

# Steele Farm Management Plan

*Historical and Ecological Solutions  
for a New England Farmscape*

Boxborough, Massachusetts

PREPARED FOR THE  
TOWN OF BOXBOROUGH, MASSACHUSETTS  
&  
STEELE FARM ADVISORY COMMITTEE

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An expansive grassland at Steele Farm provides captivating, pastoral views of a historic New England farmscape.



Meadow grasses and forbs in the grassland at Steele Farm.



A lady slipper in the white pine forest on Steele Farm.



Stone walls frame three sides of Steele Farm's property boundaries.

# Project Overview



***Steele Farm is permanently protected by a Historic and Conservation Restriction.***

Steele Farm is a thirty-six-acre historic New England farmscape, centrally located within the small town of Boxborough, Massachusetts. This relatively open and expansive landscape provides the community with commanding views, historic structures, recreational opportunities, and wildlife habitat for many species. Steele Farm is permanently protected under a Historic and Conservation Restriction, and is registered with the National Registry of Historic Places.

The Steele Farm Advisory Committee and Town of Boxborough hired the Conway School to create a management plan for Steele Farm's future. This management plan aims to combine creative and sustainable management solutions that serve and respect the ecology of Steele Farm and the community of Boxborough, which cares deeply about this property and its continued community use.

## Public Participation

Steele Farm is a Town-owned property. The people of Boxborough enjoy recreation at Steele Farm and frequent the site during all seasons of the year. The town wants recreation to be an integral part of the management plan for Steele Farm moving forward. A winter festival and yearly volunteer appreciation event are among the public gatherings Boxborough holds at Steele Farm each year.

Two public meetings for the Steele Farm project were held at Boxborough's Town Hall and Community Center. The meetings were publicized by the Town of Boxborough, via flyers, email, and notice at the Town Hall.

The first meeting, in May 2015, was meant to gain insight into the community's wishes for Steele Farm's future, to set preliminary project goals, and to better understand the existing conditions and uses of the site.

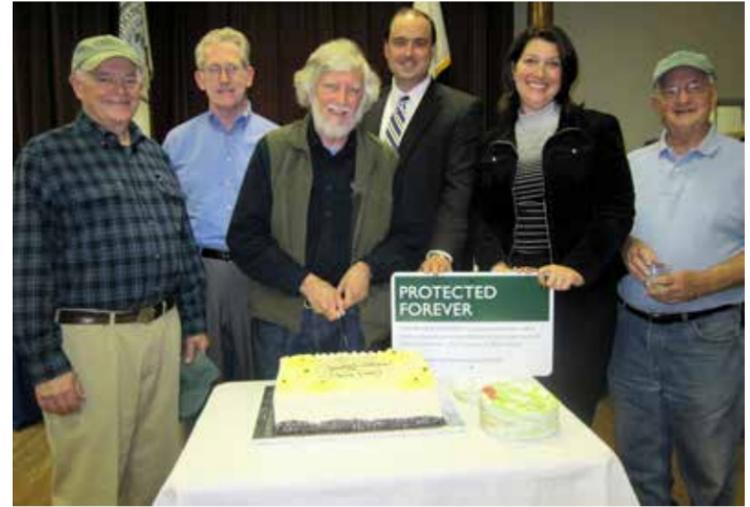
The focus of the second meeting was to present the analysis, management, and design alternatives created by the Conway design team, and gather community input for the project's final phase.

The meetings were attended by an average of fifteen people and the student team gathered information about community needs and the resources of Steele Farm. Boxborough clearly values Steele Farm for its agricultural history, stunning views, wildlife and recreational opportunities.

## Goals

***Create a management plan that celebrates and supports the wildlife habitat, recreation, and agricultural production of Steele Farm.***

- 1) Preserve the historical character of the New England farmscape at Steele Farm.
- 2) Maintain the open view south from Middle Road.
- 3) Evaluate and promote appropriate recreation at Steele Farm.
- 4) Create educational opportunities for visitors on-site.



Steele Farm celebrates a Conservation Restriction (CR) and permanent protection with Trustees of Reservations.



Pastoral views extend southward past the historic ice house on Steele Farm.



Bruce Hager of SFAC assists Jennie Bergeron of The Conway School with maps at the first community meeting.

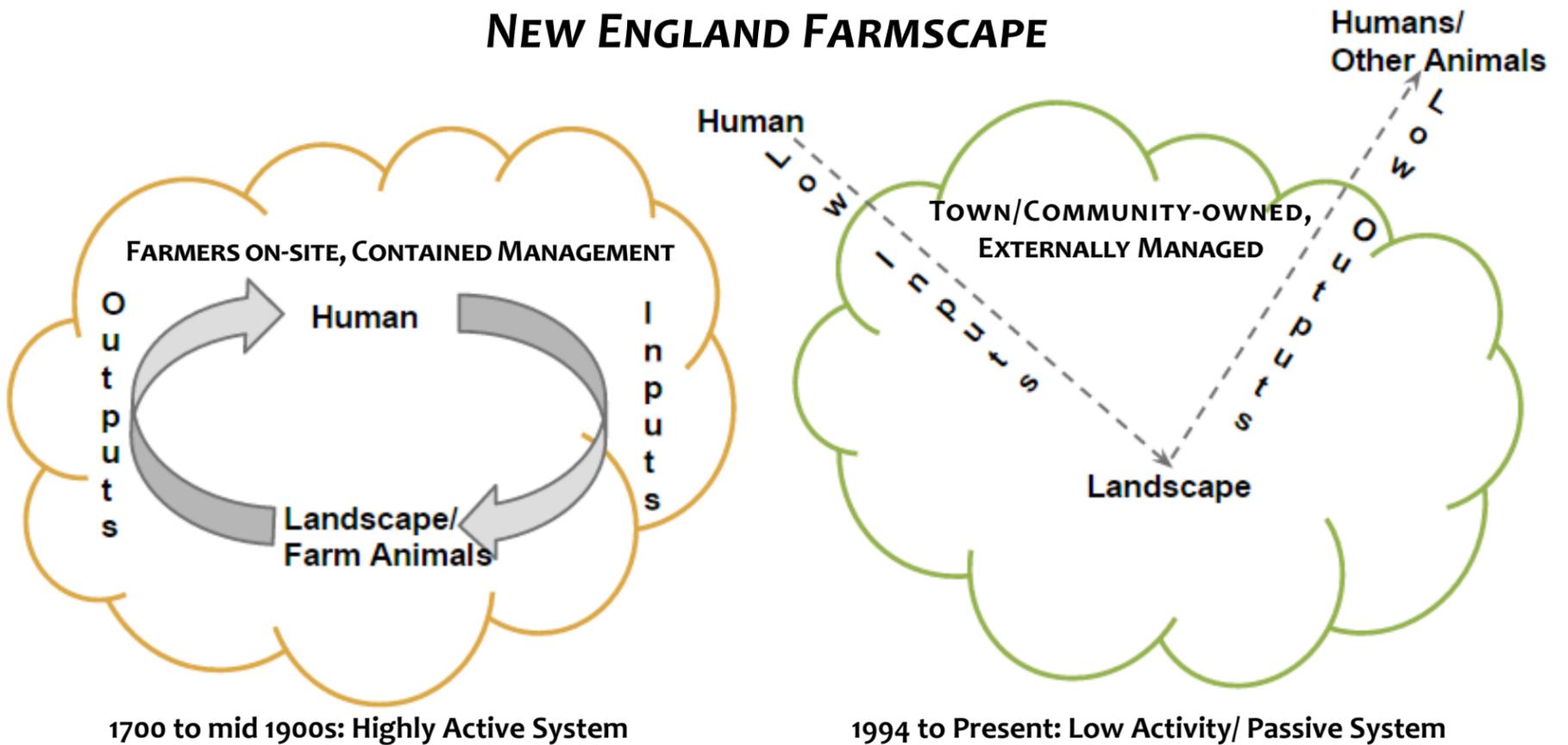


Community meeting attendees contemplate management plan goals for Steele Farm.

# Historical Context

Changes in human ecology and sense of place at Steele Farm over time.

## HISTORIC → MODERN NEW ENGLAND FARMSCAPE



Many New England farmscapes like Steele Farm have experienced a dramatic shift in ownership and site use over the past two hundred years. Family farming dramatically changed under the cultural and economic pressures of the Industrial Revolution and world wars. Steele Farm has undergone a shift from family to Town ownership, and is now open for public use. The community would like to preserve the evidence of Steele Farm’s agricultural past in the physical landscape and structures that remain on the farm today.

Steele Farm is a dynamic landscape and is the largest remaining representation of the farms that once were the heart of Boxborough’s livelihood and cultural identity.

## The ever changing landscape of Steele Farm

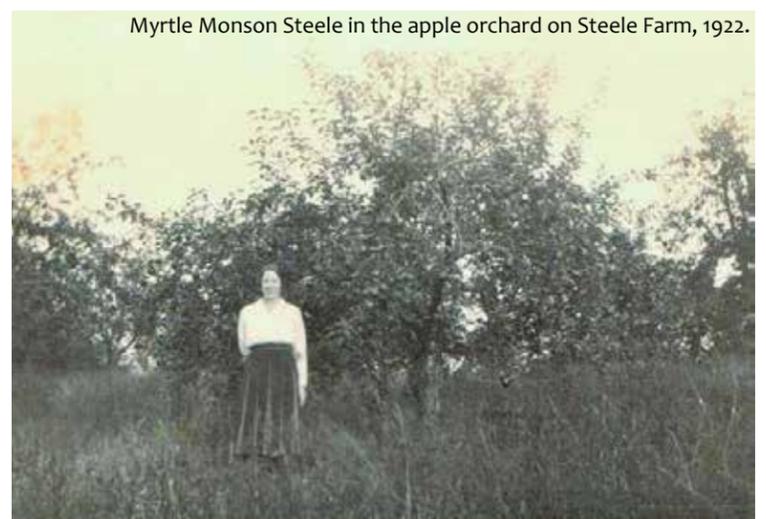
**Late 1700s:** Existing forest was cleared for agriculture.

**1800s-1900s:** An apple orchard was planted on most of the site. The dairy and orchard operation grew. Trees were sprayed, and the soil may be contaminated with lead arsenate.

**1938:** A hurricane took down many apple trees. Farm products shifted to dairy and spruce/Christmas tree business. The cultural grassland began to form.

**1994:** The Town purchased the property.

**2012:** A Conservation Restriction was created to preserve the property into the future.



1930s: A terraced west hillside was created for easier access to trees for harvest and spraying.



The 1938 hurricane leveled the barn and many apple trees.

# Existing Conditions

## Steele Farm~ A Diverse Landscape Experience



A 1784 farmhouse still stands on Steele Farm.



A historic ice house, not original to Steele Farm, perches on a knoll south of the barn, overlooking the grassland.



A grassy path atop the western hillside of Steele Farm provides utility road access, a dog run and walking area.



A wooden footbridge connects woodland hikers to Steele Farm's eastern border.



A shrub/wooded hillside covers twelve acres of the western hillside of Steele Farm. The shrubby hillside provides transitional edge habitat for birds and other wildlife between the open grassland and the denser forest.



Historic buildings, including an original farmhouse, a rebuilt barn, and an ice-house brought from off-site, mark the northern entrance to Steele Farm. A captivating view of open grassland extends southward from the historic buildings.



An open cultural grassland extends north to south, down the eastern half of Steele Farm. This uncommon grassland-nesting bird habitat covers approximately twelve acres of the property, and is a diverse mix of grasses and forbs.



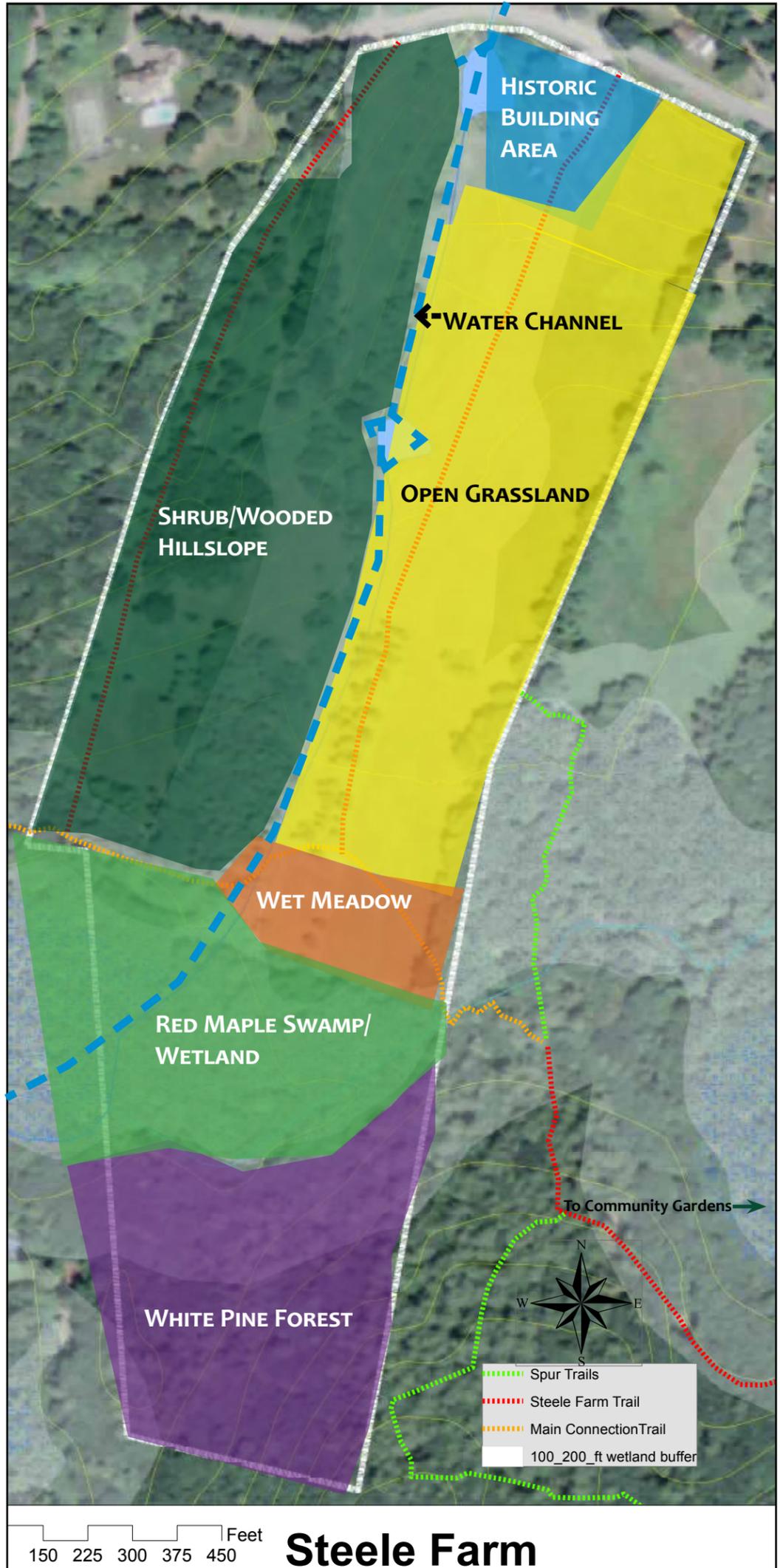
A wet meadow exists between the southern base of the grassland and the red maple swamp/ wetland. Wet meadow species play a diversifying role in the Steele Farm landscape, including the pollinator-attracting meadow plants.



A red maple swamp/ wetland separates the heavily used northern portion of Steele Farm from the southern, less frequented, white pine forest area. Informal trails and a thick understory dominates this area.

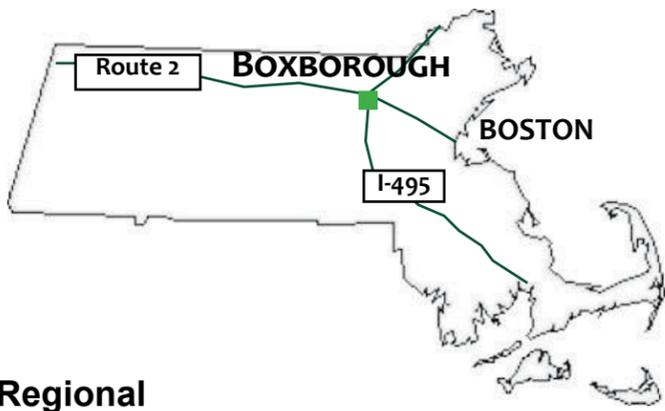


A white pine forest in the south of the property covers approximately eight acres of Steele Farm. This rich calcareous woodland supports a variety of ferns and wild lady slippers. Pine needle and dirt footpaths surrounding the forest connect Steele Farm to various local trail networks, including the Town-owned community gardens.



# Social Context

## Preserving the Rural Character



### Regional

Boxborough is a bedroom community located on the western outskirts of Boston with major highway connections to the Greater Boston area (I-495 and Route 2). Facing increasing regional development pressures, the Boxborough community wants to preserve the town's rural character and sees the protection of Steele Farm as a major component of this mission.

- This regional map illustrates the number of vehicles driving on roads in close proximity to Steele Farm. An average annual daily traffic count at Exit 28 of I-495, 1.5 miles west of Steele Farm, was 72,897 cars in 2012 (Google Earth). An average annual daily traffic count at Exit 39 of Route 2, 2.5 miles north of Steele Farm, was 45,000 cars in 2009 (Google Earth). These areas have the least rural character because of the presence of so many fast moving cars.
- The quieter roads surrounding Steele Farm pass through a more rural setting that defines most of Boxborough.

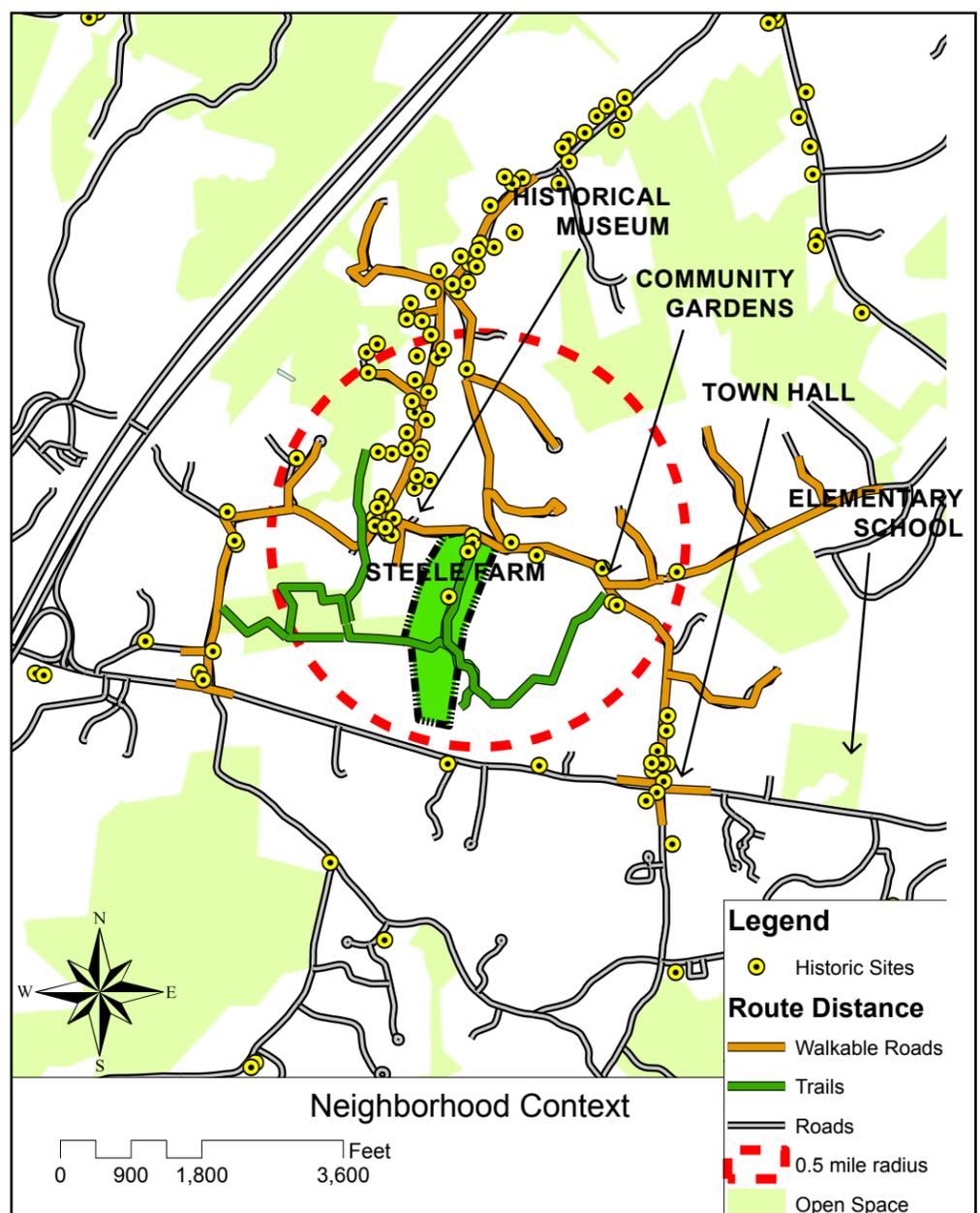
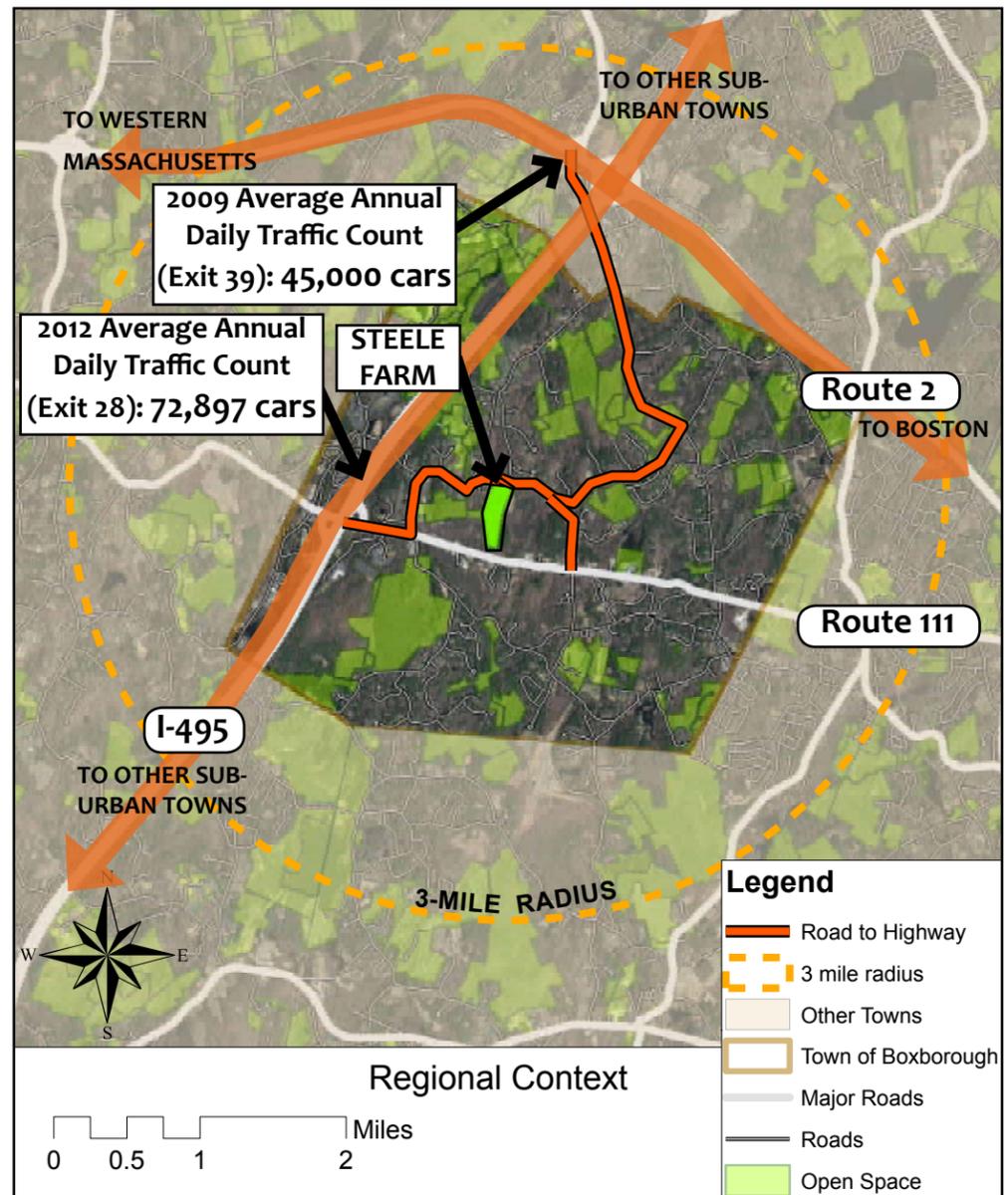
Preserving Steele Farm's picturesque farmscape and open vistas plays a major role in keeping the quiet, rural and natural setting for which Boxborough is known.

### Neighborhood

The walkability map to the right illustrates the proximity of the property to nearby residences, cultural, historical and public resources.

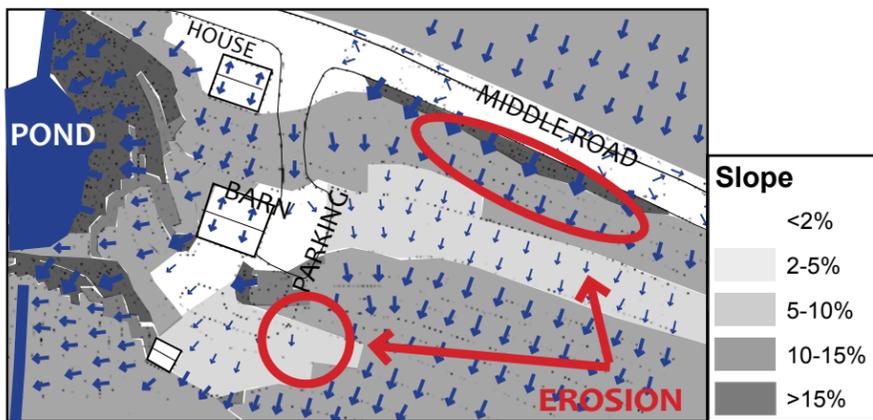
- Within a half-mile radius (as indicated by the red dotted line), there is almost as much total mileage of trails as there is of roadway. Many community members benefit from living near these trails. Approximately 85 residential properties are within a 0.5 mile walk or drive to the entrance of Steele Farm. Many more are near other trailheads at the community garden and Beaver Brook Conservation Area that connect hikers to Steele Farm.
- Steele Farm is part of a network of historic resources within this focus area, as indicated by the yellow dots. Roughly 30 inventoried historic resources are within a 0.5 mile walk or drive from Steele Farm. Steele Farm is also located near other public places. The Boxborough Historical Museum is located 600 feet to the west, the community gardens almost 0.5 mile away to the east, the town hall one mile away to the southeast, and Blanchard Elementary School just over one mile away to the southeast. Steele Farm's natural, historic and recreational resources contribute greatly to the neighborhood's greater network of public and cultural assets.
- Vehicular traffic is minimal on these streets in spite of busy through-ways nearby (Route 111 and I-495) and many residents walk on the side of the road.

The neighborhood surrounding Steele Farm is easy to navigate on foot, which was confirmed by comments by residents. A master plan for Steele Farm should ensure the farm continues to contribute to this walkable neighborhood.

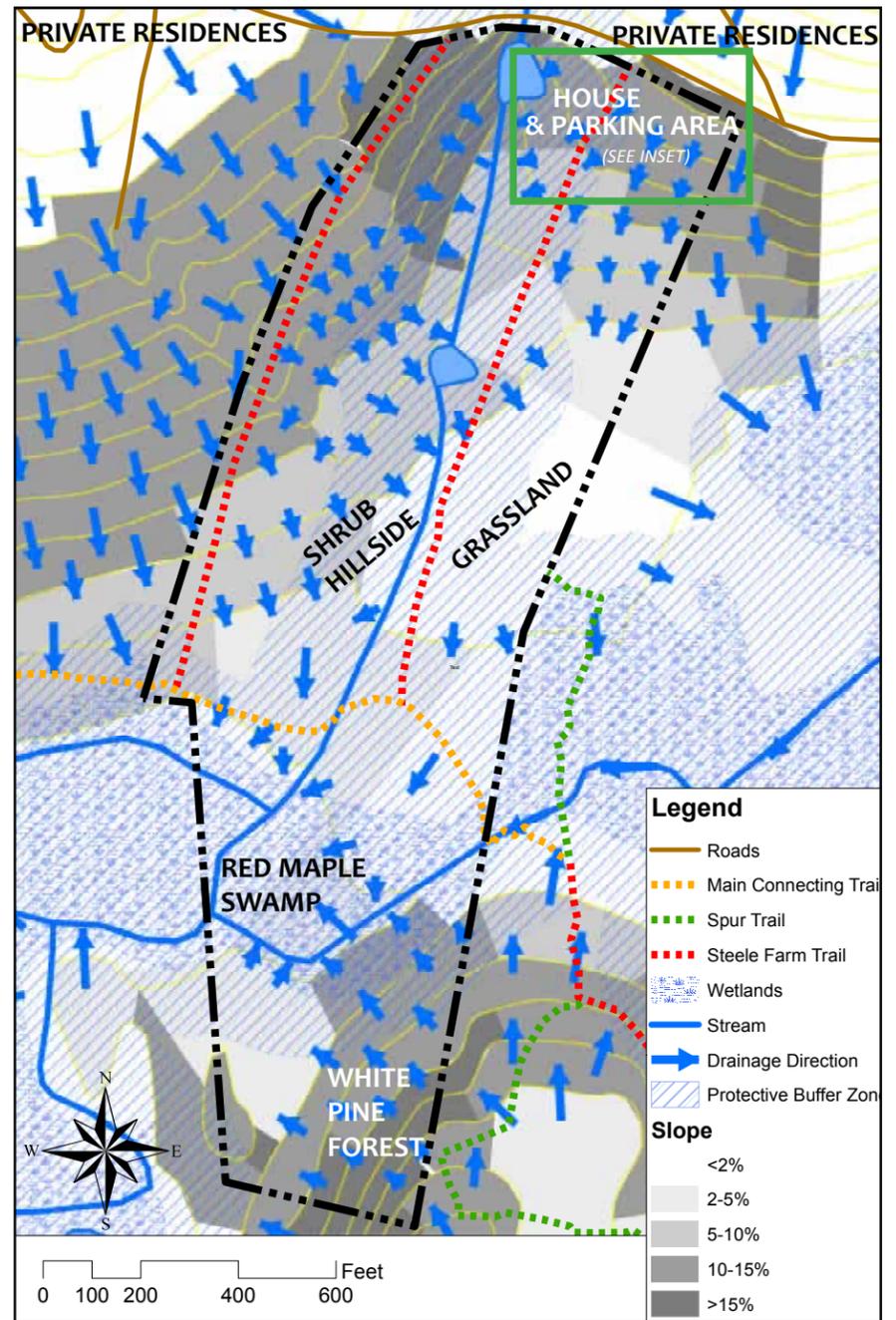


# Slopes and Drainage

- This upland landscape is characterized by a network of brooks, streams and wetlands. A perennial stream flows from north to south into a red maple swamp in the southern portion of the property. This is a part of the Beaver Brook Tributary, which sends water to the Merrimack River.
- More than half of Steele Farm is within the 200' buffer of the perennial stream and the 100' wetland buffer.
- Steele Farm is impacted by the water shedding down steep slopes from the north and south. Human activity from neighboring residences and from use of the site may impact natural resources due to erosion and possible sediments and contaminants conveyed by this water. Examples of contaminants might include automobile oil and gas, dog waste, and litter. Historic and recreational resources such as the house, parking area and trails may also be impacted due to erosion. Water flow should be controlled to protect these various resources.



**ENTRANCE AREA:** There are slopes greater than 25% around the man-made fire pond and perennial stream, and immediately adjacent to the road, north of the field. With a high frequency of human activity occurring directly around these slopes, natural resources are subject to possible contamination and/or erosion. Erosion is now occurring next to the road and parking.



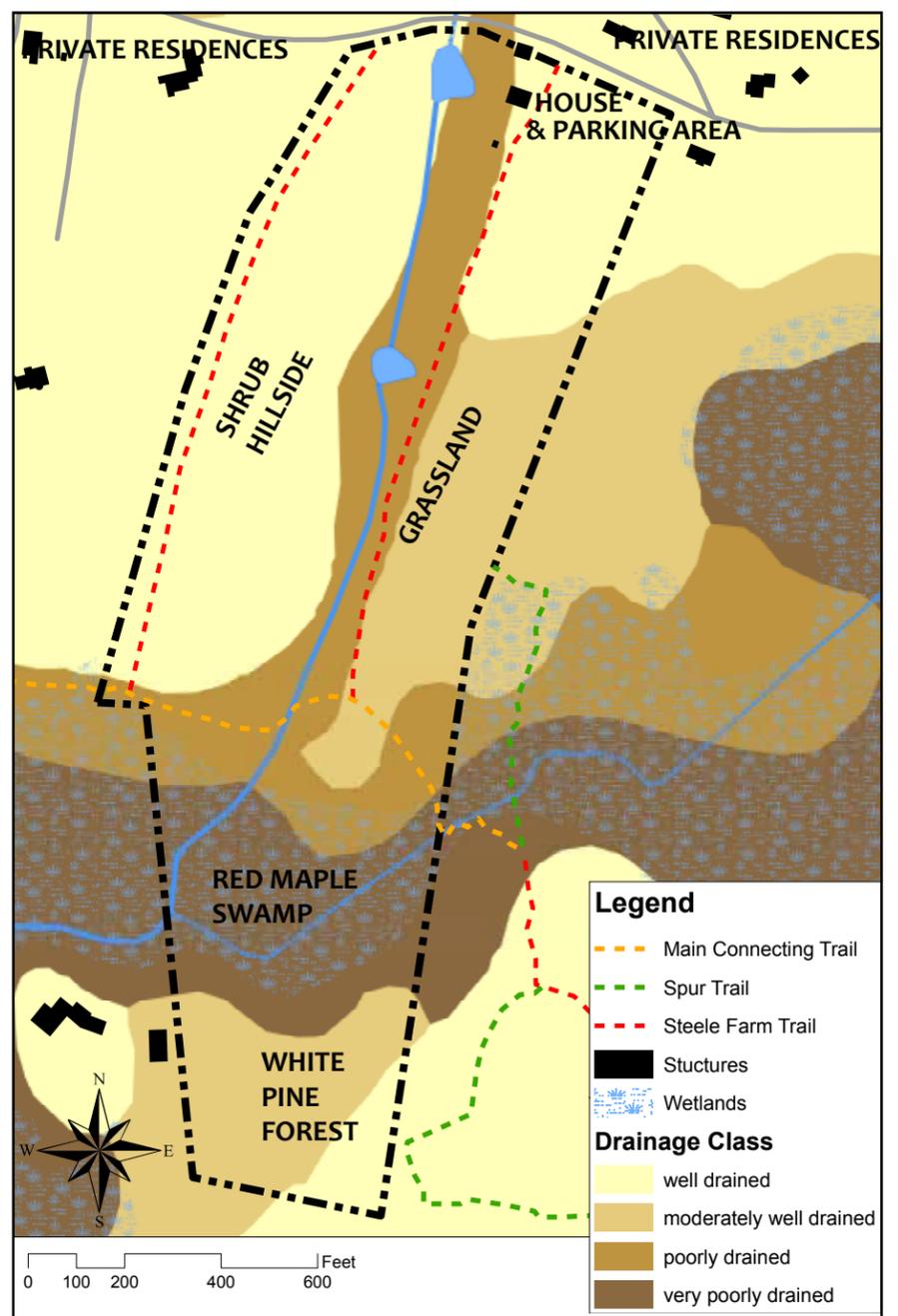
# Soils and Drainage

According to the NRCS Web Soil Survey, soils at Steele Farm are well drained, moderately well drained, poorly drained, or very poorly drained.

- Areas north and south have well drained soils with Paxton Fine Sandy Loam and Hollis Rock Outcrop, respectively. These soil types correspond closely with areas of steep slopes, which occur predominantly in neighboring private residences and the house and parking area of Steele Farm. Here, stormwater either infiltrates or sheds quickly toward Steele Farm's pond, stream and wetlands.
- Poorly drained soils underly the perennial stream and very poorly draining soils underly the wetlands. Steep slopes from the northwest, north and south and intermittent streams from the north and east convey water to these areas. While water ultimately enters Beaver Brook to the west, flow and infiltration are greatly reduced.

Human activity that occurs directly within and around these poorly draining areas will require protective measures.

- Recreational activities such as hiking, dog-walking and/or horseback riding must be regulated around poorly draining soils. With low infiltration, there is little line of defense against soil compaction, erosion, and/or contamination caused by such activities.
- There is significant erosion occurring on parking and gathering spaces, which are within the 200' buffer of the stream. Possible contamination from dog waste and leaky cars in these areas enter the stream's poorly draining soils and the stream itself. This erosion should be minimized to protect the pond and stream water.
- Residential properties upslope from Steele Farm may have an impact on the water resources of Steele Farm. Measures to capture, infiltrate and absorb stormwater flowing from the built environment can help reduce the human impact from off site.



# Agricultural Soils and Toxicity

Steele Farm's history of apple production and pesticide use.



Burpee Franklin Steele spraying apple trees at Steele Farm in 1938



Burpee C. Steele & his 1919 motorized truck in Maynard, bringing Steele Farm apples to market. Apples were a main source of income on Steele Farm.



Apple orchards once covered almost all of Steele Farm, and much of Boxborough.

During Steele Farm's apple production in the 1930s, lead arsenate pesticide was sprayed on apple trees to prevent common apple scab and insect infestations. This lead and arsenic-based chemical typically remains in the top twelve inches of soil. If the soil is disturbed or ingested it is a health hazard.

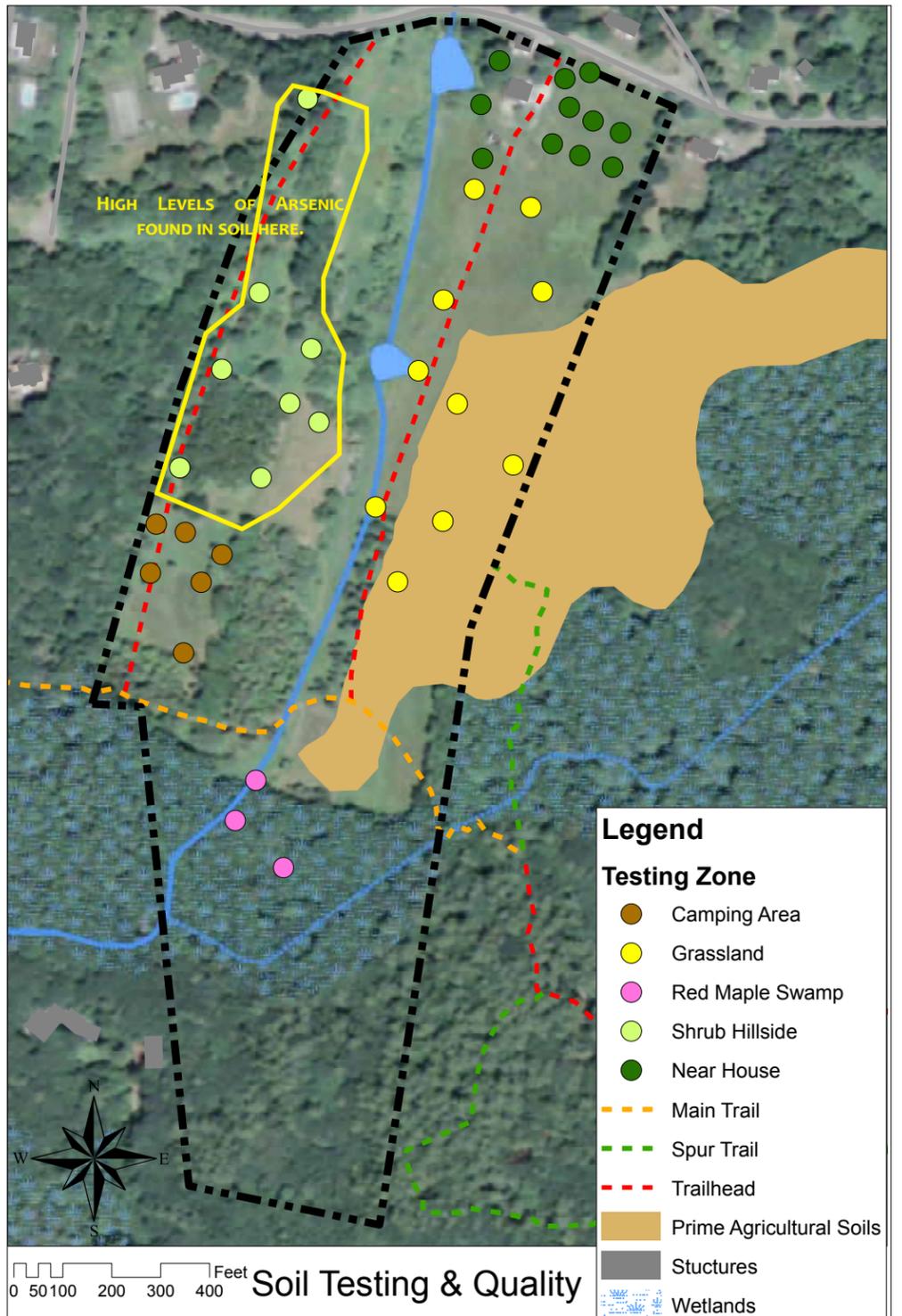
Of five separate soil test areas sampled by the Conway team in May 2015, the western hillside of Steele Farm is the only area with high arsenic levels that are dangerous to human short- and long-term health. The north hillside should remain covered by grass, and not be disturbed or tilled due to the air-borne nature of the chemical arsenic.

## Soil Testing & Quality

Soil samples were taken in five zones of the property to measure nutrient levels and potential heavy metals. Results from these tests help establish the constraints and opportunities for landscape uses, including recreation and agriculture.

See the full soil test results in Appendix B on sheet 22.

- Grassland: Low arsenic and high in nutrients. This area would be appropriate for agricultural uses, including haying.
- Shrub Hillside: High arsenic levels, rocky, and well-drained. Keep this hill stabilized with vegetation and preserve the existing apple orchard with organic practices.
- Camping Area: Low arsenic, rocky, and well drained. Opportunities exist here for agricultural uses that are tolerant of well-drained soils.
- Red Maple Swamp: Low arsenic, mucky, and very poorly drained. Wetlands need to be protected. Opportunities exist here for water-tolerant productive plants that are beneficial to wildlife and off limits to human harvesting.
- Farmhouse: Low arsenic, high macronutrients, low micronutrients, and well draining. Vegetation in this area will have to be tolerant of these nutrient levels and well-drained soils.



# Town-Wide Vegetation

Approximately 85% of Boxborough is forested, with intermittent open areas. The town of Boxborough has conserved many large areas for open space, conservation and recreational use. Steele Farm sits centrally located, as largely open land, within a town-wide matrix of heavily forested conservation areas. Most open space in Boxborough is heavily forested, which makes Steele Farm an important open place for views and recreation. This uncommon landscape in Boxborough should be carefully considered when planning for vegetation management.

## CULTURAL GRASSLANDS

Cultural grassland is created and maintained by the human clearing of land, often by mowing. It provides critical bird habitat that is often as equally important as “naturally formed” habitats.

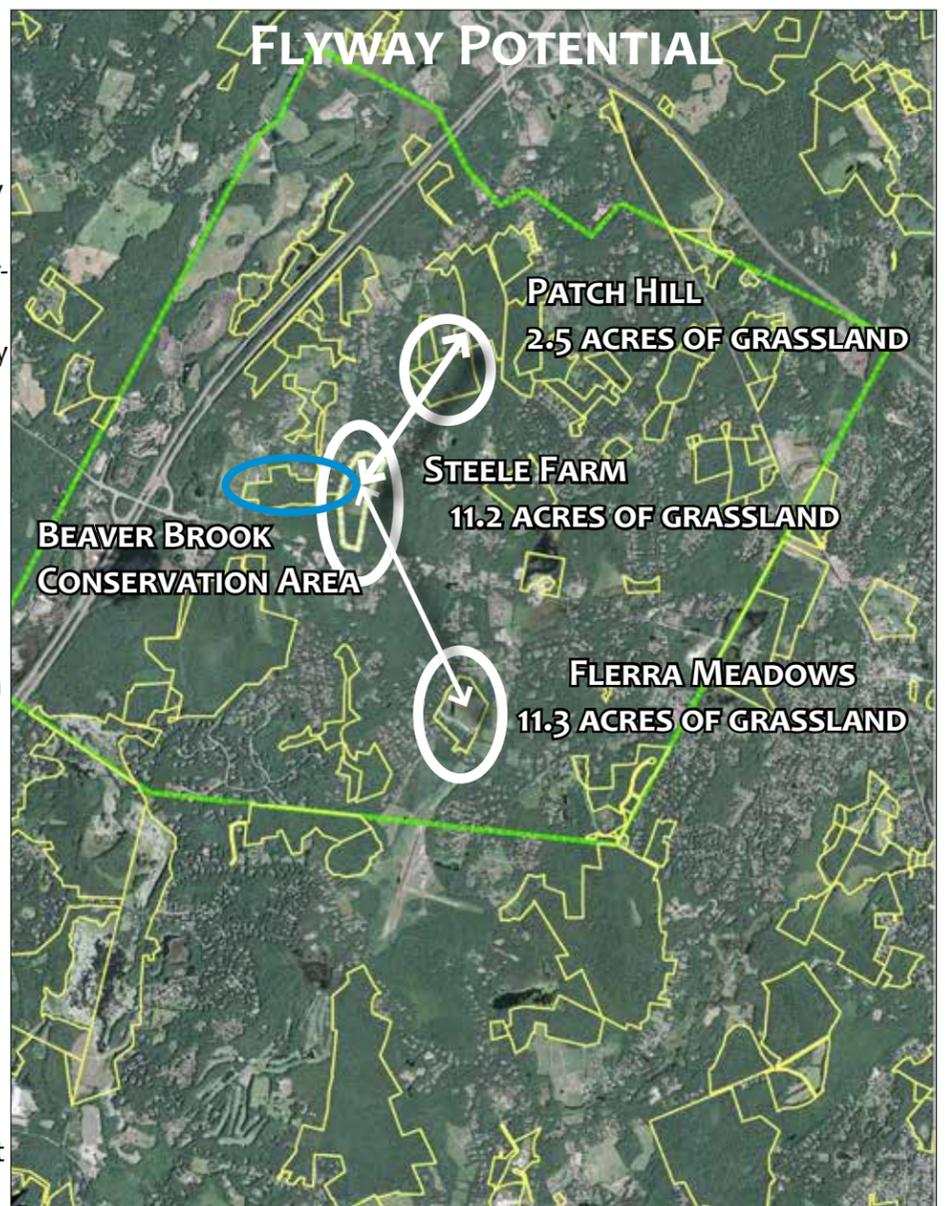
Steele Farm, Flerra Meadows, Beaver Brook, and Patch Hill Conservation Areas are the only grasslands and areas of open, publicly accessible land in Boxborough.

West of Steele Farm, Beaver Brook Conservation Area provides a link to additional meadow vegetation and is directly connected by trails and stone walls. A town-owned community garden property is connected to Steele Farm by existing trails.

Steele Farm and Flerra Meadows are the only large grassland habitats in Boxborough. Each provide approximately 11 acres of grassland habitat for wildlife and aesthetic enjoyment.

Grassland nesting birds benefit from small and large grassland areas that act as connection points during migration, nesting and foraging. **Patch Hill Conservation area** is a small, two-acre grassland that may support a grassland nesting bird flyzone and feeding area, but is too small a site to be attractive for nesting for birds like bobolinks, Eastern meadowlarks and others.

Ecologists agree that the one mile between Flerra Meadows and Steele Farm creates a high potential for flyway migration between these sites of grassland nesting birds.



### Grassland species

Orchard grass, timothy grass, sweet vernal-grass, red clover, wild madder, daisy, fleabane, Queen Anne’s lace, and pigweed form a healthy and diversified grassland.



### Wet Meadow species

Red canary grass, rush, rough-stemmed goldenrod, sensitive fern, buttercup, and Canada lily grow in wet ground conditions and can attract pollinators.



### Shrub/Wooded Hillslope

Old apple trees, hickory, beech, maple, invasive multi-flora rose, poison ivy, grapevine, and other tree and shrub species grow on the western hillslope, and provide rich edge habitat for wildlife and a cool micro-climate.



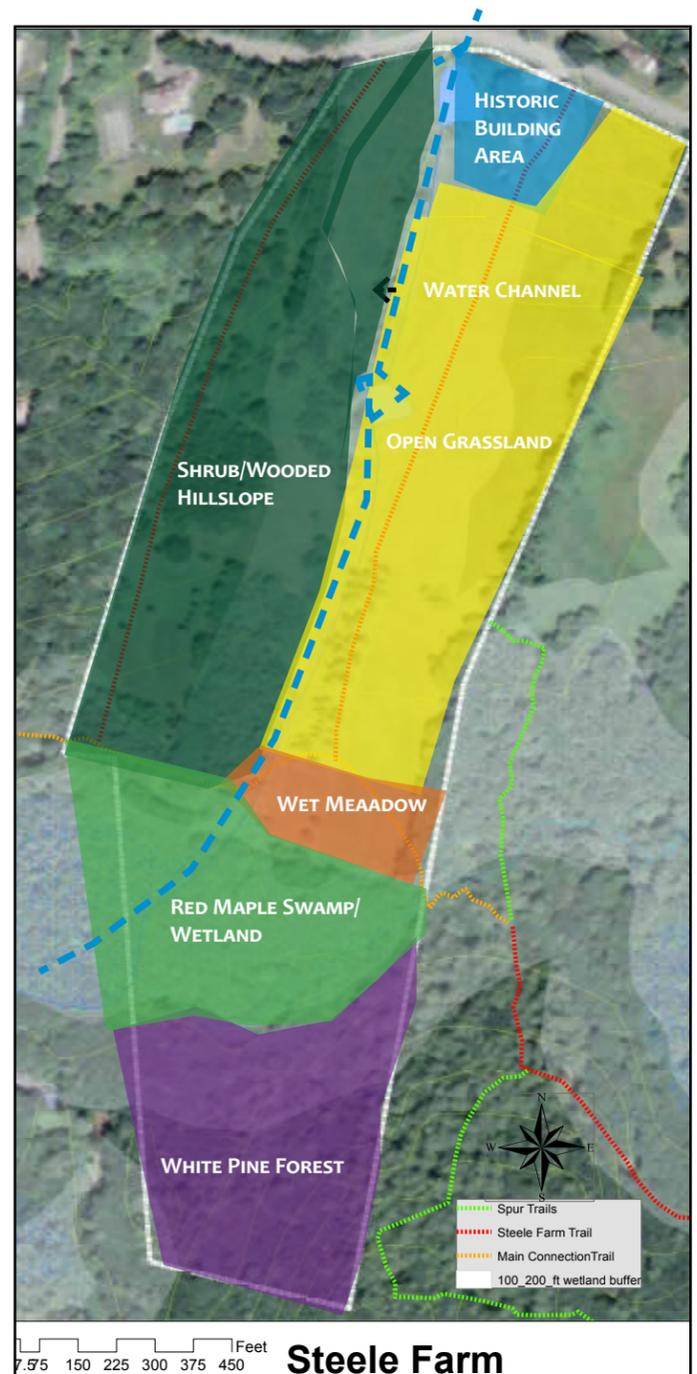
### Red Maple Wetland

Red maple, wetland species and grapevine in the swamp area provide important protected wetland habitat.



### White Pine Forest

White pine, low and medium bush blueberry, and woodland ferns are dominant in the relatively open forest. A high concentration of lady slipper orchids were observed, which indicates mineral rich soils.



# Birds and Wildlife at Steele Farm

Mass Audubon studied grasslands and meadows on Town-owned land in Boxborough. Twenty-five acres were studied at Steele Farm. Mass Audubon recorded 28 bird species in two days at Steele Farm, and concluded that “Steele Farm hayfields are among the finest grassland nesting bird habitat of all town-owned property, ideal vegetation size for Bobolinks,” and states that mowing should happen after August first. Ecologists are now recommending mid-to-late August due to frequent and intense storms, and the frequent need for re-nesting.

“Land Management Plans for Grasslands and Meadows on Town-Owned Land in Boxborough, Massachusetts” <http://www.massaudubon.org/september 2005>.

## Grassland nesting birds at Steele Farm:

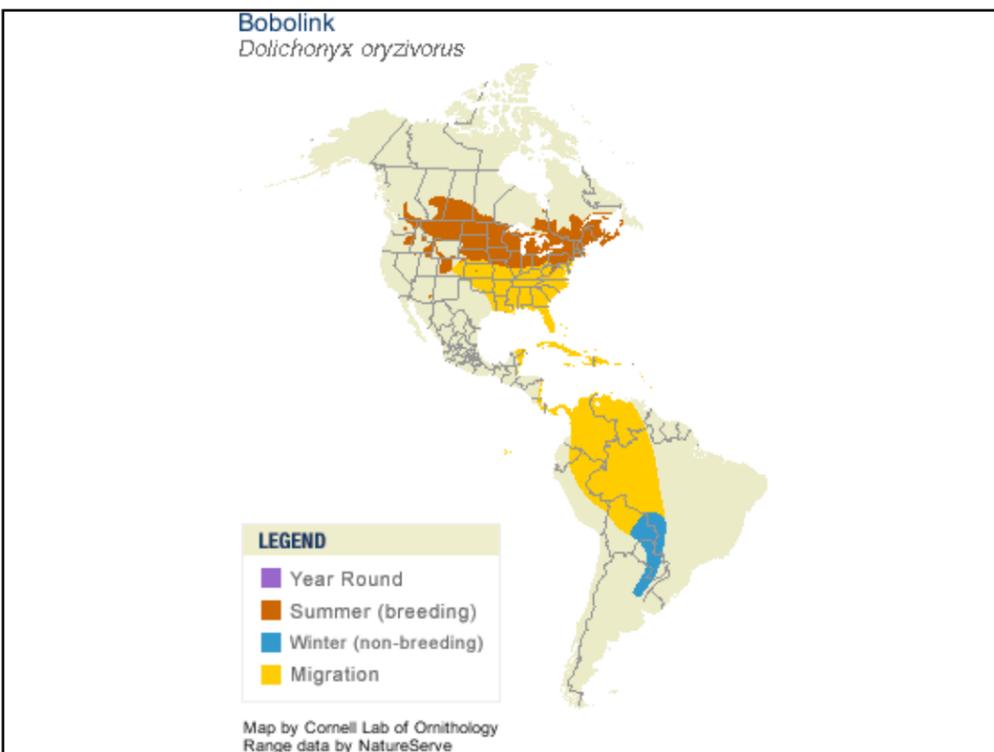
- Bobolink
- Eastern Meadowlark
- Vesper Sparrow

The shrubby hillside contains a natural birch coppice, and varying heights of vegetation that are well suited for the Eastern towhee, blue-winged warbler, saw-whet owl, and American pheasant, all seen at Steele Farm. The large spruce patch in the southern part of the grassland is home to pine siskens, barred owls and other wildlife. Steele Farm is home to insects, butterflies, moths and amphibians, small animals such as mice, voles, rabbits, fox, and turtles, and large mammals like deer, bear, and many more. This high level of species diversity plays an important role for the ecosystem at Steele Farm. While many of these species are safely surviving, the grassland birds are declining rapidly and their habitat needs our special attention if they are to continue as a part of Steele Farm.

**“Grassland birds are disappearing at an alarming rate. Between 1966 and 2012, they have experienced steeper, more consistent, and more widespread population declines than any group of birds in North America. In Massachusetts, many breeding grassland birds are identified as needing urgent conservation action.”**

-Mass Audubon Grassland Bird Program

Bobolinks migrate upwards of 12,000 miles each year from South America to the northeastern United States. As global climate change continues, bobolinks will be pushed northward towards Canada, as they try to locate cooler grassland locations for breeding. Steele Farm plays an important role in this transition, as it provides a breeding ground along their migration route.



Bobolink mother feeding her chicks in grassland nest.



Blue Winged Warbler



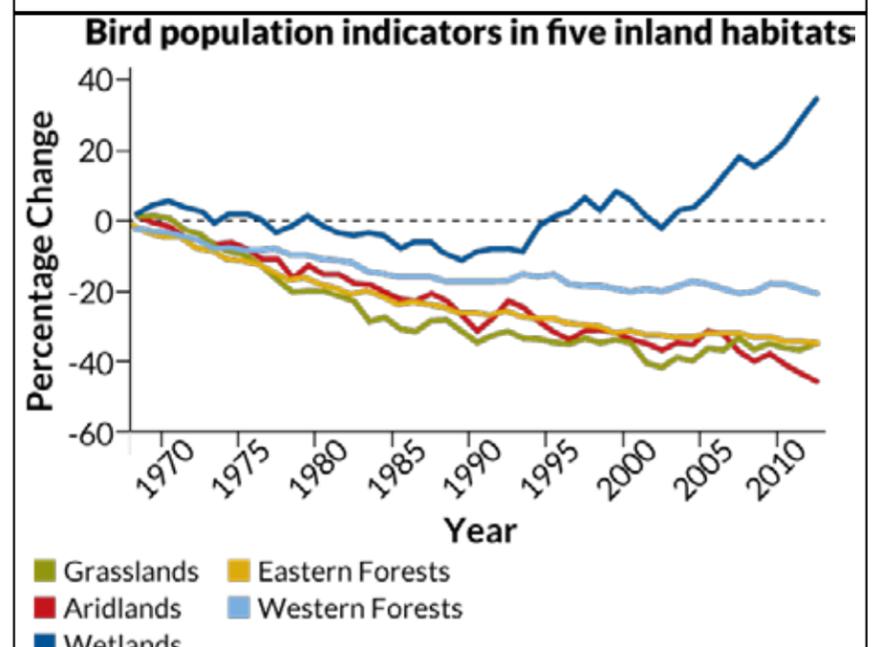
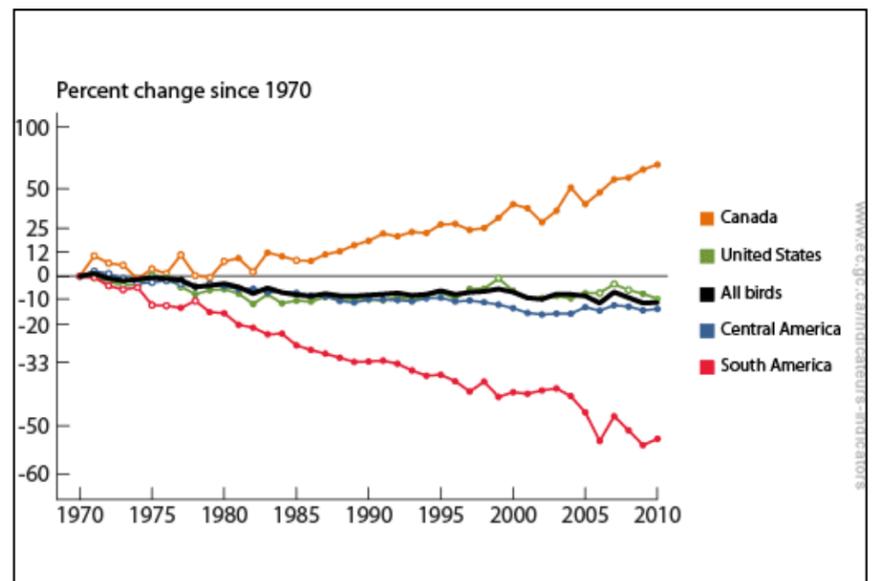
Eastern Towhee



Pheasant



Saw-whet Owl



# Access, Circulation & Views

- Parking is accessed from a north entrance from Middle Road, which is near other town locations (600 feet from the Historical Museum, a half-mile from the town commons, and 1.5 miles from the Blanchard Elementary School). Eighty-five residents live within a half-mile walk or drive to this entrance.
- Upon arrival, visitors are greeted with an impressive view of wide open grass fields.
- Trails are used by hikers, dog-walkers, and horse-back riders. Hikers mostly use a mowed path that bisects the grass field and leads to a wet meadow and to other more forested trails.
- Steep slopes, dense vegetation and the red maple swamp prevent hikers from easily accessing the white pine woods within property boundaries.
- There is minimal use of the space around the historic house and barn. As people are not allowed into the house, there is little reason for people to gather or recreate in this area. People mostly gather between the barn and ice house because it is flat and exposed to the impressive views.

## Opportunities & Constraints

A variety of habitat zones and micro-climates contribute to positive user experience throughout the property.

### 1 Main Grassland Trail

- Opportunity: The gradual slope and large viewshed make this trail the most navigable on site. It also serves as an artery to the broader trail system off-site. Because of the availability of parking at the beginning of this trail, trails on Beaver Brook Conservation Area or the community gardens property is frequently accessed through here.
- Constraint: Natural resources on Steele Farm are greatly impacted by heavy pedestrian use through here. Foot traffic causes compaction of the soils, leading to soil degradation. It also exposes the perennial stream to pollutants caused by organic waste from dogs and horses. Furthermore, this foot traffic disturbs the various habitats of the grassland. Too much human presence in this area disturbs ground-nesting birds during their nesting season (June through August).

### 2 Historic Structures

- Opportunity: The abundance of historic resources within this property provides many opportunities for education and interpretation.
- Constraint: Visitors have no guidance as to how to use the space around these historic resources and no information posted about them. The buildings have no clear space for gathering nearby. Stone walls are covered in invasive vegetation and located far away from trails or gathering spaces.

### 3 Western Trail

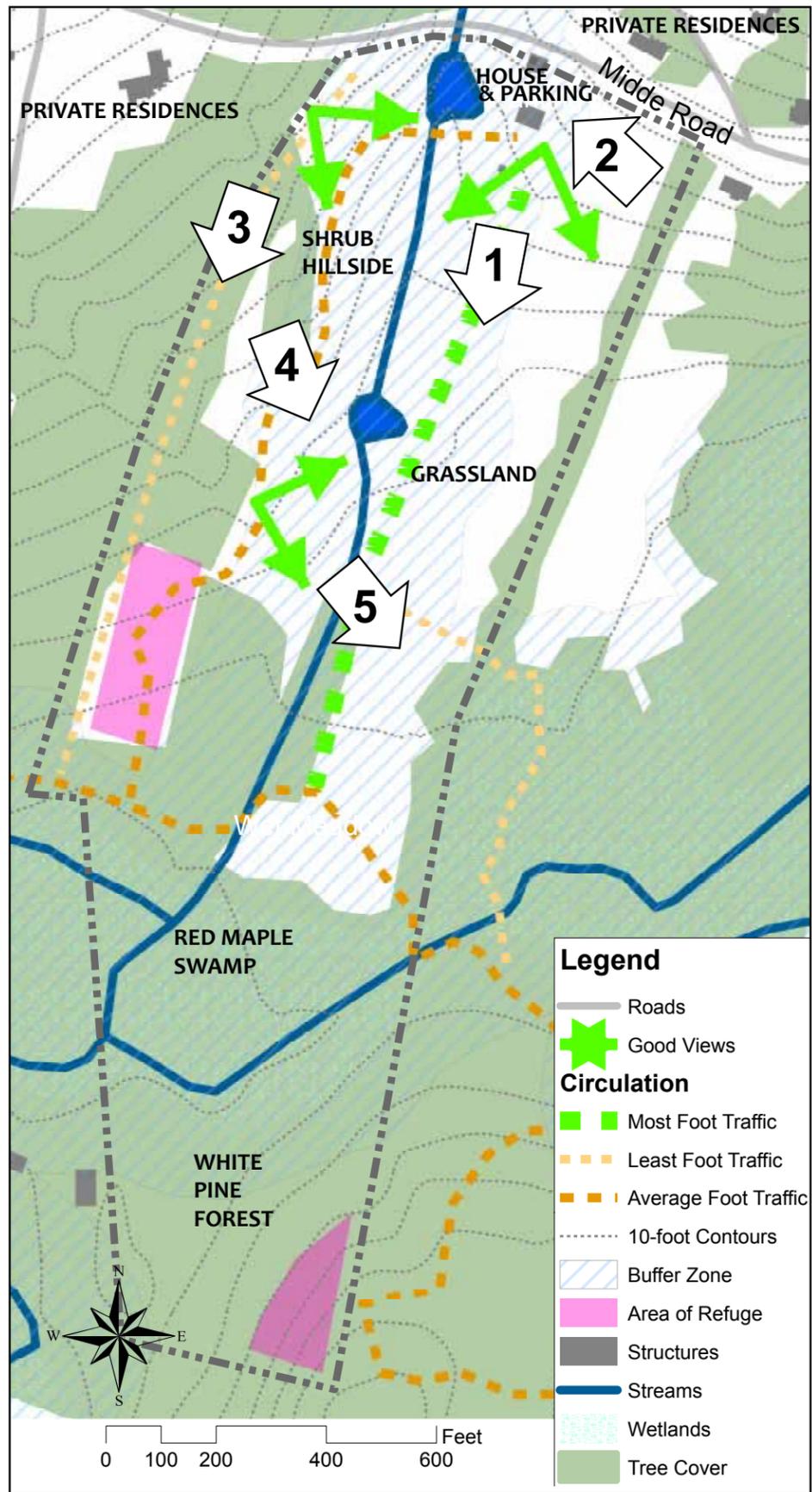
- Opportunity: The trail along the western periphery serves as a straightaway for easy hiking and it has an attractive viewpoint of the grassland, facing southeast.
- Constraint: It is difficult to access this trail due to steep slopes greater than 15% and dense vegetation.

### 4 Shrub Hillside

- Opportunity: To the south of the shrub hillside there is an area of refuge that is used for camping and Boy Scout activities. Nearby to the north is an attractive view of the grass field, facing east.
- Constraint: It is not universally accessible.

### 5 The Red Maple Swamp and White Pine Woods

- Opportunity: With limited human access to these fragile ecosystems, they will remain protected.
- Constraint: A lack of trails through the southern one-third of the property prevents visitors from experiencing this area.



People can enjoy this extensive view while driving by, upon arrival, and while hiking through the mowed path shown on the bottom right corner of this photograph. The parking area and this path experience the most circulation on the property primarily because of this favorable view.



Trails around the historic house and barn are not clearly marked. Opportunities for people to gather and learn about their history are lacking.



The trail to the western periphery of the property is a straightaway that is easy to hike but not universally accessible because of steep slopes and dense vegetation.



The informal trail along the shrub hillside is brush-hogged yearly to allow visitors to explore less traveled places like this resting stop.



A variety of natural communities exist on the property including grassland, a wet meadow, a red maple swamp, and a white pine forest. However, access to some of these resources is limited.

# Conservation Restriction

A Historic and Conservation Restriction with The Trustees of Reservations and the Boxborough Historical Society governs landscape changes at Steele Farm, restricting major changes to the topography, historic buildings, and the character of the property.

1994: Town of Boxborough purchased Steele Farm.

2006: Steele Farm registered with the National Registry of Historic Places.

2012: Conservation Restriction is enacted with The Trustees of Reservations and the Boxborough Historical Society.

- Allows only three additional parking spaces on site. Requires no negative impact on habitat for grassland nesting birds.
- Requires open areas such as the grassland field be maintained by mowing or other means.
- Allows varied types of recreation, including camping by permission, horseback riding, winter recreation, dogs, hiking, etc.



View south of Steele Farm grassland from Middle Road.

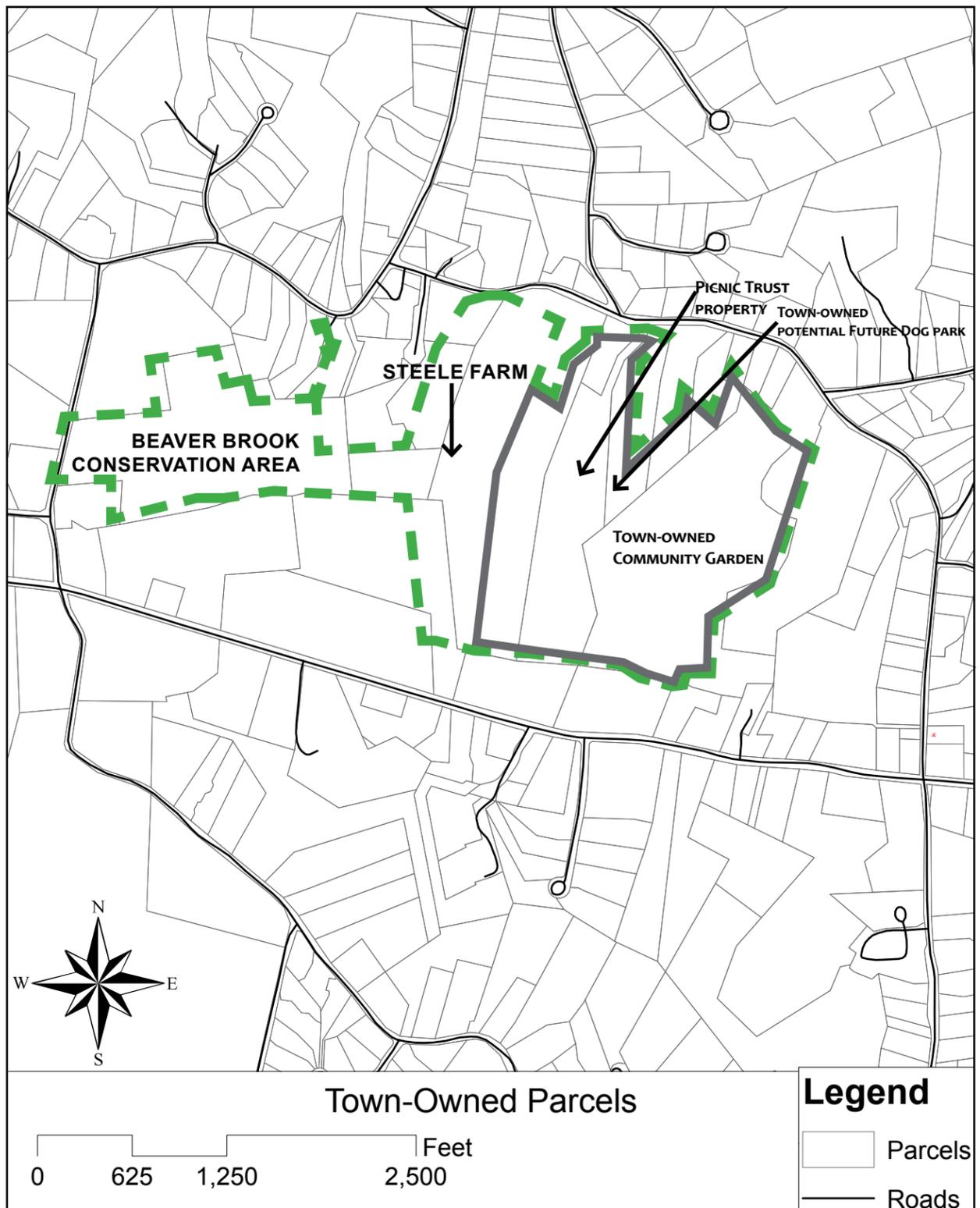


Beaver Brook Conservation Area to the East of Steele Farm.



Boxborough's Community Garden site is walkable from Steele Farm.

- Steele Farm is conveniently located between two main areas of town-owned property, Beaver Brook Conservation Area to the West, two vacant parcels, and Boxborough Community Garden to the east.
- Trail networks currently link all five parcels together, forming a large conservation and town-owned block of publicly accessible land. The Community Garden, Steele Farm, and Beaver Brook Conservation Area are often walked to by neighboring residents. The two town-owned properties to the east of Steele Farm do not often have visitors.
- Opening up the view beyond the eastern bordering stone wall to the **Picnic Trust property** (town-owned), and other adjacent town-owned lots to the east of Steele Farm would provide a widened viewshed for visiting people and additional habitat for grassland and meadow nesting birds. Bobolinks in particular have been noted to prefer wide and circular nesting habitats compared to long and narrow grasslands. If the meadow plant species next to Steele Farm are not favorable for grassland nesting birds, the widened visual landscape may increase the likelihood that they will be attracted to Steele Farm for nesting and increase breeding potential.
- The currently unused **Town-owned parcel directly next to the Community Garden** parcel has road frontage and a right of way. If a location study shows no concerns for wildlife species, it would be a potentially appropriate location for a new town dog park, where dogs could run free in an area that is not sensitive habitat. This could remove some of the recreational dog-use pressure at Steele Farm and help protect the grassland species.



# Summary Analysis

Steele Farm is shown here broken down into five zones based on site conditions. Foot traffic is the highest in Zones 1 and 2 where fragile grassland and wetland habitat needs protection. Visitors are diverted to east and west away from the red maple swamp and white pine forest, where there are opportunities for more recreation. Steep slopes surround a perennial stream at the entrance and shrub hillside to the west where parking, hiking, dog-walking, and horse-back riding might impact wetland resources. A secluded meadow to the south has relatively flat terrain and is largely outside of the 200-foot buffer of the stream, but it has trails that are not clearly marked.

## 1 Entrance

**Observations:** The prospect of experiencing an impressive view in the entrance area and hiking through a wide open field is very inviting to visitors. These activities are made possible by easily accessible parking, relatively few physical or visual barriers (historic structures are immediately bypassed upon arrival) and immediate connection to another flat staging ground. While this staging ground may also be used for formal or informal gatherings, visitors often opt to immediately start hiking down through the grassland. With no public access to the house or barn, steep slopes to the west, and tall grasses to the east (during the warm season and before mowing), there are very few alternatives for circulation within this space other than to hike the main trail. One exception is during the winter months when families and children use the hillside to go sledding. The main trail bisects a fragile grassland habitat and roughly half of this zone is within the 200-foot buffer of the perennial stream to the west.

**Implications:** Hiking this trail is popular, but it may impact seasonal ground-nesting bird habitat. The flatter spaces in this area have potential for other uses, such as gathering, but mostly lie within the 200-foot buffer. Nearby are steep slopes (>10%) that have poorly draining soils and lead to the nearby pond and stream. Human activity within this buffer will either have to be regulated or accompanied with measures to capture, infiltrate and absorb stormwater before they reach these soils and nearby water resources.

## 2 Grassland

**Observations:** Circulation through the grassland is very direct down the main trail, particularly in summer months when the hay has not yet been mowed. In winter months, more activities are possible such as cross-country skiing because of snow cover and flat terrain. Ground-nesting birds such as bobolinks or meadowlarks are very sensitive to this human presence upon their arrival after migrating in May and while they nest from June to September.

**Implications:** Existing patterns of circulation in this zone conflict greatly with ground-nesting bird habitat quality. Not only do hikers walk through this zone with high frequency, but so do dog walkers and horse-back riders. Moreover, the current method of haying in July, albeit officially permitted only after thorough monitoring, is when nesting may still be happening.

## 3 Shrub Hillside

**Observations:** Seasonal brush-hogging of this area keeps trails clear and navigable. However, with the steep terrain and dense vegetation throughout this zone, hiking here is a bit more arduous than in other areas of the property. Access from the entrance area is visible but limited because of steep slopes and an abundance of poison ivy. Access from the main trail to the south is much flatter but is not very visible. Soil samples taken throughout the southern portion of this zone indicate dangerous levels of arsenic. Roughly two-thirds of this zone lies within the 200-foot buffer of the perennial stream. Both this perennial stream and a historic stone wall lie very close to slopes greater than 10%, making them vulnerable to erosion and runoff.

**Implications:** Existing use of a brush-hog and mower to maintain trails in this area effectively keeps trails clear for hiking. More can be done to create resting or viewing spaces during this more arduous hike. Excavation of soils should be avoided to keep the arsenic and lead from becoming airborne and to keep erosion or contaminated runoff from impacting the perennial stream. Any grading or other changes that might cause erosion or runoff are regulated by both the conservation restriction and the restriction of the 200-foot buffer.

## 4 Secluded Meadow

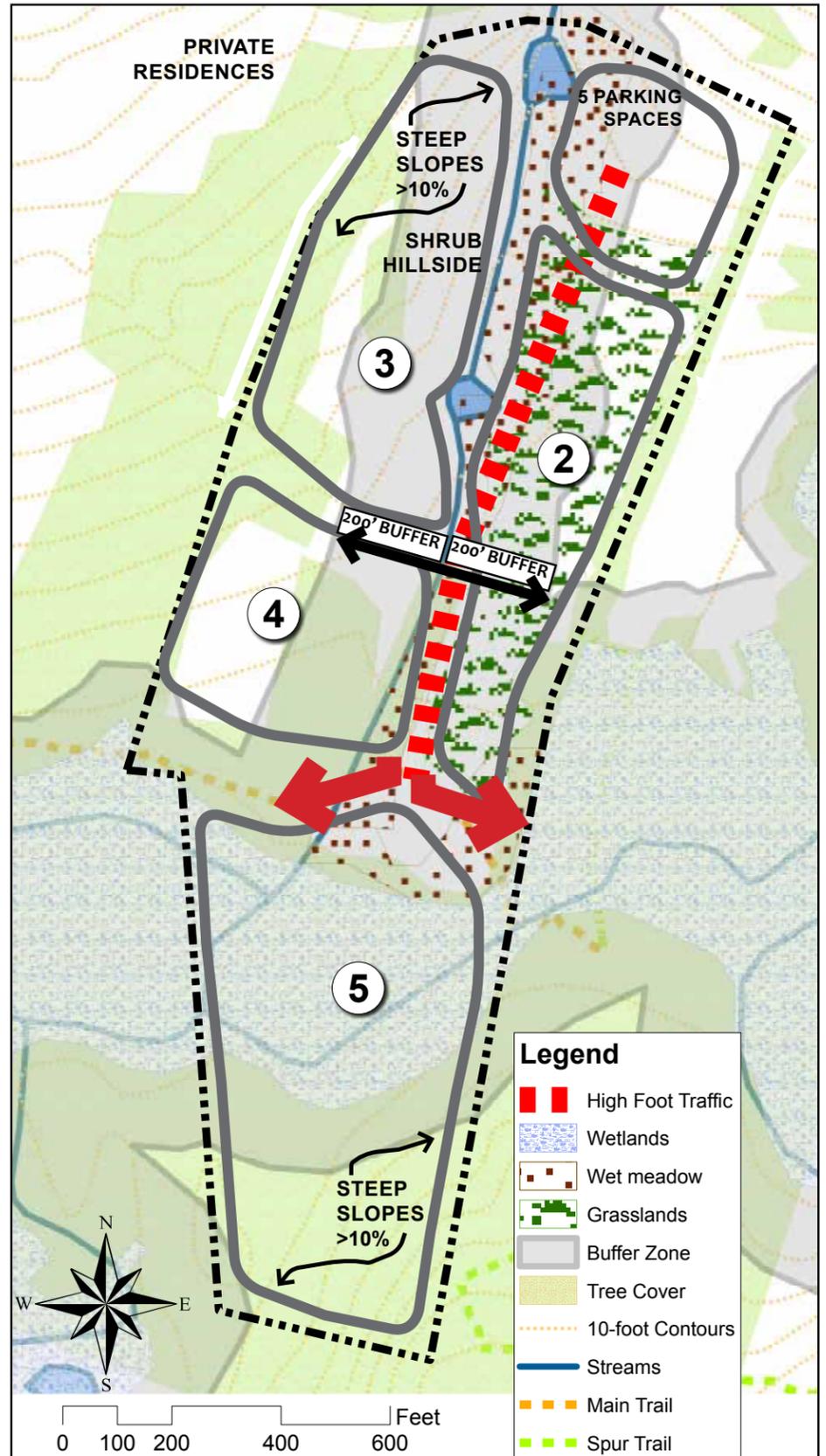
Existing use of this area as a secluded gathering spot is made easy with slopes less than 10%. Brush-hogging keeps the abundant growth of goldenrod down and allows for seasonal camping. Human presence here does not impact wetland or grassland habitat as it is located more than 200 feet from the perennial stream and even farther away from the ground-nesting bird zone. Plantings of spruce saplings currently don't impede the openness of this area but will eventually close it off when they get bigger.

Located far from fragile natural resource areas, this space has the least ecological constraints for human access, circulation and gathering. Access to nearby trails is not very visible and may be further impeded by the growth of the spruce trees. The master plan should preserve this location as a secluded gathering spot.

## 5 Red Maple Swamp & White Pine Forest

**Observations:** Part of a wider wetland corridor within the Beaver Brook Tributary, this area has abundant ecological diversity. The main trail leads hikers directly up to it but diverts them either east or west with no way to go any farther south. There is a way of viewing into this zone from various points on and off-site, but there is no direct access directly into these resource areas.

**Implications:** The presence of abundant diverse natural resources is an opportunity to provide more recreational experiences to visitors. The master plan should improve recreational and interpretive opportunities for visitors, where possible, while still protecting wetland resources.



# Management Alternative 1 Sanctuary for All

A functional landscape for wildlife and people, with an emphasis on grassland protection and enrichment.

## Opportunities:

- Grassland enlarged and enriched for nesting birds.
- Dog waste compost removes risk of contamination of water and habitat.
- Habitat disturbance is mitigated.
- Educational wildlife viewing areas created.
- Vegetated berms and basins added to infiltrate water and attract pollinators.

## Constraints:

- Walking trails are added, locations are moved. This requires adjustment to new walking areas, and increased trail maintenance is required.
- Dog presence is increased on western hillside, which may negatively impact wildlife.

## Management:

- Grassland is burned every 3 years, mowed only once a year in September.
- Shrub hillside is mowed and thinned every 3-5 years, paths more.
- Paths are mowed in warm seasons.
- White pine forest is thinned for health.



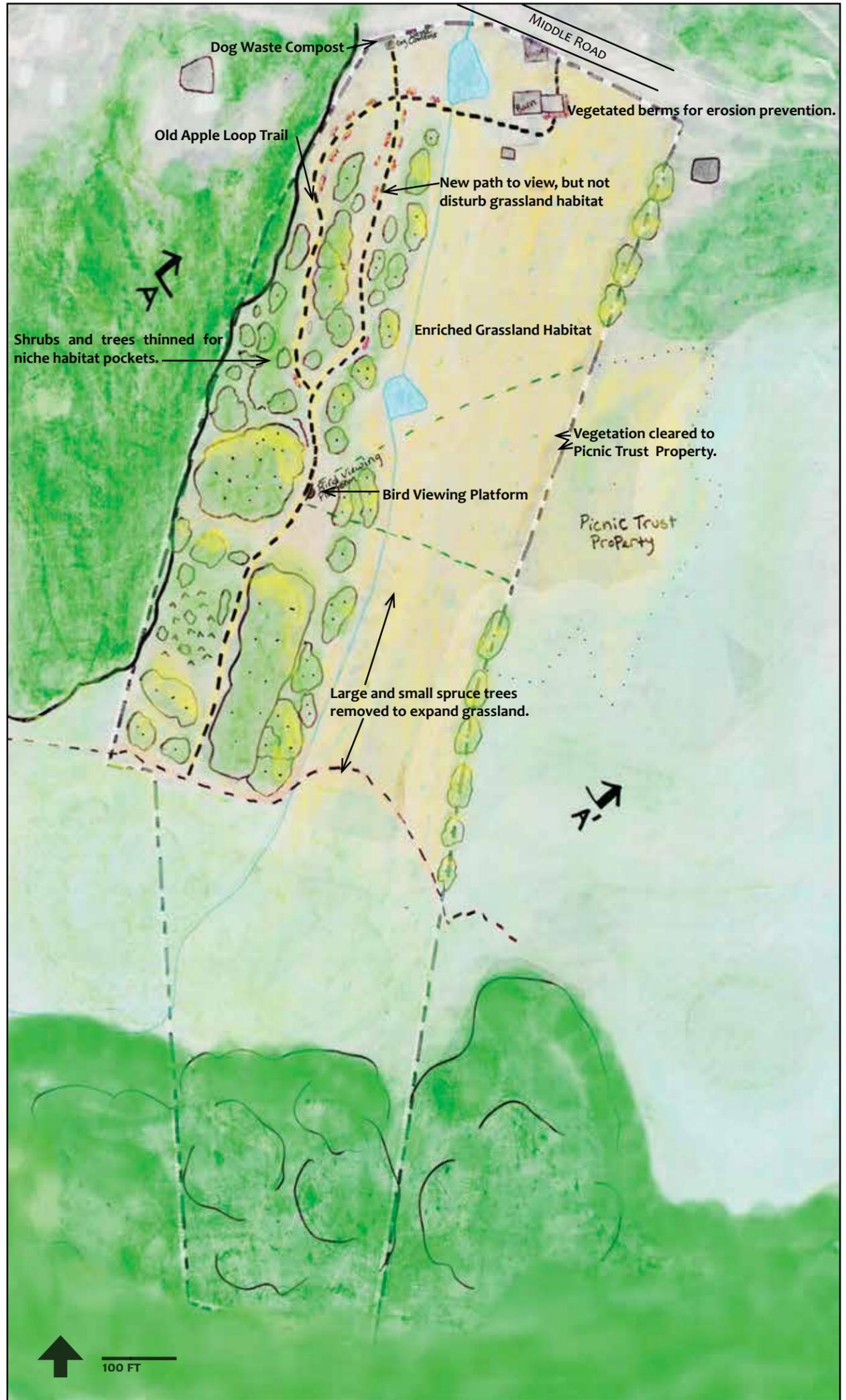
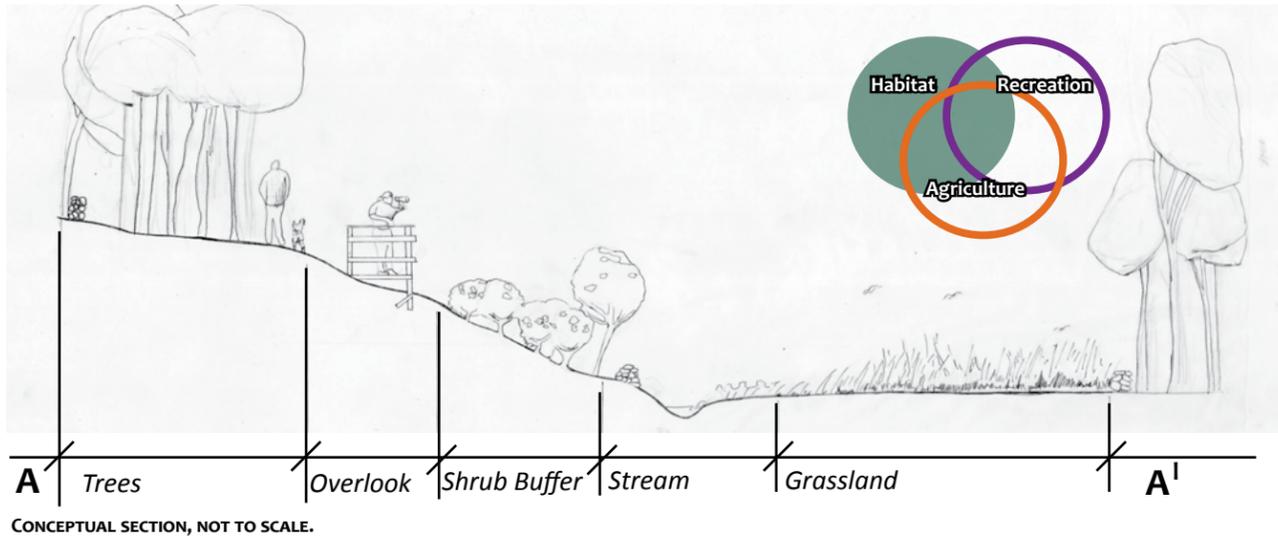
Grassland observation platform.



Pollinator/water infiltration gardens.



A high bird viewing platform.



# Management Alternative 2 Historic Journey

An educational walking journey, highlighting Steele Farm and New England agricultural history with interpretive signs and trails.

## Opportunities:

- Grassland and shrub habitat remain intact.
- Additional trails and loops are added for recreation.
- Trail access through the mature spruce stand continues.
- The wetland observation boardwalk and platform, constructed on Diamond Piers, offer educational opportunities.
- A new camping platform is constructed.
- Creation of a town historic tour circuit and connection to parking off-site at history museum.
- Interpretation and education signs are added.

## Constraints:

- Increased maintenance of trails and orchard is needed.
- Increased human use may negatively impact wildlife.

## Management:

- Grassland mowed only once per year, in September.
- Shrub/tree hillside mowed and thinned every 3-5 years.
- White pine forest thinned for trails and the health of trees when necessary.
- Paths are mowed in warm season, and the old apple trees pruned.



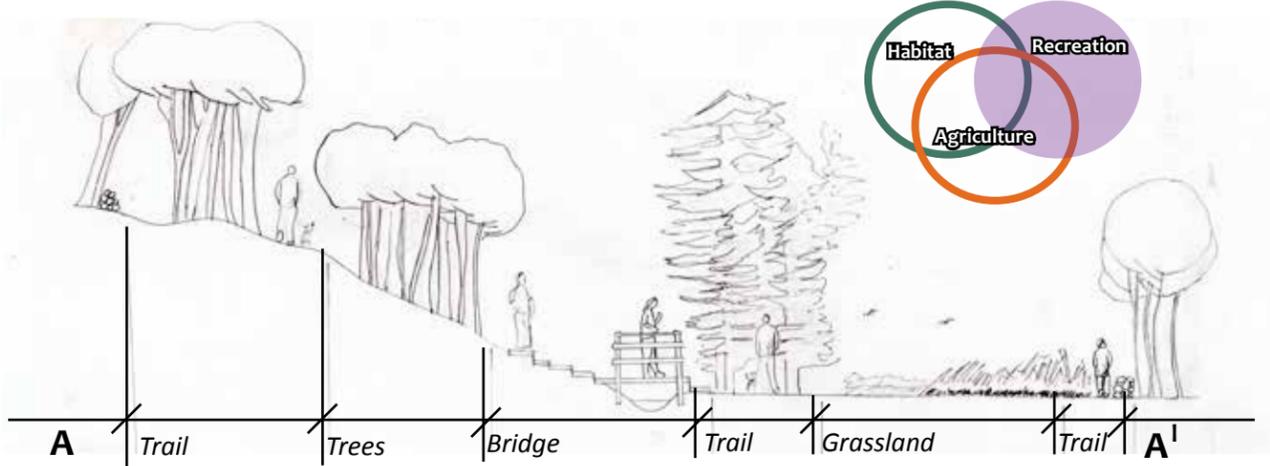
Diamond Piers being installed with no heavy equipment.



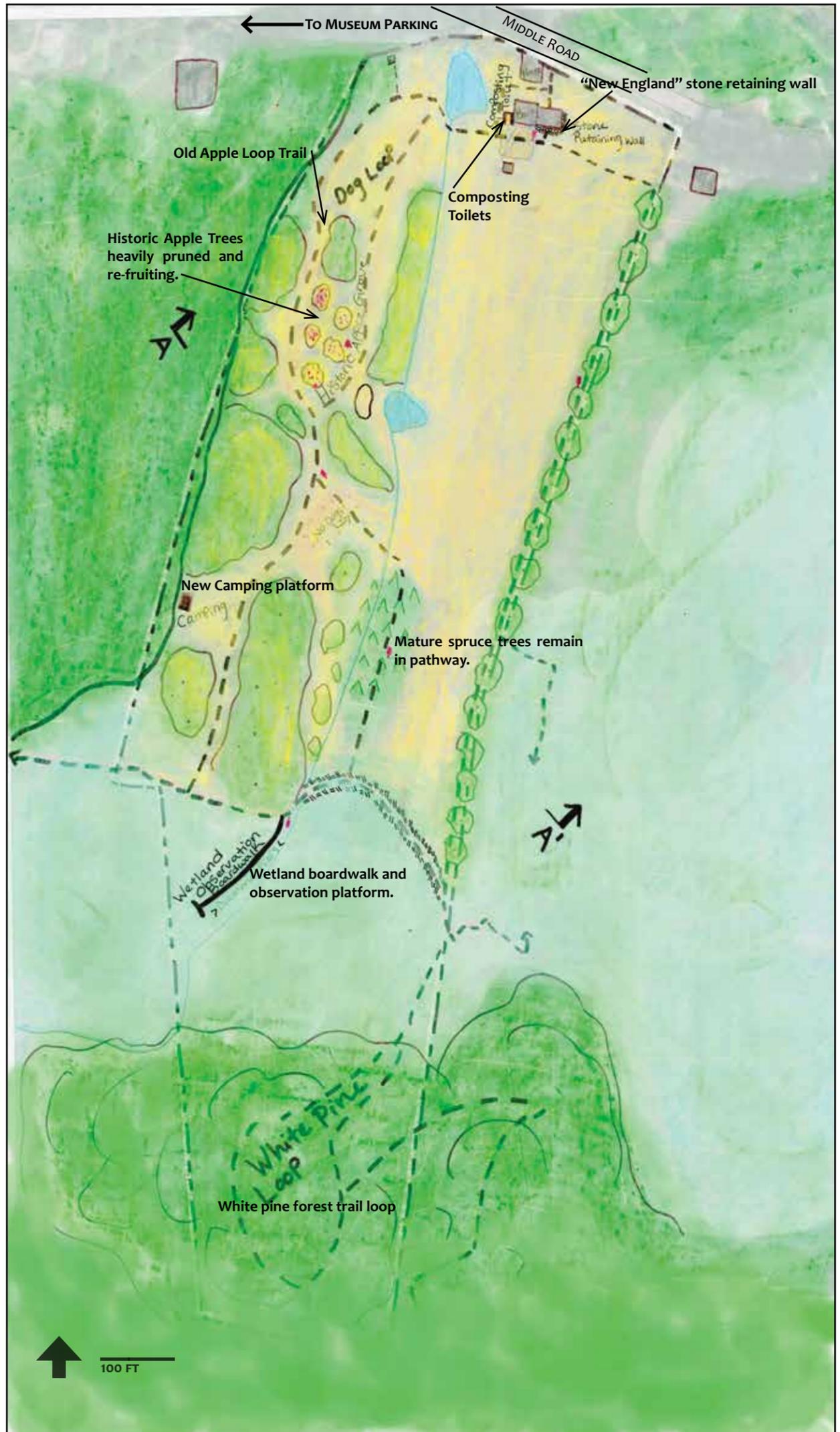
Historic apple trees can be reclaimed on Steele Farm.



A woodland boardwalk at the Silvio O. Conte site, Hadley, MA.



CONCEPTUAL SECTION, NOT TO SCALE.



# Management Alternative 3 Production Retrofit

Maximize agricultural production at Steele Farm while supporting existing recreational use and wildlife habitat.

## Opportunities:

- Animals are brought from off-site to rotationally graze invasive plants, shrubs and grassland.
- Wetlands are created to build a new food production area for native cranberries and wild rice.
- Perennial, low-till agriculture includes fruit trees, berries, nut trees, orchard renewal, mushrooms, wild rice, cranberries, and a forest garden.
- Local farmers and animals are active on-site and in silvopasture forest in the white pine forest.
- An edible landscape focus is created for wildlife and people, while the grassland remains intact.
- Local education, internships, and CSA opportunities are plentiful.
- No mowing of grassland needed if grazing occurs in September, except in paths.

## Constraints:

- Large increase in management and maintenance of site with increased production areas.
- Increased human presence and changing vegetation may decrease birds and wildlife.

## Management:

- Grassland grazed briefly in September, in rotational patches, instead of mowing.
- Shrub/tree hillside is rotationally grazed in warm months.
- White pine forest is transitioned to silvopasture forest garden.



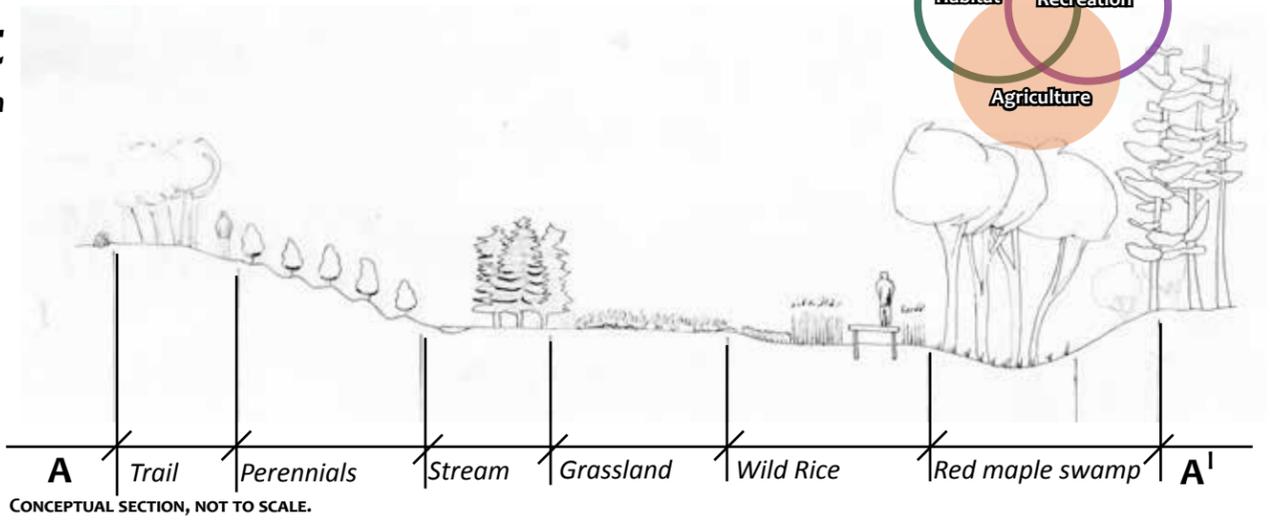
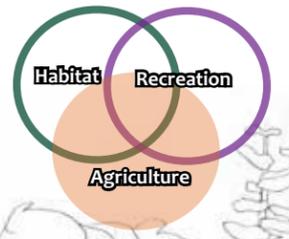
Native berries can be planted at Steele Farm to increase edibles.



Wild rice planted in the extended wetland.

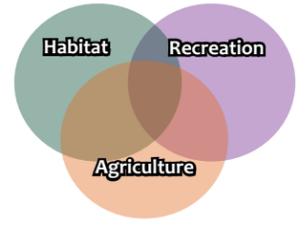


Cranberries planted in the extended wetland.



# Proposed Management Design In the Clearing

The final design highlights and expands important views, enhances habitat throughout the farm, maintains existing agricultural practices, and provides diverse walking, historic, and educational experiences for Steele Farm visitors.



① The middle path remains as the main trail through the farm. Signs will suggest using alternative paths from May through August and educate visitors about grassland birds and their nesting season.

② The historic farmstead becomes a focal point of entry and education. An outdoor classroom behind the barn provides a place to gather for groups, visiting schools, and community workshops. This area may also be rented for weddings and special events to raise money for Steele Farm.

③ A new vegetated berm and infiltration swale along the road addresses current erosion and hillside damage.

④ The trail from the parking lot is regraded to prevent erosion.

⑤ Four new parking spaces are added in the new entrance area on the northwest corner of the property. Cars park along the stone wall in the cleared area. A new “dog run” area is present along the utility road and stone wall that starts at this parking area. Various points are cleared along this walk for additional views to the east.

⑥ Movable seating areas are added behind the barn at the beginning of the trail, to take advantage of the views and multi-purpose space.

⑦ Steele Farm property is opened-up visually and physically by removing trees and invasives along the stone wall along on eastern property boundary, to include the town-owned Picnic Trust property. Grassland bird habitat may also be increased in the additional meadow. This provides broader views for visitors and wildlife alike.

⑧ Invasives, shrubs and trees are removed along the stone wall and a new path traverses the west side of the water channel on site.

⑨ A path to a footbridge directs people to a new bird viewing platform/outdoor classroom area along the “Stone Wall Trail”, to the west of the stream channel. This additional path becomes another educational place on site for habitat ecology and history, with the story of the New England stone wall. Walkers then travel back across another bridge into the grassland to walk through the old spruce trees.

⑩ The young spruce trees in the southern portion of the property are removed and high bush blueberry bushes are planted in the wet meadow.

⑪ The young spruce trees on the western slope are thinned and nut trees are planted. Camping continues on the western hillside.

⑫ An informal geology classroom area is created at the large rock erratic in the eastern part of the grassland. This can be accessed by the existing trail between the wet meadow and the grassland.

⑬ A diamond pier boardwalk connects the wet meadow and the wetland to a classroom platform for viewing plants and wildlife. This can be installed by community volunteers and requires no heavy equipment.



⑭ A white pine loop trail continues into the forest from the boardwalk and is another potential camping area.

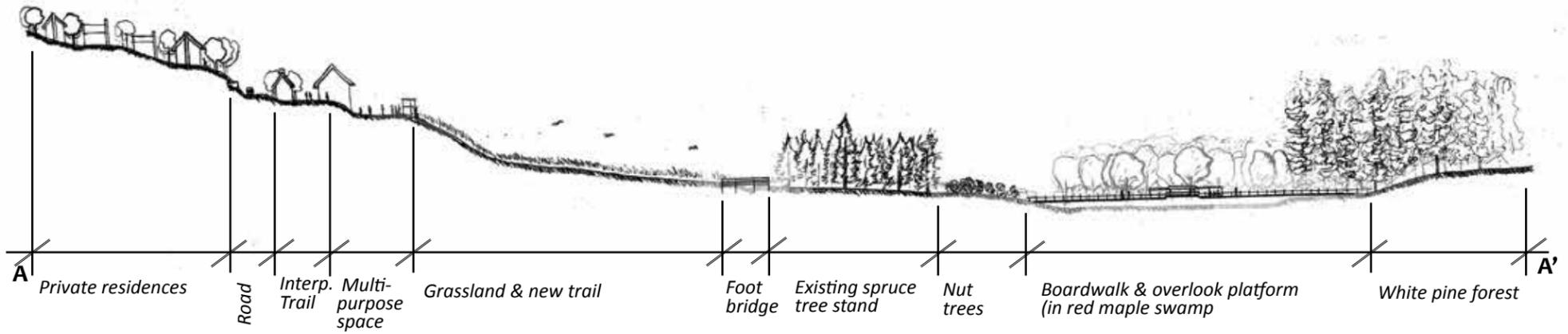
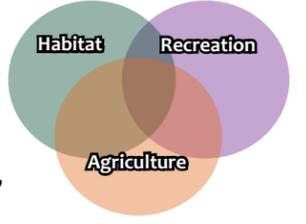
⑮ The old apple trees are heavily pruned for renewed productivity and the “Old Apple Loop” trail exists around them for a shorter walking loop.

## Grassland Management Details

- The grassland may be burned every few years for plant and habitat health. It should be mowed only once each year in late August or September to avoid habitat disturbance and to encourage grassland bird nesting.
- This management design clears specific areas to maintain and expand views from many vantage points. Clearing is important to deal with certain invasives. Animal grazing in rotation could be implemented if the town chooses this option. Goats and sheep will eat the invasives, but many are too large for initial animal removal. Integrating small grazing animals may be helpful moving forward.
- It may be necessary for the town to hire someone to mow the field once a year if interest by local farmers is lost with less frequent mowing. Workshops, educational programs on-site, and grants are some options to raise money to fund mowing, and brushhogging.

# Proposed Management Design In the Clearing

Intentionally opening up views will increase the aesthetic experience for people, habitat options for birds and other wildlife, and diversify the walking, historic, and educational experience for Steele Farm visitors.



CONCEPTUAL SECTION, NOT TO SCALE.

Multi-Use Outdoor Space

“Stone Wall” Trail

New Cleared View

“Old Apple Loop” Trail

Grassland Viewing Platform

Enriched Grassland

New Cleared View

Shrubby Hillslope

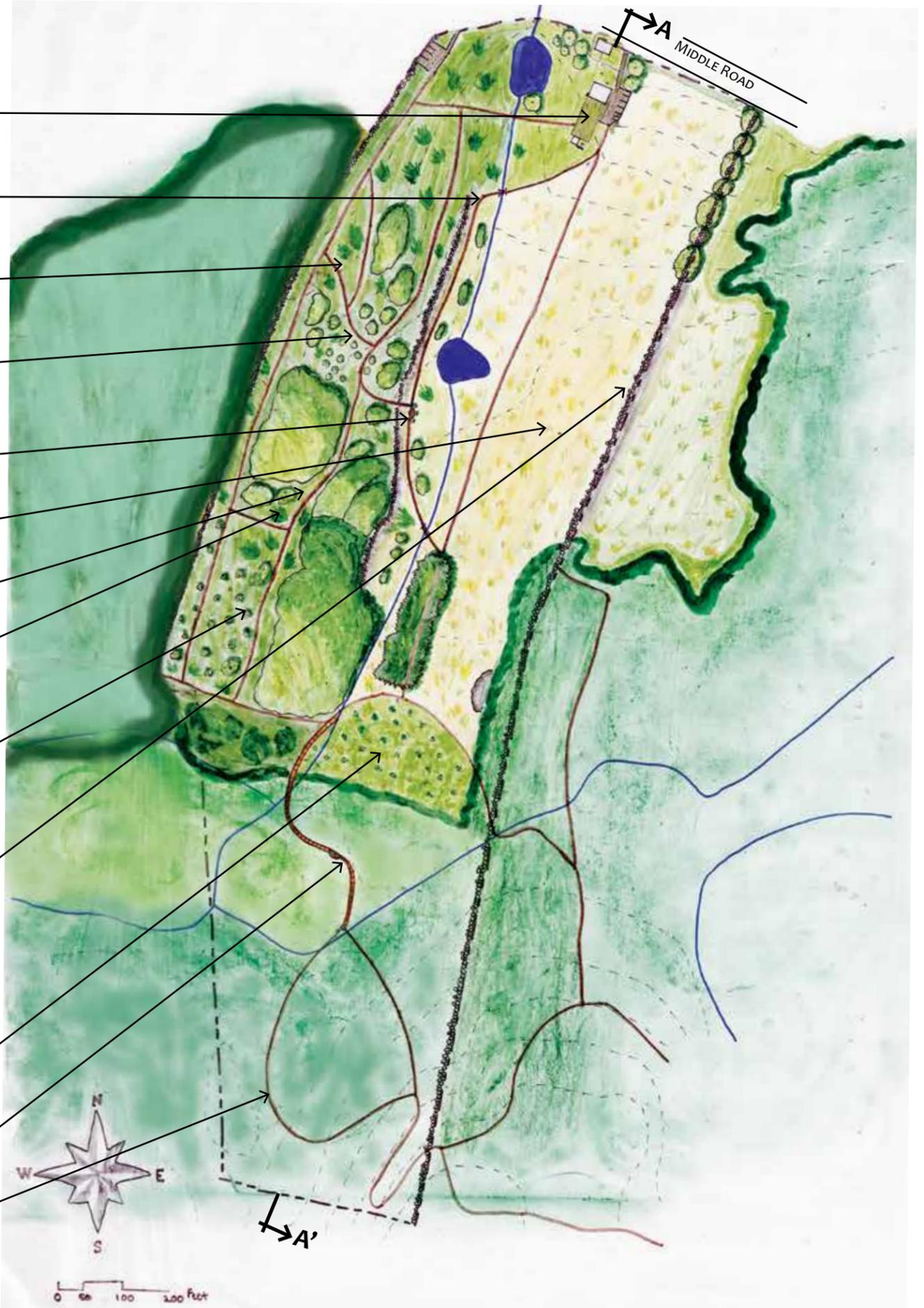
Planted Nut Trees

Trees and shrubs cleared to open east meadow.

Wet Meadow Plants and Blueberries

Serpentine Wetland Boardwalk and Viewing Platform

“White Pine Loop” Trail



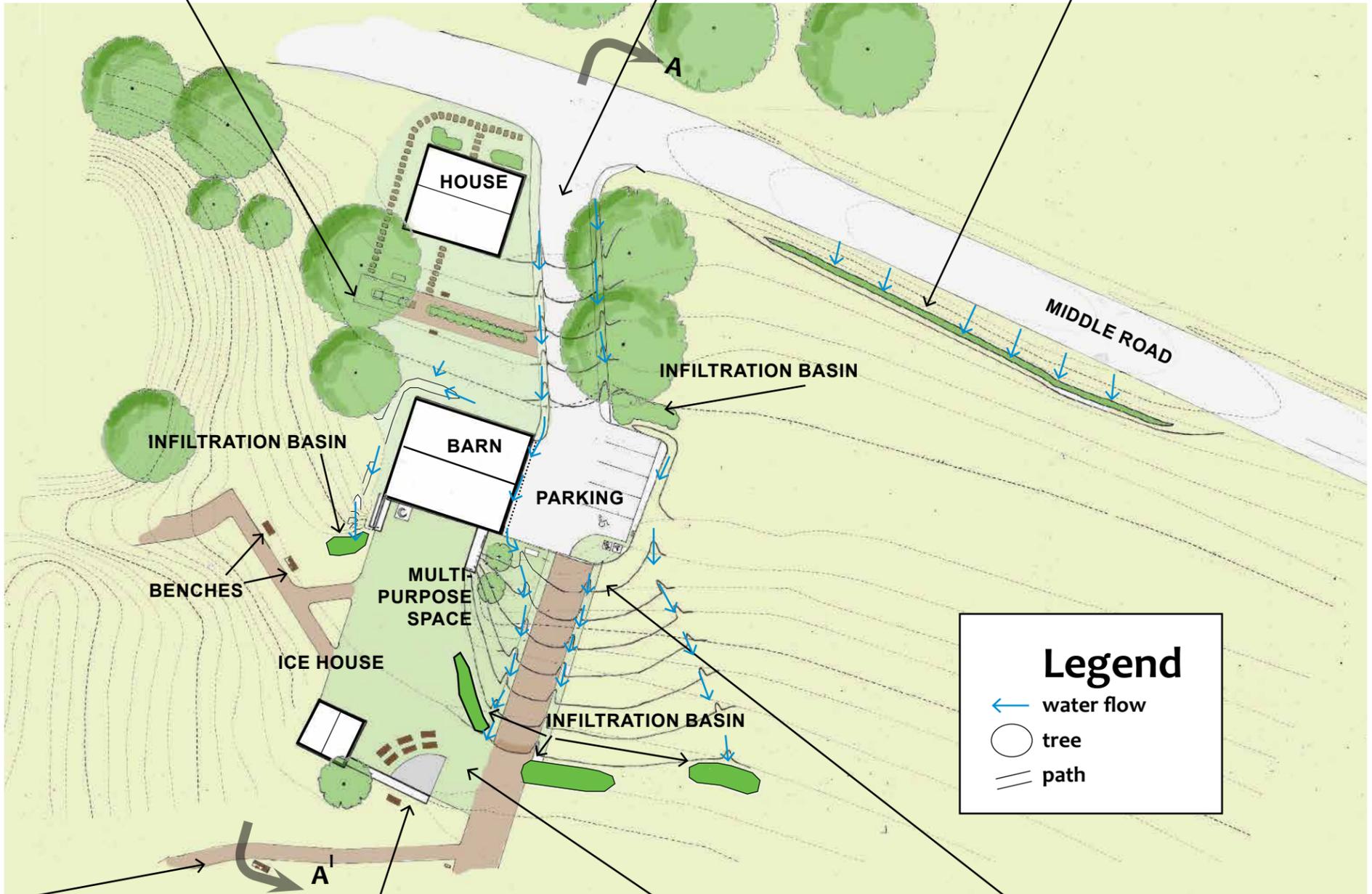
# Proposed Management Design Details

## Historic Buildings Area Management

**Interpretive Trail:** An interpretive trail follows the original tread of the historic road that used to run between the house and barn. A line of ornamental pollinator plants runs down the center, making the trail visually pleasing and benefiting wildlife. Educational signs explain the significance of the trail and the history of the house, barn, ice-house, fire pond, and farm. Two informal stone paths lead to the front and back doors of the house. Two small gardens flank the front of the house along Middle Road.

**Driveway & Parking Lot:** A gravel driveway with a 3" crown and 6" deep swales sends runoff away from the drive and parking lot. Asphalt will have to be removed, the surface regraded, and the new driveway maintained over time. To the east, an infiltration basin absorbs stormwater before it runs into the parking lot. To the west, water is sent to a tunnel along the edge of the parking lot before it runs off into more swales to the western side of the trail.

**Street-side Erosion Control:** An infiltration swale captures runoff coming from Middle Road on >25% slopes. Invasives are removed, erosion control blankets are installed, and native deep-rooting grass seed is broadcast.

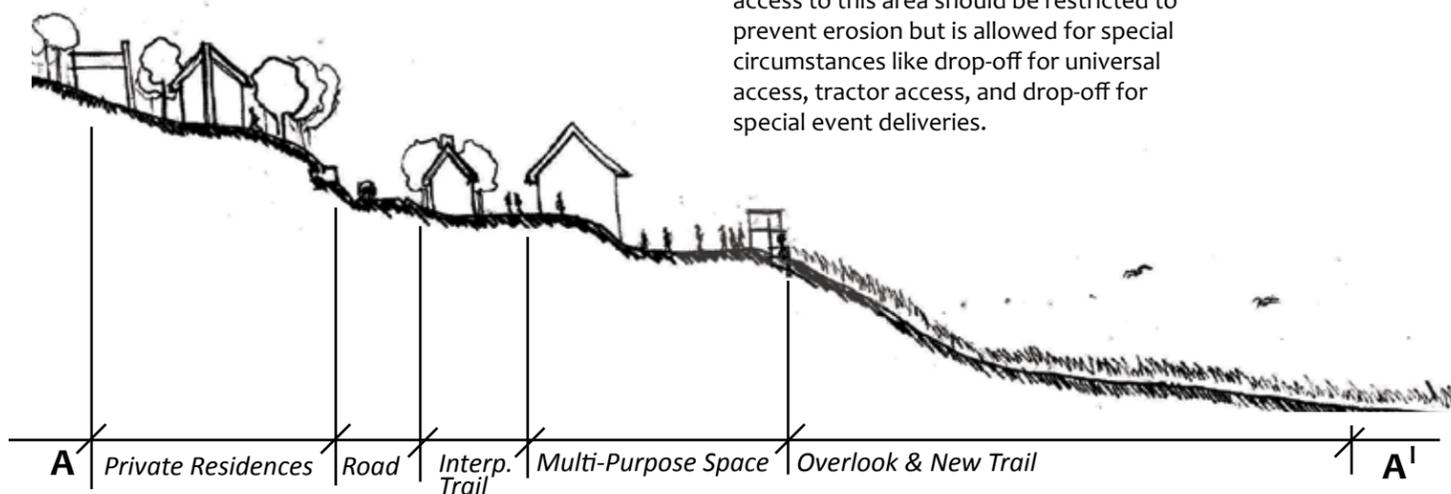


**New Trail:** A five-foot-wide mowed path runs west toward the perennial stream. It leads to a footbridge that crosses the stream. Temporary signs in a kiosk during ground-nesting bird nesting season educate visitors about the importance of protecting this habitat.

**Overlook:** A flat space with crushed stone provides an inviting platform to enjoy the view. Movable benches can be arranged around this area for a temporary outdoor classroom space.

**Multi-Purpose Space:** The house/barn/icehouse area is made accessible and usable for formal and informal events. This area emphasizes interpretation and history with signs that educate about the property's history. There is a composting toilet along the northeast corner for visitors. Vehicle access to this area should be restricted to prevent erosion but is allowed for special circumstances like drop-off for universal access, tractor access, and drop-off for special event deliveries.

**Regraded Trail Entrance:** The hillside south of the parking lot is filled to create a 10% slope with 6"-deep swales and a 3" crown to control the erosion. A more gradual slope eases access to the multi-purpose space and controls erosion in the long run.



Conceptual Section Diagram - Not to Scale

# Proposed Management Design Details

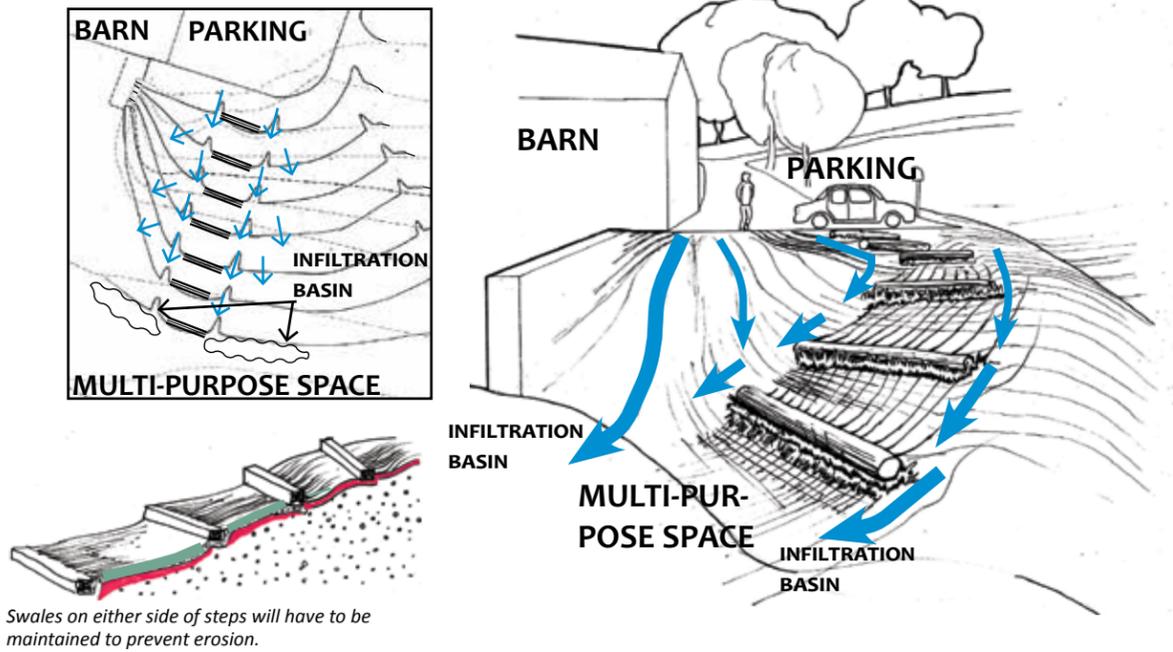
## Historic Buildings Area - Trail Management Toolbox

Two alternative designs for the entrance of Steele Farm provide ways to manage erosion while improving access and circulation. Both alternatives propose re-grading slopes to 10% or less, limiting access to pedestrians (except for handicapped, truck and event access from the northeast field), and proposes sustainable stabilization methods. Prior to any construction, the SFAC will need to apply for a variance from the governing body of the Conservation Restriction. Additional site engineering will be required.

### Steps

Six steps slow stormwater along the trail from the parking area. The trail in this design hugs the existing hillside to the west at a 10% slope and has one dam every 10 feet.

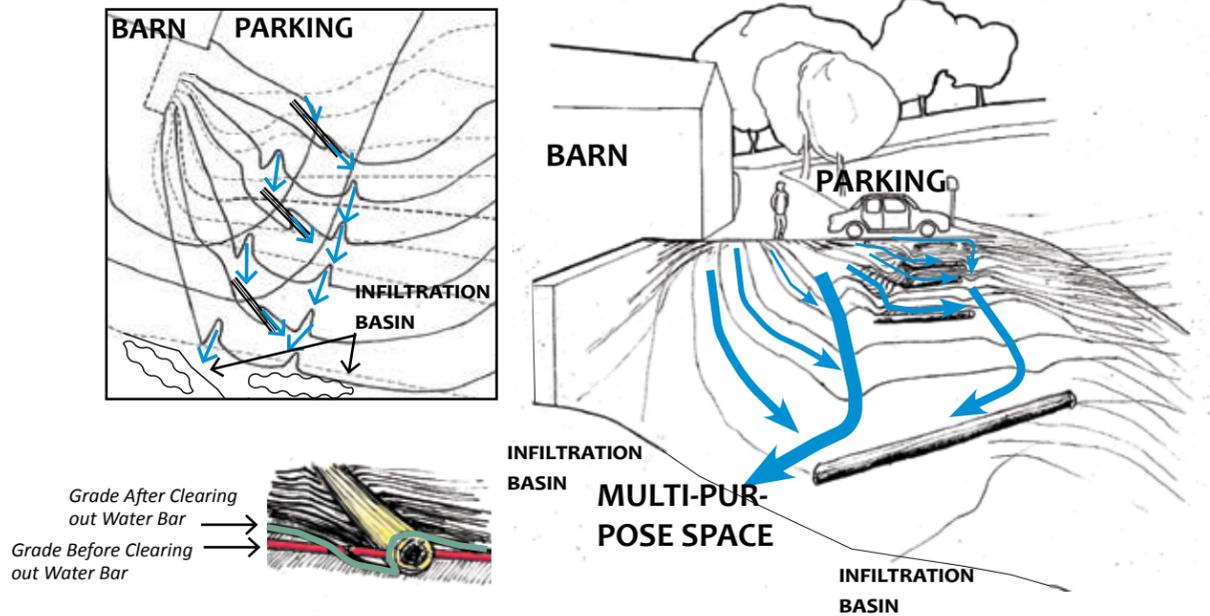
This re-grading requires the least amount of cut but will require extensive fill to the east of the trail. This alternative works with existing drainage patterns and makes the trail more pedestrian friendly and easy to maintain.



### Water Bars

Four water bars divert water away from the trail, preventing erosion or gulying. The trail in this alternative runs down the hill from the parking area at a 10% slope with one water bar every 20 feet. For proper drainage, water bars will need to be regularly cleared of debris (see Figure 2b).

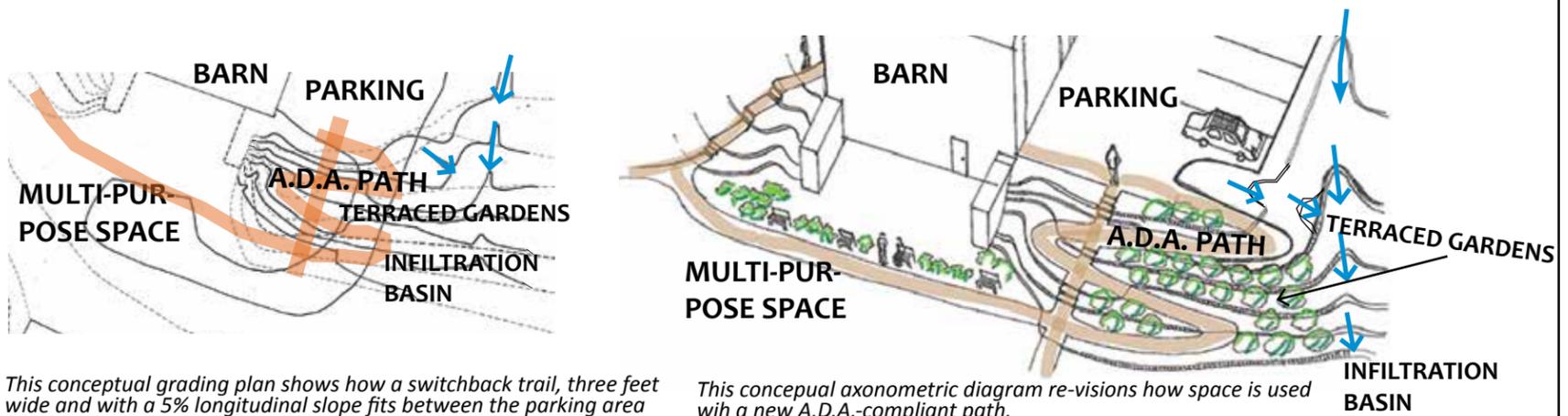
This re-grading requires some cutting along the west of the trail and will require extensive fill to the east. A gentler slope eases access and slows drainage, ensuring that the water bars will perform well and last long.



## What to Consider for Barrier-Free Access

Universal accessibility to this space may be required if the town restricts vehicular access (recommended, see previous page) and formally introduces public educational activities to the multi-purpose space. Universal accessibility calls for a trail at least 3 feet wide and a slope of no more than 5%. If the town decides to install an A.D.A.-compliant path here, the necessary grading is shown below. There are some drawbacks to this. First, it would be regulated under the property's Conservation Restriction, which restricts regrading on site and would require a variance from the appropriate governing body. Furthermore, these features may restrict some current patterns of circulation in this space such as horse-back riding, tractors and mowers, or overflow parking. The town may apply for a variance of A.D.A. regulations so as to accommodate the current access and circulation.

Universal accessibility is possible for this space. The conceptual axonometric diagram (below right) displays a barrier free switchback trail at a slope of 5% or less. Another more direct path with steps intersects this switchback trail at intermittent landings, outsloped at no more than 2%. In between the trails, 1-foot-deep retaining walls retain the moisture and erosion at every contour and provide an opportunity for terraced gardens to beautify the area. Water is channeled via a swale to an infiltration basin to the southeast. With the right site engineering, this trail can be visually appealing while also providing A.D.A. access and erosion control.



This conceptual grading plan shows how a switchback trail, three feet wide and with a 5% longitudinal slope fits between the parking area and multi-purpose space. This complies with A.D.A. regulations.

This conceptual axonometric diagram re-vision how space is used with a new A.D.A.-compliant path.

# Grassland Management

Careful measures must be taken to protect the valuable grassland at Steele Farm.

Scientific monitoring and plant enrichment with native species will help ensure a health future for wildlife and education of Steele Farm's grassland.

## Management Recommendations

- **Integrate native, warm-season grasses** into grassland to allow for both agricultural and habitat use. This can be achieved through soil slice-cutting and seeding in fall and spring. This transforms the hay crop to a later-season variety of native species that aligns with both grassland bird nesting needs and people's desire for a hay crop.
- Switchgrass, big bluestem, little bluestem, Indiangrass, broom sedge, sideoats gramma, and Eastern gamma are native species.
- **Controlled burning of the grassland every 3 years** will spur renewed growth of forbs and other plants, decrease buildup of dead plant material, enrich and reset soil nutrients, and decrease invasive plants that currently pose a problem. A burn boss will need to be hired for controlled burn organization and management. They are readily available in Massachusetts. Visit: [http://www.tncfiremanual.org/Contracting\\_a\\_burn.pdf](http://www.tncfiremanual.org/Contracting_a_burn.pdf)
- During non-burn years, mow the **grassland once a year in mid-August or later**. It is imperative for grassland habitat health that this regime be followed, as the previously recommended date of July is too early for the needs of ground nesting birds.
- **Initiate an ongoing scientific study of the grassland habitat to understand** the current and future health of grassland nesting birds at Steele Farm. Noting visual signs of birds is not enough evidence to understand an increase or decrease of birds at Steele Farm and all the factors that relate to their use of the site.



Bird studies can be ongoing at Steele Farm.



## Native Warm Season Grasses

- Switchgrass
- Big Bluestem
- Little Bluestem
- Indiangrass
- Broom Sedge
- Sideoats Gramma
- Eastern Gama



Mow grassland only once a year.



A burn boss makes a controlled grassland burn.

# Hillside Management

The hillside at Steele Farm would benefit from selective thinning of vegetation for new viewshed experiences. This could also help control invasive plants, manage forest succession, and increase path connections.

## Management Recommendations

- **Shrub/tree hillside brush-hogged/mowed and thinned every 3-5 years** allows for sufficient patches of growth and edge-habitat stability. More frequent mowing and trimming would over-thin the hillside and make it less desirable to wildlife, such as the blue-winged warbler, Eastern towhee, saw-whet owl, barred owls, pheasant, deer, fox, moles, rabbits, and many more that currently live there. Keeping the hillslope shrubby would also provide privacy in the camping areas used by town groups. Community members have said they value the area so kids can feel tucked away in the wilderness, without being far from the entrance to Steele Farm.
- **Grass paths should be mowed more frequently** through the warm months, as ticks and tall grass can be a health risk for visitors. A new dog run area on the current utility road path would need special attention for controlling dog waste and grass may need to be mowed more frequently here.
- **Edible nut trees would strengthen perennial food production at Steele Farm.** Filbert/hazelnut, walnut, chestnut, and other trees could be planted throughout the southern portion of the hillside, where tested arsenic levels are considered safe by the EPA. **Planting or soil disruption of any kind is not recommended in the northern half of the hillslope due to high levels of arsenic above the EPA standard for health risk.**



The hillslope should be selectively brush hogged every 3-5 years to maintain shrubs and trees and prevent forest secession.



Filbert trees planted on a hillside.



Dog-run area on utility road at Steele Farm.

# Trails and Boardwalk Management

Visitors to Steele Farm continue to enjoy mowed grass pathways. Two small footbridges, a bird viewing platform, and a serpentine wetland boardwalk create new walking experiences and educational opportunities.



The hillslope should be selectively brush hogged every 3-5 years to maintain shrubs and trees and prevent forest secession.

## Trails Management Recommendations

- Trails through the grassland and hillside areas should remain grass-covered. The turf covering limits soil erosion, infiltrates water, and provides a capped barrier between people, animals and heavy metal arsenic, found to be above EPA standards on the northern part of the hillside.
- Grass trails should be mowed once every few weeks if foot traffic is not keeping them below ankle high. Frequent mowing or wear from foot traffic will provide an easily walkable height of grass for visitors on foot.
- Trails in the pine forest at the southern portion of the property are not grassy, but are covered in pine needles. They should remain in their natural state, with seasonal large debris clearing on the trails by the DPW, or volunteers.



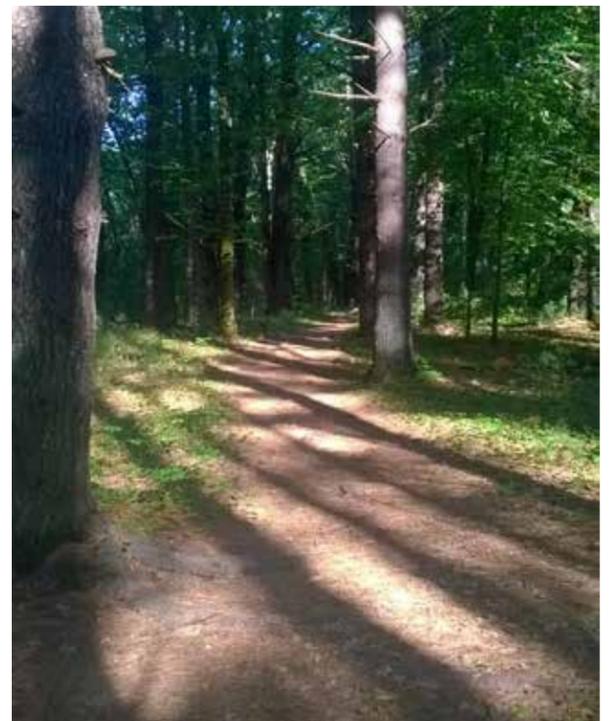
An extensive woodland boardwalk at the Silvio O. Conte wildlife area, Hadley MA, provides inspiration for Steele Farm's wetland boardwalk system.

## Boardwalk Management Recommendations

- Installation of a serpentine boardwalk on diamond piers will connect the wet meadow and adjacent wetland with the white pine forest. A wetland observation platform is centrally located on the boardwalk for educational site visits and seating for groups and individuals. Diamond piers are relatively easy to install, and they do not require heavy equipment.
- Eagle Scouts, Boy Scouts, town workers, and volunteers could be engaged to build the boardwalk. Without the need for any heavy equipment, manual techniques create less disturbance of the wetland.
- The boardwalk can be open year round as an interesting connecting walkway through a natural habitat, while protecting the wetland habitat from the harm of walking directly in the wetland.
- Boardwalk material can be milled from wood harvested from the white pine forest on-site. A more rot-resistant wood like cedar may be used and natural oils and resins can be applied to protect the wood from moisture.



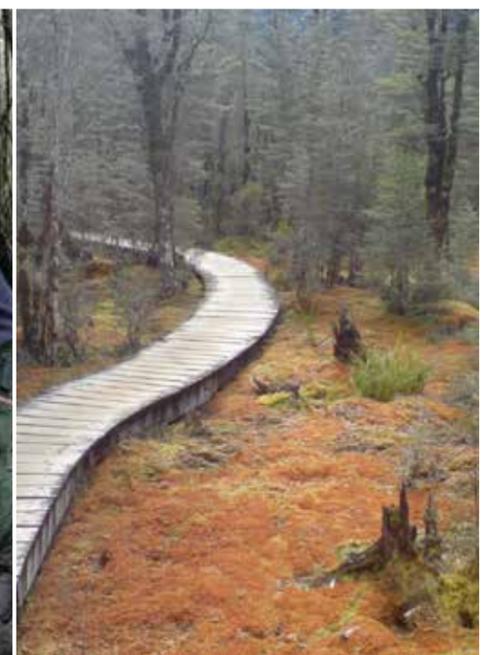
The utility road pathway provides walking with views.



Pine needle and dirt pathways connect Steele Farm to the Community Garden.



Diamond piers being installed by volunteers.



A serpentine boardwalk weaves through a wetland bog.

# Management Cost Estimates

The cost of materials and labor are divided into four management categories according to location and management requirements. Smaller scale site improvements are categorized separately, whereas the larger enterprises such as field clearing, parking improvements and bank stabilization are each categorized as a whole. For example, clearing the field between Steele Farm and the Picnic Street Trust property demands much more intensive management than smaller scale clearing of invasive plants for the bank stabilization by Middle Road. Alternatively, clearing by the road will be much more technical and demanding of resources in terms of erosion control than the field clearing will be.

Quantities are drawn from the recommendations of this management plan and applied to standard industry units of measurement. A low and high cost and subtotal present each item's range in price, which depends in part on the quality of material and from whom it is purchased. Once an item has been selected, mobilization, administration, permitting fees, taxing, and constructional survey will have to be incorporated into a grand total. These prices are not included here and will depend on different town and state governmental fees.

SITE IMPROVEMENTS	UNIT	QUANTITY	LOW UNIT COST	HIGH UNIT COST	LOW SUBTOTAL	HIGH SUBTOTAL
TRAILS: GRADING	SQUARE FOOT	4,600	\$0.15	\$0.25	\$690.00	\$1,150.00
TRAILS: CRUSHED GRAVEL	TON	15	\$45.00	\$60.00	\$675.00	\$900.00
TRAILS: LANDSCAPE FABRIC	SQUARE FOOT	150	\$1.00	\$2.00	\$150.00	\$300.00
TRAILS: FINISH MATERIAL	CUBIC YARD	50	\$40.00	\$50.00	\$2,000.00	\$2,500.00
TRAILS: STONE PATHS	SQUARE FOOT	300	\$3.00	\$4.50	\$900.00	\$1,350.00
TRAILS: A-FRAME STEPS	EACH	2	\$250.00	\$300.00	\$500.00	\$600.00
TRAILS: FOOT-BRIDGE	SQUARE FOOT	180	\$25.00	\$30.00	\$4,500.00	\$5,400.00
TRAILS: BOARDWALK	SQUARE FOOT	4,000	\$45.00	\$60.00	\$180,000.00	\$240,000.00
TRAILS: BENCHES	EACH	10	\$250.00	\$1,000.00	\$2,500.00	\$10,000.00
TRAILS: OVERLOOK PLATFORMS	EACH	2	\$15,000.00	\$20,000.00	\$30,000.00	\$40,000.00
TRAILS: SPLIT-RAIL FENCING	LINEAR FEET	100	\$35.00	\$50.00	\$3,500.00	\$5,000.00
GARDENS: LOAM	CUBIC YARD	800	\$35.00	\$45.00	\$28,000.00	\$36,000.00
GARDENS: COMPOST	CUBIC YARD	800	\$40.00	\$60.00	\$32,000.00	\$48,000.00
GARDENS: MULCH	CUBIC YARD	800	\$40.00	\$60.00	\$32,000.00	\$48,000.00
GARDENS: NEW PLANTS	SQUARE FOOT	300	\$1.50	\$3.00	\$450.00	\$900.00
RAIN GARDENS: CRUSHED GRAVEL	TON	5	\$45.00	\$60.00	\$225.00	\$300.00
RECYCLING RECEPTACLE	EACH	1	\$50.00	\$90.00	\$50.00	\$90.00
DOG WASTE COMPOST RECEPTACLE	EACH	1	\$65.00	\$115.00	\$65.00	\$115.00
COMPOSTING TOILET	EACH	1	\$4,500.00	\$7,000.00	\$4,500.00	\$7,000.00
INFORMATIONAL KIOSK	EACH	1	\$400.00	\$600.00	\$400.00	\$600.00
SIGNAGE	EACH	20	\$150.00	\$250.00	\$3,000.00	\$5,000.00
TREE REMOVAL	EACH	15	\$250.00	\$500.00	\$3,750.00	\$7,500.00
INVASIVE PLANTS CLEARING	ACRE	5	\$4,000.00	\$6,500.00	\$20,000.00	\$32,500.00
NEW PLANTS	SQUARE FOOT	75,000	\$2.00	\$3.50	\$150,000	\$262,000.00
				<b>TOTAL</b>	<b>\$173,750.00</b>	<b>\$302,000.00</b>
<b>PARKING IMPROVEMENTS</b>						
ASPHALT REMOVAL	SQUARE YARD	460	\$18.00	\$25.00	\$8,280.00	\$11,500.00
GRADING	SQUARE FOOT	2,000	\$0.15	\$0.25	\$300.00	\$500.00
PAVERS/POROUS ASPHALT/POROUS CONCRETE	SQUARE FOOT	3,600	\$8.00	\$12.00	\$28,800.00	\$43,200.00
CRUSHED GRAVEL	TON	1,800	\$50.00	\$75.00	\$90,000.00	\$135,000.00
SIGNAGE	EACH	2	\$150.00	\$200.00	\$300.00	\$400.00
				<b>TOTAL</b>	<b>\$127,680.00</b>	<b>\$190,600.00</b>
<b>BANK STABILIZATION AT THE ROAD</b>						
EROSION CONTROL	LUMP SUM	1	\$4,000.00	\$6,000.00	\$4,000.00	\$6,000.00
GRADING	SQUARE FOOT	900	\$0.20	\$0.30	\$180.00	\$270.00
SEED	ACRE	0.3	\$2,500.00	\$4,000.00	\$750.00	\$1,200.00
INVASIVES CLEARING	ACRE	0.5	\$11,000.00	\$15,000.00	\$5,500.00	\$7,500.00
				<b>TOTAL</b>	<b>\$10,430.00</b>	<b>\$14,970.00</b>

# Soil Test Results

UMass soil testing laboratory, Amherst, MA. Five soil areas sampled by the Conway team, May 2015. <https://soiltest.umass.edu/>



## Metals Test 1: Historic Buildings Area

Analysis	Value Found
Element	--mg/kg--
Lead (Pb)	67.7 mg/kg
Nickel (Ni)	7.5 mg/kg
Cadmium (Cd)	0.0 mg/kg
Chromium (Cr)	12.8 mg/kg
Zinc (Zn)	29.6 mg/kg
Copper (Cu)	2.7 mg/kg
Arsenic (As)	15.9 mg/kg
Selenium (Se)	N/A mg/kg
Molybdenum (Mo)	N/A mg/kg

## Metals Test 2: Grassland

Analysis	Value Found
Element	--mg/kg--
Lead (Pb)	58.5 mg/kg
Nickel (Ni)	8.0 mg/kg
Cadmium (Cd)	0.0 mg/kg
Chromium (Cr)	13.1 mg/kg
Zinc (Zn)	31.4 mg/kg
Copper (Cu)	2.2 mg/kg
Arsenic (As)	19.2 mg/kg
Selenium (Se)	N/A mg/kg
Molybdenum (Mo)	N/A mg/kg

## Organics Test 2: Grassland

Results		Results			
Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H2O)	5.7		Cation Exch. Capacity, meq/100g	11.9	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	4.3	
Macronutrients			Base Saturation, %		
Phosphorus (P)	3.5	4-14	Calcium Base Saturation	53	50-80
Potassium (K)	68	100-160	Magnesium Base Saturation	9	10-30
Calcium (Ca)	1265	1000-1500	Potassium Base Saturation	1	2.0-7.0
Magnesium (Mg)	133	50-120	Scoop Density, g/cc	0.75	
Sulfur (S)	17.3	>10	Optional tests		
Micronutrients *			Soil Organic Matter (LOI), %	9.5	
Boron (B)	0.2	0.1-0.5			
Manganese (Mn)	10.5	1.1-6.3			
Zinc (Zn)	1.6	1.0-7.6			
Copper (Cu)	1.2	0.3-0.6			
Iron (Fe)	18.6	2.7-9.4			
Aluminum (Al)	212	<75			
Lead (Pb)	8.5	<22			

## Organics Test 1: Historic Buildings Area

Results		Results			
Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H2O)	5.6		Cation Exch. Capacity, meq/100g	11.4	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	6.0	
Macronutrients			Base Saturation, %		
Phosphorus (P)	5.4	4-14	Calcium Base Saturation	39	50-80
Potassium (K)	91	100-160	Magnesium Base Saturation	7	10-30
Calcium (Ca)	882	1000-1500	Potassium Base Saturation	2	2.0-7.0
Magnesium (Mg)	97	50-120	Scoop Density, g/cc	0.85	
Sulfur (S)	17.3	>10	Optional tests		
Micronutrients *			Soil Organic Matter (LOI), %	6.7	
Boron (B)	0.2	0.1-0.5			
Manganese (Mn)	10.2	1.1-6.3			
Zinc (Zn)	2.4	1.0-7.6			
Copper (Cu)	0.9	0.3-0.6			
Iron (Fe)	20.8	2.7-9.4			
Aluminum (Al)	125	<75			
Lead (Pb)	8.9	<22			

## Metals Test 3: Red Maple

Analysis	Value Found
Element	--mg/kg--
Lead (Pb)	35.7 mg/kg
Nickel (Ni)	7.4 mg/kg
Cadmium (Cd)	0.0 mg/kg
Chromium (Cr)	9.2 mg/kg
Zinc (Zn)	30.0 mg/kg
Copper (Cu)	5.5 mg/kg
Arsenic (As)	5.7 mg/kg
Selenium (Se)	N/A mg/kg
Molybdenum (Mo)	N/A mg/kg

## Organics Test 3: Red Maple Swamp

Results		Results			
Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H2O)	5.5		Cation Exch. Capacity, meq/100g	23.2	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	8.4	
Macronutrients			Base Saturation, %		
Phosphorus (P)	3.2	4-14	Calcium Base Saturation	53	50-80
Potassium (K)	126	100-160	Magnesium Base Saturation	10	10-30
Calcium (Ca)	2445	1000-1500	Potassium Base Saturation	1	2.0-7.0
Magnesium (Mg)	278	50-120	Scoop Density, g/cc	0.59	
Sulfur (S)	33.6	>10	Optional tests		
Micronutrients *			Soil Organic Matter (LOI), %	21.2	
Boron (B)	0.3	0.1-0.5			
Manganese (Mn)	37.8	1.1-6.3			
Zinc (Zn)	6.5	1.0-7.6			
Copper (Cu)	1.3	0.3-0.6			
Iron (Fe)	95.3	2.7-9.4			
Aluminum (Al)	122	<75			
Lead (Pb)	5.8	<22			

## Metals Test 5: North Hillside

Analysis	Value Found
Element	--mg/kg--
Lead (Pb)	172.5 mg/kg
Nickel (Ni)	7.0 mg/kg
Cadmium (Cd)	0.0 mg/kg
Chromium (Cr)	11.2 mg/kg
Zinc (Zn)	24.8 mg/kg
Copper (Cu)	0.4 mg/kg
Arsenic (As)	68.2 mg/kg
Selenium (Se)	N/A mg/kg
Molybdenum (Mo)	N/A mg/kg

## Metals Test 4: South Hillside

Analysis	Value Found
Element	--mg/kg--
Lead (Pb)	29.0 mg/kg
Nickel (Ni)	6.5 mg/kg
Cadmium (Cd)	0.0 mg/kg
Chromium (Cr)	12.3 mg/kg
Zinc (Zn)	20.9 mg/kg
Copper (Cu)	0.0 mg/kg
Arsenic (As)	7.9 mg/kg
Selenium (Se)	N/A mg/kg
Molybdenum (Mo)	N/A mg/kg

## Organics Test 4: South Hillside

Results		Results			
Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H2O)	5.8		Cation Exch. Capacity, meq/100g	11.3	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	4.4	
Macronutrients			Base Saturation, %		
Phosphorus (P)	1.4	4-14	Calcium Base Saturation	44	50-80
Potassium (K)	104	100-160	Magnesium Base Saturation	14	10-30
Calcium (Ca)	994	1000-1500	Potassium Base Saturation	2	2.0-7.0
Magnesium (Mg)	194	50-120	Scoop Density, g/cc	0.76	
Sulfur (S)	16.2	>10	Optional tests		
Micronutrients *			Soil Organic Matter (LOI), %	9.8	
Boron (B)	0.8	0.1-0.5			
Manganese (Mn)	14.1	1.1-6.3			
Zinc (Zn)	1.2	1.0-7.6			
Copper (Cu)	1.3	0.3-0.6			
Iron (Fe)	10.0	2.7-9.4			
Aluminum (Al)	219	<75			
Lead (Pb)	5.0	<22			

## Organics Test 5: North Hillside

Results		Results			
Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H2O)	5.3		Cation Exch. Capacity, meq/100g	10.1	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	7.6	
Macronutrients			Base Saturation, %		
Phosphorus (P)	4.0	4-14	Calcium Base Saturation	17	50-80
Potassium (K)	110	100-160	Magnesium Base Saturation	5	10-30
Calcium (Ca)	338	1000-1500	Potassium Base Saturation	3	2.0-7.0
Magnesium (Mg)	63	50-120	Scoop Density, g/cc	0.76	
Sulfur (S)	26.2	>10	Optional tests		
Micronutrients *			Soil Organic Matter (LOI), %	8.5	
Boron (B)	0.2	0.1-0.5			
Manganese (Mn)	12.6	1.1-6.3			
Zinc (Zn)	2.0	1.0-7.6			
Copper (Cu)	1.4	0.3-0.6			
Iron (Fe)	22.8	2.7-9.4			
Aluminum (Al)	369	<75			
Lead (Pb)	59.4	<22			

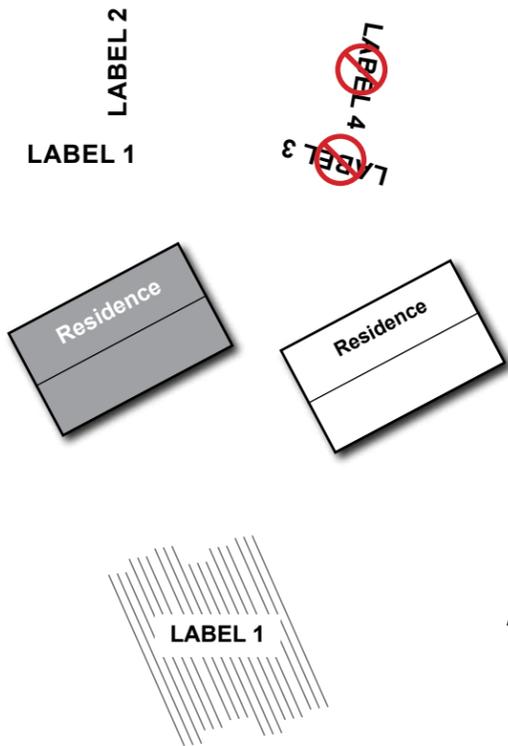
# What's what?

## Labeling elements of a plan

1

Labels directly on the plan:

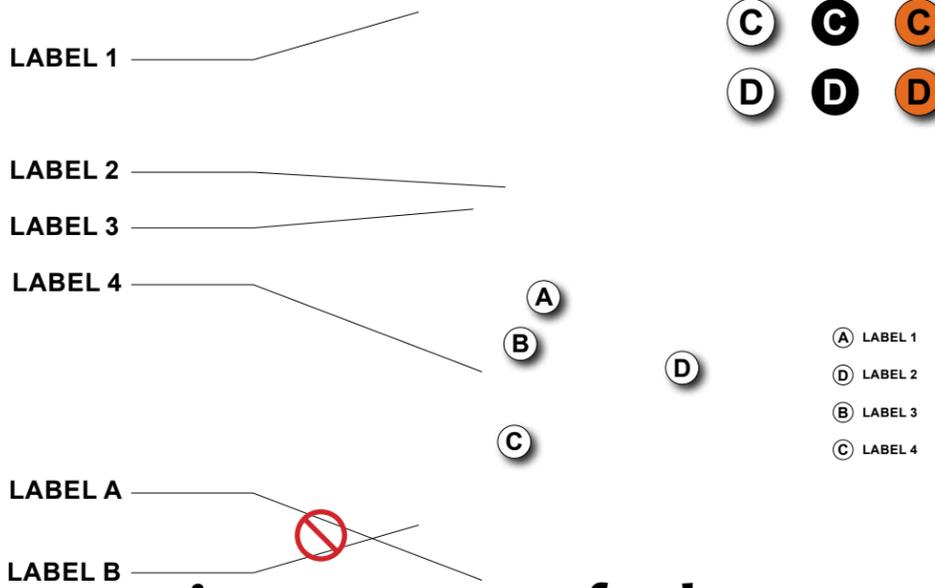
- The most direct way to identify a plan element is with a label directly on or adjacent to the element.
- Labels should not obscure what they are intended to identify.
- Labels should read from the bottom or the right and shouldn't be upside-down or oriented to the left.
- To create a white area behind a label: set the text frame background to white/paper and then in <<Text Frame Options>> set an inset to move the label off the edge of the text frame box.
- Labels should never be hyphenated.



2

Labels with leader lines:

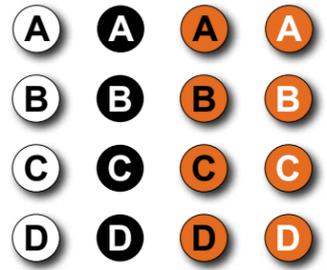
- Labels are sometimes more legible when they are placed to one or more sides of a plan or other drawing and a leader line is used to affiliate them with their corresponding elements.
- Leader lines should never cross.
- Leader lines should not visually distract from the drawing they are to label.
- It is useful for leader lines to move away from parallel labels.
- Labels should never be hyphenated.



3

Labels with markers (letters or numbers):

- With adequate contrast, the labels do not have to be too large.
- Be careful that the label doesn't obscure part of the drawing being labelled.
- The labels don't have to be the same size as the text as on the drawing.



- A LABEL 1
- D LABEL 2
- B LABEL 3
- C LABEL 4

## Diagramming on top of a base

### Adding graphics in InDesign to a hand-drawn plan

1

Showing movement:

- Use contrast, color, or X to indicate directionality.
- Drop shadows visually can help float the new graphics and reduce visual confusion with the base.
- Giving the new graphics transparency can reduce the amount of information from the base that is obscured by the new graphics.

