

Cost-Effectiveness and Benefit-Cost Analysis

Technical Assistance for Communities

FEMA is providing greater access to its Building Resilient Infrastructure and Communities (BRIC) and Flood Mitigation Assistance (FMA) grant programs for eligible communities by addressing one of the challenges identified by stakeholders—successfully completing a project Benefit-Cost Analysis (BCA).

Background

Applicants and subapplicants applying for BRIC and Flood Mitigation Assistance must provide a Benefit-Cost Analysis or other [documentation that validates cost-effectiveness](#). In no case will FEMA award a hazard mitigation project that is not cost-effective. For fiscal year (FY) 2023 BRIC and Flood Mitigation Assistance grant application cycle, FEMA is expanding the pool of projects that may be submitted without a Benefit-Cost Analysis.

- **Benefit-Cost Analysis (BCA) Assistance:** FEMA will review hazard mitigation project subapplications during the pre-award process that are competitive and otherwise eligible for selection where a small and impoverished community as defined in [Title 44 Code for Federal Relations 201.2](#). (*Flood Mitigation Assistance* only), Economically Disadvantaged Rural Communities (*BRIC* only), federally recognized tribal government, or subapplication for a hazard mitigation project within or primarily benefiting a [Community Disaster Resilience Zone](#) (defined at [Title 42 United States Code Section 5136\(a\)\(1\)](#)) is unable to calculate a Benefit Cost Ratio to demonstrate cost-effectiveness. FEMA may assist such communities with developing a BCA.
 - Projects with a total cost of less than \$1 million that qualify for BCA assistance under this provision are not required to submit a cost-effectiveness narrative. FEMA has additional guidance for this approach for selected subapplications that may qualify for this consideration. For more information visit the [FEMA BCA webpage](#).
- **Streamlined Cost-Effectiveness Determination Method:** FEMA has established streamlined cost-effectiveness determination methods for some hazard mitigation projects and project types. Using one of these methods fulfills the cost-effectiveness requirement if the project meets applicable criteria.
 - For projects with a total cost of less than \$1 million, the subapplicant may provide a narrative that includes qualitative and quantitative data showing the benefits and cost-effectiveness of the project. Total project costs include all project costs, not just the federal share. Instructions for completing a cost-effectiveness narrative may be found on the FEMA BCA website. FEMA will validate the cost effectiveness and estimate a benefit-cost ratio (BCR) of the proposed project during its review.



FEMA

- Pre-calculated benefits are available for some project types, including acquisitions, elevations, wind retrofits, tornado safe rooms, hospital generators, and post-wildfire mitigation. Further details, including application submission requirements, may be found in the HMA Policy and Program Guide and on the FEMA BCA website.
- If a **streamlined cost-effectiveness determination method does not apply**, a Benefit-Cost Analysis is required to validate cost-effectiveness. FEMA has established a set discount rate of 3% to be used in a Benefit-Cost Analysis for hazard mitigation projects for the FY 2023 BRIC and Flood Mitigation Assistance cycles. [FEMA's BCA Toolkit](#) is available on FEMA's website. Version 6.0 or newer are the only versions FEMA will accept as documentation for demonstrating cost-effectiveness. FEMA encourages the use of the BCA Toolkit to calculate the project Benefit Cost Ratio; however, applicants and subapplicants may also use a non-FEMA BCA methodology if pre-approved by FEMA in writing.
- All projects not using a streamlined cost-effectiveness determination must demonstrate a Benefit Cost Ratio of 1.0 or greater to be eligible for funding.
- Even if a streamlined cost-effectiveness determination method applies, applicants and subapplicants may use a BCA to show cost-effectiveness of a project.

Benefit-Cost Analysis Assistance – Eligibility Criteria

During the pre-award process, FEMA will review hazard mitigation project subapplications that are eligible for selection. As part of the selection process, FEMA may assist communities with developing a BCA when at least one of the following criteria is met:

- The community is a federally recognized tribal government.
- **For BRIC only**, the community is defined as an Economically Disadvantaged Rural Communities (EDRC). An EDRC consists of 3,000 or fewer individuals, with residents having an average per capita annual income not exceeding 80% of the national per capita income (based on best available data).
- **For Flood Mitigation Assistance only**, the community is defined as small and impoverished communities per [Title 44 Code of Federal Regulations Section. 201.2](#):
 - A community of 3,000 or fewer individuals that is identified by the state as a rural community and is not a remote area within the corporate boundaries of a larger city.
 - Is economically disadvantaged by having an average per capita annual income of residents not exceeding 80% of national per capita income, based on best available data.
 - The local unemployment rate exceeds by one percentage point or more, the most recently reported, average yearly national unemployment rate.
 - Any other factors identified in the state plan in which the community is located.
- The project is within or primarily benefits a [Community Disaster Resilience Zone](#) as defined [in Title 42 United States Code Section 5136\(a\)\(1\)](#).

Recommended Data to Support a Benefit-Cost Analysis

Eligible community subapplicants who meet the criteria defined above do not need to submit a BCA with their subapplication, but they should provide the best available data related to risk to structures and infrastructure from the natural hazard, level of protection provided by the project, and documentation of historical damage, if available. This data will be leveraged by the subapplicant and FEMA in developing the Benefit-Cost Analysis.

A summary of recommended data to include with the subapplication for all project types, as well as specific data for common project types, is listed below. While communities meeting the criteria described in this document are not required to submit a BCA with their subapplication, providing the data will allow for a more expeditious review of the application. FEMA will work with the subapplicant to obtain the required data if the subapplicant is unable to provide the recommended data.

Pre-Calculated Benefits

For all mitigation projects, a cost-effectiveness determination is required as a basic eligibility requirement. In many cases, this means completing a BCA using the [FEMA BCA Toolkit](#). However, under certain conditions, a project may be eligible for pre-calculated benefits, and a BCA Toolkit analysis may not be required. Project types that may be eligible for pre-calculated benefits include:

- Acquisition projects
- Elevation projects
- Hospital generator projects
- Hurricane wind retrofits
- Individual tornado safe rooms
- Post-wildfire flood diversion, soil stabilization, and/or reforestation projects

Further details, including application submission requirements, may be found in the [HMA Policy and Program Guide](#) and on the [FEMA BCA website](#).

Data for All Other Projects

The following recommended data should be included in the subapplication:

- **Annual Maintenance Costs:** Annual maintenance costs are those costs necessary for the upkeep or repair of mitigation project components so that the project maintains its originally designed and approved level of effectiveness. Standard cost-estimating software, contractors, engineering documents, or documentation from a reliable source such as a professional with relevant expertise can provide estimates.
- **Structure Information:** A map or geographic information system (GIS) data clearly identifying the structures mitigated by the project and available assessor data (structure latitude and longitude, building size, building replacement value [if greater than \$100 per square foot], building use, construction type, and number of units for multifamily residences).

- **Level of Protection:** The level of protection provided by the project, such as the design flood elevation, design wind speed, and other performance-based criteria.
- **Historical Damages:** Information on historical damage at the project location that will be mitigated by the proposed project. This includes the dates, locations, and details about past events and information on historical damage. Information may include documented flood elevations or flood depths, documented wind speeds, insurance claims, work orders, descriptions of damage for a structure or infrastructure, repair costs, response costs (including labor), FEMA Public Assistance data, and recurrence intervals for past events, if known.
- **Benefiting Area:** Information on the benefiting area of the project, such as maps, identified census tracts, or coordinates or addresses of structures benefiting from the project. Information may include a description of the benefiting area identified in the subapplication. For more information, please review the Program Support Material – Benefiting Area – for this grant cycle.
- **Additional Data, As Applicable**

There are several benefits that could be counted for a project, and any or all benefits may be needed to verify cost-effectiveness. Benefits may include avoided damage, loss of function, displacement costs and (for some projects) life safety. Subapplicants should consider the following and submit applicable supporting documentation:

- Number of residents or residential structures benefited by the project and a map of the impacted structures.
- If there are any noncritical governmental services provided by the mitigated structures, provide the annual budget for the services delivered for each building. Provide the duration for which service would be lost, based on past or estimated similar size events (e.g., estimated flood depths, wind speeds). Provide dates for past events, if applicable.
- If there are any critical services (e.g., police, fire, medical) provided by the mitigated structures, provide the following for each building:
 - Number of people served by the facility.
 - Duration for which service would be lost, based on past events or an estimated similar size event (e.g., estimated flood depths, wind speeds), including dates for past events, if applicable.
 - For hospitals and fire services, distance to the next closest similar facility.
 - For fire services, whether there are emergency medical services at the original and alternate location.
 - For police services, number of police officers in the area, both pre- and post-disaster.
 - For hospitals, population served at the next closest hospital.
- If the project protects against loss of service to a utility, provide the following:
 - Type of utility (electrical, potable water, wastewater, information technology/communications, other)

- If other, documentation that shows the economic value of the service in terms of dollars per person—per day. In these cases, the value of the service can typically be determined by the utility company, which can provide the documentation.
- Number of customers served by the utility that the project will mitigate.
- Letters or technical studies from utilities that include engineering estimates or historical evidence of impact on the service caused by an event. Provide the duration for which service would be lost, based on past events or an estimated similar size event (estimated flood depths, wind speeds, etc.). Provide dates for past events, if applicable.
- If the project protects loss of service of a road, provide the following:
 - Maps of the impacted roads and the estimated number of one-way traffic routes per day for each impacted road.
 - Additional time and miles per one-way detour trip.
 - Duration for which service would be lost based on past events, or an estimated similar size event (estimated flood depths, wind speeds, etc.). Provide dates for past events, if applicable.
 - Costs to repair road damage and any related response costs.
- If the project eliminates or reduces the need for volunteer labor, provide the following:
 - Number of volunteers and number of volunteer days needed for past events or for an estimated similar size event (e.g., estimated flood depths, wind speeds). Provide dates of past events, if applicable.
 - Description of how the need for volunteers will be reduced after the mitigation project has been completed.
- If the project changes or enhances the land use of the project area to create beneficial environmental space, provide the following to support the use of ecosystem service values:
 - Area (in acres or square feet) that will be enhanced and a description of the enhancements.
 - Percentage of land use within the enhancement area for the following categories: green open space, riparian, wetlands, forests, marine, and estuary.
 - Map or GIS files of the enhancement.
 - Description of nature-based solution(s) or green infrastructure.

If the project includes nature-based solutions or green infrastructure, provide the following based on the applicable components:

- Bioretention, green roofs, and/or permeable pavement:

- Area (in acres or square feet) and type of green infrastructure that will be constructed.
- Description of each green infrastructure component.
- Map or GIS files showing the green infrastructure areas.
- Urban trees
- Number of trees being planted

Project-Specific Considerations

This section discusses additional data that should be provided for common project types. For applicable project types, provide the following information:

Acquisition/Elevation/Dry Floodproofing Projects

- Existing flood risk data. There are two ways to demonstrate the existing risk of flooding: using engineering analysis to estimate the risk or using historical information to demonstrate the risk.
 - In many flood-prone areas, FEMA has performed an engineering analysis of the risk, included in a Flood Insurance Study (FIS), and accompanying Flood Insurance Rate Map (FIRM). If the project is not in a FEMA Special Flood Hazard Area, an independent study of the flood risk (e.g., a hydrologic and hydraulic [H&H] study) could provide the required data.
 - If the area has not been studied in detail, demonstrate flood risk through documentation of a historical flood event.
- Lowest floor elevation for each structure
- Design flood elevation (not applicable to acquisition projects)

Flood Risk Reduction Projects

- Existing flood risk data. There are two ways to estimate the existing flood risk: engineering analysis or historical information.
 - In many flood-prone areas, FEMA has performed an engineering analysis of the risk, included in a Flood Insurance Study and accompanying FIRM. If the project is not in a FEMA Special Flood Hazard Area, an independent study of the flood risk (e.g., H&H study) could provide the required data.
 - If the area has not been studied in detail, demonstrate flood risk through documentation of a historical flood event. It is likely that the project will need to be phased, allowing for development of an H&H study to demonstrate feasibility and effectiveness.
- Post-project flood risk data

- Detailed documentation in the form of an engineering report that a professional engineer has sealed. The engineering report should clearly identify the proposed project conditions and include H&H calculations used to determine post-project water surface elevations. If these calculations were completed using modeling software, provide the engineering report documenting all model inputs and outputs. Calculate post-project flood elevations for similar flood scenarios (e.g., 10, 50, 100-years) as performed for the prior to mitigation scenario. Inundation maps can support the analysis and document the structures and infrastructure at risk.
- If detailed flood analysis is not available, clearly define the project's proposed level of protection and provide engineering calculations supporting the design. If this is the best available data, it is likely that the project will need to be phased, allowing for development of an H&H study to ensure the post-project flood risk is accurate.
- Lowest floor elevation for each structure

Hurricane Wind Retrofit Projects

Provide the following for each building in the project:

- Photos of all sides of the building exterior
- Number of building stories and building size
- Primary building use
- Primary structural framing system (concrete, steel, masonry)
- Roof cover type (built-up roof, single-ply membrane)

Tornado or Hurricane Safe Room Projects

- Safe room maximum occupancy
- Predominant structure type(s) (e.g., school, institutional building, single-family residence) to be evacuated to the safe room and the corresponding percentages of occupancy for:
 - Day (6 a.m. – 6 p.m.)
 - Evening (6 p.m. – midnight)
 - Night (midnight – 6 a.m.)

Soil Stabilization Projects

- Documentation for the current risk at the site (e.g., estimated time to failure as provided by a qualified professional).
- If the area has not been studied in detail, demonstrate risk through documentation of a historical event or events. It is likely the project will need to be phased to allow for development of studies to demonstrate feasibility and effectiveness.

Drought Projects

- Population served by the drinking water utility affected by drinking water use restrictions during a drought event.
- Location- or utility-specific drought event(s) and impact data, specifically:
 - Recurrence intervals in years
 - Water demand in million gallons per day (this will likely be the same value for each drought event)
 - Water supply yield pre-mitigation in million gallons per day
 - Pre-mitigation drought duration in days (this should reflect the duration of water use restrictions or curtailed supply, if possible)
 - Water supply yield post-mitigation in million gallons per day
- Post-mitigation drought duration in days (this should reflect the duration of water use restrictions or curtailed supply, if possible)
 - If the area has not been studied in detail, demonstrate risk through documentation of a historical event. It is likely the project will need to be phased to allow for development of studies to demonstrate feasibility and effectiveness.
- If the above data are not known, the following can be used to obtain the needed information:
 - Historical drought index data representing drought conditions, available from the [Drought Risk Atlas](#) or the [U.S. Drought Monitor](#)
 - Local or regional water supply plans, modeling results, and/or reports
 - Historical utility supply yield data (e.g., groundwater pumping rates, streamflow levels, reservoir levels, treatment plant throughput)
 - Historical demand data

Additional Information and Resources

- Questions about data to support the BCA should be directed to the BCA Helpline at bchelpline@fema.dhs.gov or 855-540-6744 (toll free). Call the HMA Helpline at 866-222-3580 for questions about the Building Resilient Infrastructure and Communities and Flood Mitigation Assistance grant programs.