

**NDRC: Resilient Approaches to Water and Green Infrastructure
Webinar Transcript
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3:00 – 4:30 pm**

Patrick Taylor: Planning and Development. With that I will turn it over to today's presenters.

Duncan Yetman: Hi, welcome everyone. This is Duncan Yetman. I'm a CPD (Community Planning and Development) Specialist in the Office of Block Grant Assistance here at HUD. I'm joined here in the room by Steve Shepherd in the Office of Economic Resilience here at HUD. We're very pleased to have several excellent presenters today on today's webinar on green infrastructure and resiliency. I'm going to begin by just introducing the presenters, and then I will hand the presentation over to our first presenter.

From the Environmental Protection Agency we have Mahri Monson an Environmental Protection Specialist at the Agency. From the National Oceanic and Atmospheric Administration (NOAA) we have Kateryna Wowk with us today, a Senior Social Scientist at NOAA. From the Conservation Fund we have Kendra Briechle. She is a Senior Training Associate with the Conservation Leadership Network. From the University of Louisville Environmental Finance Center we have Dr. Lauren C. Heberle. She is the Director of the Center for Environmental Policy and Management at the University of Louisville. Then finally we have with us at the end of the presentation, Cheri Bush. Cheri is the Supervising Engineer with the Metropolitan Sewer District of Greater Cincinnati. Without further ado, I will shift the presentation over to Mahri.

Mahri: Excellent. Thank you so much. Can everyone hear me.

Duncan: Yes.

Steve Shepherd: Yes.

Mahri: Great. Thanks. I'm really thrilled to be part of this. I think the National Disaster Resilience Competition is so exciting, and I'm really excited about all of the work going into this and particularly in efforts to include green infrastructure as part of resilience strategies for building resilience in communities. First of all, the folks on the line here all know first hand about the variety of challenges that communities are facing with regard to stormwater runoff and water supply. We have garbage and other stormwater pollutants that get run off in our communities and go into our waterways degrading our waters. We have excess volume and velocity of storm water coming off of our impervious areas causing flooding and erosion.

We know big swaths of the country are facing increasing drought conditions that lead to water scarcity issues, and then after extended periods of drought, when it does rain, the runoff rates are very high. We also know that with development, typically we have increases in all of the impervious cover, and that again increases our stormwater volumes and velocity leading to water quality impacts. We've been seeing over the last number of years a paradigm shift in how we view stormwater management. The historical and traditional approach really was all about getting rainwater away from the site where it falls as quickly as possible into whatever our nearest water body is, or into detention ponds in order to do some control for peak flow.

We've really been seeing a shift over the past number of years toward green infrastructure approaches and incorporating green infrastructure into the design of our projects, whether they be new or retrofits. There are a lot of benefits that come with incorporating this green infrastructure approach viewing storm water as a resource, slowing down the flow, so that we allow infiltration

closer to the sites. We're able to manage more storm water onsite. That helps us to reduce our pollutant loads to our local waters and flooding impacts. Again, as all of the folks on this call know, climate change adds some challenges to the existing stormwater runoff impacts that we already see. Flooding is increasing.

We've got some statistics up here from various sources from our EPA Green Infrastructure and Climate Resilience Website talking about the increases in flooding that we are already seeing and will continue to face in the future, increase in droughts and in the severity of droughts, increase in coastal damage due to storm surge and sea level rise, and certainly the impacts on urban heat islands and heat waves being more frequent and more severe. We definitely see the challenges increase by climate change.

Luckily, green infrastructure is one approach that can contribute to resilience of communities to climate change. Again, I think the folks on the line hopefully know and have worked on and at least have seen lots of interesting examples of green infrastructure in your communities incorporating bioretention cells into parking lots to help manage stormwater, incorporating permeable pavements into driveways and parking lots and walkways. Bioswales next to roads to help manage stormwater runoff from roadways.

The next few slides here I have are some lovely pictures. That's one of the fun things I think about working in green infrastructure. In addition to all of the benefits for stormwater management and resilience and reduction of urban heat impacts, they are very lovely to look at and great community amenities. Here we have a couple of green roof examples. Here's a rainwater harvesting system in Houston at the Texas Medical Center that manages 1,000 gallons of rainwater through seven storage tanks. This water is used for toilet flushing and irrigation. This particular project has allowed for rain water to displace 60 percent of the water use needed.

Again, here are some examples of bioretention, managing the stormwater runoff next to roadways. There's a lot of communities doing downspout disconnection programs, which are a nice way to promote green infrastructure practices and reduce the inflow into stormwater-collection systems.

This is one slide on a particular example of a community that did a project on 134 acres of retail and residential development using a whole slew of green infrastructure approaches. They got to see this put to the actual, real world test last year when they had nearly ten inches of rain in a four-day period. Lots of other communities in the Twin Cities, Minneapolis - St. Paul area had flooding, but this particular development had only minimal runoff from their site reaching the regional infiltration basins.

Again, green infrastructure is one important contributor to building community resilience to climate change. In addition to the other benefits, this slide lays out a number of the ways that green infrastructure specifically builds resilience, from mitigating some carbon pollution, again, green infrastructure like permeable pavements and rain gardens, helping with flooding, groundwater recharge, reducing dependence on imported water, and again mitigating the urban, heat island impact. There's also a lot of interesting projects looking at living shorelines and buffers to help reduce the impact of storm surge in communities.

I'm going to tell you just a little bit about what EPA is doing for green infrastructure. One of the things that we've had ongoing over the past number of years are our green infrastructure, technical assistance. We've given more than two million dollars to 39 communities across the country. In 2014, three of those projects were specifically related to green infrastructure for climate resilience. Norfolk, Virginia is looking at coastal flooding and sea level rise. Iowa City, Iowa looking at riverfront-park options to manage flooding. There will be reports on both of those two projects forthcoming at some point.

The third example on this slide is Santa Monica, California who was looking at rainwater harvesting for public-park irrigation. That report actually is up on EPA's Green Infrastructure Website if you want to take a look at that. It's a 50 page write up of their experience in Santa Monica doing that. We also have a collaborative between a number of federal agencies, a number of active NGOs and private sector entities to lever our efforts and build our knowledge to help promote more green infrastructure adoption throughout the country. We have 30 organizations that have signed on to work with us on this. You can also check that out on our EPA Green Infrastructure Website.

There's also one particular recent report that we wanted to draw your attention to, which is specifically looking at how green infrastructure can be used to enhance sustainable communities and kind of smart growth principles. There's a link to that report there--really trying to broaden the conversation for how managing stormwater for green infrastructure can also be incorporated into achieving other public health social, economic, and environmental benefits.

With that, this is just a quick screen shot of our EPA Green Infrastructure Website where you can take a look at all of the information and resources and current opportunities that we have up there, including some information on resilience. I'm going to end it there. I understand we'll have time now if folks have questions. I'll also say that I'm really excited about the other presenters on this webinar right now. Thank you so much. [Pause from 00:11:51 to 00:11:58]

Duncan Yetman: Okay. Are there any questions for Mahri at this point? If not, we'll move onto our second presentation today.

Patrick Taylor: This is Patrick Taylor from Cloudburst. There's one question: will the Powerpoint content be available following the webcast? The answer to that is yes. All of the materials are posted on the HUD NDRC webpage on the HUD Exchange. It usually takes about seven days after each presentation for them to get posted. [Pause from 00:12:33 to 00:12:36]

Duncan Yetman: Good. Thanks, Patrick. Okay. We're moving onto the second presentation then at this point. I will turn it over to Kateryna Wowk.

Kateryna: Great. Thank you, Duncan. Can everybody hear me?

Female: Yes.

Kateryna: Wonderful! Thanks very much for attending today and for inviting me to talk to you about NOAA's work related to green infrastructure. Of course we take more of a coastal resilience perspective, which is what I'm going to talk to you today about. If you could please advance to the presenter slide, slide three. I am Kateryna Wowk. I'm a Senior Social Scientist who supports NOAA's chief economist. Our chief economist has purview over all social science in the agency. We've been doing a lot of work on green infrastructure, and the societal benefits that these approaches can advance in addition to some of the ecological benefits. Just by way of background. I was NOAA's policy lead on the Hurricane Sandy (*ed. note, unintelligible*) and have been working with other federal agencies including of course EPA, HUD and others in advancing interagency and administration efforts related to green infrastructure approaches. There's really a lot going on. Very excited to have today's topic focus on this, so we could all have a discussion a little more about it.

Next slide please. For the agenda, very briefly we'll go over a little bit on what coastal resilience is in NOAA's perspective, turning to our focus what we call natural infrastructure or green infrastructure, go over some tools and resources that we hope that you all may find useful, and then ending with some research needs, those knowledge gaps that we think are critical to fill to help advancement of these approaches.

Moving on to the next slide on coastal resilience, at NOAA we see our role as helping people, communities, and businesses find and use the right information they need to understand what their risks are and to make smart decisions, smart investments that prepare them for a changing planet because we all know some of these changes are beginning to happen more rapidly. These decisions, when we think about resilience as Mahri was saying, really span the intersection of society, the economy, and the environment.

At NOAA, again, our role is, in resilience, providing information, tools to others to help them make decisions that strengthen all three pillars of resilience: societal, economic, and ecological. If coastal resilience then really means helping communities to strengthen to secure resilience across all three of these pillars, that's of course a very tall order. It's typically not within the purview of any one entity to address all three, and there are interrelated, extreme complexities across all three aspects. One way to address this is creating tools and frameworks to help us to understand, not only the interconnectivities across all three pillars, but where any one entity or institution might be able to provide a value add in strengthening one or more of these pillars of resilience. To that end NOAA, The Nature Conservancy, and other partners have been working on other framework called Coastal Resilience 2.0. I failed to include the--

Oh, there's the web link at the bottom of the slide. I encourage you to visit the site. It provides the framework for looking at coastal resilience across four critical elements, assessing risk and vulnerability, identifying solutions, taking action, and measuring effectiveness. Certainly, this is only one tool that can help us think about coastal resilience, but we hope that it's useful to you. There's a lot of case studies in there. There's a map with some very geographically tailored information in some areas of the U.S. Again, we hope it's useful. Moving more specifically to natural or green infrastructure, of course, we see this as one approach that really can help to strengthen all three areas.

Not only can it have biodiversity benefits and strengthen ecosystem resilience, it can provide tourism, recreational benefits, even job opportunities. We think this is one approach that really holds a lot of promise.

Please, if you'd go to the next slide. Up until now, I'm sure all of you know that, when it comes to coastal protection, most people are thinking of gray, hardened, built options like seawalls, riprap, levees, dikes, et cetera. Most people, however, don't recognize that there are a lot of tradeoffs in putting in these built structures. For example, built options can have negative consequences for coastal ecosystems of course. In some cases, they can even push the force of the waves to neighboring properties, causing even more erosion and damage at the end of the built structure.

Also, built options only provide benefits when a storm surge or a wave is approaching, and they have a limited lifetime. They start to weaken the day that they are put in, the way that any hardened, engineered structure does. Of course, another option, and why we're all here today, is to think about using natural approaches such as some of the ecosystems that are featured on this slide. There is increasing evidence that natural habitats, salt marshes, coral base, mangroves, sea grass, dunes, barrier islands can provide storm and coastal flooding protection.

Next slide please. Until recently, there really has not been a lot of research to help us understand the specific attenuation and erosion protection benefits of these ecosystems. My colleagues and I at NOAA completed a literature synthesis recently and produced a paper that summarizes the state of the science on natural infrastructure approaches, and highlights the ecological factors that generally affect the amount of wave reductions that you can expect from most coastal ecosystems. I'll just note quickly that paper is cited on the final slide to my presentation today.

Going into more depth on that, these factors include generally the size of the ecosystem, vegetation denseness and stiffness and plant biomass production. In our paper, we also discussed some of the benefits of natural infrastructure as well as some of the weaknesses. I'll go into some of the benefits here, including that, instead of depreciating it actually appreciates. It tends to strengthen with time unless there is some additional stressor that is introduced. It provides benefits all of the time, not just when waves are approaching. Natural infrastructure also can be self maintaining, and it has the potential for self repair after a storm.

There are also some studies that are showing that some types of natural infrastructure can actually grow and keep pace with sea level rise, which is some exciting research. In the past few years, there's really been additionally, very exciting research in this area that's helping demonstrate the specific roles ecosystems can play in storm protection. Again, our paper is cited at the end of this presentation. We won't go into all of that research here, but I encourage you to look at our paper, which provides all of the references of the research that I'm mentioning now.

Next slide please. Here I wanted to point out that natural infrastructure provides, not only wave attenuation benefits, but many additional co-benefits to coastal communities, again, such as nursery habitat for fish, carbon sequestration and storage, water quality improvements like we just heard about, as well as, aesthetic and recreational benefits, which are important for coastal tourism. In analyzing the cost effectiveness of these approaches, we really have to consider all of the benefits that these approaches are providing to society, all of the benefits that provide us with resilience across our economies, our society, and our ecosystem.

Next slide. I wanted to point out briefly too, that there are further opportunities for innovation in this area and especially in hybrid approaches. In the hybrid approach, you have specific built infrastructure such as a removable seawall or a floodgate as shown here installed simultaneously with restored or created natural infrastructure such as salt marsh and oyster base. We think that these approaches in particular provide a lot of promise particularly for cities and urbanized areas that may not have a lot of free and open area that they can dedicate to natural infrastructure approaches, but, with a hybrid approach, you can condense down the coastal protection structures, so that natural infrastructure is providing key storm benefits for small or medium storms. Then if a large storm is expected, the built infrastructure can be used for additional protection. It's also important to note that natural infrastructure - built infrastructure, of course, is strongest when it's first implemented with natural infrastructure, it's the converse, right. It's weakest when it's first implemented, when it's first planted, and it establishes and strengthens with time. In a hybrid approach some built infrastructure can protect it while it's establishing, and after it grows stronger to later be removed, one example.

Next slide please. I wanted to point out some tools and resources that, again, we hope are useful for you all. NOAA does release grants for natural infrastructure approaches and investigating some of the key research areas. We're interested in of course, those are available through Grants.Gov. We also have experts and training opportunities through our Digital Coast platform and our Office of Coastal Management. If you haven't visited Digital Coast, I really encourage you to check it out. The data checklist that's featured here is included in that site. Digital Coast has a whole section on green infrastructure and it includes the data checklist - what data do you need when you're thinking about these approaches. It has a mapping guide. There's an armoire really of information there to guide and again like I said, even training opportunities that we hope are useful to you. I'd be happy to connect with you folks either today or later on as you're thinking about these approaches.

All that said, I want to wrap this up by noting that we do have a lot of information on the efficacy and capabilities of these approaches. We think, in many instances, we have enough information to be able to implement these approaches now with enough certainty. We also recognize that there are some critical knowledge gaps around using natural infrastructure approaches for our coast and

for our coastal protection. I wanted to end by saying that, if you all are looking to implement specific projects using green infrastructure, we really encourage you to think about these knowledge gaps, that I'm going to talk next in my final slide. Think about these knowledge gaps and how your project could both enhance your coastal resilience, provide coastal protection, but also help to address some of these knowledge gaps that, again, we think are high priority and very critical to fill if we're going to advance the more widespread adoption of these approaches and really prove out their capabilities.

These knowledge gaps have been compiled in what I think is a very useful document. If you'll go to my final slide, this is the document to which I am referring. You can google it and find it online or again contact me afterwards, and I'd be happy to direct you to it. It's the Ecosystem-Service Assessment: Research Needs for Coastal Green Infrastructure. About a month ago around the tenth anniversary of Hurricane Katrina, the White House released this research agenda. The effort was co-chaired by the Department of the Interior and NOAA, with additional agencies that contributed to the document and the task force and crafting it including EPA and HUD and others. The report synthesizes the state of the science on using natural infrastructure approaches for our coast, and then recommends high priority areas for federal research to, again, support the integration of these approaches into risk reduction, climate resilience planning, and decision making.

We hope that the report also serves as a very useful reference for state and local planners and federal planners and decision makers in communicating about the major categories of coastal green infrastructure, the ecosystem services, the co-benefits that these approaches provide, and the factors that need to be taken into account when trying to determine which approach might be right for your community. Very, very quickly I can just tell you the five research topics that we identify as high priority to fill knowledge gaps around, on metrics to evaluate effectiveness on what we call production functions.

These are mathematical equations that can express how biophysical functioning results in some of the benefits that we like to see from these approaches. Ecosystem services evaluation is number three. Number four is really providing more information and data on key socioeconomic factors that these approaches can help to strengthen and address. Number five is the decision making context, those critical decision making needs that we really need to target our information toward in using these. Again, that's a very broad overview, but I encourage you to look at this document and think about how it might fit within the scope of your work as you continue forward.

Again, in NOAA and in the U.S. we're seeing a lot of support for both natural infrastructure and for hybrid approaches. We're really looking forward to working with our sister agencies, but also with our state and local partners, with our private-sector partners and NGOs envisioning a better more resilience and healthier future for our coverage. Again, I thank you so much for your attention and look forward to the continuing discussion [Pause from 00:30:19 to 00:30:27]. That's all I have.

Duncan Yetman: Okay. Thank you, Kateryna. We do have a question that's come in to the Q&A. I'll read it. I'm not sure this is peculiar to your presentation. It might be referencing the National Disaster Resilience Competition. Maybe this is also for NOAA as well. Do you offer funding for pre- and post-intervention metrics support? We want to have a number of aspects measured to prove out effectiveness of various interventions. Would this be considered planning money?

Kateryna: I'm not sure if that question is specific to NOAA. I mean, each grant is very tailored, and so within each grant there may or may not be support and a specific requirement for such metrics development, but that's not how we would characterize - we don't characterize our

funding by planning for responses. It's not how we break it out I guess. I'm not sure that that question is specific for NOAA.

Duncan Yetman: Okay. Mahri. The questioner has actually come back to us saying either NOAA or EPA. Mahri, do you have anything to offer on that point? [Pause from 00:32:01 to 00:32:12]

Kateryna: This is Kateryna again. I will say that I think the metrics question is a particularly ripe one to move out on. Again, the number one research topic that was identified as a critical gap in the White House research agenda was on metrics. We recognize that we really need to start to hone in on a synthesized set. I cannot speak to the current grants that are out there for NOAA and whether or not they have that specific requirement. If I were a betting woman, I'd say that some of them probably do. I do think that this is going to become more and more a topic of discussion and a recognized need across the agencies and hopefully their granting processes because it's really an important, critical gap that is of much discussion at some very high levels. [Pause from 00:33:11 to 00:33:14]

Duncan Yetman: Okay. Thank you. There's no literature synthesis for review right now on resilience metrics.

Kateryna: I will say that the Department of Interior with some of their disaster relief supplemental funding has been working on -- they have an expert on metrics-- I don't want to speak on behalf of them, but NOAA participated in this group, so I can talk a little bit to it. They had a metrics expert working group that did start to identify some of the metrics that should be considered to characterize ecosystem resilience. I also know that under the climate natural resources, priority agenda, which is part of the President's climate action plan, this is a public document. It also calls for increased work and support to identify metrics for community resilience and ecosystem resilience. Many of the findings of these groups are either not fully developed yet, or not yet public, but hopefully it will become more clear soon how the public and other levels of government and other partners can become engaged, because certainly we will have to broaden it out because it's an issue we all need to weigh in on. I hope that's helpful.

Duncan Yetman: Mahri, do you have anything additional to add to Kateryna's response there? [Pause from 00:35:00 to 00:35:08] No. Okay. Alright. Well, I'm going to hand the presentation over to our next presenter, Kendra Briechele from the Conservation Fund.

Kendra Briechele: Great. Thank you. Let me just click over with the presenter requirement. Let's get started. Hi, everyone. This is Kendra Briechele. I'm with the Conservation Fund. I'm based out of Arlington, Virginia working for the Conservation Fund. I work for our Conservation Leadership Network and work across the country on green infrastructure and other issues. There we go.

I just wanted to start by saying thank you for the opportunity from HUD's perspective to be presenting to you today and talking about this subject. I think the Conservation Fund has a really rich book of work on green infrastructure, and I'll talk a good deal about that today. I want to thank Mahri and Kateryna for really teeing up the green-infrastructure issues and providing such a great context for this presentation. Their great work contributes so much to resiliency. I'm going to build off on that on how we work with communities across the country at a mix of scales on green infrastructure.

That's what we're going to go into next, do a little bit of overview and introduction to green infrastructure, introduction to resiliency, build off of the prior presentations, and then I was asked to go a little bit more into the methodology and design across the scales and then spend a good bit of

time on some examples from across the country. For those of you unfamiliar with the Conservation Fund, I did just want to provide a short background. The Conservation Fund has been around for 30 years. This is our anniversary year. We're rather unique in that we really have a unique dual mission that couples conservation and community, so economic development as well as conservation. It's really just a great place to be and really a terrific combination with green infrastructure.

On our conservation side, we've protected over seven and a half million acres of land across all 50 states, but we also work on community and economic development. That means that we believe that conservation is really essential to America's resilience, but it also takes smart development. That's what we're looking at is that intersection that's so important. We have worked on green infrastructure for over a decade. We do all kinds of training programs on green infrastructure as well as on the ground planning and implementation. I'd like to share with you more about those today.

As I mentioned, we do work across the U.S. We've done a great deal of green-infrastructure work with broad regions. We've worked with The Metropolitan Greenspace Alliance. All of those members are listed here. Many of them are also potential applicants for the NDRC program. I will provide some of those examples in just a minute, but did want to really focus on the importance of thinking of our landscapes, both the built and the natural landscape, as ecosystems. We really want to focus in on creating a vision for those areas, helping these just different stakeholders and partners to work together to shape their green infrastructure priorities through that collaborative action.

We focused on that in broad regions, but also in smaller scale - we'll get down to some other examples, but just from the county level, city level, and then touch a little bit on neighborhoods and on communities as well. When we're talking about an agenda for green infrastructure, what does that really mean? Well, coming from a planning perspective, I really focus on the broad themes that we need to incorporate into goals and objectives for land use and conservation planning efforts. I thought this slide would be a good overview of that.

At the top we're looking at the results, different areas of results, desired community results from green infrastructure investments. At the bottom, just listing some of the desired activities, the means to achieve those results from those investments. You can see that it includes resiliency and the different activities that that would include, but also a whole bunch of other benefits to communities are regions.

Today we want to walk through some of the opportunities that we have including the network design - this is part of the methodology of green infrastructure - go through the network design; look at the shaping of green infrastructure visions, how to think more about ecosystems services and even valuing those ecosystem services such as clean air, clean water, wildlife habitat, food and fiber protection as part of resiliency strategies; touch on some climate change adaptation and resiliency, and then finally just briefly at the site scale, some ways to think about resiliency through the reuse of areas with existing infrastructure.

Just giving an overview of green infrastructure, we're really trying to think very strategically about conservation and development through green infrastructure so, asking the question about what is the region's common vision and using green infrastructure to help shape that through both conservation and development and infrastructure decision. Asking very strategically what are the best places to conserve and how can you not just save a farm but save farming. So the context is really important. That's true on the development side too. We're not just thinking about site-by-site decision making but thinking, again, very strategically about our development, making sure that it really serves the community's purpose or the region's purpose.

Also thinking about hard, gray infrastructure as was talked about just a few moments ago on where to build the infrastructure, so that you're not having to recreate expensive ecological processes. Then, if there are environmental impacts from the development process, then how do you offset those? How can you get the biggest bang for your buck from mitigation. By following that green infrastructure approach, we're really trying to create that strategic approach for our communities by being proactive, systematic, making sure that you're achieving multi-functions, multiple scales, and doing that through a scientifically defensible and transparent decision making process.

The definition of green infrastructure that we use is a very broad one, thinking of going from broad landscape scale down regional, community, to small site scale and neighborhood scale. Strategy. All of those fit within this definition of a strategically planned and managed network of natural lands, working landscapes, and other open spaces that do two things: they conserve ecosystem values and functions, and benefit people. You can see with the transect on the right looking at different methods of green infrastructure depending where you are in the landscape from that landscape scale, down to the region, to the community, and then to the site scale, and going from rural to urban.

The structure that we use in defining green infrastructure, creating the green-infrastructure network is a core hub corridor model really emphasizing that interconnected network of public and private conservation lands through the physical design of this network. Again, this is science based and data driven, but we're really seeking that functional connectivity across the landscape.

I mentioned the multiple scales of green infrastructure. This slide just kind of demonstrates that. On the left is a map of downtown Nashville. We're going to talk a little bit about Nashville-Davidson County in just a moment as one of the examples, but green infrastructure implemented at the more neighborhood or site scale going up to the city, county level with the full Davidson County, Tennessee, then even broader, these were all projects that we were involved in. It could be at the state level, say the State of Tennessee, or multiple states.

On the right is a green infrastructure network design for a natural-gas pipeline company, NiSource, where we did a multistate, multispecies habitat-conservation plan. They did that with Fish and Wildlife Service, and we were asked to do the green infrastructure network design for any impacts on endangered species that took place from the operations and maintenance of the existing natural gas pipeline across 14 states in order that, if there were impacts on endangered species, that there would be a strategic method to identify where to mitigate those impacts.

Just summing this part up is really looking at developing that vision that goes from the creation of the green infrastructure network design on the left, to all of the different planning processes and organizations and agencies and multiple sectors that can be involved in green infrastructure and the implementation of green infrastructure, both planning and implementation of green infrastructure network design to really achieve the multiple benefits, resiliency, being one of those, but multiple other benefits as well to both protect, restore, and connect our communities. [Pause from 00:47:54 to 00:48:01]

Okay. Let's dive into some of the examples. I think these will help highlight the connection between green infrastructure and resiliency. This is Nashville, Davidson County. Of course, one of the potential states to applicants for the NDRC is the State of Tennessee. In Nashville, the original planning for the green infrastructure network was a partnership between the Mayor's Office and land trust for Tennessee. They asked the Conservation Fund and several other partners to create this plan, the county's first open-space plan. It was really the passion of Mayor Karl Dean who was interested in building that green connection to the creative economy and saw the protection of the green infrastructure and use of the green infrastructure as really bringing economic benefits to the city and county.

We had started this planning process, and we're getting ready for our first kickoff meeting, when something happen as often can take place. The unexpected can happen in all kinds of planning processes. May 1, 2010, the city of Nashville had 13 inches of rainfall. It was one of the largest floods in the history of the city. Over 11,000 properties were damaged, 11 people in Davidson County died. Two of the three water treatment plants were submerged, causing voluntary water rationing for a month. They were able to cut their water use by half. Other damage included to parks, greenways and trails. Many were washed away. There were over two and a half million dollars in damage just on parks, greenways, and tails. The total flood damage was estimated at almost two billion dollars. They recognized that there was that additional need for resilience.

We had already scheduled a major public meeting for early June. We talked to our partners and asked, should we go ahead with this? There was so much recovery happening. Maybe it's not the right time, but we got back the word that people really did want to go forward with this. We held forums at Belmont University, and over 200 people attended those meetings. It was really empowering because it provided the public their first opportunity to talk about the flood and conservation decisions, what land should be conserved, what land should be developed, and really the overall future of the city. In the end, it was really one of the most important events to start the healing of the city, because it allowed people to talk about a range of issues and frame the choices for Nashville's future. Certainly that factors into the economic development factors. This was the overall green infrastructure vision that was created with these different principles, but they also focused on better floodplain protection and buffers of waterways that feed the Cumberland River.

Another example from the Chicago metropolitan area. Of course, Chicago County (sic) (Cook County) and DuPage County are all potential Phase II NDRC applicants, so this might be of interest there as well. This project was funded from the Chicago Metropolitan Agency for Planning and the Donnelley Foundation. Their motivation was really to update an existing green infrastructure plan and vision by measuring ecosystem services. In 2012 there was an update of the 2004 conservation vision. They focused on informing the future planning and decision making and guiding those decisions on protecting natural assets.

Following that was the 2014 focus on ecosystem valuation. That was really an opportunity to estimate the economic value of the region's natural ecosystems, calculating those in dollar terms on how much benefit the natural systems in the vision provided for different services, so flood control, carbon storage, ground-water recharge, and water purification.

It really was an opportunity to look at the value of those ecosystem services to the overall green infrastructure. We have a lot of information on this online on the Conservation Fund website, website – www.ConservationFund.Org . I'm going to touch briefly on another ecosystem services study and green infrastructure planning effort in Houston-Galveston. This was a Sustainable Communities Initiative community. There they also did a study of the ecosystem services along with a green infrastructure plan. They're looking at the ecosystem value of water quality, air quality, water supply, stormwater regulation, flood protection, and climate regulation and carbon sequestration. This was funded by private foundations in the city, along with a partnership of the Houston-Galveston Area Council. The results here demonstrated that the green infrastructure network covered 62 percent of the land base and it provided 91 percent of the benefits for these ecosystem services--so really strong results there.

I wanted to touch, this is a coastal resilience example. We just had a good overview of that by NOAA, so I'm not going to into great detail here, but this and Greater Baltimore Wilderness, this effort was from a niff-wiff (NFWW, National Fish and Wildlife Foundation) grant from post Hurricane Sandy looking at coastal resilience for the greater Baltimore area. It's really trying to identify opportunities for future green infrastructure given sea level rise and inland flooding. This is with a variety of partners including the American Planning Association and U.S. Geological Service. One

of the great things is that there had been so much green infrastructure planning that's been conducted in Maryland, it really builds off of state and local green infrastructure planning processes.

One other area that green infrastructure used for climate change adaptation and resiliency that it's really an emerging approach for adaptation building resistance, resilience, and realignment through regional green infrastructure network design. Just looking at the opportunities and impacts. I'm going to skip forward. The last one I wanted to touch on was just in Los Angeles County working with a group the Emerald Necklace across the Los Angeles basin. This was a really fascinating example of trying to repurpose gray infrastructure, the hard infrastructure, through new strategies for creating parks, but also all kinds of site scale green infrastructure. At this Mariposa Park, this is just a great site scale example and results here.

I guess I'll close there. Just if there are any questions, but just really green infrastructure for resiliency really relies on all kinds of partners - public, private and nonprofit sector, but also some very nontraditional partners, sewage districts, arts organizations, breweries, tourism groups, all kinds of efforts. I want to thank my colleagues that work on our strategic conservation planning. Many of these examples came from the partnership across our organization and with others. With that I'll pause and see if there are any questions. [Pause from 00:58:11 to 00:58:15]

Duncan Yetman: Okay. Thank you Kendra. We do have one question that kind of came at the beginning of your presentation that was a leftover from Kateryna's presentation. There's a question about to what extent does NOAA contribute to environmental science programs for students? Kateryna, if you're there, maybe you could address that. [Pause from 00:58:44 to 00:58:49]

Patrick: This is Patrick from Cloudburst. I think Kateryna had to jump off. She was having internet connection problems, so she's not here right now.

Duncan Yetman: Oh, Okay. Alright. Maybe we can send that on to her later and she can get back. We do have another question for Kendra. What specific role would the Conservation Fund play with a jurisdiction? Are they hired or are they funded to support a jurisdiction?

Kendra Briechle: We don't have direct funding for projects, but we do work in partnerships with communities so a lot of times thinking strategically about where that funding could come from. We do fee for service work across the country. Some of the examples, I did include a mix of foundations, of government sectors, sometimes private entities, see the real value for doing green infrastructure planning as well, so a real mix of partners. Then utilities and sewage agencies being really interested in this. We'll hear a little bit more about that later. I'm looking forward to that.

Duncan Yetman: Good. Okay. Thank you. We don't seem to have any other questions right now, so I think you can pass it over to Lauren for her presentation.

Kendra Briechle: Okay. There we go. It should go to Lauren.

Dr. Lauren Heberle: Hi. Hi, everybody. Let me just make sure that I can get to the slides. I don't see the slides.

Duncan Yetman: Okay. [Pause from 01:00:51 to 01:00:58] Okay. Do you have them now?

Dr. Lauren Heberle: No. I have that looks like that's the next one. I don't see number four. It's not showing up there.

Duncan Yetman: Okay.

Dr. Lauren Heberle: Oh, there it is. Got it. That's one.

Duncan Yetman: Very good.

Dr. Lauren Heberle: Good deal. Hi. I'm Lauren Heberle and I direct the University of Louisville Center for Environmental Policy and Management. We currently house the University of Louisville Environmental Finance Center. I was asked to talk a little bit very briefly about our role as capacity builders through the HUD Sustainable Communities Initiative (SCI). There's a little disclaimer. I don't have very many slides. [Pause from 01:01:46 to 01:01:51]

We served as the lead capacity builder for the Environmental Finance Center Network under the Sustainable Communities Initiative providing technical assistance to the grantees over the course from the 2010 and 2011, the regional and the challenge grantees and a selection of EPA grantees who were included in this group of folks.

We worked closely with the environmental finance center members at the University of Southern Maine, the University of Maryland, and the University of New Mexico. We helped create a national learning network among those SCI planning grantees. Our job was to help build their capacity to meet their work plan objectives. A lot of grantees were new to this kind of planning, especially the regional ones. This was a new conversation for them to have. It was new to try to include stakeholders that hadn't necessarily been at the planning table before. It was also new for them to take down policy silo barriers and find common language to come together to create these regional plans.

We worked to increased coordination between their projects and integrate especially our job, for us the environmental science network members, to integrate the EPA priorities that are related to water infrastructure or green infrastructure, consent decrees, brownfields redevelopment, all of those kinds of things into their projects. We also worked to help them include equity and environmental justice in all of these things. Many were taking on climate change and hazard mitigation, food systems. Many of those were approaching those issues from the perspective of economic development and community development, so communities varied in how they approached the issue. Sometimes it was easier to talk about water, for instance, than it was to talk straight up about sustainability, right? So, how we got to the language of sustainability and planning sometimes was based around getting down to a conversation about water first and finding that common language.

The work that was done was accomplished through a variety of publications and webinars and in-person training events and one on one assistance as well. Much of this is available on our website, as well as archived on HUD's website and all of the other capacity builders like the Institute for Sustainable Communities website as well. I think the most valuable aspect of this capacity building activity was learning from the communities as they grappled with these new to some planning approaches, and helping them share those lessons with each other. We relied on many grantees such as the City of Cincinnati and their neighbors across the river in Covington, Kentucky, both of whom had 2020 challenge grants and had their partners in their water utilities who pushed green infrastructure and water management and that innovation envelope and served as peer to peer educators for those who are just entering this arena. You're going to hear from Cheri Bush from Cincinnati next. They're a great example of this.

Others are highlighted in the case studies or summaries that are included in the documents we produced, again, you can get from our website and other summary documents. If you're in a state that had an SCI grantee and you haven't already done so, I'd really recommend talking with those folks in depth about the value of substantive, long-term collaboration and partnerships especially with entities you might not otherwise have considered. This is especially true for water

infrastructure planning for resiliency. As you saw in Kendra Briechle's presentation. For instance, you might want to figure out how to include both the utilities and the water protection management organizations from the get go. These guys don't often talk to each other. It's one thing to talk about these really intense, very complicated networks of collaboration. It's another, being able to wrangle all of that and figure out how to get folks at the table in a substantive way, not just on paper. Find out if communities have adequately attached to your state water plans, and if your state water plan is even up to date. That might be a rallying point for you in some of the application process or down the road. I know many of you are probably far into figuring out what's next on your plate in the process.

Other things we ran across with communities in working the obstacles of implementing green infrastructure on the ground was that they didn't bring the state to the table at the beginning. Bringing your state transportation departments to the table to avoid contention down the road, if a community wants to install green infrastructure on roads that are managed by the state, is really important. We've got experiences of folks having their trees cut down because the state told them that they weren't safe. Really educating folks about what that means is really important at the start. It'll save you a lot of heartache down the road.

You'll want to find out which communities in your state might be under consent decrees with the EPA for their CSOs or for the overflows or combined sewer systems. Mahri Monson can speak to that and to the importance of that because those consent decrees can either enable them, or they might be constraining depending on those specific agreements. It's a real important piece especially as it relates to green infrastructure. And folks who are using their consent decrees in creative ways for green infrastructure can be really good examples across the state. You can learn from them, so keep track of them within your community, within your state.

The capacity builders and those within the Environmental Finance Center Network, and all of the others, the Institute for Sustainable Communities up in Vermont, Policy Link, NACCHO, Minnesota Housing Partnership, Place Matters, Smart Growth America, the National Resource Defense Council, all of those, and many other subs to those guys – they're all still around, and they all continue to provide assistance to communities in a variety of forms. It's worth your time to kind of take a look at those folks because a lot of them will know what's going on in your state as well, but they can also bring other resources to the table.

The ESC is another university-based research and policy centers continue to be valuable resources. They can get at some of that research or help you answer some in response to the call from NOAA for paying attention to where the research gaps are. See what's going on in your local university. Sometimes it's going to be at your community colleges. You'll find some interesting resources for collecting and managing that data. They'll want to connect to organizations like NOAA and folks to figure out help that community become a pilot for a particular project or something like that. Those are awesome ways to help decrease the knowledge gaps for our green infrastructure efforts.

I'll also let you know that the Environmental Finance Centers and other kind of university policy centers are good at helping communities connect to resources across federal agencies. In presentations like this you've got HUD and EPA and NOAA and others at the table. You can also get folks who have done this kind of work, can help you navigate all of the other information that's out there. There's so many different kinds of decision making tools that can help you figure out what's going to be workable for your community. Sometimes bits and pieces are more or less relevant. And if a particular center doesn't have the expertise or capacity, they should be well aware of others who can assist you.

I'm not going to keep talking. What I've got on this slide are connections to our website that tells you what kinds of resources that are out there that were produced for the sustainable communities grantees. Those are all available. There's also some hot links. These are the longer hotlinks, actual web addresses, for those resources. Please, feel free to contact me with any more specific questions as you're going through it. I'd certainly be willing to talk to you at any time. Unless there are any other additional questions, I'm going to hand it over to Cheri, so you can have another really good example of what's going on in Cincinnati. She can tell you and give you a real detailed example. [Pause from 01:11:56 to 01:12:00]

Duncan Yetman: Okay. Thank you Lauren. We don't see any questions in the queue right now, so I think we'll get right to Cheri's presentation.

Dr. Lauren Heberle: Okay. I'll hand it over. Then remember how to do that. There we go.

Patrick Taylor: This is Patrick Taylor from Cloudburst. If you do have a question and we don't have time to answer it, please, submit it to ResilientRecovery@HUD.Gov. [Pause from 01:12:24 to 01:12:33]

Cheri Bush: Okay. Can you hear me?

Duncan Yetman: Yes, go ahead.

Cheri Bush: Okay. I'm Cheri Bush. I'm a Supervising Engineer with the Metropolitan Sewer District of Greater Cincinnati. Today, I'll be giving a quick overview of our project groundwork, which is really the reason MSD is making an investment in the community. I'm going to highlight our Lick Run Project. We do have other projects, but our Lick Run Project is the largest project we have. We're designing it so it can be leveraged for community revitalization. Then I'll also talk about some of the other benefits.

Metropolitan Sewer District of Greater Cincinnati is among the top five combined sewer-overflow dischargers in the country. We discharge approximately 11 billion gallons of overflow during a typical year. If you're not familiar with combined systems, during wet weather, during a rain event, combined sewers will carry both sewage and stormwater. The storm water often fills them beyond their capacity. To release the pressure to avoid flooding or sewage backups in the buildings, combined sewers were designed to overflow into the local waterways through outfall structures known as combined sewer overflows, which we call CSOs. At the time they were built, they were an acceptable way of handling excess flows, but the environmental impacts are now controlled under the federal Clean Water Act. Our plan to address these overflows is called Project Groundwork. Due to the enormous cost of addressing these issues, our plan is over \$2.5 billion dollars, it has been cut into two phases. Our first phase started in 2009 and ends in 2018. Phase two starts after that.

Our Project Groundwork has a focus to reduce combined sewer overflows into the Mill Creek, which runs through the center of our service area. On this slide the Mill Creek is on the right side. The reduction of overflows is achieved through a mix of green and gray infrastructure projects primarily for watersheds. I'm going to talk about the Lick Run watershed, which you see on your screen. There are four neighborhoods impacted by this project. The largest impact is by the south Fairmount neighborhood that has the valley within it. This neighborhood was developed back in the 1800s with a community of homes, vibrant industries, and businesses. That neighborhood peaked in population in 1920. Then it started a population decline that really continues today.

The valley also contains some major thoroughfares for transportation, and the community has really become a pass-through point instead of the destination, as commuters travel from the

western suburbs into downtown Cincinnati. In order to build our project, we are going to be acquiring the existing buildings in the corridor and be demolishing them. This has a big impact on the entire neighborhood; however, the evidence shows that there's been a trend of long-term disinvestment in the community. To that point, over 30 percent of the housing units are vacant. Forty-six percent of the buildings in the community are in critical condition or require major repair. There's more than 40 acres which are classified as brownfields or directly adjacent to a brownfield.

What this leads to is that the property values have plummeted over 50 percent between the year 2000 and 2010. During that same time period, south Fairmount lost 27 percent of its population. To make matters worse, the median household income of this neighborhood is below the city's average, while at the same time, the household size is larger than the city's average.

This neighborhood needs to be revitalized. I'm going to talk a little bit about our projects. The sewer infrastructure in the community is also in need of repair, not only to capacity, but also to age. The Lick Run Project is the largest of our Mill Creek projects accounting for \$193 million of the total \$244 million dollar budget. The Lick Run Project includes 12 separate construction projects due to the size, the largest being the urban waterway in the valley. There are 11 other stormwater separation projects that will take the stormwater from the steep hillsides, convey it into the valley, and into the urban waterway. The three projects highlighted have significant green infrastructure components.

This is an example of one of the separation projects with green infrastructure. It is a bioswale along our Rapid Run Road. It will convey the stormwater overland and includes bioretention basins in addition to the bioswales that you see. This allows for the water to be used onsite or infiltrated into the ground, so that it doesn't even reach the system.

This is an overview of the urban waterway. You'll see on the left the wetland forebay, and there is an underground channel for the whole 1.5 mile stretch. That is to carry the larger flows. You'll see almost - not quite in the middle the headwaters area. That is where the water will come above ground and be available for the community to use and enjoy. We will maintain the bridges and the local transportation. There is a civic recreation space that will be maintained and reconfigured. Additionally, we are looking at the water quality components because obviously that is our primary objective.

This is a zoom of our urban waterway recreation space. What you'll see is that we're relocating many of the recreation spaces in this area. We're not necessarily adding new, but we're making sure there is no net loss of recreation space with this project. This reconfiguration is more functional and more inviting for the community. Therefore, we've had to work a lot with our recreation department in order to reconfigure this space. We've also reached out to our economic development group for them to find initiatives and funding opportunities to create some economic growth in this area. The transportation department has also been consulted, because transportation is a major component of this watershed.

The benefits that we have been able to see with this project is that it's improving our water quality. We're treating what we call the first flush of contaminants as it travels from the roadway into either our sedimentation separators or our green infrastructure. We're also creating new jobs. We are creating nearly 900 jobs for construction alone. That doesn't even count the jobs that are going to be created for maintaining the green infrastructure post construction. All of those jobs are local. We're not bringing in highly specialized experts from out of town. We're also creating an opportunity for neighborhood revitalization through private and public investment. We sought to create a canvass for others to leverage to revitalize the community.

While I won't talk about this on my last slide, I do want to mention that we are working to update development codes to support walkable environments and green transportation practices. I'll be happy to take any questions. [Pause from 01:22:44 to 01:22:48]

Duncan Yetman: Okay. Thank you Cheri. We are a little over time here. I'm not sure about the ability for us to take-- maybe we could take one or two questions. Would that be okay, Patrick, for us to do that?

Patrick: Yes. This is Patrick from Cloudburst. There's one question in the queue that came in for this presentation.

Duncan Yetman: Okay. I will read that. The question is there appears to be an ongoing trend by urban leaders to depopulate urban, underserved communities. How do these trends to depopulate these communities impact your work to build and sustain safe and holistic environmental structures in underserved communities?

Cheri Bush: Well, from our perspective and our project, we are not depopulating. Our project is not creating the depopulation. That is occurring through economic events of the community. What the depopulation, or I should say the population loss in this community has led to a severe blight in the area. Nobody is maintaining the buildings. It actually has been unsafe for the people who are remaining in those communities. We have met many times with the community members. In fact, we had many meetings where they provided input into this project, and they had a voice in whether this project moved forward or not. The people who lived in the neighborhood supported this and felt that our project was probably their only hope for revitalizing their neighborhood and for bringing back the wonderful community that it used to be.

Duncan Yetman: Good. Good. Thank you, Cheri.

Cheri Bush: Sure.

Duncan Yetman: I would just echo, too, that I think that for most of these projects, the project that you see here in Cincinnati and some of the other examples given by the other presenters, stakeholder involvement has been critical to their success. Obviously, that's going to be a key component of any successful approach to green infrastructure and water resiliency. Okay. I don't see any other questions here in the queue. Again, we are over time, so I will just wrap us up here. I want to thank all of our presenters today for giving us a very substantive overview of the approaches to green infrastructure and to water resiliency. Again, thank you all. Please stay tuned for our next webinar in the series, which will be next Thursday, October 8th at 3:00 p.m. That will be an NDRC NOFA (Notice of Funding Availability) specific webinar addressing the completeness requirements for the NDRC NOFA. Thank you all, and have a good afternoon.

Female: Thank you. Bye-bye.

[End of Audio]