LOUISIANA WATERSHED INITIATIVE

FUTURE FLOOD RISK IN PROJECT PLANNING AND DESIGN

Flood risk is neither certain nor static; it is affected over time by changes in land use, climate, and other environmental conditions. To quote Gov. John Bel Edwards following the signing of Executive Order JBE 2018-16, which established the Council on Watershed Management, "Louisiana is no stranger to flooding and severe weather, and people all across Louisiana have suffered tremendous loss as a result. We should advance our commitment to increasing community and regional resilience to flooding by managing, mitigating, and adapting to future flood risk."[1] Investments in flood risk management must be made with considerations of possible changes in flood risk over time to ensure that these investments are effective and that benefits last as expected. Catastrophic failures and damages are known to occur when project design levels are exceeded, which is more likely to happen if future conditions aren't adequately accounted for. For this reason, Round 1 Funding project applicants must demonstrate consideration of how flood levels can change over time in project approach and design.

This document provides how-to guidance to incorporate consideration of future flood risk into project planning for Round 1 Funding applications. Its use will also support Louisiana Watershed Initiative (LWI) application reviewers in evaluating applicants' consideration of future flood risk, accounting for varying degrees of capacity and capability in data-gathering, staff availability, and skill level amongst applicants.

It is worthwhile to note that as the state progresses toward developing higher statewide standards for data collection and use, the LWI is expected to evolve guidance for the consideration of future flood risk in mitigation action identification and design across all types of flood hazard. In the interim, applicants applying for funding for relevant mitigation actions should demonstrate in their project scope of work how consideration of future flood risk informed project development. This approach should be justified by the applicant based on the needs, criticality, timeframe, and risk tolerance of the project, and be based on best-available, actionable science, as defined by FEMA's Technical Mapping Advisory Council (TMAC).[2] Suggested sources of best-available, actionable science are provided in the following sections.

[1] Office of the Governor. 2018. "Gov. Edwards Issues Executive Order to Manage Future Flood Risks Statewide." Available online at: http://gov.louisiana.gov/index.cfm/newsroom/detail/1451.

[2] FEMA Technical Mapping Advisory Council. 2015. *Future Conditions Risk Assessment and Modeling.* Available online at: https://www.fema.gov/media-library-data/1454954261186-c348aa9b1768298c9eb66f84366f836e/TMAC_2015_Future_Conditions_Risk_Assessment_and_Modeling_Report.pdf.

DRIVERS OF FUTURE FLOOD RISK

Applicants whose projects are subject to and/or seek to address **coastal, riverine,** and/or **stormwater** flood risk **must** demonstrate consideration of the following two drivers of future flood risk, in some capacity, as detailed further in the following sections:

1. *Climate change impacts* (i.e., precipitation, sea level rise)
2. *Future development and land use* (i.e., impervious surface coverage, flood storage capacity)

Applicants whose projects are subject to and/or seek to address **coastal** and/or **riverine** flood risk are also encouraged, but not required, to consider the following driver of future flood risk:

3. Future erosion hazard

Accounting for Uncertainty: A Scenario-Based Approach

Future conditions will not necessarily reflect historical conditions. **Uncertainties** are inherent in projections of future flood risk conditions in two forms:[3]

1. Inherent uncertainty about future changes in natural systems, including variations in future climatic and atmospheric conditions, precipitation patterns, topographic changes, hydrologic and geomorphic changes in riverine systems, and future tailwater conditions; and manmade systems, such as land use and development and hydraulic changes
2. Inherent uncertainty about the accuracy and completeness of existing models and observations

For this reason, applicants should seek to ensure that they identify and quantify, in some way, the level of accuracy and uncertainty of the data used to project future flood conditions.[4] This may be best ensured by taking a scenario-based approach to determining future flood risk.[5] A **deterministic approach** uses historical averages and trends to project future conditions. This approach is strongly discouraged, given the high degree of future uncertainty. Instead, the LWI recommends that applicants take a **scenario-based approach** to considering drivers of future flood risk. Applicants should, at minimum, demonstrate consideration of **low, medium**, and **high** future scenarios for each driver of future flood risk relevant to the proposed project (e.g., precipitation, sea level rise, impervious surface coverage). The scenarios chosen must be justifiably based on best-available, actionable science and chosen to be commensurate with the nature and criticality of the project, the timeframe and level of investment of the project, and the risk tolerance of the project.

Figure 1 provides an example of a critical facilities and infrastructure mitigation action subject to and addressing coastal storm-surge-based flooding. The example demonstrates how low, medium, and high scenarios of local relative sea level rise (including rates of land subsidence), based on existing CPRA data, were used to inform project design, with a timeframe commensurate with the project useful life (2100).

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3 FEMA TMAC 2015.
4 Ibid.
5 Ibid.

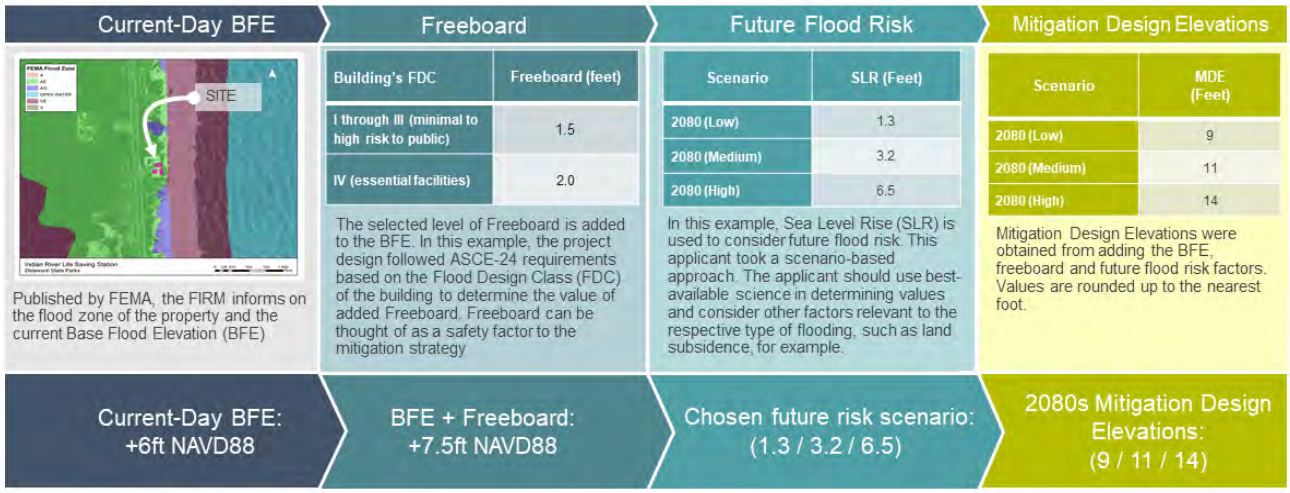

Figure 1: Example of Incorporating Future Flood Risk into Project Design – Coastal Critical Facilities and Infrastructure Mitigation Action

RECOMMENDATIONS

CLIMATE CHANGE IMPACTS

Depending on the type of flood risk the proposed project seeks to address and/or is subject to, the applicant must incorporate scenarios for **future precipitation** and/or **future sea level rise** (including expected future rates of land subsidence to reflect local conditions).

- Projects addressing and/or subject to **coastal storm-surge** flood risk must consider scenarios of future **precipitation** and future **sea level rise**, including subsidence.
- Projects addressing and/or subject to **riverine** flood risk must consider scenarios of future **precipitation**. *Where applicable* (e.g., in estuarine areas or other transition zones), project planning must also demonstrate consideration of relevant impacts of future sea level rise scenarios on riverine flooding, such as impacts on drainage patterns, tailwater conditions, and backwater effects.
- Projects addressing and/or subject to **stormwater** flood risk must consider scenarios of future **precipitation** only.

Suggested Approach

For **coastal** areas, CPRA provides future flood depths for several scenarios, which incorporate future precipitation and sea level rise values (including subsidence), in addition to other inputs such as tropical storm

intensity and frequency. These scenarios are regarded as best-available, actionable science for use by the applicant and can be found on CPRA's online Master Plan Data Viewer[6] and in CPRA's 2017 Coastal Master Plan.[7]

Similar models that can be regarded as best-available, actionable science have not yet been developed statewide for the state of Louisiana. In future rounds of funding, the LWI will move toward incorporating new models and best-available, actionable data developed through expert consensus in collaboration with stakeholders in order to further evolve this guidance and ensure consistency in the future. For the purposes of the Round 1 Funding application process, applicants pursuing mitigation actions addressing and/or subject to **riverine** and/or **stormwater** flooding may select low, medium, and high future precipitation scenarios using CPRA's plausible range of values from the 2017 Coastal Master Plan (found in Appendix C: Modeling[8]). These scenarios may be presented as historical precipitation values (found, for example, on NOAA's Atlas 14 online tool[9]) increased or decreased by specified percentages. The applicant may also extrapolate scenarios based on future carbon emissions and extreme precipitation projections published by other reputable entities, such as the National Climate Assessment[10] (NCA), within reason and with justification. **Any applicant selecting from within CPRA's plausible range of values or extrapolating based on NCA projections should justify how the range of scenarios generated (using low, moderate, less optimistic, and/or high values) adequately reflects the project's criticality, timeframe, and risk tolerance.**

FUTURE DEVELOPMENT AND LAND USE CHANGE

Development and land use change can have significant impacts on flood hazard, and projections are known to under-predict actual changes over time.[11] For example, increased use of fill within the floodplain can decrease natural flood storage capacity and increases in impervious surfaces in urban areas can increase stormwater runoff significantly. As the EPA explains, when "impervious surfaces reach 10-20% of local watershed area, surface runoff doubles and continues to increase until, at 100% impervious surface coverage, runoff is five times that of a forested watershed" (EPA 2018).[12] This can seriously impact flood levels over time. For this reason, applicants pursuing mitigation actions addressing and/or subject to **coastal, riverine**, and/or **stormwater** flooding are required to demonstrate consideration of the impacts of future development and land use change on future flood risk in project planning and design. Similar to consideration of climate change impacts, this can be achieved by taking a scenario-based approach.

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6 CPRA. n.d. Master Plan Data Viewer. Available online at: http://cims.coastal.louisiana.gov/masterplan/.
7 CPRA. 2017. *2017 Coastal Master Plan*. Available online at: http://coastal.la.gov/wp-content/uploads/2017/04/2017-Coastal-Master-Plan_Web-Single-Page_CFinal-with-Effective-Date-06092017.pdf.
8 Meselhe, E., White, E. D., and Reed, D. J. 2017. *2017 Coastal Master Plan: Appendix C: Modeling 2 – Future Scenarios*. Baton Rouge, Louisiana: Coastal Protection and Restoration Authority. Available online at: http://coastal.la.gov/wp-content/uploads/2017/04/Appendix-C_chapter2_FINAL_3.16.2017.pdf.
9 NOAA. 2018. NOAA Atlas 14 Point Precipitation Frequency Estimates. Available online at: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html.
10 USGCRP. 2017. *Climate Science Special Report: Fourth National Climate Assessment, Volume I*. U.S. Global Change Research Program, Washington DC, USA. Chapter 7: Precipitation Change in the United States. Available online at: https://science2017.globalchange.gov/chapter/7/.
11 FEMA TMAC 2015.
12 EPA. 2018. *EnviroAtlas Fact Sheet: Percent Impervious Area*. Available online at: https://enviroatlas.epa.gov/enviroatlas/datafactsheets/pdf/ESN/PercentImperviousArea.pdf.

Suggested Approach

Applicants should, at minimum, demonstrate consideration of **low, medium**, and **high** future scenarios for the following factor:

a. *Change in impervious surface coverage in the project area*. Project design should demonstrate consideration of potential changes in rainfall/runoff relations that result from each scenario.

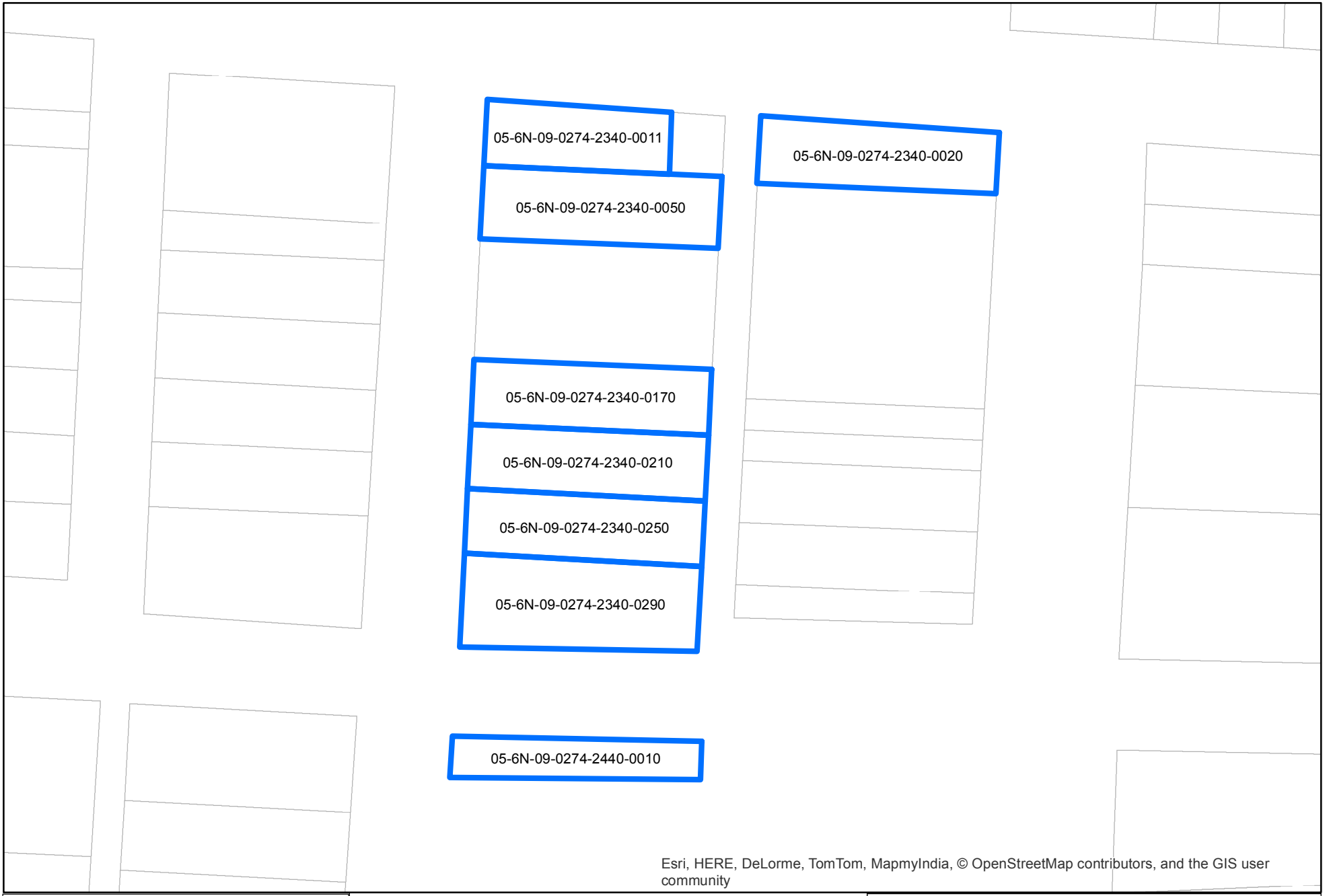
Applicants may use one of, or some combination of, the following approaches to determining future scenarios of development and land use change:

1. Use of future land use maps to predict future land use characteristics over the useful life of the project, if available (e.g., in a parish or municipality comprehensive plan)
2. Use of population growth statistics over time and by location as an indicator of future development trends
3. Use of spatial analysis techniques to predict future development patterns based on trends in zoning, permitting, and other factors

It is recommended that the applicant work with a professional engineer to undertake simple hydrologic and hydraulic analysis based on these predictions of future development and land use change in project planning and design.

FUTURE EROSION HAZARD

Coastal and riverine erosion can alter flooding patterns due to changing shorelines or channel migration. Nevertheless, existing data on future erosion hazard is sparse. Consideration of the impacts of future patterns of coastal and riverine erosion on flood risk is therefore encouraged, but not expected, for the present round of funding. In extreme cases, it is strongly preferred that the applicant demonstrate consideration of future riverine erosion hazard. Further investigation through the LWI may lead to consensus on best practices and/or best-available, actionable future coastal and riverine erosion data for the state of Louisiana.



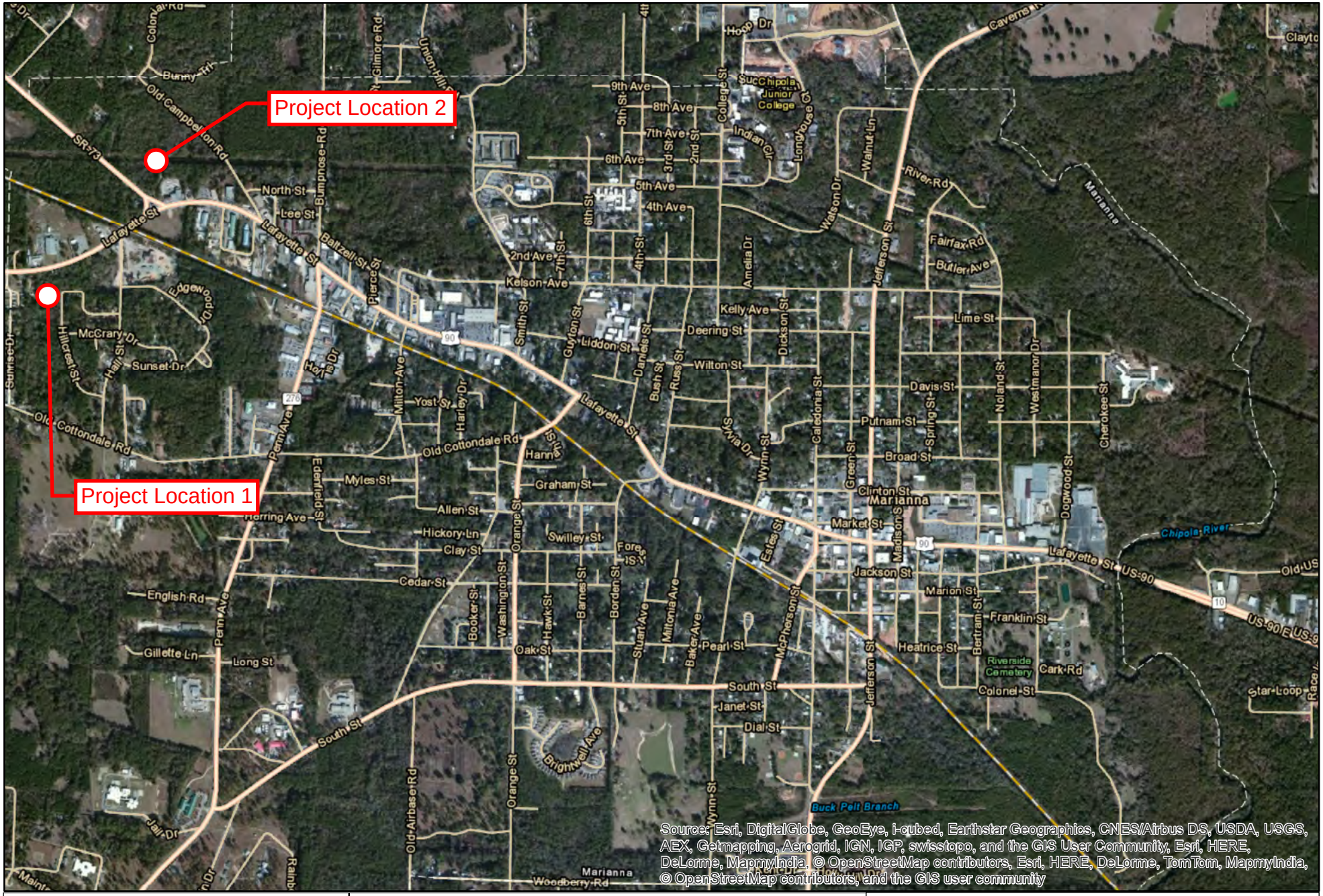
Acquisition Parcels selection

Parcels

Example Parcel Map with Property Identification Number

N

0 55 110 220 Feet



Project Location

Example Project Location Map

N

0 900 1,800 3,600 Feet

Acquisition Parcels

Contour Lines (2 feet)

Parcels

Example Topography Map

N

0 55 110 220 Feet

MAP SCALE 1" = 1000'

0 1000 2000 FEET

METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0215F

FIRM

FLOOD INSURANCE RATE MAP

JEFFERSON PARISH, LOUISIANA

AND INCORPORATED AREAS

PANEL 215 OF 600

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GRETNA, CITY OF	225198	0215	F
JEFFERSON PARISH	225199	0215	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
22051C0215F

MAP REVISED
February 2, 2018

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Primary Benefitting Area

Secondary Benefitting Area

Example Project Benefitting Area

N

0 250 500 1,000 Feet

Example Facility Map with Egress

Point of Egress

N

0 250 500 1,000 Feet

PHOTOGRAPHIC LOG	
Applicant Name:	**Site Location:**

SITE LOCATION:	INSERT PHOTO HERE
Location of Photo:	
Date:	
Photo No:	
Description:	

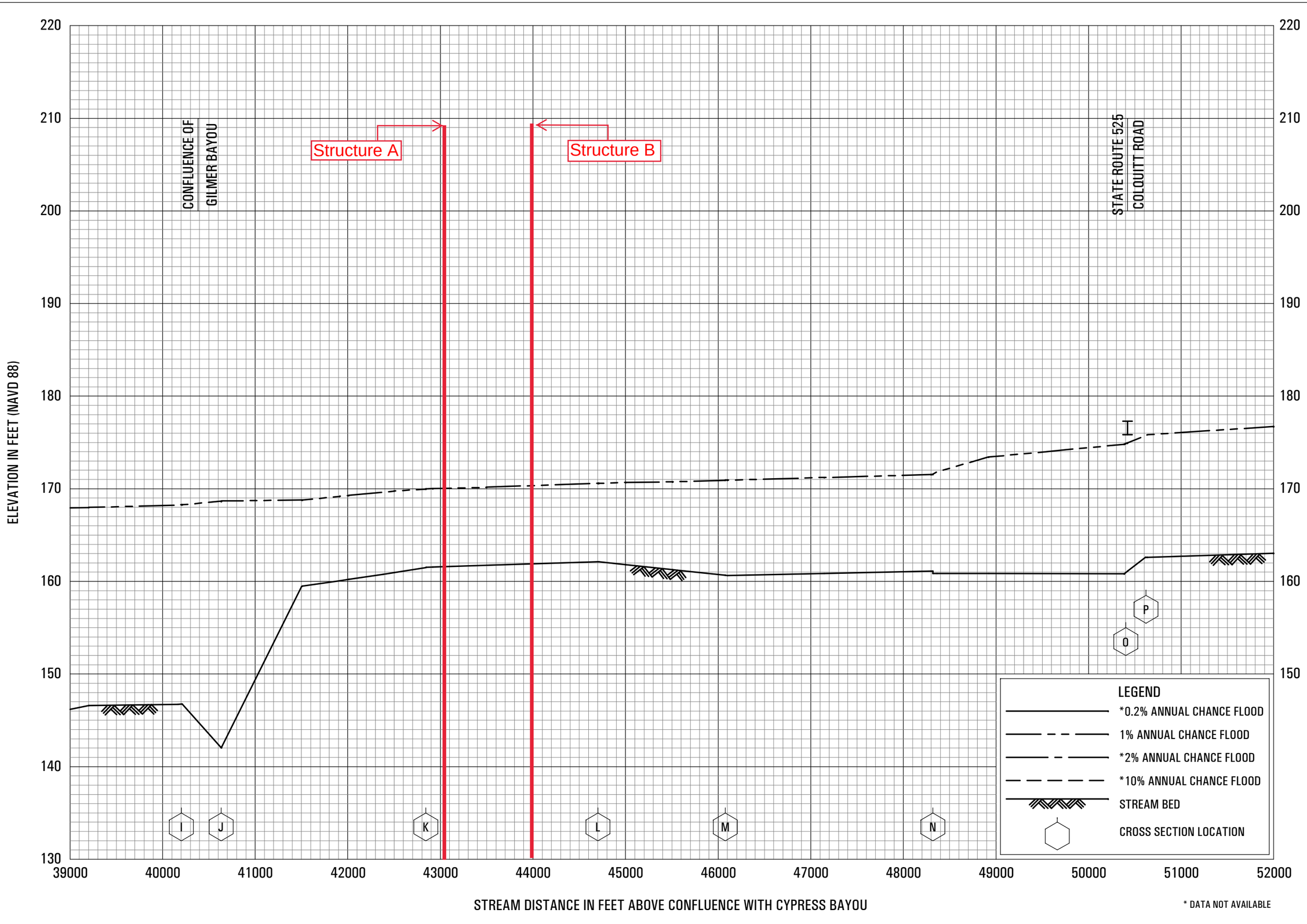
PHOTOGRAPHIC LOG	
Applicant Name:	**Site Location:**

SITE LOCATION:	INSERT PHOTO HERE
Location of Photo:	
Date:	
Photo No:	
Description:	

TABLE 4 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES cfs) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
BAYOU PIERRE (continued)					
At Pierremont Road	8.1	6,827	7,504	7,735	7,999
Upstream of Ockley Ditch	1.9	2,179	2,620	2,823	3,108
At Kings Highway	1.0	1,449	1,683	1,773	1,932
BETTEY VIRGINIA LATERAL					
At mouth	0.4	1,093	1,373	1,492	1,693
Upstream of Avery Ditch	0.02	143	184	202	231
BICKHAM BAYOU					
At mouth	5.3	3,850	5,222	5,863	6,724
At Jefferson Paige Road	2.9	2,530	3,471	3,858	4,224
At Pines Road	0.8	794	1,041	1,160	1,326
BOGGY BAYOU					
At confluence with Cypress Bayou	148.0	*	*	24,800	*
At State Route 171	79.0	11,244	16,099	19,018	22,916
Upstream of Gilmer Bayou	49.1	6,678	9,538	11,078	13,241
At Woolworth Road	41.3	*	*	11,100	*
At State Route 169	11.8	*	*	9,600	*
BOGGY BAYOU TRIBUTARY A					
At confluence with Boggy Bayou	4.1	*	*	3,900	*
At Buncombe Road	3.1	*	*	3,600	*
BOGGY BAYOU TRIBUTARY B					
At Confluence with Boggy Bayou	8.6	*	*	4,160	*
At State Route 169	3.3	*	*	3,660	*
BROADMOOR LATERAL	*	*	*	1,533	*
BROOKWOOD DITCH					
At Mouth	1.5	1,931	2,499	2,746	3,116

*Data not available



FLOOD PROFILES

BOGGY BAYOU

FEDERAL EMERGENCY MANAGEMENT AGENCY

CADDO PARISH, LA

AND INCORPORATED AREAS

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[2]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Boggy Bayou								
A-H[1]								
I	40,200	1,300	8,306	2.3	168.3	168.3	169.2	0.9
J	40,630	1,850	11,282	1.0	168.7	168.7	169.6	0.9
K	42,840	2,100	11,762	0.9	170.0	170.0	170.8	0.8
L	44,700	2,700	16,877	0.7	170.6	170.6	171.5	0.9
M	46,075	2,800	13,414	0.7	170.9	170.9	171.9	1.0
N	48,320	2,100	14,141	0.8	171.6	171.6	172.5	0.9
O-AA[1]								

[1]No floodway calculated

[2]Feet above confluence with Cypress Bayou

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

CADDO PARISH, LA AND INCORPORATED AREAS

FLOODWAY DATA

BOGGY BAYOU

LOUISIANA WATERSHED INITIATIVE

MITIGATION ACTION:

FLOODPLAIN RESTORATION AND PRESERVATION

Table 1. Types of Floodplain Restoration and Preservation Projects

- **Floodplain reforestation**
- **Floodplain expansion/benching**
- **Stream restoration**
- **Wetlands/marshland restoration/creation**
- **Conservation easements/land acquisitions**
- **Riparian buffers**

KEY CONSIDERATIONS

Is the floodplain hydraulically connected to the waterway?

Is the waterway in an urban, agricultural, or undisturbed portion of the watershed?

Is land available on one or both sides of the waterway?

Is there development in the floodplain? Is there risk to frequent flooding?

Flooding is a natural process where a river or stream overflows its banks. This may happen multiple times a year or every few years. Floodplains, when left undisturbed, are natural, vegetated areas bordering a stream or river that periodically overflows. When the banks are overtopped and the floodplain is inundated, floodwaters are slowed and temporarily stored, then returned to the stream channel, infiltrated, or evaporated as floodwaters recede. This process helps moderate peak storm flows and improves water quality by decreasing pollutant and sediment loads downstream, helps shallow groundwater recharge, and reduces instream erosion and downstream sediment transport. Additionally, floodplains are rich habitat corridors with recreational opportunities.[1]

In many urban areas, high discharge runoff from increased impervious surfaces often causes stream channels to become deeper and wider, delivering larger storm flows within the channel banks, and disconnecting from the floodplain. Some agricultural practices can lead to similar issues. The increased conveyance capacity can result in flooding downstream. Levees, parallel roadway embankments, placed fill, and other physical encroachments can have a similar impact, altering floodplain conveyance, peak flows, and increasing flooding problems downstream. Restoring and preserving natural floodplain functions can mitigate these issues.

PLANNING CONSIDERATIONS

Floodplain restoration projects allow for many co-benefits to be integrated into the designs. These could include:

- Restoring function of degraded stream(s)
- Protect existing utilities and infrastructure from actively migrating stream
- Water quality and habitat improvement
- Floodplain filtration and plant uptake
- Reduced instream erosion and sediment transport
- Volume reduction achieved by infiltration and evaporation
- Groundwater recharge
- Aesthetic and recreational features
- Demonstration project/educational opportunities

Key activities along the stream may include:[2]

- Bar and floodplain grading
- Vegetation plantings/reforestation
- Riprap placement
- Creating side cavities, side channels, or riffles and pools
- Structure removal
- Artificially placed wood/engineered logjams

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1 Chargrin River Watershed Partners, Inc. and Biohabitats. (2009). *Floodplain Restoration and Storm Water Management: Guidance and Case Study*. Retrieved from http://crwp.org/files/floodplain_restoration_sw_management_march_2009.pdf

2 Schwindt, S.; Pasternack, G. B.; Bratovich, P. M.; Rabone, G. & Simodynes, D. 2019. Hydro-morphological parameters generate lifespan maps for stream restoration management Journal of Environmental Management, 232, 475-489. doi: 10.1016/j.jenvman.2018.11.010

KEY DESIGN CONSIDERATIONS

When evaluating whether floodplain preservation or restoration will mitigate flooding, a key factor to consider is, "Is the waterway connected to a floodplain or can it be better connected to the floodplain?" Restoring floodplain connectivity must first take place in order to have flood risk reduction benefit.[3]

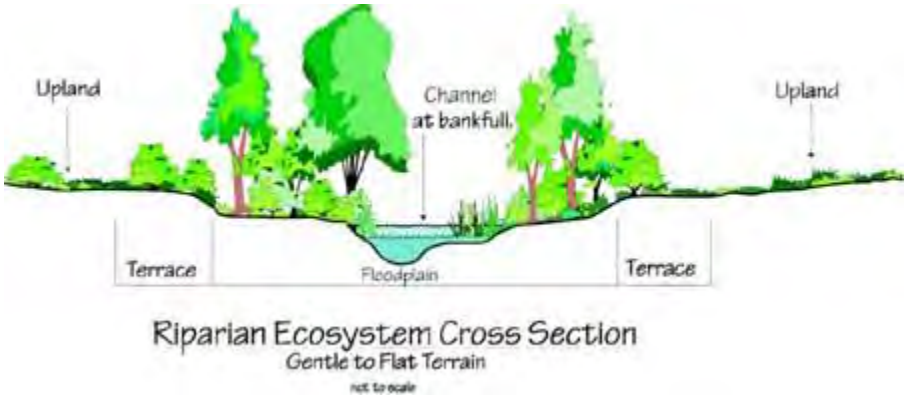

Figure 1. Illustration courtesy of United States Forest Service

Floodplain reconnection can involve multiple techniques of physically re-shaping the floodplain and stream. These include resizing the channel cross-section (changing the width and depth of the stream), raising the stream profile by raising the height of the stream bed, or redirecting the stream to a higher area of the floodplain. Additionally, re-introducing natural meanders can slow stream flow, reconnect to the abandoned floodplain, and allow more frequent overbank flooding where appropriate.

Where levees or other features constrict the natural floodplain, removal of these features may be considered to restore the hydraulic connection. Routing of high flows, similar to how flows are redirected to an offline flood storage project, can also be a method of restoring connectivity. Flows can easily be rerouted to adjacent downstream areas that are lower in elevation than the top of the bank, though at times the stream banks may need to be lowered. Additional considerations for these types of projects can be found in the *Flood Storage Mitigation Action Sheet* (Appendix 2.11.2).

If a stream and riparian buffer is undisturbed and appears to be well connected to its floodplain, actions to preserve the natural state can be taken, such as conservation easements. If the riparian buffer has been converted or degraded, but the stream and floodplain are still hydraulically connected, revegetation and reforestation activities can help restore the natural functions of the floodplain.

Case Study: Mollicy Farms

By removing portions of a 17-mile long levee built in the 1960s, this project reconnected bottomland hardwood forests to the seasonal flooding of the Ouachita River. The Nature Conservancy working with the U.S. Fish and Wildlife Service was planning to artificially breach the levee prior to historic flooding that overtopped the levee in spring 2009. Original plans were adapted, and the natural levee breaches were permanently widened. The partners then worked to restore the natural hydrology of the floodplain, recreating over 25 square miles of wetlands and bayous. The reclaimed historic floodplain again provides valuable fish and wildlife habitat in the hardwood forests as part of the Upper Ouachita National Wildlife Refuge.[4] In terms of flood risk mitigation, the project lowered the record flood stage of the Ouachita River by one foot.[5]

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[3] *Id.*
[4] *The Nature Conservancy. (n.d.). Stories in Louisiana: Mollicy Farms. The Nature Conservancy. January 9, 2019. From* https://www.nature.org/en-us/about-us/where-we-work/united-states/louisiana/stories-in-louisiana/largest-floodplain-restoration-in-mississippi-river-basin/
[5] Piazza, B. P. (n.d.). Restoring Mississippi River Basin Health with Floodplains. Retrieved from: https://www.usda.gov/oce/forum/2018/speeches/Bryan_Piazza.pdf followed up with Brian Piazza

Example Project Evaluation

Benefits to water quality. For example, a project may reduce sedimentation, reduce nutrients and impurities from runoff, process organic wastes, or moderate temperature fluctuations.[1]

Benefits to habitat value. For example, a project may add rich alluvial soils to promote vegetative growth, maintain biodiversity, maintain integrity of ecosystems, provide breeding and feeding grounds, create enhanced waterfowl habitat or protect habitats for rare and endangered species.[1]

Benefits to natural hydrology. For example, an activity may provide flood storage and conveyance, reduce flood velocities, reduce peak flows, promote infiltration and aquifer recharge or reduce frequency and duration of low surface flows.[1]

Enhance active recreational assets

Downstream benefits

Passive and reliable solution

PROS	CONS
These activities are at the heart of the Louisiana Watershed Initiative's dual mission by both reducing flood risk and addressing natural and beneficial floodplain functions. Can provide or be designed to provide co-benefits May be designed to mitigate existing flooding in addition to providing additional capacity for increased runoff and peak flows Can align with CRS credits Can be cost effective compared to urban solutions	Projects may require land acquisition or approval of private landowners to flood their land. Projects may require significant planning, engineering design, permitting, and construction, which may lead to high costs. Projects may require coordination with FEMA and submittal of Conditional Letter of Map Revision and Letter of Map Revision. Many years of monitoring are needed for restoration and revegetation projects. Potential utility and infrastructure conflicts

ACTIVITY TYPE GUIDELINES

Activities in the category should follow the relevant guidelines outlined by the National Resources Conservation Service for the proposed activity, such as the National Engineering Handbook 653 – Stream Corridor Restoration. U.S. Forest Service's Guidance for Stream Restoration and the National Engineering Handbook 654 provide additional guidance. Projects that include wetlands should also reference NEH 650.13-Wetland Restoration, Enhancement, or Creation. Additional best practices can be found in "Hydro-morphological parameters generate lifespan maps for stream restoration management" by Schwindt et al.

Image courtesy of Paul Powers
Introduction of large woody debris helps slow water and provides habitat in areas with adequate capacity

ADDITIONAL DETAILED APPLICATION GUIDELINES: FLOODPLAIN RESTORATION AND PRESERVATION

Application Checklist: Floodplain Restoration and Preservation

☐ Record of deed (AS APPLICABLE)
☐ Letter of support from land trust/state agency in charge of managing the land (AS APPLICABLE)

Technical Report Guidelines: Floodplain Restoration and Preservation

Competitive Detailed Applications will include the following information in the technical report in addition to the basic technical report requirements outlined in the detailed application.

- Documentation of how design considerations listed herein are addressed or do not apply (include any associated calculations, hydrologic and hydraulic analysis, drawings, etc.)
    - Rationale and supporting materials for conclusion regarding whether stream is hydraulically disconnected from floodplain
- List of reference sources and guidance documents used and discussion of how they were applied
- Address watershed-level concerns that may be causing stream impairments in a short narrative, in order to be sure investing in stream and floodplain restoration at the proposed location will provide lasting benefit
- Identify what measurable attributes have been collected for the following:
    - Hydrology
    - Land use/land classification (impervious surfaces, agricultural land, etc...)
    - Erosion and sediment yield
    - Floodplain/riparian vegetation
    - Channel processes
    - Water quality
    - Aquatic and riparian species and critical habitats
    - Corridor dimensions
- Proposed streambed/floodplain modification (benching, terracing, excavation, etc.)
- Proposed planting plan (initial - 3-5 years) (if applicable)

Additional References/Literature

Schwindt, S.; Pasternack, G. B.; Bratovich, P. M.; Rabone, G. & Simodynes, D. 2019. Hydro-morphological parameters generate lifespan maps for stream restoration management Journal of Environmental Management, 232, 475-489. doi: 10.1016/j.jenvman.2018.11.010, available at: https://www.researchgate.net/publication/329440377_Hydro-morphological_parameters_generate_lifespan_maps_for_stream_restoration_management

LOUISIANA WATERSHED INITIATIVE

MITIGATION ACTION:

FLOOD STORAGE

Table 1. Types of Storage Projects

- **Detention basins**
- **Retention basins**
- **Bundled smaller upstream projects**

KEY CONSIDERATIONS

How much land is available to store floodwaters?

How are floodwaters routed to the storage feature?

How are floodwaters discharged from the storage feature and returned to the receiving water body?

What is the storage volume needed to mitigate flooding?

Can this volume be provided given available land and other constraints?

How will potential sediment, debris, and trash issues be dealt with?

What maintenance is required, and can maintenance access be provided?

What is the current groundwater level, and will it adjust seasonally?

How do these projects relate to other watershed needs and projects?

What co-benefits can be integrated into design? Examples include:

- **Water quality improvement**
- **Drought mitigation**
- **Volume reduction achieved by infiltration, evapotranspiration, or reuse of stormwater runoff**
- **Groundwater recharge**
- **Addressing total maximum daily load permit requirements for area water bodies**

This document provides a brief overview of Flood Storage actions, pros and cons, key considerations, and links to additional project development resources.

Flood storage actions include regional detention basins, retention basins, and may include bundled smaller upstream detention or retention projects. Flood storage projects store excess runoff from a potentially overtopping body of water into either another body of water, or an area where it can be safely stored, such as in a wetland, undeveloped floodplain, reservoir or tank, green infrastructure element, or other storage facility.[1] Detention and retention basins are intended to reduce peak flows and the frequency or magnitude of flooding by providing available storage volume for floodwaters. Storage volume for both detention and retention basins is often created by excavation but may also be created by constructing embankments above existing grade. These actions typically complement or are part of a watershed-wide system of practices to reduce flooding.

Detention basins, often called "dry ponds," store floodwaters for a limited time, slowly releasing floodwaters after water levels in the receiving water body recede. Weirs, orifices, or other engineered outlet structures are typically used to meter release rates from detention-based practices. Real-time controls can be used to optimize detention and storage requirements.

Retention basins, often called "wet ponds," are like detention basins except that they maintain a permanent pool and remain wet. Retention is achieved through a combination of storage, infiltration to shallow or deep groundwater systems, evapotranspiration, or on-site reuse. Weirs, orifices, or other engineered outlet structures are typically used to meter release rates from detention-based practices. Real-time controls can be used to optimize retention and storage requirements. Use of forebays can extend the life of the facility and facilitate maintenance operations.

Flood storage projects that provide significant storage and reduction in flooding frequency or magnitude are often located near tributaries of rivers, streams, lakes, or bays where sufficient storage volume can be provided to obtain measurable results. Flood storage projects can also be bundled in a wholistic watershed scale approach in upstream areas along the stormwater system, farther from the receiving water body, to reduce the occurrence or magnitude of flooding in downstream areas.

PROJECT TYPE GUIDELINES

Projects in this category should refer to deq.louisiana.gov/page/storm-water-protection for guidance, as well as NOAA Green Infrastructure Options to Reduce Flooding, The Nature Conservancy's A Flood of Benefits - Using Green Infrastructure to Reduce Flood Risk, Great Lakes Coastal Resilience Planning Guide, Green Infrastructure Guidance for Flood Reduction Extended Methodology, and other more context-specific sources, as appropriate.

[1] *Federal Emergency Management Agency (FEMA). 2017. Flood Diversion and Storage Fact Sheet. Online:* https://www.fema.gov/media-library-data/1487161066306-be67b748dc934ff31ecbf849c6079e48/FDS_Fact_Sheet_Feb2017_COMPLIANT.pdf

Example Project Evaluation

For certain designs, project site can be used as active recreation areas when dry (park, recreational area, etc.).

Projects can enhance groundwater infiltration and increase baseflow.

Can be easily designed to adapt to higher flood levels

Largely passive solutions

For some designs, may increase sedimentation downstream

Photo courtesy of Harris County. Large projects show benefits downstream on a regional scale.

A competitive application in this category will identify locations that suffer from excessive flooding to be mitigated by the project and demonstrate how the design will specifically address these issues. Competitive applications should also show that the project addresses projected future flood risk or accommodates flood risk uncertainty. Projects that result in new or restored wetlands, estuaries, riparian, or green spaces are encouraged.

PROS	CONS
May provide significant floodwater storage to reduce downstream flooding frequency and extents Multiple projects can be bundled in upstream areas to obtain desired benefits downstream. May be designed to mitigate existing flooding in addition to providing additional capacity for increased runoff and peak flows resulting from future development or natural hydrologic changes Can be designed to provide co-benefits	Projects typically require significant land acquisition. Projects will require planning, engineering design, permitting, and construction. Projects require active long-term inspection and maintenance to maintain effectiveness, control vegetation, and remove accumulated sediments, trash, and debris. Projects can have unintended impacts on downstream flooding if designed improperly. Public safety and access to the project must be considered. Drowning or exposure to pollutants are risks to public.

KEY DESIGN CONSIDERATIONS

While these projects can reduce flood risk, they must be well planned and designed to avoid negative consequences and function as intended. In addition to the considerations listed above, other factors that must be considered to successfully design and maintain a project that serves its intended function include unintended downstream impacts related to improper timing of releases, groundwater impacts, potential for existing contaminated soils or groundwater, soil types, infiltration rates, plant and invasive species management, inspection and operation of hydraulic control structures, and inspection and maintenance intervals, among others.

Case Study: Harris County, Texas

The Harris County Flood Control District has begun construction on two regional stormwater detention basins that will reduce flooding risks and damages in portions of the Greens Bayou watershed in north Harris County. The basins will benefit the area by storing floodwater and slowly releasing when the threat of flooding has passed. The two basins will be able to store up to 1.05 billion gallons of storm/flood waters and will benefit more than 1,100 structures.

ADDITIONAL DETAILED APPLICATION GUIDELINES: FLOOD STORAGE

Application Checklist: Floodplain Restoration and Preservation

☐ A map of property and property owners from which easements or property rights must be acquired

Technical Report Guidelines: Flood Storage

Competitive Detailed Applications will include the following information in the technical report in addition to the basic technical report requirements outlined in the detailed application:

- Documentation of how design considerations listed herein are addressed or do not apply:
    - Planning and design methods and calculations
    - Hydrologic and hydraulic analysis/modeling
    - Preliminary plans or drawings of the proposed facilities, watershed maps, etc.
    - Water quality evaluations/modeling, if prepared
    - Flood storage footprint and available storage volume
    - Contributing drainage area
    - Storage volume required and available to provide desired flood mitigation
    - Inspection and maintenance
    - Invasive species management
    - Groundwater
    - Co-benefits
- List of reference sources and guidance documents utilized and discussion of how they were applied
- Current capacity of water body and estimated capacity if project is implemented. One method of evaluating capacity may be to demonstrate which return interval storm event (2-, 5-, 50-, 100-year, etc.) results in overbank flooding.
- Distance of proposed storage project from hazardous materials, EPA superfund sites, Animal Feed Operations, other hazardous assets
- A map of property and property owners from which easements or property rights must be acquired, status and any existing documentation or agreement, a general plan of the process expected to obtain appropriate agreements, and a statement of alternatives in case the plan is not successful

LOUISIANA WATERSHED INITIATIVE

MITIGATION ACTION:

CRITICAL FACILITIES AND INFRASTRUCTURE

The value of critical facilities and infrastructure lies in the services they provide. These services are essential to everyday life, and especially so during and after a disaster. Critical facilities often serve multiple communities, and the cascading impacts from damage can have a multiplying effect on immediate and long-term losses.

The American Society of Civil Engineers (ASCE) provides risk categories associated with facility functions to help guide decision making around mitigation level of protection. A rough guide is provided within this mitigation action sheet; refer to ASCE 24 and ASCE 7 for more detail.[1]

KEY CONSIDERATIONS

What interdependencies may also need to be addressed to provide a complete solution? For example, is the power supply to the facility also at risk? Is the facility accessible during an event?

What are the consequences of loss of service?

What assets are essential to maintaining service?

Does the whole facility or just certain assets need protection?

Critical facilities and infrastructure are assets that, because of their function, size, service area, contents, or other uniqueness, could result in further community harm if they are destroyed, damaged, or if their functionality is impaired. This could mean public health impacts, property damage, ecological impacts, or disruption of vital socioeconomic activities during or after a flood event.[2] For communities to function effectively and meet the needs of their citizens, they must have power, water, waste disposal, transportation, communications, hospitals, fire services, police, and other essential services.

Critical facilities and infrastructure flood mitigation actions are those that: a) protect against or limit disruption to public services, b) limit cascading impacts as a result of service disruption, and c) consider and address key interdependencies that could result in or exacerbate impacts as a result of a flood event.

CRITICAL FACILITIES AND INFRASTRUCTURE FLOOD RISK MITIGATION TECHNIQUES

Eligible actions will help an entity limit disruption to critical public services. Activities may include, for example, constructing localized floodwalls or berms; raising existing equipment, structures, or roadways above flood elevations; or installing submersible equipment, backflow preventers, and backup generators. Multiple activities and flood proofing techniques (see *Physical Non-Structural Flood Mitigation*, Appendix 2.11.4) are frequently combined to provide a comprehensive solution. Passive mitigation measures, those that do not require human or mechanical intervention to be effective at mitigating loss during a flood event, are preferred.

Figure 1. Active measures require proper warning time and human or electrical/mechanical intervention, while passive mitigation options require no action or moving parts to be effective.[3]

Active Mitigation	Passive Mitigation
• Temporary/retractable floodwalls • Vehicular flood gates • Ingress/egress protection within perminent floodwall • Submersible doors • Pumping systems • Flood proofing techniques	• Elevated structures/assets • Relocation of structures/assests • Natural drainage solutions • Submersible equipment • Floodwalls/berms that do not use breaks in the line of protection to provide access (for example, by using stairs or ramps)

[1] *These standards can be purchased at https://ascelibrary.org/*

[2] Federal Emergency Management Agency. January 2007. Design Guide for Improving Critical Facility Safety from Flooding and High Winds. Risk Management Series FEMA 543. Online: *https://www.fema.gov/media-library-data/20130726-1557-20490-1542/fema543_complete.pdf*

[3] *State of Florida. (2014). Public Facilities Flood Mitigation Initiative: Appendix R. Retrieved from https://www.floridadisaster.org/globalassets/importedpdfs/appendix-r-public-facilities-flood-mitigation-initiative.pdf*

Example Project Evaluation

Projects may provide multi-jurisdictional risk reduction.

Mitigation actions to critical facilities often have a project useful life of 30 to 50 years or more.

Actions should be to the .2% annual chance flood hazard standard or higher and consider future flood risk.

ASCE Category IV facilities and ASCE Category III facilities are prioritized in scoring.

Project type does not address natural floodplain functions and associated benefits.

Care must be taken to ensure some activities will not exacerbate flood risk in other areas.

May require ongoing maintenance

Contact: Jeffrey Giering, GOHSEP
Jeffrey.Giering@LA.GOV

PROS	CONS
Limiting disruption of critical public services due to flooding enhances overall public safety and community resilience.	May require significant technical expertise to understand risk, as well as develop solutions May be challenging to identify and address interdependencies in the system

Case Studies

Southwest Wastewater Treatment Plant, Baton Rouge, Louisiana[4, 5]
The Southwest Wastewater Treatment Plant in Baton Rouge installed backup generators at the plant and pump stations in response to service loss impacts with Hurricane Gustav in 2008. The backup generators allowed the collection system to maintain full operations in August 2016 when Baton Rouge was inundated with historic flooding. The city's treatment plant and pump stations incurred damages of approximately $5 million but maintained full functionality.

Texas Medical Center, Houston, Texas[6]
Following Tropical Storm Allison in 2001, Texas Medical Center (TMC) implemented numerous mitigation projects to prevent future similar flood damages. TMC constructed perimeter floodwalls, berms, and barriers to the 0.2 percent annual chance flood elevation and over 50 watertight flood doors and gates, mostly within the tunnels under TMC's campus, to allow personnel, people, and patients to move between facilities. TMC also elevated critical routes to allow drivers to access TMC from the state highway.

PROJECT TYPE GUIDELINES

Projects in the category should follow the guidelines set forth in the State Hazard Mitigation Plan, as well as the parish's local Hazard Mitigation Plan. All projects should meet ASCE 24-14 and ASCE 7-16 standards. FEMA's Performance Based Design Guidelines are a helpful resource in the development of effective flood mitigation projects. A competitive application in this category will identify key interdependencies with the asset(s) proposed for mitigation and demonstrate consideration or mitigation of possible cascading impacts in the application. For example, if the application proposes flood mitigation directly to a hospital to mitigate service disruption, the application should demonstrate how key services necessary for the functioning of the hospital have also been considered (e.g., power, water, wastewater, and gas).

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[4] *City of Baton Rouge, Parish of East Baton Rouge. 2018. South Waste Water Treatment Plant running smoothly after expansion, upgrades. Online:* http://city.brla.gov/press/arounddet.asp?gid=2590

[5] *Laggis, L. January 2017. Building a Better Baton Rouge. Municipal Sewer and Water Magazine. Online:* https://www.mswmag.com/editorial/2017/01/building_a_better_baton_rouge

[6] *Fang, Z. et. al. 2014. Case Study of Flood Mitigation and Hazard Management at the Texas Medical Center in the Wake of Tropical Storm Allison in 2001. DOI: 10.1061/(ASCE)NH.1527-6996.0000139. Online:* https://www.buildinggreen.com/sites/default/files/Fang14TMC_Final.pdf

ADDITIONAL DETAILED APPLICATION GUIDELINES: CRITICAL FACILITIES AND INFRASTRUCTURE

Application Checklist: Critical Facilities and Infrastructure

☐ For the Detailed Application: *Initial Property Assessment (Critical Facility Project)* (Appendix 2.5) and all required attachments (REQUIRED *for each facility or infrastructure item* being mitigated)

- ☐ Aerial Photograph, Map, and/or Facility Master Plan of facility grounds with structure, as well as points of ingress and egress to/from structure, identified (*REQUIRED,* see Appendix 2.8 for mapping examples)
- ☐ USGS Topographic map with facility clearly marked on the map *(REQUIRED)*
- ☐ Property Appraiser Record *(REQUIRED)*
- ☐ Conceptual or preliminary plans, narratives, and/or drawings (*REQUIRED)*
- ☐ Professional Assessment Report and Scope of Work (*REQUIRED)*
- ☐ Details and documentation of previous flooding and associated flood losses included in the *Benefit-Cost Analysis Worksheet* (Appendix 2.1) (*REQUIRED)*
- ☐ Copies of **Section C. Detailed Structure Information** (*REQUIRED for each structure being mitigated on facility grounds*)
  - ☐ Structure Photograph Log (*REQUIRED*, see Appendix 2.9 for template)
  - ☐ Elevation Certificate or survey for the structure *(IF AVAILABLE)*
  - ☐ Completed *Project Budget Template* (Appendix 0.5) for each structure *(AS NEEDED)*
  - ☐ Additional budget back-up documentation (i.e., quotes or detailed contractor assessment) *(AS NEEDED)*
- ☐ Copies of Additional Critical Assets/Systems Form (Appendix 2.12) (*AS NEEDED*)

Technical Report Guidelines: Critical Facilities and Infrastructure

Competitive Detailed Applications will include the following information in the technical report in addition to the basic technical report requirements outlined in the detailed application.

A competitive Detailed Application for the critical facilities and infrastructure project:

- Clarifies service population (or traffic counts) and potential loss of public service as a result of flooding
- Clarifies existing flood mitigation measures on site (such as flood walls or gates, pumps, stocked sandbags, backflow prevention)
- Clarifies the scale and extent of risk mitigation needed. With Round 1 Funding, it is unlikely that full system mitigation strategies will be funded, but the project application should clarify how the proposed project fits into a larger plan for infrastructure resilience at the facility or within the infrastructure system.
- Considers and clarifies interdependencies
- Provides existing facility drawings, where appropriate (site plans, structural, mechanical, electrical, and plumbing (MEP), Process Diagrams)

ASCE 7 Risk Categories (from ASCE 7-10)

Table 1.5-1 Risk Category of Buildings and Other Structures for Flood, Wind, Snow, Earthquake, and Ice Loads

Use or Occupancy of Buildings and Structures	Risk Category
Buildings and other structures that represent a low risk to human life in the event of failure	I
All buildings and other structures except those listed in Risk Categories I, III, and IV	II
Buildings and other structures, the failure of which could pose a substantial risk to human life.	III
Buildings and other structures, not included in Risk Category IV, with potential to cause a substantial economic impact and/or mass disruption of day-to-day civilian life in the event of failure.	
Buildings and other structures not included in Risk Category IV (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing toxic or explosive substances where their quantity exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released.	
Buildings and other structures designated as essential facilities.	IV
Buildings and other structures, the failure of which could pose a substantial hazard to the community.	
Buildings and other structures (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, or hazardous waste) containing sufficient quantities of highly toxic substances where the quantity exceeds a threshold quantity established by the authority having jurisdiction to be dangerous to the public if released and is sufficient to pose a threat to the public if released.[a]	
Buildings and other structures required to maintain the functionality of other Risk Category IV structures.	

[a]Buildings and other structures containing toxic, highly toxic, or explosive substances shall be eligible for classification to a lower Risk Category if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in Section 1.5.2 that a release of the substances is commensurate with the risk associated with that Risk Category.

LOUISIANA WATERSHED INITIATIVE

MITIGATION ACTION:

PHYSICAL NON-STRUCTURAL FLOOD MITIGATION

Table 1: Types of Physical Non-structural Mitigation Projects

- **Dry flood proofing**
- **Wet flood proofing**
- **Elevation**
- **Relocation**
- **Acquisition**

KEY CONSIDERATIONS

Has the structure flooded in the past? How many times and at what cost?

What is the current 1 percent annual chance flood elevation at the site? 0.2 percent?

What is the source of flood risk?

Can multiple methods be used to enhance resilience? Can improvements be integrated to further improve the area?

Are these mitigation techniques more cost-effective compared to other possible project types?

Will land need to be purchased or will easements be required?

Must residents or businesses be relocated?

This mitigation action will reduce flood risk to individual homes, businesses, or other buildings through dry or wet floodproofing, elevation, protection of equipment, reconstruction, or acquisition and relocation. The key feature of non-structural flood mitigation is that it reduces damage without influencing or obstructing the natural direction and flow of flood waters; in other words, non-structural projects are those where people adapt to nature.[1] [2] While the full definition of non-structural mitigation also includes activities such as community awareness programs, policy changes, and planning improvements, Round 1 funding is specifically focused on the *physical* non-structural project types. Applicants seeking funding for other non-structural actions should refer to the Regional Capacity Building Grant Program (Appendix 0.2). For Round 1, applicants should aim to include as many contiguous properties as possible for the proposed project.

Non-structural measures are often sustainable over the long term with minimal costs for operation, maintenance, repair, rehabilitation, and replacement.[3]

COMMON PHYSICAL NON-STRUCTURAL FLOOD MITIGATION TECHNIQUES[4]

Dry Floodproofing: This technique is intended to restrict water from entering the structure below the level of protection. This technique is only allowable for funding to non-residential or high-rise structures as it cannot be used to bring a residential structure into compliance with the flood damage prevention ordinance. This method is also unlikely to apply to high flood depths and/or high velocity flows.

Wet Floodproofing: This method allows floodwaters to enter a structure without damage and calls for all materials and equipment expected to flood to be water resistant. This method is typically not applicable to high flood depths and/or high velocity flows.

Elevation: This technique elevates a structure or equipment/assets to at least the designated flood elevation. Elevation can be performed using extended foundation walls, on piers, post, piles and columns, or through second story conversion. Use of fill is ineligible for Round 1 funding.

Relocation and/or Acquisition: This method involves physically moving or demolishing the at-risk structure and converting the land to floodplain compatible use. All relocations and acquisitions must be voluntary.

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[1] *Hamburg University of Technology. (2010). Non-structural mitigation measures. Retrieved January 16, 2019, from http://daad.wb.tu-harburg.de/knowledge-base/entry-points-of-the-knowledge-base-from-a-to-z/flood-risk-management/flood-management-measures/non-structural-mitigation-measures/*

[2] *Association of State Floodplain Managers. (2019). ASFPM Floodproofing/Retrofitting Committee. Retrieved January 16, 2019, from https://www.floods.org/index.asp?menuID=249&firstlevelmenuID=183&siteID=1*

[3] *US Army Corps of Engineers. (n.d.). National Nonstructural Committee. Retrieved January 16, 2019, from https://www.usace.army.mil/Missions/Civil-Works/Project-Planning/nfpc/*

[4] *Supra notes 2,3*

Example Project Evaluation (Acquisition)

Structures moved out of the existing floodplain and the compatible uses are maintained in perpetuity.

Addresses present day and projected future flood issues.

Significant amounts of land will need to be purchased or receive permanent easements, which could impact feasibility.

Image courtesy of Nicky Milne/Thomson Reuters Foundation. Multiple Elevated Homes in Louisiana Watershed

PROS	CONS
Most techniques may be sustainable over a long period of time with minimal maintenance, operational, repair, and rehabilitation costs. Projects can utilize multiple non-structural mitigation techniques to further enhance resilience or enhance the community. The availability of multiple subtypes allows for flexibility in approach based on the needs.	Elevation or acquisition projects may negatively impact existing communities. Dry floodproofing will require training, exercising, and emergency protective measures prior to a flood event.

Case Study: Mandeville, Louisiana[5] [6]

In Mandeville, Hurricane Isaac had a high water level approximately 0.5 feet less than Katrina (high water marks in Mandeville were 8.25 feet for Isaac (Bourdeau et al., 2013) and 8.8 feet for Katrina (FEMA, 2006)). During the Hurricane Isaac recovery, FEMA conducted a Loss Avoidance Study in Mandeville (Bourdeau et al., 2013) for 14 structures that were elevated after Katrina using federal, state, and local funding. The results of this study showed a total savings of $1,106,000 with an average savings of $79,027 per structure; the total cost of this project was $1,500,000. After just one event, the project received a 74% return on investment. It is expected that during future flood events, the project would continue to accrue additional savings.

PROJECT TYPE GUIDELINES

Projects in the category should follow the guidelines set forth in the State Hazard Mitigation Plan, as well as the parish's local Hazard Mitigation Plan. Projects in this category can also follow the guidelines set for in Louisiana's Coastal Protection and Restoration Authority Flood Risk and Resilience Program.[7] For projects other than elevation, guidelines set forth in FEMA's Reducing Flood Risk to Residential Buildings That Cannot Be Elevated should be followed.

A competitive application in this category will address multiple contiguous structures and will demonstrate consideration of the needs and desires of the community.

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[5] *Loss Avoidance Study: Southeastern Louisiana, Hurricane Isaac, 2012 | FEMA.gov. (n.d.). Retrieved March 25, 2019, from https://www.fema.gov/media-library/assets/documents/31625*

[6] *Coastal Protection and Restoration Authority. (2017). 2017 Coastal Master Plan: Appendix E : Flood Risk and Resilience Program Framework. Retrieved from www.coastal.la.gov*

[7] *Coastal Protection and Restoration Authority. (n.d.). Coastal Protection and Restoration Authority | Nonstructural Projects. Retrieved January 16, 2019, from http://coastal.la.gov/our-plan/2017-coastal-master-plan/flood-risk-and-resilience-program/nonstructural-projects/*

ADDITIONAL DETAILED APPLICATION GUIDELINES: PHYSICAL NON-STRUCTURAL FLOOD MITIGATION

Application Checklist: Physical Non-structural Flood Mitigation

☐ For the Detailed Application: Initial Property Assessment (Physical Nonstructural Project) (Appendix 2.4) and all required attachments (REQUIRED)

- ☐ Attachments required for each structure included in the application (REQUIRED)
  - ☐ Notice of Voluntary Interest from each property owner, including the Household Income Questionnaire. (REQUIRED, see Appendix 2.6)
  - ☐ Aerial Map (large enough to show the project area) with the project site and structure(s) marked on the map (REQUIRED, see Appendix 2.8 for mapping examples)
  - ☐ USGS Topographic map with structure(s) clearly marked on the map (REQUIRED, may be met with overall project map)
  - ☐ Property Appraiser record (REQUIRED)
  - ☐ Elevation Certificate or survey for the structure (IF AVAILABLE)
  - ☐ Copy of the Parcel Map(s) showing each property to be mitigated. The map should include the Tax ID numbers for each parcel, if possible. (REQUIRED, may be met with overall project map)
  - ☐ Structure Photograph Log (REQUIRED, see Appendix 2.9 for template)
  - ☐ Completed all fields included in the Detailed Application tab of the Structure Prioritization Template (Appendix 0.7) for each structure included in the application

☐ For Final Design, but to be included in Detailed application to the extent that this information is available): Detailed Property Assessment (Physical Nonstructural Project) (Appendix 3.1) and all required attachments (REQUIRED)

- ☐ Attachments required for each structure included in the application (REQUIRED)
  - ☐ Voluntary Participation Agreement from each property owner, including Household Income Questionnaire, and Flood Insurance/Loss Information (REQUIRED, see Appendix 3.2.2)
  - ☐ Declaration of Eligibility and Release of Liability form (Appendix 3.2.3) from each property owner (REQUIRED)
  - ☐ Aerial Map (large enough to show the project area) with the project site and structure(s) marked on the map (REQUIRED, see Appendix 2.8 for mapping examples)
  - ☐ USGS Topographic map with structure(s) clearly marked on the map (REQUIRED, may be met with overall project map)
  - ☐ Property Appraiser record for each structure (REQUIRED)
  - ☐ Elevation Certificate or survey for the structure (REQUIRED)
  - ☐ Copy of the Parcel Map(s) showing each property to be mitigated. The map should include the Tax ID numbers for each parcel, if possible. (REQUIRED, may be met with overall project map)
  - ☐ Structure Photograph Log for each structure included in the project (REQUIRED, see Appendix 2.9 for template)
  - ☐ Appraisal (APPLICABLE TO ACQUISITION PROJECTS ONLY)

- ☐ Hazardous/Toxic Materials Coordination Letter (AS APPLICABLE)
- ☐ Historic Preservation Coordination Letter (AS APPLICABLE)
- ☐ Professional Assessment Report and Scope of Work (REQUIRED)
- ☐ Conceptual or preliminary plans, narratives, and/or drawings (REQUIRED)

☐ Completed all fields included in the Final Design tab of the Structure Prioritization Template (Appendix 0.7) for each structure included in the application

☐ Completed Project Budget Template (Appendix 0.5) for each structure (AS NEEDED)

☐ Additional budget back-up documentation (i.e., quotes or detailed contractor assessment) (AS NEEDED)

Technical Report Guidelines: Critical Facilities and Infrastructure

Competitive Detailed Applications will include the following information in the technical report in addition to the basic technical report requirements outlined in the Detailed Application.

A competitive Detailed Application for the physical non-structural mitigation project:

- Includes as many contiguous properties as possible
- Demonstrates careful consideration in selecting the appropriate mitigation measures
- Demonstrates careful consideration of the post-project social and economic impacts to the benefitting community
- Completes the following attachments, as applicable:
  - Structure prioritization template – This will help collect by structure information and will also be useful in the case that funding is not available for all structures included in the project application
  - The **Initial Property Assessment** for each structure included in the project. The **Detailed Property Assessment** will be required in the Final Design phase, but should be submitted in the Detailed Application Phase to the extent that this information is available.
  - For acquisitions:
    - Statement of assurances
    - Model deed restrictions
    - Maintenance agreement

Additional Applicant References

The following are additional resources for applicants to reference as desired:

FEMA Dry Flood proofing:
https://www.fema.gov/media-library-data/1526500101873-c3255382abe99394daf0316e04349b6e/TX_Harvey_RA1_V051618_508.pdf

FEMA, Reducing Flood Risk of Residential Buildings that Cannot be Elevated:
https://www.fema.gov/media-library-data/1443014398612-a4dfc0f86711bc72434b82c4b100a677/revFEMA_HMA_Grants_4pg_2015_508.pdf

FEMA P936, Floodproofing of Non-Residential Buildings,
https://www.fema.gov/media-library/assets/documents/34270

LOUISIANA WATERSHED INITIATIVE

MITIGATION ACTION:

STORMWATER MANAGEMENT – GRAY INFRASTRUCTURE

Table 1: Types of Gray Infrastructure Projects

- **Storm drain and culvert improvements**
- **Hardened channels**
- **Floodgates/flap gates**

KEY CONSIDERATIONS

Does the proposed project help connect a waterway to its floodplain, or stabilize a channel?

Where do current and potential future flood issues exist?

What are flood conditions upstream and downstream of the project site?

Will the project increase erosive conditions downstream?

Are there vulnerable roadway crossings or other infrastructure vulnerabilities?

Has green infrastructure or mitigation actions that make use of natural floodplain functions first been ruled out as an effective way to mitigate flood risk? Is the gray infrastructure a necessary component to maximize the effectiveness of more natural solutions?

When water is absorbed into soil, it is filtered and ultimately replenishes aquifers or flows into streams and rivers.[1] In urban and developed areas, impervious surfaces such as pavement and roofs prevent precipitation from naturally soaking into the ground. Instead, water may run rapidly into storm drains, sewer systems, and drainage ditches and can cause flooding, erosion, turbidity, storm and sewer system overflow and infrastructure damage.[2] Stormwater is water run-off from buildings, streets, yards, parking lots, and other impervious or water-saturated surfaces. Stormwater management is an effort to reduce runoff and safely convey flows in order to mitigate potential damage and disruption from flooding, while improving water quality.

Gray stormwater infrastructure refers to stormwater management techniques that capture and convey water using non-natural, engineered methods, such as through storm drains, sewers, and culverts. It can also refer to flood management techniques that improve hydraulic efficiency such as channel hardening and straightening.[3] A successful project will reduce the risk from exposure to floodwaters and erosive flows and can effectively work in tandem with green or nature-based infrastructure (for information on green infrastructure projects, see Appendix 2.11.6). This mitigation action may also be used for redesign or enhancement of existing gray infrastructure.

Culverts allow water – whether from rivers and streams, tidal inlets, or storm events – to pass underneath a bridge, road, or railway without disrupting traffic. If sized appropriately, culverts can reduce flooding on adjacent properties by transporting large volumes of water, preventing any backup of floodwater and spillover onto adjacent properties, while still enhancing stream stability and allowing passage for fish and other aquatic life.[4]

Hardened channels efficiently convey flows by allowing increased stormwater velocities in a watercourse without resulting in erosion. Hardened channels can reduce flooding on adjacent properties by efficiently transporting larger flows in smaller cross sections or at lower depths. Channel hardening can be disruptive to the local ecosystem, but natural restoration techniques can mitigate some of these impacts and should be explored for projects integrating channel hardening.

Floodgates, flap gates, or other backflow prevention devices can be installed to prevent floodwaters from inundating upland areas during a storm event. Once the

[1] US EPA. (2017). EPA Facility Stormwater Management. Retrieved January 15, 2019, from https://www.epa.gov/greeningepa/epa-facility-stormwater-management

[2] EEC Environmental. (2018). What Is Stormwater Management and Why Is It Important? Retrieved January 15, 2019, from https://www.eecenvironmental.com/what-is-stormwater-management/

[3] Alberta WaterPortal. (2018). Introduction to green infrastructure and grey infrastructure. Retrieved January 15, 2019, from https://albertawater.com/green-vs-grey-infrastructure

[4] Naturally Resilient Communities. (n.d.). Flood Friendly Culverts. Retrieved January 15, 2019, from http://nrcsolutions.org/flood-friendly-culverts/

Example Project Evaluation

Often requires comparatively little time to design and implement

Can decrease flood risk for ASCE Category III and IV facilities, depending on siting (see Appendix 2.11.3)

Floodgates and flap gates typically require maintenance and often require active intervention in their operation.

Project could decrease water quality, habitat value, and natural hydrology if not implemented correctly — for example, by increasing flow downstream, enhancing erosion, or changing natural flow regime. In this case, the project would be ineligible for funding.

storm passes and water levels return to normal, the floodgates can be opened to allow the slow release of stormwater. Floodgates are typically installed in connection with a levee, natural embankment, or storm sewer system and they are used to prevent floodwaters from larger drainage areas to inundate smaller tributary watersheds (see Appendix 2.11.3 for additional guidance).

PROS	CONS
Can address multiple sources of flooding Can improve and increase capacity of older infrastructure that was not designed for the current flood risk context Capable of addressing present and future flood risk Can be selectively applied as part of broader green or nature-based solutions	Projects may require purchase of land and easements, which could affect project feasibility. Must be paired with other actions for the project to provide co-benefits, such as recreational value Channel hardening can cause adverse instream impacts and will be ineligible unless this can be unequivocally mitigated. Can reduce groundwater refresh and lead to erosion if poorly designed.

PROJECT TYPE GUIDELINES

Projects in the category should follow guidelines set in the National Engineering Handbook 654 for channel hardening activities and the Federal Highway Administration for culvert improvements. Floodgates and flap gates often require structural analysis. A competitive application in this category will identify locations that suffer from excessive flooding or infrastructure risk. Competitive applications should also show that the project addresses projected future flood risk. Stability of upstream and downstream systems is a key consideration. Ideal applications would involve a stable transition between natural watercourses and gray infrastructure techniques, with minimal impacts to ecosystem function. Project applications should include information on the project decision-making process, why natural systems are not appropriate in this case, and expected impacts on natural systems.

A competitive application in this category will address multiple contiguous structures and will demonstrate consideration of the needs and desires of the community.

Case Study: Stanwood, Washington[5]

Stanwood sits near the mouth of the Stillaguamish River, and parts of the city fall within a 1 percent annual chance floodplain (the FEMA Special Flood Hazard Area). The city invested in a drainage floodgate that replaced a 100-foot section of the Old Stillaguamish River Levee after experiencing severe flooding in 1996. The floodgate

[5] Stanwood, Washington – Case study – Old Stilly floodgate drains water more quickly to prevent damage – Flood Economics. (n.d.). Retrieved March 22, 2019, from https://floodeconomics.com/communities/stanwood-wa/

allows surface water to drain more quickly, preventing damage to local infrastructure, including a railroad and a busy commuter roadway. The local railroad line, often affected by flooding, reopened 12 hours after the end of rain from one flood event, compared with three to four days during previous floods. In addition, Marine Drive, which is frequented by roughly 10,000 commuters per day, was reopened in a day and a half, instead of four days. In prior floods, commuters had been forced to make a 15-mile detour until the floodwaters had cleared.

ADDITIONAL DETAILED APPLICATION GUIDELINES: STORMWATER MANAGEMENT, GRAY INFRASTRUCTURE

Application Checklist: Stormwater Management, Gray Infrastructure

No additional attachments required

Technical Report Guidelines: Stormwater Management, Gray Infrastructure

Competitive Detailed Applications will include the following information in the technical report in addition to the basic technical report requirements outlined in the detailed application:

- Describe how the project will manage storm flows and reduce flood elevations.
- Identify type of capital improvements, and how the project will improve upon existing infrastructure.
- Stormwater best management practices to be employed.
- Explain the decision-making process to select gray infrastructure, as opposed to activities that would employ natural floodplain functions.
- If applicable, describe how gray infrastructure is a necessary component to maximize the effectiveness of green or nature-based solutions.
- Identify the project design storm.
- Describe potential consequences of project design storm being exceeded.

LOUISIANA WATERSHED INITIATIVE

MITIGATION ACTION:

STORMWATER MANAGEMENT – GREEN INFRASTRUCTURE

Table 1: Types of Green Infrastructure Projects

- Stream daylighting
- Permeable pavement
- Green roofs
- Bioswales/stormwater parks
- Green streets/urban tree canopy
- Rain gardens/bioretention
- Cisterns and rainfall harvesting devices
- Subsurface infiltration
- Other innovative techniques

KEY CONSIDERATIONS

What are the soil and groundwater conditions of the existing site?

What are the current flow rates into the existing drainage systems?

What are the maintenance requirements to ensure that the green infrastructure project functions correctly?

Does the project site have existing utilities or structures that will have to be worked around?

What co-benefits can be integrated into the project?

Green infrastructure refers to a range of water management techniques that help rainfall soak into the ground, as in natural conditions. This includes adding soil, vegetation, and/or permeable pavement strategies that treat stormwater at its source in addition to reducing runoff and possible flooding by increasing infiltration.[1] These projects are mainly implemented in urban and suburban areas where the natural hydrology has been significantly altered. When designed well, green infrastructure can capture up to 90 percent of a year's rainfall.[2] Projects in less developed areas should consider additional actions that reconnect streams with their floodplains (see *Floodplain Restoration and Preservation* sheet).

HOW CAN GREEN INFRASTRUCTURE REDUCE FLOOD RISK?

Depending on the project, green infrastructure can reduce flood risk by: a) slowing, retaining, and infiltrating stormwater to reduce pressure on existing drainage networks, b) reducing the volume/regulating the flow of stormwater into bodies of water (streams and rivers), and c) emulating the natural function of floodplains.[3] In addition to reducing flood risk, green infrastructure projects have the ability to protect water quality by lowering pollutant loads and reducing stream bank erosion and sedimentation.[4]

Green infrastructure projects capture and reduce the flow of stormwater by increasing a site's ability to store and absorb stormwater and increasing the infiltration capacity to groundwater. This can mitigate against land subsidence due to dewatering (surface water pumping to lower the water table, which prevents standing water and soggy ground). Land subsidence is the gradual caving in or sinking of an area of land and it occurs when large amounts of groundwater have been withdrawn from certain types of silt, sand, and fine-grained sediments.[5] This has occurred across Louisiana due to pumping of groundwater to facilitate urban, agricultural, and industrial needs.

Large-scale green infrastructure projects can have significant impact on flood risk reduction. Multiple small-scale green infrastructure projects such as tree trenches, green parking, planter boxes, bioretention, etc., can greatly mitigate against stormwaters when networked over a large district, parish, area, or region. Applicants preparing stormwater applications should seek to integrate effective green infrastructure elements, where possible, and confirm green infrastructure is not appropriate before submitting gray infrastructure projects (see *Stormwater Management - Gray Infrastructure Mitigation Actions)*.

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[1] *United States Environmental Protection Agency (EPA). July 2018. What is Green Infrastructure? Online:* https://www.epa.gov/green-infrastructure/what-green-infrastructure

[2] U.S. Green Building Council. (n.d.). Retrieved February 27, 2019, from https://www.usgbc.org/credits/ss6?view=language

[3] *United States Environmental Protection Agency (EPA). July 2018. Manage Flood Risk. Online:* https://www.epa.gov/green-infrastructure/manage-flood-risk

[4] *United States Environmental Protection Agency (EPA). January 2015. Green Infrastructure that Arises During Municipal Operations, EPA 842-R-15-002. Online:* https://www.epa.gov/sites/production/files/2015-09/documents/green_infrastructure_roadshow.pdf

[5] *United States Geological Survey (USGS). August 2017. Land Subsidence Online:* https://water.usgs.gov/edu/earthgwlandsubside.html

Example Project Evaluation

Can decrease wet weather peak flow and volume, restoring more natural conditions

Can provide new quality habitat, especially when connecting to greenway corridors

Can provide water quality improvements by way of adsorption, biological uptake, filtration, and infiltration

Can improve health of adjacent waterbodies by reducing pollutant loads, stream bank erosion, and sedimentation. Can help restore a more natural flow regime to smaller streams

Can often be designed to integrate recreational and other co-benefits that can improve quality of local life

May be less appropriate when increasing capacity of existing infrastructure

PROS[6]	CONS
Reduces the amount of water entering the storm sewer systems, stream channels and other natural bodies of water that could cause flooding Projects can often be applied both alone and in concert with gray infrastructure improvements.	Maintenance is critical to ensuring the longevity and continued effectiveness of green infrastructure projects. Projects are based on a variety of location-specific elements such as soil type, frequencies, and groundwater levels.

Photo courtesy of Deeproot

Photo courtesy of Powerhouse Growers

Case Study: Episcopal High School, Baton Rouge, Louisiana[7]

Episcopal High School's quadrangle experienced flooding problems caused by an inadequate drainage system. The school elected to install bioswales and a rain garden to capture the first 1 inch of rainfall. This approach proved cost effective at $110,000 compared to estimates for re-piping at $500,000. The quadrangle is roughly one acre, and since the bioswales and rain garden have been installed there have been no recorded floods on the school's quadrangle. The raingarden has been able to retain 39 percent of the 10-year, 1-hour rainfall of the watershed. In addition to the flood protection, the rain garden has been used by the school as part of its environmental education curriculum.

PROJECT TYPE GUIDELINES

Projects in the category should follow the guidelines set forth in EPA's Enhancing Sustainable Communities with Green Infrastructure. General guidance can be found on EPA's website: epa.gov/green-infrastructure. A competitive application in this category will identify locations that suffer from excessive stormwater and mitigate flood risk by slowing and reducing stormwater discharges. Additionally, applications may also show the benefits of improved water and air quality, enhanced biodiversity, and any possible co-benefits involving park space or recreational possibilities.

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[6] *United States Environmental Protection Agency, Office of Wastewater Management. December 2015. Tools, Strategies, and Lessons Learned from EPA Green Infrastructure Technical Assistance Projects, EPA 832-R-15-016. Online:* https://www.epa.gov/sites/production/files/2016 01/documents/gi_tech_asst_summary_508final010515_3.pdf

[7] American Society for Landscape Architects. (n.d.). Green Infrastructure & Stormwater Management: Episcopal High School Stormwater Rain Garden. Retrieved from https://www.asla.org/uploadedFiles/CMS/Advocacy/Federal_Government_Affairs/Stormwater_Case_Studies/Stormwater Case 459 Episcopal High School Stormwater Rain Garden, Baton Rouge, LA.pdf

ADDITIONAL DETAILED APPLICATION GUIDELINES: STORMWATER MANAGEMENT, GREEN INFRASTRUCTURE

Application Checklist: Stormwater Management, Green Infrastructure

No additional attachments required

Technical Report Guidelines: Stormwater Management, Green Infrastructure

Competitive Detailed Applications will include the following information in the technical report in addition to the basic technical report requirements outlined in the detailed application.

A competitive Detailed Application for the stormwater management, green infrastructure project:

- Identifies what green infrastructure components will be used in the project
- Identifies drainage area being controlled by proposed green infrastructure
- Describes acreage/size of green infrastructure facilities
- Describes soil type/map of soil types in the project area
- Describes appropriateness of soil type to the proposed solution
- Describes change in impervious surface area
- Identifies runoff coefficient(s)
- Documents the estimated volume/flow of water that will move through the project, including consideration of frequency and duration
    - If the project reduces peak stream flow, please provide calculations showing the reduction.
- If applicable, describes history of subsidence in the area
- Identifies whether the area is being pumped for drainage and/or consumptive use

Additional Applicant References

The following are additional resources for applicants to reference as desired:

- NOAA Green Infrastructure Options to Reduce Flooding, https://coast.noaa.gov/data/docs/digitalcoast/gi-econ.pdf
- TNC, A Flood of Benefits - Using Green Infrastructure to Reduce Flood Risk, https://www.conservationgateway.org/ConservationPractices/Freshwater/HabitatProtectionandRestoration/Pages/floodofbenefits.aspx
- Great Lakes Coastal Resilience Planning Guide, Green Infrastructure Guidance for Flood Reduction Extended Methodology, http://greatlakesresilience.org/case-studies/infrastructure/green-infrastructure-guidance-flood-reduction-extended-methodology
- Stormwater BMP Guidance Tool (Orleans and Jefferson Parishes), http://nonpoint.deq.louisiana.gov/wqa/links/manuals/New_Orleans_BMP_Guidance.pdf
- EPA, Green Infrastructure – Manage Flood Risks, https://www.epa.gov/green-infrastructure/manage-flood-risk

LOUISIANA WATERSHED INITIATIVE

ROUND 1 FUNDING

APPENDIX 3.2 - CRITICAL FACILITIES INITIAL PROPERTY ASSESSMENT

INITIAL PROPERTY ASSESSMENT (CRITICAL FACILITY PROJECT)

SECTION A. FACILITY-SPECIFIC INFORMATION

Submit information describing the facility including brief mitigation details, basic information, and required attachments.

FACILITY INFORMATION			
Facility Name:			
Facility Address:			
Facility Type / Occupancy / Purpose:			
Facility service population, if applicable:			
Property Tax ID # (Parcel):			
Latitude:		Longitude:	
Facility ASCE Class *(based on ASCE 24)*: ☐ Category III ☐ Category IV			
Acreage:	# of structures:	Year Built:	Yr. of last major renovation:
Emergency Operations Plan in place: ☐ Yes ☐ No ☐ In progress If yes or in progress, provide year of last update or planned completion:			
Has the structure been previously mitigated? ☐ Yes ☐ No			

REQUIRED ATTACHMENTS
☐ Aerial Photograph, Map, and/or Facility Master Plan of facility grounds with structure, as well as points of ingress and egress to/from structure, identified (*REQUIRED,* see Appendix 2.8 for mapping examples)
☐ USGS Topographic map with facility clearly marked on the map *(REQUIRED)*
☐ Property Appraiser Record *(REQUIRED)*
☐ Conceptual or preliminary plans, narratives, and/or drawings (*REQUIRED)*

FACILITY FLOOD PROFILE

Provide general, high-level information on the facility's flood profile. More detail will be provided in **Section C. Detailed Structure Information** for each structure being mitigated on the facility grounds.

Flood zone:

☐ Zone VE or V1-30
☐ Zone AE or A1-30
☐ Zone AO or AH
☐ Zone A (no BFE given)
☐ Zone B or X (shaded)
☐ Zone C or X (unshaded)
☐ Floodway
☐ Coastal Barrier Resource Act Zone

Has the facility flooded previously? ☐ No ☐ Yes, how many times? _____ since (year) _____

Please describe any previous flooding and associated flood losses (provide details and documentation in the *Benefit-Cost Analysis Worksheet* (Appendix 2.1).

MAX 150 WORDS

Please describe any existing flood-related mitigation measures:

MAX 150 WORDS

FACILITY MITIGATION MEASURE SCOPE OF WORK

Provide a brief description of the facility mitigation measure(s) scope of work and identify any potential special considerations that should be analyzed for this facility structure. Understand that the LWI does not expect a complete scope of work at this point in the assessment phase. However, it is important that the applicant begin to understand the prioritized mitigation measures it wishes to implement as more detailed information will be required in the Final Design.

Please select the appropriate mitigation measure(s) being proposed for the facility:

☐ Ground Flood Mitigation	If checked, please indicate which type: ☐ Permanent Floodwall/Levee ☐ Temporary Floodwall ☐ Berm/Fill Solution ☐ Drainage Solution
☐ Structured Flood Mitigation (Complete **Section C. Structure-Specific Information** for every structure included)	If checked, please indicate which type: ☐ Dry Floodproofing ☐ Wet Floodproofing ☐ Elevation ☐ Relocation ☐ Reconstruction
☐ Asset/System Flood Mitigation	If checked, please indicate which type: ☐ Elevation ☐ Relocation ☐ Submersible Assets ☐ Compartmentalization ☐ Hardening in Place ☐ Asset/System Redundancies (e.g. backup power supply)
☐ Other	If checked, please describe:

Number of Structures to which mitigation actions will be performed: _____

Please provide a brief description of the scope of work for the facility and structures (if more than one facility is included in the application):

MAX 150 WORDS

SECTION C. DETAILED STRUCTURE INFORMATION

Submit information describing *each structure* on the facility campus to be mitigated under the project including flood hazard details. If the facility contains more than one structure, please provide a unique Structure ID and provide copies of **Section C. Detailed Structure Information** for each structure to which mitigation will occur.

STRUCTURE GENERAL INFORMATION (STRUCTURE ID#_____)			
Structure Name:			
Structure Address:			
Structure Type / Occupancy / Purpose:			
Property Tax ID # (Parcel):			
Latitude:		Longitude:	
Total sq. ft. of structure:	Stories above Grade:	Stories below Grade:	Year Built:
Elevator(s)? ☐ Yes ☐ No If yes, location of elevator banks: _____			
Foundation Type: ☐ Basement ☐ Crawlspace ☐ Slab on Grade ☐ Piles/Columns ☐ Other _____			
Frame: ☐ Wood ☐ Steel ☐ Masonry ☐ Reinforced Concrete ☐ Pre-Engineered ☐ Pole ☐ Other _____			
Soil Type:			
Description and location of utilities attending structure:[1]			
MAX 150 WORDS			

[1] E.g., placement of meters, AC units, natural gas lines, associated tanks, etc.

STRUCTURE FLOOD RISK INFORMATION (STRUCTURE ID#_____)

<table>
<tr><td rowspan="2">Flood zone:
☐ Zone VE / V1-30
☐ Zone V (no BFE)
☐ Zone AE / A1-30
☐ Zone B / X (shaded)
☐ Floodway
☐ Coastal Barrier Resource Act Zone
☐ Zone AO / AH
☐ Zone A (no BFE)
☐ Zone C or X (unshaded)
☐ Other
_____</td><td>Effective FEMA BFE:[2]
_____</td><td>Current First Finished Floor Elevation:
_____</td><td>Basement Elevation:
_____</td></tr>
<tr><td>Highest Adjacent Grade:
_____</td><td>Elevation of Key Water Entry Point:
_____</td><td>Datum:
☐ NAVD88
☐ NGVD29
☐ Other _____</td></tr>
<tr><td colspan="2">Depth above first floor at BFE:</td><td colspan="2">Depth above first floor at Proposed Mitigation Design Elevation:</td></tr>
<tr><td colspan="2">Flood Ordinance Required Elevation:</td><td colspan="2">Recommended CPRA CLARA elevation (coastal only):</td></tr>
<tr><td colspan="4">Approximate market value of structure: $ _____</td></tr>
<tr><td>Flood insurance policy?
☐ Yes ☐ No</td><td>Is the structure self-insured?
☐ Yes ☐ No</td><td>Contents covered?
☐ Yes ☐ No</td><td>Have any NFIP Claims been made?
☐ Yes ☐ No</td></tr>
<tr><td colspan="2">Is there a history of flooding at the structure?
☐ Yes ☐ No</td><td colspan="2">Has the structure been previously mitigated?
☐ Yes ☐ No</td></tr>
<tr><td colspan="4">Is the structure classified as Repetitive Loss? ☐ Yes ☐ No</td></tr>
<tr><td colspan="4">Describe any previous mitigation:</td></tr>
<tr><td colspan="4">MAX 150 WORDS</td></tr>
</table>

[2] Base flood elevation (BFE) found on the effective FEMA Flood Insurance Rate Maps.

Describe proposed scope of work to structure:
MAX 150 WORDS

SECTION D. DETAILED ASSET INFORMATION

If the project consists of direct mitigation action to critical assets or system, provide the following information ON A PER ASSET OR SYSTEM BASIS. If additional space is needed, please attach copies of the Additional Critical Assets / Systems Form (Appendix 2.12), as needed.

CRITICAL ASSETS / SYSTEMS (STRUCTURE ID#_____)			
Critical Asset / System Classification	**Description / Location**	**Describe Consequences of Flood Impact**	**Flood Vulnerability**
☐ Life/Fire Safety ☐ Electrical Service ☐ Heating/Cooling ☐ Potable Water ☐ Sanitary/Sewer ☐ Transportation ☐ Essential Service (e.g., Security System) ☐ Other _____			Lowest Elevation: _____ Flood depth at which asset/system no longer operational: _____ Flood elevation at which asset/system is at risk: _____ Mitigation proposed: _____ Proposed Mitigation Design Elevation (if applicable): _____ Datum: ☐ NAVD88 ☐ NGVD29 ☐ Other _____
☐ Life/Fire Safety ☐ Electrical Service ☐ Heating/Cooling ☐ Potable Water ☐ Sanitary/Sewer ☐ Transportation ☐ Essential Service (e.g., Security System) ☐ Other _____			Lowest Elevation: _____ Flood depth at which asset/system no longer operational: _____ Flood elevation at which asset/system is at risk: _____ Mitigation proposed: _____ Proposed Mitigation Design Elevation (if applicable): _____ Datum: ☐ NAVD88 ☐ NGVD29 ☐ Other _____

LOUISIANA WATERSHED INITIATIVE

ROUND 1 FUNDING

APPENDIX 3.3.2 – PROPERTY OWNER NOTICE OF VOLUNTARY INTEREST AND HOUSEHOLD INCOME QUESTIONNAIRE

PROPERTY OWNER NOTICE OF VOLUNTARY INTEREST

Please complete this form if you are interested in further exploring options for reducing flood risk to your home or business through the Louisiana Watershed Initiative (LWI). Eligible flood mitigation projects include residential elevation, non-residential floodproofing, and voluntary residential acquisition. Signing this form does not commit the LWI or you to any action.[1]

TYPE OF PROGRAM			
Please indicate the type of program:			
☐ Acquisition	☐ Elevation	☐ Non-Residential Floodproofing	☐ Other: _____

PROPERTY INFORMATION		
Property Owner:		
First Name:	Last Name:	
Property Address:		
Street:		
City / Parish:	State: LA	Zip:
Owner(s) Mailing Address (if different than physical address):		
Street:		
City / Parish:	State: LA	Zip:

[1] Note: A Voluntary Participation Form must eventually be completed by all property owners of record in order to move forward with the project, but only one property owner must complete the Notice of Voluntary Interest.

Contact Information:	
Primary Phone: ☐ Home ☐ Work ☐ Cell	Secondary Phone: ☐ Home ☐ Work ☐ Cell
Email Address:	

NOTICE OF VOLUNTARY PARTICIPATION

The LWI would like to inform you that any participation in this project is voluntary. The State of Louisiana will not use eminent domain authority to acquire the property for open-space purposes if you choose not to participate in the LWI program, or if negotiations fail. In addition, your signed notice of voluntary interest does not guarantee that your property will ultimately be part of a flood mitigation project.

Owner's Signature:	Date:

HOUSEHOLD INCOME QUESTIONNAIRE

As the Louisiana Watershed Initiative's goal is to provide a comprehensive approach to flood risk reduction, the LWI must prioritize projects that specifically benefit low- to moderate-income households. To help with the planning process, households interested in participating are asked to fill out this income questionnaire to help determine if your property meets the program goals. This form should be used for single family structures, multi-family structures up to four households, and multi-family structures for which other allowable income documentation is not available.

Please fill out for each income earner in the household and provide proof of income documentation in the form of the previous year's tax return form or three consecutive paychecks. OCD will use this information for planning and programmatic purposes only. The information reported to OCD will remain confidential.

INCOME FOR THE PREVIOUS 12 MONTHS *(Fill out one per income earning member of Household over 18 years of age)*	
Income from wages, salary, commissions, bonuses, or tips from all jobs: *Report amount before deductions for taxes, bonds, dues, or other items.*	$
Self-employment income from own nonfarm business or farm business, including proprietorships and partnerships: *Report NET income after business expenses.*	$
Interest, dividends, net rental income, royalty income, or income from estates and trusts:	$
Social Security or Railroad Retirement:	$
Supplemental Security Income (SSI):	$
Any public assistance or welfare payments from the state or local welfare office:	$
Retirement, survivor, or disability pensions:	$
Any other sources of income received regularly such as Veterans' (VA) payments, unemployment compensation, child support, or alimony:	$
TOTAL INCOME:	**$**
Space for Applicant Use Only Household qualifies as LMI?	☐ Yes ☐ No

HOUSEHOLD INFORMATION
Number of Wage Earners in the Household:
Number of Persons per Household:
Property Tax ID (if available):

STATE OF LOUISIANA
DIVISION OF ADMINISTRATION
OFFICE OF COMMUNITY DEVELOPMENT (OCD)

LOUISIANA WATERSHED INITIATIVE

REGIONAL STEERING COMMITTEE
CONFLICT OF INTEREST IDENTIFICATION, REPORTING AND AVOIDANCE PROCESS

This document provides the procedures relative to the programs of the Louisiana Watershed Initiative (LWI), by which regional steering committees (RSC) in the LWI should identify, disclose and manage all potential and actual conflicts of interest through elimination, mitigation or waivers if allowed.

This procedure is intended to assist the RSC and its members in understanding, anticipating and addressing any potential or actual conflict issues that may arise as a result of the member's role on the RSC.

1. Conflicts of Interest Provisions Addressed in this Process

The Louisiana Code of Governmental Ethics, La. R.S. 42:1102 *et seq* ("Ethics Code") applies to independent the RSC members and contractors that are "engaged in a governmental function." Therefore, the RSC members may be considered "public employees" and the provisions of the Ethics Code are applicable to them.

> "Public employee" is anyone, whether compensated or not, who is engaged in the performance of a governmental function or is under the supervision or authority of an employee of the government entity. Public employees are not limited to payroll employees of OCD, but include the RSC members in connection with the LWI.

The HUD conflict of interest rules at 24 CFR 570.611 generally apply to persons who assist an LWI partner agency, who exercise or have exercised any functions or responsibilities with respect to CDBG activities assisted under this part, or who are in a position to participate in a decision making process or gain inside information with regard to such activities, may obtain a financial interest or benefit from a CDBG-assisted activity, or have a financial interest in any contract, subcontract, or agreement with respect to a CDBG-assisted activity, or with respect to the proceeds of the CDBG-assisted activity, either for

themselves or those with whom they have business or immediate family ties, during their tenure or for one year thereafter.

This document does not address specialized conflict of interest provisions that may apply to particular trades, relationship, or professions (i.e. Louisiana Rules of Professional Conduct.)

2. General Prohibitions

In general, conflicts of interest occur when one's private interest and public duties overlap, resulting in a real or perceived lack of impartiality or the public perception that the RSC member is either not acting in the best interest of the State or inappropriately using the relationship for undue enrichment or influence.

In avoiding these conflicts, the RSC member must be familiar with the following general prohibitions:

A. Participation:

The RSC member shall not participate in any transaction involving OCD in which the RSC member has an economic interest, other than participation in transactions arising solely out of The RSC member's performance of its contractual responsibilities to OCD.

The RSC member shall not participate in any transaction involving OCD in which, to its actual knowledge or through reasonable due diligence could ascertain that any of the following persons have a financial interest:

- Any legal entity in which the RSC member owns any ownership interest;
- Any legal entity in which an officer, director, partner or trustee of the RSC member owns an ownership interest in excess of 25%;
- Any member of the immediate family of a person who is an officer, director, partner, trustee or employee of the RSC member;
- Any legal entity owned by a member of the immediate family of a person who is an officer, director, partner trustee or employee of the RSC member;
- Any legal entity with which the RSC member has an existing contract and who by reason thereof is in a position to affect directly the economic interests of the RSC member.

"Participate" is to take part in or to have or share responsibility for action of a governmental entity or a proceeding personally, as a public servant of the governmental entity, through approval, disapproval, decision, recommendation, the rendering of advice, investigation, or the failure to act or perform a duty.

"Immediate Family Member" is the public employee's children, the spouses of his children, his brothers and their spouses, his sisters and their spouses, his parents, his spouse and the parents of his spouse.

B. Prohibited Transactions

A The RSC member is prohibited from entering into any contract, subcontract, or other transaction that is under the "supervision and jurisdiction" of the RSC member's "agency." This restriction also applies to the immediate family members of the RSC member and to legal entities in which the RSC member's family members own an interest in excess of 25%.

"Transaction" is any proceeding, application, submission, and/or request for a ruling or other determination, contract, claim, case or other such particular matter. ***For the purposes of the LWI, Transaction also includes any program or project that is funded in whole or in part by the LWI.***

"Supervision and jurisdiction" is those things over which the RSC member has the power to exercise authority."

The "agency" of the RSC member includes **only the services under the scope of their contract** and not to the entire governmental agency. ***If the contract with the LWI partner agency is a task order-based contract, agency shall be determined based on task orders and assignments actually used by the LWI partner agency. However, in accepting any such task order or assignment, it is the RSC member's responsibility to identify based on diligent inquiry of all persons involved through the RSC member that the task order or assignment does not present a conflict of interest with any past or existing activity or relationship.***

C. Gifts:

Generally, the RSC member is prohibited from soliciting or accepting a gift from persons who have an economic interest in the RSC member's provision of services to an LWI partner agency.

In particular, the RSC member is prohibited from receiving any thing of economic value from any person whose economic interests will be affected by the performance or non-performance of the RSC member's contractual responsibilities.

Generally, the gift prohibition of the Louisiana Government Code of Ethics does not prohibit food or drink consumed as the personal guest of the person providing the food

or drink. The person providing the food and drink may not provide the RSC member with more than $64 of food and drink.

However***, as a matter of policy*** no RSC member should accept a gift, including of food or drink, from any person or entity that is seeking financial assistance of CDBG-MIT funds for a project within the geographic boundaries of the RSC.

3. Disclosure of Conflicts

EXISTING ACTUAL OR POTENTIAL CONFLICTS: As soon as the RSC member becomes aware of the existence of an actual or potential conflict, it shall disclose all known or potential conflicts of interest to OCD by promptly informing OCD of the circumstances giving rise to the potential or actual conflict.

The RSC member in coordination with OCD and any other affected agencies will develop and implement a Disqualification Plan. The Disqualification Plan will be a written document that identifies the alternative measures available to OCD and the RSC member to prevent participation in prohibited transactions.

FUTURE CONFLICTS: The RSC member shall refrain from entering any new relationship or undertaking any new or additional services that present an actual or potential conflict of interest.

The RSC member shall report to OCD ***any circumstance*** under which it can anticipate that potential receipt of monies or other assets, as compensation for services or otherwise, which in whole or in part are funded directly or indirectly by CDBG-MIT funds administered by the OCD. This disclosure requirement is not limited to whether a task order has been issued or is anticipated to be issued involving those circumstances.

ALL DISCLOSURES REQUIRED UNDER THIS PROCESS SHALL BE DIRECTED IN WRITING TO OCD as follows:

Via email to LWI-Round1@la.gov

The subject line of the e-mail shall include "**LWI COI POLICY DISCLOSURE**" in addition to any further description of the subject.

Caution must be exercised at all levels of governmental contracting to identify, avoid and manage any perceived or apparent conflict of interest. The identification of any conflict of interest warrants immediate attention by all parties.