Massachusetts Department of Conservation and Recreation
Bureau of Planning and Resource Protection
Resource Management Planning Program

RESOURCE MANAGEMENT PLAN

Middlesex Fells Planning Unit

Including Middlesex Fells Reservation

January 2012

dcr
Massachusetts

Middlesex Fells Planning Unit

Including Middlesex Fells Reservation

RESOURCE MANAGEMENT PLAN

2012

Deval L. Patrick, Governor
Timothy P. Murray, Lt. Governor
Richard K. Sullivan, Jr., Secretary
Edward M. Lambert, Jr., Commissioner
John P. Murray, Deputy Commissioner for Park Operations

Dear Friends, Supporters, Users and Stakeholders of the DCR Middlesex Fells Reservation;

I am pleased to introduce you to this Resource Management Plan (RMP) for the Massachusetts Department of Conservation and Recreation (DCR) Middlesex Fells Reservation. RMPs provide guidelines for management of properties under the stewardship of the DCR. They are intended to be working documents for setting priorities, enabling the DCR to adapt to changing fiscal, social and environmental conditions. The planning process provides a forum for communication and cooperation with park visitors and the surrounding communities to ensure transparency in the DCR's stewardship efforts.

For more than a century, the DCR Middlesex Fells Reservation has provided visitors a natural oasis in the midst of an urbanized landscape and an opportunity for visitors to connect with nature. The reservation offers a variety of nature-based recreational activities that are special to the residents of metropolitan Boston and beyond. It is home to ten rare plants and animals, uncommon natural communities and cultural and historic resources that live as a testament to our agrarian and industrial past.

Generations of users have traversed its trails, viewed the Boston skyline from atop its rocky hills and enjoyed the sound of birdsong echoing through the forest. This RMP strives to balance recreational use and demand with the protection of natural and cultural resources at the reservation so that these experiences, and others, are available for the generations to come.

Edward M. Lambert, Jr.
Commissioner

The Massachusetts Department of Conservation and Recreation (DCR), an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, dams, and parkways. The agency's mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources. To learn more about DCR, our facilities, and our programs, please visit us at www.mass.gov/dcr. Contact us at mass.parks@state.ma.us.

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EXECUTIVE SUMMARY

INTRODUCTION

Resource Management Plans (RMPs) are working documents that consider the past, present and future of a forest, park or reservation. They provide a guide to the short- and long-term management of properties under the stewardship of the Department of Conservation and Recreation (DCR). They include an inventory and assessment of environmental, cultural and recreation resources; identify unique characteristics and values of a property; develop clear management goals; and analyze complex resource protection and recreation issues. They are intended to enhance the management of the DCR's properties by setting priorities, targeting capital and operational resources, protecting sensitive resources and improving communication and cooperation with park visitors and the surrounding communities.

The Department of Conservation and Recreation is directed by a legislative mandate (M.G.L. Chapter 21: Section 2F) to prepare management plans for "all reservations, parks, and forests under the management of the department." Although the mandate does not specify the format or content of these management plans, it does require that:

> *"Said management 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."*

The legislative mandate also establishes two other requirements. First, that the DCR "shall seek and consider public input in the development of management plans, and shall make draft plans available for a public review and comment period through notice in the Environmental Monitor." Second, management plans must be reviewed and adopted by the Stewardship Council. Within 30 days of adoption, the Commissioner "…shall file a copy of such management plans as adopted by the council" with the Secretary of State and the Joint Committee on the Environment, Natural Resources and Agriculture.

This plan covers the DCR Middlesex Fells Planning Unit, which includes the DCR Middlesex Fells Reservation and associated facilities located in the communities of Malden, Medford, Melrose, Stoneham and Winchester.

THE DCR MIDDLESEX FELLS RESERVATION

For over 117 years, the DCR Middlesex Fells Reservation has offered abundant opportunities for natural recreation in the Boston metropolitan region. Born of its geologic, biologic and, most importantly, human history, the 2,575 acre reservation managed by the DCR is characterized by rocky outcrops, diverse plant communities, mixed woodlands, open meadows, ponds, streams, wetlands, historic structures, archaeological resources and cultural landscapes. It is well used by hikers, mountain bikers, dog walkers, runners, skiers, nature enthusiasts, bird watchers, photographers, families, anglers and many others.

The mission of the DCR is "to protect, promote and enhance our common wealth of natural, cultural and recreational resources." To achieve this mission at the DCR Middlesex Fells Reservation, this RMP articulates the following management principle and seven associated goals as a foundational structure for the Resource Management Plan, which will guide future stewardship of this important facility.

MANAGEMENT PRINCIPLE AND GOALS

Through the creative use of state management resources, partnerships and volunteer stewardship; protect the cultural and ecological resources at the DCR Middlesex Fells Reservation and provide diverse recreational opportunities that are compatible with resource protection.

Goal 1: Protect water resources. Because wetlands and water resources at the DCR Middlesex Fells Reservation provide clean drinking water, aquatic habitats and water-based recreation; manage the reservation to protect wetlands, streams, vernal pools, ponds and reservoirs.

Goal 2: Protect and enhance habitats for rare species, natural communities and native plants and animals. Monitor, protect and manage the habitats for the state-listed rare plants and animals in the Fells. Manage the priority natural vegetation communities of the Fells, including vernal pools and ridge top communities, to protect and enhance these habitats for native plants and animals.

Goal 3: Preserve the cultural resources of the reservation. Because the reservation's historic buildings and structures, archaeological resources and cultural landscapes represent important connections to both our past and future; manage these resources to stabilize, restore and protect them from damage or degradation.

Goal 4: Provide for and enhance diverse recreational opportunities. Provide diverse recreational opportunities for a variety of users while improving the user experience, reducing user conflicts and encouraging mutual respect; and provide opportunities for users to experience and interact with the beauty and wonder of nature at the DCR Middlesex Fells Reservation.

Goal 5: Enhance compliance with rules and regulations to protect resources and enhance recreational experiences. Land ownership patterns, diverse recreational demands and sensitive resources necessitate a variety of rules and regulations at the DCR Middlesex Fells Reservation. Create a culture of compliance through a combination of education, management presence, active enforcement and stakeholder self-enforcement.

Goal 6: Interpret the natural and cultural resources of the Fells. Provide rich and diverse connections to the natural and cultural resources and stories of the Fells through thematic interpretation and the development and placement of interpretive services and tools.

Goal 7: Work with diverse partners and volunteers to achieve these management goals. Diverse partner organizations and individual volunteers represent a wealth of experience, knowledge and energy. With DCR standards and oversight, partner with organizations and individuals to implement this RMP for the long-term stewardship of the DCR Middlesex Fells Reservation.

KEY FINDINGS

Sections 2 and 3 of this RMP document the existing conditions of natural, cultural and recreation resources at the DCR Middlesex Fells Reservation and describe the DCR's management resources and practices. A few of these key findings are highlighted below.

Natural Resources

- Protects and contributes to both active and back-up drinking water supplies for surrounding communities
- 12% of the reservation is surface water
- 129 vernal pools
- 10 state-listed rare species
- 5 Priority Natural Community types including a newly described sugar maple-oak-hickory forest
- 869 plant species, including 564 native plants
- 183 bird species, including 27 species in "greatest need of conservation"
- 21 mammals, 10 amphibians and 7 reptiles, including 2 reptiles in "greatest need of conservation"

Cultural Resources

- 6 recorded pre-Contact archaeological finds
- Spot Pond Brook Archaeological District
- 47 different historic buildings and structures
- Cultural landscapes, including the Sheepfold, Belleview Pond and the reservoir system

Recreation Resources

- 122 miles of trails
- 22 miles of user created trails
- Heavy recreational trail use by hikers, mountain bikers, dog walkers, runners, skiers and others
- Active recreation facilities, including the Flynn Rink, Hall Pool and Spot Pond Boating

Compliance and Conflict Issues

- Culture of non-compliance with reservation rules and regulations
- Conflicting interests and lack of civility among different users and stakeholder groups
- Design and physical characteristics of the reservation that contribute to these issues
- Lack of enforcement presence
- Cooperation with and among stakeholders

This RMP documents the condition of resources within the reservation as generally quite good, despite high levels of historic and current recreational use. It describes the most significant management issue facing the Fells as the conflicting interests and lack of civility among different users and stakeholder groups. This level of conflict is not typical of Massachusetts state parks has harmed the Fells natural and social environment. This RMP also documents two other significant management issues: the culture of non-compliance with reservation rules and regulations and the environmental impacts of off-trail uses and user created trails.

ISSUES DISCUSSION

Section 4 of this RMP discusses and analyzes four complex and controversial issues:

Land Stewardship Zoning (LSZ). This RMP identifies important resources at the DCR Middlesex Fells Reservation and assesses the sensitivity of each of these resources relative to the specific recreational and management activities occurring at the Fells. Land Stewardship Zone 1s are identified for highly sensitive resources that require special management approaches and practices to protect and preserve their features and values. This RMP concludes that the Spot Pond Brook Archaeological District, locations of four rare species and four watch-listed species, Priority Natural Communities, trail-free areas over 10 acres and a large block of Vernal Pool Core Habitat should be protected as Zone 1 in the Fells. This RMP also establishes specific management guidelines to best protect these important and sensitive resources.

Pedestrian and Mountain Biking Recreation. This RMP discusses the controversial issues surrounding pedestrian and mountain biking recreation at the DCR Middlesex Fells Reservation. The RMP analyzes and evaluates the issues surrounding the sensitivity of resources to these forms of recreation at the Fells, public safety issues, impacts to the recreational experiences enjoyed at the Fells and the management implications of these uses. This RMP concludes that, with respect to environmental impacts, these two recreational uses have similar impacts and should be evaluated similarly. This RMP recognizes that there is a potential for conflict between these two uses and that some separation of these activities should occur at the Fells through trail designation and layout. This RMP concludes that both official mountain biking opportunities and pedestrian only opportunities should be enhanced at the Fells.

Recreation with Dogs. Section 4.5 of this RMP discusses the issues surrounding recreation with dogs at the DCR Middlesex Fells Reservation. Dogs are currently welcome on-leash with their owners on all official trails at the Fells. The DCR is also working to establish and manage a pilot, designated off-leash area at the Sheepfold. This RMP evaluates additional opportunities for off-leash dog recreation on trails, and in doing so, analyzes the sensitivity of resources to dog recreation, public safety issues, impacts to the recreational experiences and the management implications surrounding recreation with dogs. This RMP concludes that there is a potential for impacts to sensitive resources, public safety and recreational experiences from additional off-leash dog opportunities at the Fells and therefore, does not recommend any additional opportunities beyond the designated area at the Sheepfold at this time.

Rules Compliance and Enforcement. This RMP describes a culture of non-compliance at the Fells as a significant issue that needs to be addressed. Section 4.6 discusses the factors that have contributed to this, including the design and physical characteristics of the park and trail system, the lack of enforcement presence on the part of the DCR and cooperation with and among stakeholder groups. This RMP then recommends a multi-pronged compliance strategy to change the status quo and create a new culture of compliance at the reservation. This strategy includes education, enhanced enforcement presence, coordination with other enforcement agencies, issuance of citations for persistent and flagrant violations, a Park Watch program, stakeholder self-enforcement and

encouragement of more positive uses in certain areas. Finally, this RMP recommends a monitoring protocol to evaluate both public safety and rules compliance. The DCR will implement this monitoring protocol and adaptively manage uses and rules at the reservation based on this information.

PRIORITY RECOMMENDATIONS

Section 5 of this RMP identifies 76 management recommendations. These are specific actions that may be taken over time to achieve the seven management goals. The following 36 priority recommendations focus on near-term actions that will help achieve the management goals.

Priority Actions	DCR Lead Unit
Goal 1: Protect water resources.	
Close targeted forest roads and trails leading directly from DCR land onto Town of Winchester water supply lands.	Operations
Close trail segments that go through or are eroding into vernal pools.	Operations
Close or add structures to trail segments that impact wetland resource areas.	Operations
Enforce dog owners properly picking up and disposing of dog waste.	Ranger Services
Implement additional recommendations to protect water supplies, wetlands and vernal pools as detailed in Appendix N and Appendix M.	Operations
Implement additional guidelines to protect vernal pools and their associated upland habitat as detailed in Appendix D.	Operations / Planning
Goal 2: Protect and enhance habitats for rare species, natural communities and native plants and animals.	
Close targeted redundant, confusing, fall-line and poor-condition trails in Zone 1 areas.	Operations with Volunteers
Enforce prohibition on off-trail recreation (unless specifically permitted).	Ranger Services
Ensure that all DCR and partner activities are appropriately reviewed, permitted and approved.	Ranger Services / Operations / Planning
Implement habitat management recommendations detailed in Appendix M, including invasive controls and selective thinning to maintain specific priority national communities.	Operations with Outside Partners / Agencies
Goal 3: Preserve the cultural resources of the reservation.	
Avoid or monitor all activities occurring on undisturbed, level and well-drained areas around ponds and wetlands until an archaeological survey has been completed.	Operations
Conduct an analysis of the stone walls, bridges, spillways, foundations and other structures within the Spot Pond Brook Archaeological District to identify areas of deterioration and prioritize needs to stabilize, rebuild or restore as necessary.	Planning
Repair deteriorated sections of and remove vegetation from stone walls and piers along Woodland Road at the Botume House, along the back edge of Greenwood Park and along South Border Road.	Planning
Stabilize the foundation walls of the MIT Observatory.	Engineering
Conduct structural analyses of the three trolley corridor bridges, Bear Hill Tower and Bellevue Pond spillway and bridge.	Engineering

Continued on next page.

Priority Actions	DCR Lead Unit
Goal 4: Provide for and enhance diverse recreational opportunities.	
Manage a designated off-leash area at the Sheepfold as a pilot off-leash opportunity in partnership with dog owner stakeholder groups.	Operations
Enforce leash regulations outside of official designated areas and circumstances and enforce a three dog per person limit.	Ranger Services
Designate Virginia Wood (with the possible exception of one connecting trail) and the Long Pond area as pedestrian only areas with signage and on maps.	Operations / Ranger Services
Designate the Reservoir Tail as a multi-use trail.	Operations
Enforce no biking on / in pedestrian only trails and areas.	Ranger Services
Close targeted redundant, confusing, fall-line and poor-condition trails in Zone 1 and 2 areas.	Operations
Reduce overlaps and intersections of main loop trails including the Skyline Trail, Reservoir Trail and Mountain Bike Loop through trail re-routes and re-designations.	Operations
Designate one to three official multi-use trails through the Dark Hollow area to provide a positive use to an area with unwanted activity and enhance mountain biking opportunities.	Operations with Planning, Ranger Services and Volunteers
Improve trail signage and marking following DCR guidelines.	Operations
Develop and distribute new DCR trail maps to improve the experience for all users.	Planning / Ranger Services
Establish, and educate users in, appropriate trail etiquette, including winter use etiquette.	Ranger Services with partners
Goal 5: Enhance compliance with rules and regulations to protect resources and enhance recreational experiences.	
Post, update and communicate through kiosks, signs, internet and personal contact, reservation rules, regulations, appropriate behaviors and etiquette.	Ranger Services
Increase DCR Ranger presence at trailheads and on trails.	Ranger Services
Provide two additional long-term seasonal rangers for the Fells District.	Ranger Services
Provide for occasional mounted patrols.	Ranger Services
Issue citations for flagrant or persistent violations of regulations.	Ranger Services
Coordinate with the State Police to provide support, periodic patrols and enforcement at specific sites.	Ranger Services with State Police
Establish a Park Watch program for the Fells.	Ranger Services
Implement a monitoring protocol with benchmarks to evaluate compliance with dogs off-leash, dog waste disposal, users staying on official trails and bikers staying on designated trails.	Ranger Services with Planning
Revise the incident reporting system to better capture actual incidents and violations of regulations.	Ranger Services
Goal 6: Interpret the natural and cultural resources of the Fells.	
Complete a Comprehensive Interpretive Plan for the DCR Middlesex Fells Reservation.	Ranger Services
Complete and install the interpretive display for the Botume House.	Ranger Services
Goal 7: Work with diverse partners and volunteers to achieve these management goals.	
Establish a Memoranda of Understanding and Stewardship Agreements with partner organizations at the Fells to outline roles, responsibilities, permitting requirements and expectations and institute an annual work plan for review and approval of activities.	External Affairs with Operations
Work with partners to encourage their members to comply with all reservation rules, regulations, permitting requirements, appropriate behaviors and etiquette (self-enforcement).	External Affairs
Work with stakeholders, partners and the public to advocate for increased state funding and raise private funds to support the implementation of this plan.	External Affairs
Encourage and expect greater civility among users and stakeholders at the Fells.	All

PUBLIC PARTICIPATION IN DEVELOPING THIS RESOURCE MANAGEMENT PLAN

The Middlesex Fells Planning Unit RMP built on a year-long public Trail System Planning Process, which was launched in September 2009 and concluded following a 60 day comment period on a draft plan in December of 2010. This RMP began with an initial launch meeting on January 31, 2011 at the McGlynn Middle School in Medford. Notice of this public meeting and of the DCR's intent to prepare a Resource Management Plan for the Fells was announced on the DCR web page and through press releases provided to area media.

The initial public meeting was followed by a series of six public workshops, facilitated by the Massachusetts Office of Public Collaboration, each on a separate topic related to the resources and management of the DCR Middlesex Fells Reservation. These workshops included presenters from a variety of professional organizations and stakeholder groups. Workshops included:

- Flora and Fauna Workshop, February 9, 2011, 6:30 – 8:30 p.m., Botume House, Stoneham
- Wetlands and Water Resources Workshop, February 17, 2011, 6:30 – 8:30 p.m., Botume House, Stoneham
- Cultural Resources Workshop, February 23, 2011, 6:30 – 8:30 p.m., Botume House, Stoneham
- Recreation Workshop, March 2, 2011, 6:30 – 8:30 p.m., McGlynn Middle School, Medford
- Education and Interpretation Workshop, March 16, 2011, 6:30 – 8:30 p.m., Botume House, Stoneham
- Enforcement Workshop, March, 23, 2011, 6:30 – 8:30 p.m., Breakheart Reservation, Saugus

At each of these workshops, the public was invited to ask questions and engage in a dialogue on the topic. Notes were recorded. All presentations and notes were posted publically at http://www.mass.gov/dcr/news/publicmeetings/rmppast.htm. Attendance at the workshops ranged from 25 to 80, with an average of 41.

Written input on the plan was also solicited at the initial public meeting, each workshop, through the Environmental Monitor announcement, on the DCR web page and in press releases. This written comment period was open from January 31, 2011 to March 31, 2011. All of this input was posted publically at http://www.mass.gov/dcr/news/publicmeetings/rmppast.htm. Over 3,050 people participated in the public input phase of the Trail Plan and RMP.

Notice of the availability of the draft RMP for the Middlesex Fells Planning Unit and a public meeting to present the draft was published in the September 7, 2011 Environmental Monitor, through a media advisory to area media outlets and via email to participants and stakeholders in the RMP process. The meeting was convened at the McGlynn Middle School on September 14, 2011.

A 60 day public comment period on the draft RMP ran from September 14, 2011 through November 14, 2011. Based on this public comment, revisions were made to the final RMP and are detailed in Appendix B.4.

Wright's Tower on Pine Hill (Photo by Bryan Hamlin)

SECTION 1. INTRODUCTION

1.1. THE DCR MIDDLESEX FELLS RESERVATION

Something like five miles northerly from Boston lies a great tract of country, all stony hills and table-lands, almost uninhabited, and of wonderful picturesqueness, and wild rugged beauty.

Sylvester Baxter, December 6, 1879

For over 117 years, the Department of Conservation and Recreation (DCR) Middlesex Fells Reservation has offered abundant opportunities for natural recreation in the Boston metropolitan region. This Resource Management Plan (RMP) addresses the challenge of ensuring consistency between the growing and changing recreational desires of users and the resource protection needs of a diverse natural ecosystem and cultural landscape under constant stress from the pressures of the urban environment. Ultimately, this RMP provides guidance that will help the DCR protect, promote and enhance the Fells' natural, cultural and recreation resources through the reservation's second century.

1.2. RESOURCE MANAGEMENT PLANS

RMPs guide the management of properties under the stewardship of the DCR. They identify a management principle and goals; compile and assess available ecological, cultural and recreation resource information; identify current management practices and capabilities and develop and prioritize specific management recommendations.

Pursuant to Massachusetts General Law (MGL) Chapter 21, Section 2F, the DCR is required to prepare management plans that address all reservations, parks and forests under the control of the department. According to this statue, 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." These objectives are achieved through the preparation and implementation of RMPs.

In 2008, the DCR conducted a statewide survey of all of its properties for the purpose of guiding and carefully expediting resource management planning

(DCR 2009*a*). Nearly 400 properties were grouped into 86 planning units, largely on the basis of physical proximity and shared management structure. The DCR is preparing an RMP for each of these planning units that address the unique and common needs and management of each individual property.

The statewide survey reviewed and synthesized existing data on each planning unit's natural resources, infrastructure and staffing (DCR 2009*a*). New information was generated on each planning unit's cultural resources, recreational activities and operations and management considerations. These variables were used to prioritize the preparation of RMPs.

This statewide survey defined the Middlesex Fells Planning Unit presented in this RMP. It also identified the planning unit as a priority for the preparation of an RMP.

1.3. The Planning Process

RMPs are developed by the DCR's Regional Planning Office through an iterative process of information gathering, analyses, writing, review and revision.

Public input is an important part of the RMP process. The legislative mandate that requires the preparation of management plans directs the Commissioner of the DCR to "seek and consider public input in the development of management plans and … make draft plans available for a public review and comment period through notice in the Environmental Monitor."

As a result of significant public and stakeholder disagreement over various management issues at the Fells, the DCR engaged the Massachusetts Office of Public Collaboration (MOPC) to assist in designing and implementing a public input and dialogue process for this RMP. Consultants from the MOPC facilitated public meetings and workshops and worked with key stakeholders to seek common ground and encourage a collaborative public process.

This RMP also built upon a year-long trail system planning process that began in the fall of 2009 and involved data collection and analysis; review of scientific and technical literature; and extensive public and agency input; and culminated in the development of a draft Trail System Plan. As a result of public disagreement over various issue addressed within the draft Trail System Plan, the plan was put on hold until the completion of the RMP. Public input during the trail planning process involved over 2,000 individuals participating in two public meetings, a participatory workshop and formal written comments.

This RMP was initiated with a launch meeting on January 31, 2011. There were two periods of public input associated with the preparation of the plan. The first occurred from January 31, 2011 through March 31, 2011 and involved a series of six workshops focused on different themes of the RMP. Workshop topics included:

- Flora and Fauna
- Wetlands and Water Resources
- Cultural Resources
- Recreation
- Education and Interpretation
- Enforcement

This period allowed for several different avenues of public comment including comment cards at workshops, verbal comments captured through workshop notes and comments directed to a dedicated email and postal address.

The second public input period occurred following the release of the draft RMP. Additional information on public participation in the development of this RMP is provided in Appendix B.

Following final public comment and RMP revisions, the final RMP is submitted to the DCR Stewardship Council for review. Once reviewed and adopted by the Council, RMPs become the primary guidance document for managing a planning unit's resources.

1.4. Management Principle and Goals

The mission of the DCR is "to protect, promote and enhance our common wealth of natural, cultural and recreational resources." To achieve this mission at the Middlesex Fells, this RMP articulates a principle and seven associated goals for managing the Middlesex Fells Planning Unit.

Management Principle

Through the creative use of state management resources, partnerships and volunteer stewardship; protect the cultural and ecological resources at the DCR Middlesex Fells Reservation and provide diverse recreational opportunities that are compatible with resource protection.

Goals

The following seven goals and associated management recommendations (Section 5) have been developed to achieve the management principle. Each is of equal importance and is listed in the order as addressed in this RMP.

Goal 1: Protect water resources. Because wetlands and water resources at the DCR Middlesex Fells Reservation provide clean drinking water, aquatic habitats and water-based recreation; manage the reservation to protect wetlands, streams, vernal pools, ponds and reservoirs.

Goal 2: Protect and enhance habitats for rare species, natural communities and native plants and animals. Monitor, protect and manage the habitats for the state-listed rare plants and animals in the Fells. Manage the priority natural vegetation communities of the Fells, including vernal pools and ridge top communities, to protect and enhance these habitats for native plants and animals.

Goal 3: Preserve the cultural resources of the reservation. Because the reservation's historic buildings and structures, archaeological resources and cultural landscapes represent important connections to both our past and future; manage these resources to stabilize, restore and protect them from damage or degradation.

Goal 4: Provide for and enhance diverse recreational opportunities. Provide diverse recreational opportunities for a variety of users while improving the user experience, reducing user conflicts and encouraging mutual respect; and provide opportunities for users to experience and interact with the beauty and wonder of nature at the DCR Middlesex Fells Reservation.

Goal 5: Enhance compliance with rules and regulations to protect resources and enhance recreational experiences. Land ownership patterns, diverse recreational demands and sensitive resources necessitate a variety of rules and regulations at the DCR Middlesex Fells Reservation. Create a culture of compliance through a combination of education, management presence, active enforcement and stakeholder self-enforcement.

Goal 6: Interpret the natural and cultural resources of the Fells. Provide rich and diverse connections to the natural and cultural resources and stories of the Fells through thematic interpretation and the development and placement of interpretive services and tools.

Goal 7: Work with diverse partners and volunteers to achieve these management goals. Diverse partner organizations and individual volunteers represent a wealth of experience, knowledge and energy. With DCR standards and oversight, partner with organizations and individuals to implement this RMP for the long-term stewardship of the DCR Middlesex Fells Reservation.

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The Botume House was constructed in the 1840s; it remains in use today as the DCR North Region Office. (Photo by the DCR)

SECTION 2. EXISTING CONDITIONS

2.1. INTRODUCTION

The 2,575 acre DCR Middlesex Fells Reservation contains a wealth of natural, cultural and recreational resources. Within and surrounded by the communities of Malden, Medford, Melrose, Stoneham and Winchester, the Fells provides a natural oasis in an urbanized metropolitan region. (See Figure 2.1.1 for an aerial view of the reservation and surrounding communities.)

2.2. HISTORICAL CONTEXT

The Fells played an important role in the very beginnings of the land conservation movement in the United States. Used for thousands of years by Native Americans as hunting and gathering grounds, tool sources and possibly habitation, the rocky landscape of the Fells region resisted heavy development by early European settlers. Although cleared, quarried, grazed, settled and in some places developed during the 1700s and 1800s, by the late 1800s the landscape of the Fells was primarily still in an undeveloped state.

Elizur Wright, who lived in Medford and owned land near Pine Hill, was one of the early advocates for the protection of the Fells. For nearly 25 years, he campaigned for the protection of the landscape from destruction and development and the creation of a regional parks agency that could acquire land and set it aside for public use.

Trees, that would go down to posterity, as the glorious patriarchs of many generations, are thus slaughtered in their teens, and the parched land knows them no more forever. The forests are of the air, and really belong to the whole people, to all who breathe, as the air does. Metes and bounds cannot confine the delicious odor of the pines and the hemlocks, nor the glorious autumnal colors of the maple and the birches. Surely at least some of the forests should be the common property of some power or authority that is likely to live as long as trees do and be made the most of, for the benefit of great cities and populous towns. And that brings me to the Middlesex Fells, and what can be done there to restore the pines, hemlocks, maples,

beeches, oaks, ash and walnuts to their primeval glory, where they hid all the jagged rocks under their immense clouds of deep green foliage.

Elizur Wright, 1882; lecture delivered to The Women's Club of East Boston

The first piece of the Fells to be protected as public open space was Virginia Wood, donated to the newly formed Trustees of Public Reservations in 1892. In 1892, a temporary commission was formed, lead by Sylvester Baxter and Charles Eliot, and the following year, based on their report, the Massachusetts Legislature established the permanent Metropolitan Park Commission (MPC), with the authority to "acquire, maintain and make available to the inhabitants of said district open spaces for exercise and recreation" (Comm. of Mass. 1893).

In the initial *Report to the Metropolitan Park Commissioners*, Baxter and Eliot highlighted the opportunity to acquire the Fells as part of a system to protect "the rock-hills, the stream banks, and the bay and the sea shores" of greater Boston (Elliot 1893).

One of the most celebrated tracts under consideration is the wild, rocky and woodland region known as "the Middlesex Fells," ... This territory has been more prominently brought to the public attention as a place demanding reservation for the use of the people than any other landscape feature in the metropolitan district.

Baxter, 1893; report to the Metropolitan Park Commissioners

Writing about both the Blue Hills and the Fells, the initial report noted:

Together these two open spaces include some five thousand acres ... those dwelling in any part of the proposed metropolitan district can reach and enjoy one or the other. The whole, in its natural wild state, could now be secured and set aside as a public reservation, park and pleasure ground, secure to all future generations at a comparatively slight cost. Their artistic development might safely be left to the future.

Report to the Board of the Metropolitan Park Commissioners, Volume 1, 1893

By 1900, the new commission had acquired 1,881 acres in the Fells. Today, the Department of Conservation and Recreation (an agency created through a merger of the Metropolitan District Commission and the Department of Environmental Management) owns and manages 2,575 acres known as the Middlesex Fells Reservation as a part of its mission to "protect, promote and enhance our common wealth of natural, cultural and recreational resources."

This section describes the present state of the natural, cultural, and recreation resources of the Middlesex Fells Planning Unit.

2.3. DESCRIPTION OF SITES

The Middlesex Fells Planning Unit includes the DCR Middlesex Fells Reservation, Middlesex Fells Reservoir, Spot Pond, Spot Pond Brook, the John W. Flynn Memorial Ice Skating Rink and the Sergeant George J. Hall Memorial Pool. These properties are included in this plan because of their physical proximity and managerial unit. Locations of these properties are identified in Figure 2.1.1.

The DCR Middlesex Fells Reservation itself contains a number of distinct geographic areas and access points as briefly described below.

Long Pond / Nanepashemet Hill. Long Pond is a popular access point and recreation area in Winchester, on the western edge of the Fells. A self-guided nature trail around the pond and the pond itself provides opportunities for nature appreciation and family recreation. The surrounding woodlands are primarily pine forests with a variety of rocky ledges and outcrops.

Bellevue Pond / Pine Hill / Silver Mine Hill. North of South Border Road in Medford and west of I-93 in the "western Fells," the Belleview Pond parking area offers easy access to Belleview Pond, Pine Hill, Wright's Tower, Panther Cave Silver Mine Hill and the Skyline Trail. This area exhibits a number of structures built by the Works Progress Administration. Various pull-offs and gates along South Border Road also provide trail access to this area.

Lawrence Woods. Added to the DCR Middlesex Fells Reservation in 1925 (Appendix F), Lawrence Woods in Medford is traversed by a number of wide woods roads. It boasts over 22 vernal pools and

other wetlands. A former 90 mm gun site is found in this section of the park, just north of Ramshead Hill, and its open landscape provides habitat for a variety of butterfly and bird species. This area also abuts Medford High School.

Sheepfold. The Sheepfold is a 10 acre grassland and picnic area just off of Route 28 and I-93 in Stoneham, on the eastern edge of the western Fells. It is the most popular access point to the Fells. The large open meadow is popular with dog owners as a place to exercise their pets. There is also access at the Sheepfold to the main loop trails including the Mountain Bike Loop, Reservoir Trail and Skyline Trail. The two parking lots at the Sheepfold can become crowded at popular times.

Bear Hill / Dark Hollow Pond. In the northern quadrant of the western Fells rises Bear Hill, the highest summit in the park. The area around Bear Hill and Dark Hollow Pond is riddled with a spider web-like network of user created trails. The woodlands are generally open, mixed oak forests with rocky outcrops. An old trolley line also bisects this area of the reservation.

Spot Pond. The largest pond in the reservation, Spot Pond dominates the eastern Fells between I-93 and Woodland Road. The pond offers scenic water views and boating, which is run by a concessionaire. Spot Pond is also part of the emergency water supply system for the Massachusetts Water Resources Authority (MWRA) system and occasionally provides water to the Town of Winchester.

John W. Flynn Memorial Ice Skating Rink. The Flynn Rink is an indoor ice skating rink originally built in 1958. The current rink on the same site was completed in 1995 and is managed by a private management company under agreement with the Friends of Flynn Rink. The rink, located at the intersection of Woodland Road and Elm Street in Medford, provides a variety of recreational skating opportunities. The parking lot also provides access to the Fells trail system including a fitness course, a Healthy Heart Trail and the Cross Fells Trail.

Eastern Fells / Rock Circuit. East of Woodland Road and South of Ravine Road in the towns of Stoneham, Medford, Melrose and Malden, lies a large section of the Fells containing many trails, vernal pools and rocky outcrops. This section also contains the Middlesex Fells Reservoir and Fells covered storage tank managed by the MWRA. The area is bisected by Fellsway East, circumnavigated by the Rock Circuit Trail and features many rocky outcrops and ledges that also offer rock climbing and hawk watching opportunities.

Virginia Wood. The first piece of the Fells protected as public open space in 1892, Virginia Wood includes the area once known as Haywardville, an industrial rubber manufacturing village. Today, Virginia Wood, bounded by Pond Street and Ravine Road, is woodland containing vernal pools, a self-guided history trail, hemlock grove, Spot Pond Brook and a bridge and pond structure built by the Civilian Conservation Corps (CCC).

Crystal Spring / Greenwood Park. North of Pond Street is an area of the Fells that includes the site of a former spring known as Crystal Spring and Greenwood Park, which has a playing field and playground structure. This area also contains Whip Hill and a variety of wetlands, including Doleful Pond, and the Fells District Labor Yard.

Walter D. Stone Memorial Zoo. The zoo was officially established in 1907 as the Middlesex Fells Zoo, housing animals collected from the reservation. In 1991, the Legislature created the Commonwealth Zoological Corporation (Appendix F) and transferred care, custody and control of the zoo to the corporation, now doing business as Zoo New England. Thus, the Stone Zoo is not further addressed in this plan.

dcr Massachusetts

The Middlesex Fells Planning Unit

Malden, Medford, Melrose, Stoneham, and Winchester, Massachusetts

Figure 2.1.1. April 2008 Orthoimagery

N W E S

- P Parking Area
- Sergeant George J. Hall Memorial Pool
- John W. Flynn Memorial Ice Skating Rink
- Middlesex Fells Reservation
- Walter D. Stone Memorial Zoo
- Spot Pond Brook
- DCR Water Supply Land
- Winchester Water Supply Land
- Town Boundary

0 0.5 1

Mile

1:28,000

Data Sources:

All protected open space boundaries are in DRAFT format.

All background geographic data supplied by the Office of Geographic and Environmental Information (MassGIS).

DCR GIS - 12/2/2011

2.4. NATURAL RESOURCES

Born of its geologic, biologic and human history, the Fells is characterized by rocky outcrops, diverse plant communities, mixed woodlands, open meadows, ponds, streams and wetlands.

Physical Features

Geology

The story of the Fells begins with the story of stone. The hills of the DCR Middlesex Fells Reservation rise above the low-lying Boston Basin on a fault line known as the Northern Boundary Fault. The underlying geology within the Fells includes a wide diversity of meta-sedimentary and igneous (volcanic) rocks. Two prevalent igneous rocks are the Lynn Volcanics and the Dedham Granodiorite, both about 600 million old. Over time, younger igneous rocks have intruded into cracks in the bedrock forming a variety of vertical dikes. One of the more notable is the Medford Dike, which runs northeast from Bellevue Pond (DCR 2007).

This complex geology creates a wide variety of underlying rock that has been further shaped in more recent times by glacial forces. Today, the reservation is characterized by both acidic and circumneutral rocky outcrops, cliffs, glacial erratics, depressions and other interesting geologic features. This diverse underlying geology now supports a wide variety of wetland, outcrop and woodland plant and animal communities.

Topography

Topographically, the Fells is dominated by two distinct north-south valleys carved out by the glaciers. Elevation ranges from 59 feet to 265 feet above sea level. The eastern valley was defined by Intervale Brook and Spot and Wright's Ponds. The western valley is formed by Meetinghouse Brook and the three Winchester reservoirs. Bear Hill, Winthrop Hill, Silver Mine Hill and Pine Hill form the highland ridge, which divides the two valleys. (See Figure 2.4.1.)

Soils

Soils within the reservation are dominated by the Rock Outcrop-Hollis Complex with slopes ranging from 3-35%. These soils are characterized by rolling to steep, shallow, somewhat excessively drained Hollis soils and exposed bedrock (Pergallo 2005). This complex is on ridge slopes and crests of upland hills and is mapped throughout most of the Fells (55% of the reservation). Other soils in the reservation include the Hollis-Rock Outcrop-Charlton Complex and the Charlton-Rock Outcrop-Hollis Complex at varying slopes, which are all similar in characteristics.

The soil survey (Pergallo 2005) also characterized the limitations of soils for different uses, including recreation development and specifically, paths and trails. Within the DCR Middlesex Fells Reservation, 83% of the soils are rated as having "slight to moderate limitations" for recreation development. These limitations are all due to slope. To address these moderate limitations, recreation trails on steep slopes in the reservation should ideally occur along contours with appropriate drainage structures to prevent soil loss.

Three soils within the reservation are rated as having "severe limitations" for paths and other recreation development all due to wetness and ponding. Trails on these soils may require special designs or structures and on-going maintenance to overcome these limitations (Pergallo 2005). These soils (nine percent of the reservation) are all wetland soils and include Ridgebury Fine Sandy Loam, Swansea Muck and Whitman Fine Sandy Loam. (See Figure 2.4.2.)

Water Resources

If the whole of the water which falls on the Middlesex Fells, by the average rainfall, can be saved, it will be sufficient not only to nourish the densest forest of pines but to furnish, as may be easily calculated, to a million of people, for every day of the year, four imperial gallons of pure water apiece… But if the hills are not clothed with the best trees that will grow on them, the springs will in a great measure dry up, the rivers will not only decrease, but become impure and sources of disease, and both population and civilization will wane.

Elizur Wright, a letter to the people of Medford, Malden, Melrose, Stoneham and Winchester; appearing in "Appeals for the Middlesex Fells and the Forests"

Water, along with the scenery of the reservation, was one of the primary resources for which the land was protected.

Ponds and Reservoirs

There are six named ponds and reservoirs within the reservation (Table 2.4.1). The total surface area of these bodies of water is 325 acres (12% of the reservation). There are also many smaller ponds and pools within the reservation that can provide important habitats, such as Hemlock Pool and Shiner Pool in the eastern Fells. Spot Pond and Middlesex Fells Reservoir are managed under Memorandum of Understanding (MOU) (Appendix T) with the MWRA. The three Winchester reservoirs (North, Middle and South) are not within the DCR-owned reservation. They are owned and managed by the Town of Winchester.

Table 2.4.1. Named Ponds and Reservoirs at the Fells

Pond	Acres[a]
Spot Pond	289.6
Middlesex Fells Reservoir	13.2
Quarter Mile Pond	6.3
Dark Hollow Pond	6.3
Doleful Pond	5.7
Long Pond	4.1

a. Acres calculated in GIS, based on the MassGIS hydrography layer.

Streams

Several streams occur throughout the reservation. Although some flow year-round (i.e., perennial streams), most do not (i.e., intermittent streams). The only named stream on the USGS 7.5 Minute Topographic Quadrangle Map is Spot Pond Brook. Other named perennial streams include Intervale Brook, Meeting House Brook, Whitmore Brook, Straight Gully Brook and Dike Brook. The flows of several of these streams, including Interval Brook and Meeting House Brook, have been altered by the historic development of reservoirs and other water supply infrastructure. For example, when Spot Pond was added to the MWRA system, it was raised 16 feet in elevation and Intervale Brook was diverted around its perimeter (MWRA 2011).

Wetlands

Marshes, swamps, fens and other vegetated wetlands all play vital roles in protecting water quality, providing wildlife habitat and preventing flooding. There are 145 acres of wetlands in the Fells. (See Figure 2.4.1.)

Threats to ponds, streams and wetlands at the Fells include chemicals and sedimentation flowing into Fells water resources from up-gradient watershed areas outside the reservation, establishment of invasive species within resource areas, sedimentation from erosion within the reservation, alteration of resource areas caused by recreational uses or development, animal waste entering water supplies and changes in hydrology due to reservation and drinking water system infrastructure.

Groundwater

There are no aquifers identified beneath any areas of the DCR Middlesex Fells Reservation.

Flood Zones

No FEMA flood zones are identified in the DCR Middlesex Fells Reservation.

Vernal Pools

Vernal pools are isolated depressions that hold water for at least part of the year. They are typically unconnected from other water bodies and often dry out completely in the summer. As a result, they do not sustain fish.

These temporary wetlands function as important wildlife habitats, particularly for the amphibians and invertebrate animals that use them to breed. Some vernal pools provide habitat for a number of rare and endangered species. The Massachusetts Natural Heritage and Endangered Species Program (NHESP) certifies the occurrence of vernal pools. This certification process relies on volunteers, with authorization from the property owner, to identify, document and submit findings to the NHESP. Natural Heritage has also identified potential vernal pools through photo interpretation. The DCR, for the purpose of this RMP, treats certified and potential vernal pools equivalently as important wetland resources and habitat.

Within the Fells, there are a surprising number of vernal pools. The NHESP lists 26 certified vernal pools and 103 potential vernal pools. (See Figure 2.4.3.) BioMap 2, using GIS modeling, has identified 844 acres in two blocks of the DCR Middlesex Fells Reservation as “Vernal Pool Core” habitat. These blocks include the Long Pond,

Lawrence Woods and Pine Hill areas. This BioMap 2 model identifies the top five percent most interconnected clusters of vernal pools and identifies a buffer of surrounding upland habitat (DFG and TNC 2010).

Potential impacts to vernal pools include sedimentation from nearby eroding roads or trails, changes in shading of pools, changes in habitat structure within pools (e.g., removal of branches or vegetation), introduction of nutrients and chemicals into pools from run-off or direct contact, invasive species, direct disturbance of pools by humans and dogs and alteration of the natural hydrological regime (e.g., ditching, impoundments, culverts) (NHESP 2009; Maine Forest Service 2006; NYNHP 2010). In addition, most vertebrate species that depend on vernal pools for breeding, spend the majority of their lives in the upland habitat around the pool. Changes in structure of adjacent upland habitats can also impact the species dependent on vernal pools, which use upland habitat during their life cycle. As a result, these adjacent upland areas also require consideration and management guidelines.

Drinking Water

The Fells plays an important role in drinking water supply and distribution for many residents north of Boston.

Middlesex Fells Reservoir (Photo by Paul Jahnige)

The drinking water for more than 2.2 million people in the Commonwealth comes from the DCR's Quabbin and Wachusett reservoirs, located in the center of the state. This water makes its way east via gravity, passing through the MWRA's John J. Carroll Water Treatment Plant in Marlborough for primary disinfection with ozone and secondary disinfection with chloramines. The treated drinking water is then transmitted by the MWRA to several locations in the metropolitan area, including the Fells covered storage tank, which supplies daily demand to four communities in the region (i.e., Melrose, Saugus, Stoneham and Wakefield).

Federal regulations require that this treated water must be enclosed to keep it from contamination. As part of the $1.7 billion Integrated Water Supply Improvement Program, the MWRA has built covered storage tanks to replace the open distribution reservoirs throughout the Boston region, including those in the Fells (MWRA 2010). The MWRA currently utilizes the 20 million gallon Fells covered storage tank and the six million gallon Bear Hill water tank. The MWRA is also in the process of constructing the 20 million gallon Spot Pond storage facility on the former New England Medical Center property. Spot Pond and Middlesex Fells Reservoir, the two open-air distribution reservoirs replaced by these covered storage facilities, continue to serve in the suite of back-up drinking water supplies for the MWRA. These sources could be brought on-line in the case of an emergency, such as the May 2010 major water pipe break in Weston, which saw the brief activation of the Sudbury Reservoir system.

The Town of Winchester owns and manages three active drinking water supply reservoirs that are in-holdings within the DCR-owned lands. These reservoirs provide a primary drinking water supply to town residents, which is treated and distributed by the town's Department of Public Works. Winchester also occasionally draws water directly from Spot Pond to augment their reservoirs prior to treatment by the town. Parts of Winchester also receive MWRA treated water from two water main connections.

The MWRA performs annual water quality sampling and analysis at all emergency distribution reservoirs, including the Middlesex Fells Reservoir, to monitor baseline water quality. The MWRA tests for 21 different parameters including fecal coliform, dissolved oxygen, total phosphorous and E. coli. Water quality monitoring has not detected any trends or increases in contamination in recent years.

Both the MWRA and Winchester water supplies meet federal and state drinking water standards (MWRA 2009). Drinking water suppliers are

concerned about all activities that occur in a watershed that will allow contaminants to enter into their reservoirs.

The DCR Middlesex Fells Reservation, as publicly protected land within the watersheds of these two drinking water supply systems, provides crucial buffers for water quality protection. Much of the western part of the Fells drains to the three Winchester reservoirs. Parts of the eastern Fells drain to Spot Pond and Middlesex Fells Reservoir. Two hundred and twenty-three acres of the DCR lands surrounding the Winchester reservoirs are classified by the Massachusetts Department of Environmental Protection (DEP) as Zone A Surface Water Protection Areas (within 400 feet of the bank of the reservoir or 200 feet of a surface water tributary) and 457 acres are classified as Zone B (one-half mile from the bank of the reservoir), including many areas on the Winchester side of the reservation and the entire Sheepfold. (See Figure 2.4.1.) These zones represent the most critical areas for surface water supply protection.

The three primary causes of impacts to drinking water from public access at the Fells are: active erosion and sedimentation into water resources, run-off from within the watershed that may include nutrients and pathogens (including bacteria from animal waste) and direct body contact with water (Gilmartin 2011). Management of the DCR Middlesex Fells Reservation must take into consideration ways to minimize recreation impacts on these active and emergency drinking water reservoirs, storage facilities and other features of the water supply infrastructure.

Vegetation

When the Fells was created in 1894, the Metropolitan Park Commission contracted Olmsted, Olmsted and Eliot to survey the plants of the Middlesex Fells, Blue Hills, Beaver Brook and Stony Brook reservations (Deane 1896). This original botanical survey, which was conducted over two years and did not include Lawrence Woods, found 680 vascular plant species, including 110 non-native species. From 2003 to 2011, volunteers Bryan Hamlin, Walter Kittredge and others surveyed the plants in the Fells as a follow-up to the original (Table 2.4.2). This current survey of the Fells documented 869 vascular plants, including 564 native species (Hamlin et al. 2012, in press). This makes the DCR Middlesex Fells Reservation one of the better known DCR properties from a botanical perspective.

The number of native species can be a measure of both habitat diversity and ecosystem health; the 564 native species found represents a high number for an urban protected area in the northeast (Hamlin et al. 2012, in press). Although the recent survey documented nearly the same number of native species present when compared to 1896, 124 native species from the original survey were not found in 2010, while 118 new species were found, a net loss of only 1.1%. Of those that were not re-found, 98 were described in 1896 as “rare” or “occasional” and many of these were in habitats known to have since been destroyed. This represents relatively little loss of native plants, so far. What losses there have been seem to be mainly due to habitat loss from projects like the flooding of Spot Pond and building of I-93 (Hamlin 2009).

Table 2.4.2. DCR Middlesex Fells Reservation Botanical Surveys[a]

Year	Native Species Found	Non-Native Species Found
1896	570 (84%)	110 (16%)
2011	564 (65%)	305 (35%)

a. Hamlin et al. 2012, in press.

Currently, the NHESP data set includes records for two rare plants, lesser snakeroot and large-bracted tick-trefoil, at the Fells and these are protected under the Massachusetts Endangered Species Act (MESA). However, lesser snakeroot was not located in the recent botanical survey. A third plant, cankerweed (i.e., lion’s foot, endangered) was confirmed in July 2011 near Pine Hill and is awaiting final inclusion in the MESA data set by the State Botanist.

Additionally, 11 watch-listed plants have been documented at the Fells (Table 2.4.3). The watch list is an unofficial, non-regulatory list of plants of known or suspected conservation concern that the NHESP is interested in tracking (NHESP 2011).

Table 2.4.3. List of Watch-Listed Plants Documented at the Fells[a]

Common Name	Scientific Name
River birch	*Betula nigra*
Maple-leaf goosefoot	*Chenopodium simplex*
Rose coreopsis	*Coreopsis rosea*
Keep's hawthorn	*Crataegus keepii*
Featherfoil	*Hottonia inflata*
Violet bush-clover	*Lespedeza frutescens*
Rock knotweed	*Polygonum tenue*
Allegheny buttercup	*Ranunculus allegheniensis*
Early buttercup	*Ranunculus fascicularis*
Cursed Crowfoot	*Ranunculus sceleratus*
Rock Spikemoss	*Selaginella rupestris*

a. Information on watch-listed plants at the Fells provided by the NHESP (2011) and Hamlin (2011*d*).

Hamlin et al. (2011*a*) also completed a sector analysis of plants within the Fells, dividing the reservation into eight sectors (including Wright's Pond, which is not DCR-owned). They documented 167 native plants that were found in only one or two sectors of the Fells. Of these, Hamlin identified 84 as seldom found elsewhere in the Boston area and 24 of these are reduced to one patch within the Fells (Table 2.4.4; Hamlin 2011*b*). A complete listing of plants is included in Appendix G and has been provided by Hamlin et al. (2010, 2011*c*).

Table 2.4.4. Sector Analysis of Native Plants Surveyed at the Fells

Sector	# of locally rare plants[a]	# present in only one patch[b]	Watch-listed plants
Lawrence Woods	21	8	0
Long Pond / Nanepashemet	21	1	0
Bear Hill / Sheepfold	37	7	4
Straight Gully Brook / Pine Hill	52	10	7
Wright's Pond (mostly non-DCR)	24	6	1
Eastern Fells / Rock Circuit	46	10	4
Crystal Spring / Virginia Wood	30	8	2
Spot Pond	12	4	1

a. "Locally rare" plants are those that were documented by Hamlin et al. (2011*b*) as being found in only one or two of eight sectors within the Fells.
b. Extent of occurrence of each species determined by Hamlin et al. (2011*b*, 2011*e*).

Threats to plant diversity in the Fells come from climate change; habitat destruction and competition from invasive species; on-going fire suppression; recreational uses, especially dense trail networks, user created trails and off-trail uses; and potentially deer-browse.

Invasive Species

Twenty-seven species of non-native plants classified as "invasive" (Table 2.4.5) and 11 species classified as "likely invasive" have been recorded on the reservation (Appendix G). These "are non-native species that have spread into native or minimally managed plant systems" where they "dominate and/or disrupt native ecosystems" (Somers et al. 2006). Their uncontrolled spread poses a threat to the diversity of native plants and animals.

Populations of invasive plants have been documented and mapped through the public input process at Bear Hill, Crystal Spring, Virginia Wood, Pine Hill, east of Little Pine Hill and at various locations along the reservation boundary.

Table 2.4.5. List of Invasive Species Documented at the Fells

Common Name	Scientific Name
Bishop's goutweed	*Aegopodium podagraria*
Black locust	*Robinia pseudoacacia*
Broadleaved pepperweed	*Lepidium latifolium*
Burning bush	*Euonymus alatus*
Common buckthorn	*Rhamnus cathartica*
Common reed	*Phragmites australis*
Creeping Jenny	*Lysimachia nummularia*
Curly pondweed	*Potamogeton crispus*
Dames rocket	*Hesperis matronalis*
Fig buttercup	*Ranunculus ficaria*
Garlic mustard	*Alliaria petiolata*
Glossy buckthorn	*Frangula alnus*
Japanese barberry	*Berberis thunbergii*
Japanese honeysuckle	*Lonicera japonica*
Japanese knotweed	*Polygonum cuspidatum*
Leafy spurge	*Euphorbia esula*
Louise's swallow-wort	*Cynanchum louiseae*
Morrow's honeysuckle	*Lonicera morrowii*
Multiflora rose	*Rosa multiflora*
Norway maple	*Acer platanoides*
Oriental bittersweet	*Celastrus orbiculatus*
Pale yellow iris	*Iris pseudacorus*
Purple loosestrife	*Lythrum salicaria*
Reed canarygrass	*Phalaris arundinacea*
Showy fly honeysuckle	*Lonicera x bella*
Tree of Heaven	*Ailanthus altissima*
Twoleaf watermilfoil	*Myriophyllum heterophyllum*

Natural Communities

Twenty-five different natural communities have been identified at the DCR Middlesex Fells Reservation, seven palustrine (non-tidal freshwater) and 18 terrestrial (Table 2.4.6). Natural communities are assemblages of plant and animal species that occur together in space and time in recurring patterns on the landscape. Plant and animal diversity at the Fells is largely a function of the diversity and health of natural communities.

The majority of the Fells, approximately 80%, is forested uplands. This forest is a mosaic of terrestrial forested natural communities, characterized mostly by a variety of oaks in combination with variable mixtures of white pine, maple, hemlock and other deciduous species.

Natural communities are classified and ranked by the NHESP based on rarity and threat. Types ranked S1 to S3 are considered Priority Natural Communities (PNCs) in Massachusetts and tracked by the NHESP. These communities are important natural features at the Fells.

In conjunction with this RMP, the NHESP conducted field surveys of potential PNCs (not including woodland vernal pools). These surveys documented and mapped 10 occurrences of five different PNC types (Table 2.4.6 and Figure 2.4.3). Other potential PNCs were surveyed, but given their size and quality, they did not meet the criteria for ranking and tracking. Some community occurrences thought possibly to be scrub oak shrubland were classified by the NHESP Community Ecologist as variants of ridgetop pitch pine-scrub oak communities. One new community for Massachusetts, a sugar maple-oak-hickory forest, was described as a result of this survey and is discussed below.

Some of these PNCs, such as circumneutral talus forest / woodland, are susceptible to invasive species and others, particularly the ridgetop, rocky summit and rock outcrop communities, are susceptible to damage by off-trail recreational users and on-going fire suppression (NHESP 2009). Potential threats to vernal pools are discussed above. Specific descriptions and recommendations for these PNCs are included in Appendix M.

One new PNC type was identified and described in conjunction with this RMP, the sugar maple-oak-hickory forest. This community is a rich forest that combines aspects of rich, mesic forest of the northern hardwoods with rich oak hickory forests of the central hardwoods. It could be considered an eastern variant of the rich, mesic forest found in Berkshire County. This community at the Fells is just east of Bear Hill and west of I-93, in the northern Dark Hollow area, and is one of three known occurrences of this community type in eastern Massachusetts. Within the Fells, this stand is diverse and distinct. On a statewide basis, this newly described type of community is uncommon and it merits consideration and protection as a habitat that is not only unique in the Fells, but very uncommon for eastern Massachusetts. This community type is particularly susceptible to invasion by non-native plants whenever the native plant community is disturbed.

Table 2.4.6. Natural Communities of the DCR Middlesex Fells Reservation[a]

Community Type	System[b]	State Rank[c]
Acidic rocky summit / rock outcrop	T	S4
Black oak-scarlet oak forest	T	S3/S4
Circumneutral rocky summit / rock outcrop	**T**	**S2/S3**
Circumneutral talus forest / woodland	**T**	**S3**
Cultural grassland	T	N/A
Deep emergent marsh	P	S4
Dry rich acidic oak forest	T	S4
Forest seep	T	S4
Hemlock ravine	T	S4
Hickory-hop hornbeam forest / woodland	**T**	**S2**
Inland acidic pondshore / lakeshore	P	S4
Mixed oak forest	T	S5
Northern hardwoods-hemlock-white pine forest	T	S5
Oak-hemlock-white pine forest	T	S5
Oak-hickory forest	T	S5
Pitch pine-oak woodland	T	S5
Red maple swamp	P	S5
Red oak-sugar maple transition forest	T	S4
Sugar maple-oak-hickory forest	**T**	**S2**
Ridgetop pitch pine-scrub oak	**T**	**S2**
Shallow emergent marsh	P	S4
Shrub swamp	P	S5
Wet meadow	P	S4
White pine-oak forest	T	S5
Woodland vernal pool	**P**	**S3**

a. Classified according to Swain and Kearsley (2001). Information from Hamlin and Kittredge (2010) and NHESP (2011).
b. T = Terrestrial and P = Palustrine (Swain and Kearsley 2001).
c. Communities are ranked from the most rare (S1) to the most common (S5); N/A indicates a cultural community, which is not ranked. **Priority Natural Communities (S1 – S3) are in bold.**

Interior Forests and Forest Core

MassWildlife has identified one block of Interior Forest within the DCR Middlesex Fells Reservation totaling 148 acres. This block occurs on the western side of the Winchester reservoirs, near the Long Pond area. Interior forest blocks are forested areas that are relatively un-fragmented by human development and may provide important habitat for some interior forest dwelling species. These blocks are identified based on their distance from roads (100-1000 meters depending on the road type) and a minimum patch size of 50 acres. The interior forest analysis was not balanced by eco-region. The designation has no regulatory associations or intentions and is subjective in nature (MassGIS 2009).

BioMap 2 is a tool used to target and prioritize land for conservation acquisition and permanent protection from development. BioMap 2 identifies 2,055 acres of the Fells as "Core Habitat" covering most of the western and southern portions of the reservation. This can be further broken down into species, vernal pool and forest core components. BioMap 2 identifies 774 acres of the western Fells, surrounding and including the Town of Winchester reservoirs, as "Forest Core Habitat." This designation represents forest areas least fragmented by development that provide habitat for numerous woodland species (DFG and TNC 2010).

Neither of these two designations identifies recreational uses or trails as having the potential to fragment habitat. The DCR conducted its own analysis based on the presence of roads and trails within the Fells and identified patches that are not within 50 meters of any trail, a distance at which various edge effects are measureable (Matlack 1992). There are only 32 patches over one acre in size within the Fells that are not within 50 meters of a trail. There are only five patches greater than 10 acres in size, the largest of which is only 17 acres and completely surrounded by trails and other development. These patches occur near Grinding Rock Hill, Money Hill, Deer Hill peninsula, Doleful Pond and Straight Gully Brook. Through trail closures, it may also be relatively easy to create an additional patch over 10 acres in Lawrence Woods.

In total, less than four percent of the DCR Middlesex Fells Reservation is not within 50 meters of a trail.

Wildlife

The Fells provides important breeding, migratory and wintering habitat for hundreds of species of wildlife. It serves as an important refuge within the highly developed Boston metropolitan region.

Some of the species present at the Fells are able to exploit both natural and built environments (e.g., squirrel, blue jay) and are common throughout eastern Massachusetts. Others species (e.g., fisher, ovenbird) require the kind of large, contiguous forests provided by the DCR Middlesex Fells Reservation. Finally, some species (e.g., tiger beetle, clam shrimp) occupy specific habitat niches that are provided within the reservation.

Knowledge of the reservation's wildlife differs among taxa, with some groups well surveyed and others less well known. Birds, amphibians and mammals have been widely surveyed at the Fells, invertebrates less so.

Birds

One hundred and eighty-three species of birds in 43 families have been documented in recent years at the Fells (Table 2.4.7 and Appendix H). Among these are 36 species of warblers, such as mourning, blackpoll and northern parula, and a variety of water birds, hawks, flycatchers and sparrows.

Table 2.4.7. Birds Observed at the DCR Middlesex Fells Reservation[a]

Family (Scientific)	Family (Common)	# Species in Family
Gaviidae	Loons	*1*
Podicipedidae	Grebes	*2*
Phalacrocoracidae	Cormorants	*1*
Ardeidae	Bitterns and Herons	*3*
Cathartidae	American Vultures	*2*
Anatidae	Geese, Swans, and Ducks	*14*
Accipitridae	Kites, Eagles, and Hawks	*9*
Falconidae	Falcons	*3*
Phasianidae	Pheasants and Turkeys	*3*
Rallidae	Rails, Gallinules, Coots	*1*
Charadriidae	Plovers and Lapwings	*1*
Scolopacidae	Sandpipers and Allies	*4*
Laridae	Jaegers, Gulls, Terns, Skimmers	*3*
Columbidae	Pigeons and Doves	*2*
Cuculidae	Cuckoos and Allies	*2*
Strigidae	Typical Owls	*4*
Caprimulgidae	Goatsuckers	*2*
Apodidae	Swifts	*1*
Trochilidae	Hummingbirds	*1*
Alcedinidae	Kingfishers	*1*
Picidae	Woodpeckers	*6*
Tyrannidae	Tyrant Flycatchers	*11*
Vireonidae	Vireos	*6*
Corvidae	Jays, Magpies, and Crows	*3*
Hirundinidae	Swallows	*3*
Paridae	Titmice	*2*
Sittidae	Nuthatches	*2*
Certhiidae	Creepers	*1*
Troglodytidae	Wrens	*3*
Regulidae	Kinglets	*2*
Silviidae	Gnatcatchers	*1*
Turdidae	Bluebirds and Thrushes	*7*
Mimidae	Mimic Thrushes	*3*
Sturnidae	Starlings	*1*
Bombycillidae	Waxwings	*1*
Parulidae	Wood Warblers	*36*
Thraupidae	Tanagers	*3*
Emberizidae	Towhees, Sparrows, Allies	*14*
Cardinalidae	Cardinals	*4*
Icteridae	Blackbirds, Orioles, Allies	*7*
Fringillidae	Fringilline Finches	*5*
Passeridae	Old World Finches	*1*
Estrildidae	Waxbills and Allies	*1*

a. Information of birds recorded status and sources is included in Appendix H.

Twenty-seven species of birds documented at the Fells are identified by MassWildlife (2006) as "Species in Greatest Need of Conservation," including 12 rare birds (Table 2.4.8). Although these rare birds have been observed at the Fells, there are no state-listed rare birds known to be nesting at the Fells and therefore none listed or regulated under MESA. Four of the "Species in Greatest Need of Conservation" are identified as potentially breeding at the Fells. Two of these, the American woodcock and eastern towhee, are ground-nesting birds.

Table 2.4.8. Birds Observed at the Fells Identified as "Species in Greatest Need of Conservation"[a]

Species	MESA Status[b]	Breeding Bird Atlas[c]
Common loon	SC	No
Pied-billed grebe	E	No
Green heron	-	Yes
Black-crowned night-heron	-	Yes
American black duck	-	No
Bald eagle	E	No
Northern harrier	T	No
Sharp-shinned hawk	SC	No
Broad-winged hawk	-	No
American kestrel	-	No
Pergerine falcon	E	No
Ruffed grouse	-	No
American woodcock	-	Yes
Eastern Whip-poor-will	-	No
Willow flycatcher	-	No
Blue-winged warbler	-	No
Golden-winged warbler	E	No
Northern parula	T	No
Prairie warbler	-	No
Blackpoll warbler	SC	No
Mourning warbler	SC	No
Louisiana waterthrush	-	No
Eastern towhee	-	Yes
Field sparrow	-	No
Vesper sparrow	T	No
Grasshopper sparrow	T	No
White-throated sparrow	-	No

a. Species designated a "Species in Greatest Need of Conservation" by MassWildlife (2006).

b. None of the rare species are known to nest at the Fells or are regulated under MESA. Status of species listed under the Massachusetts Endangered Species Act: E = Endangered; T = Threatened; and SC = Species of Special Concern.

c. Breeding Bird Atlas (BBA) data for the Boston North - 07 and Boston North - 08 blocks; nearly all of the reservation is located within these blocks. These birds were recorded on or near the reservation during the 2007-2010 breeding seasons and represent species with the potential to breed on the reservation.

Mass Audubon has identified the Middlesex Fells as an Important Bird Area (IBA) (Mass Audubon 2007). IBAs provide essential habitat to one or more species of breeding, wintering, and/or migrating birds. Specifically, IBA criteria focus on birds that are vulnerable because they are species with a restricted range, species of conservation concern, species requiring unique habitats or species that are vulnerable because they congregate and occur in high densities at specific sites.

The Fells has been designated an IBA because it is an important migratory stopover and seasonal concentration site for migratory land birds (e.g., warblers). Large protected parks in otherwise highly developed landscapes can be essential for night-time migrants looking for a place to rest and feed when overtaken by daylight (Petersen 2011). In the Boston metropolitan area, the Fells stands out as a beacon of darkness in a sea of light.

Potential threats to birds at the Fells include habitat fragmentation, disturbance from recreational uses, natural forest succession, impacts created by invasive species and brood parasitism by brown-headed cowbirds (Mass Audubon 2007).

Brown-headed cowbirds lay their eggs in other birds' nests, in a process referred to as nest parasitism. A female cowbird is capable of laying 40 - 60 eggs per season. Their young then out-compete or kill the original hatchlings. Under extreme conditions, cowbird parasitism may result in the extirpation of local populations of songbirds.

Invasive plant species can also have a dramatic effect on native and migratory birds (Clark 2011). For example, certain plants, such as porcelain berry and common buckthorn out-compete other native fruit-bearing species, however their berries do not contain the same nutrition as native fruit. Accordingly, migratory birds may not obtain nutrients of sufficient quality to enable them to successfully complete what are oftentimes very long fall migrations. Some invasive insects may also affect birds and their food sources.

Some bird species require early successional habitats such as old fields and shrublands for nesting. At the Fells, species like the brown thrashers, prairie warblers and eastern towhee are shrubland specialists. As the forests in the Fells mature, and fire suppression continues, this valuable habitat and the species that rely on it, will gradually be lost. Already, brown thrasher numbers are down and prairie and blue-winged warblers have disappeared as breeders (Rines 2011).

Habitat fragmentation at the landscape scale can seriously impact breeding bird populations, but the protected landscape of the Fells provides a substantial refuge from human development north of Boston. Fragmentation on a smaller scale can nonetheless impact sensitive, interior forest-dwelling and ground-nesting species. High road and trail densities, high levels of human use, off-leash pets and other "camp-following" mammals, such as raccoons and skunks, can disturb wildlife, particularly ground and low-shrub nesting birds (Petersen 2011*a*). As noted above, there are only five patches within the Fells that are 50 meters from existing trails and greater than 10 acres. Certain species that might otherwise occur or breed at the Fells might not be present as a result of high levels of recreational disturbance.

Mammals

Twenty-one species of mammals have been confirmed in the DCR Middlesex Fells Reservation. An additional 26 species are known from the region and may potentially occur on the reservation (Appendix I). Confirmed mammals include a variety of common species found in urban and suburban woodlands such as squirrels, chipmunks, mice, voles, foxes and skunks; and also some species that are less common in urban environments such as beaver, mink and fisher. Coyote, though illusive, are also present in the Fells.

Coyote (Photo by Andrew Sempere)

No state-listed rare mammals are known to occur in the Fells. The New England cottontail, a candidate for listing under the U.S. Endangered Species Act, is possible at the Fells.

White-tailed deer are present and can significantly impact urban woodlands through over-browse of vegetation. Deer browse can affect forest regeneration and impact rare plant species. At the Fells, the current deer population has not yet reached

a level at which this is an issue, however the population should be monitored (Rawinski 2011).

Threats to mammals in the Fells include disturbance by high levels of recreational use (Reed and Merenlender 2008), especially off-trail use, off-leash dogs, night-time use and a lack of refuge areas where animals can escape human disturbances (Brown 2009).

Reptiles

There are seven species of reptiles confirmed at the Fells including snapping turtle, painted turtle and five species of harmless snakes (Appendix J). An additional five species of turtles, three of which are rare, and four snakes are possible at the Fells. No state-listed reptiles are known at the Fells. Two species of snakes are identified by MassWildlife (2006) as "Species in Greatest Need of Conservation," the eastern ribbon snake and North American racer.

Common gartersnake (Photo by Paul Jahnige)

Amphibians

Ten species of amphibians have been confirmed at the DCR Middlesex Fells Reservation and there are an additional nine, including three state-listed rare species, that are possible, but have not been confirmed (Appendix K).

Many of these amphibians require vernal pools for breeding, and as noted above, the Fells hosts a large number of these habitats. Local student research at the Fells indicates that the reservation's largest, un-fragmented areas contain the greatest diversity of amphibian species (Gage 2011). This study during 2007-2008 documented nine species in the Straight Gully Brook area, seven species in Lawrence Woods and six species in the Eastern Fells.

Insects

Insects are often the hidden fauna. As is true for many properties, insect lists are not comprehensive for the Fells. Among the groups of insect documented, some are better known than others.

Seventy-one species of butterflies and 124 species of moths are documented at the Fells (Appendix L), including three state-listed species; frosted elfin, oak hairstreak and orange sallow moth.

Two rare tiger beetles, Hentz's redbelly and purple tiger beetle, are documented in the reservation. These are often found in association with open outcrops and along trails.

An additional state-listed insect is associated with the Fells' wetlands. The name of this insect is not disclosed in accordance with the NHESP's policy of not disclosing the name or location of certain species.

There are also undoubtedly a number of dragonflies and damselflies at the Fells, but a current list is not available. Photographs of seven different species are shown at http://nygren.org/images/2006/07-fells.

Recent surveys for rare insects at the Fells, conducted in conjunction with this RMP, failed to document any additional rare insects. However, these surveys did add significantly to the Fells' insect species lists.

Rare Species

Ten rare species, listed and regulated under the Massachusetts Endangered Species Act (MESA), have been documented at the DCR Middlesex Fells Reservation (Table 2.4.9; NHESP 2010).

Table 2.4.9. State-Listed Species of the DCR Middlesex Fells Reservation

Species	Type[a]	MESA[b]
American clam shrimp	C	SC
Frosted elfin	I	SC
Hentz's redbelly tiger beetle	I	T
Oak hairstreak	I	SC
Orange sallow moth	I	T
Purple tiger beetle	I	SC
Name not disclosed	I	E
Cankerweed (i.e., lion's foot)	P	E
Large-bracted tick-trefoil	P	T
Lesser snakeroot	P	E

a. Types of state-listed species includes: C= Crustacean; I = Insect; P = Plant.
b. Status of species listed under the Massachusetts Endangered Species Act: E = Endangered; T = Threatened; and SC = Species of Special Concern.

One of these plant species, lesser snakeroot, has not been documented recently at the Fells, despite extensive botanical surveys. This record will soon go historic and no longer be regulated at the Fells. Another plant, cankerweed (i.e., lion's foot, endangered) has been documented and is awaiting final inclusion in the MESA list by the State Botanist (Harper 2011).

Surveys for three species of rare insects, conducted in conjunction with this RMP, did not document any additional occurrences of frosted elfin, purple tiger beetle or the name not disclosed insect. An attempt was made to trap four additional rare moths that might be present in scrub oak habitats in the Fells, pine barrens zale (special concern), sandplain euchlaena (special concern), Melsheimer's sack bearer (threatened) and barrens daggermoth (threatened). These were not documented.

The NHESP designates Priority Habitat for state-listed plants and animals. Approximately 40% of the DCR Middlesex Fells Reservation has been designated Priority Habitat, concentrated in the southern half of the reservation. (See Figure 4.2.3.) These Priority Habitat areas are also included in the Core Habitat designation of BioMap 2 (DFG and TNC 2010).

Habitat needs, threats and management recommendations for protecting these rare species are further detailed in Appendix M.

2.5. CULTURAL RESOURCES

The land within the DCR's parks is a storehouse of cultural resources. Historic buildings, structures, archaeological sites, landscapes and objects are reminders of the important role the Commonwealth has played in this nation's history since long before European contact. These resources document the human experience and our common heritage in Massachusetts during pre- and post-Contact times. Their protection and preservation is a vital component of the DCR's mission and policy for resource stewardship.

The DCR's Office of Cultural Resources (OCR) has established procedures for the protection of significant cultural resources contained within the DCR's parks. As part of this effort, this section of the RMP describes and evaluates the cultural resources of the DCR Middlesex Fells Reservation. The RMP process has resulted in a cultural resource inventory, where resources are field verified using a handheld GPS to record location, condition, materials, threats and recommendations (included in Appendix Q).

Cultural resources that are over 50 years old are considered potentially historic and evaluated for significance (NPS n.d.*a*). The DCR treats properties as historically significant if they meet the criteria for listing on the National Register, even if the property has not been formally nominated or listed.

This section describes the known and potential cultural resource areas in the DCR Middlesex Fells Reservation, including pre-Contact and historical archaeological resources and historic buildings, structures and landscapes. Section 5 provides specific recommendations for cultural resources that require additional research, documentation, stabilization or preservation.

Regional Pre-Contact Context

The lower Charles, Mystic and Saugus river drainages, with their tributaries, lakes, ponds and wetlands, and the rugged interior highlands that create a rim around the low-lying Boston Basin, would have provided Native American populations with valuable flora and fauna resources during all seasons of the year, as well as the necessary raw material for the manufacture of stone tools. Simply, the DCR Middlesex Fells Reservation area would

have been a focal point for Native American occupation and subsistence beginning in the Paleo Period (c. 11,000 – 9,000 years ago).

The Mystic River and the Arlington Plain

The Arlington Plain is one of the few broad, relatively flat areas in the vicinity and lies about one mile southwest of the Fells. It extends south of the Mystic Lakes along the Mystic River to its confluence with Alewife Brook, southerly to Fresh Pond and westerly to Spy Pond. The plain (1.5 miles wide by 2.5 miles long) lies within a large natural bowl protected by Arlington Heights, the hills of Somerville, the moraine ridge flanking Fresh Pond, the West Medford Highlands and the Fells.

The Mystic River is fed by a series of fast flowing streams, which emanate from hills in Woburn and Winchester. Along its five mile course, it is confined to a fairly steep-sided valley as it winds its way southerly through the Mystic Lakes. Prior to historic damming, the river would have passed over several waterfalls before it emptied into the Charles River estuary.

Although most of this area is developed, recent analysis of artifacts that were collected at a number of sites in the 19th century suggest that the Arlington Plain was occupied from as early as Late Paleo Indian times (c. 9,500 years ago) and more or less continuously until European contact. It is likely that the Arlington Plain served as a focal point of local occupation from at least Middle Archaic times (c. 8,000 years ago).

Besides being partially sheltered, the adjacent Mystic River and Alewife Brook were major spawning runs and during the spring, were extremely important sources of food. In addition, the valuable fisheries and shellfish bed of the estuary and coast were close at hand, as were the various resources of the nearby uplands such as the Fells.

From base camps located on the Arlington Plain, hunting and gathering parties would have had easy access to a wide variety of resident and transient fauna and abundant flora of the adjacent uplands such as the Fells. The Fells also supplied another important resource, outcrops of the Lynn Volcanics, which provided excellent quality stone for the manufacture of stone tools.

In addition to sites which lie on the Arlington Plain, several are also known on the north and eastern sides of the Mystic Lakes. One site of particular interest was discovered in the late 19th century by Francis Brook. He reportedly encountered the remains of eighteen Native Americans who had been buried in "sitting position" along with an assortment of personal implements. It is apparent from Brook's account that he had encountered a Late Woodland or Contact Period burying ground, because the tightly flexed fetal position, which he described as "sitting," was a characteristic burial practice of that time.

The only reference to the presence of Native Americans at a specific location within the Fells itself comes from a report that alludes to settlement at Turkey Swamp (Winchester's South Reservoir) (Levin and Mahlstedt 1990).

By late prehistoric times, and around the Contact Period, the Mystic River area appears to have emerged as an important social and political center. It became one of the seats of power of Nanepashemet, a sachem of the Pawtuckets. Here, somewhere in the hills of Medford, Nanepashemet built a palisaded fortress to protect himself from his enemies, the Tarratines from Maine. His fort is described vaguely as being located on a hill and constructed of pointed stakes that were driven into the ground to form a 50 foot circular enclosure with a moat-like ditch around it that measured five feet deep by seven feet wide. In 1619, after years of hiding and shuffling from one fort and camp to the other, the Tarratines finally caught up with Nanepashemet and killed him.

For many years after that, Nanepashemet's widow, who became known as the Squaw Sachem, ruled at least some of the Massachusetts groups who occupied territories north of the Boston Basin. Others, who lived near the Charles River and south to Plymouth realigned themselves with Chickatawbut.

The Saugus River

Although the Saugus River is not as close to the Fells as the Arlington Plain and the Mystic River, it is nevertheless well within a day's journey by footpath and the reservation could easily have been visited by hunting and gathering groups who resided along it or its tributaries.

Human occupation of the Saugus River drainage can be traced to Paleo Indian times, from approximately 12,000 years ago, when the first people entered a

tundra-like landscape after the retreat of the glacier. Paleo Indian sites are rare in southern New England, yet they are known along the entire length of the Saugus River, from its mouth to its tributaries far inland.

Quarry, the best known of these and perhaps the only irrefutable Paleo site in the entire Boston Basin, was located on the lower Saugus River. At that time, however, this location still lay several miles further inland and it was not associated with the Saugus River's estuary as it would be today. Despite its riverside location, the principal activity at the site appears to have been the extraction of an easily knapped stone that is called "Saugus Jasper."

Inland, on the Mill River in Wakefield, an important tributary of the Saugus, a site known as Ossini's Garden has also yielded possible evidence of Paleo Indian activity. Artifacts clearly indicate that it was occupied during the Early Archaic Period between 8,000 and 9,500 years ago. Several other sites in the immediate vicinity also appear to have been inhabited at this early time, suggesting that an interior upland core area developed along the Saugus River and remained significant throughout prehistory.

The Lower Charles River

Located on the north bank of the Charles River, the Watertown Arsenal site appears to have been a major center of human occupation. Situated as it was, next to the first major falls on one of the region's largest rivers, it was a prime location for taking spawning fish in the spring. Artifacts recovered through the years suggests that occupation here dated to Paleo Indian times, between 11,000 to 9,000 years ago, and that Native Americans continued to return to this riverside location throughout prehistory.

From summer base camps on the lower Charles, small hunting and gathering parties would have been attracted to the uplands of the Fells for game and raw materials for stone tools. During the late fall and most of the winter, the uplands were particularly well suited for temporary encampments.

Prehistoric Archaeological Sites within the DCR Middlesex Fells Reservation

There are currently six recorded pre-Contact sites within the DCR Middlesex Fells Reservation (Table 2.5.1) and hundreds of sites located within a five mile radius. Evidence from these sites indicates that this portion of Massachusetts was occupied from early Paleo Indian times (c. 11,000 – 9,000 years ago) more or less continuously through early historic times in the 17th century. Three of these sites were single artifact "find" spots, collected by a Mr. Carty in the late 19th century. No information other than site location is available for these three sites. During a recent RMP public meeting (March 2011), an audience member offered the location of another more recent surface find, a bi-facially worked stone hand tool made thousands of years ago. The potential for recovering additional surface "finds" is high and this issue will be further addressed in Section 5.

Table 2.5.1. Prehistoric Archaeological Sites within the DCR Middlesex Fells Reservation[a]

Site ID	Type	Period[b]
19-MD-810	Artifact Find	Unknown
19-MD-811	Artifact Find	Unknown
19-MD-812	Artifact Find	Unknown
N/A	Bi-face Find	Unknown
19-MD-698	Tool Workshop	Archaic-Woodland
19-MD-699	Tool Workshop	Archaic-Woodland
19-MD-700	Tool Workshop	Archaic-Woodland

a. Site IDs from the Massachusetts Historic Commission inventory of prehistoric sites.
b. Time periods are Paleoindian Period = 12,000 to 9,000 years before present (BP); Archaic Period = 9,000 to 2,700 BP; Woodland Period = 2,700 to 450 BP; and Contact Period = 450 to 250 PB.

In 1992, an archaeological site exam revealed three archaeological sites adjacent to Spot Pond. All three sites, 19-MD-698, 19-MD-699 and 19-MD-700, were identified as pre-Contact stone tool workshops (Mahlstedt 1992). All three sites contained high-density deposits of lithic material, the results of stone tool manufacturing. The presence of fire pits at these sites was also recorded. The data and analytical techniques could not conclusively indicate when these sites were used, but the characteristics of the unfinished tools recovered suggest the sites could date from the Late Archaic or Woodlands Periods (c. 6,000 – 450 years ago).

The sites have the potential to yield important information about the pre-Contact settlement in the uplands of the Boston Basin and the utilization of the felsites associated with the Lynn Volcanic Complex. In addition, the three sites provide important contextual and predictive information on pre-Contact resources that may be present in the area adjacent to the reservation. Based on the results of the archaeological site exam, these three sites meet the

criteria of eligibility for listing on the National Register of Historic Places.

The lower frequency of documented sites within the DCR Middlesex Fells Reservation, as compared with the surrounding area, does not necessarily indicate less intensive occupation. The lack of more pre-Contact sites within the reservation is most likely because there has been little development and only one systematic archaeological survey.

The current archaeological evaluation places much of the land within the DCR Middlesex Fells Reservation in areas that are considered highly sensitive for pre-Contact resources. These resources can be disturbed by any activity that involves soil disturbance, including invasive removal or trail construction activities.

Historic Resources within the DCR Middlesex Fells Reservation

Dozens of historic sites, buildings, structures and landscapes are included in the Cultural Resources Inventory (CRI) within the DCR Middlesex Fells Reservation. The historic resources of the Fells represent over 350 years of evolving land uses in the region, including farming, mill-based industries, quarrying, public water supply, recreation development and even military defense. These diverse layers of history are all critical to defining the present-day character of the Fells. Table 2.5.2 lists the historic resources evaluated as having "high" integrity in the CRI. Historic resources are further described in Appendix Q.

Table 2.5.2. Historic Resources at the DCR Middlesex Fells Reservation with High Integrity[a]

Resource	Type	Condition[b]
Dark Hollow RR viaduct	Structure	C
RR bridge 1	Structure	C
Sheepfold box culvert 1	Structure	C
Sheepfold restroom facility	Building	C
Soap box derby track	Structure	B
Silver mine	Arch. Site	C
Wright's Tower	Structure	A
Bellevue Pond overlook	Structure	C
Bellevue Pond culvert 1	Structure	C
Bellevue Pond dam	Structure	C
Bellevue Pond	Landscape	C
Bellevue Pond culvert 2	Structure	C
Bellevue Pond culvert 3	Structure	C
Springhouse	Structure	D
Bellevue Pond culvert 4	Structure	C
Bellevue Pond bridge	Structure	C
Botume House	Building	B
Botume garage	Building	B
Botume wall	Structure	C
Spot Pond	Landscape	B
Spot Pond east gatehouse	Building	B
Spot Pond south gatehouse	Structure	A
Spot Pond (Gillis) pumping station	Building	A
MIT observatory	Structure	C
M marker	Object	B
Middlesex Fells Reservoir	Structure	B
Middlesex Fells Reservoir gatehouse	Building	A
Virginia Wood plaque	Object	C
Copeland house	Building	B
Copeland shed	Building	F
Mill raceway	Arch. Site	D
Dam	Structure	C
Bucknam dam	Structure	C
Middle mill dam	Structure	B
Middle mill pond	Structure	C
Raceway	Structure	C
Cellar hole	Arch. Site	F
Virginia Wood	Landscape	B
Crystal Spring	Structure	C

a. Integrity of the resources in terms of location, design, setting, materials, workmanship, feeling and association are identified as H = High, M = Medium and L = Low, in accordance with Federal guidelines (NPS n.d.*a*).

b. Condition assessment using Park Heritage Landscape Inventory definitions: A = Excellent; B = Satisfactory; C = Unsatisfactory; D = Nonfunctioning; F = Critical Failure. (See Appendix Q.)

Historic Archaeological Resources

Spot Pond Brook Archaeological District. The Spot Pond Brook Archaeological District, listed on the National Register of Historic Places, comprises the above- and below-ground remains of an area where concentrated settlement and water-powered industry first developed in Stoneham. In the late 18th century, the Spot Pond Brook Archaeological District was a

small village occupied by yeoman farmers who operated mills powered by Spot Pond Brook. By the second half of the 19th century, it had evolved into the rubber factory village known as Haywardville, complete with steam-powered machinery and related buildings and shops. Spot Pond Brook, the topographical focal point of the district, flows from Spot Pond on a west to east course. The greatest concentration of archaeological remains, which contains three milldams, associated mill ponds and the remains of dwellings, is on the eastern half of the brook. Another large level area, where the late 19th century rubber mill complexes and dwellings were situated, runs along Fellsway East from the corner of Pond Street. This location permitted easy access to transportation routes leading to Malden and Boston.

The remains of a gristmill site, including a non-functioning mill raceway in good condition and a dam structure associated with the Vinton and Richardson gristmill, are extant on Spot Pond Brook. An earlier mill built in the late 1600s by Captain John Lynde may have previously occupied this site (Levin and Mahlstedt 1990).

In 1790, Ebenezer Buckman purchased most of the land along the stream, built a stone dam to create a mill pond, which in turn powered his sawmill. In the 1930s, the upper portion of the dam and its spillway were reconstructed by the Civilian Conservation Corp (CCC) and the Works Progress Administration (WPA).

Middle Mill Pond was created in the late 1700s by John Rand when he built a dam into the natural rocky ledge. The Middle Mill Dam is associated with this pond.

Medford / Quigley Quarries. One of the many types of stone present within the DCR Middlesex Fells Reservation is a richly colored, dark rock known as Medford Granite, which was the focus of 19th century quarrying activities. The gravel had a characteristic reddish brown color as a result of oxidation. Most of the quarrying occurred in the vicinity of Pine Hill. The quarries in the Pine Hill area, known as Medford Quarries, were commercially most active between the 1830s and the late 1870s, but small quarries may have been opened earlier. The granite and gravel were very popular during the 1840s and 1850s when they were used to line the paths and walkways of the Boston Common and the Public Garden. Many of the mansions built on the exclusive eastern shore of Spot Pond were constructed with this indigenous stone. Quarrying at Pine Hill continued into the late 1870s. Evidence of these quarries is still visible to the east of the Quarry Road Trail that leads north from Bellevue Pond. Quarrying also took place to the south of Long Pond in an area known as the Quigley Quarries.

Ram's Head Tower Foundation. At the peak of Ram's Head Hill in the Lawrence Woods section of the Fells are remnants of an observation tower that was constructed c. 1899. Visible today are square rock cuts showing the locations of the original concrete footings for the tower legs and the base of a set of concrete stairs. Called the Lawrence Observatory, the tower featured steel supports with six levels of wood platforms rising to a height of 81 feet. The tower was very similar in design to the original Bear Hill Tower.

Girl Scout Camp. Southeast of the Woodland Road culvert, a slumped fieldstone wall leads off to the remains of the c. 1938 Malden Girl Scout camp, located on the southwestern edge of the Spot Pond Brook Archaeological District. The remains of the camp consist of a large stone chimney with a double hearth.

Historic Buildings

Gould Farmhouse. Agriculture was an early land use in the Fells. One of the major farmsteads located within the boundaries of the reservation was established by the Gould family in the early 18th century, located to the northeast of Spot Pond on both sides of today's Pond Street. A section of the farm is now occupied by the Walter D. Stone Memorial Zoo. An extensively altered Greek Revival house, dating from the early 1800s, currently serves at the administrative headquarters for the zoo. Featuring a stone foundation and distinctive cornice returns on the gable ends, this house was originally built as a residence for the Gould Farm. The main farmhouse for the property, a 2 ½-story wood-framed building with multiple ells attached, was constructed in the 1830s at a location just to the west of the existing house and demolished in the late 20th century. More research is necessary to understand the functional relationship between the existing Gould Farmhouse and its former neighbor.

John Botume House. Beginning in the 1840s, a trio of Boston businessmen acquired land along the eastern shore of Spot Pond with the intent of

dividing it up into lots and developing residential estates. Known as "Wyoming," the area saw the construction of several mansions and outbuildings through the 1880s. William Foster, one of the original developers, owned a number of lots along the pond edge and constructed his main estate on a raised promontory along the pond edge. Constructed c. 1858, the mansion was designed by William Bailey Lang in the Italianate style and features local stone, bracketed cornices, slate roofs and a decorative iron balconet. The building is enhanced by a series of stone walls with iron gates along the edge of Woodland Road. John Botume, Jr., a local merchant, later acquired the property from Foster and resided there until it was taken by the Metropolitan Park Commission in 1894. The mansion at 4 Woodland Road now serves as the park headquarters for the DCR Middlesex Fells Reservation. Between 2006 and 2010, the DCR undertook major exterior and interior rehabilitation work at the mansion, including the construction of a new entrance ramp and exit stair, restoration of the interior and exterior and installation of a new heating, cooling and ventilation system.

Associated with the Botume House is a one-story, three-bay garage, constructed in the early 1900s. The garage is constructed of structural clay tile with a stucco finish and features a corbelled cornice along the parapet.

Charles Copeland House. Charles Copeland, the owner of a Boston confectionary, was one of the first to purchase lots in the Wyoming development and eventually owned extensive property on both sides of Woodland Road. The house at 1 Woodland Road is the lone building remaining from the Copeland estate. Built c. 1870, the house is noted for its restrained Queen Anne styling, including bracketed gable eaves and contrasting shingle and stone exterior treatment. Today, the DCR uses the building for storage and a caretaker's residence.

Tudor Barn. South of the Botume House is another remaining building from the Wyoming estate development, a stone barn constructed c. 1855. The barn was originally built and owned by one of the early developers of the area and was subsumed into the estate of Frederick and Henry Tudor when their family acquired land along Spot Pond in the 1870s and 1880s. The side-gabled barn is constructed of local stone and features wood doors and granite lintels. The barn was in a serious state of disrepair, with a collapsed roof and walls, until the DCR undertook a restoration of the barn in 2005. The barn is currently used for storage.

Historic Structures

Silver Mine. Located to the east of Winchester's South Reservoir is the site of a silver mine that briefly operated from 1881 to 1883. The opening of the 25 foot deep shaft was covered by a reinforced concrete cap in 1936 for safety reasons. The concrete cap is still visible today, along with a series of concrete posts that appear to have been part of a protective fence around the site.

MIT Observatory. Just north of the intersection of East Border Road and Fellsway East in Malden is a prominent ridge with exposed ledge outcroppings referred to as "Boojum Rock." Atop the secondary summit of this ridge is a low square wall of stones with an opening on the north side. These stones are the remnants of an observatory constructed in 1899 by the Massachusetts Institute of Technology's Civil Engineering Department. In concert with other similar observatories on Prospect Hill in Somerville and in the Blue Hills in Milton, the building was designed to facilitate the measurement of longitude and latitude, elevation and the curvature of the earth using geodetic survey techniques. Most of the stones have lost their mortar and the wall remains have been subject to vandalism.

Trolley Corridor. Through the combined efforts of the Boston Elevated Railway Company and the Boston & Northern Street Railway, a new railway was constructed between 1907 and 1910 to provide electric trolley service from Sullivan Square in Charlestown to the center of Stoneham. Service was terminated along the railway in 1946. Within the boundaries of the DCR Middlesex Fells Reservation, the railway followed a path roughly parallel to Route 28, passing through a portion of the Sheepfold. The railway corridor is still largely intact through much of the Fells and much of it has been incorporated into the reservation's trails system. Trapezoidal built-up sections of the railroad bed still exist, beginning near the intersection of Route 28 and the Half Mile Road Trail and extending north to just beyond the north end of Dark Hollow Pond. Three bridges constructed for the railway also are intact. These include two single-span concrete arch bridges; one crossing above the access road to the Sheepfold

parking lot, the other crossing above Bear Hill Road. Concrete is spalling (a condition where water infiltrates the material and causes the surface to peel, flake or pop off) and cracking on both of these bridges, exposing reinforcing steel bars. Iron railings along their parapets are also in poor condition. A third railroad bridge crosses a ravine to the west of Dark Hollow Pond. This trestle bridge consists of a series of paired concrete piers (rising to a maximum height of approximately 30 feet) supporting a concrete deck with a shallow, cantilevered parapet that has lost its iron pipe railings. Most of the deterioration is limited to cracking and spalling along the parapet. An engineering analysis of each bridge is recommended in order to examine its structural stability, load capacity and overall safety. Finally, near the Sheepfold, the railway crosses over a concrete culvert-like structure with a rectilinear opening measuring approximately 6 feet square. This structure was allegedly constructed as an underpass to allow the sheep, grazing in the open fields to the west, to cross below the railway.

Bear Hill Tower. At the summit of Bear Hill, directly adjacent to the enclosed Bear Hill water tank, stands an observation tower constructed of reinforced concrete. The hexagonal tower was built in 1910 to replace an earlier wood tower and was designed by the firm of Stickney & Austin, who were responsible for the designs of many other buildings and structures within the Metropolitan Parks System (De Las Casas et al. 1910). The lower set of circular stairs is constructed of concrete, while the upper portion is constructed of iron. Many areas of spalling concrete have resulted in exposed sections of the reinforcing steel bars, leading to rusting and expansion. The tower is also a popular target for vandalism and graffiti.

Wright's Tower. One of the most popular and visible historic structures within the DCR Middlesex Fells Reservation is Wright's Tower, perched atop Pine Hill with expansive views to the east, south and west towards metropolitan Boston. This stone structure features a pyramidal slate roof, narrow slit window openings and an observation platform with openings on all four sides. The tower was built by the Works Progress Administration in 1937 and named in memory of Elizur Wright, who owned an estate in the vicinity of Pine Hill in the late 1800s and was an early advocate for the preservation of the Fells. The wood roof of the tower suffered extensive damage in a fire in 1980s; the DCR completed a restoration of the tower in 2008. A bronze plaque honoring Wright was installed on the inside of the tower that same year.

Crystal Spring Springhouse. In a small valley to the north of Pond Street stands a stone springhouse above the location of Crystal Spring. It is constructed entirely of mortared rubble stone with an arched top. An arched opening on the south side of the structure has been infilled with cut granite blocks. Water from the spring drains out an iron pipe at the base of the structure and flows away to the south. More research is needed to identify a date of construction for the springhouse and clarify the history of the spring.

Historic Parkways. Historic parkways provide transportation links and recreational experiences and also qualify as historic and natural landscapes. The parkways of the DCR Middlesex Fells Reservation consist of an interconnected system of border and internal roads that travel through a mixed setting of wooded landscape, wetlands and parks, as well as pockets of modern and historic residential and commercial development. Associated with the parkways are stone walls, medians, miters and rotaries. The DCR Middlesex Fells Reservation parkways, listed in the National Register of Historic Places, include East Border Road, Elm Street, Fellsway East, Fellsway West, Hillcrest Parkway, Pond Street, Ravine Road, South Street, South Border Road and Woodland Road.

In 2006-2007, the DCR undertook a participatory parkway planning process to develop a vision for enhancement of the parkway system at the Fells. The results of this process are included in Appendix V.

Cultural Landscapes

The cultural landscape is fashioned from a natural landscape by a cultural group. Culture is the agent, the natural are the medium, the cultural landscape is the result.

Carl Sauer, The Morphology of Landscape, 1925

Cultural Landscapes are distinct geographical areas or properties that uniquely represent the combined work of nature and of man (UNESCO 2005). The Fells contains a variety of important cultural landscapes.

Sheepfold

In addition to the Gould Farm, agricultural activities were prevalent on the west side of Spot Pond during the 19th century, evolving from small family farmsteads to commercial operations. One of the remaining landscape features from this era of land use is the open field at the Sheepfold area of the Fells. After the taking of this property for the establishment of the reservation, the Metropolitan Park Commission (MPC) proposed, in 1901, to maintain the former pastureland by introducing sheep. This was facilitated by the donation of a flock of sheep and the construction of a shelter. By 1909, the Sheepfold featured 26 sheep and rams and was one of the reservation's most popular attractions (Levin and Mahlstedt 1990). With the construction of the railway through this area in 1910, the MPC elected to remove the sheep. However, the area maintained its popularity due to the access provided to it by the new railway, which featured a terminal at the Sheepfold. By 1917, the MPC had installed recreation equipment for the visitors, including picnic tables, water fountains, playground equipment and a bandstand, while the former sheep shelter was converted into a refreshment stand. Active recreation continued to take place at the Sheepfold after the electric trolley service was terminated in 1946, given its accessibility via automobile. A soap box derby track was constructed in the late 1950s on the north slope of a hill, just to the east of the open field, and remained in regular use until 2006. In recent years, the Sheepfold has been a popular location for recreation with dogs and the DCR is currently designating an official off-leash area here.

Middlesex Fells Zoo

Although not currently under the care and control of the DCR, the zoo at the DCR Middlesex Fells Reservation has its roots in a private collection of animals captured in the reservation by Charles P. Price, who became superintendent in 1896. As the collection grew, the Metropolitan Park Commission took on the costs of managing it in the early 1900s and over time, took on animals from other locations. It is unclear when the collection of animals was first located at the site of the current zoo on Pond Street. Given that this is the location of the former Gould Farmstead, it is likely that barns and other outbuildings may have remained from the farm after the MPC's acquisition of the land in the late 1800s. These buildings would have been easily repurposed for the housing and exhibition of the animals and over time, these facilities have been improved and developed as housing and exhibition facilities

In 1959, Walter D. Stone became the first appointed zoo director, overseeing both the Middlesex Fells Zoo and the Franklin Park Zoo in Boston. In 1969, the zoo was renamed in his memory. In 1991, the Legislature created the Commonwealth Zoological Corporation (Appendix F) and transferred care, custody and control of the zoo to the corporation, now doing business as Zoo New England.

Additional research is necessary to determine how the zoo was developed and transformed over the last century.

Virginia Wood

The section of the DCR Middlesex Fells Reservation bordered by Pond Street, Fellsway East, Ravine Road and Woodland Road is known as "Virginia Wood." In addition to its historic archaeological significance for its associations with industrial activities from the late 1600s to the late 1800s, this is an important cultural landscape related to the history of land conservation at the local, state and national level. As local efforts to protect the Fells forestland proceeded, Charles Eliot's vision for a metropolitan parks system led to the creation of the nation's first public land trust in 1891, the Trustees of Public Reservations. The very first gift of conservation land donated to the organization was located in this area of the Fells, given by Mrs. Fannie Tudor as a memorial to her daughter, Virginia, who had died in a horse riding accident in the forest. The property was later donated to the Metropolitan District Commission in 1923. Virginia Wood is also notable for its stand of stately hemlock trees, one of the largest and healthiest collections of such trees in the greater Boston area.

Bellevue Pond

Bellevue Pond and its surrounding landscape were largely shaped by the efforts of the Works Progress Administration (WPA) from 1937 to 1939. The WPA, a federal program to assist the unemployed by engaging them in various public works initiatives, took on the tasks of dredging the pond, constructing stone spillways, building gravel pathways and erecting stone bridges and culverts. Most of these stone features are still in active use and remain in

generally good condition. The spillway is one structure that requires extensive stabilization.

Reservoir System

As the city of Boston grew in the early 19th century, the need to secure new sources of pure drinking water became increasingly imperative. On more than one occasion, officials considered Stoneham's Spot Pond as a potential solution, a natural body of fresh water that featured a surface area of 296 acres and a watershed of 1,100 acres. Finally, responding to the pressures of a growing population and increased demand, in 1867, a group of local businessmen formed the Spot Pond Water Company and purchased the pond's water rights. Two years later, the Company sold their water rights to the towns of Medford, Malden and Melrose for $60,000.

The Town of Winchester developed a series of reservoirs within the adjacent towns of Medford and Stoneham in the 1870s. The first to be constructed was the North Reservoir, completed in 1874. The Middle and South reservoirs were constructed by 1880. Together, the reservoirs comprise a surface area of 198 acres and a water volume of 993 million gallons.

In 1895, the Metropolitan Water Board emerged and acquired jurisdiction over the same district served by the Metropolitan Park Commission and in 1898, the Board took Spot Pond and its adjacent property in fee. This was the Board's first step towards establishing a water supply system to more efficiently serve the communities north of Boston, which became known as the Middlesex Fells System. This system was supplemented by the construction of the Middlesex Fells Reservoir in 1899 and the Bear Hill Reservoir in 1902.

The Middlesex Fells System was served by the Wachusett Reservoir between 1900 and 1940. Water was carried via a series of aqueducts and tunnels to the Chestnut Hill Reservoir in Brookline. From there, water was pumped to Spot Pond, which served as the principal distributing reservoir of the Middlesex Fells System. Spot Pond acted as a "low service reservoir" from which water was pumped to both the Bear Hill and Middlesex Fells reservoirs, referred to as "high service reservoirs." Water from the high service reservoirs was fed by gravity to the surrounding communities. Upon the completion of the Quabbin Reservoir c. 1940, the Chestnut Hill Pumping Station became obsolete. After that, water was received directly from the Wachusett Reservoir through a combination of gravity and pumping stations.

Spot Pond

Upon acquiring Spot Pond in 1898, the Metropolitan Water Board determined that its water quality was sub-standard and sought ways to increase the reservoir's capacity, which led to a series of improvements. The Board commissioned the Olmsted Brothers landscape architectural firm to design the upgrades to the reservoir, which included dredging the shallow areas of the pond, raising the water level by nine feet and landscaping the new shoreline in a naturalistic manner. These improvements were completed by 1901. More recently, Spot Pond was drained and re-dredged in 1979 (Levin and Mahlstedt 1990).

The Metropolitan Water Board also worked with the architectural firm of Shepley, Rutan & Coolidge to design the Spot Pond Pumping Station, located on the eastern shore of the reservoir, along Woodland Road. The 1 ½-story station was designed in the Classical Revival style, featuring an exterior of gray Roman brick accented by limestone cornices, quoins and trim at the arched wall openings. The original tiled hipped roof was destroyed in a 1975 fire and replaced by an asphalt shingle roof. Shepley, Rutan & Coolidge also designed two, one-story gatehouses at the edge of the reservoir, the East Gatehouse, located just behind the pumping station, and the South Gatehouse at the southern end of Spot Pond. The East Gatehouse is a concrete structure with an ashlar granite exterior and tile roof, while the South Gatehouse more closely mimics the pumping station with the same brick exterior and limestone quoins and trim at the arched wall openings. The three buildings were constructed 1898-1900. Today the buildings are under the care and control of the MWRA.

Middlesex Fells Reservoir

Located 2,500 feet southeast of Spot Pond, the Middlesex Fells Reservoir originally consisted of two basins separated by a rock and concrete dam and was excavated from a former alder swamp. The Metropolitan Water Board, sensitive to the park setting of the reservoir, hired the Olmsted Brothers firm to design it in a naturalistic manner. When completed in 1900, the Middlesex Fells Reservoir covered 8.2 acres with a capacity of 41 million

gallons, but due to an increased demand, a third basin was added in 1940. The one-story gatehouse was designed by Shepley, Rutan & Coolidge and positioned between the two original basins. Constructed in 1900, the building features walls of irregular granite with cut granite quoins and foundations. Today the reservoir and gatehouse are under the care and control of the MWRA. In 1998, in compliance with federal regulations, the MWRA put into service a covered, below-grade water tank located on the footprint of Basin 3.

Bear Hill Reservoir

Bear Hill Reservoir was constructed in 1902 to provide greater water pressure to the town of Stoneham. It was built near the summit of Bear Hill by constructing dams across a natural depression in the rocky ridge and excavating within the area. Like the other gatehouses in the Middlesex Fells System, Bear Hill's was designed by Shepley, Rutan & Coolidge. It features a granite stone exterior in a Classical Revival style. The MWRA replaced the original open reservoir with a concrete above-grade water tank in 1986.

2.6. RECREATION RESOURCES

Recreational Activities

A variety of recreational activities occur at the DCR Middlesex Fells Reservation, some on developed sites or facilities, but most on trails within the reservation.

Managed Recreational Activities

The following activities are identified as "managed activities" at the Fells, in other words, recreational activities that the DCR specifically allows and may actively manage for:

- Bicycling (mountain)
- Bicycling (road)
- Boating (non-motorized)
- Culture study
- Driving (for pleasure)
- Dog-walking (on-leash)
- Frisbee
- Hiking / Walking
- Horseback riding
- Ice hockey (indoor only)
- Nature study
- Photography
- Picnicking
- Playground use
- Running / Jogging
- Running (cross-country)
- Skating (ice, indoor only)
- Skiing (cross-country)
- Snowshoeing
- Soap box derby
- Soccer
- Stewarding the environment
- Swimming (indoor only)
- Zoo visitation

Developed recreation facilities include the Sheepfold picnic area, soap box derby track, Greenwood Park and playground, Hall Pool, Stone Zoo, Flynn Rink, Virginia Wood self-guided history trail and Long Pond self-guided nature trail. Locations of developed recreation facilities are shown on Figure 2.1.1.

The National Survey of Recreation and the Environment (NSRE 2008) records recreational activities by state and region for nature-based activities, developed land settings, water-based activities and snow / ice-based activities. According to this survey 86% of the population in Massachusetts participates in walking, 38% hiking, 25% mountain biking, 15% canoeing, 8% cross-country skiing and 2% orienteering (Table 2.6.1). In the northeast region of the state, slightly higher percentages of people participate in each of these activities except rock climbing.

Table 2.6.1. National Survey of Recreation and the Environment: Participation in Outdoor Recreational Activities[a]

Activity	% MA Statewide	% NE MA Region
Walk for Pleasure	86%	88%
View / Photo Natural Scenery	67%	72%
Drive for Pleasure	53%	56%
Swim at a Pool	47%	52%
View / Photo Wildlife	46%	48%
Day Hike	38%	41%
Mountain Bike	25%	31%
Sled	20%	21%
Canoe	15%	21%
Cross-country Ski	8%	11%
Horseback Trail Ride	5%	4%
Rock Climb	4%	2%
Orienteer	2%	3%

a. Results of the National Survey of Recreation and the Environment (2008), selected data for Massachusetts statewide and Northeast region.

To help quantify trail uses, the DCR conducted trailhead counts from the fall of 2009 to the spring 2011, both mid-week and weekend, at four trailhead access points. Initial counts did not differentiate walkers with dogs from walkers without dogs, but did record the number of dogs and whether they were on- or off-leash.

These counts indicated high usage mid-week, particularly by walkers and dog walkers, but notably higher usage on the weekends by mountain bikers and runners. Overall, 45% of users were walkers / hikers, with or without dogs. Mountain bikers (21%), runners / joggers (16%) and others (18%) (often noted as "live parkers" or people who stayed in their car) were also noted in large numbers (Figure 2.6.1). Dogs actually outnumbered hikers and of those observed, over 85% were off-leash.

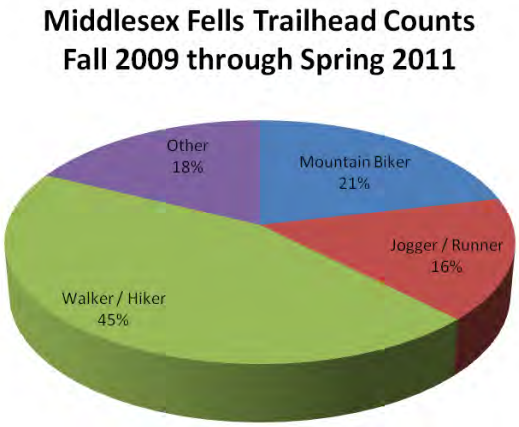


Figure 2.6.1.

A student researcher completed a winter trail use study during the 2010-2011 winter season (Russell 2011). This study found dog walkers to be the largest group of users (45%), followed by snowshoers / walkers (35%), cross-country skiers (15%) and runners and mountain bikers at only 2% each. It should be noted that the 2010-2011 winter season was relatively snowy (Figure 2.6.2).

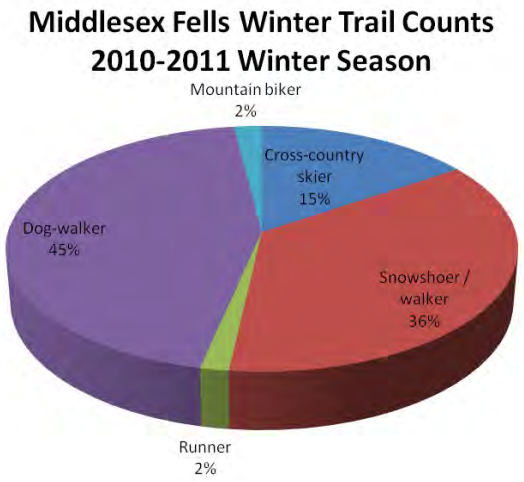


Figure 2.6.2.

Other Recreational Activities

In addition to managed activities, there are several recreational activities that occur at the Fells that may be legitimized, allowed by permit or restricted as necessary. These include:

- Dog recreation (off-leash, currently against DCR regulations)
- Fishing
- Geo-caching / letterboxing (off-trail uses are currently against DCR regulations)
- Orienteering
- Rock climbing

Activities that occur that are in violation of DCR regulations include:

- Biking on hiking only trails
- Camping
- Commercial dog walking
- Drinking alcohol
- Dumping
- Off-highway vehicle riding
- Paintball recreation
- Parking in un-designated areas
- Partying / campfires
- Public sex
- Swimming (outdoor)
- Trespassing (on posted Winchester Water Department lands)
- Unpermitted off-trail recreation
- Walking a dog off-leash on trails

Off-trail uses, in violation of regulations, impact soils vegetation and wildlife resources in the Fells. (See Section 4.2 for a further discussion.) And users trespassing on Town of Winchester Water Department lands have the potential to impact active drinking water supplies.

Off-leash dogs occur throughout the reservation on trails and are currently a violation of DCR regulations and local ordinances. Off-leash dogs may disturb wildlife, natural resources and other users and dogs. (See Section 4.3 and 4.5 for a further discussion.)

Sexual activity in the Fells is also a resource protection and management concern. This activity is concentrated in the woods between the Sheepfold and Bear Hill, but may also occur in other areas of the reservation, including the eastern Fells and around Bellevue Pond. The most active times are mid-day on weekdays. The intensity of this activity at the Fells, its impact on the park resources and impact that it can have on the comfort of other users raises this issue to a level of concern. It must be noted that when activities associated with this issue are indistinguishable from activity by other users, such as accessing public parking and hiking along existing, authorized trails, it is not a management concern. However, this activity generally occurs off legal trails, creating "spider-webs" of new trails that impact natural resources. While public sex is illegal, the courts have found that sexual activities where one may have an expectation of privacy such as off-trail in the woods, is not. But the pursuit of privacy takes users off-trail, in violation of regulations and impacting natural resources. The recommended strategy for addressing this issue involves bringing more diverse use and management presence consistently into areas where the activity occurs.

The DCR's Bureau of Ranger Services records complaints and illegal activities in an incident reporting database. Not all occurrences of illegal activities may be reported or recorded. Table 2.6.2 provides a summary of incidents in the Fells from 2007 through 2010, by type.

Table 2.6.2. Incident Summary by Type within the DCR Middlesex Fells Reservation, 2007-2010[a]

Incident	Number
Violation of DCR Regulations	33
Personal Property Theft	22
Illegal Dumping	16
Fight / Disorder	11
Vehicle Accident	9
Lost Person	8
Vandalism	8
Fire	6
Injury	6
Death	4
Waterfront	3
Hazardous Material	1

a. Incidents recorded by the Bureau of Ranger Services staff from 2007 through 2010.

Table 2.6.3 provides an additional breakdown of "violations of DCR regulations."

Table 2.6.3. Summary of Violations of DCR Regulations, 2007-2010[a]

Incident	Number
Dog Related Incident	12
Off-highway Vehicle	5
Camping	5
Swimming	3
Drinking	2
Illegal Entry	2
Private Boat on Spot Pond	2
Public Indecency	2
Tree Cutting	1
Paintballing	1

a. Incidents recorded by the Bureau of Ranger Services Staff from 2007 through 2010.

A review of all incidents for this period revealed that, in total, there were 19 dog-related incidents, including four recorded bites or attacks and one mountain bike related complaint.

Recreational Demands

Through both the year-long Fells trail system planning process and the resource management planning process, the public has expressed a strong desire for improved recreation management at the Fells. As noted in Section 1.3, over 3,000 individuals participated in the Fells planning process by attending meetings and contributing comments.

Based on comments, the DCR identified the following experiences desired by trail users at the Fells.

- Observing, exploring, discovering, and sharing nature from existing trails
- Experiencing diverse landscapes and views from the trails
- Walking, hiking and snowshoeing on a variety of types and difficulties of trails and terrain
- Mountain biking on a variety of types and difficulties of trails and terrain
- Engaging in the above experiences with a family dog and exercising and socializing a family dog with other dogs
- Running on a variety of types and difficulties of trails and terrain
- Cross-country skiing on a variety of types and difficulties of trails and terrain
- Finding solitude
- Orienteering at the Fells
- Engaging in these experiences as members of a family, especially parents with their children
- Stewarding and improving the Fells environment

These experiences are further described and discussed in the trail system plan (Appendix N).

Through the resource management planning public process, the DCR sent a survey to all participants via an online SurveyMonkey[tm] tool. (See Figure 2.6.3.) Users were asked to identify their favorite activities at the Fells. The DCR received 1,250 responses to this survey (Table 2.6.4).

Table 2.6.4. Responses to "Which are your favorite activities at the Fells?"[a]

Activity	Percent
Walking / Hiking	72.9%
Biking	54.6%
Experiencing / Appreciating nature	52.5%
Experiencing views and scenery	50.9%
Finding solitude	33.7%
Recreating with / Allowing a dog to exercise	26.6%
Running	19.6%
Cross-country skiing	17.2%
Experiencing cultural features	8.2%
Orienteering / Geocaching	6.2%

a. Responses from a non-random, online survey focusing on interpretation at the Fells. The survey was online from March 5, 2011 through March 21, 2011. Notification of the survey was sent to all who had participated in any Fells planning meeting or submitted comments.

Significant public disagreement and perceived conflicts exist for certain recreation issues, as evident in the public comments received during these processes (DCR 2010*b*; DCR 2011). This level of conflict is not typical of Massachusetts state parks. This is, perhaps, the most significant issue impacting the natural and social environment of the DCR Middlesex Fells Reservation. In an effort to help better understand the interests of the public, the DCR RMP team reviewed the public comment and attempted to reframe sentiments and statements in terms of "interests" rather than "positions." For those interests identified as potentially incompatible with each other, collaboration or compromise by the DCR and the various stakeholder groups will be required. Public "interests" at the Fells include:

Shared Interests

- Interest in having access to the scenery of the Fells, including high points and water features
- Interest in collaborating to improve and steward the Fells
- Interest in having the Fells' natural and cultural resources protected
- Interest in enjoying the Fells without having to worry about feeling unsafe or threatened
- Interest in enjoying the Fells comfortably with children
- Interest in having issues like theft, assaults, trash, fires, drinking and sexual conduct addressed
- Interest in having all dogs (whether on- or off-leash) follow basic behaviors

Possibly Compatible Interests

- Interest in having the Fells be open and welcoming for all users
- Interest in a community of unselfish users
- Interest in not having users fight for their own interests
- Interest in enjoying the Fells without seeing signs of degradation and damage
- Interest in meeting and developing a community of users at the Fells
- Interest in finding solitude and serenity
- Interest in rules that make sense
- Interest in having the rules firmly followed (and if necessary, strictly enforced)
- Interest in having all users treated equitably

- Interest in having dogs recognized and honored as parts of families who recreate in the Fells
- Interest in being in the Fells with a dog for personal safety
- Interest in not seeing or stepping in dog waste

Conflicting Interests

- Interest in having room within the reservation for dogs to be able to recreate off-leash with their owners
- Interest in being able to be in the Fells without being approached by a dog
- Interest in expanded, and more challenging, opportunities for mountain bike recreation
- Interest in visiting the Fells without encountering a mountain bike
- Interest in having all uses allowed on all trails
- Interest in having hiking only trails and experiences

User Attitudes and Behaviors

As described in Appendix N, there is a broad disregard for the rules exhibited by a majority of people and across the spectrum of users at the Fells (Rudge 2011). This culture of non-compliance is one of the most significant management issues at the Fells. It has become a social norm in the reservation and is self-reinforcing. In other words, when a user sees another person break a rule, it becomes much easier for them to follow suit and/or justify their own illegal actions. Overall, this exacerbates managerial challenges, environmental impact and user conflict. The most notable examples of violations of laws, rules and regulations are:

Off-leash Dogs. Dogs are required to be on-leash at all areas in the Fells under current DCR regulations and local leash laws. Yet, as noted, nearly 85% of dogs are off-leash.

Trespassing on Water Supply Lands. The Town of Winchester water supply lands are clearly and unequivocally posted "No public access" to protect drinking water and yet many users regularly walk or bike past these signs.

Off-trail Use. Going off-trail is a violation of DCR regulations in urban parks. However, many users, be they nature enthusiasts looking for wild flowers, bird watchers, bikers free-riding, individuals engaging in sexual activity or off-leash dogs, go off-trail in the Fells. All off-trail uses create new trails, trample plants, compact soils and impact the environment significantly more than any on-trail use. (See Section 4.2 for a detailed discussion.)

Biking on Hiking Trails. Many trails, including most sections of the Skyline, Rock Circuit, Cross Fells and Reservoir trails, are clearly signed for pedestrians only and yet mountain bikers continue to ride these trails and advertise them on the internet.

After Dark Use. Although the Fells is closed from dusk to dawn, many users continue to walk, hike, bike, drink or party after dark. This poses both safety risks and may further disturb wildlife.

Engaging in sexual conduct. On any given afternoon, multiple individuals may be engaged in this activity, particularly in the area between the Sheepfold and Bear Hill off-trail or in secluded spaces.

The lack of management presence and enforcement has contributed to these issues. The DCR, working with enforcement personnel and organized stakeholder groups, will need to change this culture of non-compliance.

Recreational Conflict

Although many users reported that most visitors to the Fells are courteous and respectful to each other, and that actual incidents of conflict are rare, public comments through the planning processes indicate that there is significant recreational conflict among some users at the Fells (DCR 2010*b*; DCR 2011). These are also reflected in the "potentially incompatible interests" above. Conflict is one of the most significant issues affecting both the natural and social environment at the Fells and ranges from physical incidents that may cause harm or injury, to feelings of threat or discomfort, to perceptions of trail or environmental damage, to clashes of social values of recreation and conservation.

Specific areas of conflict include:

- Confrontations with dogs not under the control of their owners
- Encountering or fear of encountering individuals having sex
- Fear of encountering fast moving bicycles on narrow trails

- Encountering physical or human barriers to biking on trails
- Fear of being approached by a dog
- Trail tread or environmental degradation
- Disruption of cross-country ski tracks by other users
- Encountering dog waste
- Experiencing rudeness or discourteous behavior

Research conducted during the winter of 2010-2011 specifically explored conflicts among winter recreational users at the Fells through site-intercept surveys. This research recorded observed behaviors that might contribute to conflict such as rudeness, failure to yield, riding or skiing too fast, owners allowing dogs off-leash and owners not picking up after dogs (Table 2.6.5).

Table 2.6.5. Behaviors Observed by Users of the Fells that Might Contribute to Conflict[a]

Behavior	Observed by Users
Dog owners allowing dogs off-leash	77%
Dog owners not cleaning up after their dog	66%
Dogs misbehaving or threatening	33%
Hikers / snowshoers being rude	22%
Mountain bikers passing too closely	18%
Hikers /snowshoers disrupting winter trail conditions	16%
Skiers not giving warning on approach	11%
Mountain bikers not yielding	9%

a. These behaviors were observed by other recreational users during prior winter visits to the Fells and reported through questionnaire administered by Russell 2011. N=251. Select data only.

It is interesting to note that some behaviors were observed and reported differently by different groups. For example, cross-country skiers were much more likely to report hikers / snowshoers disrupting winter trail conditions (58%) than other groups were. Hikers / snowshoers were much more likely to report mountain bikers not yielding (17%) than other groups. However, some behaviors, such as dog owners allowing dogs off-leash and owners not picking up after their dogs, were reported similarly by all groups (Russell 2011).

The research further explored whether or not recreationists experienced conflict as a result of these behaviors. The most prevalent conflicts centered on dogs. Sixty-seven percent of users experienced conflict with owners not picking up after their dogs (including 66% of dog owners). Fifty-six percent of users reported experiencing conflicts with dogs off-leash at the Fells (including 42% of dog owners). Thirty-eight percent experienced conflict with misbehaving or threatening dogs (including 31% of dog owners) and 45% experienced conflict with dogs disrupting trail conditions.

Users reported relatively low, but notable levels of conflict with certain mountain biking behaviors, including failure to give warning (19%), failure to yield (18%) and riding out of control (15%).

Users also reported relatively low, but notable levels of conflict with hikers / snowshoers as a result of rude behavior (17%) and disrupting winter trail conditions (14%). Similarly, users experienced conflict with skiers for failure to give warning (17%) and rude behavior (13%). Very few users experienced conflict with runners.

Finally this research, following the model of recreational conflict discussed by Vaske et al. (2007), further classified conflict into two categories: "interpersonal" conflict and "social values" conflict. Interpersonal conflict arises when a user encounters a behavior by another user that interferes with their experience (e.g., encountering rude behavior or being startled by a passing bike). Social values conflict occurs when values clash, but there is no direct contact between individuals (e.g., believing that bicycles do not belong on trails in natural areas).

Appendix N further describes research related to conflicts on recreation trails and approaches to addressing and minimizing conflicts.

2.7. INFRASTRUCTURE RESOURCES

Property Boundary

The Fells has a boundary totaling 30.1 miles. Much of the boundary is bordered by roads or parkways. Fences mark some boundaries, including along I-93, Marjam Industries in the Bear Hill section and around the former Boston Regional Medical Center site, which now owned by the Gutierrez Company and proposed for mixed use re-development. The reservation shares 5.4 miles of boundary with the Winchester Water Department lands in the western Fells. This boundary is visibly posted "No Trespassing" at all access points and has a fence

bordering the Sheepfold. The remaining boundaries are poorly marked.

Buildings and Structures

Buildings and structures within the DCR Middlesex Fells Reservation are listed in Appendices R and S.

Historic Buildings and Structures. The historic buildings and structures in the reservation are described in Section 2.5, Cultural Resources and in Appendix Q.

Spot Bond Boating. The boating program shed is a non-fixed, pre-fabricated shed used for non-motorized boat rental during the spring, summer and fall. A wooden ramp connected to a floating dock system is provided for boat users at this site.

The Sergeant George J. Hall Memorial Pool. Hall Pool is an outdoor pool facility, consisting of a large deep-water pool, small wading pool, playground and bathhouse. The deep-water pool, wading pool and the bathhouse are in fair condition. Pool drainage system sewer upgrades are planned for the fall of 2011.

The John W. Flynn Memorial Ice Skating Rink. Flynn Rink is an indoor ice skating facility originally built in 1958. The current rink was completed in 1995. The rink is in good condition. Its cooling tower was replaced in 2008. The rink is operated by a management company through a contract with the Friends of Flynn Rink.

The Fells District Labor Yard. The Labor Yard is comprised of seven major structures, which support both the DCR and other agencies.

The lower yard is comprised of an operations building, engineering office, engineering testing lab, engineering storage shed, tree nursery and a fueling station. The upper yard is comprised of a CNG (compressed natural gas) fueling station, regional supply building, regional vehicle maintenance building, mobile maintenance equipment storage building, salt storage shed, district transfer station and the state police canine unit headquarters building.

In the summer of 2010, the DCR replaced roofs on the maintenance building, North Region supply building and operations / mobile maintenance storage garage. In the fall of 2010, the DCR installed two new security gates on the property, one at the yard entrance and one in front of the salt shed and transfer station.

Water System Infrastructure. Infrastructure supporting the MWRA drinking water system is detailed in Section 2.4, Water Resources and 2.5 Cultural Resources.

Other Structures. There is a playground structure, pavilion, picnic tables and soccer nets at Greenwood Park; Jerry Jingle Park includes a gazebo; and picnic tables are also present at Straw Point and the Sheepfold.

Roads

The DCR owns and manages various roads and parkways within and associated with the DCR Middlesex Fells Reservation (Table 2.7.1).

Table 2.7.1. DCR Managed Roads and Parkways within the Fells District

Road / Parkway	Community
East Border Road	Medford
Elm Street	Medford
Fellsway East	Melrose and Medford
Fellsway West	Malden, Medford and Stoneham
Highland Avenue	Malden and Medford
Hillcrest Parkway	Winchester
Lynn Fells Parkway	Melrose
New South Street	Stoneham
North Border Road	Medford
Pond Street	Stoneham
Ravine Road	Stoneham
Reservoir Street	Winchester
South Border Road	Medford and Winchester
South Street	Stoneham
Woodland Road	Stoneham and Medford

In addition, as described in Appendix N, various water supply management roads occur within the Fells, including the Fells Reservoir Dam Road and various roads within the Town of Winchester water supply lands. These management roads are not part of the DCR trail system and public access to these management roads is / may be restricted.

Parking

Parking to access the reservation's various resources is available at 14 locations, providing nearly 400 spaces.

Table 2.7.2. Parking at the Fells[a]

Lot	Town	#	Condition
Bellevue	Medford	20	Fair
Botume / Spot Pond	Stoneham	50	Fair
Crystal Spring	Stoneham	5	Good
Elm Street	Medford	4	Good
Fells East Pull-Off	Malden	10	Fair
Flynn Rink	Medford	80	Good
Greenwood Park	Stoneham	45	Good
Hall Pool	Stoneham	10	Good
Jerry Jingle	Stoneham	30	Good
Long Pond	Winchester	20	Good
Pond Street Pull-Off	Stoneham	4	Good
Sheepfold	Stoneham	70	Poor
South Border Pull-Off	Medford	10	Fair
South Border Pull-Off	Winchester	10	Good
Straw Point	Stoneham	26	Good

a. Estimates of number of spaces and assessments of conditions by Fells District staff.

Users also park at various locations not under the ownership or care and control of the DCR, including off of Fallon Road, at the Stone Zoo, Gutierrez Company site and Lawrence Memorial Hospital and within bordering residential areas. Parking is not permitted along reservation roads and parkways except at established pull-offs.

Trails

The trail system plan (Appendix N) details the extent, condition and issues relative to the 79 miles of official roads and trails and 22.7 miles of illegal trails at the reservation. The plan documents that the trails are in relatively good condition, with an average of four damage points per mile, which are generally repairable with standard trail maintenance practices.

Signs and Kiosks

The reservation contains 12 main facility identification signs and three cantilevered identification signs.

The reservation includes 12 informational kiosks, including three four-sided kiosks. Kiosks are located at main parking areas and reservation access points. They include a reservation map and information on reservation rules, regulations and upcoming programs that are updated periodically.

There are three interpretive waysides within the reservation: two at Virginia Wood and one at the MIT observatory site on the Rock Circuit Trail.

There are two self-guided trails with markers: a history trail in Virginia Wood that is accompanied by a brochure and a nature trail at Long Pond with interpretive panels.

There are 48 additional trail name, directional and informational signs.

Reservoir Trail Loop Sign (Photo by Paul Jahnige)

A variety of parking and regulatory signs are also present along roadways and in parking areas of the reservation that have not been inventoried.

Memorials and Markers

The reservation contains seven memorials and markers listed in Table 2.7.3.

Table 2.7.3. Memorials and Markers in the Fells

Marker	Location
Dedication stone	Botume House
Memorial plaque	Flynn Rink lobby
Memorial plaque	Hall Pool, in front of bathhouse
Memorial plaque	Affixed to stone, Virginia Wood
Shute's marker	Great Island, Spot Pond
Dedication plaque	Wright's Tower
Engraved stone	Straw Point

2.8. DEMOGRAPHICS

There is no comprehensive demographic profile of the reservation's visitors. However, various data sources provide information on the likely profiles of users. According to the 2000 Census, 76,357 people live within a half mile of the DCR Middlesex Fells Reservation. Over 1.8 million live within a 10 mile radius. The population living within this "catchment" is 48% male and 52% female; 20% children (under 18), 67% adults and 13% seniors

(Table 2.8.1). This represents a population that is somewhat older than the general population of Massachusetts and this seems to be more pronounced in communities closer to the Fells.

Table 2.8.1. Gender and Age of Population Surrounding the Fells[a]

	½ mile	1 mile	5 miles	10 miles
Population	*76,357*	*139,104*	*848,121*	*1.8 mil.*
Gender				
Male	48%	47%	48%	48%
Female	52%	53%	52%	52%
Age				
Children	20%	21%	19%	20%
Adults	63%	63%	67%	67%
Seniors	17%	16%	14%	13%

a. Based on the 2000 Census Block Group data. Block Groups were selected if they intersected with a given buffer.

The 2010-2011 winter trailhead counts at the Fells recorded gender and found that visitors were 57% male and 43% female, indicating that, at least during the winter, Fells visitors represent a greater percentage of males than the general population. This survey also asked users what town they resided in; 32% reported living in an abutting community, 81% in northern metropolitan Boston, 98% in greater Boston and only 2% outside of greater Boston.

Table 2.8.2 describes demographics of race, ethnicity and primary language spoken within 10 miles of the Fells. The communities immediately surrounding the Fells are largely white with relatively small percentages of African-Americans and a relatively larger percentage of people who speak a non-English / non-Spanish European language at home.

Table 2.8.2. Race, Ethnicity and Language Spoken of Population Surrounding the Fells[a]

	½ mile	1 mile	5 miles	10 miles
Race				
White	88.5%	87.1%	82.0%	76.1%
Black	2.8%	3.7%	4.7%	9.3%
Asian	6.2%	6.0%	6.2%	6.6%
Native American	0.1%	0.2%	0.3%	0.3%
Ethnicity[b]				
Hispanic	2.0%	2.4%	8.0%	8.7%
Language[c]				
English	78.7%	78.6%	73.3%	72.8%
Spanish	2.5%	2.8%	6.7%	7.7%
European	13.5%	13.6%	14.6%	13.4%
Asian	4.0%	3.8%	4.0%	4.7%
Other	1.3%	1.1%	1.3%	1.4%

a. Based on the 2000 Census Block Group data. Block Groups were selected if they intersected with a given buffer.
b. Ethnicity identify as Hispanic is a separate category from race.
c. This census category records "language spoken at home."

Household income and educational attainment of individuals over 25 are described in Table 2.8.3. The surrounding communities are somewhat wealthier and more educated than the general population of Massachusetts.

Table 2.8.3. Income and Education of Population Surrounding the Fells[a]

	½ mile	1 mile	5 miles	10 miles
Income[b]				
Low	21%	22%	24%	25%
Medium	44%	44%	44%	43%
High	35%	34%	33%	32%
Education				
< High School	11%	12%	15%	15%
High School	27%	28%	25%	24%
< Bachelor's	23%	23%	20%	20%
Bachelor's	23%	22%	21%	22%
> Bachelor's	16%	15%	18%	19%

a. Based on the 2000 Census Block Group data. Block Groups were selected if they intersected with a given buffer.
b. Low = < $25,000; Medium = $25,000 to $74,999; and High = > $75,000.

Over 1,200 individuals who participated in the resource management planning process, also participated in an opt-in, online survey on education and interpretation at the Fells. This survey recorded the Zip Code of the respondents and the results are displayed in Figure 2.6.3.

The Boston skyline as viewed from the Fells. (Photo by the DCR)

SECTION 3. MANAGEMENT RESOURCES AND PRACTICES

3.1. INTRODUCTION

The DCR Middlesex Fells Reservation contains diverse natural, cultural, recreation and infrastructure resources (Section 2). Their management is complex and subject to a variety of laws, regulations, policies, plans and legal agreements. Management is also subject to available resources and staffing.

The DCR manages its parks, forests and reservations under a management structure of regions that are further divided into districts and, in some cases, clusters. The DCR Middlesex Fells Reservation is managed as a part of the Breakheart Cluster, a group of DCR facilities within the Fells District of the North Region.

Management resources are assigned and divided variably by region, district and cluster. This section will describe different management resources available for this management unit, as well as the relevant management practices, regulations, policies and legal considerations that guide management. A list of relevant Massachusetts regulations is presented in Appendix E.

3.2. MANAGEMENT PRACTICES

Landscape Designation

As a result of a year-long Forest Futures Visioning Process, recommendations from an external technical steering committee, input from an advisory group of stakeholders and the general public, and adoption by Secretary of Energy and Environmental Affairs Ian Bowles in April of 2010, the DCR initiated a robust public process to designate DCR lands as Parklands, Woodlands and Reserves. (See Section 4.3 and DCR 2011*a* for details.) Under the Landscape Designation process (currently underway), the Fells has been identified as Parkland.

This designation is consistent with the historic purposes for which the Fells was acquired, the landscape context within which the Fells exists, the character of the resources at the Fells and the historic and on-going use and management of this property.

Specific management guidelines for Parklands are described in *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guideline* (DCR 2011*b*). These guidelines will not

result in any substantive changes to the way that the Fells is used or managed.

Natural Resources

Water Resources

Activities within the DCR Middlesex Fells Reservation that occur within a wetland resources area, riverfront area or wetland buffer, as defined by the Massachusetts Wetlands Protection Act (WPA), and that have the potential to fill, dredge, remove or alter these resource areas are regulated by the local conservation commissions and the Department of Environmental Protection (M.G.L. Chapter 131, Section 40).

Activities within the DCR Middlesex Fells Reservation that affect the quantity or quality of storm water are regulated by a National Pollutant Discharge Elimination System (NPDES) plan and permit that covers multiple DCR properties (DCR 2007*a*). This permit identifies Best Management Practices (BMPs) employed by the DCR to properly manage storm water. Management practices implemented at the reservation-level include catch basin maintenance, washing vehicles at off-site locations and continued compliance with the Wetlands Protection Act.

The management of Spot Pond and the lands surrounding Spot Pond are governed by a Memorandum of Understanding (MOU) with the MWRA (MDC and MWRA 1999). The area encompassing the Middlesex Fells Reservoir basins is governed by a separate MOU (MWRA and MDC 1995; Appendix T).

Through this resource management planning process, the DCR has identified guidelines for the protection and volunteer certification of vernal pools. These are detailed in Appendix D.

Vegetation

There is no single management plan for the reservation's vegetation. The *de facto* management policy is to permit individuals and/or populations of most species of plants to grow, die, reproduce, increase or decrease without human intervention. Invasive species are an exception to this and may be controlled through biological, chemical and mechanical methods to reduce their extent and competition with other plants or plant communities.

A Habitat Management Plan (Appendix M) includes recommendations to guide the management of Priority Natural Communities, watch-listed plants and state-listed rare plants within the Fells. This plan has been developed in consultation with the NHESP and provides an exemption from MESA review for identified and approved activities. The NHESP (2010) has also made specific recommendations regarding the management of vegetation along trails in Priority Habitat. These have been incorporated into Appendices M and N.

The reservation's work plan (Appendix P) guides the mowing, trimming and weeding of vegetation in landscaped areas. The frequency of these activities changes throughout the year. In general, grass in landscaped areas is mowed and trimmed every 14 to 18 days, or as needed during the growing season. In natural areas, grass may be mowed less frequently.

Wildlife

There is no single wildlife management plan for the reservation. The *de facto* management policy is to permit most wildlife populations to increase or decrease without human intervention.

A third-party wildlife tracking survey and report (Brown 1999; Brown 2009) includes recommendations for the management of mammals and their habitats within the Fells. These include maintaining some trail-less areas within the Fells, eradicating some invasive species, natural history education and restricting off-trail uses, especially off-leash dogs.

A Habitat Management Plan (Appendix M) provides recommendations for the management of the reservation's state-listed animals and their habitats. This plan has been developed in consultation with the NHESP and provides an exemption from MESA review for identified and approved projects. Any undertaking by any individual or agency within Priority Habitat (Figure 2.4.3) that is not covered by an exemption is subject to MESA and review and permitting by the NHESP. Undertakings include trail construction, basic trail maintenance, invasive removals, etc., and the DCR, as a state agency, has an even higher responsibility to protect state-listed species than private parties.

Wildlife research is regulated through Special Use Permits issued by the DCR and by Scientific Collecting Permits issued by MassWildlife.

Cultural Resources

The DCR's Office of Cultural Resources (OCR) supports planning for, and management of, cultural resources on DCR property through project management and resource management planning. The OCR coordinates all regulatory compliance related to state and local laws protecting historic and archaeological resources. The OCR also prepares nominations of properties for inclusion in the State and National Registers of Historic Places.

Any project undertaken, funded, permitted or licensed in whole or in part by the DCR may be subject to review by the Massachusetts Historical Commission (MHC). Projects with federal involvement may also be subject to Section 106 of the National Environmental Policy Act (NEPA). OCR staff assess regulatory needs and, when applicable, notify the MHC through the filing of a Project Notification Form or an Environmental Notification Form. This is done so that the MHC can make a Determination of Effect of the project on historic and archaeological resources. Finally, OCR staff coordinate any archaeological surveys, testing and excavation with the State Archaeologist through an archaeological permit.

Buildings, structures, landscapes, sites and objects that are a minimum of 50 years old, retain historic integrity and are of significance on the local, statewide or national level may be listed in the National Register of Historic Places (NPS n.d.*a*). Historic resources are identified in Appendix Q. A Determination of Eligibility has been issued for the entire Metropolitan Park System of Greater Boston. Because the DCR Middlesex Fells Reservation was one of the original parks within this system, all of the reservation as it existed under the MPC is considered eligible for the National Register. Repairs, rehabilitation and other preservation activities on listed and eligible resources follow guidelines in the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (NPS 2001).

Maintenance, repair and modification of the reservation's historic parkways are conducted by the management units in accordance with *Historic Parkways Preservation Treatment Guidelines* (DCR 2006).

Massachusetts law requires the review of all sub-surface disturbances on state property. All projects at the Fells that involve soil disturbance, including invasive removals, tree planting and installing posts or certain types of trail construction are subject to regulatory review. An agreement is under development, between the MHC and the DCR, to have the DCR's archaeologist provide an initial review of activities that result in sub-surface disturbance. Under this agreement, the DCR's archaeologist will be the primary reviewer of such projects and activities at the Fells.

Recreation Resources

Public use of the reservation is limited to dawn through dusk. Managed, allowed and illegal recreational activities are described in Section 2.6.

A variety of recreational activities are regulated by permits. Concerts, charity events, community service projects, weddings, road races and group gatherings that include amusements, barbecues and/or amplified sound are among those recreational activities that require Special Use Permits. Commercial filming, photography and videography are regulated through Filming and Photography Special Use Permits. All Special Use Permits are issued by the DCR's Department of Special Events (http://www.mass.gov/dcr/permits).

Activities such as school field trips and scientific research require Recreational Use or Research Permits. These are issued by district Operations staff.

Recreational and trail use is managed through a variety of regulations and policies. Regulations governing the use of reservations and parkways (Appendix E) restrict all users to the trail tread.

Pedestrian uses are allowed on all official and marked trails in the reservation. Off-trail uses are not allowed without a permit. Pedestrians must yield to horses, but have the right-of-way when encountering bicycles. All trail users are encouraged to stay off of trails during the month of March or when conditions create soft trail surfaces.

Mountain bike use is geographically and seasonally limited. Bikes are currently allowed on all "fire roads" or "forest road / trails" and excluded from most single-track trails within the reservation other than the Mountain Bike Loop. Bikes are restricted

from trails in the reservation during the month of March or as posted when conditions warrant. Trails closed to bikes are posted with a "no bicycle" sign. Cyclists are required to yield to both hikers and horses.

Most of the reservation's trails are officially open to horses on a year-round basis. However, narrow trails, steep topography and low, overhanging branches effectively limit the use of some trails. Horses have the right-of-way when encountering other trail users. Equestrian users are encouraged to stay off of trails during the month of March or when conditions create soft trail surfaces.

Cross-country skiing is permitted on all official trails with sufficient snow cover. As with hikers, skiers must yield to horses. The DCR will encourage other users to walk beside, rather than on, ski tracks.

Dogs are welcome to accompany trail users on all official trails provided that they are on a leash with a maximum length of seven feet. Dogs are not permitted off-leash anywhere in the reservation, except that a pilot off-leash area has been designated at the Sheepfold.

Motor vehicles are not permitted on the reservation's trails with the following exceptions. The DCR, MWRA and emergency and utility vehicles, may access the "forest road / trails" as necessary for management and public safety. Other Power-driven Mobility Devices (OPDMDs) may be allowed on certain trails subject to the DCR's OPDMD policy, which is under development. Off-highway Vehicles are not permitted anywhere on the reservation.

Swimming is not permitted in any ponds in the reservation.

Private boats are not permitted on Spot Pond, although a concession, Spot Pond Boating, does make non-motorized boating available to the public.

Infrastructure Resources

Property Boundary

There are no reservation-wide management activities currently related to marking or monitoring boundaries.

Significant encroachments, when identified, are resolved through a process outlined in the DCR's guide for encroachment resolution and land reclamation (DCR 1997).

Buildings and Structures

The management of DCR-owned buildings is primarily performed by DCR employees or contractors. Non-DCR buildings are managed by their respective owners. Some DCR-owned buildings and structures are occupied by tenants (Table 3.2.1). Management responsibilities for these buildings are specified in agreements between the DCR and the tenants.

Table 3.2.1. Tenant-Occupied Buildings and Facilities at the DCR Middlesex Fells Reservation

Building or Facility	Tenant
Flynn Rink	Friends of Flynn Rink
K-9 Barracks	State Police
Middlesex Fells Reservoir gatehouse	MWRA
Spot Pond Boat House	Spot Pond Boating Concession
Spot Pond East Gatehouse	MWRA
Spot Pond South Gatehouse	MWRA
Spot Pond Pumping Station	MWRA

Agreements between the DCR and its tenants typically identify the term of the agreement; specify associated fees; provide for DCR access; identify the disposition of capital improvements; identify the tenant as the responsible party for obtaining all necessary permits; specify required casualty insurance; and include a hold harmless agreement. Specific conditions (e.g., maintenance responsibilities) vary among agreements.

Under a 1992 Memorandum of Understanding (MOU), the Massachusetts State Police occupy former MDC police station barracks.

The DCR maintains recreation facilities and structures such as the Hall Pool and Greenwood Park playground on a regular maintenance schedule detailed and updated at http://www.mass.gov/dcr/maintenance (Appendix P). This maintenance includes trash barrel pick-up, litter removal, mowing, trimming, weeding and graffiti removal.

Roads

The DCR maintains and repairs park roads and parkways (Table 2.7.1). Management of traffic and related systems is supervised by the Parkways Section of the DCR's Engineering Bureau and guided by the American Association of State Highway and Transportation Officials guidelines, the *Manual on Uniform Traffic Control Devices*

(MUTCD; U.S. DOT FHA 2009) and the *Historic Parkway Preservation Treatment Guidelines* (DCR 2006).

Snow removal on DCR roads and parkways is generally performed by MassDOT. The DCR is responsible for plowing Hillcrest Avenue and access roads into DCR facilities. An interactive map, which identifies the DCR's snow management priorities, is available at http://maps.massgis.state.ma.us/DCR_Snow_Priority/viewer.htm.

The DCR, or its contractors, maintain the reservation's roads and parkways on a regular maintenance schedule detailed and updated at http://www.mass.gov/dcr/maintenance (Appendix P). This maintenance generally includes litter removal every 14 days; mowing, trimming and weeding every 18 days; sweeping monthly and cleaning associated catch basins annually.

The portion of I-93 that passes through the reservation is managed, maintained and repaired by MassDOT. Select roads are maintained and repaired by local municipalities.

In accordance with an MOU (Appendix T), the MWRA has the right to maintain roads and trails needed to access their infrastructure at Bear Hill, Spot Pond and the Middlesex Fells Reservoir.

Parking

The DCR maintains and repairs the reservation's parking areas. Most snow removal is performed by the DCR.

Trails

The design, planning, management, maintenance and marking of trails are guided by the DCR's *Trails Guidelines and Best Practices Manual* (DCR 2010*a*).

Trail segments are repaired, enhanced, created or closed, as needed and appropriate, by DCR staff, trail crews and/or volunteers with the prior approval and supervision of the DCR, and in accordance with the DCR's standards and volunteer policy (DCR 2011*c*).

New trail proposals are evaluated by DCR Operations staff, with input from Planning and Ranger Services staff, through the Trail Proposal Form, Appendix B of the *Trail Guidelines and Best Practices Manual* (DCR 2010*a*).

Trails may be designated as "official" or "unofficial" by DCR Operations staff at any time and the status indicated on maps, websites or through signage. Official or unofficial trails may be closed by DCR Operations or Ranger Services staff at any time. Closures may be indicated on maps, websites or through signage. The closure of trail segments is achieved using the methods detailed in Appendix N.

The DCR does not generally engage in a public process for new trails, changes in trail designation or trail closure decisions. However, in certain cases, where high levels of conflict exist, such as at the Fells, or where changes could impact a significant portion of a trail system, the DCR may seek public input on such changes.

Trail markings are installed and maintained by DCR Operations and Ranger Services staff, trail crews and by volunteers with approval and supervision of the DCR. Old markings and signs may be actively removed and trails remarked in accordance with current agency guidelines and best management practices (DCR 2010*a*).

Kiosks and Signs

The format and placement of regulatory and informational signs are governed by the *Manual on Uniform Traffic Control Devices for Streets and Highways* and guided by the DCR *Graphics Standards Manual* (DCR n.d.*a*). The design and construction of kiosks are also governed by the graphics manual.

Informational kiosks are managed by DCR Rangers Services staff who update the content multiple times per year.

Memorials and Markers

The placement of markers or plaques at the Fells is managed by regulations governing the use of reservations and parkways. Under these regulations, memorials and markers are treated as signs and are prohibited without the written permission of the Commissioner. Revised regulations, which treat plaques and markers as memorials, are in development.

Interpretive Services

Interpretive services and environmental education programs at the Fells are provided by the DCR, the Friends of the Fells and a variety of other non-profit organizations and ad hoc groups.

The DCR Bureau of Ranger Services is currently developing a reservation-wide Comprehensive Interpretive Plan (CIP) to outline interpretive themes, identify interpretive tools and programs and coordinate interpretive services among various entities.

DCR rangers currently provide seasonal hikes and programs at the Fells. These events include sledding, first day hikes, maple tapping, environmental programs and full moon hikes.

Environmental education by DCR personnel is not limited to formal programs. Rangers provide interpretive information to visitors at the Regional Office, the reservation's primary contact station. They also regularly educate visitors encountered while working throughout the reservation. Written educational materials are posted at kiosks throughout the reservation.

In response to the DCR's survey on interpretation at the Fells, participants identified trail signage and maps as the most important interpretive tools for the Fells (Figure 3.2.1).

A variety of other non-profit organizations and ad hoc groups offer a wide array of interpretive programs and materials at the Fells. The Friends of the Fells offer a host of environmentally-themed hikes (e.g., bird walks, wildflower hikes, geology tours). They also run a weekly "Babes in the Woods" program that caters to caregivers with young children. They organize a hike and carry clean-up program, invasive removals and a winter lecture series focusing on a variety of topics from geology to history to wildflowers.

The Winchester Trails Association has created a nature program focused on the Long Pond area and works to bring local Winchester school children into the Fells to learn about and appreciate nature.

The Boston Chapter of the Appalachian Mountain Club (AMC) leads a series of hikes and events in the Fells and has engaged in trail stewardship.

Other organizations providing programs in the Fells include scouts, local schools, meet-up groups, the New England Mountain Biking Association (NEMBA), FellsDog and others.

Interpretive themes tools, programs, and services provided by the DCR and its partners will be further detailed and coordinated in the CIP.

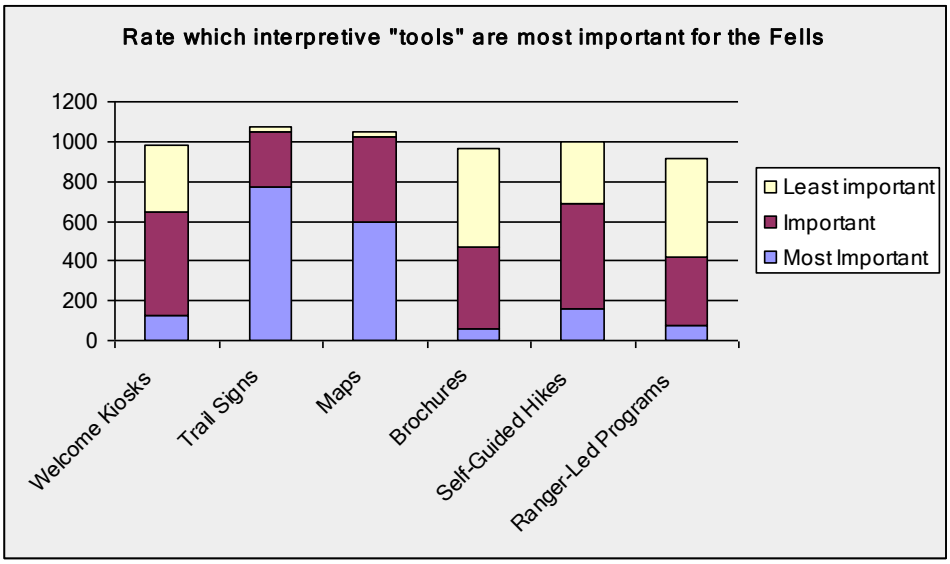


Figure 3.2.1.

DCR Regulations

The DCR has the authority to make and enforce regulations regarding parks, forests and reservations. These regulations are designed to accomplish three goals – protect public safety, protect natural and cultural resources and protect user experiences. The regulations that currently apply at the Fells are detailed in 350 CMR 2.01; Government and Use of the Reservations and Parkways Under the Care and Control of the Department of Conservation and Recreation (Appendix E). Selected regulations are described in Table 3.2.2.

Table 3.2.2. Selected and Abridged Regulations in Effect at the Fells[a]

Regulation (350 CMR 2.01)	Sub-Section
Reservation open from dawn to dusk	(b)
DCR may post rules restricting activities	(c)
Forbids offensive disorderly conduct	(e)
Forbids obstruction of free passage	(f)
Dogs must be on a leash seven feet or less	(g)
Requires proper disposal of dog waste	(g)
Use of bicycles may be prohibited in designated areas	(h)
No destruction or defacement of any sign, structure or tree	(j)
No one shall engage in a business without permit	(n)
No injuring or disturbing birds, animals or their habitat	(q)
No littering or dumping	(r/s)
Must obey posted signs and instructions	(t)
Use allowed on established park trails only, no off-trail uses without a permit	(u)

a) Regulations detailed in 350 CMR 2.01, Appendix E. New DCR regulations are currently under development.

New regulations for DCR parks, forests and reservations are currently under development and will be released for public comment prior to their adoption.

3.3. Operational Resources

DCR Staffing

North Region

The North Region of the Division of Urban Parks and Recreation includes the Fells District, Charles District and the Coastal District. Staff assigned to the North Region have operational and administrative responsibilities throughout the region. There are currently 70 full-time and roughly 300 seasonal staff within the region (including Fells District staff). The bulk of these seasonal positions are lifeguards. Six full-time staff within the region have some responsibilities for the Fells.

Fells District

The Fells District includes properties in the Mystic Cluster and the Breakheart Cluster (see Appendix P for a listing of sites). The Fells and its associated facilities is managed as a part of the Breakheart Cluster; other properties include Breakheart Reservation, Camp Nihan, Holland Memorial Pool, Lloyd Memorial Pool and various roads and parkways. Staff assigned to the Fells District have operational and administrative responsibilities for properties, facilities and parkways throughout the district. Operational responsibilities include parkway maintenance, mowing, hazard tree removal, erosion control and trailhead garbage removal (see Appendix P). Ranger duties include opening and locking gates, responding to emergencies, crowd and parking control, interpretive services, monitoring and enforcement. There are currently 19 full-time and 71 part-time staff assigned to the district (Table 3.3.1).

Table 3.3.1. Staffing Resources in the Fells District and North Region

Job Title	Year-round	Seasonal
Fells District[a]		
District Manager	1	0
Administrator I	1	0
Clerk I	1	0
Forest & Parks Supervisor I	1	3
Forest & Parks Supervisor II	3	1
Forest & Parks Supervisor IV	2	0
Laborer I	2	12
Laborer II	2	0
Lifeguard I	0	34
Lifeguard II	0	9
Lifeguard III	0	1
Maintenance Equip. Operator II	1	1
Park Foreman II	1	0
Park Ranger I	1	3
Rec. Facility Supervisor I	0	4
Rec. Facility Supervisor III	0	3
Rec. Facility Supervisor IV	2	0
Visitors Services	1	0
North Region[b]		
Regional Director	1	0
Administration I	1	0
Administration II	1	0
Clerk II	0	1
Forest and Parks Supervisor I	0	1
Ranger I	0	2
Ranger II	2	0
Ranger III	1	0

Continued on next page.

a. Fells District employees provide support to Breakheart Reservation, Camp Nihan, Beaver Brook Reservation, Mystic River Reservation, Shannon Beach, various parkways, pools and other properties within the North Region.
b. Regional staff with assignments that include the Middlesex Fells.

Bureau of Planning and Resource Protection

The Bureau of Planning and Resource Protection includes Regional Planning, Recreational Facilities Planning, Landscape Architecture, Architecture, GIS, Land Protection, ACEC, Ecology and the Office of Cultural Resources. These programs within the bureau prepare RMPs and Trail System Plans; develop and update GIS data; provide technical assistance with the management of archaeological and historic resources; identify and acquire properties to be added to the DCR system; maintain an archive of park documents; and provide technical support on ecological resources. Recent activities at the Fells include the draft Middlesex Fells Trail System Plan, this RMP, a cultural resources inventory, a road and trail inventory and extensive GIS mapping.

Bureau of Engineering

The Bureau of Engineering is responsible for the engineering and construction of parkways, dams, buildings and recreation facilities. It also provides a Regional Engineer to oversee the day-to-day maintenance and construction projects and to maintain a working relationship with the Regional Director in identifying capital improvement priorities. The bureau also provides ongoing street sweeping, catch basin cleaning and leaf pick-up in support of park operations.

Bureau of Recreation

The Bureau of Recreation provides support for the development and implementation of policies and procedures around recreational uses and management.

Bureau of Ranger Services

The Bureau of Ranger Services supports interpreters and field ranger staff in providing education, interpretation and public safety on and to the natural and cultural resources of the parks, forests and reservations.

Bureau of Forestry

The Bureau of Forestry manages a variety of programs, including management forestry, forest health and urban and community forestry, that provide technical assistance and services on forestry-related issues to DCR parks, forests and reservations.

Supplemental Staffing

Department of Corrections (DOC) Work Crew

District personnel are also supplemented by a six to eight member work crew from the Massachusetts Department of Corrections (DOC). These crews, which are assigned to the entire Fells District, are made possible through an MOU between the DOC and the DCR. They provide litter control, leaf raking, brush cutting and chipping, the cleaning of culverts and snow and ice removal. They are supervised by both DOC and DCR staff.

Trail Crews

Trail crews from the Student Conservation Association (SCA) provide services to the Fells District each year with projects selected through a competitive application process. The SCA crew performs general trail maintenance, closures and repairs. In 2010, an SCA crew of six worked in the reservation for two weeks, for a total of 60 person-days worked. These crews work under the direction of DCR Operations and Ranger Services staff.

Volunteers

Volunteers can provide a variety of human and intellectual resources to support the management and maintenance of the reservation. Volunteer services include clean-ups, trail maintenance, monitoring, botanical surveys, grant writing, interpretive programming and others. Volunteers may be individuals or members of groups, businesses or organizations, and may be organized by DCR staff or partner organizations.

All volunteer activities must be conducted with prior approval and supervision of the DCR and in accordance with DCR standards and volunteer policy (DCR 2011*c*), including documentation through a Volunteer Project Description form and/or Stewardship Agreement.

The Friends of the Fells (FOF) has a long history of partnering with the DCR at the Fells. They organize a number of different educational and recreational volunteer programs including lectures, hikes and clean-ups. In addition, the FOF has previously organized trail adoption and maintenance projects within the Fells trail system (see http://www.fells.org/getinv/adopt.cfm). They have provided assistance in obtaining grants to restore historic structures, maintain trails and install signs and have committed volunteer time to organizing these efforts. The FOF has worked with the MWRA to protect water quality in the Fells. They have organized vernal pool certification efforts and funded a wildlife tracking survey for the DCR Middlesex Fells Reservation.

The New England Mountain Biking Association (NEMBA) has organized trail riding events, trail maintenance days and a volunteer trail patrol (http://www.gbnemba.org/mtb-patrol.html) within the Fells.

The Appalachian Mountain Club (AMC) has partnered with various groups to organize both hikes and volunteer events.

Other volunteer partners include local businesses, schools, universities and clubs.

Researchers

Researchers from local colleges and universities can also provide a wealth of information valuable to understanding and managing the complex environment of the Fells. Several independent research efforts have contributed to this RMP. Proposed research projects must be reviewed and approved by DCR Operations and Planning staff.

Enforcement and Public Safety

The Massachusetts State Police has primary law enforcement authority on state-owned lands. Under the terms of the 1992 MOU, the state police's responsibilities at DUPR properties include enforcing all laws and park rules and regulations, providing visible patrol of park lands, traffic management, crowd control, accident investigation, crime investigation and facility checks.

Other departments provide supplemental law enforcement. The Executive Office of Energy and Environmental Affairs' Office of Law Enforcement provides primary enforcement of hunting and fishing regulations. Local police provide additional law enforcement on the reservation, within their respective jurisdictions. The Town of Winchester Water Department has limited, but additional patrol staff.

DCR rangers, whose duties include opening and locking gates, responding to emergencies, crowd and parking control, interpretive programming and education, monitoring and enforcement, have only limited enforcement authority. Rangers who have received the appropriate training are able to issue citations on the reservation for violations of DCR regulations.

Fire control and emergency medical response are provided by municipalities. DCR rangers and lifeguards provide first aid.

General Budgetary Information

A variety of funds support the operations, maintenance and capital improvement of DCR facilities.

Operating Budget

The annual operating budget supports daily operations and maintenance of the Fells, including utilities, supplies, equipment, administration and the maintenance and minor repair of facilities, vehicles and equipment. All regions and districts receive operations funds.

Funding for the operation and maintenance of the Fells comes from the North Region's operating budget. There are no dedicated operating budgets for individual properties. Overall, the DCR's operating budget has declined 30% in recent years.

In Fiscal Year 2010, the North Region's operating budget, including personnel costs, was approximately $3,500,000. However, the majority of this funding supports staff and these positions are primarily responsible for pool safety and operations and roadway maintenance and operations.

Fells District personnel provide services to facilities throughout the district on an as needed basis. Similarly, North Region personnel, such as rangers, provide services throughout the region on an as needed basis.

Capital Budget

The capital budget supports projects (e.g., construction and major repair) and items (i.e., equipment) with a per-unit cost of at least $5,000 and an expected lifespan of at least seven years.

Capital projects are identified and funded through a five-year capital plan. These plans identify proposed capital projects, their costs and the year in which they are to be funded.

Capital plans are reviewed within the DCR (i.e., Division of Urban Parks and Recreation, Division of State Parks and Recreation and the Bureaus of Planning and Resource Protection, Engineering and Capital Planning), approved by the Commissioner and included in the DCR's annual budget. This budget is then reviewed by the Executive Office of Energy and Environmental Affairs, the Executive Office of Administration and Finance and the Governor. Additional capital initiatives may be identified and added to the budget by the Commissioner of Conservation and Recreation, Secretary of Energy and Environmental Affairs and/or the Governor during this review process.

Various capital budget annual programs that may provide funding for specific projects in the Fells include:

- Deferred Maintenance
- Landscape Improvements
- Sidewalk Improvements
- Parkway Maintenance and Reconstruction
- Playground Improvements
- Environmental Remediation

Grants

Public-private partnership grants, which are administered by the Massachusetts Executive Office of Energy and Environmental Affairs, have supported projects at the Fells, such as the Tudor Barn and Wright's Tower renovations. Both the DCR and its partner organizations have applied for and received Recreational Trails Grants to support trail maintenance and improvement efforts in the Fells.

The Fells may also be a good candidate for various private and federal grants including storm water management and historic preservation grants.

Earmarks

Earmarks are funds directed to specific projects by the Massachusetts General Court via the annual state budget. Such earmarks periodically provide funding for projects in specific parks.

Urban Parks Trust Fund

This trust fund uses donations to support special initiatives above and beyond basic property maintenance. It is funded through charitable contributions to the DCR, including those donations placed into the "iron ranger" (a secure metal donation box) located at the Botume House. There are currently no dedicated trust funds for the Fells.

Dedicated Funds

In accordance with a 2009 MOU, the Gutierrez Company, owners of the former Boston Regional Medical Center site, have placed $1.8 million in escrow to be used for "design, permitting, reviews, consulting / project management services and construction of the improvements" as shown in the Traffic Safety Improvement Plan (Fellsway and DCR 2009).

Retained Revenues

There are currently no retained revenues for the DCR Middlesex Fells Reservation. However, the Spot Pond Boating concession offers an opportunity for retained revenues.

View of the Winchester reservoirs from the Fells trails. (Photo by Paul Jahnige)

SECTION 4. ISSUES DISCUSSION

4.1. INTRODUCTION

The resource management planning process for the Fells brought to light several complex and controversial recreational, resource protection and managerial issues. This section of the RMP addresses those issues and explains the analysis and decision-making process used to develop management recommendations for the following topics:

- Land Stewardship Zoning
- Pedestrian and Mountain Biking Recreation
- Recreation with Dogs
- Rules Compliance and Enforcement

To develop potential recommendations, the DCR RMP team, including representatives from Operations, Ranger Services, Ecology, GIS, Regional Planning, Recreation, Commissioner's Office, Water Supply Protection, External Affairs and Cultural Resources, drew from six sets or "pillars" of information. These are:

- Data from the Fells (e.g., botanical surveys, research projects and ranger incident data)
- Scientific and technical literature (i.e., peer-reviewed journal articles in recreation ecology and visitor management)
- Previous planning documents (e.g., DCR Middlesex Fells Reservation Historic Land Use Study, MDC Mountain Biking Policy)
- Best Management Practices (BMPs) and models (e.g., BMPs for controlling soil erosion, DCR trail signage standards)
- Agency input from both the DCR and sister agencies (e.g., DCR staff expertise and input from the NHESP and MWRA)
- Public input and recreational demands (i.e., all the comments received during the planning processes)

After compiling and considering each of these sets of information, the DCR RMP team developed potential recommendations. These were then further evaluated through the "filters" of state law and regulations, active permits and existing agreements and agency policies to develop final recommendations for this RMP.

Evaluating Consistency between Recreation and Resource Protection

Massachusetts General Law Chapter 21, Section 2F calls for the DCR to prepare RMPs and specifies that they should "ensure consistency between recreation and resource protection."

In evaluating the appropriate role of a recreational activity at a DCR facility and to ensure consistency with resource protection, the DCR evaluates that activity relative to the following criteria:

- Public demand for the activity
- Susceptibility of important natural and cultural resources, at the facility scale, to damage from the specific recreational activity
- Public safety issues
- Benefits and impacts to recreational experiences
- Management considerations

When evaluating existing, approved recreational uses at a facility, the DCR will generally continue, and may promote and enhance that use, recognizing that all recreational uses will have impacts on natural and cultural resources, unless specific evidence demonstrates that it:

- Actively degrades significant natural or cultural resources
- Poses a substantial risk to public safety
- Requires excessive management

In any of these instances, the activity may be restricted, curtailed or terminated, or mitigation or alternative management options may be pursued.

New recreational uses may be permitted and developed only if it can be demonstrated that the added resource impacts or public safety risks are acceptable and the benefits of approving the new recreational use outweighs negative impacts, risks or management burden.

The next section describes the current state of knowledge around recreational impacts to natural resources.

4.2. Environmental Impacts of Recreational Activities

The old adage to "take nothing but pictures and leave nothing but footprints" is outdated. In many places, too many footprints have left an unwanted legacy.

David Cole, Ecological Impacts of Wilderness Recreation and their Management

All recreational uses occurring within a natural environment have measureable impacts on that environment. Specifically, passive, trail-based recreation has a variety of both direct and indirect impacts to soils, vegetation, wildlife and water. Soils can be compacted or dislodged, vegetation trampled, species composition altered, wildlife feeding and nesting behavior disturbed and water quality degraded (Leung and Marion 2003).

The field of recreation ecology has provided extensive literature describing and quantifying these impacts and recommending management strategies for minimizing them. The primary conclusion of recreation ecology is "the simple notion that impact is inevitable with recreation. Avoiding impact is not an option, unless all recreation use is curtailed" (Cole n.d.*a*).

The Fells was acquired for public use, recreation and exercise (Acts of 1893, Chapter 407; Appendix F) and has been actively developed and managed for water resources, transportation and recreation since its inception, including the development of an extensive system of roads and trails in the late 1800s and early 1900s (Section 2).

Recognizing that all recreation in the Fells has had impacts for over a century, it is important to understand the characteristics that influence the magnitude of these impacts. Environmental impacts from recreation are a function of both the characteristics of the recreational use and the characteristics of the environment (Cole 1993).

Environmental Characteristics

The extent and condition of the reservation's environmental resources is fully described in Section 2.4. These are documented as diverse, extensive and overall, in generally good condition. Environmental characteristics of these natural resources include both the *resistance* (the ability to withstand impacts

without significant damage) and the *resilience* (the ability to recover following impacts) of the particular soils, vegetation and wildlife at a site-specific level and the degree of protective hardening or structures that are put in place to shield these resources from specific impacts.

Resistance

As noted in Section 2.4, the majority of the soils within the Fells are moderately resistant to impacts from recreational use, with limitations primarily due to slope. Erosion on these soils from trail uses will be primarily related to the layout and design of the trail and is limited to steep, fall-line sections of trail. Soil erosion and "washouts" have been documented through the DCR's road and trail inventory and the magnitude of these are in line with woodland trail systems statewide. Some soils in the Fells, most notably the wetland soils, are potentially more vulnerable to impacts from existing recreation without special structures to protect them. There are currently 13 miles of both official and unofficial trails in the Fells intersecting with these soils, some with protective structures such as bridges and stonework, but some, where recreational uses including mountain biking and pedestrian uses, have negatively impacted the wetland resource areas.

Most of the terrestrial natural vegetation communities within the Fells are moderately resistant to impacts from recreation. However, the ridgetop, rock outcrop and the forest seep communities are more vulnerable to trampling from existing recreation at the Fells and the talus forest and sugar maple-oak-hickory forest are susceptible to invasive plant introductions (NHESP 2007) (Table 4.2.1).

Table 4.2.1. Resistance of Terrestrial Natural Vegetation Communities to Recreation in the Fells

Community Type[a]	Resistance[b]
Acidic rocky summit/rock outcrop	L
Black oak-scarlet oak forest	M
Circumneutral rocky summit/rock outcrop community	L
Circumneutral talus forest/woodland	L
Cultured grasslands	H
Dry rich acidic oak forest	M
Forest seep community	L
Hemlock ravine	H
Hickory-hop hornbeam forest/woodland	M
Mixed oak forest	M
Northern hardwoods-hemlock-white pine forest	M
Oak-hemlock-white pine forest	M
Oak-hickory forest	M
Pitch pine-oak forest/woodland	M
Red oak-sugar maple transition forest	M
Sugar maple-oak-hickory forest	L
Ridgetop pitch pine-scrub oak	L
White pine-oak forest	H

a) Classified according to Swain and Kearsley (2001).
b) Resistance classified based on Pickering (2010) and identification of threats from NHESP natural community fact sheets, H=High resistance, M=Moderate resistance, L=Low resistance.

Wildlife species at the Fells have different levels of resistance to disturbance from recreation and the distances at which disturbance occurs varies with species, age, past experience and time of day. Disturbance of many species of both mammals and birds has been measured at 50 meters from trails and for some species, up to 100 meters from trails (Miller et al. 1998; Lenth et al. 2008). At the Fells, some species of small mammals and birds exhibit a high tolerance to disturbance from existing recreation. Some larger mammals and birds exhibit moderate to low tolerance to disturbance from typical recreational users. For example, although the Fells is a large forested block and has a 774 acre portion mapped as BioMap 2 Forest Core, certain bird species that might otherwise be found in such a block, such as cerulean warbler, have not been observed and certain mammals, such as bobcat, are not believed to reside here.

There are 27 species of birds identified as "Species in Greatest Need of Conservation" that have been observed at the Fells and four that may be nesting here. Two of these are ground-nesting: American

woodcock and eastern towhee. These, and other ground-nesting birds, are likely to be more vulnerable to disturbance from recreation.

Some reptiles and amphibians may be susceptible to trampling by typical recreational uses. Two species of reptiles are identified as "Species in Greatest Need of Conservation," the eastern ribbon snake and North American racer. The North American racer, which inhabits rocky areas and may sun on rocks or trails, may be more susceptible to disturbance or injury from recreation.

The habitat needs and threats to rare species in the Fells are discussed in Appendix M. In particular, two rare plants (large-bracted tick-trefoil and cankerweed) and four watch-listed plant species (listed in Appendix M) are vulnerable to trampling by off-trail recreational uses at the Fells. Wetland habitats of the American clam shrimp and the name not disclosed insect are vulnerable to degradation from erosion and sedimentation. Tiger beetle adults and larvae are susceptible to trampling from recreational trail users, but also benefit from trail habitat created by trail use. As described in Section 3, all new activities within Priority Habitat must be approved by the NHESP.

Drinking water resources are moderately resistant to the typical recreational activities occurring at the Fells. Other than those that involve body-water contact, outdoor recreational activities coexist with drinking water resources throughout the Commonwealth. At the Fells, water quality monitoring has not detected significant trends or impacts to drinking water quality from any recreational activities.

Below ground archaeological sites, including both prehistoric and historic resources, are resistant to activities that do not involve digging or significant soil disturbance, including allowed recreational activities on official trails or in designated spaces. Archaeological resources are highly sensitive to any activity that involves soil disturbance, including invasive removal projects, tree planting or certain types of trail construction and maintenance. As described in Section 3, all such activities must be reviewed and approved by the DCR and potentially the MHC. Historic structures can be moderately sensitive to activities that involve climbing or otherwise disturbing the structures.

Resilience

The resilience of resources is more complicated to assess and characterize. The natural resources currently within the Fells have coexisted with high levels of recreational use for decades, if not over a century. The high diversity of plant and wildlife species that exist today is a testament to both the resistance and resilience of these resources in relation to high levels of recreational use.

With respect to off-trail uses and user created trails in the Fells, the resilience of different habitats is an important factor in how quickly sites may recover if and when these illegal uses can be stopped. For example, trails that have been closed in the Bellevue Pond area for at least three years still show clear signs of soil compaction and vegetation loss.

Some sites, such as vernal pools, may be vulnerable to impacts from recreation during certain times of the year, but also have a high degree of resilience (Windmiller and Calhoun 2003). Other sites, such as ridgetop and rocky outcrop communities, which tend to have thin soils and slower growing plant communities, will likely have lower levels of resilience and will take longer to recover from impacts.

In general, thinner soils, slower growing plant communities, rare species and archaeological resources have lower levels of resilience (Pickering 2010).

Use Characteristics

Characteristics of recreational use also have important influences on the degree of environmental impact from recreation. These are:

- Amount of use
- Type of use
- Behavior of users
- Spatial distribution of use
- Temporal distribution of use

Amount

An important finding of recreation ecology is that the relationship between amount of use and impact is curvilinear. In other words, most of the impacts to resources occur early (sometimes with just a few passes), with incremental impacts decreasing as use expands or continues. Where use levels are low, such as off-trail, small differences in the amount of

use can result in substantial differences in impact. However, where use levels are high, such as on well established trails, even large increases in use will result in minimal increases in impact (Dale and Weaver 1974; Cole 1993; Wimby and Marion 2010).

This finding is important relative to the Fells, which has and continues to see very high levels of recreational use throughout the reservation. Much of this use occurs on trails and concentrating and directing use to existing trails is the best management approach for minimizing impacts from recreational trail use (Cole 1981; Leung and Marion 2000; Park et al. 2008). Indeed, increasing use levels or adding uses in places that are already heavily used will likely have few negative effects (Cole 1993).

Type

The type of use can also influence the degree of impact. Research indicates that motorized users will have greater impacts to soils, vegetation and wildlife than non-motorized users (Weaver and Dale 1978); campers will have greater impacts than day-hikers (Cole n.d.*b*); and horses will have greater impacts than hikers or mountain bikers (Wilson and Seney 1994). Multiple uses on narrow trails may contribute to trail widening.

The available recreation ecology literature indicates that the magnitude of impacts from mountain biking is similar to that of hiking. Therefore, with respect to environmental impacts, these two uses should be evaluated similarly. There are some mechanical differences in how feet and wheels move and thus, in the specifics of how they impact soils. For example, boots and wheels break and roll differently, especially going uphill versus downhill; however, this should not lead to a conclusion that one creates a greater magnitude of impact than the other. There are also differences in user behavior that can influence specific impacts. For example, mountain bikers that spin tires going uphill or skid going downhill are likely to have greater impacts than hikers (Chui and Kriwoken 2003). In New England, the mountain bike community has also developed extensive knowledge and expertise in trail design and repair and riders tend to volunteer extensively to build, maintain and improve trails.

In reviewing the scientific literature from the field of recreation ecology, the DCR reviewed the breadth of comparative studies of pedestrian and mountain biking impacts.

In a controlled, comparative study on sites in Montana, on existing trails with a variety of soils that are at least as erodible as soils in the Fells, the researcher found that the impacts to soils from hiking and mountain biking were similar. The study found that horses produced the greatest sediment yields and the sediment yields were greatest on pre-wetted trails. The authors note that these results apply to many (if not most) environments. The study also reported that horses and hikers (hooves and feet) displaced more sediment than wheels on pre-wetted trails (Wilson and Seney 1994).

In an experimental study of hiking and biking on undisturbed sites in Ontario, Canada, with a forest type and soils that are comparable to the Fells, Thurston and Reader (2001) investigated the impacts of experimental hiking and biking on vegetation loss, species loss and compaction. Their three main findings were 1) impacts on vegetation and soil increased with biking and hiking activity; 2) the impacts of biking and hiking measured were not significantly different; and 3) impacts did not extend beyond 30 centimeters of the trail centerline.

White et al. (2006) completed a study of biking trails in five common ecological zones in the southwestern U.S., where soils are more erodible than in the northeast, and found that mountain bike trails are comparable in width, incision and soil displacement to hiking trails. However, this study compared its results to hiking trails from another study with different methods, so this result may not be transferable.

In Australia, while greater impacts from both hiking and mountain biking were documented on slopes and wet soils, researchers were not able to find a significant difference between hiking and mountain biking (Chui and Kriwoken 2003).

A new study published during the RMP public comment period evaluated the impacts of mountain biking and hiking on a sub-alpine grassland site in Australia. Though not especially comparable to the Fells, the study measured a variety of vegetation and soil parameters at different levels of use and up, down and across slopes. The study documented greater impacts when traveling up and down slope versus across slope. The study generally found that

the environmental impacts between hiking and mountain biking were similar. For some vegetation parameters, at the highest number of passes (500) with one statistical test, mountain biking had a greater impact than hiking (Pickering et. al 2011).

With respect to wildlife disturbance, Taylor and Knight (2003) investigated mammal responses to hiking and mountain biking, comparing alert distance, flight distance and distance moved, and found that wildlife did not respond differently to mountain biking versus hiking. However, the authors speculate that because of the distance travelled, mountain biking may have the potential for a greater impact per unit time.

Lowney (2011) investigated the effects of newly opened mountain biking trails on red squirrels whose numbers have rapidly declined in the U.K. The study found no negative effects caused by the presence of mountain biking trails.

Pickering (2010*a*), in the most recent and comprehensive review of all the available literature on this subject, while noting various methodological issues and needs for further study, concluded: "researchers found no evidence that mountain bike impacts to soils, vegetation and trails were significantly greater than impacts from hikers."

At the Fells, as a part of this RMP, the DCR conducted a specific analysis of the Fells road and trail inventory data, calculating the points of trail damage per mile of single-track trail and found that mountain biking trails at the Fells are no more damaged than hiking only trails. The named hiking trails in the Fells had an average of 10 damage points per mile, compared to less than 8 damage points per mile for single-track sections of the Mountain Bike Loop. It is important to reiterate, however, that this does not suggest that mountain biking is less damaging to trails than hiking, but rather that trail damage is likely to be largely a result of alignment and trail design, rather than use.

Despite this body of scientific literature, which documents in a variety of environments and for a variety of parameters that the impacts from mountain biking and hiking are similar, some comments during the resource management planning process have suggested that the greater impacts of mountain biking on trails at the Fells are obvious. One of the characteristics of bike tire tracks on soft soil is that they are obvious. However, this visual evidence of biking is not evidence of erosion or trail damage and does not lead to a conclusion that mountain biking impacts are greater. Measurements of the pressure (g/cm^2) exerted by mountain bikers versus hikers show that these uses exert similar pressures (Thurston and Reader 2001) and that these pressures are an order of magnitude less than those of equestrian users.

It has also been suggested that because mountain bikers generally travel faster than hikers, their impacts per visit or per unit time must be several times higher. As Cole (1993) and others have described, on existing trails, impacts are not linear. Mountain bikes, which travel between 3-10 miles per hour (with an average of about seven) and runners will likely travel farther than an average hiker in a visit; however, on existing trails and in an area where overall recreational use is high, this increase in distance or even an increase in use, does not translate into greater impacts.

The one area of difference in potential impacts between mountain biking and pedestrian uses involves the potential for direct impacts to certain wildlife species that may occur within the trail tread. Although it has not been documented in the scientific literature, the DCR RMP team speculates that because of greater average speeds and continuous tread contact, mountain bikes might be more likely to trample, injure or even kill species such as snakes, salamanders or beetles that find themselves in the trail tread (MacGillivray 2010; DCR 2011*d*; Knisley 2011).

Dogs, particularly off-leash dogs, have been shown to disturb certain wildlife species more than just people alone. The presence of dogs is correlated with significant reductions in both bird abundance and diversity in protected areas in the urban fringe in Australia (Banks and Bryant 2007). This effect is most pronounced for ground-nesting birds. Lenth et al. (2008), studying dog impacts in Colorado, found that trails with dogs had fewer deer, squirrel, rabbit and bobcat detections up to 100 meters from the trail, but higher red fox detections.

In some studies, however, the presence of dogs did not result in a greater documented impact. In urban parks, many species may be somewhat adapted to the presence of dogs. Forrest and St. Clair (2006) found that leash regulations for dogs had no effect

on the diversity or abundance of birds or mammals in small urban parks. Knight and Miller (1996) found that deer were disturbed more when dogs were present, but certain species of birds were disturbed more when humans were present with or without dogs.

Dog waste, if not removed, can also contribute fecal coliform and other bacteria to soils and potentially water. However, water quality monitoring at the Fells has not detected increased levels of bacteria due to dog waste (MWRA 2011).

User Behaviors

The behaviors of users can also affect the type and magnitude of impacts. For example, bird-watchers who approach birds directly (direct approaches) and get too close to nests can contribute to nest abandonment (Cole 1993). Skidding or spinning by mountain bikers has a greater impact on soil displacement (Chui and Kriwoken 2003). Partiers may leave excessive litter at specific sites and some dogs may dig holes and chase or even kill some birds or mammals.

In the Fells, the construction of trail-related features has been observed and this can have particular impacts on soils, habitat and vegetation. Some features, such as steps, water bars and bridges are built with DCR permission and guidelines specifically to harden trail surfaces and protect resources. Other features are constructed illegally to enhance recreational experiences or create a challenge. Mountain biking features include ramps, jumps and log rides. Pedestrian-related features include labyrinths, shelters and blinds used by hikers, individuals engaged in sexual activity and paintballers. Partiers build campfires and benches.

Labyrinth along the Skyline Trail (Photo by Paul Jahnige)

Most importantly, any activity that brings users off-trail will produce significantly greater impacts to soils, vegetation and wildlife than on-trail activities (Cole 1993; Knight and Miller 1996; Leung and Marion 2003). The most prevalent off-trail activities at the Fells involve individuals seeking secluded spaces to have sex and other users seeking solitude. These activities have created significant areas of environmental impact in the forests between the Sheepfold and Bear Hill and in the Little Pine Hill area. Nature enthusiasts, geocachers and orienteers are all active off-trail in the Fells. Bikers going off-trail have been observed in the Fells. Finally, off-leash dogs are active off-trail in the Fells and may range up to 85 meters (Lenth et al. 2008).

Spatial Distribution

Where use is widely dispersed, more of an area is disturbed. Unfortunately, in the Fells, as described in Appendix N, recreational uses are dispersed throughout the reservation. While there are a few areas of more concentrated use, such as the Sheepfold and Long Pond areas, both on-trail and off-trail uses occur at relatively high densities everywhere. Indeed, the desires of users to seek solitude and serenity in the Fells may specifically contribute to this distribution.

As a result, there are very few areas of the Fells that have even a moderate density of trails and use and no areas with low trail densities. There are only 32 patches over one acre in size that are not within 50 meters of a trail, a distance at which many wildlife species exhibit disturbance and various edge effects are measureable (Miller et al. 1998; Matlack 1993). There are only five trail-free areas greater than 10

acres in the Fells, the largest of which is only 17 acres. In total, less than four percent of the DCR Middlesex Fells Reservation is not within 50 meters of a trail. Consequently, wildlife in the Fells have very few areas where they can find meaningful separation from human activity.

Temporal Distribution

Users are in the Fells during all seasons and all hours during daylight. Weekends and afternoons see the highest usages. During winter, mid-day sees higher usage (Russell 2011).

Soils in the Fells may be more vulnerable when they are wet, particularly during spring "mud season." All users are encouraged to stay off of wet trails during this season and mountain biking is specifically prohibited during the month of March.

The reservation is officially closed from dusk to dawn, although people are still present in the park after dark. Some wildlife species may be especially vulnerable to disturbance at certain times of the year, such as when they are nesting, migrating or stressed by winter conditions, or at certain times of the day, such as at night, dusk or dawn.

4.3. Landscape Designation and Land Stewardship Zoning

The DCR uses a two-tiered system for guiding the management of its parks, forests and reservations:

1. Landscape Designations, in development, are advisory and intended to assess and guide land management of properties throughout the DCR system.
2. Land Stewardship Zoning, called for by M.G.L. Chapter 21, Section 2F, is applied to properties on an individual basis through the resource management planning process. It incorporates site-specific information to protect resources and guide management of specific areas within these properties.

These two systems, while applied at different scales, work in coordination with each other to provide primary ecosystem services while recognizing and protecting site-specific resources. All Land Stewardship Zones can exist in all Landscape Designations.

Landscape Designation

At the statewide scale, the DCR is currently designating all of the facilities within the state and urban parks systems as Parklands, Woodlands or Reserves as a means to differentiate the primary ecosystem services that these facilities provide. Designations will also help guide land use management decisions based upon these ecosystem services and communicate the agency's land management objectives to the public. These designations are currently being determined through the application of GIS modeling with additional input from DCR staff and the public through a robust public process. It is important to note that the term "reservation" historically applied to Fells is unrelated to the "Reserve" designation.

Parklands are areas where the primary ecosystem service objectives are the provision of public recreational opportunities that depend on natural areas, preservation of ecologically significant areas and special places and promotion of cultural values.

Woodlands emphasize the provision of ecosystem services that require forest management prescriptions with intensities that are less compatible with the activities in the Parklands or Reserves. Woodlands will demonstrate, to private and municipal landowners and the general public, the practice of sustainable forestry through excellent forest management.

Reserves are areas representative of the Commonwealth's least fragmented, diverse forest settings, where the dominant ecosystem service objectives are biodiversity maintenance and the underlying supporting services of nutrient cycling and soil formation, watershed protection and long-term carbon sequestration; important secondary services include the provision of wilderness values and recreation.

Under the current draft designations, the Fells has been designated as a Parkland. This is consistent with the historic purposes for which the reservation was acquired, the landscape context within which the Fells exists, the character of the resources at the Fells and the historic and on-going use and management of this property. The NHESP also concurs with this designation (Harper 2011*a*).

Selection criteria and management guidelines for Parklands are described in *Landscape Designations*

for DCR Parks & Forests: Selection Criteria and Management Guidelines (DCR 2011*b*).

Land Stewardship Zoning Overview

At the site-specific scale, inventory and assessment of resources during the resource management planning process leads to the zoning of areas and sites within DCR facilities based on the sensitivity of important resources to recreational and management activities that are typical for that facility.

Three land stewardship zones (LSZ) provide a general continuum to categorize resources and their sensitivity to potential degradation from human activities, from sites with highly sensitive resources (Zone 1), through important but stable resources (Zone 2), to sites that have been developed and consistently used for intensive recreation or park administration purposes (Zone 3). Significant feature overlays are applied to highlight resource features that have been researched and assessed by professional resource specialists.

The management guidelines associated with each LSZ provide protection for natural and cultural resources and ensure consistency between resource stewardship and recreation.

Land Stewardship Zones

Zone descriptions are listed below. Additional information and the management guidelines for each zone are included in Appendix X.

Zone 1. Unique, exemplary and highly sensitive natural and cultural resources that require special management approaches and practices to protect and preserve their features and values. Examples include rare species habitat identified as being highly sensitive to human activities, sensitive archaeological or cultural sites and certain rare or exemplary natural communities.

Zone 2. Areas containing commonly encountered, yet important natural and cultural resources on which standard forestry practices and dispersed recreational activities occur at sustainable levels, without damaging the potential for improved ecological health, productivity or protection through active management. Examples include ecosystems characterized by a diversity of wildlife and plant habitats and rare species habitats that are compatible with sustainable forestry and dispersed recreation.

Zone 3. Developed administrative, maintenance and recreation sites, structures and landscapes that accommodate concentrated use by staff and visitors and require intensive maintenance. Examples include park headquarters and maintenance areas, parking lots, swimming pools and skating rinks, paved bikeways, swimming beaches, campgrounds, playgrounds and athletic fields, parkways, golf courses, picnic areas and concessions.

Significant Feature Overlays. The three LSZs may be supplemented with significant feature overlays that identify specific, formally designated or otherwise recognized resources. These overlays recognize, maintain, protect or preserve unique and significant values, regardless of the zone in which they occur, and provide more precise management guidance. Examples of significant feature overlays include areas subject to public drinking water regulations or areas subject to historic preservation restrictions. Specific management guidelines are provided by resource specialists or by the government agency that has recognized and listed the resource or site.

Applying Land Stewardship Zoning at the Fells

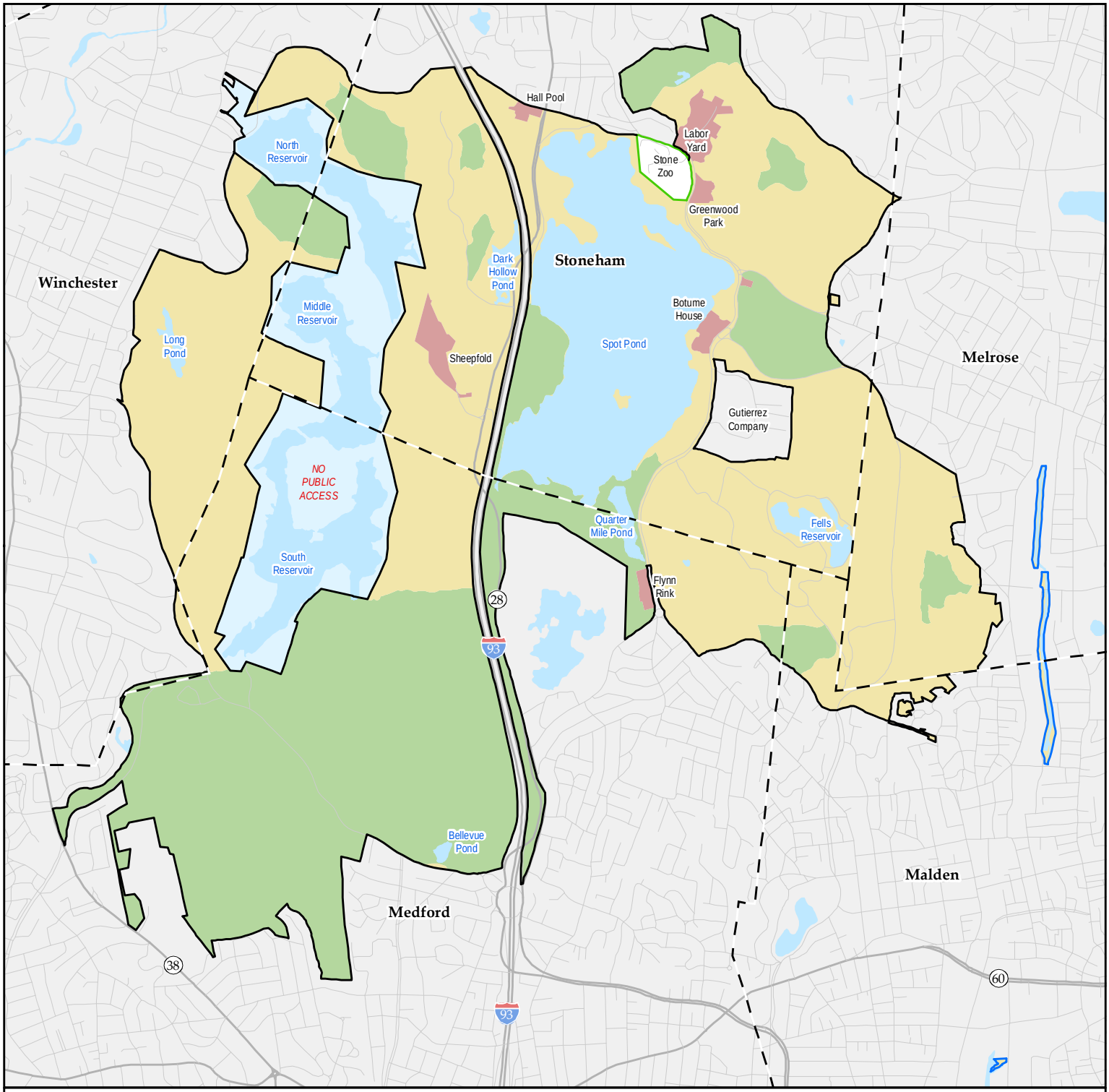
Application of the LSZ is the result of an analysis of multiple resources in the context of existing and potential public recreation and park management activities.

At the Fells, this process begins with identifying important natural and cultural resources and their potential sensitivity to degradation from recreational and management activities. As described in Section 2, the DCR Middlesex Fells Reservation hosts a variety of important resources (Table 4.3.1).

Table 4.3.1. Important Natural and Cultural Resources at the Fells[a]

Below-ground Archaeological Resources
Historic Structures, Sites and Buildings
State-Listed Rare Species
Priority Natural Communities (S1-S3), including Vernal Pools
Watch-Listed Plants
Wildlife Species in Greatest Need of Conservation
Drinking Water Resources
General Floral and Faunal Diversity

a) Important resources as identified and described in Section 2.



The Middlesex Fells Planning Unit

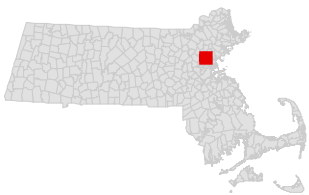
Malden, Medford, Melrose, Stoneham, and Winchester, Massachusetts

Figure 4.3.1. Land Stewardship Zoning

- Middlesex Fells Reservation
- Walter D. Stone Memorial Zoo
- Spot Pond Brook
- Town Boundary
- Open Water
- Winchester Water Supply Land

Land Stewardship Zoning

- Zone 1
- Zone 2
- Zone 3



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Data Sources:

All protected open space boundaries are in DRAFT format.

All background geographic data supplied by the Office of Geographic and Environmental Information (MassGIS).

DCR GIS - 12/2/2011

Section 4.2 discusses the sensitivity of these resources from recreational uses at the Fells. These are further analyzed and discussed in Sections 4.4 and 4.5, below. Specific resources that may be sensitive to potential degradation from recreational and management activities are identified in Table 4.3.2.

Table 4.3.2. Resources that may be Sensitive to Recreation and Management at the Fells[a]

Archaeological Resources
Spot Pond Brook Archaeological District
Below ground prehistoric resources
State-Listed Rare Species
Large-bracted tick-trefoil
Cankerweed (i.e. Lion's foot)
American clam shrimp
Name not disclosed insect
Priority Natural Communities (S1-S3)
Ridgetop pitch pine-scrub oak
Circumneutral rocky summit/rock outcrop
Circumneutral talus forest/woodland
Sugar maple-oak-hickory forest
Woodland vernal pools
Watch-Listed Plants
Early buttercup
Allegheny buttercup
Rock knotweed
Rock spikemoss
Wildlife Species in Greatest Need of Conservation
American woodcock
Eastern towhee
North American racer
General Floral and Faunal Diversity

a) Sensitivity to recreation and management identified and discussed in Sections 4.2, 4.4 and 4.5.

In determining Zone 1 areas at the Fells, the DCR RMP team, in consultation with the NHESP, evaluated which of these identified resources met the criteria of "unique, exemplary and highly sensitive," that "require special management approaches to protect and preserve their features and values" and that can effectively be zoned.

The DCR RMP team identified the archaeological resources, state-listed rare species and Priority Natural Communities, not including woodland vernal pools, identified in Table 4.3.2 as meeting these criteria.

Watch-listed plants, woodland vernal pools, wildlife identified as "Species in Greatest Need of Conservation" and general flora and faunal diversity, while important and potentially sensitive to certain recreational and management activities, did not meet these criteria. Some of these resources will be encompassed by the Zones 1 identified above. The NHESP concurred with this assessment (Harper 2011*a*).

Nonetheless, given the important character of the Fells, the role it plays as a large woodland within the greater Boston ecosystem and the public sentiment in support of protecting resources here, the RMP is recommending additional Zone 1 areas to best protect some of these resources. These include buffered locations of the sensitive watch-listed plants, the southern block of Vernal Pool Core habitat and trail-free areas over 10 acres. The southern block of Vernal Pool Core habitat in the Lawrence Woods and Straight Gully Brook area was chosen because it overlaps with various other Zone 1 areas and resources, including locations of sensitive rare species, priority natural communities and trail-free areas over 10 acres. It also contains the area with the highest diversity of amphibian species as documented by Gage (2011) and the highest number of locally rare plants as documented by Hamlin et al. (2011*b*).

The DCR, in consultation with the NHESP, mapped known locations of these resources, with appropriate buffers if applicable, as Zone 1 (Table 4.3.3 and Figure 4.3.1).

Table 4.3.3. Zone 1 Areas at the DCR Middlesex Fells Reservation

Spot Pond Brook Archaeological District
Occurrences of:
- Ridgetop pitch pine scrub oak
- Circumneutral rocky summit/rock outcrop
- Circumneutral talus forest/woodland
- Sugar maple-oak-hickory forest
Buffered known locations of :
- Large-bracted tick-trefoil
- Cankerweed
- American clam shrimp
- Name not disclosed insect
- Early buttercup
- Allegheny buttercup
- Rock knotweed
- Rock spikemoss
Trail-free areas over 10 acres
Southern block of Vernal Pool Core Habitat

Zone 3 areas include the Botume House and associated grounds, MWRA structures and facilities, Greenwood Park, Hall Pool, Flynn Rink, North Region Labor Yard and Sheepfold meadow.

General management guidelines to protect and preserve features and values of each zone are listed in Appendix X. The DCR has identified additional special guidelines for the Fells Zone 1 areas to provide resource specific protections, including:

- All trails within Zone 1 areas will be evaluated. Targeted redundant, confusing, fall-line and poor-condition trails in Zone 1 areas will be closed or re-routed.
- No new trails will be permitted within the trail-free areas over 10 acres.
- Trail definition (borders) will be added to official trails in proximity to sensitive plants.
- Existing allowed trail uses (including pedestrian uses, mountain biking and on-leash dog walking) may be allowed on authorized trails within Zone 1, as designated by the DCR through maps and signage.
- No off-trail uses will be permitted in Zone 1, except scientific research.
- Geocaches off-trail will not be permitted in Zone 1.
- Invasive species removal projects will only be allowed following careful DCR review of potential impacts and if necessary, permitting through the MHC and NHESP.
- Vegetation management will be used only to preserve and enhance identified resource features and values.

4.4. Pedestrian and Mountain Biking Recreation at the Fells

Pedestrian recreation (including hiking / walking, jogging, cross-country skiing and snowshoeing) and mountain biking are all approved recreational trail uses throughout the DCR park system and allowed on designated trails at the Fells. As described in Section 2.7, there has been a significant expressed desire for additional mountain biking access at the Fells and concurrent objection to the expansion of this use. There is also disagreement over the proper roles and balance of mountain biking and pedestrian recreation at the Fells.

Important Natural and Cultural Resources

Sections 2.4, 2.5 and 4.3 above describe the important natural and cultural resources at the Fells.

Susceptibility of Resources to Pedestrian and Mountain Biking Recreation

As described in Section 4.2, hiking / walking and mountain biking have similar impacts to natural and cultural resources. Evidence in the scientific literature and at the Fells supports the conclusion that mountain biking and hiking cause similar amounts of vegetation trampling, soil erosion, trail damage and wildlife disturbance. Winter pedestrian uses (cross-country skiing and snowshoeing) are likely to have fewer impacts to soils and vegetation due to snow cover, but may have a greater impact on some species of wildlife because of the stresses of winter conditions.

On-trail recreation, of any kind, concentrates and so minimizes potential impacts to soils, vegetation and water (Cole 1993). However, even on-trail hiking and mountain biking both have the potential to disturb certain wildlife species. Disturbance of many species of both mammals and birds has been measured at 50 meters from trails and for some species, up to 100 meters from trails (Miller et al. 1998; Lenth et al. 2008).

As noted above, trails are ubiquitous in the Fells. In total, less than four percent of the Fells is not within 50 meters of a trail. In developing trail management recommendations, it will be important to close some trails to allow the creation of more and larger undisturbed patches and protect existing trail-free areas from intrusion by all recreational users.

Twenty-seven species of birds identified as "Species in Greatest Need of Conservation" have been documented at the Fells (Table 2.4.8; MassWildlife 2006). Most of these are migrating through and not breeding here, in large part due to a lack of early successional habitats and perhaps in part to high levels of recreational disturbance. Four of these "Species in Greatest Need of Conservation" may be breeding at the Fells: green heron, black-crowned night-heron, American woodcock and eastern towhee. These last two nest on or near the ground in grasslands, scrub or shrublands and may be especially susceptible to disturbance from recreation. High levels of recreational use, especially off-trail, may disturb foraging, feeding, nesting and breeding behaviors of some birds (Zande et al. 1984). Recreational users that approach birds directly (such as bird watcher or photographers) are more likely to

disturb birds than users going by on-trail (Smith-Castro and Rodewald 2010), but otherwise, mountain biking and pedestrian users have similar levels of impact on birds (Bennett and Zuelke 1999).

Two reptiles, the North American racer and eastern ribbon snake, confirmed at the Fells, are identified as "Species in Greatest Need of Conservation" by MassWildlife (2006). However, both are also identified by MassWildlife (2006) as common both globally and in Massachusetts. The eastern ribbon snake is found in or near wetland habitats and not likely on trails. Racers may be found in rocky and open habitats. Threats from recreational trail uses are not documented, but because of greater average speeds that bikes can travel, and the racers' tendency to bask in open areas on rocks or trails, the DCR RMP team speculates that this species may be somewhat more susceptible to disturbance, trampling or occasional injury by recreational mountain bikers.

On-trail recreational uses at the Fells also have the potential to both benefit and impact many of the state-listed rare species in direct and indirect ways. Trails, as a form of disturbance, may create or help maintain habitat for six of the state-listed species at the Fells, including the plants and insects (Appendix M). However, recreational trail uses may trample rare plants, watch-listed plants and host plants for rare insects if they occur near trails.

Trail uses both create habitat for and pose a potential risk to tiger beetles. These beetles inhabit and breed in the compacted soils along the edge of trails. However, adults and larvae may also be trampled by pedestrian or mountain bikes (Knisley 2011). Although not documented, the DCR RMP team speculates that because of greater average speeds and continuous tire contact, mountain bikes may be more likely to trample tiger beetles than feet. In developing recommendations, it will be important to clearly delineate the trail tread when it is in proximity to rare, watch-listed or host plants; to close some trails near rare or watch-listed plants and restrict mountain biking and/or hiking from some tiger beetle habitats, such as along the Skyline Trail.

Archaeological and historic resources are not sensitive to allowed recreational activities on official trails or in designated spaces. Archaeological resources are potentially sensitive to any activity that involves digging or soil disturbance, such as invasive removal projects or new trail construction. As described in Section 3, all such activities must be reviewed and approved by the DCR and potentially MHC.

As described in Section 4.2, the most detrimental recreational uses to the important and sensitive resources of the Fells are **any off-trail uses**. Off-trail uses compact undisturbed soils, trample plants, further disturb wildlife, fragment priority natural communities and have the potential to destroy rare plants and insects. The most prevalent off-trail occurrences at the Fells involve pedestrian uses including individuals seeking sexual contacts, people seeking solitude, nature observers and geocachers. Mountain bike riders have also been observed off-trail in the Fells. Off-trail uses should continue to be prohibited in the Fells. In developing recommendations, it will be important to close unofficial trails, educate users about the impacts of off-trail uses, enforce staying on-trail and implement strategies to curtail the activities of individuals seeking sexual experiences in the Fells.

Public Safety

Significant public comment during the planning process addressed user mode conflicts, particularly between hikers and mountain bikers. Many comments related the experience of having to jump or pull children out of the way of a fast moving bike, and two individuals related being hit by mountain bikes.

Rocky and sometime steep trails are characteristic of the Fells. The faster speeds at which bikes can travel and the presence of obstacles on narrow trails can result in the potential for additional risks and conflicts on shared use, single-track trails. This may be particularly true on trails with fall-line alignments, constrained sight lines and those that are not designated as multi-use, where pedestrian users do not expect to encounter bikers, such as the Skyline Trail.

Recognizing that all recreational uses pose some risks, as the potential public safety issues of pedestrian and mountain biking recreation on trails in the Fells is evaluated, it is important that both the actual safety issues and perceived risks are assessed.

The DCR manages over 3,000 miles of trails statewide. Nearly all of these trails are open to multiple uses including hiking, skiing, horseback

riding, mountain biking and, in some cases, motorized vehicles. The DCR Ranger Services staff responds to and records accidents and injuries that occur on DCR trails. Although they occasionally occur, the DCR has few recorded incidents involving mountain bikes and pedestrians despite high levels of use statewide. The majority of incidents between bikes and pedestrians occur on paved, multi-use paths, such as rail trails. As described in Section 2.6, from 2007 through 2010, the DCR recorded 138 specific incidents at the Fells. Only one of these involved mountain bikes and it was a complaint of legal mountain biking on a paved, multi-use pathway. No accidents or injuries were reported.

A review of mountain biking and pedestrian safety issues by Cessford (2002) found similar results in other parts of the world. While perceptions of safety risks exist among users and are recognized by managers, the actual public safety risk of accidents appears very low. Although some potential safety issues do exist on shared use paths and the DCR incident reporting system may not be capturing all potential incidents or issues, the DCR's experience, data at the Fells and incident data statewide does not support a conclusion that a significant safety risk exists between pedestrian and mountain biking uses on shared use trails at the Fells.

As recommendations are developed, one potential management solution to addressing a potential or perceived safety risk and conflicts from shared use is to establish some single use paths, i.e., designating some trails for pedestrian uses only and some for mountain biking only (DCR 2010*a*). As the urban built environment exemplifies, separating uses can be an appropriate strategy to reduce risk and conflict. The DCR may also consider maintaining the Skyline Trail as a pedestrian only trail because the alignments and sight lines may contribute to a higher risk from mountain biking use. The DCR may also consider designating mountain biking only trails.

For shared use trails, as recommended by national environmental organizations such as the Sierra Club (1994), it will be important to establish and communicate clear expectations of trail etiquette and develop strategies to encourage compliance with such etiquette. These approaches have proven successful in minimizing conflict in other urban parks in Massachusetts and nation-wide.

Recreational Experiences

The DCR seeks to provide for and enhance diverse recreational experiences at the Fells.

As described in Appendix N, the Fells provides high quality pedestrian trail experiences. Scenic views, high points, diverse habitats, opportunities for finding solitude and a wide variety of types, challenges and distances of trail opportunities all contribute to excellent pedestrian trail experiences. However, these experiences can be diminished by encountering damaged, eroded or wet trails; the presence of trash; and situations that make the user feel uncomfortable or unsafe. Specifically, many comments during the resource management planning process noted that encountering mountain bikes and having to move out of the way of a fast moving bike diminished the pedestrian experience at the Fells. This may be particularly true for older and younger users. Encountering other users, especially bikes, may also disturb opportunities to experience solitude in the Fells for some users.

Research related to recreational conflict between winter users at the Fells (Section 2.6) documented that 19% of all users and as many as 29% of hikers / snowshoers experience some conflict with mountain bikes at the Fells and 17% of all users and as many as 64% of skiers experienced some conflict with hikers / snowshoers (Russell 2011). In following the model of recreational conflict discussed by Vaske et al. (2007), this research further classified conflict into two categories: "interpersonal" conflict and "social values" conflict. Interpersonal conflict arises when a user encounters a behavior by another user that interferes with their experience (e.g., encountering rude behavior or being startled by a passing bike). Social values conflict occurs when values clash, but there is no direct contact between individuals. At the Fells, with the exception of encountering rude behaviors, at least 80% of conflicts between pedestrian users and mountain bikers were found to be social values conflicts (Russell 2011).

Substantial public opinion has expressed a desire for enhanced mountain biking opportunities in the Fells. During the Fells trail planning process, over 2,000 individuals wrote to request expanded mountain biking opportunities. The DCR Middlesex Fells

Reservation can provide high quality mountain biking experiences. Scenic views, high points, diverse habitats, rock features and a wide variety of types, challenges and distances of trail loops and opportunities have the potential to create excellent mountain biking experiences. However, the Fells currently provides limited opportunities for legal mountain biking. Mountain bikes are allowed on wide, improved-surface forest roads or "fire roads" and the Mountain Bike Loop, which contains about two miles of narrow, single-track trail. However, many of the 30 miles of forest roads do not provide appropriate trail opportunities since they do not create loops, dead end at posted lands or lead out of the reservation. National organizations, including environmental groups, recognize the need to have mountain biking trail systems that provide adequate experiences as a way to minimize conflict and the desire of users to use off-limit areas (Sierra Club 1994).

While some mountain bikers enjoy riding wide, improved-surface trails, most riders desire to increase their level of technical challenge as they develop their skills. Single-track trails, rock features and a diversity of terrain all contribute to the mountain bike experience. Loops of various lengths and difficulties are important to the different riders. In the Fells, the mountain biking experience is currently limited by the number of trails open to mountain biking, particularly single-track and more challenging trails, poor signage and marking, hidden obstacles and negative encounters with other users (Appendix N).

Managing and mitigating conflicts and perceptions of conflict between pedestrian and mountain bikers is the biggest challenge to enhancing both mountain biking and pedestrian uses at the Fells. Solutions to this may include stakeholder cooperation, education and etiquette, monitoring and some separation of uses (Sierra Club 1994).

Conflict in outdoor recreation settings can best be defined as goal interference attributed to another's behavior (FHWA 1994). Trail conflict has been found to be related to:

- Activity style (mode of travel, level of technology, etc.)
- Focus of trip
- User expectations
- Perceptions of the environment
- Level of tolerance for others
- Different norms held by different users

Twelve principles for minimizing conflicts on multi-use trails are identified as best practices (FHWA 1994) and described in Appendix N. The DCR will integrate these principles through the RMP recommendations to help reduce conflict within the Fells. These include:

- Recognizing conflict as goal interference
- Providing adequate trail opportunities to minimize contacts
- Establishing appropriate user expectations
- Identifying the actual sources of conflict
- Promoting trail etiquette
- Encouraging positive interaction among different users
- Favoring "light-handed management"

The RMP recommendations around this issue seek to follow these BMP principles in order to address user conflict at the Fells. Specifically, the DCR will seek to provide adequate trail opportunities to each user group, establish appropriate expectations, minimize points of actual conflict within the trail system, promote trail etiquette and encourage stakeholder groups to engage in positive joint interactions. It is our hope that statewide environmental and user groups will join the DCR in efforts to reduce levels of tension and conflict at the Fells.

In identifying specific trails and areas that may be appropriate for enhancing mountain biking and pedestrian only opportunities, the DCR RMP team evaluated areas with respect to following criteria:

Mountain biking experiences.

- Single-track trails
- Loop opportunities or varying challenges
- Rock features
- High points and scenic views
- Opportunities for mountain biking only trails
- Proper separation from sensitive resources

Pedestrian experiences.

- Opportunities to experience solitude
- Opportunities for natural and cultural appreciation
- High points and scenic views
- Wider, more accessible trails appropriate for younger and older users
- Pedestrian only areas
- Areas accessible from major trailheads
- Proper separation from sensitive resources

Management Considerations

Management issues for improving pedestrian and mountain biking uses at the Fells include signage, marking and user education; enforcement and compliance with rules and regulations; trail stewardship; and monitoring.

Trail signage, marking and user information at the Fells is currently in poor condition and users of all types have identified signage and maps as some of the most important interpretive tools needed at the Fells (Section 3.2). The current state of signage contributes to conflict between pedestrian uses and mountain biking as it can be difficult to stay on designated trails. There is no good map showing approved mountain biking opportunities at the Fells. The current Mountain Bike Loop crosses the pedestrian Skyline Trail 12 times and shares three segments of tread with this trail. In each of these cases, it can be confusing for users to know if they are on a mountain biking, pedestrian or shared use trail. Any changes in trail designation at the Fells will require clear communication with users and clear marking and signage on the ground. The *DCR Trail Guidelines and Best Practices Manual* (DCR 2010*a*) includes standards for signage and marking, but creating, installing and maintaining this signage will take financial and human resources.

As noted in Section 2.7, compliance with reservation rules and regulations is a significant issue for both pedestrians and mountain bikers. For example, many pedestrians at the Fells go off-trail or trespass onto Town of Winchester water supply lands and many mountain bikers ride on pedestrian only trails and off-trail. Enforcement of these rules and regulations at the reservation has been minimal. Resources for enforcement are limited and the lack of obvious consequences to breaking rules for oneself or others fosters an attitude of non-compliance in the Fells. The non-compliance and enforcement issues are broader than pedestrian and mountain biking recreation and will be further discussed in Section 4.6. However, one common sense element of a larger compliance strategy is to better align recreational demands with rules and legal opportunities as a way to encourage greater self-compliance.

Monitoring is an important component of effective trail use management. In developing recommendations for both pedestrian uses and mountain biking, the DCR will establish a monitoring protocol with compliance benchmarks to monitor trail use and compliance.

Trails require maintenance and stewardship. Well-used trails require appropriate designs, maintenance and occasionally structures to address issues that arise. As described in Section 3.3, the DCR has limited staff and trail crew resources available for trail maintenance and stewardship. Friends of the Fells along with the mountain biking community, in general, and NEMBA, in particular, are important trail stewardship partners. NEMBA has developed extensive experience and expertise in trail design, repair and maintenance. They have shared this expertise through trainings and workshops and their members are effective and willing to volunteer to repair and improve trails statewide.

At the Fells, these stakeholders have the capacity to bring significant trail stewardship and financial resources to assist in signage, marking, trail design and trail maintenance. However, in the past, these groups have not been able to work effectively together. In developing recommendations, the DCR should consider the value of tapping into these stewardship resources and engage these stewardship partners, either separately or together, to the greatest extent possible.

Conclusion

In making a final evaluation of the mountain biking and pedestrian recreational issues at the Fells, the DCR desires to be responsive to organizations, such as the Sierra Club, that have raised concerns about this use on public lands. The DCR has completed the evaluation of these recreational uses in the Fells consistent with the Sierra Club's articulated a policy with regard to mountain bikes (Sierra Club 1994). See Appendix N and specifically, Sub-appendix N.5 for a detailed review.

The DCR RMP team evaluated the information and issues surrounding pedestrian and mountain biking uses at the Fells. The team arrived at a consensus that mountain biking and hiking are both suitable recreational activities on trails at the Fells and that opportunities for both uses should be enhanced at the Fells, including providing more single-track and advanced riding opportunities for mountain biking and better protecting, enforcing and managing pedestrian only opportunities.

The team agreed that the goal should be to enhance the mountain biking and pedestrian experiences at the Fells and not necessarily to expand the volume of either use. The goal should also be to decrease mountain biking on trails designated for pedestrians only and encourage positive trail etiquette, joint projects and respect for other users in an effort to reduce potential conflicts.

The team specifically noted the importance of clear maps, signs and other user information. The team noted that the introduction of positive uses, such as official mountain biking in the Dark Hollow area between the Sheepfold and Bear Hill, could help dissipate unwanted uses that contribute to the degradation of natural resources.

The team identified the Reservoir Trail as an appropriate shared use loop trail with generally good sight lines, moderate grades, scenic views and some rock features that will be appropriate for intermediate to advanced riders and hikers. The team also recommended a new all-persons (accessible) trail connection from the Flynn Rink to Quarter Mile Pond. Finally, the team recommended designating some additional single-track trails in the eastern Fells in the future (including appropriate portions of the Rock Circuit Trail) as multi-use to provide a longer, more challenging loop trail that will help disperse mountain bikers away from the more popular western Fells and provide more rock features, resistant rock surfaces and scenic views.

In evaluating potential locations for exclusive pedestrian uses, the team identified Virginia Wood and the Long Pond area. These are both areas near residential neighborhoods and main trailheads with established interpretive trails, scenic views and good opportunities for natural and cultural appreciation. They also have a variety of loop trail opportunities that may be appropriate for a wide variety of users, including older and younger visitors. A multi-use connecting trail may need to be identified or developed in Virginia Wood. The team also identified the Skyline Trail as a longer distance and more challenging hiking only trail with a diversity of habitats, high points and scenic views.

4.5. Recreation with Dogs

Dogs are currently welcome on-leash with their owners on all official trails at the Fells and the reservation has become a popular destination for dog owners to bring their dogs to exercise and socialize. Within a five mile radius of the Fells, there are 343,828 households. Approximately 35% of households own an average of 1.7 dogs (HS 2011). Consequently, as many as 204,000 dogs may live in households within five miles of the Fells.

Based on DCR trailhead counts at the Fells itself, there is approximately one dog for every two people visiting the reservation (or the same number of feet and paws). This is an average of 16 dogs per trailhead, per hour.

Within the DCR system (excluding some trails at Callahan State Park, but including all trails at the Fells) dogs are required to be on-leash at all times and yet, approximately 85% of dogs are off-leash at the Fells. DCR staff has observed that the majority of these dogs are not under effective voice command of their owners. Voice command requires that dogs be in sight and under control of their owners at all times. Effective voice command means that a dog will come immediately when called the first time.

The DCR has announced that it will establish a pilot designated off-leash area at the Sheepfold and will work with dog owner groups to implement this pilot. However, many dog owners have expressed further desire for additional, legal, off-leash opportunities. Given the number of dogs visiting the Fells and living nearby, dog recreation and management are significant issues to address.

Important Natural and Cultural Resources

Sections 2.4, 2.5 and 4.3 above describe the significant natural and cultural resources at the Fells.

Susceptibility of Resources to Off-Leash Dogs

Several researchers have found that dogs, and particularly off-leash dogs, disturb various wildlife species more than humans alone, particularly mammals and birds (Section 4.2). Dogs may also exhibit specific behaviors, which can be influenced by breeding, training and social and environmental conditions. In particular, some dogs have been bred for specific behaviors such as defending, tracking, flushing and retrieving. These instincts will affect how dogs interact in and with the natural environment. Training also plays a critical role in dog behavior in social and environmental settings; well-trained dogs can be controlled so that they will not disturb other visitors or wildlife.

As noted in section 2.4 and 4.2 above, 27 species of birds identified as "Species in Greatest Need of Conservation" have been documented at the Fells (Table 2.4.8). Off-leash dogs at the Fells may disrupt feeding and foraging behaviors for some of these species more than dogs on-leash or humans alone. Nesting behaviors of ground-nesting birds may be particularly susceptible to off-leash dogs (Banks and Bryant 2007). Four of the bird species in "Greatest Need of Conservation" may be breeding at the Fells and two of these are ground-nesting: the American woodcock and eastern towhee.

The presence of off-leash dogs will also extend the general area of disturbance to wildlife around trails (Brown 2009) and off-leash dogs may range up to 85 meters off-trail (Lenth et al. 2008). As noted above, there are very few patches in the Fells that are not near trails. Wildlife refuge areas are already few and far between and off-leash dogs may constrict these even more.

Dogs are unlikely to significantly disturb the two reptiles identified as "Species in Greatest need of Conservation." However, off-leash dogs have been observed entering vernal pools at the Fells. This has the potential to disturb or dislodge amphibian egg masses within the pool during breeding season and both dogs and humans can trample vegetation surrounding the pool (MacGillray 2011).

With the exception of potential disturbance to vernal pools that serve as habitat for the American clam shrimp, off-leash dogs are unlikely to have a significant impact on any of the other state-listed species or watch-listed plants at the Fells.

If their owners allow them to engage in digging behaviors, dogs may have the potential to disturb below-ground archaeological resources, including prehistoric sites. Otherwise, cultural resources are not likely to be disturbed by dog recreation.

Dogs that are allowed to enter drinking water resource areas and dog waste can impact drinking water supplies. However, direct water quality impacts have not been detected at the Fells. An owner of a dog off-leash may have reduced likelihood of spotting and collecting their dog's waste. Other owners appear to lack the motivation to follow up on appropriate waste disposal, as the presence of carefully bagged waste abandoned along trail edges is a frequent sight at the Fells.

Much of the potential for impact from off-leash dogs could be minimized or mitigated if dogs and their owners follow basic behaviors such as:

- Staying on-trail
- Picking up dog waste
- Not digging
- Not chasing wildlife
- Staying out of vernal pools, wetland resource areas and water supply lands

In developing recommendations, the DCR will consider how to best achieve compliance with these behaviors.

Public Safety

As noted, at the Fells a large number of users are dog owners who recreate with their dogs, most off-leash. There are also commercial dog walkers who bring multiple dogs, often as many as 10 at a time, to the Fells to walk and exercise them, some off-leash. The majority of off-leash dogs at the Fells do not appear to be under effective voice command by their owners.

Many individuals commented during the public process about safety risks associated with off-leash dogs. Some comments expressed a fear of dogs and a desire not to be approached by a dog. Some dog owners expressed concern about their dog being approached by another dog. And some comments expressed concern for small children who may be frightened by an approaching dog.

Dog bites can be a major public safety issue for both other users and dogs. DCR rangers have reported both dog bites and dog fights at the Fells. Section 2.6 describes 138 recorded incidents at the Fells between 2007 and 2010, 19 of these were dog-related and four involved dog bites or attacks. Lost dogs due to dog fights have also occurred at the Fells.

In developing recommendations for dog recreation at the Fells, public safety will be a significant concern (DCR 2009). All dogs should be under control at all times at the Fells and should not approach other people or dogs unless invited to do so. A leash is a standard form of ensuring that control. Before the DCR considers allowing additional off-leash opportunities for dogs, provisions for ensuring that dogs are reliably under voice control by their owners should be established to ensure public safety.

Recreational Experience

Dogs are an important part of today's society and vital members of many of the families who frequent the Fells. Pet ownership brings many benefits to individuals, families and communities, including a tendency for dog owners to visit parks and exercise more often (Reeves et al. 2011).

Just like humans, dogs need to both exercise and socialize with other dogs to be healthy (Allen 2007). An important part of many dog owners' recreational experience at the Fells includes allowing their dogs to exercise and socialize off-leash, particularly at the Sheepfold. Indeed, a community of dog owners has developed around this activity and location. The experience of allowing a dog to recreate and socialize off-leash can be enhanced by wide open spaces, an attractive natural setting and a friendly environment. The experience can be diminished by a constrained area, overuse, aggressive or out of control dogs, dog waste and negative encounters with other users.

Many hikers, walkers, runners and bikers also enjoy engaging in their recreational activity with their dog off-leash and the companionship of their dog enhances their overall experience at the Fells. This experience can be diminished, however, by negative encounters with other dogs or people.

Dogs, especially off-leash dogs, however, can negatively impact other users' experiences at the Fells. Aggressive dogs can pose a safety risk, especially to other dogs and younger users. Multiple dogs together can be intimidating. Some dogs will chase bikers, skiers or runners. Encountering dog waste or a bag of dog waste can negatively impact an experience. And some visitors do not want to be approached even by a friendly dog.

Research into recreational conflict in the Fells this past winter (Section 2.6) indicates that a majority of users, including high percentages of dog owners, experience conflicts with certain behaviors of dogs and dog owners including: owners not picking up after a dog (67%), dogs off-leash (56%), dogs disrupting trail conditions (45%) and misbehaving or threatening dogs (38%). The majority of these conflicts are classified as interpersonal conflicts, meaning they arise from actual incidents encountered by users.

In developing recommendations, the DCR will need to consider what options may be available for enhancing the experiences of dog owners, while not significantly detracting from the experiences of others.

Management Considerations

Management implications for dog recreation include user education and expectations; off-leash area management; dog waste management; enforcement and compliance with rules, regulations and basic behaviors; and monitoring.

Currently at the Fells, most dog owners walk their dogs off-leash in violation of DCR regulations. Many dog owners seem to believe that it is acceptable to do so. As described in Section 2.6, many dogs and owners currently exhibit behaviors that are not acceptable at the Fells such as not picking up after a dog or allowing a dog to approach another user. User education will have to play an important role in changing the understanding of acceptable behaviors at the Fells. User education will come in the form of signs and posted informational materials, electronic communications, peer-to-peer communication and ranger information.

The establishment of a designated off-leash area at the Sheepfold will require effective and on-going monitoring, management and maintenance. Management issues and best practices for off-leash recreation areas are discussed in *Welcoming Dog Owners as Partners in Our Parks: A Call to Action* (DCR 2009) and detailed in Allen (2007).

Dog waste management is a significant concern for parks users, dog owners and managers both from an aesthetic and resource impact perspective. Not all dog owners pick-up after their dogs in the Fells and some that do, will then leave bags of dog waste around the park. Dog waste contains high levels of bacteria and these bacteria can find their way into soils and water resources, impacting those resources (SMRC n.d.). User education and enforcement will need to be part of any strategy to improve dog waste management. The DCR Division of Water Supply Protection has provided various educational resources surrounding this issue (Zimmerman 2011). The DCR should also consider developing a monitoring protocol and benchmarks for monitoring and evaluating dog waste management efforts.

Enforcement, compliance and monitoring are significant and complex management issues that need to be addressed around dog management at the Fells, whether or not off-leash opportunities are allowed. As noted, approximately 85% of dogs are off-leash on trails at the Fells in violation of current regulations. Dog waste and the number of dogs per person also are significant issues. The DCR has typically done limited enforcement or education around leash violations at the Fells.

Non-compliance, enforcement and monitoring involve various users and issues and will be further discussed in Section 4.6.

Conclusion

The DCR RMP team carefully evaluated the issues and information around dog recreation at the Fells and discussed whether or not to suggest any off-leash opportunities in addition to a designated off-leash area at the Sheepfold.

The team recognized the importance of providing opportunities for dog owners to bring their dogs to the Fells and to recreate with their dogs. The team also recognized the significant desire from many dog owners for additional opportunities that will allow their dogs to recreate and socialize off-leash, on-trail at the Fells and a significant desire for the DCR to better control off-leash dogs at the Fells to reduce impacts to wildlife, water resources, public safety and other users' experiences.

The team discussed the importance of creating off-leash opportunities at the Fells in conjunction with other off-leash opportunities within urban parks. The team agreed that, with respect to both a designated off-leash area at the Sheepfold and any potential future off-leash opportunities, a significant commitment and potential capital investment from a stakeholder group, such as FellsDog, would be a necessary component. The team identified the need for strict enforcement of a three-dog limit per person and that commercial dog walking should require permits.

Finally, the team agreed that the goals of any efforts around recreation with dogs at the Fells must be to:

- Provide opportunities for dog owners to recreate and exercise with their dogs
- Reduce situations in which dogs impact other users' experiences (including dogs approaching other users without invitation and encountering dog waste or bags of waste)
- Reduce disturbance of wildlife and impacts to water resources by dogs
- Enhance compliance with acceptable behaviors and regulations

In evaluating options for recreation with dogs at the Fells, the DCR RMP team considered the following (see Appendix W for a further analysis):

- Enhancing enforcement of current leash regulations throughout the reservation
- Opportunities provided by a designated off-leash area at the Sheepfold for dogs under voice control
- Options for providing a single designated off-leash trail, or set of trails, for dogs under voice control
- Options for designating "courtesy hours," when dogs would be allowed off-leash under voice control on trails at certain times, but would require leashes at all other times (i.e., dawn to 9 a.m.)
- Options for creating a certified dog program that would be managed by a third party and allow dogs who could demonstrate that they could follow required behaviors and be under full voice control to be off-leash in the Fells
- Keeping the status quo

The team also discussed the importance of establishing a monitoring protocol with some benchmarks to assess compliance issues and the

need to be able to either add or restrict opportunities based on this monitoring.

4.6. RULES COMPLIANCE AND ENFORCEMENT

As noted in Section 2.6, the Fells suffers from a "culture of non-compliance" in which a majority of users are violating one or more regulations from leash rules to trespassing to going off-trail to disobeying posted signs. This RMP offers an opportunity to try to change this culture, to focus on gaining far greater levels of compliance by all users within the reservation and to create a self-reinforcing culture of compliance instead. The DCR is committed to enhancing compliance through a multi-faceted strategy of education, enforcement, trail closures, design changes and trail use changes.

The issues of compliance at the Fells are primarily related to three factors: the design and physical characteristics of the park, a lack of management and enforcement presence and cooperation with and among stakeholder groups.

Design and Physical Characteristics

The DCR Middlesex Fells Reservation has over 30 miles of boundary and 5.4 miles of internal border with Town of Winchester water supply lands. There are 110 access points to the Fells and 42 trails that lead directly to posted lands. The trail system is extensive and confusing with 132 dead end trails, various trails crossing each other multiple times and nearly 2,000 intersections (Appendix N). These conditions create an environment in which even the well-intentioned user can have difficulties in understanding and following the rules.

In addition, much of the Fells is bordered by residential neighborhoods, which can contribute to an attitude that the Fells is an extension of one's backyard. The apparent wildness of the Fells, part of its charm, contributes to a feeling of freedom where rules might not apply.

These physical factors contribute to an environment in which users are inclined to disregard rules, especially if they do not make sense to that individual (e.g., it does not make sense to many dog owners to have to leash a dog in the middle of the woods).

Lack of Enforcement Presence

As a result of limited staffing resources and a long menu of responsibilities, including facility security, public safety, user education, interpretive programming, resource protection, rules enforcement, special events and administration, the DCR and its enforcement partners have had a limited presence in the Fells enforcing the reservation's rules (Appendix E and Table 3.2.2). Furthermore, the priorities for these enforcement resources have been targeted toward significant public safety and resource protection concerns, such as swimming in Spot Pond and the Middlesex Fells Reservoir, or pursuing off-highway vehicles. The DCR has also been reluctant to strictly enforce leash regulations given the public demand for legal off-leash recreational opportunities.

Some issues, such as individuals engaging in sexual activities, are also complex from an enforcement standpoint. Public sex is illegal under state law and offensive conduct is against DCR regulations. However, walking around or hanging out in the woods is certainly not a violation of any regulation and the courts have found that off-trail in the woods, people may have a reasonable expectation of privacy.

Many comments during the resource management planning process, including those from statewide environmental organizations, noted the lack of enforcement presence, the need for enforcement and a credible threat of consequences as key ingredients in any effort to change unwanted behaviors at the Fells.

Cooperation with Stakeholders

A key element of any strategy to increase compliance in parks is communication, coordination and cooperation with and between organized stakeholder groups. Stakeholder groups can play an important role in communicating rules to their members and encouraging members to follow those rules. Positive interactions between the DCR and various users and stakeholder groups can also help to strengthen the social fabric of the community of users and contribute to both self-enforcement and compliance with rules.

Unfortunately, at the Fells, various stakeholder groups have focused on competing interests rather

than common ones, and there has been a lack of the kind of cooperation among groups that has proven so positive in other parks. Many issues, including this RMP, have become polarized and this has contributed to a social environment that is characterized by mistrust and a lack of cooperation and empathy among various groups, including the DCR.

Going forward, the DCR should take a leadership role in effectively communicating rules and regulations, establishing user etiquette and setting appropriate expectations for both users and stakeholder groups. In addition, the DCR should encourage stakeholder groups to engage with the DCR in positive interactions to most effectively achieve both rules compliance and resource stewardship.

Stakeholder groups that cannot work collaboratively with each other or the DCR to reduce levels of conflict and increase compliance by their members will likely find their influence and partnership with the DCR diminished.

Those stakeholder groups, including statewide environmental organizations, who believe that enhanced enforcement of reservations rules and regulations is critical, must also be prepared to bring their own resources, fundraising, advocacy and organizing to the table to support the DCR in this expanded effort.

Compliance Strategy

DCR Operations and Ranger Services staff, in conjunction with the DCR RMP team, have identified the following strategies that will be implemented to change the levels of compliance within the Fells. The DCR is committed to enhancing education and enforcement at the Fells to change the culture of non-compliance. The strategy includes:

Information and Education. DCR staff will develop, post on kiosks and communicate via the internet, updated information on rules, regulations, appropriate behaviors and etiquette at the Fells.

Additional Rangers. This summer, two additional seasonal rangers have been added in the Fells District who will provide an additional presence at the Fells.

Citations. Following enhanced education, the DCR will write citations for flagrant or persistent violation of regulations.

Sweeps. The DCR may bring the resources of a Major Impact Team (ranger resources from other regions and districts) to conduct spot "sweeps" at the Fells.

State Police. The DCR will coordinate with the state police and other agencies to add periodic patrols and enforcement at specific sites.

Park Watch. This summer, the DCR has launched a Park Watch Program at the Fells, including two training sessions for interested volunteers.

Stakeholder Self-enforcement. The DCR will work with stakeholder groups to encourage self-enforcement.

Strategic Positive Use. The DCR may identify some areas to promote additional or specific positive uses as part of a strategy to curtail or dissipate unwanted uses.

In considering the resources necessary for a successful compliance strategy within the current resource-constrained environment, the DCR has identified a need for the continued funding for two long-term seasonal rangers dedicated to the Fells. The DCR also believes that an additional Forest and Park Supervisor, a Natural Resource Specialist or seasonal Forestry Assistant and Laborer, dedicated to the Fells, would provide additional management and enforcement presence, an enhanced ability to work with stakeholders and additional maintenance for the Fells.

Monitoring

Monitoring compliance with specific rules and regulations that create conflict, environmental impact or public safety risks is an important component of a broader compliance strategy.

The DCR should revise its incident reporting procedures to more accurately capture actual incidents and violations in the reservation.

The DCR road and trail inventory and this RMP (Section 2) established a baseline and protocol for on-going monitoring of trail and environmental conditions.

The DCR should also establish a trail use and compliance monitoring protocol to implement in 2011. This protocol should evaluate public safety incidents and compliant use as a percentage of total use at specific points over specified time periods. Details will be maintained internally by the DCR in order to ensure accuracy. Compliance monitoring should focus on the following behaviors at the Fells:

- Dogs on-leash where required
- Owners picking up and properly disposing of dog waste
- Users staying on marked, official trails
- Bikers staying on trails designated for that use

The DCR will establish and may revise specific benchmarks for compliance of each behavior. The general starting target for compliance will be 75%, which is consistent with other compliance monitoring efforts (NPS 2009).

Management Responses

When compliance, based on the DCR protocol over the specified time period, falls below the identified benchmark, various primary management options may be implemented by the DCR. If monitoring reveals a persistent issue of non-compliance over a 12 month period, the DCR may consider a secondary management response.

Primary management responses include focused enforcement; additional education (e.g., additional signs, fliers and public meetings); and coordination with stakeholders.

Secondary management responses include citations or increased fines for violations of rules and regulations; greater restrictions on allowed activities by time and/or area; trail or area closures; and additional and more restrictive rules or regulations.

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Ridgetop Pitch Pine-Scrub Oak Community (Photo by Paul Jahnige)

SECTION 5. RECOMMENDATIONS

5.1. INTRODUCTION

In developing recommendations for the management of the Fells, the DCR RMP team considered the existing natural and cultural resources and their conditions and needs described in Section 2; existing recreational uses, demands, behaviors and impacts described in Sections 2 and 4; public, stakeholder and staff input; and management resources and practices described in Section 3.

The table below organizes these recommendations by the management goals articulated in Section 1 and identifies priorities, resources and parties involved in implementation.

Priorities have been assigned to each recommendation by DCR Planning, Operations and Senior Management staff, based on an assessment of public safety and environmental protection needs, user demands and agency priorities.

Resource levels are assigned based on current and projected DCR operating and capital resource availability and priorities, but also known resources available from partner organizations and sister agencies.

It is important to note that an RMP is not an implementation plan or a work plan. It does not include a timetable. Recommendations will be implemented by DCR staff based on priorities and resources available. The DCR may phase certain recommendations, prioritizing some such as education and enforcement. The DCR may also work to implement certain sets of recommendations together, such as maps, signs and use designations. Priorities and responsible parties may change over time.

Recommendation	Priority[a]	Resources[b]	Responsible Party[c]
Goal 1. Protect water resources. *Because wetlands and water resources at the DCR Middlesex Fells Reservation provide clean drinking water, aquatic habitats and water-based recreation; manage the reservation to protect wetlands, streams, vernal pools, ponds and reservoirs.*			
G1.1. Work with the Town of Winchester Police and Water Departments to enforce no trespassing from DCR land to posted water supply lands.	M	2	R, A
G1.2. Close targeted forest roads and trails leading directly from DCR land onto Town of Winchester water supply lands.	H	2	O, V, A
G1.3 Work with the MWRA to protect water resources and infrastructure under their jurisdiction from degradation.	M	1	O, P, A
G1.4 Permit organizations such as the Vernal Pool Society to work with volunteers to certify potential vernal pools.	M	1	V
G1.5. Close trail segments that go through or are eroding into vernal pools.	H	1	O, C, V
G1.6. Close or add structures to trail segments that impact wetland resource areas.	H	1	O, C, V
G1.7. Fill the DCR Middlesex Fells Reservation Forest and Park Supervisor II and Laborer I positions to provide support for trail closures.	H	3	O, F
G1.8. Develop and implement an educational program to teach trail users about ecological impacts of trail use.	M	1	R, P
G1.9. Implement and enforce a trail closure for mountain bikes during the month of March (or as conditions warrant) and encourage all users to avoid wet trails.	M	1	O, R
G1.10. Enforce dog owners properly picking up and disposing of dog waste.	H	2	O, R
G1.11. Educate dog owners about the potential impact of dog waste on water supplies.	M	1	O, R, A
G1.12. Implement additional recommendations to protect water supplies, wetlands and vernal pools as detailed in Appendix N and Appendix M.	H	1-2	O, R, C, V, A
G1.13. Implement additional guidelines to protect vernal pools and their associated upland habitat as detailed in Appendix D.	H	1	O, P, R, V
Goal 2. Protect and enhance habitats for rare species, natural communities and native plants and animals. *Monitor, protect and manage the habitats for the state-listed rare plants and animals in the Fells. Manage the priority natural vegetation communities of the Fells, including vernal pools and ridge top communities, to protect and enhance these habitats for native plants and animals.*			
G2.1. Close targeted redundant, confusing, fall-line and poor-condition trails in Zone 1 areas.	H	1-2	O, C, V
G2.2. Maintain large trail-free areas as trail-free.	M	1	P, O
G2.3. Enforce prohibition on off-trail recreation (unless specifically permitted).	H	1-2	R
G2.4. Partner with the NHESP and area researchers to permit endangered species, natural community and native plant and animal monitoring efforts at the Fells.	M	1-2	P
G2.5. Increase staff awareness and protection of natural resources through participation in training offered by the DCR's Bureau of Planning and Resource Protection.	M	1	P, O
G2.6. Ensure that all DCR and partner activities are appropriately reviewed, permitted and approved.	H	1	R, O, P
G2.7. Add trail definition (trail tread borders and signs) to official trails in proximity to sensitive plants and wildlife resource locations.	M	1	O, V
G2.8. Implement habitat management recommendations detailed in Appendix M, including invasive controls and selective thinning to maintain specific priority national communities.	H	1-2	O, C, V, A
G2.9. With neighboring community Fire Departments, prepare a Fire Management and Response Plan that addresses operational responsibilities, public safety, habitat management, impacts to rare species and the creation and maintenance of associated infrastructure (e.g., fire roads).	L	3	C, O, P, A
G2.10. Fill the Natural Resource Specialist position to provide support for habitat management, trail closures and species protection.	M	1-3	O

Recommendation	Priority[a]	Resources[b]	Responsible Party[c]
G2.11. Develop an organic composting operation at the Labor Yard, managed by a third party to provide the public and DCR with composting opportunities and products.	M	2	C, L, O
G2.12. Implement additional recommendations as detailed in Appendices N and M.	M	2	O, R, C, V, A
Also See – G1.4, G1.5, G1.12, and G1.13.			
Goal 3. Preserve the cultural resources of the reservation. *Because the reservation's historic buildings and structures, archaeological resources and cultural landscapes represent important connections to both our past and future; manage these resources to stabilize, restore and protect them from damage or degradation.*			
G3.1. Increase staff awareness and protection of cultural resources through participation in workshops and training offered by the DCR's Office of Cultural Resources.	M	3	P, R
G3. 2. Conduct an archaeological survey of the reservation to evaluate the significance of known and potential archaeological and historic sites.	M	3	P
G3.3. Develop a Cultural Resource Protection Plan based on the above survey.	M	3	P
G3.4. Develop a seasonal monitoring program to address human and natural impacts to these archaeological resources.	M	3	P
G3.5. Avoid or monitor <u>all</u> activities occurring on undisturbed, level and well-drained areas around ponds and wetlands until an archaeological survey has been completed.	H	1	P, O
G3.6. Conduct an analysis of the stone walls, bridges, spillways, foundations, and other structures within the Spot Pond Brook Archaeological District (as a part of or separate from the above Cultural Resource Protection Plan) to identify areas of deterioration and prioritize needs to stabilize, rebuild or restore as necessary.	M	2	P, C, E
G3.7. Repair deteriorated sections of and remove vegetation from, stone walls and piers along Woodland Road at the Botume House, along back edge of Greenwood Park and along South Border Road.	M	2	P, C, O
G3.8. Stabilize the foundation walls of the MIT Observatory.	M	2	P, C
G3.9. Preserve and interpret remnants of 90mm site.	M	2	A, P
G3.10. Remove graffiti at the Wright's and Bear Hill towers.	M	1	O
G3.11. Conduct structural analyses of the three trolley corridor bridges, Bear Hill Tower and Bellevue Pond spillway and bridge.	M	2	C, E, P
G3.12. Dependant on above analyses, repair deteriorated features, remove encroaching vegetation and install safety railings.	H	2-3	C, E, P
G3.13. Analyze current use of 1 Woodland Road and consider the property for inclusion in the Historic Curatorship Program.	M	1	O, P
G3.14. Maintain internal and border parkways in accordance with the *Preservation Guidelines for Historic Parkways* and implement parkway vision plan.	M	3	E
G3.15. Research the Stone Memorial Zoo as a cultural landscape to assess its existing features and evolution in the context of the historic development of zoos at the local, state and national level. Include assessment of Gould Farmhouse and its functional history.	L	3	P
G3.16. Research history of the Girl Scout Camp once located south of Long Pond, Crystal Spring springhouse and Greenwood Park for inventory and interpretive purposes.	L	1	P
Goal 4. Provide for and enhance diverse recreational opportunities. *Provide diverse recreational opportunities for a variety of users while improving the user experience, reducing user conflicts and encouraging mutual respect; and provide opportunities for users to experience and interact with the beauty and wonder of nature at the DCR Middlesex Fells Reservation.*			
G4.1. Develop all-persons accessible trail opportunities in both the western Fells and from Flynn Rink.	M	1-3	O, P, V, C
G4.2. Renovate the Sheepfold parking lots to improve safety, access, parking, plowing and storm water drainage.	H	3	P, E, C, F
G4.3. Renovate the Sheepfold bathroom building as a visitor contact station.	H	3	P, E, C, F
G4.4. Consider a "pay and display" day use fee at the Sheepfold with an annual pass option.	M	1	O, P, R

Recommendation	Priority[a]	Resources[b]	Responsible Party[c]
G4.5. Manage a designated off-leash area at the Sheepfold as a pilot off-leash opportunity in partnership with dog owner stakeholder groups.	H	1	O, P, R, V
G4.7. Enforce leash regulations outside of official designated areas and circumstances and enforce a three dog per person limit.	H	1-2	O, R
G4.8. Designate Virginia Wood (with the possible exception of one connecting trail) and the Long Pond area as pedestrian only areas with signage and on maps.	H	1	O, P, R, V
G4.9. Designate the Reservoir Tail as a multi-use trail.	H	1	O, P, R, V
G4.10. Designate one to three official trails within the Dark Hollow area for mountain bike use to provide enhanced mountain biking opportunities.	H	1	O, P, R, V
G4.11. Consider designating single-track trails and areas in the eastern Fells as multi-use, including appropriate portions of the Rock Circuit Trail, to provide more advanced mountain biking opportunities on sustainable surfaces and disperse biking from the western Fells.	M	2	O, P
G4.12. Enforce no biking on / in pedestrian only trails and areas.	H	1-2	O, R
G4.13. Close targeted redundant, confusing, fall-line and poor-condition trails in Zone 1 and 2 areas.	H	1-3	C, O, P
G4.14. Reduce overlaps and intersections of main loop trails including the Skyline Trail, Reservoir Trail and Mountain Bike Loop through trail re-routes and re-designations.	H	2	C, O, P, V
G4.15. Improve trail signage and marking following DCR guidelines.	H	2	O, R, C, V
G4.16. Develop and distribute new DCR trail maps to improve the experience for all users.	H	1	P, O, R
G4.17. Establish, and educate users in, appropriate trail etiquette, including winter use etiquette.	H	1	P, O, R
G4.18. Consider designating an area or set of trails for cross-country skiing when conditions allow.	M	2	P, O, R
G4.19. Implement additional recommendations as detailed in Appendix N.	M	2	O, R, C, A, V
G4.20. Work with the MBTA to establish an additional bus stop along the northern portion of the Fells to facilitate public access to those areas and encourage the use of public transit.	M	1-2	A, X, O
Also see goals G.1, G1.8, G1.9, G1.10, and G2.1.			
Goal 5: Enhance compliance with rules and regulations to protect resources and enhance recreational experiences. *Land ownership patterns, diverse recreational demands and sensitive resources necessitate a variety of rules and regulations at the DCR Middlesex Fells Reservation. Create a culture of compliance through a combination of education, management presence, active enforcement and stakeholder self-enforcement.*			
G5.1. Post, update and communicate through kiosks, signs, internet and personal contact reservation rules, regulations, appropriate behaviors and etiquette.	H	1	R
G5.2. Increase DCR Ranger presence at trailheads and on trails.	H	1-2	R
G5.3. Provide two additional long-term seasonal rangers for the Fells District.	H	2	O, R
G5.4. Provide for occasional mounted patrols.	H	1	R
G5.5. Issue citations for flagrant or persistent violations of regulations.	H	1-2	R
G5.6. Bring DCR Major Impact Team to conduct “sweeps” at the Fells.	M	1	R
G5.7. Coordinate with the State Police to provide support, periodic patrols and enforcement at specific sites.	H	1	A, R
G5.8. Establish a Park Watch program for the Fells.	H	1	R
G5.9. Designate one to three official multi-use trails through the Dark Hollow area to provide a positive use to an area with unwanted activity.	H	1	O, P, V
G5.10. Implement a monitoring protocol with benchmarks to evaluate compliance with dogs off-leash, dog waste disposal, users staying on official trails and bikers staying on designated trails.	H	1	R, P

Recommendation	Priority[a]	Resources[b]	Responsible Party[c]
G5.11. Revise the incident reporting system to better capture actual incidents and violations of regulations.	H	1	R
Also see goals G1.10, G2.3, G4.7 and G4.12.			
Goal 6: Interpret the natural and cultural resources of the Fells. *Provide rich and diverse connections to the natural and cultural resources and stories of the Fells through thematic interpretation and the development and placement of interpretive services and tools.*			
G6.1. Complete a Comprehensive Interpretive Plan for the DCR Middlesex Fells Reservation.	H	1	R, O, V
G6.2. Use the renovated Tudor Barn for interpretive programming.	M	1	R, O, V
G6.3. Complete and install the interpretive display for the Botume House.	H	1	R, O, C
Also see goals G1.8, G1.11, G2.5, G2.10, G3.2, G3.9, G3.15, G3.16, G4.16, G4.17 and G5.1.			
Goal 7: Work with diverse partners and volunteers to achieve these management goals. *Diverse partner organizations and individual volunteers represent a wealth of experience, knowledge and energy. With DCR standards and oversight, partner with organizations and individuals to implement this RMP for the long-term stewardship of the DCR Middlesex Fells Reservation.*			
G7.1. Establish Memoranda of Understanding and Stewardship Agreements with partner organizations at the Fells to outline roles, responsibilities, permitting requirements and expectations and institute an annual work plan for review and approval of activities.	H	1	X, O, P, L, V
G7.2. Work with partners to encourage their members to comply with all reservation rules, regulations, permitting requirements, appropriate behaviors and etiquette (self-enforcement).	H	1	X, O, R, P, V
G7.3. Work with stakeholders, partners and the public to advocate for increased state funding and raise private funds to support the implementation of this plan.	H	NA	V, X
G7.4. Encourage and expect greater civility among users and stakeholders at the Fells.	H	1	O, R, P, X, V
Also see goals G1.4, G2.4, G2.6, G4.5, G5.8 and G6.1.			

a. Priorities are High (H), Medium (M), or Low (L).
b. Availability of resources for implementing recommendations: 1 – funding is currently available; 2 – funding is currently unavailable, but may become so in the near future; 3 – funding is currently unavailable, but may become so within five years.
c. The following codes identify the party responsible for implementing the recommendation: A = Agency partner; C = contractor or consultant; E = Bureau of Engineering; F = Administration and Finance; L = Legal Services; O = Operations; P = Bureau of Planning and Resource Protection; R = Ranger Services; V = volunteer or partner; X = Office of External Affairs and Partnerships.