

Creating a Long-Term, Adaptive Approach to Flood Mitigation

Tulsa, Oklahoma



QUICK FACTS

Population¹. 400,699
 Flood-Related Disaster² 14
 % of City Properties at Risk³ 14%
 Avg. Cost of Flood Insurance Per Household⁴. . . \$720
 FEMA Community Rating System Score (2019)⁵ 2



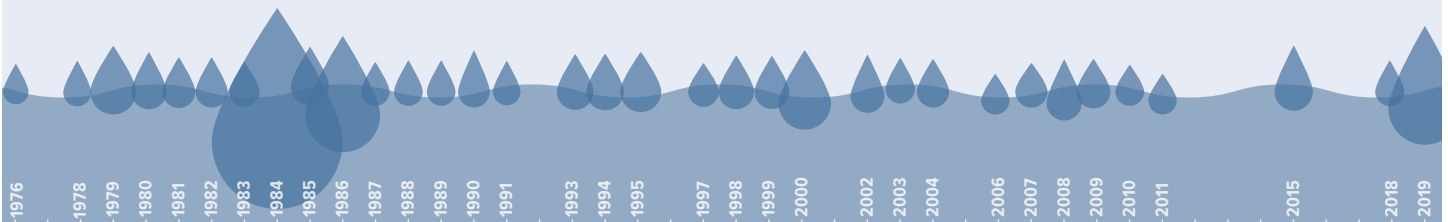
CHALLENGES

Tulsa experienced a devastating flood in 1984 that resulted in 14 deaths, 288 injuries, and extensive damage to the city’s buildings and infrastructure. While the flood catalyzed a progressive flood mitigation program, the program has continually adapted to meet changing needs over the last 30+ years.



YEARS WITH DAMAGING FLOODS, 1976-2019

Size proportional to National Flood Insurance payments.



LESSONS LEARNED

Risks, regulations, and funding sources related to flood mitigation are constantly changing and require adaptability.

Tulsa’s willingness to reimagine its approach to mitigating floods has allowed its programs to remain useful and relevant. Tulsa originally created a Stormwater Management department to manage flood risk but later adapted to changing needs by distributing stormwater staff across government departments.

Mitigation is stronger when it becomes a way of life for city operations and planning.

Tulsa’s Stormwater Management department developed a master drainage plan to help them strategically implement projects across government departments. Tulsa’s stormwater staff always have a seat at the project-planning table, ensuring mitigation is considered in capital improvement projects.

Public outreach maintains community support.

Tulsa’s stormwater staff prioritize public outreach to ensure flood risk is communicated to community members through regular meetings and stakeholder networks.

Flood mitigation is long-term work.

Flood projects do not end once the physical infrastructure is built. Effective mitigation programs require ongoing outreach and maintenance. While Tulsa’s major construction phase was completed by the 1990’s, the city continues to decrease its flood risk through ongoing maintenance and stormwater management projects. Their stormwater utility fee allows consistent funding for these projects.

OVERVIEW

Tulsa is nationally recognized as a leader in flood mitigation. Their progressive approach to flood mitigation began in response to a major flood on Memorial Day in 1984. The flood devastated Tulsa, resulting in 14 deaths, 288 injuries, and \$180 million (1984 dollars) in damages.⁶

The flood prompted Tulsa to rethink its approach to flood control. The city relocated 300 homes and a mobile home park, invested more than \$10 million in flood control projects, and spent \$2.1 million to develop master drainage plans.⁷ It was an early adopter of the National Flood Insurance Program's Community Rating System (CRS). Over time it has reduced its rating in that system to a 2, one of only six communities in the country with such a low rating. (The rating system ranges from 1 to 10, with 1 being the best possible score.) As a result of their participation in CRS and their rating, Tulsa residents benefit from a 40% discount on National Flood Insurance Program premiums.



The Community Rating System

The Community Rating System (CRS) was instituted in 1990 as a complement to the National Flood Insurance Program. CRS is designed to incentivize proactive flood mitigation projects by reducing National Flood Insurance Program premiums when cities implement specific mitigation activities. CRS scores range from 10 (in which communities have implemented no or minimal mitigation efforts) to the best possible score of 1.

When communities implement mitigation projects within the following categories, they can lower their CRS score:

- Public Information
- Mapping and Regulations
- Flood Damage Reduction
- Flood Preparedness

The more qualifying mitigation projects that communities undertake, the lower their CRS score. For every one-point score reduction, residents who live in special flood hazard areas receive a 5% reduction in their National Flood Insurance Program premiums. Tulsa's CRS score of 2 indicates that the city has done a great deal to mitigate its flood risk. As a result, its residents in special flood hazard areas receive a 40% reduction in their flood insurance premiums resulting in approximately \$790 annual savings per household.

Funding Highlights: Stormwater Maintenance		
Local	State	Federal
\$8.35 monthly stormwater utility fee	Oklahoma agencies have funded projects with mitigation co-benefits (e.g., OK Dept. of Transportation)	Hazard Mitigation Grant Program funding

ADAPTING GOVERNMENT PROCESSES TO MEET FLOOD CHALLENGES

One of the results of Tulsa's initial flood mitigation efforts following the 1984 flood was the establishment of a Stormwater Management department within city government. The new department helped build support for and implement mitigation projects.

As the construction phase of Tulsa's mitigation projected ended, the city diversified its flood control to focus more on maintenance. In 1991, stormwater management employees were moved into other departments, including engineering, streets, and development, to increase efficiency and collaboration. Stormwater management is now integrated throughout government processes, enabling mitigation to be incorporated into seemingly unrelated capital improvement projects. Since stormwater management is now incorporated into many different city departments, stormwater staff always have a seat at the table when decisions about the city's infrastructure are being made.

The city has also committed to a stormwater-oriented approach to flood mitigation through the establishment of its Stormwater Management and Hazard Mitigation Program, which was written into Tulsa's Code of Ordinances in 2008. In addition to defining the scope and responsibilities of stormwater management staff within the Public Works department, the Code also defined the Stormwater Drainage and Hazard Mitigation Advisory Board. The board's purpose is to advise the mayor on appropriate policy to protect Tulsa from flood risk, to commission studies on stormwater issues and flooding, and to review Tulsa's hazard and disaster plans.

MASTER DRAINAGE PLAN

Tulsa's investment in planning and creating a master drainage plan has been key in enabling its adaptive approach to flood mitigation. The purpose of a master drainage plan is to identify potential or actual drainage problems and to develop strategies to fix them. Since 1990, Tulsa has had a citywide master drainage plan that identifies recommendations, goals, and objectives, and prioritizes projects according to their flood risk reduction potential along with several other criteria. The plan is updated routinely on an as-needed basis.



Tulsa often leverages money from the Department of Transportation to help fund stormwater improvements to its road infrastructure.

According to city officials, the master drainage plan has been integral to incorporating flood mitigation into projects throughout the city. For example, the master drainage plan enabled the integration of drainage improvements into a major, decade-long transportation project to widen and update a stretch of interstate highway (I-44) that runs through Tulsa. Having a master drainage plan in place gives Tulsa the ability to make consistent

and strategic decisions about drainage projects throughout the city, as well as to include drainage system updates in transportation and other related projects.

A LONG-TERM APPROACH

Tulsa remains a leader in flood mitigation more than 30 years after its program was initiated—quite a feat, especially considering the relative absence of major flood events during that time. Flood mitigation has been institutionalized through the master drainage plan and stormwater management staff throughout local government, as well as through communications strategies to increase risk awareness.

From the beginning of its flood mitigation programs in 1984, Tulsa has prioritized public outreach to increase community awareness about flood risk. This includes conducting community meetings as well as building networks with stakeholders. For example, the Disaster Resilience Network was incorporated in 2000 with the mission of empowering “people, businesses, and communities to reduce the impact of disasters.” The Council’s subgroup on housing has conducted outreach about the use of low-impact development practices and green infrastructure strategies to address flooding and stormwater drainage issues such as rain gardens, bioswales, and pervious concrete.

As cities contemplate mitigation programs, it is important to consider how these programs will be maintained over time. Tulsa’s willingness to adapt its approach to flood control allowed the city government to evolve with changing needs. Deciding on a governance structure and maintenance plan for flood projects are key decisions for local governments. For Tulsa, writing a master drainage plan, maintaining and implementing it, establishing a department to administer flood mitigation, and deciding where that department should be situated within local government were all critical decisions that contributed to long-term success in reducing flood risk.



Stormwater utility fee

Tulsa uses a stormwater utility fee to help fund its Streets and Stormwater Department projects, including operation and maintenance of detention ponds and other stormwater facilities. The 2020 rate for Tulsa residents is \$8.35 per month.⁸ When compared to other tools for generating local revenue, stormwater utility fees are typically a more predictable and stable source of funding.

Taxpayers may resist the creation of stormwater utility fees, so generating support through public information and education campaigns is critical. Explain that the fee will be used to fund projects that will make the community safer and result in more reliable infrastructure. Emphasize that investing in the community today will help the community avoid tragedies that could have enormous costs tomorrow.

LEARN MORE ABOUT TULSA'S FLOOD MITIGATION EFFORTS

City of Tulsa

Flood Control: <https://www.cityoftulsa.org/government/departments/engineering-services/flood-control/>

Flood History: <https://www.cityoftulsa.org/government/departments/engineering-services/flood-control/flooding-history>

How Tulsa Became a Model for Preventing Floods. NPR: <https://www.npr.org/2017/11/20/564317854/how-tulsa-became-a-model-for-preventing-floods>

The City Preparing for Climate Change Without Ever Saying the Words. Governing: <https://www.governing.com/topics/transportation-infrastructure/gov-tulsa-climate-change-resilience-adaptation-flooding.html>

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CITATIONS

1. U.S. Department of Commerce. (2020). Census Bureau, Population Division, Washington, D.C.
2. Federal Emergency Management Agency. (2020). *Disaster declarations summary*. (Version 2). Retrieved from <https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2>
3. First Street Foundation. (2020). *Flood factor*. Retrieved from <https://floodfactor.com/>
4. Federal Emergency Management Agency. (2020). *National Flood Insurance Program redacted claims dataset*. Retrieved from <https://www.fema.gov/openfema-data-page/fima-nfip-redacted-claims>
5. Federal Emergency Management Agency. (2020). *Community Rating System eligible communities*. Retrieved from https://www.fema.gov/sites/default/files/2020-08/fema_crs_eligible-communities_oct-2020.pdf
6. City of Tulsa. (n.d.) Flooding history. Retrieved from <https://www.cityoftulsa.org/government/departments/engineering-services/flood-control/flooding-history/>
7. National Weather Service. (n.d.) May 26 – 27, 1984 Tulsa Memorial Day flood. Retrieved from https://www.weather.gov/tsa/1984may26_tulsamemorialdayflood
8. City of Tulsa. 2019. Utility rates and customer service fees. Retrieved from <https://www.cityoftulsa.org/media/11998/2019-utility-rate-book.pdf>
9. Shade, K. and C. Young (2020, August 10). Disaster changed Tulsa. *Tulsa World*. Retrieved from https://tulsaworld.com/archive/disaster-changed-tulsa/article_35cb6124-ca70-5f49-ba66-b64063e44158.html

THIS REPORT IS PART OF A SERIES

This case study is part of a series entitled *Building for the Future: Five Midwestern Communities Reduce Flood Risk*.

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Creative mitigation strategies: Using sports fields as stormwater detention basins

Tulsa's stormwater management program includes over 155 publicly and privately maintained detention basins.⁹ Detention basins are designed to either temporarily or permanently hold floodwaters during heavy rain events. In Tulsa, many of its "dry" detention basins are large grassy areas that serve as parks, soccer fields, and football fields during normal days. When heavy rain events occur, the water temporarily pools up and is stored in the basin, reducing the flow of runoff water. By preserving vegetation and trees, the basins decrease downstream flooding impacts while also helping to promote water quality.

Tulsa also has "wet" detention basins that permanently hold water. An example of a wet detention basin is Carol's Pond, named after the late Tulsa resident and flood-mitigation advocate Carol Sue Williams. This pond was created after properties on the floodplain were bought, and the space was transformed into a park. The detention basin and surrounding green space provide fishing, golfing, and frisbee opportunities while improving stormwater drainage.

Detention basins require regular maintenance to prevent clogging and ensure full drainage capacities. Tulsa funds this maintenance through its stormwater utility fee.