



Bower Springs Conservation Area Management Assessment Bolton, Massachusetts

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ACKNOWLEDGEMENTS

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PROJECT BACKGROUND

Across the country, land management is starting to become a more significant and visible concern for communities. The physical, social, and aesthetic effects of habitat loss, the decline of open space, and overdevelopment have brought citizens and governments together to thoughtfully and thoroughly protect remaining resources while reclaiming some of what has been lost.

The town of Bolton, Massachusetts, has an extensive network of contiguous and protected open space, with a variety of land owners and managers. As of 2004, over 25% of the town’s land area was permanently protected open space, managed by the state, town, a land trust, or private landowners. Approximately 1000 acres, one-third of Bolton’s permanently protected open space, was town-owned land managed by the Conservation Commission. However, none of the 22 parcels currently has a management plan in place to determine what its future might be.

Each parcel in the care of Bolton’s Conservation Commission needs guidance, and this document seeks to clarify the process by which the Commission might develop management plans for these sites in concert with one another. A team from the Conway School of Landscape Design worked with the Bolton Conservation Commission to identify such a plan specifically for Bower Springs. This document provides site recommendations to resolve ecological and social conflicts on site; additionally, the groundwork is laid to complete a more comprehensive plan following the design process detailed within the document.

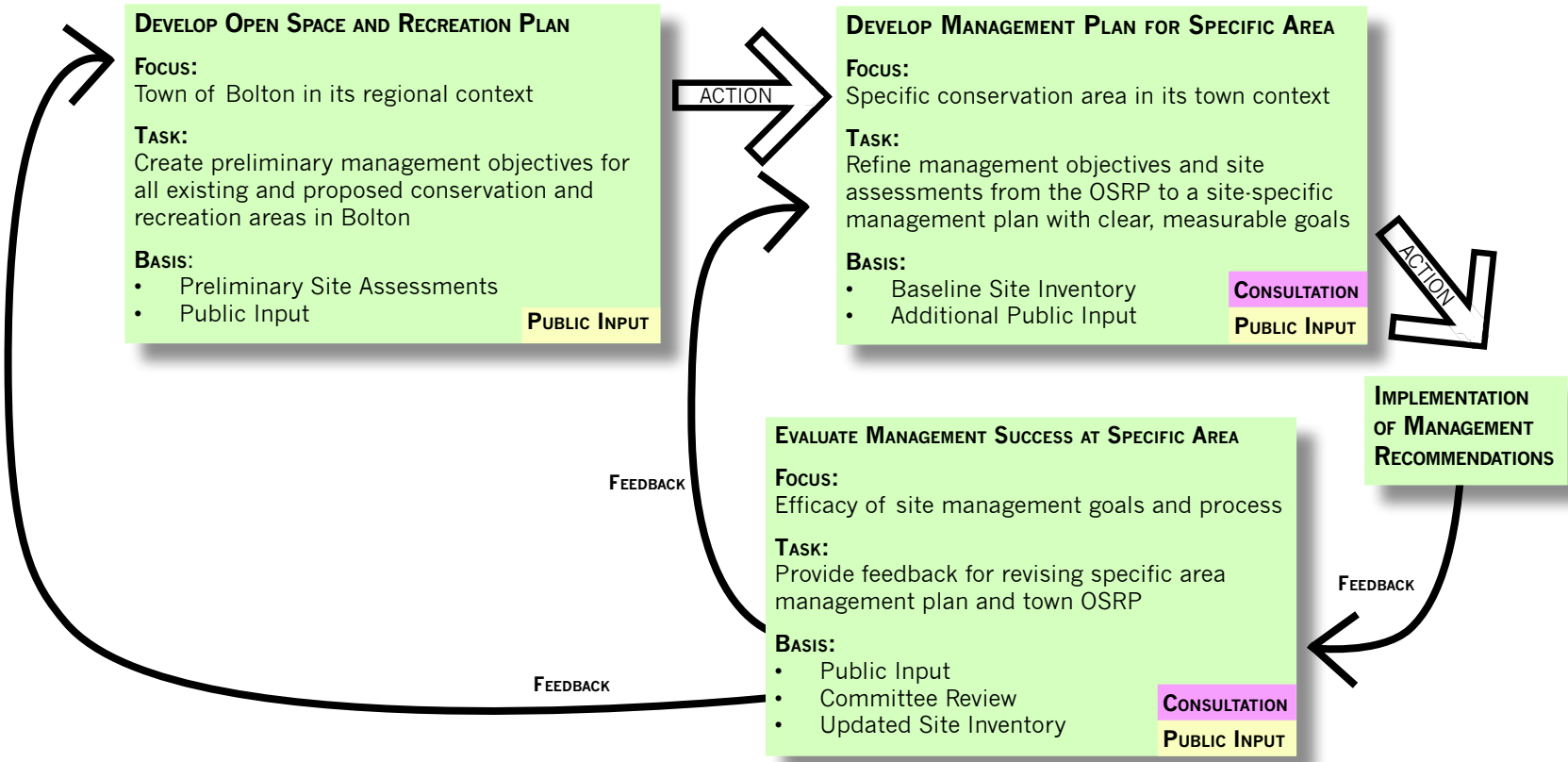
PROCESS

The diagram at right distills the iterative process by which towns are able to determine and implement appropriate management plans for open spaces. A management plan has its origins in a town’s Open Space and Recreation Plan, in which preliminary management objectives are developed in concert with basic site assessments. At this step, the town seeks to determine the active/passive recreation, conservation, educational, and social resources it has in its protected open space. These, along with the locations and conditions of potential land acquisitions and their presumed uses, guide the initial management objectives.

Land management professionals use this framework to create site-specific goals, determined by detailed site reconnaissance, an ongoing public dialogue, and the refinement of management objectives for the site as suggested in the OSRP. Proposals are submitted to the client and the public, keeping the process open and inclusive. Public meetings are an opportunity for the client and consultants to explain assessments and recommendations, to ask questions, and to consider other points of view. A management plan provides the client with clearly stated goals for a site in the near- and long-term, and clear methods for achieving those goals. The success of the plan can only be determined over time, and continual review of the status of the plan’s goals informs revisions to the plan and to the OSRP process.



The beginnings of a site inventory, and an example of the usefulness of public input.





A tree swallow enjoys the waterfront property



Beaver engineering in action



Milkweed along the edge of an old field, the habitat of Monarch butterflies

TOWN OF BOLTON 2005 OPEN SPACE AND RECREATION PLAN

In 2005, after two years of collaboration with town government, citizen boards, committees, and the general public, the Bolton Open Space Committee produced the Bolton 2005 Open Space and Recreation Plan (OSRP). The Plan built on the 1998 OSRP, revisiting its successes, updating its information, and revising its previous components and goals. The 2005 OSRP recommended dozens of actions be taken over a five-year period to reach listed objectives. These objectives, 29 of them in total, are based on the six goals listed below.

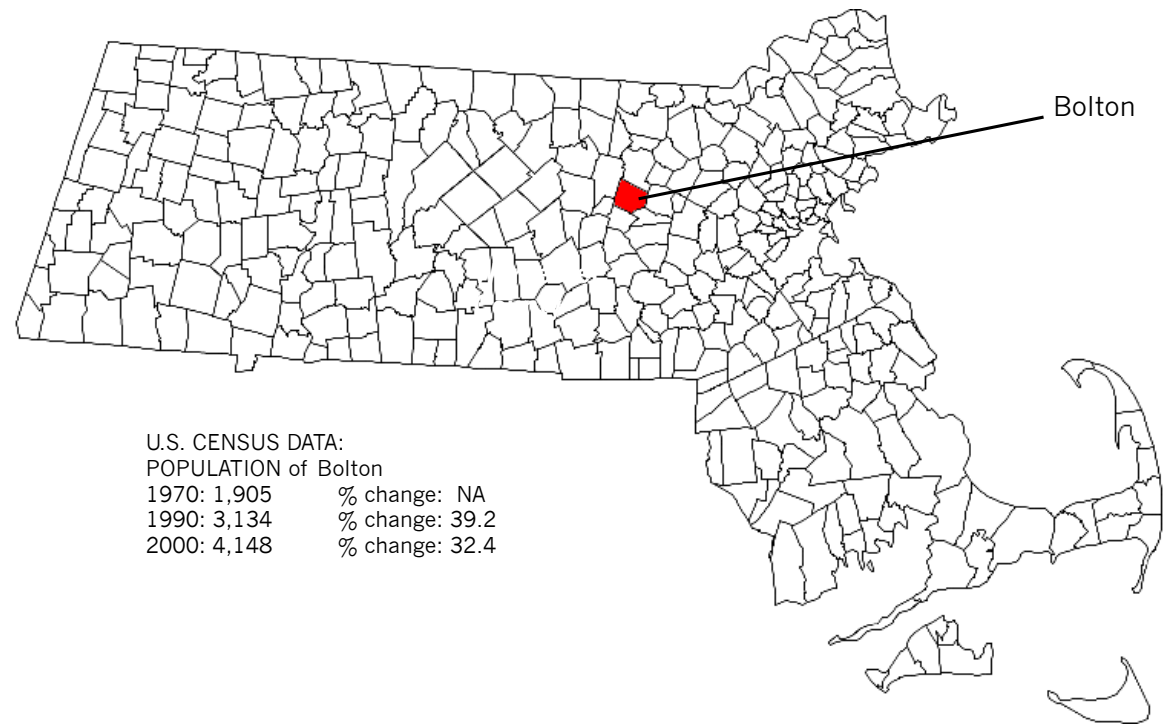
1. Preserve the rural and historical **character** of Bolton.
2. Protect the **water resources** of Bolton.
3. Preserve and encourage **agriculture**.
4. Protect **natural resources** and **wildlife habitats**.
5. Conserve open space **areas for public use**.
6. Provide **active recreation** opportunities to Bolton citizens.

BOWER SPRINGS CONSERVATION AREA MANAGEMENT STUDY OBJECTIVES

The objectives for the Bower Springs Conservation Area Management Assessment were created by a student team from the Conway School of Landscape Design, by incorporating relevant goals from the 2005 Open Space and Recreation Plan, which states that “Management and maintenance of existing conservation and recreation lands is a huge need.”

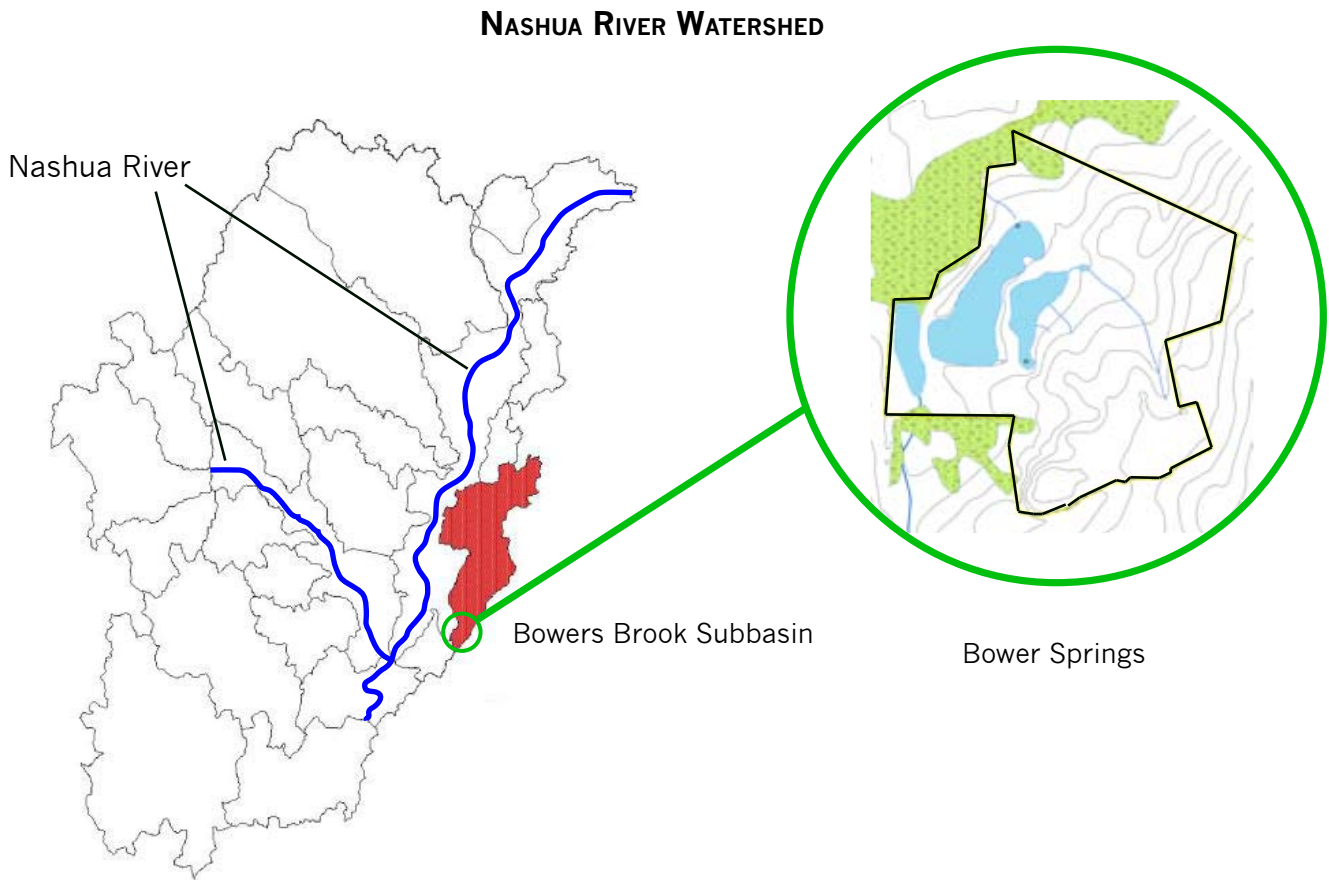
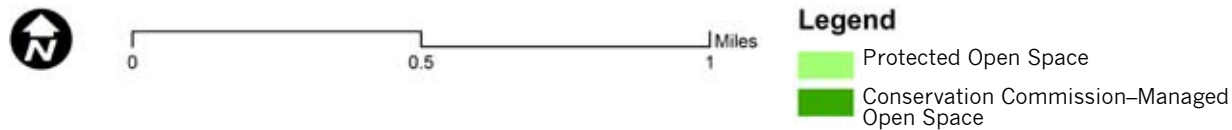
OBJECTIVES

1. Propose a vision for the management of Bower Springs consistent with its historical, natural, and cultural context.
2. Identify methods to enhance habitat and species diversity while maintaining appropriate recreational opportunities at Bower Springs.
3. Identify existing and potential natural processes, habitats, and wildlife uses of Bower Springs.
4. Identify existing and potential conflicts between human recreation and natural processes.
5. Specify management strategies to resolve conflicts on-site and anticipate future conflicts.
6. Recommend next steps to create a management structure that involves the community, clarifies procedures for the use of land by individuals and organizations, and serves as a model for the management of conservation land in Bolton.



REGIONAL CONTEXT

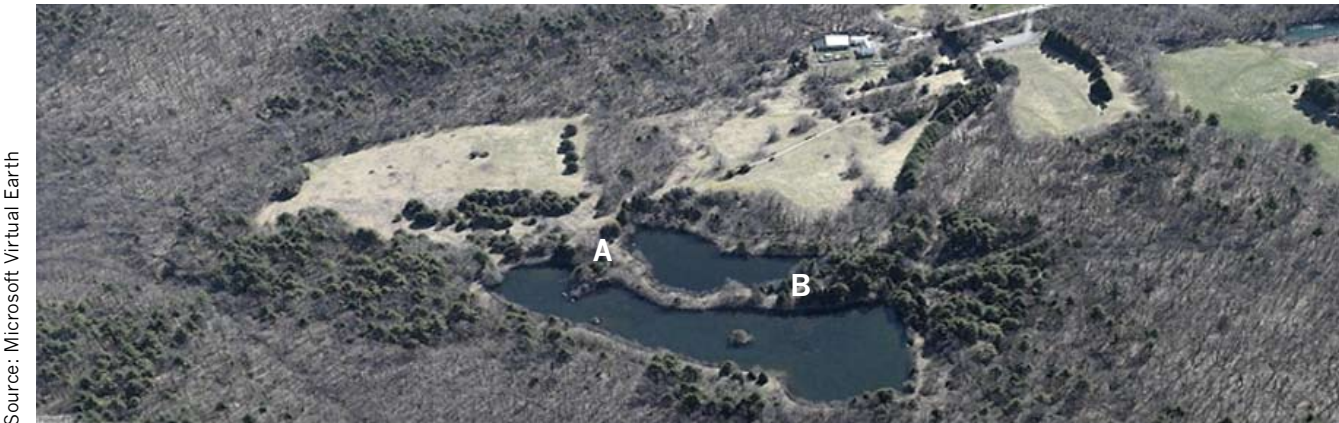
Historically, Bolton was an agricultural area because of its rich soil and rolling hills. The lack of any major rivers prevented the early formation of industry. After Interstate 495 was built through the town in 1957, Bolton saw rapid development as it became a commuter base for nearby larger urban areas. In the most recent census (2000), Bolton was recorded as having over 4,000 residents with just over 200 residents per square mile over 20 square miles. This is a fairly high population density for a town without a concentrated center. Providing the population with the opportunity to enjoy open space has been a high priority of the community and while there are a number of open spaces within the town, there is not a clear use associated with the different locations. According to Bolton’s 2005 Open Space and Recreation Plan, open space is land that is “retained in substantially a natural, wild, or open condition, or in landscaped condition in such a manner as to allow to a significant extent the preservation of wildlife and natural resources.” Bower Springs, the first protected open space parcel within the town, is part of a larger connected chain of open space, which, if managed correctly in conjuncture with neighboring parcels, could act as a wildlife corridor in the region. Highlighting the importance of such a plan is Bower Spring’s location along the eastern border of the Nashua River Watershed.





EXISTING CONDITIONS

Bower Springs is a 48.1-acre parcel of town-owned land managed by the conservation commission, which was acquired in 1972 as the first conservation area in Bolton. At the same time, the neighboring town of Harvard purchased an abutting parcel of land, which, in combination with the Bolton parcel, created Bower Springs, for conservation and recreation activities. Unique to the area are the two ponds and three sizable old fields, remnants of the parcel's agricultural use and more recently developed for a trailer park that was never built. The Visockas family, previous owners of the property, built a house between the ponds on the southern end, leaving a driveway that still remains today and is used as a trail to the ponds from a parking area, which is able to hold about ten cars. The area is heavily used by the local population for passive recreation activities like hiking, jogging, dog-walking, fishing, horse riding, and observing wildlife, as well as special events like summer camps or, in the past, a winter festival. The site's unique characteristics, beaver habitat, available parking, and extensive trail network facilitate access to nature, unlike other conservation commission managed land within the town.



Aerial view of Bower Springs, facing east. Visible are the two man-made ponds and the three fields, along with a row of pines leading to the ponds from the parking lot, and some of the heavily used trails near the pond and cutting through the fields. The wintertime exposure also shows the location of conifers in relation to the rest of the deciduous vegetation. The locations shown in the two photographs below are at A and B.



(A). Unobstructed views and access to the ponds shortly after they were created, looking southwest. Courtesy of Bolton Conservation Commission.



(B). Former house between ponds and pine saplings, looking south. Courtesy of Bolton Conservation Commission.



Nashaway Trackers



Children's Summer Nature Camp

BOWER SPRINGS USERS & USER GROUPS

One of the most pressing issues for the Conservation Commission is the varying needs of diverse user groups at Bower Springs. There are daily users and those who use the site infrequently or only for special events like summer camps or cross-country meets. Some users value Bower Springs for its conservation value while others view it solely as a recreational destination. Compounding this lack of clarity is the absence of clear guidelines on site. Several of the most visible user groups are listed below, and it is likely that among such a wide range of users there are diverse visions for what Bower Springs should become. The diversity of users is an asset in the process of creating a management plan: different users bring a range of commitments to preserving Bower Springs and are a valuable source of information for establishing baseline conditions and site identity.



Horse Riding



Dog Walking

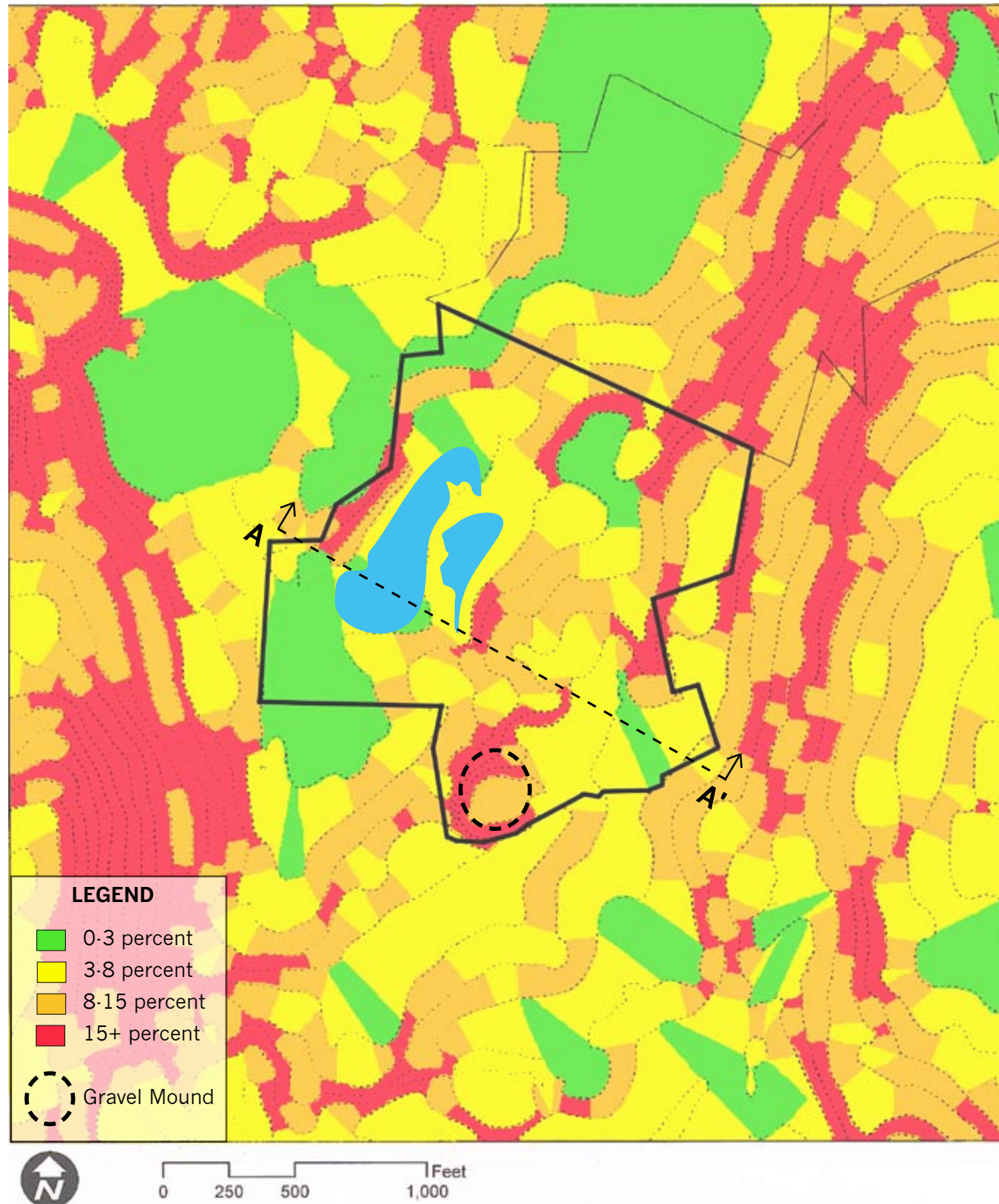


Cross-Country events



Bird-watching enthusiasts

- Nashoba Regional High School Cross-Country Teams
- Troop 1 Bolton, Boy Scouts of America
- Tom Denney Nature Camp
- Bolton Conservation Trust
- Bolton Trails Committee
- Nashaway Trackers
- Fishing enthusiasts
- Horseback riders
- Bird watchers
- Dog walkers
- Naturalists
- Hikers

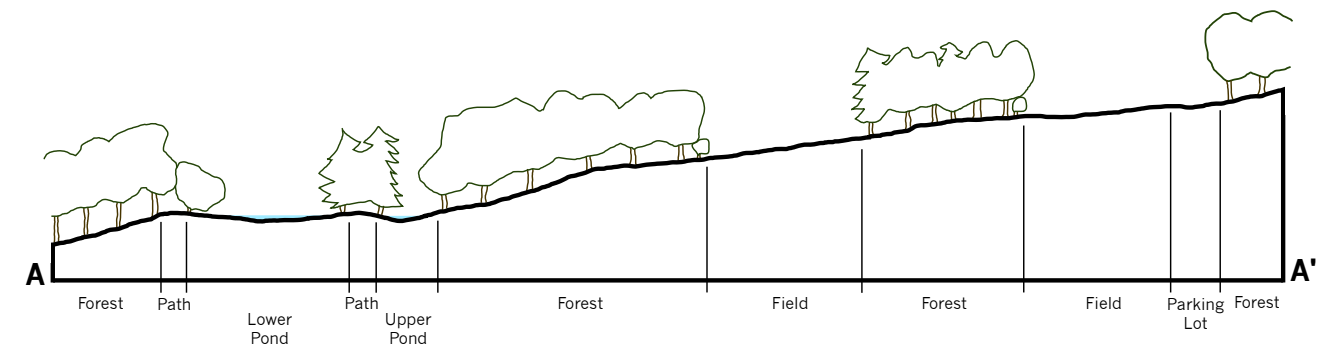


SLOPES ANALYSIS

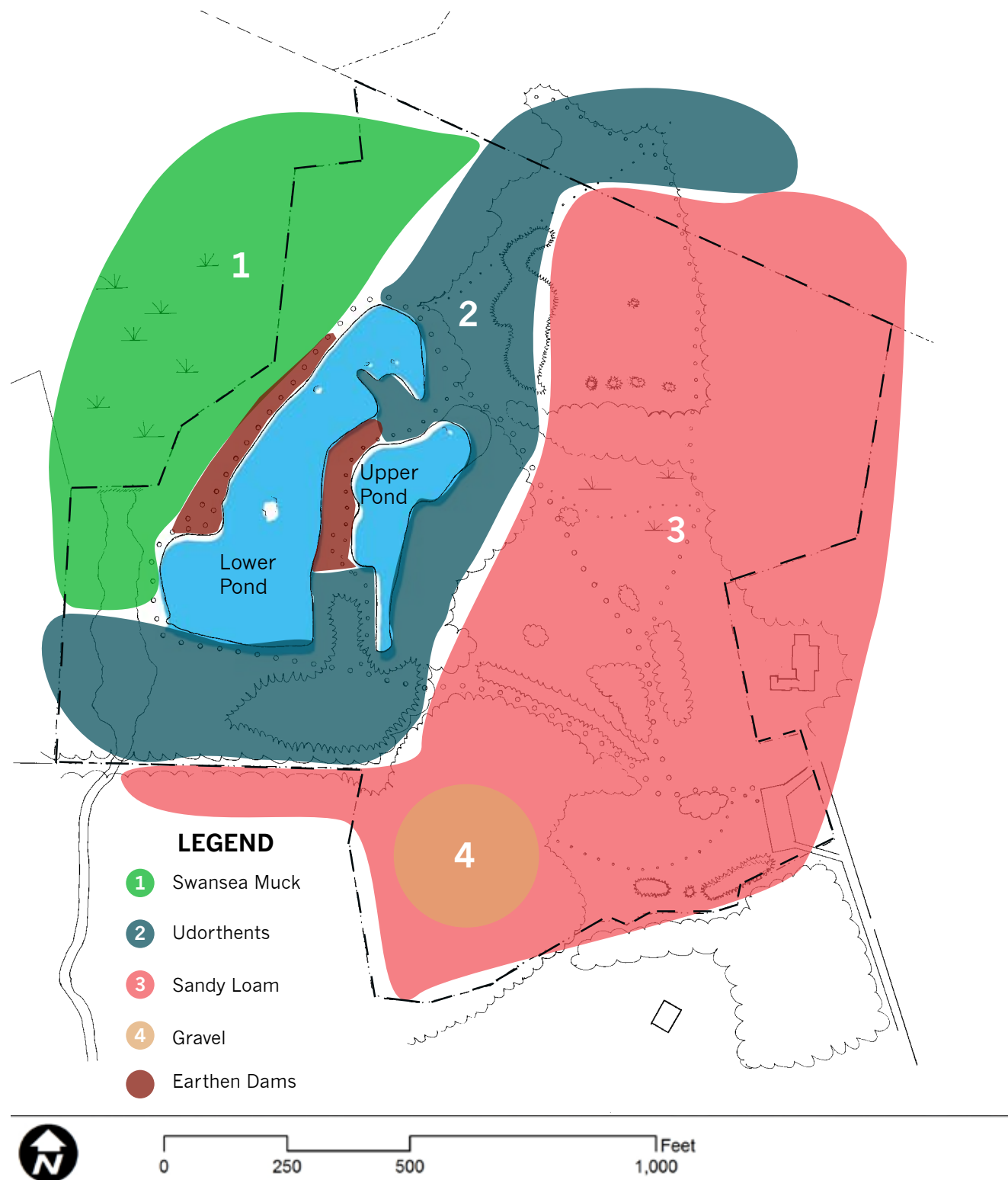
Bower Springs sits at the southeastern edge of a valley with steep slopes to the east and west. Except for a mounded gravel area on the southern end of the property, where the Tom Denney Nature Camp meets in the summer, the site generally slopes down from the southeast to the northwest. Separating two relatively flat locations to the southeast and northwest are bands of steeper slopes, many exceeding 15%, running southwest to northeast. Extended steep slopes surround the nature camp area, with an approach at less than 15% only possible from the east, resulting in routes that necessitate a hard vertical climb or descent. One potential problem in flat areas is the pooling of water, making soils more susceptible to damage when disturbed.

Management Implications

- Generally, the steeper a slope is the more susceptible it is to erosion by water and wind, which results in loss of topsoil, minerals, and nutrients, and creates sediments that can threaten water quality and destroy wildlife habitat. Disturbance from natural events or human use removes stable top soils and vegetation, exacerbating the problem greatly.
- To avoid erosion, it is appropriate to curtail the creation of any new trails and review the status of trails located where there are slopes approaching 15% or greater, or wherever there is evidence of erosion.



Cross-section of the site, facing north-northeast. 1 inch = 300 feet. Vertical exaggerated 2x



SOILS ANALYSIS

The site contains well-drained upland soils to the east and poorly-drained muck to the west. A large strip of filled land separates the two, where the ponds were created in the 1960s. The sandy, loamy soils were well-suited to the previous pastoral uses of the site, retaining nutrients well and holding water without becoming saturated. Swansea muck, a soft soil with a seasonal high water table, fills the wetland by Bower's Brook. Between the muck and loam along the ponds' edges is udorthent fill, a firm and dense soil of poor tilth that is susceptible to erosion when exposed. Udorthents were used to create the man-made earthen dams that detain the water in the two ponds. Along these dams, trees, brush, and other deep-rooted plants have established themselves, potentially weakening the integrity of the dam.

Management Implications

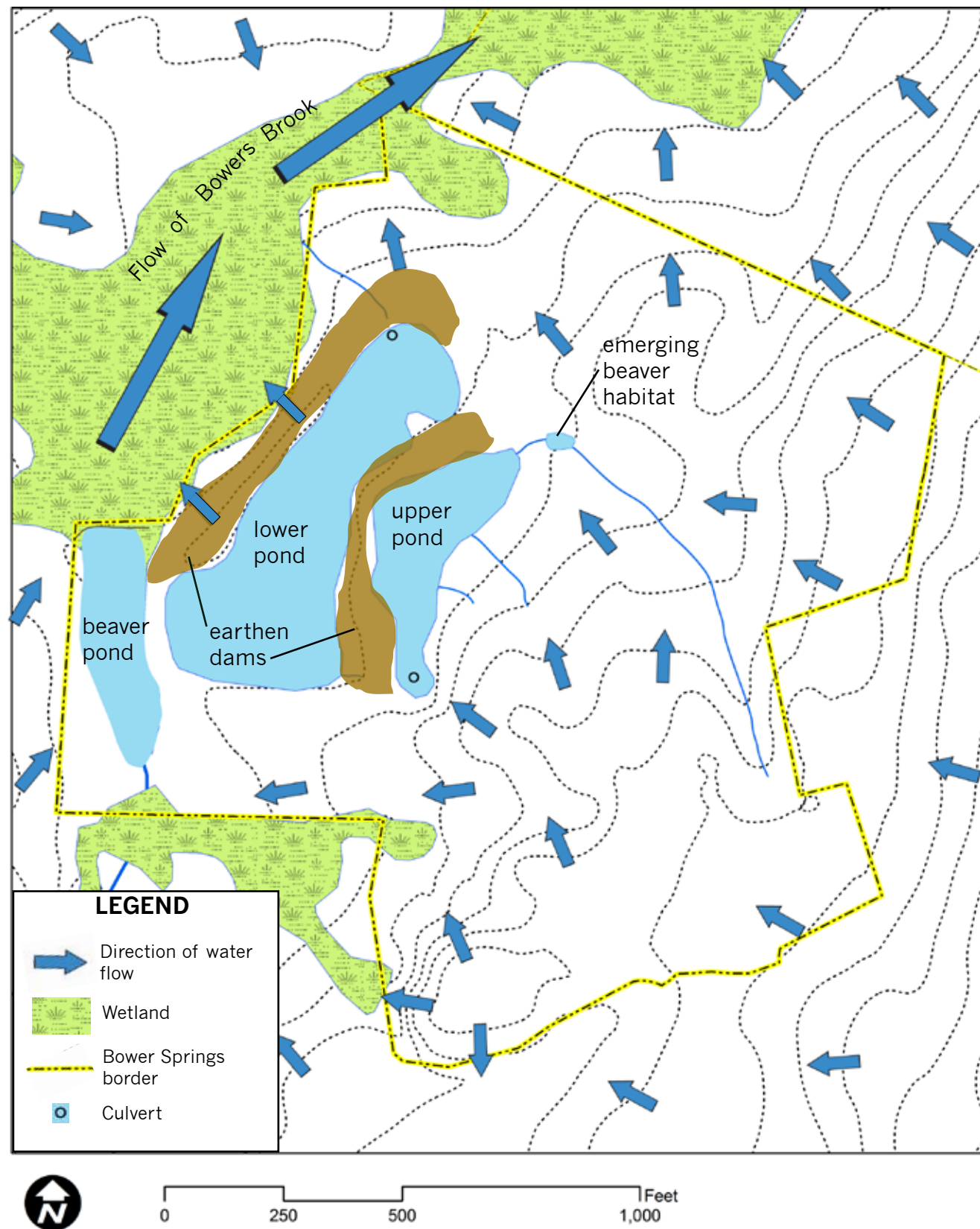
- Preservation of old field habitat in the nutrient-rich sandy loam requires consistent disturbance to prevent rapid forest regeneration.
- Understory vegetation is unlikely to establish itself on inhospitable gravel soil.
- The low soil strength of Swansea muck makes it easily erodible when disturbed. Access to trails in this area should be limited to periods when the soil is dry or frozen.
- The earthen dams should be inspected by a qualified expert, such as an official from the Massachusetts Department of Conservation and Recreation Office of Dam Safety. The trails atop the dams are wide enough to accommodate foot traffic, but the presence of burrowing rodents and deep-rooted plants may compromise dam integrity.



Gravel removal on site in 1972, courtesy of Bolton Conservation Commission



Trees growing on gravel mound, 2009.



HYDROLOGY ANALYSIS

Bower Springs lies on the eastern edge of the Nashua River Watershed; several headwater streams originate on site. Water enters the site from the south and southeast and flows northwest, where it meets Bowers Brook snaking through a swamp on its way northward to Harvard's drinking water supply. Natural drainage patterns on site have been greatly altered by man and beaver, resulting in the creation of two earthen-dammed man-made ponds and two beaver ponds. Culverts, with metal fences to prevent beavers from plugging them, are positioned on each pond to help regulate the water level. The groundwater on site is fairly high: a natural spring feeds the upper pond and there is a seep with ferric discharge along the southern end of the lower pond where the former house site was situated. Although the brown color in the ferric discharge may be unattractive, it is actually the result of a natural process that occurs between water and iron. On other sites, ferric dosing is sometimes used to mitigate the impact of nutrient loading in lakes by reducing the bioavailability of phosphorus in the water, preventing eutrophication in water systems.

Management Implications

- Activities near headwater streams greatly influence sediment dynamics, stream flow, flood peaks, on-site habitat for riparian species, and ecological linkages within larger watersheds. Avoiding stream crossings is preferred, but footbridges or boardwalks should be constructed to reduce negative effects wherever trails are unable to avoid a stream crossing.
- Legal restrictions prevent managers from removing beaver dams. Management practices will have to reflect the dynamic conditions created by beavers, when, for example, trails are affected by the natural damming process.
- A high water table means there is less filtering of water before it reaches the groundwater. Pollutants on site, such as dog and horse waste, need to be strictly controlled at Bower Springs, which feeds the drinking water supply for the town of Harvard.



Spring at the southern edge of the upper pond.



Ferric discharge from old house site, into lower pond.



Site Management Implications

- Each vegetation area has characteristics that should be inventoried to determine the species likely to find habitat there, and the species that are doing so now.
- The irregularly-shaped vegetation areas will bring many types of wildlife and vegetation into close contact to one another.
- Invasives need to be monitored closely along edge habitat. (See sheet 16.)

VEGETATION/HABITAT ANALYSIS



Coniferous woods are found predominantly north, south, and west of the ponds, and in patches elsewhere. The trees' needles, seeds, bark, and architecture provides food, housing, and cover for birds and small animals. There is generally little understory or ground cover because of the heavy shade from the trees.

- Selective removal of some trees will open the canopy to allow ground cover to grow.



Deciduous woods cover much of the site, with high densities of beech, birch, and maple trees to the south and an older oak-dominated area to the north leading into Harvard. The vertical variety from understory to canopy meets a large variety of habitat needs for wildlife through cover, housing, perch, and nuts.

- Encourage the growth of trees that produce food and other beneficial animal habitat qualities.



Old fields exist in three distinct areas, extending from the parking lot northward into Harvard. The fields are reduced in size yearly as the borders are slowly converted into forest. Old fields, rare in the region, provide insect habitat, cover and food for ground-nesting birds and rodents, and prey for larger birds and mammals.

- Increase the acreage of a rare habitat on the decline in Bolton and Massachusetts



Wooded swamps encircle the western half of the site, joining a much larger swamp along the entire northwest border. Swamps provide habitat, breeding, and snag cavity use for fish, amphibians, insects, birds, and mammals. The swamps also detain flood water, and filter and retain aquatic pollutants, metals, and sediments.

- Protect all swampland as it is a sensitive ecosystem that benefits humans and animals



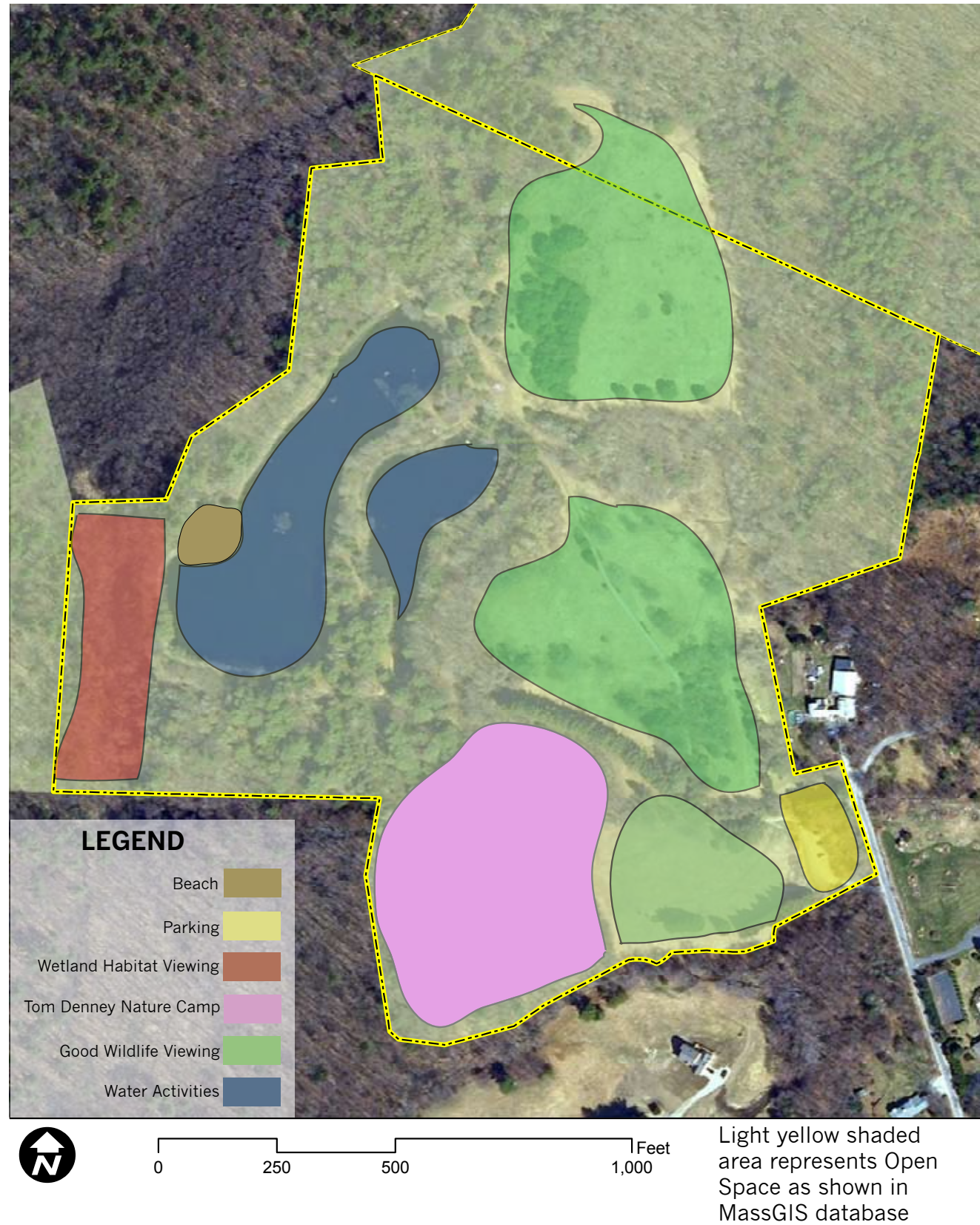
Open water includes the upper and lower ponds, and the beaver pond. The beaver pond has heavy tree cover around the edges and many dead snags within the center. The man-made ponds were created in a wetland/field area and have young woods surrounding their edges. Open water provides migratory birds an area to land and take off and allows sunlight to reach the plants and animals living in the sediment layer on the bottom.

- Determine places for people to use the open water and areas to be left to wildlife.



Edge habitat exists anywhere there is a border between two different habitats. Edge habitat has a large amount of species diversity because it acts as an ecological transition area that many animals use as they go through different phases of their life cycle. Invasive exotics often spread quickly along edges.

- Monitor the edges for invasives species.



PUBLIC USE ANALYSIS

Almost all of the 48.1 acres of Bower Springs are used by the public. A ten-car parking lot sits at the southeast corner of the property, where the majority of users enter and exit the site. A flat area of the southernmost field, close to the parking lot, is the main gathering area and location for grills, tables, portable restrooms, etc. for any special events. The trash can here is the only one on site, and there is no formal seating here or anywhere else at Bower Springs. A large wooden sign posts the limited rules: no motorized vehicles, no parking in the lot after the site closes at 8:00 pm, no swimming, no littering, and no alcoholic beverages; however, exemptions to these rules are available by special permit from the Conservation Commission. The Tom Denney Nature Camp meets throughout the summer on a wooded hill with a gravel substrate at the southern edge of the property. The camp provides nature education for children, and the camp supervises swimming from the beach by the lower pond. The ponds are also popular draws for fishing, skating, dog swimming, and picnicking, all of which affect water quality. A beaver pond on the western border of Bower Springs has an impromptu path leading to the dam for wildlife viewing. Wildlife enthusiasts, particularly bird watchers, enjoy the three fields for their edge habitat and species diversity. Dog owners enjoy letting their dogs roam off-leash, which has a negative impact on wildlife habitat.

Management Implications

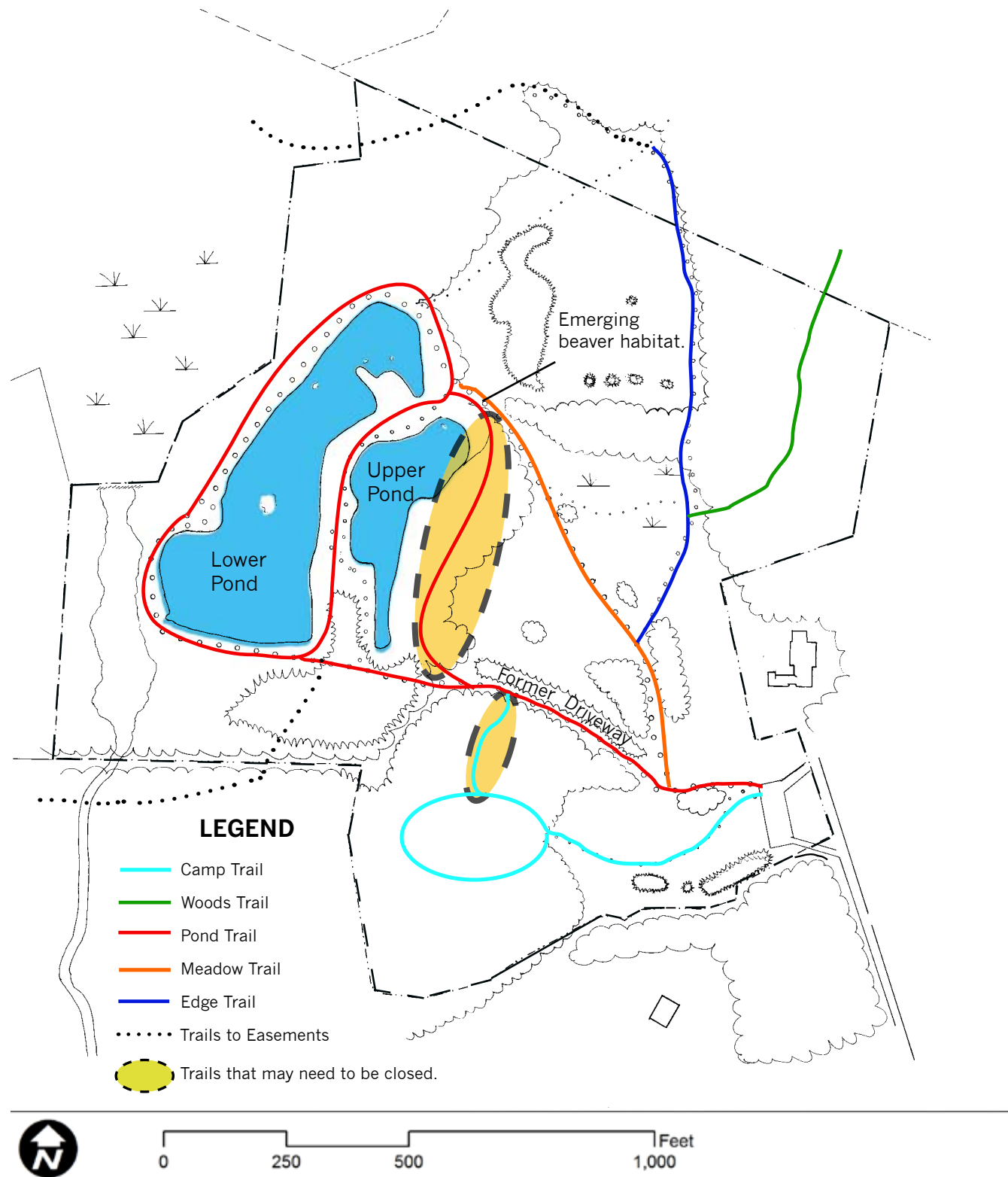
- Off-leash dogs compromise wildlife habitat; however, it is inappropriate to ban them from Bower Springs without determining a policy for dogs on all Bolton conservation land.
- The parking area’s heavy use makes it an appropriate spot to focus amenity improvements, such as available trash cans, benches, bags for collecting dog waste, etc. and to communicate site information: trail openings or closings, special events, and information on management techniques.
- Water quality needs to be checked regularly to ensure that pond use is not compromising the quality of drinking water in Harvard. If levels exceed acceptable limits, the presence of people and pets in the ponds should be suspended and the reasons for this decision should be posted.
- Management of the fields should reflect their importance as unique landscape features within the regional matrix. Furthermore, their ability to provide habitat for wildlife needs to be recognized when creating a future maintenance regime.



Parking area at entry to Bower Springs



Individual enjoying fishing on the lower pond.



CIRCULATION ANALYSIS

There are five spots to enter or exit Bower Springs. The most popular access point is from the parking area in the southeast corner of the site. Additionally there are four trails leading off-property, two into Harvard's open space and two into permanently protected easement lands. The trail network is very popular with hikers, walkers, horse riders, joggers, dog walkers, and cross-country skiers. It has characteristics often appreciated in good trail systems: variety of habitat types and a wealth of route connections. A former driveway leading from the parking lot to the ponds is a popular corridor and is still used as emergency access for the area. The trails leading off site to the west travel over wetland and have boardwalks and bridges in only the wettest spots. Near the northern border of the upper pond an emerging beaver habitat has created wet conditions where the Meadow Walk joins the Pond Path. A particularly steep and eroded trail connects the wooded gravel hill at the southern end of the site with the ponds. Currently the ponds are completely encircled by trails, making it hard for some animals to access the open water. The Bolton Loop Trail, an extensive trail system still under construction that traverses public and private land, enters Bower Springs through the parking area and exits towards the west. Laminated 8½ x 11-inch maps on short stakes are located on trails exiting the site.

Management Implications

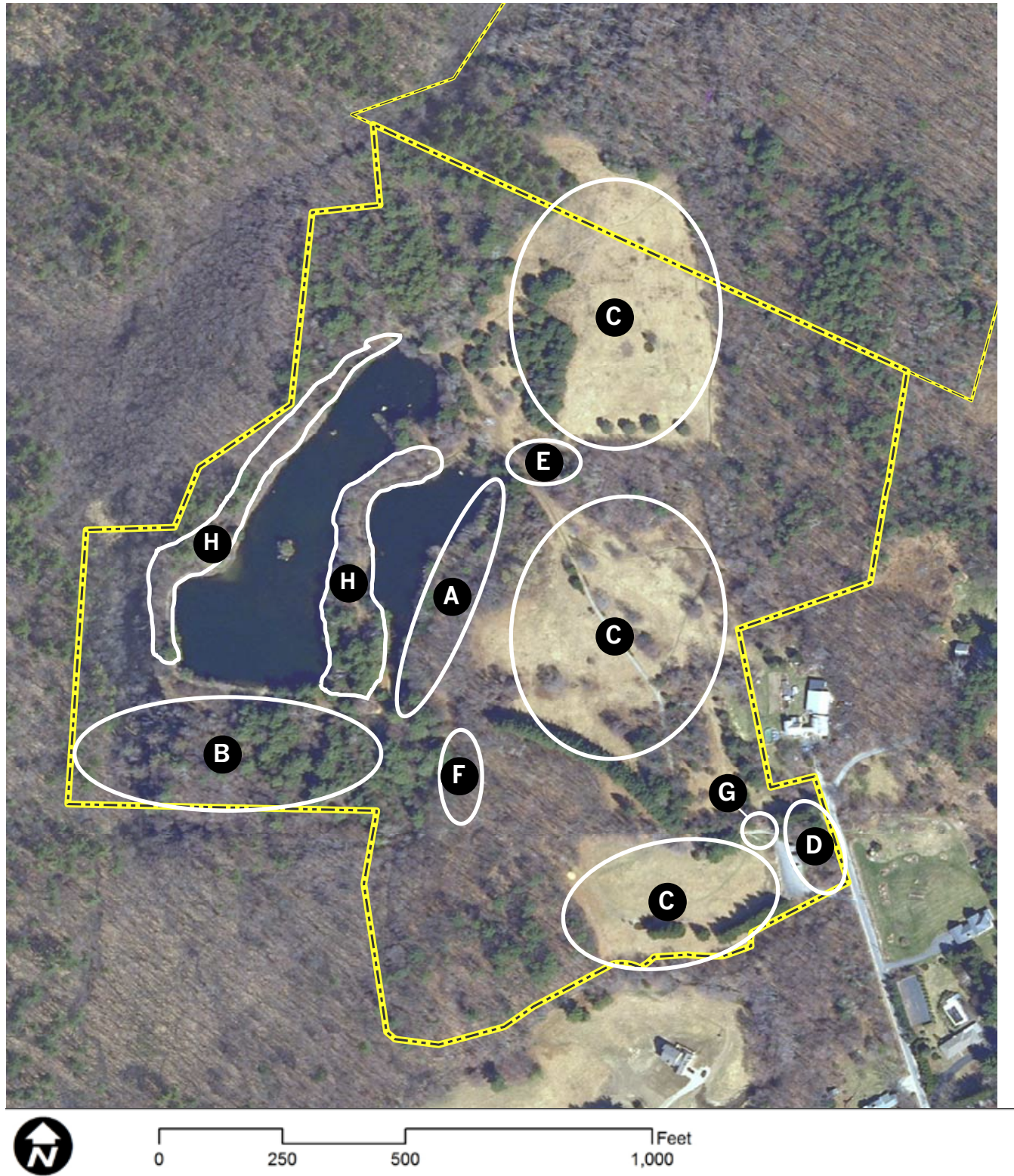
- Regular trail monitoring is necessary because of the high number of users and various environmental conditions, like emerging wetlands, that affect trails.
- Trails with erosional problems, such as the one connecting the ponds and the gravel hill, need to be redesigned or closed.
- Trails that cross wetlands, such as those leading off site to the west, need to be reconstructed to protect the fragile wetland, or closed during wet seasons.
- Trails that disturb essential wildlife functions should be closed seasonally or permanently depending on the needs of wildlife.
- A clearer, larger, easily readable map posted at a prominent location, like the parking area, would help users navigate the site.



Footbridge crossing a stream on a trail leading off site to the west, surrounded by skunk cabbage.



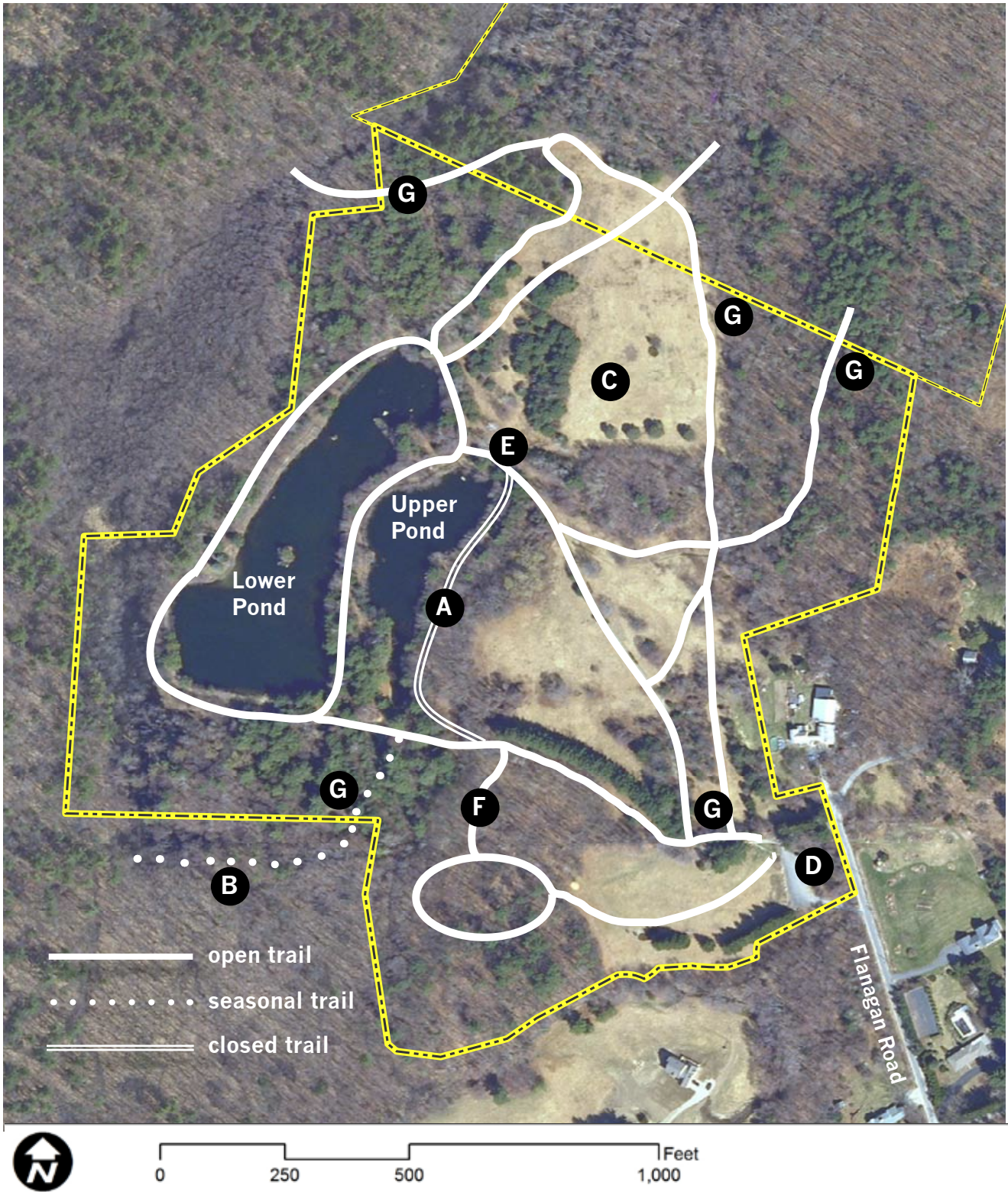
Posted trail map leading north towards Harvard.



SUMMARY ANALYSIS

The areas identified have significant problems associated with their use, design, and/or management. Recommendations to address the problems are on sheet 14.

- A** Some wildlife is cut off from accessing the open water because there are trails encircling both ponds completely. The trail hugging the eastern border of the upper pond is overgrown and crosses several seasonal streams, creating muddy conditions.
- B** The southernmost trail leading off-site towards the west, part of the Bolton Loop Trail, crosses fragile muck soil located in a wetland that is important for both wildlife habitat and the water quality of a first-order stream.
- C** The three large fields are shrinking every year because of the encroachment of the surrounding woods. In this region of New England, fields are uncommon and therefore important for providing habitat.
- D** There is a massing of exotic invasives at the parking area at the southeast corner of the site. In addition to making it hard to see clearly when entering or exiting the site, the invasives are easily spread to other portions of the site by visitors, pets, and wildlife who transport the seeds.
- E** The emerging beaver habitat created by water pooling behind a plugged culvert on the north end of the upper pond is providing valuable habitat but also flooding a popular trail.
- F** The trail linking the ponds with the area where the Tom Denney Summer Nature Camp meets is on a very steep slope and is beginning to see significant erosion problems.
- G** Visitors arriving to the site do not have updated information on how the site is to be used or who to contact about questions or concerns. The current sign is outdated and the maps are small and hard to understand.
- H** The earthen dams have trees growing on them that may reduce their structural integrity.



RECOMMENDATIONS FOR THE NEAR TERM

Within the next 12 months, improvements can be made to the Bower Springs Conservation Area. These improvements are not meant to determine the future of Bower Springs or substitute for a management plan, but they will begin the process of active management.

	Management Recommendation	Rationale	Elements	References	Notes
A	Permanently close the trail along the Upper Pond's eastern edge	Wet soil and two stream crossings make passage difficult	Brush piles of cleared debris at trail connections will deter foot traffic.	Analysis: Soils, Hydrology, Access	This area will still require attention for invasive species management.
B	Close the Bolton Loop Trail in the wet season	Wetland soil is poorly equipped to tolerate foot traffic in the spring and early summer	Interpretive kiosk at arrival and signs at trail connections can inform visitors of the closings	Analysis: Soils, Hydrology, Access	Consult with Bolton Trail Committee to co-ordinate expectations and procedures
C	Mow one-third of each field per year	Diverse old field habitat enhances wildlife diversity	Mowing equipment	Analysis: Habitat Methodology: Seasonal Mowing	Consultation with the Harvard Conservation Commission and parties responsible for mowing
D	Clear the entrance area of invasive species	Improve visitors' arrival experience and establish native vegetation at main entry	Work party crews, hand tools	Analysis: Access Methodology: Invasive Species	Replace removed invasive species with native vegetation
E	Re-open the concrete culvert to the northeast of the Upper Pond and install a beaver excluder	Water is gathering on well-used trails and is stagnant at culvert	Beaver excluder device.	Analysis: Hydrology	Presence of beaver dam will create attractive habitat for amphibians
F	Regrade the trail linking the Tom Denney Nature Camp with the pond trails	Erodible gravel soils sit on a slope approaching 20%	Landscaping rakes, trail drags, terrain graders, soil, gravel	Analysis: Access, Areas of Use, Soils, Slopes	Trail improvements can be conducted in concert with Nature Camp and Nashoba Regional High School
G	Place signs along trails at parcel boundaries and place a central kiosk by the parking area	Lack of cohesive orientation at entry and along trails	Constructed kiosk and trail signs	Analysis: Circulation	A sign-in book for visitors to record their activities and impressions will provide feedback or management decisions

Figure 1: Step installation options for stair regrading

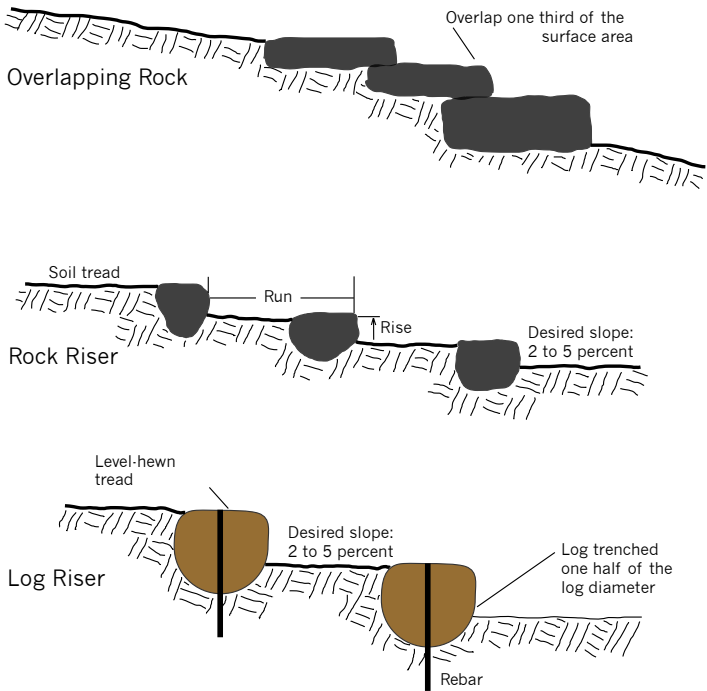


Figure 2: Step Proportions

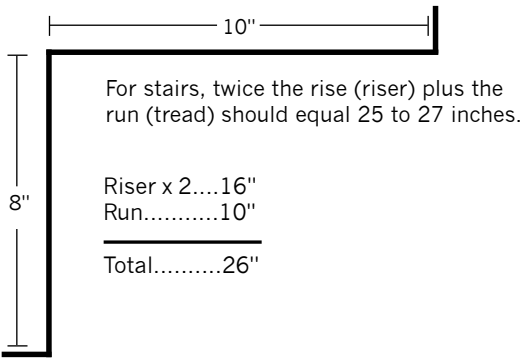


Figure 3: Trail Corridor Clearing Standards

Type of Trail	Vertical Clearance	Trail Width	Horizontal Clearance*
Hiking	8 feet	Single Lane: 2 feet	2 feet
Biking	8 feet	Single Lane: 4 feet	2 feet
Mountain Biking	8 feet	Single Lane: 2 feet	2 feet
Equestrian	10 feet	Single Lane: 4 feet	2 feet
Multiple Use	10 feet	Single Lane: 8 feet	2 feet

* Horizontal distance from both trail edges.

DESIGN DETAILS: PAGE ONE

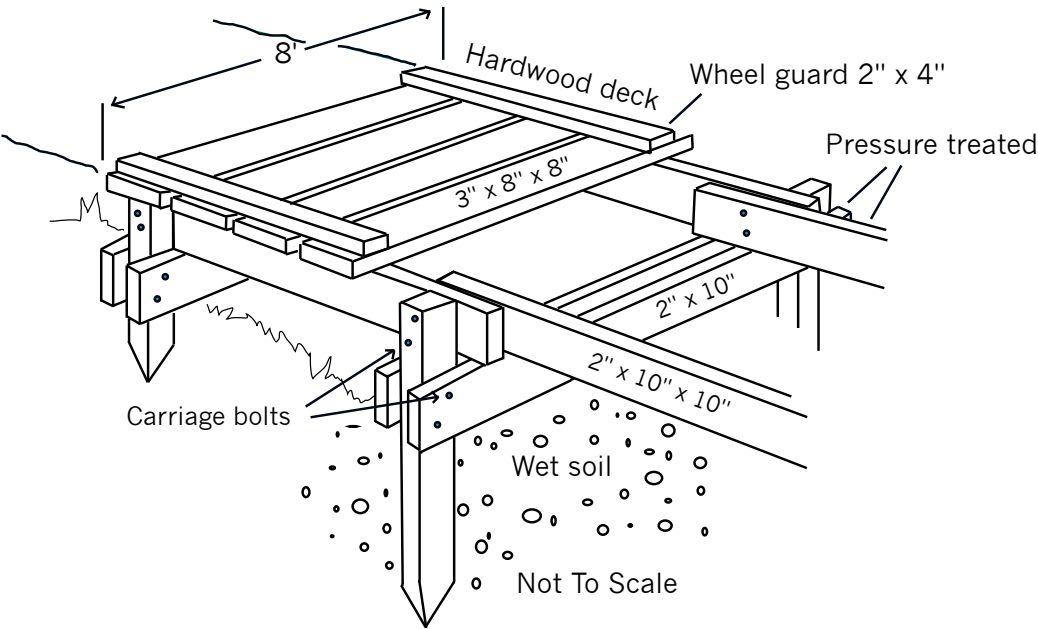
Bower Springs Conservation Area contains miles of trails that are used every day. However, the variety of slopes, soils, and destinations prevents the trails from wearing uniformly. The details shown in figures 1 to 4 pertain to trail conditions, standards, and improvements.

Figure 1, far left, shows three options for installing stairs where a steep slope – such as the one found at the southern end of the trail connecting the Nature Camp with the Pond Trail – allows water to erode the dirt and gravel trail. Figure 2 supplements this with a diagram of acceptable step proportions.

Figure 3, below left, contains standards for the width and clearance requirements for trails of different uses.

Figure 4, below, is a detail of a raised plank path, useful where a trail is unable to avoid a stream or wetland crossing.

Raised Plank Decking Diagram



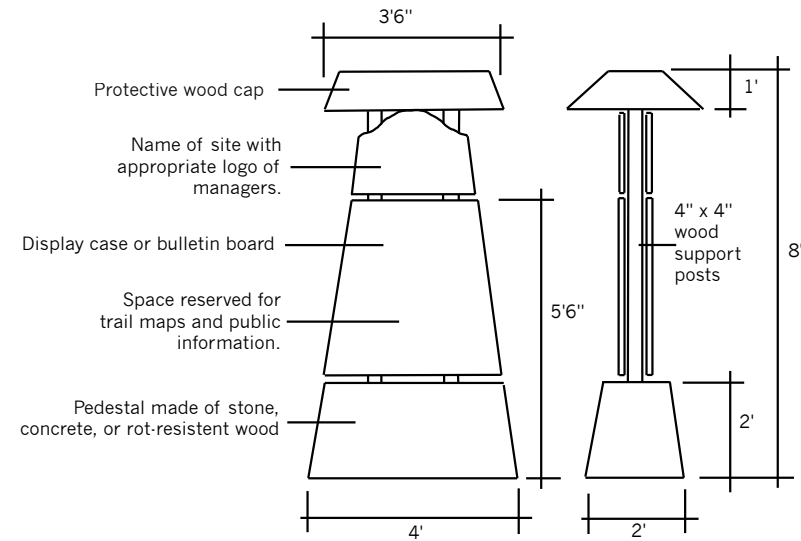


Figure 5: An option for kiosk construction (not to scale)



Figure 6: An interpretive kiosk design.

DESIGN DETAILS: PAGE TWO

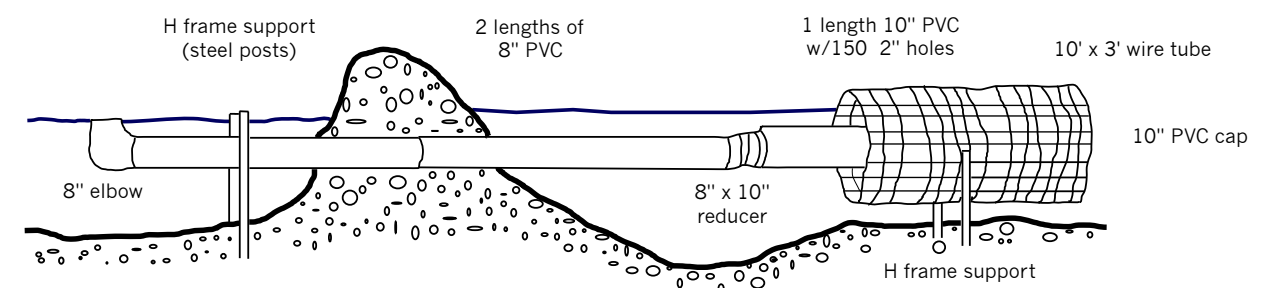
Most visitors to Bower Springs arrive via the parking lot to the southwest. There is a large wooden sign by the trail to the ponds that informs visitors of the rules. A large kiosk appropriately placed and capable of displaying site and event information would be appropriate at this site.

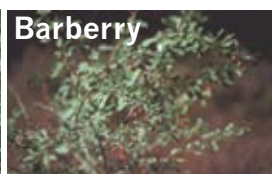
Figure 5, top left, is a design detail of a kiosk that could meet these needs.

Figure 6, below left, is a rendering of an alternative kiosk design for Bower Springs.

Figure 7, below, is of a beaver excluder device that could ensure that the concrete culvert currently backed up and unable to drain streams into the upper pond remains clear and functional.

Figure 7: Clemson Beaver Pond Leveler





Aggressive vine growth blocks sunlight from trees.



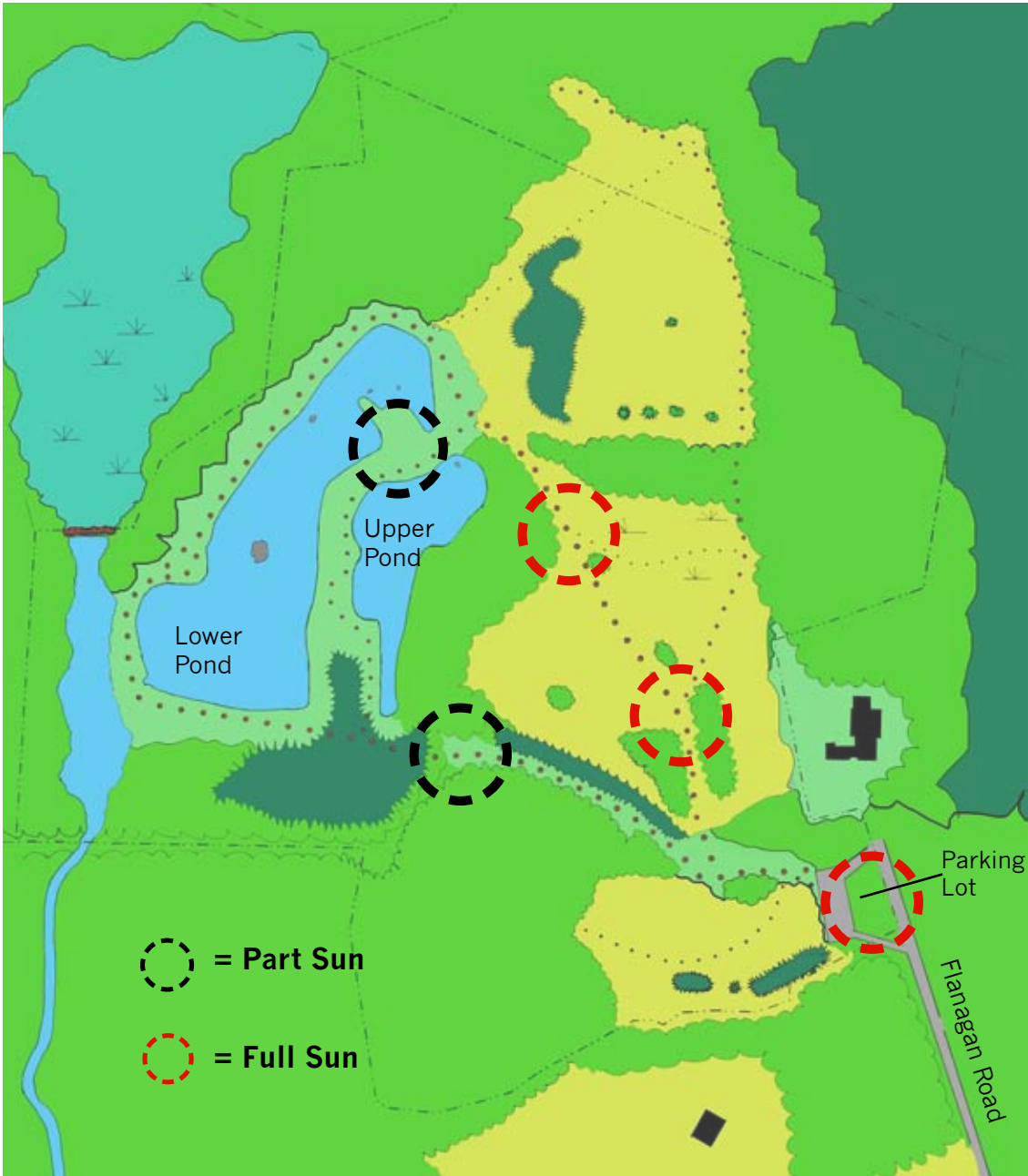
Bittersweet growing on pines at Bower Springs.

MANAGING INVASIVE SPECIES

According to the National Invasive Species Information Center, an invasive species is “a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.” Without the organisms and diseases found in its area of origin to limit its growth and resource share, an invasive species will overtake the native species in an area, diminishing wildlife diversity.

The extensive and advanced presence of invasive species is a challenge to habitat diversity at Bower Springs. The five species at the lower left are in abundance in the areas circled on the map. These popular areas, which include the gateway to Bower Springs and pond-viewing space, are places to concentrate eradication or containment efforts.

Invasive species are difficult and costly to remove, but by far the most challenging part of the process will be the initial efforts. Management plans typically call for a combination of hand-pulling, mowing/cutting, girdling, tilling, flooding, and herbiciding tactics. The amount of mowing required (up to 6 times/year for 3-5 years) would be detrimental to the development of old field habitat and lead, in the short term, to the vigorous re-sprouting of the invasives, many of which alter soil composition, making it difficult for natives to re-establish themselves. Therefore, it is not recommended. The presence of the beaver dam by the concrete culvert to the upper pond will provide the Conservation Commission with an interesting opportunity to study the effectiveness of flooding, which can reduce the presence of barberry, honeysuckle, buckthorn, bittersweet, multiflora rose, and olive shrubs/vines. Girdling works well against buckthorn shrubs in conjunction with herbicide. Hand-pulling is an effective way to remove the younger specimens on-site and get site users involved with some of the important maintenance activities, but the soil disturbed by removal should be put back in place. With good gloves and a brief training session, a work party can make a big difference over the course of a weekend.



Location of invasive vegetation that receives full and partial sunlight.

RESTORING HEALTHY ECOSYSTEM VEGETATION USING NATIVE PLANTS

Removing and controlling invasive species is only one objective if the goal is to return a landscape to a healthy, functional ecosystem. Just as important are the sedges, plants, grasses, shrubs, and trees that are brought in to the newly opened space. Removal of invasives is an excellent opportunity to re-establish native Massachusetts plants to limit the re-sprouting of invasives, fit the pastoral heritage of the parcel, and provide valuable resources for wildlife.

The plants listed below are appropriate for the conditions indicated. The grasses, sedges, and shrubs will do well in full sun. Those with a blue dot next to them tolerate and do well in partly sunny areas. Those with a red dot next to them are particularly attractive to butterflies, and will bring more of them to Bower Springs. Green dots represent plants that attract birds because of their ability to provide food or shelter.


	Scientific Name	Common Name	
●	<i>Mitchella repens</i>	partridgeberry	
●	<i>Gaultheria procumbens</i>	eastern teaberry	
●	<i>Asarum canadense</i>	wild ginger	
●	<i>Polystichum acrostichoides</i>	Christmas fern	
●	<i>Ageratima altissima</i>	white snakeroot	
●	<i>Carex appalachica</i>	Appalachian sedge	
●	<i>Eurybia divaricata</i>	white wood aster	
●	<i>Deschampsia flexuosa</i>	crinkled hair grass	
●	<i>Viola labradorica</i>	Labrador violet	
●	<i>Symphytotrichum cordifolium</i>	blue wood aster	
●	<i>Chasmanthium latifolium</i>	Indian sea oats	
●	<i>Dicentra eximia</i>	wild bleeding heart	
●	<i>Dennstaedtia punctilobula</i>	hay-scented fern	
●	<i>Clethra alnifolia</i>	summersweet clethra	
●	<i>Carex praegracilis</i>	clustered field sedge	
●	<i>Sedum ternatum</i>	woodland stonecrop	
●	<i>Menispermum canadense</i>	common moonseed	
●	<i>Carex pensylvanica</i>	Pennsylvania sedge	
●	<i>Vaccinium angustifolium</i>	lowbush blueberry	
●	<i>Lindera benzoin</i>	common spicebush	
●	<i>Hydrangea quercifolia</i>	oakleaf hydrangea	
●	<i>Asclepia amplexicaulis</i>	milkweed	
●	<i>Spiraea tomentosa</i>	steeplesbush	
●	<i>Eupatorium fistulosum</i>	Joe-pye weed	
●	<i>Apocynum cannabinum</i>	dogbane	
●	<i>Rudbeckia hirta</i>	black-eyed Susan	
●	<i>Ceanothus americanus</i>	New Jersey tea	
●	<i>Pycnantheum virginianum</i>	mountain mints	
●	<i>Rhus glabra</i>	smooth sumac	
●	<i>Solidago spp.</i>	goldenrod	
●	<i>Achillea millefolium</i>	yarrow	
●	<i>Lespedeza hirta</i>	bush clover	
●	<i>Daucus carota</i>	Queen Anne's lace	

● Bird value


● Full sun

● Shade tolerant


● Butterfly value




Part Shade
Ground cover
Asarum Canadense



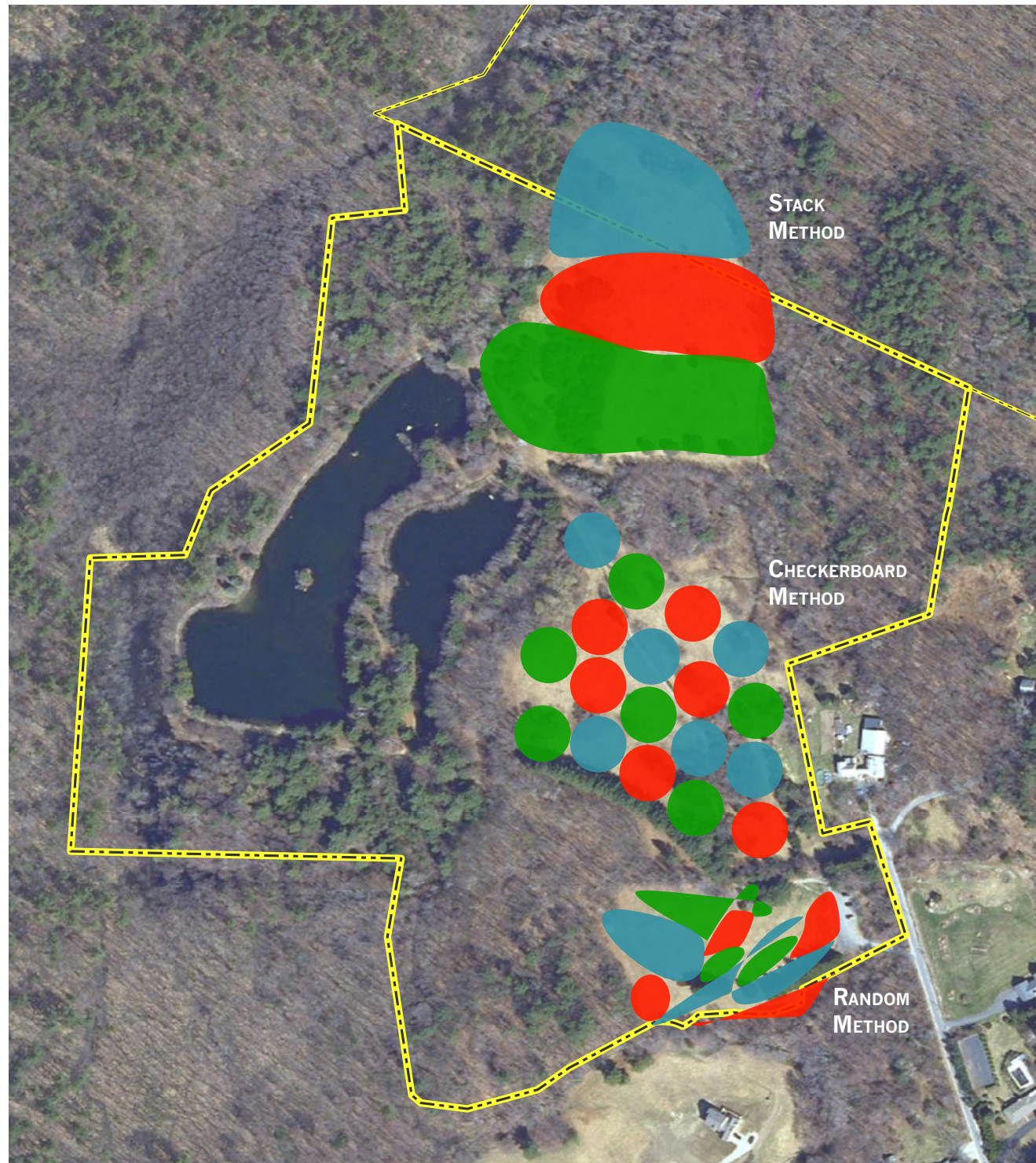
Sun/Shade
Flower
Dicentra eximia



Full Sun
Forb
Eupatorium fistulosum



Full Sun
Tree
Rhus glabra



MOWING PRACTICES AND BENEFITS

Mowing is one of the most common methods of disturbance for preventing a forest from regenerating in an old field. Recently, more land managers and stewards have begun to consider the ecological implications of when and how fields are mown. In Massachusetts, many parcels are managed to preserve old fields as reforestation returns the state to forest levels not seen since the years before the state’s peak agricultural productivity of the mid-to-late 19th century. It was in this time that the state saw the departure of moose, beaver, wolf, black bear, deer, and bobcat. Grassland birds, particularly bobolink and meadowlark, along with sandpiper and savannah sparrow, were at their population zeniths, nesting, feeding, and brooding amid the pastureland maintained by the dairy farmers.

The Bower Springs Conservation Area contains three old fields, remnants of Bolton’s agricultural and pastoral history, with an area totalling about 15 acres. These fields are mown annually, toward the late summer. Mowing after August 15th is preferred, as ground-nesting birds will be most active in the fields from mid-April to mid-August. It is recommended that in addition to mowing after the highest period of nesting and brooding, mowing also be done with blades 12” from the ground and in a “patch” manner, mown from the patch’s center outwards. This last step gives animals an opportunity to move away from the mower. The result in each field is a “patchy” habitat with a variety and abundance of food and cover that changes from year to year as new patches grow and old patches mature and see grass, sedge, and forb growth.

For illustrative purposes, each of the fields is shown with a different regimen, but using a different one in each field isn’t necessary. Each patch is mown once in three years. The red patches are mown in the first year, the blue patches in the second year, and the green patches in the third year. In the upper field, the stack method maintains three large areas. In the middle field, the checkerboard method brings about more contact between areas of different growth. In the lower field, the random method creates an irregular and dynamic pattern. Each method maintains the open nature of the fields while enhancing their habitat values for insects, small mammals, ground-birds, and birds of prey.



The upper field in the sun, facing south toward the pine stand



Field corridor at southern end of upper field, with little transition or vertical connectivity.

THE POTENTIAL OF PRESCRIBED BURNING



Grassy forest before a burn.



In the midst of the burn.



Weeks after the burn.

Images from University of Texas website—

Grassland prescribed burns are used frequently in Massachusetts, performing some functions that mechanical and chemical management techniques cannot. Performed before grassland bird species have nested and the native species of grass begin to grow, a prescribed fire burns old grass stems, woody growth, and shallow-rooted invasive species like barberry and buckthorn. A field burned in the early spring removes dead vegetation and turns it into ash, smoke, and steam, and provides nutrients that are immediately available to plants. Dead grass, leaves, and brush piles are often completely consumed and serve to carry fire throughout the target area. Removing these elements will reduce the amount of cover available in an old field, but allow sunlight to reinvigorate the grasses and flowers growing in the fields, providing a lush summer habitat for insects, small mammals, and ground-nesting birds.

The year after a fire, some plants flower vigorously in response to the pulse of nutrients released. Fruiting peaks two to three years after a fire. The abundance of new growth in the years after a fire attracts a variety of animals, both vertebrate and invertebrate, with different species attracted to different stages of plant succession. Several of the rare plants that grow in sandplain grasslands have responded well to fires, with enhanced flowering and seedlings occurring in greater numbers in the burned areas. Seeds survive in the litter layer below the plants, of which only the surface layer is burned.

As of April 2, 2009, the Commonwealth of Massachusetts is developing a council to join the National Coalition of Prescribed Fire Councils. Currently, a controlled burn permit can be obtained at the Bolton Fire Department. However, for larger-scale burns, professionals should be consulted. They will typically determine the following:

- Descriptions of the acreage and current vegetative state of the site.
- Required regulatory agency notifications: air quality agencies, wildlife agencies, forestry departments, etc.
- Fuel model and proportions: developed by the U.S. Forest Service, these categorize vegetation types according to fuel properties and help fire managers realistically estimate fire behavior or fire danger.
- Safety hazards: a description of items that may pose a hazard to participating individuals (e.g., fences, holes, foundations, snags located near firebreaks, etc.).
- Safety zones: areas that someone attending or participating in the burn can go to should the fire threaten the crew.
- Site management goals describing what the manager is trying to accomplish with the use of fire.
- Burn objectives describing how the burn will help meet site management goals.
- Smoke management hazards evaluating potential impacts to downwind areas, especially those particularly sensitive to smoke (e.g., schools, health care facilities, highways, etc.).

Maintaining grassland with prescribed burning maintains the habitat of many rare plants and animals. Bushy rockrose, Nantucket shadbush, sandplain flax, and sandplain blue-eyed grass are grassland species that need open conditions. Several butterflies use specific grassland species for larval foods, and the adults rely on other grassland flowers for nectar. Grasshopper sparrows and short-eared owls are among the birds that require the open character of grasslands. Although these different natural communities have evolved to require different fire frequencies and intensities, fire is a part of their natural dynamism. Some wetland grasslands also have histories of frequent fire and prescribed burning is used in restoring these habitats as well.

Many of the early descriptions of fire-influenced habitats describe fires in the spring and fall seasons. Most prescribed burns are still conducted at those times, but under conditions that minimize smoke impacts and the possibility of a burn escaping the burn unit boundaries. Most burns are set in relatively moist conditions, and timed to avoid the breeding seasons of rare, endangered, or priority species. Leaving some portions of the habitat out of the burn area gives animals a place to go during the fire and gives the site a ready source of vegetation for recolonization.

FOREST MANAGEMENT OPTIONS

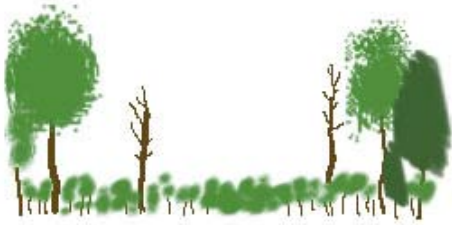
COMPLETE CLEARCUT

in which all trees are removed from a stand, regardless of age or condition



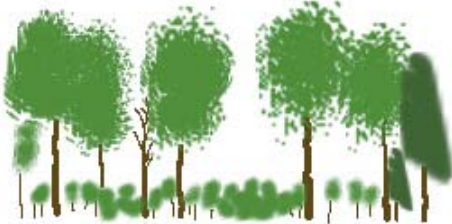
WILDLIFE CLEARCUT

in which a few trees of varying size, age, and purpose are left behind for wildlife use



CLOSED SHELTERWOOD

in which canopy cover is retained, but understory trees are removed



SINGLE-TREE SELECTION

in which one to three trees are removed in stands to encourage a small-scale mosaic



GROUP SELECTION

in which several trees are removed along stands for a larger-scale mosaic



Adapted from DeGraaf and Yamasaki, *New England Wildlife: Management of Forested Habitats*

SILVICULTURE ELEMENTS AND OPTIONS

Silviculture is the art and science of controlling the establishment, growth, composition, health, and quality of forests to meet the needs of land managers. Bower Springs has the opportunity to explore the use of silviculture for ecological and commercial benefit, an issue raised at a Conservation Commission meeting in 2006. The forests of Bower Springs, particularly in the northeast section, fit the profile of a healthy forest: high fertility, abundant soil moisture, and situated in a valley. With careful planning, silviculture can help the Bower Springs Conservation Area remain a healthy and functional ecosystem.

Ecologically-focused silvicultural practices will focus on creating the optimal mix of species, density, and successional stages on the site. There are several different techniques that can be carried out at a variety of scales, five of which are illustrated at left and expanded upon below. These are grouped together as regeneration cuts, so termed because the primary purpose is to bring about the early succession habitats that vast numbers of species thrive upon.

Long-term sustainability should be the primary objective behind all forest management activities at Bower Springs. Well-managed stands maintain a healthy, functioning forest and the suite of benefits that goes along with that: aesthetic enjoyment, wildlife habitat, watershed protection, soil protection, and recreation.

Silvicultural Method	Program	Applicable to:	Purpose	Notes
Complete Clearcut	Removal of all stems in a stand	Forested areas of varying age, size, and density	Forest regeneration without overstory shade	Primary succession species (quaking aspen, black cherry, white pine) will flourish
Wildlife Clearcut	Extensive stem removal, but some stable trees remain	Even-aged stands: trees in the main canopy within 20-year age range	Establish regenerating forest without eliminating structural elements for habitat	Dead trees (snags) ideal to leave standing: cavity use for animals without shady canopy.
Closed Shelterwood	Removal of all understory and lower crown canopy trees	Even-aged stands	To use older, mature trees as a protective cover for emerging trees	Shade-tolerant species (white ash, white oak, eastern hemlock) will flourish
Single-Tree Selection	Removal of trees singly or in groups of two or three	Uneven-aged stands: trees of several 20-year age classes	Clearing space for small-scale vertical habitat diversity	Removing weakest trees first ensures long-term viability
Group Selection	Removal of groups of trees, usually in stands of 1/10 – 2/3 acre	Uneven-aged stands	Opening space for regenerating forest stands and pioneer species to grow adjacent to mature forest stands	Group width to be at least two times the size of the adjacent trees' height; irregularly-shaped patches preferable



- young forest
- old field
- formal and interpretive elements

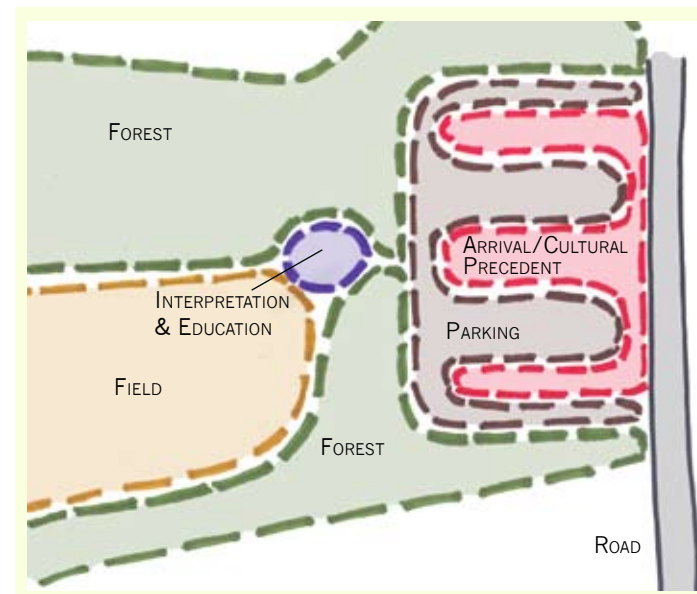
MANAGEMENT CONCEPT 1: FOREST CONNECTIONS

ENHANCING HABITAT THROUGH CONNECTIVITY

In *Forest Connections*, the emphasis for management has been placed on connecting forest through the property from the east to the south. Young forest, with its vertical variety, offers forage and cover options surpassing those of the more mature habitats on the rest of the site. The forest band extends from the existing portion between the upper and center fields, runs along the upper pond, and connects to the forest by the Tom Denney Nature Camp. Some of the area of the lower field is allowed to grow into young forest, and the result is an instructive walk through successional habitats for the campers.

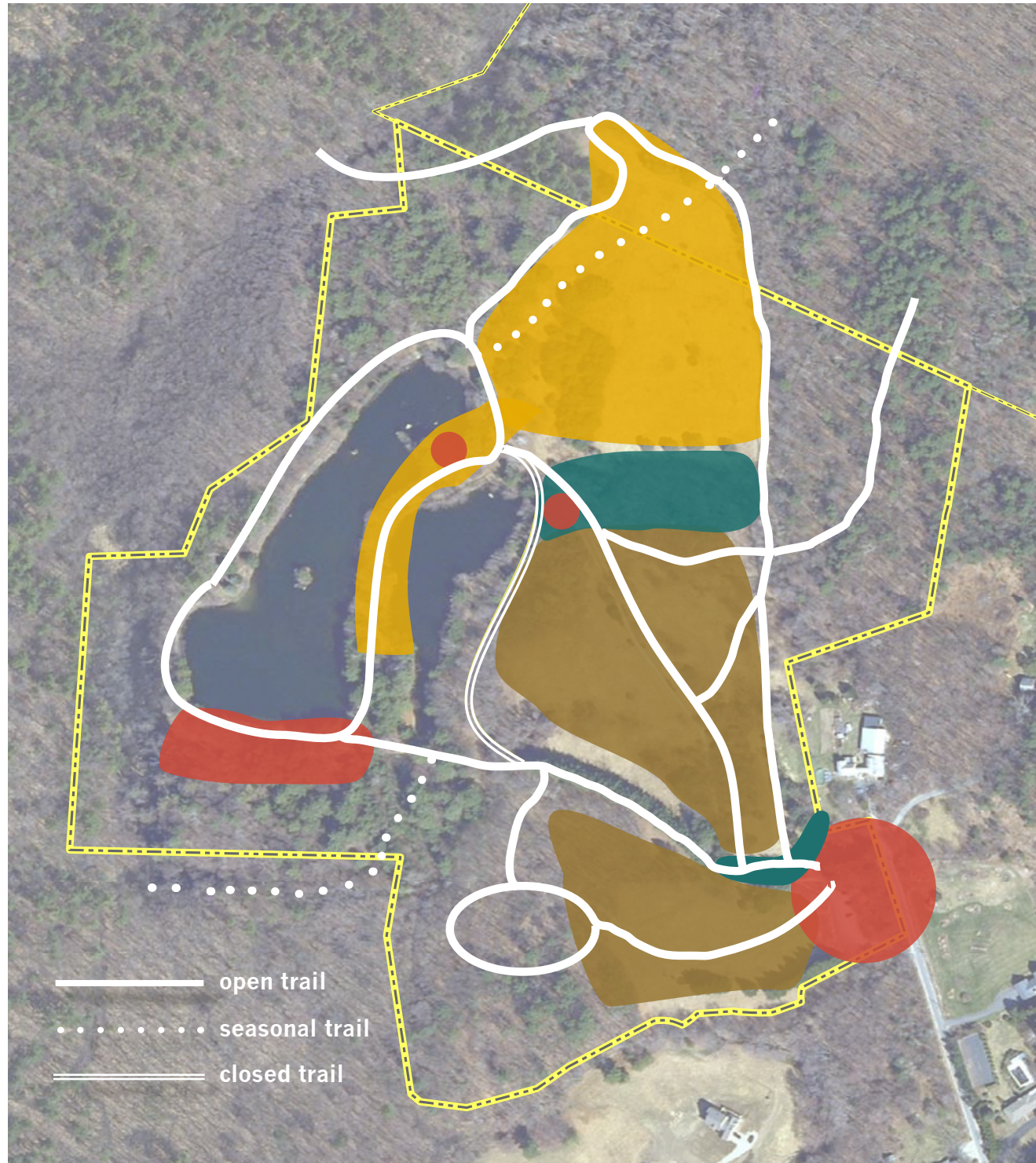
The tree and shrub layer around the northern edge of the lower pond has been cleared away to bring the field to the pond's edge, introducing another relationship to the site. Visitors walking along the trails will continually pass through a variety of habitats whatever their destinations may be. Interpretive elements placed at two trail connections explain the ecological and visual function of the young forest stage.

In keeping with the theme of ecological connection, the conceptual parking area below connects visitors to ecology. Parking and arrival areas are woven together, and visitors walk through small patches of young forest, foreshadowing the ecological transitions the site offers.



Arrival Area Focus

- **Young forest** band provides **buffer** from parking to rest of site, and **connects** forest patches
- Visitors guided to interpretation and education center upon **entrance**
- **Parking area** integrated with cultural precedent area to **engage** visitors
- Interpretation/education center provides clear view of two different habitat types: field and forest



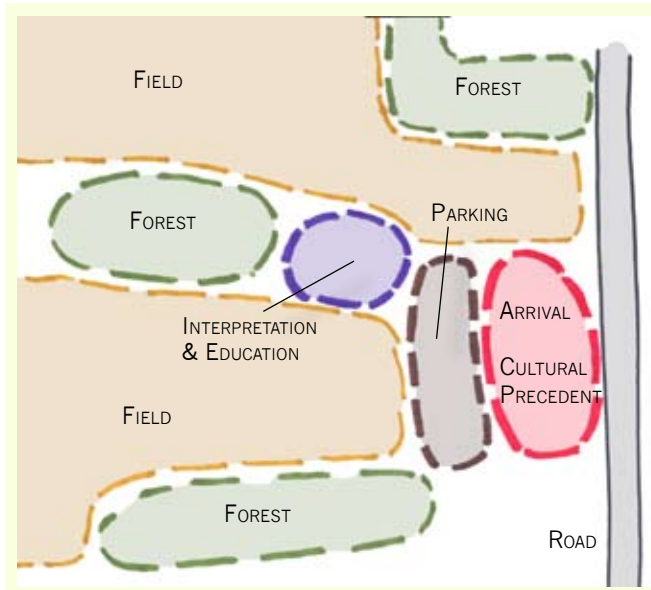
MANAGEMENT CONCEPT 2: MANAGED SUCCESSION

ENHANCING HABITAT THROUGH PERIODIC DISTURBANCE

Managed Succession showcases silvicultural management while providing formal places for passive recreation and continued disturbance for wildlife benefit. The northern field is managed to maintain its present status as old field, and it is isolated from the other open areas by a thick, shady buffer to prevent the transfer of non-native flora and fauna. The white pine stand is thinned to reduce competition between residual trees, providing habitat to the birds of prey on site.

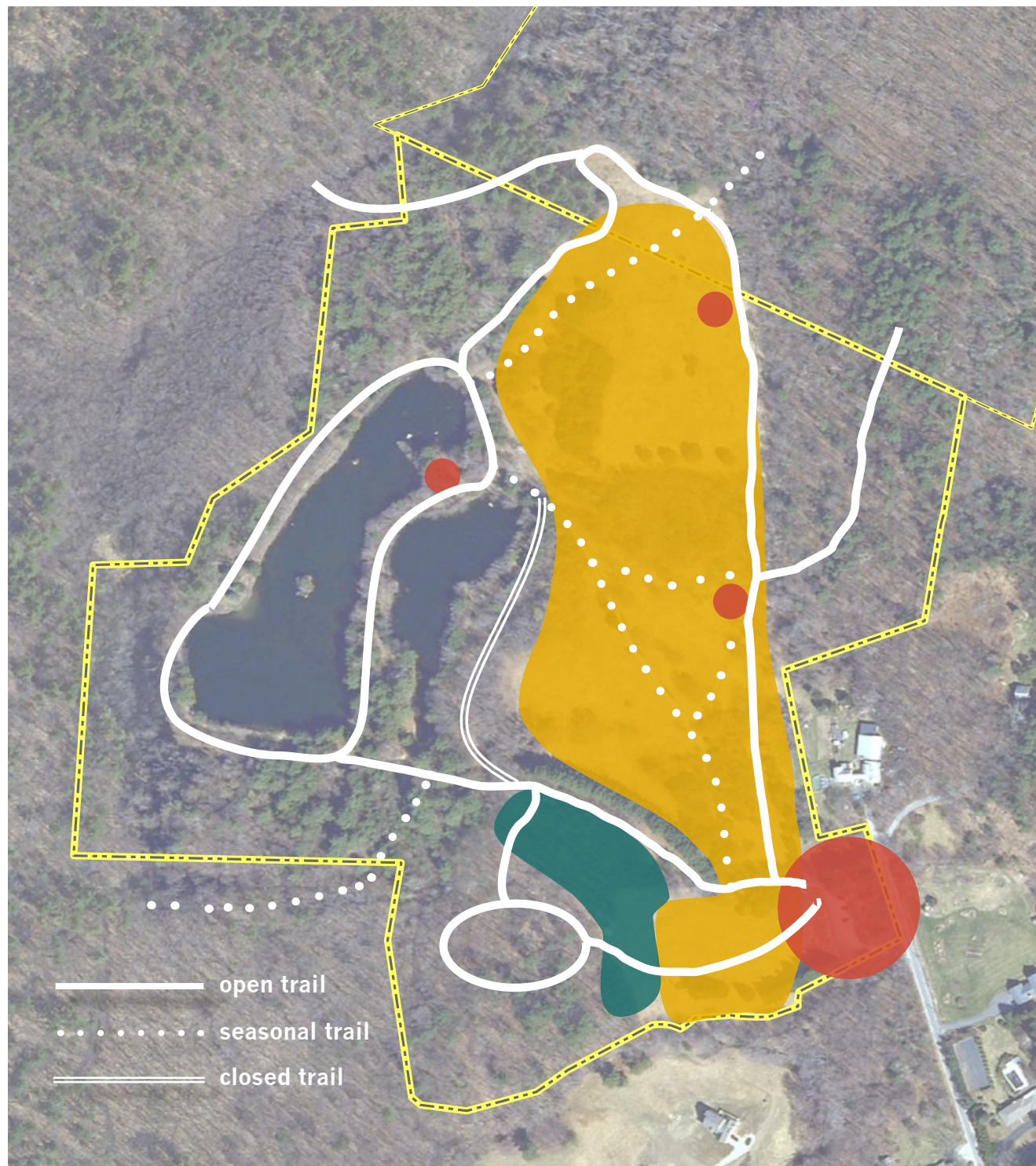
In order to ensure the structural integrity of the dam between the ponds, all trees with a diameter at breast height greater than 8" are removed, but the trail remains for visitor use. Formal gathering areas are opened up by the ponds, clearing out invasive species and encouraging the growth of native overstory trees and ground covers. An informational kiosk and covered picnic tables welcome visitors to the area.

This alternative also calls for a continual ebb and flow of field and forest in the lower fields. One space is managed as an old field, while the other is managed for emerging forest habitat. Over time, the young forest is brought back to field habitat and the field is allowed to grow into young forest. This model creates valuable habitat, enhances the fertility of site soils, and provides educational opportunities for children and adults interested in forest succession and the interactions between people and the natural environment. The fields are brought to the arrival and parking area, which contain small grid plots in different successional stages.



Arrival Area Focus

- **Informational kiosk** explains active management strategies on site
- **Shade trees** grow over informal gathering area by interpretive center
- Arrival area is host to 10'x10' meter **grid plots** grown to different successional stages.



- young forest
- old field
- formal and interpretive elements

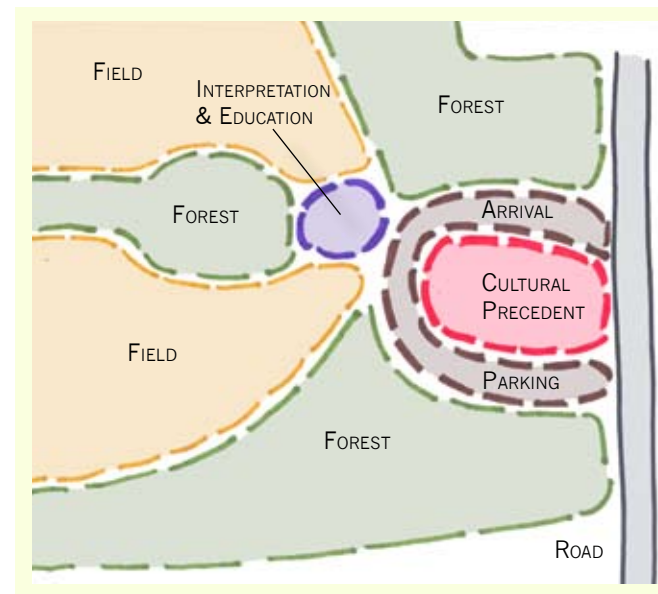
MANAGEMENT CONCEPT 3: AN OPEN MEADOW

ENHANCING HABITAT THROUGH CORE EXPANSION

An Open Meadow proposes sweeping changes to the heart of the property and brings to the forefront the recreational and ecological functions of old fields. By clearing away some of the trees separating the three fields and thinning other stands, the amount of field habitat is increased, as well as the proportion of patch habitat to edge habitat. While most birds in New England do not require more than 10 acres of open field, some, such as bobolink or American woodcock, prefer larger areas and the increase in acreage may entice these species to roost at Bower Springs.

In order to support the integrity of the old field's habitat and function, trails crossing through are closed from early April through late August. People and pets are still able to get to the ponds and circumnavigate the field year-round, but their absence at this crucial period of breeding, nesting, and brooding will be of great benefit to the bird species that inhabited much of Bolton during its agricultural heyday.

Bolton's agricultural history is a fitting complement to the design's ecological direction. In the conceptual parking arrival area below, the site's past agricultural use is referenced via the stone wall at the entryway. A farm machinery display calls to mind the former use of this parcel.



Arrival Area Focus

- **Stone wall** and **farm machinery** display
- **Rain garden** demonstration in Arrival Area
- **Fields** visible from entry, and highlighted at interpretive center

MANAGEMENT CONCEPTS: SUMMARY AND EVALUATION

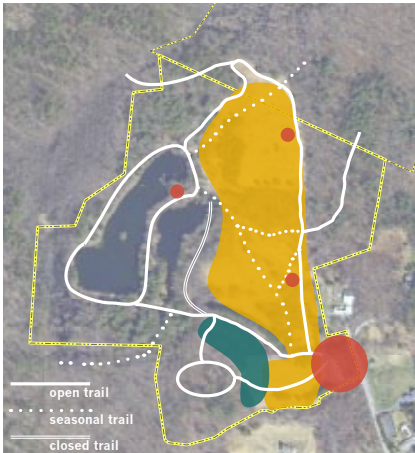
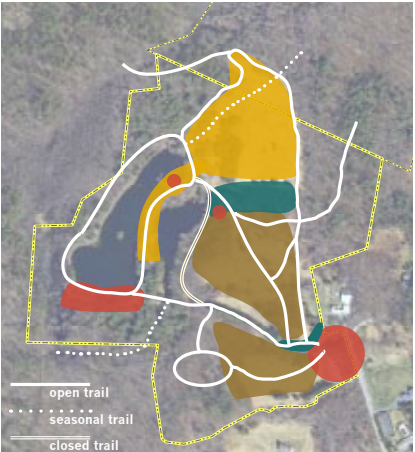
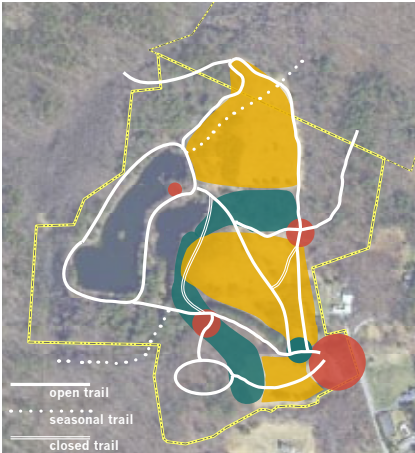
Site analysis, personal observation, public input and feedback, client interaction, historical research, and professional consultation have led the design team to view the Bower Springs Conservation Area as a site of remarkable ecological diversity atop 48 acres of land where signs of Bolton’s history are still legible. Today, Bower Springs is very much a part of the social and cultural fabric of the town. As a result, this highly popular destination bears the marks of some conflicting uses, some unplanned uses, and some inappropriate uses. Some of these situations can be resolved in the short term, but these short-term actions do not constitute a management plan, which presents a vision for the future and lays out the actions that will bring that vision to pass.

Presented here are three alternatives that illustrate the potential of the Bower Springs Conservation Area to model ecological function and diversity. These are explorations based on nine objectives chosen by the design team as applicable to Bower Springs from the 29 listed in the 2005 Open Space and Recreation Plan. By their divergent nature, these objectives illustrate the extent to which Bower Springs is a recreation, education, and conservation asset in Bolton. The site’s connection to currently protected open space and high-priority acquisition areas identified in the 2005 OSRP should encourage the town to view Bower Springs through the lens of habitat management for ecological function and recreational accessibility. To the right are thumbnails of the alternatives and a brief overview of their strengths and shortcomings. Below is a matrix illustrating the extent to which each alternative meets the nine objectives individually.

It is important to note that this assessment tool is most valuable when compared with similar assessments for all 22 parcels under the Conservation Commission’s stewardship, and when viewed in relation to the many objectives of the 2005 Open Space and Recreation Plan.

Alternative Concepts Assessment Matrix

2005 OSRP OBJECTIVES	FOREST CONNECTIONS	MANAGED SUCCESSION	AN OPEN MEADOW
Establish wildlife corridors	<div></div>	<div></div>	<div></div>
Preserve historical sites	<div></div>	<div></div>	<div></div>
Protect water resources	<div></div>	<div></div>	<div></div>
Preserve/maintain open fields	<div></div>	<div></div>	<div></div>
Publicize Bolton’s natural resources	<div></div>	<div></div>	<div></div>
Preserve protected land ecology	<div></div>	<div></div>	<div></div>
Develop integrated management strategies	<div></div>	<div></div>	<div></div>
Enhance picnic options	<div></div>	<div></div>	<div></div>
Expand environmental education	<div></div>	<div></div>	<div></div>
<div><div></div> design meets objective</div> <div><div></div> design partially meets objective</div> <div><div></div> design does not meet objective</div>			



FOREST CONNECTIONS

- PROS:
- Forested corridor connection from east to south.
 - Corridor edge along fields creates edge habitat for species diversity.
- CONS:
- Invasive species can aggregate along edges, particularly of young forest

MANAGED SUCCESSION

- PROS:
- An “outdoor laboratory” for the display of disturbance, regeneration, and stewardship
 - Formal gathering spots by the ponds concentrate impact for simplified planning
- CONS:
- Disturbance regime may seem unsightly
 - Water quality may be compromised by formal seating areas at the lower pond

AN OPEN MEADOW

- PROS:
- Unified field increases core habitat in the meadow’s interior
 - Enhanced wildlife and recreation opportunities in broad, open space
- CONS:
- Reduction in edge habitat
 - A lack of connectivity to similar habitat in the surrounding area