

Natural Grass Playing Field Case Study: Marblehead, MA

20 Acres of Organically Managed Playing Fields

THE TOWN OF MARBLEHEAD, Massachusetts, has managed all of its playing fields organically since 2002. This approach had its origins in a policy adopted by Marblehead's Board of Health in 1998, which noted the adverse health and environmental effects of pesticides and made a commitment to protecting children's health.

The town has achieved its performance goals by focusing on building and maintaining a healthy ecosystem with active microbial life in the soil and a strong root system. Key elements of the program are frequent aeration, frequent mowing, soil testing, and the use of organic fertilizer and soil amendments.

This case study provides detailed information on the number of hours played at four multi-use fields in Marblehead. Each of these fields may serve as a useful model for other communities interested in organic field management. For example, the Seaside Park field is used for baseball and field hockey. The scheduled practice and play time on this 105,000 square foot field totaled about 1,180 hours in 2018. With estimated informal recreation included, the field was used for approximately 1360 hours.

The annual cost of organic management of Marblehead's fields, including products, mowing, aeration, and other activities, is approximately \$4,250 - \$4,500 per acre.

Marblehead also has one artificial turf field, installed in 2013. Information is provided on maintenance costs for the artificial turf field, including grooming, cleaning, compaction testing, decompaction, and disinfection.



Organically managed fields at Veterans' Middle School located in Marblehead, MA

Introduction

This case study has been developed by the Toxics Use Reduction Institute (TURI) as part of an effort to provide information to municipalities, schools and other institutions as they make decisions about play surfaces. TURI has documented information on the materials often used in artificial turf playing fields.¹ TURI has also gathered information on natural grass fields and has developed a series of case studies to share experiences.

This case study focuses on the organic management of natural grass on 20 acres of sports fields by the town of Marblehead. The organic practices described in this case study can be used on grass properties of any size.

Communities often have questions about whether natural grass can meet their recreation needs and be cost-effective. TURI has compiled the following information for other communities to learn from the successes of Marblehead.

Overview

In 1998, the Board of Health of the Town of Marblehead adopted a statement on pesticides that enumerated the adverse health and environmental effects of pesticides, with a particular emphasis on children's health. In this statement, the Board of Health made a commitment to phasing out pesticide use, stating: "The Board of Health of the Town of Marblehead hereby commits itself to the goal of reduction and eventual phase-out of pesticide use in the Town of Marblehead, both on public and private property."²

With support from a TURI grant, in 1999-2000 Marblehead developed the state's first municipal organic lawn demonstration site, serving as a resource for residents interested in alternatives to pesticides. The town also developed the state's first organic pest management policy,³ and served as host to a wide variety of educational programs for landscapers, homeowners and others. Building on this commitment, Marblehead began organic management of all its publicly managed land,

including sports fields. All of Marblehead's fields have been managed organically since 2002.

Marblehead currently has twenty acres of publicly owned grass fields, all of them managed organically. This total area includes both grass and skinned surfaces (i.e., clay in infield areas of baseball and softball fields).

Specifically, the fields include the following: five little-league baseball fields; four girls' softball fields; three all-purpose fields (soccer, lacrosse, youth football, and other activities); one 90-foot regulation baseball field where the outfield is also used for field hockey; one 90-foot regulation baseball field where the outfield is also used for all-purpose practice, including football; and additional areas used for informal recreation, including a neighborhood pocket park.⁴ The town is also planning to build a new, fully renovated field, which will be organically managed from the outset.

¹ Massachusetts Toxics Use Reduction Institute (TURI). 2018. *Athletic Playing Fields: Choosing Safer Options for Health and the Environment*. TURI Report #2018-002. Retrieved from www.turi.org/artificialturfreport

² Town of Marblehead Board of Health. 1998. *Statement on Pesticides, May 14, 1998*. Retrieved from www.turi.org/Our_Work/Community/Topic_Areas/Pesticides/Marblehead_Organic_Lawn_and_Garden_Demonstration_Project/Project_Materials/Town-Statement-on-Pesticides

³ Town of Marblehead Board of Health. 2001. *Organic Pest Management Policy for Turf and Landscape, May 3, 2001*.

⁴ 90-foot refers to the distance in feet between bases. This is a standard baseball field size.

This case study focuses on four of the athletic fields in Marblehead, as shown in Table 1. The Seaside Park field is a well-designed park with good drainage and few maintenance difficulties; the Hopkins Field is a high-use park; the Veterans’ Middle School field is used for physical education and recess and was used for field hockey in the past; and the Village School Lower Field back half

field is a field with very high use and some design problems. This case study helps to illustrate the successes of a 100% organic management program, as well as the ways in which the grounds managers have overcome specific difficulties that can be faced by many communities using or renovating existing fields.

Table 1: Marblehead athletic fields included in this case study^a

Park	Area (sq. ft.) ^b	Sports/other information
Seaside Park	105,000	Fitness trail, cross country meets, conditioning, baseball (adult & youth), field hockey
Hopkins Field	65,000	Football, soccer, lacrosse, middle school physical education
Veterans’ Middle School field	90,000	Girls’ youth softball, high school softball, middle school physical education, middle school advisory, high school field hockey, youth flag football, middle school ultimate Frisbee ^c
Village School Lower Field back half	65,340 ^d	High school lacrosse, boys’ youth lacrosse, youth soccer, middle school recess, high school soccer, youth soccer

^a Marblehead has 20 acres of athletic fields, all of them managed organically. This table only shows the fields for which detailed information is provided in this case study.

^b Area shown is total for grass only.

^c Advisory is an activity break in which the students play outdoor games and do team-building activities

^d The full Village School field is 3 acres, but the section covered in this case study is 1.5 acres (65,340 sq. ft.).

Hours of Activity: Examples from Four Sports Fields

Decision-makers often have questions about how many hours of use a natural grass field can accommodate. Marblehead documented the use of their athletic fields in 2018. Total hours of use are presented for each activity and age group, and include practice and games for sports. Hours of use per season were estimated by multiplying the number of hours booked for each activity by the number of weeks each activity was played per season.

These fields are also used by Marblehead residents for informal activities, such as pick-up games, or passive recreation, such as picnics. These activities take place during open park hours that have not been scheduled for team use, or on areas of the complex that are not in use during formally scheduled activities. In the absence of data on

informal activities, TURI estimated that each case study park was used an additional 14 hours per week for informal/unscheduled activity.

Cancellations

Marblehead chooses to cancel games when there is standing water on fields. Notifications are sent by email to residents. Youth groups have learned about the importance of preserving the grass in good condition; the youth are protective of the fields and careful not to play when they are too wet. In 2018, between April 1 and November 15, the fields were closed five times due to rain and twice due to extreme heat. Each was a one-day closure. The heat-related closures were the first that the town has experienced.

Seaside Park: Baseball and Field Hockey Field within a Larger Park

Seaside Park is a 34-acre park that offers a network of walking trails as well as a play area, including a baseball diamond, a playing field, tennis courts, basketball courts, and other resources. The baseball field is a regulation 90-foot baseball field. The outfield of the 90-foot regulation baseball diamond is also used for field hockey. The total grass area is 105,000 square feet.

The fitness trail and part of the field space are used for cross-country meets. Several teams

use the fitness trail for conditioning as well.

Youth and high school baseball are played on the field in the spring and summer, and field hockey is played on the field in the fall. In 2018, there were about 1,180 scheduled hours of practice and play on the field.⁵ Adding estimated informal recreation time in the summer months, the estimated total is about 1,360 hours of use. This total does not account for the five day-long closures that occurred in 2018.



Baseball and field hockey fields at Seaside Park

Table 2: Seaside Park baseball and field hockey complex: hours of use, 2018

Sport	Age group	Season	Total use: hours per week	Weeks per season	Approximate hours per season ^a
Baseball	Youth	Spring	31	13	400
	High school	Spring	20	13	260
	Youth	Summer	35	9	320
Field hockey	Middle school	Fall	15	13	200
Total scheduled use – all seasons					1180
Estimated informal recreation hours (summer only)			14	13	180
Estimated total hours – all seasons					1360

Note: Hours shown here do not account for cancellations. In 2018, there were five day-long closures of Marblehead fields due to rain and two due to heat.

^a Totals rounded to the nearest 10.

Hopkins Field: Full-Sized Football Field

Hopkins Field is a full-sized football field surrounded by a track. The total grass area is 65,000 sq. ft. The field is used for soccer, lacrosse, and middle school physical education in the spring, and soccer, football, and middle school physical education in the fall. Other youth soccer-related activities are also scheduled weekly between the end of June and the end of August. In 2018, there

were about 1,680 hours of scheduled practice and play on the Hopkins Field. Adding estimated informal recreation time in the summer months, the estimated total is about 1,860 hours of use, not accounting for the five day-long closures that occurred in 2018.

When organic management of Hopkins Field began in 2004, 35% of the field was covered in weeds,

⁵ In summer 2019, the Seaside playing field was temporarily shut down for improvements, allowing only one third of the season to be played on this field.

primarily broadleaf plantain. The high percentage of weeds was due to compaction of the fields. Compaction led to low oxygen levels, creating anaerobic conditions that fostered the growth of microbes that were not conducive to a healthy root system for the grass. The situation was reversed over time through the application of organic techniques.



Hopkins Field, a full-sized football field

Table 3: Hopkins Field full-sized football field: hours of use, 2018

Sport	Age group	Season	Total use: hours per week	Weeks per season	Approximate hours per season ^a
Lacrosse	Youth	Spring	21	13	270
Soccer	Youth	Spring	8	13	100
Soccer	Adult	Spring	4	13	50
Phys Ed	Middle School	Spring	30	8	240
Soccer	High School	Fall	17.5	13	230
Soccer	Youth	Fall	11.5	13	150
Soccer	Adult	Fall	2	13	30
Football	Youth	Fall	13.5	13	180
Phys Ed	Middle School	Fall	30	8	240
Other youth soccer activities (summer only)					190
Total scheduled use – all seasons					1,680
Estimated informal recreation hours (summer only)			14	13	180
Estimated total hours – all seasons					1,860

Note: Hours shown here do not account for cancellations. In 2018, there were five day-long closures of Marblehead fields due to rain, and two due to heat.

^a Totals rounded to the nearest 10.

Veterans' Middle School Field: Softball Diamonds and Playing Field

The Veterans' Middle School field consists of two softball diamonds, one with an extended outfield. Together, these fields have an area of 90,000 square feet of grass.⁶ In the spring, the field is used for high school and youth softball, and middle school physical education and school advisory. In the fall, the field is used for high school field hockey, youth flag football, middle school ultimate

Frisbee, and middle school physical education and advisory.⁷ During the summer in 2018, the field was used 189 hours for additional youth soccer activities. A total of about 2,140 hours of practice and play were scheduled on the field in 2018. Including estimated informal recreation, the field complex was used for about 2,320 hours.

⁶ Each softball infield is 8,000 square feet. There is some sharing of outfields.

⁷ Advisory is an activity break in which the students play outdoor games and do team building activities.

Table 4: Veterans' Middle School Field two softball diamonds and overlapping playing field: hours of use, 2018

Sport	Age group	Season	Total use: hours per week	Weeks per season	Approximate hours per season ^b
Softball	High school	Spring	34	13	440
Softball	Youth	Spring	55	13	720
Phys ed	Middle school	Spring	30	8	240
Advisory	Middle school	Spring	5	8	40
Field Hockey	High school	Fall	15	13	200
Flag Football	Youth	Fall	10	14	140
Phys Ed	Middle school	Fall	30	10	300
Advisory ^a	Middle school	Fall	5	10	50
Ultimate Frisbee	Middle school	Fall	1	6	6
Total scheduled use – all seasons					2,140
Estimated informal recreation hours (summer only)			14	13	180
Estimated total hours – all seasons					2,320

Note: Hours shown here do not account for cancellations. In 2018, there were five day-long closures of Marblehead fields, and two due to heat.

^a Advisory is an activity break in which the students play outdoor games and do team-building activities.

^b Totals rounded to the nearest 10.

To aid in comparing the activity level on this field with fields in other communities, it may be helpful to consider the softball activities separately from other activities that occur on the field. The softball hours on the two diamonds total about 1,160

hours, or an average of about 580 hours per field (although there is some overlap of the outfields). Other scheduled field activities total about 980 hours.

Table 5: Veterans' Middle School Field: Subtotals of scheduled hours

Softball only	1160
All other scheduled field activities	980

Village School Lower Field Back Half: Two U10 Soccer Fields⁸

The Village School Lower Field back half is equivalent in size to two soccer fields for age group U10, or one full sized, plus a quarter sized field. The total area is 65,340 square feet.⁹ For practices, the field can accommodate four teams simultaneously; for games, it accommodates fewer teams. The field is used for youth soccer in the spring and fall, boys' lacrosse in the spring, high school soccer in the fall, and middle school recess in both fall and spring. In

the summer, the field is scheduled for other youth soccer-related activities for just over 300 hours and use by a medical sports clinic for 380 hours. Thus, in spring, summer and fall 2018, a total of 2030 hours of practice, games, and recess were scheduled on the field. In addition, there were an estimated 180 hours of informal use, leading to an estimated total of 2210 hours for all seasons.

⁸ U10 is a soccer age group classification of 10 years and under

⁹ The full Village School field measures 3 acres, but the section covered in this case study is 1.5 acres (65,340 sq. ft.).

Table 6: Village School Lower Field back half two U10 soccer fields: hours of use, 2018

Sport	Age group	Season	Total use: hours per week	Weeks per season	Approximate hours per season ^a
Soccer	Youth	Spring	32	13	410
Lacrosse	Youth	Spring	9	13	120
Soccer	High school	Fall	18	13	230
Soccer	Youth	Fall	25	13	330
Recess	Middle school	Spring, fall	7	37	250
Other youth soccer activities (summer only)					310
Medical sports clinic (summer only)					380
Total scheduled use – all seasons					2030
Estimated informal recreation hours (summer only)			14	13	180
Estimated total hours – all seasons					2210

Note: Hours shown here do not account for cancellations. In 2018, there were five day-long closures of Marblehead fields due to rain, and two due to heat.

^a Totals rounded to the nearest 10.

Maintenance

The elements of field maintenance include mowing, aeration and application of products such as fertilizer and soil amendments. Field areas with extra heavy use, such as in front of soccer goals, are also “over-seeded” with grass seeds to allow fuller plant growth to withstand more wear.

Chip Osborne, Chair of the Marblehead Recreation and Parks Commission, designed the maintenance and testing protocols for the fields. He uses soil testing to determine the appropriate amount of products to use and the most effective maintenance approach for individual fields. This eliminates over-application of products and allows the town to adjust maintenance according to the performance needs of each field. Soil testing measures several characteristics of soil, including nutrients (such as nitrogen, potassium, and phosphorus), physical elements (such as soil texture), and biologicals (such as nematodes).

Marblehead has divided field management practices into three tiers according to intensity of use. Tier 1 fields (totaling 12 acres) receive the top level of management for heavy sports use; Tier 2 fields (totaling four acres) receive the same

amount of mowing but half of other maintenance activities; and Tier 3 fields (totaling four acres) receive mowing only, with occasional fertilizer.

Over the years, the Marblehead field manager has experimented with a variety of approaches to optimize soil health and grass quality. The details described here represent the current approach, but can be varied.

Fertilizers and Soil Amendments

Marblehead uses organic fertilizers and soil amendments from PJC Organics, a small consulting company and fertilizer producer/distributor in Massachusetts. Amount of product ordered and their application schedules for each park are based on soil results along with the performance needs of each individual field.

The fields are fertilized four times a year with a granular fertilizer at a low dose. These granular applications are carried out in late April, mid-June, late August, and early October. In addition to the granular applications, there are three liquid

fertilizer applications, in June, August, and early October.

The industry standard for use of granular fertilizers on a conventionally managed field is one pound of nitrogen per 1,000 square feet for each application. Because Marblehead uses soil testing to estimate the amount of fertilizer needed for individual fields, the most heavily used fields receive 3/4 pound of fertilizer per 1000 square feet for each application. For fields with lighter use, such as some of the baseball fields, a smaller amount of nitrogen is used.

A mycorrhizal inoculation and a biological supplement are also added to certain fields in June and August. The mycorrhizal inoculation strengthens the system of beneficial fungi that colonize root systems and supports healthy plant growth.

Marblehead field managers also add a soil conditioner to fields to jump-start microbial activity. The soil conditioner is made with biochar (charcoal), kelp, molasses, and soybean and is used

to improve the chemistry, structure, and biological activity in the soil.

Aeration, Mowing, and Irrigation

Aeration is accomplished by pulling up plugs of soil and grass using a riding or push machine. This process relieves soil compaction and grass thatching and allows air, water, and added nutrients to penetrate the soil. Aeration can be a time-consuming process, but is arguably the most important step for maintaining healthy, organic grass.

The groundskeeping crew uses two types of aerators interchangeably throughout the year to penetrate 4 inches into the soil. One is a hydraulic core aerator, and the other is a shatter-tine aerator. The crew aims to aerate the fields five times a year, although some years they aerate four times depending on staff availability and weather.

Mowing frequency changes throughout the year. Fields are mowed once a week, except during the peak grass growing season in July, August and September, when fields are mowed twice a week. Fields are irrigated once a week for 26 weeks.

Community Participation in Field Rehabilitation

At the beginning of the organic management program for Seaside Park, the density of weeds was high. This was reversed using organic techniques over the course of five years. The last stage of the field's rehabilitation occurred when a number of weed species had already been reduced and knotweed was the only remaining weed of concern in the field. This was addressed through mechanical means: The girls' hockey team, a group

of 40 players, spent several hours walking systematically across the field and pulling up all the knotweed. The next day, the field was aerated and seeded, and grass grew to fill in the spaces created by removing the knotweed. In this way, the team was able to participate in the management of the field, and the weeds were removed without using herbicides.

Costs

The principal costs associated with organic maintenance of fields in Marblehead cover

products, labor for organic management activities such as aeration, and labor for mowing.

Annual product costs, including fertilizer and soil amendments, are typically \$1,500 - \$1,750 per acre, or \$30,000 - \$35,000 for the full 20 acres.

A dedicated Turf Specialist with a salary (including benefits) around \$75,000 per year was responsible for aerating, seeding, applying fertilizer and soil amendments to the fields. The Turf Specialist spent slightly under half of annual work time on these activities, costing around \$34,400.¹⁰ Separate staff

members were responsible for mowing all 20 acres 25 times per year. Average salary for these staff members was \$60,000 (including benefits). Mowing one acre took around 50 minutes, plus 25 minutes additional time for staging (travel, set-up, break-down). Thus, total labor costs for mowing were approximately \$20,500 for the year. This brings the total cost for products and labor per acre to \$4,250 - \$4,500 per year.

Table 7: Estimated annual costs associated with organic management of 20 acres of athletic fields in Marblehead, MA

Cost category	Costs per acre	Total costs (20 acres)
Products (e.g. fertilizer, soil amendments)	\$1,500 - \$1,750	\$30,000 - \$35,000
Maintenance labor (e.g. aeration, other activities)	\$1,720	\$34,400
Mowing labor	\$1,030	\$20,500
Annual total for 20 acres of athletic fields	\$4,250- \$4,500	\$84,900 - \$89,900

Note: Cost values were revised in November 2020 based on information provided by Marblehead Recreation and Parks.

Artificial Turf

For a maintenance and cost comparison, TURI also gathered information on Marblehead’s 1.5-acre (65,340 square foot) synthetic turf field.¹¹ The field was installed in 2013; funding of \$1.3 million was obtained privately for this project, and youth leagues pay a per-player fee to help support maintenance costs. Maintenance for the synthetic turf field requires grooming, cleaning, compaction testing, and decompaction.

The cost information presented here refers only to field maintenance, not to the initial acquisition and installation of the field. For detailed information on both acquisition and maintenance costs, see TURI’s sports turf alternatives assessment cost analysis.¹²

For field maintenance, the town made a capital investment of between \$10,000 and \$14,000 for a

Gator utility vehicle, and \$7,500 for a brusher to attach to it. The field is groomed by an in-house Marblehead Recreation and Parks Department staff member who spends about a half day every three weeks in the spring and fall and every four weeks in the summer. That equates to \$1,000 - \$1,400 in labor costs (including fringe).

Marblehead received a bid for a disinfection product that contains several potential human carcinogens. For two applications per year, the total annual disinfection bid was \$6,000. A less toxic, enzyme-based treatment could be provided for a higher cost, but specific figures are not available for this option. Assuming use of the lower-cost disinfection option, total annual costs for the 1.5-acre field add up to \$7,000 - \$7,400, not

¹⁰ The Turf Specialist’s time allocated to field maintenance was estimated for the time periods April-June, July-August, and September-October at 90%, 65%, and 75%, respectively, for an annual total of approximately 46% time.

¹¹ Marblehead All Sports Foundation. Web page available at marbleheadallsports.com/track/masf/.

¹² Sports Turf Alternatives Assessment: Preliminary Results Cost Analysis. Toxics Use Reduction Institute. 2016. Available at turi.org/artificialturf.

including up-front capital costs for field installation or maintenance equipment.

To gain more information on cost options, the town of Marblehead obtained a cost quote for synthetic turf maintenance performed entirely by an outside contractor. For two maintenance visits per year (including grooming, cleaning, de-compacting, field inspection, impact testing

and infill depth measurements) the total cost would be \$5,300 per year. A higher cost option would provide six visits per year, with disinfectant applied at each visit, as well as minor repairs. This option is offered for \$6,800 per year for maintenance of the 1.5-acre field. Other costs to consider include those associated with disposal and replacement of synthetic turf surfacing and padding after 8-10 years of wear.

Summary

Marblehead has maintained high quality, organically managed grass fields throughout the community over a period of more than 15 years. Young athletes are invested in the goal of protecting and maintaining their fields, and take pride in the results

The town has focused on maintaining high quality fields on a limited budget. They are able to maintain a healthy soil ecosystem on 20 acres of natural grass with the use of soil testing, aeration, frequent mowing, and the use of organic fertilizer and soil amendments.

"Marblehead's twenty-year example of organic fields shows that success can be achieved in a variety of ways. It is an approach that focuses on healthy, biologically active soil combined with best management cultural practices and the exclusive use of natural, organic inputs. It is not measured in terms of 60 or 90 days, but rather over multiple years when results meet or exceed expectations. The goal here in Marblehead always has been playing fields that are free from harmful pesticides and meet community expectations."

- Chip Osborne, Chair, Marblehead Recreation and Parks Commission

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The Toxics Use Reduction Institute is a multi-disciplinary research, education, and policy center established by the Massachusetts Toxics Use Reduction Act of 1989. The Institute sponsors and conducts research, organizes education and training programs, and provides technical support to help Massachusetts companies and communities reduce the use of toxic chemicals.

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