Martha's Vineyard Synthetic Fields Impact Study (Partial):
Anticipated Geofill Contamination

I. Introduction.

The Safe Healthy Playing Fields Coalition (SHPFC) is a national group of scientists, parents and other citizens concerned about the human, environmental and fiscal costs of synthetic turf fields. To support the efforts of Vineyard residents who are performing due diligence on the proposed installation of up to five synthetic turf fields, SHPFC was asked to comment on information provided to the public about one of the proposed infill products, Geofill, sold by Shaw Sports Turf. Based on the limited product information published by the vendor, and to the best of our knowledge, we can make a few important comments regarding Geofill. However, these are preliminary and absolutely not a complete assessment of risk.

Martha's Vineyard is a unique island community with:

- A single source aquifer that receives high demand during summer seasonal months.
- Strict septic and waste management rules.
- Very sandy soils that drain down into the surface water and directly into groundwater.
- Fragile, protected aquatic ecosystem that incorporates rare freshwater habitats, salt marsh habitats, and ocean shore habitats. These habitats serve as nurseries for numerous species that support other species in the aquatic ecosystem.
- A location subject to major storm events.
- A year-round population that is environmentally aware and protective.

Basic structure of a synthetic field. Synthetic turf systems include a drainage and irrigation systems laid under the plastic "grass" carpet in a bed of compacted gravel and rock. The native soil and grass, a biosphere in itself, is excavated to nearly three feet, and the drainage system is installed. A layer of gravel and rock backfills where soil was, and occasionally an optional synthetic cushioning layer is installed. The plastic "grass" carpet is laid on top of the compacted rock. That carpet includes a plastic backing system. The plastic "grass" carpet is then infilled with granular filler. "Infilled" means that the plastic turf fibers are interspersed with tiny crumbs of ground up material intended to provide stability and resiliency, and to keep the plastic grass blades upright. The infill can be made of many substances, including waste tires, waste plant-based material, plastic-coated sand, and/or other materials. There is no regulation on substances that can be used in the infills, nor regulation on the crumb size or characteristics of the infill material content despite its known use for children's playing fields. For the Vineyard fields, the proposed infill consists of a layer of silica sand, and a product called Geofill, and possibly under layers of composite synthetic material for cushioning. This document focuses on the Geofill layer and is not a complete assessment of the MSDS or product information for the other field components such as the silica layer, the composite synthetic sub-carpet cushion layer, or the plastic "grass" carpet, each of which should be examined more fully for impacts.

II. Concerns.

Massive quantities of infill material loss into environment. According to Shaw Sports Turf, 120,000 lbs of Geofill is required for one 80,000 sq ft field. The Geofill FAQ states that approximately 10% (12,000 lbs) of the Geofill will need to be replenished every 2-3 years. **In other words, approximately 4,800 lbs (2.4 tons) will be lost from a single field, migrating into the local environment, waterways and municipal systems, every year, indefinitely.** For the proposed five synthetic fields, approximately 24,000 lbs (12 tons) of Geofill will make its way into the Vineyard's ecosystems annually.

Annual Geofill Material Loss into Environment

Loss (Geofill material only)	1 Field Annual Loss	5 Field Annual Loss
10% of 120,000 lbs every 2.5 years	4,800 lbs or 2.4 tons	24,000 lbs or 12 tons

NOTE: Again, we presume these quantities only include the Geofill material and not the silica sand product that is the majority weight component of the infill. We suggest you verify with Shaw Sports Turf whether silica is included in the loss estimates listed in the product FAQ. If not, those losses (transfers of silica material from field to the environment) will be in addition to the values above.

The figures clearly indicate tons of contamination, in both solid and likely in leachate form, discharged directly into the water pathway to the Vineyard's economically valuable marine resources. According to the information provided in the product information published by the vendor, and presuming the field will have a subsystem drainage with no mitigation or capture, since none is specified, as a precaution, the field should be assumed to not be in compliance with US Clean Water Act standards, and subject to enforcement penalties.

How will these fields be installed to prevent them from becoming point sources of pollution? Given the massive quantities of Geofill that will inevitably accumulate in the Vineyard environment, knowing for sure what is in Geofill is crucial to assessing environmental risk and management of that risk. However, since there is no regulation on the substances used, there are no mitigation steps suggested or acknowledged. Each community is left to decide if the risk is acceptable. Note: Failure to mitigate or even attempt to mitigate discharge and contamination is a pattern that we have seen throughout the US in thousands of granular surface fields.

Synthetic field components are unregulated, un-controlled and non-uniform. While reliable testing is essential, it is practically impossible due to the product's high variability. Geofill materials (and the plastic carpet "grass) are imported from multiple sources in Asia, and none are subject to health regulations, or scrutiny of any kind. There are no controls on the various treatments of infill or plastic carpet products (flame retardants, pesticides, herbicides, anti-clumping agents, UV stabilizers, anti-bacterials, anti-fungals, colorants, etc.). There is no required reporting of those treatments to vendors, or to end users/buyers. It is therefore essentially impossible to know

precisely what is in any given field or even any batch of Geofill, or the plastic "grass" carpet that supports the infill. Once installed, pesticides and herbicides, as well as cleaning agents (such as the biocides for the biological contamination such as vomit, blood, snot, sweat, spit, dog or bird feces and other biological detritus that would break down naturally on grass), are frequently applied to these fields. Most groundskeepers are not trained in application of these products, since artificial turf fields are not the original intended use for these treatments, singly or in combination, and under the Vineyard's unique conditions. From a toxicology standpoint, non-uniform material treated with multiple chemicals during its lifetime should be expected to contain "hotspots" of concentrations of those chemical treatments, which pose a risk of acute exposure to children. In sum, field treatments present a known, harmful exposure risk for athletes and the environment, but those risks are not explained or quantified, singly or in combination, to buyers or users.

The material data safety sheets (MSDS) for some of the field components offer some basic insights regarding risk. For example, the silica sand MSDS specifically states that it should be cleaned up immediately if it released or spilled. It also states that it contains quartz silica sand and that it is a known human carcinogen according to the International Agency for Research on Cancer (IARC), and a causal factor for silicosis, a lung disease.

The fields produce dust that will expose children, players and the environment to the substances from all field components. Normal field use grinds the silica sand and Geofill into the plastic carpet, continuously generating small particulate "dust" made of the carpet and infill components. The dust then coats plastic grass blades, infill crumbs, surrounding surfaces, and players. As children play, the tiny particles loft up into the breathing zone, forming a "particulate cloud" around them. The smaller sized particles, invisible to parents or coaches, can remain suspended for a long time. Therefore, children playing and breathing on the fields will inhale, ingest and have dermal exposures to the substances in the infill and plastic carpet with every contact. According to the MSDS, silica dust is known to be hazardous and creates a lung condition called silicosis. The synergistic interactions between silica sand and dust from the other components are not explained in the product information. Further, the Geofill dust will be drained into the aquatic ecosystem. The Geofill MSDS states that the product is "non-biodegradable" and "insoluble in water." Given that pulverized coconut and cork are expected to degrade naturally, we ask for clarification of the rationale behind those statements, and exactly what chemicals are they treated with and what impact can those – and the accumulation of tons of Geofill – be expected to have on the Vineyard environment.

No longitudinal health or environmental impact information is available. No pediatric health impact studies have been conducted on the long-term inhalation, ingestion or dermal exposure impacts to children's health, yet. To date there are also no long-term impact studies on the effect of massive Geofill (or plastic carpet fiber or silica sand migration) on the aquatic environment. This does not mean the fields are safe for inhalation, ingestion or safe for an aquatic ecosystem; it simply means that the work to assess impacts has not been done.

A single field needs about 64,000 gallons of supplemental irrigation annually during peak season in summer. Irrigation is required to avoid additional dust and migration, and reduce hardness of field surface**.** Geofill requires a year round 30%-40% moisture content for optimal performance. These estimates assume that synthetic fields will be irrigated during dry weather. The

FAQ states, if the proper moisture content is not maintained, "additional Geofill may need to be added more frequently [as] dry Geofill breaks down more quickly than properly maintained Geofill." Based on 20 waterings (total) during dry weather, a single field could demand 64,000 gallons each year in irrigation alone to keep the humidity at the safe level. The draw impact during peak season and hot weather to the sole source aquifer needs to be examined.

Additional impacts from plastic carpet and other components remain unstudied and are not included in this analysis. Further, we did not address any type of environmental or health impacts from the rest of the components such as the plastic "grass" carpet or shock pad. Synthetic carpets are comprised of several types of plastics, heavy metals and color fixatives, treated with flame-retardants, UV stabilizers, and herbicides, and weigh over 50 tons each. Over its 7-10 year life span, those plastic carpet fibers break down – with age, weather, and use – into smaller particulate (indicating the need for a new carpet), which migrate from the field into the air above the fields, into the water pathways and into the environment. This chemical-laced, plastic debris represents additional impacts not addressed in this document. However, it is important to note that this type of micro-plastics water pollution has been found in aquatic and marine food chains. Small bits of plastic are poisonous to organisms once ingested.

A hurricane or storm event could mean near-total loss of infill material into Island environment. Material loss and runoff calculations are based on average rainfall and company-supplied irrigation rates. They do not address risks associated with worst-case situations such as major storm events (which are increasing due to the effects of climate change), so they are grossly underestimated for those circumstances. Since the surface material is loose, un-encapsulated and lightweight, it is possible that a single hurricane or storm could wash/blow the crumb material entirely off the field surface and into the surrounding waterways and environment; it would be unrecoverable.

Anticipated runoff management and aquatic impacts issues. Based on local rainfall averages and irrigation estimates according to Geofill requirements, **the average annual expected drainage/runoff value from one field is 2,407,703 gallons** (see calculations below). For the proposed five synthetic fields, the runoff estimate is 12,038,667 gallons per year**.** At these levels, leachate and environmental impact studies are strongly recommended to examine the risk of contamination of ground water and require the construction of significant, costly runoff management conveyances. To our knowledge, neither the feasibility nor the costs of these are addressed in the existing proposal.

The environmental impacts from disposal of field materials every 7-10 years are not addressed in product literature and require thorough assessment. We have not been made aware of even a single artificial turf field, anywhere, having been recycled, or going anywhere but to a landfill. In the case of Martha's Vineyard, the environmental impacts associated with disposal would largely fall on another community; however the economic impacts of this cycle will hit the Vineyard harder than most given the transportation issues. We are not aware that these have been considered or quantified.

As explained above, according to Shaw Sports Turf, Vineyard residents will inevitably face contamination from about 2.4 tons (per field, per year) of chemical-laced particulate into the

waterways from the Geofill alone. Once they migrate, these materials are essentially unrecoverable, so it is assumed that whatever is in the infill – as well as the crystalline silica and plastic grass fibers – will remain in the Island ecosystem indefinitely. The same is true for the accumulation of chemical applications required for field maintenance.

III. Recommendations.

Though the Geofill manufacturer provided some information in its product brochures, it did not specify or calculate the impacts from the migration of the field material into the Vineyard environment and waterways, and into the surrounding community and municipal systems (carried by players in shoes, bags, clothes, etc.) We have observed the migration of material off the field and into the environment and municipal systems in every granular surface fields system.

More urgently, there has been no study of risk to the Vineyard's critically important sole source aquifer or groundwater, despite the enormous quantity of infill and runoff in question. Further, while insurance issues and liability concerns are not covered here, we recommend appropriate risk management steps be taken in recognition of the potentially dire implications for Vineyarders, should these fields result in harmful outcomes. For example, the proposal should be modified to include a storm water management system able to accommodate heavy weather events, as well as a water treatment system to prevent contamination of the Vineyard's drinking water, and a reliable, highly sensitive, groundwater-monitoring program.

We strongly advise that a qualified hydrogeologist / Massachusetts LSP and environmental engineer with no financial interest or conflicts of interest be hired for a full risk assessment.

Safe Healthy Playing Fields Coalition
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Calculation Assumptions

Annual rainfall (1)	47	inches
Single irrigation session (2)	3,200	gallons
Number of irrigation sessions per year (3)	20	
Total annual irrigation	64,000	gallons
Field size	80,000	sq ft
Geofill Needed (Note: we presume this is Geofill product only; not including silica layer; needs to be verified)	1.5	lbs per sq. ft.
Total Geofill per field (not including silica layer)	120,000	lbs

1. http://www.usclimatedata.com/climate/edgartown/massachusetts/united-states/usma0132
2. Geofill recommends irrigating with 3,200 gallons (5 oz. per square foot) whenever the field moisture content drops below 30%.
3. Based on Martha's Vineyard high average ambient humidity and low day temperatures, we assume 20 irrigation sessions. To recalculate, simply use the per session rate above, times the actual number of sessions expected, and add to total rainfall.

Annual Runoff and Irrigation Volumes

	1 Field		5 Fields	
Annual Runoff - Rainfall Only	2,343,733	gallons	11,718,667	gallons
Annual Runoff - Irrigation Only	64,000	gallons	320,000	gallons
Total Annual Runoff - Rainfall + Irrigation	2,407,733	gallons	12,038,667	gallons

Sources

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Geofill Material Data Safety Sheet. March 30, 2010.
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