



# Benefit/Cost Analysis

The benefits of a mitigation project are the elimination and/or reduction of future damages and losses. In other words: Benefits are simply avoided damages and losses. Benefits are calculated by estimating future damages and losses with and without undertaking the mitigation project. For benefit-cost analysis (BCA), much of the effort is focused on estimating damages and losses. Mitigation project benefits are calculated by estimating both damages and losses; both before and after the mitigation project and then taking the difference between the two. The greater the damage and losses are prior to mitigation project, the greater the potential benefits of mitigation. The benefits considered in benefit-cost analysis are the benefits to the community, not just the benefits to FEMA or the federal government.

Benefits for a mitigation project fall into four categories:

- Avoided Physical Damages
- Avoided Loss-of-Function Costs
- Avoided Casualties
- Avoided Emergency Management Costs.

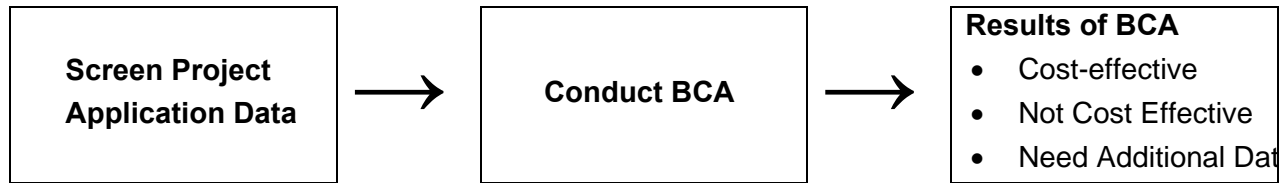
A BCA always involves looking at damages and losses twice. The benefits are simply the difference in expected damages and losses before and after the mitigation project are completed.

**Using Flooding as an example:** The greater the frequency and depth of flooding for a given home, the higher the annualized damages and losses. To the extent that a mitigation project reduces or eliminates these damages and losses, the greater the potential benefits of the mitigation project. For BCA, a similar calculation is done after mitigation, and then benefits are calculated as the difference between annualized damages with and without undertaking the mitigation project

## Why FEMA requires Benefit-Cost Analysis?

1. To meet the statutory and regulatory requirement eligibility requirement, as specified in the Stafford Act and in 44 CFR. To be eligible for FEMA funding each mitigation project must be shown to be cost-effective. As defined in the regulations, cost-effective means that the benefits of each project must exceed the costs (i.e., that the benefit-cost ratio exceeds 1.0).
2. To determine whether or not a mitigation project is worth doing.
3. To provide a common basis with which to compare and prioritize mitigation projects and to help ensure that limited mitigation funds result in the greatest possible reduction in future damages and losses.
4. And to demonstrate that mitigation works. Benefit-cost analysis can be a powerful tool to help sell the concept of mitigation and to convince individuals and communities that mitigation investments are in their own self interest and their actions are fiscally sound.

## The BCA Review Process (Flooding Example)



**Step 1:** Gather data relating to cost-effectiveness including economic, environmental and engineering data. Often, these data are missing or limited.

Subject	Flood Project Data
Hazard Data (often not included in application)	Flood Insurance Study (FIS) data, or historical flood data from application
First Floor Elevation	Available from engineering surveys or estimated from observed flood depths?
Scope	What problem does the project address? How vulnerable is the building or area?
Cost	Is there a well-documented cost-estimate or only a rough estimate?
Useful Lifetime	How long will the project provide protection against damages and losses?
Economic Considerations	Square footage of the building. Replacement values of the building and contents?
Damage Estimates – <i>Before Mitigation</i>	Why do damages occur? What are the historically-observed damages?
Damage Estimates – <i>After Mitigation</i>	How effective will the project be in reducing future damages

**Step 2:** Determine which benefit-cost analysis tool to use. Provisions are available for conducting a BCA with less than a full set of data. If the project application data are limited or incomplete, then a benefit-cost analysis that uses limited data should be employed. If the data in the project application are more or less complete, then a more robust method of analysis can be used.

- Consider flood depth is expressed in feet of water above the top of the lowest finished floor of the house. Known as the First Floor Elevation, this elevation is measured from sea level.
- Estimate the annual probabilities of floods at each depth are determined by information in the Flood Insurance Study (FIS) for this community. This information is not always available.
- Develop scenario damages and losses - the total damages and losses that are estimated to occur each time a flood of a given depth occurs. These include damages to buildings, contents, and displacement costs. Scenario damage estimates indicate damages when a flood of a given depth occurs; but do not factor in the likelihood of such flooding.
- The expected annual damages and losses consider not only the damages and losses each time flooding occurs but also whether flooding will occur. Mathematically, the expected annual damages and losses are the product of the annual probability of each flood depth and the scenario damages and losses at each flood depth. The sum of the expected annual damages and losses is the best estimate of the total vulnerability of the building to flood damages (both before and after mitigation).

**Step 3:** If the project is cost-effective, the application moves to the next level in the funding process. If it is not cost-effective, the project is rejected.

**Complete information can be found in OMB Circular A-94 and the FEMA Mitigation compact disc BCA Toolkit available by calling 800-480-2520**

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