

2022 Prioritization Framework for the Allocation of Funds from the Harris County Flood Resilience Trust

April 26, 2022



Purpose

This document outlines the 2022 Prioritization Framework for the Harris County Flood Control District's (District) approach to allocating funds from the Flood Resilience Trust. The District strives to complete projects that prevent the worst impacts on people first ("worst first" approach). This document evaluates a combination of several factors to develop a prioritization framework.

The 2018 Bond Program identified over 200 flood mitigation projects throughout Harris County. All projects have been initiated and are at various stages of the project lifecycle, but some projects may have a gap in funding due to a lack of anticipated partnership funding such as Federal or State grants or may need contingency funding. The 2022 Prioritization Framework summarized in this document includes evaluation criteria and a weighting process that will provide input to the allocation of funds from the Harris County Flood Resilience Trust towards 2018 Bond Projects with funding gaps or contingency funding needs throughout the remaining lifetime of the Bond, as well as input to the allocation of any surplus or unused Flood Resilience Trust funds towards additional projects not currently included in the 2018 Bond Project list.

Types of Projects

The following are the major types of projects that may be scored with the Prioritization Framework to determine prioritization for funding:

- Right-of-Way, Planning, Design and/or Construction Projects – Traditional infrastructure projects to reduce flooding potential.
- Floodplain Preservation and Right-of-Way Acquisition – Acquisition of property deep in the floodplain for preservation as well as acquisition of property for future projects.
- Wetland Mitigation Banks – Creation of wetlands for permanent protection and wetland mitigation credits to offset the loss of wetlands due to development.
- Storm Repairs and Restore Channel Capacity - Projects that include fixing side slope failures and desilting channels to restore the channel capacity to the original design.
- Subdivision Drainage Improvements – Projects typically in partnership with another agency that has primary jurisdiction to improve the internal subdivision drainage in conjunction with District channels.

The 2022 Prioritization Framework presented here is intended for use in evaluating both projects that are ongoing and newly identified projects that may be funded using any remaining Flood Resilience Trust funding once all existing 2018 Flood Bond projects are fully funded.

However, this framework is not suited for evaluation of buyout projects or countywide projects:

- Buyout projects are necessarily long-term projects that require close collaboration with local communities.
- Countywide projects do not fit easily within the framework developed here due to the challenges in estimating the flood risk reduction benefits from these projects. These projects in the 2018 Flood Bond include the following:

- o Flood Warning System – Improvements and advancements to the existing District’s Flood Warning System and
- o Floodplain Mapping Updates – Updates to the Federal Emergency Management Agency (FEMA) 1% floodplain maps and other mapping products.

As such, these projects are separately funded and are not anticipated to draw from the Flood Resilience Trust.

Project Prioritization

Evaluation criteria were developed to determine the prioritization score for flood mitigation projects. These criteria allow for an opportunity to create objectivity in the prioritization process. The Weighted Factors Analysis used to evaluate the remaining projects is described below in detail with the following criteria:

- Project Efficiency
 - o Project Efficiency using People Benefitted
 - o Project Efficiency using Structures Benefitted
- Existing Conditions
- Social Vulnerability Index
- Long Term Maintenance Costs
- Environmental Impacts
- Potential for Multiple Benefits

Each project is assigned a score for each criterion below ranging from 0 to 10. A score of “10” represents that a project for which the criterion was fully met and a score of “0” indicates that the project met did not meet the criterion.

2022 Prioritization Framework Criteria

Metric	Description	Weight
Project Efficiency	<i>People Benefitted</i> Total Cost of Project/Number of people benefitted by the project (Table 1).	15%
	<i>Structures Benefitted</i> Total Cost of Project/Structural benefits in 100-year rainfall (Table 2).	30%
Existing Conditions	<i>For channel and detention projects:</i> Capacity of the existing Flood Control District channel to manage a flooding event. Lower system capacity means a higher score (Table 3). <i>For subdivision drainage projects:</i> Estimated existing drainage conditions, using a combination of the maximum excess rainfall in a 100-yr event and the existing quality of drainage infrastructure in the project area (Table 4).	20%
Social Vulnerability Index (SVI)	CDC measure of communities' ability to survive and recover from a disaster (Table 5).	20%
Long-Term Maintenance Costs	Long-term operating costs of projects (Table 6).	5%
Environmental Impacts	<i>For channel and detention projects:</i> Anticipated environmental impact of the project, including whether it requires a permit from the US Army Corps of Engineers or requires the purchase of mitigation credits (Table 7). <i>For subdivision drainage projects:</i> Anticipated right-of-way impacts of the project (Table 8).	5%
Potential for Multiple Benefits	<i>For channel and detention projects:</i> Anticipated recreational or environmental benefits of the project (Table 9). <i>For subdivision drainage projects:</i> Ability of the project to work in conjunction with a nearby detention basin or channel improvement project (Table 10).	5%
Total		100%

Project Efficiency

Project efficiency is the measure of the amount of funding that is required to reduce the risk of flooding for people or structures from a 100-year rain or flood event. Project efficiency is divided between two measures of efficiency: Project Efficiency using People Benefitted, and Project Efficiency using Structures Benefitted.

Project Efficiency using People Benefitted

Tables 1 provides scoring for ranges of project efficiency using people benefitted. This measure is defined as the total cost of the project divided by the number of people that receive a flood damage reduction benefit from a 100-year flood or rainfall event, based on the estimated population within the project benefit area.

$$\text{Project Efficiency using People Benefitted} = \frac{\text{Total Cost of Project (\$)}}{\# \text{ of People Benefitted}}$$

Table 1: Project Efficiency using People Benefitted Scoring Criteria

Criteria	Score
Greater than \$77,000/person	1
\$28,001 to \$77,000/person	4
\$15,001 to \$28,000/person	6
\$6,000 to \$15,000/person	8
Less than \$6,000/person	10

Project Efficiency using Structures Benefitted

Table 2 provides scoring for ranges of project efficiency using structures benefitted. This measure is defined as the total cost of the project divided by the number of structures that receive a flood damage reduction benefit from a 100-year flood or rainfall event.

$$Project\ Efficiency\ using\ Structures\ Benefitted = \frac{Total\ Cost\ of\ Project\ (\$)}{\#\ of\ Structures\ Benefitted}$$

Table 2: Project Efficiency using Structures Benefitted Scoring Criteria

Criteria	Score
Greater than \$261,000/structure	1
\$106,001 to \$261,000/structure	4
\$60,001 to \$106,000/structure	6
\$23,000 to \$60,000/structure	8
Less than \$23,000/structure	10

Existing Conditions

The existing conditions metric for District channels utilizes a data set that was developed to determine the system capacity of the channel. The capacity ranges from 1% Annual Exceedance Probability (AEP), or 100-year storm, to the 50% AEP storm, or 2-year storm. A channel with system capacity greater than the 1% AEP is expected have less than 1% probability of flooding in a given year, while a channel with system capacity less than 50% AEP is expected to have greater than 50% probability of flooding in a given year. Table 3 defines the scoring associated with the system capacity for the District channel in question.

Table 3: Existing Conditions Scoring Criteria (Channel and Detention Projects)

Criteria	Score
System capacity is > 1% AEP storm (100-year storm)	0
System capacity is < 1% AEP storm (100-year storm)	1
System capacity is < 2% AEP storm (50-year storm)	2
System capacity is < 4% AEP storm (25-year storm)	4
System capacity is < 10% AEP storm (10-year storm)	6
System capacity is < 20% AEP storm (5-year storm)	8
System capacity is < 50% AEP storm (2-year storm)	10

A major source of flooding in Harris County occurs outside of the 100-year floodplain, in large part due to inadequate stormwater infrastructure. For projects that provide flood reduction benefits outside the 100-year floodplain, such as subdivision drainage improvement projects, the Existing Conditions metric is based on the estimated excess rainfall accumulation in a 100-year flood event using MAAPNext rain-on-grid data *and* existing quality of drainage infrastructure in the project area. The existing quality of drainage infrastructure is classified using the following criteria:

- *High-Quality Infrastructure* = Streets and roads within the subdivision of proposed improvement are constructed with curb-and-gutter streets post-1984.
- *Medium-Quality Infrastructure* = Streets and roads within the subdivision of proposed improvement are constructed with curb-and-gutter streets pre-1984.
- *Low-Quality Infrastructure* = Streets and roads within the subdivision of proposed improvement are open ditch.

Table 4 defines the scoring associated with the Existing Conditions metric for subdivision drainage improvement projects.

Table 4: Existing Conditions Scoring Criteria (Subdivision Drainage Improvement Projects)

Criteria	Points
Low estimated excess rainfall AND high-quality drainage infrastructure	0
Intermediate estimated excess rainfall OR medium-quality drainage infrastructure (but not both)	3
Intermediate estimated excess rainfall AND medium-quality drainage infrastructure	6
High estimated excess rainfall OR low-quality drainage infrastructure (but not both)	9
High estimated excess rainfall AND low-quality drainage infrastructure	10

Social Vulnerability Index

Social vulnerability refers to the resilience of communities when confronted with disasters such as flooding. Communities that are more socially vulnerable are at greater risk for loss of life during a disaster and are slower to recover after a disaster. The Centers for Disease Control has created its Social Vulnerability Index (SVI) using 15 U.S. Census variables that influence a community's ability to prepare for, respond to, and recover from a disaster. These factors include the percentage of elderly residents, limited English proficiency, households without a vehicle, and other factors. The SVI score of the community served by a given project determines the scoring of this criterion. Table 5 provides the scoring ranges to account for social vulnerability.

Table 5: Social Vulnerability Scoring Criteria

Criteria	Score
SVI indicates low level of vulnerability	1
SVI indicates low to moderate level of vulnerability	4
SVI indicates moderate to high level of vulnerability	7
SVI indicates high level of vulnerability	10

Long Term Maintenance Costs

Maintenance costs for each type of project varies. For channel and detention projects, considerations include the ability to access the channel, channel geometry and material, and maintenance berm width. For example, concrete-lined channels have different maintenance costs than grass-lined channels. Additionally, the size of the channel and/or stormwater detention basin will affect the maintenance costs. Table 6 defines the scoring associated with long term maintenance costs.

Table 6: Long Term Maintenance Costs Scoring Criteria

Criteria	Score
Project will require extensive or specialized maintenance	2
Project will require maintenance outside of District's or jurisdiction's regular maintenance practices	6
Project only requires regular, on-going maintenance	10

Minimize Environmental Impacts

Tables 7 and 8 define the scoring associated with project specific environmental mitigation. For channel and detention projects, environmental mitigation could include purchasing credits at a wetlands or streambank mitigation bank, completing environmental permits, and creating self-mitigating projects. Each of these items has an impact on project cost and schedule.

Table 7: Minimize Environmental Impacts Scoring Criteria (Channel and Detention Projects)

Criteria	Score
Project will have significant environmental impacts requiring a Corps of Engineers Individual Permit and mitigation bank credits	0
Project will have significant environmental impacts requiring mitigation bank credits	2
Project is able to significantly avoid environmental impacts	6
Project has minimal or no environmental impacts	10

For subdivision drainage improvement projects, impact on the environment is minimized when a project can be completed within the road's existing right-of-way.

Table 8: Minimize Environmental Impacts Scoring Criteria (Subdivision Drainage Improvement Projects)

Criteria	Score
Project will require acquiring additional right-of-way	6
Project can be completed within the road's existing right-of-way	10

Potential for Multiple Benefits

Tables 9 and 10 define the scoring associated with the project's potential for multiple benefits including recreational and environmental enhancements. For subdivision drainage improvement projects, multiple benefits are achieved when the drainage improvement project's benefit area also benefits from a nearby detention basin or channel improvement project.

Table 9: Potential for Multiple Benefits Scoring Criteria (Channel and Detention Projects)

Criteria	Score
Project does not have multiple benefits	0
Project has recreational benefits	4
Project has environmental enhancement benefits	6
Project has recreational and environmental enhancement benefits	10

Table 10: Potential for Multiple Benefits Scoring Criteria (Subdivision Drainage Improvement Projects)

Criteria	Score
Project area does not benefit from a District improvement such as a nearby channel improvement or detention basin project	6
Project area also benefits from a District improvement such as a nearby channel improvement or detention basin project	10

Weighted Factors Analysis

The Weighted Factors analysis allows criteria to be weighted based on percentages that sum to 100 percent. Each of the criteria was given a percentage weighting based on a holistic view of flood risk reduction priorities. The District's mission is to provide flood damage reduction projects that work, with appropriate regard for community and nature-driven values; therefore, flood risk reduction for people and structures is the most heavily weighted factor, with the remaining factors weighted in decreasing order of priority: infrastructure and community equity, maintenance, and other factors that influence the long-term value of the project.

- Project Efficiency Weighting Factor
 - Resident Benefits Efficiency 15%
 - Structure Benefits Efficiency 30%
- Existing Conditions Weighting Factor 20%
- Social Vulnerability Index Weighting Factor 20%
- Long Term Maintenance Costs Weighting Factor 5%
- Minimizes Environmental Impacts Weighting Factor 5%
- Potential for Multiple Benefits Weighting Factor 5%
- 100%

RECOMMENDED 2022 PRIORITIZATION FRAMEWORK FOR THE ALLOCATION OF FUNDS FROM THE HARRIS COUNTY FLOOD RESILIENCE TRUST

April 26, 2022

The previously adopted “Prioritization Framework for the Implementation of the Harris County Flood Control District 2018 Bond Program” (2019 Prioritization Framework), was a major step forward for Harris County. Two years have passed since the 2019 Prioritization Framework was adopted with the original intended purpose of helping determine the order in which 2018 Bond Projects were initiated. Today, all 2018 Flood Bond projects have been initiated and are at various stages of the project lifecycle. The proposed 2022 Prioritization Framework presented in this item is intended for the purpose of allocating funding from the Flood Resilience Trust to projects with partnership funding gaps or in need of contingency funds, as well as help prioritize funding for new projects not included in the 2018 Flood Bond program. The proposed 2022 Prioritization Framework builds upon the previous framework and would not change the funding allocations for projects that are fully funded and underway.

A first version of the proposed modifications was presented to Commissioners Court on 12/14/21. The Court directed the Harris County Flood Control District (HCFCD) and the Office of County Administration (OCA) to solicit feedback from the Community Flood Resilience Task Force (CFRTF) on the proposed modifications.

On 02/17/22, the Community Flood Resilience Task Force (CFRTF) released recommendations on these revisions which included:

1. Use People to Measure People Benefitted
2. Adjust the Assigned Values for Projects Without Direct Benefits to Structures
3. Remove Committed Partnership Funding from the Prioritization Framework
4. Use a More Recent Range of Data for the Level of Service (LOS) Proxy

The proposed 2022 Prioritization Framework incorporates the CFRTF’s recommendations as well as staff-level recommendations from the Engineering Department and Flood Control District, and maintains the following overarching goals:

- 1. The Prioritization Framework should place greater emphasis on the number of people a project benefits.**
- 2. The Prioritization Framework should no longer consider potential *or committed* partner funding as a factor.**
- 3. The Prioritization Framework should recognize projects that address structural flooding both inside and outside the 100-year mapped floodplain.**

OVERVIEW OF RECOMMENDED MODIFICATIONS FOR THE 2022 PRIORITIZATION FRAMEWORK

Measure	Description	Old Weight	New Weight
Flood Risk Reduction	<i>Eliminate</i> % of structures in a watershed from which the 100-yr floodplain is removed	25%	-
Project Efficiency using People Benefitted	<i>Add</i> Total cost of project/number of people benefitted by the project	-	15%
Project Efficiency using Structures Benefitted	Total cost of project/ structural benefits in 100-yr rainfall	10%	30%
Partnership Funding	<i>Eliminate</i> Estimated partner funding as % of project cost	10%	-
Existing Conditions	<i>Add comparable measure subdivision drainage improvement projects based on the maximum excess rainfall in a 100-yr event and existing quality of drainage infrastructure in the project area.</i> Capacity of the existing Flood Control District channel to manage a flooding event. Lower system capacity means a higher score.	20%	20%
Social Vulnerability Index (SVI)	CDC measure of communities' ability to survive and recover from a disaster	20%	20%
Long-Term Maintenance Costs	Long-term operating costs of projects	5%	5%
Environmental Impacts	<i>Add comparable measure for subdivision drainage improvement projects based on whether the project requires additional right of way.</i> Anticipated environmental impact of the project, including whether it requires a permit from the US Army Corps of Engineers or requires the purchase of mitigation credits.	5%	5%
Potential for Multiple Benefits	<i>Add comparable measure for subdivision drainage improvement projects based on whether the project area also benefits from a nearby channel improvement or detention basin project.</i> Anticipated recreational or environmental benefits of the project.	5%	5%
TOTAL			100%

RECOMMENDATIONS FOR MODIFICATIONS FOR THE 2022 PRIORITIZATION FRAMEWORK

Recommendation 1: The 2022 Prioritization Framework should place greater emphasis on the number of people benefitted by a project.

Under the 2019 Prioritization Framework, the benefits of flood mitigation projects are measured primarily by the number of structures removed from a 100-year rain or flood event. This value is included in both the Flood Risk Reduction metric which measures the *percentage* of structures in a specific watershed that a project benefits and the Project Efficiency metric. The former metric had the unintended consequence of equally scoring projects in the category even though one project may have a dramatically higher number of structures benefitted, while the latter metric primarily offers a measure of the project's cost efficiency rather than a measure of benefits accrued by people.

The CFRTF's input was to provide greater emphasis on benefits to people instead of structures by implementing a formula that estimates people benefitted. We recommend that the modified Prioritization Framework accomplish that goal by eliminating the Flood Risk Reduction (25%) metric and instead weigh Project Efficiency at 45% using a combination of two efficiency metrics: Project Efficiency using People Benefitted (15%) and Project Efficiency using Structures Benefitted (30%).

The proposed method to estimate the number of people who benefit from a given project is a structure-weighted approach which calculates the average number of people per structure at the sub-watershed level and multiplies that factor by the count of structures benefitted for each project. This method also addresses the CFRTF's recommendation to keep the formula as simple as possible with the fewest number of assumptions, use the most recent and finest grain data possible, and capture benefits for people in the project area, including first and upper floors.

By including both people and structures benefitted, the Prioritization Framework can estimate benefits accrued by residents in the project area, regardless of the floor level, *and* first floor flood risk reduction benefits to structures. As additional data on the number of housing units in each structure becomes available, this method can be refined to produce more precise estimates of the number of people benefitted by a project.

For projects that do not benefit people and structures directly, the 2019 Prioritization Framework assigns values from 1-10, with 10 being the highest score. The CFRTF recommended modifying the assigned values to balance projects with direct flood risk reductions to people with projects that meet broader resilience goals, such as nature-based solutions. Therefore, we recommend:

- Adding a Natural Channel Design category, scored at a 6.
- Reducing the score of Wetland Mitigation Banks from a 6 to a 4, but higher than 1, the CFRTF's recommended value, due to the critical nature of these projects for advancing the portfolio of existing flood risk reduction projects and broader ecological benefits these projects provide.

The following table outlines the recommended scoring for all types of projects that do not directly benefit people and structures.

Type of Project	Benefit to People/Structures	Recommended Assigned Points
Floodplain Preservation	Fully removes future risk, benefits future people and or structures.	7
Natural Channel Design	Can reduce the velocity of water and thus reduce the severity of damage; also offers water quality and ecological benefits in the near term.	6
Wetland Mitigation Bank	Meets a federal regulatory requirement and allows the HCFCD to advance flood reduction projects that impact wetlands. Maintains a no net loss of wetlands which prevents worsening of flood risk and provides ecological benefits.	4
Study/Investigation	Critical first step in the project life cycle and necessary to advance future projects that directly benefit people/structures.	2
Stabilization, Restoration, or Rehabilitation	Primarily operations and maintenance projects that restore or maintain the existing level of service of the channel, thus the risk removal benefit to people/structures is limited.	1

Recommendation 2: The 2022 Prioritization Framework should no longer consider potential or committed partner funding as a factor.

The previous recommendation submitted on 12/14/21 suggested combining three metrics into a proposed Benefit Efficiency metric, calculated by Total Project Cost minus Committed Partnership Funds divided by Total Number of Benefitted Structures. The intention was to eliminate the use of the Potential Partnership Fund metric in the framework and instead account for committed partnership funds as a reduction of the total project cost to the County. However, the CFRTF recommends evaluating the merit of a project based on its overall cost efficiency, calculated using the project’s total cost without factoring in committed partnership funding.

As the CFRTF notes and the HCFCD recognizes, the use of potential and/or committed partnership funds in a Prioritization Framework can be a disadvantage to projects that aren’t able to obtain other forms of local, state, or federal funds. While securing partnership funding is a challenge for all projects, there are clear examples of disproportionate impact to historically excluded communities. For example, the Federal government’s Benefit Cost Ratio, which rates a project’s merit based on a ratio of damages avoided to project cost and determines eligibility for many Federal funding programs, disadvantages low-income minority communities affected by historical disinvestment.

Therefore, to ensure that local funds are distributed equitably, we recommend removing the Potential Partnership metric as a separate factor and assigning 45% to the combination of two Project Efficiency measures as stated in recommendation 1. The HCFCD and Harris County will continue to aggressively pursue partnership funds for all projects while using local funds to advance projects.

Recommendation 3: The 2022 Prioritization Framework should recognize projects that address structural flooding both inside and outside the 100-year mapped floodplain.

A significant amount of flooding occurs outside of the FEMA effective (mapped) 100-year floodplain. In part, this is because floodplain maps must be updated to account for new design rainfall rates, development, and advances in engineering technology. However, a primary reason flooding occurs outside the limits of the mapped floodplain is due to inadequate local drainage systems which do not effectively convey water to the Flood Control District's channel system during very intense and/or prolonged rainfall events. Neighborhoods may flood even when the channel system is effectively doing its job.

The responsibility of upgrading and maintaining the subdivision or local drainage system typically resides with cities, municipal utility districts (MUDs), other entities, and/or Harris County. The County continues to take steps to upgrade subdivision drainage and partner with other entities. These subdivision drainage investments are essential not only to reduce flood risk but to ensure the maximum benefit is derived from large-scale channel investments.

The 2019 Prioritization Framework quantifies benefits by estimating the number of structures in the 100-year floodplain which are benefitted. To account for structures and people benefitted from subdivision drainage improvement projects as part of the Project Efficiency metric we recommend using the number of structures and people which will be protected from ponding or flooding outside the floodplain during a 100-year rainfall event. This provides an apples-to-apples measure that defines benefits as protection from a 100-year event either inside or outside the floodplain.

In addition, to measure the Existing Conditions metric for a subdivision drainage improvement project, we recommend scoring existing conditions for a given project based on the maximum estimated excess rainfall accumulation in a 100-year flood event using MAAPNext data *and* the existing quality of drainage infrastructure in the project area.

- The HCFCD has developed a mapping tool through the MAAPNext initiative that captures flooding outside of the floodplain. This tool is called a "rain-on-grid" model and estimates the excess rainfall in a 100-year event, considering topography and in-ground infiltration. It shows areas of likely ponding or flooding outside the floodplain.
- The existing quality of drainage infrastructure will be evaluated based on whether the local drainage infrastructure is an open ditch network or enclosed curb-and-gutter streets and the detention standards of the infrastructure, for example, whether the drainage system was designed before or after 1984, the year that Harris County adopted minimum stormwater detention mitigation requirements for the construction of roads.

Finally, we recommend adding comparable measures in the Prioritization Framework for local drainage projects in the following categories:

- Environmental Impacts Metric
 - Add a comparable measure for subdivision drainage improvement projects based on whether the project requires additional right of way.
- Potential for Multiple Benefits Metric

- Add comparable measure for subdivision drainage improvement projects based on whether the project area also benefits from a nearby detention basin or channel improvement project.