26,769	98.0%
Duplin	24,853	17,711	71.3%
Durham	86,877	81,106	93.4%
Edgecombe	25,074	17,879	71.3%
Forsyth	138,923	133,383	96.0%
Franklin	25,371	24,066	94.9%
Gaston	107,629	102,966	95.7%
Gates	4,794	3,973	82.9%
Graham	5,338	3,686	69.1%
Granville	21,684	20,987	96.8%
Greene	9,888	8,044	81.4%
Guilford	169,582	162,259	95.7%
Halifax	29,058	26,023	89.6%
Harnett	49,331	45,317	91.9%
Haywood	32,648	26,763	82.0%
Henderson	49,212	45,086	91.6%
Hertford	11,724	9,768	83.3%
Hoke	19,371	16,766	86.6%
Hyde	4,318	264	6.1%
Iredell	81,021	75,885	93.7%
Jackson	20,479	16,130	78.8%
Johnston	66,226	59,150	89.3%
Jones	5,640	3,502	62.1%
Lee	23,910	22,103	92.4%
Lenoir	26,580	18,843	70.9%
Lincoln	43,933	41,921	95.4%
McDowell	25,440	21,130	83.1%
Macon	26,128	22,916	87.7%
Madison	16,358	13,762	84.1%
Martin	11,423	9,296	81.4%
Mecklenburg	302,636	280,771	92.8%

North Carolina
Residential Flood

Minimum Flood Premiums by County for a Uniform Risk

County	Locations	Locations with Minimum Premium	Percentage
Mitchell	10,519	8,558	81.4%
Montgomery	16,383	15,221	92.9%
Moore	48,754	46,278	94.9%
Nash	43,258	36,157	83.6%
New Hanover	80,888	36,579	45.2%
Northampton	15,779	13,669	86.6%
Onslow	63,407	46,077	72.7%
Orange	44,602	41,852	93.8%
Pamlico	9,777	3,276	33.5%
Pasquotank	16,531	8,649	52.3%
Pender	28,668	12,636	44.1%
Perquimans	7,197	5,286	73.4%
Person	20,644	19,626	95.1%
Pitt	56,588	38,854	68.7%
Polk	10,211	9,481	92.9%
Randolph	74,581	72,217	96.8%
Richmond	23,715	22,846	96.3%
Robeson	52,639	31,100	59.1%
Rockingham	53,813	52,668	97.9%
Rowan	66,292	63,694	96.1%
Rutherford	35,181	33,223	94.4%
Sampson	30,093	23,855	79.3%
Scotland	15,840	12,648	79.8%
Stanly	33,931	32,266	95.1%
Stokes	23,047	22,573	97.9%
Surry	46,094	44,932	97.5%
Swain	7,928	6,170	77.8%
Transylvania	20,277	17,142	84.5%
Tyrrell	2,465	684	27.7%
Union	82,230	77,213	93.9%
Vance	20,195	19,606	97.1%
Wake	289,270	263,474	91.1%
Warren	14,909	14,045	94.2%
Washington	6,771	5,149	76.0%
Watauga	29,082	24,883	85.6%
Wayne	60,526	47,008	77.7%
Wilkes	45,311	42,546	93.9%
Wilson	30,624	25,326	82.7%
Yadkin	26,127	25,698	98.4%
Yancey	13,419	11,129	82.9%

Notes
1. Premium calculated using the following assumptions:
   $200,000 Coverage A
   $100,000 Coverage C
   100% Coverage A ITV
   $0 Coverage D
   $5,000 Deductible
   Single Story, First Floor Height=1, Frame Construction, No Endorsements

North Carolina
Residential Flood

Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Alamance	Minimum	$200	36.11138468	-79.29243247
Alamance	10th	200	36.06655135	-79.38186083
Alamance	25th	200	36.06844483	-79.47727765
Alamance	50th	200	36.14083878	-79.42004028
Alamance	75th	200	36.08301886	-79.32520905
Alamance	90th	200	36.09670054	-79.48855016
Alamance	Maximum	17,731	36.12216752	-79.40166642
Alamance	Average	271		
Alexander	Minimum	200	35.99846732	-81.14760952
Alexander	10th	200	35.91230143	-81.02354514
Alexander	25th	200	35.89523676	-81.20423107
Alexander	50th	200	35.85280966	-81.33002041
Alexander	75th	200	35.99254589	-81.05787289
Alexander	90th	200	35.8136557	-81.3078752
Alexander	Maximum	19,270	35.99707773	-81.23231646
Alexander	Average	284		
Alleghany	Minimum	200	36.43154102	-81.15078216
Alleghany	10th	200	36.52258107	-80.97514053
Alleghany	25th	200	36.56024324	-81.07259598
Alleghany	50th	200	36.56299675	-81.30359088
Alleghany	75th	200	36.46527855	-81.2749649
Alleghany	90th	200	36.4903078	-81.27733084
Alleghany	Maximum	24,512	36.47749249	-81.12013662
Alleghany	Average	573		
Anson	Minimum	200	34.81505649	-80.22681352
Anson	10th	200	34.83922534	-80.03505013
Anson	25th	200	34.94066598	-80.00832576
Anson	50th	200	35.00840174	-80.20442473
Anson	75th	200	35.00627663	-80.19674116
Anson	90th	200	34.9645798	-79.93499714
Anson	Maximum	16,047	35.00558402	-80.20959841
Anson	Average	239		
Ashe	Minimum	200	36.30899951	-81.57729443
Ashe	10th	200	36.37043793	-81.41898426
Ashe	25th	200	36.44476567	-81.45660305
Ashe	50th	200	36.37815559	-81.47334935
Ashe	75th	200	36.28070035	-81.50846149
Ashe	90th	5,086	36.45057538	-81.59181744
Ashe	Maximum	24,688	36.39448599	-81.69055462
Ashe	Average	1,739		
Avery	Minimum	200	36.09322655	-81.7695453
Avery	10th	200	36.04142431	-81.90511018
Avery	25th	200	36.01218823	-81.8820643
Avery	50th	200	36.07119747	-81.7732591
Avery	75th	200	36.17631824	-81.91074246
Avery	90th	4,064	36.02573295	-82.01716416
Avery	Maximum	26,473	36.00564875	-81.77974277
Avery	Average	1,572		
Beaufort	Minimum	200	35.41779238	-77.13201737
Beaufort	10th	200	35.51934841	-76.92488061
Beaufort	25th	200	35.48182072	-76.86894199
Beaufort	50th	248	35.42308774	-76.86238736
Beaufort	75th	1,049	35.56811256	-77.0873739
Beaufort	90th	3,342	35.50044444	-76.6720124
Beaufort	Maximum	35,354	35.4897455	-76.95950435
Beaufort	Average	1,251		
Bertie	Minimum	200	35.98914645	-76.95345455
Bertie	10th	200	36.07296884	-76.90251761
Bertie	25th	200	36.11891158	-76.90254186
Bertie	50th	200	36.002954	-76.95037649
Bertie	75th	200	36.19116503	-76.76307361
Bertie	90th	485	36.04190429	-77.00992172
Bertie	Maximum	11,991	35.89858281	-76.92142773
Bertie	Average	369		

North Carolina
Residential Flood

Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Bladen	Minimum	200	34.80109076	-78.7879663
Bladen	10th	200	34.72177585	-78.70191155
Bladen	25th	200	34.51567364	-78.81995868
Bladen	50th	200	34.39922777	-78.33553882
Bladen	75th	253	34.76810796	-78.44694299
Bladen	90th	684	34.46826494	-78.8390049
Bladen	Maximum	24,354	34.61205405	-78.51950091
Bladen	Average	450		
Brunswick	Minimum	200	33.97091471	-78.32516815
Brunswick	10th	200	33.88838107	-78.56703018
Brunswick	25th	200	34.33699595	-78.11210838
Brunswick	50th	237	34.09018447	-78.12326524
Brunswick	75th	1,456	34.04058873	-78.0399959
Brunswick	90th	12,732	33.86663618	-78.5161607
Brunswick	Maximum	100,058	33.87321322	-78.48945837
Brunswick	Average	3,735		
Buncombe	Minimum	200	35.49210533	-82.5542178
Buncombe	10th	200	35.55652942	-82.66538657
Buncombe	25th	200	35.51786954	-82.71090974
Buncombe	50th	200	35.5723184	-82.60549644
Buncombe	75th	200	35.62001874	-82.32094631
Buncombe	90th	200	35.67230173	-82.55307808
Buncombe	Maximum	24,726	35.51116564	-82.25648085
Buncombe	Average	511		
Burke	Minimum	200	35.7320367	-81.39394738
Burke	10th	200	35.7570462	-81.60791539
Burke	25th	200	35.75661763	-81.69147962
Burke	50th	200	35.65312446	-81.78484091
Burke	75th	200	35.70010056	-81.62322836
Burke	90th	200	35.68929842	-81.74509909
Burke	Maximum	27,630	35.64244265	-81.6762283
Burke	Average	433		
Cabarrus	Minimum	200	35.38543937	-80.38989185
Cabarrus	10th	200	35.39106659	-80.74710858
Cabarrus	25th	200	35.34594774	-80.52868539
Cabarrus	50th	200	35.35407026	-80.54215253
Cabarrus	75th	200	35.48117279	-80.58619018
Cabarrus	90th	200	35.39011452	-80.56654344
Cabarrus	Maximum	18,655	35.44099831	-80.44099497
Cabarrus	Average	281		
Caldwell	Minimum	200	35.95433592	-81.48333201
Caldwell	10th	200	35.87005471	-81.62657198
Caldwell	25th	200	35.79865169	-81.34851324
Caldwell	50th	200	35.88510128	-81.43645448
Caldwell	75th	200	35.84346388	-81.485376
Caldwell	90th	200	35.81590937	-81.44293781
Caldwell	Maximum	26,903	36.00847098	-81.76535483
Caldwell	Average	680		
Camden	Minimum	200	36.35393753	-76.19064301
Camden	10th	200	36.24779356	-76.02944017
Camden	25th	200	36.34928531	-76.12703563
Camden	50th	200	36.27340066	-76.09033359
Camden	75th	427	36.48154742	-76.34210649
Camden	90th	1,131	36.45226503	-76.28897153
Camden	Maximum	14,593	36.30040164	-76.21485531
Camden	Average	541		
Carteret	Minimum	200	34.70278854	-77.03139557
Carteret	10th	200	34.73245438	-76.81552311
Carteret	25th	200	34.72781281	-76.80080655
Carteret	50th	253	34.67159478	-76.98658344
Carteret	75th	1,052	34.81474489	-76.65558275
Carteret	90th	4,228	34.68848913	-76.89388347
Carteret	Maximum	90,494	34.67837985	-76.95128261
Carteret	Average	1,861		

North Carolina
Residential Flood

Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Caswell	Minimum	200	36.53148261	-79.14742392
Caswell	10th	200	36.27487881	-79.47875996
Caswell	25th	200	36.37072111	-79.51805493
Caswell	50th	200	36.30821251	-79.20275144
Caswell	75th	200	36.29032588	-79.22920457
Caswell	90th	200	36.50709808	-79.17422631
Caswell	Maximum	13,857	36.2673631	-79.46004136
Caswell	Average	209		
Catawba	Minimum	200	35.74086954	-81.35375017
Catawba	10th	200	35.58212327	-81.10811438
Catawba	25th	200	35.66422109	-81.0919159
Catawba	50th	200	35.62537989	-81.17997695
Catawba	75th	200	35.60595079	-81.11009497
Catawba	90th	200	35.61170187	-81.14813054
Catawba	Maximum	23,414	35.7085771	-81.39903354
Catawba	Average	273		
Chatham	Minimum	200	35.74412321	-79.06721452
Chatham	10th	200	35.60468983	-79.48224535
Chatham	25th	200	35.70780144	-79.18800188
Chatham	50th	200	35.81332627	-79.35934509
Chatham	75th	200	35.74234087	-79.44794699
Chatham	90th	200	35.85689268	-79.02277472
Chatham	Maximum	18,434	35.76978932	-79.14359217
Chatham	Average	268		
Cherokee	Minimum	200	35.05343223	-83.98542478
Cherokee	10th	200	35.20132371	-83.81015979
Cherokee	25th	200	35.11619362	-84.08318799
Cherokee	50th	200	35.21646686	-83.89178246
Cherokee	75th	200	35.098428	-83.96340232
Cherokee	90th	245	35.14555262	-83.97215338
Cherokee	Maximum	25,989	35.16134031	-84.04432455
Cherokee	Average	679		
Chowan	Minimum	200	36.27736973	-76.62342965
Chowan	10th	200	36.08997129	-76.68000619
Chowan	25th	200	36.07244073	-76.6006236
Chowan	50th	200	36.0590682	-76.61252523
Chowan	75th	200	36.22250352	-76.7033024
Chowan	90th	307	36.06842309	-76.60609961
Chowan	Maximum	29,985	36.2215621	-76.71006328
Chowan	Average	315		
Clay	Minimum	200	34.99363195	-83.73150763
Clay	10th	200	35.00215507	-83.81902918
Clay	25th	200	35.02084035	-83.73587621
Clay	50th	200	35.01650292	-83.73198237
Clay	75th	200	35.03968786	-83.64499038
Clay	90th	412	35.04535571	-83.6630999
Clay	Maximum	23,618	35.02444831	-83.66938298
Clay	Average	1,149		
Cleveland	Minimum	200	35.432238	-81.60611191
Cleveland	10th	200	35.32353962	-81.51238069
Cleveland	25th	200	35.41355087	-81.54295157
Cleveland	50th	200	35.29134797	-81.67839139
Cleveland	75th	200	35.26942545	-81.5640757
Cleveland	90th	200	35.25096083	-81.49979692
Cleveland	Maximum	20,210	35.21893863	-81.74282425
Cleveland	Average	255		
Columbus	Minimum	200	34.15890166	-78.85019811
Columbus	10th	200	34.32668773	-78.70177175
Columbus	25th	200	34.29974777	-78.74198058
Columbus	50th	200	34.33178684	-78.72143264
Columbus	75th	284	34.27113633	-78.99482445
Columbus	90th	900	34.17343794	-78.90436232
Columbus	Maximum	21,621	34.31711851	-78.23766396
Columbus	Average	498		

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Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Craven	Minimum	200	35.28474426	-77.12689623
Craven	10th	200	35.05095412	-77.01761859
Craven	25th	200	35.21568594	-77.15570821
Craven	50th	200	35.11498634	-77.10942411
Craven	75th	468	34.86250649	-76.88977397
Craven	90th	1,937	35.13272788	-77.0683438
Craven	Maximum	36,521	35.06572054	-77.07896123
Craven	Average	871		
Cumberland	Minimum	200	35.11953325	-78.93772094
Cumberland	10th	200	34.98221919	-78.92083301
Cumberland	25th	200	35.10342076	-79.00530952
Cumberland	50th	200	34.96521862	-79.02669158
Cumberland	75th	200	34.97680876	-78.90658819
Cumberland	90th	389	35.19586293	-78.99142015
Cumberland	Maximum	31,079	35.05882382	-78.86745119
Cumberland	Average	410		
Currituck	Minimum	200	36.30979706	-75.8105003
Currituck	10th	200	36.40390436	-76.09418511
Currituck	25th	200	36.48443367	-76.14153631
Currituck	50th	200	36.2496863	-75.87303877
Currituck	75th	335	36.31951928	-75.80797016
Currituck	90th	1,020	36.50787449	-75.91751883
Currituck	Maximum	37,819	36.54770849	-75.86821275
Currituck	Average	609		
Dare	Minimum	200	36.0550818	-75.69023187
Dare	10th	200	35.97762934	-75.64386873
Dare	25th	200	35.25614858	-75.55129906
Dare	50th	744	36.01317895	-75.72639066
Dare	75th	2,846	36.01763991	-75.65981077
Dare	90th	8,028	35.3415333	-75.50657512
Dare	Maximum	83,653	36.19102056	-75.75481193
Dare	Average	2,551		
Davidson	Minimum	200	35.81860658	-80.26064894
Davidson	10th	200	35.79928483	-80.31165989
Davidson	25th	200	35.7121522	-80.10827665
Davidson	50th	200	35.86439168	-80.06357834
Davidson	75th	200	35.55132208	-80.10091939
Davidson	90th	200	35.96053899	-80.16510405
Davidson	Maximum	22,818	35.70804601	-80.13588638
Davidson	Average	281		
Davie	Minimum	200	36.01251277	-80.66532494
Davie	10th	200	36.013926	-80.47682522
Davie	25th	200	35.95001941	-80.65294731
Davie	50th	200	35.80730924	-80.47374399
Davie	75th	200	35.97510619	-80.43395817
Davie	90th	200	35.91062756	-80.53990866
Davie	Maximum	22,460	35.80800975	-80.55949813
Davie	Average	219		
Duplin	Minimum	200	34.79888404	-77.77338146
Duplin	10th	200	34.85718978	-78.10250865
Duplin	25th	200	35.01905738	-77.90895843
Duplin	50th	200	34.83035674	-77.8177846
Duplin	75th	242	34.88289758	-77.77743106
Duplin	90th	723	34.99717486	-77.7881189
Duplin	Maximum	15,328	34.92017732	-78.01939591
Duplin	Average	440		
Durham	Minimum	200	36.00057125	-78.72754853
Durham	10th	200	36.05472923	-78.78354501
Durham	25th	200	35.93753812	-78.92223905
Durham	50th	200	35.95665082	-78.93032293
Durham	75th	200	35.91355271	-78.92177721
Durham	90th	200	35.88807618	-78.92972183
Durham	Maximum	15,107	36.07124896	-78.90955229
Durham	Average	270		

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Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Edgecombe	Minimum	200	35.72420408	-77.70145053
Edgecombe	10th	200	35.90689046	-77.53816403
Edgecombe	25th	200	35.81224654	-77.4611699
Edgecombe	50th	200	35.89111461	-77.54319719
Edgecombe	75th	244	35.92329386	-77.79256195
Edgecombe	90th	861	35.90874823	-77.53279353
Edgecombe	Maximum	18,709	35.94917783	-77.70184938
Edgecombe	Average	508		
Forsyth	Minimum	200	36.03435587	-80.25501445
Forsyth	10th	200	36.20388349	-80.39965812
Forsyth	25th	200	36.04147279	-80.41513267
Forsyth	50th	200	36.03280918	-80.4127518
Forsyth	75th	200	36.13275661	-80.10927354
Forsyth	90th	200	36.00347377	-80.34430907
Forsyth	Maximum	16,114	36.11919238	-80.29526892
Forsyth	Average	249		
Franklin	Minimum	200	35.97585703	-78.28036402
Franklin	10th	200	35.99900479	-78.35968028
Franklin	25th	200	35.99516169	-78.27030564
Franklin	50th	200	36.21533301	-78.3801074
Franklin	75th	200	36.10145407	-78.29884798
Franklin	90th	200	35.99999593	-78.41356913
Franklin	Maximum	17,401	35.97855668	-78.42198258
Franklin	Average	280		
Gaston	Minimum	200	35.1977429	-81.27915351
Gaston	10th	200	35.19061939	-81.15044654
Gaston	25th	200	35.36768481	-81.21567908
Gaston	50th	200	35.3950534	-81.36082564
Gaston	75th	200	35.27782831	-81.17369447
Gaston	90th	200	35.26869821	-81.09581449
Gaston	Maximum	22,175	35.35372581	-81.14969798
Gaston	Average	276		
Gates	Minimum	200	36.5286394	-76.57666583
Gates	10th	200	36.5330778	-76.61801229
Gates	25th	200	36.5384093	-76.64684103
Gates	50th	200	36.54558857	-76.76883854
Gates	75th	200	36.338861	-76.59572331
Gates	90th	305	36.46475152	-76.8101505
Gates	Maximum	9,104	36.32970003	-76.65961715
Gates	Average	277		
Graham	Minimum	200	35.3179458	-83.84865888
Graham	10th	200	35.31404694	-83.8079858
Graham	25th	200	35.26524834	-83.76199022
Graham	50th	200	35.38905636	-83.63274843
Graham	75th	315	35.36293288	-83.82043189
Graham	90th	14,426	35.3822295	-83.68019178
Graham	Maximum	25,786	35.38469192	-83.62517443
Graham	Average	2,759		
Granville	Minimum	200	36.09530284	-78.77775274
Granville	10th	200	36.09586344	-78.7764304
Granville	25th	200	36.26719618	-78.63749111
Granville	50th	200	36.31007905	-78.58223826
Granville	75th	200	36.29448133	-78.76946181
Granville	90th	200	36.30733319	-78.57374619
Granville	Maximum	15,705	36.27545767	-78.60654813
Granville	Average	235		
Greene	Minimum	200	35.49534736	-77.69571193
Greene	10th	200	35.55106424	-77.73248042
Greene	25th	200	35.59637861	-77.70027182
Greene	50th	200	35.41509281	-77.56958745
Greene	75th	200	35.38958947	-77.66574612
Greene	90th	362	35.50932662	-77.67820155
Greene	Maximum	9,768	35.40619244	-77.78678333
Greene	Average	318		

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Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Guilford	Minimum	200	36.04217054	-79.88528208
Guilford	10th	200	36.1025025	-79.79281322
Guilford	25th	200	36.02098278	-79.77980582
Guilford	50th	200	36.04917802	-79.70801069
Guilford	75th	200	36.03299876	-79.83103839
Guilford	90th	200	36.10776208	-79.54113142
Guilford	Maximum	16,528	36.00991129	-79.98444453
Guilford	Average	267		
Halifax	Minimum	200	36.462125	-77.685322
Halifax	10th	200	36.465331	-77.716203
Halifax	25th	200	36.119107	-77.386859
Halifax	50th	200	36.466263	-77.700654
Halifax	75th	200	36.458379	-77.682041
Halifax	90th	217	36.395177	-77.629303
Halifax	Maximum	15,651	36.434268	-77.654648
Halifax	Average	296		
Harnett	Minimum	200	35.47096319	-78.65339526
Harnett	10th	200	35.52620441	-78.75796112
Harnett	25th	200	35.34730593	-79.03988884
Harnett	50th	200	35.27780242	-78.60440971
Harnett	75th	200	35.36837484	-78.99787668
Harnett	90th	200	35.2955117	-79.04726466
Harnett	Maximum	22,746	35.3309481	-78.69374147
Harnett	Average	287		
Haywood	Minimum	200	35.44550143	-83.00032486
Haywood	10th	200	35.55114563	-82.85631627
Haywood	25th	200	35.47928707	-82.87349042
Haywood	50th	200	35.51863371	-83.13368636
Haywood	75th	200	35.50827018	-83.07884237
Haywood	90th	2,833	35.48007047	-82.99965611
Haywood	Maximum	25,416	35.41371301	-82.80938437
Haywood	Average	1,350		
Henderson	Minimum	200	35.43646246	-82.50412244
Henderson	10th	200	35.28209087	-82.54169796
Henderson	25th	200	35.3058805	-82.5510036
Henderson	50th	200	35.30739321	-82.5828091
Henderson	75th	200	35.3378639	-82.41411244
Henderson	90th	200	35.29146261	-82.55029741
Henderson	Maximum	24,852	35.20024567	-82.47970458
Henderson	Average	480		
Hertford	Minimum	200	36.43416889	-77.10282071
Hertford	10th	200	36.34099795	-76.96507088
Hertford	25th	200	36.24737665	-76.75564085
Hertford	50th	200	36.47147235	-77.0547458
Hertford	75th	200	36.53442776	-77.13978745
Hertford	90th	319	36.52435862	-76.97209847
Hertford	Maximum	13,150	36.3152174	-76.7270424
Hertford	Average	338		
Hoke	Minimum	200	35.01425434	-79.35899865
Hoke	10th	200	35.03445274	-79.38066395
Hoke	25th	200	34.96035399	-79.22001901
Hoke	50th	200	34.96039538	-79.0680369
Hoke	75th	200	34.97382489	-79.22961218
Hoke	90th	271	34.98147902	-79.16931025
Hoke	Maximum	16,315	34.97561033	-79.21654468
Hoke	Average	298		
Hyde	Minimum	200	35.56546245	-76.3912473
Hyde	10th	339	35.67976717	-76.59963815
Hyde	25th	1,159	35.57723307	-76.47638644
Hyde	50th	2,870	35.4432695	-76.07213985
Hyde	75th	4,932	35.10598445	-75.98558938
Hyde	90th	7,026	35.58536308	-76.50896202
Hyde	Maximum	20,553	35.11487457	-75.96677509
Hyde	Average	3,370		

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Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Iredell	Minimum	200	35.56723445	-80.80763225
Iredell	10th	200	35.65524354	-80.82334018
Iredell	25th	200	35.76056935	-80.98143084
Iredell	50th	200	35.81327096	-80.78204862
Iredell	75th	200	35.83782095	-80.75078927
Iredell	90th	200	35.61318951	-80.90166575
Iredell	Maximum	14,408	36.0455043	-80.84609595
Iredell	Average	253		
Jackson	Minimum	200	35.25136821	-83.06070823
Jackson	10th	200	35.29671971	-83.11985445
Jackson	25th	200	35.32038892	-83.25989621
Jackson	50th	200	35.426705	-83.34598965
Jackson	75th	200	35.50869896	-83.24901695
Jackson	90th	9,505	35.30370992	-83.16183661
Jackson	Maximum	26,751	35.38618442	-83.27480649
Jackson	Average	2,033		
Johnston	Minimum	200	35.7695729	-78.27092024
Johnston	10th	200	35.72530435	-78.39263605
Johnston	25th	200	35.78142601	-78.29139289
Johnston	50th	200	35.55402395	-78.63804084
Johnston	75th	200	35.52478698	-78.31874012
Johnston	90th	232	35.61369586	-78.48064144
Johnston	Maximum	15,713	35.56939994	-78.18605803
Johnston	Average	302		
Jones	Minimum	200	35.00075972	-77.20526271
Jones	10th	200	34.91156293	-77.23372396
Jones	25th	200	34.90420349	-77.23335058
Jones	50th	200	34.98697884	-77.24313058
Jones	75th	342	35.07213763	-77.12511498
Jones	90th	1,377	35.03118115	-77.62070914
Jones	Maximum	16,382	35.06003355	-77.35581796
Jones	Average	638		
Lee	Minimum	200	35.6139901	-79.11027624
Lee	10th	200	35.44538087	-79.12583356
Lee	25th	200	35.43827321	-79.21463358
Lee	50th	200	35.38425077	-79.21586349
Lee	75th	200	35.43892815	-79.06603356
Lee	90th	200	35.51677565	-79.12503767
Lee	Maximum	20,269	35.42312145	-79.13741179
Lee	Average	383		
Lenoir	Minimum	200	35.34674943	-77.71535083
Lenoir	10th	200	35.12780079	-77.6549926
Lenoir	25th	200	35.34046468	-77.74979061
Lenoir	50th	200	35.28500105	-77.53475745
Lenoir	75th	243	35.19153915	-77.77637841
Lenoir	90th	793	35.2775366	-77.58943649
Lenoir	Maximum	13,875	35.24009082	-77.58349538
Lenoir	Average	473		
Lincoln	Minimum	200	35.56724185	-81.52853751
Lincoln	10th	200	35.51647403	-81.41623815
Lincoln	25th	200	35.53630976	-81.27471208
Lincoln	50th	200	35.45447185	-80.98941146
Lincoln	75th	200	35.47551668	-81.20751826
Lincoln	90th	200	35.55000253	-81.07873551
Lincoln	Maximum	19,785	35.51053167	-81.43261408
Lincoln	Average	251		
McDowell	Minimum	200	35.70719561	-82.02725347
McDowell	10th	200	35.76052209	-82.03281971
McDowell	25th	200	35.75345693	-81.96285038
McDowell	50th	200	35.63621458	-82.04320813
McDowell	75th	200	35.56929341	-82.24313561
McDowell	90th	2,168	35.61583068	-82.17410992
McDowell	Maximum	27,324	35.79823215	-82.11240904
McDowell	Average	1,212		

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Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Macon	Minimum	200	35.14399034	-83.35855999
Macon	10th	200	35.17211558	-83.42239495
Macon	25th	200	35.22390043	-83.35180351
Macon	50th	200	35.05436164	-83.38139961
Macon	75th	200	35.26743857	-83.42917809
Macon	90th	309	35.12706688	-83.62601554
Macon	Maximum	24,417	35.12499035	-83.28414003
Macon	Average	916		
Madison	Minimum	200	35.80440672	-82.84312483
Madison	10th	200	35.95627035	-82.50092237
Madison	25th	200	35.83464028	-82.55302336
Madison	50th	200	35.71702296	-82.77349924
Madison	75th	200	35.8110939	-82.90125783
Madison	90th	399	35.83999639	-82.71387507
Madison	Maximum	22,957	35.83620621	-82.61436779
Madison	Average	1,042		
Martin	Minimum	200	35.85123948	-77.06747302
Martin	10th	200	36.00974846	-77.25763686
Martin	25th	200	35.81185998	-77.27321149
Martin	50th	200	35.87557591	-77.10046876
Martin	75th	200	35.84168651	-77.05291592
Martin	90th	360	35.84144903	-76.97693206
Martin	Maximum	12,133	35.79495219	-76.94992847
Martin	Average	336		
Mecklenburg	Minimum	200	35.01790054	-80.82473194
Mecklenburg	10th	200	35.32232453	-80.96557397
Mecklenburg	25th	200	35.3418679	-80.89901863
Mecklenburg	50th	200	35.15511711	-80.68576742
Mecklenburg	75th	200	35.07269318	-80.99636747
Mecklenburg	90th	200	35.37097594	-80.8075395
Mecklenburg	Maximum	18,648	35.30663057	-80.69911308
Mecklenburg	Average	312		
Mitchell	Minimum	200	35.92972488	-82.07045819
Mitchell	10th	200	36.05006557	-82.31765706
Mitchell	25th	200	35.90206627	-82.11540051
Mitchell	50th	200	36.02316317	-82.21899312
Mitchell	75th	200	36.01800321	-82.11178689
Mitchell	90th	1,649	36.10456957	-82.3143608
Mitchell	Maximum	26,163	36.0450846	-82.29829787
Mitchell	Average	1,387		
Montgomery	Minimum	200	35.34363102	-79.80414371
Montgomery	10th	200	35.45472083	-79.82800379
Montgomery	25th	200	35.42143001	-79.76482673
Montgomery	50th	200	35.37378674	-80.03304993
Montgomery	75th	200	35.39065206	-79.95524894
Montgomery	90th	200	35.32256056	-79.86165728
Montgomery	Maximum	16,423	35.2713463	-79.91051202
Montgomery	Average	278		
Moore	Minimum	200	35.27814309	-79.4904556
Moore	10th	200	35.1653122	-79.39198987
Moore	25th	200	35.21605214	-79.41049778
Moore	50th	200	35.26563918	-79.33088028
Moore	75th	200	35.21131	-79.62385088
Moore	90th	200	35.19852224	-79.42262704
Moore	Maximum	17,875	35.46440926	-79.49481652
Moore	Average	284		
Nash	Minimum	200	35.78204553	-78.1088305
Nash	10th	200	35.9397325	-78.11646449
Nash	25th	200	35.94994605	-77.8071622
Nash	50th	200	35.94517291	-77.85289181
Nash	75th	200	35.93646032	-77.85483444
Nash	90th	415	35.93872059	-77.97915444
Nash	Maximum	19,293	35.95212098	-77.82528462
Nash	Average	427		

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Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
New Hanover	Minimum	200	34.10588108	-77.91114822
New Hanover	10th	200	34.20183842	-77.91678709
New Hanover	25th	200	34.19199233	-77.93299278
New Hanover	50th	242	34.29359424	-77.85060251
New Hanover	75th	866	34.31376922	-77.88483115
New Hanover	90th	4,032	34.22830749	-77.88692005
New Hanover	Maximum	95,492	34.27770099	-77.73622084
New Hanover	Average	2,041		
Northampton	Minimum	200	36.52447821	-77.89070601
Northampton	10th	200	36.49216268	-77.44368971
Northampton	25th	200	36.26853968	-77.29556043
Northampton	50th	200	36.51944427	-77.67608327
Northampton	75th	200	36.43751382	-77.20994296
Northampton	90th	244	36.29415029	-77.27245552
Northampton	Maximum	18,740	36.49131586	-77.68055389
Northampton	Average	281		
Onslow	Minimum	200	34.65008783	-77.18943831
Onslow	10th	200	34.7596761	-77.3759715
Onslow	25th	200	34.90249449	-77.5563215
Onslow	50th	200	34.74432445	-77.33838247
Onslow	75th	232	34.73618039	-77.31835278
Onslow	90th	1,237	34.74556011	-77.50406391
Onslow	Maximum	103,900	34.51513887	-77.37234206
Onslow	Average	2,247		
Orange	Minimum	200	35.99100304	-79.12577089
Orange	10th	200	36.09722513	-79.25687665
Orange	25th	200	36.07832203	-79.12547343
Orange	50th	200	36.09449691	-79.21453465
Orange	75th	200	36.08243601	-79.11075954
Orange	90th	200	36.07511738	-79.18307192
Orange	Maximum	18,649	35.98843393	-79.20814568
Orange	Average	339		
Pamlico	Minimum	200	35.12771284	-76.92418923
Pamlico	10th	200	35.09210596	-76.83682594
Pamlico	25th	200	34.96903807	-76.80299232
Pamlico	50th	549	35.14451991	-76.77260635
Pamlico	75th	1,871	35.02624888	-76.69981177
Pamlico	90th	4,625	35.13685551	-76.80083181
Pamlico	Maximum	34,408	34.97446205	-76.78515166
Pamlico	Average	1,775		
Pasquotank	Minimum	200	36.41944142	-76.35827973
Pasquotank	10th	200	36.37023006	-76.27350698
Pasquotank	25th	200	36.43790104	-76.42703421
Pasquotank	50th	200	36.29367445	-76.2150115
Pasquotank	75th	380	36.27239452	-76.26901199
Pasquotank	90th	888	36.30689411	-76.22867639
Pasquotank	Maximum	18,107	36.33819942	-76.22443615
Pasquotank	Average	470		
Pender	Minimum	200	34.55914943	-77.91544318
Pender	10th	200	34.3940964	-77.6757145
Pender	25th	200	34.71599068	-78.06221718
Pender	50th	248	34.54737166	-77.91731288
Pender	75th	1,186	34.38005757	-77.9329664
Pender	90th	8,087	34.43334785	-77.60884902
Pender	Maximum	86,088	34.35117769	-77.6480193
Pender	Average	3,299		
Perquimans	Minimum	200	36.29754176	-76.53478805
Perquimans	10th	200	36.34356521	-76.5608196
Perquimans	25th	200	36.33228015	-76.49992253
Perquimans	50th	200	36.24359002	-76.55103551
Perquimans	75th	220	36.13238125	-76.40431461
Perquimans	90th	446	36.10230459	-76.51950825
Perquimans	Maximum	13,210	36.19347499	-76.46465139
Perquimans	Average	346		

North Carolina
Residential Flood

Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Person	Minimum	200	36.3977869	-78.98551613
Person	10th	200	36.40338987	-78.98580322
Person	25th	200	36.40902975	-78.94390698
Person	50th	200	36.47286487	-79.13932032
Person	75th	200	36.24326811	-78.93356245
Person	90th	200	36.34183642	-78.88947189
Person	Maximum	16,573	36.24639453	-78.91914123
Person	Average	245		
Pitt	Minimum	200	35.50056222	-77.39331053
Pitt	10th	200	35.59161051	-77.35412362
Pitt	25th	200	35.57479495	-77.34137888
Pitt	50th	200	35.61637775	-77.32160838
Pitt	75th	256	35.6099696	-77.38455539
Pitt	90th	705	35.52114613	-77.42041759
Pitt	Maximum	23,498	35.67148913	-77.44602417
Pitt	Average	454		
Polk	Minimum	200	35.22955368	-82.17751163
Polk	10th	200	35.23057336	-82.22504164
Polk	25th	200	35.25256468	-82.13037845
Polk	50th	200	35.2269533	-82.32396723
Polk	75th	200	35.3635391	-82.15371341
Polk	90th	200	35.35574898	-82.10671835
Polk	Maximum	26,997	35.22391349	-82.27052724
Polk	Average	679		
Randolph	Minimum	200	35.55597982	-79.7962818
Randolph	10th	200	35.74563039	-79.78772876
Randolph	25th	200	35.74925717	-79.73343176
Randolph	50th	200	35.64527291	-79.94596118
Randolph	75th	200	35.83251916	-79.77581773
Randolph	90th	200	35.68491378	-79.84071318
Randolph	Maximum	22,786	35.83016414	-79.96457989
Randolph	Average	263		
Richmond	Minimum	200	35.11292981	-80.00735569
Richmond	10th	200	35.11199266	-79.79331171
Richmond	25th	200	34.95192036	-79.68583716
Richmond	50th	200	35.03147109	-79.77662158
Richmond	75th	200	34.96680717	-79.68355108
Richmond	90th	200	34.95071573	-79.75053426
Richmond	Maximum	15,373	35.0367395	-79.70167387
Richmond	Average	242		
Robeson	Minimum	200	34.77446033	-79.31809838
Robeson	10th	200	34.64345102	-79.26799109
Robeson	25th	200	34.80053232	-78.97673341
Robeson	50th	200	34.63769574	-78.93528185
Robeson	75th	386	34.64208531	-78.95043213
Robeson	90th	868	34.48172276	-79.11913837
Robeson	Maximum	13,134	34.64047651	-79.29020832
Robeson	Average	439		
Rockingham	Minimum	200	36.51988554	-79.67681632
Rockingham	10th	200	36.48348447	-79.5811794
Rockingham	25th	200	36.5054097	-79.75234887
Rockingham	50th	200	36.36402419	-79.69240613
Rockingham	75th	200	36.37009947	-79.66554435
Rockingham	90th	200	36.53607832	-79.55388886
Rockingham	Maximum	18,923	36.51848223	-79.99182387
Rockingham	Average	227		
Rowan	Minimum	200	35.68928479	-80.44048801
Rowan	10th	200	35.69104975	-80.68080788
Rowan	25th	200	35.68248727	-80.43615596
Rowan	50th	200	35.74098899	-80.67295999
Rowan	75th	200	35.6913459	-80.54463285
Rowan	90th	200	35.63459853	-80.47283727
Rowan	Maximum	16,621	35.50782883	-80.64849714
Rowan	Average	245		

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Residential Flood

Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Rutherford	Minimum	200	35.19168157	-81.90657123
Rutherford	10th	200	35.18778809	-81.78200359
Rutherford	25th	200	35.24520381	-81.76468074
Rutherford	50th	200	35.48346454	-81.94399751
Rutherford	75th	200	35.26011872	-81.79807526
Rutherford	90th	200	35.30589988	-81.72980818
Rutherford	Maximum	24,307	35.44298489	-82.2631733
Rutherford	Average	445		
Sampson	Minimum	200	34.79749235	-78.2616205
Sampson	10th	200	34.8321278	-78.2479059
Sampson	25th	200	35.0066352	-78.31964283
Sampson	50th	200	34.9766566	-78.32157551
Sampson	75th	200	35.00219335	-78.35563747
Sampson	90th	449	35.10606633	-78.57705265
Sampson	Maximum	15,899	34.99267482	-78.32588363
Sampson	Average	388		
Scotland	Minimum	200	34.84572611	-79.43040777
Scotland	10th	200	34.75135216	-79.52327162
Scotland	25th	200	34.86130441	-79.45576915
Scotland	50th	200	34.71850154	-79.51311241
Scotland	75th	200	34.67269076	-79.43435641
Scotland	90th	448	34.79170946	-79.4526395
Scotland	Maximum	10,013	34.76734994	-79.44818725
Scotland	Average	311		
Stanly	Minimum	200	35.26481603	-80.22263436
Stanly	10th	200	35.26949737	-80.10483739
Stanly	25th	200	35.4494412	-80.24103174
Stanly	50th	200	35.20590528	-80.34440439
Stanly	75th	200	35.27518501	-80.20204956
Stanly	90th	200	35.41304722	-80.20993167
Stanly	Maximum	22,132	35.16898441	-80.41486369
Stanly	Average	285		
Stokes	Minimum	200	36.51480808	-80.21707017
Stokes	10th	200	36.36185893	-80.15494773
Stokes	25th	200	36.27953707	-80.35197614
Stokes	50th	200	36.36029641	-80.09599599
Stokes	75th	200	36.27528652	-80.37137263
Stokes	90th	200	36.40812634	-80.22945502
Stokes	Maximum	19,423	36.4194391	-80.27458362
Stokes	Average	239		
Surry	Minimum	200	36.45954628	-80.79439632
Surry	10th	200	36.30813181	-80.45313099
Surry	25th	200	36.39719988	-80.70567195
Surry	50th	200	36.33733995	-80.64900161
Surry	75th	200	36.43975974	-80.54260729
Surry	90th	200	36.28906017	-80.85504024
Surry	Maximum	21,206	36.44261859	-80.57784979
Surry	Average	265		
Swain	Minimum	200	35.39307621	-83.48699245
Swain	10th	200	35.43942161	-83.41484052
Swain	25th	200	35.39704756	-83.3481436
Swain	50th	200	35.44640403	-83.44999119
Swain	75th	200	35.37469827	-83.53901658
Swain	90th	10,230	35.43074952	-83.44973805
Swain	Maximum	27,246	35.46693191	-83.87778786
Swain	Average	2,280		
Transylvania	Minimum	200	35.10073984	-82.78387482
Transylvania	10th	200	35.10798383	-82.94453601
Transylvania	25th	200	35.17194001	-82.73936988
Transylvania	50th	200	35.23768998	-82.7425861
Transylvania	75th	200	35.25041385	-82.66478275
Transylvania	90th	396	35.18575521	-82.94812895
Transylvania	Maximum	26,024	35.24525712	-82.88359611
Transylvania	Average	840		

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Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Tyrrell	Minimum	200	35.85569438	-76.26429488
Tyrrell	10th	200	35.89592824	-76.36190412
Tyrrell	25th	200	35.92606563	-76.35922452
Tyrrell	50th	458	35.9156612	-76.25234312
Tyrrell	75th	1,041	35.91613311	-76.24969531
Tyrrell	90th	1,978	35.9690451	-76.07858475
Tyrrell	Maximum	8,312	35.9288528	-76.3172528
Tyrrell	Average	835		
Union	Minimum	200	35.02033725	-80.69288788
Union	10th	200	35.03678724	-80.37881602
Union	25th	200	35.01543837	-80.59556302
Union	50th	200	35.08638719	-80.64463431
Union	75th	200	34.97160824	-80.72619896
Union	90th	200	35.10294731	-80.67072859
Union	Maximum	19,369	34.9234517	-80.56259791
Union	Average	282		
Vance	Minimum	200	36.33467747	-78.38959553
Vance	10th	200	36.32398318	-78.38324926
Vance	25th	200	36.21662382	-78.44904149
Vance	50th	200	36.39622812	-78.49193975
Vance	75th	200	36.31378027	-78.45647339
Vance	90th	200	36.32611707	-78.39834019
Vance	Maximum	17,744	36.29431972	-78.36571956
Vance	Average	242		
Wake	Minimum	200	35.80709919	-78.85481725
Wake	10th	200	35.66125153	-78.55221455
Wake	25th	200	35.8101245	-78.66823228
Wake	50th	200	35.54727359	-78.77786517
Wake	75th	200	35.76650553	-78.85415337
Wake	90th	200	35.75114059	-78.4609782
Wake	Maximum	20,976	35.75653827	-78.64393393
Wake	Average	367		
Warren	Minimum	200	36.30236491	-78.2170363
Warren	10th	200	36.41748464	-78.20940015
Warren	25th	200	36.33550697	-78.2537507
Warren	50th	200	36.46757423	-78.16946179
Warren	75th	200	36.37208847	-78.1073365
Warren	90th	200	36.48198828	-77.92845676
Warren	Maximum	13,428	36.39586287	-78.16577156
Warren	Average	229		
Washington	Minimum	200	35.81853177	-76.77676505
Washington	10th	200	35.79210468	-76.40801512
Washington	25th	200	35.83632085	-76.73703446
Washington	50th	200	35.92380334	-76.63008165
Washington	75th	200	35.90104526	-76.38996616
Washington	90th	418	35.8945787	-76.64789429
Washington	Maximum	14,526	35.90175937	-76.68944747
Washington	Average	299		
Watauga	Minimum	200	36.1226654	-81.73325742
Watauga	10th	200	36.21837449	-81.68971767
Watauga	25th	200	36.20260108	-81.87037155
Watauga	50th	200	36.14922493	-81.78401523
Watauga	75th	200	36.33383792	-81.83826653
Watauga	90th	410	36.23814027	-81.76061377
Watauga	Maximum	25,655	36.18793912	-81.74549327
Watauga	Average	1,128		
Wayne	Minimum	200	35.26454796	-77.97350824
Wayne	10th	200	35.43598648	-77.86871369
Wayne	25th	200	35.314082	-78.0127861
Wayne	50th	200	35.32291404	-78.0473184
Wayne	75th	200	35.57258956	-77.97376861
Wayne	90th	432	35.59351644	-78.03801049
Wayne	Maximum	18,887	35.22766074	-77.85729731
Wayne	Average	357		

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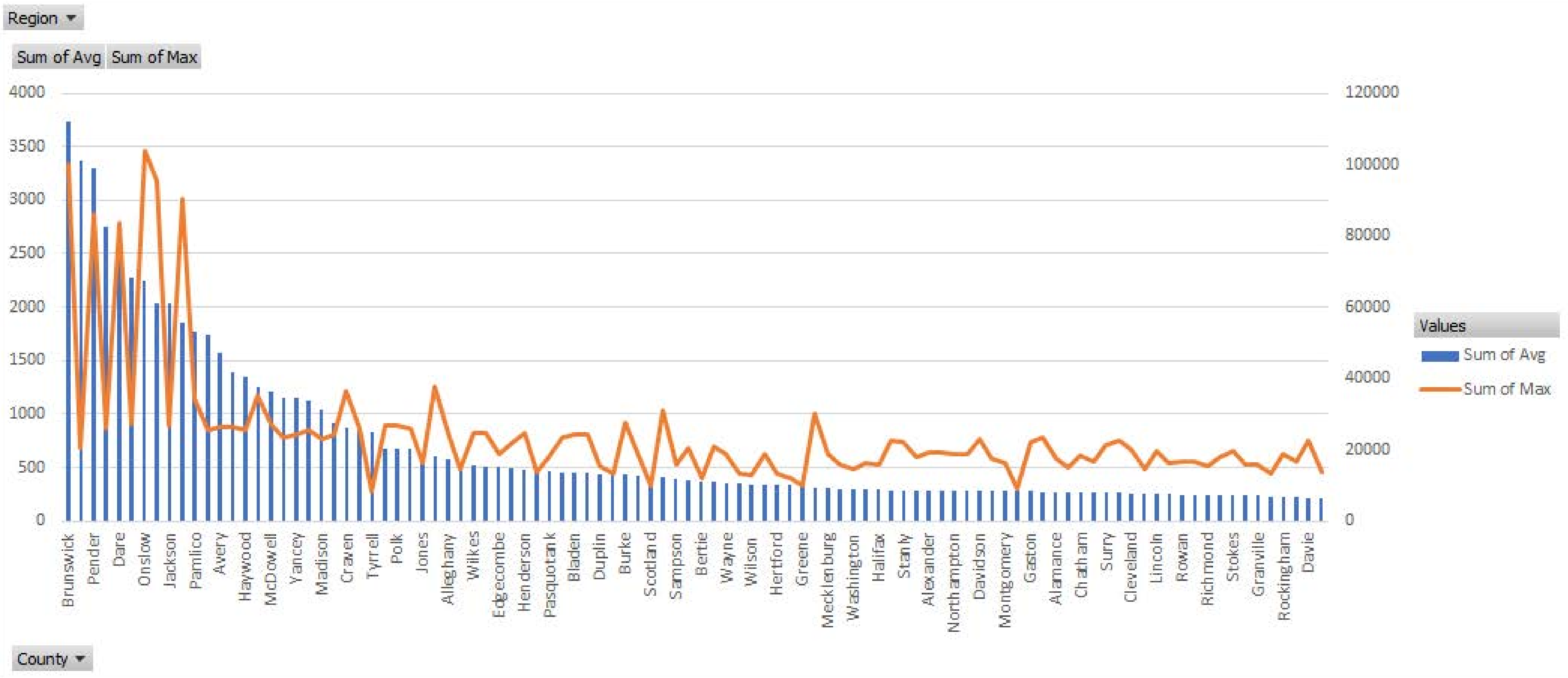
Flood Premiums by County for a Uniform Risk

County	Percentile	Manual Premium	Latitude	Longitude
Wilkes	Minimum	200	36.34711787	-81.0316675
Wilkes	10th	200	36.06307081	-81.29324225
Wilkes	25th	200	36.22193618	-80.88808013
Wilkes	50th	200	36.06711773	-80.97739822
Wilkes	75th	200	36.12155399	-81.06499603
Wilkes	90th	200	36.21334449	-81.3853462
Wilkes	Maximum	24,853	36.32266648	-81.33216573
Wilkes	Average	517		
Wilson	Minimum	200	35.74592433	-78.06178122
Wilson	10th	200	35.67986009	-78.06739512
Wilson	25th	200	35.6516228	-77.77598208
Wilson	50th	200	35.73787713	-77.91419379
Wilson	75th	200	35.77185717	-77.77648515
Wilson	90th	337	35.84104525	-77.87455815
Wilson	Maximum	13,075	35.8505335	-77.80741031
Wilson	Average	345		
Yadkin	Minimum	200	36.24479056	-80.5367785
Yadkin	10th	200	36.13792804	-80.58839362
Yadkin	25th	200	36.23917386	-80.80603961
Yadkin	50th	200	36.09841759	-80.77180425
Yadkin	75th	200	36.07359002	-80.58219836
Yadkin	90th	200	36.19766136	-80.72713259
Yadkin	Maximum	16,659	36.07394566	-80.79235981
Yadkin	Average	222		
Yancey	Minimum	200	36.00227833	-82.34731971
Yancey	10th	200	35.91676134	-82.19533964
Yancey	25th	200	35.82412942	-82.35898887
Yancey	50th	200	35.9813099	-82.49242984
Yancey	75th	200	35.92548035	-82.42643806
Yancey	90th	471	36.00135128	-82.39951206
Yancey	Maximum	24,432	35.76421966	-82.20671388
Yancey	Average	1,147		

Notes

1. Premium calculated using the following assumptions:
   $200,000 Coverage A
   $100,000 Coverage C
   100% Coverage A ITV
   $0 Coverage D
   $5,000 Deductible
   Single Story, First Floor Height=1, Frame Construction, No Endorsements


Region
Sum of Avg
Sum of Max
4000
3500
3000
2500
2000
1500
1000
500
0
120000
100000
80000
60000
40000
20000
0
Brunswick
Pender
Dare
Onslow
Jackson
Pamlico
Avery
Haywood
McDowell
Yancey
Madison
Craven
Tyrrell
Polk
Jones
Alleghany
Wilkes
Edgecombe
Henderson
Pasquotank
Bladen
Duplin
Burke
Scotland
Sampson
Bertie
Wayne
Wilson
Hertford
Greene
Mecklenburg
Washington
Halifax
Stanly
Alexander
Northampton
Davidson
Montgomery
Gaston
Alamance
Chatham
Surry
Cleveland
Lincoln
Rowan
Richmond
Stokes
Granville
Rockingham
Davie
County
Values
Sum of Avg
Sum of Max