



## HURRICANE/TROPICAL STORM HARVEY: POLICY PERSPECTIVES

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“Hurricane/Tropical Storm Harvey: Policy Perspectives”

Hurricane/Tropical Storm Harvey clearly revealed what most of us have known for a long time: Houston and the Houston-Galveston region have major flooding problems, and the sooner we stop denying this fact, the sooner we can begin finding solutions. Being honest about the extent and urgency of our problem will not harm us, but will form the basis for recovery. Denying fundamental truths and moving forward with business as usual will be the economic death knell for the Houston region. And make no mistake about it—how we respond to this horrible reality will determine the economic future of our region.

This article is not about the technical aspects of Harvey as a devastating hurricane. A major, forthcoming report from the Severe Storm Prediction, Education, and Evacuation from Disasters Center (SSPEED) at Rice University will offer an initial comprehensive assessment of facts and figures about Harvey. Suffice it to say that Harvey was an extremely large flood event caused by an average of 35-40 inches of rain over 3.5 days, with some areas receiving upwards of 50 inches. The recorded 24-hour rainfall was just over 16 inches in several watersheds, surpassing the 100-year rainfall amount, which averages just over 13 inches across Harris County.

It is doubtful that any city in the United States or the world could have “handled” 40 inches of rain in 3.5 days or even 16 inches in 24 hours. This is a huge amount of water to handle. However, the extent of the damages and misery can be substantially reduced the next time we have a similar “weird weather” event that now seems the norm.

The task for Houston going forward is to adopt a series of policies and actions that can and will make a difference. To paraphrase Albert Einstein, the Houston we have created to date as a result of our thinking thus far has problems that cannot be solved by thinking the way we were thinking when we created them. That is our challenge—to think boldly and creatively to develop ideas and policies that are, indeed, different.

Ideas about where we can start and what concepts might be viable are set out below. These are not intended to be exhaustive; rather, they are meant to initiate a conversation about designing a Houston for the future.

1. A clear starting point is to identify the areas that did not flood during Harvey. These areas will form the backbone of the Houston of tomorrow.
2. There are several areas, mostly deep in the mapped floodplains, where multiple floods have damaged homes again and again. Some have been flooded three or more times since Tropical Storm Allison in 2001. We need to identify these areas and remove these homes from harm's way; it is unlikely we can develop strategies to protect them from severe rainfall events that are much more frequent than labels such as “100-year” or even “500-year” rainfall events suggest. In order to do this, there will need to be a massive buy-out program. At this early stage, it has been estimated that over 75,000 homes flooded during and after Harvey; that number is likely to double when all the data is in. A fair but extensive home buyout and removal program must be established.

3. Based on the above two steps, three clear geographic zones of strategy will become evident. They should be mapped and separate policies should be considered for what might be regarded as the “safe” area, a “transitional” area where only single-event flooding has occurred, and the “buyout” area, which will become a key element of our future green infrastructure that will, along with the “safe” area, provide urban design definition to the Houston of tomorrow.
4. The Addicks and Barker Reservoirs are excellent flood control reservoirs that are in need of repair, rescue, and resuscitation. Multiple strategies should be considered here.
  - a. The Corps of Engineers has to fix the deteriorated levee conditions that caused these reservoirs to be classified as two of the six most dangerous flood control dams in the United States. Although some work has been completed, more needs to be done. We must determine what needs to happen to get this work underway, and the repairs must be completed.
  - b. These two reservoirs have accumulated extensive amounts of silt and sediment over the last 60-plus years of operation. That dirt needs to be removed. By doing this, at least two or more feet of capacity can be restored to each of these reservoirs—capacity that was desperately needed during Harvey. This is an easy fix.
  - c. These two reservoirs, although designed for multiple-day flood events, are not large enough for the rain that fell during Harvey, and caused extensive flooding downstream on Buffalo Bayou as well as upstream behind the dams. A new flood control reservoir has been sited and at least partially designed by the Harris County Flood Control District. If constructed as proposed, it would offer significant relief to the Addicks Reservoir. This new reservoir has not been pursued to date due to a decision to seek federal funding rather than paying for and building it ourselves. Had this been funded and constructed at the time it was first suggested, there would have been important additional capacity available. This alternative should be pursued immediately.
5. Severe storms are in our future. Whether you say it is climate change or just “weird weather,” the fact is that we are looking at larger, more severe storm events than we have previously contemplated. It is hard to grasp how large and how serious these storms can be. Harvey, for now, has defined the edge of severe rainfall events, but we have not seen the worst hurricane surge that is likely to occur at some point in the future. Rice’s SSPEED Center has completed the modeling of realistic future scenarios that predict larger storm surges than experienced to date on the upper Texas coast. Surge levels of up to 25 feet above sea level are generated by reasonable worst-case storms of the future. Such a storm would devastate the chemical and refining heart of the Houston economy and cause one of the worst environmental disasters in U.S. history. We have to understand that these storms indeed can and will happen. Harvey showed us that fact.
6. We must determine the appropriate 100-year and 500-year rainfall events for the design, planning, and engineering that will occur in the aftermath of Harvey. A 100-year rainfall in Harris County has become so common that residents laugh when they hear we

have just experienced another 100-year flood. The fact is, our rainfall patterns are becoming more severe, and we must address that situation as soon as possible. It is likely that most of Harris County's flood damage occurred within the 500-year floodplain, which was determined on the basis of about 19 inches of rain over a 24-hour period. As an interim measure, we might adopt the mapped 500-year floodplain as Houston's official floodplain rather than continue using the out-of-date 100-year storm. Then, once more realistic rainfall levels are set, the resulting 100-year and 500-year floodplains should be comprehensively remapped.

7. A thorough analysis of the role and future of the Federal Emergency Management Agency's (FEMA) flood insurance program needs to be undertaken. Although this program is a source of much-needed subsidized flood insurance that would be generally unavailable through the private sector, it also enables floodplain development based on maps that it publishes (although much of the work is done by Harris County). These floodplains are too small because the rainfall amounts they are based on are too small. We have to get this information right, and FEMA has a major role in this. FEMA regulations concerning floodplain development that all communities in the federal flood insurance program must follow depend on the accuracy of these maps in order to succeed. Further, strengthening these regulations by limiting new construction in these danger zones should be considered. This program is simply failing to alleviate flood damages at this time.

8. Native prairies and wetlands still exist in the western and northwestern portions of Harris County. We should establish programs to preserve these areas because they have an amazing natural capacity to absorb rainwater and store it in the soil. Here, there are market-based approaches that could be excellent methods of paying landowners to raise a "crop" of stored water. There are also certain steps that need to be taken to ensure that such market approaches can function in Texas and the United States, not only for flood water containment, but also for carbon farming, the most likely "crop" to generate substantial income for farmers and ranchers. The SSPEED Center has developed the Texas Coastal Exchange to create a trading system, details of which will be explained in a forthcoming Baker Institute publication. This approach requires no local, state, or federal funding.

9. More money must become available for flood damage reduction and flood planning than is currently available. We have put off spending money on excellent projects because our government officials have not been willing to ask people in the region to pay for them. Although politicians will resist this idea, we need a special flooding abatement tax, but with safeguards such as specifying details about the projects and approaches to be funded with the revenue raised by these taxes. The Dutch have a national tax for flooding abatement because it is considered a matter of national security. We need one for regional security.

10. We need tools to help us live with the floods that we know are in our future. We need the best flood warning and flood information system in the United States—one that matches the extent of our flooding problem, which is among the worst in the United States, according to payouts on flood insurance (and that was before Harvey). With the technology of today, we should be able to obtain information in real time about rainfall intensities,

bayou conditions, and flooded roads and intersections. No one should die because they have driven into a submerged intersection that is known to have problems during a heavy rain. Certain high priority municipal areas—including arts and other civic venues—must be flood-proofed, much as the Texas Medical Center has become much more resilient, with a sophisticated warning system and flood gates that are deployed based on the warnings. These and many other tools are there if we just search for them.

11. Our pattern of development has been outward from the center of Houston and up the watersheds of the various bayous and creeks. As such, new development has dumped increased runoff onto older downstream subdivisions and commercial structures. Inadvertently, we have dumped runoff on older neighborhoods while attempting to keep flood control costs lower in new developments, effectively subsidizing new development on the backs of the downstream residents. Fort Bend County has much more stringent drainage regulations than does Harris County and it fared better in the storm than did Harris County. Fort Bend County also has had excellent economic growth. We can design better, safer subdivisions and still thrive economically. Do not believe otherwise.

12. There are some building techniques that work better than others in Houston. As a general proposition, our storm sewers handle the most frequent storms and our streets are the secondary drainage system up to a 25-year storm event. Additional runoff into flooded streets simply moves over the curbs and into our yards. It is likely that homes with floor slabs that are not elevated higher than the top of street curb will flood in larger storm events. We should encourage, if not require, that the foundations of all new and rebuilt homes be elevated well above the crown of the street.

13. We need to help our citizens learn about flooding, its risk, and how it may impact them. We should have easily available information about floodplains and their accuracy (at least until new ones come out), where the major flooding occurred, and where the repetitive flooding has occurred. Those moving into hurricane evacuation zones should be informed of this fact. A public marker showing the height of the surge flooding from Category 4 and 5 hurricanes was removed by a local governmental entity because “it interfered with land sales.” Well, of course it did. Well-informed buyers make good decisions. Bad decisions are enabled by bad information.

14. Harvey was a huge rainfall storm, but it did not have a surge component of any magnitude in Galveston Bay. Our region has not seen a worst-case damage scenario such as would come with a 20- to 25-foot surge engulfing the refining and chemical complex that is a centerpiece of Houston’s economy. Such a storm would likely generate the worst environmental disaster in U.S. history and render areas around Galveston Bay uninhabitable. There are at least two viable solutions to protect both the economy of the area and residents along with western shoreline of Galveston Bay and the city of Galveston. The alternative favored by many—the Ike Dike—costs perhaps as much as \$15 billion and cannot be funded by local governments alone. Another—the mid-bay solution—costs about \$3 billion, offers about 95% of the protection provided by the more expensive alternative, and can be funded and built locally. We should carefully consider how any

federal money that is forthcoming is spent. We may not have the luxury of spending \$15 billion on any single alternative.

15. We need to develop metrics to keep up with the success or failures of our alternatives and expenditures. We need to keep a tally sheet by watershed of the number of acres in the floodplain and floodway (and report changes such as occurred in 2004-2007), the number and location of homes flooded, the streets and intersections that flooded the worst, the number of cars flooded, the amount of damages per watershed, the amount of money spent on flood damage reduction per watershed, the number of grandfathered permits and variances issued, etc. The point is, we need public accountability and transparency in our flood control work. Every major corporation in the United States has excellent metrics of virtually all aspects of their business, often displayed on their website for all to view. Houston needs a similar system going forward.

These ideas are a starting point for discussion and action to improve our situation relative to flooding. It is time to pull out every option that we have and figure out how to use them collectively. It is not all or nothing. It is a mixture of strategies both structural and non-structural that will lead us to find better ways to live here on the Texas coast.