FY 21 HMA – Grant Application Review Summary

Subapplication Number	EMA-2021-BR-005-0012		
Project Title	City of Gastonia Duharts Creek - Critical Infrastructure Protection and Stream Restoration		
Applicant Name	North Carolina Department of Public Safety		
Subapplicant Name	City of Gastonia		
Project Type	Flood Risk Reduction		
Recommendation	Yes with Conditions		
Federal Cost (FEMA GO)	$5,979,200	**Phased Project**	Yes
BCR (subapplication)	1.46	**Duplicate Project**	No
BCR (reanalysis)	1.02	**Benefits (reanalysis)**	$8,673,496

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 and cost-effective; therefore, it is recommended for further consideration with the conditions listed in the conclusion.

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. The City of Gastonia (subapplicant) has submitted a subapplication for a nature-based approach to bank stabilization and stream restoration of Duharts Creek and realignment of wastewater pipes that are within the stream corridor. Two wastewater gravity feed pipes and a force main pipe have become vulnerable to failure owing to severe bank erosion. Bank erosion has exposed buried pipe in two locations and has generated tree loss that piles up at the footings of an aerial pipe crossing. In addition, local and high-tension power lines cross the creek, with one 45-foot Class 3 power pole located approximately 8 feet from the bank edge.

The project includes Phase 1 design completion and permitting using a nature-based approach. Phase 2 includes management and construction activities to stabilize and rebuild the channel and floodplain, and to improve resiliency of wastewater and electrical infrastructure. The scope of work does not include a description of the completion of relevant studies, such as a hydrologic and hydraulic (H&H) study or geomorphological assessments of the stream, which should be included as part of the engineering-related activities. The proposed project is intended to reduce the risk of loss of wastewater and electrical services to community lifelines and critical facilities.

Technical Feasibility

Project Schedule

The schedule provided indicates the project would be completed in 33 months. The schedule does include all items in the scope of work and is reasonable.

Cost Estimate

The cost estimate includes sufficient line items. Line items included design completion, permitting, stream restoration components, wastewater relocation components, and construction and project management. The cost estimate is consistent with the scope of work but does not include a cost estimate narrative. The cost estimate was prepared by the project engineer. The project cost in FEMA GO does not match the supporting documentation provided by the subapplicant, which includes grant application in the budget and not in the management costs section.

Technical Design Information

To achieve bank stability and stream restoration over approximately 8,000 linear feet and decrease flood risk for aboveground electrical lines and buried wastewater pipes, the following information and documentation were provided to support the project:

- Preliminary engineering report, including conceptual design drawings, rate of bank erosion calculations, and hydrologic and geomorphic analyses prepared by the project engineer. The rate of bank erosion between 2017 and 2021 was calculated as 1 foot per year averaged from three monitored cross sections. A regional bank erosion curve calculated a similar erosion rate of 1.14 feet per year. The engineering report did not include hydrologic and hydraulic (H&H) modeling results.
- Hydrologic and geomorphic analyses were used to develop conceptual design criteria for the proposed channel geometry.
- Proposed design would stabilize erosion of the channel banks by rebuilding the channel and a connected floodplain using geomorphologically appropriate parameters, and by realignment of wastewater pipes. The proposed level of protection was undefined.
- Proposed design assumed that construction of a restabilized channel and floodplains would accommodate frequent storm recurrence events. Rainfall recurrence intervals (RIs) were used to develop assumptions. Hydraulic modeling results were not provided, and the magnitude of flood RIs that would be accommodated were not discussed. The subapplication states that the flooding source is a combination of upstream development, stream alterations, and more intense rainfall events due to climate change. Riverine flooding would require flood RIs rather than rainfall RIs to estimate damage-causing events.
- Consideration of residual risks was not included in the preliminary engineering report.
- Upstream and downstream impacts were considered negligible because the proposed project area was less than 1% of total watershed area. This assumption should be verified during the completion of an H&H study.

Based on the documentation provided, the project is technically feasible and effective at reducing risk to individuals and property from natural hazards. The following conditions were identified:

- Cost estimate should be verified or amended, as necessary, to match supporting documentation.
- Documentation should be provided to show that the proposed project will be designed and constructed in compliance with all applicable federal and local codes and standards.
- Scope of work should include an H&H study or other analysis to demonstrate that the proposed project assumptions are supported by flood flow RIs rather than rainfall RIs, and that the project

will reduce flood levels and damages. The H&H study should also be used to verify that the project will not cause adverse impacts upstream and downstream of the project site.

- Projects that affect the hydrologic or hydraulic characteristics of a flooding source may require a Conditional Letter of Map Revision (CLOMR) and/or a Letter of Map Revision (LOMR) if they result in changes to the existing regulatory floodway, the effective Base Flood Elevations (BFEs), or the Special Flood Hazard Area (SFHA).

The following Phase 1 deliverables will be needed to determine technical feasibility and effectiveness prior to Phase 2:

- H&H data/modeling and/or other relevant technical data (such as a geomorphic analysis)
- Engineering design (typically 30/60/90) and cost estimate
- Technical body of information needed to support the desired level of effectiveness/protection or amount of risk reduction.

Cost-Effectiveness

The Benefit-Cost Analysis (BCA) for this project was completed based on professional expected damages using the damage frequency assessment module of the FEMA BCA Tool. The BCA evaluated the reduced risk of electrical power outages and wastewater spills through a nature-based bank stabilization and stream restoration approach.

The following was found during review of the submitted BCA:

- *Project Useful Life (PUL):* PUL utilized was 30 years for the protection of the wastewater and electric utility. This PUL is consistent with the FEMA standard value for a stream restoration project and is appropriate for the protection of the wastewater line. However, the subapplicant used an imminent failure approach to evaluate the mitigation to the electrical power line, which requires the PUL to be equivalent to the time to failure, which is 8 years for this project.
- *Annual Maintenance Cost:* Annual maintenance cost is estimated at $50,000. Costs were estimated at between 0.5 and 1 percent of mitigation project costs. The City of Gastonia Department of Public Works 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 $8,526,452 ($7,905,999 without maintenance). The initial project cost in the BCA is consistent with the project cost estimate documentation but not with the project cost in FEMA GO.
- *Loss of Function:* Wastewater utility service loss of function was estimated for 25,830 customers via spatial analysis and expert opinion, using utility connections and census data, but did not include backup data or calculations. The number of customers was entered as 9,800 in the BCA, which was inconsistent with the BCA narrative of 25,830 customers.

  Electrical power loss of function was estimated as 9,800 customers via spatial analysis and expert opinion, using utility connections and census data, but did not include backup data or calculations. The number of customers was entered as 25,830 in the BCA, which was inconsistent with the BCA narrative of 9,800 customers.
- *Before-Mitigation Damages:* Before-mitigation damages were calculated in the BCA by entering rainfall RIs associated with the loss of function to wastewater and electrical services.

  The before-mitigation damages for wastewater loss of function were estimated as 1 day for a 2-year RI event, 2 days for a 5-year RI event, and 5 days for a 10-year RI event. The RIs were

based on an assumption that a bankfull flow that typically occurs every 1 to 2 years is a channel-forming flow that produces enough rain to cause bank erosion and transport organic materials downstream. Larger storms would produce even higher velocities and more erosion. Because pipes were documented as exposed in two areas, additional erosion of bank soils in those areas, especially beneath the pipes, could cause collapse and uncoupling that would result in influent leakage into the stream. The logic that bankfull flow could cause enough erosion to compromise the pipes seemed reasonable. However, it was unclear how the damages associated with other rain event RIs (5 and 10 years) were determined.

The before-mitigation damages for electrical power loss of function were estimated as 1 day for an 8-year event based on the assumption that the average 1-foot per year bank erosion rate observed at three monitored cross sections would likewise occur at the power pole location. If that rate were to continue unabated, the pole could experience collapse.

- *After-Mitigation Damages:* After-mitigation damages were calculated in the BCA by entering rainfall RIs associated with the loss of function to wastewater and electrical services.

  The after-mitigation damages for wastewater loss of function were estimated based on a 25-year rainfall RI. The subapplicant assumed that a 25-year precipitation event would damage and disrupt municipal utility services similar to a 10-year event before mitigation. No documentation was provided to support this assumption.

  The after-mitigation damages for electrical power loss of function were estimated based on a 31-year RI. The subapplicant assumed that the channel would remain stable for the 30-year PUL, and the residual risk would occur at Year 31. No documentation was provided to support this assumption.

Reanalysis BCA

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

- Number of customers served for wastewater loss of function was changed to 25,830, which was consistent with the BCA narrative but inconsistent with 9,800 (as was entered into the subapplicant's BCA).
- Before-mitigation damages were estimated based on the assumption that a bankfull flood would cause enough erosion to collapse the pipeline. A 2-year flood was assumed to be equivalent to a bankfull flood, which is a geomorphologically reasonable assumption. Because it is assumed that this flood event would collapse the pipeline, damages were estimated as the cost of the work proposed to mitigate damages to the pipeline. No damages for the 5- or 10-year events were included.
- After-mitigation damages for the loss of function of the wastewater utility were estimated assuming that a significantly larger event would cause the wastewater line to collapse. As a conservative approach, it was assumed that a collapse would be caused by a 25-year event.
- Number of customers served for electrical power loss of function was changed to 9,800, which was consistent with the BCA narrative but inconsistent with 25,830 (as was entered into the subapplicant's BCA).
- Damages associated with the loss of function of electrical utility were estimated using FEMA's imminent failure methodology. Following FEMA guidance, the PUL of the damage-causing event was changed to 8 years (estimated time to failure) from 30 years (stream restoration PUL).

- After-mitigation damages for the loss of function of the electric utility were estimated assuming that a significantly large event will cause enough erosion to collapse the electrical infrastructure. As a conservative approach, it was assumed that a collapse would be caused by a 25-year event.

Based on the reanalysis BCA, the total benefits associated with this project, $8,673,496, are greater than the total project cost of $8,526,452, producing a BCR of 1.02.

Based on the documentation provided, the project is cost-effective. The following conditions were identified:

- Documentation should be provided to verify the number of customers for wastewater and electrical loss of functions.
- Documentation to support the proposed mitigation will provide at least a 25-year level of protection.

The following Phase 1 deliverables will be needed to determine cost-effectiveness prior to Phase 2:

- Refinement of the BCA.

Conclusion

Based on the information provided, the project was found to be technically feasible and cost-effective; therefore, it is recommended for further consideration with the following conditions:

- Cost estimate should be verified or amended, as necessary, to match supporting documentation.
- Scope of work should include an H&H study or other analysis to demonstrate that the proposed project assumptions are supported by flood flow RIs rather than rainfall RIs, and that the project will reduce flood levels and damages. The H&H study should also be used to verify that the project will not cause adverse impacts upstream and downstream of the project site.
- Documentation should be provided to show that the proposed project will be designed and constructed in compliance with all applicable federal and local codes and standards.
- Projects that affect the hydrologic or hydraulic characteristics of a flooding source may require a Conditional Letter of Map Revision (CLOMR) and/or a Letter of Map Revision (LOMR) if they result in changes to the existing regulatory floodway, the effective Base Flood Elevations (BFEs), or the Special Flood Hazard Area (SFHA).
- Documentation should be provided to verify the number of customers for wastewater and electrical loss of functions.
- Documentation to support the proposed mitigation will provide at least a 25-year level of protection.

Phase 1 deliverables needed to determine full project eligibility, technical feasibility and effectiveness and cost-effectiveness include:

- H&H data/modeling and/or other relevant technical data (such as a geomorphic analysis)
- Engineering design (typically 30/60/90) and cost estimate
- Technical body of information needed to support the desired level of effectiveness/protection or amount of risk reduction
- Refinement of the BCA

- Additional documentation required to support compliance with eligibility, technical feasibility, cost-effectiveness, and EHP requirements.

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.