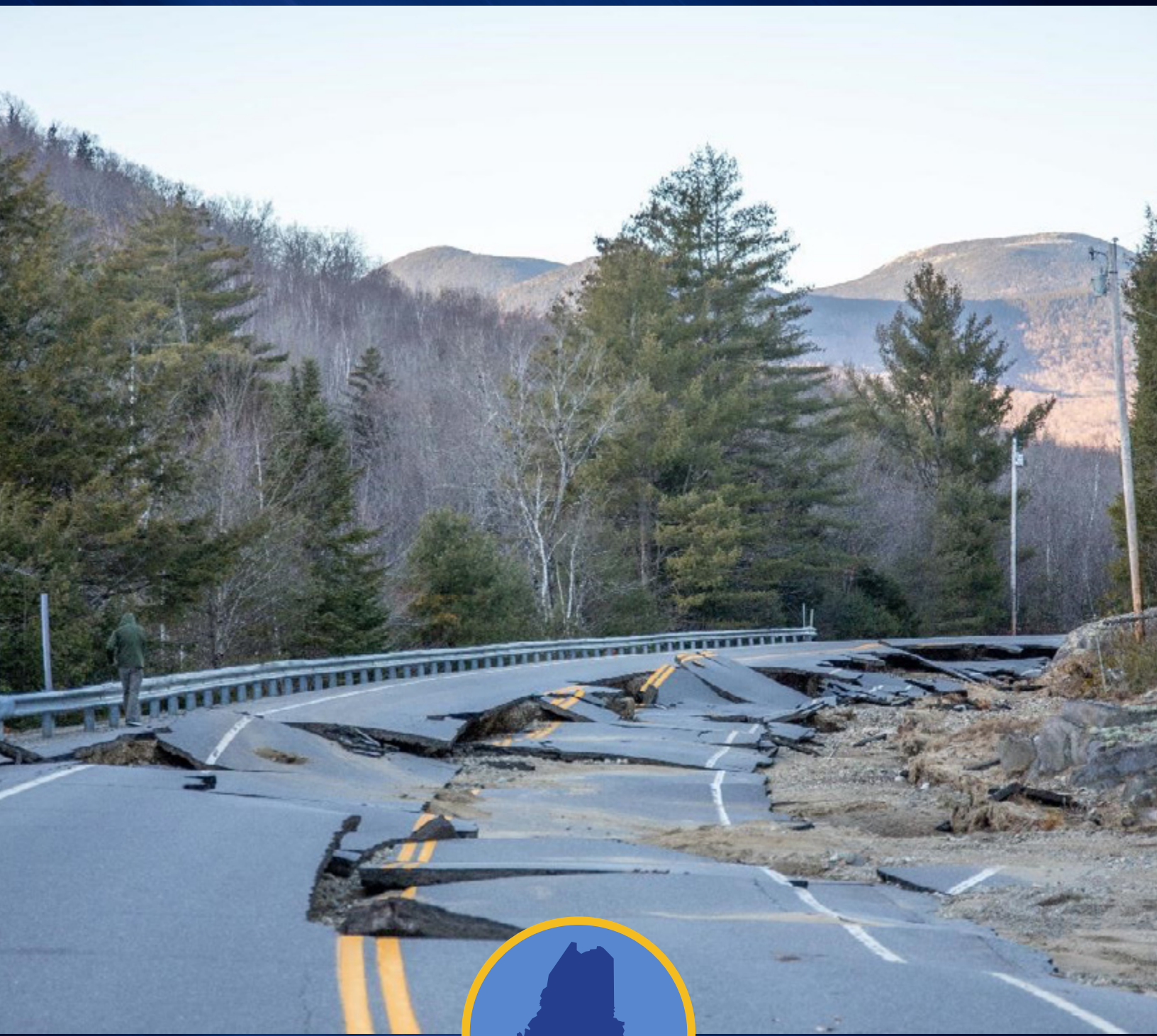
STATE OF MAINE

Infrastructure Rebuilding and Resilience Commission



NOVEMBER 2024 | INTERIM REPORT

November 2024

Dear Governor Mills,

As co-chairs of the Infrastructure Rebuilding and Resilience Commission, established by Executive Order in May, we are pleased to deliver this interim report that synthesizes learnings from the Commission's listening sessions across Maine, summarizes the Commission's work to date, and presents preliminary recommendations for your consideration. As directed, this report identifies near-term rebuilding and resilience priorities, upon which we will build and deliver a long-term resilience plan for Maine in May 2025.

First, we again extend our gratitude for the opportunity to lead this important effort on behalf of the people of Maine. The Commission is a remarkable group who, over the last six months, have volunteered their extensive knowledge and experience to examine not only the effects on Maine from last winter's historic storms, but the long-term trends that climate scientists are warning will become more prevalent in the years to come. As a result of that work, we agreed by consensus to preliminary recommendations to improve the state's response, recovery, and rebuilding from extreme storms.

Since launching in late May, the Commission has traveled widely throughout Maine to visit communities on the front lines of storm-related damage and climate vulnerability. We held public listening sessions and site visits in Stonington, Old Orchard Beach, Saco, Rumford, Mexico, Jay, Rockland, Machias, and Caribou, in addition to several virtual meetings.

The Commission heard from state and local public officials, police, firefighters and other emergency responders, commercial fishermen, business owners, construction experts, residents, and many others about the urgent need to strengthen our state's communities and infrastructure against future extreme storms, storm surge, rising sea levels, inland flooding, and other significant climate change impacts.

As our work unfolded, a sobering truth came into focus — climate change is harming the daily lives and future prospects of Maine people. The violent storms of December 2023 and January 2024 wrought widespread devastation in communities across the state, levying millions of dollars in damage and claiming four lives. They instilled shock, fear, and apprehension about how to respond when such storms return, potentially as soon as this coming winter.

While your Administration and the Legislature have committed to addressing this unsettling reality, evidenced by the $60 million in storm relief for working waterfronts, infrastructure projects, and business recovery, our task is to consider not only immediate responses but also strategies that strengthen Maine's resiliency for years to come. Taking bold steps now and into the future is vital to limiting unsustainable and preventable spending on repeated rebuilding from these events. Maine, like many states devastated by increasingly frequent and damaging storms, cannot afford the costs of inaction.

The Commission heard clearly where improvements are needed. Examples include bridging disaster data and communications gaps among state and local officials; streamlining the permitting to rebuild infrastructure, especially for smaller communities; increasing the supply and availability of construction workers and engineers; and examining how to fund the sheer scale of infrastructure resilience needs in Maine, which is beyond the ability of local communities or the state to meet.

Most important, is increasing the human capacity on the state, regional, and local levels to prepare for, endure, and respond to these extreme climate effects. Whether planning and mitigation, emergency response, or engineering and construction, Maine needs more people working on this complex challenge that threatens our state.

With this letter, we include a series of preliminary recommendations, which we will continue to shape as a Commission in the coming months. This interim report is intended to help inform possible near-term approaches to strengthening resiliency in Maine that could be proposed through the upcoming budget process and legislative session.

Although the challenges ahead are vast, our Commission is heartened by the stories of hope, resiliency, and heroism we heard around the state. Emergency responders took to bucket loaders to navigate flooded streets; town officials balanced multiple unfolding crises to protect their communities; numerous businesses and organizations raised funds, provided shelter, and offered services to meet their community's urgent needs; and countless neighbors reached out to one another in solidarity.

Our Commission is tackling its charge with this same spirit. With the support of the Maine Community Foundation, whose president Deb Ellwood serves on the Commission, and the NorthLight Foundation, we secured the services of a resiliency expert with deep ties to Maine, Dr. Sam Brody of Texas A&M University, who led a similar resiliency commission for the State of Texas. We have also engaged with officials from Vermont and Colorado to gain insights from their responses to extreme storm and flooding events over the last decade. And we will continue to listen to Maine people on the front lines throughout our work.

As we transition from the first six months of our work toward the long-term resilience plan due in May, we will continue to be guided by a unifying theme — we must act today to improve the resiliency of our people, environment, and economy from future storms and climate impacts to protect the Maine we love for future generations.

In closing, we along with all of the Commission's members extend our appreciation to everyone who has contributed to the Commission's work. This includes the many participants in the listening sessions, the officials who have hosted us around the state, the numerous experts who have presented to the Commission, and staff from the Governor's Office of Policy Innovation and the Future and the Maine Emergency Management Agency. We look forward to further discussions regarding the recommendations of this interim report, which we will refine and expand upon as we prepare the final report for delivery to you and the people of Maine next year.

Thank you again, Governor Mills, for this opportunity to lead the Commission and chart a path toward a more resilient Maine.

Linda Nelson, Economic and Community Development Director, Town of Stonington

Dan Tishman, Principal and Chairman of Tishman Realty & Construction

Co-Chairs, Infrastructure Rebuilding and Resilience Commission

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EXECUTIVE SUMMARY

A new era of storms and natural disasters has marked its arrival in Maine with dramatic and devastating results. Between March 2022 and May 2024, Maine experienced an extraordinary nine natural disasters, each severe enough to merit Presidential disaster or emergency declarations. The rising severity and frequency of these storms and floods raise urgent alarms about the risks that climate change is escalating in our state and drives home the imperative that Maine plan for and invest in climate resilience at the state, regional, and local levels.

In May 2024, Governor Mills established the Commission on Infrastructure Rebuilding and Resilience by Executive Order and charged its 24 members with recommending strategies that can reduce the risk of damage from extreme storms and floods, and actions to improve Maine's ability to respond and recover when the next disasters hit.

Recognizing the urgency of the situation, the Governor and the Legislature took initial steps in April 2024, designating $60 million for storm recovery and rebuilding damaged infrastructure with greater resilience. So far, this funding has enabled repair and recovery investments in 43 towns and cities, nearly 70 working waterfront facilities, and over 100 businesses and nonprofits. Additionally, the Federal Emergency Management Agency (FEMA) has directed over $26 million to date to communities and households over the past two years for disaster recovery costs, a number that will grow substantially as FEMA makes payments to local governments for the damage to public infrastructure in December and January.

These are important initial investments but only a start in meeting Maine's long-term needs. The growing severity of storms fueled by a warming climate combined with centuries of development in areas at risk is a challenge that Maine must confront immediately with commitment, investment, and innovation. This interim report offers preliminary recommendations for immediate steps the state can take to prepare for the next storm season, actions that provide Maine with a strong foundation of resources and capabilities for resilience, and transformational policies that deeply integrate resilience principles into decision-making at all levels of government.

The preliminary recommendations in this report reinforce the work of the Maine Climate Council and anticipate the activities that the state of Maine and its partners are beginning, supported by a historic $69 million climate resilience grant from the National Oceanic and Atmospheric Administration (NOAA). The newly established Maine Office of Community Affairs, which will house a new state Resilience Office, will work with state agencies to coordinate resources and services through a "one stop shop" model of community engagement and assistance.

The Commission will continue to refine and add to these recommendations over the months ahead, with particular attention to applying data and analysis to better understand disaster risks and suggest ways to target interventions. The Commission will deliver a final report in May 2025.

INTERIM RECOMMENDATIONS

Immediate Actions to Improve Storm Response

1. Enhance communications during and immediately after emergencies.

- Identify and share strategies for municipal leaders to ensure dependable communication with residents during emergencies.
- Develop strategies to streamline and improve information sharing among state, county, and local emergency managers and officials.

2. Strengthen coordination and rapid reaction capabilities with the philanthropic and nonprofit sector to alleviate immediate post-disaster needs.

- Develop and coordinate opportunities for the philanthropic and nonprofit sector to help fill needs not currently being met by disaster relief programs.
- Increase engagement and education among county and municipal officials, the philanthropic and nonprofit sector, and donors about the mechanisms for requesting and providing assistance.

3. Expedite state permitting for post-disaster rebuilding.

- Create educational materials to raise awareness of permitting requirements and eligibility for expedited state permitting.
- Increase capacity at state agencies through temporary contracts to review permit applications during periods of high demand.
- Prioritize review of permit applications for disaster-recovery activities.
- Consider additional regulatory exemptions for emergency activities and streamlined permitting for recovery and rebuilding.

Cementing the Foundation for Resilience

4. Improve data and information sharing to help leaders make informed decisions about risk.

- Launch an Online Disaster Data Service that centralizes existing regional and community-level hazard, risk, and vulnerability information.
- Establish a statewide communication and public information program that informs local decision makers and residents about the risk from flooding and other hazards, providing guidance on how they can mitigate potential adverse impacts.

5. Identify and strengthen critical vulnerable infrastructure.

- Expand tools and resoures for communities and regions to assess vulnerabilities in community infrastructure, including culverts and stormwater assets, drinking water and wastewater systems, transportation, and other public and private facilities that are essential to local economies.
- Provide data and education for communities to establish "resiliency overlay districts" using the best available science and data to reduce risk in areas where additional protective measures are needed.

- Preserve working waterfronts by identifying and mapping the most vulnerable infrastructure and creating new policy options, funding, technical assistance, and programs to protect access and coastal livelihoods.

6. Assist communities to reduce risk and proactively prepare for disasters.

- Increase state and regional capacity to assist communities with flood and natural hazard risk reduction, prioritizing the smallest and most vulnerable to natural disasters.
- Help towns lower residential flood insurance premiums by assisting municipal participation in FEMA's Community Rating System.
- Establish a homeowners resilience program to provide grants to residents to strengthen their homes and properties against damage and loss from severe weather.
- Consider a statewide watershed flood planning program that incentivizes the adoption of regionally collaborative plans for reducing flood risk and impacts.
- Formalize networks and contracts for disaster recovery services (e.g., debris management, construction contractors).

7. Maximize federal funding for disaster recovery and proactive resilience projects.

- Position Maine to maximize current and future federal funding to build capacity for storm risk reduction, including at the community level.
- Adopt an enhanced state Hazard Mitigation Plan to qualify for additional federal resilience funding.
- Increase assistance to communities to navigate complex federal grant programs.
- Take proactive steps to diversify, expedite, and maximize federal disaster relief and recovery funding.
- Help communities access federal recovery funding by adopting a suite of targeted incentives.

8. Improve and protect energy infrastructure and increase energy resilience for customers.

- Collect and publish trend data on electricity outages and grid vulnerabilities. Engage residents, community leaders, and critical facility operators to understand vulnerabilities.
- Enable the adoption of clean-energy technologies, such as microgrids, that enhance storm resilience, especially for critical services and facilities that serve vulnerable populations.
- Address winter energy reliability, volatility, and cost concerns for electricity generation and delivery of fuels for home heating.

9. Review state and local regulatory processes for opportunities to support resilience and efficient post-disaster rebuilding.

- Balance environmental protections with expediency for disaster recovery and flexibility for building with resilience by expanding options for permit-by-rule.
- Develop and incentivize adoption of model ordinances that help communities protect the environment and reduce risks from flooding and other natural hazards.

Integrating Resilience for the Long Term

10. Build long-term analytical capabilities for understanding and communicating about risk.

- Establish a statewide Disaster and Risk Information Center, which would inventory existing data sources, host and maintain the Disaster and Risk Information Center described in Recommendation 4, and identify critical data gaps and needs.
- Improve real-time access to water level monitoring and predictions by increasing the number of river and tide gauges.
- Develop products and tools based on coastal and inland flood risk models.
- Analyze flood insurance data to develop a more accurate assessment of flood risk and mitigation opportunities.

11. Develop funding and financing strategies for long-term resilience needs.

- Develop long-term funding options for improving the resilience of Maine's infrastructure, including drinking water, wastewater, and stormwater infrastructure.
- Evaluate a statewide disaster insurance program for public infrastructure.
- Encourage philanthropy to support capacity-building, pilots, and community engagement for resiliency.

12. Explore options for buildings and infrastructure to become more resilient.

- Review state building codes for opportunities to increase resilience and protect structures from storm and flood damage.
- Utilize FEMA grant funding for implementation of resilient building codes.
- Provide assistance and incentives for communities to adopt resilient building codes and standards.

Rockland Fire Department and Public Services crews collaborate on post-storm tree clearing following the January 2024 storm events. (Credit: City of Rockland)

INTRODUCTION

The dangers of unchecked climate change became undeniable in Maine over the past two years, as a series of extreme storms caused millions of dollars in damage and claimed four lives. Heroic action by hundreds of first responders across the state likely saved many more lives.These storms raise alarms about the dangerous climate risks facing our state, and the need to plan for and invest in immediate and long-term climate resilience at the state, regional, and local levels.

In a span of just four weeks during December 2023 and January 2024, three historically severe storms caused catastrophic inland and coastal flooding, resulting in unprecedented devastation to infrastructure and communities across the state. The damage to public infrastructure reached at least $90 million, with millions more in losses for private homes and businesses.

In response, Governor Mills requested federal disaster declarations for all three storms through two major disaster declaration requests. With additional storms in March and May, the state of Maine is now simultaneously grappling with an unparalleled eight major disaster declarations and one emergency declaration. This is a dramatic increase over recent decades when Maine had averaged just one disaster or emergency declaration per year.

Between December 17 and 21, 2023, heavy rainfall, rapid snowmelt, partially frozen ground, and presaturated soils all resulted in catastrophic flooding across three of Maine's largest river systems and their tributaries, the Kennebec River, the Androscoggin River, and the Saco River. Over a dozen river gauges reached major or record flood levels following heavy rain and snowmelt, requiring two municipalities to perform emergency evacuations. Flooded rivers caused the closing of hundreds of roads, stranding entire communities and preventing emergency responders and power recovery crews from accessing hard-hit areas for days. Furthermore, widespread prolonged and damaging winds ranging between 45-80 miles per hour resulted in extensive downed trees and power lines, leaving over 440,000 properties without power for several days. The storm claimed the lives of four people, including two whose vehicle was swept away by floodwaters. State officials estimate that damages exceeded $20 million across 10 of Maine's 16 counties. Some of the hardest-hit areas were rural communities with limited fiscal, staff, and community capacity for guiding recovery, and several counties that have been sites of prior declared disasters over the past year alone.

The next storm, on January 10, 2024, caused significant flooding and infrastructure damage along the Maine coast. Heavy wind, rain, and flooding destroyed homes, buildings, and roadways. Record-high storm tides damaged lighthouses and devastated docks, wharves, and piers serving Maine's iconic and vital working waterfronts. On January 13, just three days later, the state experienced a second coastal storm and new record-high storm tides that further damaged coastal homes, businesses, beaches, and waterfront infrastructure. Initial public infrastructure damage estimates from these storms were over $70 million, far surpassing those incurred from the December storm. With the start of fishing season just months away, waterfront businesses that serve the industry faced a daunting timeline to repair and rebuild. As in December, some of the most affected communities were smaller towns with fewer resources on hand to navigate one of the most complex recoveries in Maine history.

Coastal storms and extreme inland precipitation over the past two years in Maine have exposed the significant vulnerability of our infrastructure and communities to the effects of climate change. These events demonstrate an urgent need to invest now in long-term resilience strategies that avoid the ballooning and preventable costs of repeated cycles of damage and rebuilding.

An aerial view of the storm damage done to the waterfront in New Harbor shows the start of cleanup and rebuilding efforts. (Credit: Island Institute)

With 3,500 miles of tidal coastline, Maine has the fourth-longest coast in the continental United States. The Maine coast is an economic engine for the state, attracting millions of visitors annually and supporting working waterfronts for the state's important fishing, lobstering, aquaculture, and shipbuilding industries, and related marine businesses. Rising sea levels and a rapidly warming Gulf of Maine threaten coastal communities and the marine resources they depend on. Maine's central and western mountain areas have been hit repeatedly with intense storms that caused severe flooding along major rivers and minor streams alike, resulting in serious infrastructure and economic damage to natural-resource-based industries and important tourism sectors, such as outdoor recreation.

Relentless warming trends on land and at sea drive extreme storms, rising seas, flooding, and drought, all of which threaten our environment, heritage industries, infrastructure, and the future of our communities and economy. Maine's coastal and inland communities currently face numerous climate threats and challenges:

- **Accelerating sea-level rise:** The rate of sea level rise continues to accelerate in Maine. Since 2000, the rate of sea level rise is roughly 2.5 times faster than the long-term trend since 1912. Between January and December 2023, the record for highest monthly mean water level was broken at all long-term gauges in Maine for 6 months, with mean water levels between 6 and 10 inches higher than the long-term averages for those months. The trend has continued in 2024. At the time of this writing, new record water levels were set for 5 of the first 9 months in 2024. A "Cost of Doing Nothing" analysis conducted in 2020 by the Maine Climate Council (MCC) found that forecasted sea level rise by 2050 threatens more than 21,000 coastal jobs in tourism, fishing, and real estate, which is equivalent to 3 percent of Maine's workforce.

- **Inland flooding:** Inland flooding endangers people and impacts transportation, water, and other community infrastructure. In the next 30 years, approximately 2,300 inland road culverts have a two-in-three chance of overtopping during flood events, according to an analysis from The Nature Conservancy. Failed culverts and roads severely impair the ability to transport people, deliver emergency services, and restore electricity and communications. In rural areas, lengthy detour distances due to road washouts can inflict financial and emotional burdens on individuals and communities.

Increased frequency and intensity of storm events: In recent decades, Maine has experienced an average of one disaster or emergency declaration annually.

However, since March 2022, Maine has seen eight disaster declarations and one emergency declaration:

DISASTER DECLARATION

When: October 30-31, 2022

Where: Knox, Waldo, and York Counties

What: Severe Storm Flood Event

DISASTER DECLARATION

When: December 23-24, 2022

Where: Franklin, Knox, Oxford, Somerset, Waldo, and York Counties

What: Severe Storm Flood Event

DISASTER DECLARATION

When: April 30-May 1, 2023

Where: Franklin, Kennebec, Knox, Lincoln, Oxford, Sagadahoc, Somerset, and Waldo Counties

What: Severe Storm Flood Event

DISASTER DECLARATION

When: June 26, 2023

Where: Oxford County

What: Severe Storm Flood Event

DISASTER DECLARATION

When: June 29, 2023

Where: Franklin County

What: Severe Storm Flood Event

EMERGENCY DECLARATION

When: September 15-17, 2023

Where: Across the State

What: In Advance of Hurricane Lee's Landfall

DISASTER DECLARATION

When: December 17-21, 2023

Where: Androscoggin, Franklin, Hancock, Kennebec, Oxford, Penobscot, Piscataquis, Somerset, Waldo, and Washington Counties

What: Severe Storm Flood Event

DISASTER DECLARATION

When: January 9-13, 2024

Where: Cumberland, Hancock, Knox, Lincoln, Sagadahoc, Waldo, Washington, and York Counties

What: Severe Storm Flood Event

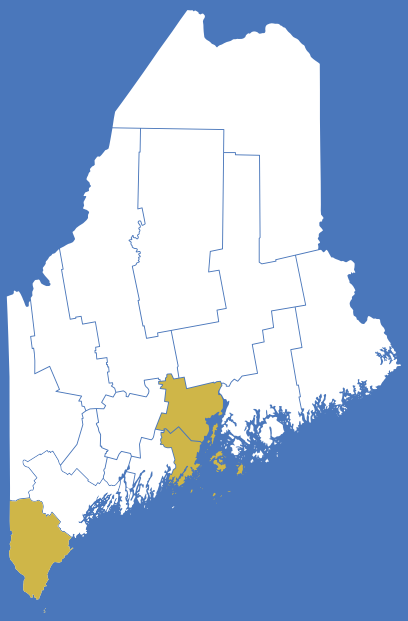
DISASTER DECLARATION

When: April 3-5, 2024

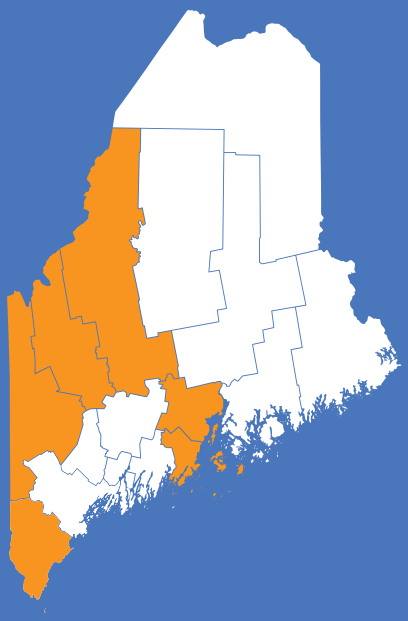
Where: Cumberland and York Counties

What: Severe Winter Storm

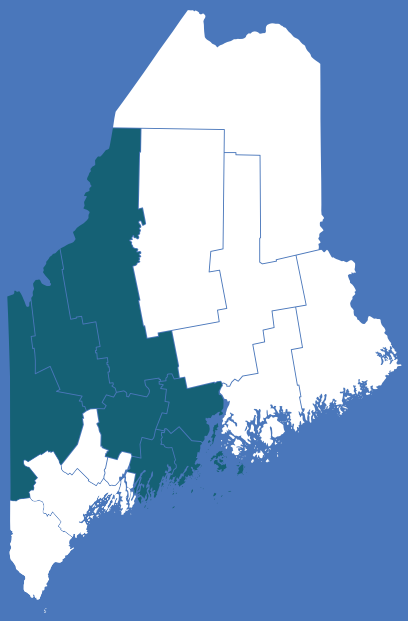
October 30-31, 2022



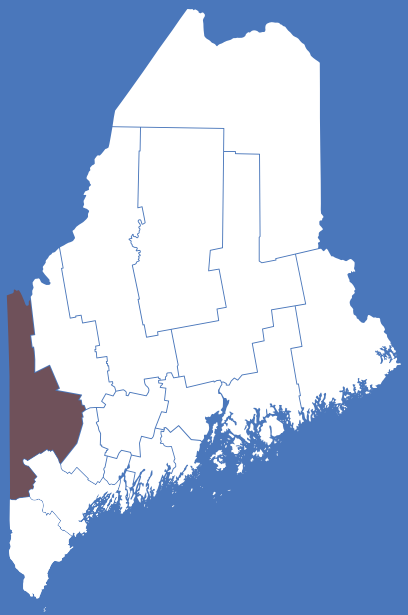
December 23-24, 2022



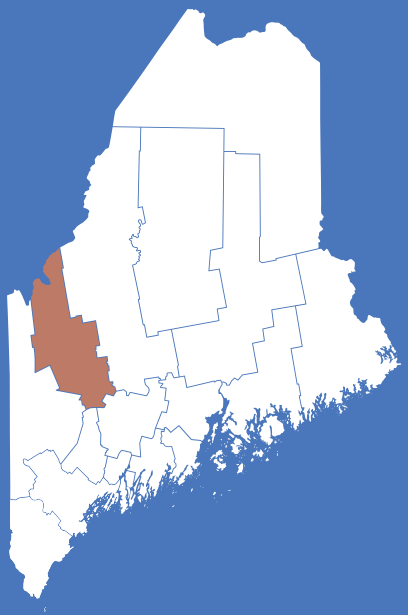
April 30-May 1, 2023



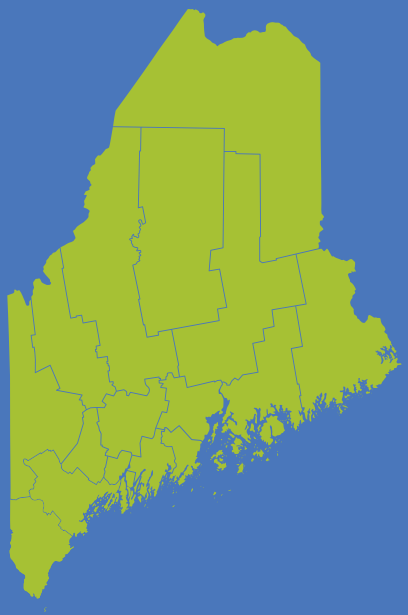
June 26, 2023



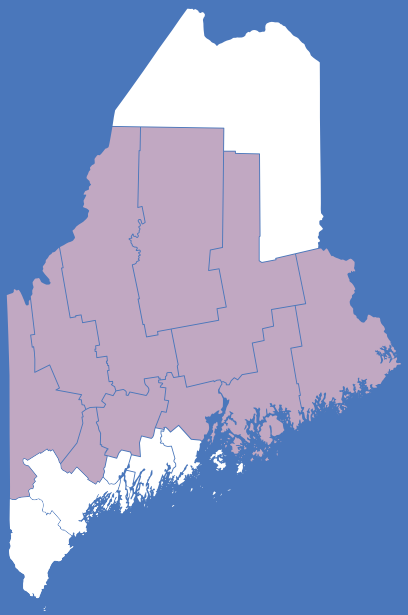
June 29, 2023



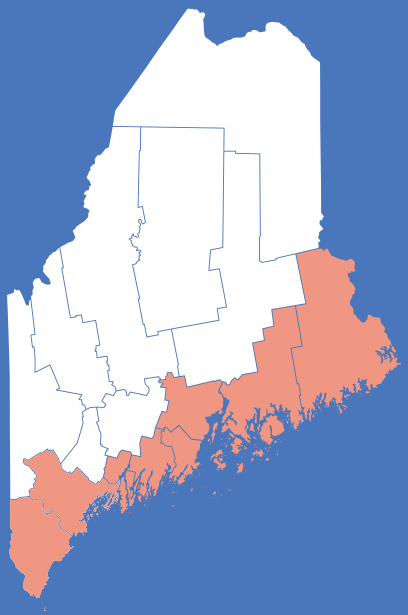
September 15-17, 2023



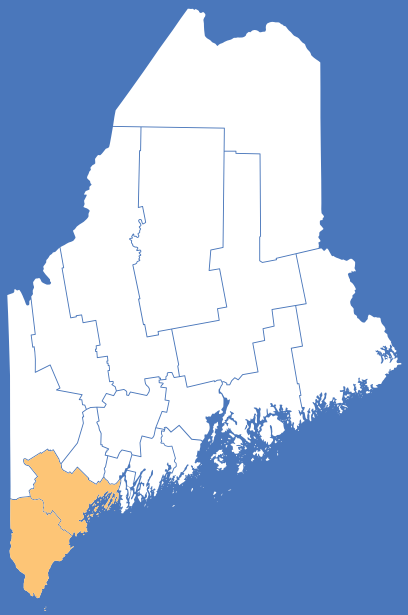
December 17-21, 2023



January 9-13, 2024



April 3-5, 2024



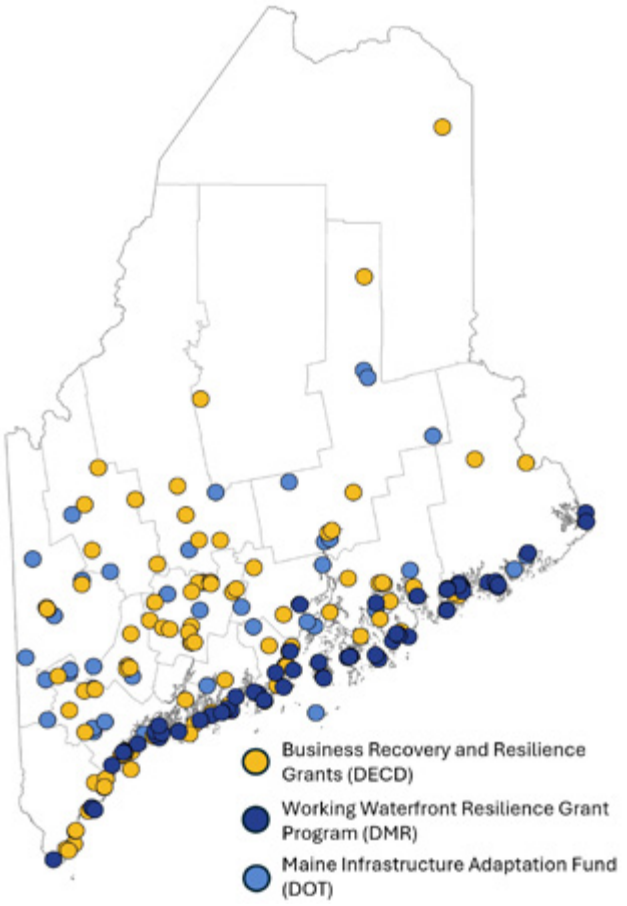
Maine's response to and recovery from these disasters hinged on resources from individuals, businesses, philanthropy, and a host of local, state, and federal sources. In April 2024, the Governor and the Legislature made $60 million available for rebuilding public infrastructure and critical working waterfront piers and wharves and assisting small businesses with recovery costs. Awards were distributed across three programs targeting different impacted entities:

1. Through the Maine Infrastructure Adaptation Fund, Maine Department of Transportation (Maine DOT) awarded over $25 million to 43 municipalities to mitigate the impact of intense storms, flooding, and rising sea levels.

2. Maine DOT and the Department of Marine Resources awarded over $21 million in grants to reconstruct and improve damaged wharves and piers, rebuild and restore key marine support buildings, and repair and upgrade fuel and electrical systems at nearly 70 working waterfront businesses.

3. The Department of Economic and Community Development awarded nearly $6 million in grants in the first round of the Business Recovery and Resilience Fund program. Over 100 impacted businesses and nonprofits received grants to help with design, permitting, and construction costs for projects that address the impacts of last winter's storm. The Department anticipates opening a second grant round in coming months.

Cleanup crews begin the process of rebuilding the Rockland Harbor Trail where it meets the breakwater following the January storms that damaged the waterfront. (Credit: City of Rockland)



Maine's response to and recovery from the December and January disasters hinged on resources from individuals, businesses, philanthropy, and a host of local, state, and federal sources. In April 2024, the Governor and the Legislature made $60 million available for rebuilding public infrastructure, working waterfront piers and wharves, and assisting small businesses with recovery costs. Awards were distributed through three programs from Maine Department of Transportation, Department of Marine Resources, and Department of Economic and Community Development

Federal relief and recovery resources have augmented the state's rebuilding funds. This year, impacted families and households in Maine received $11.4 million in relief funds through FEMA's Individual Assistance program for the December and January storms. An additional $17.8 million has been reimbursed to municipal governments and the state through FEMA's Public Assistance program for the disasters prior to December 2023 (reimbursements for the December and January disasters have not started flowing yet). Earlier this year, Maine competed successfully for a $69 million grant from the National Oceanic and Atmospheric Administration to improve the resilience of Maine's communities,

environment, and working waterfronts to extreme storms, flooding, and rising sea levels. Even with this success, there are billions of dollars available through other federal funding programs for resilience projects that Maine has not had the capacity to access.

In response to the storms, Governor Mills created the Infrastructure Rebuilding and Resilience Commission by Executive Order on May 21, 2024. It is charged with reviewing and evaluating Maine's response to the recent storms, identifying crucial areas for near-term investment and policy needs, and developing the state's first

Disaster Recovery in Hallowell

A takeout container floats on floodwaters surging through the streets of downtown Hallowell on the night of December 19, 2023.

Rich and Barb Friscia (below), the owners of 140 Water Street (right) purchased the property in December 2020.

Originally built in 1840 at the lowest point on Water Street, it was home to a coffee shop, gift store, and four rental residences above when water intruded through the basement foundation.

"Everything inside both businesses was completely wiped out," said Barb Friscia.

They applied for and received a state Business Recovery and Resilience Fund award of nearly $60,000 to help with their recovery costs, which included replacing all floor joists on the first floor for the affected businesses, mold remediation, foundation strapping, re-insulation, electrical work, basement flood vent installation, sump pumps, and sloped drainage to allow for easier water recession. Both first-floor businesses were able to reopen in April 2024, and the upper-floor residents remained in their homes during the repair process.

The couple even hopes to restore the building using heritage colors, a restoration which they'd planned on well before the flood. "We're extremely grateful for the grant and for helping those businesses become profitable and thriving again," Friscia said. "If we hadn't had the flood insurance, we would have lost the building and may have faced bankruptcy," she said. "Our flood insurance did not cover all of our out-of-pocket costs by a long shot. On the other hand, the Resiliency Grant awarded will allow us to better secure the building with preventative measures from sustaining this type of damage in the future. The grant award has allowed us to build back our funding used for disaster rebuild and now can move forward with our plans on making this building more attractive on Hallowell's Main Street hub. We are extremely grateful!"

Credit: Barb Friscia

"We want to express our immense gratitude to the exhausting hard work of many people that stepped in to complete repairs, problem solve, and work together to pull off almost the impossible. We would not have been able to get this even started without their own sacrifices immediately following this disaster. We are greatly indebted to you all!"

long-term infrastructure plan to ensure that Maine is ready for the harsh storms ahead. The Commission will complement and reinforce the work of the Maine Climate Council, which has defined "resilience" in the state's climate action plan, *Maine Won't Wait*, as the "ability of a community, business, or natural environment to prepare for, endure, react to, and move forward from the impacts of climate change."

This interim report of the Commission suggests strategies to reduce the risk of extreme storms and floods and actions to improve Maine's ability to respond and recover when the next disasters hit. While many of the Commission's preliminary recommendations will require legislative and budgetary action to be put into motion, other recommendations can be taken by proactive individuals, communities, and organizations.

Governor Janet Mills signed the Executive Order creating the Infrastructure Rebuilding and Resilience Commission at the Stonington Lobster Co-Op, which was heavily damaged during the intense January storms, on May 21, 2024. Stonington and neighboring Deer Isle experienced some of the most significant impacts in Maine from the storms, including extreme flooding that closed and damaged many public roads and storm surge that severely damaged working waterfronts. (Credit: Governor's Office)

THE IMPERATIVE FOR ACTION

In the weeks and months following the December 2023 and January 2024 storms, families, business owners, communities, and the state worked diligently to repair and rebuild. Questions and uncertainty swirled as owners looked upon damaged homes, storefronts, wharves, and roadways. How quickly could it be rebuilt? Should it be built here? How would it be paid for?

For many, urgency and cost were understandably the primary concerns. With the depth of winter still ahead, many needed a reliable shelter for their families or their businesses. Others anxiously looked ahead to the next tourism or fishing season. In the western hills, that meant reopening as rapidly as possible for ski season and winter recreation. On the coast, with the start of fishing season just a few months away, mobilizing to rebuild wharves, piers, and other working waterfront infrastructure took on an urgent resolve. In beach towns, sand dunes that defend homes and infrastructure from the sea lost much of their size and may take years to regenerate naturally. Even after nearly a year, restoring both humanmade and natural protections for the upcoming winter storms remains front of mind for many.

As the Commission toured the state, members heard stories from town officials, emergency managers, first responders, and business owners about the speed and scale of damage and the challenges of recovery and rebuilding. Officials from nearly every town expressed shock at the number of severe rain or storm events in recent years and the challenges of navigating the rebuilding process.

- In Stonington, as the second storm in three days barreled towards the town, community members hurried to secure damaged wharves and bait sheds with chains and, in one case, parked a forklift on a damaged pier to prevent it from being carried away on the next storm tide.
- In Old Orchard Beach, the sand dunes and beaches that are the lifeblood of the summer tourism season are also the first layer of defense against winter's coastal storms. The dunes were severely eroded in January, leaving town and county officials worried about how to protect the community from battering waves in the coming winter.
- The towns of Rumford and Mexico are accustomed to annual spring floods when snowmelt swells the rivers, but leaders shared their sense that the December flood was completely different. The Androscoggin River and its tributaries rose faster than ever before, leaving officials and residents with little time to prepare or evacuate. In Mexico, the Swift River reached the highest flow rate ever recorded, claiming the lives of two residents. County emergency managers shared stories of deep fatigue from repeated disaster recoveries.
- In Jay, a severe summer rainstorm in June 2023 washed out roads and culverts in many locations. Navigating FEMA systems has consumed much of the town staff's time, spending upwards of 10 hours per week on the phone with federal officials. There are still several washouts that have not been repaired because of limited town resources and lengthy federal recovery processes.

Commission members view the Androscoggin River at the Rumford Falls dam, which recorded its second highest flow rate ever during the December 2023 storm.

Parts of Route 133 in Jay, Maine sustained heavy damage from runoff during an historic summer rainfall in June 2023 that required months of repairs.

- In Machias, the town offices were flooded and severely damaged, as were businesses along Route 1. The dike that carries Route 1 and the Downeast Sunrise Trail is critical to regional connectivity and popular for walking and recreational fishing. It was overtopped by floodwaters and town leaders feared the dike might have been breached, until the waters receded and revealed it to be damaged but intact.

- In Aroostook County, which did not experience severe conditions in December or January but has weathered previous severe storm events, officials are concerned about the lack of updated flood maps as ice jams and flooding become more frequent and less predictable. The county's remoteness means that communities must plan for extended periods without electricity, fuel, and other resources.

For many people affected by the storms, the repeated episodes between 2022 and 2024 left little doubt that Maine has entered a new era of storm intensity and vulnerability. Questions about how to rebuild have become commonplace. How much higher should buildings or wharves be to avoid the next flood? How much stronger to withstand the next onslaught? In far too many instances, decades-old flood maps and building codes did not offer sufficient answers for the magnitude of the challenge. When confronted with the need to rebuild quickly, property owners, engineers, contractors, and communities frequently lacked designs and approaches that could be trusted to withstand the next big storm. Many took educated guesses, while others simply rebuilt what had been destroyed.

"Resilience is the ability and capacity to handle these disasters. I think this has to be a collaborative effort at all levels. We need the ability to incorporate new ideas into planning for our infrastructure repairs and replacements. We need capacity in all communities to do this work, from the smallest to the largest."

—SHILOH LAFRENIERE
JAY TOWN MANAGER,
COMMISSION MEMBER

Last century's thinking will not solve this century's problem. Maine needs new approaches to how and where communities rebuild. These approaches should be contained in policy, plans, and funding programs that together ensure near-term decisions are aligned toward long-term resilience. These new solutions must be available immediately in the aftermath of a disaster so that when urgency and emotion are high, the path to recovery is clear and actionable.

The following are the most important messages the Commission heard and the lessons that inform the recommendations in this interim report:

- **The situation is urgent.** Maine cannot assume that the recurring storms of the past two years are an anomaly. Individuals, communities, and the state must prepare for storms and disasters that are becoming more intense, more damaging, and more disruptive to lives and economies in our state.

- **Maine needs to change how and where we build.** Most of Maine's infrastructure was built for the last century. The climate is different today and will be different decades from now. The damage that communities suffered over the past two years is largely the result of two factors: a warming climate that is changing the frequency and severity of storms, and the growth of Maine's towns and cities over centuries in places that today have higher risks of flooding, storm surge, and other natural hazards. Maine must simultaneously act to curb the causes of climate change, adapt to increased risk, and anticipate future risk when making decisions about where and how to build. The state and communities must prepare for difficult conversations about getting out of harm's way and relocating critical infrastructure to safer areas.

- **The cost of inaction far exceeds proactive investment.** Extreme weather events are costing the U.S. close to $150 billion each year, according to the Fifth National Climate Assessment. The total cost of storms in Maine over the past two years likely exceeds $100 million. We must pay, now or later, for improvements to our infrastructure, homes, and businesses. The choice Maine faces is whether to make proactive investments to safeguard our infrastructure and communities against the fury of storms and floods we know will come, or to wait for those storms to hit and pay for the fallout — preventable loss of life, avoidable community devastation, and unnecessary economic disruption. Decades of studies by the National Institute of Building Sciences have repeatedly shown that investments in proactive measures yield savings many times greater by preventing and avoiding casualties, damage, and economic disruption.

- **Maine will have to be strategic and efficient with resources.** Funding and human capacity, both state and local, are likely to be insufficient to individually assist each of Maine's nearly 500 cities, towns, plantations, and rural communities. Ensuring that every community in Maine is prepared for future storms and disasters will require:

  - Regional collaboration supported by regional capacity that makes efficient use of limited resources and encourages cooperative problem solving for many issues. Storms and floods do not care about municipal boundaries. Maine is a home rule state where decisions with long-term effects are often made at the municipal level. Maine will need to lean into and leverage its experience addressing regionally significant issues like infrastructure and services, transportation, and housing to become more resilient.

  - A strategy for long-term resilience funding that 1) acknowledges the need for Maine to commit significant resources over the coming decades to protecting and preparing communities and infrastructure for natural disasters; 2) recognizes that the state's public resources will be insufficient and must be deployed efficiently; and 3) develops new sources of funding and finance from within and beyond the state budget.

BUILDING A MORE RESILIENT MAINE

The Commission developed the preliminary recommendations in this interim report by traveling to and learning from impacted communities around the state, hearing from experts in Maine and other states, and drawing upon the knowledge and experience of its members. The recommendations attempt to consider the breadth of resources and capabilities needed to lead Maine toward a more resilient future. However, as this is an interim report, the Commission will continue to learn, to refine, and to add to these recommendations — and in certain cases may simultaneously begin to act upon them.

The Commission's recommendations are presented in three sections that together suggest a step-by-step approach with immediate-, medium-, and long-term timeframes for implementation. This framing proposes a comprehensive set of reinforcing capabilities and policies that are layered upon steady and deliberate action. In practice, however, Maine must begin work on all of these timeframes simultaneously. With the frequency and intensity of storms seemingly increasing every year, Maine must accelerate action, making both immediate preparations for the next storm and investing in capabilities and systems that build transformative, long-term resilience.

Immediate Actions to Improve Storm Response

Recent experience shows that the next major storm may be just around the corner. While many of the recommendations in this interim report will require legislative or budgetary authority, some actions can be initiated immediately. Putting "no regrets" actions into practice can provide a basic layer of insurance until more robust policies are set in motion.

1. Enhance communications during and immediately after emergencies.

- Identify and share strategies for municipal leaders to ensure dependable communication with residents during emergencies.

> *"Areas that had never seen flooding were flooded within minutes. A frequent response from families during rescue efforts was 'I should have left.'"*
>
> —FIRE CHIEF JOHN GILBOY
> OLD ORCHARD BEACH

- Develop strategies to streamline and improve information sharing among state, county, and local emergency managers and officials.

Effective communication of timely and accurate information before, during, and following emergencies is both critical and challenging. In recent disasters, numerous communities relied on social media platforms to communicate with residents due to the absence of reliable alternatives. To address this issue, some communities, including Dover-Foxcroft, are implementing subscriber-based cell-phone notification systems that allow users to receive text messages or emails with important information. These notifications are limited to individuals who opt in to the service, so a robust public education effort is required to onboard residents.

A solution the state can provide is FEMA's Integrated Public Alert and Warning System (IPAWS). Unlike subscription-based systems, IPAWS allows for the dissemination of Wireless Emergency Alerts, which are sent by cellular carriers to all mobile phones within a designated area without requiring prior user registration. It is essential to share options like these, along with best practices for their implementation, among municipal officials and emergency managers. Opportunities to deploy these solutions on a regional scale to enhance adoption while managing costs should be actively explored.

The Town of Dover-Foxcroft is implementing a subscriber-based cell-phone notification system that allows users to receive text messages or emails with important information. American Woolen Company Foxcroft Mill, Dover-Foxcroft, Maine. (Credit: Jack Clukey)

In addition, strategies must be developed to streamline the flow of information among state, county, and local emergency managers. Community leaders have expressed concerns regarding receiving unclear or conflicting information from county and state officials. To mitigate this issue, Maine Emergency Management Agency (MEMA) should routinely exercise and practice emergency communications across the entire network and communities should prioritize participation. This will ensure that all participants understand what information to expect and when to expect it.

2. Strengthen coordination and rapid reaction capabilities with the philanthropic and nonprofit sector to alleviate immediate post-disaster needs.

- Develop and coordinate opportunities for the philanthropic and nonprofit sector to help fill needs not currently being met by disaster relief programs.

- Increase engagement and education among county and municipal officials, the philanthropic and nonprofit sector, and donors about the mechanisms for requesting and providing assistance.

The demand for services and resources climbs dramatically in the aftermath of a disaster. MEMA, along with county and local partners, work quickly to identify the immediate needs of individuals, businesses, the agricultural community, and local governments. As state agencies follow established procedures to request federal disaster relief resources, there is an opportunity to strengthen the role of nongovernmental organizations (NGOs) that specialize in providing immediate relief needs, such as meals, cleanup services, and shelter.

MEMA, the Maine Long Term Recovery Board, and representatives of the philanthropic and nonprofit sector should develop and coordinate additional opportunities for the NGO sector to fill needs for individuals, businesses, and communities that are not met by federal or non-governmental organization disaster relief programs. The Island Institute, for example, quickly made small grants available for working waterfront businesses to stabilize damaged

"A community notification system serves several important purposes, primarily around the timely and effective dissemination of critical information to residents, businesses, and other stakeholders. Dover-Foxcroft's Resident Alert System is a crucial tool for disseminating information and community engagement."

—ALSINA BRENENSTUHL,
DOVER-FOXCROFT COMMUNICATIONS DIRECTOR/
PROJECT MANAGER

wharves and waterfront buildings in the immediate aftermath of the January coastal storms. The Maine Coast Fishermen's Association, in cooperation with many organizations across the philanthropic community, also made small grants to fishing families and businesses for recovery activities. It is critical for activities by the NGO sector to be coordinated closely with the state Emergency Operations Center and the Maine Long-Term Recovery Board.

MEMA and the Board should proactively expand engagement, communications, and planning for these roles with philanthropic and nonprofit organizations (including corporate philanthropy) that are positioned to assist. Relationship building, education, and planning that improves the understanding of the mechanisms for assessing needs and distributing resources can produce a more comprehensive approach to disaster relief and recovery. These organizations know their communities well and can anticipate some of the needs in advance of a disaster. There may already be trusted relationships between the organizations and communities that can speed assistance to where it is needed. As relief operations transition to long-term recovery, opportunities for philanthropies include helping individuals and communities access state and federal funding for rebuilding and long-term resilience planning by communities and regions.

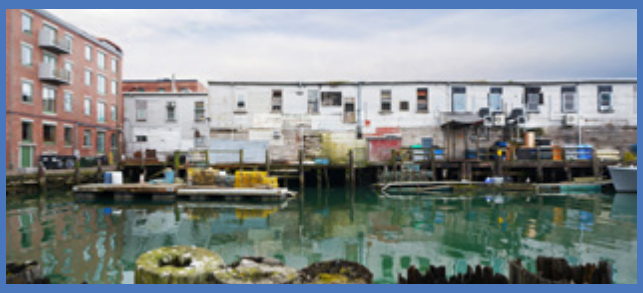
3. Expedite state permitting for post-disaster rebuilding.

- Create educational materials to raise awareness of permitting requirements and eligibility for expedited state permitting.
- Increase capacity at state agencies through temporary contracts to review permit applications during periods of high demand.
- Prioritize review of permit applications for disaster-recovery activities.
- Consider additional regulatory exemptions for emergency activities and streamlined permitting for recovery and rebuilding.

The urgency to rebuild hundreds of damaged buildings, facilities, and infrastructure can strain regulatory agencies that have a statutory responsibility to review activities taking place in or adjacent to protected natural resources. Agencies expended enormous effort after the December and January storms to review permit applications with speed and urgency but were limited by

Resilience in Action

The Island Institute and Maine Coast Fishermen's Association each quickly made small grants available for working waterfront businesses to stabilize damaged wharves and waterfront buildings in the immediate aftermath of the January coastal storms.



capacity. The Department of Environmental Protection (DEP), in coordination with other agencies, should create educational materials to raise awareness of permitting requirements as well as the types of disaster response and recovery activities that are exempt from permitting or eligible for an expedited permit-by-rule. This can help get answers to the public more quickly and ensure that applicants have the information they need to submit the right type of application.

Clean up, recovery, and rebuilding increases demand on government services for months following a disaster. When rebuilding activity is elevated and permit application volumes are high, DEP and other agencies could call upon third-party environmental consulting firms to assist with application review. Temporary surge capacity can reduce processing times for permit applications so that property owners can more quickly start rebuilding. During this time, agencies involved in the review process should continue to prioritize review of applications for post-disaster rebuilding projects and ensure these applications are reviewed before applications for other less urgent activities.

Lawmakers and DEP should consider additional activities that could be eligible for permit-by-rule or exemptions, while maintaining strong environmental safeguards. "Permit-by-rule" regulations identify activities taking place in or adjacent to wetlands and waterbodies that should not significantly affect the environment if carried out according to the standards contained in the regulations. Legislation in 2024 created new permitting flexibilities in the Natural Resources Protection Act (NRPA) to facilitate disaster response and recovery. The law allowed piers, wharves, and docks to be rebuilt higher over the water through permit-by-rule; exempted elevating a building foundation within its existing footprint from review; and created a new NRPA exemption for emergency flood alleviation activities conducted by the state or a municipality in a river, stream, or brook in certain limited circumstances. The NRPA also contains previously existing exemptions for repair of structures and reconstruction of roads, bridges, culverts, and other public works.

Following the December and January storms, the Department of Environmental Protection (DEP) prioritized the review of permit applications for rebuilding projects, including several working waterfront wharves and piers. Where appropriate, DEP encouraged permit applicants to make use of permit-by-rule and exemptions for rebuilding to avoid lengthy reviews. DEP's rules allow for the replacement of structures in protected natural resource areas through permit-by-rule. One of the requirements of permit-by-rule is that the timing of in-water work must be approved by the Department of Marine Resources (DMR). DMR provided blanket approval.

Foundation for Resilience

The next six areas of recommendations will expand Maine's capabilities and solidify the foundation for long-term resilience in the state. Many of these actions will require legislation, investment, and new capacity to initiate. As Maine experiences more damaging storms, these investments and capacities will be repaid many times over by lives saved, damage and rebuilding costs avoided, safer communities, and better-performing infrastructure.

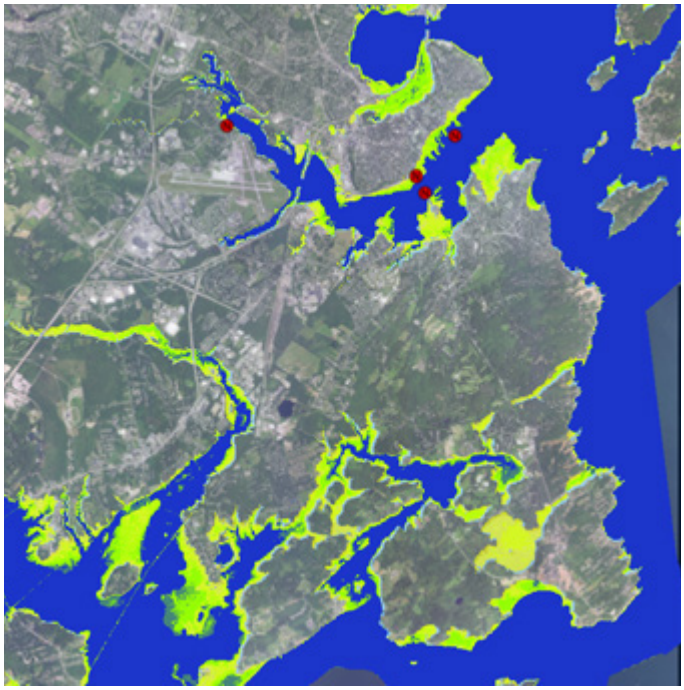
4. Improve data and information sharing to help leaders make informed decisions about risk.

- Launch an Online Disaster Data Service that centralizes existing regional and community-level hazard, risk, and vulnerability information.

- Establish a state-wide communication and public information program that informs local decision makers and residents about the risk from flooding and other hazards, providing guidance on how they can mitigate potential adverse impacts.

Reliable and accessible data is the foundation of risk management decisions. However, important data is often fragmented and siloed at various agencies and institutions across the state, lacking integration and analysis that could enable better decision making. Furthermore, under-resourced communities frequently lack the technical capacity to analyze existing data in ways that could advance their resilience goals.

An important early action is to make existing data more readily accessible to many types of users. An Online Disaster Data Service would gather, curate, store, analyze, and make critical datasets available to communities and users across the state. It should include much of the flood and natural hazard data discussed throughout this report, including the electricity outage and grid vulnerability maps referenced in Recommendation 8 and real-time coastal tide and river gauge data in Recommendation 10. The Online Service would assess community information needs and barriers, then develop easy-to-understand maps, visualizations, decision-support tools, and communication aids. The Online Service should also host user guides and step-by-step blueprints for utilizing the specific data to make assessments and decisions. The Online Service could be hosted and maintained by the Disaster and Risk Information Center described in Recommendation 10.



This interactive map available on the Maine Geological Survey's website allows users to see the approximate extent of innundation from several scenarios. These data are meant to help inform decisions at the local, regional, and state-level for storm surge and sea level rise using the Highest Astronomical Tide as the starting point. (Credit: Maine Geological Survey)

"It's a challenge to plan to assist communities in storm preparation and recovery when the flood maps and data are all out of date. Our newest map is from the 1980s."

—DARREN WOODS
AROOSTOOK COUNTY EMERGENCY MANAGEMENT AGENCY DIRECTOR

More readily available information enables more effective communication. One of the most important times to communicate flood and other hazard risks is during the real-estate transaction process. Maine's new flood disclosure law requires sellers to inform prospective buyers of certain flood risks. Existing online federal tools are cumbersome because they are not designed for real estate professionals. Developing an online tool that makes this information easy to find and transparent would benefit parties on both sides of the transaction. The tool can also help homeowners assess their needs for flood insurance and determine if improvements are needed to strengthen their home against damage (see Recommendation 6). An example of such an online tool is BuyersAware (www.buyersaware.com), which makes flood and fire risk information available and easy to understand for property owners in Texas.

5. Identify and strengthen critical vulnerable infrastructure.

- Expand tools and resources for communities and regions to assess vulnerabilities in community infrastructure, particularly culverts and stormwater assets, drinking water and wastewater systems, transportation, and other public and private facilities that are essential to local economies.

- Provide data and education for communities to establish "resiliency overlay districts" using the best available science and data to reduce risk in areas where additional protective measures are needed.

- Preserve working waterfronts by identifying and mapping the most vulnerable infrastructure and creating new policy options, funding, technical assistance, and programs to protect access and coastal livelihoods.

Community Resilience Partnership (CRP) staff tour the Blue Hill Wastewater Treatment plant in December 2022. The towns of Blue Hill and Brooksville partnered on a vulnerability assessment supported by the CRP to make their facility more resilient to climate impacts. (Credit: Allen Kratz)

The storms of the past two years have prompted the state and many communities to begin assessing the vulnerabilities of their public buildings and infrastructure. A basic assessment can inventory vulnerabilities based on local knowledge and past storm events. Uncovering vulnerabilities deeper within systems and understanding the risk of multiple "cascading" failures may require more effort and sophisticated methods than most communities can muster alone, so assistance is necessary. Community drinking water, wastewater, and stormwater infrastructure require special attention in these assessments, as they are critical to maintaining public health. The high cost and complexity of improving the resilience of these facilities necessitates longer timelines for planning, financing, and implementation. Assessments should include cellular and broadband communication infrastructure, which are critical to both emergency management and to restoring local economies quickly. Hospitals and rural health care facilities are also critical to emergency

State Spotlight: Texas

BuyersAware shows prospective home buyers and sellers in Texas flood and fire risks and provides information on how these risks can be mitigated. Users can simply enter a street address or click on a parcel and receive a graphic and statistical risk assessment for a selected property.

Portland and South Portland are developing a Coastal Flood Resilience Overlay Zone that will have higher standards for elevating new buildings above the 100-year flood level without having to completely revise existing development codes.

response and public health. Because these facilities may be the only urgent care provider for an entire region, their vulnerabilities should be well understood and mitigated.

The state should expand tools and resources for communities to assess vulnerabilities and encourage regional approaches to understanding and addressing disaster risks. These tools and resources should include information about how to integrate nature-based solutions into post-disaster rebuilding. The Community Resilience Partnership and Maine Coastal Program provide grants to communities for vulnerability assessments, and to service provider organizations for regional assessments. In addition to funding these projects, Maine should develop additional data products that help communities understand future risks, such as sea-level rise inundation maps, inland flood maps, and information about other hazards like wildfire and wind. The Maine Climate Council provides specific estimates for future sea level rise. Similar guidance for other hazards will help community planning and policies.

Once hazards and vulnerabilities have been determined, communities and regions can delineate high-risk areas with resiliency overlay districts using the best available science and data about future conditions. These districts can indicate where additional measures are needed to protect buildings and infrastructure against a higher risk of specific hazards, and where to consider not building or removing structures from high-risk areas. For example, Portland and South Portland are developing a Coastal Flood Resilience Overlay Zone that will have higher standards for elevating new buildings above the 100-year flood level without having to completely revise existing development codes. While overlay districts are commonly used to apply higher standards, they do not have to be regulatory in nature. Education and outreach should emphasize how overlay zones can be used to direct investments in critical infrastructure technical assistance, and incentives for building and developing in ways that reduce adverse impacts over the long term.

Maine's working waterfront infrastructure was heavily impacted by the two coastal storms in January 2024. In addition to storm vulnerabilities, much of this privately owned infrastructure faces growing pressure from competing uses. Maintaining access to the shorefront and infrastructure is critical to Maine's fishing and maritime economies. An inventory of working waterfront infrastructure and risks should consider natural hazards, impacts of climate change, and economic pressures as part of a process that identifies priority areas for preservation and resilience.

In addition to $25 million allocated through the state budget in 2024 for rebuilding damaged working waterfront facilities, two new grants to Maine from NOAA, totaling $16 million, will advance resilience and preservation activities for working waterfronts. These resources are an opportunity to strengthen strategies for increasing the resilience of working waterfronts and piloting models for protection and preservation. The state and others can support community conversations about potential benefits and drawbacks of alternative ownership models for working waterfront infrastructure. Communities and the state should collaborate on options to strengthen working waterfront infrastructure and protect access, considering strategies like development fees or impact fees on non-marine-dependent uses to fund improvements to critical working waterfront infrastructure; and public, private, and philanthropic rapid reaction options for preserving working waterfront properties when they are put up for sale.

"Towns are working to mitigate and adapt to storm impacts, but sometimes infrastructure is washed away after rebuilding. It is not a simple thing to relocate a causeway or road when there are homes on the other side and no alternative route."

—JAMES FISHER, DEER ISLE TOWN MANAGER

6. Assist communities to reduce risk and proactively prepare for disasters.

- Increase state and regional capacity to assist communities with flood and natural hazard risk reduction, prioritizing the smallest and most vulnerable to natural disasters.
- Help towns lower residential flood insurance premiums by assisting municipal participation in FEMA's Community Rating System.
- Establish a homeowners resilience program to provide grants to residents to strengthen their homes and properties against damage and loss from severe weather.
- Consider a statewide watershed flood planning program that incentivizes the adoption of regionally collaborative plans for reducing flood risk and impacts.
- Formalize networks and contracts for disaster recovery services (e.g., debris management, construction contractors).

The string of storms and floods during the past two years has made clear that Maine lacks the reserve capacity at all levels of government to navigate complex, widespread, and long-duration disaster recoveries and rebuild with long-term resilience in mind. Maine needs to build new human capacity that can flex between proactive risk mitigation and resilience activities during fair weather, and response and recovery activities in the aftermath of disasters. For example, most towns in Maine do not have a floodplain manager. In fair weather, these positions help communities identify flood risks and take action to reduce the threats. After a flood disaster, they can help organize damage information and navigate federal recovery programs.

The state should invest in additional staffing at MEMA and the Floodplain Management Program to help communities develop more robust hazard mitigation plans that consider climate impacts; implement

risk reduction strategies for flooding, fire, wind, and other hazards; and assist with the development of grant applications and sustainable funding strategies for local resilience priorities. Additional staff at MEMA would enable the state and communities to develop more competitive federal grant applications, draw more funding from federal programs like FEMA's Building Resilient Infrastructure and Communities grant, and leverage the new Safeguarding Tomorrow Revolving Loan Fund for large infrastructure projects. Additional staff at the Maine Floodplain Management Program can increase assistance to towns, helping them safely manage development in the floodplain, proactively reduce flood risks, and maximize participation in the National Flood Insurance Program.

Maine should also increase regional capacity to assist communities with hazard mitigation and long-term resilience projects, including additional staff at the county emergency management level and at the state's 10 Regional Councils. Maine's smallest and most vulnerable communities need expertise and assistance to plan, fund, and execute projects that reduce flood risks and other natural hazard risks to people and infrastructure. The state of Vermont provides free technical assistance to qualified flood-impacted communities through the state's regional planning commissions. Maine should explore funding floodplain manager positions or sponsor certification training for staff at each of the Regional Councils, perhaps through an initial pilot project with the philanthropic community. This regional capacity can be an efficient way to assist communities with local and regional flood risk reduction activities.

New state and regional capacity for flood and natural hazard mitigation can increase municipal participation in FEMA's Community Rating System, allowing towns to capture financial benefits for residents of risk reduction activities. The Community Rating System is an incentive-based program that guides communities to exceed the National Flood Insurance Program's minimum standards for flood risk management. By taking specific risk-reducing actions — including public communications, protecting open spaces and the natural functions of floodplains and wetlands, adopting higher flood protection standards and resilient building codes, and identifying repetitively flooded properties whose owners may want assistance with relocating — towns can reduce flood insurance premiums for residents by 5 to 45 percent. On average, towns that participate in the program experience 50 percent less loss per year than towns that do not participate. Currently, 15 towns in Maine participate in the program, representing just 26 percent of the flood insurance policies in force, so there is a substantial opportunity to save residents money and reduce risk as flood insurance rates rise nationally. An early step in the Community Rating System is adoption of the Maine Uniform Building and Energy Code (Recommendation 12 addresses building codes in more detail).

Maine should incentivize homeowners to protect their property from severe storms and other hazards. The state should consider establishing a program modeled on the successful "Strengthen Alabama Homes" program (www.strengthenalabamahomes.com) to provide grants to Maine residents to strengthen their homes

"In storm recovery, it's important to make sure businesses can operate in the short term and get equipment usable again. If there are future catastrophic storms, some working waterfront owners could feel that challenges such as expensive repairs are so insurmountable that they'll have to sell the place. Preservation of the working waterfront that's left is paramount to the town and state."

—TRAVIS FIFIELD, STONINGTON SELECTMAN AND BUSINESS OWNER

Some examples of potentially qualifying updates to homes to prepare for disasters include replacing windows, removing overhead branches, and grading for water rediretion to reduce erosion around home foundations.

against loss from weather events. Examples of projects eligible for program funding might include roof replacement, purchase and installation of storm windows or shutters, removal of tree branches overhanging an insured structure, re-grading to reduce flooding potential, and construction of retaining walls to redirect water flow or reduce erosion around a foundation. Homeowners who complete these types of projects might also be eligible for a reduction in their homeowner's insurance. Eligibility for the program should be targeted to insurable properties that are owner-occupied. Projects funded by the program should be completed in accordance with local permitting and inspection requirements, as well as national home resiliency standards established by the Insurance Institute for Business & Home Safety.

Maine should consider options for encouraging and incentivizing watershed planning. Floods and flood damage are increasingly occurring outside the 100-year floodplain as development and increasing rainfall shift how watersheds behave in extreme conditions. Because

watersheds can span multiple municipalities, regional planning supported by state agency collaboration can lead to more effective planning and implementation of flood risk reduction measures.

Vulnerability assessments may uncover very high-risk areas for coastal or riverine flooding, where stronger building codes and flood mitigation practices might be insufficient for protecting infrastructure and properties. Local leaders will need information, assistance, and resources to navigate difficult conversations with community members about where not to build in the future and about getting out of harm's way by relocating existing vulnerable infrastructure. Coastal towns such as Saco, Scarborough, and Cape Elizabeth have already grappled with choices about maintaining or removing frequently flooded or damaged roadways.

7. Maximize federal funding for disaster recovery and proactive resilience projects.

- Position Maine to maximize current and future federal funding to build capacity for storm risk reduction, including at the community level.
- Adopt an enhanced state Hazard Mitigation Plan to qualify for additional federal resilience funding.
- Increase assistance to communities to navigate complex federal grant programs.
- Take proactive steps to diversify, expedite, and maximize federal disaster relief and recovery funding.
- Help communities access federal recovery funding by adopting a suite of targeted incentives.

Maine should take steps to maximize federal funding for proactive planning, capacity building, hazard mitigation, and resilience projects. While Maine has successfully garnered several large federal grants for resilience (notably $69 million for the Resilient Maine initiative through NOAA's Climate Regional Resilience Challenge and more than $200 million from the Department of Energy's Grid Resilience and Innovation Partnerships Program), billions more are available from federal programs for locally and regionally critical projects in Maine.

Maine should develop and adopt an "enhanced" state Hazard Mitigation Plan in the next planning cycle. An enhanced plan will qualify Maine to receive five percentage points additional funding from FEMA's Hazard Mitigation Grant Program than with a standard plan. An enhanced plan demonstrates that the state is committed to long-term risk reduction ("mitigation") by going beyond minimum requirements, integrating hazard mitigation across government, and deploying state funding alongside federal for mitigation programs. Additional planning and mitigation staff capacity at MEMA is necessary to carry out this recommendation.

Maine should increase assistance to communities to develop resilience projects and apply for federal funding. Maine underutilizes federal competitive grant programs despite having a need to fund large and expensive infrastructure projects, often because communities do not have the capacity or expertise to navigate the complex application process. Maine is expanding grant assistance to communities by funding regional resilience coordinators at each of the 10 Regional Councils for five years as part of the recent NOAA grant award for

State Spotlight: Alabama

In 2011, the Alabama State Legislature established the Strengthen Alabama Homes program to help homeowners improve their homes to reduce property damages caused by hurricanes and windstorms, potentially qualifying the owner for homeowner insurance discounts. Funding for this program comes from the insurance industry in Alabama and is not funded from the state's general budget.

"In Saco, we have 10 storm events for every 1 that a FEMA disaster is declared."

— PATRICK FOX, FORMER SACO PUBLIC WORKS DIRECTOR

climate resilience. A permanent and more robust solution to regional assistance is needed.

Federal disaster relief and recovery funding comes in many forms, and a successful recovery hinges in part on maximizing the use of all available funding types. Maine should develop coordinated strategies to maximize and braid together multiple types of resources. To start, Maine should increase awareness among residents and communities of the various recovery programs and assist them to understand the application processes. Funding for recovery and rebuilding can come in the form of reimbursements to municipalities and households for certain disaster-related costs (FEMA's Public Assistance and Individual Assistance, respectively), insurance payouts to property owners for damages (National Flood Insurance Program), loans to businesses (Small Business Administration), and voluntary acquisition "buyouts" of properties at risk of repetitive flooding (75 percent FEMA plus 25 percent non-federal funds).

Next, Maine should reduce barriers to receiving FEMA recovery funding. Adopting FEMA's Consensus-Based Codes, Specifications, and Standards speeds the application process for federal Public Assistance funds. FEMA can make funding decisions more quickly when certain construction standards are known to be in use statewide. This helps all communities navigate bureaucracy and rebuild more quickly. Other barriers include availability of detailed information communities need to complete FEMA applications.

Third, increasing the state's contribution to FEMA's non-federal cost-share requirements can be an incentive for communities to adopt higher standards, such as Maine DOT's standards for roads, bridges, and culverts, or other proactive resilience measures. Currently, FEMA requires a 25 percent local match to qualify for federal disaster assistance. The state of Maine contributes 15 percent, leaving 10 percent for communities to pay. Using a graduated cost-share incentive based on community resilience standards can help both increase adoption of more protective policies and ease the financial burden on communities that have just experienced a disaster. In Vermont, for example, the state covers up to 17.5 percent of the cost-share for communities that adopt certain resilience policies but just 7.5 percent for communities that choose not to participate. Similar incentives could also be applied to leveraging federal funds for voluntary buyouts of properties at risk of repetitive flooding, allowing

State Spotlight: Vermont

The State of Vermont's Emergency Relief and Assistance Fund covers up to 17.5 percent of FEMA's non-federal cost share requirement for communities that adopt certain resilience policies and just 7.5 percent for communities that choose not to participate. At a special resilience meeting of the Maine Climate Coucil in January, Julie Moore, Secretary of the Vermont Agency of Natural Resources, explained, "In terms of Vermont's key tools and approaches, a big piece has been aligning state programs, funding, and incentives. This includes the Emergency Relief and Assistance Fund program that increases cost shares for municipalities who are taking the necessary steps to improve their infrastructure."
—Julie Moore, Secretary of the Vermont Agency of Natural Resources

residents to move to less flood-prone locations. A non-federal cost share of 25 percent is usually required in a FEMA-supported buyout. The towns of Canton and Van Buren have taken advantage of this FEMA program after storms several decades ago. A state contribution to the non-federal match requirement can encourage Maine communities to utilize the voluntary buyout option as a strategy to incrementally reduce damage in high flood risk areas over time.

8. Improve and protect energy infrastructure and increase energy resilience for customers.

- Collect and publish trend data on electricity outages and grid vulnerabilities. Engage residents, community leaders, and critical facility operators to understand vulnerabilities.

- Enable the adoption of clean-energy technologies, such as microgrids, that enhance storm resilience, especially for critical services and facilities that serve vulnerable populations.

- Address winter energy reliability, volatility, and cost concerns for electricity generation and delivery of fuels for home heating.

Electricity outages are one of the most common and disruptive storm impacts to people and businesses in Maine. As a rural and heavily forested state, two significant challenges for the electric grid are very long distribution circuits with relatively few customers and a high probability that trees and tree limbs will fall during wind or ice storms, knocking down utility lines. As Maine transitions toward a clean energy economy and electrifies more energy uses, making the grid more reliable and customers more energy resilient must be a priority. The recommended activities below build upon work already in progress by the Governor's Energy Office and in proceedings at the Maine Public Utilities Commission (PUC), including 10-year Climate Change Protection Plans that Maine's utilities are developing as required by law; Integrated Grid Plans to be developed by Maine's investor-owned utilities; and an inquiry by the PUC into improving resiliency and addressing rising storm costs.

The Governor's Energy Office, in coordination with state agencies and electric utilities, should collect data related to the frequency and duration of electricity outages and the electric grid's vulnerabilities to severe weather and climate impacts. Such information may be initially provided through the PUC's existing planning processes. Improving access to this data will buttress Recommendation 4 and aid state and local leaders to make informed decisions about risk. The state should develop a statewide critical facilities map that contains information about energy resilience characteristics at each site (such as the capacity of existing generators and backup battery storage, outage survivability requirements, and the populations served by the facilities). This map can form the basis for a community engagement initiative that helps emergency managers and utilities plan for disasters and facility operators to continue to improve the site's performance. Colorado's Critical Infrastructure and Facility Prioritization Process is an example of this inventory, prioritization, and outreach.

"Even though our town has done a lot of planning for storms, finding the time and money to handle the projects after a disaster is a huge challenge. Communications around recovery funding amounts and timelines were not clear. It wasn't represented with the initial visiting team that first came and what help we were told was available. We lost a lot of docks that many can't afford to build back."

—KATHLEEN BILLINGS
STONINGTON TOWN MANAGER

Maine should accelerate the adoption and deployment of clean energy technologies that can provide resilience to energy customers. In a state with some of the most frequent electricity outages, battery storage is a technology with significant benefits for energy resilience. Batteries that store enough energy for a few hours of use can help prevent some of the basic nuisances of power outages. Combining battery storage with on-site solar or wind generation can extend the resilience benefit substantially. Microgrid technology that employs on-site batteries and generation can help critical facilities like hospitals, shelters, warming and cooling centers, and emergency operations centers maintain a high level of functionality during extended power outages, improving safety and services for residents who might be at greater risk when the power goes out. The federally funded Maine Grid Resilience Grant Program provides implementation funding for eligible grid resilience activities, including microgrid deployment. In summer 2024, the Governor's Energy Office announced the first round of conditional awards under the program, including a community microgrid project. Best practices for the funding of electric grid infrastructure should be a continued focus, considering options that are both ratepayer-funded and not funded by ratepayers. Education about the benefits of community microgrids can expand interest and opportunities for deployment.

The state of Colorado's Microgrids for Resilience Program provides planning and construction grants for projects at critical facilities and community centers in vulnerable areas.

The state will continue to collaborate with the ISO New England grid operator to ensure reliable electricity generation during winter months. As long as the New England grid is reliant on natural gas for generating electricity, Maine will continue to be subject to volatile global natural gas markets that can adversely affect energy prices and availability. The availability of natural gas for electricity generation can fluctuate widely during the winter months when demand rises to heat homes. During especially cold periods, natural gas availability for generation can dip worryingly low. ISO New England views increasing solar deployment on the grid as a mitigating factor for this issue. Home heating fuels — oil, propane, and kerosene — face similar global and regional volatility issues, especially during extended periods of very cold weather and winter storms. Road closures due to culvert washouts or fallen trees can prevent fuel deliveries at critical times for residents. Multiple state agencies and fuel delivery companies are focused on this issue, including the Governor's Energy Office, MEMA, Maine DOT, and Efficiency Maine Trust.

> *"Currently, we have one generator to power three pump stations during a power outage. The equipment is used to pump down the downstream pump station, is moved to the next upstream pump station, and then to the next pump station, and then the process is reversed until power is restored. Our future resilient goal would be to have backup energy at each pump station."*
>
> —DAVID CYR, FRENCHVILLE TOWN MANAGER

9. Review state and local regulatory processes for opportunities to advance resilience and efficient post-disaster rebuilding.

- Balance environmental protections with expediency for disaster recovery and flexibility for building with resilience by expanding options for permit-by-rule.
- Develop and incentivize adoption of model ordinances that help communities protect the environment and reduce risks from flooding and other natural hazards.

Rendering of a 56 MW Form Energy energy storage system. Form Energy's planned project in Lincoln will be 85 MW. Credit: Form Energy

Environmental regulations are critical tools for protecting, preserving, and restoring natural resources and the environment in Maine. In a changing climate, these regulations play an important role in preserving natural functions of the environment that can reduce negative impacts from storms, floods, wildfire, and other hazards. There are some instances, however, where regulations or regulatory processes hamper efforts to engineer or rebuild with greater resilience. Environmental protection and resilience are goals that can and should reinforce one another with thoughtful approaches and application.

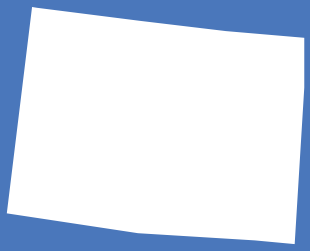
The Department of Environmental Protection should explore ways to evolve environmental regulation to integrate goals for resilience and, in emergencies, expedience for rebuilding. For example, being flexible

"Restrictive permit conditions may limit impacts of human activity on resources, but nature's effects are unconstrained. We have seen single storm events undo decades of well-intentioned regulatory restrictions. Time-of-year restrictions and limits on work can cause delays and drive up costs. A new, common-sense approach is needed to both strengthen and repair critical infrastructure."

—JACK PARKER
CHAIRMAN & CEO,
REED & REED, COMMISSION MEMBER

State Spotlight: Colorado

The State of Colorado's Microgrids for Resilience Program provides planning and construction grants for projects at critical facilities and community centers in vulnerable areas. Microgrid technology that employs on-site batteries and solar generation can help critical facilities like hospitals, shelters, and emergency operations centers maintain a high level of functionality during extended power outages.



with state agency-recommended in-stream work windows during disaster recovery periods could expedite rebuilding efforts. Agencies might also look for opportunities to increase the use of permit-by-rule in post-disaster situations to build or rebuild with greater resilience. They can create case studies highlighting designs and construction practices that are more likely to be approved when an individual permit is required. State and local governments might explore more flexible processes to update regulations as disaster science and building practices advance. Agencies might additionally consider whether standardizing designs or practices for post-disaster rebuilding of roadways and other infrastructure in environmentally sensitive areas, such as sand dunes, can reduce the need for permit review.

Developing or revising model ordinances to contain higher standards for resilience can help communities protect natural floodplain functions, prevent new development in the highest risk areas, and reduce flood risk in floodplains. Incentivizing adoption of model ordinances can speed acceptance and standardization of higher standards across the state without resorting to top-down regulation.

Damaged waterfront structures at the Stonington Co-Op show the force of storm surge on waterfront infrastructure.

Integrating Resilience for the Long Term

As foundational activities become established and move towards greater resilience, Maine must have long-term strategies, capabilities, and mechanisms to integrate disaster risk reduction more deeply into how decisions and investments are made. The past two years have shown that last century's thinking is not sufficient for this century's challenges. The recommendations below range from logical next steps to transformative ideas that can ensure Maine has the necessary resources and abilities to weather the coming decades.

10. Build long-term analytical capabilities for understanding and communicating about risk.

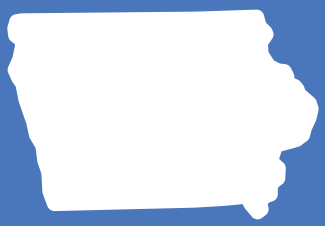
- Establish a statewide Disaster and Risk Information Center, which would inventory existing data sources, host and maintain the Disaster and Risk Information Center described in Recommendation 4, and identify critical data gaps and needs.
- Improve real-time access to water level monitoring and predictions by increasing the number of river and tide gauges.
- Develop products and tools based on coastal and inland flood risk models.
- Analyze flood insurance data to develop a more accurate assessment of flood risk and mitigation opportunities.

A USGS stream gauge along the Kennebec River in Hallowell is surrounded by flood water after heavy rains from the December 2023 storm.

The ability to gather, analyze, and disseminate information about risk is paramount to making informed policy and emergency decisions. Recommendation 4 identifies early actions that would better organize and share existing information. However, there are critical gaps in information about natural hazards, risk, and disasters in Maine. For example, many areas of the state, especially rural areas, are not covered by digital flood data and rely on decades-old paper maps. Potentially informative data from past disasters, such as the locations of road washouts, have not until recently been retained and may be valuable for historical analysis. Maine should develop sophisticated capabilities to collect, interpret, and communicate information about disasters and risks so that everyone, from individual households to the state Legislature, can make informed decisions.

State Spotlight: Iowa

The Iowa Flood Center is the nation's only academic research center devoted solely to flooding. The Center develops tools and reliable information to help community leaders, homeowners, and businesses make better flood-related decisions. The Center's work is accessible to everyone through the online Iowa Flood Information System, which communicates real-time information about stream levels, flood alerts and forecasts, and hydrologic conditions for the entire state.



Maine should establish a robust Disaster and Risk Information Center with a mission to provide high quality disaster risk information to diverse users and decision makers. The Center could be establishedin partnership with universities in Maine with staff to coordinate information gathering, analysis, and communication as well as research and education. The Center would collaborate with state agencies on activities such as maintaining hydrologic models, supporting community-based programs to improve flood monitoring and prediction, informing early warning systems, documenting and retaining information about disasters for future analysis, and assisting the development of a skilled workforce for research, floodplain management, and hazard strategies. Public engagement by the center should help residents and community leaders understand strategies for preparedness, mitigation, and resilience. Similar centers in other states include the Iowa Flood Center at the University of Iowa and the Institute for a Disaster Resilient Texas at Texas A&M University. The Center could be involved in the following recommendations.

One of the most valuable tools for local leaders and emergency managers during the storms in December and January were river and tide gauges that provided real-time water levels as floods approached. Maine should expand the network of river and tide gauges so that more communities have access to timely information about their rivers and coastlines during emergencies. Gauge data should be integrated with national data networks maintained by NOAA and the U.S. Geological Survey.

The Department of Transportation is currently developing a Coastal Flood Risk Model that will provide maps for sea-level rise scenarios and coastal storm flood risks. The resilience activities funded by the NOAA climate resilience grant Maine received in October 2024 will include assessing needs for inland flood mitigation tools, which may entail inland flood modeling analogous to the coastal model. The state should evaluate the pre-requisite data needs for an inland flooding model and develop easy-to-understand user guides, map products, and other tools that make the models accessible for many types of users. River corridor maps based on new models, for example, would identify high-risk areas and could be helpful to communities that have outdated flood insurance maps.

As part of its work through May 2025, the Commission will conduct an inventory of existing data sources in Maine and assess critical data gaps and needs. This will provide a preliminary summary of the long-term data gathering and analysis needs and how filling these gaps will enable better decision making and emergency preparedness. The Commission will also begin analysis of flood and insurance data to understand in greater detail where flooding and flood damage is occurring in Maine so that future risk education and reduction efforts can be targeted to high-risk areas. The Disaster and Risk Information Center can build upon and regularly update both the information needs assessment and the insurance analyses.

11. Develop funding and financing strategies for long-term resilience needs.

- Develop long-term funding options for improving the resilience of Maine's infrastructure, including drinking water, wastewater, and stormwater infrastructure.

State Spotlight: Rhode Island

The Rhode Island Infrastructure Bank is Rhode Island's central hub for financing infrastructure improvements, including climate resilience, for municipalities, businesses, and homeowners. The Infrastructure Bank leverages limited capital in a revolving fund to offer financing for an array of infrastructure-based projects including water and wastewater, roads and bridges, and energy efficiency and renewable energy.

"Even as one of the larger communities in the area, we don't have capacity to go after grants and all that is involved in finding, understanding, writing, and applying for grants. Capacity is a big concern with managers wearing too many hats."

—PENNY THOMPSON
CARIBOU CITY MANAGER

- Evaluate a statewide disaster insurance program for public infrastructure.
- Encourage philanthropy to support capacity-building, pilots, and community engagement for resiliency.

While Maine should maximize the use of existing state and federal funding for resilience projects (see Recommendation 7), there is an urgent need to develop long-term funding and financing strategies that sustain momentum and allow Maine to address complex and expensive infrastructure vulnerabilities. Drinking water, wastewater, and stormwater infrastructure, along with communications and broadband, are some of the most expensive systems to upgrade or relocate for climate resilience and would benefit from funding and financing strategies. The Maine Climate Council is recommending the state explore a "resilience bank" concept. This and other ideas should be part of a comprehensive funding and financing plan.

The climate resilience activities funded by the recent NOAA grant to Maine will include a comprehensive assessment of funding options for both planning and project implementation that leads to the development of a sustainable, long-term resilience financing strategy. The assessment should identify opportunities to 1) optimize existing state funding and programs, especially in ways that leverage larger federal funds; 2) suggest items that need a state budget strategy; and 3) propose new funding sources beyond the state budget. The process will include a feasibility study to explore policy, regulatory, and legislative options for execution of the strategy, including the potential for a centralized financing entity such as a resilience bank.

Maine should evaluate the feasibility of a statewide disaster insurance program for public infrastructure. Currently, public infrastructure like roads and water systems are not insured against damage. It is assumed that local, state, or federal governments will cover the costs of repairing storm and flood damage to public infrastructure. As storms increase in frequency and severity and damages mount, this assumption becomes more of a gamble. A study of a public insurance program for public infrastructure should test for financial feasibility under various assumptions about risks, revenue, payouts, coverage, and participation. It should address complex questions about the price of risk, how premiums might be collected and from whom, and identify underwriting standards, among other issues. A resilience bank and a disaster insurance program would be complementary and a study should identify the benefits of implementing both programs.

Philanthropy and the nonprofit sector should be a key part of long-term resilience building in Maine. There is a deep need for capacity building in rural communities

"Relying simply on economic good fortune to provide sufficient resources to respond to storms is not going to be enough. I think we're going to have to radically rethink how we fund all of this in the long term."

—CHARLIE COLGAN, CENTER FOR THE BLUE ECONOMY, MIDDLEBURY INSTITUTE OF INTERNATIONAL STUDIES AT MONTEREY AND PROFESSOR EMERITUS, UNIVERSITY OF SOUTHERN MAINE, COMMISSION MEMBER

A stream crossing on Route 2 near New Sharon was improved in 2023 and survived the flooding that December.

"About 10 years ago we decided to change our state culvert standards from a 25-year storm to a 100-year storm sizing. It was controversial at the time. However, today we can look back and say we have not lost a single culvert that has been upgraded to the new standards."

—JOYCE TAYLOR, MAINE DOT CHIEF ENGINEER

and regions and for education and community engagement in all parts of the state. Philanthropic entities with established relationships with community organizations are ideally placed to develop and tailor programming that meets local and regional needs for information, for dialogue, and for implementation. Pilot projects are one way that philanthropy can encourage innovation, test new approaches to engagement and capacity, and scale up successful models. Philanthropy also plays as an important role in land conservation, a role that can be expanded to include voluntary land acquisition for storm and flood risk reduction and habitat benefits.

12. Explore options for buildings and infrastructure to become more resilient.

- Review state building codes for opportunities to increase resilience and protect structures from storm and flood damage.
- Utilize FEMA grant funding for implementation of resilient building codes.
- Provide assistance and incentives for communities to adopt resilient building codes and standards.

Building codes are regulations used to establish minimum safety requirements for the construction of new buildings and retrofits to existing buildings. Building codes underpin how housing and other building types are designed and constructed. The Maine Uniform Building and Energy Code (MUBEC) applies to all towns in the state. MUBEC is composed of several sets of international codes, including the International Building Code (IBC) and the International Residential Code (IRC), that are in use in all 50 states. The IBC and IRC are updated every three years. Maine is currently two cycles behind the current standards, with an update to the 2021 version pending. Adopting the most recent codes will put the state and communities at an advantage for federal funding that prioritizes or rewards jurisdictions with newer codes.

Resilience in Action

The Maine Uniform Building and Energy Code (MUBEC) applies to all towns in the state. MUBEC is composed of several sets of international codes, including the International Building Code (IBC) and the International Residential Code (IRC), that are in use in use in all 50 states. The IBC and IRC are updated every three years. Maine is currently two cycles behind the current standards, with an update to the 2021 version pending. Adopting the most recent codes will put the state and communities at an advantage for federal funding that prioritizes or rewards jurisdictions with newer codes.

There are numerous examples around the country of homes or communities that were designed and built to the latest building codes that not only survived a significant natural disaster but were able to continue their intended function, helping the occupants or community quickly recover and remain resilient. A 2019 study by the National Institute of Building Sciences found that communities save $11 for every $1 invested in adopting the latest building codes. These cost savings come from lower property damage, reduced insurance premiums, and fewer emergency response incidents. Stronger building codes will also help communities score higher in the FEMA Community Rating System and reduce insurance premiums for residents (see Recommendation 6).

Maine should review the current building codes for opportunities to increase resilience. Features of the most recent building codes to improve flood resilience in high-risk areas include elevating the lowest occupied floor, electrical panels, and ductwork above the design flood elevation; designing and anchoring foundational elements to resist hydrodynamic pressures, debris impacts, buoyancy, and other loads; and

Resilience in Action: Van Buren

Courtesy of Van Buren

"With FEMA's assistance, homeowners in vulnerable areas volunteered to relocate to safer ground, and the properties were deeded to the town. These former residential lots are now being transformed into a resilient community space. By creating a public park with a community garden and walking path, we are not only revitalizing the area but also enhancing our town's ability to adapt to future challenges, promoting environmental sustainability, and fostering community cohesion."

—LUKE DYER
VAN BUREN TOWN MANAGER

preventing structures from being located in areas subject to high-velocity flows, ice jams, and flash flooding.

Maine should utilize federal funding to review building codes and implement strategies to encourage local adoption of higher standards. There are communities in Maine that recognize the value of higher standards and would benefit from assistance and incentives. FEMA's Building Codes Plus Up program offers every state up to $2 million to improve building codes to more effectively address increasing natural-hazard impacts, climate change, and resiliency. The funding may be used for adoption or implementation of codes that reduce risk, enhancing existing codes to incorporate higher standards, enforcement, and workforce training. Recruiting and training code enforcement officers will be important to successful implementation of building codes (as well as successful participation in the Community Rating System). Regional approaches to code enforcement may enhance cost effectiveness and present opportunities to link code compliance with floodplain management. The currently underutilized Third-Party Inspector program could improve compliance with codes in very rural parts of the state. The state Fire Marshal's Office is currently utilizing a FEMA grant to build capacity for local code enforcement to effectively enforce building codes with an emphasis on the current and anticipated effects of climate change.This project and ongoing energy code training for contractors and code enforcement officers can provide lessons for successful implementation. Maine should explore ways to utilize these and other federal programs to assist communities that are ready to adopt higher standards. For example, the state can assist communities to gather needed technical information or develop engineering designs to access FEMA funding for post-disaster sand dune restoration, helping to keep protective dunes between infrastructure and the ocean.

In July, Governor Mills toured Fisherman's Wharf in Portland with White House National Climate Advisor Ali Zaidi and NOAA Administrator Rick Spinrad, as well as U.S. Senator Angus King and Congresswoman Chellie Pingree. Governor Mills hosted a press conference with NOAA to announce the recipients of $575 million in highly competitive Climate Resilience Grant Challenge awards. These awards fund transformational climate initiatives nationwide, including a $69 million grant for Maine to strengthen and protect communities and working waterfronts.

IMPLEMENTATION

Several significant workstreams and planning processes advancing in parallel with the Commission's work are opportunities to increase the efficiency and impact of the report's recommendations.

State Activities and Collaboration

In July 2024, NOAA announced that Maine had won a $69 million climate resilience grant through NOAA's highly competitive Climate Resilience Regional Challenge. The goal of this initiative is to protect Maine's communities, environment, and working waterfronts from extreme storms, flooding, and rising sea levels.

The state will use the grant funding to accelerate and expand climate action by working with communities to take strong, pragmatic steps to address vulnerabilities, protect people, and ensure critical infrastructure is prepared for future impacts. Focus areas of the grant include:

- Expanding resources to communities through the Community Resilience Partnership, which now works with over 220 towns, cities, and Tribal governments to increase planning and projects to address climate effects, based on priorities identified by local leaders and residents.
- Making investments in critical infrastructure projects through the Maine Infrastructure Adaptation Fund, the state's primary program funding and implementing significant construction projects to address serious climate vulnerabilities.
- Expanding ongoing efforts to preserve and protect vital working waterfronts and businesses, and accelerate efforts to protect vulnerable coastal and inland ecosystems through nature-based solutions, flood modeling, and community support.
- Establishing a resilience office within state government, dedicated to leading cross-agency efforts to enhance climate resilience across the state, especially in communities with significant climate vulnerabilities impacting residents, infrastructure, and the environment.

The NOAA-funded state Resilience Office will be created in the Maine Office of Community Affairs which was recently established to partner with Maine communities to strengthen planning and implementation at the local level.

The Maine Office of Community Affairs will serve as a one-stop shop within state government to provide coordinated and efficient planning, assistance, and financial resources to towns, cities, Tribal governments, and regional entities, which will help them better plan for common challenges, pursue solutions, and create stronger, more resilient communities. An early project for the Office will be developing a single grant portal for communities to access multiple state grant programs. Programs involving land use, housing and floodplain planning, as well as building codes, coastal management, and some climate resilience funding and programs, will be reorganized into the new Office starting in July 2025. This includes:

- Community Resilience Partnership, currently in the Governor's Office of Policy Innovation and the Future
- Maine Coastal Program, currently in the Department of Marine Resources
- Maine Floodplain Program, currently in the Department of Agriculture, Conservation and Forestry
- Municipal Planning Assistance Program, currently in the Department of Agriculture, Conservation and Forestry
- Housing Opportunity Program, currently in the Department of Economic and Community Development
- Maine Uniform Building and Energy Code/Code Enforcement, currently in the Office of State Fire Marshal

- Volunteer Maine, an independent state office currently connected to the Department of Education that leads to a stronger Maine through volunteerism.

At a time when substantial federal funding is available to help communities address long-term challenges like climate resilience, the Maine Office of Community Affairs will help to unlock these opportunities, especially for the smallest and most under-resourced communities, through the delivery of robust planning and technical assistance, coordination of resources across agencies, and ensuring that the state's interactions with communities are consistent.

Other state programs that provide relevant services to communities will remain in other agencies, with the Maine Office of Community Affairs ensuring increased coordination across agencies and program staff.

By December 1, 2024, the Maine Climate Council will deliver the update to the state's climate action plan, *Maine Won't Wait*. The Maine Climate Council, an assembly of scientists, industry leaders, bipartisan local and state officials, and engaged residents, was created to develop the state's climate action plan, including strategies to address the impacts of climate change on Maine, build resiliency to climate effects, and meet state statutory targets to reduce greenhouse gas emissions. The original four-year plan, *Maine Won't Wait*, was delivered to Governor Mills in 2020. The plan made recommendations to better prepare Maine communities and people to withstand accelerating climate change impacts, especially the most vulnerable people and communities, including increasing assistance and funding for community resilience and investing in climate-ready infrastructure. The plan highlights the importance of equity

The late Bill Kitchen, Machias Town Manager, describes the extent of flooding along Route 1 in Machias during the January 2024 storm, when wind-driven waves and storm surge caused water to flow over the Machias dike, damaging the structure and flooding adjacent downtown areas of Machias.

in new programs and the allocation of resources, and addresses Maine's unique challenges as a highly rural state, with thousands of miles of coastline, and the oldest population by median age in the country.

The draft recommendations currently under consideration by the Maine Climate Council for the 2024 climate action plan update continue to emphasize the importance of increasing resilience to climate impacts, with strategies that include increasing local capacity for climate resilience with grants, tools, and technical assistance; enhancing the state's ability to prepare for and recover from natural disasters by increasing capacity for disaster planning and management at state, county, and local levels; expanding access to funding and financing for climate adaptation and emissions reduction; helping Maine people prepare their homes and businesses for climate changes; protecting critical working waterfront infrastructure; and strengthening public health monitoring, education, and prevention including the mental health impacts of extreme storm events and other climate change effects.

The Community Resilience Partnership, a recommendation of the 2020 *Maine Won't Wait*, provides grants and technical assistance to Maine communities to help them identify and address local priorities to reduce greenhouse gas emissions, transition to clean energy, and become more resilient to climate effects such as extreme storms, flooding, rising sea levels, and threats to public health. The Partnership was launched in December 2021 with an initial goal of assisting 100 communities in its first year. Today, more than 220 communities are participating in the Partnership, and the program has awarded nearly $11 million in grants for resilience and clean-energy initiatives in communities across the state.

Tracking Implementation Progress

Clear and concise metrics, informed by diligent data collection and publicly communicated at regular intervals, are essential for measuring the state's progress against the goals set out in this report. The metrics detailed in this section measure the extent to which the Commission's recommended interventions increase infrastructure resiliency, augment state and local emergency management capacity, and contribute to equitable and effective recovery from emergency events.

These metrics fall into three categories: Lowering Barriers to Aid Following an Emergency Event; Timely and Equitable Distribution of Financial and Technical Assistance; and Increased Resilience Towards Future Emergencies.

Lowering Barriers to Aid Following an Emergency Event

The Commission is recommending a wide range of actions meant to increase capacity at MEMA and ease permitting restrictions in the immediate aftermath of emergencies. The below metrics can help determine whether these actions have meaningfully decreased the barriers to recovery:

- Average time to process applications for state and federal recovery funding
- Average time to process permitting applications for resiliency and rebuilding projects
- Number of communities reached by emergency communications tools

Timely and Equitable Distribution of Financial and Technical Assistance

Emergencies impact different communities in different ways, and they can require varying levels of assistance. The Commission's recommendations prioritize timely and equitable distribution of financial and technical assistance in the wake of these emergency events. Distribution measurements should account for geography, type of impacted entity, and existing readiness levels.

- Geographic distribution of state and federal rebuilding funds
- Access to state and federal vulnerability assessment tools to provide communities with insights about their most significant risk areas

Increased Resilience Towards Future Emergencies

Maine people and communities can act now to better prepare for more frequent and worsening weather events in the future. Progress towards the metrics below will lessen the impact of future emergencies; strengthen Maine's infrastructure; and provide financial assistance for municipalities, businesses, and residents.

- Participation in FEMA's Community Rating System and the National Flood Insurance Program
- State and federal recovery dollars requested following emergency events
- Federal hazard mitigation dollars secured by MEMA
- Adoption of an enhanced state Hazard Mitigation Plan
- Adoption of latest IBC and IRC building codes by municipalities

Continued collaboration among state agencies, philanthropic organizations, and municipal governments can help provide the data necessary to measure progress against the metrics listed above. In turn, the Commission will make use of existing communications channels to publicize the state's progress, including the established outreach arms of the Maine Climate Council and the Governor's Infrastructure Implementation Committee, both of which are coordinated by the Governor's Office of Policy Innovation and the Future. In addition, any progress achieved against these metrics will be reflected in the Commission's final report in May 2025.

Fire Chief John Gilboy describes the storm impacts of the January 2024 storms experienced in Old Orchard Beach. The sand dunes and adjacent infrastructure experienced severe damage from flooding and storm surge, including the loss of approximately five feet of sand on the beach (exposing ledge and old stormwater pipe infrastructure), and damage to structures behind dunes. The impacts to the beach led to a change in rip currents which endanger beachgoers, and a loss in habitat and decreased nesting for piping plovers.

THE COMMISSION'S PROCESS

The Commission is co-chaired by Dan Tishman and Linda Nelson, and includes 24 individuals, including state and local officials; representatives of affected communities, businesses, and industries; and experts in infrastructure, construction, engineering, electrical utilities, floodplain management, financing, philanthropy, emergency response, and climate science. Staff from the Governor's Office of Policy Innovation and the Future and MEMA provide policy and technical support, while a consulting team provides analytical services, strategy research, and expertise in disaster resilience practices.

The Commission held five community listening sessions and seven meetings between May and October 2024. The listening sessions allowed the Commission members to learn directly from town leaders, municipal and county emergency managers, and impacted residents and businesses. The Commission's official meetings, held both virtually and in person, engaged experts from other states, including Vermont, Texas, and Colorado, and leveraged the expertise of each member.

Community Listening Sessions

The Resilience Commission held listening sessions throughout Maine to hear about storm impacts and recovery efforts from local leaders, emergency responders, and municipal staff. Visits included Stonington in Hancock County; Old Orchard Beach and Saco in York County; Rumford and Mexico in Oxford County; Jay in Franklin County; Machias in Washington County; and Caribou in Aroostook County.

During visits to Maine's coastal counties, Commission members toured areas impacted heavily during the January 2024 storms. These storms impacted much of Maine's diverse coastline, ranging from severe sand dune erosion in southern Maine's low-lying coastal areas to flooding and wave damage in Midcoast and Downeast Maine's rocky harbors and shorefronts. During visits to Maine's inland counties, Commission members toured areas heavily impacted by the June 2023 and December 2023 storms. Community

In July 2024, the Commission met with local leaders from the Towns of Rumford, Mexico, and Jay, and emergency managers from Oxford County Emergency Management Agency to discuss impacts from storms over the past two years and subsequent recovery and rebuilding efforts. Community leaders highlighted the need for administrative support for documenting damages during the FEMA insurance reimbursement process, as well as planning and engineering technical assistance for rebuilding with resilience.

leaders in Franklin, Oxford, and Aroostook counties spoke of heavy rain and fast-rising water levels that stranded people, washed out roads, closed businesses, and damaged homes and neighborhoods.

Each listening session and site visit provided Commission members with local examples of the challenges communities face as they recover from storm damages and prepare for future storms.

Stonington Listening Session

Stonington, located in Hancock County, is one of the most productive working waterfronts in Maine. Stonington and neighboring Deer Isle experienced significant impacts from the January 2024 storms, including extreme flooding that closed and damaged many public roads and storm surge that severely damaged public and private working waterfront infrastructure. The Deer Isle Causeway, the sole access to Deer Isle and Stonington, was overtopped and impassable during much of the storms' duration. The Commission's site visit to Stonington included the Governor's signing of the Executive Order to Establish the Commission on Infrastructure Rebuilding and Resilience, a tour of storm impacts and rebuilding efforts, and a listening session with local leaders.

Old Orchard Beach and Saco Listening Session

In York County, the increasing frequency and severity of coastal storm events represent a major threat to area visitors, jobs, and wages. The back-to-back January 2024 storms brought hazards including snow, rain, wind, flooding, storm surge, and power outages to York County. In the aftermath of the January storms, county officials have mobilized to address the impacts of these storms but face significant bureaucratic, financial, and logistical challenges.

The Commission visited Camp Ellis in Saco, a residential beach community at the mouth of the Saco River. A mile-long jetty constructed by the Army Corps of Engineers in the 1870s was intended to keep the river mouth navigable by preventing sedimentation. Instead, the jetty deprives the adjacent beach of its source of sand and concentrates wave energy on the beach dune during storms. The beach is now almost entirely eroded, leaving little natural defense for the community and infrastructure at Camp Ellis.

Rumford, Mexico, and Jay Listening Session

The Commission visited Rumford, Mexico, and Jay to meet with local leaders and view areas impacted by multiple flooding events in 2023. The towns of Rumford and Mexico are located along the Androscoggin River in Oxford County. Like numerous towns in western Maine, Rumford and Mexico experienced severe flooding impacts during the December 2023 storm that dropped approximately 7 inches of rain on the region and caused the Androscoggin River and adjacent tributaries to overtop roads, flood houses, wash out culverts, and cause extensive damage. The town of Jay is located along the Androscoggin River in Franklin County and experienced washouts during numerous 2023 storms, including in May, June, and December.

Rockland Site Tour

The Commission visited Rockland for a tour of waterfront infrastructure that sustained damage during the January storms. Rockland's multi-use piers and related facilities serve commercial and recreational vessels, are home to various marine businesses, and enable transportation and emergency services for island

communities. Adjacent landside parks host three major festivals each year that bring thousands of visitors to the region. The city has undertaken extensive resiliency planning in recent years to guide improvements to waterfront facilities, park spaces, and adjacent infrastructure. The plans include "flexible resilience" that prepares for sea levels 2.7 feet higher than today and allows for additional adaptive measures in the future without requiring a full rebuild of the facilities. The city has secured state and federal funding for some phases of construction and is in need of additional funding to fully implement the plans.

Machias Listening Session

The Commission visited Machias to meet with local leaders, view areas impacted by recent flooding, and learn about climate resiliency measures the Town is pursuing. Machias is the county seat of Washington County and serves as a key service center for the region. Machias has a highly vulnerable downtown waterfront with a complex environment of natural and manmade features. Three major freshwater rivers enter Machias Bay — the Machias River, the Middle River, and the East Machias River — and the Bay's natural tidal funneling effect causes high vertical tidal range. In addition, the bowl-shaped geography of downtown Machias causes high stormwater flow into the downtown during precipitation events, stressing the aging stormwater infrastructure and further exacerbating tidal and freshwater flooding.

U.S. Highway Route 1, which cuts through downtown Machias and serves as a major road artery in the region, passes over the Machias Dike. The Machias Dike and causeway is an embankment structure with multiple box culverts, timber and stone masonry, earthen fill, and tidal flap gates. The dike crosses the Middle River where the river joins the tidal portion of the Machias River. The dike is severely deteriorated from a transportation infrastructure standpoint and restricts tidal flow and fish passage to the upstream tidal marsh of the Middle River. During storm events, including the recent January 2024 storms, prevailing winds out of the south and southeast push water and waves directly at the dike, and storm surge causes water to flow over the dike and causes further deterioration, as well as flooding adjacent downtown areas of Machias. Recent storms have also damaged the Down East Sunrise Trail, a popular multi-use corridor connecting eastern Maine that passes through Machias and serves as an economic lifeline for the town.

Caribou Listening Session

The Commission conducted a hybrid virtual and in-person listening session in Caribou in Aroostook County to hear from regional and local leaders and emergency managers about storm events experienced in the last few years, resilience planning, and regional needs. Aroostook County flood maps are out of date, making it challenging to assist communities in resilience planning for floods. Local leaders noted several challenges specific to Aroostook County's northern location. For example, fuel is typically delivered to the county from southern Maine. Poor weather and storm events can cause delays in fuel reaching northern towns. The electrical system in the region is antiquated, and mitigating potential long-term power outages is a resilience focus area for the county. Managing an extended outage includes addressing access to resources such as food and fuel, as well as systems such as communications, work, and banking.

Commission Meetings

Between July and September 2024, the Commission convened regularly to hear perspectives from local leaders and state experts on Maine's current approach to response, recovery, and rebuilding from extreme storms, and considerations of how to improve the state's approach moving forward. The Commission also heard from other states — including Texas, Vermont, and Colorado — on lessons learned in flood and disaster response and infrastructure resiliency. During October and November 2024, the Commission reviewed and refined recommendations and determined priority areas.

Expert presentations and key discussions included the following:

- **2023-2024 Storms and Climate Connections, Sea-Level Rise:** A presentation on the 2023-2024 Storm Science and Climate Connections from the Maine Geological Survey and University of Maine highlighted recent climactic trends in Maine. Maine's climate is getting warmer and wetter with more extremes, and sea-level rise has been increasing (from 0.8 inches per decade on a long-term scale, to about 2.0 inches per decade since 2002). Mean sea levels set numerous records in 2023, and this trend is continuing in 2024. The storms on January 10 and January 13, 2024 set records along Maine's coastline due to coinciding storm surge, tide level fluctuations, and sea-level rise.

- **Storm Preparation, Response, and Delivery:** The Maine Emergency Management Agency (MEMA) provided background on their role coordinating support across all phases of emergency management mitigation, preparedness, response, and recovery.

- **Lessons learned from the Rebuild Texas Commission:** Dr. Sam Brody, Director of the Institute for a Disaster Resilient Texas at Texas A&M University, provided an overview of the Texas "Eye of the Storm" report developed following Hurricane Harvey. The report provided a flood mitigation framework centered around four components: Avoid, Accommodate, Resist, and Communicate.

- **Lessons from Vermont: Policy actions taken after Tropical Storm Irene:** Vermont experienced major flooding in 2011 and again in 2023. Julie Moore, Vermont's Secretary of Natural Resources, shared key tools and approaches Vermont has implemented over the past few years to increase the state's flood resilience, including establishing a Municipal Technical Assistance Program, an Emergency Relief Assistance Fund, and a Flood Resilient Communities Fund. Based on lessons from Vermont, Commission members discussed emerging recommendations, such as exploring state codes and standards to help expedite the post-disaster FEMA reimbursement process and rebuilding process, bolstering the state's municipal technical assistance programs, leveraging regionalism and partnerships as vehicles to scale solutions, reducing barriers to funding opportunities, and statewide insurance mechanisms. The Commission discussed the need to better understand changes in risk; ways of evaluating costs and risks when making decisions; and available information, modeling, and digital tools related to flood risk (for example, climate-informed floodplain modeling).

- **Working Waterfront Overview & Perspectives on Working Waterfront Resilience:** The Department of Marine Resources provided an overview of the status of working waterfront infrastructure in Maine and existing programs in the state that support and protect working waterfronts. Much of Maine's working waterfront infrastructure experienced severe storm damage in the January 2024 storms. In addition, working waterfront infrastructure faces pressure from competing uses, redevelopment, and disrepair. A panel on perspectives on working waterfront allowed the Commission to hear about challenges facing the waterfront construction and engineering industry, and barriers faced by municipalities to address working waterfront resiliency in their communities.

- **Managing the Unavoidable:** Capacity and Planning, Permitting, and Paying for Resilient Infrastructure: The Maine Climate Council's Community Resilience Working Group provided an overview of their recommendations to assist communities in understanding their exposure to climate threats and taking proactive steps to become more resilient. MEMA provided an overview of capacity challenges within their agency, detailing the limited capacity among staff to take on additional resiliency planning responsibilities (exacerbated by multiple federal disaster recovery processes). The Department of Environmental Protection (DEP) provided an overview of permitting processes, proposed legislation, and the need for customer support capacity to field calls, complete site visits, and suggest the level of permitting necessary for projects. The Maine Bureau of Insurance provided an overview of flood insurance programs and relatively low participation in Maine and offered considerations for improvement.

- **State of Maine Energy Landscape & Electric Utility Resilience:** The Maine Governor's Energy Office gave an overview of the energy challenges in Maine and several potential recommendations for consideration, including expanding baseline assessments of outages and grid vulnerabilities, adopting clean-energy technologies, exploring innovative solutions, engaging regionally to advance cost-effective reliability systems, and planning for challenges in volatile fuels that impact home heating. The Maine Public Utilities Commission gave an overview of grid planning, climate resilience planning, and addressing storm damage costs. The Commission also heard from Maine's two investor-owned electric utilities, Central Maine Power and Versant Power, about storm impacts, recovery, and long-term resiliency efforts.

- **Lessons from Colorado:** Colorado Grid Resilience Strategy & Funding: The Commission heard from the Colorado Energy Office and Colorado Resilience Office about Colorado's approaches to grid resilience, microgrid grant program, and cooperation with utilities and communities.

- **Water-Related Systems and Infrastructure:** The Commission heard from state leaders on Maine's drinking water, wastewater, and stormwater infrastructure to inform their understanding of resilience upgrade needs. The Maine Center for Disease Control & Prevention highlighted the vulnerability of public water sources to climate impacts, such as drought, saltwater intrusion, flooding of public wellheads, power outages, and pollutant runoff. Maine DEP highlighted vulnerabilities of wastewater facilities. Many wastewater infrastructure plants are located in vulnerable places: they are low lying, gravity fed, and/or adjacent to surface waters. Facilities include piping, mechanical systems, and electronic equipment, none of which are meant to be submerged by floodwaters. Furthermore, climate change is an additional burden and cost; according to the most recent Environmental Protection Agency (EPA) Clean Watersheds Needs Survey, Maine will need to spend over $2 billion to meet wastewater needs, up from $1 billion just 10 years prior. Finally, the Commission also discussed vulnerabilities within the stormwater system, including aging infrastructure, more frequent flooding and lack of comprehensive information across the state.

Aerial views show the progress of the $50 million Water Resource Recovery Facility Upgrade project in Saco. The project consists of a new treatment building with aerobic granular sludge treatment processes, secondary filtration, and UV disinfection with upgraded grit removal and solids handling, as well as the conversion of existing clarifiers for additional stormwater storage and site grading alterations to mitigate tidal flooding from the adjacent Saco River.

Next Steps

This interim report reflects the Commission's initial learning and recommendations to date. The Commission will release a final report by May 15, 2025, building upon the interim recommendations. In the months ahead, the Commission will gain additional insights from a robust data analysis of flood risk in Maine, research into federal funding opportunities, additional expert presentations, and engagement with communities, businesses, and residents.

Analysis and Research

The Commission secured the services of a consulting team consisting of Dr. Samuel Brody and Dr. Wes Highfield, both of Texas A&M University, and Basilia Yao of Matter + Form Consulting. The team's members supported commissions in Texas following Hurricane Harvey and in New York City following Superstorm Sandy. Among several specialties and services, the team is analyzing data related to flood risk and recovery funding in Maine.

Analyses are ongoing using OpenFEMA datasets to evaluate funding disbursed in the aftermath of disasters, with a focus on understanding the distribution of federal assistance. These analyses involve tracking the allocation of disaster relief funds across counties and over time. Datasets that include FEMA Public Assistance, Individual Assistance, hazard mitigation grants, and National Flood Insurance Program claims.

A data gap analysis is also in progress, including an assessment of existing datasets, their applications, and appropriateness for inclusion in analyses that address flood risk and mitigation. The analysis includes data held by the state and existing open federal sources.

Proposed analyses in the coming months will provide a more detailed picture of flood risks in Maine and catalog the many federal funding programs that the state should consider to reduce those risks. The planned work includes:

- Evaluating flood risks, storm surge threats, and vulnerabilities using a range of data and methodologies. The analyses will evaluate risk status based on factors such as floodplain map ages, storm surge risk to both structures and populations, and LiDAR data to determine the readiness of high-resolution elevation models.
- Assessing the social vulnerability of communities using standardized measures, including Maine's social vulnerability data and health-based measures from the Behavioral Risk Factor Surveillance System (BRFSS). Additionally, risks from natural-technical hazards (NATECH) will be evaluated based on federal Toxic Release Inventory (TRI) and EPA Superfund locations.
- Evaluating flood risks that may exist outside of officially delineated floodplains, particularly focusing on High-Water Marks and areas with National Flood Insurance claims and policies in X-zones.
- Cataloging agricultural losses from past floods, with cross-references to recovery grants funded by the U.S. Department of Agriculture.
- Assessing the distribution of existing flood insurance policies, the status of structures in high-risk zones, and the state of Pre-FIRM claims, second home claims, and Repetitive Loss/Severe Repetitive Loss properties.
- Providing links to potential funding opportunities, particularly in relation to projects and needs identified in Maine's state Hazard Mitigation Plan.

The analyses will also propose conceptual methodologies for generating future mapping resources, including delineating hazard overlay districts and watershed planning districts that can be used to inform future growth and development while reducing flood risks.

COMMISSION MEMBERS

A representative with expertise in hazard mitigation:

Sam Roy, Supervisory Physical Scientist, United States Geological Survey

A leader from Maine's philanthropic sector:

Deborah Ellwood, President, Maine Community Foundation

An expert in climate science and related storm events:

Peter Slovinsky, Marine Geologist, Maine Geological Survey

A representative with expertise in infrastructure finance and planning:

Charlie Colgan, Center for the Blue Economy, Middlebury Institute of International Studies at Monterey, and Professor Emeritus, University of Southern Maine.

A representative with expertise in insurance:

Robert Carey, Superintendent, Maine Bureau of Insurance

A representative of populations facing disproportionate impacts from storm events:

Noël Bonam, State Director, AARP Maine

A representative of an electrical utility:

Joseph Purington, President & CEO, Central Maine Power

Representatives from the construction industry:

Dan Tishman (Co-Chair), Principal and Chairman, Tishman Realty & Construction

Jack Parker, Chairman & CEO, Reed & Reed

A representative of the engineering industry:

Lissa Robinson, Senior Civil Engineer and Hydrogeologist, GEI Consultants

Representatives from impacted industries:

Curt Brown, Marine Biologist, Ready Seafood; Lobsterman; Co-Chair, Coastal and Marine Working Group, Maine Climate Council

Jim Murton, Owner, North Country Rivers; Registered Maine Guide

Two representatives from municipal government:

Shiloh LaFreniere, Town Manager, Town of Jay

Linda Nelson (Co-Chair), Director of Economic and Community Development, Town of Stonington

A representative from a regional council or county government:

Emily Rabbe, Lincoln County Regional Planning Commission

Members from state agencies

Bruce Van Note, Commissioner, Maine Department of Transportation

Patrick Keliher, Commissioner, Maine Department of Marine Resources

Heather Johnson, Commissioner, Maine Department of Economic and Community Development

Amanda Beal, Commissioner, Department of Agriculture, Conservation and Forestry (designee: Judy East, Director, Bureau of Resource Information and Land Use Planning)

Melanie Loyzim, Commissioner, Maine Department of Environmental Protection

Dr. Puthiery Va, Director, Maine Center for Disease Control and Prevention

Peter Rogers, Director, Maine Emergency Management Agency

Hannah Pingree, Director, Governor's Office of Policy Innovation and the Future

Dan Burgess, Director, Governor's Energy Office

EXECUTIVE ORDER 8

An Order Establishing the Maine Infrastructure Rebuilding and Resilience Commission

FY 23/24

WHEREAS, Maine communities endured severe damage from record-breaking riverine flooding, coastal storm surge, and high winds during three extreme storm events striking in rapid succession between December 18, 2023 and January 13, 2024;

WHEREAS, communities suffered more than $90 million in damage to public infrastructure as a result of these storms and millions of dollars more in damage to private property, businesses, and homes, demanding public investment to help restore a broad range of infrastructure that is critical to local communities and the state's economy;

WHEREAS, Maine has requested eight presidential disaster declarations for severe weather events in the past two years, far more than the preceding decade, challenging the state's emergency management systems and response capabilities;

WHEREAS, preexisting concerns such as increasing real estate valuations, the shortage of affordable housing, and diminishing working waterfront infrastructure combine to create policy and fiscal challenges for Maine's communities and economy;

WHEREAS, recovery and rebuilding resources will continue to be needed as extreme storms, inland and coastal flooding, and other natural hazards are projected to increase in frequency and severity as the climate warms;

WHEREAS, the Governor introduced, and the Legislature has now passed legislation to appropriate $60 million to the Maine Infrastructure Adaptation Fund, Working Waterfront Resilience Grant Program, and Business Recovery and Resilience Fund for grants to communities, businesses, and other entities to repair, rebuild, and adapt infrastructure to support public safety, protect essential community and economic assets, and ensure long-term resilience to increasingly severe weather;

WHEREAS, Maine has an opportunity to learn lessons for improving response and disaster recovery and long-term resilience from the Maine Emergency Management Agency's Disaster Recovery Team and from other states affected by catastrophic flooding and coastal storms; and

WHEREAS, philanthropy, private capital, and local, state, and federal government entities can collaboratively support and reinforce long-term rebuilding and resilience strategies that leave communities with less risk and better prepared for the next disaster.

NOW THEREFORE, I, Janet T. Mills, Governor of the state of Maine, pursuant to authority conferred by Me. Const. Art. V, Pt. 1, §§ 1 & 12, do hereby Order the following:

I. Commission Established; Purpose

A. The Maine Infrastructure Rebuilding and Resilience Commission ("Commission") is hereby established;

B. The purpose of the Commission is to advance and support the state's approach to response, recovery, and rebuilding related to the disasters of the preceding eighteen months, and provide analysis, lessons and strategies from this recovery period, and make a report and recommendations to:

1. Ensure that Maine is maximizing the use of all federal, state, municipal and private funding resources available for storm recovery and rebuilding and effectively deploying those funds alongside state resources;

2. Monitor and describe the limitations of federal, state, and private sources of funding, including insurance markets, on recovery and long-term resilience, and recommend both short-term solutions to fill immediate gaps and long-term mechanisms to sustain resilience investments into the future;

3. Explore and encourage public-private partnerships with private firms, engineering and consulting experts, as well as private investors and philanthropy, to support rebuilding efforts and long-term economic and community resilience in the face of storm recovery;

4. Document lessons from recovery activities that can be applied to future response and recovery efforts, including recommendations for improving state and local systems for community engagement and communications, response, and recovery;

5. Prepare a plan for Maine's infrastructure that increases resilience and speeds rebuilding through strategies that improve state and local planning, permitting, infrastructure design and engineering, finance mechanisms, workforce capacity, and related needs while leveraging available funding sources and capabilities; and

6. Build on recommendations from the Maine Climate Council and its working groups that are relevant to the work of this Commission, including those supporting working waterfronts, preparing for increasing coastal and riverine flooding, and informing policies intended to improve storm response and greater long-term resilience.

II. Membership and Chairs

The Commission shall consist of the following members:

1. The Commissioner of the Department of Transportation or their designee;
2. The Commissioner of the Department of Marine Resources or their designee;
3. The Commissioner of the Department of Economic and Community Development or their designee;
4. The Commissioner of the Maine Department of Environmental Protection or their designee;
5. The Commissioner of the Department of Agriculture, Conservation and Forestry or their designee;
6. The Director of the Maine Emergency Management Agency or their designee;
7. The Director of Governor's Office of Policy Innovation and the Future or their designee;
8. The Director of the Maine Center for Disease Control and Prevention or their designee;
9. The Director of the Governor's Energy Office or their designee;
10. A representative with expertise in hazard mitigation;
11. A leader from Maine's philanthropic sector;
12. An expert in climate science and related storm impacts;
13. A representative with expertise in infrastructure finance and planning;
14. A representative with expertise in insurance;
15. A representative of populations facing disproportionate impacts from storm events;
16. A representative of one of Maine's electrical utilities;
17. A representative with expertise in engineering;
18. Two representatives with expertise in construction and rebuilding;
19. Two representatives from impacted industries;
20. Two municipal leaders, one from an inland and one from a coastal community; and
21. A representative from a regional council or county government.

The Governor shall appoint two members to serve as Co-Chairs of the Commission.

III. Funding and Staffing

A. The Governor's Office of Policy Innovation and the Future shall provide such staff as may be necessary to fulfill the Commission's charge and may seek staffing and financial support from other state agencies and private entities to accomplish the goals and work of the Commission;

B. The Co-Chairs and the members of the Commission shall serve without compensation.

IV. Proceedings and Records

A. The Co-Chairs will preside at, set the agenda for, and schedule Commission meetings. The Commission shall meet as often as it deems necessary to complete its work. To the extent practical, and to the extent that its fact-finding mission is not hindered, the Commission should conduct its work in a manner that is open and accessible to the public. Records, proceedings and deliberations of the Commission are not subject to the requirements of 1 M.R.S. c. 13, in accordance with sections 402(2)(F), (3)(J) and § 403(6) of that Chapter. The Commission may conduct its work through subcommittees.

B. The Commission shall issue a public report of its findings to the Governor and Legislature. The Commission shall issue an interim report by November 15, 2024 and shall issue a final report no later than May 15, 2025.

Janet T. Mills
Governor

APPENDIX

A Toolbox for Property Owners and Policymakers

This appendix offers property owners and policymakers a range of solutions to be ready for the next river flooding disaster or coastal storm. This toolbox envisions a range of different users, from state agencies to town governments to individuals and businesses. Like any well-stocked toolbox, the combination of tools selected for a project depends on the user's needs and goals. The tools selected by a southern Maine beach town may differ from those employed by a Kennebec Valley mill town. The report provides examples of when and where different tools might be appropriate and gives communities guidance and flexibility to choose the combinations that are right for their goals and concerns.

Many more options are offered here than any single building or community will need. Each owner or community should select the combination of practices that enable them to feasibly and effectively manage flooding risks. While some of the options here are practical at a property level, there is considerable advantage when communities, or even regions, adopt and apply similar sets of strategies.

To more effectively address the growing threat of floods, communities should consider and adopt a range of different mitigation strategies working synergistically over time. These activities range from drainage infrastructure and elevation of structures to the protection of wetlands and techniques for risk communication. In choosing a portfolio of flood risk reduction strategies, decision makers and planners should consider the characteristics of their community.

The Flood Risk Reduction and Disaster Resilience Framework presented here (and adapted from the Governor's Commission to Rebuild Texas, 2018. Eye of the Storm. Texas A&M University System, College Station, TX) is an integrated approach for communities interested in reducing flood risk and associated impacts over the long term. Initially developed for Texas' recovery from Hurricane Harvey, the framework is highly applicable to both inland and coastal settings in Maine. It is composed of four categories that every flood-prone community should consider if the goal is to minimize adverse impacts from floods over the long term: *Resistance, Avoidance, Accommodation, and Communication* (Figure 1, see page 60).

Figure 1 Flood Risk Reduction Framework. Adapted from Eye of the Storm, 2018.

Resistance

A major historical component of flood protection in the U.S. is to resist the intrusion of wave or rainfall-based flood waters into human settlements. Resistance strategies most often involve structural measures, such as large-scale building and construction projects that actively protect communities situated in vulnerable areas. This "stand and fight" approach to flood risk reduction recognizes the importance of locating or retaining certain development in flood-prone areas for commerce, industrial production, recreation, and aesthetics (see Table 1 on page 65 for complete listing of strategies by category).

Armoring Strategies

For much of the last century, structurally based resistance activities involved "armoring" the coastline and riverbanks. Today, coastal armoring is considered a last resort and used where substantial human investments are at risk, making it necessary to protect the upper portion of a beach profile from storm-induced erosion and flooding. Dikes and levees consist of solid concrete walls, either above or below ground, that prevent elevated water levels from flooding interior lowlands. Dikes are usually associated with eliminating

wave-based flooding caused by storm surges along the coast. Levees are located along stream and river channels to prevent flooding from precipitation-based runoff or storm surge that travels upstream along the floodplain. These structures are best used where there is existing heavy development or location of critical facilities. Dikes and levees enable development to occur in flood-prone areas, particularly in the short term. However, these structures are often expensive, politically contentious, and can have adverse environmental impacts. Moreover, if they are not monitored and maintained properly, they can fail, causing catastrophic damage.

Dams are ubiquitous structural flood mitigation measures consisting of artificial barriers usually constructed across a stream channel to impound or store water. Spillway systems are constructed to convey normal stream and flood flows over, around, or through the dam. Dams can be very effective in modulating stream flows and shielding downstream coastal communities from flooding, but they can result in reduced nutrient and sediment transport, channel obstruction, loss of floodplain area, and overall hydrologic fragmentation. Also, failure of the dam structure can generate a sudden catastrophic pulse of water and debris that inundates downstream areas (as has happened periodically since the 1800s). The Maine Office of Dam Safety maintains records of 1,145 dams, of which 743 meet definitions of dams that require regulation.

Revetments consist of erosion-resistant materials placed on an existing slope, embankment, or seawall to protect the backside area from storm-driven waves. These structures are composed of three components: 1) a stable armor layer, 2) a filter cloth or under-layer, and 3) toe protection. The filter and under-layer support the armor while allowing for the passage of water through the structure. Different types of materials are used to absorb wave action, including geotextiles, sandbags, concrete tetrapods, rock, or wood. Revetments are generally low-cost coastal flood mitigation techniques that complement other structural approaches. While revetments are ubiquitous for coastal mitigation across the U.S., they are also prone to failure. If the toe fails, the entire revetment can unravel. Also, overtopping and loss of foundation material can negate the effectiveness of this armoring approach.

Moderating Strategies

A second set of structural flood resistance activities involve "moderating" the impacts of coastal storms. Near-shore **breakwaters** consist of detached structures built parallel to the coast, typically in high wave-energy environments, that act to disperse or redirect wave energy and reduce impacts along the shoreline. In addition to protecting inland communities from storm surge damage, breakwaters can help maintain beach width for recreational purposes, reduce erosion, and stabilize wetland systems.

Groins are typically short stabilization structures attached perpendicular to the shoreline. They extend across at least part of the beach and out into the surf zone. Once installed, accretion over time causes a positive increase in beach width up-drift of the groin. Groins are constructed to maintain a minimum beach width to buffer the impacts of wave-based storms. Coastal zone management policy in the U.S. often discourages the use of groins for shore protection due to a history of poorly designed and improperly sited structures stemming from a lack of understanding of their functional design, failure to implement the correct construction sequence, or improper cross-sectional shape.

Nature-Based Strategies

A third category of structural flood mitigation techniques aimed at resisting the impacts of storms are the construction of natural features. This approach is increasing in popularity because these techniques can replicate ecosystem services found naturally. Construction or restoration of **dune systems** is also gaining favor and were proposed to protect communities in New Jersey impacted by Hurricane Sandy

in 2012. Dunes can be constructed by themselves entirely of sand or with a solid core to leverage the benefits of a dike. These techniques provide ecological and recreational benefits, are aesthetically preferable, and maintain the coastline in a more natural state. The feasibility of dunes is dependent on a convenient source of sand for renourishment, the success of establishing grasses or vegetation to hold the sand in place, and a commitment to maintain these features over the long term. Finally, existing or constructed **coastal wetlands** can dampen the impact of storm surge and tidally based flood events. Depending on the nature of the storm, wetlands can reduce the depth and extent of inundation originating from coastal waters.

Avoidance

An avoidance approach to flood risk reduction entails removing development or steering new development away from the most vulnerable areas, such as the 100-year floodplain or category 1 storm surge zone. While wholesale retreat from the coast or river corridor may not be politically or economically viable, the idea of avoiding specific areas that experience chronic inundation from either precipitation or tidal events is gaining acceptance across the country. Avoidance can be vertical movement, where structures and people are lifted or elevated above areas of inundation risk, or horizontal movement, where critical assets are either pulled back or prevented from being placed in flood-prone areas from the start.

Vertical Avoidance Strategies

The most prominent structural technique to vertically avoid flood waters is the **elevation of buildings** on pilings or some other support structure. Communities participating in the National Flood Insurance Program already must elevate new residential buildings in a 100-year floodplain to or above the base flood elevation (BFE), the level flood waters are expected to reach in a 100-year flood. Many communities, however, have concluded that elevation to the BFE does not provide sufficient protection from floods.

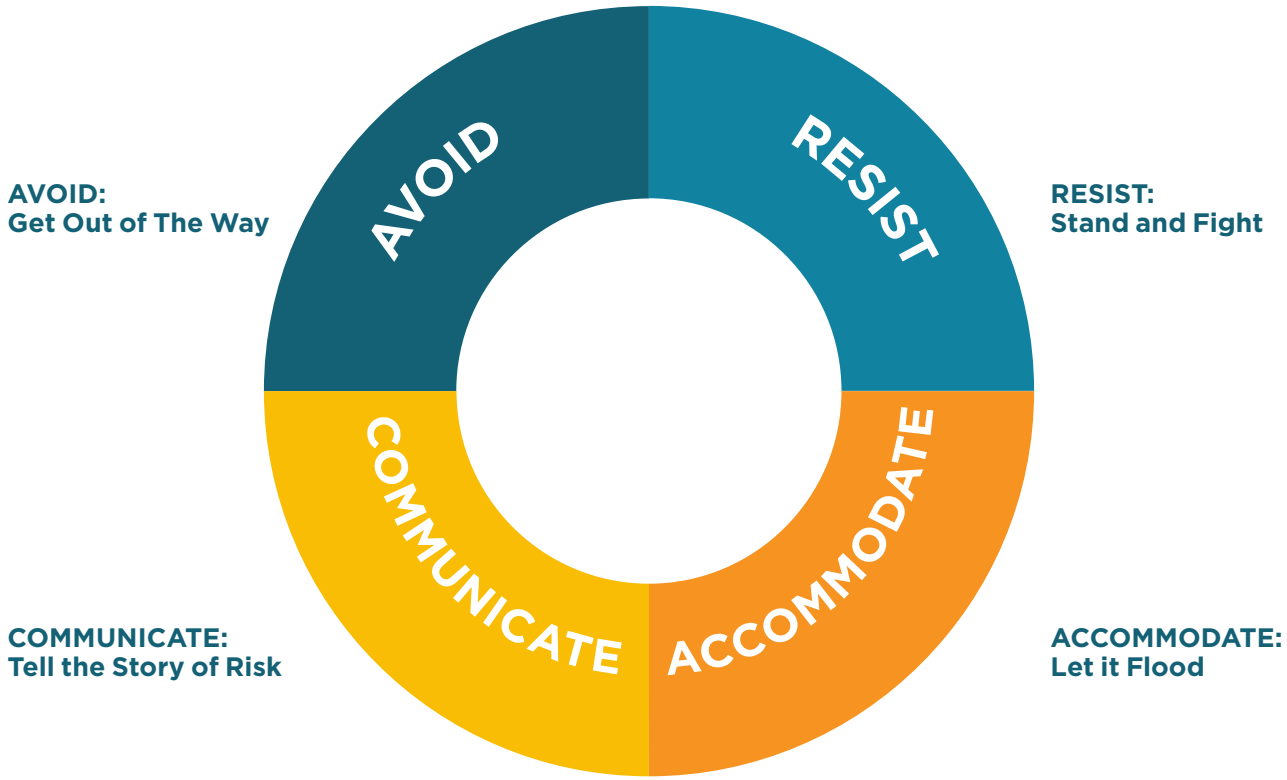


Figure 1 Flood Risk Reduction Framework. Adapted from Eye of the Storm, 2018.

To achieve an extra margin of safety, homes can be raised to an even higher level. This additional height is usually expressed as **freeboard**, the number of feet the first floor of a building is raised above the BFE. A freeboard requirement provides an extra margin of protection that accounts for waves, debris, changing future weather conditions, and new development, as well as a general lack of accurate data. For example, a freeboard requirement of one foot means that the lowest floor (or lowest horizontal structural member) is one foot above the base flood elevation. Freeboard requirements can be adopted by entire states or by individual communities. The Maine standards require that communities adopt a freeboard of one foot. Several communities across the state, such as the Town of York, require a two-foot freeboard on new construction.

Before adopting freeboard standards, the costs and consequences of building higher must be considered. According to a study conducted by the Association of State Floodplain Managers (ASFPM), for example, the approximate cost of elevating a 2,000-square-foot house higher than the BFE is between $890 and $4,470 per foot. Freeboard requirements can be costly, and difficult if the structure is a "slab on grade" design (that is, a concrete slab poured over excavated soil). The upfront costs, however, usually are offset by avoided flood losses over time. For example, a national study showed localities adopting freeboard standards each saved about $800,000 in flood losses annually. Among the 18 different mitigation strategies assessed, freeboard requirements were the most effective of all mitigation strategies considered in the study in terms of avoiding flood losses to residential structures.

Freeboard standards also can lower homeowner insurance costs. Elevating structures so that they are considered outside the base flood area significantly lowers required federal flood insurance rates. An ASFPM analysis, for example, found that building a 2,000-square-foot home two feet above the BFE (with fill underneath) would reduce annual flood insurance premiums by more than $1,400. The cost of the elevation would be offset by just 3.3 years of premium savings, and ultimately would yield $37,300 in savings during a 30-year mortgage. Similarly, a 2011 analysis by FEMA calculated that spending an additional $12,000 to elevate a structure three feet above the BFE would save a homeowner more than $151,000 in insurance premiums during a 30-year mortgage. Freeboard requirements also offer several indirect benefits. For example, a home built or retrofitted to freeboard standards may become more valuable at the time of sale due to lower risk and lower insurance costs, particularly when surrounding structures have flooded before. And while elevating structures may be expensive in the short term, it's generally far less expensive than demolition and relocation — and the property continues to generate taxable revenue for the jurisdiction.

Another form of vertical avoidance is using fill to raise a structure above BFE. Fill, as an avoidance strategy, allows naturally occurring landscapes to be altered by increasing its elevation with dirt or sand. This technique is done for either individual or a series of parcels in a new subdivision before a building is put in place. A major advantage of fill is that it can be combined with additional avoidance measures, such as crawlspace foundation on compacted fill material, thereby providing a higher level of flood protection. Parcel fill is becoming increasingly used by developers, especially in sprawling urban areas where the pressure to build in floodplains is high.

Horizontal Strategies

Most flood avoidance strategies involve non-structural mitigation techniques that fall squarely into the domain of land use planning at the local level. These policies focus on horizontal avoidance in that they are meant to guide or pull development away from vulnerable areas, such as coastlines, floodplains, or river bottoms. Strategies under this category of mitigation include both regulatory and incentive-based policies that can help facilitate more flood-resilient development patterns over the long term.

Regulatory techniques often involve planning-based policies, such as human-use restrictions around critical areas where development should not take place. **Buffers** or **setbacks** designated in local development codes are one of the most effective methods for achieving horizontal avoidance because they can literally peel back development along riparian areas, sensitive tidal surge zones, and other vulnerable locations. These tools usually already exist in local plans for protecting critical natural habitats and can easily be expanded or modified to cover flood mitigation as well. Buffer distances range widely across the U.S., from 50 to over 1,000 feet, depending on the specific locational characteristics being considered.

Another common regulatory approach to horizontal avoidance is protecting one or multiple parcels through **land acquisition techniques**, such as fee-simple or development rights purchases. With this strategy, all or part of a parcel is purchased to remove or prevent development occurring in extremely vulnerable areas. The public purchase of flood-prone properties, to remove residents from flood risks while compensating them financially, is usually called a "buyout." **Buyouts** can protect natural habitats and return the land to its natural flood function while creating open-space amenities for nearby residents. It is important to note that almost always homeowners volunteer for or request a buyout, and only the most chronically and severely damaged properties should be considered. The largest and most comprehensive program for such buyouts is FEMA's Hazard Mitigation Grant Program (HMGP). Under this program, FEMA provides 75 percent of the funds needed for a buyout and requires a 25 percent match from the local government. Land acquired in this way cannot be developed again, but instead must be used for one of several purposes specified by FEMA , such as wetland restoration, wildlife refuges, gardens, and campgrounds. FEMA estimates the benefits communities can gain from open space preservation at $2.57 and $12.29 per square feet per year, respectively. As of 2019, Maine had 118 FEMA-funded property buyouts, 94 of which were in Canton.

Incentive-based mitigation policies create a pull towards the least vulnerable areas for development rather than the regulatory push described above. These techniques often allow for increased development intensity in desirable areas in exchange for relieving development on chronically flooded parcels. For example, **clustering** provisions that allow homes to be concentrated in a specific portion of a land parcel can help avoid flood loss. **Density or building height bonuses** in less vulnerable or more structurally protected areas within a community can help focus new development in a flood-resilient manner. Also, **transferring development rights** from the floodplain to receiving areas in higher elevations provides developers incentives to locate structures where it is less likely to flood. Finally, **targeting public infrastructure**, such as sewer and water lines in the least flood-prone areas within a community, will also encourage safer development over the long term. Proactive planning measures that focus development either outside of the 100-year floodplain or away from flood-prone watercourses are most effective at minimizing flood damage in low-lying coastal communities experiencing rapid growth.

Accommodation

In an accommodation approach, community-based strategies allow or even encourage flooding in specific areas or under certain conditions. The idea is that communities can co-exist with periodic inundation and even provide a relief valve when there is an excessive build-up of stormwater runoff.

A commonly used accommodation strategy is the placement of retention or detention ponds that collect, hold, and slowly release stormwater. **Retention ponds** always contain water and store floodwaters by allowing them to infiltrate slowly. These facilities are often placed in full view as attractive amenities, essentially artificial lakes. While retention ponds can add more value to a community, greater attention must be paid to maintaining proper water levels in them during heavy rains. In contrast, **detention**

ponds usually are vegetated depressions hidden behind houses, possibly used as playing fields during dry periods. They hold water for a short time during flood events and usually remain dry at other times. Retention and detention ponds are most effective in well-planned communities where they can be strategically placed for maximum effect. A third technique is the creation of **underground cisterns** for holding flood waters from surface runoff. This option serves the same purpose as retention or detention but doesn't consume as much developable land. However, cisterns can be expensive to build and require viable soil substrates to properly maintain their function.

Protecting or constructing **wetlands** in both coastal and riverine settings for flood-risk reduction is another effective flood mitigation technique. Wetlands function as natural retention/detention devices by collecting, holding, and slowly releasing flood waters. In fact, naturally occurring wetlands have been shown to significantly reduce freshwater flooding and flood losses. Both natural and constructed wetlands can be coupled with ecological, aesthetic, and recreational values. Even if no functional wetlands are present on site, parcels designated as parkland or for passive recreation can also be designed to hold flood waters.

A final type of acceptance-based flood mitigation strategy involves the design of buildings. **Building codes** can require the construction of homes or businesses to allow inundation by flood waters without compromising the integrity of the structure. For example, coastal structures elevated above the BFE can also be required to have break-away walls. With this technique, storm surge can flow under the first floor without destroying the entire building. Similarly, vents along the lower walls of garages can accept flood water from tidal events without resulting in a total loss. However, if valuables such as automobiles are stored on the bottom floor or in garages, significant damage can still occur during a surge event. This strategy could be effective in reducing flood impacts for Maine working waterfront communities.

Communication

Communication of flood risk to residents, property owners, and policymakers is as important as the structural components of the disaster resilience framework. When residents understand the risks of flooding and how best to mitigate the adverse effects of storm events on their property, overall losses at the community level can be significantly reduced. Outreach projects that educate residents about the probability of inundation in and around the 100-year floodplain can help them make more informed decisions when purchasing or improving homes. Risk communication is effective when it converts knowledge to action. Information about the various options available to mitigate flood impacts to households, from purchasing flood insurance to dry-proofing basements, will help residents protect their investments.

Web-based analytical and **visualization tools** help communicate flood risk and promote risk reduction strategies. Systems such as the FEMA Risk Mapping, Assessment, and Planning can help users understand risks from the watershed level all the way down to specific lots. Crowdsourced web platforms also can be used to communicate risk and household needs, particularly for response efforts and short-term recovery.

Perhaps the most important time to communicate flood risk is during the real estate transaction process. It is essential that prospective buyers understand the risk they will incur before purchasing a particular property. Most prospective buyers don't take the time to investigate whether a property is subject to flooding and may not be aware of information that could help them. **Disclosure** of whether a property is within or close to a 100-year floodplain or if the structure has been inundated in the past will help home buyers make more informed decisions. In 2024, Maine passed a law requiring disclosure of flood risk by sellers of real estate. Under the bill, sellers must notify buyers in writing whether the property is located in a special flood hazard area, the presence and cost of any active flood insurance policy for the property, any

The January storms ravaged the landmark Lobster Pound along the beach in Lincolnville, nearly destroying it and flooding other nearby businesses.

previous flood damage incurred, any flood insurance claims filed, and any flood-related disaster aid received while the prospective seller owned the property.

To help buyers and sellers to navigate the disclosure requirement, an easy-to-use **risk communication platform** can allow users to search for an address and view understandable and transparent risk information about the property and structure. Such a platform can help sellers share accurate information and help buyers make informed decisions. The state of Texas launched BuyersAware.org to make flood and fire risk more transparent.

Lastly, increasing the reach and quality of **early warning systems** to communicate impending severe weather and other hazards can help save lives by giving people and officials time to prepare, evacuate, or avoid high-risk areas. Early warning systems can be incorporated into existing flood management practices to foster public awareness of flooding issues and communicate actions that should be taken or avoided.

Establishing a Portfolio of Coastal Flood Mitigation Strategies

While each strategy described above can have an individual effect, communities should consider adopting programs where multiple techniques work in concert to reduce flood damage. Comprehensive community flood risk reduction lies at the intersection of avoidance, resistance, accommodation, and communication. It is up to each community to decide its optimal portfolio of flood mitigation strategies based on specific local characteristics. For example, a locality afflicted by storm surge events may opt to construct a "dike in dune" barrier behind which new development requires freeboard of several feet. Or a community that experiences heavy rainfall may buffer development along critical riparian areas, transfer these development rights to a nearby urban core, and at the same time protect naturally occurring wetlands that provide recreational opportunities to surrounding residents. Both examples could involve education and awareness programs to ensure residents are informed about potential flood risks.

Table 1: Flood Risk Reduction Strategies

Mitigation Strategy	Description
Resistance	
Dikes/Levees	Solid constructed walls that prevent elevated water levels from flooding interior lowlands.
Dams	Artificial barriers usually constructed across a stream channel to impound or store water.
Flood Gates/Barriers	Adjustable gates that prevent storm surge from flooding coastal areas.
Breakwaters	Detached structures built parallel to the coast.
Groins/Jetties	Typically, short structures attached perpendicular to the shoreline, extending across at least part of the beach out into the surf zone.
Bulkheads	Vertical retaining walls to hold or prevent soil from sliding seaward.
Revetments	Armoring materials placed on an existing slope, embankment or seawall to protect the backside area from storm-driven waves.
Artificial Reefs	Construction of reefs in nearshore areas to reduce the impacts of storm surge and waves.
Constructed Dunes	Building or replacing dunes to protect communities from storm surge and wave action.
Channel Maintenance	Clearing debris and maintaining the structural integrity of streams, rivers, and other conveyance-based water bodies.
Protecting Critical Facilities	Hardening and flood-proofing critical facilities in flood-vulnerable areas.
Dry-proofing	Mitigation techniques that prevent water from entering structures, including sealants, movable barriers, sealed windows, etc.
Fill Restrictions	Restrictions on using soil to fill in or raise the land surface in flood-prone areas, including the 100- and 500-year floodplains.
Tax Abatement	Provision of local tax incentives for household-level mitigation techniques.
Avoidance	
Freeboard/Building Elevation	Elevating structures above base flood to protect from inundation.
Fill	Elevating landscapes with compacted soil or dirt before construction of buildings to prevent inundation.
Buffers/Setbacks	A specific distance for which structures must be set back.
Clustering	Increasing the permissible development density in the least vulnerable areas within a specific property.
Density Bonuses	Increasing development density and height requirements for specified parcels.
Transfer of Development Rights (TDR)	Transfer of development rights from a vulnerable area to a less vulnerable or sensitive area.
Targeted Public Infrastructure	Invest in public utilities and other infrastructure in the least vulnerable areas.
Acquisition	Purchase of some or all of property rights for open space protection for flood mitigation.
Relocation	Remove structures from a vulnerable location to a less vulnerable location.

Drainage Maintenance	Maintaining drainage devices (canals, ditches, storm drains, etc.) to ensure they operate effectively during a flood event.
Protected Areas/Open Space	Designating one or multiple parcels as protected open space for flood mitigation.
Local Plans	Adoption of local planning instruments (e.g. floodplain plans, comprehensive plans, local mitigation strategies, etc.) that set forth a series of coordination policies aimed at mitigating flood impacts.
Down Zoning of Floodplains	Zoning provisions that significantly reduce the density and intensity of land uses in flood-prone areas.
Development Prohibitions Floodplain	Regulations that prevent all development from occurring in the FEMA 100-year floodplain or other flood-prone area.
Prohibitions on Burying Streams	Regulations that prevent burying on paving over streams, channels, or other watercourses.
Subdivision Regulations	Subdivision regulation that requires new structures to avoid the most flood-prone areas.
Impact Fees	Provision of local impact fees or taxes on development in the 100- and 500-year floodplains.
Watershed Planning	Adoption and implementation of watershed plans that seek to reduce the adverse and unintended consequences of upstream development.
Accommodation	
Retention/Detention	Either dry or wet holding areas/ponds that collected stormwater.
Underground Cisterns	Large stormwater holding areas underground.
Breakaway Walls	First-story walls on elevated homes designed to break away during storm surges.
Garage Vents	Openings at the base of a garage that allow water to pass through the structure.
Protected Open Space	Designating protected open spaces or passive recreation sites for flood detention.
Constructed Wetlands	Creating wetlands around structures or on vacant parcels.
Low-Impact Development	Development standards and techniques designed to that work with ecological functions to manage stormwater as close to its source as possible (e.g., bioswales, rain gardens, permeable pavement).
Green Roofs	Development standards that encourage or incentivize the installation of green roofs that collect and store rainwater.
On-Site Retention Requirements	Regulations that prohibit increases in stormwater runoff from developed properties.
Communication	
Flood Risk Information	Providing information about flood risks through multiple formats and outlets.
Education/Training	Training through classes, workshops, certifications, etc.
Hazard Disclosure	Disclosing a property's potential flood hazard to prospective buyers before the lender notifies them of the need for flood insurance.
Flood Warning	Real-time flood forecasting, warning, and response tools.
Crowd-Sourcing Flood Impact Information	Alternatives for reporting and sharing real-time flood impacts, including 311 calls, highwater marks postings, third-party resources, etc.

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