



CIRCA Municipal Resilience Grant Program and Matching Funds Program Summary

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Municipal Resilience Grant Program Summary

CIRCA awarded four rounds of Municipal Resilience Grants. The request for proposals called for projects from municipal governments and council of governments for initiatives that advance resilience, including the creation of conceptual design, construction (demonstration projects or other) of structures, or the design of practices and policies that increase their resilience to climate change and severe weather.

Project proposals develop knowledge or experience that is transferable to multiple locations in Connecticut and have well-defined and measurable goals. Preference for funding was given to projects that leveraged multiple funding sources and that involved collaboration with CIRCA to address at least one of the following priority areas:

1. Develop and deploy natural science, engineering, legal, financial, and policy best practices for climate resilience;
2. Undertake or oversee pilot projects designed to improve resilience and sustainability of the natural and built environment along Connecticut's coast and inland waterways;
3. Foster resilient actions and sustainable communities – particularly along the Connecticut coastline and inland waterways – that can adapt to the impacts and hazards of climate change; and
4. Reduce the loss of life and property, natural system and ecological damage, and social disruption from high-impact events.

To date CIRCA has awarded nearly \$750,000 for eighteen projects located in nine different municipalities (Darien, East Lyme, Fenwick, Hartford, Milford, New Haven, Oxford, Stamford, and Waterford) and five council of governments (MetroCOG, Northwest Hills COG, South Central Regional COG, Southeast COG, and Western COG). These projects are described in more detail below.

Municipal Resilience Grant Program Awarded Projects (alphabetical by organization/city)

Darien - Low Impact Development for Resilience Against Flooding, Storm Water, and Climate Change

Heights Road in Darien and commercial properties to the north frequently flood due to an undersized stream culvert beneath the road. Run off from the adjacent Connecticut Department of Transportation train station parking lot also drains to Heights Road immediately to the north. This flood mitigation project uses principles of Low Impact Development and consists of a combination of flood storage pipes beneath Heights Road and storage and infiltration structures with the fill beneath the nearby train station parking lot. The project addresses the needs of municipalities and businesses to reduce the impact of climate change and increased precipitation. The two objectives of this project are:

- To maximize the stormwater volume that is stored or infiltrated in order to provide greater flood resiliency to the existing stormwater system.
- To develop a Design Guidance Checklist that will have application to other flooding sites in Connecticut and clearly define tasks needed to evaluate and design stormwater management in urban areas that may contain historical urban fill. This is a complex process that can be challenging given the sometimes conflicting technical and regulatory requirements.

East Lyme - Coastal Resilience, Climate Adaptation, and Sustainability Project

The Town of East Lyme seeks to enhance community sustainability and resilience to the impacts of climate change, sea level rise, and extreme weather by developing specific policies and recommendations for inclusion in the town's *Plan of Conservation and Development*. This CIRCA grant project will create a new Flood Ordinance and establish a Flood Commission made up of members from the Board of Selectman, Zoning Commission, Planning Commission, and local professionals such as engineers, surveyors, and insurance professionals. The project will also: 1) identify adequate freeboard requirements (or factors of safety expressed in feet above a flood level) and areas in need of increased safety in anticipation of sea level rise and climate change; 2) identify projects such as living shorelines within East Lyme that advance resiliency; and 3) update the town's Geographic Information System mapping to incorporate Coastal A-Zones, municipal wastewater infrastructure, CIRCA site suitability for living shorelines, and other flooding data. The project will build on recent work by The Nature Conservancy and also leverage completed CIRCA research projects. Outcomes can be used as a model for other coastal communities and not only increase East Lyme's resilience and sustainability by establishing sound land use policies and regulations, but may also improve the town's community rating within the National Flood Insurance Program.

Fenwick - Hepburn Dune and Marsh Preservation Project

The Hepburn Dune and Marsh Preservation Project implements living shoreline strategies at a site on the coast of Long Island Sound, located just east of the Katherine Hepburn Estate in the Old Saybrook Borough of Fenwick. A breach of an existing beach at this site would likely impact: 1) the marsh and creek hydrology, including flood inundation; 2) erosion and sedimentation within the marsh; 3) the ecology (flora and fauna) of the marsh; 4) erosion along sections of the beach; and 5) neighboring infrastructure and property. The intent of Fenwick's project is to use a Living Shoreline (or hybrid) approach, providing both shoreline protection and environmental enhancement. The project involves analysis of several shoreline protection alternatives and design of the selected alternative. Restoration strategies could include dune restoration, coir log placement, restoration of tidal wetlands, and construction of low profile stone sills. In addition to selection and design of an appropriate natural and nature-based shore protection alternative, the project goals also include advancing the technical practice of Living Shoreline design and construction in Connecticut.

Hartford - Green Infrastructure Specialist for a More Resilient and Sustainable Future

The City of Hartford received grant assistance from CIRCA to hire a Green Infrastructure Specialist for 12 months. Hartford seeks this assistance in the context of its rigorous, comprehensive climate resiliency effort – the Climate Stewardship Initiative (CSI) – which aims to improve quality of life through environmental stewardship, while advancing the economy, improving public health, and promoting social equity. Through the CSI, Hartford has collaborated with corporations, private foundations, and government agencies to make strides in five action areas (energy, land, transportation, waste, and water). Of these five areas, the city has the least expertise and the most need in the area of water – specifically in managing stormwater. The Green Infrastructure Specialist will help Hartford not only respond to threats of flooding, but also strategize proactively for the future by evaluating and advancing green infrastructure projects.

MetroCOG – Beardsley Zoo Green Infrastructure Project

MetroCOG received an award for a “Beardsley Zoo Green Infrastructure Project”, which is a highly visible green infrastructure retrofit project at the zoo located along the Pequonnock River in Bridgeport. This collaborative project between MetroCOG, the Beardsley Zoo, the Connecticut Fund for the Environment and its bi-state program Save the Sound will build on regional resilience planning efforts and the successful completion of a green infrastructure demonstration project at the Zoo in spring 2016. Through the installation of 2,000 square feet of porous pavement and up to 2,000 square feet of bioretention gardens, over 1,000,000 gallons of stormwater runoff will be captured and filtered annually from an acre of existing parking area. Interpretive signage, targeted outreach, volunteer engagement opportunities, and workshops will help to educate the 275,000 people who visit the Zoo each year about stormwater runoff and flood resiliency. Workshops conducted by a partnership of CFE/Save the Sound, the Beardsley Zoo, and the Northeast Organic Farmers Association of Connecticut (CT NOFA) will also reach target audiences of underserved, urban youth and adults to promote an understanding of stormwater infrastructure issues in Long Island Sound, increase environmental awareness, and enhance green job skills. CIRCA’s funding for this project is supporting installation and outreach efforts including signage and workshops.

MetroCOG – Designing Resilience: Living Shorelines for Bridgeport

The Connecticut Metropolitan Council of Governments (MetroCOG), in partnership with the City of Bridgeport and The Nature Conservancy (TNC) will develop preliminary, semi-final and final design plans for a living shoreline project at Bridgeport’s West Johnson Creek. This project will advance design concepts from the existing National Fish and Wildlife Foundation-Department of Interior (NWF/DOI) funded Regional Framework for Coastal Resilience in Southern Connecticut, which supported the development of conceptual designs for coastal resiliency/living shoreline projects identified as “high priority” by local stakeholders. Construction-ready plans funded through this round of CIRCA’s Municipal Resilience Grant Program will position the Bridgeport project for future implementation.

Johnson’s Creek is located in Bridgeport’s East End, a distressed area that has suffered from disinvestment and past environmental degradation. Due to the area’s relatively low

elevation, it is continually vulnerable to flooding. The NWF funded conceptual design will reduce the slope to allow vegetative stabilization and support potential wetland migration. Other ecological benefits include the removal of debris and invasive species and the creation of habitat for marsh species. The design is also consistent with CIRCA's "Enhancing Coastal Resiliency in Connecticut" site suitability model. Ultimately, the goal for Johnson's Creek is to create a passive recreational trail along the water for public use and restoration.

City of Milford – Developing and Implementing a Restoration and Management Plan to Combat Threats and Challenges to Coastal Dune Resiliency in Urban Landscapes

With 17.5 miles of coast, the City of Milford has the longest shoreline in the state. This coastline was severely impacted in both storms Irene and Sandy. To address the impacts of the storms, the City proposed restoring a degraded dune in a high-traffic area and developing a plan for post-restoration management of the dune. The goal of this living shorelines approach is to restore the natural buffering capacity of the dune to storms like Irene and Sandy, making the City more resilient to future events. The restored dune will be located in what is now known as the Walnut Beach area. The project will involve removing invasive plant species and replanting with those that are native. The City of Milford hopes that creating a dune demonstration site in this region will serve as a model for other similar projects in Milford and in other coastal towns and cities.

This project also features a strong public engagement component. The City will provide educational opportunities for citizens and visitors alike to learn about dune restoration and enhancement and about living shorelines activities more generally. This project involves a direct partnership with the Walnut Beach Association with support from the Connecticut Sea Grant and the Long Island Sound Study Outreach Program.

New Haven – New Haven Industrial Toolbox

The City of New Haven is a coastal town with repetitive flooding problems. In response to frequent flooding, the City organized the Program for Public Information, a committee charged with making recommendations to help address flooding issues. One recommendation of the committee was to create and implement the New Haven Commercial Industrial Toolbox (CIT). The CIT will enhance the resilience of the City's commercial infrastructure to flooding and sea level rise by serving as a guidebook for the necessary steps all owners should take before a flooding event occurs. When complete, the CIT will be a manual that 1) protects people and property from flooding; 2) ensures that federal flood insurance and disaster assistance are available; 3) save tax dollars; 4) avoid liability and lawsuits; and 5) reduce future flood losses. The CIT is highly transferable to other municipalities in Connecticut that are adversely impacted by flooding and sea level rise. Once the CIT is developed, the City of New Haven will collaborate with CIRCA to distribute the CIT throughout the state.

New Haven – Assessing Impacts of Tides and Precipitation on Downtown Storm Sewer System Through Use of Real-Time Depth and Flow Monitoring

The City of New Haven was awarded its second CIRCA Municipal Resilience Grant for a project entitled, "Assessing Impacts of Tides and Precipitation on Downtown Storm Sewer

System” Through Use of Real-Time Depth and Flow Monitoring.” The city experiences frequent flooding at several locations crucial to the functioning of the city and regional transportation systems during high intensity, short duration rainfall events. The flooding is exacerbated during high tide events such that a small storm (less than a one year occurrence) can lead to flooding of critical facilities. Significant gaps and inconsistencies still exist in the understanding of this large and complex drainage area. Until now, the City’s strategy lacked a long-term data gathering component to provide data on the performance of the City’s stormwater infrastructure in widely varying conditions. This CIRCA funded project will create a low-cost “smart city” stormwater sensor network to provide a detailed record of the interaction of rainfall, tides, green stormwater infrastructure, and sewer conveyance systems on the hydrology of New Haven’s urban core. A better understanding of system response during a range of hydrologic conditions will allow the City to value engineer cost-effective and resilient solutions. Techniques and approaches developed in New Haven also be transferred to other urban communities facing similar problems.

NHCOG – Building Municipal Resilience and Climate Adaptation through Low Impact Development

With flooding, erosion, and sedimentation becoming an increasing concern for Northwest Connecticut towns, the Northwest Hills Council of Governments (NHCOG) proposed the creation and adoption of a Low Impact Development (LID) Design Manual. The LID Design Manual will include the specific information needed by engineers and project designers to successfully construct LID projects. Additionally, the LID practices described and promoted in the manual will serve to increase the resilience of Connecticut’s small towns by protecting their drinking water supplies and other water resources, improving their water quality within watersheds, protecting agricultural resources, and protecting the built human environment from flooding. When complete, this manual may be used in any town in Connecticut. The applicant has leveraged financial support from several sources, including the Town of Morris, the Community Foundation of Northwest Connecticut, the Connecticut Community Foundation, and the Bantam Lake Protective Association.

NHCOG – Enhancing Rural Resiliency: A Vision and Toolkit for Adaptation in the Northwest Hills

The Northwest Hills Council of Government (NHCOG) received an award for its project, “Enhancing Rural Resiliency: A Vision and Toolkit for Adaptation in the Northwest Hills.” NHCOG and regional partners will use CIRCA’s support to craft a vision of *A Resilient Northwest Hills* and produce a web-hosted climate change adaptation toolkit for municipalities. As a region of 21-towns, the Northwest Hills will experience a variety of climate changes including changes to precipitation rates, shifts in seasons, increased high heat and high-ozone days, and extreme weather events. The NHCOG’s Municipal Resilience Grant project is consistent with their 2017 regional Plan of Conservation and Development, which specifically identifies climate change-related policies and specifically lists preparing, “a climate change adaptation plan including a web-based toolkit” as a strategy to help achieve the goal. While this project achieves several regional objectives, it will also be highly transferable to other towns in Connecticut.

Oxford - Planning for Flood Resilient and Fish-Friendly Road-Stream Crossings in the Southern Naugatuck Valley

The Town of Oxford, in partnership with the Town of Seymour, will assess its road-stream crossings to identify undersized structures (looking at current and future climate conditions). In both towns, road-stream crossings are highly vulnerable to floods as well as potential areas for conscious, conservation-oriented development. The towns will work with several partners to identify priority crossings, in order to target their future mitigation efforts. Oxford and Seymour will develop pre-replacement plans for structures most at-risk, and prioritized based on flood damage risk, crossing condition and maintenance need, and habitat restoration value. The towns plans to collaborate with CIRCA for the culvert vulnerability modeling portion of the project.

Through this project the towns will also develop a road-stream crossing inventory and a management plan. The resulting planning documents will be adopted as an annex to each town's Natural Hazard Mitigation Plan facilitating implementation of the identified mitigation responses.

SCCOG – Southeastern Connecticut Critical Facilities Assessment

The Southeastern Connecticut Council of Governments (SCCOG) conducted an assessment of 18 community facilities located in or near flood zones that are critical for ongoing public services, including fire and police stations, town halls, and departments of public works. The assessment identifies the risks to properties and service continuation from flooding, wind damage, and snow loads now and over the next several decades. For each site, the assessment recommends appropriate flood prevention measures, potentially including relocation, site modifications such as flood walls, flood proofing, and elevation of utilities. This CIRCA funded project was a recommendation of the region's 2012 Multi-Jurisdictional Hazard Mitigation Plan. Results will help municipalities incorporate resilience planning into funding priorities.

SCRCOG - Climate Adaptation and Resiliency Planning for Protection of Public Drinking Water

SCROG is integrating climate change information into water planning processes for the South Central region as well as developing an adaptation plan for the region and the South Central Connecticut Regional Water Authority. With changing precipitation patterns, sea level rise, and drought anticipated due to climate change, water resource managers will benefit from integration of climate data into planning. The SCRCOG is working with regional planners, utility water managers, and climate science experts to identify climate risks and thresholds of importance to the regions water utilities, conduct a historical climate data analysis for the region, and prepare/analyze future climate projections and impacts. Using a scenario approach SCRCOG will assist water utility managers as they incorporate this data into planning activities. SCRCOG will also create a guide for other regional entities and/or municipalities considering integration of climate change data into planning efforts.

SCRCOG - Design and Technical Guide for Implementing Innovative Municipal Scale Coastal Resilience in Southern Connecticut

Coastal adaptation and resilience planning at the municipal scale faces multiple challenges including concerns with the tax base, lack of decision support tools, and gaps in valuing

urban ecosystem services. This CIRCA grant project seeks to overcome challenges that practitioners, planners, and policymaker's encounter by using coastal adaptation strategies applied to projects in Old Field Creek in West Haven and Cosey Beach in East Haven. These two projects build on past efforts of the Regional Framework for Coastal Resilience in Southern CT and the Yale Urban Ecology Design Lab (UEDLAB) project funded by The Nature Conservancy.

Sites in West and East Haven are at different stages in planning and each is distinct in population density, hydrology, erosion and wave patterns, and types of habitat. Building on previous experiences and findings, a core group of landscape architects, regional planners, land use attorneys, economists, and engineers will work closely with the municipalities to create initial design proposals and leverage the planning process developed as part of the Regional Framework for Coastal Resilience. Outcomes will include a Design and Technical Guide based on evaluation from an Economic Analysis/Decision Making Support Tool. The Design and Technical Guide will be integrated into the municipal planning process. These outcomes will help transition municipalities driven by hard infrastructure, road transportation and developer-driven housing to spaces created with equity, human health, ecosystem function, and climate change as drivers of planning and design.

Stamford – Resilience Opportunity Assessment

Stamford was awarded a CIRCA grant for its “Resilience Opportunity Assessment” for a pilot project to review the potential vulnerability to climate change hazards at the Stamford Government Center and Stamford High School. Government Center is where the majority of City operations are housed the school is one of several locations serving as a public emergency shelter during blackouts and storms. The City is partnering with New Ecology, Inc., a Hartford-based non-profit that has developed a resilience assessment process for identifying hazards (including flooding, erosion, drought, extreme heat and cold, storms, fires, etc.) and implementation priorities (including but not limited to: elevating mechanical and electrical equipment, flood proofing buildings, flood barriers, perimeter drains, backflow preventers, portable water storage, etc.). The product of this CIRCA Municipal Resilience Grant will be a set of recommendations for mitigation approaches ranked in terms of cost, risk, and vulnerability for these two buildings. This pilot assessment will not only provide an opportunity to advance resiliency in specific municipal buildings, but an opportunity to improve how the entire City functions and recovers from possible disaster.

Waterford – Waterford Municipal Infrastructure Resilience Project

Through a recent workshop, facilitated by the Nature Conservancy, the Town of Waterford identified their sewer pump stations as potentially highly vulnerable to impacts from flooding and sea level rise. The town's *Waterford Municipal Infrastructure Resilience Project* is a two-part project that will assess the vulnerabilities of the sewer pumps stations as well as include an analysis of drainage at Gardiners Wood Road. CIRCA is pleased to fund the sewer pump station assessment and adaptation portion of the project. Under this assessment the Town will conduct an inventory of sewer pump stations in the Special Flood Hazard Area (the FEMA 100-year floodplain). The Town will then create a list of priority actions and cost estimates to reduce each sewer pump station's present and future vulnerability. This portion of the Town's project will create a replicable process that can be

applied to other sewer pump stations within Waterford as well as other Connecticut municipalities. This is a key first step in addressing the vulnerabilities of the sewer pump stations in the town. Wastewater treatment plant systems are considered critical infrastructure that are often at risk from flooding throughout Connecticut.

WestCOG– Regional CRS Program

In order to stem the high cost of flooding to home and business owners, the Federal Emergency Management Agency (FEMA) offers flood insurance in communities that comply with basic floodplain management standards through the National Flood Insurance Program. Communities may choose to enter into the National Flood Insurance Program's Community Rating System (CRS) in order to reduce the cost of flood insurance premiums for their property owners. Communities participating in the CRS go above and beyond the minimum standards and, depending on their level of mitigation efforts, they can garner insurance premium reductions from 5-45%. In this project, the Western Connecticut Council of Governments (WestCOG) will take steps to create a regional CRS program to assist communities within Western Connecticut as they undertake the challenging CRS program. Establishing this program will provide flood resiliency benefits for the Western Connecticut region and may be used as a model throughout Connecticut. CIRCA will provide assistance for the Regional CRS kickoff meeting, outreach, training, data gathering, and analysis. Additional funds pledged by the Western Connecticut Council of Governments will further provide support for development of the Regional CRS Program.

Matching Funds Grant Program Summary

The CIRCA Matching Funds Program considered requests from Connecticut municipalities, institutions, universities, foundations, and other non-governmental organizations for matching funds for projects that address the mission of the Institute. To be funded, a successful Matching Funds request must have a commitment of primary funding within 6 months of the CIRCA award announcement, or have received a waiver from the CIRCA Executive Steering Committee. CIRCA Matching Funds provide up to 25% of the primary funder's contribution (from other than a municipal or State of Connecticut funding) to enhance the likely success of project proposals that advance CIRCA research and implementation priorities.

Projects develop knowledge and/or experience that is transferable to multiple locations in Connecticut and have well-defined and measurable goals. Preference for funding was given to projects that involve collaboration with CIRCA to address at least one of the following priority areas:

- Improve scientific understanding of the changing climate system and its local and regional impacts on coastal and inland floodplain communities;
- Develop and deploy natural science, engineering, legal, financial, and policy best practices for climate resilience;
- Undertake or oversee pilot projects designed to improve resilience and sustainability of the natural and built environment along Connecticut's coast and inland waterways;
- Create a climate-literate public that understands its vulnerabilities to a changing climate and which uses that knowledge to make scientifically informed, environmentally sound decisions;
- Foster resilient actions and sustainable communities – particularly along the Connecticut coastline and inland waterways – that can adapt to the impacts and hazards of climate change; and
- Reduce the loss of life and property, natural system and ecological damage, and social disruption from high-impact events.

Proposals were received and reviewed on a two month rolling basis. CIRCA awarded over \$330,000 for the eleven projects described below.

Matching Funds Grant Program
Awarded Projects
(alphabetical by organization)

CRCOG – Capitol Region Natural Hazards Mitigation Plan

The Capitol Region Council of Governments (CRCOG) was awarded Pre-Disaster Mitigation grant funding from FEMA to update a multi-jurisdictional natural hazard mitigation plan by mid-2019 and CIRCA's Matching Funds award supports their plan update. The goals of the update project are: 1) to assist participating municipalities in assessing risks and local capabilities related to natural disasters, and evaluating and establishing mitigation strategies including policies and actions that can be implemented to reduce risk and future losses from floods, dam failure, drought, forest fires, winter storms, hurricanes, tornados, windstorms, earthquakes, sea level rise and other natural hazards identified through the planning process; and 2) create a FEMA-approved natural hazard mitigation plan update that will enable participating municipalities to apply for FEMA hazard mitigation project grants. The planning process will include a thorough review of the current regional natural hazards mitigation plans as well as new research and an evaluation of other existing reports, plans, maps and municipal regulations and ordinances, particularly new documents available since the preparation of the current plan.

- Project Lead: Lynne Pike DiSanto
- Primary Funding Source: FEMA

Clean Water Fund – Execution of EASE Program (“Education and Action for Secure Energy”) to provide education and technical assistance for municipalities planning for energy security and resilience

EASE (“Education and Action for Secure Energy”) is a focused program of education and technical assistance to help local decision makers in Connecticut plan for a secure supply of energy in extreme weather and other emergencies and to plan more broadly for local energy security and independence. EASE brings together state and private sector experts, and a peer to peer support system to help participants address these challenges and take full advantage of emerging renewable technologies. The program is run through The Clean Water Fund, which consists of a team of expert advisors on energy, infrastructure, and planning.

This CIRCA Matching Fund grant allows an EASE pilot program to be refined and fully implemented. The pilot was initially presented in the fall of 2016 to an audience of volunteers from Clean Energy Task Forces. A refined curriculum will be rolled out to an expanded audience of elected officials, appointed boards and commissions, municipal staff and volunteer committee members in the winter and spring of 2017. This program will support the establishment of solid frameworks and road maps to guide local planning for energy security and resiliency. It will produce and provide clear and technically sound approaches and strategies for engaging needed local partners to help those responsible for energy supply management and security in Connecticut municipalities. EASE will help local government staff, board, and commission members to reach a shared understanding of what it takes to ensure the resiliency of local energy systems and infrastructure to keep our

communities safe.

- Project Lead: Melissa Everett, Clean Water Fund
- Primary Funding Source: Emily Hall Tremain Foundation

Kent Land Trust – *Creation of a Strategic Workplan to Identify Parcels Enhancing Climate Resilience*

The Kent Land Trust was established in 1989 to preserve natural resources in Kent and surrounding areas through land protection, stewardship, public outreach, education, and research. The primary goal of their CIRCA Matching Fund project was to develop a more science-based climate-focused land acquisition and land management strategy. The new model strikes a balance between cultural, historic, and aesthetic considerations and natural resource criteria linked to climate resilience. The Kent Land Trust uses this conservation strategy to increase engagement with partners to develop more sustainable natural and human communities. Outcomes include:

1. Establishment of enhanced selection criteria for KLT land protection efforts,
 2. Comprehensive and science-based management priorities for existing properties based on the revised conservation strategy,
 3. Engagement with the Town of Kent, including the Kent Conservation Commission, and other local and regional conservation partners in associated efforts to develop more sustainable communities.
- Project Lead: Connie Manes, Kent Land Trust
 - Primary Funding Source: Kent Land Trust

Northwest Conservation District – *Building Municipal Resilience Using Low Impact Development Design*

Northwest Conservation District (NCD) is working in partnership with CIRCA and the Northwest Hills COG to develop a model Low Impact Development (LID) Design Manual. The prototype manual has been developed in the town of Morris containing Bantam Lake and substantial drinking water watershed lands. With this CIRCA Matching Fund award, NCD will produce customized LID Design Manuals to guide development in the towns of Washington, Warren and Woodbury. NCD is working with elected officials, land use commissions and staff as well as the design/build community to build broad understanding and support for the use of LID. Each town will adopt their customized LID Manual as the standard for future development. The LID Manuals will establish clear expectations for all land use changes, enhance cooperation among all parties and improve environmental protection. The LID Design Manual will provide the technical framework to implement strategies to protect local water resources from adverse impacts associated with climate change and development.

- Project Lead: Jean Cronauer, Northwest Conservation District
- Primary Funding Source: Connecticut Community Foundation

Norwalk Land Trust – *Village Creek Saltmarsh Restoration Demonstration*

The Village Creek Saltmarsh Restoration project will restore sustainability and resiliency to the degraded Village Creek Estuary in Norwalk, CT. Property damage due to coastal flooding happens very frequently in this area and with the increase in sea level rise and extreme weather events, coastal damage is projected to increase even more in the coming years. Historically, this healthy ecosystem acted as a buffer to storm damage. However, after years of contamination and neglect it has lost its functionality, not only to coastal resilience but as habitat for important aquatic species that live in the Sound. Through largely investigatory and scientific analyses, the Village Creek Saltmarsh Restoration project will assess the most feasible and cost effective way to bring stability and resiliency back to this coastal community.

- Project Lead: Rob Everich, Norwalk Land Trust
- Primary Funding: Long Island Sound Futures Fund

RiverCOG – *Regional Long Term Recovery-Land Use Resiliency Plan*

The RiverCOG is developing a Regional Long Term Recovery and Land Use Mitigation Plan for 17 towns based on real-time data and forecasts, mapping, and best management engineering practices for infrastructure (transportation, water, wastewater, utilities) as they relate to resilience in land use policies and climate adaptation. The Plan will create a template for towns to incorporate land use and infrastructure policies that will improve resiliency from natural hazard events and a strategy for long term recovery efforts after natural hazard events, specifically those that cause coastal and riparian inundation.

The creation of the Plan will strengthen the 17 towns' capabilities to mitigate damage from storm events, react more quickly in their recovery efforts, and provide a clear path toward resiliency in the face of climate change and rising seas. The Regional Long Term Recovery Plan will guide recovery actions that result in an overall resilient, safe, physically accessible, sustainable, and economically strong region. The project is designed to encourage partnership between local, regional, and state governing bodies, the private business sector, and the residents of the region. Encouraging collaboration of the 17 towns will expedite the recovery process through sharing resources and educating a large segment of the public.

- Project Lead: Jean Davies, Lower Connecticut River Valley Regional COG
- Primary Funding Source: HUD

Sacred Heart University – *Stratford Point Living Shoreline: Restoring Coastal Habitats to Maintain Resiliency and Function*

Led by researchers at Sacred Heart University, this project expands an existing living shoreline project at Stratford Point, Fairfield County, Connecticut. On-going coastal restoration efforts and research at the site consist of an artificial reef, smooth cordgrass (*Spartina alterniflora*) marsh, high marsh, coastal dune and upland woody/grassland mosaics. In total, the project will provide an additional 750 feet of coastal erosion control, 4.5 acres of intertidal habitat, 1.5 acres of coastal dune habitat and 25 acres of woodland/meadow mix. Subsequent monitoring will provide additional understanding

regarding the potential effectiveness of living shorelines as a means to increase coastal resilience and will inform future designs/guidelines for Connecticut and coastal communities in New England.

- Project Lead: Jennifer Mattei, Sacred Heart University Department of Biology
- Primary Funding: U.S. Army Corps of Engineers Connecticut In-Lieu Fee Program

University of Connecticut – *How Will Sea Level Rise-Driven Shifts in Wetland Vegetation Alter Ecosystem Services?*

This project examines how sea level rise (SLR) - induced shifts in vegetation will mediate ecosystem service provision by LIS coastal wetlands. Specifically, the project will: 1) quantify the delivery of ecosystem services associated with dominant tidal wetland plant species of the LIS; 2) examine impacts of SLR and interactions; 3) forecast how shifts in dominant tidal wetland species will alter ecosystem service provision of LIS coastal wetlands; 4) promote understanding of the complex interactions among SLR, coastal wetlands, and ecosystem services among diverse audiences in the LIS region.

- Project Lead: Beth Lawrence, UConn Natural Resources and the Environment
- Primary Funding: Long Island Sound Study – CT Sea Grant Research Awards

University of Connecticut – *Natural Resources Conservation Academy: Fostering Young Scientists in Connecticut Communities*

The Natural Resources Conservation Academy's mission is to provide transformative and authentic learning opportunities to diverse groups of high school students; stimulating critical thinking, creativity, decision-making, and appreciation of science application and nature while contributing to local environmental solutions. The NRCA directly educates high school students from throughout the state each year on climate change effects in Connecticut as well as solutions to climate change issues. All NRCA student conservation projects are conducted in both coastal and inland communities and a majority of projects address adaptation or mitigation solutions to climate change. Student conservation projects also often include an educational component, in which the student's community will learn about the climate change issue that the student's project is addressing and possible solutions. NRCA will advance the development of resilience and sustainability of coastal and inland communities that are vulnerable to the impacts of climate change.

- Project Lead: Laura Cisneros, UConn Natural Resources and the Environment
- Primary Funding: Diebold Foundation

University of Connecticut – *Public Support for Adaptation to Sea Level Rise*

This project is intended to provide insight about the public value of gains and losses in both natural and built assets maintained in the face of a dynamic, changing coastal environment. The project will develop and implement a survey, drawing on established tools of environmental economics to gather knowledge about factors affecting the willingness of Connecticut coastal residents to support incentives or programs that lead coastal landowners and decision makers to alter plans for climate adaptation to better reflect the

value of public trust resources that may be lost as a result of a narrow focus on defense of built assets.

A spreadsheet-based tool will be created that decision-making advisors could use to evaluate the relative value of climate adaptation scenarios in the context of landowners in a position to propose adaptation actions using conventional coastal armoring or green(er) options. The project will also contribute:

- Knowledge regarding how coastal stakeholders identify the relative value of critical coastal habitats in the context of their desire to sustain services of developed land-uses while protecting ecosystem assets affecting human well-being;
- Quantitative and qualitative evaluation of public priorities for rational use of coastal and marine space;
- Economic and social science-based information to aid communities developing plans for coastal resilience to be better able to identify policy or incentive alternatives that balance human-built and natural assets;
- Foundations for policy decisions that better align economic incentives with such public priorities.

Beneficiaries will include policy and legislative officials (through our outreach involvement), residents of coastal communities needing to understand the priorities of their neighbors, and conservation organizations attempting to sustain ecosystem services.

- Project Lead: Stephen Swallow, UConn Agricultural and Resource Economics
- Primary Funding: Connecticut Sea Grant Research Awards

University of Connecticut – *Resilient Coastal Communities Under Wind and Flood Hazards*

This project seeks to improve the resiliency of coastal communities by better understanding the trade-offs in single family residential (SFR) building design that is preferred for reduction of flood hazard exposure (via elevation) but, simultaneously, increasing exposure to wind-related hazards. Because flooding caused so much damage during Sandy, the adaptive response has been to change zoning regulations and building codes to require, in certain locations, elevation of single-family homes above new higher flood levels. For example, in Fairfield where flooding damaged thousands of homes, 48 single-family residences are now elevated with additional SFR elevations already in the planning stages. While elevating homes minimizes flood risk, these newly elevated homes may now be at greater risk from exposure to damaging winds.

Complicating wind hazard exposures in Connecticut and other New England regions are SFR building designs which tend to be multiple stories high (e.g., typical colonial) with steeply sloping roofs. These typical design elements exacerbate the potential risk from wind damage because building height and roof slope increase wind loads. And, while existing SFR homes must be elevated, no wind retrofit design elements are required to be installed during the elevation process. The question coastal communities' must consider is, do SFR elevation requirements without consideration of additional wind load exposure

make their community more (or less) resilient? This project aims to help coastal communities answer this question by exploring the tradeoffs between flood and wind risks.

To evaluate these trade-offs, damage assessment methodologies for coastal communities under wind and flood hazards will be built and applied to real-world residential buildings in Fairfield and Milford. Deliverables include: 1) geographical information systems (GIS) based community resiliency maps for wind and flood hazards; 2) maps showing potential reductions in separate and multi-hazard vulnerabilities; 3) design parameters for new and retrofit SFR, such as recommended elevation height of low rise buildings to avoid flood hazard, building type or roof type and slope, etc.; and 4) educational materials on wind/flood hazard and recommendations to improve coastal community resiliency.

- Project Lead: Wei Zhang, UConn Civil and Environmental Engineering
- Primary Funding: Connecticut Sea Grant Research Awards