FEMA BENEFIT COST ANALYSIS TOOL 6.0
2022 UPDATES IN REVIEW

Louisiana Floodplain Management Association (LFMA)
2023 Annual Conference

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Who Am I? Who Am I Not?

Who I am:

Consulting Engineer
End User of the FEMA BCA 6.0 Tool

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Louisiana Professional Engineer #36775
Certified Floodplain Manager since 2021
Employee of C.H. Fenstermaker and Associates, LLC

Who I am NOT:

Not an agent or representative for FEMA
Not an agent or representative for GOHSEP
Not a subcontractor for any of the above

For Detailed BCA Questions, Please Contact:
FEMA Region 6
FEMA's BCA Helpline
Your GOHSEP SAL

NOT ME

NOT ME

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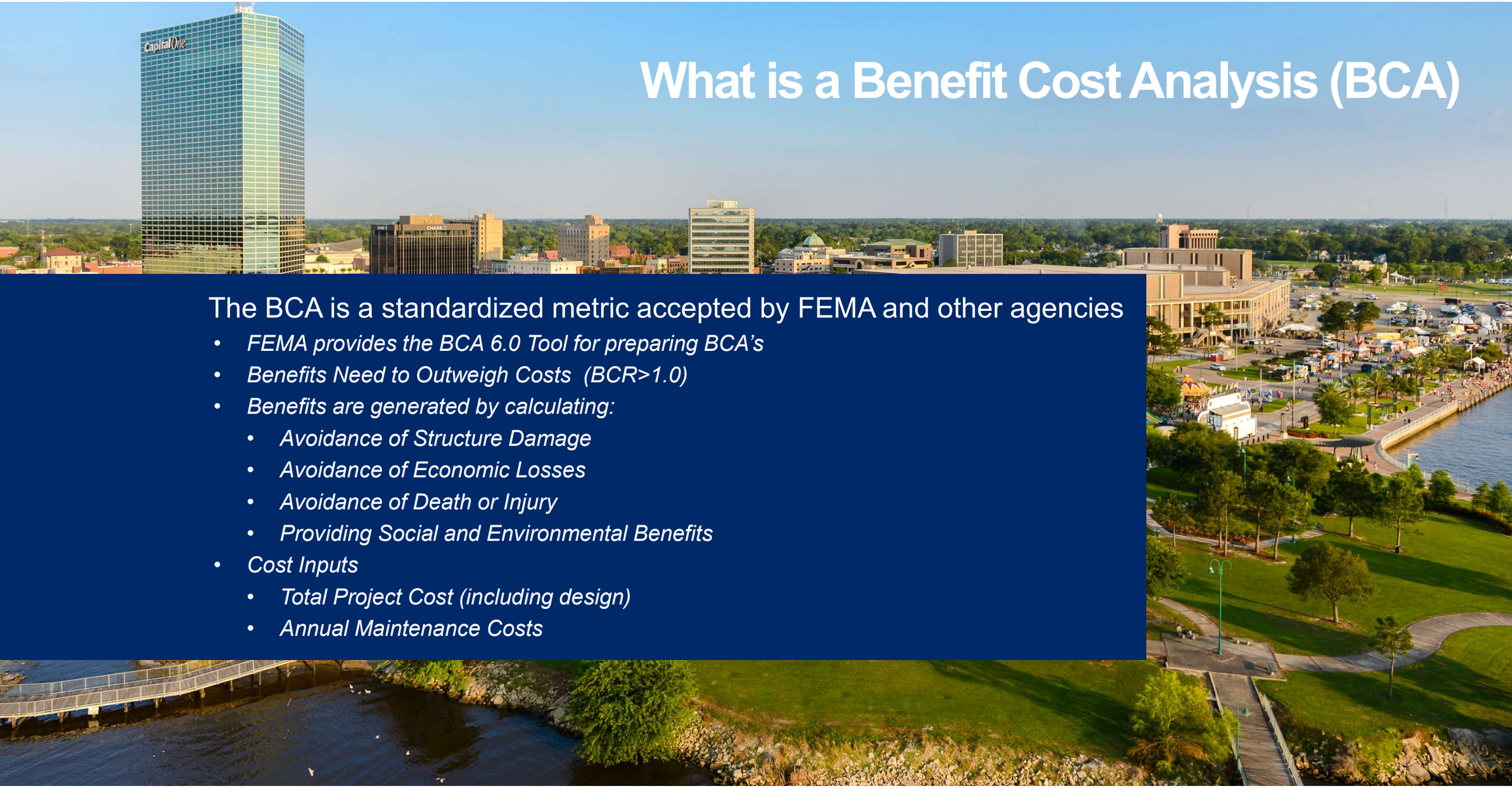
What is a Benefit Cost Analysis (BCA)



The BCA is a standardized metric accepted by FEMA and other agencies

- *FEMA provides the BCA 6.0 Tool for preparing BCA's*
- *Benefits Need to Outweigh Costs (BCR>1.0)*
- *Benefits are generated by calculating:*
  - *Avoidance of Structure Damage*
  - *Avoidance of Economic Losses*
  - *Avoidance of Death or Injury*
  - *Providing Social and Environmental Benefits*
- *Cost Inputs*
  - *Total Project Cost (including design)*
  - *Annual Maintenance Costs*

How often is the BCA 6.0 Tool Updated? What Have I missed?

Major Release Updates

Benefit-Cost Calculator
V.6.0 (Build 20230103.1822 | Release Notes)

1 Update in 2023

8 Updates in 2022

6 Updates in 2021

Important Updates for FY 2023 Grant Planning

3% Discount Rate for FMA/BRIC

2022 Sea Level Rise Updates

Green Infrastructure Calculators

Updates to Economic Values

Dealing with Construction Cost Inflation

Photo Credit: OpenAI Dall-E

3% Discount Rate for FMA/BRIC: Demystified

If you Qualify, Traditional BCA's will Pass with a 0.75 or Above

To Utilize the 3% Discount Rate, your project must first meet **both** of these criteria:

1. BCA Generated at the 7% discount rate must be equal to or greater than 0.75
2. BCA Generated at the 3% discount rate must be equal to or greater than 1.0

Alternative Cost Effectiveness Methodology Memo (PDF)

*That's very specific, **but not very helpful.** What does this **mean?***

I did all the discount rate math for you. The lower discount rate **reliably gives a >25% improvement to BCA's** with a **Project Useful Life of 10 YR or Greater.**

Any of the following FMA/BRIC project types almost certainly will pass with a 0.75 Traditional BCA:

Acquisition	Roof Diaphragm Retrofits
Elevation	Non-Structural Building Elements
Mitigation Reconstruction	Building Retrofit Projects
Infrastructure Projects	Major Utility Mitigation Projects
Floodplain and Stream Restoration	Heavy Equipment
Flood Diversion and Storage	Generators?
Safe Rooms	Soil Stabilization?
Green Infrastructure	Aquifer Storage and Recovery

3% Discount Rate for FMA/BRIC: Qualifying

Does My Project Qualify:

The Easy Way:

Projects within a Tribal Jurisdiction or Insular Area qualify

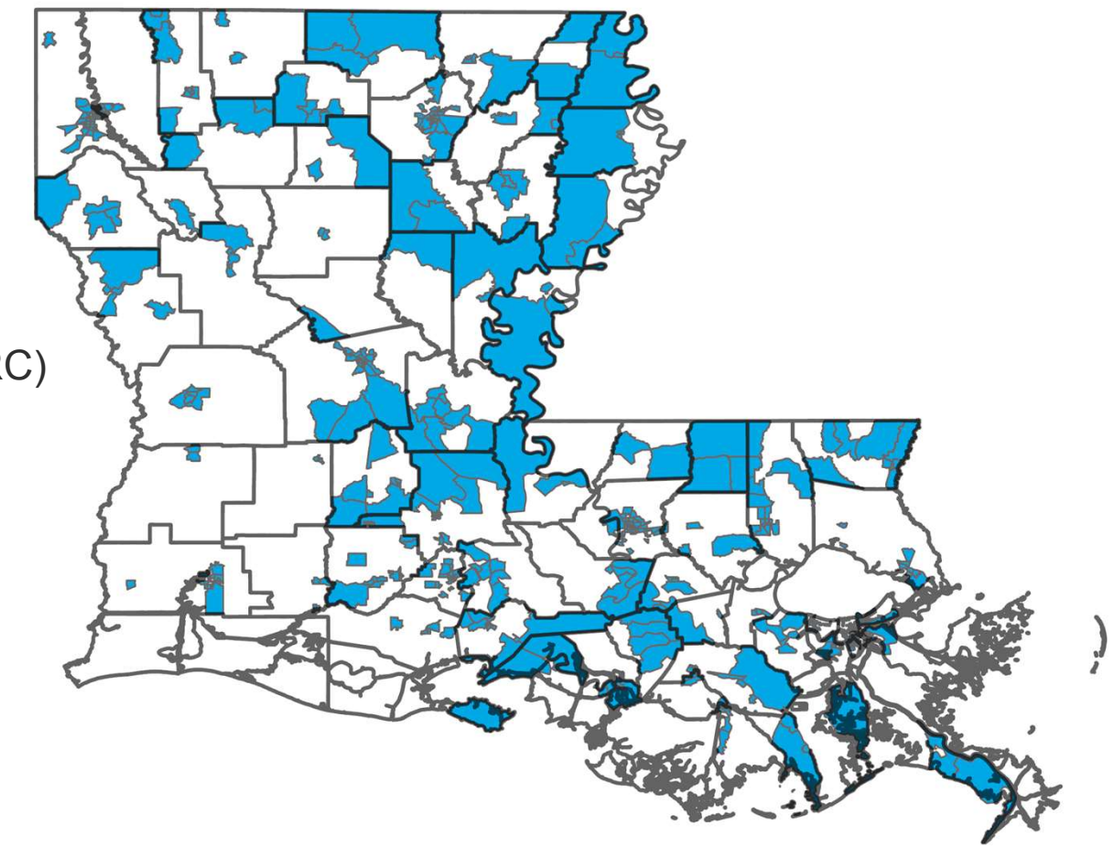
Projects primarily benefiting a **Census Tract** with >0.6 according to CDC Social Vulnerability Index (SVI)

For BRIC, Economically Disadvantaged Rural Communities (EDRC) also qualify

Demystifying a bit:

Every Parish except Cameron and West Feliciana have a qualifying census tract

For BRIC Only: Economically Disadvantaged Rural Communities (EDRC) also qualify



Census Tracts with Social Vulnerability Index >0.6

3% Discount Rate for FMA/BRIC

***The Hard Way**:*

- Projects addressing significant impact caused by climate change, such as more intense storms, increases in extreme rainfall, extreme temperatures, drought, prolonged wildfires, extreme flooding, and changes in sea levels.
  - *The subapplication should describe how the project will enhance climate adaptation and resilience, detail how the project is being responsive to the effects of climate change (such as sea level rise) and/or other future conditions (population/demographic/land use, etc.), and cite data sources, assumptions, and models*
  - The project is subject to substantially higher costs due to incorporation of low carbon materials or compliance with the Federal Flood Risk Management Standard. The subapplication should include cost estimates and a narrative description to explain the increased costs.
- The project provides significant benefits that are difficult to quantify or cannot be monetized and are not captured in FEMA's BCA toolkit. The subapplication should provide a narrative description of the benefits.

It's probably not worth the maximum 25% benefit to cross those hurdles.

NOAA's 2022 Sea Level Rise Technical Report Impacts on BCAs

By The Numbers Approach

Summary of Changes

- Updated, More Detailed Predictions
- Much More Extensive Computations
- Near-term (30-year) predictions are down
- Long-term (5-100 year) trajectory unchanged

- How can you use this data today?
- How does it affect your mitigation strategy?

2022 Sea Level Rise Updates

By The Numbers:

Pre-2022 Predictions:

Eustatic Sea Level Rise: 2050
High: 0.66 Meters (2.16 Feet)
Low: 0.31 Meters (1.02 Feet)

Eustatic Sea Level Rise: 2100
High: 1.98 Meters (6.49 Feet)
Low: 0.31 Meters (1.02 Feet)

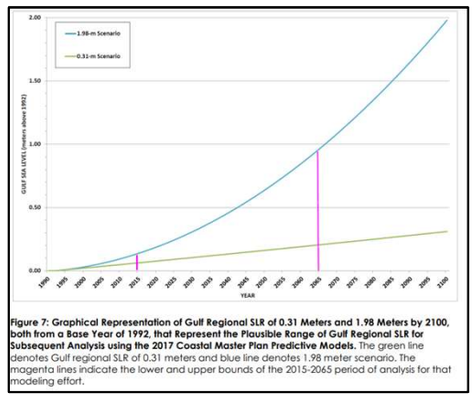


Figure 7: Graphical Representation of Gulf Regional SLR of 0.31 Meters and 1.98 Meters by 2100, both from a Base Year of 1992, that Represent the Plausible Range of Gulf Regional SLR for Subsequent Analysis using the 2017 Coastal Master Plan Predictive Models. The green line denotes Gulf regional SLR of 0.31 meters and blue line denotes 1.98 meter scenario. The magenta lines indicate the lower and upper bounds of the 2015-2065 period of analysis for that modeling effort.

NOAA 2022 Predictions:

Eustatic Sea Level Rise: 2050
High: 0.34 Meters (1.12 Feet) **Δ = -1.04**
Low: 0.19 Meters (0.64 Feet) **Δ = -0.48**

Eustatic Sea Level Rise: 2100
High: 1.98 Meters (6.49 Feet)
Low: 0.37 Meters (1.20 Feet) **Δ = -0.18**

All other Intermediate Scenarios are derived from these baseline predictions

Subsidence was unchanged, Based on Regional Values
High: 3.5-20.5 mm/yr
Low: 2.0-11.8mm/yr
Source: CPRA 2017 Master Plan

To view the NASA Interagency Tool
For Sea Level Rise at Sabine Pass

2022 Sea Level Rise Updates

Typical Values for Various Project Types

Utilizing the NASA Interagency Tool for Sabine Pass:

Project Type: Elevation
Project Useful Life: 30 Years
Useful Life 2020-2050

Intermediate-High Scenario
1.28' Total Sea Level Rise

Project Type: Acquisition
Project Useful Life: 100 Years
Useful Life 2020-2120

Intermediate-High Scenario
7.46' Total Sea Level Rise

Restrictions: Can only be applied in current a Coastal SFHA's

2022 Sea Level Rise Updates

Pain Points and Limitations of using Sea Level Rise in the BCA Tool

Pain Point #1: Establishing Sea Level Rise Values
See References to this Presentation; USACE Calculators are outdated

Pain Point #2: Obtaining Coastal Transect Information
Contact your FEMA Representative

Limitation #1: Being limited to current Coastal SFHA's
Establishing specific, federally-accepted values allows for Long Term Mitigation Planning

Limitation #2: Inability to Capture Combined Coastal/Riverine Hazards
Coastal Transition Zone Modeling and Future Combined Risk Mapping are the essential next step

Without addressing these pain points and limitations, Sea Level Rise will continue to be underutilized

Still, it is one of the most powerful tools in your coastal mitigation toolbox

2022 Sea Level Rise Updates

How Does this Impact our Coastal Mitigation Strategies

- Establish updated SLR values for your community

- Obtain Coastal Transect model results for future planning

- Prioritize Coastal SFHA Structure Acquisitions and prepare preliminary BCAs
  - Prioritizing long-term mitigation strategies produces more economic benefit

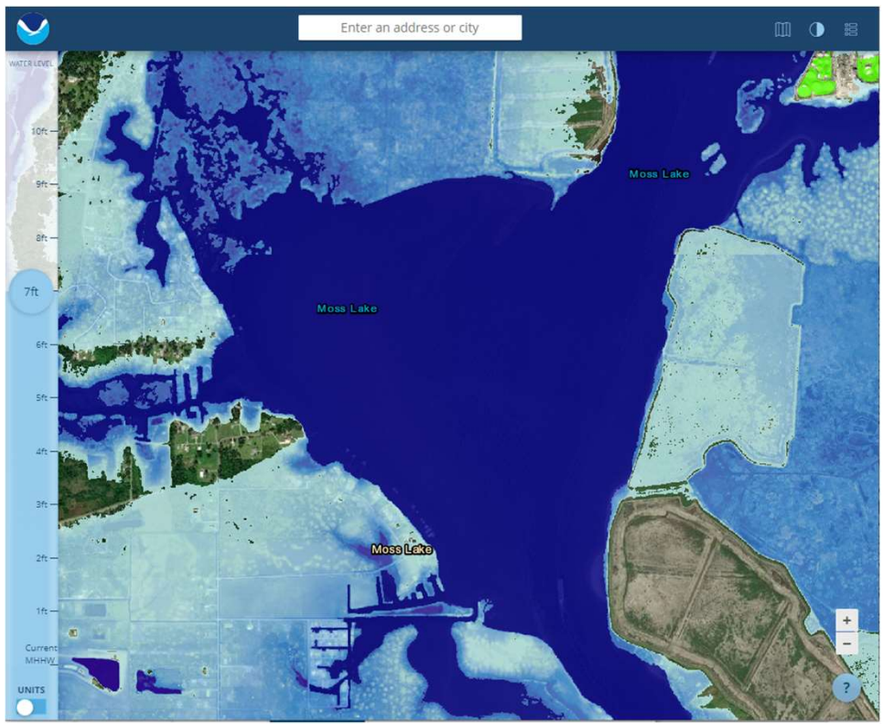
- Fund Backlog of Current Needs within same Project Type
  - Projects of similar type can be combined (Elevation and Acquisition)
  - Creates opportunities to fund at-risk applicants with limited mitigation funds
  - Address local drainage concerns not captured by FIS mapping
  - Address properties outside of mapped SFHA's

- Stack with Environmental Benefits by restoring Coastal/Riparian habitat

2022 Sea Level *Rise* Updates

How Does this Impact our Coastal Mitigation Strategies

One preliminary evaluation tool is the NOAA Sea Level Rise Viewer:
https://coast.noaa.gov/slr/



If the structure FFE is less than the 100-year projected Sea Level Rise, it is a good candidate for potential acquisition and should generate significant benefits

Bioretention

Green Roofs

Permeable Pavement

Urban Trees

Green Infrastructure Calculators

Simple Tools for GI Designers

Summary of Changes

- Introduced August 30, 2022
- Easy to Use
- Simple Inputs

Bioretention Calculator

Economic Values
$2.84 per ft² per year
$123,598.82 per acre per year

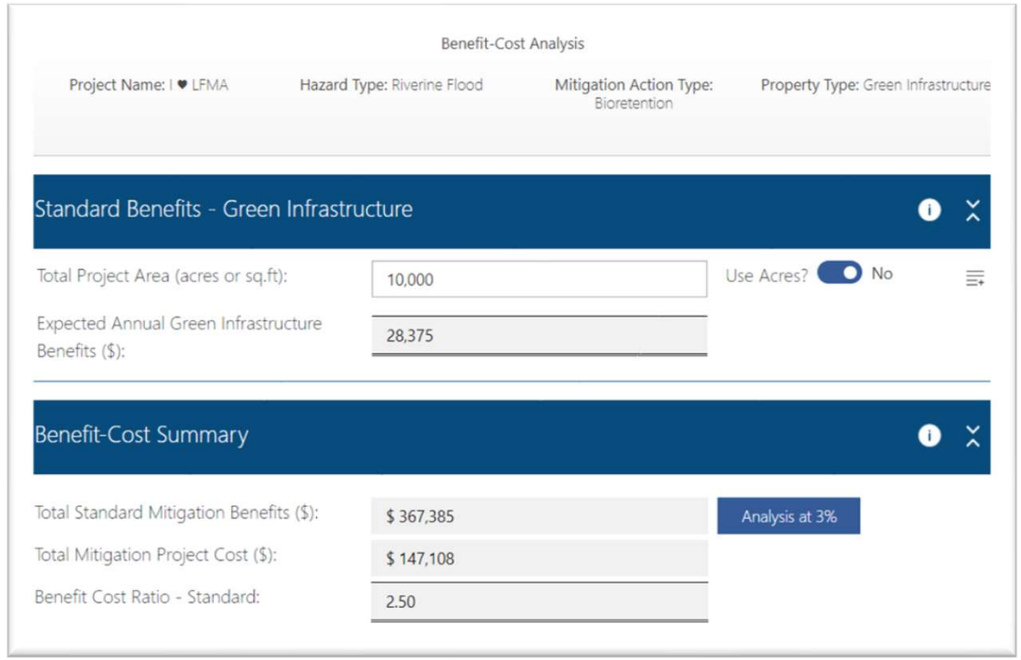
BCA Input
Footprint of Bioretention Facility

Present Value Benefits at the standard 35-Year Project Useful Life (PUL):

$3.67/Sq. Ft.

($1.6M/Acre)

Total BCA will be sensitive to Overall Cost Including Design, Operation and Maintenance



BCA Example:
10,000ft² Bioretention Facility
$5/ft² Installation Cost
$0.75/ft²/yr Maintenance Cost
Resulting Standalone BCA: 2.50

For a 35YR Project Useful Life @ 7% Discount Rate
*Annual Maintenance Costs x **12.95** = Total Mitigation Cost*

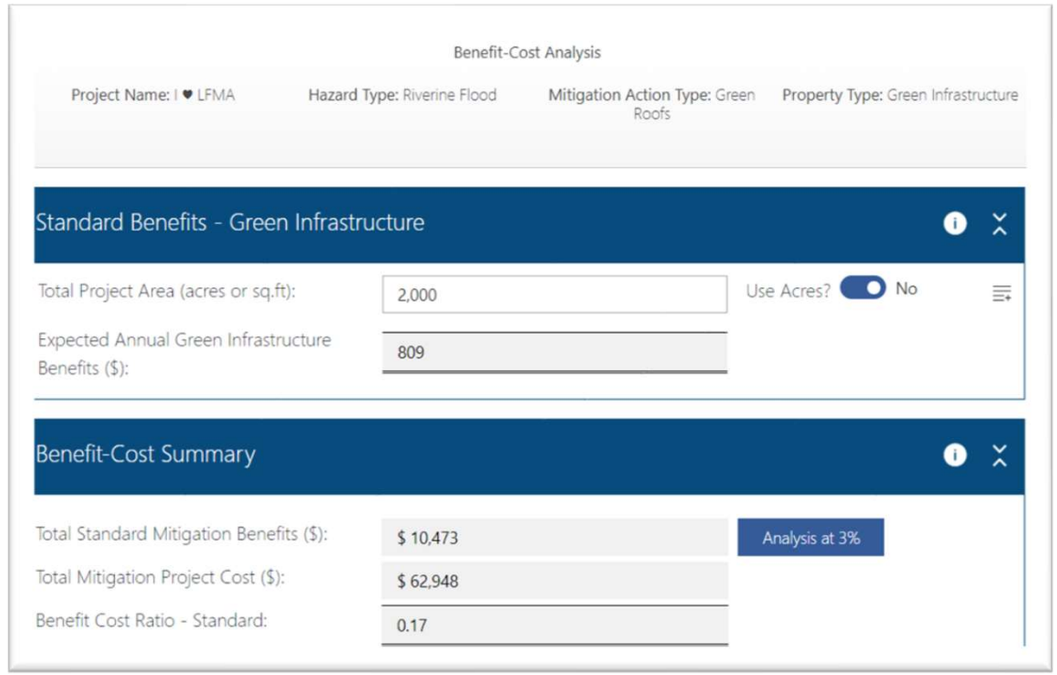
Green Roof BCA Calculator

Economic Values
$0.40 per ft² per year
$17,616.66 per acre per year

BCA Input
Footprint of Green Roof Area

Present Value Benefits @ Standard
35-Year Project Useful Life (PUL):
$5.24/sq.ft.
($228,095/Acre)

Conclusion: **Unlikely to cover installation**
Unlikely to cover maintenance costs
Potentially useful as component of a larger project



BCA Example:
2,000ft² Green Roof
$25/ft² Installation
$0.50/ft²/yr Maintenance
Resulting Standalone BCA: 0.17

Permeable Pavement BCA Calculator

For a 30YR Project Useful Life @ 7% Discount Rate

*Annual Maintenance Costs x **12.4** = Total Mitigation Cost*

Economic Values

$27,949.13 per acre per year

($0.64 per ft^{2}per year)

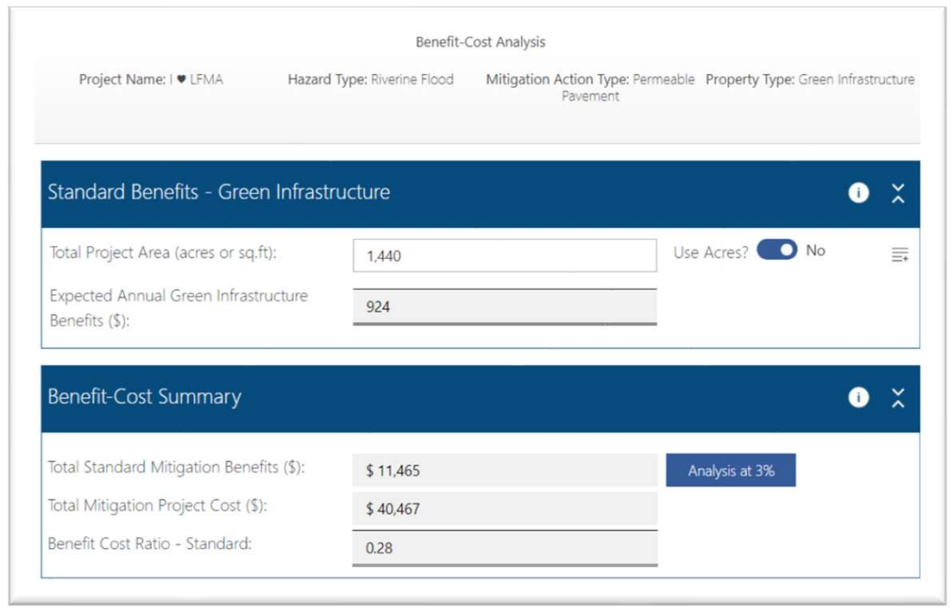
BCA Input

Footprint of Permeable Paving Area

Present Value Benefits @ Standard 30-Year Project Useful Life (PUL):

$7.96/sq.ft.

($346,822/Acre)



NOTES: Unlikely to Justify Retrofit or Standalone Projects

Depending on application, replacing hard paving components on existing projects will generate an improved BCA

BCA Example:

1,440ft^2 (~10 Parking Spaces)

$25/ft^2 Installation

Maintenance = $360 per Year (1%)

Resulting Standalone BCA: 0.28

Urban Trees BCA Calculator

For a 25YR Project Useful Life @ 7% Discount Rate

*Annual Maintenance Costs x **11.65** = Total Mitigation Cost*

Economic Values

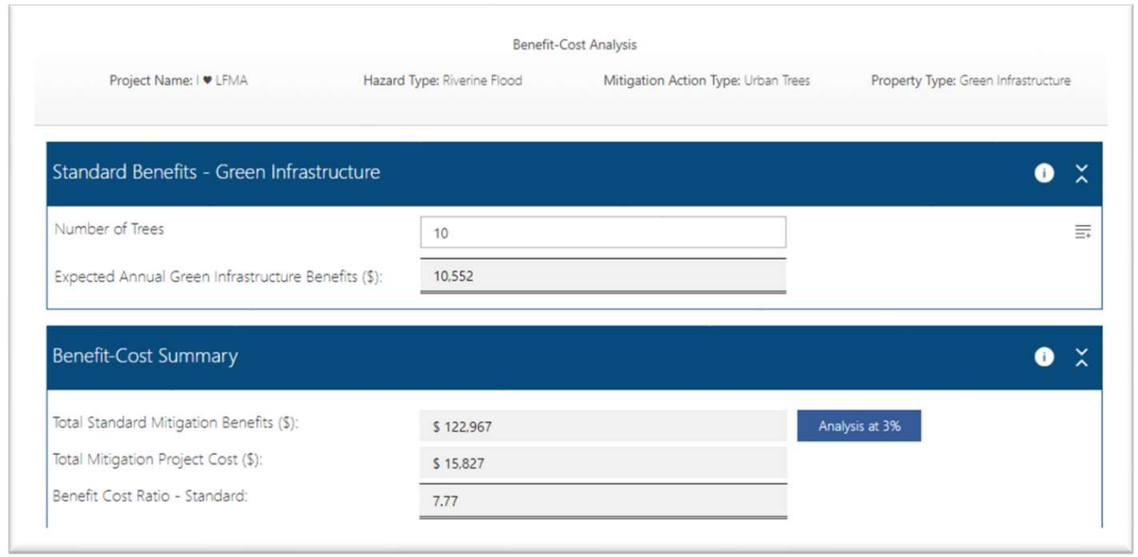
$1,055.19 per tree per year

BCA Input

Total Number of Trees

Present Value Benefits @ Standard 25-Year Project Useful Life (PUL):

$12,297 per Tree



NOTES:

Installation costs are highly variable BUT

Benefits appear strong even when costs are high

Have you hugged a tree today?

BCA Example:

10 Trees

Installation: $1,000/Tree

Maintenance = $50/Tree/Year

Resulting Standalone BCA: 7.77

Updates to Economic and Ecosystem Values

Marginal Increases to Standard Economic Values

Standard Economic Value (Sept 2022 Update)	Former Value	Updated Value	% Change
Value of Lost Time	$34.72	$38.07	9.65%
Traffic Delays for Roads and Bridges	$32.18	$35.60	10.63%
Federal Mileage Rate (7/1/22 to 12/31/22)	58.5 cents	62.5 cents	6.84%
Loss of Electric Services	$174	$182	4.60%
Loss of Wastewater Services	$58	$60	3.45%
Loss of Potable Water Services	$114	$116	1.75%
Loss of Communications/IT Services	-	$130	-
Per Diem Cost of Food at Home	$7/person/day	$9/person/day	28.57%
GSA Lodging Per Diem (FY2023)	$96/room/day	$98/room/day	2.08%
NFIP Federal Policy Fee	$40/year	$47/year	-

BCA toolkit now pulls local Per Diem data automatically according to project address (July 2022 Update)

Ecosystem Service Values:

Urban and Rural Open Space

Previously:

Green Open Space at $8,308/Acre/Yr

$118,548 Benefit per Acre for Acquisition Projects

Updated To:

Urban Green Open Space at $15,541

$221,758 Benefit per Acre for Acquisition Projects (100yr PUL)

Examples: Urban parks and recreational sites, neighborhood green spaces, pocket parks, green corridors and lawns

Rural Green Open Space at $10,632

$151,711 Benefit per Acre for Acquisition Projects (100yr PUL)

Examples: Rural parks and open space, open fields, and rangelands.

Ecosystem Service Values:

Urban and Rural Open Space

Green Open Space is considered "Urban"

If it meets the criteria specified in the U.S. Census Bureau's "2010 Census Urban and Rural Classification and Urban Area Criteria," which includes both Urbanized Areas (population of 50,000 or more) and Urban Clusters (population between 2,500 and 50,000).

Examples of urban green open space include urban parks and recreational sites, neighborhood green spaces, pocket parks, green corridors and lawns.

Select "Urban Green Open Space" if your community appears in this list:
https://www2.census.gov/geo/docs/reference/ua/ua_list_all.xls

The list of qualifying Louisiana communities is shown at right:

Abbeville	Eunice	Lafayette	Opelousas
Alexandria	Farmerville	Lake Arthur	Pierre Part
Amite City	Ferriday	Lake Charles	Port Barre
Arcadia	Fort Polk	Lake Providence	Rayne
Bastrop	Franklin	Leesville	Rayville
Baton Rouge	Franklinton	Livonia	Ruston
Benton	Galliano--Larose--Cut Off	Mamou	St. Martinville
Bogalusa	Gramercy--Lutcher	Mandeville--Covington	Shreveport
Breaux Bridge	Hammond	Mansfield	Slidell
Bunkie	Homer	Many	South Vacherie
Buras	Houma	Marksville	Springhill
Church Point	Iowa	Minden	Sunset
Cottonport	Jeanerette	Monroe	Tallulah
Crowley	Jean Lafitte	Morgan City	Ville Platte
Delhi	Jena	Natchitoches	Vinton
DeQuincy	Jennings	New Orleans	Vivian
DeRidder	Jonesboro	New Roads	Welsh
Donaldsonville	Kaplan	Oakdale	Winnfield and Winnsboro

Ecosystem Service Values:

Coastal and Inland Wetlands

Previously:

Wetlands at $554/Acre/Yr

$7,762 Benefit per Acre for Acquisition Projects

Updated To:

Coastal Wetlands at $8,955

$86,500 Benefit per Acre for 20 Year Project Useful Life

$127,781 Benefit per Acre for 100 Year Project Useful Life

Inland Wetlands at $8,171

$78,927 Benefit per Acre for 20 Year Project Useful Life

$116,594 Benefit per Acre for 100 Year Project Useful Life

Description: Areas of tidal wetlands (herbaceous and/or woody vegetation) or deepwater habitats in which plants grow and form a continuous cover principally on or at the surface of the water (e.g., algal mats, kelp beds, submerged aquatic vegetation); AND vegetation coverage is greater than 20%; AND these waters are tidally influenced and have a salinity greater than or equal to 0.5 parts per thousand.

Description: Areas dominated by perennial herbaceous vegetation, shrubland vegetation or forest; AND the soil or substrate is at least periodically saturated with or covered with water; AND these waters are not tidally influenced and have a salinity of less than 0.5 parts per thousand.

Comparison to Real-World Costal Restoration Costs

Coastal Marsh Restoration Costs (at scale)

Project Size: 1,000 Acres
Construction Cost Estimate: $35k per Acre
Design and Project Management: (25%) $9k per Acre
Maintenance and Monitoring: (2% per Year) $7.4k per Acre

Project Useful Life = 20 Years

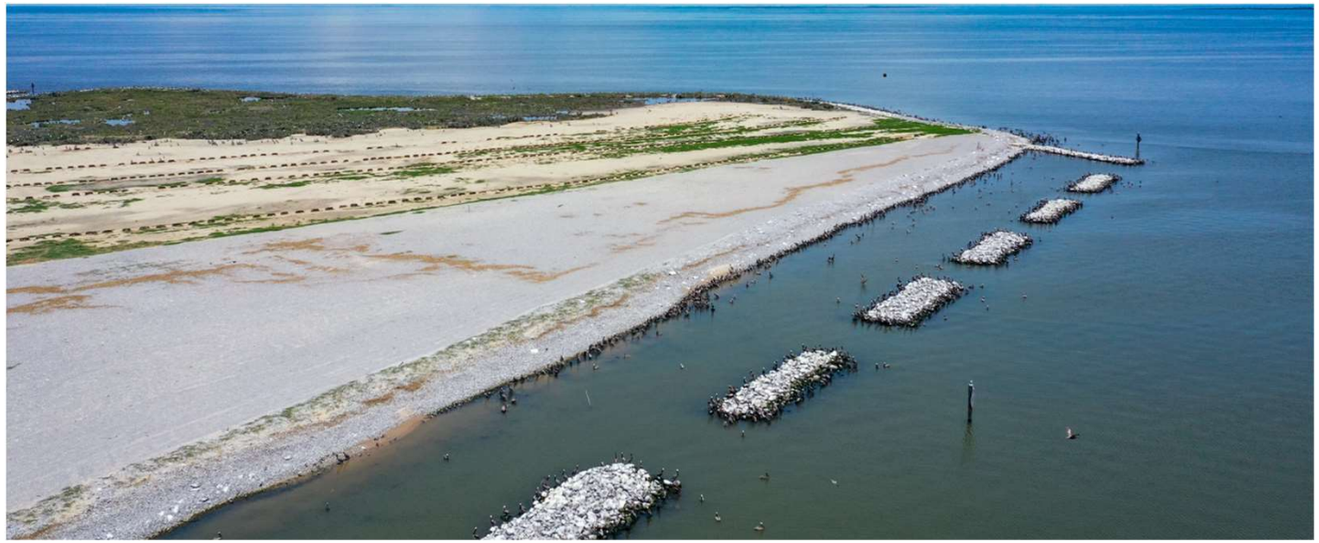
Total Costs: **$51.4k per Acre**
Benefits: **$86.5k per Acre**

Estimated BCA = 1.68

Ecosystem Service Values:

Beaches and Dunes now valued at $300,649 per Acre per Year

$4,290,036 Benefit per Acre for Acquisition Projects (100yr PUL)



Description: Gently sloping zone adjacent to the edge of a waterbody, such as an ocean or lake, consisting of unconsolidated material such as sand, pebbles, rocks or shell fragments. Beaches extend landward from the low-water line to either a line of permanent vegetation or a definite change in material or landform, such as a cliff.

Ecosystem Service Values:

Riparian and Forest Habitats

Riparian Land Use Type Adjusted Downward

From $39,545 per Acre per Year to $37,199 per Acre per Year (-6%)

Forest Land Use Type Increased Significantly

From $6,010 per Acre per Year to $12,589 per Acre per Year

Marine and Estuary now includes Coral and Shellfish Reefs

Previous Value: $1,799 per Acre Per Year

Now:
Coral Reef: $7,120 per Acre Per Year
Shellfish Reef: $2,750 per Acre Per Year

How to deal with Construction Cost Inflation

Rising construction costs create uncertainty for projects with marginal BCR's

When using modeled BCA's the default replacement values is $100/sq. ft.

Per the 2022 National Building Cost Manual:

Area Modification Factors

Louisiana Average		2%
Alexandria	713-714	4%
Baton Rouge	707-708	10%
Houma	703	4%
Lafayette	705	8%
Lake Charles	706	13%
Mandeville	704	-3%
Minden	710	-5%
Monroe	712	-8%
New Orleans	700-701	2%
Shreveport	711	-4%

Alexandria, Baton Rouge, Houma, Lafayette, Lake Charles and New Orleans all have building costs higher than the national average.

A 1.500sq. Ft residential home in Lake Charles (Class 4, Good Standard) can utilize a value at up to $155 per square foot, depending on type of construction.

With average costs likely exceeding the $100/sq.ft. default value, utilizing the latest available cost data will allow the BCA tool to calculate a proportional increase in avoided damages (benefits), although total funds available is still a concern

Credits

A Special Thanks To:

Robert Leslie – FEMA BCA Mentor/Occasional Wizard
Taught me many secrets, he has

Gary O' Neal – HMGP Grants
Constant support and encouragement to contribute to LFMA/NHMA

Jennifer Cobian - Calcasieu Parish Police Jury
For giving us the opportunity to put Sea Level Rise to work for CPPJ

Dennis Lambert, Michael Morgan-Dodson, Dennis Quan: GOHSEP
State Technical Assistance

FEMA Technical Staff and Contractors for creating and continually updating the tools we use

Thank You to LFMA for giving me the opportunity to present

References

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Urbanized Areas (Census.gov)
https://www2.census.gov/geo/docs/reference/ua/ua_list_all.xls

Sea Level Rise References:
NOAA 2022 Sea Level Rise Technical Report:
https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report-sections.html

NASA Interagency Sea Level Rise Scenario Tool:
https://sealevel.nasa.gov/task-force-scenario-tool?psmsl_id=1835

Sabine Pass Sea Level Rise Scenario Download Link:
https://d3qt3aobtsas2h.cloudfront.net/edge/ws/search/projection?psmsl_id=1835&format=csv&task_force=true

Coastal Protection and Restoration Authority, 2017 Coastal Master Plan Attachment C2-2: Subsidence
http://coastal.la.gov/wp-content/uploads/2017/04/Attachment-C2-2_FINAL_3.16.2017.pdf

Q&A

Link to Presentation PDF

Next Year's Presentation:

Hours, Not Days: 1D and 2D Modeling Best Practices

Lessons Learned from the Louisiana Watershed Initiative