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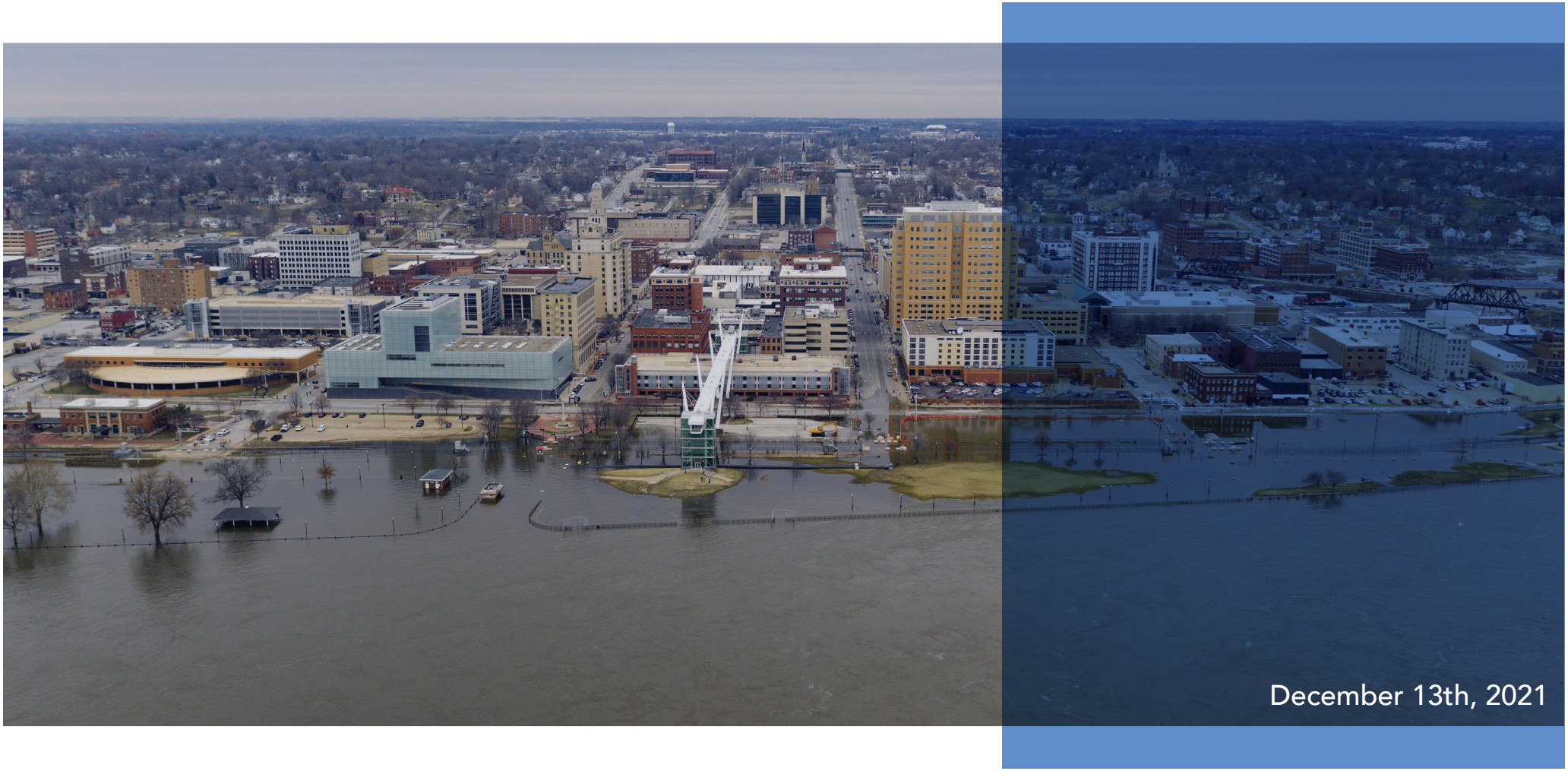

The 4th National Risk Assessment

Climbing Commercial Closures

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Contributors to the The 4th National Risk Assessment

The following First Street Foundation current and past personnel contributed to the preparation of this report, data, or First Street Foundation products supporting this report. Our First Street Foundation Flood Model partners, First Street Foundation Flood Lab members, Advisory Board members, and many others also deserve credit for their valuable contributions.

Mike Amodeo
Mark Bauer
Dr. Kyra Bryant
Helena Cawley
Sara Chadwick
Matthew Eby
Neil Freeman
Ho Hsieh
Angela Jin
Mike Kaminski
Shannon Keane
Dr. Edward J. Kearns
Dr. Jungho Kim
Kelvin Lai
Marguerite Lally
Sharai Lewis-Gruss
Lucy Litvinova
Mike Lopes
Anna McIntosh
David Miller
Natalie Pardy
Dr. Jeremy R. Porter
Nathan Rosler
Daniel Seripap
Michelle Shapiro
Evelyn Shu
Sean Surdovel
Otis Wilcox
Dr. Bradley Wilson
Ray Yong

Collaborators

ARUP

To estimate physical building damage, repair costs and time needed to repair that damage (downtime days), the Foundation collaborated with global engineering and consulting firm Arup in order to leverage their expertise in climate risk and resiliency consulting.

Arup Team Members:

Ibrahim Almufti
Meg Ackerson
Jinal Mehta
Kenny Buyco
Hussein Moussa
Tom Smith
Karen Barns
Jack Hogan
Jelena Djurovic
Nicolas Bouvier
Kaustubh Bakare
Julian Olley
Rebecca Birmingham

Special thanks to our valuable data partners

Without them, our analysis would not be possible.

LIGHTBOX

To define building characteristics, improvement percentages, and property parcel details, the Foundation leveraged data from LightBox, a leading provider of CRE data and workflow solutions.

mapbox

To calculate flood depths to the building structure, the Foundation leveraged building footprint data supplied by Mapbox. Mapbox also provided geocode lookups and map integrations for the Flood Factor experience.

State and county boundaries from the U.S. Census TIGER dataset is used on all pages showing maps. This report is not endorsed or certified by the Census Bureau.

This report is neither affiliated with, nor authorized, sponsored, approved, endorsed, or certified by any of the foregoing providers.

Disclaimers

First Street Foundation's flood and climate change risk and damage estimates are based on one or more models designed to approximate risk and are not intended as precise estimates, or to be a comprehensive analysis of all possible flood-related and climate change risks.

The 4th National Risk Assessment: Climbing Commercial Closures | © First Street Foundation

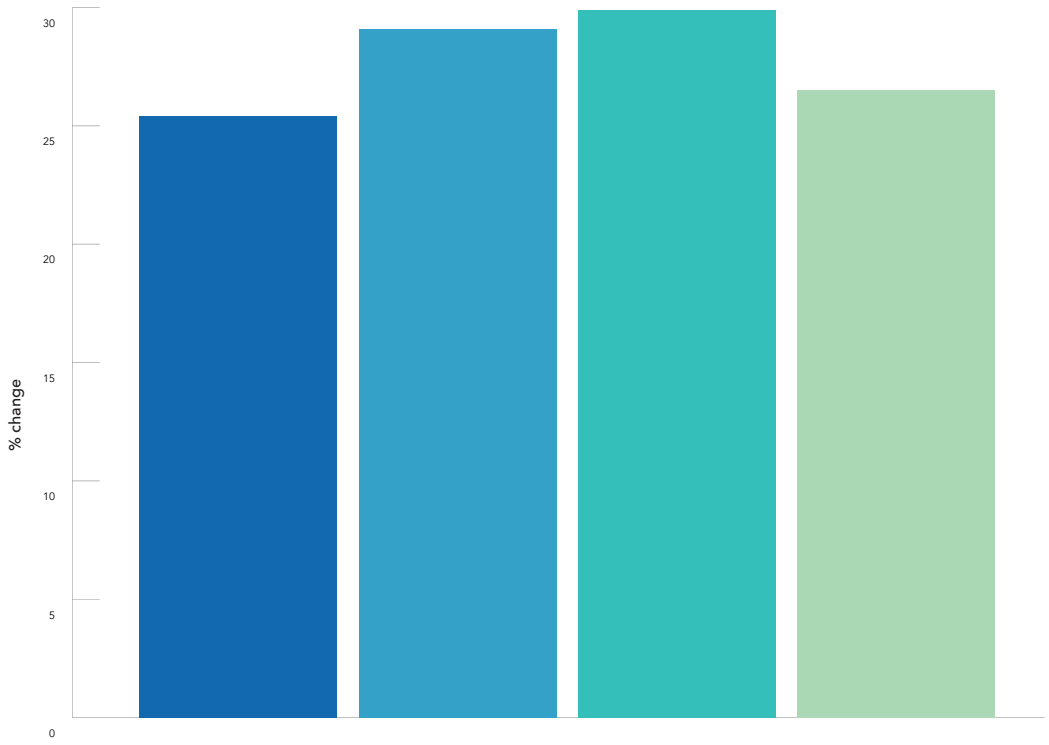
Abstract

Flooding is one of the largest national disasters in terms of reach and cost in the United States (https://www.ncdc.noaa.gov/billions/). While many analyses have focused on flood risk in relation to residential properties, insurance protections, and demographic populations, very little attention has been paid to the impact of flooding on the commercial market. This is notable given that the commercial market is often made up of the most valuable physical structures in communities, employs much of the local labor force, and generally plays a key role in the sustainability of the local, regional, and national economy. To date, several large corporate headquarters, faced with climate risk, have engaged in a series of high profile re-locations, including the Spirit Air Operations Center from Florida to Nashville, Hewlett Packard in Houston, and Roper Hospital in Charleston. In this analysis, a "first principles of engineering" approach is taken to estimate damage, downtime, and downstream economic effects based on current and future estimates of probabilistic flood hazard projections.

The results of the analysis indicate that there are currently 729,999 retail, office, and multi-unit residential properties at risk of annualized flood damage in the contiguous United States, and the absolute count of buildings at risk will grow by about 8% by the year 2052 as a result of climate change. The structural damage associated with this risk is currently over $13.5 billion annually and expected to grow to $16.9 billion over the same time period (~25.4% increase), with the combined lost days of building operation for all retail and office buildings growing from 3.1 million to 4.0 million lost days of operation over that time period for existing structures (~29.1% increase). On top of the structural damage to the building structures, the economic impacts on local economies is estimated to to grow from $26.8 billion in direct lost output and $23.0 billion in indirect impacts due to downtime days ($49.9 billion total) to $34.0 billion and $29.1 billion ($63.1 billion total), respectively (~26.5% increase over the time period).

Click here to access the data presented in this report.

% change in risk from 2022-2055



Category	Number at risk 2022	Number at risk 2052	Change in category
Structural damage	$13.5B	$16.9B	3.4M more dollars in structural damage associated with risk
Lost days of operation	3.1M	4M	1.1M more combined lost days of building operaton for all retail and office buildings
Direct impact	$26.8B	$34B	7.2B more dollars in direct lost output
Indirect impact	$23B	$29.1B	6.1B more dollars in indirect impacts due to downtime days

Introduction

Recent research in the area has highlighted the emergence of significant trends in the relationship between climate and the economy which are expected to be further amplified in the near future (Brookings Institute, 2019). In the United States, damages to the economy will grow as temperatures change at a continuously increasing rate. Additionally, the effects of the changing climate will not be felt evenly across the US. In fact, those locations already exposed to climate hazards, and those projected to see an onset of exposure in the near future, are where the risk will likely be most pronounced across a number of other risk indicators. Most central to that risk is the vulnerability of the individual residential properties, shared community infrastructure, and components of the local labor market, including impacts to retail and office structures. These physical retail and office structures are an important component of market health, as they facilitate the trade of goods and services, therefore serving as an essential part of economic and community prosperity. As flooding severity and frequency changes along with a changing climate, increasing commercial flood risk understanding is especially important. Understanding and quantifying the ways in which that exposure relates to commercial real-estate vulnerability is essential to understanding where the effects of climate are already being felt, and where they will be most pronounced in the future.

The Intergovernmental Panel on Climate Change (IPCC) presents a framework for understanding flood risk through the necessary components of hazard (H), exposure (E), and vulnerability (V) (Reisinger et al., 2020). Exposure in this study is calculated at high-resolution for the entire country, following similar methodology as previous reports and peer reviewed papers, applying parcel-level property information to the high-resolution (parcel-level) hazard information provided by the First Street Foundation Flood Model (FSF-FM; Bates et al., 2021). The hazard information provided by the FSF-FM includes the integration of a national database of more than 20,000 unique flood adaptation measures, multiple flood types (tidal, pluvial, fluvial, and surge), and multiple flood return periods (2-, 5-, 20-, 100-, 250-, and 500-year), currently and in the future. Hazard information in existing research that models the flood exposure or risk of properties within the United States often relies on outdated inputs, low-resolution data, or overly simplistic modeling techniques. Research modeling exposure is often restricted by data availability issues. For example, property information may not differentiate between building and use types if sourced from satellite imagery, or may be limited to analysis of only critical infrastructures provided by government databases. The property information utilized in this report comes from Lightbox, which has high-resolution data covering use-types and other building characteristics (such as building materials and square footage). Machine learning is used to impute missing values to ensure risk estimates may be provided for each property. Importantly, this report has developed and applied a new methodology for estimating vulnerability (which is specific to large buildings, such as retail, office, and multi-unit residential buildings) in order to provide a more comprehensive understanding of risk. Estimates related to vulnerability include structural damages (repair costs), downtime (days closed and unable to work for repair), direct economic damages (from retail and office buildings being closed), and indirect economic damages (macro-economic level impacts). Economic damages are not estimated for multi-unit residential buildings, but the fragility curve developed for estimating structural damages for retail and office buildings may be used for similarly built and sized buildings, allowing for estimates of vulnerability through the calculation of predicted structural damage.

Average annual loss (AAL) or similar loss estimates are often calculated through simple linear depth-damage functions, where higher flood depths directly translate to higher damage estimates. These types of depth-damage functions are increasingly recognized to be problematic as they do not provide an accurate understanding of structural fragility and susceptibility to damage. Wing et al. compare historic flood claims within the United States obtained through the National Flood Insurance Program (NFIP) database with commonly applied depth-damage functions, such as from Hazus (a widely used GIS-based tool to estimate property damage with a depth-damage function), and find low agreement. These simple depth-damage models do not account for building specific attributes. One of the most readily observable limitations is that these depth-damage models generally estimate the same proportion of economic losses (taking the repair costs as a percentage of the total replacement value) for buildings of different heights and stories, even though the first floor is the only one likely to be impacted. Multivariate models are typically more useful (i.e. Thieken et al., 2008; Merz et al., 2013; Schroter at al., 2014), but the complexity of many of these developed multi-variate models has posed a barrier for standard application in flood risk assessments (Wing et al., 2020). Additionally, depth-damage functions (even if non-linear) will have greatly reduced uncertainty when developed separately for different building types, especially if analysis aims to provide property-specific estimates. The results captured in this report make use of a series of building specific, multivariate, damage functions that were developed using a component based approach, rather than simply on historic damage observations. This differentiation allows for the overcoming of the limitations documented above through the application of a "first principles of engineering" approach.

Furthermore, much of existing literature finds that the costs of disasters is often undervalued as they only account for structural impacts. Economic impacts of natural hazards are not well understood, especially due to their indirect and macro-economic effects. Many estimates from government agencies (for example, the European Environmental Agency; see EEA, 2012) and global disaster databases (such as the EM-DAT dataset from the Centre for Research on the Epidemiology of Disasters) undervalue the cost of disasters as they do not account for these types of impacts (Carrera et al., 2015).

Within this report, vulnerability is indicated through archetype specific loss fragility models to estimate structural damage and downtime, as well as through direct economic damages (by applying downtime to GDP contribution), and economic cost multipliers from the Bureau of Economic Analysis' Regional Input-Output Multiplier, which are explicitly designed to capture the impact of industry location on local wages, sales, supply chain needs, and other economic activity that may not be tied directly to the building or industry itself.

Introduction

Measuring Flood Risk

The contributions of this model include the following improvements:

High Resolution Input Data

The development of a national scale, high-resolution commercial flood risk model is achieved through the input of high-resolution hazard and property data for the contiguous United States. Flood hazard data is sourced from the First Street Foundation Flood Model (FSF-FM; Bates et al., 2021). Property specific spatial parcel data is sourced from county-level property assessor records collected and standardized by Lightbox (a 3rd party data provider). These high-resolution data sources allow for high-precision risk assessments at a national level that many other sources of hazard and property data do not allow for.

Multi-Source Flood Hazard Information

The high-resolution and nationally consistent flood hazard estimates include the integration of multiple sources of flooding. Many previous risk score developments rely on single-source hazard information, (i.e. - surge, riverine, rainfall, or tidal, or a limited combination of these sources resulting in lower model fidelity). The FSF-FM hazard information incorporates flooding from tidal, surge, fluvial, and pluvial sources for a more comprehensive characterization of flood hazard for the entire country. It also facilitates the quantification of average annual losses, an important indicator of risk.

Multi-Return Period Hazard Information

A probabilistic approach for the magnitude of expected flooding and probabilities of the occurrences of those magnitudes is utilized in the hazard information, avoiding the limitations of other hazard sources where only a single hazard probabilistic layer is utilized. This allows for a better and more consistent view of flood hazard which varies across location and is based on the flood profile of each unique area.

Archetype-Specific Multivariate Depth-Damage Functions

Multivariate depth-damage functions relate flood depth to structural damage and downtime days (length of time building is inoperable) for thirty building archetypes representing office, retail, and multi-unit residential spaces of various heights (low, mid, and high rise categories), construction material (timber versus non-timber), and basement configurations. Each archetype model was populated with typical building components, including structural members, equipment, plumbing, electrical lines, partitions, and finishes according to building properties such as area, height, and usage. This approach is unique as many previous research efforts have been limited by simple linear depth-damage functions based on historic observation or are provided by low resolution, spatially relevant depth-damage functions (i.e. - at the census block level) as multivariate depth-damage functions are typically hard to apply across different settings.

Integration of GDP and Economic Multipliers Information

GDP data by sector at the state and county level and economic multipliers by sector at the state level are utilized to create broad level estimates on the direct and indirect economic impacts caused by the downtime estimates for each retail and office property. These costs are typically undervalued in other approaches that consider only structural damage costs rather than economic impacts.

Future Facing Risk

The FSF-FM additionally allows for the estimation of relative risk now and 30 years in the future. The same flood hazard modeling approach is utilized for the development of future flood hazard layers, which is then applied to the existing property and vulnerability inputs to isolate the effects of a changing environment on existing vulnerability by holding development, population shifts, and adaptation efforts constant. Additionally, costs are in current dollars and do not consider inflation. This reduces uncertainty by focusing only on changes in existing risk rather than including information with additional uncertainty, allowing for more reliable identification of areas and infrastructure which may experience higher risk due to flood hazard in the current climate and in future climate scenarios.

Methods

The flood model used to estimate the hazard in this analysis is the First Street Foundation - Flood Model (FSF-FM; see Bates et al., 2021) which represents a high resolution inundation model at a 3m horizontal resolution. The risk modeling approach simulates the impact of hundreds or thousands of different flooding scenarios using a virtual model of the building to estimate the extent and severity of flood damage on individual building components, and translates it to consequences such as structural damage costs and downtime. The estimates are then produced for our current climate conditions and adjusted into the future by creating expected annualized depth in each year as the sum of the probabilities that relate to each flood likelihood

$$Expected\ Depth = \sum Avg(D_i, D_{i+1}) * (P_{i+1} - P_i)$$

In the above equation, D and P show the depth and probability, respectively, and i is the numerator for different return period scenarios. By coupling the high precision FSF-FM with the first principles of engineering approach employed in the development of the risk model, this analysis represents the first damage analysis of commercial properties at a national scale, developed at the precision of the building level. Property data were obtained through a Lightbox and represent the full suite of assessment based characteristics and the value-added standardized property level indicators necessary for the development of the damage functions and the assignment of building archetypes

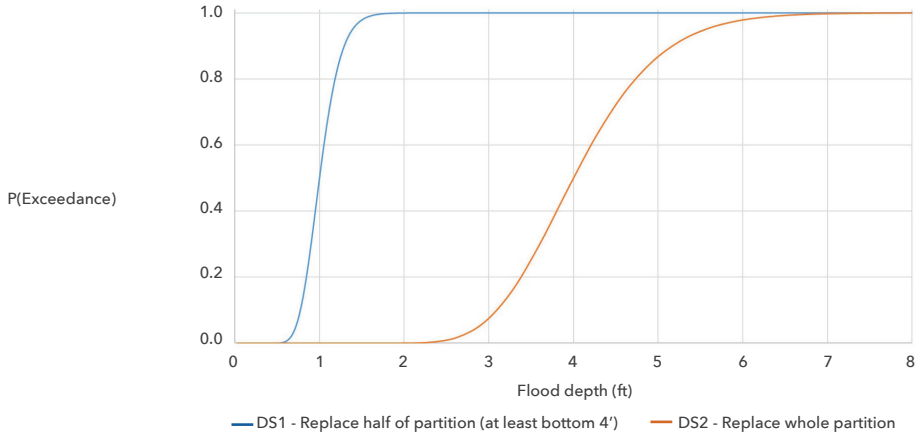


Figure 1. Fragility curves for interior building partitions

(as represented by the multiple return periods in the FSF-FM) multiplied by associated flood depths, using the equation presented here:

(https://www.lightboxre.com/).

In order to couple vulnerability with hazard exposure, Arup, a leading global engineering and consulting firm, developed vulnerability curves in conjunction with the First Street Foundation for various building archetypes. The development of the building archetypes allows for the generalization of flood damages based on expected costs, susceptibility to damage, and the normative locations of building components in each of the archetypes developed for this analysis. At the building level, the probility that individual components would sustain a certain severity of damage (from minor or repairable damage to full replacement) for a given flood depth is defined by these fragility curves. To develop the compnent-based fragility curves, Arup used first principles of engineering, observations from field reconnaissance in the aftermath of past flood events (e.g. Hurricane Harvey), other guidelines (e.g. NEMA Ingress Protection standards), or adapted from the literature. Figure 1 shows an example family of fragility curves for interior partitions, where DS1 refers to partial failure of the partitions (which requires replacement of at least the bottom 4ft of drywall panel) and DS2 represents complete failure of the partitions (which requires full replacement from floor to ceiling).

Arup developed this component-based approach for flood risk analysis based on a methodology that was originally used to quantify seismic risk, adopted from FEMA P-58 (Applied Technology Council, 2013) and enhanced to more realistically capture building downtime with Arup's Resilience-based Earthquake Design Initiative (REDi) methodology (Arup, 2013). In the past several years, Arup has adapted this seismic component-level approach to climate-related hazards. Recently, academic researchers have also been adapting this type of approach for flood risk modeling (Nofal & Van de Lindt, 2020)

The overall process makes use of building characteristics associated with the number of stories, presence of a basement, square footage, assessed value, construction, year built, and location to develop the 30 different archetypes. Each building model, populated with components arranged according to its size and archetype, was subjected to incremental flood depths from one foot up to fifteen feet. For each flood depth, one thousand Monte Carlo simulations were run, sampling the fragilities of each component so that component-level damage results were produced for each of the one thousand realizations. This modeling approach captures the inherent variability in flood impacts and quantifies the bands of uncertainty statistically so that they may be sampled as a range of probable damage estimates within reason. This report focuses on the 50th percentile of this damage distribution but also extracts the 10th and 90th percentiles as representation of the low and high confidence envelope around those estimates (see Figure 2 as an example). Where possible, these results were compared to literature as a benchmarking exercise (FEMA, 2020; U.S. Army Corps of Engineers, 2009; Nofal & Van de Lindt, 2020)

Structural Damage Impacts

By applying the flood hazard to the building archetype, the number of units for each component which needed to be repaired or replaced (according to its damage state) were obtained for each simulation for each building. This information defining the damage state was used in a consequence function for calculating the "structural damage cost" from repairs required (based on data procured by Arup's internal cost estimators) as well as downtime calculations. In order to get

Methods

baseline estimates, the costs to repair and replace equipment were estimated for Washington, D.C. in 2020 USD. Based on the level of damage, the total building structural damage cost was calculated for each realization as a sum across all damaged components for each flood depth. The estimates produced through the Washington D.C. baseline application were then adjusted to be appropriate for each of the other geographical locations through the use of price parity multipliers from the Bureau of Economic Analysis (BEA) by Metro area (CBSA), or state, for counties outside of metro areas.

Downtime Impacts

Downtime estimates are directly related to structural damage and influenced by post-disaster market conditions. These are calculated through the additional inclusion of the aggregated repair time per damaged component in the building and impeding factors that delay the initiation of building repairs such as from local market conditions associated with the availability of construction/repair labor following the modeled flood event. The downtime calculation followed the REDi methodology, which was originally published in REDi for Seismic (Arup, 2013) and adapted for flood by Arup (publication pending). Overall, the process for the calculation of downtime estimates follows a similar process as that for structural damage estimates. For downtime estimates, rather than information on the cost of replacement for each component to estimate monetary loss, information regarding the repair times for damaged components and impeding factors that delay the initiation of building repairs are utilized to calculate time. Impeding delays include time for floodwater

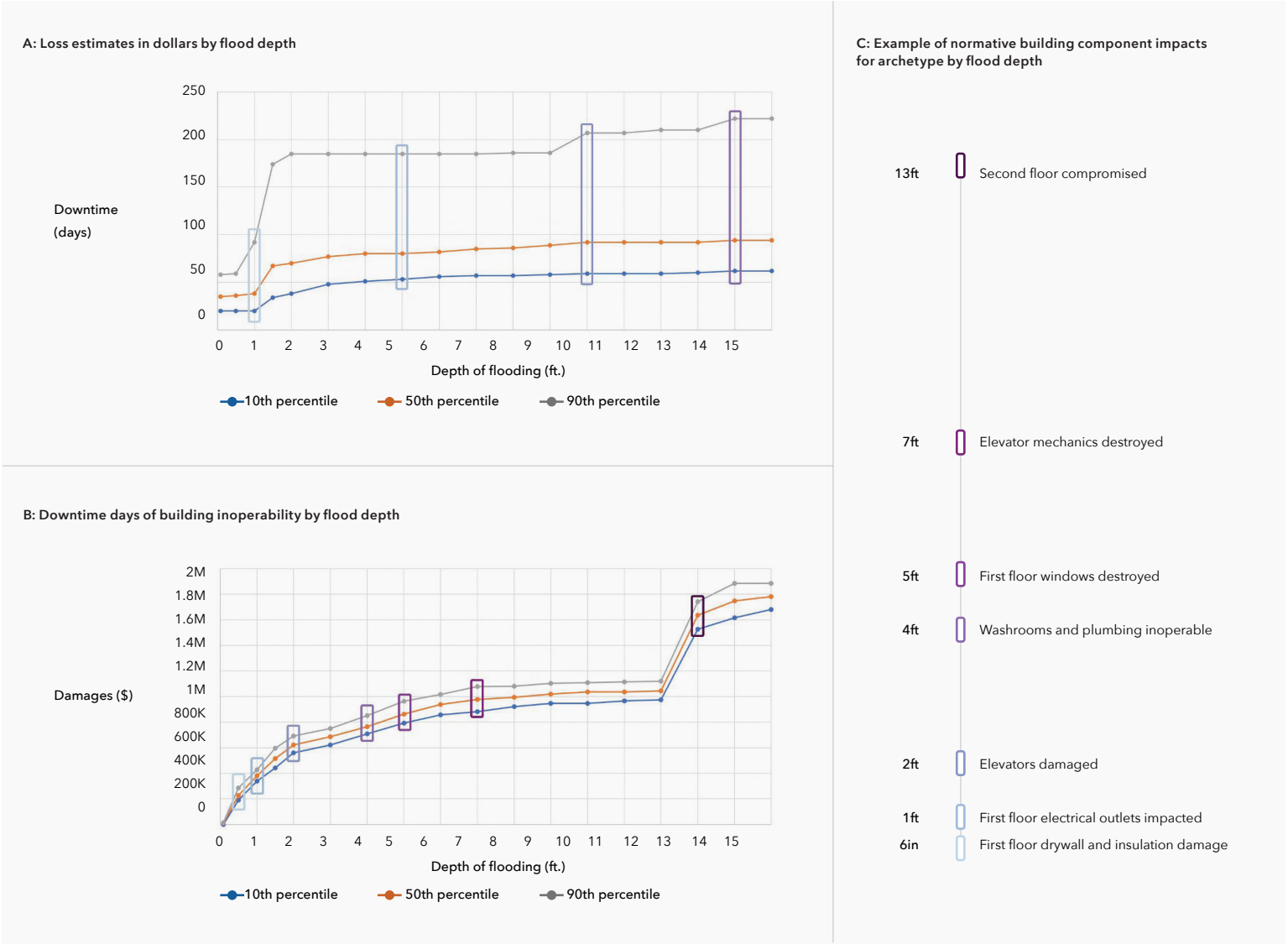


Figure 2. Low-rise Office building (Non-timber) building archetype vulnerability curve for the 10th, 50th, and 90th percentile losses and downtime days

Methods

recession, building restoration, contractor and engineer mobilization, and equipment long lead times.

Once the impending delays are resolved, the downtime model allocates crews of workers to make repairs to damaged components based on specific trades (e.g. electrical). A construction of realistic repair sequences that mimic actual contractor logistics is aggregated to quantify the overall building downtime.

Economic Impacts

Finally, economic impacts (direct and indirect) from retail and office buildings are estimated as indicators in the reduction of outputs and other associated economic activity due to downtime, and are calculated through the inclusion of information on land-use, geographic location, square footage, GDP contribution by sector, and RIMS II multipliers capturing indirect market-level impacts (https://apps.bea.gov/regional/rims/rimsii/home.aspx). Economic impacts refer to the economic damages incurred due to retail and office buildings being closed from flooding. This includes direct economic damages from economic activity not occurring that would normally occur in the impacted building due to the estimated downtime (detailed above). Additionally, indirect impacts (also referred to as flow or downstream effects) are partially captured here through the application of state and sector specific economic multipliers provided by the BEA RIMS II. These indirect impacts refer to the foregone economic activity in the region due to the direct economic impacts. For example, an office building which normally purchases large amounts of office operations due to flooding results in indirect impacts due to this foregone market activity where it is not engaging in the purchase of those supplies during downtime. More broadly, indirect impacts result when a flooded building cannot operate as a supplier for outputs, or cannot operate as a buyer during downtime.

The model here for estimating these economic impacts utilizes three sets of input data: (1) state and county-level GDP information identifying contributions by different economic sectors, (2) mappings between economic sectors and land uses, and (3) economic multipliers by state and sector. These data sets are sourced from the BEA, First Street Foundation (FSF), and the BEA RIMS II, respectively. In order to link the existing parcel data to BEA-RIMS industry sectors, BEA data is mapped to a land use category consistent with the land use types included in the archetype development. The sector GDP data is summarized by land use to give "land use GDP", or the economic contribution of a given land use category by state and county.

Next, the property database is used to generate total building square footage for buildings with retail and office land uses. The "land use GDP" is divided by the total square footage per land use to compute the expected land use GDP-per-sqft for each land use category by state and county. For each retail and office property with flooding, the estimated downtime, the building square footage is multiplied by the expected land use GDP-per-sqft. This is the property's direct economic damages. A deflator is used which assumes only 40% of activity decreases, as people may be able to work from home. It is also important to note that since the GDP information is provided on a state or county resolution and GDP for the land use categories involve the aggregation of multiple sectors, direct economic damages will not be an accurate portrayal of individual properties but should be considered only on a larger geographical scale, or labor market level.

Indirect damages are calculated by multiplying the direct damages by a land use multiplier, which is computed through utilizing the RIMS sector multipliers. These indirect damages account for economic activity like lost output, lost value, lost household earnings, and lost jobs (BEA, 2012). As the sectors used in the RIMS multipliers are much more specific than the land use categories utilized in the property data here (office and retail), a "land use multiplier" is computed for each of the two categories by taking a weighted average of each sector included within each land use category, based on the ratio of each included sector's contribution to GDP. This is done individually for each state.

The RIMS II multipliers for each state and sector exist as type 1 and type 2, where the type 2 multipliers not only consider the downstream impacts of foregone macro-level market transactions but also the impacts of foregone purchases due to employees' income being reduced from their place of work being closed. A key assumption utilized here is the appropriateness of the RIMS II type 1 multipliers over the type 2 multipliers. The type 1 multipliers were utilized as it was assumed that employee income and purchasing power would not be reduced. This relies on an additional assumption that most employees receive incomes through salary rather than hourly pay. Additionally, this supports that some employees may be able to work from home during downtime. When considering retail buildings such as restaurants where employees are more likely to be employed on an hourly basis and cannot as often work from home, this presents an obvious opportunity for model improvement when this type of high resolution data is available.

Results

Metro Impacts

The distribution of the total number of buildings with risk and total structural damage costs by metropolitan area varies across the United States (Figure 3). There are predominant patterns of high risk when considering structural damage costs in large cities where these types of office, retail, and multi-unit residential buildings are more likely to be concentrated. The top five metropolitan areas with the highest aggregated total structural damage costs across office buildings, retail buildings, and multi-unit residential buildings are the Miami, FL (with an estimated $1.07 billion in structural damages); New York, NY ($0.58 billion); Pittsburgh, PA ($0.45 billion); Boston, MA ($0.33 billion); and Houston, TX ($0.29 billion) metropolitan areas (Table 1).

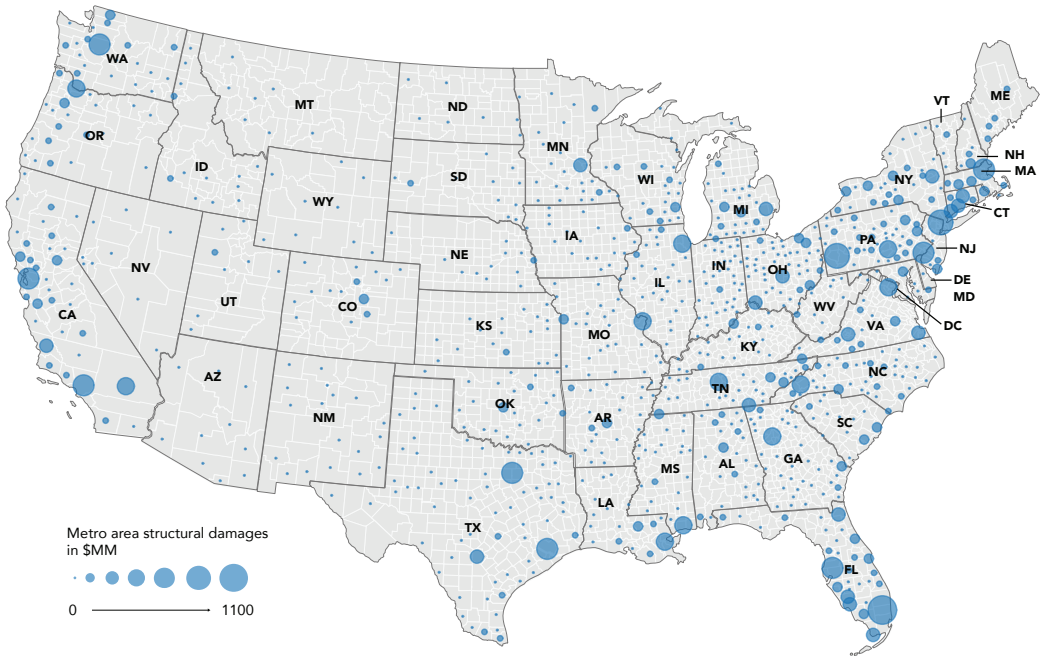


Figure 3: Metropolitan Structural Damages

Metro area	Total Office Buildings		Total Retail Buildings		Total Multi-unit Residential		Total	
	Count w/ damage	Structural damage ($MM)	Count w/ damage	Structural damage ($MM)	Count w/ damage	Structural damage ($MM)	Total count w/ damage	Total damages ($MM)
Miami, FL	4,750	$209.1	13,240	$374.1	7,980	$489.9	25,970	$1,073.1
New York, NY	2,320	$62.4	23,990	$366.4	4,060	$153.6	30,370	$582.4
Pittsburgh, PA	1,710	$90.6	8,810	$329.3	840	$28.0	11,360	$447.9
Boston, MA	1,090	$75.0	5,560	$200.6	1,680	$55.3	8,330	$330.9
Houston, TX	2,130	$36.1	18,120	$207.9	850	$43.1	21,100	$287.1
San Francisco, CA	1,560	$43.5	5,240	$201.7	1,000	$38.7	7,800	$283.9
Tampa, FL	3,750	$92.8	6,820	$137.7	1,030	$25.3	11,600	$255.8
Los Angeles, CA	3,900	$46.9	15,640	$129.3	2,220	$67.0	21,760	$243.2
Dallas, TX	900	$30.9	5,980	$116.6	300	$79.9	7,180	$227.5
Seattle, WA	2,110	$71.0	4,080	$98.2	1,210	$40.2	7,400	$209.4
Philadelphia, PA	680	$102.0	6,830	$90.7	3,590	$15.2	11,100	$208.0
Chicago, IL	1,070	$17.5	14,490	$149.3	6,250	$32.8	21,810	$199.6
Atlanta, GA	700	$42.0	2,790	$122.4	250	$15.8	3,740	$180.2
Washington, DC	1,050	$52.6	2,700	$88.6	1,470	$17.4	5,220	$158.5
Harrisburg, PA	730	$71.2	1,960	$69.1	260	$7.4	2,950	$147.7
Riverside, CA	800	$6.8	6,480	$112.2	520	$11.4	7,800	$130.5
Asheville, NC	370	$12.6	1,280	$89.1	1,140	$18.5	2,790	$120.1
Gulfport, MS	800	$7.7	1,660	$105.8	400	$5.9	2,860	$119.4
St. Louis, MO	500	$8.5	4,210	$100.9	460	$7.9	5,170	$117.2
Portland, OR	1,000	$47.5	3,420	$52.8	510	$14.4	4,930	$114.7

Table 1: Top 20 Metropolitan Areas - Current Structural Damages

Results

Metro Impacts

While there are similar patterns of large metropolitan areas showing up frequently within the top 20 rankings (Table 2) for highest amounts of aggregated total economic damages (direct and indirect economic damages across office and retail buildings), there are some differences in the ordering of the rankings. Differences in the ranking by total economic damage costs as compared to the ranking of total structural damages exist not only due to the exclusion of risk for multi-unit residential buildings, but also due to differences in the level of market activity byarea. That is, some areas may be made up of more commercial building types that have high revenue per square foot and are integral components of supply chains, so downstream (indirect) impacts are large when operation is disrupted. The top five areas with the highest aggregate economic damages include Miami, FL (with a total estimated $4.96 billion in economic direct and indirect damages); New York, NY ($4.55 billion); Boston, MA ($2.47 billion); Pittsburgh, PA ($2.00 billion); and Philadelphia, PA ($1.61 billion) metropolitan areas.

While rankings in Table 2 are by total economic damages (direct and indirect), total downtime days also vary by metropolitan area and by categorization of land use type (aggregated sectors of office and retail buildings). Not only is this due to the aggregation of economic damages for both categories for the ranking of total economic damages, but also because GDP contribution for each varies by area as well as the multipliers for each area. The final column of "% of GDP" refers to the total economic damages within the GDP associated with those land uses.

When looking at changes in damages over the next 30 years (to 2052) for areas which have the largest increases in structural damages, persistent patterns are displayed across the Gulf and east coast of the contiguous United States. When looking at the aggregate change of structural damage across all categories of office, retail, and multi-unit residential buildings, metropolitan areas within Texas, Louisiana, Florida, and North Carolina are predominantly displayed in the top 20 list. The top 5 areas for highest aggregate structural damage cost change are the Bay City, TX (with a 600.6% increase); Beaumont, TX (552.4% increase); Houma, LA (510.4%); Morgan City, LA (494.3%); and Lake Charles, LA (403.9%) metropolitan areas.

Metro area	Total Office Buildings Count		Total Retail Buildings Count		Total Economic Impacts	
	Downtime days	Economic damages ($MM)	Downtime days	Economic damages ($MM)	Economic damages ($MM)	% of GDP
Miami, FL	23,120	$3,261.6	60,130	$1,700.3	$4,961.9	2.0%
New York, NY	7,300	$3,409.0	95,450	$1,140.9	$4,549.9	0.4%
Boston, MA	5,310	$1,968.7	35,940	$501.8	$2,470.5	0.8%
Pittsburgh, PA	21,580	$1,370.8	111,230	$633.7	$2,004.5	2.2%
Philadelphia, PA	3,550	$1,429.9	24,080	$182.3	$1,612.2	0.6%
Chicago, IL	1,820	$997.9	31,850	$322.4	$1,320.3	0.3%
San Francisco, CA	4,800	$995.9	27,010	$259.8	$1,255.7	0.3%
Tampa, FL	11,920	$794.7	32,390	$298.2	$1,092.9	1.0%
Bridgeport, CT	1,350	$956.1	8,900	$119.2	$1,075.3	1.6%
Los Angeles, CA	7,400	$798.2	25,410	$218.4	$1,016.6	0.1%
Seattle, WA	8,660	$623.8	27,750	$386.5	$1,010.3	0.4%
Houston, TX	2,350	$474.6	57,030	$296.4	$771.0	0.3%
Columbus, OH	5,380	$542.2	5,540	$105.1	$647.3	0.8%
Atlanta, GA	3,280	$415.4	11,380	$201.6	$616.9	0.2%
Harrisburg, PA	17,810	$458.1	30,460	$145.6	$603.6	2.9%
San Jose, CA	2,510	$498.9	1,830	$21.5	$520.4	0.2%
Washington, DC	2,780	$373.1	13,280	$139.3	$512.4	0.2%
Jacksonville, FL	5,500	$397.0	7,660	$82.5	$479.4	0.9%
Dallas, TX	1,810	$324.2	8,460	$124.7	$448.9	0.1%
Milwaukee, WI	1,070	$337.8	5,360	$51.8	$389.6	0.7%

Table 2: Top 20 Metropolitan Areas - Current Downtime and Economic Damages

Results

Metro Impacts

An interesting point to note here is that across the four impact metrics captured within Table 3 (each represented by a column), while the ranking order refers to the largest percent changes in structural damage costs, different metropolitan areas will have different percent changes for the other metrics, which will also be useful for understanding relative risk over time. For example, the top 5 metropolitan areas on this list (by structural damage cost change) have varying levels of change when looking at their counts of structures with damage, where the top 5 list ranges from an 5.8 - 39.3% increase in the count of these structures. Meanwhile, Port Lavaca, TX, which is ranked as sixth on this list, has a 128.1% increase in the count of structures with damage over the next 30 years. This variability also exists for percent change in downtime days and economic damages, where the top 3 list ranges from a 450.4 - 804.6% increase in downtime days, and Morgan City, LA, which is ranked fourth, has an estimated 625.4% increase over the next 30 years. The top 3 list ranges from a 588.3 - 908.5% increase in economic damages, and Morgan City, LA has a 766.1% increase over the next 30 years.

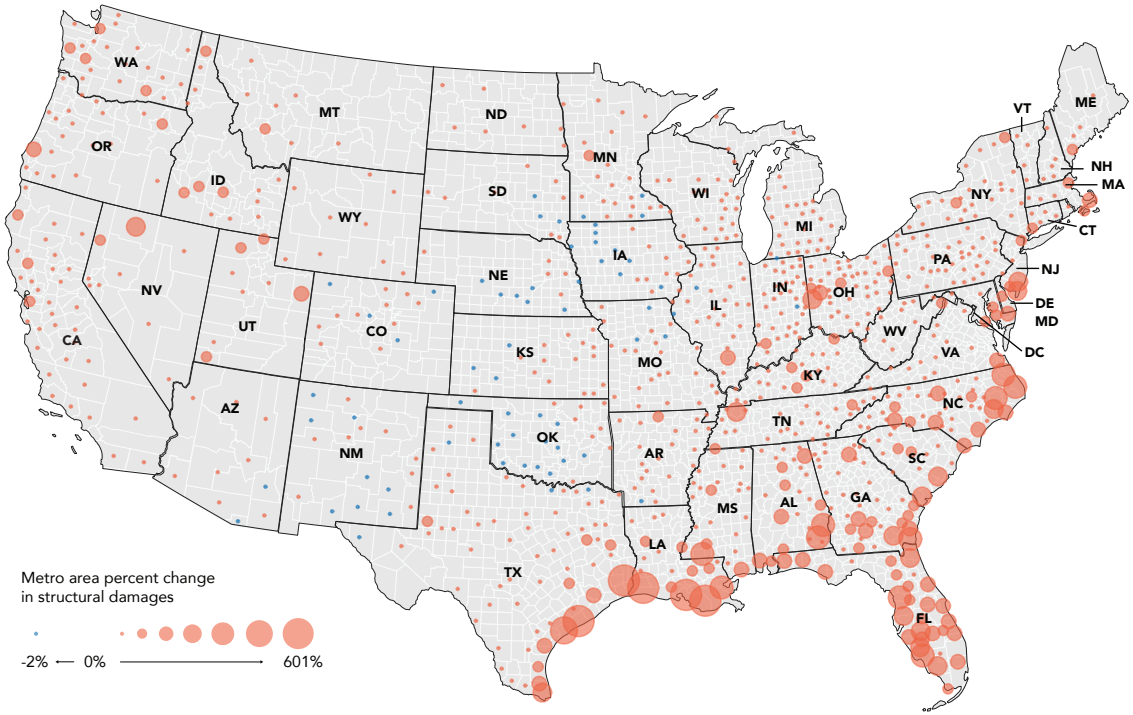


Figure 4: Change in Metropolitan Structural Damages in the Next 30 Years

Metro	30 yr change in count w damage	30 yr change in structural damage	30 yr change in downtime days	30 yr change in economic damages
Bay City, TX	5.8%	600.6%	804.6%	908.5%
Beaumont, TX	26.3%	552.4%	649.3%	588.3%
Houma, LA	11.0%	510.4%	450.4%	597.3%
Morgan City, LA	37.4%	494.3%	625.4%	766.1%
Lake Charles, LA	39.3%	403.9%	479.2%	446.0%
Port Lavaca, TX	128.1%	223.6%	347.2%	751.5%
Homosassa Springs, FL	4.2%	145.3%	116.3%	120.5%
Cape Coral, FL	11.6%	143.5%	130.5%	156.9%
Elizabeth City, NC	20.3%	135.7%	136.9%	138.1%
New Orleans, LA	1.9%	134.3%	183.9%	314.7%
McComb, MS	14.3%	127.3%	12.5%	51.6%
Washington, NC	1.4%	116.3%	115.2%	101.5%
Eufaula, AL	11.1%	104.7%	109.1%	177.6%
Ozark, AL	0.0%	103.6%	80.0%	120.6%
St. Marys, GA	31.0%	103.2%	140.6%	219.1%
Kill Devil Hills, NC	19.5%	100.4%	97.4%	134.0%
Jacksonville, FL	20.4%	99.7%	94.1%	103.4%
Winnemucca, NV	16.7%	99.3%	150.0%	648.0%
Charleston, SC	26.6%	94.7%	133.7%	78.4%
Tampa, FL	25.1%	93.2%	91.1%	91.6%

Table 3: Top 20 Metropolitan Areas - Change in Impacts in the Next 30 Years

Results

State Impacts

Similar to the variation by metropolitan area, the distribution of the total number of buildings with risk and total structural damage costs by state varies across the United States (Figure 5). The top five states with the highest aggregated total structural damage costs across office buildings, retail buildings, and multi-unit residential buildings are Florida (with an estimated $1.95 billion in structural damages); Pennsylvania ($1.22 billion); California ($1.19 billion); New York ($0.95 billion); and Texas ($0.82 billion) (Table 4). These 5 states also represent the top five states in regards to total population, meaning the risk to the commercial sector is primarily concentrated in densely populated areas.

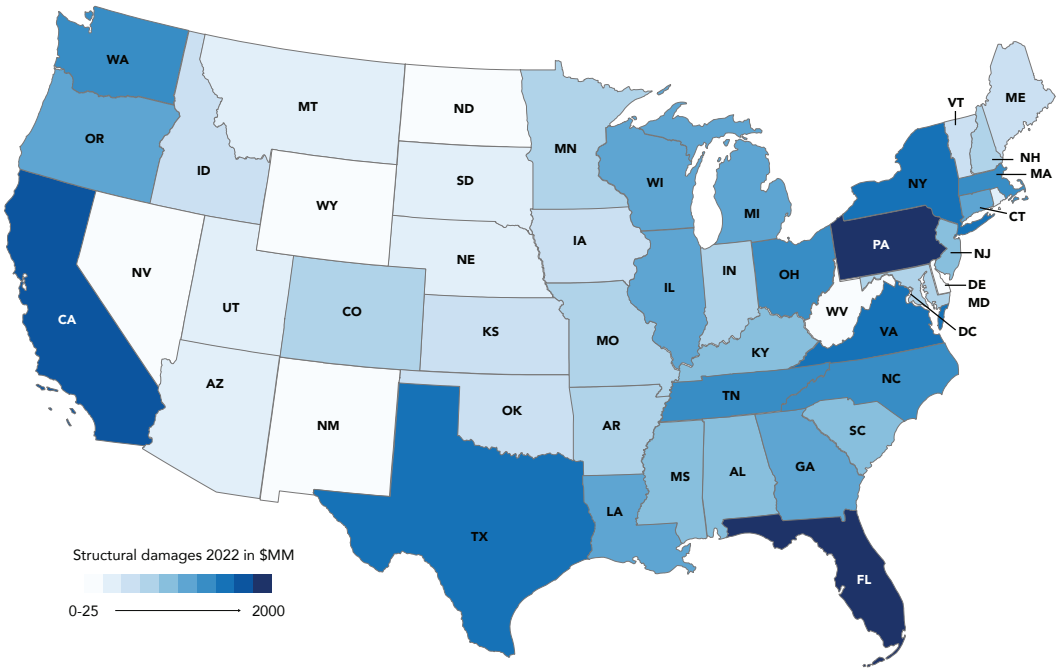


Figure 5: State Structural Damages

State	Total Office Buildings		Total Retail Buildings		Total Multi-unit Residential		Total	
	Count w/ damage	Structural damage ($MM)	Count w/ damage	Structural damage ($MM)	Count w/ damage	Structural damage ($MM)	Total count w/ damage	Total damages ($MM)
Florida	19,250	$491.1	39,730	$868.5	12,920	$589.3	71,900	$1,948.9
Pennsylvania	4,900	$324.3	31,650	$810.3	7,390	$83.9	43,940	$1,218.6
California	15,460	$243.4	50,960	$728.2	9,330	$216.4	75,750	$1,188.0
New York	4,630	$131.7	30,740	$551.6	11,140	$262.1	46,510	$945.4
Texas	6,140	$98.1	50,500	$562.0	3,680	$163.8	60,320	$823.9
Virginia	2,840	$116.4	9,100	$301.1	1,990	$58.8	13,930	$476.3
Massachusetts	1,710	$85.5	9,680	$285.9	2,350	$72.2	13,740	$443.6
Ohio	4,440	$118.1	17,240	$295.0	2,260	$29.5	23,940	$442.6
Washington	5,180	$112.5	13,550	$233.7	4,170	$71.6	22,900	$417.7
Tennessee	3,400	$67.4	11,780	$303.9	1,060	$45.1	16,240	$416.4
North Carolina	3,200	$71.1	11,480	$278.4	3,280	$51.6	17,960	$401.1
Georgia	4,380	$105.5	8,580	$213.9	1,350	$23.9	14,310	$343.3
Connecticut	680	$35.2	6,920	$226.3	760	$26.7	8,360	$288.2
Michigan	1,680	$28.1	15,960	$250.7	480	$9.1	18,120	$288.0
Illinois	1,100	$18.4	20,870	$223.0	6,820	$41.9	28,790	$283.3
Oregon	2,200	$60.7	13,220	$179.8	2,450	$35.6	17,870	$276.2
Louisiana	2,850	$26.5	15,550	$146.5	2,670	$74.9	21,070	$248.0
Wisconsin	600	$28.6	13,060	$202.1	680	$13.7	14,340	$244.5
New Jersey	460	$7.4	13,870	$198.4	1,240	$14.4	15,570	$220.3
Alabama	2,870	$41.6	8,190	$139.4	900	$16.1	11,960	$197.1

Table 4: Top 20 States - Current Structural Damages

Results

State Impacts

Table 5 shows the highest amounts of aggregated total economic damages (direct and indirect economic damages across office and retail buildings). In the table, most of the top 5 are consistent with the previous rankings, where Florida ($7 billion), New York ($5.4 billion), Pennsylvania ($5.2 billion) and California ($4.9 billion), and represent the top 4, but Massachusetts ($2.6 billion) replaces Texas ($2.2 billion). Similar to the patterns we find in the tables above, this indicates that the concentration of economic activity, as it relates to the commercial buildings at risk, is most concentrated in these states. This economic activity is most directly linked to the estimated days of building inoperability due to the modeled vulnerability of the commercial structures. Florida, for example, is estimated to see over 265k days of loss accessibility to buildings at risk in the state. Of note, New York (165k days), Pennsylvania (345k days), California (151k days), Texas (139k days), and Ohio (129k days) are all expected to see the highest number of building interoperability days.

State	Office Buildings Total		Retail Buildings Total		Total Economic Impacts	
	Downtime days	Economic damages ($MM)	Downtime days	Economic damages ($MM)	Economic damages ($MM)	% of GDP
Florida	81,180	$4,840	185,150	$2,190	$7,030	1.0%
New York	18,930	$3,791	145,860	$1,584	$5,375	0.4%
Pennsylvania	53,580	$3,845	289,660	$1,396	$5,241	1.2%
California	31,320	$3,645	119,750	$1,315	$4,960	0.3%
Massachusetts	7,330	$1,982	56,850	$652	$2,634	0.7%
Texas	12,740	$1,380	126,220	$847	$2,227	0.2%
Connecticut	3,570	$1,481	38,690	$362	$1,843	1.0%
Illinois	2,480	$1,265	54,310	$390	$1,655	0.3%
Ohio	23,470	$1,059	105,310	$585	$1,644	0.5%
Washington	18,240	$897	60,320	$595	$1,492	0.4%
Virginia	12,410	$949	57,140	$372	$1,321	0.4%
New Jersey	1,520	$717	68,660	$501	$1,218	0.3%
Georgia	31,300	$860	37,360	$327	$1,187	0.3%
Wisconsin	2,170	$974	56,030	$192	$1,166	0.7%
North Carolina	19,470	$526	73,330	$407	$933	0.3%
Tennessee	15,160	$385	64,870	$456	$841	0.4%
Oregon	6,280	$365	55,960	$269	$634	0.5%
Maryland	5,930	$350	25,050	$260	$610	0.3%
West Virginia	9,560	$285	60,040	$313	$598	1.9%
Michigan	3,580	$370	36,660	$190	$560	0.2%

Table 5: Top 20 States - Current Downtime and Economic Damages

Results

State Impacts

When looking at changes in damages over the next 30 years (to 2052) for areas which have the largest increases in structural damages, persistent patterns are displayed across the Gulf and east coast of the contiguous United States. When looking at the aggregate change of structural damage across all categories of office, retail, and multi-unit residential buildings,the states of Louisiana (130% increase), Florida (66% increase), Delaware (50% increase), South Carolina (46% increase), and Texas (40% increase) make up the top 5.

When only looking at the change in count of properties expected to experience damage, there is a different ordering with Virginia expecting to see the highest increase in the number of buildings estimated to be damaged (27%), followed by Florida (22%), South Carolina (21%), Maryland (19%), Massachusetts (18%) and Mississippi (18%).In regards to the largest increases in downtime days, Louisiana (224% increase), Florida (75% increase), Texas (73% increase), Mississippi (53% increase), and South Carolina (51% increase) are estimated to see the biggest increases in lost operability time of retail and office buildings. Finally, the largest increases in overall impacts to the larger economy are estimated to be felt in Louisiana (192% increase), Florida (74% increase), Delaware (48 increase), South Carolina (48% increase), and Texas (34% increase). Ultimately, all of these indicators continue to highlight the point that the largest risk today and into the future exists in currently vulnerable areas that are going to see their economic risk increase as the changing environment continues to increase the risk of flooding in these states.

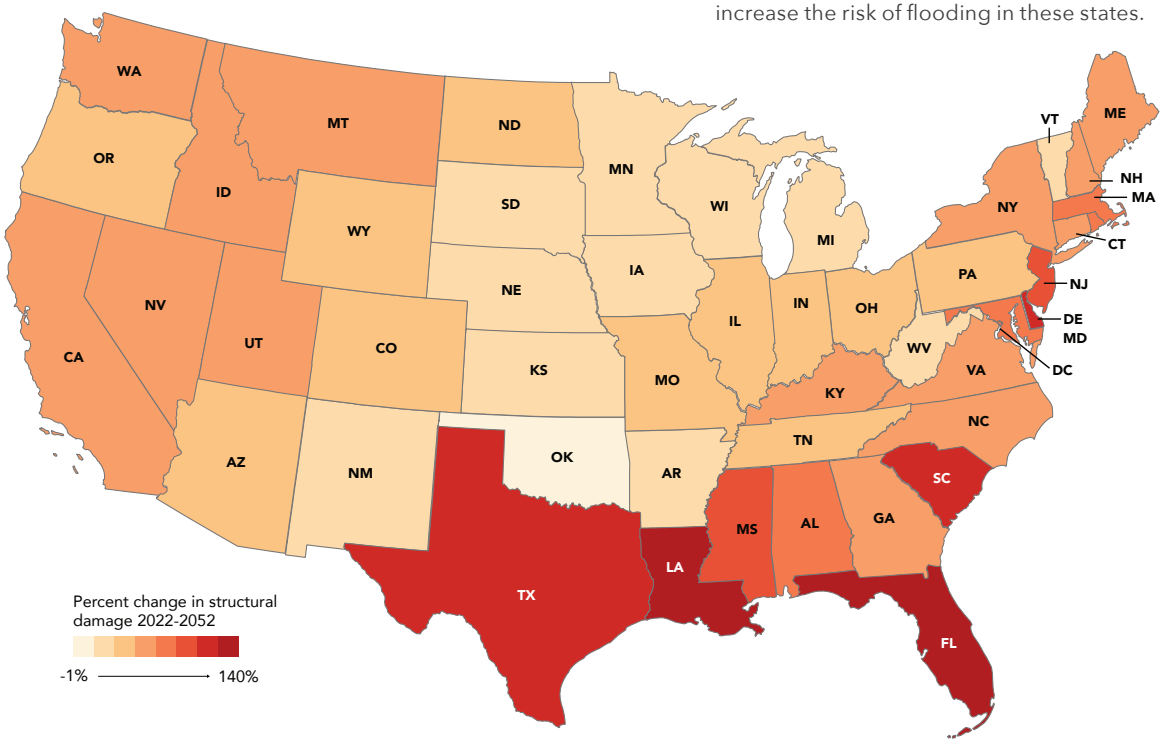


Figure 6: Change in State Structural Damages in the Next 30 Years

State	30 yr change in buildings w damage	30 yr change in structural damage	30 yr change in downtime days	30 yr change in economic damages
Louisiana	8.4%	139.7%	224.0%	192.4%
Florida	21.8%	65.9%	74.6%	73.9%
Delaware	17.9%	49.5%	46.2%	48.3%
South Carolina	21.2%	46.1%	51.3%	48.2%
Texas	7.2%	40.1%	72.5%	34.0%
New Jersey	17.2%	36.4%	38.8%	28.8%
Mississippi	18.2%	34.6%	52.5%	36.2%
Massachusetts	18.2%	25.9%	32.4%	31.6%
District of Columbia	7.6%	25.8%	19.5%	32.7%
Alabama	6.3%	21.7%	27.7%	26.2%
Maryland	18.9%	21.5%	31.6%	23.3%
Rhode Island	12.2%	20.7%	26.1%	23.9%
Georgia	8.1%	19.8%	31.0%	21.1%
North Carolina	6.5%	19.0%	22.9%	27.8%
New York	12.5%	18.3%	15.7%	23.8%
Nevada	7.7%	17.6%	19.5%	36.6%
Virginia	26.5%	17.0%	18.0%	23.6%
California	5.6%	16.0%	14.8%	13.9%
Connecticut	12.5%	15.8%	16.7%	15.1%
Washington	7.6%	13.0%	12.4%	13.0%

Table 6: Top 20 States - Change in Impacts in the Next 30 Years

Implications

Understanding the flood risk to commercial markets is crucial to providing communities and policy makers the information needed to guide investment, mitigation, and adaptation. Commercial markets can utilize this type of comprehensive risk information to guide their prioritization of investment in areas where there is lower exposure and where the local economy also has lower impacts (such as due to the indirect impacts of a more restricted market). Additionally, commercial markets will be able to prioritize their involvement with mitigation efforts on a local scale or that is building-specific to decrease their vulnerability through structural damage and the resulting downtime impacts as well as to not be located in an area where the local economy is overly restricted from large amounts of indirect economic impacts. Lastly, these vulnerability indicators are versatile enough to inform other risk assessments that commercial markets may undergo, and can be useful for understanding and prioritizing adaptation strategies so that building-specific vulnerabilities are reduced. This includes planning for the facilitation of remote work if downtime is necessary so that direct economic outputs are reduced only at minimum levels, planning for the streamlining of construction work to speed up repair time to shorten the amount of downtime necessary, and understanding the amount of potential financial obligations involved with their estimated flood risk so that additional money may be set aside and the business is not overly handicapped by surprise costs.

Outside of commercial markets, it will also be useful for governments to understand the risk as it relates to their local tax base, and to plan accordingly. Large impacts for local economies may result in lower tax revenues, slower economic growth (such as from decreased investment in the area, populations moving out, etc.), and generally unhappy citizens. Outside of these investment concerns, the results provided here can be used as inputs for areas which hope to develop more comprehensive risk models, especially as related to economic impacts (for example, governments may lack the resources to model flood hazard, exposure, and structural damage at a high-resolution themselves). An example of an opportunity of how economic impacts can be built out is through the inclusion of the impact of reduced wages on indirect economic damages. For example, if an area has many retail properties with wage-based employees, market impacts are likely to occur when there are substantially reduced wages.

Additionally, urban areas and rural areas will have important differences in their economic impacts, so the integration of higher resolution economic data would also prove useful for a more comprehensive view of risk. For example, a commercial building impacted by flooding in a highly urbanized area (UC) versus a commercial building impacted by flooding in a very rural area (RC). UC may have more options available for contracting repair work, shortening downtime,while RC may be in an area with only one available repair team (efficiency is reduced from lesser specialization, operating more like a monopoly, etc.). Economic direct impacts for the UC may be higher due to its being a larger organization that engages in higher level trade (potentially losing several thousands of dollars from each day of downtime), while RC may have less direct economic impacts (each day potentially losing only a few hundred in revenue). However, the area where RC is located may have higher vulnerability for indirect economic impacts: in the urban area, economic activity may be able to occur elsewhere (if UC cannot produce output, their clients may be able to find a different supplier), while this could be impossible in a rural area (if RC cannot produce output and there are no other suppliers in the region, downstream trade is potentially completely unable to occur).

Finally, there is a strong need for individuals to understand the risk in their area given its potential impact on income opportunities, market accessibility, and general satisfaction. Flood risk in commercial markets not only impacts commercial industries, but, due to the role commercial buildings play in general market health and economic growth opportunities, these impacts also affect individuals living in the area. Homeowners and renters may not be directly impacted by flooding causing structural damage to their homes, but flood risk in the surrounding area may still be highly relevant.

METRO AREA DETAILS

MIAMI-FORT LAUDERDALE-POMPANO BEACH, FL

Miami Metro Area

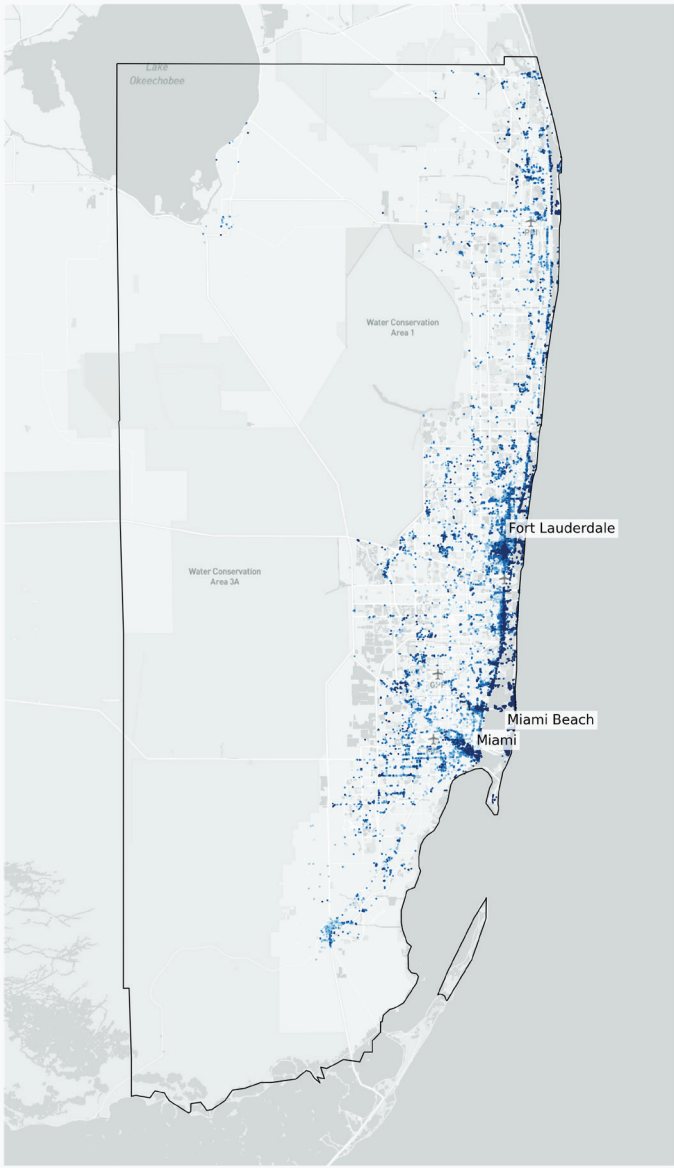
In the Miami metro area, 53.1% of all office, retail and multi-unit residential properties (25,970) face risk of structural damage from flooding, amounting to $1,073 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 158,000 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $5.0 billion in economic damages due to downtime days.

Greatest structural damage costs within Miami metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Miami Beach	1,560	1,560	$301.4	54,420
2	Miami	6,940	3,930	$182.3	19,320
3	Fort Lauderdale	4,520	3,740	$149.4	25,870
4	Hollywood	2,590	1,430	$45.0	9,490
5	North Miami	630	510	$28.0	2,920
6	Hallandale Beach	500	480	$25.9	5,300
7	Pompano Beach	2,170	1,300	$23.8	5,070
8	North Miami Beach	480	340	$20.1	2,200
9	Palm Beach	180	170	$18.5	3,420
10	Dania Beach	660	510	$17.4	2,640

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



METRO AREA CHANGE

MIAMI-FORT LAUDERDALE-POMPANO BEACH, FL

Miami Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 4,730 properties are expected to experience financial loss from flood damage in the Miami metro area.

This area will see a 54.9% increase in annualized structural damages, with a 71.7% increase in annualized downtime days. This downtime results in a 62.1% increase in economic damages.

Greatest growth in structural damage costs within Miami metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	South Miami	200	+39	+519.4%	+200.0%
2	Oakland Park	960	+118	+243.4%	+915.7%
3	Golden Glades	210	+9	+193.5%	+166.9%
4	Miami Springs	160	+17	+171.8%	+288.0%
5	Lauderdale Lakes	150	+106	+143.0%	+1800.0%
6	Homestead	470	+25	+141.9%	+192.8%
7	West Little River	240	+40	+136.6%	+132.6%
8	Glenvar Heights	110	+8	+133.0%	+156.8%
9	Pembroke Park	470	+10	+123.2%	+9.6%
10	North Palm Beach	160	+64	+119.4%	+115.2%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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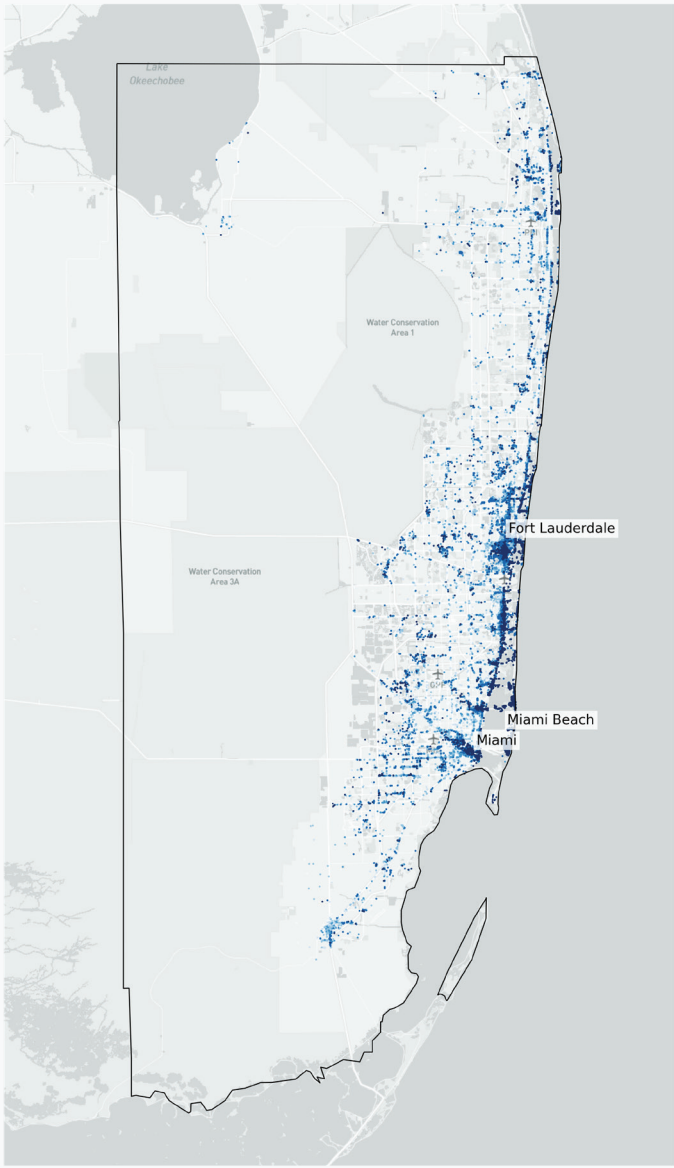


30 year change in damage

Percent change in structural damage 2022-2052

0 → 200% +

METRO AREA DETAILS

NEW YORK-NEWARK-JERSEY CITY, NY-NJ-PA

New York Metro Area

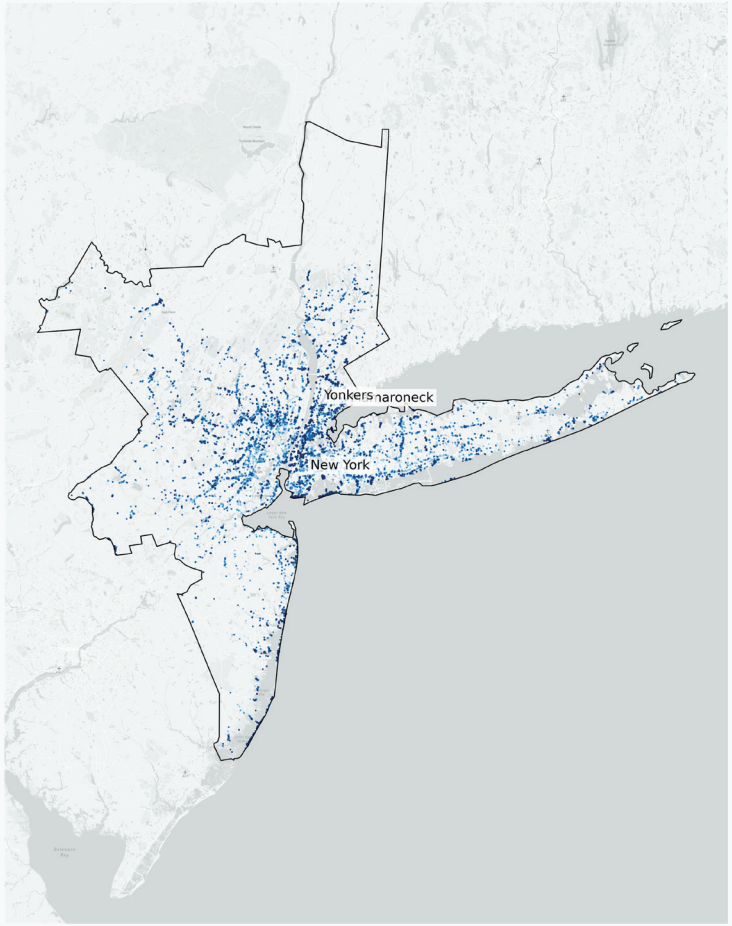
In the New York metro area, 16.5% of all office, retail and multi-unit residential properties (30,370) face risk of structural damage from flooding, amounting to $582 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 126,040 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $4.5 billion in economic damages due to downtime days.

Greatest structural damage costs within New York metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	New York	75,510	10,200	$257.0	31,570
2	Yonkers	2,790	360	$22.0	2,010
3	Mamaroneck	700	200	$6.6	4,360
4	New Rochelle	960	140	$6.4	1,340
5	Freeport	440	180	$6.1	2,950
6	Elmsford	160	80	$4.2	650
7	White Plains	710	130	$4.0	280
8	Port Chester	1,090	120	$3.7	550
9	Garfield	420	160	$3.5	1,280
10	Point Pleasant	190	50	$3.3	1,060

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

NEW YORK-NEWARK-JERSEY CITY, NY-NJ-PA

New York Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

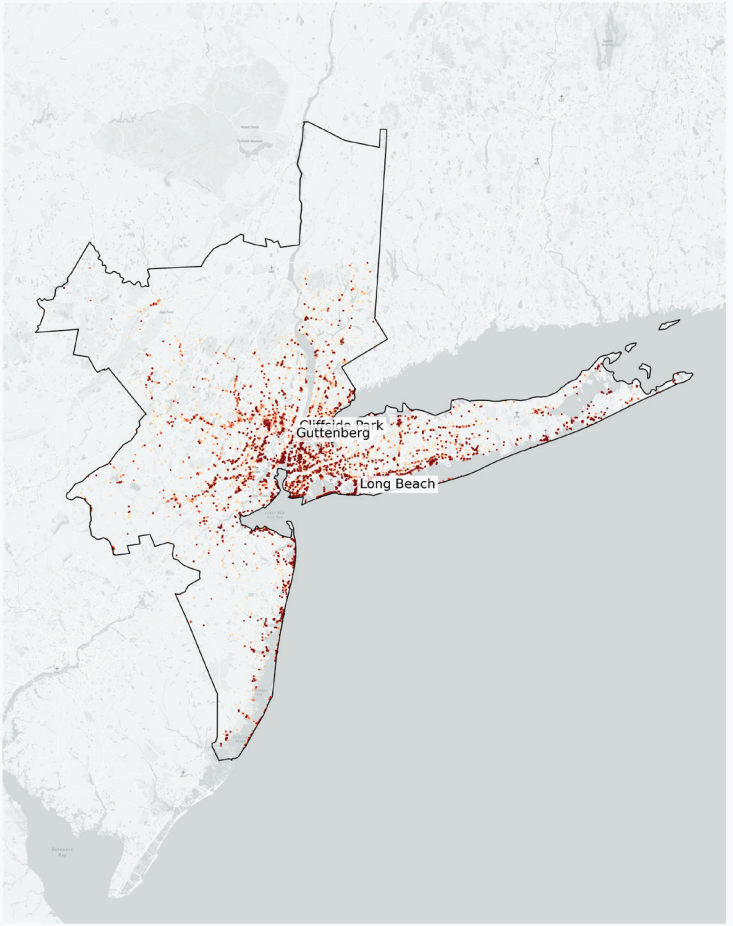
Over the next 30 years, an additional 6,900 properties are expected to experience financial loss from flood damage in the New York metro area.

This area will see a 29.7% increase in annualized structural damages, with a 30.7% increase in annualized downtime days. This downtime results in a 39.7% increase in economic damages.

Greatest growth in structural damage costs within New York metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Long Beach	230	+152	+698.1%	+783.5%
2	Cliffside Park	350	+0	+403.0%	+1800.0%
3	Guttenberg	170	+0	+286.5%	+160.0%
4	Hoboken	820	+291	+269.8%	+745.9%
5	Perth Amboy	670	+15	+254.0%	+455.6%
6	Sag Harbor	150	+15	+176.8%	+219.7%
7	East Northport	160	+0	+172.3%	+98.1%
8	Oceanside	270	+66	+166.2%	+113.5%
9	West Islip	210	+31	+158.8%	+220.5%
10	Dobbs Ferry	170	+1	+155.6%	+125.0%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



30 year change in damage

Percent change in structural damage 2022-2052

0 200% +

METRO AREA DETAILS

PITTSBURGH, PA

Pittsburgh Metro Area

In the Pittsburgh metro area, 36.0% of all office, retail and multi-unit residential properties (11,350) face risk of structural damage from flooding, amounting to $448 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 140,790 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $2.0 billion in economic damages due to downtime days.

Greatest structural damage costs within Pittsburgh metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Pittsburgh	5,720	2,250	$117.7	26,860
2	Sharpsburg	150	150	$11.3	2,300
3	Coraopolis	170	160	$10.6	2,460
4	Charleroi	240	210	$10.2	6,600
5	McKeesport	380	270	$10.1	2,670
6	McKees Rocks	170	160	$8.3	1,890
7	Carnegie	240	190	$7.2	2,530
8	Monongahela	120	100	$6.5	4,720
9	California	100	80	$5.5	3,700
10	Monessen	130	90	$5.4	3,320

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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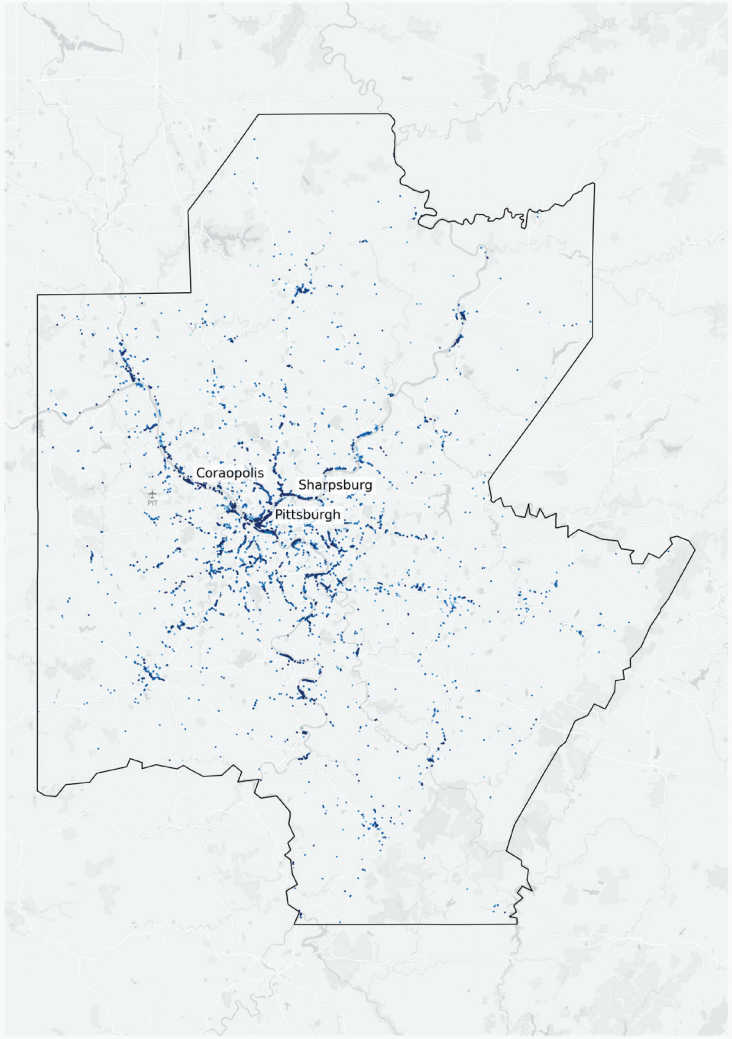
§ Downtime days are defined as days the structure is under repair.



Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

PITTSBURGH, PA

Pittsburgh Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 180 properties are expected to experience financial loss from flood damage in the Pittsburgh metro area.

This area will see a 6.8% increase in annualized structural damages, with a 6.1% increase in annualized downtime days. This downtime results in a 5.6% increase in economic damages.

Greatest growth in structural damage costs within Pittsburgh metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Tarentum	120	+2	+126.3%	+103.8%
2	West View	120	+0	+114.1%	+54.6%
3	Homeacre-Lyndora	120	+0	+96.8%	+40.8%
4	Munhall	150	+0	+84.9%	+26.5%
5	Arnold	120	+8	+81.4%	+237.5%
6	Castle Shannon	200	+0	+57.4%	+30.0%
7	Pleasant Hills	130	+0	+32.8%	+26.7%
8	Greensburg	300	+0	+29.1%	+17.3%
9	New Kensington	210	+1	+18.3%	+15.4%
10	White Oak	140	+0	+17.2%	+9.2%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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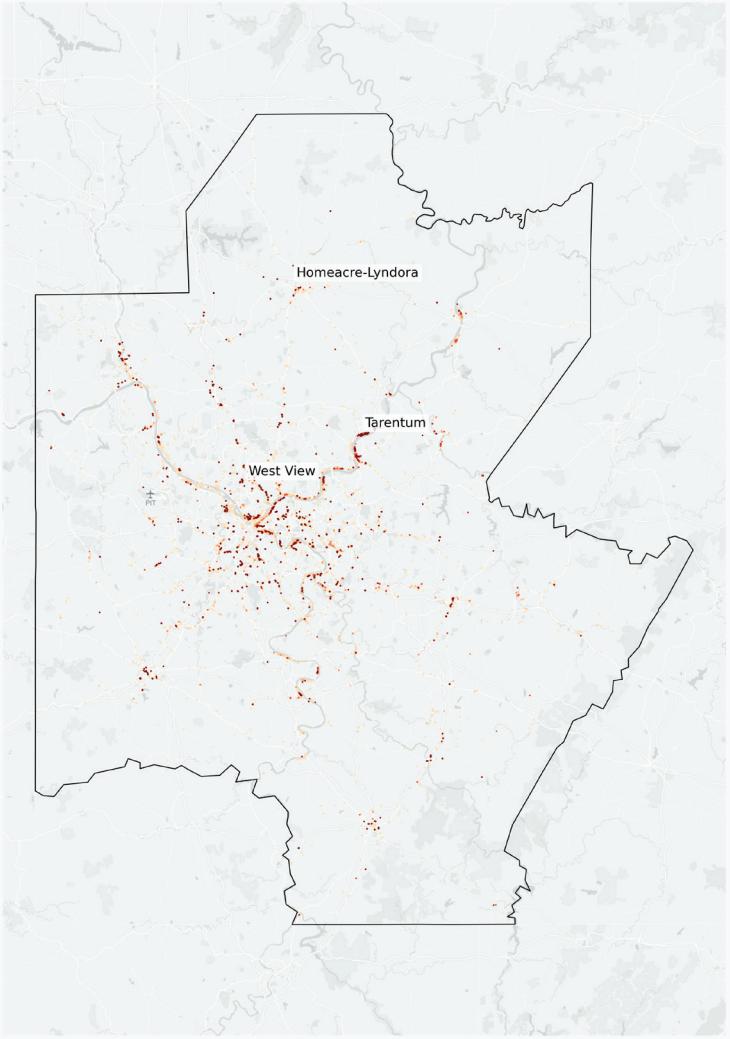

30 year change in damage

Percent change in structural damage 2022-2052

0 → 200% +

METRO AREA DETAILS

BOSTON-CAMBRIDGE-NEWTON, MA-NH

Boston Metro Area

In the Boston metro area, 23.1% of all office, retail and multi-unit residential properties (8,330) face risk of structural damage from flooding, amounting to $331 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 51,010 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $2.5 billion in economic damages due to downtime days.

Greatest structural damage costs within Boston metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Boston	4,840	1,530	$59.9	3,960
2	Revere	560	160	$20.4	1,780
3	Lawrence	530	310	$18.1	2,630
4	Haverhill	610	200	$16.7	3,390
5	Quincy	720	200	$11.2	990
6	Salisbury	160	80	$10.3	1,630
7	Gloucester	430	160	$8.7	3,980
8	Lowell	1,210	330	$7.5	2,750
9	Chelsea	440	80	$6.9	470
10	Methuen Town	350	100	$6.3	1,240

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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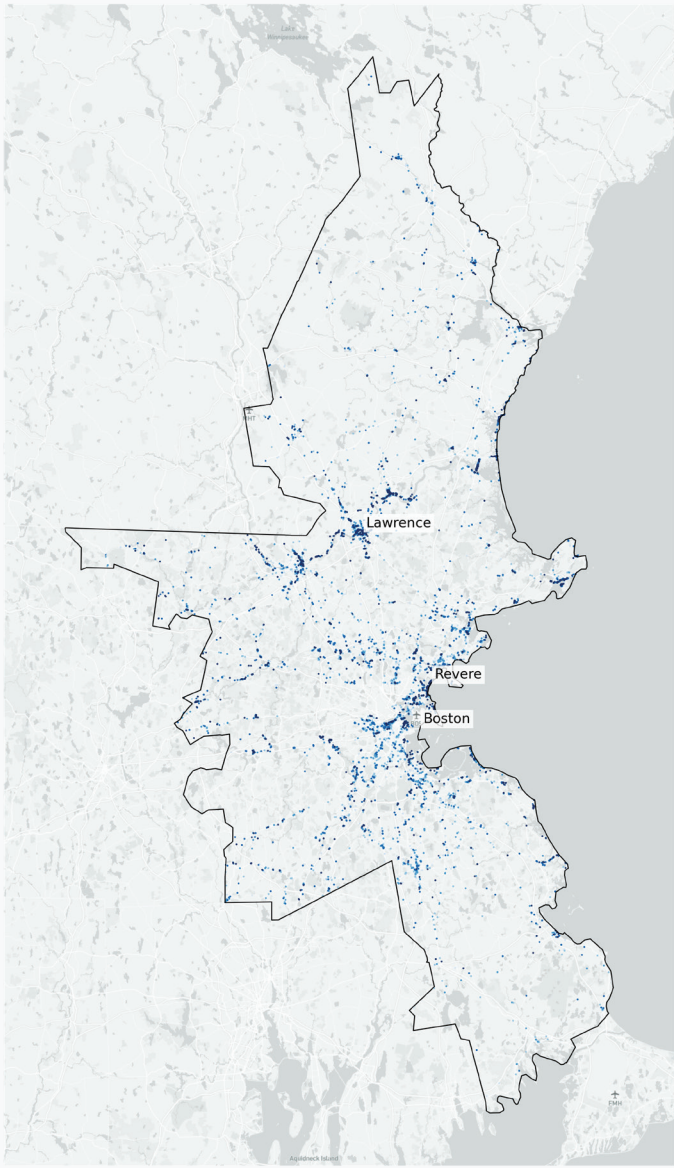

Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

BOSTON-CAMBRIDGE-NEWTON, MA-NH

Boston Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 1,980 properties are expected to experience financial loss from flood damage in the Boston metro area.

This area will see a 29.6% increase in annualized structural damages, with a 37.3% increase in annualized downtime days. This downtime results in a 35.8% increase in economic damages.

Greatest growth in structural damage costs within Boston metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Marshfield	100	+33	+221.8%	+156.6%
2	Malden	160	+12	+182.5%	+106.8%
3	Salem	600	+109	+166.9%	+160.6%
4	Danvers	360	+23	+131.4%	+151.9%
5	Hull	100	+8	+126.1%	+120.1%
6	Lynn	740	+38	+113.5%	+139.5%
7	Hampton Beach	130	+12	+94.7%	+101.9%
8	Newburyport	210	+17	+92.9%	+70.9%
9	Derry	300	+10	+79.4%	+20.8%
10	Melrose	150	+5	+67.7%	+60.0%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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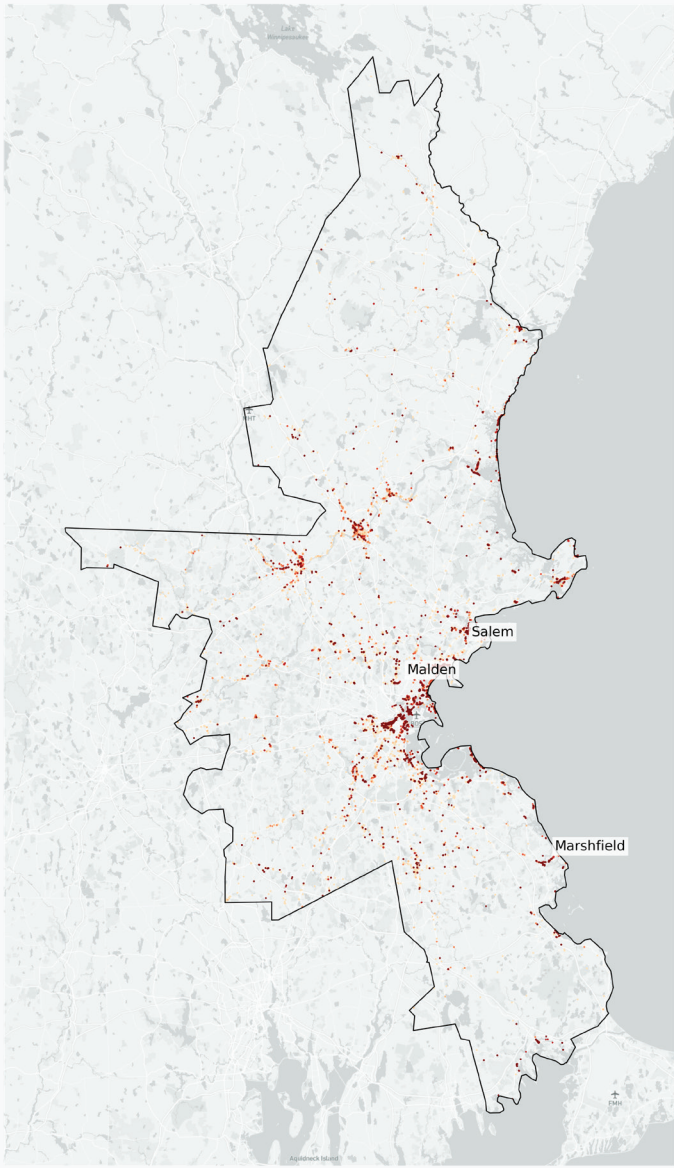

30 year change in damage

Percent change in structural damage 2022-2052

0 200% +

METRO AREA DETAILS

HOUSTON-THE WOODLANDS-SUGAR LAND, TX

Houston Metro Area

In the Houston metro area, 35.0% of all office, retail and multi-unit residential properties (21,110) face risk of structural damage from flooding, amounting to $287 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 62,400 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.8 billion in economic damages due to downtime days.

Greatest structural damage costs within Houston metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Galveston	1,310	1,300	$106.1	20,300
2	Houston	25,510	7,570	$61.0	7,160
3	League City	850	660	$13.9	2,090
4	Sugar Land	990	560	$7.7	1,000
5	Texas City	880	840	$7.1	1,300
6	Kemah	140	140	$5.4	1,330
7	Dickinson	310	310	$4.9	800
8	Missouri City	650	380	$4.7	1,740
9	The Woodlands	620	90	$4.7	200
10	Alvin	660	520	$4.3	2,190

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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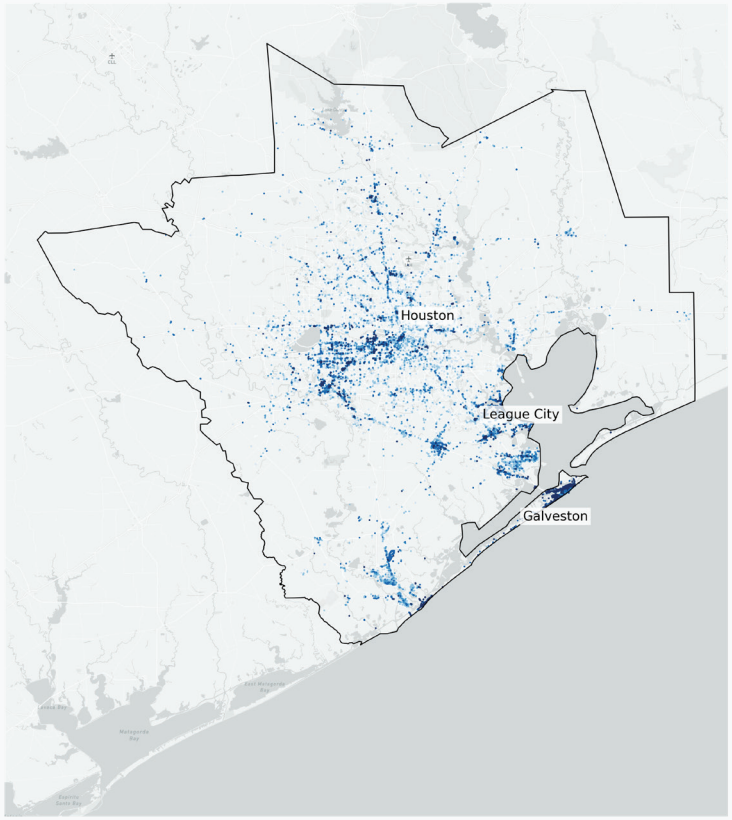

Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

HOUSTON-THE WOODLANDS-SUGAR LAND, TX

Houston Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 1,910 properties are expected to experience financial loss from flood damage in the Houston metro area.

This area will see a 61.6% increase in annualized structural damages, with a 72.1% increase in annualized downtime days. This downtime results in a 34.5% increase in economic damages.

Greatest growth in structural damage costs within Houston metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Lake Jackson	360	+36	+785.5%	+572.6%
2	Webster	350	+158	+660.3%	+988.0%
3	Clute	470	+0	+589.5%	+652.8%
4	La Marque	410	+14	+425.2%	+418.6%
5	Texas City	880	+15	+350.4%	+413.8%
6	Baytown	1,060	+362	+328.8%	+239.8%
7	Freeport	410	+0	+312.7%	+360.1%
8	La Porte	320	+74	+285.7%	+281.7%
9	Cloverleaf	100	+2	+237.7%	+800.0%
10	League City	850	+96	+178.5%	+124.6%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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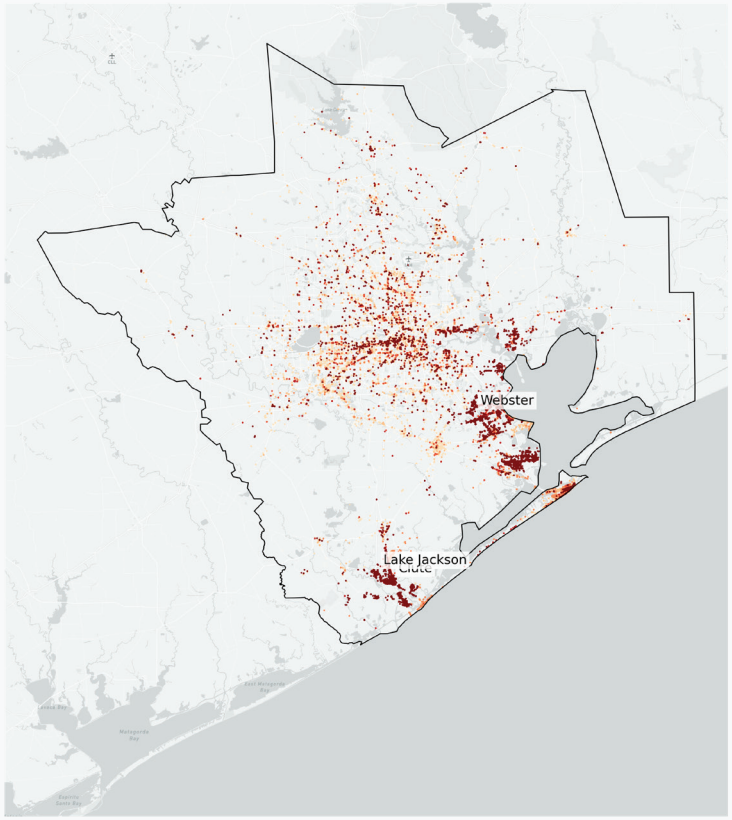

30 year change in damage

Percent change in structural damage 2022-2052

0 → 200% +

METRO AREA DETAILS

SAN FRANCISCO-OAKLAND-BERKELEY, CA

San Francisco Metro Area

In the San Francisco metro area, 19.9% of all office, retail and multi-unit residential properties (7,800) face risk of structural damage from flooding, amounting to $284 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 39,860 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $1.3 billion in economic damages due to downtime days.

Greatest structural damage costs within San Francisco metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	San Rafael	1,290	710	$81.3	11,310
2	Mill Valley	250	170	$18.8	1,920
3	Burlingame	490	200	$17.4	1,700
4	Redwood City	770	380	$16.8	2,110
5	Corte Madera	110	80	$12.8	2,830
6	Sausalito	190	90	$12.7	1,550
7	Larkspur	200	70	$10.0	1,350
8	San Mateo	970	260	$8.8	1,200
9	Oakland	4,190	730	$7.0	1,400
10	Novato	590	370	$6.9	1,780

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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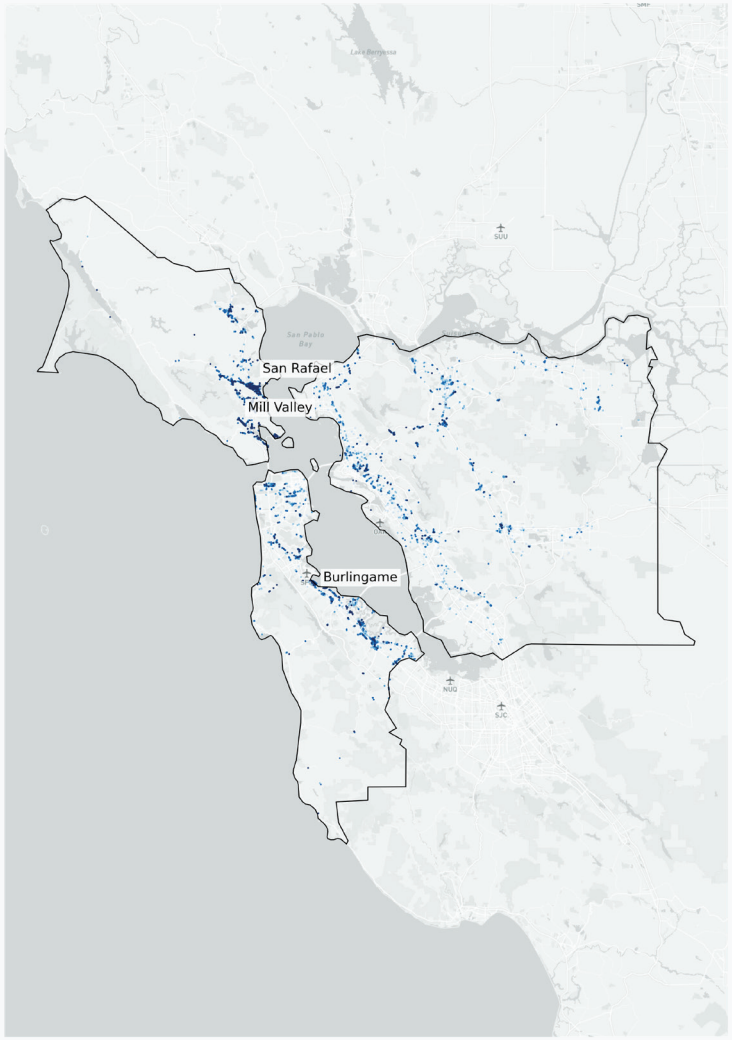

METRO AREA CHANGE

SAN FRANCISCO-OAKLAND-BERKELEY, CA

San Francisco Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 1,050 properties are expected to experience financial loss from flood damage in the San Francisco metro area.

This area will see a 30.9% increase in annualized structural damages, with a 30.5% increase in annualized downtime days. This downtime results in a 56.7% increase in economic damages.

Greatest growth in structural damage costs within San Francisco metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Redwood City	770	+63	+128.6%	+105.9%
2	Union City	130	+10	+116.0%	+100.0%
3	San Mateo	970	+89	+83.6%	+85.9%
4	Ashland	180	+1	+77.9%	+11.4%
5	North Fair Oaks	160	+11	+46.5%	+0.0%
6	San Bruno	350	+9	+44.0%	+7.7%
7	San Rafael	1,290	+55	+39.5%	+37.3%
8	Sausalito	190	+20	+35.3%	+44.4%
9	Antioch	450	+4	+19.6%	+22.6%
10	Menlo Park	380	+9	+19.2%	+16.5%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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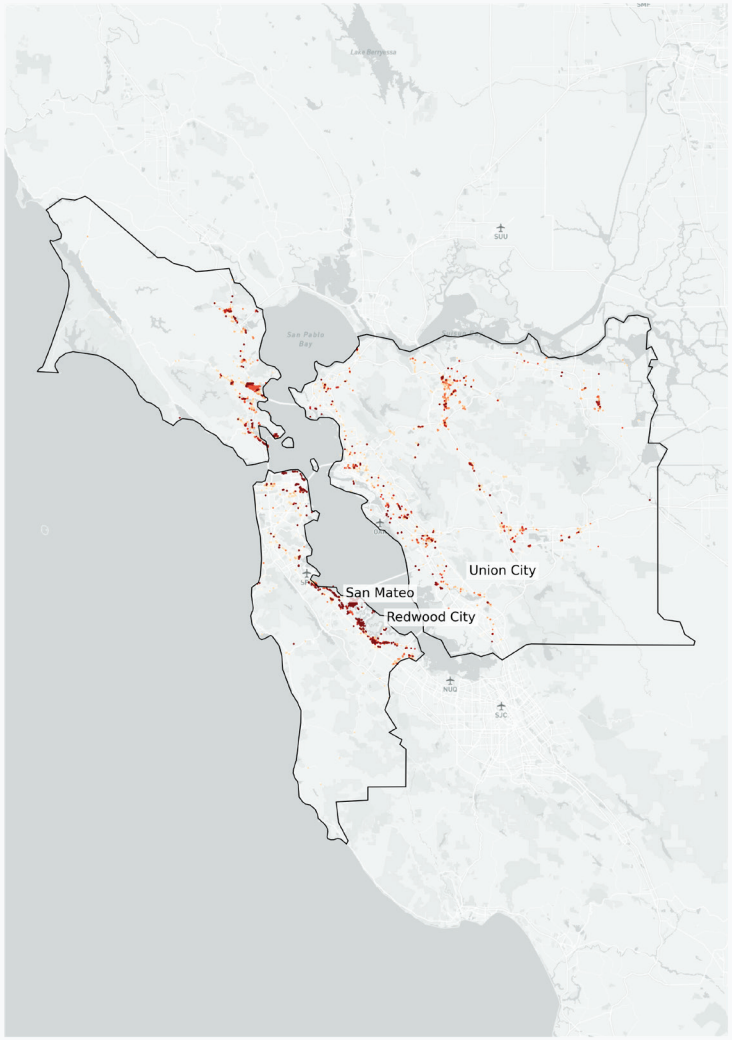

30 year change in damage

Percent change in structural damage 2022-2052

0 200% +

METRO AREA DETAILS

TAMPA-ST. PETERSBURG-CLEARWATER, FL

Tampa Metro Area

In the Tampa metro area, 35.3% of all office, retail and multi-unit residential properties (11,590) face risk of structural damage from flooding, amounting to $256 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 52,640 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $1.1 billion in economic damages due to downtime days.

Greatest structural damage costs within Tampa metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Tampa	7,170	3,080	$77.1	8,410
2	St. Petersburg	3,070	1,160	$40.3	5,990
3	St. Pete Beach	260	260	$12.7	4,120
4	Town 'n' Country	710	480	$12.1	1,690
5	Clearwater	1,670	390	$11.9	3,010
6	Treasure Island	200	200	$9.2	3,380
7	Madeira Beach	150	150	$7.0	2,810
8	Palm River-Clair Mel	280	210	$6.8	860
9	Indian Rocks Beach	120	120	$5.0	2,040
10	New Port Richey	480	340	$4.1	1,360

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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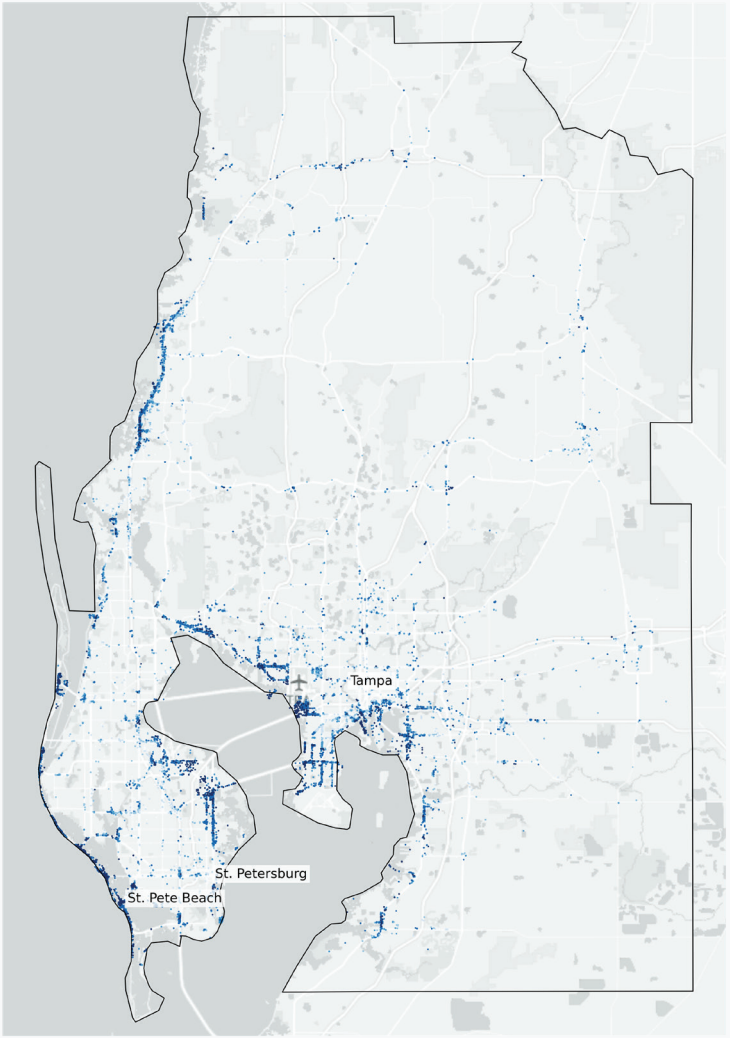

Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

TAMPA-ST. PETERSBURG-CLEARWATER, FL

Tampa Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 2,900 properties are expected to experience financial loss from flood damage in the Tampa metro area.

This area will see a 93.2% increase in annualized structural damages, with a 91.1% increase in annualized downtime days. This downtime results in a 91.6% increase in economic damages.

Greatest growth in structural damage costs within Tampa metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	High Point	100	+2	+260.8%	+86.4%
2	Jasmine Estates	140	+3	+210.7%	+231.4%
3	Oldsmar	160	+0	+174.7%	+224.3%
4	West Lealman	130	+63	+166.2%	+134.2%
5	Westchase	170	+15	+158.0%	+128.0%
6	Seminole	260	+24	+156.7%	+106.1%
7	Largo	980	+222	+137.0%	+136.1%
8	New Port Richey	480	+41	+136.1%	+134.4%
9	Ruskin	160	+2	+136.0%	+138.9%
10	Pinellas Park	720	+266	+132.9%	+201.7%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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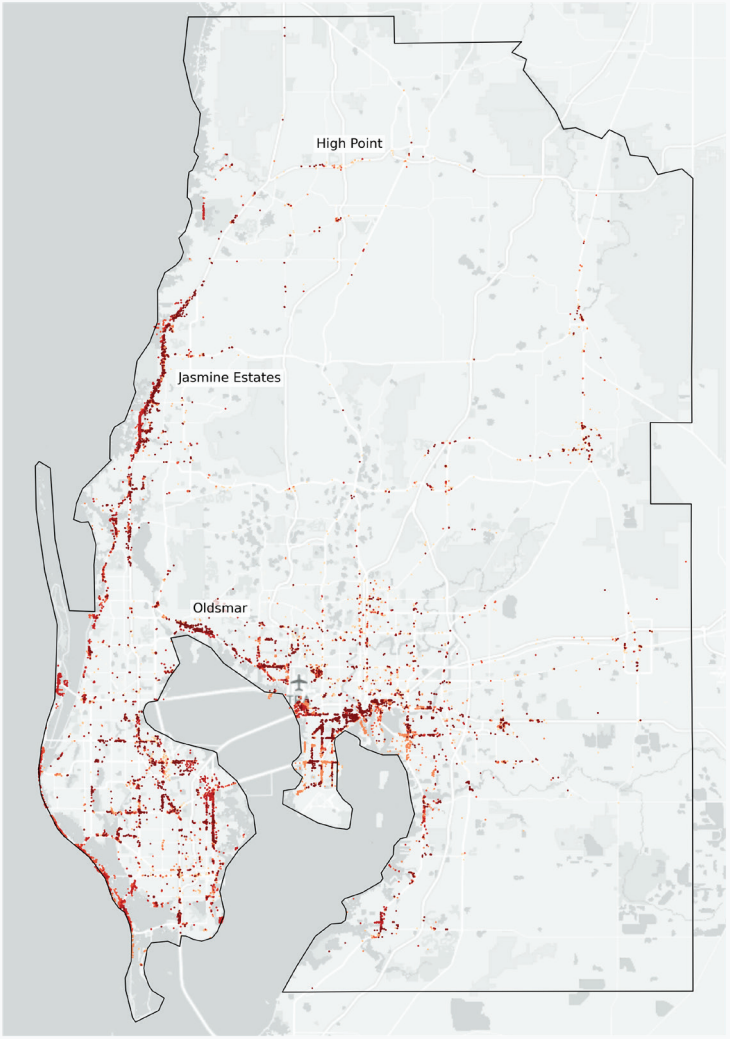

30 year change in damage

Percent change in structural damage 2022-2052

0 → 200% +

METRO AREA DETAILS

LOS ANGELES-LONG BEACH-ANAHEIM, CA

Los Angeles Metro Area

In the Los Angeles metro area, 21.7% of all office, retail and multi-unit residential properties (21,760) face risk of structural damage from flooding, amounting to $243 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 39,570 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $1.0 billion in economic damages due to downtime days.

Greatest structural damage costs within Los Angeles metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Newport Beach	1,240	340	$47.5	4,280
2	Laguna Beach	180	20	$4.3	540
3	Seal Beach	320	90	$4.1	500
4	Anaheim	1,500	260	$1.4	120
5	Los Angeles	740	70	$1.1	150
6	Santa Ana	1,060	100	$1.0	30
7	Fullerton	560	240	$0.9	70
8	Huntington Beach	790	120	$0.5	90
9	Orange	450	120	$0.5	60
10	Buena Park	450	290	$0.4	40

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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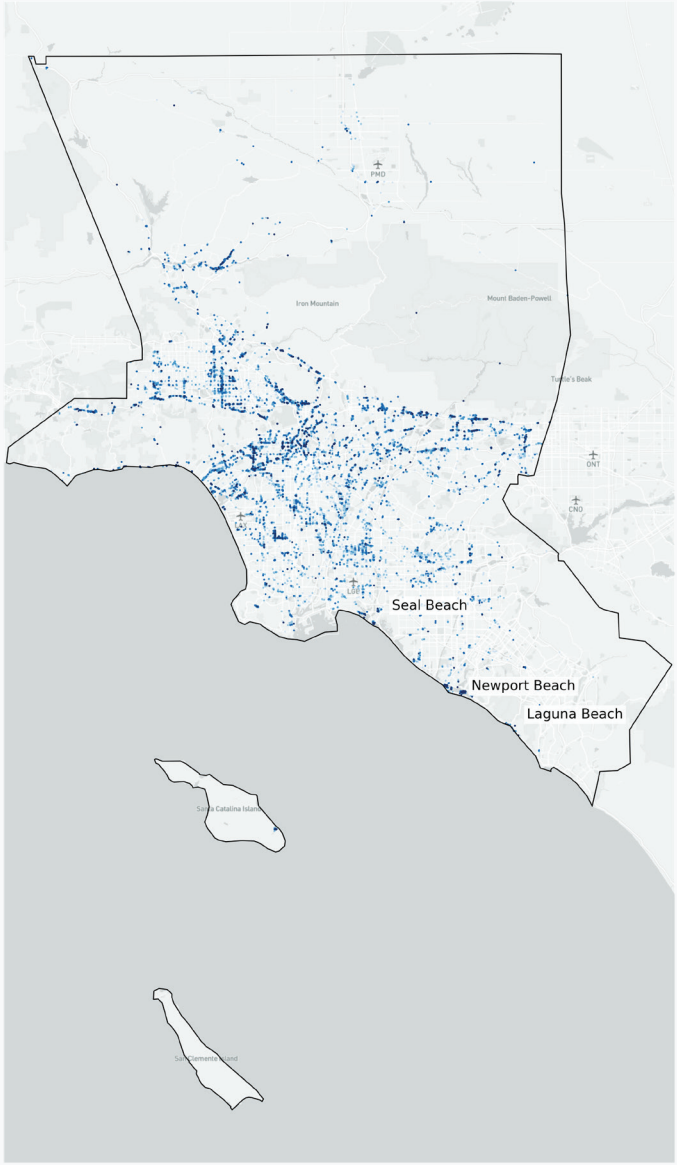


METRO AREA CHANGE

LOS ANGELES-LONG BEACH-ANAHEIM, CA

Los Angeles Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

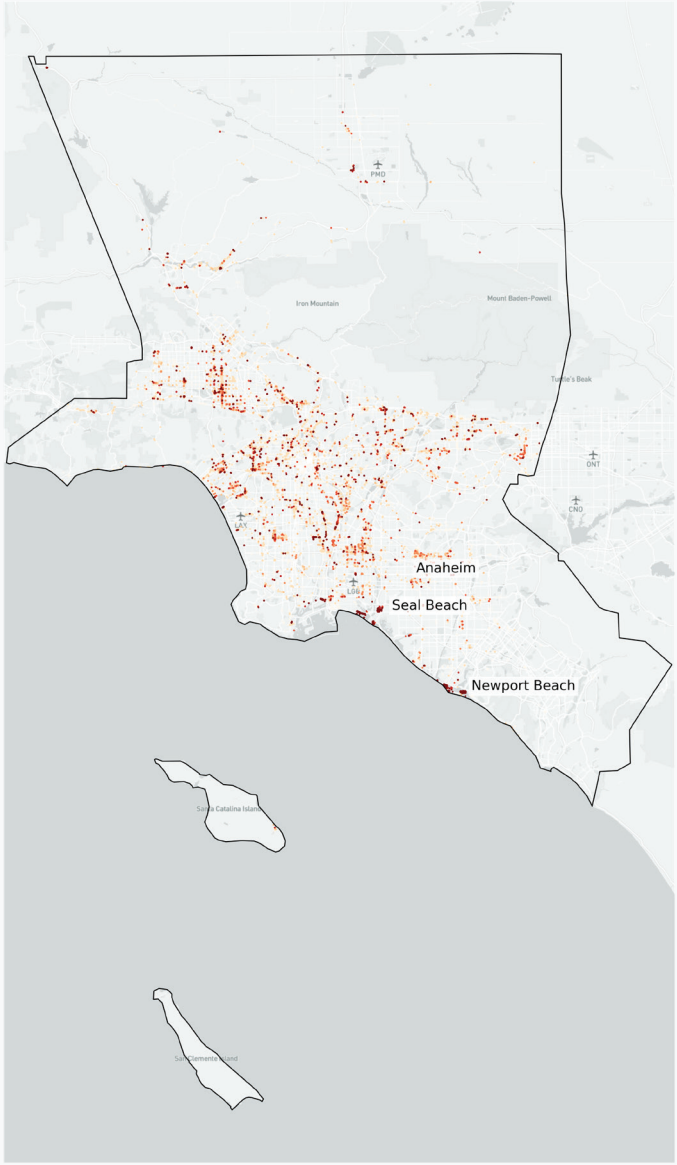
Over the next 30 years, an additional 1,010 properties are expected to experience financial loss from flood damage in the Los Angeles metro area.

This area will see a 17.8% increase in annualized structural damages, with a 13.9% increase in annualized downtime days. This downtime results in a 6.4% increase in economic damages.

Greatest growth in structural damage costs within Los Angeles metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Seal Beach	320	+179	+120.7%	+90.3%
2	Newport Beach	1,240	+21	+47.8%	+52.6%
3	Anaheim	1,500	+8	+10.7%	+10.0%
4	Huntington Beach	790	+19	+8.7%	+7.7%
5	Los Angeles	740	+0	+5.5%	+7.2%
6	Buena Park	450	+7	+4.4%	+7.9%
7	Garden Grove	590	+1	+2.7%	+7.5%
8	Laguna Beach	180	+0	+2.2%	+5.2%
9	Tustin	240	+4	+1.8%	+0.0%
10	Fullerton	560	+5	+1.6%	+4.5%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



METRO AREA DETAILS

DALLAS-FORT WORTH-ARLINGTON, TX

Dallas Metro Area

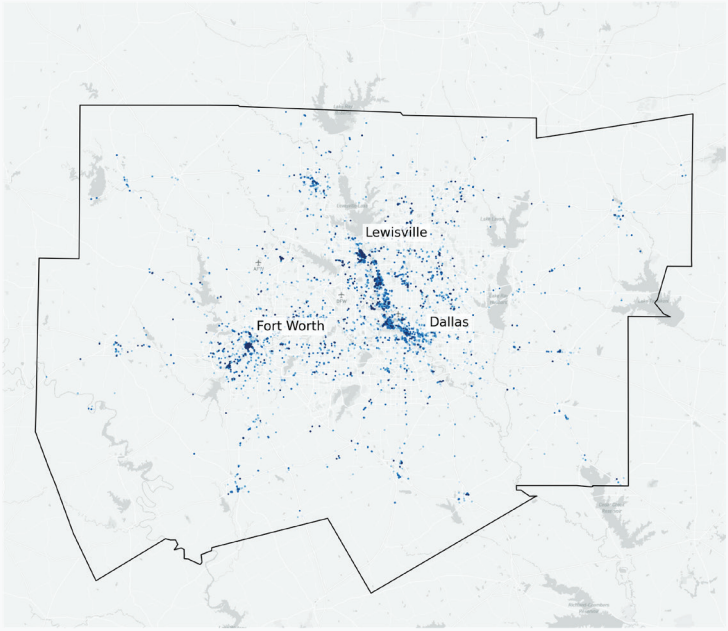
In the Dallas metro area, 10.6% of all office, retail and multi-unit residential properties (7,180) face risk of structural damage from flooding, amounting to $227 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 10,980 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.4 billion in economic damages due to downtime days.

Greatest structural damage costs within Dallas metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Fort Worth	6,560	920	$71.5	2,710
2	Lewisville	1,560	270	$34.1	940
3	Dallas	13,400	2,510	$21.3	1,880
4	Plano	2,500	130	$14.5	130
5	Carrollton	1,470	300	$6.5	160
6	DeSoto	410	10	$4.5	30
7	Grand Prairie	1,340	100	$4.5	140
8	Irving	2,070	270	$4.3	150
9	Frisco	1,390	100	$4.3	380
10	Denton	2,430	310	$2.9	480

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

DALLAS-FORT WORTH-ARLINGTON, TX

Dallas Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 220 properties are expected to experience financial loss from flood damage in the Dallas metro area.

This area will see a 4.7% increase in annualized structural damages, with a 6.2% increase in annualized downtime days. This downtime results in a 4.0% increase in economic damages.

Greatest growth in structural damage costs within Dallas metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Flower Mound	500	+1	+40.3%	+32.0%
2	Greenville	960	+0	+34.8%	+5.6%
3	McKinney	1,460	+1	+22.9%	+7.1%
4	Rockwall	600	+3	+15.4%	+30.8%
5	Cedar Hill	350	+0	+15.3%	+11.1%
6	Irving	2,070	+8	+14.4%	+12.3%
7	Benbrook	160	+2	+13.8%	+5.0%
8	Farmers Branch	620	+6	+13.6%	+22.2%
9	Carrollton	1,470	+20	+12.3%	+15.4%
10	Addison	350	+1	+11.2%	+22.7%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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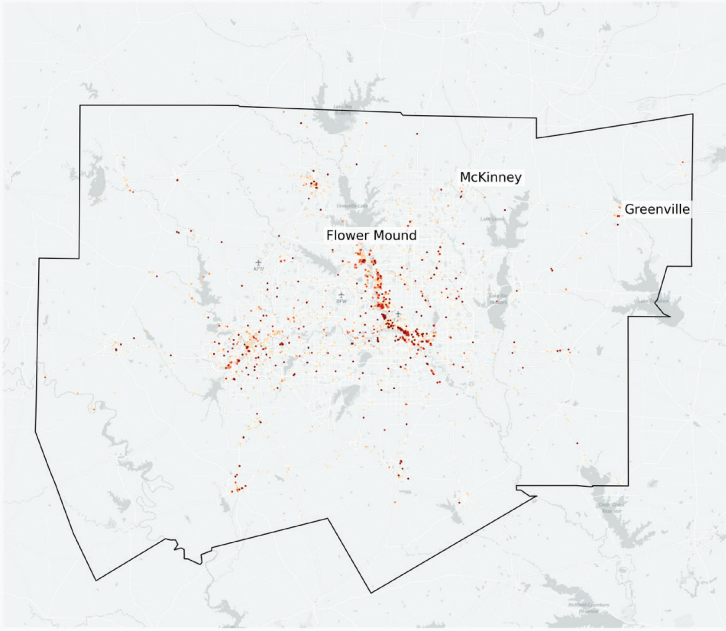


30 year change in damage

Percent change in structural damage 2022-2052

0 200% +

METRO AREA DETAILS

SEATTLE-TACOMA-BELLEVUE, WA

Seattle Metro Area

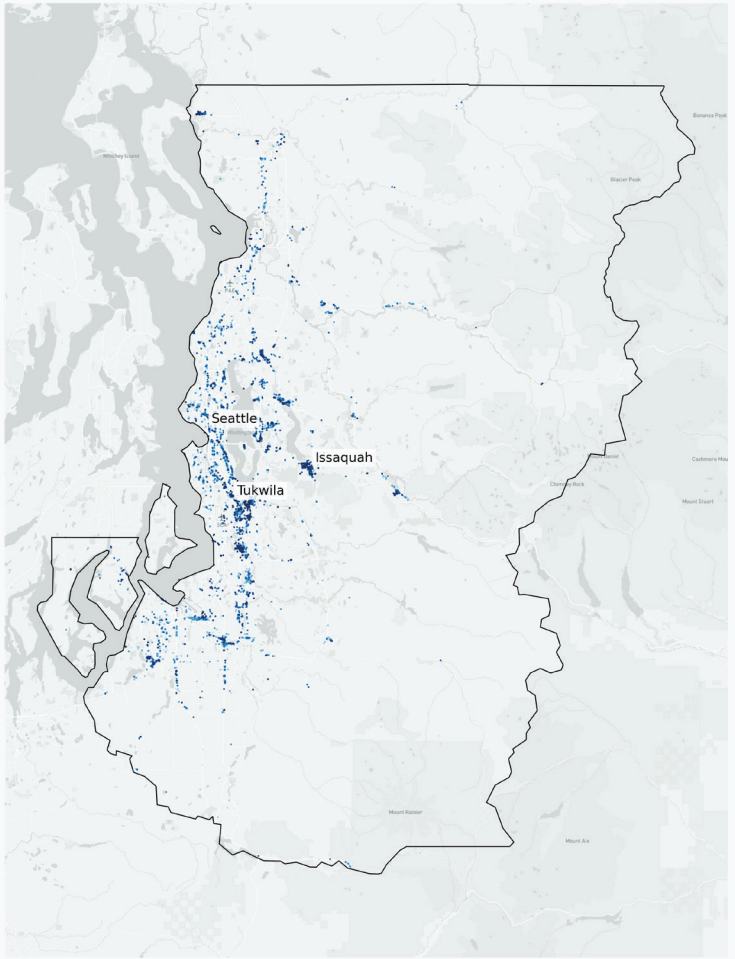
In the Seattle metro area, 19.4% of all office, retail and multi-unit residential properties (7,390) face risk of structural damage from flooding, amounting to $209 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 40,210 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $1.0 billion in economic damages due to downtime days.

Greatest structural damage costs within Seattle metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Tukwila	380	240	$20.1	1,840
2	Seattle	12,810	1,490	$19.8	2,820
3	Issaquah	430	280	$19.7	1,860
4	Kent	1,070	400	$14.8	1,220
5	Bellevue	1,240	240	$14.6	760
6	Renton	1,020	440	$12.4	1,030
7	Everett	1,720	200	$10.9	1,680
8	Stanwood	150	110	$9.1	1,900
9	Lakewood	710	230	$7.7	1,110
10	Auburn	750	350	$7.1	970

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

SEATTLE-TACOMA-BELLEVUE, WA

Seattle Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 480 properties are expected to experience financial loss from flood damage in the Seattle metro area.

This area will see a 11.0% increase in annualized structural damages, with a 6.7% increase in annualized downtime days. This downtime results in a 11.0% increase in economic damages.

Greatest growth in structural damage costs within Seattle metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Bonney Lake	110	+0	+280.7%	+150.0%
2	Snohomish	310	+1	+135.0%	+6.0%
3	Edmonds	500	+5	+67.3%	+68.7%
4	Marysville	610	+14	+44.3%	+13.8%
5	Bothell	360	+4	+34.8%	+6.4%
6	White Center	200	+3	+34.5%	+42.9%
7	Woodinville	130	+0	+32.7%	+27.9%
8	Monroe	320	+4	+32.1%	+32.5%
9	Shoreline	420	+1	+29.4%	+28.3%
10	Auburn	750	+16	+23.2%	+7.5%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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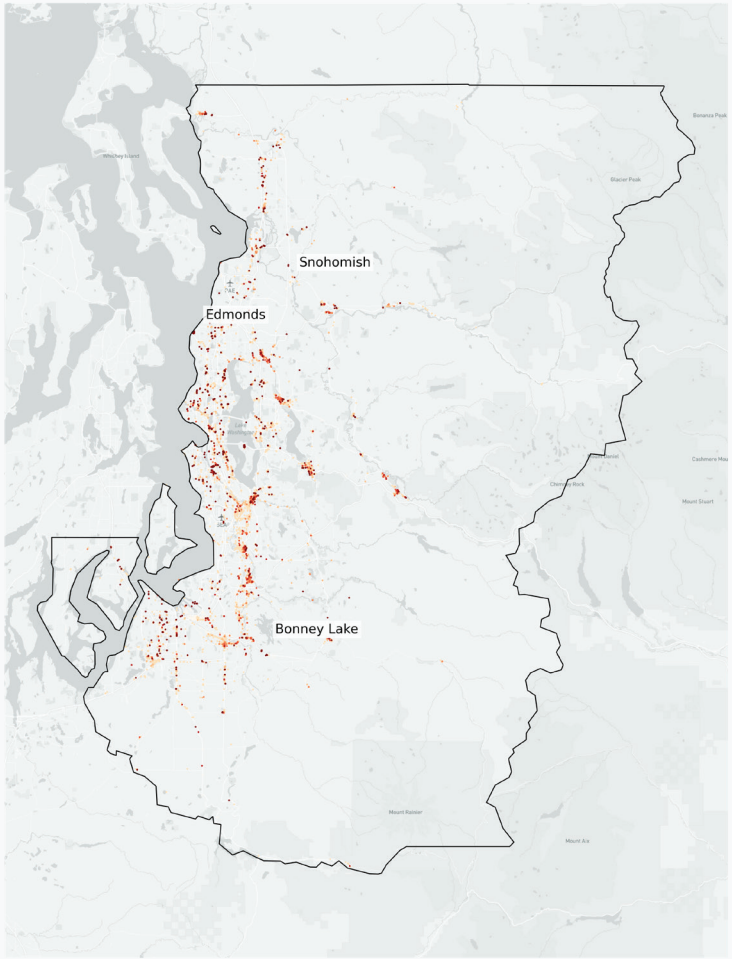

30 year change in damage

Percent change in structural damage 2022-2052

0 → 200% +

METRO AREA DETAILS

PHILADELPHIA-CAMDEN-WILMINGTON, PA-NJ-DE-MD

Philadelphia Metro Area

In the Philadelphia metro area, 10.7% of all office, retail and multi-unit residential properties (11,100) face risk of structural damage from flooding, amounting to $208 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 34,310 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $1.6 billion in economic damages due to downtime days.

Greatest structural damage costs within Philadelphia metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Philadelphia	54,240	5,860	$30.4	8,480
2	Conshohocken	190	20	$20.4	240
3	King of Prussia	260	40	$13.3	300
4	New Hope	140	100	$5.0	2,930
5	Wilmington	3,160	310	$3.4	1,760
6	Bristol	240	160	$2.3	410
7	Burlington	160	160	$1.7	780
8	Norristown	610	80	$1.6	440
9	Glenside	190	80	$1.5	310
10	Pottstown	480	80	$1.4	400

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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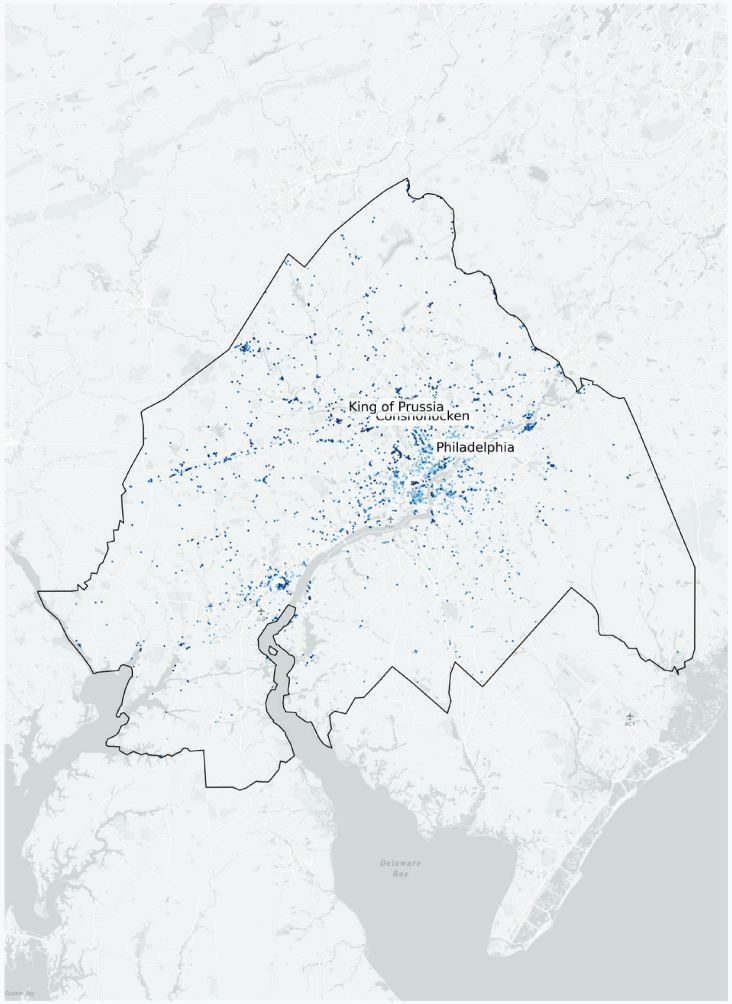

Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

PHILADELPHIA-CAMDEN-WILMINGTON, PA-NJ-DE-MD

Philadelphia Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 1,380 properties are expected to experience financial loss from flood damage in the Philadelphia metro area.

This area will see a 20.4% increase in annualized structural damages, with a 25.9% increase in annualized downtime days. This downtime results in a 11.3% increase in economic damages.

Greatest growth in structural damage costs within Philadelphia metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Pennsville	120	+66	+178.6%	+245.9%
2	Gloucester City	190	+17	+132.1%	+107.9%
3	Edgemoor	110	+0	+131.7%	+163.6%
4	Levittown	180	+0	+131.5%	+90.0%
5	Camden	1,080	+60	+87.7%	+74.4%
6	Collingdale	170	+2	+86.3%	+34.4%
7	New Castle	160	+1	+71.4%	+44.0%
8	Collingswood	270	+3	+61.5%	+50.0%
9	Wilmington	3,160	+61	+57.3%	+65.1%
10	Chester	500	+1	+49.3%	+16.7%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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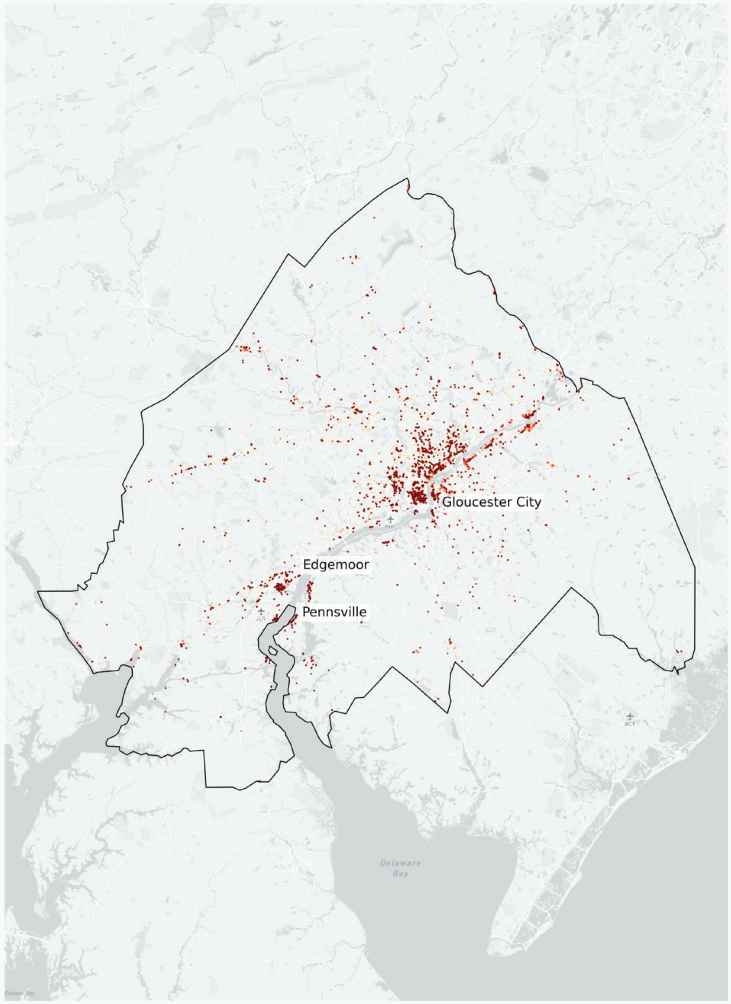

30 year change in damage

Percent change in structural damage 2022-2052

0 200% +

METRO AREA DETAILS

CHICAGO-NAPERVILLE-ELGIN, IL-IN-WI

Chicago Metro Area

In the Chicago metro area, 21.0% of all office, retail and multi-unit residential properties (21,810) face risk of structural damage from flooding, amounting to $200 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 43,010 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $1.3 billion in economic damages due to downtime days.

Greatest structural damage costs within Chicago metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Chicago	32,550	9,810	$64.3	15,590
2	Joliet	1,100	310	$6.0	2,330
3	Naperville	880	130	$5.5	360
4	Aurora	1,220	190	$4.7	870
5	Elgin	810	210	$4.5	1,460
6	Highland Park	360	50	$3.6	160
7	Lemont	180	50	$3.5	610
8	East Dundee	100	50	$3.1	810
9	Pleasant Prairie	210	40	$2.7	80
10	Lisle	300	60	$2.3	170

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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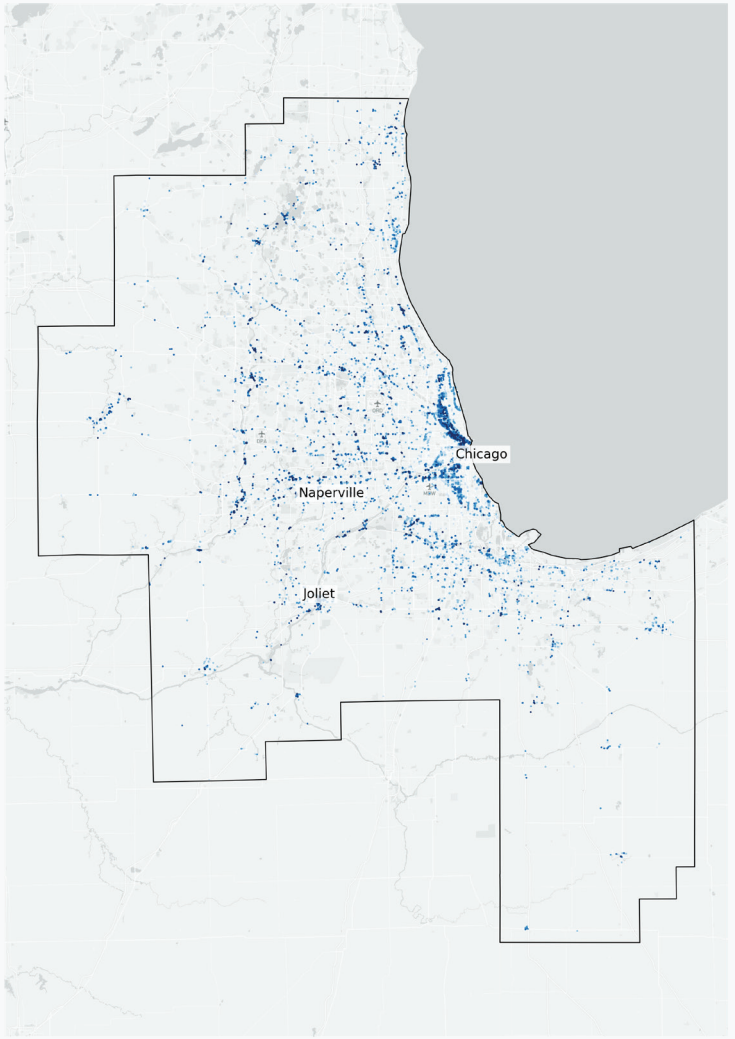

METRO AREA CHANGE

CHICAGO-NAPERVILLE-ELGIN, IL-IN-WI

Chicago Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 700 properties are expected to experience financial loss from flood damage in the Chicago metro area.

This area will see a 5.0% increase in annualized structural damages, with a 4.2% increase in annualized downtime days. This downtime results in a 4.1% increase in economic damages.

Greatest growth in structural damage costs within Chicago metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Streamwood	120	+0	+139.8%	+125.0%
2	Steger	140	+0	+107.9%	+26.5%
3	Lincolnshire	120	+2	+71.9%	+26.7%
4	Zion	370	+1	+70.0%	+25.6%
5	Crestwood	220	+3	+69.5%	+27.9%
6	Schaumburg	540	+3	+64.3%	+40.5%
7	Cedar Lake	160	+0	+59.5%	+40.9%
8	Gurnee	330	+0	+55.5%	+14.3%
9	Bolingbrook	240	+3	+46.4%	+27.3%
10	Hillside	170	+0	+46.3%	+43.4%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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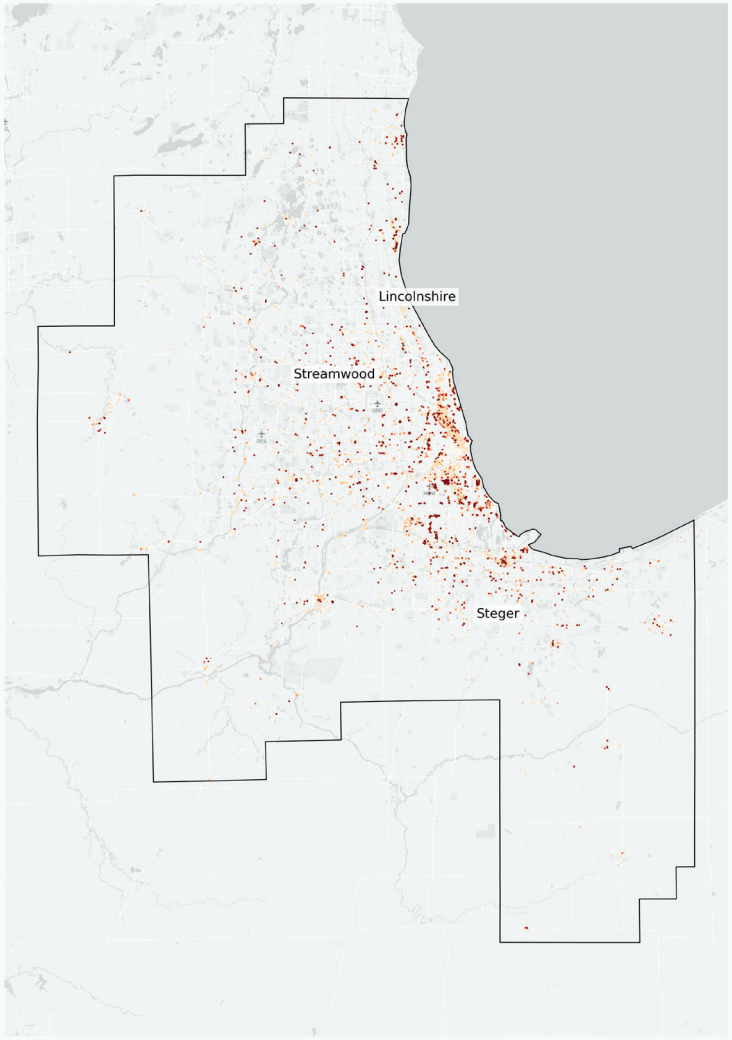

30 year change in damage

Percent change in structural damage 2022-2052

0 → 200% +

METRO AREA DETAILS

ATLANTA-SANDY SPRINGS-ALPHARETTA, GA

Atlanta Metro Area

In the Atlanta metro area, 7.2% of all office, retail and multi-unit residential properties (3,730) face risk of structural damage from flooding, amounting to $180 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 16,050 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.6 billion in economic damages due to downtime days.

Greatest structural damage costs within Atlanta metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Atlanta	5,410	540	$25.8	2,000
2	Sandy Springs	660	60	$11.5	330
3	Canton	390	60	$8.7	470
4	Cartersville	910	190	$7.2	720
5	Marietta	2,030	160	$7.2	640
6	Brookhaven	310	40	$6.8	500
7	Alpharetta	1,080	30	$6.3	190
8	Woodstock	620	90	$5.1	940
9	Stonecrest	360	20	$4.2	100
10	Peachtree Corners	380	50	$3.9	190

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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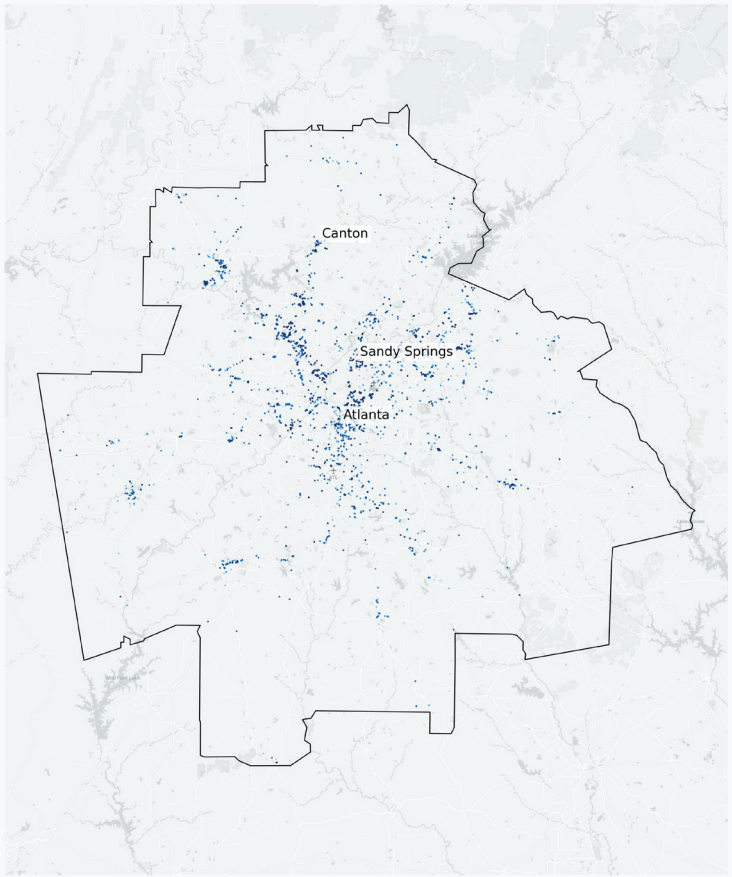
§ Downtime days are defined as days the structure is under repair.



Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

ATLANTA-SANDY SPRINGS-ALPHARETTA, GA

Atlanta Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 230 properties are expected to experience financial loss from flood damage in the Atlanta metro area.

This area will see a 16.6% increase in annualized structural damages, with a 14.4% increase in annualized downtime days. This downtime results in a 16.6% increase in economic damages.

Greatest growth in structural damage costs within Atlanta metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Dallas	250	+1	+159.1%	+9.3%
2	College Park	330	+2	+99.7%	+22.2%
3	Griffin	720	+1	+93.2%	+28.9%
4	Decatur	290	+0	+83.5%	+79.4%
5	Monroe	320	+0	+52.6%	+13.8%
6	Lithia Springs	220	+0	+47.8%	+17.3%
7	Norcross	280	+5	+46.7%	+39.1%
8	Mableton	450	+6	+39.1%	+19.2%
9	Marietta	2,030	+10	+36.5%	+28.5%
10	Kennesaw	530	+2	+36.2%	+14.2%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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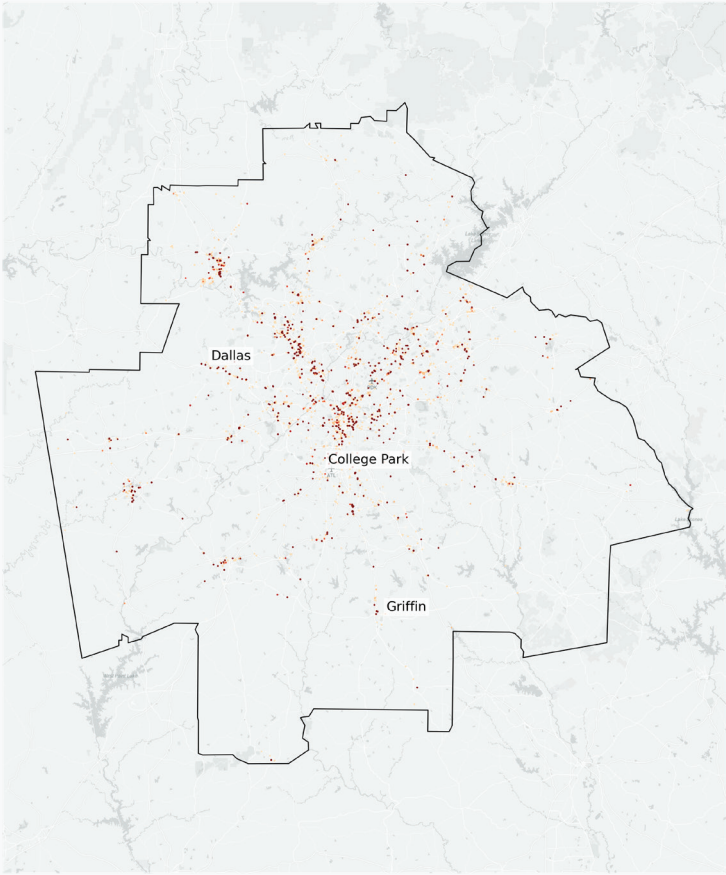

30 year change in damage

Percent change in structural damage 2022-2052

0 200% +

METRO AREA DETAILS

WASHINGTON-ARLINGTON-ALEXANDRIA, DC-VA-MD-WV

Washington Metro Area

In the Washington metro area, 10.4% of all office, retail and multi-unit residential properties (5,220) face risk of structural damage from flooding, amounting to $159 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 18,890 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.5 billion in economic damages due to downtime days.

Greatest structural damage costs within Washington metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Washington	19,900	1,890	$35.3	2,500
2	Alexandria	1,580	320	$21.3	1,390
3	Front Royal	440	160	$10.5	4,140
4	Arlington	1,040	150	$4.1	200
5	Frederick	1,150	220	$4.1	880
6	Ashburn	210	30	$3.1	70
7	Bethesda	430	40	$2.6	110
8	Waldorf	790	70	$2.5	90
9	Vienna	200	40	$2.4	150
10	Fairfax	350	30	$2.2	90

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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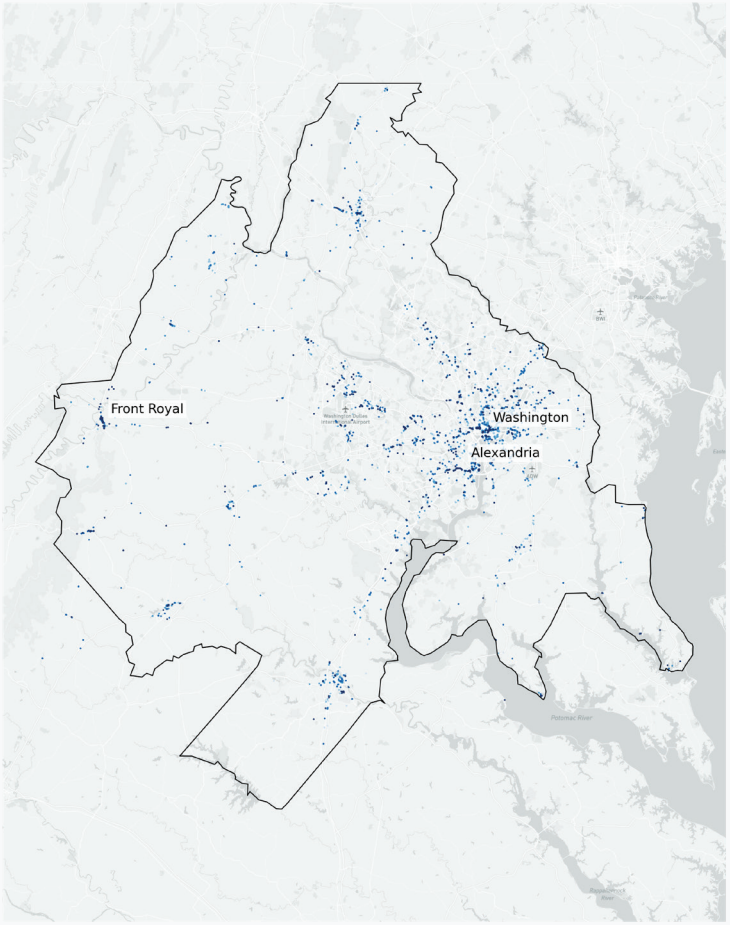


Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

WASHINGTON-ARLINGTON-ALEXANDRIA, DC-VA-MD-WV

Washington Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

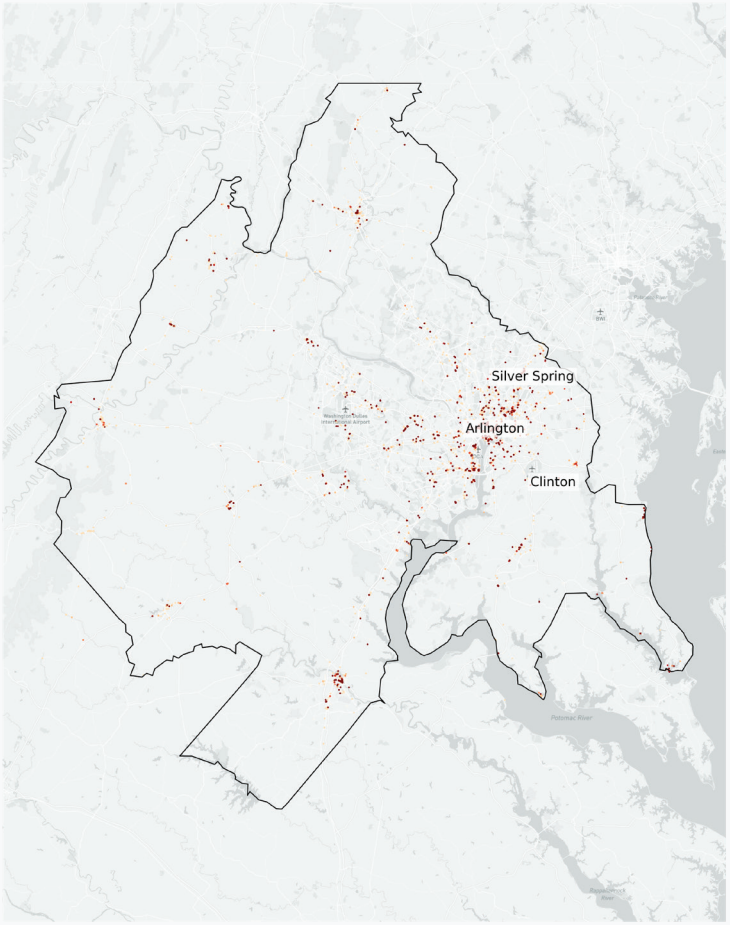
Over the next 30 years, an additional 320 properties are expected to experience financial loss from flood damage in the Washington metro area.

This area will see a 17.5% increase in annualized structural damages, with a 14.7% increase in annualized downtime days. This downtime results in a 27.9% increase in economic damages.

Greatest growth in structural damage costs within Washington metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Clinton	220	+0	+69.4%	+16.7%
2	Arlington	1,040	+6	+65.3%	+45.5%
3	Silver Spring	580	+7	+65.0%	+15.6%
4	Springfield	200	+0	+51.0%	+33.3%
5	Falls Church	250	+0	+48.2%	+20.7%
6	Fredericksburg	870	+4	+47.8%	+46.1%
7	Chillum	160	+0	+46.4%	+65.0%
8	Bowie	150	+0	+42.0%	+58.3%
9	Manassas	680	+0	+36.4%	+21.2%
10	Manassas Park	140	+0	+33.6%	+66.7%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



30 year change in damage

Percent change in structural damage 2022-2052

0 → 200% +

METRO AREA DETAILS

HARRISBURG-CARLISLE, PA

Harrisburg Metro Area

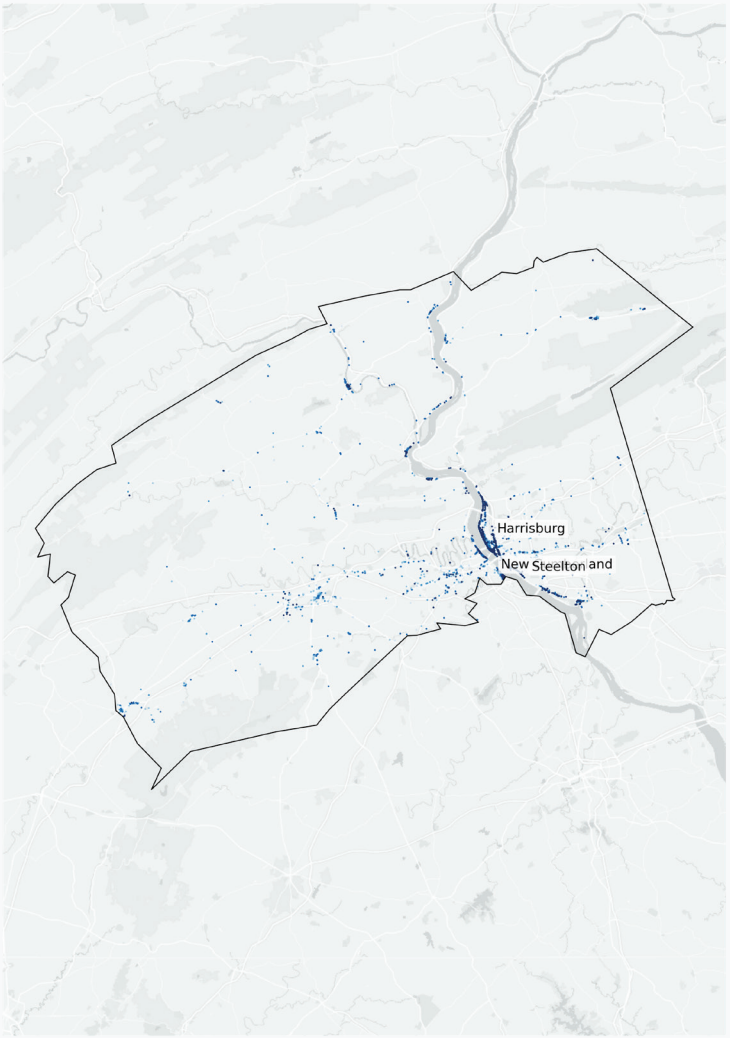
In the Harrisburg metro area, 31.8% of all office, retail and multi-unit residential properties (2,940) face risk of structural damage from flooding, amounting to $148 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 51,500 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.6 billion in economic damages due to downtime days.

Greatest structural damage costs within Harrisburg metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Harrisburg	1,360	1,040	$83.5	20,580
2	New Cumberland	260	210	$6.8	4,970
3	Carlisle	580	100	$1.1	190
4	Hershey	150	20	$0.4	80
5	Shippensburg	230	50	$0.3	130
6	Lemoyne	290	20	$0.3	70
7	Mechanicsburg	350	20	$0.1	30
8	Newville	110	20	$0.1	110
9	Enola	140	10	$0.0	50
10	Camp Hill	210	10	$0.0	10

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



METRO AREA CHANGE

HARRISBURG-CARLISLE, PA

Harrisburg Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

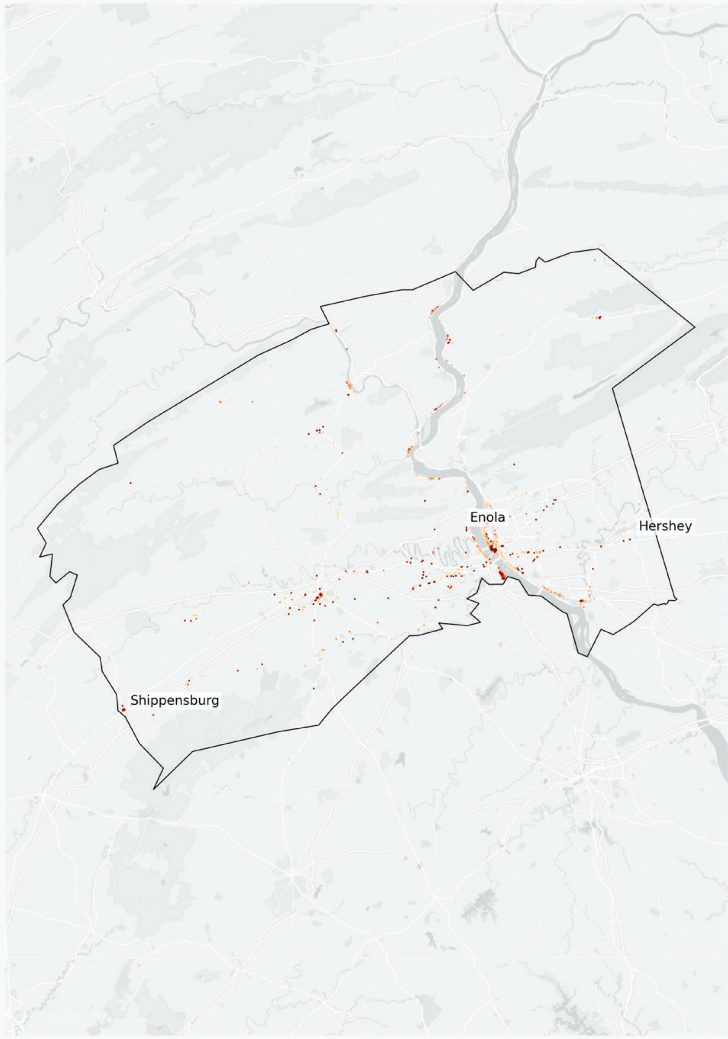
Over the next 30 years, an additional 40 properties are expected to experience financial loss from flood damage in the Harrisburg metro area.

This area will see a 9.9% increase in annualized structural damages, with a 11.1% increase in annualized downtime days. This downtime results in a 9.9% increase in economic damages.

Greatest growth in structural damage costs within Harrisburg metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Enola	140	+1	+86.2%	+25.0%
2	Hershey	150	+1	+32.2%	+12.0%
3	Shippensburg	230	+1	+22.2%	+23.9%
4	Carlisle	580	+2	+16.7%	+31.2%
5	Camp Hill	210	+1	+16.1%	+14.3%
6	Lemoyne	290	+0	+14.9%	+17.1%
7	Harrisburg	1,360	+7	+10.9%	+15.1%
8	New Cumberland	260	+5	+8.2%	+8.5%
9	Newville	110	+0	+4.3%	+7.1%
10	Mechanicsburg	350	+0	-5.0%	+0.0%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



30 year change in damage

Percent change in structural damage 2022-2052

0 → 200% +

METRO AREA DETAILS

RIVERSIDE-SAN BERNARDINO-ONTARIO, CA

Riverside Metro Area

In the Riverside metro area, 19.9% of all office, retail and multi-unit residential properties (7,800) face risk of structural damage from flooding, amounting to $130 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 19,910 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.2 billion in economic damages due to downtime days.

Greatest structural damage costs within Riverside metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Riverside	3,640	630	$22.9	2,100
2	San Bernardino	3,310	1,100	$16.6	2,960
3	Menifee	320	100	$9.9	450
4	Palm Springs	1,080	540	$9.5	1,500
5	Temecula	1,280	610	$9.3	1,590
6	Murrieta	1,030	400	$9.2	1,640
7	Corona	1,800	430	$9.0	1,260
8	Rancho Cucamonga	1,350	390	$6.1	1,270
9	Ontario	2,300	400	$3.4	530
10	Lake Elsinore	730	90	$2.4	370

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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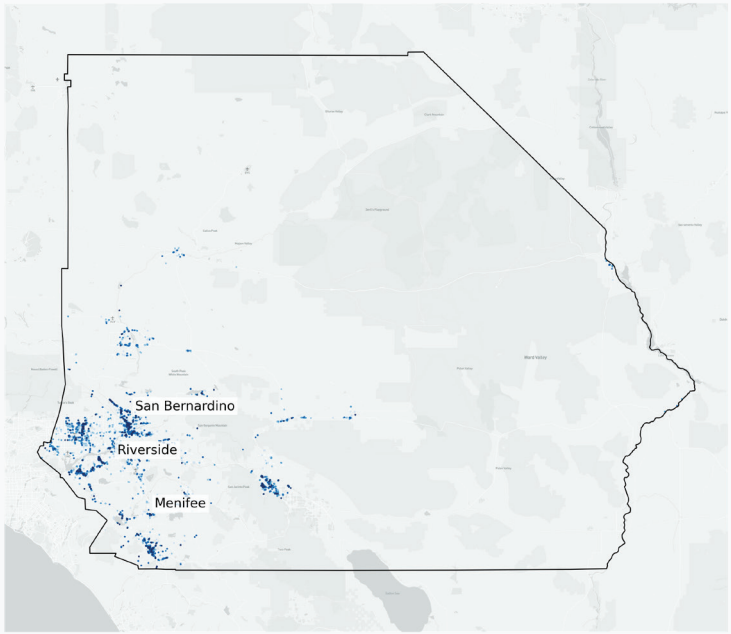

Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

RIVERSIDE-SAN BERNARDINO-ONTARIO, CA

Riverside Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 80 properties are expected to experience financial loss from flood damage in the Riverside metro area.

This area will see a 2.7% increase in annualized structural damages, with a 3.9% increase in annualized downtime days. This downtime results in a 1.9% increase in economic damages.

Greatest growth in structural damage costs within Riverside metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	San Jacinto	410	+8	+39.8%	+27.5%
2	Hesperia	850	+1	+31.6%	+37.5%
3	Chino	910	+4	+19.7%	+17.3%
4	Jurupa Valley	950	+9	+11.9%	+31.8%
5	Barstow	640	+2	+8.2%	+7.5%
6	Loma Linda	220	+1	+7.0%	+5.0%
7	Temecula	1,280	+3	+5.9%	+10.0%
8	Perris	490	+0	+5.2%	+17.4%
9	Menifee	320	+0	+4.7%	+11.2%
10	Hemet	880	+0	+4.5%	+4.7%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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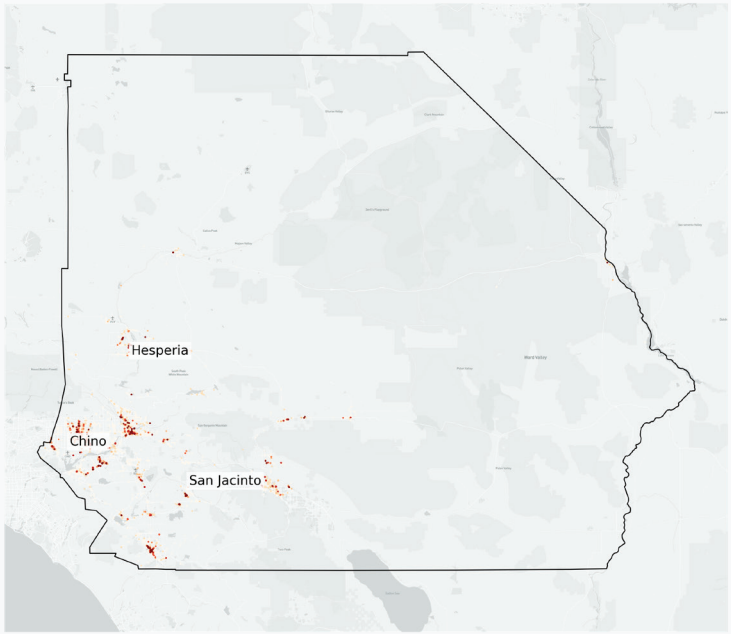


30 year change in damage

Percent change in structural damage 2022-2052

0 200% +

METRO AREA DETAILS

ASHEVILLE, NC

Asheville Metro Area

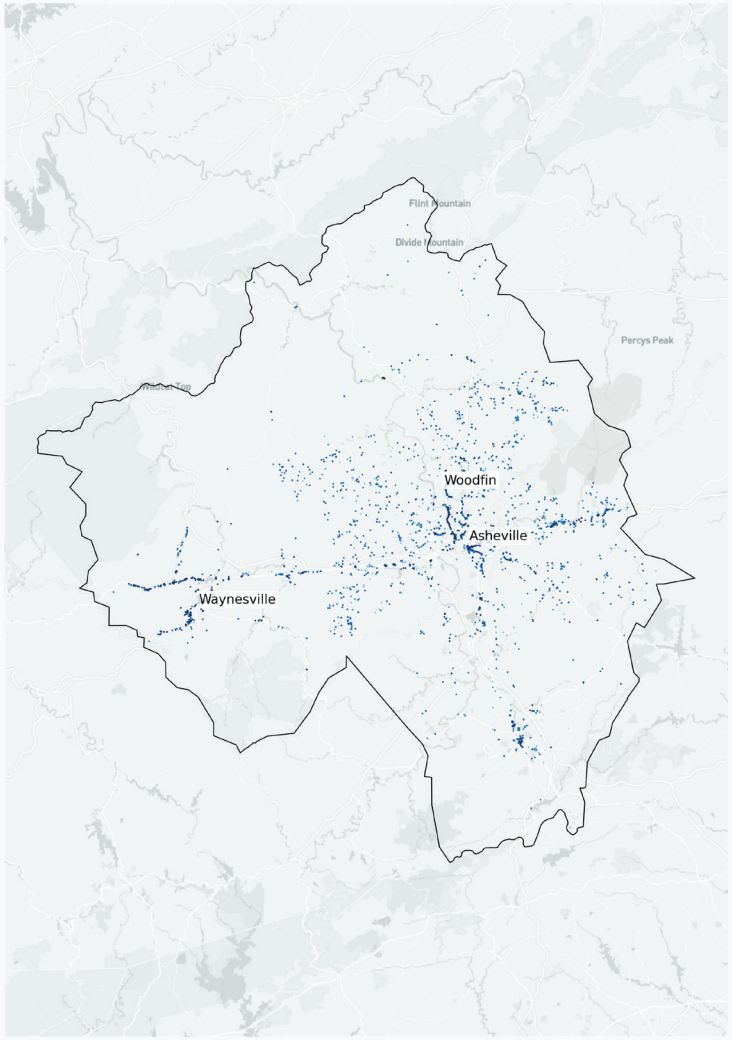
In the Asheville metro area, 25.1% of all office, retail and multi-unit residential properties (2,790) face risk of structural damage from flooding, amounting to $120 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 36,490 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.1 billion in economic damages due to downtime days.

Greatest structural damage costs within Asheville metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Asheville	3,070	620	$42.5	5,490
2	Woodfin	230	80	$13.5	1,110
3	Waynesville	400	200	$9.5	1,860
4	Hendersonville	870	160	$5.5	1,120
5	Swannanoa	210	90	$4.9	790
6	Black Mountain	350	80	$4.0	750
7	Canton	140	60	$1.1	420
8	Weaverville	130	10	$0.2	110
9	Fletcher	120	10	$0.1	60
10					

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



METRO AREA CHANGE

ASHEVILLE, NC

Asheville Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 50 properties are expected to experience financial loss from flood damage in the Asheville metro area.

This area will see a 3.9% increase in annualized structural damages, with a 5.6% increase in annualized downtime days. This downtime results in a 5.4% increase in economic damages.

Greatest growth in structural damage costs within Asheville metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Black Mountain	350	+1	+15.0%	+6.1%
2	Canton	140	+8	+7.0%	+9.3%
3	Weaverville	130	+1	+6.1%	+3.7%
4	Hendersonville	870	+6	+4.4%	+7.2%
5	Swannanoa	210	+1	+4.3%	+12.8%
6	Asheville	3,070	+18	+3.3%	+7.3%
7	Waynesville	400	+2	+3.1%	+4.9%
8	Fletcher	120	+0	+1.5%	+7.0%
9	Woodfin	230	+1	-0.8%	+3.2%
10					

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
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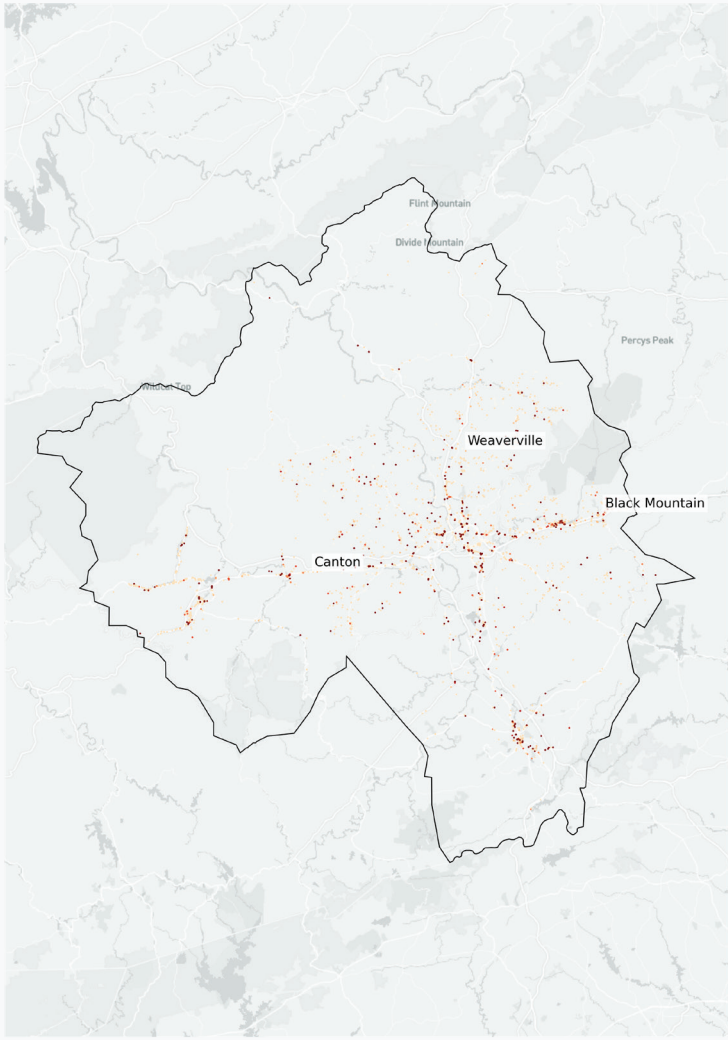


30 year change in damage

Percent change in structural damage 2022-2052

0 200% +

METRO AREA DETAILS

GULFPORT-BILOXI, MS

Gulfport Metro Area

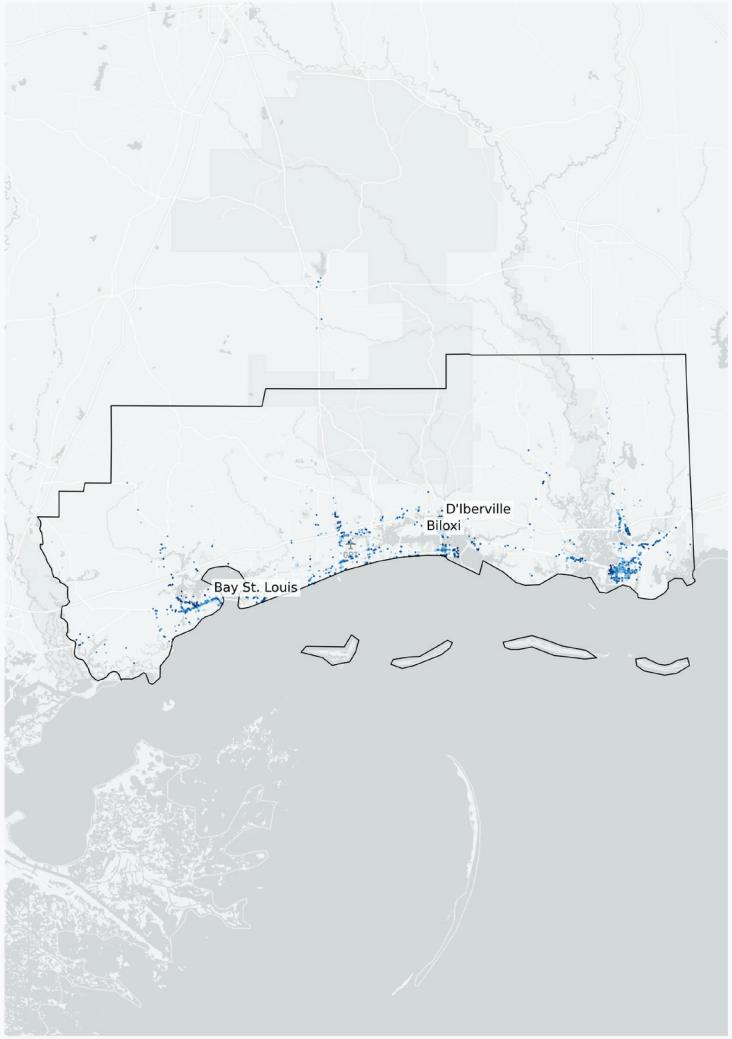
In the Gulfport metro area, 45.3% of all office, retail and multi-unit residential properties (2,870) face risk of structural damage from flooding, amounting to $119 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 11,100 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.1 billion in economic damages due to downtime days.

Greatest structural damage costs within Gulfport metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Biloxi	860	310	$70.3	1,300
2	D'Iberville	220	160	$20.7	540
3	Bay St. Louis	250	230	$5.6	1,620
4	Pascagoula	740	740	$4.8	1,640
5	Gulfport	1,690	480	$4.6	790
6	Waveland	140	140	$2.5	930
7	Moss Point	310	220	$2.2	620
8	Gautier	210	130	$0.7	380
9	Ocean Springs	470	50	$0.5	320
10	Long Beach	220	70	$0.5	240

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

GULFPORT-BILOXI, MS

Gulfport Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 960 properties are expected to experience financial loss from flood damage in the Gulfport metro area.

This area will see a 42.7% increase in annualized structural damages, with a 87.7% increase in annualized downtime days. This downtime results in a 47.4% increase in economic damages.

Greatest growth in structural damage costs within Gulfport metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Gulfport	1,690	+302	+114.8%	+200.1%
2	Ocean Springs	470	+205	+87.6%	+205.6%
3	Long Beach	220	+31	+86.8%	+114.9%
4	Moss Point	310	+44	+74.4%	+72.9%
5	Gautier	210	+69	+70.3%	+112.4%
6	Pascagoula	740	+6	+67.3%	+58.3%
7	Waveland	140	+0	+52.1%	+73.6%
8	Bay St. Louis	250	+22	+44.4%	+41.9%
9	Biloxi	860	+183	+38.1%	+112.5%
10	D'Iberville	220	+33	+25.0%	+178.0%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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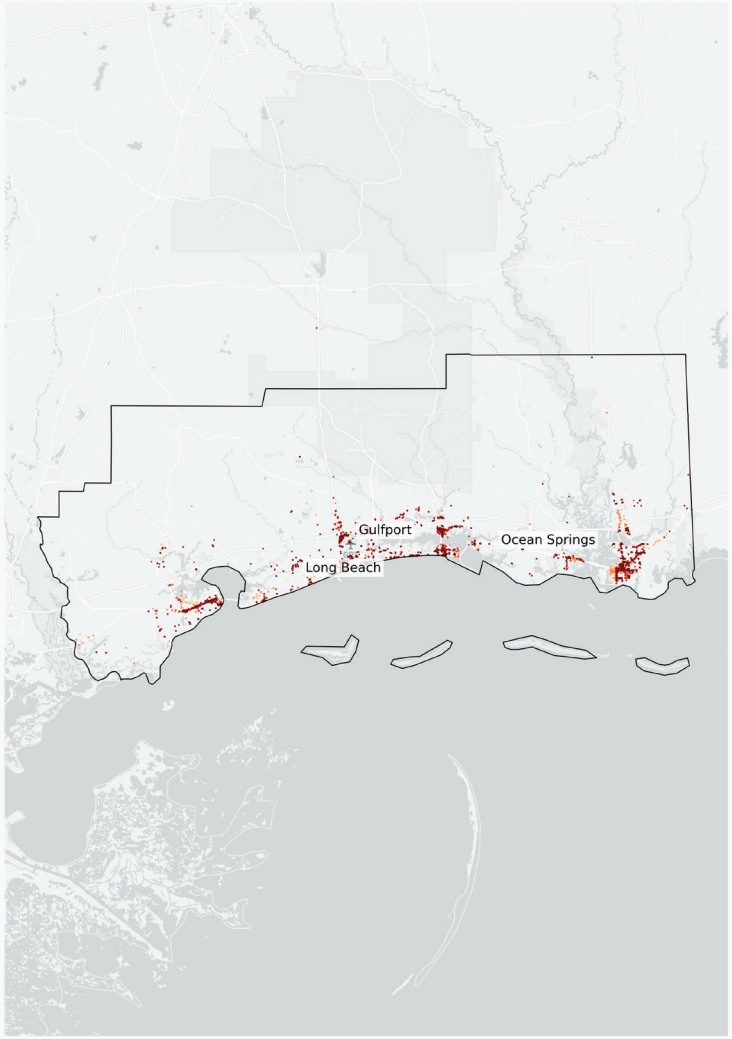


30 year change in damage

Percent change in structural damage 2022-2052

0 → 200% +

METRO AREA DETAILS

ST. LOUIS, MO-IL

St. Louis Metro Area

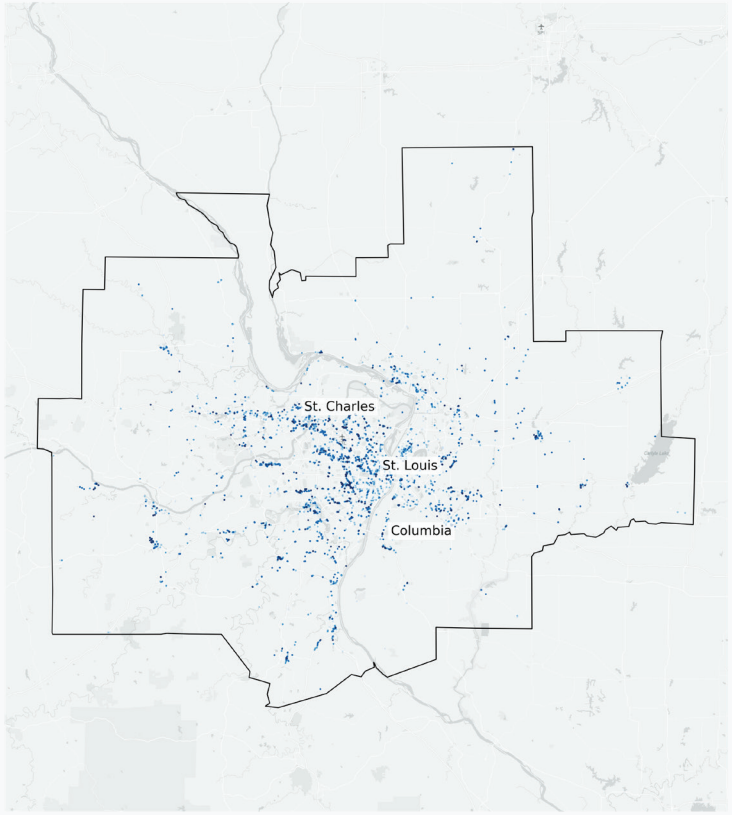
In the St. Louis metro area, 15.1% of all office, retail and multi-unit residential properties (5,160) face risk of structural damage from flooding, amounting to $117 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 16,180 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.2 billion in economic damages due to downtime days.

Greatest structural damage costs within St. Louis metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	St. Charles	1,090	240	$28.4	660
2	St. Louis	3,170	470	$3.4	740
3	Columbia	190	40	$3.2	320
4	O'Fallon	670	80	$2.9	240
5	Richmond Heights	160	20	$2.6	40
6	St. Peters	1,120	130	$2.6	150
7	Belleville	1,110	90	$2.4	560
8	Washington	470	50	$2.2	100
9	Union	330	50	$2.2	270
10	Brentwood	230	90	$2.1	420

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

ST. LOUIS, MO-IL

St. Louis Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

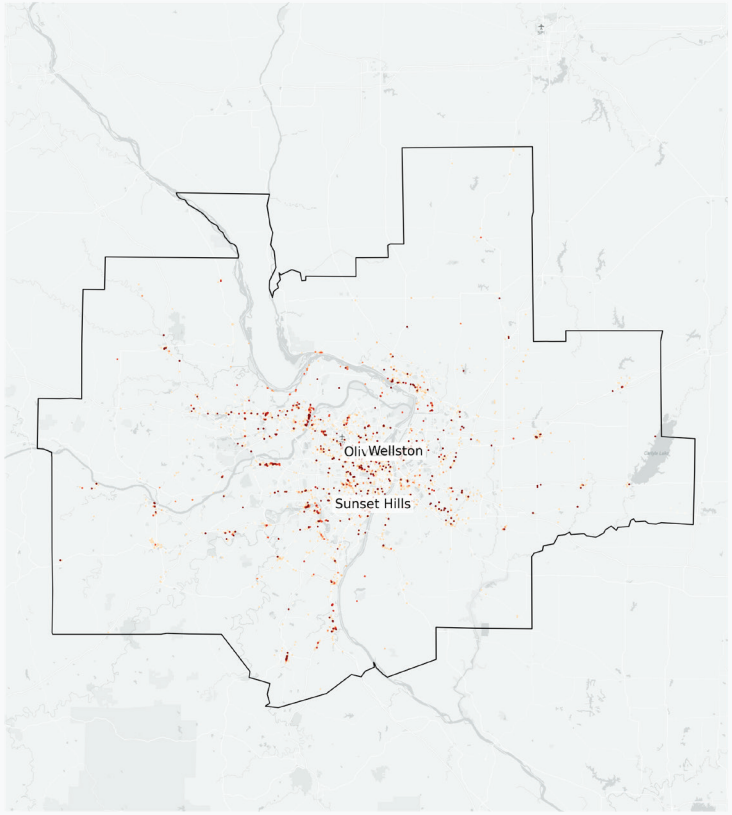
Over the next 30 years, an additional 170 properties are expected to experience financial loss from flood damage in the St. Louis metro area.

This area will see a 10.2% increase in annualized structural damages, with a 10.1% increase in annualized downtime days. This downtime results in a 10.6% increase in economic damages.

Greatest growth in structural damage costs within St. Louis metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Olivette	110	+0	+150.0%	+66.7%
2	Wellston	100	+0	+42.2%	+58.6%
3	Sunset Hills	140	+1	+37.7%	+37.1%
4	Greenville	170	+2	+29.8%	+2.1%
5	Alton	740	+12	+27.7%	+18.0%
6	Ferguson	210	+2	+26.6%	+7.9%
7	Belleville	1,110	+1	+19.5%	+13.3%
8	University City	460	+3	+18.6%	+25.3%
9	Kirkwood	340	+0	+16.9%	+37.4%
10	Swansea	230	+0	+16.4%	+12.9%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



30 year change in damage

Percent change in structural damage 2022-2052

0 200% +

METRO AREA DETAILS

PORTLAND-VANCOUVER-HILLSBORO, OR-WA

Portland Metro Area

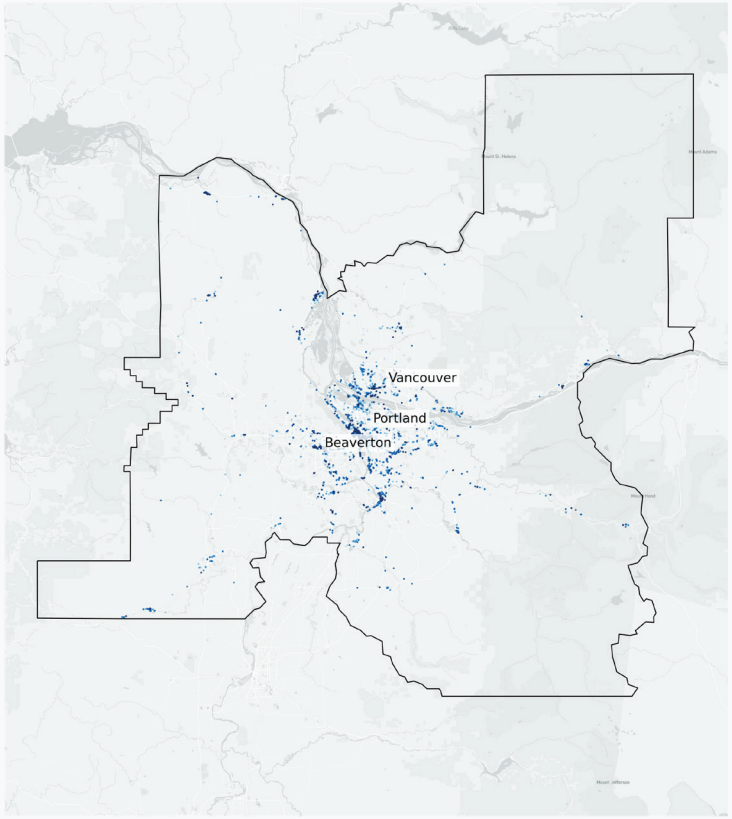
In the Portland metro area, 22.6% of all office, retail and multi-unit residential properties (4,930) face risk of structural damage from flooding, amounting to $115 MM in damages annualized this year.

This damage equates to a combined lost days of building operation, or downtime days, this year for all retail and office buildings of 14,490 days. On top of the structural damage to the building structures, the economic impacts on the local economy is estimated to result in $0.3 billion in economic damages due to downtime days.

Greatest structural damage costs within Portland metro area, 2022

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Portland	7,430	2,270	$43.1	4,870
2	Beaverton	770	180	$25.6	880
3	Vancouver	2,300	450	$11.6	860
4	Oregon City	480	160	$2.9	1,390
5	St. Helens	270	120	$2.5	520
6	Tualatin	280	60	$2.2	150
7	Gresham	700	110	$2.0	180
8	Milwaukie	280	130	$1.8	470
9	Tigard	530	50	$1.4	90
10	Battle Ground	220	70	$1.3	300

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
‡ Damage costs consider structural damage only.
§ Downtime days are defined as days the structure is under repair.



Properties with damage

Structural damages 2022 in $

0 → $50,000 +

METRO AREA CHANGE

PORTLAND-VANCOUVER-HILLSBORO, OR-WA

Portland Metro Area

As flood events become more expansive, more intense, and more frequent due to a changing climate, the overall number of properties at risk will increase, as well as the resulting financial damage to those properties which were already at risk.

Over the next 30 years, an additional 220 properties are expected to experience financial loss from flood damage in the Portland metro area.

This area will see a 10.5% increase in annualized structural damages, with a 11.2% increase in annualized downtime days. This downtime results in a 10.2% increase in economic damages.

Greatest growth in structural damage costs within Portland metro area, 2022-2052

Rank	Municipality	Properties*	With damage	Structural damage ($MM) ‡	Downtime days §
1	Walnut Grove	100	+0	+109.2%	+180.0%
2	Tigard	530	+5	+74.6%	+4.7%
3	Estacada	130	+17	+42.0%	+37.6%
4	Camas	190	+2	+35.3%	+30.6%
5	Troutdale	100	+0	+25.4%	+9.4%
6	Wilsonville	260	+0	+21.2%	+72.4%
7	Washougal	200	+10	+20.7%	+21.0%
8	McMinnville	490	+5	+15.4%	+33.3%
9	Gladstone	180	+5	+13.7%	+13.7%
10	Canby	260	+2	+13.6%	+12.5%

* Total properties includes properties classified with use-type of office, retail or multi-unit (4+) residential. Office includes classifications such as professional buildings (such as legal, real estate, and business), financial buildings,and medical buildings. Retail includes buildings such as department stores, restaurants, and grocery stores. Locations with fewer than 100 properties and 10 with damage are excluded from tables.
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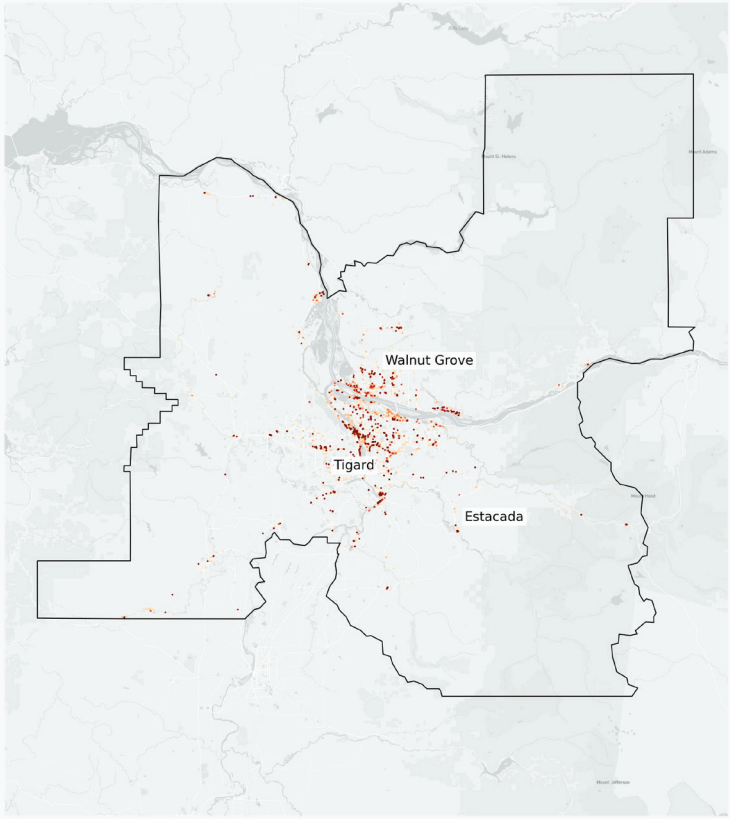

30 year change in damage

Percent change in structural damage 2022-2052

0 200% +