ROCK MEADOW

A Conservation Master Plan

for the Town of Belmont, Massachusetts

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SPRING 2018

the Conway School
Graduate Program in Sustainable Landscape Planning + Design

CONTEXT

ANALYSIS

DESIGN

DETAILS

INTRODUCTION

Rock Meadow has been a meadow for as long as anyone can remember.

Believed to be part of a former glacial pond, it was burned by the native Pequosette Indians and maintained as meadow for at least a thousand years. By the time British colonists arrived in 1630, Rock Meadow was "park-like," with open meadows and little dense forest ("Rock Meadow Conservation Land in Belmont, MA").

As the colonial economy grew, built upon agriculture with livestock at the core, Rock Meadow was a regionally important pasture. The large quantity of rocks and water rendered it poor for cultivation and development, but an excellent place to grow grass for grazing animals. In 1908, the McLean Psychiatric Hospital purchased Rock Meadow, and until 1945, when it was shut down due to a labor shortage during World War II, it served as the hospital's farm. It supplied milk, pork, and water from wells in the meadow.

Rock Meadow lay fallow for almost twenty years until 1968 when the Town of Belmont purchased the land from McLean for $550,000, half of which was funded by the U.S. Bureau of Outdoor Recreation. Since then, the Conservation Commission of Belmont has managed Rock Meadow as conserved, open grassland used for passive recreation like hiking, birding, picnicking, dog-walking, and gardening. The following client objectives seek to improve Rock Meadow and garner public support for its preservation as a meadow into the future....

CLIENT:
Belmont Conservation Commission

OBJECTIVES:

1. **Design an eco-historic walking tour** that honors Rock Meadow's cultural and ecological past and present
2. **Develop a management plan** for controlling and reducing aggressive, exotic plants
3. **Increase ecosystem services, ecological corridors & wildlife habitat**
4. **Redesign main parking lot** to accommodate more cars, reduce erosion & improve arrival experience

10,000 years ago
Glacial pond breached at south end of Rock Meadow, leaving soil mixture of sandy loam & rocks.

1630
British colonists arrive & found Watertown. Rock Meadow is "park-like."

1908
McLean hospital purchases Rock Meadow from private owners. For 40 years, it serves as the hospital's farm.

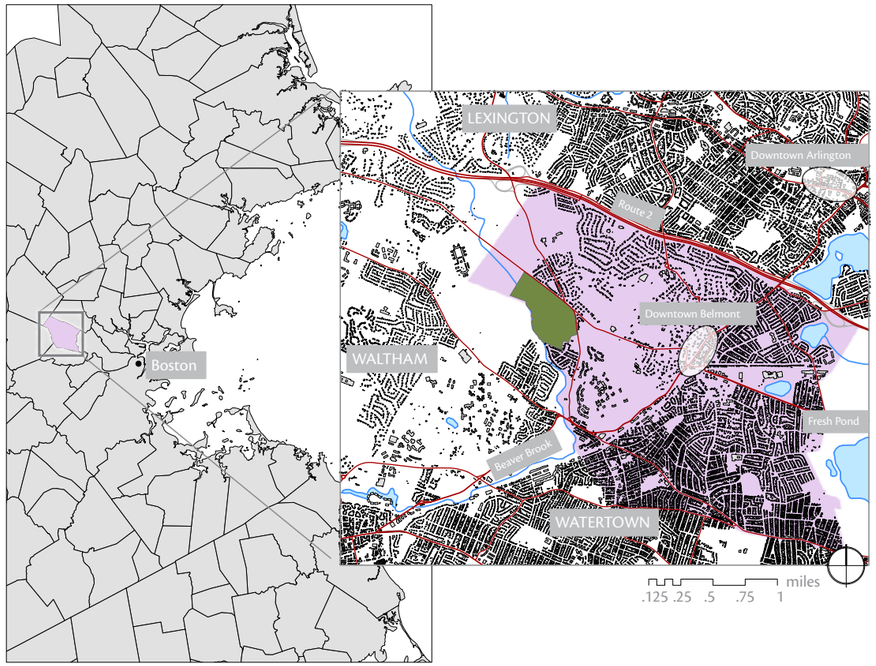
Today
Conservation Commission manages Rock Meadow as open, grassland.

Until 17th century
Pequosette Indians managed & burned Rock Meadow for several thousands of years.

18th-19th centuries
Belmont's colonial economy grows, built upon agriculture.

1968
Town of Belmont purchases Rock Meadow for $550,000.

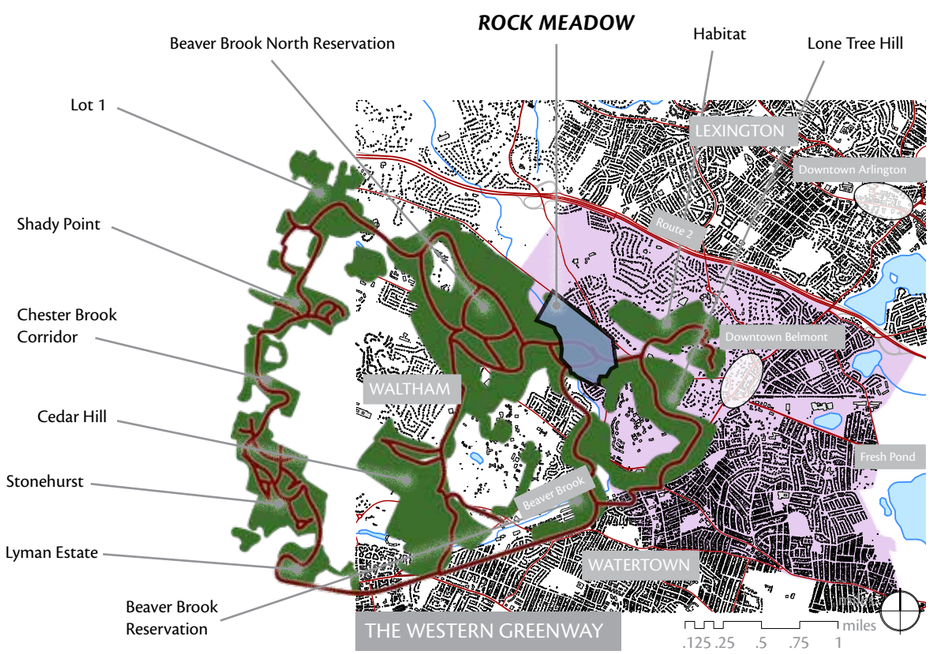
REGIONAL CONTEXTS



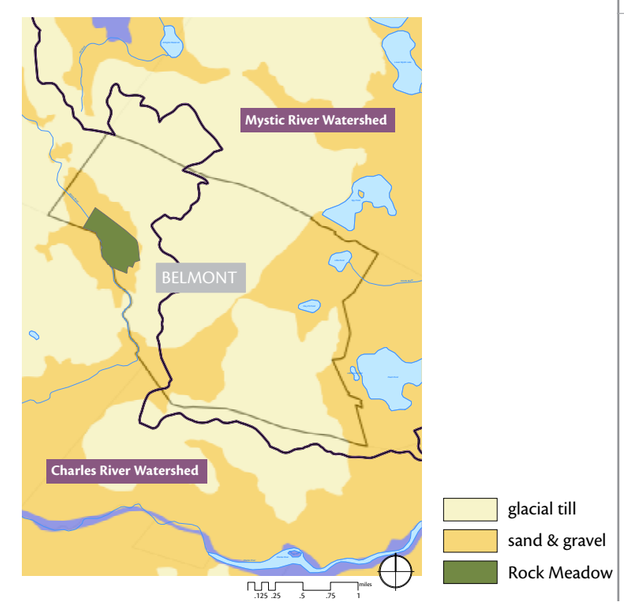
Rock Meadow is located in the residential suburb of Belmont, Massachusetts —about ten miles west of Boston.

It forms part of Belmont's western border with Waltham and draws visitors from several adjacent towns. (It is within five miles of downtown Lexington, Arlington, and Watertown.) Rock Meadow is connected to a larger "green necklace" called the Western Greenway (bottom left in green), which comprises 1,100 acres of open space and ten miles of trails and is an important stop on the Northeast Flyway for migrating birds ("Rock Meadow Conservation Land in Belmont, MA"). The Western Greenway is not overseen by a single legal entity, but a coalition of land trusts and conservation groups from Belmont, Lexington, and Waltham working to preserve this linkage of open spaces for wildlife habitat and recreation. Led and managed by the volunteer organization *Friends of the Western Greenway*, the coalition negotiates for access and preservation of open space. While several parcels in the Western Greenway are protected under conservation restrictions—like Habitat Wildlife Sanctuary (MassAudubon) and Lone Tree Hill (Trustees of Reservation)—there are other undeveloped publicly and privately owned parcels whose future is still undetermined. Rock Meadow is not currently legally protected as conservation land.

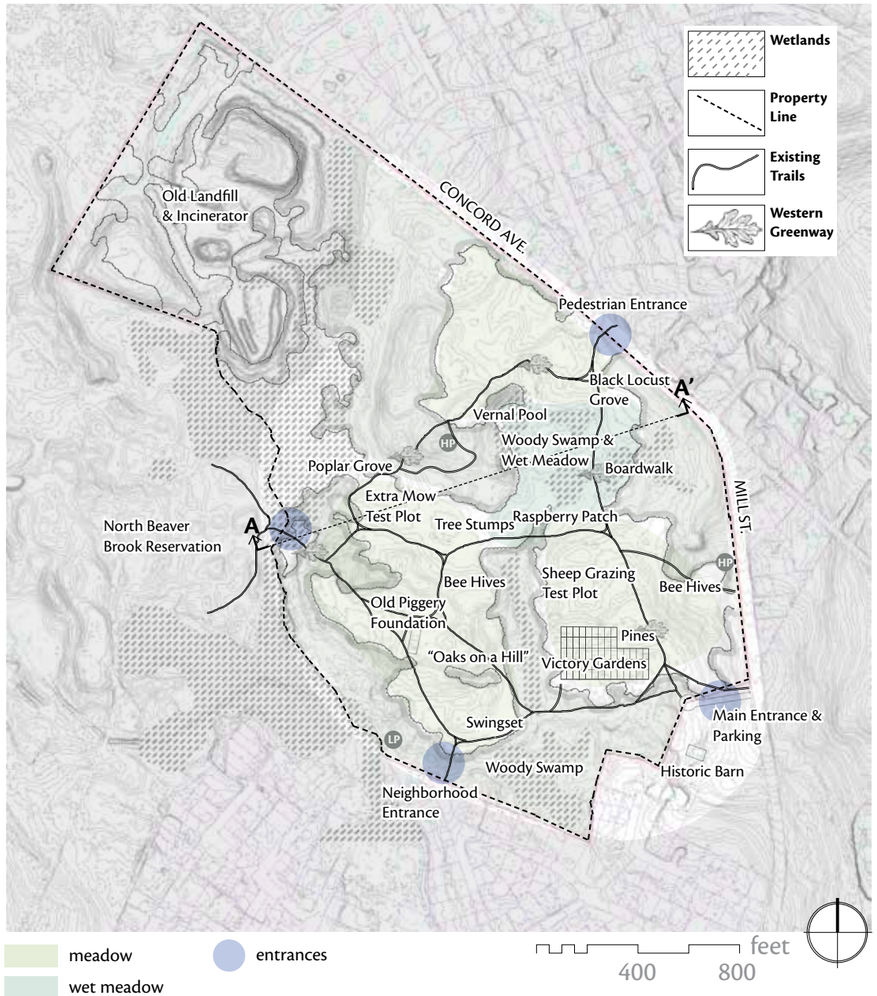
Belmont rests within two watersheds, of the Mystic and Charles Rivers, both of which drain to the Boston Harbor. Rock Meadow drains to Beaver Brook, a perennial stream that forms the western boundary of both Belmont and the Meadow, which eventually empties into the Charles River. Geologically, the region is underlain predominantly with glacial till parent material with pockets of sand and gravel that increase in size moving eastward to the coast. Despite being underlain by sand and gravel, a relatively well-draining parent material, Rock Meadow is a uniquely wet site due to a high water table.



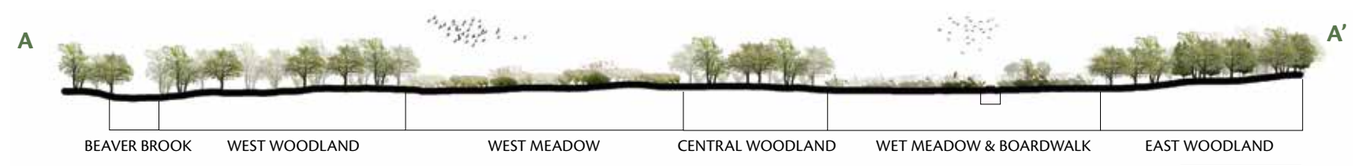
The Western Greenway (green in map to left) contains ten miles of blazed trails, including a loop through Rock Meadow that connects Beaver Brook North Reservation and Habitat Wildlife Sanctuary.



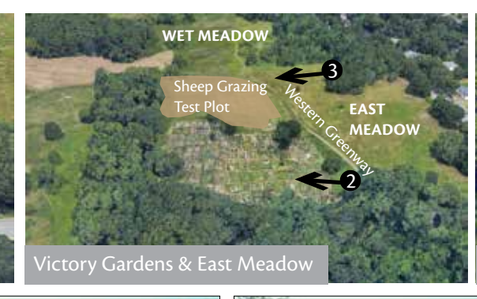
EXISTING CONDITIONS



Rock Meadow is part of a 71-acre parcel that features many diverse habitats, including open grassland meadow, wet marshes, early-successional shrubland, mature deciduous woodland, and vegetable gardens. From 1938 until 2007, Rock Meadow had been succeeding to woodland, with trees and shrubs slowly expanding into the open fields. In 2007, a Mass Audubon management plan was implemented to restore Rock Meadow to 50% grassland coverage with clear, delineated edges and controlled exotic plant communities (see bottom left). Today, meadows consist of cool-season European grasses and are mowed every fall. An old incinerator (closed in the 1970s) and landfill transfer facility lie at the northern part of the property; this section is under review for future development, which will be restricted to recreational uses. A delineated meadow wetland is located in the center of the property, and contains a certified vernal pool. Beaver Brook forms the western boundary of Rock Meadow; a small wooden bridge that is maintained by mountain bikers traverses the perennial stream and connects the property to the rest of the Western Greenway via North Beaver Brook Reservation. There are four entrances to Rock Meadow including the main entrance off Mill Street, where the parking lot is eroded with potholes and has no clear, organized circulation pattern. A robust trail system—including a section of the Western Greenway— currently transects the site; paths are about two feet wide, and there are two desire paths entering the meadows from Mill Street. The Victory Gardens, inaugurated in 1968, contain 140 garden plots that are rented for $65 per season and supplement the Conservation Commission's maintenance budget. An old piggery foundation leftover from the era of McLean Hospital Farm rests in the West Meadow, and the historic wood and brick barn adjacent to the parking lot has recently been awarded Community Preservation Act funds for stabilization.

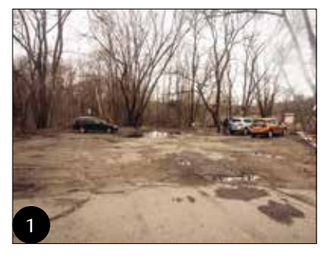


Main Entrance



Victory Gardens & East Meadow

Old Piggery Foundation & West Meadow

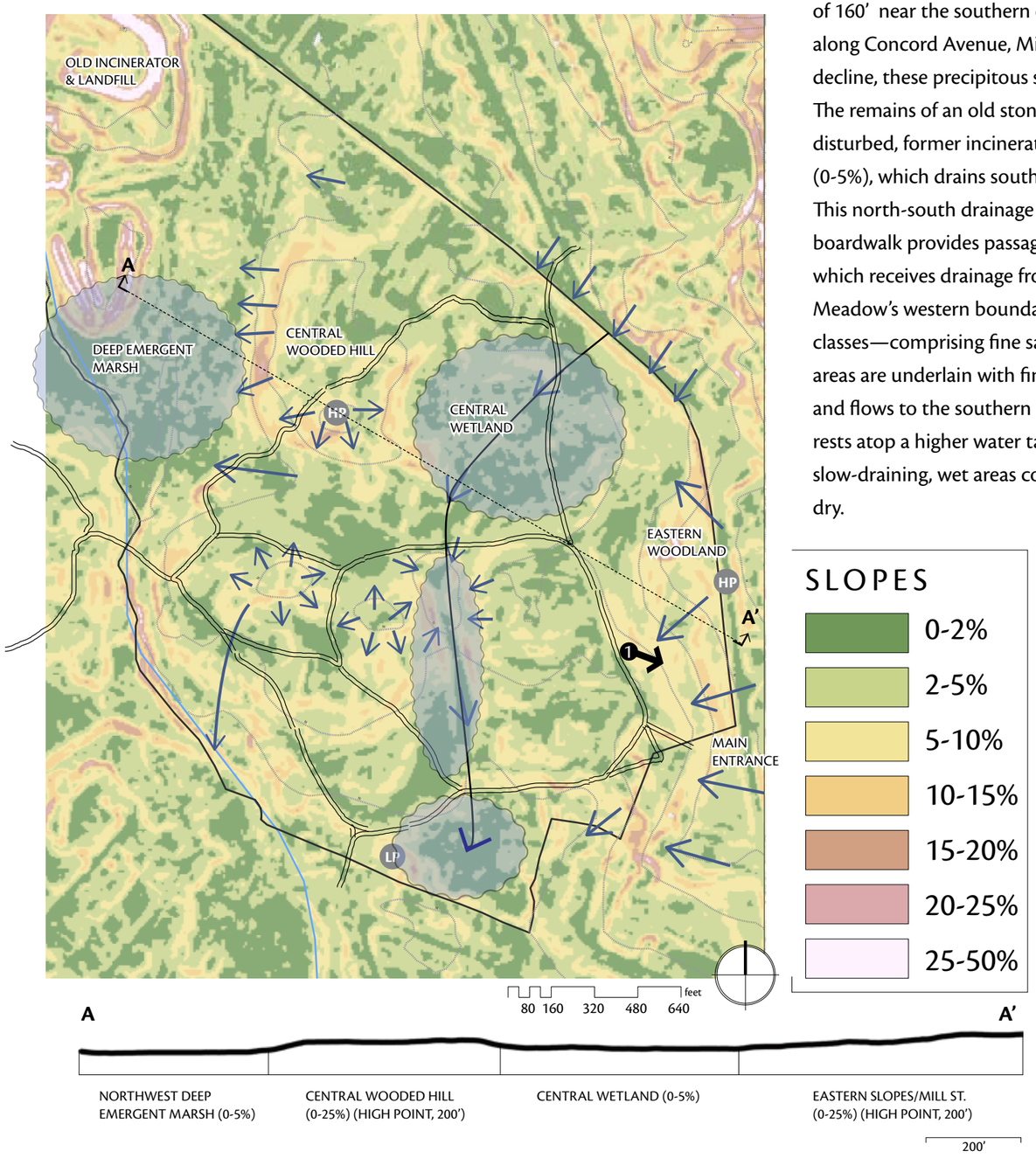


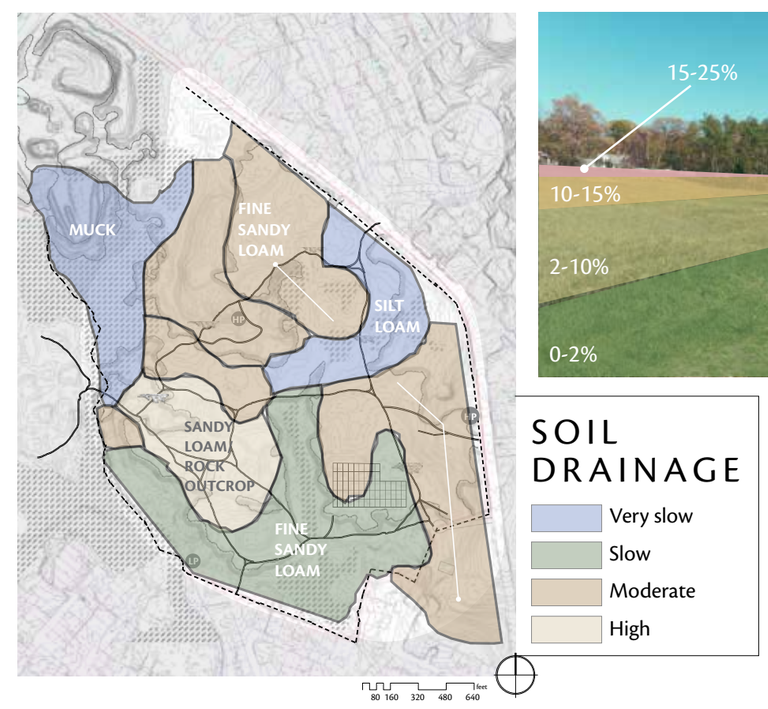
Shrubs and trees had been encroaching into the meadows for decades until 2008 when a Mass Audubon management plan was implemented to restore contiguous meadow habitat. Several copses of trees were removed from the interior and shrubs were removed to more clearly define meadow edges. In 2007, the meadows only covered 25% of the site; in 2017, they covered 50%.

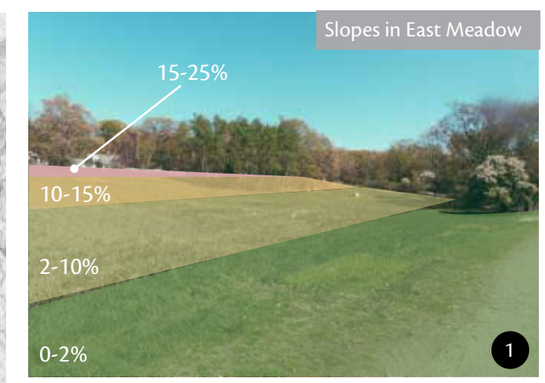
SOILS, SLOPES & DRAINAGE

Rock Meadow slopes down from northeast to southwest with high points of 200' (elevation) on the east and central hills and a low point of 160' near the southern entrance. The site contains broad, undulating topography, with strips of 15-25% slopes on the eastern perimeter along Concord Avenue, Mill Street, and the descents around the central wooded hill. Unless sub-grade fill is imported to soften the decline, these precipitous slopes along the eastern perimeter streets would make any entry drive steep if placed perpendicular to the road. The remains of an old stone retaining wall form a "J" of 25-50% slopes in the eastern woodland and similar grades are present in the heavily disturbed, former incinerator site north of the deep emergent marsh. One of the lowest-lying, flattest areas on site is the central wetland (0-5%), which drains southwards via a man-made channel that in turn feeds Beaver Brook in the southwest corner of the property.

This north-south drainage axis is a wet corridor that is traversed by existing trails three times: the stream is culverted twice and a raised boardwalk provides passage over the central wetland. The other low-lying area of shallow grades is the deep emergent marsh (0-5%), which receives drainage from the steep, western descents of the central wooded hill and directly feeds Beaver Brook (which forms Rock Meadow's western boundary). Soils correlate with hydrologic conditions on site: upland dry areas are of moderate and high soil drainage classes—comprising fine sandy loams or shallow bedrock (south-central Narragansett-Hollis-Rock Outcrop complex)—and low-lying areas are underlain with finer, siltier soils with slower infiltration rates. The central wetland contains a poorly draining Pittstown silt loam and flows to the southern Woodbridge fine sandy loam, which, unlike the Montauk fine sandy loam (in brown), is slowly draining and rests atop a higher water table (typically 10" higher). The deep emergent marsh is underlain with Swansea muck. Trails that pass through slow-draining, wet areas could be elevated boardwalks or supported with a crushed gravel overlay to inhibit erosion and keep the paths dry.







Not for construction. Part of a student project and not based on a legal survey.

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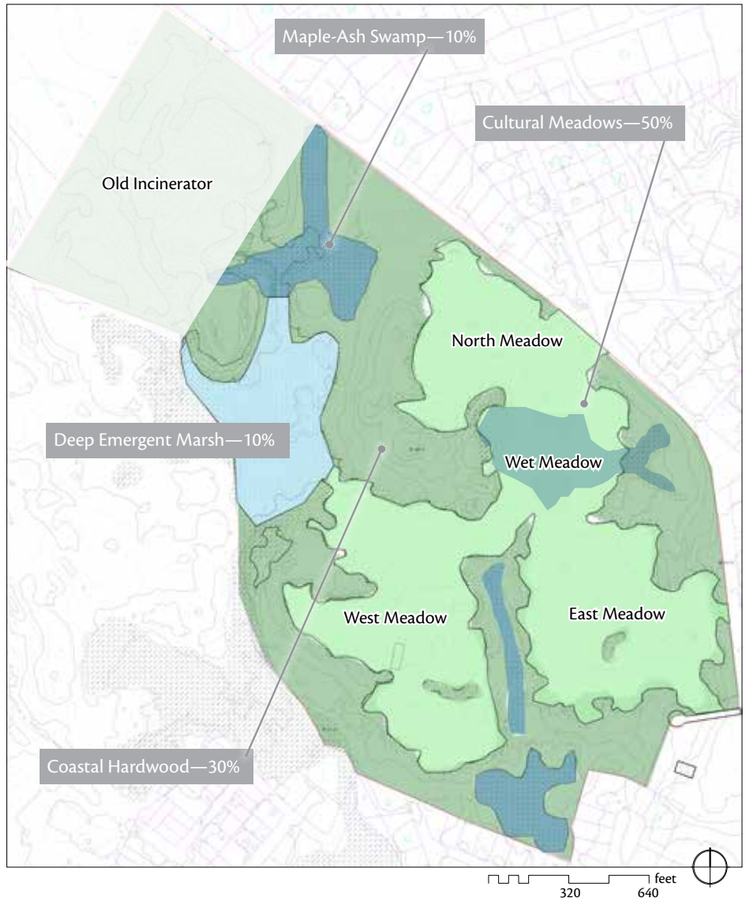
Spring 2018

ROCK MEADOW
A Master Plan for Conservation
Belmont, MA

soils, slopes & drainage

VEGETATION



For thousands of years, Rock Meadow was maintained by the Pequosette Indians, resulting in a diverse patchwork of meadows, woodlands, and wetlands. Indigenous people no longer manage Rock Meadow, but a mosaic of ecosystems is still maintained today. Four plant communities can be currently observed on site: cultural meadows, coastal hardwood, maple-ash marsh, and deep emergent marsh. Surrounding the meadows is a coastal hardwood forest community that is dominated by a canopy of oak, hickory, and white pine. (Though at Rock Meadow white pine is underrepresented, save a small copse northwest of the victory gardens and a few mature individuals near the western property boundary.) To the northwest, a deep emergent marsh—characterized by perennial, non-woody wetland plants—divides Rock Meadow and the old incinerator site. Connecting to the marsh from the east is a northern swamp dominated by red maples (*Acer rubrum*). Rock Meadow is the only site throughout the Western Greenway that hosts extensive grassland meadow habitat.

DEEP EMERGENT MARSH

- *Perennial, non-woody wetland plants*

MAPLE-ASH SWAMP

- *Woody shrubs & small trees with openings from wind-throw & seasonal flooding*

COASTAL HARDWOODS

- *Oak, hickory & white pine—historically maintained by fire*

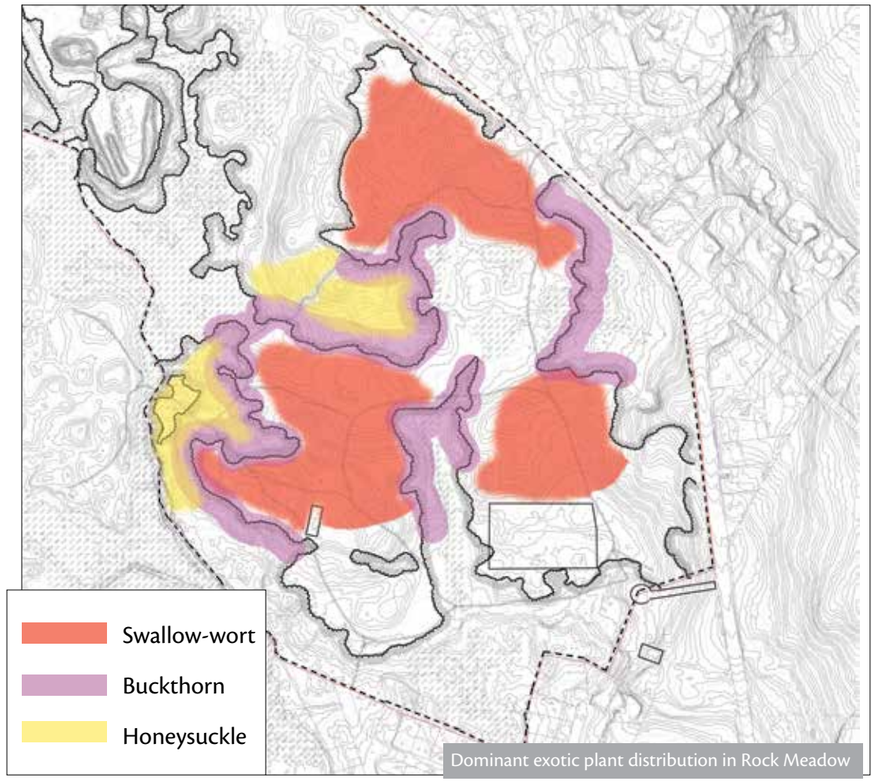
CULTURAL MEADOWS

- *Typical of abandoned agricultural fields with European succession species like Queen Anne's Lace*

Nature Conservancy Local Habitat Types

Historically, beavers and Native Americans were the primary forces responsible for creating and maintaining grassland habitats in New England. These meadows were either burned to improve forage for game and to promote certain plant food sources (such as blueberry), or created as abandoned beaver dams succeeded to grassland after water drained and the nutrient-rich soil was exposed to sunlight. In more recent history, fire suppression and limits to where beavers are allowed to build dams has meant that grasslands are restricted mainly to agricultural areas (UNH Extension). Meadow systems in New England are on the decline as woodlands regenerate from nearly 80% deforestation in the 18th century. Since the colonial period, agricultural grasslands in New England have been reduced by 60% and native grasslands, by 90%. (Shriver et al. 2005) With the loss of the meadows, grassland-dependent birds, like bobolinks, lose vital habitat—and these species have declined faster than any other group of birds in New England (Mass Audubon). Rock Meadow needs to be managed to remain as a meadow; without this intervention, it will revert to woodland, causing shifts in vegetation pattern and wildlife habitat.

EXOTIC PLANT SPECIES



Dominant exotic plant distribution in Rock Meadow

Non-native plant species can be found throughout Rock Meadow. While these species may have some ecological value, such as shelter and food for wildlife, many exotic plants have been noted to displace native vegetation, which can adversely affect wildlife that is evolutionarily adapted to certain food sources. Targeting specific species for control—and addressing the implications of removal—may help boost the ecological value of Rock Meadow. With the removal of exotic plants, sometimes known as "invasive" species, native flora like warm-season grasses, wildflowers, and shrubs in Rock Meadow may successfully support more grassland birds, pollinators, and small mammals.

Species of highest concern in Rock Meadow are honeysuckle—found throughout the woodland interior—buckthorn, which appears along disturbed edges around the meadows, and black swallow-wort—an extremely aggressive, vining species that spreads within the meadow itself. Each species requires its own technique for removal. Black swallow-wort is the most difficult to remove since it is resistant to grazing pressure, mowing, and burning, which may actually *encourage* new growth. Both buckthorn and black swallow-wort are able to persist in the seedbed for years before losing viability. Honeysuckle removal, on the other hand, may *require* disturbing the seed bank to uproot the plant, which would potentially encourage new growth of other undesired species.

Other exotic species found on site—but with smaller and localized populations—are Norway maple (*Acer platanoides*), multi-flora rose (*Rosa multiflora*), barberry (*Berberis thunbergii*), purple loosestrife (*Lythrum salicaria*), garlic mustard (*Alliaria petiolata*), Japanese knotweed (*Fallopia japonica*), mugwort (*Artemisia vulgaris*), black locust (*Robinia pseudoacacia*) and dame's rocket (*Hesperis matronalis*). Because they are relatively small populations—and easier to remove through hand-pulling or brush-hogging (multi-flora rose; barberry)— it is advisable to target these species (and replace them with more appropriate plants) as soon as possible before they spread.

Questioning the "Invasives" Paradigm

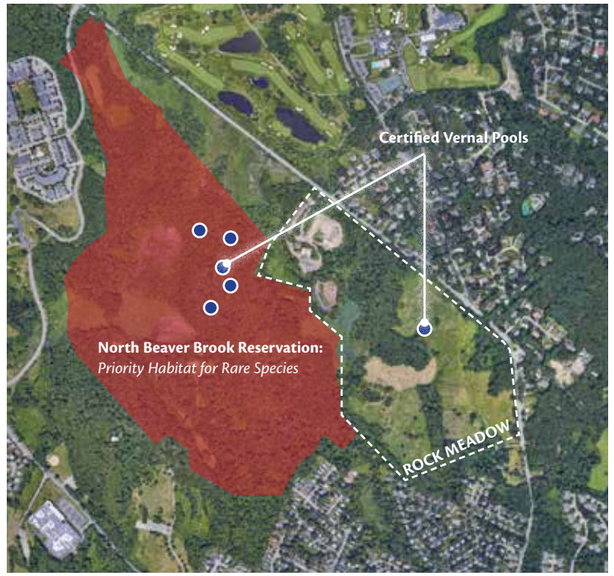
In 2012, the federal government spent $2.2 billion trying to prevent, control and sometimes eradicate invasive species, in an effort that involved 13 different agencies and departments. But in many cases, there are conflicts between eradicating an invasive species and protecting an endangered or "native" one that has come to depend on it ("Invasive Species: Not Always the Enemy"). Moreover, the planet has been so fundamentally remade and "globalized" by human beings—the ultimate invasive species—that the words "exotic" and "native" become somewhat imprecise terms. **Might we instead call these species "opportunistic" plants, which are responding to an altered environment?** 12,000 years ago, when a mile of ice covered New England, none of the plants growing here now grew here then, so how do we accurately define nativity? In 2011, 19 ecologists co-authored an influential article in *Nature* arguing that we should judge species not by their origin, but by their impact on the environment. Purple loosestrife, for example—so often maligned as the ultimate invasive—supports 29 different species of wildlife and has not been found to out-compete cattails, or any other species (Anderson 1995). And while there *is* pressure to remove exotic, aggressive species to preserve a diversity of vegetation in Rock Meadow, these plants still fill a niche and provide ecological services. They control erosion, manage stormwater, sequester carbon, supply food and cover for wildlife, and grow where other species may not. Instead of asking, "Is this plant invasive?" perhaps a better question to guide conservation effort is, "Does this plant provide ecosystem services and increase biodiversity, or not?"

Black swallow-wort *(Cynanchum louiseae)*
- Milkweed-like plant does not support monarch butterflies; larvae die on it
- Resistant to mowing, burning & grazing

Buckthorn *(Rhamnus cathartica)*
- Fruit can cause digestive problems for birds
- Removal methods include cutting, herbicide treatments & seed bank exhaustion

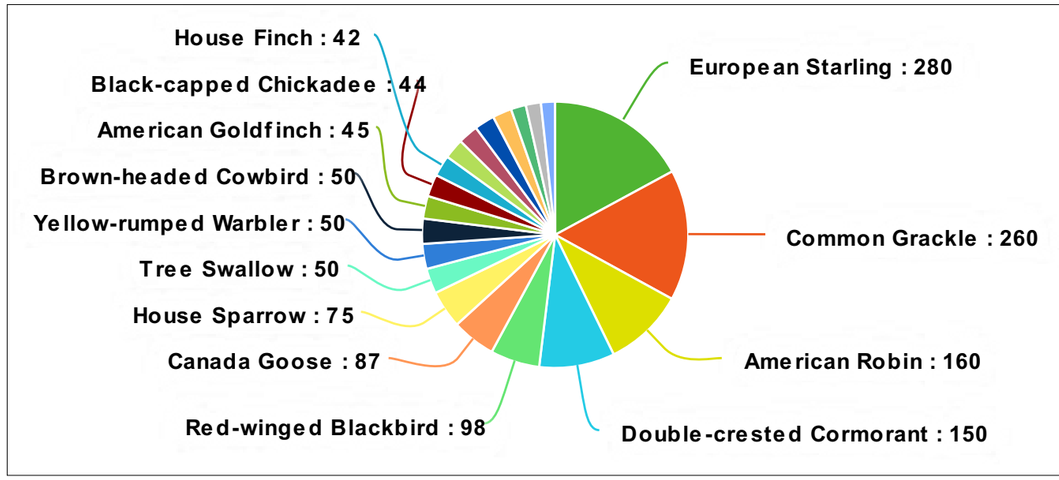
Honeysuckle *(Lonicera japonica)*
- Birds that nest here are typically exposed to higher predatory levels
- Removal includes cutting, herbicides, uprooting & burning

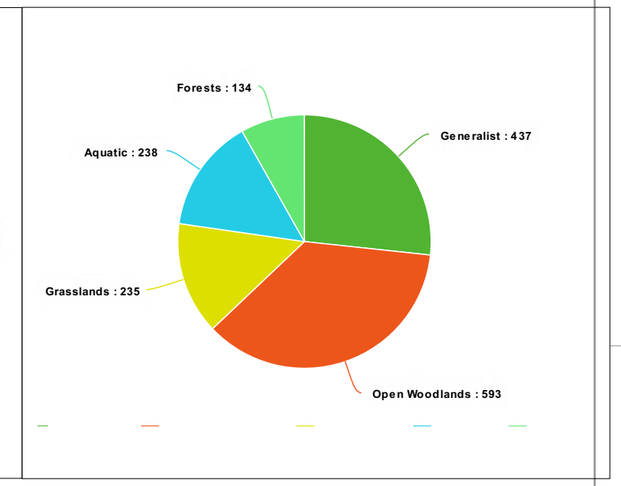
WILDLIFE

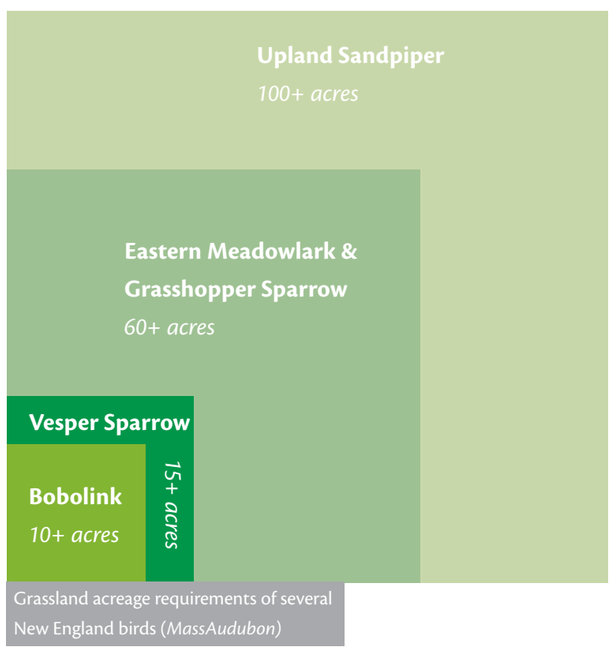


According to the BioMap2 statewide habitat assessment, Rock Meadow does not currently host any priority or "core" wildlife habitat for rare species; but, it *is* adjacent to the wooded North Beaver Brook Reservation, a priority habitat of rare species. However, Rock Meadow's diverse plant communities, low-impact recreational development, abundant wetland habitat (including a certified vernal pool), and regionally unique meadow systems certainly allow the site to support a rich suite of species—including birds, reptiles, amphibians, and mammals. Moreover, if its meadows are maintained properly and with sufficient contiguous habitat, Rock Meadow may be able to attract rare species like grassland-dependent birds—a severely declining population in New England. Opportunities exist to increase and enhance meadow habitat through expanding acreage, removing aggressive species like black swallow-wort, and seeding of native warm-season grasses. Additionally, by creating productive edges between woodlands and meadows—called *ecotones*—novel plant communities can be encouraged that like disparate habitats and support a greater diversity of wildlife. Examples of ecotones at Rock Meadow could include early successional shrubland or open savanna. Based on community meetings, the three most important wildlife groups the public wants to see at Rock Meadow are (1) birds (grassland birds, in particular), (2) pollinating insects like butterflies, and (3) bats.

Recorded Birds at Rock Meadow → Preferred Habitat







The pie charts above show (1) the thirteen most-sighted bird species at Rock Meadow in the last ten years, and (2) the total number of birds that are specialists to each preferred habitat on site. Bird species at Rock Meadow range from generalists to specialists, exotic to native, and wetland to interior forest species. Despite being composed of almost 50% meadow (by acreage), Rock Meadow the data indicate that—at least in relation to bird habitat—the site is functioning more as an "open woodland" than "grassland" based on the types of birds visiting the site. Grassland-dependent species require at least ten acres of perceived grassland (see table at left), so an expansion of current meadow systems would need to occur to achieve the requirements for many grassland nesting birds of New England.

BOBOLINKS

- A rare species for Rock Meadow—of cultural value; declining populations; declining habitat
- Preferred habitat: 10 acres of contiguous grassland; few forbs

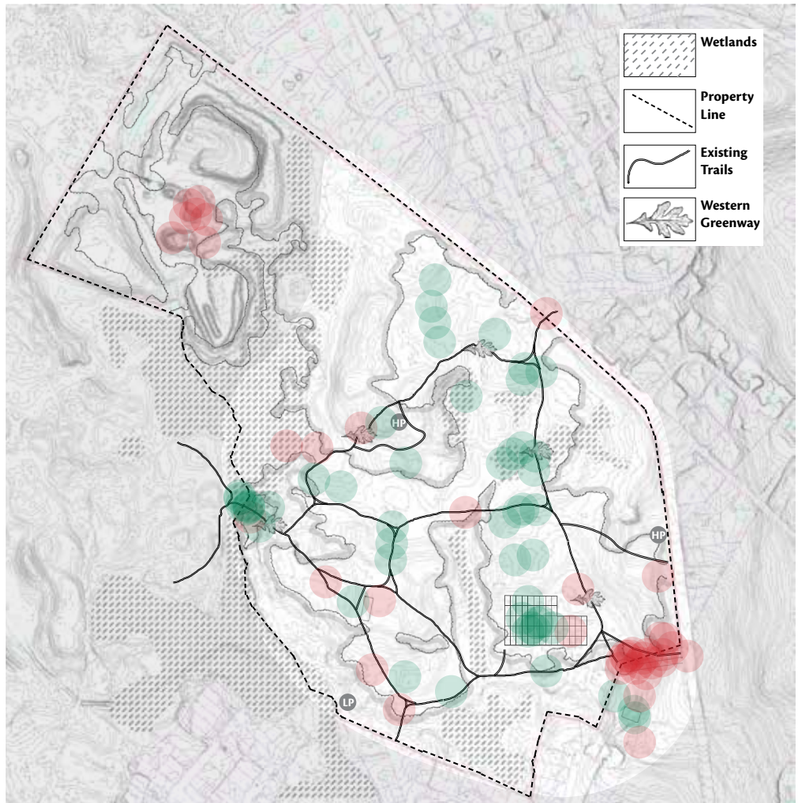
BATS

- Rare species and historically present in area
- Habitat: proximity to insect-rich sites, tree snags for roosting

POLLINATING INSECTS

- Pollinator-supporting flowers threatened by exotics & pesticides
- Flowers may conflict with grassland-nesting birds, which prefer limited flower composition in meadows

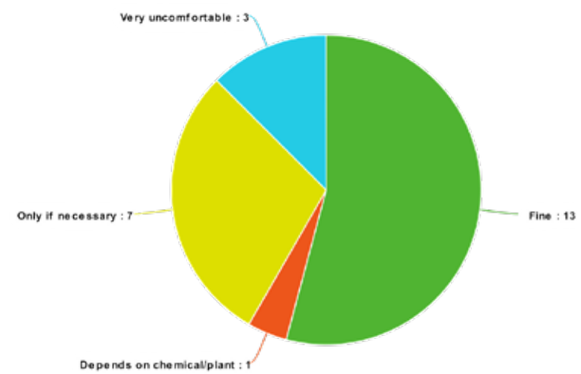
COMMUNITY ENGAGEMENT



Composite map of "assets" (green) and "conflicts" (red) as determined by the community

Two community meetings were conducted—on May 8 and May 26, 2018—to present initial site analyses and gather public feedback on design priorities. Each meeting followed the same format: first, a presentation of current findings, analyses, and/or designs; second, an individual mapping activity and questionnaire; and third, a group mapping activity wherein each cluster of community members came to consensus and presented to the group. Both individual and group responses were recorded and compiled into maps—like the one at left showing a composite of individual "assets" and "conflicts" at Rock Meadow—charts, and word clouds, which yielded important findings. Consistent with the composite map, beloved features of Rock Meadow include the Victory Gardens and the "quiet openness" of the meadows, while conflicts or desired changes include the arrival experience and parking lot, as well as the spread of "invasive" plants. As a testament to the level of concern about such plants, when asked about the use of herbicides to control their spread, more than half of the meeting participants said they accepted their use.

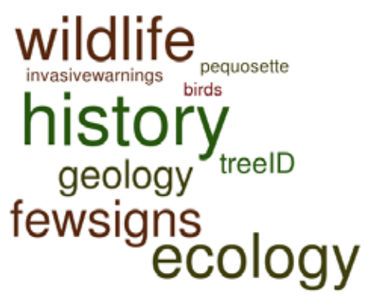
"How do you feel about the use of herbicides to control exotic/ aggressive plants?"




Community meeting on May 29 at Belmont Town Hall

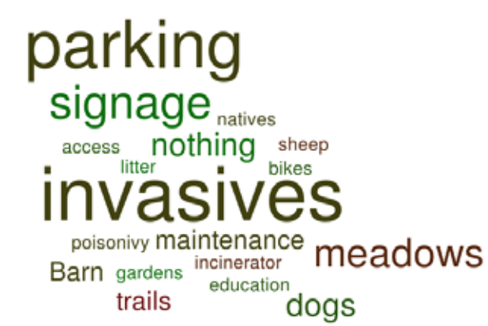
"What wildlife would you like to encourage?"

"What should the eco-historical tour highlight?"

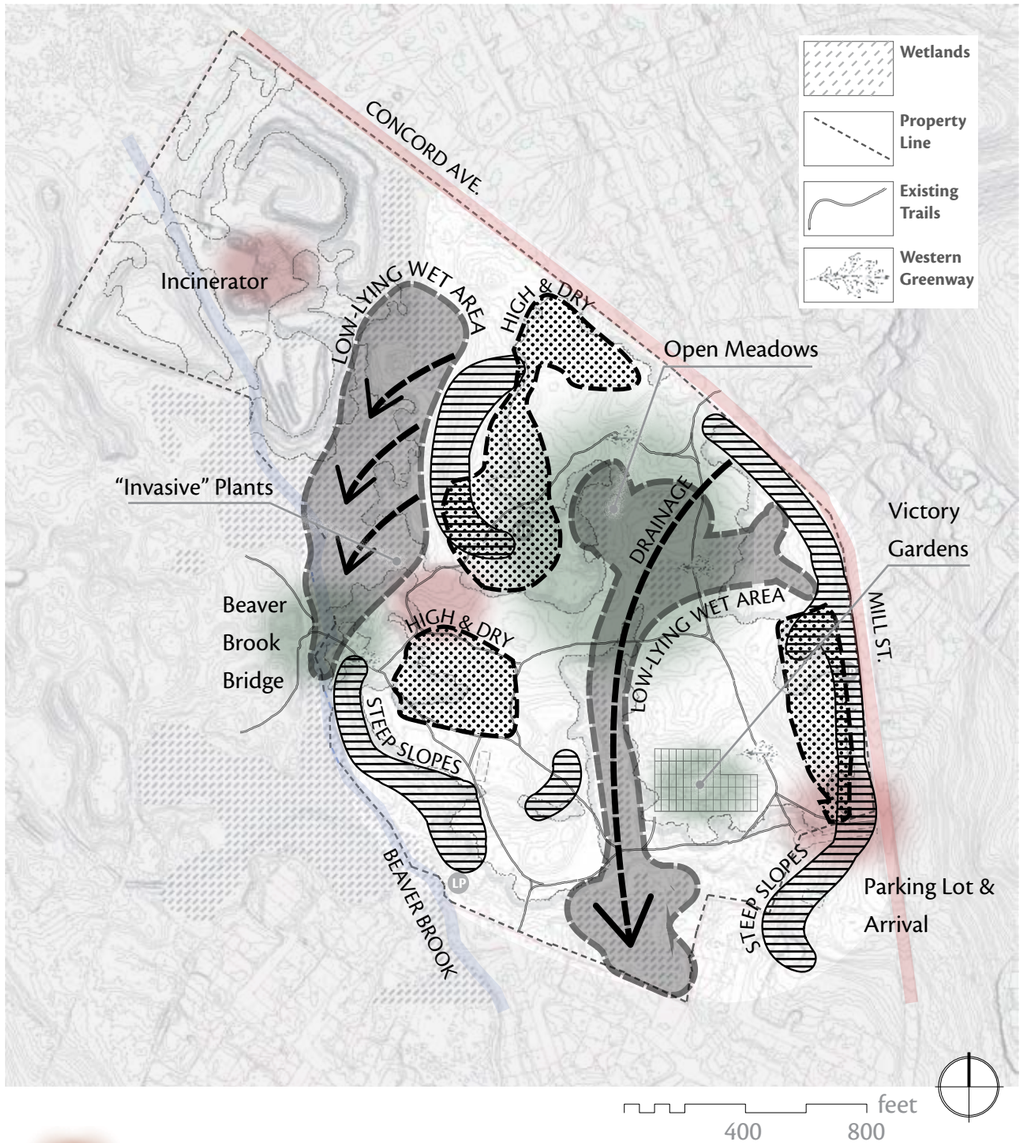


"Why do you come?"

"What would you change?"



SUMMARY ANALYSIS



conflicts/concerns

assets/joys

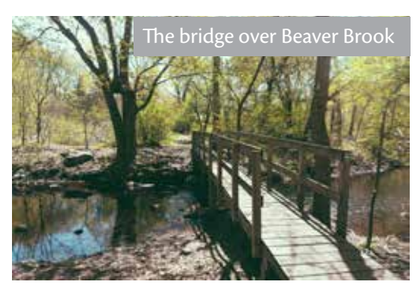
Rock Meadow is a beautiful and diverse landscape with differing micro-climates, terrains, and experiences throughout the site. This diversity provides both design challenges and opportunities.

The site is bordered by two northwest-southeast axes: Concord Avenue and Mill Street to the east and Beaver Brook to the west. Both corridors abut strips of steep slopes (15-50%) at their respective segments spanning the southern parts of the property; the high point at Mill Street (190') is thirty feet higher in elevation than Beaver Brook. The western axis of Beaver Brook—along with the wooden bridge that connects Rock Meadow to Beaver Brook Reservation—is a beloved feature of the site. The eastern axis roads, however, form an unpleasant channel of vehicular traffic and noise that creates disharmony with the open, peaceful meadows within the conservation area. The arrival experience at the main entrance off Mill Street is the community's greatest source of dissatisfaction—not only because of high traffic speeds that endanger pedestrians crossing from Habitat Wildlife Sanctuary, but also because the steep, narrow, and eroding parking lot has poor delineation, disintegrating signs, and unwelcoming vegetation. Because of steep slopes along Mill Street, leveling the entry could be difficult without relocating and paving a more sinuous driveway—a financially and ecologically costly option—or raising the existing drive by importing sub-grade fill.

The other major, community-voiced discontents with Rock Meadow include the old incinerator site—which is soon-to-be converted into non-commercial or -residential developments and outside the scope of this project—and areas most affected by exotic, opportunistic ("invasive") plant species that can crowd out otherwise diverse communities of flora. The most extensive of these occur in drier areas. The species of concern are black swallow-wort (red, below), buckthorn (purple), and honeysuckle (yellow)—the latter two being limited to disturbed woodland edges and the former restricted to open meadows. Exotics in wetter areas, and more localized populations, include garlic mustard and Japanese knotweed.

Generally speaking, "concern" zones occur at edges, gateways, and perimeters, whereas site assets are related to Rock Meadow's openness.

Pathways traverse Rock Meadow's undulating landscape of high, dry knolls and low, wet marshes and streams; they intersect wetlands at three different points and steep slopes at two different points. Any new trails should abide by wetland regulations (no cut, no fill) and will require some regrading to be ADA-compliant.


The bridge over Beaver Brook


Entry drive from Mill St.: 15% slopes


Dominant exotics distribution

VISION & DESIGN ALTERNATIVES

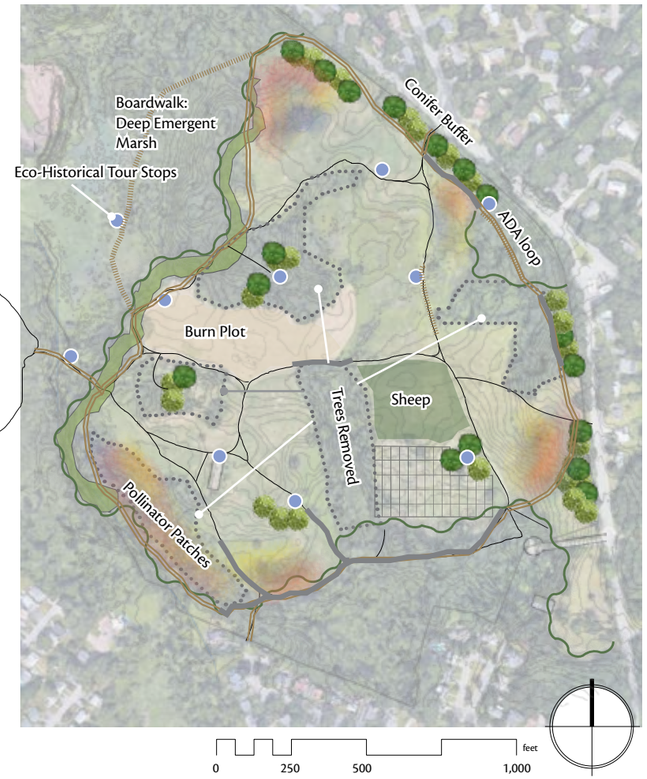
During the first community meeting, participants expressed their desire to create an overarching vision statement to capture Rock Meadow's core identity, inform design alternatives, and guide conservation efforts into the future. The statement below was approved by the community on May 29th and used to inform design alternatives. These initial directions focused on preserving open grassland, improving the accessibility of trails, and selecting appropriate locations for eco-historical signage and educational points. They were then synthesized to create a final design.

Rock Meadow Vision Statement

"Rock Meadow shall be a meadow for years to come, continuing its hallowed legacy borne from glaciers and preserved by the First Peoples for thousands of years. It will be home to thriving plants, abundant wildlife, and rich dark soils. For the people of Belmont and the surrounding region, Rock Meadow shall be a refuge that supports both tranquil stillness and mindful movement through the experience of nature. It shall be safe and accessible to all and serve as a unique and stunning linkage to the rest of the forested Western Greenway. It shall be an educational hub through which Belmont's ecological and cultural past and present may be witnessed and celebrated.

Rock Meadow shall be a verdant sanctuary where humans and nature meet—indeed, where they may be one."

HISTORY & HABITAT



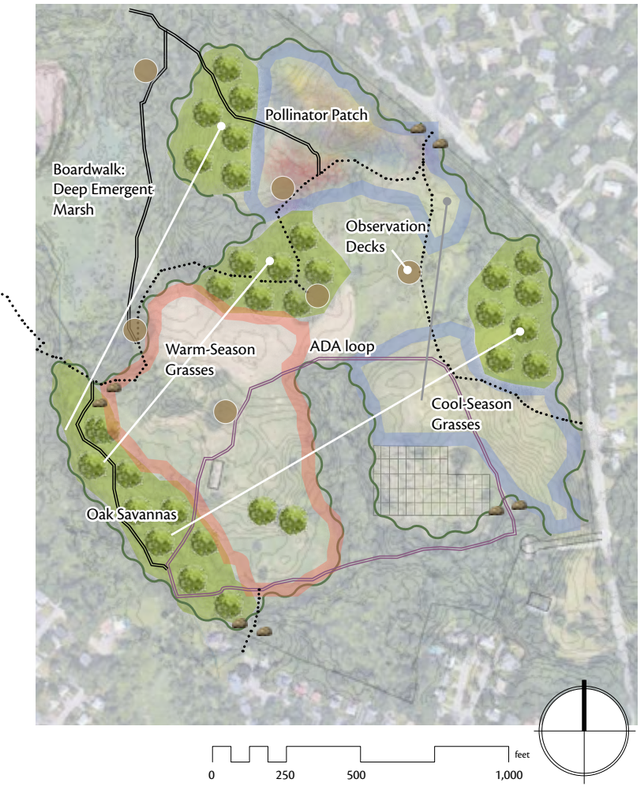
PROS

- Maximum grassland nesting bird habitat & open meadow
- Burn and grazing plots add fertility/organic matter to soil
- Pollinator patches punctuate entrances
- Added trail segment through deep emergent marsh
- Mixed evergreen buffer to shield from traffic on Concord Avenue
- Robust eco-historical tour with unobtrusive educational signage

CONS

- Significant loss of existing woodland cover
- New ADA-compliant loop at perimeter is impactful & close to roads
- Mountain bikers & dog-walkers prohibited from inner trail network during grassland bird nesting season

IN THE PARK



PROS

- Oak savanna eco-tone introduces habitat & vegetation diversity
- Meadow diversity: two cool-season grass areas; one warm-season
- Added trail segment through deep emergent marsh
- Observation decks with educational signage
- Forbs limited to north meadow to preserve grassland bird habitat
- ADA-compliant path is the smallest loop for least impact

CONS

- Too "park-like" and curated (community feedback)
- Observation decks: costly and possibly impactful
- Significant reduction of trails & easy passage throughout the site

FINAL DESIGN: *The Meadows*

Trail Updates & Additions

An ADA-compliant, crushed gravel trail loop (maximum 5% slope) provides wheelchair access to the Victory Gardens, Piggery Picnic Area, western oak-hickory savanna, and natural playground. New trail segments include: 1 a wooden boardwalk running north-south through the deep emergent marsh, 2 a compacted earth path that bisects the north meadow and leads to the former landfill site, and 3 an extended loop emerging from the central woodland to an observation deck. Additionally, several existing trail segments are removed from the west meadow to establish optimum grassland bird nesting habitat and the burn plot.

Oak-Hickory Savannas

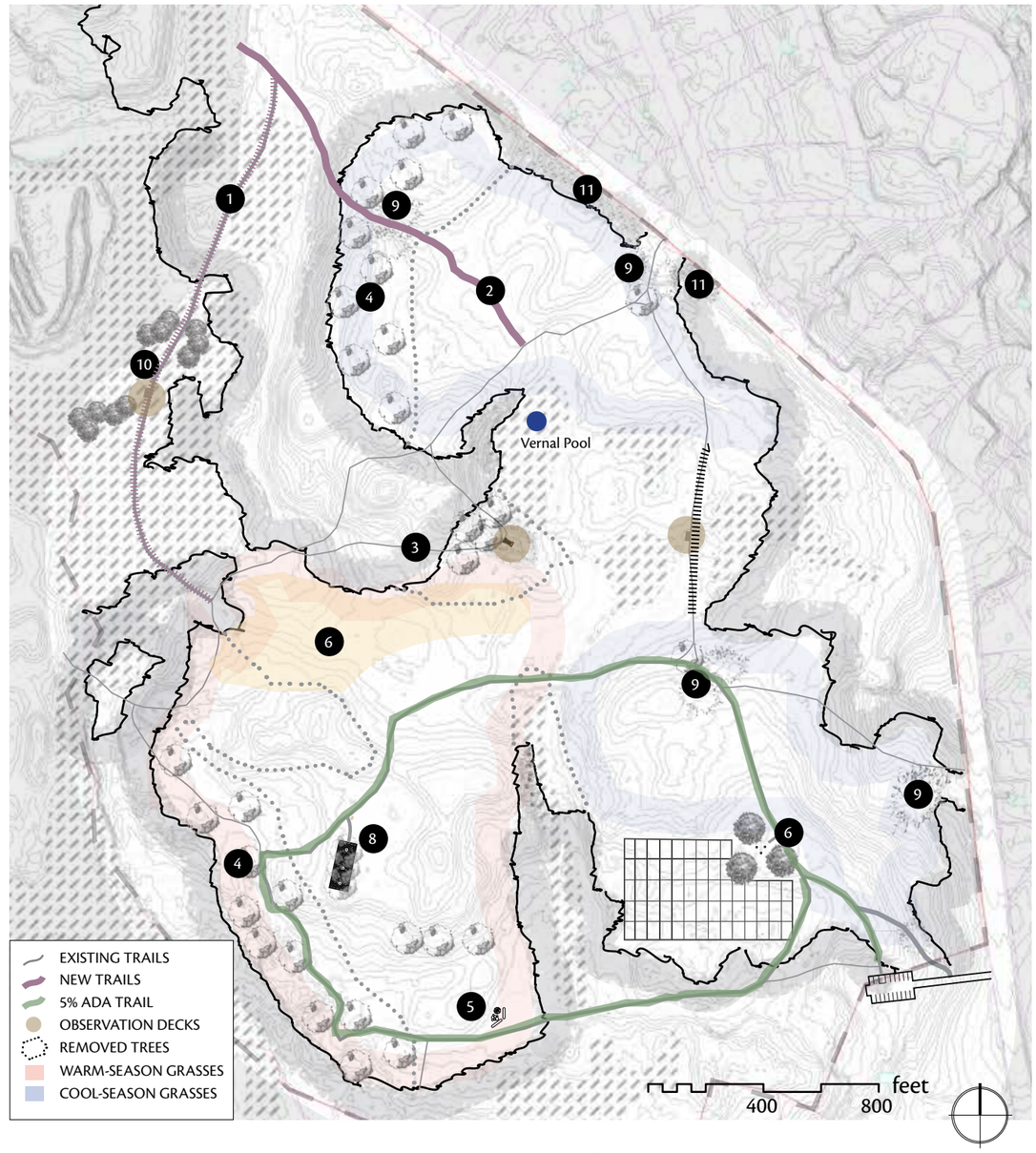
Two sections of existing edge woodland are cleared and replanted with groves of oaks and hickories 4 above an understory of shade-tolerant grasses, which may be managed through grazing or mowing. These savannas provide fat- and protein-rich nuts for wildlife and edge habitat as an ecotone between meadow and woodland.

Meadow Expansion

Three additional areas of woodland are removed to expand existing grassland habitat to 40+ contiguous acres: 1) the tip of the central wooded hill, 2) copses in the west meadow, and 3) a portion of the "southern finger" extending west of the Victory Gardens. This provides suitable acreage for bobolinks (requiring 10 contiguous acres), vesper sparrows (requiring 15 contiguous acres; threatened in Massachusetts), and savanna sparrows (requiring 25 contiguous acres). The west meadow is managed as warm-season native grassland with few forbs; the east and north meadows remain as cool-season fields seeded with pollinator-supporting flowers.

Observation Decks

Three inconspicuous wooden overlooks are strategically placed 1) adjacent the existing central wetland boardwalk, 2) off the newly proposed boardwalk in the northwestern deep emergent marsh, and 3) atop the central wooded hills with a view to the surrounding meadows below. Signs on decks detail key ecological elements on site, such as wetland flora, Atlantic white cedars, and the vernal pool.



Natural Playground & Garden Gathering Area

Replacing or accompanying the swingset in the southern corner of the west meadow is a nature-inspired playground 5 of logs, stumps, and rock piles. Another gathering and picnic area is located northeast of the Victory Gardens 6, enclosed by the existing copse of white pines.

Burn Plot in West Meadow

A 2- to 3-acre experimental burn plot 7 is established south of the central woodland as an homage to the Pequosette legacy of maintaining Rock Meadow through fire. A controlled burn every two years in early spring encourages native warm-season grasses, builds soil fertility, and limits the growth of woody and exotic plant species.

Grazing Plots in North & East Meadows, Savannas

Rotational grazing 1- to 2-acre paddocks with sheep and goats maintains and enriches meadows and savannas where mowing and burning don't occur—a tribute to McLean Farm's legacy of food production. Funds from a potential meat CSA program could supplement the Conservation Commission's management budget.

Piggery Picnic Area

The old piggery foundation in the west meadow 8 is reclaimed and transformed into an intentional gathering area with seating and an elevated wooden deck through which three disease-resistant "Accolade" elm varieties rise and shade the 3,000 ft^2 footprint.

Pollinator Patches

Clusters of pollinator-attracting perennial forbs 9 are established to punctuate entrances, thresholds, and trail crossings.

Evergreen Vegetation

Atlantic white cedars 10 line the boardwalk in the deep emergent marsh, introducing an historically important evergreen species to a hardwood-dominated canopy. Red cedar, mountain laurel, and American holly 11 provide cover from Concord Avenue in the north meadow.

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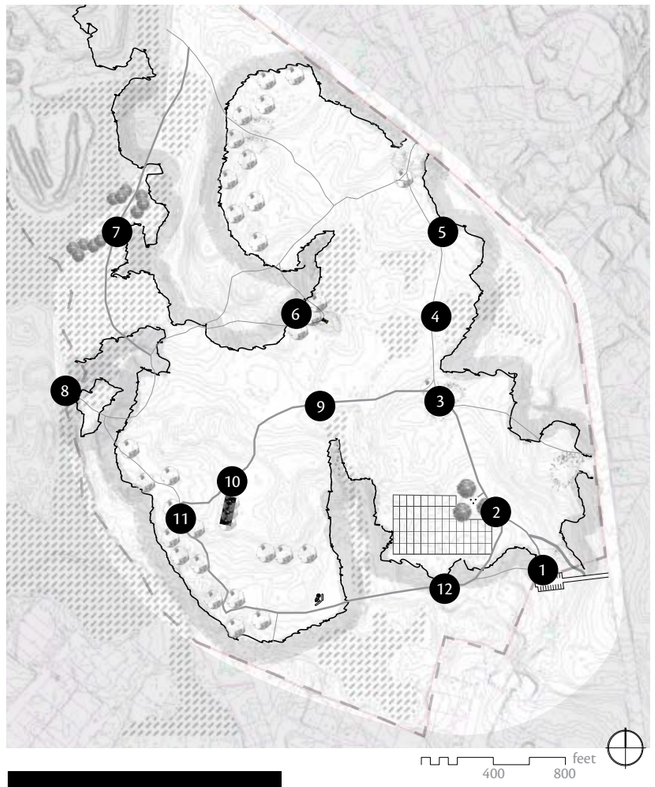
ECO-HISTORICAL TOUR



1 The Eco-Historical Tour at Rock Meadow begins in the landing area north of the parking lot with an introduction to the site's history—from its **geologic history** and **legacy of indigenous management** to its **heritage as McLean Hospital's working farm** and current ***raison d'être* as meadow conservation land** (including the vision statement).

2 The Victory Gardens, established in 1968, present an opportunity to showcase the site's **history of food production** and **current gardening practices and products.**

3 Trail intersections are formalized with boulders at the base of **"sentinel" trees**—labeled specimens that punctuate the landscape and tell **stories about climate change and shifting species composition**.

4 The central **delineated wetland** is an important ecological feature of Rock Meadow whose **function, flora, and beauty** should be celebrated. The **Mystic Valley amphipod** (*Crangonyx aberrans*), a tiny shrimp-like crustacean that inhabits this wetland and is "of special concern" in Massachusetts, can also be highlighted.

5 This **grove of mature black locust** (*Robinia pseudoacacia*) presents an educational opportunity to explore the topic of **invasive species**. Black locust, native to Appalachia, is illegal to plant in Massachusetts because of its vigorous growth rate, but provides innumerable ecosystem services. It grows biomass, and thus sequesters carbon, grows easily in poor, dry soils; it is an effective pollinator; it provides extremely rot-resistant wood for building; it fixes nitrogen in the soil; it has delicious, edible flowers; and it is beautiful and aromatic.

6 An observation deck provides educational information about the **vernal pool** (located 200' to the northeast), **chestnut grove**, and **old rock wall** that runs along the trail loop from the main path.

7 Another observation deck provides access to, and information about, the ***deep emergent marsh*** and gives historical context to planted **Atlantic white cedars**.

8 The bridge over Beaver Brook is commemorated with information about **Belmont Springs**—founded in 1876 using water from Beaver Brook—and the **early colonial textile industry**. Additionally, this tour stop highlights a **"sentinel" cottonwood tree** on the east bank of the brook.

9 A sign provides historical context and education about the role of **prescribed burning** in landscape management, as well as the importance of **warm-season grasses** to **grassland bird nesting habitat**.

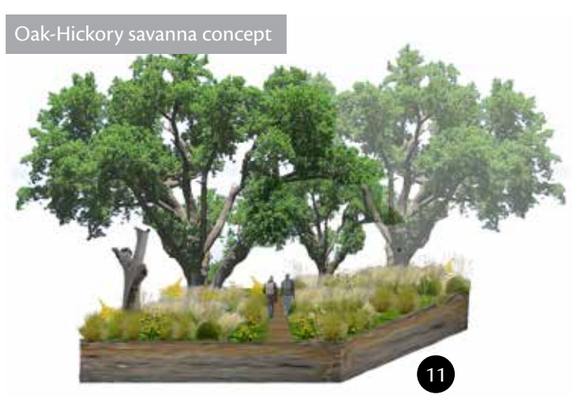
10 The Piggery Picnic Area sign details the legacy of **animal husbandry on the old McLean Farm** and the **history of the American elm** in North America.

11 This trail intersection is marked with signs exploring the **ecological features of the Oak-Hickory savanna**, including wildlife habitat, biodiversity, and indigenous landscape management history. It will also highlight the value of silvopasture (grazing in savannas).


Mystic River amphipod

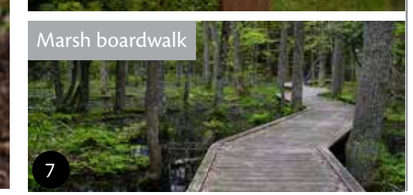

Formalized trail intersections with "sentinel" tree 3


Wetland overlook with educational signage 4


Oak-Hickory savanna concept 11

Sign precedent


Sign precedent


Marsh boardwalk 7

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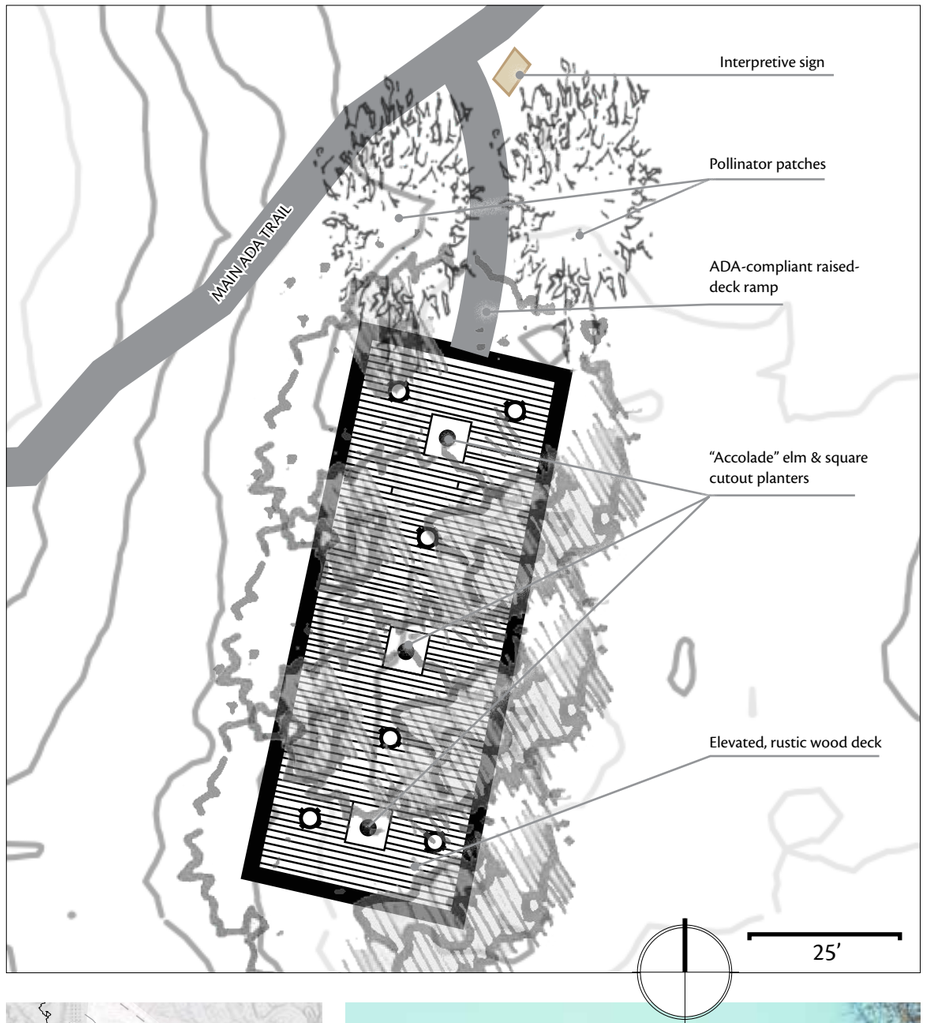
ROCK MEADOW
A Master Plan for Conservation
Belmont, MA

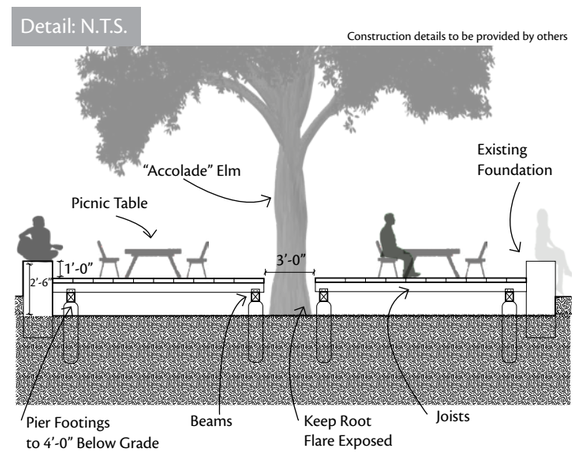
eco-historical tour

DESIGN DETAIL: *Piggery Picnic Area*



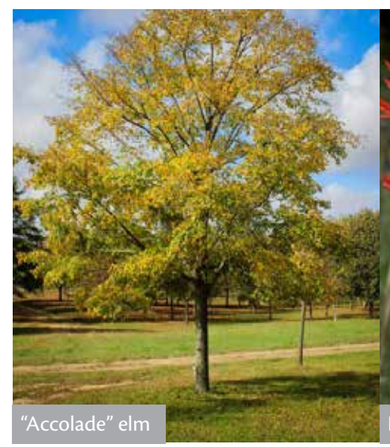
A new picnic and gathering area sits atop the old McLean Hospital piggery foundation and looks out over the billowing warm-season grasses of the west meadow.

A trail spur from the main, universally accessible crushed gravel path gives access to the 3000 ft² "picnic deck" and is flanked by warm-season grasses punctuated by Indian paintbrush (*Castilleja coccinea*)—endangered in much of New England— and interpretive signs communicating the historical significance of the piggery to the meal supply of McLean Hospital in the early 20th century. The sign will also present the history of the American elm (*Ulmus americana*) and its near elimination at the hands of Dutch elm disease. The picnic area itself accommodates at least six tables and is shaded by a hybrid disease-resistant cultivar of Asian elm called "Accolade" (*Ulmus japonica x wilsoniana* 'Morton')—a variety that grows to a 50'-wide canopy. Visitors can also sit or lounge on the low 3'-wide walls along the edge of the structure. An elevated rustic wood deck replaces the old cracking cement flooring to provide a wheelchair-accessible surface. It can be constructed from rot-resistant black locust harvested on site. The Piggery Picnic Area is the primary, large group congregation space at Rock Meadow.




Piggery Picnic rendering


Existing piggery foundation with early-successional shrubs


"Accolade" elm


Indian paintbrush


Rustic wood decking


Square tree planter concept

Not for construction. Part of a student project and not based on a legal survey.

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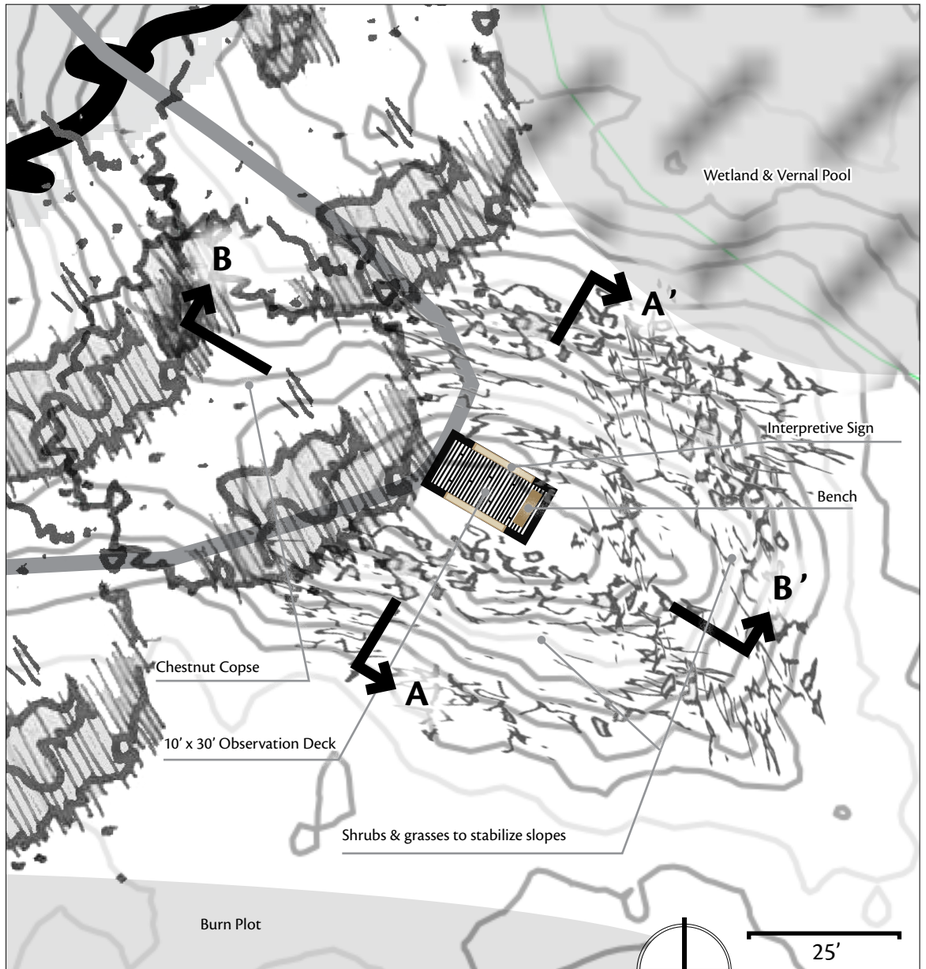
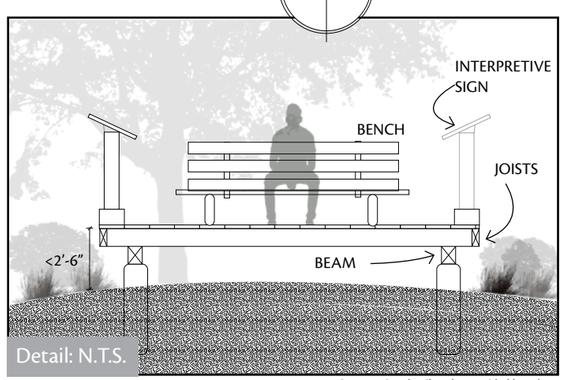
ROCK MEADOW
A Master Plan for Conservation
Belmont, MA

piggery picnic

DESIGN DETAIL: *Observation Deck*





Detail: N.T.S.

Construction details to be provided by others

At one of the high promontories on site, a spurred loop off the main woodland trail leads to a rustic wooden observation deck that provides expansive views of Rock Meadow—including of the grasslands, wetlands, and Piggery Picnic Area.

This area of the site's "uplands," 200' south of the certified vernal pool, are cleared of existing woodland (leaving the roots masses intact) and the steep slopes are replanted with low-growing shrubs and meadow grasses, as well as a stand of blight-resistant chestnut northwest of the observation deck. The chestnut variety, *Castanea dentata x mollissima,* is a hybridized cultivar called "Dunstan" that grows up to 60' tall, bears nuts in 3-5 years, and serves as an important food source for wildlife. Interpretive signs on the observation deck will detail the history of the American chestnut (as well as the chestnut blight), and highlight the adjacent vernal pool and burn plot. Like the Piggery Picnic, observation decks can also be constructed with in situ black locust. It features a small bench facing southwest, with sweeping meadow views. Slopes up to the observation deck are between 30-50% and therefore may require stone or wooden steps to access. If this area is within 100' of a delineated wetland, construction will require permitting.

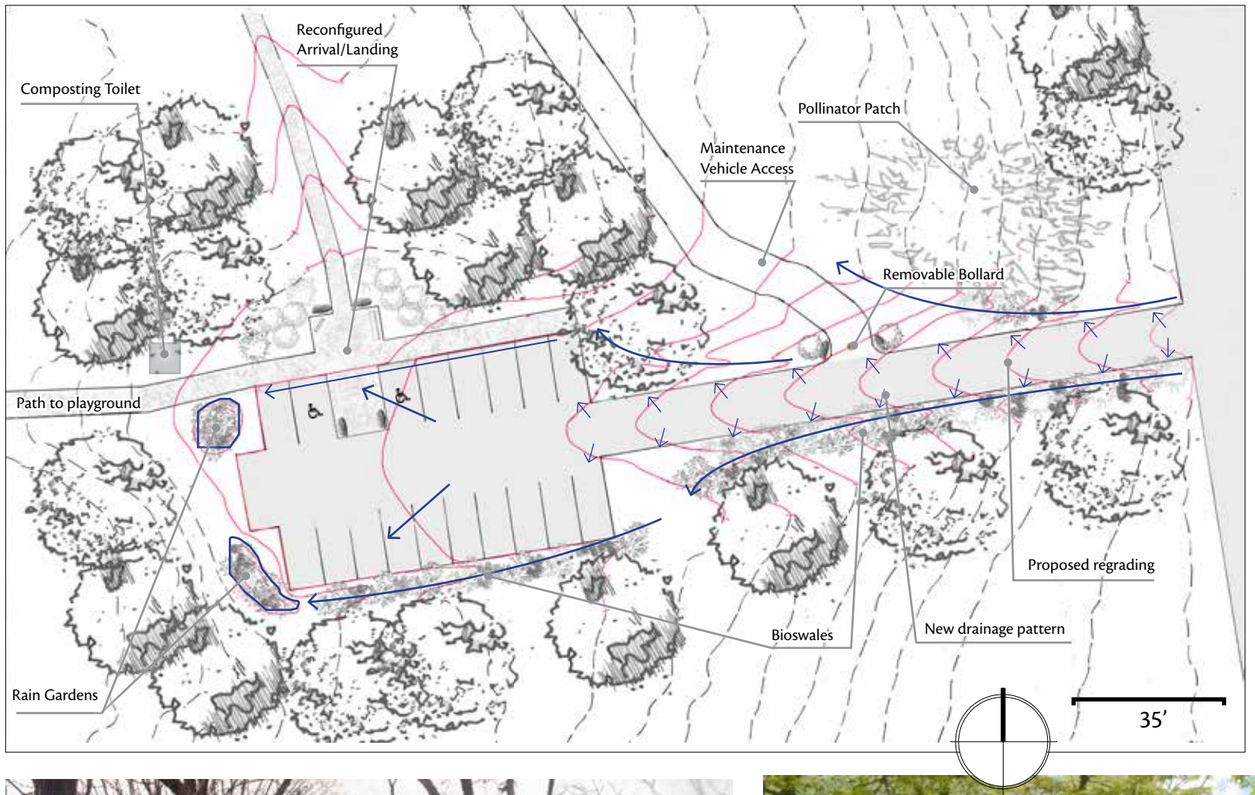
Section A-A' N.T.S.

Section B-B' N.T.S.

Castanea dentata

Not for construction. Part of a student project and not based on a legal survey.

FINAL DESIGN: *The Parking Lot*



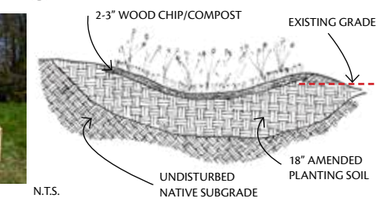
"The entrance described is not attractive and does not do justice to the beautiful area beyond. In addition to the falling-away grade, the awkward circulation pattern, and the poor definition of edges, there is widespread littering and vandalism that contribute to the unkempt appearance of Rock Meadow's entrance." — *A Program for Renewing Rock Meadow* (1968)

The entrance to Rock Meadow was seen in 1968 as unattractive, unkempt, and disorganized. Today, not much has changed: The driveway is too steep (15%) and narrow (14' wide), the parking lot is eroding and puddled, and the surrounding vegetation lacks intentional design. This design proposes expanding the entry drive to 16' wide, repaving and regrading the entire lot (<5%), and delineating 18 parking spots—including two ADA-compliant spaces adjacent to a crushed gravel landing zone. Bioswales—vegetated trenches—clean and direct runoff from crowned impervious surfaces into two rain gardens west of the parking area where water is infiltrated. The northern edge of the parking lot is curbed to avoid drainage onto the landing zone. Northern views to the meadow are kept unobstructed as visitors are greeted by a vibrant, low-growing pollinator patch. A removable wooden bollard prevents visitors from driving down the maintenance vehicle access drive. The stepped path to the west meadow is redirected north of the lot to connect with the crushed stone landing area and ADA-accessible path, where updated "welcome" information is condensed to one kiosk. An ADA-compliant, enclosed chamber composting toilet is located north of the rain gardens. A dense threshold of boulders and shrubs signals the entrance to the expansive meadows.


Current arrival experience from the main parking lot


Proposed arrival experience


Composting toilet




Pollinator bioswale

Not for construction. Part of a student project and not based on a legal survey.

COST ESTIMATE & PHASING

Element	Unit	Quantity	Low cost/unit ($)	High cost/unit ($)	Low subtotal ($)	High subtotal ($)
Demolition						
Asphalt removal	square yard	746	18	25	13,428	18,650
Clearing and grubbing	acre	6	4,000	6,000	24,000	36,000
Tree removal	each	250	250	500	62,500	125,000
Site improvements						
Grading	square foot	8,500	0.15	0.25	1,275	2,125
Trails: stone dust	ton	375	15	18	5,625	6,750
Asphalt parking	square foot	8,200	7	9	57,400	73,800
New trails	square foot	4,080	2	3	8,160	12,240
Boardwalk	square foot	1,300	40	50	52,000	65,000
Landscaping						
Trees (3'4" caliper)	each	20	500	750	10,000	15,000
Shrubs	lump sum	300	30	40	9,000	12,000
Groundcover	acre	0.3	3,500	6,500	1,050	1,950
Warm-season meadow seed	pound	322		24		7,728
Wet meadow seed	pound	72		135		9,720
Semi-shade meadow seed	pound	210		87		18,720
Wildflower seed	pound	92		86		7,912
Boulder	each	12	0	0	0	0
Amenities						
Willow tunnel (playground)	each	1	500	1,000	500	1,000
Build-your-own lean-to	each	1	500	1,000	500	1,000
Play log	each	5	0	0	0	0
Wood bench	each	4	800	1,000	3,200	12,800
Decking	square foot	3,320	40	50	132,800	166,000
Sign (small directional)	each	8	250	400	2,000	3,200
Sign (large information)	each	6	1,500	4,000	9,000	24,000
Picnic table	eavh	6	800	1,000	4,800	6,000
Trash receptacle	each	4	800	1,000	3,200	4,000
Kiosk	each	1	500	700	500	700
Composting toilet	each	1	5,000	7,000	5,000	7,000
Subtotal					449,018	633,695
Sales tax					67,353	95,054
Design/admin (15-25%)					66,761	182,187
Contingency (10%)					51,637	72,874
TOTAL					**$634,769**	**$983,810**

Phase 1: *Year 1-4*

- **Replace parking lot**
  - — Remove asphalt
  - — Import fill, regrade, and repave
  - — Install bioswales and rain gardens
  - — Install trees and vegetation
  - — Install kiosk, trash receptacle, composting toilet, and boulders
- **Regrade and install universally accessible trail loop**
- **Install new trail section** (north meadow)
- **Install trail intersection "nodes"**
  - — Plant sentinel trees
  - — Place boulders
- **Clear trees and seed west meadow** (warm-season grass seed mix) in May/June
- **1st round: thin, plant, and seed oak-hickory savannas**
- **Seed and plant wet meadow**
- **Plant evergreen buffer (Concord Avenue)**
- **Plant pollinator patches**

Phase 2: *Year 4-7*

- **Install central hill observation deck**
  - — Clear trees on hill and re-plant with shrubs on steep slopes
- **Plant "Dunstan" chestnut grove**
- **Install Piggery Picnic Area**
  - — Seed Indian paintbrush
  - — Concrete footings, beams, joists, and decking
  - — Plant "Accolade" elms
  - — Install picnic tables
- **2nd round: thin, plant, and seed oak-hickory savannas**

Phase 3: *Year 7-10*

- **Install boardwalk through deep emergent marsh (and observation deck)**
  - — Plant Atlantic white cedar and shrubs
- **Install observation deck in central wetland**
- **Install natural playground**
- **3rd round: thin, plant, and seed oak-hickory savannas**

ESTABLISHMENT & MANAGEMENT

West Meadow

After clearing trees and seeding with warm-season grasses in early spring or late fall, the west meadow is mowed every six weeks thereafter for one year to deter cool-season grasses maximizing light availability for warm-season seedlings. For the following two years of this 3 year establishment phase, mowing occurs before August 15 when warm-season grasses form root systems and growth rates are high. During establishment, grassland birds will be unable to nest due to the timing and frequency of mowing. After this period, mowing takes place annually in early spring, allowing for the return of grassland nesting birds. Thatch is removed every three years to allow for regeneration of warm-season grasses and to provide clear, "dusty" areas for nesting habitat; it is composted in the Victory Gardens or other meadows.

Burn Plot

Burning should take place between March 1 and April 15 every two years, and should be conducted by a licensed burn crew. Prescribed fire is the most effective way to maintain and rejuvenate warm-season grasslands: it releases nutrients back into the soil, clears thatch, promotes the growth of native grasses, deters undesired plant species, and does not rely on as many fossil fuels as mowing requires. Burned grasslands have higher avian nesting densities than unburned sites, and produce more succulent vegetation that supports more wildlife and insects as a food source for visiting birds ("Maintaining and Restoring Grasslands").

Central Wetland

Currently, the central wetland has high integrity in terms of species richness and diversity. To further enhance ecological function, the wet meadow is planted in early spring or late fall with a mix of shrubs and forbs (see Plant Palette III). Further study of hte functions of the channelized waterway that drains the wetland is recommended and may reveal opportunities for restoration of the original wetland.

Exotic Plant Management

PHASE 1—*First five years*: In April, buckthorn and honeysuckle are brush-hogged, removed, and stem-injected with Glyphosate, then replaced with native shrubs. In June, black swallow-wort stands are mowed during flowering, and a month later spot-treated with Triclopyr (a chemical that doesn't affect grasses), and replanted with grasses. In August, Japanese knotweed is stem-injected with Glyphosate and replaced with shade-tolerant herbaceous plants. Volunteers are recruited to hand-pull garlic mustard and mugwort.

PHASE 2—*Next five years*: Manual removal and replacement of buckthorn and honeysuckle continues. Regrowth of Japanese knotweed is mowed and replaced again. Hand-pulling efforts are organized for remaining populations of black swallow-wort.

PHASE 3—*Ongoing*: Continue manual removal of stands without herbicide applications.

North & East Meadows

Cool-season grasses are already established in these meadows, and therefore the meadows require only continued mowing, which should occur at least annually outside of the May 15-August 15 grassland bird nesting window. One-acre paddocks are delineated to be rotationally grazed by sheep and/or goats at a stocking rate of at least 1,000 pounds of "animal weight" per acre (eg. 10, 100-pound sheep per acre) (UMass Extension). Pastures are left to recover for 2-6 weeks after they are grazed to 3"-tall grass. Soil tests are taken to monitor soil fertility and organic matter increases.

Existing Woodland

Efforts to maintain oak-hickory canopies are continued by removing any aggressive exotic trees. Tree snags are left untouched, and more are created to provide more roosting habitat and food sources for bats. Wildlife-supporting understories are planted, including blueberry, hazelnut, and dogwood. Partner with the American Chestnut Foundation to support ongoing efforts to re-introduce the species in Rock Meadow.

Oak-Hickory Savannas

These areas are cleared and grubbed of other tree species and understory shrubs, and reseeded with shade-tolerant grasses to be mowed every six weeks during the growing season for one year until establishment. Cut trees are used for the natural playground logs or left to decompose and provide habitat in woodlands. Oaks and hickories are planted at a density of 25 trees per acre at 30' spacing with no more than 50% canopy coverage. Grasses may be mowed annually after establishment, or rotationally grazed under the trees in a silvopasture system, which is an important climate change resiliency technique (Project Drawdown, "Silvopasture"). If woody shrubs appear, brush hog or graze with goats, making sure to protect young trees.

Pollinator Patches

Portions of the north and east meadow are tarped for a season to kill grasses, then reseeded with perennial wildflowers (four pounds per acre) in late winter. Patches are mowed every six weeks during the growing season to suppress annuals. Following establishment, they are mowed every two years.

PLANT PALETTE I

MAIN ENTRANCE/PARKING LOT

Trees

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Asimina triloba	pawpaw	15-30'	Full sun to part shade	May-September
Fagus grandifolia	American beech	50-80'	Part to full shade	Year-round

Shrubs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Hamamelis virginiana	American witchhazel	10-15'	Part to full shade	September-December
Corylus americana	American hazelnut	6-12'	Part to full shade	April-June
Cornus sericea	red-osier dogwood	6-12'	Part shade	Year-round

Forbs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Asclepias tuberosa	butterflyweed	1-2'	Full sun	May-September
Eutrochium purpureum	purple joe-pye weed	2-6'	Full sun to part shade	July-September
Veronia noveboracensis	New York ironweed	5-8'	Full sun	August-September
Liatris spicata	spiked gayfeather	3-4'	Full sun	July-September
Onoclea sensibilis	sensitive fern	1-3'	Part to full shade	June-Novemeber
Osmunda cinnamomea	cinnamon fern	3-6'	Full sun to part shade	May-June

Grasses

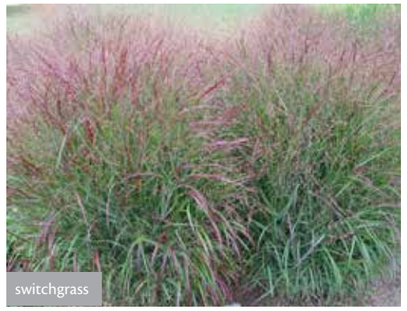
Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Panicum virgatum	switchgrass	3-6'	Full sun	August-November
Eragrostic spectabilis	purple lovegrass	1-2'	Full sun	August-September
Calamagrostis canadensis	Canada blue joint	3-6'	Full sun to part shade	June-August
Juncus tenuis	path rush	1-3'	Part shade	April-May


pawpaw


witchhazel


hazelnut


New York ironweed


switchgrass


cinnamon fern


butterflyweed


purple lovegrass


red-osier dogwood

PLANT PALETTE II

WEST MEADOW

Grasses

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Schizachryium scoparium	little bluestem	2-4'	Full sun	June-December
Andropogon geradii	big bluestem	4-8'	Full sun	August-November
Sorghastrum nutans	indian grass	3-8'	Full to part sun	August-October
Festuca rubra	red fescue	1-3'	Full sun	April-September
Panicum virgatum	switchgrass	3-6'	Full sun	August-November

OAK-HICKORY SAVANNA

Trees

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Quercus alba	white oak	80-100'	Full sun	October (acorns)
Quercus macrocarpa	bur oak	80-100'	Full sun	October (acorns)
Carya ovata	shagbark hickory	70-90'	Full to part sun	October (hickory nuts)
Carya glabra	pignut hickory	50-80'	Full to part sun	October (hickory nuts)

Grasses

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Elymus canadensis	Canada wild rye	2-4'	Full to part sun	March-June
Festuca rubra	red fescue	1-3'	Full sun	April-September
Elymus virginiana	Virginia wild rye	2-4'	Full sun	March-May
Juncus tenuis	path rush	1-3'	Part shade	April-May

Forbs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Chamaecrista fasciculata	partridge pea	1-3'	Full to part sun	June-October
Liatris spicata	spiked gayfeather	3-4'	Full sun	July-September
Onoclea sensibilis	sensitive fern	1-3'	Part to full shade	June-November
Solidago flexicaulis	zigzag aster	2-4'	Full to part sun	July-October
Eutrochium fisulosum	hollow-stemmed joe-pye weed	2-7'	Full to part sun	July-September
Eupatorium perfatolium	boneset	3-6'	Full to part sun	June-October


little bluestem


big bluestem


red fescue


indiangrass


switchgrass


sensitive fern


zigzag aster


shagbark hickory


boneset

Graduate Program in Sustainable Landscape Planning + Design
the ConwaySchool
Sam Freedman | Taurean Gagnon
Spring 2018

ROCK MEADOW
A Master Plan for Conservation
Belmont, MA

PLANT PALETTE III

CENTRAL WET MEADOW

Shrubs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Cornus ammomum	silky dogwood	6-12'	Part to full shade	March-April
Cornus sericea	red-osier dogwood	6-12'	Part shade	Year-round
Ilex verticillata	winterberry	6-10'	Full to part sun	April-January

Forbs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Euthrochium maculatum	spotted joe-pye weed	3-6'	Full to part sun	August-September
Mimulus ringens	square-stemmed monkey flower	2-4'	Full sun	June-September
Iris versicolor	blue flag iris	2-3'	Full to part sun	May-August
Symphyotrichum laterflorum	starved/calico aster	2-3'	Full to part sun	August-October
Veronia noveboracensis	New York ironweed	5-8'	Full sun	August-September
Asclepias incarnata	swamp milkweed	2-4'	Full to part sun	June-September
Bidens aristosa	beggar ticks	3-6'	Part sun	July-August
Junuc effusus	soft rush	1'	Full sun	July-September
Carex crinita	fringed sedge	1-2'	Part to full shade	July-September
Schoenoplectus tabernaemontani	green bulrush	6-9'	Full sun	April-May
Poa palustris	fowl bluegrass	1-2'	Part sun	April
Carex lupulina	hop sedge	1-2'	Part shade	March-April
Glyceria grandis	American mannagrass	3-6'	Full sun	May-August
Carex lurida	lurid sedge	1-3'	Part sun	March-May
Carex tribuloides	blunt broom sedge	1-3'	Part sun	April-May
Carex vulpinoidea	fox sedge	1-3'	Part sun	July-August

DEEP EMERGENT MARSH

Trees & Shrubs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Chamaecyparis thyoides	Atlantic white cedar	40-75'	Part shade	Year-round
Clethra alnifolia	sweet pepperbush	6-12'	Full to part sun	July-August
Ilex glabra	inkberry	6-12'	Part shade	June-September


silky dogwood


winterberry


square-stemmed monkey flower


swamp milkweed


spotted joe-pye weed


green bulrush


Atlantic white cedar


sweet pepperbush


inkberry

PLANT PALETTE IV

PIGGERY PICNIC AREA

Trees & Forbs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Ulmus japonica x wilsoniana 'Morton'	"Accolade" elm	35-45'	Full to part sun	Year-round
Castilleja coccinea	scarlet Indian paintbrush	1-3'	Full sun	May-July

OBSERVATION DECK (CENTRAL HILL)

Trees & Shrubs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Castanea dentata	American chestnut "Dunstan"	40-60'	Full to part sun	June-September
Ceanothus americanus	New Jersey tea	1-3'	Full to part shade	March-April
Comptonia peregrina	sweetfern	2-4'	Full sun	May-August

EVERGREEN BUFFER (CONCORD AVE.)

Trees

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Juniperus virginiana	red cedar	30-40'	Full sun	Year-round
Ilex opaca	American holly	25-60'	Full to part sun	Year-round

Shrubs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Viburnum prunifolium	blackhaw viburnum	12-15'	Part shade	April-June
Corylus americana	American hazelnut	6-12'	Full to part shade	April-June
Kalmia latifolia	mountain laurel	12-20'	Full to part sun	June-July


"Accolade" elm


Indian paintbursh


sweetfern


New Jersey tea


red cedar


American holly


blackhaw viburnum


mountain laurel


"Dunstan" chestnut

PLANT PALETTE V

POLLINATOR PATCHES

Forbs

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Chamaecrista fasciculata	partridge pea	1-3’	Full to part sun	June-October
Heliopsis helianthoides	ox-eye sunflower	3-5’	Full sun	June-September
Coreopsis lanceolata	lanceleaf coreopsis	1-2’	Full to part sun	April-June
Rudbeckia hirta	black-eyed susan	1-2’	Full sun	June-October
Liatris syriaca	spiked gayfeather	3-4’	Full sun	July-September
Asclepias syriaca	common milkweed	3-5’	Full sun	June-August
Veronia noveboracensis	New York ironweed	5-8’	Full sun	August-September
Symphyotrichum novae-angliae	New England aster	3-6’	Full to part sun	August-October
Eutrochium purpureum	purple joe-pye weed	2-6’	Full to part sun	July-September
Asclepias tuberosa	butterflyweed	1-2’	Full sun	May-September
Solidago juncea	early goldenrod	3-10’	Full to part sun	June-August
Eupatorium perfoliatum	boneset	3-6’	Full to part sun	June-October


partridge pea


ox-eye sunflower


spiked gayfeather


lanceleaf coreopsis


New England aster


early goldenrod

SENTINEL TREES

Botanical Name	Common Name	Height	Sun Exposure	Season of Interest
Gymnocladus dioicus	Kentucky coffeetree	80-100’	Full to part sun	June-October
Juglans nigra	black walnut	50-75’	Full sun	April-September
Populus deltoides	eastern cottonwood	50-80’	Full sun	March-April
Quercus macrocarpa	bur oak	100’	Full to part sun	March-May


Kentucky coffeetree


black walnut


eastern cottonwood

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