



Flood Control – Drainage Improvement Worksheet

For preliminary Benefit Cost Analysis conducted by the State Mitigation Technical Team

Applies for the following mitigation activities: **FLOOD CONTROL – DRAINAGE IMPROVEMENT (FLOOD RISK REDUCTION) projects which include drainage improvements, roadway/bridge elevation, flood protection measures for utility systems, floodplain and stream restoration, flood diversion, flood diversion and storage measures, and non-localized flood risk.** For assistance, contact the State of Florida Mitigation Technical Unit.

IMPORTANT: This worksheet is required as part of your application. The State of Florida Mitigation Technical Unit will conduct a Benefit Cost Analysis (BCA) for your project and the following information is needed to evaluate cost effectiveness. Once a preliminary BCA is completed, the reviewer will contact you to collect support documentation.

NOTE: A complete worksheet will expedite the Technical Review.

Requirements

To complete a successful project application, a minimum amount of technical information is required for review. Data collected in this worksheet will provide reviewers with preliminary information necessary to evaluate project eligibility, feasibility, and cost effectiveness. Carefully review and confirm that you are aware of the following information.

All flood risk reduction projects must clearly define the level of protection the project provides and shall be designed in strict compliance with Federal, State and Local applicable Rules and Regulations. It is recommended that the sub-applicant consult a professional engineer to assist in preparing the application, as many of the documentation requirements are technical in nature. An engineer will be required for design and implementation. Initial funds may be obtained to produce detailed designs of the project (Phase 1) for further FEMA review and approval prior to construction (Phase 2).

Proposed flood risk reduction projects must be for the purpose of increasing risk reduction capabilities of the existing structures and cannot constitute only repairs. Additionally, they must demonstrate that the project will not have negative impacts upstream or downstream of the project area. Localized flood risk reduction projects may not constitute a section of a larger flood control system.

I confirm that I have reviewed the requirements listed above (signature):

For additional resources, please refer to [FEMA Technical Review Job Aid](#) for Flood Risk Reduction projects.

Section I – Project General Information

<i>Project Name:</i>	<i>Worksheet completed by:</i>
	<i>Name:</i>
	<i>Title:</i>
<i>Sub-Applicant:</i>	<i>Phone:</i>
	<i>Email:</i>

Section II – Project Cost Information

<i>Mitigation Project Cost:</i>	<i>Annual Maintenance Cost:</i>



Section III – Project Specific Information

Project location:		
Type of mitigation measures you are proposing for this project: (Select all that apply)		
<input type="checkbox"/> Drainage Improvements (Stormwater Management)	<input type="checkbox"/> Flood Protection Measures for Utility Systems	<input type="checkbox"/> Floodplain and Stream Restoration
<input type="checkbox"/> Roadway/Bridge Elevation	<input type="checkbox"/> Flood Diversion and Storage Measures	<input type="checkbox"/> Non-Localized Flood Risk Reduction
<input type="checkbox"/> Other (provide a brief description):		
Are you proposing a Phased or Non-Phased flood control project?		
<input type="checkbox"/> Phased Project	<input type="checkbox"/> Non-Phased Project	
Does the proposed project include land purchasing?		
<input type="checkbox"/> No	<input type="checkbox"/> Yes (provide brief explanation):	

Section IV – Historical Damage Information

A flood control project is expected to reduce floods risks to several facilities, including buildings, roads, and utilities. The following sub-sections provide guidance to better identify the benefits (avoided losses) that are expected with the implementation of the proposed project, using information from past flooding events.

1. Roadway/Bridges Loss of Function

Will the proposed project mitigate the loss of service due to past flood events at a roadway or bridge?	<input type="checkbox"/> Yes, complete Table 1 below.
	<input type="checkbox"/> No, continue to Sub-section 2 - Historical Damage Information

Table 1. The table below allows for listing the road(s) and/or bridge(s) that have been impacted by flood events. Please complete the information requested on each column using the best available information. If additional structures need to be listed, please attached a document with the information requested below.

Road/Bridge Location	Storm Name	Date of Flood Event	Estimated One-Way Traffic Trips per Day	Additional Reroute Time (hrs./days)	Additional Miles for Reroute	Road/Bridge Closure Duration (hrs./days)



Section IV – Historical Damage Information (continued)

2. Building Damages

Will the proposed project reduced physical damages and/or displacement costs to residential and/or non-residential buildings? Yes, complete Table 2 below. No, continue to Sub-section 3 - Historical Damage Information

Table 2. The table below allows for listing the location of residential and/or nonresidential building(s) that have experienced flood damages in the past and are expected to benefit from the proposed project. Please complete the information requested on each column using the best available information. If additional structures need to be listed, please attached a document with the information requested below.

Property Location (address)	Storm Name	Date of Flood Event	Flood Depth Above Finished Floor (ft.)	Documented Losses (\$)	If people trapped, how long? (hrs.)



Section IV – Historical Damage Information (continued)

3. Avoided Emergency Management Costs

Has the City incurred on any expenses attending the emergencies during past events that would be avoided with the implementation of the proposed project?

- Yes, complete Table 3 below.
- No, continue to Sub-section 4 - Loss of Critical Function

Table 3. The table below allows for identifying expenses incurred by the sub-applicant attending emergencies related to the flood risks being mitigated. Please complete the information requested on each column using the best available information. If additional structures need to be listed, please attached a document with the information requested below.

Emergency Location	Date of Flood Event	Emergency Expense Description	Cost of Emergency Expense (\$)

4. Loss of Critical Function

Will the proposed project reduce the loss of function of a critical facility?

- Yes, complete the Tables 4.1, 4.2, 4.3, 4.4, and 4.5, as applicable.
- No, continue to Section V - Professional Expected Damages

Please complete the tables below, as applicable. If additional facilities are impacted, please attach a separate table with the complete list of structures with the responses to the columns below

Table 4.1 Fire Station

Property Location (Address)	Date of Flood Event	Population served by the Station	Does the Station provide EMS*?	Address of the nearest fire station	Address of the nearest fire station with EMS*	Loss Of Service/Function Duration (hrs./days)

*EMS: Emergency Medical Services

Table 4.2 Police Station

Property Location (Address)	Date of flood event	Population served by the Station	How many police officers work or report to this police station?	How many police officers have a designated office space at this police station?	Loss Of Service/Function Duration (hrs./days)



Section IV – Historical Damage Information (continued)

Table 4.3 Hospital					
<i>Property Location (Address)</i>	<i>Date of flood event</i>	<i>How many people are being served by this hospital?</i>	<i>Provide the address of the nearest hospital capable of providing the same type of service:</i>	<i>How many people are being served by the nearest hospital capable of providing the same type of service?</i>	<i>Loss Of Service/Function Duration (hrs./days)</i>

Table 4.4 Utility				
<i>Property Location (Address)</i>	<i>Date of flood event</i>	<i>Type of Utility</i>	<i>Number of customers directly served by the utility system:</i>	<i>Loss Of Service/Function Duration (hrs./days)</i>

Table 4.5 Other Critical Facility Type				
<i>Property Location (Address)</i>	<i>Date of flood event</i>	<i>Provide a brief explanation on why it is considered a critical facility</i>	<i>Facility Annual Operational Budget</i>	<i>Loss Of Service/Function Duration (hrs./days)</i>



Section V – Professional Expected Damage Information

Complete the tables below if a preliminary or final H&H study is available. Using your H&H results, please provide before and after mitigation data based on the modeled scenarios:

Professional Expected Damages BEFORE Mitigation					
<i>Property Location (address)</i>	<i>Recurrence Interval</i>	<i>Estimated Structural Damage (\$)</i>	<i>Estimated Content Damage (\$)</i>	<i>Displacement Cost (\$)</i>	<i>Road Closures (hrs.)</i>
Professional Expected Damages AFTER Mitigation					
<i>Property Location (address)</i>	<i>Recurrence Interval</i>	<i>Estimated Structural Damage (\$)</i>	<i>Estimated Content Damage (\$)</i>	<i>Displacement Cost (\$)</i>	<i>Road Closures (hrs.)</i>



Section VI – Additional Information

Please use this page to expand on the information provided above or to include any additional information relevant to the proposed mitigation project.



FLOOD CONTROL – DRAINAGE IMPROVEMENT WORKSHEET INSTRUCTIONS

Refer to the instructions below to complete the Flood Control – Drainage Improvement Mitigation Worksheet using the best available data.

Section I – Project General Information

Project Name: Enter the name of the project title. The title should be short but descriptive (e.g., City of Orlando, Basin 3 Floodgate, Drainage).

Sub-Applicant: Enter your organization’s legal name.

Worksheet completed by: Enter name, title, phone number, and email of the person completing this Worksheet. This person must have the knowledge and/or the resources to accurately answer all questions and provide supporting documentation, as needed. Information may come from multiple creditable sources.

Section II – Project Cost Information

Mitigation Project Cost: Enter the total cost of the project. A lump sum on this worksheet is acceptable for preliminary BCA, but a detailed breakdown attached to your application is required.

Annual Maintenance Cost: Enter the cost associated with maintaining the effectiveness of the components installed as part of the proposed mitigation project.

Section III – Project Specific Information

Project Location: Provide a clear delineation of areas disturbed to construct the project, including potential off-site areas such as spoils disposal locations. For multiple locations, please provide information on Section VIII of this worksheet.

Type of mitigation proposed: A flood control project can include a combination of multiple mitigation activities. From the options provided, please check all the mitigation actions that apply to your project.

- **Drainage Improvements (Stormwater Management):** Stormwater management is defined as efforts to reduce the impact of increased runoff that results from new development in a watershed. Stormwater management projects include the construction, installation or modification of culverts, drainage pipes, pumping stations, floodgates, bioswales, detention and retention basins, and other stormwater management facilities.
- **Roadway/Bridge Elevation:** Mitigation measures to provide flood protection and stabilization measures for roads and bridges.
- **Flood Protection Measures for Utility Systems:** Mitigation actions to provide flood protection for water and sanitary sewer systems or other utility systems.

- **Flood Diversion and Storage Measures:** Flood diversion and storage projects are climate resilient mitigation actions. These projects involve diverting floodwaters from a stream, river or other body of water into a wetland, floodplain, canal, pipe, or other conduit (e.g., tunnels, wells) and storing them in aboveground reservoirs, floodplains, wetlands, green infrastructure elements or other storage facilities that allow for a controlled release to reduce the peak flows and velocities to mitigate flooding.
- **Floodplain and Stream Restoration:** These projects restore and enhance the floodplain, stream channel and riparian ecosystem’s natural function. They provide baseflow recharge, water supply augmentation, floodwater storage, terrestrial and aquatic wildlife habitat by restoring the site’s soil, hydrology and vegetation conditions that mimic the pre-development, or pre-alteration natural channel/floodplain connectivity. Floodplain and stream restoration projects typically encompass the restoration of the stream’s active channel and streambanks, as well as the adjacent floodplain and riparian zones.
- **Non-Localized Flood Risk Reduction:** Non-localized flood risk reduction measures are those actions or projects that lessen the frequency or severity of flooding and decrease predicted flood damage within an area that is hydraulically linked or connected to a drainage basin that is regional in scale. These projects reduce flood hazards in areas larger than those of localized flood risk reduction projects and may include but are not limited to: The construction, demolition or rehabilitation of dams and weirs. Construction or modification of dikes, levees, floodwalls, seawalls, groins, jetties, breakwaters and stabilized sand dunes. Large-scale channelization of a waterway.
- **Other:** There are additional types of flood mitigation projects that do not fall under the categories listed on this section. Please describe the proposed mitigation project.

Are you proposing a Phased or Non-Phased flood control project? Please check the type of project that applies to your application.

- **Phased Project:** Allow for development of a Hydrology and Hydraulic (H&H) study to ensure feasibility and effectiveness. Phased projects may include but are not limited to surveying, engineering, design, plans preparation, permitting and bidding for the proposed project, for Phase II approval. No construction activities for this project have been approved.
- **Non-Phased:** Non-phased projects must be fully designed and compliant with EHP requirements.

Does the proposed project include land purchasing? Please specify if your project includes the purchasing of any



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property/land necessary to complete the project (e.g., purchasing of a lot to build a new pond) and provide a brief explanation.

Section IV – Historical Damage Information

1. ROADWAY/BRIDGES LOSS OF FUNCTION:

Road/Bridge Location: Please enter the address of the road/bridge that will benefit from this project.

Storm Name: Enter the name given to the natural hazard event when damage occurred.

Date of Flood Event: Enter the date of the historical flood event.

Estimated One-Way Traffic Trips per Day: Enter the total number of one-way daily trips. Daily one-way traffic trips can be estimated by roadside counters and tolls, or by estimates from State, county, parish, borough, township, or other local departments of transportation or public works agencies, or highway engineers. Estimates of daily one-way traffic trips can be obtained in writing from the relevant entity or person competent to determine the traffic count. The estimates should be dated and signed, be provided on the letterhead of the estimating official, and include the assumptions used in determining the estimated number of trips.

Additional Reroute Time to Avoid Flooded Area (hrs./days): Enter the estimated time, in hours or days, for taking a reroute to avoid the flooded area. Documentation sources could be online mapping services or from estimates from State, county, parish, borough, township, or other local departments of transportation or public works agencies, or highway engineers. For road or bridge losses that do not have an available detour, the number of daily trips is still based on the number of one-way trips, but the Additional Time per One-Way Trip should be 12 hours. Documentation should show clearly that no detour is available.

Number of Additional Miles for Reroute: Enter the number of additional miles when taking a reroute. Additional miles may be obtained using online mapping services, scaling the distance on a highway map, or by driving the detour route and using the vehicle odometer. Speed limit data can be obtained by a field visit. Both distance and speed limit data can be provided in writing from county, parish, borough, township, or other local departments of transportation and public works agencies, or highway engineers. The estimate should be dated and signed and be provided on the letterhead of the estimating official.

Road/Bridge Closure Duration (hrs./days): If the bridge/roadway has experienced closures in the past due to flooding events, enter the time, in hours or days, the roadway/bridge was closed.

2. BUILDING DAMAGES

Property Location: Enter the location of the residential or non-residential building for the associated damages being provided.

Storm Name: Enter the name given to the natural hazard event when damage occurred.

Date of Flood Event: Enter the date of historical flood event.

Flood Depth Above Finish Floor (feet): Provide an estimate of the flood depth above the Finish Floor. This information can be obtained from claims, damage assessment, high water marks, photos, etc.

Documented Losses (\$): Enter the estimated cost, in dollars, of the losses documented for the property due to the flooding event. The losses can include physical damages to the structure, content damages and/or the displacement cost experienced by the residents. Damage costs may be documented with Insurance claims, receipts from repair of flood damages, FEMA Public Assistance Worksheets, photos, property owner affidavit or other relevant source.

If people trapped, how long (hrs.)? Provide the duration, in hours, the residents were trapped due to the flooding event.

3. AVOIDED EMERGENCY MANAGEMENT COSTS

Emergency Location: Provide the location (address) where the emergency management costs were incurred.

Date of Event: Enter the date of historical flood event.

Emergency Expense Description: Describe any additional expenses incurred by the City or County while attending the emergency during the historic damage event. Documented expenses may include but are not limited to renting portable generators, chillers, sewage truck rental to clean up spills, overtime paid to personnel to attend the emergency, etc.

Expense Cost (\$): Enter the total cost of the additional expenses incurred by the County or City.

4. **LOSS OF CRITICAL FUNCTION:** A flood control project is expected to reduce floods risks to several facilities, including buildings, roads, and utilities. The following subsections provide guidance to better identify the benefits (avoided losses) that are expected with the implementation of the proposed project.

4.1. FIRE STATION

Property Location: Provide the location of the critical facility for the associated damages being provided.

How many people are served by the Fire Station? Enter the number of people served by the fire station. If only one fire station serves the entire population of a community, that number may be used. For larger communities with multiple fire stations, only the population directly served by the station being mitigated can be used. Documentation for the service population can come from the fire station, local planning office, or other creditable source.



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Does the fire station provide Emergency Medical Services (EMS)? Select “Yes” if the fire station provides EMS or has EMS trained personnel; Otherwise, select “No”.

Provide the address of the nearest fire station: The nearest fire station would serve as an alternative station to provide fire protection due to loss of function of the fire station being mitigated.

Provide the address of the nearest fire station with EMS: The nearest fire station would serve as an alternative station to provide EMS and fire protection due to loss of function of the fire station being mitigated. (If the nearest fire station also provides EMS, please provide same address).

Loss of Service/Function Duration (hrs./days): Enter the duration, in hours or days, the critical facility was not able to provide service/function in the past, due to flooding events.

4.2. POLICE STATION

How many people are served by this police station? Enter the number of people served by the police station. If only one police station serves the entire population of a community, that number may be used. For larger communities with multiple police stations, only the population directly served by the station being mitigated can be used. Documentation for the service population can come from the police station, local planning office, or other creditable source.

How many police officers work or report to this police station? Enter the number of sworn officers that work or report at this location.

How many police officers have a designated office space at this police station? Enter the number of police officers that have a designated office space at this police station. It is assumed that police officers with a designated office space would be restricted to perform their regular duties if the police station were shut down due to a disaster. This information is necessary to estimate the loss of function due to the increased crime caused by a reduction of police officers in service.

Loss of Service/Function Duration (hrs./days): Enter the duration, in hours or days, the critical facility was not able to provide service/function in the past, due to flooding events.

4.3. HOSPITAL

How many people are being served by this hospital? Enter the number of people being served by this hospital. Only the population directly served by the hospital being mitigated can be used. Documentation for the service population can come from the hospital, local planning office, or other creditable source.

Provide the address of the nearest hospital capable of providing the same type of service: Identify the nearest

hospital capable of providing similar services as the hospital being mitigated.

How many people are being served by the nearest hospital capable of providing the same type of service? Enter the number of people served by the nearest hospital capable of providing the same service. Only the population directly served by the alternative hospital can be used. Documentation for the service population can come from the alternative hospital, local planning office, or other creditable source.

Loss of Service/Function Duration (hrs./days): Enter the duration, in hours or days, the critical facility was not able to provide service/function in the past, due to flooding events.

4.4. UTILITY

Type of utility: From the dropdown menu options, select the type of utility(es) that will be mitigated by the proposed project.

- **Electrical Power:** Potential structures include but are not limited to power generation facilities, transmission (e.g., overhead, and underground transmission), distribution (e.g., overhead, and underground distribution).
- **Potable Water:** Potential structures include but are not limited to source structures, potable water treatment facilities, water storage structures, pumping stations, piping and appurtenances.
- **Wastewater:** Potential structures include but are not limited to gravity sewers, pumping stations, force mains, wastewater treatment facilities.
- **IT Services / Communications:** Potential structures include but are not limited to emergency communication towers, telecommunications, etc.
- **Other:** Describe type of utility to be mitigated. Documentation is required that shows the economic value of the service in terms of dollars per person per day. In these cases, the value of the service is typically determined by the utility company.

Number of customers directly served by utility system: Enter the number of the customers (people) directly connected to the location(s) that will be mitigated. The number of customers affected by the loss of service can be obtained from the entity, agency, or company providing the utility service. The documentation should be in the form of a letter from the utility on their letterhead. For multiple locations, specify the number of customers connected to each specific location.

Loss of Service/Function Duration (hrs./days): Enter the duration, in hours or days, the critical facility was not able to provide service/function in the past, due to flooding events.

4.5. OTHER

Specify Facility Name: Enter the name of the critical facility that will be mitigated.



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What is the Annual Operational Budget for this critical facility? Enter the annual budget for the critical facility that is being mitigated. Documentation should include the annual budget for the building that is being mitigated. If the building houses multiple local agencies, the cumulative budget should be used. Alternately, if the annual budget is for an entire school district and one of the buildings is being mitigated, documentation should include how the annual budget was calculated for the single school building.

H&H model results, enter the time, in hours or days, the roadway/bridge is expected to be closed to unsafe conditions (i.e., floodwaters above road > 6”).

Professional Expected Damages AFTER Mitigation: The same scenario flood events as before mitigation should result in reduced damages due to the mitigation project being implemented. The after-mitigation damages should be estimated based on the level of protection provided by the project. For example, for a flood wall that protects 10 structures during the 100-year flood event, it could be assumed that there would no longer be damages to the structures below the 100-year level of protection but there may be some minor damages due to overtopping in a 500-year event.

Section V – Professional Expected Damage Information

The industry standard analysis of professional expected damages is for a minimum of three (3) flood event scenarios to be modeled and presented. The modeled events must be different recurrences and are project specific, based on the H&H report and the level of protection the project will accomplish. Generally, more modeled scenarios lead to a more thorough understanding of the project and often more benefits that can be applied.

Professional Expected Damages BEFORE Mitigation: Before mitigation damages are based on existing conditions at the site. To demonstrate the flood risk, expected damages for certain severity events must be modeled (e.g., 10-year flood, 50-year flood, 100-year flood, etc.)

- **Recurrence Interval:** The recurrence interval (RI) is the frequency of event which is expected to cause flood damages at the project location.
- **Estimated Structural Damage (\$):** Dollar value of the estimated structural damages (i.e., the cost to repair or replace the damaged property such as foundation, walls, roof, etc.) expected, using results from the H&H BEFORE mitigation model. Damages estimates can be obtained using industry accepted depth damage functions (DDFs) or other reliable source.
- **Estimated Content Damage (\$):** Dollar value of the estimated content damages (i.e., the cost to repair or replace the damaged property such as flooring, HVAC, plumbing, etc.) expected, using results from the BEFORE mitigation H&H model. Damages estimates can be obtained using industry accepted depth damage functions (DDFs) or other reliable source.
- **Displacement Cost (\$):** Displacement costs occur when occupants (of residential, commercial, or public buildings) are displaced to temporary quarters while damage is repaired. These costs include rent and other monthly costs, such as furniture rental and utilities, and one-time costs, such as moving and utility hook-up fees. They can also include loss of business income for commercial buildings.
- **Road Closures (hrs.):** If a bridge/roadway is expected to experienced closures in as a result of the BEFORE mitigation

- **Recurrence Interval:** The recurrence interval (RI) is the frequency of event which is expected to cause flood damages at the project location. This recurrence intervals should match those used for the BEFORE mitigation estimates.
- **Estimated Structural Damage (\$):** Dollar value of the estimated structural damages (i.e., the cost to repair or replace the damaged property such as foundation, walls, roof, etc.) expected, using results from the H&H AFTER mitigation model. Damages estimates can be obtained using industry accepted depth damage functions (DDFs) or other reliable source.
- **Estimated Content Damage (\$):** Dollar value of the estimated content damages (i.e., the cost to repair or replace the damaged property such as flooring, HVAC, plumbing, etc.) expected, using results from the AFTER-mitigation H&H model. Damages estimates can be obtained using industry accepted depth damage functions (DDFs) or other reliable source.
- **Displacement Cost (\$):** Displacement costs occur when occupants (of residential, commercial, or public buildings) are displaced to temporary quarters while damage is repaired. These costs include rent and other monthly costs, such as furniture rental and utilities, and one-time costs, such as moving and utility hook-up fees. They can also include loss of business income for commercial buildings.
- **Road Closures (hrs.):** If a bridge/roadway is expected to experienced closures in as a result of the AFTER mitigation H&H model results, enter the time, in hours or days, the roadway/bridge is expected to be closed to unsafe conditions (i.e., floodwaters above road > 6”).