FINAL REPORT
FOR

MARTHA'S VINEYARD HIGH SCHOOL
Athletic Field Master Plan

Prepared For:
Daedalus Projects, Inc. &

Marthas Vineyard Regional High School

February 4, 2019

Prepared by:

HUNTRESS *Sports*
Landscape Architects & Planners
17 Tewksbury Street Andover, MA 01810

HUNTRESS ASSOCIATES
Landscape Architecture & Land Planning

January 31, 2019

Mr. Joe Sullivan
Daedalus Projects, Inc.
One Fanuel Hall Marketplace, South Market Building
Floor 3, Suite 4195
Boston, MA 02109

Re: Martha's Vineyard Regional High School – Athletic Field Master Plan

Dear Mr. Sullivan;

I have reviewed the conditions associated with the existing athletic facilities at Martha's Vineyard High School in Oak Bluffs, Massachusetts. The following in a summary of our efforts and our recommendations moving forward.

PROJECT DESCRIPTION
Huntress Associates, Inc was engaged to provide Master Plan services for athletic field improvements at Martha's Vineyard Regional High School in Oak Bluffs, Massachusetts. HAI to provide Master Plan design services for the development of a campus-wide Athletic Facilities Master Plan.

The scope of work includes review of the existing athletic facilities, including One (1) 400m Track & Multi-Purpose Field, Two (2) Baseball Fields, Two (2) Softball Fields, Five (5) Tennis Courts, Two (2) Multi-purpose football/soccer fields, one (1) 500 seat grandstand and press box, and all walkways, parking areas and associated site improvements.

Our scope also includes the preparation of an Athletic Facilities Master Plan detailing two (2) alternative plans. Master Plan Option A: Keeps all facilities in their present location while recommending upgrades and improvements at each location. Option B: Will review reorganization of the athletic campus to achieve more efficient use of space and better location for planned activities.

Existing Conditions Documentation: HAI compiled an existing condition plan utilizing resources from the Massachusetts Geographical Information System (MassGIS) to determine existing property lines, topographic contours, structures, flood plains, wetlands and boundaries associated with the Natural Heritage Endangered Species Program.

We also reviewed soil test reports available from the test pit exploration conducted by Gale Associates in December of 2015. The test pits were done in four different locations throughout the athletic campus. The on-site soils were classified as gravelly coarse sand (Type A), and ground water was observed at a depth greater than eight (8') feet. Please refer to the attached soil reports for additional information.

Site Visit & General Observations: HAI conducted site visit to review existing conditions on 10/24/18, 11/15/18 and 12/06/18. We also met with student athletes, coaches and staff to review their concerns and thoughts about how to best move forward. The most common discussion with all user groups was their desire to see a synthetic turf surface at the High School. We also met with abutting neighbors near the

existing track who expressed concern about noise from early morning and late afternoon games and practices at the track and field. The following is a summary of our observations.

1. **400m Track & Field:** The 400m Track and Field is in the south west corner of the existing site. The track was originally constructed over twenty years ago, and the existing resilient track surface received a spray applied topcoat and new lane markings in 2016. The track surface has noticeable heaves and depressions. The resilient surface is delaminated in many areas and the asphalt surface is cracking and in need of replacement. The typical life span for a running track with bituminous concrete is twenty to twenty-four years. This track is at the end of its useful life and the MVRHS should consider plans for replacement soon.

Figure 1 - 400m Track & Field

Figure 2 - 400m Track & Field

Figure 3 - 400m Track & High Jump

The field athletic field conditions within the track are poor. The grass is bare in much of the field, the surface is very uneven and noticeable tripping hazards are evident throughout the site.

Figure 4 – Existing natural grass athletic field

Other observations made at the time of our visit to the 400m Track & Field include the following: 1) Long Jump facilities are too close to the edge of the playing field side line, 2) Discus event is in conflict with the athletic field and presents a hazard to those using the jumping events, 3) Common finish line is on the opposite side of the track, 4) Limited storage of athletic supplies, 5) Limited spectator viewing, 6) Natural grass condition is poor, 7) The facility is not ADA compliant. To be ADA compliant the facility needs an "accessible route" from the parking area to the track, field and spectator areas. This route should be a paved surface with a minimum of 4' width, 8) Neighbors have complained about the proximity of the field to their homes and the resulting impact from noise during sporting events.

2. **Multi-Purpose Field (Football Field):** The multi-purpose field is in the northeast area of the site. The field accommodates football, soccer, field hockey and lacrosse as a varsity game field. The field is supported by irrigation, grandstands, pressbox, sports lighting and a ticket booth. The field is in northwest orientation. Although this is arguably the best high school field on the campus, the natural grass is suffering from over compaction and variation in grade from over use.

Figure 5 – Multi-purpose Field

Figure 6 – Over compaction in wear areas.

Figure 7 – Over use in wet weather.

Observation made at the time of our site inspection include the following: 1) Orientation is acceptable, 2) Sports lighting is acceptable, 3) Natural grass condition is poor, 4) Limited storage for athletic equipment, 5) Spectator seating is adequate, 6) Although the grandstands are ADA compliant, the accessible route to the grandstands is not compliant.

Figure 8 – Access to grandstands is not ADA compliant.

Figure 8(a) – Existing Facilities Building

Figure 8(b) – Ticket & Concessions Building

3. **JV Baseball Field:** The JV Baseball Field is in the south east corner of the site. The field accommodates JV baseball and has a multi-purpose (soccer) field across the outfield. The baseball field is supported by a backstop structure, two dugouts, spectator seating, and a storage building. The field orientation faces northwest and is adequate.

   Observations made at the time of our inspection include: 1) Field orientation is adequate, 2) Outfield is in conflict with soccer, 3) The infield is entirely stone dust, 4) No foul poles or outfield fence, 5) Natural Grass condition is poor, 6) Limited storage, 7) Limited spectator viewing, 8) The field access, seating and dugouts are not ADA compliant. To be ADA compliant the facility needs an "accessible route" from the parking area to the field and spectator areas. This route should be a paved surface with a minimum of 4' width.

Figure 9 – JV Baseball Field

Figure 10 – JV Baseball Infield

Figure 11 – JV Baseball Dugouts

4. **Overall Facility Observations:** The following are a summary of our overall impressions regarding the entire athletic campus. Overall, the campus area contains approximately forty-seven (47) acres presently dedicated to athletic use. This area is large and significant and should accommodate your present and future use quite well. The soils are well drained, with ground water below an 8' depth. The school district is also fortunate that there are no wetlands, flood plains, vernal pools or other environmental constraints on site which may limit your future plans. The NHESP areas for habitat and wildlife protection have also been revised over the past three years to eliminate any real constraint to your future plans for the site. Refer to the NHESP limit plan in the attachments for additional information.

General Observations:

a. The present challenges on this site stem from overuse of the existing fields and improper / inefficient layout resulting in overlapping and overused field areas.
b. The natural grass playing surfaces are in very poor condition throughout the entire campus. Natural grass surfaces are uneven and over-compacted, resulting in conditions that could be dangerous for spectators and athletes.
c. Site parking, access and seating areas are not ADA compliant.
d. Vehicular arrival and drop off areas for the athletic facilities need to be better defined. Drop-off and pick-up areas could be better delineated to improve pedestrian safety on campus.
e. Utilities, including water and electric power appear to be enough for your future use. Sewer capacity is in question and needs further study. The State Building code requires bathroom and restroom facilities within 300' of any spectator seating areas proposed in a renovation project.
f. The athletic campus at MVRHS has enough area to accommodate a new master plan with adequate field space. Please refer to the attached master plan alternatives below for additional information.

Figure 11(a) – MVRHS Athletic Campus Overview

MASTER PLAN ALTERNATIVES

Option A: The following plan rearranges the athletic field program to bring the track and field forward to front of the site. This new facility would combine the multi-purpose football field with a new 400m eight lane running track. The new track and field facility is shown with a new sports lighting system, and 1000 seat grandstand and pressbox.

Figure 12 – Athletic Field Master Plan – Option A

Highlights of the Athletic Field Master Plan Option A include the following:

1. Varsity and JV Softball are relocated to the old track and field area and combined with a dedicated field for Field Hockey and Lacrosse.
2. Four (4) full size fields with playing surface dimensions of 200' x 360' are in the middle of the site.
3. JV baseball is reconstructed to have a preferred north-east orientation and shares the outbuildings and facilities associated with the MV Sharks Baseball field at the rear of the site. The relocation would require some limited tree clearing at the south east corner of the campus.
4. The five (5) existing Tennis Courts stay in their present location and orientation.
5. A new, expanded, parking area is proposed just north of the existing buss parking lot. This new vehicle parking would allow for a more well-defined pick-up and drop-off location for spectators and athletes.

6. All facilities could be connected by ADA compliant walkways and provided with accessible seating and viewing areas.

Option B: After our community presentation of November 15th, we met with the staff and coaches at MVRHS to discuss option A.

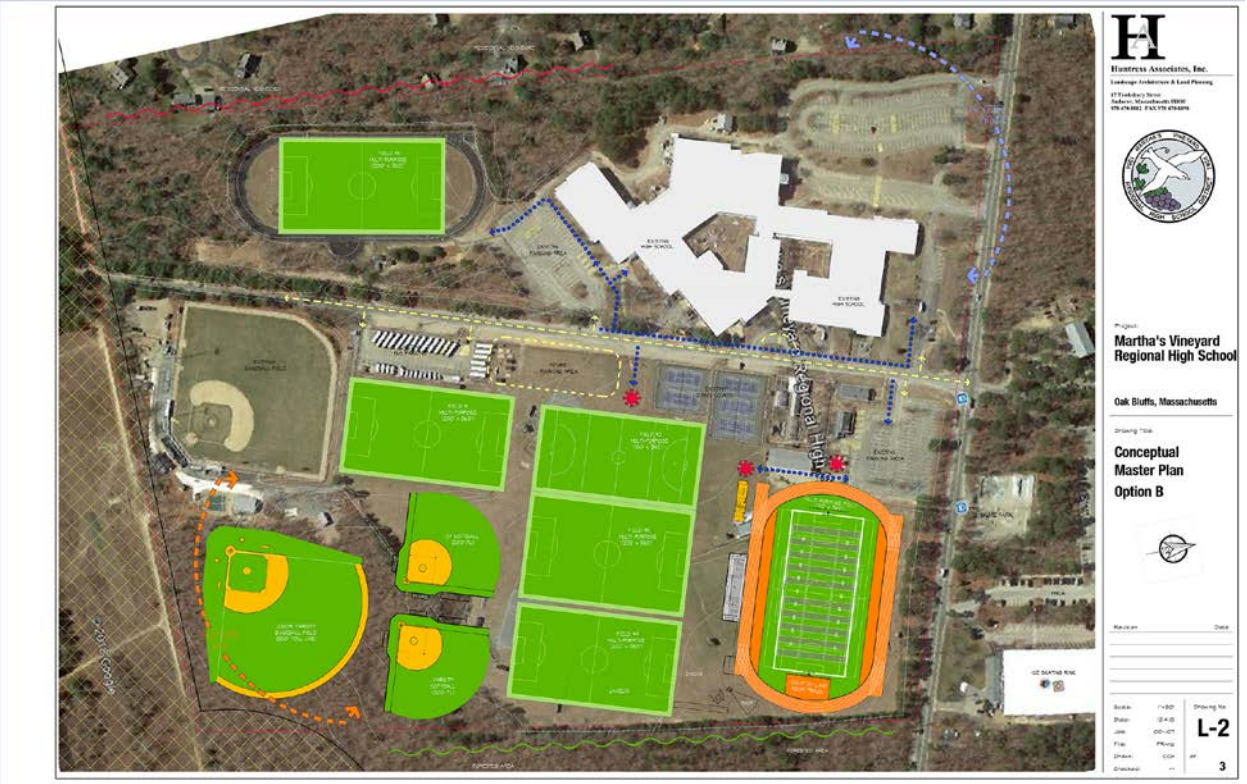


Figure 13 – Athletic Field Master Plan – Option B

The above plan rearranges the athletic field program to bring the track and field forward to front of the site. The changes to this plan include moving softball from the old track and field location to provide for two dedicated softball fields. This plans also shifts the JV baseball field a bit further south. This layout would allow for better softball tournaments and allow all baseball and softball fields to share the facilities associated with the MV Sharks Baseball Field. The new track and field facility is currently shown with a new sports lighting system, and 1000 seat grandstand and pressbox.

Option C: The following plan leaves all facilities in their present location and would anticipate renovation in place. Although this plan would likely be the least expensive, this layout would not alleviate any of the over-crowding or inefficiency of the current field locations.

Figure 14 – Athletic Field Master Plan – Option C (Existing Layout)

HAI is not recommending Option C currently for the following reasons:

1. Does not correct any of the over-lapping field areas.
2. Makes investments in facilities that do not have proper field orientation.
3. Fails to address any issues with abutting land owners regarding noise.

Preferred Alternative – Master Plan:

At their regular meeting on December 6, 2018 the MVRHS Athletic Facility Sub-Committee voted to adopt the Athletic Field Master Plan 'Option B' as the preferred option. HAI advanced the plan for Option B to show ADA compliant walkway connections, grandstands, storage buildings, parking areas and landscape plantings.

At the request of the committee, we have also added a conceptual plan for the proposed fieldhouse. This field house layout plan accommodates two (2) locker rooms, ticket booth, concessions and bathroom facilities. The proposed fieldhouse contains approximately 3000 square feet of area on a single level and would have enough space to accommodate two football teams during half-time and provide enough bathroom space for the proposed 1000 seat grandstand structure. The proposed building is located on the southwest corner of the track and field. Please refer to *Figures 15 and 16* for additional information.

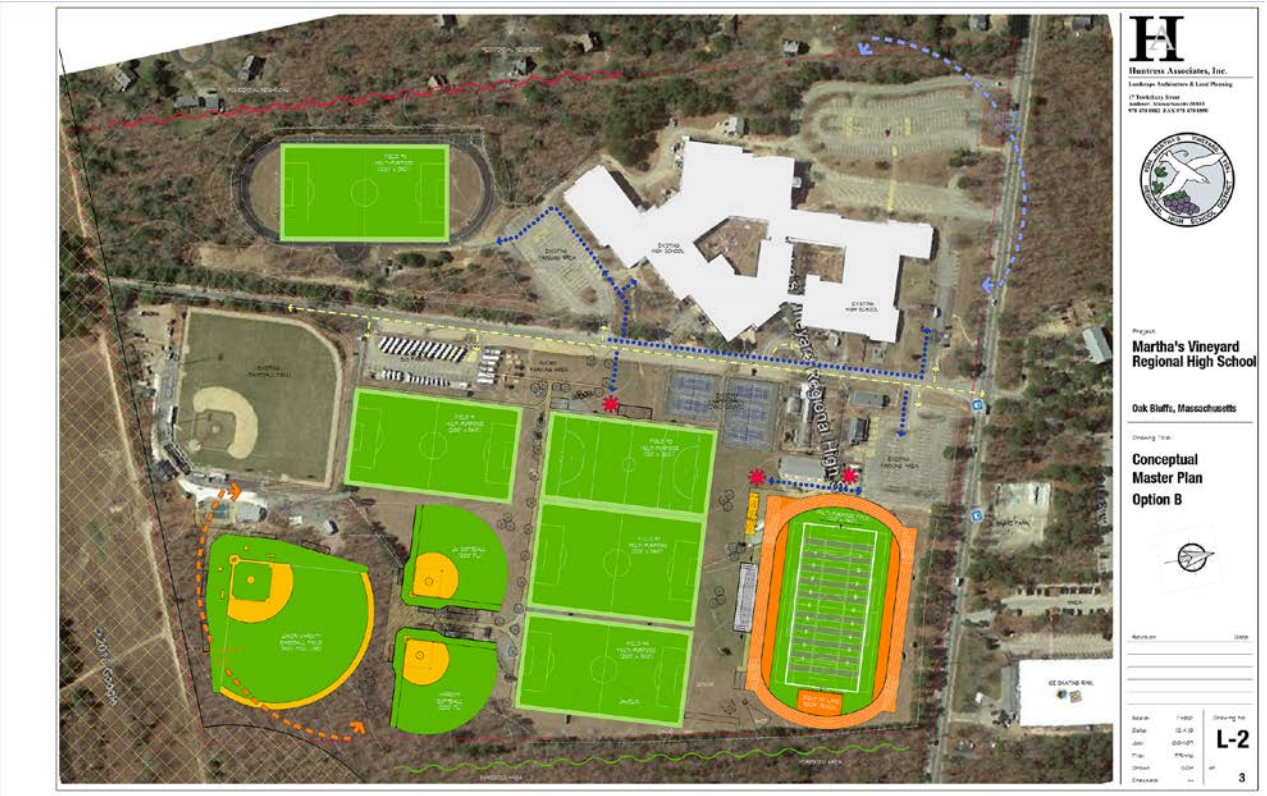


Figure 15 – Athletic Field Master plan - Preferred Option (Option B)

This option shows a 400m running track in what is called the international style or "broken-back" configuration. In this layout the straight-aways are shortened and the radius curves are elongated. This helps to fit the 400m track dimensions into the space available at MVRHS, but also provides for a very wide athletic field. The total width of the athletic field is approximately 232' across, allowing for a 220' wide soccer field and easily accommodating all other sports.

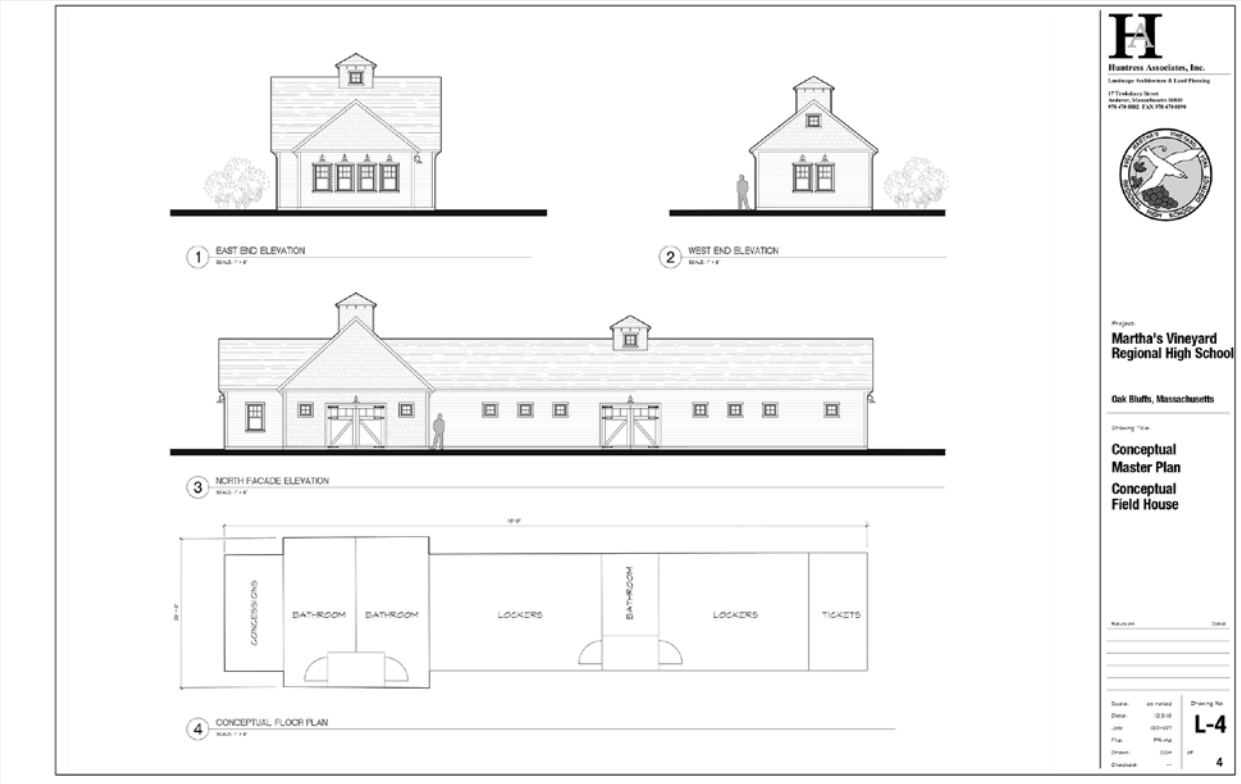


Figure 16 – Athletic Field Master Plan – Conceptual Field House Plans

As with any master plan, as we advance into construction documents we can expect to made adjustments. Areas we would look for further develop would include the impact to the existing ticket booth and concession building. Our hope is that the plan could adjusted to either leave it in place or move the structure to be at the new front door of the existing facility.

As mentioned previously, all new athletic facilities are required to provide bathroom facilities within 300' of the spectator viewing areas. Although there is a sewer line in the roadway, we are aware that there are some concerns about the existing capacity of that sewer line. Further study and engineering would be required to determine if a connection to that system would be feasible for this project.

The next steps would include engaging a design firm to advance the project through to permitting and construction documents. The first piece of that scope would include a thorough existing conditions survey and additional geotechnical investigation. The survey should include topographic contours, property lines, structures, utilities and existing paved surfaces. Although we used survey from MassGIS for this study, it would not be suitable for construction documents. During the next phase a wetland scientist should be engaged to reconfirm that the site is clear or any wetlands, flood plains, habitat and/or wildlife areas.

Preferred Alternative – Phase One:

Figure 16(a) - Preferred Alternative – Phase One

The above Phase One layout looks to focus on the construction of the 400m running track, multi-purpose athletic field, sports lights, 1000 seat grandstand, pressbox, field house and associated site improvements. At the same time, we would recommend a full reconstruction of the existing natural grass athletic field within the existing track. As a cost saving measure, we have not removed the existing track at this time, allow it to stay in place for school/community use and t serve as a spectator viewing area for events on the infield.

We have lost one softball field in this phase. We could look to reconstruct that field within the track or find an off-site location that might accommodate the JV softball team.

FIELD USE ANALYSIS

To help determine the proper annual maintenance requirements for your existing and proposed athletic fields, HAI reviewed the number of current and proposed annual athletic events held on the high school campus. As this effort was primarily focused on reducing the overuse and compaction of the existing natural grass fields, we did not include numbers for baseball and softball as those sports are primarily impacting the infield areas.

The summary of annual events held on the high school campus, both existing and proposed, have been provided by MVRHS staff and are attached as an appendix to this report. The following table *(Figure 17)* shows a breakdown of the existing field usage extended across your existing and proposed athletic fields. The annual events are multiplied by a rate of 2.5 hours per event to translate the annual event numbers into an annual hours of use per field. The Sports Turf Managers Association (STMA) recommends that a well-maintained natural grass field can support a maximum of 680 to 820 hours of use per field annually. The range of 680 to 820 annual hours is dependent upon the geographic location of the field. Fields in the South and Southwest can expect a top range of 820 hours of use per year. This is based upon the fact that the growing season is much longer in those southern climates as compared to the North and Northeast regions of the United States. For this reason, we recommend an upper limit of 680 hours of annual use on well-maintained natural grass fields at MVRHS.

MVRHS - Existing Athletic Field Use Analysis

Plan Title	Annual Events	Hours/Event	Total Use Hours	Number of Fields	Annual Hours/Field
Existing Conditions	**1,400**	**2.5**	**3500**	**5**	**700**
Master Plan - Option A - 100% Natural Grass	1,400	2.5	3500	6	**583**
Master Plan - Option B - 100% Natural Grass	1,400	2.5	3500	6	**583**
Master Plan - Option C - 100% Natural Grass	1,400	2.5	3500	5	**700**
Master Plan Alternative - Use of Synthetic Turf					
Master Plan - Option A or B - **One (1) Synthetic Turf Field**	550	2.5	1375	1	**1375**
Master Plan - Option A or B - Five (5) Natural Grass Fields	850	2.5	2125	5	**425**
Master Plan - Option A or B - **Two (2) Synthetic Turf Fields**	1,100	2.5	2750	2	**1375**
Master Plan - Option A or B - Four (4) Natural Grass Fields	300	2.5	750	4	**188**

** Does not include 848 annual events associated with MV United, and 84 annual events associated with adult leagues. See proposed conditions use analysis for additional information.*

Sports Turf Managers Association - Recommendation **Well maintained natural grass fields can support between 680 - 820 hours of use per year.**

Figure 17 – Existing Athletic Field Use Analysis

The current impact of 1400 events, results in total 3500 annual hours spread across five (5) existing fields. This translates to 700 average annual hours per natural grass field. This is above the 680 annual hours per field recommended by STMA. The existing annual use numbers drop to 583 for both Master Plan Options A & B because the use is spread across six (6) fields. This analysis is intended to help the owner understand the impact of adding or removing annual events, adding additional natural grass fields, or introducing a synthetic turf surface.

In *Figure 17* we also provide a review of the impact of adding one or two synthetic turf surfaces to the campus. Synthetic turf surfaces can be expected to support 2-3 times as many annual events as compared to well-maintained natural grass fields. For this purpose, we have assumed a conservative number of 550

events would be shifted to each synthetic turf field built on your campus. This would reduce the total annual hours being spread across the remaining natural grass fields to get those fields into a range that they could support the expected annual use at MVRHS.

Figure 17 shows that the introduction of one synthetic turf surface would drop the annual hours per remaining natural grass field to approximately 425 hours per year. A second turf field would drop the annual hours on the remaining natural grass fields to approximately 188 hours per year.

We were also asked to review the impact to the High School athletic fields should the MV United Soccer Leagues and MV Adult Leagues be allowed to use the facilities at the High School. MV United represents approximately 848 events per year, and the adult leagues would add 84 events per year. This would translate into a total of 5830 total hours of use on the high school fields. *Figure 18*, below, shows the impact of increasing the activity on the campus by including MV United. Under the existing conditions the annual field hours jump to 1166, and under the Master Plan Options A & B the annual hours per field would be adjusted to 972.

MVRHS - Proposed Athletic Field Use Analysis

Plan Title	Annual Events	Hours/Event	Total Use Hours	Number of Fields	Annual Hours/Field
Existing Conditions	**2,332**	**2.5**	**5830**	**5**	**1166**
Master Plan - Option A - 100% Natural Grass	2,332	2.5	5830	6	**972**
Master Plan - Option B - 100% Natural Grass	2,332	2.5	5830	6	**972**
Master Plan - Option C - 100% Natural Grass	2,332	2.5	5830	5	**1166**
Master Plan Alternative - Use of Synthetic Turf					
Master Plan - Option A or B - **One (1) Synthetic Turf Field**	550	2.5	1375	1	**1375**
Master Plan - Option A or B - Five (5) Natural Grass Fields	1,782	2.5	4455	5	**891**
Master Plan - Option A or B - **Two (2) Synthetic Turf Fields**	1,100	2.5	2750	2	**1375**
Master Plan - Option A or B - Four (4) Natural Grass Fields	1,232	2.5	3080	4	**770**
Master Plan - Option A or B - **Three (3) Synthetic Turf Fields**	1,650	2.5	4125	3	**1375**
Master Plan - Option A or B - Three (3) Natural Grass Fields	682	2.5	1705	3	**568**
Sports Turf Managers Association - Recommendation	**Well maintained natural grass fields can support between 680 - 820 hours of use per year.**				

HUNTRESS Sports 15-Dec-18

Figure 18 – Proposed Athletic Field Use Analysis

Figure 18 also shows the impact of adding additional synthetic turf surfaces to the proposed conditions. As shown above, MVRHS would have to consider the addition of up to three (3) synthetic turf surfaces to bring the remaining natural grass surfaces to a sustainable annual maintenance level of less than 680 hours of use per field.

Give the results of the above study, it is our recommendation that MVRHS would benefit from the introduction of at least one synthetic turf surface. Additional synthetic turf surfaces should be considered as demand is increased on your campus. Additional copies of *Figure 17* and *Figure 18* have been included in the appendix.

ATHLETIC FIELD SURFACE RECOMMENDATIONS

Given the history of discussion related to installing synthetic turf on Marth's Vineyard we have researched all the most current and most sustainable trends in the synthetic turf industry. Below is an outline of our goals and objectives in the review of available products to be considered at MVRHS.

Goal: To develop a sustainable synthetic turf specification which addresses concerns related to human health, player safety, heat, water quality and recycling at the end of life.

Objective #1: Specify a turf product that eliminates the polyurethane coating and heavy backing from the synthetic turf carpet.

HAI recommend that MVRHS consider a woven synthetic turf carpet. The woven products eliminate the use of polyurethanes in the backing and simplifies the recycling efforts at the end of the field's useful life. Presently there are two manufacturers in the United States that make a woven product, **ACT Global and Greenfields.** Please refer to the product information attached in the appendix.

Objective #2: Identify an alternative infill that is sustainable harvested, containing no heavy metals, PAH, VOC or other chemically based ingredients.

HAI recommends that MVRHS consider a product called **BrockFill**, Manufactured by **Brock USA**. This innovative infill product is manufactured from sustainably harvested Loblolly Pine trees from Georgia. The product is 100% organic, recyclable at the end of its useful life, and eliminates the need to use crumb rubber as an infill. The installed cost is also comparable to crumb rubber. Please refer to the product information attached in the appendix.

Objective #3: Identify a resilient shock pad which meets the above criteria, reduces the reliance on infill, and improves player safety and shock attenuation.

HAI Recommends that MVRHS consider the YSR resilient turf underlayment manufactured by Brock USA. The YSR pad is made of recyclable polypropylene, is cradle-to-cradle certified and has a 25-year warranty. The use of a resilient underlayment has been shown to reduce the risk of injuries from head to field contact by as much as 50%. Please refer to the product information attached in the appendix.

Objective #4: Draft a specification that requires end-of-life recycling, including chain of custody certification for all products.

The ability to recycle an entire synthetic turf field, at little to no cost to the owner, is now possible. HAI recommends that MVRHS explore the possibility of requiring that their turf go to a recycling facility at the end of its useful life. This process should be documented through proper chain of custody certification to insure the products do not get re-purposed or end up in a landfill. One such recycling facility is presently being constructed in Pennsylvania by ReMatch Turf Recycling, Inc., and is expected be fully operational by 2019.

PROBABLE PROJECT COSTS (Preferred Master Plan Alternative)

ESTIMATE OF PROBABLE CONSTRUCTION COSTS

Project: Marha's Vineyard Regional High School - Athletic Field Master Plar
Project Manager: CCH
Client: Martha's Vineyard Regional High Schoo
Plan Title: Athletic Field Master Plan - Option E

Date: December 18, 2018

By: Huntress Associates, Inc.
17 Tewksbury Street
Andover, MA 01810

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
ATHLETIC FIELD MASTER PLAN				
GENERAL CONDITIONS & SITE PREP				
Construction Bonds & Insurance	1	ls	$120,000.00	$ 120,000.00
Mobilization & De-mobilization	1	ls	$50,000.00	$ 50,000.00
Materials Testing & Lab Expenses	1	ls	$10,000.00	$ 10,000.00
Replace unsuitable materials (Allowance)	1	alw	$10,000.00	$ 10,000.00
Site Prep & Demolition	1	alw	$100,000.00	$ 100,000.00
Silt Fence & Erosion Control	1	alw	$15,000.00	$ 15,000.00
Subtotal				**$305,000.00**
400 METER TRACK & SYNTHETIC TURF FIELD				
Synthetic Turf - Subbase & Drainage Construction	98,500	sf	$ 3.50	$ 344,750.00
Synthetic Turf - Provide & Install New Multi-Purpose Synthetic Turf	98,500	sf	$ 4.50	$ 443,250.00
Synthetic Turf - Resilient Underlayment	98,500	sf	$ 1.50	$ 147,750.00
Synthetic Turf - Alternative Infill	98,500	sf	$ 0.50	$ 49,250.00
New 1000 Seat Grandstand	1,000	sf	$ 350.00	$ 350,000.00
New Elevated Pressbox & Lift	1	alw	$ 105,000.00	$ 105,000.00
Football Goal posts & pads	2	ls	$ 7,500.00	$ 15,000.00
Construct new gravel base for track surfaces (8")	7,500	sy	$ 18.00	$ 135,000.00
Bituminous Concrete - Asphalt Surface	7,500	sy	$ 27.00	$ 202,500.00
Resilient Surface (1/2" Polyeurethane, Red - base mat structural spray)	7,500	sy	$ 42.00	$ 315,000.00
Long Jump / Triple Jump/ Pole vault systems	2	ea	$ 20,000.00	$ 40,000.00
Pole Vault Landing Pads, Boxes & Runway	1	allow	$ 17,500.00	$ 17,500.00
Shot Put Landing Area	1	ea	$ 14,000.00	$ 14,000.00
Shot Put pad	1	ea	$ 5,000.00	$ 5,000.00
Discuss pad w/ cage	1	ea	$ 14,500.00	$ 14,500.00
Safety Netting (Both Ends)	1	ls	$ 18,000.00	$ 18,000.00
Sports Lighting & Power	1	allow	$ 400,000.00	$ 400,000.00
4' Chain Link Fence and Gates	1,400	lf	$ 48.00	$ 67,200.00
Subtotal				**$ 2,683,700.00**
STADIUM FIELD HOUSE				
3000 sf Field House with Bathrooms, Concessions, Locker Rooms & Storage	3,000	sf	$ 400.00	$ 1,200,000.00
Subtotal				**$ 1,200,000.00**
MULTI-PURPOSE FIELD #1				
Natural Grass Athletic Field Improvements (200' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
MULTI-PURPOSE FIELD #2				
Natural Grass Athletic Field Improvements (180' x 360')	1	ls	$ 250,000.00	$ 250,000.00
New 500 Seat Grandstand	500	ea	$ 350.00	$ 175,000.00
Subtotal				**$ 425,000.00**
MULTI-PURPOSE FIELD #3				
Natural Grass Athletic Field Improvements (225' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
MULTI-PURPOSE FIELD #4				
Natural Grass Athletic Field Improvements (200' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
MULTI-PURPOSE FIELD #5				
Natural Grass Athletic Field Improvements (200' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
JV BASEBALL FIELD				
JV Baseball Field Construction	1	ls	$ 450,000.00	$ 450,000.00
Baseball Dugouts and Storage	2	ea	$ 50,000.00	$ 100,000.00
Subtotal				**$ 550,000.00**
VARSITY SOFTBALL FIELD				
Varsity Softball Field Construction	1	ls	$ 300,000.00	$ 300,000.00
Softball Dugouts and Storage	2	ea	$ 40,000.00	$ 80,000.00
Subtotal				**$ 380,000.00**
JV SOFTBALL FIELD				
JV Softball Field Construction	1	ls	$ 200,000.00	$ 200,000.00
Softball Dugouts and Storage	2	ea	$ 25,000.00	$ 50,000.00
Subtotal				**$ 250,000.00**
SITE IMPROVEMENTS				
Bituminous Concrete Walkways (Excluding Phase One)	38,000	sf	$ 12.00	$ 456,000.00
New Parking Area Improvements	75	ea	$ 3,000.00	$ 225,000.00
Track Storage Building	720	sf	$ 90.00	$ 64,800.00
Field #2 Storage Building	720	sf	$ 90.00	$ 64,800.00
Planting & Buffer Screening	1	allow	$ 60,000.00	$ 60,000.00
Subtotal				**$ 870,600.00**
Subtotal				$ 7,664,300.00
Island Contingency (25%)				$ 1,916,075.00
Design & Engineering (8%)				$ 613,144.00
Construction Contingency (15%)				$ 1,149,645.00
TOTAL				**$ 11,343,164.00**

ESTIMATE OF PROBABLE CONSTRUCTION COSTS

Project: Marha's Vineyard Regional High School - Athletic Field Master Plan
Project Manager: CCH
Client: Martha's Vineyard Regional High School
Plan Title: Athletic Field Master Plan - Option B - **PHASE ONE**

Date: December 18, 2018

By: Huntress Associates, Inc.
17 Tewksbury Street
Andover, MA 01810

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
ATHLETIC FIELD MASTER PLAN-PHASE ONE				
GENERAL CONDITIONS & SITE PREP				
Construction Bonds & Insurance	1	ls	$60,000.00	$ 60,000.00
Mobilization & De-mobilization	1	ls	$25,000.00	$ 25,000.00
Materials Testing & Lab Expenses	1	ls	$5,000.00	$ 5,000.00
Replace unsuitable materials (Allowance)	1	alw	$10,000.00	$ 10,000.00
Site Prep & Demolition	1	alw	$60,000.00	$ 60,000.00
Silt Fence & Erosion Control	1	alw	$7,500.00	$ 7,500.00
Subtotal				**$167,500.00**
400 METER TRACK & SYNTHETIC TURF FIELD				
Synthetic Turf - Subbase & Drainage Construction	98,500	sf	$ 3.50	$ 344,750.00
Synthetic Turf - Provide & Install New Multi-Purpose Synthetic Turf	98,500	sf	$ 4.50	$ 443,250.00
Synthetic Turf - Resilient Underlayment	98,500	sf	$ 1.50	$ 147,750.00
Synthetic Turf - Alternative Infill	98,500	sf	$ 0.50	$ 49,250.00
New 1000 Seat Grandstand	1,000	sf	$ 350.00	$ 350,000.00
New Elevated Pressbox & Lift	1	alw	$ 105,000.00	$ 105,000.00
Football Goal posts & pads	2	ls	$ 7,500.00	$ 15,000.00
Construct new gravel base for track surfaces (8")	7,500	sy	$ 18.00	$ 135,000.00
Bituminous Concrete - Asphalt Surface	7,500	sy	$ 27.00	$ 202,500.00
Resilient Surface (1/2" Polyeurethane, Red - base mat structural spray)	7,500	sy	$ 42.00	$ 315,000.00
Long Jump / Triple Jump/ Pole vault systems	2	ea	$ 20,000.00	$ 40,000.00
Pole Vault Landing Pads, Boxes & Runway	1	allow	$ 17,500.00	$ 17,500.00
Shot Put Landing Area	1	ea	$ 14,000.00	$ 14,000.00
Shot Put pad	1	ea	$ 5,000.00	$ 5,000.00
Discuss pad w/ cage	1	ea	$ 14,500.00	$ 14,500.00
Safety Netting (Both Ends)	1	ls	$ 18,000.00	$ 18,000.00
Sports Lighting & Power	1	allow	$ 400,000.00	$ 400,000.00
4' Chain Link Fence and Gates	1,400	lf	$ 48.00	$ 67,200.00
Subtotal				**$ 2,683,700.00**
STADIUM FIELD HOUSE				
3000 sf Field House with Bathrooms, Concessions, Locker Rooms & Storage	3,000	sf	$ 400.00	$ 1,200,000.00
Subtotal				**$ 1,200,000.00**
MULTI-PURPOSE FIELD #5				
Natural Grass Athletic Field Improvements (200' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
SITE IMPROVEMENTS				
Bituminous Concrete Walkways (Excluding Phase One)	12,000	sf	$ 12.00	$ 144,000.00
Track Storage Building	720	sf	$ 90.00	$ 64,800.00
Planting & Buffer Screening	1	allow	$ 20,000.00	$ 20,000.00
Subtotal				**$ 228,800.00**
Subtotal				$ 4,530,000.00
Island Contingency (25%)				$ 1,132,500.00
Design & Engineering (8%)				$ 362,400.00
Construction Contingency (15%)				$ 679,500.00
TOTAL				**$ 6,704,400.00**

Construction of Phase One improvements, exclusive of the field house building, could be expected to be completed in a four-month schedule. The time of year that would be best suited for construction would include the months of April through November.

ANTICIPATED PERMITS

The following are a list of anticipated permits and approval required to complete the renovation of the existing athletic facilities.

1. **Planning Board & Zoning Board of Appeals**
   a. Special Permit – Sports Lighting
   b. Special Permit – Site Plan Review
   c. Special Permit – Water Resource Protection Overlay District

2. **Zone II Wellhead Protection & The Water Resources Protection Overlay District.**
   A portion of the high school athletic fields falls within the Zone II Wellhead Protection delineated by MA DEP. The MA DEP Zone II protection is afforded to a well generating over 100,000 gallons per day. Zone I is within 400' and carries certain restrictions of what can be located within that close proximity of the well. Those restrictions typically include things like storage of gasoline tanks, dumps, hazardous materials, etc.. Zone II is a broader zone, and would encompass every other piece of land that is within the watershed of the protected well. Zone II protection could, and does in this case, extend for miles. The Mass DEP offers guidance for Zone II wellhead protection, but the authority and restriction fall to the local zoning bylaw. In this case the Town of Oaks Bluffs has a **Water Resource Protection Overlay District (WRPOD).** This bylaw could require that the project secure a Special Permit from the Oak Bluffs Planning Board under the WRPOD. The following are the allowed and prohibited used in the WRPOD,

   8.2.4 The following uses are prohibited in the WRPOD:
   1. New Underground Fuel Tanks
   2. Chemical Treatment of Septic Systems
   3. Outside storage of road salt, fertilizers and pesticides.

   8.2.5 The following Uses are permitted in the WRPOD:
   1. Commercial or residential development with on-site subsurface sewerage disposal systems, provided that the wastewater flow estimates for new lots shall not exceed the standards of 310CMR 15.00 for nitrogen sensitive areas.

   8.2.6 The following uses are allowed by Special Permit in the WRPOD:
   1. Any use established after the date of the adoption of this bylaw which involves the generation, use or storage of toxic or hazardous materials in greater quantities than that associated with a normal household use.
   2. Parking Lots greater than 3500 square feet, unless the lot shall have an impervious surface and shall be constructed with oil retention catch basins.

3. **Martha's Vineyard Commission**
   a. Development of Regional Impact (DRI)

4. **Local Building Permits**
   a. Grandstands, Sports lighting, Scoreboard, Field House & Storage Buildings.

SUMMARY & RECOMMENDATIONS

The MVRHS Athletic Field Master Plan has identified the opportunities and constraints associated with your existing campus and outlines a path to move forward. The preferred Master Plan Option B eliminates the overlapping of sports field, which will help with soil compaction and overall field safety. Huntress Associates recommends that the MVRHS support the following next steps:

1. Provide ADA accessibility to all athletic facilities.

2. Support the construction of a new 400m running track, multi-purpose field, grandstands, pressbox and sports lighting, as shown on the preferred option.

3. Consider the introduction of at least one (1) synthetic turf surface. We recommend that the multi-purpose field within the 400m track include a synthetic turf surface. To get the most out of your synthetic turf surface it should be installed with sports lights and spectator seating.

4. Consider a synthetic turf system and specification which uses sustainable products. Also, plan for the end of life disposal now, as you purchase the system, so it will be easier and less expensive to ensure that the products do no go into a landfill.

5. Commit to a natural grass maintenance program that insures the health and stability of your remaining natural grass field for 20 years or more. This would include the appropriate annual funding for maintenance activities for the natural grass fields.

Throughout the process of our review we have been asked about the impact of a synthetic turf field to the existing groundwater. The MVRHS is located within a Zone 2 Aquifer Recharge Area and the question deserves some discussion. Attached you will find a study completed by Haley & Aldrich dated July 2015. This study reviews many of the same concerns raised at our public hearings and is worthy of review. We have included the study here for your information only. It may be important to understand the Haley and Aldrich study analyzed fields with an SBR crumb rubber infill, which is not being recommended for your high school campus.

Please refer to the following attachments for photos, testing results and documents mentioned within this report. Thank you for inviting us to assist in your effort. Please feel free to call with any further questions or concerns.

Sincerely;
Huntress Associates, Inc.

Christian C. Huntress
President

Att:

APPENDIX

Attachments	**Pages**
1. HAI - Master Plan Alternatives	6
2. HAI - Estimates of Probable Construction Costs	4
3. MVRHS – Existing & Proposed Field Use Events	2
4. HAI - Existing & Proposed Athletic Field Use Analysis	1
5. Soil Reports – Gale Associates	8
6. NHESP – Habitat Mapping	1
7. Haley & Aldrich Report – Groundwater Impact from Synthetic Turf	17
8. Synthetic Turf System	
a. Green Field Woven Turf System – MX Elite	2
b. ACT Global – Woven Turf System – Extreme Turf WX50	1
c. ACT Global – Synthetic Turf Maintenance Guidelines	12
9. Resilient Turf Underlayment – Product Data & MSDS Information	2
10. Synthetic Turf Infill Material – Product Data & MSDS Information	2
11. Questions and Answers provided to the Facilities Sub-Committee	14

Huntress Associates, Inc.

Landscape Architecture & Land Planning

17 Tewksbury Street
Andover, Massachusetts 01810
978 470 8882 FAX 978 470 8890

Project:

Martha's Vineyard Regional High School

Oak Bluffs, Massachusetts

Drawing Title:

Conceptual Master Plan Option A

Revision	Date

Scale:	1"=80'	Drawing No.	
Date:	10.25.18	**L-1**	
Job:	00-107		
File:	PR-mp		
Drawn:	CCH	of	
Checked:	--	1	

Huntress Associates, Inc.

Landscape Architecture & Land Planning

17 Tewksbury Street
Andover, Massachusetts 01810
978 470 8882 FAX 978 470 8890

Project:

Martha's Vineyard Regional High School

Oak Bluffs, Massachusetts

Drawing Title:

Conceptual Master Plan Option B

Revision	Date

Scale:	1"=80'	Drawing No.	
Date:	12.4.18		L-2
Job:	00-107		
File:	PR-mp		
Drawn:	CCH	of	
Checked:	--		3

Huntress Associates, Inc.

Landscape Architecture & Land Planning

17 Tewksbury Street
Andover, Massachusetts 01810
978 470 8882 FAX 978 470 8890

Project:

Martha's Vineyard Regional High School

Oak Bluffs, Massachusetts

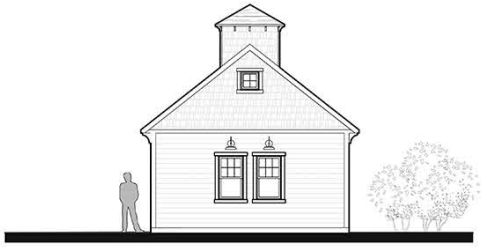
Drawing Title:

Conceptual Master Plan Option C

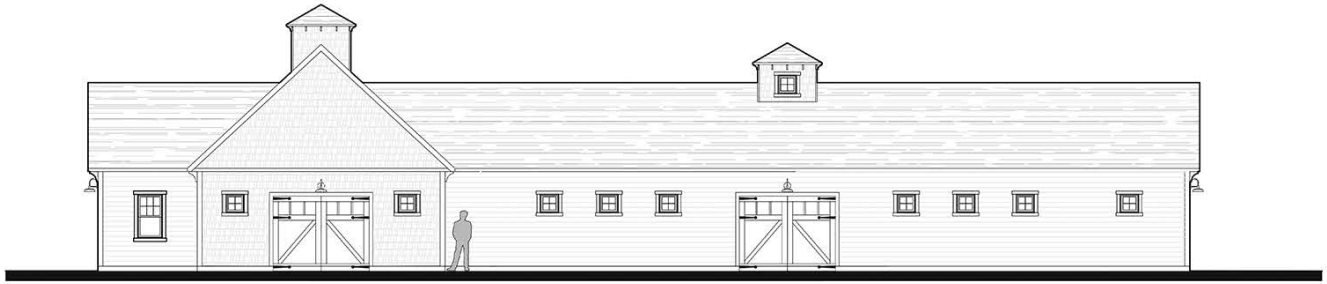
Revision	Date

Scale:	1"=80'	Drawing No.
Date:	12.4.18	**L-3**
Job:	00-107	
File:	PR-mp	of
Drawn:	CCH	**3**
Checked:	--	

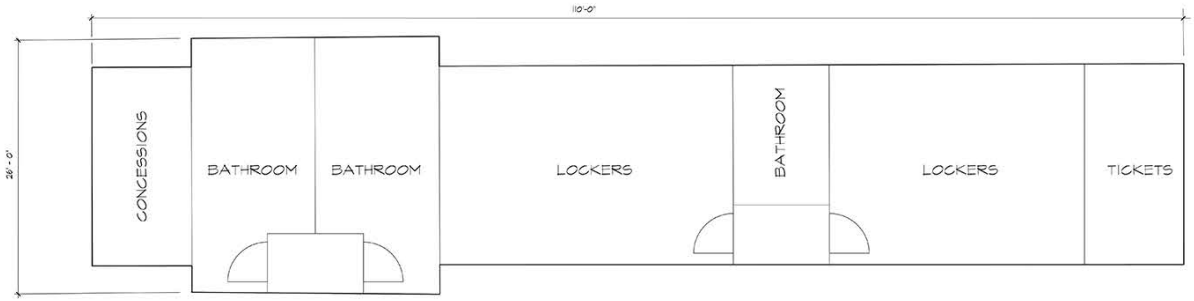
1 EAST END ELEVATION
SCALE: 1" = 6'



2 WEST END ELEVATION
SCALE: 1" = 6'



3 NORTH FACADE ELEVATION
SCALE: 1" = 6'



4 CONCEPTUAL FLOOR PLAN
SCALE: 1" = 6'

Huntress Associates, Inc.
Landscape Architecture & Land Planning
17 Tewksbury Street
Andover, Massachusetts 01810
978 470 8882 FAX 978 470 8890

Project:

Martha's Vineyard Regional High School

Oak Bluffs, Massachusetts

Drawing Title:

Conceptual Master Plan

Conceptual Field House

Revision	Date

Scale:	as noted	Drawing No.
Date:	12.3.18	L-4
Job:	00-107	
File:	PR-mp	
Drawn:	CCH	of
Checked:	--	4

Huntress Associates, Inc.

Landscape Architecture & Land Planning

17 Tewksbury Street
Andover, Massachusetts 01810
978 470 8882 FAX 978 470 8890

Project:

Martha's Vineyard Regional High School

Oak Bluffs, Massachusetts

Drawing Title:

Conceptual Master Plan Option B

Revision	Date

Scale:	1"=80'	Drawing No.	
Date:	12.4.18	**L-2**	
Job:	00-107		
File:	PR-mp		
Drawn:	CCH	of	
Checked:	--	3	

Huntress Associates, Inc.

Landscape Architecture & Land Planning

17 Tewksbury Street
Andover, Massachusetts 01810
978 470 8882 FAX 978 470 8890

Project:

Martha's Vineyard Regional High School

Oak Bluffs, Massachusetts

Drawing Title:

Conceptual Master Plan Phase One

Revision	Date

Scale:	1"=80'	Drawing No.	
Date:	12.4.18		L-5
Job:	00-107		
File:	PR-mp		
Drawn:	CCH	of	
Checked:	--		5

ESTIMATE OF PROBABLE CONSTRUCTION COSTS

Project: Marha's Vineyard Regional High School - Athletic Field Master Plar
Project Manager: CCH
Client: Martha's Vineyard Regional High Schoo
Plan Title: Athletic Field Master Plan - Option E

Date: December 18, 2018

By: Huntress Associates, Inc.
17 Tewksbury Street
Andover, MA 01810

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
ATHLETIC FIELD MASTER PLAN				
GENERAL CONDITIONS & SITE PREP				
Construction Bonds & Insurance	1	ls	$120,000.00	$ 120,000.00
Mobilization & De-mobilization	1	ls	$50,000.00	$ 50,000.00
Materials Testing & Lab Expenses	1	ls	$10,000.00	$ 10,000.00
Replace unsuitable materials (Allowance)	1	alw	$10,000.00	$ 10,000.00
Site Prep & Demolition	1	alw	$100,000.00	$ 100,000.00
Silt Fence & Erosion Control	1	alw	$15,000.00	$ 15,000.00
Subtotal				**$305,000.00**
400 METER TRACK & SYNTHETIC TURF FIELD				
Synthetic Turf - Subbase & Drainage Construction	98,500	sf	$ 3.50	$ 344,750.00
Synthetic Turf - Provide & Install New Multi-Purpose Synthetic Turf	98,500	sf	$ 4.50	$ 443,250.00
Synthetic Turf - Resilient Underlayment	98,500	sf	$ 1.50	$ 147,750.00
Synthetic Turf - Alternative Infill	98,500	sf	$ 0.50	$ 49,250.00
New 1000 Seat Grandstand	1,000	sf	$ 350.00	$ 350,000.00
New Elevated Pressbox & Lift	1	alw	$ 105,000.00	$ 105,000.00
Football Goal posts & pads	2	ls	$ 7,500.00	$ 15,000.00
Construct new gravel base for track surfaces (8")	7,500	sy	$ 18.00	$ 135,000.00
Bituminous Concrete - Asphalt Surface	7,500	sy	$ 27.00	$ 202,500.00
Resilient Surface (1/2" Polyeurethane, Red - base mat structural spray)	7,500	sy	$ 42.00	$ 315,000.00
Long Jump / Triple Jump/ Pole vault systems	2	ea	$ 20,000.00	$ 40,000.00
Pole Vault Landing Pads, Boxes & Runway	1	allow	$ 17,500.00	$ 17,500.00
Shot Put Landing Area	1	ea	$ 14,000.00	$ 14,000.00
Shot Put pad	1	ea	$ 5,000.00	$ 5,000.00
Discuss pad w/ cage	1	ea	$ 14,500.00	$ 14,500.00
Safety Netting (Both Ends)	1	ls	$ 18,000.00	$ 18,000.00
Sports Lighting & Power	1	allow	$ 400,000.00	$ 400,000.00
4' Chain Link Fence and Gates	1,400	lf	$ 48.00	$ 67,200.00
Subtotal				**$ 2,683,700.00**
STADIUM FIELD HOUSE				
3000 sf Field House with Bathrooms, Concessions, Locker Rooms & Storage	3,000	sf	$ 400.00	$ 1,200,000.00
Subtotal				**$ 1,200,000.00**
MULTI-PURPOSE FIELD #1				
Natural Grass Athletic Field Improvements (200' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
MULTI-PURPOSE FIELD #2				
Natural Grass Athletic Field Improvements (180' x 360')	1	ls	$ 250,000.00	$ 250,000.00
New 500 Seat Grandstand	500	ea	$ 350.00	$ 175,000.00
Subtotal				**$ 425,000.00**
MULTI-PURPOSE FIELD #3				
Natural Grass Athletic Field Improvements (225' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
MULTI-PURPOSE FIELD #4				
Natural Grass Athletic Field Improvements (200' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
MULTI-PURPOSE FIELD #5				
Natural Grass Athletic Field Improvements (200' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
JV BASEBALL FIELD				
JV Baseball Field Construction	1	ls	$ 450,000.00	$ 450,000.00
Baseball Dugouts and Storage	2	ea	$ 50,000.00	$ 100,000.00
Subtotal				**$ 550,000.00**
VARSITY SOFTBALL FIELD				
Varsity Softball Field Construction	1	ls	$ 300,000.00	$ 300,000.00
Softball Dugouts and Storage	2	ea	$ 40,000.00	$ 80,000.00
Subtotal				**$ 380,000.00**
JV SOFTBALL FIELD				
JV Softball Field Construction	1	ls	$ 200,000.00	$ 200,000.00
Softball Dugouts and Storage	2	ea	$ 25,000.00	$ 50,000.00
Subtotal				**$ 250,000.00**
SITE IMPROVEMENTS				
Bituminous Concrete Walkways (Excluding Phase One)	38,000	sf	$ 12.00	$ 456,000.00
New Parking Area Improvements	75	ea	$ 3,000.00	$ 225,000.00
Track Storage Building	720	sf	$ 90.00	$ 64,800.00
Field #2 Storage Building	720	sf	$ 90.00	$ 64,800.00
Planting & Buffer Screening	1	allow	$ 60,000.00	$ 60,000.00
Subtotal				**$ 870,600.00**
Subtotal				$ 7,664,300.00
Island Contingency (25%)				$ 1,916,075.00
Design & Engineering (8%)				$ 613,144.00
Construction Contingency (15%)				$ 1,149,645.00
TOTAL				**$ 11,343,164.00**

ESTIMATE OF PROBABLE CONSTRUCTION COSTS

Project: Marha's Vineyard Regional High School - Athletic Field Master Plan
Project Manager: CCH
Client: Martha's Vineyard Regional High School
Plan Title: Athletic Field Master Plan - Option B **- PHASE ONE**

Date: December 18, 2018

By: Huntress Associates, Inc.
17 Tewksbury Street
Andover, MA 01810

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
ATHLETIC FIELD MASTER PLAN-PHASE ONE				
GENERAL CONDITIONS & SITE PREP				
Construction Bonds & Insurance	1	ls	$60,000.00	$ 60,000.00
Mobilization & De-mobilization	1	ls	$25,000.00	$ 25,000.00
Materials Testing & Lab Expenses	1	ls	$5,000.00	$ 5,000.00
Replace unsuitable materials (Allowance)	1	alw	$10,000.00	$ 10,000.00
Site Prep & Demolition	1	alw	$60,000.00	$ 60,000.00
Silt Fence & Erosion Control	1	alw	$7,500.00	$ 7,500.00
Subtotal				**$167,500.00**
400 METER TRACK & SYNTHETIC TURF FIELD				
Synthetic Turf - Subbase & Drainage Construction	98,500	sf	$ 3.50	$ 344,750.00
Synthetic Turf - Provide & Install New Multi-Purpose Synthetic Turf	98,500	sf	$ 4.50	$ 443,250.00
Synthetic Turf - Resilient Underlayment	98,500	sf	$ 1.50	$ 147,750.00
Synthetic Turf - Alternative Infill	98,500	sf	$ 0.50	$ 49,250.00
New 1000 Seat Grandstand	1,000	sf	$ 350.00	$ 350,000.00
New Elevated Pressbox & Lift	1	alw	$ 105,000.00	$ 105,000.00
Football Goal posts & pads	2	ls	$ 7,500.00	$ 15,000.00
Construct new gravel base for track surfaces (8")	7,500	sy	$ 18.00	$ 135,000.00
Bituminous Concrete - Asphalt Surface	7,500	sy	$ 27.00	$ 202,500.00
Resilient Surface (1/2" Polyeurethane, Red - base mat structural spray)	7,500	sy	$ 42.00	$ 315,000.00
Long Jump / Triple Jump/ Pole vault systems	2	ea	$ 20,000.00	$ 40,000.00
Pole Vault Landing Pads, Boxes & Runway	1	allow	$ 17,500.00	$ 17,500.00
Shot Put Landing Area	1	ea	$ 14,000.00	$ 14,000.00
Shot Put pad	1	ea	$ 5,000.00	$ 5,000.00
Discuss pad w/ cage	1	ea	$ 14,500.00	$ 14,500.00
Safety Netting (Both Ends)	1	ls	$ 18,000.00	$ 18,000.00
Sports Lighting & Power	1	allow	$ 400,000.00	$ 400,000.00
4' Chain Link Fence and Gates	1,400	lf	$ 48.00	$ 67,200.00
Subtotal				**$ 2,683,700.00**
STADIUM FIELD HOUSE				
3000 sf Field House with Bathrooms, Concessions, Locker Rooms & Storage	3,000	sf	$ 400.00	$ 1,200,000.00
Subtotal				**$ 1,200,000.00**
MULTI-PURPOSE FIELD #5				
Natural Grass Athletic Field Improvements (200' x 360')	1	ls	$ 250,000.00	$ 250,000.00
Subtotal				**$ 250,000.00**
SITE IMPROVEMENTS				
Bituminous Concrete Walkways (Excluding Phase One)	12,000	sf	$ 12.00	$ 144,000.00
Track Storage Building	720	sf	$ 90.00	$ 64,800.00
Planting & Buffer Screening	1	allow	$ 20,000.00	$ 20,000.00
Subtotal				**$ 228,800.00**
Subtotal				$ 4,530,000.00
Island Contingency (25%)				$ 1,132,500.00
Design & Engineering (8%)				$ 362,400.00
Construction Contingency (15%)				$ 679,500.00
TOTAL				**$ 6,704,400.00**

MVRHS Field Usage by Sport
2018

High School Sport Usage

Team	Weeks Scheduled	Events/week	Event/annually
V Boys soccer	13	6	78
JV Boys soccer	13	6	78
B Girls soccer	13	6	78
JV Girls soccer	13	6	78
V Football	14	6	84
JV Football	14	6	84
V Boys lacrosse	11	6	66
JV Boys lacrosse	11	6	66
V Girls lacrosse	11	6	66
JV Girls lacrosse	11	6	66
V Field hockey	13	6	78
JV Field hockey	13	6	78
Spring track	10	5	50
		Total	**950**

Youth Sport Usage Currently at HS

Program	Weeks Scheduled	Events/week	Events/Annually
MV Youth football	8	5	40
MV Youth flag football	6	4	24
Girls & Boys Youth lacrosse	16	16	256
Babe Ruth Baseball	16	5	80
		Total	**400**

Summer Camps

Program	Events		
Mass Youth Soccer	10		
Club camp	5		
Metter's camp	20		
Field Hockey	5		
Track Camp	5		
Football	5		
Total	**50**		

Potential Users Who Have requested the use of the high school field

MV United

Program	Events		
MV United Spring Rec	72		
MV United Travel Spring	512		
MV United Island Fall League	192		
MV United Soccer Tournament if the facilty would allow multiple fields (150 Teams)	72		
Total	**848**		

Adult Leagues

Program	Events		
Open Soccer League	16		
Over 40 Men's soccer	24		
Women's League	20		
99 League	24		
Total	**84**		

Total Current Usage	**1400**
Total Potential Usage	**2332**

MVRHS - Existing Athletic Field Use Analysis

Plan Title	Annual Events	Hours/Event	Total Use Hours	Number of Fields	Annual Hours/Field
Existing Conditions	**1,400**	**2.5**	**3500**	**5**	**700**
Master Plan - Option A - 100% Natural Grass	1,400	2.5	3500	6	**583**
Master Plan - Option B - 100% Natural Grass	1,400	2.5	3500	6	**583**
Master Plan - Option C - 100% Natural Grass	1,400	2.5	3500	5	**700**
Master Plan Alternative - Use of Synthetic Turf					
Master Plan - Option A or B - **One (1) Synthetic Turf Field**	550	2.5	1375	1	**1375**
Master Plan - Option A or B - Five (5) Natural Grass Fields	850	2.5	2125	5	**425**
Master Plan - Option A or B - **Two (2) Synthetic Turf Fields**	1,100	2.5	2750	2	**1375**
Master Plan - Option A or B - Four (4) Natural Grass Fields	300	2.5	750	4	**188**

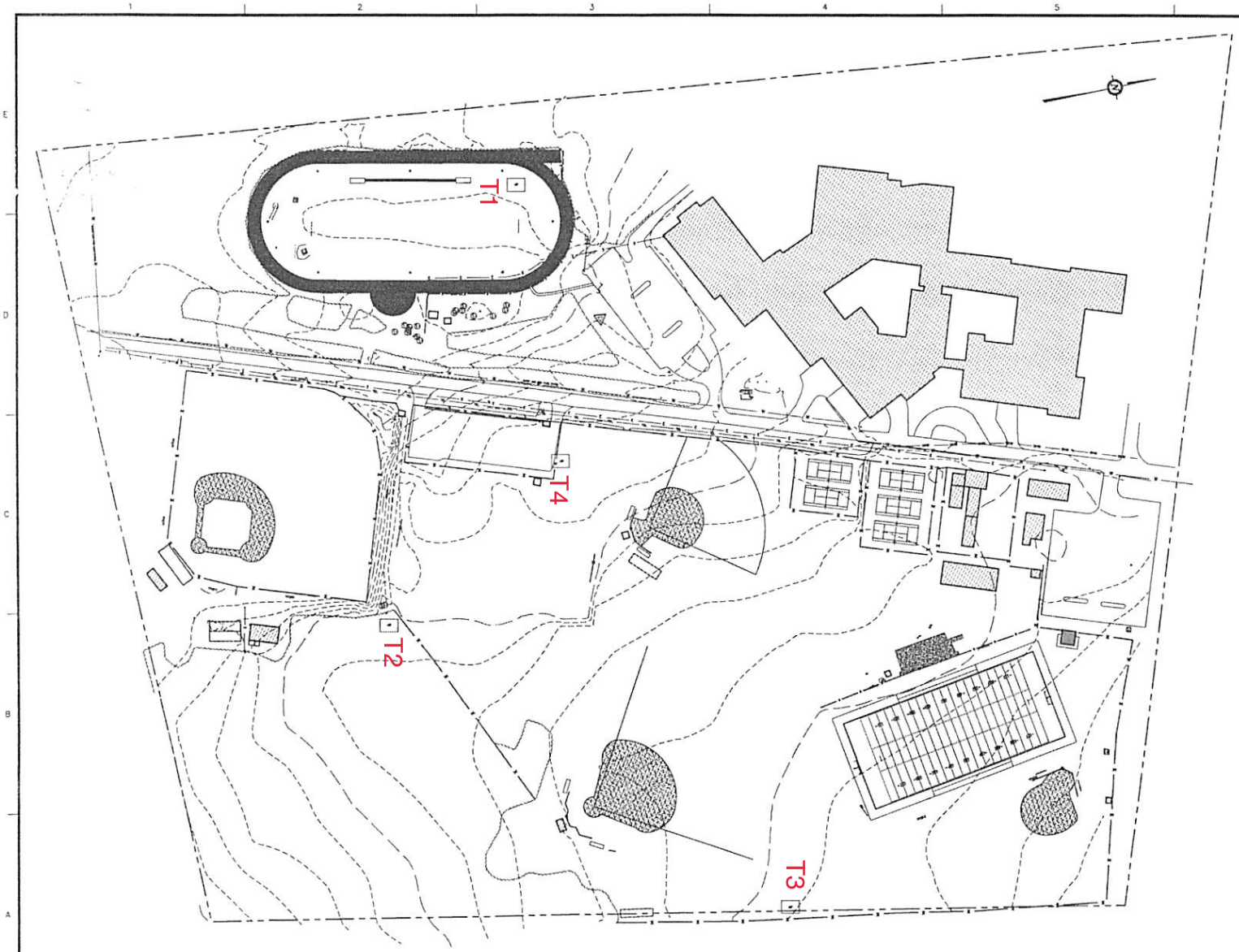
** Does not include 848 annual events associated with MV United, and 84 annual events associated with adult leagues. See proposed conditions use analysis for additional information.*

Sports Turf Managers Association - Recommendation **Well maintained natural grass fields can support between 680 - 820 hours of use per year.**

MVRHS - Proposed Athletic Field Use Analysis

Plan Title	Annual Events	Hours/Event	Total Use Hours	Number of Fields	Annual Hours/Field
Existing Conditions	**2,332**	**2.5**	**5830**	**5**	**1166**
Master Plan - Option A - 100% Natural Grass	2,332	2.5	5830	6	**972**
Master Plan - Option B - 100% Natural Grass	2,332	2.5	5830	6	**972**
Master Plan - Option C - 100% Natural Grass	2,332	2.5	5830	5	**1166**
Master Plan Alternative - Use of Synthetic Turf					
Master Plan - Option A or B - **One (1) Synthetic Turf Field**	550	2.5	1375	1	**1375**
Master Plan - Option A or B - Five (5) Natural Grass Fields	1,782	2.5	4455	5	**891**
Master Plan - Option A or B - **Two (2) Synthetic Turf Fields**	1,100	2.5	2750	2	**1375**
Master Plan - Option A or B - Four (4) Natural Grass Fields	1,232	2.5	3080	4	**770**
Master Plan - Option A or B - **Three (3) Synthetic Turf Fields**	1,650	2.5	4125	3	**1375**
Master Plan - Option A or B - Three (3) Natural Grass Fields	682	2.5	1705	3	**568**

Sports Turf Managers Association - Recommendation **Well maintained natural grass fields can support between 680 - 820 hours of use per year.**



GALE

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Boston Baltimore Orlando San Francisco

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PROJECT
MARTHA'S VINEYARD REGIONAL HIGH SCHOOL
ATHLETIC FACILITIES IMPROVEMENTS
100 EDGARTOWN – VINEYARD HAVEN ROAD
OAK BLUFFS, MA 02557

OWNER
MV ⊕ PLAY, INC.

REVISIONS

NO.	DATE	DESCRIPTION

CADD FILE	717120_C001
DESIGNED BY	
DRAWN BY	HAM
CHECKED BY	KDH
DATE	
DRAWING SCALE	1"=80'

GRAPHIC SCALE
0 80' 160'

SHEET TITLE
OVERALL SITE EXISTING CONDITIONS PLAN

DRAWING NO.
C000

PROJECT NO. 717120

SOIL EVALUATOR FORM

Location Address or Lot No. Martha's Vineyard Regional High School

On-site Review

Deep Hole Number: TP-1 Date: 12-30-2015 Time: 10:30 am Weather: Cloudy 42 degrees

Location (Identify on site plan): See Map

Land Use: Athletic Field Slope (%): 0-5 Surface Stones: None

Vegetation: Grass

Landform:

Position on Landscape (sketch on the back):

Distances from:

Open Water Body:	feet	Drainage way:	feet
Possible Wet Area:	feet	Property Line:	feet
Drinking Water Well:	feet	Other:	feet

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox/ Mottles	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-4	A	Sandy Loam	10YR 3/2		Topsoil
4-18	Fill	Fine Loamy Sand	10YR 5/6		
18-32	B	Fine Sand	10YR 7/1		
32-96	C	Gravelly Coarse Sand	7.5YR 5/6	@60"	

Notes:

Mottling observed appears to be from "rust stains" from soil high in iron. Excavator's historic knowledge of site stated that observed water table is much deeper than the 8-ft depth of test pit.

Parent Material (geologic) Gravelly coarse sand Depth to Bedrock: None

Depth to Groundwater: >96" Weeping from Pit Face: None

Estimated Seasonal High Ground Water:

SOIL EVALUATOR FORM

Location Address or Lot No. Martha's Vineyard Regional High School

On-site Review

Deep Hole Number: TP-2 Date: 12-30-2015 Time: 12:30 pm Weather: Cloudy 42 degrees

Location (Identify on site plan): See Map

Land Use: Wooded area Slope (%): 0-5 Surface Stones: None

Vegetation: Grass

Landform:

Position on Landscape (sketch on the back):

Distances from:

Open Water Body:	feet	Drainage way:	feet
Possible Wet Area:	feet	Property Line:	feet
Drinking Water Well:	feet	Other:	feet

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox/ Mottles	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-12	A	Sandy Loam	10YR 3/2		Topsoil
12-24	B	Fine Loamy Sand	10YR 5/6		
24-84	C	Coarse Sand	10YR 7/1		

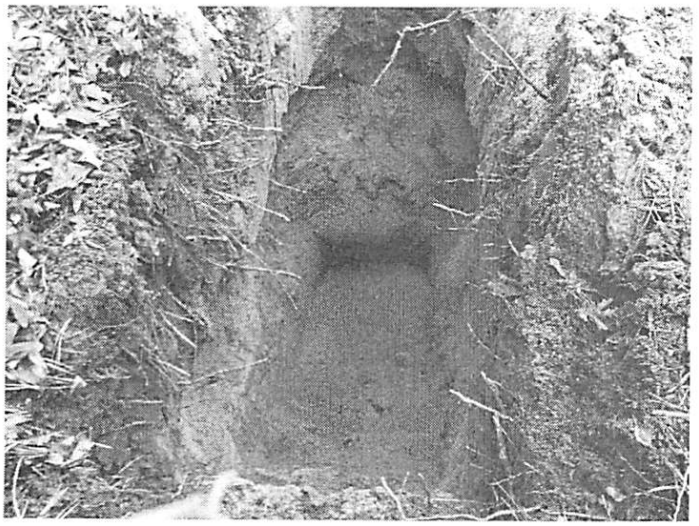
Notes:

Parent Material (geologic) Gravelly coarse sand Depth to Bedrock: None

Depth to Groundwater: >84" Weeping from Pit Face: None

Estimated Seasonal High Ground Water:

Test Pit #2:



SOIL EVALUATOR FORM

Location Address or Lot No. Martha's Vineyard Regional High School

On-site Review

Deep Hole Number: TP-3 Date: 12-30-2015 Time: 1:30 pm Weather: Cloudy 42 degrees

Location (Identify on site plan): See Map

Land Use: Athletic Field Slope (%): 0-5 Surface Stones: None

Vegetation: Grass

Landform:

Position on Landscape (sketch on the back):

Distances from:

Open Water Body:	feet	Drainage way:	feet
Possible Wet Area:	feet	Property Line:	feet
Drinking Water Well:	feet	Other:	feet

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox/ Mottles	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-7	A	Sandy Loam	10YR 3/2		Topsoil
7-20	B	Fine Loamy Sand	10YR 5/6	@42"	
20-96	C	Gravelly Coarse Sand	10YR 7/1 7.5YR 5/6		

Notes:

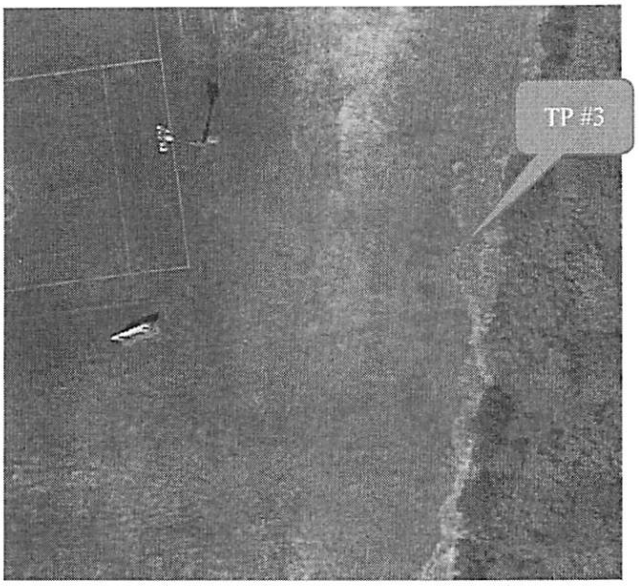
Mottling observed appears to be from "rust stains" from soil high in iron. Excavator's historic knowledge of site stated that observed water table is much deeper than the 8-ft depth of test pit.

Parent Material (geologic) Gravelly coarse sand Depth to Bedrock: None

Depth to Groundwater: >96" Weeping from Pit Face: None

Estimated Seasonal High Ground Water:

Test Pit #3:



SOIL EVALUATOR FORM

Location Address or Lot No. Martha's Vineyard Regional High School

On-site Review

Deep Hole Number: TP-4 Date: 12-30-2015 Time: 11:30 am Weather: Cloudy 42 degrees

Location (Identify on site plan): See Map

Land Use: Grass Area Slope (%): 0-5 Surface Stones: None

Vegetation: Grass

Landform:

Position on Landscape (sketch on the back):

Distances from:

Open Water Body:	feet	Drainage way:	feet
Possible Wet Area:	feet	Property Line:	feet
Drinking Water Well:	feet	Other:	feet

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox/ Mottles	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-6	A	Sandy Loam	10YR 3/2		Topsoil
4-24	B	Fine Loamy Sand	10YR 5/6		
24-84	C	Coarse Sand	10YR 7/1		

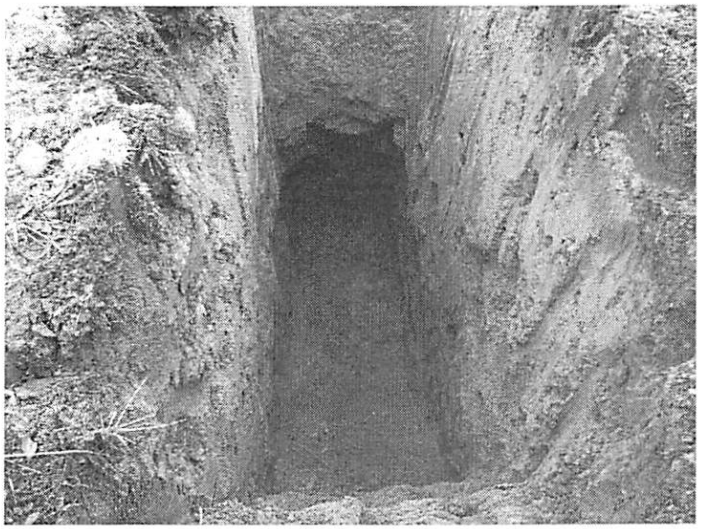
Notes:

Parent Material (geologic) Gravelly coarse sand Depth to Bedrock: None

Depth to Groundwater: >84" Weeping from Pit Face: None

Estimated Seasonal High Ground Water:

Test Pit #4:



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OLIVER Updates
Search for a location
Zoom to a town
Available Data Layers
Search data layers
Active Data Layers
Check all
Uncheck all
Remove all
Major MassDOT Routes
Massachusetts Towns
NHESP Estimated Habitats of Rare Wildlife
NHESP Priority Habitats of Rare Species
Legend
Major MassDOT Routes
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State
Massachusetts Towns
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REPORT ON

POTENTIAL FOR SYNTHETIC TURF FIELD TO AFFECT GROUNDWATER CONCORD-CARLISLE HIGH SCHOOL CONCORD, MASSACHUSETTS

by Haley & Aldrich, Inc.
Bedford, New Hampshire

for Concord Carlisle At Play
Concord, Massachusetts

File No. 42185
July 2015

HALEY & ALDRICH, INC.
3 Bedford Farms Drive
Bedford, NH 03110
(603) 625.5353

30 July 2015
File No. 42185-000

Concord Carlisle At Play, Inc.
33 Bradford Street
Concord, Massachusetts 01742

Attention: Mr. John Boynton, President

Subject: Potential for Synthetic Turf Field to Affect Groundwater at Concord-Carlisle Regional High School in Concord, Massachusetts

Ladies and Gentlemen:

As you are aware, as a board-certified Environmental Toxicologist with over 30 years of experience, I routinely conduct risk assessments addressing the potential impacts of hazardous chemicals to both humans and wildlife. In 2011, I was asked to serve as an expert in the evaluation of the potential impact that a new synthetic turf field at the Fenn School might have on groundwater quality. At that time I provided assurance to the Concord Natural Resources Commission ("CNRC") that synthetic turf would not result in metals and organic compounds to occur in groundwater at concentrations above the safe drinking water standard. Since that time, groundwater monitoring has shown this prediction has been true as the water quality of the aquifer has not changed from the original baseline conditions.

Subsequently, per the request of Concord Carlisle at Play, Inc. ("CCAP"), I have been asked to develop a more comprehensive review than provided in 2011 to the CNRC for the Fenn School. The attached report provides a comprehensive review of peer-reviewed articles, grey literature documents and regional case studies to examine the overall weight-of-evidence on the probability that synthetic turf may contaminate underlying groundwater. The conclusion of the report affirms what has observed over 4 years (16 quarterly reports) of monitoring at the Fenn School, which is that there is no credible evidence to suggest that either new or weathering synthetic turf fields pose a risk to the environment.

This report also includes an Appendix with the results of past laboratory analytical measurements that have been performed on the synthetic turf blades and recycled crumb rubber that is to be used on the new field at the Concord-Carlisle High School. Although the vendor (Sprinturf) guarantees that their turf polymer will be lead free and their crumb rubber product will not pose a hazard to underlying groundwater, CCAP requested that the product to be used at the high school also go through the same tests used to develop Sprinturf's original product specifications. The results of both the bulk laboratory analysis as well as the vigorous leaching tests show that the turf materials, even under harsh environmental conditions, should remain well below levels that may pose a risk to humans and the environment.

The additional literature identified since my initial review for the Fenn School in 2011, as well as the confirmation of the original Sprinturf product specifications by the current testing of the product to be used at the Concord-Carlisle High School, should give both CCAP and the residents of Concord the confidence that the installation of new synthetic turf fields will not pose a risk to groundwater after construction.

Sincerely yours,
HALEY & ALDRICH, INC.

Stephen R. Clough
Senior Toxicologist, Ph.D., DABT

Jay Peters
Lead Risk Assessor

Enclosures

G:\42185 Concord Carlisle At Play\Deliverables\FINAL PDF 7.30.15\2015-0730-CCAP-Groundwater Assessment-F.docx

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1. Introduction

Concord-Carlisle At Play, Inc. (CCAP) is in the final stages of the development of an outdoor athletic complex that will be one of the highlights of the new Concord-Carlisle Regional High School (CCRHS). CCAP enlisted the services of Gale Associates, Inc. to provide a comprehensive analysis of what will be required for the proposed athletic complex (Gale, 2013). Their report covered all aspects of development including alternative strategies, planning, permitting, renovation, construction and environmental considerations/concerns. They concluded that the choice of a new synthetic turf field ("Option 2") would be the most effective alternative in terms of both playing efficiency (750 times/year) and long term costs. The selection of a synthetic turf field that has already met the approval of both the Concord Natural Resources Commission ("CNRC"), Board of Health ("BoH"), Concord Public Works ("CPW"), and the town residents (via a majority vote at a Concord Town Meeting on April 14th 2015).

Synthetic turf fields in Concord are not a new development. The existing athletic facilities at CCRHS already have two multi-purpose synthetic turf fields, and Middlesex School constructed two synthetic turf fields in 2010. Additionally, the new synthetic field (installed in 2011) at the Fenn School was controversial (for similar reasons), but regular monitoring at that facility over 4 years has shown no impacts to the environment. Despite these precedents, the Town of Concord is always proactive in terms of maintaining a high level of environmental stewardship. The Town of Concord Zoning Board of Appeals ("ZBA"), in concert with CPW and BoH, has requested CCAP to ensure that the new facility presents *de minimus* risk to the environment. More specifically, they have requested that the "synthetic turf field material (all colors) and rubber infill are free of heavy metals and hazardous materials" and that stormwater "leachate is free of heavy metals or hazardous materials from the synthetic turf material and rubber infill in compliance with all applicable laws, regulations and standards of practice." These stipulations can be found in Condition #7 of the Special Permit issued by the ZBA dated May 2, 2014 (the "Special Permit Documentation" – Appendix A).

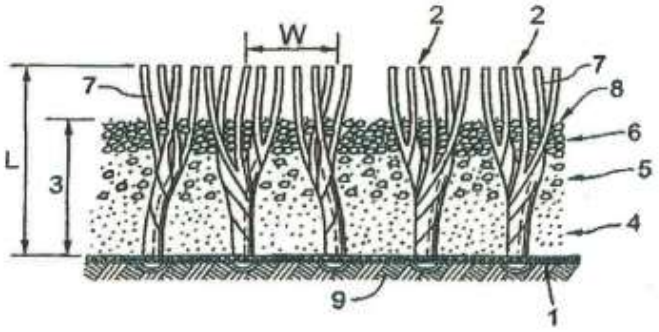
As synthetic turf fields have been in existence for over three decades, there is considerable evidence, as documented through both national and regional reviews, that both the turf fiber and the crumb rubber infill (used as a shock-absorbing ballast) presents a insignificant exposure and *de minimus* risk to humans and the surrounding environment (Cheng *et al*., 2014; RMA, 2013; Lioy and Weisel, 2011; Simon, 2010). Because the location of this field is above an aquifer that is classified as a potential drinking water source, the Town of Concord has requested additional information as to whether the presence of the new field may impact underlying groundwater. The purpose of this paper, therefore, is to collate existing case studies that are applicable to the effect of synthetic turf on groundwater and to present whether the overall "weight-of-evidence" is sufficient to warrant any concern at CCRHS.

2. Synthetic Turf Design

Gale Associates recently provided CCAP with extensive documentation necessary to fulfill the requirements of the Special Permit, including specifications for the synthetic turf field carpet (Appendix B) and certifications by Sprinturf, the provider contracted to supply and install the synthetic turf system, that provides a guarantee that the plastic turf will be lead free and the crumb rubber infill will have no adverse effect on groundwater (Appendix C). This letter was intended to assure CCAP that the design,

construction and materials that will be performed and/or installed at CCRHS will conform to strict industry performance standards.

The proposed system consists of an "above ground" playing surface component (i.e., plastic backing and turf blades; crumb rubber infill) and a "below ground" component (i.e., base layers that consist of drainage matting). The following is an artist's rendering of a typical cross section of a segment of synthetic turf (Gale, 2013):



Because both the plastic components of the carpet and the crumb rubber infill are polymers, almost all of the chemicals used in making the turf are bound up in the polymer matrix (i.e. plastic or rubber) and therefore not "bioavailable" (i.e., cannot be absorbed by humans playing on the field). Additionally, Sprinturf, in order to maintain a quality product and meet industry standards, will copiously wash and rinse all of the turf materials to ensure that they meet the requirements of the American Society for Testing and Materials ("ASTM"). This is to ensure that the material meets the specifications provided to CCAP (Appendix B). For example, the plastic turf blades must be certified as "lead free" prior to the installation and the crumb rubber infill needs to be less than 0.005% free metal content measured in accordance with the ASTM D 5603 7.3.2.

3. Regulatory Framework

At CCRHS, the aquifer below the proposed athletic facility is within the Hugh Cargill well field and thereby classified as a Zone II resource. The Massachusetts Contingency Plan thereby applies "GW-1" groundwater standards (310 CMR 40.0974(2)) to this aquifer as it can act as either a current drinking water resource (e.g., within a Zone II of a public water supply) or a potential future source of drinking water. Standards that would apply to metals and organic compounds in groundwater for this classification of water are located in Subpart B entitled "Massachusetts Oil and Hazardous Material List."[1]

The GW-1 standards are similar to, or in some cases more stringent than, the Maximum Contaminant Levels[2] that have also been promulgated to protect the health of humans, particularly children who are more sensitive to environmental contamination (pound for pound, they will receive a bigger "dose" than an adult). Concentrations at or below these levels are safe for drinking water. The MCLs listed in the drinking water regulations (310 CMR 22.00) of Massachusetts Drinking Water Regulations (310 CMR

[1] http://www.mass.gov/eea/docs/dep/cleanup/laws/mohmla.pdf
[2] http://www.mass.gov/eea/agencies/massdep/water/drinking/standards/standards-and-guidelines-for-drinking-water-contaminants.html#Standards

22.00) consist of values promulgated by the USEPA as well as some more stringent values developed and enforced by the Drinking Water Program.

3.1 ENVIRONMENTAL PERFORMANCE MONITORING

As discussed above, the Board of Appeals has required under Condition #7 of the Special Permit that the following request be addressed:

- Synthetic turf material and rubber infill proposed for installation shall be free of hazardous materials and heavy metals and in compliance with all applicable laws, regulations and standards of practice. **A minimum of two weeks prior to commencement of installation of the Stadium Field Turf in Phase 2**, the Applicant shall provide to the Health Division, CPW Engineering and Water and Sewer Divisions for review and approval specifications and test results (using applicable ASTM testing methods) demonstrating that the synthetic turf field material (all colors) and rubber infill are free of heavy metals and hazardous materials.

- Depending on the review of the specifications and the test results, the Applicant may be required by the Health Division to adopt a monitoring protocol which includes under-draining a section of the field to allow capture of undiluted leachate and testing of the undiluted leachate demonstrating that the leachate is free of heavy metals or hazardous materials from the synthetic turf material and rubber infill in compliance with all applicable laws, regulations and standards of practice.

Although Sprinturf has provided a written guarantee that ensures the field will not contaminate underlying groundwater (Appendix C: Sprinturf Letter of Certification), CCAP has requested that the "lot" of plastic turf and crumb rubber infill that will be used on the CCRHS field undergo both bulk testing (i.e. digestion of the material and analysis for hazardous constituents) as well as extraction under acid conditions to simulate "worse case" conditions like acid rain ("Synthetic Precipitation Leaching Procedure" or "SPLP"). The testing protocol is intended to replicate as nearly as possible the approach taken in the Teter Engineering Report (Appendix D) and can be summarized as follows:

- Lead Testing on Synthetic Turf Fibers ("all colors") - ASTM Method F2765 or equivalent.

- Total Metals Analysis - All samples are to be analyzed for the California Assessment Manual 17/Title 22 list of metals (CAM 17 metals) prepared by the lab for analysis of total recoverable metals by USEPA Method 3052 and analyzed using USEPA Method 6010B/7471B or equivalent.

- Leachable Metals Analysis – Measurement of infill samples should be consistent with the protocol citied in Teter Engineering report for "Leachable metals" using a modified multiple extraction version of the Synthetic Precipitation Leachate Procedure (SPLP). Fluid (leachate) will be analyzed for CAM 17 Metals using EPA Methods 6020B/7471B and Chromium VI using Method 7199 or equivalent. Per the spec sheet the SBR "Shall have less than 0.005% free metal content measured in accordance with the ASTM D 5603 7.3.2".

- Total Semi Volatile Organic Compounds and PAH's - SBR rubber infill samples are to be prepared by the lab for analysis using EPA Method 3550 or 3540 and analyzed for the SW 846 list of SVOC's using EPA Method 8270C or equivalent.

- Leachable SVOC's and PAH's - As detailed in the Teter Engineering Report, a modified multiple extraction version of the SPLP will be used to simulate a steady state leaching of SVOC's and PAH's from the crumb rubber infill.

This testing protocol is rigorous and the most effective way to determine the chemical composition of the actual materials that will be installed at CCRHS. This testing will commence once the materials have been received from Sprinturf and evaluated against the applicable performance criteria discussed below.

3.2 EVALUATION OF RISK

The results of the testing of Sprinturf's product for metals and organic compounds (such as PAHs and semi volatile compounds) were evaluated in a risk assessment that compared the levels of chemicals in the tire crumb rubber to health based standards that are known to be safe to both human health and the environment (Appendix D: Teter Engineering Report). This risk assessment tested two samples, considered to be representative of Sprinturf's synthetic field product, for total semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), leachable metals, and leachable SVOCs/PAHs. The risk assessment concluded that:

> "The concentrations of metals detected in the samples fall below the California human health soil screening levels (CHHSLs) for unrestricted land use, which are highly conservative for a recreational use scenario. Although PAHs were detected in both crumb rubber infill samples, the additional cancer risk from exposure during a recreational use scenario is estimated to fall below the EPA *de minimus* risk level of 1E-06. Furthermore, the additional cancer risk from exposure to PAHs in crumb rubber is indistinguishable from the additional cancer risk from exposure to background levels of PAHs and arsenic in rural and urban surface soils. The concentrations of zinc and phenol in the leachate from both crumb rubber samples are below levels required to affect the taste of drinking water."

The conclusions of this conservative risk assessment are important because they show, *a priori*, that constituents in Sprinturf's product will not adversely affect either human health or leach to groundwater.

Following the analysis of the "lot" sampling requested by CCAP, the results will again be compared to risk-based standards. Per the definition in ASTM Standard F2765-09 and D5603, the turf and crumb rubber will be designated as "lead free" if the analysis shows the total concentration to be less than 0.005% lead (50 mg/kg) by weight. The results of the leachate from the modified SPLP testing of the crumb rubber will be also be compared to Target Leachate Concentrations (TLC) which are protective of groundwater. The TLCs are derived by multiplying the Massachusetts GW-1 water quality criteria by a "Dilution Attenuation Factor" (DAF) of 20. In other words, the DAF anticipates that the "worst case" concentration in the stormwater runoff from the field will be diluted by a factor of 20 as it makes its way into the groundwater table.

4. Review of the Applicable Weight of Evidence to Determine if Synthetic Turf Affects Groundwater

One of the most effective methods for determining if a particular technology may pose a risk to the environment is to review as many applicable studies as possible and determine the overall weight-of-evidence, i.e. the number of studies that are, in terms of adverse impacts to groundwater, either pro or con. Table 1 presents a comprehensive review of groundwater impacts from both peer-reviewed studies as well as studies published in the grey literature. The table summarizes the purpose of the study, the experimental design, the analytical results for the media tested and a brief summary. The locations of the case studies include two major studies in Europe (France and Switzerland), one in New York, and six sites in New England (ME, VT, CT and MA), including the Fenn School in Concord which has the most robust groundwater monitoring record (quarterly over a 4 year span) of all the studies presented. These studies mainly address the potential for synthetic turf to impact groundwater, although a few reports measure metals and organics in leachate sampled from underdrains, catch basins or stormwater discharge points (chemicals measured in leachate or drainage water would be more elevated, and thus more conservative, than might be expected in groundwater).

4.1 CASE STUDIES

Both of the European studies (Bergs, 2007; Moretto, 2007) conclude that there should be no problems with using recycled tires as infill in the "pitches"; none of the EU water quality groundwater or surface water standards were exceeded. Nilson et al. (2008) who conducted laboratory leaching tests of their own that included other types of infill (Netherlands) and also reviewed investigations from Norway and Sweden, concluded that there was "no reason to question the conclusions of the elaborate Swiss, French and Dutch studies that rubber granules from car tyres pose no major environmental risk".

The New York study sampled monitoring wells at four different fields of varying ages. The results, which showed no concentrations above the method detection limits, are very convincing from the standpoint of groundwater protection. The Connecticut study (Malone and MacBroom, 2008) collected stormwater over a period of one year from three different fields and demonstrated that metals would have no adverse impact to groundwater. The study by Sheehan *et al*. (2006) was based on tire scraps used as infill but was a peer-reviewed study that is directly applicable to the effects of subsurface rubber on groundwater quality. This 5 year exposure showed no significant release of metals or organics from tire fill located above the groundwater table.

In 2011, the Fenn School won an adjudicatory hearing which claimed that tire crumb rubber would have adverse effects on the environment. As part of their Special Permit, Fenn agreed to conditions requested by the CNRC to monitor groundwater and stormwater over a 5 year period. Three monitoring wells, one upgradient of the athletic field and two downgradient, were installed in 2011 (Appendix E, Figure 1). These wells have been monitored and analyzed every quarter for the past four years. Conventional water quality parameters (temperature, conductivity, dissolved oxygen, pH and oxidation-reduction potential) were generally within normal ranges for natural groundwaters (Appendix E, Figure 2). Figure 3 (Appendix E) presents trace levels of dissolved cadmium, copper, lead and zinc plotted over time. These metals were all well below the respective MCP standards of 4, 100, 10 and 900 ug/L (Figure 3). Cadmium was rarely detected and when it was, concentrations in all wells stayed within the range in the up-gradient well (0.1 – 0.4 ug/L) during the baseline sampling program (April and May, 2011). Copper was also infrequently observed above the method detection limit and the highest up-gradient concentration of 12 ug/L was never exceeded in either of the down-gradient wells. Similarly, the highest value observed for lead (8 ug/L) in the up-gradient well (December 2012) was never exceeded in the two down-gradient wells for any sampling period. Zinc, which historically is the metal of greatest concern with regard to leaching from SBR, the ranges for down-gradient wells B202 (3.2 – 22.2 ug/L) and B203 (5.2 – 48) fell within the range for the up-gradient well (2 – 54.5 ug/L).

Although the remaining monitoring investigations were not formally published in the literature, the results are similar to, or better than, the results at Fenn School. Environmental monitoring data for the New England fields was obtained from Gale Associates, Inc. for Middlebury College (Middlebury, VT), Brookwood School (Beverly, MA) and a private sports field in Lancaster MA. As shown in Table 1, none of the New England samples obtained in these case studies had levels of organic compounds in groundwater or stormwater that were above the method detection limit (monitoring data is presented in Appendix D). Additionally, levels of metals, typically cadmium, copper, lead and zinc, were always observed below the groundwater and/or drinking water standards.

5. Summary

Based on this review of at least 9 case studies (Table 1), the overall weight-of-evidence strongly suggests that the installation of a new synthetic turf field at the CCRHS will have no adverse effect on groundwater quality. Generally speaking, the studies reviewed in the literature were either negative or, when a metal or organic chemical related to tire crumb rubber was detected, the levels were below the safe, risk-based standard.

Of all the studies examined, the Fenn study deserves special attention because it is within the same town and well field that is below the proposed CCRHS facility and is the only study to regularly monitor groundwater on a quarterly basis for an extended period of time (>2 years). This study confirmed the prediction by Haley & Aldrich that neither metals nor organic compounds from synthetic turf materials would contaminate groundwater and therefore exposure to any site-related constituents of concern would be well below risk-based standards.

Finally, Sprinturf has conducted a health risk assessment using a harsh laboratory extraction that mimics “worst case” environmental conditions (i.e. SPLP method that simulates acid rain). They provide a guarantee that the “infilled” synthetic turf system will not adversely affect the water quality in the surrounding areas and ground water” and that that the proposed synthetic turf is "lead free" per applicable regulations. CCAP is currently repeating those tests using samples from the actual “lot” that will be installed at the CCRHS facility. It is anticipated the results of that testing and the subsequent comparisons to actual regulatory benchmarks will not be significantly different from Sprinturf’s original result for their proprietary product.

References

1. Bergs, R., 2007. Swiss Study on Environmental Effects of Synthetic Sports Surfaces with Lysimeters. BASF Construction Chemicals Europe AG, Division CONICA Technik. 2006-2007. . http://www.isss-portsurfacescience.org/downloads/documents/0xp3xq07vv_bergs_swissstudy.pdf

2. Cheng, H., Hu, Y. and Reinhard, M., 2014. Environmental and health impacts of artificial turf: a review. Environ. Sci. Technol. 48, 2114−2129.

3. CTDEP, 2010. Final Report: Artificial Turf Study. Leachate and Stormwater Characteristics. Connecticut Department of Environmental Protection. July 2010

4. Gale, 2013. Concord-Carlisle Regional High School Athletic Complex Renovation Plan. Gale Associates, Inc., Libbey Parkway, Weymouth MA. December 2, 2013

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G:\42185 Concord Carlisle At Play\Deliverables\FINAL PDF 7.30.15\2015-0730-CCAP-Groundwater Assessment-F.docx

TABLE I
Evaluation of the Potential for Groundwater Contamination by Synthetic Turf Fields
Concord Carlisle At Play, Inc.
Concord, MA

Study[1] (Location)	Purpose	Design[2]	Analytical Results[2]		Summary
		Groundwater	Groundwater		
			Metals	Organics	
Sheehan *et al*. (Maine, 2006)	Designed to assess if leachates from tire shreds used as roadbed fill will pose a hazard to groundwater.	Chemical concentrations measured in reference and leachate-affected water collected from above and below the water table.	Trace metals in wells generally below limit of detection; zinc detected in one of two wells but below water quality criteria and drinking water standard.	Majority of VOCs were below the limit of detection; VOCs detected were below regulatory standards (0.5 - 16 ug/L).	Extended 5 year exposure showed no significant release of metals or organics from tire fill located above groundwater table.
Bergs (BASPO/IST, Switzerland 2006)	Comprehensive field study to examine "environmental effects of synthetic sports surfaces" by measuring individual selected chemical trace substances.	Lysimeters used as a "reliable and realistic" tool to measure leachate under field conditions (one surface type, 1 year exposure period).	None of the lysimeter tests revealed elevated zinc concentrations in leachate compared with the blank sample (gravel layer without surface).	Initially elevated levels of aniline, benzothiazole and cyclohexylamine dropped off rapidly (> 10 fold) within two months of field exposure.	Neither small quantities of leached substances nor their toxicological properties constitute any unacceptable potential risk for water resources .
Lancaster MA (2006)	Sampling and analysis of underdrains, both groundwater wells and surface water (upstream and downstream of McGovern Brook) to identify chemical impacts.	Metals, pesticides, water quality (pH, conductivity, temp, D.O.) and inorganics (ammonia, nitrate/nitrite, TKN, phosphorus) measured in underdrain and monitoring well samples.	Metals were not observed above the method detection limit in every sample but one, which was a well within a "Stormwater BMP" (retention pond).	No organic compounds were observed above the method detection limit (although PAHs and SVOCs were not selected as an analyte which was a shortcoming).	There was no evidence that metals impacted groundwater or surface water since levels were below the detection limit in all but one sample (MW-5 was positive but located within a stormwater retention swale).
Brookwood School, Beverly MA (2006)	Installation of 3 monitor- ing wells, sampling of 2 catch basins and baseline surface water sampling to ensure that site-derived chemicals would not migrate and affect the environment.	Sampling and analysis of one upgradient well (MW-3) and two downgradient wells (MW-1 and MW-2). "Discharge Point", catch basins and surface water were also sampled.	All metals (cadmium, copper, lead, zinc) were below ambient water quality criteria in surface water and below drinking water standards in groundwater.	The analysis of the full suite of both PAHs and SVOCs were not detected above the method reporting limits.	Samples taken four separate sampling events over a span of 3 years showed that chemicals from the field did not migrate into either surface water or groundwater.
Moretto (France, 2007)	Chemical analysis of "elements and substances present in the percolates" after transfer through the playin surface (both lab microcosm and field tests).	Eleven month study. Lab microcosms received 0.8 m rainfall per year (control had no SBR). Field leachate collected behind the goal and at perimeter of the "pitch" (field).	Of the 17 metals measured, 10 were highest during the first month of sampling but levels dropped off rapidly after that (below the limit of detection as well as the safe drinking water level).	Cyanide and phenol were all below the method limits of detection. PAHs were all below the "safe" EU drinking water limit of 1 ug/L.	Both laboratory and field testing showed levels of metals and organic compounds in leachates "are compatible with the water resource quality requirements".

TABLE I
Evaluation of the Potential for Groundwater Contamination by Synthetic Turf Fields
Concord Carlisle At Play, Inc.
Concord, MA

Malone and MacBroom (Connecticut, 2008)	Determine if metals leach from crumb rubber infill at a level that would adversely affect the quality of water.	Sampled stormwater that had "infiltrated the field surface in-fill material and migrated downward" into dedicated drainage (collected at 3 CT synthetic turf fields).	Laboratory analysis indicated that lead, selenium, and cadmium were below the detection limit in the drainage water; zinc levels were BDL or very low (5 - 36 ug/L).	N/A	Stormwater collected over a period of one year from three different fields showed metals would have no impact to groundwater.
Middlebury College VT (2008)	Chemical analysis of stormwater obtained from catchbasins below a newly installed synthetic turf field.	Metals (RCRA 8), PAHs and SVOCs sampled on three events (July, August, December 2008). Conventional parameters (pH, conductivity, nitrates, alkalinity) also measured.	No metals were detected above the method reporting limits.	No PAHs nor SVOCs were detected above the method reporting limits. Conventional measurements were within normal ranges.	Negative data is strong evidence that metals and chemicals derived from field materials pose no health or environmental hazard.
NYSDEC (New York, 2009)	Designed to assess potential environmental impacts from the use of crumb rubber as infill material in synthetic turf fields.	Four turf fields were selected ranging from <1 - 7 years old. Monitoring of both stormwater leachate and monitoring wells.	No metals were observed above method detection limits.	Test results of 32 groundwater samples had no detections for 68 organic compounds.	There is no significant threat from chemicals leaching into surface water and groundwater. "Crumb rubber may be used as an infill without significant impact on groundwater quality."
Connecticut DEP (2010)	Collect stormwater runoff samples from three artificial turf fields. Analyze and develop an environmental risk assessment (no groundwater samples were collected in the study).	Stormwater runoff from 3 synthetic turf fields collected during the first 30 minutes of a storm event at locations that only drained water from the fields.	Detected concentrations of zinc in the stormwater significantly lower than CAES results, with no exceedences of drinking water standards and no significant concerns for groundwater quality.	The concentrations of organic compounds in the study did not exceed Connecticut groundwater protection criteria.	No risk to groundwater protection criteria in the stormwater runoff from artificial turf fields. Conclusion is an extrapolation of the stormwater results collected and the evaluation of data presented in recent studies.
Fenn School (Concord MA, 2015)	Monitor of groundwater to ensure that applicable Massachusetts groundwater and surface water standards were not exceeded.	One upgradient well and two downgradient wells. All wells were sampled and analyzed once per quarter for 4 years.	Dissolved Cd, Cu, Pb and Zn were either ND or well below their respective MCP Massachusetts DEP groundwater standards (4, 100, 10 and 900 ug/L).	Over a period of 4 years, only bis-2(ethyl-hexyl) phthalate, a common laboratory contaminant, was detected at trace levels (3 out of 16 samples).	No significant exposure to humans or environmental receptors would be expected via groundwater or leachate.

[1]NYSDEC, NY State Dept of Environmental Conservation

[2]N/A, Not Applicable; ND, Below Detection Limit; VOC, Volatile Organic Compound; SVOC, Semivolatile Organic Compound; SBR, Crumb Rubber Infill; CAES, Connecticut Agricultural Experimental Station

LEGEND:

B201(MW) DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING CONDUCTED BY NEW HAMPSHIRE BORING OF LONDONDERRY, NEW HAMPSHIRE ON 17 MARCH 2011. (MW) INDICATES 2-IN. DIA. MONITORING WELL INSTALLED IN COMPLETED BOREHOLE.

▲RIVER-1 DESIGNATION AND APPROXIMATE LOCATION OF SURFACE WATER MONITORING POINT ON THE CONCORD RIVER AND THE ADJACENT WETLAND

NOTE:

BACKGROUND IMAGE TAKEN ELECTRONICALLY FROM GOOGLE EARTH PRO/MAPS (IMAGE DATED 10 JUNE 2010).

0 100 200
APPROXIMATE SCALE IN FEET

HALEY & ALDRICH

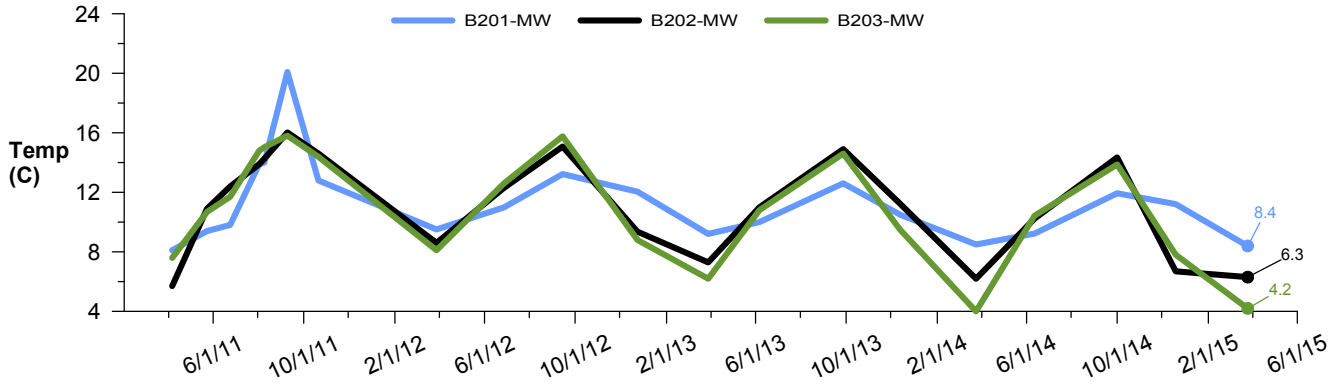
FENN SCHOOL
ATHLETIC FIELD IMPROVEMENTS
CONCORD, MASSACHUSETTS

GROUNDWATER AND
SURFACE WATER SAMPLING
LOCATION PLAN

SCALE: AS SHOWN
AUGUST 2011

FIGURE 1

J:\GRAPHIC\S\35395\35395-005-R003.DWG


B201-MW
B202-MW
B203-MW
Temp (C)
24
20
16
12
8
4
8.4
6.3
4.2
6/1/11
10/1/11
2/1/12
6/1/12
10/1/12
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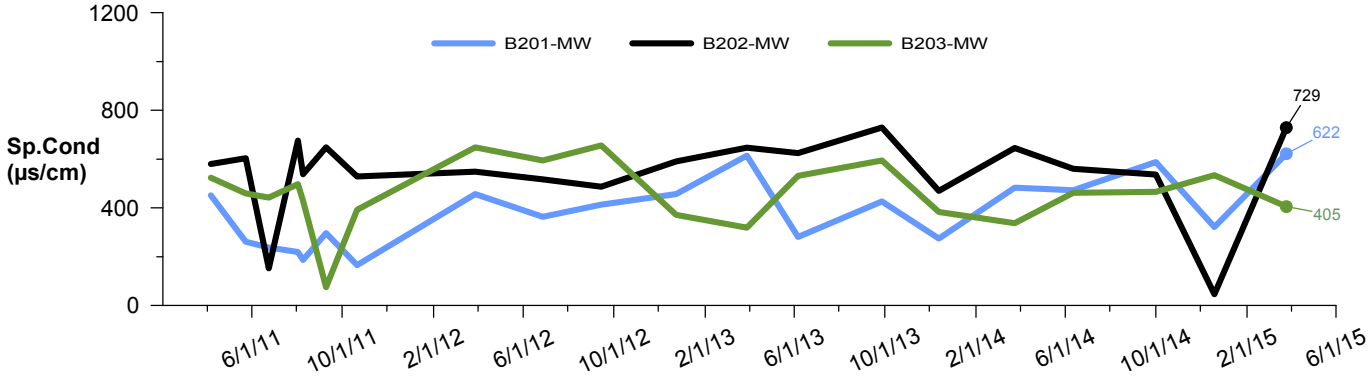
2/1/15
6/1/15


B201-MW
B202-MW
B203-MW
Sp.Cond (µs/cm)
1200
800
400
0
729
622
405
6/1/11
10/1/11
2/1/12
6/1/12
10/1/12
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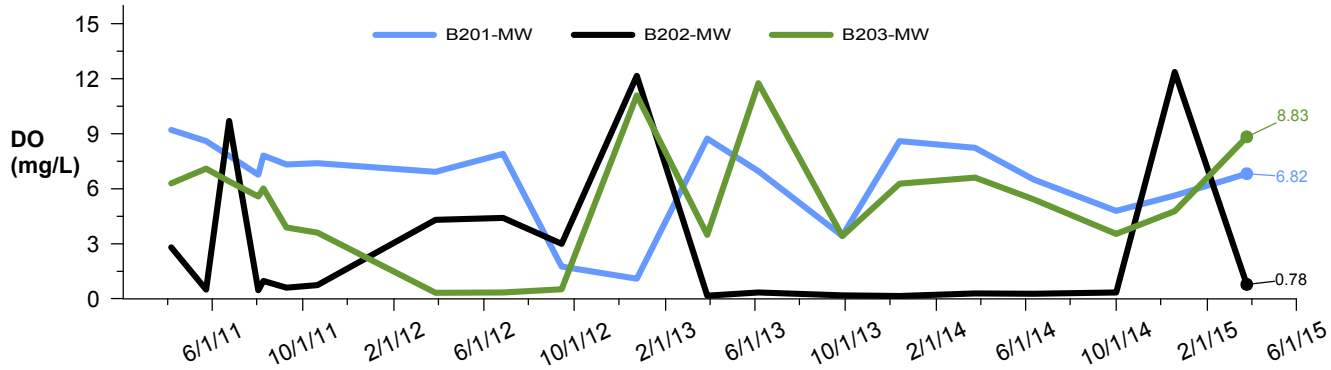
2/1/15
6/1/15


B201-MW
B202-MW
B203-MW
DO (mg/L)
15
12
9
6
3
0
8.83
6.82
0.78
6/1/11
10/1/11
2/1/12
6/1/12
10/1/12
2/1/13
6/1/13
10/1/13
2/1/14
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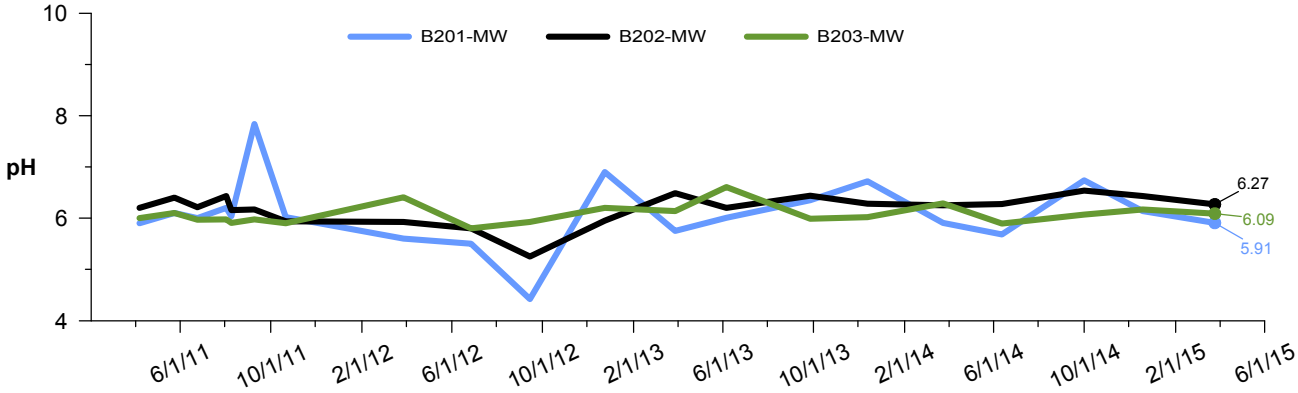
2/1/15
6/1/15


B201-MW
B202-MW
B203-MW
pH
10
8
6
4
6.27
6.09
5.91
6/1/11
10/1/11
2/1/12
6/1/12
10/1/12
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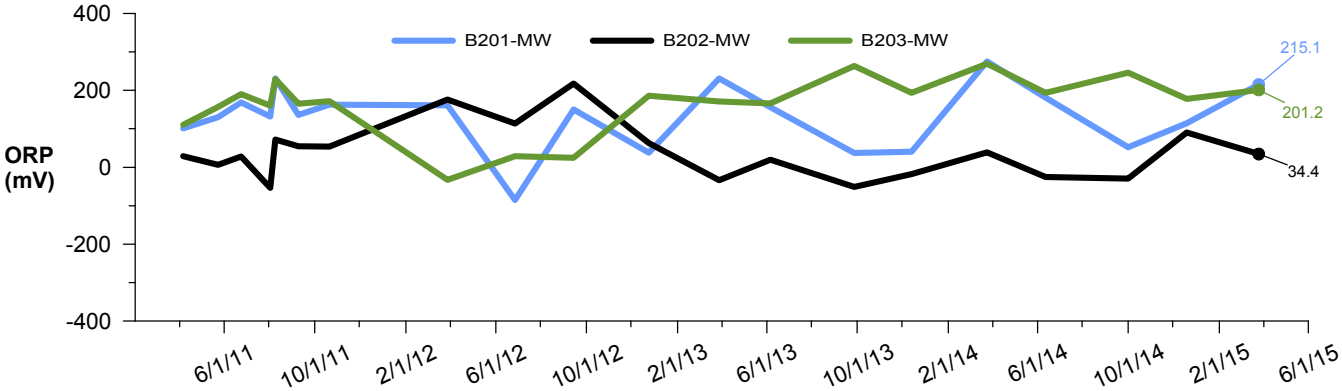
2/1/15
6/1/15


B201-MW
B202-MW
B203-MW
ORP (mV)
400
200
0
-200
-400
215.1
201.2
34.4
6/1/11
10/1/11
2/1/12
6/1/12
10/1/12
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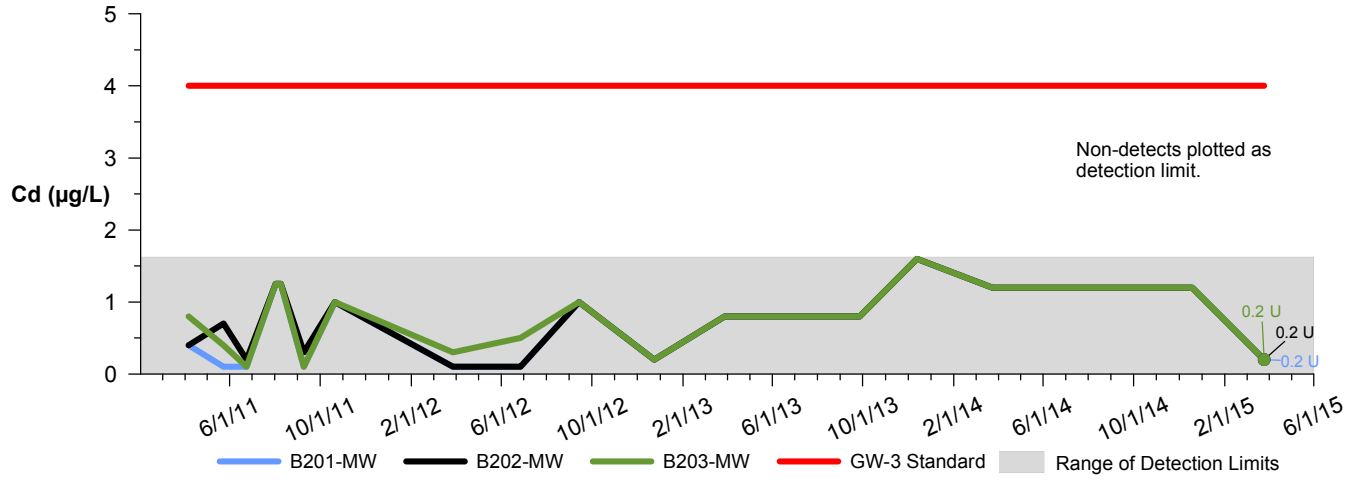
2/1/15
6/1/15


Cd (µg/L)
Non-detects plotted as detection limit.
0.2 U
0.2 U
0.2 U
6/1/11
10/1/11
2/1/12
6/1/12
10/1/12
2/1/13
6/1/13
10/1/13
2/1/14
6/1/14
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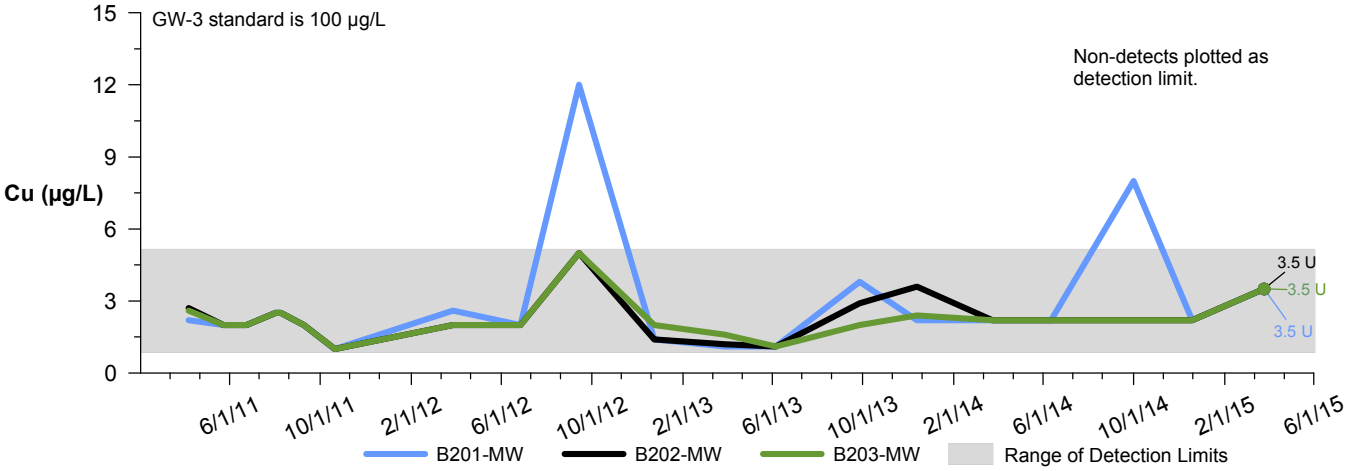
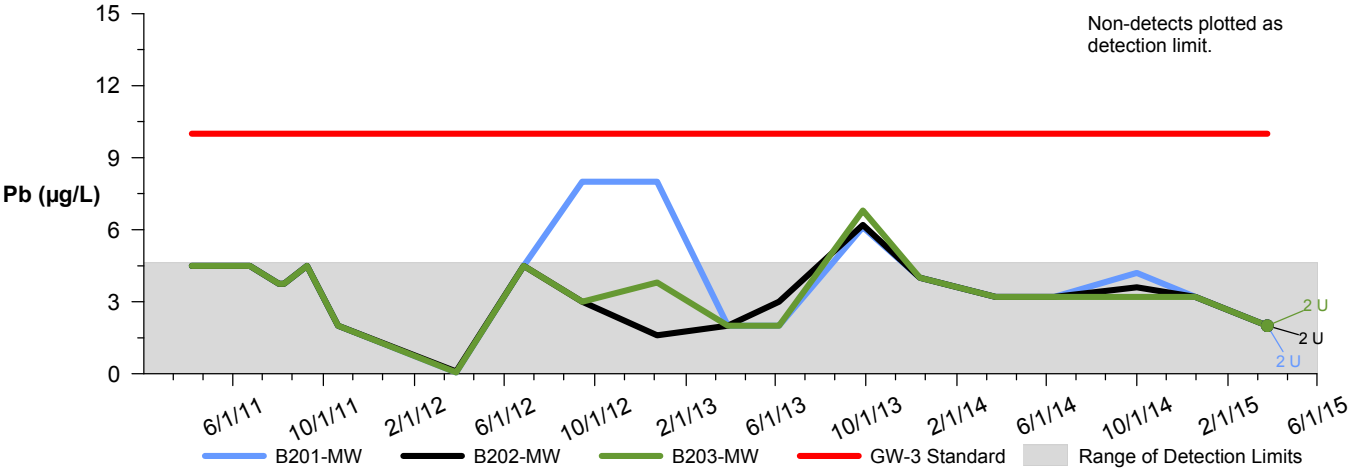
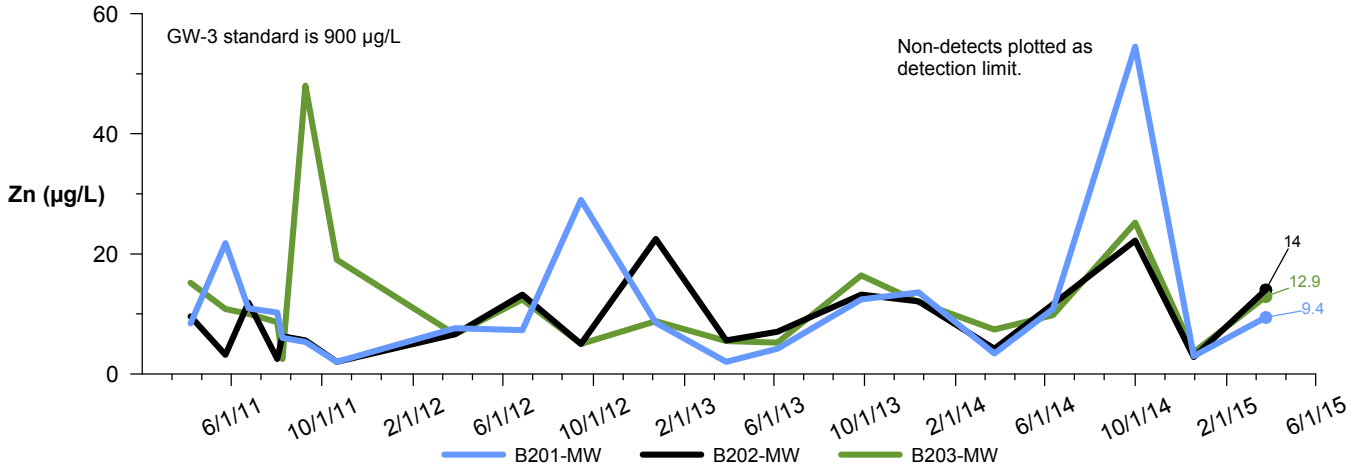
2/1/15
6/1/15
B201-MW
B202-MW
B203-MW
GW-3 Standard
Range of Detection Limits


Cu (µg/L)
GW-3 standard is 100 µg/L
Non-detects plotted as detection limit.
3.5 U
3.5 U
3.5 U
6/1/11
10/1/11
2/1/12
6/1/12
10/1/12
2/1/13
6/1/13
10/1/13
2/1/14
6/1/14
10/1/14
2/1/15
6/1/15
B201-MW
B202-MW
B203-MW
Range of Detection Limits


Pb (µg/L)
Non-detects plotted as detection limit.
2 U
2 U
2 U
6/1/11
10/1/11
2/1/12
6/1/12
10/1/12
2/1/13
6/1/13
10/1/13
2/1/14
6/1/14
10/1/14
2/1/15
6/1/15
B201-MW
B202-MW
B203-MW
GW-3 Standard
Range of Detection Limits


Zn (µg/L)
GW-3 standard is 900 µg/L
Non-detects plotted as detection limit.
14
12.9
9.4
6/1/11
10/1/11
2/1/12
6/1/12
10/1/12
2/1/13
6/1/13
10/1/13
2/1/14
6/1/14
10/1/14
2/1/15
6/1/15
B201-MW
B202-MW
B203-MW

FOOTBALL

USED AT TOP CLUBS WORLDWIDE, OUR PREMIUM 3G WOVEN PRODUCT OFFERS HIGH SPEED PROFESSIONAL PLAY

GREENFIELDS MX ELITE

Key benefits:

- Woven technology ensures maximum tuft lock
- Equal tuft spacing ensures natural ball roll
- Trio of fibres provides an elite playing performance
- 1-step recycling – backing and fibres part of the same polymer family

GreenFields MX Elite is a high-tech woven system offering the very best performance characteristics for both amateur and professional players.

The patented woven technology results in an extremely high tuft bind, stronger than that of traditional tufted products. This forces the fibres to stand even straighter and more closely resemble natural grass as well as facilitating positive infill movement which optimises performance. Even spacing between the tufts ensures equal ball roll in every direction combined with wider spacing between the individual fibres which enables easy decompaction of the infill.

GreenFields MX Elite offers the highest number of yarns per tuft with a mixture of our top performing yarns; Evolution®, diamond and trilobal shaped. This perfect fibre combination results in an optimum playing surface with a natural look as well as ultimate resilience.

> “The surface not only has to look good it has to play well too. And these do.”

PAUL ASHCROFT
Grounds Manager
Arsenal F.C.

The Groundsman - July 2016

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FOOTBALL

NATURAL BALL ROLL

HIGH RESILIENCE DUE TO HIGH DENSITY, FIBRES AND ELASTICITY

NATURAL LOOK AND PLAYING EXPERIENCE

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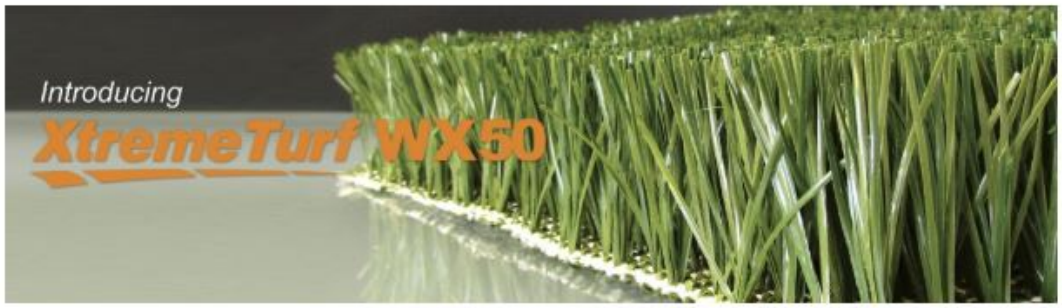
ACT Global introduces woven technology for synthetic turf



FOR IMMEDIATE RELEASE: AUSTIN, TEXAS USA

ACT Global Sports introduces the latest innovation in the synthetic turf industry

ACT Global Sports and Dywilan from Poland have signed a strategic alliance for the development and production of a breakthrough woven technology for football synthetic turf systems. The Xtreme Turf WX50 revolutionary system consists of Xtreme grass fibers locked into a woven backing system. The manufacturing method is unique to all of the previous generations of synthetic grass. One of the key features of Xtreme Turf WX50 is the resiliency of the pile. The fibers stand up straight before any infill is installed. The woven technique also creates a consistently superior ball roll characteristic in all directions due to the distinctive construction.

"The locking in of the pile in the basic triple W formation is tremendous. We are extremely excited to introduce this breakthrough technology to the world of synthetic sports turf after years of development," proclaims Wil Ditzel, Director of ACT Global Sports.

The woven technology of Xtreme Turf WX50 offers high water permeability which results in more playing hours during harsh weather seasons. The product is more environmentally friendly due to the recyclable homogeneous materials used in the system. With the growing concern for synthetic turf manufacturers to be "green" and environmentally safe, Xtreme Turf WX50 is taking a significant step in the right direction

ACT Global Sports is headquartered in Austin, Texas and has regional locations in The Netherlands, Cyprus, Poland, Thailand, Australia, France, The United Kingdom and China. Local sales and support is offered with representatives located in over 50 countries through an expanding partner network of leading sport field contractors. ACT Global Sports is notable for currently being the only company in the world that is a FIFA Preferred Producer for Football Turf, Synthetic Turf Council Certified Manufacturer and holds an ISO 9001 certification. The company also holds an ISO 14001 certification along with state of the art manufacturing on 3 continents and a dedicated research and development center.

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XtremeTurf™

UBU®

MAINTENANCE

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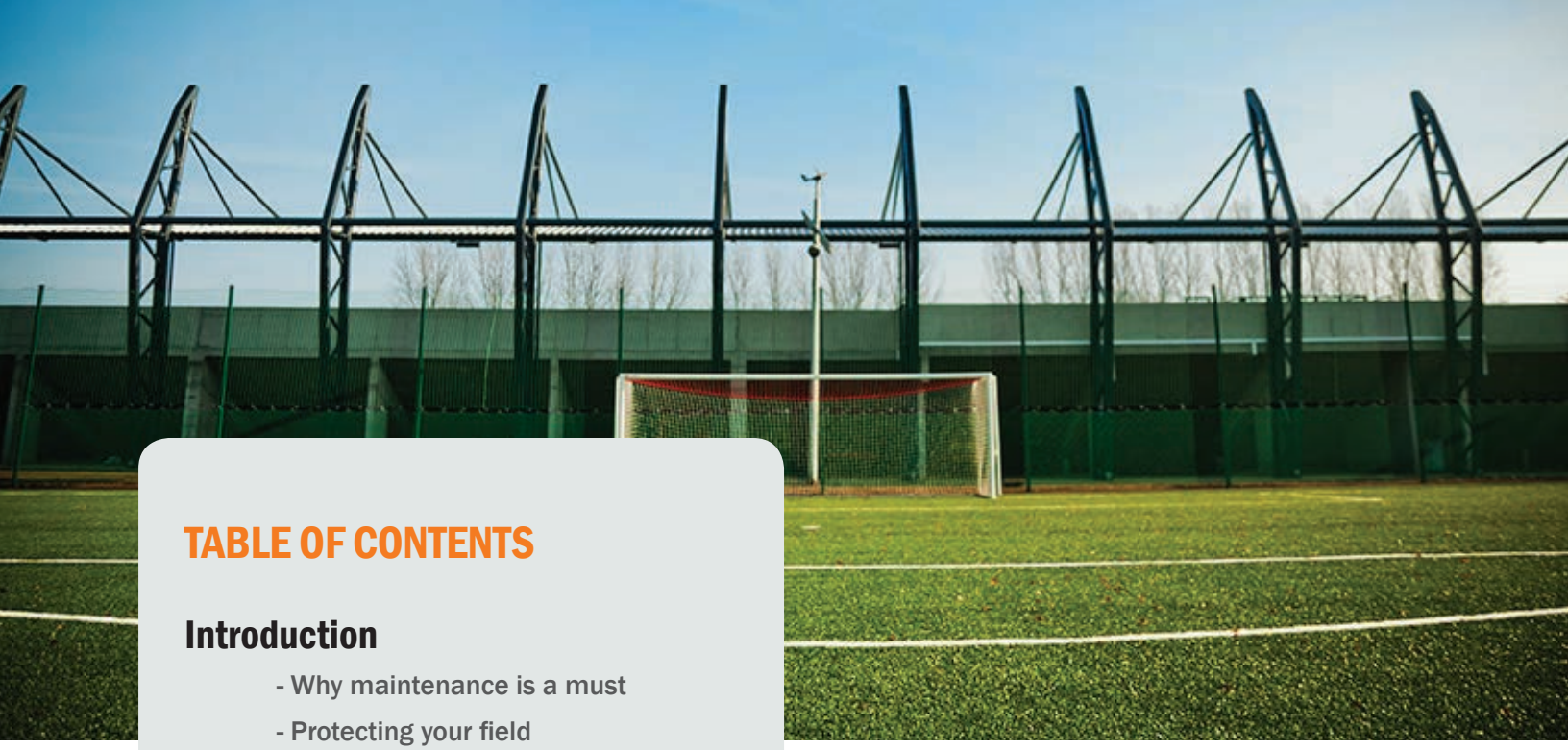
Play More.



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- Snow and ice
- Static Electricity
- Stain Removal
- Equipment Leaks or Spills
- Vehicle use
- Concentrated heavy use protection

FIFA QUALITY LICENSEE

Act Global is a FIFA Quality Licensee for Football Turf, FIH Certified, and World Rugby Preferred Turf Producer.

XtremeTurf™ UBU

INTRODUCTION

To maximize the investment of an Xtreme Turf / UBU field, proper maintenance is essential. Where field owners fail to do the necessary work on a regular basis, fields will start to look ragged, and performance will decline. If fields are not or insufficiently maintained, guarantees will become void and performance criteria may no longer be met. We hope this booklet will give you a clear overview of the general activities required to maintain your field. Please note that these instructions do not take into account possible differences due to climatic circumstances and varied intensity of use. Where and if needed, additional instructions will be given individually by our local representative.

PROTECTING YOUR FIELD

- Do not perform any maintenance or other activity that may invalidate the warranty. Make sure in advance any maintenance equipment, personnel, techniques, repairs and materials comply.
- Budget approximately one hour of inspection and maintenance for every 10 hours of playing time.
- Monitor the performance of your field throughout its useful life with periodic field testing and frequent inspections.
- The following may damage the turf: accidents, vandalism, spiked shoes, animals, wire brushes, fires, fireworks, floods, lightning strikes, chemical reactions, the use of dry cleaning fluids or improper cleaning methods, high pressure sprays exceeding 500 psi, storage of heavymaterials on the field, non-approved infill materials, and non-approved artificial lights.
- Certain activities may damage your field such as bicycle traffic, track and field events, golf activities, concerts, etc. You may consider consulting with a company that sells field protection.
- Suitable footwear should always be used. Metal spikes should be prohibited. For long-pile infilled 3G surfaces, moulded or screw in cleats/studs are preferred. Blades and flat-soled shoes should be avoided as they greatly intensify the wear and tear on synthetic turf. For sand-based 2G surfaces, flat-soled shoes or purpose built dimpled soles will deliver the best experience.
- Perform routine inspections, repairs and maintenance, and more extensive field rejuvenation, on an as needed basis.
- Evenly distribute usage and resulting wear across the pitch to prevent accelerated wear in certain areas. (This applies mainly to fields with cross-field play).

WHY MAINTENANCE

IS A MUST

Keep your Xtreme Turf / UBU field in good condition

•

Avoid degradation of heavily used playing areas and compaction of the infill

•

Live up to your field's warranty requirements

•

Maximize the appearance, playability and longevity of the turf field system

ROUTINE MAINTENANCE

The basic components of effective, routine maintenance include the following. These should be performed on a daily, weekly and/or monthly basis, depending on the level of use.

- Inspections and minor repairs to avoid playing hazards.
- Keep the playing surface clean and free of debris and contaminants.
- Groom the surface to preserve appearance, keep grass fibers upright, and maintain recommended and even infill levels.
- Maintain a detailed maintenance and activity log.

INSPECTIONS & MINOR REPAIRS

It is imperative to report any field damage immediately, and repair quickly to avoid an escalating problem.

Safety Hazards

To avoid permanent damage or safety hazards, check regularly for and address such critical items as foreign debris, low infill levels, open seams, deteriorating grass fiber, drainage concerns, etc.

High Use Areas

Pay special attention to the most heavily used areas (goal mouths, corner areas, etc.) and add new infill or redistribute infill to the recommended depth.

Seams and Joints

Check seams and joints where panels or field markings are joined together. Open joints can create a tripping hazard and should be immediately repaired. An open joint of 12 inches in length or less may not be an indication of seam failure—discuss with your field builder in advance for self-repair techniques and if self-repairs are recommended. Note that open joints of greater than 12 inches in length should be reported to and reviewed with your field builder.

XtremeTurf™ UBU

KEEP THE SURFACE CLEAN

Remove all waste items, organic materials and contaminants on a regular basis. Every loose foreign object, no matter how small, can damage your Xtreme Turf / UBU field by abrading the fibers and/or contaminating the infill. Leaves and other debris can eventually migrate into the system, inhibiting drainage and causing infill compaction. Animal waste can encourage the growth of algae, weed or moss growth. Brushing will help deter organic growth, as will the use of approved fungicides and antibacterial treatments.

Food and Beverage

Don't allow food, drink, chewing gum or tobacco products on the field, and encourage drinks to be consumed away from the play area. Provide ample litter containers on site.

Chemicals and other liquids

Do not use cleaning chemicals containing alcohol or acetone solvents. Take care to avoid spilling any petroleum-based liquids including fuel onto the surface.

- Post signage and rules for the use of the field to avoid contamination and damage.
- If the field is in a flood plain, cover it at the threat of flooding with a tarp designed to limit silt and debris from contaminating the field surface.
- Route field access traffic in such a way as to minimize the tracking of mud and dirt onto the field.

Bodily Fluids/Germs/Disinfectant

If there's an incident involving blood or vomit, note where it happened and spray it down with alcohol/Purell/hand sanitizer or similar (NOT a solvent like lacquer thinner), then dab with a towel. If the spill

REMOVAL OF

Foreign Objects & Contaminants

Chewing gum can best be removed by using either ice or an aerosol to freeze the gum, which can then be chipped or broken off the turf fibers. If gum has been smeared across fibers, peanut butter will soften the gum so that it can be wiped off.

Sunflower seeds, peanut shells, pistachio shells, etc. should be removed by using a hand held or back pack blower. To minimize the movement of infill, do not point nozzle directly into the turf. Use minimal throttle to decrease the volume of air.

Metal objects should be picked up by a magnet that is attached to grooming and brushing equipment.

Moss, mold, or algae may appear in underutilized areas of the synthetic turf, particularly if it is in shade and damp. Specialty products are available. Weeds are easily removed by hand if the infestation has not become too excessive. Treatments are also available.

is water-based, it will eventually evaporate; if the spill is oil based, the infill will have to be removed and new infill put in its place. Gatorade carts and jugs should be placed on tarps to protect the turf from spills. Proactive prevention is far better than reactive remedy.

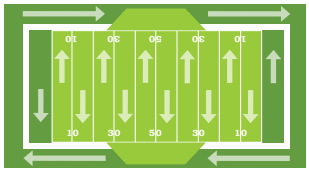
The GreenZapr is a great solution for regular/periodic disinfecting over the entire turf surface. Small areas (if you know where they are) can be managed with OTC antibacterial cleaners. Other types of disinfecting solvents and chemicals can cause strong allergic reactions and be dangerous to athletes; the field would need to have signage placed around it stating that chemicals have been applied.

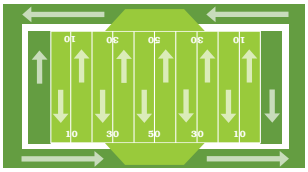
GROOM THE SURFACE & MAINTAIN INFILL LEVELS

Regular brushing (done early in the morning when the fibers are cool) helps to maintain uniform infill levels, keep the grass fibers upright, remove debris, and improve the field appearance and long-term performance.

Keep In Mind:

- Infill should be 15mm below the fiber tips (for 3G surfaces.)
- Improper infill levels or compacted infill can lead to low shock absorption and cause safety concerns.





- High use areas are prone to greater infill displacement.
- Brushing, drag mats and proper rakes can help redistribute infill evenly.
- Infill may accumulate at the edges of a field. If so, clean the material prior to brushing back into the main field.
- Using an infill depth gauge or a nail and tape measure on a grid pattern is the preferred way to measure infill depth and consistency.

Equipment

Use a static brush for general infill leveling and to stand up the grass fibers. A mechanical sweeper or other specialty synthetic turf cleaning equipment should be used to remove surface debris. Do not use maintenance equipment before receiving proper use and safety training. Use only synthetic fiber bristles, not metal or wire bristles. Do not use 6-wheel vehicles.

Method & Direction

Using an average all-purpose vehicle, keep speed low and avoid sharp turns. It is most effective to brush the surface when it is dry.

The surface should be brushed in a number of directions, alternating the direction in consecutive activities, but generally in the direction of the individual panels to avoid crossing over the main seams. On different days, start at different locations so as to alternate the brushing direction for each panel.

Brush Height Setting

The optimum brush height setting will depend on the model and type of equipment, but will generally work best when the brush barely touches the tips of the turf. Do not set the brush so low that it digs into the turf pile or backing.

	Playing hours per week:				
Suggested Maintenance	**< 10 hrs**	**10-20 hrs**	**20-30 hrs**	**30-80 hrs**	**Reason:**
Litter removal	daily	daily	daily	daily	Avoid damage by paper, bottles, chewing gum, athletic tape and such.
Refilling heavily used areas	weekly	weekly	daily	daily	Keep infill even and at the right level.
Brushing heavily used areas	weekly	weekly	weekly	daily	Keep fibres in the optimum upright position.
Total surface brushing	every 2 weeks	every 2 weeks	weekly	weekly	Keep surface in perfect condition.
Leaves, twigs, moss, weed removal	weekly	weekly	weekly	weekly	Avoid pollution and beginning compaction.
Seams inspection	monthly	monthly	monthly	monthly	Avoid field damage by faulty seams.
Specialist maintenance (or as needed)	yearly	yearly	every 6 months	every 6 months	Maintain playing properties and performance.

The above maintenance schedule is meant to assist in clarifying how the number of playing hours influences maintenance needs.

Frequencies

In general, the frequency will be related to the intensity of use; however, excessive brushing can cause fiber damage which over time will compromise the field's performance characteristics and longevity. (*See maintenance schedule on following page.*)

MAINTENANCE ACTIVITY LOG

Keep a maintenance activity log containing the following information:

- Type of activity that takes place on the field
- Estimated number of hours the field is used per week
- Average number of participants per hour
- Type of maintenance activity performed
- Remarks/Notes
- Signature of maintenance supervisor

SEMI-ANNUAL, ANNUAL & AS NEEDED

Situations Requiring Comprehensive Maintenance

Over time, the following situations may arise which will require the need for more comprehensive maintenance:

- Grass fibers become significantly bent, creased and flat.
- The playing surface becomes hard and compacted. While common to infilled systems, this impacts the players and also can create drainage issues.
- Dirt, debris and metal accumulate on or within the system despite routine maintenance.
- Seams become loose or panels shift creating a safety hazard.
- Infill levels become uneven, particularly in high wear areas, such as in front of soccer goals.

COMPREHENSIVE MAINTENANCE

Comprehensive maintenance may include the use of specialty maintenance equipment by trained professionals. Depending upon the situation, the following

actions may be performed:

Professional Field Inspection & Corrective Action

Assess the field surface, identify weak or loose seams and inlays, and repair the damage. Sport performance testing may also be desirable.

Decompaction Of Infill

Infill decompaction is important for improving shock absorption and synthetic turf drainage. Use only equipment specially designed for this purpose.

Restore Infill levels

Infill levels may decrease due to a variety of reasons—wind, storms, or may leave the field on players clothing or shoes—and over time the levels may need to be replenished. Replacement infill should meet the field's specifications.

Metal Removal

Use a magnet attached to your maintenance equipment to remove ferrous metal objects from the field.

Weed & Pest Treatment

Treat with herbicides or pesticides, as required.

FIELD REJUVENATION

Field rejuvenation is a deep compaction and deep cleaning of your field's infill, and should be performed on an as needed basis. As fields mature, the accumulation of unwanted or foreign contaminants is inevitable, especially deep within the infill layer. Events, such as flooding or dust storms, may introduce extreme levels of contamination. When a field begins to show signs of deep compaction, such as high g-max readings or significant drainage issues, full field rejuvenation may be desired. These maintenance services are performed using specialized field rejuvenation equipment and personnel and may include:

- Removal of the vast majority of dirty and contaminated infill to get rid of embedded foreign matter that has contaminated the infill system
- Untangling matted and compacted fibers
- A combination of cleaning of the original infill and/or re-installation of new infill
- Removal of dust, debris and application of a disinfectant to treat for bacteria, if the original infill will be processed and cleaned
- Use special equipment that combines mechanical brushing, suction, and an infill return system to remove surface debris and embedded contaminants.

SPECIAL CONSIDERATIONS

Field Markings

Temporary paints can be used if formulated specifically for synthetic turf. Ideally, paint should be applied only to the turf fibers, and not into the infill; although this will not be possible if infill levels are too high. Remove and reapply paint after a maximum of four applications to avoid build-up. Service companies with specialized equipment are available that can paint and remove lines, logos, end zones, graphics, etc.

Heavy Rain

If significant ponding occurs after heavy rainfall, it may be an indication of a variety of factors, such as clogged or damaged underground drain pipes or discharge outlets, base unevenness, debris in the infill, or infill surface tension. For infill surface tension, a surfactant or laundry fabric softener can be used to break the surface tension allowing the turf to drain.

Snow & Ice

Generally snow and ice should be left to melt and drain

off the system without assistance. If the sun is out and the ice or frost is not excessive, it tends to melt rapidly, especially when players are on the field.

At times, however, it is necessary to remove snow or ice to make the field playable for a scheduled event. The working principle for removing snow is to do so as near game time as possible. Use only pneumatic tires on equipment used for the removal of snow and ice. If a snow plow is used, make sure the blade is guarded with PVC pipe and corner elbows or rubber tips, and the height is adjusted to leave ¼-½" inch of snow on the surface. The remaining snow should be left to melt in the sunlight as brushing the remaining snow may also remove the infill. Avoid using a tarp on the field during freezing weather. Tarps, unless vinyl or poly-coated, can freeze to the surface, and will be very difficult to remove.

In some cases it may be necessary to use a weighted lawn roller over the field to break up ice. The broken ice can then be swept off the field.

Static Electricity

Surfactants like liquid laundry fabric softeners can reduce static electricity.

Stain Removal

Most stains can be removed easily with a solution of hot, but not boiling, water and a mild household detergent. Brush the stain with a stiff bristle brush, scrub the area with soap and water, rinse with clean water, and pat dry.

Equipment Leaks or Spills

Prevent leaks or spills by checking equipment and its components thoroughly before use on turf; do not fill fuels, oils, fluids while equipment is on the field. Wipe any excess grease from any/all fittings.

HYDRAULIC FLUID & MOTOR OIL: Petroleum-based spills can damage the synthetic turf. Use only the newer biodegradable fluids, if available for your equipment—don't use petroleum-based fluids. If a leak occurs when using petroleum-based fluids, use spill leak towels to soak up the majority of the fluid. Vacuum out the infill in the affected area, use a solution of household dishwashing liquid and water to break down and clean any remaining fluid from the turf. Once the turf is clean, you will need to install new infill.

GASOLINE AND DIESEL: Don't fill equipment while it is on the turf. Do not overfill. Use a catch pan while filling to prevent accidental spillage.

GREASE: Use grease sparingly and wipe any excess off of all fittings, bearings, chains, etc.

VEHICLES

- Do not park vehicles on the field, especially in the heat of the day, or leave vehicles on a wet or hot field for long periods of time.
- Engine exhausts should not be faced down toward the playing field, and a hot muffler or exhaust pipe should not touch the surface.
- Use lighter vehicles with LGP (Low Ground Pressure) tires with round edges to prevent rutting. Do not use cleated or traction tires.
- Heavy vehicles (over 300 pounds) should have a maximum tire pressure of 35 psi.
- Make wide, not sharp, turns, and only when the vehicle is in motion. All vehicles should move at slow speeds. Avoid abrupt and sudden braking, as well

as sudden acceleration or spinning of the wheels, especially on wet surfaces.

- All vehicles must be checked before use on the field to determine if they are leaking oil or gas. If so, they should be repaired before entry onto the field.

Concentrated Heavy Use Projection

Stages and Special Events

Stage or other set-ups for special events or activities, such as graduations, are normal. Proper field protection of the synthetic turf must be provided to prevent damaging it. Use plywood, interlocking plastic panels or similar weight distributing materials under all chairs and tables— consult the field builder or a field protection company. Use field protection that does not have a dimensional profile, e.g., corrugation, because the profile will transfer onto the turf and require heavy grooming to remove. No anchoring spikes, posts or footing should be driven into the turf. Once the field protection is removed, the area should be groomed and swept with a magnet to remove any misplaced or dropped nails, screws, etc.

Helicopter Landings

Helicopter landings may be necessary to remove an injured player, for example and the rotor wash will likely cause infill to be displaced. As soon as possible evaluate the area and groom or brush as needed.

Protecting During Renovations

Protect the synthetic turf as needed with approved tarps when nearby renovations, e.g., running track recoats or installations, cleaning or painting of bleachers, construction or repairs to lighting, renovations of adjacent natural turf fields, etc., may cause harm to the synthetic turf. Contact the field builder for a protection recommendation. Improper plastic protection will cause heat damage.

ACTGLOBAL™

MAINTENANCE MANUAL

Sample Usage Log

XtremeTurf™ UBU

Date (d/m/y)	Start Time	Stop Time	Hours Used	Baseball	Field Hockey	Football	Lacrosse	Rugby	Soccer	Softball	Other (Specify)	Responsible Person (Print)	Signature
/ /	AM PM	AM PM											
/ /	AM PM	AM PM											
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ACTGLOBAL™

MAINTENANCE MANUAL

Sample Turf Maintenance Log

XtremeTurf™ UBU

20 POINT FIELD SAFETY INSPECTION	
01	20 point infill depth check
02	Inspection of all seams
03	Inspection of hash marks
04	Inspection of numbers
05	Inspection of Arrows
06	Inspection of Logos
07	Inspection of endzone lettering
08	Inspection of five yard lines
09	Inspection of perimeter lines
10	Inspection of sideline areas
11	Inspection of secondary sports lines
12	Inspection of crease and goal areas
13	Inspection of entrance attachments
14	Inspection of surface area drains
15	Inspection of field insets
16	Inspection of field surface perimeter attachment
17	Inspect all lines for straightness
18	Inspect infill depth along field surface perimeter
19	Visual planarity inspection
20	Inspect entire area for irregularities and non-uniform areas

TURF MAINTENANCE LOG

DATE	DESCRIPTION/NOTES	FIELD GROOMING	GMAX TEST REPORT	30 MINUTE MAINTENANCE TRAINING SEMINAR	MAINTENANCE EQUIPMENT INSPECTION	20 POINT FIELD SAFETY INSPECTION	MAINTENANCE CERTIFICATE ISSUED	GENERAL CLEAN AND MINOR STAIN REMOVAL	24 HOUR EMERGENCY REPAIR SERVICE	FIELD INFILL CARIFICATION	FIELD SPRAY TREATMENT	FIELD INFILL REMOVAL	PRINT NAME	INITIALS

POWERBASE YSR
BY BROCK

Specification & Typical Properties

Product Number	PB2000YSR258
Material Type	Expanded Polypropylene Composite containing up to 23% by volume pre-consumer and/or reground post-consumer recycled material
Part Format	Interlocking panel
Part Size, nominal net coverage	24.15 sq ft per panel (2.24 sq m)
Material Density, nominal	3.62 lbs / cubic ft (58.0 g per l)
Part Thickness, nominal	1.00 in (25 mm)
Part Length, nominal	73.5 in (1867 mm)
Part Width, nominal	49.0 in (1245 mm)
Part Weight, nominal	5.56 lbs per panel (2.52 kg)

Property	Typical Value	Specification	
Tensile Strength	99 psi	> 45 psi	ASTM D3575-08
Tensile Elongation	38%	>10%	ASTM D3575-08
Vertical Permeability	978 in / hr	> 300 in / hr	ASTM F1551: EN 12616/DIN 18-035, Part 6
Lateral Transmissivity			ASTM D4716
Flow Rate @ .005 Gradient	0.62 gpm/ft	>0.47 gpm/ft	
Flow Rate @ .0075 Gradient	0.80 gpm/ft	-	
Flow Rate @ .01 Gradient	0.96 gpm/ft	-	
Flow Rate @ .015 Gradient	1.23 gpm/ft	-	
Linear Thermal Expansion per 1° C change	0.0833 mm/m	< 0.15 mm/m/°C	ASTM D696-03
Compression Strength			ASTM D1621-10
@ 25% strain	31 psi	> 25 psi	
@ 50% strain	42 psi	> 40 psi	
@ 75% strain	78 psi	-	
Compression Set – static load (35 psi, 900 sec at 23°C, meas. after 48 hrs)	2%	< 5%	Brock test protocol
Compression Set – repeated impacts (35 psi, repeated load, 10,000 cycles, after 24 hrs)	12%	< 15%	Brock test protocol
Friction Coefficient movement of artificial turf over 50mm			
maximum force	2.44 lbs max force	> 1.80 lbs max force	Brock test protocol
average force	1.35 lbs avg force	> 1.00 lbs avg force	
Head Injury Criterion – Critical Fall height (2" turf, 65/35 sand/rubber over concrete)	1.7m	1.4m	ASTM F355-E / ASTM F1292
Force Reduction (shock absorption)	70%	50%	EN 14808
Vertical Deformation	6.7mm	12mm	EN 14809
Gmax	80 g	100 g	ASTM F355-A
Environmental Standards Testing			
Cradle to Cradle	Certified	Certified	EPEA Cradle to Cradle
California Proposition 65	Pass	Pass	California Proposition Update effective 06 JUNE 2014
California Title 22	Pass	Pass	California Code of Regulations, Title 22, Division 4.5, Chapter 11
Resistance to Acid and Alkaline Liquids			EN 14030:2010
% tensile strength loss - 100yr model	0% after 12 days	-	ISPO 12960:1998
Resistance to Oxidation (Accelerated Aging)			EN ISO 13438:2004
% tensile strength loss - 100yr model	6% after 56 days @ 110°C	-	
Microbiological Analysis			
bacteria resistance	No growth	No growth	ASTM G22-76
fungi resistance	No growth	No growth	ASTM G21-96

Material Safety Data Sheet

Important: Read this MSDS before handling and disposing of this product. Pass this information on to all employees, customers and users of this product. This is covered by the OSHA Hazard Communication Rule and this document has been prepared in accordance with the MSDS requirements of this rule.

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Product Name: Brock PowerBase YSR

Company:
Brock USA
2840 Wilderness Place
Boulder, Colorado 80301
USA

Company:
JSP Specialty Foams Division
150 East Brook Lane
Butler, PA 16002
USA

For product information assistance:
Toll-free + 1 (877) 276-2587

SECTION 2 — COMPOSITE INFORMATION ON INGREDIENTS

	CAS No.	Composition by Volume
Polypropylene/Ethylene Copolymer	9010-79-1	100%

SECTION 3 — HAZARDS IDENTIFICATION EMERGANCY OVERVIEW

Health Hazards: Inhalation Hazard - particulates / dust
Dust may be an eye irritant

Physical Hazards: May produce dust on handling

SECTION 4 – FIRST AID MEASURES

General: In case of an accident or if you feel unwell, seek medical advice IMMEDIATELY.

Inhalation: Remove victim to fresh air immediately. Obtain emergency medical attention if breathing difficulty persists beyond 15 minutes.

Eye Contact: If eye contact occurs, rinse the exposed eye(s) with clean water for 20-30 minutes.

Skin Contact: Not expected to present a significant skin hazard under anticipated conditions of normal use.

Ingestion: Not expected to present a significant ingestion hazard under anticipated conditions of normal use.

Emergency Medical Treatment Procedures: Treat symptomatically.

Detoxification Procedures: After adequate first aid, no further treatment is required, unless symptoms reappear.

SECTION 5 – FIRE FIGHTING MEASURES

Fire and Explosion Hazard: Heat from fire may melt, decompose, and generate flammable vapors.

Extinguishing Media: Dry chemical, CO_2, Foam, Water.

Fire-Fighting Procedures: Do not enter fire area without proper protection. Fight from a safe distance/protected location. For fire, use lots of water as straight stream to "dig" into hot molten mass from outside to open up. Cool interior/prevent re-ignition; spray/fog for surface cooling. Keep above burning material.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

If handling results in dust generation of high temperatures, local exhaust ventilation should be provided.

Substance	Source	Date	Type	Value/Units	Time
Skin					
Particulates Not Otherwise Regulated No (Total Dust)	OSHA	1989	TWA	15MG/M3	8 HRS
Particulates Not Otherwise Regulated No (Respirable Fraction)	OSHA	1989	TWA	15MG/M3	8 HRS
Nuisance Particulates No	ACGIH	1992	TWA	10MG/M3	8 HRS

SECTION 7 – HANDLING AND STORAGE

Product should be stored away from any heat/ignition source. Adequate exhaust ventilation should be provided when handling results in dust or particulate generation.

SECTION 8 – EXPOSURE CONTROUPERSONAL PROTECTION

Eye: Dust service goggles should be worn to prevent mechanical injury or other irritation to eyes due to airborne particles, which may result from handling this product.

Skin: Not normally considered a skin hazard. Where use can result in skin contact, practice good personal hygiene. Wash hands and other exposed areas with mild soap and water before eating, drinking, smoking, and when leaving work.

General: Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet facilities. Promptly remove soiled clothing and wash thoroughly before reuse.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point: N/AP **Viscosity:** N/AP **Dry Point:** N/AP

Freezing Point: N/AP **Solubility in Water:** Negligible **Specific Gravity:** >0.07@39.2°F

Material Safety Data Sheet

SECTION 10 – STABILITY AND REACTIVITY

Hazardous Decomposition Products: Highly unlikely under normal conditions and use.

Stability: Stable **Hazardous Polymerization:** Not expected to occur

SECTION 11 – TOXICOLOGICAL INFORMATION

Component	Component Health Hazard
Polypropylene/Ethylene Copolymer	No significant hazards

SECTION 12 – ECOLOGICAL INFORMATIONS

N/AP

SECTION 13 – DISPOSAL CONSIDERATION

Landfill solids at permitted sites. Use registered transporters. Comply with federal/state/local regulations for solid waste disposal. Solids may be burned, and fired with supplemental fuel. Avoid flameouts. Assure emissions comply with applicable regulations. Contaminated product, soil or water should not be designated RCRA hazardous waste.

SECTION 14 – TRANSPORT INFORMATION

N/AP

SECTION 15 – REGULATORY INFORMATION

Colorado Right-To-Know Substance Lists
Special Hazardous Substances (CO-SHS) must be identified when present in materials at levels greater than the state specified criterion. Environmental Hazards (CO-EH) must be identified when present in materials at levels greater than the state specified criterion. Components with CAS numbers present in this material, at levels specified in section 9 – components do not require reporting under the statute.

SECTION 16 – OTHER INFORMATION

Some of the information presented and conclusions drawn herein are from sources other than direct test data on the material itself.

Disclaimer of Liability

The information in the MSDS was obtained from sources which we believe are reliable, HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRENTY, EXPRESS OR IMPLIED, REGARDING ITS CORRECTNESS

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

This MSDS was prepared and is to be used only for this product.

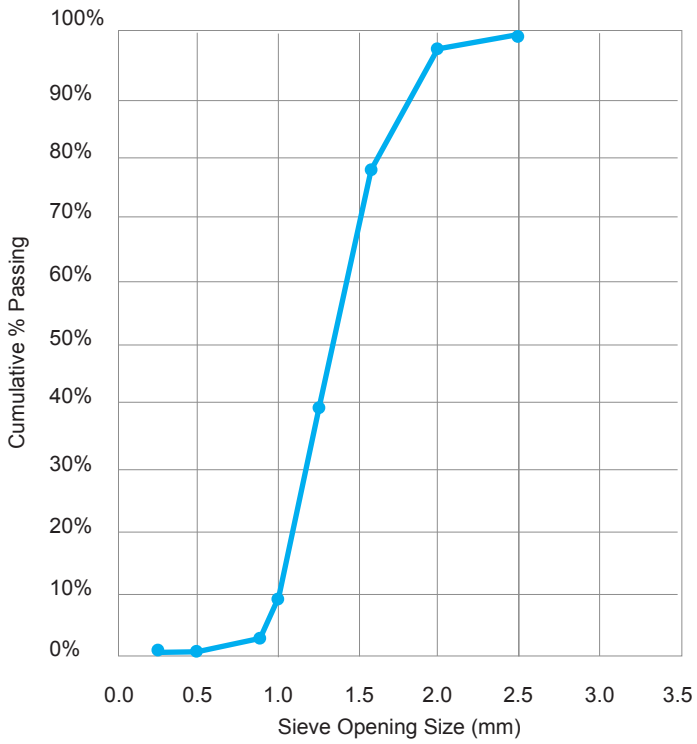
BROCKFILL
THE ENGINEERED INFILL FOR ATHLETES

Typical Properties & Specification

Product Name	BrockFILL™
Product Description	Artificial turf infill made from engineered wood particles
Bulk Density	17 lbs / cu ft.
Packaging	45 cu. ft Supersacks (approx. 765 lb) or 40 lb bales
Moisture Content	10-15% (at time of production)
Color	Natural to Medium Brown

Sieve Analysis - Typical Results
(In accordance with BS EN 933-1:2012)

Sieve Size (mm)	% Passing	Typical Range
2.50	100	95-100%
2.00	98	90-100%
1.60	78	65-90%
1.25	39	30-50%
1.00	9	5-15%
0.80	3	0-5%
0.50	1	0-5%
0.32	1	0-3%



Test	Method	Result
Pesticide Testing	AOAC Method 2007.01	PASS
Chlorinated Acidic Herbicides	FDA PAM II Method 180.292	PASS
CAM 17 Metals and Hexavalent Chromium	EPA Method 3050B; EPA Method 6020	PASS
Leachable CAM 17 Metals and Hexavalent Chromium	EPA Method 1312; EPA Method 6020	PASS
Leachable Semi-Volatile Organic Compounds including Phenols	EPA Method 1312; EPA Method 8270C	PASS

DATA ARE TYPICAL PROPERTIES ONLY. THIS DOCUMENT DOES NOT CREATE ANY WARRANTY, EXPRESS OR IMPLIED
Test reports available upon request
Patent Pending

Brock USA LLC - September 2018

MILLENNIUM
CONSULTING ASSOCIATES
A MECA Consulting, Inc. Company

"Providing Premiere Environmental & Industrial Hygiene Services since 1986"

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Oakland, CA 94621
925.808.6700
www.mecaenviro.com

October 16, 2018 Project 2054.2000

Mr. Steve Keyser
COO and VP of Engineering
3090 Sterling Circle Suite 102
Boulder, Colorado 80301

Subject: Environmental Compatibility Testing of Brock Organic Infill

Dear Mr. Keyser:

Millennium Consulting Associates (Millennium) is pleased to submit this letter report to Brock International (Brock) regarding environmental compatibility testing of a softwood-based organic infill.

PROJECT UNDERSTANDING

Brock has developed a softwood-based organic infill for use in synthetic turf systems. Brock has requested that Millennium perform an environmental compatibility analysis to determine if the infill has the potential to impact human health through direct exposure or the potential to degrade groundwater whose beneficial uses include municipal water supply or to degrade surface water whose beneficial uses include freshwater aquatic habitat. This analysis will also address if the infill may have any end-of-life waste disposal concerns.

LABORATORY ANALYSIS

Total Pesticides

A sample of the organic infill was shipped under chain-of-custody to Pacific Agricultural Laboratory (PAL) of Sherwood, Oregon. PAL analyzed the sample for a comprehensive profile of approximately 250 pesticide residues using AOAC Method 2007.01 (Pesticide Residues in Foods by Acetonitrile Extraction and Partitioning with Magnesium Sulfate; Quechers Method). No pesticide residues were detected above the method limit of quantitation (LOQ). No analytical problems were encountered.

Total Chlorinated Acidic Herbicides

The organic infill was analyzed by PAL for total chlorinated acidic herbicide residues using FDA PAM II Method 180.292 (GC-MS/MS). No chlorinated acidic herbicide residues were detected above the method LOQ. No analytical problems were encountered.

Total CAM 17 Metals and Hexavalent Chromium

A sample of the organic infill was shipped under chain-of-custody to McCampbell Analytical of Pittsburg, CA. The organic infill was extracted using EPA Method 3050B (Acid Digestion of Sediments, Sludges, and Soils) and analyzed for total CAM 17 metals using EPA Method 6020 (Inductively Coupled Plasma – Mass Spectroscopy; ICP-MS). The organic infill was also extracted using EPA Method 3060A (Alkaline Digestion for Hexavalent Chromium) and analyzed for hexavalent chromium using EPA Method 7199 (Determination of Hexavalent Chromium in Drinking Water, Groundwater, and Industrial Wastewater Effluents by Ion

Chromatography).Table 1 compares the results of total metals testing to guideline values developed for the protection of human health and threshold values for the characterization of hazardous waste. No metals were detected above guideline values for the protection of human health or threshold values for the characterization of hazardous waste. No analytical problems were encountered.

Leachable CAM 17 Metals and Hexavalent Chromium

The organic infill was extracted using EPA Method 1312 (Synthetic Precipitation Leachate Procedure; SPLP) with deionized water and analyzed for the CAM 17 suite of metals using EPA Method 6020. The organic infill will be extracted using EPA Method 1312 with deionized water and analyzed for hexavalent chromium using EPA Method 7199. Table 2 compares the results of leachable metals with target leachate concentrations developed for the protection of surface water and groundwater whose beneficial uses include municipal water supply and cold freshwater aquatic habitat. No metals were detected above laboratory reporting limits and all laboratory limits were below their respective target leachate concentrations.

Leachable Semi-Volatile Organic Compounds including Phenols

The organic infill was extracted using the Synthetic Precipitation Leachate Procedure (SPLP; EPA Method 1312) with deionized water. The extract was analyzed for semi-volatile organic compounds including phenols using EPA Method 8270C (Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectroscopy (GC/MS). No semi-volatile organic compounds were detected above the method detection limit. The laboratory control spike (LCS)/laboratory control spike duplicate (LCSD) for N-Nitrosodi-n-propylamine were slightly outside of control limits. This qualifier does not affect the validity of the results.

DISCUSSION

Total pesticide and chlorinated acidic herbicide residues were not detected above the method limit of quantitation in the softwood-based organic infill. The infill does not contain concentrations of total heavy metals that exceed guideline values for the protection of human health or threshold values for the characterization of hazardous waste. Leachable heavy metals from the infill were not detected above the method detection limit.

Sincerely,

Millennium Consulting Associates

David Teter, PhD, PE, QSD
Director, Engineering and Environmental Services

Attachments:
Tables 1-2
Laboratory Analytical Reports

HUNTRESS ASSOCIATES
Landscape Architecture & Land Planning

January 22, 2019

Mr. Joe Sullivan
Daedalus Projects, Inc.
One Fanuel Hall Marketplace, South Market Building
Floor 3, Suite 4195
Boston, MA 02109

Re: Martha's Vineyard Regional High School – Athletic Field Master Plan

Dear Mr. Sullivan;

I have reviewed the follow-up questions provided by the MVRHS Facilties Sub-committee. The following is full detail of the questions asked and our response.

Follow-up Questions

1. **Please expand your thoughts on Gmax ratings and what MVRHS could expect from the proposed synthetic turf system. Also, provide and educated guess on the Gmax rating of our current natural grass fields.**

   Response: *Gmax ratings are a measure of the firmness of the athletic field. This test can, and often is, performed on both natural and synthetic turf fields. The test results are measured on a scale of 0 – 200, with a reading of 200 being similar to a concrete surface. ASTM is reviewing a testing procedure that would identify any Gmax result above 165 to be unsafe for play at any level.*

   A very well-maintained natural grass field can be expected to test between 90-110, which is often the case for NCAA Division 1 or FIFA Certified Soccer Fields which are limited to game use only. The system we are recommending for the synthetic turf fields at MVRHS would allow a Gmax range from 90 to 125, with a guarantee that the field would not exceed 125 during the eight (8) year warranty period.

   We have not been authorized to have Gmax tests performed the natural grass fields at MVRHS. Given our experience on similar natural grass fields, I would estimate they are in excess of 165. We recommend that MVRHS have Gmax tests performed on all their existing natural grass fields.

2. **How long should a natural grass field grow in before use is allowed.**

   Response: *We typically recommend two (2) growing seasons on a field grown from seed to allow for adequate root growth prior to the first use. This typically results in a one (1) year delay before use of field. A sodded field can often be used within 4-6 week of completion.*

3. **Include Huntress' recommendation assuming we would not allow youth/adult programs to use our fields.**

Response: *The total existing use on your existing five (5) fields is 1400 events per year. The current youth and adult use totals 450 events per year. If you remove the current youth and adult use and allow only the 950 events associated with the High School sports teams, your use hours per field would be approximately 475 hours. Although this use is lower than the 680 hours recommended by STMA guidelines, it still represents a significant annual use per field. Over the last 25 year of my experience I have not seen a client reduce activity and use on their fields as implied above. I would be concerned that should the MVRHS decide today to remove the youth and adult programs that the decision would be reconsidered in the future and the use would likely return. Given the history of use and maintenance on your High School fields, our recommendations made in the December 18, 2018 report remain unchanged.*

4. **Explain the assumption of 2.5 Hours/Event in the Usage #'s and why it is accurate/appropriate in our case.**

   Response: *The Sports Turf Managers Association (STMA), recommends that a natural grass athletic field can support a maximum range of 680 to 820 hours of use per year depending on the location and soil conditions of the field in question. Additionally, STMA studies show that average event hours range from 2.76 to 3.25 hours per athletic event. These events include practices, games and special events. For the purpose of this study we use a conservative number of 2.5 hours per event. Actual time of events may vary.*

5. **Add an analysis of the life-cycle costs of Natural vs Synthetic Grass so we can understand the long-term costs of each (both capital costs & maintenance costs)**

   Response: *See attached Probable Long-Term Costs for both Natural Grass and Synthetic Turf.*

6. **Add comparison to other relevant projects. Specifically - Nantucket has a synthetic turf field.**

   Response: *I am not familiar with the turf field on Nantucket, and I am not sure what comparison is being requested. I would be happy to discuss this in person with the committee at our meeting on January 23rd.*

7. **Include information on types and quantities of Fertilizer, Weed Control, and Disease/Pest Control chemicals recommended for Natural Turf maintenance.**

   Response: *We have provided a draft Annual Turf Maintenance Program as part of our December 18, 2018 report. I have attached it here for your records. For specific fertilizer, pesticide and weed control recommendations, including rate and frequency of application, we would have to complete detailed soil testing on your fields. Soil testing requirements are also included in the attached draft Annual Turf Maintenance Program.*

8. **Amount of H2O recommended for Natural Turf field maintenance.**

   Response: *A standard multi-use athletic field of 360' x 200' requires between 1" to 2" of water per week from May through October. The amount of water is directly related to the type of soil*

and drainage system installed in the field. The result is approximately 500,000 gallons of water per year per field. Varying soil conditions may increase the amount of water needed.

9. **Specificity on recommended Synthetic Turf and Infill materials**

   Response: *A specific recommendation was made in our December 18, 2018 report and includes the following manufacturers and products. Please refer to our 12/18/18 report for product information, maintenance recommendations, specifications and MSDS data sheets.*

   1. ***Synthetic Turf Products:***
      a. *Greenfields Woven Turf System – MX Elite*
      b. *ACT Global Woven Turf System – Extreme Turf WX50*

   2. ***Synthetic Turf Underlayment***
      a. *Brock USA – Power Base YSR Resilient Pad*

   3. ***Synthetic Turf infill Material***
      a. *Brock USA – Brockfill (Organic Infill)*

10. Any additional information on timing/phasing for moving our football field/constructing a track, along with moving the affected softball/other fields, and improvements to current track area/football practice field.

    Response: *Depending on the time of year the project breaks ground, you could expect between 6-9 months for construction of all phase one improvements.*

Please feel free to call with any further questions or concerns.

Sincerely;
Huntress Associates, Inc.

Christian C. Huntress
President

Att:

ESTIMATE OF PROBABLE LONG TERM COSTS

Project: Martha's Vineyard Regional High School - Athletic Field Master Plan
Project Manager: CCH
Client: Martha's Vineyard Regional High School
Plan Title: NATURAL GRASS FIELD - 20 YEAR COST ANALYSIS

Date: February 02, 2019

By: Huntress Associates, Inc.
17 Tewksbury Street
Andover, MA 01810

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
NATURAL GRASS FIELD - 20 YEAR COSTS ANALYSIS (Years 1-10)				
NATURAL GRASS FIELD - INSTALLATION				
Natural Grass Field - Subbase & Drainage Construction	98,500	sf	$1.20	$118,200.00
Natural Grass Field - Irrigation	98,500	sf	$0.35	$34,475.00
Natural Grass Field - Topsoil Installation	3,648	cy	$24.00	$87,552.00
Natural Grass Field - Soil Amendments	98,500	sf	$0.16	$15,760.00
Natural Grass Field - Slice Seed, Hydroseed & Fertilize	98,500	sf	$0.19	$18,715.00
Subtotal				**$ 274,702.00**
MAINTENANCE				
Natural Grass Field Maintenance	10	Years	$25,084.00	$ 250,840.00
Subtotal				**$ 250,840.00**
TOTAL				**$ 525,542.00**
FIELD COST PER HOUR	**Hours**	**Years**	**Total Hours**	**Cost/Hour**
Field cost by annual use hours (years 1-10)	425	10	4,250	**$ 123.66**

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
NATURAL GRASS FIELD - 20 YEAR COSTS ANALYSIS (years 11-20)				
NATURAL GRASS FIELD - RENOVATION				
Natural Grass Field - 10 Year Renovation	1	allow	$150,000.00	$150,000.00
Subtotal				**$ 150,000.00**
MAINTENANCE				
Natural Grass Field Maintenance	10	Years	$ 25,084.00	$ 250,840.00
Subtotal				**$ 250,840.00**
TOTAL				**$ 400,840.00**
FIELD COST PER HOUR	**Hours**	**Years**	**Total Hours**	**Cost/Hour**
Field cost by annual use hours (years 11-20)	425	10	4,250	**$ 94.32**

* Based upon existing use in 2018
* Based upon 2019 costs

ITEM	Hours	Cost/hour	Product Cost	TOTAL
NATURAL GRASS FIELD - ESTIMATED ANNUAL MAINTENANCE COSTS				
Mowing & Trimming (28 cuttings @ 2.25 hours ea)	63	$42.39	$0.00	$2,670.57
Aeration, 5 times per year	40	$42.39	$0.00	$1,695.60
Fertilizer @ 4.9#s N / Year	12	$42.39	$2,295.00	$2,803.68
Soil Amendments	3	$42.39	$551.04	$678.21
Herbicide Applications	3	$42.39	$45.32	$172.49
Pre-emergent	3	$42.39	$158.65	$285.82
Weed Control - spot spray	3	$42.39	$40.00	$167.17
Game Day Prep - Soccer (1.5 hours x 6 games)	9	$42.39	$500.00	$881.51
Game Day Prep - Football (2.5 hours x 6 games)	15	$42.39	$750.00	$1,385.85
Weekly Practice Prep - All Sports (6.0 hours x 28 weeks)	168	$42.39	$500.00	$7,621.52
Overseeding	30	$42.39	$1,710.00	$2,981.70
Insecticide Applications	8	$42.39	$623.10	$962.22
Irrigation (Operation & Repair)	8	$42.39	$1,500.00	$1,839.12
Verti-drain Decompaction	8	$42.39	$600.00	$939.12
TOTAL	**373**	**$42.39**	**$9,273.11**	**$25,084.58**

* Based upon actual employee cost/hour provided by MVRHS.

ESTIMATE OF PROBABLE LONG TERM COSTS

Project: Martha's Vineyard Regional High School - Athletic Field Master Plan
Project Manager: CCH
Client: Martha's Vineyard Regional High School
Plan Title: SYNTHETIC TURF FIELD - 20 YEAR COST ANALYSIS

Date: February 02, 2019

By: Huntress Associates, Inc.
17 Tewksbury Street
Andover, MA 01810

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
SYNTHETIC TURF FIELD - 20 YEAR COSTS ANALYSIS (Years 1-10)				
SYNTHETIC TURF FIELD - MATERIALS				
Synthetic Turf - Subbase & Drainage Construction	98,500	sf	$ 3.50	$ 344,750.00
Synthetic Turf - Provide & Install New Multi-Purpose Synthetic Turf	98,500	sf	$ 4.50	$ 443,250.00
Synthetic Turf - Resilient Underlayment	98,500	sf	$ 1.50	$ 147,750.00
Synthetic Turf - Alternative Infill	98,500	sf	$ 0.50	$ 49,250.00
Subtotal				**$ 985,000.00**
MAINTENANCE				
Synthetic Turf Field Maintenance	10	Years	$ 7,454.28	$ 74,542.80
Subtotal				**$ 74,542.80**
TOTAL				**$ 1,059,542.80**
FIELD COST PER HOUR	**Hours**	**Years**	**Total Hours**	**Cost/Hour**
Field cost by annual use hours (years 1-10)	1,375	10	13,750	**$ 77.06**

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
SYNTHETIC TURF FIELD - 20 YEAR COSTS ANALYSIS (years 11-20)				
SYNTHETIC TURF FIELD - MATERIALS				
Synthetic Turf - Remove & Dispose of Existing Synthetic Turf	98,500	sf	$ 0.50	$ 49,250.00
Synthetic Turf - Provide & Install New Multi-Purpose Synthetic Turf	98,500	sf	$ 4.50	$ 443,250.00
Synthetic Turf - Alternative Infill	98,500	sf	$ 0.50	$ 49,250.00
Subtotal				**$ 541,750.00**
MAINTENANCE				
Synthetic Turf Field Maintenance	10	Years	$ 7,454.28	$ 74,542.80
Subtotal				**$ 74,542.80**
TOTAL				**$ 616,292.80**
FIELD COST PER HOUR	**Hours**	**Years**	**Total Hours**	**Cost/Hour**
Field cost by annual use hours (years 11-20)	1,375	10	13,750	**$ 44.82**

* Based upon existing use in 2018
* Based upon 2019 costs

ITEM	Hours	Cost/hour	Product Cost	TOTAL
SYNTHETIC TURF FIELD - ESTIMATED ANNUAL MAINTENANCE COSTS				
Field Grooming & Sweeping (16 time @ 2.25 hours ea)	36	$42.39	$0.00	$1,526.04
Topdressing and leveling Infill	16	$42.39	$1,000.00	$1,678.24
Seam repair and warranty issues (no charge for the first eight years)	-	$0.00	$500.00	$500.00
Gmax Impact Testing (one time annually)	-	$0.00	$1,250.00	$1,250.00
Deep Tine Cleaning (two times annually)	-	$0.00	$2,500.00	$2,500.00
TOTAL	**52**	**$42.39**	**$5,250.00**	**$7,454.28**

* Based upon actual employee cost/hour provided by MVRHS.

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, equipment and materials required to furnish, install, construct and perform all field maintenance work complete as specified herein. Contractor shall maintain all field areas including minimum 20-ft beyond field or to adjacent pathways whichever is greater as outlined below. All work will be coordinated with Martha's Vineyard Regional High School maintenance activities.

B. B Maintenance support activities, shall include, but shall not be limited to, the following:

1. Litter pickup and disposal within field area and surrounds.
2. Lawn maintenance.
3. Monthly turf maintenance/site condition report. (bi-weekly)
4. Paper posting in accordance with state laws, for chemical applications.
5. Irrigation system maintenance and repair.
6. Other work required to keep the field area turf in good condition.

1.02 SUBMITTALS

A. Samples of product literature shall be submitted to the Martha's Vineyard Regional High School prior to the ordering of material. Indicate product source, purpose, concentration, timing, means of application and frequency of application.

1.03 SOIL ANALYSIS

A. In August, one (1) composite soil sample taking at least four (4) blended auger samples from the field shall be taken by the Contractor from the Active Field Areas to determine lime and fertilizer requirements.

B. Soil analysis results shall be made available to the Martha's Vineyard Regional High School for review. The results/ recommendations of the soil testing agency shall be incorporated into the maintenance program as approved by the Martha's Vineyard Regional High School.

1.04 NOTICE

A. Maintenance Contractor shall notify the Martha's Vineyard Regional High School at least forty-eight (48) hours in advance of all site maintenance activities, for approval.

1.05 MAINTENANCE PERIOD

A. Maintenance activities shall begin immediately upon field acceptance for use and continue in accordance with these Specifications as directed by the Martha's Vineyard Regional High School.

B. The time period for the site support program shall be one year from the date of provisional acceptance and shall be renewed annually with field use permit.

1.06 QUALIFICATIONS

A. The Contractor doing field maintenance activities shall have experience in the landscape maintenance business as a proprietor, partnership or corporation. In addition, the principals must give the name of the school or organization from which their training and experience was obtained, the address and period of time by dates from start to finish of training. The Contractor shall give the names of companies, addresses and written references for whom he has done maintenance work, as required by this Section. The Maintenance Contractor must be bondable and show evidence of financial stability, satisfactory to the Martha's Vineyard Regional High School that he/she is in a financial position to carry out the work. The Contractor must also be able to take on the maintenance and welfare of the contract areas throughout the specified period. Such care and maintenance of the contract area shall be supervised by the Contractor or by a qualified subordinate acting under the direction of the Contractor. Maintenance Contractor shall be approved by the Martha's Vineyard Regional High School prior to maintenance activities.

B. Any paving, site amenities, plant materials, fencing, or any other items damaged by equipment owned, leased or others used by the Contractor or his/her agent shall be reported immediately to the Martha's Vineyard Regional High School and repaired or replaced within a reasonable period of time at the contractor's expense according to the original materials, specifications design and execution.

PART 2 PRODUCTS

2.01 TOPSOIL/LOAM MIX

A. New Topsoil: Shall be natural, fertile loam typical of cultivated topsoils of the locality, containing not less than 4% or more than 6% by weight, of decayed organic matter (humus) as determined by ASTM F-1647. If organic amendments are needed to obtain the specified matter content of the topsoil, the organic matter source may be a compost material. Compost may be used, provided that the material has been composted in an in-vessel system, has an organic content of not less than 70%, and a PH range of 6.5 to 7.2.
B. Topsoil shall be taken from a well-drained, arable site, free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris.
C. Topsoil shall be free of Quack-grass rhizomes, *Agropyron Repens*, and the nut-like tubers of Nutgrass, *Cyperus Esculentus*, and all other primary noxious weeds.
D. Topsoil shall have a pH not less than 6.0 or greater than 7.0.
E. Topsoil shall not be delivered or used while in a frozen or muddy condition.
F. Topsoil shall conform to the following particle size distribution, as determined by pipette method in compliance with ASTM F-1632:

Sand	40-60%
Silt	30-40%
Clay	5-20%

If determined by a soil test that the existing stripped topsoil does not meet these specifications, the topsoil shall be amended to provide an acceptable topsoil for use. Loam sample and test results shall be provided to Martha's Vineyard Regional High School for review of approval prior to use of loam on site.

2.02 ADMIXTURES

A. Admixtures such as lime, superphosphate, commercial fertilizer, and all other required materials for maintenance of lawns shall be submitted to Martha's Vineyard Regional High School for review and approval.

2.03 SEED MIXTURES

A. Athletic Field Mix (Irrigated Fields): The seed shall consist of 20% perennial ryegrass and 80% Kentucky bluegrass on a weight basis. The Kentucky bluegrass portion of the mix shall be a blend of thee (3) Kentucky bluegrass varieties, of which 60% of the seed mix shall be at least two of the following varieties: Able I, Aspen, Banff, Blacksburg, Challenger, Classic, Eclipse, Estate, Midnight, Princeton (P-104), Ram I, Touchdown, or Trenton. The bluegrass shall have a minimum germination percentage of 80%. The perennial ryegrass may be any one of the following: Advent, Affinity, Assure, Brightstar, Dandy, Gettysburg, Legacy, Manhattan II, Palmer II, Pinnacle, Prelude II, Prizm, Quickstart, Saturn, Seville, Sherwood, SR 4200, or Yorktown III. The perennial ryegrass shall have a minimum germination percentage of 85%. The percentage of weed seed shall not exceed 1%, and other crop seed 1% by weight of the mixture. Any variety substitutions or deviations from these specifications must be approved by the Martha's Vineyard Regional High School.

2.04 COARSE SAND

A. Sand for top dressing mowed areas shall be root zone sand as manufactured by Read Sand and Gravel, Rockland, MA or equal and shall conform to the following ideal sample range by the International Sports Turf Research Center, Olathe, KS:

TEXTURAL ANALYSIS		% Retained on Sieve	
USDA (mm)	U.S. Sieve (mesh)	Minimum	Maximum
2.00	10	--	3
<.002		--	3
.05-2.00	270-18	89	100

PARTICLE SIZE DISTRIBUTION		% Retained on Sieve	
USDA (mm)	U.S. Sieve (mesh)	Minimum	Maximum
1.00	18	--	7
0.50	35	65	85
0.25	60	65	85
0.18	80	--	85
0.15	100	--	10
0.10	140	--	10
0.05	270	--	10

PART 3 EXECUTION

3.01 MAINTENANCE

A. Watering (All field areas and use areas adjacent to field covered by field inground irrigation system)

1. Watering of the field areas shall be applied as necessary to ensure a healthy, vigorous lawn. Water shall be applied at the rate of 1-in per week subtracting the amount of natural precipitation occurring during one week form the amount to be applied by the Contractor.

Water shall be allowed to penetrate the soil to a depth of six (6) inches. Contractor shall coordinate site watering with weather conditions and scheduled uses.

2. Irrigation system as installed shall be utilized by the Contractor. The Contractor shall not be responsible for costs associated with electric service for irrigation.

B. Mowing of athletic field areas shall be the responsibility of Martha's Vineyard Regional High School and shall include the following:

1. Before the first mowing in the spring, all debris, leaves, paper, and trash that has accumulated shall be picked up and legally disposed of off the property.

2. Mowing intervals shall be spaced not more than one (1) inch of leaf blade is removed at any one time. At the time of cutting, keep mower blades adjusted for a finished cut height of between(2) and two one-half (2-1/2) inches. Grass cuttings shall be picked up and disposed of off the site by the Contractor. Areas around trees, shrub beds and other obstacles shall be hand trimmed at the time of each mowing and neat lawn edges shall be maintained. Mowing, trimming and edging shall be performed weekly, or when the grass is of sufficient length to produce clippings that are a maximum one (1) inch long. Reel or rotary mowers are acceptable and shall be well adjusted with sharp blades.

3. Trim all grass edges at each mowing; at plant bed, pavement edges and fence lines.

4. Remove and legally dispose of all visible clumps of grass after each mowing.

a. All clippings are to be raked from planting areas and pavements and be removed from the site. If grass clippings are excessive on lawn areas as determined by the Martha's Vineyard Regional High School, they shall also be removed at no additional cost.

b. All clippings are to be removed from concrete and bituminous; walks, curbs and from all manholes and catch basins after each mowing by either sweeping or hosing.

5. Care shall be taken not to damage tree trunks, walls, curbs, etc., when mowing and trimming.

C. Fertilization Program - All athletic field areas and adjacent use areas.

1. Contractor shall be responsible for furnishing and supplying commercial fertilizer at the rates recommended by the soil analysis, but not less than the following rates and frequencies to all active play field lawn areas, sodded areas, and recreational slopes. Rates may be altered based on a soil test recommendation as approved by the Martha's Vineyard Regional High School, but otherwise shall be as follows:

a. Fall Fertilization - Between October 1 and 30, apply a 19-24-12 fertilizer to the lawns at the rate of 4 pounds per 1000 square feet. The nitrogen component must be at least fifty (50) percent slow release organic source or ureaform. The fertilizer shall be evenly distributed and watered using caution that the water does not wash away the fertilizer and cause it to concentrate in areas.

b. Spring Fertilization - Between April 1 and 15, apply a 34-03-11 fertilizer to the lawns at the rate of 4 pounds per 1000 square feet. The nitrogen component must be at least fifty (50) percent slow release organic source or ureaform. The fertilizer shall be

evenly distributed and watered using caution that the water does not wash away the fertilizer and cause it to concentration in areas.

c. Early Summer Fertilization - Between June 1 and 15, apply a 24-08-15 fertilizer to the lawns at the rate of 3 pounds per 1000 square feet. The nitrogen component must be at least fifty (50) percent slow release organic source or ureaform. The fertilizer shall be evenly distributed and watered using caution that the water does not wash away the fertilizer and cause it to concentration in areas.

2. Fertilizer shall be LESCO Fertilizer products or approved equal and shall conform to applicable state fertilizer laws. They shall be uniform in composition, dry, free flowing and delivered top the site in original, unopened containers, each bearing the manufacturer's guaranteed analysis. Fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted. Percent slow release as shown above shall be percent slow release by weight of the nitrogen contents of the fertilizer, and derived from organic materials.

3. The areas shall be fertilized sufficiently to produce continuous healthy growth and an attractive appearance.

4. Apply the fertilizer only when the grass is dry. After the Application, wash the material into the soil to prevent discoloration or burning of the grass.

5. When fertilizer is applied, Contractor shall provide proper posting as required by State law.

D. Liming - All sport field areas and adjacent use areas to surrounding pathways.

1. Lime shall be ground limestone containing not less than eighty-five (85) percent of total carbonated and shall be ground to such a fineness that fifty (50) percent will pass through a twenty (20) mesh sieve. Coarser material shall be acceptable provided specified rates of application are increased proportionately on the basis of quantities passing the one hundred (100) mesh sieve.
2. At the start of the maintenance program, soil tests shall be performed as required under Paragraph 1.04A. This should reveal the condition of the lawns as to whether liming will be required at that time.
3. Ground limestone will be applied to lawn areas to bring to a desired 5.5 to 6.5 pH level.
4. Rate of application of ground limestone shall be at least thirty (30) pounds, but shall not exceed fifty (50) pounds per thousand (1,000) square feet at any one time, with at least thirty (30) day. between applications to bring the pH to the desired level.
5. Lime applications shall be in late fall (mid/late November).
6. Limestone and fertilizer shall be separate applications.

E. Weed Control

1. If and when weeds occur, they should be identified and the appropriate selective herbicide selected by the University of Massachusetts Experiment Station in Waltham, Massachusetts. Application will be carried out by the Contractor as part of the program in early spring and late fall, prior to aerification, and as recommended by the Experiment Station.

F. Disease and Pest Control

1. The contractor shall notify the Martha's Vineyard Regional High School of any diseased or distressed grass areas, and submit diseased or distressed samples to the University of Massachusetts Experiment Station in Waltham, Massachusetts, for recommendations and application procedures. The Contractor shall apply insecticides and/or fungicides to lawn only where necessary and as recommended by the Experiment Station.

G. Aeration & VertiDrain

1. Aeration shall be done with a device which removes plugs of earth approximately one-half (1/2) inch in diameter and a minimum of ten (10) inches deep. Multiple passes in different directions are recommended, with a goal of 12-16 plugs per square foot. Make minimum two (2) passes. Soil plugs are to be removed from the field. Shorter tines may be used upon review with and prior approval from the Owner

2. VertiDrain - Provide a full depth aeration with VertiDrain equipment. Larger VertiDrain equipment that penetrates the full 12" depth of topsoil is preferred. VertiDrain equipment drives tines into the soil and fractures the compacted topsoil.

H. Top Dressing

1. All lawn and sod areas shall be aerated and top dressed with one-quarter (1/4) inch layer of topdressing sand and thoroughly worked into the soil. Adjust top dressing program to the specific conditions to be corrected.

I. Slice and Seed

1. After aeration and top dressing, slice and seed with athletic field seed mix specified. Slice seeder and method shall be approved by the Martha's Vineyard Regional High School. Seeding shall be done in two directions at right angles to each other using an approved seeder which slices existing turf and plants seed approximately 1/4-in deep into soil.

J. Topsoil/Loam Fill

1. Topsoil/loam all bare areas, depressions and washouts to bring finished grade level to adjacent turf areas and seed.

K. Lawn Maintenance Task Schedule

Task	As Nec.	Weekly	Monthly	Yearly	J	F	M	A	M	J	J	A	S	O	N	D
Soil Tests				X	-	-	-	-	-	-	-	X		-	-	-
Watering (of irrigated turf areas)	X				-	-	-	-	X	X	X	X	X	O	-	-
Mowing and Edging by Owner	X			-	-	-	X	X	X	X	X	X	X	X	-	
Fertilizing				4X	-	-	-	X	-	X	-	-	X	X	-	-
Liming				X	-	-	-	-	-	-	-	-	-	-	X	-
Weed Control	O				-	-	-	-	-	X	O	O	O	X	-	-
Disease and Pest Control	O				-	-	-	-	O	O	O	O	O	O	-	-
Slice and Seed				2X	-	-	-	-	X	-	-	-	X	-	-	-
Aeration																
1. Active Areas			2X		-	-	-	X	-	-	-	-	X	-	-	-

VertiDrain												
1. Active Areas	1X	-	-	-	-	-	-	-	-	X	-	-	-
Top Dressing												
1. Active Areas	2X	-	-	-	X	-	-	-	X	-	-	-	
Rolling	1X	-	-	-	-	X	-	-	-	-	-	-	-

X = Task is mandatory
O = Task shall be done as necessary and an approval is required by the Martha's Vineyard Regional High School

3.02 IRRIGATION SYSTEM MAINTENANCE

A. System Familiarization

1. The Contractor shall inspect the irrigation system and become familiar with the layout of the system, all materials and equipment used and all services relating to it. This includes the irrigation system as installed, all piping, valves, sprinkler heads, access boxes, controls, drains, wells, pumps and all appurtenances.

B. Shop Drawings

1. It shall be the responsibility of the Contractor to obtain a set of the complete Shop Drawings and As-Built Drawings from the Martha's Vineyard Regional High School.

C. Operation and Maintenance Manual

1. At the start of the irrigation system maintenance program, the Contractor shall obtain one (1) copy of the Operation and Maintenance Manual from the Martha's Vineyard Regional High School.

D. System Maintenance Procedures

1. The Contractor shall maintain the irrigation system in optimum operating condition during the entire maintenance period. The Contractor shall be responsible for ensuring that the manufacturer's printed instructions and recommendations are closely followed.

2. If at any time any item or part of the system is not properly functioning, or is not as intended, it is the responsibility of the Contractor to bring this to the attention of the Martha's Vineyard Regional High School and record the problem in the semi-monthly summary report with a detailed estimate of repair or replacement being sent to the Martha's Vineyard Regional High School immediately after damage inspection and the Martha's Vineyard Regional High School's approval. The Contractor shall be prepared to supplement water by hose truck at stated irrigation rates, if any part of the system is malfunctioning for longer than one week between May 1st and September 1st and shall continue until the system is fully operational at the cost of the Contractor. All replacement parts, materials and labor, except for defects in the original parts, materials and workmanship, shall be the responsibility of the Contractor. it shall also be the responsibility of the Contract to provide and ensure that any necessary condition. The Contractor shall carry out the replacement with the approval of the Martha's Vineyard Regional High School and with the cost being borne by the Martha's Vineyard Regional High School unless there has been negligence on the part of the Contractor.

3. All replacement parts and irrigation pipe shall be by the same manufacturer or approved equal according to original specifications.

4. In all cases for repairs or changes, a reasonable time period shall be determined during which the work can be accomplished.

5. The Contractor shall be responsible for the following items on a weekly basis:

   a. Check spray heads to assure their proper operation which includes design coverage, volume and timing and to check for vandalism. Head spray pattern shall be adjusted, if required, to provide complete and adequate coverage of the areas to be watered.

   b. Clean spray head of any sand, silt or debris and trim grass around heads.

   c. Repair all damage that may occur immediately, after notifying the Martha's Vineyard Regional High School's Representative and also noting the problem in the semi-monthly report.

6. The Contractor shall twice per year, remove the last spray head from each line and flush pipe lines of grit and gravel by drainage and blowing out each line with compressed air. See start-up and winterizing maintenance procedures in this Division. This shall be done more frequently if it is necessary.

7. The Contractor shall be responsible for start-up of the irrigation system in the spring.

   a. The entire system shall be blown out. The system shall not be drained.

   b. The Contractor shall test the entire irrigation system, including the pump station. The test shall clearly demonstrate that each and every part of the system functions as intended.

      1) Manual feature of the irrigation system shall be tested for satisfactory operation. Water shall be turned into each portion of the irrigation line and maintained at full pressure for not less than one-half hour after all air has been expelled from the line. If unsatisfactory performance or any leaks developed, this shall be described in the summary report, the condition corrected and these testing procedures repeated until satisfactory operation is obtained.

3.03 MISCELLANEOUS MAINTENANCE

A Trash and Litter Pickup

1. Litter shall be picked up after each event on a daily basis and legally disposed of off the site by the Contractor.

3.04 DAMAGE INSPECTION

A Contractor shall inspect for and report all vandalized and otherwise damaged conditions on a monthly basis and include the damage report in the monthly summary report to the Martha's Vineyard Regional High School.

B The Martha's Vineyard Regional High School will provide the Contractor with the necessary checklist to facilitate the reporting.

C Forms shall be submitted in triplicate to the Martha's Vineyard Regional High School on the first Monday of each Month.

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