



**Manassas National Battlefield Park
Climate Action Plan
September 2013**

Introduction 1

 Manassas National Battlefield Park..... 1

 Manassas National Battlefield Park Climate Action Commitment..... 1

 The Challenge of Climate Change 2

 Manassas National Battlefield Park and Climate Change..... 2

 Inventory Process 3

Park Emissions Profile 4

 Manassas National Battlefield Park GHG Inventory – FY 2011 4

Strategies for Reducing Emissions..... 6

 Strategy 1: Reduce GHG Emissions from Energy Use by 14 percent by 2018..... 6

 Strategy 2: Reduce GHG Emissions from Transportation by 11 percent by 2018 7

 Strategy 3: Reduce GHG Emissions from Waste by 4 percent by 2018..... 8

 Strategy 4: Increase Climate Change Education and Outreach 9

Conclusion 10



Introduction

MANASSAS NATIONAL BATTLEFIELD PARK

Manassas National Battlefield Park (park) spans over 5,200 acres. The park features monuments, historical structures, and sites that demonstrate the battle positions, casualties, and other significant events of the First and Second Battles of Manassas (Bull Run). Visitors come to the battlefield to experience the history of the Civil War battles through tours and historical demonstrations. Manassas National Battlefield Park also offers several trails for visitors to enjoy.



MANASSAS NATIONAL BATTLEFIELD PARK CLIMATE ACTION COMMITMENT

As a participant in the National Park Service (NPS) Climate Friendly Parks (CFP) Program, Manassas National Battlefield Park belongs to a network of national parks that are at the forefront of sustainability planning. By developing a greenhouse gas (GHG) emissions inventory, setting an emissions reduction target, developing this climate action plan, and committing to educate park staff and the public about climate change and mitigation efforts, the park is leading by example. The park commits to reducing GHG emissions from park operations by 10 percent below fiscal year (FY) 2011 levels, by 2018, through the following actions:

1. Prioritize building improvements that will reduce park energy use.
2. Reduce emissions from mobile combustion by upgrading park fleet, mowers, and infrastructure.
3. Develop a solid waste reduction plan that includes composting and recycling.
4. Develop strategies for greener employee meetings.
5. Educate park staff on ways to reduce emissions during the workday.
6. Educate visitors about climate change risks and impacts as well as the actions they can take to help reduce emissions at home and while visiting Manassas National Battlefield Park.

The Manassas National Battlefield Park climate action plan serves to support and enhance existing initiatives, such as the park's environmental management system (EMS) and the National Capital Region (NCR) EMS. The park's EMS is a comprehensive management system that addresses all environmental programs at the park and provides the context for actions that reduce park emissions. The NCR EMS addresses the energy- and climate-related goals for all parks in the region and aligns with the NPS Green Parks Plan; Executive Order (EO) 13423, "Strengthening Federal Environmental, Energy, and Transportation Management"; and EO 13514, "Federal Leadership in Environmental, Energy, and Economic Performance." The goals in this climate action plan will be incorporated into the park's EMS to more efficiently track progress and ensure continual improvement toward the park's emissions reduction goal. Additionally, the climate action plan supports the park's long-term planning efforts. It should be noted that the purpose of this climate

action plan is to reduce park GHG emissions, and it is not intended to address park adaptation to climate change impacts.

THE CHALLENGE OF CLIMATE CHANGE

The atmosphere has a natural supply of gases—known as greenhouse gases or GHGs—that trap heat and keep the temperature of the Earth warm enough for life to survive. However, the release of certain GHGs—including carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O)—has disturbed this balance. These gases result from burning fossil fuels during processes such as industrial manufacturing, energy production, and driving vehicles. The gases can stay in the atmosphere for at least 50 years but often remain over many centuries, and they are accumulating in the atmosphere faster than natural processes are able to remove them. The increase in GHGs is causing an overall warming of the planet, commonly referred to as “global warming.” The term “climate change” describes the variable consequences of global warming over time.

According to the Intergovernmental Panel on Climate Change, the leading international scientific organization for the assessment of climate change, “continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.”¹ Climate change is expected to affect temperatures and precipitation patterns and result in sea level rise. In addition to this, impacts to all aspects of the water cycle are anticipated, including snow cover, mountain glaciers, timing of spring runoff, water temperature, ocean currents and upwelling, salinity levels of inland coastal waters, and aquatic life. Climate change is also expected to affect human health, alter crop production, modify animal habitats, and change conditions of natural and managed environments.

MANASSAS NATIONAL BATTLEFIELD PARK AND CLIMATE CHANGE

In the area around Manassas National Battlefield Park, climate scenarios suggest an increase in the frequency of extreme temperature and precipitation events due to climate change.² Changes in precipitation and temperature will affect the ecological, cultural, and recreational features of the park. Park staff considered the following potential climate change impacts while identifying actions to reduce greenhouse gas emissions:

- Changes in growing seasons, which will affect vegetation.
- Increased opportunity for invasive species due to ecosystem changes.
- Unpredictable management needs for the park’s natural resources due to climate change uncertainty.
- Changes in visitation due to changes in seasonal patterns.

¹ Intergovernmental Panel on Climate Change, *Climate Change: 2007: Synthesis Report*, page 45, www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf.

² Gonzalez, Patrick. “Climate Change Trends for Resource Planning at Catoctin Mountain Park.” National Park Service, June 25, 2012.

By measuring and reducing GHG emissions from park-related activities, Manassas National Battlefield Park intends to minimize its contribution to climate change and educate the public about how to reduce their emissions.

INVENTORY PROCESS

Manassas National Battlefield Park staff gathered data about park operations and completed an emissions inventory using the Climate Leadership in Parks (CLIP) tool. The CLIP tool was initially developed by the NPS CFP program, in association with the U.S. Environmental Protection Agency, to account for GHG emissions specific to national parks. The tool is designed to:

- Convert energy and resource use data into metric tons of carbon dioxide equivalent (MtCO₂e), which is a single unit that standardizes CO₂, N₂O, and CH₄.
- Educate park employees about the sources of GHGs and the emissions inventory process.
- Assist with identifying strategies to reduce GHG emissions.
- Enable park personnel to track current and future progress toward emissions reduction goals.

Park activities such as fuel and electricity use, refrigeration, and treatment of solid waste all produce different types of GHGs. Since not all GHGs affect climate change to the same degree, it is necessary to convert each GHG to a common unit in order to compare them in the park inventory. The CLIP tool automatically converts the park's data into MtCO₂e. The conversion to MtCO₂e is based on the potential of a specific GHG to contribute to climate change; this is known as the GHG's global warming potential (GWP) and is relative to the potential of CO₂, which is assigned a GWP of 1. The GWP of CH₄ is 21, meaning that CH₄ has 21 times the potential of CO₂ to cause global warming. The results of the CLIP tool describe the park's emissions profile, which provides a description of the amount of emissions from each source. The park used this information to prioritize GHG emission reduction strategies, as outlined in this action plan.

To create a baseline GHG inventory, Manassas National Battlefield Park staff gathered FY 2011 annual usage data (e.g., gallons of fuel used in FY 2011) related to park operations and visitor travel within park boundaries. Employee commuting data was collected and included in the inventory as well, through an online survey developed by the CFP program.

Data categories include stationary combustion, mobile combustion (e.g., the park's vehicle fleet and mowers), purchased electricity, solid waste, refrigeration, visitor emissions, and employee commuting. These categories can be divided into direct and indirect GHG emissions. Scope 1 emissions are direct emissions from sources owned and operated by the park. This includes emissions produced when fuel is burned within park boundaries (e.g., wood) or when fueling a park vehicle; it also includes "fugitive" emissions released from refrigeration use. Scope 2 emissions are indirect GHG emissions produced from park consumption of purchased electricity. Scope 3 emissions are all other indirect emissions, such as emissions from visitor vehicles, employee commuting, and offsite waste disposal.

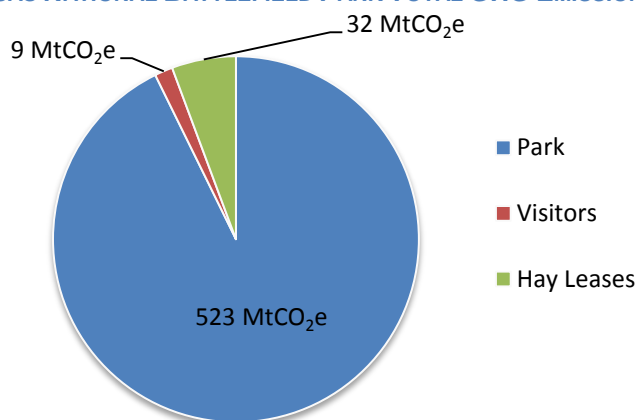
Park Emissions Profile

The Manassas National Battlefield GHG inventory for FY 2011 includes emissions from park operations, visitors, and farmers who lease land from the park. Sources of emissions from park operations include natural gas, diesel fuel, burned wood, purchased electricity, gasoline and biodiesel used for park-owned or park-leased vehicles and equipment, solid waste disposal, refrigerant use, livestock (four horses), and employee commuting. The park uses a small amount of fertilizer, but the associated emissions are negligible and therefore not represented in the inventory. The park does not send wastewater to an offsite treatment plant; all wastewater is treated through the septic system and there are no associated emissions. Visitor emissions are estimated based on annual visitation numbers for visitor vehicle transportation on park owned roads. The hay lease operations at the park result in emissions from agricultural equipment. A summary of the inventory is detailed below.

MANASSAS NATIONAL BATTLEFIELD PARK GHG INVENTORY – FY 2011

Total GHG emissions from park operations, farmers, and visitors for FY 2011 amounted to 564 MtCO₂e. For comparison, this is equal to the CO₂ emissions from the electricity use of 84 homes in the U.S. for one year.³ Park operation emissions accounted for the greatest percentage of the total emissions from Manassas National Battlefield, producing approximately 521 MtCO₂e (92 percent of total emissions). Visitor emissions produced 9 MtCO₂e (2 percent of total emissions), primarily from vehicle travel on park owned roads. Note that visitor travel on 10.1 miles of non-park owned roadways, including US 29 and VA 234, is not within the scope of this inventory. There were 660,220 visitors in 2011, and most of the visitors use US 29 or VA 234 to access Battlefield attractions. There are only 1.74 miles of park-owned roads from which visitor vehicle miles traveled were calculated. This was determined per Climate Friendly Parks guidance. Visitor vehicle emissions would be significantly higher if miles traveled on non-park owned roadways were included. Hay lease operations produced 32 MtCO₂e (6 percent of total emissions), and horses produced 2 MtCO₂e (less than 1%). Figure 1 below shows the total park GHG emissions profile for FY 2011.

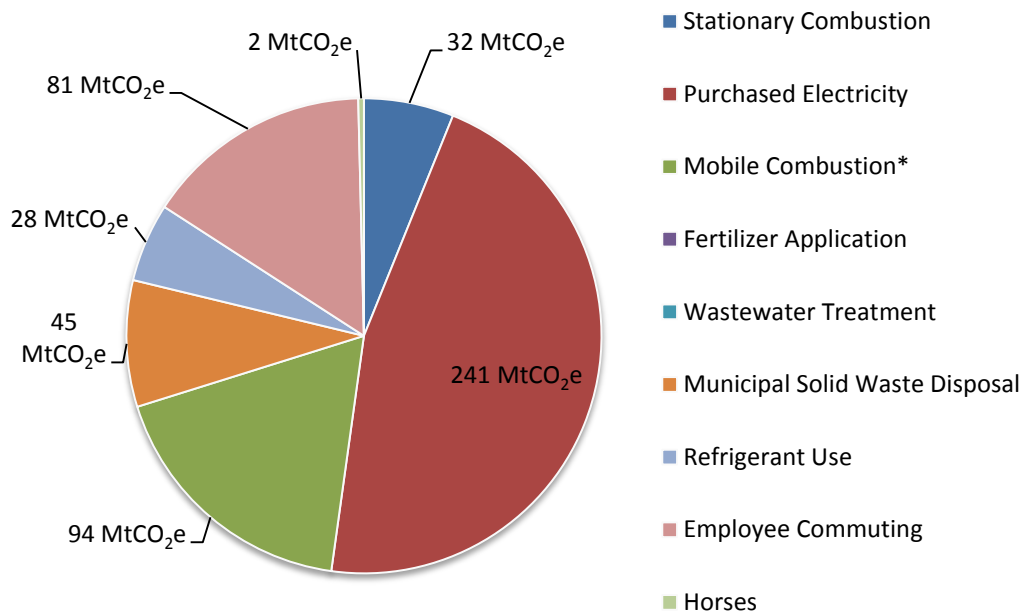
FIGURE 1: FY 2011 MANASSAS NATIONAL BATTLEFIELD PARK TOTAL GHG EMISSIONS – 564 MtCO₂e



³U.S. Environmental Protection Agency. "Greenhouse Gases Equivalencies Calculators." Clean Energy Resources. EPA, 2011. Web. <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.

In order to target emissions reduction efforts, the park assessed park operations emissions by source. At 241 MtCO₂e (46 percent of total park operations emissions), purchased electricity is by far the largest contributor of GHG emissions from park operations. Mobile combustion contributed 94 MtCO₂e (18 percent) to the total park operations emissions, making it the second largest contributor. The third largest contributor was park employee commuting, which contributed 81 MtCO₂e (16 percent) to the park's GHG emissions. Solid waste contributed 45 MtCO₂e (9 percent), stationary combustion contributed 32 MtCO₂e (6 percent), and refrigeration (e.g., refrigerators, freezers, and air conditioning) contributed 28 MtCO₂e (5 percent). Horses contributed 2 MtCO₂e (less than 1 percent). See Figure 2 for a breakdown of emissions from park operations.

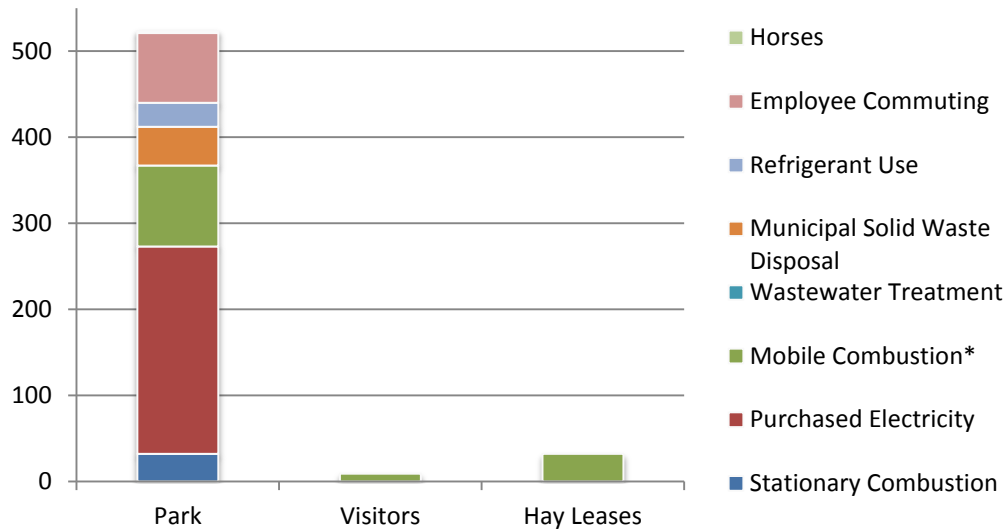
FIGURE 2: FY 2011 MANASSAS NATIONAL BATTLEFIELD PARK OPERATIONS GHG EMISSIONS BY SOURCE – 523 MtCO₂e



* Note: Mobile combustion does not contain emissions from biodiesel. In the CLIP, biodiesel is assumed to be carbon-neutral.

Figure 3 below provides a comparison between the emissions profiles for the park, visitors, and hay lease farmers.

FIGURE 3: FY 2011 MANASSAS NATIONAL BATTLEFIELD PARK GHG EMISSIONS BY SOURCE – SOURCE CONTRIBUTION



* Note: Mobile combustion does not contain emissions from biodiesel. In the CLIP, biodiesel is assumed to be carbon-neutral.

Strategies for Reducing Emissions

Manassas National Battlefield Park staff developed reduction strategies and actions during the park’s CFP workshop held on June 11, 2013, at Manassas National Battlefield Park Headquarters. These strategies focus on reducing energy consumption, reducing transportation emissions, reducing the amount of solid waste sent to the landfill, and increasing climate change education efforts. Since park wastewater is treated by a septic system, which does not produce a significant amount of emissions, wastewater was not a top priority for action planning; however, as natural resource stewards, staff are still dedicated to reducing water use. Park staff identified a number of strategies to reduce emissions based on emission reduction potential, cost-effectiveness, feasibility, co-benefits, and local impact.

STRATEGY 1: REDUCE GHG EMISSIONS FROM PARK ENERGY USE BY 14 PERCENT BELOW FY 2011 LEVELS BY 2018

The largest contributor of GHGs from park operations is purchased electricity, which produced 46 percent of the park-related emissions, or 241 MtCO₂e, in FY 2011. Because of this, Manassas National Battlefield Park will focus on reducing energy consumption from its 11 buildings as a top priority. In addition to reducing overall GHG emissions, reducing energy consumption will provide the park with reduced costs and overall operational savings.

PROGRESS AS OF JUNE 2013:

- Performed retrofit on main lighting, updating to light-emitting diode (LED) lamps in the Visitor Center and Headquarters.
- Reduced newly installed LED tube lighting based on occupant's preferences from four bulbs down to two bulbs in the entrance lobby of Headquarters and two offices.
- Installed on-demand hot water heaters in the Maintenance Shop and Headquarters.
- Insulated park housing.
- Installed a split air system at Rosefield.
- Installed Big Belly (solar) trash compactor at the Brownsville Picnic Area.
- Installed solar-powered well for drinking fountain.
- Installed waterless urinals and low-flow toilets in new bathrooms.
- Installed motion sensors on water faucets.

MANASSAS NATIONAL BATTLEFIELD PARK COMMITS TO THE FOLLOWING ACTIONS IN ORDER TO REDUCE PARK ENERGY USE:

1. Reduce building energy intensity with the following actions:
 - Complete weatherization of the building envelopes at Headquarters and the Maintenance Shop by 2014. Weatherize remaining buildings over time.
2. Reduce the number of vending machines on site.
3. Install programmable thermostats in housing and set temperature limits.
4. Install or replace bay doors in the park headquarters.
5. Analyze opportunities to reduce energy use in the server room.
6. Implement a more energy-efficient lighting system.
 - Install directional lighting on display areas in the Visitor Center.
 - Install solar level lighting monitors to reduce light levels based on the amount of natural light coming from windows.
 - Install solar lighting upgrades.
 - Research and install motion sensors for LED lights.
7. Renovate the Visitor Center with energy-efficient upgrades.
 - Install geothermal energy system.
 - Upgrade bathroom fixtures.
 - Construct a vestibule entrance/exit in the Visitor Center.

STRATEGY 2: REDUCE GHG EMISSIONS FROM TRANSPORTATION BY 11 PERCENT BELOW FY 2011 LEVELS BY 2018

The second largest contributor of GHGs from park operations is mobile combustion, which produced 18 percent of park-related emissions, or 94 MtCO_{2e}, in FY 2011. This includes fuel use in vehicles and small equipment such as mowers and leaf blowers. Taking actions to reduce mobile emissions sources is critical for reducing the park's GHG emissions.

PROGRESS AS OF JUNE 2013:

- Eliminated take-home vehicles.
- Acquired two hybrid vehicles.
- Arranged carpooling for internal meeting job sites and offsite training.
- Significantly reduced mowing area.
- Analyzed and right-sized the fleet.
- Staged vehicles near work sites.
- Conducted a visitor transportation survey.
- Initiated a No-Idling policy.

MANASSAS NATIONAL BATTLEFIELD PARK COMMITS TO THE FOLLOWING ACTIONS TO REDUCE PARK EMISSIONS FROM TRANSPORTATION:

1. Reduce emissions from park fleet through the following actions:
 - Acquire electric utility service vehicles.
 - Create another locked and secure maintenance storage area at Grey House, in which vehicles can be staged.
2. Reduce emissions from park staff commuting through the following actions:
 - Compress the workweek.
 - Offer more opportunities for telecommuting.
3. Consider installing a bike loop in the park with a bike share offering.
4. Implement weight restrictions and brake restrictions for trucks, or restrict the time that trucks are allowed on roads in the park.
5. Eliminate and/or reduce the number of commuters that travel through the park.
6. Change lane direction to expedite traffic during rush hour.
7. Implement traffic-calming measures, such as increased speed enforcement, and reduce speed limits within the park.
8. Continue to reach out to the county regarding traffic reduction opportunities.
9. Research opportunities to change laws regarding the use of all-terrain vehicles (ATVs) so that they can be driven across roads and do not have to be trailered to nearby work sites.
 - Reduce trailering of ATVs or get exemption to allow driving them across roads.
10. Review the need to continue keeping horses for law enforcement.

STRATEGY 3: REDUCE GHG EMISSIONS FROM WASTE BY 4 PERCENT BELOW FY 2011 LEVELS BY 2018

Solid waste disposal creates emissions when organic matter decomposes in the landfill. Because the waste in landfills has little exposure to oxygen, the organic matter decomposes anaerobically, releasing methane in the process. The disposal of solid waste produced 45 MtCO₂e (9 percent of park-related emissions) in FY 2011. Although this is a relatively small contributor to the overall emissions, there are opportunities to significantly reduce GHG emissions associated with this activity. In addition, reducing solid waste can save on disposal fees and staff time.

PROGRESS AS OF JUNE 2013:

- Increased number of recycling bins at the Visitor Center and Headquarters.
- Decreased amount of trashcans park-wide.
- Co-located recycling bins and trashcans throughout the park.
- Created separate bins for recycling at offices and the Maintenance Shop.
- Recycled scrap metal, aluminum, copper, and brass and used funds earned from recycling to purchase LED lights.
- Recycled:
 - All batteries
 - All fluorescent light bulbs
 - Electronics
 - Refrigerants
 - All cardboard
 - Tires
 - Aluminum cans and plastic bottles
 - Pallets
- Used recycled lumber for boardwalks.
- Stopped washing vehicles on site, reducing wastewater runoff.

MANASSAS NATIONAL BATTLEFIELD PARK COMMITS TO THE FOLLOWING ACTIONS TO REDUCE PARK EMISSIONS FROM SOLID WASTE DISPOSAL:

1. Consider implementing trash-free policies gradually throughout the park, including the following locations:
 - Visitor Center.
 - Stonebridge, by the end of summer 2013.
 - Entire park, except for picnic areas, by 2015.
2. Increase visitor education regarding waste reduction.
 - Develop educational materials for visitors about reducing waste associated with lunches brought to the park.
 - Send teachers educational materials to teachers before park visits that explain how students can reduce trash while visiting the park.
 - Make trash educational materials accessible online via the park website.
3. Reduce the amount of junk mail received.
4. Post permanent signage explaining how visitors should manage horse waste at trailer parking lot.
5. Research and consider recycling construction waste materials.
6. Ensure staff are printing double-sided from computers and copiers.

STRATEGY 4: INCREASE CLIMATE CHANGE EDUCATION AND OUTREACH

Over 660,200 people visited Manassas National Battlefield Park in FY 2011. The park will encourage GHG emissions reductions within and outside of the park by educating its visitors on actions they can take to reduce emissions at the park and in their daily lives. The park is also dedicated to taking advantage of opportunities to educate park staff and members of the surrounding community.



MANASSAS NATIONAL BATTLEFIELD PARK COMMITS TO THE FOLLOWING ACTIONS TO INCREASE CLIMATE CHANGE EDUCATION AND OUTREACH FOR PARK STAFF, VISITORS, AND THE LOCAL COMMUNITY.

1. Educate visitors about decreasing emissions while at the park.
 - Encourage visitors to use walking trails to see the park.
 - Encourage visitors eliminate idling while in the park.
 - Have park staff suggest trails based on length of trail and time it takes to walk to encourage visitors to plan walking tours.
2. Educate visitors about how the park is decreasing emissions.
 - Post signage on low emissions vehicles.
 - Post signage on buildings highlighting the park's energy reduction efforts.
3. Educate staff on how to reduce emissions at the park.
 - Create a sustainable operations brochure for distribution to park staff that explains how the park is already reducing emissions, and major reduction efforts for the future.
 - Create an education piece explaining how staff can reduce emissions during the workday with energy saving behaviors.

Conclusion

Manassas National Battlefield Park has a unique opportunity to educate visitors and set an example for reducing GHG emissions in the NCR and Servicewide. By addressing emissions in a targeted, prioritized manner, the park can efficiently and effectively reduce its GHG emissions. Additionally, by sharing these strategies with park visitors and partners, Manassas National Battlefield Park will promote an awareness of climate change and encourage visitors and staff to take action to reduce GHG emissions on a broader scale. These efforts will further support the park's commitment to environmental stewardship.