

Landscape Performance Report

U.S. Coast Guard Headquarters



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Landscape Performance Report: US Coast Guard Headquarters¹

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CONTENTS

ACKNOWLEDGEMENTS	i
EXECUTIVE SUMMARY.....	1
Biodiversity	1
Heat Island Effect	2
Stormwater Management	2
Carbon Sequestration.....	2
Transportation Alternatives	3
Worker Satisfaction and Subjective Site Assessment	3
Use of Courtyards and Outdoor Space	4
Water Conservation	4
TIMELINE	5
BENEFITS OVERVIEW	6
Environmental Benefits	6
Social Benefits	8
Economic Benefits	8

Note: Additional information regarding the project research strategy and detailed data findings are available upon request.

EXECUTIVE SUMMARY

The quantified landscape performance of the General Services Administration's (GSA) United States Coast Guard Headquarters campus is measured and discussed in this report. The primary goals of the research conducted were to learn from the design and construction of the headquarters in order to inform future GSA projects, promote GSA's leading work as a model and precedent for others, and increase the collective capacity to achieve sustainability through landscape solutions. In the report that follows, the site's performance is quantified over a range of environmental, social and economic benefits, including the assessment of biodiversity, heat-island effect, carbon sequestration, stormwater management, infiltration and cost avoidance. These performance measures are intended to add supportive richness and detail to the discussion of project benefits often missed with traditional post-construction economic analysis. Following the landscape performance analysis is a discussion of future opportunities and strategies that may help GSA improve and maintain the performance of the site. Performance and recommendations for each area of measurement are summarized briefly below.

Biodiversity

The design performance for measures of biodiversity shows that the Coast Guard headquarters far exceeds the traditional design approach to large office buildings. The performance review indicated an increase of eight times more native trees and seven times more native woody species than was found on a comparable site of traditional office building design. Based on these limited design parameters, the design was deemed effective for supporting biodiversity. Longer-term field studies aimed at quantifying on-site fauna,

such as beneficial insect populations including pollinators, could reinforce the strength of these findings and conclusions.

Heat Island Effect

The heat island study shows that summer surface temperatures are considerably lower at the Coast Guard headquarters than were estimated for a traditionally designed office complex. Overall, the headquarters weighted average surface temperatures were up to 15 degrees cooler at peak times and 1.6 degrees cooler on average than a traditional office complex during the July study period. The native meadow portions of the green roof produced the lowest daytime surface temperature measurements on-site, which were ten degrees cooler than a traditional rubber roof at peak times and four degrees cooler on average. Further gains could be realized by replacing more lawn and sedum roof with meadow conditions. Overall, the headquarters design demonstrated superior surface temperature performance over the traditional design for reductions in heat island effect.

Stormwater Management

The green roofs and tree canopy at the Coast Guard headquarters are highly effective strategies for intercepting and storing stormwater. Green roofs capture and store up to 424,000 gallons or 100% of the 95th percentile storm. The planted tree canopy currently intercepts an additional 230,000 gallons annually. At maturity, the trees will intercept up to 766,000 gallons annually.

Carbon Sequestration

Carbon sequestration at the Coast Guard headquarters was found to be four times higher than was estimated at a traditionally designed office complex. Estimates were based on the number of trees, and the species of trees only. There are clear long-term carbon performance benefits to the headquarters design assuming regular maintenance and tree

care. The i-Tree Streets model developed by the USDA Forest Service, together with the integrated Mobile Community Tree Inventory application, presents an outstanding opportunity for the headquarters grounds crew to document and monitor the long-term health and benefits of the trees on campus. The initial population of 985 trees in this database has already been completed and used for the carbon storage and canopy interception analyses in this report.

Transportation Alternatives

Bus transit, walking and biking options are all available and used by employees of the Coast Guard headquarters. Only 56% of survey respondents listed “car” as their primary mode of travel to work and 18% percent reported using multiple modes of transportation. An on-site commuter count recorded 478 employees arriving to work by bus, 147 by walking and 55 by bike. The arrival area was designed with a drop-off area, seven bus stops and a 12-foot wide shared use path to serve the needs of commuters searching for alternatives to automobiles and parking spaces. Alternative options for travel to work were designed into the headquarters infrastructure and evidence shows that it is being used extensively.

Worker Satisfaction and Subjective Site Assessment

A workplace survey indicated that 66% of Coast Guard headquarters employees were satisfied overall with their workplace. In contrast, 88% were satisfied with the outdoor spaces and courtyards. In general, employees agreed that the campus was walkable, accessible, supported social interaction and had a positive impact on the local ecosystems. Even the lowest indicator on the survey—a view to outdoor space—was in positive agreement on average. This does not mean that all employees were in agreement or satisfied with each of the performance measures, but on average a strong majority of the

employees agreed that the landscape was performing well. A number of answers to the open-ended questions shed light on how the courtyards are being used and suggested ways in which the courtyards could be improved such as by adding more shade structures and moveable chairs.

Use of Courtyards and Outdoor Space

A time-lapse record of courtyard use showed a consistent utilization of the courtyards. A pattern of transient individuals throughout the day, and a second pattern of sedentary individuals around the lunch hour accounted for a total of 336 distinct individuals between the hours of 8:35 AM and 3:35 PM. These findings are generally supported by a workplace survey that indicates approximately 17% of employees access the courtyards daily, and access is distributed evenly throughout the day. The findings suggested that the courtyard is functioning as designed for movement across the campus and as a place to gather and sit for extended periods. Some survey respondents suggested that more options for seating and more shade from the sun were desirable. Temporary shade structures and moveable chairs might address these concerns until the canopy matures.

Water Conservation

Water conservation saves money and protects water resources. The Coast Guard headquarters conserves water by harvesting stormwater in a large retention pond and recirculating this water for use in site irrigation. It is estimated that approximately 520,000 gallons of water are recycled for irrigation each year. By harvesting stormwater rather than using potable water, the headquarters leaves 520,000 gallons in DC reservoirs and saves over \$2,750 in annual water costs. Precise measurement of the rainfall amounts and

irrigation pumping is possible with existing equipment on-site. A complete Rain Bird weather station is available near the retention pond pumping station but is not currently being operated. The pumping station is equipped with digital interface and flow metering that has not been set to run. With only minimal effort, a wealth of performance information could be made available for monitoring, maintenance and decision-making.

TIMELINE

Date	Activity
November 14, 2014	Kick off webinar
December 10, 2014	Kick off meeting on site
January 22, 2015	Workplace survey questions reviewed
February 13, 2015	Interim project conference call
February 27, 2015	Initial USCG biodiversity analysis completed
March 20, 2015	GSA document access approved
April 10, 2015	Site security approval request meeting
May 13, 2015	Temperature logger installation
May 14, 2015	U of M Institutional Review Board approval
June 9, 2015	Temperature data logger checkup, time lapse photography
June 30, 2015	Temperature sensor location change
August 5, 2015	Non vehicular traffic counts
August 5, 2015	Temperature sensor collection
August 12, 2015	Workplace survey conducted
September 24, 2015	Final report submitted

BENEFITS OVERVIEW

A detailed set of methods used to quantify the landscape performance of the U.S. Coast Guard headquarters site is provided in the Overview of the University of Maryland's Research Strategy. The text below is a simple listing of all the landscape benefits that were documented during the project for ease in accessing them. They are also listed as findings after the documented background and method description provided for each benefit.

Environmental Benefits

- Intercepts 233,587 gallons of stormwater annually by planting 985 trees.
When planted conifers/understory trees reach 3" DBH and canopy trees reach 10" DBH, they will intercept 766,294 gallons of stormwater annually.
- Retains 423,896 gallons of stormwater on green roofs which is equal to 100% of the 95th percentile storm event (1.7 in).
- Includes over 247,000 native plants from 104 different species by incorporating ecosystem themed courtyards and forest regeneration areas.
- Harbors eight times more native trees than a traditional office landscape by incorporating ecosystem themed courtyards and forest regeneration areas.
- Includes seven times more native woody plant species than a traditional office landscape by incorporating ecosystem-themed courtyards.
- Protected bald eagle nesting area by moving security fence and removing a second helipad from the design.

- Sequesters 152,517 pounds of carbon annually by planting 985 trees. When planted conifers/understory trees reach 3" DBH and canopy trees reach 10" DBH, they will sequester 883,306 pounds of carbon annually. This is equivalent to about four times the carbon sequestration of a traditional site.
- Reduces surface temperatures of the sedum green roof compared to that of a traditional roof. From 7/1/2015 to 7/14/2015 the average surface temperature of the sedum green roof was 83° F—four degrees lower than the traditional rubber roof. During the same period, the average maximum daily surface temperature of the sedum green roof was 115° F—twelve degrees lower than the traditional rubber roof.
- Reduces surface temperatures of the tall grass green roof compared to that of a traditional roof. From 7/1/2015 to 8/4/2015 the average surface temperature for the tall grass green roof was 84° F—four degrees lower than the traditional rubber roof. During the same period, the maximum daily surface temperature of the tall grass green roof was 177° F—ten degrees lower than the traditional rubber roof.
- Reduces site surface temperatures of the U.S. Coast Guard headquarters compared to that of a traditional office complex. From 7/5/2015 to 7/10/2015, the average site surface temperature of the Coast Guard headquarters was 86.7° F—1.6° F less than that modeled for the traditional office complex.

Social Benefits

- Enables 478 employees to commute daily on public bus transit, 55 employees by bicycle, and 147 employees on foot due to the bus stop and shared use path.
- Provides outside time for 336 distinct individuals by designing a courtyard as a lunch area and outdoor hallway.
- Creates outdoor spaces that 77% of survey respondents reported being satisfied with. Satisfaction with outdoor space is significantly correlated with respondent's opinion that there is ample (r: 0.48, p: 0.000), walkable (r: 0.48, p: 0.000), outdoor space that was good outdoor for social interaction (r: 0.43, p: 0.000).

Economic Benefits

- Saves \$2,771 annually on potable water costs by recycling stormwater for all irrigation.