In terms of lives lost and property damaged, floods are just behind tornadoes as the top natural disaster. In the United States, flood damages totaled $8.41 billion in 2011. There were 113 flood-related deaths. Floods can affect any area to some degree; wherever rain falls, flooding can occur.

As water falls to the Earth in the form of rain or snow, it seeps into the ground. But if the ground is frozen or the surface impervious (asphalt or concrete are two contenders) or the soil is already saturated and cannot absorb the water faster than it falls from the sky, problems arise

Water from floods can take time to build up, allowing the population in an area time to be warned in advance. But sometimes flooding occurs quickly. [Flash floods](https://www.livescience.com/6592-science-flash-floods.html) gather steam within six hours of the events that spawned them. They are characterized by a rapid rise of fast-moving water. Fast-moving water is extremely dangerous — water moving at 10 miles an hour can exert the same pressures as wind gusts of 270 mph (434 kph), according to a 2005 article in [USA Today](http://www.usatoday.com/money/perfi/housing/2005-09-08-wet-homes-usat_x.htm). Water moving at 9 feet per second (2.7 meters per second), a common speed for flash floods, can move rocks weighing almost a hundred pounds. Flash floods carry debris that elevate their potential to damage structures and injure people

The top five deadliest floods in world history occurred when the Huang He (Yellow) River in China exceeded its banks. The yellow silt that provoked the river's name can pile up higher than the land around it, causing the water to spill out of its causeway and onto the flat land surrounding it. Natural ice dams add to the problem. In an effort to control the damage, the Chinese government has built channels, dams and dikes to moderate the flow.

The deadliest flood came in 1931, when between 1 and 4 million people were killed. Thirty-four thousand square miles (88,000 sq km) of land were flooded, leaving 80 million people without homes. In 1887, natural flooding claimed between 1 and 2 million lives.

Strategic military flooding of the river top the third and fourth deadliest spots. In 1642, approximately 300,000 people died to flooding, famine, and plague when the Ming governor of Kaifeng ordered his men to break dikes along the river in an attempt to drown rebels assaulting his city. In 1938, the river was again used as a defensive weapon to halt the advance of invading Japanese troops, killing nearly a million people.

The worst dam collapse in history occurred in 1975, when significant rainfall following a typhoon assaulted the Banqiao dam on the Ru River in China. Almost 4 feet of rain poured down in a single day. A smaller dam upstream broke, sending a wall of water rushing downstream. A total of 62 dams failed in the incident, with walls of water between 10 and 20 feet high pouring onto the plains below. In an effort to control the flooding, some dams were deliberately destroyed with hopes of relieving some of the pressure. Approximately 230,000 people were killed.

Although China takes a frequent beating from flooding, the Netherlands also boast a number of deadly floods in its history. High tides and storms were responsible for the deaths of approximately 100,000 people in the Netherlands and England in 1099. A violent weather pattern known as a "Great Storm" created a storm tide in 1287 that broke a dike and killed up to 80,000 people. The same storm killed people in England. In 1421, the tenth deadliest flood in the world occurred when storms caused dikes to collapse. Water flowed across the lowlands, killing nearly 10,000.

The deadliest natural disaster in American history was the [Hurricane of 1900](https://www.livescience.com/57671-hurricane-season.html) in Galveston, Texas. The Category 4 storm killed over 6,000 people, with most official reports citing closer to 8,000 dead. Storm surge killed many on trains attempting to evacuate the city. Floodwaters destroyed bridges and telegraph lines, keeping those outside of the city from realizing the extent of the damage for some time.

In fact, storm surge deaths caused by hurricanes dominate the list of flood dangers in the United States. These include the second most dangerous storm, the Okeechobee Hurricane in 1928, which caused over 2,500 deaths. In contrast, [Hurricane Katrina](https://www.livescience.com/22522-hurricane-katrina-facts.html) claimed fewer than 2,000 lives.

Other dangerous incidents of flooding include a 1972 dam failure in Buffalo Creek, West Virginia. The dam, declared "satisfactory" only four days before the disaster, set off a chain reaction, as pressure from first broken dam caused a second to burst, and then a third. More than 132 million gallons of water were released, claiming 125 lives while injuring more than 1,100 people. Almost all 5,000 of the residents downstream were left homeless.

Advertisement

A 1976 flash flood in Colorado's Big Thompson Canyon after excessive rainfall created powerful water that ultimately killed 144 people and resulted in almost $40 million in damages. Waters reached speeds of more than 30 feet per second, moving 250-ton boulders with their powerful currants.

In the [Great Flood of 1993](https://www.livescience.com/7508-history-repeats-great-flood-1993.html), excessive rainfall in the Mississippi River basin caused significant flooding that did $20 billion in damages over a period of several months.

As the globe warms, flooding could become a more widespread problem. Warm air holds more moisture than cool air, so the heaviest precipitation events could become heavier as air temperatures tick upward. In 2015, [Climate Central](http://www.climatecentral.org/news/across-us-heaviest-downpours-on-the-rise-18989) analyzed rain gauge records since 1950 and found that 40 out of the 48 states in the continental United States have seen increased heavy downpours over that time period. The Northeast now sees 31 percent more heavy downpours than it did in 1950. The Midwest sees 16 percent more.

Heavy downpours are defined as events where the precipitation dropped from the skies is more than the amount that accumulates from the top 1 percent of all rain and snow days over the study period. These bursts of precipitation — which usually fell as rain but sometimes as snow, the analysis found — are tough on infrastructure and can cause flooding. [NOAA data](https://www.ncdc.noaa.gov/extremes/cei/graph/us/4/01-12) also shows an increase in one-day precipitation events (single days of either rain or snow) since the middle of the 20th century. Climate models suggest that global flood risk will change as the world warms[. One 2013 study in Nature Climate Change](https://go.redirectingat.com/?id=92X1590019&xcust=livescience_in_4395720192166285000&xs=1&url=http%3A%2F%2Fwww.nature.com%2Fnclimate%2Fjournal%2Fv3%2Fn9%2Ffull%2Fnclimate1911.html&sref=https%3A%2F%2Fwww.livescience.com%2F23913-flood-facts.html), for example, found large increases in the frequency of floods in eastern Africa, Southeast Asia, parts of India and parts of the Andes under climate change.

In glacial areas, [climate change](https://www.livescience.com/37003-global-warming.html) is likely to contribute to devastating floods more directly. Melting glaciers can put pressure on the natural dams that corral meltwater into the stunningly beautiful high-altitude lakes that dot places like the Himalayas and the Andes. When these dams fail, they can cause sudden and catastrophic outburst floods that send water ricocheting into narrow valleys below. In June 2016, [researchers observed firsthand](http://www.the-cryosphere.net/11/443/2017) a glacial outburst flood at the Lhotse Glacier near [Mount Everest](https://www.livescience.com/23359-mount-everest.html) that loosed about 4.8 million cubic miles (about 2 million cubic meters) of water from within the glacier itself. Fortunately, a village below the glacier was saved by stone walls that had been recently constructed, and nothing more was lost than a footbridge and one outbuilding.

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**. Introduce better flood warning systems**

The UK must "improve our flood warning systems", giving people more time to take action during flooding, potentially saving lives, the deputy chief executive of the Environment Agency, David Rooke, said. Advance warning and pre-planning can significantly reduce the impact from flooding.

**2. Modify homes and businesses to help them withstand floods**

The focus should be on “flood resilience” rather than defence schemes, according to Laurence Waterhouse, director of civil engineering flood consultancy Pell Frischmann. He advised concreting floors and replacing materials such as MDF and plasterboard with more robust alternatives. “We are going to have to live with flooding. It's here to stay,” Mr Waterhouse said. “We need to be prepared." His recommendations were echoed by Mr Rooke, who suggested waterproofing homes and businesses and moving electric sockets higher up the walls to increase resilience.

**Read more**

[**Read more Devastated families claim they were 'sacrificed' to the floods**](https://www.independent.co.uk/news/uk/uk-flooding-devastated-families-claim-they-were-sacrificed-to-the-floods-a6788851.html)

**3. Construct buildings above flood levels**

Britain should construct all new buildings one metre from the ground to prevent flood damage, the former president of the Institution of Civil Engineers has suggested. Professor David Balmforth, who specialises in flood risk management, said conventional defences had to be supplemented with more innovative methods to lower the risk of future disasters.

**4. Tackle climate change**

Climate change has contributed to a rise in extreme weather events, scientists believe. Earlier this month the leader of the Green Party, Natalie Bennett, welcomed the landmark Paris Agreement, whereby governments from 195 countries pledged to “pursue efforts” to limit the increase in global average temperatures to 1.5°C above pre-industrial levels. “It is now crucial that world leaders deliver on the promise of Paris,” Ms Bennett said. “The pressure is now on the British government to reverse its disastrous environmental policy-making.”

**5. Increase spending on flood defences**

Figures produced by the House of Commons library suggest that real terms spending on flood defences has fallen by 20 per cent since David Cameron came to power. Yesterday [MON] the Prime Minister rejected this allegation, insisting the amount being spent had risen. Mr Cameron promised to review spending on flood defences after chairing a conference call of the government's emergency Cobra committee at the weekend.

**6. Protect wetlands and introduce plant trees strategically**

The creation of more wetlands – which can act as sponges, soaking up moisture – and wooded areas can slow down waters when rivers overflow. These areas are often destroyed to make room for agriculture and development, the WWF said. Halting deforestation and wetland drainage, reforesting upstream areas and restoring damaged wetlands could significantly reduce the impact of climate change on flooding, according to the conservation charity.

**7. Restore rivers to their natural courses**

Many river channels have been historically straightened to improve navigability. Remeandering straightened rivers by introducing their bends once more increases their length and can delay the flood flow and reduce the impact of the flooding downstream.

**Read more**

[**Read more Make no mistake, the floods in the north are a national disaster**](https://www.independent.co.uk/voices/letters-make-no-mistake-the-floods-in-the-north-are-a-national-disaster-a6787651.html)

**8. Introduce water storage areas**

Following the severe flooding of 2009 a £5.6 million flood alleviation scheme was established in Thacka Beck, on the outskirts of Penrith, Cumbria. More than 675 metres of culverts underneath the streets of Penrith were replaced and a 76,000m³ flood storage reservoir – the equivalent of 30 Olympic sized swimming pools – was constructed upstream to hold back flood water. The risk of flooding from the beck was reduced from a 20 per cent chance in any given year to a one per cent chance, according to Cumbria Wildlife Trust.

**9. Improve soil conditions**

Inappropriate soil management, machinery and animal hooves can cause soil to become compacted so that instead of absorbing moisture, holding it and slowly letting it go, water runs off it immediately. Well drained soil can absorb huge quantities of rainwater, preventing it from running into rivers.

**10. Put up more flood barriers**

The Environment Agency uses a range of temporary or “demountable” defences in at-risk areas. These can be removed completely when waters recede. Temporary barriers can also be added to permanent flood defences, such as raised embankments, increasing the level of protection. “As the threat and frequency of flood risk increases, the use of passive flood defence has to be the only realistic long term solution,” Frank Kelly, CEO of UK Flood Barriers claimed earlier this month in Infrastructure Intelligence, a magazine for the infrastructure sector. Mr Kelly’s company was responsible for designing a self-activating flood barrier he said had proved to be “invaluable” in protecting properties close to the River Cocker.

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Floods are now an annual nightmare in many parts of southern and western India. Valleys in the states of Maharashtra, Karnataka and Kerala that [weren’t considered flood-prone](http://www.geol-amu.org/notes/be1a-3-8.htm) until recently are at risk.

During floods and landslides in August 2019, two villages were completely destroyed [killing several people](https://thewire.in/environment/kerala-puthumala-wayanad-rains-landslide), while a year earlier Kerala saw its [worst floods in a century](https://www.bbc.co.uk/news/world-asia-india-45243868).

These floods appear to be getting more severe. Climate change is causing stronger and more erratic rainfall with recurrent floods in low-lying areas while population growth is putting more people in risky areas. And another problem comes from deforestation in the mountain range where much of the water first fell: the Western Ghats.

More than 500 people died in severe flooding in Kerala in 2018. AJP / shutterstock

The Western Ghats run for 1,600km in parallel with India’s west coast, from Gujarat right down to Tamil Nadu at the tip of the subcontinent. It is – or was – a picturesque landscape of serene valleys, steep gorges and virgin forests. Yet recurring floods and landslides in the mountains, hills and areas downstream (between the Ghats and the sea) show that India must rethink its environmental law to balance the needs of nature and humans.

The Western Ghats follow India’s western coast. [Nichalp / wiki](https://commons.wikimedia.org/wiki/File:Indiahills.png), [CC BY-SA](http://creativecommons.org/licenses/by-sa/4.0/)

The mountains are teeming with life. Though they cover only a small part of India’s total land area, the Ghats are home to [more than 30% of the country’s species](https://www.wwf.org.uk/where-we-work/places/western-ghats) of plants, fish, reptiles, birds and mammals, including both wild elephants and tigers. Its combination of unique species and habitat loss means Unesco has recognised it as one of eight global “[hottest hotspots](https://whc.unesco.org/en/list/1342/)” of biodiversity.

Climate change is already having an obvious impact, with unprecedented rains in monsoon seasons and severe drought and dry rivers in [summer](https://www.downtoearth.org.in/news/natural-disasters/kerala-after-the-deluge-a-drought-in-the-works-61653). And as the human population has grown, people have chopped down the forests and replaced them with spice, tea, coffee and rubber plantations. Thousands of [illegal stone quarries](https://www.asianage.com/india/all-india/080918/save-western-ghats-from-demolition-men.html) now also operate in the Ghats, where mountainsides are demolished to generate stones and sand for the construction industry. Deforestation and the use of highly destructive explosives mean these areas are prone to increased [seismic tremors](https://www.theguardian.com/environment/2012/oct/02/kerala-quarrying-sea-erosion) and landslides.

Large dams on major rivers offer renewable energy yet also raise another set of environmental problems. In Kerala, many are located in eco-sensitive parts of the Western Ghats, with some dating back to British rule. As demand for energy increases, India plans to build [more dams](https://www.thehindubusinessline.com/economy/agri-business/more-and-more-dams-planned-but-where-is-the-water/article26323057.ece) which in turn could lead to massive deforestation and ecosystem destruction. All this makes flooding more severe, as deforestation in the catchment area of a river reduces the land’s ability to retain water.

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**Flood forecasting** is the use of forecasted [precipitation](https://en.wikipedia.org/wiki/Precipitation_(meteorology)) and [streamflow](https://en.wikipedia.org/wiki/Streamflow) data in [rainfall-runoff](https://en.wikipedia.org/wiki/Runoff_model) and [streamflow routing](https://en.wikipedia.org/w/index.php?title=Streamflow_routing&action=edit&redlink=1) models to forecast flow rates and water levels for periods ranging from a few hours to days ahead, depending on the size of the watershed or [river basin](https://en.wikipedia.org/wiki/Drainage_basin).[[1]](https://en.wikipedia.org/wiki/Flood_forecasting#cite_note-1) Flood forecasting can also make use of forecasts of precipitation in an attempt to extend the lead-time available.

Flood forecasting is an important component of [flood warning](https://en.wikipedia.org/wiki/Flood_warning), where the distinction between the two is that the outcome of flood forecasting is a set of forecast time-profiles of channel flows or river levels at various locations, while "flood warning" is the task of making use of these forecasts to tell decisions on warnings of floods.

Real-time flood forecasting at regional area can be done within seconds by using the technology of artificial neural network.[[2]](https://en.wikipedia.org/wiki/Flood_forecasting#cite_note-2) Effective real-time flood forecasting models could be useful for early warning and disaster prevention

**flood prediction -**The study of rainfall patterns, catchment characteristics, and river hydrographs to predict the future average frequency of occurrence of flood events. Flood predictions seek to estimate the probable discharge that, on average, will be exceeded only once in any particular period, hence the use of such terms as ‘50-year flood’ and ‘100-year flood’. Compare FLOOD FORECASTING

Disaster prevention and prediction Flood prediction using machine learning approach.

Proposed solution:

1)PREDICTION: APPROACH 1: A dataset with the amount of rainfall and if a flood had occured in a particular area/state/city, in the previous years, will be used. The dataset will have the rainfall data for a duration of 3 months approx.

Using this dataset, we take average rainfall for every 10 days and plot it on a graph to visualize it. We take this average data of rainfall, as input to our machine learning model and if it causes a flood or not as the output labels. We train our model and save it.(depending on some threshold value of average rainfall in the dataset)

Given the input data, for consecutive 10 days, we give this data as an input, and let the model predict, if whether there is a possibility of flooding or not, by setting some threshold in the training data. Our basic approach for this problem is binary classification, using basic machine learning algorithms(linear regression or logistic regression).

This approach can be made real time prediction and accuracy can be improved with adding more features such as the type of land in that area, the location of the area etc.

APPROACH 2: There is an official website called [www.india-water.gov.in](http://www.india-water.gov.in/) , which updates itself regularly saying whether the water level in a particular area is 1)above normal flood, 2)severe flooded or 3)extremely flooded (with yellow,orange and red colour respectively).

We plan to scrap data out from this webpage from time to time and store it in a database.

2)SENDING WARNING: The database will be accessed and red alert warning will be sent to the mobile phones of all the people in the effected area, using a free online text message sending portal.

2) The goal of this project is to see if natural disasters (such as fires and floods) can be effectively used as artistic styles. That is, can we **visually predict what a natural disaster may look like**?

1) We gathered before and after images for 28 flooded locations. One image was used as a "style" image (representing a typical flood) to apply to other location's before images. We generated output images which serve as compromises between before-image content and style-image style, and then compared these output images (via the same unweighted loss functions) to the true after images

2) Artistic style transfer utilizes a pretrained convolutional neural network, therefore there is no "training"; parameters are not tuned, only hyperparameters (such as loss function tradeoff and neural style depth) are. We found the hyperparameter combinations which minimize the loss/error between output images and 20 post-flood images, then used this combination to evaluate performance on 7 test set images. The model-generated outputs of which are below

EVALUATION

Overall the results are pretty impressive! Notably, however, the model will not "add water". Our model primarily gives the scenes a muddy and eroded appearance, suggesting that we are more reasonably predicting the aftermath (rather than the presence) of a flood. Due to this, the predictions are less impression on locations which lack abundant plant life.

**BEFORE A FLOOD (WHEN FLOODING IS FORECAST)**

**Be alert.**

* Monitor your surroundings.
* Monitor NOAA Weather Radio, local television and radio stations, or go to [www.weather.gov](http://www.weather.gov/).

If a **flash flood warning** is issued for your area: **Climb to safety immediately.**

* Flash floods develop quickly. Do not wait until you see rising water.
* Get out of low areas subject to flooding.
* If driving, do not drive through flooded roadways!

**Assemble disaster supplies:**

* Drinking water – Fill clean containers.
* Food that requires no refrigeration or cooking.
* Cash.
* Medications and first aid supplies.
* Clothing, toiletries.
* Battery-powered radio.
* Flashlights.
* Extra batteries.
* Important documents: insurance papers, medical records, bank account numbers.

**Be prepared to evacuate.**

* Identify places to go.
* Identify alternative travel routes that are not prone to flooding.
* Plan what to do with your pets.
* Fill your car’s gas tank.
* If told to leave, do so quickly.

**Review your Family Disaster Plan.**

* Discuss flood plans with your family.
* Decide where you will meet if separated.
* Designate a contact person who can be reached if family members get separated. Make sure every family member has the contact information.

**Protect your property.**

* Move valuables and furniture to higher levels.
* Move hazardous materials (such as paint, oil, pesticides, and cleaning supplies) to higher locations.
* Disconnect electrical appliances. Do not touch them if you are wet or standing in water.
* Bring outside possessions indoors or tie them down securely. This includes lawn furniture, garbage cans, and other movable objects.
* Seal vents to basements to prevent flooding.

**DURING A FLOOD**

**Be alert.**

* Monitor your surroundings.
* Monitor NOAA Weather Radio, local television and radio stations, or go to [www.weather.gov](http://www.weather.gov/).

**Don’t drive unless you have to.  
If you must drive, travel with care.**

* Make sure your vehicle has enough fuel.
* Follow recommended routes. DO NOT sightsee.
* Avoid disaster areas. Your presence might hamper rescue or other emergency operations and put you at further risk.
* Watch for washed out roads, earth slides, and downed trees or power lines.
* Be especially cautious at night, when it is harder to recognize flood dangers.
* If the vehicle stalls, abandon it.
* If water rises around your car, leave the vehicle immediately. Climb to higher ground as quickly as possible.

**NEVER drive through flooded roadways. STOP! Turn Around Don’t Drown.**

* The roadbed may be washed out.
* You can lose control of your vehicle in only a few inches of water.
* Your car may float. Vehicles can be swept away by less than 2 feet of water.
* Do not drive around a barricade. Turn around and go another way!

**Get to high ground – Climb to safety!**

* Get out of low areas that may be subject to flooding.
* Avoid already-flooded areas and do not attempt to cross flowing water.
* Stay away from power lines and electrical wires.

**Evacuate immediately, if you think you are at risk or are advised to do so!**

* Act quickly. Save yourself, not your belongings.
* Move to a safe area before access is cut off by rising water.
* Families should use only one vehicle to avoid getting separated and reduce traffic jams.
* Shut off water, gas, and electrical services before leaving.
* Secure your home: lock all doors and windows.
* If directed to a specific location, go there.

**Never try to walk or swim through flowing water.**

* If flowing water is above your ankles, STOP! Turn around and go another way.
* If it is moving swiftly, water 6 inches deep can knock you off your feet.
* Be aware that people have been swept away wading through flood waters.
* NEVER allow children to play around high water, storm drains, creeks, or rivers.

**Shut off the electricity at the circuit breakers.  
If someone falls in or is trapped in flood water:**

* Do not go after the victim!
* Use a floatation device. If possible throw the victim something to help them float, such as a spare tire, large ball, or foam ice chest.
* Call 911. Call for assistance and give the correct location information.

**AFTER A FLOOD**

**Wait until it is safe to return.**

* Monitor NOAA Weather Radio or local television and radio stations.
* Do not return to flooded areas until authorities indicate it is safe to do so.
* Do not visit disaster areas following a flood. Your presence may hamper urgent emergency response and rescue operations.

**Travel with care.**

* Follow recommended routes. DO NOT sightsee.
* Watch for washed out roads, earth slides, and downed trees or power lines.
* Stay away from downed power lines.

**If a building was flooded, check for safety before entering.**

* Do not enter a building if it is still flooded or surrounded by floodwater.
* Check for structural damage. Inspect foundations for cracks or other damage.
* Turn off any outside gas lines at the meter tank.
* Do not enter a building that has flooded until local building officials have inspected it for safety.

**Use extreme caution when entering buildings.**

* Wear sturdy shoes. The most common injury following a disaster is cut feet.
* Use ONLY battery-powered lighting. Flammable material may be present.
* Look for fire hazards (such as damaged gas lines, flooded electrical circuits, or submerged furnaces).
* Check for gas leaks. If you smell gas or hear a blowing or hissing noise, open a window and quickly leave the building. If possible turn off the gas at the outside main valve. Call the gas company.
* Report broken utility lines to appropriate authorities.
* Check for electrical system damage (sparks, broken or frayed wires, or the smell of burning insulation). Turn off the electricity at the main circuit breaker if you can reach it without stepping in water.
* Examine walls, floors, doors, windows, and ceilings for risk of collapsing.
* Watch out for animals that might have entered with the floodwaters.
* Let the building air out to remove foul odors or escaping gas.

**Take pictures of the damage**, both of the building and its contents, for insurance claims.

**Get professional help.**

* Seek necessary medical care. Do not neglect minor wounds or illnesses.
* Food, clothing, shelter, and first aid are available from the American Red Cross.
* If the gas has been turned off for any reason, it must be turned back on by a professional.
* Have an electrician check the electrical system and appliances.
* Wells should be pumped out and the water tested for purity before drinking.

**Your home is no longer a safe place.**

* Throw away medicine, food, or water that had contact with floodwaters (including canned goods).
* If water is of questionable purity, boil drinking water for 10 minutes.
* Restrict children from playing in flooded areas.
* Keep windows and doors open for ventilation.
* Pump out flooded basements gradually (removing about 1/3 of the water volume each day) to avoid structural damage.
* Keep the power off until an electrician has inspected the system for safety. All electrical equipment should be checked and dried before being returned to service.
* Clean and disinfect everything that got wet.
* Service damaged sewage systems as soon as possible.

**When making repairs, protect your property from future flood damage.**

* Follow local building codes.
* Use flood-resistant materials and techniques.
* Elevate electrical components above the potential flood height.
* Elevate utilities (washer, dryer, furnace, and water heater) above the level of anticipated flooding.
* Consider elevation of the entire structure.
* Install a backflow valve in the sewer system.

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