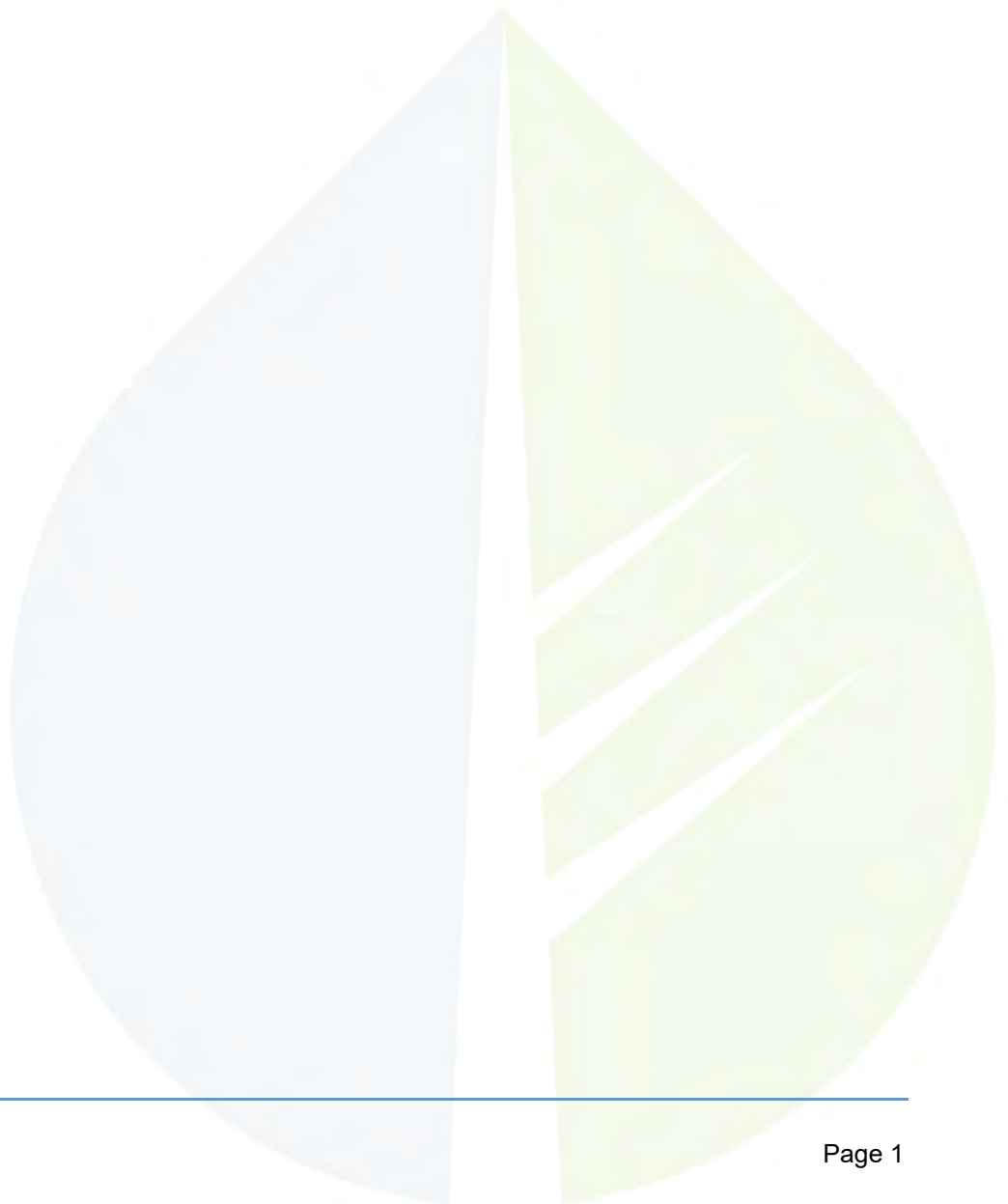


Louisville Metro Hazard Mitigation Plan Floodplain Management Plan 2022 Plan Update



1.0 Introduction

Louisville Metro prepared the 2016 Hazard Mitigation Plan pursuant to the Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. 5165, as amended by Section 104 of the Disaster Mitigation Act of 2000, P.L. 106-390 (DMA 2000) and regulations set forth in 44 CFR §201. The Plan identifies potential hazards, assesses risk, and presents mitigation strategies to build community resilience. The plan is also used as the Floodplain Management Plan for Louisville Metro. Flooding continues to be the most significant natural hazard in Kentucky and the Louisville Metro. The purpose of this document is to update the flood and dam & levee portions of the hazard plan.

2.0 Summary

Disasters can cause loss of life; damage buildings and infrastructure; and have devastating consequences for a community's economic, social, and environmental well-being. Hazard mitigation reduces disaster damages and is defined as a sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Proactive mitigation policies and actions help reduce risk and create safer, more disaster resilient communities. Hazard mitigation and floodplain management are investments in the community's future safety and sustainability.



March 2021 Flooding in Louisville Metro

Hazard mitigation activities may be implemented prior to, during, or after an event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.

Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act enacted under the Disaster Mitigation Act of 2000 (DMA 2000) established revitalized approaches to mitigation planning with a new requirement for Local Mitigation Plans. The Louisville Metro Hazard Mitigation Plan was developed and funded through the Pre-Disaster Mitigation (PDM) grant program and the Flood Mitigation Assistance (FMA) grant program; both part of the Hazard Mitigation Assistance (HMA) grants program of the Federal Emergency Management Agency (FEMA). The DMA 2000 emphasizes greater interaction between State and Local mitigation planning entities, highlighting the need for improved linkages of hazard assessment and capability analyses. This can be accomplished through comprehensive risk assessments which form a solid foundation for decision-making, input from a wide range of stakeholders who play a key role in the implementation of mitigation actions, and who have committed to a mitigation strategy that is organized, easily referenced, and functions as a tool for tracking progress toward community resilience. While many jurisdictions develop and utilize a stand-alone Hazard Mitigation Plan and floodplain management plan, Louisville Metro decided to combine these two planning processes into one effort. Louisville Metro and the Louisville Metropolitan Sewer District (MSD) have been dedicated to floodplain management for many years as shown by earning the Community Rating System (CRS) Class 3 status.

The purpose of the Louisville Metro Hazard Mitigation Plan is to set a strategy for building a more resilient community that will mitigate damages and losses caused by hazard events. The plan is the result of a systematic evaluation of the nature and extent of the vulnerability posed by the effects of hazards (risk assessment) and includes a five-year action plan to minimize future vulnerability (mitigation strategy),

accompanied by a schedule that outlines a method for monitoring and evaluating plan progress (plan maintenance).

3.0 Floods

A flood is a natural event for rivers and streams and is caused in a variety of ways. Floods can be slow, or fast rising, but generally develop over a period of days. Winter or spring rains, coupled with melting snows, can fill river basins too quickly. Torrential rains from decaying hurricanes or other tropical systems can also produce flooding. The excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto the banks and adjacent floodplains. Floods are generally the result of excessive precipitation, and can be classified under two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and general floods, caused by precipitation over a longer time period and over a given river basin.

In Kentucky, the severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing. Flood currents also possess tremendous destructive power as lateral forces can demolish buildings and erosion can undermine bridge foundations and footings, leading to the collapse of structures.

Flood Risk Table	
Period of occurrence:	Ohio River: December through May Flash floods: anytime, but primarily during Summer rains
Number of events:	127
Probability of events:	6.35
Past damages:	\$251,915,000
Warning time:	River flooding – 3-5 days Flash flooding – minutes to hours Out-of-bank – several hours/days
Potential impact:	Impacts human life, health, and public safety, utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Can lead to economic losses such as unemployment, decreased land values, and Agribusiness losses. Floodwaters are a public safety issue due to contaminants and pollutants.
Potential of injury or death:	Flooding has a moderate potential for injury or death in Louisville, mostly from flash flooding.
Possible extent:	1937 – Ohio River crested at 460 feet above mean sea level, or 40 feet above its normal height, causing more than 60% of the city to be inundated. 190 flood-related deaths.

Flash flooding events usually occur within minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held back by a dam or levee. General floods are usually longer-term events and may last for several days. The primary types of general flooding include riverine flooding and urban flooding.

Periodic flooding of lands adjacent to rivers, and streams is a natural and inevitable occurrence

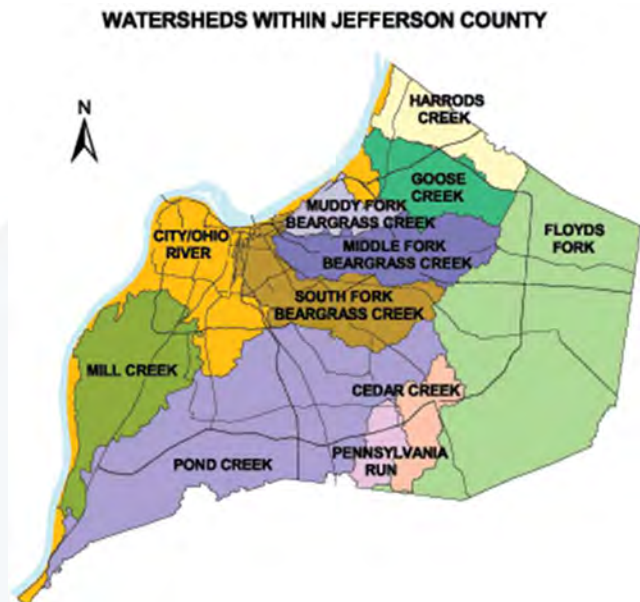
that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval. A "floodplain" is the lowland area adjacent to a river, lake, or ocean.

Floodplains are designated by the frequency of the flood that is large enough to cover them. One way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year.

Flooding is the most significant natural hazard in Kentucky. Major flooding occurs within the state almost every year and it is not unusual for several floods to occur in a single year. Flooding is Kentucky's most costly natural disaster. The economic, social, and physical damage resulting from floods can be severe.

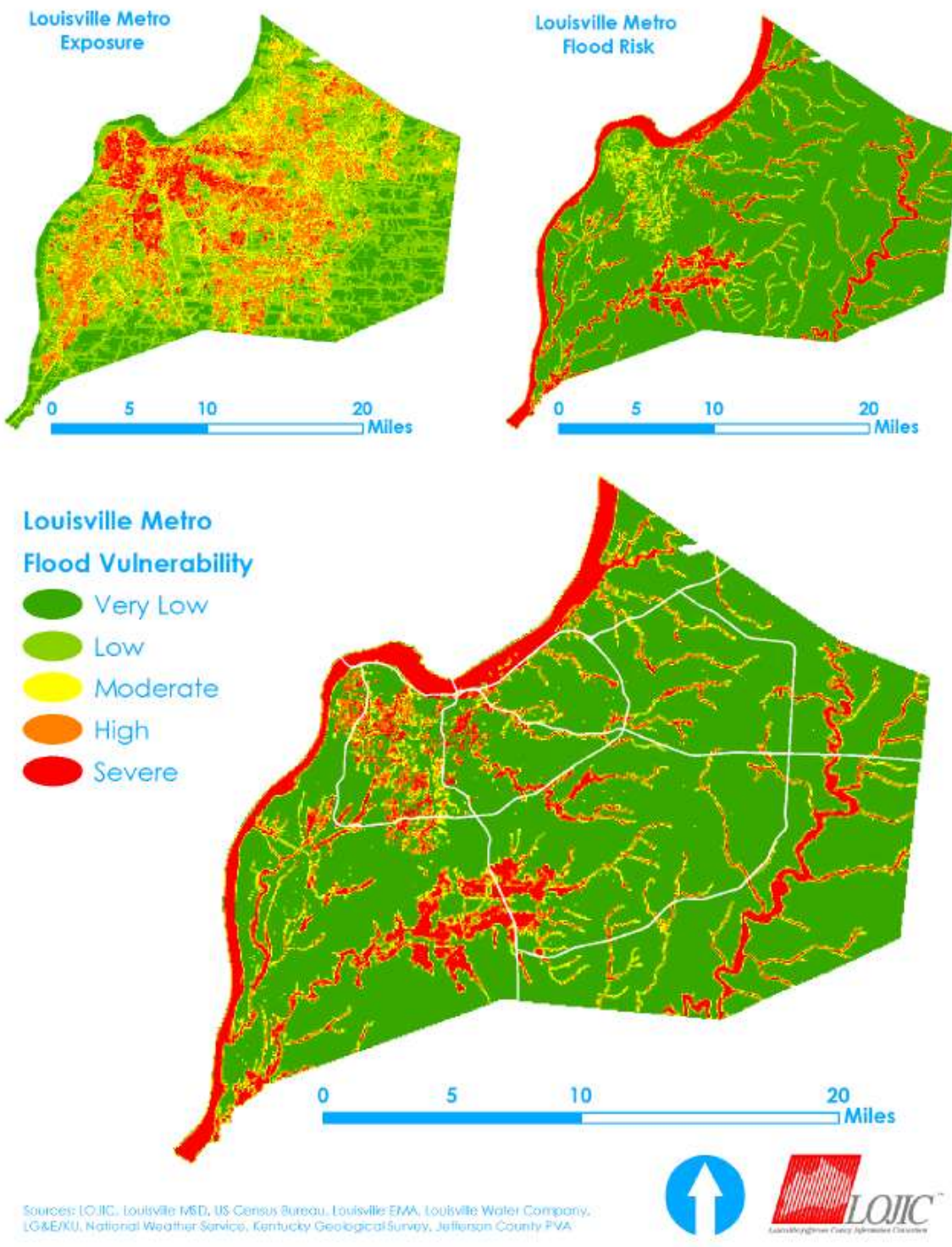
A detailed Risk Assessment was performed for each watershed in Louisville Metro providing data for the following:

- Identifying critical/essential facilities and infrastructure located within the Regulatory Floodplain
- Assessing and quantifying natural and beneficial function areas
- Mapping known hazard areas (Regulatory Floodplain, Repetitive Loss Properties, Severe Repetitive Loss, Historic Claim Properties, Flood Hotspots, and the Combined Sewer Floodprone area zones)
- Assessing the impact flood will have on life, safety and health facilities and the effects on the community's economy through loss estimation
- Providing a description of known flood hazards, including source of water, depth of flooding, velocities, and identifying key warning time gauges.



For more information regarding the flood risk assessment and historical flooding, see the 2016 Louisville Metro Hazard Mitigation Plan, which can be found here: https://louisvillemsd.org/sites/default/files/inline-files/lm_hmp_2016_final.pdf.

Flood Hazard Vulnerability Map



4.0 Dam & Levee Failure

Profile Risk Table	
Period of occurrence:	At any time
Number of events:	1
Probability of events:	.02
Past Damages	\$0 Publically Recorded
Warning time:	Minimal, depends on frequency of inspection.
Potential impact:	Impacts human life and public safety. Economic loss, environmental damage, and/or disruption of lifeline facilities. High Hazard-classified dam failure would cause loss of life, serious damage to homes, industrial or commercial buildings, important utilities, main highways. Moderate Hazard-failure would cause significant damage to property, homes, highways, utilities but no loss of life. Low Hazard-failure would cause loss of dam, little or no damage to other structures or loss of life.
Potential of injury or death:	Dam/Levee has a low potential for injury or death in Louisville.
Possible Extent:	A dam failure at one of the identified FEMA Class C High Hazard Dams

Kentucky statute KRS 150.100 defines a dam as any artificial barrier including appurtenant works that do, or can, impound or divert water and:

- Is 25 feet or more high from the natural bed of the stream or watercourse at the downstream toe of the barrier, as determined by the Natural Resources and Environmental Protection Cabinet;
- Has or will have an impounding capacity of 50 acre feet or more at the maximum water storage elevation.

There are about 80,000 dams in the U. S., the majority of which are privately owned. Other owners are state and local authorities, public utilities, and federal agencies. The benefits of dams are numerous; they provide water for drinking, navigation, and agricultural irrigation. Dams also provide hydroelectric power and create lakes for fishing and recreation. Most important; dams save lives by preventing/reducing floods.

While dams have many benefits, they can also pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if there is development downstream of the dam. Historically, dams that failed had some deficiency, as characterized above, which caused the failure. These dams are typically termed "unsafe". The National Dam Safety Program is dedicated to protecting the lives of American citizens and property from the risks associated with the development, operation, and maintenance of America's dams.

Dam and Levee Failure Flooding are potentially the worst flood events. A dam failure is usually the result of neglect, poor design, or structural damage caused by a major event such as an earthquake. When a

dam fails, an excess amount of water is suddenly let loose downstream that could cause significant damage. Many dams and levees are built for flood protection. They usually are engineered to withstand a flood with a computed risk of occurrence. For example, a dam or levee may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If a larger flood occurs, then that structure may be overtopped. If during the overtopping the dam or levee fails or is washed out, the water behind it is released and becomes a flash flood. Failed dams or levees can create floods that are catastrophic to life and property because of the tremendous energy of the released water.

Dams are classified based on the evaluation of damage possible downstream. The FEMA guide to dam classifications uses the following system:

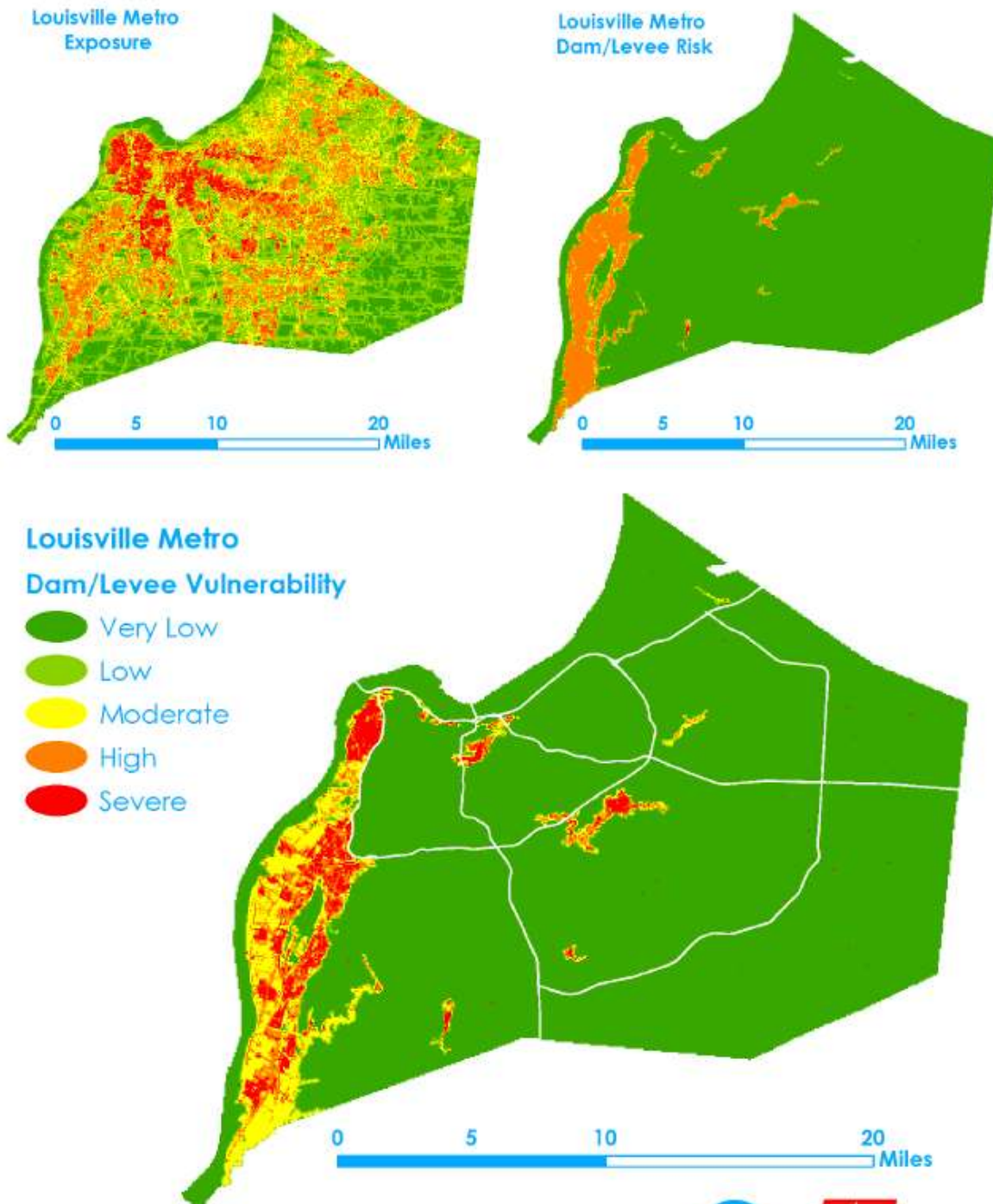
Classification	Description
Class A (Low)	No loss of human life is expected and damage will only occur to the dam owner's property
Class B (Moderate/Significant)	Loss of human life is not probable, but economic loss, environmental damage, and/or disruption of lifeline facilities can be expected
Class C (High)	Loss of one or more human life is expected

Following is an inventory of Louisville Metro dams maintained by the U.S. Army Corps of Engineers and the Kentucky Cabinet for Natural Resources and Environmental Protection, Division of Water. The nine Class C dams are at the highest risk and are required to have an emergency action plan, which is maintained by the dam owner.

The list of Louisville Metro's 40 dams according to the Kentucky Division of Water (KDOW) is as follows:

	Name of Dam	Hazard Class	Owner Type	Location	Height	Area
1.	Tom Wallace Lake Dam	(Class C) High	MUN	Valley Station	31	2.5
2.	Pine Hill Lake No. 1	(Class C) High	PRI	Louisville West	27	2.8
3.	Windsor Forest Dam	(Class C) High	PRI	Louisville West	29	4
4.	Mitchell Hill Lake Dam	(Class C) High	PRI	Valley Station	20	1.9
5.	LG&E Waste Water Dam	(Class C) High	PRI	Lanesville	12	40
6.	S Fork Beargrass Creek Dry Bed Dam	(Class C) High	MUN	Jeffersontown		13.9
7.	Roberson Run (Dry Impoundment)	(Class C) High	MUN	Louisville East	17	0
8.	Whipps Mill Rd Dry Dam	(Class C) High	MUN	Anchorage	21	
9.	Norton Commons Dam	(Class C) High	PRIV	Anchorage	16	2.4
10.	Waterstone Park Dam	(Class B) Moderate	PRIV	Louisville East	32	
11.	Silver Crystal Dam	(Class B) Moderate	PRIV	Brooks	15	10.2
12.	Lake McNeely Dam	(Class B) Moderate	DOFW	Brooks	32	45
13.	Long Run Park Lake Dam	(Class B) Moderate	MUN	Crestwood	43	27
14.	Big Horn Lake Dam	(Class B) Moderate	PRI	Valley Station	28	3.7
15.	Waverly Park Dam	(Class B) Moderate	PRI	Louisville West	20	4.9
16.	Mirror Lake (Lower) Dam	(Class B) Moderate	PRI	Jeffersontown	28	3.7
17.	Joe Guy Hagan Dam	(Class B) Moderate	PRI	Jeffersontown	28	4.5
18.	LG&E Mill Creek Station Ash Dam A	(Class B) Moderate	PRI	Kosmosdale	77	56.91
19.	NTS Detention Dam Section 6b	(Class B) Moderate	PRI	Jeffersontown	21	4.2
20.	Polo Fields	(Class B) Moderate	PRIV	Crestwood	27	13.3
21.	AS Properties Dam No 2	(Class B) Moderate	PRIV	Jeffersontown	24	2
22.	Vulcan Quarry Dam	(Class B) Moderate	MUN	Brooks	16	
23.	Riggs Lake Dam	(Class A) Low	PRI	Jeffersontown	18	8.9
24.	Fern Creek Sportsman Club Dam	(Class A) Low	PRI	Waterford	25	2.8
25.	Dreamland Dam	(Class A) Low	PRI	Louisville West	13	5
26.	Woodhaven Country Club Dam	(Class A) Low	PRI	Louisville East	18	4.6
27.	Lowry Dam	(Class A) Low	PRI	Jeffersontown	35	2
28.	Wildwood Country Club Dam	(Class A) Low	PRI	Jeffersontown	18	4.6
29.	Sampson Dam	(Class A) Low	PRI	Fisherville	40	7.9
30.	Willow Dam	(Class A) Low	PRI	Anchorage	33	7.4
31.	Putneys Pond	(Class A) Low	PRI	Anchorage	15	7.3
32.	Logan Lake Dam	(Class A) Low	PRI	Fisherville	36	5.8
33.	Bill McMahan Lake Dam	(Class A) Low	PRI	Jeffersontown	35	
34.	Twin Lakes Lower Dam	(Class A) Low	PRI	Fisherville		
35.	Du Pont Fly Ash	(Class A) Low	PRI	Louisville West	18	20
36.	Glenmary Dam	(Class A) Low	PRI	Mount Washington	25	4.21
37.	Lake Forest Golf Course No 2	(Class A) Low	PRI	Crestwood	21	6.5
38.	Lake Forest Golf Course No. 1	(Class A) Low	PRIV	Crestwood	23	5
39.	Springhurst Lake Dam	(Class A) Low	PRIV	Anchorage	18	5.7
40.	Gault Eastpoint Lic Dam	(Class A) Low	PRIV	Anchorage	20	5.4

Dam/Levee Failure Hazard Vulnerability Map



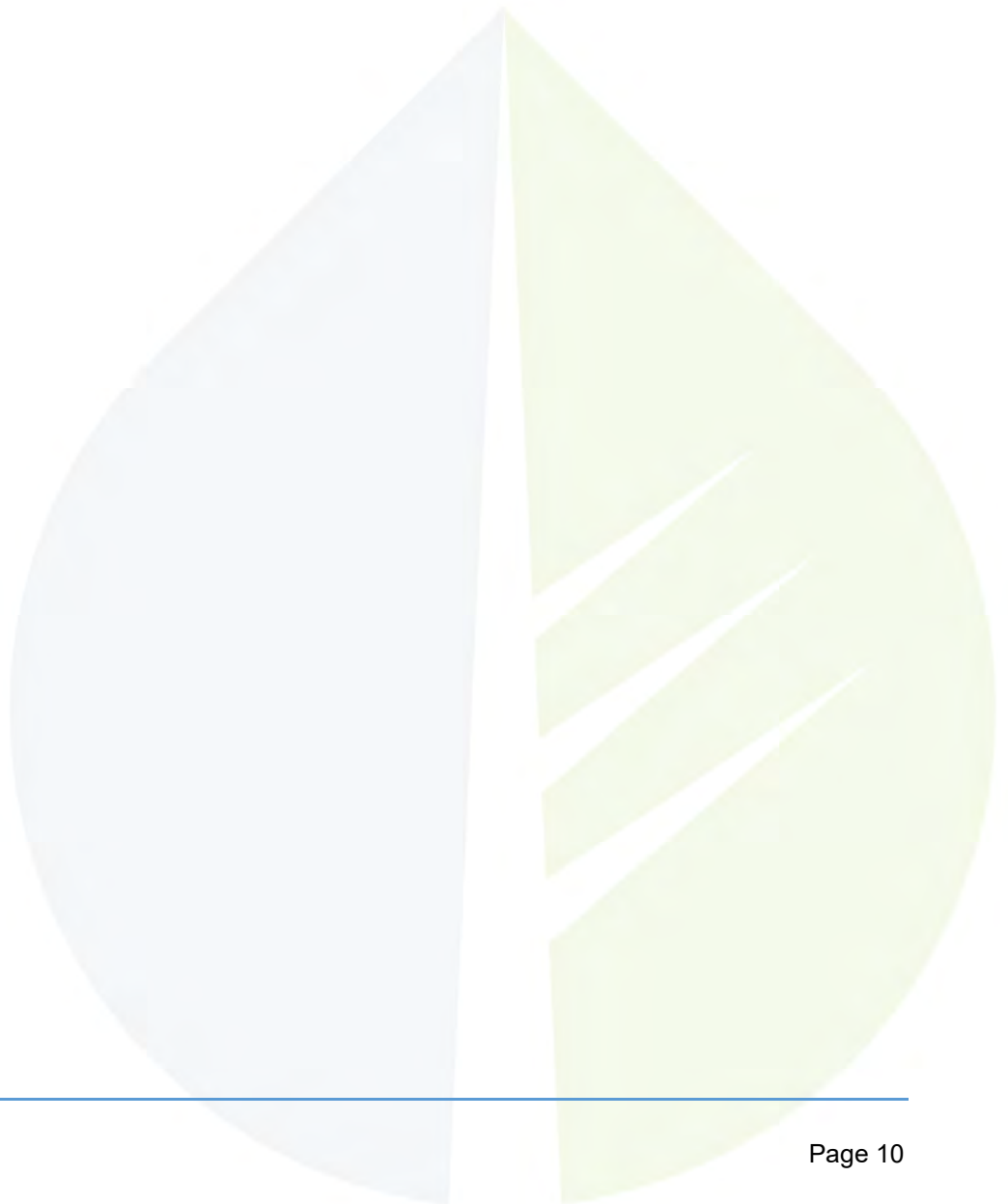
Sources: LOJIC, Louisville MSD, US Census Bureau, Louisville EMA, Louisville Water Company, LG&E/KU, National Weather Service, Kentucky Geological Survey, Jefferson County PVA



For more information regarding risk of dam or levee failure, see the 2016 Louisville Metro Hazard Mitigation Plan.

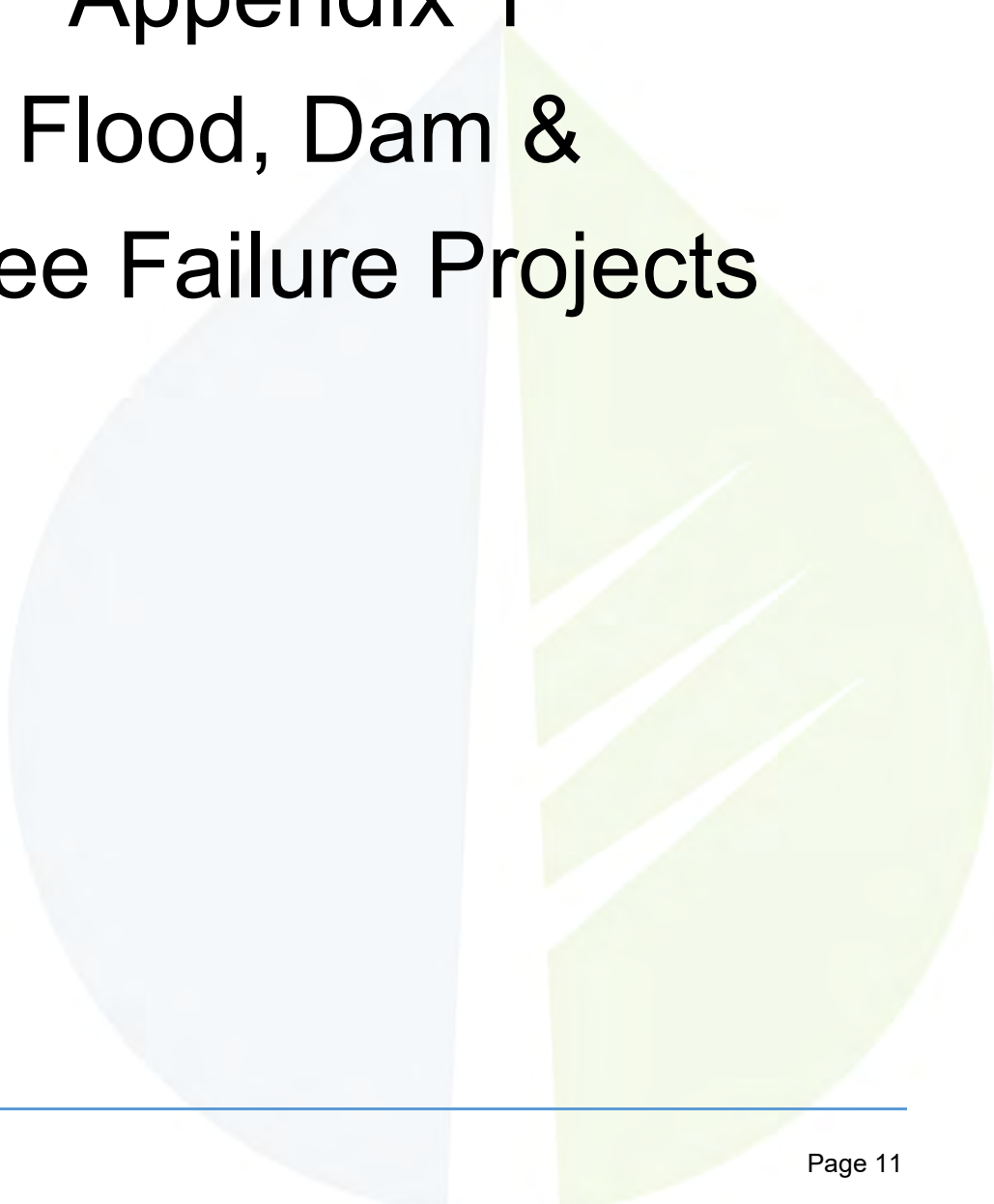
5.0 Project Updates

The Louisville Metro Hazard Mitigation Plan includes 19 flood projects and 13 dam & levee failure projects. The projects were developed through the planning process to address flood related needs in Louisville Metro. Appendix 1 includes the project list with project descriptions, proposed schedules, contacts and partners, benefit-cost prioritization, budget considerations, and project updates. The project updates were determined based on input from the lead implementers for each project. Several of the projects have been completed since the plan was created, such as updating the Floodplain Ordinance, while others have been put on hold. Many projects are on-going and continue to be implemented, such as the public outreach related to flooding and the floodplain buyout program. For example, Louisville Metro was awarded five new flood acquisition grants in 2021 and continues to apply for new grant opportunities annually.



Appendix 1

Flood, Dam & Levee Failure Projects



Appendix 1
Louisville Hazard Mitigation Plan - Flood, Dam & Levee Failure Projects
2022 Update

Action Number	Hazard Type	Type of Activity or Project	Proposed Schedule	Lead Implementer & Contact Person	Other Proposed Partners	Benefit-Cost Prioritization	Funding/ Budget Considerations	Updates
2.1	Flood	Update Floodplain Ordinance 1. Create Floodplain Ordinance Workgroup to review existing ordinance and propose changes to improve safety and resiliency, as well as improve ordinance administration	In process, 2016 adoption	MSD - David Johnson	KDOW - NFIP	High	Normal Operating Budget	Revised Floodplain Ordinance was adopted 8/25/2017
2.2	Flood	Flood Studies for Mitigation Update flood models in areas with known flooding issues and problematic modeling, including the 10-year flood interval, specifically including: - Greasy Ditch - Buechel Branch - Brooklawn Tributary	As budget is available	MSD - Lori Rafferty	Private Development Community, USACE	High	Normal Operating Budget, Grants	- Greasy Ditch Phase 1 completed in 2017, Phase 2 completed in 2018, Phase 3 (Snider Branch LOMR) submitted to FEMA and under review - Buechel Branch completed with 50/50 funding with USACE in 2019
2.3	Flood	Mitigation: Project to Protect Existing Buildings And Infrastructure. Target at-risk public and private buildings from flood for mitigation/retrofit 1. Inventory public buildings at-risk (also, see All Hazards # 4 & 5) 2. Develop a plan for mitigation for public property. 3. Develop a plan	In process, complete 2016	MSD - Lori Rafferty, LOJIC - Curt Bynum, Jeffersontown - Matt Meunier	Metro Public Works, Metro Facilities, JCPS, Louisville Free Public Library, LDP	Medium	Normal Operating Budget for inventory and strategy, Grants for retrofit	Inventory of government buildings has been completed.
2.4	Flood	Future Floodplain Buyouts Throughout The County 1. Identify repetitive loss, severe repetitive loss candidates, and other floodprone properties 2. Prepare grant applications as funds become available	Grant dependent	MSD - David Johnson, Lori Rafferty	Metro EMA, KyEM	High	Grants	MSD continues to work on existing grants, including 5 new grants that were approved in 2021. Nine additional acquisition grants are under review by FEMA.
2.5	Flood	Acquisitions in Western Louisville CSSA Area Continue acquisition projects approved by FEMA in Maple Street, Belquin, Algonquin, Wewoka West Park, and Linwood areas. Continue to look for additional potential areas, if needed and if funds become available	Grant dependent	MSD - Lori Rafferty	Metro EMA, KyEM	High	Grants	All grants closed other than Wewoka which closes in March. MSD is currently working with Louisville Metro Government on a long term land use plan for acquisition areas of the Maple Street grants.
2.6	Flood	Place Flood Elevation Markers or Other Signage Along Floodprone Roads and Parking Areas, Especially roads that are frequently overtopped to demonstrate to drivers/pedestrians how deep the water is. 1. Complete an inventory of current sign locations 2. Develop strategy for other at-risk areas 3. Post signs	Grant dependent	MSD - Tony Morrison, Metro Public Works - Stuart Sparks	NWS, Metro Parks, KYTC, Suburban Cities, LDP	Medium	Normal Operating Budget	Follow up with contacts: Metro Public Works has placed signs at 34 railroad viaduct locations which have historically flooded during rain events. MSD is working toward permits to allow the installation of level devices in viaduct stations to allow MSD to work with Public Works for notification of high water.
2.7	Flood	Review and Update Flood Related Emergency Preparedness and Response Plans including evacuation of at-risk populations including seniors and disabled. 1. Complete an inventory 2. Review Plans 3. Update Plans	Ongoing	Metro EMA - Jim McKinney, MSD -Meghan Brown	USACE, LMPD, All Fire Districts, NWS, Mayor's Office, Metro Public Works, Metro Office of Community Services and Revitalization, Metro Office of Housing and Community Development, LDP	Very High	Normal Operating Budget	Plans are updated as needed. MSD and EMA are currently working with FEMA to create evacuation routes in the event of Ohio River levee failure. The Emergency Preparedness Plan (EPP) for Louisville Metro's Flood Protection System is updated annually. Although FEMA's evacuation consultant, TMS, is currently developing an evacuation concept of operations plan as part of the Catastrophic Urban Flood Plan, it will not be a part of the EPP. A project has been performed by the USACE through the Flood Plain Management Assistance Program that modeled and mapped. This has assisted in identifying at what flood gauge level would critical or life-line infrastructure begin to be impacted, but also when high-risk population and facilities, major traffic arteries and intersections would be impacted as well.

Appendix 1
Louisville Hazard Mitigation Plan - Flood, Dam & Levee Failure Projects
2022 Update

Action Number	Hazard Type	Type of Activity or Project	Proposed Schedule	Lead Implementer & Contact Person	Other Proposed Partners	Benefit-Cost Prioritization	Funding/ Budget Considerations	Updates
2.8	Flood	LaCiede Basin – Proposed flood control basin located near end of W. Indian Trail and Greasy Ditch	Grant dependent	MSD – John Loechle, Lori Rafferty		High	Grant	This project is no longer feasible based on additional information.
2.9	Flood	Tin Dor Way Basin - proposed flood control basin in Fairdale near Tin Dor Way If flood control basin is not feasible, then develop strategy for possible buyouts	Grant dependent	MSD – John Loechle, Lori Rafferty		High	Grant	Project is on hold.
2.10	Flood	Flood Pump Stations 1. Rehab, replace and update flood pump stations 2. Inventory and verify emergency generators and backup. Apply for grants where needed.	Ongoing	MSD – Josh Dickerson	USACE, LDP	Medium	Normal Operating Budget, Grants, WRDA	Pump stations with major pump repairs or rehabilitation projects include: Beargrass Creek Flood, 4th St, 10th St, Shawnee Park, Paddy's Run, Upper Mill Creek, and Pond Creek. Beargrass Creek has also had all the electrical switchgear and motor controls replaced. BRIC funds requested for Paddy's Run Pump Station and design has begun. Pump Station repairs, replacement and upgrades are ongoing.
2.11	Flood	Metro Parks Reviewing Its Buildings For Flood Damage Mitigation 1. Reviewing backflow prevention devices, floor drains, sump pumps, gutters and downspouts, and sheet runoff diversion. Develop inventory. 2. Mitigation projects identified in this review will be placed on repair schedule 3. Accomplished as funds permit over the next five years.	Ongoing	Metro Parks – Jason Canuel	MSD – Backwater Valve program	High	Normal Operating Budget	Project is on hold.
2.12	Flood	Establish and Coordinate Tree Programs And Partnerships To Increase Tree Canopy, Parkway Areas Metro Parks and MSD are expanding the tree canopy in the metropolitan area. Part of the plant 10,000 trees campaign. 1. Metro Parks will continue over the next five years to replace trees along parkways and in landscaped park areas as needed to retain tree canopy cover in the metropolitan area.	Ongoing	Metro Parks – Mesude Duyar-Ozyurekoglu Louisville Metro Community Forestry - Barry Edgar MSD - Brett Clark	Metro Sustainability, LDP	Very High	Normal Operating Budget	Metro Parks and MSD both plan to continue planting trees, including 2,000 trees from Metro Parks Urban Forestry and and 1,000 trees from MSD each year.
2.13	Flood	Public Outreach about Basement Flooding 1. Education of the public from keeping critical items out of basements – computers, books, important files etc... 2. Target the audience on regulatory floodplain or MSD customer service requests rather than just the FEMA floodplains	Ongoing, annual letter to everyone in floodplain and repetitive loss properties, Louisville Magazine and Business First advertisements	MSD – Lori Rafferty and Sheryl Lauder	Media, LFPL, Develop Louisville	High	Normal Operating Budget	Annual letters sent in Winter 2021, other advertising continues on a regular basis.

Appendix 1
Louisville Hazard Mitigation Plan - Flood, Dam & Levee Failure Projects
2022 Update

Action Number	Hazard Type	Type of Activity or Project	Proposed Schedule	Lead Implementer & Contact Person	Other Proposed Partners	Benefit-Cost Prioritization	Funding/ Budget Considerations	Updates
2.14	Flood	Public Outreach: Evaluate Ways to Get Message to a Targeted Audience Message is to better educate the public regarding floodprone areas including flood insurance and plumbing modification programs	Ongoing, annual letter to everyone in floodplain and repetitive loss properties.	MSD – Lori Rafferty and Sheryl Lauder	Media, LFPL, LDP	Very High	Normal Operating Budget	Annual letters sent in Winter 2021, other advertising continues on a regular basis.
2.15	Flood	Increase Coordination of Flood Warning using NWS Chat Rooms NWS Chat Rooms are set up to coordinate with staff in an official capacity. Several chat rooms exist, and NWS can set up additional ones if needed. Chat Rooms already include USGS, Corp, media, & EMS and can be made available to other agencies.	Ongoing	NWS – Joe Sullivan	USGS, USACE, MSD, Media, Metro EMS, Metro EMA, LDP	Very High	Normal Operating Budget	NWS continues to coordinate with other agencies as needed.
2.16	Flood	Construct additional rain gages and stream gages on un-gaged streams to be used for warning, forecast flooding	Grant dependent	MSD- Dwight Mitchell, Marc Thomas	USGS, EMA, USACE, NWS	High	Grant dependent	Existing rain gauges are being maintained by MSD. Additional gauge installations have not been necessary at this time.
2.17	Flood	Elevation of floodprone properties along the Ohio River 1. Phase 1 - Determine if elevation is feasible and cost effective for existing floodprone homes. 2. Phase 2 - If feasible, elevate homes to at least one foot above the local regulatory floodplain elevation	Phase 1 - 2018, Phase 2 - Grant dependent	MSD - Lori Rafferty	FEMA, KyEM	High	Phase 1 - Normal Operating Budget, Phase 2 - Grant dependent	Due to the location of homes along the river in the floodway/conveyance zone, MSD is not currently pursuing this project.
2.18	Flood	Drainage improvement projects to reduce structural flooding, such as upsizing culverts, constructing detention basins, and widening channels 1. Phase 1 - Complete studies for areas with structural flooding concerns 2. Phase 2 - Construct cost effective projects determined to be feasible in studies	Phase 1 - 2017, Phase 2 - Grant dependent	MSD - Stephanie Laughlin	Small cities (Jeffersontown, Hurstbourne, Prospect, etc), FEMA, KyEM	High	Phase 1 - Normal Operating Budget, Phase 2 - Grant dependent	Project is on hold
2.19	Flood	Beargrass Creek Stream Restoration and Beargrass Creek Greenway. Flood Risk Reduction through stream restoration and ecosystem services	2018	Metro Parks – Jason Canuel	MSD, Metro Public Works, Metro Sustainability	High	Grants, Normal Operating Budget, Metro Council	Project is complete.
3.1	Dam & Levee Failure	Risk Assessment: Develop A Dam & Levee Risk Assessment With Best Available Data PHASE 1: Verify GIS locations for existing dams. Develop data inventory of all dams within Louisville Metro area. Steps: 1. Collect data from KDOW for locations and assessment of the State-Owned dams. 2. Perform research in the State Dam Safety Program records, which requires an "Open Records" request to the KDOW. 3. Research records and locations of dams within metro boundaries. 4. From research, collect other important data, e.g. current EOPs, dam materials, past inspections, violations, etc... 5. Collect inventory of dam locations and geo-code. 6. Verify which Class C dams have an EOP. * FEMA grant submitted in 2016 by Metro	2017 for research, Mapping complete, EOPs in process, inspections complete for Class C, inundation maps completed in 2014, all Class C have EOP	MSD - Meghan Brown, LOJIC - Curt Bynum, KDOW Dam Safety Program - Marilyn Thomas	NRCS, Metro/Suburban Fire Districts, Metro Parks, USACE - Brandon Brummett	High	Grants, Normal operating Budget for maps	USACE has completed their Semi-Qualitative Risk Assessment(SQRA) on MSD flood protection system/levees Project is on hold.

Appendix 1
Louisville Hazard Mitigation Plan - Flood, Dam & Levee Failure Projects
2022 Update

Action Number	Hazard Type	Type of Activity or Project	Proposed Schedule	Lead Implementer & Contact Person	Other Proposed Partners	Benefit-Cost Prioritization	Funding/ Budget Considerations	Updates
3.2	Dam & Levee Failure	PHASE 2: Perform Risk Assessments on Class B and C Dams Class C, High-Hazard Dams 1. Verify all Class C dams have and maintain an EOP (tied to above action item results). 2. Verify downstream warning system, public notice, etc. are included in EOP. Class B, Moderate/Significant Risk Dams 3. Assess Class B dams for any downstream construction that might raise dam classification	In process, risk assessments complete for Class C	MSD - Meghan Brown, Metro Parks - Jason Canuel	KDOW, Private Dam Owners, LOJIC, USACE - Brandon Brummett	High	Grant dependent	Phase 2, Item 1 is complete for this project. Remaining items are on hold. Item no. 2 has not been completed; however, projects for installing level sensors on high hazard dams that MSD are responsible and the Willowbrook flood protection area for are in progress. These should provide real-time warning through MSD's SCADA system of any sudden change in water elevations behind these areas A new template has been developed for dam EOPs. EOP's for all high-hazard dams MSD is responsible for are being updated.
3.3	Dam & Levee Failure	Mitigation: Develop EOPs for Class C Dams 1. Develop EOPs for dams without plans 2. Update existing EOPs 3. Add NWS notification for alerts via weather radios	In process	MSD - Lori Rafferty, Metro Parks - Jason Canuel, KDOW - Carey Johnson	Private Dam Owners, Metro EMA, NWS, LOJIC, USACE - Brandon Brummett	High	Normal Operating Budget, Potential new budget item or grant funding	EOPs have been completed for all Class C dams, remaining items are on hold.
3.4	Dam & Levee Failure	Mitigation: Post a Sign/Landmark On Dams With Classification Type (A, B, or C). * Signs to include: 1. Contact numbers 2. Name of dam 3. Maximum water impoundment * Project dependent upon dam inventory (Phase 1)	Dependent upon dam inventory (Phase 1)	MSD - Meghan Brown	KDOW, Private Dam Owners, Metro EMA, LOJIC, Metro Parks, USACE - Brandon Brummett	Medium	Potential new budget item or grant funding	Dependent on dam inventory.
3.5	Dam & Levee Failure	Mitigation: Removal or Replace Unsafe Dams Once inspections are complete, the list of unsafe dams will determine next steps for repair and/or removal of dams. An unsafe dam would move to a Priority A project for immediate action. * Project dependent upon dam inventory and assessment (Phases 1 & 2)	Ongoing	KDOW Dam Safety Program - Marilyn Thomas	NRCS, Private Dam Owners, LOJIC, MSD, Metro Parks, USACE - Brandon Brummett for Low Head Dam removal	High	Metro Parks MSD Capital Projects NRCS	As dams are determined to be unsafe at annual inspections, they are addressed.
3.6	Dam & Levee Failure	Risk Assessment and Mitigation 1. Place a benchmark or similar point on dams to determine if movement is occurring. 2. Benchmark placement should coincide with inspection and data development.	Phase 1 & 2 dependent	Metro Parks - Jason Canuel, MSD - Josh Dickerson, KDOW Dam Safety Program - Marilyn Thomas	Private Dam Owners, Metro EMA, Develop Louisville, LOJIC, USACE - Brandon Brummett	High	Potential new budget item or grant funding	Project is on hold.
3.7	Dam & Levee Failure	Consider Requiring EOP for Class B Dams 1. Class B dams have at-risk structures below the levee, therefore should require an emergency plan. 2. Partner with KY DOW Dam Safety Program for requirements and regulations	Phase 1 & 2 dependent 2015	KDOW Dam Safety Program - Marilyn Thomas	MSD, Metro Parks, Private Dam Owners, LOJIC, USAC - Brandon Brummett	Very High	Normal Operating Budget	A new template has been developed for dam EOPs. EOP's for all high-hazard dams MSD is responsible for are being updated.
3.8	Dam & Levee Failure	Mitigation: Evaluate Damage To Levee And Flood Protection System Primarily Ohio River Flood Protection System and large pump stations (i.e. Beargrass Creek). Corps annual inspection is ongoing. Five-year inspection is more detailed	Ongoing maintenance, bi-annual inspections by MSD, annual inspections by USACE	MSD-Daren Thompson, USACE - Brandon Brummett	LG&E, LDP	High	MSD funded; estimated at \$2.2 million/yr. (\$38 million Total Est. Cost)	Inspections continue as scheduled.

Appendix 1
Louisville Hazard Mitigation Plan - Flood, Dam & Levee Failure Projects
2022 Update

Action Number	Hazard Type	Type of Activity or Project	Proposed Schedule	Lead Implementer & Contact Person	Other Proposed Partners	Benefit-Cost Prioritization	Funding/ Budget Considerations	Updates
3.9	Dam & Levee Failure	Mitigation: Develop Better Local Dam Construction And Inspections Criteria. In order of the following: 1. Develop inspection and construction criteria to review existing dams 2. Begin periodic dam inspection to develop reports. Metro Parks has a plan in place and performs regular inspections.	2017-2019	Metro Parks - Jason Canuel, MSD - Lori Rafferty	KDOW, Private Dam Owners, Metro EMA, Develop Louisville, USACE - Brandon Brummett	Low	Normal Operating Budget, Grants	MSD Design Manual updated in August 2018 to include requirements for construction of new high hazard dams. Dam inspections are completed by KDOW. All Metro Parks dams are inspected on an annual basis. Parks is preparing a documentation checklist for these inspections.
3.10	Dam & Levee Failure	Metro Parks Remedial Work on their Dams Remedial work needs to be competed on some dams 1. Maintenance and inspection needed 2. Coordinate with MSD	2017-2020	Metro Parks - Jason Canuel	MSD, USACE - Brandon Brummett	High	Normal Operating Budget, Grants	Necessary repairs noted during inspection are addressed as funding is available with any noted safety deficiencies being prioritized. Repairs for the dam at Charlie Vettiner Park are complete.
3.11	Dam & Levee Failure	Public Awareness Signage of the flood protection system history and assets, indicate allowed/prohibited activities	2017-2021	MSD - Meghan Brown	Corp of Engineers-Brandon Brummett KDOW	Medium	Normal Operating Budget	Signage is installed that lists prohioted activities on the levee system.
3.12	Dam & Levee Failure	Ash Ponds – HazMat Ensure they are safe (The LG&E ash pond at this location is closed, The closure of the former ATB and operation of a much smaller, non-ash, process pond may eventually result in a reduced hazard classification for the unit. In such an event, KY-DOW's annual inspection frequency may also be reduced.)	Ongoing	LG&E - Paul Puckett, KDOW - Marilyn Thomas	EPA, Metro EMA, USACE - Brandon Brummett	Medium	Normal Operating Budget	Although the ash pond is closed in place and the current configuration represents a significant reduction in the potential hazard classification, LG&E continues to evaluate and maintain the former berms, slopes, and levee.
3.13	Dam & Levee Failure	24-hour high hazard dam monitoring and warning system for those in inundation area	2017	MSD - Tony Morrison & Marc Thomas, USGS - Tom Ruby	LG&E, Metro Parks, USACE - Brandon Brummett, KDOW Dam Safety, USGS, Property Owners	High	Silver Jackets	Moving forward with design and construction of monitoring equipment on High Hazard dams maintained by MSD.
3.14	Dam & Levee Failure	Catastrophic Flood/Levee Failure Planning Study	2018	MSD - Meghan Brown	Metro EMA, KyEM, APCD, USACE, KDOW, Business Owners, Louisville Forward, Develop Louisville, Silver Jackets, LMPD, LMPD, Suburban fire districts, Metro EMS, KOSHA,	High	Silver Jackets, Grants	This project has completed the Regional Resiliency Assessment Program by DHS and the intermediate breec study by the USACE under the Flood Plain Management Assistance Program. FEMA's evacuation consultant is currently developing a concept of operations plan. Once this plan has been reviewed and approved the actual evacuation plan will be developed. FEMA requested a standard form 424 relating to the grant award under DR-4428. The award of the grant is expected soon. This will allow the contracting of a consultant to bring all the parts that have been developed together, write the actual plan, exercise it and finalize it.