



DCR PROJECT SHADE **KIT OF PARTS** **& DESIGN GUIDELINES**



THIS PAGE INTENTIONALLY LEFT BLANK

DCR PROJECT SHADE **KIT OF PARTS** & DESIGN GUIDELINES

JUNE 30, 2024

PREPARED FOR:



**Massachusetts Department of
Conservation and Recreation**
10 Park Plaza, Suite 6620
Boston, MA 02116-3978

PREPARED BY:



Stantec
40 Water St Third Floor
Boston, MA 02109
<https://www.stantec.com/en>

ACKNOWLEDGMENTS

DCR would like to recognize the contribution of the following individuals to this project:

Commonwealth of Massachusetts

Maura T. Healey, Governor

Kimberley Driscoll, Lieutenant Governor

Rebecca L. Tepper, Secretary, Energy and Environmental Affairs

Brian Arrigo, Commissioner

DCR Project Staff

James P. Allen

Celeste De Palma

Ginna Johnson

Francisco Rodriguez

Raul Silva

Kathryn Ward

Sarah J. White

Design Review was provided by DCR's Operations, Conservation & Resource Stewardship and Design & Engineering staff.

Photography / Image Credits

All images courtesy of Stantec unless credited otherwise.



Credit: DCR

TABLE OF CONTENTS

Executive Summary

I. Introduction and Project Goals

1.1 Project Background	3
1.2 Kit of Parts Goals	4

II. Design Guidelines

2.1 Approach	7
2.2 Site-Specific Design	7
2.3 Co-Benefits	7
2.4 Native Canopy Trees	8
2.5 DCR Historic Structures	9
2.6 Nature-based Solutions	10

III. Kit of Parts Overview

3.1 Tree Canopy	13
3.2 Pavilion	16
3.3 Bench Shelter	19
3.4 Canopy	21
3.5 Awning	23
3.6 Umbrellas	25
3.7 Gazebo	27
3.8 Pergola	29
3.9 Solar Charging Shelter	31

IV. Pilot Projects 33

Appendices

Appendix A Shade Suitability Assessment Sites	61
Appendix B Details	73
Appendix C Specifications, Operations & Maintenance Plans	80



EXECUTIVE SUMMARY

This Kit of Parts—a catalogue of DCR shade design standards—has been assembled to facilitate the rapid and effective deployment of shade in our parks and public spaces. Heat is the number one weather-related cause of death in the US, ahead of hurricanes, floods, and tornadoes. Per the 2022 Massachusetts Climate Assessment, the projection for extreme heat is close to 30 days above 90°F per year by 2050. Increasing shade across DCR's parks is a priority in line with DCR's mission, capabilities, and the agency's climate adaptation goals, and it aligns with the Commonwealth's resiliency goals. It is the agency's direct response to this climate hazard and the best next step DCR can take to protect our visitors and staff, and to ensure the well-being of all.

The project began with a data-driven Shade Suitability Assessment to determine the hottest locations in the DCR system that serve Environmental Justice Communities that face disproportionate impacts from heat island effect. The assessment helped inform pilot site selection during the project phase and will continue to inform ongoing shade installation beyond the pilot sites. Please see Section 1 for a description of the assessment methodology. The Appendices have a link to a tabular list of the sites identified in the assessment. DCR will prioritize installation of shade structures at these hottest sites, as the agency also works to incorporate new shade structures and tree plantings in all park and greenway capital projects.

The name “Kit of Parts” reflects DCR's design approach—using multiple strategies to increase shade as we protect park character and resources. This balancing act, protecting DCR's natural and cultural resources as we build shade infrastructure, is key to the success of the design standards project. The Kit of Parts is meant to be used by DCR Operations staff, cultural resource planners, arborists, stormwater engineers, project

managers, and design consultants working as a team to provide the best possible park shade design. See Section 1 for the Kit of Parts Goals, and Section 2 for an outline of design guidelines which emphasize the importance of tree canopy, nature-based solutions and low impact design and preservation of our existing historic shade shelters. Section 3 documents the many shade structures in current use in DCR parks as well as new products and technologies. Finally, the shade standards will be piloted at 10 sites across the Commonwealth to understand site installation issues as well as durability and ease of maintenance. The Pilot Project proposals and lessons learned to date are included in Section 4. Input from our visitors and Operations staff will guide us as we move from concepts to design and implementation.

This catalogue is a living document that will continue to be revised as DCR learns from each shade intervention project.



Credit: DCR

THIS PAGE INTENTIONALLY LEFT BLANK

A photograph of a park with a paved path, tall trees, and two people walking in the distance. The scene is bright and sunny, with long shadows cast across the grass. The path leads into the distance, flanked by lush green trees and grass. Two people are walking away from the camera on the path. The overall atmosphere is peaceful and natural.

I. INTRODUCTION AND PROJECT GOALS

1.1 PROJECT BACKGROUND

1.2 KIT OF PARTS GOALS

1.1 PROJECT BACKGROUND

Climate Impact: Extreme Heat

The 2023 ResilientMass Plan established climate impact projections for the Commonwealth. The projection for extreme heat is 23 to 29 high heat days (temperatures 90°F and above) by 2050. As extreme heat is a public health issue—the leading cause of weather-related deaths (WHO) and adversely impacting vulnerable populations like the elderly, those with respiratory illness, and environmental justice populations—DCR has prepared the Kit of Parts to enable the agency to install a range of standards that protect visitors and staff as we enhance the character of DCR parks.

Shade Suitability Assessment

As part of the project and to better understand DCR parks' vulnerability to extreme heat, staff from the Asset Management and Modernization Program (AMMP) conducted an in-house Shade Suitability Assessment. The assessment identified parks in close proximity to or used by Environmental Justice populations, proximity to areas experiencing high Urban Heat Island (UHI), and existing park amenities. These are the hottest parks that serve the most vulnerable populations. The analysis yielded a list of optimal locations within the Massachusetts State Parks System where installation of new shade would be most beneficial to increase resiliency of our parks to extreme heat and to lessen the burden of heat impacts on Environmental Justice communities.

The analysis was used as a guide to select 10 pilot sites to help inform shade design guidelines, components of the Kit of Parts, and proof of concepts for particular shade needs within DCR Parks Systems—shade at athletic fields (both for participants and spectators), pools, playgrounds, linear paths, beaches, picnic areas, and others. The 10 Pilot Projects, or case studies, included

in Section 4 provide replicable shade solutions and lessons learned for similar sites across the Commonwealth.

To find the parks identified as most suitable for new shade, please visit [here](#). Please refer to the Appendices to find the results of the FY24 analysis in list form. This assessment will be updated to integrate the latest available data, but the FY24 results give DCR a set of data-driven priority locations to advance the agency's heat resiliency work.

Next Steps:

FY25 ResilientMass Plan funding will advance shade implementation at the sites identified by the FY24 analysis to decrease DCR's heat vulnerability. Moving forward beyond this project and to change the status quo, opportunities to provide shade shall be incorporated into capital planning and construction projects to the greatest extent possible. Staff should prioritize installation of new shade and prioritize repairs to existing shade structures at parks and along greenways that are in close proximity to or used by Environmental Justice communities. DCR will identify capital programs and maintenance contracts to furnish shade structures from the Kit of Parts, perform tree maintenance and install new trees, and repair existing shade shelters.

1.2 KIT OF PARTS GOALS

Meet the increased need for shade to protect both DCR visitors and staff.

- Prioritize parks that serve Environmental Justice communities.

Develop a reference for staff and consultants that enables DCR to install shade structures that enhance park character, foster social gathering, protect our natural and cultural resources, and meet and exceed applicable regulations.

- Design for universal accessibility.
- Protect, maintain and extend our tree canopy.
- Meet DCR's Net-Zero and Climate Adaptation Goals.
 - » *Install only net-positive or net-zero facilities.*
 - » *Prioritize nature-based solutions.*
 - » *Manage stormwater responsibly.*
 - » *Plant only species native to the ecoregion.*
- Employ low-impact design principles, including sustainably-sourced materials.
- Develop standards that are durable, resistant to weather, low maintenance and easy to repair.
- Document forward-looking technologies and strategies that meet DCR goals.

Install standards Commonwealth-wide efficiently and effectively.

- Develop capital programs and maintenance contracts to streamline installation of shade projects.
- Develop metrics and data collection procedures to gauge progress on addressing extreme heat in DCR parks.



Credit: DCR

THIS PAGE INTENTIONALLY LEFT BLANK



II. DESIGN GUIDELINES

- 2.1 APPROACH
- 2.2 SITE-SPECIFIC DESIGN
- 2.3 CO-BENEFITS
- 2.4 NATIVE CANOPY TREES
- 2.5 DCR HISTORIC STRUCTURES
- 2.6 NATURE-BASED SOLUTIONS (NBS)

2.1 APPROACH

The approach to design of shade projects is the same as best management practices (BMPs) for all DCR projects. In addition to complying with environmental regulations and DCR's Stormwater Design Guidelines, CMR 521 for universal accessibility, and DCR's Climate Resilience Goals, DCR project managers and Operations staff should consult the following guidelines as well as the Pilot Projects described in Section 4 to ensure shade projects support DCR's mission and core principles as they meet our goals for shade.

2.2 SITE-SPECIFIC DESIGN

The unique landscape and history of each of DCR's parks are striking and resist standardization. To protect the natural and cultural resources of our parks, each shade intervention project needs to start with a site visit with relevant Park Operations staff and others who can help inform design with important visitor use information, including circulation patterns, active recreation uses, security issues, abutter concerns, and site conditions like property lines, resource areas, archaeological sites, localized flooding, and maintenance challenges. Projects should also try to integrate new shade structures with existing amenities—as these are popular destinations for our visitors. Alternatively, in consultation with Operations staff, shade shelters could be placed in park areas that are accessible but currently underutilized by visitors to better distribute activity areas and avoid over-crowding of existing facilities.

2.3 CO-BENEFITS

An important element of the shade project is to look for co-benefits for each installation. As outlined in the following sections, native canopy trees, and adaptive re-use of historic structures as well as new structures can provide benefits in addition to shade. For instance, a large new pavilion introduces additional impervious surface to a park, but the pavilion roof could be designed to harvest stormwater to irrigate trees in times of drought or support a solar array for net-zero lights, grills and charging stations (especially important in remote locations). Another co-benefit of providing shade is creating new community gathering spaces. Each project should consider how the investment can mitigate for any impacts and further benefit the park and its visitors.

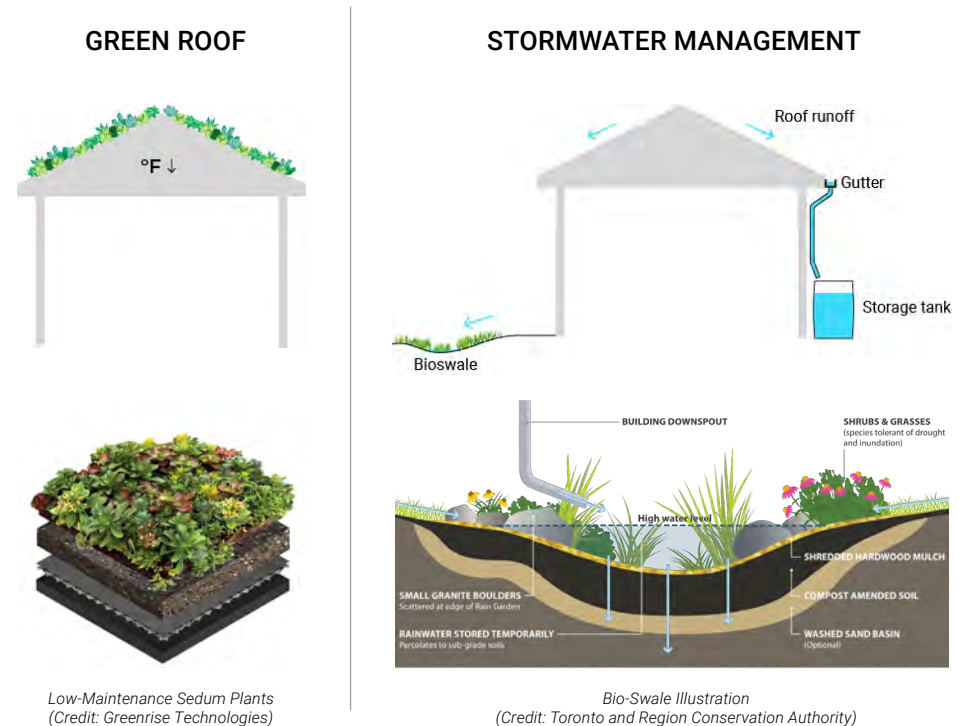
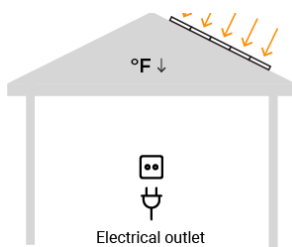


Figure 2-1. Co-Benefits Diagram

2.4 NATIVE CANOPY TREES

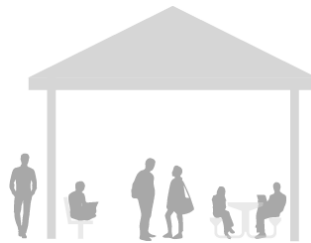
The benefits of native trees are well-known: For the human community, trees filter the pollutants out of air and water, reduce localized flooding by absorbing up to a ton of water a day, and their root systems reduce erosion. Natural communities are a web of interconnected species in which native trees play a critical role as habitat and food source both above ground and in the soil profiles. For DCR's climate resilience initiatives, trees also play an important role in sequestering and storing carbon and of course, providing shade, reducing surface temperatures up to 9°F*.

SOLAR PANEL



- Optimum orientation: due south
- Optimum angle: matching latitude (41-43 degree)

COMMUNITY-BUILDING



- Shared use resources prompting social interaction
- Charging/workstation areas

As structures are installed, each new shade intervention project should follow DCR BMPs for trees, including:

- Protect existing native canopy trees and tree root zones when installing shade structures. Protect drainage patterns to assure healthy trees continue to get water.
- Request a certified arborist provide maintenance to the existing park canopy to improve tree health and visitor safety and if required, make recommendations to amend root zone soils.
- In consultation with Operations staff, locate and request installation of new canopy trees. Review with Archeology to confirm sites have no adverse impact. Protect new tree plantings with split rail fence or post and rope as specified in the Kit of Parts.
- Install hammock poles as specified in the Kit of Parts. By providing an alternative to tying hammocks to trees, which is detrimental to tree bark, hammock poles will help to protect trees.

*Source: <https://www.epa.gov/heatislands/using-trees-and-vegetation-reduce-heat-islands>

2.5 DCR HISTORIC STRUCTURES

The preservation of historic shade structures—significant cultural resources—is essential not only to providing shade, but to DCR’s mission and identity. However, because they are unique, and it would be inappropriate to replicate them, the documentation of existing historic structures is not included in the Kit of Parts. However, these structures provide significant shade and DCR will expand a renovation program for existing and historic shade structures. Historic shade structures and other existing assets can be found [here](#). For a tabular version of this information click [here](#).

For historically significant structures that no longer serve their intended purpose, adaptive reuse could be a means to achieve the DCR mission to protect cultural resources, while meeting contemporary needs. If a structure is historically significant and retains its original character (“historic integrity”), the DCR Office of Cultural Resources may recommend that the structure be sensitively rehabilitated as a site-specific shade structure.

Although adaptive reuse can introduce additional design, permitting, or costs, the preservation of historically significant structures retains embodied energy, keeps waste out of landfills, and may be feasible where new shade structures cannot be permitted. Importantly, these cultural resources may retain a sense of place for the public’s enjoyment.



Figure 2-2. Eliot Pavilion and Tower at Blue Hills Reservation (Credit: DCR)



Figure 2-3. Revere Beach Boulevard at Revere Beach Reservation (Credit: DCR)



Figure 2-4. Pickle Barrel at Dorchester Shores Reservation (Credit: DCR)

2.6 NATURE-BASED SOLUTIONS (NBS)

An important element of DCR's Mission is to balance active recreation with the protection of our cultural and natural resources. To this end, all projects should employ nature-based solutions, defined by [ResilientMass](#) as “adaptation measures focused on the PROTECTION, RESTORATION, and/or MANAGEMENT of ecological systems to safeguard public health, provide clean air and water, increase natural hazard resilience, and sequester carbon.”

NBS is often differentiated as “green” design vs. conventional engineered solutions or “gray” design. Formerly, an area of localized flooding in a lawn area might be addressed by installing a drainage pipe with an outlet into a nearby stream. However, this engineered solution uses manufactured or “gray” components to eliminate a problem—ponding—at one location while potentially creating other problems—increased runoff velocity and streambank scouring—at another location. Nature-based solutions engage natural systems to solve problems. Nature-based solutions might include absorbing runoff by planting a tree that prefers hydric soils like black willow, installing a vegetated swale planted with wetland woody or herbaceous species, or returning the area to forested wetland and reducing the size of the lawn or relocating it.

Likewise, for the shade interventions, it is important that the solution to one climate impact, extreme heat, not create other impacts to a site. Therefore, the design of shade projects will employ NBS in treatment of stormwater management, installation of utilities, and maintenance of the structures.



Credit: DCR