Landscape Maintenance Manual
Excerpted from
Preservation Management Plan
for the
Elm Street Cemetery
Braintree, Massachusetts
Volume I: Report

Prepared for:

The Town of Braintree
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February, 2011

LANDSCAPE MAINTENANCE

The Planned Landscape and Its Loss

While the First Parish Burying Place developed like other colonial burial grounds of the period, the landscape took on a more formalized appearance in 1824/1825 with the development of a section of tombs across its southern border and associated passageway. Benjamin Vinton French appears to have been influential in that design. In addition, Benjamin Vinton French purchased one of the tombs (Figure 3-26).

The Braintree Cemetery was clearly a planned landscape - reminiscent of the New Haven Burying Ground (today often called the Grove Street Cemetery). As Sloane observes for New Haven, Braintree Cemetery created a landscape that revolved around the family – "families spent large amounts of money celebrating the kinship, rather than the individual achievements of those buried within the lot" (Sloane 1991:32). At the center of the new addition were six lots – all purchased by Charles French for his family. As a result of the landscape design at the Braintree Cemetery and the efforts of Benjamin Vinton French, the landscape of the parish burying place began to be transformed into what is often called the Town Burial Ground plan. There horticultural plans combined elements of "eighteenth century English gardens, American domestic graveyards, and the flowering orchards of the surrounding countryside" (Sloane 1991:32). The planned layout and ornamental plantings would have set apart the northern and southern portions of present-day Elm Street Cemetery and the division would have been made clear by the row of mounded tombs.

The only list of plants thus far identified is provided by the 1999 assessment. These plants are identified as rosebay rhododendron (*Rhododendron maximum*), black chokeberry (*Aronia melanocarpa*), periwinkle (*Vinca* spp.), rose (*Rosa* spp.), snowberry (*Symphoricarpos albus*), spiraea (*Spiraea* spp.), and yucca (*Yucca filamentosa)*.

Deciduous trees in the cemetery in 1991 included American horsechestnut (*Aesculus hippocastanum*), littleleaf linden (*Tilia cordata*), Norway maple (*Acer platanoides*), sugar maple (*Acer saccharum*), black oak (*Quercus velutina)*, black cherry (*Prunus serotina*), English hawthorn (*Crataegus laevgata*), and Japanese maple (*Acer palmatum*). Evergreen trees include white cedar (*Thuja occidentalis*) and Colorado blue spruce (*Picea pungens*).

Considering the years of neglect, it is likely that by the early 1990s many of the original plantings had succumbed. It is also likely that some of the plantings, such as the Japanese maple, were rather recent introductions into the cemetery landscape (based on their size). Although some reduction in landscape plantings is recognizable on historic aerial photographs for the 1940s and 1950s, it is clear that the greatest loss occurred during the late 1990s (Figure 3-27).

Figure 3-27. Aerial photographs of the cemetery in the mid-twentieth century. On the left is an April 1947 photograph. On the right is a photograph from May 1954.

The 1999 assessment does confirm that by that time many of the trees were in fair to poor condition; however, only 11 of the 31 trees were recommended for removal by an ISA certified arborist. The remaining trees, plus new plantings, were designed to ensure that the historic landscape was maintained.

These professional recommendations were based upon an understanding of the historic landscape and adherence to the Secretary of the Interior's Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscapes (http://www.nps.gov/history/hps/hli/landscape_guidelines/index.htm). They represented the best professional practice to ensure the significance of the vegetative landscape, structures, and associated features are maintained.

Unfortunately, the town chose to ignore these recommendations, removing eight tombs, dramatically altering the structure of the site, as well as its topography. The town also chose to remove not 11 of the 31 trees, but 19 – leaving only 11 examples of the larger vegetation (4 black oaks, 2 Japanese maples, 1 English hawthorn, 1 littleleaf linden, 2 white cedar, 1 Colorado blue spruce, and the 1 rosebay rhododendron.

Virtually all of the shrubs have disappeared – only a few yucca remain, as well as one abused barberry (*Berberis vulgaris*).

When asked why these dramatic and destructive changes were made, the people who have provided maintenance for many years stated that the previous supervisor was only concerned ease of maintenance. Time was of the essence. However well intentioned, the effort to streamline maintenance procedures forced upon this historic cemetery has completely destroyed the distinction between the north and south sections, has destroyed the historic landscape, and has dramatically affected the National Register eligibility of the site.

The destruction of the landscape demonstrates what can happen when those with inadequate training and expertise are allowed to make alterations. The town is now faced with a critical need to mitigate the damage and restore the property to its historic roots. This is an essential undertaking in order to maintain the National Register eligibility of the site. In a following section we will make recommendations on the introduction of new plantings in an effort to mitigate the damage and repair the cultural landscape.

Staffing

We have reviewed in some detail how funding (and staffing) for Braintree's four public cemeteries of just over 9 acres has been dramatically cut with the 2008 town reorganization. The budget in 2008 was $72,772. By 2009 it had been slightly to $81,238, although the 2010 budget was slashed to a mere $70,954.

While there was once a Cemetery Division within the Department of Public Works, today cemetery maintenance is subsumed under the Highways and Grounds Division. Care is provided to the cemeteries by two individuals. These same two individuals are also responsible for the care of other town properties, including parks and ball fields. They have candidly admitted that the cemeteries are a low priority and receive only the most minimal attention. On average they may spend one-day a week attending to needs in the cemeteries (representing 20% of their time). Most of that time is spent at the still active Plain Street Cemetery. By their own estimates "less than 5%" of their time is spent at the Elm Street Cemetery – or about 2 hours per week.

Many municipalities place cemeteries under the control of some sort of park and recreation department. This is almost always a mistake. Association with a highway and grounds organization is no better and

may be quantitatively worse.

Cemeteries are scenic landscapes and in that sense similar to parks or open spaces. But they are far more; they are sacred sites, permanent collections of three-dimensional artifacts, and archives. The care they require is very different from the ordinary community park or recreation center. They demand different expertise and attention to the preservation of their historic integrity and historic landscape. There is far more to the maintenance of a cemetery than simply cutting the grass. This is clearly revealed in the tragic errors that have damaged the landscape and topography of the Elm Street Cemetery.

By associating cemetery duties with roadways, the town has further relegated the care and preservation of these burial grounds to a tertiary role – an activity of limited consequence, oversight, funding, or support.

We typically recommend two workers and one supervisor per 10 acres. This is based on the Boston Historic Burying Grounds Initiative (Atwood et al. 1989) and is particularly suitable for Braintree's situation since it is estimated that mowing old cemeteries with 3-dimensional monuments requires six-times the labor than modern lawn park cemeteries (Klupar 1962:239; Llewellyn 1998:100).

Thus, for the approximately 9 acres of Braintree cemeteries, we recommend a full-time, dedicated staff of three trained individuals.

The current staffing level is impossibly low and affects the ability of the town to have an adequate presence in any of the cemeteries, perform the necessary maintenance, and help ensure the long-term viability of the properties. The higher level of staffing would also help minimize vandalism and inappropriate activities in the cemetery.

Perhaps an appropriate level of staffing would also have reduced the pressure to make inappropriately destructive landscape alterations at the Elm Street Cemetery and aided in the maintenance of the property's cultural landscape.

Appropriate maintenance established by good practice includes weed control, tree trimming, pruning, seasonal cleanup, maintaining the roads, conducting section inspections, survey of monuments for maintenance needs, maintenance of shrub beds, maintaining section signs, maintaining water lines, rehabilitation of barren areas, raking, resetting stones as needed, inspecting and repairing fences, watering newly planted areas, sodding as necessary, identification of trees for removal, removal of flowers and grave decorations, removal of wild growth, and inspection and cleaning of catch basins (see, for example, Klupar 1962:226-228). The importance of maintenance was clearly stated by West, "one thing is certain, the cemetery must be maintained in a proper manner or public confidence will suffer" (West 1917:26).

This larger, permanent, and dedicated crew would also allow the town to train certain employees in the appropriate way to reset monuments, as well as make simple repairs. It would be possible to undertake, for example, an appropriate level of fence maintenance at the Elm Street Cemetery. It is important that these employees be assigned exclusively to the cemetery, allowing them to develop a sense of ownership and continuity.

In addition to these maintenance efforts, efficient cemetery operation also depends on management activities that Llewellyn describes as ranging from "land use (master planning), road maintenance, utility operation (backbone utilities like water), budget balancing (sales to cover expenses), long-term financial concerns, community relations, enforcement of rules and regulations, and so on" (Llewellyn 1998:206). In fact, he spends an entire chapter on administrative responsibilities of the cemetery manager.

Consequently, the town must provide a staffing level that will maintain the beauty, dignity, and historical significance of this cemetery. Braintree is not doing this at present and the care of the Elm Street Cemetery (and we suspect the others) is suffering as a result.

Staff Training

Sadly, professional training in the landscape industry, at least among the public, is undervalued. This contributes to rapid turn-over and inappropriate maintenance activities.

In 2005 the Associated Landscape Contractors of America (ALCA) and the Professional Lawn Care Association of America (PLCAA) merged to form the Professional Landcare Network (PLANET). This organization offers three certification programs.

The first is the Certified Landscape Technician – Exterior. The exam for this certification is a hands-on field test and candidates can be tested in Installation, Maintenance, or Irrigation.

The second is Certified Turfgrass Professional – a comprehensive study of both warm and cool-season turfgrasses developed by the University of Georgia Center for Continuing Education. Certification in this area demonstrates a mastery of weed, insect and disease identification/control, as well as diagnosis of common turfgrass problems. The material supports Integrated Pest Management concepts and pesticide safety – significantly reducing the town's liability for operations.

The third is Certified Ornamental Landscape Professional. This certification emphasizes tree and shrub maintenance procedures with candidates concentrating on landscape trees and ornamental woody plant physiology, health care management, and establishment.

There are also local programs. For example, the Massachusetts Horticultural Society is the home of the state's Master Gardener Program (http://www.masshort.org/Master-Gardener-Program). The Massachusetts Nursery and Landscape Association provides certification training for professional horticulturalists (http://progrownews.com/Certification.html).The Massachusetts Association of Landscape Professionals also offers a certification program and continuing education classes (http://mlp-mclp.org/sections/MCLP_certification.php).

Unfortunately, no one associated with the town's cemeteries is a member of these organizations or has received certification training.

We imagine that much of the focus has been (and continues to be) on the turfgrass at athletic facilities or public parks. Braintree's Department of Public Works should not assume that the problems of grass maintenance are the same, regardless of where the turf is situated.

An excellent publication on cemetery lawns notes that, "there are peculiar problems which confront only the person responsible for the development and care of cemetery lawns." These include the age of cemetery grounds and the fact that rarely were cemetery choices made on the basis of appropriate soils (Anonymous 1932:4).

The town must provide opportunities for its staff to become certified in different areas – and must emphasize the importance of this certification. Such efforts would improve the level of care and maintenance and develop a greater sense of stewardship. Eventually this core of trained individuals could also provide in-house training to other staff.

Given the importance of trees to the vistas and historic landscape, as well as the demonstrated damage that has already occurred to the property's historic vegetation, it is critical that at least one individual with oversight of the town's burial grounds be an International Society of Arboriculture (ISA) Certified Arborist.

Certified arborists have a minimum of three years experience in some aspect of tree care and have passed an exam developed by an international panel of experts. The exam extensively covers every aspect of tree care and the individuals must have an acceptable level of knowledge in all areas of arboriculture.

One individual associated with the cemetery is a member of the Massachusetts Tree Wardens & Foresters Association. This organization does provide training to its members, but it does not offer a certification program. Membership is open to all tree wardens (as defined by local ordinance), arborists and industry related personnel, regardless of training.

The Quality of Supervision

Regardless of the credentials or certification, the complexities of the cemetery landscape require that the technicians are well supervised and are held accountable for their performance. It is especially important, therefore, that the supervisory position we recommend be carefully defined. The selected individuals must not only be well trained and knowledgeable, but also possess demonstrated supervisory experience. The supervisor must be expected to work alongside the crews on a daily basis – this means that the town must not burden this individual with administrative duties.

Continuity of the Staff

Maintaining the continuity of a maintenance staff with a commitment to the preservation of a historic cemetery is critical. It not only serves to help ensure the highest possible quality of care, but also allows the specialized knowledge that accrues to be transferred to new staff members over time.

Obtaining this continuity, of course, demands that the town provide a reasonable pay scale for new workers and ensure that staff does not feel trapped in a dead-end job.

Turfgrass Issues

Turfgrass should be an important concern of cemeteries, although rarely is it given adequate attention. With an appropriate turfgrass, mowing frequency is reduced. This reduces labor costs, pollution, equipment expenditures, and perhaps most importantly for historic properties, damage to the stones.

The Elm Street Cemetery lacks a well-defined turf grass, although many areas were predominately a fine fescue. According to the town no effort has been expended to develop a turfgrass and the grass has received little attention beyond mowing. This has lead to an overall decline in appearance and an increase in maintenance costs. It is no surprise, therefore, that much of the cemetery contains broad leaf "weeds" – undesirable species that cause the grounds to look unkempt and require frequent mowing to keep them in check.

Mowing

Mowing at the cemetery is conducted using a John Deere Z Trak F620 Mower with a 48" mower deck. At times a commercial walk behind mower is also used. Although the deck size of the F620 is the smallest offered, the use of such equipment in a historic cemetery can be problematical since large equipment is more difficult to control and ensure that no damage occurs to stones or landscape plants.

We recommend that the use of riding mowers be abandoned at the Elm Street Cemetery and only walk behind mowers with decks no larger than 21-inches be used. Even with the smaller sized mowers, all equipment used in the cemetery should have a closed cell foam pad attached to the sides and front edges. This bumper will help to minimize accidental damage.

Stones in the cemetery clearly reveal the damage that can be done by large equipment and less than perfect handling (Figure 3-28).

It is reported that mowing is conducted "every three weeks" and the cemetery was mowed immediately prior to this assessment. Reports from other stakeholders interviewed during this assessment suggests that this mowing frequency is not adequate. We received reports that the grass was often 6" or higher – suggesting that mowing every two weeks would be more appropriate.

Figure 3-28. Examples of mower and trimmer damage. Top photo shows mower impacts on the sides of a slate stone. The bottom photo shows parallel scars from too heavy nylon trimmer line.

In general, most cool season turfgrasses should be mowed to a height of 2½ to 3½ inches and frequently enough so that no more than 1/3 of the total leaf surface is removed in one mowing. If the grass is allowed to become too high, the removal of grass adjacent to monuments would become more difficult with longer and thicker grass blades – and this in turn could lead to more damage to the stones. In addition, the removal of more than 1/3 of the blade causes undue stress on the turf.

It is also critical that mower blades be frequently sharpened. Dull mowers tear the grass blades rather than cut them (Figure 3-29). This can result in excessive injury to the plants as well as a brownish cast to the turf. In addition, mower blade injury can cause several adverse effects, including increased turfgrass water use and the promotion of disease infection.

In addition to mowing, nylon trimmers are used around monuments, coping, fencing, and plantings. This is an acceptable practice, but it is critical that a very light weight line be used – along with worker attention – to minimize damage to soft stone such as marble. The maximum line diameter for use in the cemetery should be 0.065". Thicker lines will cause unnecessary damage to the stones. Unfortunately the town is using trimmer line that is 0.095" and Figure 3-28 reveals damage done to markers by the use of this line.

Figure 3-29. Grass at the Elm Street Cemetery has been cut with very dull mower blades, resulting in the leaves being torn, rather than cleanly cut.

A final issue of concern is that the Roads and Grounds staff are not picking up trash in the cemetery prior to mowing. Instead, the trash is being mowed over. We observed plastic, aluminum, and other items (including remnant plot chains) that had been mowed over (Figure 3-30). The cemetery, at the time of the assessment, also exhibited multiple areas where leaves and other trash had been allowed to collect – all of this debris must also be removed prior to mowing.

In other areas we observed that the mowing had severely damaged plantings. For example, Figure 3-30 illustrates yuccas that were simply mowed over, rather than being mowed around. This indicates a disregard for the historic landscape and is inexcusable. Sufficient care must be taken to ensure that all plantings are adequately protected from mowing or other maintenance activities.

Figure 3-30. Unacceptable mowing practices include a failure to collect trash, litter, and branches prior to mowing and mowing over plantings.

The overall feel is that maintenance is being done too quickly, without adequate care. This may be the result of insufficient training or it may be the result of the staff being too pressed for time to allow a proper job. In either case, the landscape of the cemetery is suffering and the level of care reflects poorly on the town of Braintree and its staff.

The town reports that soil tests are not made for the improvement of the turfgrass. In addition, no pre-emergent or post emergent weed control is used.

Soil testing by the Soil and Plant Tissue Testing Laboratory at the University of Massachusetts Amherst costs only $9 per sample (pH, buffer pH, extractable nutrients, extractable heavy metals such as lead, cation exchange capacity, and percent base saturation) and the practice of testing the soil every two to three years is a critical step in establishing a healthy turf (http://www.umass.edu/soiltest/pdf/soil_test_brochure_2009.pdf).

During this assessment one sample was collected, combining soil from the four quadrants of the burial ground. As might be predicted with no turfgrass maintenance program, the soils exhibit very low levels of nutrients (Table 3.3).

Table 3.3. Soil test for turfgrass at the Elm Street Cemetery

Soil pH: 4.6	Organic Matter: 6.8% (4-10% desirable)	
Buffer pH: 5.8	Total Estimated Lead: 255ppm (low)	
	Micronutrient levels: normal	
Phosphorus (P)	5 ppm	Low
Potassium (K)	38 ppm	Low
Calcium (Ca)	40 ppm	Very Low
Magnesium (Mg)	11 ppm	Very Low

Based on these results, an appropriate regimen for turfgrass is the application of 50 lbs. of dolomitic limestone/1000 square feet in the early spring and again in mid-autumn. The soil should be retested next year to evaluate the soil pH adjustment.

The soil also requires 2 lbs. of P_2O_5, 4 lbs. of K_2O per 1000 square feet, and 1 lb of nitrogen per 1000 square feet.

Using conventional 20-3-12 fertilizer the report recommends 5 lbs per 1000 square feet in late April, late June, and very late August. In addition, a 0-20-0 (superphosphate) should be applied in very late August at the rate of 5 lbs. per 1000 square feet. The 20-3-12 will require application for at least two successive years; the superphosphate should be applied only the first year.

In order to minimize salt uptake by the stones, slow release organic fertilizers are preferable to commercial inorganic fertilizers. An excellent source explaining the differences between organic and inorganic fertilizers is http://www.cmg.colostate.edu/gardennotes/234.pdf. The publication at http://pubs.caes.uga.edu/caespubs/pubs/PDF/C853.pdf provides information on converting traditional inorganic fertilizer recommendations to safer organic recipes.

For example, 1.8 lbs of steamed-bone meal per 1000 square feet will provide the recommended P2O5 levels. Sulfate of Potash Magnesia will meet the K_2O demand at a rate of 2.8 lbs. per 1000 square feet. The recommended nitrogen levels can be supplied by the addition of 0.5 lb of blood meal per 1000 square feet.

Obviously, the timing of fertilization is critical, especially for stressed turf which does not have supplemental irrigation. Thus, it is important that no fertilizer be applied during the summer months when cool-season turfgrasses are naturally stressed and easily out-competed by many weed species. Dormant or brown turf should also not be fertilized.

Figure 3-31. Lawn problems. The top photograph shows heavy soil compaction. The bottom photograph shows moss invading the turfgrass.

Weed Control

The assessment found a variety of weeds invading the turfgrass (Figure 3-31). While directly attacking these weeds using pre- and post-emergent herbicides may be necessary, other cultural practices should be instituted first. The most important is aeration. During this assessment we found that the cemetery soils were heavily compacted.

Compaction causes a variety of problems, including reducing drainage and inhibiting air exchange, decreasing soil oxygen, altering infiltration and percolation rates, and contributing to the build-up of thatch since the conditions for microbial activity and decomposition are adversely affected.

We recommend hollow tine core aeration with treatments at least twice a year, typically in May and September. Given the compaction level it may be necessary to core aerate the Elm Street Cemetery for several years before establishing a yearly schedule.

Klupar (1962:223) states that weed eradication "is an operation considered essential in a well-kept cemetery." Thus, while the cemetery clearly reveals the need for extensive post-emergent (and possibly pre-emergent) herbicide use in order to rehabilitate the turfgrass, it is critical that the pesticides be carefully applied and that overuse should be carefully avoided. Use should also ensure that drift does not occur and that the herbicide is not applied directly to the stone.

We recommend that the weed issue be revisited after core aeration and after appropriate fertilization for several years.

Pest Control Practices

Low maintenance turf care accepts some degree of pest damage. However, the town should be alert to significant pest problems. One Purdue lawn pest publication that may help is available at http://extension.entm.purdue.edu/publications/E-61.pdf.

We also observed areas of dense moss growth. The presence of moss is often an indicator of compaction, improper soil pH, or too much shade. Since shade does not seem to be a major problem where the moss is

densest, we suspect that compaction combined with poor soil fertility are the primary problems (Figure 3-31).

Renovation

There are areas in the cemetery where the turf has been heavily invaded by weeds. After fertilization and core aeration for several years, it may be appropriate for the town to implement a renovation program in these areas in order to establish a good stand of turf.

Section 5, "Establishment, Renovation, and Repair" in the publication, *Lawn and Landscape Turf Best Management Practices* (available at http://www.umassturf.org/publications/online_pubs/lawn_landscape_bmp.pdf) provides good guidance.

Irrigation

Although the assessment questionnaire reported that the Elm Street Cemetery did not have hose bibs, one was identified during the assessment, although it was inoperable. Our sense is that the meter controlling this bib was turned off when the Braintree Water and Sewer Department began charging other town departments for their water usage.

The inability to provide any spot watering is causing stress on vegetation. We strongly recommend that the meter be turned on to allow spot watering. The town could easily install a Woodford (or equivalent) sanitary hydrant that would provide back flow prevention, frost proofing to a depth of 2-3 feet, and allow the faucet to be locked to prevent misuse. If backflow prevention is not required, the Woodford Yard Hydrants can prevent frost damage to a depth of 5 feet.

Having the ability to spot water will be critical when some turf areas are renovated, as well as for other preservation activities (such as the repair of stones and cleaning heavy lichen deposits).

Cemetery Trees

We have previously explained that the only list of possible original plantings is provided by the 1999 assessment and that since that time the town removed a great many of the cemetery trees, leaving a stark landscape that is not historically accurate and detracts from the cemetery's beauty. Therefore one of the most significant tasks will be the replanting of the cemetery landscape. Table 3.4 provides some information on the trees present in the cemetery.

Selection Issues

Cemeteries, in general, have historically been dominated by large deciduous trees, although evergreens are also very common. They provide a distinctly inviting image for visitors and passersby. These trees also provide some visual separation from adjacent buildings – especially in cluttered urban environments.

Ideally the trees selected should be historically appropriate. In the case of a planned cemetery, such as the Elm Street Cemetery, the ideal would be to use those trees selected by the original designers – respecting their original intent and interpretation. Thus, Table 3.4 provides an excellent beginning point (excepting perhaps the Colorado Blue Spruce, which is a fairly late introduction).

All other issues being equal – plantings should focus on those tree species that are known to have been used. While diversification may be acceptable, it should not dilute the original design or intent. Therefore, we urge care in selecting additional plantings, focusing on a small number of historically appropriate trees

Table 3.4. Trees Associated with the Elm Street Cemeterv

Tree	# in 1999	# today	Origin	Cultivation			Size (HxS)	Litter	Breakage	Roots	Notes
				Zone	Light	Drought					
American horsechestnut (*Aesculus hippocastanum*)	2	0	Exotic: 1576	4-7	FS	M	50-80x40-50	Significant	Resistant	No Problem	Used for bordering.
Littleleaf Linden (*Tilia cordata*)	1	1	Exotic:	4-7A	PS-PS	M	40-50x25-40	None	Resistant	No Problem	Particularly susceptible to Japanese Beetles.
Norway maple (*Acer platanoides*)	12	0	Exotic: 1792	4-7A	PS-PS	M	40-60x35-40	None	Resistant	Problem	Requires pruning; seeds sprout readily. Used as a speciment tree.
sugar maple (*Acer saccharum*)	1	0	Native: 1735	3-8A	S-PS	M	50-80x35-80	None	Resistant	No Problem	Excellent colors through all seasons; frequently used for ornamental plantings.
black oak (*Quercus velutina*)	4	4	Native: 1800	3-9	PS-PS	M	50-60x variable				
black cherry (*Prunus serotina*)	1	1	Native: 1629	3B-9A	PS-PS	H	60-90x35-50	Significant	Resistant	No Problem	Can seed itself into landscape.
English hawthorn (*Crataegus laevgata*)	1	1	Exotic: 1786	4B-8	FS	H	20-25x15-25	None	Resistant	No Problem	Casts heavy shade if lower branches left in place; must be pruned for turf areas. Highly recommended by Downing.
Japanese maple (*Acer palmatum*)	2	2	Exotic: 1830	5B-8	PS-PS	M	15-25x15-25	None	Resistant	No Problem	Winter interest, but may be damaged by Spring frosts.
white cedar (*Thuja occidentalis*)	2	2	Native: 1536	2-7	PS-PS	M	25-40x10-12	None	Resistant	No Problem	Good screen or hedge plant; not commonly used as a specimen plant.
Colorado blue spruce (*Picea pungens*)	4	1	Native: 1862	4-7	PS-PS	M	30-50x10-20	None	Resistant	No Problem	Rarely used prior to 1880s.

to maintain the historical integrity of the cemetery.

Some trees, whether historically appropriate or not, should probably be avoided since they pose significant maintenance issues. These include trees that produce dense shade (causing problems with the turfgrass); trees that exhibit suckers or surface roots (also causing turfgrass problems); trees that drop large quantities of leaves, seeds, or sap; and trees that are especially weak or vulnerable to wind or ice damage.

Obviously, there is no such thing as a perfect tree. Many of the historically appropriate species have significant problems. At least some of these problems, however, can be overcome through judicious placement and appropriate planning.

Given the excessive removal of historic vegetation from the Elm Street Cemetery, we strongly recommend that an ISA Certified Arborist be retained to assess the health and condition of the existing trees and develop a long-term tree plan. Table 3.5 provides a list of several ISA Certified Arborists in the vicinity of Braintree.

Table 3.5. ISA Certified Arborists in the Braintree Area

Name	Company	Location	Phone
Caswell, Todd	Natural Tree & Lawn Care	Avon, MA	781-297-3674
DiBlasi, Joseph	Tree Surgeon	Weymouth, MA	781-706-4767
Martin, James	Consulting Arborist	Chelmsford, MA	781-572-7924

Trees should be replanted as older ones are removed and a general effort should be made to plan for future tree replacement, perhaps using a mix of fast-growing but short-lived trees intermixed with slow-growing but long-lived trees to create a planned appearance. It is also appropriate to plant replacement trees in anticipation of their need, allowing them an opportunity to become established before the diseased or damaged tree is removed.

The 1999 assessment recommended that additional plantings take place on the east and west lines of the cemetery in order to screen the cemetery from the adjacent, and intrusive, properties. This is still a very valid recommendation. These adjacent properties do not enhance the cemetery experience and, in many

cases detract from the solitude and beauty of the property. Evergreens would be particularly effective at shielding these views.

The southern half of the cemetery also requires replanting in order to begin restoring the original appearance of the property. Decorative or specimen trees would be appropriate for this area.

Planting Issues

Locations chosen for planting should not interfere with gravestones, curbing, or fences. Issues of security should also be considered and the use of small trees that obscure eye level views should generally be limited or avoided.

Research is suggesting that trees, especially older mature trees, improve in health when turfgrass is removed under the branch spread and mulch is applied at a depth not exceeding 3 to 4". This is a practice that could be productively employed at the Elm Street Cemetery. Staff should be closely supervised to prevent over mulching of vegetation.

All replacement trees should be of at least 1-inch caliper and meet the minimum requirements of the American Nursery and Landscape Association's American Standard for Nursery Stock (ANSI Z60.1-2004).

Maintenance Issues

Maintenance involves at least four basic issues: watering, fertilization, pruning, and pest control.

The town does not, on a routine basis, water trees in the cemetery, relying instead on rainfall.

We are told that past experience with water bags has been poor, with the bags being vandalized. This vandalism, however, appears limited to far more public locations and may not be applicable to the cemetery. Watering is a critical element to ensure that newly planted trees survive and we recommend that the use of water bags be attempted.

The staff reports that no tree fertilization is conducted, although no reason is offered. The trees in the cemetery are vital components of the landscape. They represent part of the historic fabric and steps must be taken to protect that aspect of the landscape and vista.

While shoot growth (growth occurring in the present year) and foliage color are often used as indicators of nutrient deficiency, the best indicator of whether fertilization is necessary is a soil test.

Soil testing has been conducted as part of this assessment (see Table 3.2). While we recommend that a certified arborist review these recommendations for deciduous plantings, in general soil pH is low and should be modified by the addition of 12 cups of ground limestone per cubic yard for new plantings. The established trees should be top dressed with the addition of 7 cups of ground limestone per 100 square feet.

Existing deciduous plantings could also benefit from the addition of 3 cups of a 5-10-5 fertilizer per 100 square feet, applied as a top dressing. New plantings would benefit from 5 cups of 5-10-5 fertilizer per cubic yard of backfill. This could be further supplemented by the addition of compost or composted manure.

Evergreen plantings require less modification. Recommended is the addition of 10 cups of ground

limestone per cubic yard for new plantings to achieve adequate pH adjustment. The established evergreen trees should be top dressed with the addition of 3 cups of ground limestone per 100 square feet.

Existing evergreen plantings would benefit from the addition of 1½ cups of a 10-10-10 fertilizer per 100 square feet, applied as a top dressing. New plantings would benefit from 4 cups of 10-6-4 fertilizer per cubic yard of backfill. This could be further supplemented by the addition of compost or composted manure.

It is best to fertilize trees when they are actively growing and have available water to help absorb nutrients. In Massachusetts this is typically from the spring, after new leaves emerge, through mid-season. Fertilizer should not be applied late in the season or during periods of drought.

Figure 3-32. English hawthorn that requires pruning to remove dead wood.

During the assessment our observations suggest that the remnant trees are generally healthy, although several require pruning to remove deadwood (especially the English hawthorn, Figure 3-32). Several additional trees could benefit from pruning to either thin or clean. Thinning is a technique of pruning that removes selected branches to increase light and air movement through the crown. This also decreases weight on heavy branches. The natural shape of the tree is retained and its overall health is improved. In cleaning, the pruning removes branches that are dead, dying, diseased, crowded, broken, or otherwise defective. This includes narrow crotches.

Trees should be pruned in such a manner as to preserve the natural character of the plant and in accordance with ANSI A300 (Part 1) - 2001 standards.

In pruning, branches should always be cut just beyond the branch collar (an extension of the main stem) and not flush with the trunk. Large branches should be removed with three cuts to prevent tearing of the bark which can weaken the branch and lead to disease. All pruning within the cemetery should be performed by an ISA Certified Arborist.

Trees should be inspected for potential threats to monuments, as well as general health. Ideally these inspections should be made yearly and after any storm where the winds exceed 55 mph. They should be pruned to remove potentially hazardous dead wood on a yearly basis, but safe pruning every 5 years by a certified arborist is acceptable. Under no circumstances are tree climbers (hooks, spikes, gaffs) to be worn while ascending, descending, or working in trees to be pruned.

There are some situations in the cemetery where voluntary plantings have grown to interfere with the stone fence (Figure 3-33). These detract from the landscape and will ultimately pose problems for the maintenance of the fence. Those voluntary or weedy species on the cemetery should be removed.

There are also voluntary species outside the cemetery wall that lean over the wall and will pose problems. The town should contact the adjacent property owners and arrive at a plan for the removal or pruning of this vegetation in order to protect the burial ground from future damage (Figure 3-34).

Figure 3-33. Voluntary trees that are detracting from the cemetery landscape and that may cause eventual damage to the cemetery wall. These trees and weedy plants should be removed.

Just as the town removed many trees, it appears that the shrubs have also been removed, further altering the historic landscape and dramatically changing the appearance of the cemetery. In some respects the loss of shrubbery is to be even more regretted since the individual shrubs were likely the historic remnants of original lot owner plantings.

The plantings at a cemetery cannot be easily replaced and, in fact, represent artifacts just like the stones themselves. It is essential that the town re-evaluate the level of maintenance being provided to the cemetery.

Today the only shrubs still recognizable in the cemetery include the Rosebay rhododendron, situated in the middle of the northern portion of the cemetery, a very small and poorly attended barberry (*Berberis* sp.), and

Pest Control

During this visit we observed no obvious evidence of pests but Massachusetts is at risk for a great many problems, including the Emerald Ash Borer, Asian Longhorn Beetle, Sudden Oak Death, and Gypsy Moth. Given the importance of the trees to the cemetery landscape, it is of critical importance that the cemetery trees be very carefully inspected on at least an annual basis.

Shrubbery

Shrubbery would have been used extensively by families burying loved ones in the south section of the Elm Street Cemetery. By 1999, however, only six shrubs were identifiable, including Rosebay rhododendron (*Rhododendrum maximum*), rose (*Rosa* spp.), snowberry (*Symphoricarpos albus*), spiraea (*Spiraea* sp.), yucca (*Yucca filamentosa*), and black chokeberry (*Aronia melanocarpa*). Mentioned as a ground cover was periwinkle (*Vinca minor*).

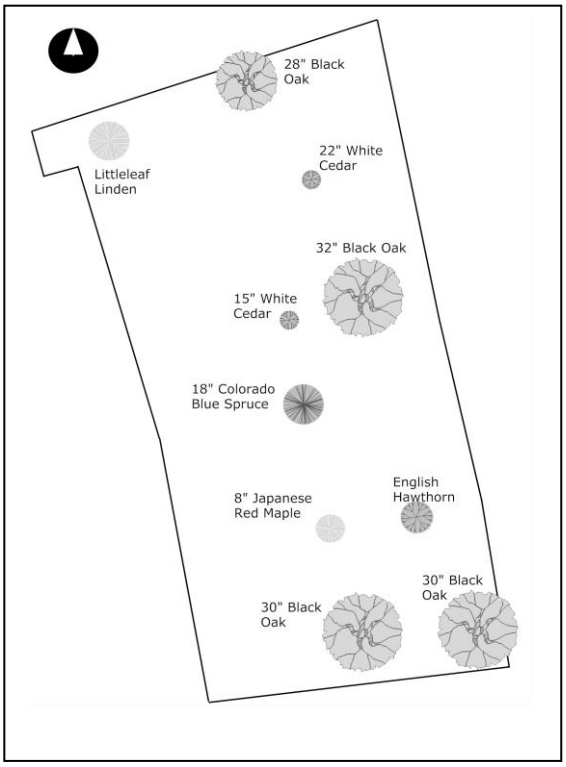

Figure 3-34. Extant trees in the cemetery.

numerous yucca plants (many of which are being routinely mowed over) (Figure 3-35). Also present is a bed of day lilies (*Hemerocallis* spp.) in the southwest corner of the cemetery. They, too, are inexplicably being mowed over.

Figure 3-35. Shrubs at the Elm Street Cemetery. Upper left is the Rosebay Rhododendron, an excellent specimen that should be carefully tended. Upper right is an example of the yucca present in the cemetery. Many of these are being mowed over – a practice that should be halted immediately. Lower row shows the barberry that is being improperly "pruned" using a nylon trimmer.

Selection and Planting

As with trees, when shrubs require replacement, they should generally be replaced with like material, especially if they represent plants traditionally used in cemetery settings. If planting lists cannot be located for the cemetery, plants such as boxwood, forsythia, hydrangea, lilac, and memorial rose are all known to be period appropriate.

Fertilization

As with trees, the best indication of the need for fertilization is a soil test, which should be performed at least every three to five years. While some shrubs, such as boxwood, provide an indication of deficiency through the yellowing of lower leaves, such evidence can be missed and does not indicate the extent of the problem.

Where fertilization is necessary most shrubs, because of their shallow root systems, respond adequately to broadcasting the appropriate organic fertilizer around the base of the plant, typically at the drip line.

Most shrubs should be fertilized when they are actively growing and have available water to help absorb nutrients. Broad-leaved evergreens, such as boxwood, are best fertilized in the winter or spring. Summer or fall fertilization of these plants may induce late season growth that is highly susceptible to winter injury. Some plants which exhibit episodic growth, such as forsythia, may benefit from a more continual fertilization program based on soil analysis and plant growth response. The rhododendron will benefit from a fertilizer designed for "acid-loving" plants (more correctly, rhododendrons are acid-tolerant) and a pH of 5.5 to 6.5 is typically appropriate.

Pruning

It is again in the category of pruning maintenance that we see problems. A good example of this problem can be seen in Figure 3-35, where a barberry has been "pruned" using a nylon trimmer. This practice is even worse than shearing since it leaves the stems broken, crushed, and damaged, promoting disease and creating a rounded shape that is inappropriate for the shrub. In addition, deadwood that should be pruned out has been left intact.

The continuous shearing of the shrubs has caused a thick outer shell of foliage which creates dense shade on the interior branches. This continuous shade will result in significant foliage drop, decreasing the health, value, and aesthetics of the plants.

Shrubs are best pruned, rather than sheared, to maintain a natural shape and to keep plants at a desired size so that they do not outgrow their landscape too quickly. With much deadwood on their interiors, significant rehabilitation may be necessary – as in the case of the barberry.

Thinning (cutting selected branches back to a side branch or main trunk) is usually preferred over heading back. Thinning encourages new growth within the interior portions of a shrub, reduces the size, and provides a fuller, more attractive plant.

Figure 3-36. Stone at the edge of the rosebay rhododendron. Very judicious and careful pruning can help make the stone more visible without damaging this exceptional specimen.

The rhododendron has partially overgrown one stone (we carefully examined the interior of the plant and there are no other stones) (Figure 3-36). The plant may be pruned back moderately in this location in order to make the stone more legible. It is essential, however, that the pruning not become heavy-handed or damage this magnificent specimen.

Other Landscape Issues

Noxious Weeds

Poison ivy was found in numerous areas of the cemetery, including the southern and western walls, as well as around plots and stones (Figure 3-37).

Figure 3-37. Poison ivy is beginning to become established in the cemetery and should be manually

While not yet a significant problem, its presence in the cemetery is attributable to inadequate maintenance attention. It is found in areas where nylon trimmers cannot conveniently be used, indicating that the staff is not using clippers to remove the vine when observed.

Stone such as marble and granite can be damaged by the application of herbicides such as glyphosate, 2,4-D amine, and triclopyr typically used to treat poison ivy. Instead of spraying, we recommend that indidivual vines be cut and the freshly exposed stem be painted with herbicide to assist in the killing of the root system. A good herbicide is Dow's Garlon 4 (http://www.cdms.net/ldat/ld0B0013.pdf) which is 61.6% triclopyr (http://npic.orst.edu/factsheets/triclogen.pdf).

Collection of Leaves and Debris

We have previously mentioned that leaves and debris are not being collected prior to mowing. It is important to again emphasize that these materials must be removed from the cemetery and not allowed to collect. There are several options.

Many cemeteries deal with leaves by using power equipment to create rows that are then either mechanically bagged or, just as often, mulched using mowers with micro mulch blades. The latter approach not only eliminates the work of gathering and removing leaves, but it also adds nutrients back into the soil.

For example, a Lexington, Kentucky cemetery deals with 130 acres of leaves with a crew of seven employees using blowers to blow all the leaves to the driveways. Next, a crew of three picks up the leaves using a large vacuum, which shreds and shoots them into a covered dump wagon. The shredded leaves

can then be composted.

The process at Spring Grove Cemetery and Arboretum in Cincinnati, Ohio is even simpler. There, on 430 acres, they blow the leaves away from markers and flower beds, then mulch them with riding mowers. The same can be accomplished at the Elm Street Cemetery if the push mowers are fitted with mulching blades. These are specially designed blades that pulverize clippings. For example, some blades have jagged teeth instead of a traditional-looking cutting edge. Others have multiple cutting edges. Many mulching mowers employ kickers or tails that force blades upward for repeated chopping. Mulched leaves contain less nutritional value than green clippings, so the main value is in reducing your need to dispose of huge volumes of leaves in the fall.

Examples of commercial mulching mowers include the Toro 21" Heavy Duty models, Snapper Pro with their Ninja blade, and the Honda HRC Commercial mowers. All get very high ratings from professional users.

Maintenance Schedule

We also recommend that the Highways and Grounds Division create a cemetery maintenance program that outlines specifically what must be done by season and/or month. Such a maintenance program can assist in quality control, clearly describes the minimal level of care, and ensures that staff are always aware of what needs to be done. One example of such a plan can be found at www.holyroodcemetery.org/fallservices.pdf. There are additional maintenance schedules and checklists available at the Chicora website (http://chicora.org/lawn-maintenance.html).

Recommendations

The historic landscape has been severely damaged by the inappropriate removal of trees, shrubs, and even below ground tombs. This practice must cease immediately and an effort to restore the damaged landscape is a critical priority.

Proper maintenance and upkeep of Braintree's cemeteries requires at least one three-person crew working year-round. We recommend hiring to achieve that level of cemetery staffing. In addition, this crew should be dedicated solely to cemetery needs and activities. The Supervisor should work in the field with the crew.

Technicians and the supervisor should be encouraged to become certified by PLANET (or some similar local organization) in categories such as Landscape Technician – Exterior, Turfgrass Professional, or Ornamental Landscape Professional.

The town should work to ensure continuity of the staff by providing appropriate pay levels, fringe benefits, and educational opportunities (such as certification opportunities).

The planned landscape has been damaged by improper tree and shrub removal. It is necessary to institute a program that replants the cemetery, restoring its original design and beauty.

The use of large deck mowers in the cemetery is causing damage to monuments and the practice must be stopped. Only 21-inch walk-behind mowers should be used on the cemetery grounds. All mowers should be fitted with closed cell foam bumpers to reduce accidental damage to the stones. These bumpers should be inspected on a weekly basis and replaced as needed.

Mower blades should be periodically sharpened to prevent the tearing of the grass stems evidenced during this assessment.

The nylon trimmer line being used by the town currently is too heavy and is resulting in damage to monuments. The existing 0.095" line must be replaced by line that is not over 0.065".

Soil analysis has been conducted and reveals that adjustments are necessary for the turfgrass. Fertilization should be organic, slow release in order to minimize salt damage to the stones.

Limited pre-emergent and post-emergent weed control should be instituted at the cemetery, taking care to avoid stones. The herbicides will affect the stones and this work will need to be very carefully done to ensure that the stones are not damaged. However, a better stand of turf will reduce the overall maintenance cost of mowing.

We recommend a gradual program of turf renovation until sustainable stands of a single turf are achieved.

The cemetery soil is compacted and we recommend at bi-yearly hollow tine core aeration. After several years it may be possible to aerate once a year.

The water bib in the cemetery should be inspected and repairs made if necessary. Consideration should be given to replacing the existing bib with freeze proof, lockable faucet, eliminating the need to drain the line during the winter.

Tree and shrub selection within the cemetery should be focused on historically appropriate species, based on identification of either original planting lists, replication of identified historic species in the cemetery, or using period lists. Species should, however, be evaluated to eliminate those with problems such as suckers, surface roots, inherent weakness, etc. The town should develop a tree plan to ensure that when any tree must be removed, an appropriate replacement is planted in its place.

All replacement trees should be of at least 1-inch caliper and meet the minimum requirements of the American Nursery and Landscape Association's American Standard for Nursery Stock (ANSI Z60.1-2004). Nursery stock should be carefully inspected and specimens with wounds, crooked or double leaders, broken branches, or girdling roots should be rejected.

Trees within the cemetery should be fertilized on a routine basis. This will require that soil testing be conducted every 3-5 years. The results should be evaluated by an ISA Certified Arborist. All trees should be inspected yearly and after any storm with winds in excess of 55 mph.

The Cemetery evidences a number of tree maintenance issues, likely the result of inadequate staff. There are trees in the cemetery that require pruning for thinning or cleaning. These issues should be dealt with immediately. A contract should be awarded to an ISA Certified Arborist for the work.

The cemetery evidences weedy trees and brush, particularly along the walls, that need to be removed before they cause damage to the wall or nearby monuments. Their existence reveals that those performing cemetery maintenance are either not adequately trained or that the staffing is too low. This requires immediate attention.

Shrubbery is not common, but the little still present is being mowed over or sheared using a nylon trimmer. There is much damage as a result. These practices must cease immediately. If the town

cannot devote trained staff to care for the shrubbery, a contract be let specific to this purpose.

Poison ivy in the cemetery requires hand clipping following by painting of an herbicide on the cut stem.

Leaves and debris must be collected prior to mowing. Currently it appears that leaves are largely ignored and trash is mowed over. These practices degrade the cemetery and must be stopped.

Highways and Grounds should develop a maintenance schedule for the Elm Street Cemetery to ensure that all aspects of the cultural landscape are appropriately maintained on a regular basis.