

FY 21 HMA – Grant Application Review Summary

Subapplication Number	EMA-2021-BR-005-0033		
Project Title	Greenbriar Flood Mitigation and Stream Restoration		
Applicant Name	North Carolina Department of Public Safety		
Subapplicant Name	City of Greenville		
Project Type	Flood Risk Reduction		
Recommendation	No - BCA		
Federal Cost (FEMA GO)	\$942,817.50	Phased Project	No
BCR (subapplication)	1.19	Duplicate Project	No
BCR (reanalysis)	0.69	Benefits (reanalysis)	\$877,499.00

Summary

This is a technical feasibility and cost-effectiveness review in support of the National Technical Review process. No contact was made with the applicant or subapplicant; this review is solely based on information provided in the subapplication. The project was found to be technically feasible but not cost-effective; therefore, it is not recommended for further consideration.

This review only constitutes an evaluation of the technical feasibility and cost-effectiveness of the proposed project. Additional Environmental Planning and Historic Preservation (EHP), eligibility and completeness, and funding limitation considerations may affect the selection of this subapplication for further consideration and funding.

Scope of Work

The scope of work is well-defined and clearly explains the activities necessary to complete the work. City of Greenville (subapplicant) has submitted a subapplication for the drainage improvements to the Greenbriar stormwater system and for acquisition and demolition of 110 Greenbriar Drive, Greenville, North Carolina. The project includes stormwater infrastructure improvements, such as culvert installation and some culvert upsizing. It also includes stream restoration, such as floodplain benching and bank stabilization and improvements to impacted utilities (gas, water, sewer, and electric).

The proposed project is intended to reduce risk to 12 properties (11 homes) and provide flood reduction and protection of city roadways that impact the entire neighborhood of 50 homes. The project will protect roadways from flooding and failure from stream bank erosion and preserve the only ingress and egress access to residential structures for citizens and emergency services, such as police, fire, and emergency medical services. The improvements are modeled to provide the desired 10-year level of service. The project is intended to protect against erosion to Club Road and properties adjacent to the stream through installation of bioengineered structural enhancements to stabilize the stream bank where most applicable. The project will reduce damage and destruction to property, critical services, and infrastructure from future flood events and effects of erosion.

Technical Feasibility

Project Schedule

The schedule provided indicates the project would be completed in 16 months. The schedule does include all items in the scope of work and is reasonable. While not included in the outlined schedule, the design is anticipated to be completed by July 2022.

Cost Estimate

Cost estimate includes sufficient line items. Line items included mobilization, environmental assessment, erosion control, removal of existing pipes, demolition of the house at 110 Greenbriar Drive, sanitary sewer removal and replacement, reinforced concrete pipe culvert removal and installation, asphalt paving, and planting and stabilization items that include 630 sq ft of a mechanically stabilized earth (MSE) living wall. The cost estimate included \$250,000 for acquisitions and easements.

The cost estimate is consistent with the scope of work. The source of the cost estimate is not clear; however, it appears reasonable for the scope of work.

Technical Design Information

To achieve the flood mitigation with culvert improvements, stream restoration, and stabilization improvements, the following information and documentation were provided to support the project:

- Thirty-percent design drawings of the proposed culvert improvements and the stream restoration and stabilization improvements were provided.
- City of Greenville Greens Mill Run Watershed Master Plan, 2016, includes H&H models, erosion models, and water quality analysis. An engineering firm prepared the technical data.
- Property at 110 Greenbriar Drive is intended to be demolished since it is surrounded with public drainage infrastructure on all sides. Existing pipes will be daylighted to a riparian area. The City's H&H modeling completed for the Greens Mill Run Watershed, 2016, included data that show flooding at the property at the 25-year recurrence interval.
- Subapplication stated that the project will be designed in accordance with the most recent adopted codes for North Carolina, 2018 NC Building Codes, which include building (residential and commercial), plumbing, mechanical, energy, gas, rehabilitation, and fire codes.
- Subapplication stated that the before-mitigation level of protection is less than the 10-year storm event.
- Series of maps and figures showing the project benefit area and showing that portions of 110 Greenbriar Drive within the 0.2-percent annual chance flood hazard.
- Subapplication discusses residual risk—some flooding remains in the area for storm events greater than the 10-year, 24-hour design storm. Large flooding events may still cause temporary flooding across the roadway or low-lying structures.
- It is not clearly documented if the upstream and downstream impacts of the project were considered.
- Photos and discussion regarding the erosion near Club Road were included as supporting documentation. Additional documentation to support the 'erosion rate' was not provided. The documentation provided did not include analysis or study that clearly indicated the roadway would face catastrophic failure if it experienced an additional 10 inches of erosion, nor did it sufficiently justify an erosion rate of 0.1 ft per year.

Based on the documentation provided, the project is technically feasible and effective at reducing risk to individuals and property from natural hazards. The subapplication did not include (1) documentation to support that the proposed project will not have adverse upstream or downstream impacts or (2) documentation to support the erosion rate and hazard for Club Road from erosion due to the adjacent ditch.

Cost-Effectiveness

The Benefit-Cost Analysis (BCA) for this project was completed based on professional expected damages using the damage-frequency assessment (DFA) module of the FEMA BCA Tool. The BCA used four mitigation actions to evaluate the drainage improvements to culverts, channels, and stream restoration to reduce flood risk. The property acquisition for this project was completed based on modeled damages using the acquisition module of the FEMA BCA Tool.

The following was found during review of the submitted BCA:

- *Project Useful Life (PUL):* PUL utilized was 50 years, which is not consistent with the FEMA standard value of 30 years for a culvert replacement or a project based on imminent failure due to erosion. The project is primarily composed of culvert replacements and additions. A PUL of 100 years was used for the acquisition, documentation of deed restriction of the acquisition property was not provided.
- *Annual Maintenance Cost:* Annual maintenance cost is estimated at \$1,500, which appears reasonable. Costs were estimated based on maintenance that includes basin cleaning, pipe flushing, joint repair, erosion repair, trash and debris removal, and vegetation management. City of Greenville is responsible for all maintenance after the project is complete.
- *Total Mitigation Project Cost:* Total mitigation project cost (including maintenance) indicated in the BCA was \$1,277,791. The total project cost in the BCA matches the cost estimate provided in the subapplication.
- *Lowest Floor Elevations (LFEs):* The lowest floor elevation at 110 Greenbriar Drive was determined using The National Map of the USGS. The 5-foot map contours do not meet the requirement of 2-foot contours. The datum was NAVD88.
- *Damage Curve:* Damage curve selected was USACE Generic and is appropriate.
- *Flood Hazard Data:* The flood hazard data was obtained from the City of Greenville Greens Mill Run Watershed Master Plan. For the *acquisition mitigation*, the Master Plan provided flood depth information for the 10-, 25-, 50-, and 100-year recurrence intervals. For *mitigation of the drainage conditions*, 2-, 10-, and 25-year recurrence intervals were inputted for Greenbriar Drive and Fairlane Road. The datum used in the Greens Mill Run Watershed Master Plan was NAVD88. Documentation was not provided to support the streambed elevation.
- *Building Information:* The property information at 110 Greenbriar Drive—including building size, construction information, and year built—was obtained from the Pitt County Property Appraiser.
- *Building Replacement Value (BRV):* BRV was based on the nonstandard value of \$120/sq ft. The source used to determine the BRV was the average of \$100/sq ft and \$140/sq ft from the Homeblue.com website for new construction (excluding cost of sitework and land) in North Carolina.
- *Contents Costs:* The FEMA default value was used to determine the contents value.
- *Building Occupancy:* Building occupancy was not used in the BCA tool.
- *Displacement Costs:* Displacement costs were not used in the BCA tool.
- *Loss of Function:* The proposed project will mitigate drainage conditions on Greenbriar Drive, Fairlane Road, and Club Road. Flooding is expected to disrupt transportation services. The loss

of function for roads and bridges was used to calculate the benefits for each mitigation activity. The recurrence intervals used were 2-year, 10-year, and 25-year. For Club Road, the infrastructure failure module of the BCA was used with a recurrence interval of 8 years.

- The project will alleviate flooding for the 10-year precipitation event. Greenbriar Drive is a dead-end street; as a result of flooding, there are safety concerns caused by lack of roadway access. The ITE Trip Generator was used to determine that—for 21 single-family dwelling units—the estimated number of one-way trips per day was 100. The assumption was made that flooding of the road will result in no ingress or egress from the west side of Greenbriar Drive. A 12-hour delay time was used. The additional miles entered was zero because there are no detours available.
- Fairlane Road experiences flooding. The ITE Trip Generator was used to determine that—for 30 single-family dwelling units—the estimated number of one-way trips per day was 144. Online mapping tools were used to estimate the detour length of 1.6 miles and the additional time was 11 minutes per trip.
- Club Road experiences erosion and the subapplicant indicated that the road is degrading. The BCA toolkit used the hazard type input of 'Infrastructure Failure' to determine the benefits associated with the mitigation. The ITE Trip Generator was used to determine that—for four single-family dwelling units—the estimated number of one-way trips per day was 19. Online mapping tools were used to estimate the detour length of 0.45 mile and the additional time was 4 minutes per trip.
- *Before-Mitigation Damages:* Three recurrence intervals (2-, 10-, and 25-year) were inputted in the BCA for before-mitigation damages at Fairlane Road and Greenbriar Drive. The drainage model analyzed the 2-, 10-, and 25-year recurrence intervals in the existing conditions and were entered as inputs in the BCA tool.
 - Benefits associated with the before-mitigation damages for road loss of function at Fairlane Road and Greenbriar Drive assumed that impact days were 1-day for the 2-year event, 1.5-day for the 10-year event, and 2 days for the 25-year event. Documentation to support the number of impact days and associated recurrence intervals was not provided.
 - Benefits associated with the before-mitigation damages for the erosion failure of Club Road used an 8-year recurrence interval. The calculation used by the subapplicant to determine the recurrence interval assumes that the channel bank erodes at 0.1 foot per year. The rate is based on online mapping imagery from 2012 to 2022. The distance from the roadway to the eroding bank is 10 inches. The supporting documentation estimates that if the roadway is washed out and needs complete reconstruction, the estimated cost is \$310,203 and it could take 18 months to complete the construction. The subapplicant needs to use the rate of erosion BCA methodology to calculate benefits, where the PUL correlates to the recurrence interval. Additional documentation to support the rate of erosion and damages was not provided.
- *After-Mitigation Damages:* The after-mitigation recurrence interval inputted in the BCA was 11 years for the benefits calculated at Fairlane Road and Greenbriar Drive; the related impact days were assumed to be 1.5 days. The level of service for the design is 10 years. For Club Road, the infrastructure failure module of the BCA was used. The after-mitigation recurrence interval inputted in the BCA was 58 years. The impact days were 270 days.

- *Volunteer Costs, Social Benefits, and/or Environmental Benefits:* Volunteer costs and social benefits were not used in the BCA tool.
- *Environmental Benefits:* Ecosystem service benefits were included for 0.79 acre along Greenbriar Drive roadway right-of-way and 0.38 acre from the acquired property at 110 Greenbriar Drive. Both areas are included in the BCA as 100-percent riparian land use. The documentation provided does not clearly support that 100 percent of the 0.38 acre would be fully riparian area and it is unclear if the property would be deed restricted, which may be necessary to justify the 100-year PUL.

Reanalysis BCA

A reanalysis BCA was performed for this subapplication and the following edits were made:

- PUL was updated to 30 years to be in compliance with the FEMA standard value for culvert improvements/replacements.
- Ecosystem Service Benefits were recalculated for the 0.38 acre of acquired property. The land-use breakdown was based on evaluation of the 30-percent plans and was estimated as 55-percent green open space and 45-percent riparian.
- Three occupants were added to the 110 Greenbriar Drive structure.
- The infrastructure failure of Club Road was removed from the analysis due to lack of documentation to support the hazard.

Based on the reanalysis BCA, the total benefits associated with this project, \$877,499, are less than the total project cost of \$1,275,704, producing a BCR of 0.69.

Based on the documentation provided, the project is not cost-effective. The following documentation was not provided:

- Documentation to support the erosion rate and hazard for Club Road from erosion due to the adjacent ditch. The appropriate BCA methodology for rate of erosion would best represent this mitigation action.
- Documentation to support the LFE of 110 Greenbriar Drive.
- Documentation to support 110 Greenbriar Drive property would be a deed restricted property for the acquisition.
- Documentation to support the streambed elevation.
- Documentation to support the impact days associated with the roadway loss of function and associated recurrence intervals.
- Documentation to support ecosystem services type of land use for the 110 Greenbriar Drive acquisition.

Conclusion

Based on the information provided, the project was found to be technically feasible but not cost-effective; therefore, it is not recommended for further consideration.

This review only constitutes an evaluation of the technical feasibility and cost-effectiveness of the proposed project. Additional EHP, eligibility and completeness, and funding limitation considerations may affect the selection of this subapplication for further consideration and funding.