

HAZARD MITIGATION ADDENDUM

Please select all mitigation initiatives the Applicant is interested in including with their facility repairs. FEMA considers measures denoted by an asterisk (*) to be cost-effective Public Assistance mitigation if the measures do not exceed 100 percent of the eligible repair cost.¹

Building² Please select one or multiple options the Applicant would choose to reduce the potential of future damage.

- ☐ Elevate or relocate components above the Base Flood Elevation³ (based on Best Available Information – plus required freeboard)
- ☐ Elevate the building *
- ☐ Dry or wet floodproof the building *
- ☐ Anchor the building to foundation *
- ☐ Add defensible space around exterior for wildfire protection
- ☐ Add seismic bracing; connect roof, walls, and foundation
- ☐ Relocate the facility
- ☐ Increase resiliency of openings (doors, windows, and vents)
 - ☐ Install shutters on windows*
 - ☐ Replace doors, door frames, hinges, and hardware with wind-resistant units*
 - ☐ Replace glass with impact-resistant material*
 - ☐ Strengthen windows*
 - ☐ Upgrade the weather stripping to prevent water infiltration*
 - ☐ Replace with water-resistance vents. *
 - ☐ Use ember and flame-resistant vents (e.g., screen all attic vents with wire mesh or hardware cloth with openings no larger than 1/8 inch).
- ☐ Improve structural integrity
 - ☐ Underpin spread footings
 - ☐ Reinforce soft-stories and unreinforced masonry
 - ☐ Install shear walls to improve the seismic and wind resistance
 - ☐ Replace siding with a stronger materials and attachments to the wall sheathing and structure. *
 - ☐ Utilize non-combustible component materials (e.g., concrete, bricks, stucco, and stone)
- ☐ Increase resiliency of Gutters and Downspouts
 - ☐ Upgrade to direct water away from the structure to prevent interior or basement water damage. *
 - ☐ Cover gutters with gutter screens to prevent the accumulation of leaves and pine needles for fire protection.
- ☐ Brace interior walls, partitions, parapets, anchor veneer or cladding, suspended light features, drop ceilings, soffits, etc. ⁴
- ☐ Increase resiliency of roof(s)
 - ☐ Replace gable roof(s) with hipped roof framing

¹ (Help Text) PA Mitigation measures must meet one of the following tests of cost-effectiveness: 1.) The mitigation measure is specifically listed in "Appendix J: Cost-Effective Public Assistance Hazard Mitigation Measures" of the PAPPV V4, AND the cost of the mitigation measure does not exceed 100 percent of the damaged facility's repair cost to which the mitigation measure applies; OR 2.) The cost for the mitigation measure does not exceed 15 percent of the damaged facility's repair cost to which mitigation measures apply; 3.) The applicant demonstrates that a mitigation project is cost-effective with FEMA's Benefit-Cost-Analysis (BCA) Toolkit. Additional resources are available through these links [Building Science Resource Library | FEMA.gov](#) or https://www.fema.gov/sites/default/files/documents/fema_p-2181-hurricane-and-flood-mitigation-handbook-for-public-facilities.pdf, [FEMA P-754 Wildfire Hazard Mitigation Handbook for Public Facilities \(wbdg.org\)](#).

² Functionality: Question triggered if "Building" was selected on the Impact List Addendum.

³ (Help Text) For more information please see [Base Flood Elevation \(BFE\) | FEMA.gov](#).

⁴ (Help text) To prevent collapse because it would cause injury and/or block safe exit of a building during an earthquake or high-wind event.

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- ☐ Install hurricane clips, fasteners, anchors, straps, and connectors that are compatible with the roof system and corrosion-resistant in coastal areas. *
- ☐ Low slope roof(s)
 - ☐ Replace entire roof covering with a fully adhered roof covering, such as a modified bitumen membrane roof.^{5*}
- ☐ Strengthen roof openings, such as hatches and skylights. *
- ☐ Strengthen the high-wind pressure areas (e.g., corner zones, roof soffits, overhangs). *
- ☐ Upgrade the roof system to a wind speed rating above the Codes and Standards minimum wind speed rating.
- ☐ Use roof coverings, sheathing, flashing, skylights, roof and attic vents, eaves, and gutters that conform to ignition-resistant construction standards.

Communication system⁶ Please select one or multiple options the Applicant would choose to reduce the potential of future damage..

- ☐ Add guy-wires or additional support. *
- ☐ Undergrounding communication lines
- ☐ Upgrade foundation (e.g., larger footings)
- ☐ Upgrade hardware supporting communication structures (e.g., antennae towers) and/or strengthen assembly connection points.

Contents, equipment, supplies⁷ Please select one or multiple options the Applicant would choose to reduce the potential of future damage..

- ☐ Provide seismic ties, straps, or clips to secure replaced furniture, cabinets, computers, bookcases, and other furnishings. *
- ☐ Elevate components above the Base Flood Elevation (BFE).
- ☐ Other. Please describe:

Drainage Structures. [Hydrologic and Hydraulic study required]⁸

- ☐ Replace the structure with multiple structures or a larger structure. ^{9*}
- ☐ Add properly designed entrance and exit structures, such as a headwall, wingwalls, flared aprons, or energy dissipation measures to increase efficiency and help to minimize scour and erosion. *
- ☐ Protect bank or slope from erosion by using gabion baskets, rip rap with geotextile fabric underneath, cast-in-place concrete, crushed stone or rock, grouted rip rap, sheet-piling, geotextile fabric, or similar measures to control erosion.^{10 *}
- ☐ Protect bank or slope with use of vegetation or a combination of vegetation and construction materials such as live fascines, vegetated geogrids, live crib walls, brush mattresses, root wads, or similar measures. *
- ☐ Upgrade materials to improve resilience

⁵ (Help text) FEMA does not provide Public Assistance mitigation funding for loose laid insulation or membranes as punctures can cause large amounts of water intrusion. This includes loose laid roof membranes with loose ballast stones, as the stones can become projectiles in high winds.

⁶ Functionality: Question triggered if "Communication system" was selected on the Impact List Addendum.

⁷ Functionality: Question triggered if "Contents, equipment, supplies" was selected on the Impact List Addendum.

⁸ (Help text) The Applicant must submit an hydrologic and hydraulic (H&H) study to determine the appropriate culvert size with no adverse up or downstream impacts and National Flood Insurance Program regulations.

⁹ (Help text) The Applicant may use existing SLTT drainage criteria for sizing replacement culverts. The Applicant must consider replacement structures with regard to the total drainage system.

¹⁰ (Help text) Projects involving grouted rip rap may be subject to an environmental assessment and may not be allowable in all instances.

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Energy facility or system¹¹ Please select one or multiple options the Applicant would choose to reduce the potential of future damage.

- ☐ Elevate or dry floodproof components or systems vulnerable to flood damage, including equipment controls, electrical panels; heating, ventilation, and air conditioning/machinery rooms; emergency generators; and fuel tanks. *
- ☐ Elevate pad transformers above the Base Flood Elevation. *
- ☐ Provide looped distribution service or other redundancies in the electrical service to critical facilities. ¹² *
- ☐ Install surge suppressors and lightning arrestors. *
- ☐ Increase resiliency of Power Lines. Please select all that apply.
 - ☐ Add guy-wires or additional support. *
 - ☐ Undergrounding power lines
- ☐ Increase resiliency of Power Poles. Please select all that apply.
 - ☐ Add cross-bracing to H-frame poles to provide additional strength. *
 - ☐ Replace large diameter line with smaller diameter lines to reduce wind load on lines and poles. *
 - ☐ Replace damaged power pole(s) with higher-rated power poles (preferably two classes stronger) of the same or different material. ¹³ *
- ☐ Support pole-mounted transformers with multiple poles. *
- ☐ Add seismic retrofitting.

Fence/gate¹⁴ Please select one or multiple options the Applicant would choose to reduce the potential of future damage.

- ☐ Upgrade foundation to concrete or increase the depth of the post.
- ☐ Add line or corner braces or additional connectors to posts on chain link fencing.
- ☐ Add line or corner

Signage. ¹⁵ Please select one or multiple options the Applicant would choose to reduce the potential of future damage.

- ☐ Replace sign panels and their supports with a stronger type of system of supports and panels. ^{16*}

Parks or recreation. ¹⁷ Please select one or multiple options the Applicant would choose to reduce the potential of future damage.

- ☐ Anchor components
- ☐ Strengthen component materials
- ☐ Elevate or relocate components above the Base Flood Elevation.
- ☐ Add green roof(s) to reduce the amount of stormwater runoff.
- ☐ Add permeable pavement which allows stormwater to soak into the ground through porous materials, common in parking lots and shoulders.

¹¹ Functionality: Question triggered if "Energy facility or system" was selected on the Impact List Addendum.

¹² (Help text) Critical facilities are identified in a local hazard mitigation plan; if there is not a plan they are defined as: education, emergency medical care, emergency (including police, fire, and rescue), homeless and domestic violence shelters, prison, utility, other facilities that provide public health and safety services of a governmental nature. Administrative and support facilities essential to the critical facilities are allowable, such as student housing, hospital and prison laundry and cooking facilities, parking, and storage for items needed on-site.

¹³ (Help text) When replacing poles with higher-rated poles, install guys and anchors to provide lateral support for poles supporting pole-mounted transformers, regulators, capacitor banks, reclosers, air-break switches, or other electrical distribution equipment.

¹⁴ Functionality: Question triggered if "Fence/gate" was selected on the Impact List Addendum.

¹⁵ Functionality: Question triggered if "Signage" was selected on the Impact List Addendum.

¹⁶ (Help text) Consider using multiple support post and stronger panels and fasteners.

¹⁷ Functionality: Question triggered if "Park, recreation, or other natural and cultural resource" was selected on the Impact List Addendum

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- ☐ Design rain garden(s) to collect and absorb stormwater runoff in a shallow, vegetated basin near the facility.
- ☐ Integrate rainwater harvesting to collect and store rainfall for later use. ¹⁸
- ☐ Add tree canopy to reduce stormwater runoff and reduce the urban heat island effect.
- ☐ Add tree trenches: a row of trees planted in an underground infiltration structure made to store and filter stormwater.
- ☐ Add vegetated swale(s): a channel holding plants or mulch that absorbs and treats stormwater.
- ☐ Beaches and Shorelines. Please select all that apply.
 - ☐ Stabilize or regrade banks.
 - ☐ Beach nourishment.
 - ☐ Add bulkhead or increase the size or materials of an existing bulkhead
 - ☐ Add drainage-promoting measures (e.g., chimney slope, trench drain, or a berm).
 - ☐ Dune restoration or nourishment to increase size or volume of dune
 - ☐ Add vegetation and/or sand fencing to dunes to maintain dune stability and reduce erosion
 - ☐ Install living shorelines (a combination of living components, such as plants, with structural elements, such as rock or sand).
 - ☐ Restore marshland through regrading/fill, planting native vegetation, edging, sills, breakwaters, and reef balls.
 - ☐ Install oyster reefs to buffer coasts from waves and filter surrounding waters.
 - ☐ Relocate components above the Base Flood Elevation or outside the Special Flood Hazard Area (SFHA).
 - ☐ Restore coastal wetlands along the ocean, estuary, or freshwater coastlines.
 - ☐ Revetment
 - ☐ Add sloped structure placed at the toe and/or face of a coastal bank to dissipate wave energy.
 - ☐ Design waterfront parks to intentionally flood during extreme events, reducing flooding elsewhere.
- ☐ Pier. Please select all that apply.
 - ☐ Upgrade substructure components (e.g., larger diameter piling, install pile tips to deeper elevation, upgrade piling material in consideration of marine environment, evaluate the benefits of a sacrificial superstructure in an effort to protect the substructure.
 - ☐ Install open decking or floating decking with uplift-resistance tie-downs and fasteners, if attached to decking. *

Transportation. ¹⁹ Please select one or multiple options the Applicant would choose to reduce the potential of future damage.

- ☐ Road(s). Please, select all that apply.
 - ☐ Use geotextile fabric and revetments to stabilize shoulders and embankments. *
 - ☐ Use geotextile drainage blankets between the pavement sections and the subbase. *
 - ☐ Reduce ground motion hazards, like liquefaction and ground failure such as installing geogrids or drainage mats.²⁰
 - ☐ Strengthen foundation, construct structural slabs to bridge narrow susceptible zones, or replace rigid pavement with flexible pavement.
 - ☐ Add permeable surface to allow stormwater to soak into the ground through porous materials, common in parking lots and shoulders.
- ☐ Bridge(s). ²¹ Please, select all that apply.

¹⁸ (Help text) May not be legal in all jurisdictions.

¹⁹ Functionality: Question triggered if "Transportation" was selected on Impact List Addendum.

²⁰ (Help text) Remediation methods such as compaction, reinforcement and containment, vertical drains, and underpinning.

²¹ Functionality: Question triggered "Bridge" was selected on the Impact List Addendum.

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- ☐ Install Longitudinal Peaked Stone Toe Protection with nature planting, upstream of a failed abutment. ²² *
- ☐ Install cables to restrain a bridge from being knocked off piers or abutments during floods or earthquakes. *
- ☐ Install girder and deck uplift tie-downs to prevent their displacement from the substructure. *
- ☐ Replace with a low-water crossing where traffic counts are low. *
- ☐ Use geotextile fabric and revetments to stabilize shoulders and embankments. *
- ☐ Use fire resistant materials on bridge.
- ☐ Elevate the bridge above the Base Flood Elevation. ²³
- ☐ Extend or underpin bridge footings below the scour line.
- ☐ Increase the bridge span to increase the cross-sectional area of flow. ²⁴
- ☐ Install automatic bridge closures using Earthquake Early Warning Systems.
- ☐ Install flow deflectors and bull noses on upstream piers.
- ☐ Realign pier and abutment to match direction of stream flow.
- ☐ Reduce ground motion hazards, like liquefaction and ground failure. ²⁵
- ☐ Strengthen foundation, construction of structural slabs to bridge narrow susceptible zones, or replacement of rigid pavements with flexible pavement.
- ☐ Low-water crossing(s).²⁶ Please, select all that apply.
 - ☐ Use geotextile fabric and revetments to stabilize shoulders and embankments. *
 - ☐ Add culvert(s) ²⁷
 - ☐ Anchor the toes with vertical steel rebars in holes drilled into the bedrock.
 - ☐ Form and pour deeper concrete toes along the upstream and downstream edges.
 - ☐ Form and pour steel reinforced concrete instead of grouted riprap on the slopes.
 - ☐ Increase the steel reinforcing in the concrete slab and toes.
 - ☐ Reduce ground motion hazards, like liquefaction and ground failure. ²⁸
 - ☐ Replace the low water crossing with a bridge. ²⁹

Water control. ³⁰ Please select one or multiple options the Applicant would choose to reduce the potential of future damage.

- ☐ Add headwall, wingwalls, flared aprons. *
- ☐ Bank protection (gabion baskets, rip rap, cast-in place concrete).
- ☐ Bank protection with a combination of vegetation and construction materials.

²² (Help text) Consider other relevant Bio-engineering applications such as engineered logjams, log vanes or log bendway weir.

²³ (Help text) Base flood elevation is the computed elevation to which floodwater is anticipated to rise during the base flood. Base flood is a flood which has a one percent chance of being equaled or exceeded in any given year (also known as a 100-year flood). FEMA provides flood hazard information. For more information, see the Codes and Standards section in the [Public Assistance Program and Policy Guide](#).

²⁴ (Help text) This mitigation measure may require a Hydrological and Hydraulic Study; include the cost on the Hydrological and Hydraulic Study on this project.

²⁵ (Help text) Remediation methods such as compaction, reinforcement and containment, vertical drains, and underpinning.

²⁶ Functionality: Question triggered if "Low-water crossing" was selected on the Impact List Addendum.

²⁷ (Help text) This mitigation measure may require a Hydrological and Hydraulic Study; include the cost on the Hydrological and Hydraulic Study on this project.

²⁸ (Help text) Remediation methods such as compaction, reinforcement and containment, vertical drains, and underpinning.

²⁹ (Help text) This mitigation measure may require a Hydrological and Hydraulic Study; include the cost on the Hydrological and Hydraulic Study on this project.

³⁰ Functionality: Question triggered if "Water control" was selected Impact List Addendum. (More info) Water control facilities are those facilities built for the following purposes: Channel alignment, Recreation, Navigation, Land reclamation, Irrigation, Maintenance of fish and wildlife habitat, Interior drainage, Erosion prevention, Flood control, or Storm water management.

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- ☐ Embankment and slope stabilization techniques.
- ☐ Energy dissipation measures.
- ☐ Installation of trees and brush growth on slopes and crests.
- ☐ Geotechnical engineering design concepts such as soil nailing, terracing, geocells, etc.
- ☐ If pumps and their attached motors are damaged by stormwater inundation, replace them with submersible or inline pumps as appropriate. *
- ☐ Strengthen or widen spillway.
- ☐ Culvert(s). *Please, select all that apply.*
 - ☐ Add or improve the designed entrance and exit to minimize erosion and scour. ³¹ *
 - ☐ Realign the culvert vertically or horizontally or relocate the culvert to improve flow and minimize erosion and scour. *
 - ☐ Change or increase the shape, size, and/or number of culvert(s). ³² *
 - ☐ Extend the discharge end beyond the toe of the embankment. *
 - ☐ Install a debris barrier or fins to prevent blockage. ³³ *
 - ☐ Install a debris barrier riser to allow debris to float up with the rising floodwaters without blocking flow into the culvert. *
 - ☐ Use geotextile fabric and revetments to stabilize shoulders and embankments. *
 - ☐ Reduce ground motion hazards, like liquefaction and ground failure. ³⁴
 - ☐ Remove and replace culvert liners.
 - ☐ Strengthen foundation, construct structural slabs to bridge narrow susceptible zones, or replace rigid pavements with flexible pavement.

Water/ Wastewater. ³⁵ *Please select one or multiple options the Applicant would choose to reduce the potential of future damage.*

- ☐ Elevate or dry floodproof components or systems vulnerable to flood damage. ³⁶ *
- ☐ Install camlocks, transfer switches, and electrical panels to facilitate the connection of portable emergency generators. *
- ☐ Install switches, circuit isolation, and/or quick connect capability to facilitate rapid connection of backup power for any damaged or susceptible mechanical and electrical components. *
- ☐ Provide seismic bracing for electrical lines, conduit, piping, ductwork, water heaters, and other Mechanical, Electrical, and Plumbing equipment. ³⁷ *
- ☐ Roof-Mounted Equipment. *Please select all that apply.*
 - ☐ Secure to roof top via a continuous load path. ³⁸ *

³¹ (More info) Including headwalls, wingwalls, flared aprons, energy dissipation measures, gabion baskets, rip rap, cast-in-place concrete, crushed stone or rock, grouted riprap, sheet-piling, geotextile fabric, vegetation (or combination of vegetation and construction), etc. Consider using green infrastructure techniques such as bioswales, bioretention, rain gardens, etc. This mitigation measure may require a Hydrological and Hydraulic Study; include the cost on the Hydrological and Hydraulic Study on this project.

³² (More info) This mitigation measure may require a Hydrological and Hydraulic Study; include the cost on the Hydrological and Hydraulic Study on this project.

³³ (More Info) Debris fins are walls built in the stream channel upstream of a culvert or bridge. Their purpose is to align debris, such as logs, with the axis of the culvert or bridge so that the debris will move through the culvert or bridge opening. For more information, see Federal Highway Administration's [Debris Control Structures Evaluation and Countermeasures](#).

³⁴ (More Info) Remediation methods such as compaction, reinforcement and containment, vertical drains, and underpinning.

³⁵ Functionality: Question triggered if "Water/Wastewater" was selected on the Impact List Addendum.

³⁶ (More info) Including equipment controls, electrical panels; heating, ventilation, and air conditioning/machinery rooms; emergency generators; and fuel tanks. If elevation is not possible, replace with equipment suitable for submerged applications.

³⁷ (More info) Components can be wall mounted, floor mounted, or suspended.

³⁸ (More info) Use tie-downs, straps, or other anchoring systems that will resist expected wind forces.

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- ☐ Other. *Please describe:*
- ☐ Pipe(s). *Please select all that apply.*
- ☐ Install automatic shut-off valves so that damage sections of pipe can be isolated.
 - ☐ Install continuous lining or encasement to prevent infiltration or structural collapse. *
 - ☐ Replace pipes with more ductile material.
 - ☐ Install pipe joint restraints, flexible piping at pipe/conduit connections, or replace pipes with more ductile material. *
 - ☐ Underground Pipes. *Please select all that apply.*
 - ☐ Install shut-off valves so that damaged sections of the underground pipe can be isolated. *
- ☐ Storage Tank(s). *Please select all that apply.*
- ☐ Anchor or otherwise protect from movement by strengthening or stiffening base connections. *
 - ☐ Install self-initiating disconnects and shut-off valves between storage tanks and distribution lines to minimize damage and leaks. *
 - ☐ Upgrade storage tank materials to increase resilience.
 - ☐ Replace combustible tanks with non-combustible tanks.
- ☐ Water/Wastewater: *Please select all that apply.*
- ☐ If pumps and their attached motors are damaged by stormwater inundation, replace them with submersible inline pumps as appropriate. *
 - ☐ Raw water intakes: Install buttressing to prevent damage from erosion, scour, and flood debris. *
 - ☐ Sewer Access Covers: Elevate to the hydraulic grade line. When elevation is not feasible or practicable, install devices to prevent infiltration into access holes such as cast-iron watertight frames and covers. *
 - ☐ Well Systems: Seal exposed portions of well casing or raise the elevation of the well head to prevent infiltration of flood waters. *