Darden Towe Park: Synthetic Turf Pre-Design Study

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Submitted To:

Albemarle County Facilities and Environmental Services -
Facilities Planning & Construction Division

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BACKGROUND AND STUDY METHODOLOGY

*(*Note: The terms Synthetic Turf and Turf are synonymous. The terms Grass and Natural Grass are synonymous. References to The County, refer to Albemarle County, unless otherwise stated.)*

The intent of this pre-design study is to characterize the advantages and risks associated with the installation and maintenance of synthetic turf fields for athletic facilities. More specifically, this study will identify unique conditions at Darden Towe Park, see **Figure 1**, that may impact decisions to use synthetic turf at that facility, accounting for site-specific characteristics and adjacent site conditions. The goal is to provide a broad range of information to help inform the County's decision-making process relative to the use of synthetic turf at the park by addressing issues typically associated with the advantages and benefits of turf, regarding playing capacity, impacts on revenue, player safety, long-term maintenance costs, and environmental impacts.

The study findings are organized around the specific topics provided by Albemarle County and described in each of the six sections below. The information provided within each section is intended to describe the primary ***advantages, challenges, and risks*** associated with the use of synthetic turf on athletic fields as relates to each topic. Findings represent research and data from a variety of sources, including Kimley-Horn experience with similar projects and technologies, knowledge of industry standards, case studies, and input from product manufacturers, contractors and facility managers.

Kimley-Horn relied on certain information from a variety of sources as part of this study, including the reference materials listed at the end of this document. The findings do not represent recommendations regarding decisions to convert grass fields to synthetic turf. This information is intended to provide an overview of the key considerations that should be taken into account when making decisions about using synthetic turf fields as part of your overall athletic field inventory, user profiles, and revenue goals. While there are a significant number of factors that may inform these decisions, the key considerations are typically associated with the following issues when comparing synthetic turf fields to natural grass:

1. ***Capital Costs:*** Without exception, the install cost for synthetic turf fields represents an order of magnitude increase compared to natural turf fields. That difference in cost can be larger or smaller depending upon the quality of turf facilities as well as the quality of natural grass fields being compared. The decision to convert to synthetic turf fields typically relies upon the long-term pay-back and cost benefits relative to potential for additional playing time and revenue generation.

2. ***Life-Cycle and Long-Term Maintenance Costs:*** The report provides some industry metrics for the life expectancy for quality synthetic turf fields, assuming good installation and maintenance practices. Data for actual maintenance costs of synthetic turf fields versus natural grass suggest that the difference between the two is not the most significant factor in making a decision between them. The fact that Albemarle County does not use chemical fertilizers, pesticides or herbicides on natural grass, even further reduces the delta in maintenance costs between the two options. Turf maintenance does require an intensive program and well-trained staff, new equipment purchase or leasing, and possible third-party agreements so the old myth of no-maintenance artificial grass is certainly not a valid input for decision-making. Replacement costs of synthetic turf fields must also be examined along with capital costs for initial installation.

3. ***Playability and Revenue Generation:*** The primary benefits of synthetic turf surfaces relate to potential for extended playing time and the resulting increase in revenues as well as improved service to the community. Natural grass field availability, and playability, is very susceptible to weather conditions. Wet conditions can not only limit playing time, but damage resulting from playing on wet fields can significantly increase maintenance needs and reduce availability for play. With added lighting, benefits can extend to even longer playing times per day.

4. ***Player Safety and Liability:*** This report discusses some of the issues and related testing associated with player safety, understanding that this is still an evolving area of study with many unknowns. In terms of field conditions, turf fields generally can deliver a more stable, consistent playing surface which is one potential benefit for better playing conditions, especially for sports dependent upon consistent ball contact with the ground (i.e. soccer, field hockey).

   Regarding the evolving issues around player concussions, there are standardized tests to assess a playing fields reaction to impact. GMax is the most common and relevant to public facilities and is affected by many factors including the design section and quality of maintenance. Head Injury Criterion (HIC) is not relevant to Darden Towe, assuming a program that excludes full contact sports.

5. ***Environmental Impacts:*** A decision to convert to synthetic turf fields may include concerns or stated polices around environmental protection. Albemarle County is very assertive in this regard and turf facilities represent an opportunity to support the County's goals, with some consideration to potential risks. The primary benefits of synthetic turf are related to the reduction or elimination of fertilizers (not applicable to the County in

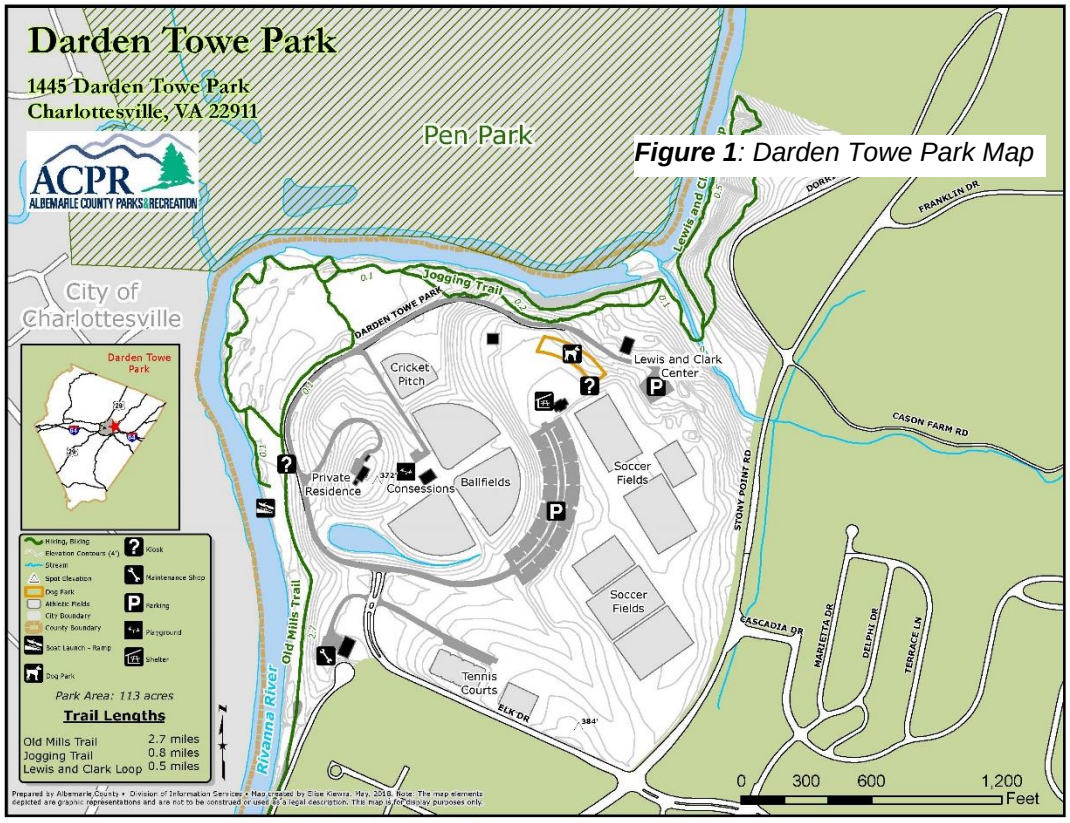


Figure 1*: Darden Towe Park Map*

this case), water usage, and emissions from gas-powered maintenance equipment. Current studies regarding the potential for harm from migration plastic products into water resources or as a harmful agent to users suggests very minimal potential for negative impacts on people or environment.

SECTION 1: DESIGN CONSIDERATIONS AND CONSTRUCTION METHODS

Synthetic turf has a multitude of uses in today's world, from high level professional sports to the simplest residential installation. On the sports side, which is relevant here, synthetic turf is commonly used for soccer, football, field hockey, and baseball fields to provide a more consistent playing surface, reduce potentially harmful environmental impacts, extend the overall capacity of play and reduce injuries by providing a more consistent surface. All of these potential benefits are impacted by decisions about design details and construction methods, as well as the quality of the actual installation. The field turf itself comes in fifteen-foot-wide rolls that are sewn or glued together, so almost any layout or configuration is possible. Construction methods may vary depending upon the type and quality of facility and site conditions. The design and quality of construction is critical to the long-term performance of these facilities.

Program for Play

The intended program for play is relevant to decisions regarding material sections and design in that various sports inherently have requirements, or preferences, regarding surface characteristics and playability. Based upon input from Albemarle County, the following is a general understanding of the intended program for play:

Sports: The intended uses include Soccer, Lacrosse, and potentially Field Hockey. The implications related to the intended use includes decisions regarding the height of the carpet pile and amount of infill. For example, Soccer, field hockey and lacrosse typically prefer a playing surface with a lower pile height and less infill, to promote a more uniform roll along the playing surface.

Note: It is assumed, for purposes of this report that football is not an intended use. This report makes that assumption in terms of relevant design and construction commentary.

Ages of Play: It is understood that the planned facilities are intended to target youth and adult play. Thus, field design will include full size and cross-play layouts with appropriate run-off areas for player safety.

Following are some general guidelines relative to accepted standards for playing surface layouts for selected sports. The County will plan for minimum field sizes of 200 feet x 300 feet.

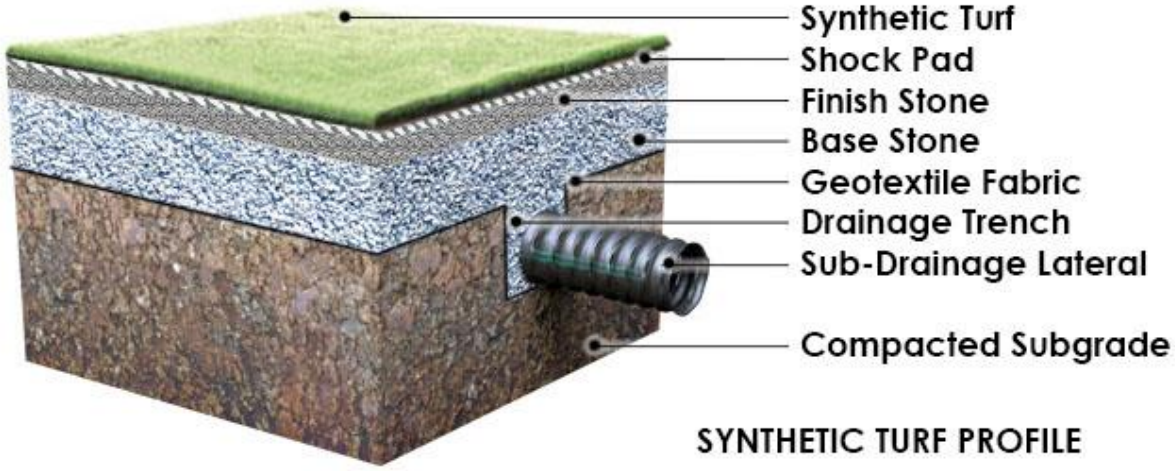
- Soccer Fields – generally soccer fields are laid out with a north to south orientation, with one goal to the north and the other to the south. The official soccer field size for adults can range from 150 to 300 feet wide by 300 to 390 feet long. However, the rules allow soccer field sizes to be reduced for women, players with disabilities and for players under 16 and over 35 years of age. The most common dimension is 225' wide by 360' long.
- Field Hockey – Field dimensions are typically 300' long by 180' wide. The pile height of the turf fiber is generally shorter for field hockey to maintain consistent ball roll.
- Lacrosse Fields – Recommended field dimensions (Ref. US Lacrosse) are 120x70 yards for women's play, and 110x60 yards for men's play. Youth play can vary considerably from those guidelines. Similar to Field Hockey, the length of carpet pile and infill amounts can be controlled to promote a truer ball roll.

- With this installation being multi-purpose, the depth of the infill and the pile height of the turf should accommodate that of soccer, as it requires the deepest of both.

Construction of the Turf Section

Base Material: Synthetic turf is generally installed over a stone base to provide a structural foundation for the carpet and good drainage. The field base construction typically includes the following components:

- The stone base is built upon a prepared subgrade. The subgrade is most generally compacted to 95%.
- Geotextile fabric is laid over the entire sub-grade to provide support of the stone base above and prevent fine material from the subgrade from pushing up into the stone.
- Base stone – A 3/4" minus washed stone is laid over the geotextile fabric. The depth of this material is dependent on the storm-water volume it will carry or potentially store. This material is generally 4" in depth at a minimum.



- Finish stone – A 3/8" minus washed stone is laid over the base stone. This stone serves as a leveling course for the synthetic turf carpet to lay. As a finer stone, the contractor can fine grade or finish the surface with greater accuracy. Secondly, the finer stone is less abrasive to the backing of the synthetic turf, negating premature wear.

Drainage: The importance of a properly designed sub-drainage system is critical to the success and longevity of turf fields. Drainage considerations for large sports fields are often the biggest cause in the deterioration of synthetic fields due to the presence of standing water around or beneath the field. Generally, the surface water and the water that drains through the perforated backing of the artificial grass will follow the slope to the lowest areas of the base. This water needs to be collected and carried away from the field area. The installation method is critical for a successful system and it is strongly recommended to include a drainage professional in the design phase of turf fields.

It should be noted that soils testing and geotechnical investigations are recommended to inform decision-making regarding the selection of materials and construction details, particularly around drainage issues.

Drainage requirements for a water permeable base include additional subsurface drains to collect the water that seeps through to the sub-base. The base is usually leveled with a slope between 0.5 – 1%. There exists a close relationship between soil permeability, spacing, and depth of drains. The capacity of water that drainage pipes can carry depends on the pipe's inside diameter, the slope at which it will be installed and the material the pipes are made of. The location and surroundings of the proposed site and the water outlet locations are important factors in the design of a drainage system to ensure that discharge of runoff is directed to the appropriate drainage system, stormwater management facilities, or natural drainageways surrounding the fields.

Shock Pad: In some installations a shock pad is installed directly under the turf and over the stone layer. The two main reasons to install a shock pad is for comfort underfoot and to protect athletes from impact injury while at play. Fields that utilize a shock pad can demonstrate the safety, speed and impact performance that replicates a quality natural turf surface, drain faster, and may last longer.

A shock pad should always be used when installing light-weight infill systems, common with alternative / organic infills, as there isn't enough infill material in the system to provide the necessary shock absorption. To meet the needed industry safety requirements, a shock pad is added under the system to provide the adequate performance.

A shock pad can also be used to limit or reduce the amount of shock absorbing rubber and reduce pile height of the synthetic turf. This is sometimes desirable for sports where the playing field surface wants to be firmer and faster.

Installations without a shock pad will generally require more shock absorbing material in the infill to meet the proper GMax levels. With deeper infill, comes a taller pile height of synthetic turf fiber. Installations of this configuration are the most common.

Synthetic Turf Carpet

The synthetic turf carpet, or rug, is installed either over the shock pad or over the finish stone. The synthetic turf carpet is made up of the turf backing and the turf fibers. The turf fibers are sewn through the turf backing in a process known as tufting.

Fiber - Typically, the fiber used in synthetic turf is textured or non-textured polypropylene, polyester, polyethylene, nylon or other suitable performing hybrid or copolymer in tape form or monofilament. Minimum fiber sizes are 50 microns for polypropylene or polyester, 100 microns for tape form (slit-film) polyethylene, 140-300 for monofilament polyethylene (shape dependent) and 500 denier for nylon.

Polyethylene - The most commonly used material in synthetic sports turf. It is very durable, but not so thick that it is uncomfortable or abrasive when an athlete comes into contact with it.

Monofilament - Single blades of fiber that stand up straight, sometimes with a thickened spine or edges to help them stand on end. Monofilament turf is the best-looking turf because the blades stay upright longer. It can be great for baseball because the upright fibers lend themselves to a

slower ball roll, but the nature of individual fibers means there tends to be more infill splash, so it may not be ideal for soccer, but more for baseball, football or lacrosse.

Slitfilm - Extruded tape-like flat strands that are sliced (slit) forming a honeycomb-like fiber. Once the turf system is installed, the tops of the strands break apart (or 'filibrate') creating a more natural looking surface. Slit film turf holds up to high use activity better than monofilament. It tends to provide a faster ball roll and less infill splash, making it an ideal product for soccer or multi-use fields.

Hybrid - The hybrid systems include a combination of monofilament and slit film turf fibers, making it the best of both worlds. The monofilament fibers give the surface the great look while the slitfilm provides the durability.

Infill

The infill is spread over the synthetic turf carpet and groomed or raked into the turf fiber. The primary function of the infill is to:

- Provide stability to the turf carpet
- Provide a consistent playing surface
- Provide cushion and resiliency comparable to natural grass surfaces

As stated throughout, the typical field section will vary relative to a variety of factors including:

- the type of play
- intensity of usage
- soil conditions and drainage approach
- use of shock pad or other design decisions relative to concussion management

Following is a list of construction methods and details that impact playability, maintenance, durability, and life expectancy of the product

- Using hard connections at the lateral / collector junction will eliminate the possibility of settling at the perimeter collector.
- The use of laser grading equipment is essential in preparing the sub-grade, eliminating the possibility of low spots.
- Testing the stone for durability, stability and bridging are essential in the longevity of the drainage characteristics of the stone base.

- Sewing seams between the synthetic turf rolls in lieu using glue proves time and again to prove more durable.



Site Specific Considerations: The extent of the land disturbance will be determined during the design process, specifically during mass grading and overall drainage system connection location.

At Darden Towe, the extent of disturbance will be subject to the final layout, size and field configuration. It could be anticipated that the extent of grading and disturbance can be limited to a reasonable distance from the intended playing field perimeter, allowing for some transition of grading between, and around the fields. Elements such as pedestrian walks, bleachers or fan viewing areas and perimeter fencing, if included in the construction scope, will all have an impact on the ultimate extent of land disturbance but the primary influence is field layout.

SECTION 2: INFILL PRODUCT CONSIDERATIONS

This section addresses important considerations when selecting infill materials for athletic field turf, including several alternative infill options and the associated pros and cons for each.

It is important to note that each manufacturer has their own proprietary products. Thus, the actual field sections recommended by each vendor can vary depending upon the products they sell. For example, a vendor that puts an emphasis on a specific infill product may prefer more volume of that infill, and in turn reduce the carpet pile height. This can have an impact on field performance, longevity, and maintenance practices.

Infill Material Options

Besides sand, there are basically five types of infill materials on the market—SBR (Styrene Butadiene rubber) Crumb Rubber, TPEs (Thermoplastic Elastomers), EPDM (Ethylene Propylene Diene Monomer) Rubber, Organic Infill materials, and Acrylic Coated Sand. Each infill product on the market has advantages and disadvantages.

The primary considerations in the selection of infill material include the following:

- Intended type of use and playability
- Maintenance requirements
- Potential environmental (and heat) risks associated with product alternatives
- Order of magnitude costs for alternative products

Crumb Rubber

Crumb Rubber is derived from scrap car and truck tires that are ground up and recycled. Two types of crumb rubber infill exist: Ambient and Cryogenic. Together these make up the most widely used infill in the synthetic sports field and landscape market.

Crumb rubber infill is substantially metal free, and, according to the STC Guidelines for Crumb Rubber Infill, should not contain liberated fiber in an amount that exceeds .01% of the total weight of crumb rubber, or .6 lbs. per ton.

Historically, some manufacturers of crumb rubber have had poor quality control in their processing, leading to an excess of fines and fiber in their final product. This can lead to problems with durability and water percolation.

There are reports from agencies including the Consumer Product Safety Commission, and the U.S. EPA that acknowledge the presence of hazardous chemicals in crumb rubber, but find no evidence that the chemicals are released in harmful amounts.

Crumb Rubber characteristically retains more heat and causes higher field temperatures. Depending on geographic regions humidity and precipitation rates, irrigation may be a consideration to mitigate field temperatures.

Cryogenic Crumb Rubber has been studied by a number of state and city agencies and has not been found to be detrimental to the environment or to athletes who use the fields.

A typical maintenance requirement of the crumb rubber infill is a practice called brooming. Through heavy use of a synthetic field, infill material gravitates towards the edges of the field where it can become compacted and skews the distribution of the material through the field. Brooming is the practice of sweeping the infill to loosen the compaction and move the material away from the edges to re-level and re-distribute the field.

Coated Rubber Infill

Both ambient and cryogenic rubber can be coated with colorants, sealers, or anti-microbial substances if desired. Coated rubber provides additional aesthetic appeal, reduction of dust by products during the manufacturing process and complete encapsulation of the rubber particle.

With the ability of these coated rubber infills being coated with a colorant, it can decrease field temperatures by minimizing heat retainment. Additionally, with any infill material the typical brooming practice will be required to maintain the longevity of the turf system.

EPDM Infill

EPDM (Ethylene Propylene Diene Monomer) is made from new virgin material rubber granules – is a polymer elastomer with high resistance to abrasion and wear and will not change its solid form under high temperatures. Typical EPDM colors are green and tan. EPDM has proven its durability as an infill product in all types of climates. Its excellent elasticity properties and resistance to atmospheric and chemical agents provide a stable, high performance infill product.

EPDM infill requires the typical grooming maintenance and comes in a variety of colors which advertises to significantly reduce heat effect. However, the EPDM is more expensive compared to crumb rubber, costing ~$4.00/sf more.

Organic Infill

There are several organic infills available in the North American market, all utilizing different organic components, such as natural cork, ground fibers from the exterior coconut shell, rice husks, and walnut shells. These products can be utilized in professional sports applications as well as for landscaping. At the end of its life cycle it can be recycled directly into the environment.

Organic materials are more environmentally conscience and create less field heat but are prone to additional maintenance requirements. The organic material experiences a higher rate of compaction that requires regular brooming. This material also requires a certain moisture content to maintain the cooler field temperature. The application of herbicides is required to minimize weed growth and the degradation of the natural materials may require replenishment

every 2-3 years. Material can be susceptible to freezing after a rain event, causing the product to break down prematurely.

Costs can be from $1.50 / sf, up to $4.00 / sf more than crumb rubber. A shock pad is required with organic infills at an additional cost of $1.00 to 1.25 / sf more. Infill may need replenishment every 2-3 years, as this material tends to break down. Initial and overall cost may be more significant compared to alternatives.

Sand (Silica) Infill

Pure silica sand is one of the original infilling materials utilized in synthetic turf. This product is a natural infill that is non-toxic, chemically stable and fracture resistant. Silica sand infills are typically tan, off-tan or white in color and - depending upon plant location - may be round or sub-round in particle shape. As a natural product there is no possibility of heavy metals, and the dust / turbidity rating is less than 100. It can be used in conjunction with many other infills on the market to provide a safe and more realistic playing surface. The round shape plays an integral part in the synthetic turf system. It is important that silica sand have a high purity (greater than 90%) to resist crushing and absorption of bacteria and other field contaminants. Silica sand can either be coated with different materials as a standalone product or can be used to firm up in combination with traditional crumb rubber infill systems.

The sand infill is a common infill in conjunction with any alternative, and offers a potential recycle, reuse, or repurpose life-cycle. If appropriate processes are used to separate the sand from synthetic turf, the sand may be re-sold for other purposes.

The sand infill offers a cooler field temperature but is susceptible to compaction. Thus, regular brooming will be required to maintain the longevity of the field.

Coated Silica Sand Infill

This class of infill consists of coated, high-purity silica sand with either a soft or rigid coating specifically engineered for synthetic turf. These coatings are either elastomeric or acrylic in nature (non-toxic) and form a bond with the sand grain sealing it from bacteria to provide superior performance and durability over the life of a field. Coated sand is available in various sizes to meet the application's needs. Depending on the amount and type of infill, coated sands can either be used with or without a pad and are available in various colors. The coatings are generally non-toxic and are bonded to the quartz grain for superior performance and durability over the life of your field. These materials are typically used as a homogenous infill which provides both ballast and shock absorbing qualities to a synthetic turf application.

Similar to many of the other infills, coated silica is recommended to use a shock pad and has a lower heat buildup on the playing surface but is also more expensive than crumb rubber.

TPE Infill

Thermo Plastic Elastomer (TPE) is made from virgin material thermoplastic rubber granules – the infill can be free of lead, zinc and other non-toxic material. These surfaces are cooler to play on, as they are available in a variety of colors that resist fading. These surfaces are very long lasting and are 100% recyclable and re-useable as an infill when the field is replaced. TPE infill,

when utilizing virgin-based resins, will offer consistent performance and excellent g-max over a wide temperature range. ***Synthetic Turf Council*

TPE is also expensive. To reduce cost, some manufacturers of TPE's will use fillers that can be detrimental to the health of an athlete and the environment. Some TPE's can contain heavy metals. Others do not have crush resistance, flexibility, and softness. Some TPEs may not have UV stabilizers.

The problems cited above can be controlled with a well written specification detailing specific testing required by the manufacturer prior to delivery and acceptance of the product.

Although typically not required, the Synthetic Turf Council highly recommends a shock pad with TPE infill. The TPE field without a shock pad experiences a higher g-max (too firm) and therefore must be monitored with frequent tests. The results of the tests will determine additional grooming needed to maintain the field.

BrockFILL

New to the synthetic turf INFILL industry. This material is an engineered wood particle specifically designed for synthetic turf. It is manufactured from a species of southern pine.

- It's made in the USA from a species of southern pine that is grown, harvested, and replanted in continuous cycles, making it ideal for a sustainable, renewable organic infill product.
- 10-year warranty
- 20 degrees cooler when dry, up to 40 degrees cooler when moist
- Requires a shock pad under the turf carpet
- Maintenance requirements are similar to other organic products
- Order of magnitude costs are typically higher due to cost of shock pad

Construction Costs

The cost information provided within for new filed construction are intended for illustration purposes only. For budgeting purposes, it is common to assume construction costs for a synthetic turf field in a range from $6.00, up to $12.00 per square foot, depending upon several factors. Following are some common variables that can significantly impact costs specific to each unique project.

Project Scale and Phasing: Some efficiency of cost can be impacted by the size of a project (number of fields, square footage, etc.) and how the work is phased. Generally, the larger the project the better pricing is typically available for the primary product components (carpet, infill, stone base, etc.), as well as contractor mobilization and sitework. Executing construction of all fields at one time will also typically result in some savings. In cases where field construction must be phased to keep some facilities active during construction, costs will typically be higher due to the need for additional mobilization, more complex sequencing of work, and working around site access limitations.

Design Section: Decisions regarding the design section can impact costs significantly. The inclusion of a shock pad is one significant cost component that is optional, depending upon the intended use and other factors. The need for subsurface drainage can be a major cost component as well.

Sitework: The extent of site work to prepare the field base will vary depending upon topographic conditions at each site. For areas at Darden Towe where existing fields are being replaced, mass grading will be minimal but excavation still necessary to create the stone base and drainage layer. Sitework costs can escalate where grading transitions are required between fields or around field perimeters to blend grading back to the surrounding areas and to direct stormwater runoff to appropriate areas.

Drainage: Drainage from turf field will be conveyed to the existing storm drainage system in the park. The cost variable is related to how much of a piped system is required to tie into existing system, and whether any additional management features will be required. In the absence of detailed engineering, it appears that the overall drainage approach Darden Towe drainage will not be substantially different with turf fields than natural fields.

Infill Selection: As illustrated below, infill product selection will impact costs. These estimated costs were derived from average costs quoted by a number of different turf manufacturers. Costs can vary widely based upon the manufacturer selected as they each have their own proprietary products.

4 Synthetic turf fields w/ 48oz product and the following infill options 75,900 SF / Synthetic turf field - 200' x 300' field w/ 15' run-off perimeter 6" stone base with a sub-drainage system of flat panel laterals & 12" perimeter collector						
Product	Area	Unit	Cost	Base Cost	Infill Cost	Total Cost
Base Work	303,600	SF	$4.00	$1,214,400		
Turf / SBR and sand	303,600	SF	$3.00		$ 910,800	$ 2,125,200
Turf / EPDM Infill (virgin)	303,600	SF	$5.65		$1,715,340	$ 2,929,740
Turf / organic Infill w/ pad	303,600	SF	$4.95		$1,502,820	$ 2,717,220
Turf / coated sand & SBR	303,600	SF	$3.35		$1,017,060	$ 2,231,460
Turf / TPE Infill	303,600	SF	$6.30		$1,912,680	$ 3,127,080
Turf / BrockFill w/ pad	303,600	SF	$4.25		$1,290,300	$ 2,504,700

Synthetic Turf Renovation Costs

Synthetic turf fields that have reached the end of their lifecycle use can be renovated with new carpet and infill materials, retaining the base section if it is still stable and functioning properly. Turf renovation costs can range from $3.00 to $5.00 / sf, depending on the extent of the renovation, base condition, what products are replaced and the costs to re-use or recycle the old turf.

A turf renovation project requires more than just replacing the synthetic turf carpet. The contractor should remove the infill and stockpile for testing to determine if it can be re-applied or moved to a

recycling facility. Next, the synthetic turf carpet can be systematically removed and hauled away for re-use or recycling. After the turf and infill is removed, the stone base should be tested for acceptable percolation. If the stone is still performing well, it can be re-leveled and prepared for the new synthetic turf carpet. If the stone is not performing, corrections or total replacement should be performed at that time. After the new synthetic turf is installed, the infill can be put back into place or replaced as necessary.

SECTION 3: ENVIRONMENTAL and PUBLIC HEALTH CONSIDERATIONS:

Environmental considerations of turf fields include consideration regarding the introduction of infill materials into natural systems via stormwater runoff, the disposal of replaced infill material into the municipal waste management system, the elimination of fertilizers associated with natural grass maintenance and the reduction in water consumption for maintenance activities.

Heavy Metals and Material Content

Highly toxic perfluorinated chemicals (PFCs), specifically per - and polyfluoroalkyl substances (PFAS), have recently been found in the plastic backing and in the blades of some synthetic turf fields. *16 PFAS* is an additive used during production of plastic polymers to prevent molten plastic from clogging extrusion machines and has been classified as a "chemical hitchhiker" that remains on products.

To battle the inclusion of these and other chemicals and heavy metals, the turf specification should include a section on testing, product analysis and evaluation criteria.

- The Turf Company will conduct and submit product analysis with the project bid. Analysis will be presented in the form of current, certified laboratory results using specified standards and processes.
- Representative samples of the turf fibers, turf backing, and infill material shall be analyzed for total metals content and semi-volatile organic compounds (SVOCs), as well as select analyses for leachable metals concentrations.
- The detected concentrations of lead, chromium, and zinc in the samples of the turf infill material shall not exceed the threshold values for total metals and leachable metals analyses.
- The Turf Company shall provide verification that brominated flame retardants have not been intentionally added in the manufacture of the turf fiber, backing, underlayment or infill materials. Verification can take the form of a signed letter from the manufacturer, or appropriate laboratory analyses of the product proving that levels of elemental bromine are lower than 1% by weight.

Reduction in Fertilizer / Chemicals

In most municipalities, synthetic turf will replace a sports field that has been grown and maintained with harmful fertilizers, pesticides and herbicides which have significant health and environmental implications. Albemarle County does not allow the use of these chemicals, so there would not be a reduction in chemicals here.

Reduction in Noxious Emissions

Synthetic turf helps reduce noxious emissions resulting from use of gas-powered maintenance equipment. ***(the EPA reports that a push mower emits as much pollution in one hour as 11 cars and a riding mower emits as much as 34 cars)***. www.peoplepoweredmachines.com/faq-environment.htm

Municipal Waste Stream Reduction

Turf fields eliminates the need to dispose of grass clippings associated with grass fields, which the EPA states are the third largest component of municipal solid waste in landfills. ***Synthetic Turf Council*

Heat-Gain

Surface temperatures and ambient heat-gain is an environmental consideration related to the use of turf fields. During the summer months, when synthetic turf is exposed to direct sunlight, some synthetic turf fields have reported surface temperatures significantly hotter than the surface temperature of a natural grass field. The Synthetic Turf Council advocates specific heat-acclimation guidelines published by the National Athletic Trainers' Association. These conditions are typically managed by one, or a combination of the following practices:

- Scheduling practices and games for the cooler times of day
- Limit the number and duration of practices. This could be a consideration when assessing overall field utilization goals.
- Using organic materials for the infill material is an environmentally friendly way to battle heat gain on the synthetic turf surface.
- Periodic watering of the fields
- Regular misting of the athletes during play and keeping them properly hydrated. A misting station normally needs only five gallons of water per hour based on full use. On a typical day, when the heat is at its peak for four to six hours, that equals 20 to 30 gallons of water.
- There are other commonly used products on the market as well, including, but not limited to, the following:

    - HydroChill is a precoat that is applied to the infill. It is activated by adding moisture and can provide cooling for days. This product does have to be re-applied.
    - CoolPlay is an extruded blend of polymers and cork that replaces the top layer of crumb rubber.
    - Envirofill is a product that uses a rounded quartz core that is coated with a polymer and infused with anti-microbial.

Site-Specific Environmental Considerations

Darden Towe Park is situated topographically above a buffered branch of the Rivanna River. The use of synthetic turf fields should include plans for stormwater runoff control, similar to typical best management practices to control runoff and sedimentation from migrating downstream to the river. Migration of fill materials is most likely to occur with poorly drained fields when ponded water runs off of the fields, carrying suspended infill material into drainageways. The prevention of infill material from migrating beyond the playing surface can be effectively done by a combination of design decisions and maintenance practices related to good drainage:

- Construct the field section with proper drainage characteristics to prevent ponding
- Monitor the drainage functions of the fields

- Maintain the regulated buffers as well as grass landscape areas between the playing fields and drainage features to trap any migrating materials.

Means for preventing infill migration can also include a turf product with a thatch zone. Turf thatch is a textured yarn that is situated below the face yarn to enhance grass-pile recovery. It is added to systems to create a matrix of protection that minimizes infill movement, reduces migration and helps eliminate rubber splash common to most synthetic turf products.

Proper drainage design will also include control of the rate of release for runoff from the turf fields that enters the downstream stormwater system. With proper design and construction, the use of infill materials should pose little risk to the environment. The elimination of the fertilizers and chemicals utilized to grow natural turf is a certain identifiable benefit to the wildlife and natural resources surrounding the park.

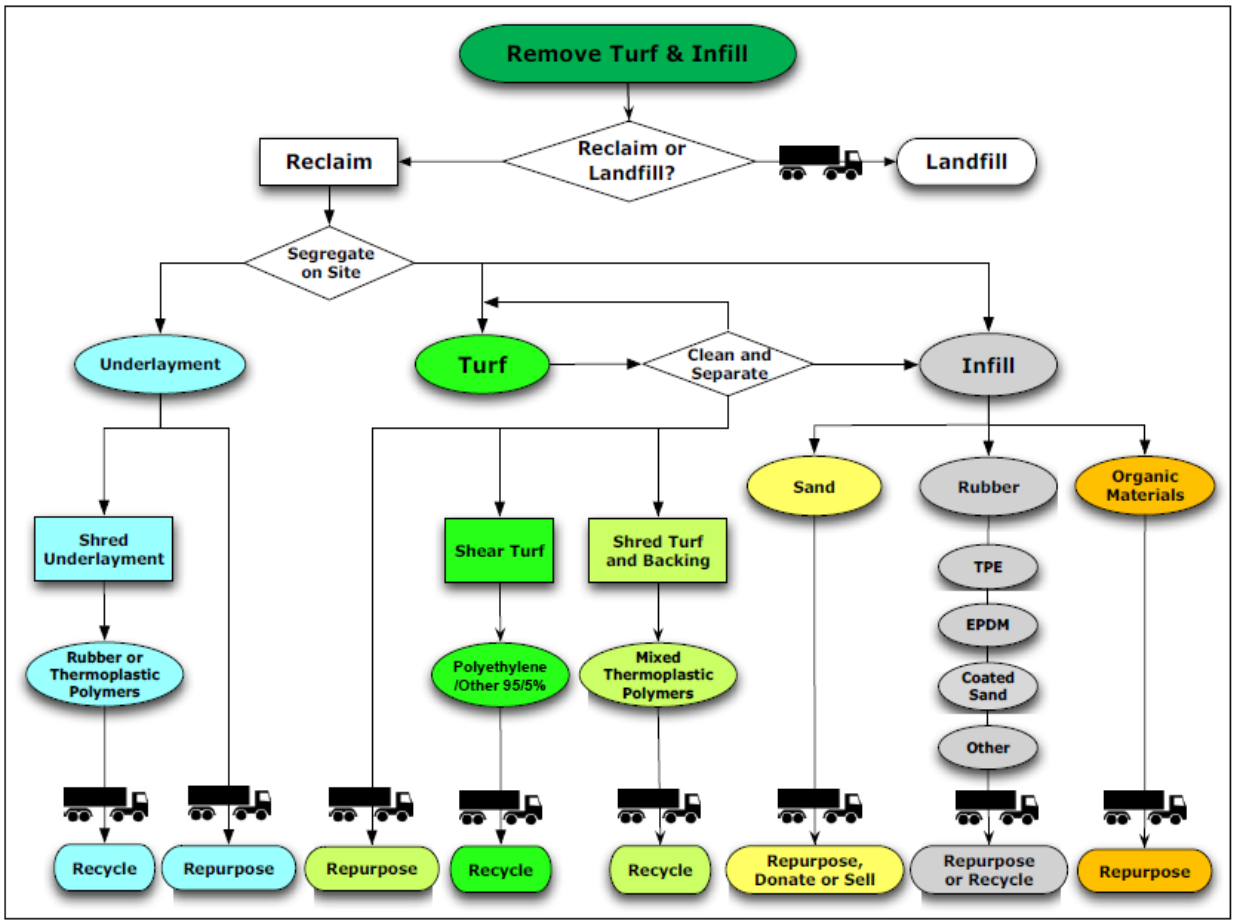
Disposal of Excess or Replaced Infill, Turf Materials

The STC encourages owners of existing synthetic turf system applications to recycle, reuse, and repurpose the turf system components whenever possible. Current practices in the United States, replace worn turf at the end of their life cycle that either ends up in a landfill, incinerated, or rolled up and stored in another yard location. These practices cause excessive unusable waste in storage facilities and landfills while also contributing a large amount of air pollution through incineration.

With appropriate cleaning and separating practices, synthetic turf and infill each can be recycled, reused, or repurposed. Synthetic turf can potentially be reused in cases of batting cages, golf mats at driving ranges, band practice fields, highway erosion control, dog parks, and many other uses. The infill materials of sand, rubber or organic material additionally have opportunities for a second life through re-sale, recycling and repurposing. However, the effectiveness to recycle, reuse, or repurpose the turf and infill depends on the separating process and needs to be executed by an experienced professional due to constraints of reliable sample collection methods, contaminants and debris within the infill, and the physical integrity and performance properties of the worn material.

AGR (Artificial Grass Recyclers) are a company that specializes in the re-sale and re-use of synthetic turf. They have 47 locations nationwide, with the closest being in Charlotte and Philadelphia. They provide a chain of custody, disclosing that the turf will not be exposed in a landfill.

It should be noted that future practices may eliminate synthetic turf and infill ending in an incinerator or landfill. A Scandinavian company, Re-Match, has developed a mechanical separation process that makes it possible to clean and recycle 99% of old synthetic turf. Currently it costs $20,000 to ship one field overseas to the Denmark located Re-Match facility. Re-Match has stated plans to open 2 U.S. recycling facilities in Pennsylvania and California to help mitigate shipping costs and create accessibility to these the services within the United States.



Water Quality Benefits

During a rain event, water enters into the top surface of the synthetic turf and then passes through the many layers of the profile, essentially filtering the water as it travels. The water moves through an inch and a half of infill (mineral, rubber, silica sand and granular plastic), down through a woven geotextile fabric that makes up the turf backing. From there, the water passes through six inches of stone base and is either carried through a sub-drainage system to the river or it passes through an additional geotextile before it enters back into the groundwater. This process of filtration provides for a superior water quality treatment prior to discharge compared to that of a natural turf playing field system.

End of Life Recycling Plan

The County may consider including in the specification for construction and end of life recycling plan. This plan would require the winning contractor to provide, with their bid proposal, detailed plan for the management of all turf product components at the end of their useful life, including:

- Manner of reuse / recycling for each product component
- Identification of parties responsible for the removal and disposal of the field products.
- A detailed description of the reuse or recycling process.

- A signed commitment from the winning proposal's signatory guaranteeing implementation of the plan within a reasonable time after removal.
- These plans shall not include incineration, or any other type of high temperature conversion technology.

Public Health Considerations

The use of crumb rubber as an infill material has been studied extensively since its marked increase as a preferred infill material. More than 50 independent and credible studies from groups such as the U.S. Consumer Product Safety Commission, and statewide governmental agencies such as the New York State Department of Environmental Conservation, New York State Department of Health and the California Environmental Protection Agency, have validated the safety of synthetic turf with crumb rubber infill. Recent highlights include:

- In October 2010, the California Office of Environmental Assessment completed its multi-year study of air quality above crumb rubber infilled synthetic turf, and bacteria in the turf, and reported that there were no public health concerns.
- In July 2010, the Connecticut Department of Public Health announced that a new study of the risks to children and adults playing on synthetic turf fields containing crumb rubber infill shows "no elevated health risks."
- The California EPA released a report dated July 2009 which indicated there is a negligible human health risk from inhaling the air above synthetic turf.
- Independent tests conducted by the New York State Department of Environmental Conservation and New York State Department of Health, released in May 2009, proved there were no significant health concerns at synthetic turf fields.
- In July 2008, a U.S. Consumer Product Safety Commission staff report approved the use of synthetic turf by children and people of all ages.
- More recently, user groups of synthetic turf have raised health and safety concerns about the use of crumb rubber infill on synthetic turf fields. In 2016, a multi-agency research effort was launched to address these concerns, including the following:
    - CDC – Centers for Disease Control and Prevention
    - ATSDR – Agency for Toxic Substances and Disease Registry
    - EPA – U.S. Environmental Protection Agency
    - CPSC – Consumer Product Safety Commission

The goal of the research is to characterize potential human exposure to the substances associated with crumb rubber infill used on synthetic turf surfaces. Results are being reported in two parts.

- Part 1, released in 2019, communicates the research objectives, methods, results and findings for crumb rubber infill characterization research.
- Part 2, not yet released, will characterize potential human exposures to the chemicals found in the crumb rubber infill while using synthetic turf fields.

Neither part 1 nor part 2 of the study will constitute an assessment of the risks associated with playing on synthetic turf fields with crumb rubber infill but can be used to inform future risk assessments.

SECTION 4: LIFE CYCLE CONSIDERATIONS

Life cycle expectations for turf fields are integrally tied to design decisions, construction methods, installation quality, and maintenance procedures. Premature turf failure can result from a problem in any one, or combination of these areas of responsibility. Total hours of play and types of play and activity on the turf will also have an effect on the life of the turf surface. Fields that are used 8 hours a day for an average of 3000 hours a year are not going to last as long as fields with half the hours, similar to miles on the odometer of a car.

Types of play, as a second example, can have a great effect on the longevity of a field. A properly maintained soccer field should last longer than that of a football practice field with the same hours of play on it. Part of this is because of the concentration of the activity between the hash marks. The stress on the turf as offensive and defensive linemen plant for traction will also have an effect. Compare those stresses on the surface to that of soccer play that is generally spread out and played with lighter athletes.

Field Maintenance

Decisions regarding the installation of turf fields must include an assessment of maintenance costs, staff capabilities, equipment needs, and liability. The basic objectives of effective maintenance are that:

- The playing surface is kept clean on a consistent basis;
- The playing surface remains level and of consistent texture so that it gives a true and predictable performance;
- The infill materials are evenly distributed and kept at the correct levels;
- The effective drainage of surface water is managed throughout the life of the field's surface;
- The playing surface does not become over compacted and hard;

Staffing for Successful Field Maintenance

A full-time person with an assistant should be able to handle the day to day maintenance of four to five synthetic turf fields. The fields should be walked daily to evaluate the turf surface for the following:

- Debris or contamination must be cleaned or removed.
- Check and maintain proper infill levels to provide a level and consistent playing surface. Pay special attention to areas with heavy traffic or play. Add new infill or redistribute migrated infill to recommended depth.
- Check for seam failure. Open seams should be immediately repaired as they can cause tripping hazards for users.
- Note any visual signs of problems, such as drainage concerns, excess wear, infill migration.
- Maintain a maintenance and activity log for each synthetic turf field.

Comprehensive maintenance occurring every six to twelve months can be handled by the original field builder or a third-party maintenance contractor. The owner should review these activities, techniques, repairs and material with the turf manufacturer and the field builder to ensure they are in line with the field builders specifications and warranty.

A more detailed report and description of these maintenance activities can be found in the attached *Synthetic Turf Council's Guidelines for Maintenance.*

Water Usage

Synthetic turf offers a significant advantage over natural turf in that they require little, if any water usage. Natural turf fields with native soil require, on average, a half inch of water for each week of the local growing season. Natural turf fields with a sand base rootzone require double that or one inch of water per week to maintain proper grass health as a successful sport surface.

Most generally, synthetic turf does not require water unless it is being applied for cooling through evaporative cooling. To quantify this, a typical multi-purpose field measuring 200' x 300' with a 15' run-off zone the full perimeter is 75,900 SF. A native soil field of this size requires 23,000 gallons of water per week and a sand based field will require 47,000 gallons per week.

If your water is pumped from the river, such as our example here, the water itself is free. However, the process to manage and operate its application is not without cost. Risks is also a factor should a pump fail or available water in the river were to minimize.

Life Cycle Expectations

The playing fields at this park, understood to be soccer, lacrosse and field hockey, should last well beyond their warranty period of eight years, if they are engineered properly, constructed well, and maintained appropriately. If any one of these three activities are lacking, the life cycle of the playing field can be shortened or present a failure.

Replacement of a field for poor performance or a failure will most generally relate back to the warranty and guarantee of the turf installer or turf manufacturer. For this reason, it is generally good practice for the turf installer to be a certified installer for the specific product being installed. This eliminates finger pointing between installer and manufacturer. This also highlights the importance of the warranty and its coverage.

Replacing the synthetic turf after its useable life should be a consideration as well. The stone base and sub-drainage system should be useable for another life cycle, should they be designed and constructed well. These systems can and should be tested for proper operation and the finish stone re-leveled prior to covering them with new turf. The old infill should be evaluated for re-use on the new synthetic turf carpet.

SECTION 5: PROCUREMENT STRATEGIES and DUE DILIGENCE

The selection of vendors, product suppliers and contractors to help plan, design and construct high quality turf facilities is critical to the long-term success of your projects. Following are recommendations regarding some suggested best-practices for due-diligence and background checks toward selection of vendors and contractors and discussion of challenges commonly experienced in this industry

There are really two ways to look at procuring this work. One is through the traditional competitive bid environment and the other is a cooperative agreement with cooperative manufacturer's contracts.

Competitive Bid

The competitive bid process will, at its core, identify the lowest price for the work identified in the plans and specifications. If that is goal number one, this is the process to follow.

Cooperative purchasing

The cooperative purchasing process gives the Owner more flexibility to selecting products they have identified as best fit for their project. This process should reduce the administrative burden of purchasing and should expedite the purchasing process. When using a cooperative contract, you are relying on the work of another agency that has already run a competitive bid process.

Contractor Qualifications

It may be beneficial to the County to include qualifying requirements of the bidding Contractors to help identify the stronger and sometimes weaker bidders.

The playing field designer may include in the specification, a qualification submittal package required by the Playing Field Contractor prior to selection. These requirements can include the following:

- It is the preference of the County that the playing field contractor holds a current certification by the American Sports Builders Association for the construction of synthetic turf field construction.
- Minimum of Five (5) similar municipal or greater synthetic turf soccer pitch construction projects, which they have completed within the last three (3) years that are similar in scope and size.
- The five (5) similar projects submitted must provide the following information:
    - Name of the project.
    - Location and description of project.
    - The original playing field budget, completion date and state it was completed
    - Contact name, phone number of the representative overseeing the work performed.

- Statement signed by the owner of the playing field construction company “stating that the company has NO present or past legal action and or litigation against the company over the past seven (7) years for poor workmanship, warranty issues, non-payment to sub-contractors and or project delays”. If so, please submit a written letter of explanation.
- Number of fulltime employees that company currently has on staff that specialize in synthetic turf playing field construction. No part-time or sub-contractors shall be included in the number of employees.
- Please identify the Playing Field Contractors Jobsite Superintendent, similar playing field experience and telephone contact number.
- List all the name of all sub-contractors to be under the direct responsibility of the playing field contractor in association with the construction of this project.
- The playing field contractor shall submit a preliminary bar chart for the playing field construction schedule that lists the type of work and length of time for each task.
- The playing field contractor is responsible for all quantities of materials necessary for the complete construction of the entire synthetic turf playing field system. The bid pricing shall be a lump sum bid. No potential value engineering items shall be part of the final bid submission.
- The synthetic field system work shall be performed by a firm and crew meeting the following criteria:
    - A minimum of five (5) successful fields in the last three (3) years on projects comparable to this project.
    - The firm installing the turf product shall have the approval of the synthetic field surfacing materials manufacturer.
- Firms must have been in business under the same Ownership for at least seven years, and shall have been installing similar sports fields for that entire period.

General: Warranties / Guarantees

The playing field designer may include in the specification, statements regarding the synthetic turf warranty and / or guarantee additional to and running concurrent with the Warranty from the manufacturer or field installer. The following may be included as part of the specifications to protect the County:

The items below are inclusive of the term “Playing Field System” for provisions of the guarantee:

- Final grade tolerances to one-quarter inch in the length of 25' of finish grade in any direction.
- Synthetic turf product as specified and represented by the Turf manufacturer/vendor also including seams and adhesives used in the installation.
- Working functions of the drainage system.
- All materials and products specified.

- Drainage thru the turf, infill and finished topping stone material shall be guaranteed to have a percolation rate of no less than 6 inches per hour

Statement of Supervision: Upon completion of the Work, The Contractor shall submit a written statement signed by the Synthetic Turf Manufacturer. Stating that the field observation conducted by the Synthetic Turf Manufacture representative appears to be sufficient to insure proper application of the complete system and materials used and the system was constructed in accordance with the Contract Documents, and that the installation is acceptable to the Synthetic Turf Manufacturer".

G-Max Testing: The synthetic surface manufacturer shall retain a third party certified testing laboratory and shall perform G-Max (based on highest level of intended athletic sports usage) testing prior to acceptance / Substantial Completion. The County shall be responsible for maintain the field and testing each year for the life of the Guarantee. The playing field is limited to the following athletic uses: sports such as soccer, lacrosse and field hockey, etc. would be acceptable usage. The County is fully aware that American tackle football or competitive rugby on this field is not allowed because of potential player safety issues.

- Initial testing G-Max testing shall be provided by the synthetic turf manufacturer third party certified testing laboratory prior to acceptance / Substantial Completion. The County and the Engineer are to receive a copy of the Initial G-Max-testing results.
- Testing shall consist of shock attenuation per ASTM F-355-A (full system). Testing shall be in accordance with ASTM Test Method F-1936 or as described in the construction documents.
    - Initial test shall not exceed 175G's nor shall it be less than 90G's at any one point on the field.
    - G-Max shall not change more than 5% (five percent) at any one location per year over the life of the Guarantee.
        - In cases where the results of the above testing exceed the specified values, the condition shall be corrected by the synthetic turf manufacturer.
        - The synthetic turf manufacturer shall provide adequate information to confirm that the mitigation measures were effective.
    - At no time in the life of the Guarantee shall the G-Max exceed 200G's at any one point on the field. The County shall conduct yearly testing and retain the records for all corrective measure taken, if any.
- The depth of the infill material shall be measured at the point of each test location.
- The testing shall be performed by a certified independent lab and paid for by the County.
- If the Contractor does not perform the tests within 30 days of the dates noted, the County shall at its discretion order this work performed and the Contractor shall bear this cost.

Contractor shall not be held liable for incidental or consequential damages. The Synthetic Turf Warranties described shall be conditioned upon:

- County shall make all minor repairs to the synthetic turf system as discovered.
- County shall maintain field as described in the Owner's Manual submitted by the Contractor to the County.

The Warranty does not cover any defect, failure, damage caused by or connected with abuse, neglect, deliberate acts, acts of God, casualty or loads exceeding the Contractor's recommendations.

Total warranty length shall be eight (8-year) minimum.

There are many parts to a synthetic turf warranty. However, the two most important parts of a synthetic turf warranty are the synthetic turf ***products*** and the total field ***installation***.

Product Warranty

UV degradation, fiber strength, stability of the backing and tufted yarn integrity are items generally covered by the yarn and component manufacturers warranties. If failure of these items is detected prior to the warranty period, they can be tested per ASTM standard test methods by a certified testing agent. If a problem arises and you need to exercise your warranty, you will want a copy of your construction contract, warranty, invoice and payment documentation.

Installation Warranty

Most warranties, unless specified, will not cover items such as construction materials (other than the synthetic turf), construction workmanship, labor, shipping and handling, removal and any dump or hauling fees. For this reason, it is important to include in the specification their inclusion.

Third-Party Warranty

A bonded third-party warranty protects the customer should the manufacturer or installer go out of business prior to the expiration of the warranty. Secondly, a third-party warranty can cover the material, the installation and the disposal of the old material. These warranties tend to be more expensive than a manufacturer's or an installers warranties. You may want to consider including payment for this warranty in the bid cost. Consider including a third-party warranty in the specifications written for your work.

SECTION 6: PRACTICAL EXAMPLES

Kimley-Horn contacted representatives from three selected peer facilities to obtain general information regarding their experiences with successful turf field installations and operations in similar locales around the region. The goal was to ascertain data from those entities having experience with design, installation, and maintenance of in-place turf installations regarding product selection, procurement method, usage statistics, and economic impact. This task also includes a brief discussion of the economic impacts associated with one peer facility.

PRACTICAL EXAMPLE #1: Fairfax County Park Authority

Fairfax County currently operates over 100 synthetic turf playing fields and has several years of experience with these types of facilities. Based upon their collective experience, and given the many advantages of turf fields, Fairfax County states that they have no plans to develop natural grass fields in the future.

1. Design
    a. What does the synthetic turf section look like that was designed?
    Standard design, typically without a shock pad.
    b. What infill was utilized?
    Cryogenic rubber
    c. What pile height of turf was installed?
    2.5”
    d. What design decisions would you do differently?
    Would install shock pad if we could afford it, in most cases. Shock pad could be reused for 2nd turf replacement and protect against high GMAX values.

    Would also fence in fields entirely and inside of curb, funnel traffic, extend turf 15’ beyond playing dimensions for a safety buffer and to keep players, spectators, etc. off of natural grass areas in an effort to protect the system and extend the life.

    e. What is best design decision you made?
    Strategic fencing to manage traffic flow to protect the turf system and lifecycle.

2. Installation
    a. Were seams sewn or glued?
    Seams are sewn, inlays are glued.

    b. Was the same contractor that installed the base, used to install the synthetic turf?
    Same GC usually, but base work usually different as turf manufacturers tend to want to install their product with their own crews. GC will typically be the turf company and sub out to others for site work.

    c. Was the installer a certified installer for the specific synthetic turf manufacturer used?
    Yes, typically is the manufacturer’s crew or their preferred sub-contractor.

3. Maintenance

a. How often are the fields groomed?
2x/week: pull - behind groom
1-2x/yr: deep cleaning
Magnetic sweep: used to remove metal objects with each grooming

b. What equipment is utilized to maintain the fields?
UTVs to pull groomers, Deep cleaning vacuums (SportChamp or Redexim), magnets, blowers, GMAX equipment, hot glue machines for turf repairs.

c. Are the fields tested for GMax and if so how often?
Yes. 1-2x/year or additionally as needed.

d. Who does your testing?
Staff on parks and Contractors on schools.

e. What are your annual costs for maintenance as compared to natural grass?
$19,059 synthetic vs. $16,652 natural grass (Park field comparison)

f. Do you own your equipment or lease?
Own

g. Do you use third party for maintenance?
Yes, for some. Park fields maintained by staff, School fields by contractors.

h. If so, what is cost impact?
25k/year budget figure for all contracted services per field.

4. Product Selection
   a. What manufacturer was utilized for the turf, shock pad, infill?
   Field Turf mostly, some Shaw and SprinTurf.

   b. How were the products selected?
   Existing co-op contracts

   c. How do the products selected compare to other existing fields you utilize? Better surface or not as good?
   Generally, all the same.

   d. Are you utilizing any organic or heat mitigating infills in your installs? Are you finding success?
   2 Thermo Plastic Elastomer fields, no actual monitoring. Need pads due to harder product vs CR.

   e. Is your organization happy with the fields that have been built?
   Generally, yes, some anomalies with product and workmanship deficiencies require correction occasionally.

5. Procurement Method
   a. Did you utilize a competitive bid for any or all of your project?
   Mostly existing coop contracts.

b. Did you utilize a cooperative agreement to purchase specific products?
Yes.

c. Private agreement?
No

d. Is your organization generally happy with the process you utilized and the resulting installation? Would you repeat that same process again for your next installation or change it?
Yes, yes.

6. Usage Statistics
How many hours of play do you have programed for the fields per week, month, year?
We schedule the fields 60 hours per week- 5-11 on weekdays and 8AM to 11PM on weekends

a. What age groups are utilizing your fields?
We schedule youths 7U though adults

b. What sports are being played on the surface?
All: football, soccer, lax, field hockey, cricket, baseball, etc.

c. Are the surfaces used for contact sports – football, rugby?
Yes, mostly football, some limited rugby.

d. Do your fields have lights?
Most synthetics have lights to maximize the benefit during winter hours.

e. Did you document an increase in play from previous usage?
We know that we get consistent usage from the turf fields – rare cancellations- the hours that we schedule are the hours that are used- weather was huge impact before turf.

7. Economic Impact
a. What has been the economic impact of the synthetic turf install?
The cost of field conversion from grass to synthetic turf is funded either by bond funds or by private funds. Replacement cost is funded from users' fees

b. What did your organization spend on building the synthetic turf surfaces? Price per SF?
Currently PA has a total of 44 fields on park properties. Some fields were obtained through proffers but most of the fields were built by PA. Total cost for these facilities is unknown. Current conversion cost is ~$12 per SF

8. Lifecycle
a. How long have these been in place?
Circa 2003

b. How long last – replaced?
10-year life cycle if quality product installed correctly and maintained well.

9. Environmental
   a. How have you handled heat gain issues common to synthetic turf?
   Don't address heat, user choice to not play if it is too hot.

   b. Do you have a plan in place for recycling the infill / turf after life cycle?
   No, installers responsible for proper disposal when resurfacing existing synthetic fields.

   c. Do you have any migration of infill off of the field?
   Limited if at all, most infill gets tracked off the field from shoes, but occasionally a worn field with a poor drainage and heavy rain will migrate infill off the field to perimeter natural grass areas.

10. Warranty
   a. What type warranty did you secure? Is your warranty prorated or material only?
   Generally, all warranties are 7-8 years, full coverage.

   b. Is your warranty a third party warranty?
   No, from manufacturer/installer.

   c. Are your field inspections in-house or external?
   Internally, but we get opinions from all directions.

11. BIG Picture: Lessons Learned
   a. What is most important thing you tell another municipality building a similar facility?
   Have a full maintenance program from day one to protect your investment. We played catch up for years until we could get all the early fields replaced. Have the budget conversations early and often to secure funding before the field is built.

   b. Any Litigation history during the build? After the build?
   None that I'm aware of.

PRACTICAL EXAMPLE #2: R.A.D Sports Synthetic Field Projects – Various Locations
R.A.D. Sports is an industry leader in construction of synthetic and natural sports fields at every level of competition. The responses below are relative to recently completed synthetic turf field projects, and trends in design and construction across the country.

1. Design
    a. What does your typical muni synthetic turf section look like?
    The preferred section has changed over time, since 2014. This is mostly related to how municipalities characterize pervious and impervious surfaces. The stone base system can be used for stormwater storage and to convey to the adjacent stormwater systems. 8 in drainage stone base is fairly common.

    b. Did you utilize a shock pad under the synthetic turf carpet?
    This is much more common now, primarily because the move toward organic infills. The shock pad is required with organics. The pad does improve longevity but is a significant expense. It obviously has safety component as well.

    c. What infill is most commonly used now?
    There is a definite move away from sand and crumb rubber toward organics. Some popular proprietary products include:
        - **"Geofill" Coconut + cork = shaw industries**
        - **Brockfill = southern pine wood product**
        - **Envirofill = acrylic coated sand**

    Organics perform better to mitigate heat-gain, but do require a shock pad. Even though research does not tie this product to health issues, many municipalities prefer to avoid any potential liability associated with the product. They can freeze in cold climates but that typically does not limit play in those conditions.
    It should be noted that EPDM rubber is becoming a good choice for those that want the playability – it plays like traditional sand + rubber mix – but is a virgin material, not made from recycled tires.

    d. What design decisions are changing or being revisited the most?
    The move to alternative infills and shock pads.

    e. What is best design decision you made?
    Strategic fencing, traffic flow, anything to protect the turf system and lifecycle.

2. Installation
    a. Were seams sewn or glued?
    Changing – back to glue…..better product for cold weather work
    Seams are sewn, inlays are glued

    b. Was the same contractor that installed the base, used to install the synthetic turf?
    Not normal – some General Contractors can do all in-house; base work usually different as turf manufacturers tend to want to install their product

with their own crews. General Contractors will typically be the turf company and sub out to others for site work.

c. Was the installer a certified installer for the specific synthetic turf manufacturer used?
Yes, typically is the manufacturer's crew or their preferred sub-contractor.

3. Maintenance **(can out-source maintenance to contractor specifications)**
   a. How often are the fields groomed?
   1x/week pull - behind groom is ideal but 4x/yr. is fine
   1-2x/yr. deep cleaning

   b. Are magnets utilized to remove metal objects?
   Litter cat & magnet at each groom.

   c. What equipment is utilized to maintain the fields?
   UTVs to pull groomers, Deep cleaning vacuums (SportChamp or Redexim), magnets, blowers, GMAX equipment, hot glue machines for turf repairs.

   d. Are the fields tested for GMax and if so how often? Who?
   At installation on GC spec but by 3rd party testing.
   Yes, 1-x/year for life – on owner or GC contract 8yr.

   e. Who does your testing?
   Staff on parks and contractors on schools.
   f. What are your annual costs for maintenance as compared to natural grass (as previous surface)?
   Out-source $2500 per visit

   g. Do you own your equipment or lease? **Municipality**
   Varies but most get equipment with installation contract

   h. Do you use third party for maintenance?
   Typically – municipalities keep detailed maintenance logs to cover any issues of liability if a problem occurs.

4. Product Selection
   a. What manufacturer was utilized for the turf, shock pad, infill?
   Stick to major manufacturers
   Visit fields
   Tight turf spec
   Field Turf mostly, some Shaw and SprinTurf.

   b. How were the products selected?
   Existing co-op contracts

   c. How do the products selected compare to other existing fields you utilize? Better surface or not as good?
   Generally, all the same.

5. Procurement Method

a. Did you utilize a competitive bid for any or all of your project?
TradE BID – need good spec
Buying coops to purchase from coop
Finance options

b. Did you utilize a cooperative agreement to purchase specific products?
Yes.

c. Private agreement?
No

d. Is your organization generally happy with the process you utilized and the resulting installation? Would you repeat that same process again for your next installation or change it?
Yes, yes.

6. Usage Statistics -
   a. What sports are being played on the surface?
   All: football, soccer, lax, field hockey, cricket, baseball, etc.

   b. Are the surfaces used for contact sports – football, rugby?
   Yes, mostly football, some limited rugby.

   c. Do your fields have lights?
   Most synthetics have lights to maximize the benefit during winter hours.

7. Lifecycle
   a. How long have these been in place?
   8 yr. stand warranty – 10 year typical

   b. How long last – replaced?
   10-year life cycle if quality product installed correctly and maintained well.

8. Environmental
   a. How have you handled heat gain issues common to synthetic turf?
   None lately - hydrochill additive with CR + sand

   b. Do you have a plan in place for recycling the infill / turf after life cycle?
   20 fields target tech takes carpet to recycle Malaysia / ReMatch + chain of custody – used in post-consumer products – put in specs no landfill
   Remove turf and extract infill – re-bag
   Infill – re-purpose lesser demand uses – not athletic
   No, installers responsible for proper disposal when resurfacing existing synthetic fields.

   c. Do you have any migration of infill off of the field?
   Limited, if at all

9. Warranty
   a. What type warranty did you secure? Is your warranty prorated or material only?
   Generally, all warranties are 7-8 years, full coverage.

b. Is your warranty a third party warranty?
No, from manufacturer/installer.

c. Are your field inspections in-house or external?
Internally, but we get opinions from all directions.

10. BIG Picture:
    a. What is most important thing you tell another municipality building a similar facility?
    Proper maintenance; increasing usage hours + lights

    b. Any Litigation history during the build? After the build?
    Limited for injuries
    Related to turf patents
    Degrading too soon

REFERENCES

Prior Studies – Albemarle County Sponsored or Referenced

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- *Memorandum of Understanding between School Board of Albemarle County, VA and the Albemarle Board of Supervisors -* August 11, 2016
- *Grass Field Use for the Albemarle County Public Schools - 2018-19*
- Budget FY20 Support Data Towe Fields
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- *Considerations When Buying Synthetic Grass for Landscape Use* Synthetic Turf Council - September 2013
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- *Guidelines for Minimizing The Risk of Heat-Related Illness*
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- *Suggested Environmental Guidelines for Infill*
  - Synthetic Turf Council – August 2015
- *A Guideline To Recycle, Reuse, Repurpose And Remove Synthetic Turf Systems*
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- *The Dangerous Pileup of Artificial Turf -* The Atlantic, Marjie Lundstrom, Eli Wolfe, And Fairwarning – December 19, 2019
- *Report on Alternate Infill Materials for use on Syntetic Turf Athletic Surfaces* Loudoun County, VA Staff report – February 23, 2017