dcr
Massachusetts

Resource Management Plan
Orange State Forest

Adopted by the DCR Stewardship Council MONTH, 2025

Massachusetts Department of Conservation and Recreation
Division of Conservation and Resource Stewardship
Office of Cultural Resources

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Purpose

Resource Management Plans (RMPs) are foundational documents that identify a park, forest, or reservation's defining natural, cultural, and recreational resources and identify potential threats and opportunities to guide DCR's continued stewardship of the property and to inform future decisions about the property in a way that celebrates and preserves its identity.

RMPs are prepared for "all reservations, parks, and forests under the management of the department" (M.G.L. c. 21, § 2F). These plans "shall include guidelines for the operation and land stewardship of the aforementioned reservations, parks and forests, shall provide for the protection and stewardship of natural and cultural resources and shall ensure consistency between recreation, resource protection, and sustainable forest management." DCR finalizes RMPs following a public process and adoption by the DCR Stewardship Council. The contents of this RMP represent the best available information at the time of adoption by the Stewardship Council.

Mission and Core Principles

The Massachusetts Department of Conservation and Recreation, an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, dams, parkways, and over 100 National Register listed properties. The agency's mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources for the well-being of all.

DCR strives to be an exemplary leader in conservation and recreation. DCR's staff is passionate, dedicated, and continuously employs best practices, expertise, and a sense of place in carrying out the mission. The following core principles ground the agency in its work. For the benefit and well-being of all—people and the environment—DCR pledges to:

- Provide access to a diversity of outdoor recreational experiences and unique landscapes that is equitable, inclusive, and welcoming.
- Conserve lands, water, and forests by integrating science, research, and technical expertise into the management of our natural resources.
- Advance climate change mitigation and adaptation efforts by implementing sustainable practices and advancing resiliency across our infrastructure, assets, and resources.
- Support healthy communities by providing places for people to connect with nature and each other.
- Inspire generations of stewards by recognizing and honoring our legacy through partnerships, public engagement, and education.

Stewardship

DCR honors Indigenous peoples for their care, throughout many generations, of the land that DCR now stewards on behalf of the people of the Commonwealth. DCR embraces this legacy of stewardship, fostering a sense of shared responsibility by all people for protection of the waters, lands and living things for the enjoyment and appreciation of all.

To learn more about the DCR, its facilities, and programs please visit us at www.mass.gov/dcr. Contact us at mass.parks@mass.gov.

Orange State Forest

1. Property Overview

Characteristic	Value
Date Established	1936
Location	Orange, Warwick
Ecoregion	Worcester Plateau
Watershed	Chicopee, Millers
DCR Region	Central
DCR District	Central Highlands
DCR Complex	Erving
Management Forestry District	Eastern Connecticut Valley
Fire Control District	Franklin
Size (acres)	738.4
Boundary Length (miles)	9.6
Elevation - Minimum (feet)	583.5
Elevation - Maximum (feet)	1,131.1
Environmental Justice (acres)	0.0
Estimated Annual Attendance (2023)	500
Interpretive Programs (# programs, 2023)	0
Interpretive Programs (# attendees, 2023)	0

2. Landscape Designations

Designation	Acres
Parkland	0.0
Reserve	671.7
Woodland	0.0
No Designation	140.0

3. Regulatory Designations

Designation	Acres
Outstanding Resource Waters - Quabbin Reservoir	4.2

4. Long-Term Agreements

Agreement	Expiration Year
None Identified	N/A

5. Concessions

Concession Type
None

6. Partners & Friends

Group(s)
None Identified

7. Features of Interest

Feature
Connectivity to two additional Reserves
Coolidge Swamp
Linear rock outcrops

8. Natural Resources

Resource	Value
Tree Canopy (acres)	707.4
Rivers and Streams (miles)	1.8
Open Water (acres)	0.0
Wetlands (acres)	40.3
Certified Vernal Pools (#)	0
Potential Vernal Pools (#)	3
State-Listed Species (# Regulatory)	1
State-Listed Species (# Non-Regulatory)	0
Federally Listed Species (#)	0
Aquatic Invasive Plants (# known species)	0
Terrestrial Invasive Plants (# known species)	5

9. Forest Management (Since 2012)

Management Objective	Acres
N/A	0.0

10. History of Wildfires and Conditions Influencing Future Wildfires

Wildfire Attribute	Value or Characteristic
Number of wildfires on property; 2019–2023	0
Acres burned by wildfires on property; 2019–2023	0.0
Number of wildfires in Fire Control District; 2019–2023	220
Acres burned by wildfires in Fire Control District; 2019–2023	108.5
Type of Wildland-Urban Interface	Intermix
Predicted rate of spread, based on Fire Behavior Fuel Model 13	Not Easily Spread

11. Natural Hazards

Hazard Type	Acres
Flood (1.0%-chance)	Data unavailable
Flood (0.2%-chance)	Data unavailable
Hurricane Inundation (Cat. 1)	N/A
Hurricane Inundation (Cat. 4)	N/A

12. Climate Change (By 2070)

Type of Change	Amount of Change
Increase in annual days over 90° F	>30
Change in annual maximum daily rainfall (inches)	>10
Massachusetts Coastal Flood Risk Model area of inundation (acres)	N/A

13. Cultural Resources

Resource Type	#
Archaeological	0
Historic - Total MACRIS Listed	0
Historic - National Register Listed	0
Historic - National Historic Landmark	0

14. Recreation Resources

Resource	#
Trail segments	1

15. Recreation Activities

Activity
Hiking/Walking
Hunting
Nature study/Photography
Wildlife viewing

16. Roads and Trails

Metric	Value
Roads - Unpaved (miles)	0.0
Roads - Paved (miles)	0.6
Forest Roads - Unpaved (miles)	2.7
Forest Roads - Paved (miles)	0.0
Trails - Unpaved (miles)	0.4
Trails - Paved (miles)	0.0
Trails - Unauthorized (miles)	0.9
Trail Density (miles/acre)	0.005
Area of Impact (acres)	245.5

17. Parking

Parking Resources	#
Lots	0
Parking Spaces - Total	0
Parking Spaces - Accessible (HP)	0
Parking Spaces - Other	0

INTRODUCTION

Orange State Forest (Orange or the Forest) is located in the Towns of Orange and Warwick, approximately 5 miles northwest of Quabbin Reservoir and approximately equidistant between the cities of Greenfield and Gardner. The Forest abuts three other DCR Division of State Parks and Recreation properties, Erving, Warwick, and Wendell State Forests. Thirty-five percent of the Town of Orange is permanently protected open space, with DCR-owned land accounting for 4% of the land in town (Orange Open Space and Recreation Update Committee and Franklin Regional Council of Governments 2016). Orange is composed of three isolated tracts (See Figure 1. Land Stewardship Zoning Map, page 19); they are:

- **Moss Brook Road Tract.** This tract is located north of Route 2 and east of Moss Brook Road along the Orange-Warwick town line. It is functionally an extension of the adjacent Warwick State Forest, with that Forest's trails passing through this tract and connecting to trails on the New England Forestry Foundation's Battle Dorrance Memorial Forest. A 115.7-acre parcel on the west side of Moss Brook Road was once part of Orange State Forest but is now part of Erving State Forest.
- **Gidney Road Tract**. This tract is located south of Route 2 and along the east side of the Wendell-Orange town line. Gidney Road forms a portion of its eastern border, before becoming an internal road. Coolidge Swamp, the Forest's largest wetland, is located in this tract.
- **Chestnut Hill Tract.** This tract is located on the northwest slope of Chestnut Hill, between the Wendell-Orange town line and Gidney Road. Wendell State Forest's trail system extends eastward into this tract. The Chestnut Hill Tract is separated from the Gidney Road Tract by an approximately 96-acre parcel of Wendell State Forest.

The Forest is on land shaped by generations of Indigenous peoples and non-Indigenous inhabitants. Past and present Indigenous residents embody fluid, relational connections to the places and spaces now known as Orange State Forest. Groups and individuals, including Indigenous peoples known as the Nipmuc, Pennacook, and Wabanaki (Dawnland Confederacy), are recorded in available documentation (Native Land Digital 2023) as having relationships to this place over seasons and generations. Indigenous peoples' "occupation probably occurred primarily on the lowlands adjacent to the Miller's River" (Massachusetts Historical Commission (MHC) 1982). Following Indigenous peoples' dispossession, lands that would become the Town of Orange were granted to settlers between 1735 and 1765, with incorporation occurring in 1810 (MHC 1982). Orange State Forest was established in 1936, with an initial size of 59 acres (Massachusetts Department of Conservation 1936). It remained this size through at least the mid-1950s (Massachusetts Department of Natural Resources (DNR) 1955). A period of rapid expansion soon followed, as indicated by a 1961 topographic map that shows all three of today's tracts (United States Geological Survey 1961). At this time, the Forest was approximately 510 acres in size. A second period of expansion took place in the 1980s through early 2000s, with the Forest attaining its current size and configuration. Both expansion periods focused on acquiring land contiguous with larger adjacent forests (i.e., Erving and Wendell State Forests).

Although the specific reason(s) for the establishment of Orange State Forest went undocumented, general reasons for the establishment of Massachusetts State Forests are well known. The Massachusetts State Forest system was established in the early 1900s "for timber cultivation within the Commonwealth," with the State Forester having the authority to "reforest and develop such lands…to

increase the public benefit and enjoyment therefrom and to protect and conserve water supplies of the Commonwealth" (Massachusetts General Court (MGC) 1914). In 1924, Chapter 284 of the Acts of 1924 authorized the Commissioner of Conservation "to lay out, construct, and maintain trails or paths through or over lands in state forests" (MGC 1924). The following year, the Legislature authorized the regulated "hunting and trapping of certain birds and animals" on public lands in the Commonwealth (MGC 1925). The establishment of the Forest in 1936 was likely for these purposes, the societal priorities of the day. At least one commercial timber harvest took place in the Forest, with approximately 120,000 board feet of white pine, hemlock, maples, white oak, and "miscellaneous mixed hardwoods" cut in 1972 (DNR 1972). Prior to adoption of this Resource Management Plan (RMP), Orange State Forest was managed under a regional Guidelines for Operations and Land Stewardship plan (i.e., GOALS plan) covering the Northeastern Connecticut Valley Region (Massachusetts Department of Environmental Management 1997).

In 2012, Orange State Forest was designated a Reserve. Reserves are large contiguous blocks of high-value ecosystems where the dominant ecosystem service objectives are biodiversity maintenance, nutrient cycling and soil formation, and long-term carbon sequestration (DCR 2012). The primary purpose of Reserves is to "allow forests to develop relatively unimpeded by human disturbance and to create late successional habitat" (DCR 2012: 15). With limited exceptions, "habitat manipulation, silvicultural treatments, and commercial harvesting operations are not permitted in Reserves (DCR 2012). In conjunction with portions of larger adjacent State Forests (i.e., Warwick and Wendell), Orange contributes to Reserve areas both north and south of Route 2.

PARK IDENTITY

Orange State Forest is part of a broad conservation landscape but lacks a strong identity of its own. It is an eastward extension of Wendell State Forest and a southern extension of Warwick State Forest. All future activities and improvements should be consistent with Orange's identity as a Reserve area "relatively unimpeded by human development" (DCR 2012: 15).

DEFINING RESOURCES AND VALUES

Resources that define the Forest are related to its size, proximity to larger DCR properties, limited recreation infrastructure, and limited recreation-related disturbance to natural and cultural resources. They include:

- Physical and administrative connections between Orange State Forest and Wendell State Forest.
- Orange contributes to two blocks of Reserve, one associated with Warwick State Forest and the other with Wendell State Forest.
- The Forest is part of a broad, conservation landscape. The Moss Brook Road Tract is contiguous with Warwick State Forest and Erving State Forest, which is contiguous with Northfield and Mount Grace State Forests. The Gidney Road and Chestnut Hill Tracts are contiguous with Wendell State Forest. Numerous non-profit (e.g., Massachusetts Audubon Society, Mount Grace Land Trust) and municipal-owned lands, and conservation restrictions, are part of this landscape and contiguous with these DCR-owned properties.
- Coolidge Swamp, which provides habitat for a state-listed species of Special Concern.
- A near absence of recreation infrastructure and low levels of estimated visitation.

- Orange provides permanently protected open space for dispersed recreation.
- Bedrock outcrops erupting through the soil form mound-like north-south oriented ridges in the Gidney Road Tract. (See cover photo.) Although these features are not unique to Orange, they are an interesting landscape feature that makes for a memorable visitor experience.

STATEMENTS OF SIGNIFICANCE

Statements of Significance describe the importance or distinctiveness of a place and its resources (National Park Service (NPS) 1998). These statements reflect current scholarly inquiry and interpretation and go beyond a simple listing of resources to include contextual information that makes the facts more meaningful. Significance statements cover the following categories of information:

- The property's significance at the time of its establishment.
- How the property, or society's understanding of the property, has changed since its acquisition that makes it significant or unique within the state park system today.
- The property's role in recreation and its importance to the community it supports, particularly regarding activities that are unique to that property.

For park planning, these statements focus management actions on the preservation and enjoyment of those attributes that most directly contribute to the importance of the place. For interpretive planning, they comprise the information upon which the interpretive themes and overall program are built.

The following Statement of Significance has been identified for Orange State Forest. The sequence of these statements does not reflect their level of significance.

- Beyond the original intents of timber harvesting, pest control, and fire control, DCR forest management objectives have evolved to include carbon sequestration and storage, diverse wildlife habitats, forest resiliency, safety, and water quality.

UNIFYING THEME

The Unifying Theme is a statement that ties a property's stories together and shapes the overall interpretive message that DCR wants to share with visitors in their experience at the property. The theme provides an overarching conclusion for visitors to contemplate (Ham 2013) and answers the question "so what?" The theme guides all interpretation for the park, both personal (i.e., formal and informal interactions with visitors) and non-personal (e.g., exhibits, signage, brochures).

The Unifying Theme for Orange State Forest is:

> Passive management can allow natural processes to determine the long-term structure and dynamics of a forest.

VISITOR EXPERIENCE

Orange State Forest provides limited visitor experiences, including the following:

- **Virtual Experience.** Potential visitors will find little information about Orange State Forest on DCR's web site. The "Find a Park" tool (https://www.mass.gov/info-details/find-a-park) identifies the Forest's location and lists Hiking/Walking as activities that visitors may enjoy here. There is no additional information to help potential visitors plan a trip. The Wendell State Forest web page does

not list Orange as one of its "related parks." The Moss Brook Road Tract is shown on the Erving State Forest trail map and some of the Gidney Road Tract and all of the Chestnut Hill Tract are shown on the Wendell State Forest trail map. Orange State Forest is unlabeled on both maps.

- **Entering the Park.** Access to the Forest varies among tracts. Visitors to the Moss Brook Road Tract park on that road's shoulder to access the tract. Visitors access the Gidney Road Tract from an informal trailhead on the south shoulder of Route 2, crossing approximately 1,200 feet of private property before reaching the Forest. The Chestnut Hill Tract is accessed from trails within adjacent Wendell State Forest. Formal parking areas and identification signs are absent from all tracts.
- **Off-trail Passive Recreation**. Unlike most DCR properties, there is no formal trail system or trail-based passive recreation. Visitors participate in off-trail recreation activities, such as hunting and wildlife viewing.

THREATS AND OPPORTUNITIES

The following information identifies potential threats to the park's natural and cultural resources and identifies opportunities to enhance their protection and stewardship. Although recreation is not considered a resource under statute (M.G.L. c. 21, § 2F), it is included below because recreation is an important part of the park-going experience, helps define a park's values, and is a key part of assessing the consistency of activities taking place in the Commonwealth's forests, parks, and reservations.

Threats and opportunities identified below are used to inform the development of management recommendations. Potential recommendations must meet prioritization criteria to be included in the Priority Recommendations table (Table 19, page 23).

Natural Resources

Threats

- Hemlock wooly adelgid and red pine scale, two invasive insects, are present in the Forest. They, along with other introduced pests and pathogens, pose a threat to the Forest's vegetation.
- The following four species of invasive plants have been identified in the Forest: common buckthorn, Japanese barberry, multiflora rose, and oriental bittersweet. Invasive species may negatively impact both the ecological integrity and biodiversity of the Forest.
- Trail repair, modification, or construction activities performed prior to conducting a Forest-wide natural resources inventory may negatively impact these resources.

Opportunities

- Approximately 140 acres of the Forest has no Landscape Designation (DCR 2012). Designation of these areas could help protect associated natural resources.
- Avoiding the use of mechanical equipment for park maintenance and/or habitat management within 300 feet of the bank of Moss Brook (Moss Brook Road Tract) between March 15 And November 15, would better protect State-listed species on adjacent properties (Schlüter 2024).
- Some of the three potential vernal pools may provide breeding habitat for amphibians and other obligate vernal pool species. Surveying and certifying these pools (Massachusetts Division of Fisheries and Wildlife (MassWildlife) 2009), as appropriate, may help better protect these animals.

- The limited extent of trails and absence of other recreation infrastructure creates an opportunity for a "clean sheet" approach to ensuring consistency between the Forest's recreation and natural resources. Natural and Cultural resource surveys could determine the appropriate location, types, and levels of passive recreation within the Forest.
- The Forest is located within the Quabbin to Cardigan Initiative's (Q2C) project area. This initiative is a public-private collaborative effort to conserve the Monadnock Highlands of north-central Massachusetts and western New Hampshire. The Forest's location within the project area offers opportunities to participate in organizational partnerships, grants, and land acquisitions in support of DCR's and Q2C's mutual conservation and recreation goals (Q2C 2023).

Cultural Resources

Threats

- The primary threat to the Forest's cultural resources is a lack of information.
- Current digitized and spatially referenced flood maps from FEMA do not cover Orange State Forest. This limits DCR's ability to identify potential threats from flood events to cultural resources in the Forest.
- Trail repair, modification, or construction activities performed prior to conducting a Forest-wide cultural resources inventory may negatively impact resources not yet documented.
- Erosion associated with natural weather events and human recreation activities (e.g., hiking, mountain biking, OHV use) has the potential to damage archaeological resources at all tracts.

Opportunities

- Approximately 140 acres of the Forest has no Landscape Designation (DCR 2012). Assigning Landscape Designations to these portions of the Forest could help with management of associated cultural resources.
- There is an opportunity to work with Indigenous partners to inventory, document, conserve, and interpret Indigenous peoples' resources and Indigenous peoples' history within the Forest.
- Although there are no post-Contact resources documented (i.e., listed in the Massachusetts Cultural Resource Information System (MACRIS)), a mill site, three cellar holes, stone walls, and some older roads are extant in the Forest. An opportunity exists to inventory, document, conserve, and interpret these and other uninventoried resources.
- The Forest is located approximately 9 miles east of the Turners Falls Sacred Ceremonial Hill Site, a "highly significant Native American "prayer hill" containing stone features" (Matthews 2008). This property has been determined to be eligible for listing on the National Register (Matthews 2008). The "site is considered by Tribal authorities to be part of a ceremonial district" (Shutesbury Historical Commission (SHC) 2021). Although the boundaries of the district "are presently undetermined," its approximate boundary is "a 16-mile radius around the Turners Falls Site" (SHC 2021). Because of the Forest's location within this potential district, there is a possibility that Indigenous peoples ceremonial stone features occur within the Forest.
- The limited extent of trails and absence of other recreation infrastructure creates an opportunity for a "clean sheet" approach to ensuring consistency between the Forest's recreation and cultural

resources. Cultural resource surveys could determine the appropriate location, types, and levels of recreation within the Forest.

Recreation

Threats

- There is limited official information available on Orange State Forest. DCR's webpage does not include information on the Forest, making it difficult for potential visitors to become aware of the property and its recreational opportunities.
- Current digitized and spatially referenced flood maps from FEMA do not cover Orange State Forest. This limits DCR's ability to identify potential threats from flood events to recreational resources in the Forest.

Opportunities

- Adding an Orange State Forest web page to DCR's web site would allow potential visitors to become aware of the Forest, its resources, and associated recreation opportunities.
- There is an opportunity to ensure a compatible level and location of trails by conducting natural and cultural resource inventories prior to any creation, expansion, or improvement of trails.

Climate Change

Climate change impacts nearly every aspect of DCR's properties, from ecosystem health, to infrastructure, to recreation. (See DCR 2024 for an overview of these impacts.) The Department is actively working to mitigate and adapt to current and future impacts through such actions as forest management; decarbonizing DCR's buildings, vehicles, and power equipment; protecting wetlands; and using nature-based solutions to minimize stormwater impacts. Information on these, and other, efforts is incorporated into RMPs as available and appropriate.

Any discussion of climate change requires a shared understanding of terminology. Because of this, this RMP section adopts commonly accepted terms to the greatest extent possible. In general, climate-related technical terms used in this RMP are as defined in the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2021). Exceptions to this are the terms Adaptation, Risk, and Sensitivity, which are used as defined in DCR's Climate Change Vulnerability Assessment (CCVA; Weston and Sampson 2022).

DCR manages its forests to provide a range of ecosystem services such as recreation, clean water, wood commodities, and wildlife habitat (DCR 2020). For ecosystems under its management, DCR carefully considers both their vulnerability to climate change and their ability to mitigate the effects of climate change by storing carbon in ecosystems and harvested wood products. Several approaches are used to monitor DCR forests and to design forest management strategies to adapt to climate change and provide ecosystem services. (See Swanston et al. (2016) for information on adaptation strategies and approaches associated with DCR's forest management.) Established in 1957, DCR's Continuous Forest Inventory (CFI) system uses a network of more than 2,000 permanent plots on which repeated measurements are taken on an ongoing basis. The CFI measures the status, size, and health of over 100,000 trees; other vegetation; down woody material; and the forest floor. (See DCR 2022 for additional information on the CFI system.) This information helps DCR understand at a strategic scale the current character, condition,

and trends of forest ecosystems under its care. DCR also uses operational inventory to help plan specific treatments and evaluate their outcomes. Using these different scales of information, remotely sensed data, and local and regional external expertise, DCR plans projects that help its stands, forests, and other lands adapt to climate change and mitigate greenhouse gas emissions. The conservation and science-based management of forest lands are an essential element to ensuring crucial carbon storage and advancing climate change resilience (Massachusetts Executive Office of Energy and Environmental Affairs (EEA) 2024). For additional information on the relationship between DCR's forest management practices and climate change, please see pages 77–85 in Massachusetts Forest Action Plan 2020 (DCR 2020) and Managing Our Forests…For Carbon Benefits (DCR 2023).

The Department is actively assessing and addressing the vulnerability of its properties and facilities to the impacts of climate change. In 2022, DCR conducted a Climate Change Vulnerability Assessment (Weston and Sampson 2022). Findings from this CCVA are being used by DCR to enhance park operations and maintenance, inform resilient investment, and provide a framework for hazard mitigation and climate adaptation for natural resources, cultural resources, recreational activities, buildings, facilities, and other infrastructure. Property-specific climate change information from the CCVA is included in the Climate Change (by 2070) table (Table 12) at the beginning of this RMP. An overview of the impacts of climate change on DCR facilities and operations is presented in the DCR Climate Impacts Story Map (DCR 2024).

Climate Exposure and Impacts

A summary of the ways in which the Commonwealth's natural, cultural, and recreational resources may be impacted by climate change is provided below. During the preparation of Resource Management Plans some resources may be identified as having particularly high exposure and/or sensitivity to the anticipated hazards or consequences of climate change. When this occurs, these resources and the projected impacts to them are described. In some instances, the potential impacts of climate change on a given resource are not well understood. When this occurs, only exposure is discussed.

Natural Resources—General Impacts

Climate change affects temperature, precipitation, and atmospheric and ocean chemistry, which in turn directly and indirectly affect the natural environment, including the plants, animals, and natural communities of DCR's forests, parks, and reservations.

Climate is known to influence the presence, absence, distribution, reproductive success, and survival of both native and non-native plants (Finch et al. 2021). Native northern and boreal species, including balsam fir, red spruce, and black spruce may fare worse under future conditions, but other species may benefit from the projected changes in climate (Janowiak et al. 2018). Some non-native invasive species will be affected by climate change while others will remain unaffected, and some non-invasive non-native species are likely to become invasive (Finch et al. 2021). In general, elevated temperature and CO2 enrichment associated with climate change increases the performance of non-native plants more strongly than the performance of native plants (Liu et al. 2017). Climate change may result in the presence of new non-native invasive plants on a property, and changes to the distribution and/or abundance of invasives already present on a property.

Exposure to a changing climate affects wildlife in a variety of ways. For animals that live in or near aquatic environments, "changes in habitat and hydrological regimes are expected to shift their abundance and

distribution" (Isaak et al. 2018: 89). Impacts to terrestrial animals are expected to be highly variable (Halofsky et al. 2018) but may be considered to fall into the following four categories: 1. habitat loss and fragmentation; 2. physiological sensitivities (i.e., innate characteristics that influence the ability to cope with changing temperature and precipitation conditions); 3. alterations in the timing of species' life cycles; and 4. indirect effects (e.g., disruption of ecological relationships) (Friggens et al. 2018). Although all Northeast wildlife are exposed to hazards associated with climate change, some groups, "including montane birds, salamanders, cold-adapted fish, and freshwater mussels, could be particularly affected by changing temperatures, precipitation, sea and lake level, and ocean processes" (MassWildlife 2015: 357). In addition, it is the position of the Massachusetts Natural Heritage and Endangered Species Program that state-listed species and Priority Natural Communities are likely to be highly sensitive to climate change and that all state-listed species will be negatively affected by hydrologic changes, changes in water, soil, and air temperature, and changes in forest composition.

Natural Resources—Property-Specific Exposure and Impacts

Coolidge Brook, which flows northward out of Coolidge Swamp, has been identified as a Coldwater Fish Resource by MassWildlife. Such streams provide important habitat for coldwater species, which are typically more sensitive than other species to alterations in stream flow, water quality, and temperature (Massachusetts Bureau of Geographic Information (MassGIS) 2022). The entire lengths of the brook within the Forest are exposed to climate impacts.

Climate change may cause some vernal pools to dry earlier in the season than they have historically, potentially interfering with amphibian life cycles (Cartwright et al. 2022). Because of this, some of the Forest's pools and associated wildlife may be negatively impacted.

Cultural Resources—General Impacts

Climate change may negatively affect cultural resources, their preservation, and maintenance (EEA 2022; International Council on Monuments and Sites (ICOMOS) Climate Change and Cultural Heritage Working Group 2019; Rockman et al. 2016: 3, 18; United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Center 2007). In Massachusetts, cultural resources may be exposed to the following natural phenomena that are correlated with adverse impacts: higher annual average temperature (especially in winter), increased numbers of freeze-thaw cycles, increased precipitation intensity, higher relative humidity, higher wind speeds, an increase in severe storm events, increased numbers and severity of wildfires, more severe seasonal droughts, increase in number and severity of inland flood events, increased coastal flooding and erosion, increased probability of landslides, changes in groundwater levels, shifts in native and invasive species distribution, performance, and phenology; and changes in oceanic and atmospheric chemistry (Rockman at al. 2016; Commonwealth of Massachusetts 2023: 5.1-31–5.1-61).

The phenomena listed above may produce a variety of adverse impacts to Massachusetts' cultural resources. Sensitivity and potential impacts vary based on resource category (i.e., archaeological sites, cultural landscapes, ethnographic landscapes and sites, and buildings and structures). Resource-specific factors such as location, design, materials, condition, etc. will also influence sensitivity and consequent impacts. All categories of cultural resources may be subject to complete or partial destruction through wildfire, inland flooding, sea level rise, storm surge, or landslides. Additionally, these resource categories may be subject to other types of impacts, as follows. Archaeological sites may have site stratigraphy

disrupted by changes in hydrography, may suffer accelerated decomposition of artifacts and features, and may be impacted inadvertently during disaster response. Cultural landscapes may lose plantings due to a variety of stressors (e.g., drought or flood, pests, soil salinity), may be infiltrated by invasives, may be eroded by surface runoff, may experience more rapid deterioration of hardscaping and site furnishings, and may be damaged by high wind or heavy snow events. Ethnographic landscapes, traditional cultural places, and associated communities (including Indigenous peoples) may suffer both tangible and intangible impacts such as loss or diminishment of natural species used for food, ceremony, or medicine; alterations in timing of hunts, etc.; increased difficulty of vulnerable subgroups (e.g., the elderly) to perform outdoor tasks; and a loss of cultural knowledge associated with resources and practices. Buildings and structures may be damaged or destroyed by high wind or heavy snow events, suffer accelerated deterioration through a variety of mechanisms (e.g., elevated humidity, chemical reactions, destructive pests and organisms), may be destabilized by hydrological changes, or be damaged by inadequate gutters or drainage systems (ICOMOS Climate Change and Cultural Heritage Working Group 2019: 73–89; Rockman et al. 2016: 20–24). (See Rockman et al. 2016: 19–24 for a detailed assessment of the potential impacts of climate change on cultural resources.)

Cultural Resources—Property-Specific Exposure and Impacts

No cultural resources with known elevated exposure or sensitivity to potential consequences of climate change were identified at this property.

Recreation—General Impacts

Outdoor recreation and park visitation are dependent on weather and climate and will be affected by a warming climate (Wilkins and Horne 2024). Higher temperatures positively affect participation in most outdoor activities, except snow-based activities (Wilkins and Horne 2024). “Winter is warming substantially faster than other seasons, and winter warming is especially pronounced in the...Northeastern United States” (Wilkins and Horne 2024: 15). Exposure to this climate change phenomenon is projected to significantly reduce the length of winter recreation seasons for downhill skiing, cross-country skiing, and snowmobiling, decreasing recreational opportunities and causing substantial economic impacts (Wobus et al. 2017). Whitewater rafting, primitive area use, and hunting are also projected to be negatively impacted by exposure changing weather patterns associated with climate change (Askew and Bowker 2018). Although “coldwater fishing habitat is expected to decline under a warming climate, which will likely result in fewer fishing days,” overall fishing participation in the Northeast is projected to rise “due to the more favorable temperatures” (Wilkins and Horne 2024: 11). Horseback riding on trails, boating, swimming, and visiting interpretive sites are also expected to see higher participation in the Northeast under climate change (Askew and Bowker 2018). Temperature preferences of campers indicate that the “number of ideal days” for camping will also increase (Wilkins and Horne 2024: 13). Participation in biking is also projected to increase, especially in the winter and shoulder months (Wilkins and Horne 2024: 13). Climate change may also impact outdoor recreation through increased impacts to recreation infrastructure (e.g., flooding impacts), and increased exposure to disease vectors (e.g., mosquitoes and ticks), longer pollen seasons, and heat-related illnesses (O’Toole et al. 2019).

Recreation—Property-Specific Exposure and Impacts

No recreation resources or activities with known elevated exposure or sensitivity to potential consequences of climate change were identified at this property.

APPLIED LAND STEWARDSHIP ZONING

DCR assesses the appropriate uses and stewardship of its properties at two spatial scales: the landscape level and the property level.

Landscape Designation

In 2012, DCR engaged in a comprehensive system-wide assessment of lands managed by its Division of State Parks and Recreation, designating them as Reserve, Woodland, or Parkland. (See Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines (DCR 2012) for details.) Multiple Landscape Designations may apply to individual properties with diverse resources and levels of development. All of Orange State Forest was designated Reserve. Identification of Land Stewardship Zones within Orange was performed in the context of the Reserve Landscape Designation.

The following Land Stewardship Zoning is recommended to guide management and any future development. (See Figure 1. Land Stewardship Zoning Map, page 19, and the Land Stewardship Zoning layer on DCR's Stewardship Map: https://dcrsgis-mass-eoeea.hub.arcgis.com/.) As indicated in Priority Recommendations for Orange State Forest, this Land Stewardship Zoning should be revisited as more natural and cultural resources information becomes available.

Zone 1

Zone 1 areas have highly sensitive ecological and/or cultural resources that require additional management approaches and practices to protect and preserve these special features and their values (DCR 2012). The following areas of Orange State Forest have been designated Zone 1.

- No areas within the Forest have been designated Zone 1.

Zone 2

Zone 2 areas provide for a balance between resource stewardship and recreational opportunities that can be appropriately sustained. They include stable yet important cultural and natural resources. These areas provide a buffer for sensitive resources, recharge areas for surface and groundwaters, and large areas where existing public recreation activities can be managed at sustainable levels (DCR 2012). The following areas of Orange State Forest have been designated Zone 2.

- All of the Forest.

Zone 3

Zone 3 areas include altered landscapes in active use and areas suitable for future administrative, maintenance, and recreation areas (DCR 2012). The following areas of Orange State Forest are currently developed, appropriate for potential future development, or intensively used for recreation. They have been designated Zone 3.

- No areas within the Forest have been designated Zone 3.

Significant Feature Overlay

Significant Feature Overlays provide precise management guidance in order to maintain or preserve recognized resources features regardless of the zone in which they occur. The following Significant Feature Overlays were developed for Orange State Forest.

- **Sensitive Rare Species Overlay**. This overlay extends 600-feet from Moss Brook, in and near Priority Habitat polygon PH 1682. The use of mechanical equipment for park maintenance and/or habitat management within 300 feet of the bank of Moss Brook is to be avoided between March 15 And November 15 (Schlüter 2024). Within 600-feet of the brook, applicable Conservation Management Practices are to be followed for forestry activities (see https://www.mass.gov/info-details/forestry-and-rare-species-review). The associated State-listed species and required Conservation Management Practices may be identified through a pre-filing consultation with NHESP.
- **Watershed Protection Act Overlay**. Land uses and activities within this overlay should be consistent with Massachusetts Watershed Protection Act (WsPA) regulations. Overlay boundaries on map encompass WsPA Primary and Secondary Protection Zones and are approximate, other geographic areas may be regulated under the WsPA. See 313 CMR 11.00 for regulations and the associated guidance document (DCR 2017) for details on the processes used for implementation of the act.. Geospatial data for this overlay are drawn from Watershed Protection Act (WsPA) Buffers – Primary & Secondary Zones (MassGIS 2024).

DCR Stewardship Map Tool

This RMP should be viewed in conjunction with DCR's Stewardship Map, a GIS-based tool that allows users to view a property's natural, cultural, and recreational resources. The Stewardship Map tool is dynamic, and information continues to be updated after adoption of an RMP. Guidance for using the tool, as well as Best Management Practices for resource stewardship, are located on the Stewardship Map site: https://dcrsgis-mass-eoeea.hub.arcgis.com/.

Consistency Review

Resource Management Plans "shall ensure consistency between recreation, resource protection, and sustainable forest management" (M.G.L. c. 21, § 2F). For planning purposes, an activity is considered consistent with resource protection if it has no significant, long-term, adverse impact on resources. To this end, a series of indicators were developed to evaluate the impacts of recreation and forest management on natural and cultural resources.

Many activities with the potential to negatively affect resources are already subject to agency and/or regulatory review (e.g., forest management activities, projects within Priority Habitat). For these activities, compliance with state regulations, regulatory authority guidance, DCR policies and processes, and Best Management Practices (BMPs) is considered an indicator of consistency between park use and resource protection. New indicators were generated for activities not subject to agency or regulatory review, and are based on available data, information readily identifiable via aerial imagery or site visits, assessments by DCR subject matter experts, or the property manager's knowledge of park conditions and use. (See Table 18, page 20.)

Indicators are applied during the RMP planning process in order to ensure a standardized assessment of consistency across all properties in the DCR system. Inconsistencies identified via the application of indicators are used to inform the development of management recommendations.

The status of indicators (Yes, No, Unknown, and N/A) were accurate at the time this RMP was prepared and were used for planning purposes. However, they represent a snapshot in time and may not reflect future conditions. In addition, the status of indicators will change as recommendations get implemented.

MANAGEMENT RECOMMENDATIONS

Eight priority management recommendations were developed for the Forest. They are presented in Table 19, Priority Recommendations for Orange State Forest, page 23. All recommendations are of equal importance.

Priority management recommendations derive from Threats, Opportunities, and Consistency Assessment information presented in this RMP. For a recommendation to be considered a priority and listed in the table, it must meet one or more of the criteria listed below. Maintenance and management needs not meeting one or more of these criteria are not included in the table but are identified in the Threats and Opportunities sections.

The following types of recommendations are considered priority:

- Natural resource stewardship and restoration activities consistent with park identity and intended to improve ecological function and connectivity.
- Cultural resource management activities consistent with park identity and intended to prevent the loss of integrity of significant cultural resources.
- Improvements consistent with park identity that are needed to support intended park activities.
- Actions required for regulatory compliance or compliance with legal agreements.
- Activities that prevent or ameliorate threats to the health and safety of park visitors and employees.
- Activities that address inconsistencies among recreation, resource protection, and sustainable forest management, as identified through use of the Consistency Assessment checklist.

Progress toward implementing priority recommendations is tracked through the use of DCR's Capital Asset Management Information System (CAMIS). The property manager should enter each recommendation listed in Table 19 (page 23) into CAMIS as a separate work order, noting "*RMP" in the description field. Non-traditional work orders (e.g., volunteer trail work, posting of DPH Fish Consumption Advisory posters, certification of vernal pools) should be closed out by the property manager, once the recommendation has been implemented.

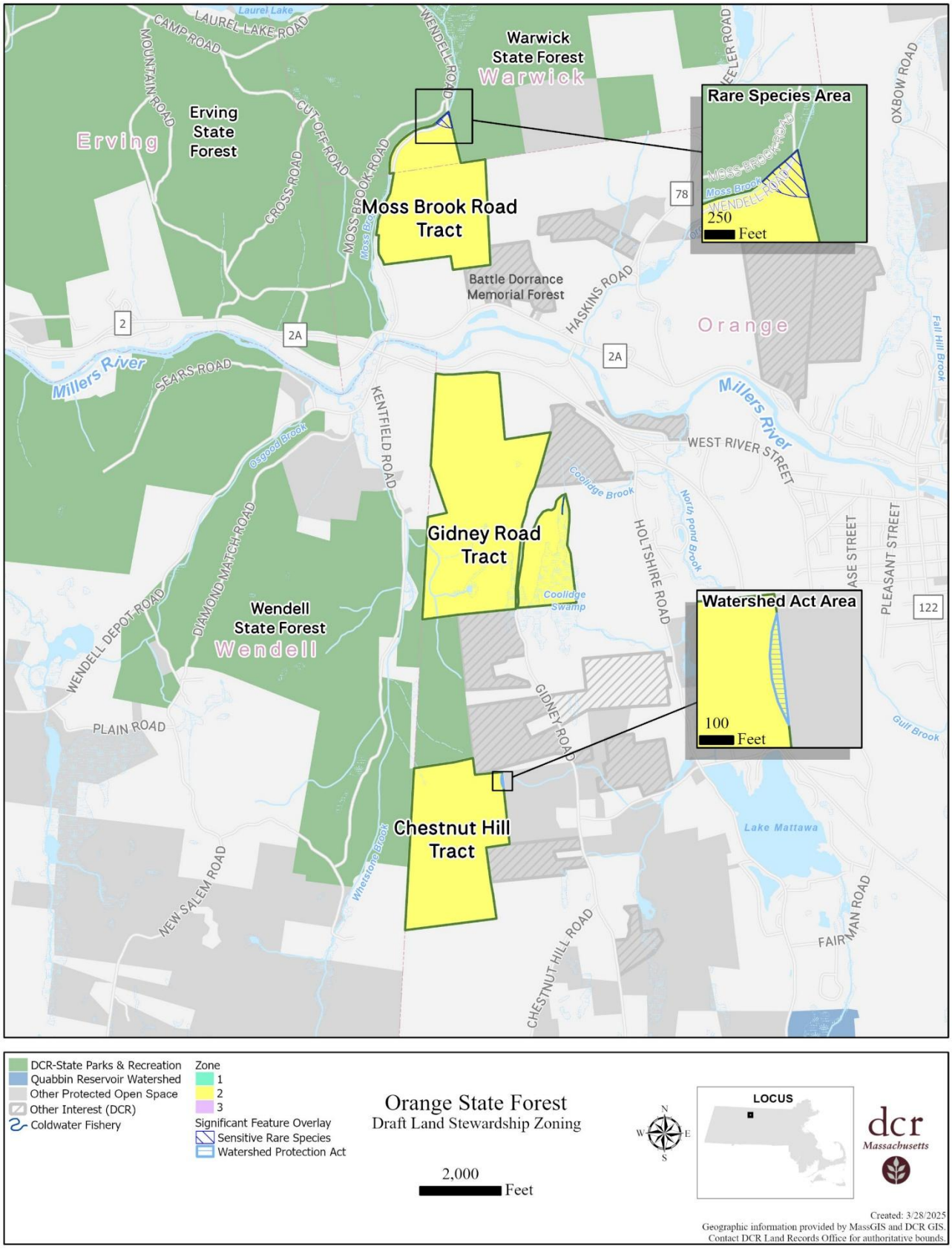

Figure 1. Land Stewardship Zoning Map.

Table 18. Consistency Assessment. This assessment represents a snapshot in time and may not reflect future conditions.

Category	Metric	Status
Landscape Designation	1. All development and uses of the park since 2012, or currently planned for the park, are consistent with its Landscape Designation(s).	Yes
Natural Resources	1. All projects (normal maintenance activities, special projects, volunteer projects) conducted within Priority Habitat were reviewed and approved through DCR's internal review process and by NHESP for potential impacts to rare species and their habitats.	N/A
Natural Resources	2. All projects conducted within areas subject to state and/or federal wetlands or waterways regulations were reviewed and approved through DCR's internal review process; reviewed and approved through the appropriate, local, state, and/or federal review process; and were carried out in accordance with the terms of a valid permit.	Yes
Natural Resources	3. Sensitive resource areas, such as steep slopes, riverbanks, streambanks, pond and lakeshores, wetlands, and dunes are free of desire paths and other user-created trails.	Yes
Natural Resources	4. Aquatic areas adjacent to beaches, boat ramps and launches, roads, and hiking trails are free of eroded sediments.	N/A
Natural Resources	5. The extent of exposed soil in campground and/or picnic sites is stable or decreasing.	N/A
Natural Resources	6. The extent of native vegetation in campground and/or picnic sites is stable or increasing. (As assessed by property manager.)	N/A
Natural Resources	7. Area of trail impacts in Reserves is less than 50% of area. (See Naughton (2021) for information on primary area of trail impacts.)	Yes
Natural Resources	8. Congregations of breeding, migratory, or wintering wildlife are protected from disturbance by temporary (e.g., seasonal) restrictions on recreational access.	N/A
Natural Resources	9. Geocaches, letterboxes, orienteering control locations, and other discovery destinations are located outside sensitive natural resource areas and their locations have been reviewed and approved by park personnel. (As assessed by property manager.)	N/A
Natural Resources	10. Zone I wellhead protection areas are free of vehicle parking, chemical storage, or concentrated recreation.	N/A

Category	Metric	Status
Natural Resources	11. All boat ramps and launches have cleaning stations and/or educational signs and materials on preventing the spread of aquatic invasive organisms. (As assessed by property manager.)	N/A
Natural Resources	12. For each barrier beach there is a current, approved Barrier Beach Management Plan and all beach-related activities are conducted in accordance with this plan.	N/A
Cultural Resources	1. All maintenance activities and projects with the potential to cause sub-surface disturbance are being reviewed by the DCR archaeologist for potential impacts to archaeological resources.	Yes
Cultural Resources	2. All maintenance activities and projects affecting historic properties (buildings, structures, and landscapes over 50-years-old) are being reviewed by the Office of Cultural Resources to avoid adverse impacts.	N/A
Cultural Resources	3. Historic buildings, structures, and landscapes are being used, maintained, and repaired in a manner that preserves their cultural integrity and conveys their historic significance to park visitors.	N/A
Cultural Resources	4. Recreational activities such as hiking, biking, and boating are not eroding cultural properties such as archaeological sites or historic landscapes through creation of desire lines, rutting in the landscape, damage to historic built features, or excessive scouring (erosion) of coastal and shoreline areas.	Unknown
Cultural Resources	5. Geocaches, letterboxes, and other discovery destinations are located away from sensitive cultural resources, and their locations have been reviewed and approved by park personnel.	N/A
Cultural Resources	6. Historic buildings, structures, landscapes, archaeological sites, and concentrations of historic resources are located outside of areas predicted to be subject to flooding, storm surge, or sea-level rise.	Unknown
Recreation	1. Types of recreation, levels of recreational use, and types and extent of recreation infrastructure are consistent with the park's identity statement.	Yes

Category	Metric	Status
Recreation	2. Trail density is consistent with the park's Landscape Designation(s). (See Trails Guidelines and Best Practices Manual (DCR 2019) for density thresholds.)	Yes
Recreation	3. All authorized trail construction was performed in accordance with an approved Trail Proposal Form.	Yes
Recreation	4. Over 90% of the park's official trails network is classified as being in Fair or better condition.	Yes
Recreation	5. Recurring use by OHVs is restricted to authorized trails. (As assessed by property manager.)	N/A
Recreation	6. There is a high level of compliance with dog leash regulations and policies. (As assessed by property manager.)	Unknown
Recreation	7. Athletic fields are free of recreation-caused impacts (e.g., bare spots) to turf. (As assessed by property manager.)	N/A
Recreation	8. Water-based recreation is consistent with "Uses Attained" designation as identified by the Massachusetts Department of Environmental Protection (MassDEP) in its most current integrated list of waters (e.g., MassDEP 2023); DPH fish consumption advisories; and/or water quality testing at waterfront areas.	N/A
Recreation	9. Recreation facilities are located outside of areas subject to flooding, storm surge, or sea-level rise.	Yes
Sustainable Forest Management	1. Forestry activities are consistent with Landscape Designation and associated forestry guidelines.	Yes
Sustainable Forest Management	2. Forestry activities are consistent with current Forest Resource Management Plan.	N/A
Sustainable Forest Management	3. Tree cutting is performed in accordance with an approved cutting plan, if required under the Massachusetts Forest Cutting Practices Act (M.G.L. c. 132, §§ 40–46).	N/A

Table 19. Priority Recommendations for Orange State Forest. All recommendations are of equal importance. When multiple agency parties are responsible for implementing a recommendation, the lead party, or parties, are identified parenthetically in the Implementation column. Property managers should enter these recommendations as work orders in CAMIS to ensure their tracking and implementation.

Category	Recommendation	Implementation
Natural Resources	Designate all portions of Orange State Forest currently lacking a Landscape Designation as Reserve.	Management Forestry
Natural Resources	Conduct natural resources surveys prior to creation, expansion, or improvement of any trails.	Management Forestry (Co-Lead), Office of Natural Resources (Co-Lead), Partner, Trails and Greenways Program
Cultural Resources	Work with Indigenous partners to inventory, document, conserve, and interpret Indigenous peoples' resources and Indigenous peoples history within the Forest.	Interpretive Services, Office of Cultural Resources (Lead), Partner
Cultural Resources	Inventory, document, conserve, and interpret post-Contact historic features within the Forest. Submit inventory forms to the Massachusetts Historical Commission.	Contractor, Interpretive Services, Office of Cultural Resources (Lead), Volunteers
Cultural Resources	Conduct cultural resources surveys, for both Indigenous peoples' resources and post-contact historic features, prior to any creation, expansion, or improvement of trails.	Contractor, Office of Cultural Resources (Lead), Partner, Trails and Greenways Program
Recreation	Add information on Orange State Forest to Erving and Wendell State Forests' web pages.	Interpretive Services, Regional Staff (Lead), State Parks Operations, Web Content Creator
Recreation	Update Erving and Wendell State Forests' trail maps to include information on Orange State Forest	GIS Program (Co-Lead), Graphic Designer, Trails and Greenways Program (Co-Lead)

Category	Recommendation	Implementation
Recreation	Following completion of natural and cultural resources surveys, revisit the Land Stewardship Zoning and adjust as needed to reflect new information on the Forest's resources.	Office of Cultural Resources

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