

# **Building Coastal Resilience Through Infrastructure Planning: Final Report**

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## **Project Rationale and Goals**

Capital improvements, specifically new and replacement infrastructure and public buildings are often the largest investments made by communities. In coastal communities where capital improvements are being driven by growth and development as well as degradation by extreme weather events and climate hazards such as sea level rise, capital improvement costs are even higher. Because capital improvements are planned, either in a formal plan or on a project-by project basis, a tremendous opportunity exists to make coastal communities more resilient by informing capital improvement planning through techniques that incorporate information from extreme weather events, climate hazards and changing ocean conditions.

Because local practitioners working on the ground complete these projects, techniques must be mainstreamed; these practices must become common and expected in all communities. They cannot sit in agency silos nor rest only among academic literature. The Association of State Floodplain Managers (ASFPM) and the American Planning Association (APA) represent two of the largest practitioner communities in coastal communities –floodplain managers and planners. With a combined 52,000 members nationally, ASFPM and APA have developed materials to be used by practitioners to incorporate into their local programs. Without mainstreamed techniques, we will fail as a nation to make our coastal communities resilient.

The overall project goal is to mainstream techniques that increase community resiliency by incorporating information from extreme weather events, climate hazards, and changing ocean conditions into local or regional capital improvement plans. Key outcomes from implementing this project are:

- Identification and development of tools, and development of guidance documents that can be used by practitioners in coastal communities nationwide
- Improvement of community capacity to incorporate information related to extreme hazards and climate change into capital improvement planning
- Implementing resilience and adaptation measures in coastal community infrastructure and public buildings
- Better understanding and quantification of costs to replace or construct new public infrastructure and building projects when extreme weather and climate hazards are taken into account.

The deliverables associated with this project are a Planning Advisory Service report, a Technique Inventory, presentations at the APA national conference, ASFPM national

conference, and at the Natural Hazards Workshop in Boulder, Colorado, as well as workshops with our two pilot communities.

## **Scoping**

The initial stages of the project involved reviewing case studies and conducting surveys and interviews with planners, floodplain managers, and other allied practitioners to gauge current strategies and opinions on capital infrastructure planning for future climate. Online surveys were sent to ASFPM and APA members inviting them to provide input on incorporating climate adaptation considerations in CIP planning. NOAA's Digital Coast Partnership organizations were invited to share the survey with their organization's members. Key findings were that local plans and policies vary dramatically, and that oftentimes, engineers and planners do not work collaboratively in developing capital projects. This work falls largely to engineers, while planners respond reactively as needed but without supplying their insight and comprehensive perspective during initial steps. Additionally, climate adaptation planning is generally siloed from capital infrastructure planning. Therefore, need exists to not only increase communication and collaboration across departments, but also to provide techniques that serve communities not only with robust planning processes, but also communities with very limited capacity. In response to these findings, the project was expanded to define "CIP" as capital infrastructure projects in general, not just capital improvement plans; this was intended to be more inclusive to communities without such a standardized plan.

## **Pilot Communities**

In order to evaluate our research findings and gauge usability, the project team worked closely with two coastal pilot communities: Lucas County and the City of Toledo, Ohio, and Chatham County and the City of Savannah, Georgia. These communities were selected because there was prior project experience with these communities and these communities were interested in addressing climate change in their community. These communities are of comparable size and both located on coasts, but experience different climate impacts and have unique challenges. Toledo, situated on Lake Erie, has experienced flooding due to high precipitation events and may be at risk due to fluctuating lake levels, but is not exposed to hurricanes, sea level rise, and tidal activity as Savannah is. Toledo's primary concerns are revitalizing their downtown and redeveloping blighted areas, while Savannah must confront development in a limited space while preserving historic structures.

Three visits were planned to these pilots over the course of the project: the first two were to become familiar with local partners and discuss needs, and the final visit was to

present our completed workshop. These workshops will be described in detail later in this report.

### **Conference Presentations**

This project was presented in sessions during the APA and ASFPM conferences (in April and May of 2019, respectively), as well as via poster at the Natural Hazards Workshop, hosted by the Natural Hazards Center at the University of Colorado- Boulder in July of that same year. This was an excellent opportunity for feedback before the final report and workshops were completed. ASFPM attendees typically represent professionals involved in floodplain management and the APA attendees typically represent professionals involved in various planning related activities in the academic, public and private sectors. The Natural Hazards Workshop primarily consists of students and academics involved in a variety of natural hazard research and policy areas. Conversations with all of these diverse audiences was extremely helpful in determining next steps for our work. Overall, there was a lot of excitement and interest in this topic, and the need for future climate considerations in infrastructure planning was made abundantly clear.

### **Workshops**

Ultimately, four workshops were presented throughout Fall 2019. The audiences for each workshop were quite different, which allowed the project team to assess usability in different groups. The first of these was presented at the Minnesota Floodplain Managers Association Conference at Southwest Minnesota State University in Marshall, MN on November 15, 2019. Approximately 30 floodplain managers and allied professionals from communities across the state of Minnesota participated. This was an unusual set-up, because the workshop was originally intended for all members of the same community to gather, but it was also a great opportunity to learn from knowledgeable experts in floodplain management. The final three workshops were with City of Toledo staff on November 20th, Lucas County staff on the 21st, and a combined City of Savannah and Chatham County group on December 13th. In Savannah, staff from departments within the city, the county, and other communities within the county such as Tybee Island were involved.

The workshops were structured to take place over one work day, five hours total including a break for lunch. Lunch was provided to attendees by the project team. The topics and order in which they were presented was based loosely on the structure of the PAS report, which was being written concurrently with workshop development. During the course of the workshop, attendees were expected to learn:

1. The process of planning, designing, and building a capital infrastructure project (including the “players” involved)
2. The relationship between climate, flood hazards, and infrastructure planning
3. The role and involvement of urban planners and land use planning
4. How climate data is developed and how it can be meaningfully integrated into this process
5. How practitioners or departments can help improve the capital infrastructure planning process for their communities

The first half of the workshop focused on planning for infrastructure resilience: in other words, understanding the people, plans, and data that need to be considered as the foundation of a solid infrastructure process. Instruction alternated between lecture and activities or group discussions. Topics included an overview of how hazards, climate, and infrastructure interact, the benefits of urban planners for infrastructure planning, and a guided activity where the group walked through all of their components in developing an infrastructure project. Given five broad steps of project planning, individuals added more specific activities that would happen during that stage of development (e.g. Site Selection, Public Input, etc). The project team also guided participants in a discussion of how to interpret and find appropriate climate data for their region. In Savannah, we engaged in an additional lunchtime activity tutorial of the *Adapting Stormwater Management for Coastal Flooding* Digital Coast tool.

The second half of the workshop, following lunch, sought to compile those foundational concepts introduced previously and determine how to implement them. Climate data and well informed community plans, such as the comprehensive plan, can be used to inform standards, guidelines, and regulations that are effective and appropriate for long term planning. We also discussed methods to conduct a vulnerability assessment, which can be helpful in prioritizing projects and in site selection.

The final activity of the workshop was to return to the full project process that we developed at the beginning of the day. At this point, participants were divided into three groups with three corresponding post-it note colors: green for climate and scientific data, blue for community plans and social data, and red for barriers. The teams were asked to then place these stickers along the larger process when they would be most useful. For example, “weekly weather forecast” was a green post-it note placed during the Construction phase, and “funding” was a consistent answer for the red notes. Ultimately, it was clear to the group that both social and climate data is essential along the entire development of a capital infrastructure process, and a good design can only come from justified decisions using up-to-date information.

Workshops were evaluated using a course evaluation form adapted from a FEMA template. The form included questions about what kind of department or agency the individual worked for, whether they were involved in infrastructure planning in their day-to-day work, and nine ranked questions about the printed materials, visual materials, length, and so other metrics. Answer options for the ranked questions went from “Strongly Disagree” to “Strongly Agree”.

## **Workshop Findings**

### *Minnesota, November 15th*

The first workshop was held at the Minnesota Floodplain Managers Association Conference at Southwest Minnesota State University on Friday, November 15, 2019. In attendance were approximately 30 individuals, mostly floodplain managers from around the state. Although this was not the audience the workshop was designed for, it provided an opportunity to gain feedback from educated professionals well versed in the topics at hand. However, it lacked the focus around one specific community, which is a key component of the workshops that took place afterward.

All in all, reviews from this group were largely positive. It was understood that the audience here was somewhat out of scope, as very little of Minnesota lies on the coast (Lake Superior). Individuals noted that they found benefit from anecdotal examples provided by Bill Brown and encouraged the development of more specific case studies in the future to enhance broader generalized information. Case studies particularly relating to social vulnerability were of interest, as this issue has gained more awareness in both academic and professional groups. We believe that as capital infrastructure as an intervention for community hazards resilience becomes more standard practice, case studies and examples will follow and can enhance the existing structure of this workshop.

The final recommendation made by this group was to provide a list of resources related to each topic. Now that the Technique Inventory has been completed, it could be offered to workshop participants preceding or during the event.

We were also concerned with determining the scalability of these efforts to different sizes and types of communities. The gathered Minnesota conference attendees saw potential for scaling this workshop to rural communities, and also emphasized the value in reaching out to that audience. While larger urban communities may have money, personnel, or technical resources, rural locales may benefit from external assistance.

### *City of Toledo, November 20th*

Following Minnesota, the workshop was run for nine attendees, all staff in various departments for the City of Toledo. A wide variety of allied fields were represented including Environmental Services, the Department of Public Utilities, City Engineering, Division of Streets, Bridges, and Harbor, Division of Building Inspection, and the Toledo Lucas County Planning Commission. The content of the workshop was nearly identical to that which was presented in Minnesota, but with members of one community working as a team. In this way, the workshop was more successful, because we were able to engage with the participants about very specific issues and needs.

Again, reviews were largely positive from attendees. They believed that the presenters were well prepared and engaged with participants, and enjoyed the group exercises. The only suggestion was that more local examples specifically in a lake setting would be helpful, as many of our case studies involved issues like sea level rise and hurricane preparedness. It may be possible to adapt the workshop and have two versions, each relating to the different conditions of lake versus ocean settings.

The success of this workshop relied largely on the energy and interest of the participants. We were extremely grateful to the staff in Toledo who coordinated our visit, arranged a meeting space, and came prepared with interesting questions and meaningful discussion.

### *Lucas County, November 21st*

One of the biggest challenges in this ambitious project was maintaining relationships with local contacts over its entire course. This made buy-in from potential attendees more difficult to ensure than anticipated. Therefore, when we met with Lucas County staff, we adapted our content, PowerPoint slides, and activities to be more of a loosely structured group discussion. We had three participants from the County, representing Facilities, Engineering, and the Toledo-Lucas County Sustainability Commission. Instead of the original workshop, we focused on a discussion of what they believe Lucas County's strengths are in reference to infrastructure planning, challenges they face, and topics they would like more information and resources about in the future. Hopefully, with this information, we can inform the scope of future projects and meet expressed needs.

Lucas County's strengths lie in the quality of local partnerships with robust, popular organizations such as the Toledo Zoo, the Toledo Metropolitan Area Council of Governments, and the Metroparks. Attendees also agreed that communication between County departments tends to be good, and that they had assembled a comprehensive and current GIS database of their current infrastructure projects, available to view

online. This increases transparency and allows not only the public, but also other informed County stakeholders to understand changes in the community and weigh in.

However, many obstacles exist that are commonplace in many parts of the nation. Certain urban planning policies, such as zoning, have no rigorous enforceability and can be easily changed. Staff are limited in the projects that they can pursue, often only being able to work with proposals that are immediately vital. This can cause some structures to be repaired piecemeal, ultimately being more costly and less effective. The site selection process also causes holdups in the process. It is more cost effective to develop green space rather than redevelop blighted parcels; no incentive exists to develop more densely.

Lucas County's needs are largely related to this final issue. They would like to learn more about tax incentives for rebuilds and improving existing buildings, case studies where the benefits of blight removal and redevelopment were quantified, and examples from comparable communities which have a robust process for evaluating flood risk on existing sites.

#### *City of Savannah/Chatham County, December 13th*

The final workshop was a combined audience of City of Savannah staff, Chatham County Engineering staff, a private consultant from GMC, representation from the Metropolitan Planning Commission, and a member of the Tybee Island staff. This made for a lively discussion and was a good combination of all the types of people we designed the workshop to engage. This nine person group completed the workshop as written, identical to the City of Toledo other than an additional lunchtime demonstration of NOAA Digital Coast tools. At workshop completion, we compiled a list of takeaways suggested by the attendees.

The whole group agreed that there is real value in "bringing everyone to the table", and admitted that this rarely happens and would be a good practice to continue in the future. Other consensus sentiments were that having reliable and current climate data is essential, and that planners should be invited to capital infrastructure discussions. This group was, as in the City of Toledo, interested in social and environmental justice. There was a strong sense that community members who will be most greatly impacted by flooding should be involved in planning processes across the county. The addition of the Digital Coast tutorial was also positively received. Awareness of that wealth of resources is not as high as expected; in the future, greater integration of Digital Coast tools into workshops would be informative and also entertaining, as it can be highly interactive.



As in Lucas County, the workshop leaders asked participants what topics they would like to learn more about in the future. The main interests were in living shorelines, low maintenance green infrastructure projects, and specific case studies of those projects in comparable communities.

### **Technique Inventory**

The Technique Inventory is a comprehensive document that summarizes case studies, reports, and other useful resources related to capital infrastructure planning and climate. This sixteen page compilation is divided into sections: Data Tools, Vulnerability Assessment, Urban Planning Tools and Plans, Standards Guidelines and Regulations, Adaptation, Relocation of Key Facilities, Legislation, and Financing Mechanisms. Each entry includes a web link to access the resource as well as a brief summary of what can be found there and how it could be used. Some resources include a “Replicability” section, which describes how easily a particular case study could be adapted in a different community or context. Many of these resources are also highlighted in the PAS report, but this inventory goes beyond the report to include others that didn’t naturally fit into the body of the report.

### **PAS Report**

Planning Advisory Service reports, or PAS reports, are a quarterly publication produced by the APA as “practical guides for practicing planners”. The PAS report is arguably the farthest reaching and most essential deliverable from this project. The final document of PAS 596 consists of seven chapters and 128 pages, published in full on December 31, 2019. By monthly average, The *Planning for Infrastructure Resilience* is the most viewed PAS report in APA history. As of January 2020, it had been downloaded 860 times, with a total of 2,791 page views. This illustrates a clear interest and desire for more information concerning infrastructure and climate, and a need to provide sound guidance at the local level on these difficult topics.

We believe that the PAS Report is extremely successful as a big-picture, nationally scaled view of the challenges and state of practice of planning for infrastructure resilience. However, there were a few inherent limitations to this report. The topic of planning for infrastructure that is resilient to climate impacts is still emerging in practice. Guidance for planners would naturally follow better-defined guidance for those practitioners directly involved in the siting, design, and construction of infrastructure. This guidance, however, is fractured, disjointed, and surprisingly sparse, especially in communities that are not major cities. This issue is noted throughout the report, but especially in the chapter dealing with infrastructure design. This made developing guidance for *planners specifically*, extremely challenging.

As outlined in the original scope of work, the PAS Report was intended for coastal communities. Throughout the development of the report, however, we noted the need for guidance outside of specifically coastal communities. By transitioning to a more national scope, we helped to center this conversation beyond those communities dealing with sea level rise. However, we were also faced with confronting some of those same challenges that non-coastal cities and communities must deal with. In reality, this is reflected in the quality of data and tools for climate change-related changes to precipitation patterns. The science is far more variable, conflicting, and uncertain in this area, as precipitation rates are much more heavily dependent upon extremely complex local and regional weather and geographic particularities. While we noted this throughout the report, we did admittedly lean more heavily on sea-level and coastal impacts than precipitation impacts. This is one area of potential future study.

Finally, given the various changes made to the PAS Report throughout its development, we believe that some of the more prescriptive outlining and content developed at the beginning of the project were ultimately restrictive. Only by going through a long development and editorial process were we able to develop a strong outline and report. Rather than attempting to develop the PAS Report simultaneously along with other project deliverables, the report should have begun development upon *completion* of those deliverables. This would have given us far firmer ground to stand on, and real world applications for the guidance we were developing. Eventually, this is where the report ended up, but only through the course of a very complex period of revisions and rewriting.

Even in light of these limitations and shortcomings, we believe that this report is among the most comprehensive compilations of guidance on this subject in the nation. There is a wide (but still limited) array of literature on this topic. Rarely has it been assembled into a defined process, and never before has it been applied specifically to the practice of community planning. Therefore, this report breaks new ground in an extremely underexplored area of practice. We believe that charting this path forward is crucial for advancing both the role of planning in community resilience, and the urgent need to proactively plan for infrastructure that is resilient to climate change and its impacts.

### **Project Findings and Limitations**

The largest variable in determining success or failure of pilot community projects is the presence or invested partners in that community. “Gate keepers”, or influential and respected community leaders, are highly necessary to develop and maintain lasting relationships. In some cases, if a project is endorsed by a well liked local official, that is the key to having anyone attend an event such as a workshop. While national partners

such as ASFPM and APA can forge contacts, it is extremely challenging to bridge those relationships as staff turns over, or elections displace officials. It isn't clear how best to remedy that situation, but is a recurring issue that needs to be addressed. National guidance is good and necessary, but actually achieving this in practice requires concerted ongoing effort, training, and education in a targeting manner. This may require prolonged engagement with specific communities to train them on every step of the process, not in three visits, but through many small projects and interactions.

A frustration inherent to working at the national level is that one general, prescribed solution cannot suit all communities. As previously described, local conditions, capacity, and staff structure vary widely. This begs the question of whether broad, conceptual workshops can be helpful to any community without many built in components that can be adapted and personalized. While this project team did reach out to pilot communities before meeting and attempted to be well versed on local plans and policies, there may be a better process for bringing this project to the local level. Group discussions and more loosely defined conversational time at the workshop was essential to ensuring that the topics actually of interest were addressed to a satisfactory level for the participants.

It is extremely daunting to create guidance language and plans about future climate, while so many aspects of future climate are yet unknown. There are no "tried and true" strategies that have proven effective and can be easily copied from one community to another. In the absence of public or political interest, funding, or technical capacity, local staff either cannot or will not develop guidelines and standards that may be seen as impediments to capital growth. Even in places where staff are interested, willing, and able to create language surrounding future climate conditions planning, there is no solid precedent to follow. This limitation is even more daunting considering that projects at a federal level are no longer required to consider future climate.

Every workshop group requested more success stories in the future. Finding communities that have succeeded in small or large climate planning projects would be useful, and making sure that local practitioners who want to hear these stories are made aware of them and can easily access them. This necessitates ongoing communication from ASFPM and APA to local departments and staff, beyond the temporal bounds of this particular project.

Our scoping findings were reinforced, as multiple workshop groups agreed that planners are rarely involved in the infrastructure planning process, community plans are not consulted, and planners tend to act in a reactive capacity to development proposals, rather than proactively working to develop them. In all of our workshops, there were individuals essential to their community's civic livelihood who had not met before in

person. More future projects that build coalitions of diverse local staff may lead to forward motion on climate resilience, as these individuals learn together as a group and continue meeting over time. In this way, our national scale staff can assist in creating structures at the local level that can persist after the workshop itself has ended.

### **Recommendations and Next Steps**

The relationship of capital infrastructure, future climate hazards, and urban planning is only beginning to be understood as a meaningful way to ensure safety and vitality in our cities. As a project in a new realm of research, this work was idealized, especially in reference to site selection. An assumption was made that we were describing brand new projects on land that has no conflict/existing structures, which is hardly, if ever, the case in a real community. A recurring topic of discussion in every workshop was interest in learning more about how to ease redevelopment of parcels or improving/updating existing projects. This includes the need for reliably scheduled maintenance and planning for long term funding of maintenance projects. This cost is difficult to plan for, not politically attractive, and difficult to ensure when a structure is first built. Guidance specifically about how to advocate for inclusion of maintenance funding was requested.

Finally, making active and thoughtful use of our partner resources would make such a workshop more engaging, more informative, and would also benefit our partner organizations. NOAA, as an example, has a wealth of Digital Coast tools that we had assumed our pilot communities were aware of. However, that assumption was incorrect; these tools are interesting and can be utilized to inform future work.

As communities or private organizations develop Capital Plans that incorporate climate adaptation considerations, it is important to identify those entities so that others can learn from their experiences. It is recommended that an online repository of best practices and case studies be developed and maintained, providing others with resources to develop or enhance their own programs. We would encourage NOAA to consider either developing or supporting such a repository.