



Anatomy of a Flood

Learning from Experience—Voices of the Decision Makers

Although most officials interviewed after Rhode Island's Great Flood of 2010 believed that Warwick and Rhode Island's response to the flood was as good as possible—considering the lack of warning and unanticipated severity of the impact—many offered suggestions on improving both the preparations for and the response to future flood events.

Communication Breakdown

Several interviewees cited communication (between local government agencies, municipalities, and FEMA) as an area that needs improvement for future emergency situations. Communication “early and often” that includes all relevant parties can help to create and sustain an effective emergency response. Without communication, local, state, and national entities cannot properly coordinate their efforts. A statewide guidance document on adaptation could assist in standardizing communication.

- “We really weren’t part of EMS command,” said Warwick wastewater treatment facility director, Jeanine Burke. “If we had been involved in EMS command structure, I think that would have been a huge help. When they implement that, every department is supposed to be represented at the table.”
- “The communication between agencies was lacking,” said Warwick Sewer Authority Director Joel Burke. “DEM is aware of this criticism and is working on making things better.”
- “Coordination. No one can do it alone,” said Warwick Mayor Scott Avedisian. “That cooperation was really good with all of us, but we haven’t figured out what form that takes with the rest of the state.”
- “If we can’t agree on what happened, how can we make sure it doesn’t happen again?” said Warwick City Planner William DePasquale. He went on to say that engineers couldn’t agree whether the flood was a 200-year or a 500-year event, which causes problems when rebuilding.

- “One benefit of this storm was that a very small area was affected in a very small state. The meetings were in Warwick or Providence—no one had to drive too far. This would have been more difficult in a larger state,” said a regional EPA official.
- “Politics between municipalities are very different,” said DePasquale. “We need a statewide role for hazard mitigation planning and adaptation. Rhode Island’s municipalities lack uniformity, cooperation, and consistent, comprehensive plans.”

You’re in Good Hands?

After the Great Flood of 2010, reports revealed that only 4 percent of Rhode Island’s residential and commercial buildings were covered for flood damage. Currently, property owners in Rhode Island whose property is located within a floodplain or who apply for mortgages are legally required to obtain flood insurance—and this serves as formal disclosure, informing people that they do indeed live in a floodplain.

However, through information from interviewees, the opinion was that this requirement does not provide property owners with enough actual information about the risks of living in a floodplain. Instead of simply requiring property buyers to obtain flood insurance, the state should require a floodplain assessment and include educational materials about the area’s flood likelihood and effects of floods—thereby making the risks very clear.

- “Most people getting a mortgage have no knowledge relative to flood insurance. There’s no connection to flood zone implications, so they don’t really understand what it means. After March, people might understand it a bit more. But no one doesn’t buy a house because it is a flood site,” said Warwick’s DePasquale, adding, “Groundwater infiltration isn’t covered under flood insurance plans.”
- “There is disclosure, but our 100-year floodplain map is outdated,” said a state conservation engineer. “They’re actually much larger now—probably more like 20-year floods.”

- “People living in FEMA-designated 100-year floodplains, if they have mortgages or lines of credit, then they have to have flood insurance—it is required,” said RI Emergency Management Agency Floodplain Coordinator Michelle Burnett.
- “When you buy a property, you have to get flood insurance, so there has to be some type of disclosure. My insurance company required a floodplain assessment of our property,” said RIEMA official Armand Randolph.
- “What we saw in Pawtuxet Industrial Park pretty much happens all the time, and if businesses moved in there without knowing that it happens all the time, it’s unfair,” noted Jeanine Burke.
- Even if the FEMA assistance program is in actuality objective, it appears to outsiders to be biased. “We had a situation where one FEMA agent came out and approved for everything a family had, and some where people were denied coverage almost completely. It seemed to depend on [which FEMA official] came out,” said one DEM interviewee. “This perceived or actual bias could create negative feelings in the community, pitting neighbor against neighbor or the community against FEMA.”
- Ensuring that the affected community members comprehend the mission of—and the limitations of—FEMA assistance could also help to ensure a smoother recovery effort. “I think people expected that FEMA was going to pay for whatever damage was done to their property. When they started to understand the limits to the FEMA process, people started to get pretty angry,” said a DEM official.



A home in Coventry flooded by the West Branch of the Pawtuxet River, in the Great Flood of 2010.

Photo Credit: RI DOT

FEMA Needs Award Standards

There emerged a perceived need to standardize the way in which FEMA funds are awarded to disaster victims, and there needs to be an attempt to remove any possible subjectivity from the process in addition to clarifying FEMA’s role to the affected community. Although this is more of a recovery-phase adaptation, normalizing this process would help relations with the community.

- “FEMA insurance was the only federal help given in this case. If water was in their basement, they could go to FEMA. Over 2,500 residents were affected. People could apply for reimbursement, and each household could get \$2,000,” said regional EPA contacts.

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- Warwick Mayor Scott Avedisian noted, “Within days of the flooding, we heard people saying don’t even bother to apply for FEMA assistance, because the first round of people who went heard that they wouldn’t be covered.”

Reinforce Facilities

One method of adapting would be structurally reinforcing those facilities that cannot be easily or efficiently relocated, such as the Warwick wastewater treatment facility, and considering using the historic floods as a new benchmark.

- James Boyd, a policy planner at the RI Coastal Resources Management Council, said, “The only thing we can do is reinforce those facilities and hope that we never achieve those floods or the circumstances that led to them ever again. But who knows? We’ve set a new benchmark.”
- “Critical points should be elevated,” said regional EPA contacts. “We need to do outreach from other wastewater treatment plants to ones in flood plains.”
- Businesses and homeowners who cannot or will not relocate can consider using freeboard and

adapting to future flood events by “building a foot higher than recommended,” said RIEMA’s Burnett.

- “The Warwick Mall, in rebuilding, has done nothing to adapt and was rebuild to its preexisting condition,” said city planner DePasquale. “If the flood were to happen again today, the exact same thing would happen.”
- “If this is going to happen on a regular basis, we need to have a plan to try to move some pumping stations out of the floodplains. We have 48 of them, and a lot on the coast and all up and down the river. Twenty of the 48 are vulnerable,” said Jeanine Burke. “The City has a \$10 million catastrophic dollars insurance policy,” added Burke. “Seven million was spent on fixing the plant and pumps. It’s been eight months, and we’ll probably need \$5 million more. But we will still be as vulnerable as we were in March.”



Flooding in the area of Routes 2 and 5, and the Warwick Mall, in the Great Flood of 2010.

Photo Credit: RI DOT

Municipal Buyouts of Vulnerable Properties

When possible, cities and municipalities should consider buying out properties located in the floodplain to convert them back into natural floodplains. Although this can become a sensitive and politicized issue, particularly in established neighborhoods, in the wake of flood events like that of the 2010 flood, there may be more opportunities to approach property owners for buyouts. Floodplains are flat areas that experience flooding, either occasionally or periodically, and if restored to their original state, can serve as flood buffers for towns and cities.

- “The city is very interested in using FEMA monies to purchase some of those properties that were flooded out along the river. The idea would be that they would purchase the properties, get rid of any buildings, and basically restore it to floodplains,” said CRMC’s Boyd. “Let’s face it, we’ve built structures in 500- and 100-year floodplains, which is permissible under the rules, provided we do compensatory flood storage, but I don’t think that’s a very effective way to manage floodplains. This is my personal opinion, but to the

degree that the city and other municipalities can purchase property from owners willing to sell their property, they should do so and restore the sites as floodplain.”

- “Cranston is going to buy some homes and remove people. And they can do that because they have fairly unanimous support in the residents in being bought out,” said Mayor Avedisian. “(Warwick is) the opposite. Our residents don’t want to go. It’s a very different attitude. We have probably only six homes that we’re considering forcing people out of.”
- “Certainly it couldn’t possibly be affordable to purchase all properties at risk, but it’s something,” said two DEM contacts. “The option is to remove those properties that are most at risk for severe damage, and I guess that’s kind of the course municipalities are taking.”
- “Some properties are so damaged they will need to be bought out,” said Warwick’s DePasquale. “They could become recreational areas instead, to help stop the event from reoccurring.”
- The USDA has a floodplain easement program that is open to anyone whose property was flooded within the last 10 years, or multiple times within a decade. “The owner has to agree to sell an easement and then USDA, through sponsorships, will relocate the family and restore the property,” said a state USDA conservation engineer, Kevin Farmer. “It is better to restore a floodplain rather than build on it, and it will help buffer against future floods.”

Limit Permitting

Purchasing property in floodplains can be difficult, and is a measure that takes place after the properties have already been built on. Increasing the difficulty of receiving permits to build in a floodplain in the first place could be a better way to leave floodplain undeveloped.

- “Floodplain building regulations should be strengthened, tightened,” said DePasquale. “It’s very hard to get non-complying builders to listen.” He added, “Too much building in flood plains makes downstream flooding worse. Flood compensation calculations are outdated—many are based on 1960s standards. Buildings weren’t built to FEMA’s regulations. The flood proved this system doesn’t work. People will build on anything.”
- “Currently, our rules do not prevent building in a floodplain. Most times you can’t, if you can’t mitigate sufficiently. But you can, as long as you can demonstrate that building code requirements will be met and that the flooding potential on the property and downstream properties will be no worse than the current condition. It has been difficult to get a permit to build in a floodplain since 1971,” said DEM contact Russell Chateaufneuf. “Notwithstanding, even if you can meet the permitting requirements, it may still be unwise to build in or near a floodplain. The current regulations generally prevent impacting 100-year floodplain functions, but this does not protect against greater flooding events nor protect the permissible structures within the 100-year floodplain—say, like a parking lot. The government is faulted for allowing development, but I think it’s made clear to folks going forward that they are building in a hazardous area.”

Get the Word Out to the Public

Making up-to-date climate science and emergency flood information easily accessible to Rhode Island government officials, as well as the public, was viewed as a must. This could take the form of remapping flood zones more frequently, or updating hazard mitigation plans to include wastewater treatment plants. And while all of the key interviewees spoken to acknowledged that climate patterns are changing, and a majority of informants attributed climate change to more severe flood events—this may not be the case throughout all of Rhode Island.

- “Local leaders should have somewhere to go to get state and federal consistency based on science,” said Warwick’s DePasquale. “The best management practices need to include climate change. They have to have applicability of development.”
- “Many officials elected either don’t believe in climate change or ran on platforms that didn’t believe in climate change,” said the Sewer Authority’s Burke.
- “We’re in the process of additional work for FEMA, for developing their regression equations, and predicting magnitude and frequency of flood flows. It will let the public click on any stream in Rhode Island and will tell them the exceedence probability of a flood. These equations are very important in designing culverts or bridges. Doing that, and doing a bunch of hydrological models. This flood is keeping us busy a long time. I think these will be done a year or so from now,” said a USGS hydrologist Gardner Bent. He continued, “We’re trying to get the message out there because people sometimes don’t know about it. There is information to help the public, the towns, the state, other agencies—before, during or after the flood.”
- “One lesson learned was getting the word out to the public during the event and during the recovery,” said DEM’s Terry Gray.

Critically Review Transportation

Local and state governments, the Department of Transportation, and Department of Environmental Management are starting to brainstorm ways to ensure that roads and highways remain open in the years ahead. Rhode Island should take a critical look at their roads and highways, both those that exist and those that are being constructed. Planning to prevent flooding and washouts could end up saving money on repairs in the future.

- “There’s the question of (Route) 95—to redesign or to raise?” said DOT official Charles St. Martin. “The sandbagging operations and pumping worked pretty well. And it is not realistically worth spending money for precautions against a 200-year flood.”
- “Having a washout can be pretty severe. Almost all the roads crossing the river were closed. It hampered movement in the state and the economic impact was significant,” said Chateaufneuf from

the DEM. “This idea of trying to make sure that passageways and roadways can be maintained and kept open is probably going to be a focus of some of these departments in the years ahead.”

- “We had to try to get out there and keep roads open,” said DOT’s St. Martin. “But the most we could do was wait. There probably are 300 locations that were identified as ‘flood damaged.’ It took 60 different projects to fix it—some are still ongoing. Now we know where the trouble spots are.”
- “The Interstate is not controlled by the city, so they can’t put together an adaptation plan,” said a Warwick’s DePasquale. “We didn’t realize that without I-95, Warwick is completely cut off.”

Implement New Stormwater Regulations

State legislation passed in 2007 required the DEM and CRMC to cooperatively develop and implement a [new state stormwater manual](#) through existing state regulatory programs. Unfortunately, the final legislation did not include requirements at the local level. The primary purpose of the new manual is to implement the requirements of the *Smarter Development for a Cleaner Bay Act of 2007*. One benefit of new stormwater regulations would result in diminishing the severity of flood events. It emphasizes low impact development practices that reduce the overall amount of runoff leaving a development site—such as reducing hard (impervious) surfaces such as pavement—as well as calculating runoff rates and volumes using updated precipitation data to increase accuracy of estimates.

- “It was a trap that we set for ourselves,” said John Torgan of Save the Bay. “The development that didn’t consider the potential for floods, and the overdevelopment in floodplains and estuaries. Since they have created impervious surfaces and pavement in the watershed and drainage basin of the Pawtuxet, even small rain events equal large flood events. All you can do is try to soften the watershed by requiring better storm practices, vegetated swales, and removing some of the built property and returning it to vegetated space.”
- “50 years ago, the water had more places to go. Now there is development,” said Joel Burke. “Parking lots and roads don’t absorb any water—they send it straight to the river.”
- “We’re going to see an increase in these larger storm events and their frequency. I think what it says to

us is that our stormwater management systems need to be able to deal with these,” said CRMC’s Boyd. “In the new stormwater manual, we’ve incorporated precipitation values reflecting the new science and data, and we’re dealing with best management practices, and structural devices like basins to accommodate these large storm events. I can’t emphasize it enough—the best way to adapt to future flooding events is to adopt and use the 2010 stormwater manual.”

- “The legislation that required both the DEM and CRMC to revise the existing state manual was to use the manual in review of any state permits, but did not require the local municipalities to use the manual, so that was a really big gap. We’re going to find creative ways over the next few years to get this implemented at the local level,” commented Boyd.
- “The new stormwater manual is going to require an analysis of the downstream condition (to check if development is increasing the amount of runoff). Having said that, we’re also requiring for every storm event, new development must recharge stormwater into the ground, essentially the same amount of water or more going into the ground as there was previous to development. This will help prevent contributing to downstream flooding events. This is a new requirement and speaks to the state’s overall stormwater control strategy. We had been seeing the problem arise more often in partially developed watersheds as they became more developed. Putting more water back into the ground is critical. Something to help in the future, but it’s more preventive than curing current problems. Some watersheds have a substantial amount of development already,” said the DEM’s Chateauneuf.
- “All states are moving towards a similar stormwater policy to address water quality and the developed environment’s effect on water resources—this idea of using low impact development as a way to reduce the footprint of development but also to get as much runoff into the ground as possible and handle runoff at the source, as opposed to maxing out property disturbance, creating large impervious areas and then discharging that runoff into the nearest water body. The focus is to reduce the amount of runoff created in the first place,” said a DEM interviewee.

“Reverse 911” Works

All of the interviewees who mentioned the Reverse 911* calling system thought it was a good idea and a strong step in sharing important flood-related information. However, the Reverse 911 calling system only called landlines, and many people now only use cell phones—especially young adults. To improve the Reverse 911 calling system for future flood events, we recommend that cell phones be added to the directory.

- “We used a Reverse 911 system, which makes automated calls that go out to everybody. We created an ability to call everyone. We did find if people were able to get the messages it was great, but in the Pawtuxet business complex, people weren’t even able to get to their buildings to check their answering machines,” said Mayor Avedisian.
- “Another positive: as soon as the facility was inundated, word went out not to shower or use washing machines so that the flow was minimized. The Reverse 911 was especially helpful,” said an EPA regional contact.

**The Reverse 911 system allows government officials to mass-dial all phone numbers on a list—such as all local residents—with major public alerts.*

Keep Talking to Each Other

There is an expressed need to sustain a dialogue between Rhode Island government agencies, municipalities and the federal government about the risks and benefits of changing the requirements for zoning and building codes to protect against larger storm occurrences. Rhode Island state building codes currently require construction of new or substantially improved buildings within special flood hazard areas, which are delineated on FEMA Flood Insurance Rate Maps, to meet 100-year storm standards, but many contacts spoken to mentioned that increasing the codes to protect against the 150- or 200-year storm event is a discussion worth having. Additionally, commercial development regulations need to be revised at the federal level so planners at the city level have a new basis to work from.

- “Draft new language into legislation to include these kinds of flood events. Commercial development needs regulations to be revised,” said Warwick planner DePasquale.
- “There needs to be dialogue among informed people, and not just environmental folks—insurance experts, risk management, FEMA—to discuss this question

and decide if there are sufficient warrants to go to a 200-year storm level,” said a DEM interviewee.

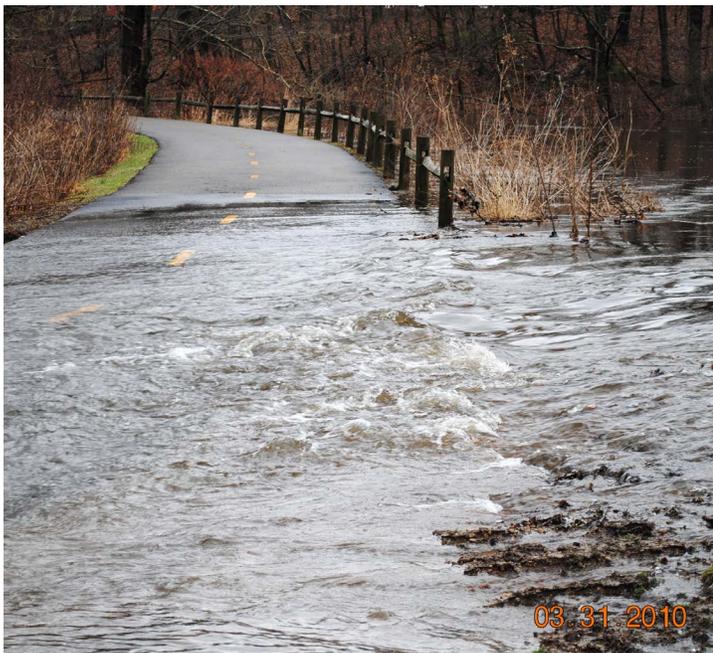
- “The basis that we’ve used is the 100-year floodplain. It was not considered to be appropriate at the time the Freshwater Wetlands Act was enacted to design past 100-year floods. At this point there isn’t a discussion here at DEM on the topic. Do we need to look at something other than a 100-year storm to design for? But what storm is appropriate—150-year, 200-year? And then who decides what elevation a 150, 200-year storm is? They could probably accurately map it, but it would be a huge effort, to map a 200-year floodplain,” said the DEM’s Russell Chateaufort.
- “I’m sure the fact that this was a 500-year flood will change things in the local towns,” said RIEMA official Armand Randolph.
- “We do need to look at continued changes to the zoning code. We know that there are developments in areas where they’re going to be problematic, and we need to discourage that and look at other ways of acquiring property,” said Warwick Mayor Avedisian.
- “Especially in coastal zones, should the standards for construction be changed, understanding that climate change is happening?” said a DEM official. “CRMC may be looking to update from 100-year floods to something higher. They update the zones where those apply, not the building codes. When you’re resource constrained, it’s tough to make time to innovate and think ahead.”
- Boyd elaborated on the Rhode Island building codes and pointed out, “There is a caveat—Rhode Island adopted a new state building code in July 2010 for both residential and commercial buildings. It requires a one-foot freeboard above and beyond the elevation requirement shown on the FEMA Flood Insurance Rate Maps: If you’re in a coastal high hazard area or a coastal A zone, you have to comply with the freeboard standard. However, there is no freeboard requirement for inland areas not subject to coastal flooding.” Looking to expand this requirement may help businesses and homeowners in riverside communities like Warwick adapt in the future.

Land and Water Buffers

In considering adaptation, there is also the need to have better buffers between water and land. This can

take the form of both coastal and urban management strategies.

- One way to do so is with living shorelines. “Living shorelines are non-structural/living media such as oyster reefs, mussel beds, or marsh vegetation that prevent erosion and mitigate the impacts of coastal sea level rise. They are an alternative to seawalls, hard walls and rocky things that amplify effects of floods. They soften shoreline by putting living media as buffers,” said Torgan of Save the Bay.
- “The wetlands have been destroyed, and it’s better to restore a floodplain rather than build on it. Wetlands act as a sponge that will help buffer future floods,” said USDA official Farmer.



Riverwater pouring over the Blackstone River Bikeway, in the Great Flood of 2010. *Photo Credit: RI DOT*

- “It’s certain that the damage that the state saw would have been much worse had we not had the Freshwater Wetlands Act. DEM has for years scrutinized any development within 200 feet of major streams and in the floodplain, and has for the most part significantly limited exacerbation of flooding impacts,” said a DEM contact.
- “The only long-term solution in my view, is to implement better stormwater management practices throughout watersheds statewide, and methodically remove structures within vulnerable floodplain areas and restore the floodplain (vegetation and storage capacity) to minimize future flooding,” said Boyd.

- “One of the things that made Warwick so vulnerable was the amount of built environment,” said RIEMA’s Burnett.
- “Warwick doesn’t have a lot of greenspace or green infrastructure,” said USDA’s Farmer. “More porous pavement, so water can go through, could help.”
- “Parking lots and roads don’t absorb any water—they send it straight to the river,” said Warwick’s Burke.

Time to Move Forward

Overall, Rhode Island should attempt to use the flood event as an opportunity to move forward in planning for and adapting to climate change. Local and national government, as well as the public, should not forget the flood event and how strongly it impacted Rhode Island. Climate change and flood emergency regulations and education should be improved for everyone, not just the public.

- “They should ‘soften’ these areas, but aren’t really doing so. It’s unfortunate—a Stop & Shop is being built already in one of the areas that was hardest hit,” said Torgan.
- “Regulation needs to integrate these failed things into the way that things are built. It doesn’t seem to be sinking in,” said DePasquale. “Warwick has a lot of skeptics. You need new regulation to restrict growth in these areas, but it’s hard. Mitigation has a more formed body of evidence, where adaptation is new—but it needs more study and science behind it to go forward. Green is ‘in.’ Adaptation needs to be ‘in.’”
- “How do you make it more clear to people that they’re taking risks when they’re building?” said the DEM’s Chateaufeuf.
- “Frankly I think the state and region is just beginning to think about responding to climate change. We’re in the very early stages. There are various governmental organizations forming study groups to look at that very question,” said a DEM interviewee. “The flooding is one piece of a multitude of concerns that comes with climate change.”
- “DEM has 30 individual offices. Many of them have their own climate change context they’re dealing with, but there’s no overarching policy for the department on climate change. Adaptation is like a whole other world,” said DEM’s Terry Gray.