Case Study

Municipality/Nonprofit Organization: City of Cambridge & Resilient Mystic Collaborative
Project Title: Completing a watershed-wide analysis to optimize and coordination regional stormwater management in the Mystic River Watershed
Grant Award: $350,000.00
Match: $243,450.00

Community Overview:
Provide a general description of your community as a brief introduction to the project.

The City of Cambridge is one of 17 municipalities in the Upper Mystic River Watershed, which includes communities upstream of the Amelia Earhart Dam. Portions of the City of Cambridge are located in the Alewife catchment, a low-lying sub-basin within the Upper Mystic watershed that is particularly vulnerable to precipitation-based flooding from fluvial (riverine) and pluvial sources.

The Resilient Mystic Collaborative is a partnership among neighboring communities in Greater Boston's Mystic River Watershed working to protect the people and places within the watershed from climate-intensified risks. The RMC includes both Upper and Lower Mystic River communities and multiple working groups, one of which is the Upper Mystic Stormwater Working Group (UMSWG). The 17 Upper Mystic watershed municipalities that coordinated on this MVP regional stormwater management project are a subset of the RMC and include: Arlington, Belmont, Burlington, Cambridge, Everett, Lexington, Malden, Medford, Melrose, Reading, Somerville, Stoneham, Wakefield, Watertown, Wilmington, Winchester, and Woburn.

Description of Climate Impact:
Address the community's current and potential future vulnerability to climate change impacts. What are the specific threats to the project area/site and reasons for applying to the grant program?

Extreme precipitation events, impacted by climate change, cause the Mystic River watershed to flood more frequently and severely due to changes in intensity and rainfall volume. For example, the Mystic River Watershed experienced a 25-year precipitation event during a March 2010 Nor'easter that caused significant flooding in multiple communities. Memories of that storm, along with increasingly frequent smaller flood events, have made stormwater management a top priority for RMC communities. Many municipalities contributing to this project identified stormwater flooding as a top concern, and some have begun planning infrastructure to be designed to (or accommodate) flooding for events such as the 2070 10-

year, 24-hour precipitation event using downscaled climate projections and hydrologic and hydraulic (H+H) modeling.

The UMSWG recognizes that by working regionally, downstream communities benefit from regional flood and drought management while upstream communities get more funding for improved open space and nature-based solutions (NbS).

Project Goals:
What were the specific goals of the project?

The overall objective of this project was to collaborate, identify, and act upon opportunities of watershed-scale flood mitigation.

The primary goals of this project were to: 1) improve watershed planning tools and data sharing, 2) identify opportunities to scale up nature-based solutions, and 3) explore innovative technologies such as Active Reservoir Management (ARM).

Five secondary goals of this project included:

- Encourage coordination between municipalities and foster co-production and co-learning;
- Modeling realistic, achievable solutions;
- Identify specific barriers to implement and improve long-term readiness of future sites;
- Identify projects that maximize co-benefits (e.g. improved water quality, social equity);
- Provide a replicable and transferable approach

Approach and Result:
How did the project team implement the project? Describe the methodology or your approach to achieve the project goals. Describe, and quantify (where possible) project results (e.g. square footage of habitat restored or created). Provide web links, if available, to your project deliverables.

At the outset of the project, the technical team and Mystic River Watershed Association (MyRWA), conducted interviews with each of the 17 municipalities to gather feedback on previous modeling efforts and municipal staff knowledge of precipitation-based flood exposure. These interviews solicited input from municipal engineers, planners, conservation and emergency management services (EMS) staff.

The mutually shared data allowed upgrades to be made to a regional flood model, pioneering an approach for a shared watershed planning database. This regional participation resulted in a tool that allows communities to better understand present day and future flooding, independent of municipal boundaries. The regional flood model and associated flood maps are beneficial resources, supplementing the FEMA maps, and provide the communities a better understanding of future flood risks using similar datasets, assumptions and scenarios.

To identify key opportunities for green infrastructure (e.g., constructed stormwater wetlands, wetland restoration, distributed green infrastructure, and other NbS), the project team completed tabletop assessments of all 425 open space parcels three acres or more across the Mystic River Watershed. Ranked by physical, equity, and feasibility characteristics, the team narrowed the list down to 140, then 20, then to six locations to develop 10% level conceptual designs.

Key deliverables created through Phase I of this project allowed RMC member municipalities to build consensus around six priority wetland-scale project sites to advance to 10% concept design, while also building a larger portfolio of future GI and ARM opportunities to be prioritized for implementation in future phases for regional stormwater management. The six GI concepts include over 13 acres of stormwater wetlands that manage over 1,000 acres of upstream drainage, creating over 14 million gallons (MG) of new flood storage and cumulatively reducing phosphorus on the order of 600 lbs./year. The project also identified two priority locations (Spy Pond, Arlington and Wright's Pond, Medford) to further explore potential for ARM, or 'smart' forecast-based controls.

To the authors' knowledge, the Mystic Viewer mapping tool, which made modeled flood scenario maps accessible to all Upper Mystic municipalities, is the first application that specifically incorporates the operational procedures at the Amelia Earhart Dam (AED). This tool may be used in the future to inform flood mitigation planning in the watershed by providing new baseline data for storm events such as 1-, 2-, 5-, and 10-year precipitation events. This is an important achievement of this project since these data were not previously generated, or available at the regional watershed scale.

Link to Mystic Viewer Tool (watershed H+H model):
https://geo.stantec.com/MysticRiver/viewer/
Link to project updates website: https://resilient.mysticriver.org/upper-mystic-learn-more
Link to project summary writeup (MyRWA):
https://mysticriver.org/news/2021/2/3/managing-flooding-in-the-upper-mystic?blm_aid=178807809
Link to NEWEA ReACT presentation: https://vimeo.com/481270458

Lessons Learned:

What lessons were learned as a result of the project? Focus on both technical matter of the project and process-oriented lessons learned.

A major takeaway from this project was that communities need to reduce the negative impacts of directly connected impervious areas (DCIA) in order to reduce flooding to an acceptable level/mitigate it completely. After going through the regional modeling exercise and extrapolating to the entire watershed, one of the key outcomes was that the technical analysis helped verify (numerically) that watershed-scale flood volumes cannot be fully mitigated by just creating more upstream stormwater storage. In addition to running the regional stormwater model for the top 6 GI sites and ARM at select sites, a watershed-wide reduction of 30% directly connected impervious area (DCIA) was also simulated. Results from these model simulations indicate the need for additional flood mitigation strategies beyond the addition or restoration of distributed watershed storage. In other words, while constructed stormwater wetlands (and other wetland restoration and NbS projects adding more flood storage) have a multitude of water quality, recreation and other cobenefits, there is not enough non-developed space to fully manage stormwater flooding via wetlands alone.

The outcomes of this modeling exercise have helped the UMSWG better contextualize the necessary balance between structural and non-structural flood mitigation solutions. In particularly, a major takeaway – informing next steps to planning and policy-making within the Upper Mystic Watershed – is to distinguish between "flooding" and "flood damage" and to focus more attention on preventing the latter—especially as it affects people, habitat, and the built environment. Now that the Upper Mystic communities now have a better understanding of where flooding occurs in their communities, planned next steps will include assessing economic impacts, critical infrastructure and mobility flood disruption, and assess equity implications. It is envisioned that these next steps will help communities better prioritize flood mitigation projects based on opportunistic areas for long-term solutions, as well as equitable investment needs.

A few other key lessons learned include the following:

- As discussed during multiple rounds of planning workshops and community engagement, long-term strategies for implementing nature-based solutions for flood mitigation may require addressing structural barriers to implementation. For instance, many low-quality wetland areas, both from hydrologic and ecological perspective, often have local protections or State protections, such as deed restrictions, Article 97, and/or specific Wetland Protection Act protections, which are well-meaning but can be significant roadblocks to permitting or implementation of NbS. While these may seem like upfront barriers to a project, additional coordination of restoration objectives and co-benefits may help unlock greater value in these natural resource areas.

- With the new Alternative TMDL's participatory approach in the Mystic River watershed, many communities also recognize how nature-based projects have localized benefits, such as nutrient reduction and ecological restoration. For urbanized watersheds, these projects should be considered for all of the values they impart (e.g., flood storage, nutrient reductions, wildlife habitat, passive recreation, temperature moderation).

- The ongoing pandemic has shed new light on the importance of open space recreational areas. The co-benefit of wetland parks as passive recreation facilities was very clear and served as an additional driver for some participating communities to consider these multi-benefit, performance-based natural infrastructure concepts.

- Through engagement activities and site investigations, it was noted that another significant driver beyond flood mitigation was the potential water quality benefits that could be achieved through wetland GI projects of this scale. Water quality benefits would help municipalities achieve MS4 compliance.

- Significant insights and ideas were shared by engaging municipal conservation staff early in the project. Flood mitigation and water quality analyses are often performed by planning and engineering staff. However, the identification of opportunities for large-scale nature-based solutions and GI requires a watershed perspective and knowledge of natural lands that many conservation staff can readily contribute. Such knowledge can greatly supplement top-down processes, such as those using GIS methods and aerial imagery, and save substantial effort in identifying target opportunities.

Partners and Other Support:
Include a list of all project partners and describe their role in supporting/assisting in the project.

Kathy Watkins and Catherine Woodbury (City of Cambridge DPW) led grant management activities and participated in all project steering team meetings.

The *Resilient Mystic Collaborative*'s Upper Mystic Stormwater Working Group provided the forum for all communications and workshops for this regional project. Emily Sullivan (Upper Mystic Stormwater Working Group lead) facilitated all communication between the technical consultant team and the many engineers/planners/conservation/EMS staff, which included municipal staff from Arlington, Belmont, Burlington, Cambridge, Everett, Lexington, Malden, Medford, Melrose, Reading, Somerville, Stoneham, Wakefield, Watertown, Wilmington, Winchester, and Woburn.

Kleinfelder led the technical team of consultants, leading the development of the desktop analysis and screening of green infrastructure/ARM opportunities, overseeing the data integration, modeling, and concept development tasks, and all coordination and project management activities.

Stantec led the development and integration of the regional H+H model, and assisted in the interviews and upfront data collection from municipalities.

Dr. Indrani Ghosh (*Weston & Sampson*) provided engineering support for modeling tasks, as well as independent technical review of all desktop analysis and screening of green infrastructure/ARM opportunities.

Hatch Landscape Architects produced the conceptual designs for the six priority green infrastructure sites based on observations from field investigations and site-specific concept discussions with each of the municipalities engineering, planning, and conservation staff.

Mystic River Watershed Association (MyRWA) co-hosted all workshops with the technical team, participated in the field investigations, and assisted in the interviews and upfront data collection from municipalities.

OptiRTC assisted in the development of draft control logic, supporting concept development and modeling for ARM opportunities at Spy Pond and Wright's Pond.

The *Consensus Building Institute (CBI)* assisted in the preparation of the January UMSWG workshop, and facilitated the May (virtual) workshop's interactive polling and breakout group discussions.

Project Photos:

In your electronic submission of this report, please attach (as .jpg) a few representative photos of the project. Photos cannot show persons who can be easily identified, and avoid inclusion of any copyrighted, trademarked, or branded logos in the images.


HATCH