



COMPREHENSIVE FLOOD MANAGEMENT PLAN:

STRATEGY

VOLUME 1



Jacobs

May 2023

FLOOD MANAGEMENT NEED

Montgomery County (the County) has experienced an increase in flooding events, causing impacts to property and people. The County's Office of Legislative Oversight notes that "there has been an upward trend of urban flooding, from 2 to 4 occurrences per year before 2010 to 11 to 39 occurrences per year since 2010."

Significant factors contributing to the increase in local flooding occurrences are increased precipitation and change in the nature of that precipitation, increased impervious surface area from new development, infill development, redevelopment, and aging stormwater drainage and management infrastructure built to older design standards that are unable to handle the large volumes of water associated with higher levels of imperviousness and more intense precipitation events.

The County is subject to flooding from intense rainfall producing local flooding (referred to as "**urban flooding**", "**interior flooding**" or "**pluvial flooding**") and from streams and rivers overflowing their banks (referred to as "**riverine flooding**" or "**fluvial flooding**"). The spectrum of impact of flooding within the County varies from nuisance to fatal flooding events.

The University of Maryland's Center for Disaster Resilience has characterized urban flooding as a "**significant source of economic loss, social disruption, and housing inequality.**"

Maryland's Stormwater Management Climate Change Action Plan FY 2021

A variety of laws, regulations, policies, and procedures govern the development of the built environment that contributes to stormwater runoff and the infrastructure that is designed to handle this runoff; however, those regulations, policies, and procedures have not been modified to keep up with the continued development in the County or the increase in frequency and intensity of rainfall.

Regulations and infrastructure related to stormwater runoff management fall into roughly three categories. Regulations and related infrastructure that focus on management of comparatively small volumes of stormwater runoff to improve water quality are typically called "**stormwater management**" infrastructure. In contrast, infrastructure designed for conveyance of larger volumes of water for drainage of roadways is typically called "**stormwater drainage**" or "**storm drain**" infrastructure. Finally, regulations and infrastructure related to management of extreme storm events is typically described as "**flood management**" or "**flood mitigation**" infrastructure. Within this document, the term "**stormwater and flood mitigation infrastructure**" is used to describe infrastructure that may serve any of these purposes. Refer to the image below for examples.

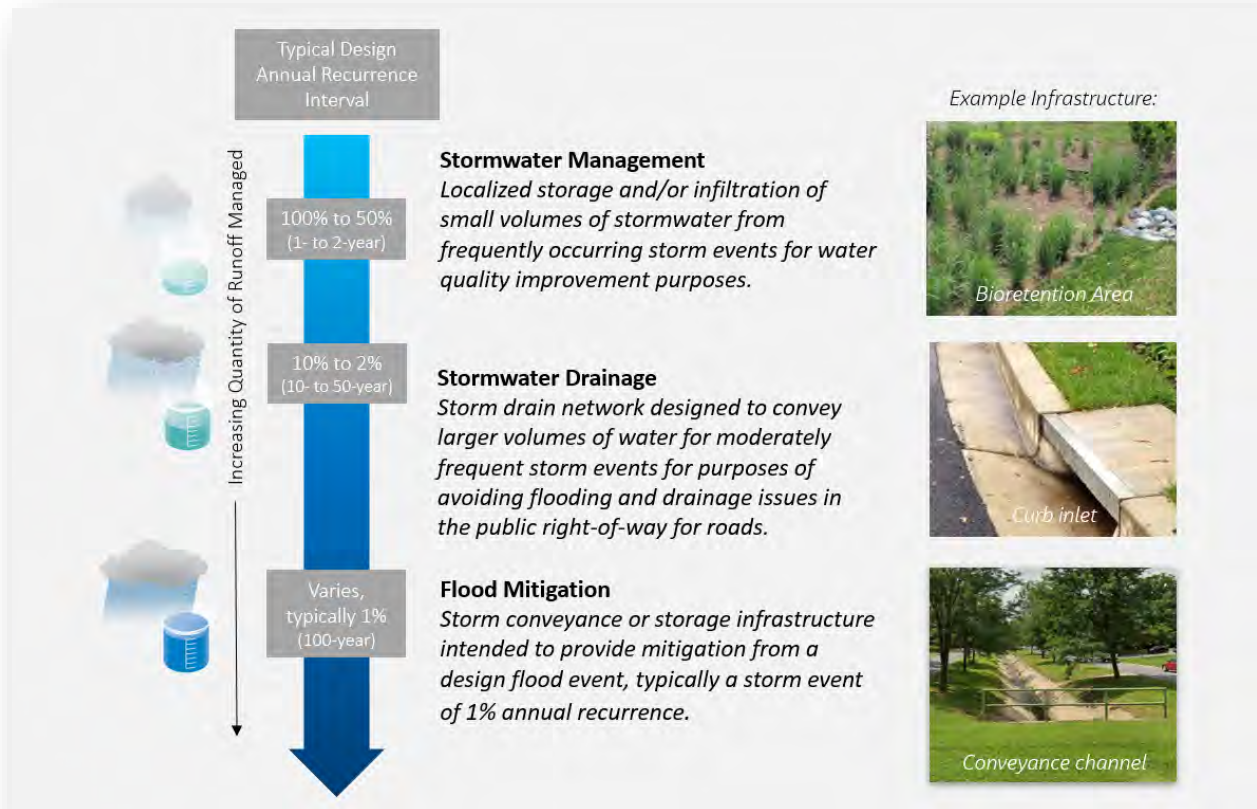
Montgomery County Office of Legislative Oversight, Measuring Climate Resilience Report 2021

- Average of **nine flash flood warnings** per year.
- Increase in **complaints** related to flooding.
- Without significant policy interventions, it is likely climate change and the subsequent increase of extreme weather events will **reinforce and amplify current socioeconomic disparities.**

Montgomery County's 311 Call System

- **8900 flooding- and drainage-related calls** from January 19, 2010 to June 3, 2022
- **87%** related to maintenance and information
- Remaining calls are focused on roadway (2%), private property (4%), lot-to-lot (6%), and groundwater (1%) flooding





Several County departments and agencies have a role in the planning, design, review, approval, installation, maintenance, and management of both the built environment, stormwater infrastructure, and flood mitigation infrastructure. In some cases, the roles and responsibilities are very clear and the processes well-defined. In other cases, they are not so clear, and the County can be perceived as nonresponsive to complaints from residents and businesses about flooding concerns.

The combination of physical challenges, due to aging infrastructure and high-intensity rainfall events, and organizational challenges, due to dispersed responsibilities and regulations, produce an urgent need for more comprehensive flood management planning.

DOCUMENT INTENT

The County initiated a set of questions in recognition of the needs and risks associated with flooding. What constitutes a flood? How does and should the County respond to flooding? To consider these questions, the County initiated a Comprehensive Flood Management Plan engagement. Three phases have been structured to carry the County through this planning effort.



The Strategy document is the culmination of this Phase 1 effort. It is designed to set the direction for comprehensive flood-related efforts within the County. This direction includes the actions and the priority and timing of those actions that the subsequent phases will focus upon. This Strategy document focuses on:

- Recognizing that flooding is a complicated issue and the solutions are complex
- The need for better cross-departmental coordination and collaboration
- The need for community outreach, specifically focused on historically marginalized groups who have received fewer flooding mitigation and recovery resources
- Understanding of flooding history based upon available data and identification of data gaps
- Recognition of potential future flooding challenges
- Identification and agreement of a flooding responsibility structure within the County
- Recommendations for organizational and policy change to accomplish the agreed-upon responsibility structure

Additional documents have also been produced as part of the Phase 1 effort. Those documents focus on the specific detail of the data collection and assessment in response to the elements listed above and should be referenced for further clarification. *The Comprehensive Flood Management Plan Phase 1 Governance & Policy Review Report* (Jacobs, 2023) provides a summary of Phase 1 approach, roles and responsibilities, existing regulations and policy, and a framework for defining outcomes necessary for management of flooding. *The Historic Flood Conditions and Data Gaps Technical Memorandum* (Jacobs, 2022) provides a review of available data, discussion of County watershed flood exposure, and assessment of data required for detailed flood studies. This document summarizes those results and focuses on the suggested direction.



STAKEHOLDER ENGAGEMENT

Flood-related activities include planning, implementation, management, and response responsibilities. This breadth of responsibilities requires many roles to be fulfilled. Roles differ depending on the type and location of infrastructure and regulatory and policy guidance. For the County, this breadth of responsibilities is met by employing a group of agencies. In order for a comprehensive flood management plan to both be developed and take root, representation from the appropriate collection of agencies must be present. Seven agencies agreed to be the core group of representatives for this comprehensive effort: Montgomery County Department of Transportation (MCDOT), Montgomery County Department of Environmental Protection (MCDEP), Office of Emergency Management and Homeland Security (OEMHS), Montgomery County Department of Permitting Services (MCDPS), Office of the County Executive (OCE), Montgomery County Planning Department of the Maryland-National Capital Park and Planning Commission (PLANNING), and Montgomery County Parks Department of the Maryland-National Capital Park and Planning Commission (PARKS). This group is referred to as the Core Team.

Agency Engagement

- **Seven agencies** comprised the Core Team: MCDOT, MCDEP, OEMHS, MCDPS, OCE, PLANNING, and PARKS.
- **20 hours** of workshop sessions
- **Over a dozen** in-depth interviews

Core Team - This Core Team participated in a structured series of ten 2-hour workshops. Their consistent engagement assured the broad representation of the multiple elements of flood management. The expectations associated with their involvement included developing content through workshop engagement, review and commentary on draft products, and committing to the resulting language of the effort.

In addition to the workshop setting, interviews were conducted with those Core Team member agencies and other advisory agencies. Questions covered in these interviews included clarifying items related to their flooding-related responsibilities: roles, asset ownership, data collection and management, funding, and regulatory and policy drivers.

Community Survey

- **Over 500** responses
- **98%** of responses from County residents
- **Over 700** reported flooding locations mapped from survey
- **87%** are at least somewhat concerned about future impacts
- **63%** of the responses indicated urban flooding contributed to flooding events they have experienced

The effort did not end with just engaging County agencies. The effort extended to engaging with the community. The objective of community stakeholder engagement was to gather information related to historic flooding events and impacts and educate stakeholders on key aspects of the flood management effort. The engagement strategy included community interaction and peer engagement.

Community Survey - An online community survey was held to gather feedback from the community on past flooding events. Questions included a request to identify locations of flooding impacts, type and magnitude of impact, and some demographic information. The survey was launched September 19, 2022 and remains open at the date of this writing.

Pop-up Events - To aid in increasing awareness of the survey and perform outreach to multilingual communities survey pop-up events



were held at five locations throughout the County. Informational materials were provided in English and Spanish. Later events included materials translated to Chinese (Mandarin), Vietnamese, Amharic, and Korean. Bilingual personnel were provided by the consultant and MCDEP (Vietnamese, Spanish) to aid in reaching non-English-speaking populations.

Community Forums - Two virtual online forums were held in October 2022 to describe the intention of the comprehensive flood management planning, gain insight on community flooding issues, understand community expectations, and ask for participation and sharing of the Community Survey. Events also provided a venue for anecdotal data collection from community members.

Pop-up Events

- **5 events** scattered throughout the County
- **370 total engagements** at the events
- **Over 60% of total engagements** with persons identifying as Spanish speakers
- **Over 75% of total engagements** with persons identifying as Black, Indigenous, and Persons of Color

Peer Engagement

- **8 jurisdictions** interviewed
- **Anne Arundel County**
- **Charlotte-Mecklenburg Stormwater**
- **City of Baltimore**
- **Metropolitan Water Reclamation District of Greater Chicago (MWRD)**
- **City of Denver & Mile High Flood District**
- **District of Columbia**
- **City of Fort Worth**
- **Pittsburgh Water and Sewer Authority**

Peer Engagement - The final stakeholder engagement was performed with peer organizations—other municipal governments comparable in size and scale to the County who could offer some insight into how they have or are approaching comprehensive flood management. Eight jurisdictions were approached with questions, including the following: What is your jurisdiction’s structure/organization with respect to flood management? How is your jurisdiction working to integrate understanding of non-Federal Emergency Management Agency (FEMA) flood hazard areas into management?

The combination of internal County agency participants, community members, and peer organizations provide a broad sense of need and opportunity considered in the Comprehensive Flood Management Strategy.



OBSERVATIONS

The delivery of flood-related efforts is a complex and intertwined choreography of multiple regulations, asset ownership, and agency responsibility across the flood-related life cycle.

While the County is performing flood-related activities and functions as required by current regulations and policies, it recognizes that a more systematic and comprehensive approach is needed going forward. Recent intense storm events have illustrated that current County regulations, policies, and management systems may need to be re-evaluated to maintain the expected levels of service. The assessment of the current responsibilities, policies, and systems, conducted as part of this Phase 1, served to produce a set of observations. These observations provide context for defining improvements to support the County's advancement toward more comprehensive flood planning and management. These 10 observations were reviewed and improved with the Core Team and are discussed in further detail within the *Comprehensive Flood Management Plan Phase 1 Governance & Policy Review Report* (Jacobs, 2023).

1

There is no functional County-wide definition of flooding.

- Varied characterizations of flooding and/or diverse definitions of what constitutes flooding may lead to conflicting planning, management, and/or response
- Clarification between County responsibilities on public and private areas – and addressing public expectation with respect to these responsibilities - is needed
- May lead to inequitable identification, planning, and/or response to flooding

2

Regulations for flooding-related planning, engineering, and permitting activities are related to specific *sources* of flooding rather than *effects* due to flooding.

- Regulations are based on understanding of flood risk from sources causing historic impacts and climatic conditions and predicted hydrology within the County at the time of policy formation
- Quality-focused regulations have some impact on quantity management
- The stated desire of the Core Team is to focus more on management of stormwater quantities and associated areas of inundation
- New or additional agency organizational structures may be warranted to support comprehensive management of flooding

3

Management of stormwater quantities in the County is limited to requirements for achieving water quality and roadway drainage goals. There is limited watershed level assessment of flooding impacts due to extreme storm events.

- Watershed level assessment to understand existing and future quantities of stormwater runoff are not carried out
- It is unclear if existing infrastructure is adequate to meet current levels of service
- Agencies are driven by different criteria dictated by specific regulations or policies
- Agencies focus on specific asset types and/or location/rights-of-way (ROWs)
- Currently there are no agreements among agencies to recognize, share, or distribute responsibilities for flood management
- Several agencies are responsible for management of stormwater and flood mitigation infrastructure



4

There is no County-wide assessment of flood risk outside of FEMA and County-studied riverine areas.

- This results in limited County-wide characterization of flood vulnerabilities
- The Floodplain District contains a significant amount of unmapped floodplain areas

5

Available data do not allow conclusions regarding the location, cause, and/or effect of flooding.

- Quality of available data results in questions on actual source and/or effect of a recorded event or impact
- Data has limited characterization of resident impacts
- Location information on data is questionable or not available
- Available data is not representative of all residents/communities as some populations are less likely to report and engage with available County resources (MC311, MCDOT Drainage Assistance Requests, MCDEP calls)

6

Flood management data and information resources are neither collated nor coordinated across agencies.

- There is no regulatory requirement for this
- Coordination of data is expected to be increasingly important for assessment of climate change impacts
- Information sharing between agencies is ad hoc
- MCDPS plan submittals only recently have required GIS/CAD information, thus a large amount of legacy information is not readily/easily accessible
- MCDPS, which has historically received floodplain studies, does not have dedicated GIS staff
- Rainfall data is used by several agencies, to achieve agency-specific goals, (MCDEP, MCDOT, OEMHS) yet is not coordinated among them

7

County currently has limited ability to incorporate knowledge of recurrent flood impacts in permitting and development reviews.

- Fluvial flooding is considered in permitting and development review based on the County's limited 100-year average return period floodplain maps, and in some cases new site-specific 100-year floodplain mapping where existing floodplain mapping is inadequate
- Pluvial flood risk, which is unmapped in the County, is generally not considered during permitting and development reviews

8

There is currently no means to support consideration of watershed-wide impacts to runoff volumes as a result of stormwater management permit applications (for example, using watershed level quantity planning).

- The "reasonableness of use" doctrine of the State-modified Civil Law Rule allows the higher landowner to discharge across a lower landowner's property
- No assessment of the impact of Zoning changes on flood risk



9

Public outreach related to flood risk and management is not coordinated.

- There is no agency with sole responsibility for public outreach related to flooding
- There is no coordinated effort to define, for the public, the multi-faceted issues that can result in flood risk increase. Likewise, there has been limited outreach to educate residents on the purpose and associated limitations of existing County regulations. Comprehensive flood risk information is currently not available

10

There is currently no process for integrating knowledge of existing and future urban flood risk in the land use planning process.

- Impacts to existing flood risk and/or network-level (versus local) storm drain capacity are not typically a consideration for land use planning
- As a standard practice, master plans don't always review and analyze flooding issues. Areas with historical flooding impact are considered in certain cases where new development is being proposed in floodplain areas known for severe flooding impacts
- ZTA/Special Exceptions/Mandatory Referrals (which occur after the general planning process) may have impacts to local flooding; storm drain design capacity is assumed to be sufficient
- Climate change will potentially magnify the uncertainty of these impacts



DEFINITION OF FLOODING

Montgomery County initiated this effort to produce a comprehensive flood management strategy. Yet as noted by Observation 1 above, there is no unifying nor universal definition of what constitutes a flood in the County. This lack of uniform definition presented a challenge to the Core Team – without an understanding of what the County defines as flooding, it was difficult to assess whether the Core Team was focused on the same challenge and producing an appropriate comprehensive flood management plan. To remedy the challenge, the Core Team produced a definition of flooding. This definition served the Core Team in its effort to produce this Comprehensive Flood Management Strategy.

Flooding is defined as the...

Accumulation or conveyance of water exceeding planned volume, levels, or timing having a significant disruptive or destructive impact on built infrastructure, environment, operations, and/or intended use

...impacting residents, businesses, or visitors.

This definition differs from the FEMA definition and is more expansive than the existing narrow definition within the County's Floodplain Regulations. The collective wisdom of the Core Team focused their interest and concern more toward defining a flood by the effect of flooding within the County rather than the sources of flooding.

The conversation and ultimate wording choice of a flooding definition was carried out to focus the comprehensive flood management planning effort. This definition is inadequate, by itself, to forestall all the potential issues mentioned in Observation 1. With progression to the next phase of this comprehensive flood management planning effort, this definition should be revisited.

VISION OF FLOODING MANAGEMENT

The vision is the aspirational goal for the County relative to flooding. It sets the agreed upon direction of the organization and what it strives to achieve relative to a comprehensive flood management outcome. As with the lack of a flooding definition, the Core Team lacked a collective direction, or vision, for the comprehensive flood management planning effort. As a remedy, the Core Team created this vision. It is not a characterization of the County's responsibilities. Rather, it is intended to serve as

Flooding Management Vision:

Montgomery County leads the nation in reducing existing and future flooding through well informed residents and sustainable and equitable mitigation, planning, and adaptive development.

the aspirational goal of the comprehensive planning effort. It encompasses the entire flood-related 'life cycle' from land use planning and zoning to avoid floods, design and implementation of infrastructure to manage flooding, and to response and recovery in the event of flooding. All agencies with responsibility for some part of the flood-related life cycle should see themselves within the vision and recognize how they may contribute to its accomplishment. As suggested for the flooding definition, this vision should be reviewed and refreshed as the comprehensive flood management activities continue.



OUTCOMES

The County recognizes that it must improve policies, processes, and systems in order to advance to an organization capable of accomplishing comprehensive flood management. The assessment of the current regulations, policies and distributed responsibilities; the synthesis of observations; the engagement of multiple stakeholders (in particular, agency representation through the Core Team); the review of peers' performance; and the professional knowledge of the consultant team all contributed to a collection of Outcomes that encapsulate what is needed to reach comprehensive flood management performance. With attainment of these Outcomes, the County will have created an organization capable of comprehensive flood management.

Seventeen Outcomes characterize conditions that are necessary for the County to reach comprehensive flood management. Together, these Outcomes describe the breadth of activities, processes, and information needed to adequately and proactively plan for, prepare for, respond to, and recover from a flooding event. Capabilities, or competencies, associated with these Outcomes are discussed within the referenced *Governance & Policy Review Report* (Jacobs, 2023).

The numbers associated with the Outcomes do not infer any type of priority. These Outcomes are grouped into categories to provide a clear method of organization and a general sense of the topic in which the Outcome focuses. This set of Outcomes was reviewed and improved by the Core Team.

#	Category	Outcome
1	Governance	Flood risk management roles and responsibilities and overall governance structure are documented and clearly understood.
2	Flood Management Planning	Comprehensive land use plans reflect flood risk.
3		Development and redevelopment standards and building codes are updated to reflect established levels of service and current and future climate conditions for areas of riverine and urban flooding.
4		Clear permit process and enforcement of development and redevelopment standards reflecting flood risk exists.
5	Flood Hazard and Risk Information	Flood management information is universally accessible and uniformly utilized by all County agencies.
6		Flood risk and mitigation information is readily available and widely communicated to the public.
7		Flood Insurance options are well-defined and communicated to the public.
8		Flood risk data and analyses are developed and periodically updated.



#	Category	Outcome
9		Urban Flood Zones/ Riverine Floodplain are defined/mapped.
10	Flood Mitigation	Capital Improvement Program incorporates flood mitigation needs.
11		County environmental, sustainability, and equity goals are incorporated in flood mitigation activities.
12	Asset Management	Asset management principles are followed to ensure infrastructure assets continuously deliver established levels of service (LOS) at an acceptable risk of failure while minimizing lifecycle costs of owning and maintaining the assets.
13		O&M of drainage and flood control infrastructure is proactive to maintain LOS.
14	Emergency Management	The County has an emergency management plan that addresses preparedness, response, and recovery for flood events.
15		The County's emergency management plan includes early warning systems for high-risk areas.
16	Budget and Finance	Financing options are well defined and communicated.
17		County budget and staffing needs are comprehensively collated, communicated, and decided upon.



STRATEGY ACTION PLAN

The 17 Outcomes represent the comprehensive flood management strategy; however, that strategy requires more details to allow the County to set in motion the activities to achieve the Outcomes. Moving forward with all seventeen Outcomes at once is daunting. There must be a timing designation to ensure appropriate focus. Achieving the Outcomes will be dependent on the expertise among the multiple flood management related agencies. The movement from the current County conditions to the achievement of the Outcomes differs, i.e., some Outcomes are closer to accomplishment than others. Each Outcome is presented as an individual page with eight defining elements. The 17 pages that follow, in combination, present the Action Plan for accomplishing the Outcomes. As noted in the previous section, detailed discussion of each of the outcomes can be reviewed in the *Governance & Policy Review Report* (Jacobs, 2023).

Outcome

1 **1**

Flood risk management roles and responsibilities and overall governance structure are documented and clearly understood.

5
Importance

3 2
Performance

4 8
Urgency Score

2

 Category
Governance

Timing
Year 1 2 3

Stewardship
DEP

Necessary Competencies

1.1	Flood risk management roles, responsibilities and efforts are clearly defined, coordinated and shared among all responsible stakeholders (e.g., County departments, municipalities, State Highway Administration).
1.2	Authorities and those accountable for decisions are clearly aware of their responsibilities.
1.3	A centralized authority exists for overseeing flood management planning, risk assessment, flooding response, and recovery activities in the County.

Level of Lift

Regulations, Policies, Level of Service	Decision Responsibilities	Process	Communication/ Data	Personnel Resources
MODERATE	HIGH	HIGH	MODERATE	MODERATE

Each Outcome follows this structure:

- 1 The number designation and phrase of the Outcome lead the page.
- 2 The Outcome Category is referenced. Categories serve to group similarly focused Outcomes and generally highlight the type of Outcome.
- 3 The Outcomes were presented to the Core Team. The team rated the 17 Outcomes relative to importance and performance:

IMPORTANCE				
1 - No urgency to improve	2 - Minimal urgency to improve	3 - Some Urgency to improve	4 - Moderate urgency to improve	5 - Very urgent to improve

PERFORMANCE				
1 - We don't do this	2 - Lots of room to improve	3 - Some room to improve	4 - We're pretty good but should improve	5 - We do very well but can always improve

Both the number and a bar represent the numerical rating on a 1 to 5 scale.

- 4 Importance and Performance ratings serve as inputs to the Urgency Score calculation:

$$\text{Urgency Score} = \text{Importance Score} + \left(\frac{\text{Importance Score} - \text{Performance Score}}{2} \right)$$

This calculation provides a sense of the more urgent need to advance the Outcome. The higher the number the more relative urgency. Highest Urgency Score is 9.



Outcome

01 Flood risk management roles and responsibilities and overall governance structure are documented and clearly understood.

5 Importance	2 Performance	8 Urgency Score
	5 Timing Year 1 2 3	6 Stewardship DEP

Necessary Competencies

1.1	Flood risk management roles, responsibilities and efforts are clearly defined, coordinated and shared among all responsible stakeholders (e.g., County departments, municipalities, State Highway Administration).
1.2	Authorities and those accountable for decisions are clearly aware of their responsibilities.
1.3	A centralized authority exists for overseeing flood management planning, risk assessment, flooding response, and recovery activities in the County.

Level of Effort

Regulations, Policies, Level of Service	Decision Responsibilities	Process	Communication/ Data	Personnel Resources
MODERATE	HIGH	HIGH	MODERATE	MODERATE

- 5** A total of 17 Outcomes is a large number, requiring focus and investment. The Urgency Score does provide a sense of need, but many of the Outcomes have leading and lagging relationships where one or more Outcomes are needed in order to effectively accomplish another Outcome. For these reasons, initiation of Outcomes should be placed on a logical time horizon. This cell suggests the year in which the Outcomes should be initiated: Year 1, 2, or 3. Note that the suggestion for initiation does not imply that the Outcome would be completed in that year timeframe. The initial timing suggestions were presented and reviewed by the Core Team.
- 6** The breadth of capabilities across the multiple flooding-associated agencies must be shared to implement the improvements required to achieve the Outcomes; however, management of an effort by committee leads to inefficiency and missed milestones. This cell designates one agency as the steward of the Outcome. Stewardship implies the following:
- Taking on the responsibility of engaging a team
 - Initiating and driving the effort to accomplish the Outcome
 - Determining scope, schedule, and budget
 - Requesting resources and investments
 - Monitoring and reporting progress, and
 - Promulgating the results
- Performing the Steward role does NOT imply that the agency in that role is performing all the effort to



Outcome

01 Flood risk management roles and responsibilities and overall governance structure are documented and clearly understood.

5 Importance	2 Performance	8 Urgency Score
	 Year 1 2 3	

7 Necessary Competencies

1.1	Flood risk management roles, responsibilities and efforts are clearly defined, coordinated and shared among all responsible stakeholders (e.g., County departments, municipalities, State Highway Administration).
1.2	Authorities and those accountable for decisions are clearly aware of their responsibilities.
1.3	A centralized authority exists for overseeing flood management planning, risk assessment, flooding response, and recovery activities in the County.

8 Level of Lift

Regulations, Policies, Level of Service	Decision Responsibilities	Process	Communication/ Data	Personnel Resources
MODERATE	HIGH	HIGH	MODERATE	MODERATE

accomplish the Outcome. The stewarding agency likely has either current capabilities or knowledge that supports accomplishing the Outcome, but it cannot be assumed that the entirety of the capabilities are housed solely within that agency, thereby the need for collaboration among multiple agencies.

7 The Outcomes are collectively comprehensive but are not defined in enough detail to provide actionable results. Necessary Competencies are the refinement of the Outcomes that provide specific direction in achieving the Outcome through specific actions or activities and, as the name implies, are necessary for advancing the Outcome. If an organization evokes the stated Necessary Competencies, it is advancing the intended Outcome. A total of 73 Necessary Competencies are scattered across the 17 Outcomes.

8 Level of Lift characterizes the level of change and effort required to move from the current baseline of Montgomery County performance to accomplishment of the Necessary Competencies and advancement of the Outcome. Five categories of 'lift' are characterized for each Outcome as either HIGH, MODERATE, or LOW. The following table lists the five lift categories and defines the high, moderate, and low designations within each category. The lift required to advance an Outcome may vary across the five categories as reflected by the subject of the Outcome (that is, Outcomes with a focus upon information management would likely have more association with the Communication/Data category). The level of lift also provides a sense of the areas in which the stewarding agency should focus (that is, higher level of lift denotes more emphasis in expertise or focus required in that category to accomplish the Competencies and advance the Outcome).



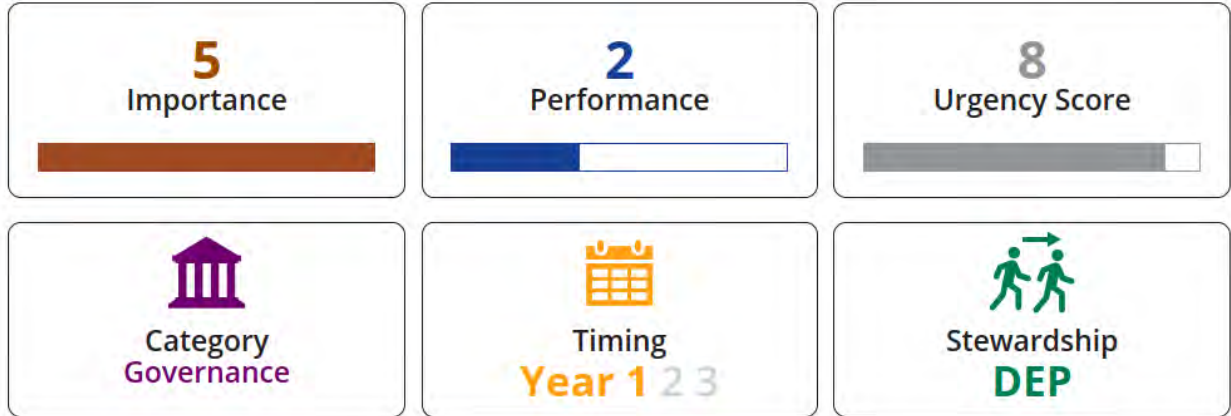
	Regulations, Policies, Levels of Service	Decision Responsibilities	Process	Communication/ Data	Personnel Resources
	What level of lift is required to reach agreement and/or accomplish modification of written policy or the interpretation of a regulation or a changed and/or formalized agreement on levels of performance or service?	What level of lift is necessary to clarify or change who has responsibility and/or authority to drive results and/or reach conclusions?	What level of lift is suggested to codify a process(es) or the improvement to process(es) within or among agencies and/or with outside stakeholders?	What level of lift is necessary to determine data needs, collection of the data, collation, access, ownership, distribution and/or use of data and the communication of information in which formats or forums and by whom?	What level of personnel resourcing is required to accomplish the necessary competencies?
HIGH	<i>Regulation, policy, or level of service does not exist, requiring high or significant level of lift for a new regulation, policy or level of service agreement.</i>	<i>Significant shift or establishment of new roles, authorities, or responsibilities and agreement to those roles.</i>	<i>Processes or procedures do not exist and must be created.</i>	<i>New data collection and management systems need to be created and/or implemented.</i>	<i>Significant investment and/or dedication of new personnel and/or resources needed to accomplish the Outcome.</i>
MODERATE	<i>Significant modification to existing regulatory, policy language, and/or level of service agreement.</i>	<i>Moderate shift of existing roles, authorities, or responsibilities.</i>	<i>Significant modification of existing processes or procedures.</i>	<i>Improvement to existing data management systems and/or data collection and availability.</i>	<i>Moderate investment in new resources and/or dedication of existing resources needed to accomplish the Outcome.</i>
LOW	<i>Minor changes to existing regulation, policy and/or existing level of service agreement.</i>	<i>Minor modification or clarification of existing roles, authorities, or responsibilities.</i>	<i>Minor modification of existing processes.</i>	<i>Minimal modification to data availability and access within existing systems.</i>	<i>Current compliment of resources capable of absorbing the actions and accomplishing the Outcome.</i>



Outcome

01

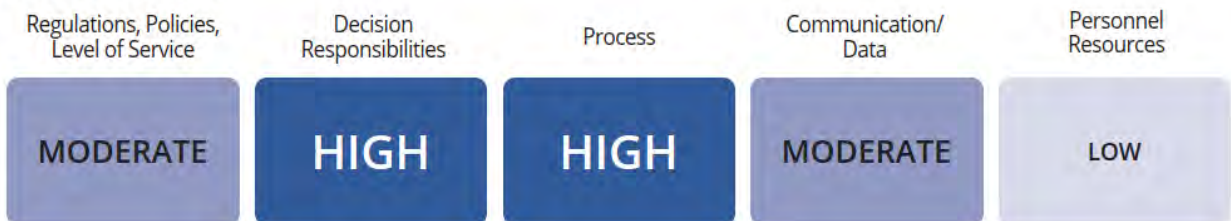
Flood risk management roles and responsibilities and overall governance structure are documented and clearly understood.



Necessary Competencies

1.1	Flood risk management roles, responsibilities and efforts are clearly defined, coordinated and shared among all responsible stakeholders (e.g., County departments, municipalities, State Highway Administration).
1.2	Authorities and those accountable for decisions are clearly aware of their responsibilities.
1.3	A centralized authority exists for overseeing flood management planning, risk assessment, flooding response, and recovery activities in the County.

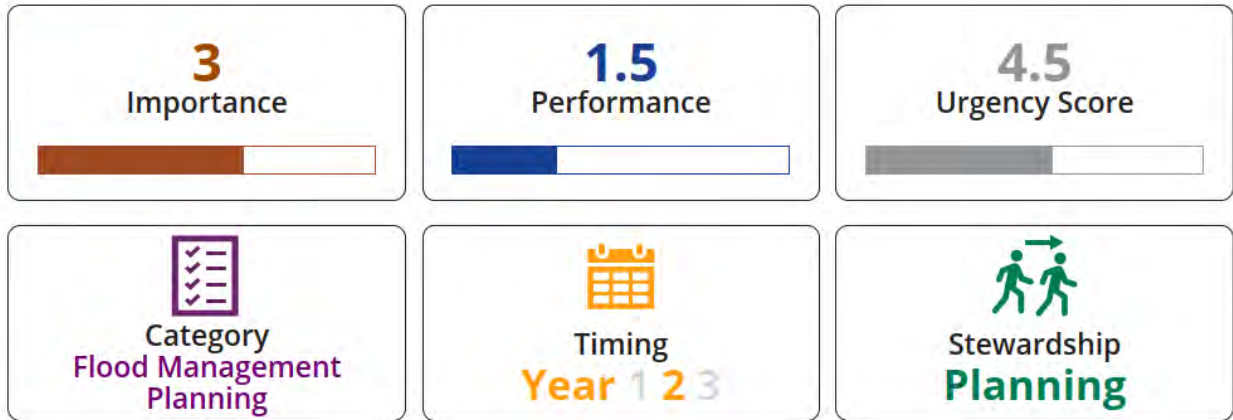
Level of Lift



Outcome

02

Comprehensive land use plans reflect flood risk.



Necessary Competencies

2.1	County master plans incorporate flood risk information, including flood risk for historically vulnerable populations and Equity Emphasis Areas.
2.2	A community-wide flood risk management plan is used to inform zoning and land use changes.
2.3	Areas that provide natural flood conveyance, storage, and/or mitigation functions are identified and protected.
2.4	Flood risk for culturally and historically significant areas and structures is well understood and geolocated.

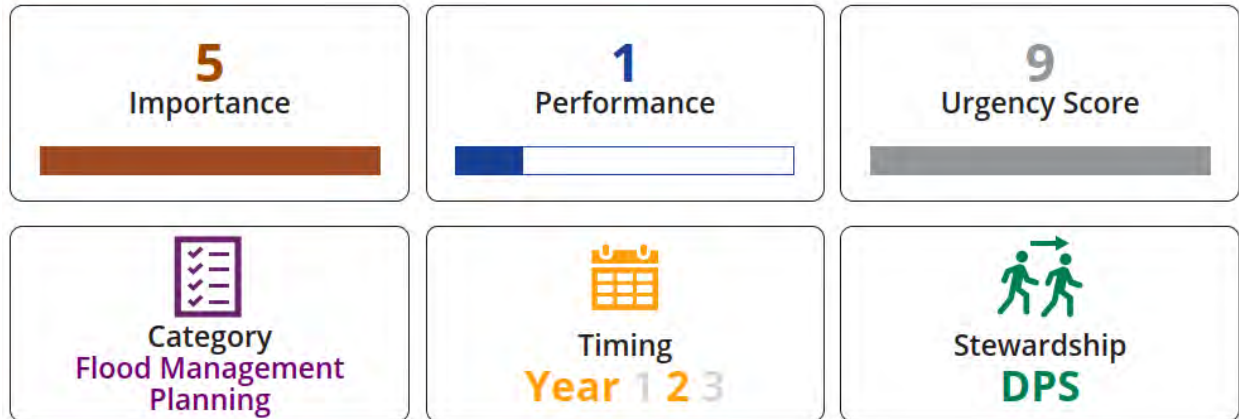
Level of Lift



Outcome

03

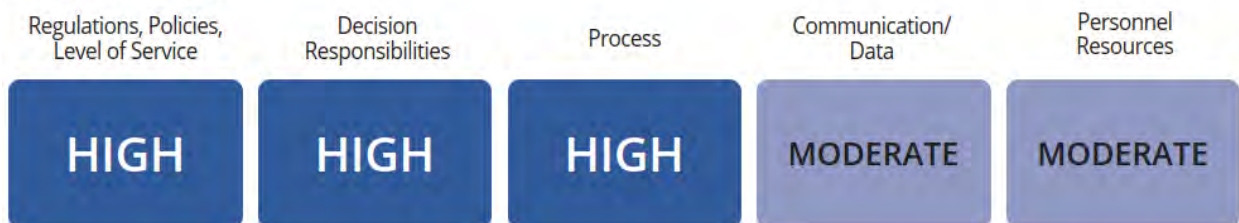
Development and redevelopment standards and building codes are updated to reflect established levels of service and current and future climate conditions for areas of riverine and urban flooding.



Necessary Competencies

3.1	A watershed plan that evaluates future (climate and land use) conditions and short- and long-duration storms is used to implement stormwater management and development regulations. Such a plan addresses wetlands/natural areas and stream channel protection and potential for infill development/re-development impacts.
3.2	Watershed plan flood risk information is used to inform building code and development standard updates in areas of known or projected future flood risk.
3.3	Stormwater and flood control infrastructure Levels of Service (LOS) are established, communicated and periodically measured and reported, for each part of drainage/stormwater system.
3.4	Staff members know where to find climate data and can utilize it in their current roles.

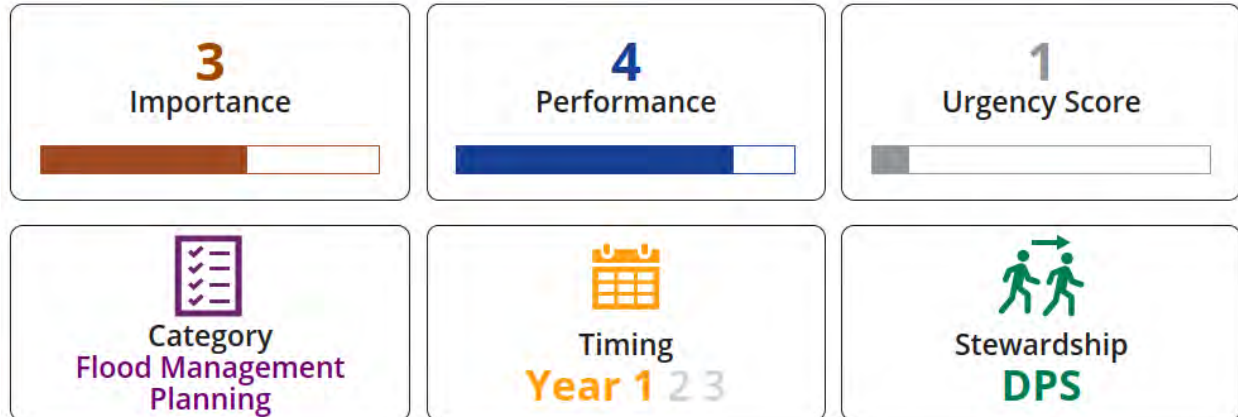
Level of Lift



Outcome

04

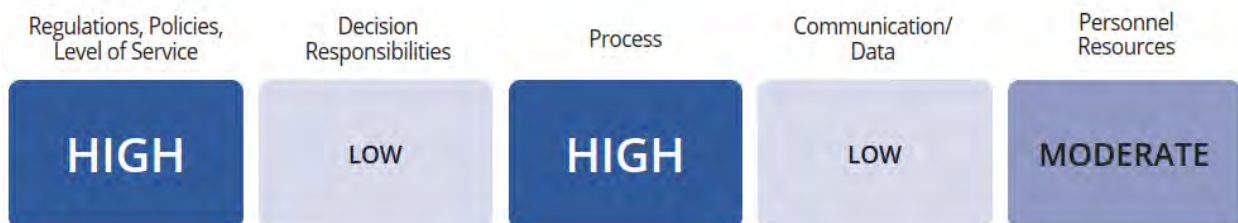
Clear permit process and enforcement of development and redevelopment standards reflecting flood risk exists.



Necessary Competencies

4.1	All development in the Floodplain District is reviewed through the Floodplain District Permit review process.
4.2	The County's Floodplain Management regulations are uniformly enforced.
4.3	All development in areas of urban flood risk are reviewed through a permit review process.
4.4	Peak flows for each new development are reviewed to ensure that runoff from a site will not exceed pre-development runoff.
4.5	The development and redevelopment review processes are clearly mapped using a process flowchart indicating which departments and staff members are responsible for activities and approvals associated with stormwater and flood management.

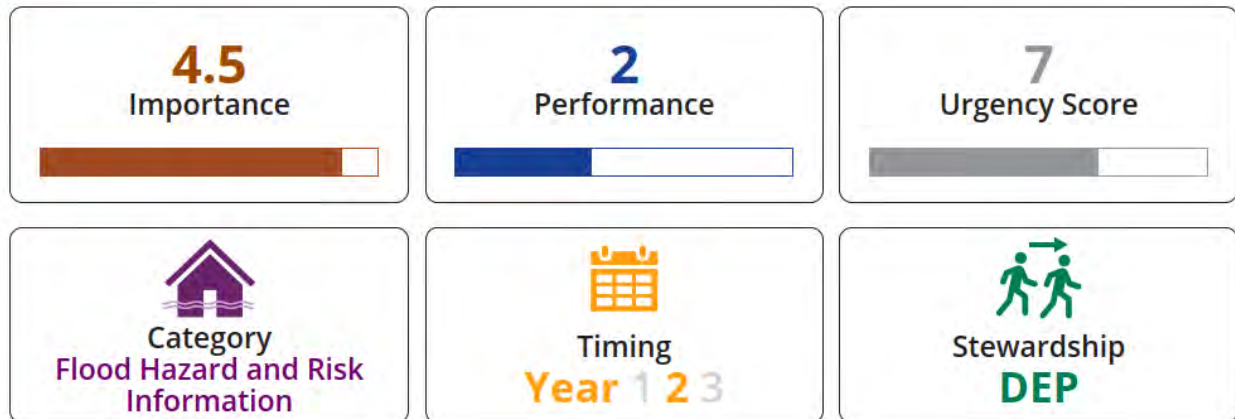
Level of Lift



Outcome

05

Flood management information is universally accessible and uniformly utilized by all County agencies.



Necessary Competencies

5.1	Staff reviewing new development and redevelopment applications have access to geographic locations of, and information on, previously flooded areas.
5.2	Standards exist and are used to ensure that flood management GIS data, detailed studies, and reporting are produced in a uniform manner to support end uses.
5.3	A standardized set of baseline and projected future climate data has been collected and made available.
5.4	Staff members know where to find climate data and can utilize it in their current roles.
5.5	Data sharing processes are established to enable agencies to achieve other outcomes.

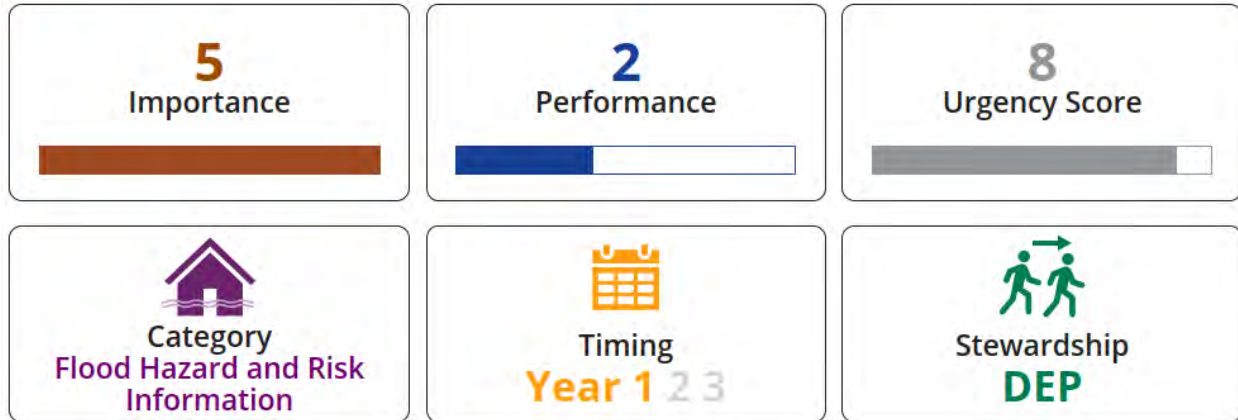
Level of Lift



Outcome

06

Flood risk and mitigation information is readily available and widely communicated to the public.



Necessary Competencies

6.1	The public knows how and where to find information about their current and future flood risk.
6.2	Information on flood insurance is readily available in hardcopy form and on the County website.
6.3	An on-going program of public outreach to increase flood hazard awareness and motivate actions to reduce flood damage, encourage flood insurance coverage, and protect natural functions of the floodplain is coordinated among agencies involved in County flood management.
6.4	Flood hazard mapping is available and used in disclosure of flood hazard information during real estate transactions.
6.5	Information to assist residents in protecting their properties is available in County libraries and on the County website.
6.6	All entities conducting development or redevelopment in the Floodplain District are made aware of the Floodplain District Permit process.

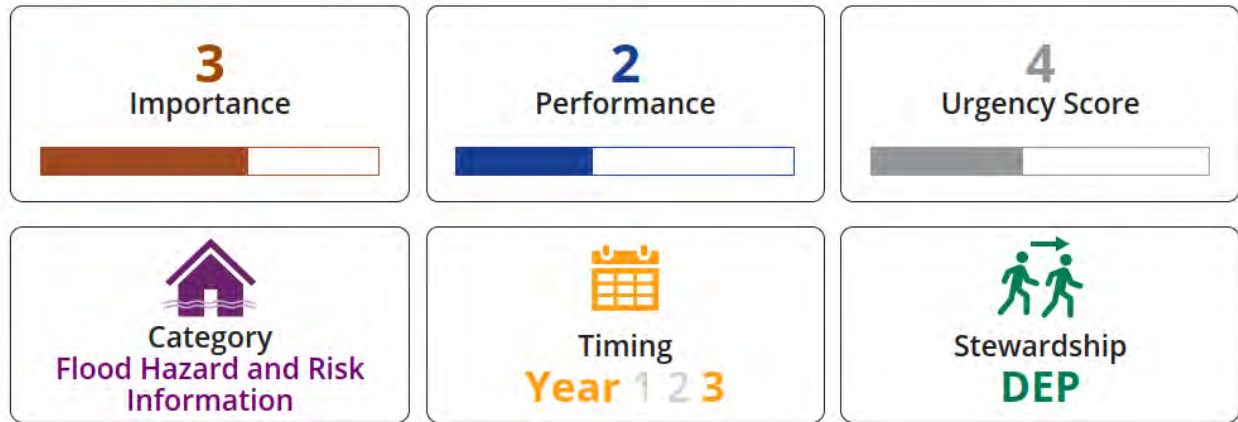
Level of Lift



Outcome

07

Flood Insurance options are well-defined and communicated to the public.



Necessary Competencies

7.1	The level of available insurance coverage is known and aligned with flood risk areas.
7.2	There is a plan for increasing flood insurance use among property owners.

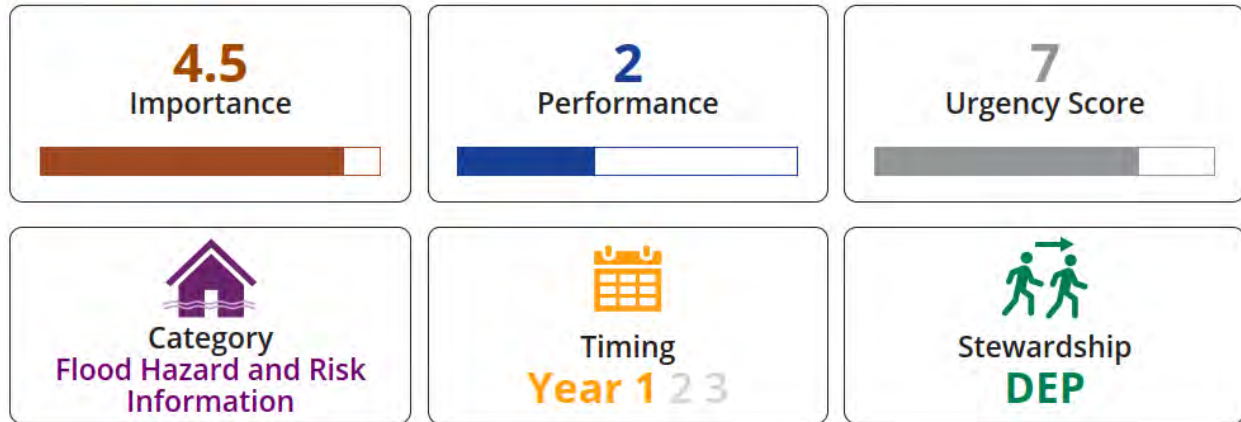
Level of Lift



Outcome

08

Flood risk data and analyses are developed and periodically updated.



Necessary Competencies

8.1	Building elevation certificates are collected as part of a permit review process, certificates are reviewed for accuracy and completeness, and are catalogued and available for reference.
8.2	Flood risk geospatial data used for flood risk assessment is kept up-to-date. Geospatial data is defined as georeferenced data sets (environmentally sensitive areas, socially vulnerable areas, commercial/economic impacts areas, but not including stormwater infrastructure asset data - see Outcome #1) that inform flood risk.
8.3	There is a well-defined and documented process for assessing and estimating damages following a flood event by type and extent of impact.
8.4	Critical facilities and critical infrastructure have been identified and geolocated on GIS.
8.5	The County has and maintains a community-wide flood risk management plan (including definition of areas of riverine and urban flood risk).
8.6	Flood risk impact for historically vulnerable populations and Equity Emphasis Areas is well understood.

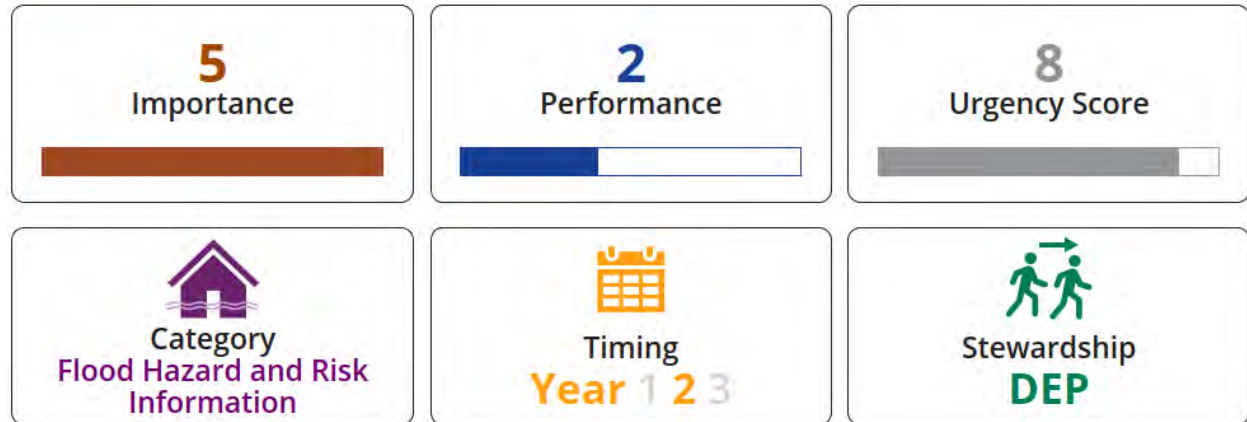
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Outcome

09

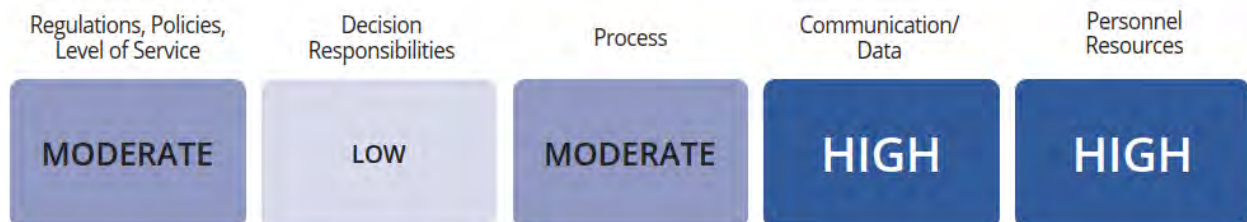
Urban Flood Zones/ Riverine Floodplain are defined/mapped.



Necessary Competencies

9.1	Riverine and pluvial/urban flood hazard areas are clearly mapped for different levels of service (storm recurrence). Areas of flood risk outside FEMA and County Planning studies have been identified and clearly defined.
9.2	The County has the technical capability to assess projected future flood risk, reflecting buildout conditions, and future climate projections for design storms.
9.3	Floodplain Districts for the entire county are developed with consistent details.

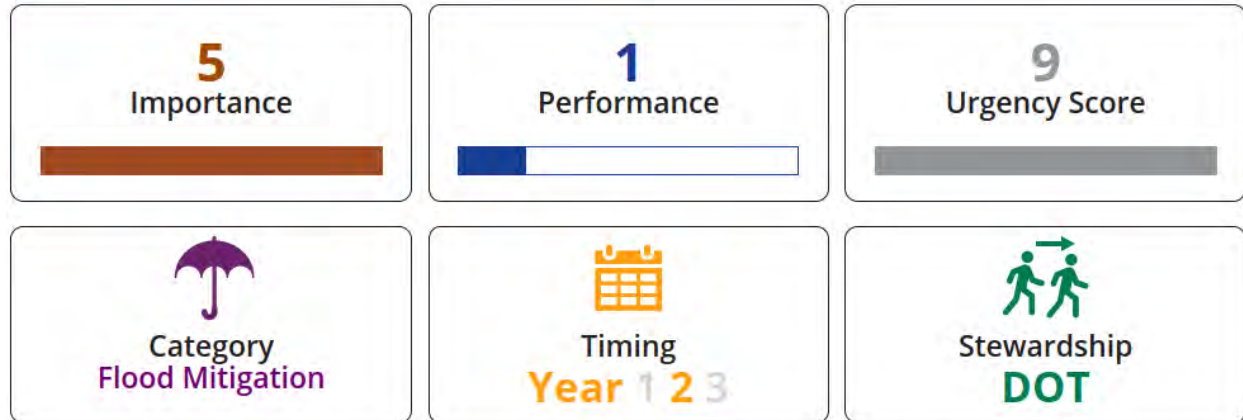
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Outcome

10

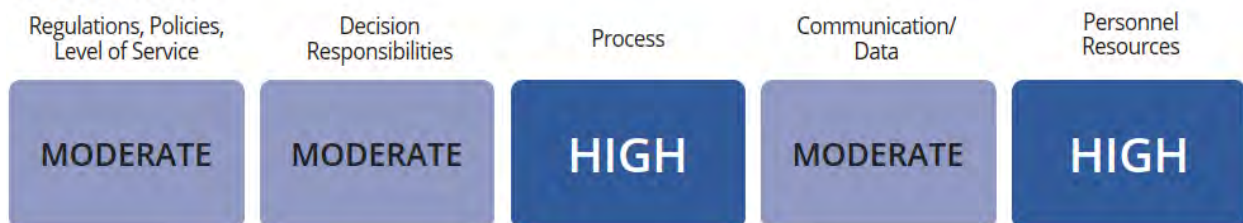
Capital Improvement Program incorporates flood mitigation needs.



Necessary Competencies

10.1	The County has the technical capability to develop mitigation measures for current and future flood risk (from climate change and future development).
10.2	Future considerations (e.g., climate change impacts, development, increased impervious areas) are included in storm drainage infrastructure design.
10.3	Flood mitigation projects that reduce County flood risk have been identified.
10.4	A mitigation plan for repetitive loss areas has been developed and is being carried out.
10.5	Buildings within areas of high flood risk are acquired or relocated.
10.6	There is a comprehensive capital improvement program for addressing drainage problems.

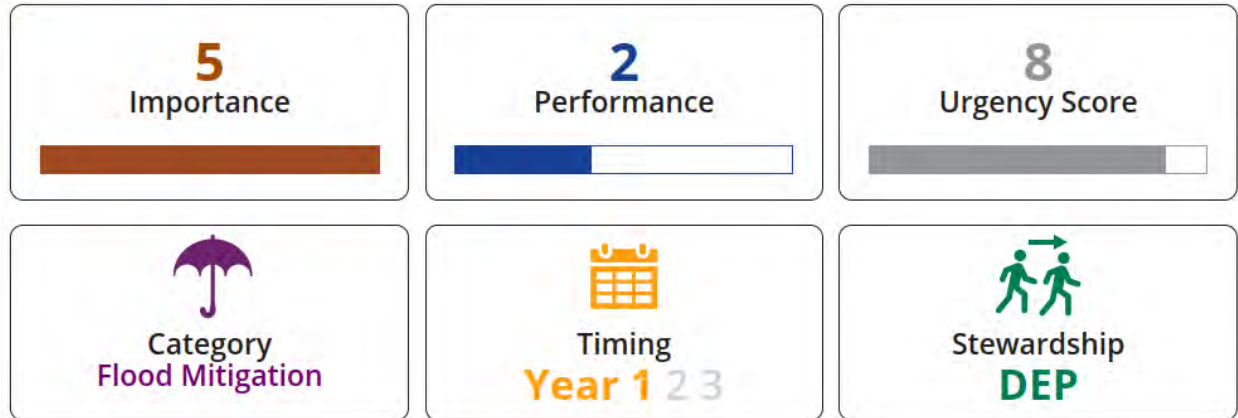
Level of Lift



Outcome

11

County environmental, sustainability, and equity goals are incorporated in flood mitigation activities.



Necessary Competencies

11.1	The County's water quality improvement efforts and regulatory compliance are integrated with flood risk management programs.
11.2	County sustainability goals are considered in development of flood mitigation activities.
11.3	County equity goals are considered in development of flood mitigation activities.
11.4	Erosion and sediment control regulations exist for all construction sites for protection of water quality and drainage systems.
11.5	WQPC credit is provided for implementing flood mitigation beyond water quality requirements.

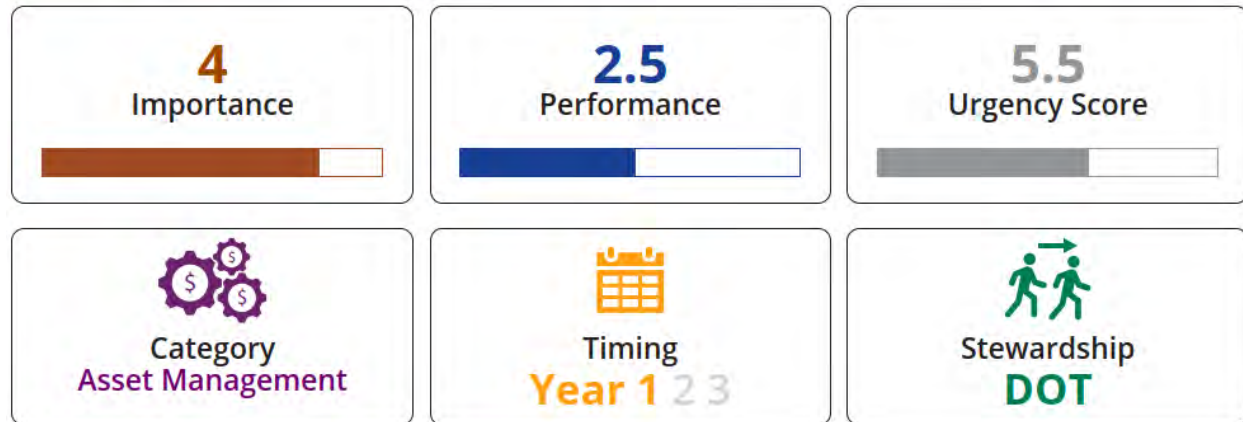
Level of Lift



Outcome

12

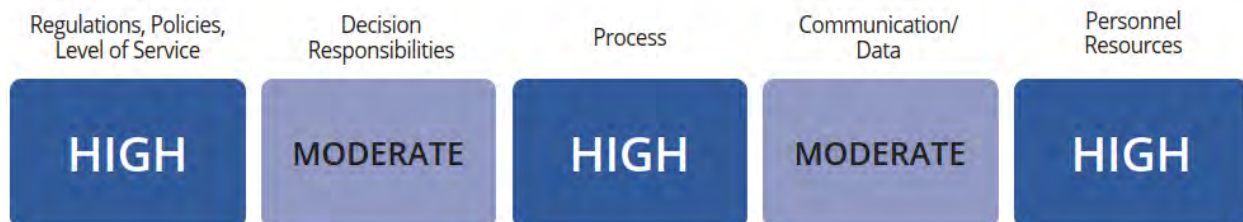
Asset management principles are followed to ensure infrastructure assets continuously deliver established levels of service (LOS) at an acceptable risk of failure while minimizing lifecycle costs of owning and maintaining the assets.



Necessary Competencies

12.1	A frequently updated asset management plan and program built on a reliable asset inventory and characterizing resources and timescales requirements for all stormwater and flood control infrastructure exists.
12.2	The Asset Management Program establishes and periodically reviews and updates the levels of service to be met by stormwater and flood control systems. Actual levels of service provided are measured and reported.
12.3	A reliable, accurate, and regularly updated inventory of stormwater and flood control infrastructure assets, with their attributes, exists. The inventory is accessible to all parties that inform the inventory or use it for planning purposes.
12.4	The condition and likelihood of failure, along with the consequences of failure, of all stormwater and flood control infrastructure is periodically updated and is easily accessible by staff.
12.5	The risk due to failure of stormwater and flood control infrastructure assets to meet established LOS is periodically updated and used to develop maintenance schedules, needed rehabilitation, replacement, and additional infrastructure assets.

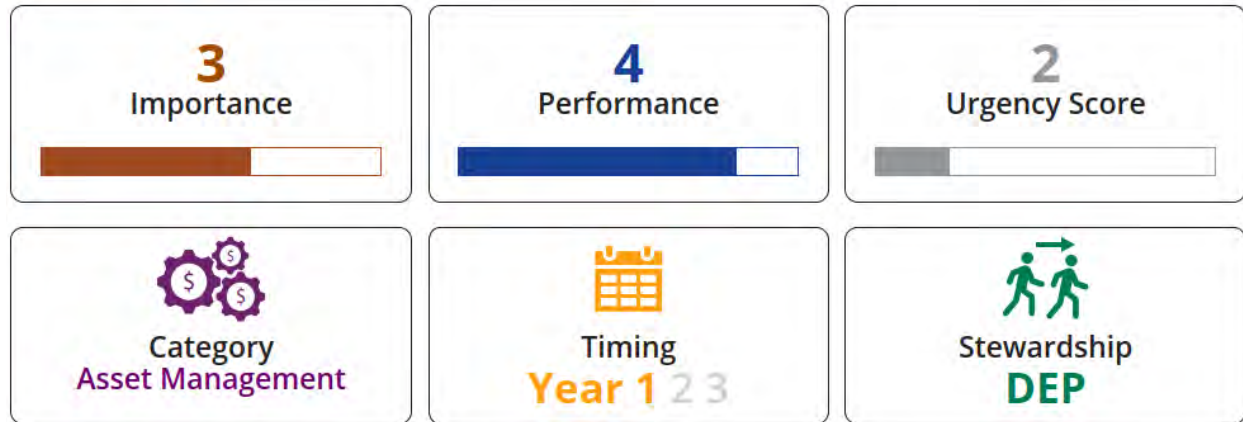
Level of Lift



Outcome

13

O&M of drainage and flood control infrastructure is proactive to maintain LOS.



Necessary Competencies

13.1	Natural channels on both public and private property are inspected and debris is removed.
13.2	Known problem sites are recorded and given additional attention, as appropriate.
13.3	Regulations prohibiting dumping in streams exist and are publicized and enforced.
13.4	Private stormwater storage facilities are inspected and maintained on a regular basis, or enforcement measures exist if they are not maintained.
13.5	Public stormwater [infrastructure and] storage facilities are inspected and maintained on a regular basis.

Level of Lift



Outcome

14

The County has an emergency management plan that addresses preparedness, response, and recovery for flood events.



Necessary Competencies

14.1	The County has failure recognition procedures for dams and levees.
14.2	Response operations for failure of critical infrastructure and critical facilities are planned and practiced through periodic exercises.
14.3	Dam and levee failure planning is coordinated with owners and operators of critical facilities and infrastructure.
14.4	The County encourages owners and operators of critical facilities located in high risk areas to have their own flood response plan.

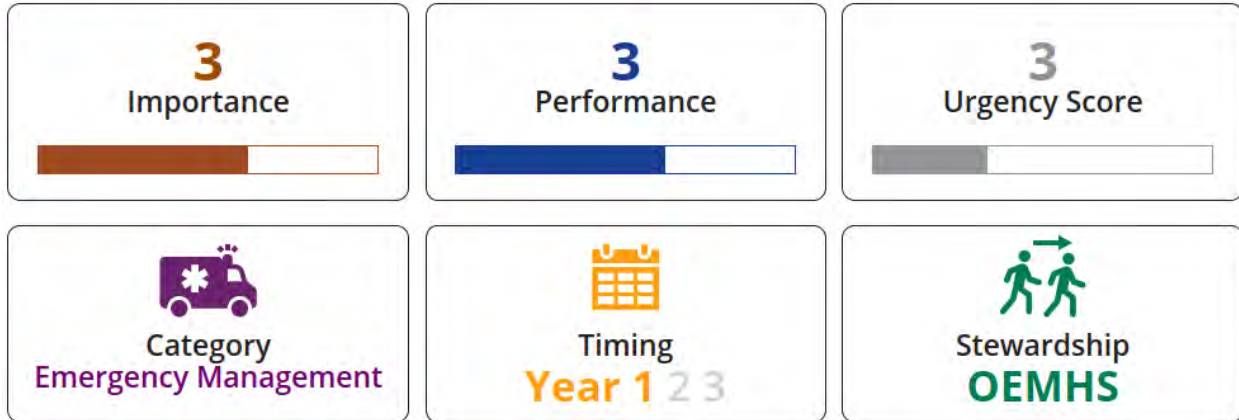
Level of Lift



Outcome

15

The County's emergency management plan includes early warning systems for high risk areas.



Necessary Competencies

15.1	The County has an effective flood warning system based on flood prediction.
15.2	Planning for dissemination of flood warnings is coordinated with owners and operators of critical facilities and critical infrastructure.
15.3	The County is designated by NWS as StormReady.

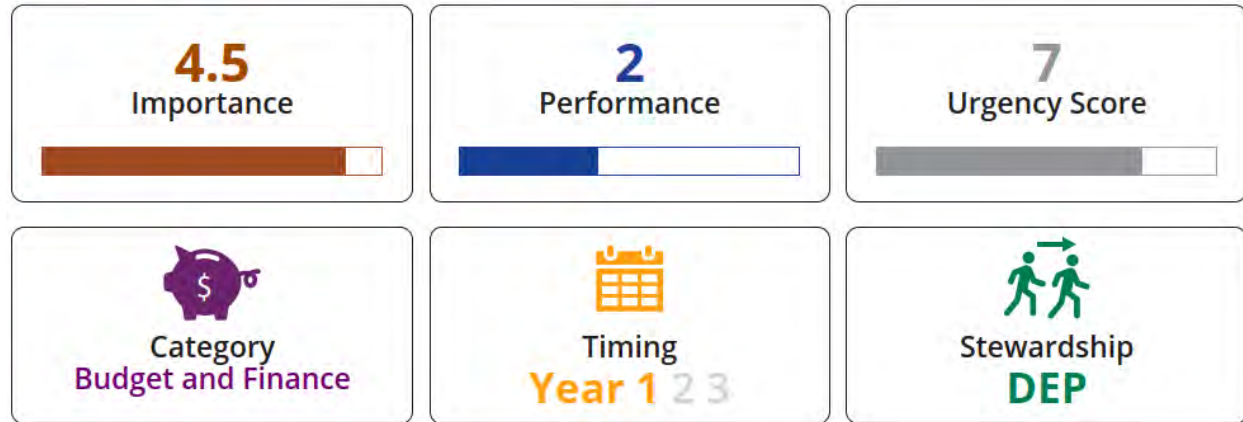
Level of Lift



Outcome

16

Financing options are well defined and communicated.



Necessary Competencies

16.1	Grant and loan resources for capital improvements and flood preparedness are known and planned for.
16.2	Grant and loan resources for flood event recovery are known and there are resources to apply for these funds.
16.3	Flood protection resources and financial assistance is communicated to property owners by staff trained in retrofitting and grants availability information.
16.4	County grant program exists for acquisition of flood prone properties.

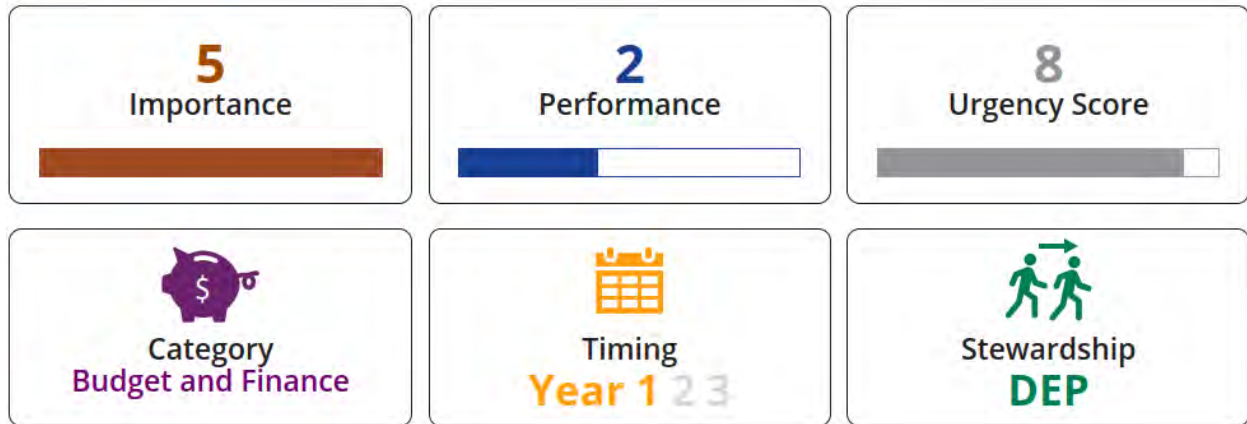
Level of Lift



Outcome

17

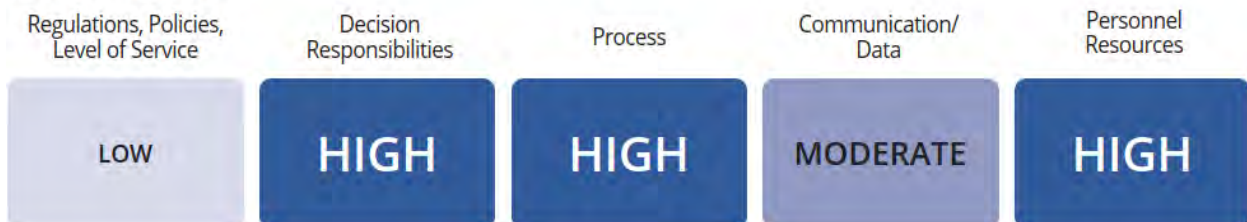
County budget and staffing needs are comprehensively collated, communicated, and decided upon.



Necessary Competencies

17.1	Operations and maintenance funding needs for stormwater and flood control infrastructure (e.g., green infrastructure, dams, levees) are known and planned for.
17.2	A flooding centered capital improvement plan is developed and updated annually.
17.3	Decisions regarding adequacy of flooding centered staffing and resources is performed by the collection of responsible County agencies.

Level of Lift



PROGRAMMATIC DELIVERY

The County is meeting flooding-related requirements as stipulated by current regulations and policies; however, the needs identified in the first section of this document point to significant increased development along with the increased frequency and intensity of storms that result in a much higher likelihood of flooding. County leadership realizes it can and must better plan for avoid, mitigate, manage, and recover from flooding. The Outcomes recommended in this Strategy document outline the technical needs such as data collection and communication, risk and impact assessment, as well as stormwater and flood mitigation infrastructure capital improvement planning and delivery. These technical needs must be integrated with land use planning policies and procedures along with development standards and permitting procedures. To advance the technical, land use, site development, and permitting elements associated with the Outcomes, the County must be organizationally structured and functional to effectively and efficiently use data, modify policies, and reach agreements. The following organizationally focused recommendations are designed to support the County in being fully capable of meeting the Outcomes. The overarching recommendation is to institute a Programmatic Delivery approach. Six specific recommendations follow:



Maintain the Current Agency Structure.

- The current agency structure, which is clearly regulatory driven, is meeting regulatory requirements and is allowing the County to move forward to more comprehensive flood management. Thus, there is no short-term need to adjust the current agency structure.
- Modifications of the structure and organization may result from advancing the Outcomes.



Institute a Steering Committee.

- In order for the comprehensive flood management effort to both be initiated and take hold within the County, reliance upon the current agency structure is not enough.
- A Steering Committee formulated to represent the agencies and provide guidance and provide coordinated, unified advice and recommendations to County leadership is paramount.
- This Steering Committee will be responsible for answering comprehensive flood management questions such as: Where are we going? What are we doing? What needs to be done? What are the required leading investments? Are we consistent across agencies? Are we effectively using staff among these multiple agencies to produce the result associated with the Competencies and Outcomes?
- The Core Team, as part of the Phase 1 effort, was purposely designed to incorporate representation from seven agencies who engage, in some way, with flood-related efforts. The Steering Committee should reflect this same complement of agency representation – MCDOT, MCDEP, OEMHS, MCDPS, OCE, PLANNING, and PARKS.
- The Steering Committee should meet in frequently cadenced meetings, at least once a quarter.

- This Committee serves to initiate the comprehensive flood management program, but equally important it learns of the influences and requests upon resources being asked of their agencies and aims to reach consensus in recommendations made to County leadership.
- This Steering Committee must have the direction and authority to move the entire Montgomery County organization to achieve the recommended Outcomes, including pressing upon individual agencies to advance specific investments and improvements. For this reason, the representative from each agency should be the agency's Director.
- The Steering Committee should select a chair who will lead the Committee and also select a vice-chair who will lead the Committee in the chair's absence.



Develop a Program Construct.

- An overarching purview, or umbrella view, must be developed and maintained that takes advantage of the expertise and experience among the agencies. The proposal is to formulate a programmatic approach that gathers the experience and resources from the appropriate agencies and tackles the accomplishment of the Outcomes together.
- Since the current agency construct is remaining, it is crucial to take a programmatic approach that gathers the experience and resources across agencies to manifest capabilities, skills, and expertise to achieve the Outcomes.
- A programmatic approach will provide the functional processes needed to engage, communicate, manage, and produce results and support the advancement of the Outcomes. At a minimum, the following three functions must be put into place:
 - Performance Management – includes the development of key performance indicators (KPIs) and targets, plus the collection, collation, reconciliation, packaging, reporting and communicating the progress toward the KPI targets, along with needs, and challenges of the programmatic effort.
 - Documentation and Communication – the means to develop and distribute appropriate documents, from reporting templates to public information to Council presentations.
 - Budgeting and Funding - the methodology to calculate cost estimates, designating possible funding mechanisms, and appropriation of operations and capital budgets to achieve the initiation and implementation of the Outcomes.
- The Steering Committee must guide the development, implementation, and progress of this programmatic construct.



Form a Program Delivery Team.

- While the Steering Committee is tasked with advising and guiding, the Program Delivery Team delves into the details of developing the program functions and delivering the Outcomes.
- The Program Delivery Team should be comprised of representation from the agencies involved in delivery of the Outcomes; that is, representation from MCDOT, MCDEP, OEMHS, MCDPS, OCE, PLANNING, and PARKS.



- Members of the Program Delivery Team must stay abreast of Steering Committee activities and decisions, and coordinate with their Director to ensure consistency in messaging and decision-making.
- The Program Delivery Team also ensures the operational relationships among the representative agencies are further developed.
- The Program Delivery Team should select a chair who will lead the Team and also select a vice-chair who will lead the Team in the Chair's absence.



Produce a Business Plan.

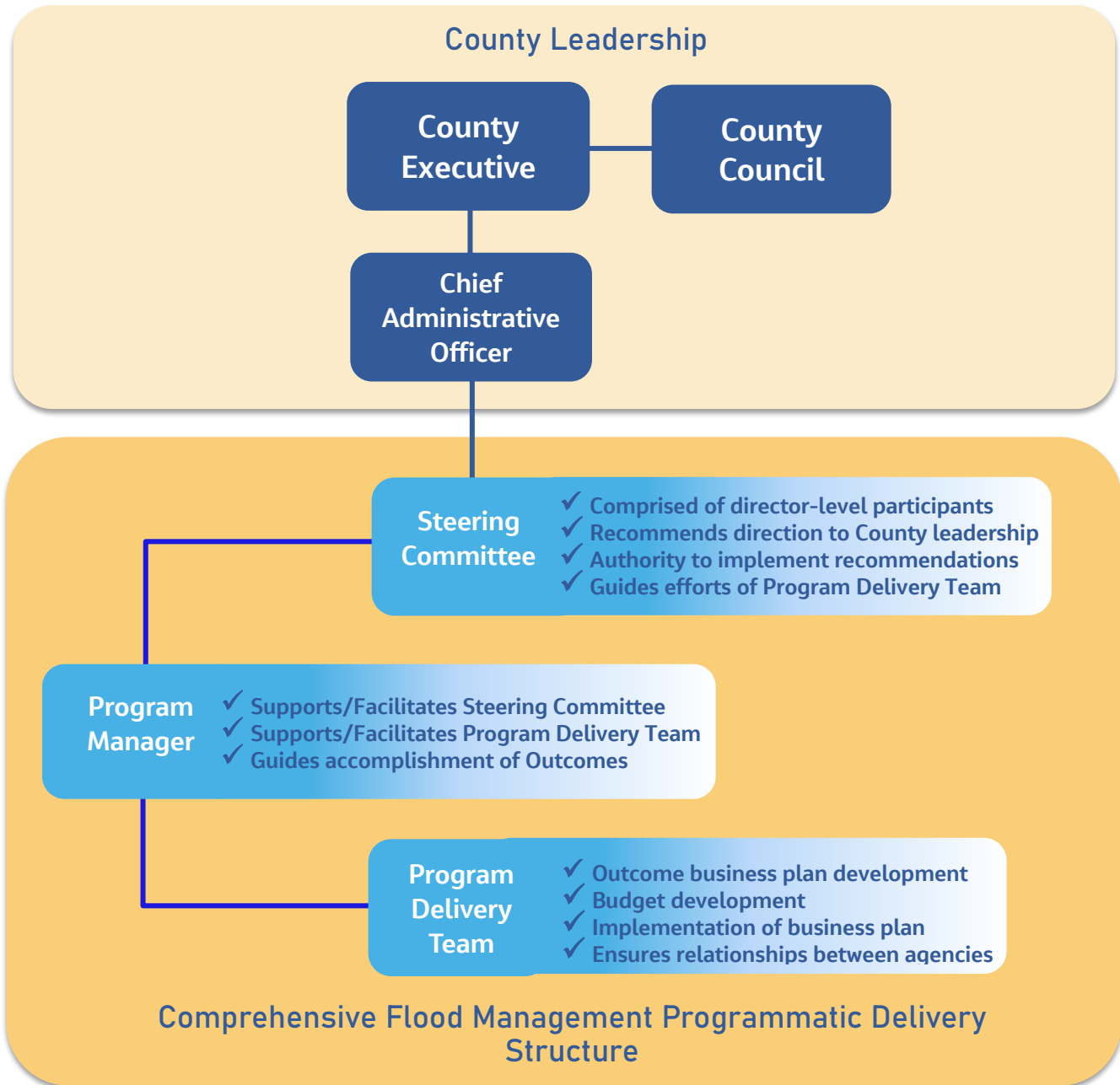
- A Business Plan should be produced and annually updated to characterize details of the comprehensive flood management delivery for the upcoming year's budgeting process.
- This Business Plan is produced by the Program Delivery Team and validated by the Steering Committee.
- The Business Plan includes details on the following:
 - Designation of the priority Outcomes on which to focus .
 - Characterization of specific personnel needs to deliver the Outcomes.
 - Estimates of the costs and investment requirements to reach the desired Competencies and advance the Outcome (includes the breakdown of costs for both agency resources and the external costs for contracted support and tools).
 - Characterization of the funding opportunities for specific Outcome investments.
 - Validation of the stewarding agency and designation of additional agencies and specific resources to support the fulfillment of the Outcomes.
 - Scheduling of the activities throughout the Year 1 time horizon, and subsequently future years.
- The Business Plan document is the primary submittal to the County's leadership characterizing project-level details of accomplishing the Competencies and advancing the Outcomes.



Structure Program Manager Role.

- Designate a program manager who will have responsibility across the entire programmatic effort of advancing the comprehensive flood management Outcomes, not just a single Outcome.
- The program manager is not intended to have authority over operations of any agency, but rather to focus on advancing the interagency program utilizing and supporting the agency representatives embedded in the Program Delivery Team and Steering Committee.
- The program manager must be able to guide the activities associated with implementing the programmatic approach, accomplishing multiple Outcomes, maintain the energy and focus of those efforts, request program administration funding through the appropriate channels, document results, collate performance data, manage the interactions of the Program Delivery Team, support facilitation of the Steering Committee, and report progress.

The resulting recommended organizational construct for programmatic comprehensive flood management delivery is captured in the simple graphic below.



REFERENCES

Jacobs, 2023. *Comprehensive Flood Management Plan Phase 1 Governance & Policy Review Report*. February 10, 2023.

Jacobs, 2022. *Historic Flood Conditions & Data Gaps Technical Memorandum*. December 5, 2022.

