

Beardsley Zoo  
Green  
Infrastructure  
Project Phase II:  
Final Report to the  
Connecticut Institute for  
Resilience & Climate  
Adaptation (CIRCA)  
Author: Patrick Carleton



1000 Lafayette Boulevard, Suite 925, Bridgeport, CT 06604  
203-366-5405 [www.ctmetro.org](http://www.ctmetro.org)



December 12, 2018

Mr. James O' Donnell  
Executive Director  
Connecticut Institute for Resilience & Climate Adaptation  
University of Connecticut: Avery Point Campus  
1080 Shennecossett Road  
Groton, Connecticut 06340

Re: Final Report - Beardsley Zoo Green Infrastructure Project – Phase II  
**University of Connecticut Research Agreement: No. 171862**  
**UConn Account #: 6365830**

Dear Mr. O'Donnell:

Enclosed is the Final Report for the Beardsley Zoo Green Infrastructure Project – Phase II which was funded under University of Connecticut Research Agreement No. 171862. Our final Progress Report and Invoice were submitted on December 6<sup>th</sup>. Of the \$35,980 that was awarded to us, MetroCOG expended a total of \$35,969.89.

We would like to thank the Connecticut Institute for Resiliency and Climate Adaptation for the funding awarded to us through the Municipal Resilience Grant Program. This project allowed us to work collaboratively with the Connecticut Fund for the Environment/Save the Sound to implement a highly-visible and sustainable green infrastructure solution to stormwater runoff and urban flooding that could be replicated statewide. Should you have any questions or require any additional information regarding our Final Report please contact me at 203-366-5405 or by e-mail at [mfulda@ctmetro.org](mailto:mfulda@ctmetro.org).

Sincerely,

A handwritten signature in blue ink, appearing to read "Matt Fulda", is written over a light blue horizontal line.

Matt Fulda  
Executive Director

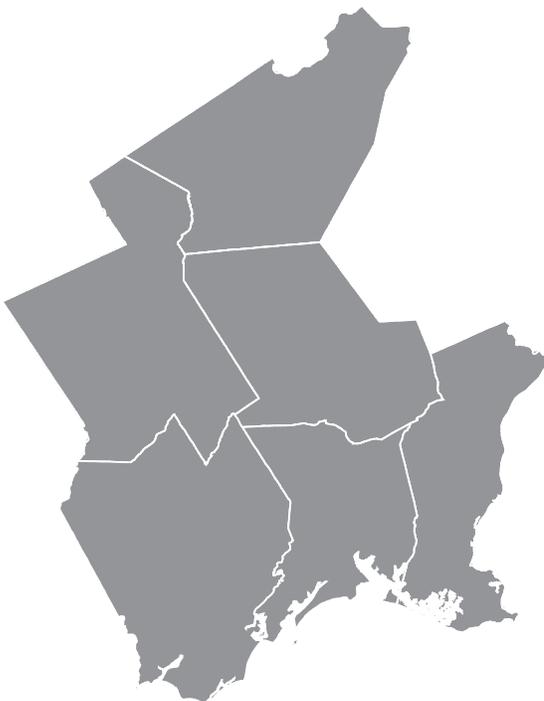
## Contents:

- A. Introduction
- B. Project Overview and Summary
- C. Project Goals and Methods
- D. Project Outcomes
- E. Advancement of CIRCA's Mission and Priority Areas
- F. Final Project Schedule & Budget

Appendix A: Press Release

Appendix B: Educational Sign

Cover, from top to bottom:  
Site prior to construction;  
Volunteers preparing site for plantings;  
and completed green infrastructure installation  
Attribute: CFE/Save the Sound



The Connecticut Metropolitan Council of Governments (MetroCOG) is a multi-discipline, regional planning organization made up of six member communities — Bridgeport, Easton, Fairfield, Monroe, Stratford and Trumbull. As a Council of Governments, the Region's Chief Elected Officers serve as MetroCOG's Board of Directors. MetroCOG is also the federally designated transportation planning organization for the region.

The Connecticut Metropolitan Region is situated approximately 50 miles from New York City and 150 miles from Boston and is part of the I-95 urban corridor that forms the "spine" of the megalopolis that stretches from Boston south to Washington, D.C. This close proximity to major population centers has enabled The Region to become one of the premier transportation hubs in southern New England, including an extensive highway network, rail facilities, intra-regional bus services, a regional airport, port facilities, and ferry services to Long Island. Within this compact region of 143 square miles is a diversity of people, natural features, culture, and recreational activities. Long Island Sound is the Region's dominant natural feature, adjoining coastal beaches, marshlands, and natural harbors..

*This publication was supported by a sub-award agreement from the Connecticut Institute for Resilience and Climate Adaptation, the University of Connecticut with funds provided by Grant No. PO#43280, PS#2014-14249 from CT Department of Energy and Environmental Protection. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of UConn or CT Department of Energy and Environmental Protection.*



Phase II of the Beardsley Zoo Green Infrastructure Project. The completed project is at the top and site preparation is below. Attribute:CFE/Save the Sound

### A. Executive Summary

The Connecticut Metropolitan Council of Governments (“MetroCOG”) and the University of Connecticut (“UConn”) entered into Research Subaward Agreement #171862 which funded the Beardsley Zoo Green Infrastructure Project – Phase II, a highly visible green infrastructure retrofit project at Connecticut’s Beardsley Zoo, which is situated along the Pequonnock River in Bridgeport, Connecticut. This collaborative project between MetroCOG, the Connecticut Fund for the Environment and its bi-state program Save the Sound (CFE/Save the Sound) and the Beardsley Zoo continued the Greater Bridgeport Region’s resiliency planning efforts. These efforts have included MetroCOG’s Coastal Resilience Plan for Fairfield and New Haven Counties and our Natural Hazard Mitigation Plan as well as CFE and Save the Sound’s (CFE/STS) Phase I of the Beardsley Zoo Green Infrastructure Project which was completed in the Spring of 2016.

This project advanced the next phase of green infrastructure identified in the Zoo’s Master Plan and will be used to capture and infiltrate stormwater runoff from an acre of existing parking area through the installation of porous pavement and bioretention gardens, as identified in the Pequonnock River Watershed Based Plan (MetroCOG was a participant in this planning process as well). Interpretive signage, targeted outreach, volunteer engagement opportunities, and workshops about stormwater runoff and flood resiliency were also included as part of the project to help educate the 275,000 people who visit the Zoo each year.

## B. Project Background & Context

### Project Description

Phase II of the Beardsley Zoo Green Infrastructure Project was a collaborative effort between multiple organizations and funders, including the Connecticut Institute for Resiliency and Climate Adaptation (CIRCA) and the National Fish & Wildlife Foundation (NFWF). The overall project included the installation of green infrastructure, including the enhancement of existing lawn areas with 1,400 sq. ft of bioretention gardens and tree pits. 2,700 sq. ft. of impervious pavement was replaced with pervious pavers (2,000 sq. ft. of permeable pavers and 700 sq. ft of grass pavers).

### Community Engagement & Education

The project also consisted of a Planting Workshop and Education Signage Installation at the Zoo. This workshop was geared toward local youth and included attendance by more than 40 high school students from three local youth groups: Beardsley Zoo's Conservation Discovery Corps, Groundwork Bridgeport, and buildOn Bridgeport. These volunteer engagement opportunities targeted underserved, urban youth and adults to promote an understanding of stormwater infrastructure issues in Long Island Sound, as well as to increase environmental awareness and enhance green job skills.

Students learned about the importance of stormwater management, how green infrastructure improves water quality, and the potential for employment in the field. Following the workshop, CFE and the Zoo organized a volunteer planting event with the students, who planted the bioretention gardens. The high school students completed the planting of the 300+ plants in bioretention gardens and Zoo staff began maintenance and up-



keep by watering and weeding the gardens.

Through the workshop and the volunteer planting event, CFE engaged with more than 50 members of the public to educate them about stormwater management and encourage hands-on training in green infrastructure best management practice (GI BMP) installation. The Education Signage was designed in August 2018. The sign was fabricated in October and installation completed on November 12, 2018. A visual is in Appendix B.

## C. Project Goals & Methods

Phase II of the Beardsley Zoo Green Infrastructure Project consisted of a hybrid of retrofits identified in the Beardsley Zoo Long Range Plan. This project addressed the problems associated with urban runoff through the accomplishment of the following outcomes: 1) measurably reduce the volume of stormwater entering the Pequonnock River through the management and treatment of

Students at the  
volunteer planting  
event.  
Attribute: CFE/  
Save the Sound



Site construction.  
Attribute: CFE/  
Save the Sound

1,000,000 gallons of polluted stormwater; 2) demonstrate a suite of green infrastructure “Best Management Practices” (BMPs); 3) educate volunteers about the uses and benefits of green infrastructure through a hands on workshop so that they may utilize these technologies; and 4) provide significant opportunities for volunteer engagement in an EPA-designated “environmental justice” community.

### Stormwater Reduction

Based on the sites and drainage areas identified, it was estimated that the green infrastructure BMPs that would be designed and constructed under Phase II will intercept 100% of the runoff from one acre of impervious surface during a 1-inch storm and divert 1,000,000 gallons of stormwater from the combined sewer system annually. This estimate is based on removing runoff from the target impervious surface with an average annual rainfall of 48” and capturing 80% of the annual rainfall.

### Youth Education

Another goal of Phase II was Community Involvement and Education. The Connecticut Fund for the Environment, the Beardsley Zoo and MetroCOG developed a youth educational workshop based on the design and construction plans for bioretention areas. In addition to the education workshop, the Conservation Discovery Corps, buildOn Bridgeport and Groundwork Bridgeport also participated in a hands-on workshop to assist in completion of the bioretention green infrastructure installations and conduct plantings.

### D. Project Outcomes & Lessons Learned:

All of the project partners learned valuable lessons regarding the planning, construction, maintenance, and outreach associated with green infrastructure. By performing detailed site assessments with the engineering contractor and Zoo staff, CFE/Save the Sound accurately identified suitable locations for GI BMPs at the site.

### Site Constraints

However, during construction, shallow bedrock was encountered in some of the proposed locations, which required altering the design of several GI BMPs in the field through coordination with the engineering team and construction contractor. This situation emphasized the importance of having professional partners who are flexible; in this case the engineer and the construction

---

“...the Conservation Discovery Corps, buildOn Bridgeport and Groundwork Bridgeport also participated in a hands-on workshop to assist in completion of the bioretention green infrastructure installations and conduct plantings.”

---

contractor were able to adapt the plans on short notice.

### Grass Pavers

Additionally, CFE discovered that one of the selected GI BMPs, the grass pavers, were less effective than the other GI BMPs (bioretention gardens and porous pavers). Several months following installation, the grass pavers did not contain any vegetation and began to erode. CFE suspects that this is due to the substrate that was used to plant the grass seed. The contractor followed the specifications detailed by the grass paver manufacturer but expressed reservations about its effectiveness at the time of installation. CFE is now working with the Zoo to repair the grass paver area and use different substrate where possible or modify the installation to mitigate erosion in other ways.

### Site Maintenance

The issue with the grass pavers emphasized another key lesson, the importance of maintenance and the value of a willing and capable project partner/site owner. It is well known that functional green infrastructure is dependent on frequent maintenance. The Zoo's maintenance and landscape crews are well equipped to reduce plant mortality and ensure that the GI BMPs continue to collect and manage runoff. Conservation organizations should identify a capable maintenance partner in coordination with the site owner early in the project process.

## E. Advancement of CIRCA's Mission & Priority Areas

CIRCA's mission "is to increase the resilience and sustainability of vulnerable communities along Connecticut's coast and inland waterways to growing impacts of climate change on the natural, built and human environment." Phase II of the Beardsley Zoo Green

Infrastructure Project advanced this mission through the implementation of a highly-visible and sustainable green infrastructure solution to stormwater runoff and urban flooding.

### Green Infrastructure Solutions

Plagued by rising costs and crumbling sewer infrastructure, communities across the country are struggling to deal with increasing expenses associated with controlling stormwater runoff and sewer overflows. Outdated and leaking infrastructure and the expansion of hard surfaces, such as pavement and roofs, are increasing flood potential and sending polluted stormwater and sewage into surrounding waterways. As the effects of climate change have accelerated over time, these problems have become more severe.

Located within a vulnerable city and with a high level of public access, this implementation project has, and will continue to serve as a critical model for the success and value of green infrastructure investments.

Site construction.  
Attribute: CFE/  
Save the Sound



### Vulnerability & Resiliency

This green infrastructure implementation project addressed sustainable solutions for critical infrastructure in a CIRCA identified vulnerable community. Bridgeport was identified in CIRCA's research as one of the most distressed 25 municipalities in Connecticut (State Agencies Fostering Resilience Connecticut Connections Vulnerability Assessment and Resilience Concept, National Disaster Resilience Competition). This project implemented strategies identified in MetroCOG's Southern Connecticut Regional Framework for Coastal Resilience and Natural Hazard Mitigation Plan and has provided a sustainable solution to reducing the volume

of stormwater entering the Pequonnock River through green infrastructure technologies. Additionally, the project provides an educational experience for students and practitioners to learn about green infrastructure in a hands-on workshop format and apply that knowledge to additional project sites going forward, whether they be in Bridgeport or other communities across Connecticut.

**“Located within a vulnerable city and with a high level of public access, this implementation project has, and will continue to serve as a critical model for the success and value of green infrastructure investments.”**

## F. Final Project Schedule & Budget

Activity	Time Period
Coordinate/develop educational workshop programming for bioretention planting with local youth groups	March/April 2018
Purchase plantings and supplies for planting bioretention areas	March 2018
Host workshop with local youth group to install plantings in bioretention features.	May 5, 2018
Design, produce, and install educational signage	August–November 2018
Presentation to MetroCOG's CTAC	September, 2018
Development of Final Report & Project Close Out	November, 2018

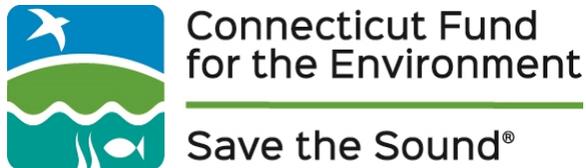
### Funding Source

Task	CIRCA	NFWF LIS Futures	Private	Total Project Budget
Personnel	\$5,969.89			
Project Admin.		\$21,973	\$9,875	\$31,812
Engineering		\$20,000	\$13,000	\$33,000
Construction		\$100,686		\$100,686
Communications				
Signage	\$15,000			\$15,000
Plants	\$15,000			\$15,000
Supplies				\$1,108
Travel		\$470.00		\$470.00
<b>Sub-Total</b>	<b>\$35,969.89</b>	<b>\$143,093</b>	<b>\$23,983</b>	<b>\$197,076</b>
A & G		\$6,740	\$8,118	\$14,858
<b>Total</b>	<b>\$35,969.89</b>	<b>\$149,833</b>	<b>\$32,101</b>	<b>\$211,934</b>

# Appendices



Completed green infrastructure installation. Attribute: CFE/Save the Sound



FOR IMMEDIATE RELEASE  
May 17, 2018

Contact: Laura McMillan, 540-292-8429

## **Youth build green infrastructure skills at Beardsley Zoo planting**

*Hands-on rain garden planting workshop teaches benefits of green infrastructure while combatting river pollution*

Bridgeport, Conn. – Bridgeport youth volunteers gained green infrastructure skills recently at a hands-on rain garden planting workshop led by Save the Sound, a bi-state program of Connecticut Fund for the Environment. Saturday’s workshop at Beardsley Zoo is part of Save the Sound’s ongoing efforts to spread the word about the benefits of green infrastructure, and builds upon rain gardens previously installed at the zoo by Save the Sound and volunteers.

Green infrastructure uses natural principles and landscaping to manage stormwater, reduce flooding, and filter pollutants. The rain gardens built at the Beardsley Zoo slow the flow of rain water runoff and helps filter polluted rainwater before it reaches the Pequonnock River and Long Island Sound.

“The beauty of rain gardens and other green infrastructure is that they are mostly above ground, so they’re visible. And because rain gardens are visible, they both have value in beautifying neighborhoods and serve as great tools for educating people about sustainable water management,” **said Kevin Dahms, Save the Sound’s Green Infrastructure project manager.** “The new rain gardens combined with installations of porous pavement in the Zoo’s parking lot filters 1,000,000 gallons of urban runoff annually. With the completion of the rain gardens, more than fifty percent of the Zoo’s parking lot is now sustainably managed.”

The Beardsley Zoo green infrastructure project, a partnership between Save the Sound and Connecticut’s Beardsley Zoo, first broke ground in spring 2016. Save the Sound and partners installed a rain garden and a porous walkway that allows stormwater runoff from the Zoo’s parking lot to percolate into the soil. Area youth and Save the Sound have since followed up with multiple rounds of plantings to reinforce the garden.

About 40 volunteers, including local young people from Beardsley Zoo Youth Conservation Discovery Corps, Groundwork Bridgeport, and BuildOn Bridgeport participated in the Saturday morning workshop. They learned about the harmful effects of stormwater runoff and how green infrastructure prevents flooding and water pollution, then gained hands-on experience by planting native perennials to filter runoff from the zoo’s parking lot. Species included joe-pye weed, coreopsis, bee balm, and switchgrass, among others. All are tolerant of both wet soil and periods of drought—critical as climate change is expected to generate less-frequent, but higher-intensity storms that drop a great deal of rain in a short amount of time.

Together, the porous pavement and rain gardens provide a two-step process for capturing and filtering stormwater runoff, and releasing clean water into the Pequonnock River. In addition, the

rain gardens and porous pavement's prominent location in a highly-trafficked Connecticut tourism destination function as a public education site.

The Beardsley Zoo green infrastructure project is generously supported by a sub-award from the Connecticut Metropolitan Council of Governments (MetroCOG) through an agreement from the Connecticut Institute for Resilience and Climate Adaptation, the University of Connecticut with funds provided by Grant No, PS#43280, PS#2014-14249 from CT Department of Energy and Environmental Protection. Additional project funding was received from the National Fish and Wildlife Foundation, Jeniam Foundation, and Newman's Own Foundation.

###



# CAPTURING THE RAIN

at CONNECTICUT'S BEARDSLEY ZOO

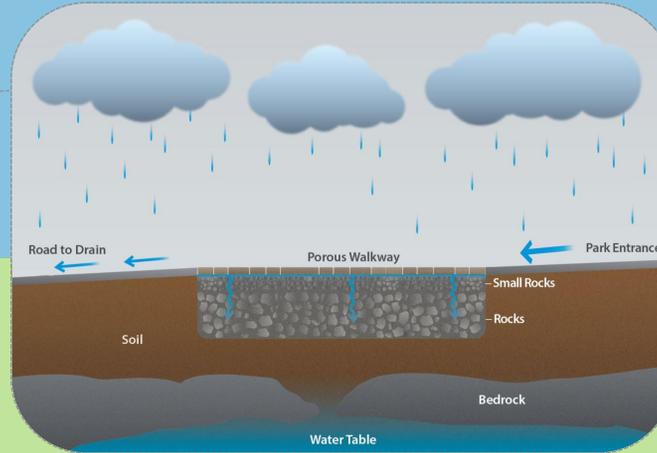
**During a storm,** rain flows over hard, impervious surfaces like the zoo's parking lot, picking up dirt, oil, and debris as it runs off the land, into storm drains, and into the Pequonnock River and Long Island Sound. This polluted rain water runoff is harmful to both people and wildlife.



Credit: Chris Zurcher

**Special surfaces** called porous pavers, like those below your feet, help eliminate pollution to the Pequonnock River by capturing and filtering rain water where it falls.

**Porous Pavers**  
are like a filter and a sponge.



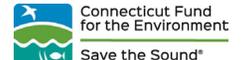
**The pavers** you see on the surface help absorb and clean the rainwater runoff. Below the surface, soil and stone clean the water even more before it soaks deeper into the ground.

**Install rain-absorbing porous pavers of your own!**  
Visit [reducerunoff.org](http://reducerunoff.org) to learn more.



**The fish** will thank you!

Connecticut Fund for the Environment and its bi-state program Save the Sound are working to restore and protect the Pequonnock River and Long Island Sound. This project was made possible through the collaboration of our partners:



# Acknowledgements

## Council of Governments

---



City of Bridgeport:  
Mayor Joseph P. Ganim

---



Town of Easton:  
First Selectman Adam W. Dunsby  
Secretary

---



Town of Fairfield:  
First Selectman Mike Tetreau  
Chair

---



Town of Monroe:  
First Selectman Ken Kellogg

---



Town of Stratford:  
Mayor Laura Hoydick  
Vice Chair

---



Town of Trumbull:  
First Selectman Vicky Tesoro

---

## MetroCOG Staff

---

Patrick Carleton  
Deputy Director

---

Lawrence Ciccarelli  
Administrative Services Director

---

Matt Fulda  
Executive Director

---

Mark Goetz  
Senior Transportation Planner/GIS Director

---

Mark Hoover  
GIS Specialist

---

Colleen Kelleher  
Deputy Finance Director

---

George B. Obeng  
GIS Specialist

---

Meghan A. Sloan  
Planning Director

---



*MetroCOG staff are entirely responsible for the design and format of this report, using a style guide developed through SRMC (Susan Rubinsky Marketing Consulting). The opinions, findings and conclusions expressed in this publication are those of MetroCOG and do not necessarily reflect the official views or policies of the federal and state agencies through which MetroCOG is funded.*



**METROCOG**  
Connecticut Metropolitan Council of Governments